Jerry Gilfoyle's Enotebook

DOE 2000 Electronic Notebook

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262. Difference between fids and nofids (2.6r) (gpg) [Last Modified Wed Sep 30 14:02:22 2009 (GMT)]
263. Checking changes in ALTp for 2.6r (gpg) [Last Modified Fri Mar 4 14:42:08 2011 (GMT)]
264. Checking effect of MM2 cut and fids and nofids on 2.6n (gpg) [Last Modified Fri Oct 2 17:14:12 2009 (GMT)]
265. gemc EC (gpg) [Last Modified Wed Nov 11 17:22:26 2009 (GMT)]
266. 2.6n Calina simulation (gpg) [Last Modified Wed Oct 7 14:09:48 2009 (GMT)]
267. Systematic uncertainty on 2.6r ALTp (gpg) [Last Modified Fri Oct 2 14:16:08 2009 (GMT)]
268. Another round of W scans for 2.6n (gpg) [Last Modified Sun Oct 4 16:32:11 2009 (GMT)]
269. Checking W range for both data sets. (gpg) [Last Modified Sat Oct 3 17:33:12 2009 (GMT)]
270. Effect of fiducials on 2.6n with new W cut (gpg) [Last Modified Sun Oct 4 16:55:32 2009 (GMT)]
271. W and MM2 cut uncertainties on 2.6n with new W and MM2 ranges (gpg) [Last Modified Mon Oct 5 03:03:48 2009 (GMT)]
272. GRRRR! Used wrong momentum corrections for 2.6n (gpg) [Last Modified Fri Oct 9 13:54:45 2009 (GMT)]
273. Effect of fiducial cuts on revised 2.6n results (gpg) [Last Modified Tue Oct 6 14:48:54 2009 (GMT)]
274. MM2 and W scans around the peaks for 2.6n (gpg) [Last Modified Wed Oct 7 18:58:16 2009 (GMT)]
275. Summary of changes to 2.6n and 2.6r results (gpg) [Last Modified Sat Oct 10 19:19:15 2009 (GMT)]
276. Last (?) pass on 2.6r (see entry 279) (gpg) [Last Modified Thu Oct 22 19:25:31 2009 (GMT)]
277. Variation of 2.6r ALTp dip and W cut (gpg) [Last Modified Fri Oct 9 14:28:03 2009 (GMT)]
278. NDE differences for GMn (gpg) [Last Modified Sat Oct 10 20:28:38 2009 (GMT)]
279. Effect of Mp cut on 2.6r (gpg) [Last Modified Fri Oct 23 01:41:33 2009 (GMT)]
280. Effect of Mp cut on 2.6n (gpg) [Last Modified Sun Oct 25 01:49:48 2009 (GMT)]
281. MM2 accuracy for 2.6n (gpg) [Last Modified Mon Oct 26 02:17:49 2009 (GMT)]
282. Effect of additional 2.6n proton momentum correction (gpg) [Last Modified Mon Oct 26 18:32:40 2009 (GMT)]
283. MM2 Accuracy for 2.6r (gpg) [Last Modified Tue Oct 27 19:47:02 2009 (GMT)]
284. Effect of proton momentum correction on 2.6r (gpg) [Last Modified Wed Nov 4 17:13:53 2009 (GMT)]
285. test (Jerry Gilfoyle) [Last Modified Wed Nov 4 16:14:02 2009 (GMT)]
286. Recovering Back to the 2.6r Future (gpg) [Last Modified Mon Nov 23 14:45:50 2009 (GMT)]
287. Deleted page
288. Effect of fiducial cuts on 2.6r W spectrum (gpg) [Last Modified Mon Nov 9 03:16:04 2009 (GMT)]

289. MM2 and W uncertainties for 2.6r (gpg) [Last Modified Mon Nov 9 19:17:50 2009 (GMT)]
290. Electron Plots for CLAS12 software EC talk (gpg) [Last Modified Wed Nov 18 19:12:08 2009 (GMT)]
291. Neutron Plots for CLAS12 software EC talk (gpg) [Last Modified Wed Nov 18 04:17:42 2009 (GMT)]
292. Dependence of ALTp on MM2 for 2.6r (gpg) [Last Modified Sat Nov 28 00:58:58 2009 (GMT)]
293. Dependence of ALTp on W for 2.6r (gpg) [Last Modified Wed Nov 25 05:00:04 2009 (GMT)]
294. Dependence of ALTp on MM2 for 2.6n (gpg) [Last Modified Sat Nov 28 00:47:11 2009 (GMT)]
295. Dependence of ALTp on W for 2.6n (gpg) [Last Modified Wed Nov 25 04:41:02 2009 (GMT)]
296. Systematics of GMn (gpg) [Last Modified Thu Dec 3 16:49:44 2009 (GMT)]
297. GEn/GMn (gpg) [Last Modified Tue Dec 1 14:24:29 2009 (GMT)]
298. Fraction of events within W2 cut for CLAS12 GMn (gpg) [Last Modified Wed Dec 2 18:09:46 2009 (GMT)]
299. Update plots (gpg) [Last Modified Tue Dec 15 21:37:48 2009 (GMT)]
300. Effect of changing exit channels in genevD (gpg) [Last Modified Thu Dec 17 02:49:24 2009 (GMT)]
301. Progression of cuts plot for update (gpg) [Last Modified Sun Jan 3 03:03:08 2010 (GMT)]
302. Testing Hermiticity cut on 4.2-GeV, E5 data (gpg) [Last Modified Thu Dec 24 19:11:51 2009 (GMT)]
303. 4.2-GeV analysis in preparation for update presentation (gpg) [Last Modified Sun Dec 27 00:45:40 2009 (GMT)]
304. Testing the hermiticity cut on the E5 data. (Jerry Gilfoyle) [Last Modified Sun Dec 27 01:07:22 2009 (GMT)]
305. Effect of reducing the θ_{pq} on the inelastic background (gpg) [Last Modified Mon Jan 4 16:27:59 2010 (GMT)]
306. Investigating the N=3 tracks for the hermiticty cut (gpg) [Last Modified Wed Jan 6 20:54:05 2010 (GMT)]
307. Study out-of-time tracks (gpg) [Last Modified Wed Jan 20 15:15:49 2010 (GMT)]
308. Background inelastic events subtraction (gpg) [Last Modified Wed Jan 20 15:18:49 2010 (GMT)]
309. Hermiticity of CLAS12 (Mac question) (gpg) [Last Modified Fri Jan 29 01:19:54 2010 (GMT)]
310. Fix EC position in gemc (gpg) [Last Modified Fri Feb 5 13:26:24 2010 (GMT)]
311. Putting in clipped off lead sheets in EC (gpg) [Last Modified Tue Feb 9 20:48:30 2010 (GMT)]
312. Strips and digitization of EC events in gemc (gpg) [Last Modified Wed Feb 24 02:18:56 2010 (GMT)]
313. Systematic uncertainty due to radiative effects (gpg) [Last Modified Wed Feb 24 02:53:56 2010 (GMT)]
314. EC geometry version 1.0 (gpg) [Last Modified Thu Feb 25 16:33:21 2010 (GMT)]
315. Transverse size of EC shower in gemc (gpg) [Last Modified Fri Feb 26 18:20:23 2010 (GMT)]
316. Sampling Fraction in EC (gpg) [Last Modified Thu Mar 11 13:11:30 2010 (GMT)]
317. Resolution in gemc and comparison with GSIM (gpg) [Last Modified Tue Mar 9 17:10:50 2010 (GMT)]
318. Position resolution in gemc (gpg) [Last Modified Tue Mar 9 03:12:45 2010 (GMT)]
319. Position resolution, shower size, and Plots for Collaboration meeting (gpg) [Last Modified Tue Mar 16 20:18:16 2010 (GMT)]
320. EIC BEC plots (gpg) [Last Modified Wed Apr 21 03:54:32 2010 (GMT)]
321. First Look at Bose-Einstein Correlations at the EIC. (gpg) [Last Modified Wed Aug 11 22:32:28 2010 (GMT)]
322. eod: checking effect of radiative corrections (gpg) [Last Modified Tue Apr 27 18:59:35 2010 (GMT)]
323. Radiative Corrections for Fifth Structure Function Analysis (gpg) [Last Modified Wed May 12 02:44:36 2010 (GMT)]
324. Problems with Mathematica Interpolation (gpg) [Last Modified Tue May 11 20:36:48 2010 (GMT)]
325. Draft of tutorial stuff for CSW (gpg) [Last Modified Mon May 24 00:15:20 2010 (GMT)]
326. Tests of eod exclurad calculations (gpg) [Last Modified Thu Jun 3 21:25:06 2010 (GMT)]
327. Behavior of RC calculations (gpg) [Last Modified Tue Jun 8 00:05:39 2010 (GMT)]
328. Speed test of new cluster (gpg) [Last Modified Fri Jun 18 14:17:42 2010 (GMT)]
329. Production plots of RC calculations (gpg) [Last Modified Mon Feb 21 17:37:53 2011 (GMT)]
330. Testing the new form of the EC geometry. (gpg) [Last Modified Fri Aug 6 17:33:18 2010 (GMT)]
331. Track Reconstruction with Socrat (gpg) [Last Modified Tue Aug 3 14:44:27 2010 (GMT)]
332. Testing new cluster in Richmond (gpg) [Last Modified Wed Sep 15 15:50:29 2010 (GMT)]
333. Testing effect of shape of BEC (gpg) [Last Modified Wed Sep 22 16:07:44 2010 (GMT)]
334. Effect of fragmentation asymmetry on BEC Correlation Function (GPG) [Last Modified Fri Oct 1 17:03:34 2010 (GMT)]
335. Study of transverse and longitudinal source size in Pythia (gpg) [Last Modified Tue Oct 12 21:31:24 2010 (GMT)]
336. Study of TOF NDE (gpg) [Last Modified Fri Nov 19 20:55:19 2010 (GMT)]
337. Elastic Kinematics (gpg) [Last Modified Wed Aug 24 19:50:31 2011 (GMT)]
338. NDE γ distribution (gpg) [Last Modified Fri Dec 24 18:11:12 2010 (GMT)]
339. NDE angular distributions (gpg) [Last Modified Tue Jan 4 21:47:36 2011 (GMT)]
340. Precision Tests for BEC (gpg) [Last Modified Thu Dec 16 16:28:46 2010 (GMT)]
341. NDE for E_{dep} > 33 MeV (jerry) [Last Modified Fri Jan 28 19:57:13 2011 (GMT)]
342. Building gemc (gpg) [Last Modified Thu Feb 3 03:46:43 2011 (GMT)]
343. RC correction for ALTp (gpg) [Last Modified Fri Mar 25 20:42:20 2011 (GMT)]
344. Low p_m asymmetry for 2.6r (gpg) [Last Modified Fri Mar 4 03:25:36 2011 (GMT)]
345. Comparison of 2.6r old and new (gpg) [Last Modified Wed Apr 20 15:15:56 2011 (GMT)]
346. Test sampling fraction cut choices (gpg) [Last Modified Tue May 24 19:06:20 2011 (GMT)]
347. Proton Mass cut (gpg) [Last Modified Tue Mar 22 12:19:01 2011 (GMT)]
348. Setting up DOE2000 elog (gpg) [Last Modified Wed May 25 20:03:41 2011 (GMT)]
349. RC corrections for 2.6r ALTp (gpg) [Last Modified Thu May 26 17:03:49 2011 (GMT)]
350. List of ELOG entries. (gpg) [Last Modified Thu May 26 17:07:10 2011 (GMT)]
351. Testing RC on 2.6r (gpg) [Last Modified Thu May 26 21:45:52 2011 (GMT)]
352. RC check (gpg) [Last Modified Thu May 26 21:49:20 2011 (GMT)]
353. ALTp(phi) method. (gpg) [Last Modified Thu May 26 21:52:19 2011 (GMT)]
354. testing 2.6r RC correction for pm = 0.20-0.25 GeV/c (gpg) [Last Modified Thu May 26 22:01:03 2011 (GMT)]
355. Results of fixes to 2.6r RC application (gpg) [Last Modified Fri May 27 02:00:23 2011 (GMT)]
356. turn on 2.6r mp cut (gpg) [Last Modified Fri May 27 03:49:15 2011 (GMT)]
357. Effect of RC and mp cut on 2.6n ALTp (gpg) [Last Modified Fri May 27 20:25:21 2011 (GMT)]
358. Effect of efids/pfids with mp and RC on 2.6n (gpg) [Last Modified Thu Jun 2 11:14:36 2011 (GMT)]
359. Generated vs Reconstructed Electron Theta (Mark Moog) [Last Modified Thu Jun 2 11:23:04 2011 (GMT)]
360. Minimum electron angle in CLAS12 (gpg) [Last Modified Thu Jun 2 17:28:55 2011 (GMT)]
361. Missing Mass Squared (Mark Moog) [Last Modified Fri Jun 3 16:09:04 2011 (GMT)]
362. Return to NDE - impact of Edep cut (gpg) [Last Modified Mon Jun 13 16:41:51 2011 (GMT)]

363.	Missing Mass Update (Moog)	[Last Modified Sat Jun 18 15:01:58 2011 (GMT)]
364.	Comparison of deltaP / P (Mark Moog)	[Last Modified Sat Jun 18 14:48:35 2011 (GMT)]
365.	Testing the 2.6n, no-fids analysis (gpg)	[Last Modified Wed Jun 15 03:22:00 2011 (GMT)]
366.	testing the 2.6r no-fids analysis (gpg)	[Last Modified Sun Jun 19 16:39:45 2011 (GMT)]
367.	Doing 2.6r delta_ALTp correctly (gpg)	[Last Modified Sun Jun 19 16:47:44 2011 (GMT)]
368.	Do 2.6n delta_ALTp correctly. (gpg)	[Last Modified Sun Jun 19 17:21:44 2011 (GMT)]
369.	Enhancing 2.6n statistics (gpg)	[Last Modified Sun Jun 19 17:39:37 2011 (GMT)]
370.	Mp cut uncertainty for 2.6r (gpg)	[Last Modified Sun Jun 19 17:44:09 2011 (GMT)]
371.	Mp cut uncertainty for 2.6n (gpg)	[Last Modified Mon Jun 20 00:25:50 2011 (GMT)]
372.	Ratio of triggers to simulated QE events (gpg)	[Last Modified Mon Jun 20 00:31:08 2011 (GMT)]
373.	Non/Noff ratio (gpg)	[Last Modified Mon Jun 20 00:39:53 2011 (GMT)]
374.	Energy Deposited in P1B (Mark Moog)	[Last Modified Thu Jun 30 17:51:42 2011 (GMT)]
375.	Luminosity study (gpg)	[Last Modified Wed Jun 22 19:47:00 2011 (GMT)]
376.	OTOF Energy Deposited Update (Mark Moog)	[Last Modified Thu Jun 30 17:51:32 2011 (GMT)]
377.	Testing ADC and TDC output (Mark Moog)	[Last Modified Tue Jun 28 20:23:05 2011 (GMT)]
378.	Updated Neutron Energy Deposited Info (Mark Moog)	[Last Modified Thu Jun 30 17:51:19 2011 (GMT)]
379.	Updated Electron Deposited Energy Info (Mark Moog)	[Last Modified Thu Jun 30 17:51:05 2011 (GMT)]
380.	Even newer energy deposited info (for electrons) (Mark Moog)	[Last Modified Wed Jul 20 17:39:51 2011 (GMT)]
381.	New TDC/ADC info (Mark Moog)	[Last Modified Thu Jun 30 17:47:56 2011 (GMT)]
382.	Energy deposited info (for neutrons in p1a) (gpg)	[Last Modified Sun Jul 24 00:23:29 2011 (GMT)]
383.	P1A Neutron Energy Deposited Study (Mark Moog)	[Last Modified Sun Jul 24 00:55:32 2011 (GMT)]
384.	P1B Neutron Energy Deposited Study (Mark Moog)	[Last Modified Sun Jul 24 03:53:09 2011 (GMT)]
385.	P2B Neutron Energy Deposited Study (Mark Moog)	[Last Modified Mon Jul 25 02:57:03 2011 (GMT)]
386.	Pions in P2B (Mark Moog)	[Last Modified Wed Jul 20 21:19:59 2011 (GMT)]
387.	Pi0 vs Pi+ Study (Mark Moog)	[Last Modified Sat Jul 23 16:59:50 2011 (GMT)]
388.	Generated Momentum and Theta Momentum Deltas (Mark Moog)	[Last Modified Tue Aug 2 17:58:45 2011 (GMT)]
389.	Gamma vs Energy Deposited Plots (Mark Moog)	[Last Modified Tue Jul 26 21:47:13 2011 (GMT)]
390.	QE-Inelastic overlap (gpg)	[Last Modified Wed Aug 3 13:52:16 2011 (GMT)]
391.	Momentum Resolution (Mark Moog)	[Last Modified Thu Aug 4 20:14:58 2011 (GMT)]
392.	Edep threshold effect on NDE (gpg)	[Last Modified Sat Aug 6 21:27:55 2011 (GMT)]
393.	How I run NDE calculations (Mark Moog)	[Last Modified Fri Aug 5 19:22:16 2011 (GMT)]
394.	No P1B NDE (gpg)	[Last Modified Mon Aug 8 11:56:12 2011 (GMT)]
395.	EC ADC (gpg)	[Last Modified Tue Aug 9 18:34:58 2011 (GMT)]
396.	Update on CLAS12 EC sampling fraction (gpg)	[Last Modified Thu Aug 11 00:30:04 2011 (GMT)]
397.	Check on final 2.6n ALTp (gpg)	[Last Modified Thu Aug 11 18:56:25 2011 (GMT)]
398.	Check on final 2.6r ALTp (gpg)	[Last Modified Fri Sep 2 17:55:21 2011 (GMT)]
399.	Impact of Edep threshold on sampling fraction (gpg)	[Last Modified Mon Aug 15 20:26:55 2011 (GMT)]
400.	W_{vo} study (gpg)	[Last Modified Tue Sep 20 22:07:33 2011 (GMT)]
401.	2D cut for QE events (gpg)	[Last Modified Tue Sep 20 21:44:13 2011 (GMT)]
402.	Checking Target Cuts (gpg)	[Last Modified Sat Oct 1 21:35:15 2011 (GMT)]
403.	Comparing Missing Mass and Wvo (gpg)	[Last Modified Tue Oct 4 03:06:10 2011 (GMT)]
404.	Questions on x>2 events (gpg)	[Last Modified Thu Oct 6 10:51:20 2011 (GMT)]
405.	Checking on target configuration (gpg)	[Last Modified Sat Oct 15 17:31:33 2011 (GMT)]
406.	Comparison with WVO calculations averaged over x for 2.6r. (gpg)	[Last Modified Sun Oct 16 19:26:06 2011 (GMT)]
407.	Q^2-x distribution (gpg)	[Last Modified Thu Oct 20 17:52:43 2011 (GMT)]
408.	Tracking results for GMn target (gpg)	[Last Modified Mon Oct 24 13:30:27 2011 (GMT)]

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Jerry Gilfoyle's Enotebook page 1 - test (Jerry Gilfoyle)

[Modified Wed Nov 4 16:14:02 2009 (GMT) Jerry Gilfoyle]

test

test again.

DOE 2000 Electronic Notebook

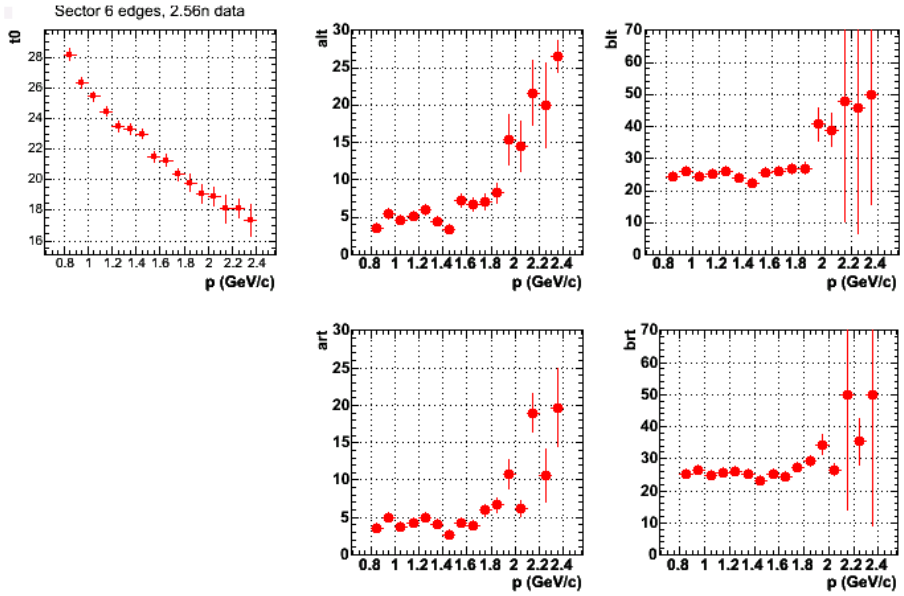
Jerry Gilfoyle's Enotebook page 2 - sector 6 2gen fits (gpg)

[Modified Thu Jun 2 11:17:28 2011 (GMT) gpg]

the second generation fits for sector 6 initially look quite bad. there are many points that lie far from the trend of most of the data. see plot in paper notelbook. see entry 234 in e5 elog. remove the following angular points.

```
pbin    thetabin
 8         33 42 43
 9         32 41 42
 10       30 31 40 41
 11       30 40 41
 12       29 39 40
 13       28 29 39 40
 14       27 28 38 39
 15       27 38 39
 16       27 38 39
 17       26 27 38 39
 18       26 38 39 40
 19       25 26 36 37
 20       25 26 35 36
 21       25 26 31 32
 22       25 29 30
 23       24 25
```

Click here to view the object (2nd generation fits with points removed.) you uploaded.



Sun Jul 18 22:34:40 2004

Systematics of fit parameters for sector 6. see plot above for fits.

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Jerry Gilfoyle's Enotebook page 3 - sector 5 results (gpg)

[Modified Mon Jul 19 20:35:05 2004 (GMT) gpg]

first pass through sector 5 gives the following.

Click here
to view the object (First pass at 2gen fits.) you uploaded.

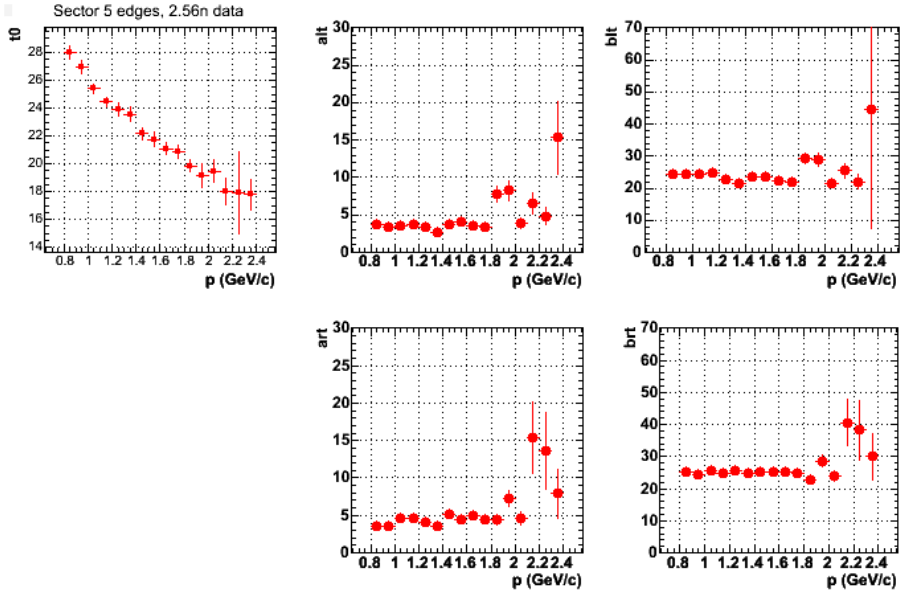
to view and fit single histograms for electron fiducials using myfit9.C.

```
#include
#include "TH3D.h"
gStyle->SetOptFit(1111);
gStyle->SetStatW(0.125);
gStyle->SetStatH(0.10);
.L myfit9.C
int plo=8;
int phi=8;
int pbin = plo;
int tlo=42;
int thi=42;
int thetabin = tlo;
float xlo = 300.;
float xhi = 360.;
float fitlo = 90.;
float fithi = 150.0;
helectron_fiducials->GetZaxis()->SetRange(plo,phi);
TH2D *h1 = (TH2D*) helectron_fiducials->Project3D("xy");
h1.Draw()
TH1D *h3 = (TH1D*) h1->ProjectionX("h1",tlo,thi)
h3->GetXaxis()->SetRange(xlo,xhi)
h3.Draw();
TF1 *func = new TF1("fitf",fitf,270,330,5);
func->SetParNames("Low-Bottom","Low-Top","High-Top","High-Bottom","Plateau");
func->SetParameters(98.2,7.3,36.,1.4,27.)
func->SetParLimits(0,275,360)
func->SetParLimits(1,0,50)
func->SetParLimits(2,0,50)
func->SetParLimits(3,0,50)
h3->Fit(func,"rem");
myfit9()
```

first pass through sector 5 gives the following.

Click here
to view the object (Second pass at 2gen fits.) you uploaded.

systematic results for sector 5 look good.



Mon Jul 19 16:33:26 2004

Sector 5 fit parameter systematics

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Jerry Gilfoyle's Enotebook page 4 - sector 4 results (gpg)

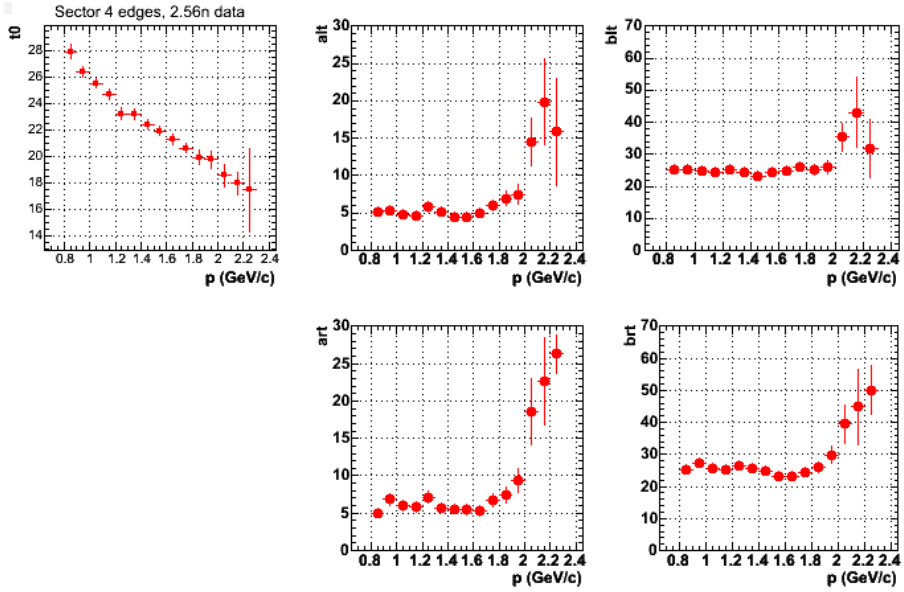
[Modified Tue Jul 20 16:08:57 2004 (GMT) gpg]

first pass at 2nd generation fits is here.

Click here
to view the object (2gen fits for sector 4) you uploaded.

second pass at 2nd generation fits is here.

Click here
to view the object (2gen fits for sector 4) you uploaded.



Tue Jul 20 12:07:56 2004

Sector 4 fit systematics

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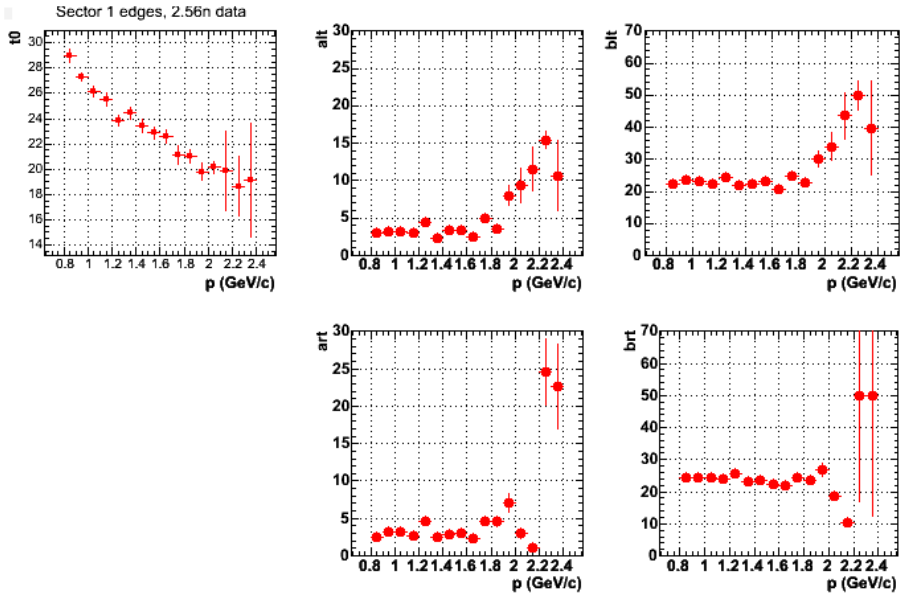
Jerry Gilfoyle's Enotebook page 5 - sector 1 results (gpg)

[Modified Tue Jul 20 18:13:35 2004 (GMT) gpg]

plots and fits of sector edges are here.

Click here
to view the object (sector 1 2gen fits) you uploaded.



Tue Jul 20 14:12:37 2004

Systematics of fit parameters for sector 1 2gen fits

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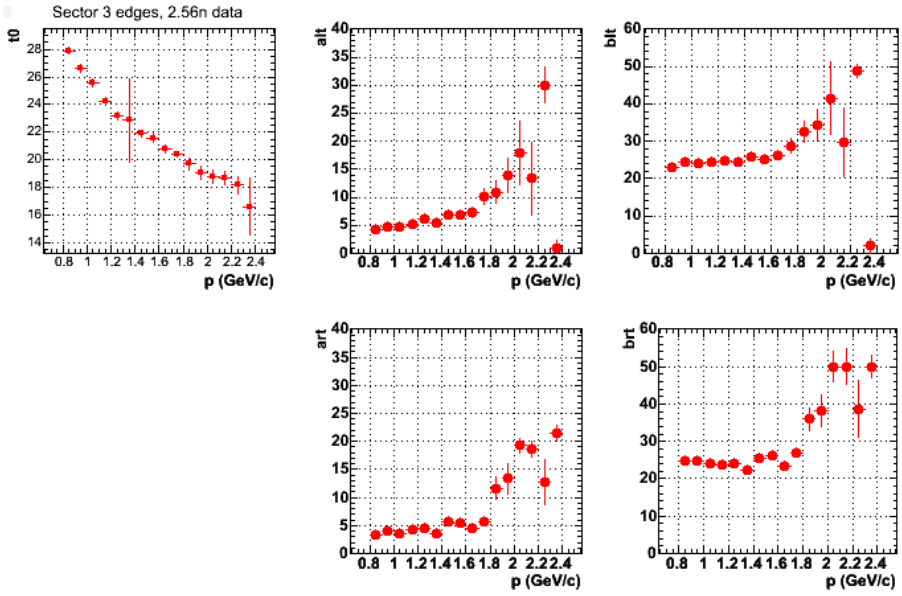
Jerry Gilfoyle's Enotebook page 6 - sector 3 results (gpg)

[Modified Tue Jul 20 21:21:50 2004 (GMT) gpg]

fit to edges of sector 3 are shown here.

Click here
to view the object (Sector 3 2gen fits.) you uploaded.

sector 3 systematics for fit parameters.



Tue Jul 20 17:16:28 2004

Systematics of sector 3 fit parameters.

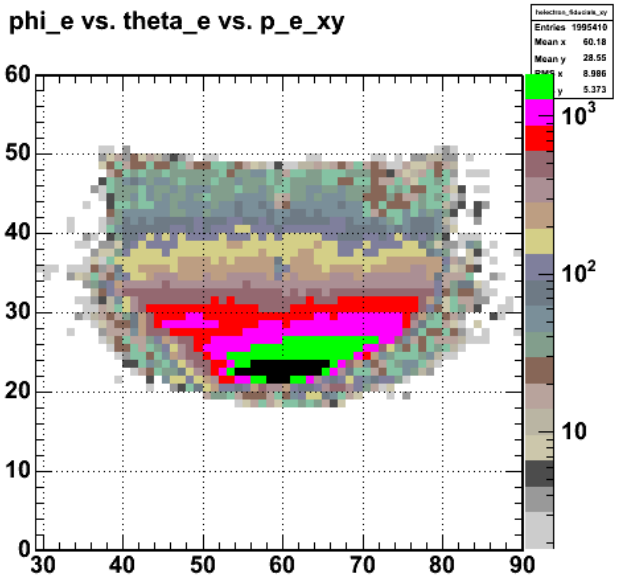
DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 7 - sector 2 results (gpg)

[Modified Thu Jul 29 17:26:01 2004 (GMT) gpg]

the sector 2 2gen fit results are below. this sector appears to have lots of holes. the results below are after cleaning up fits for pbins=11-13. see paper log for original.

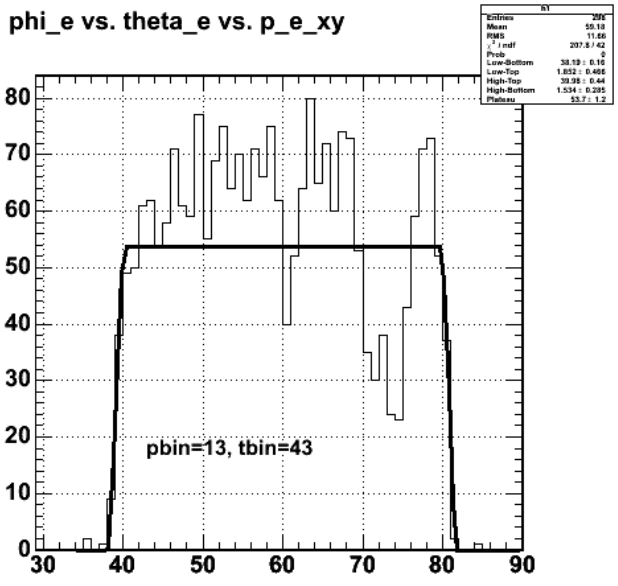
Click here to view the object (sector 2gen fits) you uploaded.



2004-07-22 10:09:48

Sector 2, theta-e vs. phi_e

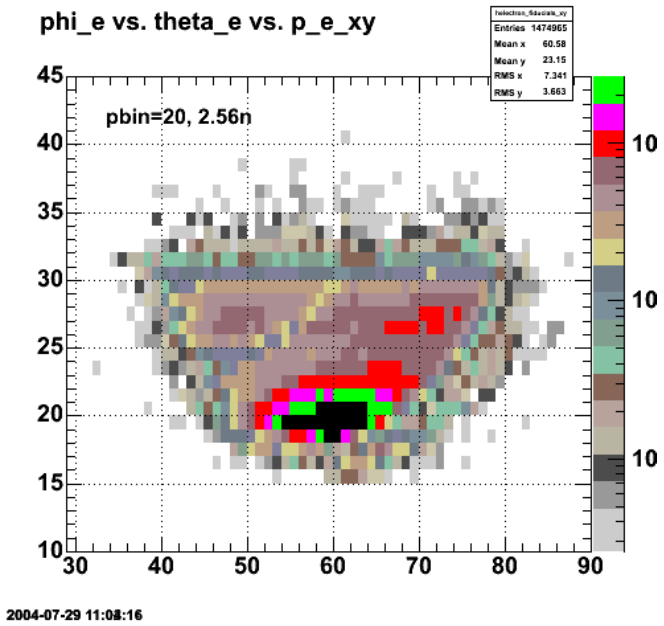
an example of one hole is shown below.



2004-07-22 10:18:05

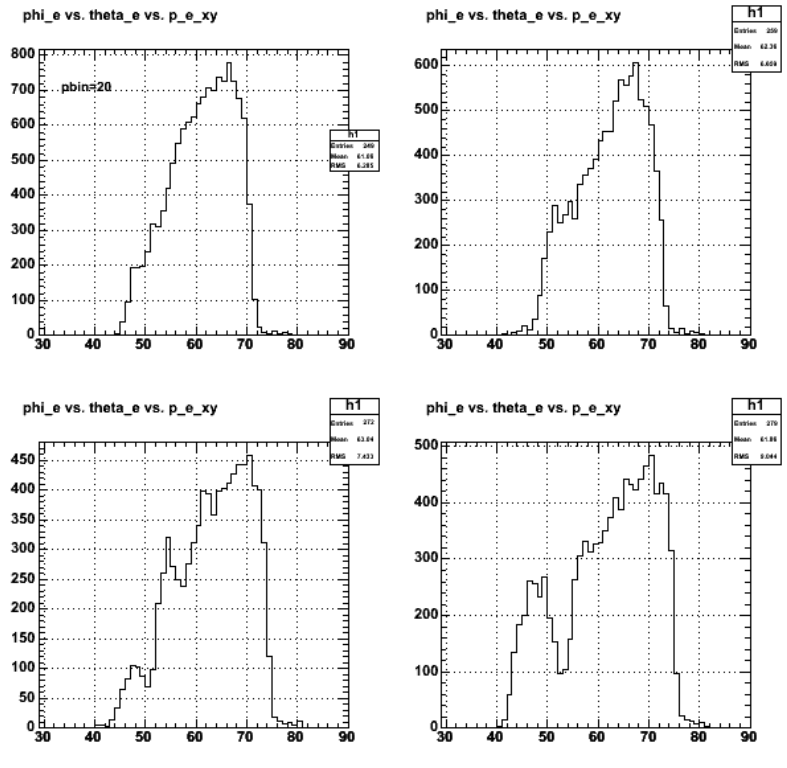
sector 2, pbin=13, tbin=43. note hole

the holes get worse at higher electron momentum.



Electron singles at p=2.0 GeV/c

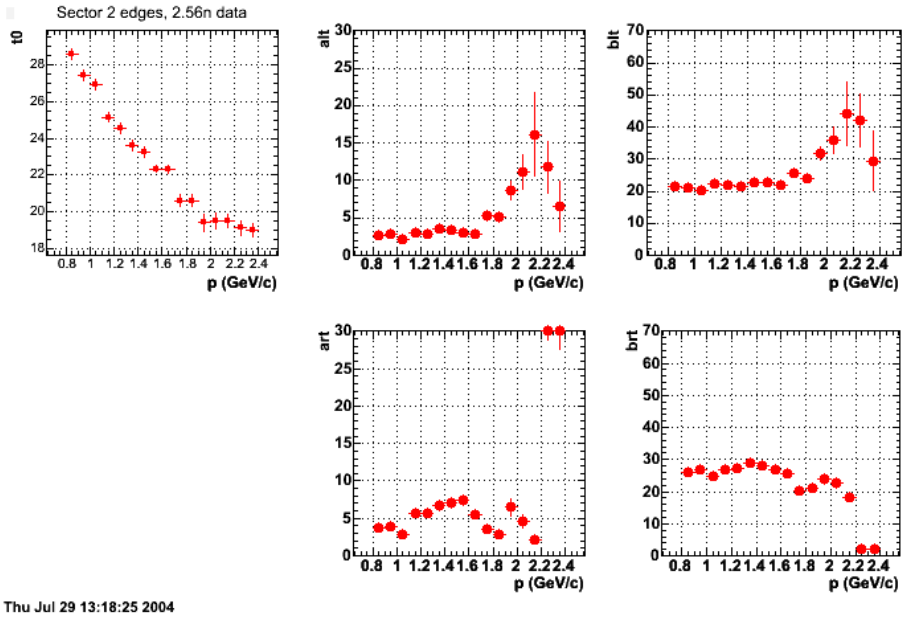
the plot below for pbin=20 (p_e=2.0-2.1 GeV/c) shows how the hole destroys the flat region of the acceptance for much of the phi range and then gradually receeds.



Series of phi_e distributions showing the effects of holes in the acceptance.

the question now is how do we handle these regions. do we delete them entirely, figure out the edge of the acceptance by eye. for example, in the plot above we could make the low-phi_e_angle edge the following values:

tbin	low phi_e edge	uncertainty
23	48	2
24	50	2
25	48	2
26	47	2



Systematics for sector 2, 2.56n

The last two points in the plot above should be ignored because the dominanat feature of the phi distribution is a hole. See plot below. Many of the edges for the low phi_e part simply could not be fit so i just eyeballed the 'flat' region.

Click here to view the object (Last four momentum bins or sector 2, 2.56n.) you uploaded.

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Jerry Gilfoyle's Enotebook page 8 - momentum corrections 1 (gpg)

[Modified Tue Aug 3 13:30:35 2004 (GMT) gpg]

Using the method described by Jeff Lachniet in entry 109 Rusty and Artie have been trying to reproduce Jeff's results for the momentum corrections. Rusty has found initially that the overall difference between the measured momentum and the momentum of the electron calculated from its polar angle is very small (about 0.1% , the ratio of measured to calculated is 1.001). The standard measure is to use the ep->e'pi+X reaction, calculate the missing mass which should be dominated by the neuttron, and compare the result with the neutron momentum. Rusty's finds the average MM for a single 2.56n run using the measured momentum is 0.935 GeV (versus the accetped value of 0.9396 GeV). This is a difference of 0.4% which is much large than the momentum difference. The corrected momentum changes the MM very little. I have taken a look at the ratio of measured to calculated momentum and generated the plot below for the 2.56r data.

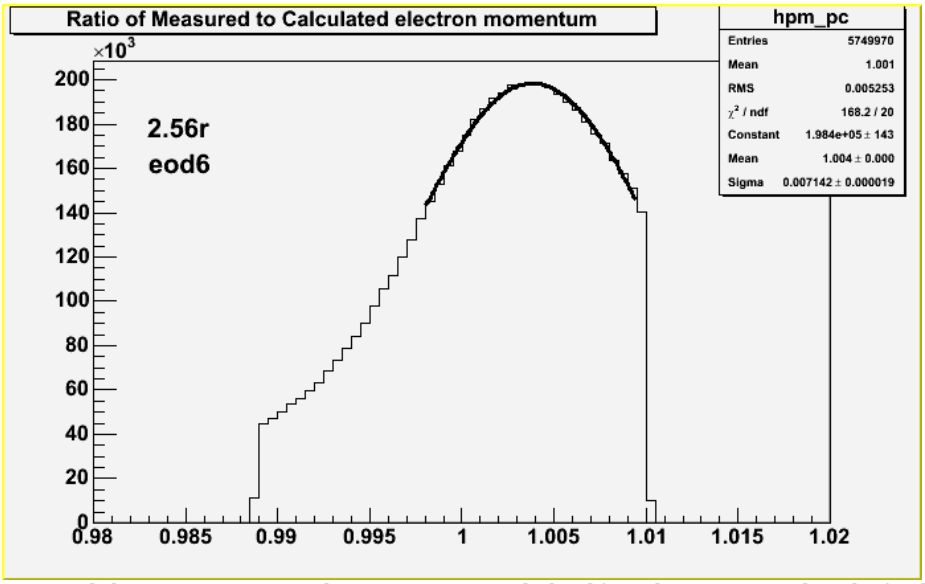

Figure 1. Ratio of measured electron momentum to electron momentum calculated from the measure track angles for the 2.56r data set.

Here, looking at a large data set the difference in the momentum is about 0.4% which agrees with the difference between the missing mass determined with the measured electron momentum.

Figure 2 is a sample plot demonstrating use of profile histograms and projections. We are having a problem with the profile histograms when we get single data points that have unphysical values, but get weighted the same as other values. See the plots below. Upper left panel of Figure 2 is the original 2D histogram. Upper right is the profile histogram made from the 2D. Note the point at a position (0.4,0.07). This is greatly different from the rest of the points. The lower left panel shows a projection of the 2D on the horizontal axis. Notice the point at 0.4 has a single count in it while the others are over a thousand. The plan here is to test on each bin to make sure there is some minimum number of points like, say, 50. If this threshold is not exceeded we throw the point out by setting the bin contents for the profile histogram for that bin to zero. The lower right panel of the next figure, Figure 3 and plots below (Figure 4) show what happens when we do that and then fit the results.

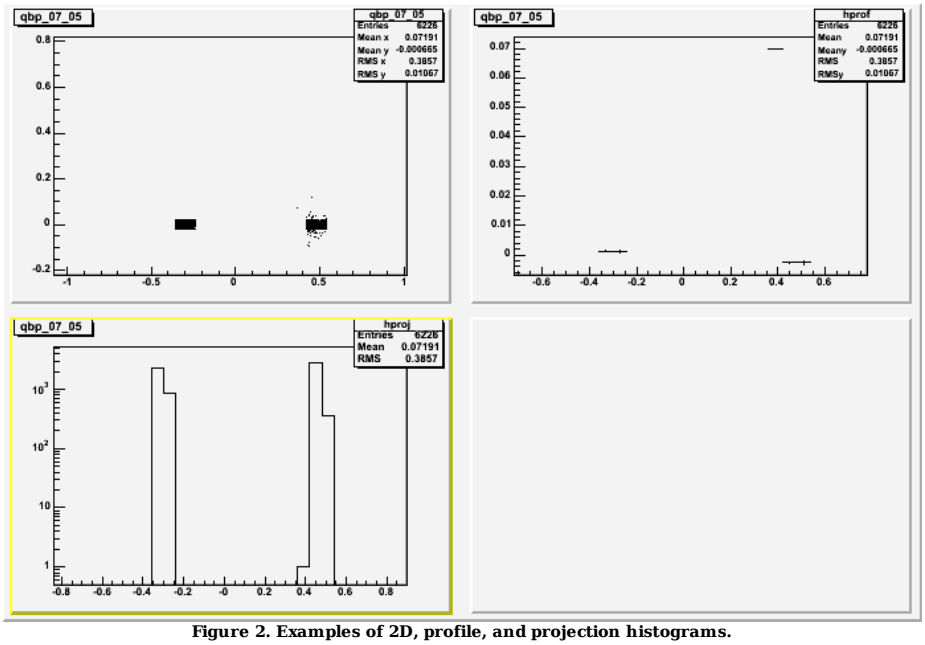

Figure 2. Examples of 2D, profile, and projection histograms.

The code below is the set of Root commands used to generate the histograms in Figure 2-4.

```
root [1] TProfile *hprof = qbp_07_05->ProfileX("hprof")
root [2] hprof.Draw()


root [4] TH1D *hproj = qbp_07_05->ProjectionX("hproj")
root [5] hproj.Draw()


root [14] hproj.GetBinContent(57)
(const Stat_t)1.00000000000000000e+00
root [15] hprof.GetBinContent(57)
(const Stat_t)7.00000000000000067e-02
root [16] hprof.SetBinContent(57,0)
root [17] hprof.GetBinContent(57)
(const Stat_t)0.00000000000000000e+00
root [18] hprof.Draw()
root [19] Info in : GIF file c1.gif has been created
 FCN=0.714787 FROM MIGRAD    STATUS=CONVERGED      41 CALLS          42 TOTAL
                     EDM=1.39411e-18    STRATEGY= 1      ERROR MATRIX ACCURATE
  EXT PARAMETER                                   STEP         FIRST
  NO.   NAME      VALUE            ERROR          SIZE      DERIVATIVE
   1  p0          -3.19161e-04   1.32374e-04   8.43275e-08   1.25040e-05
   2  p1          -4.99128e-03   3.43943e-04   2.19106e-07   1.17556e-06


root [21] TF1 *fit = hprof->GetFunction("pol1");
root [22] Double_t chi2 = fit->GetChisquare();
root [23] chi2
(Double_t)7.14787483713015037e-01
root [24] Double_t p0 = fit->GetParameter(0);
root [25] p0
(Double_t)(-3.19160863176760510e-04)
root [26] Double_t p1 = fit->GetParameter(1);
root [27] p1
(Double_t)(-4.99128412599152832e-03)
r
```

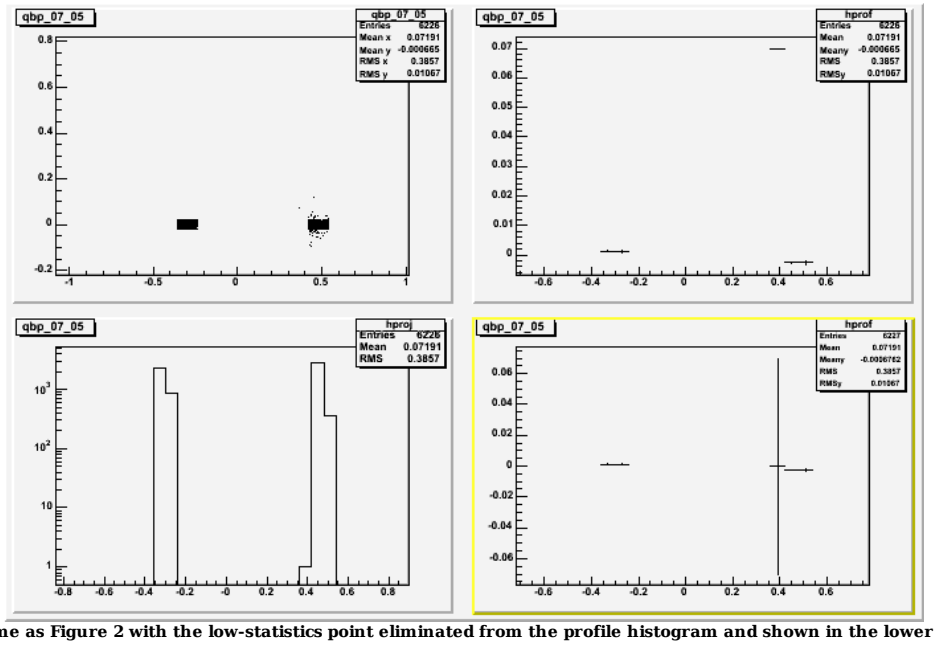

Figure 3. Same as Figure 2 with the low-statistics point eliminated from the profile histogram and shown in the lower right panel.

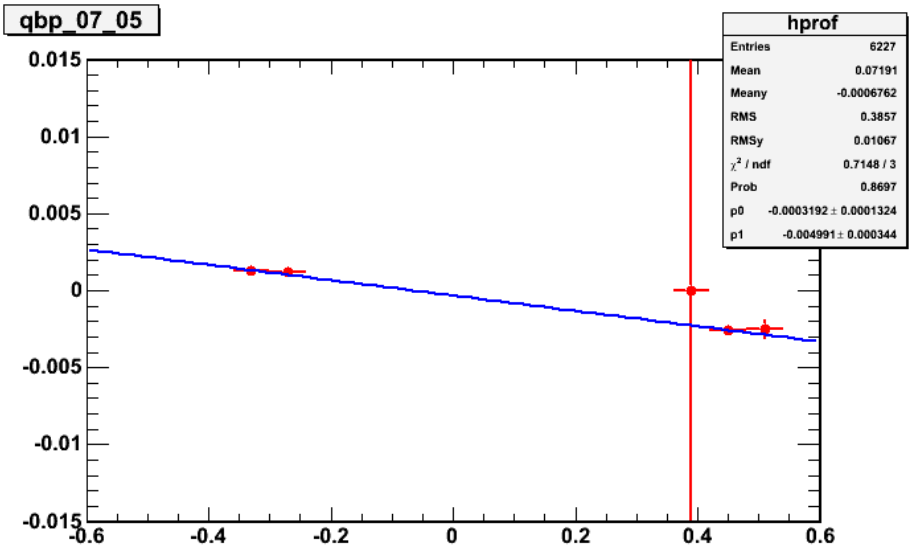

Figure 4. Final version of fit to profile histogram with low-statistics point eliminated.

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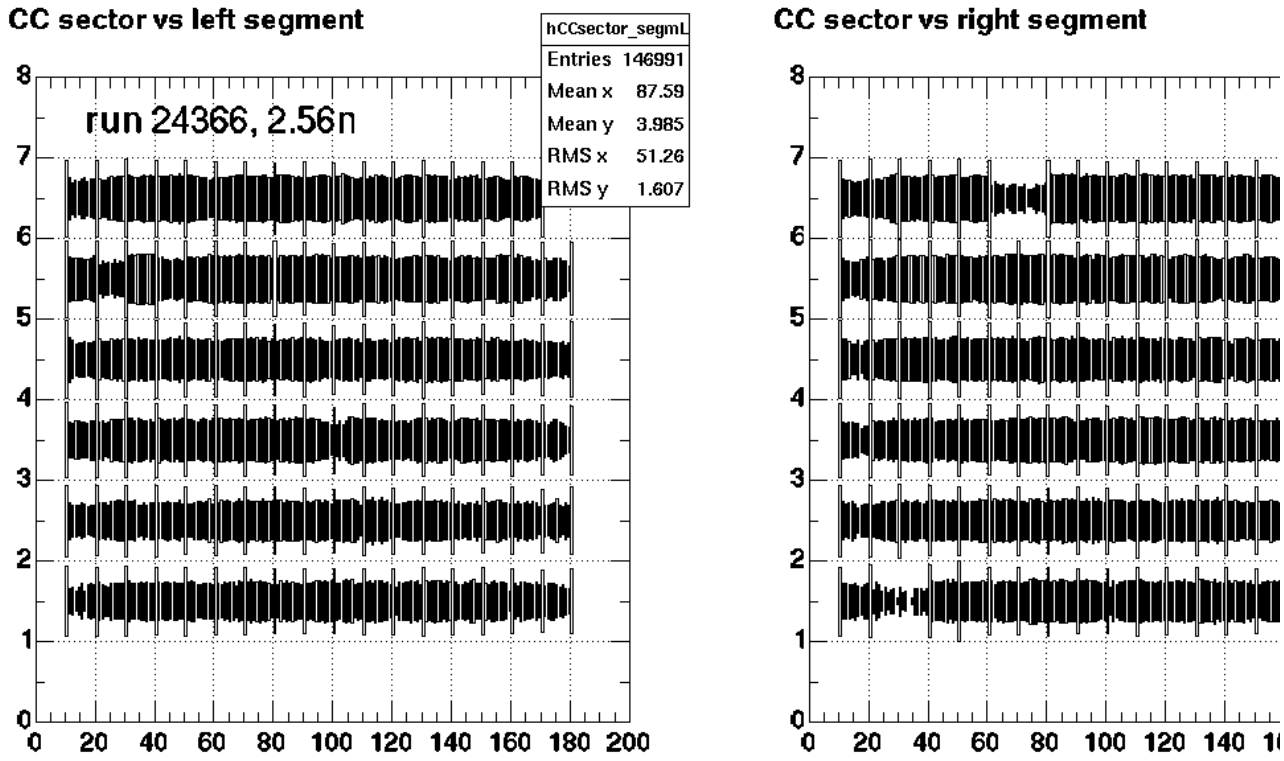
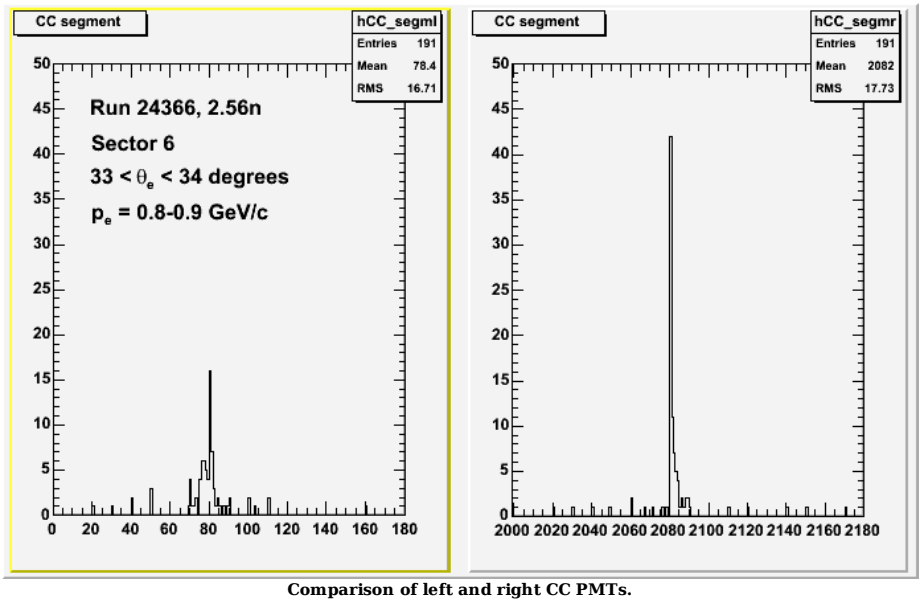
Jerry Gilfoyle's Enotebook page 9 - checking CC (gpg)

[Modified Mon Aug 2 20:30:10 2004 (GMT) gpg]

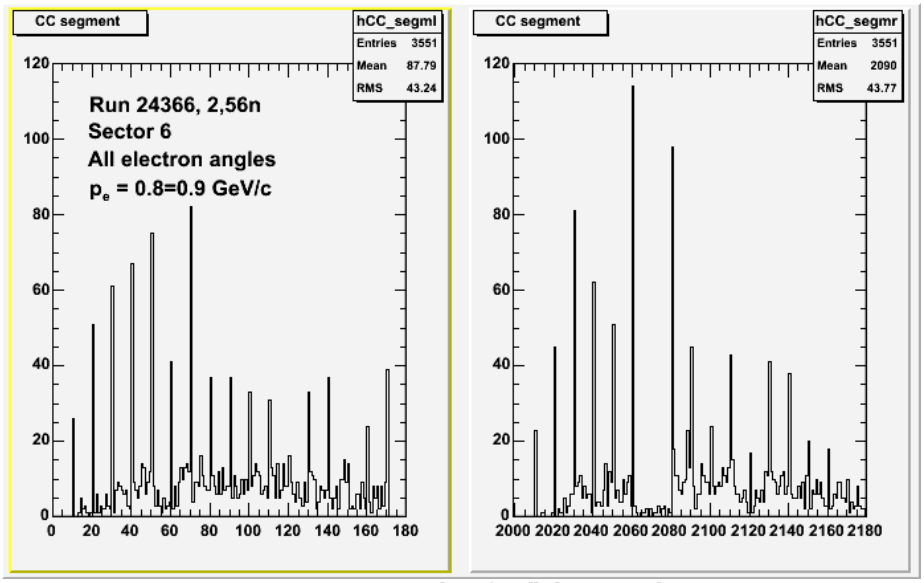
Look at the CC signals for electrons with pbin=8, tbin=33 where we first saw the large changes in the acceptance as a function of phi_e. The plot below may have an indexing problem.



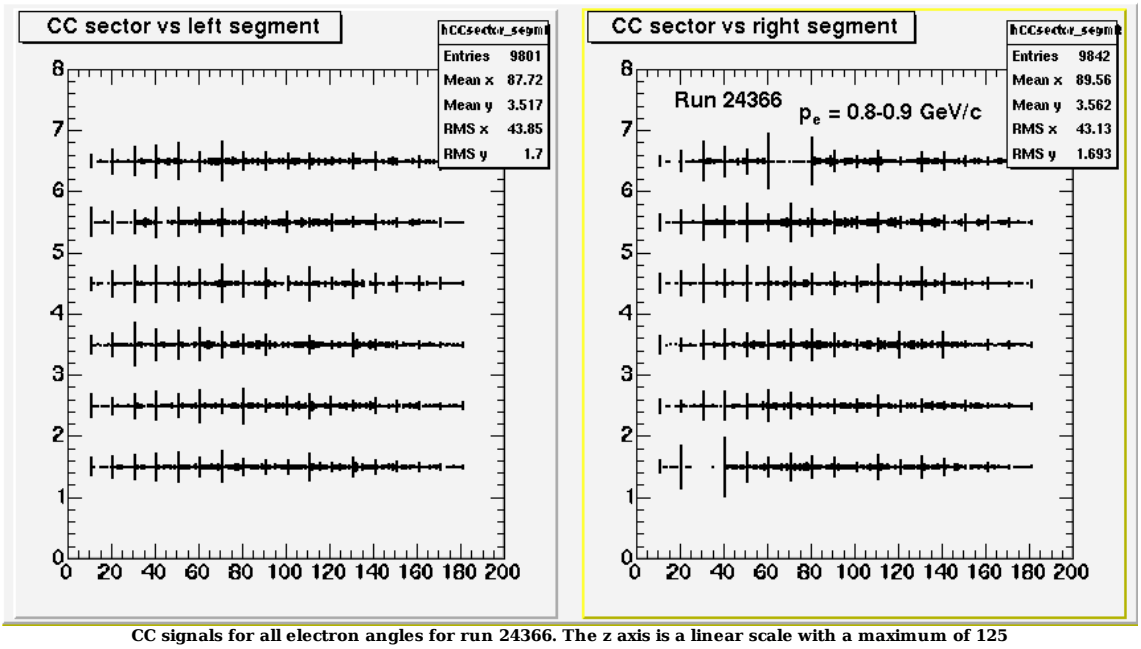
CC signals for all electron angles for run 24366. The z axis is a log scale with a maximum of 2500.



Comparison of left and right CC PMTs.



Same comparison as above for all electron angles



CC signals for all electron angles for run 24366. The z axis is a linear scale with a maximum of 125

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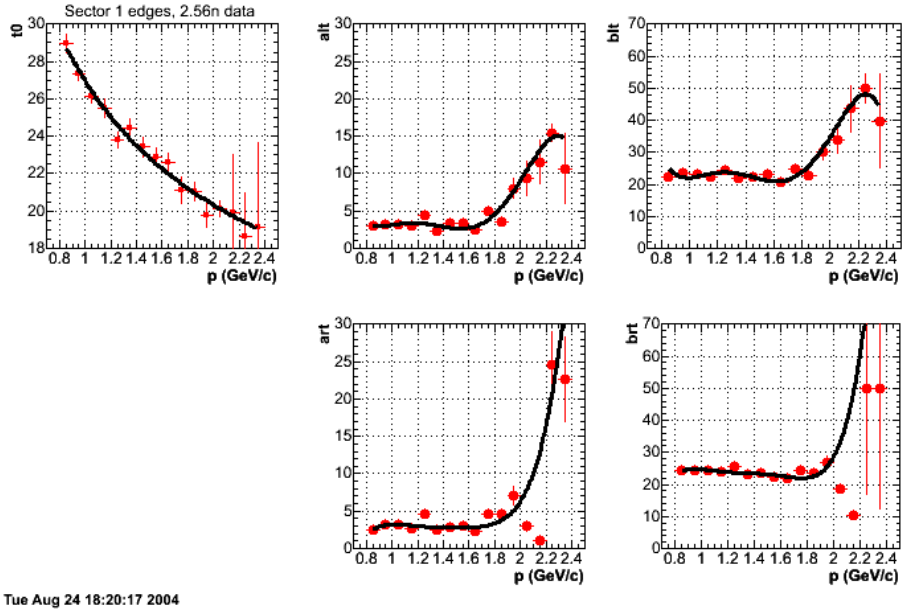
Jerry Gilfoyle's Enotebook page 10 - 3gen fits for sectors 1-6 (gpg)

[Modified Tue Aug 24 22:33:05 2004 (GMT) gpg]

The 3gen fit results are below for sectors 1-6. For t0 the fit function is to a power ([0]*pow(x,[1])). For the other fit parameters a fifth order polynomial is used. These two functions are the same ones used by dan protopopescu, et al. sector 1

```
+++++ t0 fit1 results  1, 0.8, 2.4, 26.9529, -0.406995
+++++ alt fit2 results 1, 0.8, 2.4, 202.566, -789.376, 1208, -891.092, 315.927, -42.9012
+++++ blt fit3 results 1, 0.8, 2.4, 1181.93, -4284.25, 6159.59, -4299.17, 1454.41, -190.44
+++++ art fit4 results 1, 0.8, 2.4, -178.338, 673.044, -985.612, 714.878, -257.858, 37.1169
+++++ brt fit5 results 1, 0.8, 2.4, -495.102, 2052.09, -3184.58, 2431.64, -915.253, 135.911
```

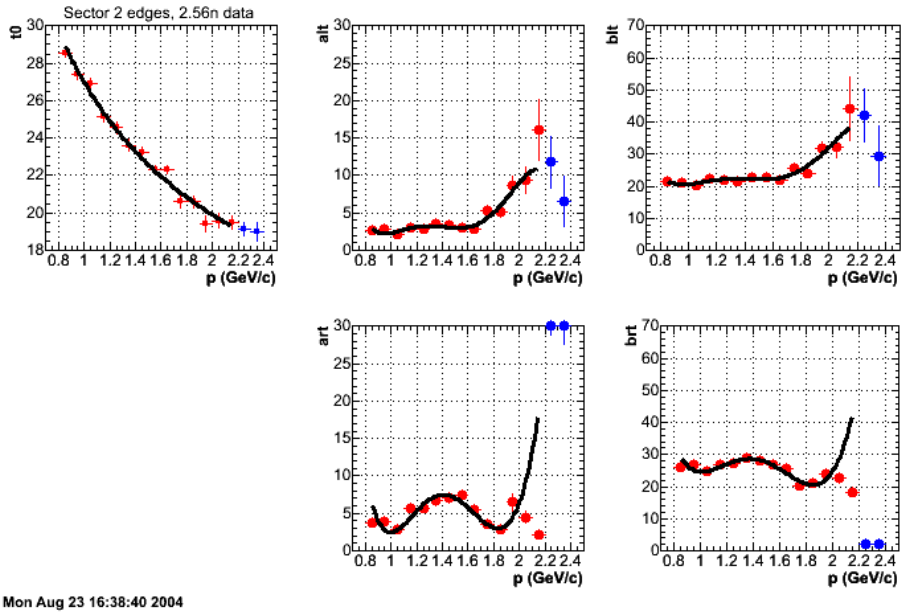


Tue Aug 24 18:20:17 2004

Fig 1. Plot of parameters from 2gen fits to sector 1 flat acceptance edges. Curves are fits to the edge positions.

sector 2

```
+++++ t0 fit1 results  2, 0.8, 2.2, 26.9709, -0.439026
+++++ alt fit2 results 2, 0.8, 2.2, 410.15, -1544.19, 2276.47, -1631.86, 568.726, -76.9783
+++++ blt fit3 results 2, 0.8, 2.2, 582.883, -2091.74, 3024.01, -2120.84, 721.187, -94.8598
+++++ art fit4 results 2, 0.8, 2.2, 757.973, -2504.3, 3148.82, -1857.28, 507.068, -49.7835
+++++ brt fit5 results 2, 0.8, 2.2, 746.711, -2305.67, 2740.33, -1470.47, 334.231, -20.4888
```

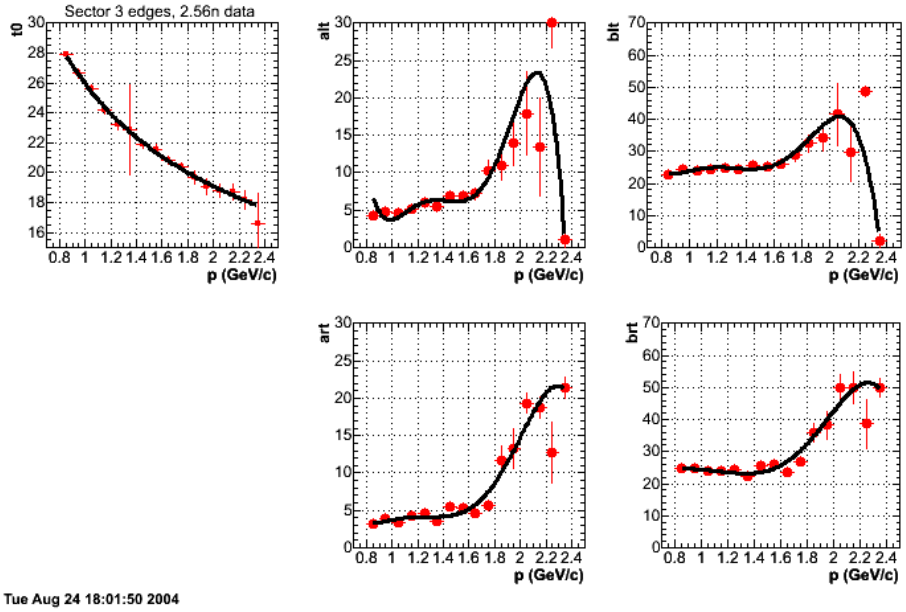


Mon Aug 23 16:38:40 2004

Fig 2. Plot of parameters from 2gen fits to sector 2 flat acceptance edges. Curves are fits to the edge positions. Blue points are excluded from the fit (see 2gen fit log entry for sector 2)

sector 3

```
+++++ t0  fit1 results 3, 0.8, 2.4, 25.9509 -0.442319
+++++ alt fit2 results 3, 0.8, 2.4, 1176.76 -4345.05 6285.33 -4435.51 1527.09 -204.919
+++++ blt fit3 results 3, 0.8, 2.4, 622.907 -2442.4 3858.74 -2953.13 1094.8 -157.028
+++++ art fit4 results 3, 0.8, 2.4, 152.299 -617.311 986.525 -758.092 279.634 -39.3261
+++++ brt fit5 results 3, 0.8, 2.4, 142.101 -526.46 921.221 -777.908 312.642 -47.195
```

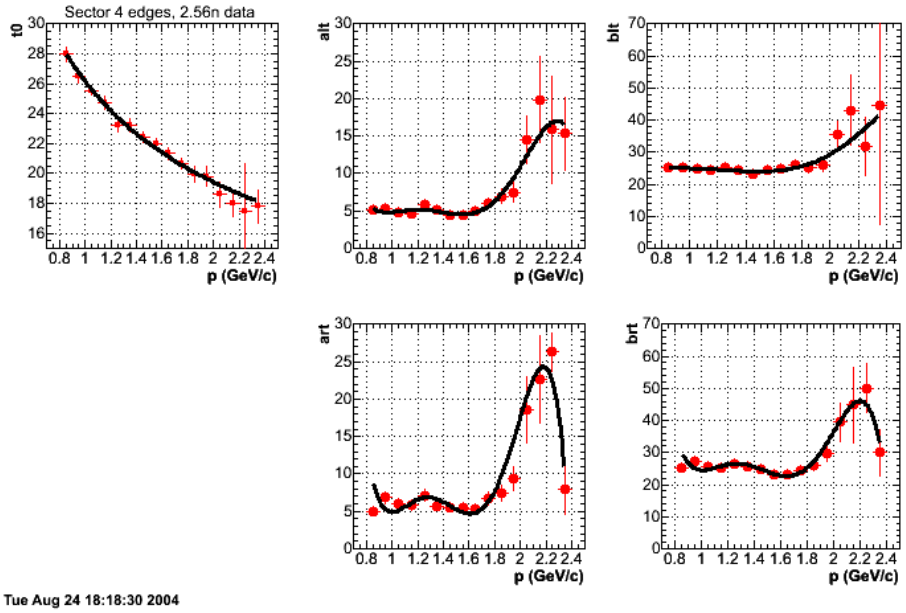


Tue Aug 24 18:01:50 2004

Fig 3. Plot of parameters from 2gen fits to sector 3 flat acceptance edges. Curves are fits to the edge positions.

sector 4

```
+++++ t0  fit1 results 4, 0.8, 2.4, 26.159, -0.429777
+++++ alt fit2 results 4, 0.8, 2.4, 1191.34, -4355.23, 6238.07, -4355.68, 1481.81, -196.327
+++++ blt fit3 results 4, 0.8, 2.4, 496.399, -1823.96, 2761.61, -2041.98, 735.833, -103.219
+++++ art fit4 results 4, 0.8, 2.4, 329.255, -1305.04, 2021.78, -1501.52, 534.119, -72.6746
+++++ brt fit5 results 4, 0.8, 2.4, 443.13, -1627.92, 2448.81, -1769.18, 611.749, -80.7525
```

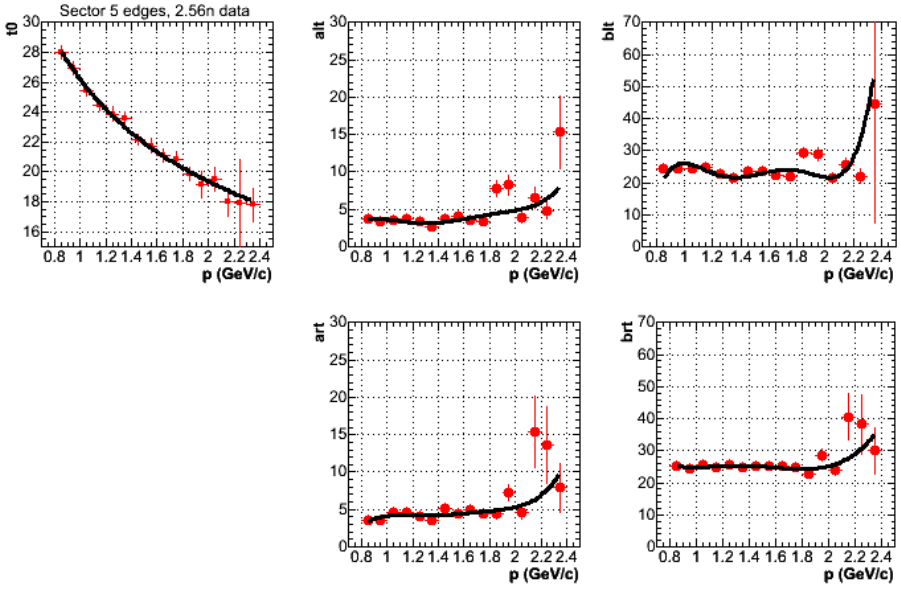


Tue Aug 24 18:18:30 2004

Fig 4. Plot of parameters from 2gen fits to sector 4 flat acceptance edges. Curves are fits to the edge positions.

sector 5

```
+++++ t0  fit1 results 5, 0.8, 2.4, 26.1886, -0.436065
+++++ alt fit2 results 5, 0.8, 2.4, -93.844, 361.737, -516.542, 355, -118.002, 15.2946
+++++ blt fit3 results 5, 0.8, 2.4, -1443.4, 5303.52, -7457.94, 5108.49, -1708.18, 223.524
+++++ art fit4 results 5, 0.8, 2.4, -112.181, 402.28, -546.646, 365.216, -120.154, 15.6332
+++++ brt fit5 results 5, 0.8, 2.4, 131.859, -362.326, 464.944, -278.843, 76.6113, -7.40082
```

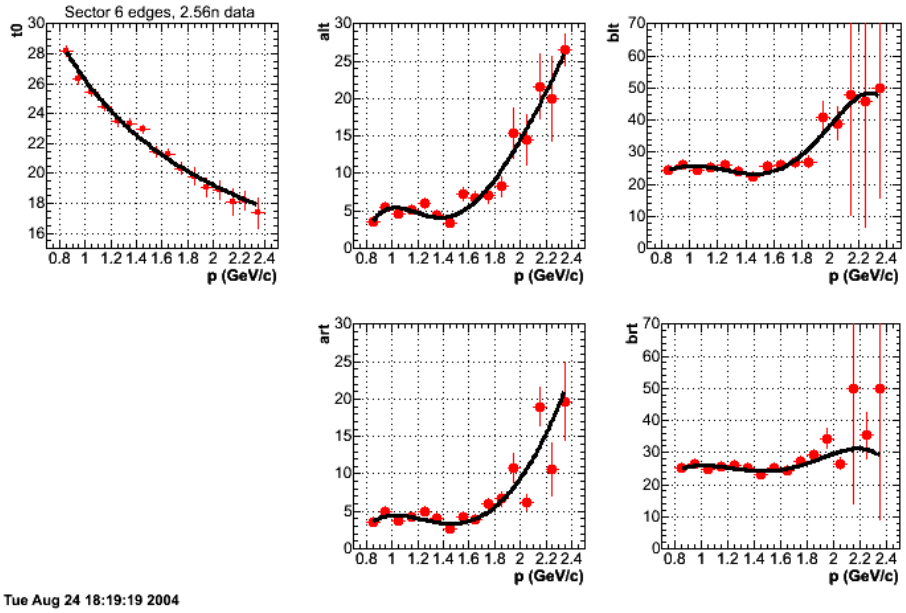


Tue Aug 24 18:14:12 2004

Fig 5. Plot of parameters from 2gen fits to sector 5 flat acceptance edges. Curves are fits to the edge positions.

sector 6

```
+++++ t0  fit1 results 6, 0.8, 2.4, 26.2421, -0.449056
+++++ alt fit2 results 6, 0.8, 2.4, -269.773, 896.671, -1115.78, 660.611, -186.963, 20.6433
+++++ blt fit3 results 6, 0.8, 2.4, 90.3752, -399.284, 814.454, -738.242, 304.424, -46.129
+++++ art fit4 results 6, 0.8, 2.4, -87.2291, 276.058, -309.028, 159.288, -38.3978, 3.77139
+++++ brt fit5 results 6, 0.8, 2.4, -65.696, 242.088, -201.502, 35.991, 22.1382, -7.02868
```



Tue Aug 24 18:19:19 2004

Fig 6. Plot of parameters from 2gen fits to sector 6 flat acceptance edges. Curves are fits to the edge positions.

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Jerry Gilfoyle's Enotebook page 11 - testing fiducial function (gpg)

[Modified Mon Aug 30 18:11:09 2004 (GMT) gpg]

The fiducial cuts described in entries 228, 234, 235, and 236 are tested below for the first time. The statistics are very limited because the fileserver is busted and I am waiting for a replacement.

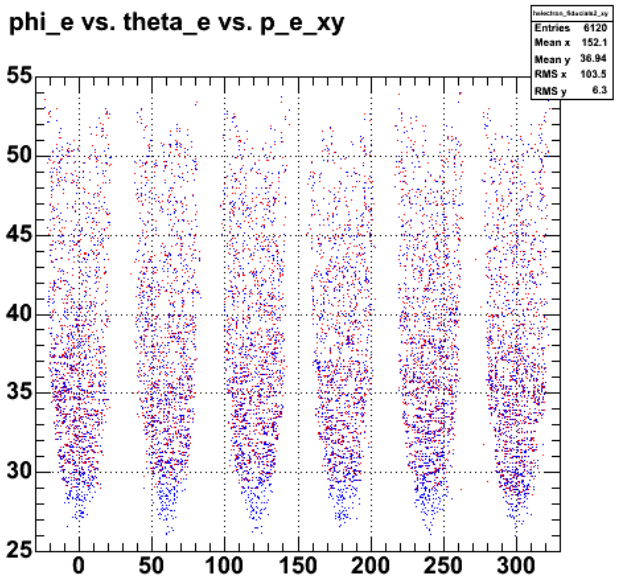

Fig 1. Testing new 2.56n electron fiducial cut.

The C++ routine is shown below.

```
Int_t eod5::DPelectron_fiducial_cut26n(float Phi_curr, float P_curr, float theta_e)
{
// This function may be called from Loop. it returns 1 if the electron theta and phi
// lie within the fiducial volume. it returns  0 otherwise.
//
// inputs.
int   sector, good_p, good_phi;
float t0, alt, blt, art, brt, theta_curr, pmin, pmax, phi_min, phi_max;

// read in the 3gen fit parameters.

float t0_pars[6][5] = {
    1, 0.8, 2.4, 26.9529, -0.406995,
    2, 0.8, 2.2, 26.9709, -0.439026,
    3, 0.8, 2.4, 25.9509, -0.442319,
    4, 0.8, 2.4, 26.159, -0.429777,
    5, 0.8, 2.4, 26.1886, -0.436065,
    6, 0.8, 2.4, 26.2421, -0.449056
};
float alt_pars[6][9] = {
    1, 0.8, 2.4, 202.566, -789.376, 1208, -891.092, 315.927, -42.9012,
    2, 0.8, 2.2, 410.15, -1544.19, 2276.47, -1631.86, 568.726, -76.9783,
    3, 0.8, 2.4, 1176.76, -4345.05, 6285.33, -4435.51, 1527.09, -204.919,
    4, 0.8, 2.4, 1191.34, -4355.23, 6238.07, -4355.68, 1481.81, -196.327,
    5, 0.8, 2.4, -93.844, 361.737, -516.542, 355, -118.002, 15.2946,
    6, 0.8, 2.4, -269.773, 896.671, -1115.78, 660.611, -186.963, 20.6433
};

float blt_pars[6][9] = {
    1, 0.8, 2.4, 1181.93, -4284.25, 6159.59, -4299.17, 1454.41, -190.44,
    2, 0.8, 2.2, 582.883, -2091.74, 3024.01, -2120.84, 721.187, -94.8598,
    3, 0.8, 2.4, 622.907, -2442.4, 3858.74, -2953.13, 1094.8, -157.028,
    4, 0.8, 2.4, 496.399, -1823.96, 2761.61, -2041.98, 735.833, -103.219,
    5, 0.8, 2.4, -1443.4, 5303.52, -7457.94, 5108.49, -1708.18, 223.524,
    6, 0.8, 2.4, 90.3752, -399.284, 814.454, -738.242, 304.424, -46.129
};

float art_pars[6][9] = {
    1, 0.8, 2.4, -178.338, 673.044, -985.612, 714.878, -257.858, 37.1169,
    2, 0.8, 2.2, 757.973, -2504.3, 3148.82, -1857.28, 507.068, -49.7835,
    3, 0.8, 2.4, 152.299, -617.311, 986.525, -758.092, 279.634, -39.3261,
    4, 0.8, 2.4, 329.255, -1305.04, 2021.78, -1501.52, 534.119, -72.6746,
    5, 0.8, 2.4, -112.181, 402.28, -546.646, 365.216, -120.154, 15.6332,
    6, 0.8, 2.4, -87.2291, 276.058, -309.028, 159.288, -38.3978, 3.77139
};
```

```
float brt_pars[6][9] = {
    1, 0.8, 2.4, -495.102, 2052.09, -3184.58, 2431.64, -915.253, 135.911,
    2, 0.8, 2.2, 746.711, -2305.67, 2740.33, -1470.47, 334.231, -20.4888,
    3, 0.8, 2.4, 142.101, -526.46, 921.221, -777.908, 312.642, -47.195,
    4, 0.8, 2.4, 443.13, -1627.92, 2448.81, -1769.18, 611.749, -80.7525,
    5, 0.8, 2.4, 131.859, -362.326, 464.944, -278.843, 76.6113, -7.40082,
    6, 0.8, 2.4, -65.696, 242.088, -201.502, 35.991, 22.1382, -7.02868
};

float phimid[6]={-0.3, 60.6, 121.4, 179.9, 240.2, 300.5};

// rescale the phi angle to match the choice of coordinates. the input angle phi
// should be in degrees and cover the range -180 -> 180 degrees. this is what you
// get if you calculate the angle using the atan2 function in C++ and then convert
// to degrees. the range used in this routine is -30 -> 330 degrees.

if (Phi_curr < -30.0) {
     Phi_curr = Phi_curr + 360.0;
}

// get the sector.

sector = get_sector_deg(Phi_curr);

// reset the logicals.

good_p = 0;
good_phi = 0;

theta_curr = theta_e;

// calculate the fit parameter for the 2gen fit for this momentum and sector.

t0 = t0_pars[sector-1][3]*pow(P_curr,t0_pars[sector-1][4]);
alt = alt_pars[sector-1][3] + alt_pars[sector-1][4]*P_curr + alt_pars[sector-1][5]*pow(P_curr,2) +
  alt_pars[sector-1][6]*pow(P_curr,3) + alt_pars[sector-1][7]*pow(P_curr,4) + alt_pars[sector-1][8]*pow(P_curr,5);
blt = blt_pars[sector-1][3] + blt_pars[sector-1][4]*P_curr + blt_pars[sector-1][5]*pow(P_curr,2) +
  blt_pars[sector-1][6]*pow(P_curr,3) + blt_pars[sector-1][7]*pow(P_curr,4) + blt_pars[sector-1][8]*pow(P_curr,5);
art = art_pars[sector-1][3] + art_pars[sector-1][4]*P_curr + art_pars[sector-1][5]*pow(P_curr,2) +
  art_pars[sector-1][6]*pow(P_curr,3) + art_pars[sector-1][7]*pow(P_curr,4) + art_pars[sector-1][8]*pow(P_curr,5);
brt = brt_pars[sector-1][3] + brt_pars[sector-1][4]*P_curr + brt_pars[sector-1][5]*pow(P_curr,2) +
  brt_pars[sector-1][6]*pow(P_curr,3) + brt_pars[sector-1][7]*pow(P_curr,4) + brt_pars[sector-1][8]*pow(P_curr,5);

// calculate the maximum and minimum phi values for this theta. see entries 288, 235, 236 in
// E5 elog.

phi_max = phimid[sector-1] + blt*(1 - (1/(1+((theta_curr-t0)/alt))));
phi_min = phimid[sector-1] - brt*(1 - (1/(1+((theta_curr-t0)/art))));

// get the applicable momentum range.

pmin = t0_pars[sector-1][1];
pmax = t0_pars[sector-1][2];

// see if it fits.

 if (P_curr > pmin && P_curr < pmax) {
   good_p = 1;
 }

 if (Phi_curr > phi_min && Phi_curr < phi_max) {
   good_phi = 1;
 }

 // keep it or throw it out.

 if (good_p > 0 && good_phi > 0) {
     return 1;
 }
 else {
     return 0;
 }
}
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 12 - SJ calculations at 12 GeV (GPG)

[Modified Sat Jul 23 16:57:06 2011 (GMT) GPG]

As a first look at things at 12 GeV, I have used Sabine's code to calculate rtlp, the response function associated with ALTp at 'low' quasielastic kinematics (E=2.56 GeV, Q2=1.0 GeV2) and 'high' kinematics (E=12 GeV, Q2 = 10 GeV2). There is a decrease in rtlp of about a factor of 10 or so. this may mean that measuring ALTp may not be feasible after the upgrade. It will depend on the actual increase in the luminosity that CLAS++ can handle.

It's worth noting a surprise for me. The RL response rl is large as expected, but rt is small and rtl is very large. I expected rt to be comparable to rl and rtl to be small. Do we understand this???

Also SJ seemed to imply in our phone conversation that rl and rt should not drop much at the higher Q2, but in these plots they high-Q2 ones are smaller by a factor of 20??

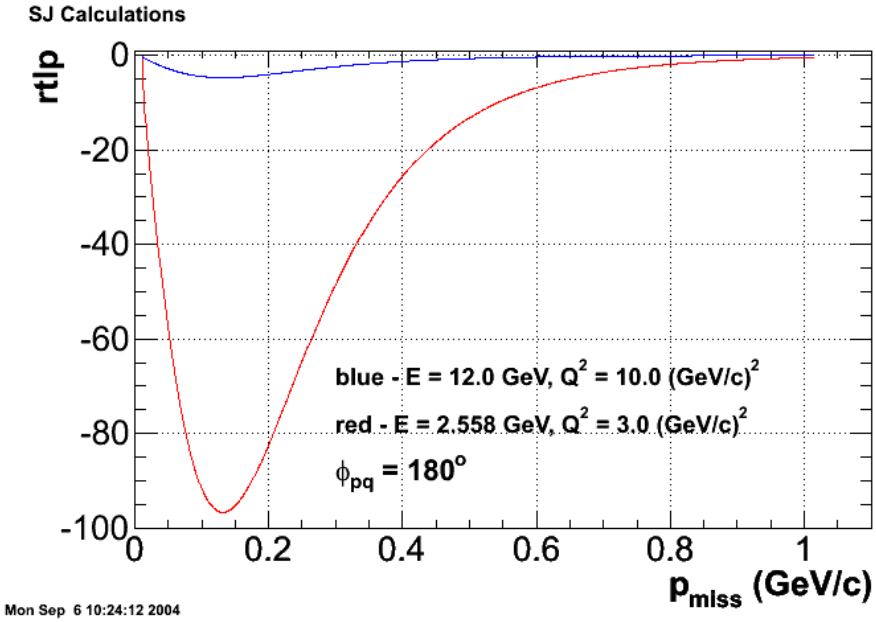

Fig 1. Comparison of rtlp from Sabine at different kinematics.

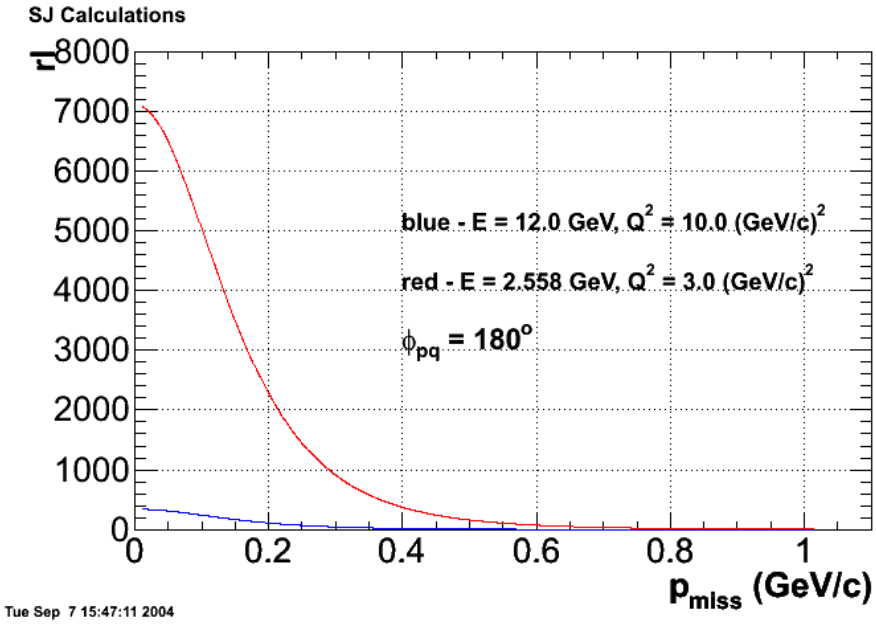

Fig 2. Comparison of rtlp from Sabine at different kinematics.

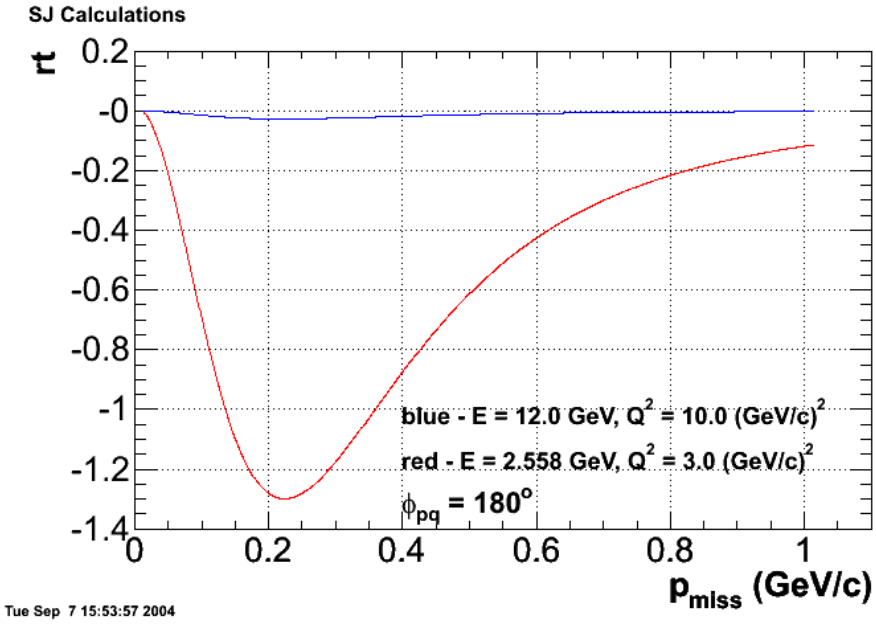

Fig. 3. Comparison of rt from SJ at different kinematics.

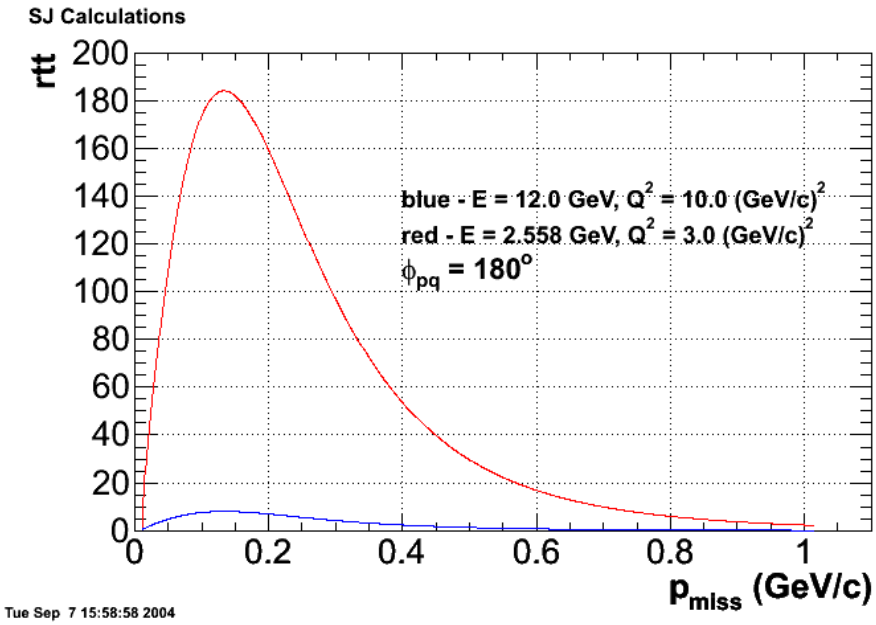

Fig 4. Comaprison of rtt from SJ at different kinematics.

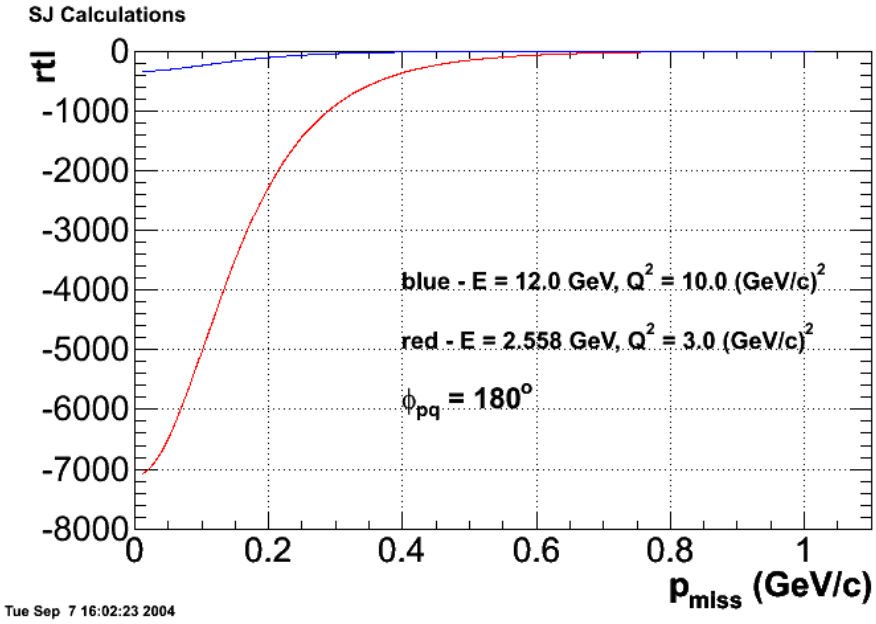

Figure 5. Comparison of rtl by SJ at different kinematics.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 13 - Momentum corrections (gpg)

[Modified Sun Sep 12 23:06:19 2004 (GMT) gpg]

The plots below show something very odd that I just stumbled upon. The plot of W for the first 100,000 events for run 24366 are very screwed up. See figure 1. When I analyze more events, things look much better. See Figures 2 and 3. What's going on?

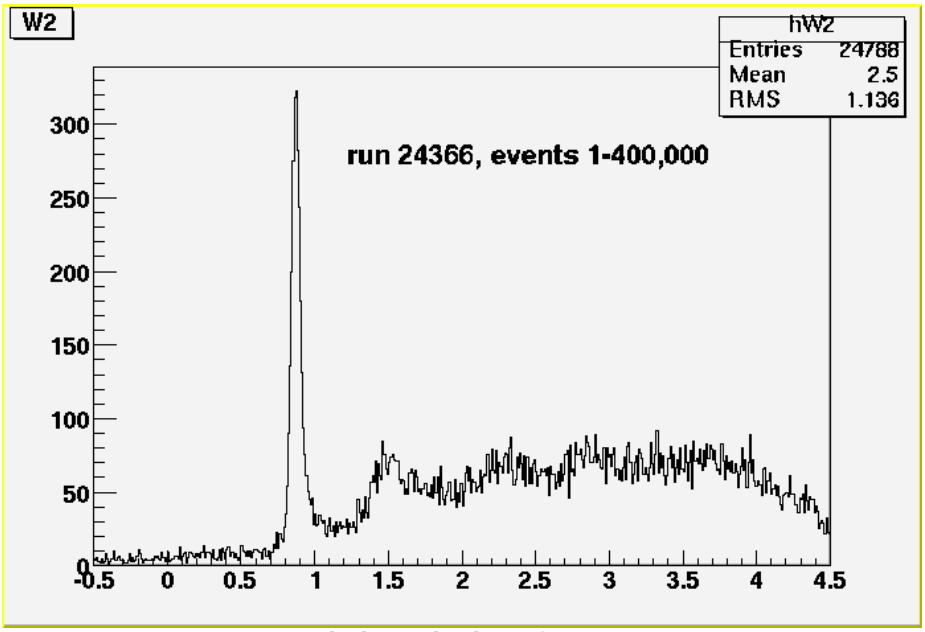

Fig 1. Checking W distribution for ep events.

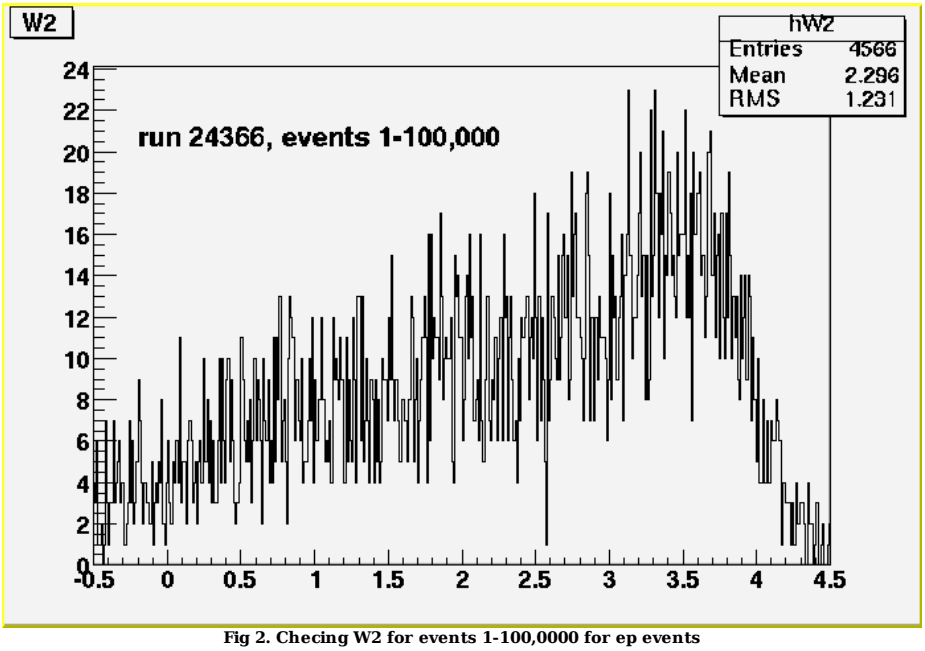

Fig 2. Checing W2 for events 1-100,0000 for ep events

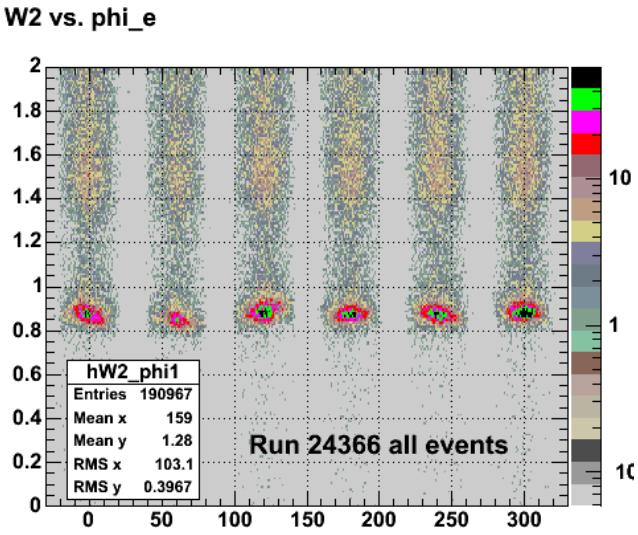

Fig 3. W^2 for run 24366 versus phi_e.

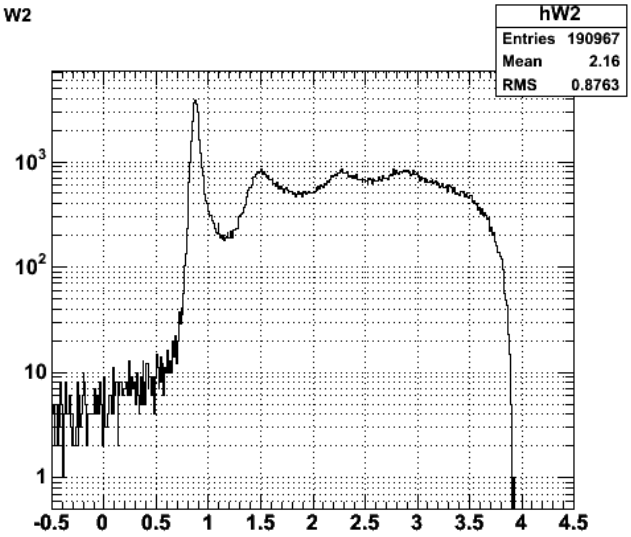

Fig 4. W^2 for all events for ep elastics.

Below is the result of fitting the proton peak in the W2 peak sector by sector.

Click here to view the object (Fig. 5. Plot of fits and parameters for W^2 sector by sector) you uploaded.

Click here to view the object (Root macro to make fits to W2 sector by sector) you uploaded.

Click here to view the object (root file with initial results from run 24366) you uploaded.

hhhmmmmm! the input file for the runs above is

```
pscm1:ep1> more data_filenames.dat
/pscr1/gilfoyle/data/clas_024035.a01.b00.root  <--- What's this??!!
/pscr1/gilfoyle/data/clas_024366.a01.b00.root
/pscr1/gilfoyle/data/clas_024366.a01.b01.root
/pscr1/gilfoyle/data/clas_024366.a05.b00.root
/pscr1/gilfoyle/data/clas_024366.a05.b01.root
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/pscr1/gilfoyle/data/clas_024366.a10.b01.root
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/pscr1/gilfoyle/data/clas_024366.a11.b01.root
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/pscr1/gilfoyle/data/clas_024366.a12.b01.root
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/pscr1/gilfoyle/data/clas_024366.a15.b00.root
```

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/pscr1/gilfoyle/data/clas_024366.a2.b00.root
/pscr1/gilfoyle/data/clas_024366.a3.b00.root
/pscr1/gilfoyle/data/clas_024366.a3.b01.root
/pscr1/gilfoyle/data/clas_024366.a7.b00.root
/pscr1/gilfoyle/data/clas_024366.a7.b01.root
/pscr1/gilfoyle/data/clas_024366.a8.b00.root
/pscr1/gilfoyle/data/clas_024366.a8.b01.root
/pscr1/gilfoyle/data/clas_024366.a9.b00.root
/pscr1/gilfoyle/data/clas_024366.a9.b01.root
pscm1:epl>
```

results for calculation of momentum corrections.

Click here to view the object (stuff for alpha calculation) you uploaded.

Click here to view the object (first attempts at alpha) you uploaded.

Click here to view the object (alpha for full run 24366) you uploaded.

Click here to view the object (root output file for rull run 24366) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 14 - Momentum corrections 2 (gpg)

[Modified Wed Sep 29 20:32:39 2004 (GMT) gpg]

First pass at momentum corrections using the JLb method. Plot below shows very little effect due to momentum corrections (at least it's not worse). Data are from run 24366.

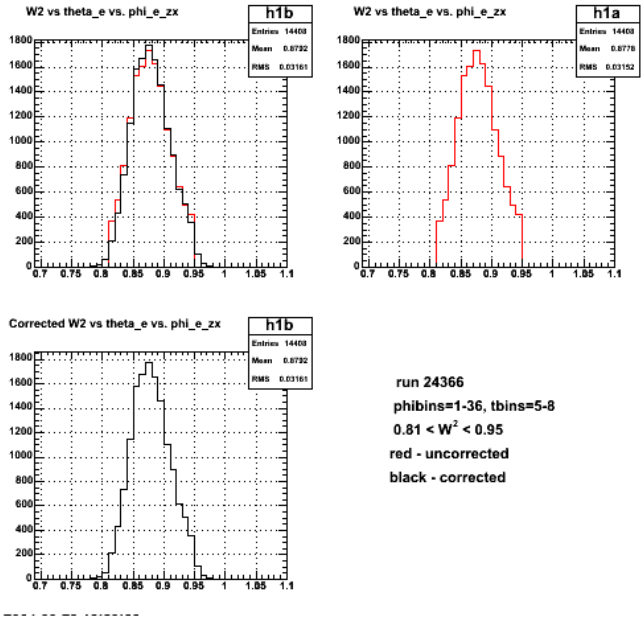


Fig. 1 Comparison of W^2 distribution for corrected and uncorrected electron momentum.

Before and after comparison for tbins=5-8.

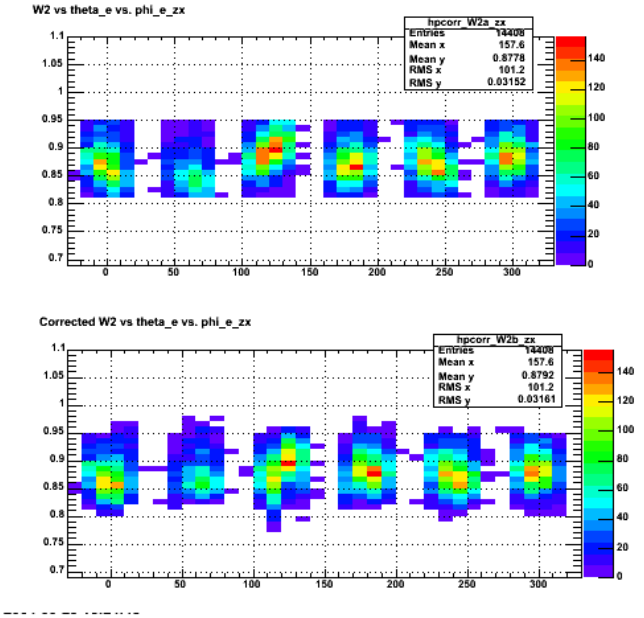
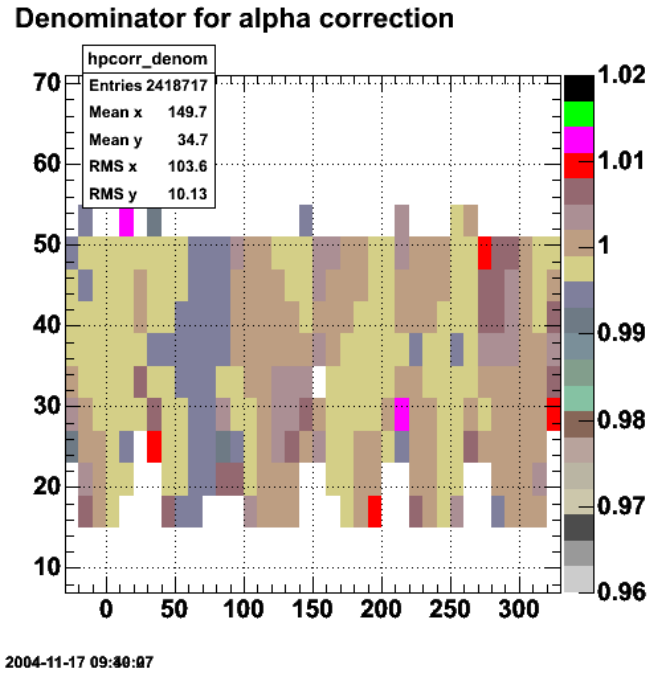


Fig 2. W^2 versus phi_e for theta bins=5-8 (theta = 27-43).

DOE 2000 Electronic Notebook

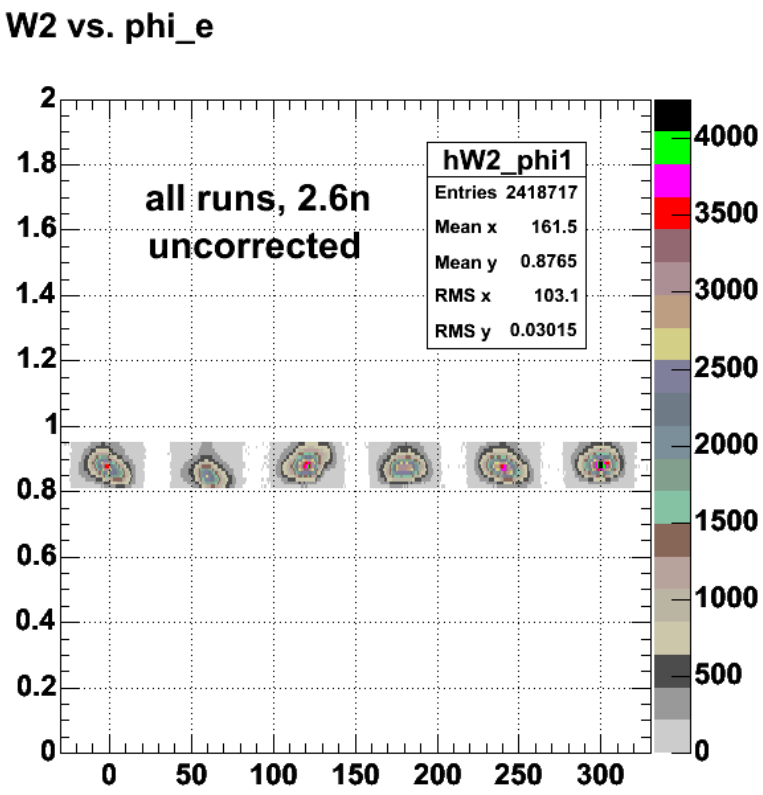
Jerry Gilfoyle's Enotebook page 15 - Momentum corrections 3 (gpg)

[Modified Wed Feb 16 01:59:41 2005 (GMT) gpg]



2004-11-17 09:30:07

Fig 1. Alpha for 2.6n.



2004-11-17 11:25:36

Fig 2. W^2 versus phi for the uncorrected electron momentum.

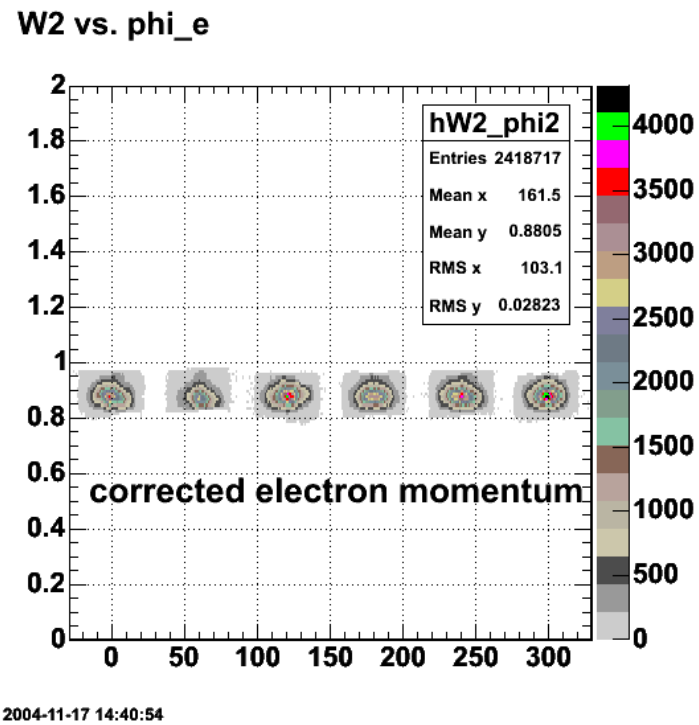


Fig 3. W^2 versus phi for the corrected electron momentum.

PS plot here of W2 proton peak for corrected electron momentum sector-by-sector.

PS plot here f W2 proton peak for uncorrected electron momentum sector-by-sector.

The improvement in the position and width of the elastic peak is shown in the table below sector by sector. The fourth column (labelled %diff) is the percentage difference between the 'after' centroid and the expected value. For comparison I also show Jeff's results that he obtained previously from the same analysis. The two analyses agree within a fraction of a percent. The final column shows the percent difference between the improved centroids for Jeff and me.

Sector	centroid (0.8804 expected)			JL centroid		
	before	after	%diff	before	after	%diff(JL-GPG)
1	0.8682	0.8790	0.16	0.8731	0.8784	0.07
2	0.8355	0.8767	0.42	0.8323	0.8697	0.80
3	0.8940	0.8808	0.05	0.8819	0.8838	0.34
4	0.8711	0.8791	0.15	0.8669	0.8763	0.32
5	0.8729	0.8793	0.12	0.8606	0.8734	0.67
6	0.8850	0.8807	0.03	0.8766	0.8809	0.02

Average improvement in the W^2 peak position is only about 1%, but sector 2 improves by about 5%.

Sector	width	
	before	after
1	0.03557	0.02789
2	0.04839	0.02699
3	0.03346	0.02800
4	0.03126	0.02781
5	0.03332	0.02870
6	0.03006	0.02957

Average improvement in the width of proton peak in the W^2 spectrum is about 20%.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 16 - recent ALTp results (gpg)

[Modified Wed Nov 24 17:09:10 2004 (GMT) gpg]

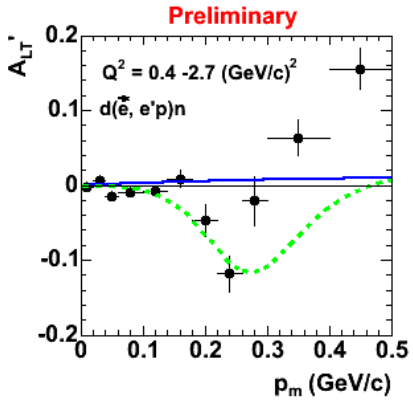


Fig 1. ALTp for 2.6n, all Q^2

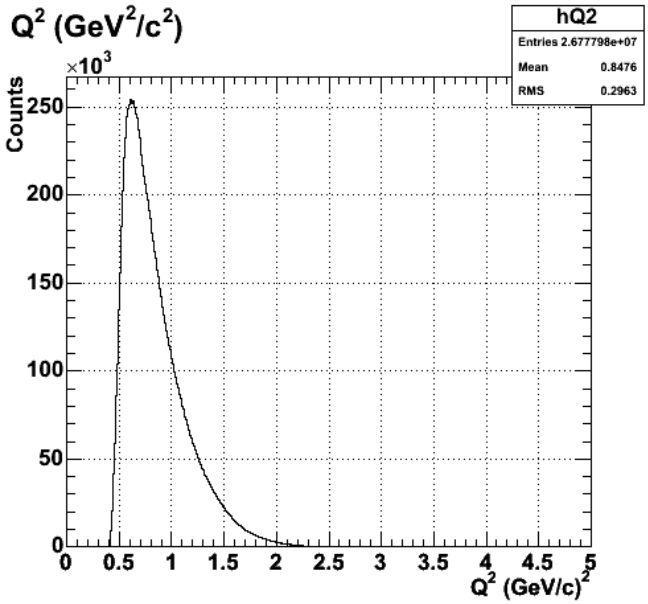


Fig 2. Q^2 distribution for ALTp in Figure 1.

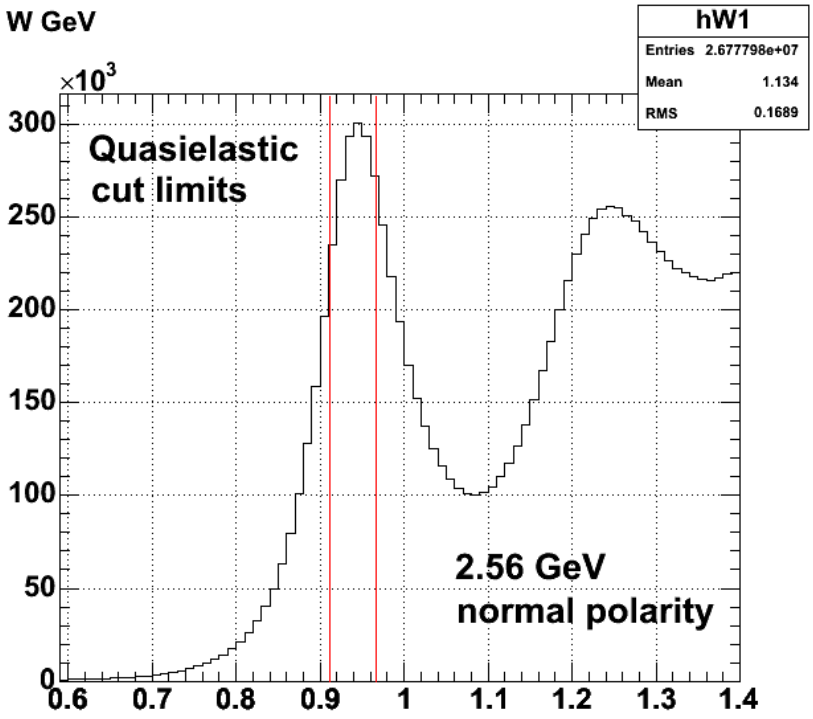


Fig 3. Quasielastic cut applied to ALTp in Figure 1.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 17 - ALTp with and without electron fiducial cuts at 2.6n (gpg)

[Modified Wed Jan 11 01:23:11 2006 (GMT) gpg]

Below is a comparison of ALTp averaged over the full Q^2 range for the 2.56, normal-polarity run. The black points are from the analysis with the new electron fiducial cuts described here and the new momentum corections. The red points have the new fiducial cuts turned off and the new momentum correctins turned on. It is disturbing that the two significant excursion from zero in ALTp with the new fiducial cuts disappear when the new cuts are turned off.

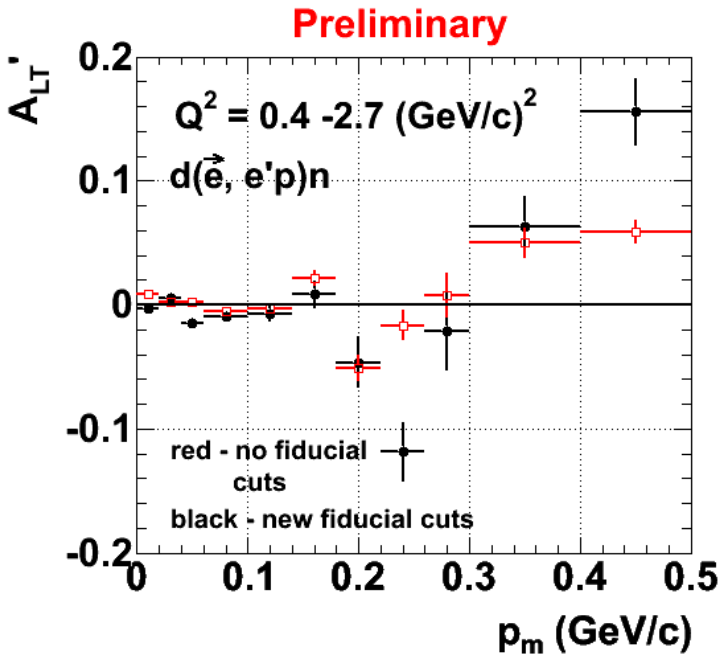


Fig 1. Comparison of A_{LT}' with (black) and without (red) the latest electron fiducial cuts.

To view the Root file used to create the above plot, click here.

The plot below shows the same stuff as above, but now I include A_{LT}' with no momentum corrections and no electron fiducial cuts. surprisingly, this looks the best. It is small for p_m close to zero, the third bin isn't way below the adjacent bins, the eigth bin isn't way below its neighbors, and it's consistent with the no electron fiducial cuts plus new momentum corrections at the other points. Why did I even bother???!! This is a mystery to me.

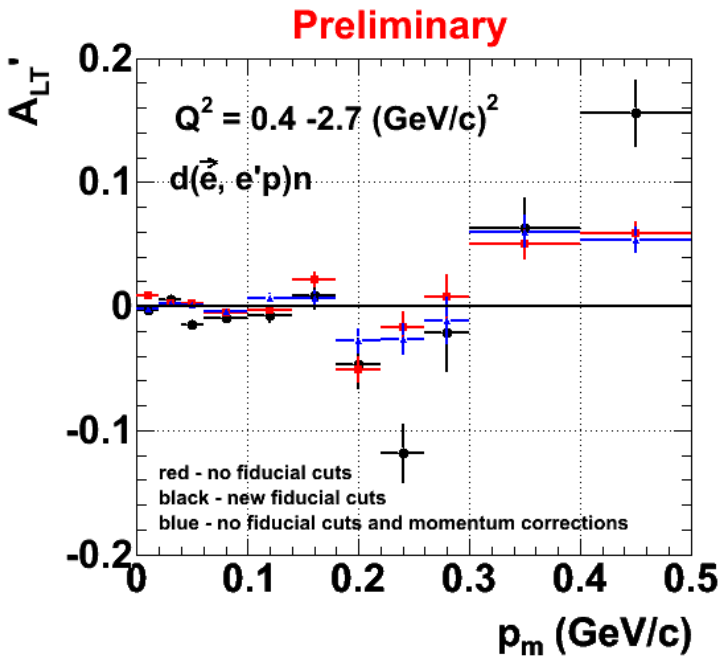


Fig 2. Same as Figure 1 with the momentum corrections off and electron fiducials off.

Now look at turning the new fiducial cuts on with the momentum corrections off.

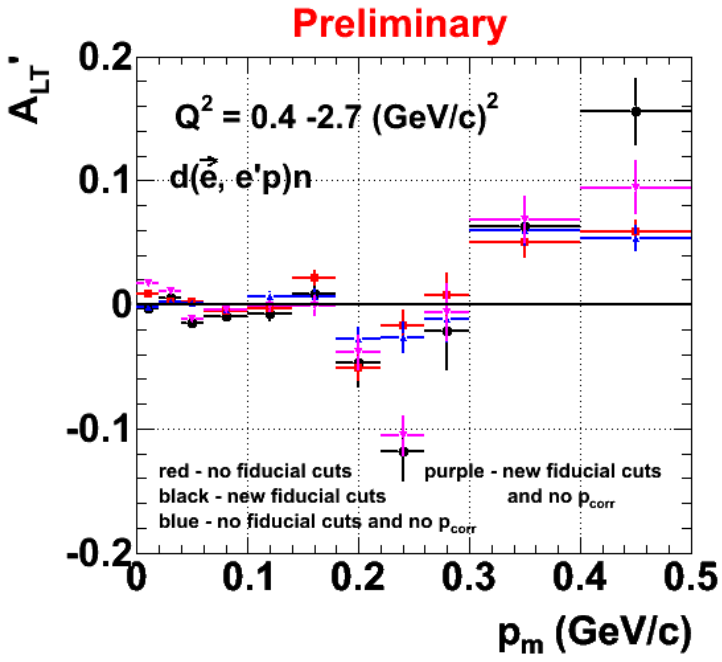


Fig 3. Same as Figure 2 with purple points for new fiducial cuts on and momentum corrections off.

The plot below shows A_{LT}' for a variety of conditions. The Root macro to create the plot is here. I have started looking at the dependence on the cut defining a quasielastic event. The original cut for the plots above was $0.912 < W < 0.966$. In the results shown below for the expanded quasielastic cuts low means $W > 0.80$ and high means $W < 1.0$.

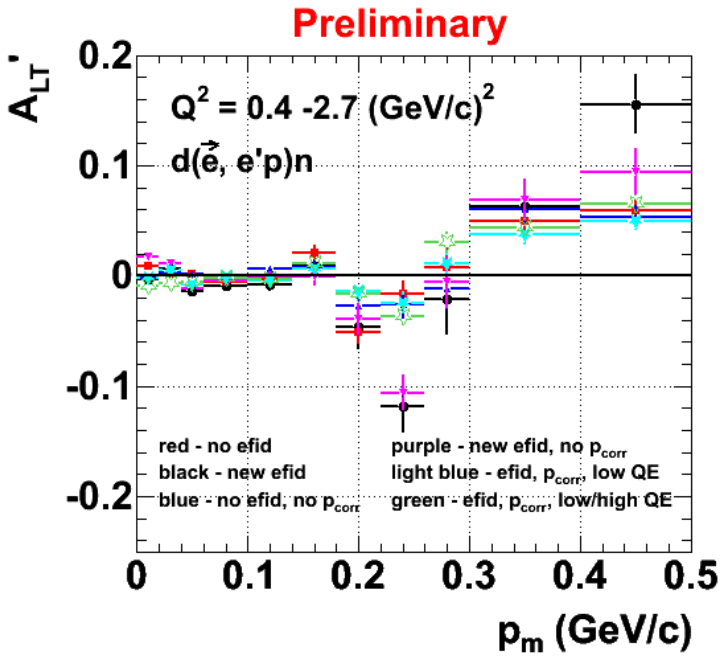


Fig 4. More comparisons of ALTp with different cuts.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 18 - ALTp comparison with different Quasielastic cuts (gpg)

[Modified Wed Dec 1 16:20:34 2004 (GMT) gpg]

The plot below shows a comparison of ALTp for different W cuts to define quasielastic events. The original cut for the plots above was 0.912 < W < 0.966. In the results shown below for the expanded quasielastic cuts low means W > 0.80 and high means W < 1.0. What is mysterious to me is the large dip at p_m=0.24 GeV/c for a narrow W cut which largely disappears when the W cut is lowered. This surprises me because I made the QE cut narrow to get above any background leaking in from the resonance region. I though letting the QE cut extend to lower W would not contaminate the QE events. Does the background from the resonance region extend down that far in W?

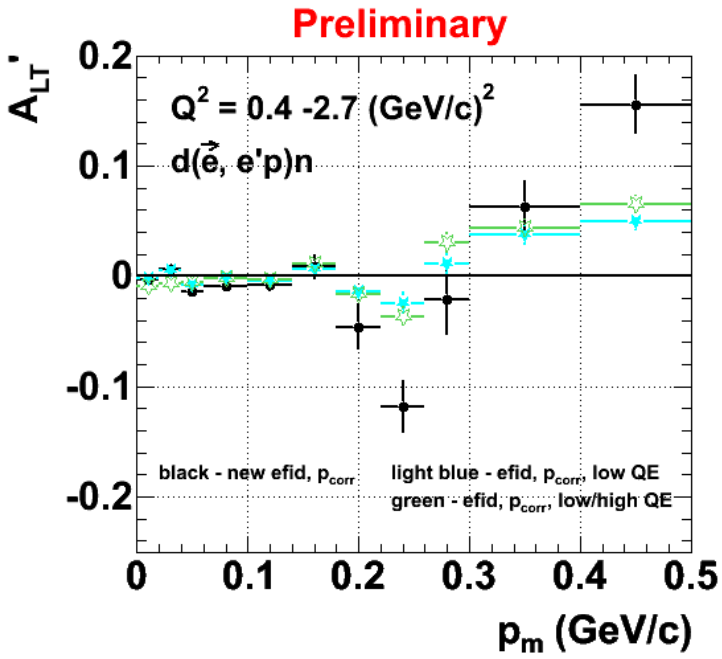


Fig 1. Comparison of ALTp using different W cuts to define quasielastic events.

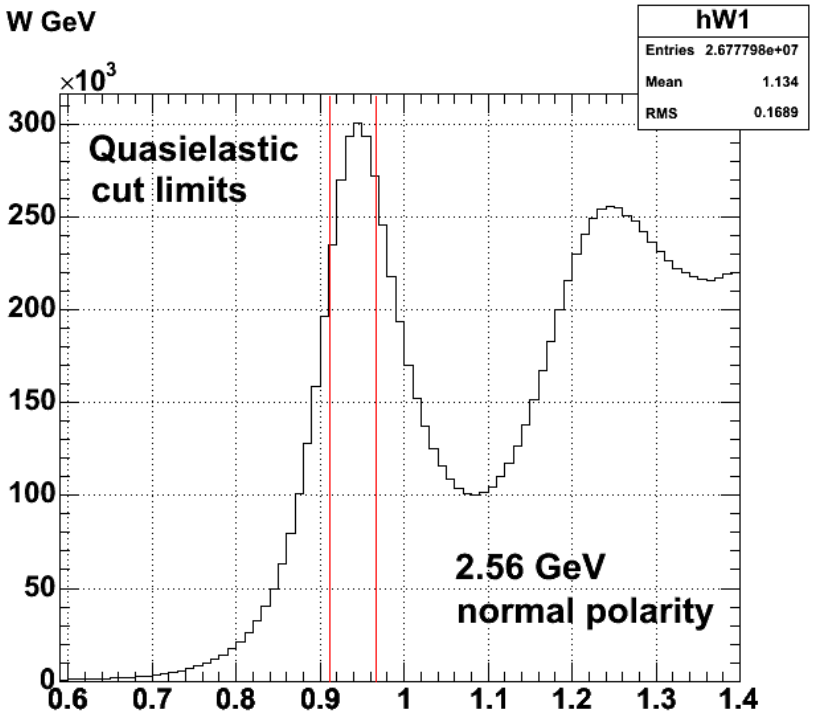


Fig. 2 W spectrum for 2.56n run. Red lines show original, tight W cut for defining quasielastic events.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 19 - selecting QE events (gpg)

[Modified Thu Dec 9 13:28:43 2004 (GMT) gpg]

Some plots below to improve quasielastic event selection. Since I'm now using a wide Q2 bin, i need to think about more careful selection of QE events. My first thought would be to apply a coplanarity cut to the data since the proton and neutron should come out in the same plane.

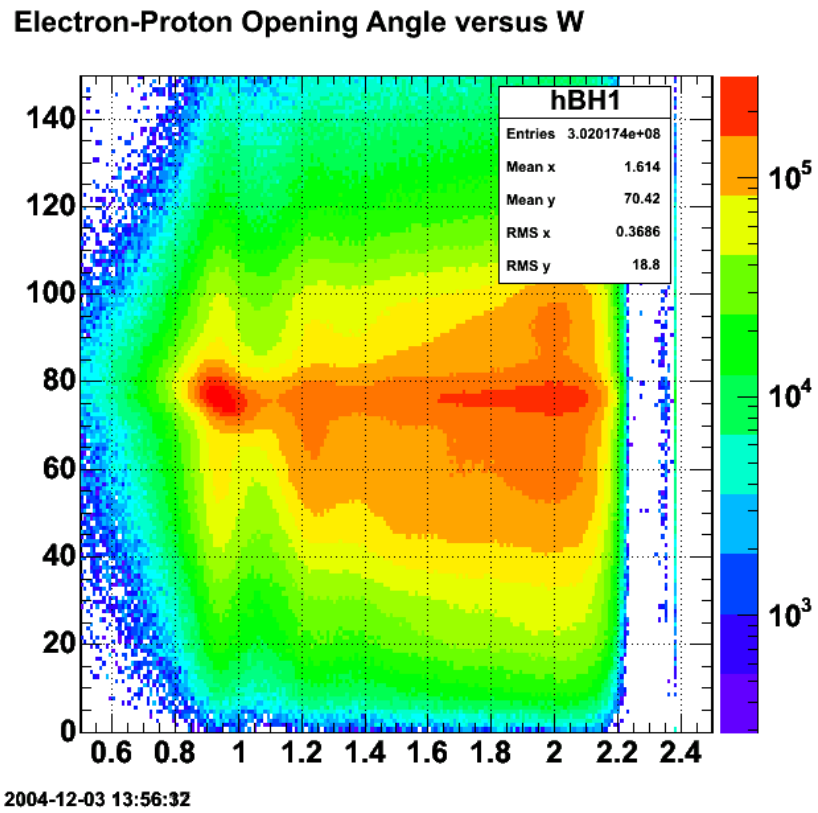


Fig 1. Electron-proton opening angle.

Plot below shows the effect of adding a cut on the angle between the virtual photon 3-momentum and the 3-momentum of the ejected proton. This is the cut Jeff uses on the Gmn analysis. The points beyond p_m ~ 0.22 GeV/c have very large asymmetry, but also huge uncertainties.

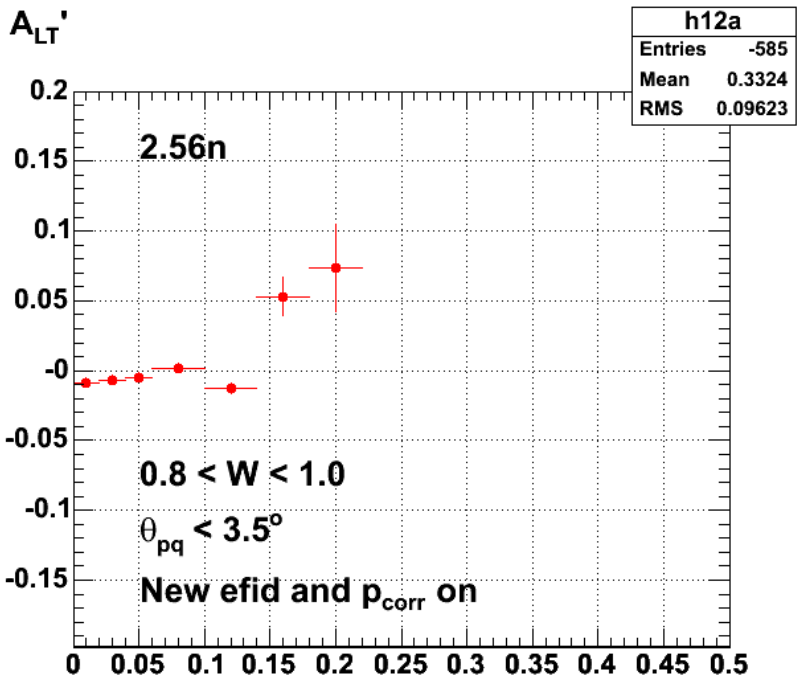


Fig 2. ALTp with an aiddition cut on the angle between the virtual photon and the ejected proton.

Results for plot below are in QEcut1.root.

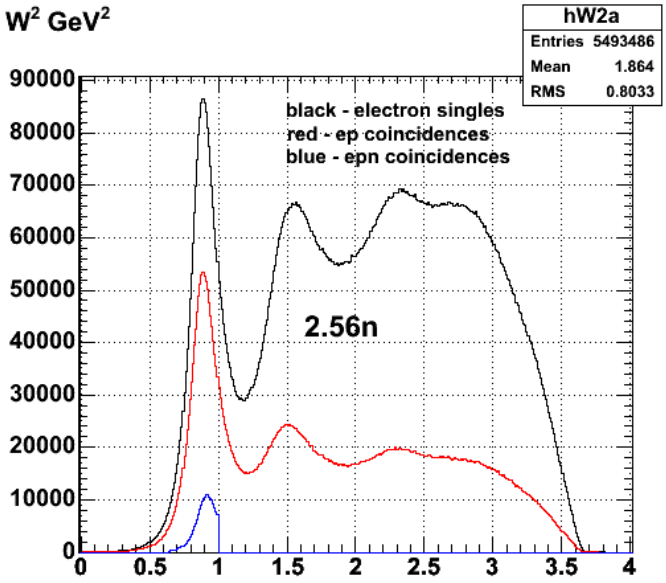


Fig 3. Effect of different cuts on the W^2 spectrum.

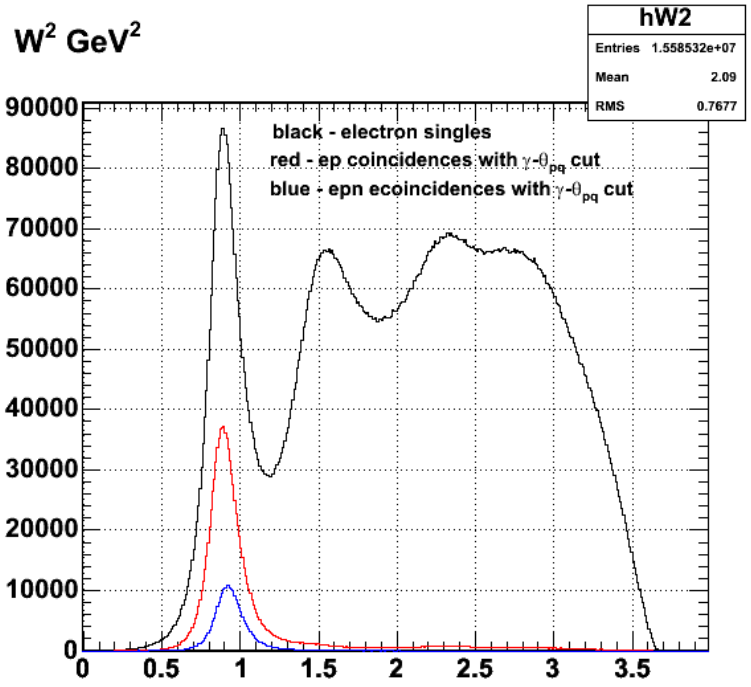


Fig 4. Test of effect of gamma-theta_pq cut.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 20 - More tests of efid and pcorr (gpg)

[Modified Wed Dec 15 16:28:20 2004 (GMT) gpg]

More tests of the new electron fiducial cuts and electron momentum corrections. These are based on the quasielastic cut 0.8 GeV2 < W < 1.0 GeV2.

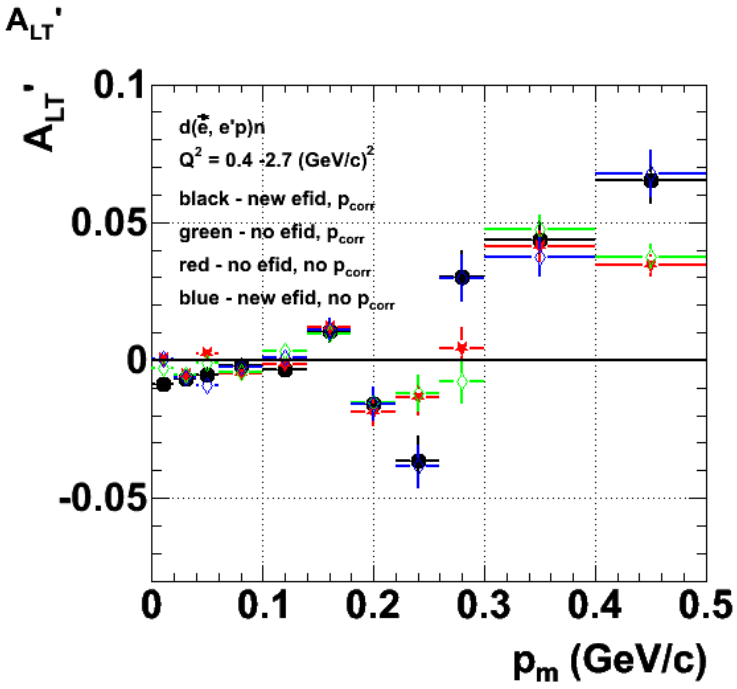


Fig 1. Comparison of ALTp for different sets of cuts and corrections.

Root file to produce the plot above is here .

WKB suggests looking at the changes in ALTp across the quasielastic peak in the W spectrum. The first such plot is shown below for a W bin 1.00-1.04 GeV. The statistics are bad so use a bigger bin next time.

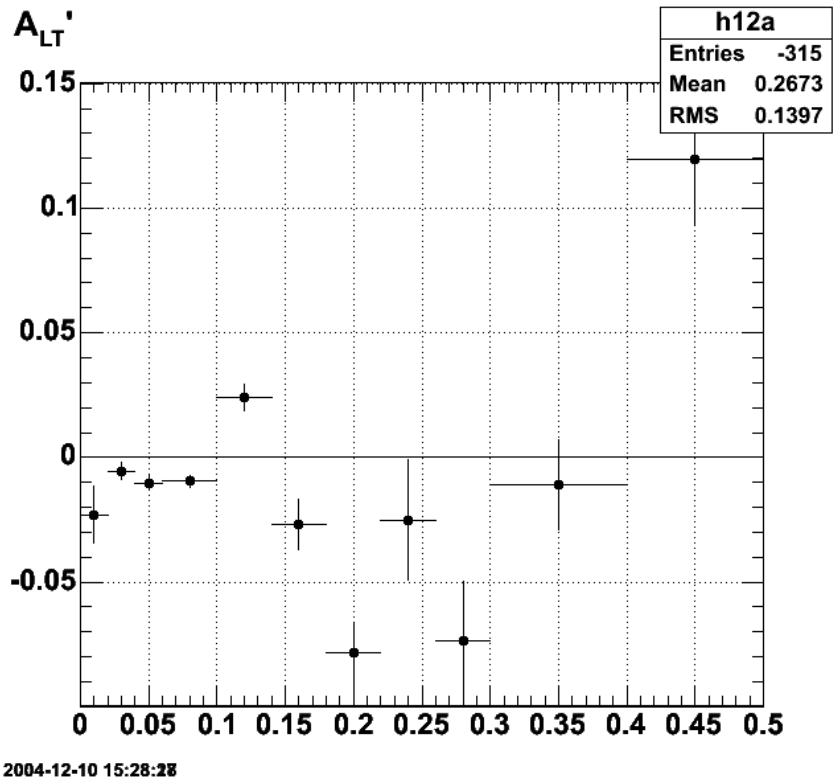


Fig 2. ALTp with p_{corr} and efid both turned on and the quasielastic cut is defined at 1.0 < W < 1.04.

A C++ file with the data in it is here.

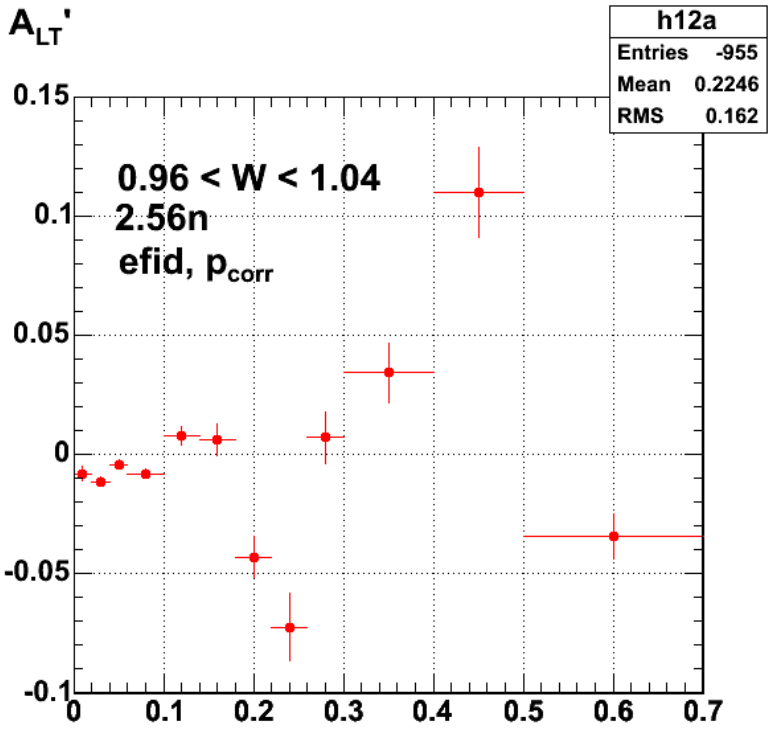


Fig 3. ALTp for 0.96<1.04 with efid and pcorr on.

Click here to get a C++ file for Root for Fig 3.

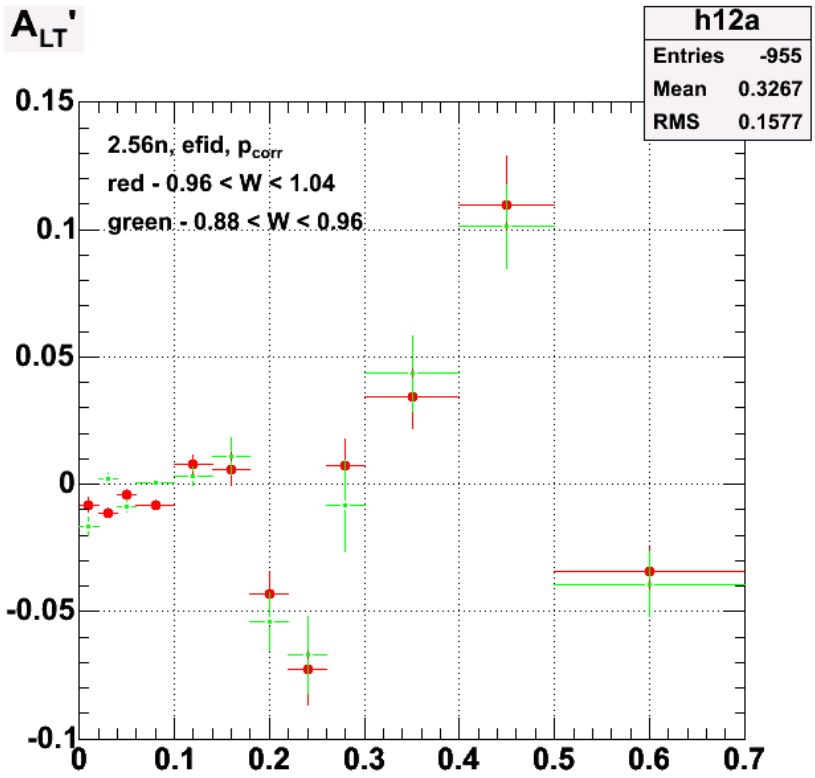


Fig 4. Updated version of previous figure.

Click here to get a C++ file to make the above plot in Root.

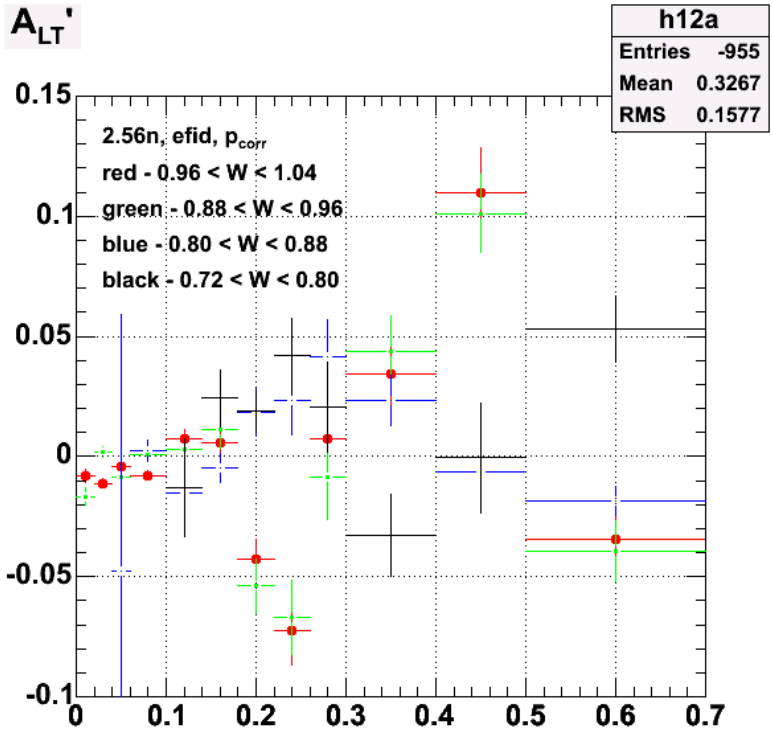


Fig 5. More of the same.

Click here to get a Root C++ macro file for the plot above.

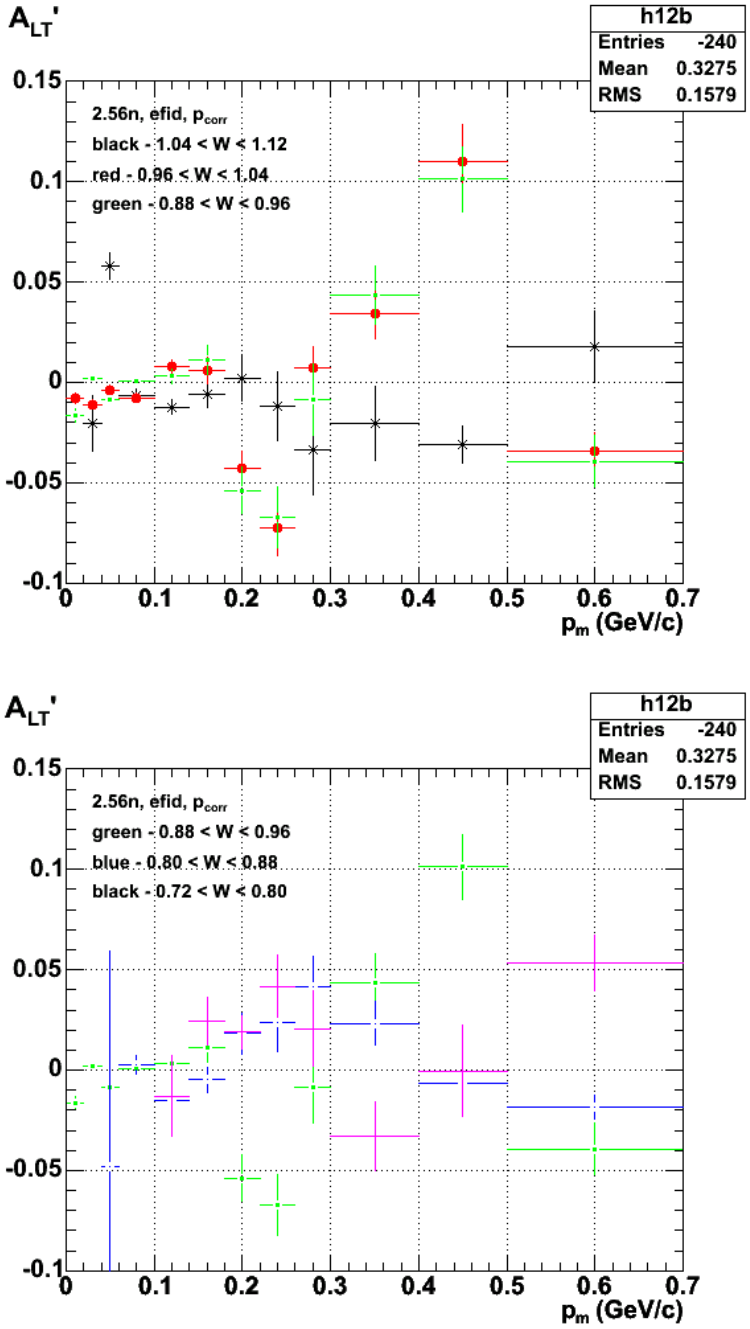


Fig 6. ALTp across the proton peak in the W spectrum plus a high and a low W bin.

Click here to get the C++ Root macro used to make the above plot.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 21 - high ALTp point for 1.04 < W < 1.12 (gpg)

[Modified Fri Dec 17 15:21:41 2004 (GMT) gpg]

There is an anomalously high value of ALTp for the 1.04<1.12 spectrum that is worth investigating. The figure below shows the sin(phi_pq) weighted spectra for positive and negative helicities. Notice the high point in the third p_m bin for the positive helicity spectrum.

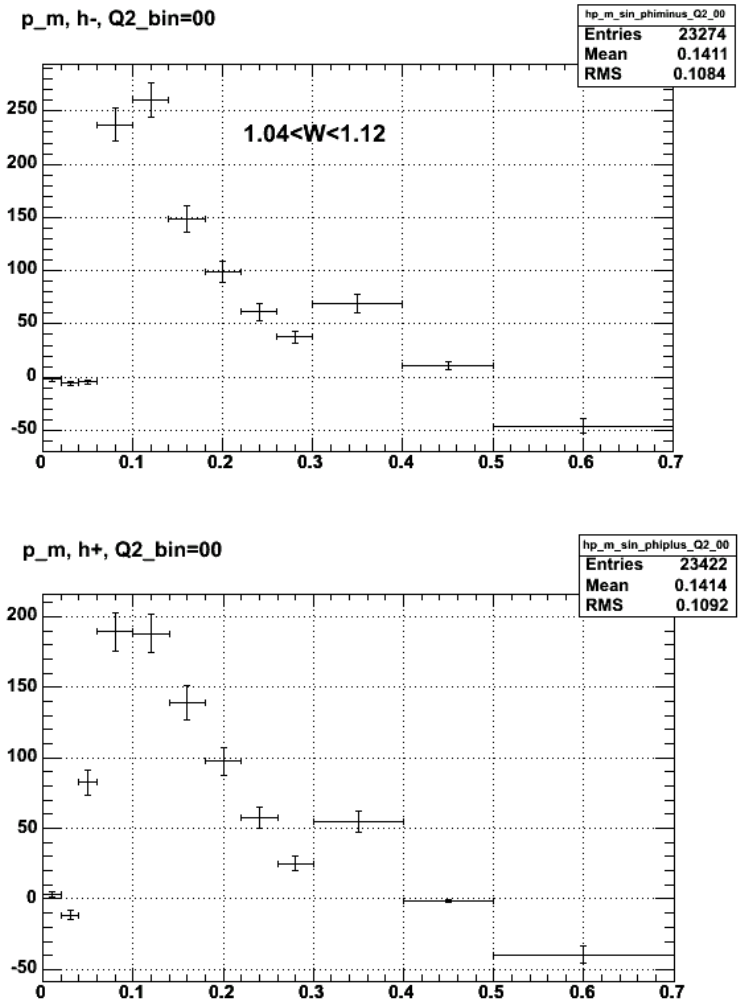


Fig 1. Sin(phi_pq) weighted histograms.

Look at the unweighted spectra below. For the third bin, the number of counts looks very similar.

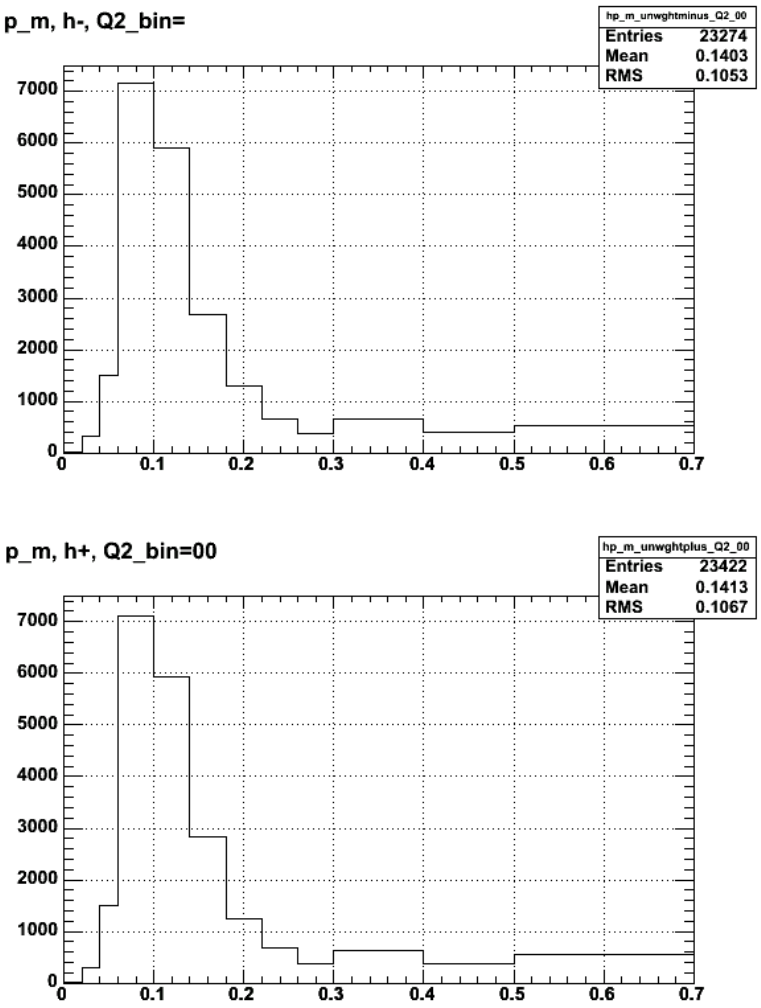


Fig 2. Same as above except for unweighted spectra.

Look at the helicity asymmetry.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 22 - root code to extract altp (gpg)

[Modified Wed Jun 22 02:15:12 2005 (GMT) gpg]

The code used to extract ALTp from the sin(phi_pq) weighted spectra is below.

```
int n_varp_mbins = 12;
Float_t p_m_bin_edges[13]={0.0,0.02,0.04,0.06,0.10,0.14,0.18,0.22,0.26,0.30,0.40,0.50,0.70};
TH1F *h1a = new TH1F("h1a","Sin(#phi) weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
TH1F *h2a = new TH1F("h2a","Sin(#phi) weighted distribution for negative helicity",n_varp_mbins,p_m_bin_edges);
h1a.Sumw2();
h2a.Sumw2();
h1a.Divide(hp_m_sin_phiplus_Q2_00,hp_m_unwghtplus_Q2_00);
h2a.Divide(hp_m_sin_phiminus_Q2_00,hp_m_unwghtminus_Q2_00);
TH1F *h12a = new TH1F("h12a","A_{LT}'",n_varp_mbins,p_m_bin_edges);
h12a.Sumw2();
h12a.Add(h1a,h2a,1.0,-0.9994);
h12a.Draw();
```

The code below is a modified version of the stuff above that includes the correction for the average polarization.

```
int n_varp_mbins = 12;
Float_t p_m_bin_edges[13]={0.0,0.02,0.04,0.06,0.10,0.14,0.18,0.22,0.26,0.30,0.40,0.50,0.70};
TH1F *h1a = new TH1F("h1a","Sin(#phi) weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
TH1F *h2a = new TH1F("h2a","Sin(#phi) weighted distribution for negative helicity",n_varp_mbins,p_m_bin_edges);
h1a.Sumw2();
h2a.Sumw2();
h1a.Divide(hp_m_sin_phiplus_Q2_00,hp_m_unwghtplus_Q2_00);
h2a.Divide(hp_m_sin_phiminus_Q2_00,hp_m_unwghtminus_Q2_00);
TH1F *h12a = new TH1F("h12a","A_{LT}'",n_varp_mbins,p_m_bin_edges);
h12a.Sumw2();
h12a.Add(h1a,h2a,1.0,-0.9994);
h12a.Multiply(1.35);
h12a.Draw();
```

Code below is for getting the helicity asymmetry as a function of phi_pq. These results are then fitted with a sine curve to get the amplitude which should agree with the results from the sin(phi_pq)-weighted analysis using the code just above.

```
Int_t n_varp_mbins = 12;
Double_t p_m_bin_edges[13]={0.0,0.02,0.04,0.06,0.10,0.14,0.18,0.22,0.26,0.30,0.40,0.50,0.70};
TH2F *hphi_p_m_sum = new TH2F("hphi_p_m_sum","#phi_{pq} versus p_{m}, Positive helicity",n_varp_mbins,p_m_bin_edges,9,-180,180);
TH2F *hphi_p_m_diff = new TH2F("hphi_p_m_diff","#phi_{pq} versus p_{m}, Negative helicity",n_varp_mbins,p_m_bin_edges,9,-180,180);
hphi_p_m_sum.Sumw2();
hphi_p_m_diff.Sumw2();
hphi_p_m_sum.Add(hphi_p_m_plus,hphi_p_m_minus,1.0,0.9994);
hphi_p_m_diff.Add(hphi_p_m_plus,hphi_p_m_minus,1.0,-0.9994);
TH2F *hALTp_phi_p_m = new TH2F("hALTp_p_m","A_{LT}^{'} versus p_{m}",n_varp_mbins,p_m_bin_edges,9,-180,180);
hALTp_phi_p_m->Divide(hphi_p_m_diff,hphi_p_m_sum,1.0,1.0);
hALTp_phi_p_m.Draw()
TH1D *hhelicity_asym = (TH1D*) hALTp_phi_p_m->ProjectionY("hALTp_phi_p_m",1,4)
hhelicity_asym.Draw();
```

The stuff above doesn't seem to work because the Add function gives me screwy results when one of the coefficients is negative. Project out the p_m bin first and then do the manipulations. Try the following for starters.

```
gStyle->SetOptStat(0000000)
gStyle->SetOptFit(0001)
Int_t n_varp_mbins = 12;
Int_t pbin=8;
char pbinlabel[3];
sprintf(pbinlabel,"%d",pbin);
TLatex *t1 = new TLatex(-150,-0.1,"pbin=");
TLatex *t2 = new TLatex(-80,-0.1,pbinlabel);
Double_t p_m_bin_edges[13]={0.0,0.02,0.04,0.06,0.10,0.14,0.18,0.22,0.26,0.30,0.40,0.50,0.70};
TH1D *hp_m_bin_plus = hphi_p_m_plus->ProjectionY("hp_m_bin_plus",pbin,pbin);
TH1D *hp_m_bin_minus = hphi_p_m_minus->ProjectionY("hp_m_bin_minus",pbin,pbin);
TH1D *hsum = new TH1D("hsum","summed hists",9,-180,180);
TH1D *hsub = new TH1D("hsub","subtracted hists",9,-180,180);
TH1D *hasym = new TH1D("hasym","(N^{+} - N^{-})/(N^{+} + N^{-})",9,-180,180);
hsum.Sumw2();
hsub.Sumw2();
hasym.Sumw2();
hsum.Add(hp_m_bin_plus,hp_m_bin_minus,1.0,0.9994);
hsub.Add(hp_m_bin_plus,hp_m_bin_minus,1.0,-0.9994);
hasym.Divide(hsub,hsum,1.0,1.0);
hasym.SetMaximum(0.2);
hasym.SetMinimum(-0.2);
hasym.Draw("e1");
TF1 *fit1 = new TF1("fit1","[0]*sin(x*0.017453293)",-180,180)
hasym.Fit("fit1","","e0")
t1.Draw();
t2.Draw();
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 23 - tests of ALTp algorithms (gpg)

[Modified Fri Dec 24 12:59:56 2004 (GMT) gpg]

I wanted to check what I was doing to extract ALTp. This was motivated in part by the anomolously high asymmetry in the top panel of Fig 1 in entry 250 at p_m=-.05 MeV/c. I did this by calculating the helicity asymmetry as a function of phi_pq, fitting it with a sine curve, and comparing my results with the analysis. I noticed that the sine fit was giving similar results to the analysis, but the error bars were bigger by about a factor of 2-2.5. I looked in the code eod5.C where I do the analysis and discovered I had not set the errors for the analysis histograms to use the sum of the squares of the weights instead of the sum of the weights!! When I did this the analysis uncertainties now agree with the sine fits to the helicity asymmetry, but the uncertainties are now twice as large and the structures in ALTp are significantly less significant!!! Damn! Damn! Damn! I am using a quasielastic bin of 0.8 < W < 1.0 GeV so I will squeeze this down. I talked to Kim E. last week and showed him some of the results from entry 250. He makes the point that the counts at high and low W are likely due to inelastic events and I should exclude them from the QE peak.

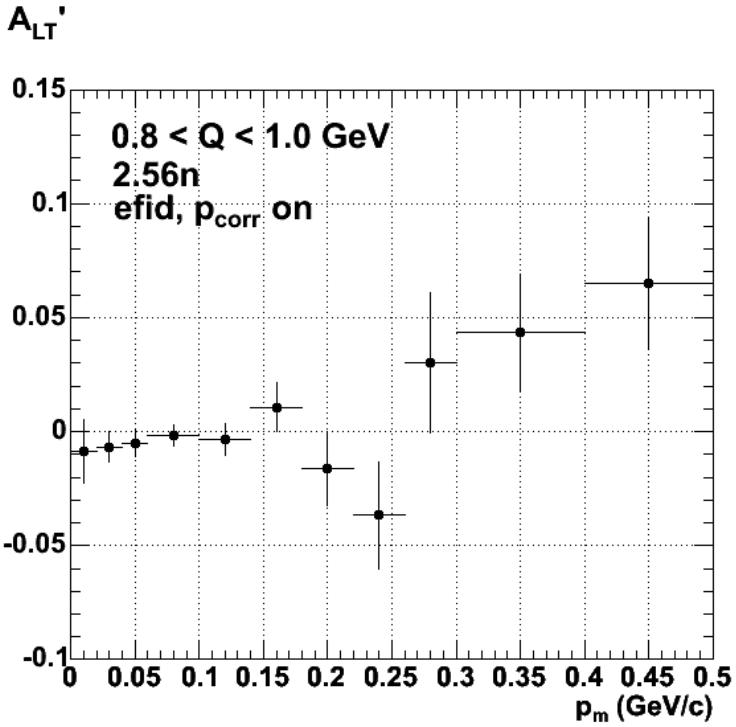


Fig 1. ALTp with correct uncertainties and wide QE definition integrated over the full Q2 distribution for 2.56n.

I'm going back to check things and I see some inconsistencies. For 2.56n with QE = 0.88 < W < 1.04, p_corr on, efid on I get the Q2 distribution shown below with 16M events. In a previous entry (16) the same plot has 27M events. This is a big difference! What is going on? Am I missing files in the analysis run?

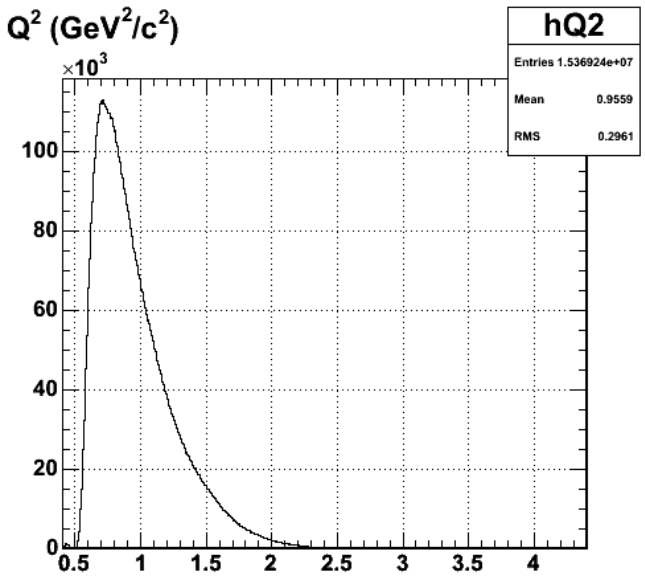


Fig 2. Check on Q2 distribution for 2.56n, QE= 0.88 < W < 1.04 GeV, efid on, p_corr on, all Q2.

The new ALTp I get is shown below.

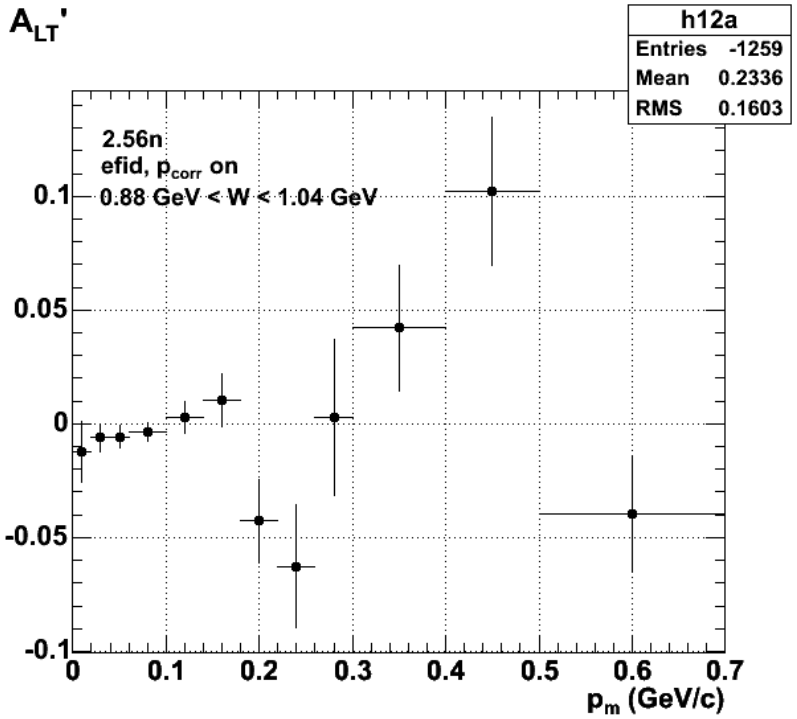


Fig 3. Revised ALTp with 'correct' uncertainties.

The actual values are shown below for the analysis.

```
root [14] h12a.Print("all")
TH1.Print Name= h12a, Entries= -1259, Total sum= -0.0119067
 fSumw[0]=0, x=-0.0291667, error=0
 fSumw[1]=-0.0123392, x=0.01, error=0.0132827
 fSumw[2]=-0.0060922, x=0.03, error=0.00603512
 fSumw[3]=-0.00581111, x=0.05, error=0.00500596
 fSumw[4]=-0.00352995, x=0.08, error=0.00418589
 fSumw[5]=0.00294208, x=0.12, error=0.0068883
 fSumw[6]=0.0105484, x=0.16, error=0.01162
 fSumw[7]=-0.0427036, x=0.2, error=0.0183638
 fSumw[8]=-0.062625, x=0.24, error=0.0268612
 fSumw[9]=0.00285033, x=0.28, error=0.0342205
```

```
 fSumw[10]=0.0421448, x=0.35, error=0.0274544
 fSumw[11]=0.102228, x=0.45, error=0.0325302
 fSumw[12]=-0.039519, x=0.6, error=0.0256536
 fSumw[13]=-0.0234547, x=0.729167, error=0.0199776
```

Some results from fitting the helicity asymmetry for several p_m bins are shown below.

```
pbin= 7

 FCN=7.88702 FROM MIGRAD    STATUS=CONVERGED      14 CALLS          15 TOTAL
                     EDM=1.02596e-27    STRATEGY= 1      ERROR MATRIX ACCURATE
  EXT PARAMETER                                   STEP         FIRST
  NO.   NAME      VALUE            ERROR          SIZE      DERIVATIVE
   1  p0          -4.42701e-02   2.04004e-02   4.00000e-04   2.22045e-12
(



bin 8

 FCN=10.4861 FROM MIGRAD    STATUS=CONVERGED      14 CALLS          15 TOTAL
                     EDM=0    STRATEGY= 1      ERROR MATRIX ACCURATE
  EXT PARAMETER                                   STEP         FIRST
  NO.   NAME      VALUE            ERROR          SIZE      DERIVATIVE
   1  p0          -7.45890e-02   2.95061e-02   4.00000e-04   0.00000e+00


pbin=11

 FCN=7.13369 FROM MIGRAD    STATUS=CONVERGED      14 CALLS          15 TOTAL
                     EDM=4.06792e-25    STRATEGY= 1      ERROR MATRIX ACCURATE
  EXT PARAMETER                                   STEP         FIRST
  NO.   NAME      VALUE            ERROR          SIZE      DERIVATIVE
   1  p0           1.17099e-01   3.72921e-02   4.00000e-04  -2.41871e-11
(Int_t)0
r
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 24 - RC for JL (gpg)

[Modified Wed Nov 24 18:46:06 2010 (GMT) gpg]

Below are some plots of the radiative correction curves and surfaces as functions of theta_pq and phi_pq. The kinematics and average radiative correction for the selected region of that_pq and phi_pq is labeled on each plot. The table below shows the desired kinematics with the average radiative correction shown for protons and neutrons in the last two column. This average radiative corrections is for the given theta_pq (actually the cos(theta_pq)) averaged over phi_pq. The plots show the phi_pq dependence.

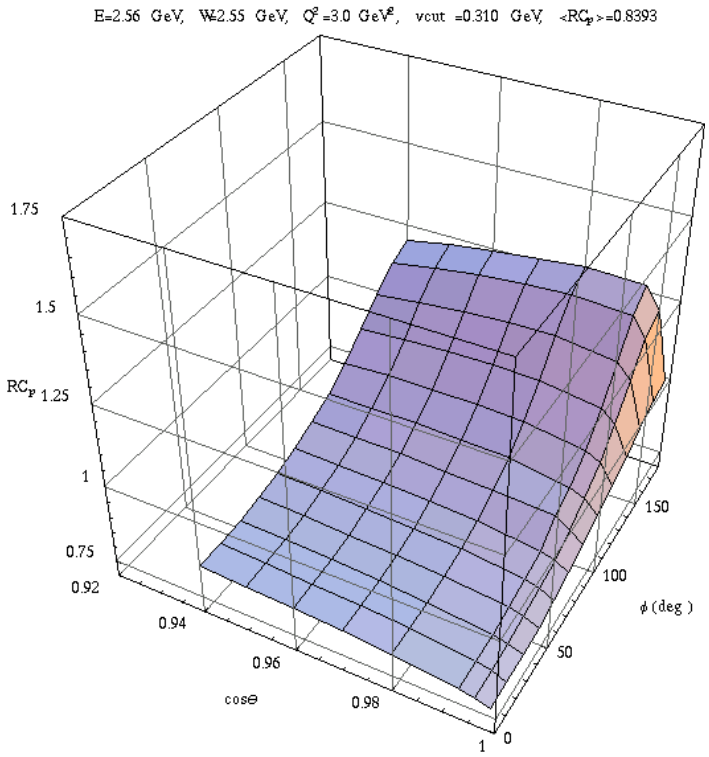
At 4.232 GeV beam energy,

Q2	W	theta_pq
0.5	2.0	3.5
1.0	2.13	3.5
1.5	2.24	3.5
2.0	2.35	3.0
2.5	2.45	2.5
3.0	2.55	2.25
3.5	2.65	2.25
4.0	2.74	2.25
4.5	2.83	2.25
5.0	2.92	2.25

At 2.558 GeV beam energy,

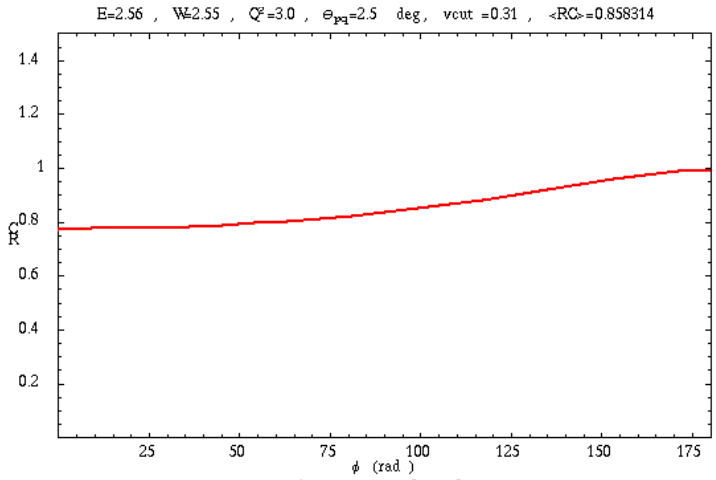
Q2	W	theta_pq	average RCp	average RCn
0.25	1.94	4.0	failed - RC's all nan's	
0.5	2.0	4.0		
1.0	2.13	4.0	0.7957	0.7956
1.5	2.24	3.5		
2.0	2.35	3.0	0.8273	0.8273
2.5	2.45	2.75	0.8424	0.8421
3.0	2.55	2.5	0.8583	0.8568

The plots that follow are the results of the analysis of the EXCLURAD output that was further massaged with Mathematica.



Click here to view the object (input data file for notebook, radcorW2.55Q23.0.dat) you uploaded.

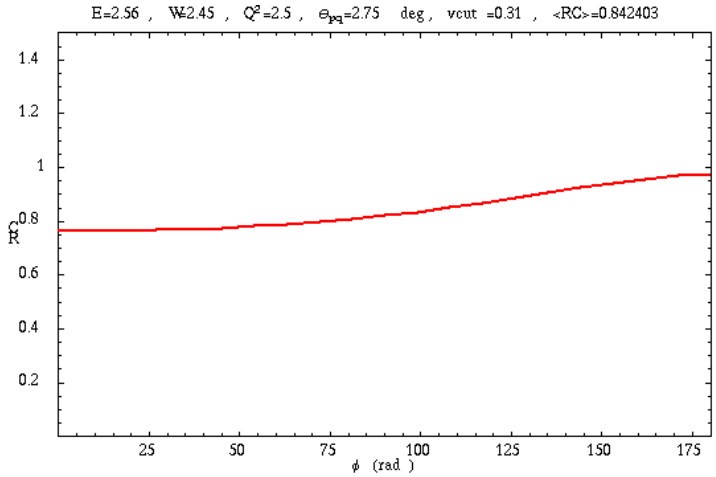
Click here to view the object (Mathematica notebook) you uploaded.



Curve for requested angle

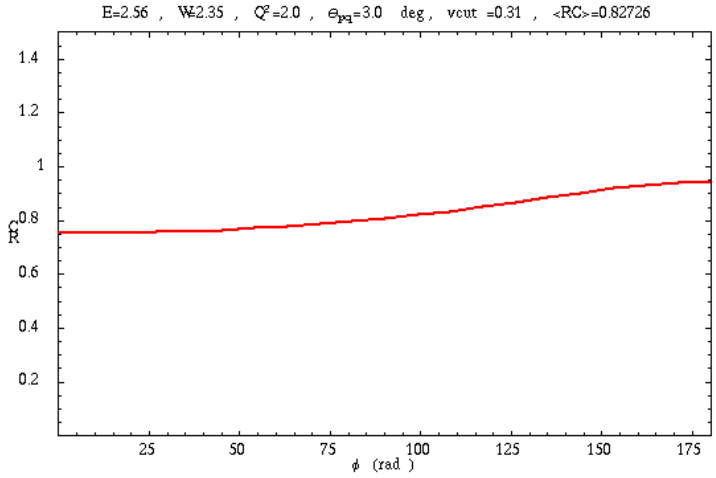
Click here to view the object (input data file for notebook, radcorW2.55Q23.0.dat) you uploaded.

Click here to view the object (Mathematical file for above plot, RCsurface.nb) you uploaded.



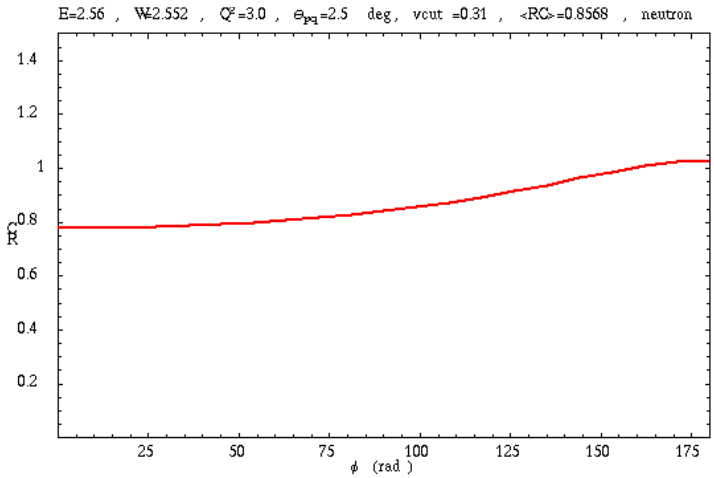
Click here to view the object (input file radcorW2.45Q22.5.dat for above plot) you uploaded.

Click here to view the object (Mathematica file for above plot) you uploaded.



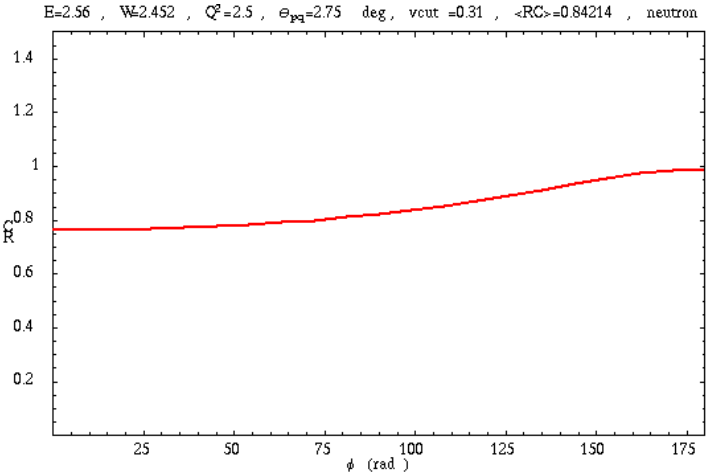
Click here to view the object (input file radcorW2.348Q22.0.dat) you uploaded.

Click here to view the object (Mathematica notebook for above plot and data file) you uploaded.



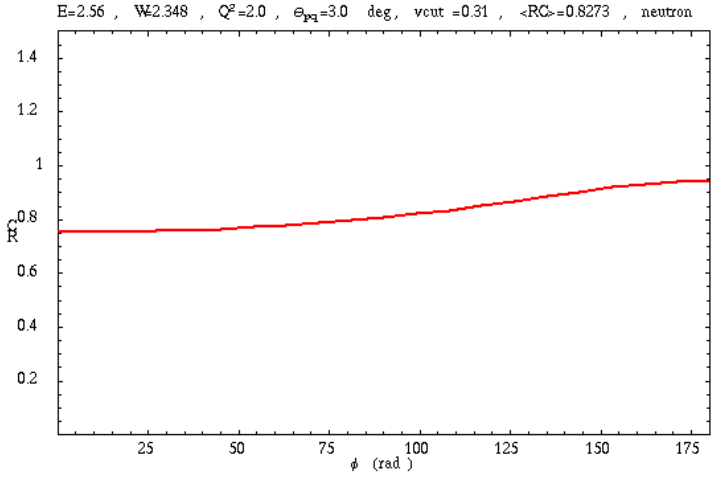
Click here to view the object (input file radcor_neutronW2.552Q23.0.dat) you uploaded.

Click here to view the object (Mathematica notebook for above plot) you uploaded.



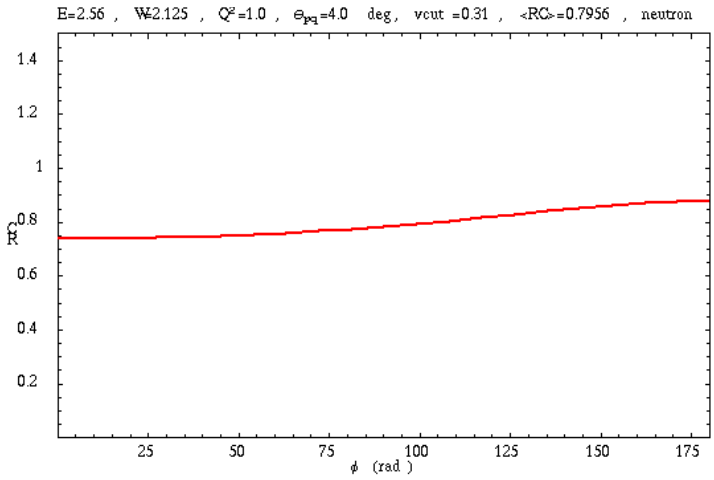
Click here to view the object (input file radcor_neutronW2.452Q22.5.dat) you uploaded.

Click here to view the object (Mathematica notebook for above plot) you uploaded.



Click here to view the object (input file radcor_neutronW2.348Q22.0.dat for the above plot) you uploaded.

Click here to view the object (Mathematica file RCsurface_neutronW2.348Q22.0.nb for the above plot) you uploaded.



Click here to view the object (Input file radcor_neutron_W2.125Q21.0.dat for above plot) you uploaded.

Click here to view the object (Mathematica file RCsurface_neutronW2.125Q21.0.nb for above plot) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 25 - R&A momentum corrections (gpg)

[Modified Thu Feb 3 04:17:23 2005 (GMT) gpg]

First results from the work of rusty and artie last summer using Jeff Lachniet's first momentum correction method (entry 109). The plot below shows a comparison of the difference between the electron momentum calculated from the electron angles and the electron momentum from tracking. The right-hand plot is for the electron momentum from tracking corrected using the limited data set that we analyzed with R&S's code last summer. The panel on the left is for the electron momentum directly from tracking with no momentum corrections.

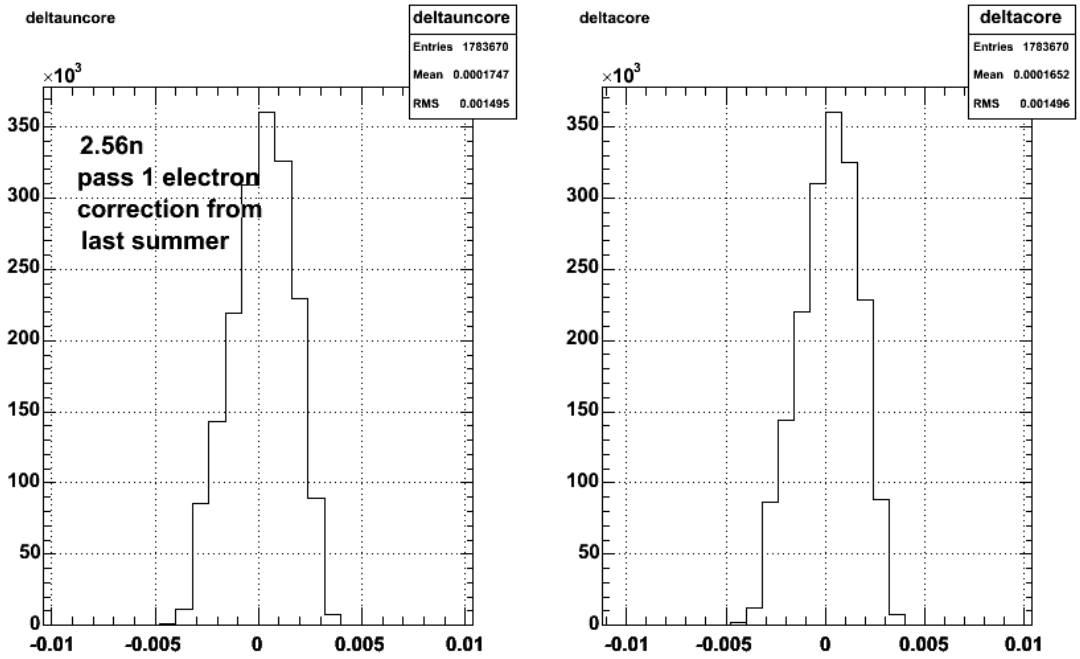


Fig 1. Comparison of difference between the electron momentum calculated from the electron angles and the corrected momentum based on a limited data run

The plot below shows the same quantities, but with the momentum corrections derived from a complete data set run instead of a partial set like Fig 1.

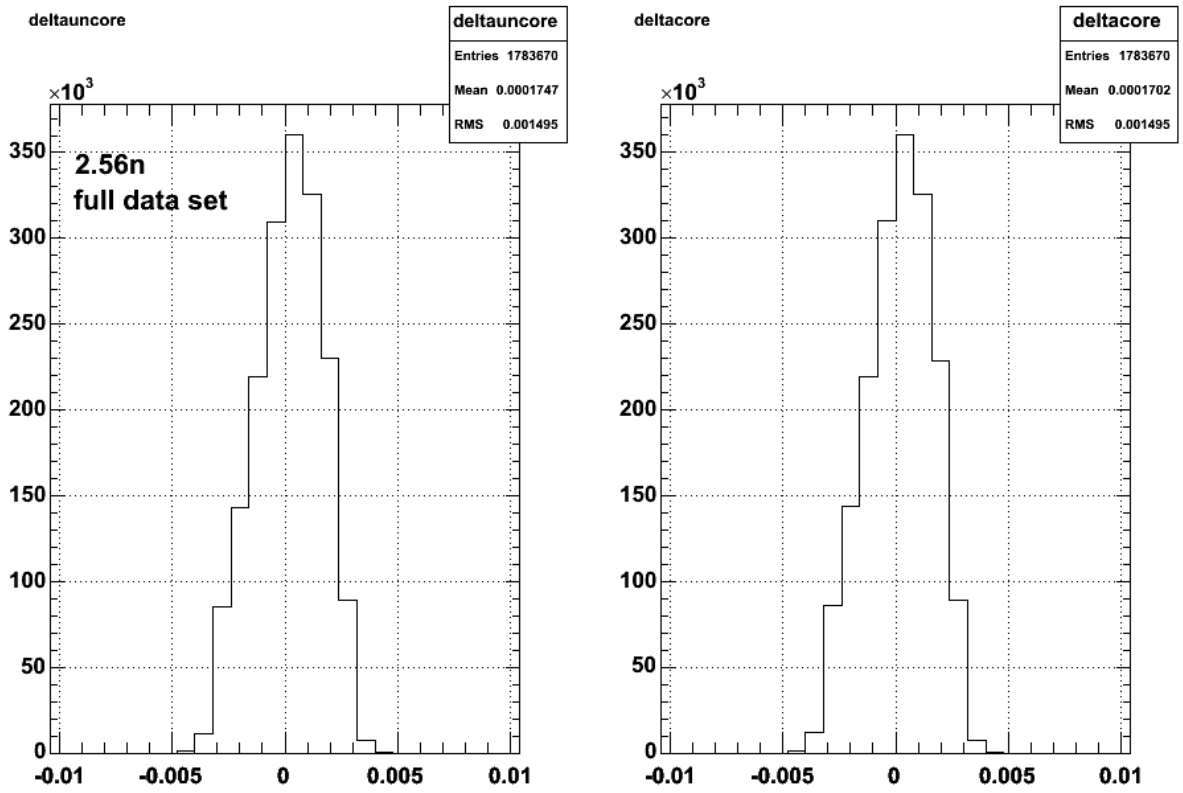


Fig 2.

The plot below shows the same quantities as Fig 2, but the latest version of the electron fiducials is used to select electron events.

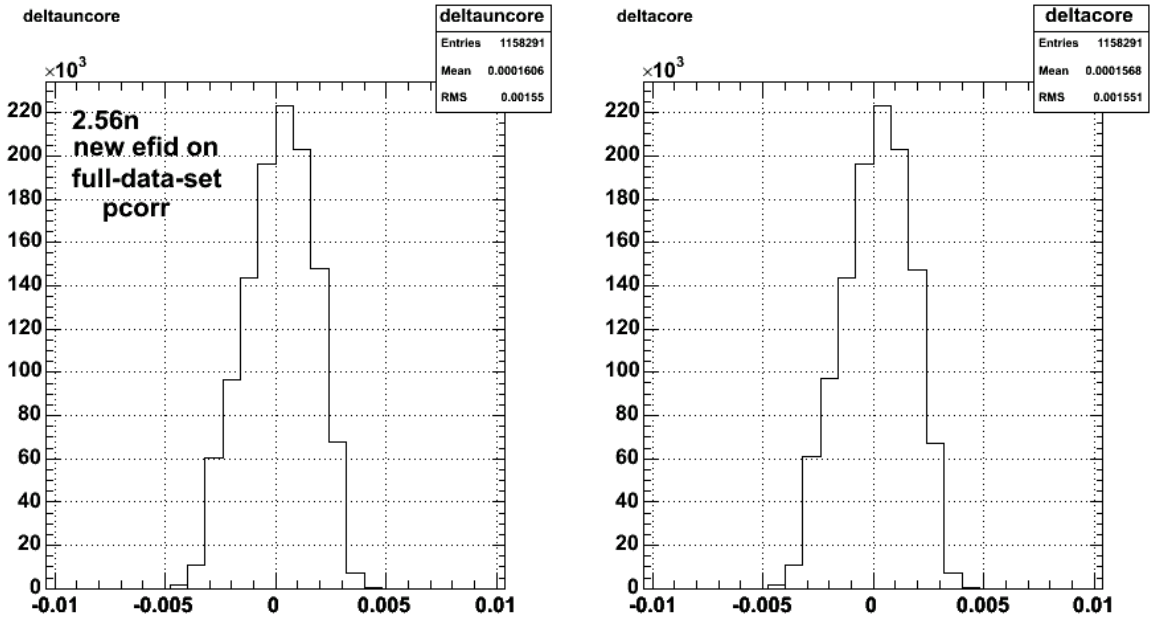


Fig 3.

The results below are for the same quantities as the previous figure, but with the momentum correction fit parameters derived from full data set run using the new electron fiducials.

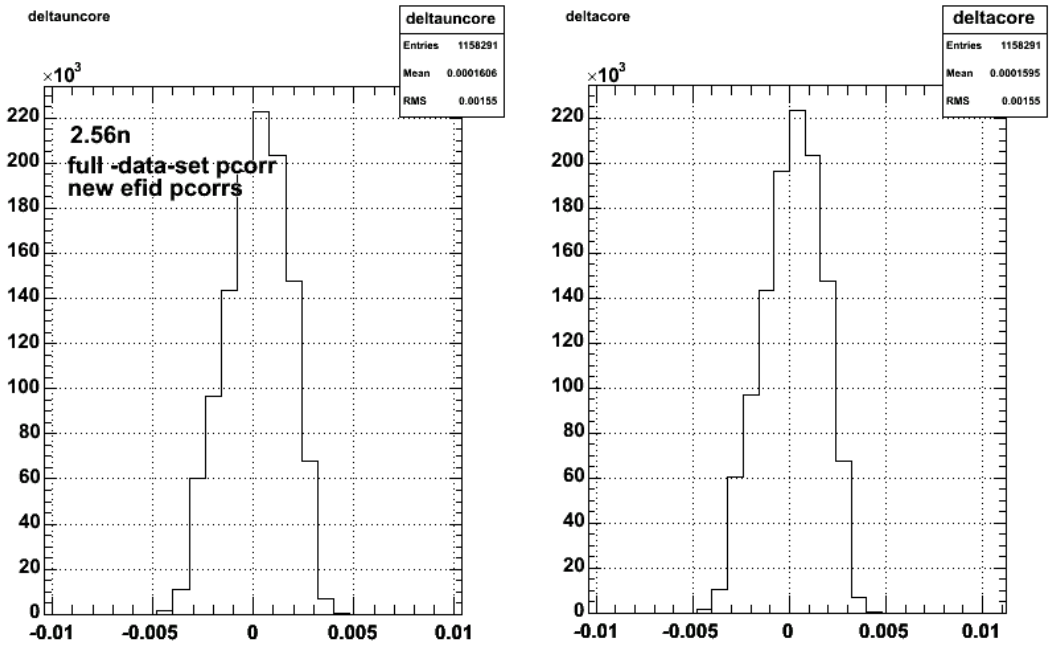
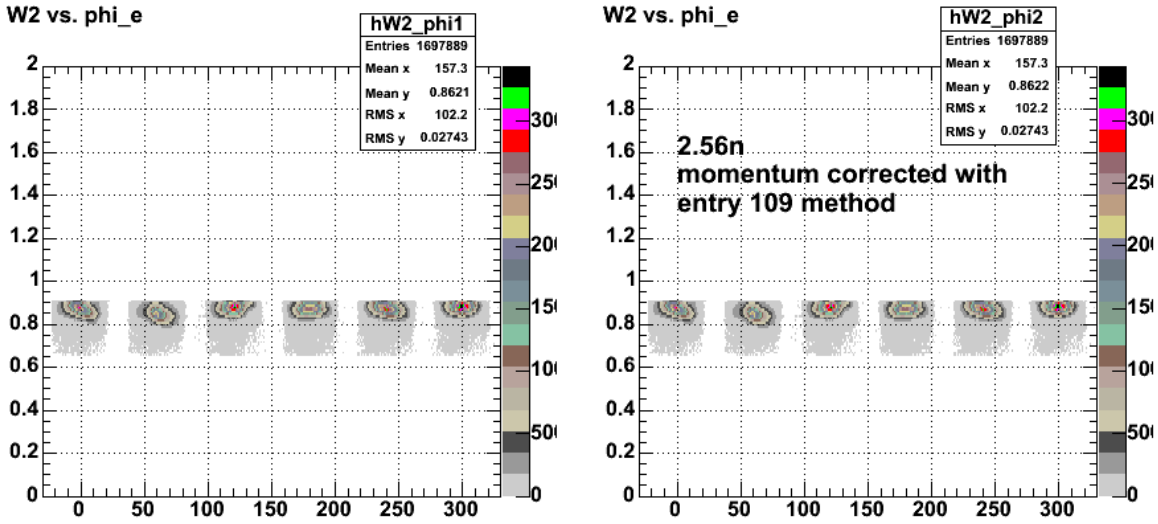
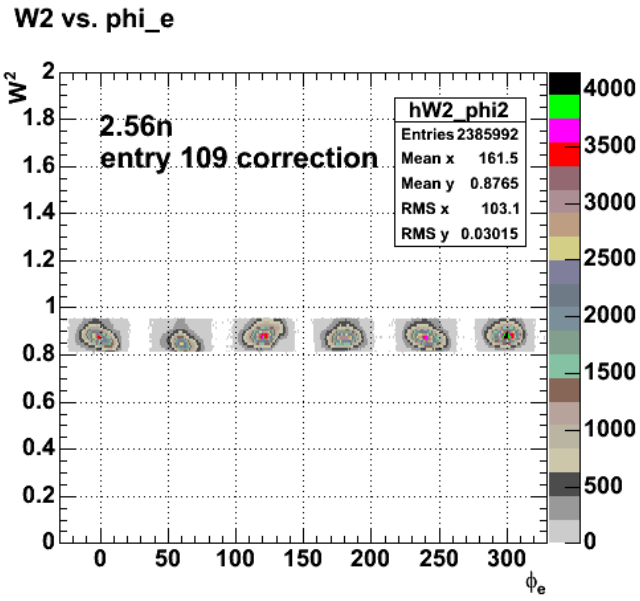


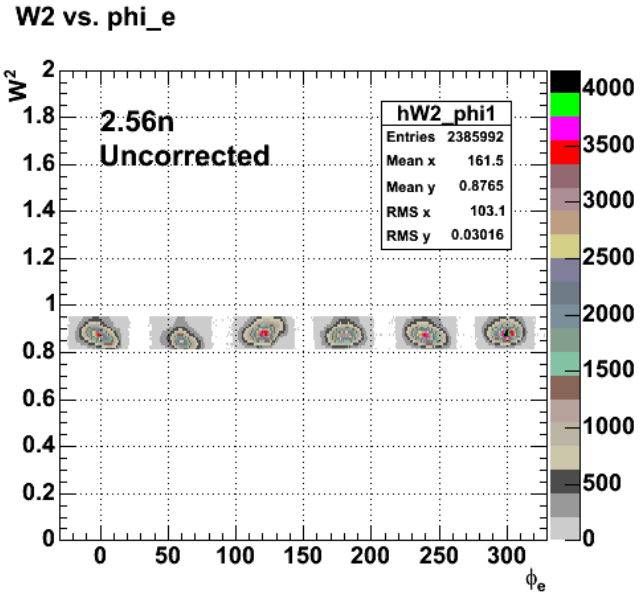
Fig 4. Same as previous plot with momentum correction fit parameters derived from full data set run using new electron fiducials



Effect of this momentum correction of W^2 versus phi_e

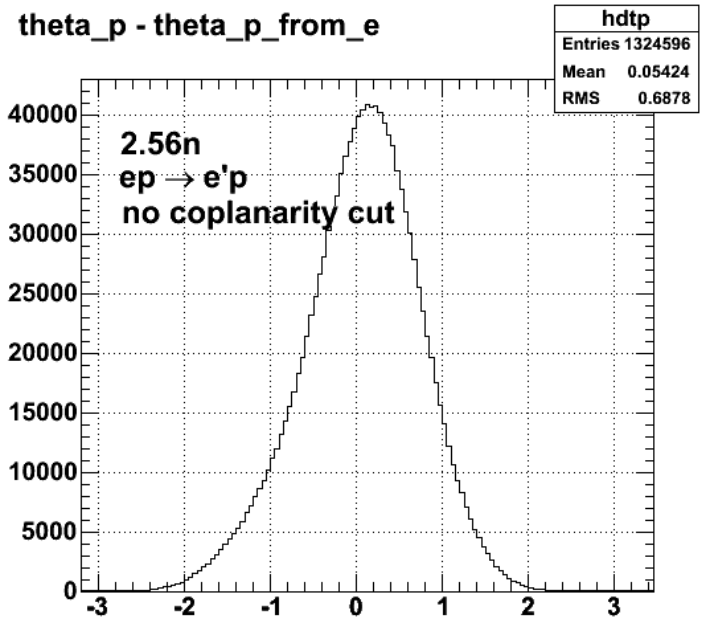


Use entry-109 electron momentum correction with ep1.C



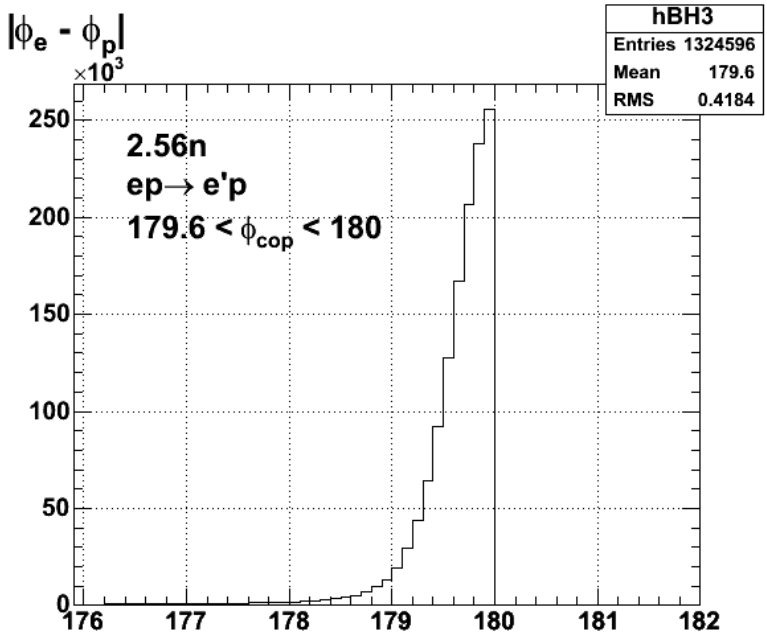
uncorrected electron momentum with ep1.C

The plot below shows a histogram of the difference between the proton scattering angle calculated from the electron information and the measured proton scattering angle. The uncorrected electron momentum was used to calculate the electron 3-momentum which was then used to get the proton 3-momentum and derive the proton scattering angle. No coplanrity cut was used in this analysis. The 2.56n data set was used.



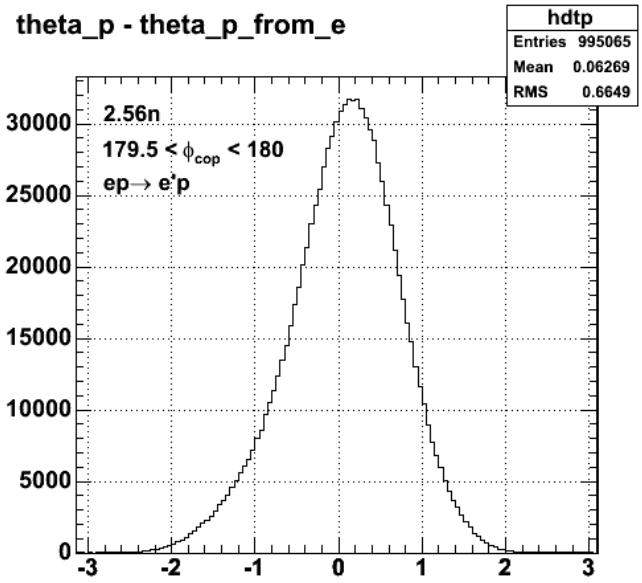
Histogram of difference between proton angle calculated from the electron information and the measured one.

The plot below shows the coplanarity distribution. This is the azimuthal angle between the scattered electron and the proton. From this plot it's clear that there are few non-elastic events. Nevertheless, I will set 180 > phi_cop >179.5 to see if there is any effect on the event selection and on the difference between the measured proton scattering angle and the proton scattering angle calculated from the electron data.



Histogram of co-planarity angle.

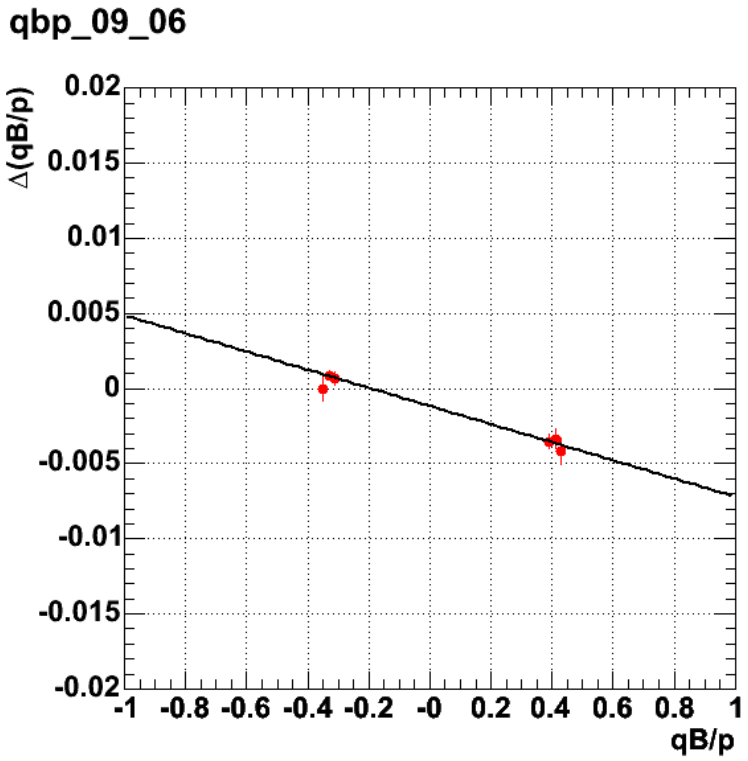
Plot below shows a test of the effect of a cut on the coplanarity angle on the difference between the scattering angle of the proton calculated from the electron results and the scattering angle of the proton from tracking. There is little change in the shape of the distribution. About 25% of the events are lost uniformly across the distribution.



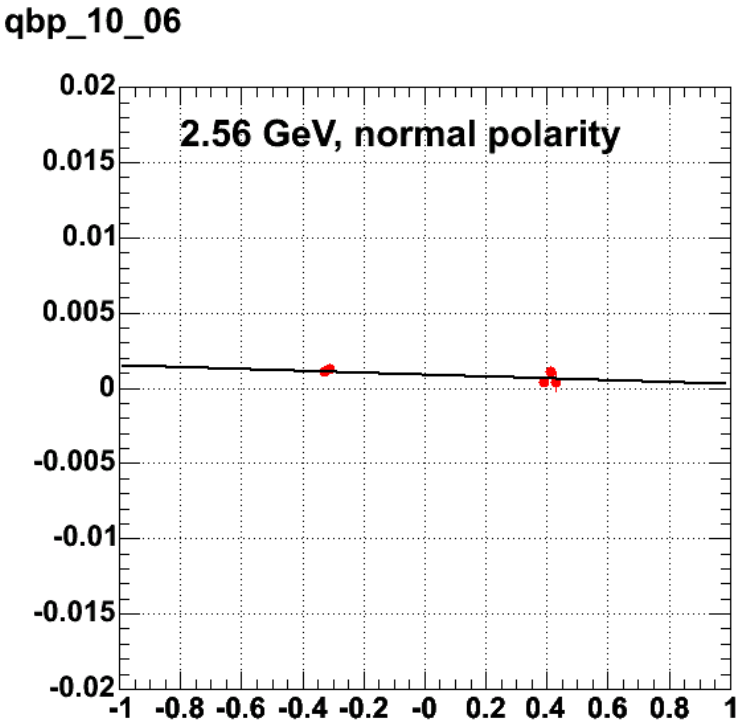
Difference between proton scattering angle calculated from the electron results and from tracking. Cut on coplanarity is required.

Click here to view the object (Profiles of d(curvature) for qbp_00_05) you uploaded.

The results below are for R&A analysis where I required that the coplanarity angle lie in the range 179.7->180.0 and the difference between the measured proton scattering angle and the one calculated from the electron results was in the range -0.02 deg -> 0.5 deg. These limits are based on the results above. Plot below shows delta(qB/p) versus qB/p for one of the bins in sector 2. Things to notice in comparison with the work in CLAS-Note 2001-018 is that the vertical range of the data is much smaller in our case. In the CLAS-Note they plot their results on the same large scale as shown in the figure below. This is to emphasize that the E5 data are in better shape after cooking than the e1b/c data.

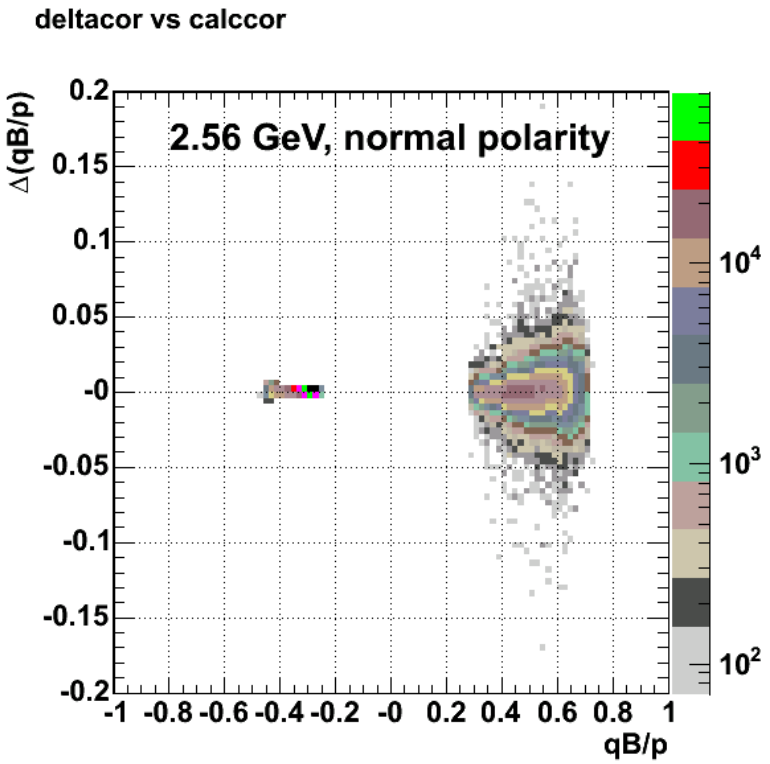


D(qB/p) versus qB/p for 2.56n run showing small deviation in the curvature from the calculated result



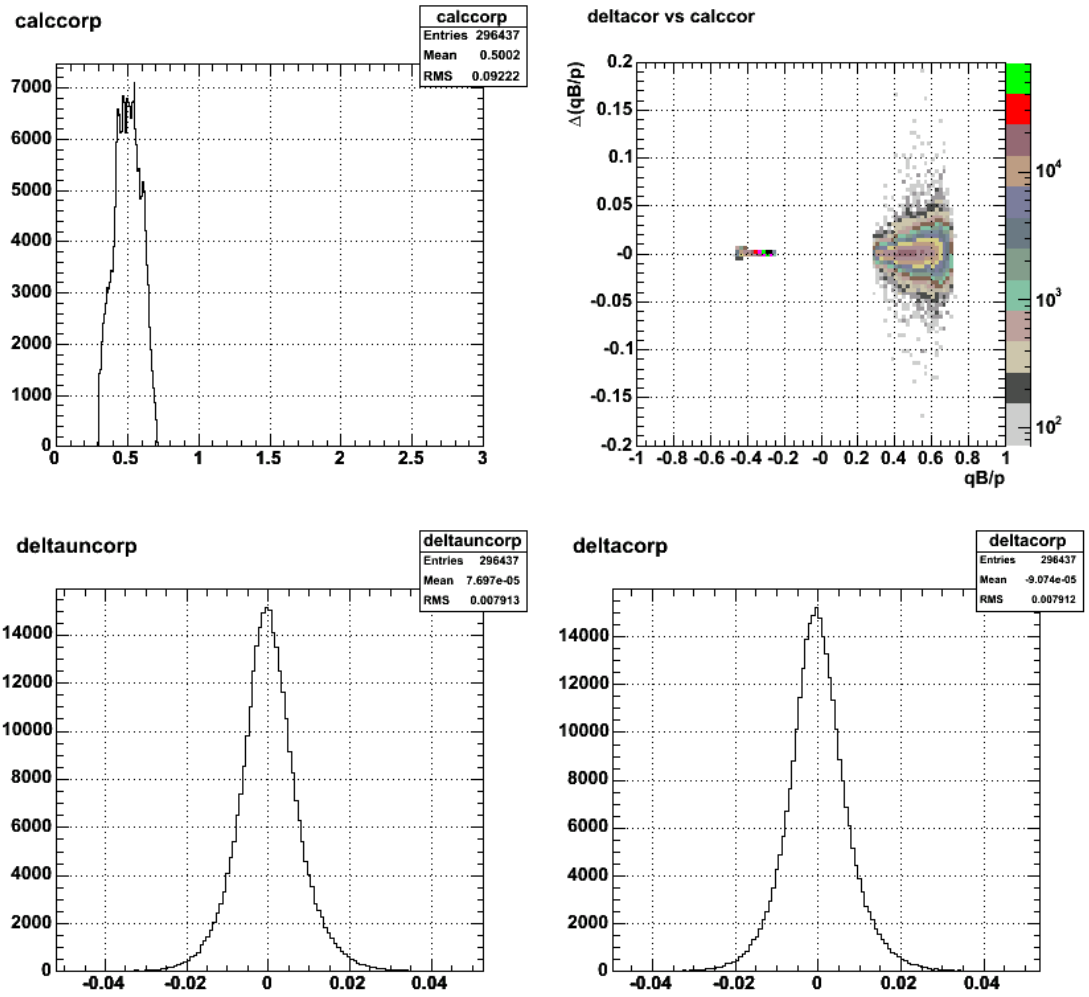
Same as above for sector 3 bin

The plot below shows delta(qB/p) versus qB/p for all angle bins lumped together. the point here is that the width of the distribution of the protons is far greated that the width of the distribution of the electrons. This would explain the small effect of the correction on W since we're dominated by the deviation of the proton momentum from the calculated value and the electron curvature deviation is small. What is mysterious to me about the plot below is the magnitude of width is huge (about a factor of 10) greater that the individual variations I see in a given bin. I may just be deceiving myself wiht the statistics of the plots for individual bins and the effect of the use of a logarithmic axis in the z direction in the plot below.



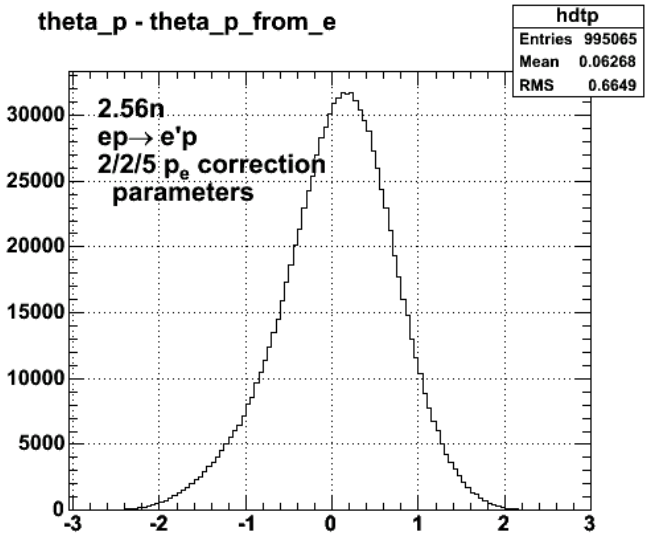
Same as above for all angle bins lumped together

One thought I had was that even though this approach seems to have little effect on the electrons, perhaps it could be used to correct the proton momentum. Unfortunately, that doesn't seem to work either. The plot below shows before and after pictures in the lower two panels of the difference between the expected proton momentum (using the measured scattering angles) and the measured one (left is uncorrected, right panel is corrected). There is no difference between the before and after picture in mean or RMS. There is no significant improvement even in the proton results.

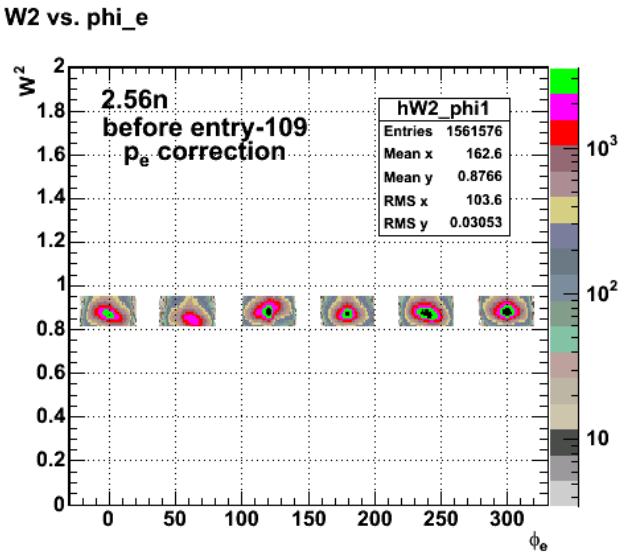


lots showing proton results before and after corrections for the protons

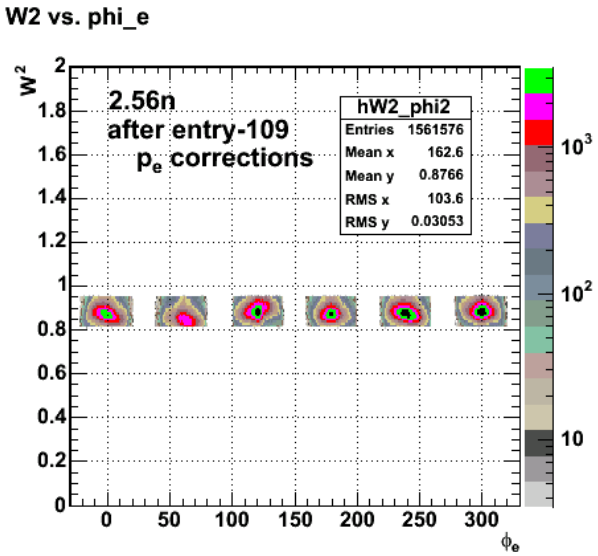
To close the loop I generated a new set of parameters to correct the electron and proton momenta using the entry-109 method. This last set was generated from data that had the coplanarity cut (179.7 < theta_cop < 180) and theta_p cut (-0.2 < theta_p_from_e - theta_p < 0.5) on it. The new parameters were inserted into ep1.C and the 2.56n data re-analyzed. No effect is seen in the W2 distribution sector-by-sector or in the histogram shown below



Difference between theta_p from tracking and theta_p from the electron data

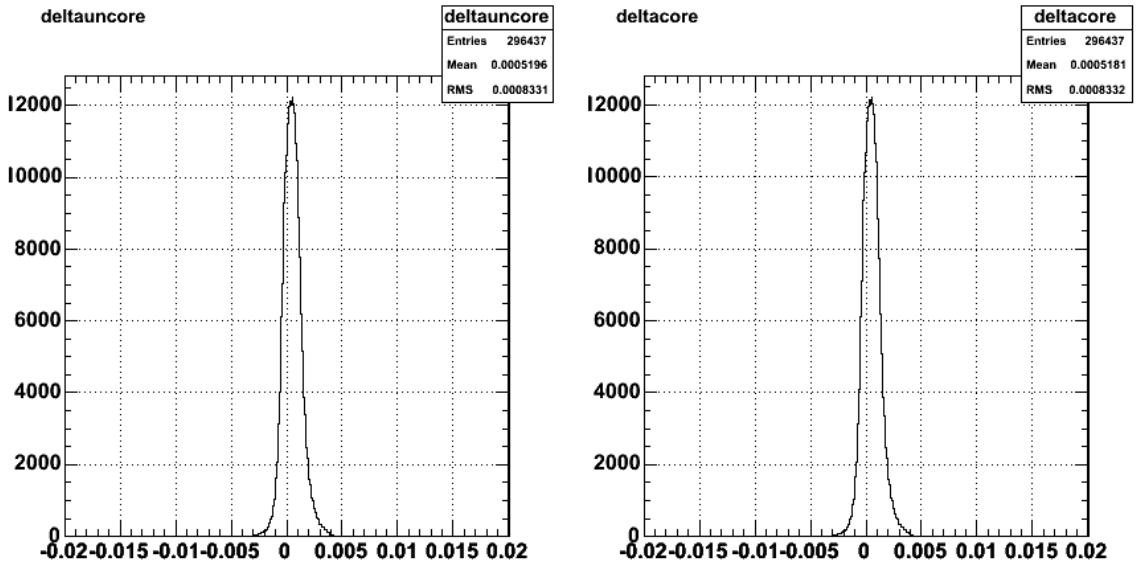


W2 distribution before applying the entry-109 correction to p_e

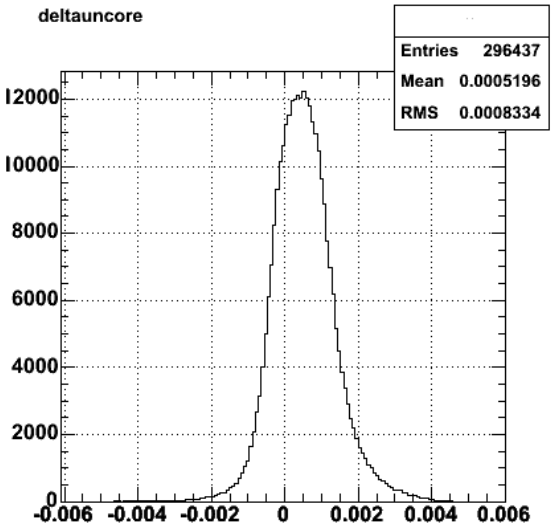


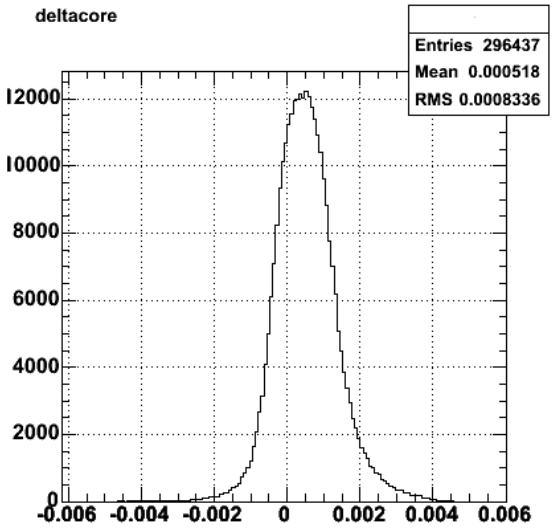
W2 distribution after applying the entry-109 correction to p_e

Last shot at entry-109 electron-proton momentum corrections. I have been using the corrected (but little changed) e and p momenta in the plots of delta(qB/p) versus qB/p. I should use the uncorrected results from tracking. I fixed this and generated a new set of parameters. Upon examination of the first few I see small changes. When I look at the difference between the corrected and uncorrected curvatures I see a small (1 part in 250) shift closer to zero and no change in the width. See plot below. I give up on this stuff. I think our cooking results are so good that I am just fitting statistical fluctuations mostly in the proton tracking.

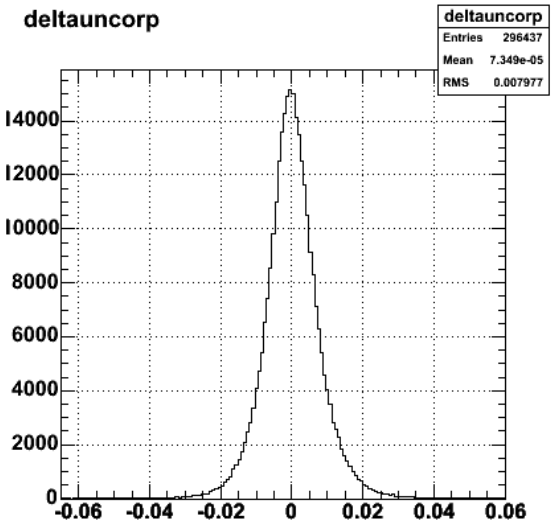


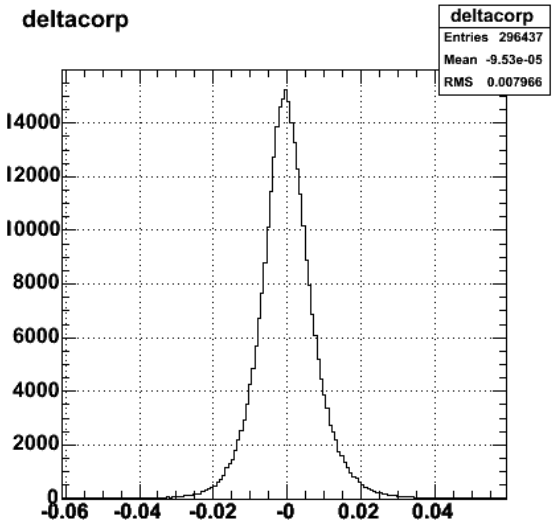
Final shot at entry-109 eletron-proton momentum corrections. See text above.





Same as plot above with expanded horizontal scale.





Same as above for protons

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[Modified Wed Feb 16 00:12:12 2005 (GMT) gpg]

Testing the results from the fit. The effect of the fit on the electron momentum are close to zero. I am trying to understand that and it appears that the deviation from the calculated values is already small. The E5 data set appears to be well calibrated for the cooking. Also the spread in the data is dominated by the proton variation. The electron scatter is about 5-10 times smaller. Nevertheless, I am testing some of the results.

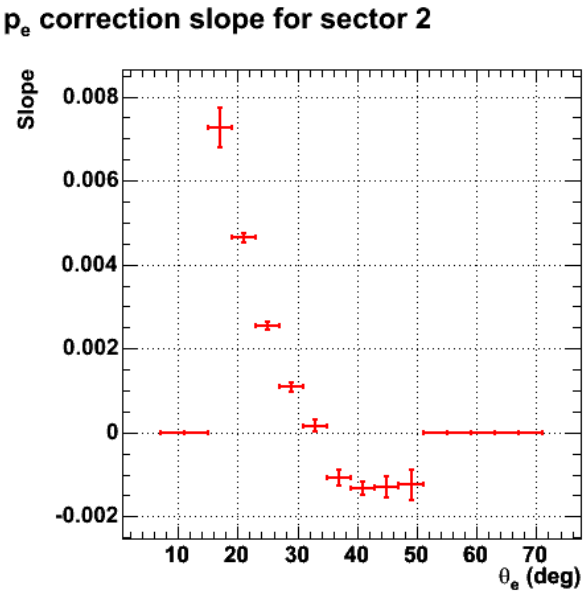


Fig 1. Slope parameter for phibin=4 (sector 2).

Here is the 2D plot of d(qB/p) versus (qB/p)_calc that was used to generate the parameters in the first, non-zero bin in the above figure.

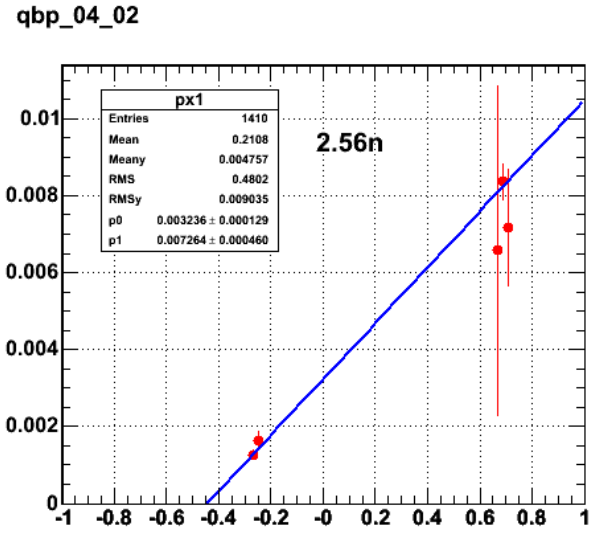


Fig 2. 2D plot used to generate parameters in Fig 1.

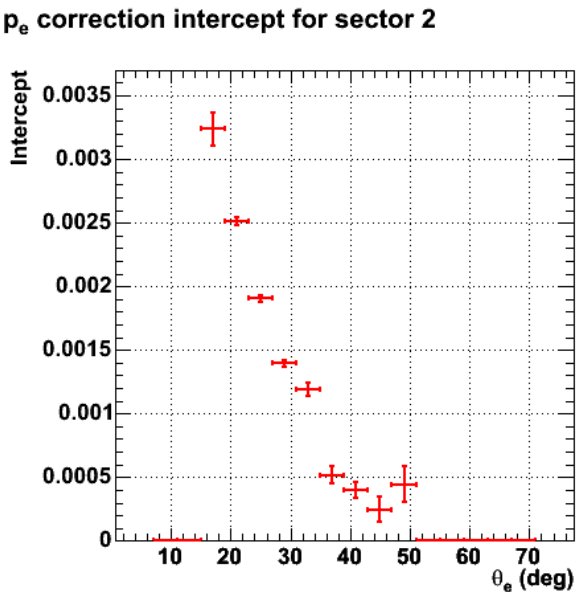


Fig 3. Intercept for this sector and phi range.

Generating ProfileX histograms in Root.

```
TProfile *px1 = qbp_04_02->ProfileX("px1",1,100,"d")
```

The plot below has cuts on coplanarity, the difference between the measured proton scattering angle and the proton angle detemined from the electron kinematics, and on W. It shows the before and after corrections after I fixed the indexing error in the pcorr_ep1 class. There is essentially no improvement. The centroid shifts, but its magnitude is essentially the same as before and the width has changed much.

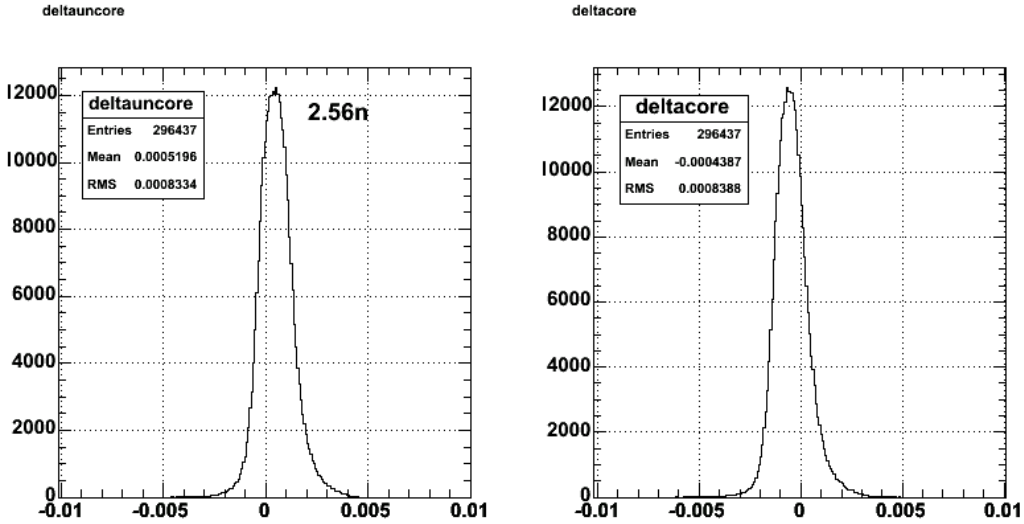


Fig 4. Comarison of spectra after correcting indexing error in pcorr_ep1 class.

The plot below is the same as figure 2 except I have now used the corrected electron and proton momenta instead of the ones from tracking. it appears that the correction does is shift things down.

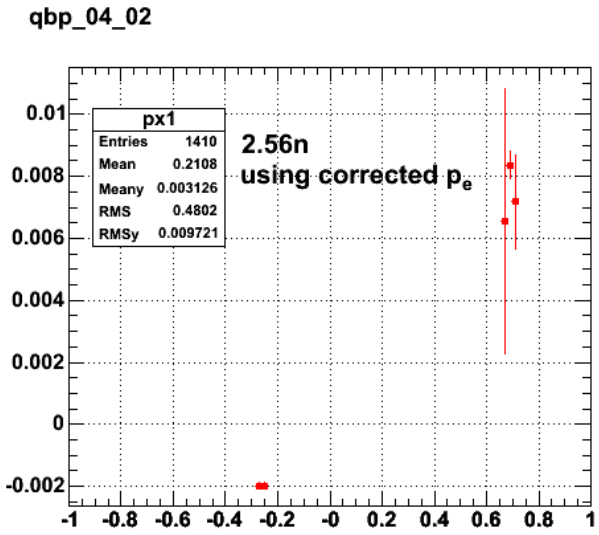
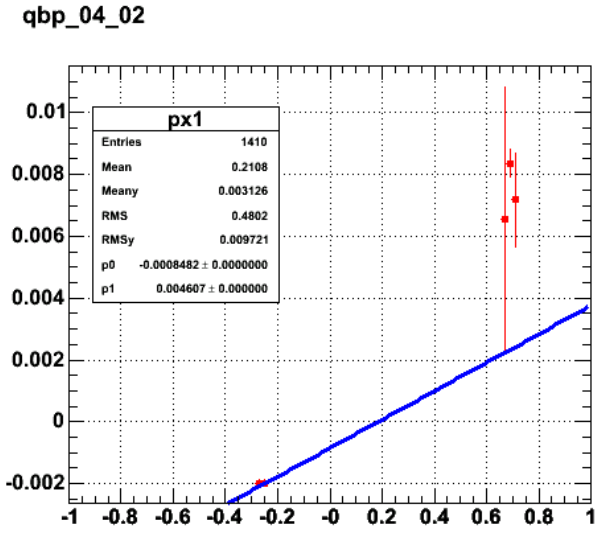


Fig 5. Same as Figure 2 with the corrected e and p momenta instead of the tracking results.



Some hopeful results below. This figure is the first look at W2 vs. phi_e after fixing the indexing error mentioned above. This is only for a single file because I'm still having problems getting the new master to work, but it does appear the sector 2 looks better and the other sectors are marginally better. The solid line is the square of the proton mass. Relative to this line sector 2 looks better and the other sectors look like they have moved from slightly below the line to above the line.

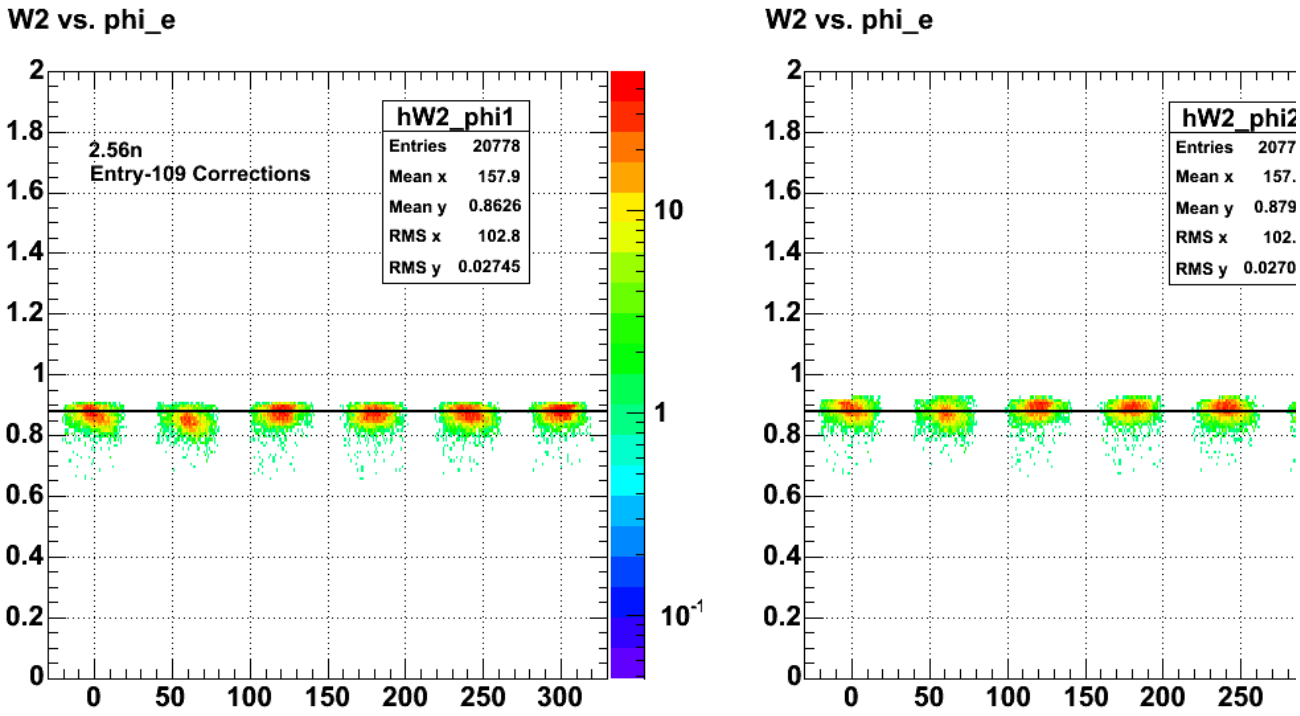


Fig 6. Before and after pictures for W2 vs. phi_e for a single run.

The plot below shows the difference between the electron momentum calculated from the measured scattering angle and the electron momentum from the track reconstruction (left panel) and the corrected electron momentum from tracking (right panel). The original, uncorrected difference is already small (6 MeV) and the distribution overlaps with zero (+/- 9 MeV). The corrected electron momentum is a little closer to zero (-3 MeV), but there is no improvement in the width of the distribution (+/- 9 MeV still). This agrees with Jeff's results based on all three running conditions, namely that the E5 data is already in good shape after cooking and this method of correcting the electron momentum has a small effect.

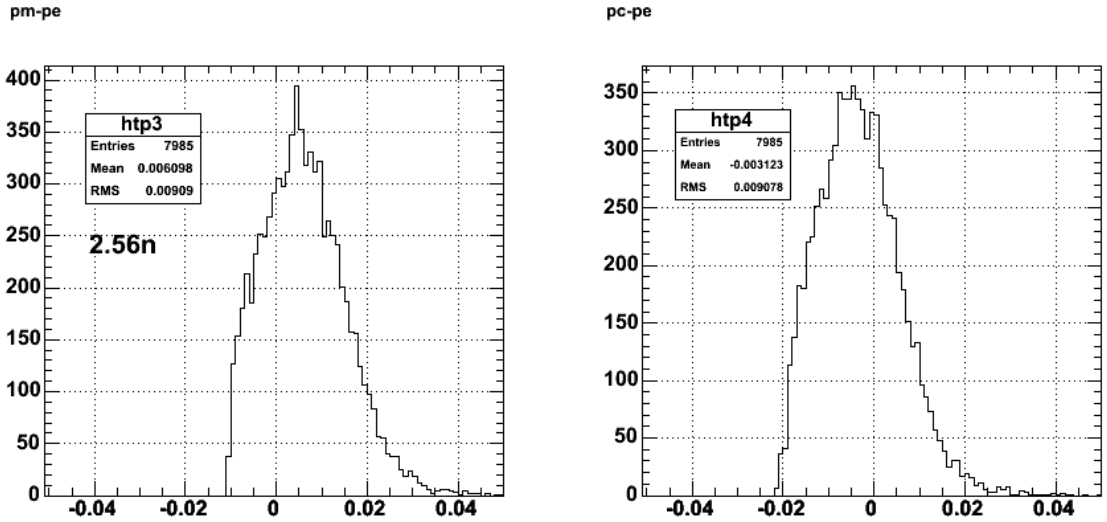


Fig 7. Comparison of the difference between the electron momentum calculated from the scattering angle measurement with the uncorrected and corrected momentum measurements.

The figure below shows the effect on W2 sector by sector of the new electron momentum corrections.

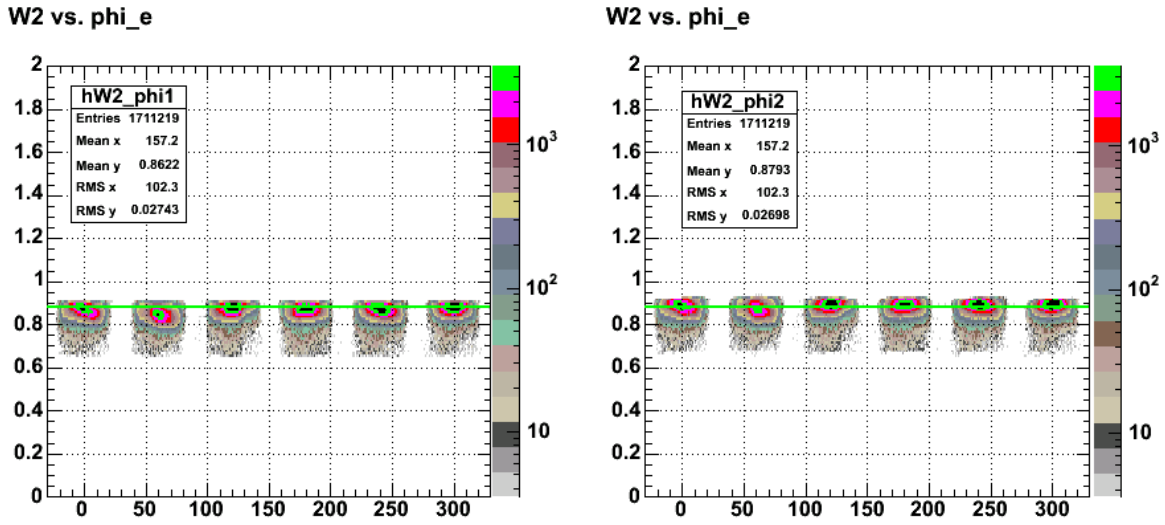


Fig 8. Same as figure 6 for the full, 2.56n data set.

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[Modified Thu Feb 17 21:04:47 2005 (GMT) gpg]

Some final (maybe, sort of) results for the entry-109 electron momentum corrections. First some plots.

Click here to view the object (Fig. 1 Uncorrected W2 spectra sector by sector with fit results.) you uploaded.

Click here to view the object (Fig 2. Corrected W2 spectra sector by sector with fit results.) you uploaded.

Some tables of results starting with the stuff from entry 245 in the E5 elog.

Sector	centroid (0.8804 expected)			JL centroid		
	before	after	%diff	before	after	%diff(JL-GPG)
1	0.8682	0.8790	0.16	0.8731	0.8784	0.07
2	0.8355	0.8767	0.42	0.8323	0.8697	0.80
3	0.8940	0.8808	0.05	0.8819	0.8838	0.34
4	0.8711	0.8791	0.15	0.8669	0.8763	0.32
5	0.8729	0.8793	0.12	0.8606	0.8734	0.67
6	0.8850	0.8807	0.03	0.8766	0.8809	0.02

Sector	width	
	before	after
1	0.03557	0.02789
2	0.04839	0.02699
3	0.03346	0.02800
4	0.03126	0.02781
5	0.03332	0.02870
6	0.03006	0.02957

Now for the entry-109 results.

Sector	centroid (0.8804 expected)		
	before	after	%diff
1	0.8698	0.8865	1.092
2	0.8389	0.8790	1.048
3	0.8873	0.9033	1.018
4	0.8722	0.8886	1.019
5	0.8743	0.8905	1.019
6	0.8845	0.8946	1.011

Sector	centroid (0.88035 expected)			
	before	after	before - 0.88035	after - 0.88035
1	0.8698	0.8865	-0.0106	0.0061
2	0.8389	0.8790	-0.0415	-0.0014
3	0.8873	0.9033	0.0070	0.0230
4	0.8722	0.8886	-0.0082	0.0082
5	0.8743	0.8906	-0.0061	0.0103
6	0.8845	0.8946	0.0041	0.0143
Ave	0.8712	0.8904	-0.0092	0.0101

Width results

Sector	width	
	before	after
1	0.03371	0.02631
2	0.04495	0.02230
3	0.03253	0.02867
4	0.03032	0.02754
5	0.03115	0.02464
6	0.02914	0.02809

Compare the two. The later-used JL results are better.

Sector	JL	R&A
1	0.8790	0.8865
2	0.8767	0.8790
3	0.8808	0.9033
4	0.8791	0.8886
5	0.8793	0.8906
6	0.8807	0.8946

```
Average   0.8793  0.8904

Ave-0.88035  -0.0011  0.0101
```

Next is the root commands for generating the plots with fits.

corrected W2 spectra sector by sector

```
TCanvas *c1 = new TCanvas("c1", "c1",180,20,1000,700);
c1->Divide(3,2)
gStyle->SetOptFit(1);
gStyle->SetStatH(0.20);
gStyle->SetStatX(0.80);
gStyle->SetStatY(0.80);
int thetalo, thetahi, philo, phihi;
thetalo = 5;
thetahi = 8;
hpcorr_W2b->GetYaxis()->SetRange(thetalo,thetahi);
TH2D *h1a = (TH2D*) hpcorr_W2b->Project3D("zx");
TH2D *hW2s1 = (TH2D*)h1a->Clone();
TH2D *hW2s2 = (TH2D*)h1a->Clone();
TH2D *hW2s3 = (TH2D*)h1a->Clone();
TH2D *hW2s4 = (TH2D*)h1a->Clone();
TH2D *hW2s5 = (TH2D*)h1a->Clone();
TH2D *hW2s6 = (TH2D*)h1a->Clone();
philo=1;
phihi=6;
TH1D *h2as1 = (TH1D*) hW2s1->ProjectionY("hW2s1",philo,phihi);
c1_1->cd();
h2as1->Draw();
h2as1->Fit("gaus","","",0.815,0.945);
philo=7;
phihi=12;
TH1D *h2as2 = (TH1D*) hW2s2->ProjectionY("hW2s2",philo,phihi);
c1_2->cd();
h2as2->Draw();
h2as2->Fit("gaus","","",0.815,0.945);
philo=13;
phihi=18;
TH1D *h2as3 = (TH1D*) hW2s3->ProjectionY("hW2s3",philo,phihi);
c1_3->cd();
h2as3->Draw();
h2as3->Fit("gaus","","",0.815,0.945);
philo=19;
phihi=24;
TH1D *h2as4 = (TH1D*) hW2s4->ProjectionY("hW2s4",philo,phihi);
c1_4->cd();
h2as4->Draw();
h2as4->Fit("gaus","","",0.815,0.945);
philo=25;
phihi=30;
TH1D *h2as5 = (TH1D*) hW2s5->ProjectionY("hW2s5",philo,phihi);
c1_5->cd();
h2as5->Draw();
h2as5->Fit("gaus","","",0.815,0.945);
philo=31;
phihi=36;
TH1D *h2as6 = (TH1D*) hW2s6->ProjectionY("hW2s6",philo,phihi);
c1_6->cd();
h2as6->Draw();
h2as6->Fit("gaus","","",0.815,0.945);
```

uncorrected W2 spectra sector by sector

```
TCanvas *c1 = new TCanvas("c1", "c1",180,20,1000,700);
c1->Divide(3,2)
gStyle->SetOptFit(1);
gStyle->SetStatH(0.20);
gStyle->SetStatX(0.80);
gStyle->SetStatY(0.80);
int thetalo, thetahi, philo, phihi;
thetalo = 0;
thetahi = 70;
hpcorr_W2a->GetYaxis()->SetRange(thetalo,thetahi);
TH2D *h1a = (TH2D*) hpcorr_W2a->Project3D("zx");
TH2D *hW2s1 = (TH2D*)h1a->Clone();
TH2D *hW2s2 = (TH2D*)h1a->Clone();
TH2D *hW2s3 = (TH2D*)h1a->Clone();
TH2D *hW2s4 = (TH2D*)h1a->Clone();
TH2D *hW2s5 = (TH2D*)h1a->Clone();
TH2D *hW2s6 = (TH2D*)h1a->Clone();
philo=1;
phihi=6;
TH1D *h2as1 = (TH1D*) hW2s1->ProjectionY("hW2s1",philo,phihi);
c1_1->cd();
h2as1->Draw();
h2as1->Fit("gaus","","",0.815,0.945);
philo=7;
phihi=12;
TH1D *h2as2 = (TH1D*) hW2s2->ProjectionY("hW2s2",philo,phihi);
c1_2->cd();
h2as2->Draw();
h2as2->Fit("gaus","","",0.815,0.945);
philo=13;
phihi=18;
```

```
TH1D *h2as3 = (TH1D*) hW2s3->ProjectionY("hW2s3",philo,phihi);
c1_3->cd();
h2as3->Draw();
h2as3->Fit("gaus","","",0.815,0.945);
philo=19;
phihi=24;
TH1D *h2as4 = (TH1D*) hW2s4->ProjectionY("hW2s4",philo,phihi);
c1_4->cd();
h2as4->Draw();
h2as4->Fit("gaus","","",0.815,0.945);
philo=25;
phihi=30;
TH1D *h2as5 = (TH1D*) hW2s5->ProjectionY("hW2s5",philo,phihi);
c1_5->cd();
h2as5->Draw();
h2as5->Fit("gaus","","",0.815,0.945);
philo=31;
phihi=36;
TH1D *h2as6 = (TH1D*) hW2s6->ProjectionY("hW2s6",philo,phihi);
c1_6->cd();
h2as6->Draw();
h2as6->Fit("gaus","","",0.815,0.945);
```

Click here to view the object (Root file used to generate the above results) you uploaded.

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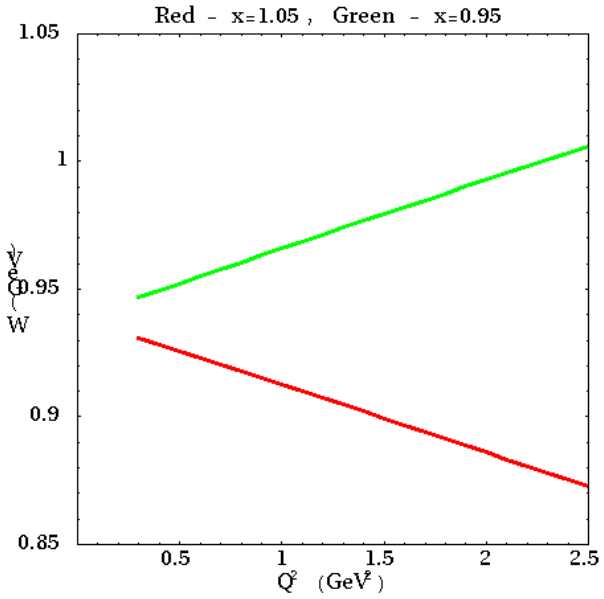
Jerry Gilfoyle's Enotebook page 28 - Don't use xBJ for quasi-elastic scattering (Gerard P Gilfoyle)

[Modified Thu Feb 17 22:00:40 2005 (GMT) Gerard P Gilfoyle]

I just discovered an 'interesting' kinematic property. In the past I have used BJorken 'x' to select quasi-elastic events. BAM told me this was a bad idea because the range of W values can change. I did not understand that fully until now. The plot below reveals the problem. It shows W calculated for electron scattering off the deuteron based on the assumption of quasi-elastic scattering (i.e. I use the proton mass instead of the full deuteron mass in calculating W). The plot shows that for a cut on x of 0.95 < x < 1.05, the range of W values that contribute increase with Q2.



Upper and lower limits of W values allowed by a 0.95 < x < 1.05 cut on x.

Click here to view the object (Mathematica notebook used to make the above plot) you uploaded.

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Jerry Gilfoyle's Enotebook page 29 - Effect of electron fiducial cuts. (GPG)

[Modified Wed Feb 23 00:05:23 2005 (GMT) GPG]

Plots below show ALTp with new electron fiducial cuts on and off.

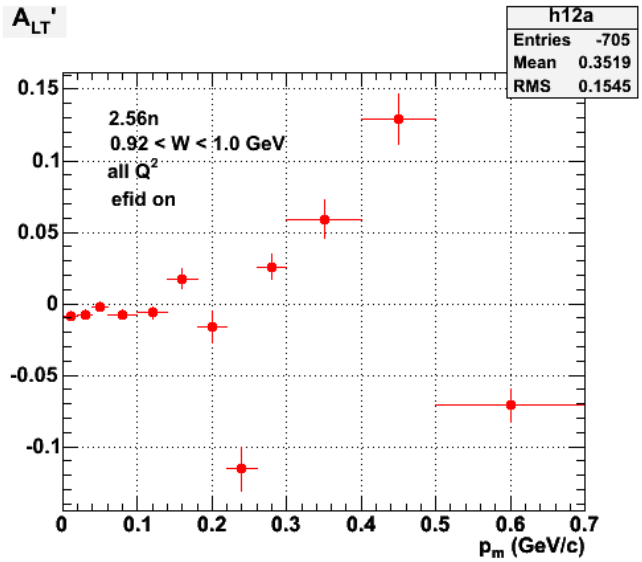

Fig 1. ALTp with fiducial cuts on

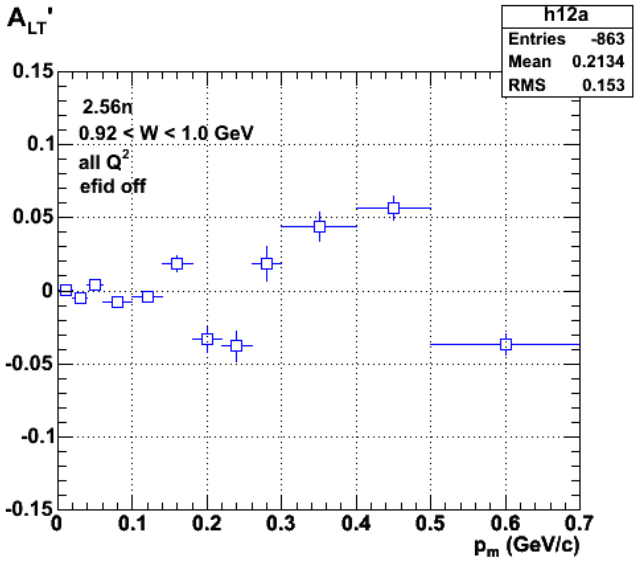

Fig 2. ALTp with fiducial cuts off

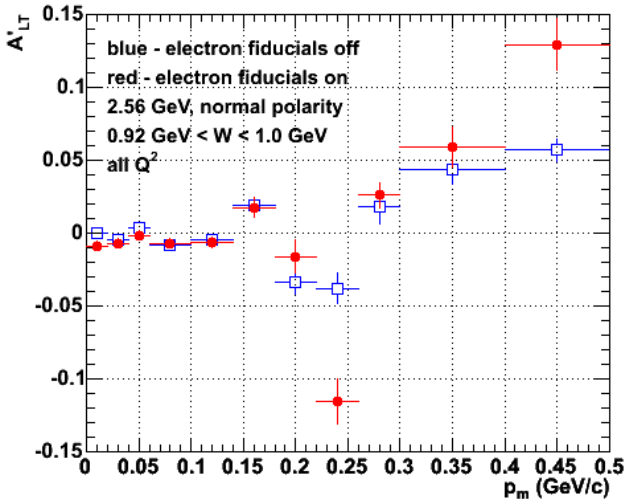

Fig 3. Nice version of the two plots above

Click here to view the object (Root macro file to draw Figure 3) you uploaded.

The plot below is for a restricted Q2 bin (0.8 < Q2 < 1.0 GeV2). It bears a striking resemblence to past plots except the for the unhappy behavior near zero.

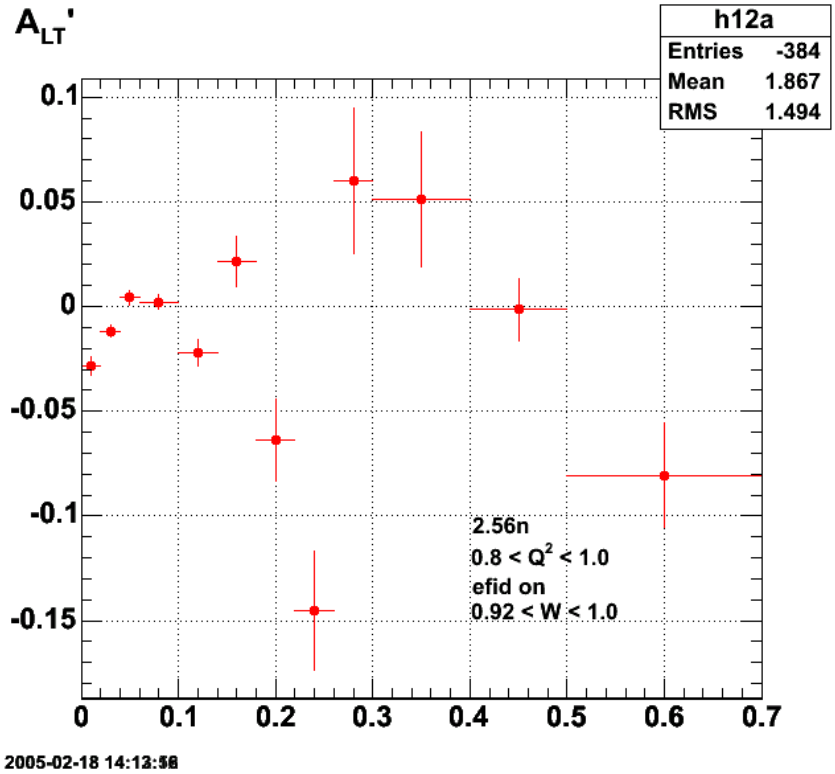

Fig 4. ALTp for restricted Q2 range.

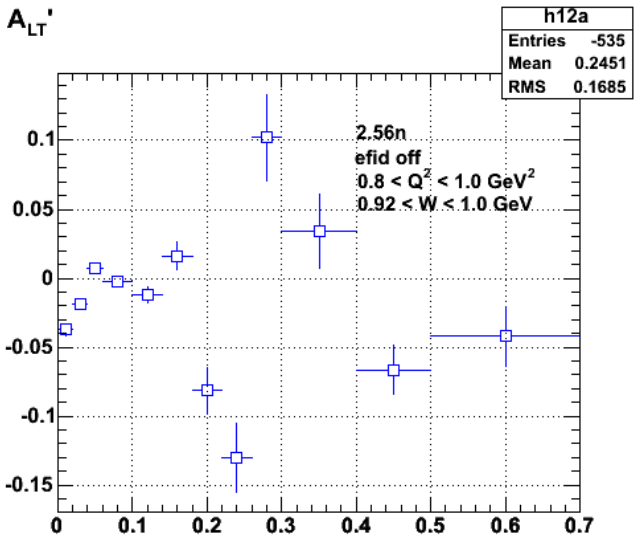

Fig 5. Same as Fig 4 with electron fiducial cuts turned off

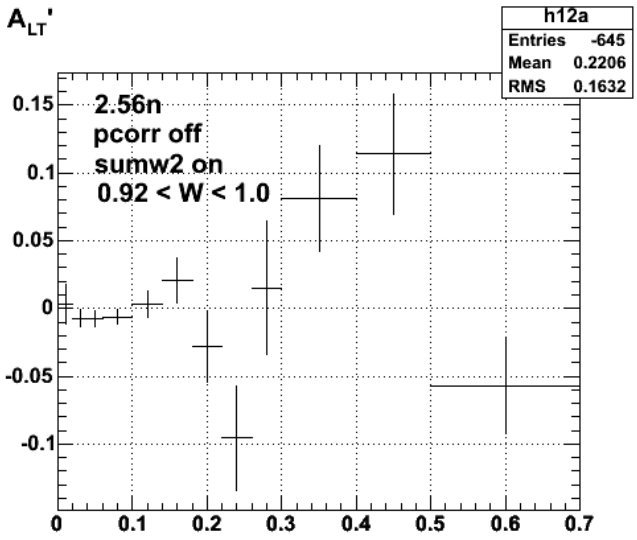

Fig 6. Turn on sumw2 errors, no p_e correction

Click here to view the object (Root C++ macro for above plot) you uploaded.

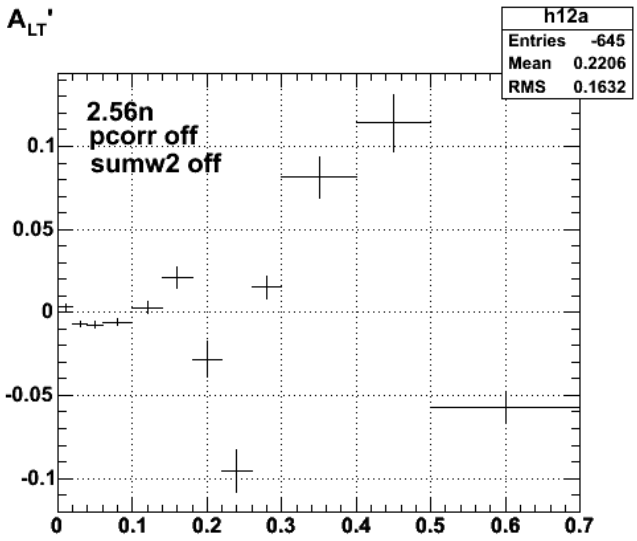

Fig 7. Turn off sumw2 errors, no p_e correction

Click here to view the object (Root C++ macro for above plot) you uploaded.

A useful command.

```
TH2D *h1a = (TH2D*) helectron_fiducials->Project3D("xy");
```

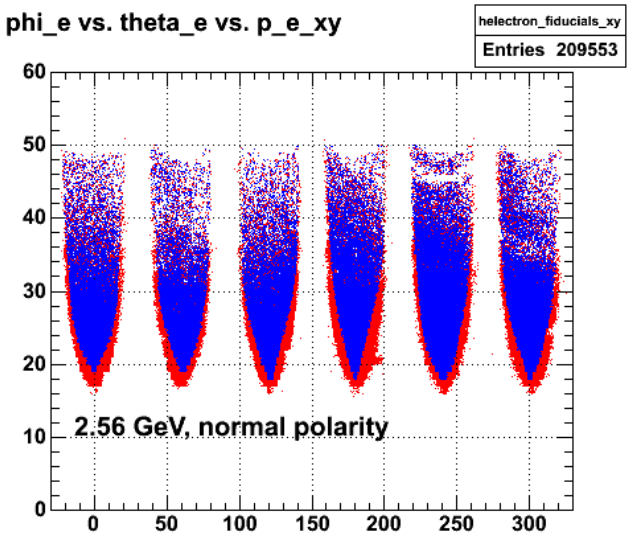

Fig 8. Before and after pictures of electron fiducucial cuts.

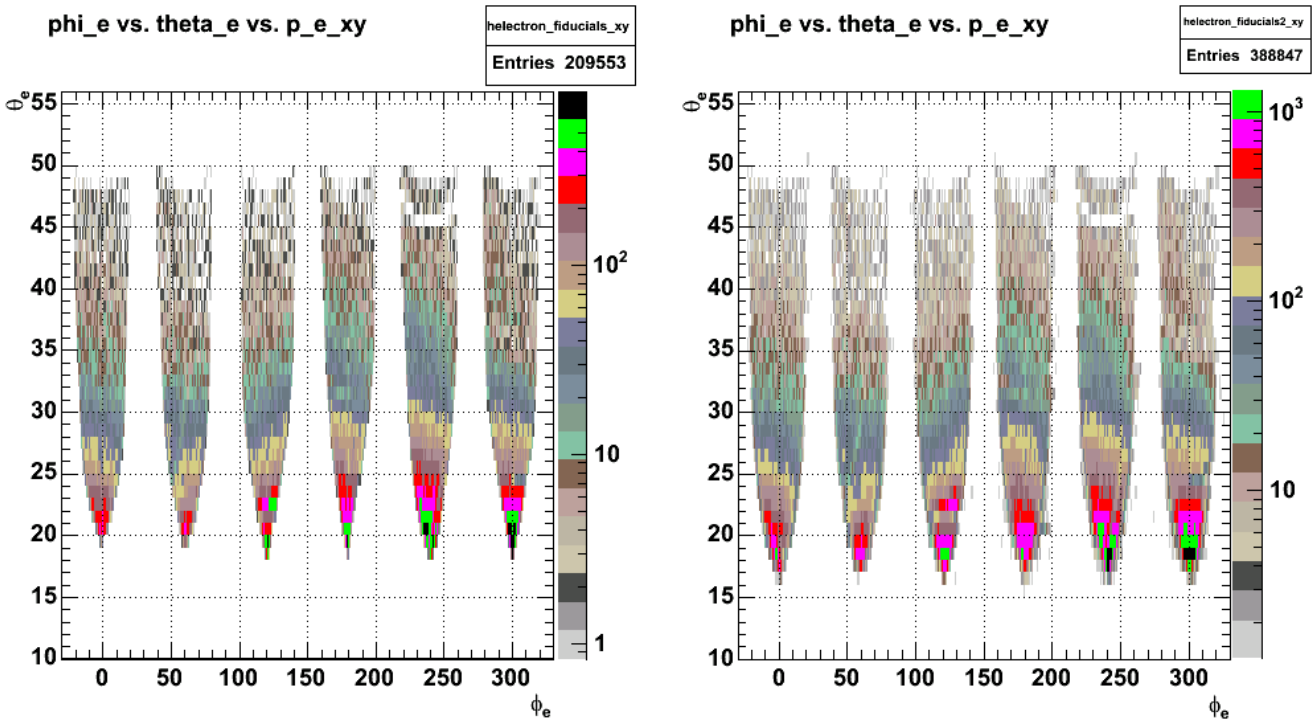

Fig 9. Contour plots of the theta_e vs. phi_e plots with electron fiducial cuts on and off.

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Jerry Gilfoyle's Enotebook page 30 - ALTp at p_m = 0.0 (gpg)

[Modified Mon Feb 21 04:31:16 2005 (GMT) gpg]

One test of data consistency is that the asymmetry ALTp should go to zero for p_m->0.0. This is because at zero theta_pq (and zero p_m) you are averaging over all phi_pq and that will give zero because of the sin(phi_pq) dependence.

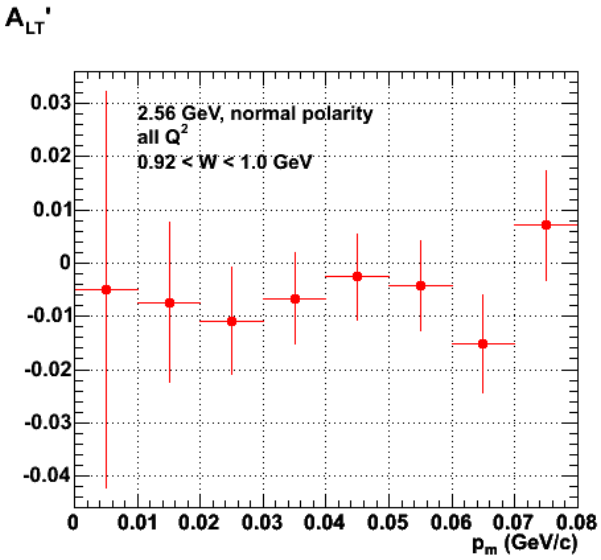

Fig 1. Plot of ALTp near p_m = zero.

Click here to view the object (C++ code for the previous plot) you uploaded.

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Jerry Gilfoyle's Enotebook page 31 - checking p_m spectra (gpg)

[Modified Fri Mar 4 05:06:47 2005 (GMT) gpg]

Using BAM's idea I generated the plots below to see if any anomalies exist in the p_m distribution. None are obvious.

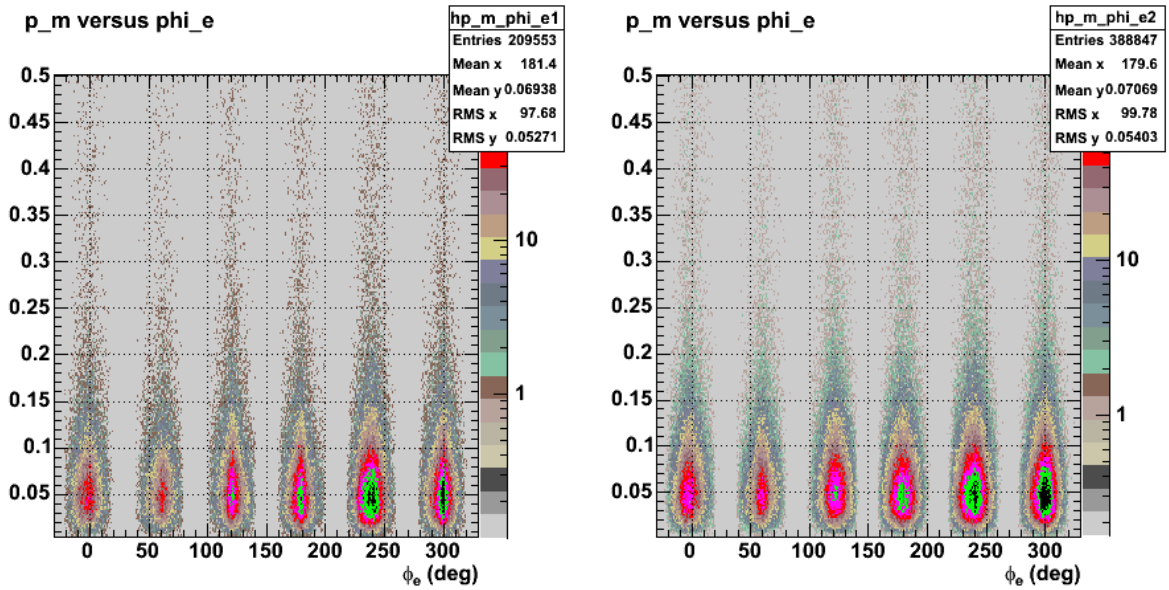

Fig 1. Plot of p_m versus phi_e. The left panel is with electron fiducial cuts on, the right with them off.

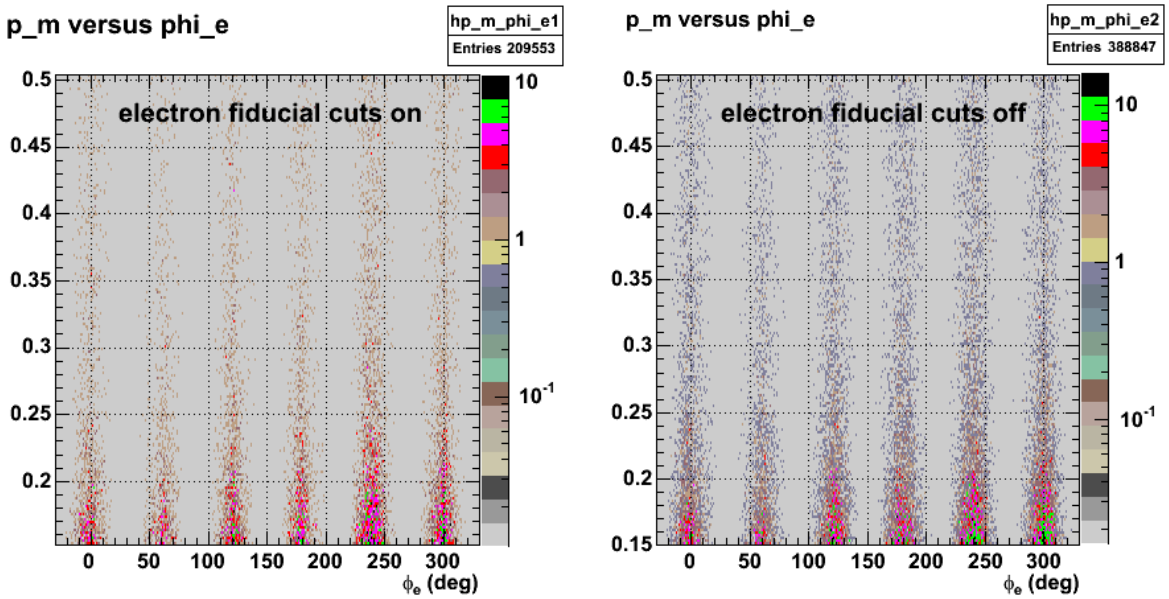

Fig 2. Same as previous plot zoomed into the region in p_m where the dip is located in ALTp.

Click here to view the object (sector-by-sector plots of p_m distribution) you uploaded.

Click here to view the object (sector-by-sector plot of p_m distribution (efids off?)) you uploaded.

Click here to view the object (Comparison of p_m with electron fiducial cuts on and off) you uploaded.

The root commands for generating the previous plot are below.

```
gStyle->SetOptStat("")
c1_1->cd()
```

```
TH1D *h1b = (TH1D*) hp_m_phi_e2->ProjectionY("h1b",1,60)
c1_1->SetLogy();
h1b->SetMinimum(1);
h1b->SetMaximum(3000);
h1b->GetXaxis()->SetTitle("p_{m} (GeV/c)");
h1b.Draw()
tex = new TLatex(0.3,400,"sector 1");
tex->Draw();
c1_1->Modified();
c1_2->cd()
TH1D *h2b = (TH1D*) hp_m_phi_e2->ProjectionY("h2b",61,120)
c1_2->SetLogy();
h2b->SetMinimum(1);
h2b->SetMaximum(3000);
h2b->GetXaxis()->SetTitle("p_{m} (GeV/c)");
h2b.Draw()
tex = new TLatex(0.3,100,"sector 2");
tex->Draw();
tex = new TLatex(0.1,1300,"black - electron fiducial cuts off");
tex->SetTextSize(0.04);
tex->Draw();
tex = new TLatex(0.1,800,"red - electron fiducial cuts on");
tex->SetTextSize(0.04);
tex->Draw();
c1_2->Modified();
c1_3->cd()
TH1D *h3b = (TH1D*) hp_m_phi_e2->ProjectionY("h3b",121,180)
c1_3->SetLogy();
h3b->SetMinimum(1);
h3b->SetMaximum(3000);
h3b->GetXaxis()->SetTitle("p_{m} (GeV/c)");
h3b.Draw()
tex = new TLatex(0.3,400,"sector 3");
tex->Draw();
c1_3->Modified();
c1_4->cd()
TH1D *h4b = (TH1D*) hp_m_phi_e2->ProjectionY("h4b",181,240)
c1_4->SetLogy();
h4b->SetMinimum(1);
h4b->SetMaximum(3000);
h4b->GetXaxis()->SetTitle("p_{m} (GeV/c)");
h4b.Draw()
tex = new TLatex(0.3,400,"sector 4");
tex->Draw();
c1_4->Modified();
c1_5->cd()
TH1D *h5b = (TH1D*) hp_m_phi_e2->ProjectionY("h5b",241,300)
c1_5->SetLogy();
h5b->SetMinimum(1);
h5b->SetMaximum(3000);
h5b->GetXaxis()->SetTitle("p_{m} (GeV/c)");
h5b.Draw()
tex = new TLatex(0.3,400,"sector 5");
tex->Draw();
c1_5->Modified();
c1_6->cd()
TH1D *h6b = (TH1D*) hp_m_phi_e2->ProjectionY("h6b",301,360)
c1_6->SetLogy();
h6b->SetMinimum(1);
h6b->SetMaximum(3000);
h6b->GetXaxis()->SetTitle("p_{m} (GeV/c)");
h6b.Draw()
tex = new TLatex(0.3,400,"sector 6");
tex->Draw();
c1_6->Modified();


c1_1->cd()
TH1D *h1c = (TH1D*) hp_m_phi_e1->ProjectionY("h1c",1,60)
h1c->SetLineColor(2);
h1c.Draw("same")
c1_2->cd()
TH1D *h2c = (TH1D*) hp_m_phi_e1->ProjectionY("h2c",61,120)
h2c->SetLineColor(2);
h2c.Draw("same")
c1_3->cd()
TH1D *h3c = (TH1D*) hp_m_phi_e1->ProjectionY("h3c",121,180)
h3c->SetLineColor(2);
h3c.Draw("same")
c1_4->cd()
TH1D *h4c = (TH1D*) hp_m_phi_e1->ProjectionY("h4c",181,240)
h4c->SetLineColor(2);
h4c.Draw("same")
c1_5->cd()
TH1D *h5c = (TH1D*) hp_m_phi_e1->ProjectionY("h5c",241,300)
h5c->SetLineColor(2);
h5c.Draw("same")
c1_6->cd()
TH1D *h6c = (TH1D*) hp_m_phi_e1->ProjectionY("h6c",301,360)
h6c->SetLineColor(2);
h6c.Draw("same")
```

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Jerry Gilfoyle's Enotebook page 32 - theta_ vs phi_e in p_m bins (gpg)

[Modified Wed Feb 23 18:35:00 2005 (GMT) gpg]

look at before and after efid plots for theta_e vs. phi_e gated on ep(n) events in a particular p_m range. The first figure is with electron fiducials on.

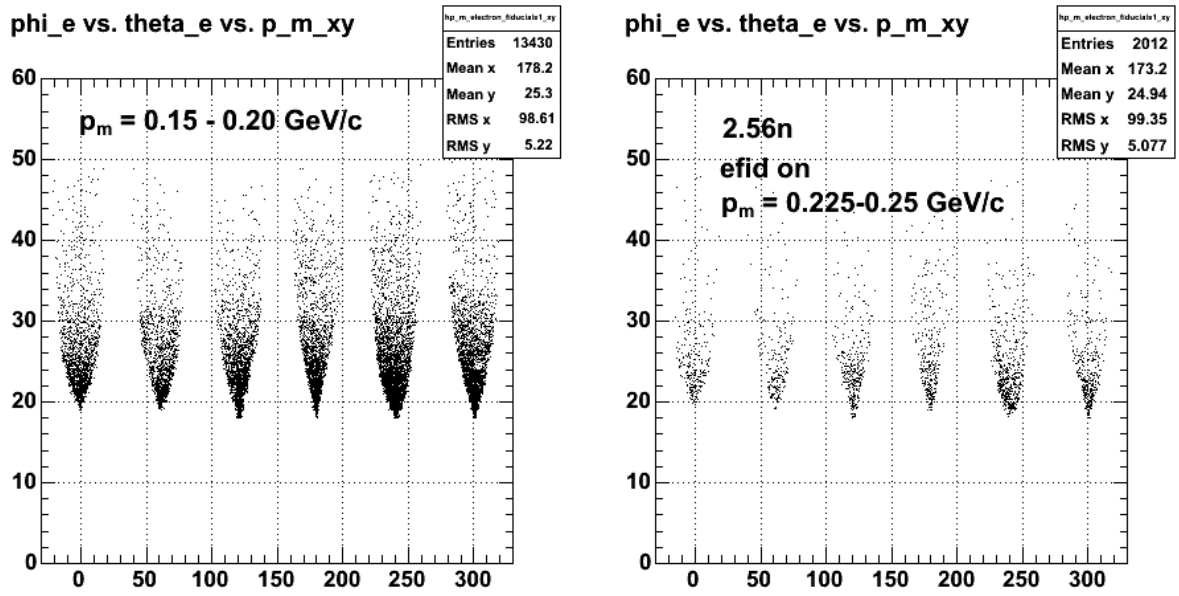

Fig 1. theta$_e$ versus phi$_e$ for ep(n) events from a particular p_m range.

Now turn the electron fiducials off.

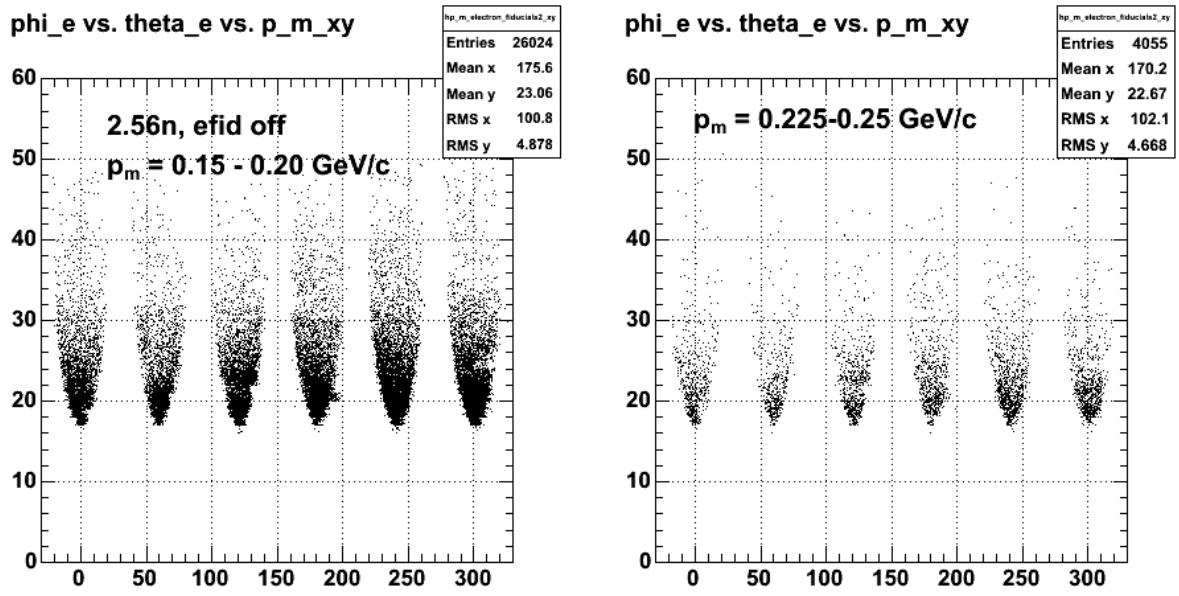

Fig 2. heta$_e$ versus phi$_e$ for ep(n) events from a particular p_m range.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 33 - Tighter efid cuts (gpg)

[Modified Wed Feb 23 22:04:48 2005 (GMT) gpg]

I modified the electron fiducial cut routine so that the cuts are now 3 degrees tighter on each side. The results are shown below. This is NUTS!

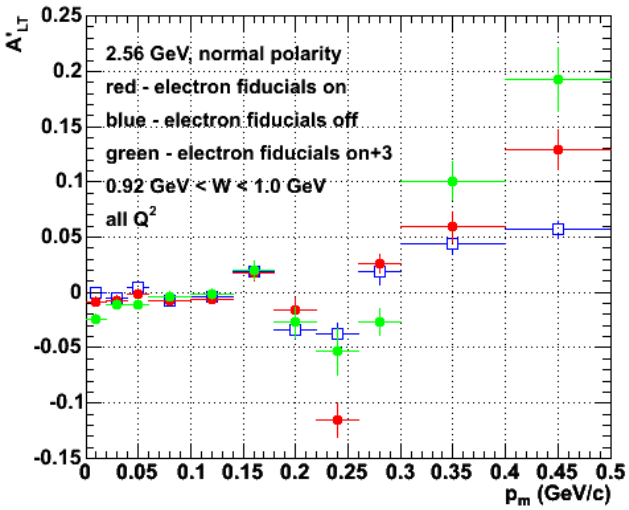

Fig 1. Added a tighter cut on the electron fiducials (green points)

Click here to view the object (Root macro for the above plot) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 34 - More tests of missing momentum (gpg)

[Modified Mon Mar 14 03:47:01 2005 (GMT) gpg]

The plots below show the 2D spectra of missing momentum p_m versus phi_e. The spectra on the right had no electron fiducial cuts, but did have all the other usual suspects turned on. The spectrum on the left is for events that are OUTSIDE the electron fiducial cuts. These are the events on the rim of each sector.

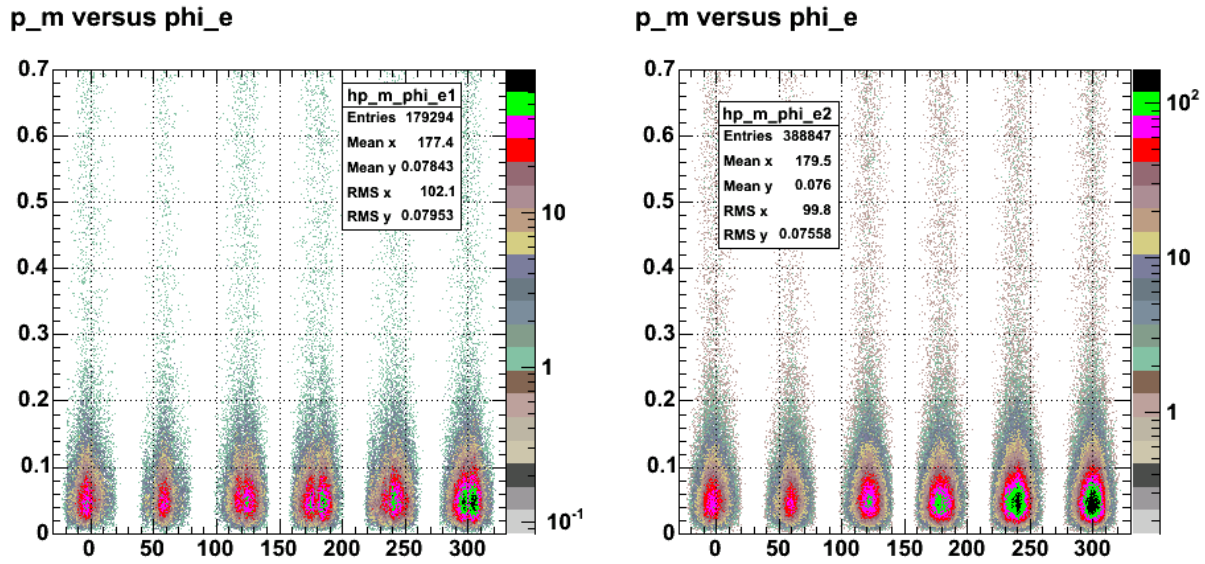

Fig 1. Comparison of p_m versus phi_e for events ourside the electron fiducial cuts (left panel) and ones wiht no electron fiducial cuts turned on.

Below is a plot of all three p_m spectra.

Click here to view the object (Fig 2. Plot of all three p_m spectra.) you uploaded.

Click here to view the object (Root macro for previous plot) you uploaded.

Table of normalization values.

```
root [158] h1cint/h1dint
(double)9.59189665296535487e-01
root [159] h2cint/h2dint
(double)8.88024048526490972e-01
root [160] h3cint/h3dint
(double)9.36956967914072680e-01
root [161] h4cint/h4dint
(double)1.04889894419306184e+00
root [162] h5cint/h5dint
(double)5.37889361702127644e-01
root [163] h6cint/h6dint
(double)1.03431109033539781e+00
```

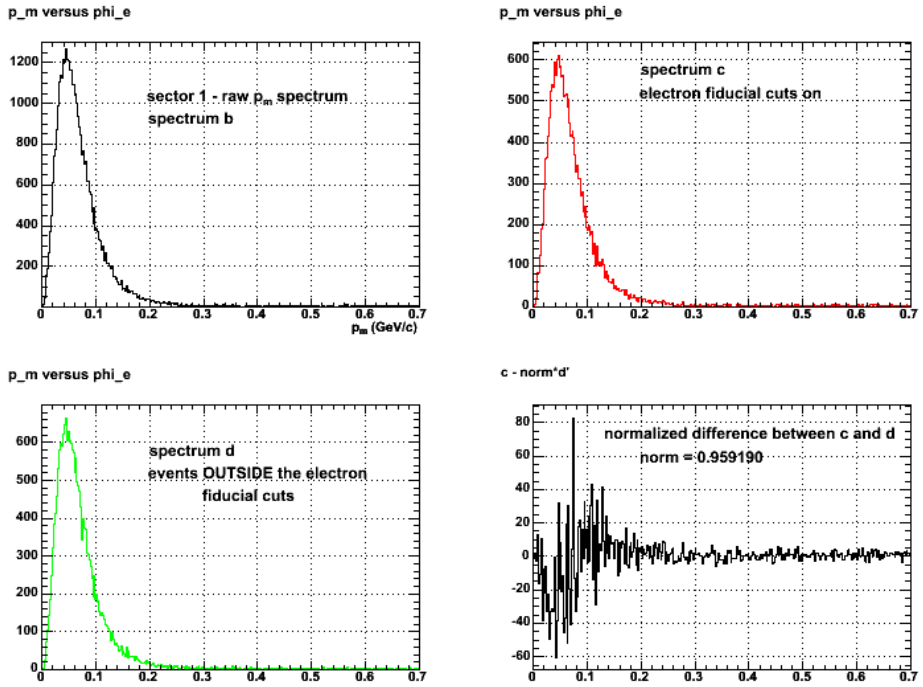

Fig 3. Normalized difference spectrum and inputs.

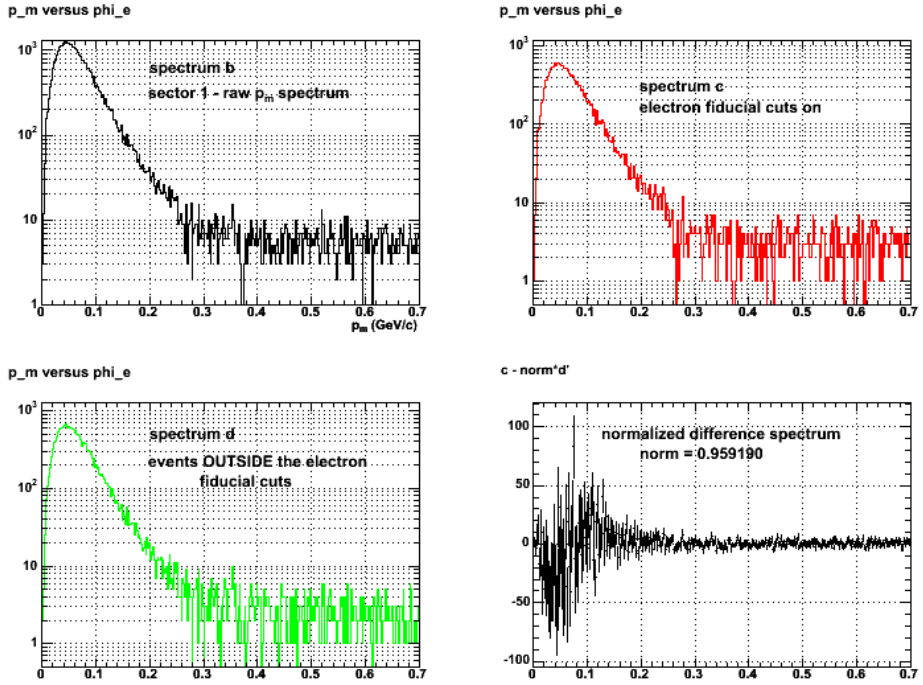

Fig 4. Another version of pervious plot.

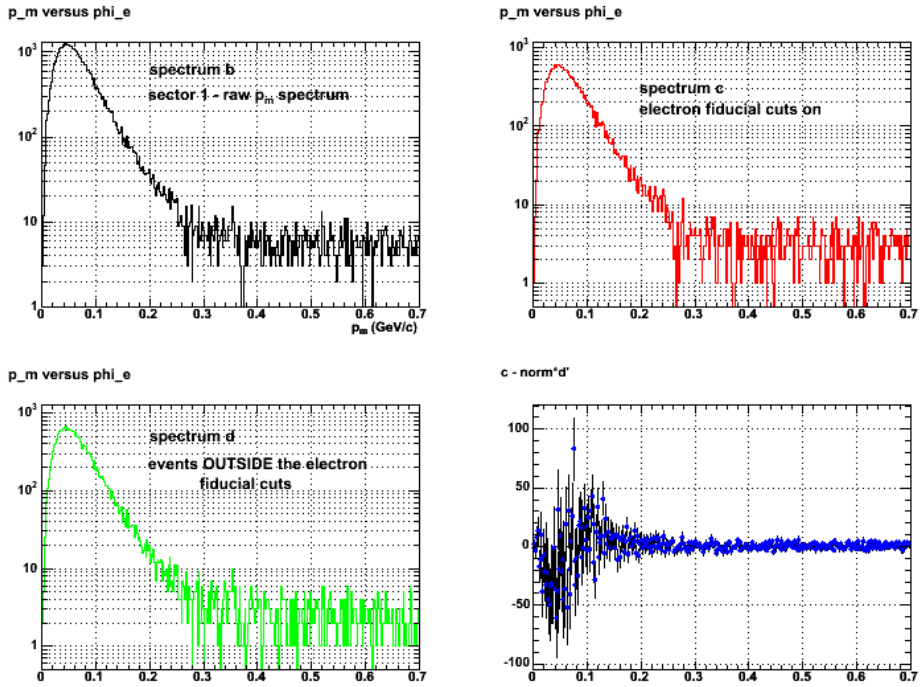

Fig 5. Another version of previous plot.

Click here to view the object (Root macro for previous plot) you uploaded.

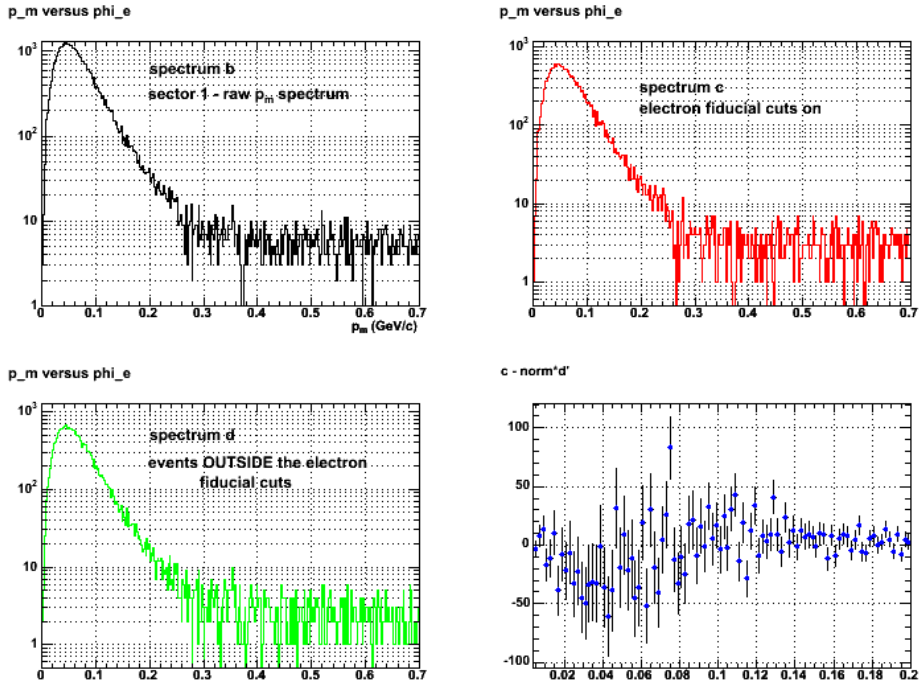

Fig 6.

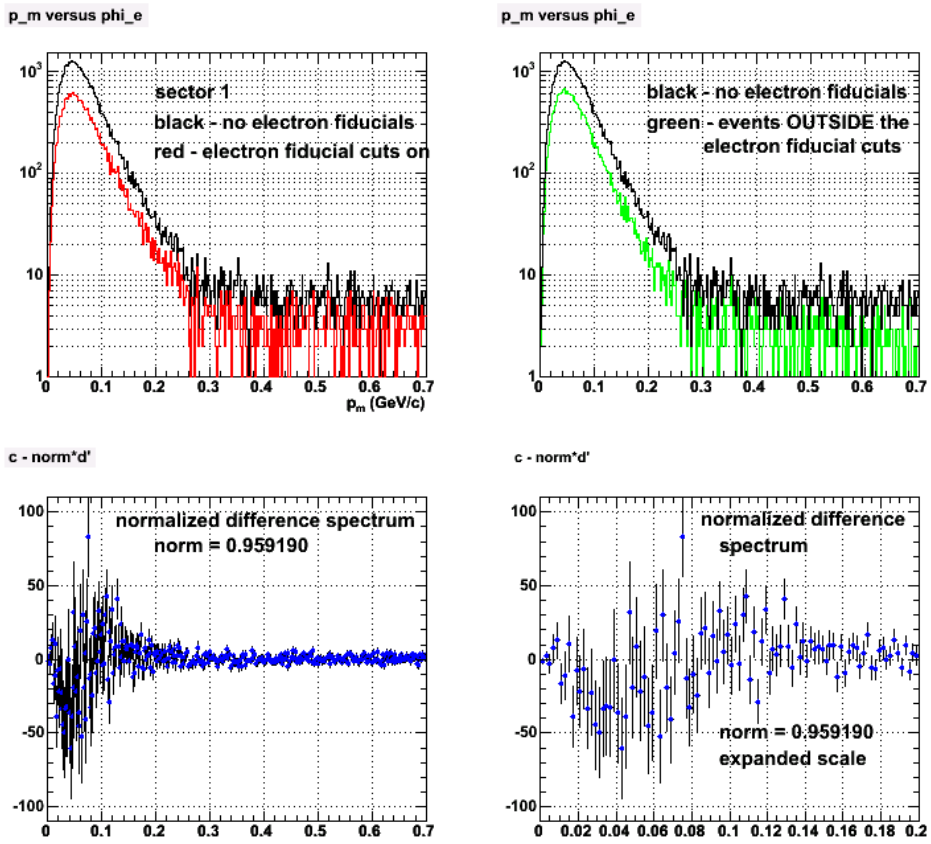

Fig 7. Cool version of previous plot.

Click here to view the object (root macro for previous plot) you uploaded.

The plot below is the summary for sector 1 of the comparison between the p_m spectrum for events in the electron fiducial region and those outside as suggested by BAM. The normalized difference spectrum is defined as the bin-by-bin difference between the p_m histogram of the events in the electron fiducial region and those outside it corrected for different yields. In other words

$N_{diff} = N_{out} - C*N_{in}$

where C is the ratio of the total yield outside the fiducial region to the yield inside the fiducial region. The red and green spectra in the top panels are both very similar to the black histogram for the p_m distribution with no electron fiducial cuts turned on. This similarity is also shown in the lower left panel. This is the normalized difference. There is a small (difference 50 events out of 600) at small p_m (about 50 MeV/c) which is 2-3 sigma outside the statistical variation. The burning question has been whether there was any evidence of a distortion in the reconstruction of events falling outside the the electron fiducial cuts that would account for the enhanced amplitude in ALTp at large p_m when the electron fiducial cuts are turned on. The normalized difference spectum in the lower left panel is zero at large p_m meaning there is little or no difference in the two spectra. This would mean that BAM's concern about a mistake in the reconstruction for events near the coils does not appear to be true. This is almost bad news since it would have provided an explanation for the enhanced ALTp amplitudes at large p_m. However, the effect may be due to KJ's explanation or, even more simply, due to a different Q^2 distribution when the electron fiducial cuts are turned on. Also I have to check ALL the sectors before I can definitively draw that conclusion.

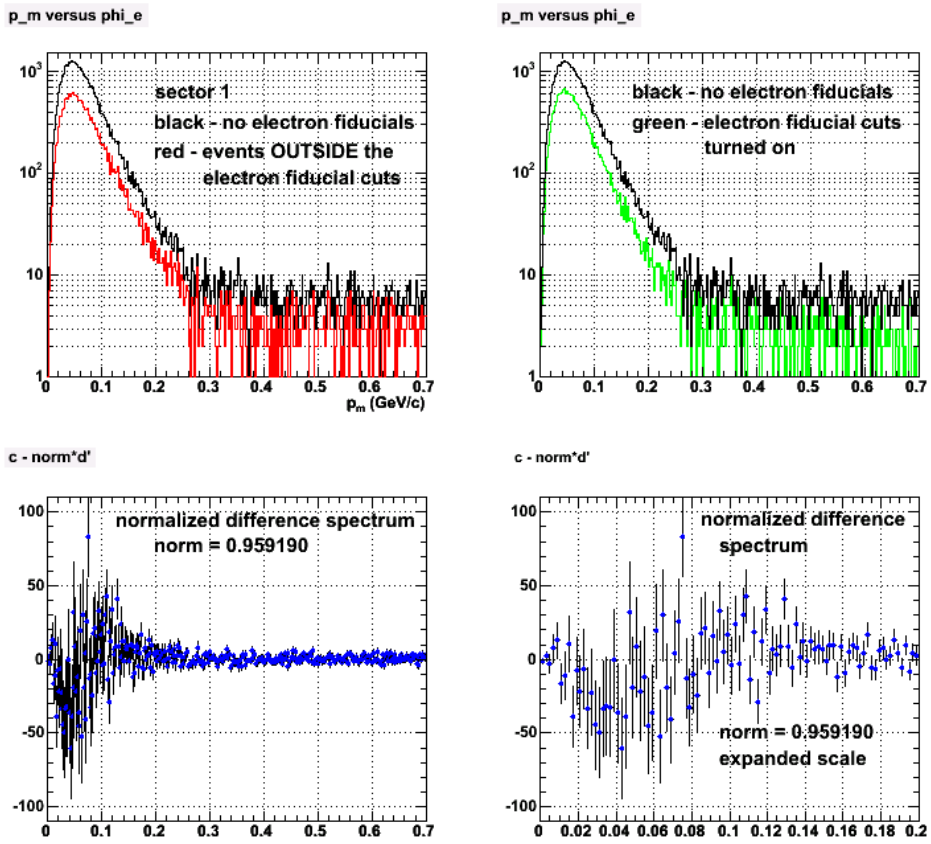

Fig 8. Cool version of previous plot.

Click here to view the object (Root macro for previous plot.) you uploaded.

Click here to view the object (Normalized difference for all sectors) you uploaded.

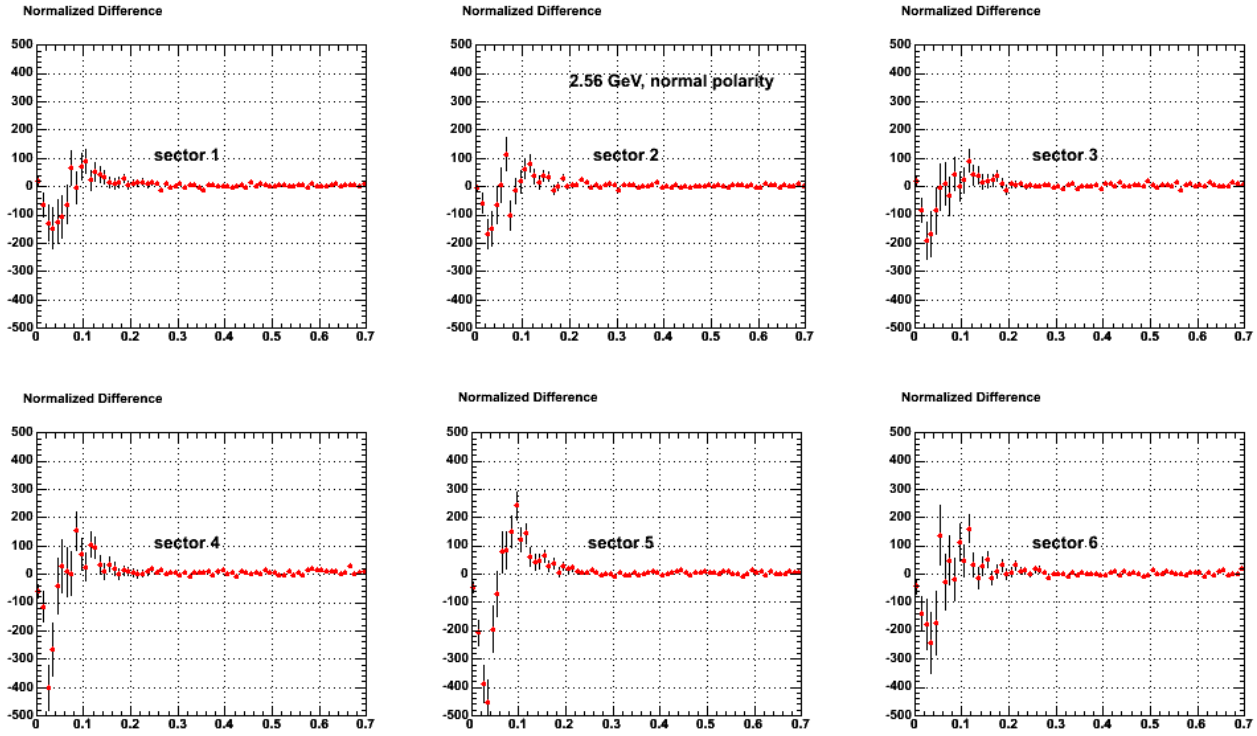

Fig 9. Normalized difference for all sectors

Click here to view the object (Root macro for previous plot) you uploaded.

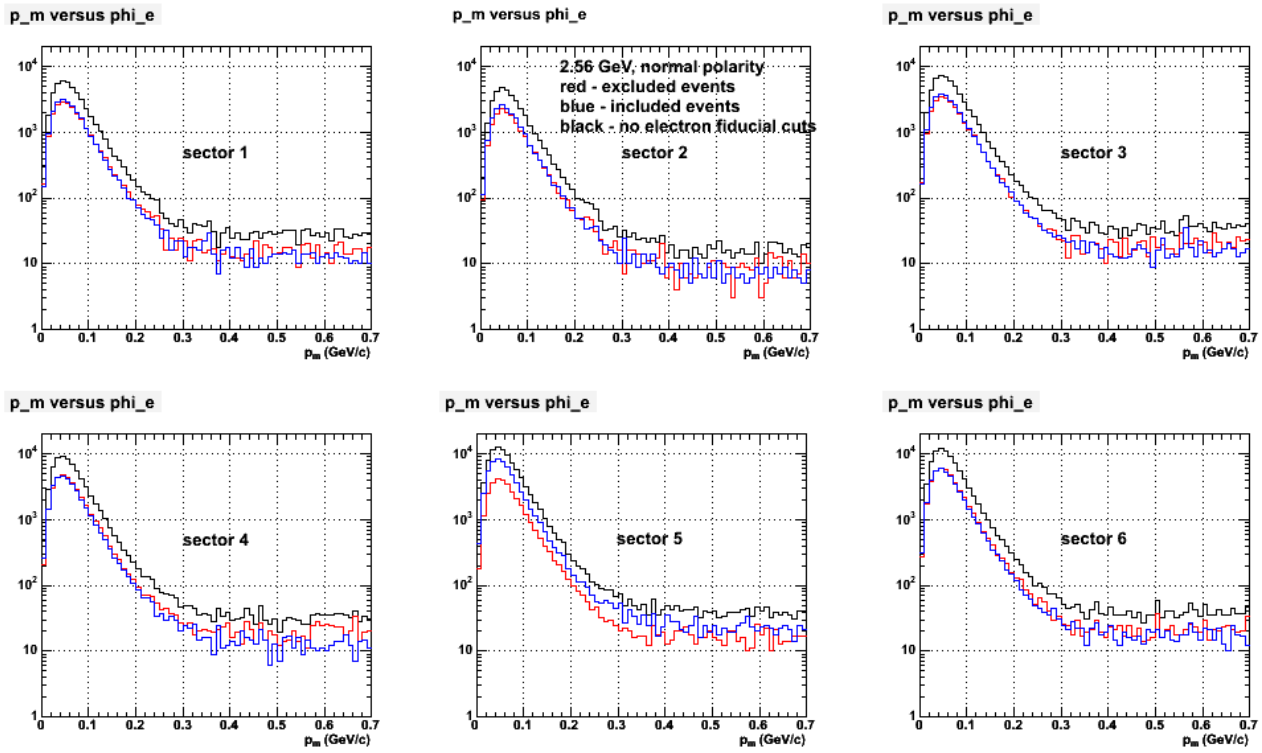

Fig 10. Missing momentum distributions.

Click here to view the object (PostScript version of previous plot) you uploaded.

Click here to view the object (Root macro for previous plot) you uploaded.

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Jerry Gilfoyle's Enotebook page 35 - Electron Fiducial Dependence of ALTp (GPG)

[Modified Thu Mar 17 21:47:35 2005 (GMT) GPG]

We have discovered recently that the use of tight electron fiducial constraints can have a significant effect of the fifth structure function asymmetry (ALTp). The electron fiducial cuts were described earlier1, 2, 3, and 4. The effect of turning these fiducial cuts on and off is shown in Figures 1-2. Figure 1 shows the effect of the fiducial cuts on the CLAS acceptance. The results are pretty typical.

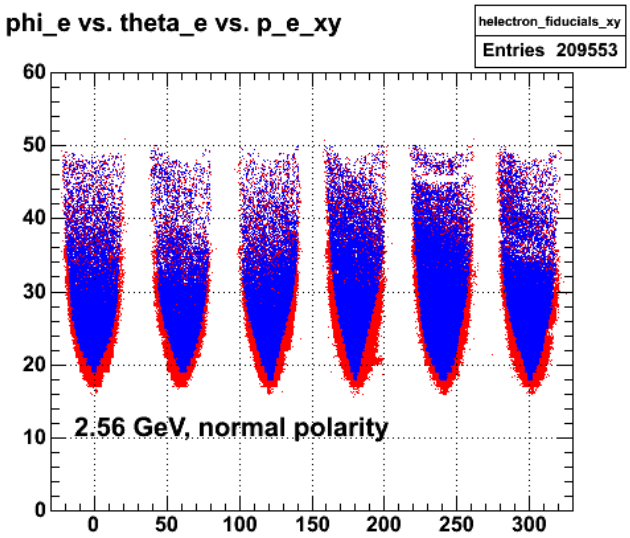


Fig 1. Effect on electron fiducial cuts on the CLAS electron acceptance.

The second figure shows the effect on ALTp of turning the electron fiducial cuts on and off. When the amplitude of the asymmetry is small there is little of no effect. When the asymmetry becomes significant, then the effect becomes large. It is a full factor of three for the point at p_m = 0.24 MeV/c and a factor of about 2.5 for p_m = 0.65 MeV/c.

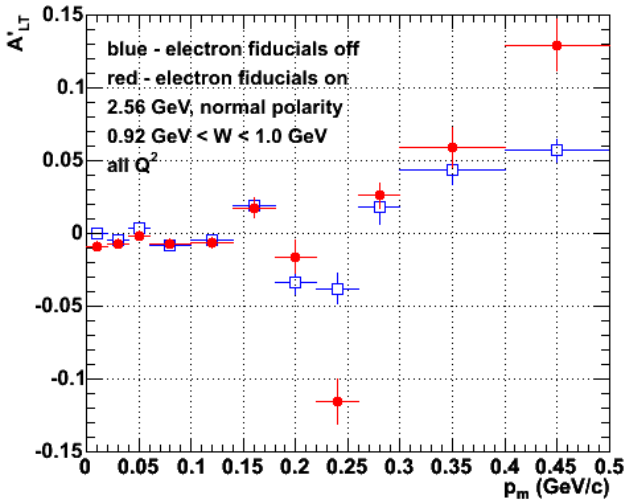


Fig 2. Effect of electron fiducial cuts on the fifth-structure-function asymmetry (ALTp).

Bernhard raised the concern that there might be a problem reconstructing tracks near the coils and along the edges of the CLAS acceptance. There are the events excluded by the new tighter electron fiducial cuts. His concern is that a small mistake at low p_m could push events out to larger p_m. Since the cross section is droping rapidly with p_m, a small mistake at small p_m could have a large effect at higher missing momentum. To test this idea consider Figures 3-4. Figure 3 shows the p_m distribution sector by sector under three sets of cuts. The black histogram in each panel has no electron fiducial cuts. The blue histogram has the electron fiducial cuts turned on. Everything else is the same as the black histogram. The red histogram represents the p_m distribution for events EXCLUDED by the new electron fiducial cuts. These are the events we throw out.

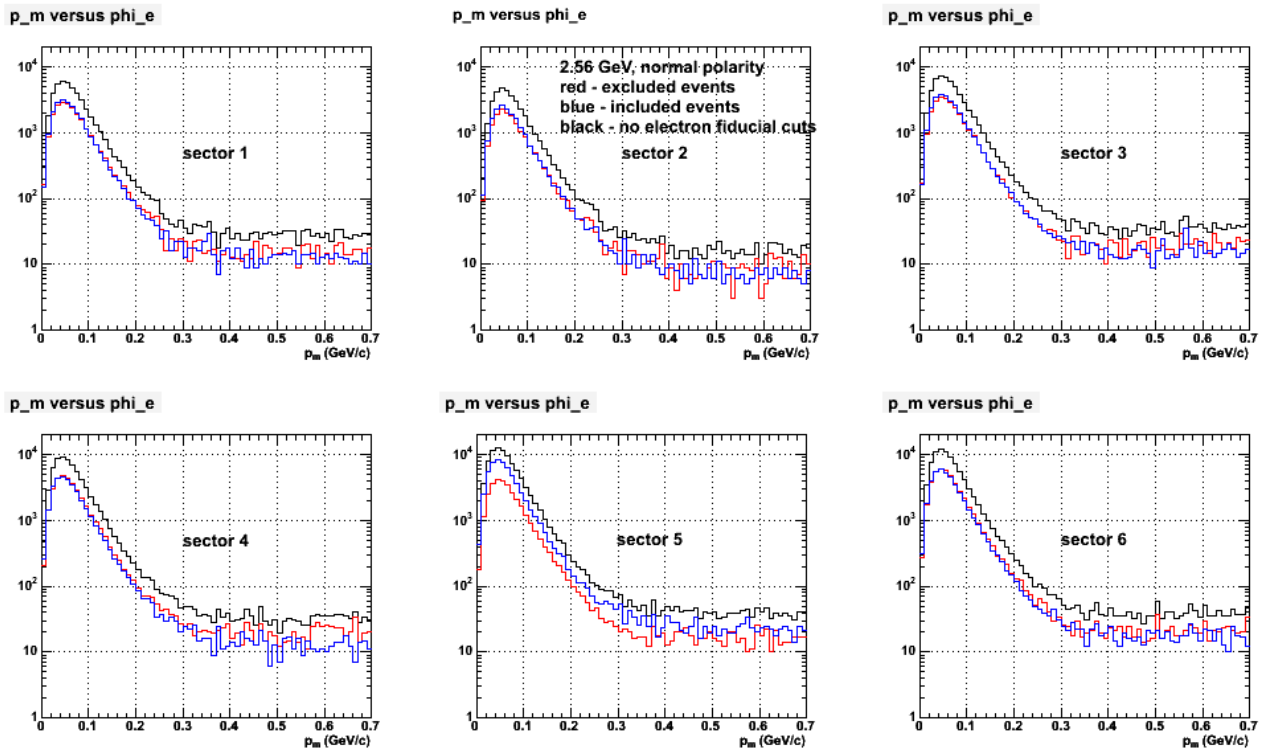


Fig 3. Missing Momentum distribution sector by sector for events with no electron fiducial cuts (black), with the electron fiducial cuts on (blue), and events excluded by the fiducial cuts (red).

In each sector all three curves have much the same shape. They differ on in overall scale. It is intriguing to me how close the red and blue curves are to one another. The excluded events look exactly like the included ones. It would appear there is no significant difference between the included and excluded events and the reconstruction is not a problem for these events.

To test this idea a bit further we generated the spectra shown in Figure 4. A comparison is made between the missing momentum spectrum for events in the electron fiducial region and those outside as suggested by BAM. The normalized difference spectrum is defined as the bin-by-bin difference between the p_m histogram of the events in the electron fiducial region and those outside it corrected for different yields. In other words

$N_{diff} = N_{out} - C*N_{in}$

where C is the ratio of the total yield outside the fiducial region to the yield inside the fiducial region. In each sector there is a small (difference 50 events out of 600) at small p_m (about 50 MeV/c) which is 2-3 sigma outside the statistical variation. The burning question has been whether there was any evidence of a distortion in the reconstruction of events falling outside the the electron fiducial cuts that would account for the enhanced amplitude in ALTp at large p_m when the electron fiducial cuts are turned on. The normalized difference spectum for each sector is zero at large p_m meaning there is little or no difference in the two spectra. This would mean that BAM's concern about a mistake in the reconstruction for events near the coils does not appear to be true. This is almost bad news since it would have provided an explanation for the enhanced ALTp amplitudes at large pm. However, the effect may be due to KJ's explanation or, even more simply, due to a different Q2 distribution when the electron fiducial cuts are turned on.

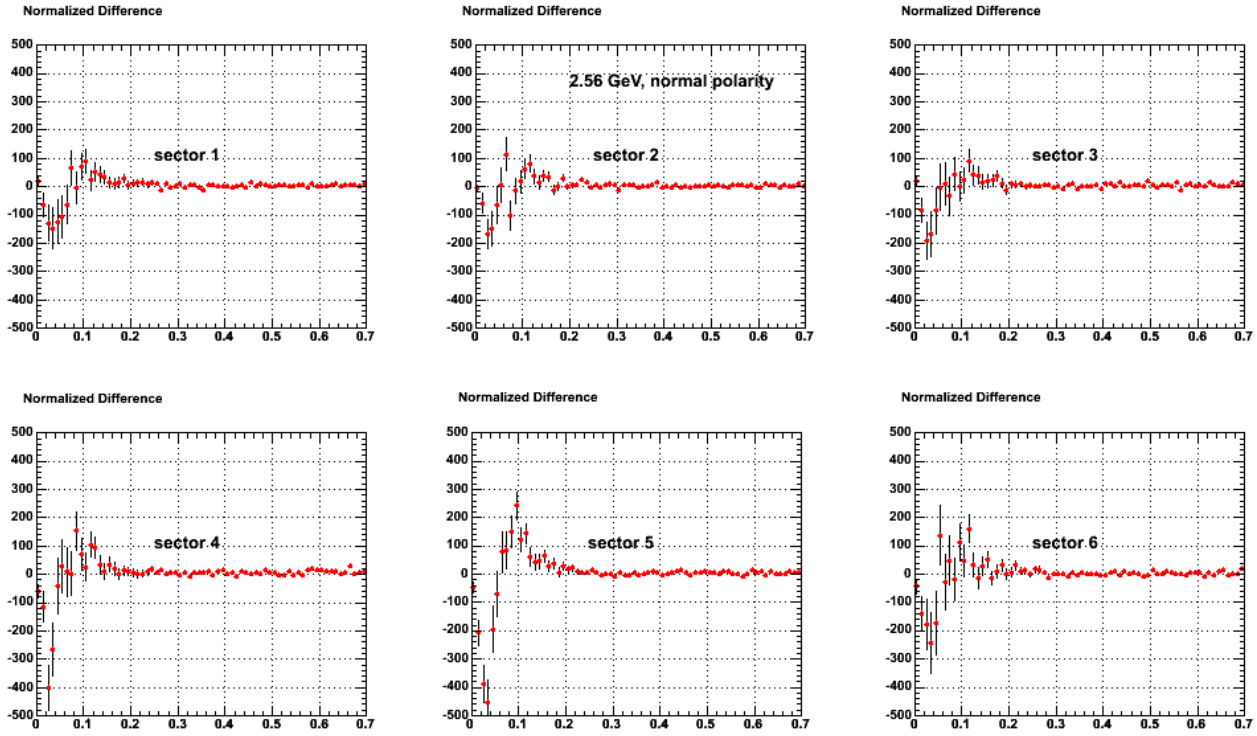


Fig 4. Comparison of missing momentum distribution sector by sector using the normalized difference defined in the text.

The normalization factors used for each sector are listed below.

Sector	excluded/included
1	9.59189665296535487e-01
2	8.88024048526490972e-01
3	9.36956967914072680e-01
4	1.04889894419306184e+00
5	5.37889361702127644e-01
6	1.03431109033539781e+00

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 36 - Talk for CLAS feb, 2005 meeting (gpg)

[Added Sun Mar 20 20:26:44 2005 (GMT) gpg]

Click here to view the object (PS file with slides.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 37 - more comparisons of ALTp to study electron fiducials effect (gpg)

[Modified Tue Jan 10 19:55:34 2006 (GMT) gpg]

We noticed soem weeks ago this surprising dependence of the fifth-structure function asymmetry ALTp on the use of our new, tighter electron fiducial cuts. One explanation offered by Kyungseon Joo at the last collaboration meeting is that we have to be careful when extracting ALTp in regions where the CLAS acceptance is changing rapidly. In such a case the ratio method may not be as effective in cancelling out acceptance effects. My interpretation of KJ's argument is here. One place where this effect might be seen is in the Q2 behavior. The cross section rises rapidly as Q2 decreases until we start losing events down the beam line and the CLAS acceptance goes to zero. To investigate this idea I have generated the following plots. The plot below is the original plot showing the effect of turning on the electron fiducial cuts. Events of all Q2 are accepted here.

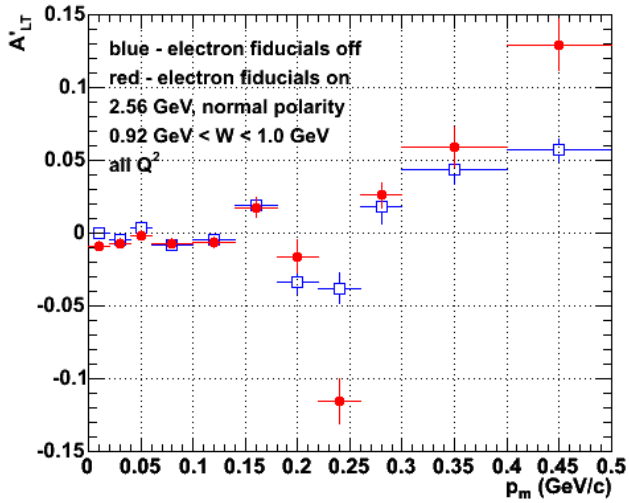


Fig 1. Plot of the fifth-structure-function asymmetry ALTp showing the effect of turning the electron fiducial cuts on. The full Q2 range4 is included.

Now put a cut on the 4-momentum transfer so Q2 > 0.7 (GeV/c)2. This restricts the data to the region above where the CLAS acceptance is starting to seriously cut into the Q2 distibution. The position of the cut is shown in Figure 2. The effect on ALTp is shown in Figure 3. Notice the effect of the electron fiducial cuts is smaller for p_m < 0.45 GeV/c and the prvious difference at p_m = 0.24 GeV/c has gone away.

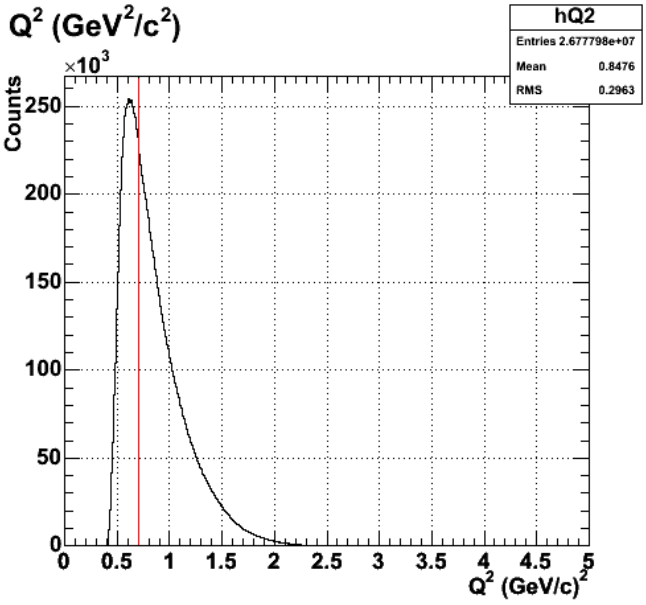


Fig 2. Q^2 distribution with cut shown.

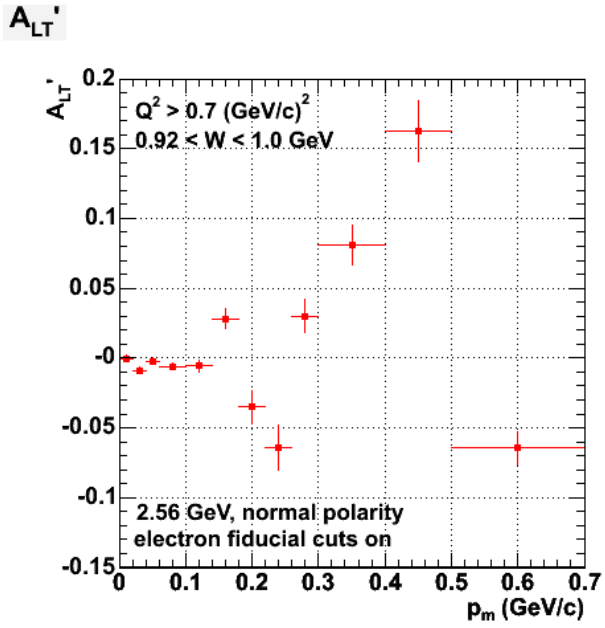


Fig 3. ALTp with electron fiducial cuts on and cut on Q2.

Click here to view the object (Root macro for above plot) you uploaded.

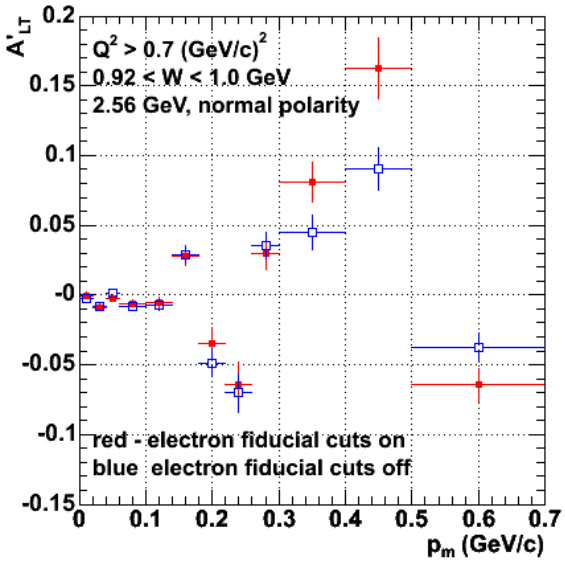


Figure 4. Comparison of ALTp with electron fiducial cuts on (red) and off (blue) like Figure 1, but with Q^2>0.7 $(GeV/c)^2$ cut on.

Click here to view the object (Root macro for above plot) you uploaded.

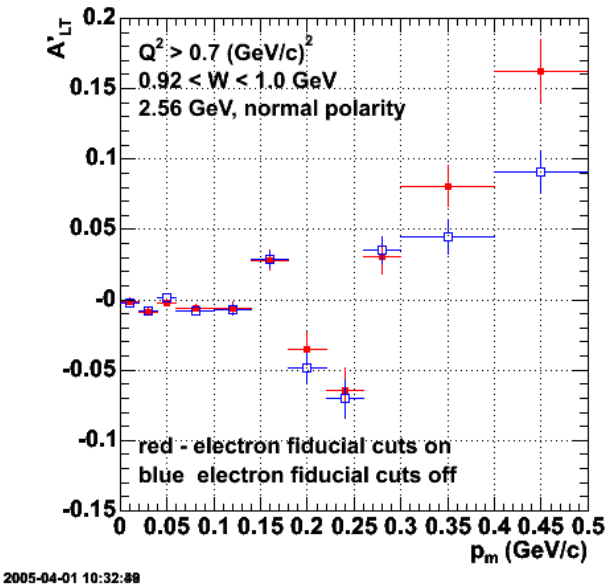


Fig 4a. Modified version of Figure 4 with restricted horizontal range to make it consistent with Figure 1.

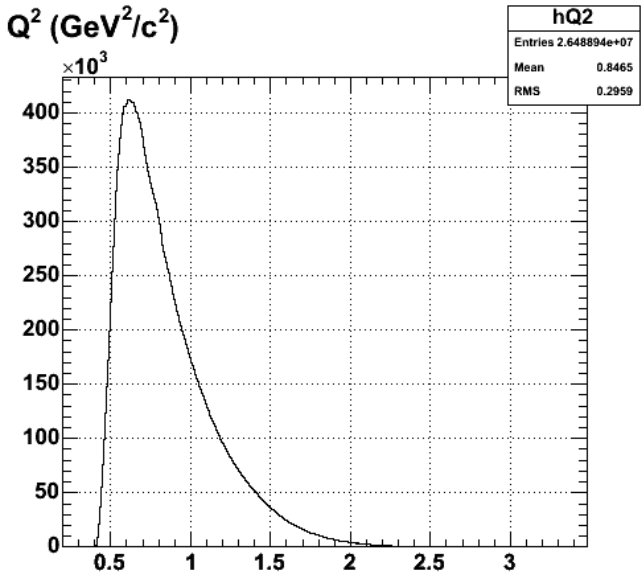


Fig 5. Q2 distribution with efid off

Click here to view the object (Root macro for above plot of Q2) you uploaded.

To study this a bit further, we generated the plot below (see Fig 6) to compare the Q2 distribution for the electron singles events with the electron fiducial cuts turned on and off. Not surprisingly the fiducial cuts throw out events mostly at low Q2 and few events at high Q2. The original effect of the fiducial cuts may simply be caused by the difference in the Q2 distribution of the events used to extract ALTp. The Q2 > 0.7 (GeV/c)2 cut used above would reduce this difference because the electron fiducial cuts have a small effect at higher Q2 as shown in the plot below. Of course, there is the sudden appearance of the anomalous peak at low Q2 for events with the electron fiducial cuts turned on. For a discussion and analysis skip over the next parapgraph and figure and go to Fig 7.

A later (Jan, 2006) follow-up check found that a large portion of the problem is due to a mistake in the neutron selection. The cut on MM2 used above to select neutrons was 0.90-0.98 GeV2. This would have been roughly correct for MM, but not for MM2! With the proper MM2 cut on, the difference in ALTp with fiducials on and off almost goes completely away. See entry 109, Fig 1. I then took that analysis and changed the MM2 range to the mistaken one (MM2=0.90-0.98) and got the following result for ALTp (Fig 5.1). It exhibits some of the same problem as we saw earlier. There is not complete agreemwnt with the previous version of ALTp, but I am also using a different QE cut (Wn=0.92-1.0) in the recent (1/06) analysis. The choice of this cut for Wn was determined in the analysis used for the Feb, 2005 NPWG talk. See entry 250 in the E5 elog.

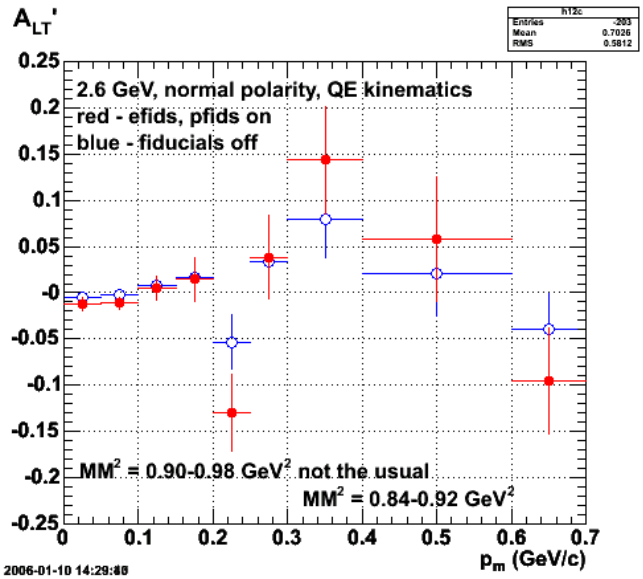


Fig 5.1 Comparison of ALTp with (red) and without (blue) electron and proton fiducial cuts on and with the old (wrong!) cut on MM2 to select neutrons.

Of course, there is the sudden appearance in Fig 6 of the anomalous peak at low Q2 for events with the electron fiducial cuts turned on. The next figure (Fig 7) shows phi_e versus Q2 for events with the electron fiducial cuts on. Notice the large clump of events at low Q2 associated with sectors 1 and 2. These events disappear when the quasi-elastic cut is turned on so it may not be important for our analysis, but they are still a mystery.

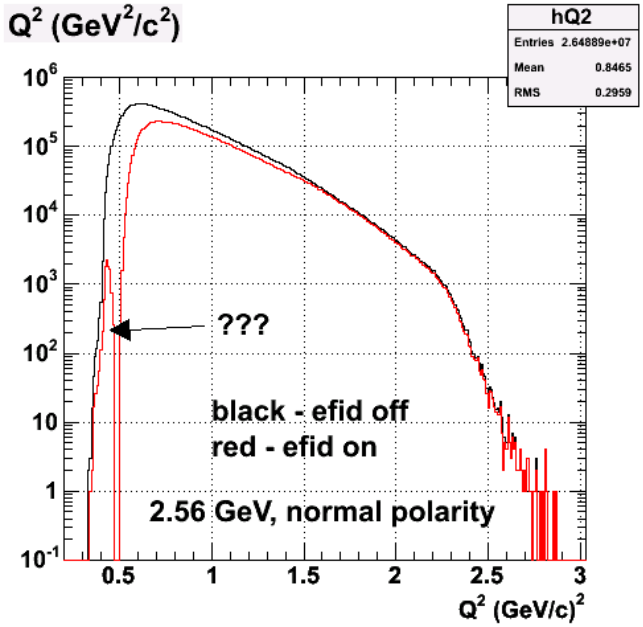


Fig 6. Comparison of Q2 distribution with electron fiducials off (black) and on (red). Note the odd peak at low Q2.

Click here to view the object (Root macro for above plot) you uploaded.

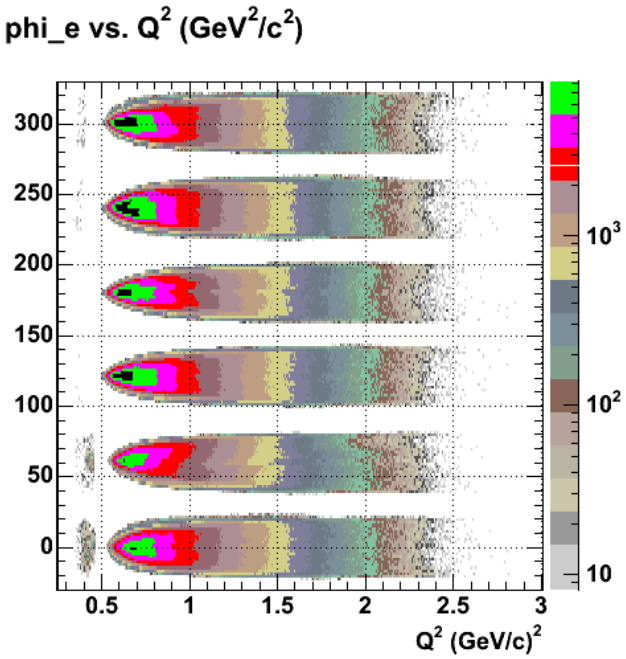


Fig 7. Plot of phi_e versus Q2. Note the 'island' of counts at low Q2. What is the source of these??

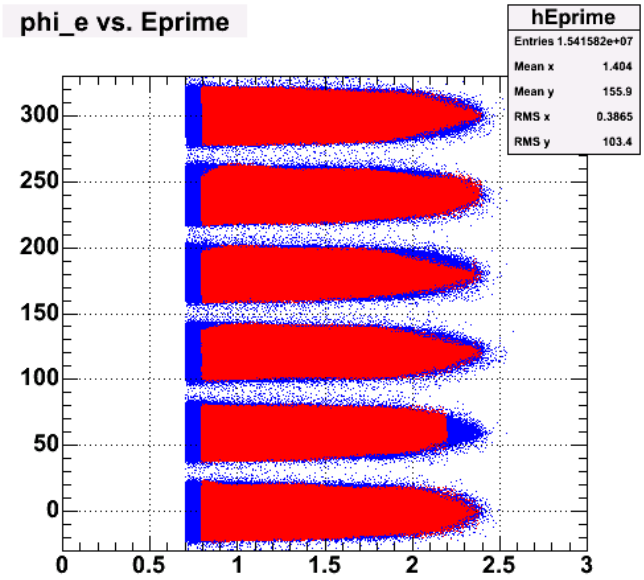


Fig 8. Plot of phi_e versus E' with the electron fiducial cuts off (blue) and on (red). Note there are no anomalous counts at low E' to account for the mysterious clump in Fig 7.

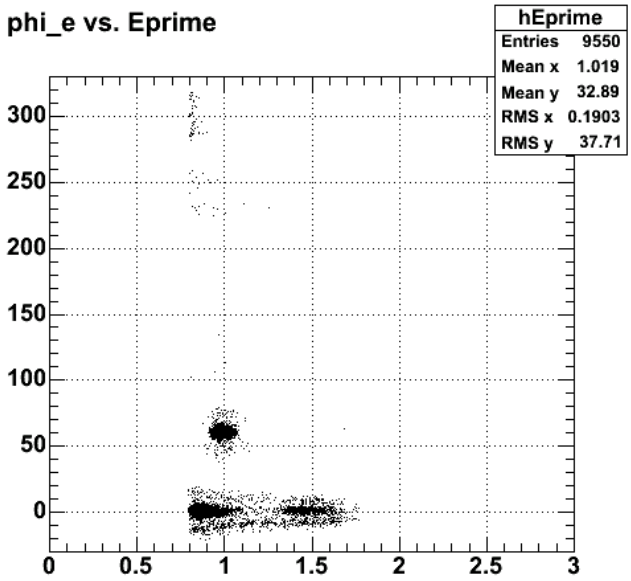


Fig 9. Plot of phi_e versus E' for events in the low-Q2 clump shown in Figure 7.

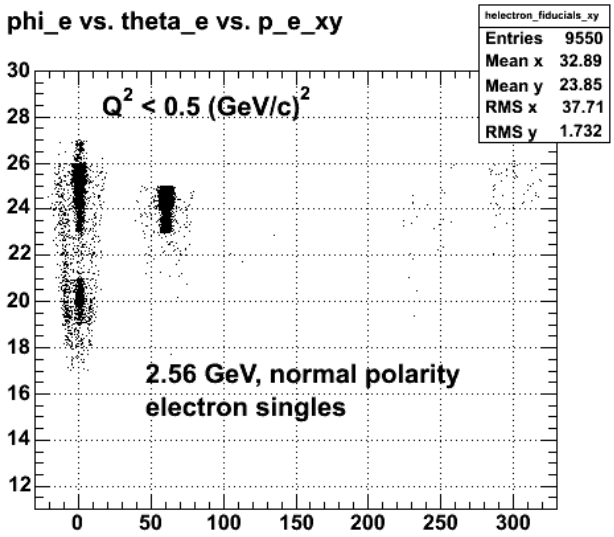


Fig 10. Plot of theta_e versus phi_e for events in the mysterious clump shown in Fig 7 at low Q2.

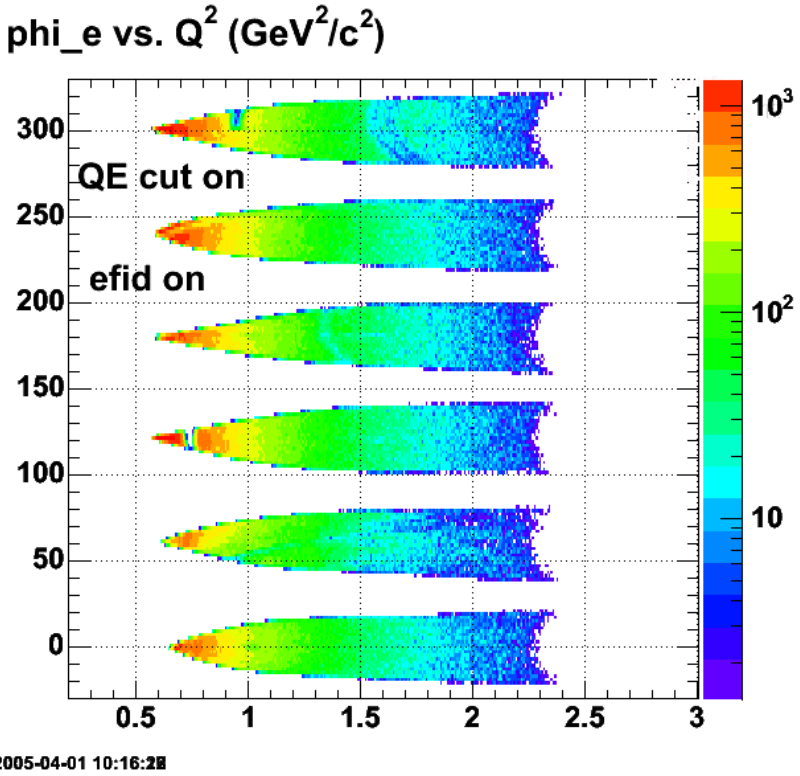


Fig 11. Plot of phi_e versus Q2 with efid on and QE cut on. Notice the mysterious clump at low Q2 for sector 1 disappears. This is analogous to Figure 7 which is the same plot except the efid and QE cuts are turned off.

Click here to view the object (KJ's explanation) you uploaded.

KJ's explanation

(1) We have assumed

$$A'_{LT} = \frac{\sigma^+ - \sigma^-}{\sigma^+ + \sigma^-} = A$$

What we want

so $A^+ = A^-$ and can

(2) What we really m

$$\int_{bin} \sigma^+(x)\, A^+(x)\, dx - \int_b$$

KJ explanation

KJ's explanation

① We have assumed

$$A'_{LT} = \frac{\sigma^+ - \sigma^-}{\sigma^+ + \sigma^-} = \frac{N^+ - N^-}{N^+ + N^-} = \frac{\sigma^+ A^+ - \sigma^- A^-}{\sigma^+ A^+ + \sigma^- A^-}$$

what we want ↑ ↑ what we measure

so $A^+ = A^-$ and cancels in the ratio.

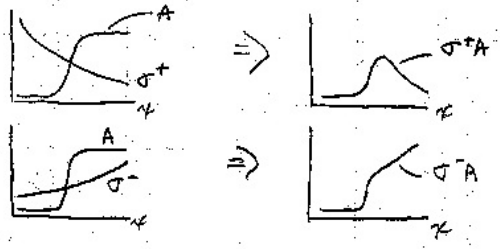
② What we really measure is

$$\frac{\int_{bin} \sigma^+(x) A(x)\,dx - \int_{bin} \sigma^-(x) A(x)\,dx}{\int_{bin} \sigma^+(x) A(x)\,dx + \int_{bin} \sigma^-(x) A(x)\,dx}$$

$x \equiv$ some kinematic variable (p_m, θ_{pq}, Q^2, ...)

so the acceptance does not simply cancel

③ an extreme example



④ Possible solutions.

Measure A_{LT} where the entire acceptance is flat.

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Jerry Gilfoyle's Enotebook page 38 - codes for determining electron fiducials (gpg)

[Modified Mon Mar 28 16:48:40 2005 (GMT) gpg]

Below are a series of links to codes for generating the electron fiducial cuts I am using for the E5, ALTp analysis. Each code is heavily commented with guidance on how to run it. If you have any questions, let me know. I may or may not be able to answer them. No guarantees on the accuracy or precision of these codes.

Click here to view the object (Sample Root file for testing the following codes) you uploaded.

Click here to view the object (efid_trapzoid.C - Root macro for doing 1st generation fits on phi_e distributions in a given momentum and theta_e bin) you uploaded.

Click here to view the object (Fitting routine trapezoid_fit.C used by efid_trapezoid.C for 1st generation fit) you uploaded.

Click here to view the object (Unix command file entitled 'process_tex_files' to generate plots of 1st generation fit. Use 'source process_tex_files' to run this.) you uploaded.

Click here to view the object (Root C++ code efid_1gen_filemaker.C for reading in the output of efid_trapezoid.C and putting the edges positions in separate files by momentum bins) you uploaded.

Click here to view the object (Root C++ code efid_edges.C for reading in the output of efid_1gen_filemaker.C and fitting the edges of the CLAS acceptance with the Protopopescu method) you uploaded.

Click here to view the object (Root macro efid_3gen.C for fitting the results of efid_edges.C as a function of electron momentum) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 39 - More tests on ALTp (gpg)

[Modified Fri Apr 8 16:25:31 2005 (GMT) gpg]

The plot below is a further comparison of ALTp extracted versus missing momentum p_m. The new development below is to look at the effect of cutting down the size of the azimuthal acceptance by +/- 3 deg to see what effect it has on ALTp. The cut of the Q2 to get rid of the Q2 region where the CLAS acceptance is rapidly falling (the beam pipe) is also included.

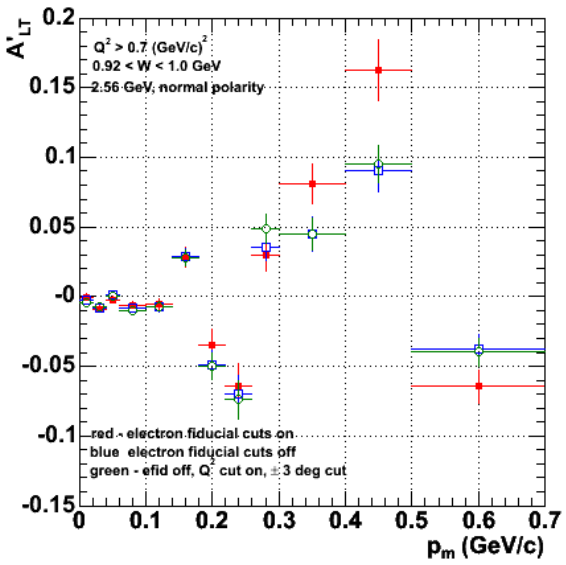

Fig 1. ALTp versus p_m with an additional reduction of the azimuthal acceptance for each theta_e bin of +/- 3 deg.

Click here to view the object (Root macro to make the above plot) you uploaded.

The plot above is flawed. The green points are very close to the blue ones. The green ones are ones where I restricted the aximuthal range of the electron fiducial cuts by an additional 3 degrees. i discovered after running the code that the electron fiducial cuts were turned off so the additional +/- 3 deg cut should have no effect. The difference betweent he green and blue points is probably due to slightly different files since the number of nodes and thus data files) changed recently.

The plot below is what Figure 1 should have been. I reduced the azimuthal range of the electrons an additional 3 degrees on each side of the range to see the effect on the asymmetry. For most points the change was as anticipated; the uncertainties increase because the statistics are worse, and there are small, statistically insignificant changes in the value of ALTp. The two exceptions are the points at the smallest missing momentum p_m and at p_m = 0.28 GeV/c. The excursion at p_m = 0.05 GeV/c is the most troubling since it should be approaching zero and the statistics are pretty good here.

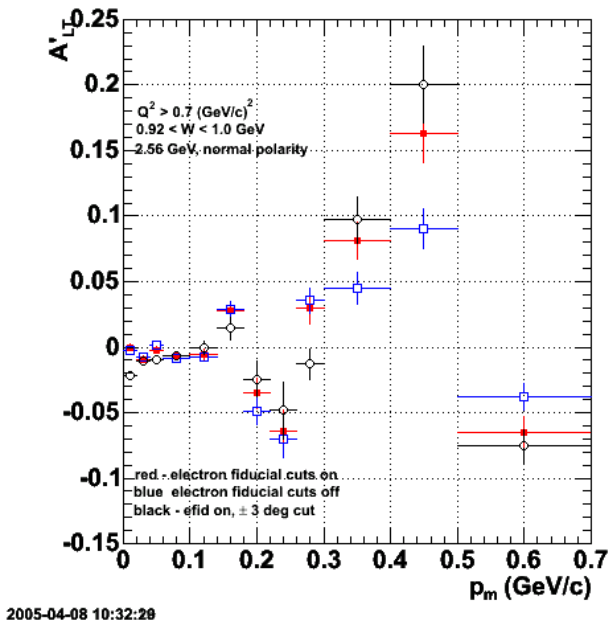

Fig 2. Revised version of Fig 1. See text.

Click here to view the object (Root file for above plot) you uploaded.

The plot below shows a fit to the helicity asymmetry in that first p_m bin. The undertainty is consideralby larger here. This may be the issue about calculating the method for calculating the uncertainties. For the fit shown below, the asymmetry is less than two standard deviations away from zero so this may just be a problem with understanding the uncertainties.

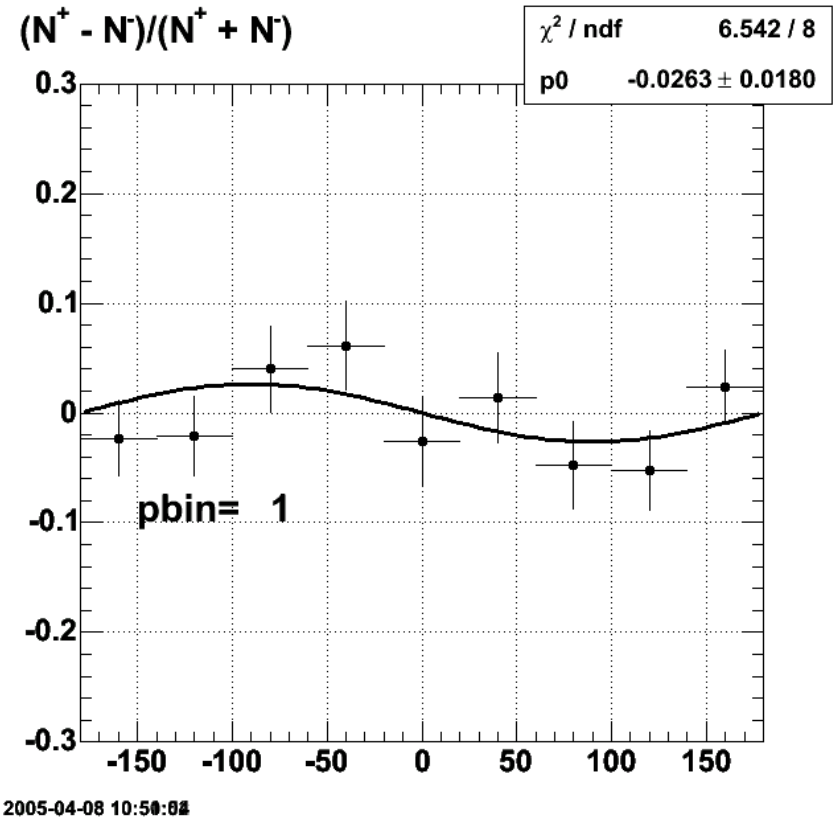

Fig 3. Fit to the helicity asymmetry for the first p_m bin from Figure 2 for efid on and +/- 3 deg additional cut on the electron fiducials.

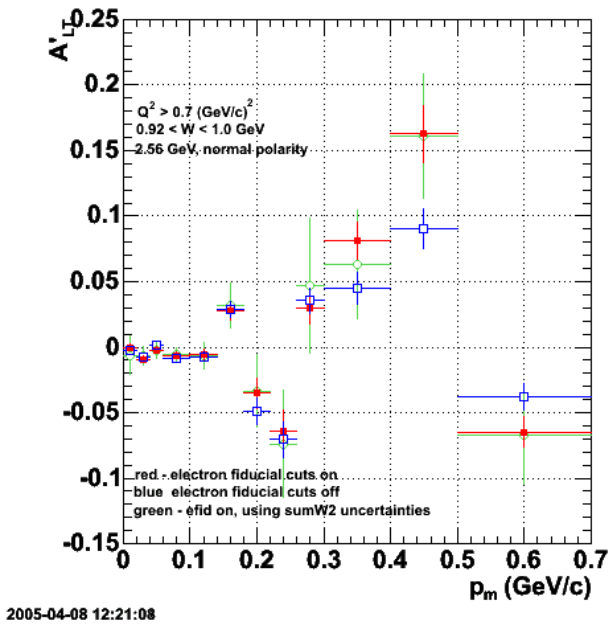

Fig 4. Comparison of previous results with the use of sumW2 uncertainties on the sin(phi_pq)-weighted histograms.

Click here to view the object (Root macro for above plot) you uploaded.

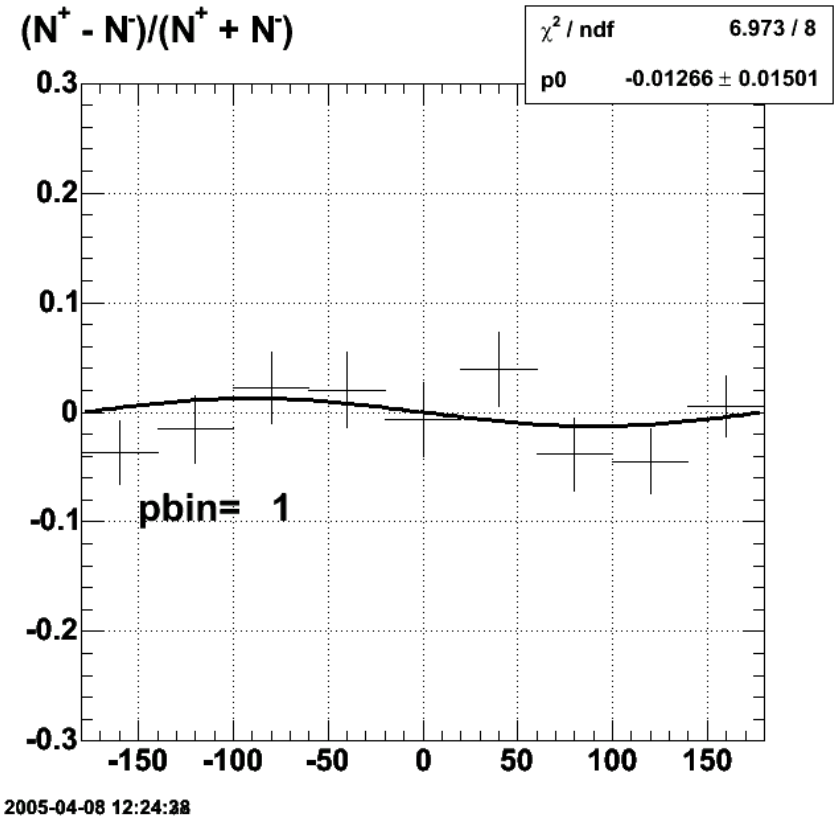

Fig 5. Revised versoin of Figure 3 with sumW2 uncertainties.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 40 - The low Q2 anomaly (gpg)

[Modified Fri May 13 04:11:57 2005 (GMT) gpg]

This entry is motivated by the observation of some mysterious low-Q2 peaks in the Q2 spectrum in sectors 1-2. These events are first reported in entry 37. These peaks (see Figure 2) turned out to be events that should have been excluded by the fiducial cuts, but passed them because of singularities and some unforseen behavior of the functions used to determine the fiducial cuts when the events came well inside the normal region of the fiducial cut curves. The details are below.

```
event by event analysis

first event examined

Ebeam=2.558;
pi = 3.141592654;
float p_e=1.01746;
float theta_e=24.0414;
float phi_e=59.4977;
float Q2 = 4*Ebeam*p_e*pow(sin(theta_e*pi/(180*2)),2)
Q2

second event.

p_e=0.974665 theta_e=24.5603 phi_e=56.9279
p_p=1.86895 theta_p=18.377 phi_p=-2.91233
evnt=947346

float Ebeam=2.558;
float Mp = 0.93827;
float Md = 1.876;
float pi = 3.141592654;
float p_e=0.974665;
float theta_e=24.5603;
float phi_e=56.9279;
float p_p = 1.86895;
float theta_p = 18.377;
phi_p = 2.91233;
float Q2 = 4*Ebeam*p_e*pow(sin(theta_e*pi/(180*2)),2)
Q2
float nu = Ebeam - p_e;
float xBJ = Q2/(2*Md*nu);
xBJ
float W2 = pow(Md,2) + (2*Md*nu) -Q2;
sqrt(W2)

float xBJ = Q2/(2*Mp*nu);
xBJ
float W2 = pow(Mp,2) + (2*Mp*nu) -Q2;
sqrt(W2)

float pzp = p_p*cos(theta_p*pi/180);
float pze = p_e*cos(theta_e*pi/180);
float ptot = pzp + pze;
ptot  2.66012001037597656e+00


float ptp = p_p*sin(theta_p*pi/180);
float pte = p_e*sin(theta_e*pi/180);
pte 4.05120193958282471e-01
ptp 5.89220345020294189e-01

---------------------------------------

from latest analysis run and listing of log files.

number of electrons with Q2 < 0.5 = 12249
number of ep events with Q2 < 0.5 = 2639

number of electrons with Q2 < 0.5 from hQ2a hist = 9369???? not consistent with log files!!!!!!!!!!!

---------------------------------------

from plot in entry 37 of gpglog

integrals:

for Q2 distribution with efid on:

total = 1.54158*10^7
Q2 < 0.5 peak = 9550

from plot in entry 37 of gpglog


when i turned on the QE cut the low Q2 events went away!!!!
```

Click here to view the object (analysis file used for above results) you uploaded.

Click here to view the object (version of eod5.C used to generate the above analysis file) you uploaded.

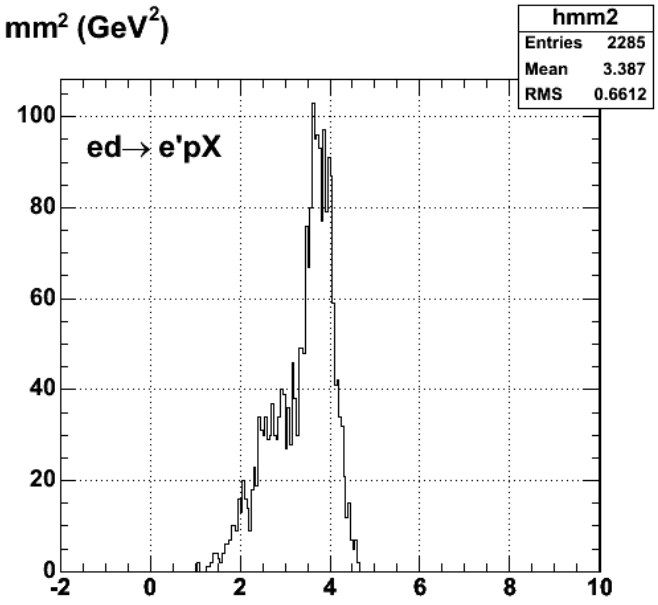

Fig 1. Missing mass squared of events with anomalously low Q2.

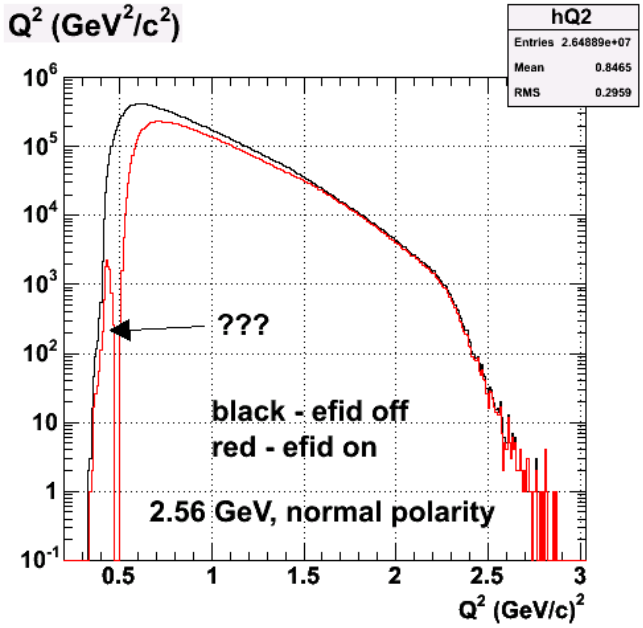

Fig 2. First sign of low Q2 anomaly.

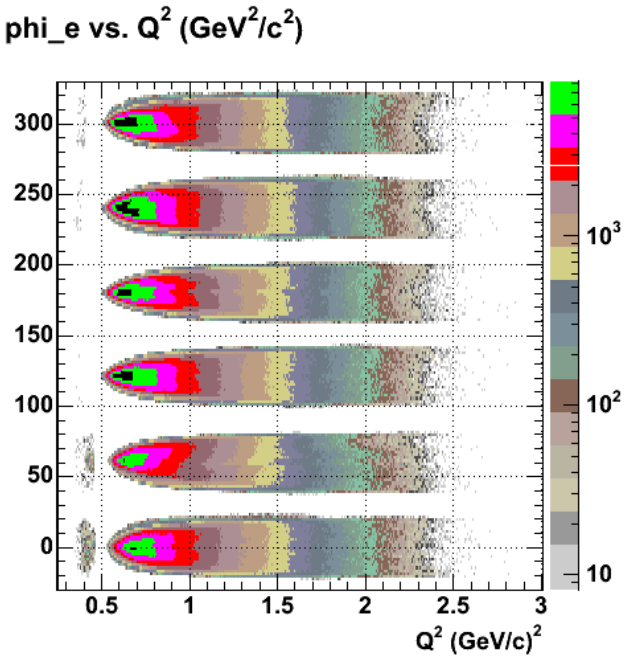

Fig 3. Acceptance for electrons showing the low Q2 anomaly is only in sectors 1 and a bit in 2.

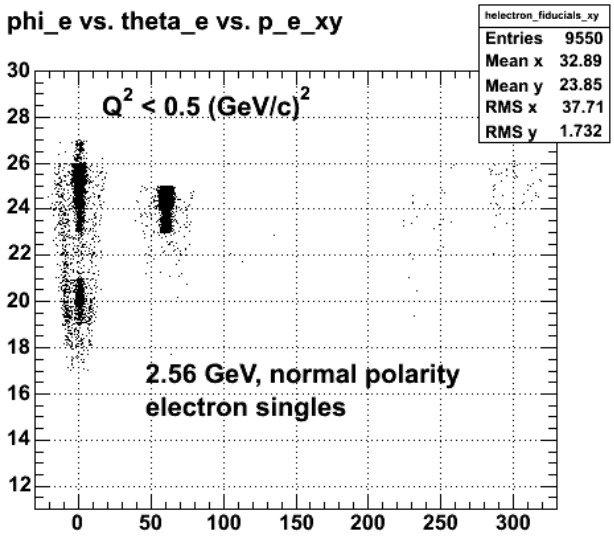

Fig 4. The low-Q2 anomaly is restricted to bnads on phi_e.

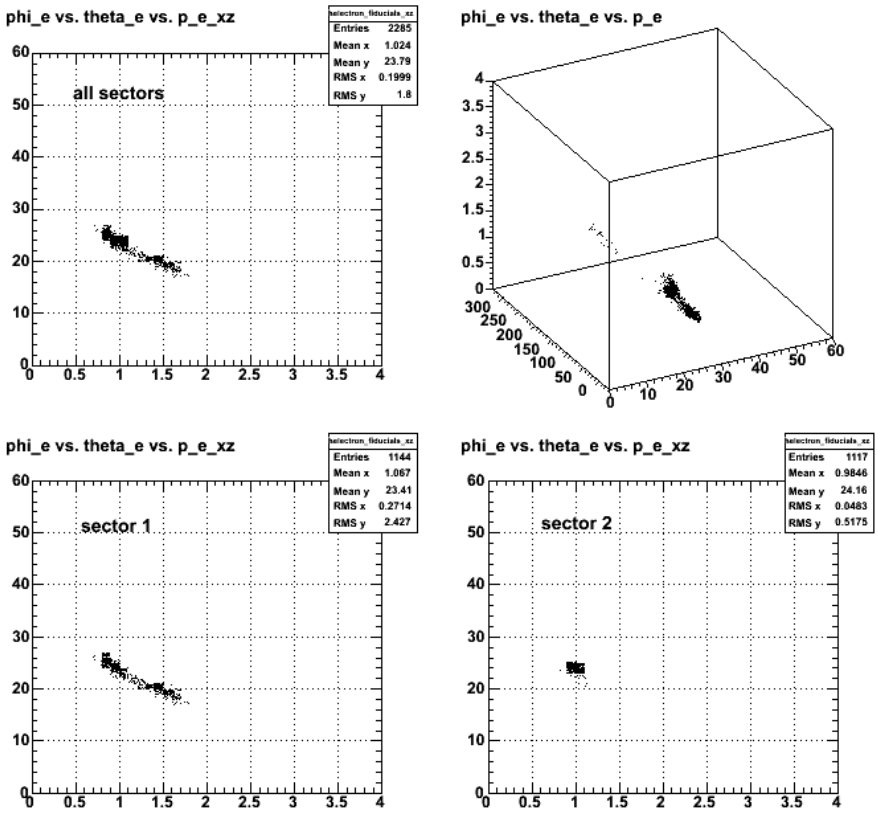

Fig 5. theta_e vs. momentum dependence for low-Q2 events.

This is still a mystery to me. The problem is probably with the measurement of the electron energy and.or momentum. We get the polar angle for the track in region 1 (mostly) so we know that reasonably well. The low-Q2 events show up even with electron singles so it's a problem with the scattered electron energy. I'm not sure what the signature would be for a screwed up electron measurement.

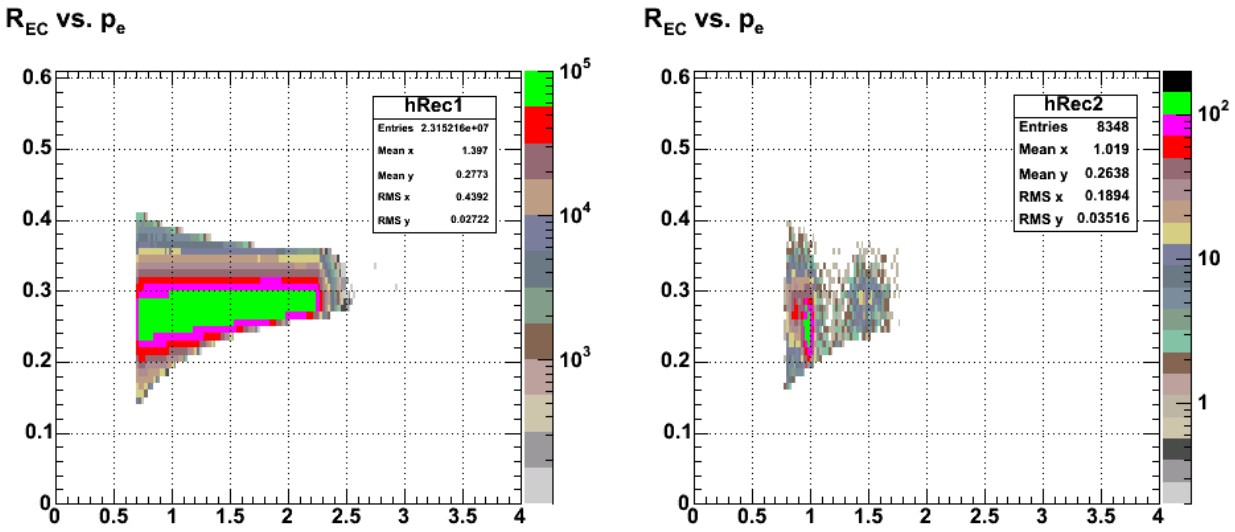

Fig 6. This shows the ration Rec of the total energy of the electron from the EC (calorimeter) to the electron energy extracted from the track (DC information) as a function of the momentum from the tracking. The left panel is all the electrons, the right panel is for events with Q2 < 0.5 GeV2.

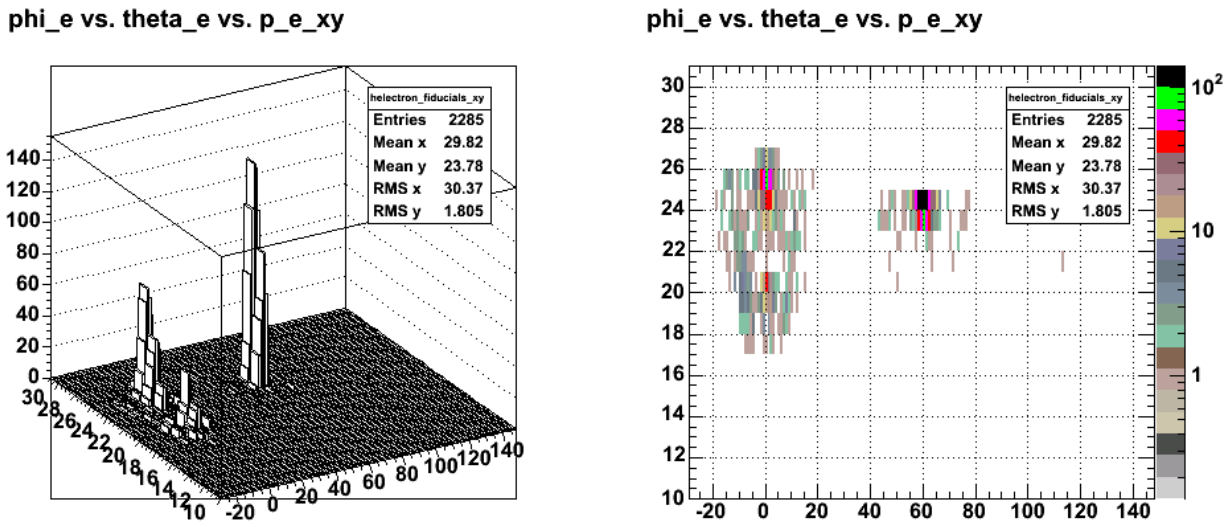

Fig 7. Plots of acceptance for the low Q2 anaomaly events. Note the large number of events in sector 2 while the sector 1 events cover a much broader range of theta_e and phi_e.

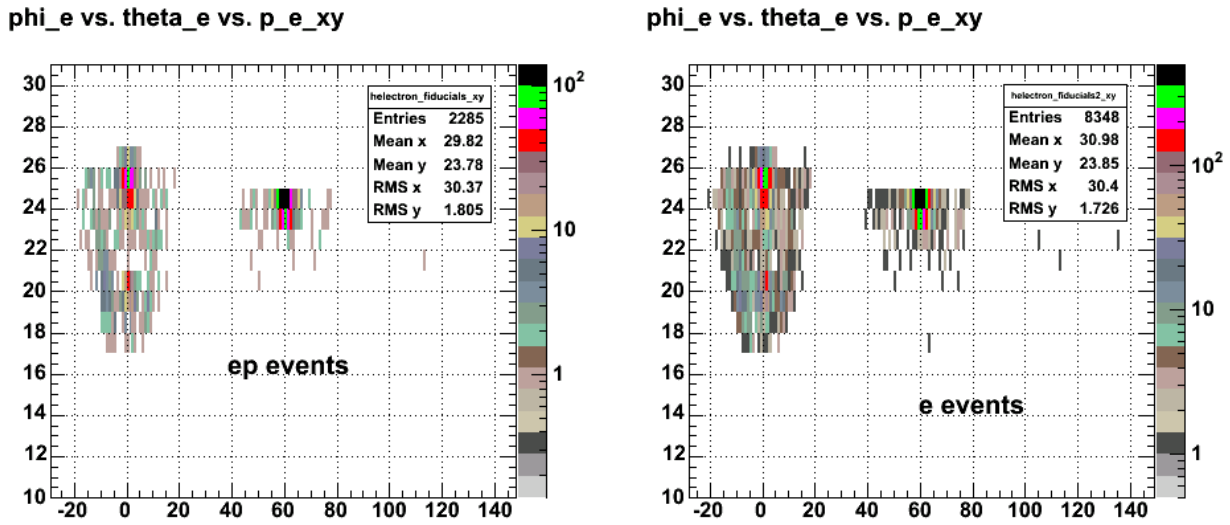

Fig 8. Comparison of anomalous events for ep coincidences (left panel) and electron signles (right panel).

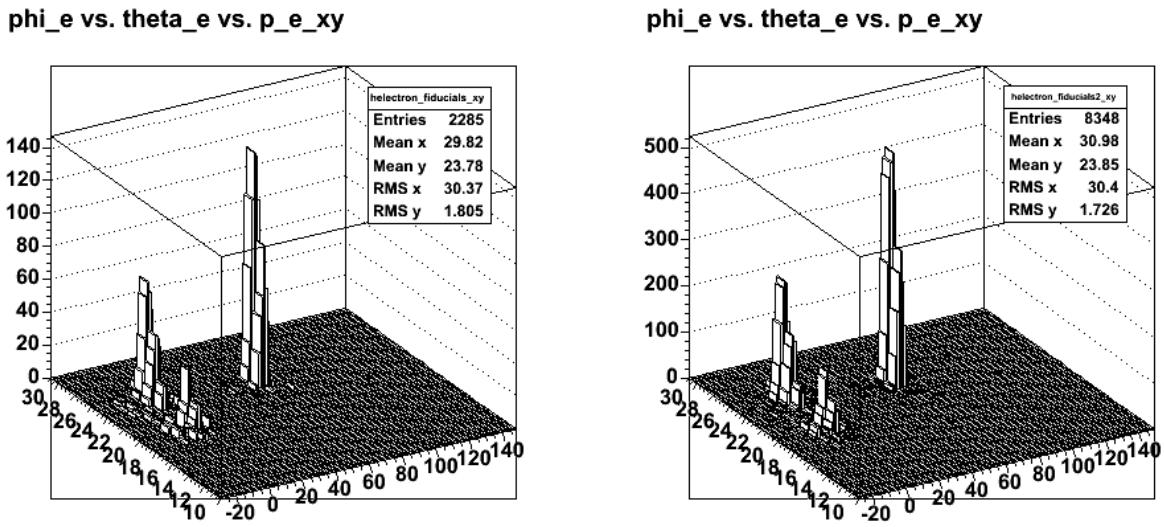

Fig 9. Comparison of anomalous events for ep coincidences (left panel) and electron signles (right panel).

The plot below is a look up the beam line at the EC hit position of the low-Q2 events (black) and the electron singles events. What is striking and disturbing is that the low-Q2 events appear to be coming outside the EC fiducial region. These data have the EC fiducial cut on them sp these events should never make it through.

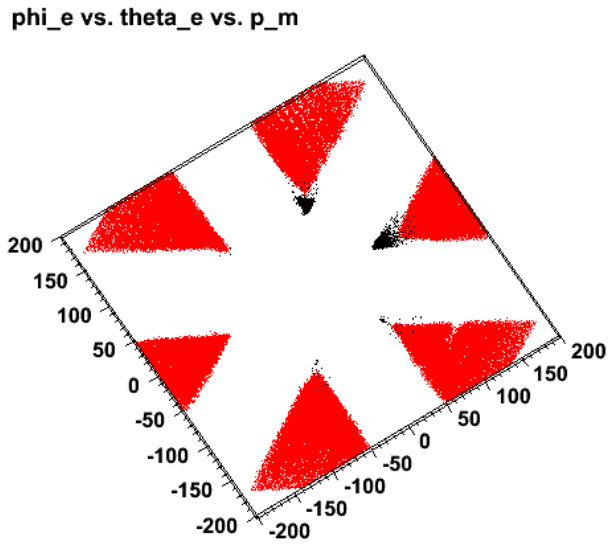

Figure 10. The EC hit position of the low-Q2 events (black) and the electron singles events (red).

The plot below shows the x-y positions of the EC hits with the electron fiducials on and off. The low-Q2 events are passing the EC fiducial cut, but they should be getting cut out by the electron fiducial cuts. They're NOT! This is like the problem that Nickolai has seen, but much less frequently. The results in Figure 11 are for a single run for electron singles. The results above in Figure 10 are for the full 2.6n data set.

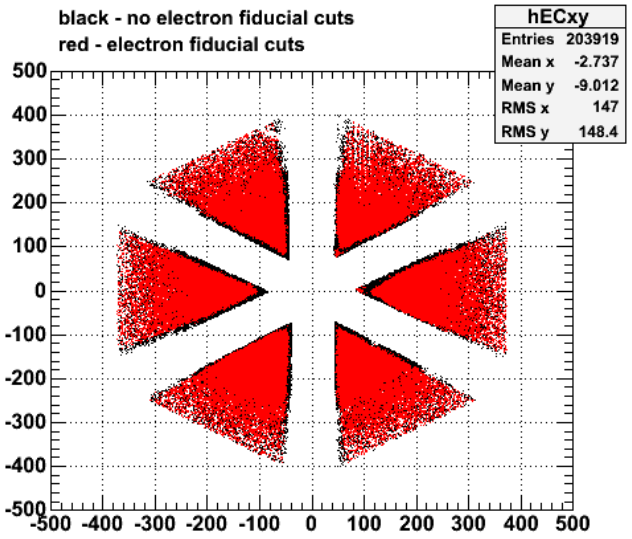

Fig 11. EC hit positions with electron fiducial cuts off and on.

I'm beginning to see the problem. The figure below shows the fiducial curves used for one of the low-Q2 anomalies. Notice the singularity in the curve near theta_e=20 deg. This is an intrinsic feature of the function I am using. The anomalous point is one that passes the EC fiducial cut and should be excluded by the fiducial cut, but it is not. The theta_e angle is below the singularity of the function where the curve has changed sign so this event now passes the cut (see the point indicated in the figure by the arrow).

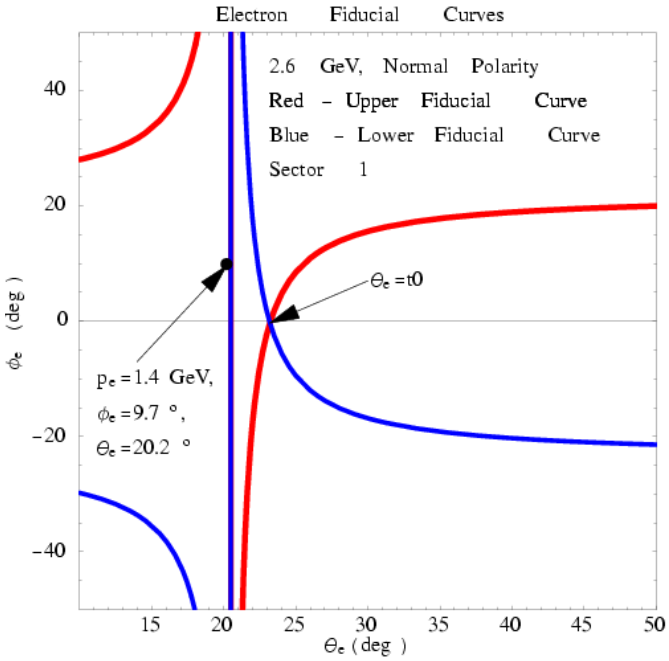

Fig 12. Fiducial curves for low-Q2 anomalous event. There are vertical lines for both red and blue curves at the singularity at near theta_e=20 deg. The blue curve is the only one visible in this region because it sits atop the red curve.

Modifying the eod5.C code to get rid of these events yields the results shown below. Compare with Figures 10 and 11 above.

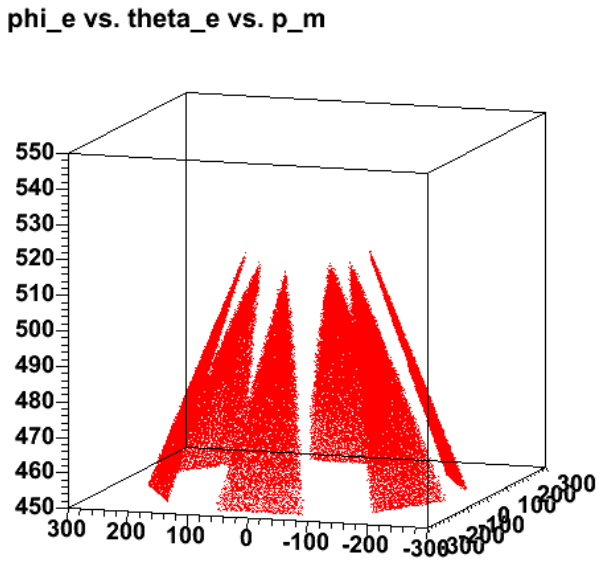

Fig 13. Plot of the hit positions of the electrons on the calorimeter.

Final resolution of the low-Q2 anomaly. The plot below shows the x-y hit positions for electron tracks on the calorimeter with the electron fiducuial cuts on (red) and off (black). The EC fiducial cuts are on in both cases. If you compare this plot with Figure 11 you see the anomalous peaks at the small-angle apex of the EC in Figure 11 have disappeared. These were the events making up the low-Q2 stuff in Figure 2-5 which got through the cuts as described above in the discussion of Figure 12. Yippeee!!!!!

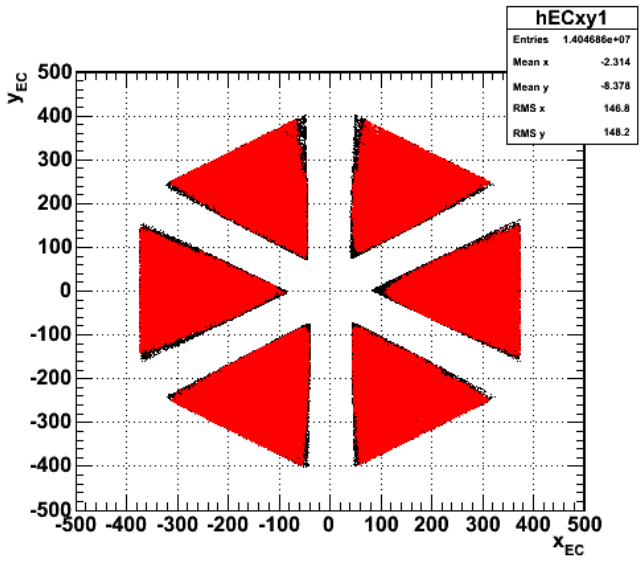

Fig 14. Comparison of EC hit postions with electron fiducials cuts on (red) and off (black). The EC fiducial cuts are on in both cases. Compare with Figure 11.

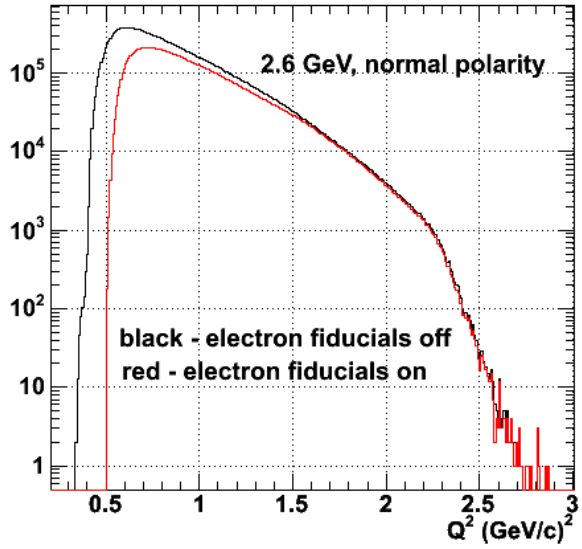

Fig 15. Final plot showing Q2 distribution for 2.6 , polarity data. Note the lack of the mysterious low-Q2 peak seen in Figure 2.

I started worryong about Fig 4 above which shows that when the broken electron fiducial is turned on, you get the odd-looking distribution of events in theta_e versus phi_e. I was concerned because I thought the events with the electron fiducial on that still get through the fiducial cut extend out to almost 30 deg. I thought these events should get cut out by the correctly-working part of the electron fiducial cut. This is not the case as shown in the figure below. The left panel shows the acceptance in theta_e versus phi_e when Q2<0.5 GeV2, the EC fiducial cut is on, and the 'broken' electron fiducial cut is on. You see this odd distribution of events. When you turn the electron fiducial off completely you get the distribution in the right-hand panel. These are now events cut only by the EC fiducial cut and they extend out to 30 deg.

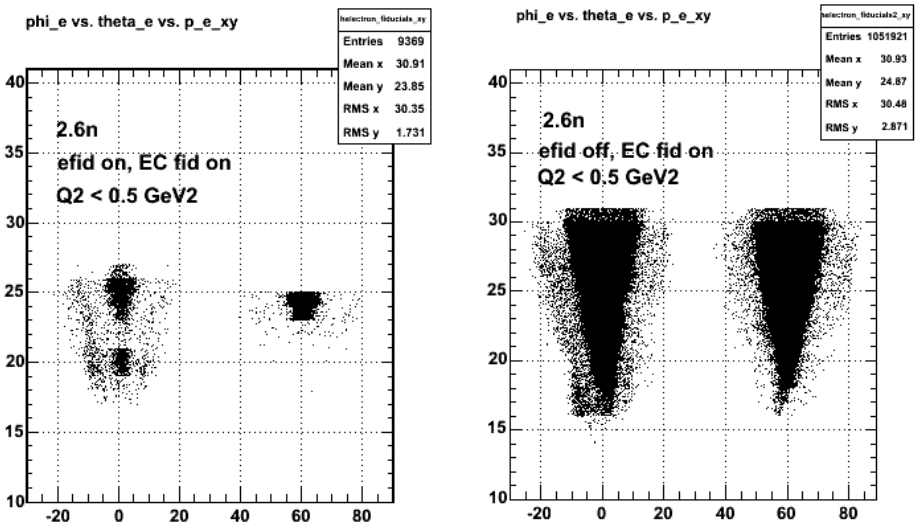

Fig 16. Acceptance plot (theta_e vs. phi_e for electrons with Q2 < 0.5 GeVs with EC fiducial cut on (both panels), incorrect electron fiducial on (left panel), and electron fiducial off (right panel).

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 41 - running exclurad for JL (gpg)

[Modified Fri Jun 10 14:55:38 2005 (GMT) gpg]

To do the E5 radiative correction start in /home/gilfoyle/eod/exclurad/run/lachniet on pscm1 and run

```
make_exclurad_script2.pl beam_energy qsq

then execute

rm ../input/input*.dat
cp input*.dat ../input/
cd ../
submit_exclurad.pl

the input files (inputnn.dat) look like the following.

/home/gilfoyle/eod/exclurad/run/input
pscm1:input> more input00.dat
4
0
2.558
0.0
1
2
0.310
8
2.3480375551898 2.3480375551898 2.3480375551898 2.3480375551898 2.3480375551898 2.3480375551898 2.3480375551898 2.3480375551898 <--W
2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0    <-- Q2
0.94 0.95 0.96 0.97 0.98 0.993 0.996 0.999   <-- cos(theta_pq)
0 0 0 0 0 0 0 0 <---- phi_pq
pscm1:input>

to create the input file for RCsurface.nb use

cat results/* > W


pscm1:run> cat results/* > radcor_neutron_W2.348Q22.0.dat
```

use one of the Mathematica notebooks in E5 elog entry 267.

```
At 4.232 GeV beam energy,

Q2        W               theta_pq   average RCp  average RCn
0.5       2.0               3.5
1.0       2.13              3.5
1.5       2.24              3.5
2.0       2.35              3.0
2.5       2.45              2.5
3.0       2.55              2.25       0.80103     0.85135
3.5       2.65              2.25                   0.81399
4.0       2.74              2.25       0.82691     0.82691/0.82695
4.5       2.83              2.25
5.0       2.92              2.25       0.85310     0.85310

At 2.558 GeV beam energy,

Q2        W               theta_pq   average RCp  average RCn
0.25      1.94              4.0      failed - RC's all nan's
0.5       2.0               4.0      failed - RC's all nan's
1.0       2.13              4.0      0.7957       0.7956
1.5       2.24              3.5
2.0       2.35              3.0      0.8273       0.8273
2.5       2.45              2.75     0.8424       0.8421
3.0       2.55              2.5      0.8583       0.8568
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 42 - First proton fiducial look (gpg)

[Modified Mon May 9 19:34:56 2005 (GMT) gpg]

Below is my first look at the proton fiducials in coincidence with an electron. We excluded quasielastic, ep events because they are strongly correlated with the electron and don't produce flat, trapezoidal distributions in phi_p. The first curious thing is the large angle proton peak. Does this make sense??

The analysis in the files below was done excluding quasielastic events in the range 0.92 < W < 1.0 which is a fairly tight constraint on the QE events. Consequently there may be (and there does appear to be) a considerable amount of quasielastic strength in the results shown below.

Click here to view the object (Root file containing data used for plots below) you uploaded.

Click here to view the object (gzipped tar fil containing PS files of gen1 fits and plot of edges vs. theta_p) you uploaded.

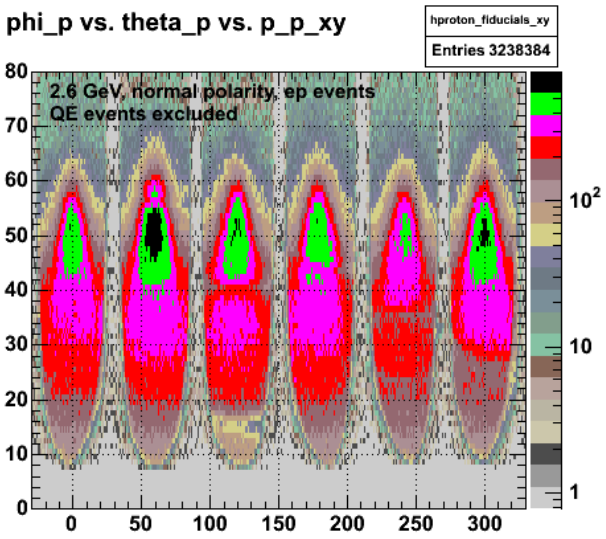

Fig 1. Acceptance for protons for ep events at 2.6 GeV excluding quasi-elastic events.

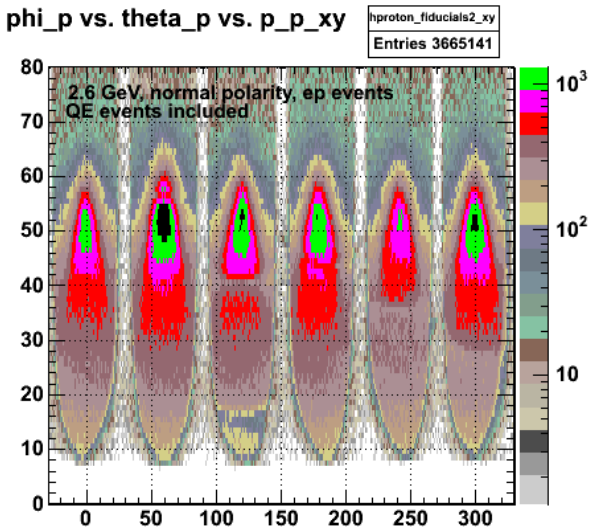

Fig 2. Acceptance for protons for ep events at 2.6 GeV including quasi-elastic events.

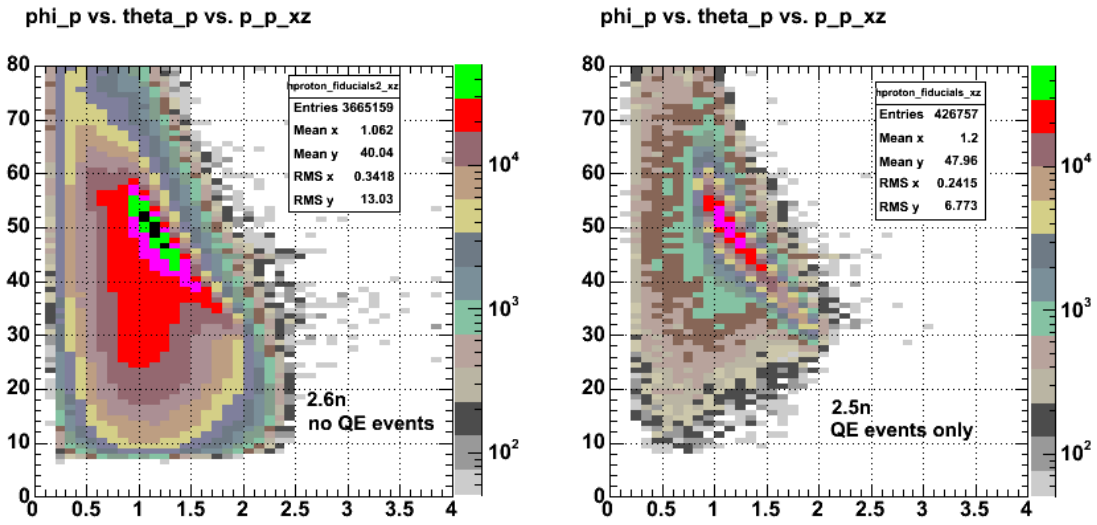

Figure 3. Checking on effect of QE cut.

Click here to view the object (PS version of previous plot) you uploaded.

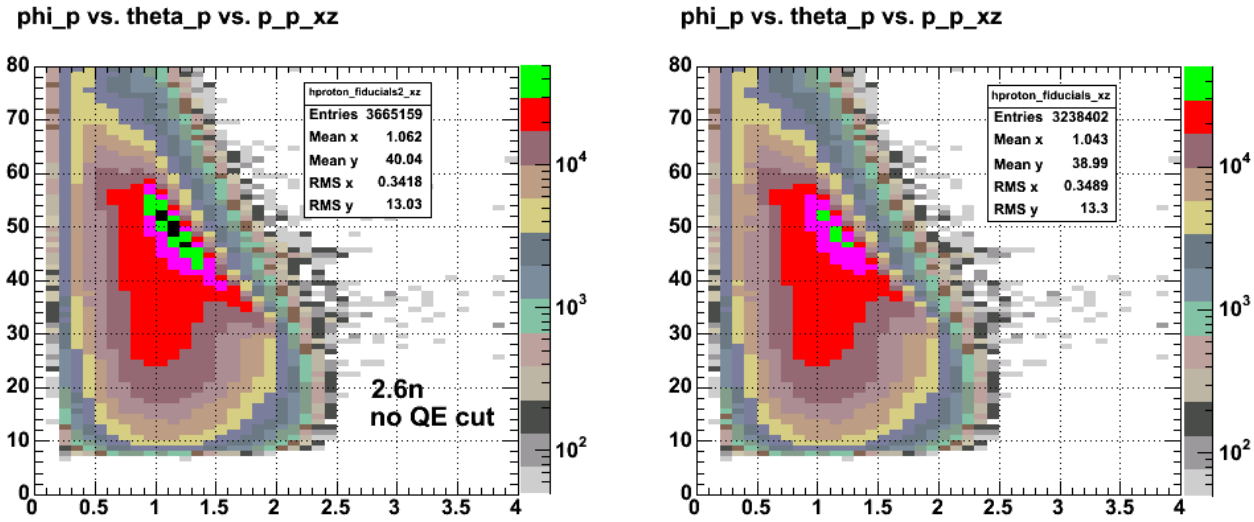

Figure 4. Checking on effect of excluding QE events. The right hand panel has quasielastic events excluded from the data.

Click here to view the object (PS version of above plot) you uploaded.

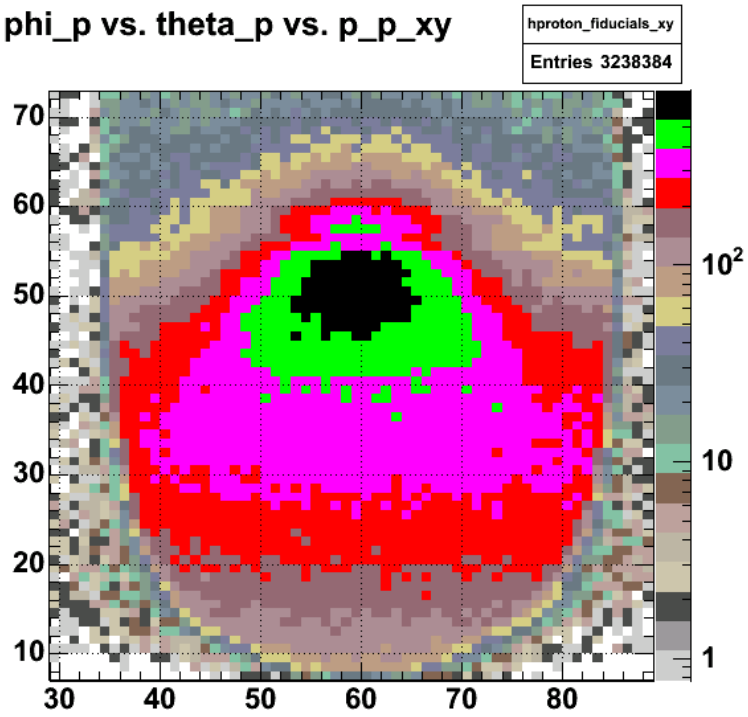

Figure 5. Acceptance for one sector of CLAS.

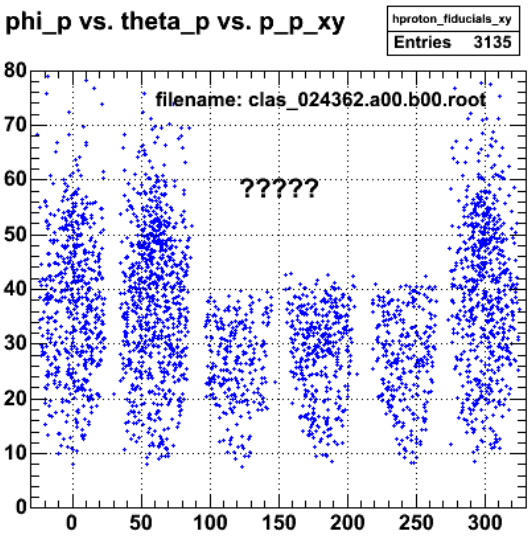

Fig 6. Why are all thos protons missing???

The protons in the plot above come from a run that may be of dubious quality. It looks like something is switched off. Did the DC's trip?? See selection of run summaries below. Run 24362 was done just at the start of the 2.6 GeV data and right after a failed run. Check the later runs to see if they also look screwy.

Run Id	Start Date	Beam Energy	Beam Current Request	Torus Current	Mini-Torus Current	Number of Events	Run Type	Target	Operator Comment
24361	2000-05-03 12:59:00.0	2558.14	0.0	2251.53	5996.0	782909	e_cosmic	D2+H2	late fail run
24362	2000-05-03 19:35:00.0	2558.14	2.0	2249.57	5996.0	2514887	beam_electron	D2+H2	First try at 2.6 GeV production run.
24363	2000-05-03 21:44:00.0	2558.14	2.0	2249.57	5996.0	2686208	beam_electron	D2+H2	
24364	2000-05-03 23:10:00.0	2558.14	2.5	2249.57	5996.0	3638623	beam_electron	D2+H2	due to dc constantly tripping off termi
24365	2000-05-04 00:01:00.0	2558.14	2.5	2249.57	5996.0	605794	beam_electron	D2+H2	
24366	2000-05-04 00:14:00.0	2558.14	2.2	2251.53	5996.0	10187648	beam_electron	D2+H2	
24367	2000-05-04 01:41:00.0	2558.14	2.3	2247.62	5996.0	10039406	beam_electron	D2+H2	
24368	2000-05-04 03:08:00.0	2558.14	2.3	2251.53	5996.0	9160237	beam_electron	D2+H2	
24369	2000-05-04 04:48:00.0	2558.14	2.3	2247.62	5996.0	10255792	beam_electron	D2+H2	production
24370	2000-05-04 06:15:00.0	2558.14	2.2	2251.53	5996.0	10089264	beam_electron	D2+H2	

Log Search | Newest Log | Today's Log | Today's Runs | Go Log

Fig 7. Run Summaries around the time of run 24362. it looks like things were just starting so these data should be excluded.

Click here to view the object (Root file containing data used for plots below) you uploaded.

Click here to view the object (dvi files for plots for first look at proton fiducials) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 43 - Second (and third) look at proton fiducials (gpg)

[Modified Mon May 16 14:28:33 2005 (GMT) gpg]

The plots below are teaken from a second pass at the proton fiducial analysis where the size of the cut for excluding quasielastic events was increased from 0.92 < W < 1.0 GeV to 0.84 < W < 1.08 GeV.

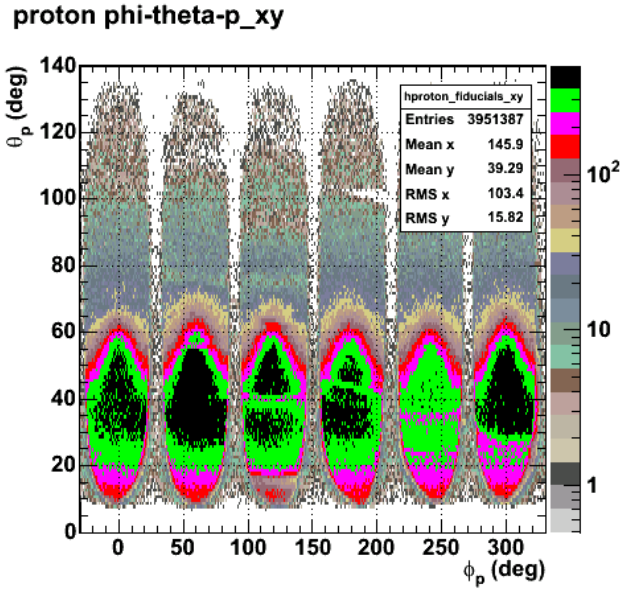

Fig 1. Acceptance for protons in coincidence with an electron (2.6 GeV, normal polarity).

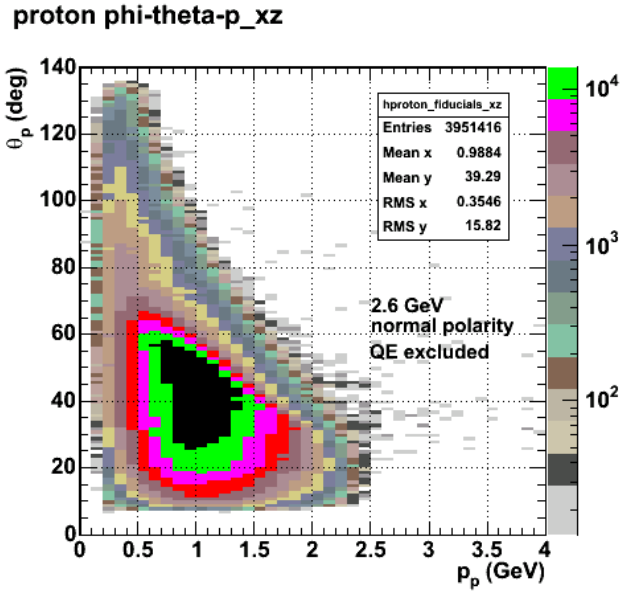

Fig 2. Proton acceptance again (theta_p vs. p_p) for protons in coincidence with electrons. Compare with Figure 3.

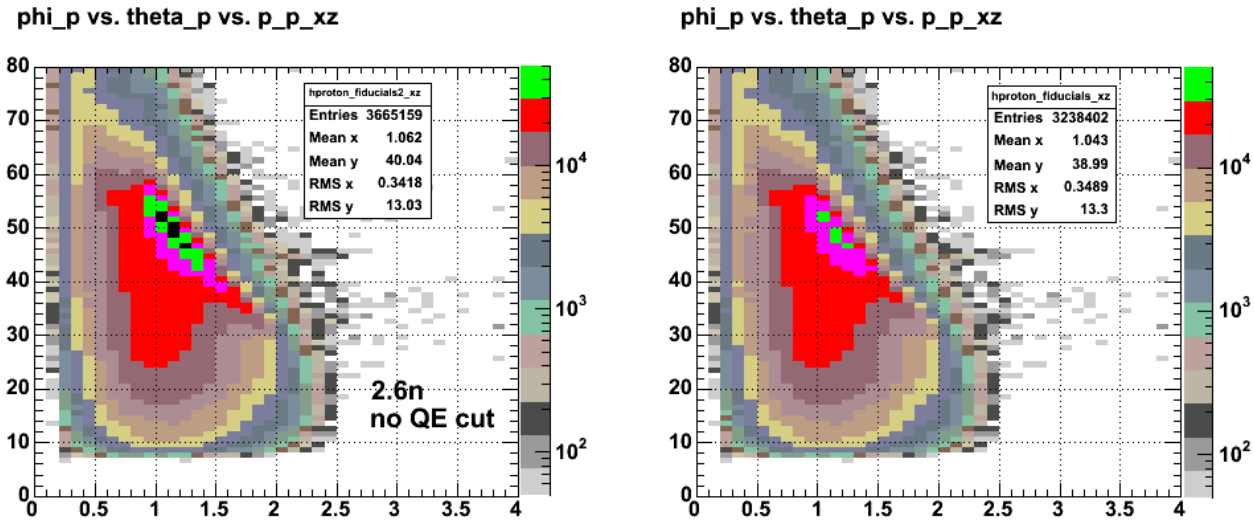

Fig 3. Checking on effect of excluding QE events. The right hand panel has quasielastic events excluded from the data.

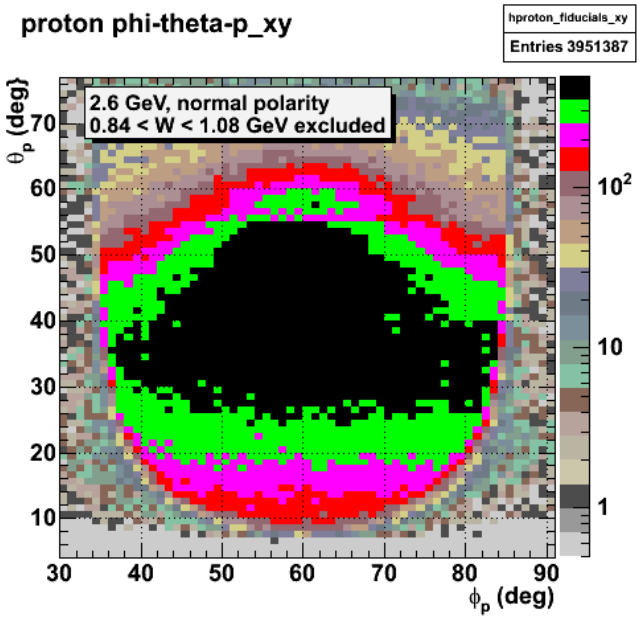

Fig 4. Acceptance for protons for sector 2 with expanded exclusion of quasielastic events.

Click here to view the object (Fig 5. Plot showing the edges from the generation 1 fits) you uploaded.

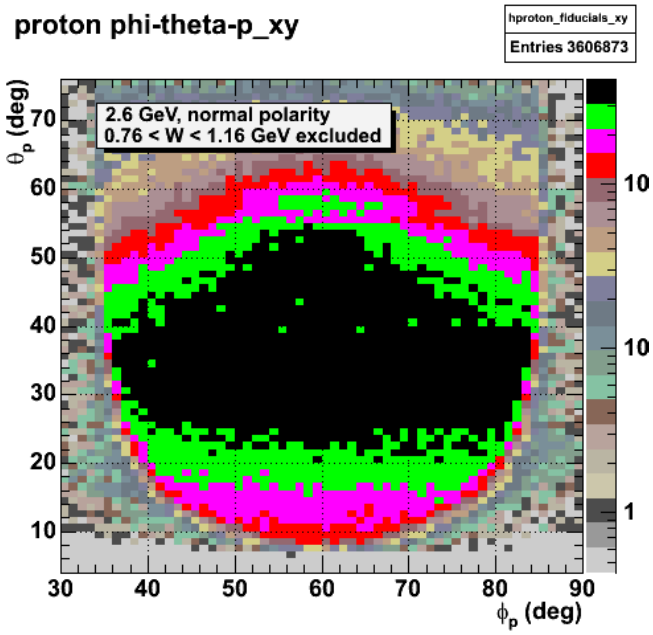

Fig 6. Acceptance for protons for sector 2 with second expanded exclusion of quasielastic events.

Click here to view the object (Fig 7. Plot showing the edges from the generation 1 fits) you uploaded.

Click here to view the object (Fig 8. Plot of proton acceptance for momentum bin 0.6-1.1 GeV/c for 0.76 < W < 1.16) you uploaded.

Click here to view the object (Fig 9. Plot of proton acceptance for momentum bin 1.2-1.7 GeV/c for 0.76 < W < 1.16) you uploaded.

Click here to view the object (Fig 10. Plot of proton acceptance for momentum bin 1.8-2.1 GeV/c for 0.76 < W < 1.16) you uploaded.

Click here to view the object (Fig 11. Plots of chi2 versus theta_p for the fits from the analysis just above) you uploaded.

Looking at the plots of the edges positions (Fig 7) and comparing them with the CLAS acceptance (Fig 8-10) I am afraid that if I use the edges from these gen1 fits I will be cutting out a large fraction of the QE peak. the problem is shown in Fig 12 which shows the simple trapezoid fit to the phi_p distribution for the p_p = 0.7 GeV and theta_p = 60 deg bin. Notice the central peak in the data is wider than the plateau of the fit. It seems like there is a set of events that are near-QE-like that form a peak in the middle of the distribution and sit atop the stable acceptance region (recall the acceptance plots above).

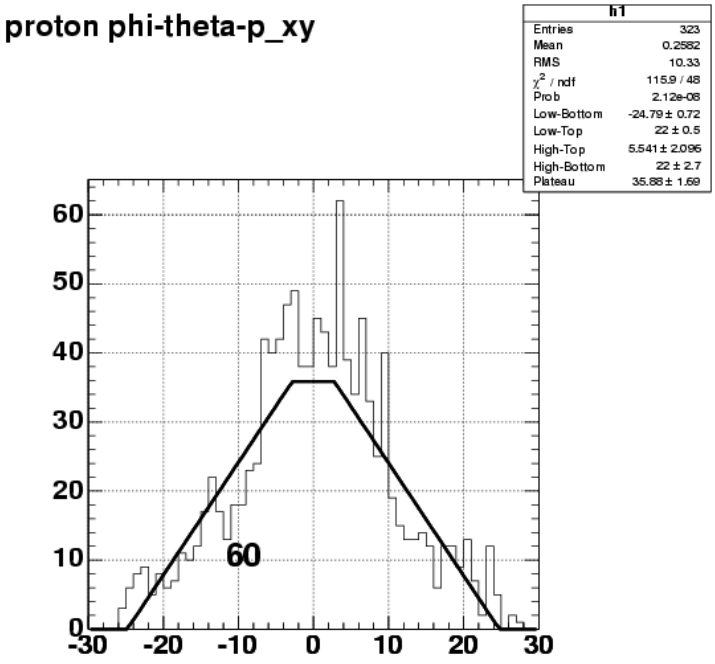

Fig 12. Phi_p distribution for pbin=7, thetabin=60 plus simple trapezoid fit.

Just be looking at the acceptance plots, the central plateau is about 15 deg wide or great in each momentum pin. Go into trapzoid.fit and set a minimum for this parameter in Minuit. The results are below.

Click here to view the object (Fig 13. Plot of edges for 0.76 < W < 1.16 GeV and with a minimum plateau width of 15 degrees for theta_p > 25 deg) you uploaded.

Big mystery!! Why is every other point missing in Fig 12??? Because I didn't include the chi2 in the read statement. The chi2 plots are shown below. The chisquare appears to get noticeably worse when the threshold requirement really starts to have an effect, but I'm willing to live with this in order to capture the QE events within the proton fiducial cuts.

Click here to view the object (Fig 13. Plot of chi2 for fits with minimum width=15 deg for theta_p > 25 deg.) you uploaded.

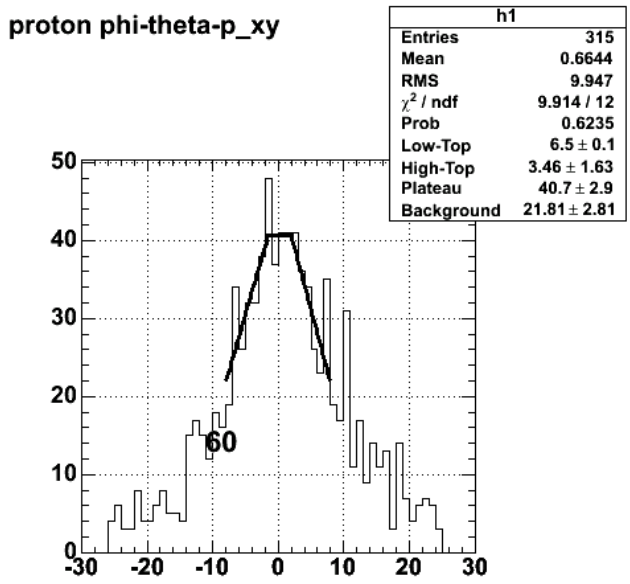

Fig 14. Plot of a gen1 fit for pbin=8 using restricted-range simple trapezoid.

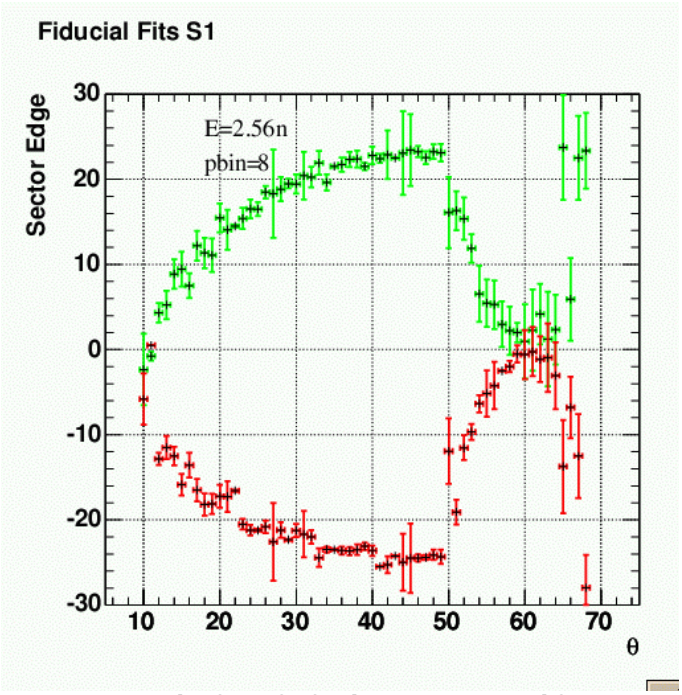

Fig 15. Results of gen1 fits for pbin=8 using trapezoid_fit4.C.

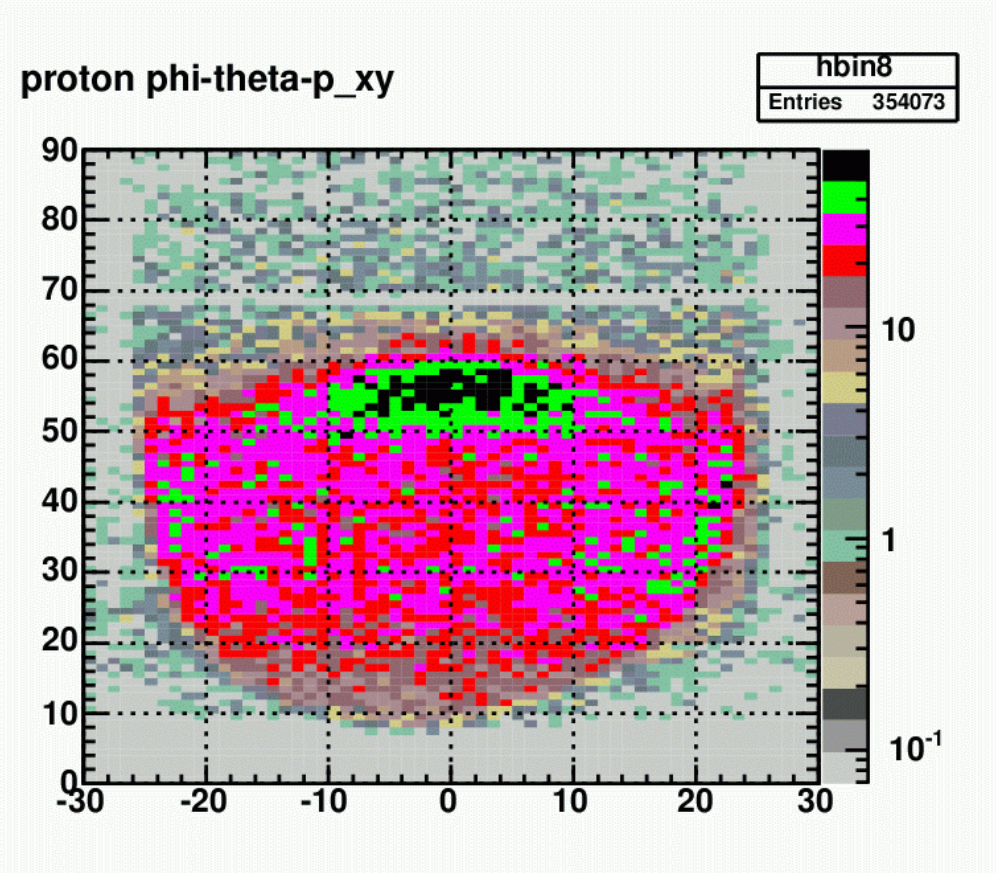

Fig 16. Initial acceptance distribution for pbin=8, sector=1.

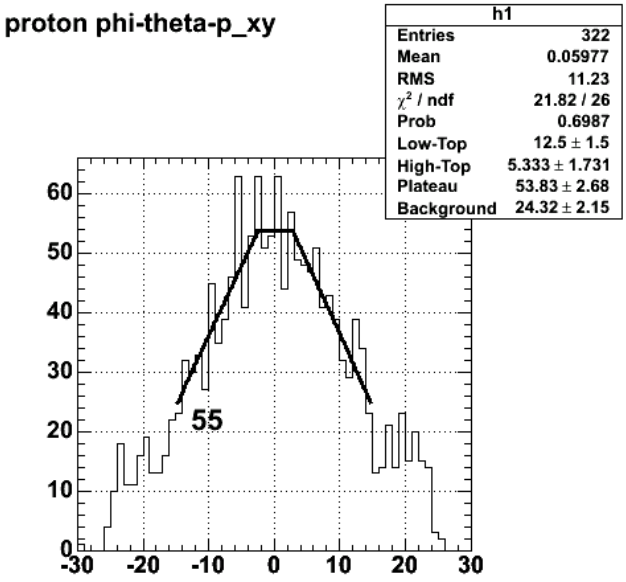

Fig 17. More results of gen1 fits for pbin=8 using trapezoid_fit4.C.

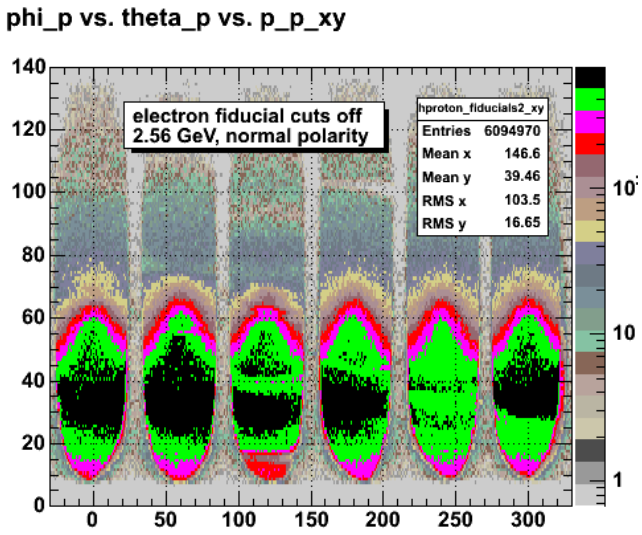

Fig 18. Turn off electron fiducial cuts to test the effect on the large-angle behavior of the proton group near theta_p=60 degrees.

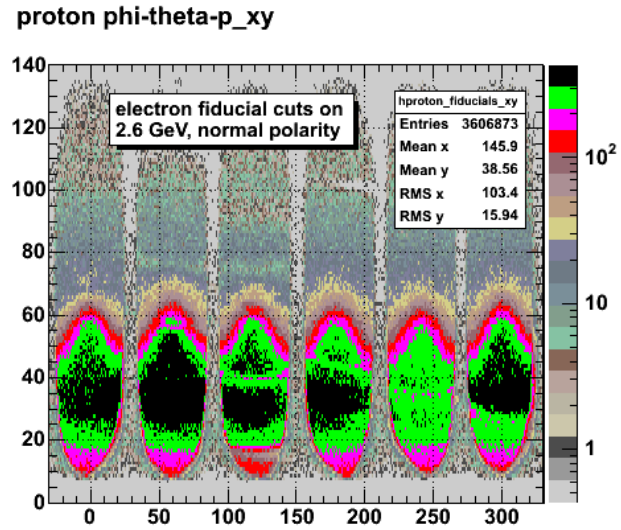

Fig 19. Turn on electron fiducial cuts to test the effect on the large-angle behavior of the proton group near theta_p=60 degrees.

Click here to view the object (Root file for the previous plots including plots with electron fiducials turned off) you uploaded.

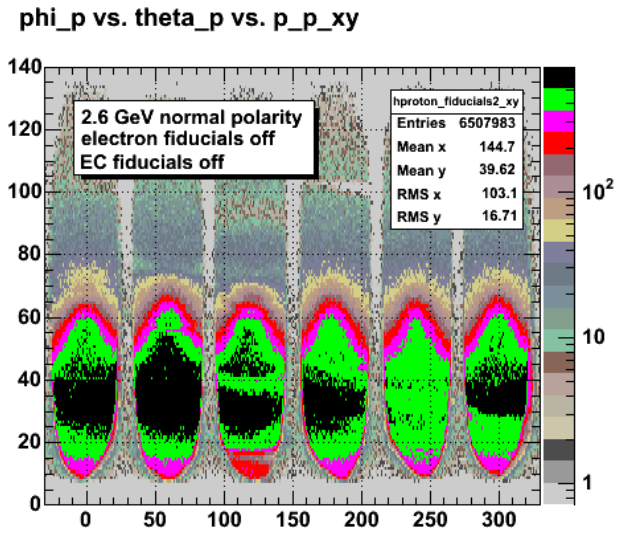

Fig 20. Turn off electron and EC fiducial cuts to test the effect on the large-angle behavior of the proton group near theta_p=60 degrees.

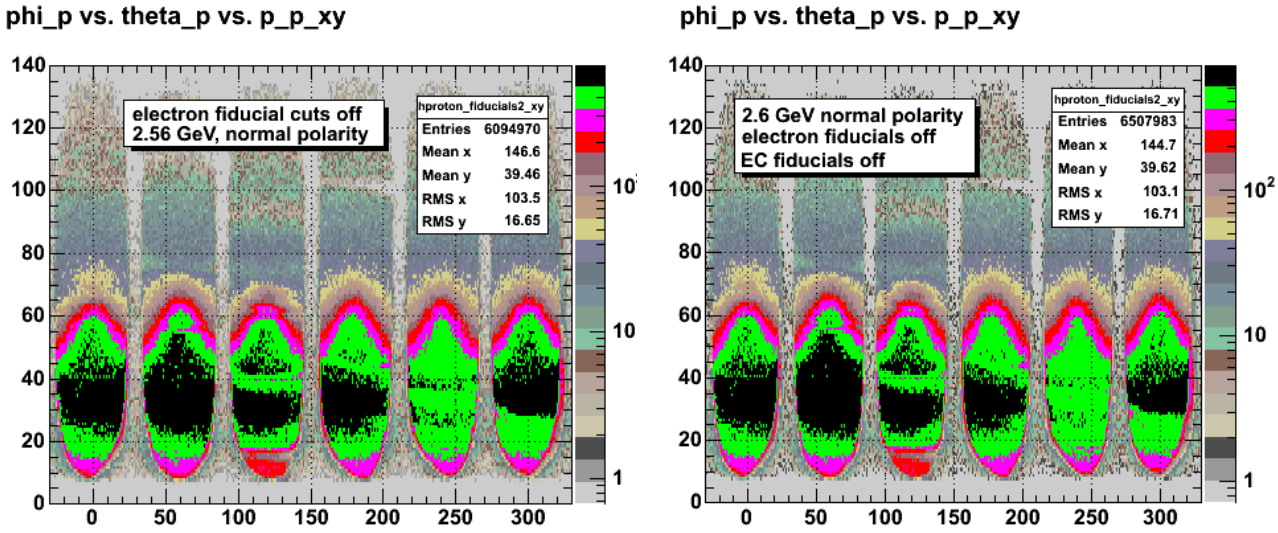

Fig 21. Side-by-side comparison of Figures 18 (left panel, electron fiducials off) and 20 (right panel, electron fiducials and EC fiducials off).

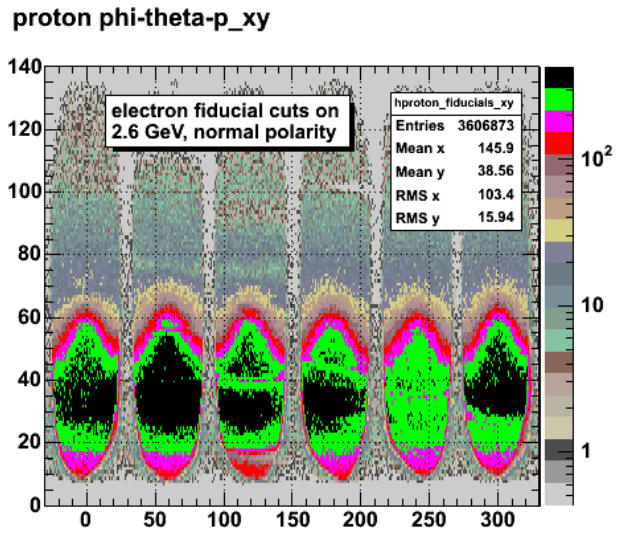

Fig 19b. Turn on electron fiducial cuts to test the effect on the large-angle behavior of the proton group near theta_p=60 degrees.

<

Click here to view the object (Root file with electron fiducials and EC fiducials turned off.) you uploaded.

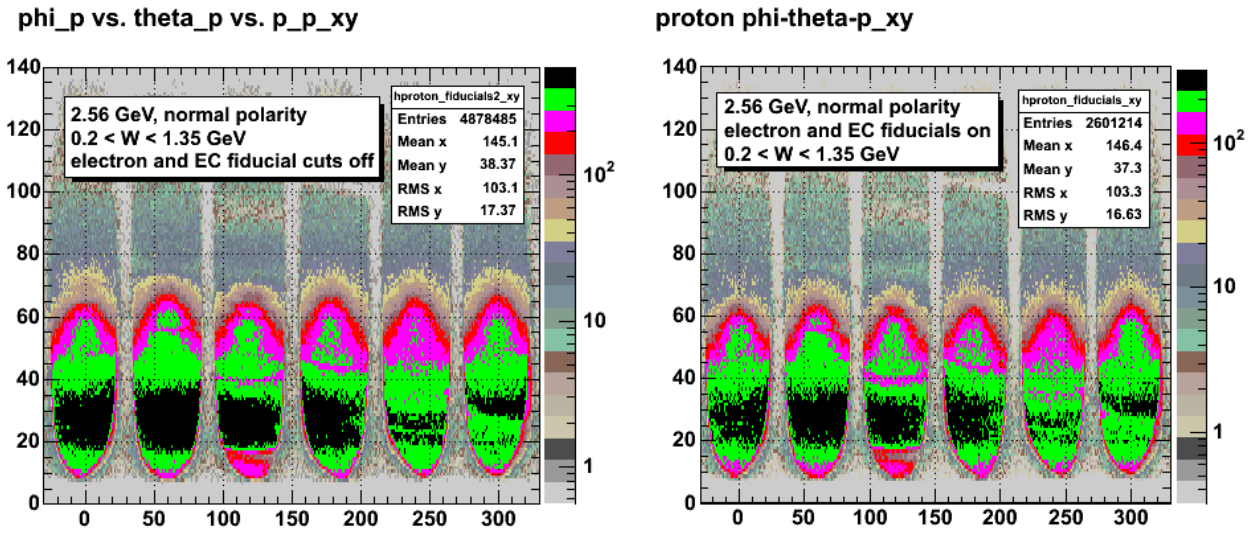

Fig 22. Turn off electron and EC fiducial cuts and exclude events with 0.2 < W<1.35 GeV (QEs) to test the effect on the large-angle behavior of the proton group near theta_p=60 degrees (left panel) and do the same with the electron and EC fiducial cuts turned on (right panel).

Click here to view the object (Root file for Fig 22.) you uploaded.

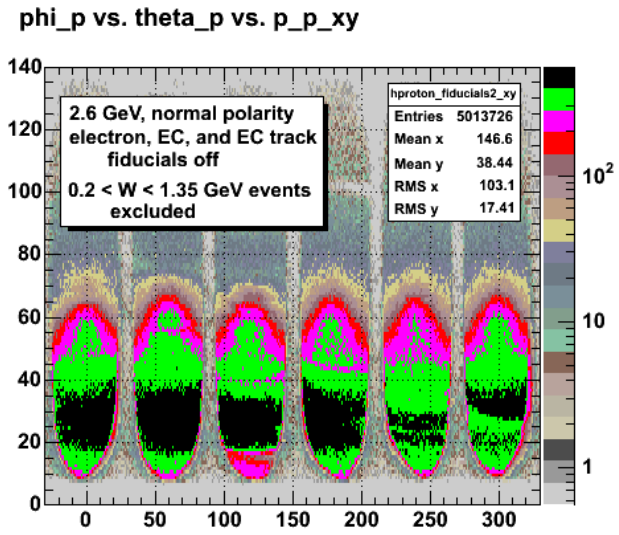

Fig 23. Now turn off the EC track fiducials and there isn't mu.ch change

Click here to view the object (Root file for Fig 23.) you uploaded.

To see how much the simple trapezoid fits actually cut out see the next plot which shows the acceptance for pbin=8, sector=1, with the results of the simple trapezoid fit superimposed atop it.

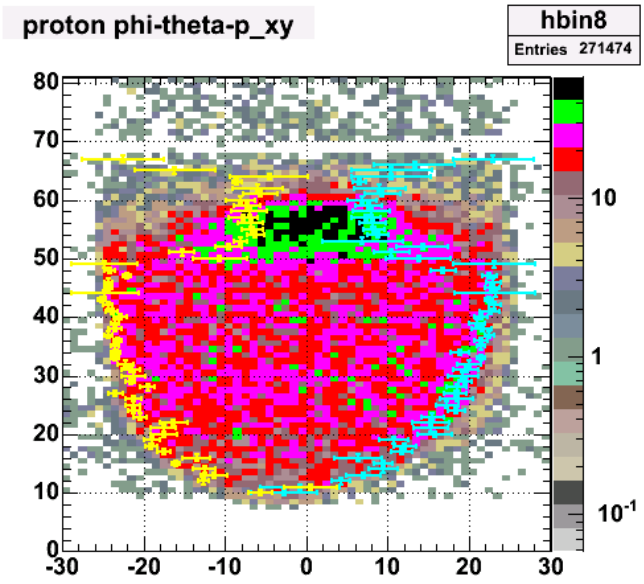

Fig 24. Using the same analysis as Fig 23 (large exclusion range for quasielastic events) we get the above results using the simple trapezoid fit for sector 1, pbin=8.

Click here to view the object (Root C++ macro for the previous plot) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 44 - Comparison with quasielastic events (gpg)

[Modified Tue May 17 03:28:25 2005 (GMT) gpg]

This is a continuation of the previous page which was just getting too long. The first plot below shows the momentum distribution of quasielastic events wich are the ones we are most interested in selecting.

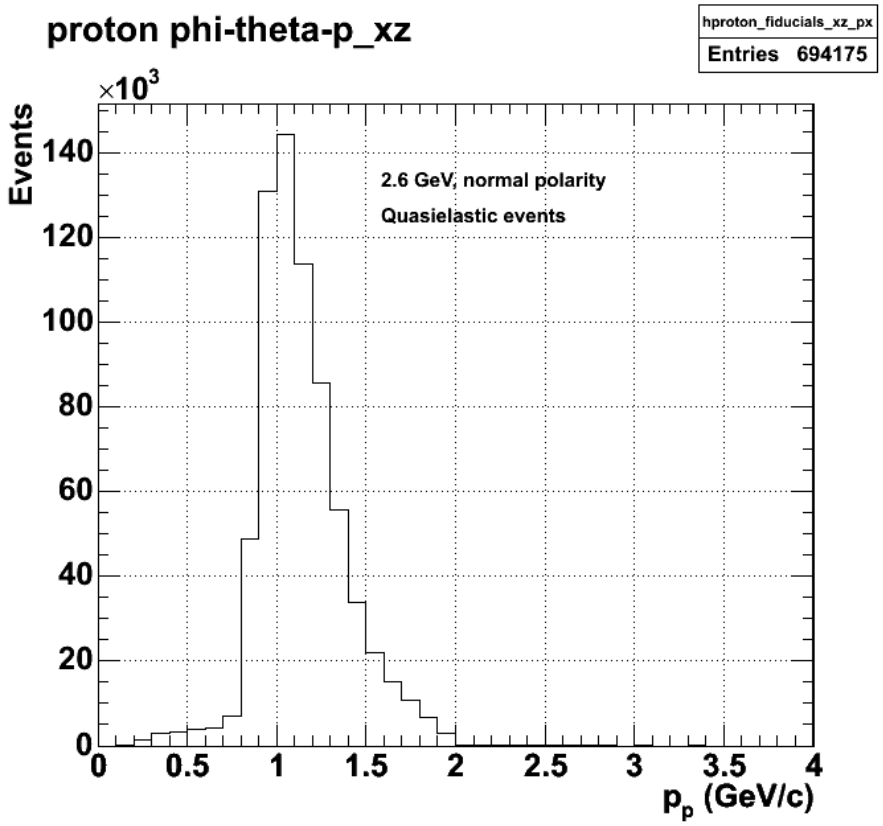

Fig 1. Proton momentum distribution for quasielastic events for 2.6 GeV, normal polarity setting.

Click here to view the object (Root file for QE events used in Fig 1) you uploaded.

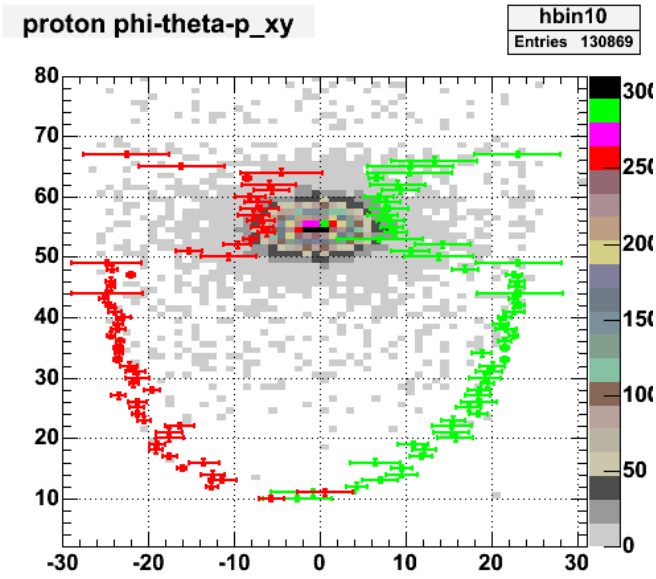

Fig 2. Plot of quasielastic events for pbin=10, 2.6GeV, normal polarity with fiducial cut for this momentum bin generated with a simple trapezoid with with events with W < 1.35 GeV excluded.

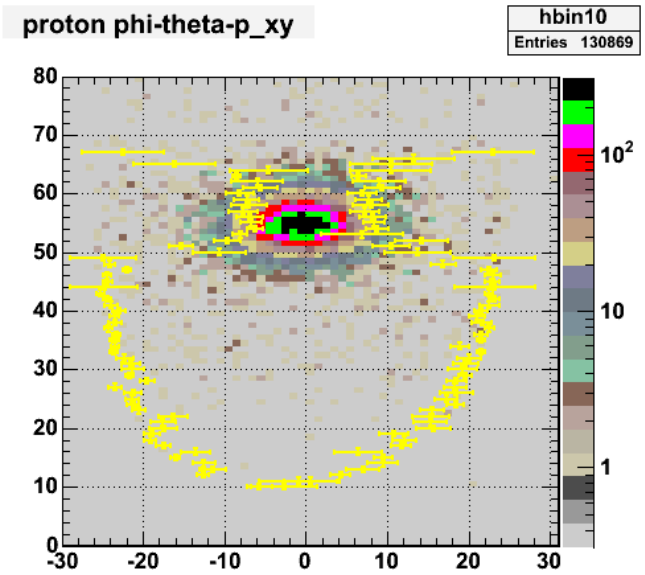

Fig 3. Log plot of Fig 2.

Click here to view the object (Root macro that was used to create Figs 2-3) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 45 - Excluding more quasielastic events (gpg)

[Modified Fri May 20 18:19:23 2005 (GMT) gpg]

The plots below show the results of raising the minimum W required so that we exclude quasielastic events because they electrona and proton in those events tend to be correlated and ruin the nice flat acceptance of CLAS.

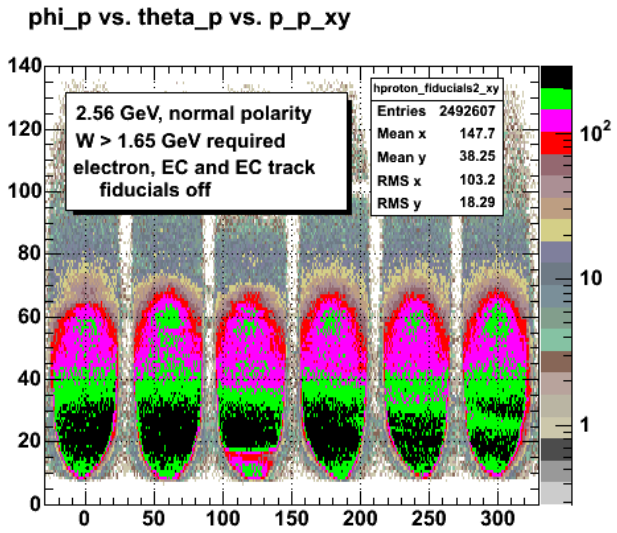

Fig 1. Acceptance for events with W>1.65 GeV and all fiducials off.

Click here to view the object (Root histogram file for above plot in Fig. 1) you uploaded.

Now crank the W threshold up to 1.9 GeV and get the following.

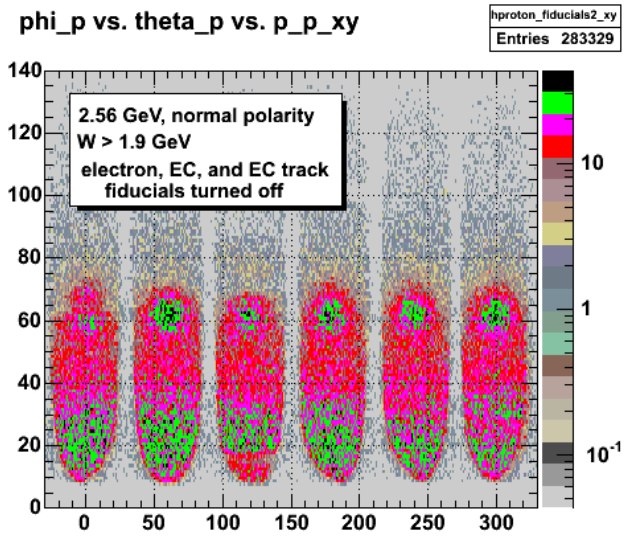

Fig 2. Acceptance for events with W>1.9 GeV and all fiducials off.

Click here to view the object (Root file for previous figure) you uploaded.

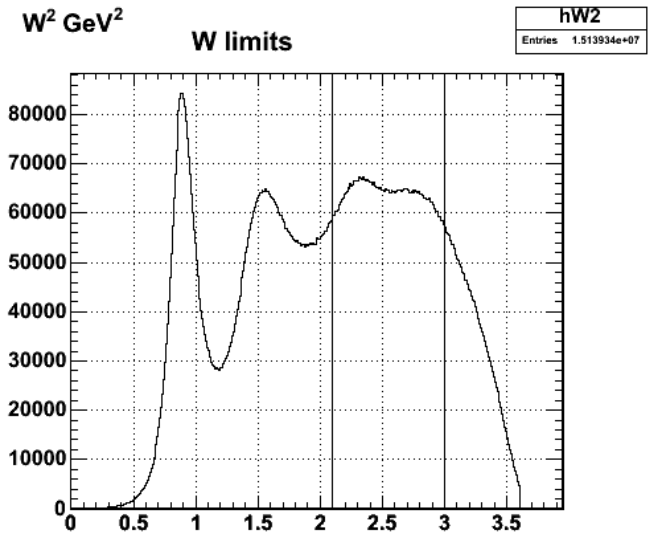

Fig 3. W^2 spectrum with limits marked.

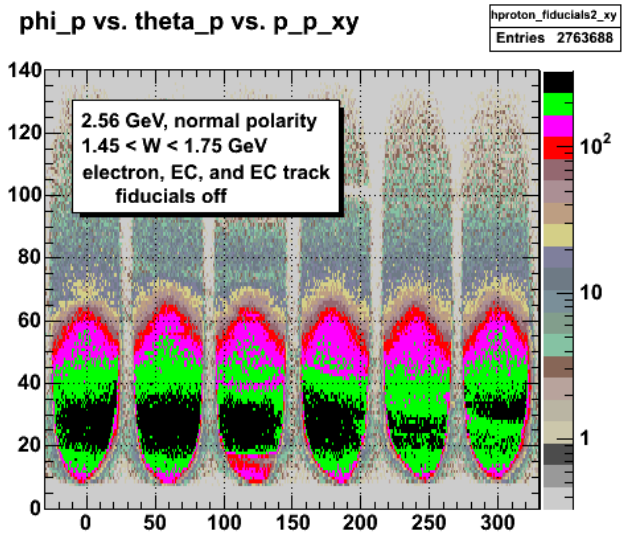

Fig 4. Acceptance for events with 1.45 < W < 1.75 GeV and all fiducial cuts off.

Click here to view the object (Root file for Fig. 4) you uploaded.

Click here to view the object (Fig 5. Plot of theta vs. phi acceptance for protons with 1.45 < W < 1.75 GeV from above analysis for Fig 4.) you uploaded.

Click here to view the object (Fig 6. First generation fit results for protons with 1.45 < W < 1.75 GeV from above analysis for Fig 4) you uploaded.

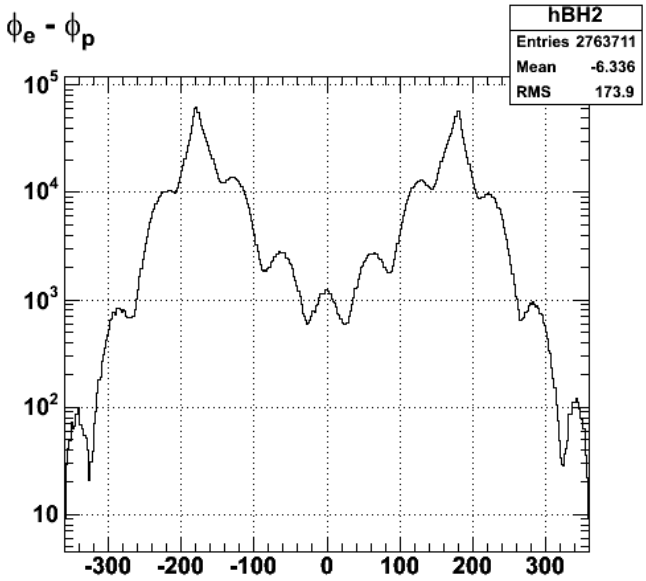

Fig 7. Coplanarity angle for 2.56 GeV, normal polarity run.

Figure 7 is perplexing because one expects that the cross section or number of events at 360 degrees should be the same as the number of events at zero degrees. However, this is not true in this case because the coplanarity is based on the difference between two angles. The difference phi_e-phi_p is close to zero whenever the electron and proton come out close to the same direction and lying in the same quadrant. This can occur for almost all possible values of phi_e and phi_p. To get a difference phi_e-phi_ close to 360, this only happens only when the electron angle is close to, but does not exceed 360 degrees and the proton is is close to zero degrees, but does not go below 0 degrees (and hence change to some value close to 360). This second situation is only true for a very small region of the detector around the x axis in the lab coordinate system.

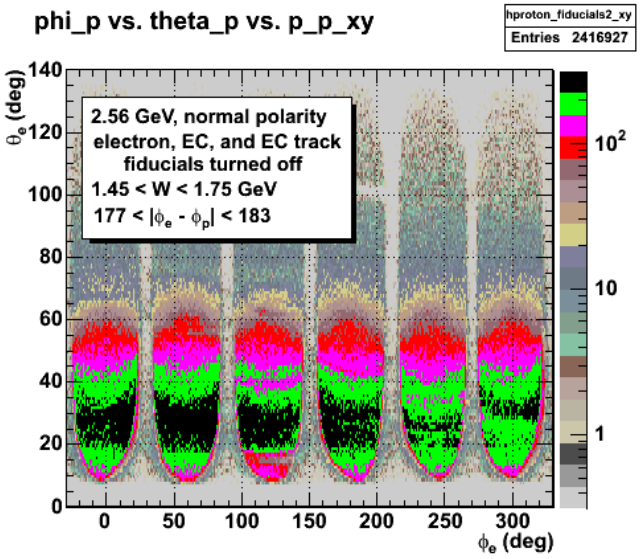

Fig 8. CLAS proton acceptance for ep coincidence that exclude events that are coplanar because they will tend to be quasielastics.

Click here to view the object (Root file for Fig 8) you uploaded.

In last week's meeting (5/13/5) there were a several questions that were raised about the proton acceptance. (1) What is the source of the large number of events in the range 70 < theta_p < 140 degrees (see Figure 1). The most likely answer appears to be these events are from pions (ed->epi+X) that get misidentified as protons. Pions can reach large angles like this while protons can't. (2) The second question was about the shape of the large proton group in the region 50 < theta_p < 70. The acceptance for electron singles typically tails off at large theta_e so that the acceptance away from the CLAS coils is uniform for a given theta_e bin. The proton acceptance shown in Figure 1 is not flat, but rounded in the region 50 < theta_p < 70. One possible explanation for this shape is that it represents the electron acceptance at forward angles. These are ep coincidences and protons at theta_p = 50-70 degrees likely come from electrons produced at forward angles where the electron acceptance has a shape like this (except it's inverted) which in turn effects the proton acceptance. (3) There appear to be a significant number of quasielasticm (QE) events in this sample. The electrons and protons in QE events are correlated which distorts the flat acceptance of CLAS. The question is how do we get rid of these events so the acceptance away from the coils is flat as a function of phi_p in a given theta_p bin. We tried several things. First, we turned off the electron and EC fiducial cuts. This significantly increased the number of events in the sample as expected, but did not significantly change the shape of the proton acceptance in the range theta_p = 50-70 degrees. We then tried excluding more and more of the events near the quasielastic peak by applying a threshold on *W*. This reduced the number of quasielastic events, but did not eliminate them (see Figure 1 in this entry). There is still enough of a correlated QE peak at large theta_p to distort the fits using a simple trapezoidal shape. The next step we took was to apply a coplanarity cut. We expect quasielastic events to be correlated and to lay in the same plane. We eliminated events by calculating the difference between the electron and proton

azimuthal angles and excluding events near 180 degrees so 177 < |phi_e - phi_p| < 180 degrees. Some of the results are shown below.

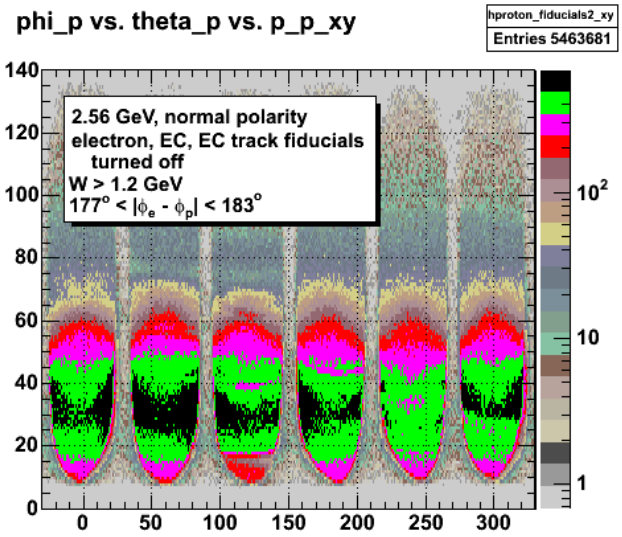

Fig 9. Tune the W range to increase the sample size. This looks like the W threshold is too low because the proton acceptance is not flat in the range theta_p = 50-70 degrees.

Click here to view the object (Root file used to generate Fig 9) you uploaded.

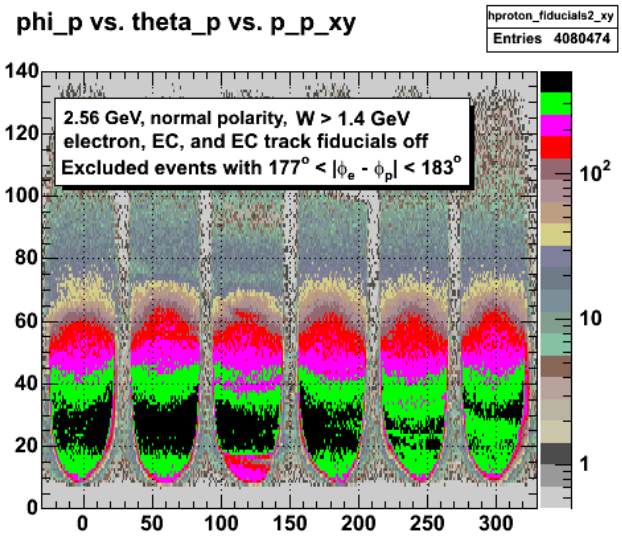

Fig 10. Tune the W range to increase the sample size.

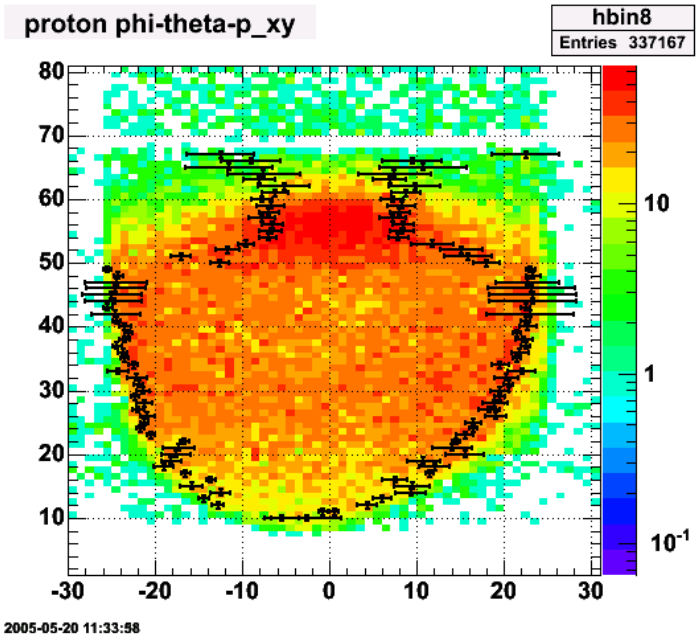

Fig 10a. First generation fits and proton acceptance for pbin=8.

Click here to view the object (Root file for Fig. 10) you uploaded.

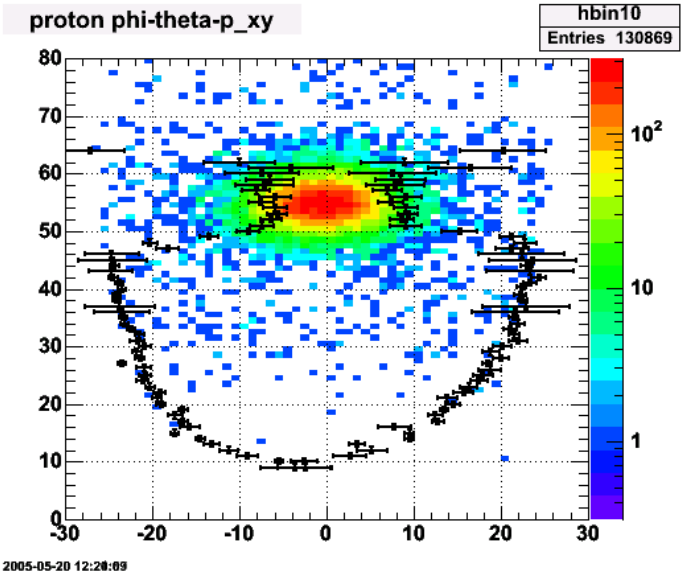

Fig 11. First generation fits and proton acceptance for pbin=10 and QE events.

Click here to view the object (Root file for Fig 11.) you uploaded.

Click here to view the object (Root C++ macro for Fig 11) you uploaded.

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Jerry Gilfoyle's Enotebook page 46 - Including positive pions with the ep events (gpg)

[Modified Thu Jun 9 21:23:40 2005 (GMT) gpg]

At WKB's suggestion, I included e+d -> e+pi+ events with the e+d -> e+p I was already using to get the hadron fiducial cuts. This inclusion is based on the assumption/standard wisdom that the proton and positive pion fiducials should be the same. The plot is below in Figure 1. The phi_h dependence in each sector now appears very smooth except in the range theta_h = 50-70 degrees where we see the same reflection of the forward-angle electron acceptance that we saw in the previous two entries.

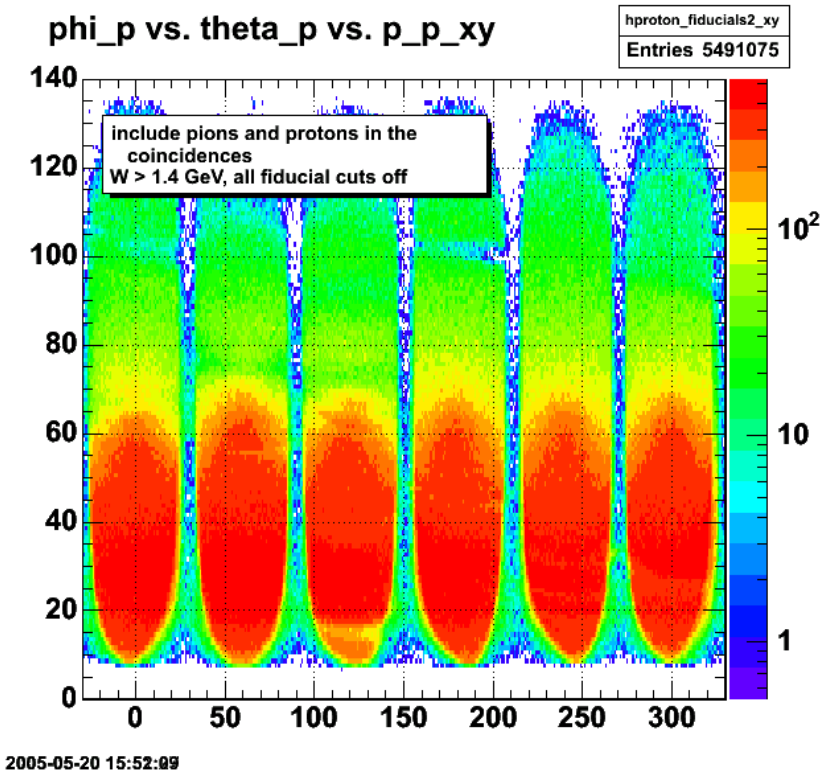


Fig 1. Hadron acceptance for W > 1.4 GeV, no electron fiducials.

Click here to view the object (Root file for Fig 1) you uploaded.

The rounded shape of the proton acceptance in the range theta_p=50-70 degrees has been attributed to the effects of the electron acceptance at the most forward angles. To test this idea we decided to put a cut on those forward-angle electrons in one sector only. We put the cut on electrons in sector 4 which should effect the protons in sector 1 since a large proportion of the electron-proton coincidences lie in the same plane. This cut should have little effect on the pions. The results are shown below and support the idea that the shape of the proton acceptance around theta_p = 60 degrees is due to the electron acceptance of CLAS at the most forward angles.

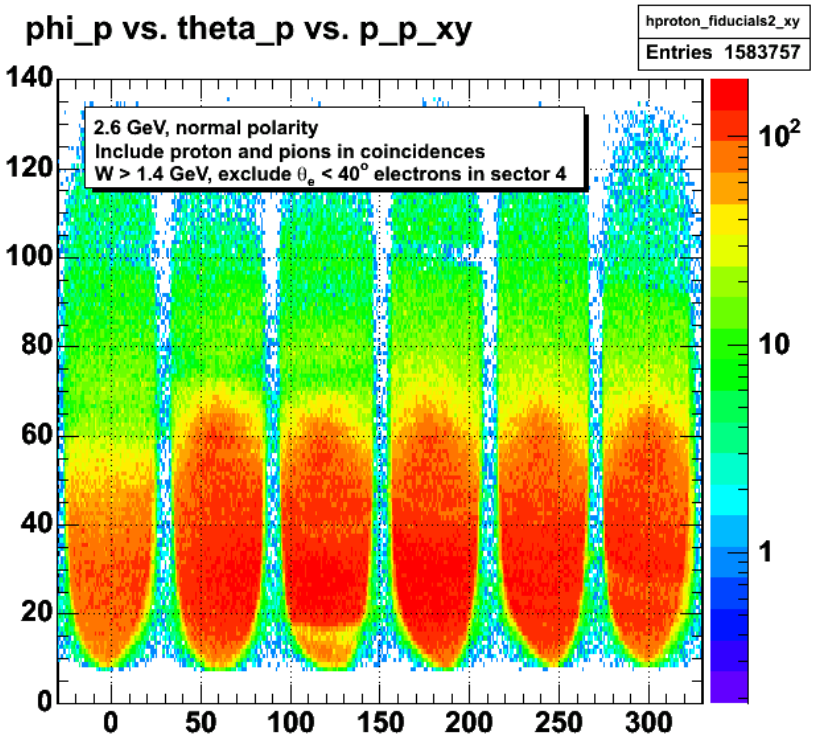


Fig 2. Try excluding electrons in sector 4, theta_e < 40 deg to see if it effects the rounded shape of the proton acceptance in the range theta_p = 50-70 degrees in sector 1. These results are for about one-fourth to one-third of the data.

The next step in the analysis would be to cut on the electrons in all the sectors to get rid of the proton peninsula and then we will have a smooth, flat distribution in each sector out to large hadron angles. The first attempt at this is shown below. The proton acceptance is flatter, but still not as flat as we would like. Fig 3 shows the proton acceptance with a theta_e > 30 deg cut on it. Raise this threshold to 40 deg.

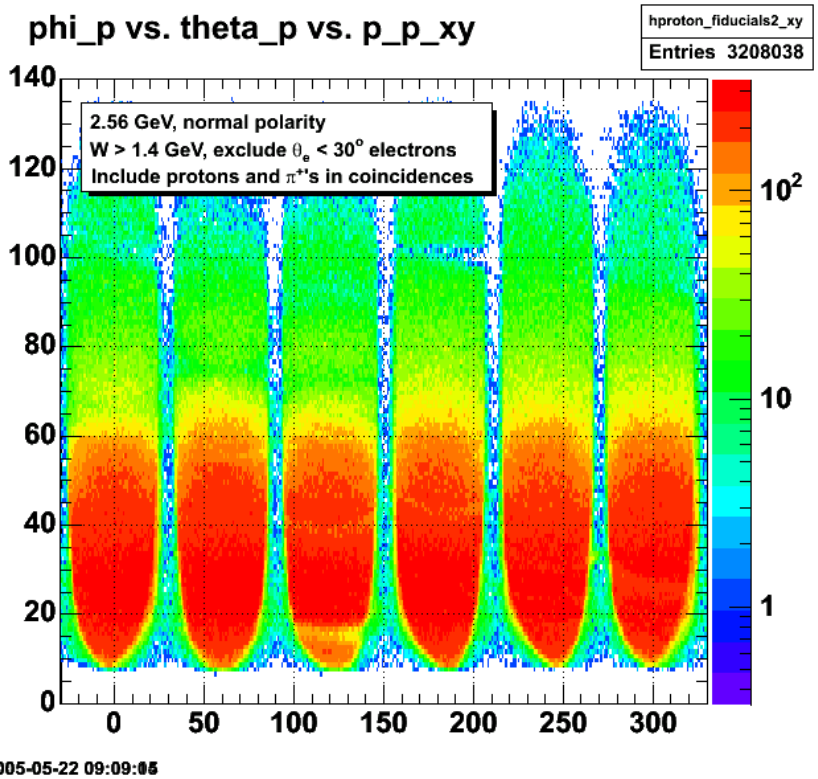
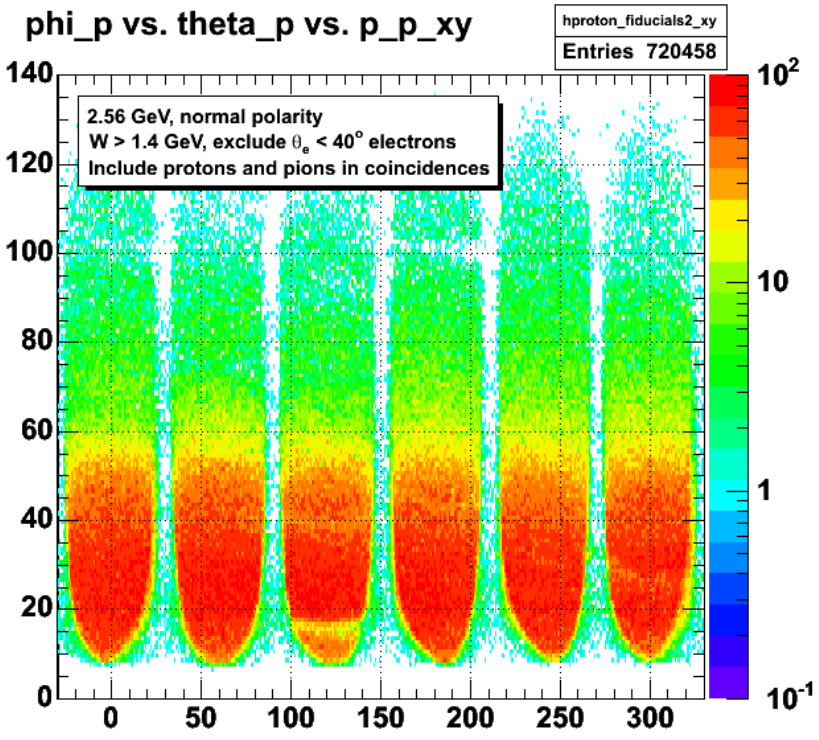


Fig 3. Try excluding electrons in all sectors, theta_e < 30 deg to see if it effects the rounded shape of the proton acceptance in the range theta_p = 50-70 degrees. These results are for the full dataset.

The results of raising the threshold on the electron scattering angles is shown below. The phi distribution in each sector is now pretty flat so we'll save this data set for the first generation fits (Opps! Maybe not. See below. It also appears that we will have to put an upper limit on theta_p (about 90-100 deg) where we run out of events.

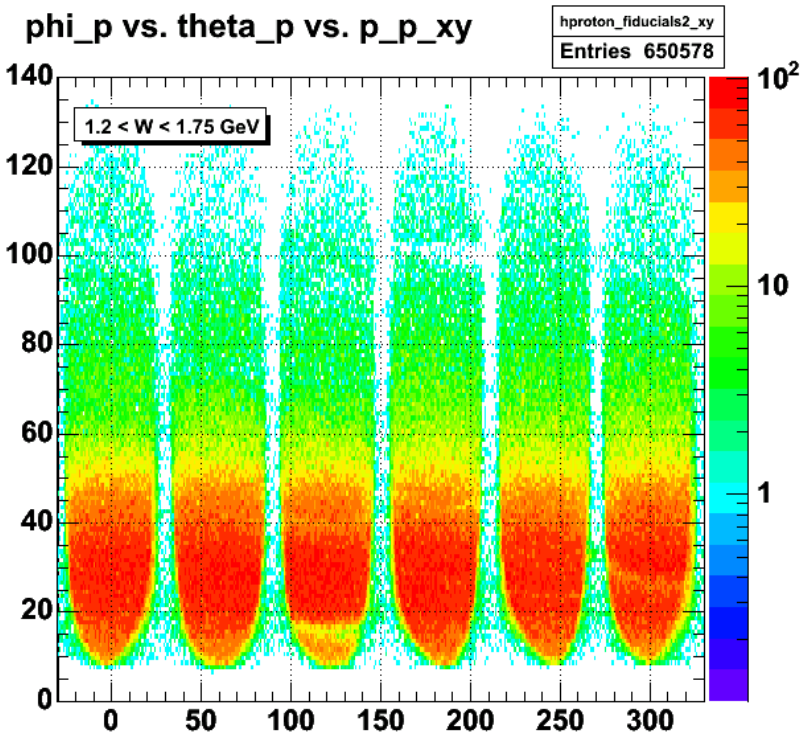


2005-05-22 10:20:88

Fig 4. Try excluding electrons in all sectors, theta_e < 40 deg to see if it effects the rounded shape of the proton acceptance in the range theta_p = 50-70 degrees. These results are for the full dataset.

Click here to view the object (Root file for Fig 4) you uploaded.

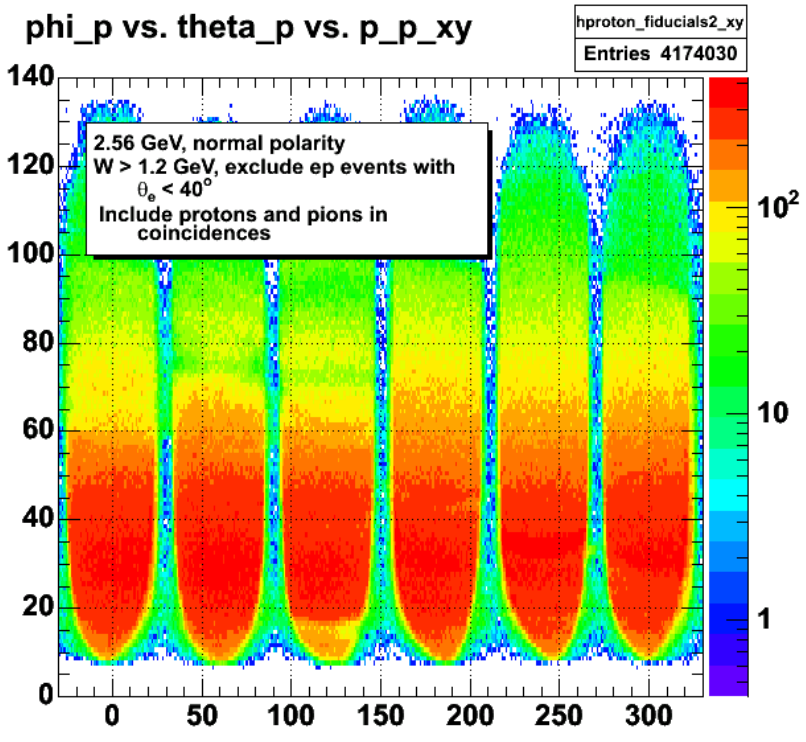
The number of events in Fig 4 has dropped dramatically from Fig 3 (a factor 4) so let's play around to see if we can recover some of those events. As a first attempt change the W requirement from W>1.4 GeV to 1.2 < W < 1.75 GeV.



2005-05-22 11:31:43

Fig 5. Try limiting the W range to 1.2 < W < 1.75 GeV to see if I can get more counts. Doesn't seem to work.

Now use W>1.2 GeV threshold and exclude only ep coincidences with theta_e < 40 deg (i.e., include the epi+ coincidences). The hope here is that we recover a significant fraction of events and the plot below shows that appears to be true.



2005-05-23 04:43:28

Fig 6. Use W>1.2 GeV threshold and exclude only ep coincidences with theta_e < 40 deg.

Click here to view the object (Root histogram file for Fig 6) you uploaded.

Doing the gen1 fits reveals there is still a significant QE peak in the data even in the range theta_p= 55-65 deg. See the PS file below. This is surprising since there is not a hint of it in Fig 6.

Fig 7. Proton acceptance for ep/epi+ events from the previous analysis.

Opps! Pilot Error! The plots in Fig 7 and the gen1 fits were generated for the wrong histogram so redo the gen1 fits. The correct acceptance plot is shown below.

Fig 8. Hadron (mixture of proton and pi+) acceptance for Root histogram file just above.

Fig 9. Plot of edges for previous analysis.

Click here to view the object (Fig 10. Updated proton/pi+ acceptance plots.) you uploaded.

Click here to view the object (Fig 11. Updated edge plot.) you uploaded.

Click here to view the object (gzipped tar file with 05-may-25 versions of C++ code and histogram file) you uploaded.

The plot below shows a comparison of the edges found in the first generation fitting using the trapezoid fit for two different data samples. The red points are from the mixed sample discussed in this entry consisting of protons and positive pions. The black points are the first generation fits for one of the previous protons-only samples. These results are for pbin=10 and sector 1, 2.6 GeV, normal polarity. For theta_h angles less than about 50 degrees the first generation fits are consistent. At larger angles the edges found with the proton sample follow the contours of the quasielastic peak and create a 'wineglass' effect that, while pretty, does a lousy job of reproducing what we think is the true region of uniform acceptance.

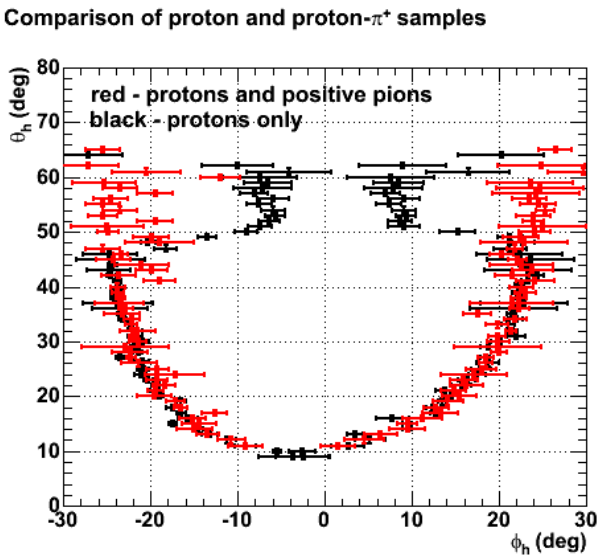


Fig 12. Comparison of edges found in the proton-only sample and in the sample consisting of protons and positive pions.

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Jerry Gilfoyle's Enotebook page 47 - S1 2-3 gen hadron fiducial fits (gpg)

[Modified Mon Jun 6 19:10:07 2005 (GMT) gpg]

The gzipped tar file below contains the 2gen fit results, eps files, C++ Root macro, and tex files for the sector 1 2gen fits.

Click here to view the object (compressed tar file with 2gen fit stuff for sector 1) you uploaded.

Click here to view the object (Histogram file for 2gen fits for sector 1 2.6 GeV, normal polarity) you uploaded.

Fig 1. Updated plot of generation 1-2 fit results after correcting the limits set on the point where the edge becomes constant.

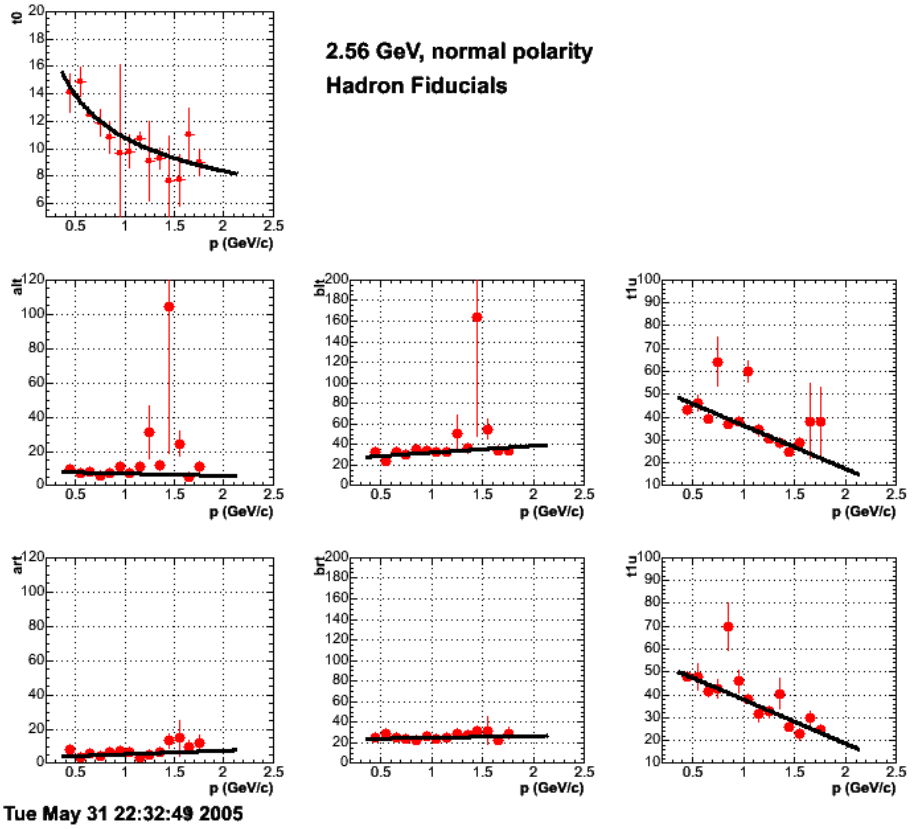

Fig 2. Parameters from 2nd generation fits along with 3rd generation fits for 2.6 GeV, normal polarity

Click here to view the object (Root C++ macro for Fig .) you uploaded.

The fit parameters for the above plot are listed below.

```
gpgl:sector1> grep +++++ pfid_3genpars.out
+++++ fit1 results 10.789 -0.364895
+++++ fit2 results 8.46272 -1.31767
+++++ fit3 results 25.5863 6.62781
+++++ fit4 results 3.26083 2.12225
+++++ fit5 results 23.3702 1.68038
+++++ fit6 results 55.3504 -18.9847
+++++ fit7 results 57.1133 -19.2231
g
```

Important question!!?? What are the maximum and minimum energies for quasielastic protons for this energy? The proton momenta vary with Q2 as shown in the table below.

Check on pbin=14 where the fit parameters for the upper portion of the sector are anomalously high. The plot below shows a comparison of the upper distribution for pbin=14 along with the distributions in the adjacent momentum bins. The distributions don't show any great differences except for 1-2 points. I could putz around and tune things, but I think that would have the same effect as just punting the pbin=14 point.

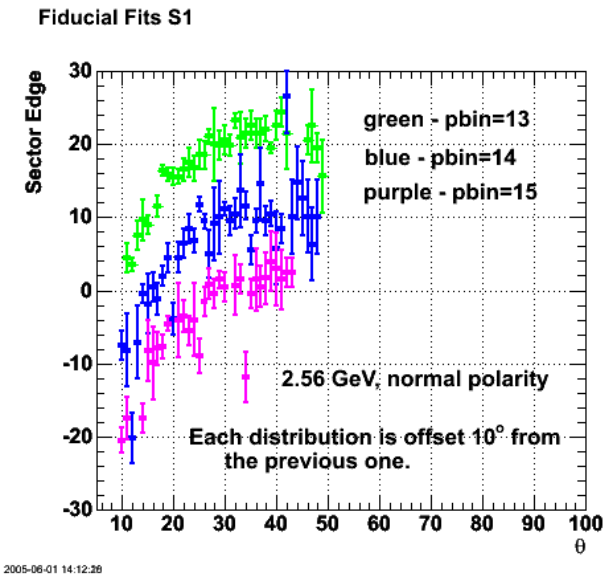

Fig 3. Comparison of the upper portion of the sector edges for pbins = 13, 14, and 15.

Click here to view the object (Root C++ macro for Fig 3.) you uploaded.

I also refit pbin=14 and got results that were much more consistent with the adjecent momentum bins. See b

```
 FCN=93.1715 FROM MIGRAD    STATUS=CONVERGED     137 CALLS         138 TOTAL
                     EDM=8.59083e-11    STRATEGY= 1  ERROR MATRIX UNCERTAINTY 100.0 per cent
  EXT PARAMETER                APPROXIMATE        STEP         FIRST
  NO.   NAME      VALUE            ERROR          SIZE      DERIVATIVE
   1  t0           7.70000e+00     fixed
   2  alt          1.19057e+01   4.92277e-01   2.33264e-03  -9.04685e-06
   3  blt          3.48045e+01   5.50657e-01   2.60925e-03   1.39198e-06
   4  phimid      -3.19499e+00     fixed
   5  t1           5.50000e+01   3.11364e+01  -0.00000e+00   0.00000e+00
```

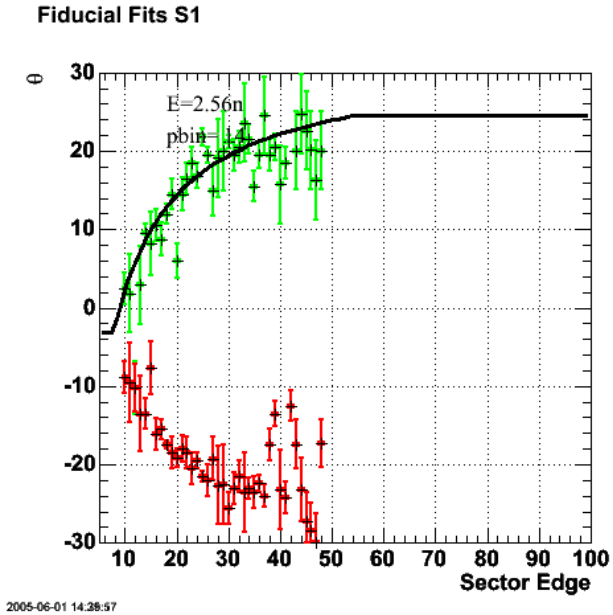

Fig 4. Revised pbin=14 fit.

Click here to view the object (Root C++ file for Fig 4) you uploaded.

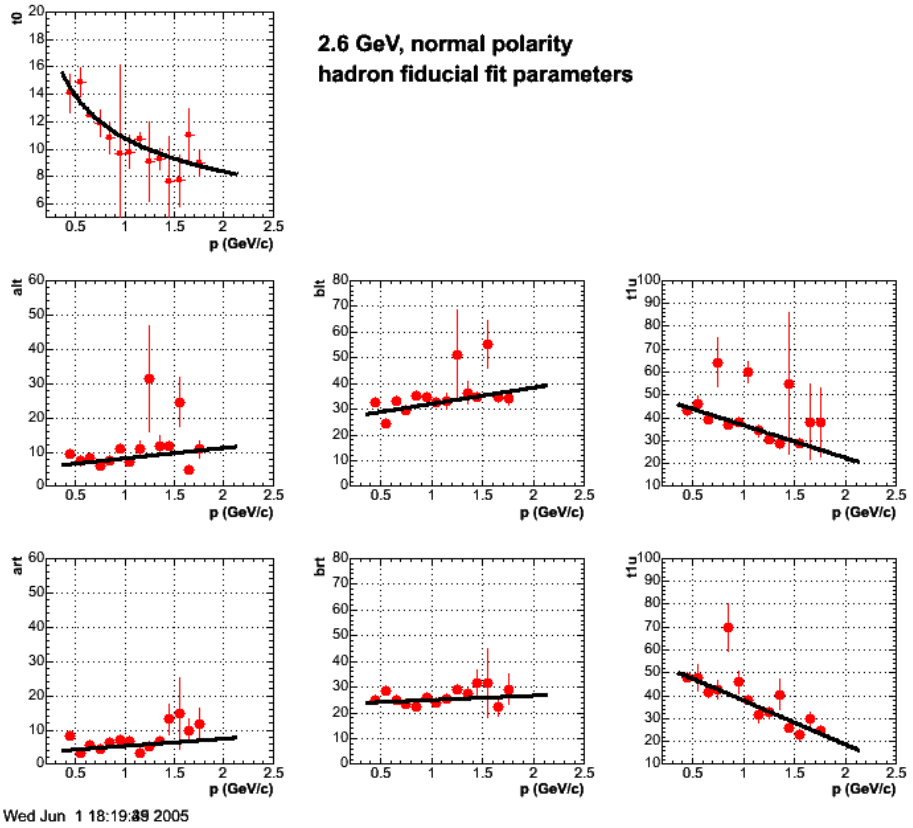

Fig 5. Updated version of Figure 2 with the 'fixed' fit for pbin =14.

Updated fit parameters for Fig 5.

```
+++++ fit1 results 10.789 -0.364895
+++++ fit2 results 5.15127 3.04357
+++++ fit3 results 25.8078 6.31294
+++++ fit4 results 3.26083 2.12225
+++++ fit5 results 23.3702 1.68038
+++++ fit6 results 51.0366 -14.2774
+++++ fit7 results 57.1133 -19.2231
g
```

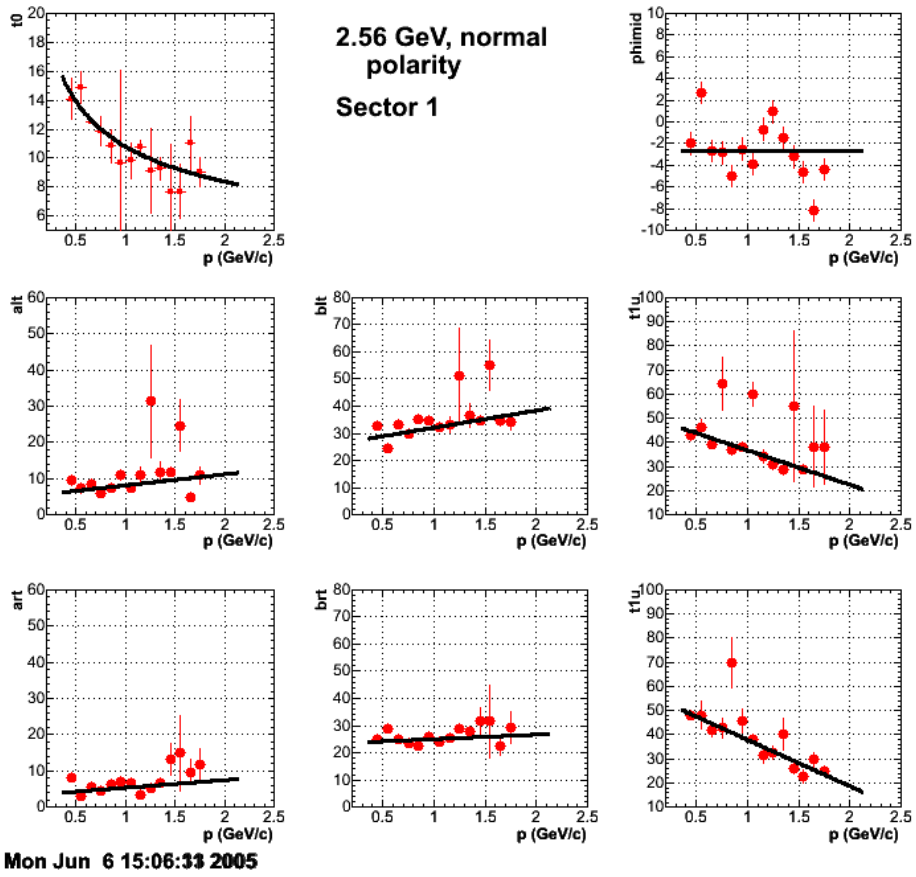

Fig 6. Added fit to phimid for sector 1, 2.6 GeV, normal polarity.

```
+++++ fit1 results 10.7889 -0.36482
+++++ fit2 results 5.15127 3.04357
+++++ fit3 results 25.8078 6.31294
+++++ fit4 results 3.26083 2.12225
+++++ fit5 results 23.3702 1.68038
+++++ fit6 results 51.0366 -14.2774
+++++ fit7 results 57.1133 -19.2231
+++++ fit8 results -2.69717
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 48 - 3rd look at proton/hadron fiducials (gpg)

[Modified Thu Jun 2 23:18:58 2005 (GMT) gpg]

At Will and Brian Quinn's suggestion, I have generated the acceptance for all positively charged tracks associated with a good electron track and with W > 1.2 GeV. I have excluded events where there is a proton in the sector opposite the electron. The results is shown below. Note there are about four times as many counts (good!), but there are several regions where the acceptance depends on phi_h which would make fitting the spectrum difficult. No electron fiducial cuts are turned on here.

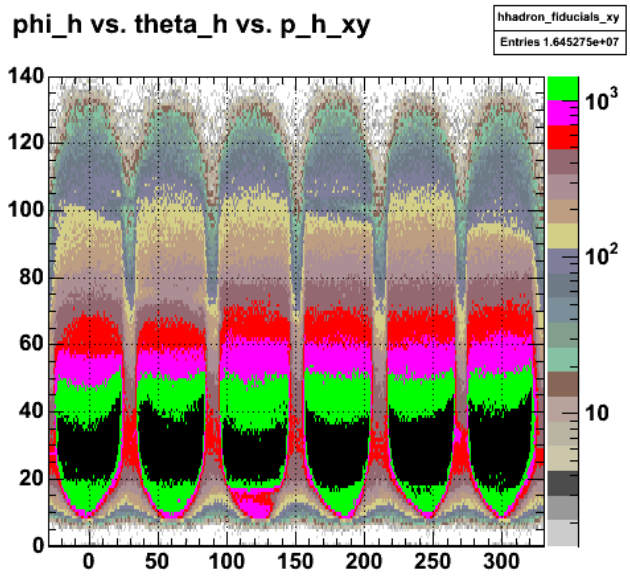

Fig 1. Hadron acceptance for 2.6 GeV, normal polarity under the conditions described above.

Click here to view the object (Root histogram file for Fig 1) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 49 - s2 2-3 gen hadron fiducial fits (gpg)

[Modified Mon Jun 6 20:32:20 2005 (GMT) gpg]

Fig 1. Plots of results of first generation fits for sector 2 for 2.56 GeV, normal polarity.

The gzipped tar file below contains the 2gen fit results, .dat files, .out files, eps files, C++ Root macro, and tex files for the sector 1 2gen fits.

Click here to view the object (compressed tar file with 2gen fit stuff for sector 2) you uploaded.

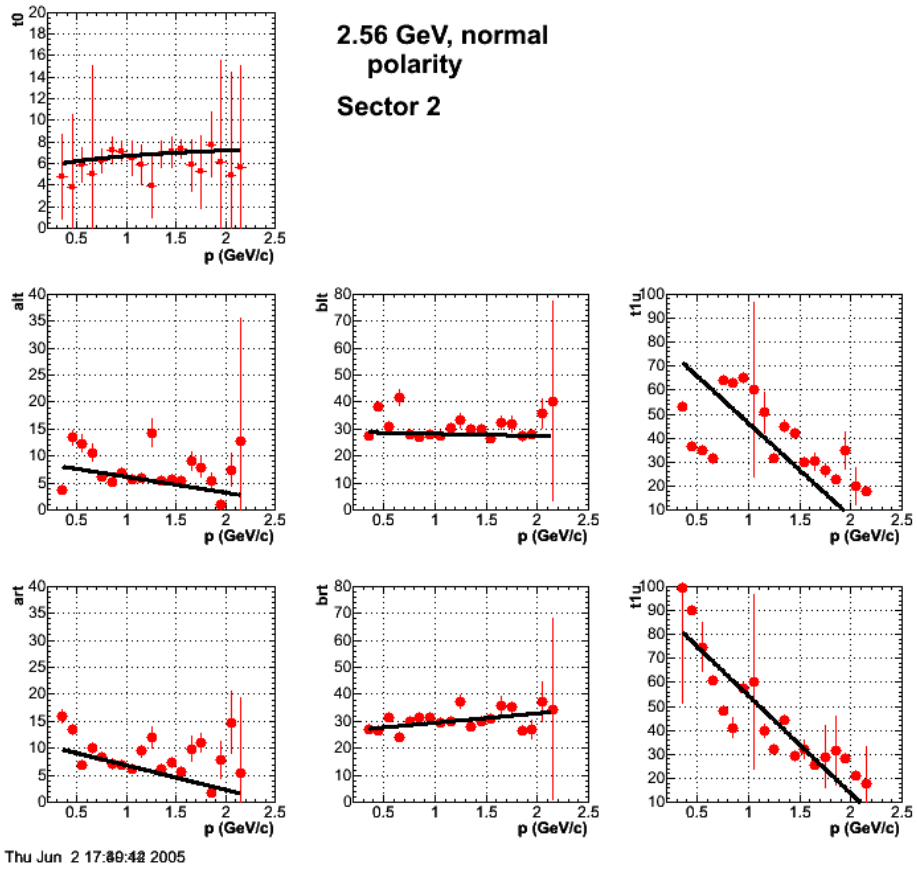

Fig 2. Initial results of 3gen fits for sector 2 for 2.6 GeV, normal polarity.

The 3gen fit parameters are below.

```
gpgl:sector2> grep +++++ pfid_3genpars.out
+++++ fit1 results 6.71178 0.106639
+++++ fit2 results 9.08854 -2.92349
+++++ fit3 results 29.0524 -0.770242
+++++ fit4 results 11.4217 -4.56037
+++++ fit5 results 25.9888 3.49619
+++++ fit6 results 85.2931 -39.0508
+++++ fit7 results 95.3324 -40.8773
g
```

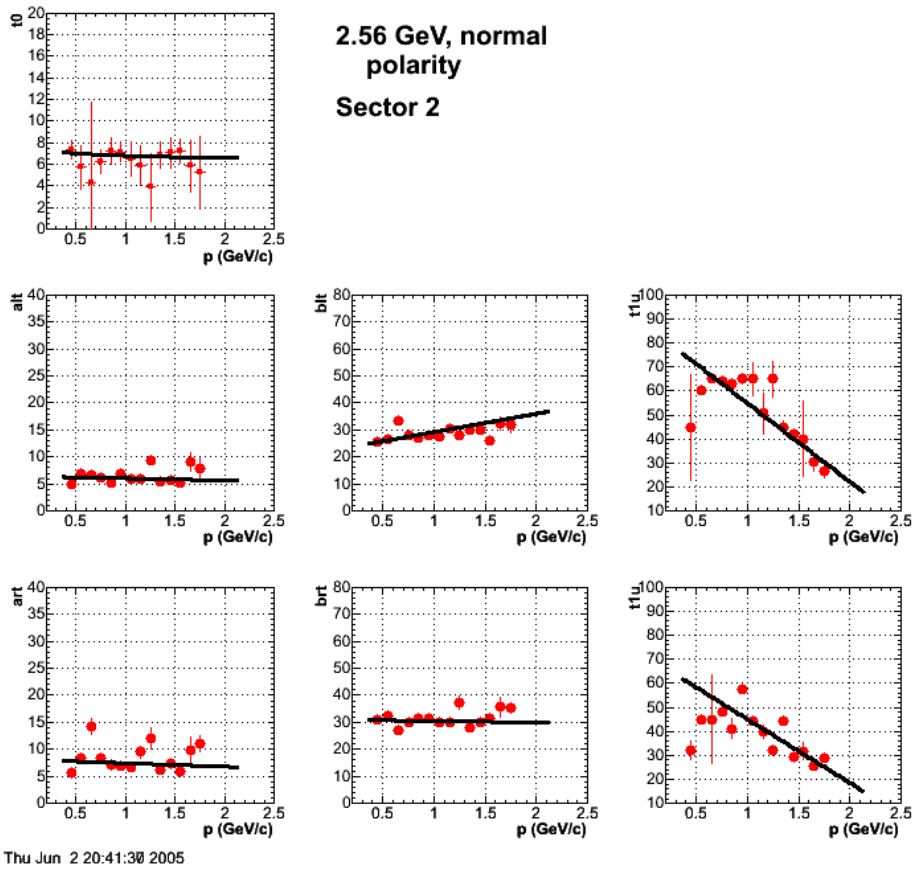

Fig 3. Updated version of Figure 2 with the momentum range reduced to eliminate low-statistics runs on the low and high ends and by refitting.

Click here to view the object (dat file with fit parameters as a function of momentum) you uploaded.

3gen fit parameters for Fig 3.

```
+++++ fit1 results 6.80411 -0.0452688
+++++ fit2 results 6.43334 -0.38127
+++++ fit3 results 22.3814 6.80096
+++++ fit4 results 8.08329 -0.641948
+++++ fit5 results 30.9947 -0.52021
+++++ fit6 results 87.5602 -32.7059
+++++ fit7 results 71.5358 -26.5223
g
```

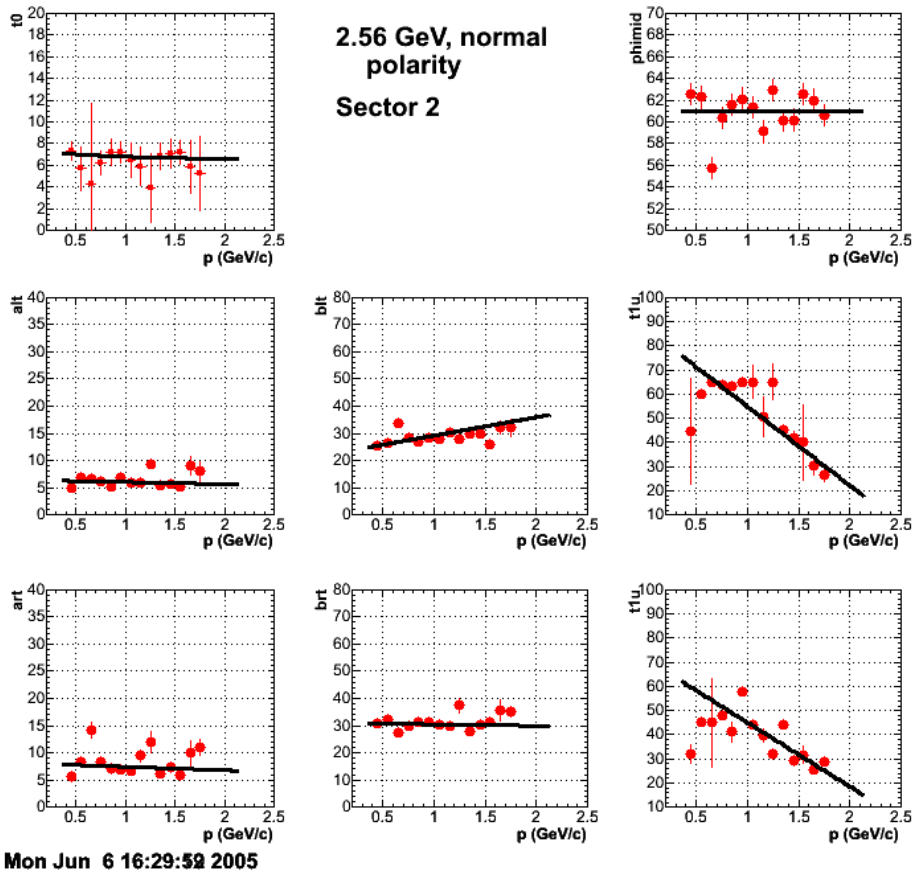

Fig 4. Added phimid to the 3rd generation fits.

```
gpg2:sector2> grep +++++ pfid_3genpars.out
+++++ fit1 results 6.80412 -0.0452677
+++++ fit2 results 6.43334 -0.38127
+++++ fit3 results 22.3814 6.80096
+++++ fit4 results 8.08329 -0.641948
+++++ fit5 results 30.9947 -0.52021
+++++ fit6 results 87.5602 -32.7059
+++++ fit7 results 71.5358 -26.5223
+++++ fit8 results 60.9601
g
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 50 - S3 2-3 gen fits (gpg)

[Modified Thu Jul 28 12:54:16 2005 (GMT) gpg]

Plot of edges from 1gen fits.

Fig 1. Plot of results of 1gen fits for sector 3.

Fig 2. Acceptance plot for hadrons for sector 3, 2.6 GeV, normal polarity.

Click here to view the object (Fit parameters for sector 3 (6/3/5, 10:53)) you uploaded.

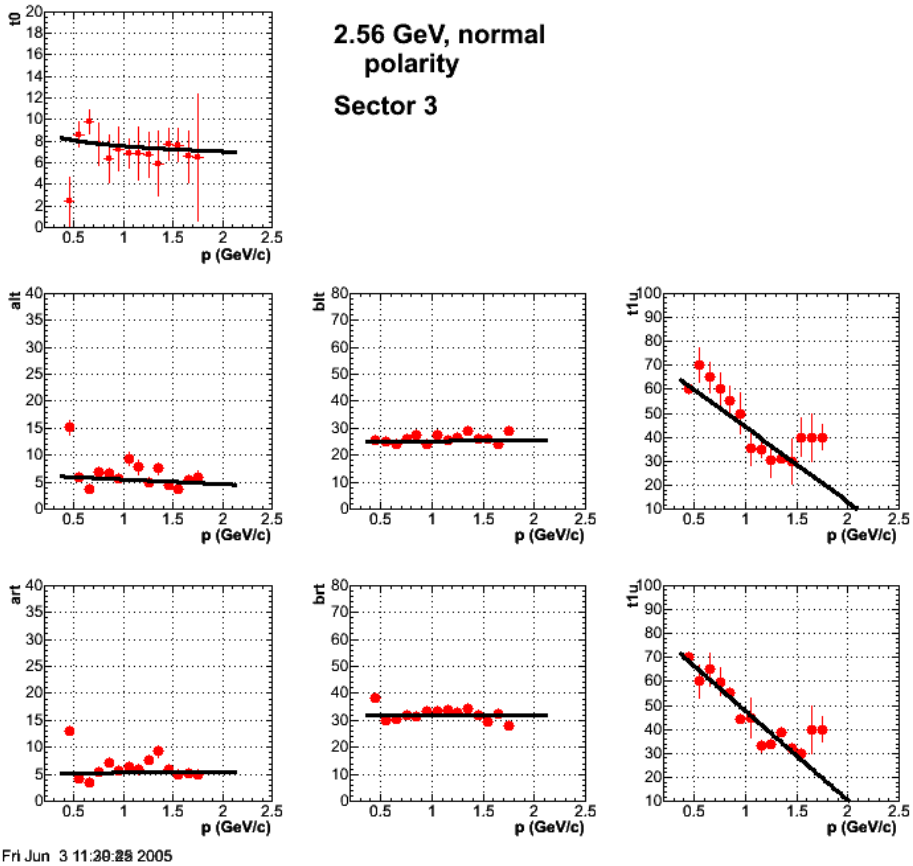

Fig 3. Third generation fits for sector 3. The values of t1 were limited to +/- 5 degrees of a value of the transition to a flat theta_h dependence that I determined by eye using Fig 2.

Fig 3b. Plots of 2gen fits associated with Fig 3.

Click here to view the object (Table of 2gen fit parameters by momentum bin for Fig 3.) you uploaded.

```
gpgl:sector3> grep +++++ pfid_3genpars.out
+++++ fit1 results 7.36413 -0.161796
+++++ fit2 results 6.39853 -0.873738
+++++ fit3 results 25.249 0.032347
+++++ fit4 results 5.18155 0.137108
+++++ fit5 results 31.7698 0.12673
+++++ fit6 results 75.514 -31.2481
+++++ fit7 results 85.0765 -37.3793
g
```

I tried opening up the range available for the value of t1, the break point where the theta_h dependence becomes constant. The results are shown in Figure 4. When I let t1 vary without limits there is a tendency for Minuit to find a fit with an unphysically large t1. The parameter t1 can vary a lot with only a small change in the chi2. This is not a surprise since you are fitting a region with little dependence on theta_h. Increasing the range for t1 to vary doesn't improve the fits much, but it does increase the variation in the other parameters. I'll stick with the smaller t1 fit range.

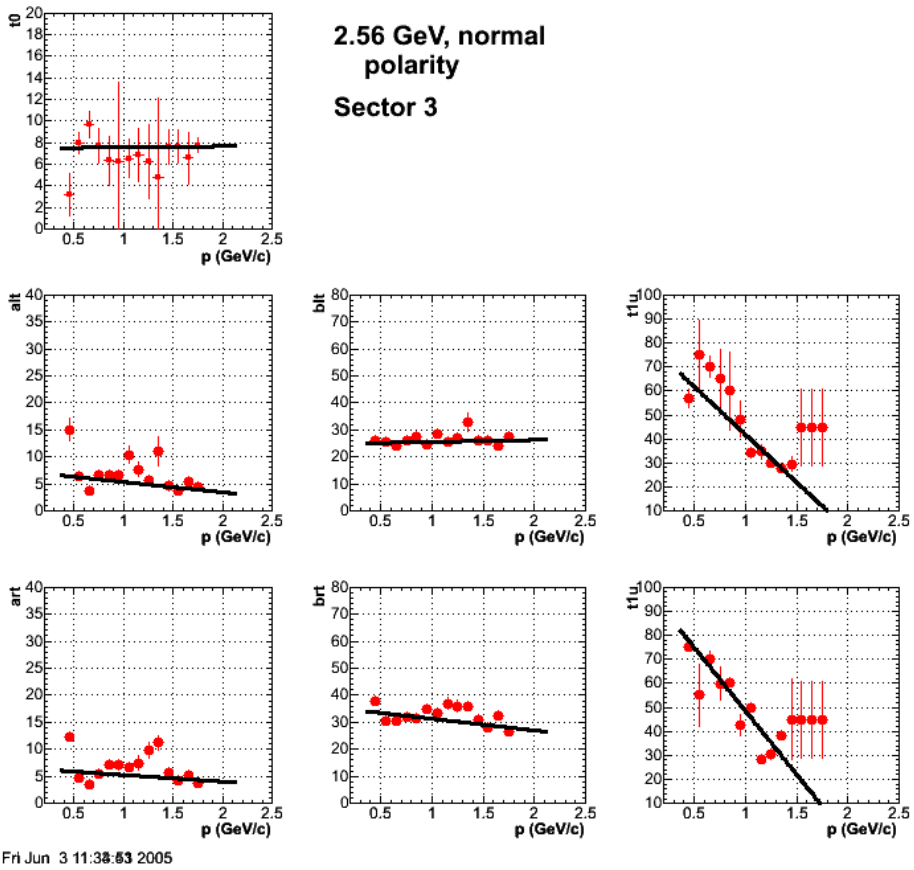

Fig 4. Same as Fig 3 with values of t1 limited to +/- 10 degrees of a value of the transition to a flat theta_h dependence that I determined by eye using Fig 2.

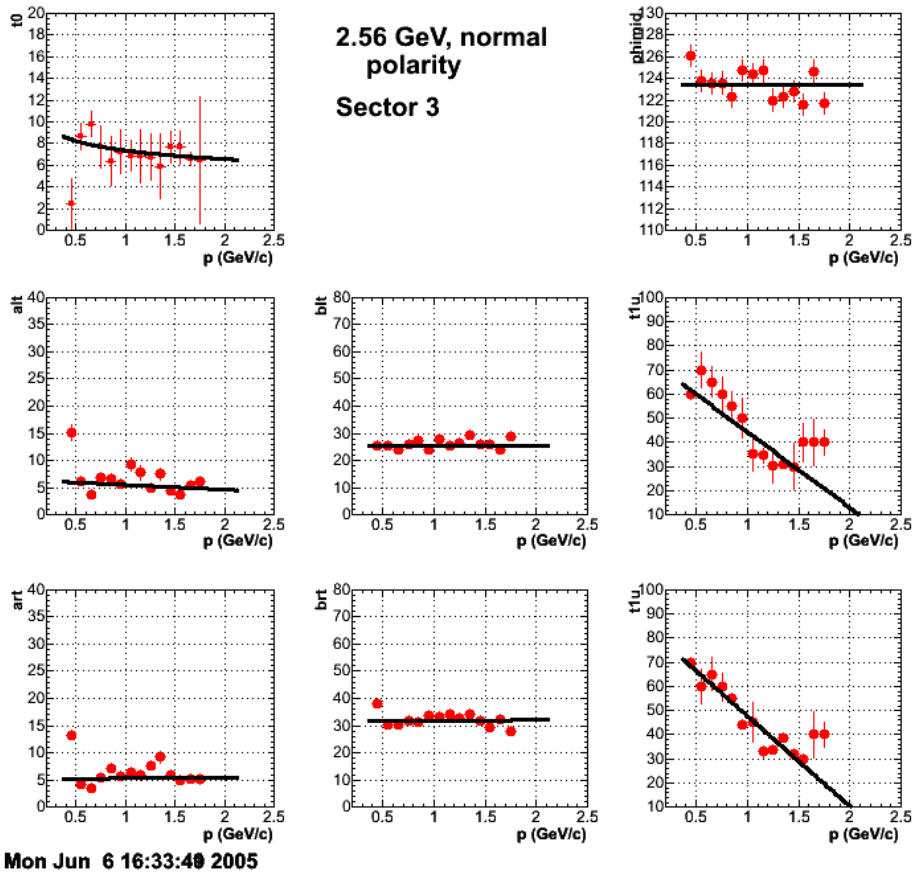

Fig 5. Added phimid to the fits for sector 3, 2.6 GeV, normal polarity

```
gpg2:sector3> grep +++++ pfid_3genpars.out
+++++ fit1 results 7.3641 -0.161756
+++++ fit2 results 6.39853 -0.873738
+++++ fit3 results 25.249 0.032347
+++++ fit4 results 5.18155 0.137108
+++++ fit5 results 31.7698 0.12673
+++++ fit6 results 75.514 -31.2481
+++++ fit7 results 85.0765 -37.3793
+++++ fit8 results 123.447
gpg2:sector3>
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 51 - Code for acceptance plots (gpg)

[Added Fri Jun 3 13:51:15 2005 (GMT) gpg]

Root C++ code for making acceptance plots.

code to make plots of theta vs. phi acceptance momentum bin by momentum bin.

example of appending to PostScript files with multiple pages.

```
c1->SetLogz();
c1->SetRightMargin(0.15);



----------------------------------------------------------------

TCanvas *c1 = new TCanvas("c1", "c1",80,20,800,500);
c1->Clear();
c1->Divide(3,2);

float pbin;

gStyle->SetOptStat(11);
c1_1->cd();
c1_1->SetRightMargin(0.16);
c1_1->SetLogz();
pbin=6;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin6 = (TH1F*)hin->Clone();
hbin6->SetName("hbin6");
hbin6->Draw("colz");

c1_2->cd();
c1_2->SetRightMargin(0.16);
c1_2->SetLogz();
pbin=7;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin7 = (TH1F*)hin->Clone();
hbin7->SetName("hbin7");
hbin7->Draw("colz");

c1_3->cd();
c1_3->SetRightMargin(0.16);
c1_3->SetLogz();
pbin=8;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin8 = (TH1F*)hin->Clone();
hbin8->SetName("hbin8");
hbin8->Draw("colz");

c1_4->cd();
c1_4->SetRightMargin(0.16);
c1_4->SetLogz();
pbin=9;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin9 = (TH1F*)hin->Clone();
hbin9->SetName("hbin9");
hbin9->Draw("colz");

c1_5->cd();
c1_5->SetRightMargin(0.16);
c1_5->SetLogz();
pbin=10;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin10 = (TH1F*)hin->Clone();
hbin10->SetName("hbin10");
hbin10->Draw("colz");

c1_6->cd();
c1_6->SetRightMargin(0.16);
c1_6->SetLogz();
pbin=11;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
```

```
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin11 = (TH1F*)hin->Clone();
hbin11->SetName("hbin11");
hbin11->Draw("colz");

c1->Print("acceptance.ps(");

gStyle->SetOptStat(11);
c1_1->cd();
c1_1->SetRightMargin(0.16);
c1_1->SetLogz();
pbin=12;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin12 = (TH1F*)hin->Clone();
hbin12->SetName("hbin12");
hbin12->Draw("colz");

c1_2->cd();
c1_2->SetRightMargin(0.16);
c1_2->SetLogz();
pbin=13;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin13 = (TH1F*)hin->Clone();
hbin13->SetName("hbin13");
hbin13->Draw("colz");

c1_3->cd();
c1_3->SetRightMargin(0.16);
c1_3->SetLogz();
pbin=14;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin14 = (TH1F*)hin->Clone();
hbin14->SetName("hbin14");
hbin14->Draw("colz");

c1_4->cd();
c1_4->SetRightMargin(0.16);
c1_4->SetLogz();
pbin=15;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin15 = (TH1F*)hin->Clone();
hbin15->SetName("hbin15");
hbin15->Draw("colz");

c1_5->cd();
c1_5->SetRightMargin(0.16);
c1_5->SetLogz();
pbin=16;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin16 = (TH1F*)hin->Clone();
hbin16->SetName("hbin16");
hbin16->Draw("colz");

c1_6->cd();
c1_6->SetRightMargin(0.16);
c1_6->SetLogz();
pbin=17;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin17 = (TH1F*)hin->Clone();
hbin17->SetName("hbin17");
hbin17->Draw("colz");

c1->Print("acceptance.ps");

c1_1->cd();
c1_1->SetRightMargin(0.16);
c1_1->SetLogz();
pbin=18;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin18 = (TH1F*)hin->Clone();
hbin18->SetName("hbin18");
hbin18->Draw("colz");

c1_2->cd();
c1_2->SetRightMargin(0.16);
c1_2->SetLogz();
pbin=19;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
```

```
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin19 = (TH1F*)hin->Clone();
hbin19->SetName("hbin19");
hbin19->Draw("colz");

c1_3->cd();
c1_3->SetRightMargin(0.16);
c1_3->SetLogz();
pbin=20;
hproton_fiducials->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) hproton_fiducials->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin20 = (TH1F*)hin->Clone();
hbin20->SetName("hbin20");
hbin20->Draw("colz");

c1_4->Clear();
c1_5->Clear();
c1_6->Clear();

c1->Print("acceptance.ps)");
```

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Jerry Gilfoyle's Enotebook page 52 - S4 2-3 gen fits (gpg)

[Modified Tue Jun 7 01:21:35 2005 (GMT) gpg]

Fig 1. Acceptance plot for hadrons for sector 3, 2.6 GeV, normal polarity.

Fig 2. Gen1 plots for sector 4, 2.6 GeV, normal polarity.

Fig 3. Gen1 plot results for sector, 2.6 GeV with penalty for exceeding phi_h=210 off) you uploaded.

Click here to view the object (Gen1 output file (minuit.out) for Fig 3.) you uploaded.

Fig 4. Edge plot with 'cleaned' files and fits.

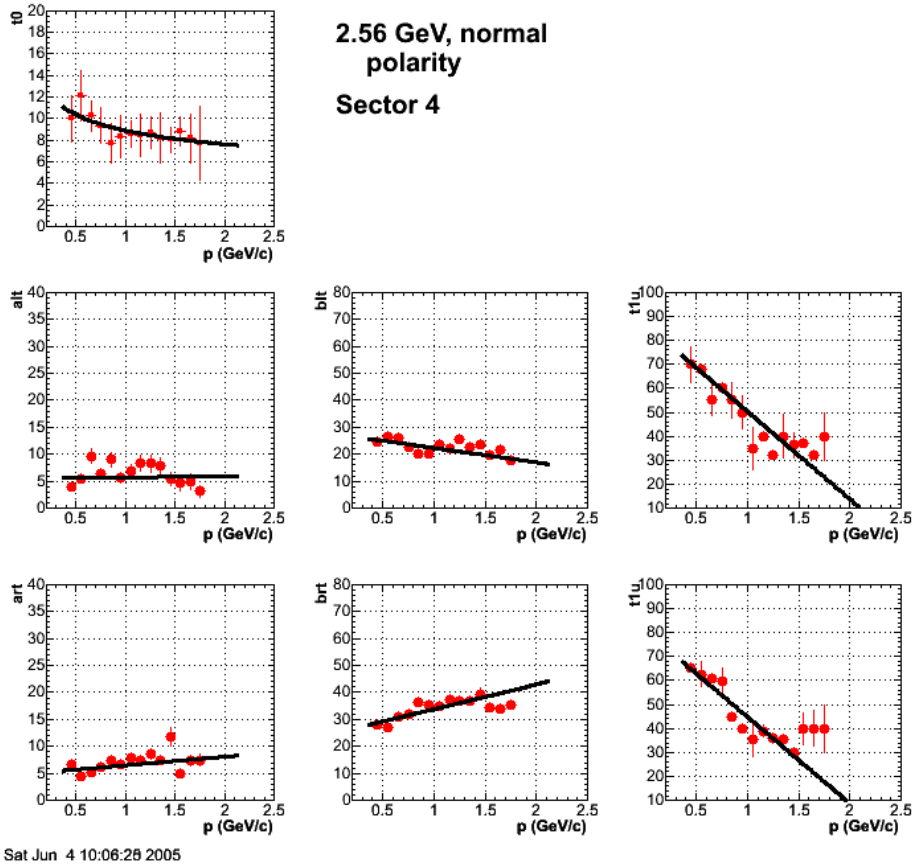

Fig 5. 3gen fits for sector 4, 2.6 GeV, normal polarity

3gen fit parameters

```
gpgl:sector4> grep +++++ pfid_3genpars.out
+++++ fit1 results 8.89809 -0.221462
+++++ fit2 results 5.4993 0.225292
+++++ fit3 results 27.6814 -5.33181
+++++ fit4 results 4.92486 1.58828
+++++ fit5 results 24.6741 9.13078
+++++ fit6 results 86.8297 -36.5331
+++++ fit7 results 80.796 -36.0104
gpgl:sector4>
```

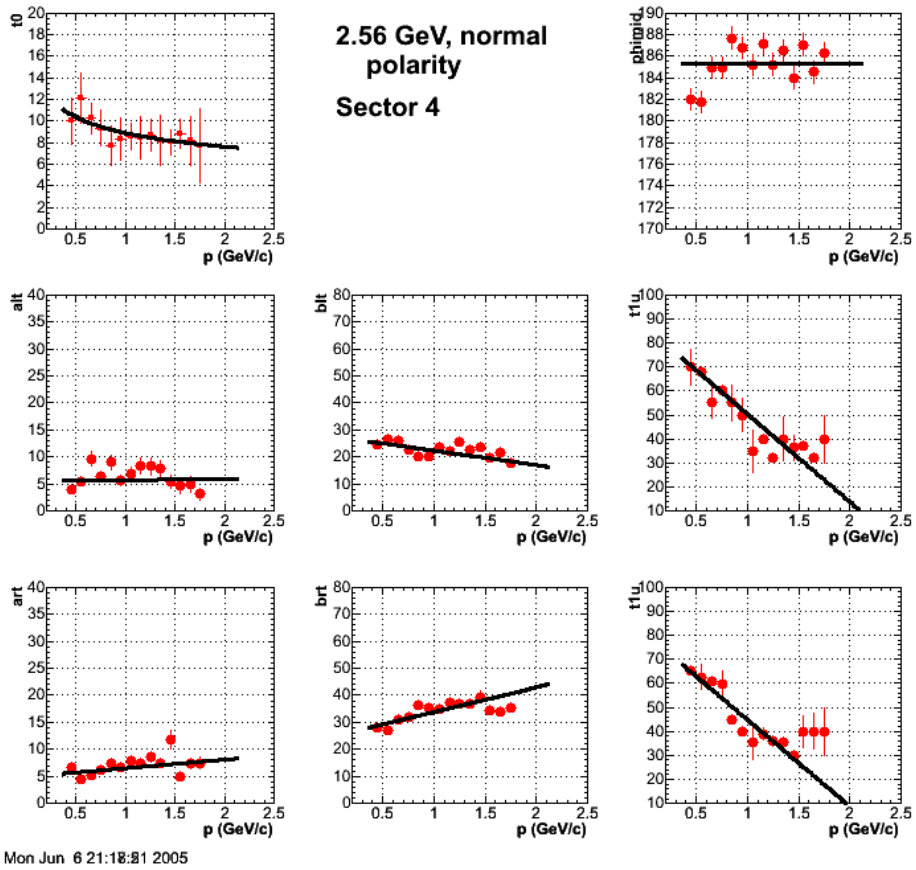

Fig 6. Updated version with phimid added.

```
gpgl:sector4> grep +++++ pfid_3genpars.out
+++++ fit1 results 8.89809 -0.221462
+++++ fit2 results 5.4993 0.225292
+++++ fit3 results 27.6814 -5.33181
+++++ fit4 results 4.92486 1.58828
+++++ fit5 results 24.6741 9.13078
+++++ fit6 results 86.8297 -36.5331
+++++ fit7 results 80.796 -36.0104
+++++ fit8 results 185.293
g
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 53 - S5 gen 2-4 plots (gpg)

[Modified Tue Jun 7 01:25:57 2005 (GMT) gpg]

Sector 5

Fig 1. 2gen fits for sector 5 on cleaned gen1 fits.

Click here to view the object (Gen1 output for sector 5, 2.6 GeV, normal polarity) you uploaded.

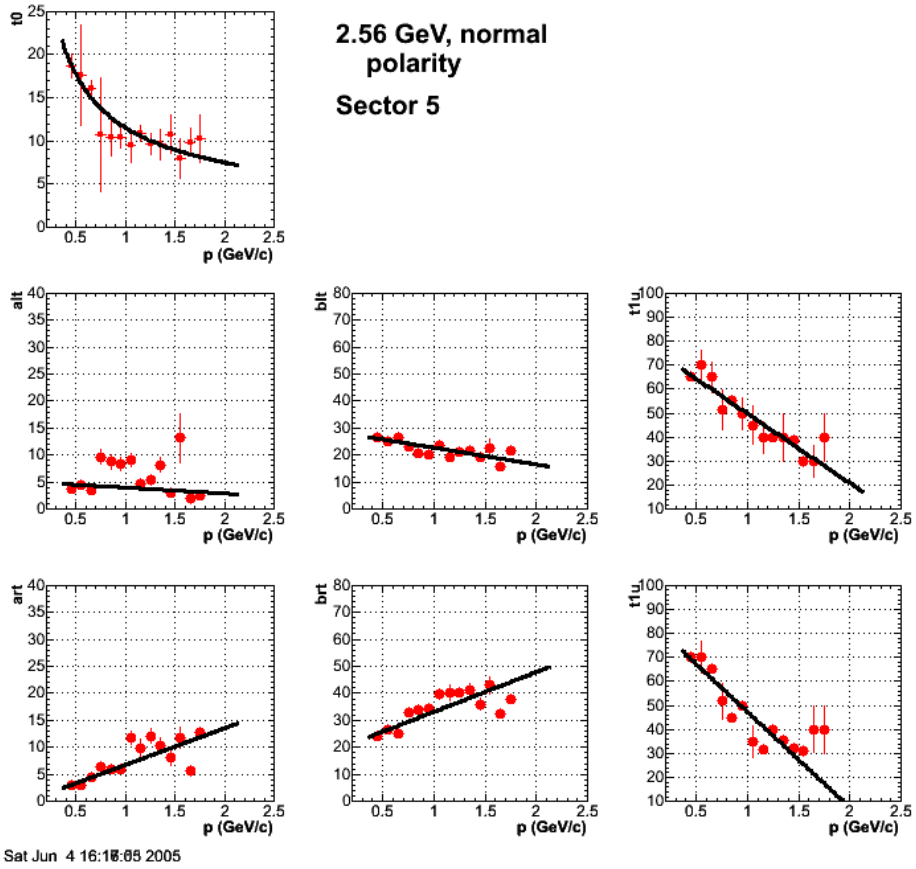

Fig 2. Gen3 fit parameters as a function of hadron momentum.

3gen fit parameters for sector 5, 2.6 GeV, normal polarity.

```
gpgl:sector5> grep +++++ pfid_3genpars.out
+++++ fit1 results 11.5219 -0.616299
+++++ fit2 results 5.07464 -1.07985
+++++ fit3 results 28.9384 -6.19918
+++++ fit4 results 0.00380337 6.7995
+++++ fit5 results 18.4747 14.7047
+++++ fit6 results 78.7429 -28.9712
+++++ fit7 results 87.0449 -39.8133
gpgl:sector5>
g
```

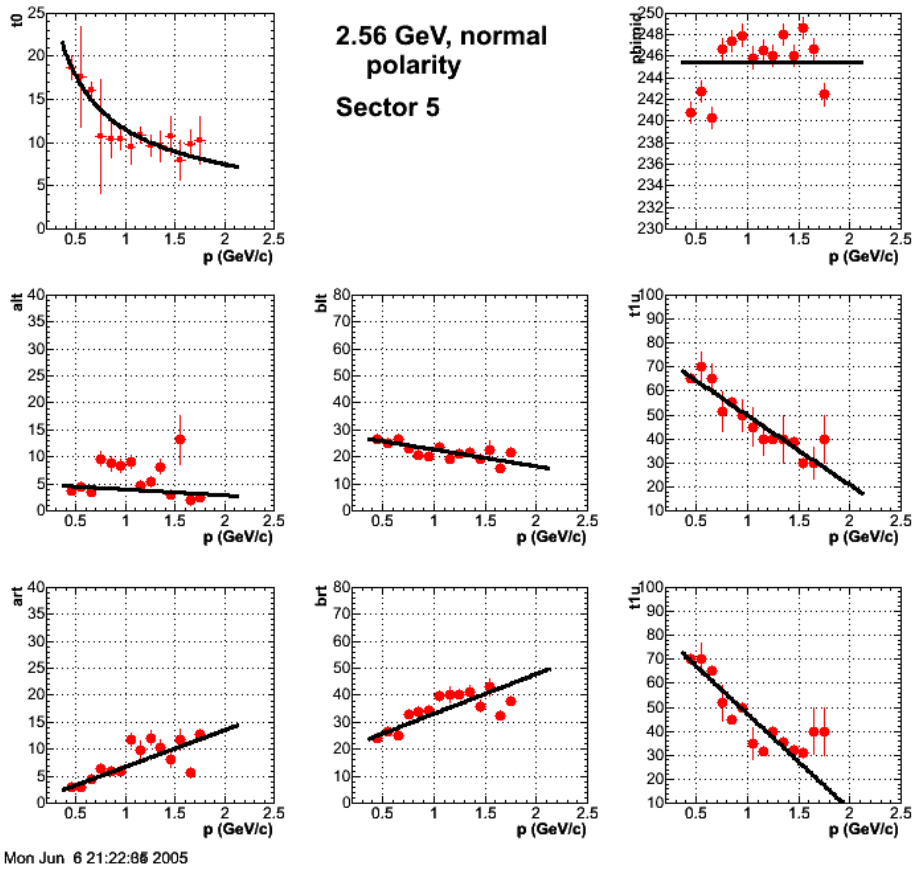

Fig 3. Updated version of Fig 2 with phimid added.

```
+++++ fit1 results 11.5219 -0.616299
+++++ fit2 results 5.07464 -1.07985
+++++ fit3 results 28.9384 -6.19918
+++++ fit4 results 0.00380337 6.7995
+++++ fit5 results 18.4747 14.7047
+++++ fit6 results 78.7429 -28.9712
+++++ fit7 results 87.0449 -39.8133
+++++ fit8 results 245.431
g
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 54 - S6 gen 2-3 fits (gpg)

[Modified Tue Jun 7 17:16:11 2005 (GMT) gpg]

Sector 6

Click here to view the object (minuit.out file from 1gen fits.) you uploaded.

Fig 1. Results of 1gen fits for sector 6, 2.6 GeV, normal polarity.

Fig 2. Results of 1-2gen fits on cleaned 1gen results for sector 6, 2.6 GeV, normal polarity.

Fig 3. Hadron acceptance for sector 6, 2.6 GeV, normal polarity.

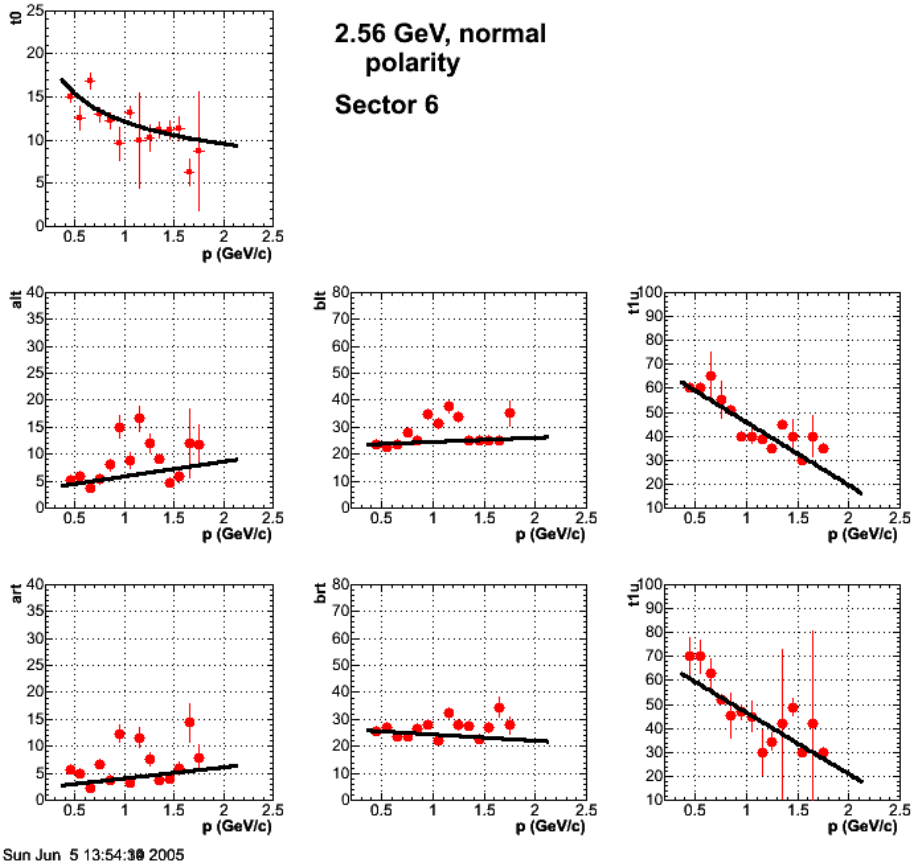

Fig 4. Results of 3gen fits for sector 6 on cleaned data, 2.6 GeV, normal polarity.

Parameters for the 3gen fits for sector 6.

```
gpgl:sector6> grep +++++ pfid_3genpars.out
+++++ fit1 results 12.1438 -0.340059
+++++ fit2 results 3.19139 2.73278
+++++ fit3 results 23.1196 1.50046
+++++ fit4 results 2.03408 2.06056
+++++ fit5 results 26.7273 -2.30042
+++++ fit6 results 72.0819 -26.2412
+++++ fit7 results 72.1863 -25.6127
g
```

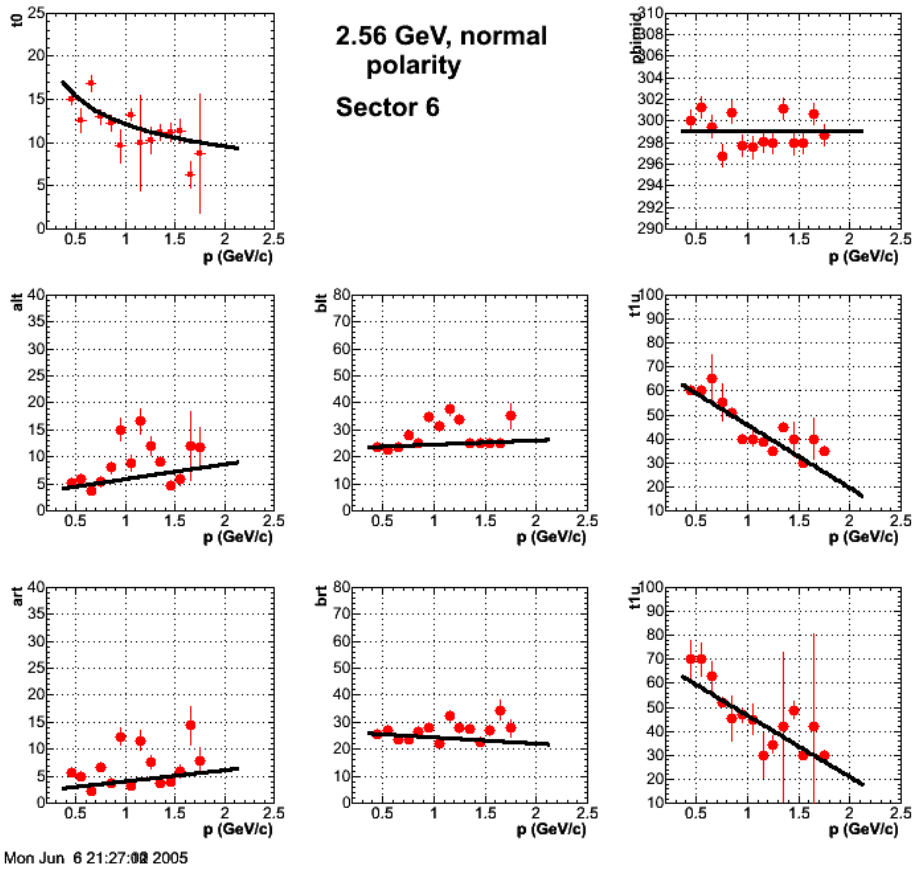

Fig 5. Updated version of Fig 4 with phimid added.

```
gpgl:sector6> grep +++++ pfid_3genpars.out
+++++ fit1 results 12.1438 -0.340059
+++++ fit2 results 3.19139 2.73278
+++++ fit3 results 23.1196 1.50046
+++++ fit4 results 2.03408 2.06056
+++++ fit5 results 26.7273 -2.30042
+++++ fit6 results 72.0819 -26.2412
+++++ fit7 results 72.1863 -25.6127
+++++ fit8 results 299.022
g
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 55 - effect of proton fiducial cuts and ALTp at 2.6 GeV, normal polarity (gpg)

[Modified Sun Jan 1 14:40:30 2006 (GMT) gpg]

The first plot below shows a comparison of the hadron acceptance with (left panel) and without (right panel) the hadron fiducials cuts turned on. There are other cuts (electron fiducials, EC fiducials, coplanarity) applied to the plot in the left panel.

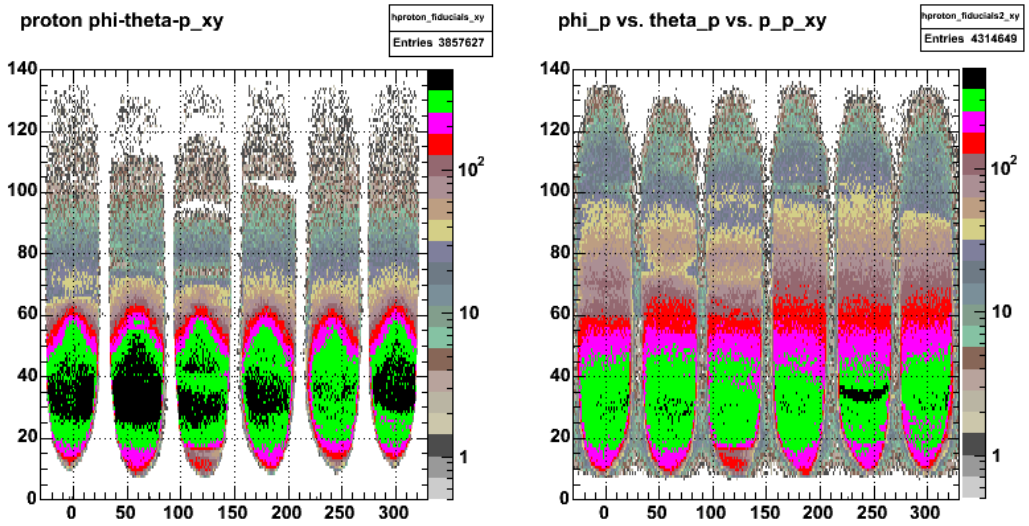

Fig 1. Comparison of hadron acceptance with (left panel) and without (right panel) the hadron fiducial cuts turned on.

The next figure is a cleaner comparison of the effect of the positive hadron fiducial cuts. The only difference in the two panels in Figure 2 is the left-hand panel has the positive hadron fiducial cuts turned on and the right-hand panel has them turned off. Both plots are for protons only with the electron fiducial cuts, EC fiducial cuts, photoelectron, and egiyan cuts turned on. It is worth noting the empty band in sector 3 at around theta_p = 90 deg. This band does not appear when the proton fiducial cuts are turned off. This is likely due to events at very low momentum which are exluded in the left-hand panel because they fell outside the range where we had good measurements of the fiducial region.

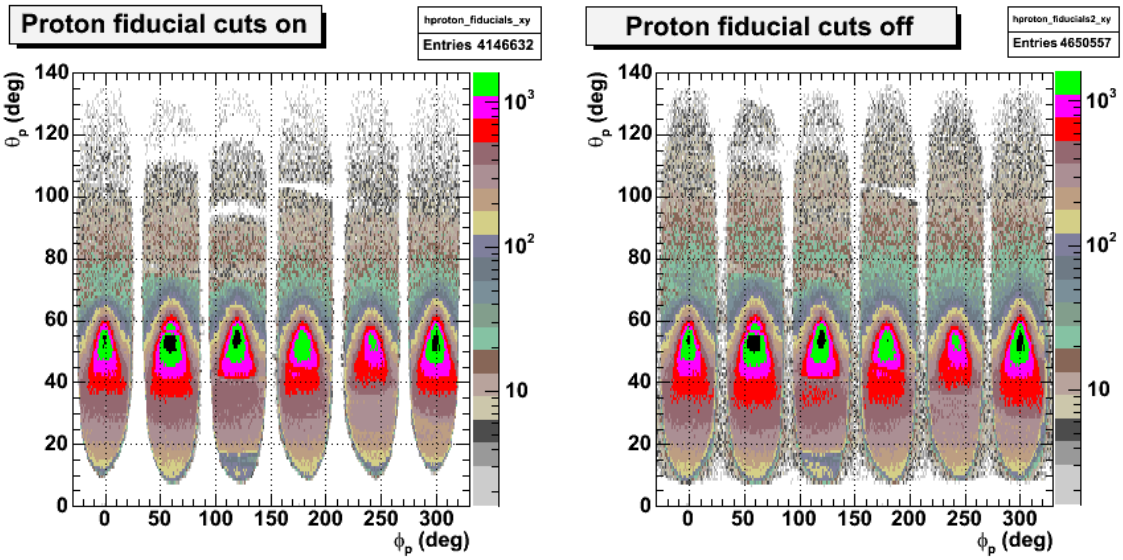

Fig 2. Cleaner comparison of proton acceptance with (left panel) and without (right panel) positive hadron fiducial cuts.

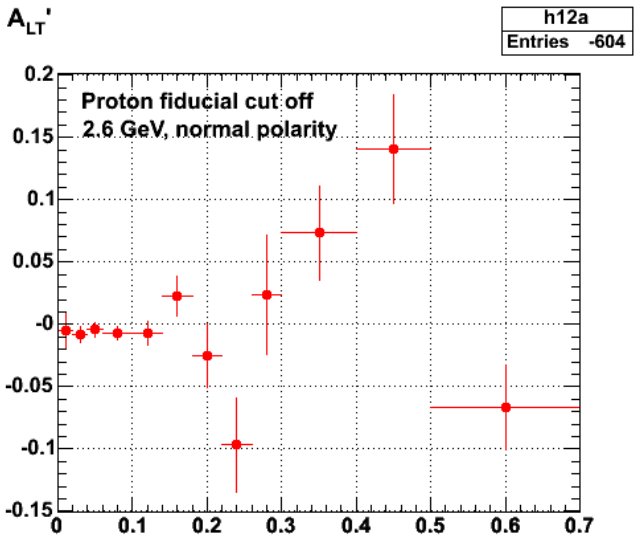

Fig 3. ALTp without the proton fiducial cuts. Compare this with previous results.

Click here to view the object (ROOT C++ macro for making Fig 3.) you uploaded.

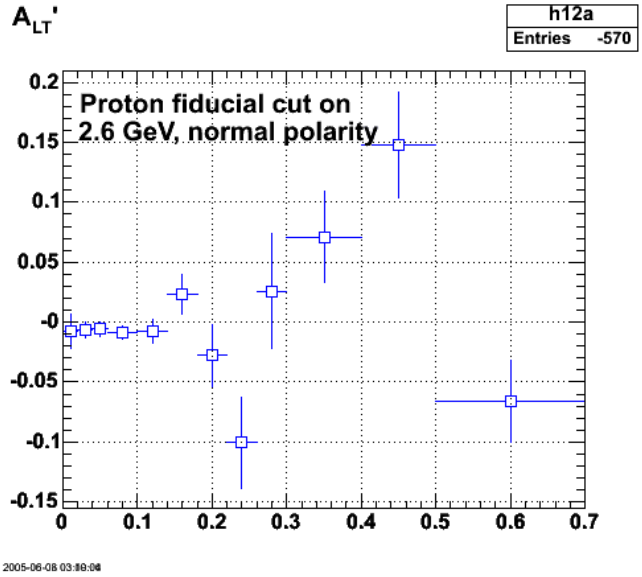

Fig 4. ALTp with proton fiducial cuts on.

Click here to view the object (ROOT C++ macro for Figure 4.) you uploaded.

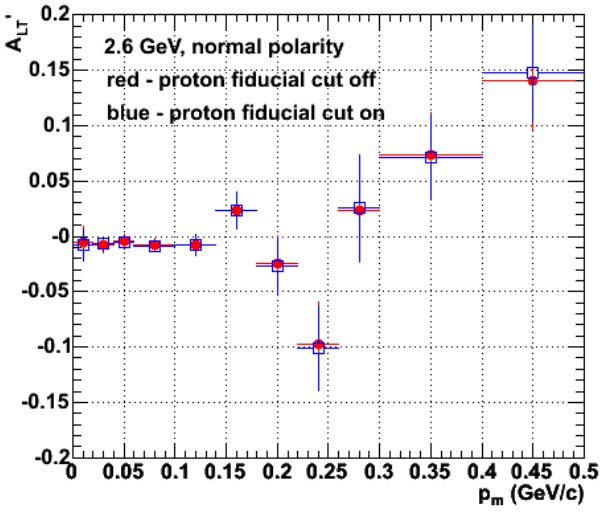

Fig 5. Prettified and combined version of Figs 3-4

Click here to view the object (Root C++ macro pfid1.C used to make Fig 5) you uploaded.

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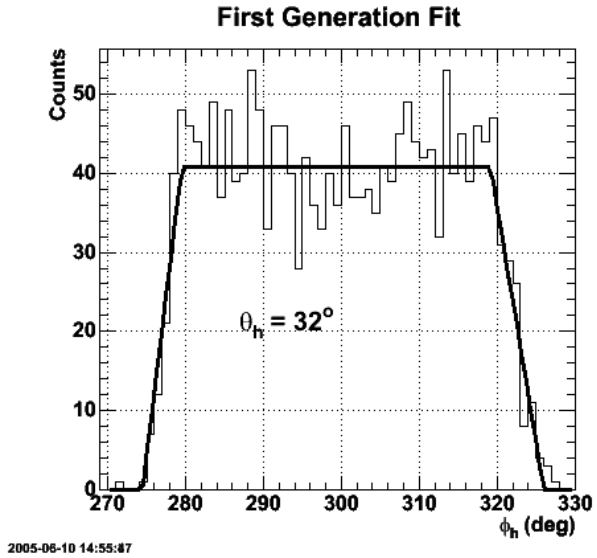
Jerry Gilfoyle's Enotebook page 56 - plots for Collaboration meeting talk (gpg)

[Modified Fri Jun 10 18:57:56 2005 (GMT) gpg]

Below are new plots that I've generated for next weeks progress report at the nuclear physics working group meeting.



Example of first generation fit.

Click here to view the object (Root C++ macro for the previous figure) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 57 - Effect of neutron cuts on ALTp (gpg)

[Modified Wed Jun 22 14:12:25 2005 (GMT) gpg]

We tried several different limits on the missing mass to see the effect on the fifth-structure-function asymmetry.

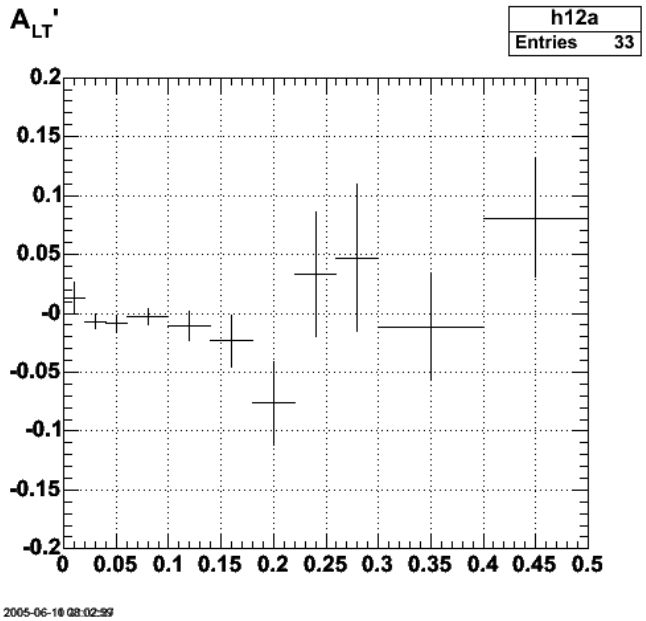


Fig 1. ALTp with mm2 = 0.90-0.98 GeV2

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

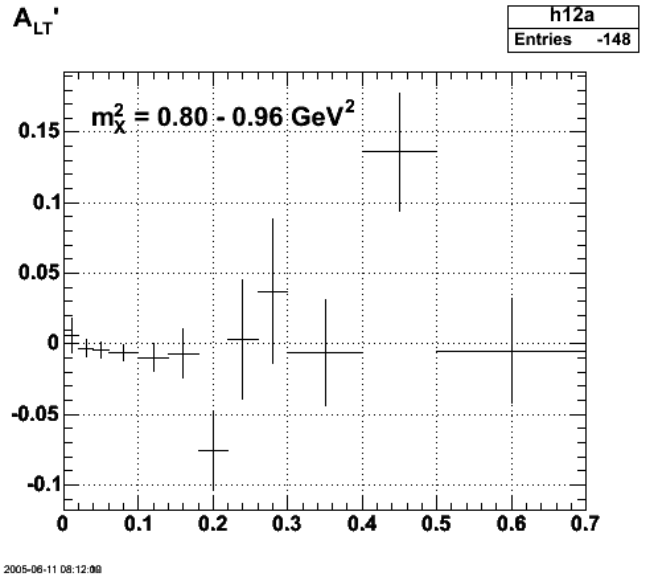


Fig 2. ALTp for mm2=0.80-0.96 GeV2, Q2 > 1 GeV2

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

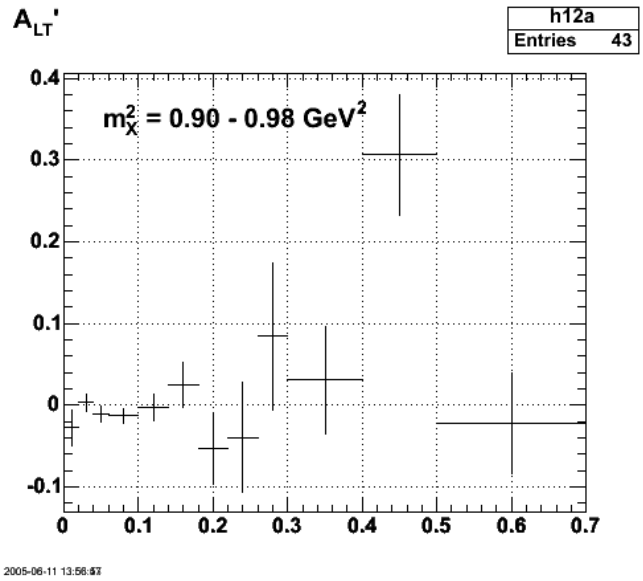


Fig 3. ALTp for mm2=0.90-0.98 GeV2, Q2 > 1.0 GeV2.

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.

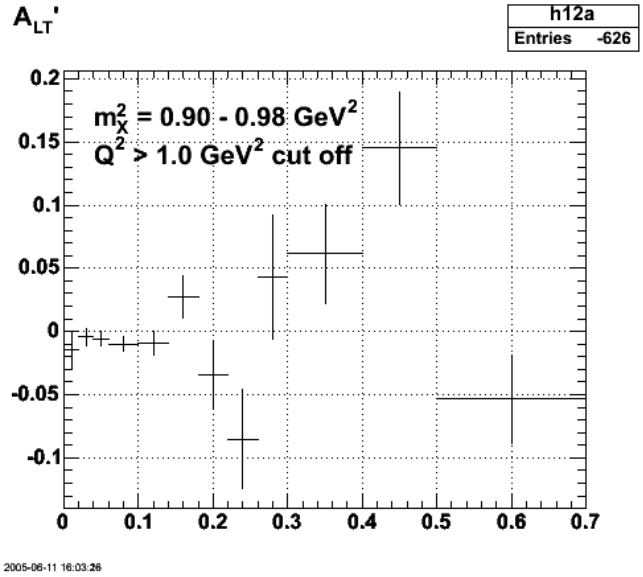


Fig 4. ALTp for mm2=0.90-0.98 GeV2, Q2 > 1.0 GeV2 cut off.

Click here to view the object (ROOT mmacro for previous plot) you uploaded.

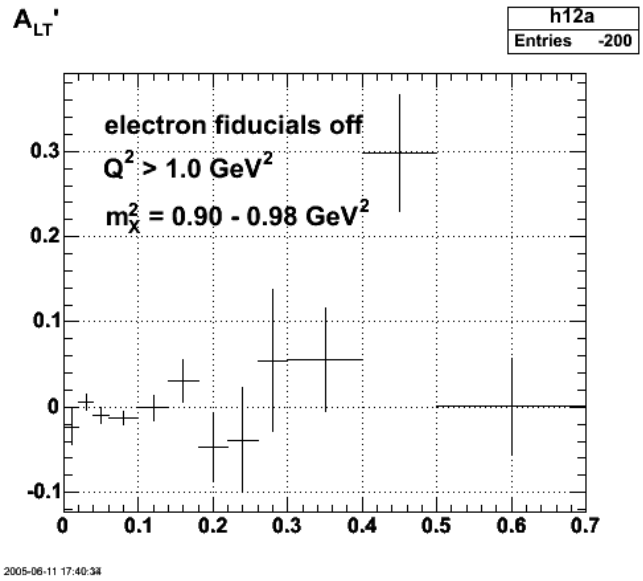


Fig 5. Turned efid off

Click here to view the object (ROOT macro for previous plot) you uploaded.

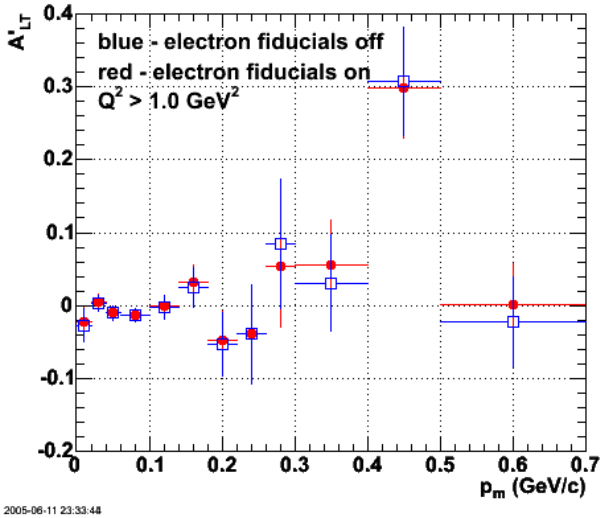


Fig 6. Comparison of ALtp for Q2>1.0 GeV2 and with electron fiducials on (red) and off (blue).

Click here to view the object (efid1.C ROOT C++ macro for Fig 6) you uploaded.

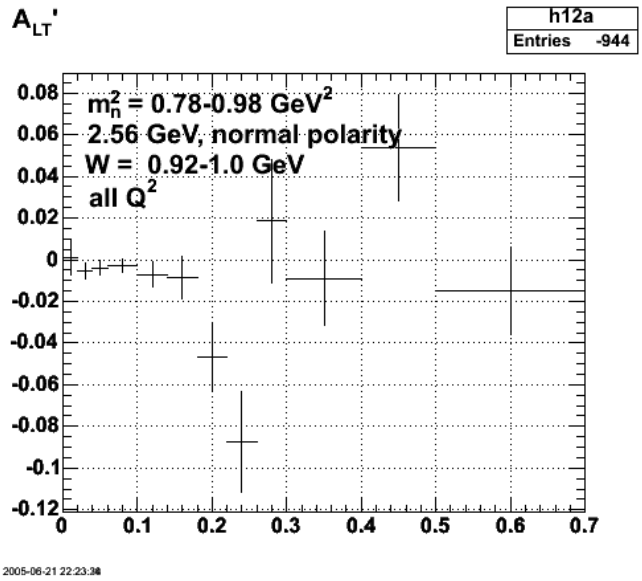


Fig 7. ALTp with efid on, MM2=0.78-0.98, all Q2

Click here to view the object (mm2a.C ROOT C++ macro for Fig 7) you uploaded.

Click here to view the object (Histogram file for Fig 7) you uploaded.

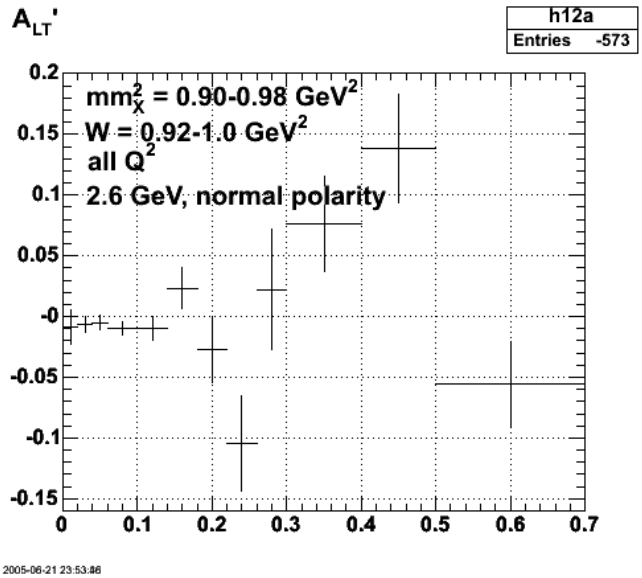


Fig 8. ALTp with efid on, MM2=0.90-0.98, all Q2

Click here to view the object (mm2b.C ROOT C++ macro for Fig 8) you uploaded.

Click here to view the object (Histogram file for Fig 8) you uploaded.

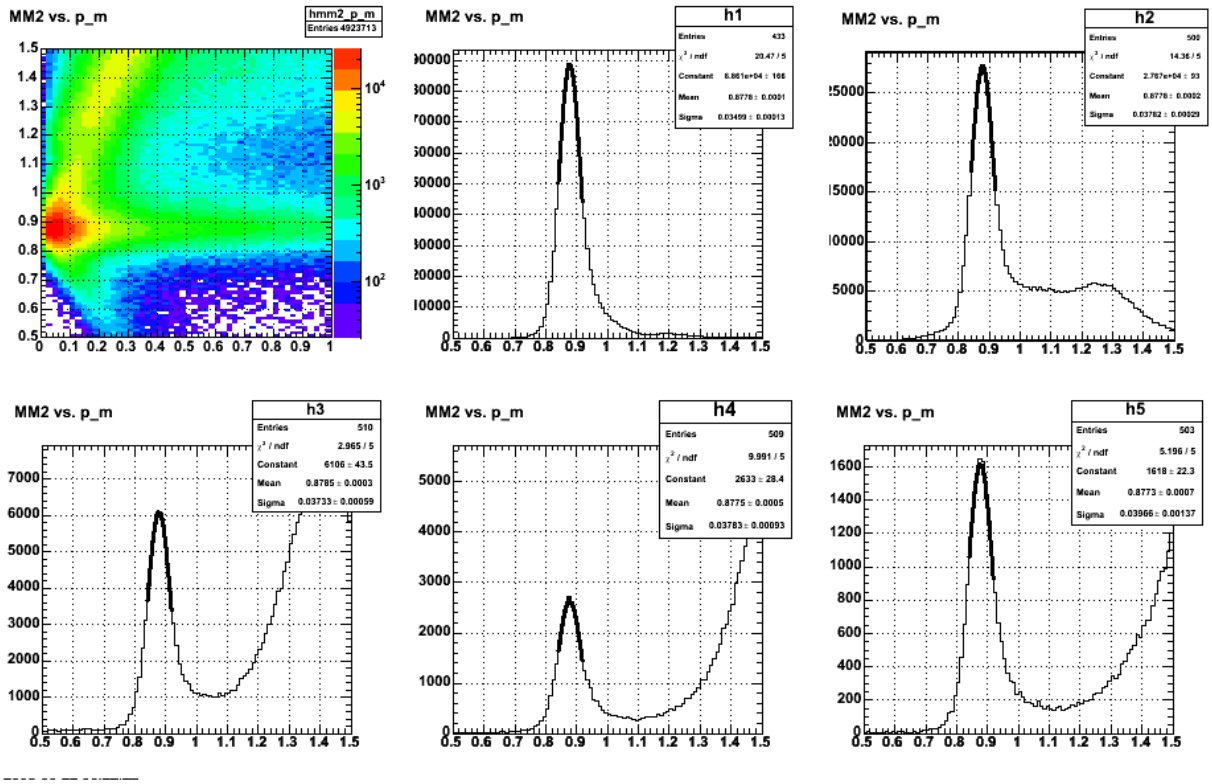


Fig 9. Missing mass spectra for Fig 7-8

Click here to view the object (ROOT C++ macro for Fig 9.) you uploaded.

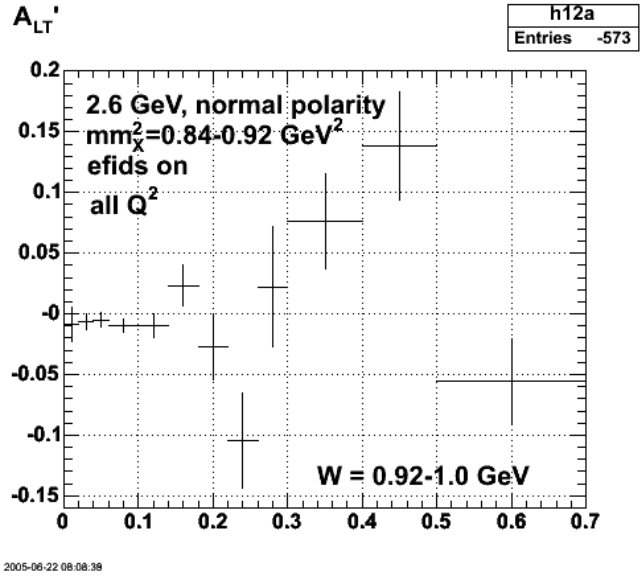


Fig 10. ALTp with efid on, MM2=0.84-0.92, all Q2

Click here to view the object (Root histogram file for mm2=0.84-0.92 GeV2) you uploaded.

Click here to view the object (ROOT C++ macro Fig 10) you uploaded.

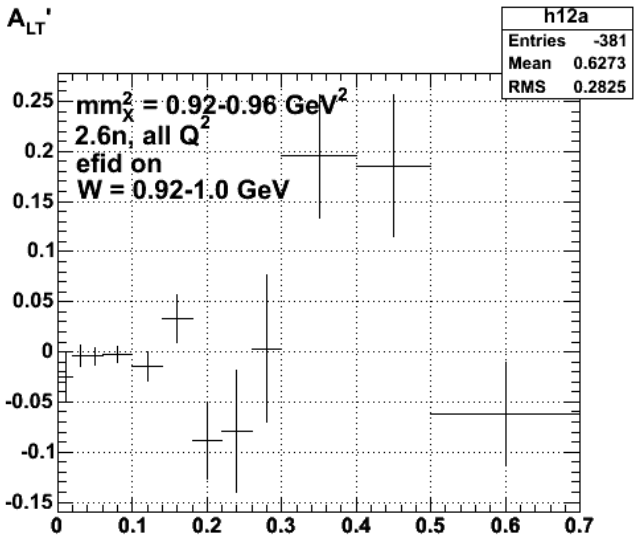


Fig 11. ALTp with efid on, MM2=0.92-0.96, all Q2

Click here to view the object (ROOT C++ macro for Fig 11) you uploaded.

Click here to view the object (Root histogram file for Fig 11) you uploaded.

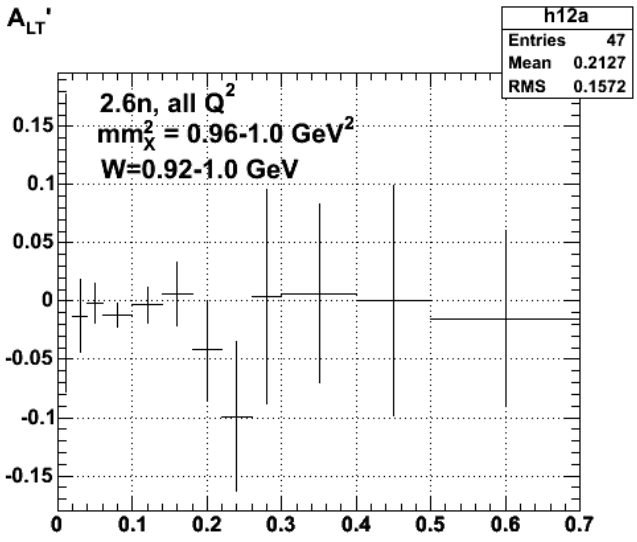


Fig 12. ALTp for mm2=0.96-1.0 GeV2

Click here to view the object (ROOT C++ macro for Fig 12) you uploaded.

Click here to view the object (Root histogram file for Fig 12) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 58 - plot of Arenhoevel curves (gpg)

[Modified Wed Jun 15 02:48:14 2005 (GMT) gpg]

Figure below is a combined plot of the Arenhoevel curves that I have. The motivation here is because the change in ALTp when we turn the electron fidcuials on seems to be greater than the change predicted by the calculation shown below for a comparable change in the peak value of the Q2 distribution.

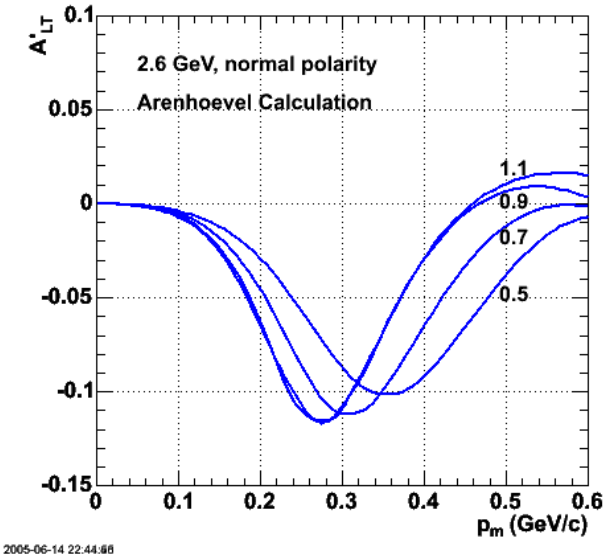


Fig 1. Plot of Arenhoevel curves. The number on the right-hand side shows the value of the Q2 used in the calculation.

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 59 - another study of electron fiducial cut effects (gpg)

[Modified Wed Jun 15 13:51:02 2005 (GMT) gpg]

In one of the earlier studies of this effect, we found that the effect on ALTp caused by the electron fiducial cuts was significantly reduced, but not eliminated by requiring Q2 > 0.7 GeV2. To push that test further, we redid the comparison requiring Q2 > 1.0 GeV2. The statistics are noticeably worse, but now all the points on the ALTp distribution are consistent well within the error bars. See the figure below.

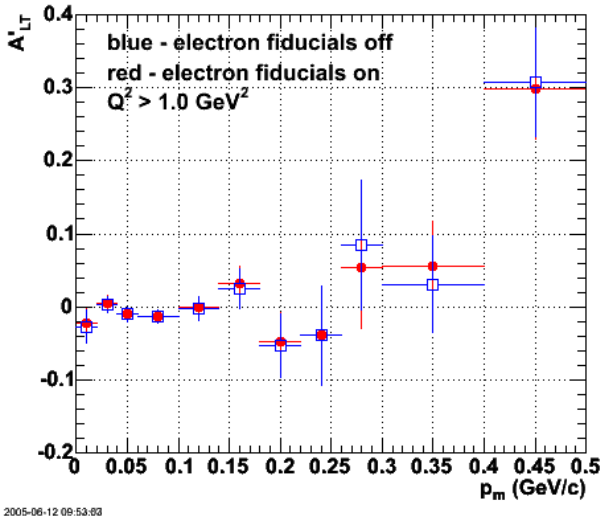
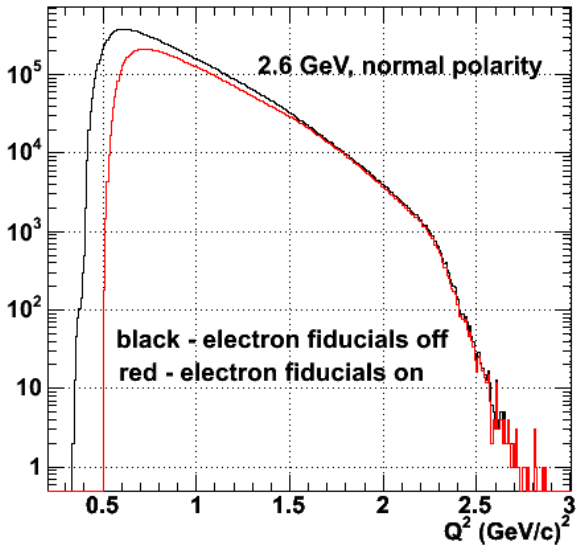


Fig 1. Comparison of ALTp with electron fiducial cuts on (red) and off (blue) requiring Q2 > 1.0 GeVs.

A comparison of the Q2 distribution is shown below. The elctron fiducial cuts have a significant effect on the Q2 distribution at low Q2, but the difference has largely disappeared by the time you reach Q2=1.0 GeV2.



Comparison of Q2 distribution for 2.6 GeV, normal polarity running with the electron fiducial cuts on (red) and off (blue).

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 60 - Rusty's results for momentum corrections at 2.6 GeV, reversed polarity (gpg)

[Modified Tue Jun 21 10:40:07 2005 (GMT) gpg]

Below is a tar file with Rusty's results from 2.6 GeV, reversed polarity running.

Click here to view the object (gzipped, tar file rustyresults1.tar.gz containing individual histogram files for 2.6 GeV, reversed polarity running and the summed historgram file) you uploaded.

DOE 2000 Electronic Notebook

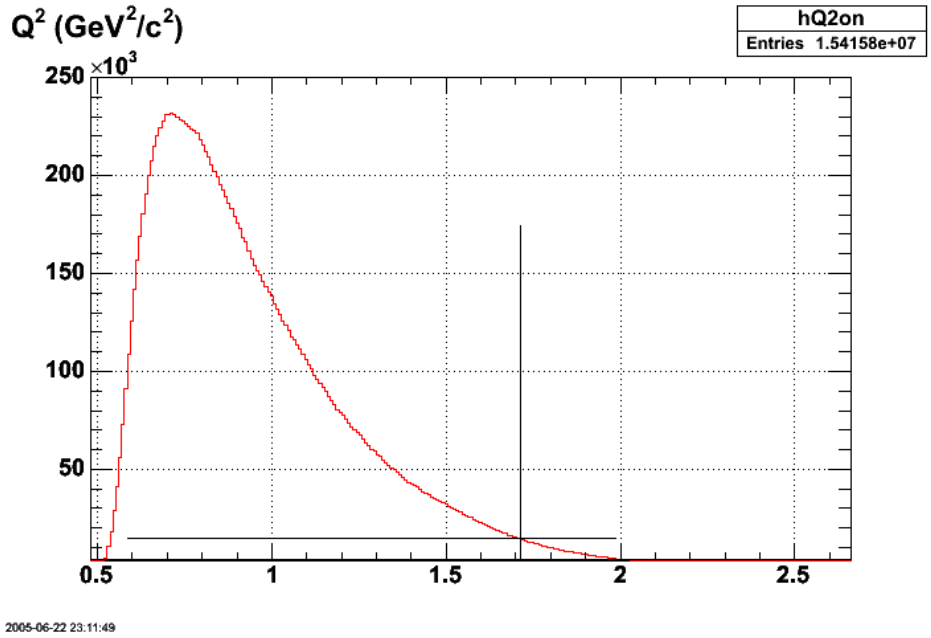
Jerry Gilfoyle's Enotebook page 61 - stuff for JML (gpg)

[Modified Thu Jun 23 03:19:52 2005 (GMT) gpg]

Ask JML to calculate ALTp or sigma_LTp using the Q2 values in the table below. These will pretty well map out the Q2 distrbution shown in Figure 1.

```
Q2

0.575
0.61
0.70
0.82
1.13
1.30
1.55
1.72
```



Q^2 distribution for electron singles, efid on

Click here to view the object (ROOT C++ macro for Figure 1) you uploaded.

Click here to view the object (ROOT C++ macro for comparing the Q2 distrubutions at 2.6n with efid on andoff) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 62 - KG reversed polarity efids (gpg)

[Modified Thu Jun 23 20:01:21 2005 (GMT) gpg]

Below are plots showing the results of Kristen's extraction of the electron fiducials for the 2.6 GeV reversed field running conditions.

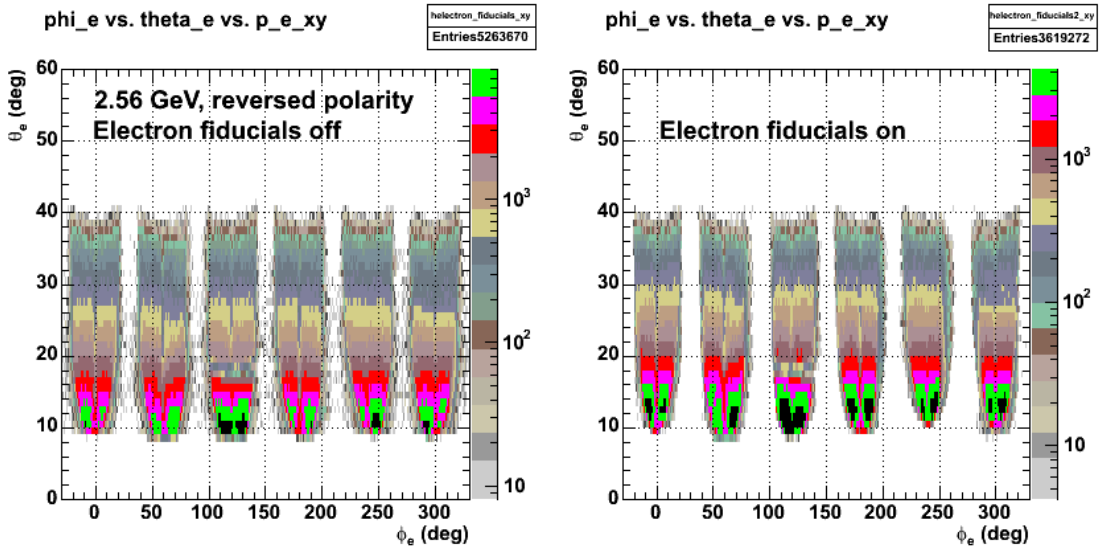


Fig 1. Electron acceptance for 2.6 GeV, reversed polarity with electron fiducial cuts off (left panel) and on (right panel)

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

The C++ routine used to apply the fiducial cuts is below.

```
Int_t eod5::DPelectron_fiducial_cut26r(float Phi_curr, float P_curr, float theta_e_deg)
{
// This function may be called from Loop. it returns 1 if the electron theta and phi
// lie within the fiducial volume. it returns  0 otherwise.
//
// inputs: Phi_curr    - azimuthal angle (phi) of the electron in degrees. See note below on the choice of scale.
//         P_curr     - momentum of the electron in GeV/c,
//         theta_e_deg - polar angle (theta) of the electron in degrees.
//
// to call this function use something like the following.
//
//       electron_fiducial_status=DPelectron_fiducial_cut26r(phi_e_deg, p[jelectron], theta_e_deg);
//       if (electron_fiducial_status==1) {
//         good_electron_fiducial = true;
//       }
//
//  based on method used by dan protopopescu and described at
//                 http://nuclear.gla.ac.uk/clas/e2doc/FiducialCuts/

int   sector, good_p, good_phi, good_theta;
float t0, alt, blt, art, brt, theta_curr, pmin, pmax, phi_min, phi_max;

// read in the 3gen fit parameters.

float t0_pars[6][5] = {
    1, 0.7, 2.4, 9.04816, 0.00281583,
    2, 0.7, 2.4, 9.46037, -0.204584,
    3, 0.7, 2.4, 9.29012, -0.174916,
    4, 0.7, 2.4, 9.07926, -0.00643768,
    5, 0.7, 2.4, 10.2191, 0.0243111,
    6, 0.7, 2.4,  7.5619, 0.448088
};
float alt_pars[6][9] = {
    1, 0.7, 2.4,  -40.5455, 89.716, -37.1725, -19.363, 16.5727, -2.99106,
    2, 0.7, 2.4,   89.2325, -315.35, 439.891, -298.557, 98.6938, -12.7236,
    3, 0.7, 2.4, -216.358, 835.205, -1250.52, 915.226, -327.441, 45.8298,
    4, 0.7, 2.4,   91.9051, -333.309, 483.615, -339.569, 114.909, -15.0235,
    5, 0.7, 2.4,   -3.09467, 36.1369, -74.3176, 68.6149, -30.156, 5.10595,
    6, 0.7, 2.4,  114.919, -518.68, 842.437, -609.862, 203.913, -25.8629
};

float blt_pars[6][9] = {
    1, 0.7, 2.4, -26.7313, 164.298, -176.286, 76.9433, -9.18978, -1.20243,
    2, 0.7, 2.2, 192.887, -443.603, 413.367, -166.576, 24.0194, 0.239278,
    3, 0.7, 2.4, -222.848, 917.666, -1287.18, 857.823, -274.993, 34.1501,
    4, 0.7, 2.4, 451.312, -1468.32, 1969.95, -1296.14, 415.912, -52.0127,
    5, 0.7, 2.4, 265.075, -758.886, 886.299, -481.645, 114.979, -8.29667,
```

```
    6, 0.7, 2.4,  223.618, -786.545, 1115.65, -714.249, 209.132, -22.4329
};

float art_pars[6][9] = {
    1, 0.7, 2.4,-288.791, 1030.39, -1389.13, 905.091, -287.393, 35.7839,
    2, 0.7, 2.2, 275.295, -988.958, 1406.35, -974.829, 328.551, -43.0601,
    3, 0.7, 2.4, -61.2678, 267.094, -414.884, 304.345, -107.172, 14.6341,
    4, 0.7, 2.4, 118.147, -427.206, 628.889, -446.024, 151.949, -19.9771,
    5, 0.7, 2.4, 213.295, -649.234, 784.361, -449.731, 119.687, -11.4194,
    6, 0.7, 2.4,  -480.804, 1665.01, -2215.56, 1439.62, -458.942, 57.5208
};

float brt_pars[6][9] = {
    1, 0.7, 2.4,-129.232, 482.761, -585.817, 348.735, -105.552, 13.2263,
    2, 0.7, 2.2, 391.479, -1407.07, 2062.96, -1453.64, 494.512, -65.2188,
    3, 0.7, 2.4, 142.544, -428.796, 570.053, -359.842, 108.151, -12.3685,
    4, 0.7, 2.4,-165.572, 498.088, -436.092, 135.067, 2.74868, -5.79622,
    5, 0.7, 2.4, -201.925, 831.927, -1150.94, 778.82, -258.197, 33.5771,
    6, 0.7, 2.4,  -1343.56, 4825.34, -6596.53, 4385.37, -1423.48, 180.783
};

float phimid[6]={-0.3, 60.6, 121.4, 179.9, 240.2, 300.5};
 float phi_test, phimid_test;


// rescale the phi angle to match the choice of coordinates. the input angle phi
// should be in degrees and cover the range -180 -> 180 degrees. this is what you
// get if you calculate the angle using the atan2 function in C++ and then convert
// to degrees. the range used in this routine is -30 -> 330 degrees.

if (Phi_curr < -30.0) {
     Phi_curr = Phi_curr + 360.0;
}

// get the sector.

sector = get_sector_deg(Phi_curr);

// reset the logicals.

good_p = 0;
good_phi = 0;
good_theta = 0;

theta_curr = theta_e_deg;

// calculate the fit parameter for the 2gen fit for this momentum and sector.

t0 = t0_pars[sector-1][3]*pow(P_curr,t0_pars[sector-1][4]);
alt = alt_pars[sector-1][3] + alt_pars[sector-1][4]*P_curr + alt_pars[sector-1][5]*pow(P_curr,2) +
  alt_pars[sector-1][6]*pow(P_curr,3) + alt_pars[sector-1][7]*pow(P_curr,4) + alt_pars[sector-1][8]*pow(P_curr,5);
blt = blt_pars[sector-1][3] + blt_pars[sector-1][4]*P_curr + blt_pars[sector-1][5]*pow(P_curr,2) +
  blt_pars[sector-1][6]*pow(P_curr,3) + blt_pars[sector-1][7]*pow(P_curr,4) + blt_pars[sector-1][8]*pow(P_curr,5);
art = art_pars[sector-1][3] + art_pars[sector-1][4]*P_curr + art_pars[sector-1][5]*pow(P_curr,2) +
  art_pars[sector-1][6]*pow(P_curr,3) + art_pars[sector-1][7]*pow(P_curr,4) + art_pars[sector-1][8]*pow(P_curr,5);
brt = brt_pars[sector-1][3] + brt_pars[sector-1][4]*P_curr + brt_pars[sector-1][5]*pow(P_curr,2) +
  brt_pars[sector-1][6]*pow(P_curr,3) + brt_pars[sector-1][7]*pow(P_curr,4) + brt_pars[sector-1][8]*pow(P_curr,5);

// calculate the maximum and minimum phi values for this theta. see entries 288, 235, 236 in
// E5 elog.

phi_max = phimid[sector-1] + blt*(1 - (1/(1+((theta_curr-t0)/alt))));
phi_min = phimid[sector-1] - brt*(1 - (1/(1+((theta_curr-t0)/art))));

// test the effect of tighter fiducial cuts.

// phi_max = phi_max - 3.0;
// phi_min = phi_min + 3.0;
phi_max = phi_max;
phi_min = phi_min;

// get the applicable momentum range.

pmin = t0_pars[sector-1][1];
pmax = t0_pars[sector-1][2];

// see if it fits.we check that p_e is in the correct range, that phi_e lies in the range determined from
// fiducial cut, and that theta_e is greater than the lowest theta_e of the curve of the fiducial cut.

 if (P_curr > pmin && P_curr < pmax) {
   good_p = 1;
 }

 if (Phi_curr > phi_min && Phi_curr < phi_max) {
   good_phi = 1;
 }

 if (theta_curr > t0-1.0) {
   good_theta=1;
 }

 // keep it or throw it out.

//  if (good_p > 0 && good_phi > 0 && good_theta > 0) {
 if (good_p > 0 && good_phi > 0) {
     return 1;
 }
 else {
     return 0;
 }
```

```
}
```

Code to make electron acceptance plot.

```
TCanvas *c1 = new TCanvas("c1", "c1",80,20,800,500);
c1->Clear();
c1->Divide(3,2);

float pbin;

gStyle->SetOptStat(11);
c1_1->cd();
c1_1->SetRightMargin(0.16);
c1_1->SetLogz();
pbin=8;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin8 = (TH1F*)hin->Clone();
hbin8->SetName("hbin8");
hbin8->Draw("colz");

c1_2->cd();
c1_2->SetRightMargin(0.16);
c1_2->SetLogz();
pbin=9;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin9 = (TH1F*)hin->Clone();
hbin9->SetName("hbin9");
hbin9->Draw("colz");

c1_3->cd();
c1_3->SetRightMargin(0.16);
c1_3->SetLogz();
pbin=10;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin10 = (TH1F*)hin->Clone();
hbin10->SetName("hbin10");
hbin10->Draw("colz");

c1_4->cd();
c1_4->SetRightMargin(0.16);
c1_4->SetLogz();
pbin=11;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin11 = (TH1F*)hin->Clone();
hbin11->SetName("hbin11");
hbin11->Draw("colz");

c1_5->cd();
c1_5->SetRightMargin(0.16);
c1_5->SetLogz();
pbin=12;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin12 = (TH1F*)hin->Clone();
hbin12->SetName("hbin12");
hbin12->Draw("colz");

c1_6->cd();
c1_6->SetRightMargin(0.16);
c1_6->SetLogz();
pbin=13;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin13 = (TH1F*)hin->Clone();
hbin13->SetName("hbin13");
hbin13->Draw("colz");

c1->Print("acceptance.ps(");

gStyle->SetOptStat(11);
c1_1->cd();
c1_1->SetRightMargin(0.16);
c1_1->SetLogz();
pbin=14;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin14 = (TH1F*)hin->Clone();
hbin14->SetName("hbin14");
```

```
hbin14->Draw("colz");

c1_2->cd();
c1_2->SetRightMargin(0.16);
c1_2->SetLogz();
pbin=15;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin15 = (TH1F*)hin->Clone();
hbin15->SetName("hbin15");
hbin15->Draw("colz");

c1_3->cd();
c1_3->SetRightMargin(0.16);
c1_3->SetLogz();
pbin=16;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin16 = (TH1F*)hin->Clone();
hbin16->SetName("hbin16");
hbin16->Draw("colz");

c1_4->cd();
c1_4->SetRightMargin(0.16);
c1_4->SetLogz();
pbin=17;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin17 = (TH1F*)hin->Clone();
hbin17->SetName("hbin17");
hbin17->Draw("colz");

c1_5->cd();
c1_5->SetRightMargin(0.16);
c1_5->SetLogz();
pbin=18;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin18 = (TH1F*)hin->Clone();
hbin18->SetName("hbin18");
hbin18->Draw("colz");

c1_6->cd();
c1_6->SetRightMargin(0.16);
c1_6->SetLogz();
pbin=19;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin19 = (TH1F*)hin->Clone();
hbin19->SetName("hbin19");
hbin19->Draw("colz");

c1->Print("acceptance.ps");

c1_1->cd();
c1_1->SetRightMargin(0.16);
c1_1->SetLogz();
pbin=20;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin20 = (TH1F*)hin->Clone();
hbin20->SetName("hbin20");
hbin20->Draw("colz");

c1_2->cd();
c1_2->SetRightMargin(0.16);
c1_2->SetLogz();
pbin=21;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin21 = (TH1F*)hin->Clone();
hbin21->SetName("hbin21");
hbin21->Draw("colz");

c1_3->cd();
c1_3->SetRightMargin(0.16);
c1_3->SetLogz();
pbin=22;
helectron_fiducials2->GetZaxis()->SetRange(pbin,pbin);
TH2D *hin = (TH2D*) helectron_fiducials2->Project3D("xy");
hin->GetXaxis()->SetRange(1,60);
hin->GetYaxis()->SetRange(1,90);
TH1F *hbin22 = (TH1F*)hin->Clone();
hbin22->SetName("hbin22");
hbin22->Draw("colz");
```

```
c1_4->Clear();
c1_5->Clear();
c1_6->Clear();

c1->Print("acceptance.ps)");
```

Click here to view the object (Fig 2. Acceptance for sector 1.) you uploaded.

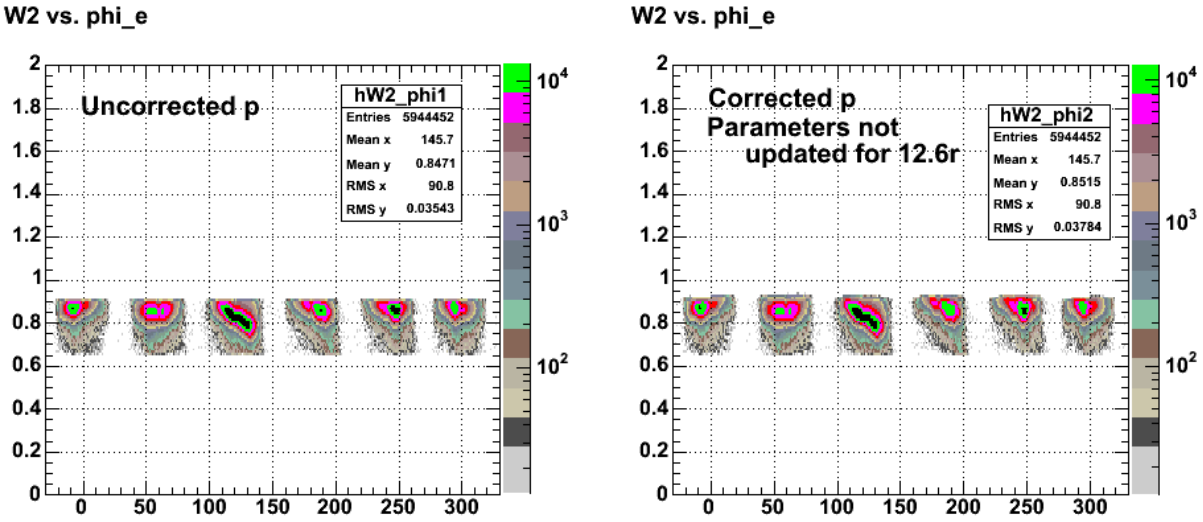
Click here to view the object (Fig 3. Acceptance for sector 2) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 63 - 2.6r pcorr1, Pitt method (gpg)

[Modified Wed Jul 6 15:44:00 2005 (GMT) gpg]

Below are some initial results for the momentum corrections for the 2.6 GeV, reversed polarity settings. In Figure 1, this is our starting point. The parameters used in the momentum-corrected results (right panel) are using the old parameters left over from the 2.6n results.



Comparison of W2 versus phi_e for uncorrected (left panel) and momentum corrected (right panel).

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

Click here to view the object (Root histogram file for Fig 1) you uploaded.

I use the run above in Fig 1 to generate the new correction factors using the entry 109/Pitt method and rerun things and get Fig 2. There is not much change, but there is some improvement in sectors 5-6. Sector 3 is little changed which is a disappointment since it looks like it could be fixed.

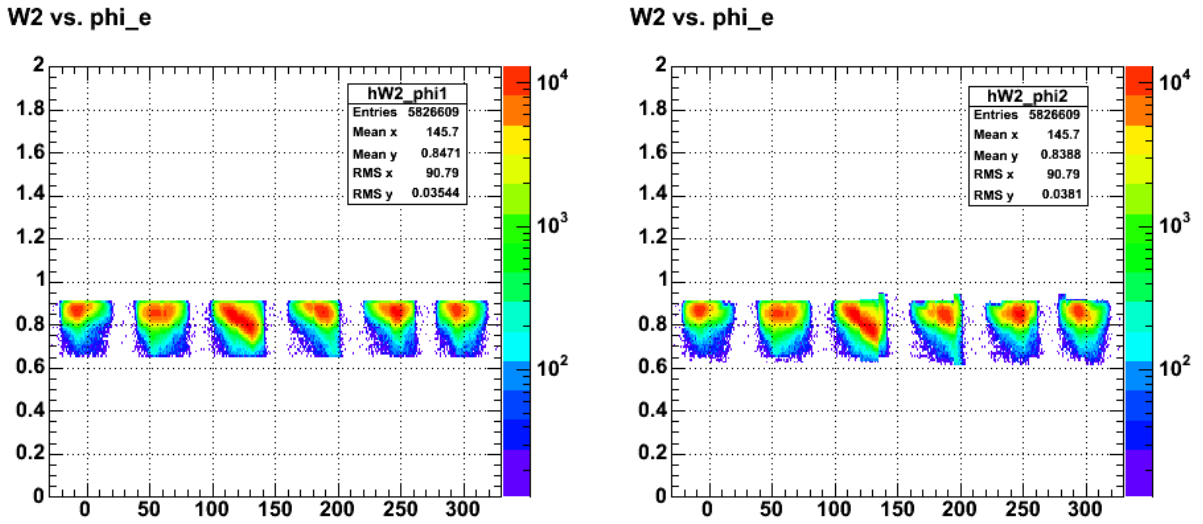


Fig 2. W2 vs. phi_e from just running my old code on the 2.6r data to get the parameters for the momentum correction. The uncorrected momenta is used in the left panel and the corrected electron momentum us used in the tright panel.

The plots below show a comparison between some results for the uncorrected and corrected electron momenta. The spectra of W^2 for ep->e'X are shown sector by sector and a gaussian fit is made to the proton peak. The results are rather discouraging. In general, the corrected W2 spectra are infinitesimally WORSE than the corrected ones. The difference is usually negligible. This is similar to what I saw for the 2.6 GeV, normal polarity running conditions and what Jeff lachniet saw in his analysis. This is, I believe a product of the observation that the uncertainty in the stiffness (qB/p) for the proton tracks is much larger than the stiffness for the electron tracks. This large scatter in the proton stiffness essentially randomizes the fits to the electron results.

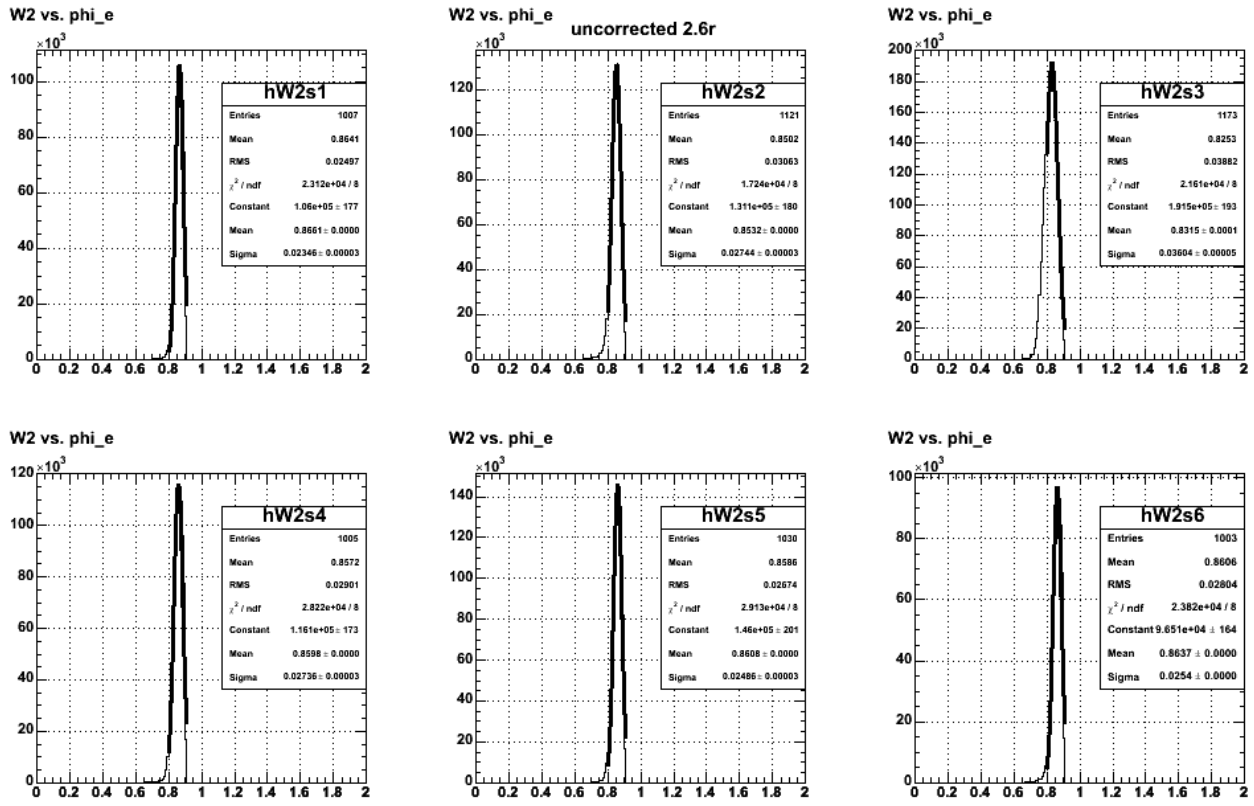


Fig 3. Fits to the uncorrected W^2 spectra sector by sector

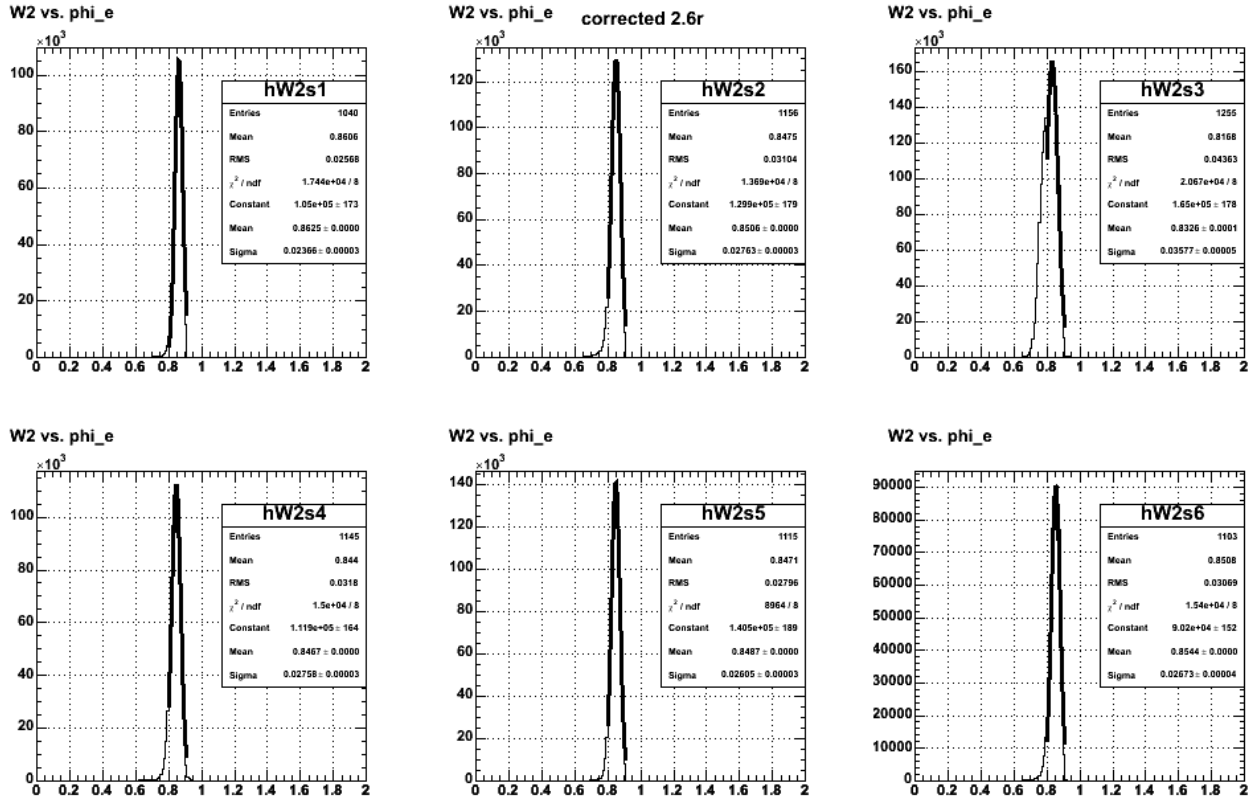


Fig 4. Fits to the coorected W^2 spectra sector by sector

The plots below show the profile histograms and fits used to extract the correction parameters for sector 3 where W2 shows the greatest dependence on phi_e (see Figs 1-2).

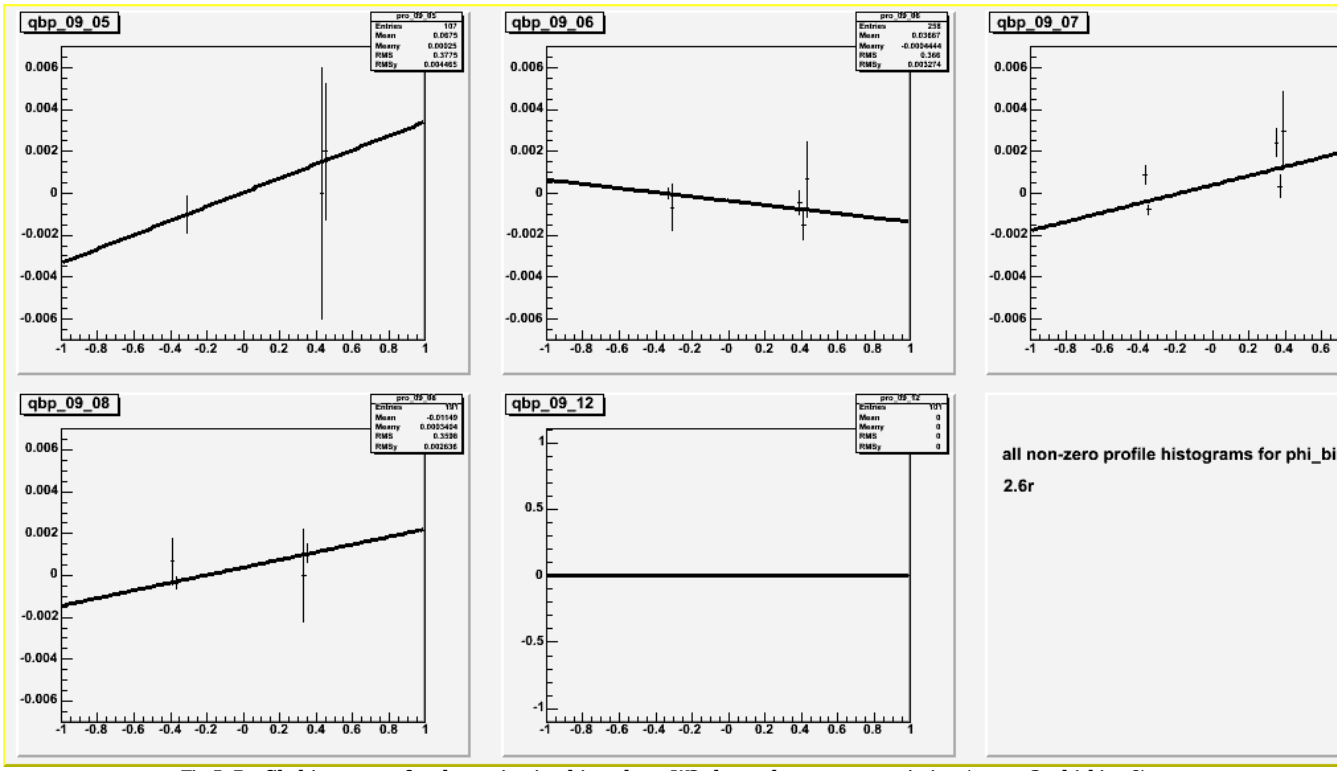


Fig 5. Profile histograms for the region in phi_e where W2 shows the greatest variation (sector 3, phi_bin=9)

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

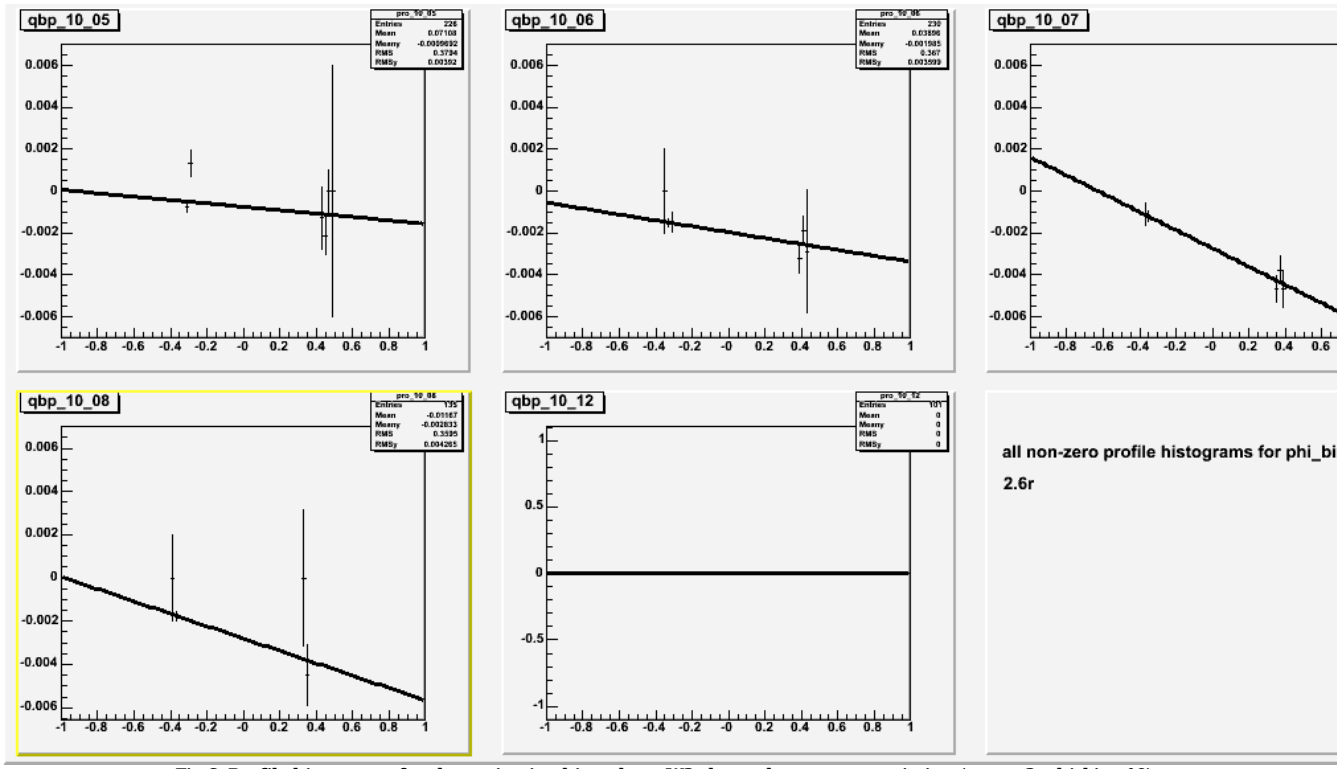


Fig 6. Profile histograms for the region in phi_e where W2 shows the greatest variation (sector 3, phi_bin=10)

Click here to view the object (ROOT C++ macro for Fig 6) you uploaded.

Click here to view the object (ROOT C++ macro for Fig 6 with fit results added) you uploaded.

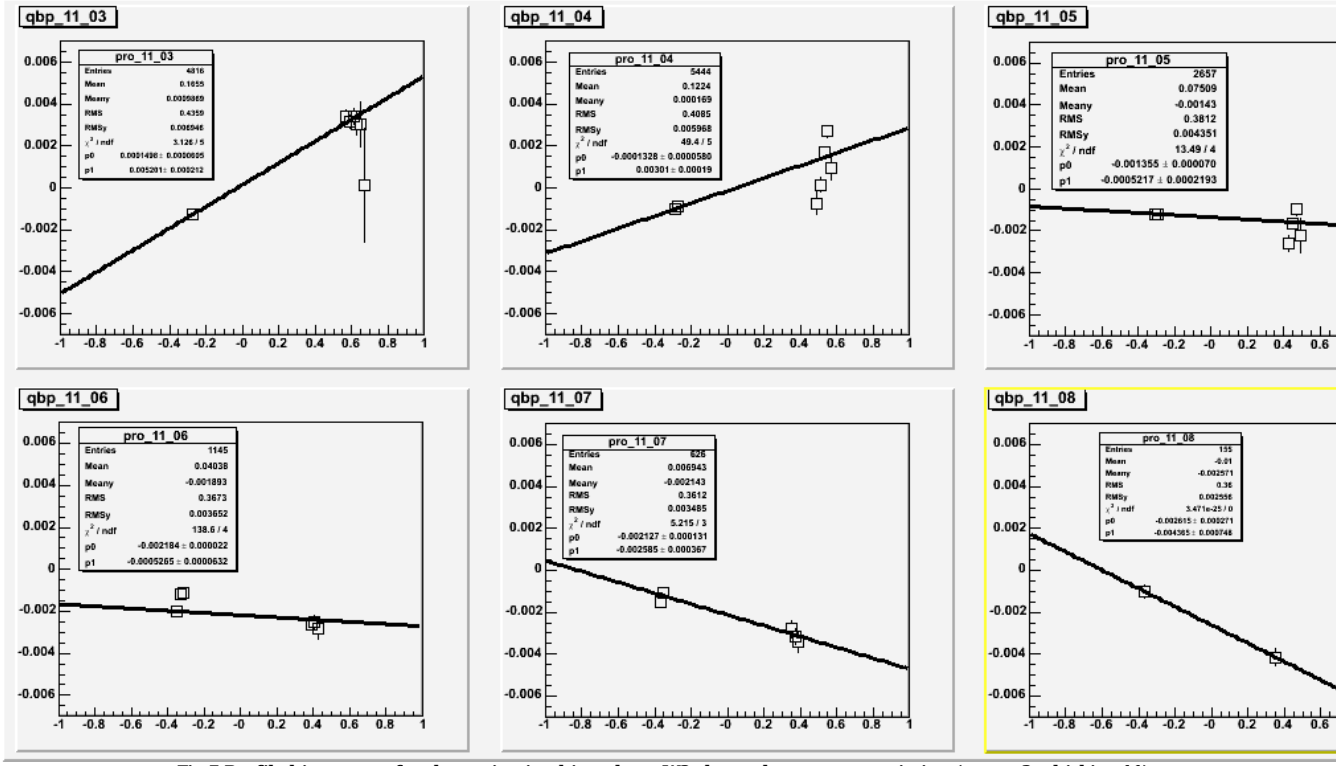


Fig 7.Profile histograms for the region in phi_e where W2 shows the greatest variation (sector 3, phi_bin=11)

Click here to view the object (ROOT C++ macro for Fig 7.) you uploaded.

Click here to view the object (pcorr_ep2.C - C++ class for the Pitt method momentum corrections, first ry with the wrong electron fiducial cuts on.) you uploaded.

I discovered that the analysis run I used to generate the momentum correction parameters above was done for the 2.6r data set using the 2.6n electron fiducial cuts (opps!). Rerun the analysis and I get the following results. The centroid of the W2 distribution improves on most of the sectors (1-5) and is infinitesimally worse on sector 6. That's the good news. The bad news is the width gets worse! It is anywhere from 20-50% larger in the corrected spectra. This is the opposite of the 2.6n results where the centroid moved, but was no better after momentum correction (it went from just below to just above the accepted value) and the width of the corrected spectra was about 20-30% better than the uncorrected spectra (for 2.6n).

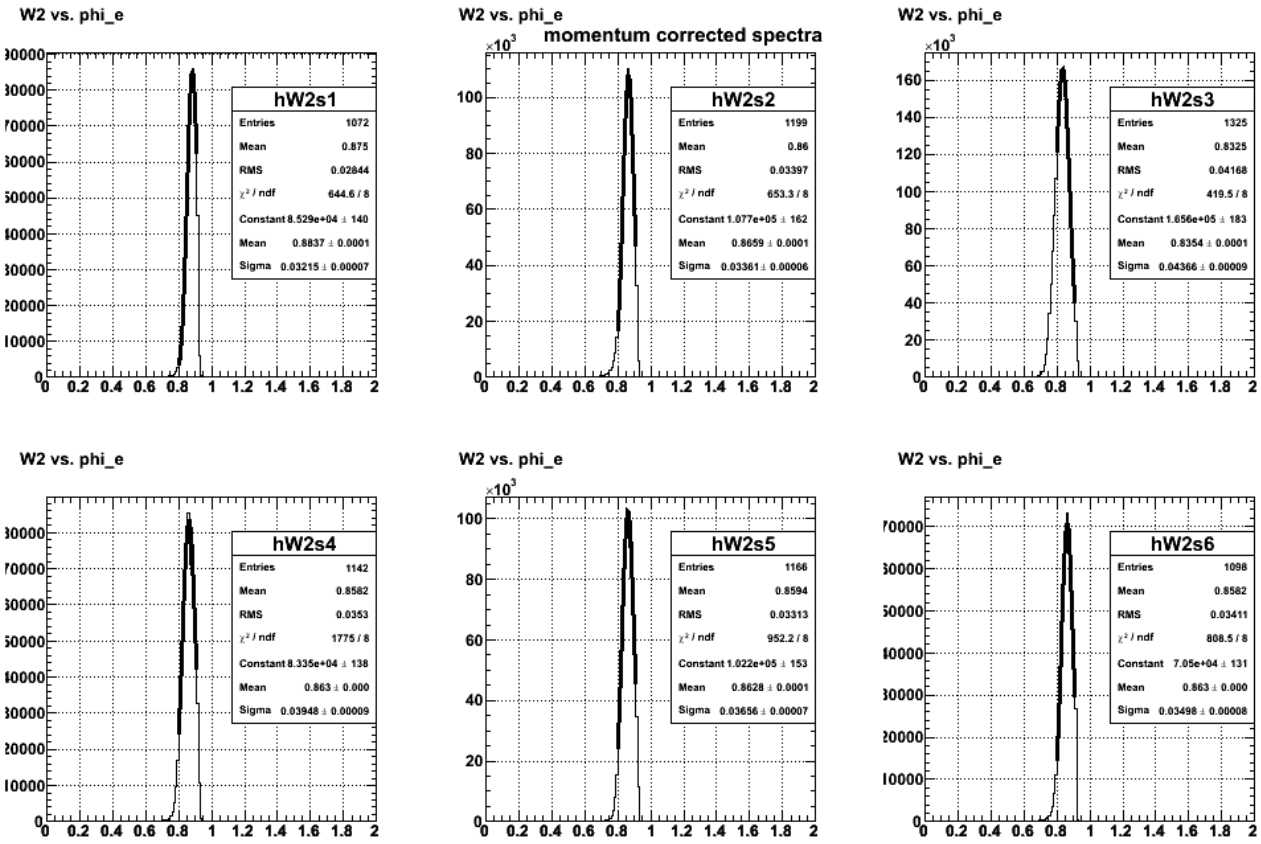


Fig 8. Momentum corrected spectra sector-by-sector for 2.6 GeV, reversed polarity.

The width is noticeably better on sectors 1-3 when I center the fit range on the peak. These sectors now have about the same width as the uncorrected spectra. Sector 3-6 are still worse.

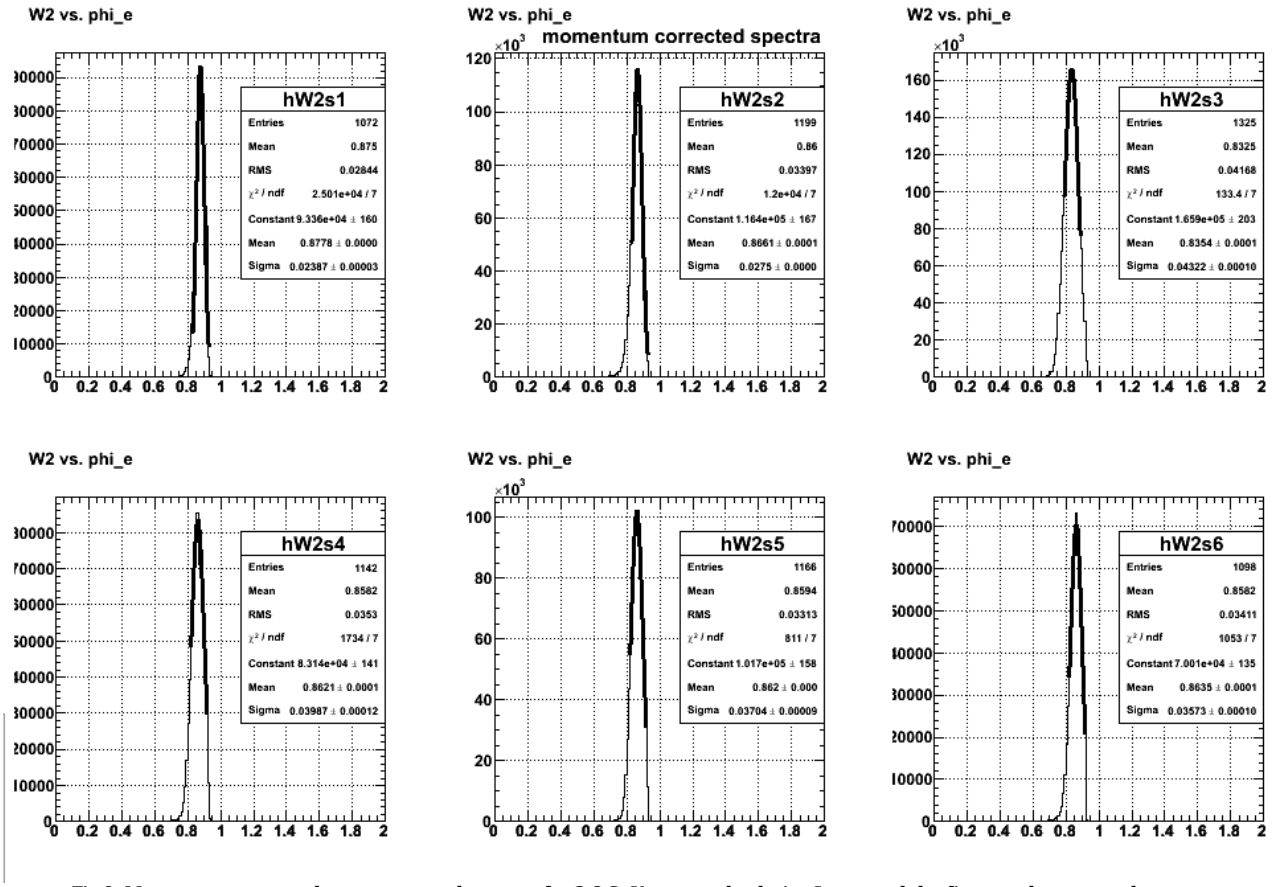


Fig 9. Momentum corrected spectra sector-by-sector for 2.6 GeV, reversed polarity. I centered the fit range bettter on these spectra.

Click here to view the object (ROOT C++ macro for Fig 9 above) you uploaded.

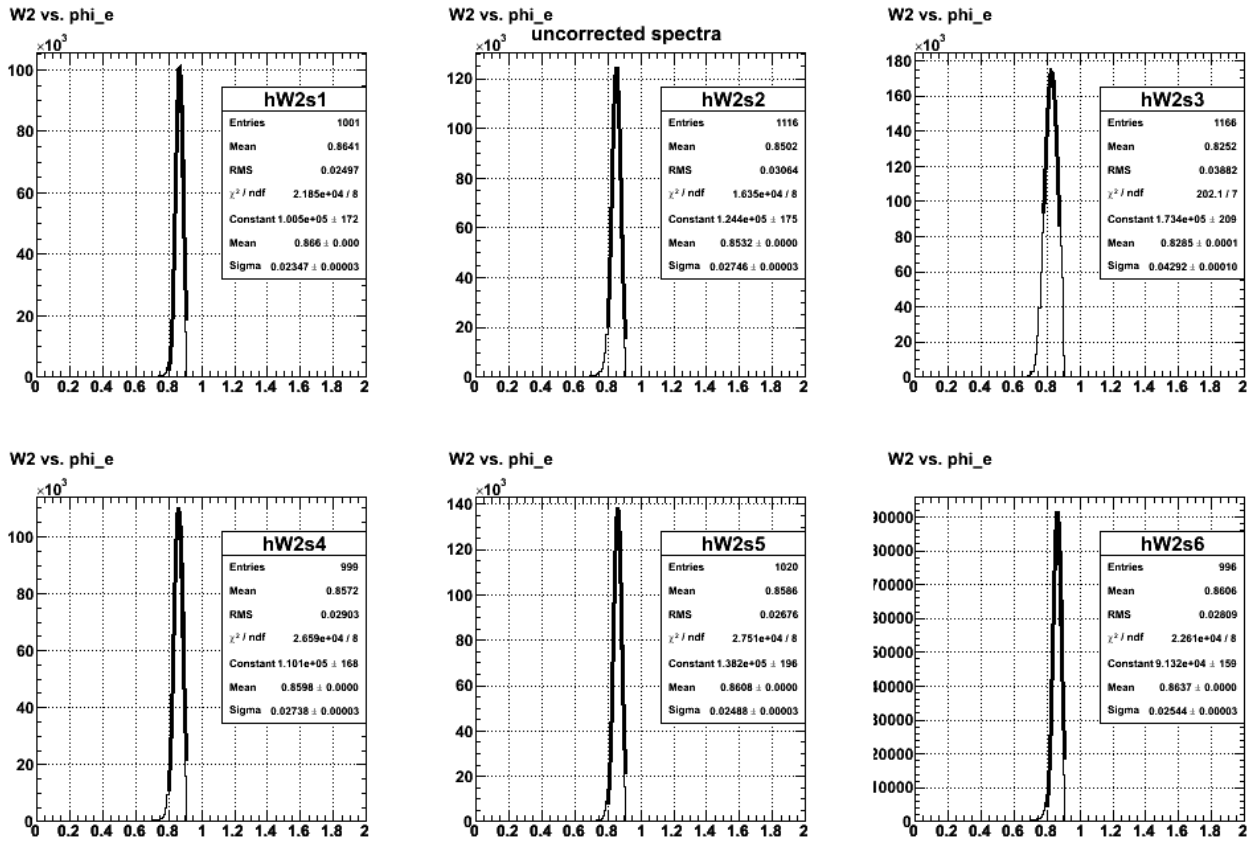


Fig 10. Uncorrected spectra for 2.6r.

Click here to view the object (ROOT C++ macro for Fig 10 above) you uploaded.

A table comparing the results in Figs 9-10 is below.

	uncorrected		corrected	
sector	centroid	width	centroid	width
1	0.8660	0.02347	0.8778	0.02387
2	0.8532	0.02746	0.8661	0.02750
3	0.8285	0.04292	0.8354	0.04322
4	0.8598	0.02738	0.8621	0.03987
5	0.8608	0.02488	0.8620	0.03704
6	0.8637	0.02544	0.8635	0.03573

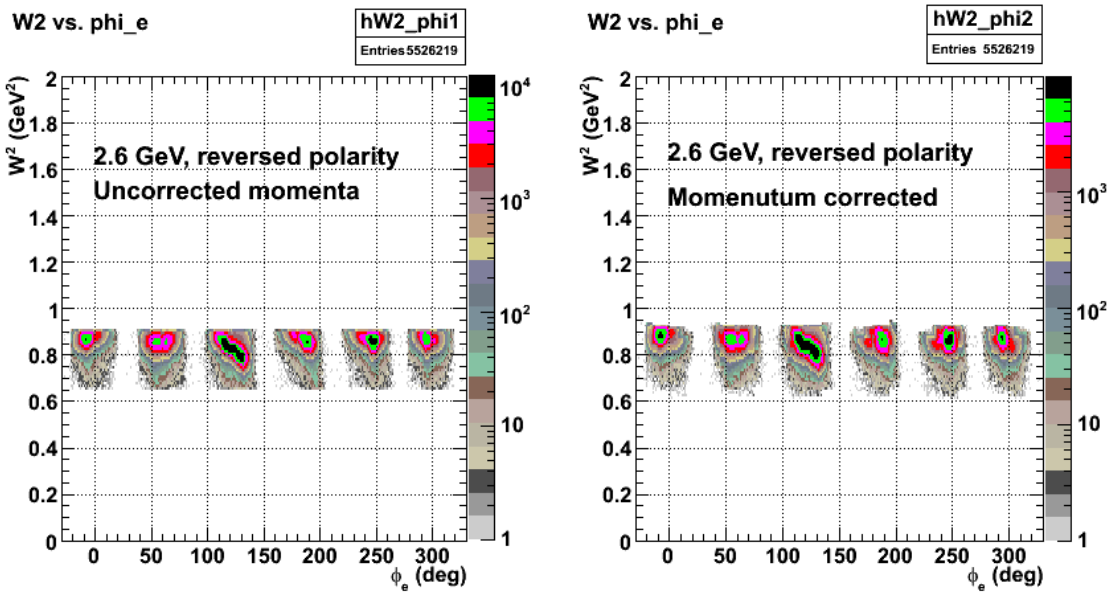


Fig 11. Comparison of W2 vs. phi_e for uncorrected momenta (left panel) and corrected momenta (right panel).

Click here to view the object (ROOT C++ macro for Fig 11 above) you uploaded.

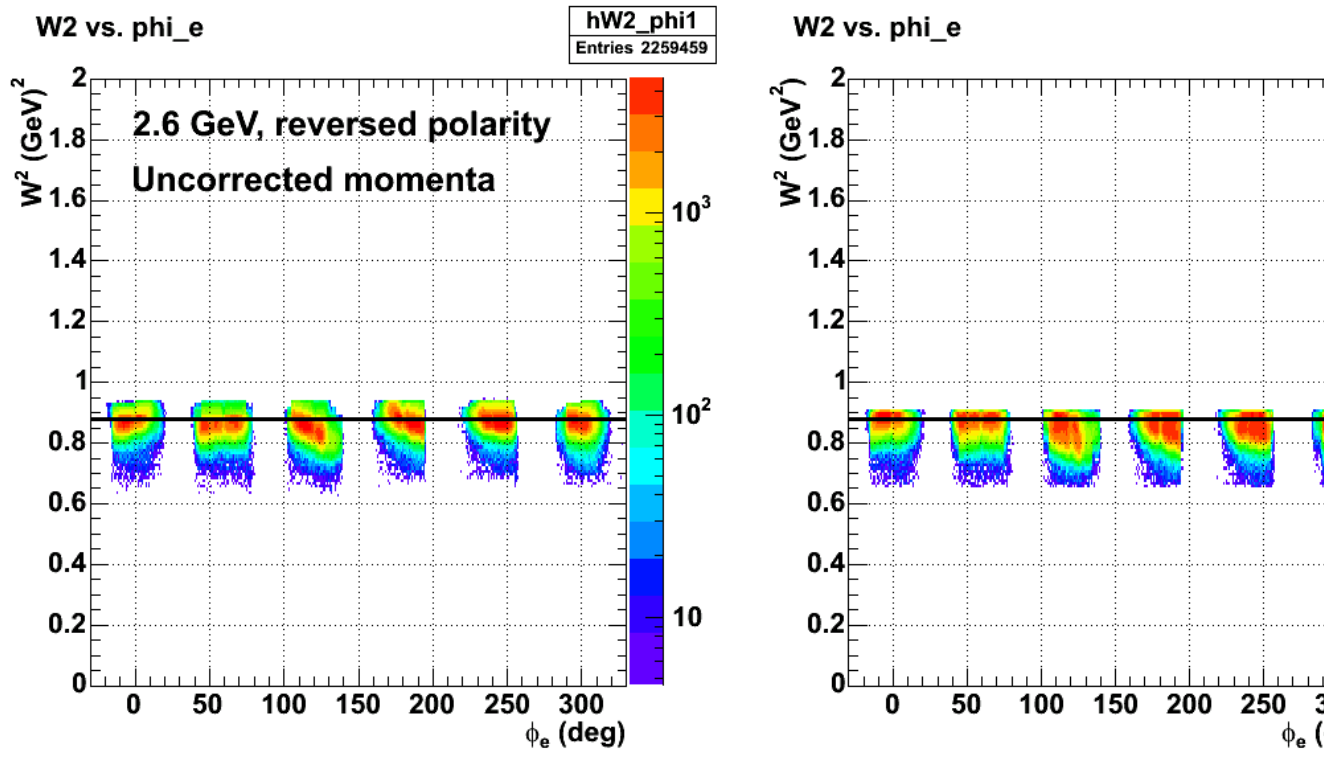


Fig 12. Comparison of effect on electron momentum corrections with corrections off (left panel) and on (right panel).

Click here to view the object (ROOT C++ macro for Fig 12) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 64 - MM2 for e'pi+X for Pitt method (gpg)

[Modified Sun Jul 3 16:46:03 2005 (GMT) gpg]

Below are results for the MM2 spectra sector by sector with uncorrected momenta for 2.6 GeV, reversed polarity.

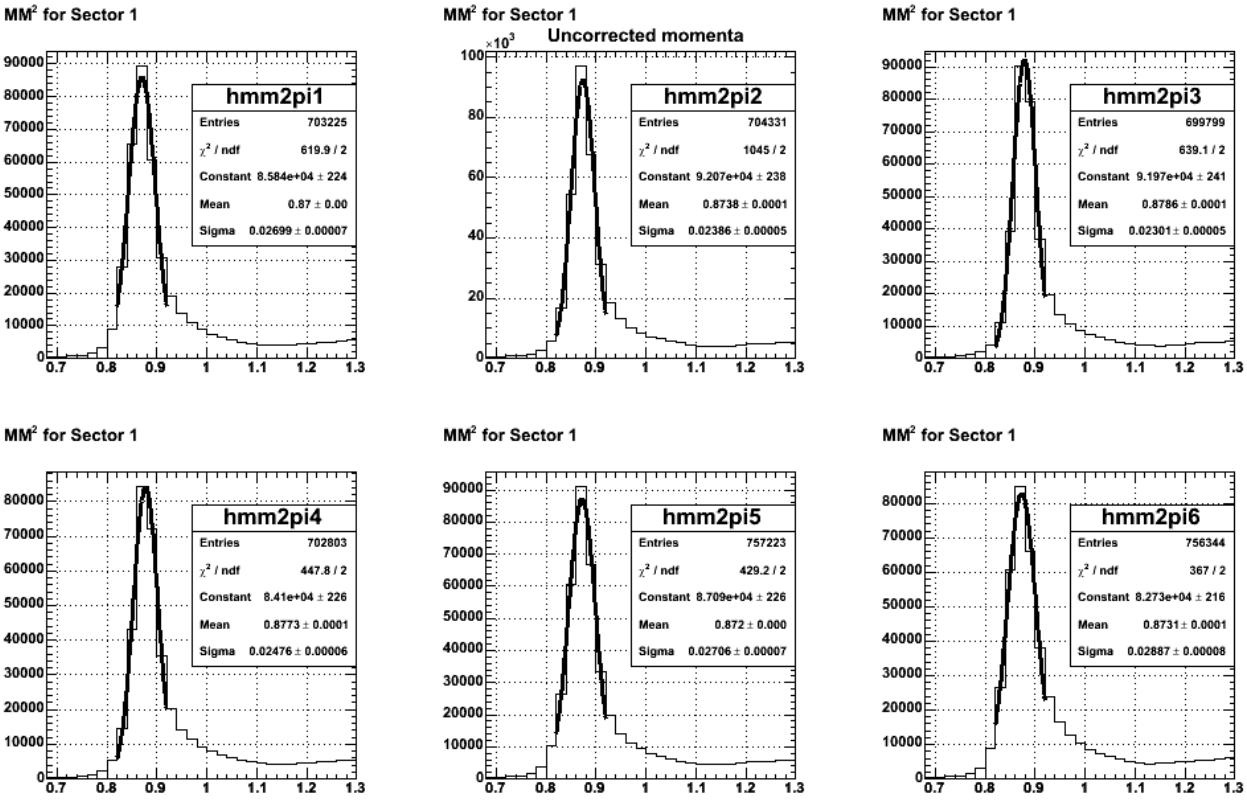


Fig 1. MM2 sector by sector for ep->e'pi+X for 2.6 GeV, reversed polarity and uncorrected momenta.

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

Click here to view the object (ROOT histogram file used to make Fig 1.) you uploaded.

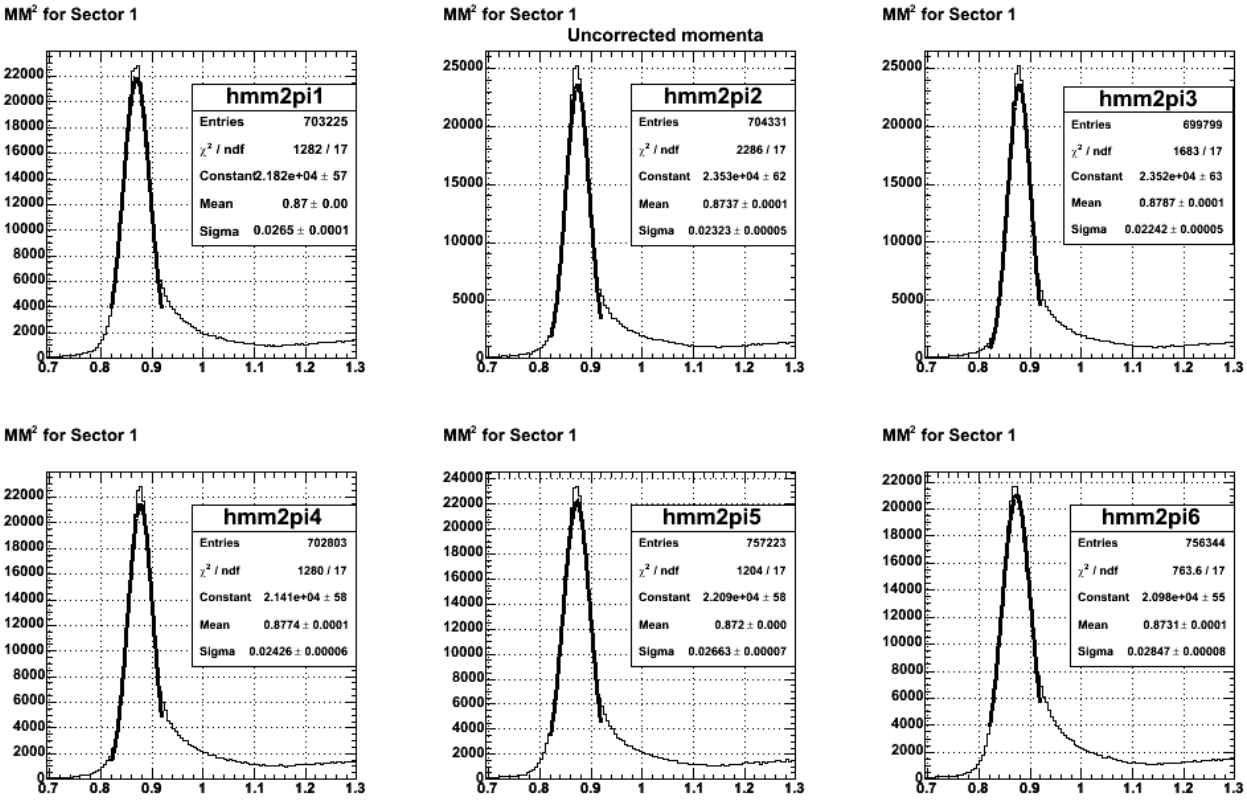


Fig 2. MM2 sector by sector for ep->e'pi+X for 2.6 GeV, reversed polarity and uncorrected momenta. Used finer binning than Fig 1.

Click here to view the object (ROOT C++ macro for Fig 2.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 2.) you uploaded.

The plots below show the results using the corrected proton and electron momenta. The corrected results are uniformly WORSE than the uncorrected ones. Even after tuning the range of the gaussian fit this still holds true. The difference is small; a fraction of a percent for the centroid and a few percent for the width, but it is still disappointing. My guess is that barring a software or calculational error, what I'm seeing is the effect of the large uncertainty on the proton's stiffness (qB/p) that was documented in entry 63. A table of the values is below.

sector	uncorrected		corrected	
sector	centroid	width	centroid	width
1	0.8689	0.02384	0.8665	0.02521
2	0.8724	0.02037	0.8704	0.02266
3	0.8775	0.02004	0.8716	0.02299
4	0.8764	0.02165	0.8776	0.02281
5	0.8714	0.02342	0.8751	0.02622
6	0.8716	0.02587	0.8698	0.02741

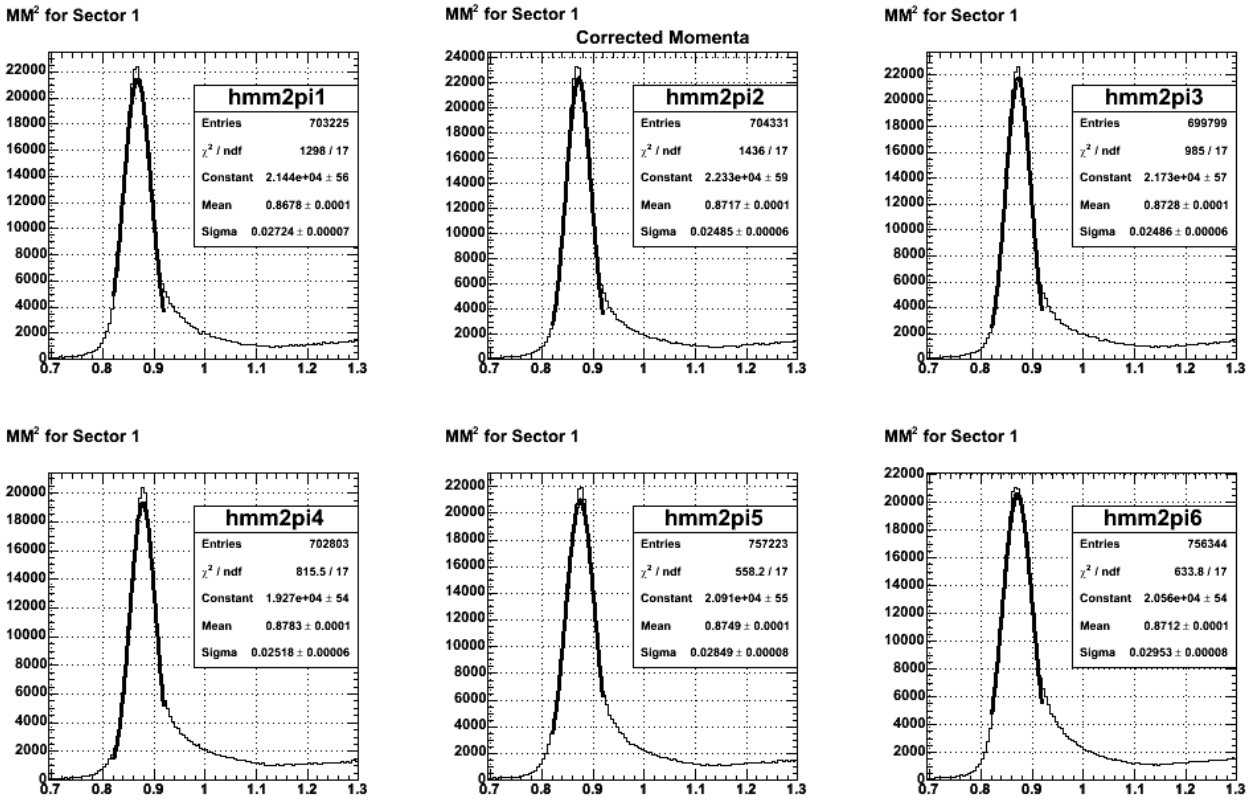


Fig 3. MM2 sector by sector for ep->e'pi+X for 2.6 GeV, reversed polarity and corrected momenta.

Click here to view the object (ROOT C++ macro for Fig 3.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 3.) you uploaded.

ROOT commands for making the plots above.

```
TCanvas *c1 = new TCanvas("c1", "c1",40,5,1000,700);
c1->Divide(3,2)
gStyle->SetOptFit(1);
gStyle->SetStatW(0.40);
gStyle->SetStatH(0.40);
gStyle->SetStatX(0.90);
gStyle->SetStatY(0.80);
int mm2lo, mm2hi, philo, phihi;
mm2lo = 40;
mm2hi = 160;
c1_1->cd();
c1_1->SetLeftMargin(0.15);
hmm2pi1->GetXaxis()->SetRange(mm2lo,mm2hi);
hmm2pi1->Draw();
hmm2pi1->Fit("gaus","","",0.82,0.92);
c1_2->cd();
c1_2->SetLeftMargin(0.15);
hmm2pi2->GetXaxis()->SetRange(mm2lo,mm2hi);
hmm2pi2->Draw();
hmm2pi2->Fit("gaus","","",0.82,0.92);
c1_3->cd();
c1_3->SetLeftMargin(0.15);
hmm2pi3->GetXaxis()->SetRange(mm2lo,mm2hi);
hmm2pi3->Draw();
hmm2pi3->Fit("gaus","","",0.82,0.92);
c1_4->cd();
c1_4->SetLeftMargin(0.15);
hmm2pi4->GetXaxis()->SetRange(mm2lo,mm2hi);
hmm2pi4->Draw();
hmm2pi4->Fit("gaus","","",0.82,0.92);
c1_5->cd();
c1_5->SetLeftMargin(0.15);
hmm2pi5->GetXaxis()->SetRange(mm2lo,mm2hi);
hmm2pi5->Draw();
hmm2pi5->Fit("gaus","","",0.82,0.92);
c1_6->cd();
c1_6->SetLeftMargin(0.15);
hmm2pi6->GetXaxis()->SetRange(mm2lo,mm2hi);
hmm2pi6->Draw();
hmm2pi6->Fit("gaus","","",0.82,0.92);
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 65 - VB p_e corrections for 2.6r (gpg)

[Modified Tue Jul 5 15:27:35 2005 (GMT) gpg]

The plot below shows a comparison of W2 for uncorrected electron momenta (left panel) and electron momenta corrected using the Volker Burckhardt (VB) method (right panel).

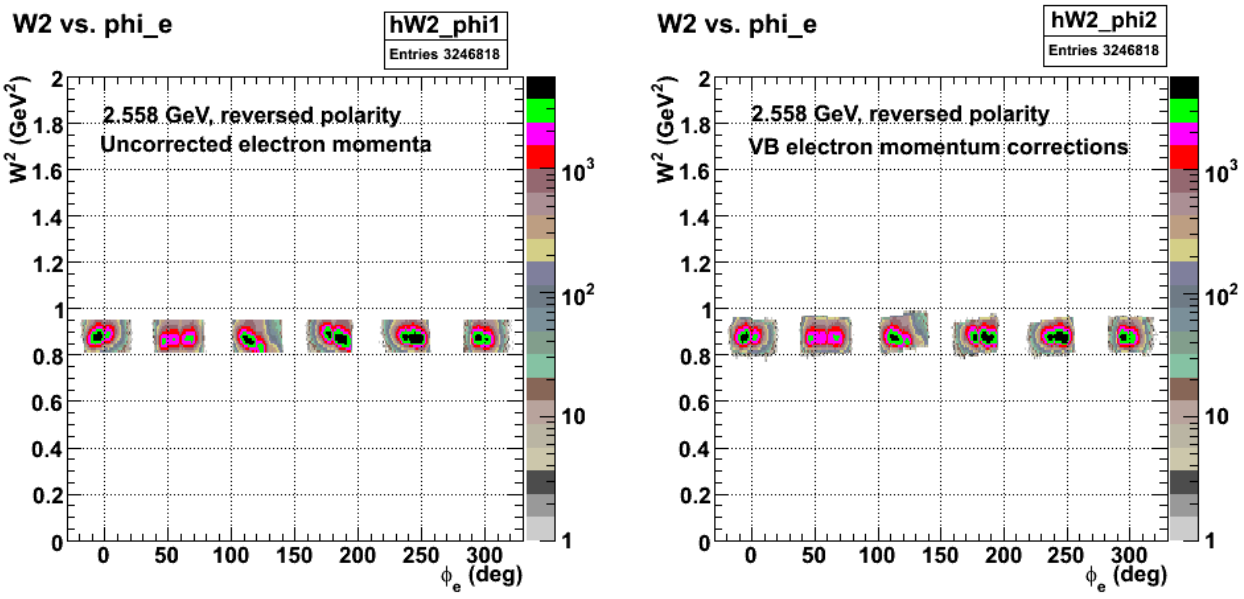


Fig 1. Comparison of W2 for uncorrected electron momenta (left panel) and electron momenta corrected using the VB method (right panel).

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

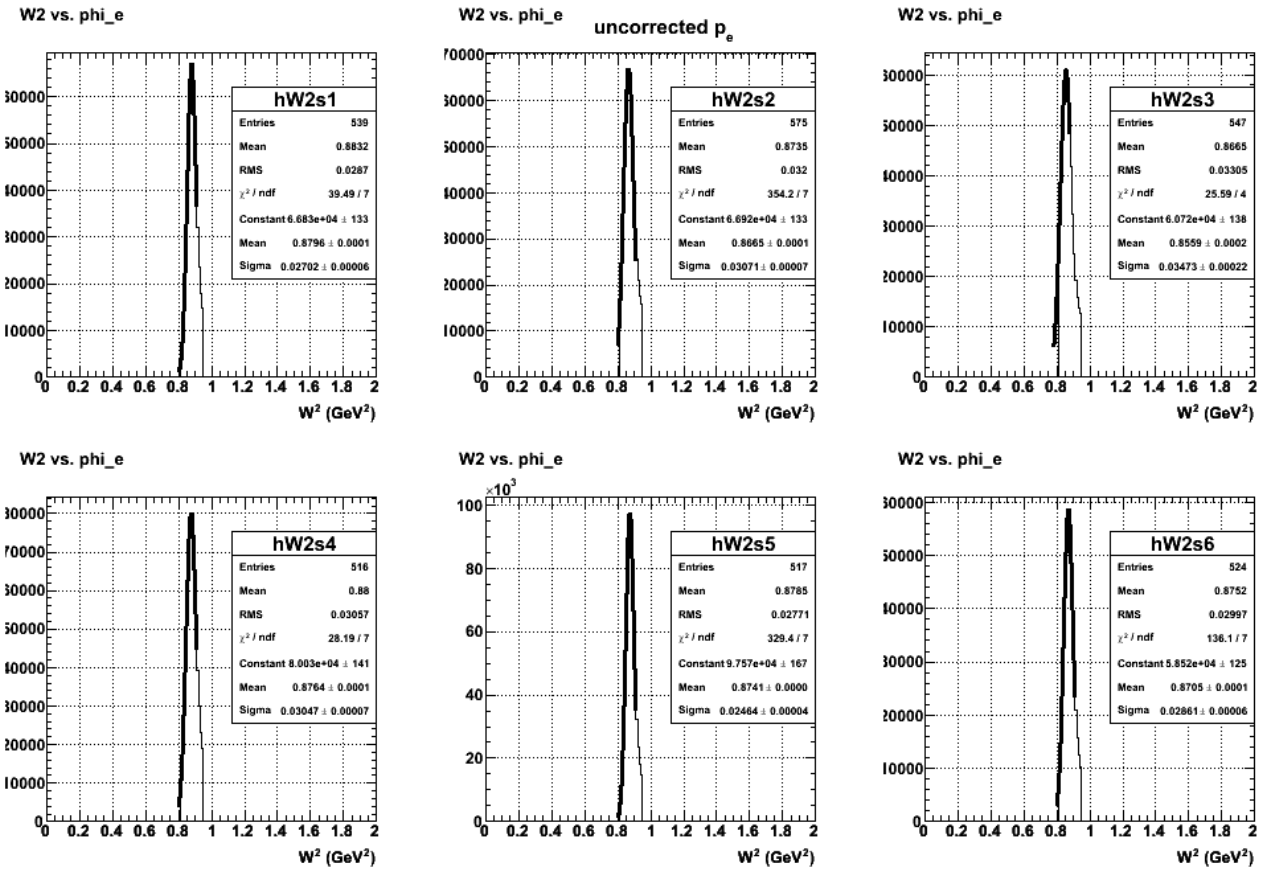


Fig 2. W2 spectra sector-by-sector for uncorrected electron momenta.

Click here to view the object (ROOT C++ macro for Fig 2.) you uploaded.

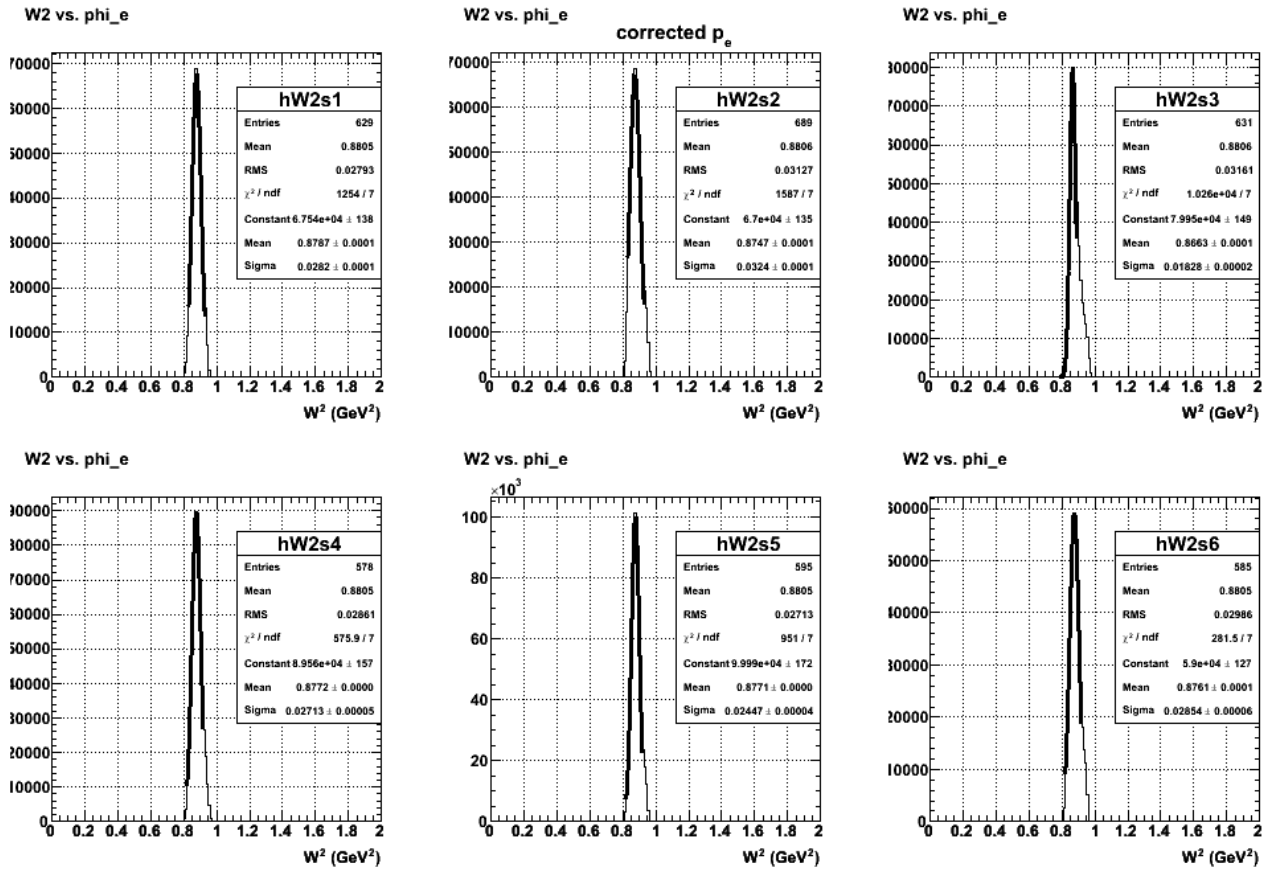


Fig 3. W2 spectra sector-by-sector for corrected electron momenta.

Click here to view the object (ROOT C++ macro for Fig 3.) you uploaded.

Comparing the corrected and uncorrected W^2 spectra above shows some improvement due to the electron momentum corrections using the VB method. The table below shows the comparison sector-by-sector. Some sectors are infinitesimally worse with the corrections (1), some are better (4,5,6), some are mixed (2), while sector 3 shows a large improvement in the width of the distribution. This shows that some of the sectors (like sector 1) were well calibrated in the first place so the corrections have little effect while other sectors (sector 3) are significantly better after the corrections.

	Uncorrected		Corrected	
Sector	Centroid	Width	Centroid	Width
1	0.8796	0.02702	0.8787	0.02820
2	0.8665	0.03071	0.8747	0.03240
3	0.8559	0.03473	0.8663	0.01828
4	0.8764	0.03047	0.8772	0.02713
5	0.8741	0.02464	0.8771	0.02447
6	0.8705	0.02861	0.8761	0.02854

The ROOT code used to extract the fits sector-by-sector is below. For the uncorrected spectra in hW2_phi1:

```
TCanvas *c1 = new TCanvas("c1", "c1",20,3,1000,700);
c1->Divide(3,2)
gStyle->SetOptFit(1);
gStyle->SetStatH(0.30);
gStyle->SetStatW(0.35);
gStyle->SetStatX(0.90);
gStyle->SetStatY(0.80);
TH2D *hW2s1 = (TH2D*)hW2_phi1->Clone();
TH2D *hW2s2 = (TH2D*)hW2_phi1->Clone();
TH2D *hW2s3 = (TH2D*)hW2_phi1->Clone();
TH2D *hW2s4 = (TH2D*)hW2_phi1->Clone();
TH2D *hW2s5 = (TH2D*)hW2_phi1->Clone();
TH2D *hW2s6 = (TH2D*)hW2_phi1->Clone();
int philo, phihi;
philo=1;
phihi=60;
TH1D *h2as1 = (TH1D*) hW2s1->ProjectionY("hW2s1",philo,phihi);
c1_1->cd();
h2as1->Draw();
h2as1->Fit("gaus","","",0.80,0.91);
philo=61;
phihi=120;
TH1D *h2as2 = (TH1D*) hW2s2->ProjectionY("hW2s2",philo,phihi);
c1_2->cd();
```

```
h2as2->Draw();
h2as2->Fit("gaus","","",0.80,0.91);
philo=121;
phihi=180;
TH1D *h2as3 = (TH1D*) hW2s3->ProjectionY("hW2s3",philo,phihi);
c1_3->cd();
h2as3->Draw();
h2as3->Fit("gaus","","",0.78,0.88);
philo=181;
phihi=240;
TH1D *h2as4 = (TH1D*) hW2s4->ProjectionY("hW2s4",philo,phihi);
c1_4->cd();
h2as4->Draw();
h2as4->Fit("gaus","","",0.80,0.91);
philo=241;
phihi=300;
TH1D *h2as5 = (TH1D*) hW2s5->ProjectionY("hW2s5",philo,phihi);
c1_5->cd();
h2as5->Draw();
h2as5->Fit("gaus","","",0.80,0.91);
philo=301;
phihi=360;
TH1D *h2as6 = (TH1D*) hW2s6->ProjectionY("hW2s6",philo,phihi);
c1_6->cd();
h2as6->Draw();
h2as6->Fit("gaus","","",0.80,0.91);
```

For the corrected spectra in hW2_phi2:

```
TCanvas *c1 = new TCanvas("c1", "c1",20,3,1000,700);
c1->Divide(3,2)
gStyle->SetOptFit(1);
gStyle->SetStatH(0.30);
gStyle->SetStatW(0.35);
gStyle->SetStatX(0.90);
gStyle->SetStatY(0.80);
TH2D *hW2s1 = (TH2D*)hW2_phi2->Clone();
TH2D *hW2s2 = (TH2D*)hW2_phi2->Clone();
TH2D *hW2s3 = (TH2D*)hW2_phi2->Clone();
TH2D *hW2s4 = (TH2D*)hW2_phi2->Clone();
TH2D *hW2s5 = (TH2D*)hW2_phi2->Clone();
TH2D *hW2s6 = (TH2D*)hW2_phi2->Clone();
int philo, phihi;
philo=1;
phihi=60;
TH1D *h2as1 = (TH1D*) hW2s1->ProjectionY("hW2s1",philo,phihi);
c1_1->cd();
h2as1->Draw();
h2as1->Fit("gaus","","",0.83,0.93);
philo=61;
phihi=120;
TH1D *h2as2 = (TH1D*) hW2s2->ProjectionY("hW2s2",philo,phihi);
c1_2->cd();
h2as2->Draw();
h2as2->Fit("gaus","","",0.83,0.93);
philo=121;
phihi=180;
TH1D *h2as3 = (TH1D*) hW2s3->ProjectionY("hW2s3",philo,phihi);
c1_3->cd();
h2as3->Draw();
h2as3->Fit("gaus","","",0.79,0.89);
philo=181;
phihi=240;
TH1D *h2as4 = (TH1D*) hW2s4->ProjectionY("hW2s4",philo,phihi);
c1_4->cd();
h2as4->Draw();
h2as4->Fit("gaus","","",0.82,0.92);
philo=241;
phihi=300;
TH1D *h2as5 = (TH1D*) hW2s5->ProjectionY("hW2s5",philo,phihi);
c1_5->cd();
h2as5->Draw();
h2as5->Fit("gaus","","",0.82,0.92);
philo=301;
phihi=360;
TH1D *h2as6 = (TH1D*) hW2s6->ProjectionY("hW2s6",philo,phihi);
c1_6->cd();
h2as6->Draw();
h2as6->Fit("gaus","","",0.82,0.92);
```

The C++ function used in the analysis code to apply the momentum corrections for the 2.6 GeV, reversed field data is below.

```
Float_t ep1::JLpcorr26r(float p_e_in, float phi_e, float theta_e)
{
  // this function corrects the electron momentum using the VB method for the 2.6 GeV, reversed
  // torus polarity setting.

  // user variables.
  int pcorr_theta_bin, pcorr_phi_bin;
  float p_e_out;

  // inputs
  float alpha[16][36] = {
 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0,
```

```
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, // end of theta bin 1
0, 0.999643, 1.00063, 1.00206, 1.01002, 0,
0, 0.997786, 0.999372, 0.999341, 1.00169, 0.986412,
0, 1.00032, 0.998114, 0.995842, 0, 0,
0, 1.00531, 1.00298, 1.00006, 0.998296, 0,
0, 0, 1.00005, 0.999146, 0.997274, 0,
0, 0, 0.999306, 0.999044, 1.00414, 0, // end of theta bin 2
0, 0.99816, 0.999205, 1.0018, 1.0067, 0,
0, 0.996271, 0.997035, 0.997979, 0.999261, 0,
0, 0.999547, 0.996533, 0.994204, 1.00501, 0,
0, 1.00601, 1.00231, 0.998035, 0.995711, 0,
0, 1.00294, 1.00024, 0.998726, 0.998125, 0,
0, 0.992314, 0.999298, 0.99819, 1.00363, 0.988397, // end of theta bin 3
0, 0.998136, 0.999981, 1.00204, 1.00421, 0,
0, 0.997303, 0.998275, 0.998956, 0.999456, 0,
0, 1.00084, 0.996208, 0.99329, 0.993778, 0,
0, 1.00473, 1.00208, 0.998628, 0.996446, 0,
0, 1.00243, 1.00134, 1.00016, 0.999296, 0,
0, 1.00495, 0.999118, 0.998147, 1.00032, 1.00671, // end of theta bin 4
0, 0.999994, 1.00164, 1.00271, 1.00359, 0,
1.00025, 0.999453, 1.0002, 1.00053, 0.999957, 0,
0, 1.0002, 0.996564, 0.993699, 0.993272, 0,
1.01107, 1.00393, 1.00178, 0.999048, 0.997262, 0,
0, 1.0026, 1.002, 1.00114, 0.999993, 0,
0, 1.00052, 0.998959, 0.998028, 0.998623, 0.98991, // end of theta bin 5
0, 1.00237, 1.00289, 1.00223, 1.00197, 1.00818,
1.00209, 1.00237, 1.00212, 1.00126, 1.00012, 0,
0, 1.00028, 0.997351, 0.99468, 0.993342, 0,
0, 1.00365, 1.00165, 0.999574, 0.997856, 0,
1.00814, 1.00311, 1.00214, 1.0009, 1.00003, 0,
0, 0.999723, 0.998768, 0.997773, 0.997949, 0, // end of theta bin 6
0, 1.00447, 1.00405, 1.00203, 1.00056, 0,
1.0051, 1.004, 1.00352, 1.00185, 0.999496, 0,
0, 1.00031, 0.997867, 0.995267, 0.993918, 0.988306,
1.00485, 1.00271, 1.00059, 0.999008, 0.99752, 0,
0, 1.00332, 1.00279, 1.0022, 1.0026, 0,
0, 0.998353, 0.997842, 0.997752, 0.998148, 0.995033, // end of theta bin 7
0, 1.00626, 1.00453, 1.00193, 0.99939, 1.00185,
1.00506, 1.00535, 1.00442, 1.00219, 0.998391, 0,
0, 1.00049, 0.998864, 0.996859, 0.994578, 0,
1.00322, 1.002, 1.00017, 0.998495, 0.996912, 0,
1.00618, 1.00576, 1.00526, 1.00388, 1.00406, 0,
0, 0.996678, 0.996194, 0.997293, 0.998127, 1.00762, // end of theta bin 8
0, 1.00655, 1.00482, 1.00202, 0.998686, 0.999177,
1.00678, 1.00601, 1.00459, 1.00239, 1.00002, 0,
0, 1.0021, 1.00082, 0.996607, 0.995036, 0,
1.00123, 1.00059, 0.999863, 0.998828, 0.995016, 0,
1.00619, 1.00429, 1.00192, 0.999539, 0.998744, 0,
0, 0.997242, 0.995787, 0.998348, 0.998418, 1.01456, // end of theta bin 9
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, // end of theta bin 10
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, // end of theta bin 11
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, // end of theta bin 12
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, // end of theta bin 13
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, // end of theta bin 14
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, // end of theta bin 15
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, // end of theta bin 16
 };

 pcorr_theta_bin = int((theta_e - 7.0)/4);
 if (phi_e < -30) phi_e = phi_e + 360.0;
 pcorr_phi_bin = int((phi_e+30)/10);
```

```
//   cout << "alpha=" << alpha[pcorr_phi_bin][pcorr_theta_bin] << " phibin=" << pcorr_phi_bin <<
//     " thetabin=" << pcorr_theta_bin << endl;

  if (alpha[pcorr_theta_bin][pcorr_phi_bin] != 0) {
    p_e_out = alpha[pcorr_theta_bin][pcorr_phi_bin]*p_e_in;

//     cout << "alpha=" << alpha[pcorr_phi_bin][pcorr_theta_bin] << " phibin=" << pcorr_phi_bin <<
//       " thetabin=" << pcorr_theta_bin << " theta_e=" << theta_e << endl;
//     cout << "p_in=" << p_e_in << " p_out=" << p_e_out << "   ************************************\n" << endl;
  }
  else {
    p_e_out = p_e_in;
//     cout << "event punted. alpha=" << alpha[pcorr_theta_bin][pcorr_phi_bin] <<
//       " phibin=" << pcorr_phi_bin << " thetabin=" << pcorr_theta_bin <<
//       " phi_e=" << phi_e << " theta_e=" << theta_e << "\n" <<
//       " alphaminus=" << alpha[pcorr_theta_bin][pcorr_phi_bin-1] <<
//       " alphaplus=" << alpha[pcorr_theta_bin][pcorr_phi_bin+1] << endl;
  }
  return p_e_out;
}
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 66 - ALTp for 2.6r (gpg)

[Modified Fri Feb 3 20:04:58 2006 (GMT) gpg]

Below is a first look at the asymmetry for the 2.558 GeV, reversed torus polarity setting.

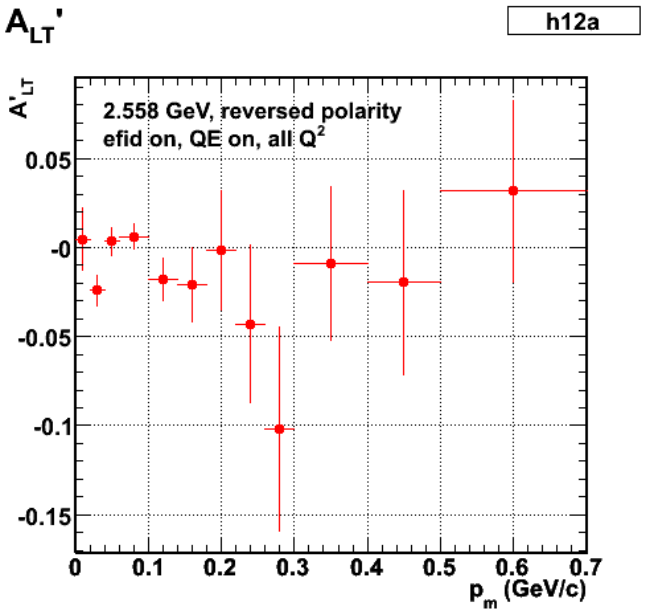


Fig 1. ALTp for efid on, all Q2, and QE kinematics.

Click here to view the object (ROOT C++ file for Fig 1) you uploaded.

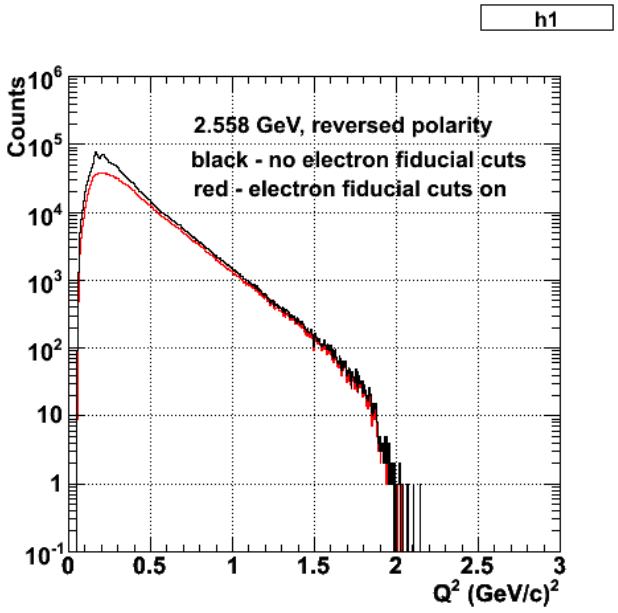


Fig 2. Comparison of Q2 distribution with electron fiducials on and off.

Click here to view the object (ROOT C++ macro for Fig 2.) you uploaded.

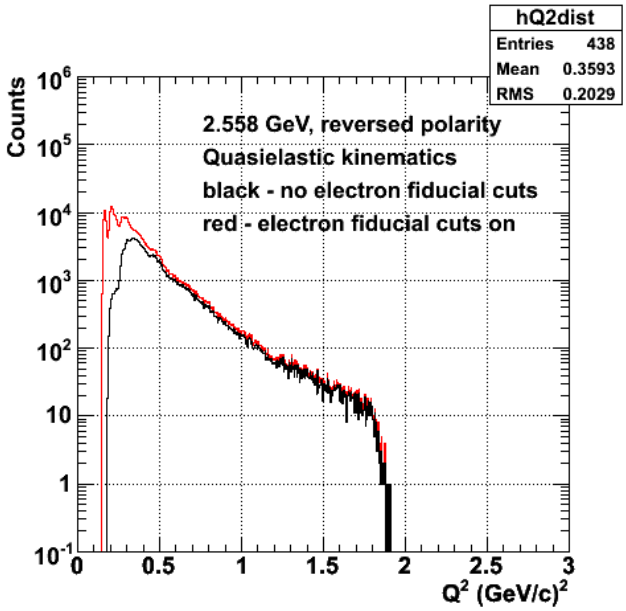


Fig 3. Same as Fig 2, but for quasielastic kinematics

Click here to view the object (ROOT C++ macro file allQ2QE.C for Fig 3.) you uploaded.

Some months later, i reran the analysis for the 2.6r data set and got the plots below. I do not understand why the uncertainties are so much smaller than the figures above. Nevertheless, this looks quite pretty!

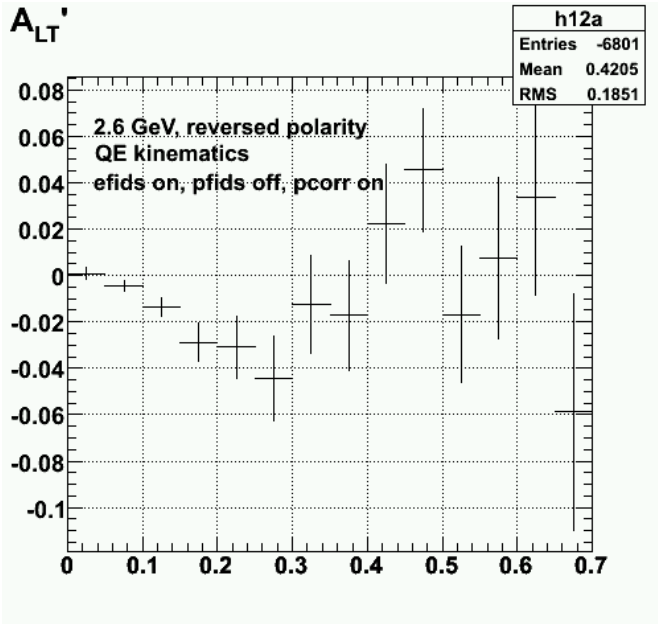


Fig 4. ALTp for 2.6 GeV, reversed field for QE kinematics with efids on, pfids off, pcorr on

Click here to view the object (ROOT C++ file for Fig 4) you uploaded.

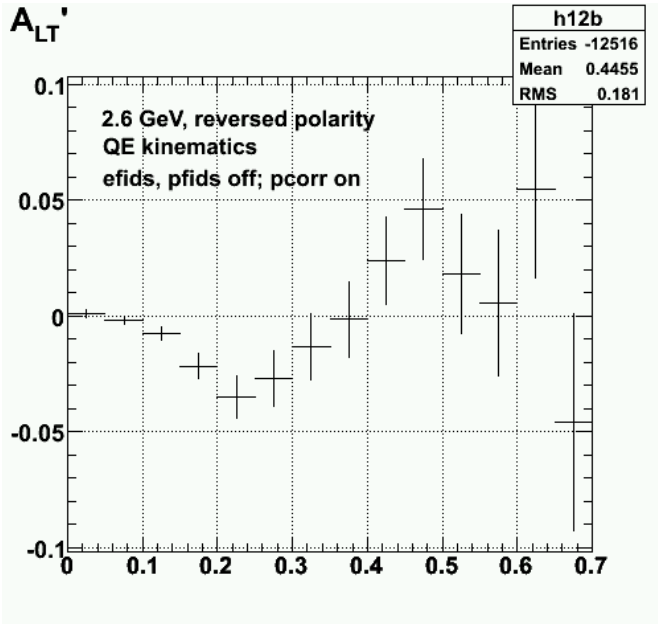


Fig 5. ALTp for 2.6 GeV, reversed field for QE kinematics with efids off, pfids off, pcorr on.

Click here to view the object (ROOT C++ file for Fig 5) you uploaded.

Click here to view the object (ROOT C++ file for Fig 4) you uploaded.

Click here to view the object (ROOT histogram file for Figs 4-5) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 67 - Acceptance for QE events for 2.6r (gpg)

[Modified Wed Jul 6 18:24:12 2005 (GMT) gpg]

Below are some plots with some 'interesting' features from the 2.558 GeV, reversed field data sets of E5.

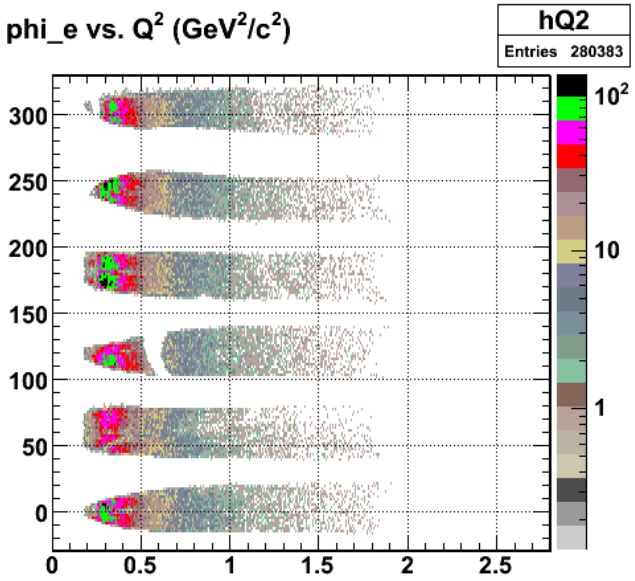


Fig 1. Acceptance with efid on for QE events, 2.6r.

Click here to view the object (ROOT C++ file for Fig 1.) you uploaded.

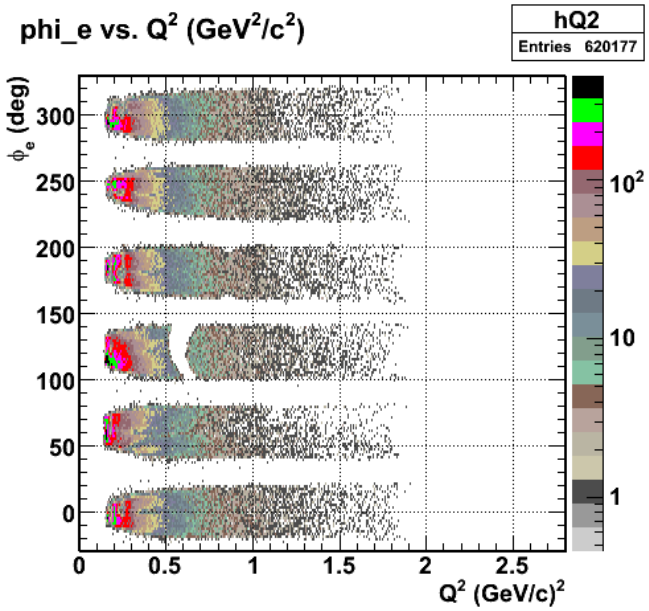


Fig 2. Acceptance with efid off for QE events, 2.6r.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 68 - JML curves (gpg)

[Modified Fri Sep 2 19:32:59 2005 (GMT) gpg]

Jean-Marc Laget has made some calculations of ALTp using his code described in a recent paper (PLB, 609 (2005) 49-56). Calculations have been done asa function of missing momentum p_m at three values of Q2 (0.70 GeV2, 1.13 GeV2, and 1.55 GeV2) for a beam energy of 2.558 GeV. The results are shown in Figure 1. There is a sharp dip at p_m~0.28 GeV/c for Q2=0.7 GeV2 which drops off at the higher Q2. The change in shape of ALTp is more rapid than what we have seen in calculations by Arenhoevel and shown in Figure 2.

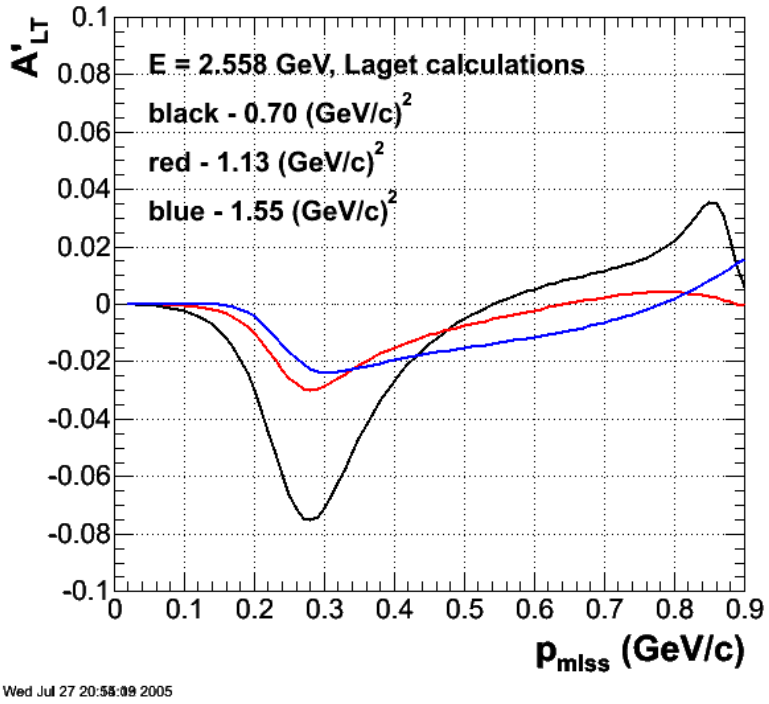


Fig 1. Comparison of JML calculations at different Q2.

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

The Arenhoevel calculation changes more slowly across a larger Q2 range than the Laget calculation. This may not be a surprise since the imit of the validity of the Arenhoevel calculation is Q2~ 1 GeV.

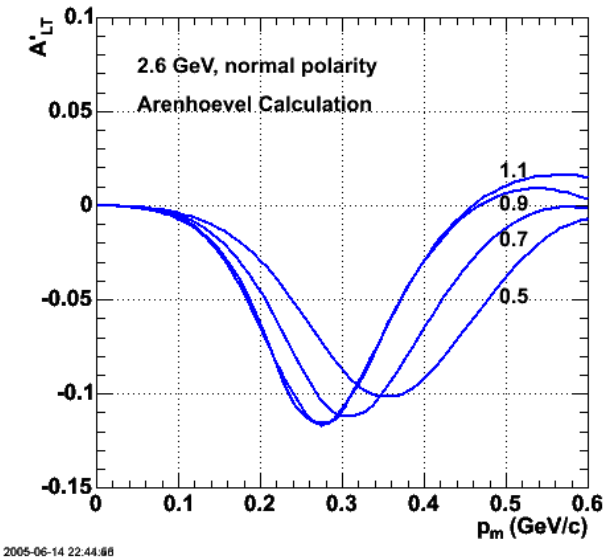


Fig 2. H.Arenhoevel calculation of ALTp as a function of missing momentum for 2.58 GeV

We have used the three calculations above to roughly average the Laget calculations over the Q2 distribution for the 2.6 GeV, normal torus polarity data. The results are shown in Fig 3. There is a dip in ALTp in the data at p_m~0.24 GeV2 which is not as wide as the Laget calculation and then a rise in the asymmetry at larger missing momentum that is not reproduced by the calculation.

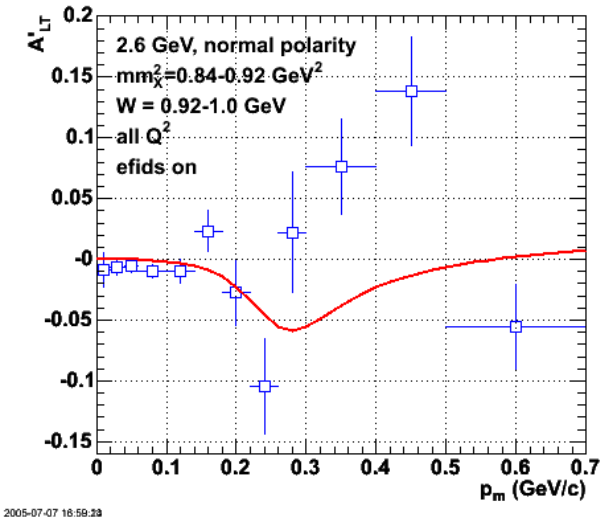


Fig 3. JML curve averaged roughly over Q2 and compared with 2.6 GeV, normal polarity data.

Click here to view the object (ROOT C++ macro file ALTp2.C for Fig 3.) you uploaded.

Click here to view the object (Mathematica notebook combiningcurves1.nb for reading in and linearly combining JML's curves for different Q2.) you uploaded.

Click here to view the object (tar file jml1.tar containing JML's curves and some of my own generated from his.) you uploaded.

The Q2 distribution used to average the Laget calculations is shown in the red curve in Figure 4. The black curve in the figure is the Q2 distribution with the electron fiducial cuts turned off.

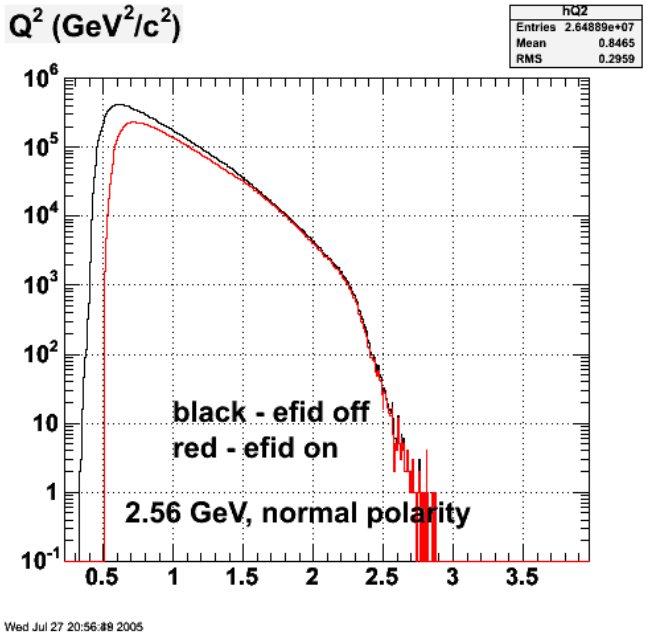


Fig 4. Q^2 distribution (red curve) used in averaging the JML curves.

Click here to view the object (ROOR C++ macro ALTp2.C for Fig 4) you uploaded.

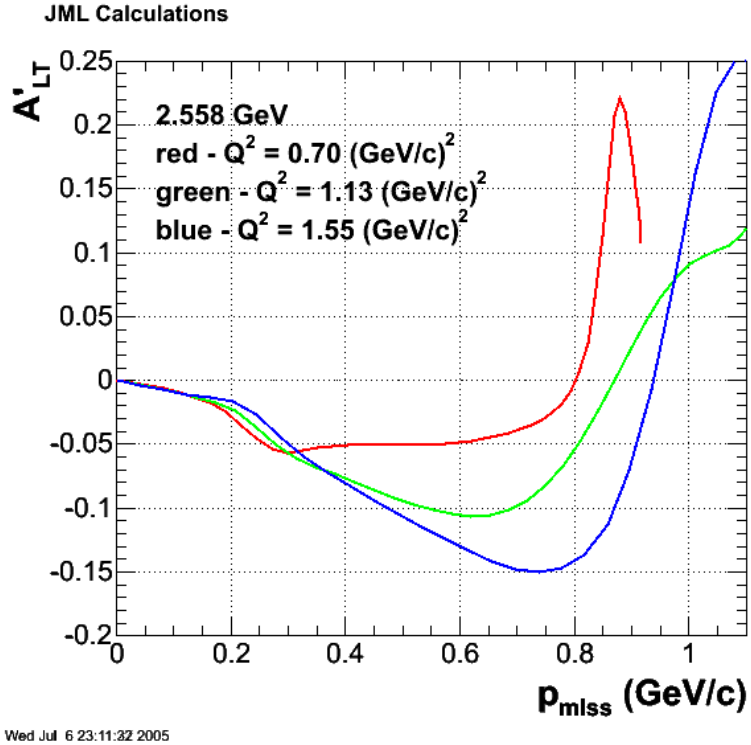


Fig 5. His first three curves he sent.

Click here to view the object (jmlALTP1.C ROOT C++ macro for Fig 5.) you uploaded.

Below is a comparison of the JML and HA calculations averaged over Q2. Both show a dip at or near p_m=0.28 GeV/c. Could this feature reflect some underlying physics. I sent JML an email asking this question.

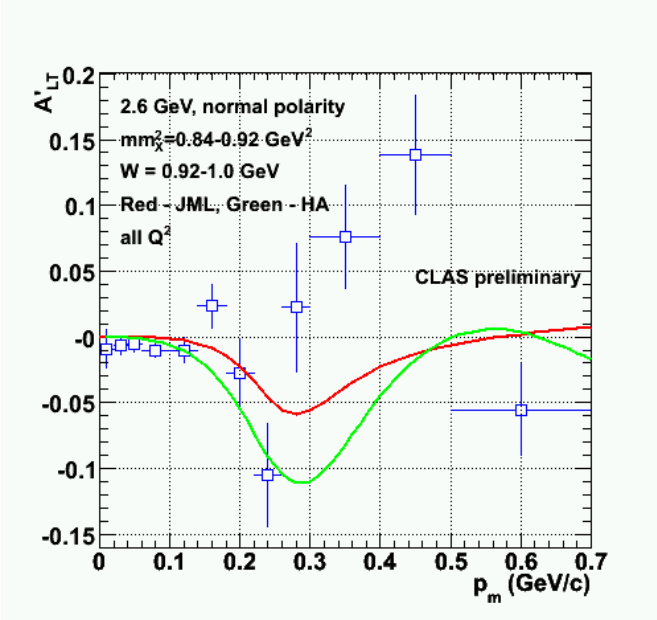


Fig. 6 Comparison of JML and HA calculations with 2.6 GeV, normal polarity data.

Click here to view the object (Mathematica code used to interpolate and Q2-average the calculations from JML and HA.) you uploaded.

Click here to view the object (tar file containing the inputs used in the Mathematica notebook above.) you uploaded.

Click here to view the object (ROOT C++ macro for Fig 6.) you uploaded.

Click here to view the object (tar file with inputs to the C++ ROOT macro used to make Fig 6) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 69 - Effect of electron momentum corrections on ALTp for 2.6r (gpg)

[Modified Fri Jul 8 05:48:42 2005 (GMT) gpg]

The plot below shows the effect of the electron momentum corrections on the fifth-structure-function asymmetry for the 2.6 GeV, reversed field polarity running conditions.

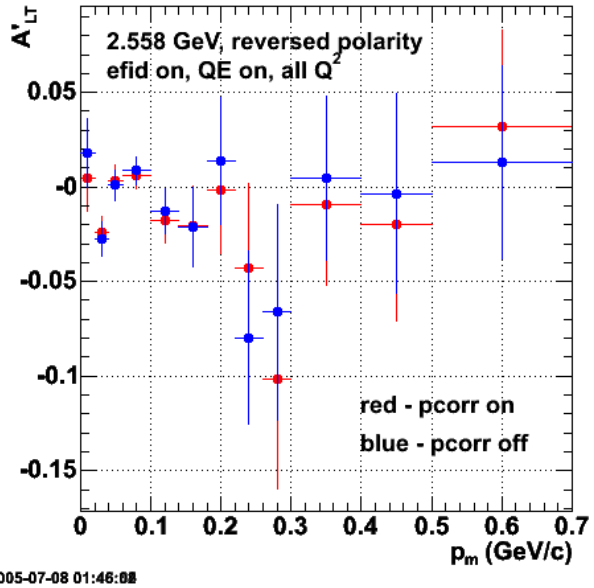


Fig 1. Comparison of ALTp with electron momentum corrections on (red) and off (blue) for 2.6r running conditions.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 70 - testing neutron ID (gpg)

[Modified Tue Jul 19 04:38:40 2005 (GMT) gpg]

The plots below are the start of my analysis of the neutron ID.

Fig 1. Plot of N- vs. p_m for wgt=1. Binning matches the usual binning for extracting ALTp.

Fig 2. Plot of N+ vs. p_m for wgt=1. Binning matches the usual binning for extracting ALTp.

Fig 3. Plot of N+ vs. p_m for wgt=sin(phi_pq). Binning matches the usual binning for extracting ALTp.

Fig 4. Plot of N- vs. p_m for wgt=sin(phi_pq). Binning matches the usual binning for extracting ALTp.

Comparison of ALTp for 2.6 GeV, normal polarity extracted using the usual method (right panel) and projecting it out of a 2D mm2 vs. N histogram and then calculating ALTp (left panel). The code for extracting ALTp with the 2D prjection method is below. The problems are obvious. Also I don't think the calculation of uncertainties in either plot is particularly trustworthy at the moment.

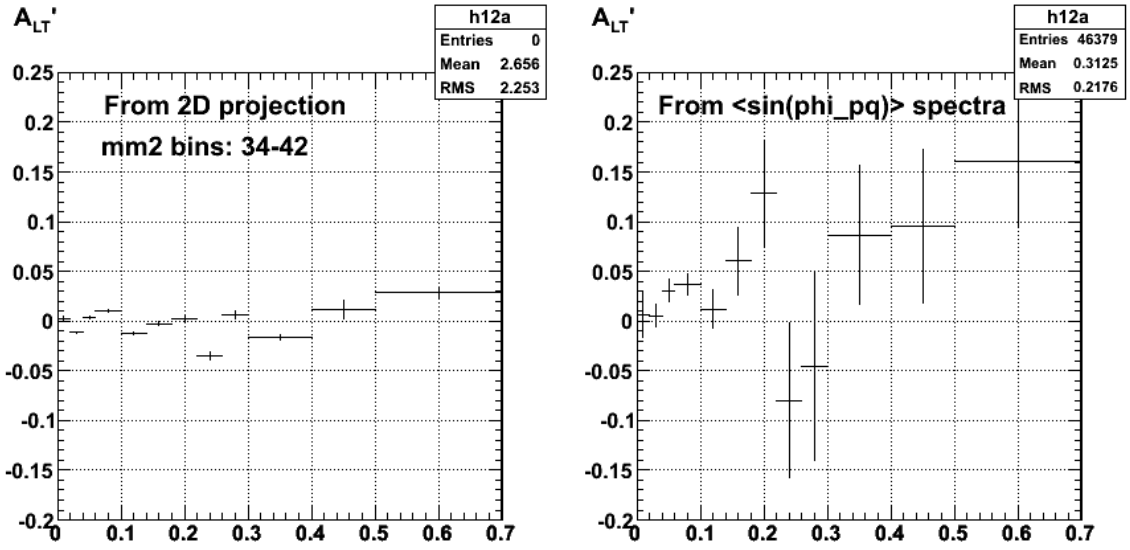


Fig 5. Comparison of ALTp for 2.6 GeV, normal polarity extracted using the usual method (right panel) and projecting it out of a 2D mm2 vs. N histogram and then calculating ALTp (left panel).

ROOT C++ macro for creating one of the input histograms for ALTp using the 2D projection method.

```
mm2bin=1;
TH1D *h1 = (TH1D*) hmm2_p_m_unwghtplus->ProjectionY("h1",mm2bin,mm2bin);
mm2bin=2;
TH1D *h2 = (TH1D*) hmm2_p_m_unwghtplus->ProjectionY("h2",mm2bin,mm2bin);
mm2bin=3;
TH1D *h3 = (TH1D*) hmm2_p_m_unwghtplus->ProjectionY("h3",mm2bin,mm2bin);
mm2bin=4;
TH1D *h4 = (TH1D*) hmm2_p_m_unwghtplus->ProjectionY("h4",mm2bin,mm2bin);
mm2bin=5;
TH1D *h5 = (TH1D*) hmm2_p_m_unwghtplus->ProjectionY("h5",mm2bin,mm2bin);
mm2bin=6;
TH1D *h6 = (TH1D*) hmm2_p_m_unwghtplus->ProjectionY("h6",mm2bin,mm2bin);
mm2bin=7;
TH1D *h7 = (TH1D*) hmm2_p_m_unwghtplus->ProjectionY("h7",mm2bin,mm2bin);
mm2bin=8;
TH1D *h8 = (TH1D*) hmm2_p_m_unwghtplus->ProjectionY("h8",mm2bin,mm2bin);
mm2bin=9;
TH1D *h9 = (TH1D*) hmm2_p_m_unwghtplus->ProjectionY("h9",mm2bin,mm2bin);
mm2bin=10;
TH1D *h10 = (TH1D*) hmm2_p_m_unwghtplus->ProjectionY("h10",mm2bin,mm2bin);
mm2bin=11;
TH1D *h11 = (TH1D*) hmm2_p_m_unwghtplus->ProjectionY("h11",mm2bin,mm2bin);

c1_1->cd()
h1->Draw()
c1_2->cd()
h2->Draw()
c1_3->cd()
h3->Draw()
c1_4->cd()
h4->Draw()
c1_5->cd()
h5->Draw()
c1_6->cd()
```

```
h6->Draw()
c1_7->cd()
h7->Draw()
c1_8->cd()
h8->Draw()
c1_9->cd()
h9->Draw()
c1_10->cd()
h10->Draw()
c1_11->cd()
h11->Draw()

c1_12->cd()
c1_12->Range(0.375,-37.3026,1.625,273.553);

tex = new TLatex(0.556593,193.813,"2.6 GeV");
tex->SetTextSize(0.1);
tex->SetLineWidth(2);
tex->Draw();

tex = new TLatex(0.540322,155.387,"Normal polarity");
tex->SetTextSize(0.1);
tex->SetLineWidth(2);
tex->Draw();

tex = new TLatex(0.540322,111.721,"h=+1");
tex->SetTextSize(0.1);
tex->SetLineWidth(2);
tex->Draw();
```

Once you have the histograms use the following ROOT macro to get ALTp.

```
mm2binlo=34;
mm2binhi=42;
TH1D *huplus = (TH1D*) hmm2_p_m_unwghtplus->ProjectionX("huplus",mm2binlo,mm2binhi);
TH1D *huminus = (TH1D*) hmm2_p_m_unwghtminus->ProjectionX("huminus",mm2binlo,mm2binhi);
TH1D *hwminus = (TH1D*) hmm2_p_m_sin_phi_wghtminus->ProjectionX("hwminus",mm2binlo,mm2binhi);
TH1D *hwplus = (TH1D*) hmm2_p_m_sin_phi_wghtplus->ProjectionX("hwplus",mm2binlo,mm2binhi);

int n_varp_mbins = 12;
Float_t p_m_bin_edges[13]={0.0,0.02,0.04,0.06,0.10,0.14,0.18,0.22,0.26,0.30,0.40,0.50,0.70};
TH1F *h1a = new TH1F("h1a","Sin(#phi) weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
TH1F *h2a = new TH1F("h2a","Sin(#phi) weighted distribution for negative helicity",n_varp_mbins,p_m_bin_edges);
h1a.Sumw2();
h2a.Sumw2();
h1a.Divide(hwplus,huplus);
h2a.Divide(hwminus,huminus);
TH1F *h12a = new TH1F("h12a","A_{LT}'",n_varp_mbins,p_m_bin_edges);
h12a.Sumw2();
h12a.Add(h1a,h2a,1.0,-0.9994);
h12a.Draw();
```

Fix some stuff (i.e. both should have QE cut!) and things looks much better. This still have to be improved because these two methods should agree exactly since they come from the same data.

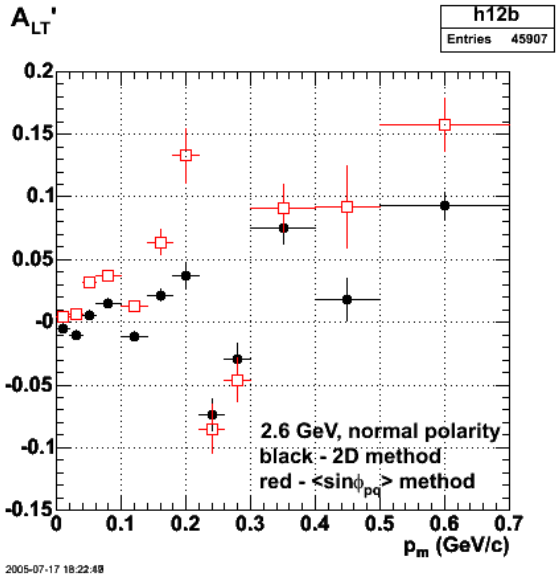


Fig 6. Comparison of ALTp for 2.6 GeV, normal polarity extracted using the usual method (red) and projecting it out of a 2D mm2 vs. N histogram and then calculating ALTp (black).

Some more tests. Compare the different spectra going into the calculation of ALTp when using the mm2 cut or projecting them out from the mm2 2D histogram.

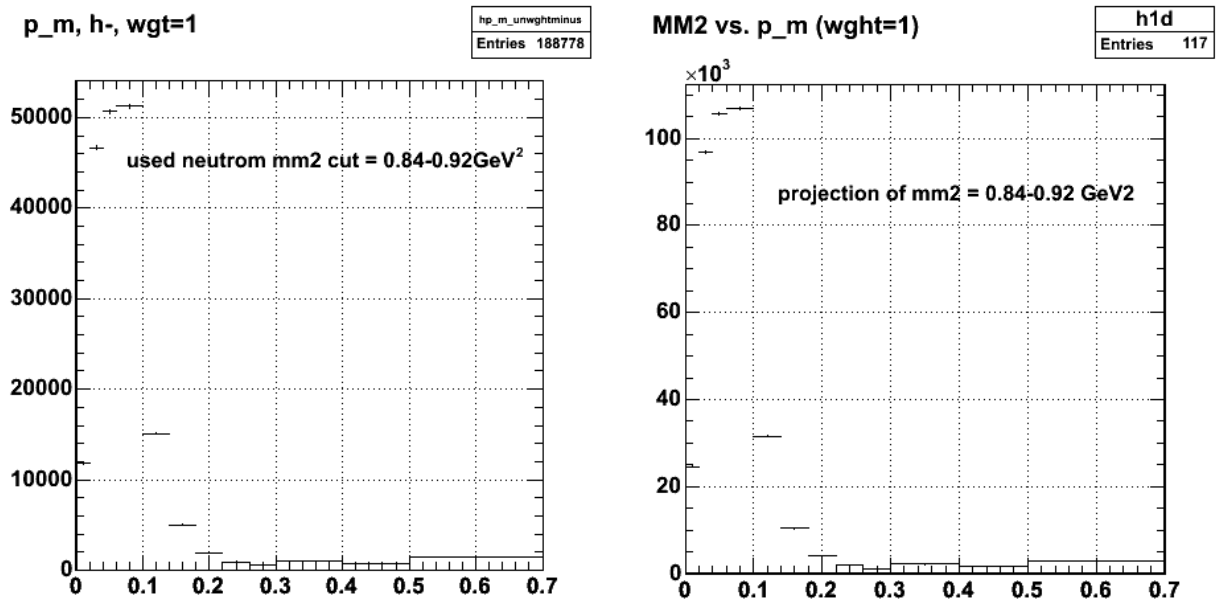


Fig 9. Comparison of the wght=1 spectra N- for the mass cut mm2=0.84-0,92 GeV2 (left panel) and the projection from the 2D mm2 vs. p_m using mm2=0.84-0.92 GeV2 (right panel)

Click here to view the object (ROOT C++ macro for Fig 9.) you uploaded.

Click here to view the object (ROOT histogram file used for Fig 9.) you uploaded.

Change the way the weights are handled when the histograms are incremented from sumW2 to simple addition of the weights. The ROOT histogram file is just below.

Click here to view the object (Root histogram file containing histograms WITHOUT sumW2 for the 2D mM2 vs. p_m hists like used in Fig 9.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 71 - Rusty's results for 2.6r pcorr (gpg)

[Modified Thu Jul 21 14:49:45 2005 (GMT) gpg]

Rusty has generated the following results for the 2.6 GeV, reversed field, momentum corrections using the Pitt method. The table below shows his results for the W2 spectra sector by sector for the reaction ep->e'X and fitting the proton peak.

The results below are for the missing mass of the reaction ep->e'pi+X and fitting the neutron peak.

The routine he wrote is below.

```
Double_t eod5::pcorr_RB26r(Float_t pmeas, Float_t theta_ep, Float_t phi_ep, Float_t q_ep)
{
  // This function corrects the electron and proton momenta.

  Double_t pcorr, bee, qbpmeas, qbpmeas_e, alpha, beta;
  int tbin, phibin;

  // constants

  Double_t torus_current=2250.0;



  // array of fit results - 24 phi bins, 16 theta bins, 9 quantities
  // each element has theta, theta_bin, phi, phi_bin, y-int, d(y-int), slope, d(slope), chisquare

  float testunc, testcor, diff, pce, calccore, diff1, diff2;
  float fit_results[24][16][9]={
    {
      //new array 6-21-05  uncorrected momentum, "straight" eod5.C (straight = PDGproton really is proton)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 {19, 3, 0, 0, 0.000969004, 6.81512e-05, -0.00380579, 0.00025235, 2.28699},
 {23, 4, 0, 0, 0.000531768, 5.08049e-05, -0.00506124, 0.000176358, 67.9093},
 {27, 5, 0, 0, 6.59499e-05, 7.28852e-05, -0.0057856, 0.000238988, 24.2468},
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 tbin = int((theta_ep - 7.0)/4);
 phibin= int((phi_ep + 180.0)/15);

 bee = torus_current/3860.0;
 qbpmeas = q_ep*bee/pmeas;

 alpha = fit_results[phibin][tbin][4];
 beta = fit_results[phibin][tbin][6];

 pcorr = q_ep*bee*(1 + beta)/(qbpmeas - alpha);

 pce = Ebeam/(1+(2*Ebeam*(pow(sin(theta_ep*0.0174533/2),2))/Mn));
 calccore =(-1*(bee))/(pce);
 testunc = q_ep*bee/pcorr;
 testcor = q_ep*bee/pce;
 diff = testunc - testcor;
 diff1 = pmeas - pce;
 diff2 = pcorr - pce;
```

```
  //cout << "pcorr_e=" << pcorr << "  pce=" << pce << "  calccore=" << calccore << endl;


//   if (phibin == 4 && tbin == 2) {
//     cout << "pmeas=" << pmeas << " pcorr=" << pcorr << " q=" << q_ep << " pce=" << pce << endl;
//     cout << "qbpu=" << testunc << " qbpc=" << testcor << " diff=" << diff << endl;
//     cout << "pm - pe = " << diff1 << "  pc - pe = " << diff2 << endl;
//     cout << "alpha=" << alpha << " beta=" << beta << " theta=" << theta_ep << " phi=" << phi_ep << endl;
//     cout << "phibin=" << phibin << " tbin=" << tbin << endl << endl;
//   }

  return pcorr;
}
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 72 - tests of 4.2 GeV efids (gpg)

[Modified Fri Sep 9 02:48:38 2005 (GMT) gpg]

Tests of 4.2 GeV efids are below.

Click here to view the object (Fig 1. Electron acceptance plot with efids OFF (despite the labeling of the plot) at 4.2 GeV) you uploaded.

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

Click here to view the object (Fig 2. Electron acceptance plot with efids ON at 4.2 GeV, sector 1) you uploaded.

Looking at the code I realized that the requirement that all events be greater than t0 (the angle where the singularity occurs in the function defining the edge of the stable acceptance region) had been turned off. Turning it back on cleared up the small number of errant events seen in Fig 2.

Click here to view the object (Fig 3. Electron acceptance plot, sector 1.) you uploaded.

Click here to view the object (Fig 4. Electron acceptance plot, sector 2.) you uploaded.

Click here to view the object (Fig 5. Electron acceptance plot, sector 3.) you uploaded.

Click here to view the object (Fig 6. Electron acceptance plot, sector 4.) you uploaded.

Click here to view the object (Fig 7. Electron acceptance plot, sector 5.) you uploaded.

Click here to view the object (Fig 8. Electron acceptance plot, sector 6.) you uploaded.

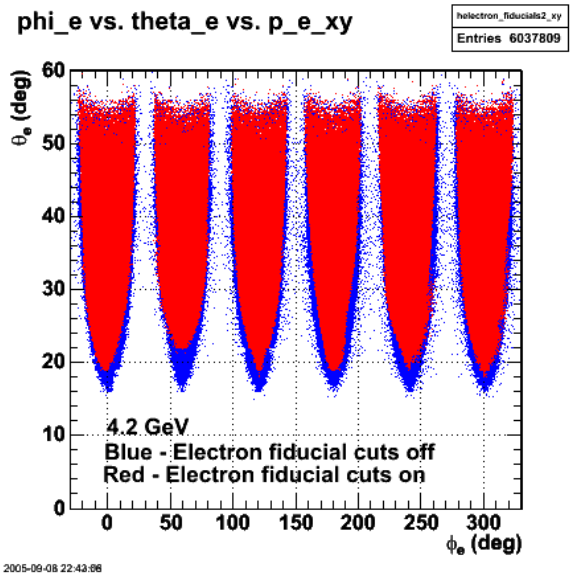

Fig 9. Plot of electron acceptance showing effect of turning efids on for 4.2 GeV.

Click here to view the object (ROOT C++ macro for Fig 9) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 73 - ALTp at 4.2 GeV (gpg)

[Modified Mon Jan 2 22:42:16 2006 (GMT) gpg]

Plots below related to ALTp at 4.2 GeV setting of the E5 data set.

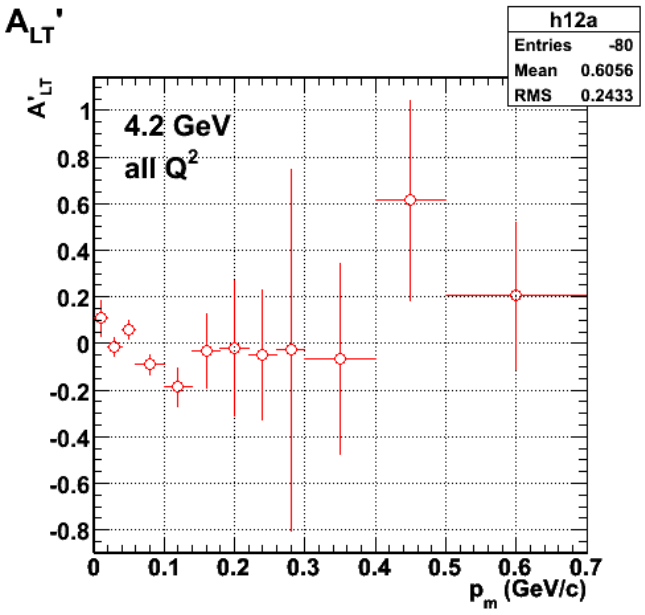

Fig 1. Initial pass at ALTp. This plot has way too few counts in it!!

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

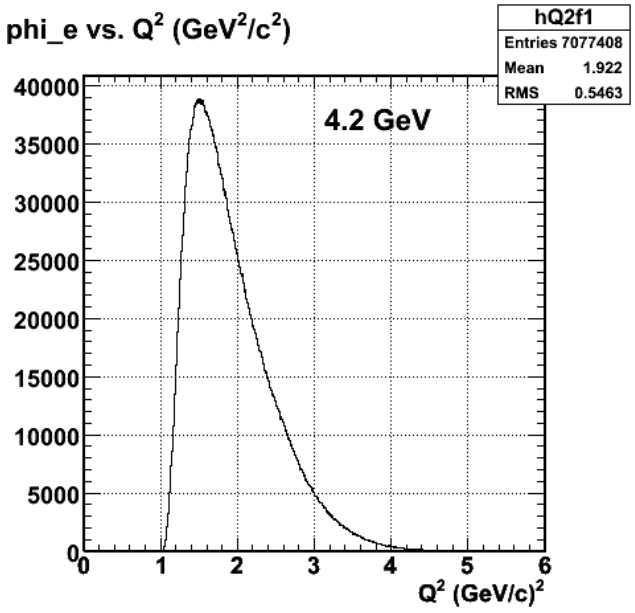

Fig 2. Distribution of Q^2 for 4.2 GeV electron singles events. Electron fiducial cuts are on

To try to improve the statistics, I expanded the bin sizes to that shown in Fig 3. There is still a nagging hint of structure at large p_m, but the statistics are lousy.

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

Click here to view the object (Latest (7/29/05:13:57 version of histogram file for ALTp that I haven't analyzed yet.) you uploaded.

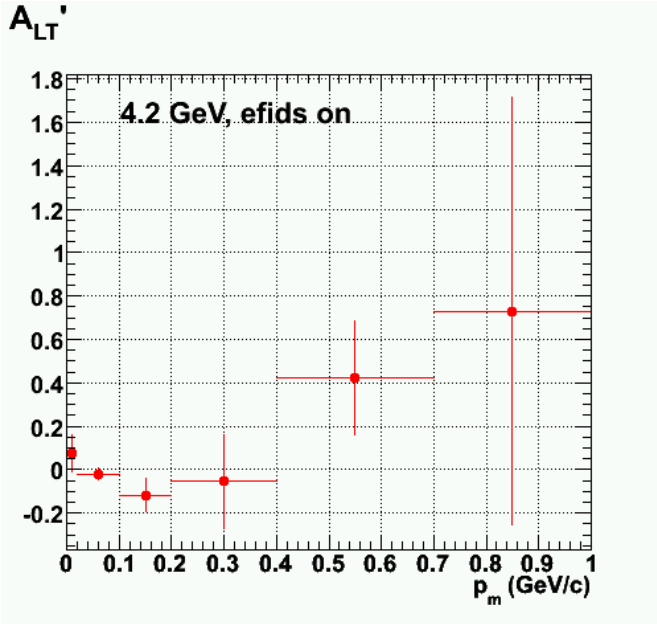

Fig 3. Same as Figure 1 with different bin sizes.

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.

In an attempt to improve the statistics, I have starting removing kinematics cuts. The Figure below shows the result of turning off the electron fiducials. Basically, ALTp is zero here.

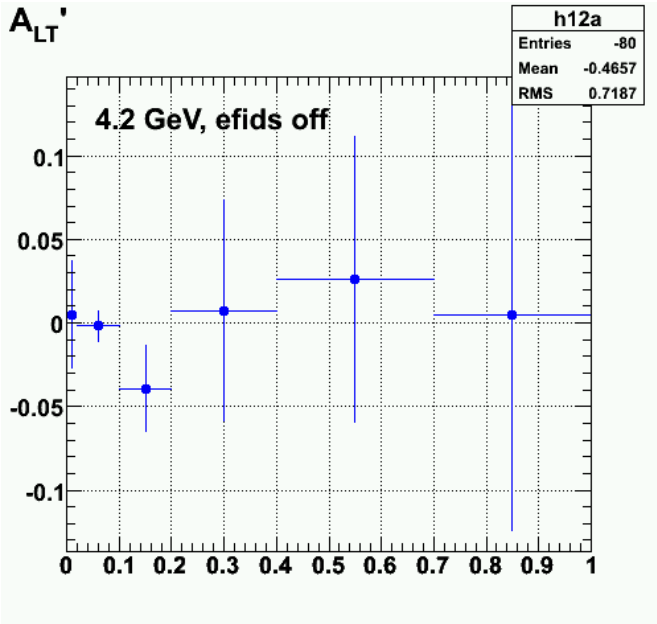

Fig 4. Same as Figure 1 with electron fiducial cuts turned off to increase the number of counts.

Click here to view the object (ROOT C++ macro for Fig 4) you uploaded.

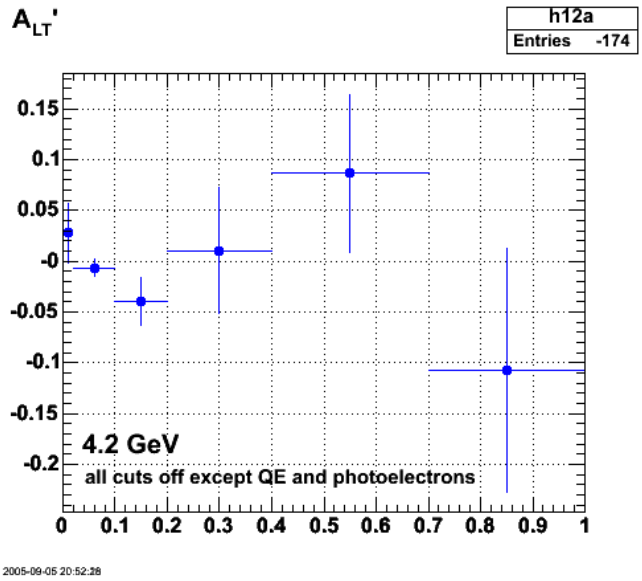

Fig 5. ALTp for 4.2 GeV with all the cuts off except QE, the number of photoelectron (N>25), and the target and event selection

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

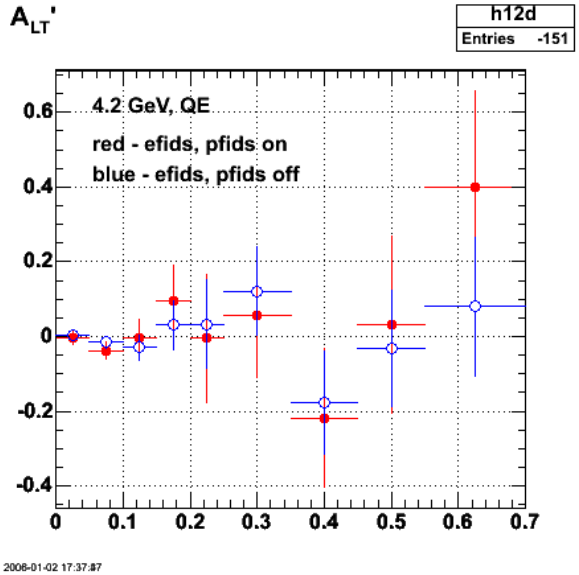

Fig 6. Comparison of QE ALTp for efids pfids on (red) and off(blue).

Click here to view the object (ROOT C++ macro for Fig 6) you uploaded.

Click here to view the object (ROOT histogram fiel for Fig 6.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 74 - code to fit W2 spectra (gpg)

[Modified Fri Jul 29 20:10:40 2005 (GMT) gpg]

Code below is to fit W2 spectra to test effect of momentum corrections.

```
 TCanvas *c1 = new TCanvas("c1", "c1",40,5,1000,700);
c1->Divide(3,2)
gStyle->SetOptFit(1);
gStyle->SetStatW(0.40);
gStyle->SetStatH(0.40);
gStyle->SetStatX(0.90);
gStyle->SetStatY(0.850);
float W2lo=0.82, W2hi=0.92;
int rlo=41, rhi=200;
int philo, phihi;
c1_1->cd();
c1_1->SetLeftMargin(0.15);
philo = 1;
phihi = 60;
W2lo = 0.81;
W2hi= 0.92;
TH1F *hs1 = (TH1F*) hW2_phi1->ProjectionY("hs1",philo,phihi);
hs1->GetXaxis()->SetRange(rlo, rhi);
hs1->Draw();
hs1->Fit("gaus","","",W2lo,W2hi);
c1_2->cd();
c1_2->SetLeftMargin(0.15);
philo = 61;
phihi = 120;
W2lo = 0.75;
W2hi= 0.92;
TH1F *hs2 = (TH1F*) hW2_phi1->ProjectionY("hs1",philo,phihi);
hs2->GetXaxis()->SetRange(rlo, rhi);
hs2->Draw();
hs2->Fit("gaus","","",W2lo,W2hi);
   tex = new TLatex(1.0,30.0,"4.2 GeV, uncorrected");
   tex->SetTextFont(132);
   tex->SetTextSize(0.05);
   tex->SetLineWidth(2);
   tex->Draw();
c1_3->cd();
c1_3->SetLeftMargin(0.15);
philo = 121;
phihi = 180;
W2lo = 0.83;
W2hi= 0.93;
TH1F *hs3 = (TH1F*) hW2_phi1->ProjectionY("hs1",philo,phihi);
hs3->GetXaxis()->SetRange(rlo, rhi);
hs3->Draw();
hs3->Fit("gaus","","",W2lo,W2hi);
c1_4->cd();
c1_4->SetLeftMargin(0.15);
philo = 181;
phihi = 240;
W2lo = 0.82;
W2hi= 0.92;
TH1F *hs4 = (TH1F*) hW2_phi1->ProjectionY("hs1",philo,phihi);
hs4->GetXaxis()->SetRange(rlo, rhi);
hs4->Draw();
hs4->Fit("gaus","","",W2lo,W2hi);
c1_5->cd();
c1_5->SetLeftMargin(0.15);
philo = 241;
phihi = 300;
W2lo = 0.82;
W2hi= 0.92;
TH1F *hs5 = (TH1F*) hW2_phi1->ProjectionY("hs1",philo,phihi);
hs5->GetXaxis()->SetRange(rlo, rhi);
hs5->Draw();
hs5->Fit("gaus","","",W2lo,W2hi);
c1_6->cd();
c1_6->SetLeftMargin(0.15);
philo = 301;
phihi = 360;
W2lo = 0.82;
W2hi= 0.92;
TH1F *hs6 = (TH1F*) hW2_phi1->ProjectionY("hs1",philo,phihi);
hs6->GetXaxis()->SetRange(rlo, rhi);
hs6->Draw();
hs6->Fit("gaus","","",W2lo,W2hi);



TCanvas *c1 = new TCanvas("c1", "c1",40,5,1000,700);
c1->Divide(3,2)
gStyle->SetOptFit(1);
gStyle->SetStatW(0.40);
gStyle->SetStatH(0.40);
gStyle->SetStatX(0.90);
gStyle->SetStatY(0.850);
float W2lo=0.82, W2hi=0.92;
int rlo=41, rhi=200;
```

```
int philo, phihi;
c1_1->cd();
c1_1->SetLeftMargin(0.15);
philo = 1;
phihi = 60;
W2lo = 0.81;
W2hi= 0.92;
TH1F *hs1 = (TH1F*) hW2_phi2->ProjectionY("hs1",philo,phihi);
hs1->GetXaxis()->SetRange(rlo, rhi);
hs1->Draw();
hs1->Fit("gaus","","",W2lo,W2hi);
c1_2->cd();
c1_2->SetLeftMargin(0.15);
philo = 61;
phihi = 120;
W2lo = 0.75;
W2hi= 0.92;
TH1F *hs2 = (TH1F*) hW2_phi2->ProjectionY("hs1",philo,phihi);
hs2->GetXaxis()->SetRange(rlo, rhi);
hs2->Draw();
hs2->Fit("gaus","","",W2lo,W2hi);
   tex = new TLatex(1.0,30.0,"4.2 GeV, corrected");
   tex->SetTextFont(132);
   tex->SetTextSize(0.05);
   tex->SetLineWidth(2);
   tex->Draw();
c1_3->cd();
c1_3->SetLeftMargin(0.15);
philo = 121;
phihi = 180;
W2lo = 0.83;
W2hi= 0.93;
TH1F *hs3 = (TH1F*) hW2_phi2->ProjectionY("hs1",philo,phihi);
hs3->GetXaxis()->SetRange(rlo, rhi);
hs3->Draw();
hs3->Fit("gaus","","",W2lo,W2hi);
c1_4->cd();
c1_4->SetLeftMargin(0.15);
philo = 181;
phihi = 240;
W2lo = 0.82;
W2hi= 0.92;
TH1F *hs4 = (TH1F*) hW2_phi2->ProjectionY("hs1",philo,phihi);
hs4->GetXaxis()->SetRange(rlo, rhi);
hs4->Draw();
hs4->Fit("gaus","","",W2lo,W2hi);
c1_5->cd();
c1_5->SetLeftMargin(0.15);
philo = 241;
phihi = 300;
W2lo = 0.82;
W2hi= 0.92;
TH1F *hs5 = (TH1F*) hW2_phi2->ProjectionY("hs1",philo,phihi);
hs5->GetXaxis()->SetRange(rlo, rhi);
hs5->Draw();
hs5->Fit("gaus","","",W2lo,W2hi);
c1_6->cd();
c1_6->SetLeftMargin(0.15);
philo = 301;
phihi = 360;
W2lo = 0.82;
W2hi= 0.92;
TH1F *hs6 = (TH1F*) hW2_phi2->ProjectionY("hs1",philo,phihi);
hs6->GetXaxis()->SetRange(rlo, rhi);
hs6->Draw();
hs6->Fit("gaus","","",W2lo,W2hi);
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 75 - my pcorr1 at 4.2 GeV (gpg)

[Modified Tue Aug 2 18:44:38 2005 (GMT) gpg]

Below are some results of looking at pcorr1 momentum corrections (Pitt methods).

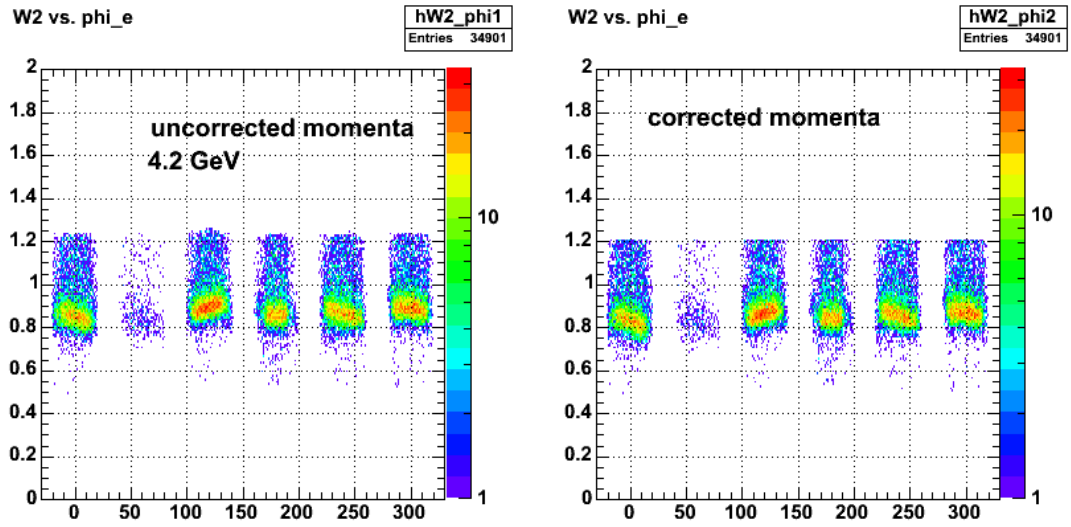

Fig 1. W^2 vs. phi_e for uncorrected (left panel) and corrected (right panel) electron momentum from Pitt methods, 4.2 GeV.

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

Results from fitting the W2 spectrum sector by sector. Basically, they suck. The corrected centroids and widths are worse than the uncorrected ones! For the second shot at them I think I turned off the electron fiducials.

Table 1.

	uncorrected		corrected #1		corrected #2	
Sector	centroid	width	centroid	width	centroid	width
1	0.8488	0.04771	0.7988	0.06696	0.8220	0.05663
2	0.8322	0.05290	0.8391	0.05604	0.8267	0.06079
3	0.8929	0.03687	0.9031	0.05069	0.8625	0.04217
4	0.8575	0.04060	0.8237	0.05855	0.8336	0.05265
5	0.8635	0.04240	0.8356	0.05342	0.8531	0.04233
6	0.8847	0.03510	0.8805	0.03696	0.8678	0.03819

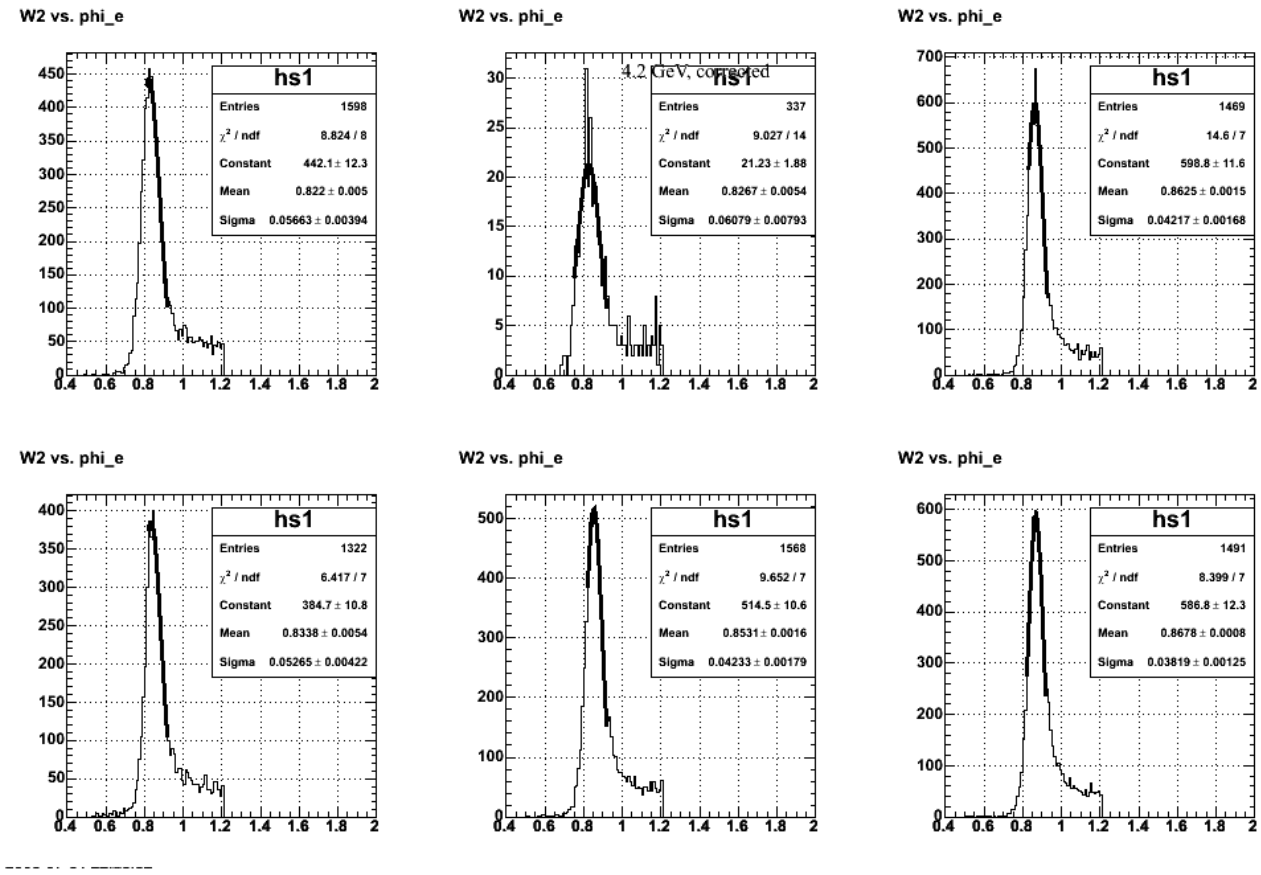

Fig 2. W^2 spectra fitted with gaussians for the results labeled 'corrected #2' in the above table.

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

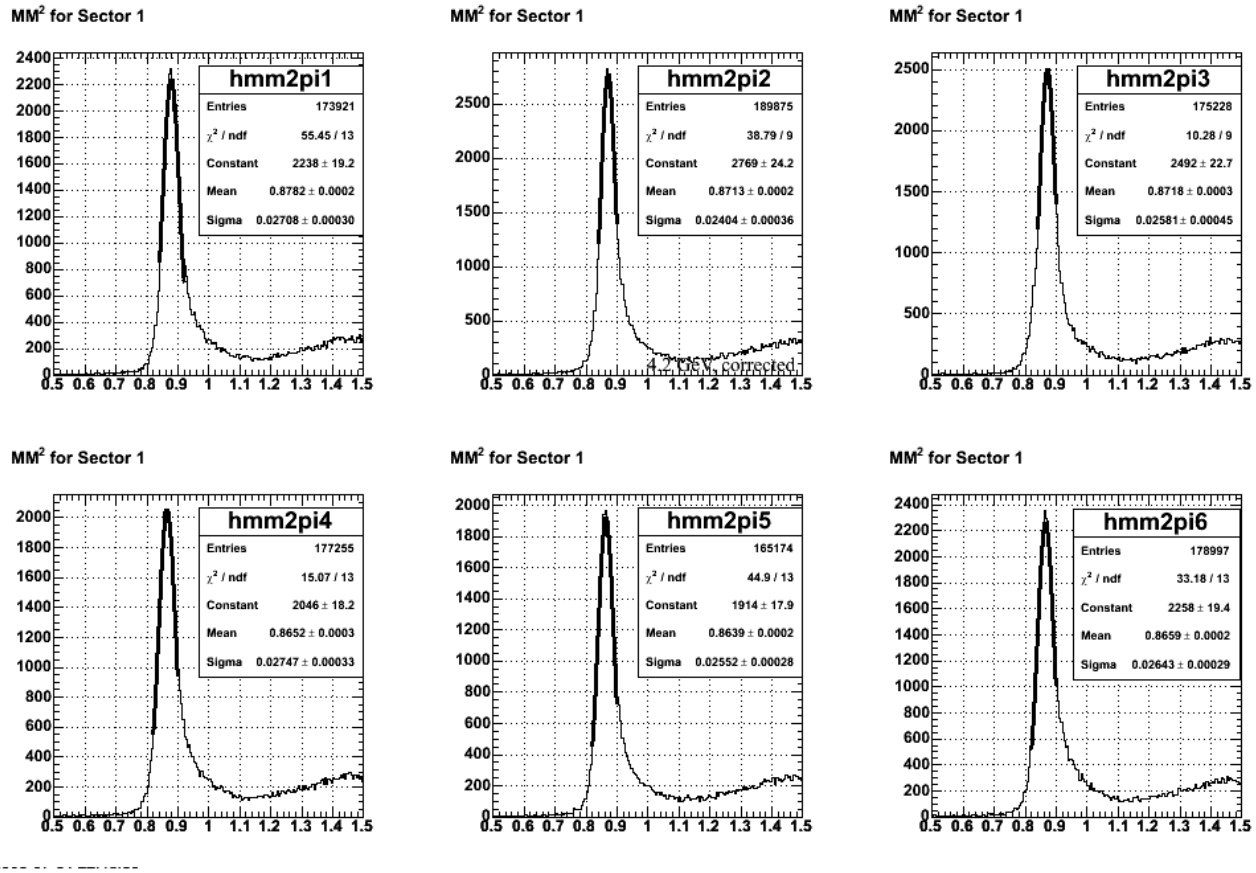

Fig 3. MM2 spectra using corrected electron and pion momenta.

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.

Click here to view the object (ROOT histogram file for Fig 3) you uploaded.

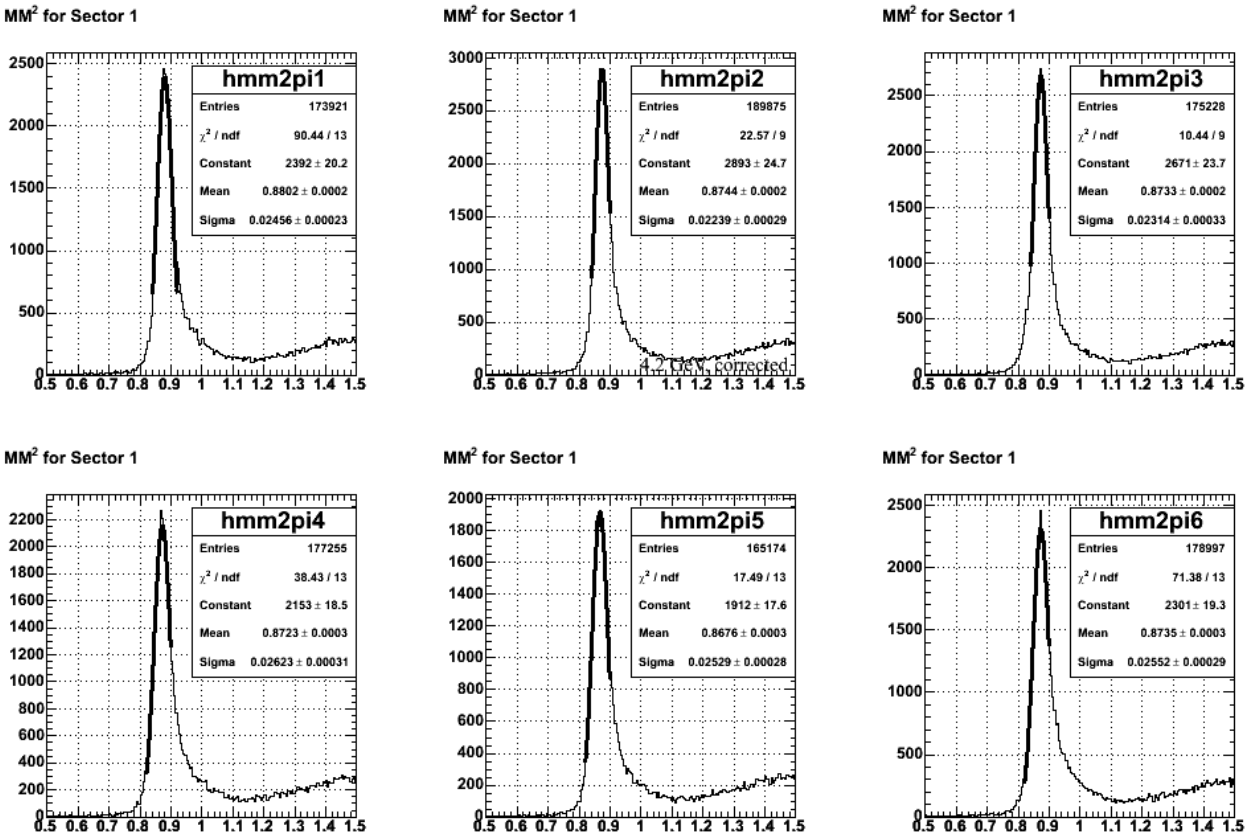

Fig 4. Uncorrected MM2 spectra to go along with Fig 3.

For the above set of parameters (i.e. for Figs 3-4) here is a table comparing the MM2 centroid and width of the ep->epi+(n) peak corrected and uncorrected. Same problem as before! The corrected results are worse than the corrected ones, though not as much worse as the W2 results.

Table 2.

	corrected		uncorrected	
Sector	centroid	width	centroid	width
1	0.8782	0.02708	0.8802	0.02456
2	0.8713	0.02404	0.8744	0.02239
3	0.8718	0.02581	0.8733	0.02314
4	0.8652	0.02747	0.8723	0.02623
5	0.8639	0.02552	0.8676	0.02529
6	0.8659	0.02643	0.8735	0.02552

The pcorr1 parameters from this latest run (7/30/05) are noticeably different from the current set so I save them below since I may try this set later.

Using those parameters from below later does make things better. I see improvements in centroid and width in some sectors and things get a little worse in others. The final comparison is below follwed by the plots and files. The table below includes the latest results using the parameters at the end of this entry, plus the results from above.

Table 3.

	W2 uncorrected		W2 corrected #1		W2 corrected #2		W2 corrected #3	
Sector	centroid	width	centroid	width	centroid	width	centroid	width
1	0.8488	0.04771	0.7988	0.06696	0.8220	0.05663	0.8894	0.04873
2	0.8322	0.05290	0.8391	0.05604	0.8267	0.06079	0.8453	0.04997
3	0.8929	0.03687	0.9031	0.05069	0.8625	0.04217	0.9376	0.03925
4	0.8575	0.04060	0.8237	0.05855	0.8336	0.05265	0.8925	0.04079
5	0.8635	0.04240	0.8356	0.05342	0.8531	0.04233	0.8972	0.0406
6	0.8847	0.03510	0.8805	0.03696	0.8678	0.03819	0.9186	0.03948
Average	0.8633	0.04260	0.8468	0.05377	0.8443	0.04879	0.8968	0.04313

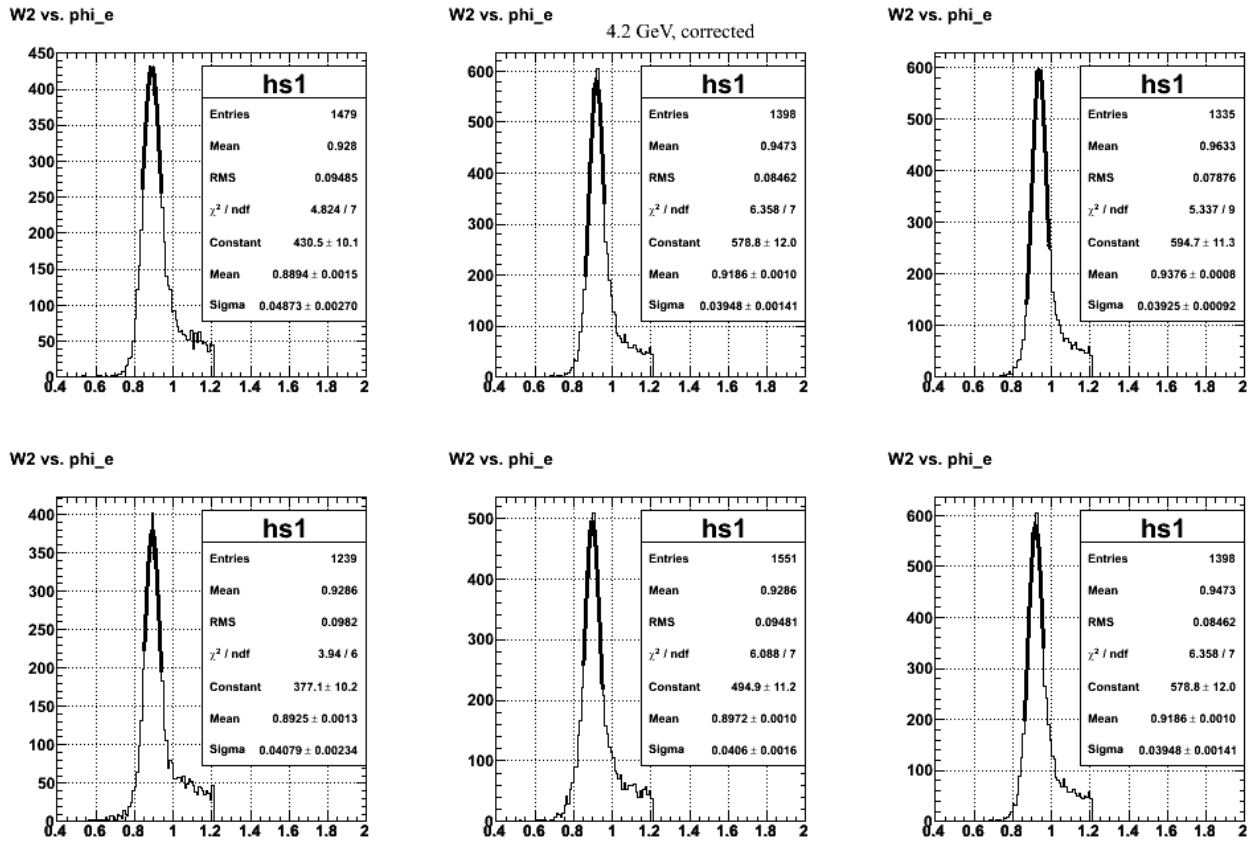

Fig 5. Fits to corrected W^2 spectra using the table of parameters at the end of this entry

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

Click here to view the object (ROOT histogram file used for Fig 5) you uploaded.

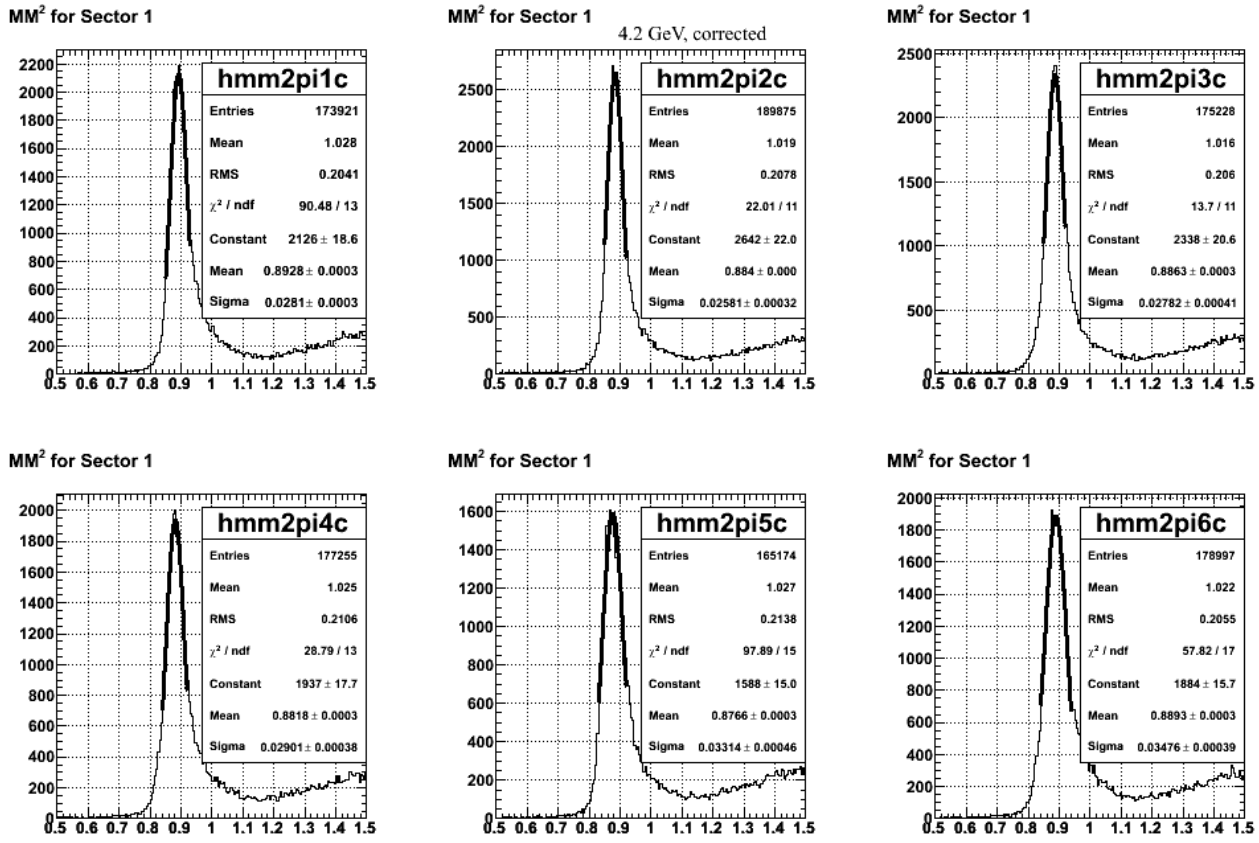

Fig 6. MM2 spectra sector-by-sector using the pcorr1 parameters from the table below for 4.2 GeV

Click here to view the object (ROOT C++ macro for Fig 6) you uploaded.

The tabel below shows a comparison of the fits to MM2 spectra. The last two columns are the latest results using the pcorr1 parameters at the end of this entry. The numbering corresponds to the parameter sets used in Table 3 above. The centroids and widths are better than the previous results with some improvement in spots and a little worse in others. Clearly better than the first set of parameters.

Table 4.

	MM2 corrected #2		MM2 uncorrected		MM2 corrected #3	
Sector	centroid	width	centroid	width	centroid	width
1	0.8782	0.02708	0.8802	0.02456	0.8928	0.0281
2	0.8713	0.02404	0.8744	0.02239	0.8840	0.02581
3	0.8718	0.02581	0.8733	0.02314	0.8863	0.02782
4	0.8652	0.02747	0.8723	0.02623	0.8818	0.02901
5	0.8639	0.02552	0.8676	0.02529	0.8766	0.03314
6	0.8659	0.02643	0.8735	0.02552	0.8893	0.03476
Average	0.8694	0.02606	0.8736	0.02452	0.8853	0.02556

Revised parameters for pcorr1.

```
++++++ {7, 0, 0, 0, 0, 0, 0, 0, 0},
++++++ {11, 1, 0, 0, 0, 0, 0, 0, 0},
++++++ {15, 2, 0, 0, 0, 0, 0, 0, 0},
++++++ {19, 3, 0, 0, 0, 0, 0, 0, 0},
++++++ {23, 4, 0, 0, 0.000800178, 0.000163694, -0.00350192, 0.000519054, 0.118025},
++++++ {27, 5, 0, 0, 0.00130217, 9.5631e-05, -0.00146504, 0.000297953, 26.8164},
++++++ {31, 6, 0, 0, 0.001396, 8.41374e-07, 0.00163243, 2.27398e-06, 0.410251},
++++++ {35, 7, 0, 0, 0.00179711, 0.000148351, 0.00135585, 0.000406387, 4.78983},
++++++ {39, 8, 0, 0, 0.00218354, 0.000182136, 0.00282338, 0.000489386, 7.26911},
++++++ {43, 9, 0, 0, 0.00215916, 0.000293966, 0.00244981, 0.00075624, 3.3616},
++++++ {47, 10, 0, 0, 0.0010022, 1.47429e-10, -0.00195648, 2.89076e-10, 0.224626},
++++++ {51, 11, 0, 0, 0, 0, 0, 0, 0},
++++++ {55, 12, 0, 0, 0, 0, 0, 0, 0},
++++++ {59, 13, 0, 0, 0, 0, 0, 0, 0},
++++++ {63, 14, 0, 0, 0, 0, 0, 0, 0},
++++++ {67, 15, 0, 0, 0, 0, 0, 0, 0},
++++++ {7, 0, 15, 1, 0, 0, 0, 0, 0},
++++++ {11, 1, 15, 1, 0, 0, 0, 0, 0},
++++++ {15, 2, 15, 1, 0, 0, 0, 0, 0},
++++++ {19, 3, 15, 1, 0, 0, 0, 0, 0},
++++++ {23, 4, 15, 1, 0, 0, 0, 0, 0},
++++++ {27, 5, 15, 1, 0, 0, 0, 0, 0},
++++++ {31, 6, 15, 1, 0, 0, 0, 0, 0},
```

```
++++++ {35, 7, 15, 1, 0, 0, 0, 0, 0},
++++++ {39, 8, 15, 1, 0, 0, 0, 0, 0},
++++++ {43, 9, 15, 1, 0, 0, 0, 0, 0},
++++++ {47, 10, 15, 1, 0, 0, 0, 0, 0},
++++++ {51, 11, 15, 1, 0, 0, 0, 0, 0},
++++++ {55, 12, 15, 1, 0, 0, 0, 0, 0},
++++++ {59, 13, 15, 1, 0, 0, 0, 0, 0},
++++++ {63, 14, 15, 1, 0, 0, 0, 0, 0},
++++++ {67, 15, 15, 1, 0, 0, 0, 0, 0},
++++++ {7, 0, 30, 2, 0, 0, 0, 0, 0},
++++++ {11, 1, 30, 2, 0, 0, 0, 0, 0},
++++++ {15, 2, 30, 2, 0, 0, 0, 0, 0},
++++++ {19, 3, 30, 2, 0, 0, 0, 0, 0},
++++++ {23, 4, 30, 2, 0, 0, 0, 0, 0},
++++++ {27, 5, 30, 2, 0.00104365, 8.99325e-11, -0.003085, 2.90105e-10, 33.1564},
++++++ {31, 6, 30, 2, 0.00100407, 7.35972e-11, 0.00269171, 1.98911e-10, 9.79755},
++++++ {35, 7, 30, 2, 0.00101216, 7.35972e-11, -0.00240936, 1.79505e-10, 1.49161},
++++++ {39, 8, 30, 2, 0.002, 2.37143e-10, -4.35074e-15, 5.44535e-10, 72},
++++++ {43, 9, 30, 2, 0.000167452, 0.000529578, -0.00166277, 0.00132493, 0.590544},
++++++ {47, 10, 30, 2, -0.000704167, 0.000605806, -0.000530977, 0.00149722, 0.354655},
++++++ {51, 11, 30, 2, 0, 0, 0, 0, 0},
++++++ {55, 12, 30, 2, 0, 0, 0, 0, 0},
++++++ {59, 13, 30, 2, 0, 0, 0, 0, 0},
++++++ {63, 14, 30, 2, 0, 0, 0, 0, 0},
++++++ {67, 15, 30, 2, 0, 0, 0, 0, 0},
++++++ {7, 0, 45, 3, 0, 0, 0, 0, 0},
++++++ {11, 1, 45, 3, 0, 0, 0, 0, 0},
++++++ {15, 2, 45, 3, 0, 0, 0, 0, 0},
++++++ {19, 3, 45, 3, 0, 0, 0, 0, 0},
++++++ {23, 4, 45, 3, 0.00152046, 0.0001342, 0.000230922, 0.000409363, 1.05099},
++++++ {27, 5, 45, 3, 0.000942258, 7.60497e-05, -0.000192958, 0.000223936, 6.99345},
++++++ {31, 6, 45, 3, 0.000800823, 0.000145219, -0.000419234, 0.000410692, 2.0906},
++++++ {35, 7, 45, 3, -0.000724283, 0.000218114, 0.00151933, 0.000598565, 1.08369},
++++++ {39, 8, 45, 3, -0.000131615, 0.000236785, -0.00133121, 0.000626758, 4.45889},
++++++ {43, 9, 45, 3, -0.000518031, 0.000312376, -0.00186629, 0.000775473, 0.391308},
++++++ {47, 10, 45, 3, -0.00027972, 0.000649466, -0.000523249, 0.00158534, 0.144075},
++++++ {51, 11, 45, 3, 0, 0, 0, 0, 0},
++++++ {55, 12, 45, 3, 0, 0, 0, 0, 0},
++++++ {59, 13, 45, 3, 0, 0, 0, 0, 0},
++++++ {63, 14, 45, 3, 0, 0, 0, 0, 0},
++++++ {67, 15, 45, 3, 0, 0, 0, 0, 0},
++++++ {7, 0, 60, 4, 0, 0, 0, 0, 0},
++++++ {11, 1, 60, 4, 0, 0, 0, 0, 0},
++++++ {15, 2, 60, 4, 0, 0, 0, 0, 0},
++++++ {19, 3, 60, 4, 0, 0, 0, 0, 0},
++++++ {23, 4, 60, 4, 0.00120762, 0.000134008, -0.0024387, 0.00043006, 0.481058},
++++++ {27, 5, 60, 4, 0.000867544, 6.26835e-05, -0.0027843, 0.000191951, 5.3825},
++++++ {31, 6, 60, 4, 0.000399662, 0.000163541, -0.00273158, 0.000466768, 1.69261},
++++++ {35, 7, 60, 4, -0.000998392, 7.35972e-11, -0.00303518, 2.23022e-10, 14.0717},
++++++ {39, 8, 60, 4, 0.000449773, 0.000250295, -0.00410874, 0.000643922, 8.72459},
++++++ {43, 9, 60, 4, -0.000337337, 0.000389647, -0.00103682, 0.00102281, 0.180408},
++++++ {47, 10, 60, 4, 0, 0, 0, 0, 0},
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++++++ {35, 7, 330, 22, 0.00100998, 7.35972e-11, -0.00253852, 1.88711e-10, 1.21829},
++++++ {39, 8, 330, 22, -3.02134e-05, 0.000449407, -0.00145927, 0.00120363, 2.15689},
++++++ {43, 9, 330, 22, -0.000211815, 0.000589695, -0.000447225, 0.00154003, 0.0351223},
++++++ {47, 10, 330, 22, 0, 0, 0, 0, 0},
++++++ {51, 11, 330, 22, 0, 0, 0, 0, 0},
++++++ {55, 12, 330, 22, 0, 0, 0, 0, 0},
++++++ {59, 13, 330, 22, 0, 0, 0, 0, 0},
++++++ {63, 14, 330, 22, 0, 0, 0, 0, 0},
++++++ {67, 15, 330, 22, 0, 0, 0, 0, 0},
++++++ {7, 0, 345, 23, 0, 0, 0, 0, 0},
++++++ {11, 1, 345, 23, 0, 0, 0, 0, 0},
++++++ {15, 2, 345, 23, 0, 0, 0, 0, 0},
++++++ {19, 3, 345, 23, 0, 0, 0, 0, 0},
++++++ {23, 4, 345, 23, 0.00104478, 2.24337e-11, -0.00308136, 7.23669e-11, 79.0116},
++++++ {27, 5, 345, 23, 0.00242672, 0.000102732, 0.00313564, 0.000307106, 37.0946},
++++++ {31, 6, 345, 23, 0.00229958, 0.000136515, 0.00392239, 0.000387656, 1.28814},
++++++ {35, 7, 345, 23, 0.00232528, 0.000165445, 0.00335614, 0.000450454, 1.02699},
++++++ {39, 8, 345, 23, 0.00189663, 0.00023587, 0.00322619, 0.00062956, 1.79876},
++++++ {43, 9, 345, 23, 0.00146891, 0.000396031, 0.00268043, 0.000958362, 0.113248},
++++++ {47, 10, 345, 23, -0.000362111, 0.000506806, -0.00191617, 0.00123903, 0.575695},
++++++ {51, 11, 345, 23, 0, 0, 0, 0, 0},
++++++ {55, 12, 345, 23, 0, 0, 0, 0, 0},
++++++ {59, 13, 345, 23, 0, 0, 0, 0, 0},
++++++ {63, 14, 345, 23, 0, 0, 0, 0, 0},
++++++ {67, 15, 345, 23, 0, 0, 0, 0, 0},
```

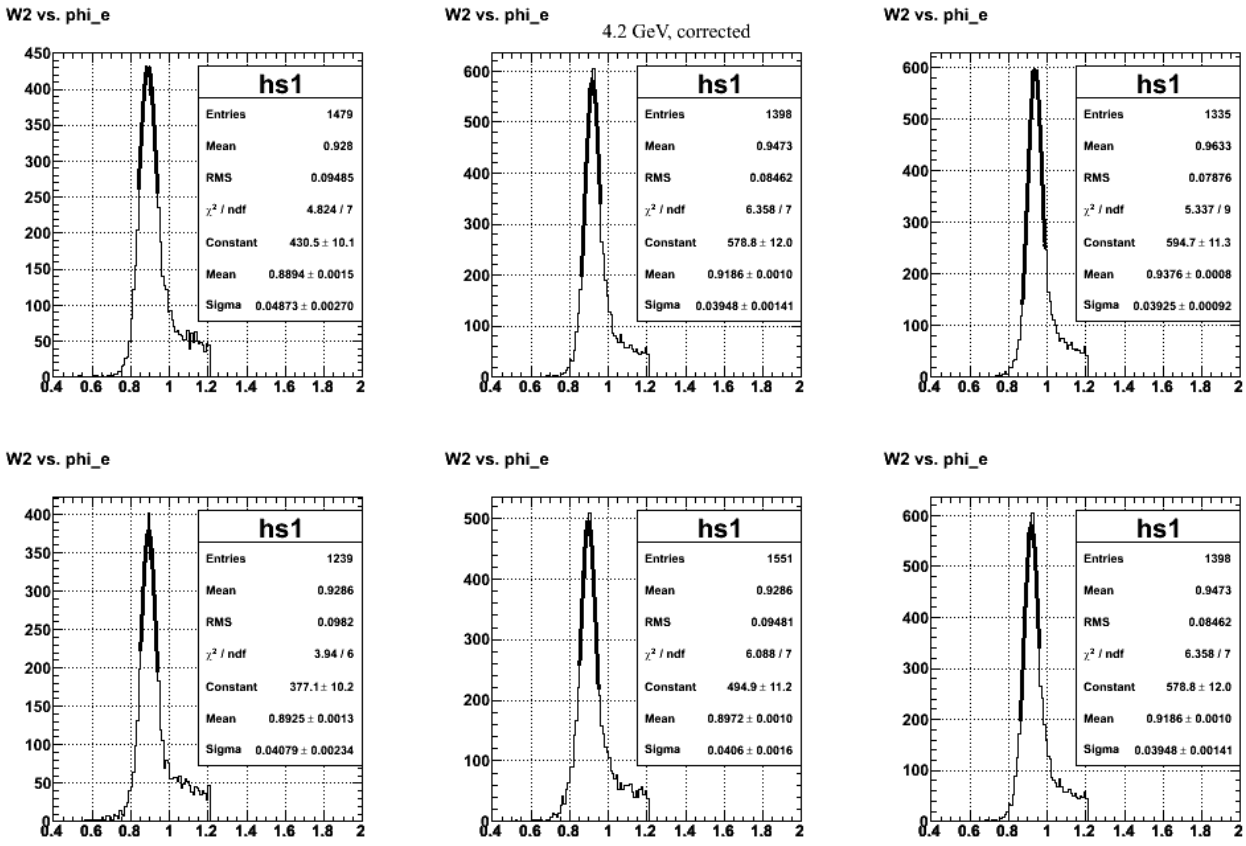

Fig 5. Fits to corrected W^2 spectra using the table of parameters at the end of this entry

Click here
to view the object (ROOT C++ macro for Fig 5) you uploaded.

Click here
to view the object (ROOT histogram file used for Fig 5) you uploaded.

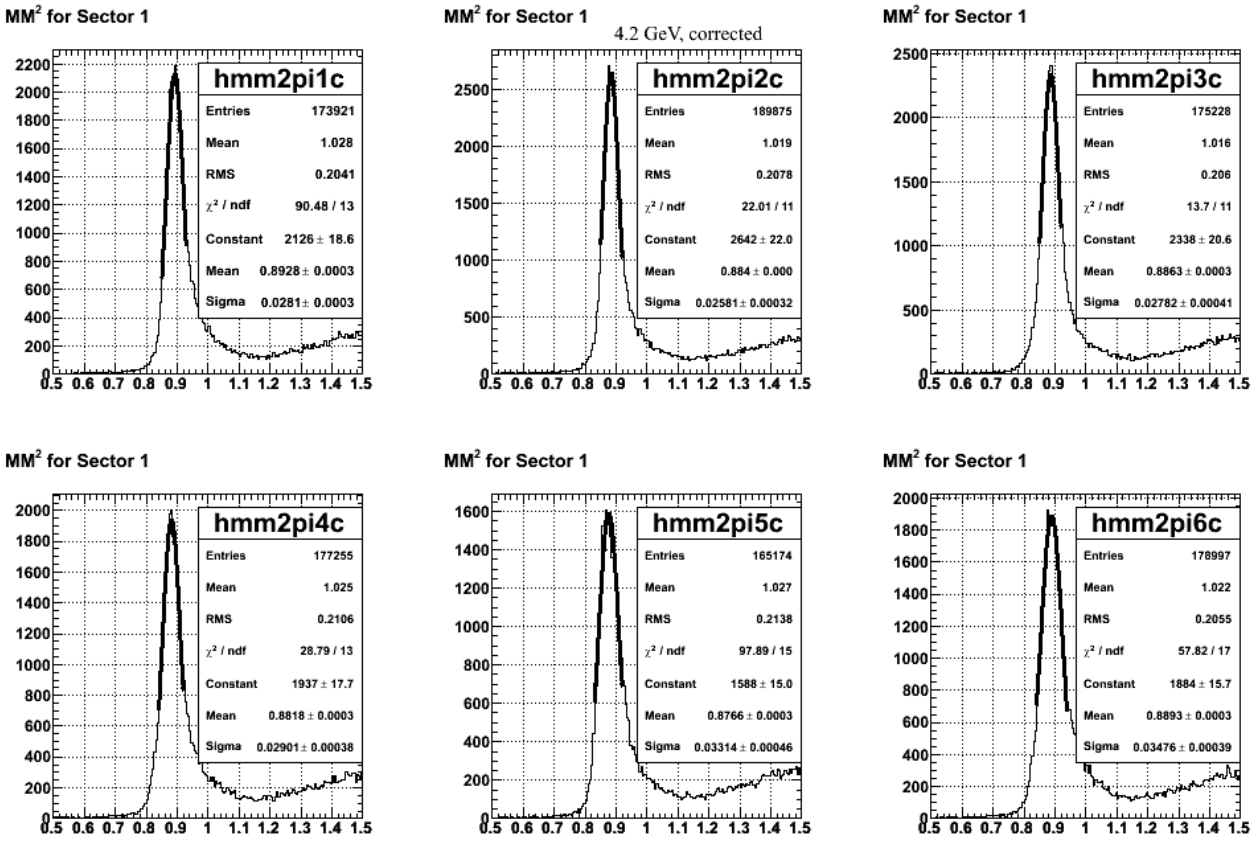

Fig 6. MM2 spectra sector-by-sector using the pcorr1 parameters from the table below for 4.2 GeV

Click here
to view the object (ROOT C++ macro for Fig 6) you uploaded.

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Jerry Gilfoyle's Enotebook page 76 - code to fit MM2 spectra (gpg)

[Added Mon Aug 1 02:52:18 2005 (GMT) gpg]

```
TCanvas *c1 = new TCanvas("c1", "c1",40,5,1000,700);
c1->Divide(3,2)
gStyle->SetOptFit(1);
gStyle->SetStatW(0.40);
gStyle->SetStatH(0.40);
gStyle->SetStatX(0.90);
gStyle->SetStatY(0.850);
c1_1->cd();
c1_1->SetLeftMargin(0.15);
mm2lo = 0.84;
mm2hi= 0.92;
hmm2pi1->Draw();
hmm2pi1->Fit("gaus","","",mm2lo,mm2hi);
c1_2->cd();
c1_2->SetLeftMargin(0.15);
mm2lo = 0.84;
mm2hi= 0.90;
hmm2pi2->Draw();
hmm2pi2->Fit("gaus","","",mm2lo,mm2hi);
   tex = new TLatex(1.0,30.0,"4.2 GeV, corrected");
   tex->SetTextFont(132);
   tex->SetTextSize(0.05);
   tex->SetLineWidth(2);
   tex->Draw();
c1_3->cd();
c1_3->SetLeftMargin(0.15);
mm2lo = 0.84;
mm2hi= 0.90;
hmm2pi3->Draw();
hmm2pi3->Fit("gaus","","",mm2lo,mm2hi);
c1_4->cd();
c1_4->SetLeftMargin(0.15);
mm2lo = 0.82;
mm2hi= 0.90;
hmm2pi4->Draw();
hmm2pi4->Fit("gaus","","",mm2lo,mm2hi);
c1_5->cd();
c1_5->SetLeftMargin(0.15);
mm2lo = 0.82;
mm2hi= 0.90;
hmm2pi5->Draw();
hmm2pi5->Fit("gaus","","",mm2lo,mm2hi);
c1_6->cd();
c1_6->SetLeftMargin(0.15);
mm2lo = 0.82;
mm2hi= 0.90;
hmm2pi6->Draw();
hmm2pi6->Fit("gaus","","",mm2lo,mm2hi);
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 77 - 4.2 GeV pcorr, VB method (gpg)

[Modified Tue Aug 2 21:20:28 2005 (GMT) gpg]

Below are the results for the 4.2 GeV, electorn momentum corrections using the VB method. The alpha ratio for 4.2 GeV is shown below. The small number of counts is a surprise. It supposedly is due to the drop in the elastic cross section.

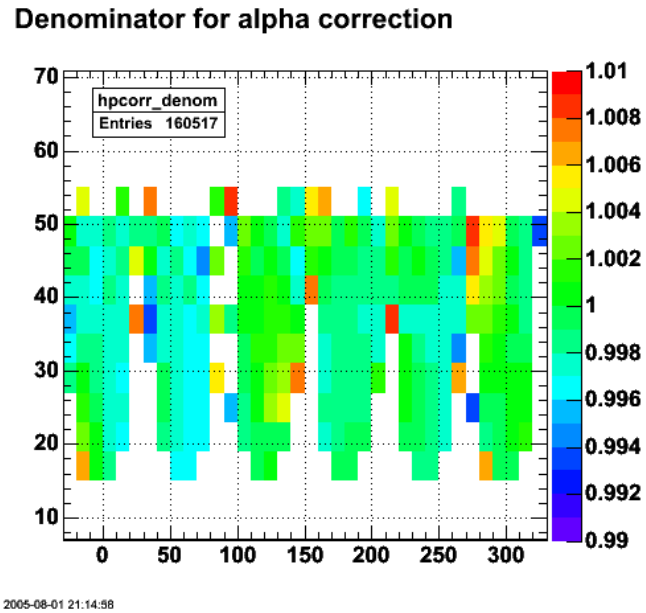

Fig 1. Alpha ratio for 4.2 GeV. The small number of counts is a surprise. It supposedly is due to the drop in the elastic cross section.

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

The plots below show the results of applying the VB method to correcting the electron momentum. The effect is small, but positive as shown in the table below.

	Uncorrected		Corrected	
Sector	centroid	width	centroid	width
1	0.8704	0.04080	0.8745	0.03416
2	0.8265	0.03718	0.8532	0.03530
3	0.8835	0.03660	0.8808	0.03370
4	0.8636	0.03211	0.8735	0.03046
5	0.8631	0.03413	0.8730	0.03079
6	0.8790	0.03068	0.8780	0.03093
ave	0.8644	0.03525	0.8722	0.03256

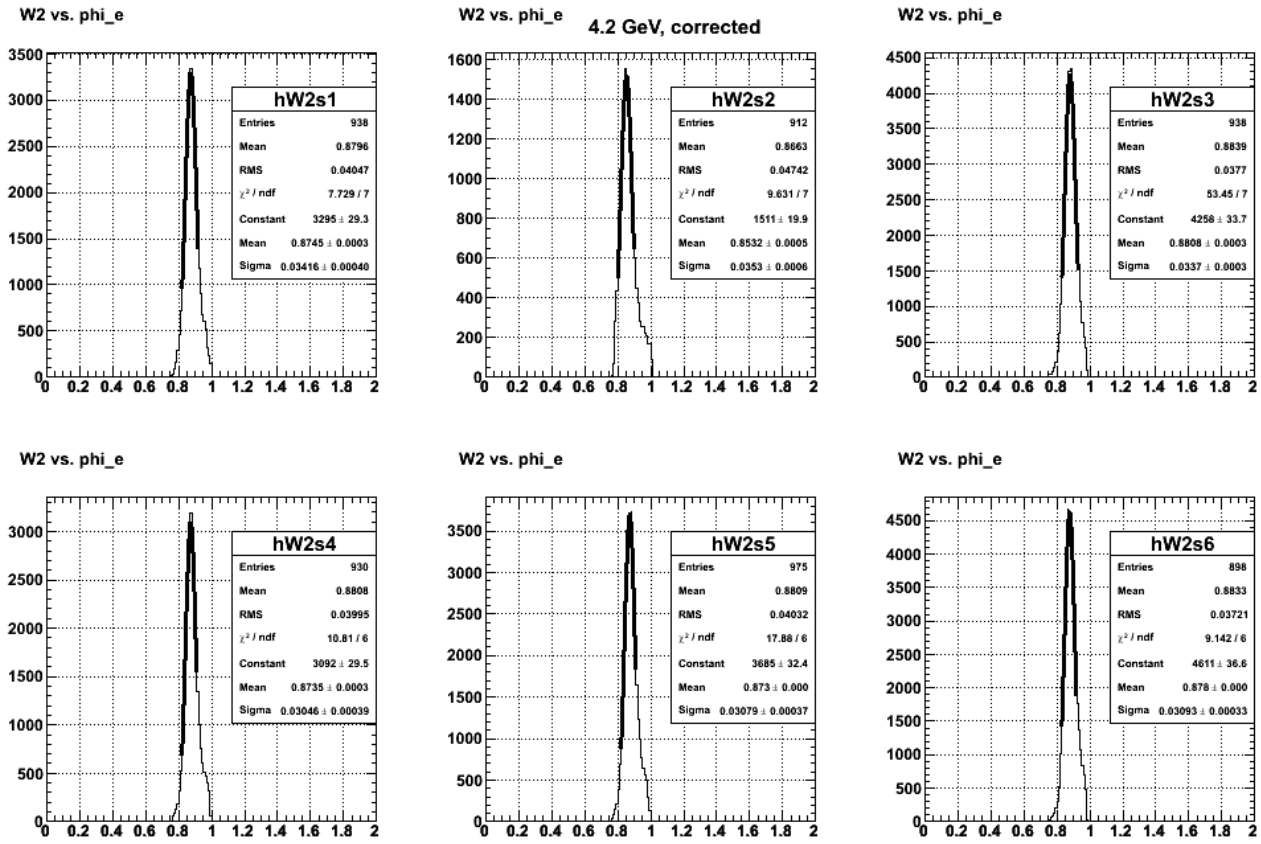

Fig 2. Fits to W^2 spectra sector by sector for 4.2 GeV using VB momentum corrections.

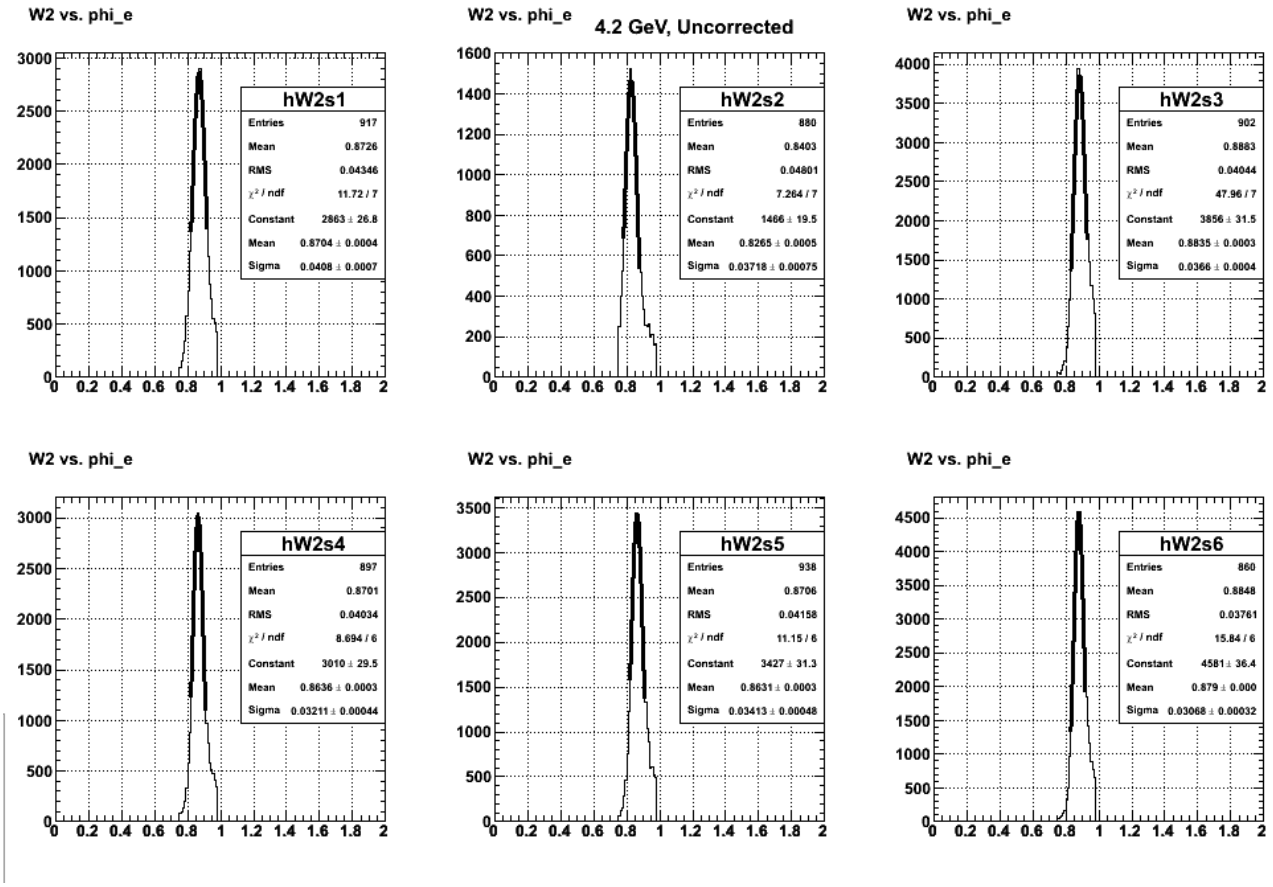

Fig 3. Fits to W^2 spectra for uncorrected electron momenta at 4.2 GeV.

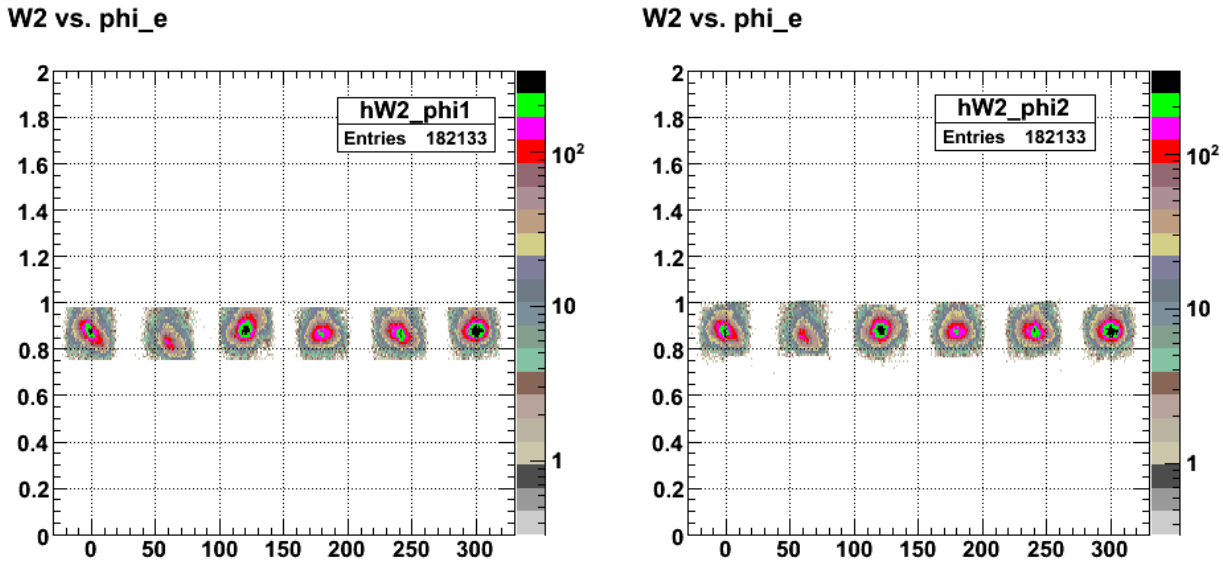

Fig 4. Plot of W^2 versus phi_e comparing uncorrected electron momenta (left panel) with the corrected one (right panel) at 4.2 GeV.

```
TCanvas *c1 = new TCanvas("c1", "c1",20,3,1000,700);
c1->Divide(3,2)
gStyle->SetOptFit(1);
gStyle->SetStatH(0.30);
gStyle->SetStatW(0.35);
gStyle->SetStatX(0.90);
gStyle->SetStatY(0.80);
TH2D *hW2s1 = (TH2D*)hW2_phi1->Clone();
```

```
TH2D *hW2s2 = (TH2D*)hW2_phi1->Clone();
TH2D *hW2s3 = (TH2D*)hW2_phi1->Clone();
TH2D *hW2s4 = (TH2D*)hW2_phi1->Clone();
TH2D *hW2s5 = (TH2D*)hW2_phi1->Clone();
TH2D *hW2s6 = (TH2D*)hW2_phi1->Clone();
int philo, phihi;
philo=1;
phihi=60;
TH1D *h2as1 = (TH1D*) hW2s1->ProjectionY("hW2s1",philo,phihi);
c1_1->cd();
h2as1->Draw();
h2as1->Fit("gaus","","",0.82,0.92);
philo=61;
phihi=120;
TH1D *h2as2 = (TH1D*) hW2s2->ProjectionY("hW2s2",philo,phihi);
c1_2->cd();
h2as2->Draw();
h2as2->Fit("gaus","","",0.80,0.91);
philo=121;
phihi=180;
TH1D *h2as3 = (TH1D*) hW2s3->ProjectionY("hW2s3",philo,phihi);
c1_3->cd();
h2as3->Draw();
h2as3->Fit("gaus","","",0.78,0.88);
philo=181;
phihi=240;
TH1D *h2as4 = (TH1D*) hW2s4->ProjectionY("hW2s4",philo,phihi);
c1_4->cd();
h2as4->Draw();
h2as4->Fit("gaus","","",0.80,0.91);
philo=241;
phihi=300;
TH1D *h2as5 = (TH1D*) hW2s5->ProjectionY("hW2s5",philo,phihi);
c1_5->cd();
h2as5->Draw();
h2as5->Fit("gaus","","",0.80,0.91);
philo=301;
phihi=360;
TH1D *h2as6 = (TH1D*) hW2s6->ProjectionY("hW2s6",philo,phihi);
c1_6->cd();
h2as6->Draw();
h2as6->Fit("gaus","","",0.80,0.91);
```

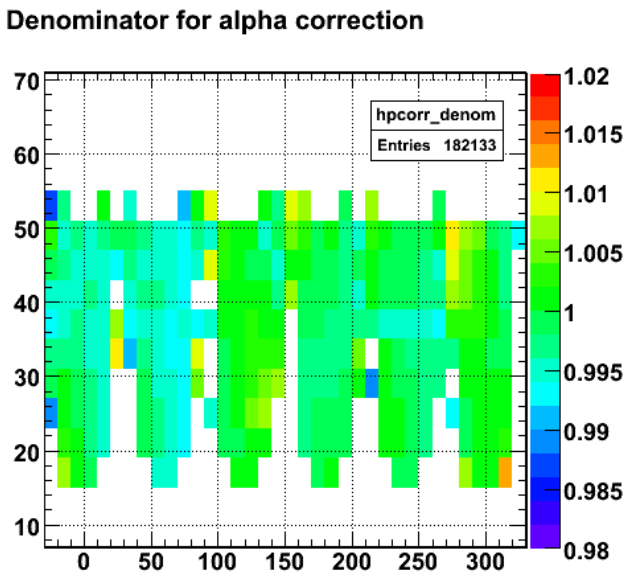

Fig 5. Alpha 2D histogram for most recent set of analysis cuts. Here I opened up the good_W_cut because in one sector(2, I think), the uncorrected proton peak was being cut out at the low MM2 side because the W cut was too high.

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

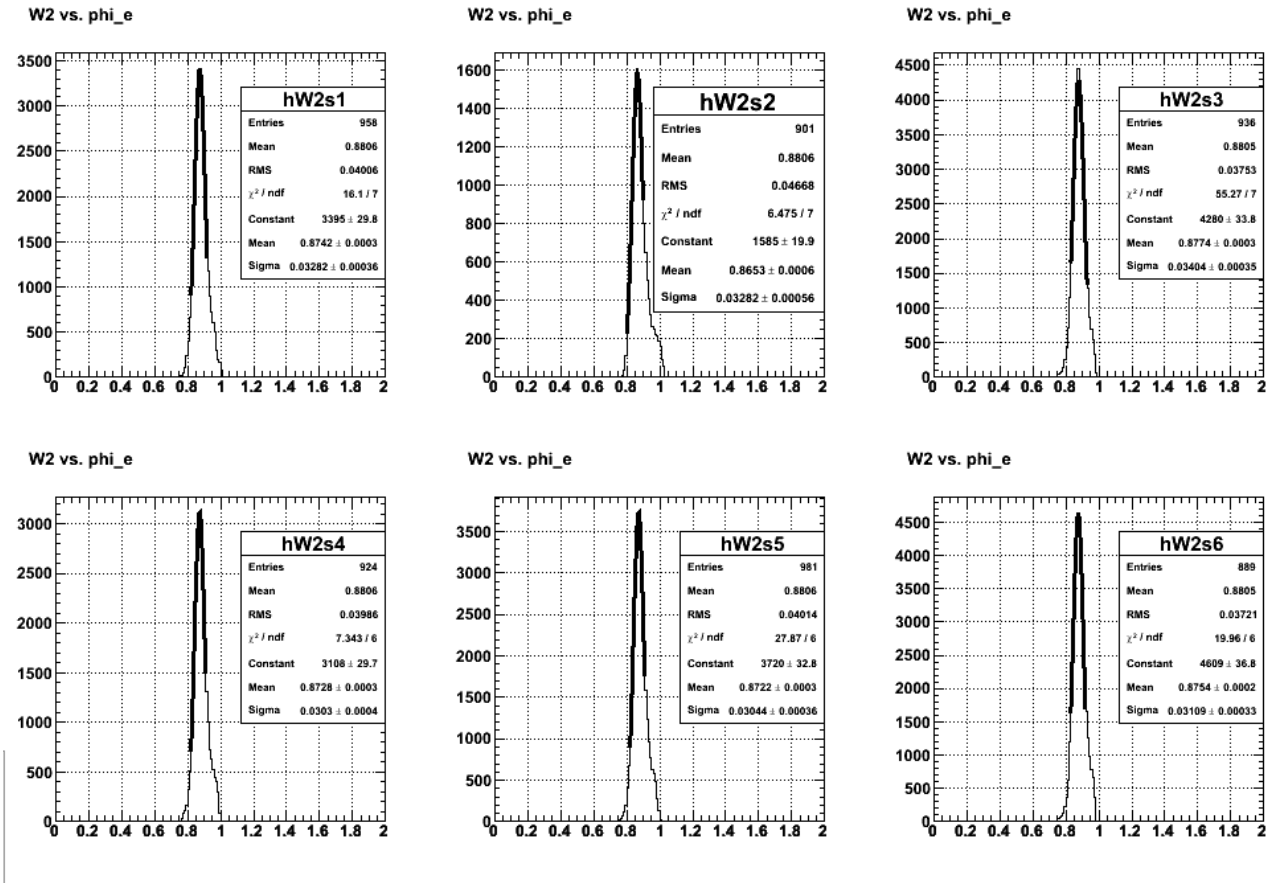

Fig 6. Fits to W^2 spectra sector by sector for 4.2 GeV using VB momentum correction with latest set of parameters after opening up the W cut.

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

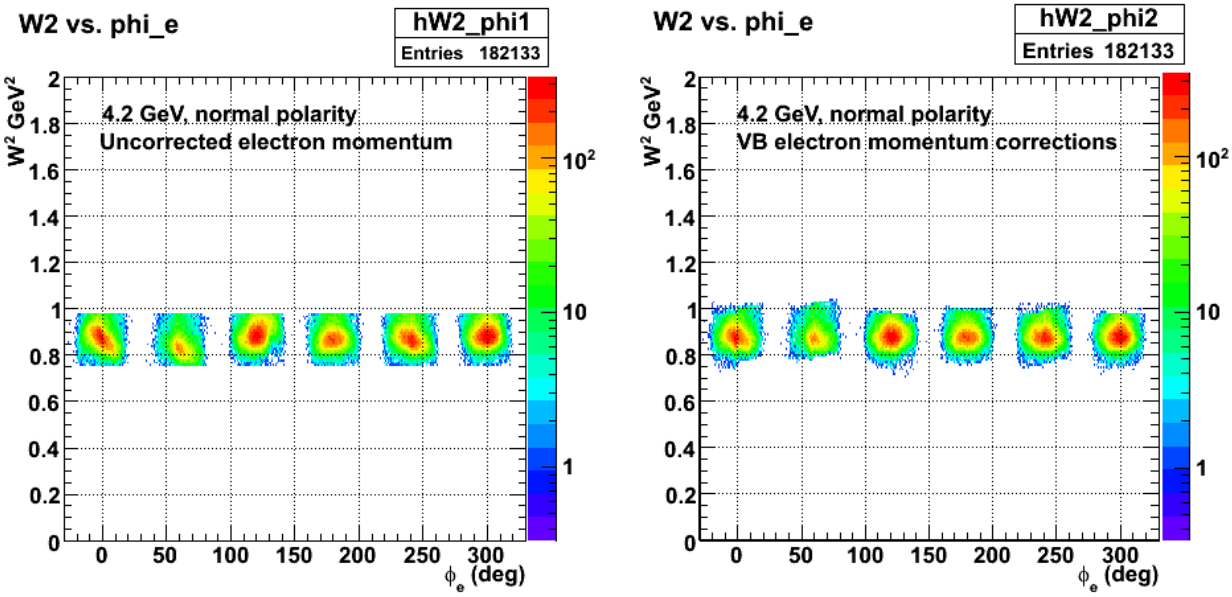

Fig 7. Comparison of W2 vs. phi_e without VB electron momentum corrections (left panel) and with them (right panel).

Click here to view the object (ROOT C++ macro for Fig 7) you uploaded.

Final comparison table with 'corrected 1' from previous table in this entry and 'corrected 2' from latest VB parameters

```
Uncorrected        Corrected 1        Corrected 2
```

Sector	centroid	width	centroid	width	centroid	width
1	0.8704	0.04080	0.8745	0.03416	0.8742	0.03282
2	0.8265	0.03718	0.8532	0.03530	0.8653	0.03283
3	0.8835	0.03660	0.8808	0.03370	0.8774	0.03404
4	0.8636	0.03211	0.8735	0.03046	0.8726	0.03030
5	0.8631	0.03413	0.8730	0.03079	0.8722	0.03044
6	0.8790	0.03068	0.8780	0.03093	0.8754	0.03109
ave	0.8644	0.03525	0.8722	0.03256	0.8729	0.03192

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Jerry Gilfoyle's Enotebook page 78 - RB 4.2 GeV momentum correction results (gpg)

[Modified Thu Aug 11 21:27:48 2005 (GMT) gpg]

Below are Rusty's results for his momentum correction scheme.

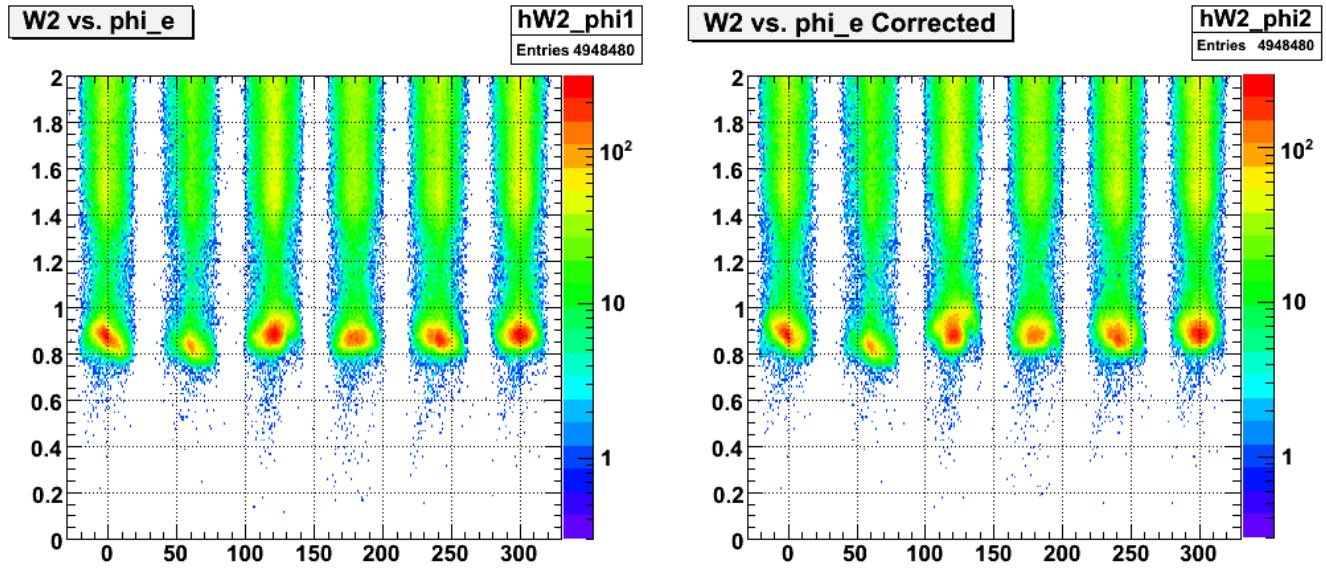

Fig 1. Comparison of W2 before and after applying momentum corrections for 4.2 GeV

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

	Uncorrected		Corrected	
Sector	Centroid	Width	Centroid	Width
1	0.8706	0.04199	0.8858	0.04106
2	0.8278	0.03844	0.8280	0.03836
3	0.8859	0.03870	0.8956	0.04502
4	0.8644	0.03500	0.8821	0.03800
5	0.8651	0.03570	0.8822	0.04940
6	0.8798	0.03160	0.8914	0.03831
Average	0.8656	0.03691	0.8775	0.04169

Rusty's results are not as good as the ones I got. He noticealby improved the centroid, but the width is about 12% worse.

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Jerry Gilfoyle's Enotebook page 79 - Some tests of kinematic cuts (gpg)

[Modified Fri Sep 2 21:50:47 2005 (GMT) gpg]

Below is a table of the effect of different counts on the number of electron singles using /pscr1/gilfoyle/data/clas_024035.a01.b00.root

```
all cuts on                5346
efid off                   7986
deuteron tgt off          18131
egiyan threshold off      23092
EC fiducial off           24371
EC track coordinates off  25197
minimum photoelectron off 37977
all cuts off              37977
```

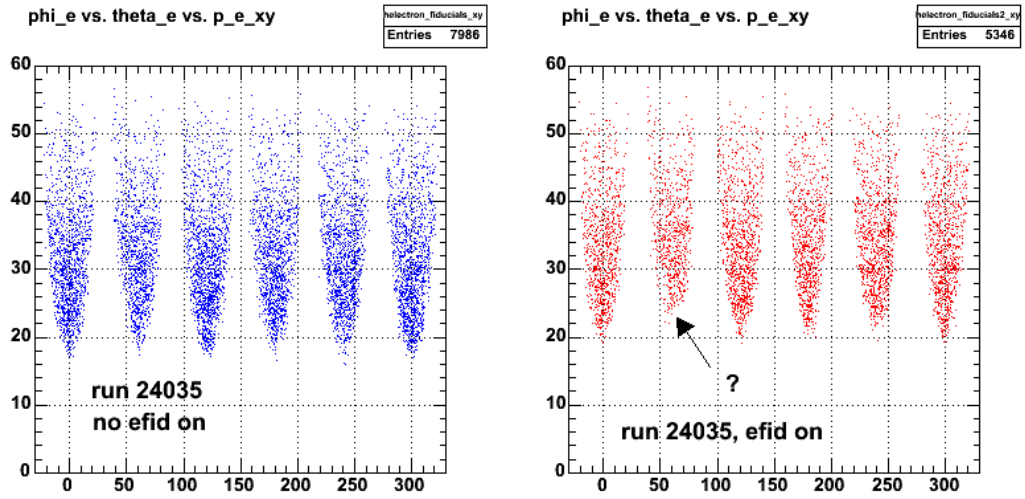

Fig 1. Comparison of electron acceptance with 4.2 GeV efids off (left panel) and on (right panel). The missing counts at forward angles of sector 2 should be investigated.

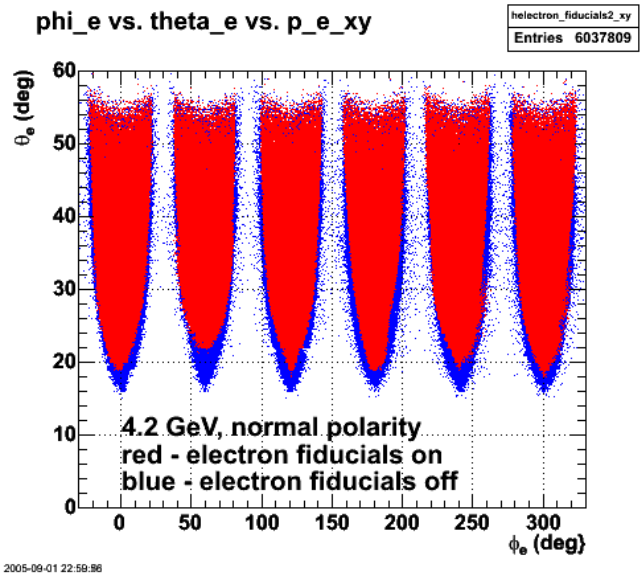

Fig 2. Same as figure 1 with most of the 4.2 GeV data.

Click here to view the object (ROOT C++ macro for Fig 2.) you uploaded.

The lack of counts at forward angles in Fig 2 for sector 2 is due to a lack of counts at high momenta in this sector. The plots of the edge positions (see link below) shows that at higher momenta there are simply not enough counts to adequately determine the position of the edge so we cut off the electron fiducials at an electron momentum of 2.2 GeV/c. These are higher momentum tracks because these are inbending electrons, the higher momentum tracks are 'stiffer' and bend less, so they can get to more forward angles before the tracks get bent down the hole.

Click here to view the object (Plots showing the degradation of the edges at higher electron momentum) you uploaded.

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Jerry Gilfoyle's Enotebook page 80 - Investigating MM2 cut to identify neutrons (gpg)

[Modified Fri Sep 2 03:20:13 2005 (GMT) gpg]

The plot below shows a comparison of N+ vs. p_m for events with the neutron identified using 0.84 < MM2 < 0.92 (left panel) and projecting N+ from a 2D spectrum of MM2 vs. p_m generated using sin(phi) weighting (right panel). The two wildly disagree.

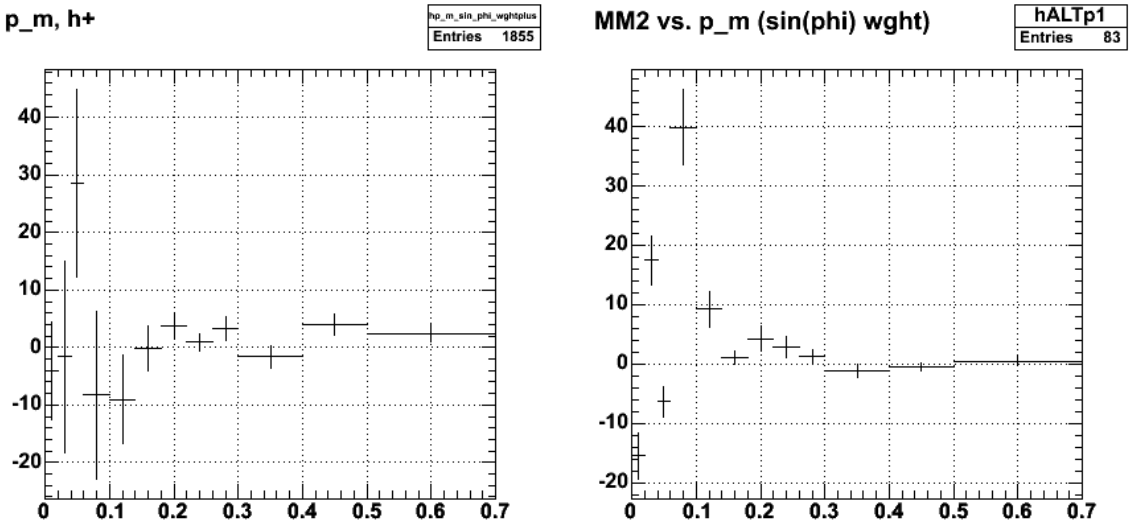


Fig 1. Comparison of N+ vs. p_m from usual method (left panel) and projecting N+ from a 2D spectrum of MM2 vs. p_m generated using sin(phi) weighting.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 81 - E1 response to reversed torus current (gpg)

[Modified Mon Sep 5 16:06:15 2005 (GMT) gpg]

Below is a link to a section of Raffaella DeVita's(?) analysis note on the E1 data taken with reversed torus polarity.

Click here to view the object (section of E1 analysis note on reversed field data) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 82 - 4.2 GeV spectra (gpg)

[Modified Fri Sep 9 02:35:11 2005 (GMT) gpg]

Plots below show some investiagtions of the 4.2 GeV data. ALTp is essentially zero here so this is an attempt to see of there is anything salvagable in these data. The only cuts in Figure 1 are for epn_events, deuteron target, and minimum photoelectrons.

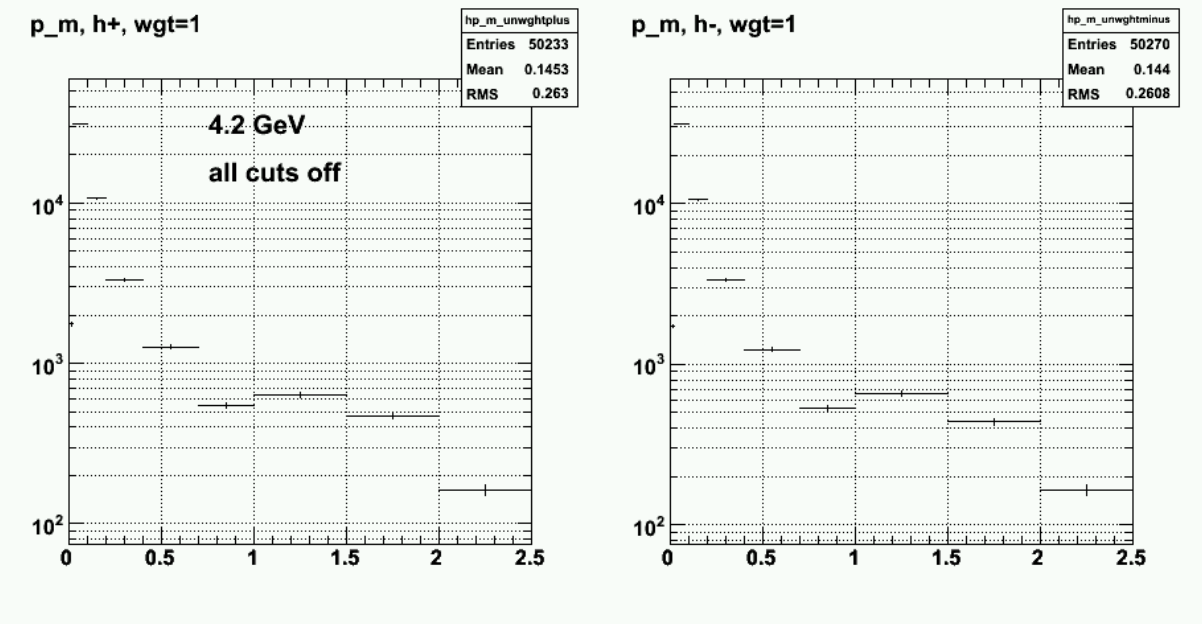


Fig 1. Unweighted spectra with all the cuts off except epn.

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

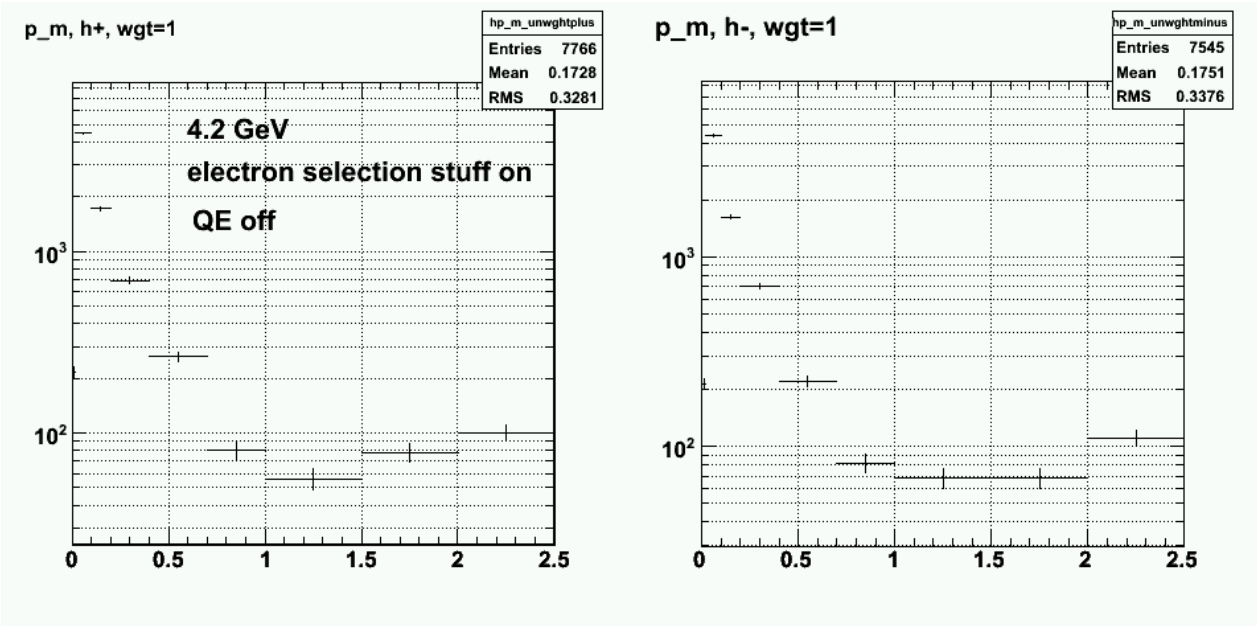


Fig 2. Unweighted spectra with all the cuts off except epn and electron selection stuff.

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

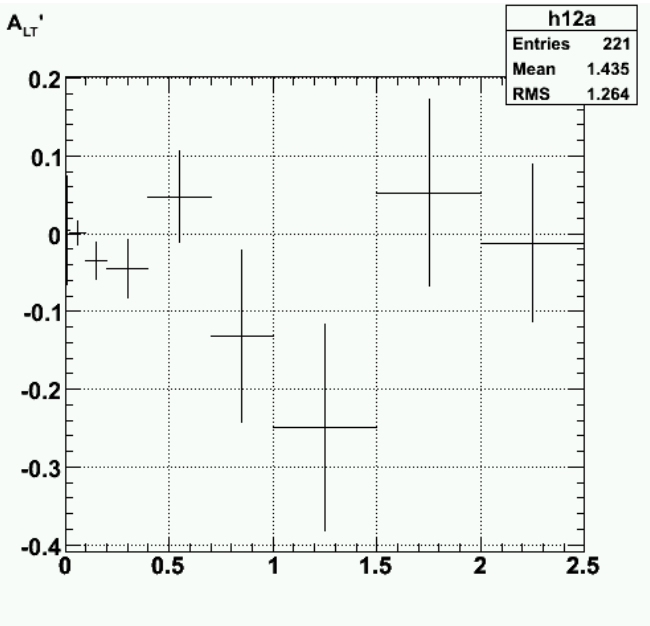


Fig 3 ALTp for cuts in Fig 2.

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.

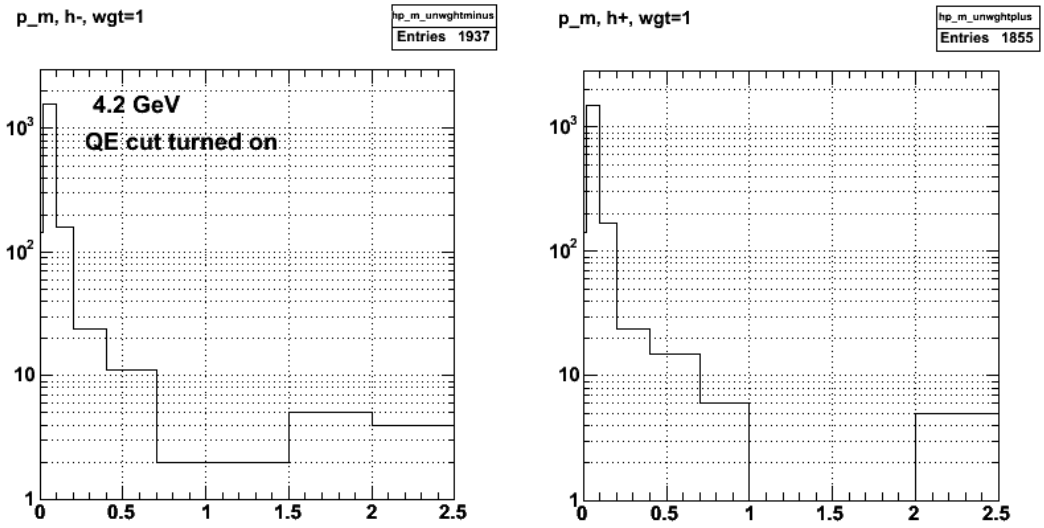


Fig 4. N+/- spectra with QE cut turned on.

Click here to view the object (ROOT C++ macro for Fig 4) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 83 - ALTp from fitting at 4.2 GeV (gpg)

[Modified Thu Sep 15 23:07:06 2005 (GMT) gpg]

A comparison of results extracting ALTp using the method versus fitting the helicity asymmerty. There is obviously something wildly wrong.

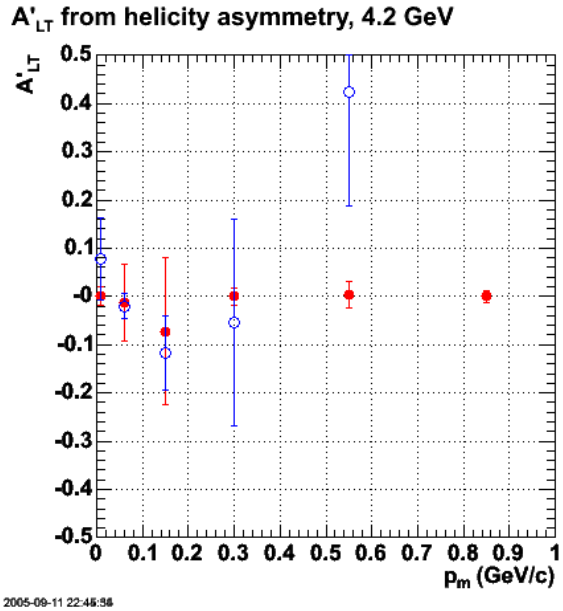


Fig 1.

Click here to view the object (ROOT C++ macro named 4.2nALTpfits.C for Fig 1.) you uploaded.

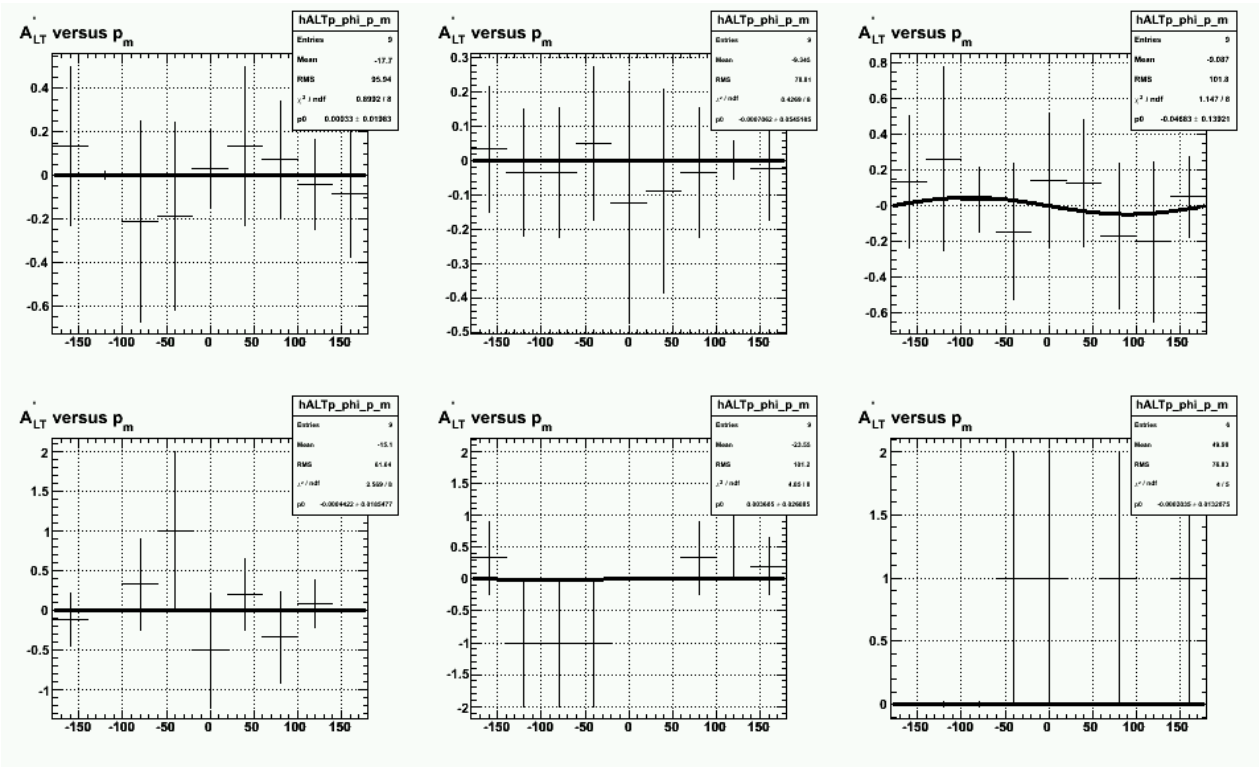


Fig 2. Fitting helicity asymmetry results

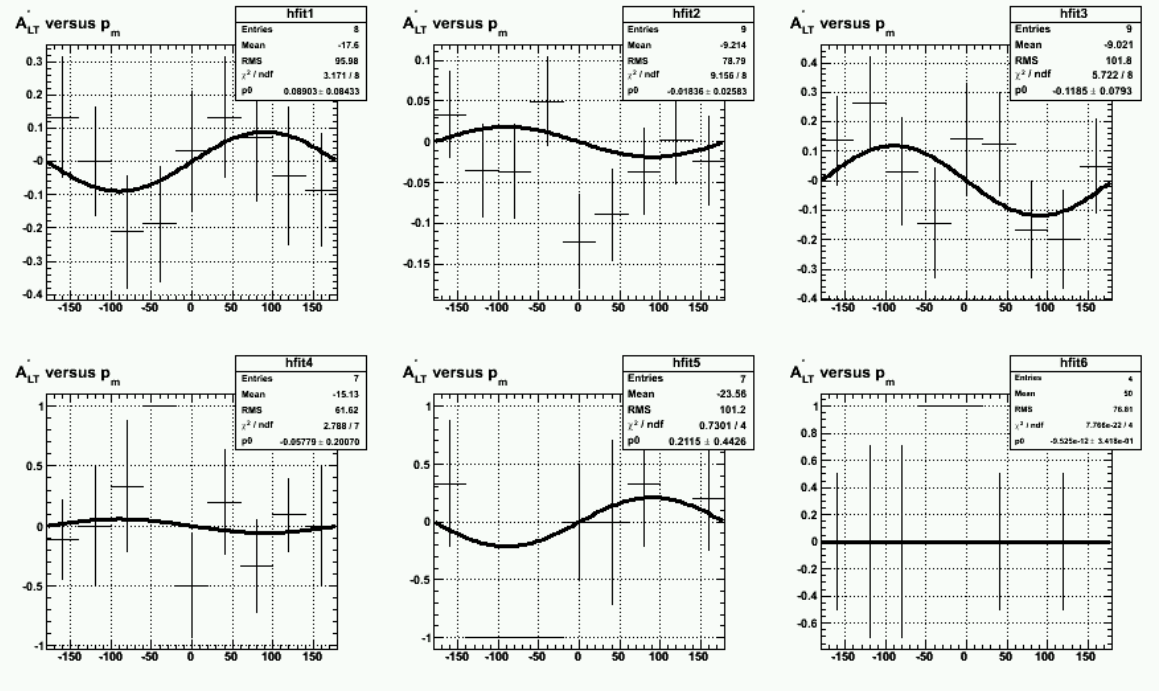


Fig 3. Fixed the uncertainties and get the above results. There is a problem in pbin=6 because there are simply so counts in some of the phi_pq bins and i don't know how to handle the uncertainty.

Click here to view the object (ROOT C++ macro for making Fig 3) you uploaded.

Click here to view the object (ROOT macro for generating Fig 3) you uploaded.

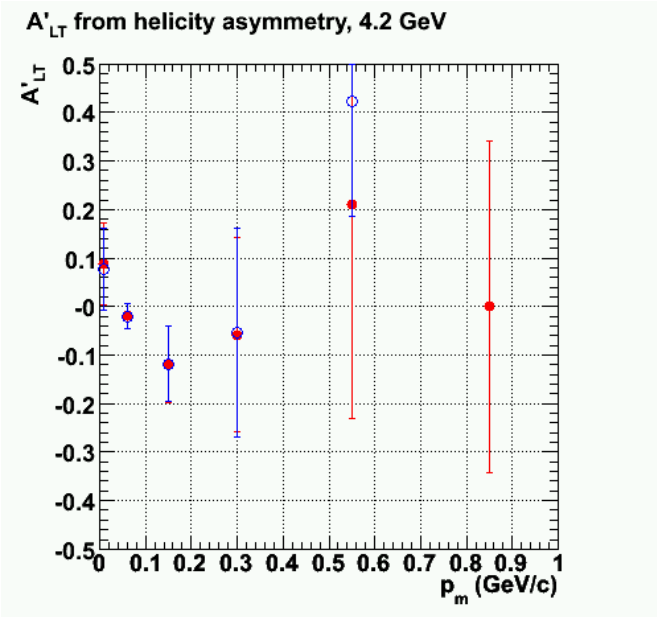


Fig 4. Comaprison of ALTp from and helicity asymmetry fits. Compare this with Fig 1. Things look much better until I run out of counts at large p_m.

Click here to view the object (ROOT C++ macro for Fig 4) you uploaded.

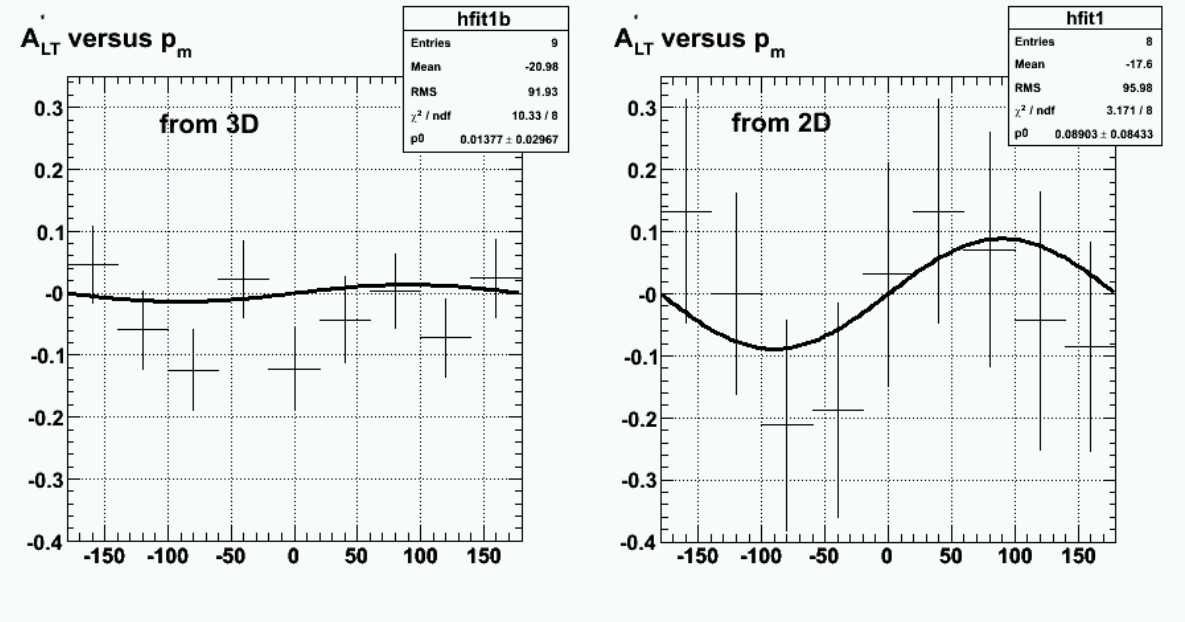


Fig 5. Compare ALTp from 3D hist with MM2 axis with results from 2D hist and used above.

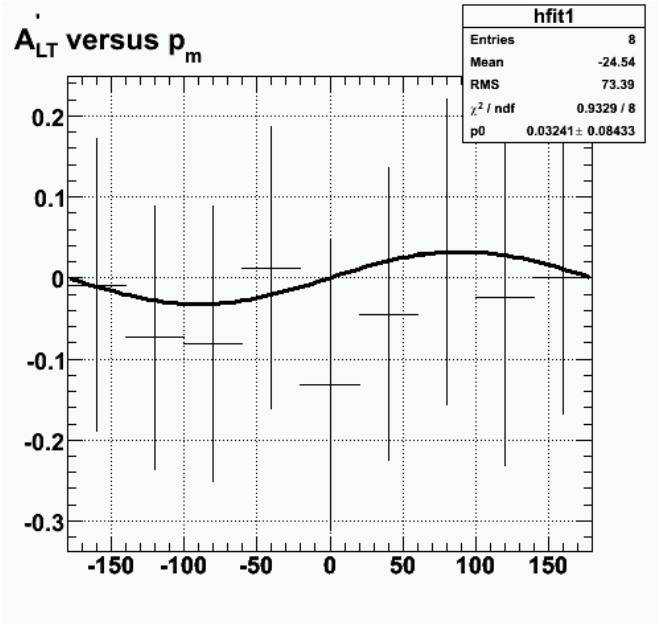
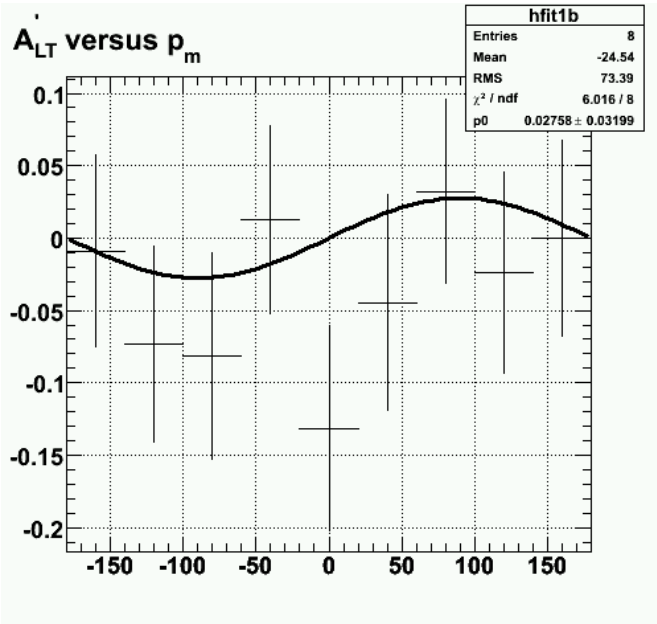


Fig 6. ALTp generated from fits to first p_m bin from 2D phi_pq vs. p_m histogram



Helicity asymmetry for p_m bin 1 generated from 2D phi_pq vs p_m histogram extracted from 3D MM2 vs. phi_pq vs. p_m

Click here to view the object (ROOT C++ macro for extracing ALTp from the 3D MM2 vs. phi_pq vs. p_m histogram for the 4.2 GeV data) you uploaded.

Click here to view the object (ROOT C++ macro for extracting ALTp vs. p_m from 2D phi_pq vs p_m 2D histogram using equal bin sizes to match the extraction of ALTp from the 3D histogram mentioned in the previous entry for 4.2 GeV.) you uploaded.

Click here to view the object (Same as previous ROOT C++ macro except it uses the 2D phi_pq vs. p_m histogram with the variable bin sizes in p_m.) you uploaded.

Click here to view the object (ROOT histogram file with the histograms used to test the ALTp algorithms in the previous 3 items.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 84 - 4.2 GeV sector 6 pfid (gpg)

[Modified Wed Sep 28 16:23:09 2005 (GMT) gpg]

Sector 6 round 3.

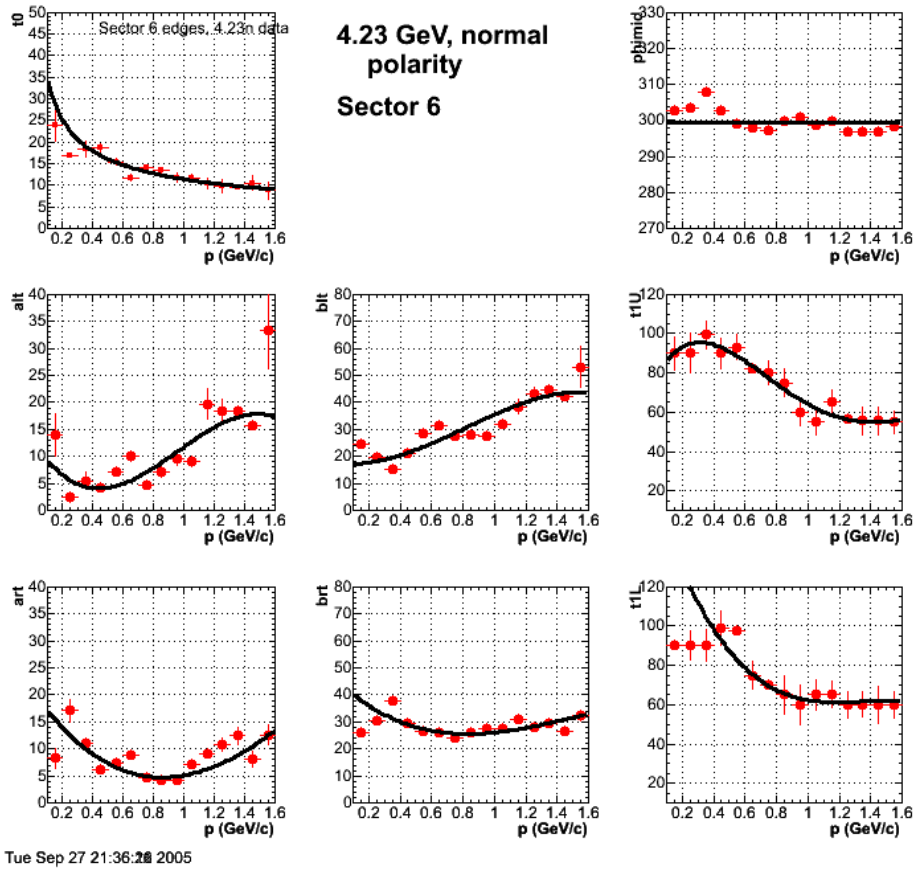


Fig 1. 3gen fits for round 3. see .dat file below.

cleaned file for fig 1.

```
gpg2:sector6> grep +++++++ edges.out
+++++++ 1 23.807 3.63225 14.0481 3.94286 24.7705 1.87219 90 8.42368 8.27148 1.85338 26.1221 1.2157 90.0002 0.764092 302.727
+++++++ 2 16.9761 0.308471 2.45437 0.94182 19.4305 0.525537 90 9.98805 17.0577 1.99179 30.2296 1.16724 90 7.38276 303.359
+++++++ 3 18.4694 1.76486 5.49952 1.60962 15.3582 0.666052 99.3138 6.86245 11.0803 0.811154 37.6657 0.687407 90 7.97273 307.832
+++++++ 4 18.6467 0.861327 4.11759 0.700198 21.0915 0.496999 90 7.82959 6.12796 0.53911 29.5631 0.524197 99.1368 8.67522 302.784
+++++++ 5 15.4698 0.70867 7.13439 0.735477 28.5597 0.571731 93.0067 6.35783 7.33356 0.648607 26.3729 0.482361 97.2847 0.550595 299.102
+++++++ 6 11.8082 0.77478 10.0565 0.975038 31.4002 0.737357 82.0473 0.271988 8.86349 0.85649 25.9826 0.58473 75 7.17894 297.928
+++++++ 7 14.0094 0.670659 4.65128 0.454879 27.7008 0.531811 80 5.89706 4.7941 0.591346 23.8587 0.546677 70.0008 0.567621 297.11
+++++++ 8 13.5047 0.719585 7.04298 0.804999 27.7782 0.805966 75 6.88997 4.13775 0.441522 25.9153 0.462259 65 9.96987 299.677
+++++++ 9 11.7112 1.08682 9.54972 1.20135 27.4969 1.07444 60 6.9176 4.12884 0.375236 27.5823 0.518755 60 9.99594 301.01
+++++++ 10 11.6542 1.02074 9.10642 1.01158 31.7908 1.07477 55 6.78302 7.02953 0.741412 27.5141 0.774575 65 7.47365 298.641
+++++++ 11 10.4129 1.28204 19.6798 2.82537 38.4058 2.7029 65 6.14909 9.16098 0.283937 30.6723 0.336649 65 6.7363 299.625
+++++++ 12 9.78213 1.47798 18.4286 2.25615 43.1622 2.54493 56.4069 0.188311 10.796 1.30514 28.0312 1.1975 59.9349 6.68547 296.723
+++++++ 13 9.53424 0.566023 18.5031 0.604394 44.4736 0.692629 55.7812 7.0834 12.4094 1.62207 29.6458 1.58701 60 6.30308 296.753
+++++++ 14 10.6012 1.71207 15.7443 0.576394 42.3599 0.709957 55.7812 7.0834 8.17941 1.46912 26.4809 1.60464 60 9.65488 297
+++++++ 15 8.80064 2.09286 33.2995 7.13183 53.1292 7.40602 55 5.5614 12.6204 1.90656 32.3816 2.09644 59.9401 6.70381 298.436
+++++++ 16 9.29796 0.890594 14.4959 0.645292 40.6408 0.8091 55 7.49741 10.4571 1.56601 31.4875 1.76943 59.9401 6.70381 297.971
+++++++ 17 8.36439 2.08204 22.4825 0.792541 46.3604 0.924017 55 7.49741 7.60299 0.452217 28.5464 0.593045 60 9.81567 299.594
+++++++ 18 7.97782 1.65185 15.3924 0.715078 40.6109 0.899565 55.7812 7.0834 13.6095 2.61849 33.6198 3.01615 60 8.8069 298.383
+++++++ 19 7.6987 1.92555 23.3399 4.88065 59.0108 6.72564 55 7.45651 21.2059 0.925182 37.6414 0.996661 60 9.81567 295.81
+++++++ 20 8.31515 27.4931 12.3045 2.71071 37.8921 3.58026 42.6123 47.4457 11.0842 0.624665 28.9284 0.
```

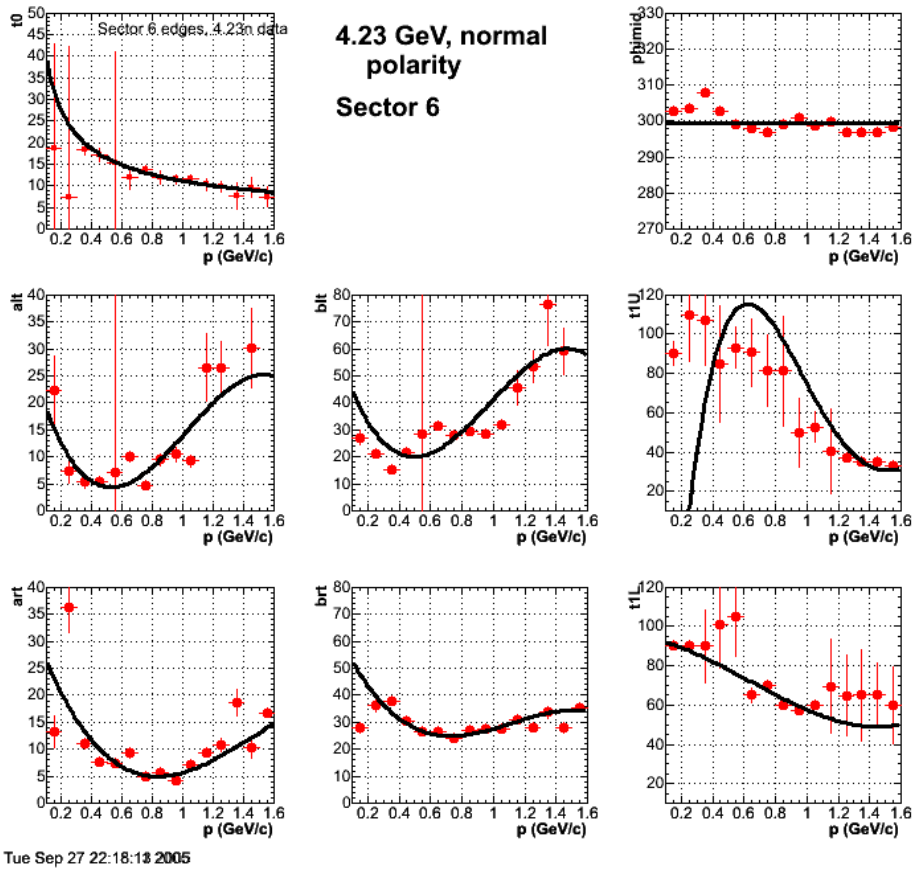


Fig 2. Fixed the array size problem for t1set and got this.

```
1 23.807 3.63225 14.0481 3.94286 24.7705 1.87219 90 8.42368 8.27148 1.85338 26.1221 1.2157 90.0002 0.764092 302.727
2 16.9761 0.308471 2.45437 0.94182 19.4305 0.525537 90 9.98805 17.0577 1.99179 30.2296 1.16724 90 7.38276 303.359
3 18.4694 1.76486 5.49952 1.60962 15.3582 0.666052 99.3138 6.86245 11.0803 0.811154 37.6657 0.687407 90 7.97273 307.832
4 18.6467 0.861327 4.11759 0.700198 21.0915 0.496999 90 7.82959 6.12796 0.53911 29.5631 0.524197 99.1368 8.67522 302.784
5 15.4698 0.70867 7.13439 0.735477 28.5597 0.571731 93.0067 6.35783 7.33356 0.648607 26.3729 0.482361 97.2847 0.550595 299.102
6 11.8082 0.77478 10.0565 0.975038 31.4002 0.737357 82.0473 0.271988 8.86349 0.85649 25.9826 0.58473 75 7.17894 297.928
7 14.0094 0.670659 4.65128 0.454879 27.7008 0.531811 80 5.89706 4.7941 0.591346 23.8587 0.546677 70.0008 0.567621 297.11
8 13.5047 0.719585 7.04298 0.804999 27.7782 0.805966 75 6.88997 4.13775 0.441522 25.9153 0.462259 65 9.96987 299.677
9 11.7112 1.08682 9.54972 1.20135 27.4969 1.07444 60 6.9176 4.12884 0.375236 27.5823 0.518755 60 9.99594 301.01
10 11.6542 1.02074 9.10642 1.01158 31.7908 1.07477 55 6.78302 7.02953 0.741412 27.5141 0.774575 65 7.47365 298.641
11 10.4129 1.28204 19.6798 2.82537 38.4058 2.7029 65 6.14909 9.16098 0.283937 30.6723 0.336649 65 6.7363 299.625
12 9.78213 1.47798 18.4286 2.25615 43.1622 2.54493 56.4069 0.188311 10.796 1.30514 28.0312 1.1975 59.9349 6.68547 296.723
13 9.53424 0.566023 18.5031 0.604394 44.4736 0.692629 55.7812 7.0834 12.4094 1.62207 29.6458 1.58701 60 6.30308 296.753
14 10.6012 1.71207 15.7443 0.576394 42.3599 0.709957 55.7812 7.0834 8.17941 1.46912 26.4809 1.60464 60 9.65488 297
15 8.80064 2.09286 33.2995 7.13183 53.1292 7.40602 55 5.5614 12.6204 1.90656 32.3816 2.09644 59.9401 6.70381 298.436
16 9.29796 0.890594 14.4959 0.645292 40.6408 0.8091 55 7.49741 10.4571 1.56601 31.4875 1.76943 59.9401 6.70381 297.971
17 8.36439 2.08204 22.4825 0.792541 46.3604 0.924017 55 7.49741 7.60299 0.452217 28.5464 0.593045 60 9.81567 299.594
18 7.97782 1.65185 15.3924 0.715078 40.6109 0.899565 55.7812 7.0834 13.6095 2.61849 33.6198 3.01615 60 8.8069 298.383
19 7.6987 1.92555 23.3399 4.88065 59.0108 6.72564 55 7.45651 21.2059 0.925182 37.6414 0.996661 60 9.81567 295.81
20 7.99814 2.62084 13.3818 2.94717 38.8701 3.79354 41.9374 6.09535 11.9983 2.63274 29.5949 2.97503 45 6.87744 296.516
```

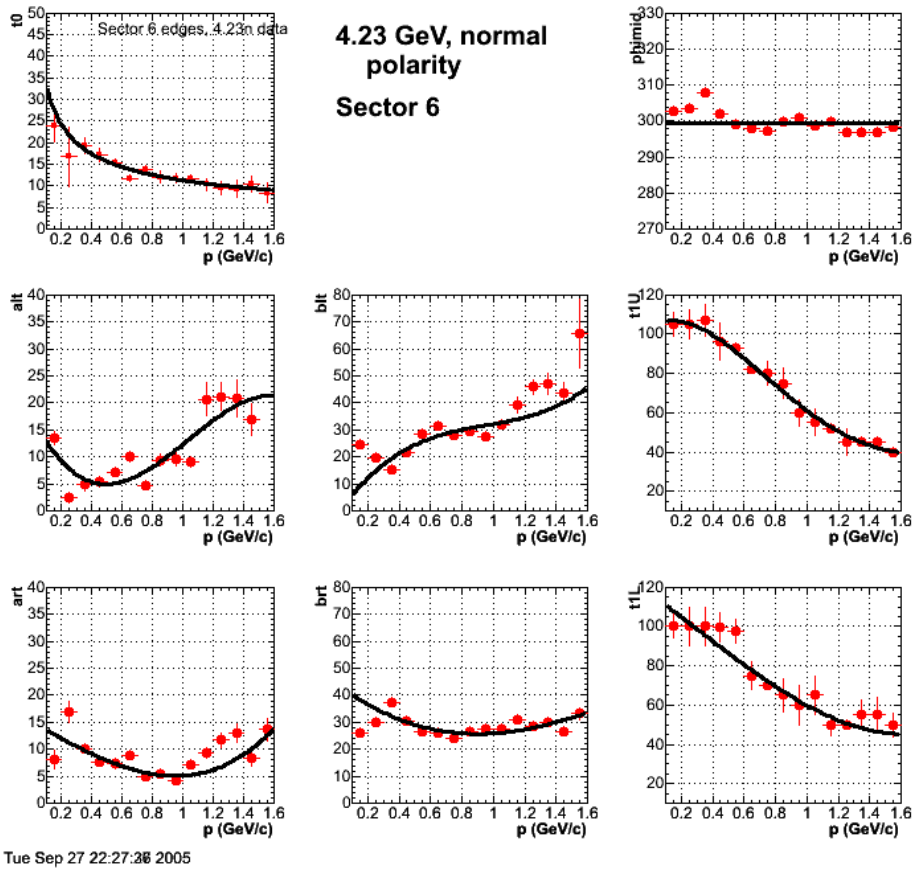


Fig 3. Final results for sector 6

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.

pfid_fitpars.dat :

```
 1 23.8659 3.59119 13.5968 1.23454 24.5516 0.587692 105 6.23184 8.12438 1.81416 26.0311 1.19362 100 5.98882 302.727
 2 16.75 6.94239 2.51794 0.944915 19.4481 0.524402 105 7.46941 16.9114 1.95254 30.0273 1.13535 100 9.8038 303.359
 3 19.3204 1.87671 4.93 1.19902 15.2113 0.568787 107.042 8.11585 9.99985 0.280962 37.0415 0.246816 100.063 9.939 307.832
 4 17.2032 1.63988 5.40272 0.841668 21.6463 0.546303 96.0221 9.47159 7.58294 0.638347 30.4014 0.572934 99.8203 7.32989 302.
 5 15.4611 0.761016 7.14318 0.738929 28.5633 0.575214 93.0381 2.65028 7.34353 0.90136 26.3776 0.819 97.6786 6.16068 299.1
 6 11.8118 0.775722 10.0505 0.97702 31.3968 0.742792 82 0.326489 8.85808 0.856196 25.9801 0.584619 75 7.18089 297.928
 7 13.9407 0.716485 4.71688 0.459272 27.7456 0.534123 80 5.89241 4.85672 0.593152 23.8951 0.546736 70.0007 0.565004 297.11
 8 12.027 1.38114 9.45075 1.04661 29.2439 0.940694 75 7.56959 5.47736 0.542281 26.748 0.513443 65 8.40275 299.677
 9 11.7193 1.09415 9.5307 1.19941 27.4853 1.07334 60 6.92146 4.12134 0.374999 27.5762 0.518624 60 9.99703 301.01
 10 11.6551 1.02208 9.10481 1.01148 31.7897 1.0747 55 6.78237 7.02808 0.741425 27.513 0.774618 65 9.84056 298.641
 11 10.3336 1.32511 20.6502 3.07381 39.2984 2.93471 51.9997 0.661778 9.40477 0.927708 30.9079 1.09339 50 5.25123 299.625
 12 9.49416 1.62947 21.1924 2.61133 45.9725 2.7512 45 6.56355 11.6693 1.41346 28.6336 1.27326 49.5 1.84332 296.723
 13 9.31509 1.94217 20.755 3.42282 46.8783 3.88007 45 2.19204 13.0495 1.69827 30.0782 1.63682 55 7.28371 296.753
 14 10.5026 1.77537 16.9338 2.94925 43.7541 3.60952 45 1.74086 8.3912 1.50432 26.6396 1.63014 55 8.89783 297
 15 8.44399 2.23129 46.0546 12.4225 65.6761 12.6752 40 1.03545 13.7027 2.07772 33.184 2.22571 50 5.96153 298.436
 16 9.20504 0.720929 15.646 3.21106 42.0112 4.00203 40 6.44323 10.7654 1.62848 31.7498 1.82365 50 7.07497 297.971
 17 7.92718 2.39051 29.6065 7.46813 53.9784 8.50669 35 2.09558 8.52568 0.483135 29.3263 0.608928 45 9.81567 299.594
 18 7.90478 1.71204 16.019 3.34822 41.3167 4.18977 38 0.00828737 13.9369 2.67916 33.8913 3.06747 45 8.43232 298.383
 19 6.45744 2.36807 34.9235 8.62682 71.6902 11.0661 35 6.8335 31.6004 1.23283 45.3676 1.19332 45 9.81567 295.81
 20 7.99813 2.57716 14.0621 3.21137 39.8545 4.13918 35 1.92582 11.9984 2.63275 29.5949 2.97504 45 8.89783 296.516
```

fit results:

```
gpgl:sector6> grep +++++ pfid_3genpars.out
+++++ fit1 results 11.2884 -0.473355
+++++ fit2 results 18.1971 -59.8906
+++++ fit3 results -2.07011 85.5094
+++++ fit4 results 15.128 -15.8178
+++++ fit5 results 44.5691 -45.3433
+++++ fit6 results 103.824 43.9954
+++++ fit7 results 116.835 -58.6413
+++++ fit8 results 299.457
gpgl:sector6>
g
```

Click here to view the object (Fig 4. PS file showing gen 2 fits.) you uploaded.

See the UR elog for final results.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 85 - pfid tests (gpg)

[Modified Tue Oct 18 13:58:25 2005 (GMT) gpg]

The first look at the effect of the 4.2 GeV pfids is disturbing as shown below. The events outside the fiducials are eliminated, but it also liiks like 80% of the events in the fiducial region are getting punted. The only difference between the left and right panels in Fig 1 is turning the proton fiducials on. A mystery??!!

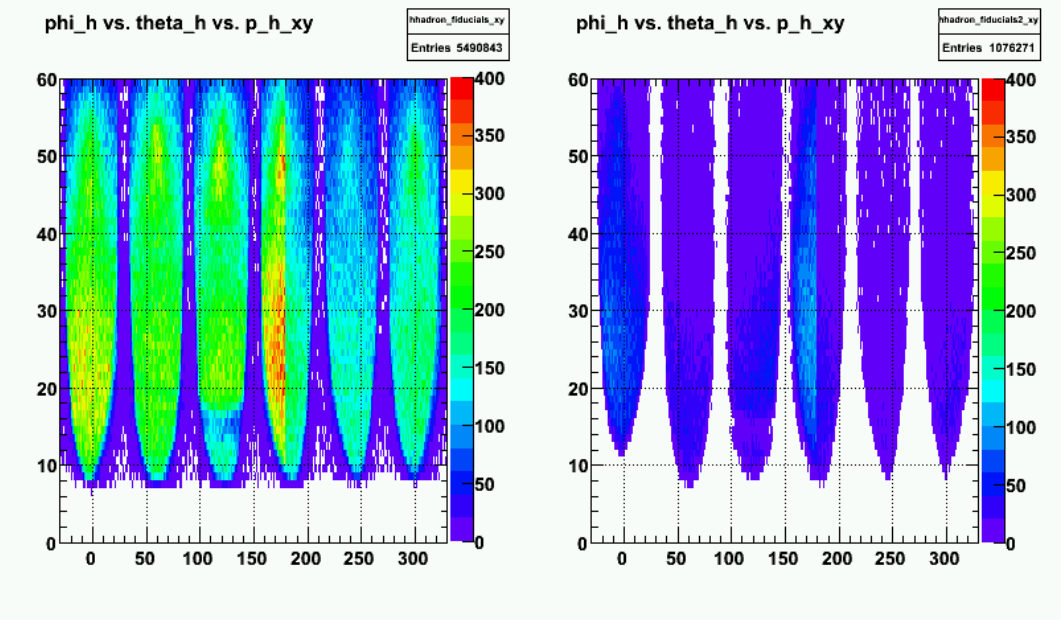


Fig 1. Comparison showing effect of no 4.2 GeV pfid cut (left panel) and with proton fiducial cuts on (right panel) for all momenta.

After fixing numerous programming errors, I get the following plot which looks much better. What is worrisoome now is why am i losing counts in the middle of the fiducial region? Is this because of the implicit momentum limits in the proton fiducial cuts? See fig 3.

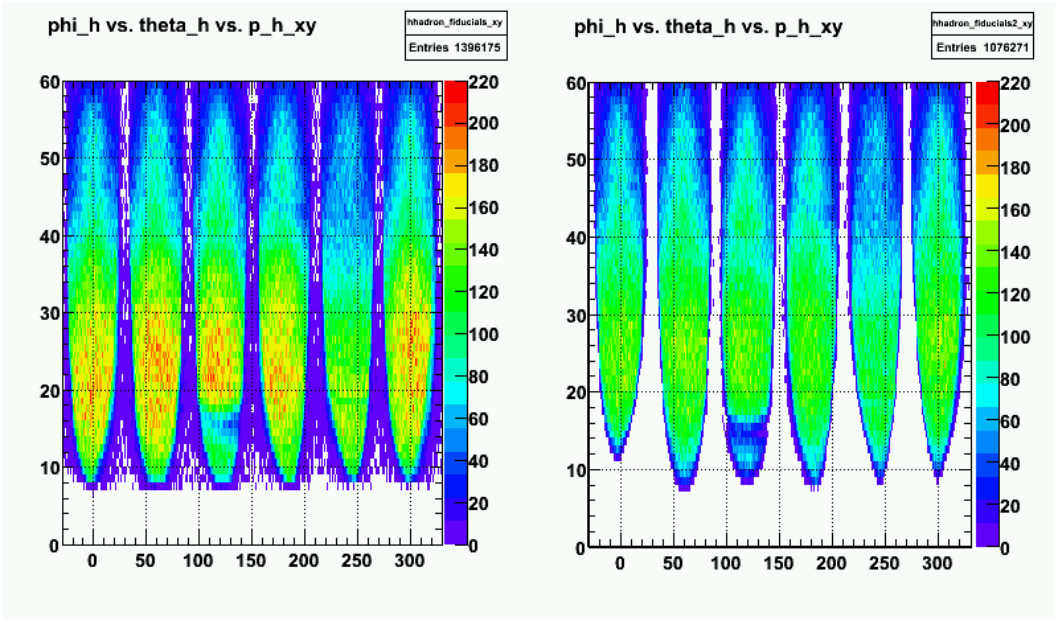


Fig 2. Comparison after fixing programming errors showing effect of no 4.2 GeV pfid cut (left panel) and with proton fiducial cuts on (right panel) for all momenta.

Click here to view the object (ROOT C++ macro for Fig 2.) you uploaded.

Do the same analysis, but restrict the range of the data with pfids off to 0.1 < p_proton < 2.1 to reproduce the implicit momentum cut on p_p in the pfid function. That appears to improve the agreement significantly. Namely, there should be little or no difference between the two acceptances in Figure 3 in the fiducial region. The proton fiducial cuts should just throw out the events outside this fiducial range. There still appears to be some small differences. Let me check the exact proton momentum range. See the results in Figure 4.

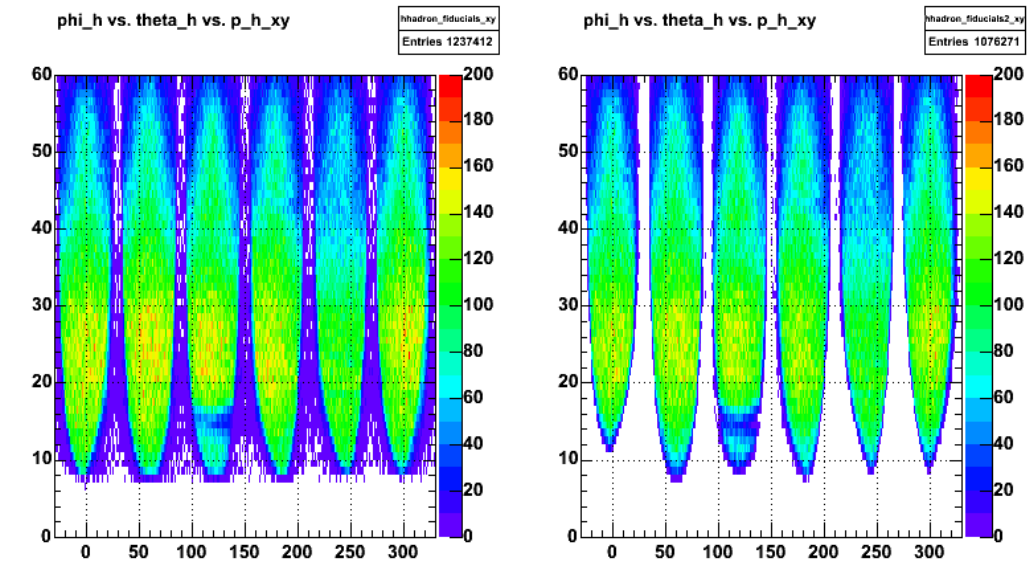


Fig 3. Comparison of effect on acceptance with proton fiducials off (left) and on (right).

Click here to view the object (ROOT C++ macro for Fig 3.) you uploaded.

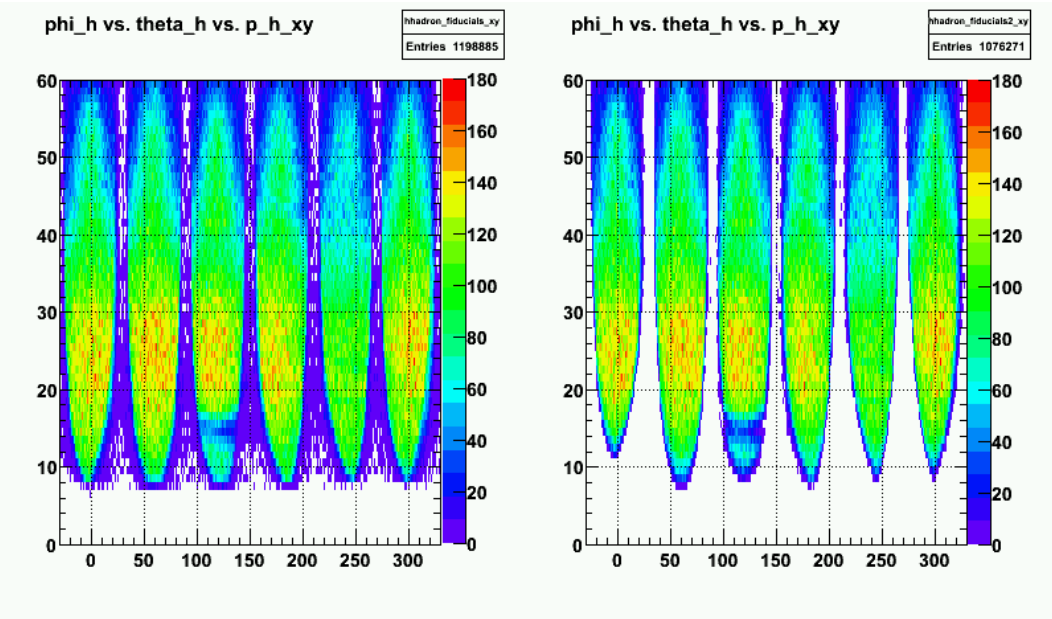


Fig 4. Same as Figure 3, but I fixed a small error in the left-hand, no-pfids acceptance. In Figure 3 I required 0.1 GeV/c < p_p < 2.1 GeV/c to reproduce the limits on p_p in the pfid function. Those limits should have been 0.1 GeV/c < p_p < 2.0 GeV/c.

Click here to view the object (ROOT C++ macro for Figure 4.) you uploaded.

Click here to view the object (ROOT histogram file for Figure 4.) you uploaded.

Click here to view the object (C++ code used in ROOT for analysis for Figure 4) you uploaded.

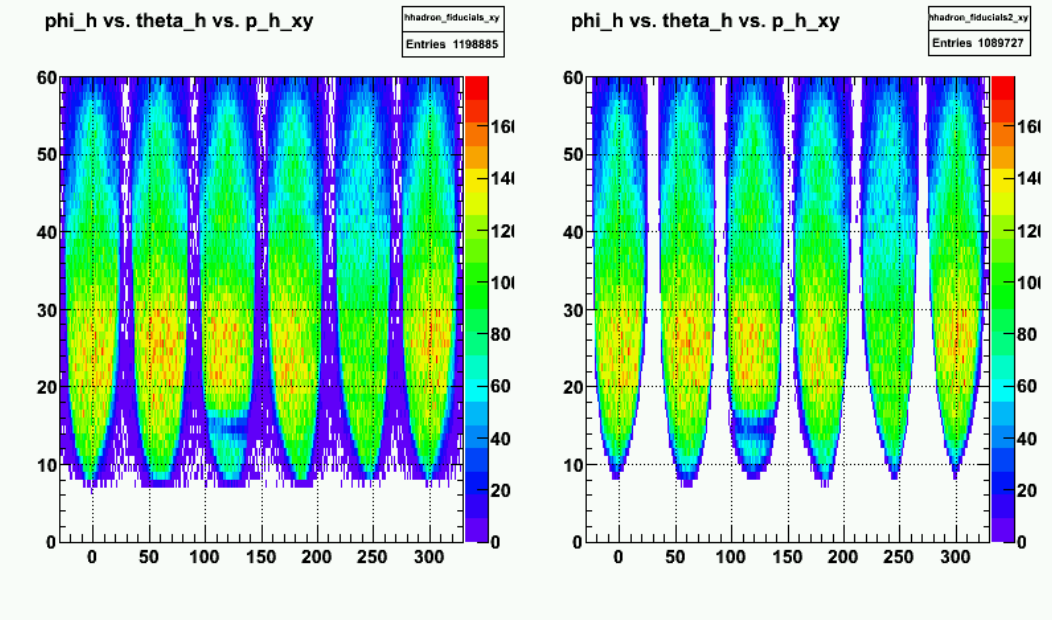


Fig 5. Same as Fig 4, but we fixed the ultra-small uncertainties on some of the points in the t0 fit for sector 1. This caused a significant change in the fit to the t0 as a function of p_p which eliminated this high theta_p cutoff that is visible in Fig 4.

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

Click here to view the object (ROOT histogram file used for Fig 5.) you uploaded.

Click here to view the object (Slightly fancier version of the ROOT C++ macro for the last figure.) you uploaded.

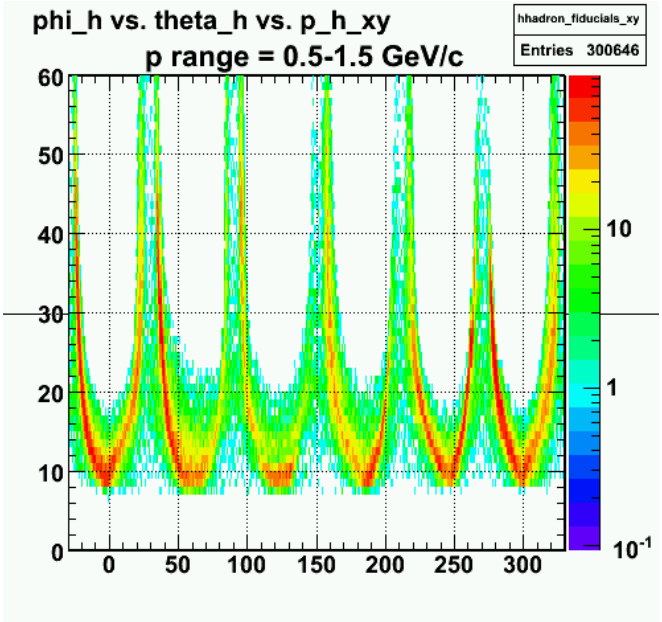


Fig 6. I am seeing lots (30%) of the events thrown out when I turn on the pfids. Looking at the excluded events shown above there is clearly a problem. Some events in the good fiducial region are getting excluded by the function.

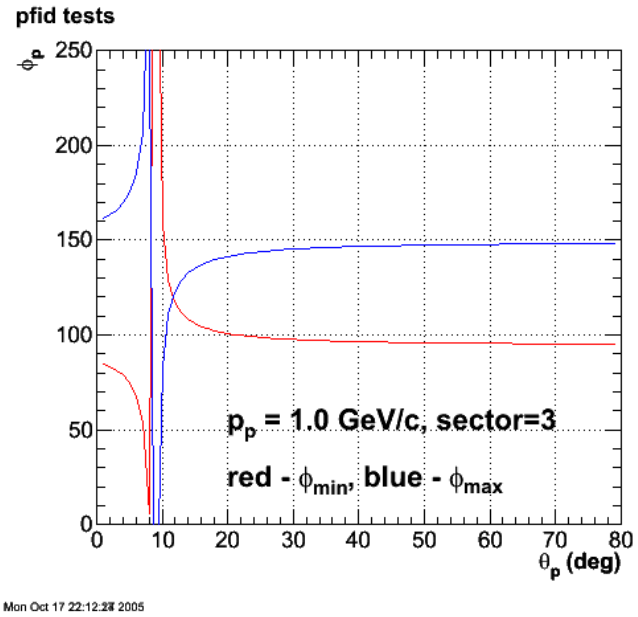


Fig 6. Examinging one sector and proton momentum fiducial cut in detail.

The results for the pfid tests actually look ok. The crappy looking stuff in Fig 5 is due to the use of a large p_p range to project out the data onto the phi_p-theta_p plane. At low p_p, the minimum angle increases. If you project out data from a low p_p to a 'high'p_p range it looks like the fiducial region of the detector is getting filled in. When you look at narrow p_p bins separately there is no problem. See Fig 7. below.

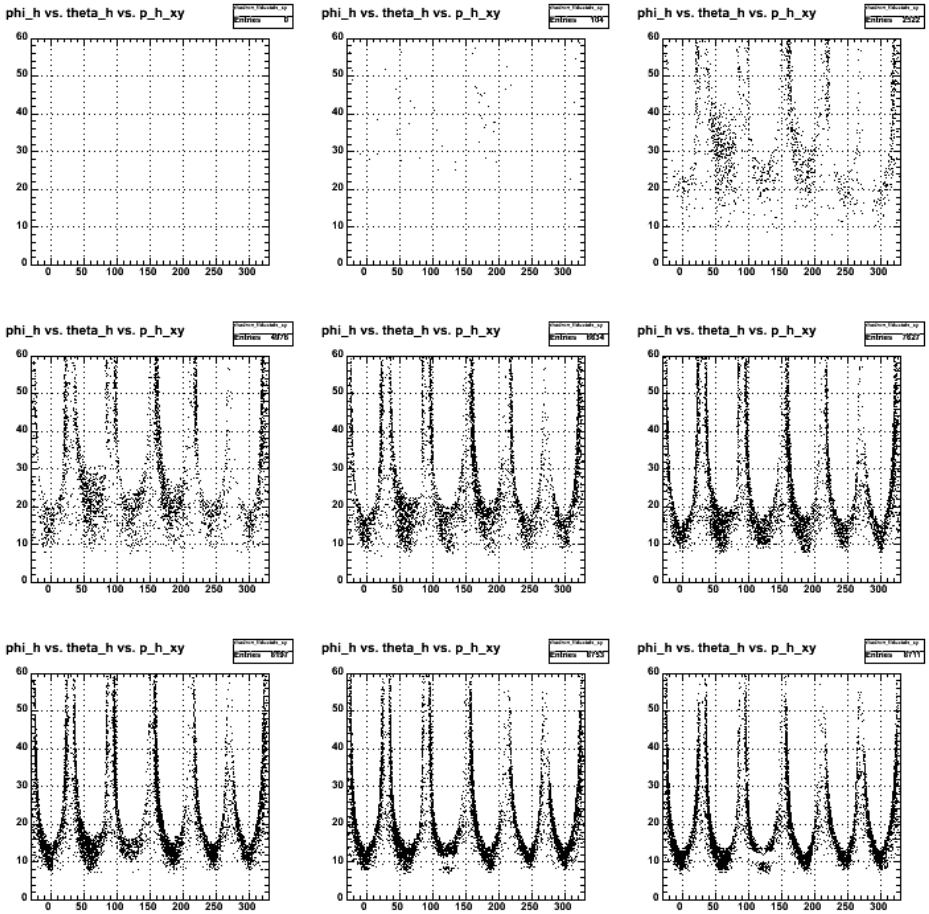


Fig 7. Plot of excluded protons for p_p = 0.1-0.9.

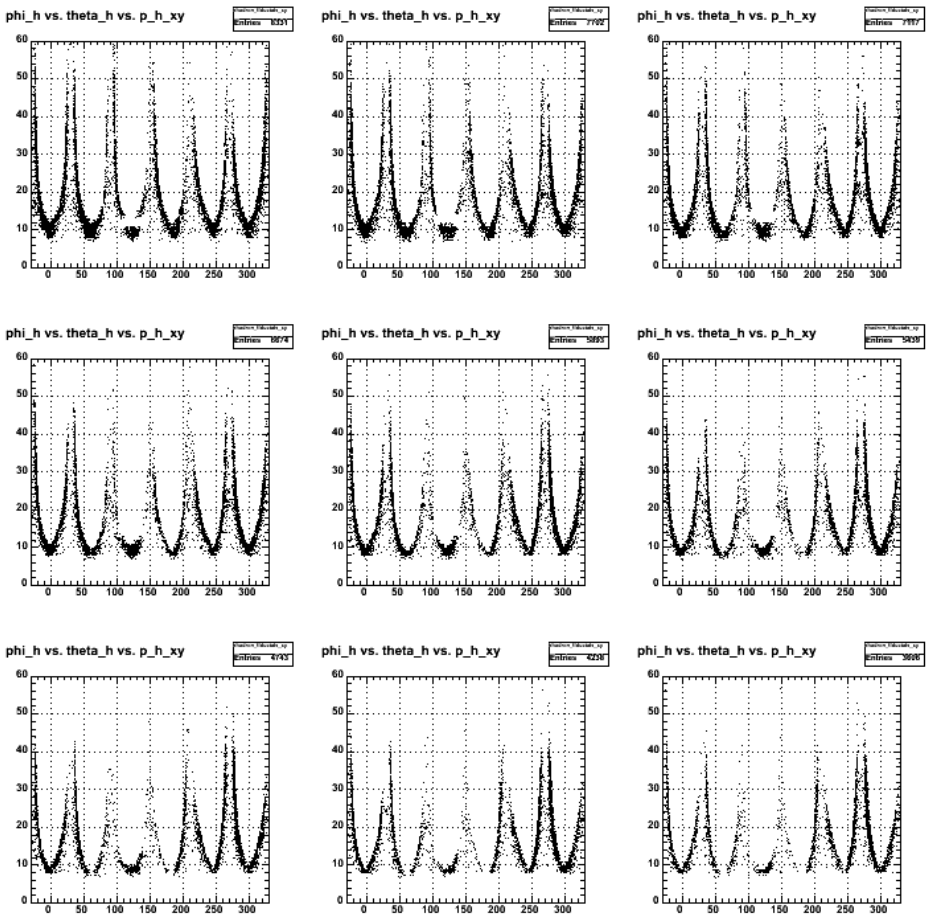


Fig 8. Plot of excluded protons for p_p = 1.0 - 1.8 GeV/c

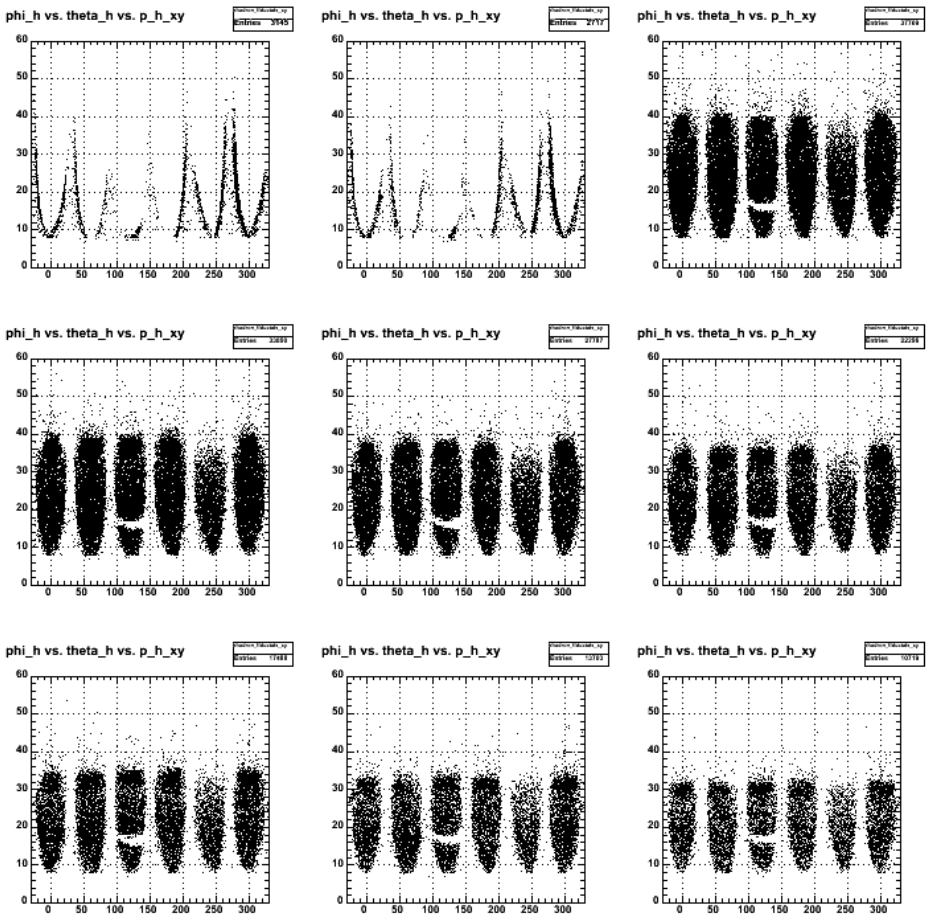


Fig 9. Plot of excluded protons for p_p = 1.9-2.7 GeV/c

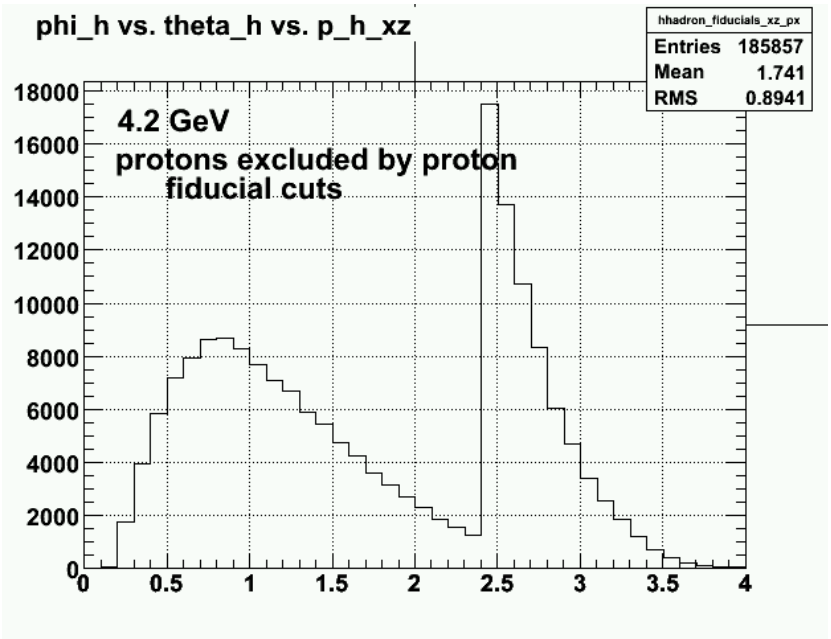


Fig 9. Momentum distribution of protons excluded by the proton fiducial cut showing the cutoff at p_p=2.4 GeV/c. The limit was extended from 2.0->2.4 GeV/c just to see the effect which looks ok. See next plot.

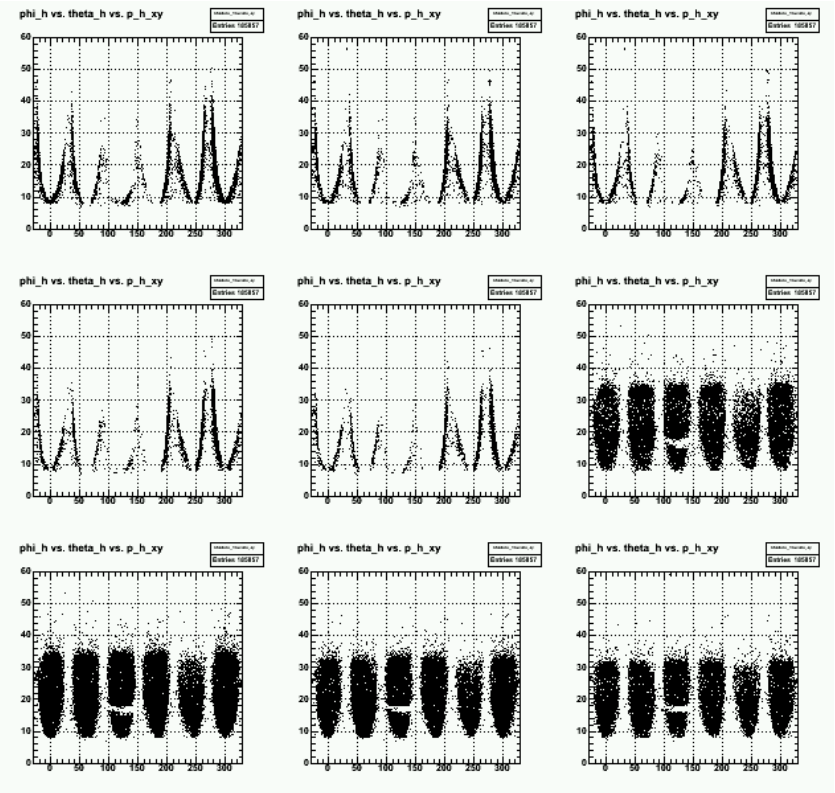


Fig 10. Extended the range of the proton fiducial cuts from 2.0->2.4 GeV/c to see if it would look ok and it does. The limit of 2.0 GeV/c was driven by the statistics of the first generation fits.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 86 - fitting missing mass spectra (gpg)

[Modified Sun Oct 16 20:28:49 2005 (GMT) gpg]

The plots below show first results from fitting the missing mass spectra with an eye to testing the effect of fitting the missing mass to get the neutron counts that go into the helicity asymmetry.

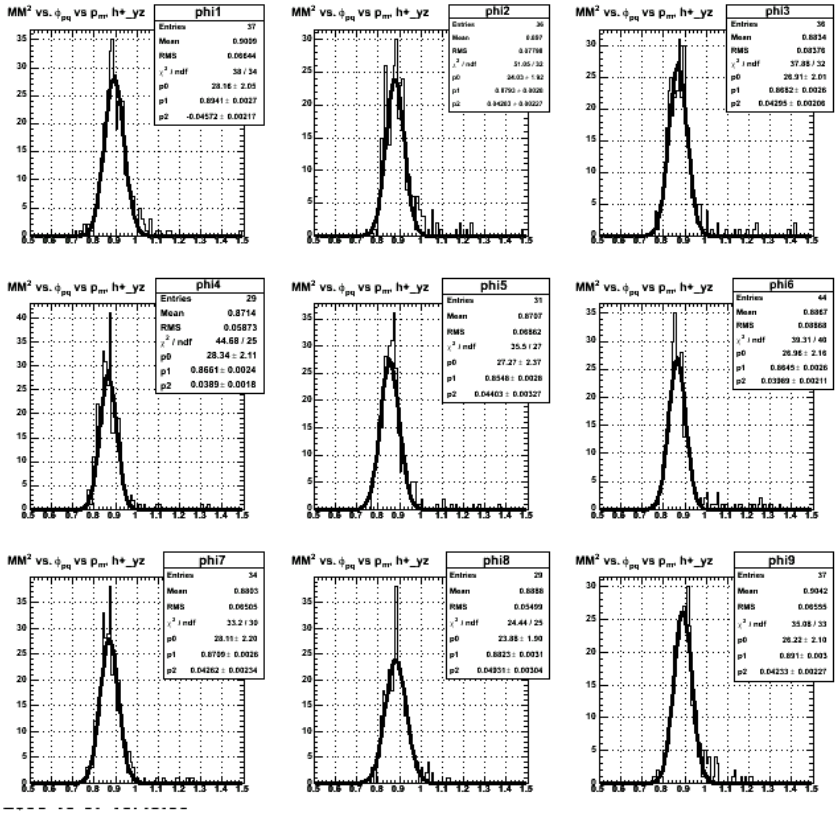


Fig 1. Fits for p_m bin=1

Click here to view the object (PS file of Fig 1.) you uploaded.

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

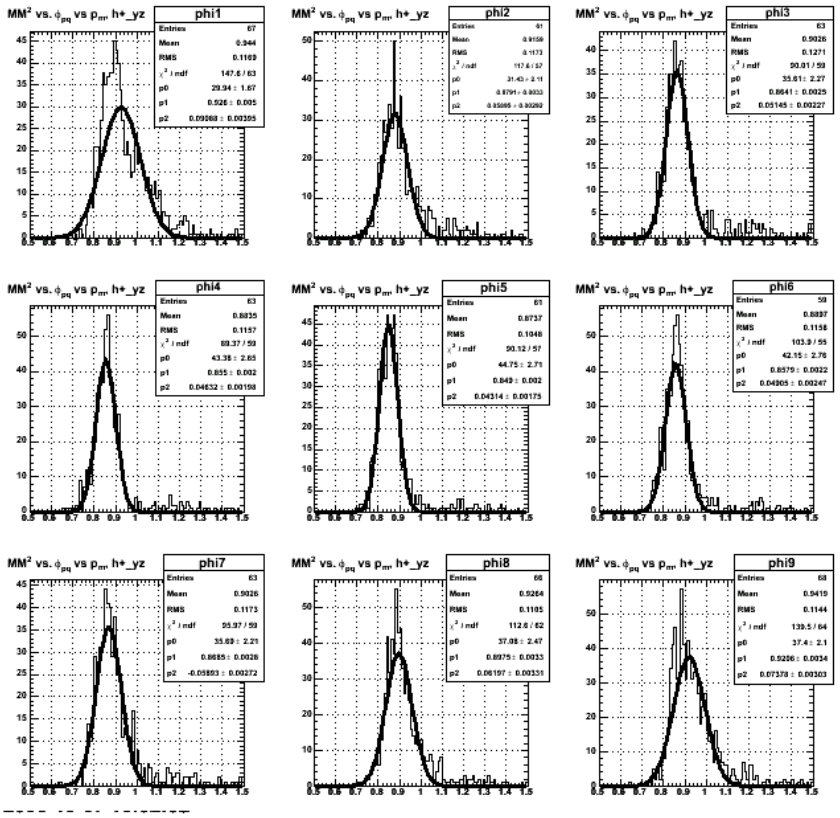


Fig 2. Fits for p_m bin=2.

Click here to view the object (PS file for Fig 1.) you uploaded.

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

I've completed writing a first version of the code for doing the fitting of the helicity asymmetry. The plot below shows the results for ALTp as a function of p_m for 4.2 GeV. The plot shows ALTp derived from a simple integral of the spectrum below MM2=1.0 GeV. When I did the same analysis using a gaussian fit, the results were ugly because there are so few counts at large p_m. The links after the figure include copies of the ROOT code, PostScript files showing the fits, and a macro for the figure itself.

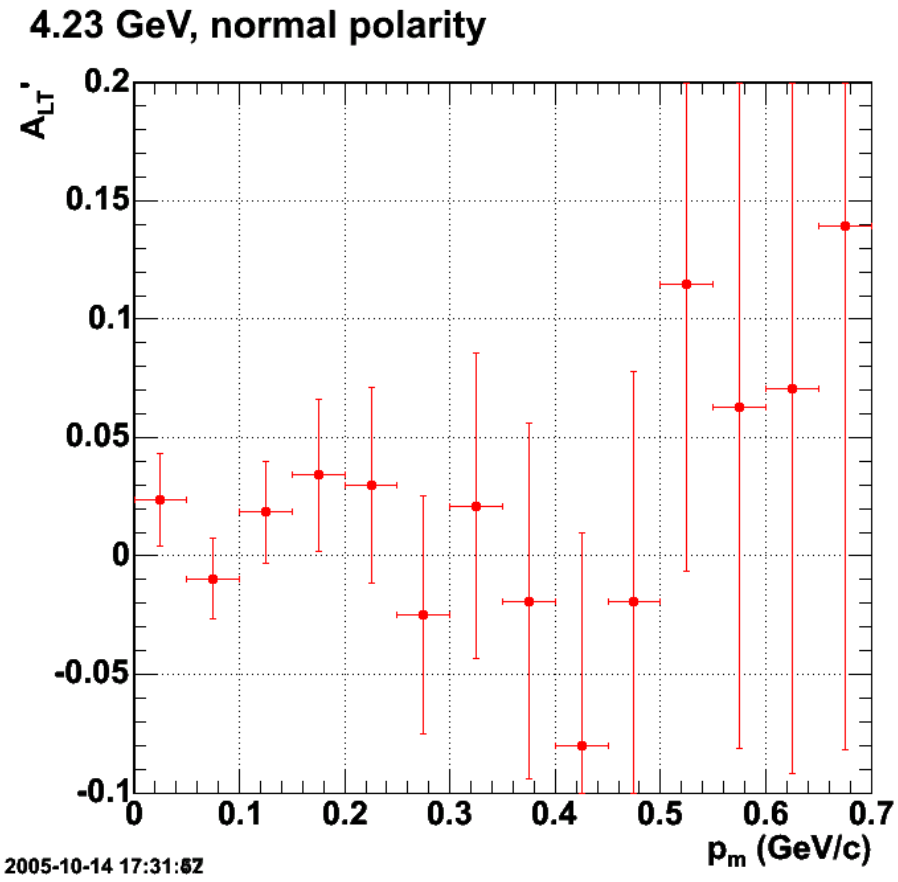


Fig 3. ALTp at 4.2 GeV from integrating MM2 spectra using the codes below.

Click here to view the object (ROOT C++ macro for Fig 3.) you uploaded.

Click here to view the object (PostScript file showing intermediate results for Fig 3) you uploaded.

Click here to view the object (ROOT C++ macro file mm2fit5.C which uses a simple integral to get the helicity asymmetry.) you uploaded.

Click here to view the object (ROOT C++ macro file mm2fit4.C which uses a gaussian to get the helicity asymmetry. Does not work well when the number of counts is very small at large p_m.) you uploaded.

Click here to view the object (ROOT histogram file used with the codes above.) you uploaded.

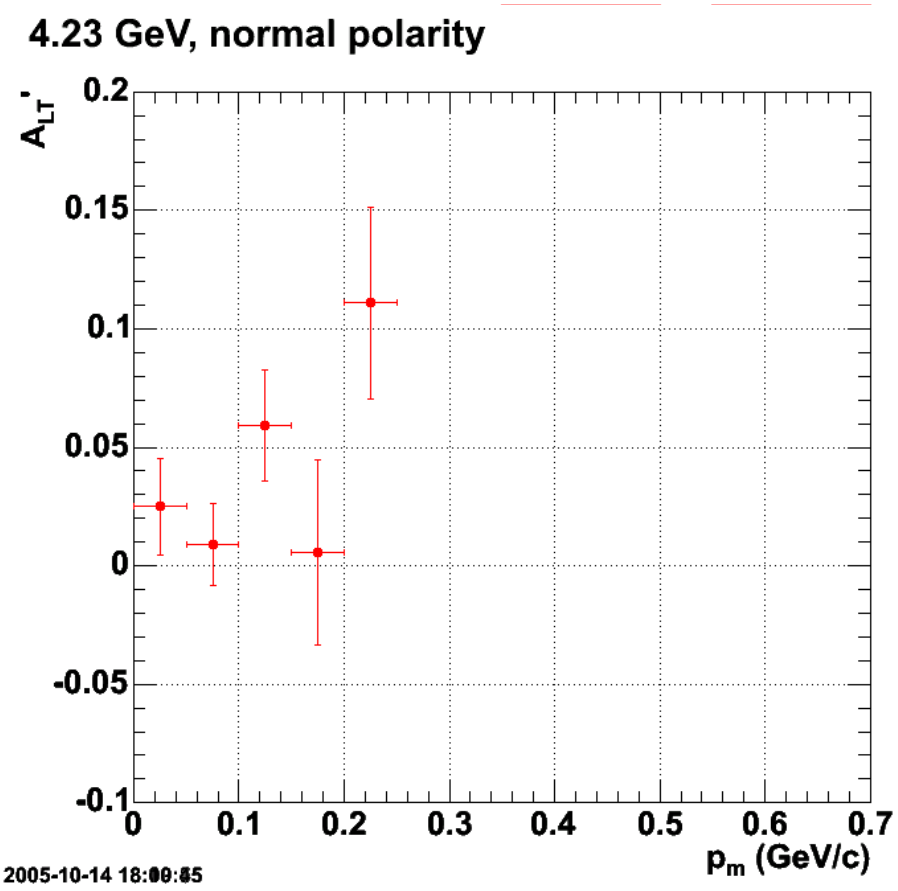


Fig 4. ALTp vs. p_m extracted with a gaussian fit. there are simply not enough counts at large p_m so the fits crap out. See the next link with the PostScript file containing the intermediate results.

Click here to view the object (PostScript file containing the intermediate fit results for Fig 4) you uploaded.

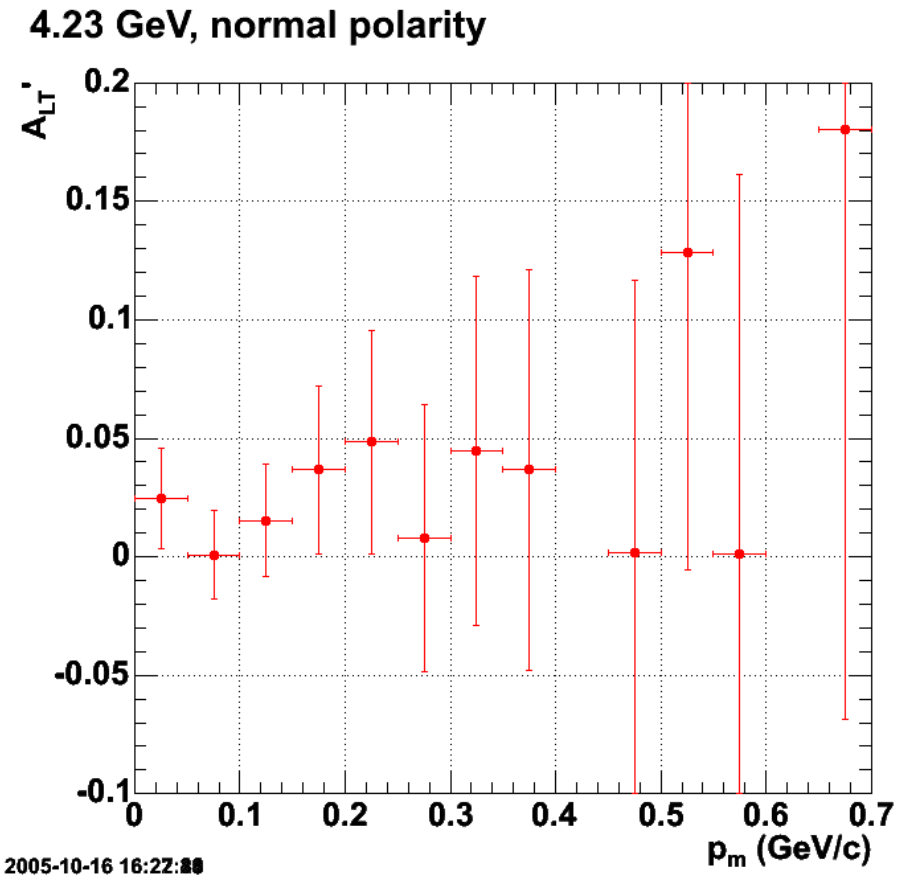


Fig 5. ALTp with MM2 < bin 42

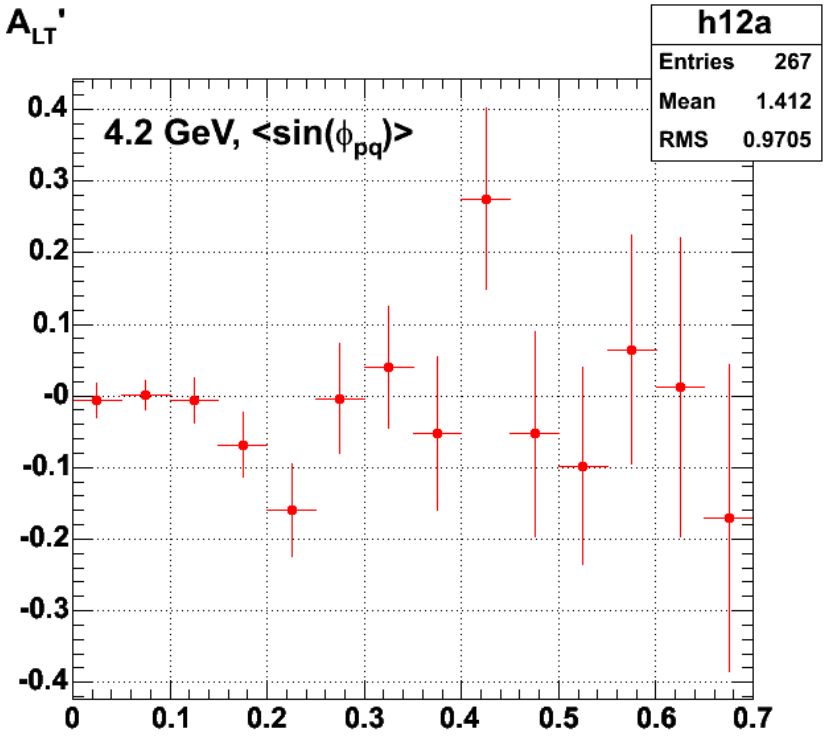
DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 87 - comparing ALTp methods for QE kinematics (gpg)

[Modified Wed Oct 26 21:58:00 2005 (GMT) gpg]

Generate the distributions and use the following code to extract ALTp.

```
TH1F *h1a = new TH1F("h1a","Sin(#phi) weighted distribution for positive helicity",14,0.0,0.7);
TH1F *h2a = new TH1F("h2a","Sin(#phi) weighted distribution for negative helicity",14,0.0,0.7);
h1a.Sumw2();
h2a.Sumw2();
h1a.Divide(hp_m_sin_phi_wghtplus, hp_m_unwghtplus);
h2a.Divide(hp_m_sin_phi_wghtminus,hp_m_unwghtminus);
TH1F *h12a = new TH1F("h12a","A_{LT}'",14,0.0,0.7);
h12a.Sumw2();
h12a.Add(h1a,h2a,1.0,-0.9994);
h12a.Draw();
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h12a->Divide(unity,0.73)
h12a->Draw();
```



2005-10-16 15:42:55

Fig 1. ALTp from the usual method with an upper limit on the missing mass squarded of 0.92

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

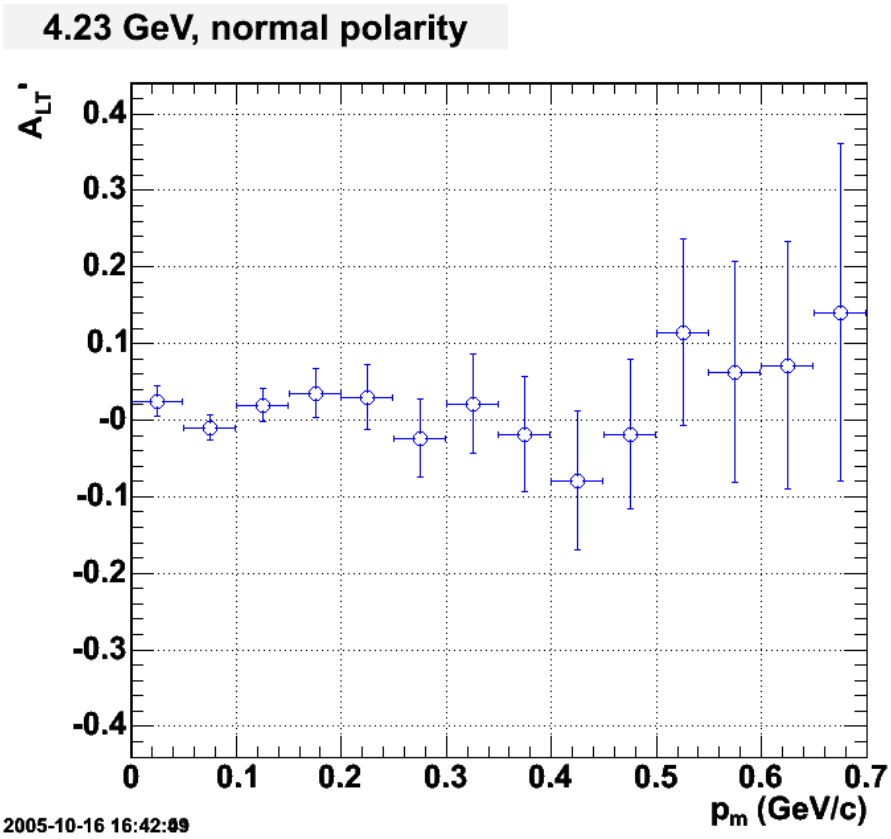


Fig 2. ALTp from mm2fit5.C

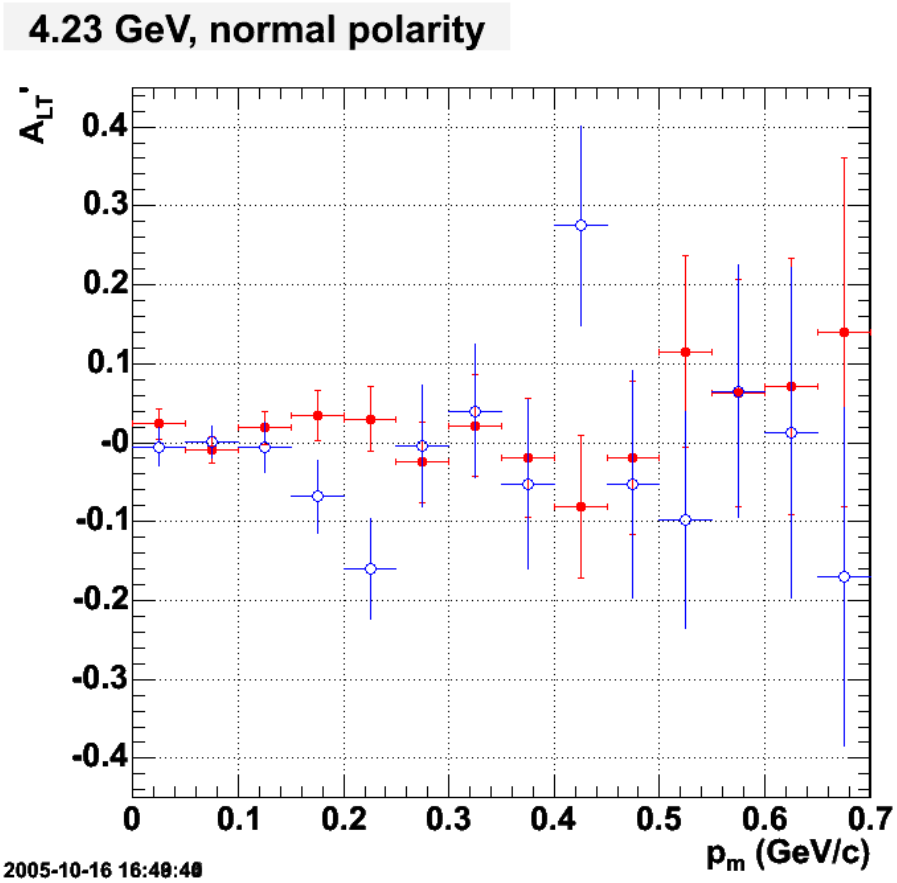
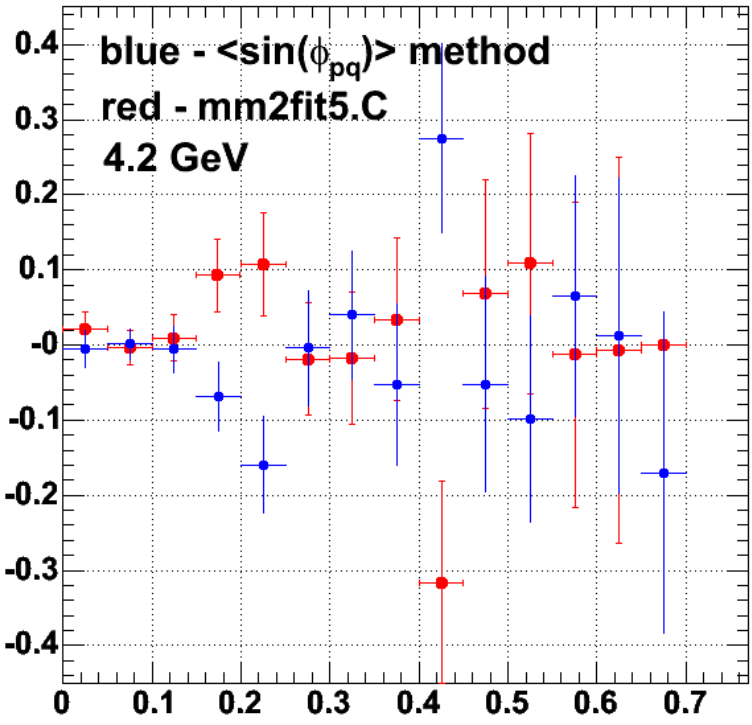


Fig 3. Comparison of Figs 1-2

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.



2005-10-16 17:29:06

Fig 4. Comparison of the two methods for extracting ALTp after I included a lower limit on MM2 in mm2fit5.C to reproduce the cuts in eod5.C. The limits are bins 34-42.

To see if the fluctuations of the data in these plots are consistent with ALTp=0.0, I fit the data with a straight line. The result is shown below and the data (asymmetries and uncertainties) are consistent with zero.

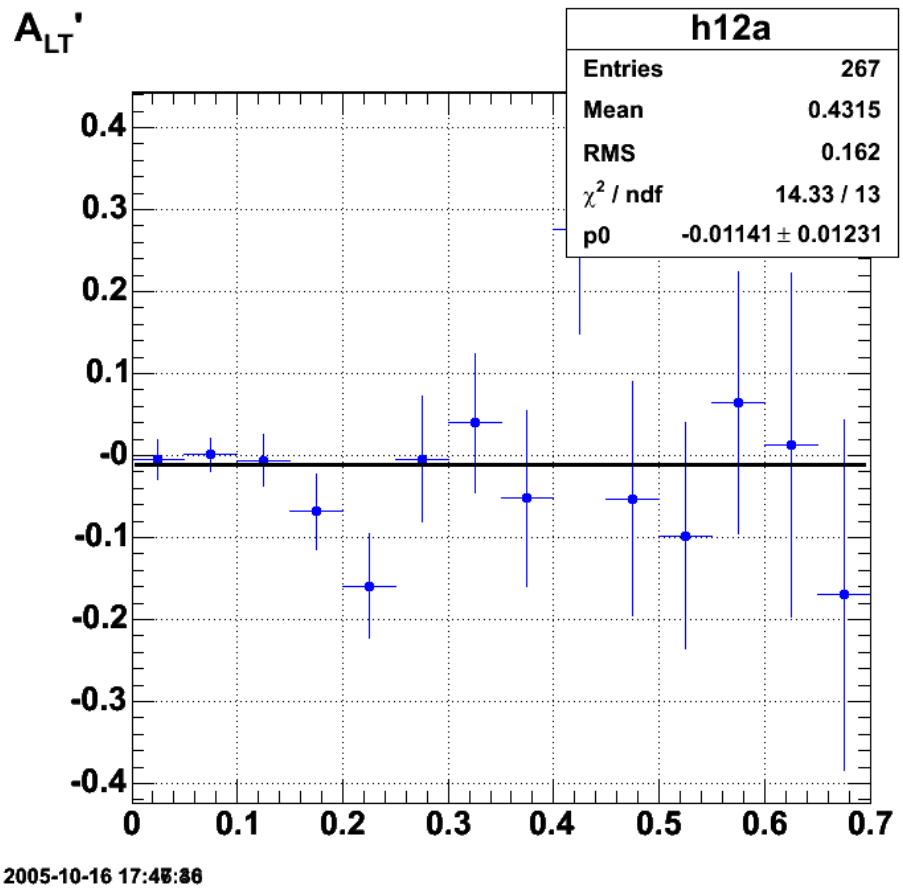


Fig 5. Checking the consistency of the asymmetries and the uncertainties.

Figures 6 and higher (below) are for quasielastic kinematics.

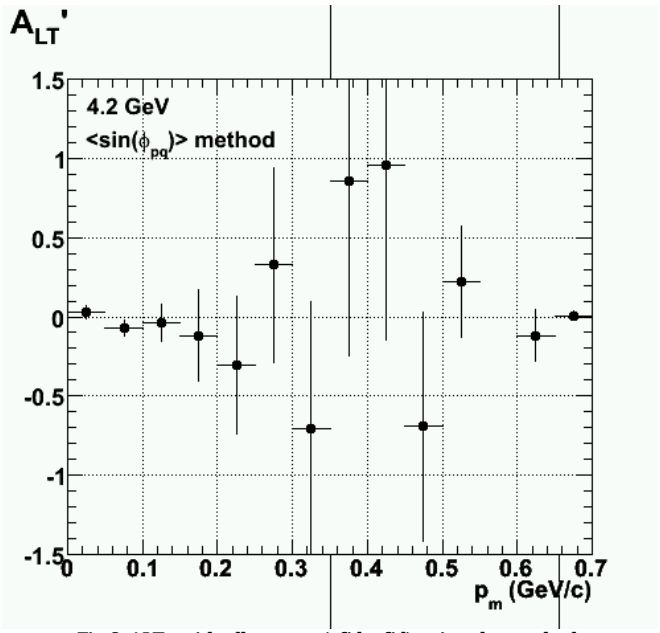


Fig 6. ALTp with all cuts on (efid, pfid) using the method.

Fig 6 should be compared to Fig 7 below, but there are some obvious problems. Fig 7 shows the results of the fits to the helicity asymmetry as a function of p_m.

Many of the missing momentum bins have few or no counts so the fits can't be made to the helicity asymmetry as a function of phi_{pq}. This is disappointing.

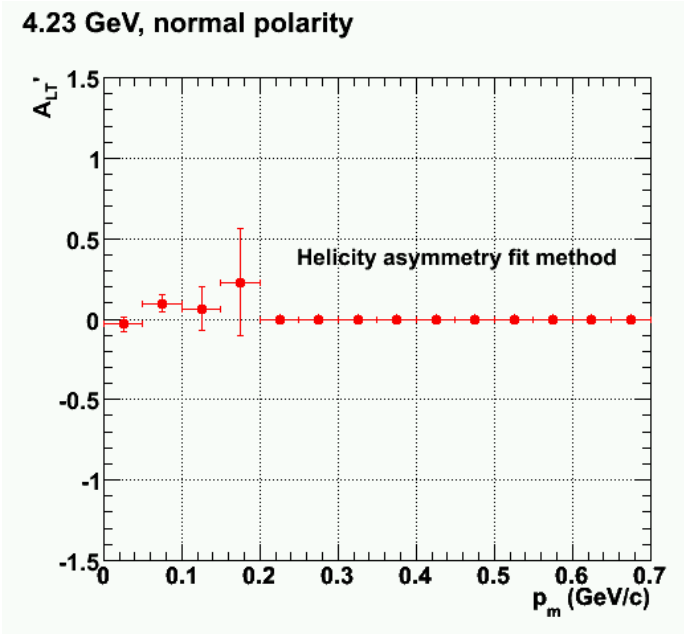


Fig 7. ALTp with efid and pfid on derived from the fits to the helicity asymmetry as a function of p_m.

Turning on the momentum corrections has a very minor effect. The values for ALTp move a bit, but much less than the error bars. See Fig 8 and the following table for a comparison.

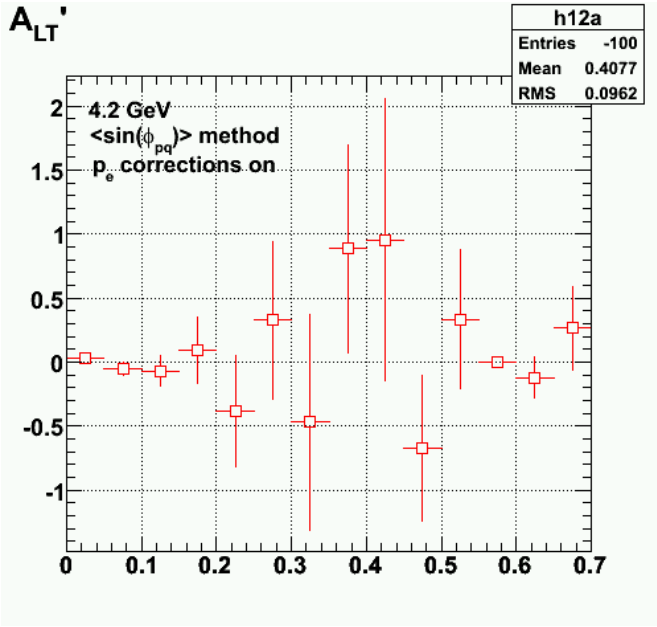


Fig 8. Same as Figure 6 with momentumc corrections turned on.

```
without momentum corrections

TH1.Print Name  = h12a, Entries= -67, Total sum= 0.347595
 fSumw[0]=0, x=-0.025, error=0
 fSumw[1]=0.0286471, x=0.025, error=0.0427026
 fSumw[2]=-0.0734598, x=0.075, error=0.0507938
 fSumw[3]=-0.0346902, x=0.125, error=0.117746
 fSumw[4]=-0.119426, x=0.175, error=0.287323
 fSumw[5]=-0.303351, x=0.225, error=0.433243
 fSumw[6]=0.326472, x=0.275, error=0.613474
 fSumw[7]=-0.704476, x=0.325, error=0.801408
 fSumw[8]=0.858817, x=0.375, error=1.1079
 fSumw[9]=0.954875, x=0.425, error=1.10353
 fSumw[10]=-0.693092, x=0.475, error=0.726146
 fSumw[11]=0.223605, x=0.525, error=0.349235
 fSumw[12]=0, x=0.575, error=0
 fSumw[13]=-0.119971, x=0.625, error=0.162344
 fSumw[14]=0.00364494, x=0.675, error=0.00515473
```

```
 fSumw[15]=-0.0103964, x=0.725, error=0.320733
root [16]


turn on the VB momentum corrections and get the following


TH1.Print Name  = h12a, Entries= -100, Total sum= 1.13269
 fSumw[0]=0, x=-0.025, error=0
 fSumw[1]=0.0288855, x=0.025, error=0.0419779
 fSumw[2]=-0.0483678, x=0.075, error=0.0513348
 fSumw[3]=-0.0677476, x=0.125, error=0.117164
 fSumw[4]=0.0918377, x=0.175, error=0.255901
 fSumw[5]=-0.384845, x=0.225, error=0.43573
 fSumw[6]=0.326517, x=0.275, error=0.613395
 fSumw[7]=-0.466273, x=0.325, error=0.843323
 fSumw[8]=0.886732, x=0.375, error=0.815359
 fSumw[9]=0.954511, x=0.425, error=1.10307
 fSumw[10]=-0.672506, x=0.475, error=0.568025
 fSumw[11]=0.335036, x=0.525, error=0.541246
 fSumw[12]=0.00071305, x=0.575, error=0.0010084
 fSumw[13]=-0.119965, x=0.625, error=0.162299
 fSumw[14]=0.268168, x=0.675, error=0.326957
 fSumw[15]=0.204162, x=0.725, error=0.272154
```

Turn off efid and pfid and we see hints of structure??!!

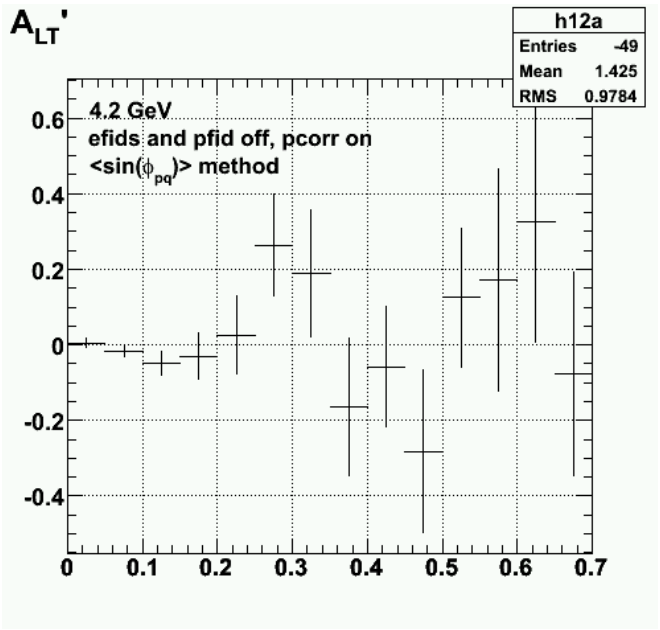
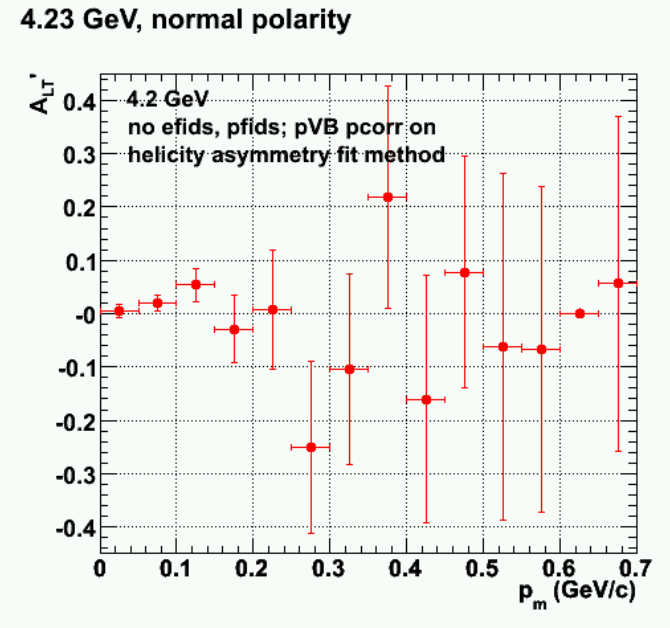


Fig 9. Same as Fig 8 with efid and pfids off.

Click here to view the object (ROOT C++ macro for Fig 8) you uploaded.



Fi 10. Same as Fig 9 using fits to helicity asymmetry.

Click here to view the object (ROOT C++ macro for Fig 10.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 88 - ALTp in dip kinematics (gpg)

[Modified Tue Jan 10 19:20:05 2006 (GMT) gpg]

The plots below show ALTp for kinematics different from the traditional quasielastic.

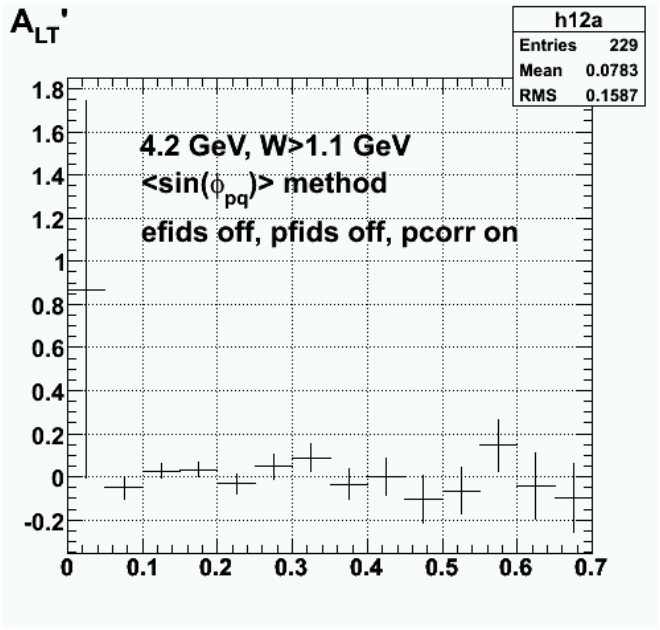


Fig 1. For W > 1.1 GeV, no efid or pfid.

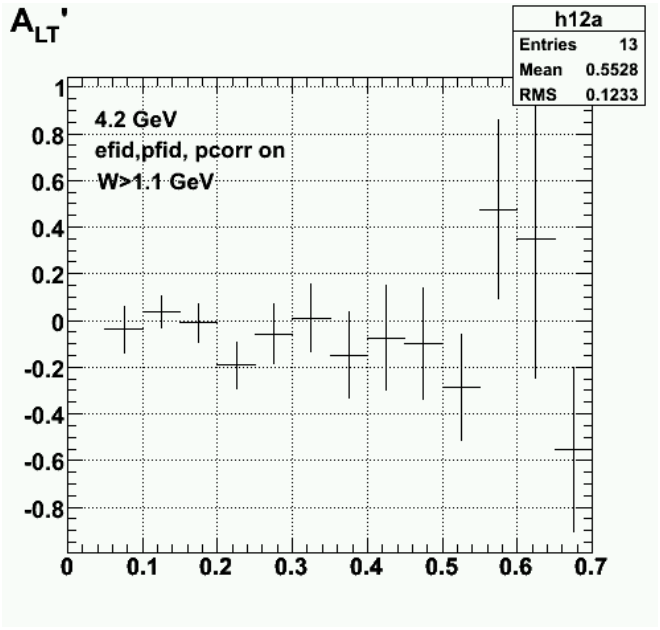


Fig 2. Same as Fig 1 with efid and pfid turned on.

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

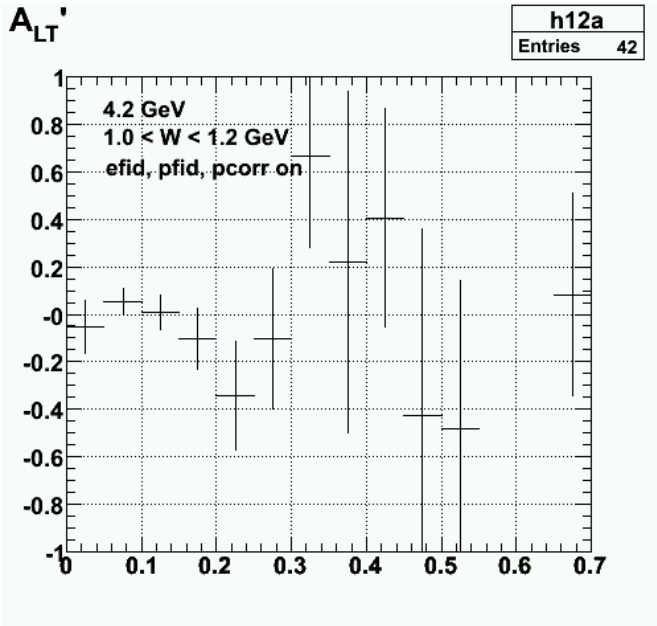


Fig 3. ALTp for a restricted W range with efids, pfids on.

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.

Click here to view the object (ROOT histogram file used to make Fig 3) you uploaded.

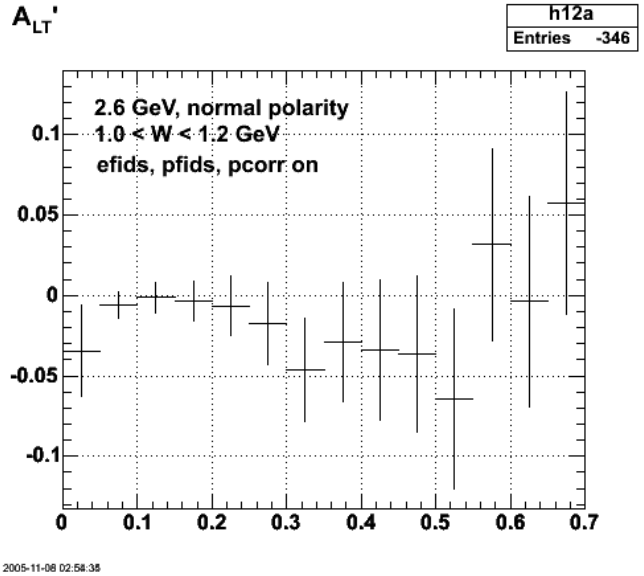


Fig 4. ALTp at 2.6 GeV, normal polarity setting with efids, pfids, pcorr on and 1.0 < W < 1.2 GeV.

Click here to view the object (ROOT C++ macro for Fig 4) you uploaded.

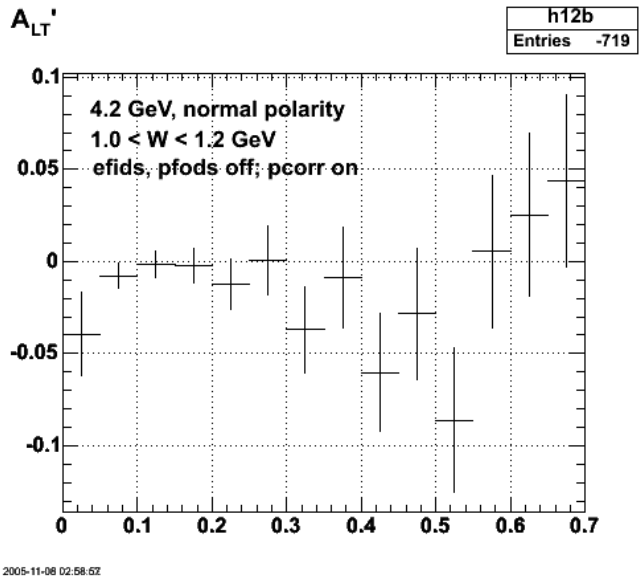


Fig 5. ALTp at 2.6 GeV, normal polarity setting with efids, pfids off; pcorr on and 1.0 < W < 1.2 GeV.

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

Click here to view the object (ROOT C++ macro for Fig 4) you uploaded.

Click here to view the object (ROOT histogram file for Figs 4-5) you uploaded.

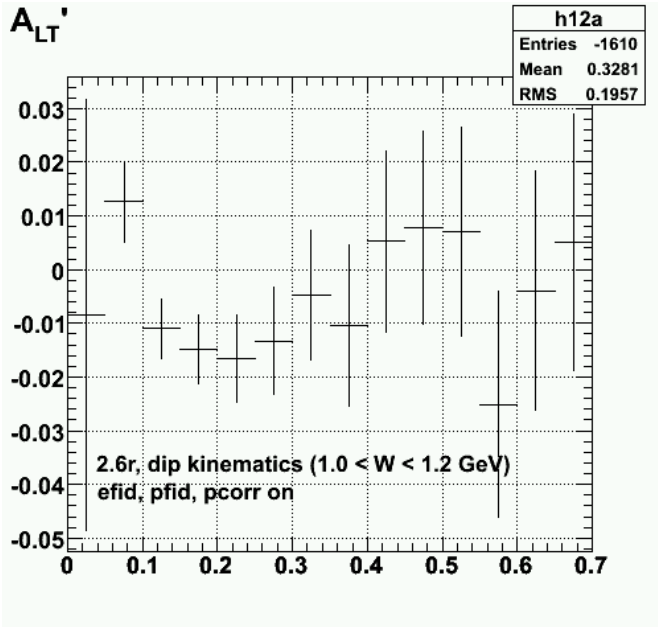


Fig 6. 2.6r results with efid, pfid, pcorr on

Click here to view the object (ROOT C++ macro for Fig 6) you uploaded.

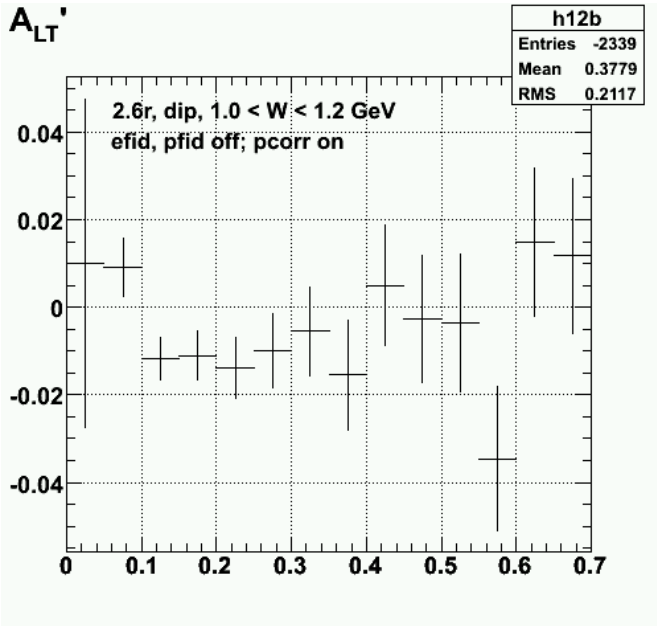


Fig 7. 2.6r results with efid, pfid off; pcorr on

Click here to view the object (ROOT C++ macro for Fig 7) you uploaded.

Click here to view the object (ROOT histogram file for Fig 6-7) you uploaded.

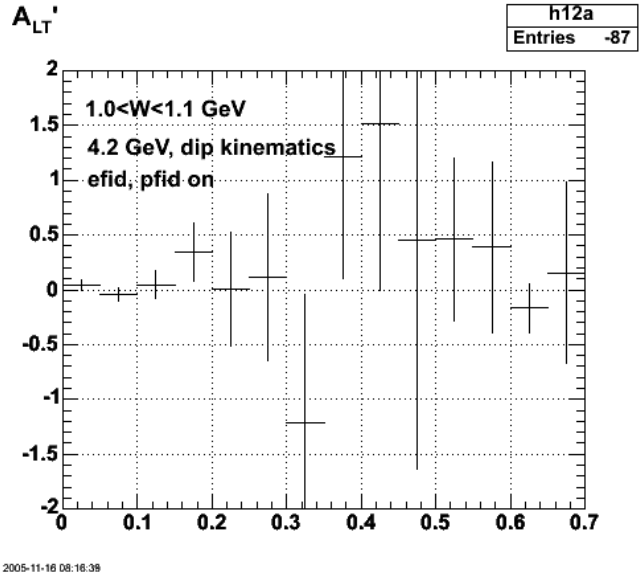


Fig 8. Play with the W range (and the definition of the dip).

Click here to view the object (ROOT C++ macro for Fig 8) you uploaded.

Click here to view the object (ROOT histogram file for Fig 8) you uploaded.

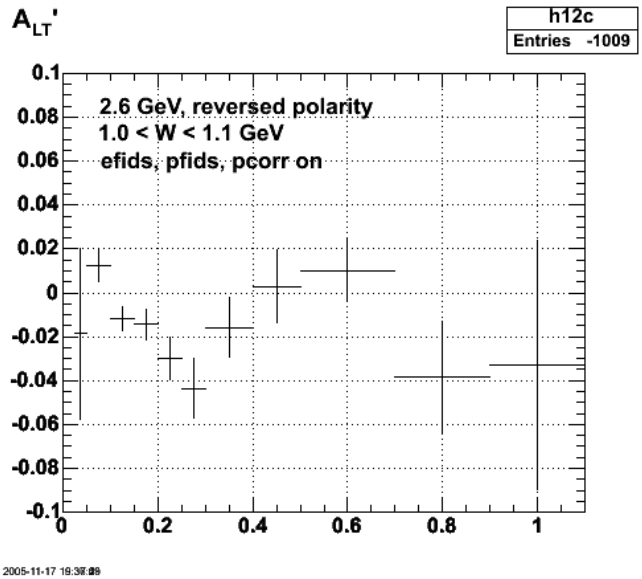


Fig 9. 2.6r results for narrower W range (1.0-1.1 GeV) and full data set.

Click here to view the object (ROOT C++ macro for Fig 9) you uploaded.

Click here to view the object (ROOT histogram file for Fig 9.) you uploaded.

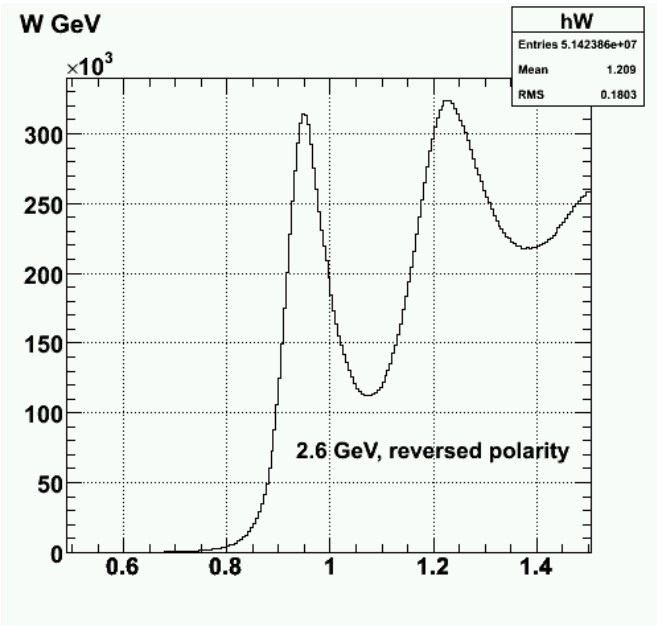


Fig 10. W distribution for 2.6r singles

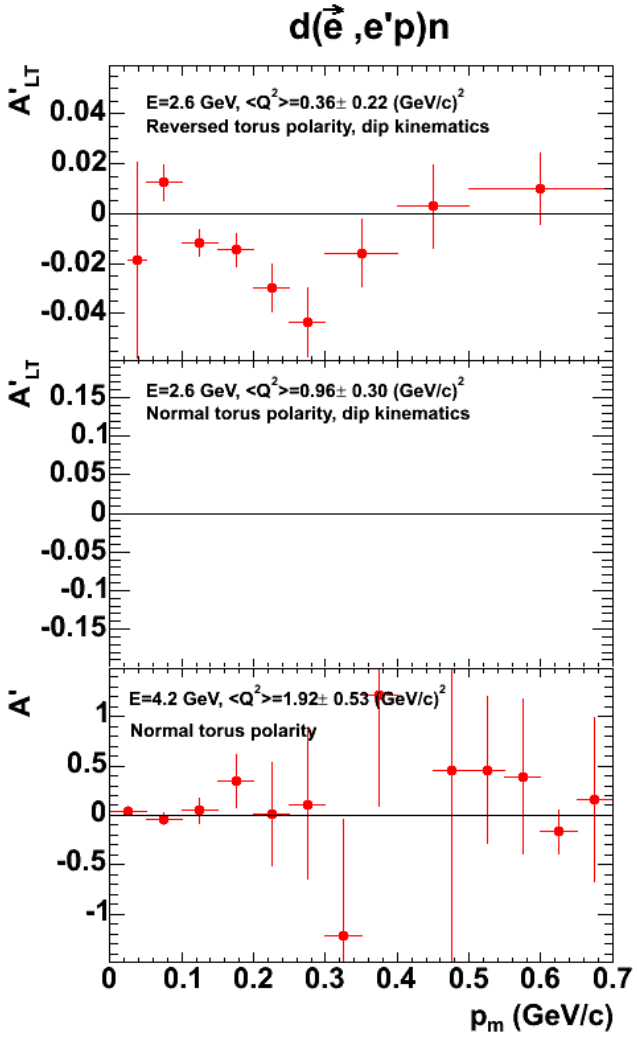


Fig 11. Plot of ALTp for above results for Wn=1.0-1.1 GeV

Click here to view the object (ROOT C++ macro for Fig 11) you uploaded.

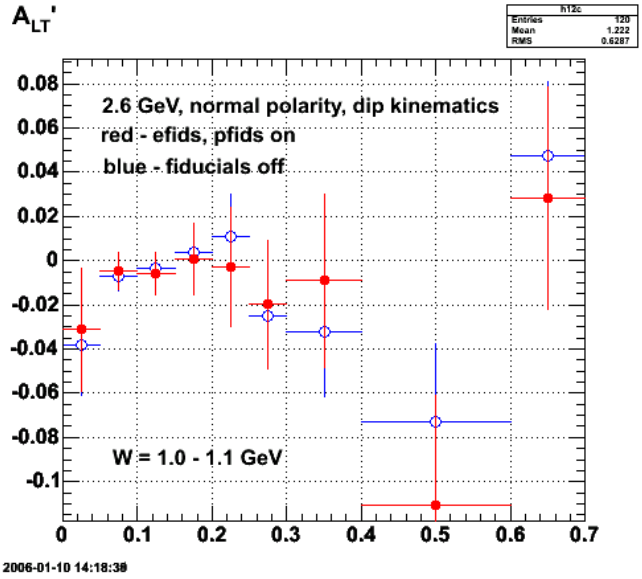


Fig 12. 2.6n results for narrower W range (1.0-1.1 GeV) and full data set.

Click here to view the object (ROOT C++ macro for Fig 12) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 89 - ALT and ATT in dip kinematics (gpg)

[Modified Wed Nov 2 00:29:31 2005 (GMT) gpg]

Below is a set of commands for calculating ATT and ALT from a ROOT histogram.

```
TH1F *h4 = new TH1F("h4","Cos(#phi) weighted distribution",14,0.0,0.7);
h4.Sumw2();
h4.Divide(hp_m_cos_phi_wght, hp_m_unwght);
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h4->Divide(unity,0.73)
h4->Draw()

TH1F *h5 = new TH1F("h5","Cos(2#phi) weighted distribution",14,0.0,0.7);
h5.Sumw2();
h5.Divide(hp_m_cos_2phi_wght, hp_m_unwght);
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h5->Divide(unity,0.73)
h5->Draw()
```

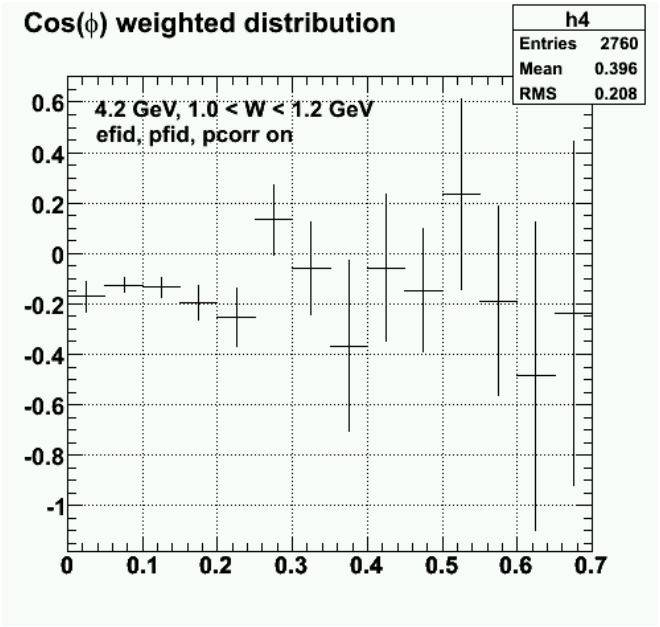


Fig 2. ALT for 4.2 GeV.

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

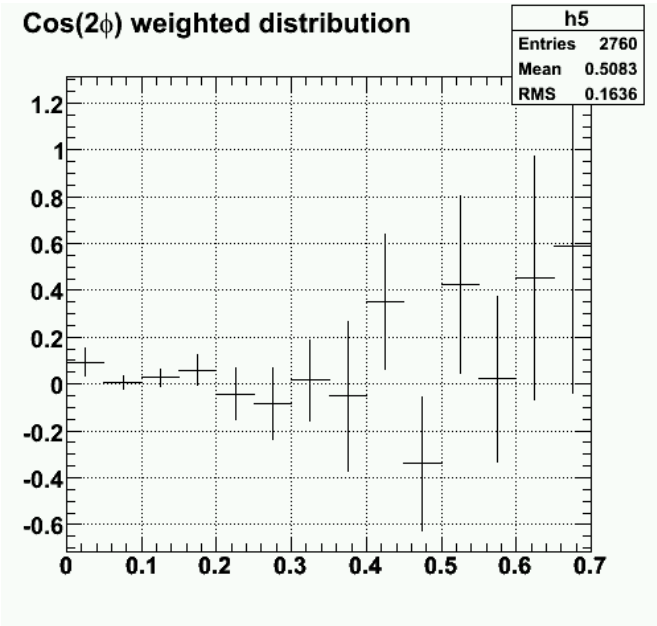


Fig 2. ATT for 4.2 GeV

Click here to view the object (ROOT C++ macro for ATT.) you uploaded.

Click here to view the object (ROOT C++ histogram file for Figs 1-2) you uploaded.

Turn off the fiducial cuts and we see that the events at small p_m agree very well with the results with the fiducial cuts on and we see some interesting structure out to large p_m.

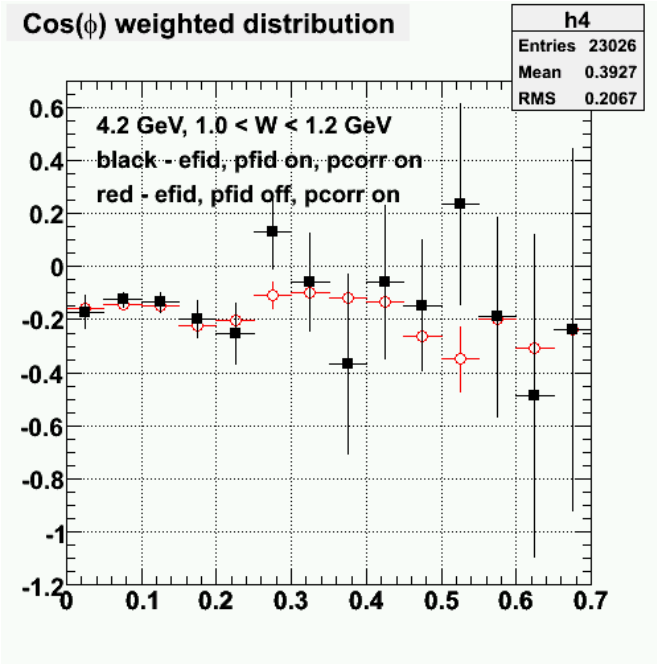


Fig 3. ALT from Cos(phi) distributions with efid and pfids off.

Click here to view the object (ROOT C++ macro cos_phi_dip1.C for Fig 3.) you uploaded.

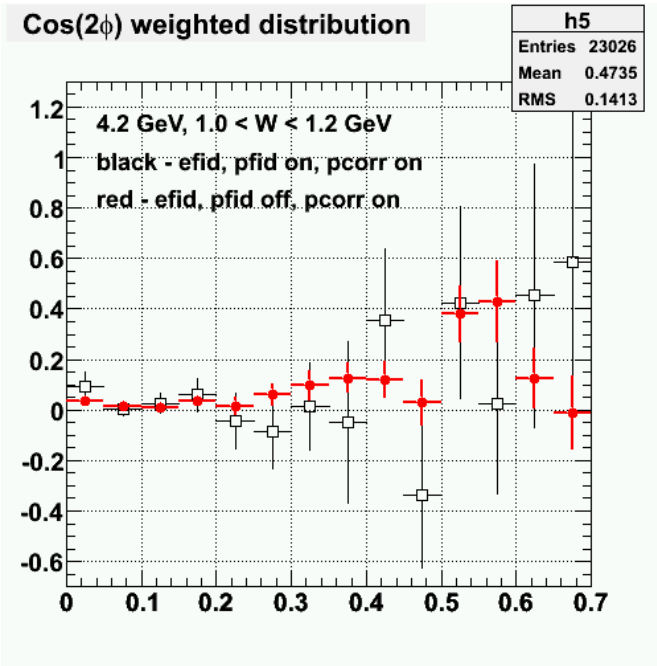


Fig 4. ATT comparison with efid, pfid off (red) and efid, pfid on (black).

Click here to view the object (ROOT C++ macro cos_2phi_dip1.C) you uploaded.

Click here to view the object (ROOT histogram file for Figs 3-4 with efid, pfid off and pcorr on.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 90 - Learning to run gsim (gpg)

[Modified Tue Nov 1 23:53:10 2005 (GMT) gpg]

Here are some notes on learning to run gsim.

```
getting gsim running

see files in /home/gilfoyle/research/eod/gsim

sequence

1. generate input file of 4-vec using gsim1.nb (Mathematica).

2. generate BOS banks using

txt2part_e5_linux -ogsim1input.evt < gsim1.dat

 to get input BOS banks for gsim.

3. start gsim_int using

source rungsim

4. once in gsim use the following to start

switch 1 2
dcut clas 2 0 10 10 0.015 0.015
trig 1

and then to see more events use

clr
dcut clas 2 0 10 10 0.015 0.015
trig 1

quit

5. run the results through recsis.

recsis -t recsis1.tcl -i gsimgpg.evt.A00 -o test1.root -np
recsis -t recsis2.tcl -i gsimgpg.evt.A00 -o test1.root -np

the above lines don't work. the runIndex is always set to zero so looking
up stuff in caldb fails. use user_ana.

user_ana -t recsis_test.tcl -i clas_045613.A00 -o test1.root -np
user_ana -t recsis2.tcl -i gsimgpg.evt.A00 -o test1.root -np

i don't understand yet what is the output of -o.


this step is where i may want to copy what jeff L. did for his analysis.

6. run a1c_ntup to create the ntuples.

7. and then convert them to root files.

h2root re5761.rzn
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 91 - ALT and ATT in QE kinematics (gpg)

[Modified Thu Nov 3 21:38:54 2005 (GMT) gpg]

The plots below show ATT and ALT at 4.2 GeV in QE (0.92 < W < 1.0 GeV) kinematics.

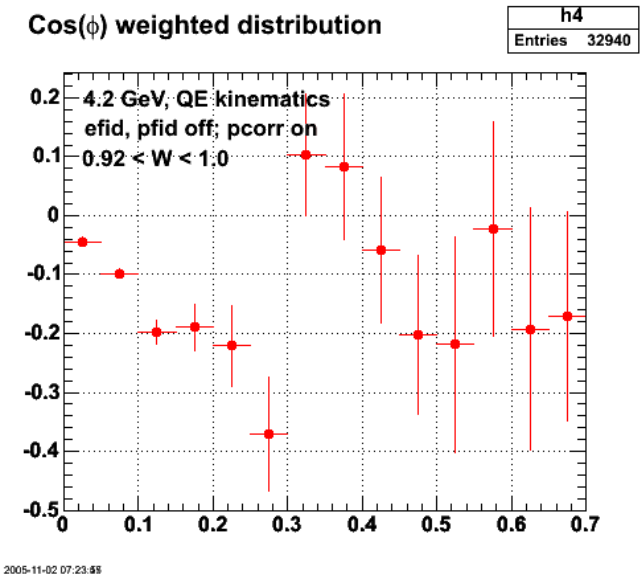


Fig 1. ALT with efid, pfid off; pcorr on in QE kinematics

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

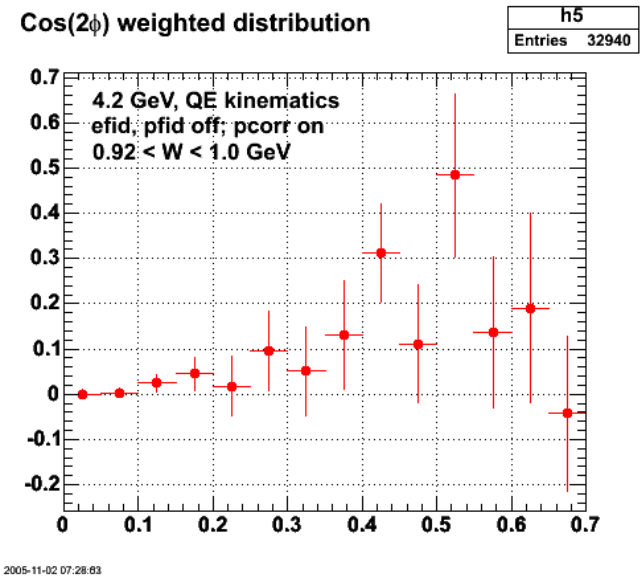


Fig 2. ATT with efid, pfid off; pcorr on in QE kinematics

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

Click here to view the object (ROOT C++ histogram file for Fig 1-2) you uploaded.

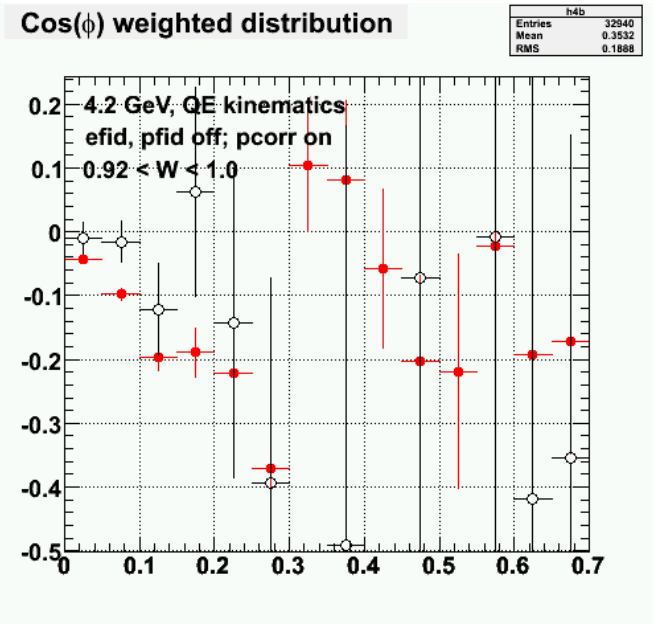


Fig 3. Comparison of QE ALT with efid and pfids on (black) and off (red)

Click here to view the object (ROOT C++ macro for Fig 3.) you uploaded.

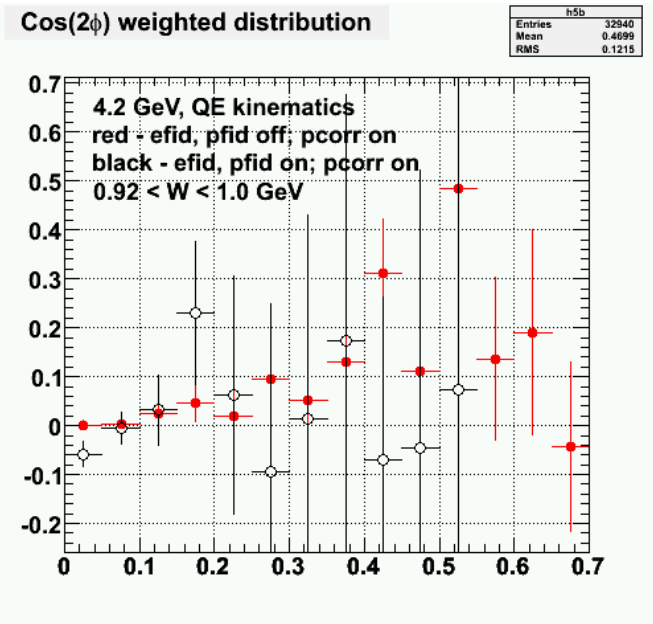


Fig 4. Comparison of QE ATT with efid and pfids on (black) and off (red)

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 92 - W range comparison (gpg)

[Modified Sat Nov 5 02:41:33 2005 (GMT) gpg]

Below are plots of electron singles from 4.2 GeV, normal polarity, 2.6 GeV, normal polarity, and 2.6 GeV reveresed polarity to see the limits on W that we can use.

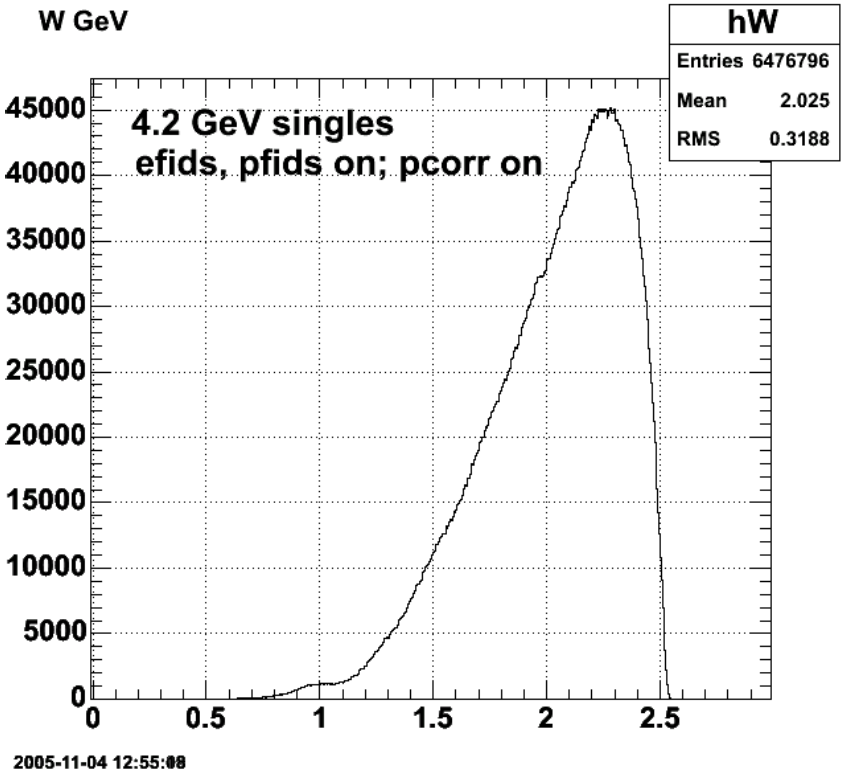


Fig 1. 4.2 GeV for the full data set.

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

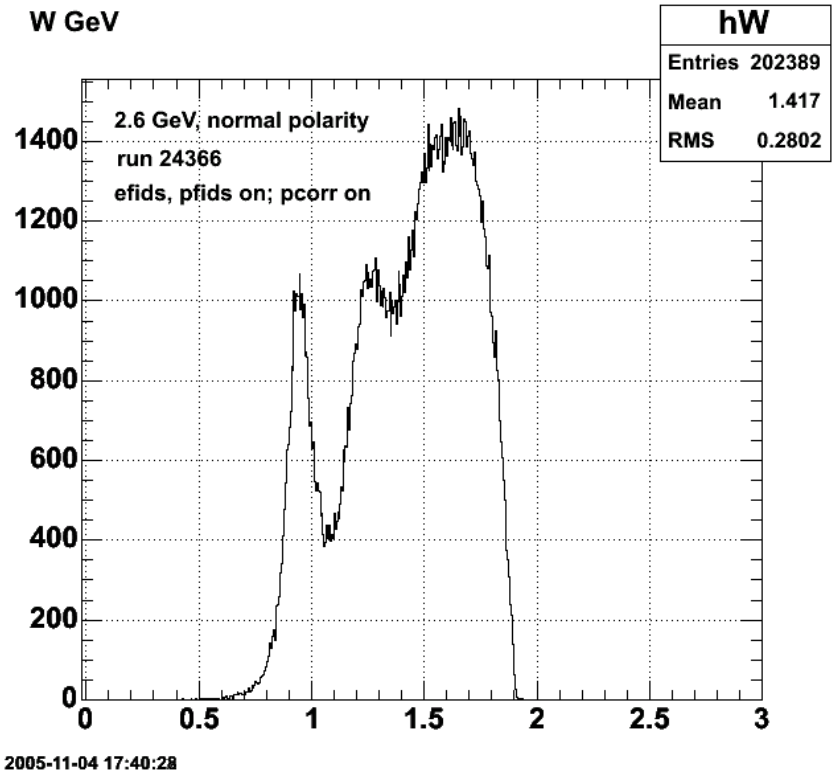


Fig 2. 2.6 GeV, normal polarity for run 24366 only

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

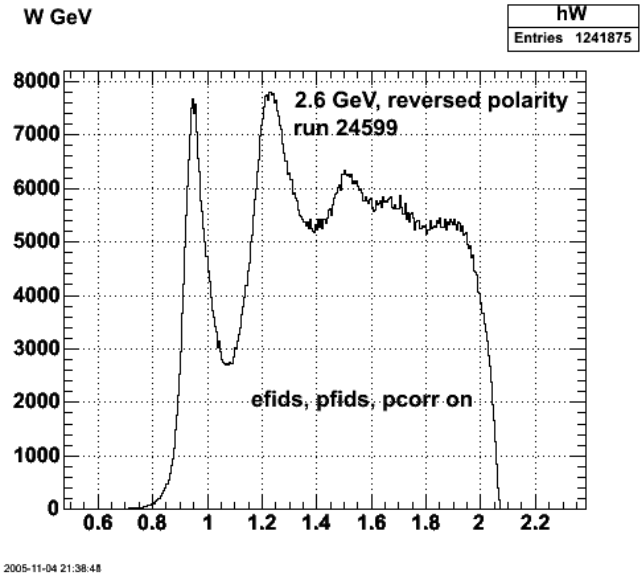


Fig 3. 2.6 GeV, reversed polarity for run 24599 only

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 93 - ALTp in delta kinematics (gpg)

[Modified Tue Jan 10 04:58:44 2006 (GMT) gpg]

New results for ALTp in delta kinematics (1.2 < W < 1.6 GeV). **Punt Figs 1-2 below. They were run with the wrong energy.**

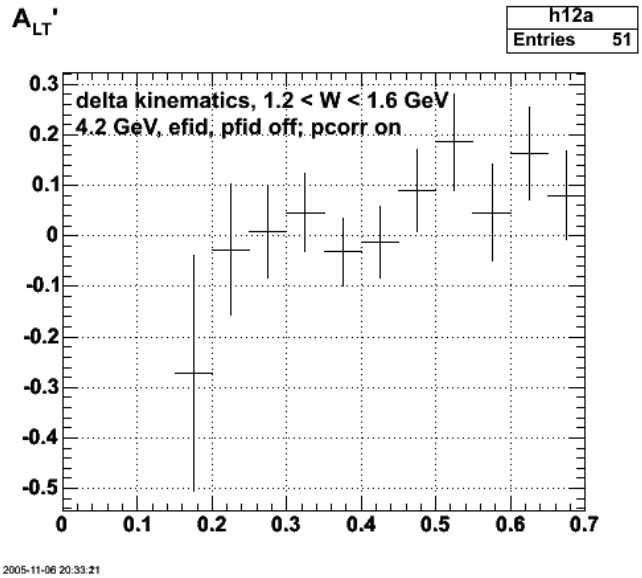


Fig 1. ALTp with efid and pfids on (the plot label is WRONG), pcorr on for 4.2 GeV

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

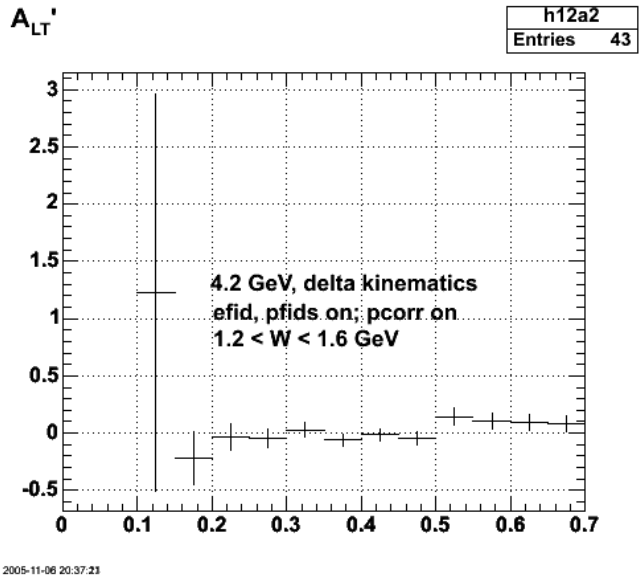


Fig 2. ALTp with efid and pfids off (the plot label is WRONG), pcorr on for 4.2 GeV

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

Click here to view the object (ROOT histogram files for Fig 1-2) you uploaded.

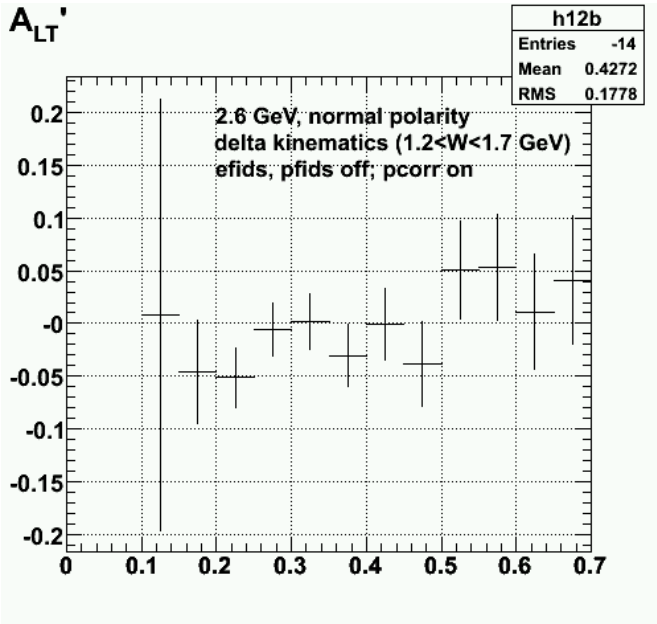


Fig 3. ALTp in delta kinematics at 2.6 GeV, normal polarity with efids and pfids off and pcorr on.

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.

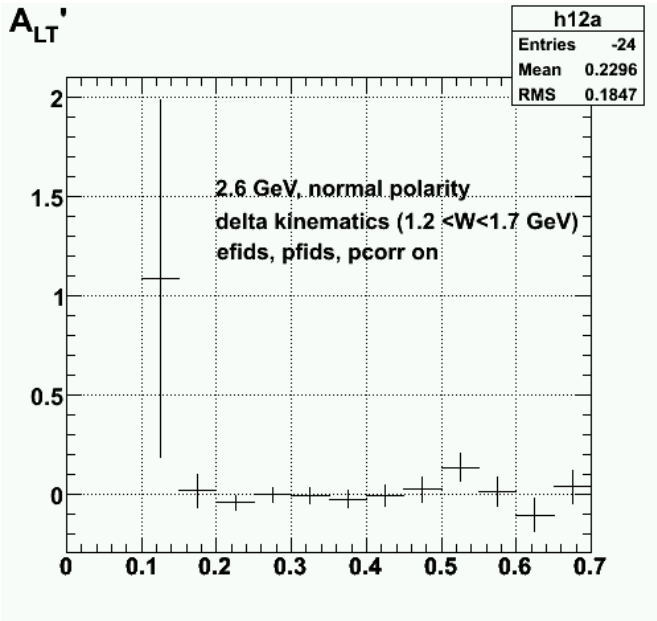


Fig 4. ALTp in delta kinematics at 2.6 GeV, normal polarity with efids and pfids on and pcorr on.

Click here to view the object (ROOT C++ macro for Fig 4) you uploaded.

Click here to view the object (ROOT histogram files for Fig 3-4) you uploaded.

The plot below was generated with the wrong pfids on! There are no 2.6r pfids at the moment and the 2.6n pfids were used which may NOT apply.

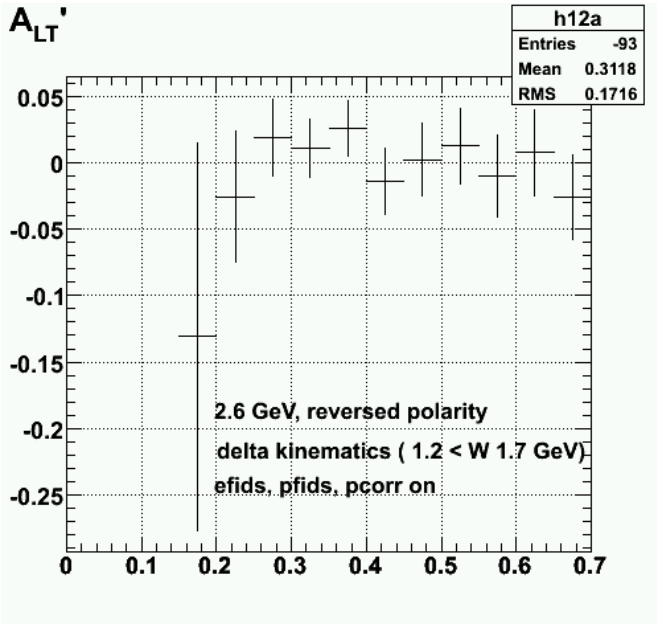


Fig 5. ALTp in delta kinematics at 2.6 GeV, reversed polarity with efids on, WRONG pfids on, and and pcorr on.

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

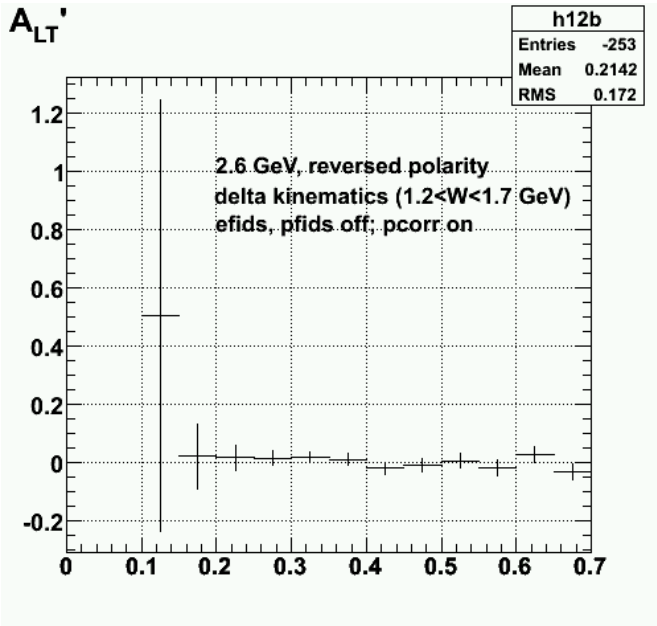


Fig 6. ALTp with efids, pfids off; pcorr on at 2.6 GeV, reversed polarity.

Click here to view the object (ROOT C++ macro for Fig 6) you uploaded.

Click here to view the object (ROOT histogram file for Figs 5-6) you uploaded.

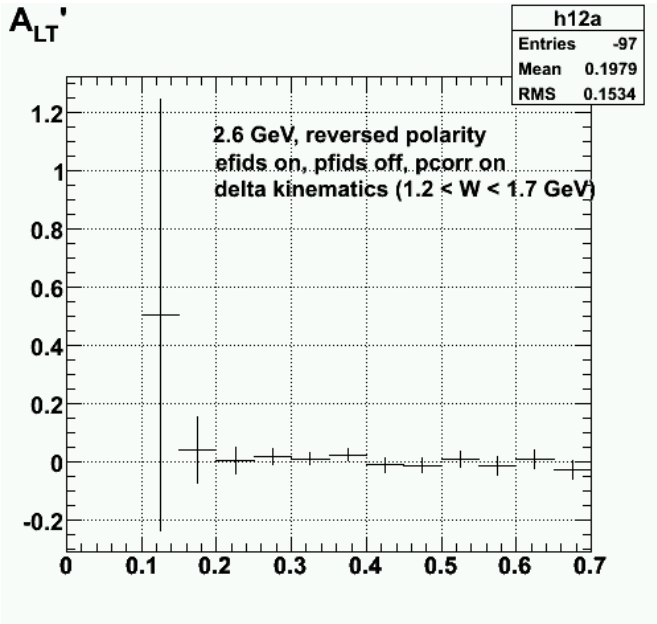


Fig 7. ALTp for 2.6 GeV, reversed field with efid on, pfid off (none exist yet), and pcorr on for delta kinematics (1.2<1.7 GeV)

Click here to view the object (ROOT C++ macro for Fig 7.) you uploaded.

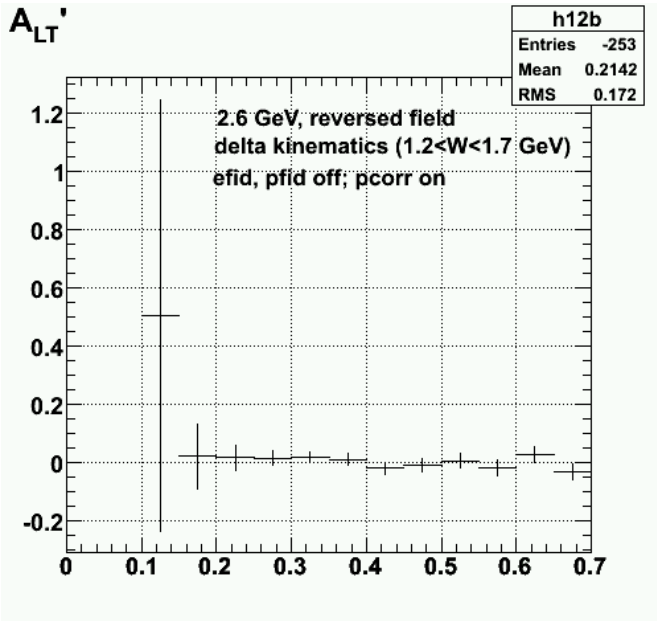


Fig 8. ALTp for delta kinematics (1.2<1.7 GeV) for 2.6 GeV, reversed polarity with efids off, pfids off, pcorr on. It should look the same as Fig 6.

Click here to view the object (ROOT C++ macro for Fig 8) you uploaded.

Click here to view the object (ROOT histogram file for Fig 7-8) you uploaded.

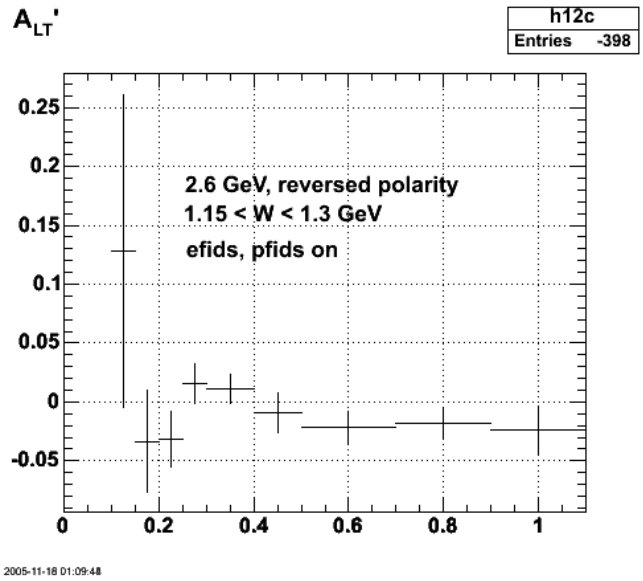


Fig 9. ALTp for 2.6r and better definition of delta kinematics from Fig 10 in entry 88.

Click here to view the object (C++ macro for Fig 9.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 9.) you uploaded.

A continuing mystery is the presence of the 'hole' at small p_m and shown in the listing of the histogram for Fig 9.

```
 root [17] h12c->Print("all")
TH1.Print Name= h12c, Entries= -398, Total sum= 0.0178834
 fSumw[0]=0, x=-0.0458333, error=0
 fSumw[1]=0, x=0.0125, error=0
 fSumw[2]=0, x=0.0375, error=0
 fSumw[3]=0, x=0.075, error=0
 fSumw[4]=0.128341, x=0.125, error=0.133072
 fSumw[5]=-0.0334653, x=0.175, error=0.0433203
 fSumw[6]=-0.0320335, x=0.225, error=0.0235098
 fSumw[7]=0.0158446, x=0.275, error=0.0170657
 fSumw[8]=0.0112904, x=0.35, error=0.0123401
 fSumw[9]=-0.00936994, x=0.45, error=0.016824
 fSumw[10]=-0.0212006, x=0.6, error=0.0136902
 fSumw[11]=-0.0182534, x=0.8, error=0.013669
 fSumw[12]=-0.0232695, x=1, error=0.0202606
 fSumw[13]=0.0108315, x=1.14583, error=0.0379184
```

For quasielastic kinematics, ALTp goes to zero at p_m=0 because ALTp is (in PWIA) due solely to FSI. At p_m = 0 or theta_pq=0, the struck proton is going straight out of the deuteron in the same direction as the incoming virtual photon. If it hit the neutron on the way out (i.e., a final-state interaction (FSI)), then it would be deflected away from p_m=0. Perhaps this no longer applies for delta kinematics because the proton can get to p_m=0 because the virtual photon and proton combine to form a delta within the deuteron which then decays. The emission of another particle can push the proton away from p_m=0 and then FSI could knock it back to p_m=0.

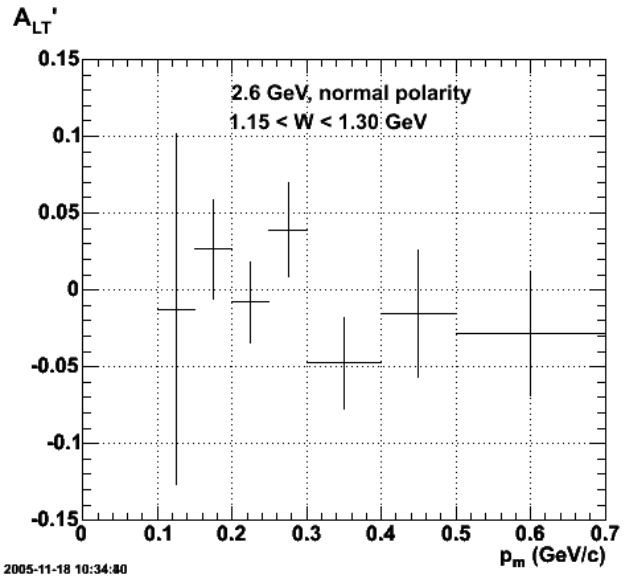


Fig 10. ALTp for 2.6 GeV, normal polarity, efids, pfids, pcorr on in delta kinematics with 1.15 < W < 1.3 GeV

Click here to view the object (ROOT C++ macro for Fig 10) you uploaded.

Click here to view the object (ROOT histogram file for Fig 10) you uploaded.

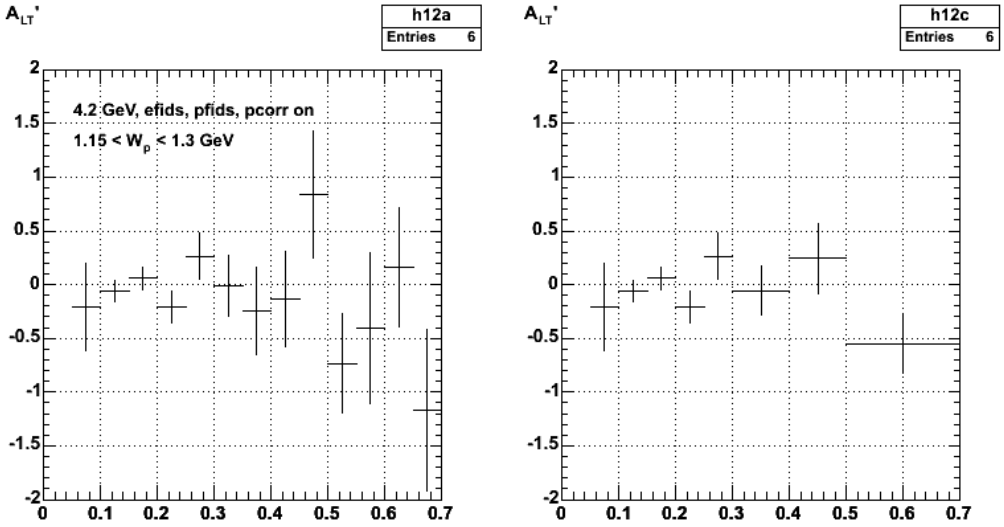


Fig 11. ALTp for 4.2 GeV, normal polarity, efids, pfids, pcorr on.

Click here to view the object (ROOT C++ macro for Fig 11) you uploaded.

Click here to view the object (ROOT histogram file for Fig 11.) you uploaded.

Code used to generate the asymmetries shown above.

```
TH1F *h1a = new TH1F("h1a","Sin(#phi) weighted distribution for positive helicity",14,0.0,0.7);
TH1F *h2a = new TH1F("h2a","Sin(#phi) weighted distribution for negative helicity",14,0.0,0.7);
h1a.Sumw2();
h2a.Sumw2();
h1a.Divide(hp_m_sin_phi_wghtplus, hp_m_unwghtplus);
h2a.Divide(hp_m_sin_phi_wghtminus,hp_m_unwghtminus);
TH1F *h12a = new TH1F("h12a","A_{LT}'",14,0.0,0.7);
h12a.Sumw2();
h12a.Add(h1a,h2a,1.0,-0.9994);
h12a.Draw();
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h12a->Divide(unity,0.73)
h12a->Draw();


Double_t p_m_bin_edges[13]={0.0,0.025,0.05,0.10,0.15,0.20,0.25,0.30,0.40,0.50,0.70,0.90,1.10};
Int_t n_varp_mbins = 12;

TH1F *h1c = new TH1F("h1c","Sin(#phi) weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
TH1F *h2c = new TH1F("h2c","Sin(#phi) weighted distribution for negative helicity",n_varp_mbins,p_m_bin_edges);
h1c.Sumw2();
h2c.Sumw2();
h1c.Divide(hp_m_sin_phi_wghtplus3, hp_m_unwghtplus3);
h2c.Divide(hp_m_sin_phi_wghtminus3,hp_m_unwghtminus3);
TH1F *h12c = new TH1F("h12c","A_{LT}'",n_varp_mbins,p_m_bin_edges);
h12c.Sumw2();
h12c.Add(h1c,h2c,1.0,-0.9994);
h12c.Draw();
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h12c->Divide(unity,0.73)
h12c->Draw();
```

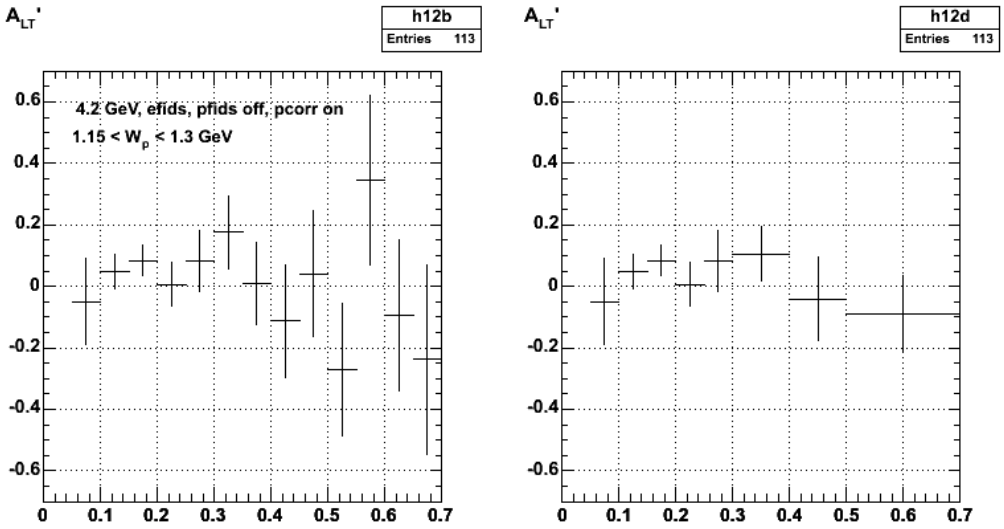


Fig 12. Same as Fig 11 with electron and proton fiducials turned off.

Click here to view the object (ROOT C++ macro for Fig 12.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 12.) you uploaded.

Code for Fig 12.

```
-----------------------------------------------------------------------------------------------


TH1F *h1b = new TH1F("h1b","Sin(#phi) weighted distribution for positive helicity",14,0.0,0.7);
TH1F *h2b = new TH1F("h2b","Sin(#phi) weighted distribution for negative helicity",14,0.0,0.7);
h1b.Sumw2();
h2b.Sumw2();
h1b.Divide(hp_m_sin_phi_wghtplus2, hp_m_unwghtplus2);
h2b.Divide(hp_m_sin_phi_wghtminus2,hp_m_unwghtminus2);
TH1F *h12b = new TH1F("h12b","A_{LT}'",14,0.0,0.7);
h12b.Sumw2();
h12b.Add(h1b,h2b,1.0,-0.9994);
h12b.Draw();
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h12b->Divide(unity,0.73)
h12b->Draw();


Double_t p_m_bin_edges[13]={0.0,0.025,0.05,0.10,0.15,0.20,0.25,0.30,0.40,0.50,0.70,0.90,1.10};
Int_t n_varp_mbins = 12;

TH1F *h1d = new TH1F("h1d","Sin(#phi) weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
TH1F *h2d = new TH1F("h2d","Sin(#phi) weighted distribution for negative helicity",n_varp_mbins,p_m_bin_edges);
h1d.Sumw2();
h2d.Sumw2();
h1d.Divide(hp_m_sin_phi_wghtplus4, hp_m_unwghtplus4);
h2d.Divide(hp_m_sin_phi_wghtminus4,hp_m_unwghtminus4);
TH1F *h12d = new TH1F("h12d","A_{LT}'",n_varp_mbins,p_m_bin_edges);
h12d.Sumw2();
h12d.Add(h1d,h2d,1.0,-0.9994);
h12d.Draw();
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h12d->Divide(unity,0.73)
h12d->Draw();
```

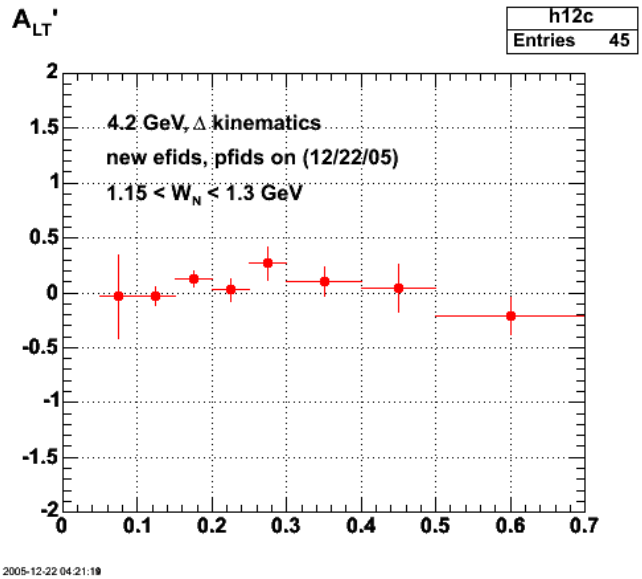


Fig 13. Same as Fig 11, with new extended efids.

Click here to view the object (ROOT C++ macro for Fig 13) you uploaded.

Click here to view the object (ROOT histogram file for Fig 13) you uploaded.

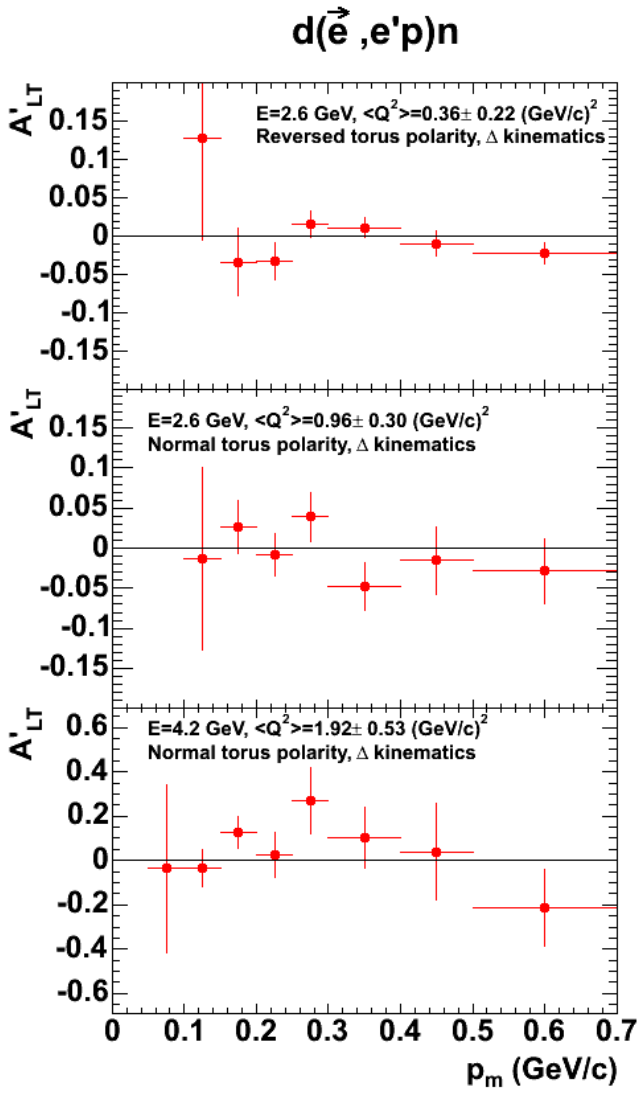


Fig 14. Combined plot of different running conditions for ALtp in delta kinematics.

Click here to view the object (ROOT C++ macro for Fig 14) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 94 - lost counts in 2.6r setting (gpg)

[Modified Wed Nov 9 04:01:00 2005 (GMT) gpg]

In re-analyzing some of the 2.6r data I found tons of extra counts in the latest analysis for ALTp. Comparing the old Q2 distribution with the latest one it's obvious why. Somehow I had lost about 80% of the data! Compare the number of counts at the peak of the Q2 distribution for Fig 1-2. Did I screw up and not analyze all the data? Mysteries abound!

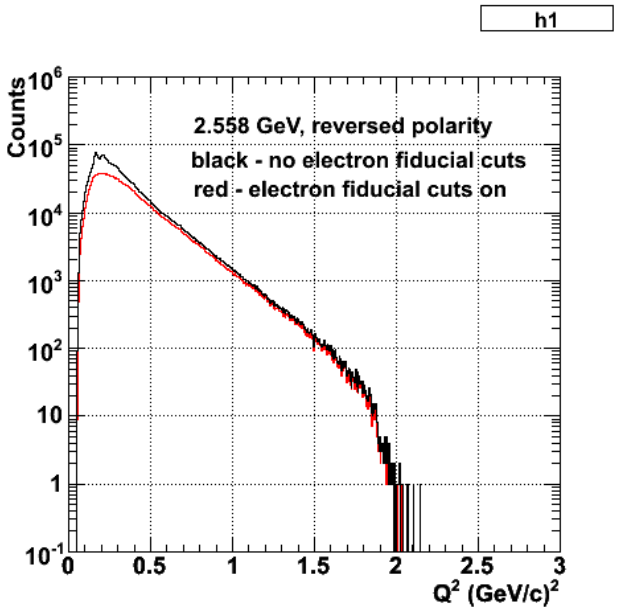


Fig 1. Old Q2 distribution for 2.6r from entry ??.

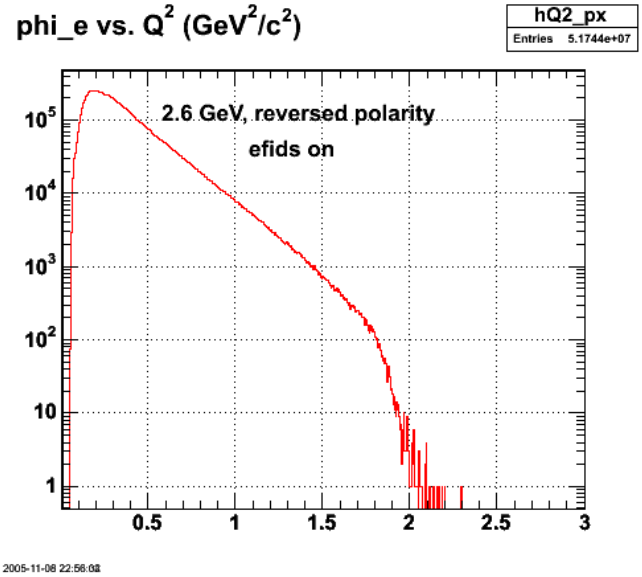


Fig 2. Recent Q2 distribution for 2.6r with efids on as in Fig 1.

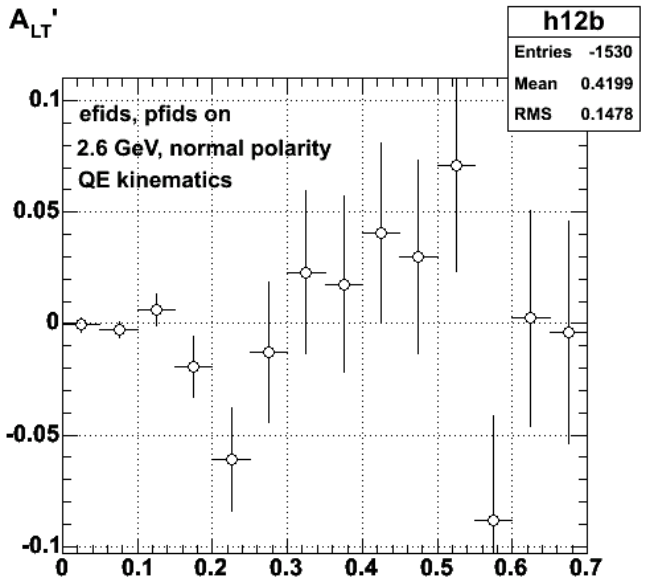
Click here to view the object (ROOT C++ macro for Fig 2.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 95 - recent ALTp results at 2.6 GeV, normal polarity (gpg)

[Modified Mon Jan 2 16:32:00 2006 (GMT) gpg]

Some recent results for ALTp for the 2.6 GeV, normal polarity data set that seem to differ from previous results.

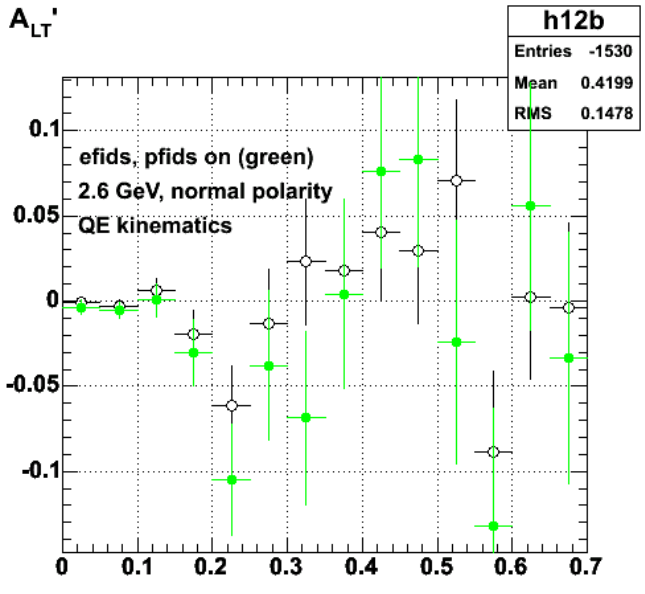


2005-11-09 12:55:88

Fig 1. ALTp for 2.6n with efids and pfds off, pcorr on. **Note**: The plot is labelled wrong.

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 1) you uploaded.



2005-11-09 14:07:28

Fig 2. Comparison with efids pfids on (green) and off (black).

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

The plot Below shows the effect of using a missing mass squared cut that I had mistakenly used during the summer. This plot looks more like the stuff I gave to JML during the summer especially at large p_m. OOPS! See Fig 6 in entry 68.

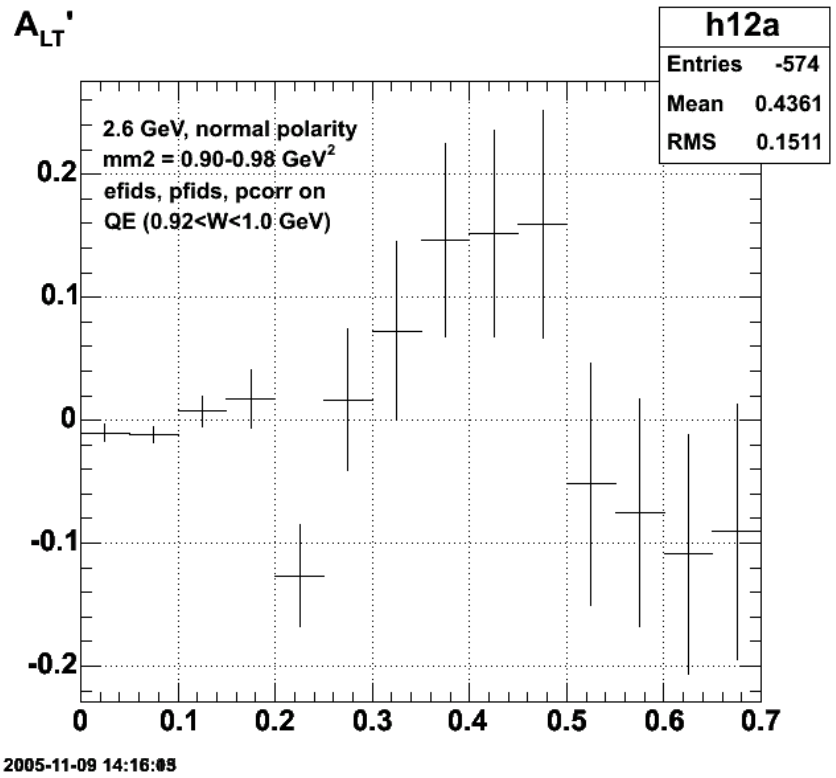


Fig 3. ALTp for QE, 2.6n with the old, WRONG choice for the missing mass range used to make the neutron cut.

Click here to view the object (ROOT histogram file for Fig 3) you uploaded.

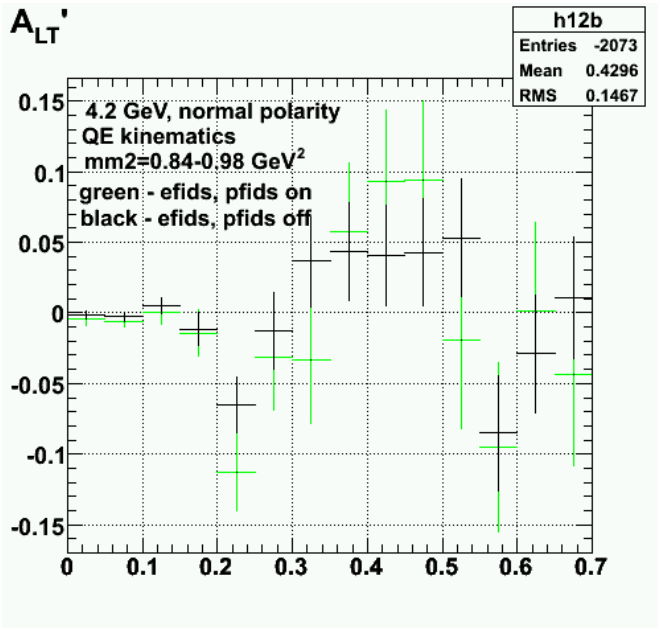


Fig 4. Playing around with the neutron cut for 2.6n, QE ALTp.

Click here to view the object (ROOT histogram file for Fig 4) you uploaded.

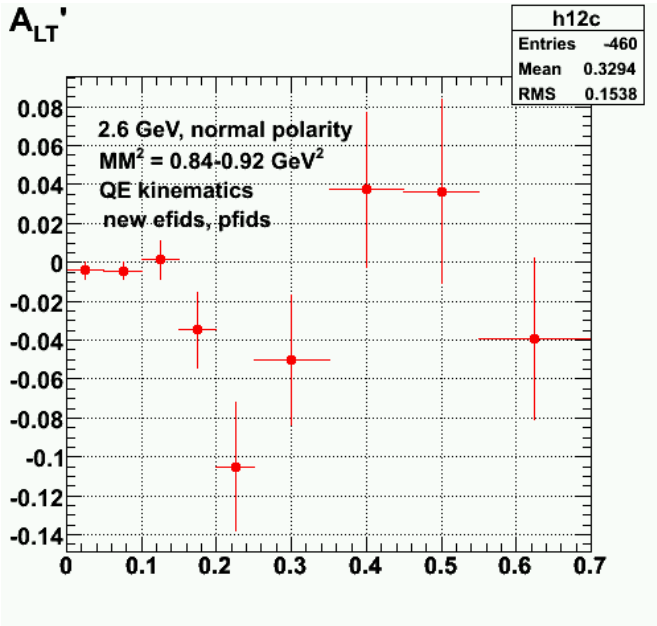


Fig 5. ALTp in QE kinematics for 2.6 GeV, normal polarity with corrected MM^2 range and new efids.

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

Click here to view the object (ROOT histogram file for Fig 5) you uploaded.

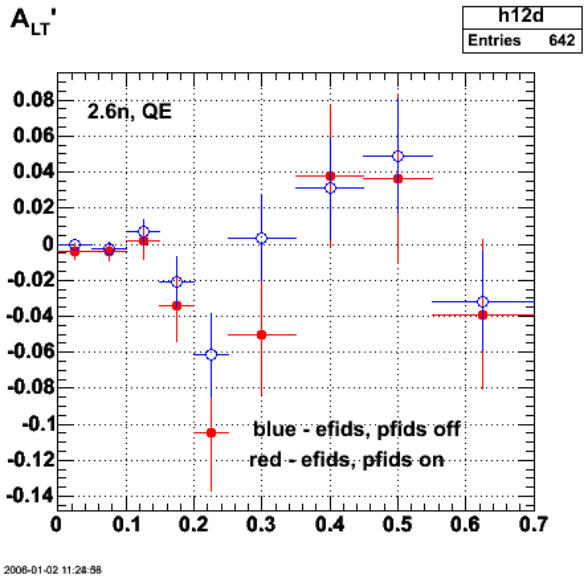


Fig 6. Comparison of ALTp at 2.6n, QE with efids, pfdis on (red) and off(blue).

Click here to view the object (ROOT C++ macro for Fig 6) you uploaded.

Click here to view the object (ROOT histogram file for Fig 6) you uploaded.

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Jerry Gilfoyle's Enotebook page 96 - e5 entry draft for QE ALTp (gpg)

[Modified Fri Nov 18 16:12:14 2005 (GMT) gpg]

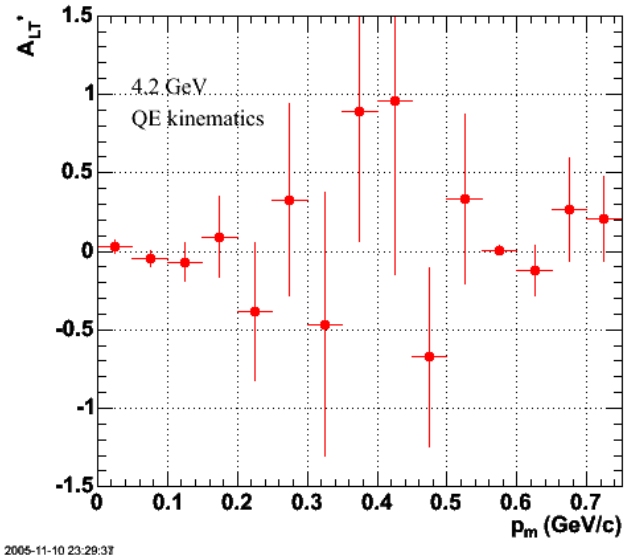

Fig 1. 4.2n, QE with efids, pfids, pcorr on

Brian and Will got the 'willies' over the point at p_m = 0.575 GeV/c so I reran this with all the data (there were about 5 runs missing when I generated Figure 1) and with variable bins sizes.

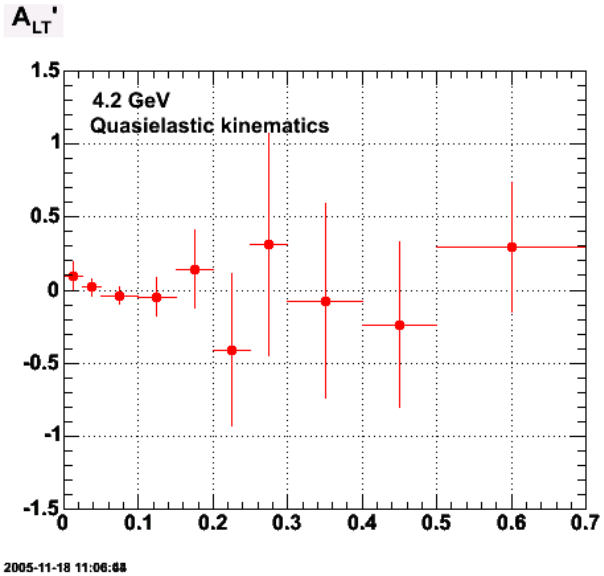

Fig 1b. ALTp for QE kinematics and the 4.2 GeV data set. Bins sizes were adjusted to compensate for small statistics in high-p_m bins in Fig 1 and I included some more runs in the final data set.

Click here to view the object (ROOT C++ macro for Fig 1b) you uploaded.

The plot below for 2.6n, QE has the extended neutron cut (mm2=0.84-0.98) which is greater than the range of the neutron cut for Figs 1 and 3 which have mm2=0.84-0.92.

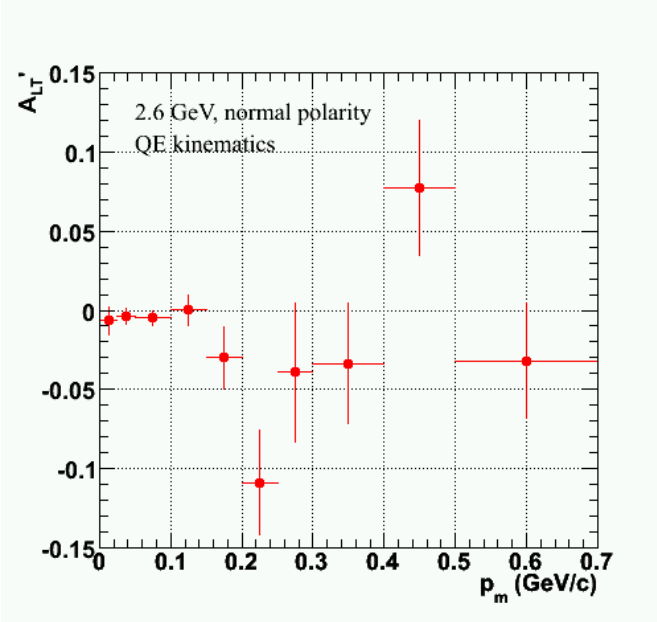

Fig 2. 2.6n, QE with efids, pfids, pcorr on.

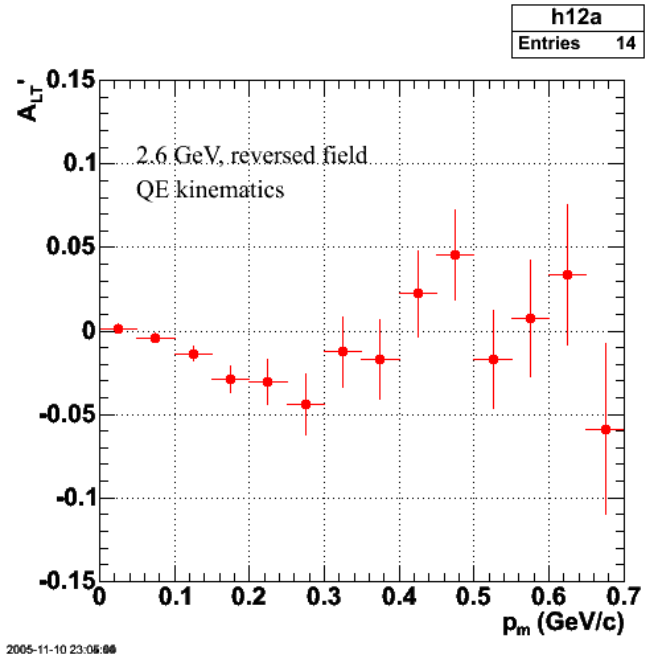

Fig 3. 2.6r, QE with efids, pcorr on.

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Jerry Gilfoyle's Enotebook page 97 - weird results for ALTp at 4.2 GeV (gpg)

[Modified Wed Nov 16 04:08:34 2005 (GMT) gpg]

Weird science??? The weirdness is that there are asymmetries that are larger than one. two effects contribute to this problem. First, the asymmetry in a particular p_m bin is calculated as

```
ALTp = < sin(phi_pq+) > - < sin(phi_pq-) >          (1)
```

where

```
< sin(phi_pq) > = Sum(sin(phi_pq)_i)/N            (2)
```

where N is the total number of positive or negative helicity events. The denominator is the sin(phi_pq)-weighted sum for a particular p_m bin. Consider an extreme case where there is a single event in the positive helicity bin wth sin(phi_pq)=+1 (phi_pq=90 deg) and a single event in the negative helicity bin with sin(phi_pq)=-1 (phi_pq=-90 deg). This will give you an ALTp close to 2. This 'problem' disappears if you increase the bin size so that you get a least a few events. Also, the uncertainty on these pathological events is very large. When I look at the histogram for plus and minus helicity, the entries are always less than one even when there are few events. See Figure 3.

This effect can be compounded because we divide out the polarization of the beam at the end which is usually about 0.73. This can push this statitistical pathologies over 1.0.

The other weird problem is that there are points at large p_m in Fig 1 in entry 96 with very small ALTp (close to zero) with an uncertainty close to zero. This again is a product of small statistics. Suppose there is one event in a bin with phi_pq = 1 deg. Then the weighted sum for that bin is sin(phi_pq) = sin(1 deg) = 0.017 +/- 0.017. You obtain a small weighted sum with a small uncertainty. The actual results that lead to the anomalous point for p_m=0.55-0.60 GeV/c are below.

```
 sinphi_weightplus=0.00071305 for p_m = 0.55-0.6 GeV/c
```

Here phi_pq=0.41 deg and the uncertainty will be equal to the same sinphi_wightplus.

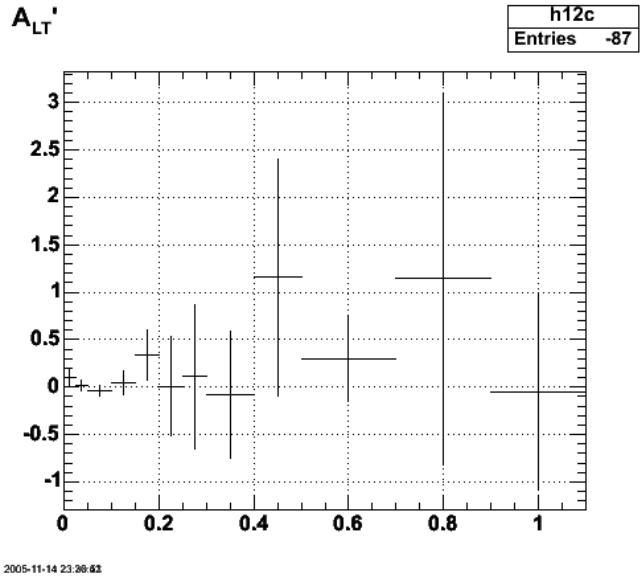

Fig 1. ALTp at 4.2 GeV showing ALTp > 1 points.

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

Click here to view the object (ROOT histogram file for Fig 1) you uploaded.

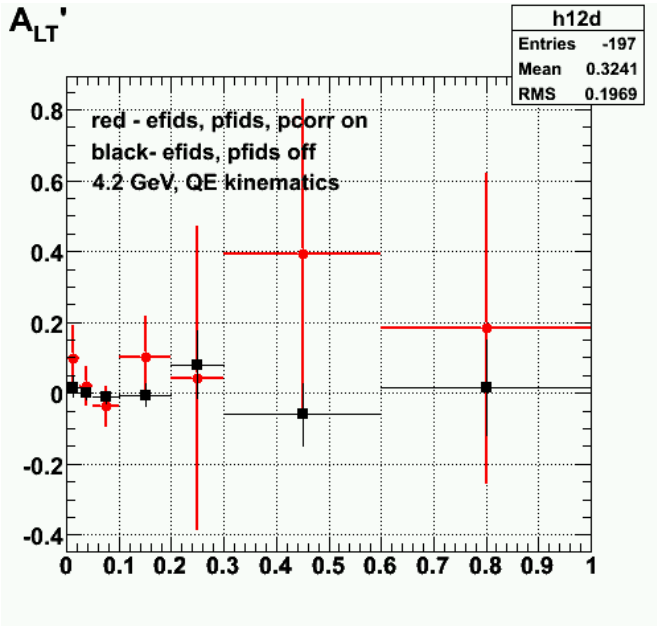

Fig 2. Tune the bin sizes to get a prettier picture.

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

Click here to view the object (ROOT histogram file for Fig 2) you uploaded.

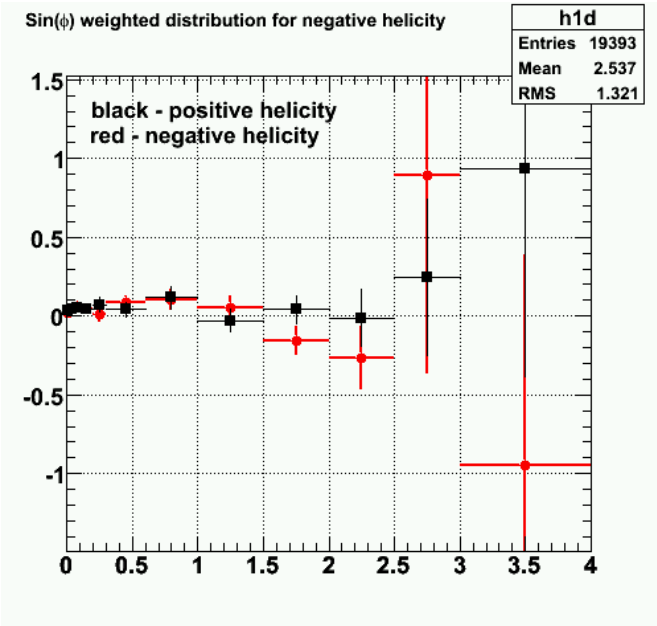

Fig 3. results for 4.2 GeV

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Jerry Gilfoyle's Enotebook page 98 - Compiling JML code in EXCLURAD (gpg)

[Modified Tue Nov 22 18:20:43 2005 (GMT) gpg]

Changes necessary to compile and link Jean-Marc Laget's code in EXCLURAD.

1. Had to add some stuff to my .cshrc file like defining the OSNAME as Linux and setting the CERNLIB environment variables to the correct values.
2. Had to explicitly declare the array pthfi(26) as real*4 because EXCLURAD has implicit real*8 defined in the main routine.
3. Put JML's object module in a separate directory so it wouldn't get deleted when I occasionally remove all the object modules. Added

   ```
   OBJ     += ../save/gdpn_mc.o
   ```

   to the Makefile to pick up JML's routines.
4. Removed

   ```
   -fno-second-underscore
   ```

   from the fortran compiling options. This fixed the following link error.

   ```
   exclurad.o(.text+0x5210): In function `phy_model_':
   /home/gilfoyle/eod/exclurad/addjmlp/exclurad.f:1087: undefined reference to `gdpn_mc_'
   collect2: ld returned 1 exit status
   make: *** [exclurad_wvojml_p_Linux] Error 1
   ```

   The old code in the Makefile was

   ```
   F77OPT  += -ffixed-line-length-none -fno-second-underscore -DLinux
   ```

   which was replaced with

   ```
   F77OPT  += -ffixed-line-length-none -DLinux
   ```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 99 - The lost events mystery, part deaux and new 4.2 GeV efids (gpg)

[Modified Thu Dec 22 15:21:33 2005 (GMT) gpg]

There is a large discrepancy in the number of epn events when the efids and pfids are turned on. I lose about 80% of the events. I have seen this before and thought it was because of the implicit momentum cuts that are in the pfids, but this now looks like that implicit momentum cuts may be costing us real events. See previous discussion in entry 85. The first plot below shows the inputs to ALTp. Note the large difference in the number of counts when the efids and pfids are turned on.

Do a simple test where I just count the number of ep events with the following conditions set, it appears there is no great problem. I lose about half (40%) of the events when I turn the electron fiducials on and another 16% when the proton fiducials are turned on.

```
for ep2_count efids on, pfids off 10846 +/- 104   16%
    ep_count efids on, pfids on    9343 +/-  97

for ep2_count efids on, pfids off 1106 +/- 33     17%
    ep_count efids on, pfids on    949 +/- 31


for ep2_count efids off, pfids off 17161 +/- 131   84%
    ep_count efids on, pfids on     9343 +/-  97
```

However, when I look at epn coincidences I see the effect again.

```
for epn2_counts efids off, pfids off 1851
    epn_counts  efids on, pfids on    229

for epn2_counts efids off, pfids on  1672
    epn_counts  efids on, pfids on    229

for epn2_counts efids on, pfids off   374
    epn_counts  efids on, pfids on    229
```

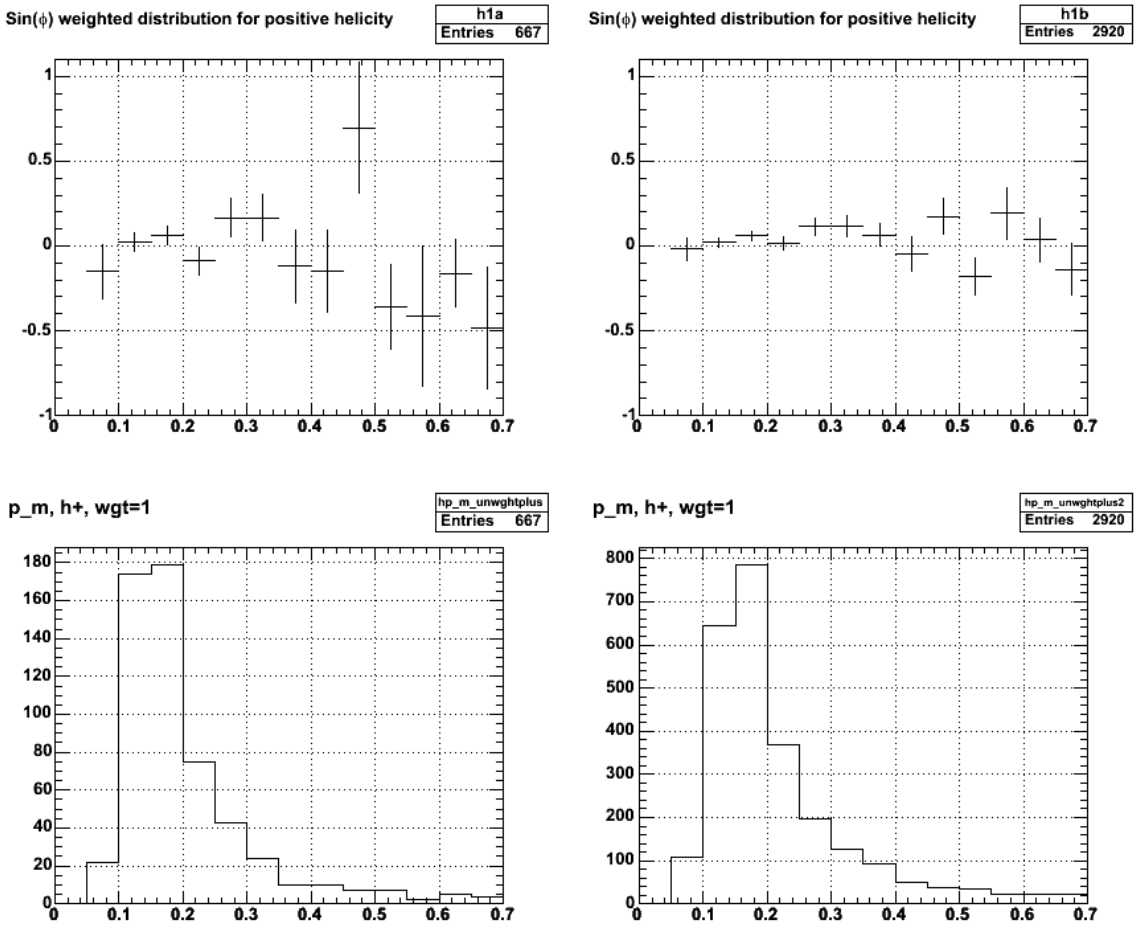

Figure 1. Comparison of inputs to ALTp for 4.2 GeV with efids and pfids on (left panels) and off (right panels). This is for delta kinematics. Compare with Fig 11 to see the happy effect of the new efids.

Continue to study the effect. Could this be a result of the implicit momentum cut in the electron fiducial cut?

```
for epn2_counts efids off, pfids off   126   0.8 < p_e < 2.4
    epn_counts  efids on, pfids on     229
```

The plot below shows epn events that are excluded by the electron fiducial cuts. The implicit momentum cut is at p_e=2.8 GeV except for secto2 where it is p_e=2.1 GeV. The problem seems to track with the implicit momentum cut. Things look ok in the range and then I start to see lots of events in the fiducial region outside the implicit momentum cut.

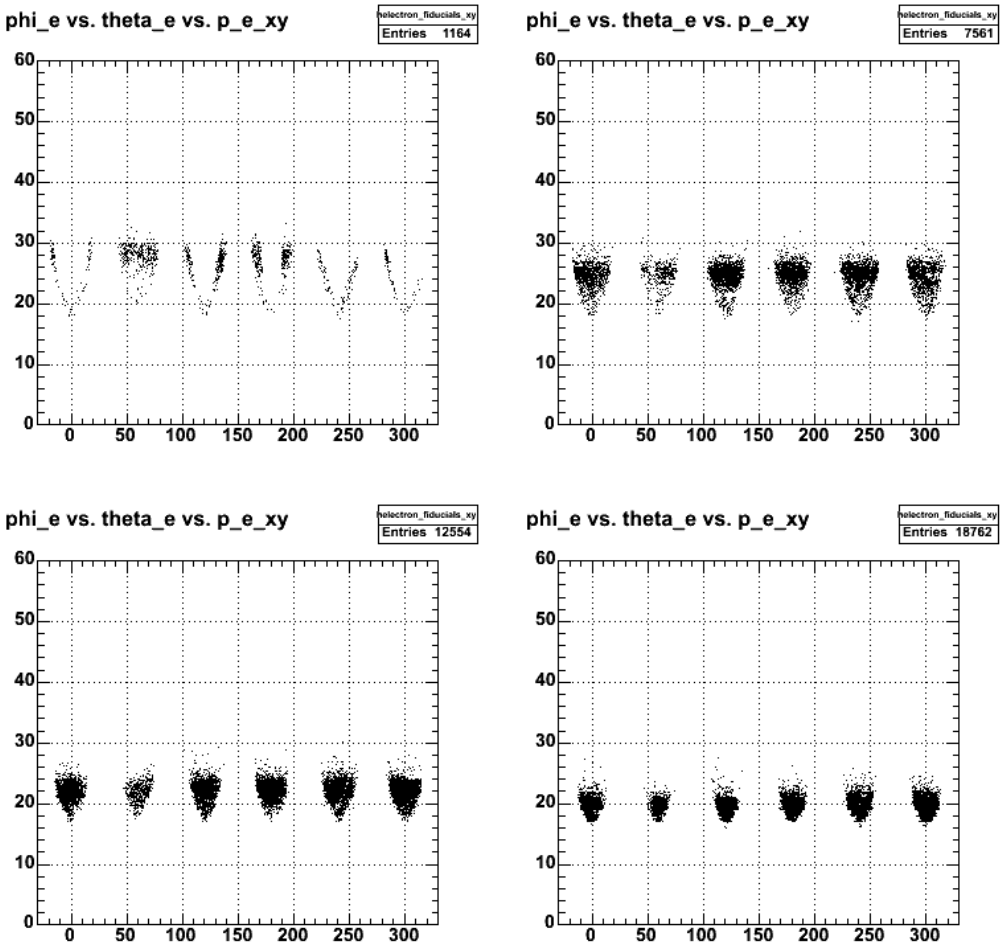

Fig 2. These are epn events that are excluded by the electron fiducial cuts.

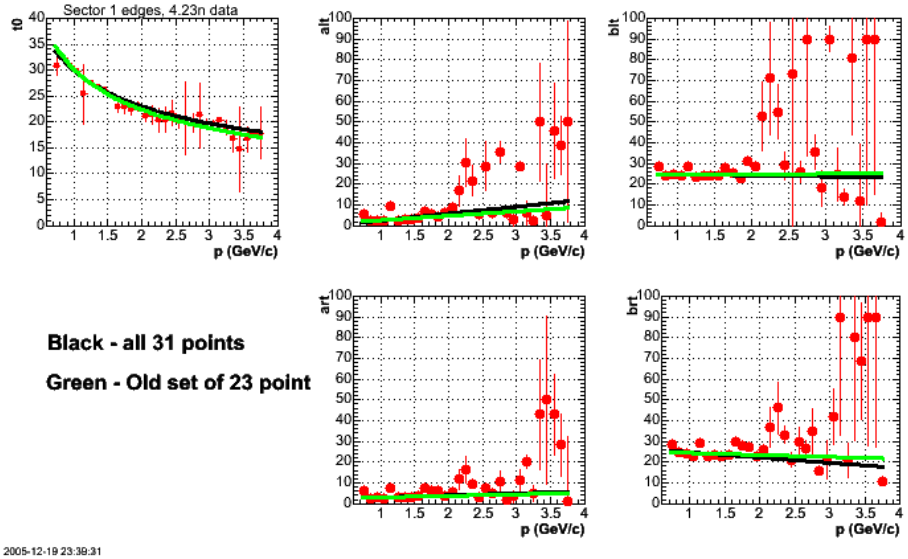

Fig 3. Effect of extending the linear fit out to p_e=3.8 GeV for sector 1

Click here to view the object (ROOT C++ macro for Fig 3.) you uploaded.

Results of fit for sector 1:

```
add one point that i left out before, 31 pts.
```

```
gpgl:4.23n2> grep +++++ edges.out
+++++ fit1 results 29.9299 -0.379235
+++++ fit2 results -0.896199 3.36788
+++++ fit3 results 25.3192 -0.548418
+++++ fit4 results 2.03041 0.983903
+++++ fit5 results 27.253 -2.52875

with the old data set, 23 points

gpgl:4.23n2> grep +++++ edges.out
+++++ fit1 results 30.1531 -0.430509
+++++ fit2 results 0.507728 2.1321
+++++ fit3 results 24.4423 0.19222
+++++ fit4 results 2.36867 0.693256
+++++ fit5 results 25.354 -0.947374
```

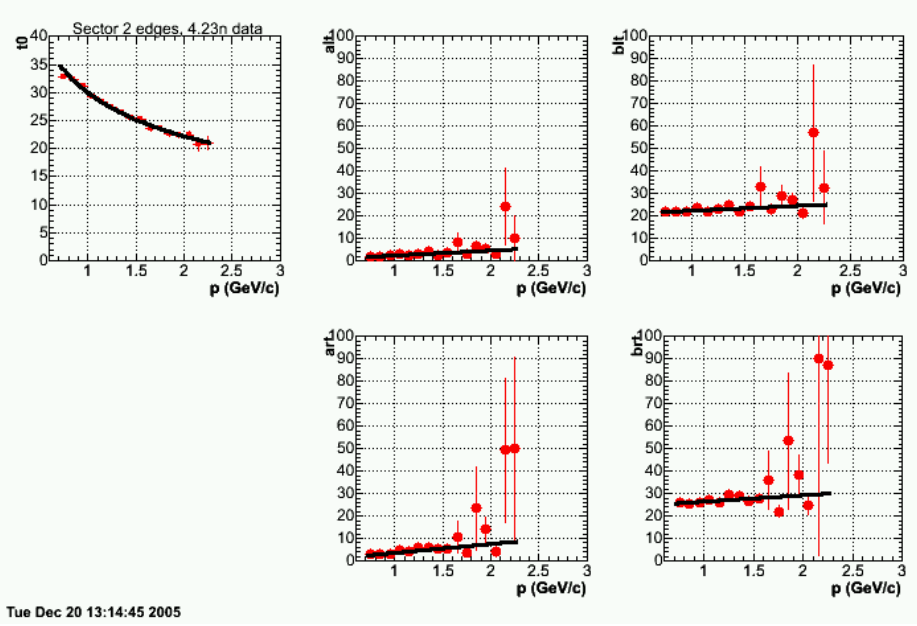

Fig 4. Sector 2 with linear fit.

Click here to view the object (ROOT C++ macro for Fig 4) you uploaded.

```
gpg2:sector2> grep +++++ edges.out
+++++ fit1 results 29.9874 -0.432049
+++++ fit2 results 0.171079 2.18763
+++++ fit3 results 20.1743 2.15645
+++++ fit4 results -3.61734 7.40558
+++++ fit5 results 23.6378 2.77829
```

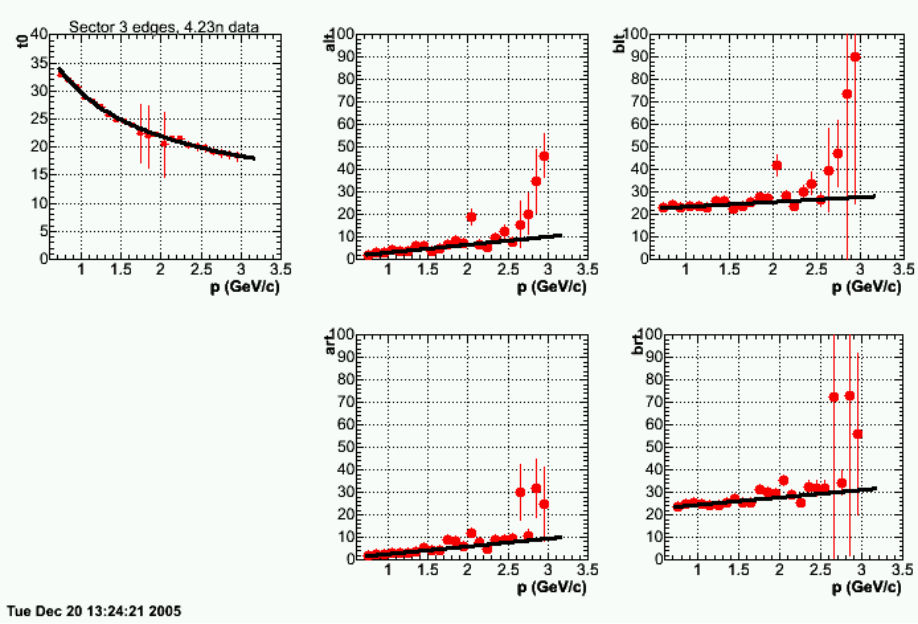

Fig 5. Sector 3 linear fit results.

Click here to view the object (ROOT C++ macro for Fig 5.) you uploaded.

```
gpg2:sector3> grep +++++ edges.out
+++++ fit1 results 29.5869 -0.432137
+++++ fit2 results -0.424624 3.50116
+++++ fit3 results 21.2749 2.14596
+++++ fit4 results -0.745404 3.37819
+++++ fit5 results 21.1447 3.3323
```

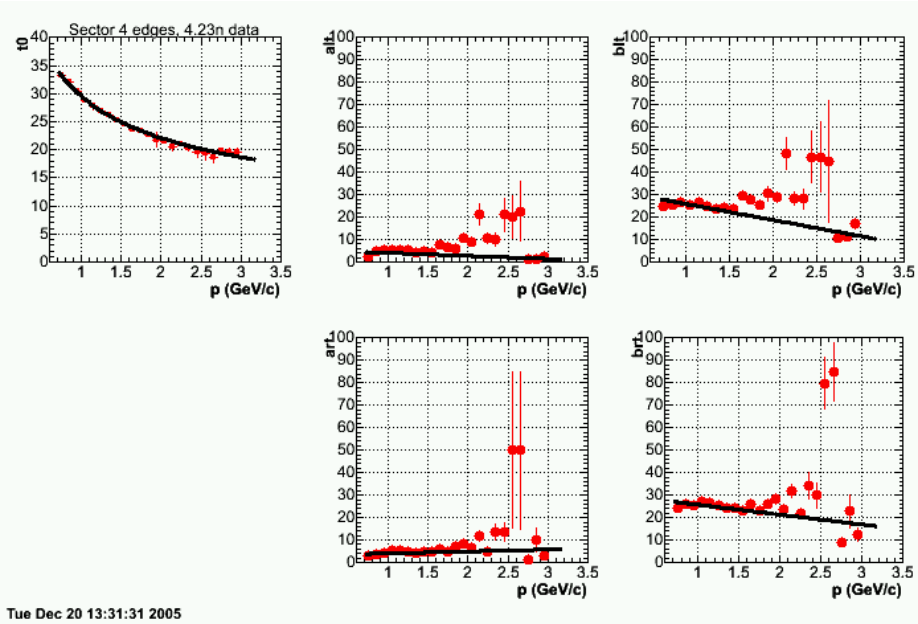

Fig 6. Sector 4 with linear fit.

Click here to view the object (ROOT C++ macro for Fig 6) you uploaded.

```
gpg2:sector4> grep +++++ edges.out
+++++ fit1 results 29.4476 -0.413666
+++++ fit2 results 5.39248 -1.31072
+++++ fit3 results 33.0682 -7.14919
+++++ fit4 results 3.19724 0.863107
+++++ fit5 results 30.1497 -4.41891
```

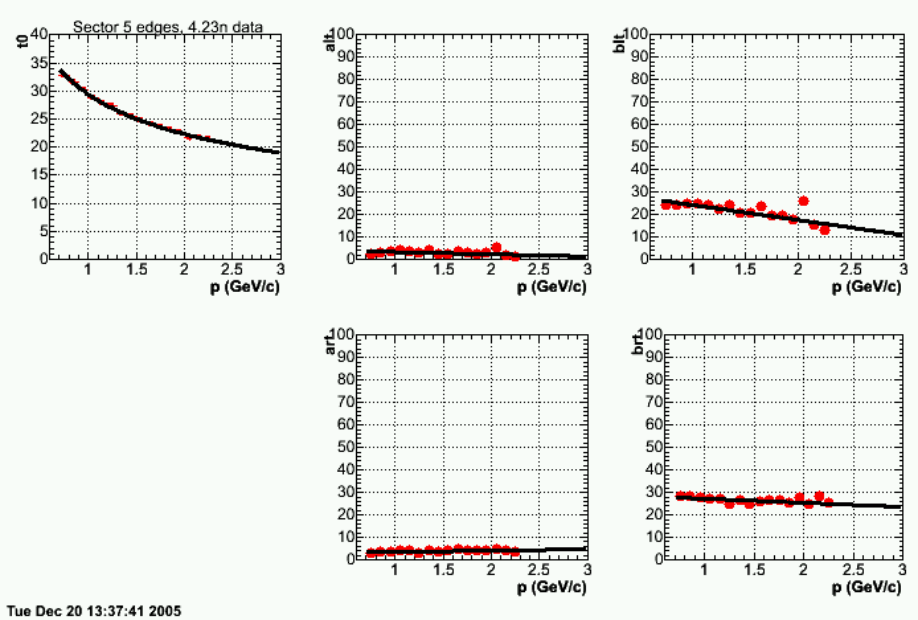

Fig 7. Sector 5 with linear fit

Click here to view the object (ROOT C++ macro for Fig 7) you uploaded.

```
gpg2:sector5> grep +++++ edges.out
+++++ fit1 results 29.4358 -0.398582
+++++ fit2 results 4.25012 -0.973866
+++++ fit3 results 30.8822 -6.66447
+++++ fit4 results 2.88325 0.614808
+++++ fit5 results 29.0079 -1.80636
gpg2:sector5>
```

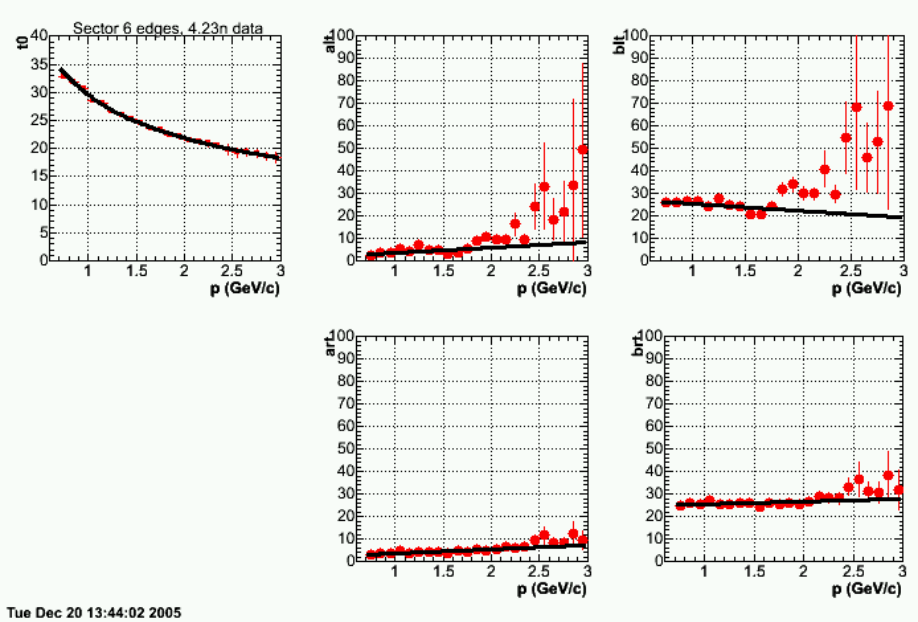

Fig 8. Sector 6 with linear fit

Click here to view the object (ROOT C++ macro for Fig 8) you uploaded.

```
gpg2:sector6> grep +++++ edges.out
+++++ fit1 results 29.5563 -0.435802
+++++ fit2 results 1.21965 2.33945
+++++ fit3 results 28.378 -3.01997
+++++ fit4 results 1.71695 1.84485
+++++ fit5 results 24.2943 1.18057
```

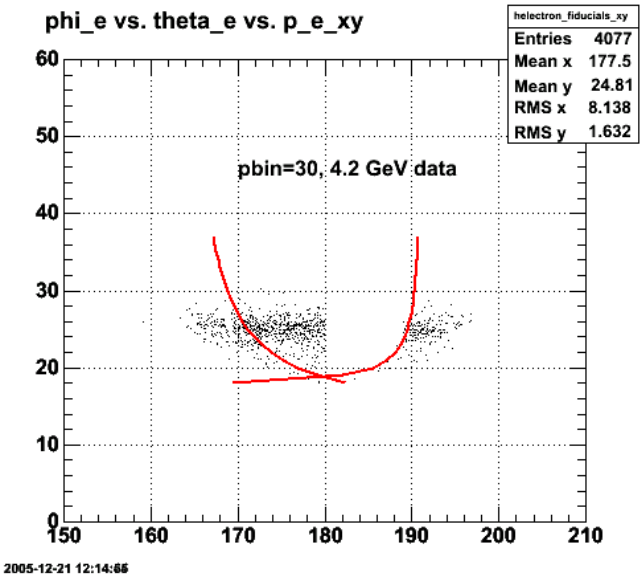

Fig 9. Problem with new efids. This turned out to be a problem with the dimension of the brt array.

Click here to view the object (ROOT C++ macro for Fig 9) you uploaded.

Click here to view the object (ROOT histogram file for Fig 9) you uploaded.

After using the linear fit to the electron fiducial momentum dependence described in the plot above, we re-examine the spectra that alerted me to the problem (see Fig 1). Fig 10 below shows the comparison. The electron and proton fidcuials are cutting out about half the data which is more typical and much better than the 80% loss in Fig 1. To make this comparison with Fig 1 more valid I have to use the same kinematics (delta, I think).

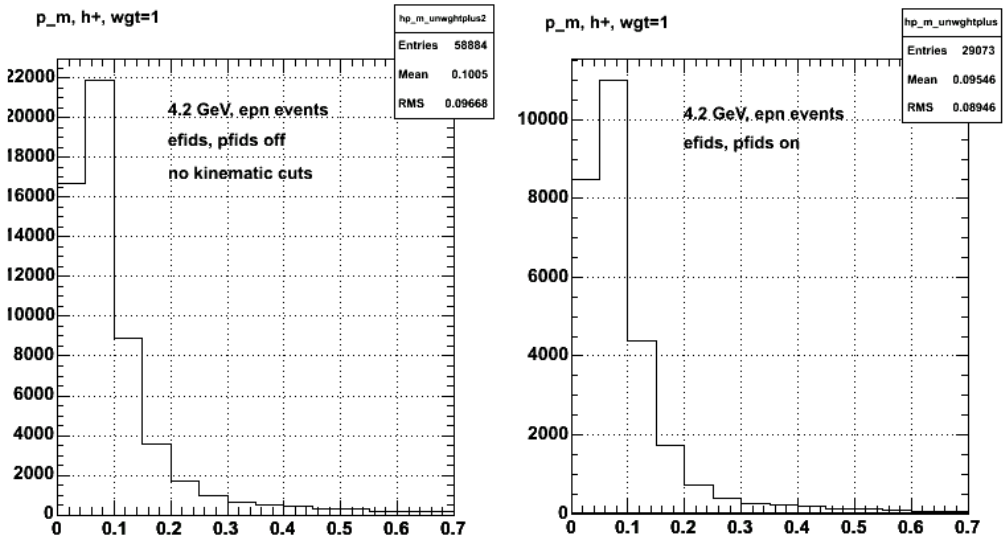

Fig 10. Comparison of unweighted missing momentum spectra for epn events with efids and pfids off (left panel) and on (right panel). There are no restrictions on the kinematics for these plots. Compare with Fig 1.

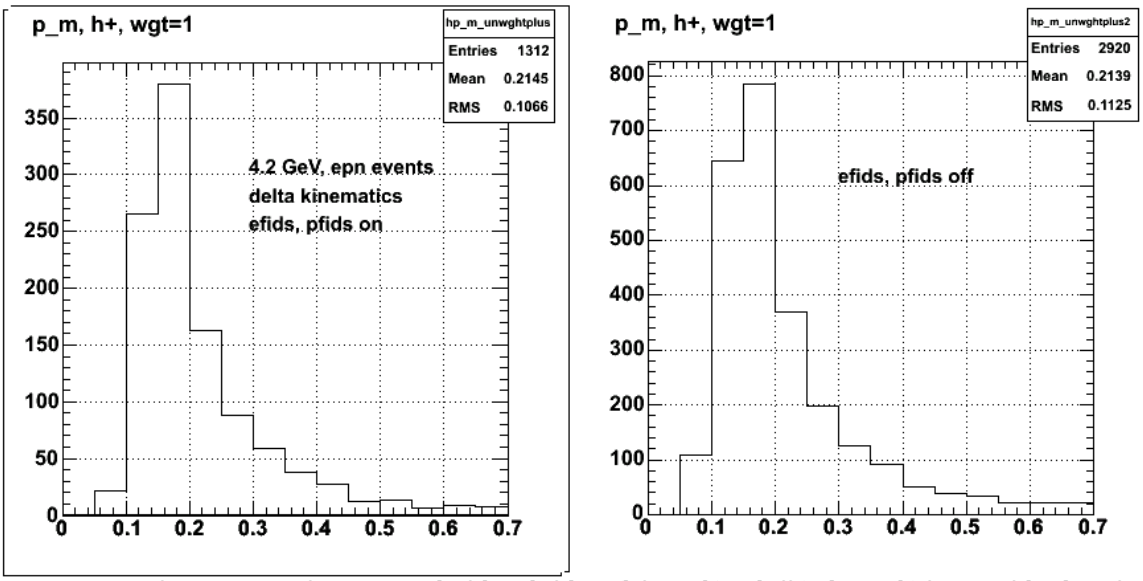

Fig 11. Comparison of inputs to ALTp for 4.2 GeV with efids and pfids on (left panels) and off (right panels) for new efids. This is for delta kinematics. Compare with Fig 1.

Click here to view the object (ROOT C++ macro for Fig 11.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 11.) you uploaded.

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Jerry Gilfoyle's Enotebook page 100 - delta kinematics at 2.6 GeV (gpg)

[Modified Mon Dec 12 19:49:57 2005 (GMT) gpg]

Calculate the np invariant mass spectrum and get the following for the 2.6 GeV, reversed field data for run 24559. Efids and pfids are off for F9gs 1-2.

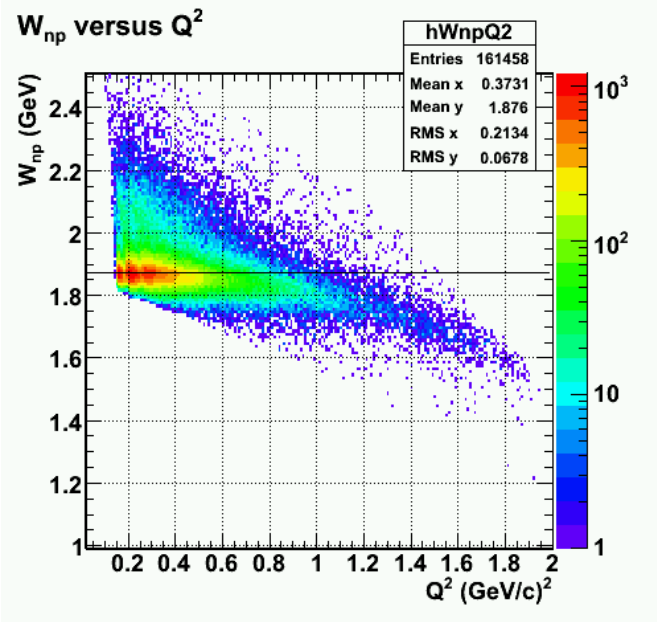

Fig 1. W_{np} versus Q^2 for 2.6 GeV reversed field. The quasielastic peak is clearly there, but there is no hint of a delta peak.

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

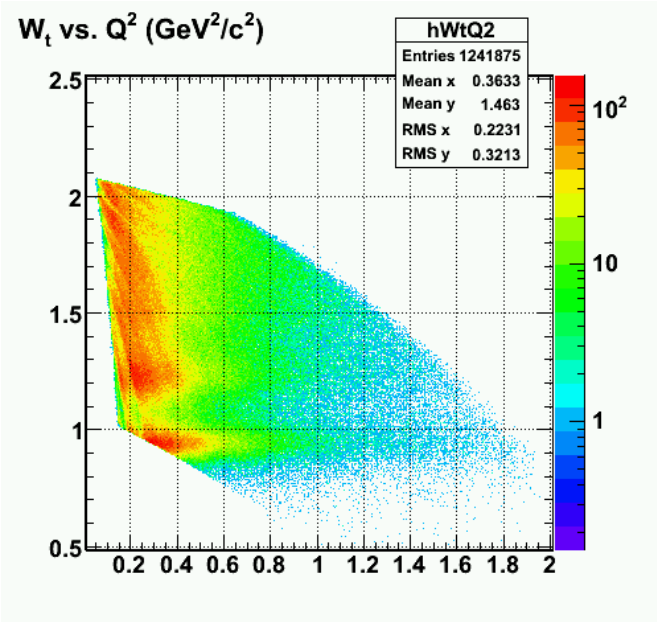

Fig 2. W_t vs. Q^2 for 2.6 GeV, reversed polarity. W_t is the traditional W calculated assuming the target mass is a nucleon.

Click here to view the object (OOT C++ macro for Fig 2) you uploaded.

Click here to view the object (ROOT histogram file for Figs 1-2) you uploaded.

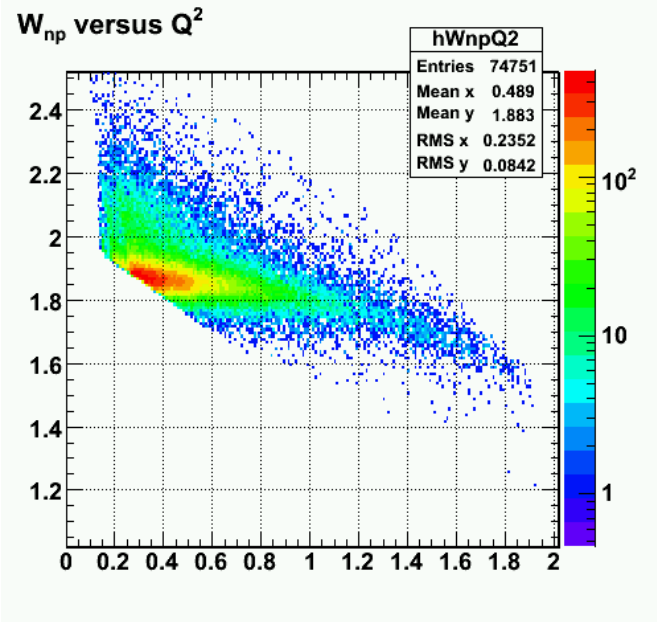

Fig 3. Same as Fig 1 with efids and pfids turned on.

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.

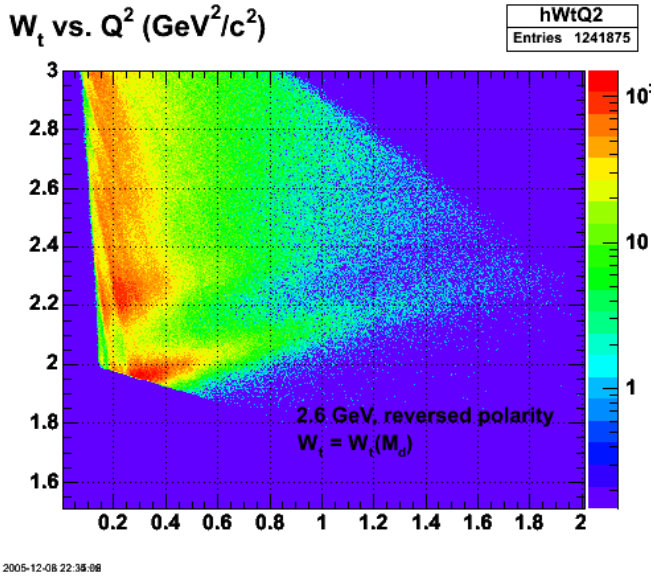

Fig 4. Calculation of W_t using the deuteron mass M_d as the target mass. Contrast this with Fig 2 above where W_t is calculated using the nucleon mass.

Click here to view the object (ROOT C++ macro for Fig 4) you uploaded.

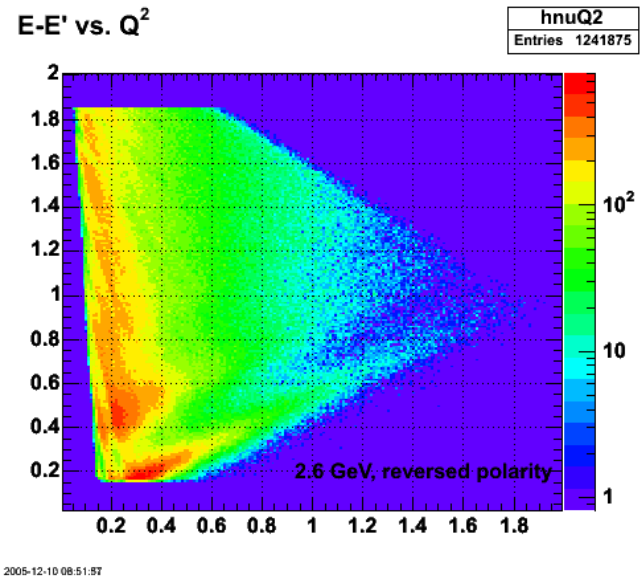

Fig 5. Energy transfer (nu) vs. Q2.

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

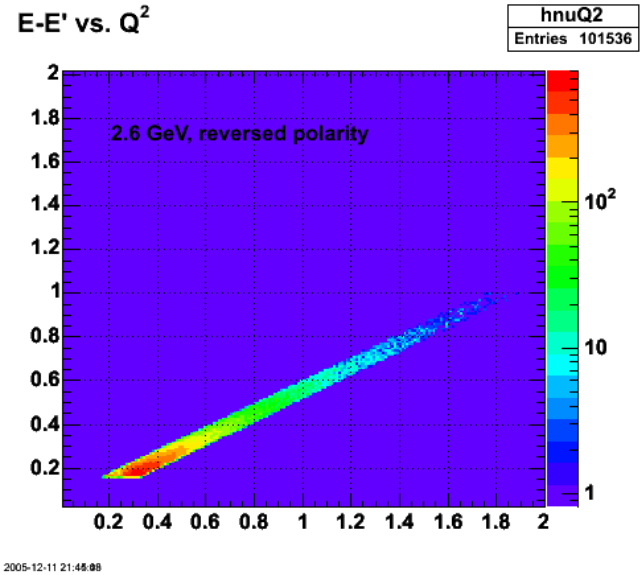

Fig 6. Effect of quasielastic cut. Same as Fig 5 with QE cut turned on.

Click here to view the object (ROOT C++ macro for Fig 6) you uploaded.

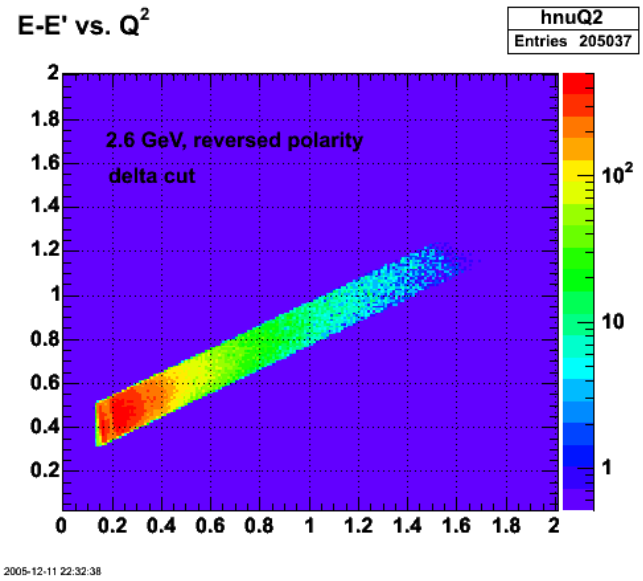

Fig 7. Delta kinematics. Same as Fig 5 with delta cut turned on.

Click here to view the object (ROOT C++ macro for Fig 7) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 101 - delta kinematics for 4.2 GeV (gpg)

[Modified Mon Dec 12 19:53:50 2005 (GMT) gpg]

Below shows the acceptance for the 4.2 GeV data set showing the bands defining quasielastic (QE) and delta kinematics. The quasielastic and delta bands are not nearly as clearly defined here as they are at 2.6 GeV. lots of mush.

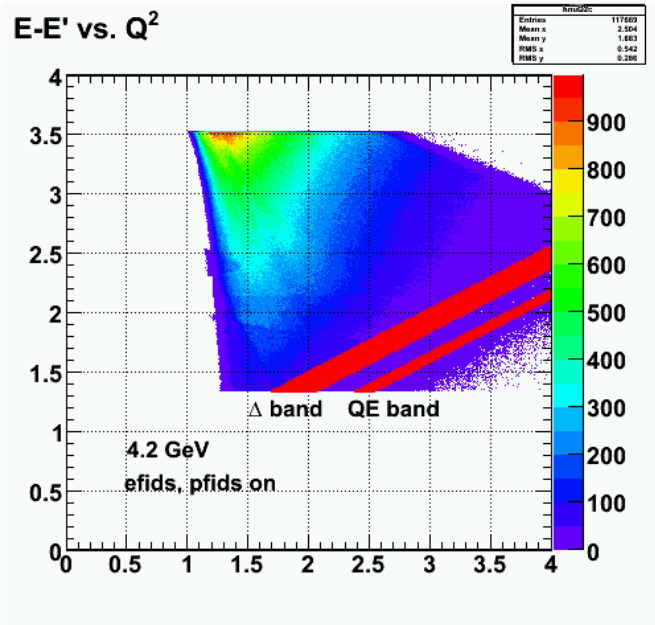

Fig 1. 4.2 GeV

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

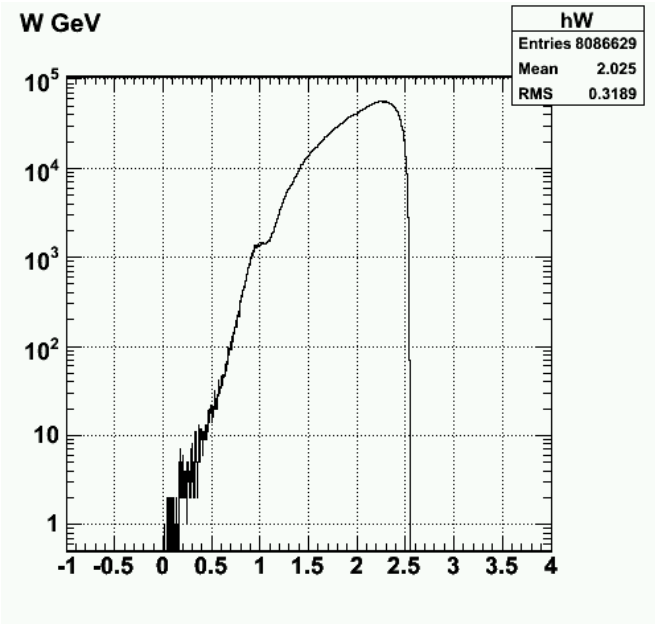

Fig 2. W' histogram (assuming the nucleon target mass).

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

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Jerry Gilfoyle's Enotebook page 102 - backup of radiative corrections CLAS-Note (gpg)

[Modified Thu Dec 22 15:04:41 2005 (GMT) gpg]

Below is the link to the gzipped tar file with the stuff for CLAS-Note 2005-022.

Click here to view the object (gzipped tar file with the stuff for CLAS-Note 2005-022) you uploaded.

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Jerry Gilfoyle's Enotebook page 103 - ALTp for QE kinematics at 4.2 GeV with new efids (gpg)

[Modified Thu Dec 22 15:24:45 2005 (GMT) gpg]

The plot below shows ALTp for quasielastic events at 4.2 GeV with the new efids described in entry 99. Compare with original results in entry 73. The two results look consistent to within the large error bars.

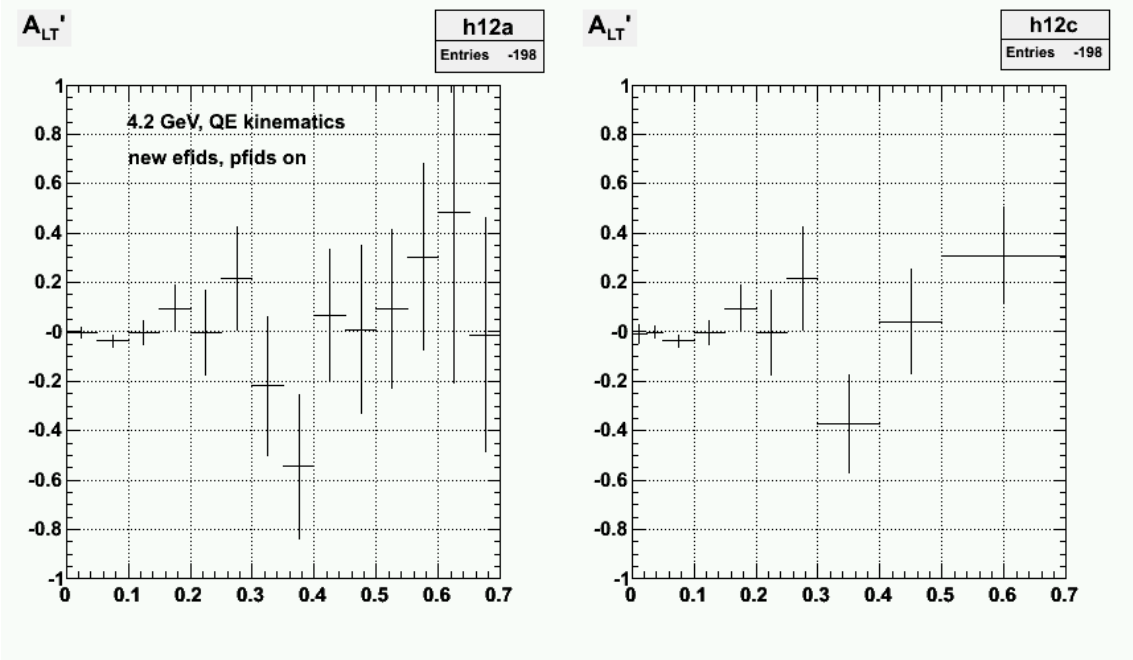

Fig 1. ALTp at 4.2 GeV for QE kinematics with fixed bin size (left panel) and variable bin size (right panel) to improve the statistics.

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

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Jerry Gilfoyle's Enotebook page 104 - Selecting order of polynomial for 2.6r pfids (gpg)

[Modified Mon Dec 26 15:19:06 2005 (GMT) gpg]

The plots and tables below are the result of a comparison of different polynomials used to fit the third generation results.

```
Explanation of labels

fit1 - t0
fit2 - alt
fit3 - blt
fit4 - art
fit5 - brt
fit6 - t1U
fit7 - t1L
fit8 - phimid

N=15

now use pol3

root [42] .! grep +++++  pfid_3genpars.out
+++++ fit1 results 22.4524 -0.386215
+++++ fit2 results 66.7708 0.920197 -1.81833 0
+++++ fit3 results 31.2003 12.0648 39.3903 -39.1768
+++++ fit4 results 141.342 9.15165 -34.4922 44.992
+++++ fit5 results 65.847 12.7916 52.538 -62.4743
+++++ fit6 results 3.94179102.203 -19.2439 -44.3892
+++++ fit7 results 12.2419100.757 -15.6877 -60.5674
+++++ fit8 results 14.26490.548637
root [43]

-----------------------------------------------------

pol2
+++++ fit1 results 22.4524 -0.386215
+++++ fit2 results 67.6107 0.289001 1.40983 0
+++++ fit3 results 50.119 15.6196 19.2809 -7.62414
+++++ fit4 results 163.064 4.63073 -11.9579 10.8874
+++++ fit5 results 92.3848 18.7888 18.9949 -8.65878
+++++ fit6 results 4.61711109.849 -63.8832 17.9434
+++++ fit7 results 14.4424110.578 -73.85 26.3777
+++++ fit8 results 14.26490.548637

-----------------------------------------------------

now use pol1 in some places.

root [10] .! grep +++++ pfid_3genpars.out
+++++ fit1 results 22.4524 -0.386215
+++++ fit2 results 73.9791 -0.376043 3.9337 0 <---- pol1
+++++ fit3 results 91.7356 18.3085 9.09579 0 <---- pol1
+++++ fit4 results 237.198 -0.699716 4.10248 0 <---- pol1
+++++ fit5 results 114.834 21.8259 7.72364 0 <---- pol1
+++++ fit6 results 4.61711109.849 -63.8832 17.9434
+++++ fit7 results 14.4424110.578 -73.85 26.3777
+++++ fit8 results 14.26490.548637
```

Looking at the Fig 1, the linear (pol1) fit for art actually goes negative at low hadron momentum. The actual fit results do not. This doesn't seem to be physically acceptable so I should use pol2 for this parameter even though going to pol2 has a limited improvement in the chisquare.

The pol1 fits look good enough for blt and brt.

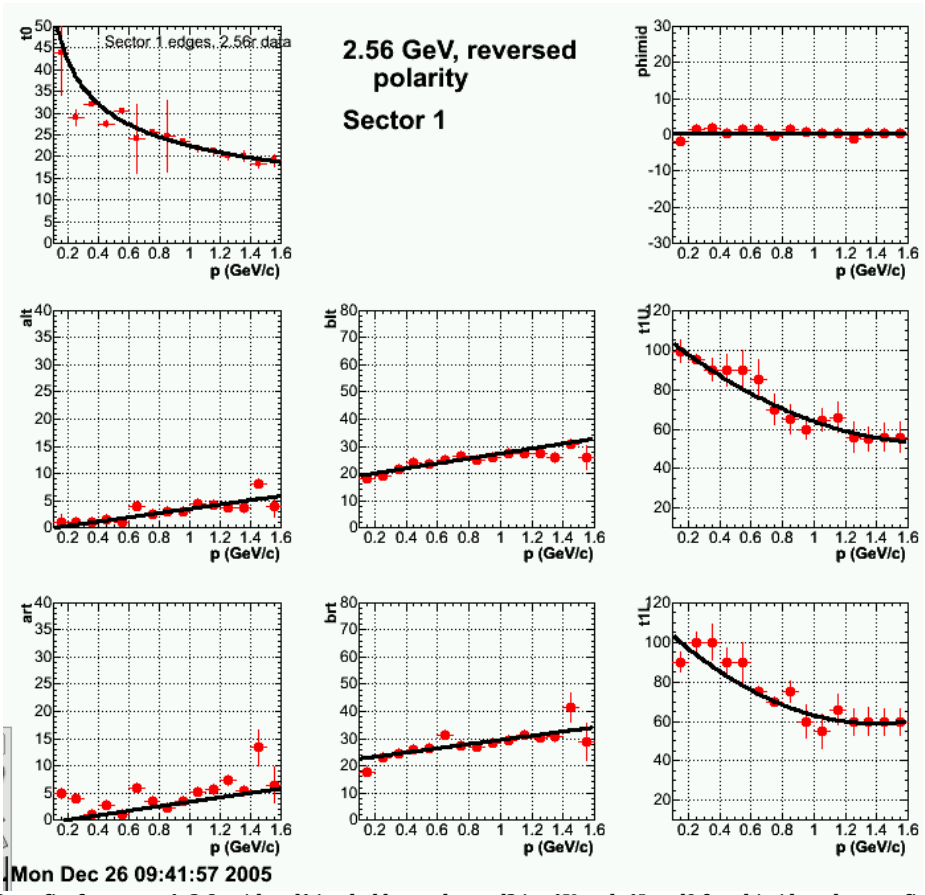


Fig 1. 3gen fits for sector 1, 2.6r with pol1 in alt, blt, art, brt; pol2 in t1U and t1L; pol0 for phimid; and power fit for t0.

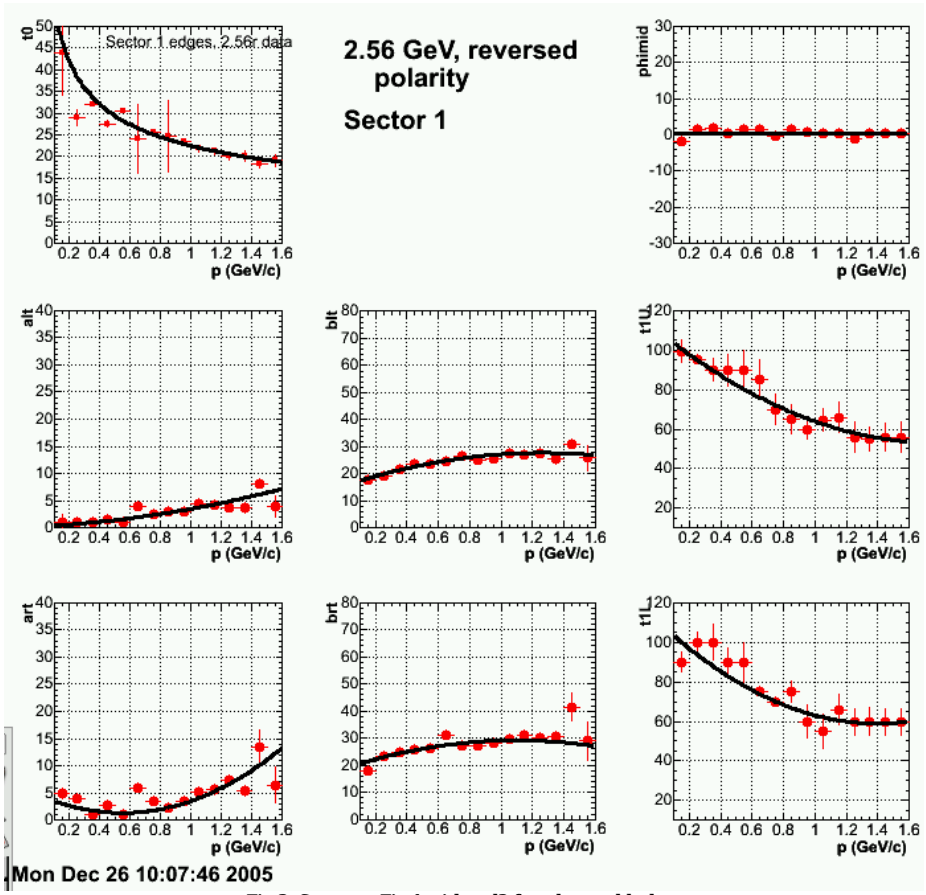


Fig 2. Same as Fig 1 with pol2 for alt, art, blt, brt.

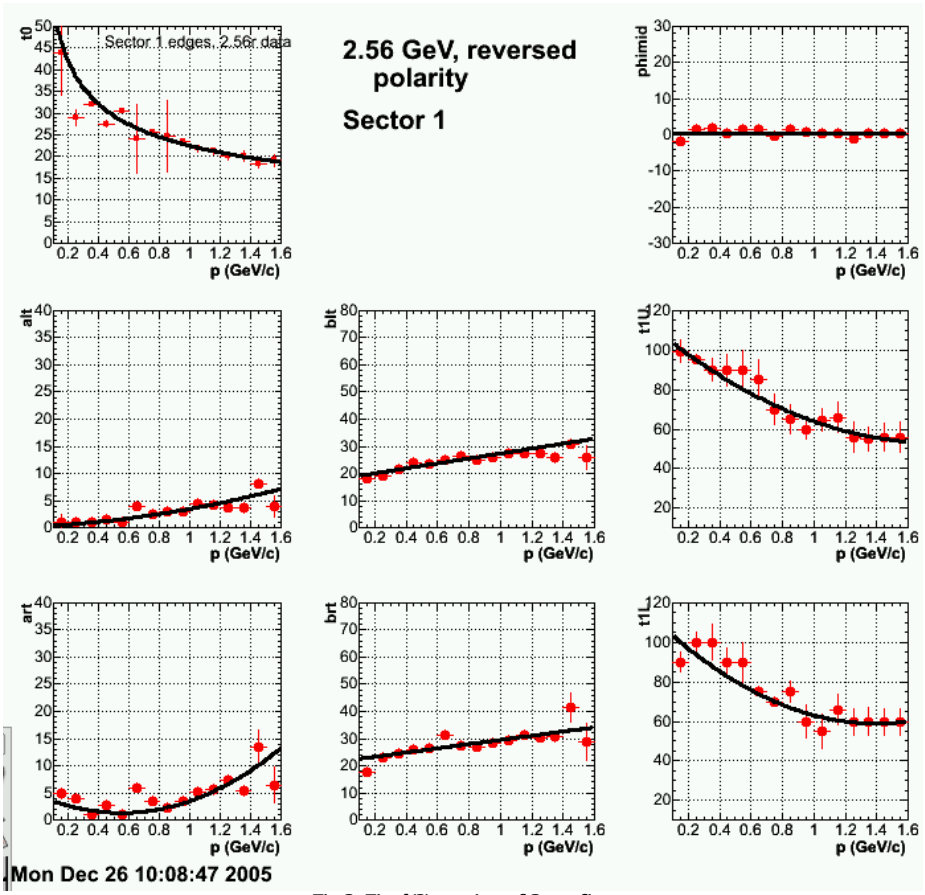


Fig 3. Final(?) version of 3gen fits.

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

Fit results.

```
root [45] .! grep +++++ pfid_3genpars.out
+++++ fit1 results 22.4524 -0.386215
+++++ fit2 results 67.6107 0.289001 1.40983 1.82882
+++++ fit3 results 91.7356 18.3085 9.09579
+++++ fit4 results 163.064 4.63073 -11.9579 10.8874
+++++ fit5 results 114.834 21.8259 7.72364
+++++ fit6 results 4.61711109.849 -63.8832 17.9434
+++++ fit7 results 14.4424110.578 -73.85 26.3777
+++++ fit8 results 14.2649 0.548637
r
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 105 - 2.6 GeV, reversed-field, pfids (gpg)

[Modified Tue Dec 27 20:04:23 2005 (GMT) gpg]

Sector 1, 2.6 GeV, reversed field, pfid results.

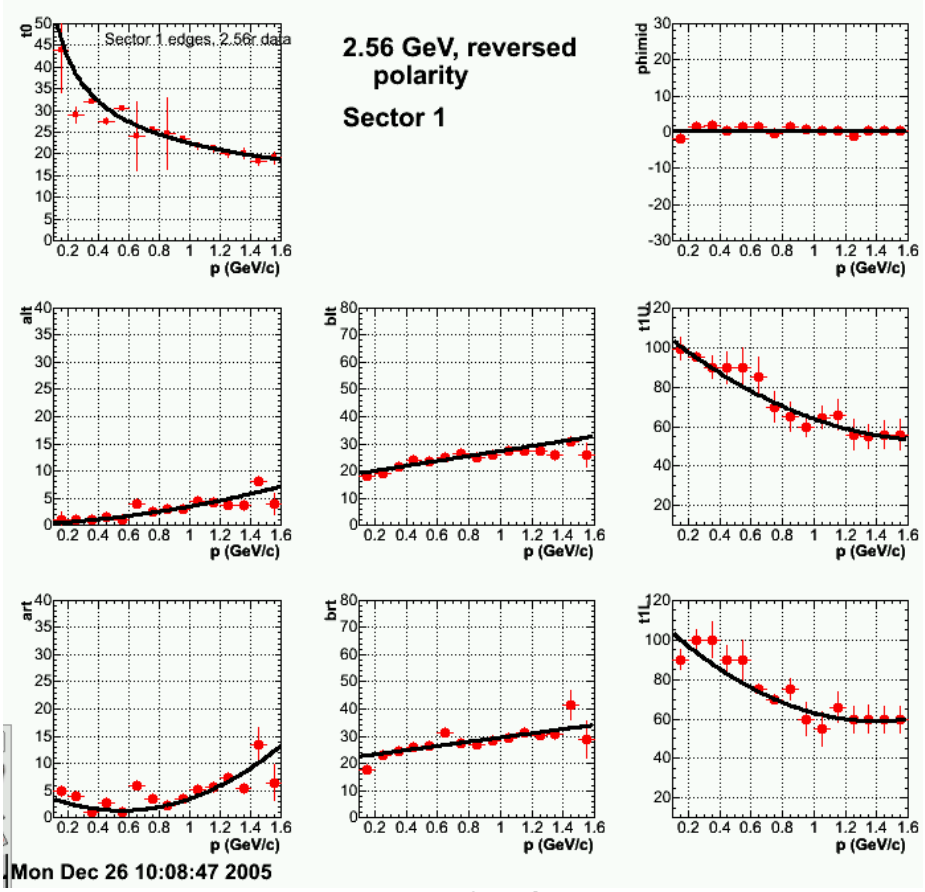


Fig 1. 3gen fit results.

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

Fit coefficients.

```
+++++ fit1 results 22.4524 -0.386215
+++++ fit2 results 67.6107 0.289001 1.40983 1.82882
+++++ fit3 results 91.7356 18.3085 9.09579
+++++ fit4 results 163.064 4.63073 -11.9579 10.8874
+++++ fit5 results 114.834 21.8259 7.72364
+++++ fit6 results 4.61711 109.849 -63.8832 17.9434
+++++ fit7 results 14.4424 110.578 -73.85 26.3777
+++++ fit8 results 14.2649 0.548637
```

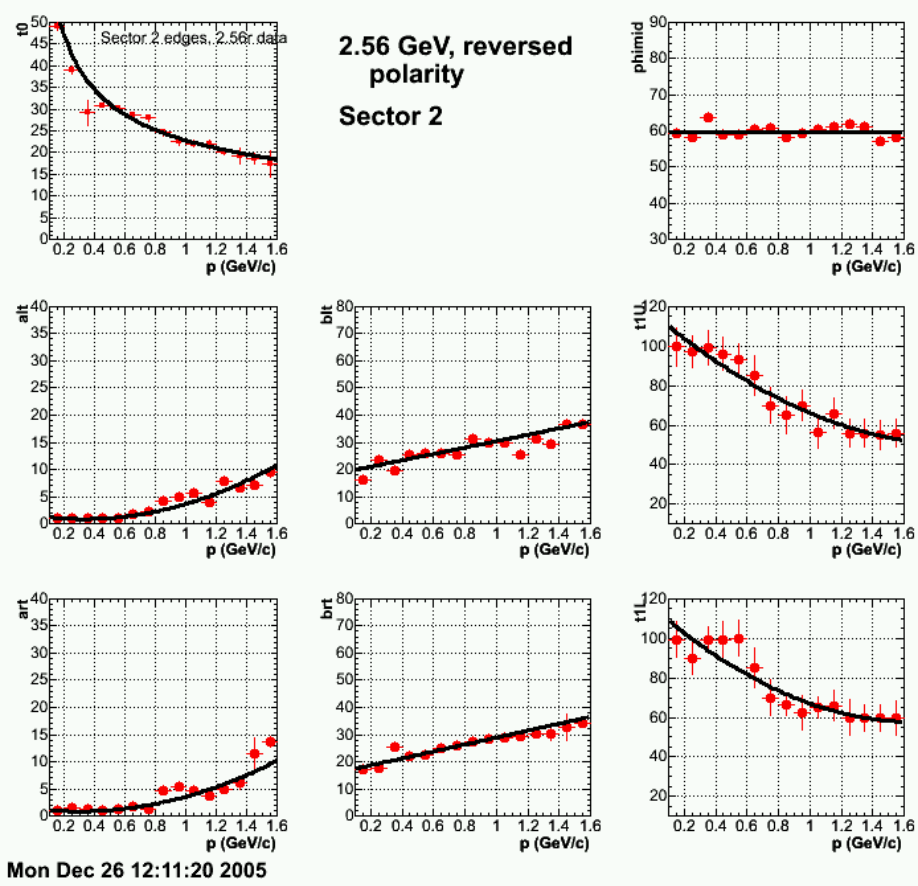


Fig 2. Sector 2 pfid 3gen fit results.

Click here to view the object (ROOT C++ macro for Fig 2.) you uploaded.

```
.! grep +++++ pfid_3genpars.out
+++++ fit1 results 12.0387 22.7866 -0.446873
+++++ fit2 results 108.923 1.57192 -4.05066 6.17853
+++++ fit3 results 856.13 18.7119 11.7671
+++++ fit4 results 81.6713 1.38124 -3.29139 5.53554
+++++ fit5 results 322.771 16.1588 12.7919
+++++ fit6 results 5.60232 116.729 -67.7917 17.1733
+++++ fit7 results 9.56232 115.695 -69.3514 20.6966
+++++ fit8 results 40.0129 59.8176
```

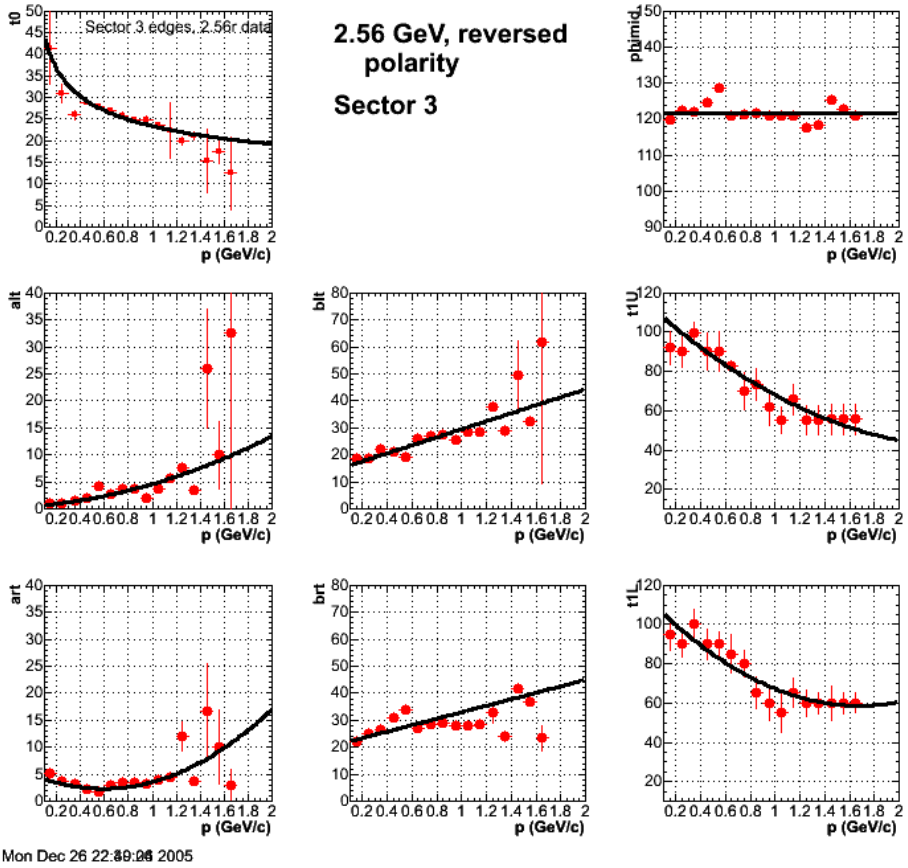


Fig 3. 3gen fit results for sector 3, 2.6r.

Click here to view the object (ROOT C++ macro for Fig 3.) you uploaded.

```
root [47] .! grep +++++ pfid_3genpars.out
+++++ fit1 results 23.088 23.3872 -0.281476
+++++ fit2 results 77.0729 0.535658 1.73981 2.37361
+++++ fit3 results 100.482 14.7078 14.8269
+++++ fit4 results 58.1482 4.96244 -8.82905 7.46298
+++++ fit5 results 331.252 21.0474 11.9644
+++++ fit6 results 10.5365 112.665 -55.6298 10.8835
+++++ fit7 results 8.08062 111.592 -63.1433 18.8305
+++++ fit8 results 106.268 121.803
```

For sector 4, I made the alt and art fits linear instead of second order because the curve seen in the previous sectors was less significant.

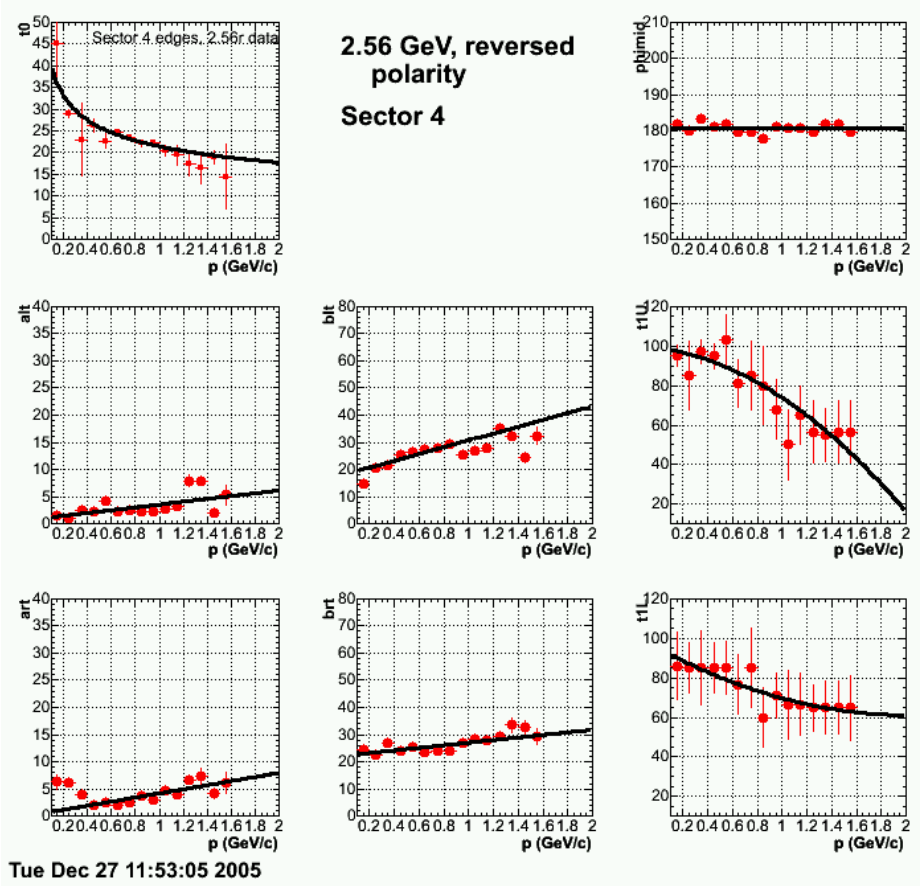


Fig 4. Sector 4, 3-gen, pfid fit results for 2.6r

Click here to view the object (ROOT C++ macro for Fig 4.) you uploaded.

```
root [6] .! grep +++++ pfid_3genpars.out
+++++ fit1 results 9.18638 21.4261 -0.272465
+++++ fit2 results 286.446 0.980568 2.60364
+++++ fit3 results 497.077 18.24 12.5209
+++++ fit4 results 175.478 0.44736 3.7678
+++++ fit5 results 224.676 22.3143 4.74735
+++++ fit6 results 4.96452 99.2651 -9.27897 -16.1769
+++++ fit7 results 1.38645 94.9879 -33.6276 8.33717
+++++ fit8 results 24.1963 180.757
r
```

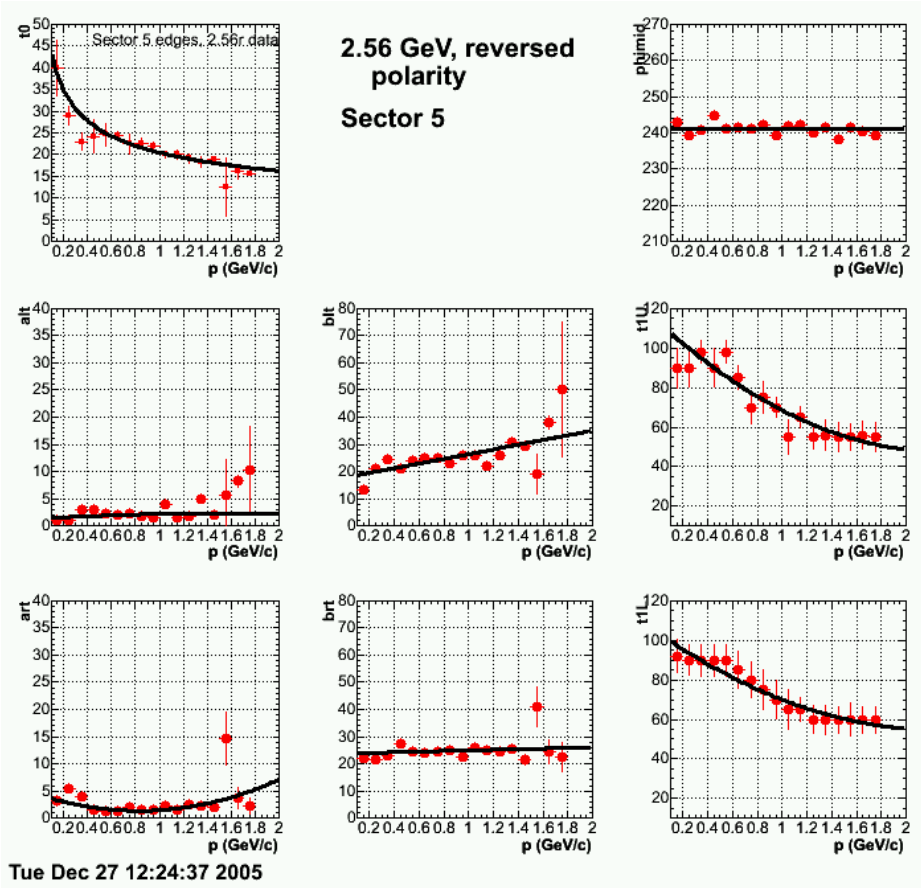
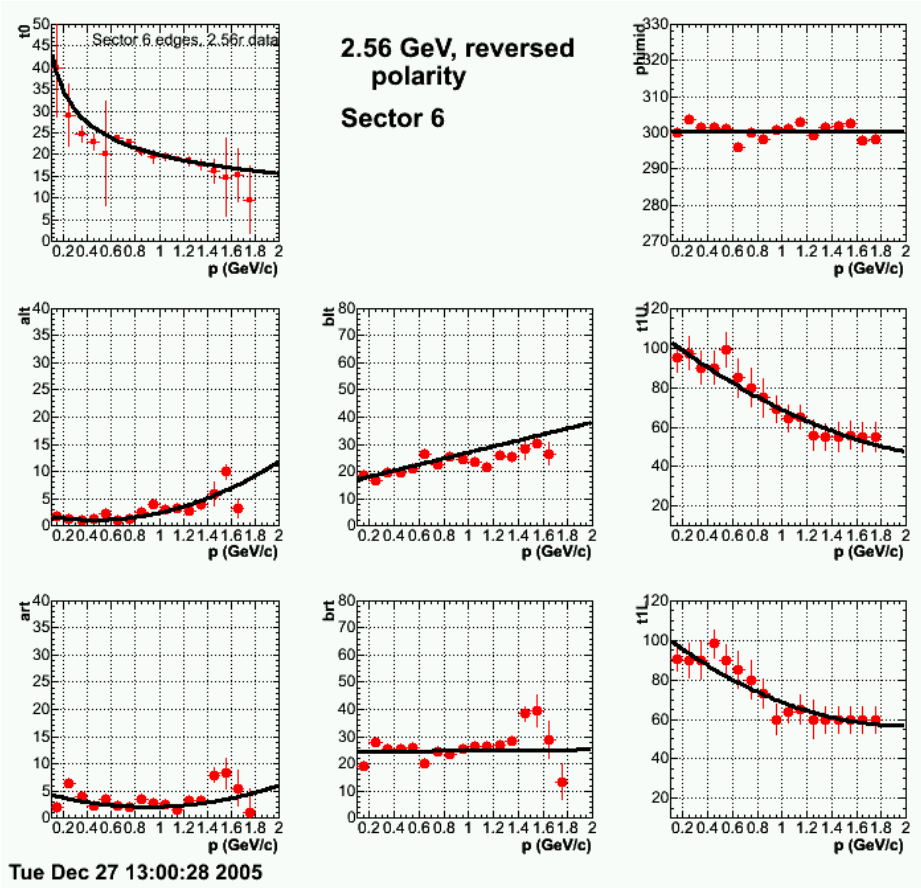


Fig 5. Sector 5, 3-gen pfid fit results for 2.6r.

Click here to view the object (ROOT C++ macro for Fig 5.) you uploaded.

```
  root [13] .! grep +++++ pfid_3genpars.out
+++++ fit1 results 22.5285 20.4774 -0.333874
+++++ fit2 results 119.05 1.3609 1.23069 -0.372899
+++++ fit3 results 1151.92 17.8294 8.61166
+++++ fit4 results 81.8571 4.28531 -7.05327 4.24486
+++++ fit5 results 318.457 23.8133 1.14912
+++++ fit6 results 12.8499 113.279 -57.1971 12.4257
+++++ fit7 results 3.13176 103.605 -43.0983 9.48397
+++++ fit8 results 40.8242 241.023
```



Sector 6, 3-gen, pfid fit results for 2.6r.

Click here to view the object (ROOT C++ macro for Fig 6.) you uploaded.

```
root [6] .! grep +++++ pfid_3genpars.out
+++++ fit1 results 10.002 19.9349 -0.345816
+++++ fit2 results 201.307 2.08676 -4.24293 4.57111
+++++ fit3 results 766.868 15.9588 11.0823
+++++ fit4 results 125.906 4.85791 -6.10235 3.35127
+++++ fit5 results 590.537 23.9426 0.865185
+++++ fit6 results 5.71293 107.96 -48.1108 8.91433
+++++ fit7 results 9.16943 104.483 -47.8639 12.0029
+++++ fit8 results 65.981 300.468
```

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Jerry Gilfoyle's Enotebook page 106 - 2.6 GeV reversed field pfid tests and ALTp (gpg)

[Modified Sat Jan 7 14:23:42 2006 (GMT) gpg]

Below are some results from applying the pfids for the 2.6 GeV, reversed field data.

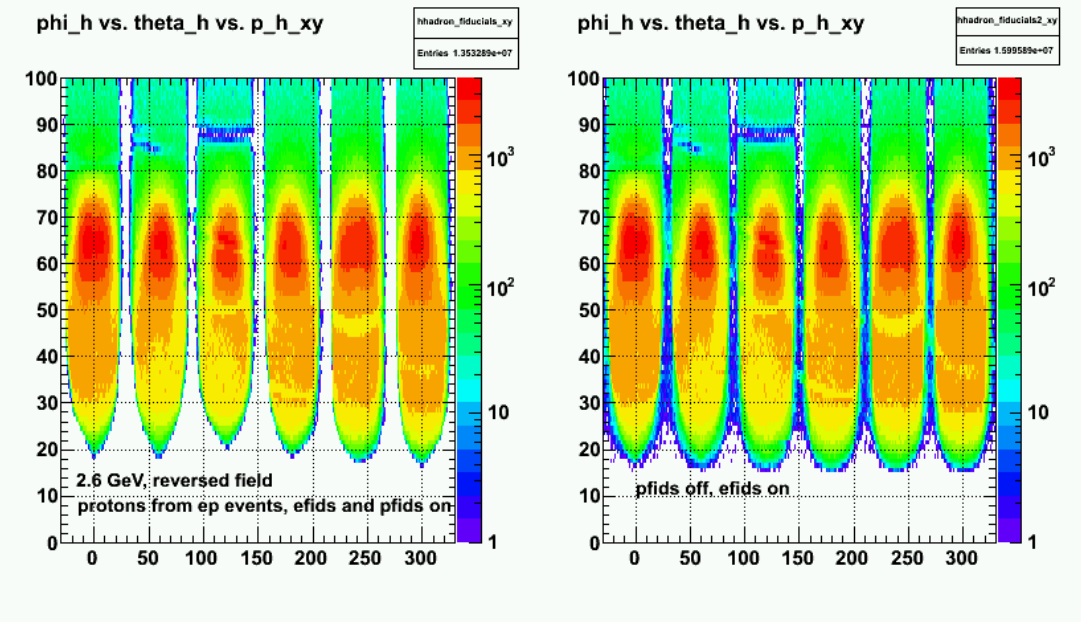

Fig 1. Comparison of the CLAS acceptance for the 2.6 GeV, reversed field data with the proton fiducials (and electron fiducials) on (left panel) and off (right panel).

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

The plot below shows a comparison of the projections of the 2D spectra in Fig 1 along the theta axis. The ratio of the counts is 1.059 so the pfids cut out only about 6% of the data.

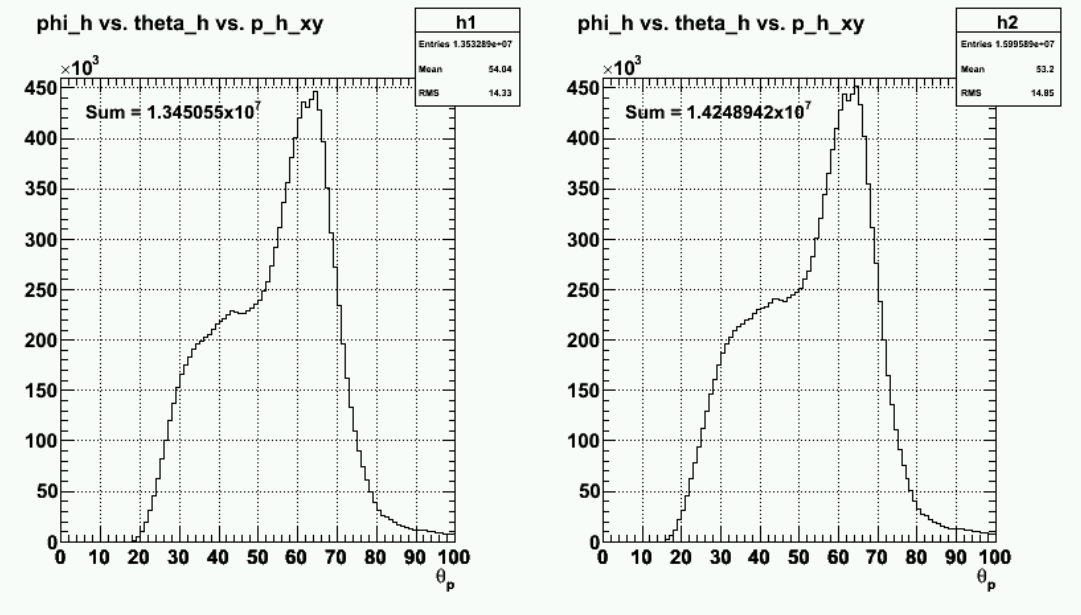

Fig 2. Comparison of the angular distribution and number of counts with pfids (and efids) on (left panel) and off (right panel).

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

The fiducial cuts have little effect on ALTp for quasielastic kinematics at 2.6 GeV, reversed field except for weakening the statistics. See Fig 3.

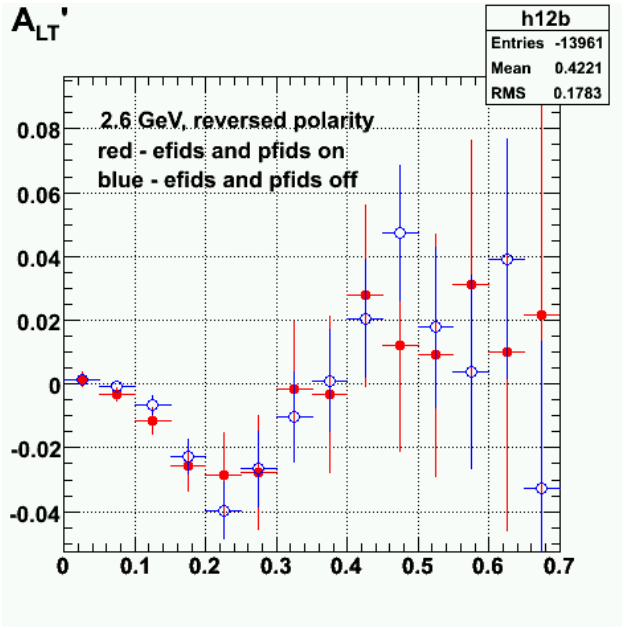

Fig 3. Comparing ALTp with efids and pfids on (red) and off (blue).

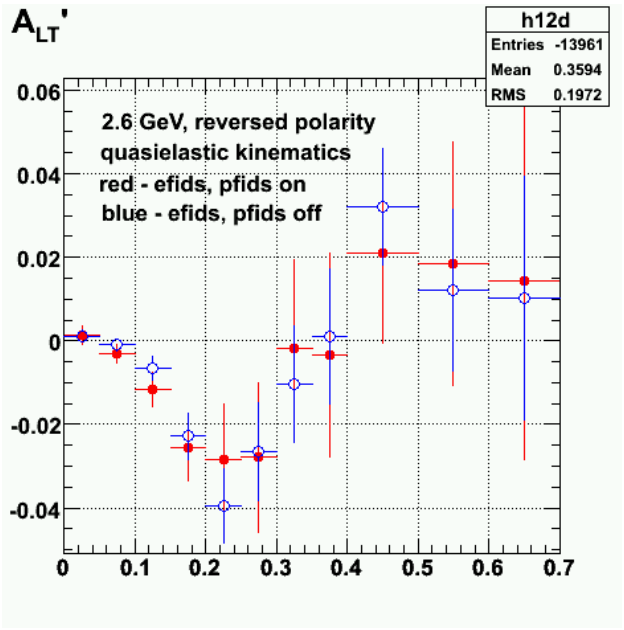

Fig 4. Comparing ALTp with efids and pfids on (red) and off (blue) using variable bin sizes.

Click here to view the object (ROOT C++ macro for Fig 4.) you uploaded.

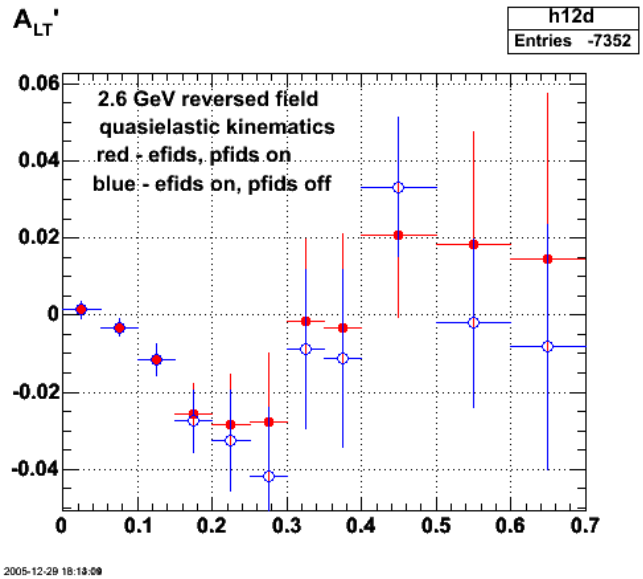

Fig 5. Comparing ALTp with efids on, pfids on (red) and efids on, pfids off (blue) using variable bin sizes.

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

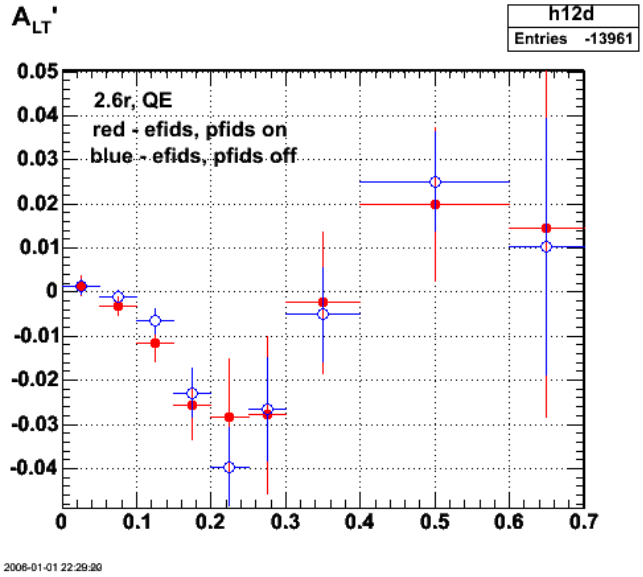

Fig 6. Comparison of ALTp for 2.6r, QE events for efids pfids on (red) and off(blue) with tuning of bin sizes to make things look goood.

Click here to view the object (ROOT C++ macro for Fig 6) you uploaded.

Click here to view the object (ROOT histogram file for Fig 6.) you uploaded.

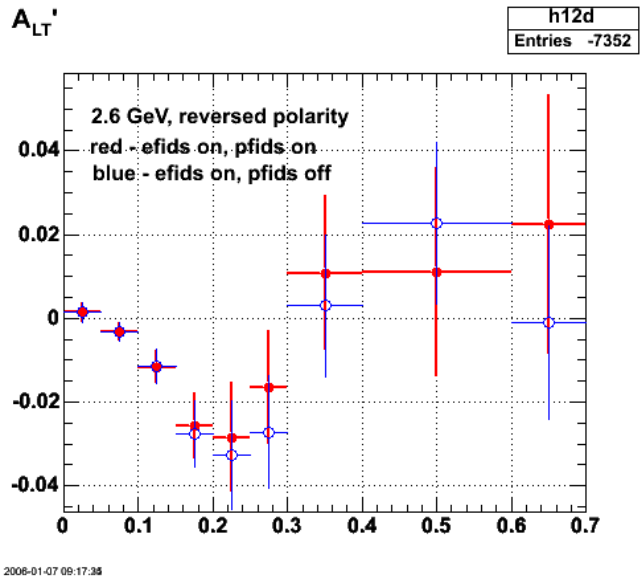

Fig 7. omparison of ALTp for 2.6r, QE events for efids on and pfids on (red) and for efids on pfids off (blue).

Click here to view the object (OOT C++ macro for Fig 7) you uploaded.

Click here to view the object (ROOT histogram file for Fig 7.) you uploaded.

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Jerry Gilfoyle's Enotebook page 107 - Latest ALTp code for QE events (gpg)

[Modified Fri Jan 6 15:01:49 2006 (GMT) gpg]

latest ALTp code.

```
TH1F *h1a = new TH1F("h1a","Sin(#phi) weighted distribution for positive helicity",14,0.0,0.7);
TH1F *h2a = new TH1F("h2a","Sin(#phi) weighted distribution for negative helicity",14,0.0,0.7);
h1a.Sumw2();
h2a.Sumw2();
h1a.Divide(hp_m_sin_phi_wghtplus, hp_m_unwghtplus);
h2a.Divide(hp_m_sin_phi_wghtminus,hp_m_unwghtminus);
TH1F *h12a = new TH1F("h12a","A_{LT}'",14,0.0,0.7);
h12a.Sumw2();
h12a.Add(h1a,h2a,1.0,-0.9994);
h12a.Draw();
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h12a->Divide(unity,0.73)
h12a->Draw();


TH1F *h1b = new TH1F("h1b","Sin(#phi) weighted distribution for positive helicity",14,0.0,0.7);
TH1F *h2b = new TH1F("h2b","Sin(#phi) weighted distribution for negative helicity",14,0.0,0.7);
h1b.Sumw2();
h2b.Sumw2();
h1b.Divide(hp_m_sin_phi_wghtplus2, hp_m_unwghtplus2);
h2b.Divide(hp_m_sin_phi_wghtminus2,hp_m_unwghtminus2);
TH1F *h12b = new TH1F("h12b","A_{LT}'",14,0.0,0.7);
h12b.Sumw2();
h12b.Add(h1b,h2b,1.0,-0.9994);
h12b.Draw();
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h12b->Divide(unity,0.73)
h12b->Draw();


Double_t p_m_bin_edges[13]={0.0,0.05,0.10,0.15,0.20,0.25,0.30,0.40,0.60,0.70,1.0,1.5,2.0};
Int_t n_varp_mbins = 12;
TH1F *h1c = new TH1F("h1c","Sin(#phi) weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
TH1F *h2c = new TH1F("h2c","Sin(#phi) weighted distribution for negative helicity",n_varp_mbins,p_m_bin_edges);
h1c.Sumw2();
h2c.Sumw2();
h1c.Divide(hp_m_sin_phi_wghtplus3, hp_m_unwghtplus3);
h2c.Divide(hp_m_sin_phi_wghtminus3,hp_m_unwghtminus3);
TH1F *h12c = new TH1F("h12c","A_{LT}'",n_varp_mbins,p_m_bin_edges);
h12c.Sumw2();
h12c.Add(h1c,h2c,1.0,-0.9994);
h12c.Draw();
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h12c->Divide(unity,0.73)
h12c->Draw();



Double_t p_m_bin_edges[13]={0.0,0.05,0.10,0.15,0.20,0.25,0.30,0.40,0.60,0.70,1.0,1.5,2.0};
Int_t n_varp_mbins = 12;
TH1F *h1d = new TH1F("h1d","Sin(#phi) weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
TH1F *h2d = new TH1F("h2d","Sin(#phi) weighted distribution for negative helicity",n_varp_mbins,p_m_bin_edges);
h1d.Sumw2();
h2d.Sumw2();
h1d.Divide(hp_m_sin_phi_wghtplus4, hp_m_unwghtplus4);
h2d.Divide(hp_m_sin_phi_wghtminus4,hp_m_unwghtminus4);
TH1F *h12d = new TH1F("h12d","A_{LT}'",n_varp_mbins,p_m_bin_edges);
h12d.Sumw2();
h12d.Add(h1d,h2d,1.0,-0.9994);
h12d.Draw();
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h12d->Divide(unity,0.73)
h12d->Draw();
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 108 - Beam charge asymmetries (gpg)

[Modified Mon Jan 2 22:35:45 2006 (GMT) gpg]

Beam charge asymmetries are calculated from the ration of the W spectra for QE scattering (Mt=Mn).

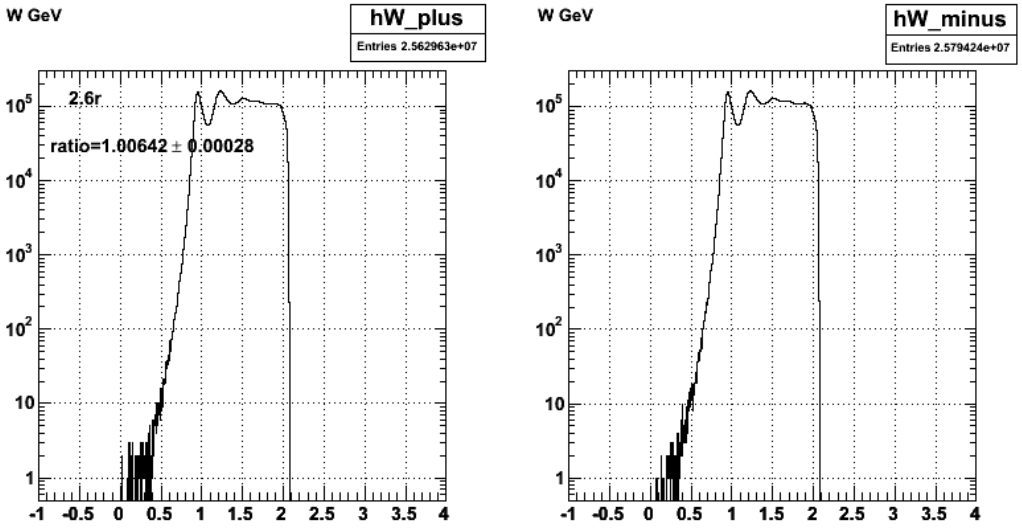

Fig 1. Spectra for 2.6 GeV, reversed field.

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

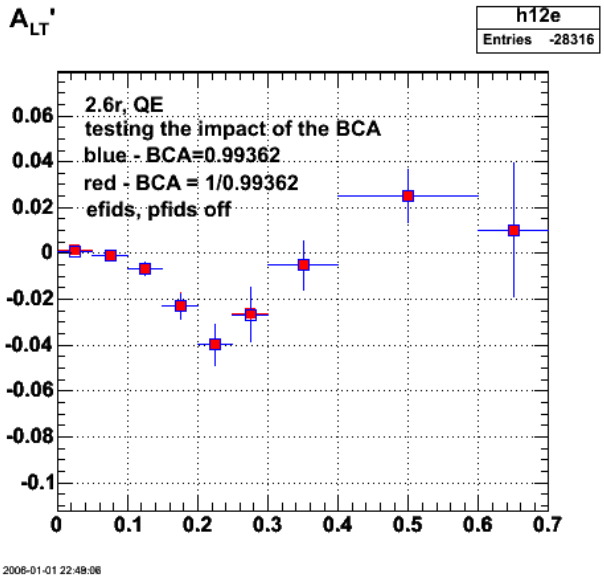

Fig 2. Comparison of impact of BCA when I put it in backwards. Basically the BCA is so close to one that getting it backwatrds has no significant effect.

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

See Fig 6, entry 106 for the ROOT histogram file used to generate Figs 1-2.

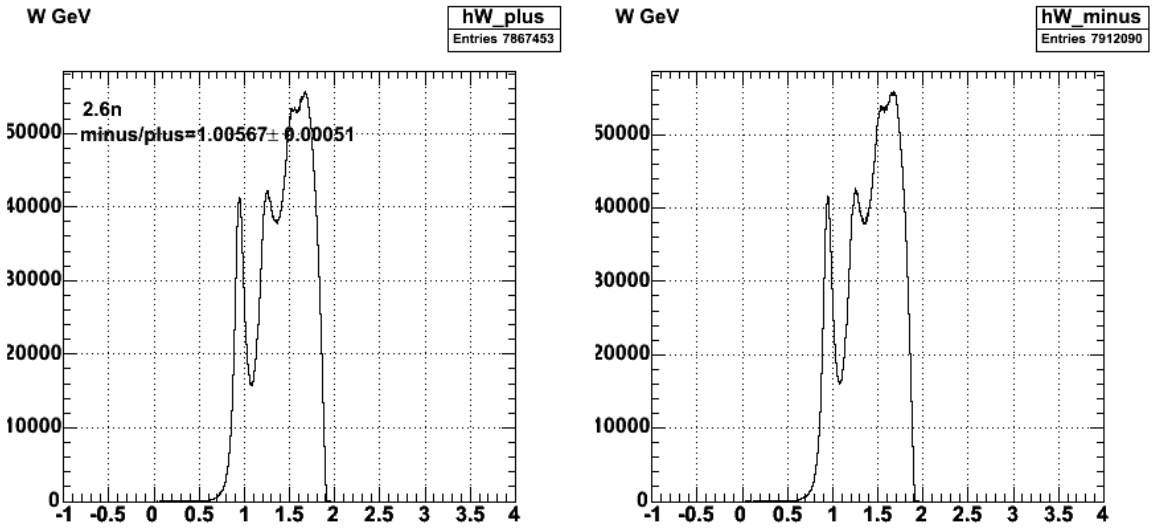

Fig 3. Spectra for 2.6 GeV, normal torus field polarity.

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.

Click here to view the object (ROOT histogram file for Fig 3) you uploaded.

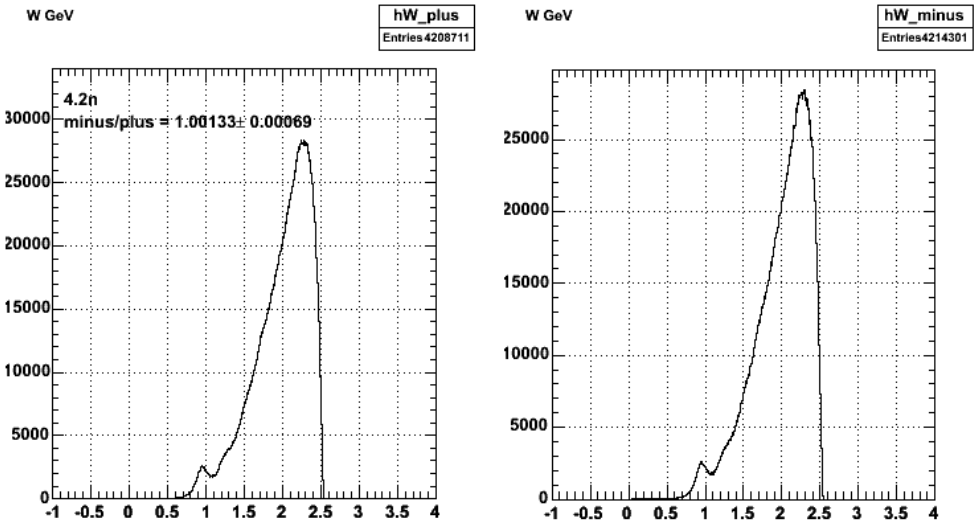

Fig 3. Spectra for 4.2 GeV, normal torus field polarity.

Click here to view the object (ROOT C++ macro for Fig 4) you uploaded.

Click here to view the object (ROOT histogram file for Fig 4) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 109 - Semi-final ALTp results for all running conditions (gpg)

[Modified Tue Apr 24 20:55:30 2007 (GMT) gpg]

Below are plots of ALTp for each set of E5 running conditions along with a plot showing the Q2 distribution for each set of running conditions.

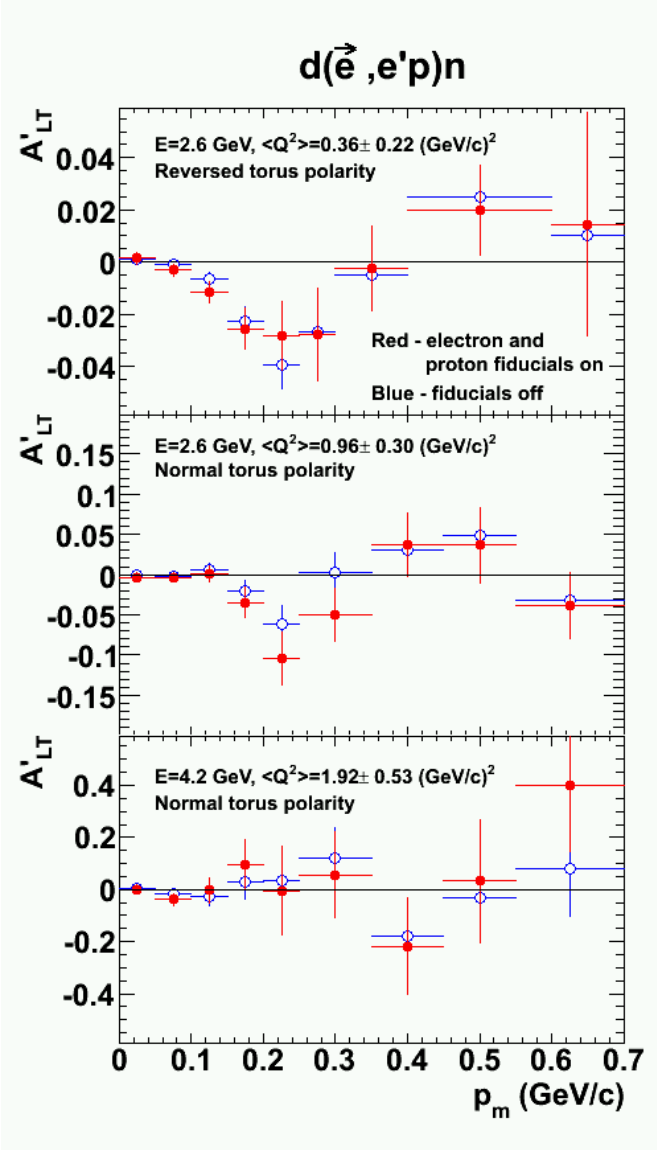

Fig 1. Semi-final ALTp results.

Click here to view the object (ROOT C++ macro named ALTp4.C used to make Fig 1.) you uploaded.

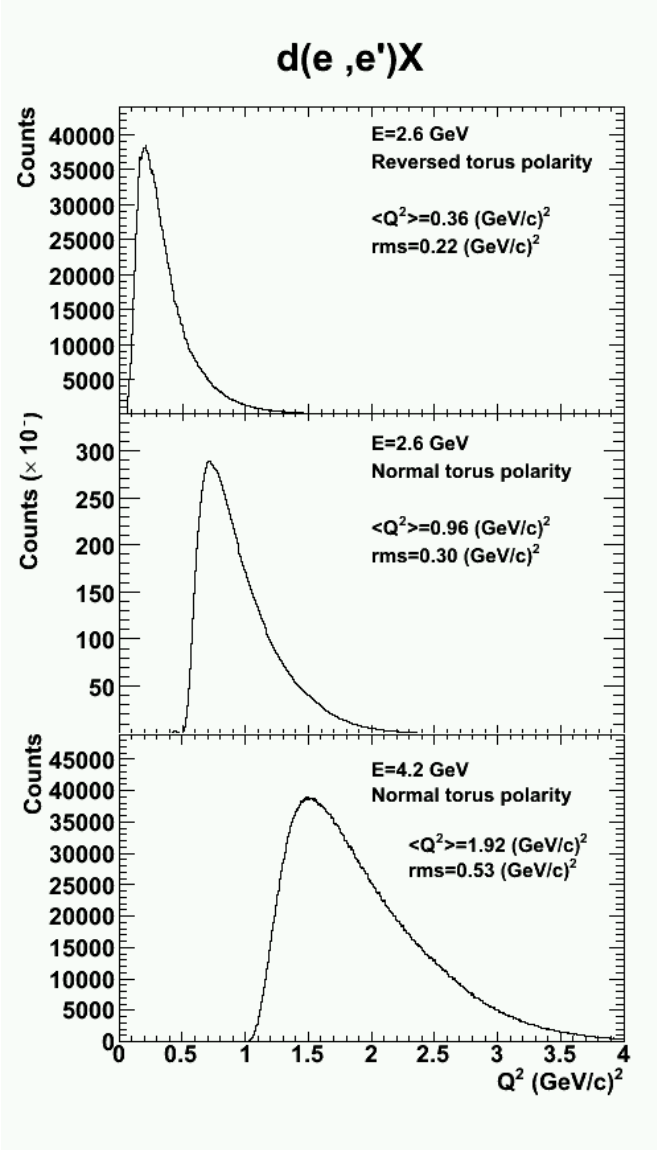

Fig 2. Q2 distribution for each set of E5 running conditions.

Click here to view the object (ROOT C++ macro named Q2d.C used to make Fig 2.) you uploaded.

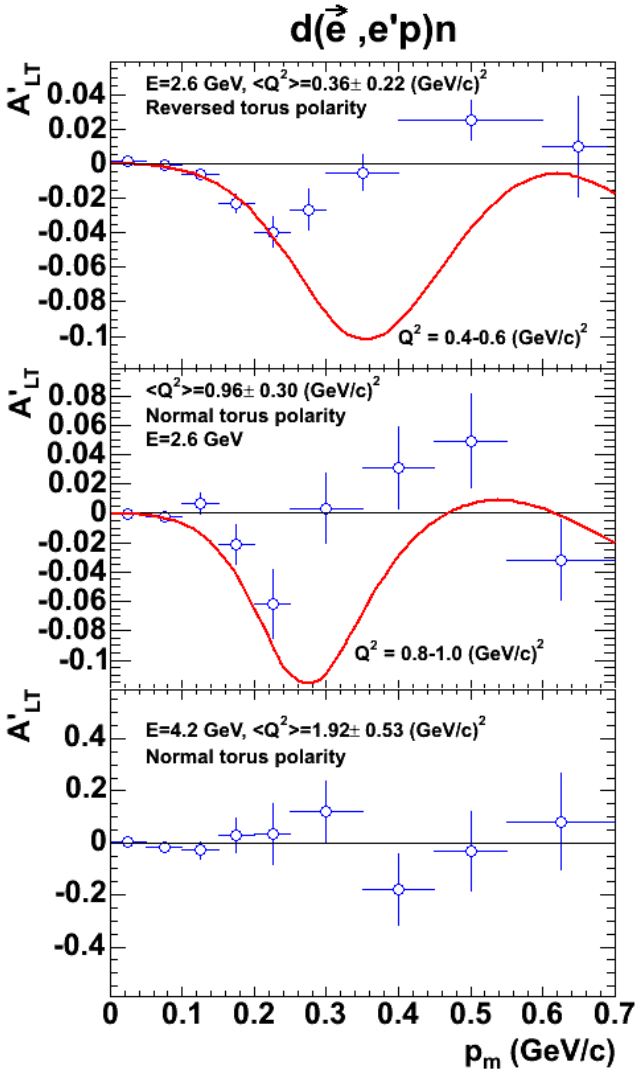

Fig 3. ALTp with no fiducials on and Arenhoevel curves.

Click here to view the object (ROOT C++ macro ALTp5.C for Fig 3.) you uploaded.

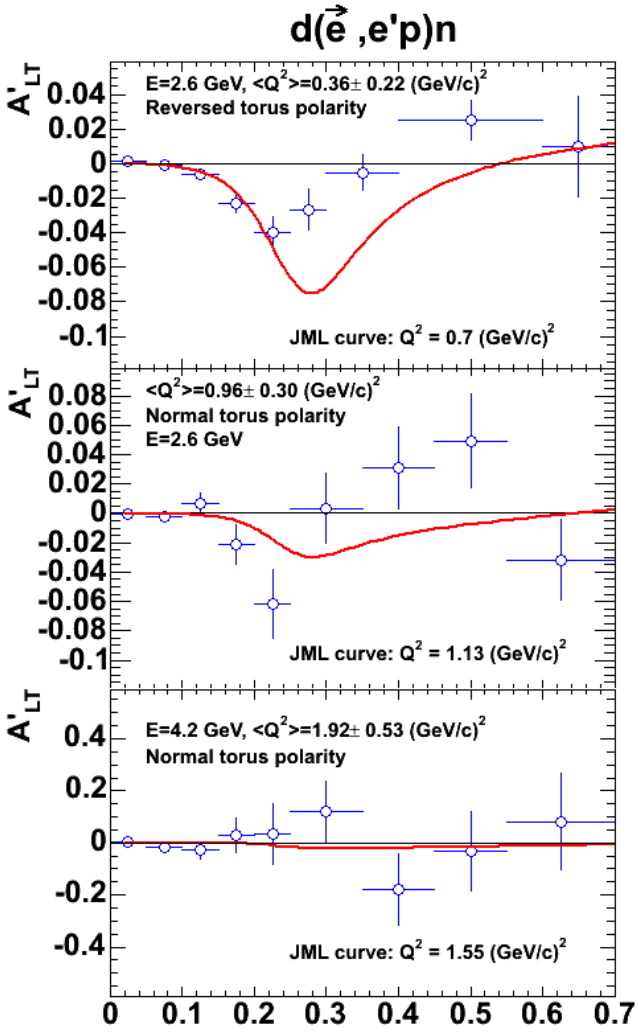

Fig 4. ALTp with no fiducials and JML curves

Click here to view the object (ROOT C++ macro named ALTp6.C used to make Fig 4) you uploaded.

Version of Fig 1 without the 4.2 GeV data.

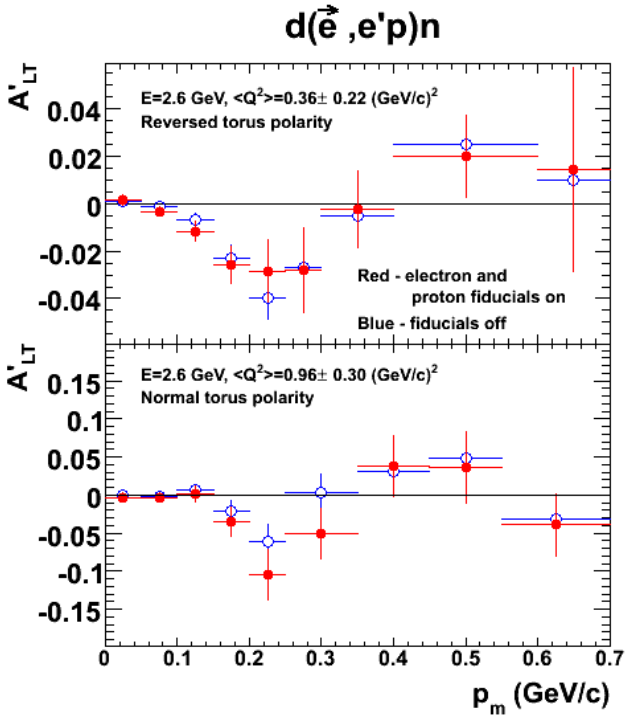

Fig 5. Asymmetries for fifth structure function with efids and pfids on and off.

Click here to view the object (ROOT macro for fig 5) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 110 - Background Asymmetries, BCAs, and elog locations (gpg)

[Modified Mon Jan 9 23:07:39 2006 (GMT) gpg]

The plots show the background asymmetries for the different run conditions extracted by adding the sin(phi_pq)-weighted spectra together.

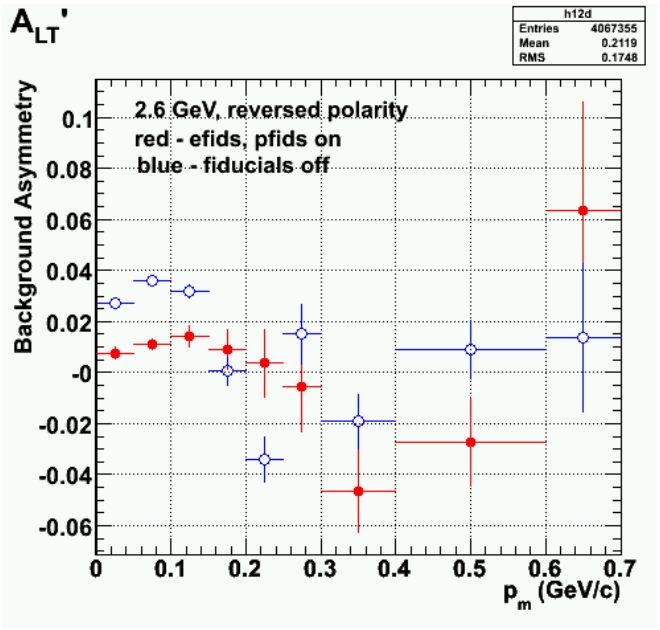

Fig 1. 2.6 GeV, reversed field background asymmetry

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

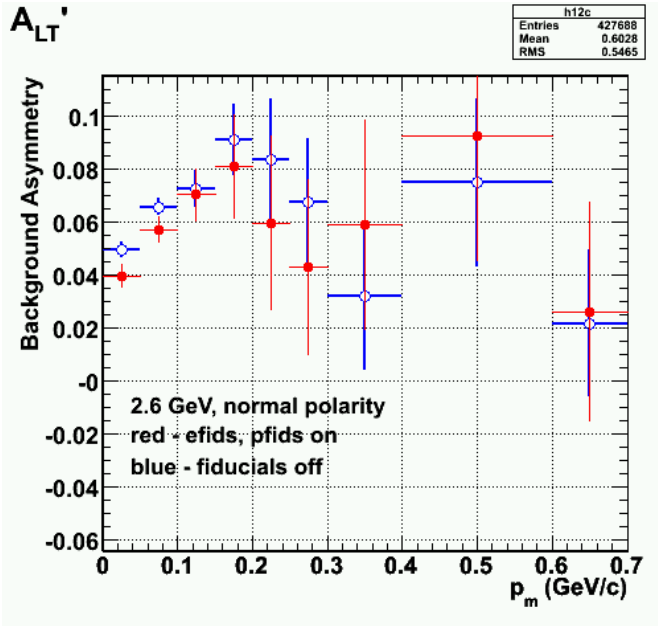

Fig 2. 2.6 GeV, normal field background asymmetry.

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

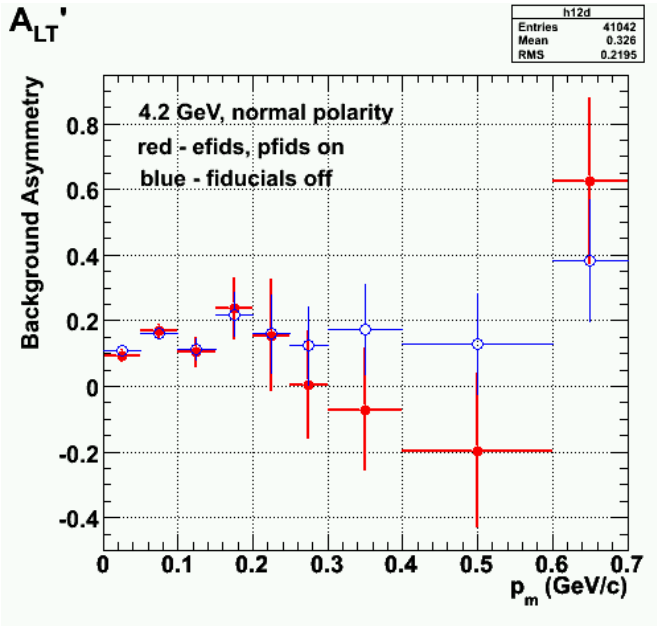

Fig 3. 4.2 GeV, normal field background asymmetry.

Click here to view the object (OOT C++ macro for Fig 3) you uploaded.

Code used to extract the background asymmetry with the following BCAs and locations in my elog.

```
2.6r: entry 106 fig 7, BCA=0.9936

2.6n: entry 95, fig 6, BCA = 0.9944

4.2n: entry 73, fig 6, BCA = 0.9987

--------------------------------------------------------------------------------

alpha code for 4.2n

Double_t p_m_bin_edges[13]={0.0,0.05,0.10,0.15,0.20,0.25,0.30,0.40,0.60,0.70,1.0,1.5,2.0};
Int_t n_varp_mbins = 12;
TH1F *h1c = new TH1F("h1c","Sin(#phi) weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
TH1F *h2c = new TH1F("h2c","Sin(#phi) weighted distribution for negative helicity",n_varp_mbins,p_m_bin_edges);
h1c.Sumw2();
h2c.Sumw2();
h1c.Divide(hp_m_sin_phi_wghtplus3, hp_m_unwghtplus3);
h2c.Divide(hp_m_sin_phi_wghtminus3,hp_m_unwghtminus3);
TH1F *h12c = new TH1F("h12c","A_{LT}'",n_varp_mbins,p_m_bin_edges);
h12c.Sumw2();
h12c.Add(h1c,h2c,1.0,0.9987);
h12c.Draw();
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h12c->Divide(unity,0.73)
h12c->Draw();

Double_t p_m_bin_edges[13]={0.0,0.05,0.10,0.15,0.20,0.25,0.30,0.40,0.60,0.70,1.0,1.5,2.0};
Int_t n_varp_mbins = 12;
TH1F *h1d = new TH1F("h1d","Sin(#phi) weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
TH1F *h2d = new TH1F("h2d","Sin(#phi) weighted distribution for negative helicity",n_varp_mbins,p_m_bin_edges);
h1d.Sumw2();
h2d.Sumw2();
h1d.Divide(hp_m_sin_phi_wghtplus4, hp_m_unwghtplus4);
h2d.Divide(hp_m_sin_phi_wghtminus4,hp_m_unwghtminus4);
TH1F *h12d = new TH1F("h12d","A_{LT}'",n_varp_mbins,p_m_bin_edges);
h12d.Sumw2();
h12d.Add(h1d,h2d,1.0,0.9987);
h12d.Draw();
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h12d->Divide(unity,0.73)
h12d->Draw();
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 111 - fiducial plots (gpg)

[Modified Tue Jan 10 00:23:10 2006 (GMT) gpg]

Below is a tar file with gifs of the electron and proton fiducial tests.

Click here to view the object (tar file with plots of fiducials tests) you uploaded.

The key for the plot names is below.

```
f1.gif 2.6r pfid
f2.fig 4.2n pfid
f3.gif 2.6n pfid
f4.gif 2.6n efid
f4a.gif 2.6n efid
f5.gif 2.6r efid
f6.gif 4.2n efid
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 112 - Q2 distribution for quasielastic epn events (gpg)

[Modified Thu Jan 19 03:57:50 2006 (GMT) gpg]

The plots below show the Q2 distribution for epn events for the different running conditions. This will be needed to average the theory calculations.

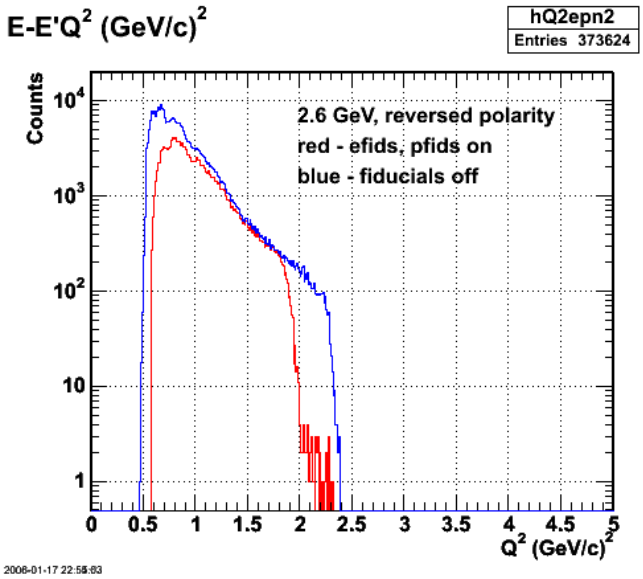

Fig 1. Q2 distribution for epn events for 2.6 GeV, normal polarity for fiducials on (red) and off (blue). The labeling of the data set on the plot is WRONG!

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

Click here to view the object (ROOT histogram file used to make Fig 1) you uploaded.

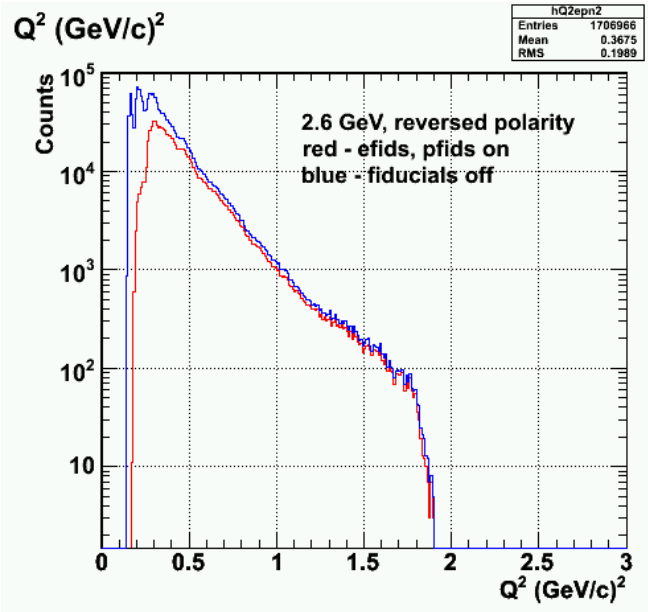

Fig 2. Q2 distribution for epn events for 2.6 GeV, reversed polarity for fiducials on (red) and off (blue).

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

Click here to view the object (ROOT histogram file used to make Fig 2) you uploaded.

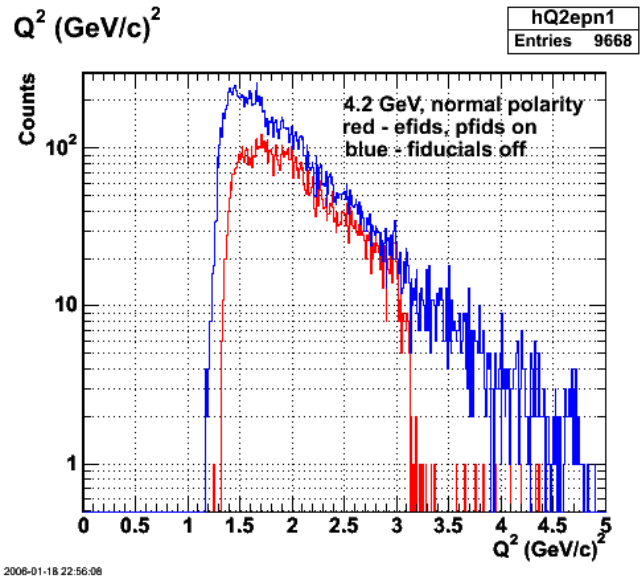

Fig 3. Q2 distribution for epn events for 4.2 GeV, normal polarity for fiducials on (red) and off (blue).

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.

Click here to view the object (ROOT histogram file used to make Fig 3) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 113 - Comparison of ALTp with HA curves (gpg)

[Modified Fri Feb 17 15:32:20 2006 (GMT) gpg]

The plots below show a comparison of the post-preliminary ALTp, quasielastic results with the old Arenhoevel calculations from 2003. The curves in Figures 1 and 3 are suspect, because I'm not sure I was getting everything right in going from HA's amplitudes (fL, fT, fLT, fTT, fLTp) to the asymmetry ALTp. See Figure 4-5 for more recent (2/10/06) calculations.

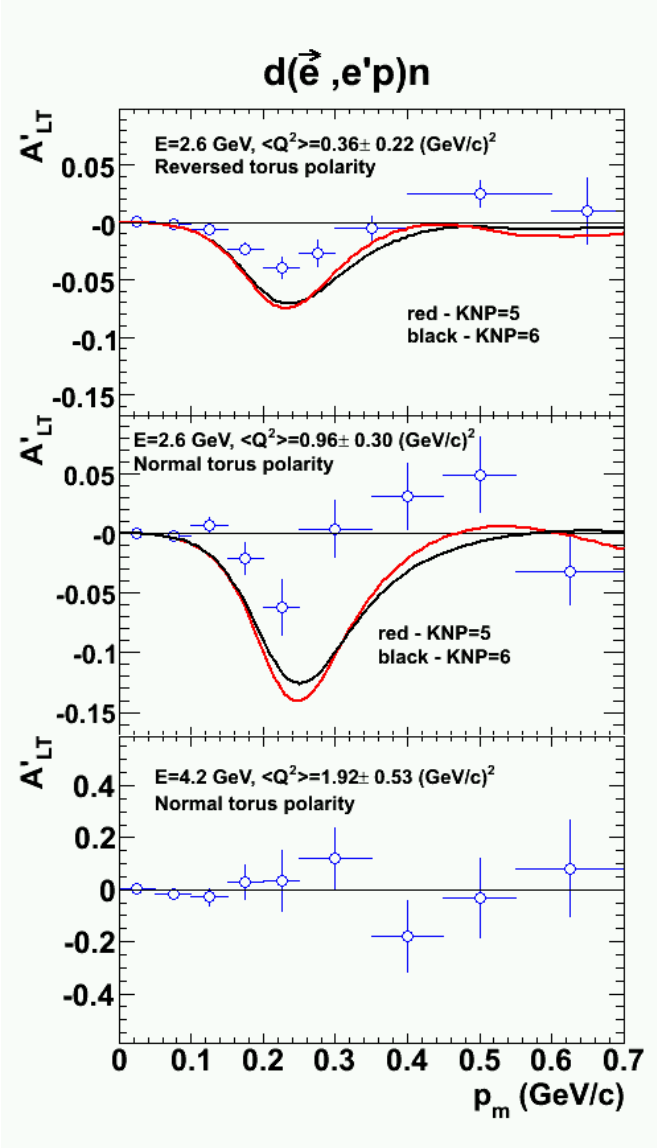

Fig 1. Comparison of ALTp in QE kinematics with Arenhoevel curves with leptonic tensor from Soong's thesis.

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

Click here to view the object (Sample Mathematica notebook used to produce the Q2 averaged Arenhoevel curves in Fig 1.) you uploaded.

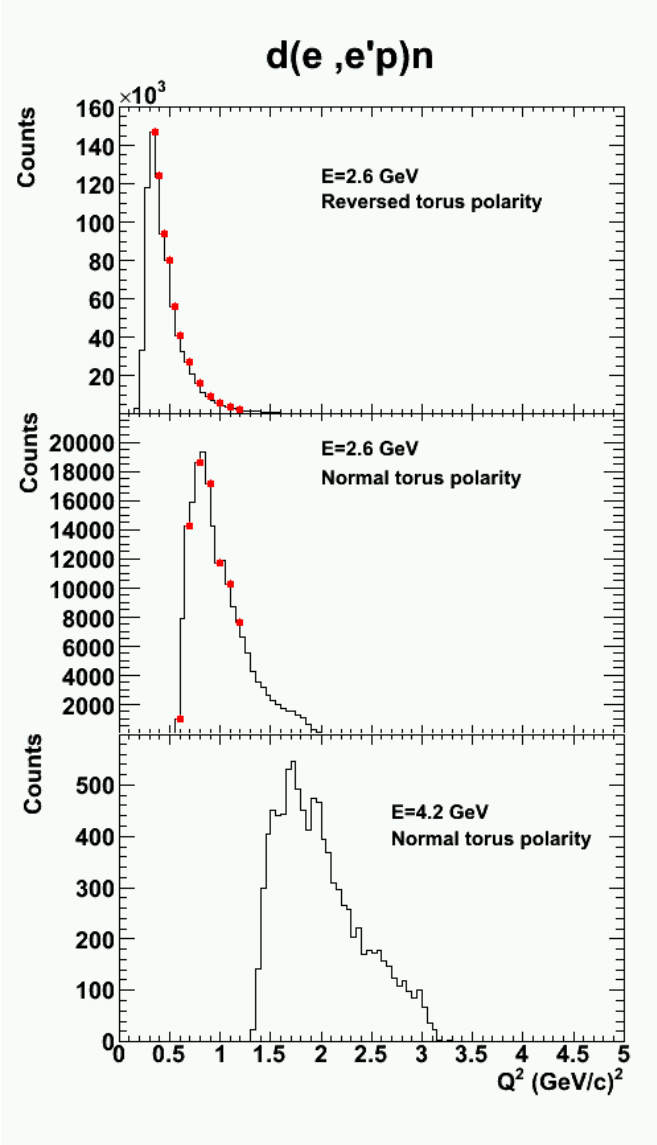

Fig 2. Q2 distribution for epn events that went into QLTp in Fig 1. The red points are the Q2 values where we have cacluations from Arenhoevel

Click here to view the object () you uploaded.

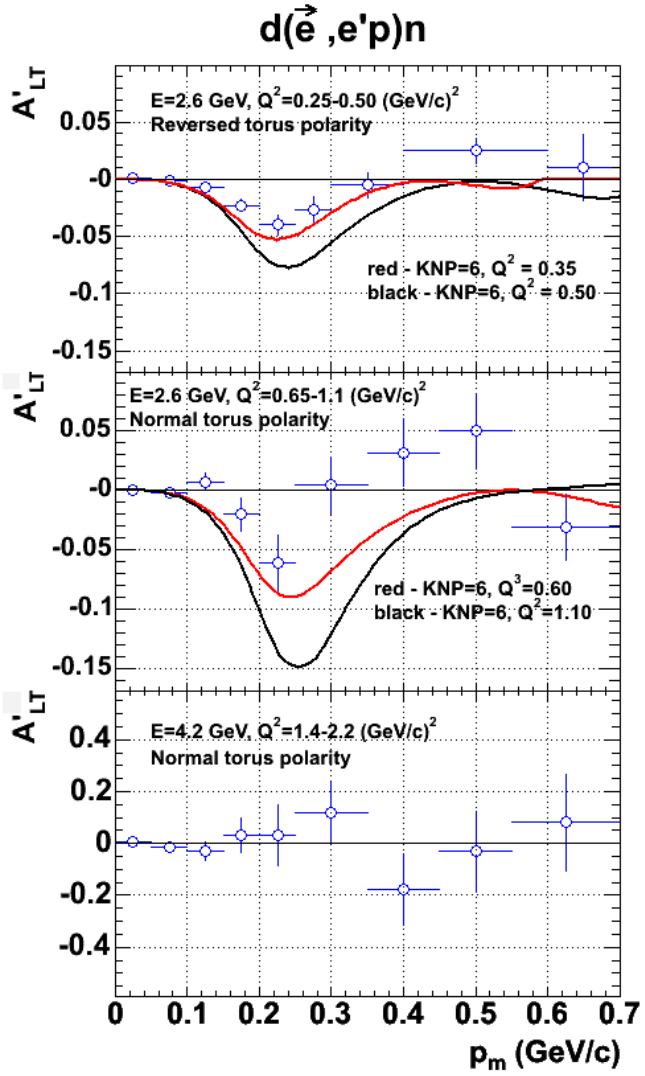

Fig 3. Comparison using curves for single values of Q2 at the limits of the Q2 range for each set of running conditions.

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.

Plots below show HA calculations after fixing several stupid, little mistakes in my calculation of ALTp from HA amplitudes. In figure 4 the data go from about Q2=0.25-0.50 GeV2. I show the Q2=0.35 GeV2 calculation from HA because that is the lowest one I have. Compare Figures 405 with Figure 1.

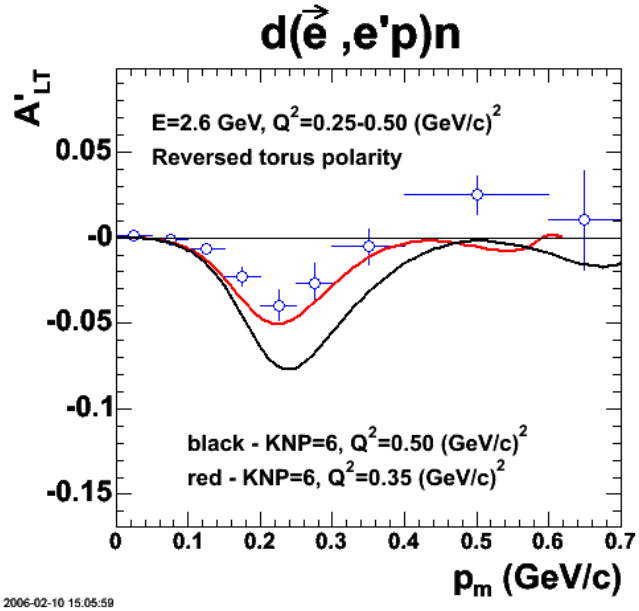

Fig 4. Comparison of 2.6 GeV, reversed polarity data with HA calculations of ALTp at, roughly, the limits of the Q2 range for these running conditions.

Click here to view the object (ROOT C++ macro for Figure 4) you uploaded.

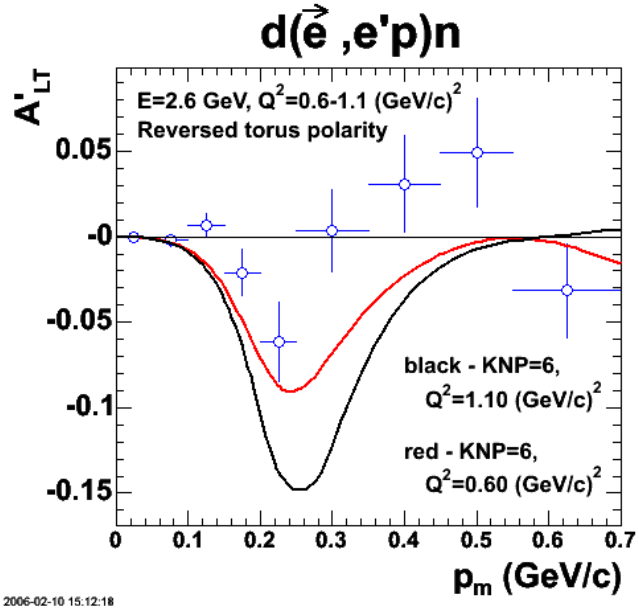

Fig 5. Comparison of 2.6 GeV, normal polarity data with HA calculations of ALTp at, roughly, the limits of the Q2 range for these running conditions. This is really NORMAL torus polarity.

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

Click here to view the object (Mathematica notebook used to make the calculations for Figures 4-5.) you uploaded.

Studying the behavior of fLTp and ALTp as functions of Q2 and theta_pq. The thing that is surprising is that for previous published calculations the magnitude of the dip in ALTp drops from about 0.11 at Q2 = 0.13 GeV2 to ALTp=0.04 at Q2=0.22 GeV2 while my calculations of ALTp are always increasing (not decreasing) as Q2 increases. I don't understand this unless it means the non-helicity-dependent components are dropping much faster than fLTp, but why does it change from the behavior at lower Q2.

The plots below were made with the Mathematica notebook just above.

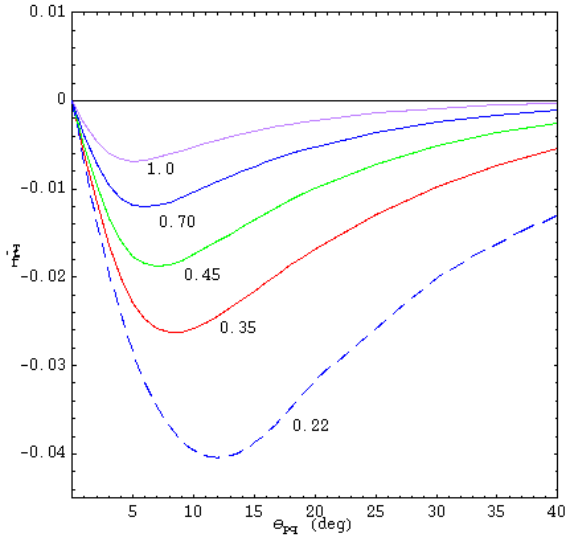

Fig 6. Fifth structure function amplitudes as a function of theta_pq for different Q2. The dashed curve at Q2 =0.22 GeV2 comes from an HA paper.

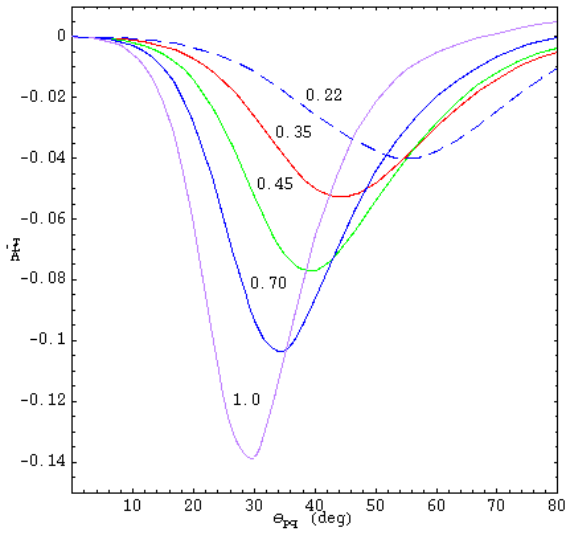

Fig 7. Fifth structure function asymmetry as a function of theta_pq for different Q2. The dashed curve at Q2 =0.22 GeV2 comes from an HA paper.

After some further thought I realized that using L,T, TT, and LT components of the cross section in the denominator of ALTp is wrong. It should just have the L and T parts. All the other pieces drop out because I integrate over all phi_pq and the TT and LT pieces will integrate to zero. In the plots below I have fixed this problem. Compare with figures 4-5 above. The HA calculations do better in general especially at small p_m. It's kind of amazing that at Q2 several times the maximum one that the calculations really don't do so bad.

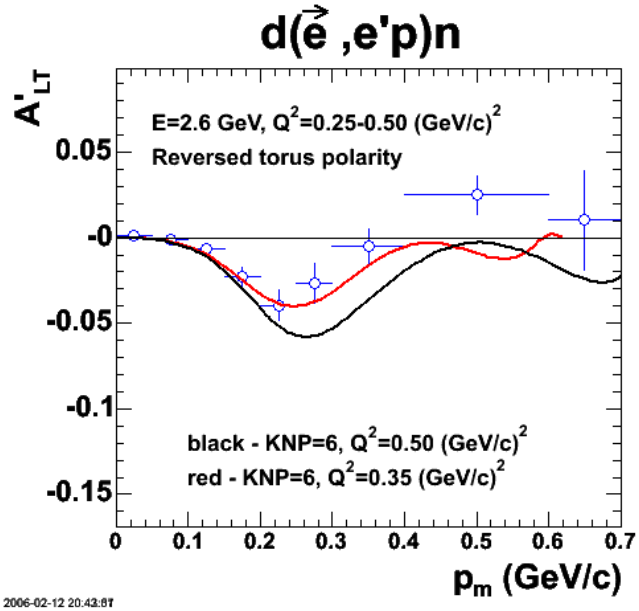

Fig 8. Comparison of 2.6 GeV, reversed polarity data with HA calculations of ALTp at, roughly, the limits of the Q2 range for these running conditions.

Click here to view the object (ROOT C++ macro for Fig 8.) you uploaded.

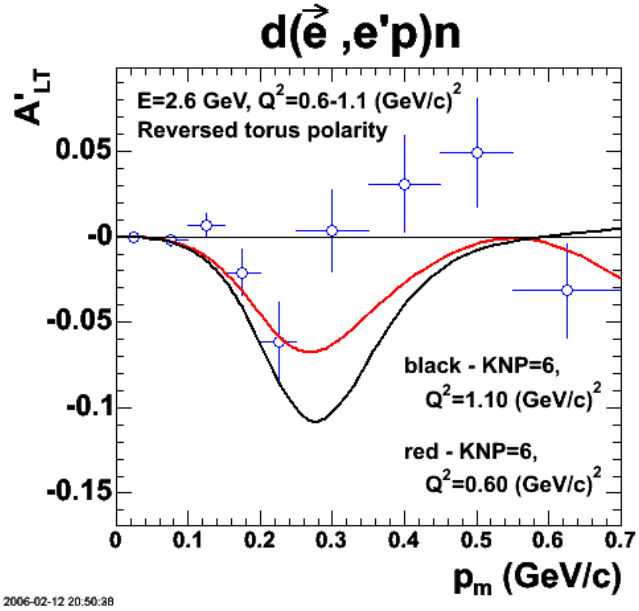

Fig 9. Comparison of 2.6 GeV, normal polarity data with HA calculations of ALTp at, roughly, the limits of the Q2 range for the 2.6 GeV, normal polarity running conditions.

Click here to view the object (ROOT C++ macro for Fig 9.) you uploaded.

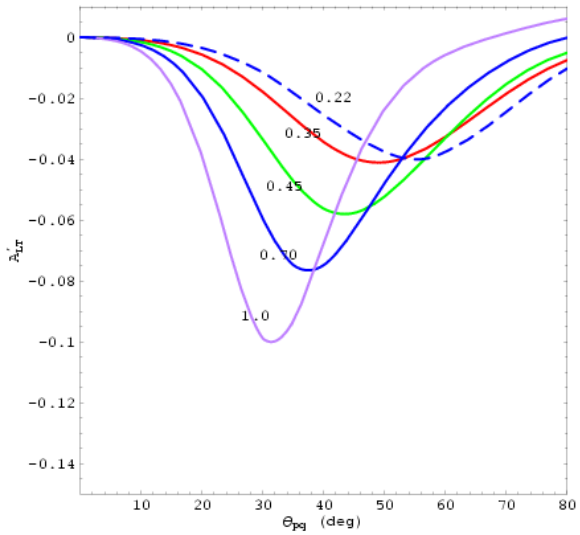

Fig 10. Revised fifth structure function asymmetry as a function of theta_pq for different Q2. The dashed curve at Q2 =0.22 GeV2 comes from an HA paper.

Click here to view the object (Mathematica notebook used to create the curves in Fig 10.) you uploaded.

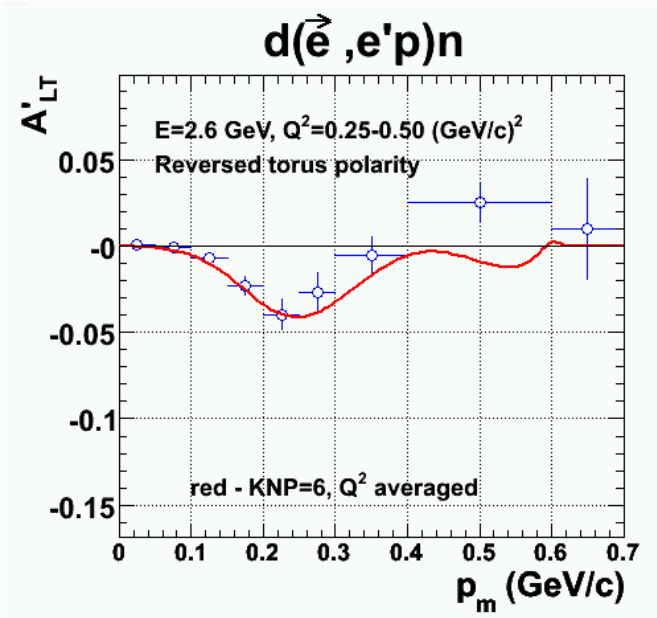

Fig 11. Comparison of 2.6 GeV, normal polarity data with HA calculations of ALTp averaged as well as I can over the Q2 distribution for the 2.6 GeV, reversed polarity data. The data go down to about Q2=0.25 GeV2, but I only have HA calculations down to Q2=0.35 GeV2. NOTE: See caption for next figure for corrections.

The set of points used in the red curve in Figure 11 is just below because I forgot to save the ROOT C++ macro.

```
graph->SetPoint(1,0.01,-0.0000831406);
graph->SetPoint(2,0.02,-0.00019344);
graph->SetPoint(3,0.03,-0.000352627);
graph->SetPoint(4,0.04,-0.000587301);
graph->SetPoint(5,0.05,-0.000925933);
graph->SetPoint(6,0.06,-0.00139994);
graph->SetPoint(7,0.07,-0.00204086);
graph->SetPoint(8,0.08,-0.00288437);
graph->SetPoint(9,0.09,-0.00396757);
graph->SetPoint(10,0.1,-0.00532193);
graph->SetPoint(11,0.11,-0.00698629);
graph->SetPoint(12,0.12,-0.00897812);
graph->SetPoint(13,0.13,-0.01132);
graph->SetPoint(14,0.14,-0.0140107);
graph->SetPoint(15,0.15,-0.0169797);
graph->SetPoint(16,0.16,-0.0202311);
graph->SetPoint(17,0.17,-0.0236479);
graph->SetPoint(18,0.18,-0.0270985);
graph->SetPoint(19,0.19,-0.0304796);
```

```
graph->SetPoint(20,0.2,-0.0336217);
graph->SetPoint(21,0.21,-0.0363526);
graph->SetPoint(22,0.22,-0.0385699);
graph->SetPoint(23,0.23,-0.0401525);
graph->SetPoint(24,0.24,-0.040983);
graph->SetPoint(25,0.25,-0.041119);
graph->SetPoint(26,0.26,-0.0404965);
graph->SetPoint(27,0.27,-0.0392237);
graph->SetPoint(28,0.28,-0.0373707);
graph->SetPoint(29,0.29,-0.0350239);
graph->SetPoint(30,0.3,-0.0322984);
graph->SetPoint(31,0.31,-0.0292947);
graph->SetPoint(32,0.32,-0.0261215);
graph->SetPoint(33,0.33,-0.0228961);
graph->SetPoint(34,0.34,-0.0196992);
graph->SetPoint(35,0.35,-0.0166261);
graph->SetPoint(36,0.36,-0.0137485);
graph->SetPoint(37,0.37,-0.0111392);
graph->SetPoint(38,0.38,-0.0088544);
graph->SetPoint(39,0.39,-0.00692688);
graph->SetPoint(40,0.4,-0.00539128);
graph->SetPoint(41,0.41,-0.00425258);
graph->SetPoint(42,0.42,-0.00352174);
graph->SetPoint(43,0.43,-0.00317835);
graph->SetPoint(44,0.44,-0.00320767);
graph->SetPoint(45,0.45,-0.00357236);
graph->SetPoint(46,0.46,-0.00423575);
graph->SetPoint(47,0.47,-0.0051501);
graph->SetPoint(48,0.48,-0.00625819);
graph->SetPoint(49,0.49,-0.00749851);
graph->SetPoint(50,0.5,-0.00878562);
graph->SetPoint(51,0.51,-0.0100324);
graph->SetPoint(52,0.52,-0.0111295);
graph->SetPoint(53,0.53,-0.011941);
graph->SetPoint(54,0.54,-0.0123081);
graph->SetPoint(55,0.55,-0.0120212);
graph->SetPoint(56,0.56,-0.0108256);
graph->SetPoint(57,0.57,-0.00847712);
graph->SetPoint(58,0.58,-0.00492954);
graph->SetPoint(59,0.59,-0.00082553);
graph->SetPoint(60,0.6,0.00205902);
graph->SetPoint(61,0.61,0.00180477);
graph->SetPoint(62,0.62,0);
graph->SetPoint(63,0.63,0);
graph->SetPoint(64,0.64,0);
graph->SetPoint(65,0.65,0);
graph->SetPoint(66,0.66,0);
graph->SetPoint(67,0.67,0);
graph->SetPoint(68,0.68,0);
graph->SetPoint(69,0.69,0);
graph->SetPoint(70,0.7,0);
```

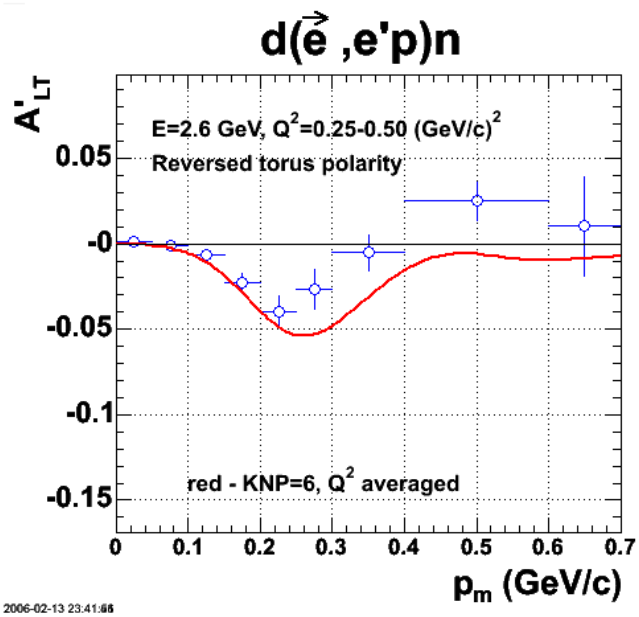

Fig 12. Corrected (?) version of Fig 11 with the properly averaged HA calculation (red curve). I think that I didn't use the proper weights in Figure 11. It looks like I used the weights for the Q2=0.35 GeV2 curve alone.

Click here to view the object (ROOT C++ macro for Figure 12) you uploaded.

Click here to view the object (Mathematica notebook used to generate the red curve in Figure 12.) you uploaded.

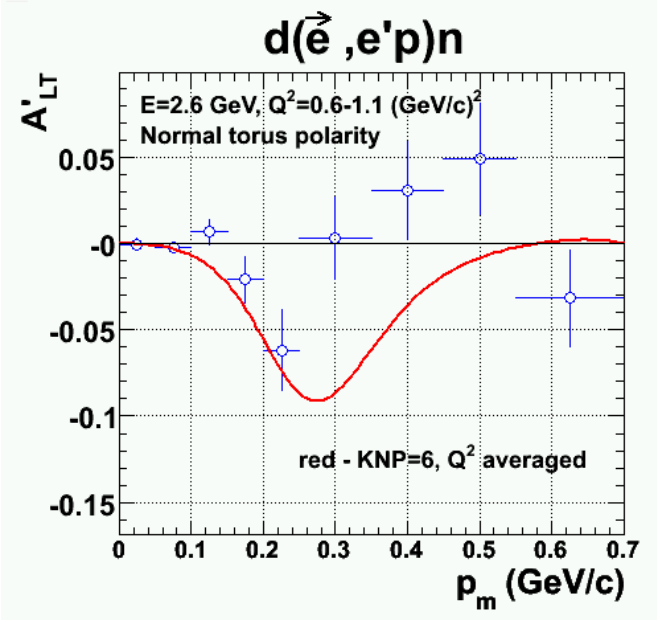

Fig 13. Comparison of quasielastic ALTp for 2.6 GeV, normal polarity data with Q2-averaged HA calculation (red curve).

Click here to view the object (ROOT C++ macro 2.6n.C for Fig 13.) you uploaded.

Click here to view the object (Mathematica notebook ha_knp6f_2.6n.nb for producing the Q2-averaged curve for Fig 13.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 114 - Harut consistency checks (gpg)

[Modified Wed Feb 22 15:46:39 2006 (GMT) gpg]

The plots below show the results of some of the consistency checks of the data that he suggested last week. The first one is for the spectrum of the quantity

$$\frac{\sum \sin(\phi_{pq})}{N}$$

for each helicity. These are the quantities whose difference is used to construct ALTp.

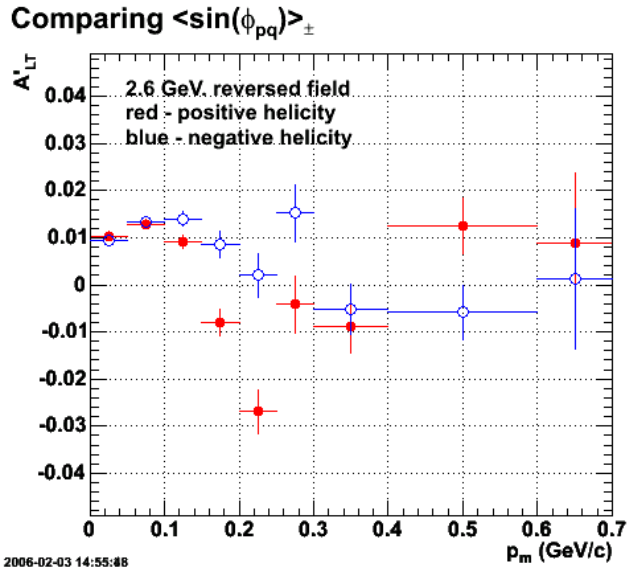

Fig 1. Normalized spectra for different helicities for 2.6 GeV, reversed polarity, quasielastic kinematics, no efids or pfids.

Click here to view the object (ROOT C++ macro harut2.6r1.C for Fig 1.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 1) you uploaded.

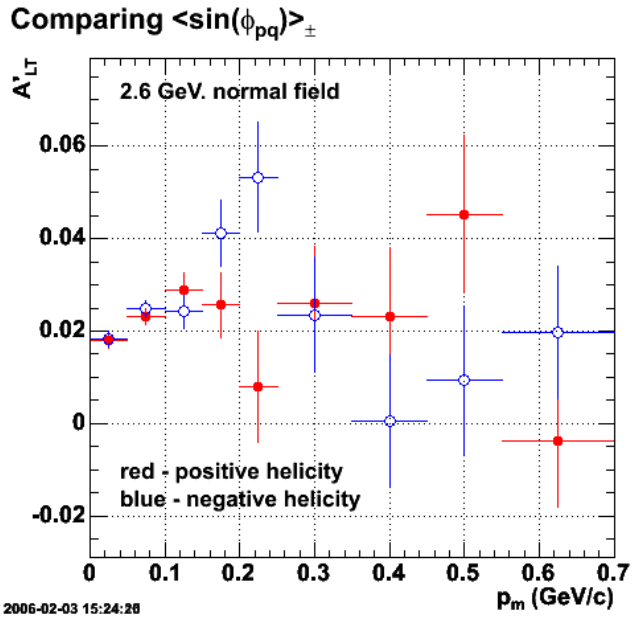

Fig 2. Normalized spectra for different helicities for 2.6 GeV, normal polarity, quasielastic kinematics, no efids or pfids.

Click here to view the object (ROOT C++ macro harut2.6n1.C for Fig 2.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 2) you uploaded.

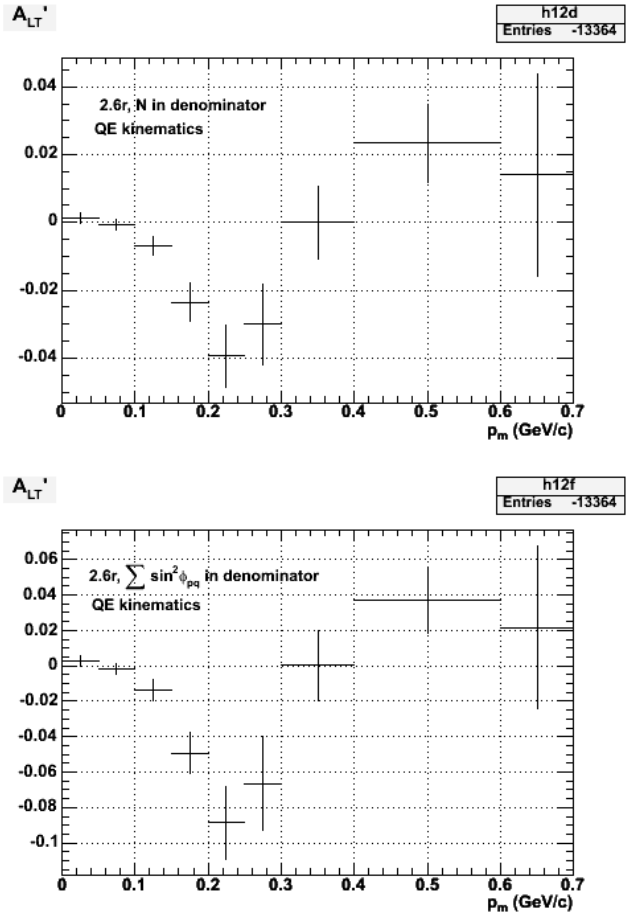

Fig 3. Comparison of ALTp using two different methods for calculating the denominators. The upper panel shows the results using just a simple sum over the events for a particular helicity. In the bottom panel the results are shown where the denominator is the sum of the weights where the weights are the square of sin (phi_pq) for each event. There is another factor of two needed to divide ALTp in the bottom panel. No efids or pfids are used here.

Click here to view the object (ROOT C++ macro for Fig 3.) you uploaded.

Click here to view the object (ROOT C++ histogram file for Fig 3.) you uploaded.

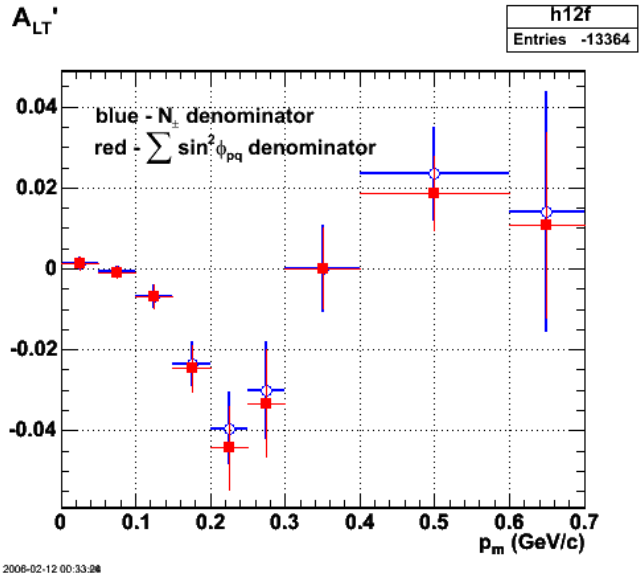

Fig 4. Comparison of ALTp using different forms of the denominator in calculating the sin(phi_pq)-weighted average.

Click here to view the object (ROOT C++ histogram file for Fig 4) you uploaded.

The analysis for Fig 4 uses the same ROOT histogram file as Fig 3. The ROOT macro below was used to generate the spectra from the histogram file,

```
no efid, pfid ones

Double_t p_m_bin_edges[13]={0.0,0.05,0.10,0.15,0.20,0.25,0.30,0.40,0.60,0.70,1.0,1.5,2.0};
Int_t n_varp_mbins = 12;
TH1F *h1d = new TH1F("h1d","Sin(#phi) weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
TH1F *h2d = new TH1F("h2d","Sin(#phi) weighted distribution for negative helicity",n_varp_mbins,p_m_bin_edges);
h1d.Sumw2();
h2d.Sumw2();
h1d.Divide(hp_m_sin_phi_wghtplus4, hp_m_unwghtplus4);
h2d.Divide(hp_m_sin_phi_wghtminus4,hp_m_unwghtminus4);
TH1F *h12d = new TH1F("h12d","A_{LT}'",n_varp_mbins,p_m_bin_edges);
h12d.Sumw2();
h12d.Add(h1d,h2d,1.0,-0.9994);
h12d.Draw();
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h12d->Divide(unity,0.73)
h12d->Draw();



latest bin choice

eod5.C:   Double_t p_m_bin_edges[13]={0.0,0.05,0.10,0.15,0.20,0.25,0.30,0.40,0.60,0.70,1.0,1.5,2.0};


sin(phi)^2 wght in denominator


Double_t p_m_bin_edges[13]={0.0,0.05,0.10,0.15,0.20,0.25,0.30,0.40,0.60,0.70,1.0,1.5,2.0};
Int_t n_varp_mbins = 12;
TH1F *h1f = new TH1F("h1f","Sin(#phi) weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
TH1F *h2f = new TH1F("h2f","Sin(#phi) weighted distribution for negative helicity",n_varp_mbins,p_m_bin_edges);
h1f.Sumw2();
h2f.Sumw2();
h1f.Divide(hp_m_sin_phi_wghtplus4, hp_m_sin_phi2_wghtplus);
h2f.Divide(hp_m_sin_phi_wghtminus4,hp_m_sin_phi2_wghtminus);
TH1F *h12f = new TH1F("h12f","A_{LT}'",n_varp_mbins,p_m_bin_edges);
h12f.Sumw2();
h12f.Add(h1f,h2f,1.0,-0.9994);
h12f.Draw();
float pol=0.73;
TF1 f1("unity","1.00",0,10)
h12f->Divide(unity,0.73)
h12f->Divide(unity,2.0)
h12f->Draw();
```

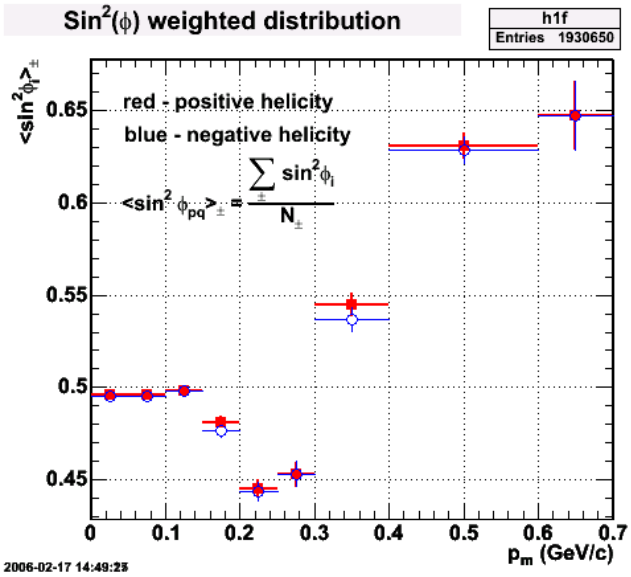

Fig 5. for opposite helicities for QE, 2.6r

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

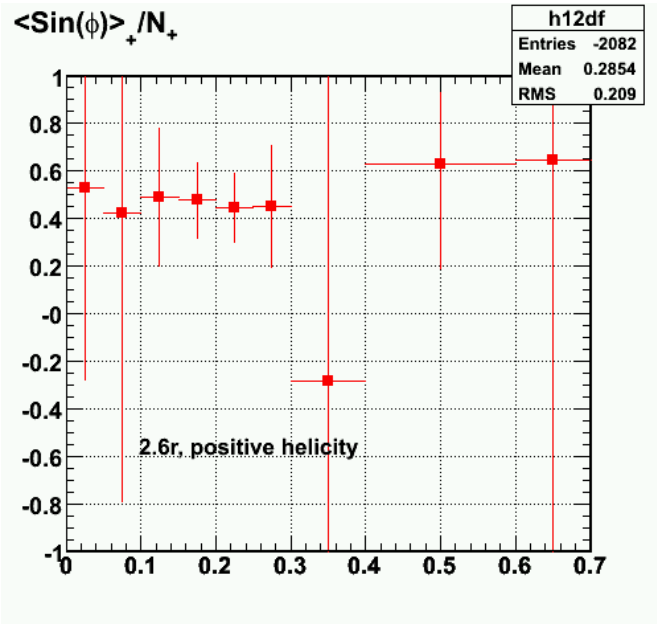

Fig 6. Ratio of ALTp with N in the denominator to ALTp with in the denominator. The conclusion here is that this looks as expected. The ratio is about 1/2 with large error bars and the values of the ratio are consistent with figure 5. The difference with figure 5 is the large uncertainties here and the smalls ones in figure 5.

Click here to view the object (ROOT C++ macro for Fig 6) you uploaded.

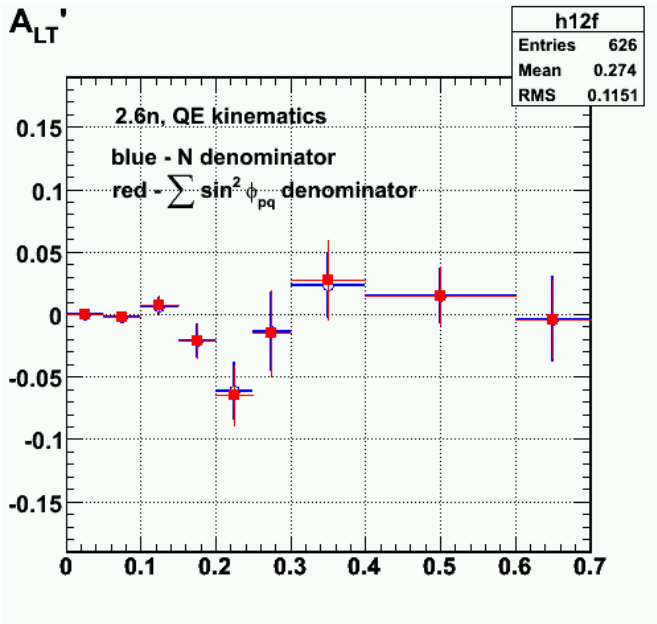

Fig 7. Comparison of ALTp calculated with normal N in deniminator versus in the denominator for 2.6 GeV, normal polarity.

Click here to view the object (ROOT C++ macro for Fig 7.) you uploaded.

Click here to view the object (ROOT histogram file for Figs 7-8) you uploaded.

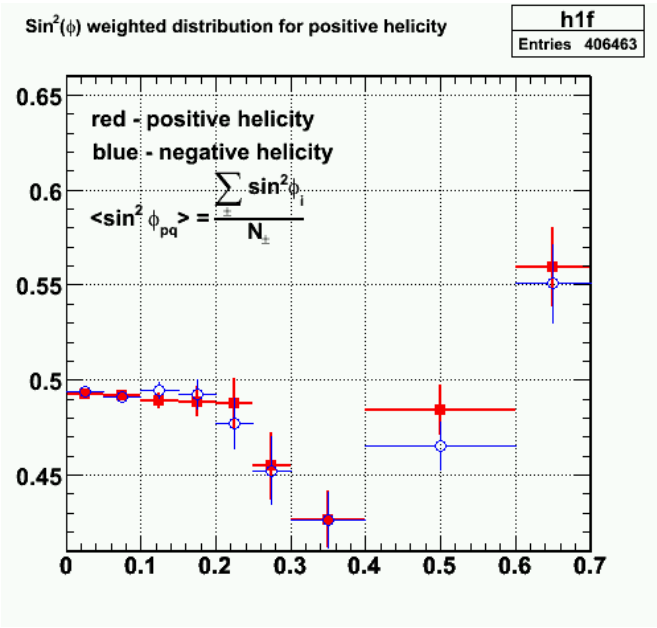

Fig 8. for opposite helicities for QE, 2.6n with efids, pfids off.

Click here to view the object (ROOT C++ macro for Fig 8.) you uploaded.

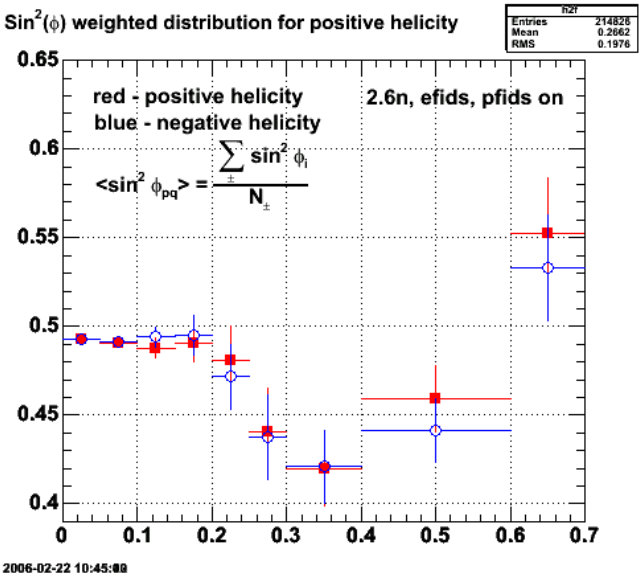

Fig 9. for opposite helicities for QE, 2.6n with efids, pfids on.

Click here to view the object (ROOT C++ macro for Fig 9.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 115 - Old Q2 dependence problem (gpg)

[Modified Fri Mar 10 01:47:40 2006 (GMT) gpg]

This is a reexamination of the old senstitivity to Q2 problem that I first discussed a year ago at the collaboration meeting (see talk on my research page) in Feb, 2005 and discussed some more at the June, 2005 collaboration meeting. The problem was that ALTp showed a strking dependence on the efids; with efids on the dip in the 2.6n ALTp was quite pronounced and then shrank by about a factor of two when the efids were turned off. This was surprising since the hope had been that by calculating ALTp (which is a ratio) the sensitivity to such stuff would be limited. What I realized a year ago was the turning on the efids had a significant effect on the Q2 distribution for the 2.6n data. This was part of the effect. I was also using fairly wide cuts to define quasielastic events (W cut) and neutrons (MM2 cut). One of the things we observed in the Feb, 2005 meeting was the dip in ALTp was most pronounced when the QE cut was centered on the proton peak and excluded the low and high W parts of the spectrum. It appears that there is a significant background from the resonance region the diluted ALTp with the wide QE cut that was reduced using the narrow W cut to define QE events. An analgous effect was seen in the neutron cut. When I made the MM2 cut more narrow, there was a noticeable reduction in the sensitivity to the electron fiducial cuts. The plots below are an exploration of the effect of different ranges for the MM2 cut defining the neutron. Again it appears that centering the MM2 right on the neutron peak reducing the dilution of the dip in ALTp. When I use MM2 ranges below the optimal one, the dip in ALTp is smaller, but still present though the statistics are weaker. When I include MM2 above the optimal one, the dip shrinks significantly. I also looked at ALTp extracted from the events EXCLUDED by the efids. In these data, at and below the optimal MM2 range for the neutron, the dip in the 2.6n ALTp is still there, but reduced in magnitude. For the MM2 range above the optimal one, the dip has gone away completely in the efid-excluded events.

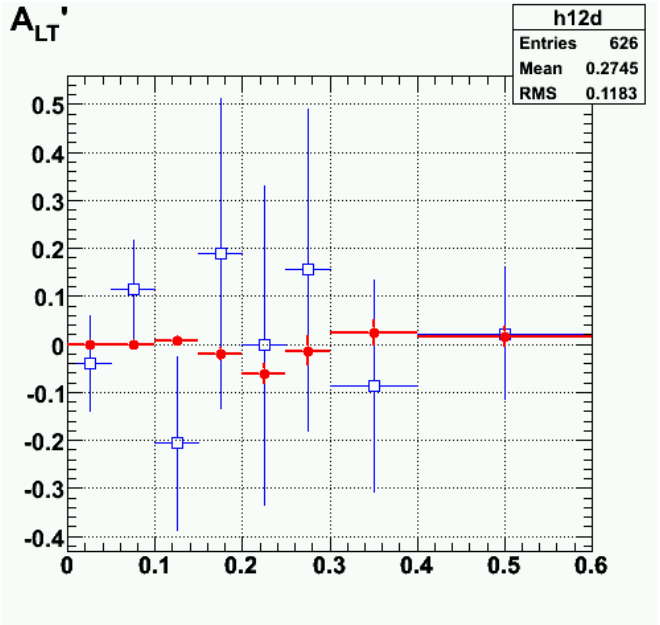

Fig 1. Comparison of ALTp with no fids with ALTp from events excluded by fids. Standard QE and MM2 cuts.

Click here to view the object (ROOT macro for Fig 1) you uploaded.

Click here to view the object (ROOT histogram file for Fig 1) you uploaded.

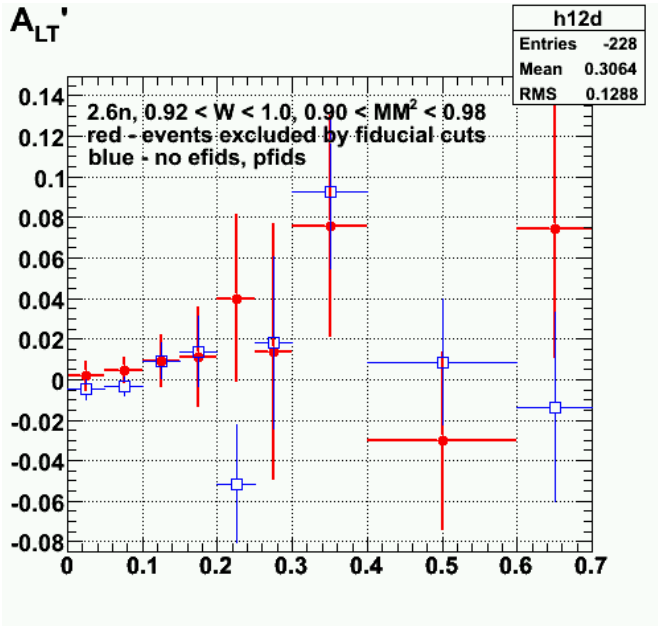

Fig 2. Comparison of ALTp with no efids or pfids (blue) and for events excluded by efids (red) for the high MM2 cuts.

Click here to view the object (ROOT macro for Fig 2) you uploaded.

Click here to view the object (ROOT histogram file for Fig 2) you uploaded.

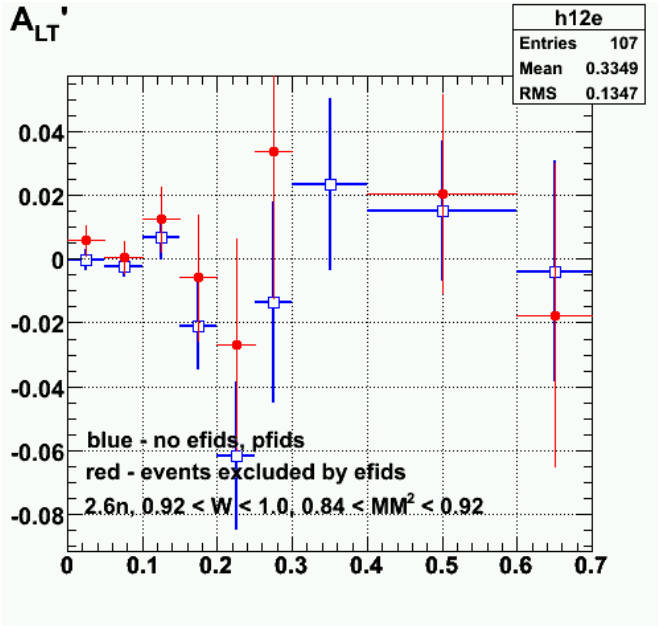

Fig 3. Comparison of ALTp with no efids or pfids (blue) and for events excluded by efids (red) for the standard MM2 cuts.

Click here to view the object (ROOT macro for Fig 3) you uploaded.

Click here to view the object (ROOT histogram file for Fig 3) you uploaded.

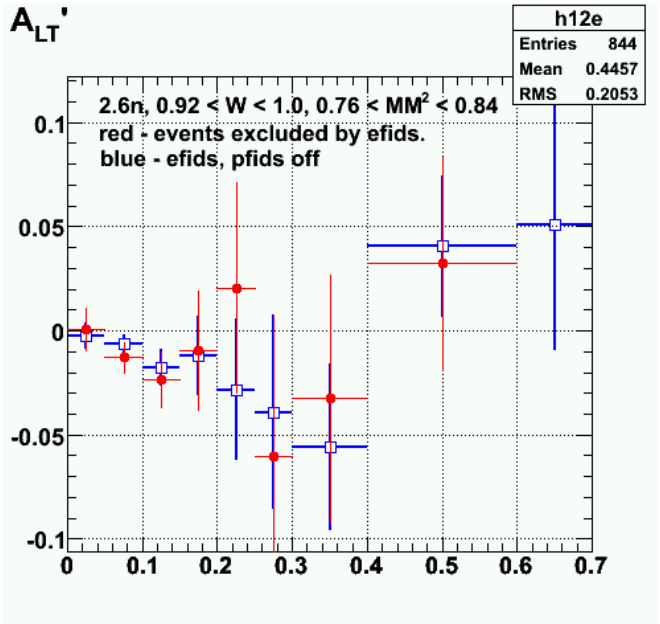

Fig 4. Comparison of ALTp with no efids or pfids (blue) and for events excluded by efids (red) for the low MM2 cuts.

Click here to view the object (ROOT macro for Fig 4) you uploaded.

Click here to view the object (ROOT histogram file for Fig 4) you uploaded.

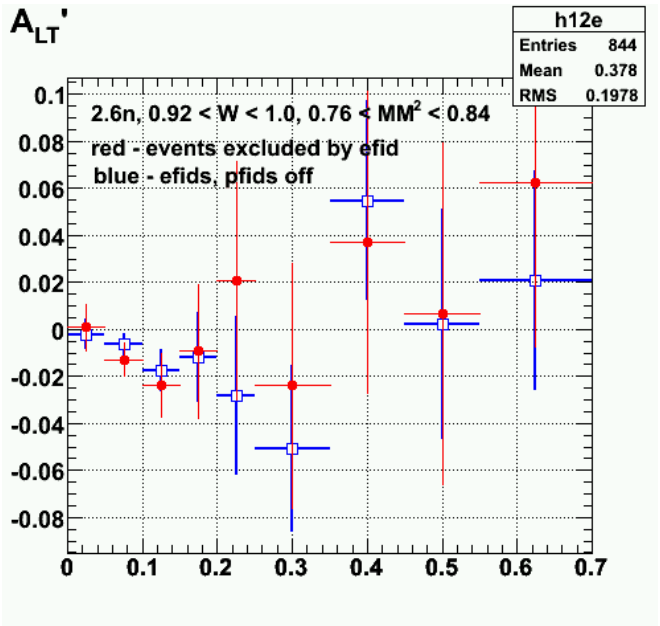

Fig 5. Comparison of ALTp with no efids or pfids (blue) and for events excluded by efids (red) for the low MM2 cuts. Made bin sizes more consistent with past plots.

Click here to view the object (ROOT macro for Fig 5) you uploaded.

Click here to view the object (ROOT histogram file for Fig 5) you uploaded.

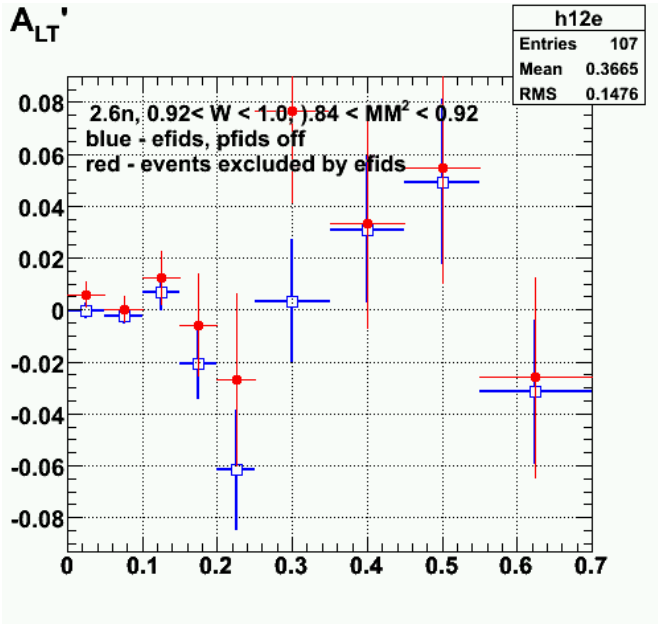

Fig 6. Comparison of ALTp with no fids with ALTp from events excluded by fids. Standard QE and MM2 cuts. Bin sizes made consistent with other plots (same data and cuts as Fig 1).

Click here to view the object (ROOT macro for Fig 6) you uploaded.

Click here to view the object (ROOT histogram file for Fig 6) you uploaded.

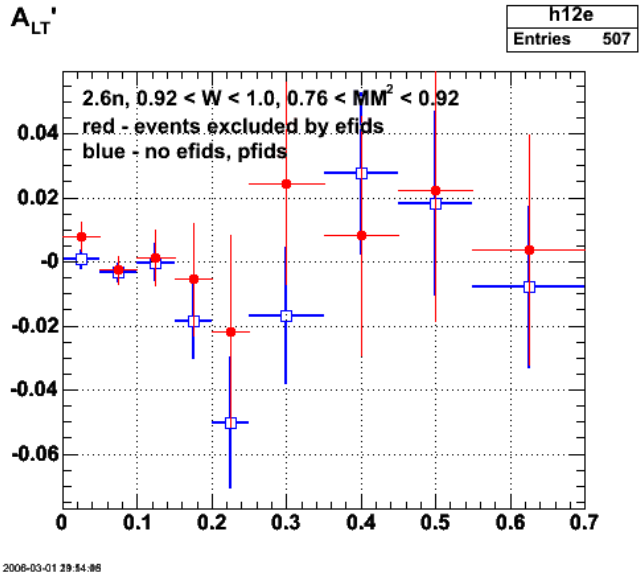

Fig 7. Comparison of ALTp with no fids with ALTp from events excluded by fids. Standard QE and extended MM2 cuts. Bin sizes made consistent with other plots (same data and cuts as Fig 1).

Click here to view the object (ROOT macro for Fig 7) you uploaded.

Click here to view the object (ROOT histogram file for Fig 7) you uploaded.

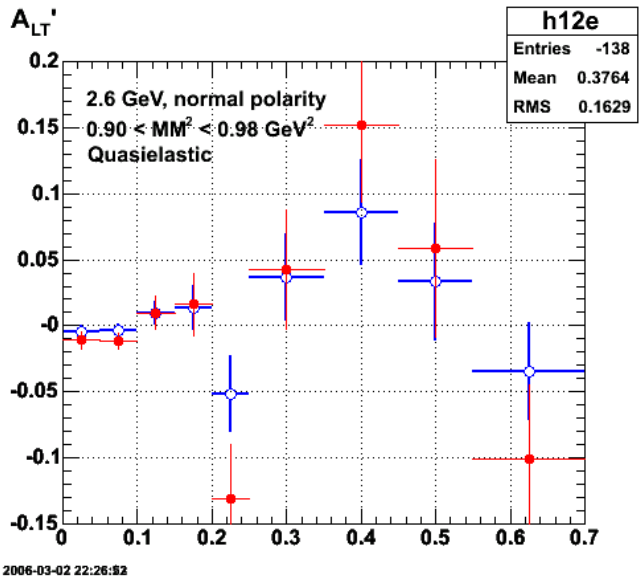

Fig 8. Comaprison of ALTp with (red) and without (blue) efids and pfids to show the big effect on ALTp for this, too-high MM2 cut.

Click here to view the object (ROOT C++ macro for Fig 8) you uploaded.

Click here to view the object (ROOT histogram file for Fig 8) you uploaded.

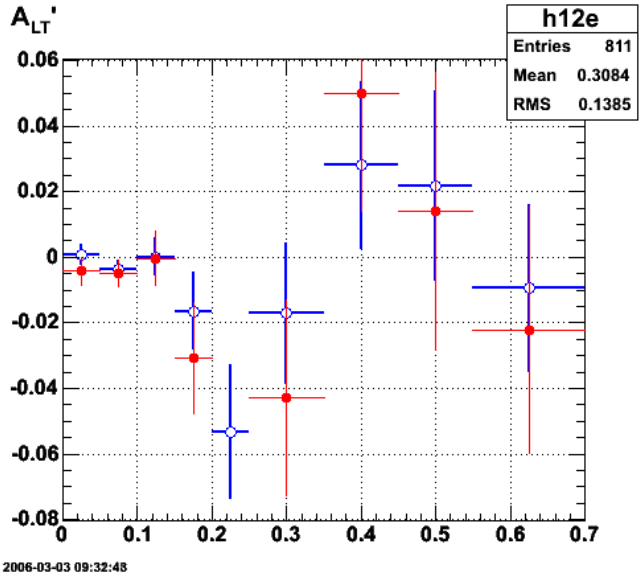

Fig 9. Comaprison of ALTp with (red) and without (blue) efids and pfids to show the big effect on ALTp for this, low MM2 cut.

Click here to view the object (ROOT macro for Fig 9) you uploaded.

Click here to view the object (ROOT histogram file for Fig 9) you uploaded.

After the study above I have lowered the low-end of the MM2 cut from 0.84->0.78. This improves the uncertainties a small amount without seriously changing the magnitude of the ALTp.

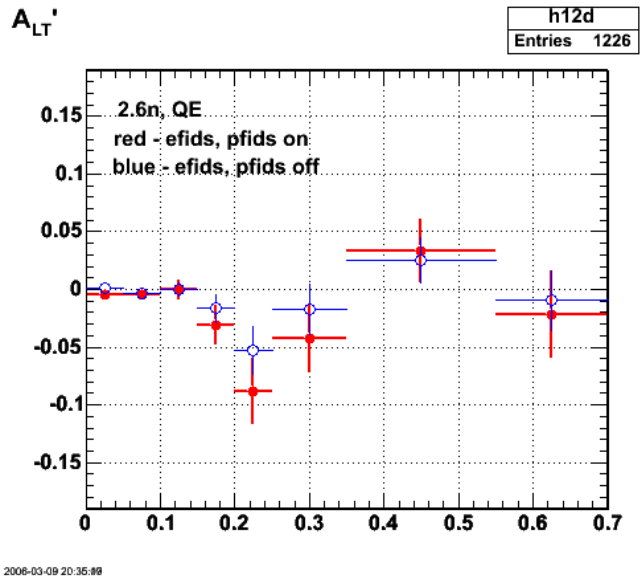

Fig 10. Comparison of ALTp for 2.6n, QE kinematics with efids and pfids on (red) and with them off (blue) with the increased MM2 range (0.74 < MM2 < 0.92)

Click here to view the object (ROOT C++ macro for Fig 10) you uploaded.

Click here to view the object (ROOT histogram file for Fig 10) you uploaded.

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Jerry Gilfoyle's Enotebook page 116 - Photon flux factor and other kinematics (gpg)

[Modified Wed Mar 8 18:29:48 2006 (GMT) gpg]

The link below is to a paper that defines the photon flux factor and some other kinematic factors.

Click here to view the object (PS file with Gaskell paper) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 117 - Extending neutron cut to lower MM2 (gpg)

[Modified Fri Mar 17 00:15:24 2006 (GMT) gpg]

I have investigated the effect of extending the MM2 on the neutron to lower MM2 to see the effect on ALTp. The effect is small. The magnitude of the asymmetry is a bit smaller at its maximum value and the uncertainty is a wee bit smaller. The plots below show the effect of the extended MM2 cut on the 2.6 GeV, reversed and normal polarity data. I haven't bothered with the 4.2 GeV data because the statistics are lousy. Compare these with entry 109.

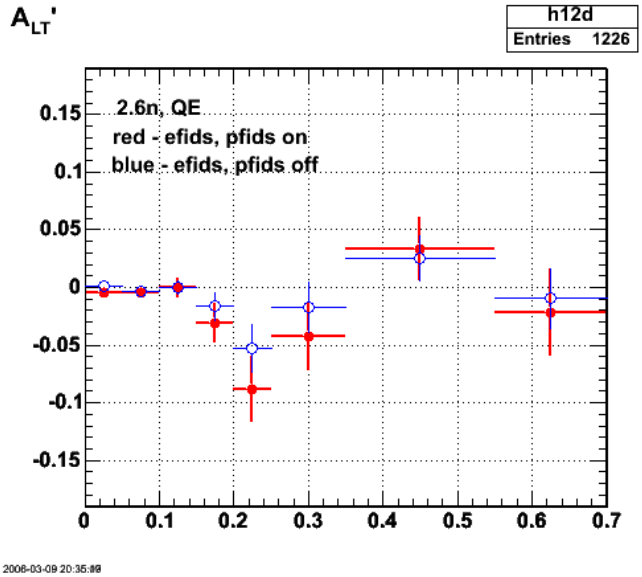

Fig 1. Comparison of ALTp with fiducial cuts on (red) and off (blue) for 2.6 GeV, normal torus polarity and with the MM2 cut on the neutron extended from 0.84 GeV2 to 0.78 GeV2.

Click here to view the object (ROOT C++ macro for Fig 1) you uploaded.

Click here to view the object (ROOT histogram file for Fig 1) you uploaded.

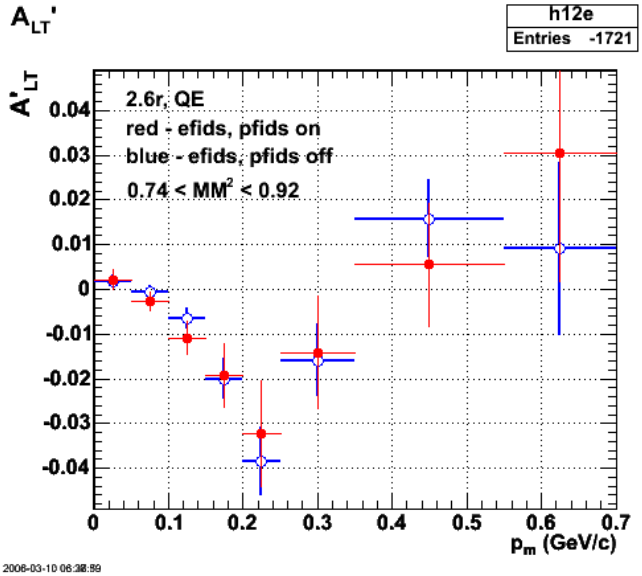

Fig 2. Comparison of ALTp with fiducial cuts on (red) and off (blue) for 2.6 GeV, reversedl torus polarity and with the MM2 cut on the neutron extended from 0.84 GeV2 to 0.78 GeV2. Note: the MM2 label on the plot is WRONG. It should be 0.78 GeV2 for the lower limit.

Click here to view the object (ROOT C++ macro for Fig 2) you uploaded.

Click here to view the object (ROOT histogram file for Fig 2) you uploaded.

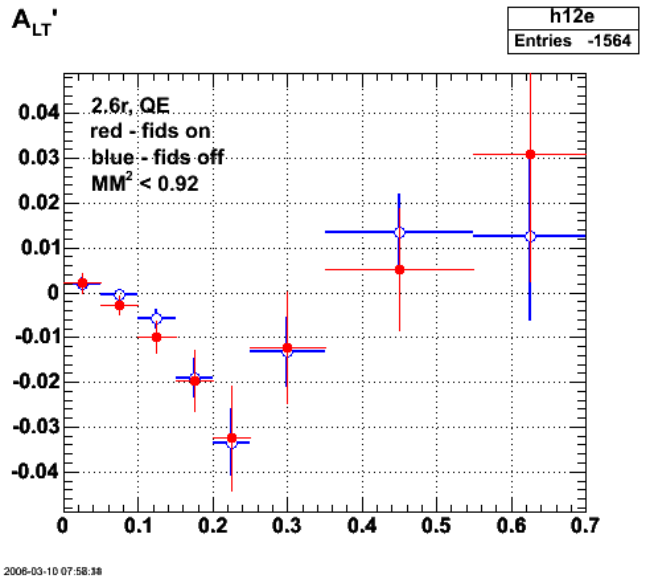

Fig 3. Comparison of ALTp with fiducial cuts on (red) and off (blue) for 2.6 GeV, reversedl torus polarity and with the MM2 cut on the neutron extended from 0.78 GeV2 to 0.58 GeV2.

Click here to view the object (ROOT C++ macro for Fig 3) you uploaded.

Click here to view the object (ROOT histogram file for Fig 3) you uploaded.

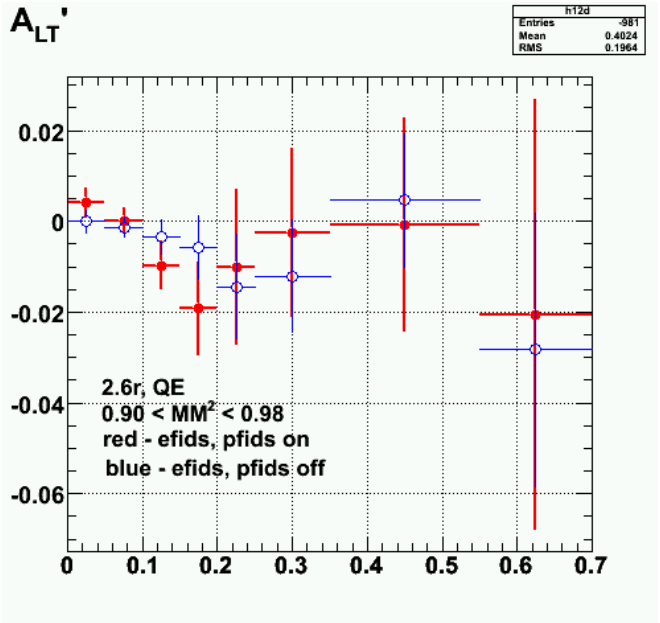

Fig 4. Comparison of ALTp with fiducial cuts on (red) and off (blue) for 2.6 GeV, reversedl torus polarity and with the MM2 cut on the neutron in the range 0.90 < MM2 < 0.98 GeV2.

Click here to view the object (ROOT C++ macro for Fig 4) you uploaded.

Click here to view the object (ROOT histogram file for Fig 4) you uploaded.

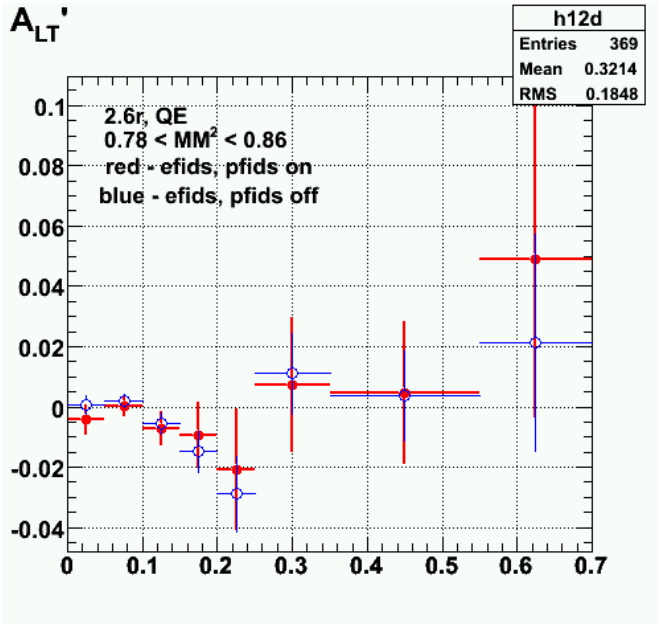

Fig 5. Comparison of ALTp with fiducial cuts on (red) and off (blue) for 2.6 GeV, reversedl torus polarity and with the MM2 cut on the neutron in the range 0.78 < MM2 < 0.86 GeV2.

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

Click here to view the object (ROOT histogram file for Fig 5) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 118 - Study of effect of MM2 cut (gpg)

[Added Fri Mar 10 17:02:38 2006 (GMT) gpg]

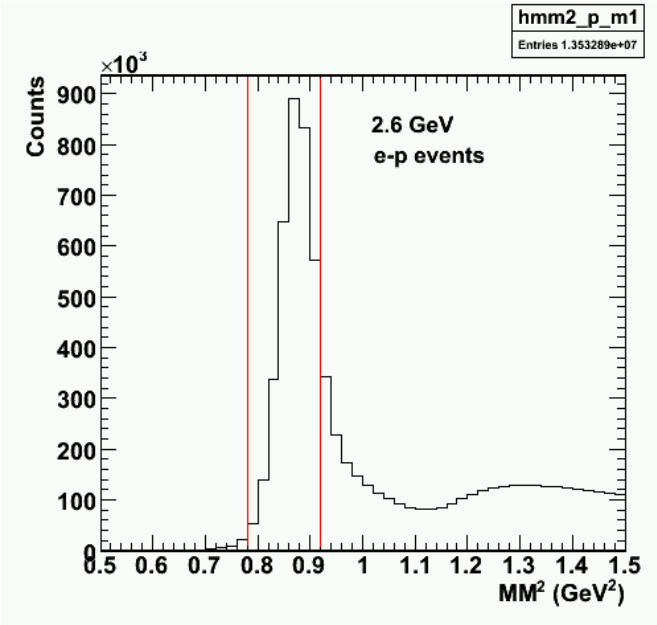

Fig 1. MM2 distribution for ep events for 2.6 GeV, normal polarity data. The red lines define the MM2 discussed in the text.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 119 - Study of effect of MM2 cut (gpg)

[Modified Fri Apr 14 18:59:06 2006 (GMT) gpg]

We have investigated the sensitivity of ALTp to changes in the cut that defines a neutron in the MM2 (missing mass squared) distribution. The first plot below shows the MM2 distribution for the 2.6 GeV, normal polarity data for 2p coincidences. See the bottom of the page for other versions of these MM2 plots, ROOT macros, and histogram files.

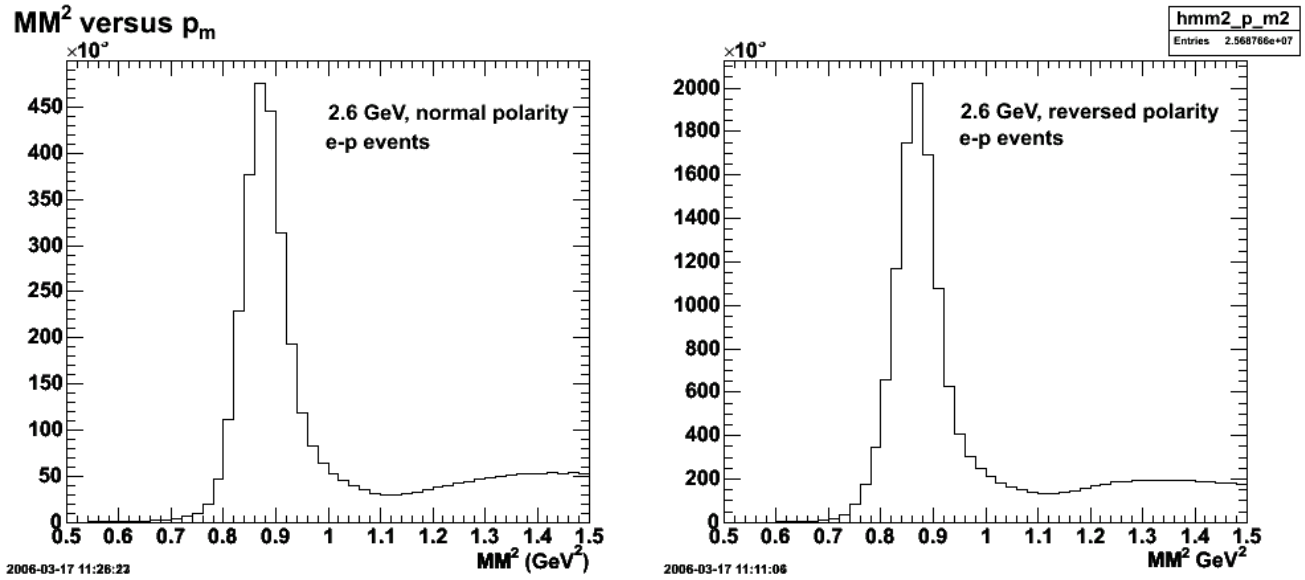

Fig 1. MM2 distribution for ep events for 2.6 GeV, normal polarity data (left-hand panel) and 2.6 GeV, reversed polarity data (right-hand panel). The red lines define the MM2 cut for Fig 4 below and are discussed in the text.

The motivation for this study can be seen by comparing Figs 2-3. Figure 2 shows ALTp for a MM2 cut on the high side of the neutron peak. The different colors represent points where the electron and proton fiducials are turned on (red) and off(blue). Notice the significant change in ALT at p_m = 0.225 GeV/c. This is the type of behavior that has prompted some concern about the reliability of the ALTp measurement. The concern here is that some of the cross section from the resonance region may be contaminating the neutron peak here.

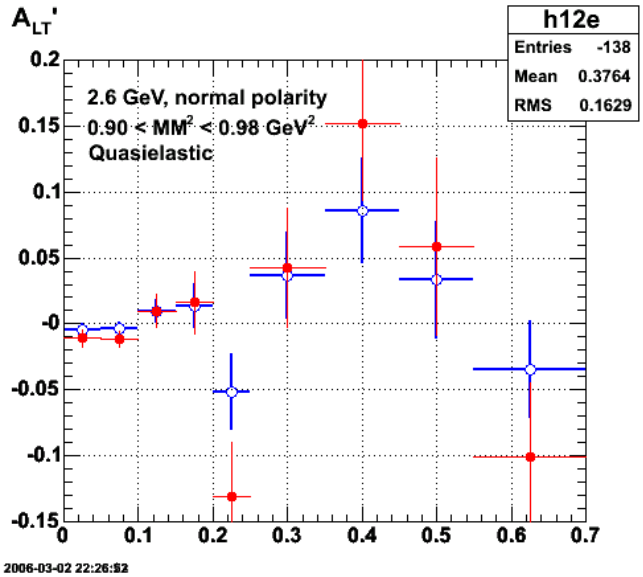

Fig 2. Comparison of ALTp with fiducial cuts on (red) and off (blue) for 0.90 < MM2 < 0.98 GeV2.

Fig 3 shows ALTp for a narrow MM2 cut centered on the neutron peak in Figure 1 (0.84 < MM2 < 0.92 GeV2). Recall that MM2 for a neutron is 0.88 GeV2. The effect of the fiducial cuts is much reduced at p_m =0.225 GeV/c.

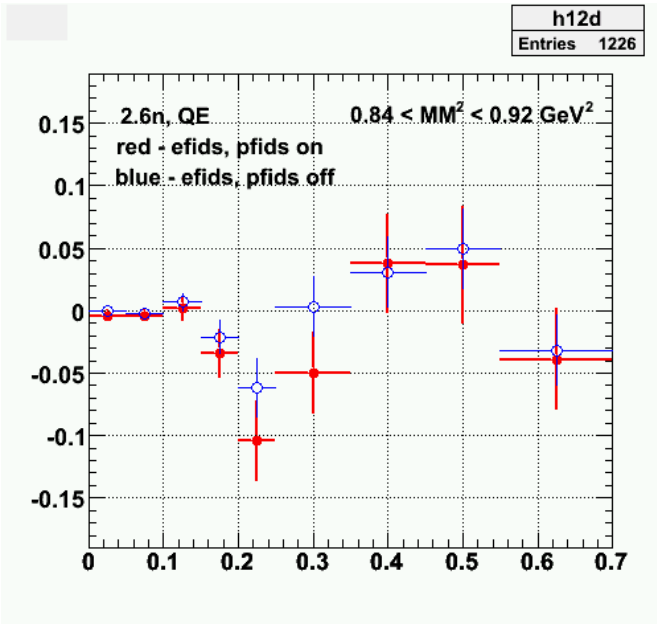

Fig 3. Comparison of ALTp with fiducial cuts on (red) and off (blue) for 0.84 < MM2 < 0.92 GeV2.

To study this effect a bit further, we extended the lower limit of the MM2 cut downward from MM2=0.84 GeV2 to MM2=0.78 GeV2. The result is shown in Figure 4. There is little difference between ALTp in Figs 3-4 We expect the background under the neutron peak from the resonance region will be less here (we're further away from the resonance region) so this MM2 range for the neutron is cleaner (and gives us a few more statistics).

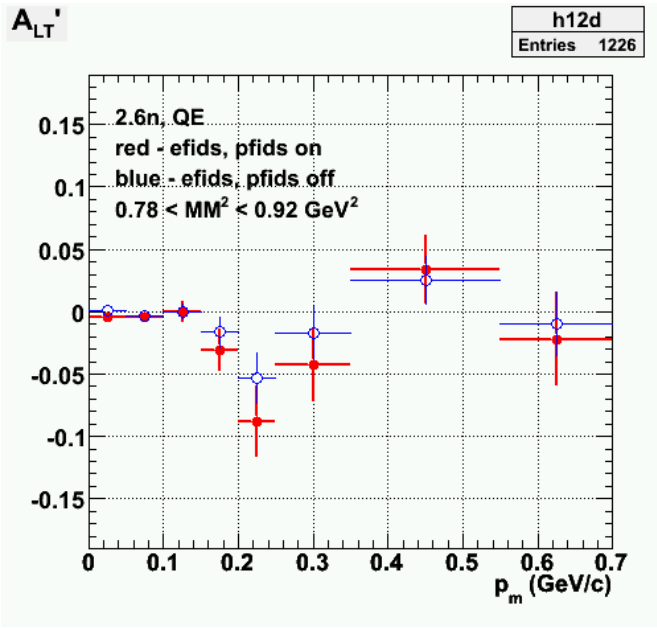

Fig 4.

We finally decided to vary the range of the MM2 cut and see the effect on ALTp for the no-fids analysis. The results are in the two plots below. In Fig 5, effect of changing the range of the neutron MM2 cuts is shown. The three ranges correspond to the high_MM2 side of the neutron peak in the MM2 spectrum (blue), centered on the neutron peak (red), and the low-MM2 side of the neutron peak (black). We compared overlapping ranges for the MM2 to retain reasonable statistics. Off the peak, the magnitude of the asymmetry decreases.

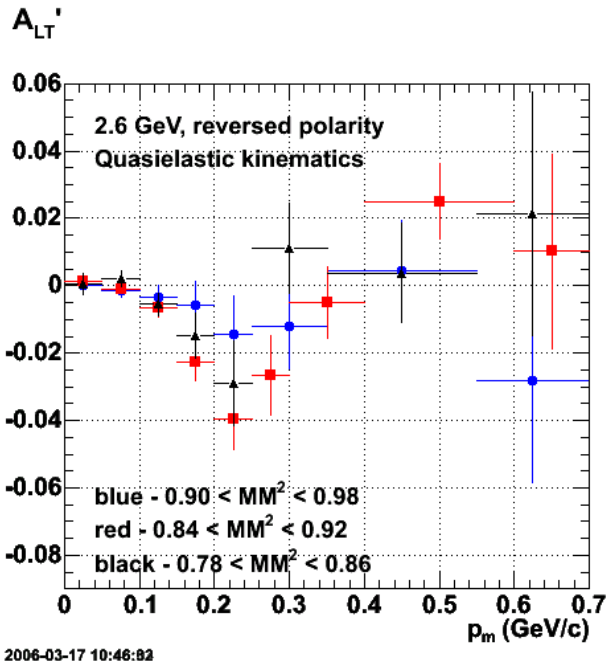

Fig 5. Comparison of different ranges for the neutron MM2 cut for the 2.6 GeV, reversed polarity data. Electron and proton fiducials are turned off.

Click here to view the object (ROOT C++ macro for Fig 5.) you uploaded.

The same comparison is shown in Fig 6 for the 2.6 GeV, normal polarity asymmetry. The statistics are weaker so it's harder to draw any conclusions. The magnitude of the dip in ALTp at p_m=0.22 GeV/c is smaller for the high- and low-MM2 cuts, but all three results are consistent within the statistics.

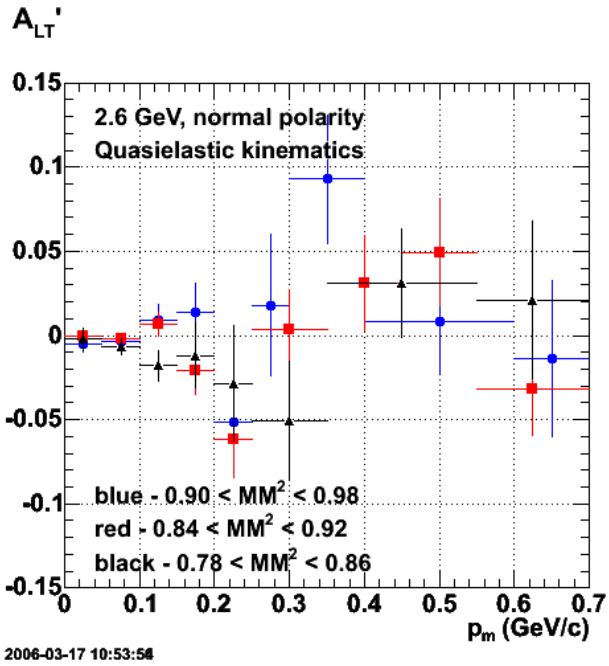

Fig 6. Comparison of different ranges for the neutron MM2 cut for the 2.6 GeV, normal polarity data. Electron and proton fiducials are turned off.

Click here to view the object (ROOT C++ macro for Fig 6.) you uploaded.

The conclusions here are that to optimize the dip in ALTp use the centered MM2 cut, but there is not a big effect even when you extend the range of the MM2 cut to higher and lower MM2.

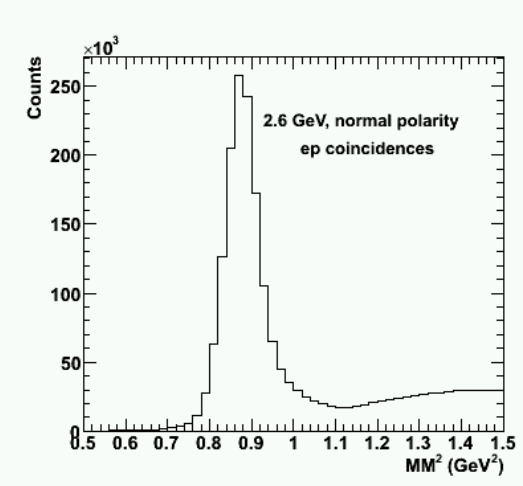

Fig 7. 2.6n Smaller version of missing mass squared plot.

Click here to view the object (ROOT C++ macro for the above plot, Fig 7.) you uploaded.

Click here to view the object (ROOT histogram file for above plot, Fig 7) you uploaded.

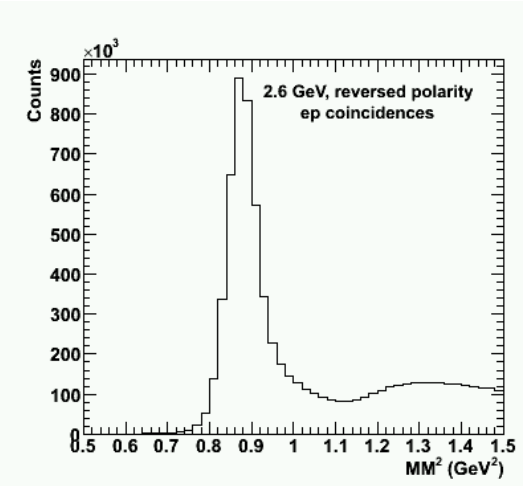

Fig 8. 2.6r Smaller version of missing mass squared plot.

Click here to view the object (ROOT macro for above plot, Fig 8) you uploaded.

Click here to view the object (ROOT histogram file for above plot, Fig 8.) you uploaded.

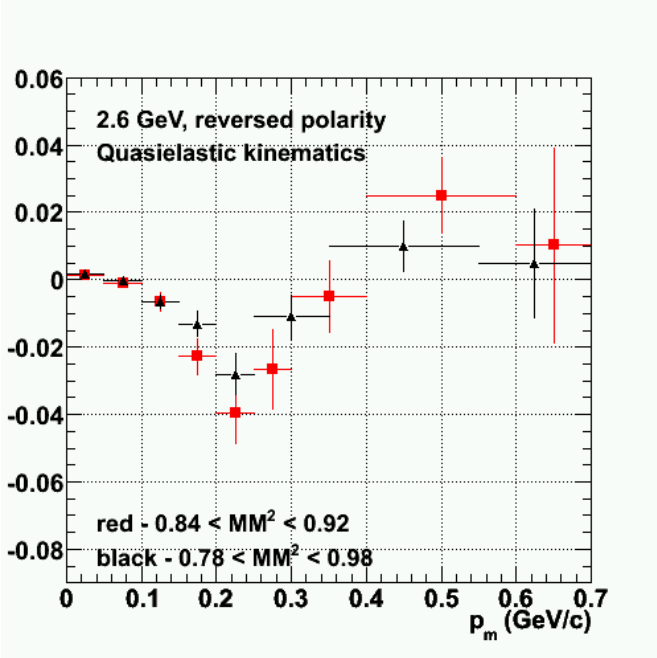

Fig 9. Comparison of ALTp for 2.6 GeV, reversed polarity for narrow MM2 neutron cuts and wide ones from the study above.

Click here to view the object (ROOT C++ macro for Fig 9.) you uploaded.

Click here to view the object (ROOT histogram file for wide MM2 neutron cut in Fig 9) you uploaded.

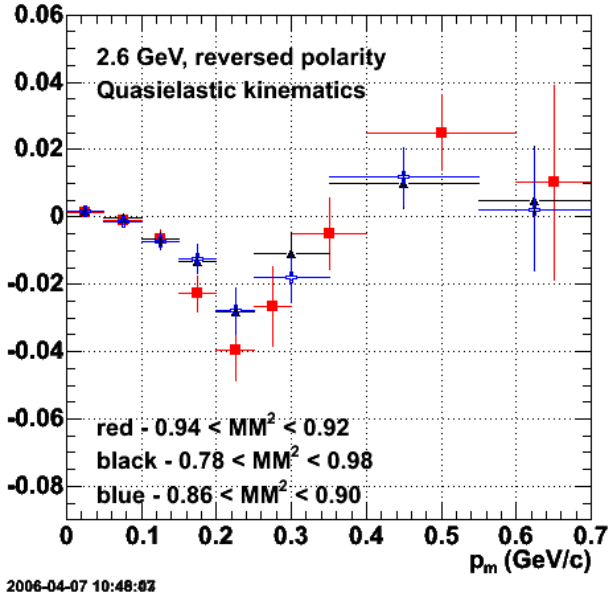

Fig 10. Same as Figure 9 but add another analysis with a smaller set of neutron cuts.

Click here to view the object (ROOT macro for Fig 10) you uploaded.

Click here to view the object (ROOT histogram file for Fig 10.) you uploaded.

I re-analyzed the data with MM2 = 0.84-0.92 GeV2 and found the resulting ALTp to be very consistent with the othre results for different MM2 neutron cuts. See Figure 10. The question now is where did the results in Figure 10 for MM2=0.84-0.92 come from and why are they a little different?

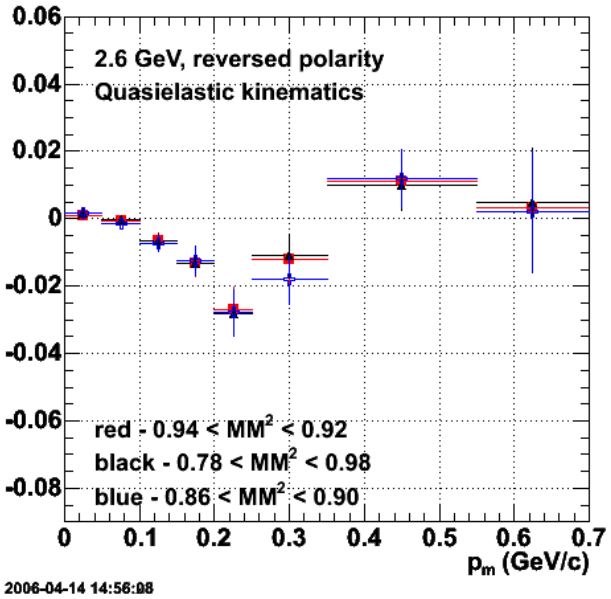

Fig 11. Comparison of ALTp for different neutron MM2 cuts. Compare with Fig 10 and see note above.

Click here to view the object (ROOT C++ macro for Fig 11) you uploaded.

Click here to view the object (ROOT histogram file for Fig 11.) you uploaded.

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Jerry Gilfoyle's Enotebook page 120 - ALTp as a function of theta$_{pq}$ (gpg)

[Modified Thu Mar 16 12:26:21 2006 (GMT) gpg]

As preparation for requesting more calculations from Hartmuth Arenhoevel, I have generated ALTp as a function of theta_pq^cm.

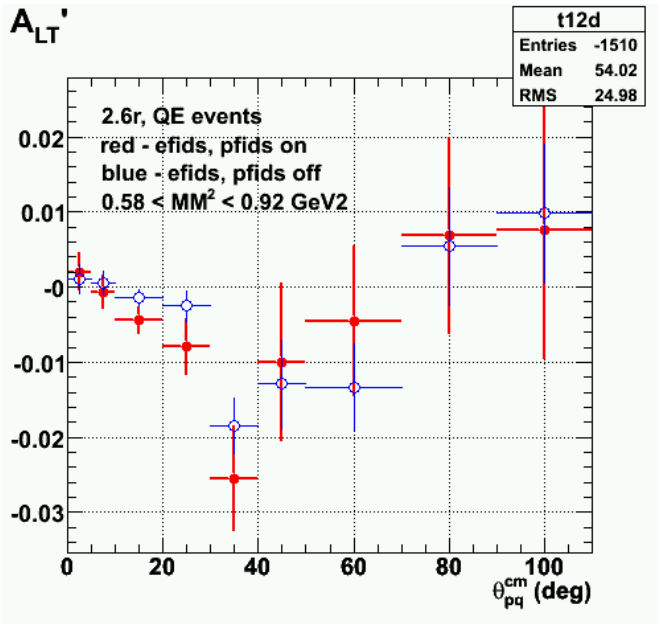

Fig 1. ALTp for quasielastic kinematics for the 2.6 GeV, reversed polarity data set.

Click here to view the object (ROOT macro for Fig 1.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 1) you uploaded.

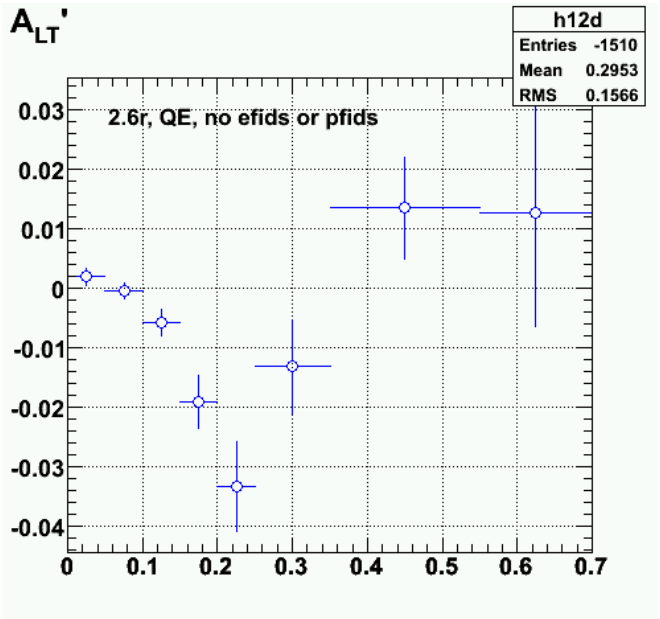

Fig 2. For comparison with past stuff, this is a plot of ALTp as a function of p_m. The MM2 cut is different for this analysis. It is 0.58 < MM2 < 0.92 GeV2.

The difference in the magnitude of the dip between ALtp as a function of p_m and as a function of theta_pq is disturbing. The next plot shows the result when i matched the theta_pq bin edges to the p_m edges using entry 192 in the E5 elog. The theta_pq bin edges are below.

```
Double_t thpq_bin_edges[10]={0.0,7.0,12.0,20.0,26.0,33.0,41.0,52.0,82.0,100.0};
```

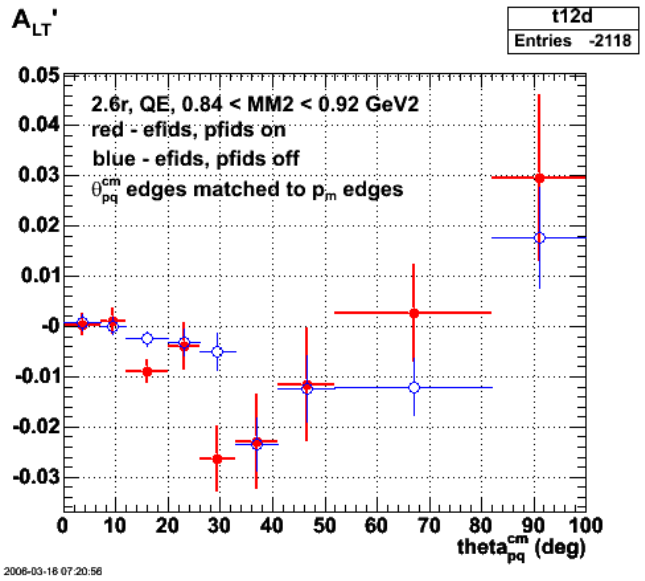

Fig 3. ALTp for quasielastic kinematics for the 2.6 GeV, reversed polarity data set. The MM2 cut on the neutron is 0.84-0.92 GeV2.

Click here to view the object (ROOT macro for Fig 3.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 3) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 121 - Set epn_event=true (gpg)

[Modified Fri Mar 24 15:24:16 2006 (GMT) gpg]

Testing the effect of setting epn_event=true for 2.6 GeV, reversed polarity and QE events.

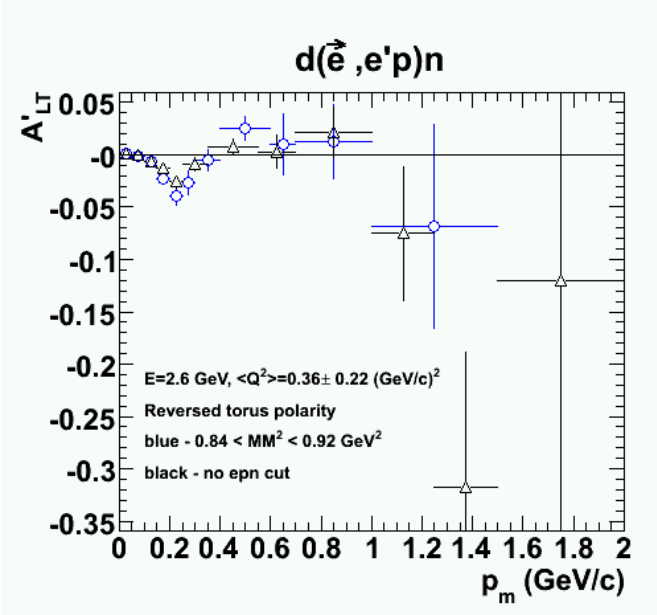

Fig 1. Comparison of 2.6r, QE data with epn_event requirement on (blue) and off (black).

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 1.) you uploaded.

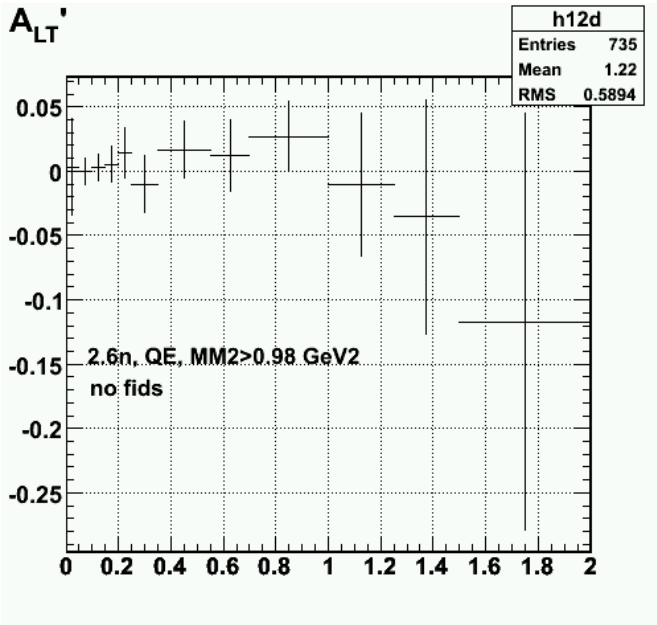

Fig 2. 2.6n, QE with fids off and MM2 > 0.98 GeV2 cut. Blaahh!!

Click here to view the object (ROOT macro for fig 2) you uploaded.

Click here to view the object (ROOT histogram file for fig2) you uploaded.

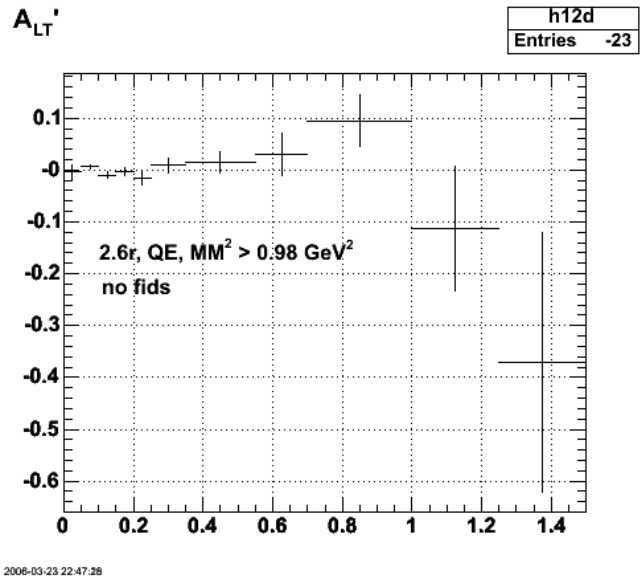

Fig 3. 2.6r, QE with fids off and MM2 > 0.98 GeV2 cut. Blaahh again!!

Click here to view the object (ROOT C++ macro for Fig 2.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 2.) you uploaded.

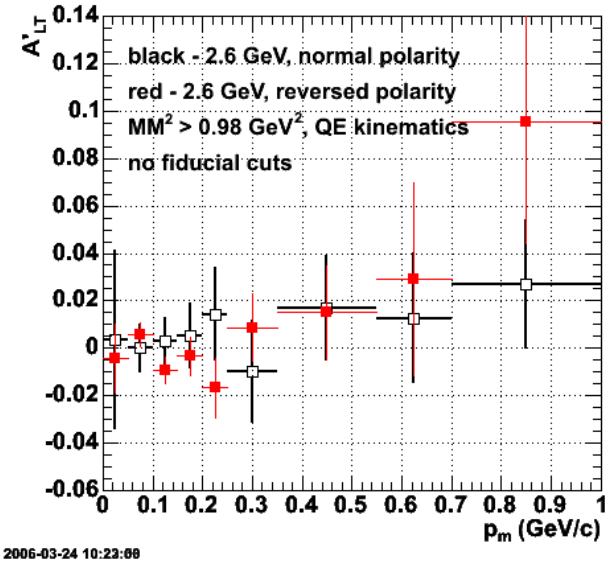

Fig 4. Prettied-up version of Figs 2-3.

Click here to view the object (ROOT macro for Fig 4.) you uploaded.

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Jerry Gilfoyle's Enotebook page 122 - simulation stuff (gpg)

[Modified Thu Apr 27 21:50:21 2006 (GMT) gpg]

Below are files from Jeff L. for doing cooking and simulation. tcl file for cooking.

```
 url2:tmp> more JL_cooking_rec_e5.tcl

source /u/group/clas/builds/PRODUCTION/packages/tcl/recsis_proc.tcl;
# define packages
turnoff ALL;
global_section off;
turnon seb trk cc tof egn lac user pid;

inputfile infile;
setc chist_filename histfile;
setc log_file_name logfile;
outputfile outfile DST 2047;
set lseb_nt_do -1;
set lall_nt_do -1;
set lmysql -1;
set runfile 0;

go 1000000000;
#
set ec1_reco_type 2;
set torus_current -2250;
setc prlink_file_name  prlink_e5_2250r.bos;
setc bfield_file_name "bgrid_tmid.fpk";
#
#setc outbanknames(1) "HEADEVNTTBIDTBTRPARTEC1 TDPLSCRC";
setc outbanknames(1) "HEADCALLDC0 SC  CC  SC1 EC  SCRCPARTTBIDHEVTEVNTDCPBDHCLCCPBSCPBECPBTDPLTBTRSCR HBERHBTRTBERTGBITRKSEC1REC1 LC
PBTLV1";
# tell FPACK not to stop if it thinks you are running out of time
fpack "timestop -9999999999"
# do not send events to event display
set lscat $false;
set ldisplay_all $false;
#set nevt_to_skip  500000; # how many events to SKIP set to .le. 0 to NOT SKIP
# tell recsis to pause or go
setc rec_prompt "[exec whoami]_recsis> ";
exit_pend;
url2:tmp>
```

tcl file for gsim.

```
 source /group/clas/builds/release-4-9/packages/tcl/recsis_proc.tcl;
turnoff ALL;
global_section off;
turnon seb trk cc tof egn lac user pid;
inputfile nde.gsim.bos.A00.gpp;
outputfile gsim.cooked.bos.out.4-9 PROC 2047;
set trigger_particle 11;
set trigger_particle_s 0;
set TargetPos(3) -10;
set torus_current 3375;
set mini_torus_current 6000;
set dc_xvst_choice 0;
set def_adc -1;
set def_tdc -1;
setc log_file_name logfile;
set poltarget_current 0;
setc prlink_file_name "prlink_e5_3375.bos"
setc outbanknames(1) "all";
fpack "timestop -9999999999"
set lscat $false;
set ldisplay_all $false;
setc rec_prompt "[exec whoami]_recsis> ";
go 1000000;
exit_pend;
```

ffread file for gsim.

```
 MLIST
CUTS   5.e-3 5.e-3 5.e-3 5.e-3 5.e-3
CCCUTS 1.e-3 1.e-3 1.e-3 1.e-3 1.e-3
DCCUTS 1.e-4 1.e-4 1.e-4 1.e-4 1.e-4
ECCUTS 1.e-4 1.e-4 1.e-4 1.e-4 1.e-4
SCCUTS 1.e-4 1.e-4 1.e-4 1.e-4 1.e-4
TARGET 'e5a'
VERT_E5 2

RUNG 10
AUTO 1
MAGTYPE 3
MAGSCALE 0.8744 0.75
KINE 1
TRIG 200000
NOGEOM 'PTG' 'ST'
NOMCDATA 'ALL'
```

```
SAVE 'ALL' 5
STOP
END
```

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Jerry Gilfoyle's Enotebook page 123 - first results on background simulation (gpg)

[Modified Wed May 17 03:28:48 2006 (GMT) gpg]

The plots below show the results for ALTp and alpha for a 3-hr simulation run.

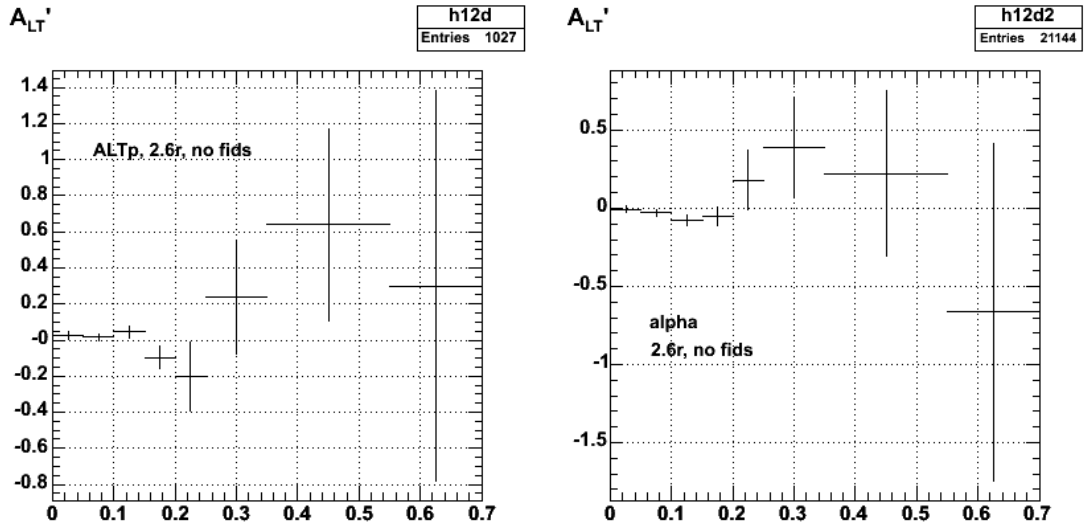

Fig 1. Plots of ALTp (left panel) and alpha (background coefficient) x2 for 2.6r gsim with no fids.

Click here to view the object (ROOT C++ macro for fig 1.) you uploaded.

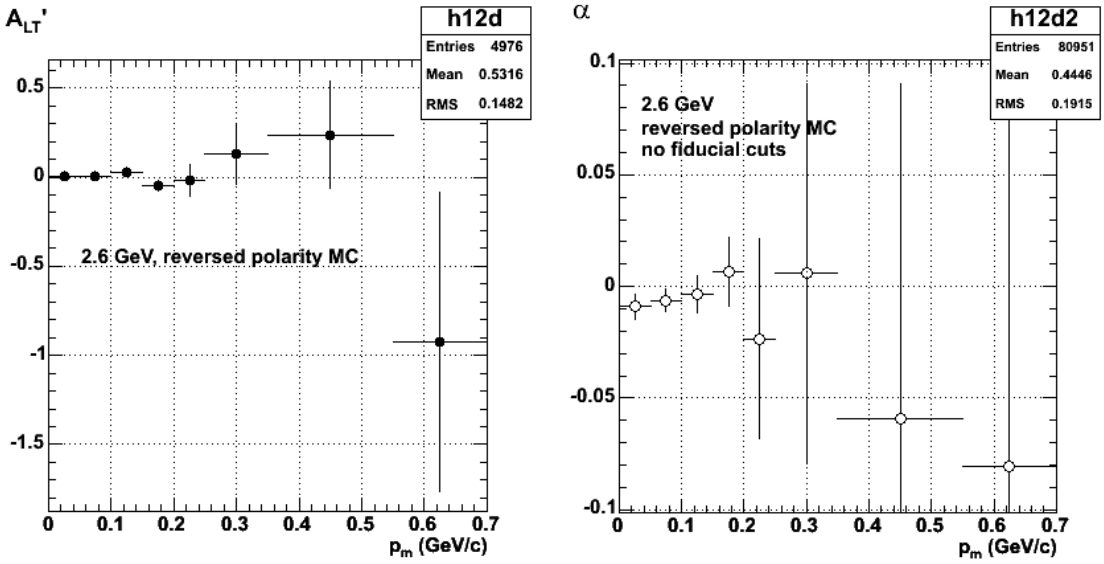

Fig 2. Same as Fig 1 with more events.

Click here to view the object (ROOT C++ macro for fig 2) you uploaded.

Draft of E5 elog entry.

Below is a comparison of the background asymmetry from the 2.6 GeV, reversed torus polarity data and a GSIM calculation. The calculation used the standard Celeg event generator, RECSIS (with Jeff's tcl input file), and my root code. In Fig 1, there is a significant (2-4%) background that is sensitive to the fiducial cuts. The normal polarity data also have such a background, but it is insensitive to the use of the fiducial cuts. This feature is not reproduced at all in the GSIM calculation in Fig 2. The background in the calculation is consistent with zero.

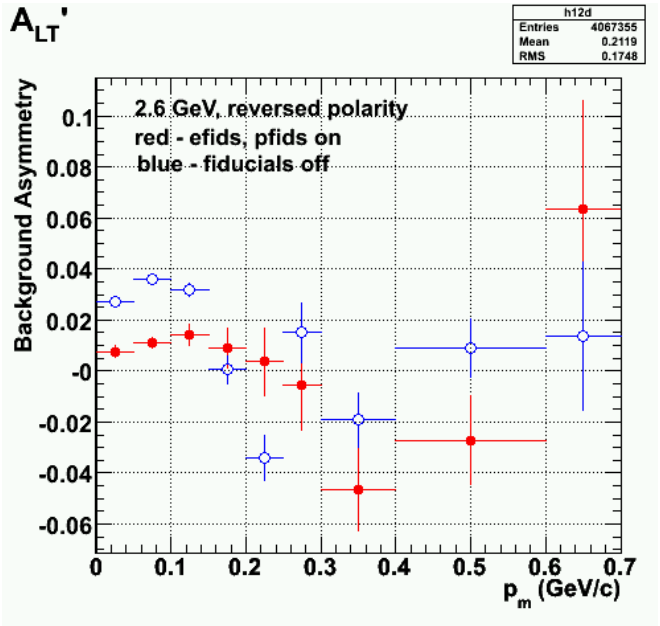

Fig 1. Comparison of background asymmetry with electron and proton fiducials on (red) and off(blue) for the 2.6 GeV, reversed polarity data.

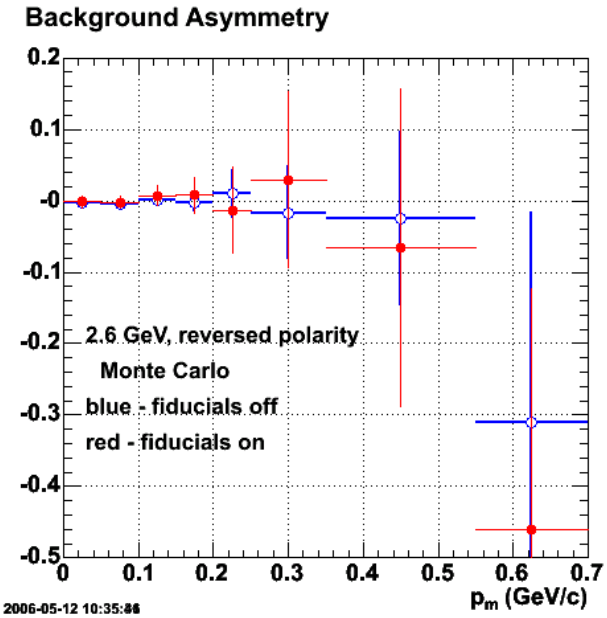

Fig 2. Preliminary comparison of calculated background asymmetry with electron and proton fiducials on (red) and off(blue) for the 2.6 GeV, reversed polarity running conditions.

Click here to view the object (ROOT C++ macro for Fig 2.) you uploaded.

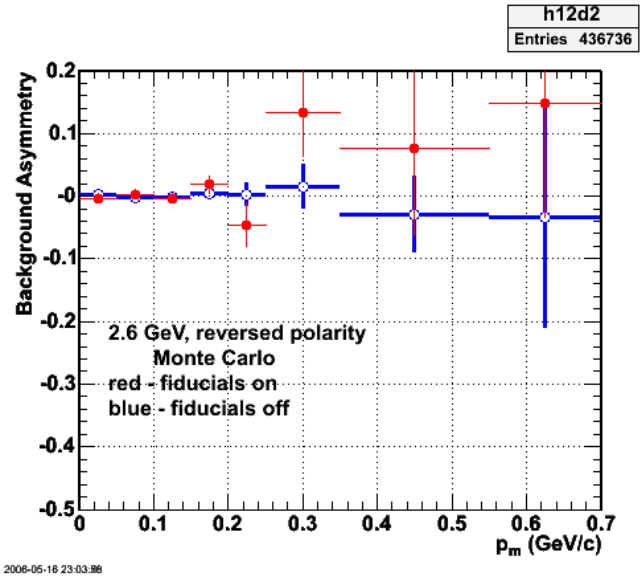

Fig 5. Same as Fig 1 with more events.

Click here to view the object (ROOT C++ macro for Fig 5) you uploaded.

I have observed that the recsis reconstruction only gets about 0.28 of the thrown events. This may be due to the small lower limit on the Q2 range in the celeg input in ftn15 which sends lots of tracks down the hole. try pushing that lower limit up to 0.5 to see if things improve. Below are the log files for node 0.

Click here to view the object (gsimulation log for Q2 rane 0.1-1.5 GeV2) you uploaded.

Click here to view the object (gsim log for Q2 rane 0.1-1.5 GeV2) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 124 - low reconstruction fraction in simulation (gpg)

[Modified Thu May 18 21:43:23 2006 (GMT) gpg]

I've noticed that with the first sim runs the fraction of events that are successfully reconstructed is low. Only about 60% of evetns pass the pattern recognition and 28% of events are getting through SEB. See recsis output below.

```
TRK_STATI  L: Cut#  Description              Value     Passed     %
TRK_STATI  L: 1  trk_evnt:  Ntrig (Nevt) >        0.0    120000   100.0
TRK_STATI  L: 2  ana_segm:  Nevt w. segm =        5.0     71748    59.8
TRK_STATI  L: 3  trk_link:  Nevt w. link =        5.0     71176    59.3   100.0
TRK_STATI  L: 4  ana_prfit: Nevt PR chi2 <       10.0     68206    56.8    95.8
TRK_STATI  L: 5  SEB_eid:   Nevt SEB     =        0.0     34489    28.7    48.5
TRK_STATI  L: 6  trk_dcam:  Nevt w. LRseg=        4.0     34474    28.7    48.4
TRK_STATI  L: 7  trk_dcam:  Nevt w. LRseg=        5.0     34344    28.6    48.3
TRK_STATI  L: 8  ana_fit:   Nevt FF1 chi2 <      30.0     33967    28.3    47.7
TRK_STATI  L: 9  ana_fit:   Nevt in TBT >         0.0     33967    28.3    47.7
```

WKB wonders if the lower limit of the Q2 range is so low that many events go down the hole. Change the Q2 range requested in celeg from 0.1->1.5 to 0.5->1.5 and things improve significantly.

```
TRK_STATI  L: Cut#  Description              Value     Passed     %
TRK_STATI  L: 1  trk_evnt:  Ntrig (Nevt) >        0.0     60000   100.0
TRK_STATI  L: 2  ana_segm:  Nevt w. segm =        5.0     49145    81.9
TRK_STATI  L: 3  trk_link:  Nevt w. link =        5.0     48806    81.3   100.0
TRK_STATI  L: 4  ana_prfit: Nevt PR chi2 <       10.0     48218    80.4    98.8
TRK_STATI  L: 5  SEB_eid:   Nevt SEB     =        0.0     41382    69.0    84.8
TRK_STATI  L: 6  trk_dcam:  Nevt w. LRseg=        4.0     41379    69.0    84.8
TRK_STATI  L: 7  trk_dcam:  Nevt w. LRseg=        5.0     41362    68.9    84.7
TRK_STATI  L: 8  ana_fit:   Nevt FF1 chi2 <      30.0     41026    68.4    84.1
TRK_STATI  L: 9  ana_fit:   Nevt in TBT >         0.0     41026    68.4    84.1
```

Now change the Q2 range selected in celeg from 0.5->1.5 to 1.0->2.0 and get the following. The percentages of successful reconstructions at the different stages now looks very good to me.

```
Run Number-    10 Event Number-             0   Total records seen-   7002
TRK_STATI  L: Cut#  Description              Value     Passed     %
TRK_STATI  L: 1  trk_evnt:  Ntrig (Nevt) >        0.0      7000   100.0
TRK_STATI  L: 2  ana_segm:  Nevt w. segm =        5.0      6156    87.9
TRK_STATI  L: 3  trk_link:  Nevt w. link =        5.0      6075    86.8   100.0
TRK_STATI  L: 4  ana_prfit: Nevt PR chi2 <       10.0      6018    86.0    99.1
TRK_STATI  L: 5  SEB_eid:   Nevt SEB     =        0.0      5512    78.7    90.7
TRK_STATI  L: 6  trk_dcam:  Nevt w. LRseg=        4.0      5512    78.7    90.7
TRK_STATI  L: 7  trk_dcam:  Nevt w. LRseg=        5.0      5510    78.7    90.7
TRK_STATI  L: 8  ana_fit:   Nevt FF1 chi2 <      30.0      5460    78.0    89.9
TRK_STATI  L: 9  ana_fit:   Nevt in TBT >         0.0      5460    78.0    89.9
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 125 - vx, vy, vz distribution (gpg)

[Modified Thu Jul 13 19:21:17 2006 (GMT) gpg]

Examine the distribution of vx, vy, and vz as a possible clue to the nature of the background asymmetry. Look at electron singles first at 2.6 GeV, reversed field.

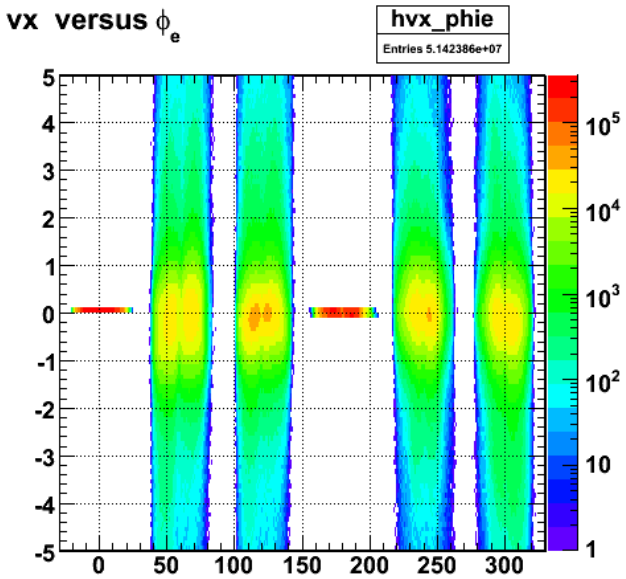

Fig 1. Distribution of the x component of the vertex position. This odd looking distribution can be ignored because it is not a well defined quantity because the track is by definition a 2-dimensional object (we chose y and z) so this distribution has no meaning.

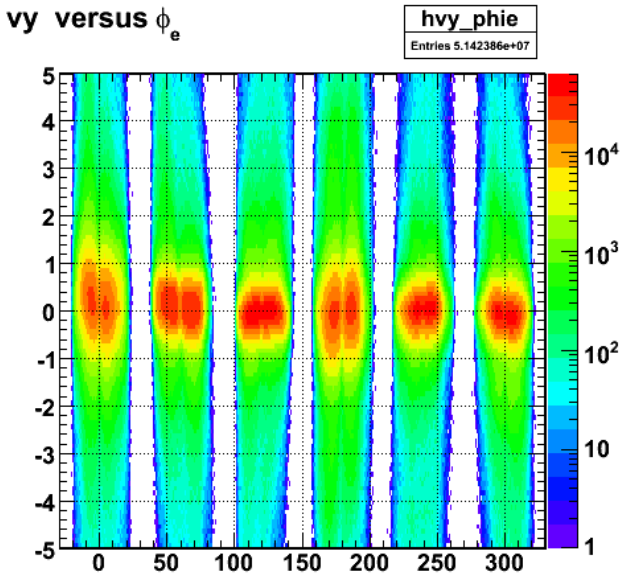

Fig 2. Distribution of the y component of the vertex position.

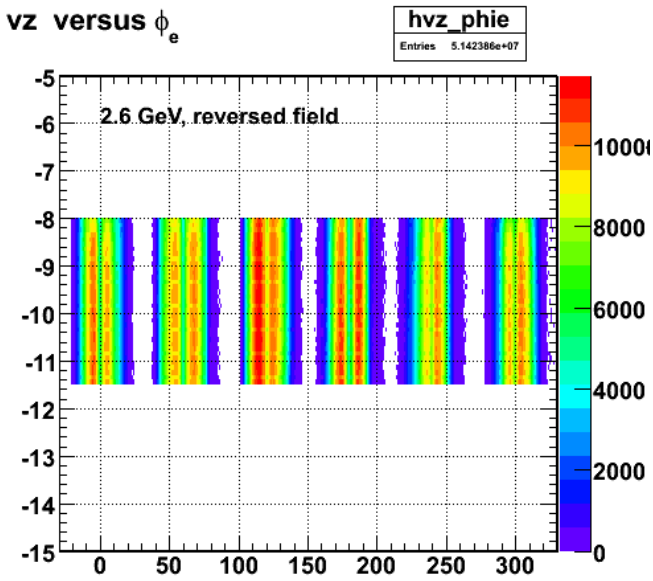

Fig 3. Distribution of the z component of the vertex position.

Now do electron vertex position distributions for e-p coincidences.

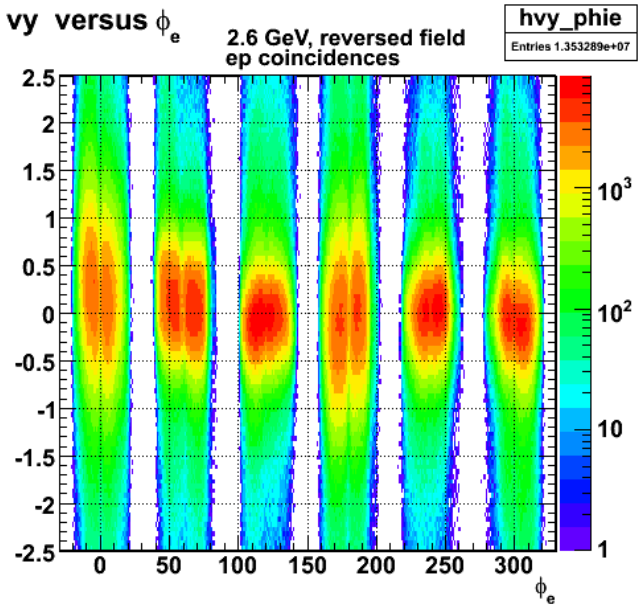

Fig 4. Distribution of the y component of the vertex position.

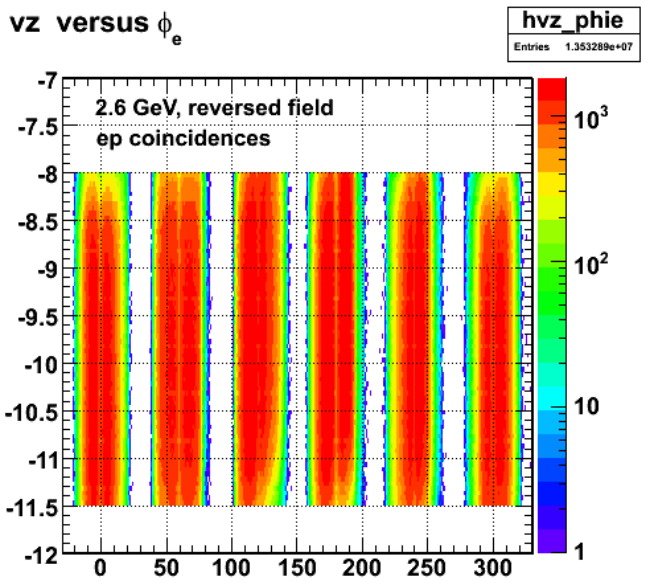

Fig 5. Distribution of the z component of the vertex position.

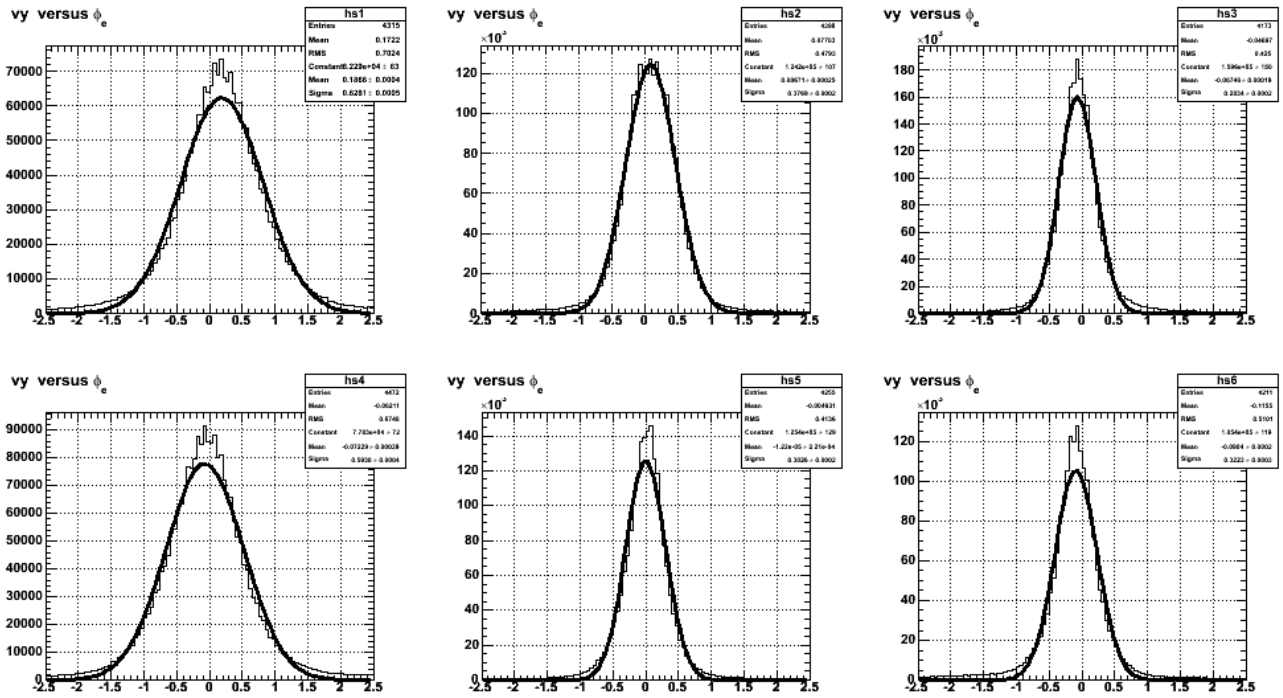

Fig 6. Plot of distribution of vy sector by sector for ep coincidences.

Click here to view the object (PS file of Fig 6.) you uploaded.

Click here to view the object (ROOT C++ macro for previous plot) you uploaded.

Plots 7-9 claim to be for epn coincidences, but the MM2 neutron cut was set wrong. Figs past Fig 9 have the proper cut.

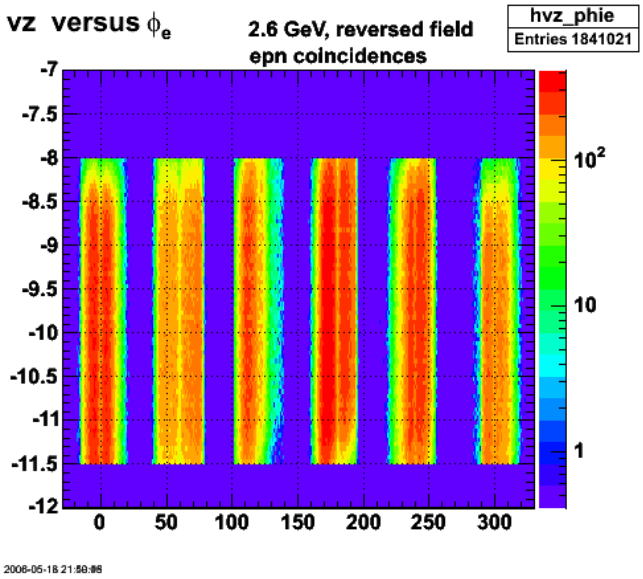

Fig 7. Plot of distribution of vz sector by sector for epn coincidences.

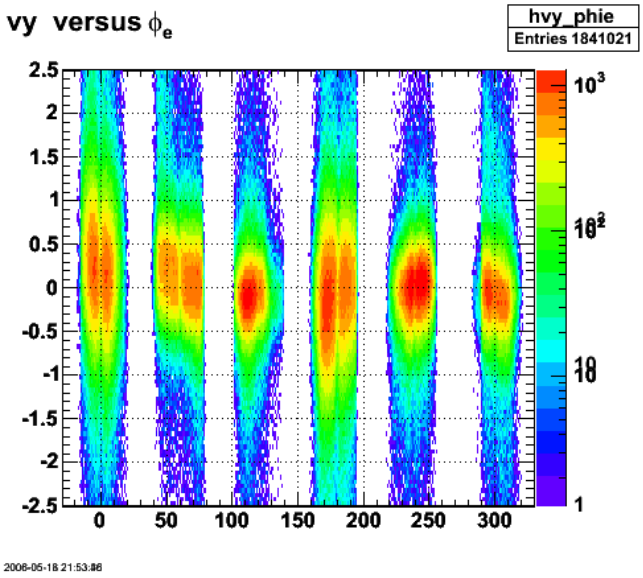

Fig 8. Distribution of the y component of the vertex position.

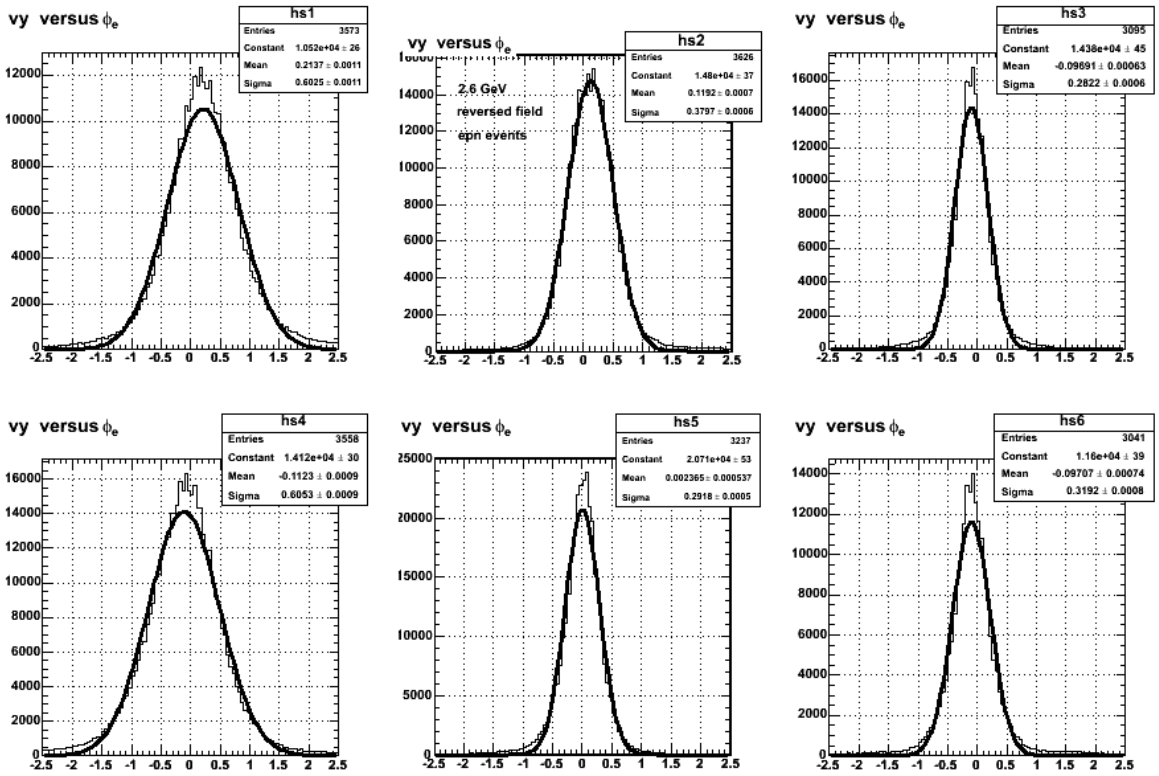

Fig 9. Plot of distribution of vy sector by sector for epn coincidences.

Click here to view the object (PS file of Fig 9.) you uploaded.

Click here to view the object (Root histogram file for Fig 9.) you uploaded.

I'm worried about the possible effect of the long tails in vy on ALTp so extract ALTp with a cut on vy.

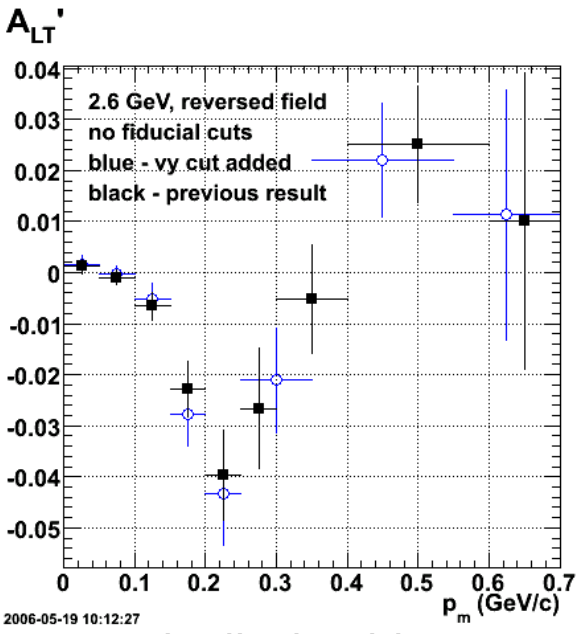

Fig 10. ALTp with an additional cut applied so -0.5 cm < vy < 0.5 cm.

Click here to view the object (ROOT C++ macro for Fig 10.) you uploaded.

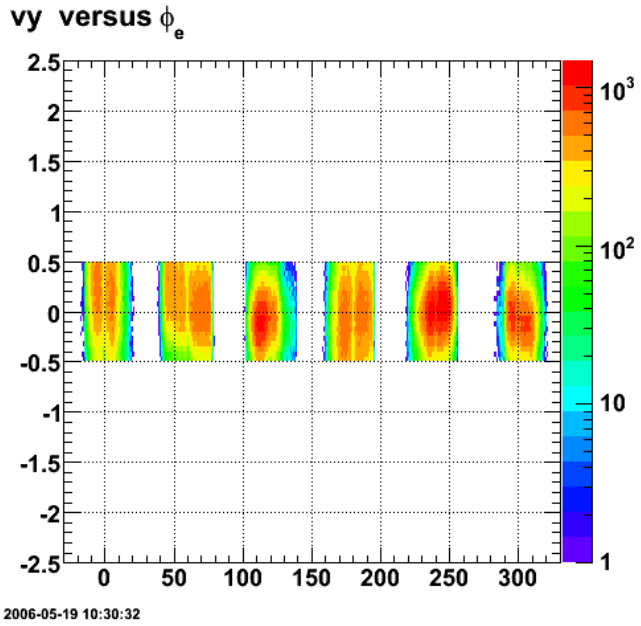

Fig 11. Distribution of the y component of the vertex position for epn events. The cutoff is due to the vy cut applied here.

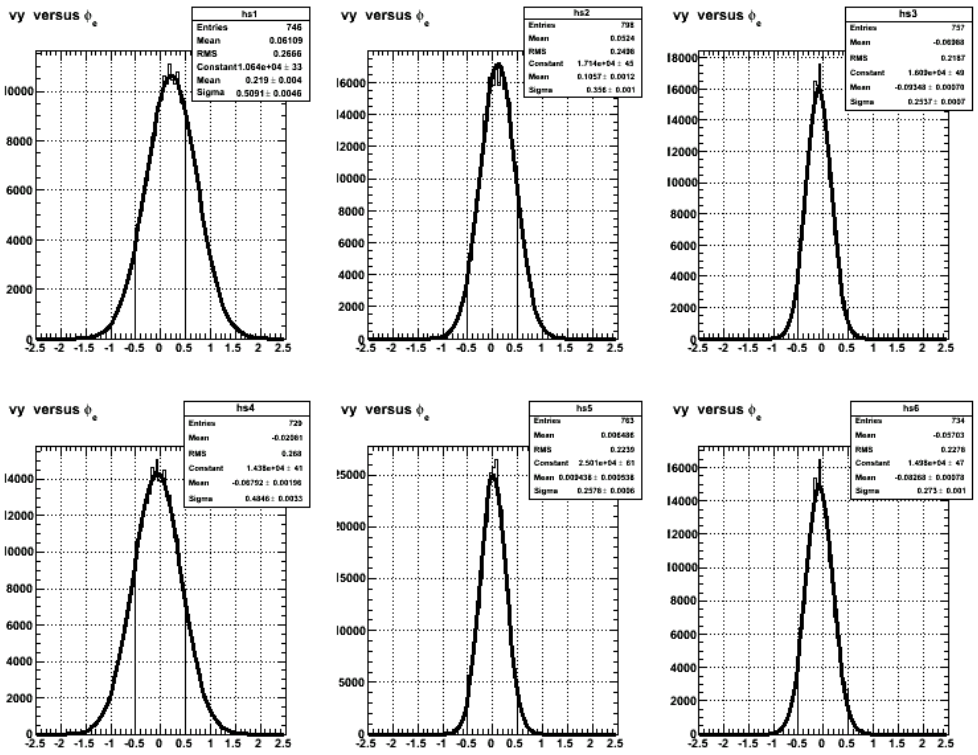

Fig 12. Updated version of gaussian fits to vy distributions with vy cut turned on.

Click here to view the object (PostScript version of Fig 12) you uploaded.

Click here to view the object (ROOT CINT macro for fig12) you uploaded.

Click here to view the object (ROOT histogram file for fig 12) you uploaded.

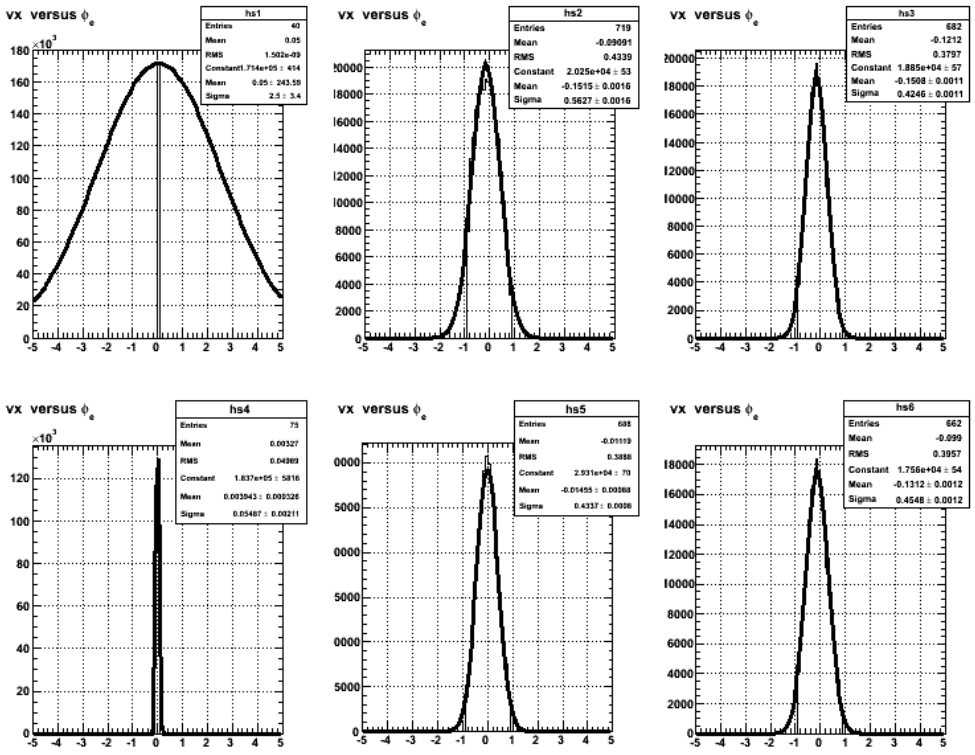

Fig 13. Updated version of gaussian fits to vx distributions with vy cut turned on.

Click here to view the object (PostScript version of fig 13) you uploaded.

Click here to view the object (ROOT CINT macro for fig 13) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 126 - Plots for GMn CAN (gpg)

[Modified Fri May 26 14:53:21 2006 (GMT) gpg]

Below are some candidate plots for the response to the first pass of the committe through the GMn CAN.

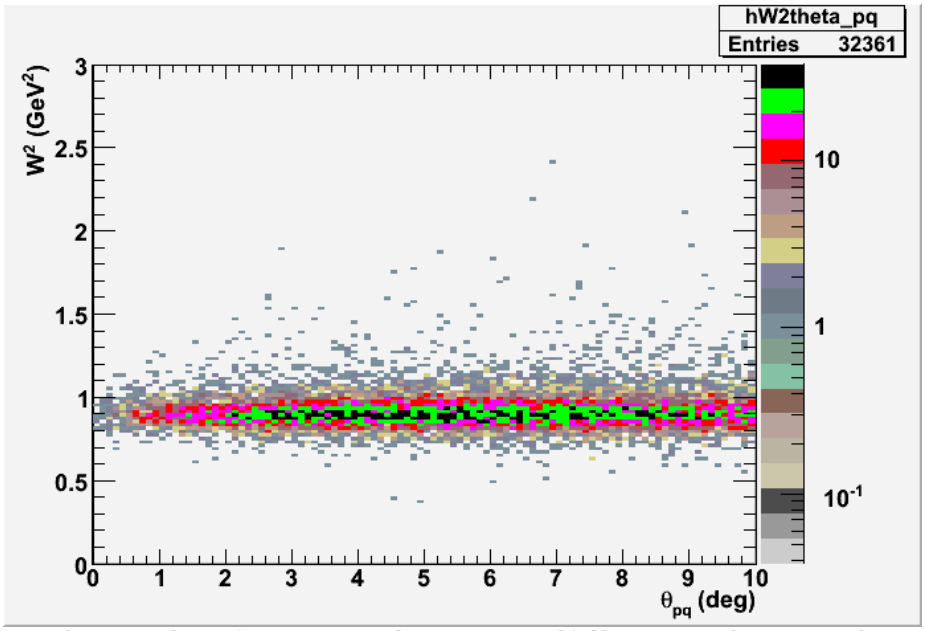

Fig 1. W2 vs. theta_pq in the CM for epn events and 2.6 GeV, reversed field. Compare with Figs 2.53 and 2.54 in CAN.

Click here to view the object (ROOT C++ macro for Fig 1.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 1.) you uploaded.

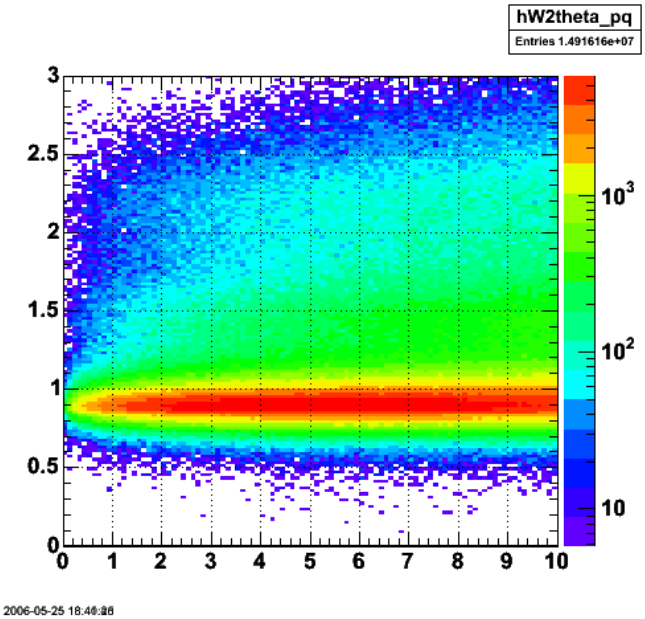

Fig 2. W2 vs theta_pq for ep events (Fig 1 is for epn events). The previous plot only analyzed the first 100,000 events in each file. The angle theta_pq is in the CM.

Click here to view the object (ROOT histogram file for Fig 2.) you uploaded.

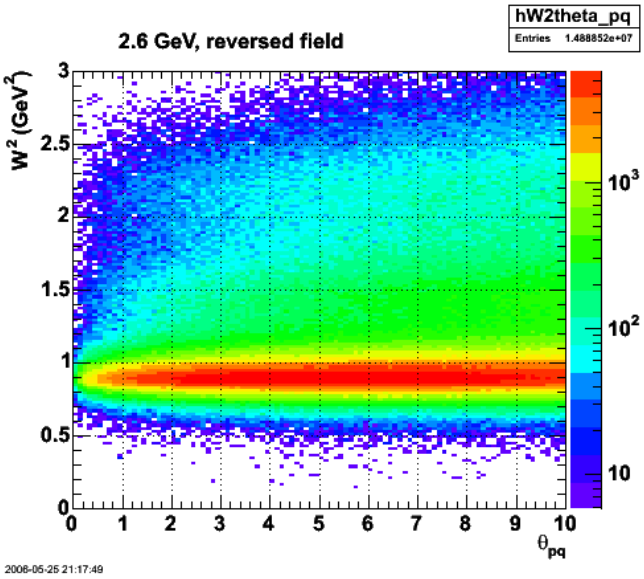

Fig 3. Same as Fig 2 with fixed EC_fiducial cut. The angle theta_pq is in the CM.

Click here to view the object (ROOT histogram file for Fig 3.) you uploaded.

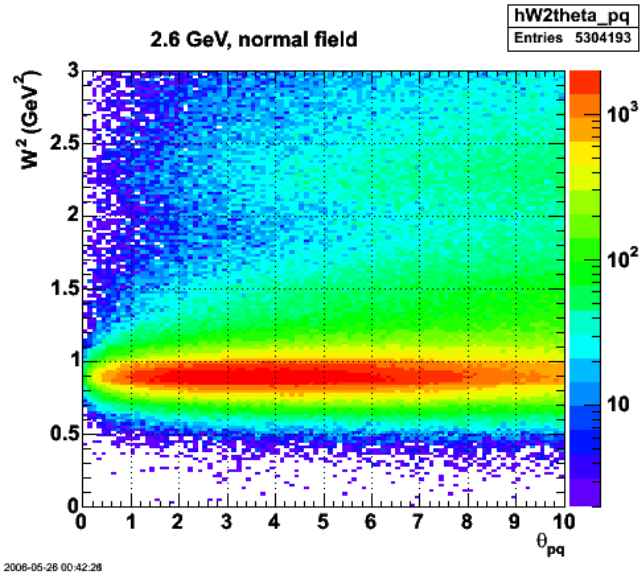

Fig 4. Same as Fig 3 for 2.6 GeV, normal polarity. The angle theta_pq is in the CM.

Click here to view the object (ROOT histogram file for Fig 4.) you uploaded.

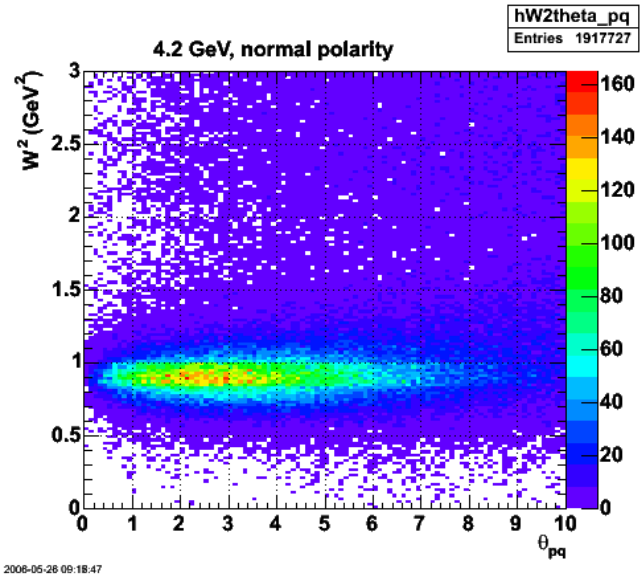

Fig 5. Same as Figs 3-4 for 4.2 GeV, normal polarity. The angle theta_pq is in the CM.

Click here to view the object (ROOT histogram file for Fig 5) you uploaded.

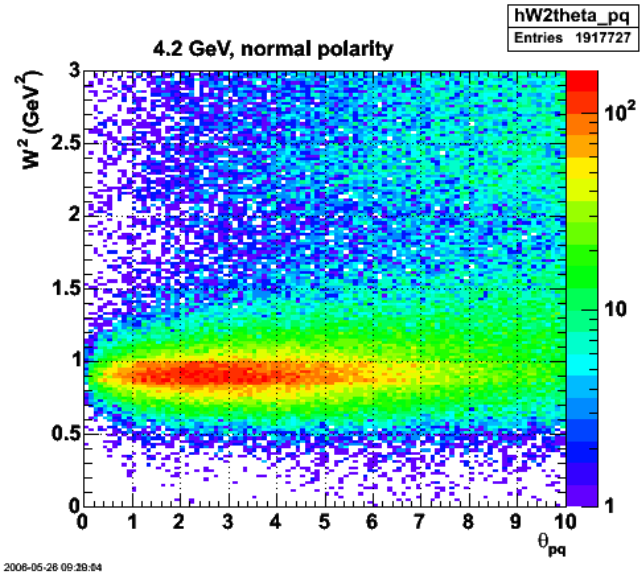

Fig 6. Same as Fig 5 with a log scale. The angle theta_pq is in the CM.

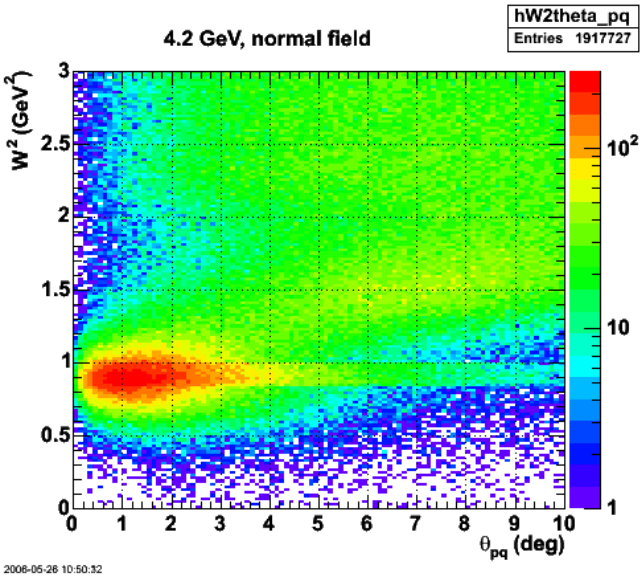

Fig 7. Sames as Figure 6, but for theta_pq in the lab to more closely overlap with the plots in the CAN.

Click here to view the object (ROOT histogram file for Fig 7) you uploaded.

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Jerry Gilfoyle's Enotebook page 127 - queeg simulation results (gpg)

[Modified Tue Jun 6 15:40:35 2006 (GMT) gpg]

Here is a first look at simulation results using queeg.

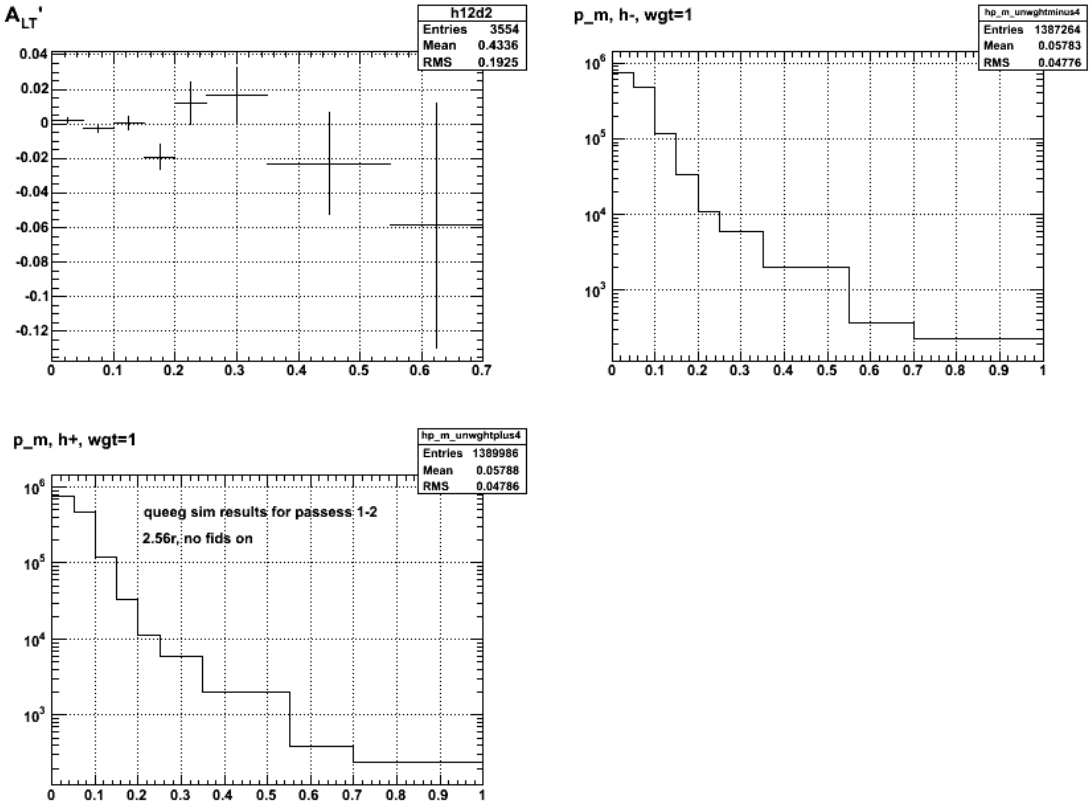

Fig 1. Plots of ALTp and the unweighted spectra as a function of p_m for positive and negative helicity.

Click here to view the object (ROOT C++ macro fir fig 1) you uploaded.

Click here to view the object (ROOT histogram file for fig 1) you uploaded.

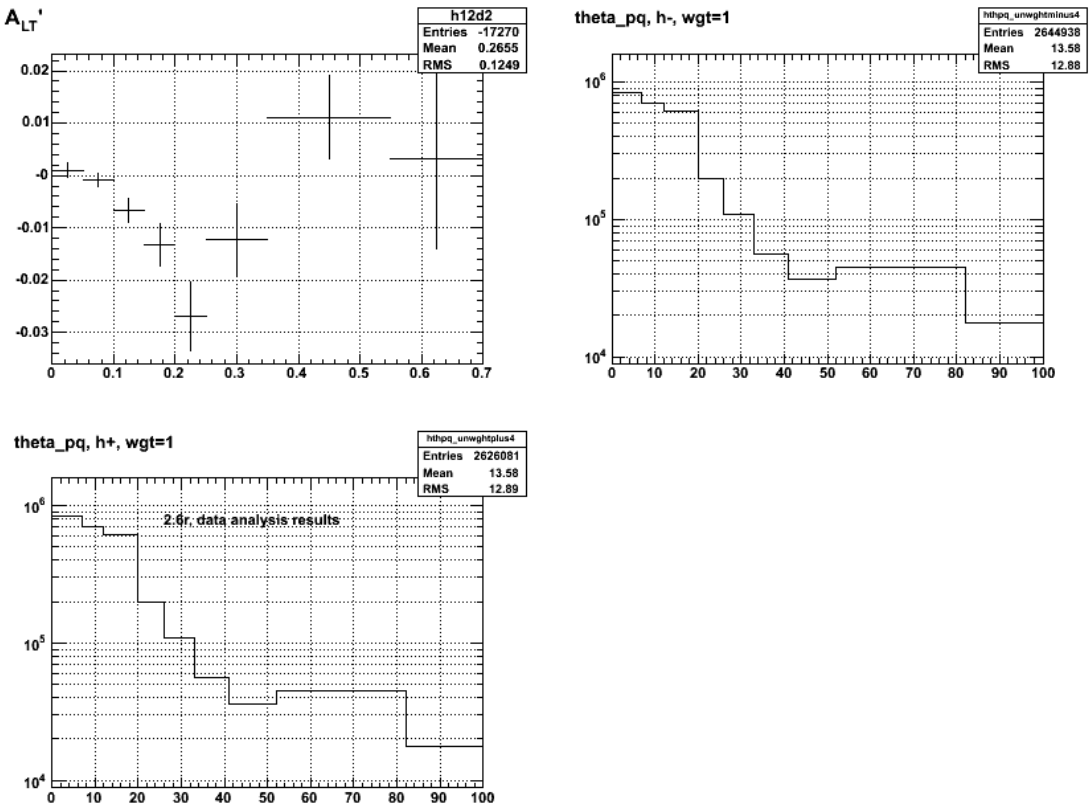

Fig 2. Same as fig 1, but now for the data.

Click here to view the object (ROOT histogram file for fig 2) you uploaded.

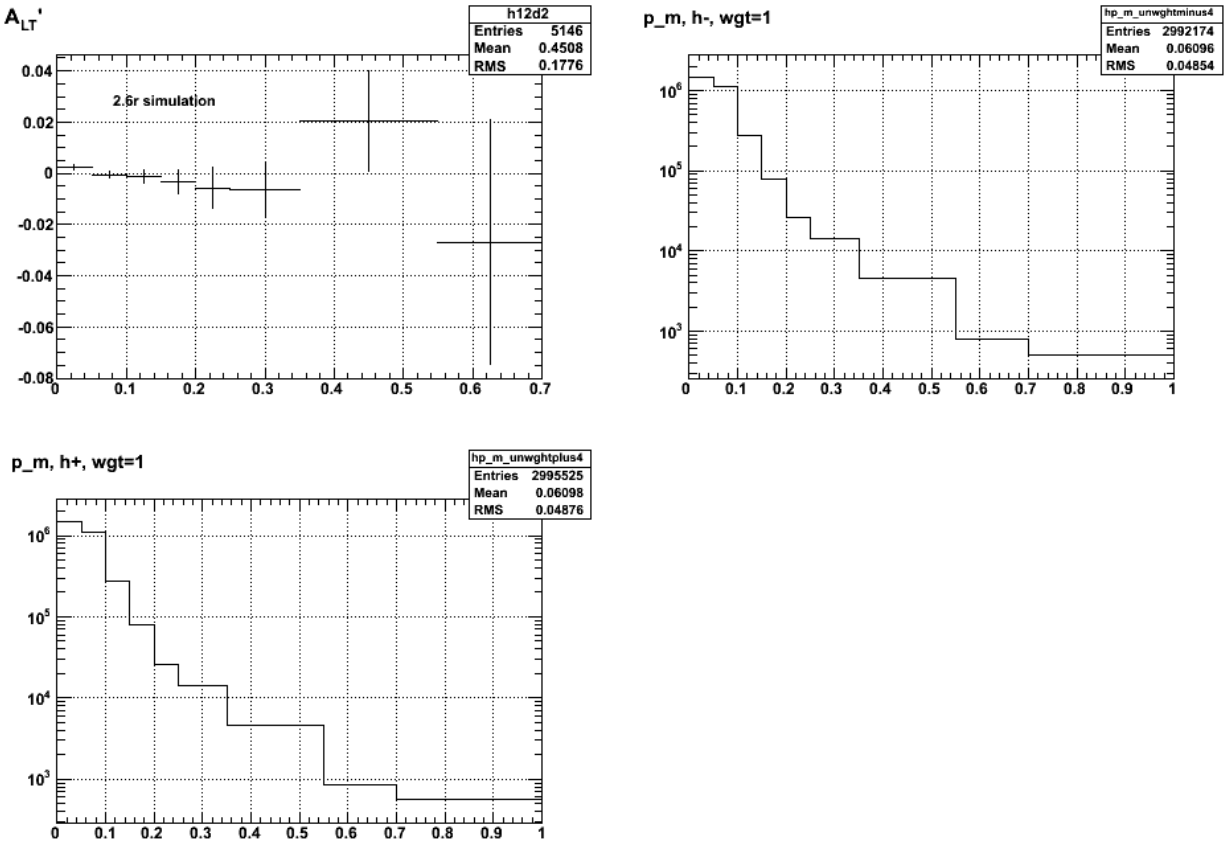

Fig 3. Plots of ALTp and the unweighted spectra as a function of p_m for positive and negative helicity. More events than Fig 1

Click here to view the object (ROOT histogram file for fig 3) you uploaded.

Click here to view the object (ROOT histogram file for Fig 3) you uploaded.

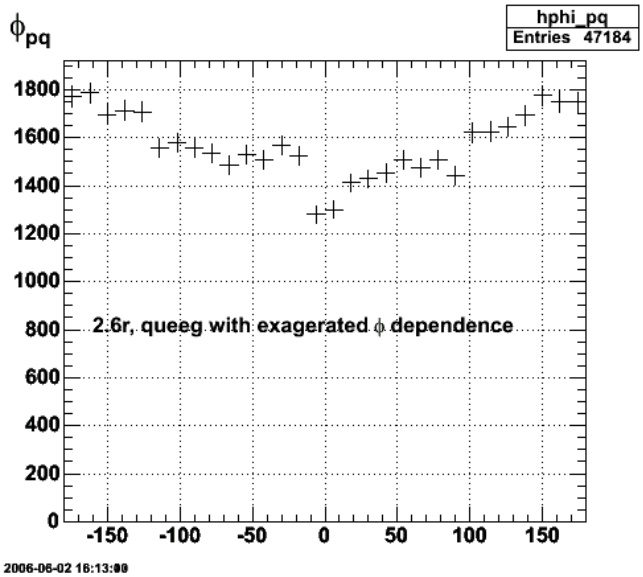

Fig 4. phi_pq dependence from PART banks.

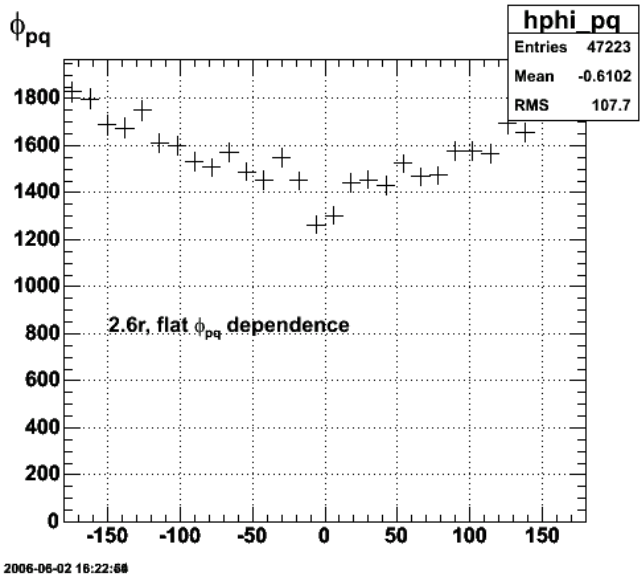

Fig 5. phi_pq dependence from PART banks.

Fix a couple of things and ALTp starts to look vaguely correct. I now see an ALTp that is consistent with the input. The amplitude was set to 0.8 for all p_m. I DON'T understand the variation in ALTp about 0.8, but that variation is small (percentagewise) compared to the uncertainties in our data. I check the background asymmetry and it was consistent with zero for all p_m.

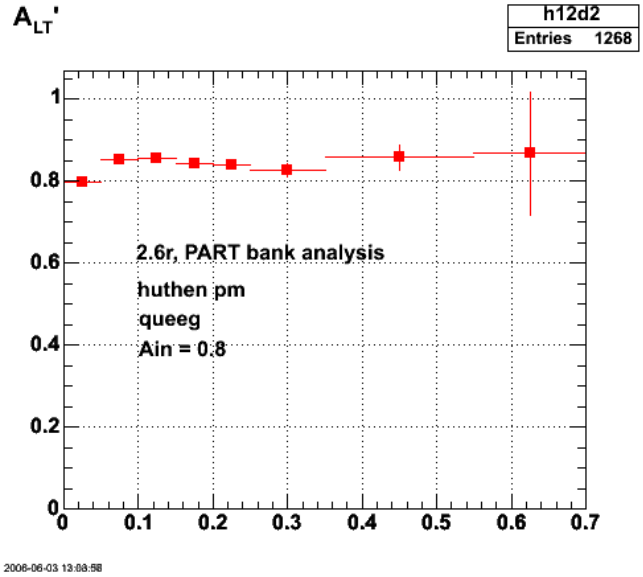

Fig 6. ALTp plot for PART banks after finally getting things vaguely correct. The elctron phi is set to zero here.

Click here to view the object (ROOT histogram file for fig 6) you uploaded.

Click here to view the object (ROOT histogram file for fig 6) you uploaded.

The next figure is for phi_e=0.0 and with a large amplitude (0.8) on ALTp that is fixed for all p_m. I see the expected sinusoidal oscillation in phi_pq for a given p_m bin.-

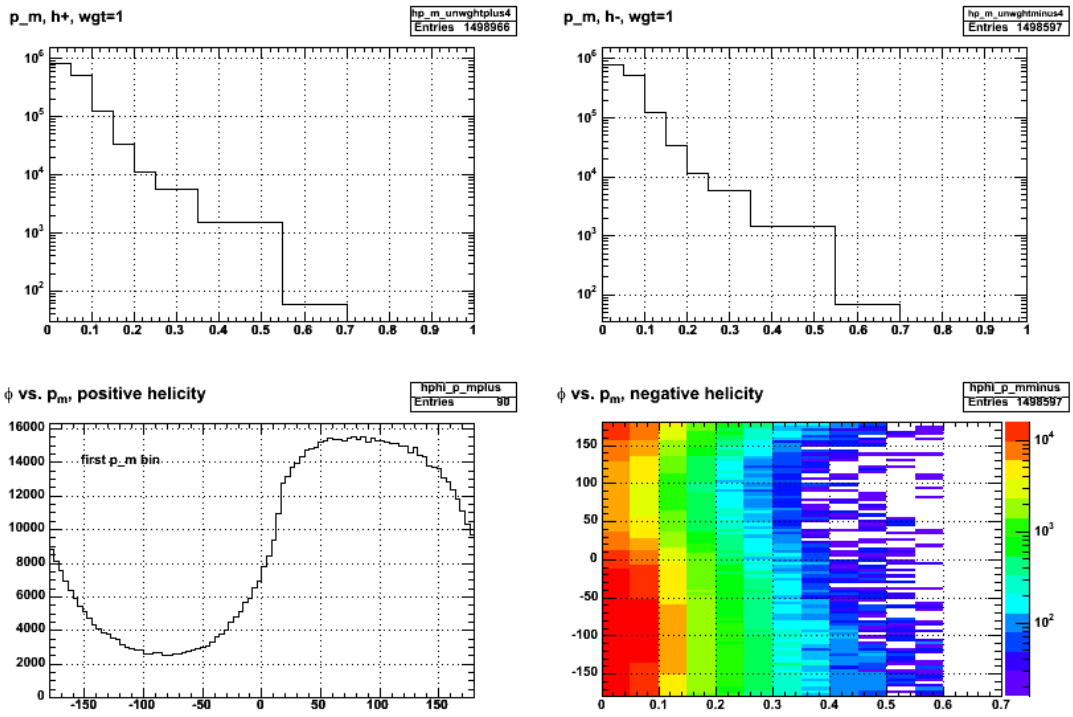

Fig 7. Plots from sim with phi_e=0.

For the next plot fix phi_e=0.0 and phi_pq=90 deg. The sinusoidal oscillation in the phi_pq vs p_m disappears, but it is NOT a spike as I expected. This may be ok. Even if I fix phi_e=0.0 and phi_pq=90.0, the proton will still have a range of momenta and theta_pq taken from the Hulthen distribution. That single phi_pq will get boosted into a range of phi_p angles in the lab. Also the electron kinematics is independent of our choices for phi_pq so that will also smear things out. Does the boost smear things out?

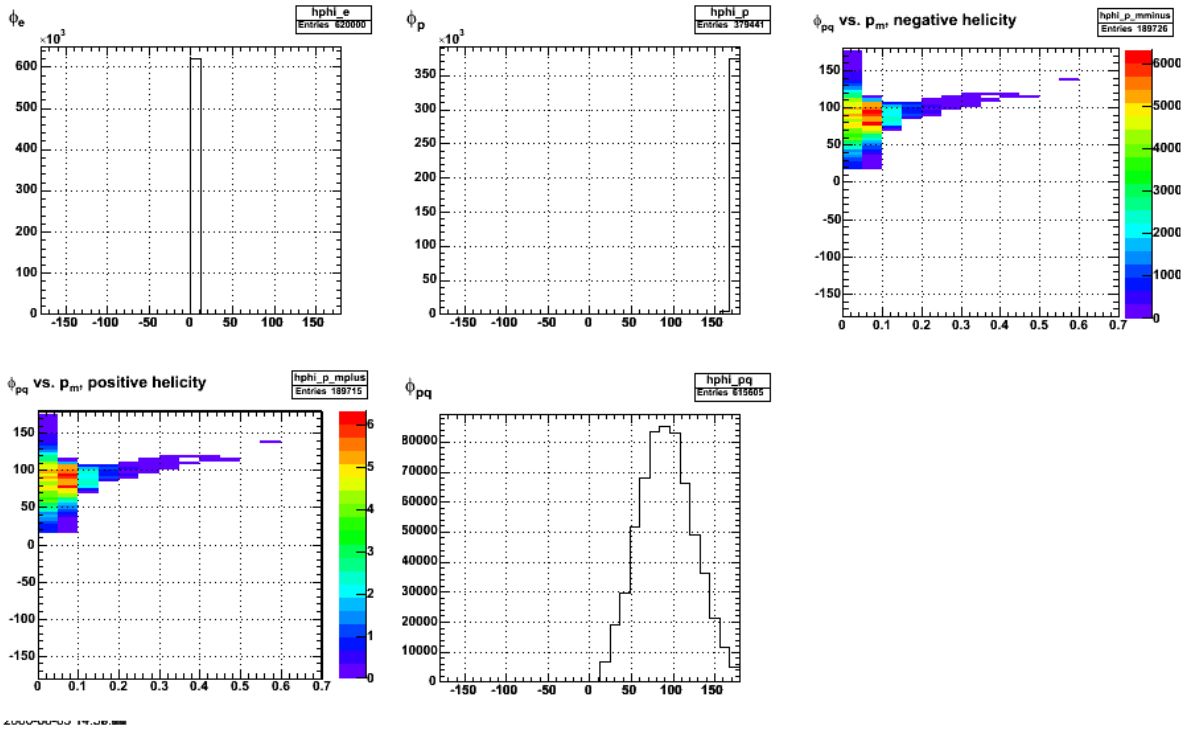

Fig 8. lots from sim with phi_e=0 .and phi_pq=90 deg.

Click here to view the object (ROOT C++ macro for fig 8) you uploaded.

Click here to view the object (ROOT histogram file for Fig 8) you uploaded.

Next I fixed cos(theta_pq) = 0.99 and pfermi = 0.05 and got the following plot. Happily, the width of the phi_pq distribution shrinks to zero it appears, but it's

now centered at phi_pq ~ 10 deg, not 90 deg???

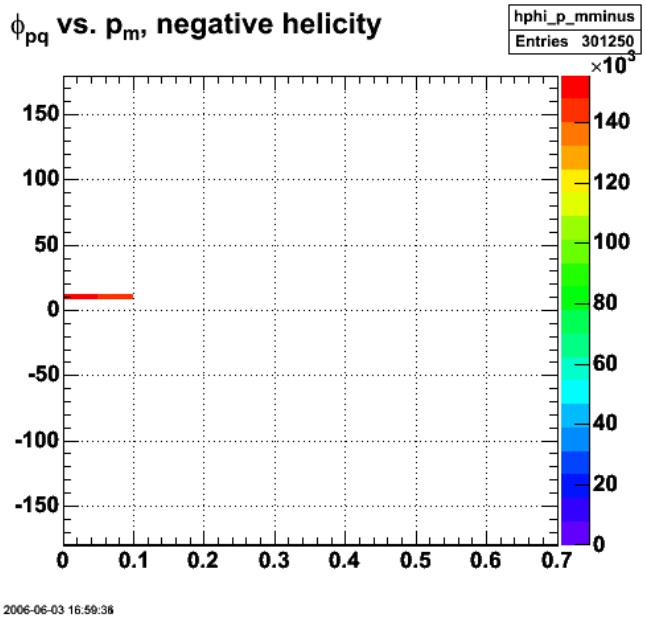

Fig 9. phi_pq vs. p_m with cos(theta_pq)=0.99, pfermi=0.05, phi_e=0.0, phi_pq=90 deg.

Click here to view the object (ROOT histogram file for Fig 9) you uploaded.

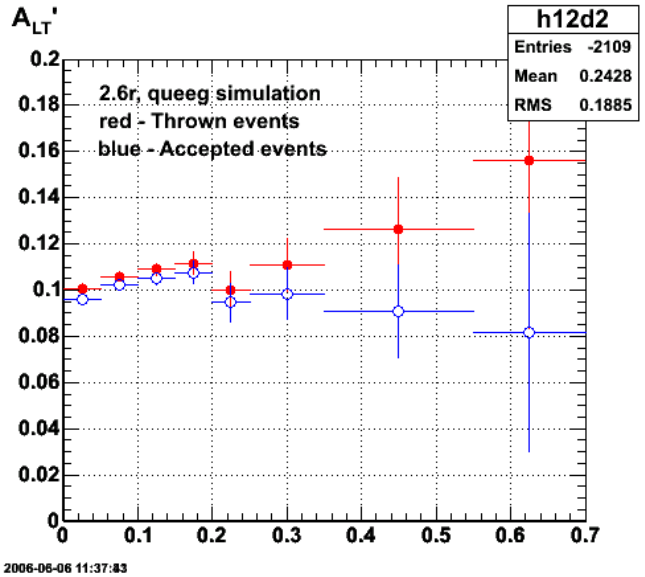

Fig 10. Comparison of thrwon and accepted events for 2.6r, queeg simulation.

Click here to view the object (ROOT C++ macro for Fig 10) you uploaded.

Click here to view the object (ROOT EVNT histogram file for Fig 10) you uploaded.

Click here to view the object (ROOT PART histogram file for Fig 10) you uploaded.

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Jerry Gilfoyle's Enotebook page 128 - Testing phi_pq distribution in queeg (gpg)

[Modified Fri Jul 14 22:54:17 2006 (GMT) gpg]

The first plot shows 2*10^6 events histogrammed directly from queeg when they were generated. Why isn't this flat? I selected events that passed Jeff's cuts so this distribution has the acceptance in it at some level.

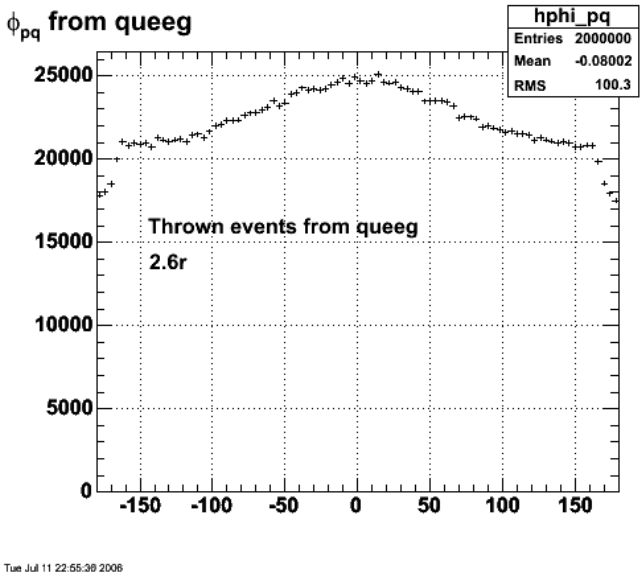


Fig 1. phi_pq distribution from queeg (2 million events).

Click here to view the object (ROOT C++ macro for fig 1) you uploaded.

Yikes, the following result looks awful!

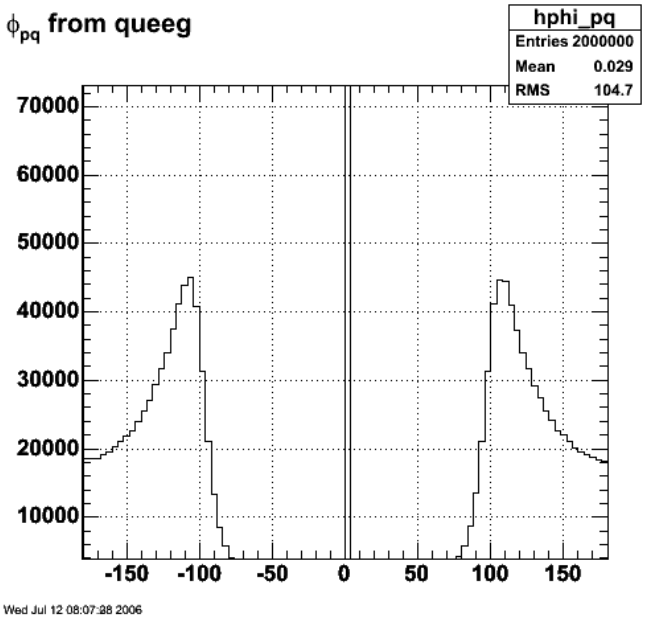
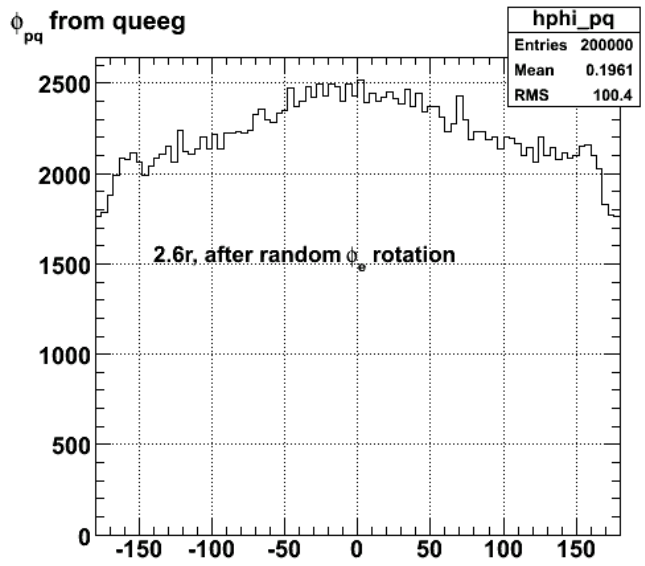


Fig 2. phi_pq distribution after putting in random phi rotation of electron and other vectors??!!

Click here to view the object (ROOT C++ macro for fig 2) you uploaded.

Pilot error as usual; bug in code. Following plot is for 1/10 the number of events, but is consistent with Fig 1.



Wed Jul 12 10:40:28 2006

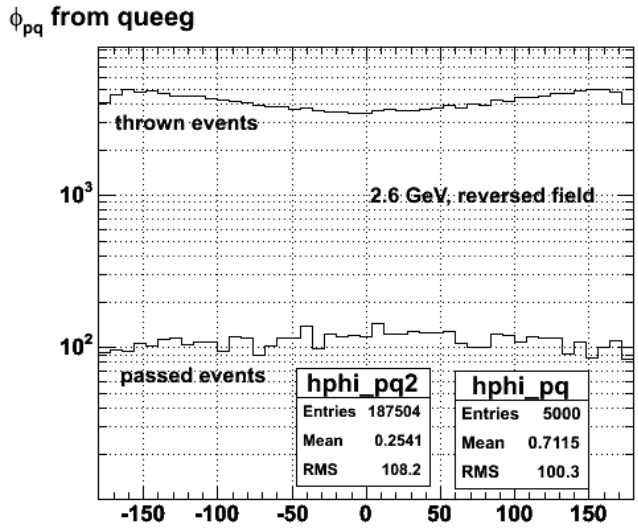
Fig 3. Corrected plot of phi_pq distribution of thrown events after the random rotation in phi_e in queeg.

Click here to view the object (ROOT C++ macro for fig 3) you uploaded.

The plot below shows a comparison of thrown and accepted events from queeg. It raises some questions.

1. Why are so many events thrown out? The ratio of thrown to accepted seems awfully high?

2. Why do the thrown events have so much structure in the phi distribution. i would have thought the distribution of thrown events would have been flat while the accepted events would have more structure in it since it has acceptance effects.



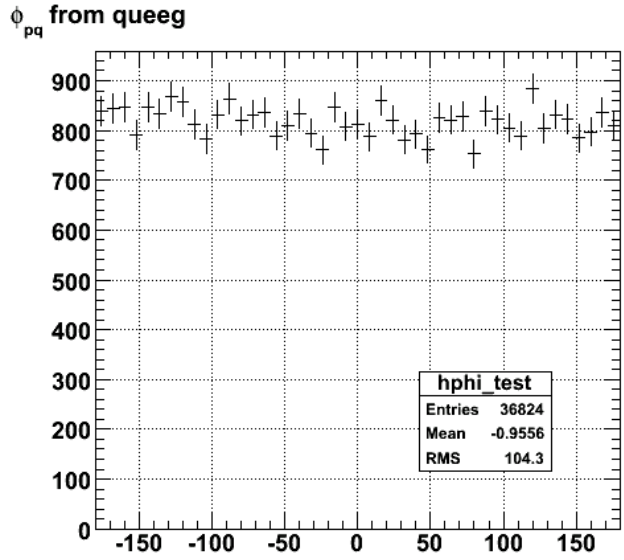
Fri Jul 14 11:55:05 2006

Fig 4. Comparison of thrown and accepted events from queeg.

Click here to view the object (ROOT CINT macro for Fig 4) you uploaded.

Click here to view the object (gzipped tar file with input and CINT macros for Fig 4) you uploaded.

Tests of distributions at the end of generating the event look random as they should. the phi distribution of phi_pq shown above is not flat. This, I guess, is the effect of a random phi distribution in the proton fermi motion getting translated in the phi_pq distribution.



Fri Jul 14 18:46:18 2006

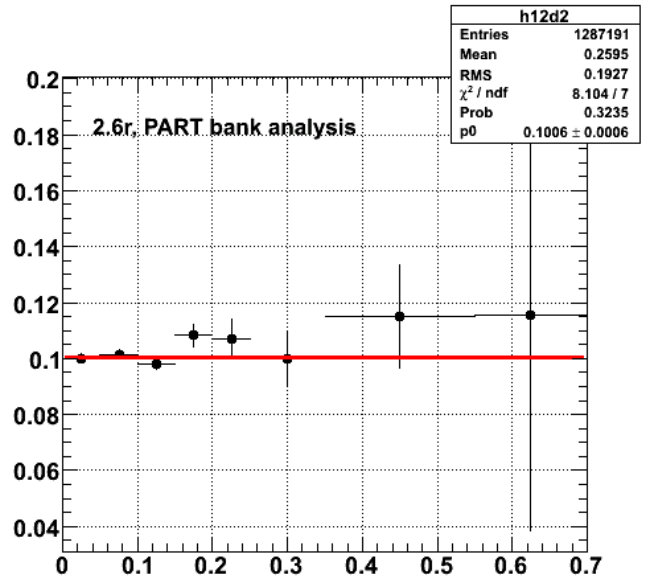
Fig 5. Test of phi_e distribution after generating event.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 129 - fixed ALTp=0.2 tests (gpg)

[Modified Wed Jul 19 01:28:27 2006 (GMT) gpg]

To test the consistency of the simulation of the non-zero helicity asymmetry, I used a fixed asymmetry in queeg and ran it through the simulation and analysis codes. The first plot is an analysis of the PART bank, the thrown events without being sent through GSIM. The fit is just a straight line to show ALTp is consistent with the input of a fixed asymmetry. The disturbing thing is this asymmetry should be flat (it is) at a value of 0.2 instead of 0.1. It's asymmetry is half what it is supposed to be. NOTE There was a problem with the perl script and the negative helicity results were getting overwritten so figures 1-3 should be ignored.



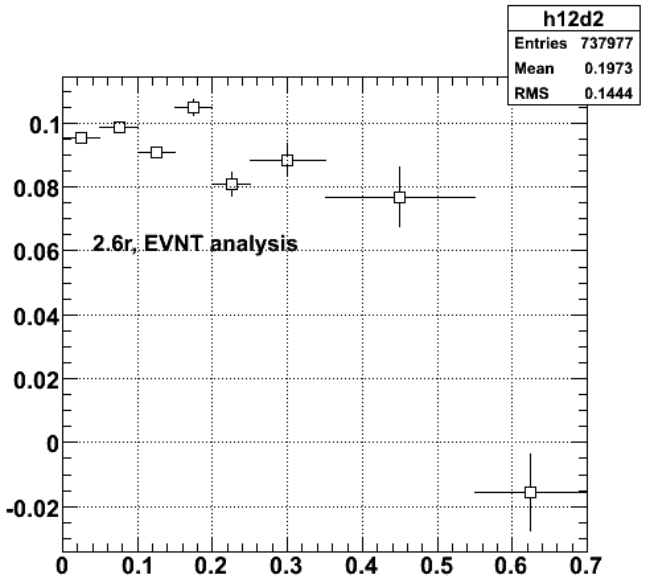
2006-07-17 09:55:20

Fig 1. ALTp for 2.6r, PART bank analysis, no efids or pfids.

Click here to view the object (ROOT CINT macro for Fig 1.) you uploaded.

Click here to view the object (ROOT histogram file for fig 1) you uploaded.

The second plot is for the EVNT analysis. It's ALTp after the events above goign through GSIM. The large difference in ALTp between the two is very disturbing. The immediate implication is that there is a large acceptance dependence in ALTp. Uugghh!



2006-07-17 10:05:44

Fig 2. ALTp for 2.6r, EVNT bank analysis, no efids or pfids.

Click here to view the object (ROOT CINT macro for Fig 2) you uploaded.

Click here to view the object (ROOT histogram file for fig 2) you uploaded.

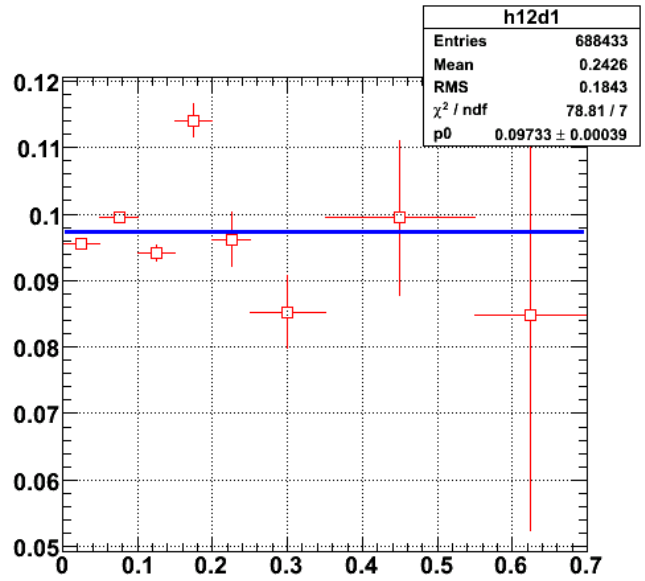


Fig 3. Same as Fig 2 with efids and pfids turned on.

Click here to view the object (ROOT CINT file for Fig 3) you uploaded.

Put the stuff above here.

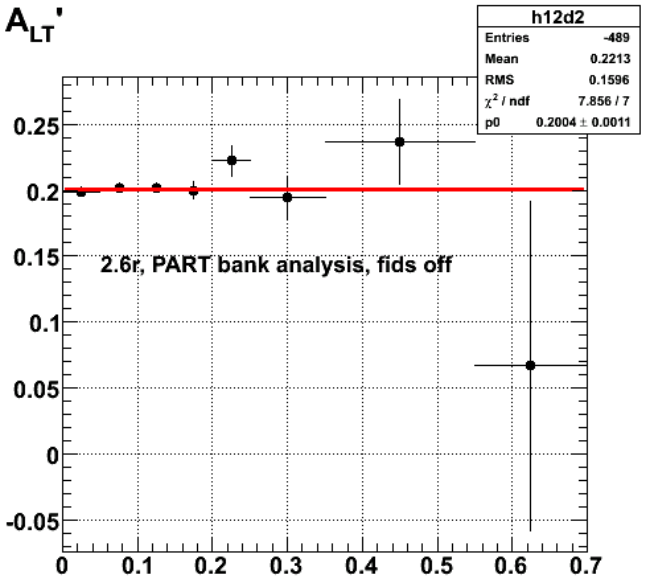


Fig 4. Corrected asymmetry for thrown events with fids off

Click here to view the object (ROOT CINT macro for Fig 4) you uploaded.

Click here to view the object (ROOT histogram file for Fig 4) you uploaded.

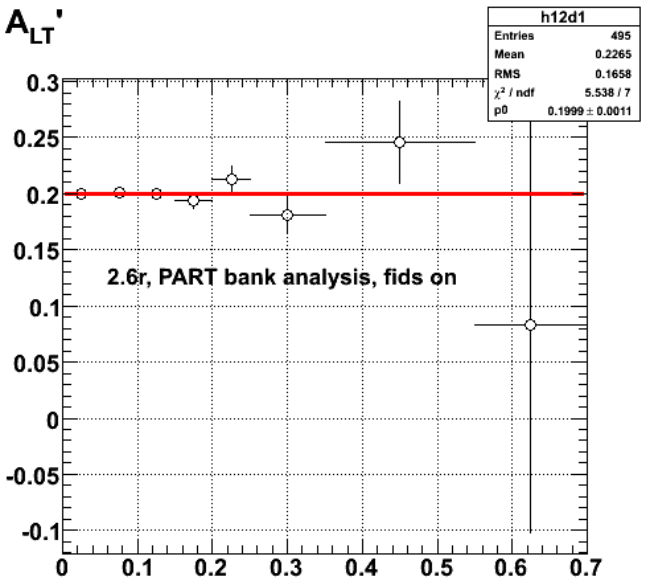


Fig 5. Corrected asymmetry for thrown events with fids on.

Click here to view the object (ROOT CINT macro for Fig 5) you uploaded.

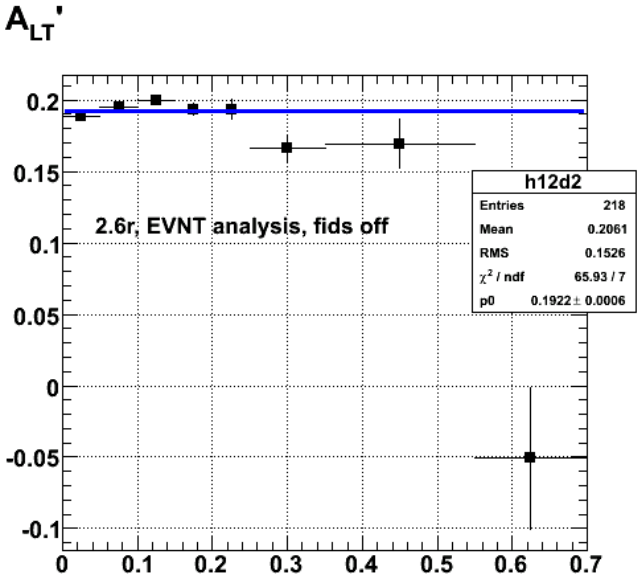


Fig 6. Corrected asymmetry for simulated events with fids off.

Click here to view the object (ROOT CINT macro for Fig 6) you uploaded.

Click here to view the object (ROOT histogram file for Fig 6) you uploaded.

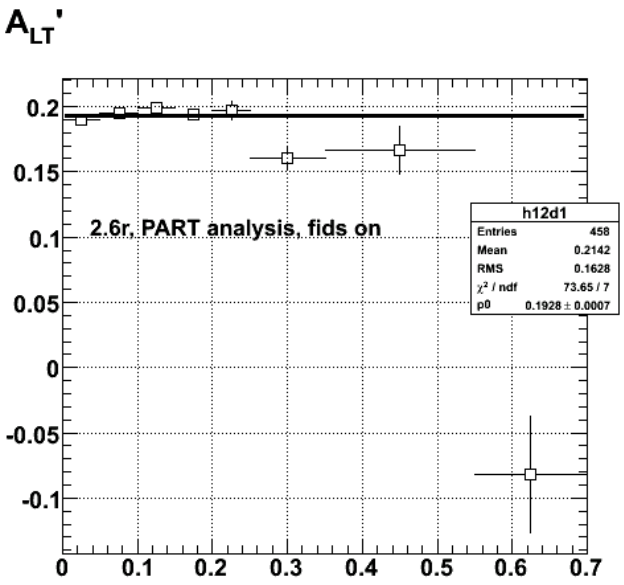


Fig 7. Corrected asymmetry for simulated events with fids on. This is EVNT analysis notPART. The plot is mislabelled.

Click here to view the object (ROOT CINT macro for Fig 7) you uploaded.

First look at acceptance corrections for E5 for different helicities. Use the same binning as the ALTp analysis for now and get the following ratio of accepted to thrown events.

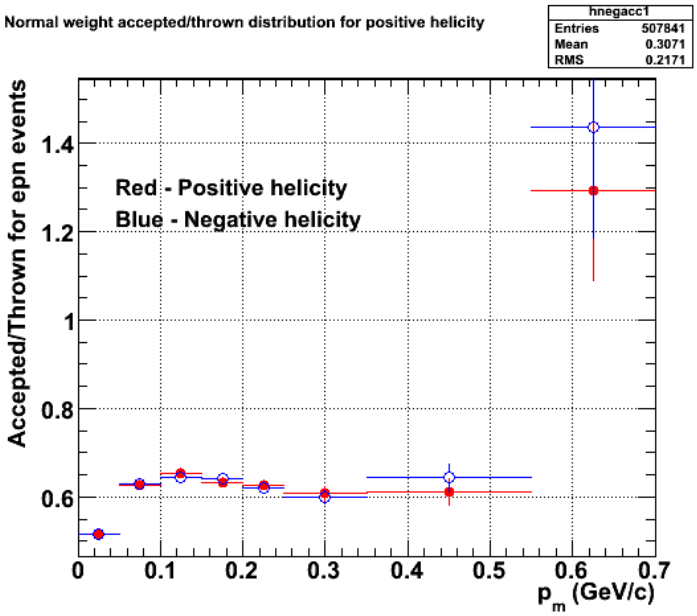


Fig 8. Ratio of accepted to thrown events as a function of missing momentum for 2.6r, positive and negative helicities.

Click here to view the object (ROOT CINT macro for negative helicity acceptance for Fig 8.) you uploaded.

Click here to view the object (ROOT CINT macro for positive helicity acceptance for Fig 8.) you uploaded.

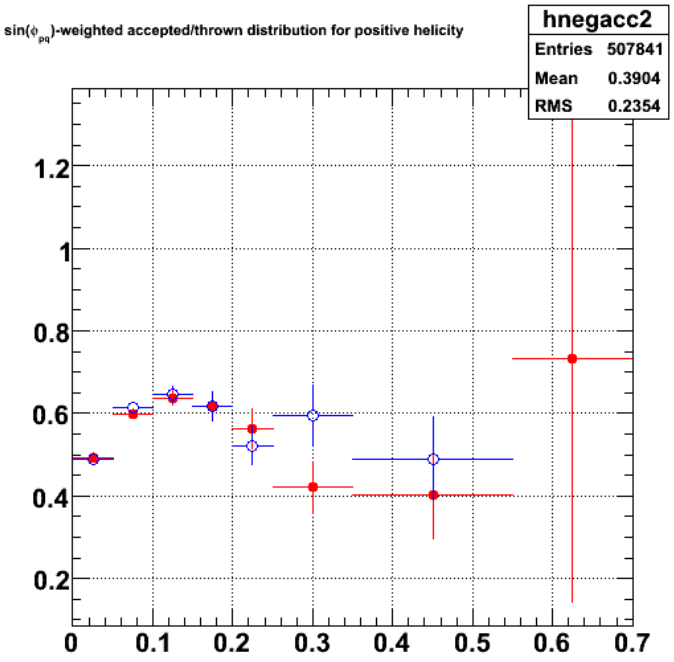


Fig 9. Ratio of accepted to thrown events as a function of missing momentum for 2.6r and sin(phi_pq)-weighted events, positive and negative helicities.

Click here to view the object (ROOT CINT macro for positive helicity acceptance for Fig 9.) you uploaded.

Click here to view the object (ROOT CINT macro for negative helicity acceptance for Fig 9.) you uploaded.

Comparison of acceptances for normal weighting of events and sin(phi_pq)-weighting and by helicity.

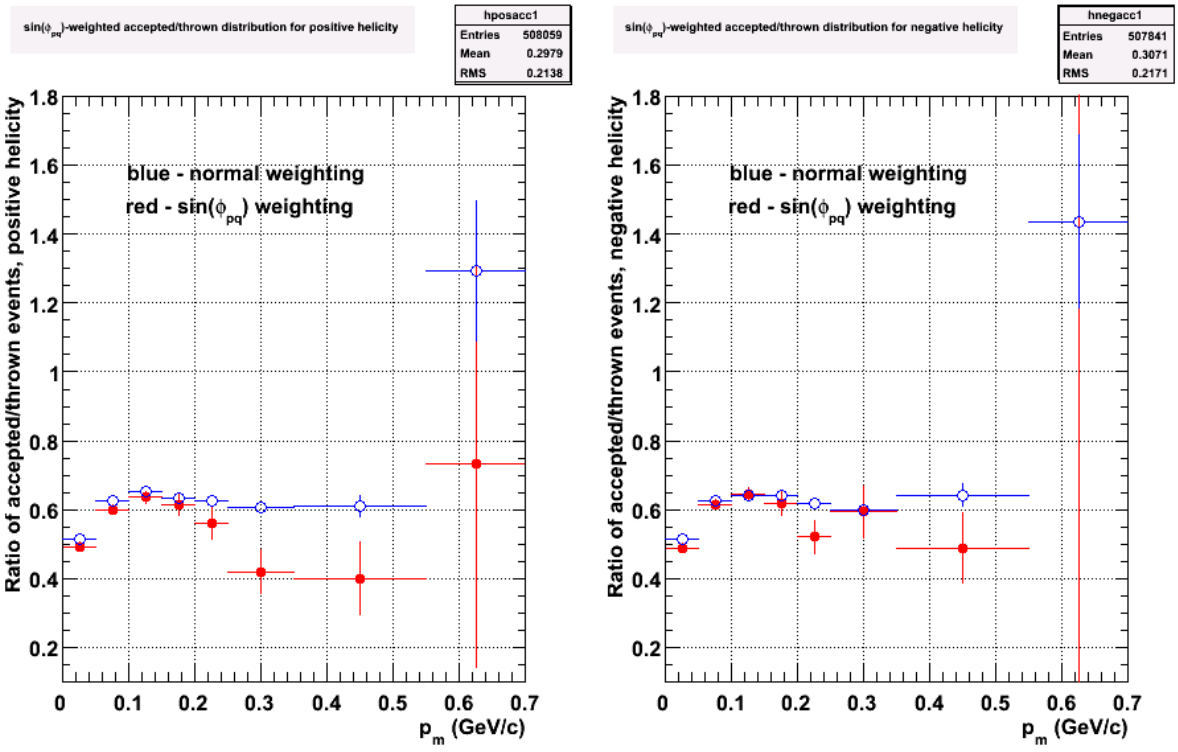


Fig 10. Comparison of acceptances for normal weighting of events and sin(phi_pq)-weighting and by helicity.

Click here to view the object (ROOT CINT macro for Fig 10) you uploaded.

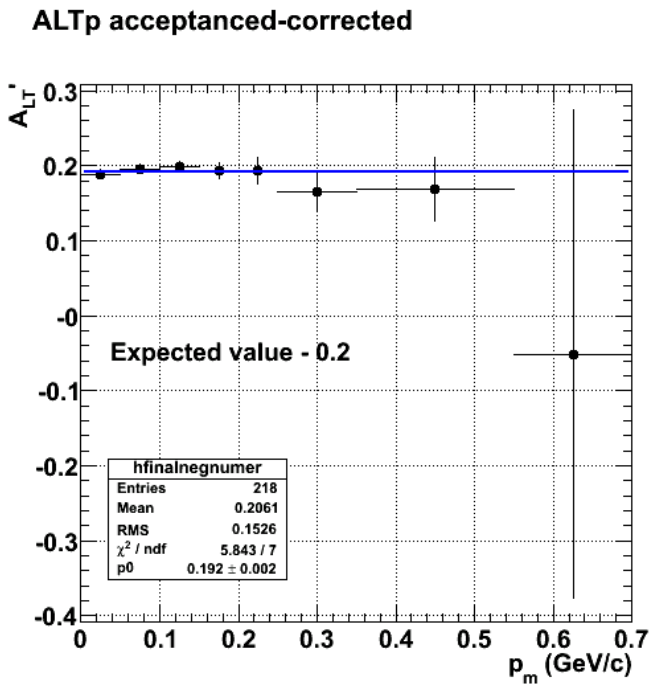


Fig 11. Acceptance-corrected ALTp, 2.6r, fods off.

Click here to view the object (ROOT CINT macro for fig 11) you uploaded.

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Jerry Gilfoyle's Enotebook page 130 - Checking ALTp=0.2 results (gpg)

[Modified Sat Jul 22 02:08:34 2006 (GMT) gpg]

Check the results of the previous entry in a more coherent sequence. The acceptance corrected asymmetry ALTp is defined in the following way

$$A'_{LT} = \langle \sin\phi_{pq} \rangle_+ - \langle \sin\phi_{pq} \rangle_-$$

$$A'_{LT} = \frac{1}{P_e} \frac{\frac{\sum_{h=+1} \sin\phi_{pq}}{Acc_+(\sin\phi_{pq})}}{\frac{N_+}{Acc_+(normal)}} - \frac{\frac{\sum_{h=-1} \sin\phi^i_{pq}}{Acc_-(\sin\phi_{pq})}}{\frac{N_-}{Acc_-(normal)}}$$

where P_e is the beam polarization, *normal* refers to event weighting of unity, and *Acc* is the acceptance for that particular bin in missing momentum p_m, Q2, and *W*. The figure below shows the ratio of the acceptance corrections for the positive polarity data from the simulation.

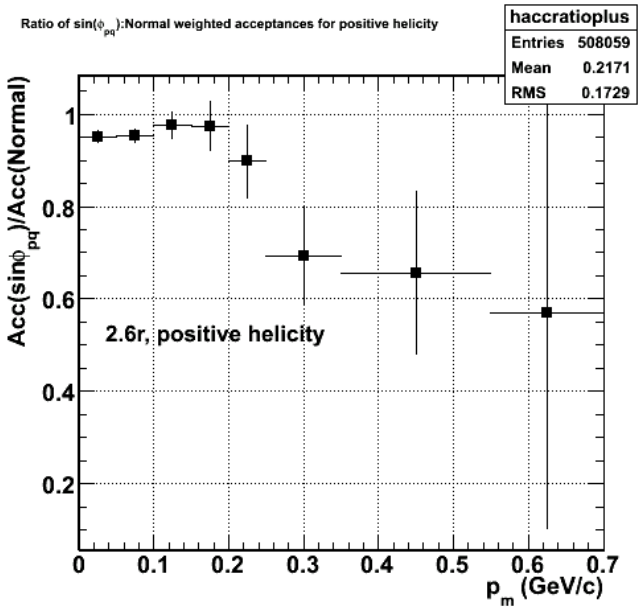


Fig 1. Ratio of sin(phi_pq) to normal weighted acceptances for positive helicity and 2.6 GeV, reversed polarity data.

Click here to view the object (ROOT CINT macro for Fig 1.) you uploaded.

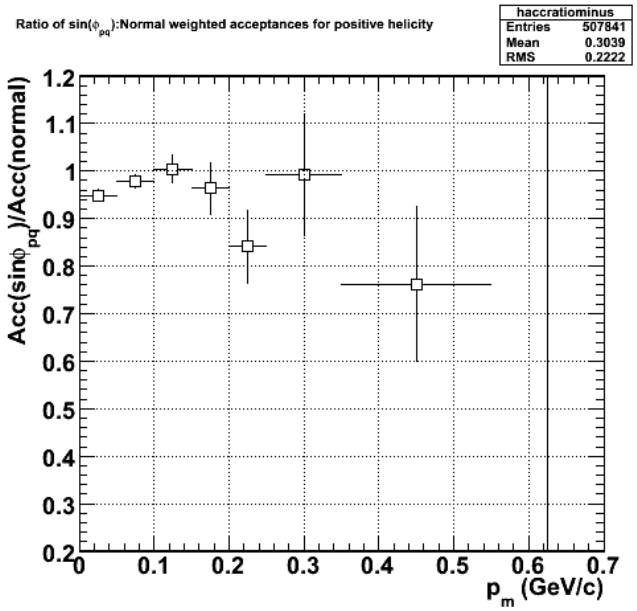


Fig 2. Ratio of sin(phi_pq) to normal weighted acceptances for negative helicity and 2.6 GeV, reversed polarity data. Note this is the negative helicity result. The plot is mislabelled.

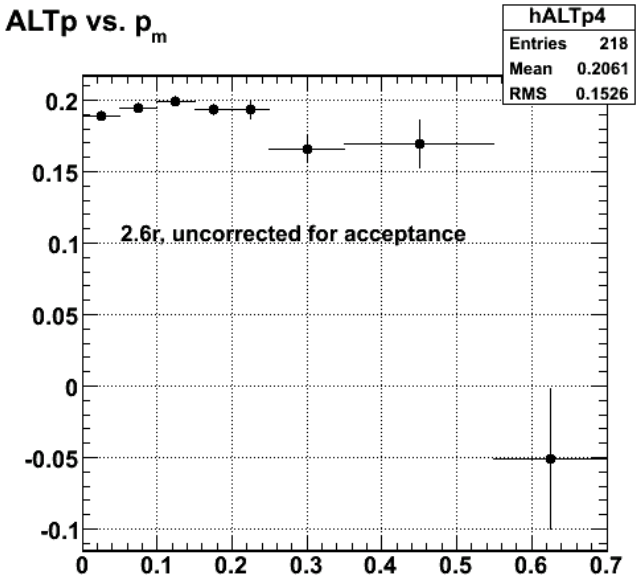


Fig 3. ALTp uncorrected for acceptance. Note: The correction for the beam polarization was left out.

Click here to view the object (ROOT CINT macro for fig 3]) you uploaded.

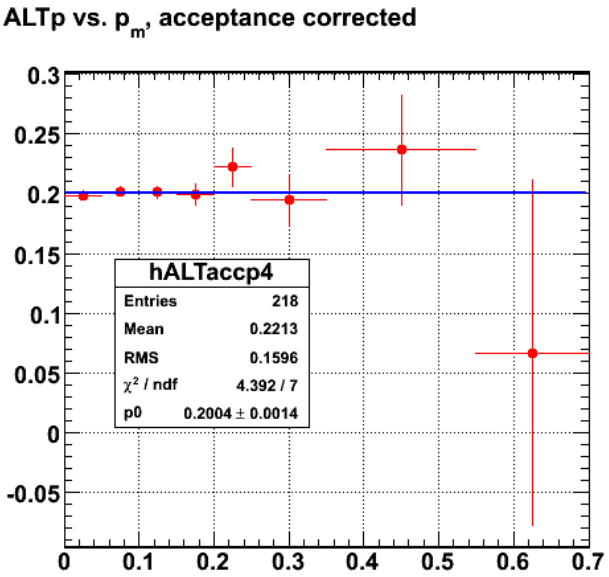


Fig 4. ALTp naively corrected for acceptance. Note: The correction for the beam polarization was left out.

Click here to view the object (ROOT CINT macro for Fig 4) you uploaded.

Click here to view the object (PART bank analysis result for this elog entry) you uploaded.

Click here to view the object (EVNT bank analysis for this elog entry) you uploaded.

The ROOT CINT code used to produce Fig 4 and the other figures above is below.

```
// clear out old stuff.
.! rm acc.root;
TFile *part = new TFile("part.root");
TFile *evnt = new TFile("evnt.root");
TFile *acc = new TFile("acc.root","recreate");
part.cd();
TH1F *hnormpartplus4  = (TH1F*)hp_m_unwghtplus4->Clone();
hnormpartplus4->SetName("hnormpartplus4");
TH1F *hsinphipartplus4  = (TH1F*)hp_m_sin_phi_wghtplus4->Clone();
hsinphipartplus4->SetName("hsinphipartplus4");
acc.cd();
TH1F *hnormpartplus4  = (TH1F*)hnormpartplus4->Clone();
TH1F *hsinphipartplus4  = (TH1F*)hsinphipartplus4->Clone();
evnt.cd();
TH1F *hnormevntplus4  = (TH1F*)hp_m_unwghtplus4->Clone();
hnormevntplus4->SetName("hnormevntplus4");
TH1F *hsinphievntplus4  = (TH1F*)hp_m_sin_phi_wghtplus4->Clone();
hsinphievntplus4->SetName("hsinphievntplus4");
acc.cd();
TH1F *hnormevntplus4  = (TH1F*)hnormevntplus4->Clone();
TH1F *hsinphievntplus4  = (TH1F*)hsinphievntplus4->Clone();

// get ratios for positive helicity.
Double_t p_m_bin_edges[13]={0.0,0.05,0.10,0.15,0.20,0.25,0.35,0.55,0.70,1.0,1.25,1.5,2.0};
Int_t n_varp_mbins = 12;
TH1F *hnormplus = new TH1F("hnormplus","Accepted/Thrown for normal-weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
hnormplus.Sumw2();
hnormplus.Divide(hnormevntplus4, hnormpartplus4);

TH1F *hsinphiplus = new TH1F("hsinphiplus","Accepted/Thrown for sin(#phi_{pq})-weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
hsinphiplus.Sumw2();
hsinphiplus.Divide(hsinphievntplus4, hsinphipartplus4);

TH1F *haccratioplus = new TH1F("haccratioplus","Ratio of sin(#phi_{pq}):Normal weighted acceptances for positive helicity",n_varp_mbins,p_m_bin_edges);
haccratioplus.Sumw2();
haccratioplus.Divide(hsinphiplus,hnormplus);


// negative helicity results.
part.cd();
TH1F *hnormpartminus4  = (TH1F*)hp_m_unwghtminus4->Clone();
hnormpartminus4->SetName("hnormpartminus4");
TH1F *hsinphipartminus4  = (TH1F*)hp_m_sin_phi_wghtminus4->Clone();
hsinphipartminus4->SetName("hsinphipartminus4");
acc.cd();
TH1F *hnormpartminus4  = (TH1F*)hnormpartminus4->Clone();
TH1F *hsinphipartminus4  = (TH1F*)hsinphipartminus4->Clone();
evnt.cd();
TH1F *hnormevntminus4  = (TH1F*)hp_m_unwghtminus4->Clone();
hnormevntminus4->SetName("hnormevntminus4");
TH1F *hsinphievntminus4  = (TH1F*)hp_m_sin_phi_wghtminus4->Clone();
hsinphievntminus4->SetName("hsinphievntminus4");
```

```
acc.cd();
TH1F *hnormevntminus4  = (TH1F*)hnormevntminus4->Clone();
TH1F *hsinphievntminus4  = (TH1F*)hsinphievntminus4->Clone();



// get ratios for negative helicity.
TH1F *hnormminus = new TH1F("hnormminus","Accepted/Thrown for normal-weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges);
hnormminus.Sumw2();
hnormminus.Divide(hnormevntminus4, hnormpartminus4);

TH1F *hsinphiminus = new TH1F("hsinphiminus","Accepted/Thrown for sin(#phi_{pq})-weighted distribution for positive helicity",n_varp_mbins,p_m_bin_edges
hsinphiminus.Sumw2();
hsinphiminus.Divide(hsinphievntminus4, hsinphipartminus4);

TH1F *haccratiominus = new TH1F("haccratiominus","Ratio of sin(#phi_{pq}):Normal weighted acceptances for positive helicity",n_varp_mbins,p_m_bin_edges)
haccratiominus.Sumw2();
haccratiominus.Divide(hsinphiminus,hnormminus);

// get ALTp without acceptance correction.

acc.cd();
// positive helicity part first.
TH1F *hsinphiplus4 = new TH1F("hsinphiplus4","sin#phi_{pq} vs. p_{m} for positive helicity",n_varp_mbins,p_m_bin_edges);
hsinphiplus4.Sumw2();
hsinphiplus4.Divide(hsinphievntplus4,hnormevntplus4);
// negative helicity part
TH1F *hsinphiminus4 = new TH1F("hsinphiminus4","sin#phi_{pq} vs. p_{m} for negative helicity",n_varp_mbins,p_m_bin_edges);
hsinphiminus4.Sumw2();
hsinphiminus4.Divide(hsinphievntminus4,hnormevntminus4);
// subtract the pieces.
TH1F *hALTp4 = new TH1F("hALTp4","ALTp vs. p_{m}",n_varp_mbins,p_m_bin_edges);
hALTp4.Sumw2();
hALTp4.Add(hsinphiplus4,hsinphiminus4,1.0,-1.0);
hALTp4.Draw();

// get ALTp with acceptance correction.

TH1F *hsinphiaccplus4 = new TH1F("hsinphiaccplus4","sin#phi_{pq} vs. p_{m} for positive helicity, acceptance corrected",n_varp_mbins,p_m_bin_edges);
hsinphiaccplus4.Sumw2();
hsinphiaccplus4.Divide(hsinphiplus4,haccratioplus);

TH1F *hsinphiaccminus4 = new TH1F("hsinphiaccminus4","sin#phi_{pq} vs. p_{m} for negative helicity, acceptance corrected",n_varp_mbins,p_m_bin_edges);
hsinphiaccminus4.Sumw2();
hsinphiaccminus4.Divide(hsinphiminus4,haccratiominus);

TH1F *hALTpacc4 = new TH1F("hALTaccp4","ALTp vs. p_{m}, acceptance corrected",n_varp_mbins,p_m_bin_edges);
hALTpacc4.Sumw2();
hALTpacc4.Add(hsinphiaccplus4,hsinphiaccminus4,1.0,-1.0);
hALTpacc4.Draw();

acc->Write();                                          // write out new stuff.
```

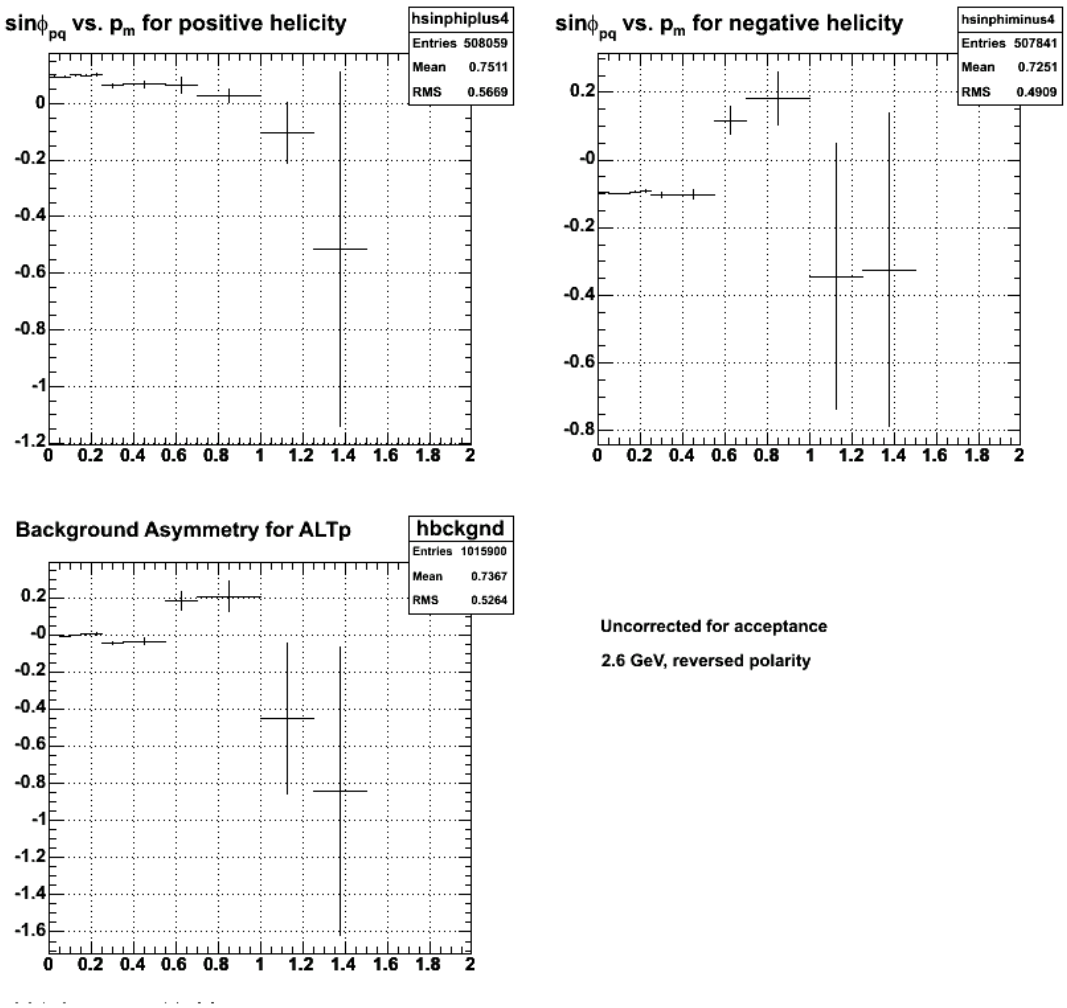


Fig 5. Background asymmetry with input spectra for 2.6r, uncorrected for acceptance. Note: I left off an overall factor of 0.5 that should multiply all the background asymmetry points for the lower, left-hand panel.

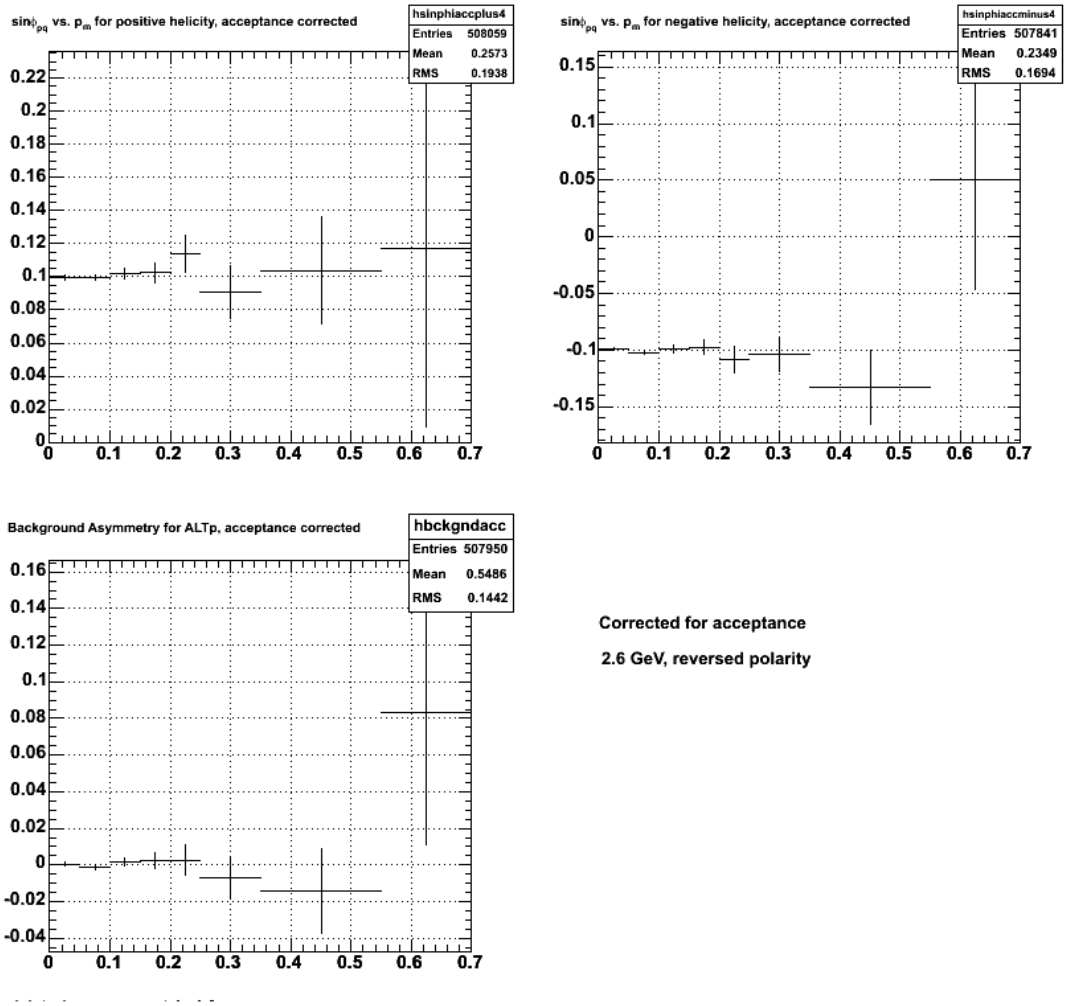


Fig 6. Background asymmetry with input spectra for 2.6r, corrected for acceptance.

Click here to view the object (ROOT CINT macro for Fig 6) you uploaded.

Look at ALTp with a longer simulation run. The events from the first run were added so the number of events should go up by about a factor of five or so.

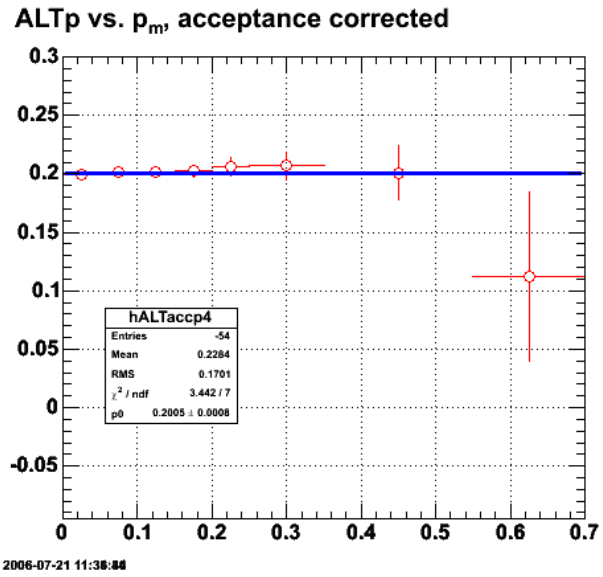


Fig 7. ALTp corrected for acceptance with more simulated events.

Click here to view the object (ROOT CINT macro for Fig 7) you uploaded.

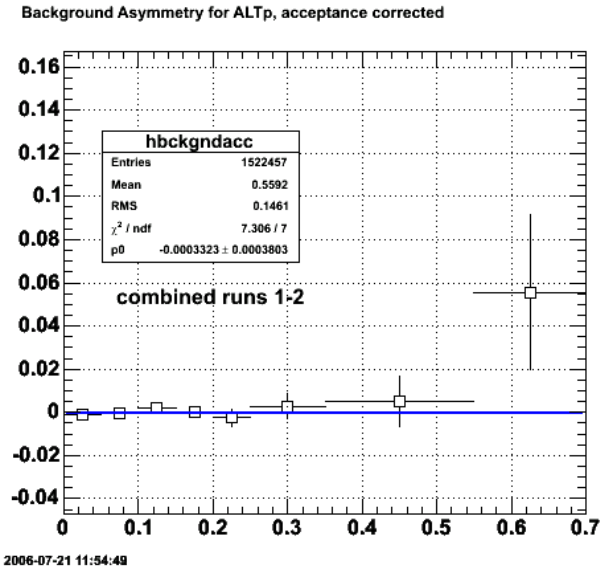


Fig 8. Background asymmetry for combined simulations runs.

Click here to view the object (ROOT CINT macro for Fig 8) you uploaded.

Click here to view the object (ROOT histogram file for run2 PART bank analysis) you uploaded.

Click here to view the object (ROOT histogram file for run2 EVNT bank analysis) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 131 - Exclurad tests (gpg)

[Added Sat Jul 29 01:23:53 2006 (GMT) gpg]

Below are links to files with results from my exclurad radiative correction tests.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 132 - p_m dependent tests (gpg)

[Modified Thu Aug 10 21:08:51 2006 (GMT) gpg]

Below are some (confusing) results playing around with different forms of the thrown ALTp.

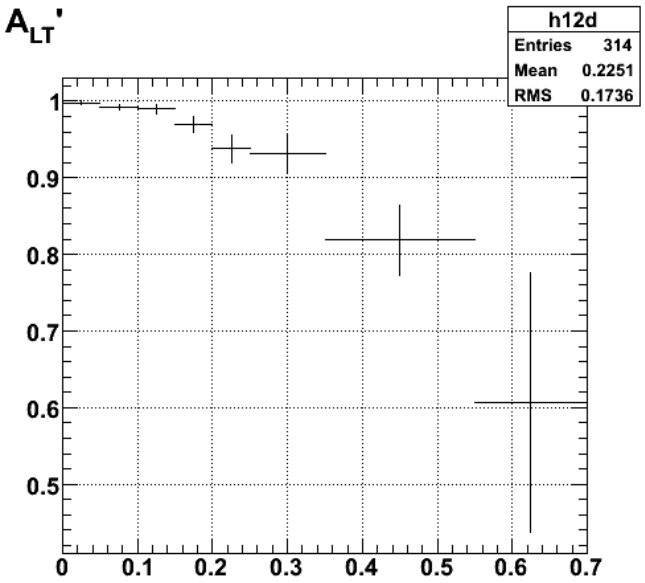


Fig 1. ALTp for amp = helicity_sign*pfermi2???

Click here to view the object (ROOT CINT macro for Fig 1) you uploaded.

The problem with my results up to now is that i was basing everything on the fermi momentum and it should be based on the missing momentum in the *d(e,e'p)n* reaction. I have modified queeg so that the modification of phi_pq depends on p_m and not on the fermi momentum. Some first results from those changes are shown in Fig 2. The amplitude for the fifth structure function (the piece that depends on sin(phi_pq) is the following

```
amp = -0.3     p_m < 0.1 GeV/c
amp = +0.1     p_m > 0.1 GeV/c
```

which is precisely reproduced for the thrown events.

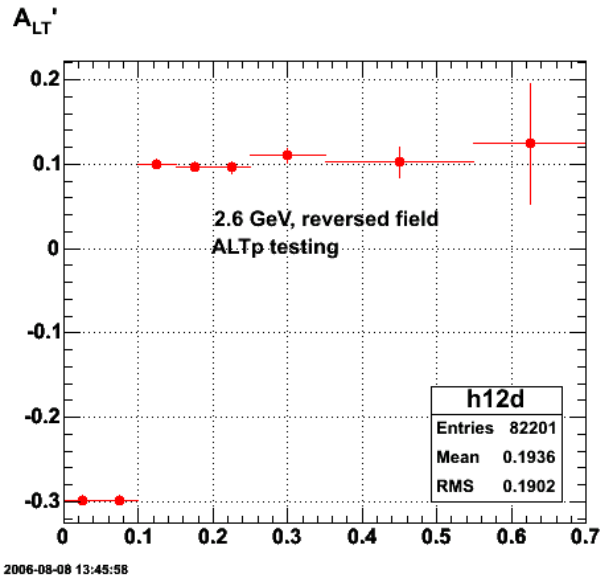


Fig 2. ALTp for thrown events with queeg. Based on 150,000 events per node.

Click here to view the object (ROOT CINT macro for Fig 2) you uploaded.

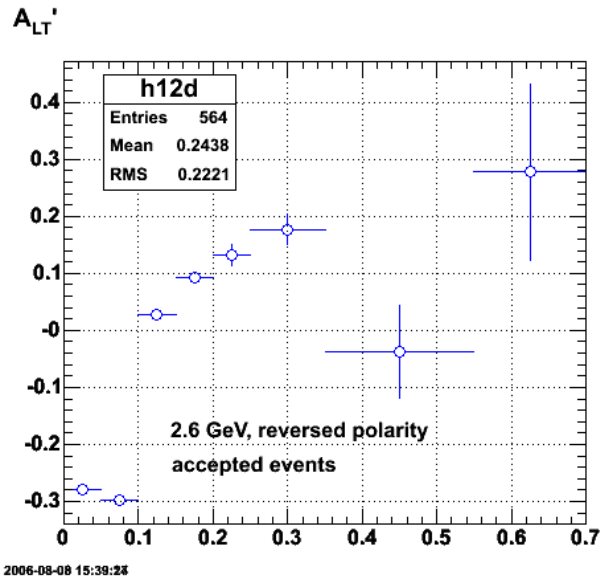


Fig 3. ALTp for accepted events with queeg. Based on 5,000 events per node.

Click here to view the object (ROOT CINT macro for Fig 3.) you uploaded.

Click here to view the object (ROOT histogram file for accepted events for Fig 3) you uploaded.

Click here to view the object (ROOT histogram file for thrown events for Fig 3) you uploaded.

The stuff above looks good though the acceptance dependence of ALTp is surprising.

Try another, more realistic, amplitude function. The one I used is

```
amp = -((0.05*x) + (-8.0*x*x) + (-5.0*x*x*x))*exp(-10.0*x)
```

where the parameters were picked to at least roughly look like the 2.6r data. The results for the thrown events are shown below. The black curve is a plot of the input asymmetry above drawn on top of the asymmetry extracted from the PART bank (the thrown events) generated by QUEEG.

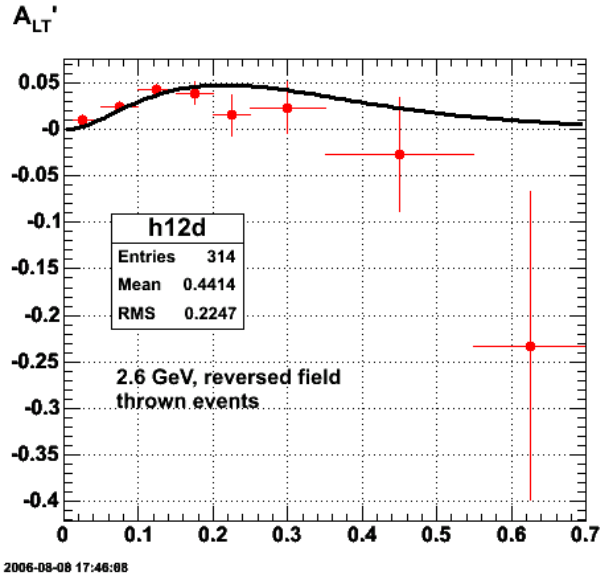


Fig 4. ALTp for thrown events with a different input asymmetry for 15,000 events per node. The black curve is the function used to determine the input asymmetry in QUEEG.

Now do a longer run.

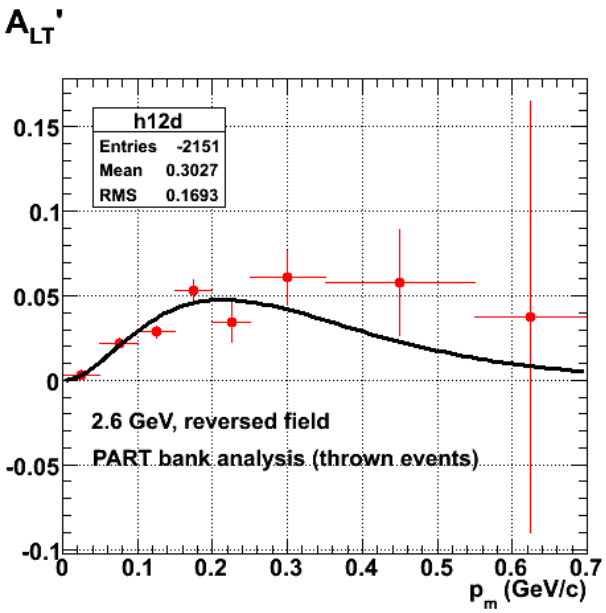


Fig 5. ALTp for thrown events with a different input asymmetry for 55,000 events per node. The black curve is the function used to determine the input asymmetry in QUEEG.

Holy Shit! What is this???

The gsim output files for the analysis of Figs 5-7 are in /data3/e5/sim/run4.

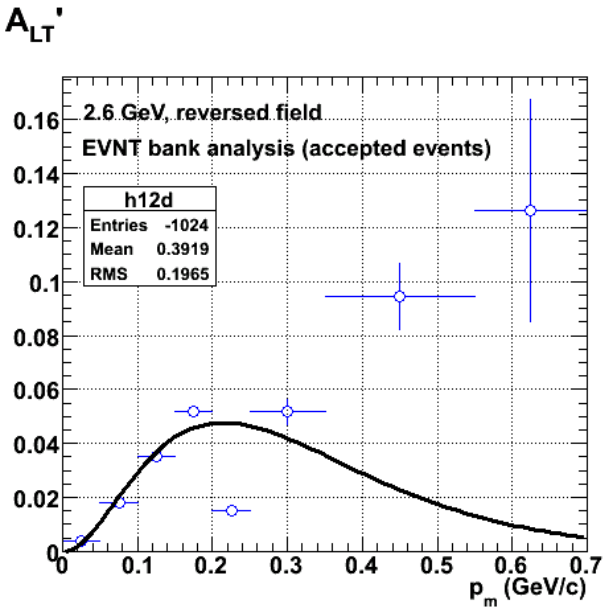


Fig 6. ALTp for accepted events with a different input asymmetry for 55,000 events per node. The black curve is the function used to determine the input asymmetry in QUEEG.

Click here to view the object (ROOT CINT macro for Fig 6) you uploaded.

Click here to view the object (PART analysis ROOT histogram file for Figs 5-6) you uploaded.

Click here to view the object (EVNT analysis ROOT histogram file for Figs 5-6) you uploaded.

Click here to view the object (example of log file for node 0 for sim runs for figs 5-6) you uploaded.

Do the acceptance correction used in entry 130.

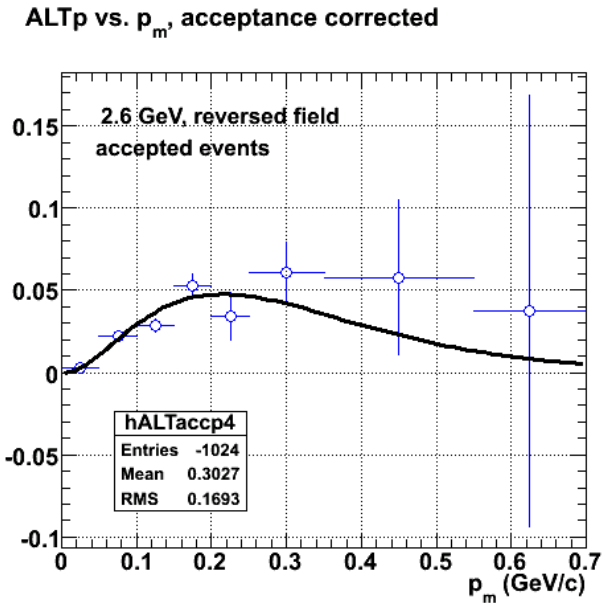


Fig 7. Acceptance corrected ALTp. Compare with Fig 6

Click here to view the object (ROOT CINT macro for Fig 7) you uploaded.

Set the amplitude of the fifth structure function to zero to see if the distortion of the accepted data persists. It does! This is a disaster! Maybe not. It just may be the asymmetry is zero which would surprise lots of theorists. The results in Fig 8 are for fiducial cuts off. Putting the fiducial cuts on changes the asymmetry just slightly and well within the uncertainty.

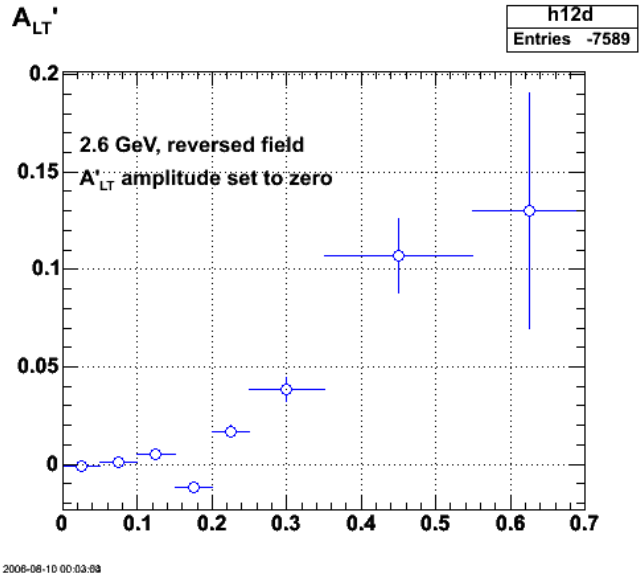


Fig 8. ALTp for accepted events with a different input asymmetry for 25,000 events per node. The input asymmetry in QUEEG was set to zero.

Click here to view the object (ROOT CINT macro for fig 8) you uploaded.

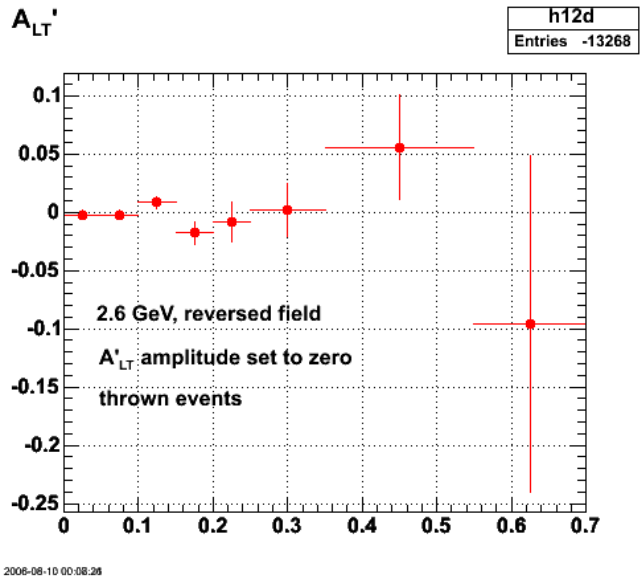


Fig 8. ALTp for thrown events with a different input asymmetry for 25,000 events per node. The input asymmetry in QUEEG was set to zero.

Click here to view the object (ROOT CINT FOR fIG 8) you uploaded.

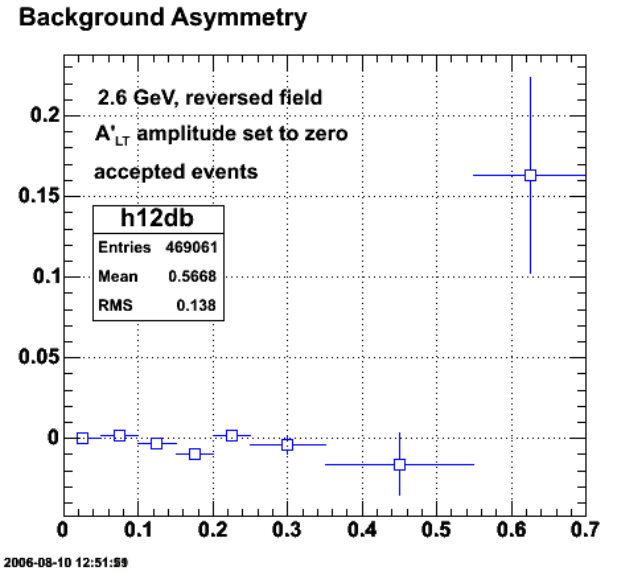


Fig 9. Background asymmetry for accepted events with a different input asymmetry for 25,000 events per node. The input asymmetry in QUEEG was set to zero.

Click here to view the object (ROOT CINT macro fig Fig 9) you uploaded.

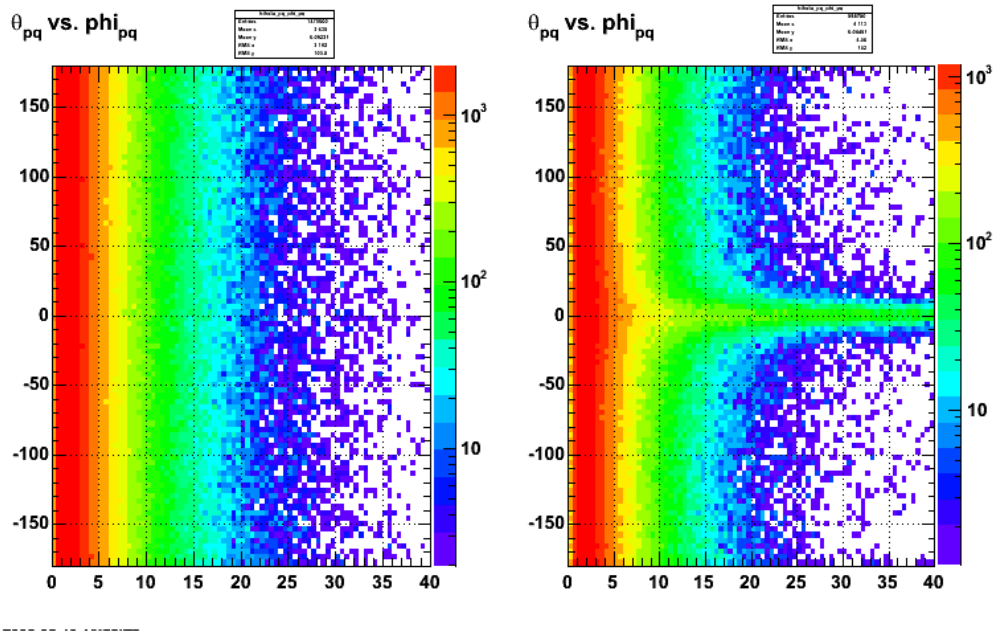


Fig 10. The labelling is backwards. Its phi_pq versus theta_pq. The PART bank results are on the left, the EVNT results are on the right. How do all those events get pushed into the midplane????

Click here to view the object (ROOT CINT macro for Fig 10) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 133 - queeg modifications (gpg)

[Modified Fri Aug 18 03:45:47 2006 (GMT) gpg]

I have modified Jeff's event generator QUEEG in order to study the effect of the CLAS acceptance on the fifth structure function analysis. The goal here is to control the size of the sin(phi_pq) dependent part of the $D(e,e'p)n$ cross section. By controlling this part of the cross section we can compare the value used in the event generator with the final results of the analysis chain. First, let me summarize how QUEEG generates events.

1. Pick a magnitude for the Fermi momentum of the proton from the Hulthen distribution and give it a random direction in the laboratory frame.
2. Transform to the (now moving) rest frame of the proton. Calculate a new beam energy for the incoming electron relative to this new rest frame of the proton.
3. Select the angle of the scattered electron based on the cross section for elastic scattering at this new electron energy.
4. Transform the angle of the scattered electron from the proton rest frame into the lab frame.
5. Determine the scattered electron energy for the $d(e,e'p)n$ reaction using the known momentum of the neutron (i.e. the negative of the fermi momentum of the proton picked in part 1).
6. Calculate the q 3-vector (3-momentum transfer), p_p (proton 3-momentum), *etc.* in the lab for this quasi-elastic scattering.
7. Randomly select the lab azimuthal angle (phi) and rotate the 3-vectors for the momentum transfer, proton, and scattered electron momenta and you're done.

The modifications I have made have been to change the angle phi_pq, the angle between the scattering plane (defined by the incoming and outgoing electron 3-momenta) and the reaction plane (defined by the proton and momentum transfer 3-vectors). The direction of the momentum transfer, the magnitude of the proton 3-vector, and the angle theta_pq are unchanged. The modifications are made steps 6 and 7 above.

1. Calculate the missing momentum based on the known momentum of the beam, scattered electron and proton. This, of course, agrees with the neutron momentum mentioned in step 5.
2. Rotate coordinates so that the z-axis is now in the direction of the 3-momentum transfer q. The y-axis stays the same for this new coordinate system and the lab system.
3. Randomly generate a new phi_pq based on a sinusoidal distribution with an amplitude that depends on the magnitude of the missing momentum.
4. calculate a new missing momentum 3-vector with the same magnitude as in part 1, but with a different phi_pq using the result of part 3.
5. Rotate back to the lab coordinate system with the z-axis along the beam.
6. Calculate a new proton 3-vector using the original beam, target, and scattered electron momenta and the modified neutron momentum.

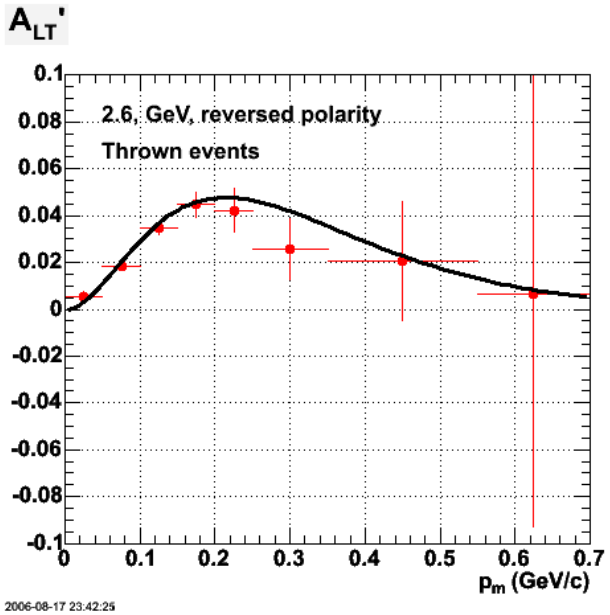


Fig 1. ALTp for thrown events with queeg modified for fifth structure function. Based on 100,000 events per node.

Click here to view the object (ROOT CINT macro for Fig 1.) you uploaded.

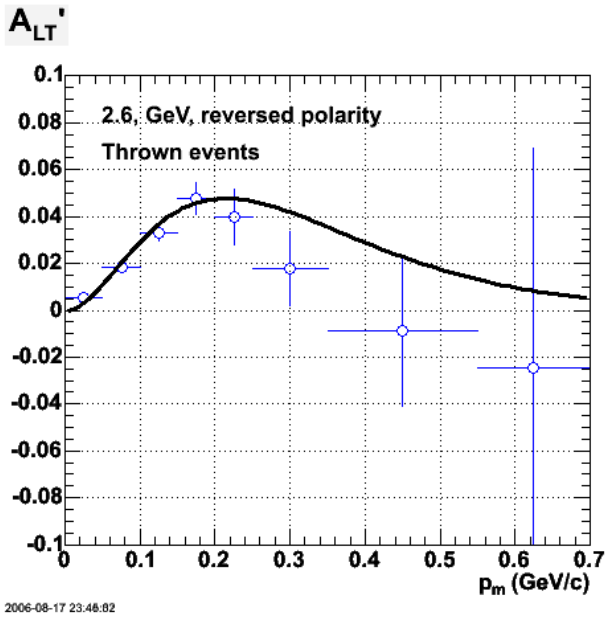


Fig 1. ALTp for accepted events with queeg modified for fifth structure function. Based on 100,000 events per node.

Click here to view the object (ROOT CINT macro for Fig 2.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 134 - the background asymmetry mystery (gpg)

[Modified Tue Aug 29 23:32:41 2006 (GMT) gpg]

Plots for unraveling the background asymmetry mystery.

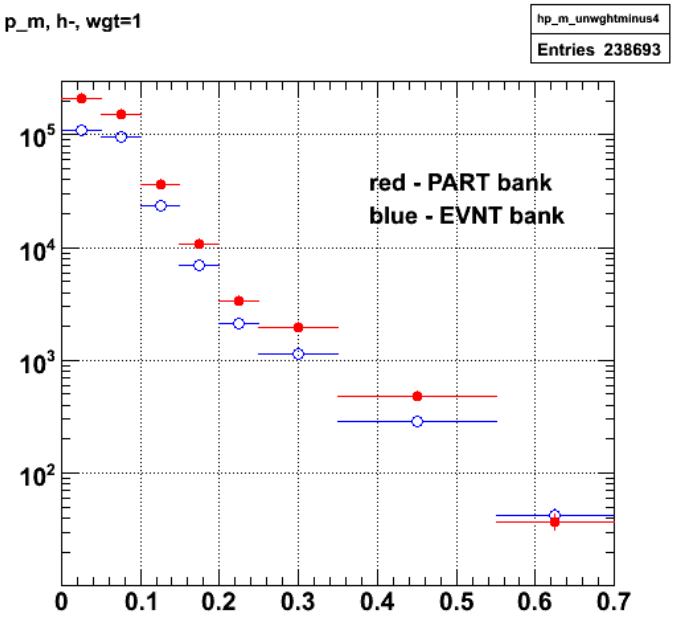


Fig 1. Normal-weighted distribution.

Click here to view the object (ROOT CINT macro for Fig 1) you uploaded.

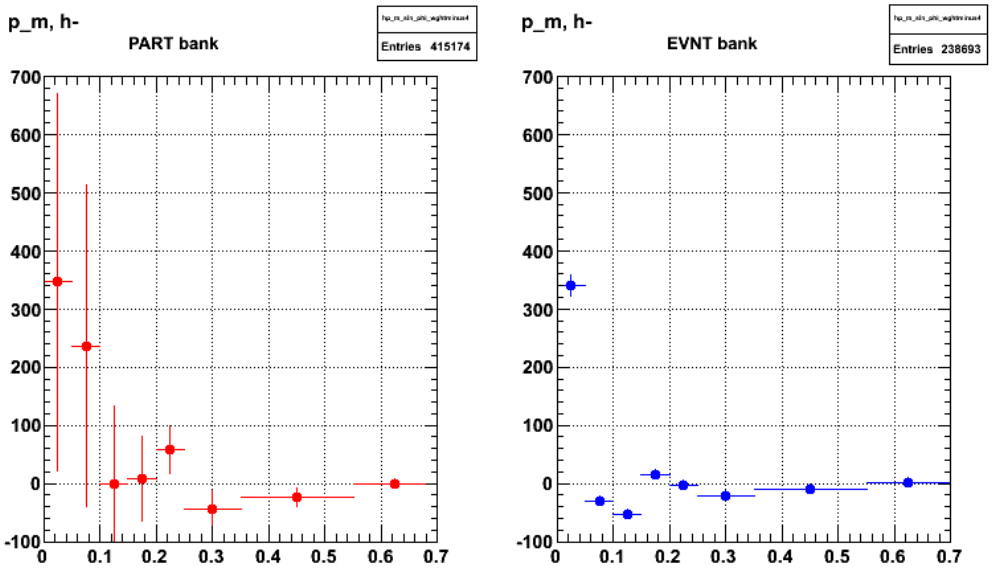


Fig 2. Sin(phi_pq)-weighted distribution.

Click here to view the object (ROOT CINT macro for Fig 2) you uploaded.

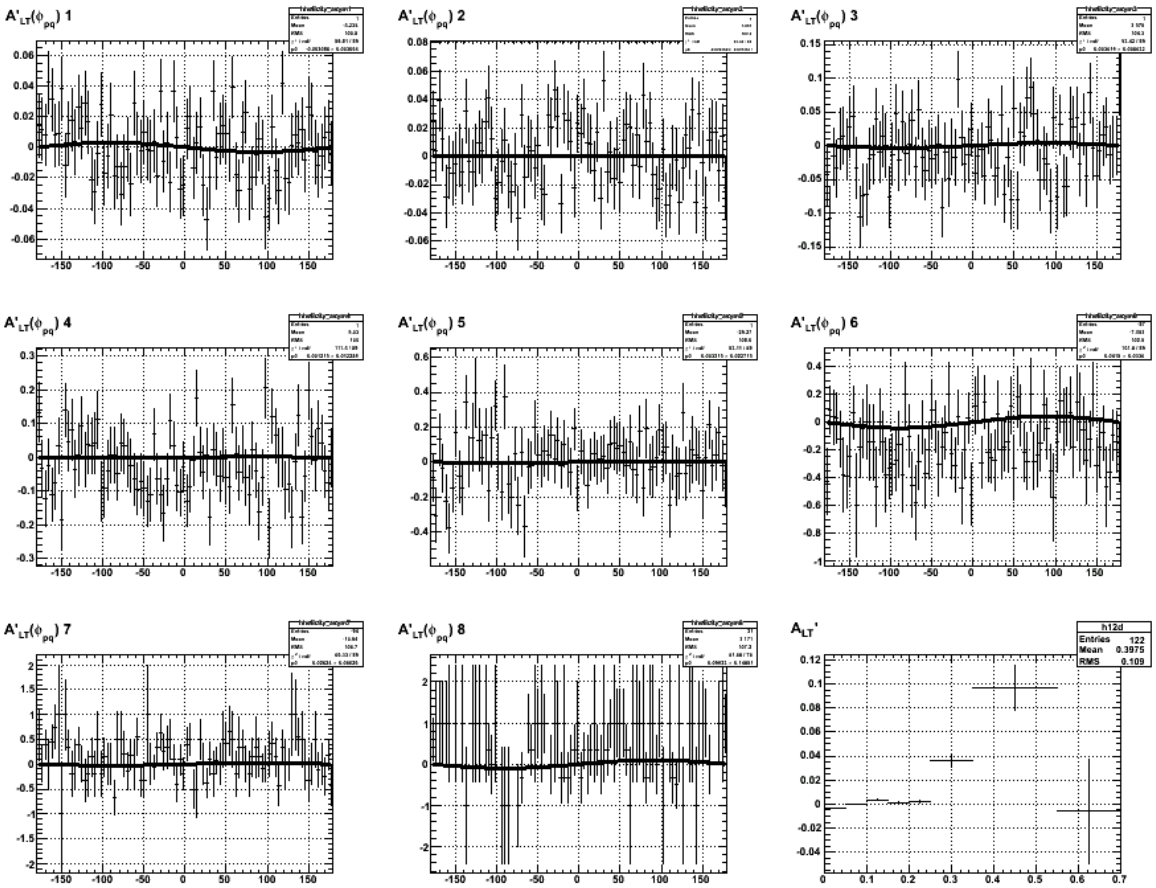


Fig 3. Helicity asymmetry fits.

Click here to view the object (ROOT CINT macro for Fig 4) you uploaded.

Click here to view the object (PS version of Fig 4) you uploaded.

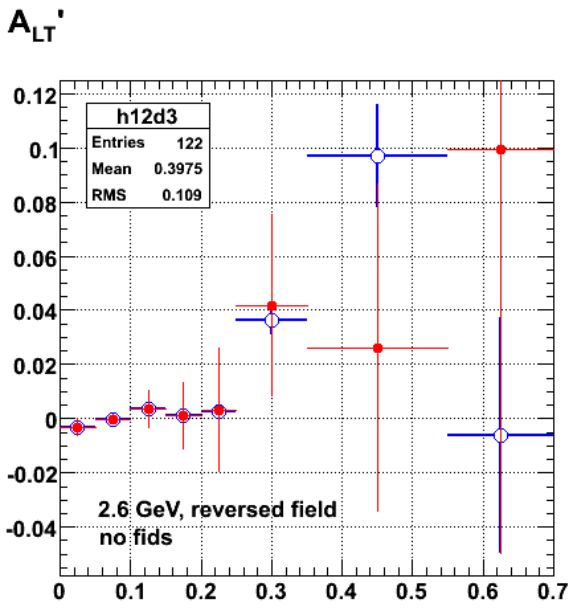


Fig 5. Comparison of ALtp from simulation with analysis and helicity asymmetry analysis.

Click here to view the object (ROOT CINT macro for Fig 5) you uploaded.

The gsim/gpp files used in the analysis above are stored in /data3/e5/sim/run5/. As usual it was pilot error. I had modularized the analysis code so that I could use the same functions to analyse the EVNT banks and the PART banks. One module defined the way to calculate the errors for the histograms used to extract ALTp. Well, bonehead me forgot to call that function in the EVNT analysis so the uncertainties for the EVNT analysis were wrong. When corrected I get the results below when the amplitude of the asymmetry is set to zero.

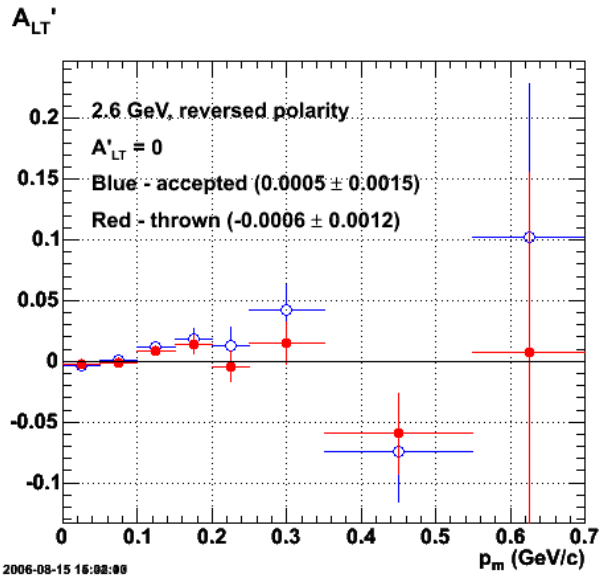


Fig 6. Comparison of ALTp for accepted and thrown events after correcting the calculation of the uncertainties for the EVNT bank analysis. The numbers for each curve are the results of MINUIT fits to a flat line to demonstrate the data are consistent with zero.

Click here to view the object (ROOT CINT macro for Fig 6.) you uploaded.

Click here to view the object (ROOT histogram file with PART bank analysis for Fig 6.) you uploaded.

Click here to view the object (ROOT histogram file with EVNT bank analysis for Fig 6.) you uploaded.

The gpp files for Fig 6 are stored in /data3/e5/sim/run6/.

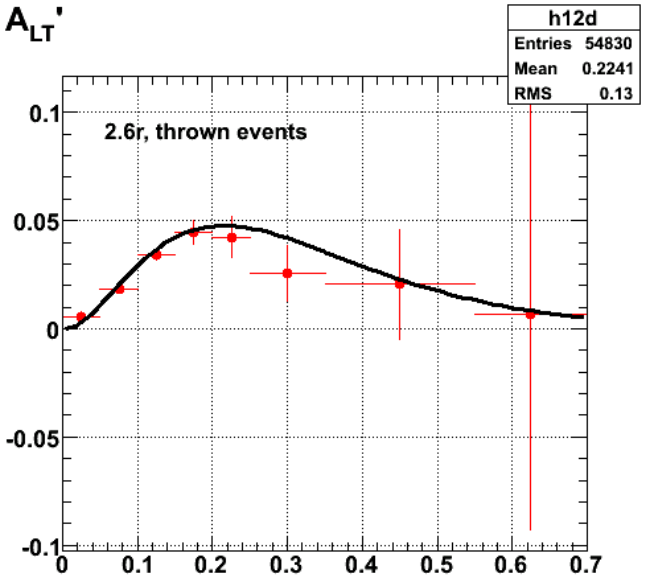


Fig 7. 2.6r, thrown events

Click here to view the object (ROOT CINT macro for fig 7) you uploaded.

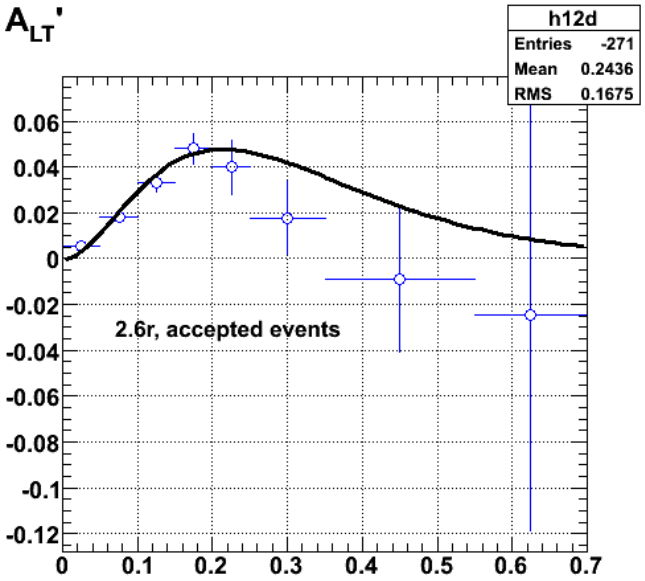


Fig 8. 2.6r, accepted events

Click here to view the object (ROOT CINT macro fog Fig 8.) you uploaded.

The results of the simulation for Figs 7-8 are stored in /data3/e5/sim/run7/.

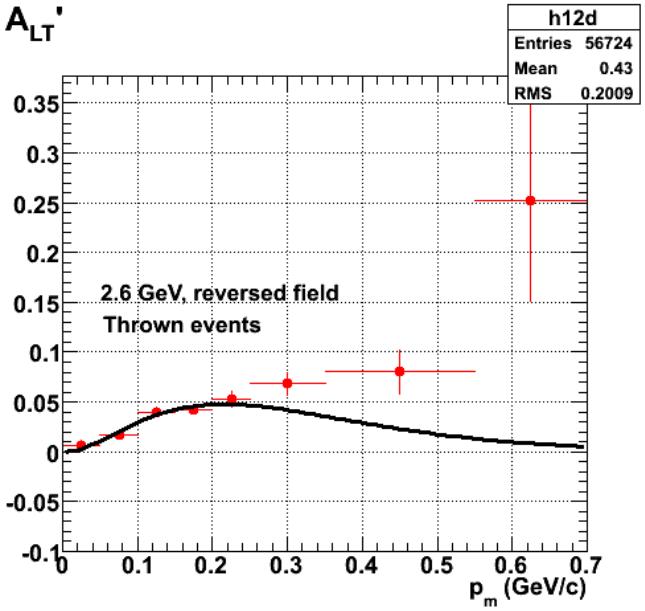


Fig 9. 2.6r, thrown events for runs 7-8

Click here to view the object (ROOT CINT macro for Fig 9) you uploaded.

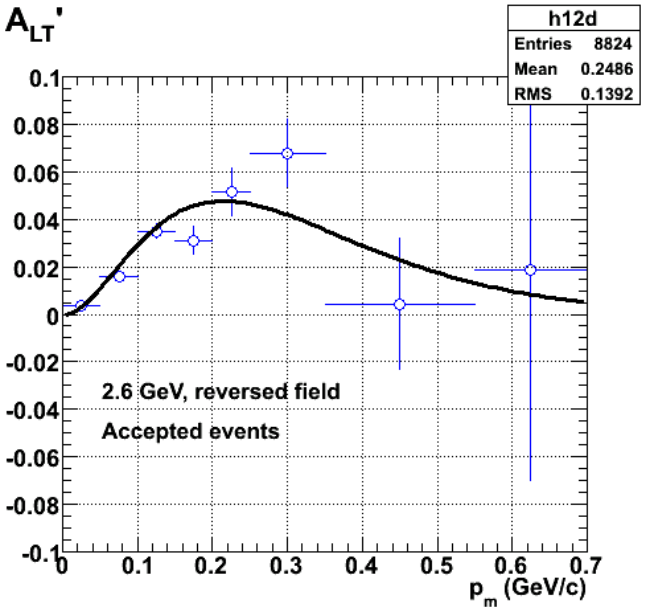


Fig 10. 2.6r, accepted events for runs 7-8

Click here to view the object (ROOT CINT macro for Fig 10) you uploaded.

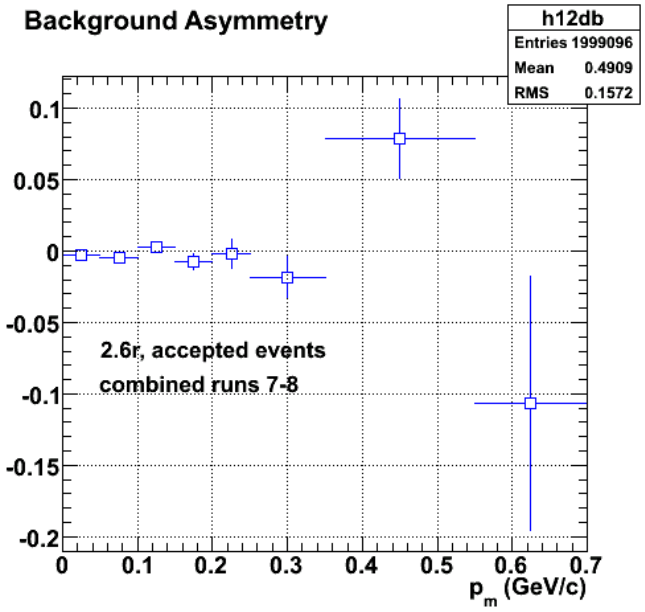


Fig 11. Background asymmetry for runs 7-8 and figs 9-10

Click here to view the object (ROOT CINT file for fig 11) you uploaded.

The results of the simulation for Figs 9-11 are combined results from /data3/e5/sim/run7/ and /data3/e5/sim/run8/.

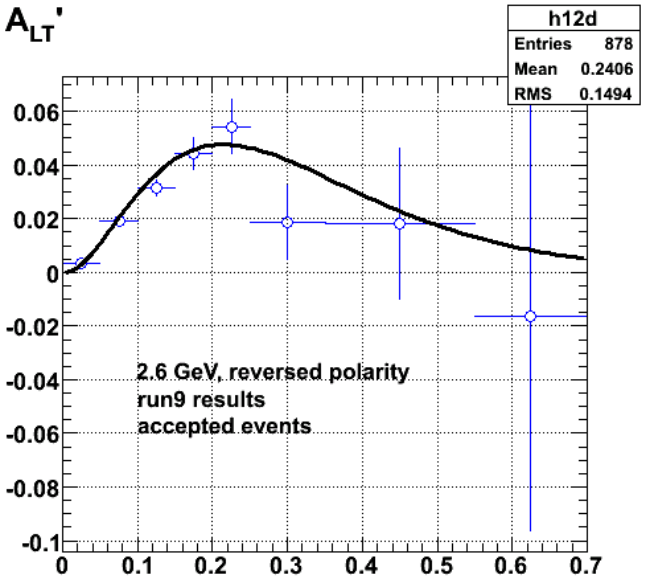


Fig 12. 2.6r, accepted events for run 9.

Click here to view the object (ROOT CINT file for fig 12) you uploaded.

The results of the simulation for Fig 12 are from /data3/e5/sim/run9.

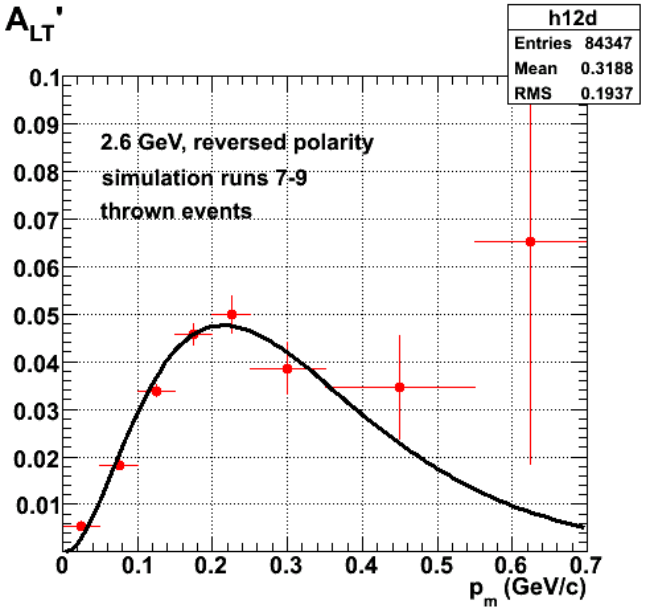


Fig 13. 2.6r, thrown events for run 7-9.

Click here to view the object (ROOT CINT macro for Fig 13) you uploaded.

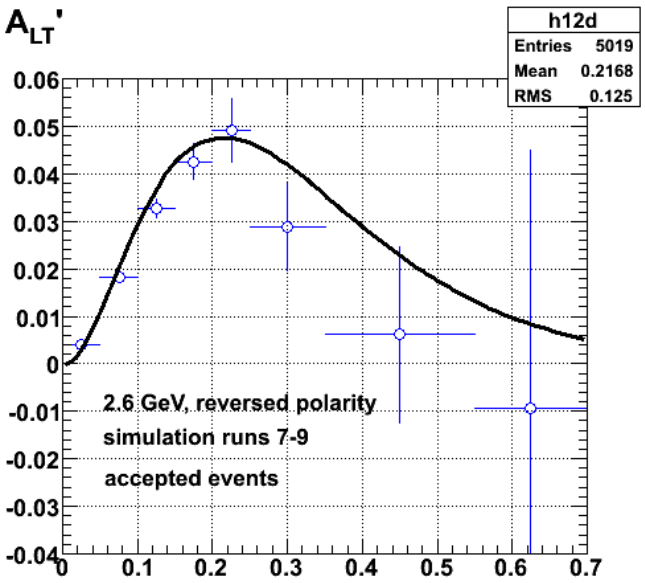


Fig 14. 2.6r, accepted events for run 7-9.

Click here to view the object (ROOT CINT macro for Fig 14) you uploaded.

Click here to view the object (ROOT histogram file for accepted events for figs 13-14) you uploaded.

Click here to view the object (ROOT histogram file for thrown events for figs 13-14) you uploaded.

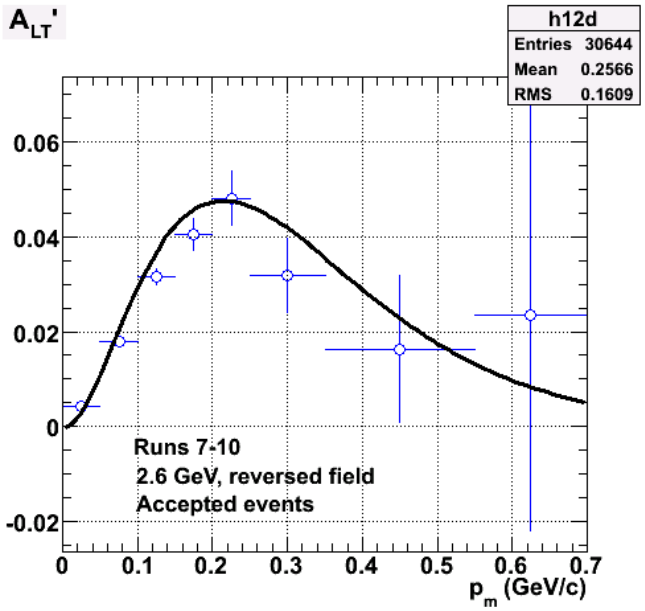


Fig 15. 2.6r, accepted events for run 7-10.

Click here to view the object (OOT CINT macro for Fig 15) you uploaded.

Click here to view the object (ROOT histogram file for accepted events for fig 15) you uploaded.

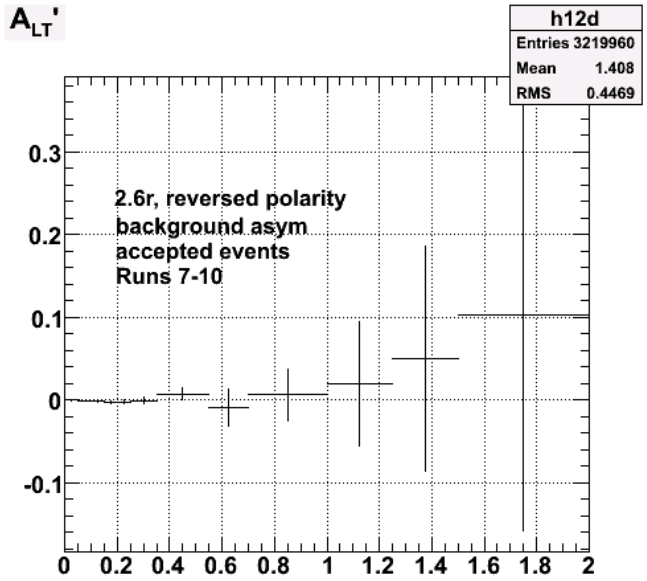


Fig 16. Background asym to go with fig 15.

Click here to view the object (ROOT CINT macro for fig 16) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 135 - Accumulating events (gpg)

[Modified Fri Nov 17 03:42:11 2006 (GMT) gpg]

The plots below shown the accumulation of events.

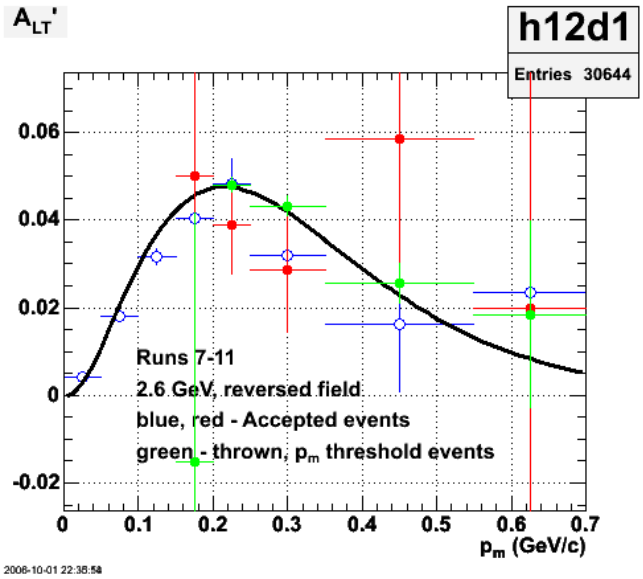


Fig 1. Runs 7-11 where run 11 is the threshold on p_m at 0.2 GeV/c.

Click here to view the object (ROOT CINT macro for Fig 1) you uploaded.

Click here to view the object (EVNT histogram file for run 11 only) you uploaded.

Click here to view the object (PART histogram file for run 11 only) you uploaded.

More accumulation. This is for runs 7-11 + 17.

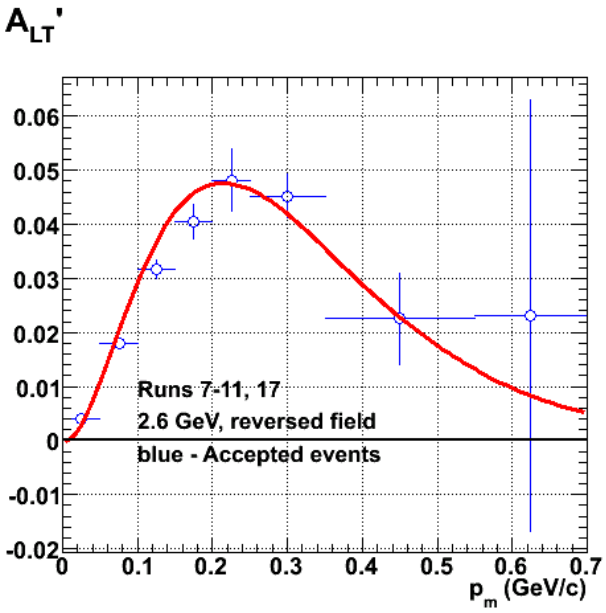


Fig 2. Accumulated ALTp for simulated events with no offsets.

Click here to view the object (ROOT CINT file for Fig 2) you uploaded.

Click here to view the object (ROOT histogram file for Fig 2) you uploaded.

The plot below shows the results of extracting ALTp from simulated events analyzed with the same codes used for the data analysis. The expectation is that by using a ratio to extract and ALTp that it should be independent of acceptance corrections. To test this we have used an arbitrary function (the red curve in Figure

1) as input for ALTp in the simulation and then compared the results extracted from the simulation with that original function (the blue 'data' points in Figure 1. There is rough agreement over most of the range of p_m between the black curve and the simulation, but some of the simulated points sit below the curve in the range p_m = 0.1-0.2 GeV/c.

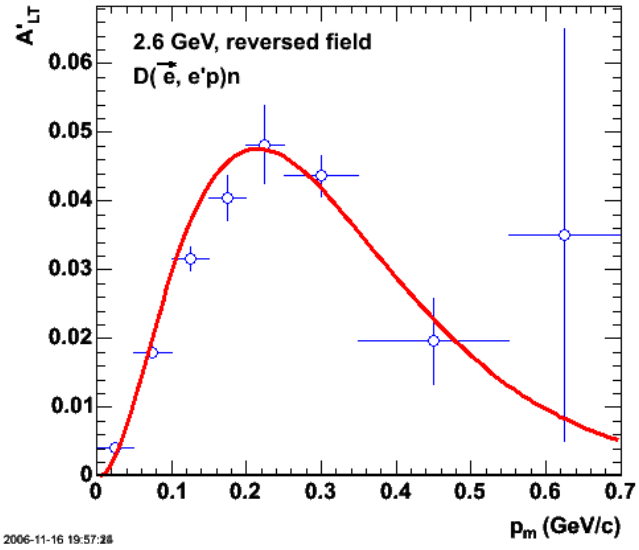


Figure 1. Comparison of ALTp curve used as input to GSIM (black curve) and the results of the simulation(blue points) for 2.6 GeV, reversed field data.

Click here to view the object (ROOT CINT macro for fig 1) you uploaded.

Click here to view the object (ROOT histogram file for Fig 1) you uploaded.

To make a better comparison between the input to GSIM and the simulated results, we averaged the input function over the same bins used in the analysis. The results are shown in Figure 2. There is good agreement over most of the range of p_m, but the points are 0.125 GeV/c and 0.175 GeV/c are still low.

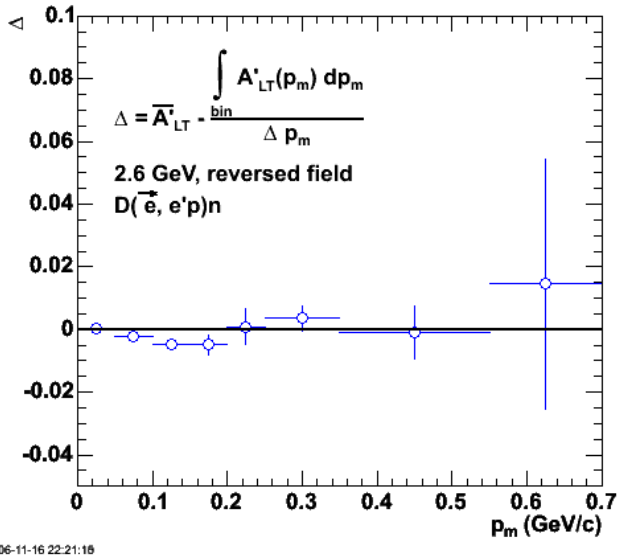


Figure 2. Comparison of the GSIM ALTp input curve averaged over the same bins used in the analysis with the results of the simulation.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 136 - cos(phi) and cos(2*phi) simulations (gpg)

[Modified Tue Oct 10 17:55:52 2006 (GMT) gpg]

The plots below show the cos(phi) and cos(2*phi) asymmetries with zero input asymmetry, but with shifts in the vertex positions of the tracks to mock up offsets in the CLAS sectors.

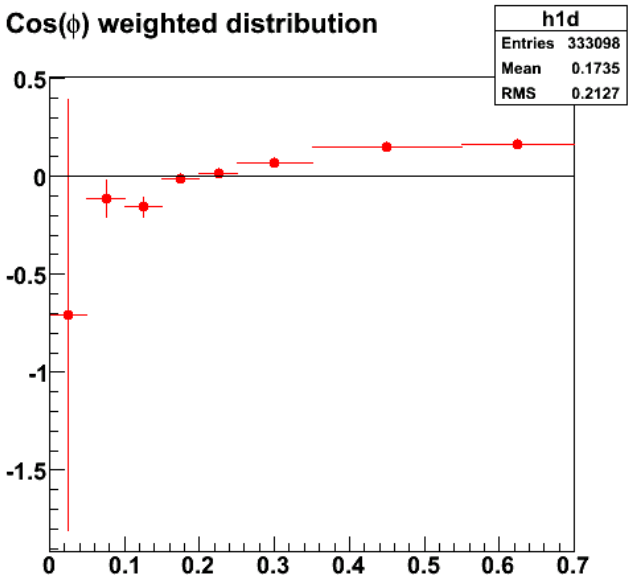


Fig 1. False asymmetry for cos(phi) from shifts in vertex positions.

Click here to view the object (ROOT CINT macro for fig 1) you uploaded.

Click here to view the object (ROOT histogram file with EVNT results used in fig 1.) you uploaded.

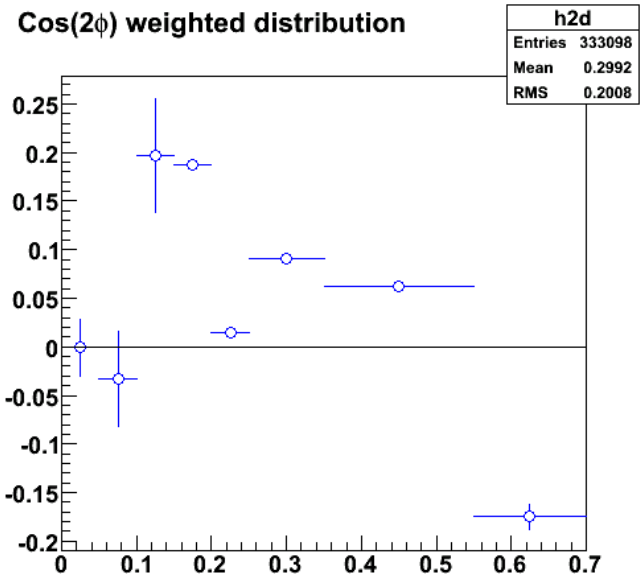


Fig 2. False asymmetry for cos(2phi) from shifts in vertex positions.

Click here to view the object (ROOT CINT macro for fig 2) you uploaded.

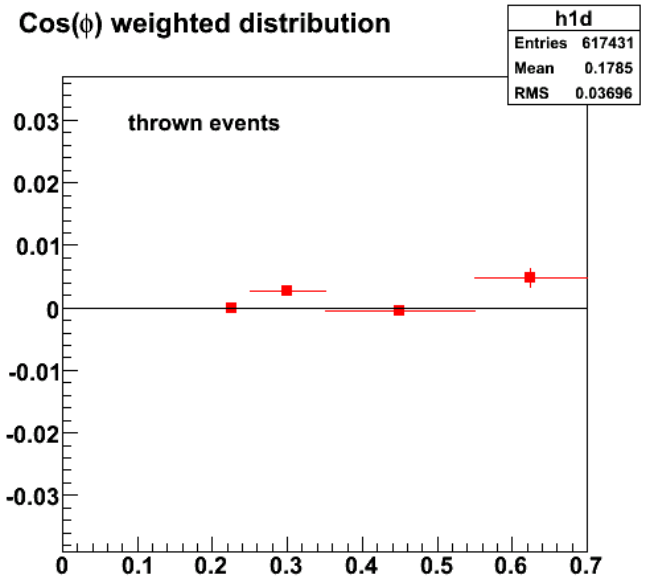
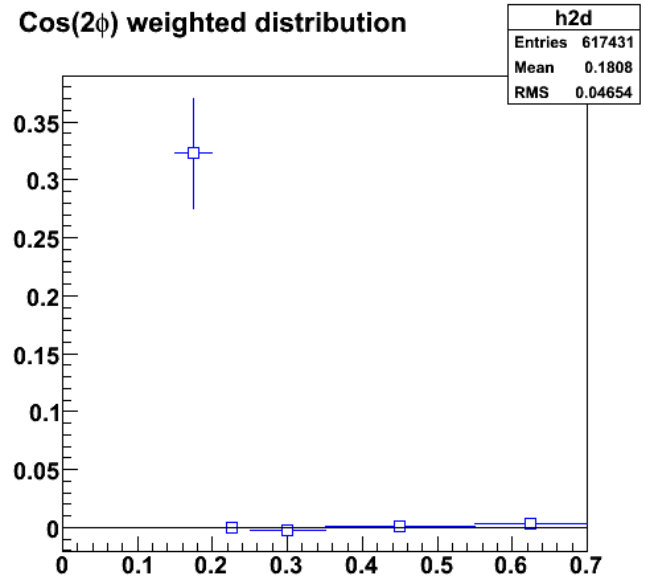


Fig 3. Same as fig 1 for thrown events.

Click here to view the object (ROOT CINT macro for fig 3) you uploaded.

Click here to view the object (ROOT histogram file with PART results used in fig 3) you uploaded.



Same as Fig 2 for thrown events.

Click here to view the object (ROOT CINT macro for fig 4) you uploaded.

The stuff above had the threshold on pfermi (p_m) set at 0.2 GeV/c. Turn that off and things look better. Note: for the plots below, the uncertainties were not calculated correctly.

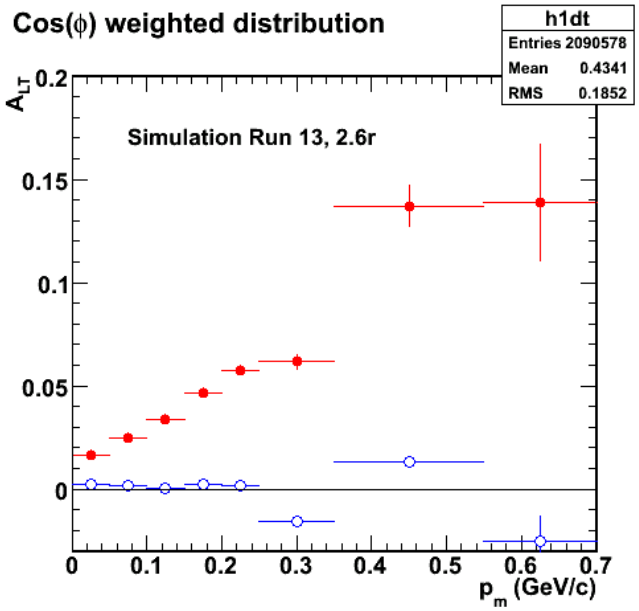


Fig 5. False asymmetry for cos(phi) from shifts in vertex positions with p_m threshold turned set to 0.0.

Click here to view the object (ROOT CINT macro for Fig 5) you uploaded.

Click here to view the object (ROOT histogram file from EVNT banks for Fig 5.) you uploaded.

Click here to view the object (ROOT histogram file with PART banks for Fig 5.) you uploaded.

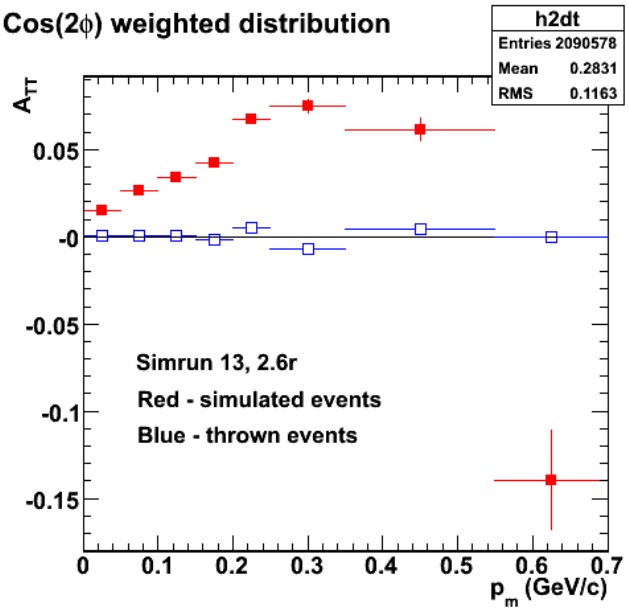


Fig 6. False asymmetry for cos(2phi) from shifts in vertex positions with p_m threshold turned set to 0.0.

Click here to view the object (ROOT CINT macro for fig 6) you uploaded.

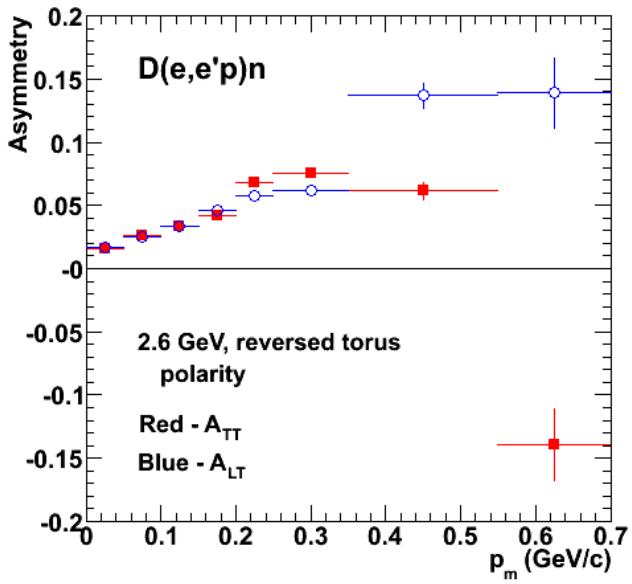


Fig 7. False asymmetry for cos(2phi) and cos(phi) from shifts in vertex positions with p_m threshold turned set to 0.0.

Click here to view the object (ROOT CINT macro for fig 7) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 137 - Record of saved simulation data (gpg)

[Modified Wed Jul 25 22:26:52 2007 (GMT) gpg]

Below is a listing of directories on the cluster disks and some notes on the nature of the simulation.

In /data3/gilfoyle:

- minus1 - used QUEEG to generate events. deleted 7/25/07.
- minus2 - used QUEEG to generate events. deleted 7/25/07.
- minus3 - used QUEEG to generate events. deleted 7/25/07.
- plus1 - used QUEEG to generate events. deleted 7/25/07.
- plus2 - used QUEEG to generate events. deleted 7/25/07.
- plus3 - used QUEEG to generate events. deleted 7/25/07.
- bothrun11
- bothrun12 - 10/01/06, sector shifts in 'by hand', calculation of uncertainties for cos(phi) and cos(2phi) histograms is WRONG, p_m threshold NOT set to zero. Includes positive and negative helicities. used QUEEG to generate events.
- bothrun13 - 10/05/06, sector shifts in 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms is WRONG, p_m threshold set to zero. Includes positive and negative helicities. used QUEEG to generate events.
- bothrun14 - 10/09/06, sector shifts in 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to zero. Includes positive and negative helicities. used QUEEG to generate events.
- bothrun15 - 10/10/06, sector shifts in 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to zero. Includes positive and negative helicities. used QUEEG to generate events.
- bothrun16 - 10/11/06, sector shifts in 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to zero. Includes positive and negative helicities. used QUEEG to generate events.
- bothrun17 - 10/19/06, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to 0.2!!!!!!! Includes positive and negative helicities. used QUEEG to generate events.
- bothrun18 - 11/15/06, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to 0.2!!!!!!! Includes positive and negative helicities. used QUEEG to generate events.
- bothrun19 - 11/15/06, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to 0.45!!!!!!! Includes positive and negative helicities. used QUEEG to generate events.
- bothrun20 - 11/18/06, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to 0.45!!!!!!! Includes positive and negative helicities. used QUEEG to generate events.
- bothrun21 - 11/22/06, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to 0.45!!!!!!! Includes positive and negative helicities. used QUEEG to generate events. Turned off gpp to see if shift in ALTp at low p_m is still there.
- bothrun22 - 11/27/06, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to **0.0!!** Includes positive and negative helicities. used QUEEG to generate events. Turned off gpp to see if shift in ALTp at low p_m is still there.
- bothrun23 - 11/30/06, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to **0.0!!** Includes positive and negative helicities. used QUEEG to generate events. Turned off gpp to see if shift in ALTp at low p_m is still there.
- bothrun24 - 12/01/06, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to **0.0!!** Includes positive and negative helicities. used QUEEG to generate events. Turned off gpp to see if shift in ALTp at low p_m is still there.
- bothrun25 - 12/04/06, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to **0.0!!** Includes positive and negative helicities. used QUEEG to generate events. Turned on gpp with -R24517 ooption.
- bothrun26 - 12/20/06, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to **0.0!!** Includes positive and negative helicities. used QUEEG to generate events. Turned on gpp with -R24517 option. Put in OPPOSITE for the asymmetry so ALTp = 0.10 instead of -0.1 as in the simulations above. the new line in queeg is the following.

```
float amp = helicity_sign*((0.05*pfermi2) + (-8.0*pfermi2*pfermi2) + (-5.0*pfermi2*pfermi2*pfermi2))*exp(-10.0*pfermi2);
```

- bothrun27 - 12/22/06, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to **0.0!!** Includes positive and negative helicities. used QUEEG to generate events. Turned on gpp with -R24517 option. Scaled ALTp by one-half. the new line in queeg is the following.

```
float amp = 0.5*helicity_sign*((0.05*pfermi2) + (-8.0*pfermi2*pfermi2) + (-5.0*pfermi2*pfermi2*pfermi2))*exp(-10.0*pfermi2);
```

- bothrun28 - 12/29/06, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to **0.0!!** Includes positive and negative helicities. used QUEEG to generate events. Turned on gpp with -R24517 option. Scaled ALTp by one-half with opposite (and positive) sign compared with bothrun27. the new line in queeg is the following.

```
float amp = helicity_sign*0.5*((0.05*pfermi2) + (-8.0*pfermi2*pfermi2) + (-5.0*pfermi2*pfermi2*pfermi2))*exp(-10.0*pfermi2);
```

NOTE It looks like run 28 had the same ALTp scale factor (=-0.5) as run 27!!!! Damn!!!

- bothrun29 - 12/31/06, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to **0.0!!** Includes positive and negative helicities. used QUEEG to generate events. Turned on gpp with -R24517 option. Set scale = +0.5. the new line in queeg is the following.

```
float amp = -helicity_sign*0.5*((0.05*pfermi2) + (-8.0*pfermi2*pfermi2) + (-5.0*pfermi2*pfermi2*pfermi2))*exp(-10.0*pfermi2);
```

Accidentally deleted the root files.

- bothrun30 - 01/02/07, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to **0.0!!** Includes positive and negative helicities. used QUEEG to generate events. Turned on gpp with -R24517 option. Set scale = +0.0. the new line in queeg is the following.

```
float amp = -helicity_sign*0.0*((0.05*pfermi2) + (-8.0*pfermi2*pfermi2) + (-5.0*pfermi2*pfermi2*pfermi2))*exp(-10.0*pfermi2);
```

- bothrun31 - 01/03/07, turned sector shifts OFF 'by hand' and calculation of uncertainties for cos(phi) and cos(2phi) histograms corrected, p_m threshold set to **0.0!!** Includes positive and negative helicities. used QUEEG to generate events. Turned on gpp with -R24517 option. Set scale = +0.5. the new line in queeg is the following.

```
float amp = -helicity_sign*0.5*((0.05*pfermi2) + (-8.0*pfermi2*pfermi2) + (-5.0*pfermi2*pfermi2*pfermi2))*exp(-10.0*pfermi2);
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 138 - Background asymmetry (gpg)

[Modified Fri Oct 13 20:33:31 2006 (GMT) gpg]

First look at the background asymmetry extracted from different helicity beams.

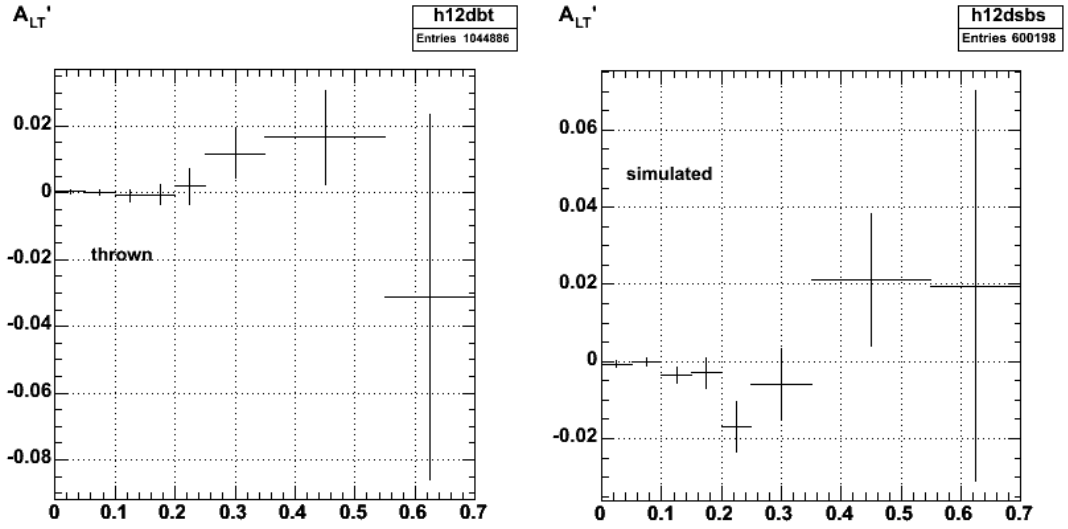


Fig 1. Comparison of thrown (left) and simulated (right) events with the vertex shift on, ALTp asymmetry on, for run 14.

Click here to view the object (ROOT CINT macro for Fig 1) you uploaded.

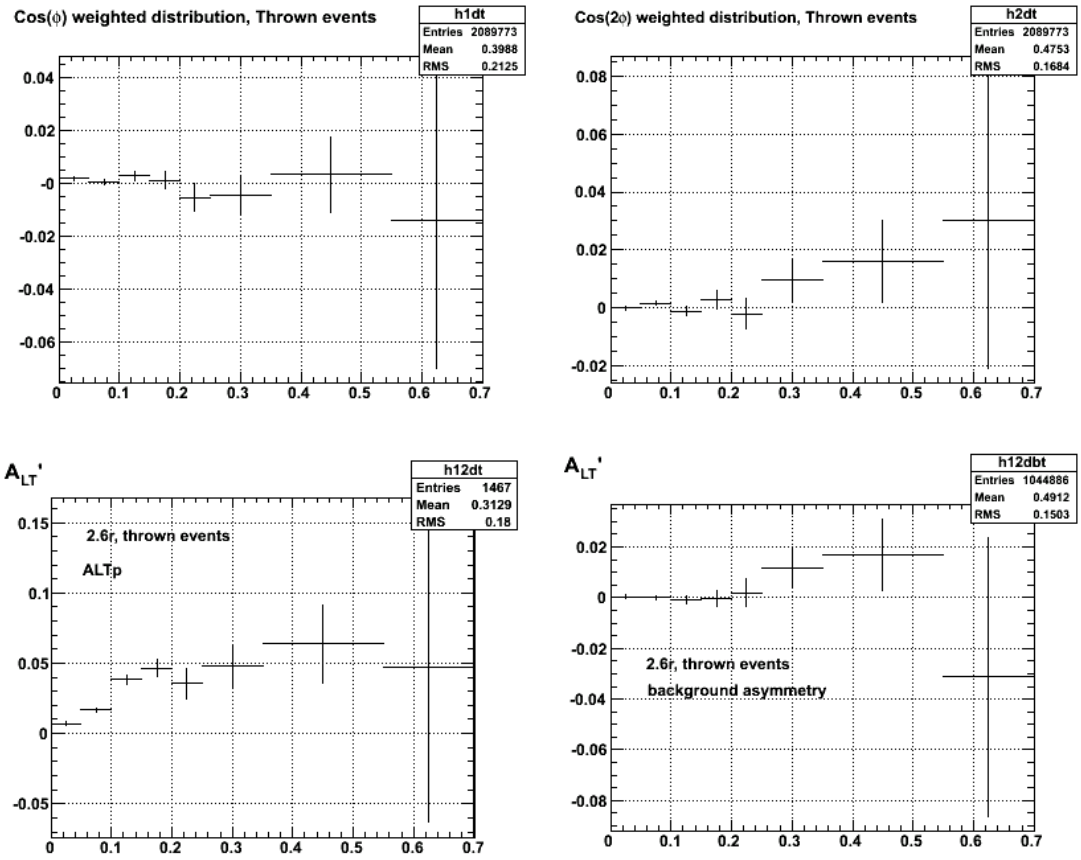


Fig 2. Asymmetries for thrown events for run 14 with ALTp asymmetry turned on, no p_m threshold, no ALT or ATT asymmetries

Click here to view the object (ROOT CINT macro for Fig 2) you uploaded.

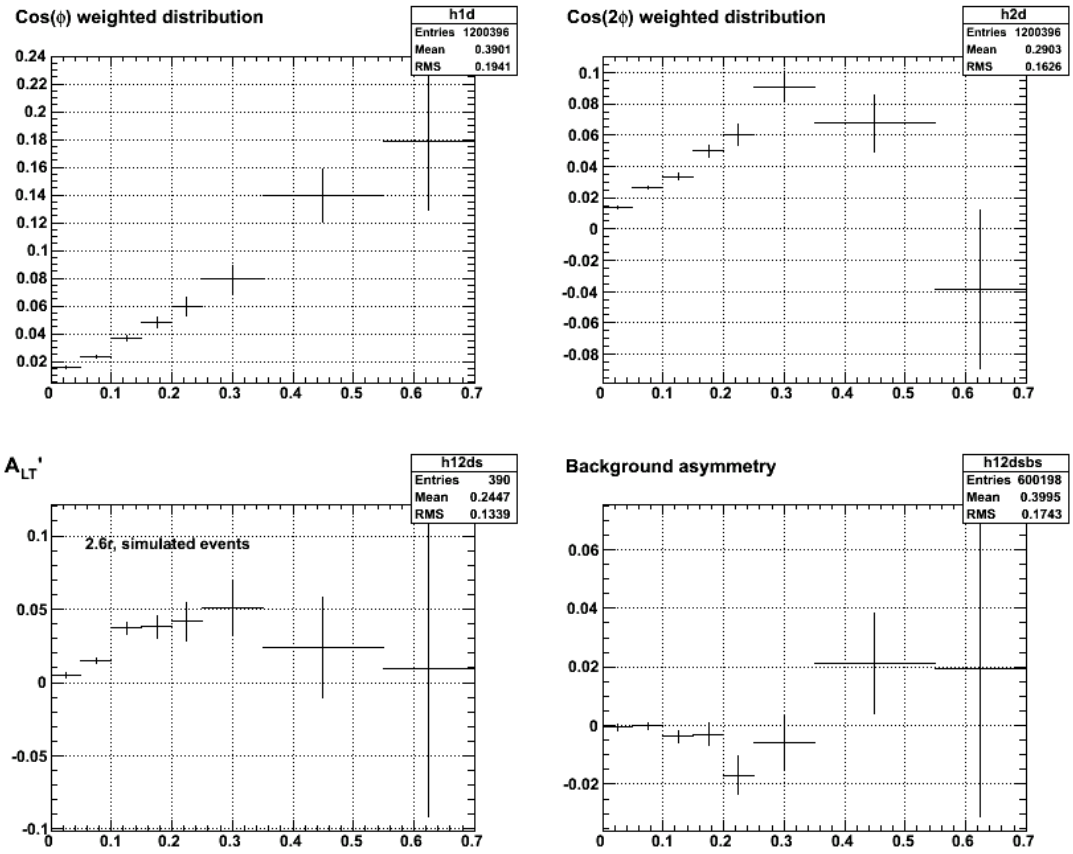


Fig 2. Asymmetries for simulated events for run 14 with ALTp asymmetry turned on, no p_m threshold, no ALT or ATT asymmetries.

Click here to view the object (ROOT CINT macro for Fig 3) you uploaded.

The results for the background asymmetry in Fig 3 are surprising since we see significant background asymmetry in the data, in the simulation of ATT and ALT, but not in the simulation of the background asymmetry using vertex offsets extracted from the data. The results for the data are shown in Fig 4.

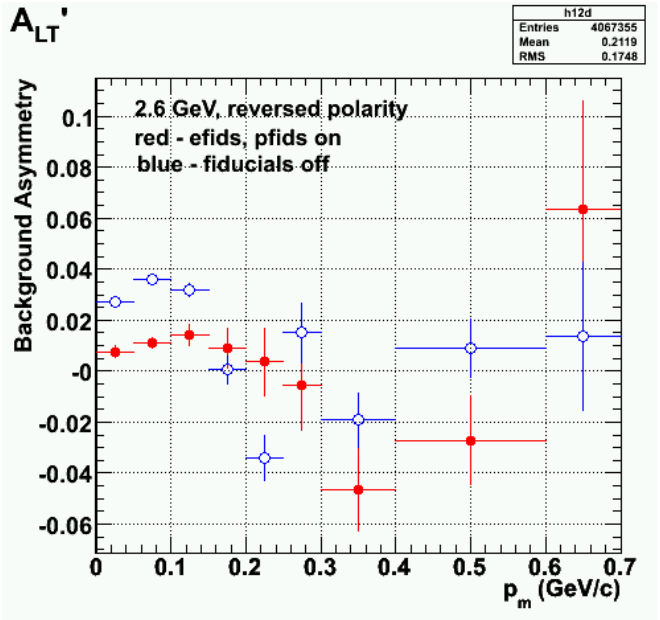


Fig 4. Background asymmetry from the data for 2.6 GeV, reversed polarity. See entry 110.

I re-analyzed the run13 data with the correct calculation of the uncertainties and added it to the gsim data for runs 14-16 and get the following. it's surprising that we get such a large false asymmetry in ALT and ATT from the vertex shifts, but there is little background asymmetry in ALTp. Ask Harut about this.

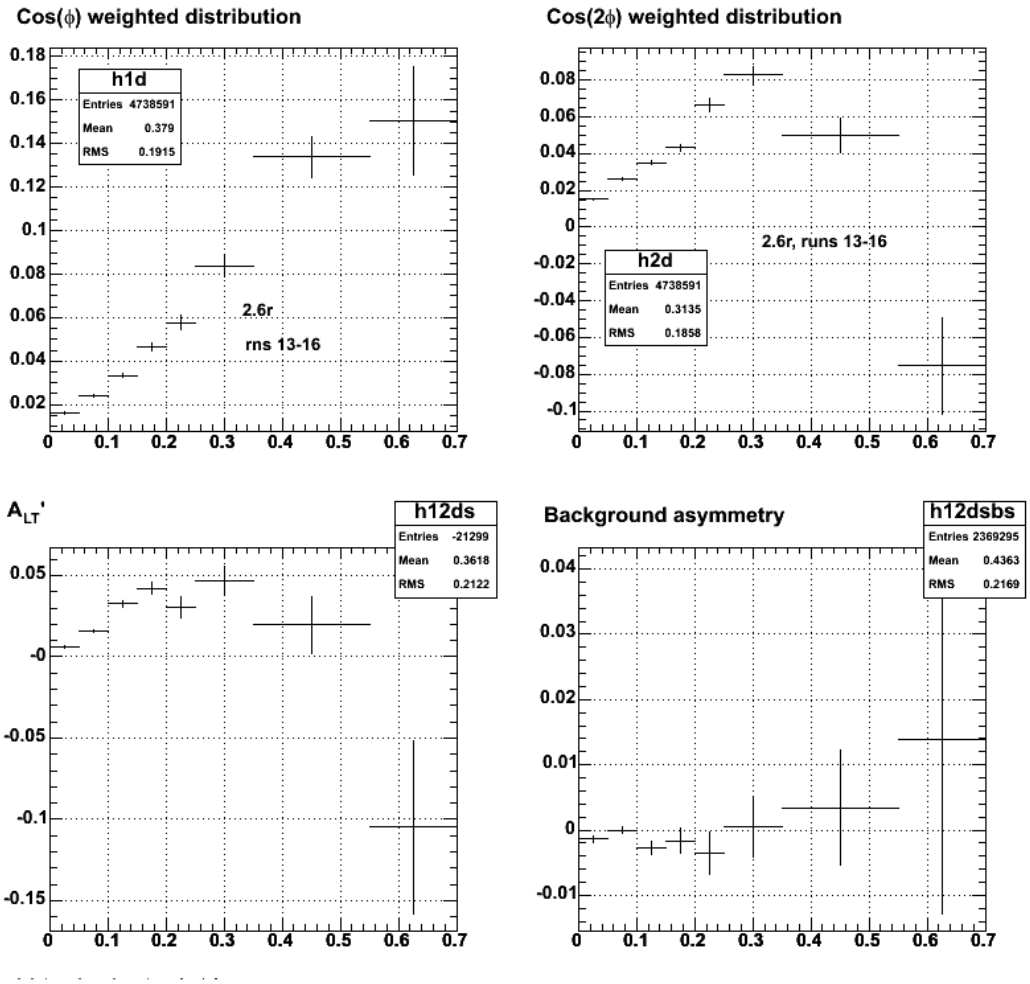


Fig 5. Asymmetry results for gsim runs 13-16 with no p_m threshold, ALTp turned on, vertex shifts turned on.

Click here to view the object (ROOT CINT macro for Fig 5) you uploaded.

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Jerry Gilfoyle's Enotebook page 139 - re-analysis of /data3/gilfoyle/bothrun13 (gpg)

[Modified Fri Oct 13 20:13:50 2006 (GMT) gpg]

I generated some new scripts that analyze the gsim data from a previous simulation run for the EVNT banks. The scripts are analyze_sim.pl which than calls no_gsim_on_node.pl. The histogram file for the data in /data3/gilfoyle/bothrun13 is below.

Click here to view the object (histogram file for the data in /data3/gilfoyle/bothrun13) you uploaded.

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Jerry Gilfoyle's Enotebook page 140 - Bin Correction factors (gpg)

[Modified Thu Jan 4 04:27:02 2007 (GMT) gpg]

In my last week before the APS meeting angst I am suddenly worried about about being asked about bin correction factors so I calculated some. For guidance I used some Hall C stuff at the following location.

http://www.krl.caltech.edu/~johna/thesis/node65.html

I then used the functional form for the simulation of ALTp and compared what I get from using the value of the curve at the center of the bin (I used the real bin sizes from the analysis) to the integral of the function over the bin and divided by the bin size. The results are shown in Figure 1.

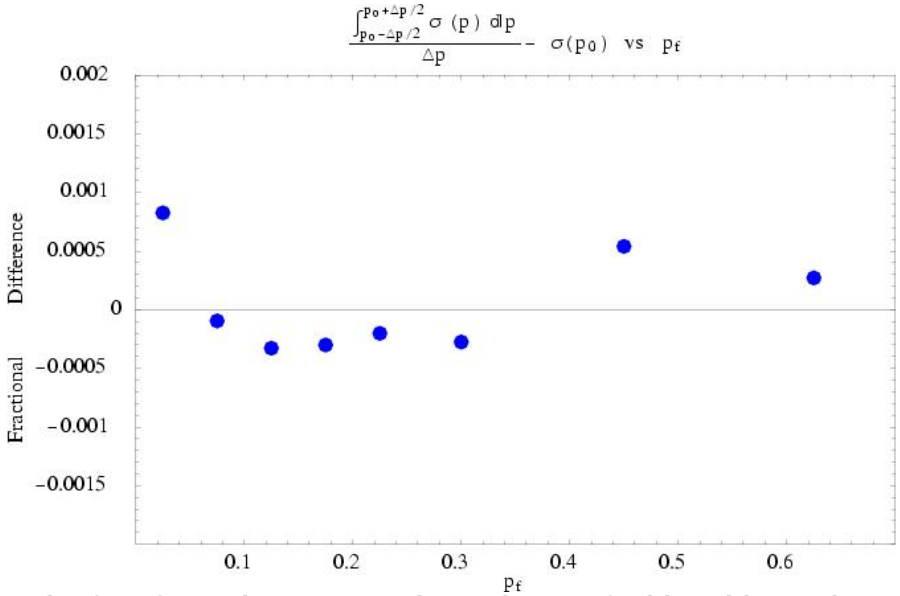

Fig 1. Difference between value of ALTp function that is input to simulation at the center of each bin and the properly averaged value as a function of the Fermi momentum.

Click here to view the object (The *Mathematica* notebook is here.) you uploaded.

Next, I took the value from each bin AFTER having run through the simulation and subtracted off the value from the function averaged over the bin. Things look GOOD! See Fig 2. <

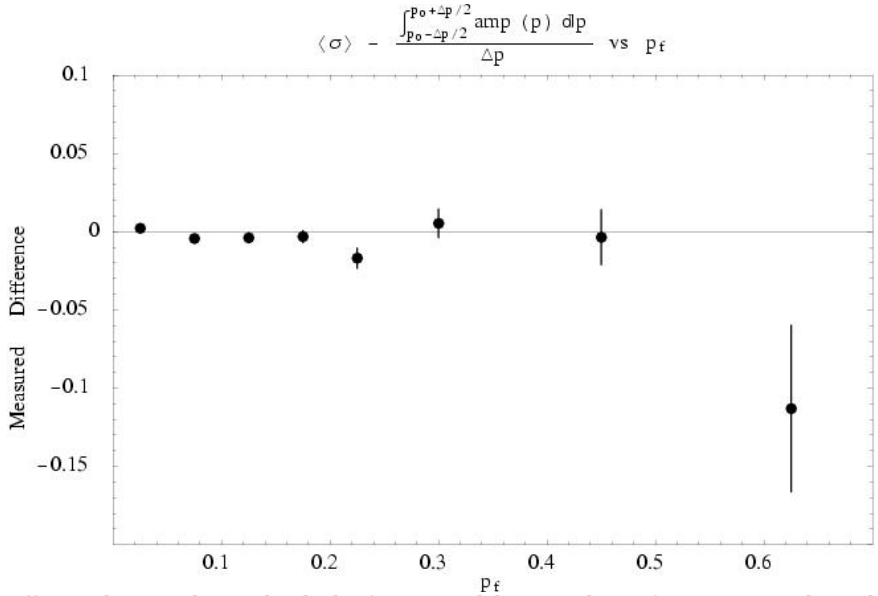

Fig 2. Difference between the simulated value for ALTp and the original input function averaged over the bin.

Click here to view the object (Updated *Mathematica* notebook is here.) you uploaded.

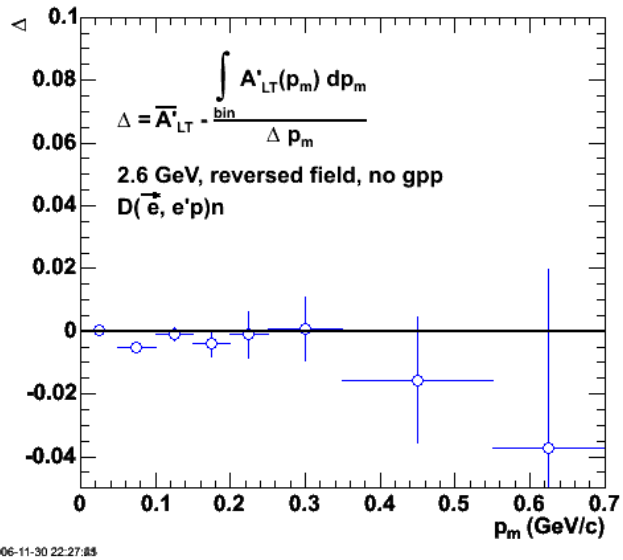

Fig 3. Comparison of bin-averaged input curve with results of gsim run with gpp turned off.

Click here to view the object (ROOT CINT macro for Fig 3.) you uploaded.

Click here to view the object (ROOT histogram file used for fig 3) you uploaded.

Click here to view the object (*Mathematica* notebook used for fig 3) you uploaded.

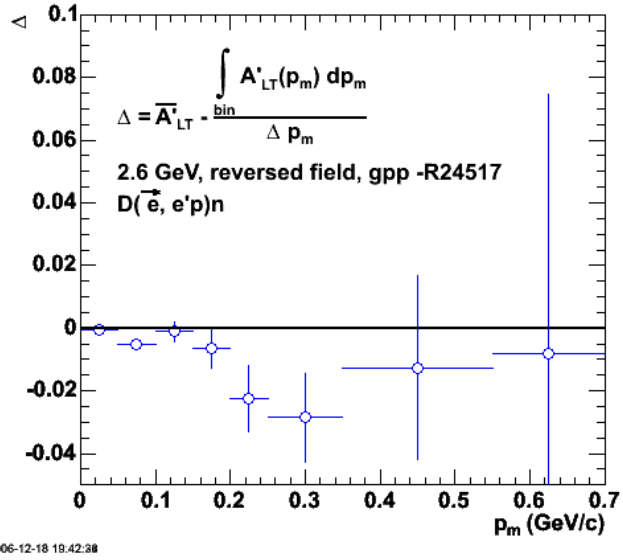

Fig 4. Comparison of bin-averaged input curve with results of gsim run with gpp option -R24517 and ALTp scale=1.0 (bothrun 25)

Click here to view the object (ROOT CINT macro for Fig 4) you uploaded.

Click here to view the object (ROOT histogram file for fig 4) you uploaded.

The plot below is very disturbing because of the large excursion from zero in the same range as the dip we see in the data!!!

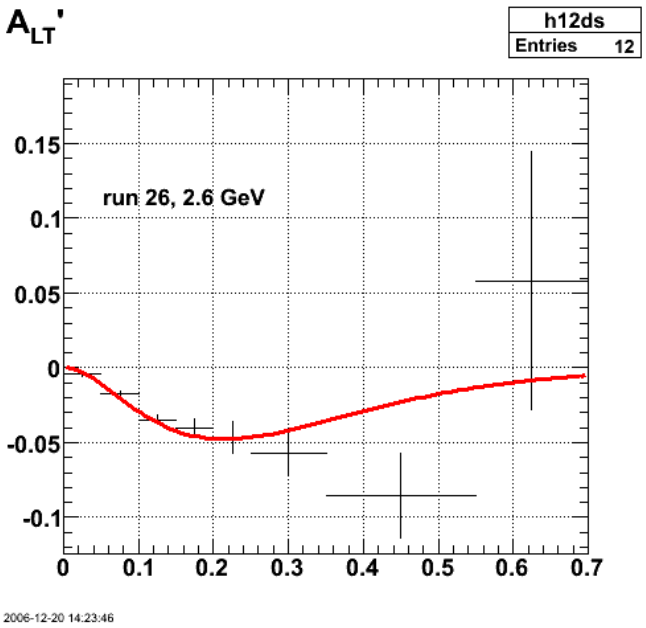

Fig 5. Comparison of run 26 results with input curve and ALTp scale=-1.0.

Click here to view the object (ROOT CINT macro for fig 5) you uploaded.

I've changed the sign of the input ALTp to see if the effect seen in Fig 5 holds up. It appears to go away (see fig 6 below), but the deviation from zero in the second p_m bin persists and has now flipped sign when I flipped the sign in the ALTp input to the simulation.

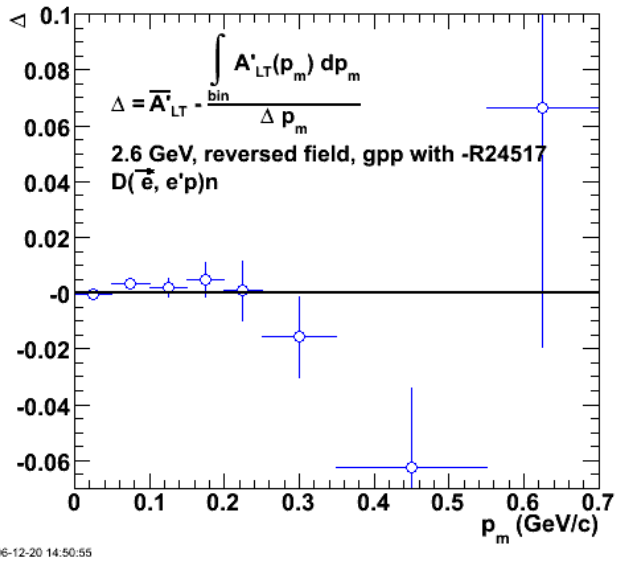

Fig 6. Comparison of run 26 results with properly averaged input curve after flipping the sign on the ALTp input to the simulation (ALTp scale=-1.0).

Click here to view the object (ROOT CINT macro for fig 6) you uploaded.

Set scale factor to one-half.

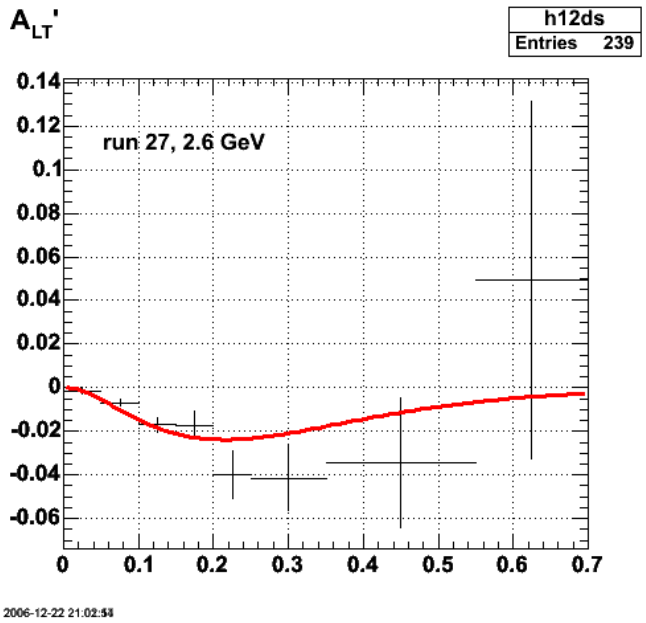

Fig 7. Comparison of run 27 results with input curve (ALTp scale=-0.5).

Click here to view the object (ROOT CINT macro for Fig 7.) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

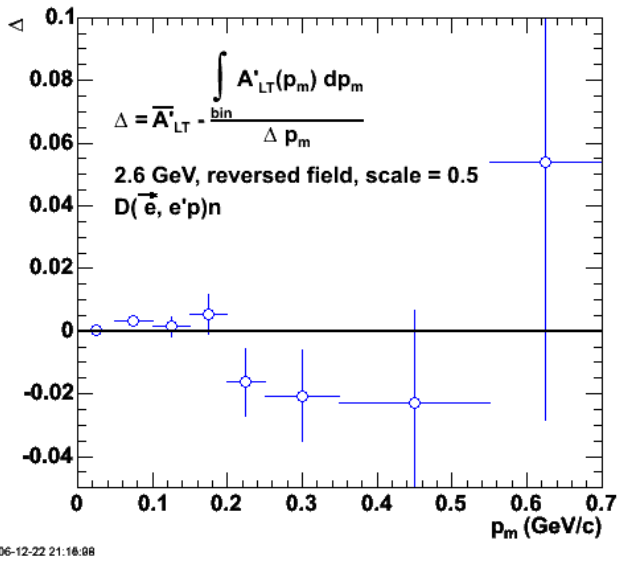

Fig 8. Comparison of run 27 results with properly averaged input curve after flipping the sign and scaling by 0.5 on the ALTp input to the simulation (ALTp scale=-0.5).

Click here to view the object (ROOT CINT file for fig 8) you uploaded.

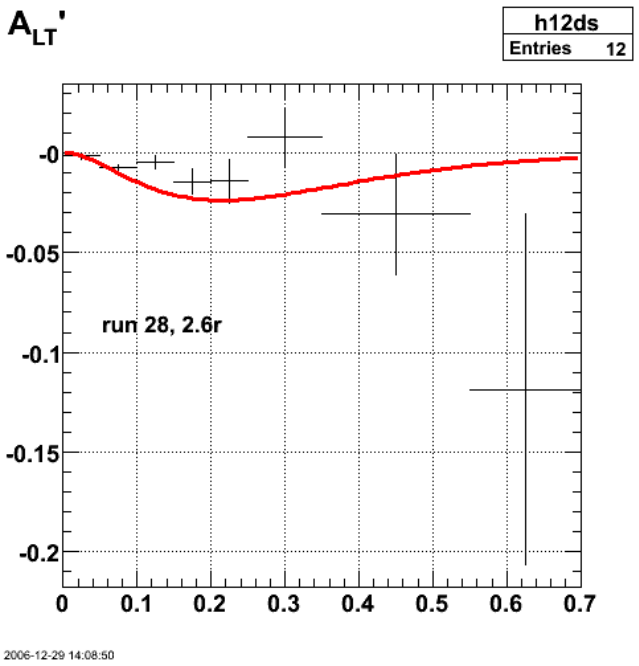

Fig 9. Comparison of ALTp with input curve for run 28 and ALTp scale = -0.5. I wanted this to be ALTp scale = +0.5, but I guess I screwed up.

Click here to view the object (ROOT CINT macro for Fig 9.) you uploaded.

Click here to view the object (ROOT histogram file for Fig 9) you uploaded.

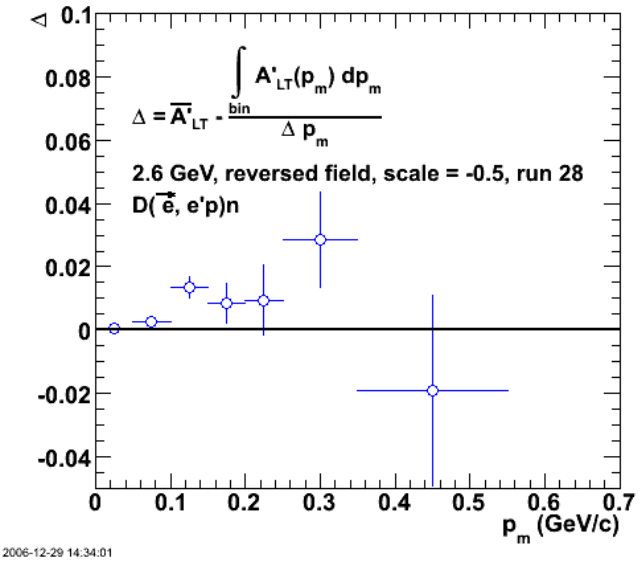

Fig 10. Comparison of run 28 results with properly averaged input curve, -R24517, and after flipping the sign and scaling by 0.5 on the ALTp input to the simulation (ALTp scale=-0.5).

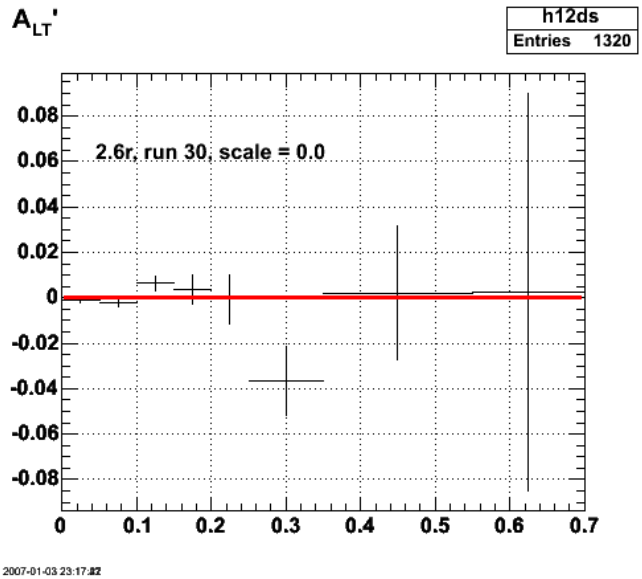

Fig 11. Comparison of ALTp with input curve for run 30 and ALTp scale = 0.0.

Click here to view the object (ROOT CINT macro for Fig 11) you uploaded.

Click here to view the object (ROOT histogram file for Fig 11) you uploaded.

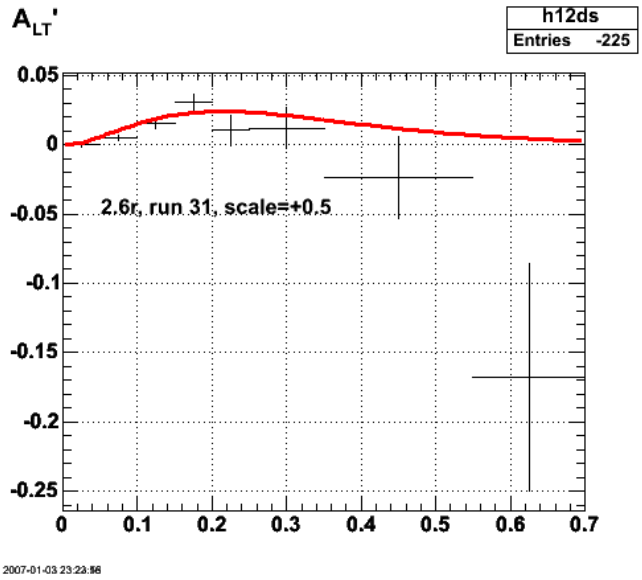

Fig 12. Comparison of ALTp with input curve for run 31 and ALTp scale = +0.5.

Click here to view the object (ROOT CINT macro for Fig 12) you uploaded.

Click here to view the object (ROOT histogram file for Fig 12) you uploaded.

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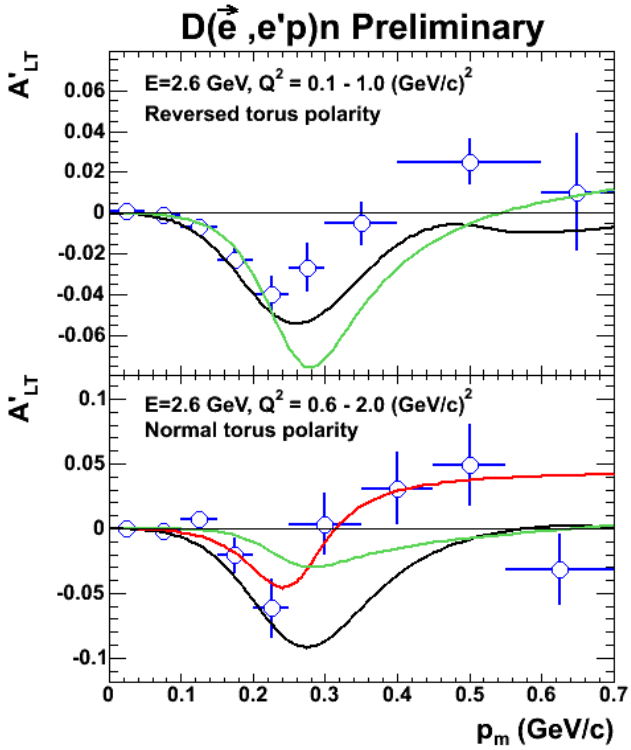
Jerry Gilfoyle's Enotebook page 141 - New calculation from Sabine Jeschonneck (gpg)

[Modified Fri Nov 17 03:36:06 2006 (GMT) gpg]

Sabine recently sent me her latest calculation of the structures functions of the deuteron using the Generalized Eikonal Approximation. She has made a calculation for Q2=1.1 GeV2 which is a bit above the average value of the Q2 for the 2.6 GeV, normal-field data set. The results are shown in Figure 1 below along with some older curves. The red curve is from Sabine. She has not made a calculation for the lower-Q2 data set yet because she does not feel her calculation is valid in that range. The green curves are from Jean-Marc Laget and they are also calculations for a single Q2 at the average Q2 value for each data set. The black curve is an older calculation from Arenhoevel that is averaged over the Q2 distribution for these data.



Comparison of ALTp for the two 2.6-GeV data sets. The curves are explained in the text.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 142 - Check on EC pion signal (gpg)

[Modified Fri Dec 15 14:51:19 2006 (GMT) gpg]

The plots below are in response to questions from the GMn review committee. We want to check the uniformity of the EC response to positive and negative pions.

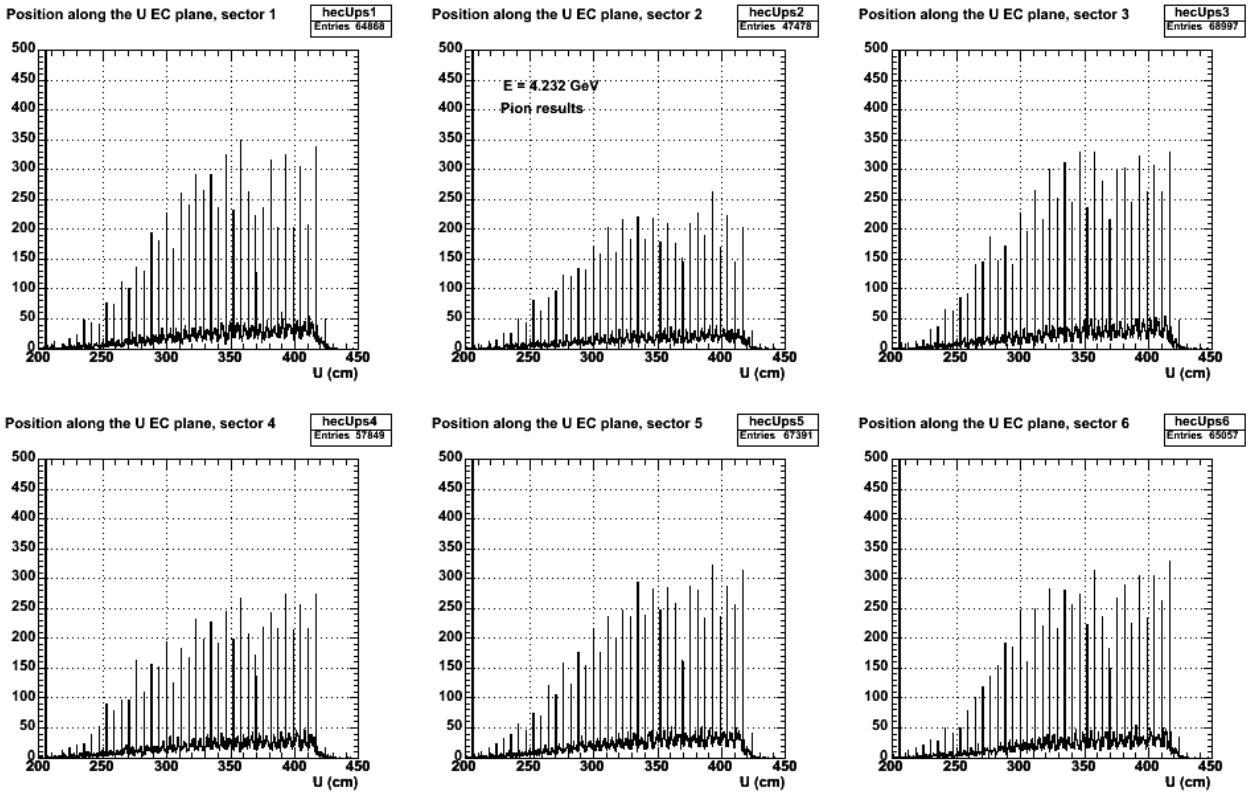


Fig 1. EC pion U signal for 4.23 GeV from proton target and e-pi+ coincidences.

Click here to view the object (PS file of Fig 1.) you uploaded.

Click here to view the object (ROOT CINT macro for fig 1.) you uploaded.

Click here to view the object (ROOT histogram file used for fig 1) you uploaded.

Click here to view the object (ROOT histogram file with full analysis of all data runs for figs 1-3) you uploaded.

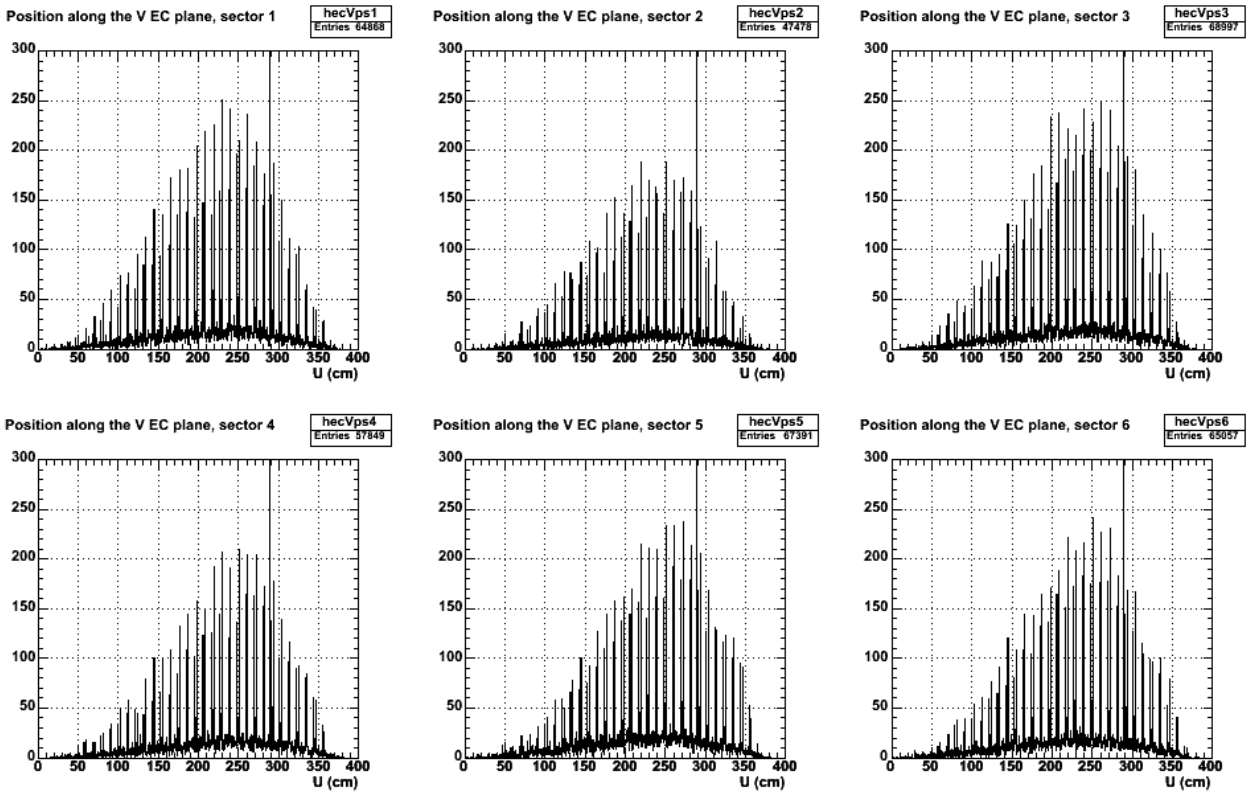


Fig 2. EC pion V signal for 4.23 GeV from proton target and e-pi+ coincidences.

Click here to view the object (PS version of fig2) you uploaded.

Click here to view the object (ROOT CINT macro for fig 2) you uploaded.

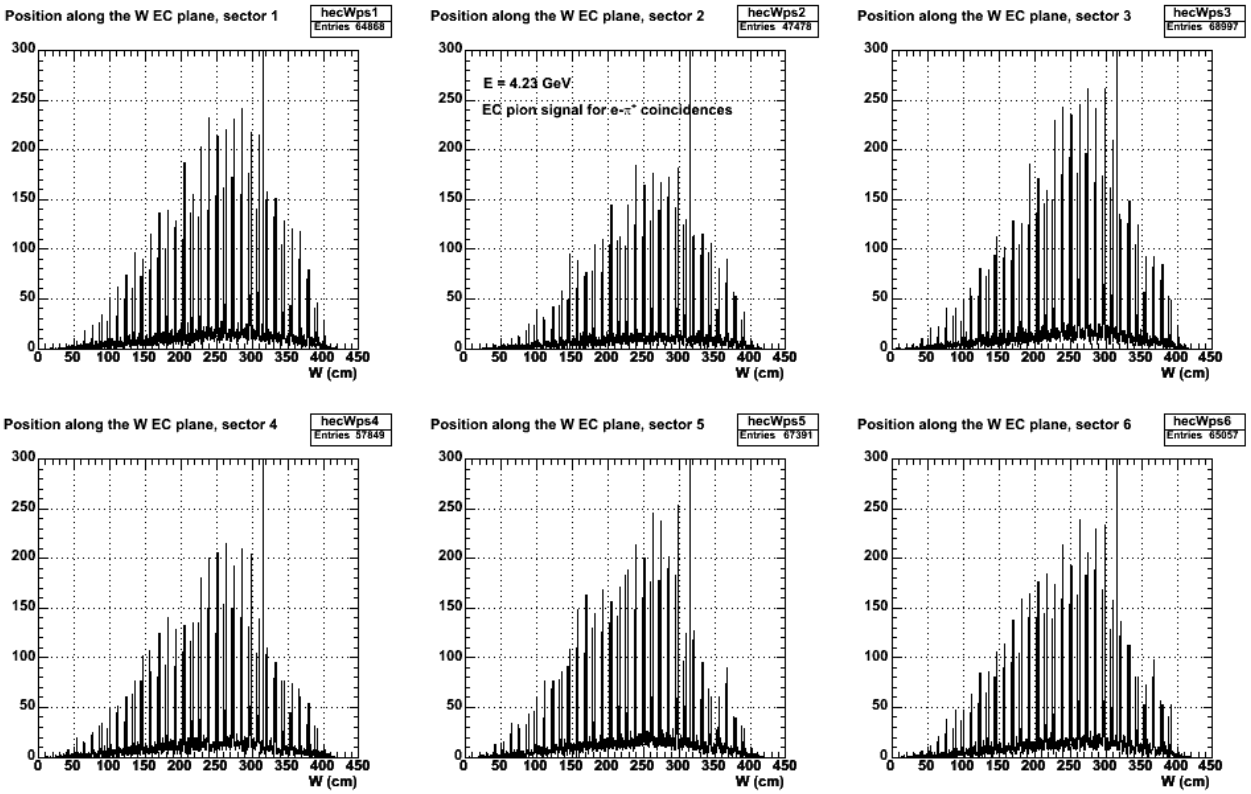


Fig 3. EC pion W signal for 4.23 GeV from proton target and e-pi+ coincidences.

Click here to view the object (S file of Fig 3) you uploaded.

Click here to view the object (ROOT CINT macro for fig 2) you uploaded.

Code below for making figs 1-3 using the histogram file linked underr fig 1.

```
c1_1->cd();
hecUps1->SetMaximum(500);
hecUps1->GetXaxis()->SetTitle("U (cm)");
hecUps1->GetXaxis()->SetRange(800,1800);
hecUps1->Draw()

c1_2->cd()
hecUps2->SetMaximum(500);
hecUps2->GetXaxis()->SetTitle("U (cm)");
hecUps2->GetXaxis()->SetRange(800,1800);
hecUps2->Draw()

c1_3->cd()
hecUps3->SetMaximum(500);
hecUps3->GetXaxis()->SetTitle("U (cm)");
hecUps3->GetXaxis()->SetRange(800,1800);
hecUps3->Draw()

c1_4->cd()
hecUps4->SetMaximum(500);
hecUps4->GetXaxis()->SetTitle("U (cm)");
hecUps4->GetXaxis()->SetRange(800,1800);
hecUps4->Draw()

c1_5->cd()
hecUps5->SetMaximum(500);
hecUps5->GetXaxis()->SetTitle("U (cm)");
hecUps5->GetXaxis()->SetRange(800,1800);
hecUps5->Draw()

c1_6->cd()
hecUps6->SetMaximum(500);
hecUps6->GetXaxis()->SetTitle("U (cm)");
hecUps6->GetXaxis()->SetRange(800,1800);
hecUps6->Draw()

--------------------------------------------------


c1_1->cd();
hecVps1->SetMaximum(300);
hecVps1->GetXaxis()->SetTitle("U (cm)");
hecVps1->GetXaxis()->SetRange(0,1600);
hecVps1->Draw()

c1_2->cd()
hecVps2->SetMaximum(300);
hecVps2->GetXaxis()->SetTitle("U (cm)");
hecVps2->GetXaxis()->SetRange(0,1600);
hecVps2->Draw()

c1_3->cd()
hecVps3->SetMaximum(300);
hecVps3->GetXaxis()->SetTitle("U (cm)");
hecVps3->GetXaxis()->SetRange(0,1600);
hecVps3->Draw()

c1_4->cd()
hecVps4->SetMaximum(300);
hecVps4->GetXaxis()->SetTitle("U (cm)");
hecVps4->GetXaxis()->SetRange(0,1600);
hecVps4->Draw()

c1_5->cd()
hecVps5->SetMaximum(300);
hecVps5->GetXaxis()->SetTitle("U (cm)");
hecVps5->GetXaxis()->SetRange(0,1600);
hecVps5->Draw()

c1_6->cd()
hecVps6->SetMaximum(300);
hecVps6->GetXaxis()->SetTitle("U (cm)");
hecVps6->GetXaxis()->SetRange(0,1600);
hecVps6->Draw()


--------------------------------------------------


c1_1->cd();
hecWps1->SetMaximum(300);
hecWps1->GetXaxis()->SetTitle("W (cm)");
hecWps1->GetXaxis()->SetRange(0,1800);
hecWps1->Draw()

c1_2->cd()
hecWps2->SetMaximum(300);
hecWps2->GetXaxis()->SetTitle("W (cm)");
hecWps2->GetXaxis()->SetRange(0,1800);
hecWps2->Draw()
```

```
c1_3->cd()
hecWps3->SetMaximum(300);
hecWps3->GetXaxis()->SetTitle("W (cm)");
hecWps3->GetXaxis()->SetRange(0,1800);
hecWps3->Draw()

c1_4->cd()
hecWps4->SetMaximum(300);
hecWps4->GetXaxis()->SetTitle("W (cm)");
hecWps4->GetXaxis()->SetRange(0,1800);
hecWps4->Draw()

c1_5->cd()
hecWps5->SetMaximum(300);
hecWps5->GetXaxis()->SetTitle("W (cm)");
hecWps5->GetXaxis()->SetRange(0,1800);
hecWps5->Draw()

c1_6->cd()
hecWps6->SetMaximum(300);
hecWps6->GetXaxis()->SetTitle("W (cm)");
hecWps6->GetXaxis()->SetRange(0,1800);
hecWps6->Draw()
```

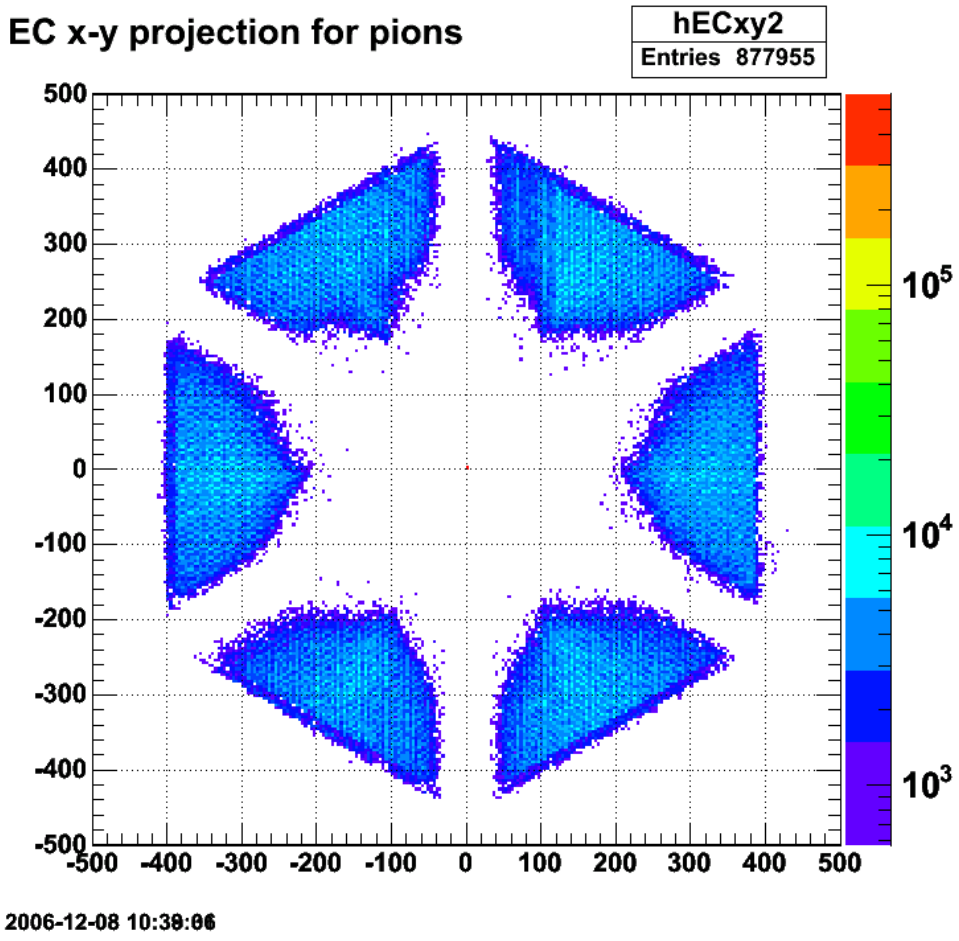


Fig 4. EC x-y projection for pions for 4.2 GeV. These are e-pi+ coincidences

Click here to view the object (ROOT CINT macro for fig 4) you uploaded.

Check effect of rebinning. Looks like I'll go with 20 bins -> 1 bin for now.

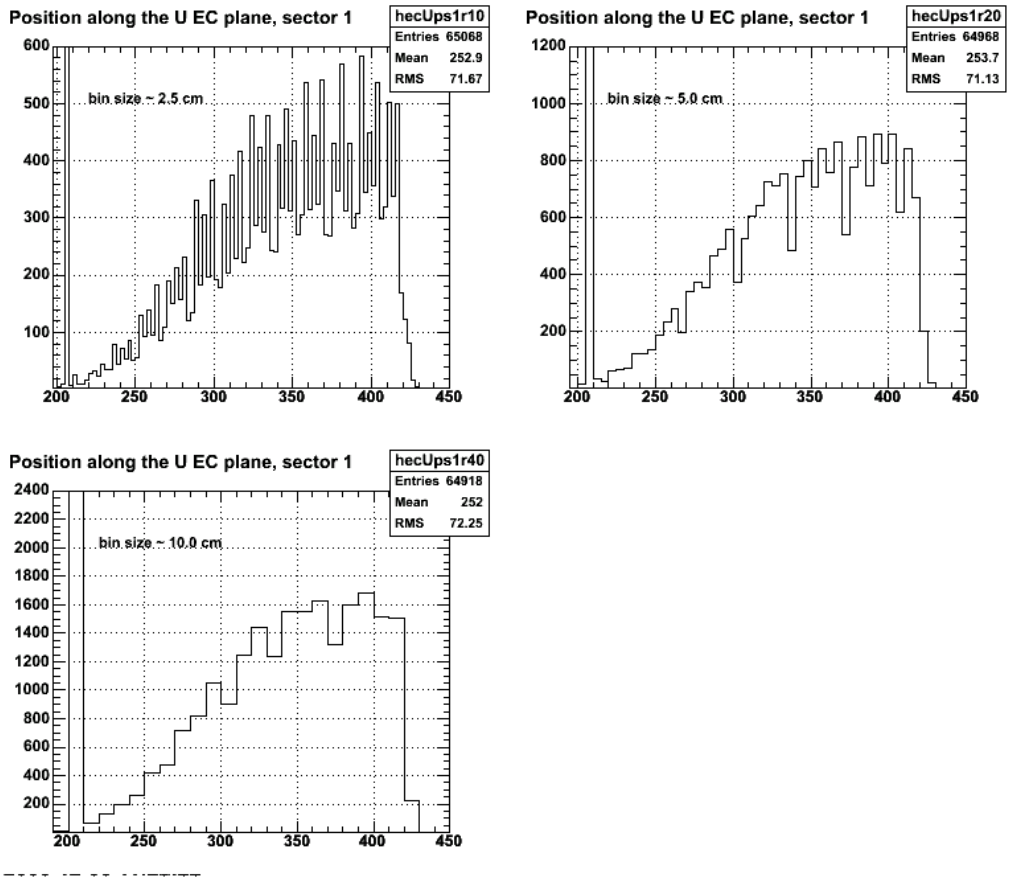


Fig 5. Effect of rebinning (4.2 GeV data).

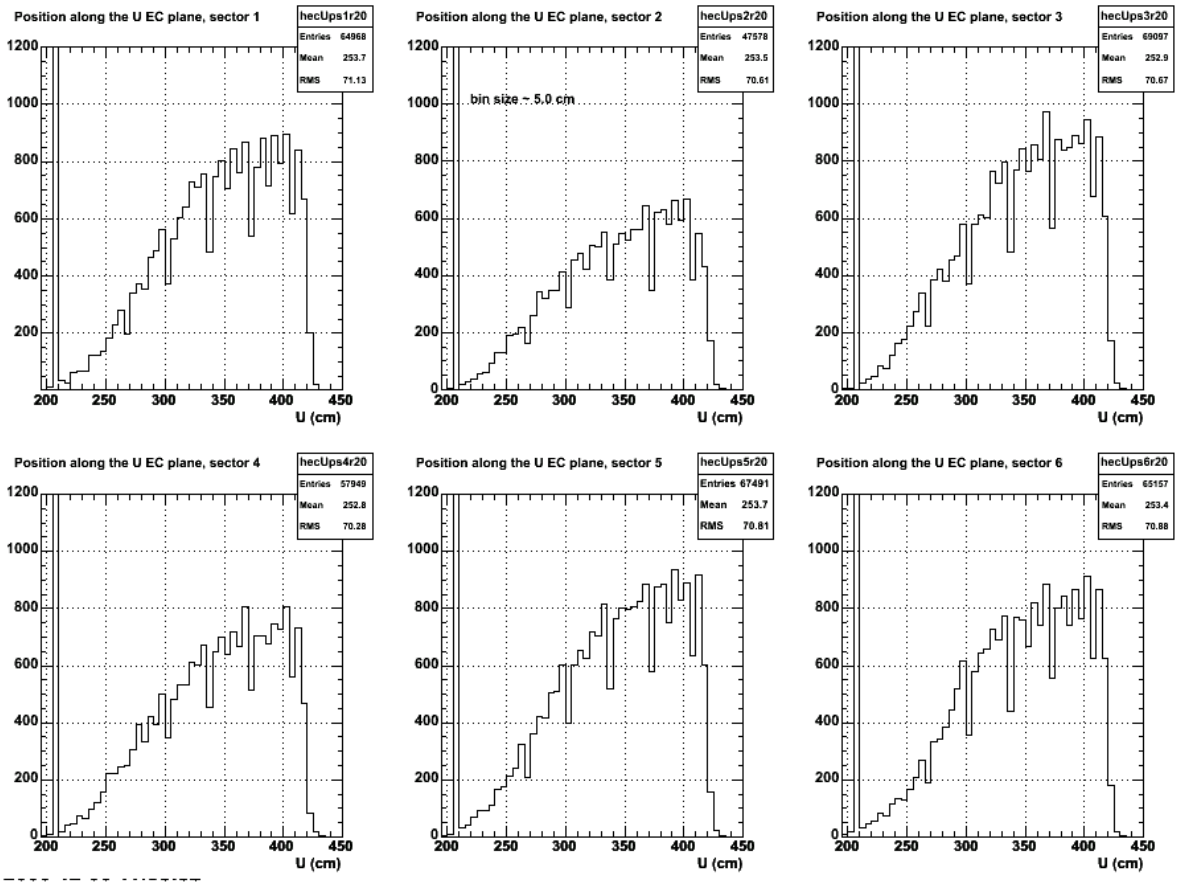


Fig 6. Rebinned pi+ U signal for 4.2 GeV.

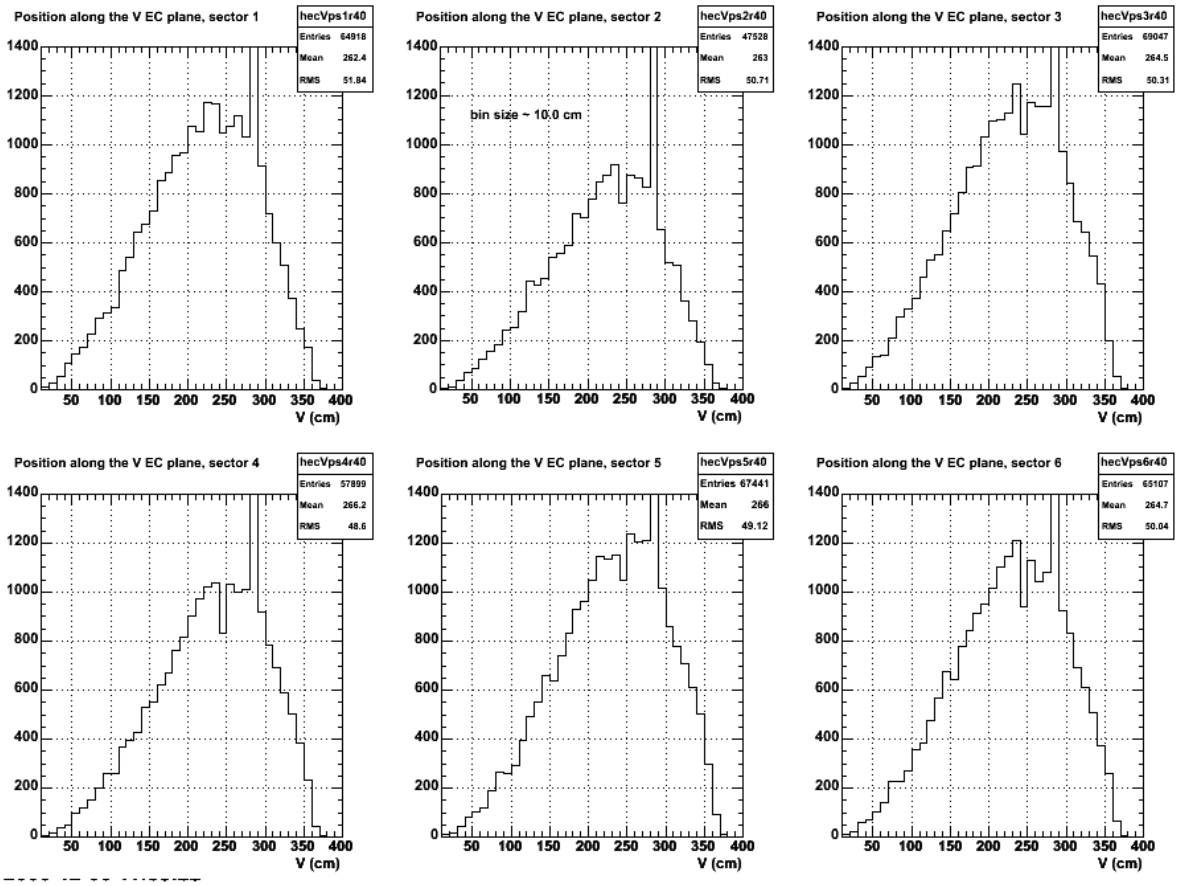


Fig 7. Rebinned pi+ V signal for 4.2 GeV.

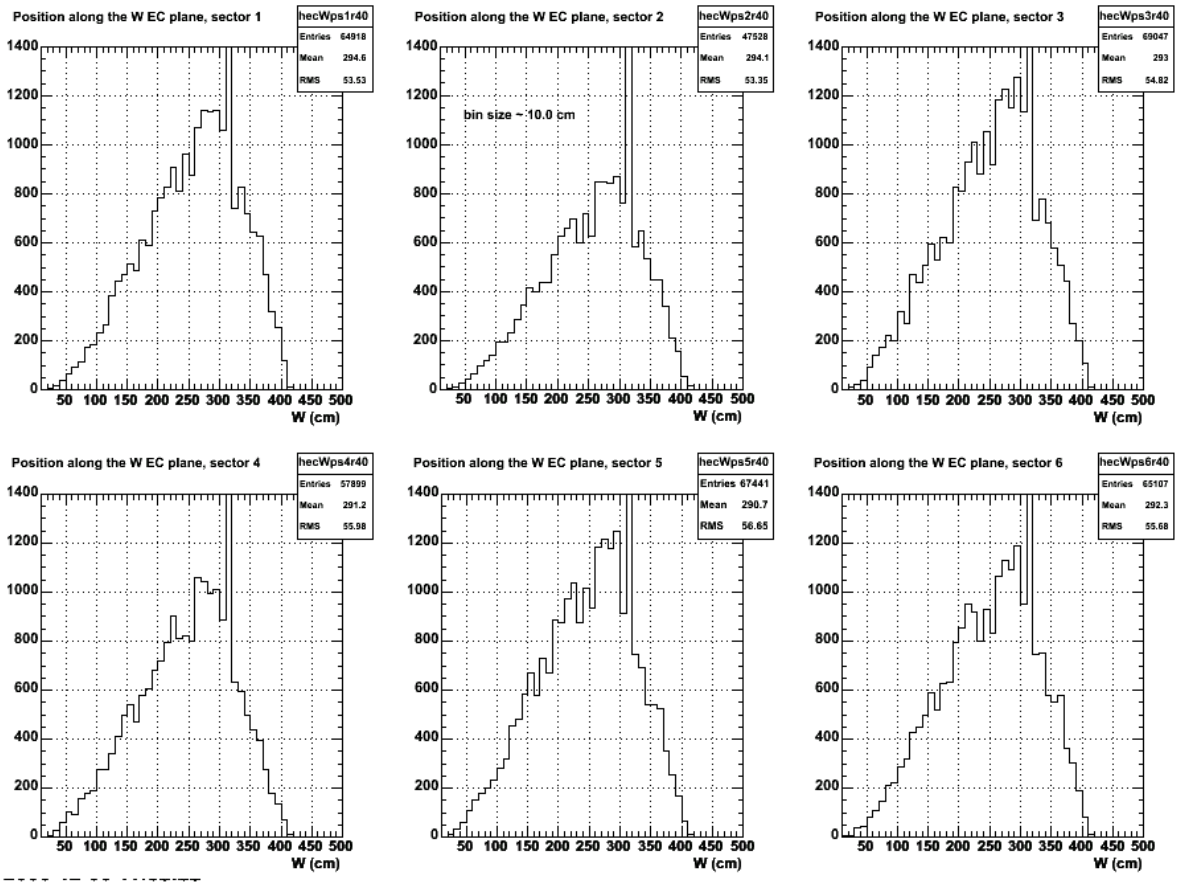


Fig 8. Rebinned pi+ W signal for 4.2 GeV.

Fig 9. Comparison of x-y projection of EC for electrons and pions. This run used the wrong hadron fiducial cuts.

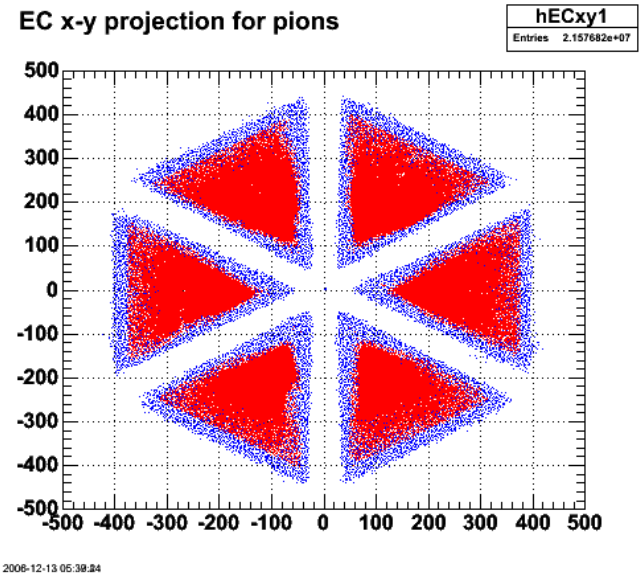


Fig 10. Comparison of x-y projection of EC for electrons and pions for 2.6 GeV, reversed field.

Click here to view the object (ROOT CINT macro for fig 10.) you uploaded.

Click here to view the object (ROOT histogram file for fig 10.) you uploaded.

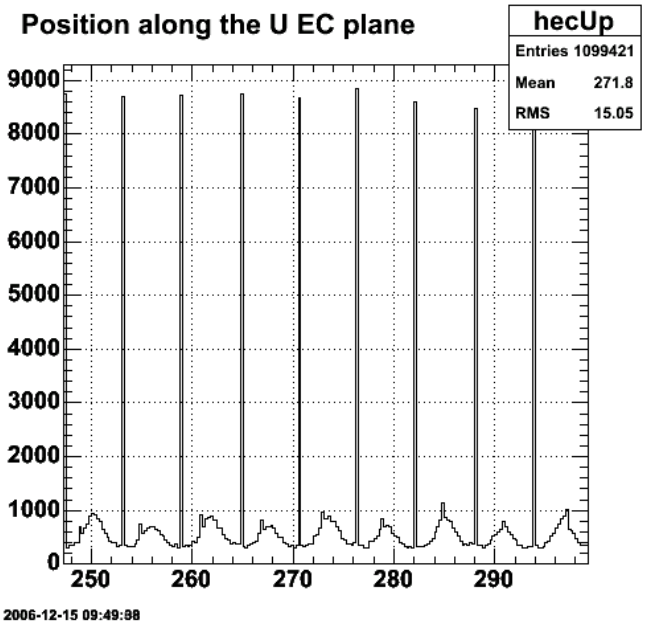


Fig 10b. Close-up of the 2.6-GeV, reversed field U spectrum for positive pions to show the spikes and peaks.

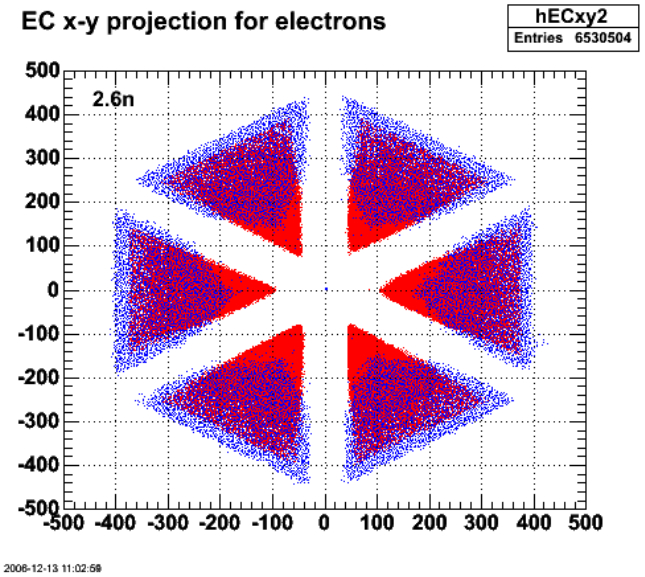


Fig 11. Comparison of x-y projection of EC for electrons and pions for 2.6 GeV, normal field.

Click here to view the object (root histogram file for fig 11) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 143 - check on UVW strips (gpg)

[Modified Wed Feb 13 15:16:41 2008 (GMT) gpg]

First pass at examing uniformity of pi+ signal in the EC by looking at the UVW inner and outer strip numbers for the 2.6r data. The plots below represent the number of hits in each event for the different EC views. A tared, gzipped archive is at the bottom of this page.

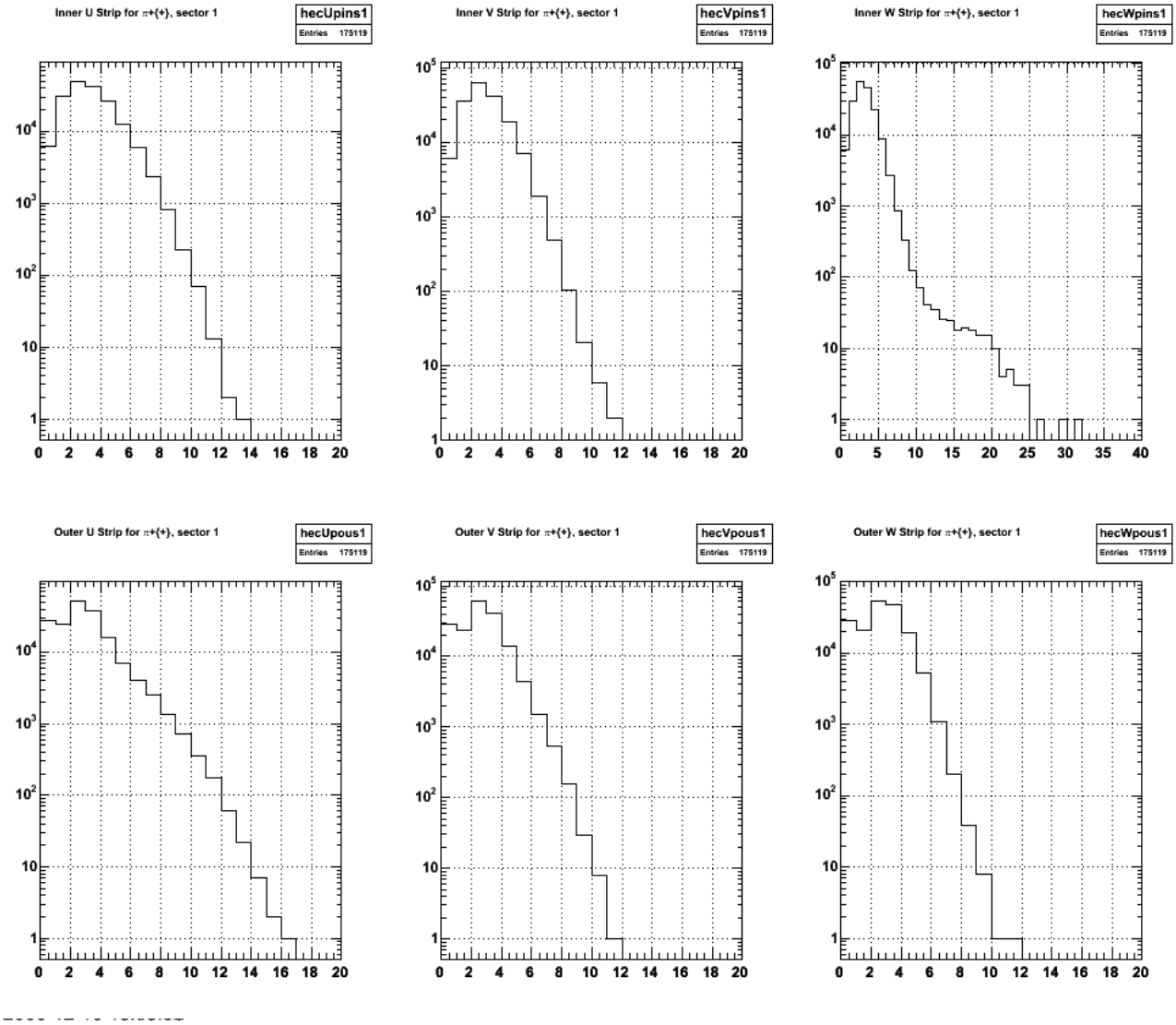


Fig 1. Sector 1, UVW strip numbers for inner and outer EC.

Click here to view the object (ROOT CINT file for fig 1) you uploaded.

Click here to view the object (ROOT histogram file for fig 1) you uploaded.

To focus on minimum ionizing particles, we require that the number of hits in each view for both the inner and outer parts of the EC be less than or equal to one. The U plot is shown below. We are dominated by the spikes, but there is still some events spread across multiple strips that we want to get rid of.

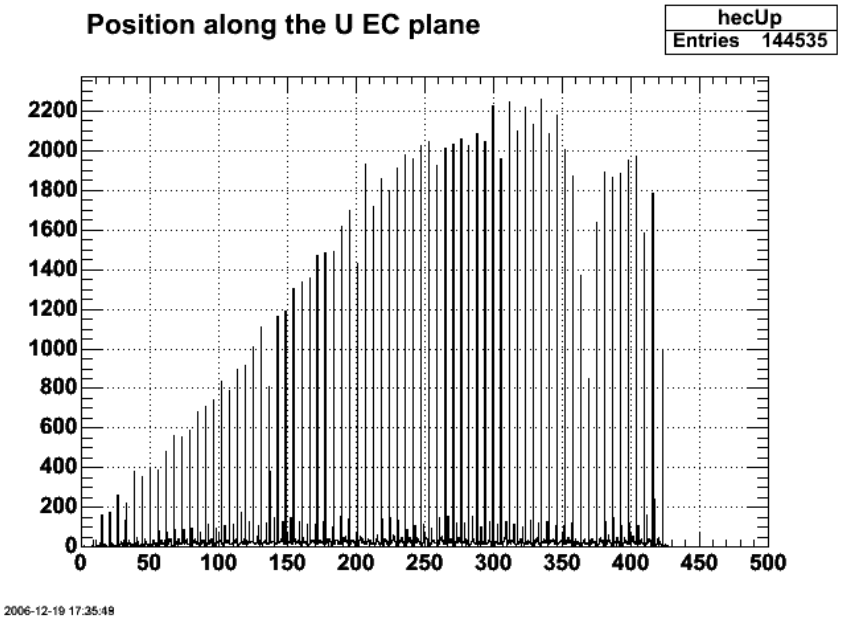


Fig 2. U view for events with 0-1 hit in all views for inner and outer EC.

Click here to view the object (ROOT histogram file for Fig 2) you uploaded.

Fix an indexing problem in the code and get the following. The 'background' is smaller, but still not zero which I thought it might be after this change.

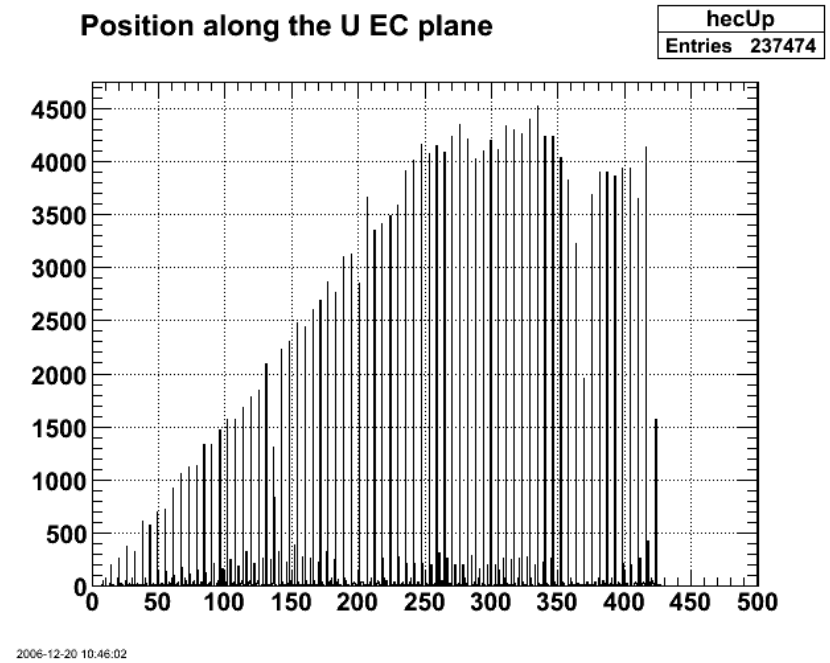


Fig 3. U view for events with 0-1 hit in all views for inner and outer EC with indexing problem fixed relative to fig 2.

Click here to view the object (ROOT histogram file for Fig 3) you uploaded.

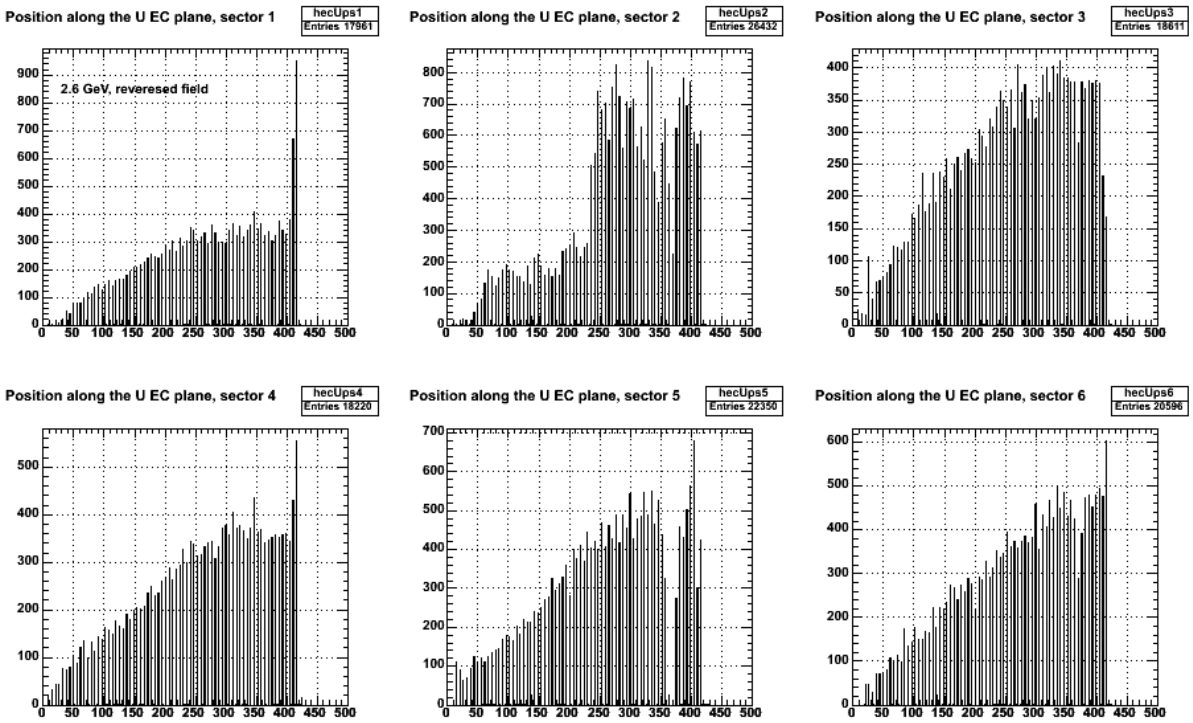


Fig 4. Cuts: 1 or fewer hits for all strips, no EC outer signal, 2.6r.

4

Click here to view the object (ROOT CINT for fig 4) you uploaded.

Click here to view the object (ROOT CINT macro for fig 4) you uploaded.

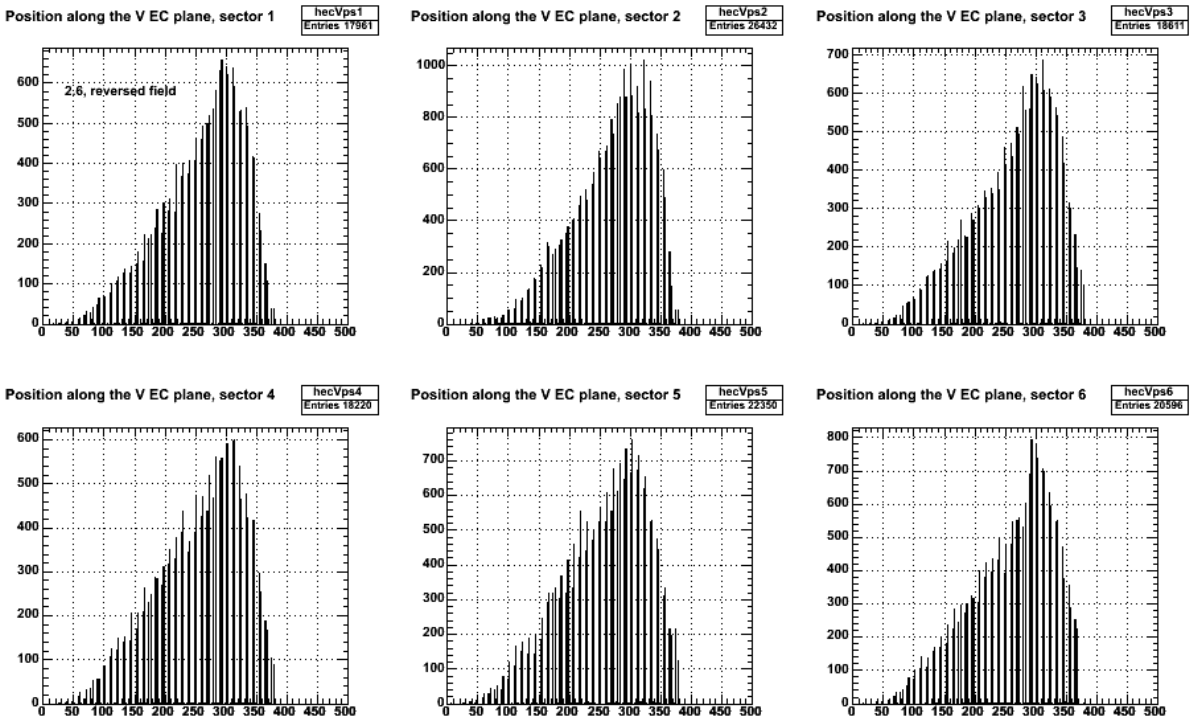


Fig 5. Cuts: 1 or fewer hits for all strips, no EC outer signal, 2.6r.

Click here to view the object (ROOT histogram file for fig 5) you uploaded.

Click here to view the object (PS file for fig 5) you uploaded.

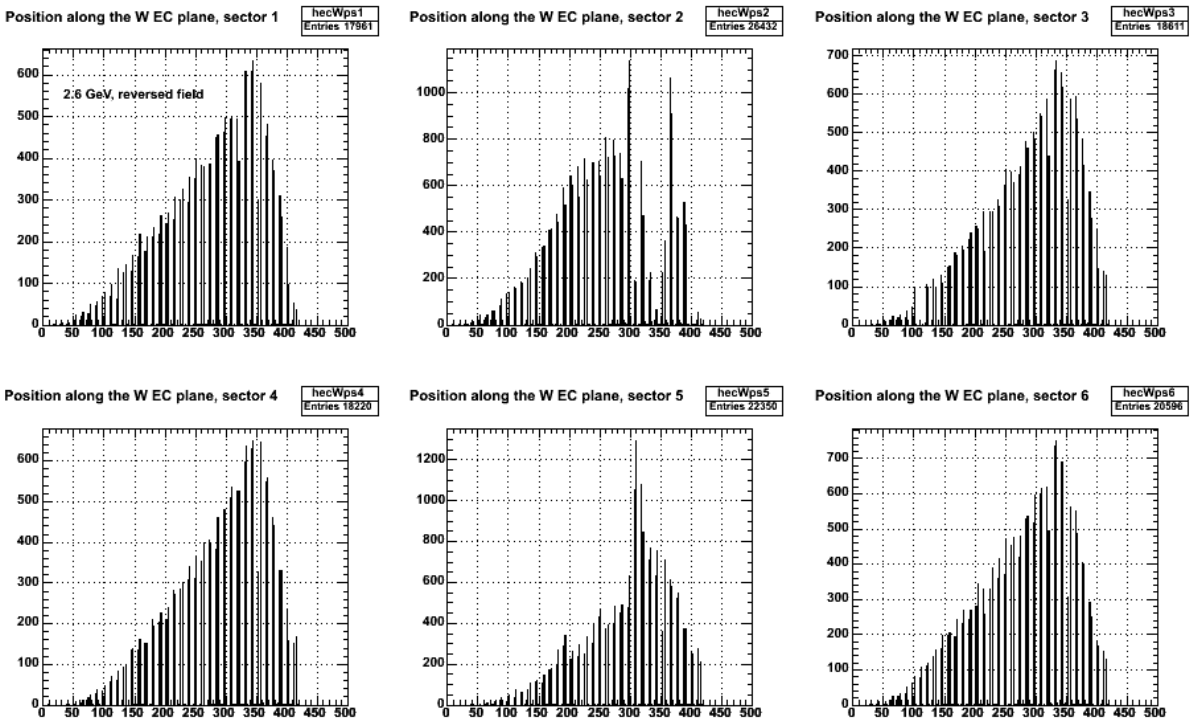


Fig 6. Cuts: 1 or fewer hits for all strips, no EC outer signal, 2.6r.

Click here to view the object (ROOT histogram file for fig 6) you uploaded.

Click here to view the object (PS file for fig 6) you uploaded.

Click here to view the object (ROOT hist file for figs 4-6) you uploaded.

Below we rebinned the U, V, and W spectra so that peaks from the same strip were lumped together. The results are shown below.

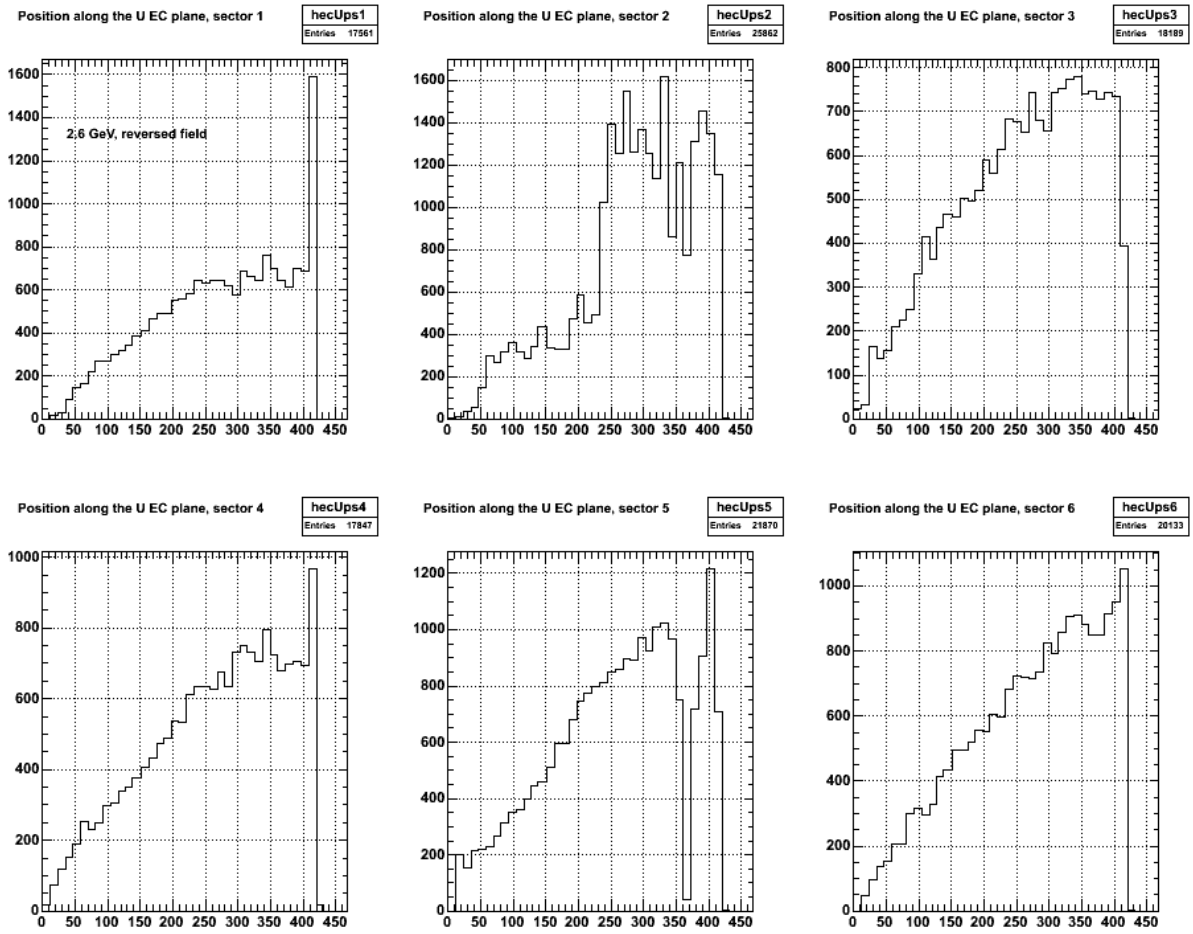


Fig 7. U spectra for single pixel events, 2.6r

Click here to view the object (PS file of Fig 7) you uploaded.

Click here to view the object (ROOT CINT file for fig 7) you uploaded.

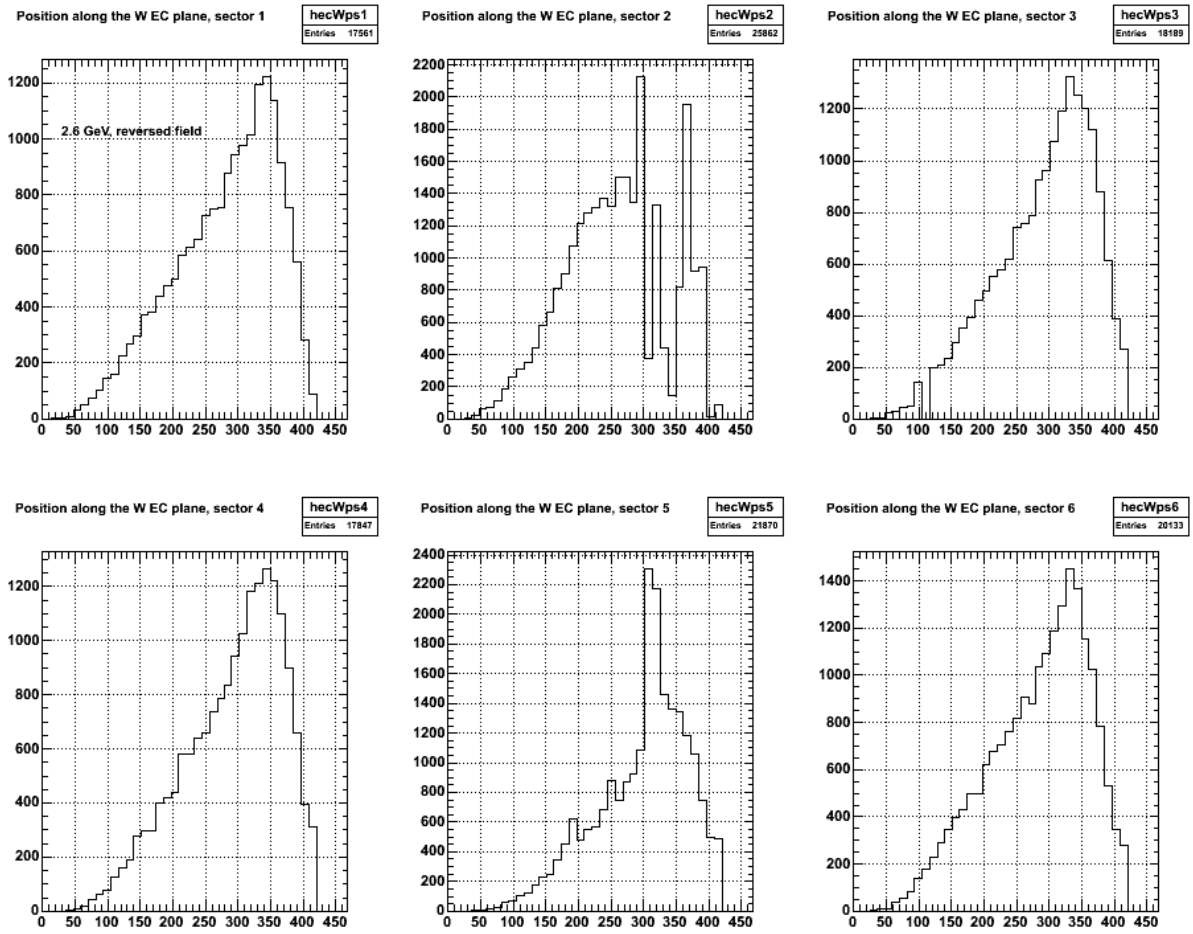


Fig 8. W spectra for single pixel events, 2.6r.

Click here to view the object (PS version of Fig 8) you uploaded.

Click here to view the object (ROOT CINT file for fig 8) you uploaded.

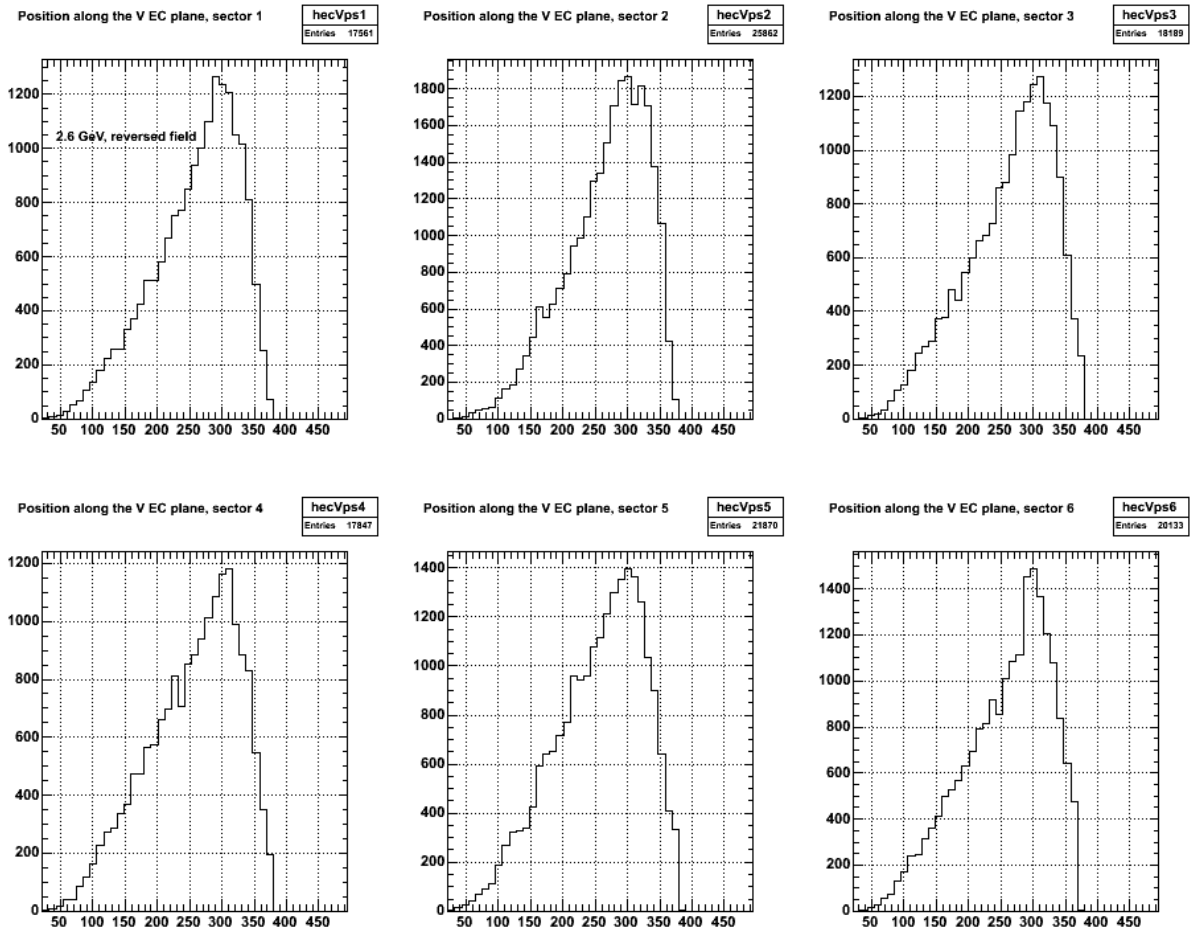


Fig 9. V spectra for single pixel events, 2.6r.

Click here to view the object (PS version of Fig 9) you uploaded.

Click here to view the object (ROOT CINT file for fig 9) you uploaded.

Click here to view the object (ROOT histogram file for Fig 7-9) you uploaded.

Click here to view the object (Tared, gzipped, archive of the code used to analyze the simulations of CLAS.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 144 - Question 9 (gpg)

[Modified Fri Jan 5 18:00:24 2007 (GMT) gpg]

```
 9) EC neutron efficiency is obtained separately for each "superpixel" (12
scintilator strips) while in SC for each separate stintillator paddle.
Can the averaging over 12 strips in EC wash out single paddle problems?
How did you check this?
```

We looked at the distribution of pi+'s in the EC which are used to tag the neutrons in the neutron detection efficiency measurement. If the pion efficiency is uniform across the EC, then we expect the efficiency of the neutrons will also be uniform. The first plot below shows the U distribution for positive pions at 2.6 GeV with reversed torus polarity. We required that all events have no more than one strip firing for each EC view (U, V, or W) to focus on minimum ionizing particles. As a result all of the events in Fig 1 are single-pixel EC events. Since the shower from each pi+ is concentrated in a single strip we cannot extract an average position along the width of the strip so the center of the strip is chosen for this position. We can still extract the position along the length of the strip, i.e., along the U, V, or W axis. This single-pixel effect creates the sharp peaks in the red histogram in Fig 1. Notice that there are twice as many of the sharp, red spikes as there are strips (see below for more). There should be 36 strips so we rebinned the histogram so that pairs of the sharp, red spikes were summed together to get a better view of the EC performance as a function of strip.

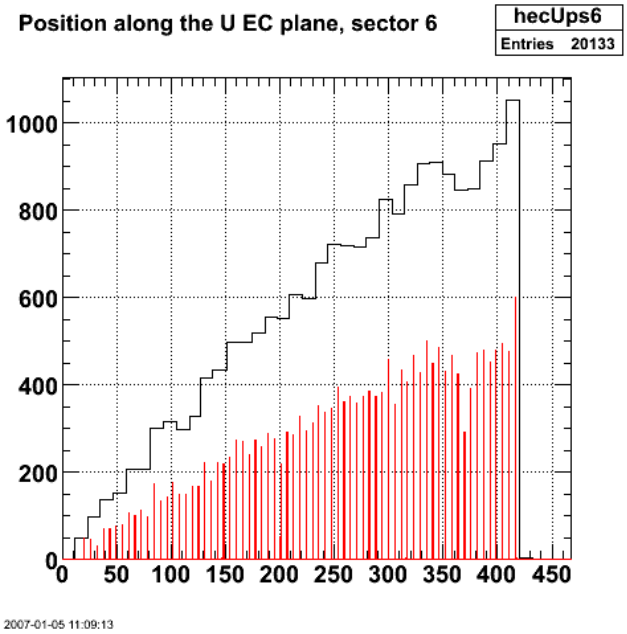


Figure 1. Histogram of the U signal in sector 1 for single-pixel events for 2.6 GeV, reversed polarity.

The results for each sector and each view is shown in Figure 2-4.

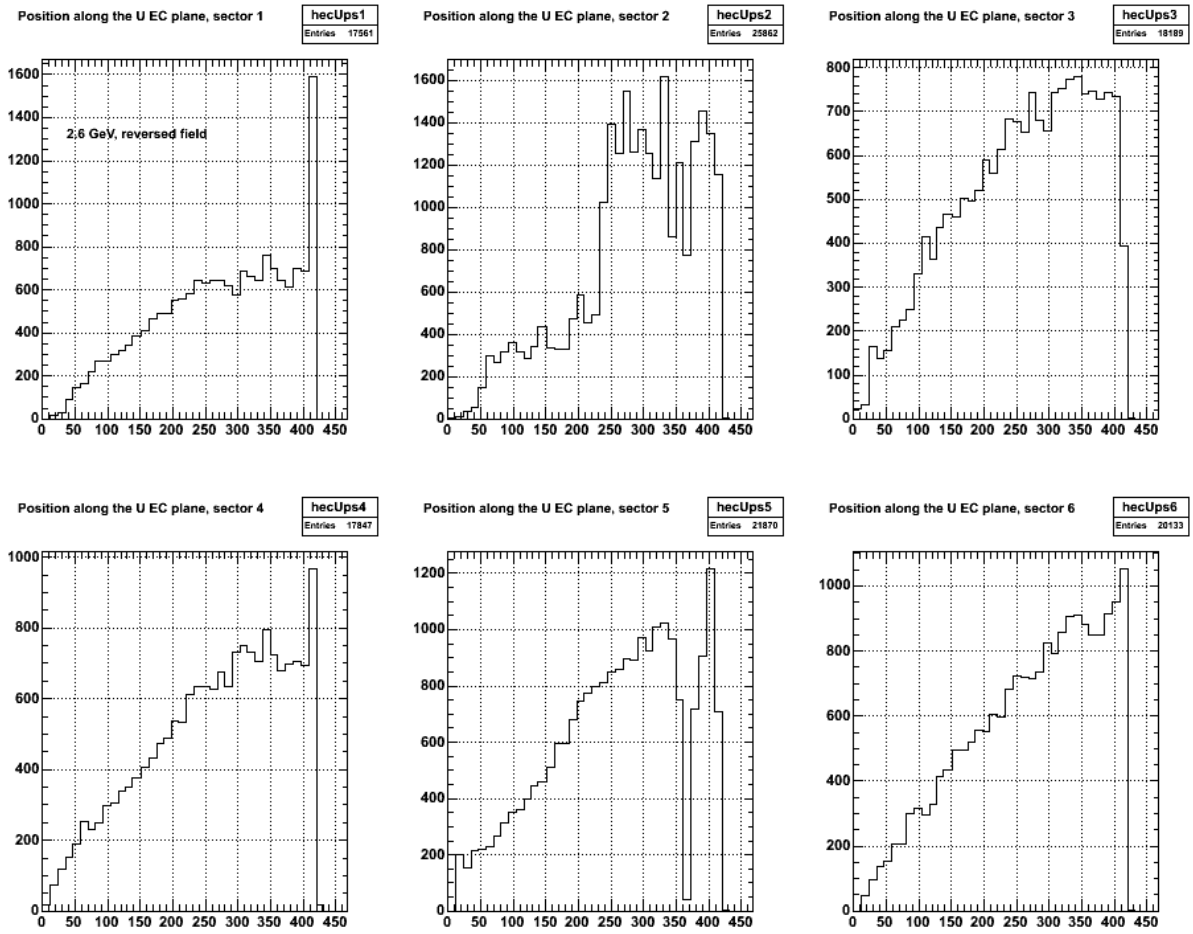


Fig 2. U spectra for single pixel events, 2.6 GeV, revesed polarity.

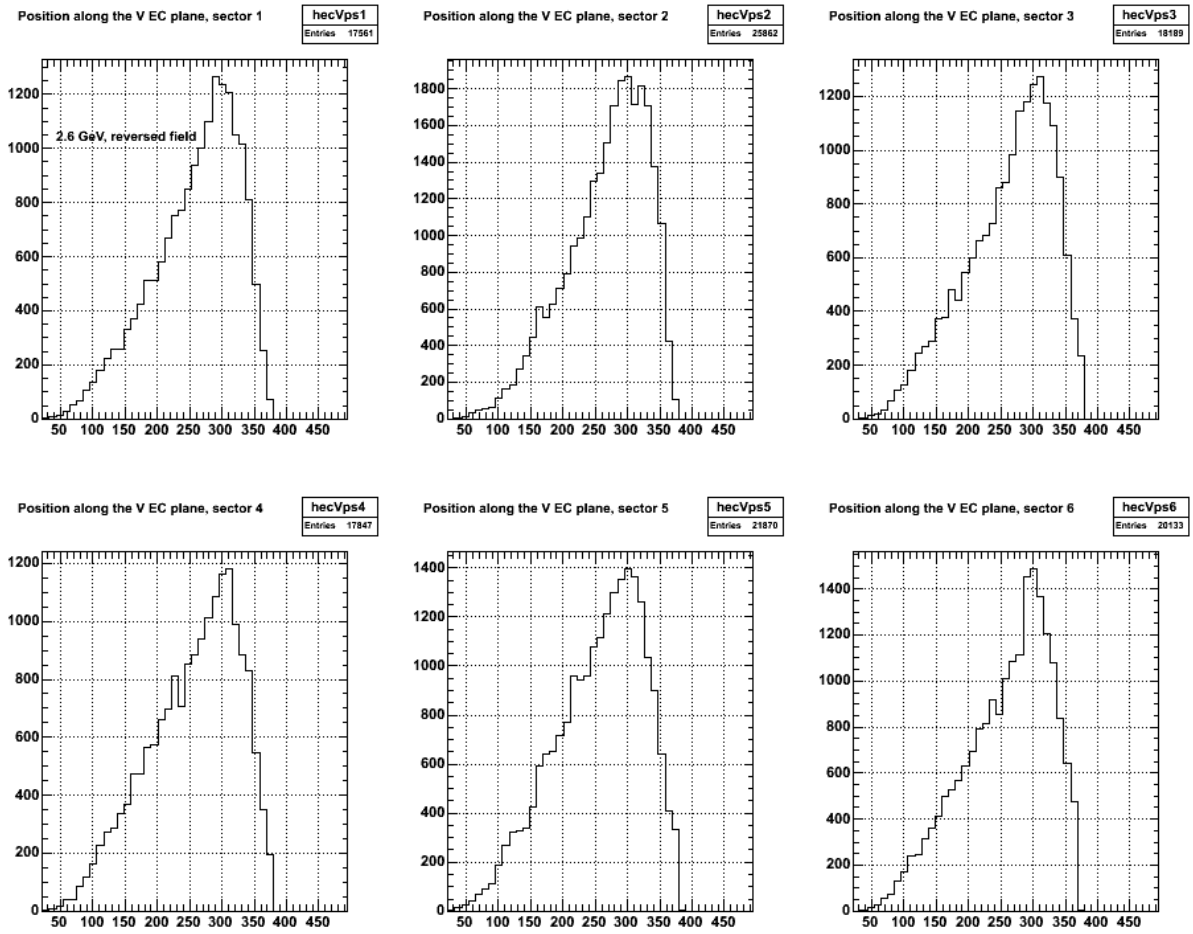


Fig 3. V spectra for single pixel events, 2.6 GeV, revesed polarity.

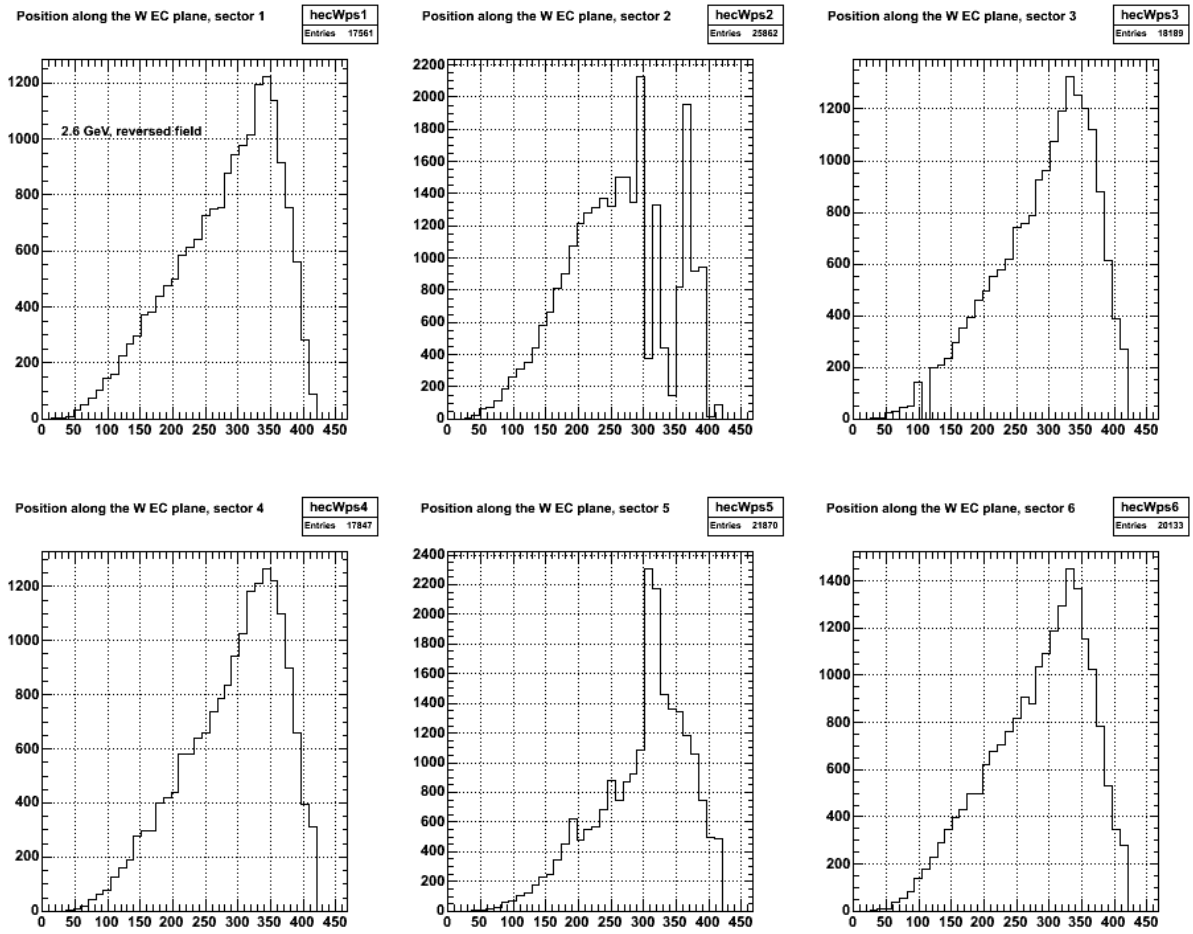


Fig 4. W spectra for single pixel events, 2.6 GeV, reversed polarity.

The U, V, and W spectra for the 2.6-GeV, reversed field data are shown below in Figure 5 summed over all sectors.

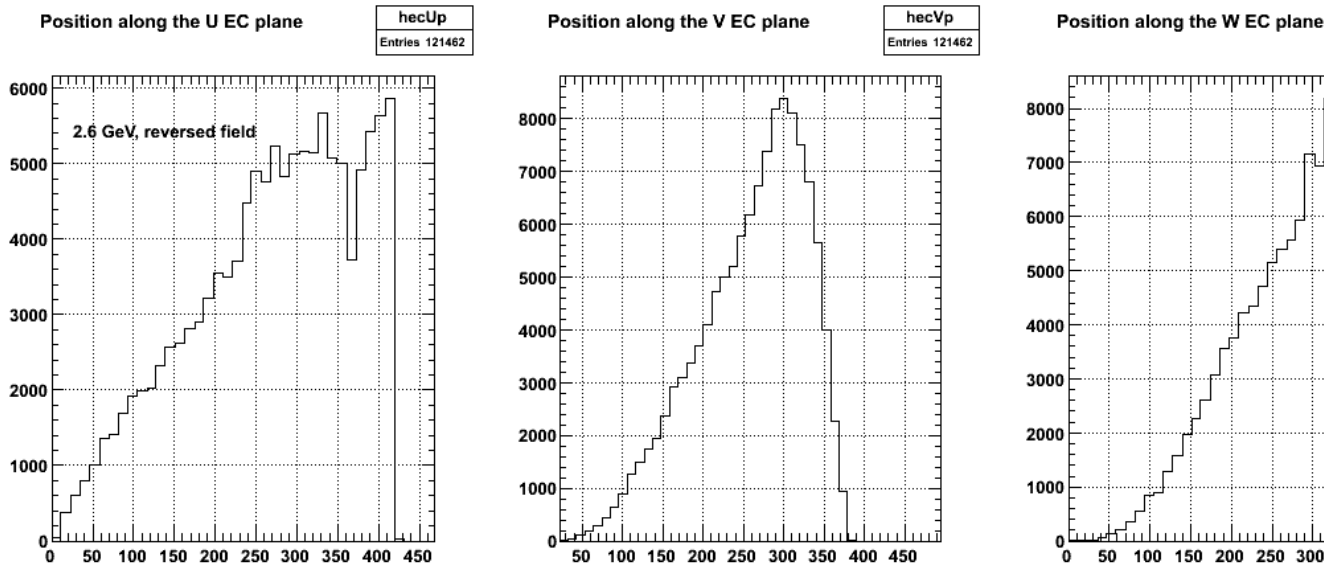


Fig 5. Plot of U, V, and W spectra summed over sectors for 2.6 GeV, reversed polairty data.

To explain the double peaks for each strip seen in Figure 1 consider the schematic diagram below of the face of the EC. It shows part of a single U strip, a single V strip, and two adjacent W strips (the black lines). The red, dashed lines are the center lines of each strip. Two EC pixels are labeled 1 (light blue) and 2

(green). For a single-pixel event in pixel 1, we will obtain some position along the red, dashed center lines in each view. Most of the events will be in the upper half of the triangular pixel simply because that half has a larger area and solid angle. The purple (magenta) lines drawn in pixel 1 show the approximate range of values we obtain for this pixel. The ranges for each view form the purple triangle inside pixel 1. Averaging over these distributions will give us a value in the upper half of the pixel and the strip.

Consider now pixel 2 (in green). Following a similar argument, the ranges of values for each strip are shown in the blue, inverted triangle. Now, when we extract the average position of the hits over these ranges, we will obtain a value in the lower half of the pixel and the strip. We will see two peaks for each strip corresponding to the different orientations of the adjacent pixels.

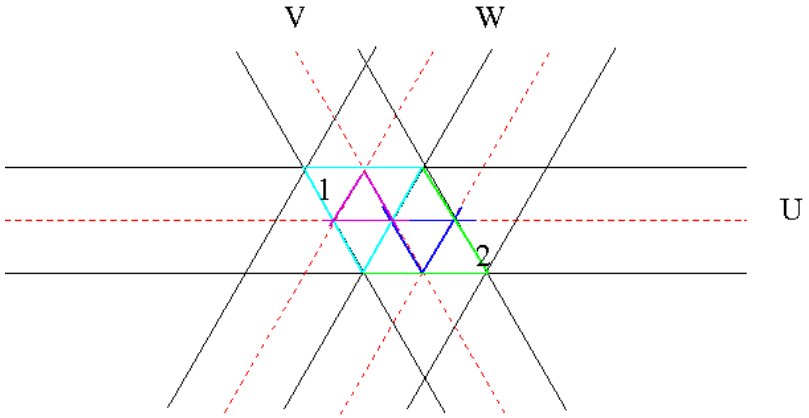


Fig 6. Schematic drawing of a portion of the face of the EC showing how the U, V, and W strips for pixels.

The high-resolution U, V, and W spectra are shown in Figures 7-9

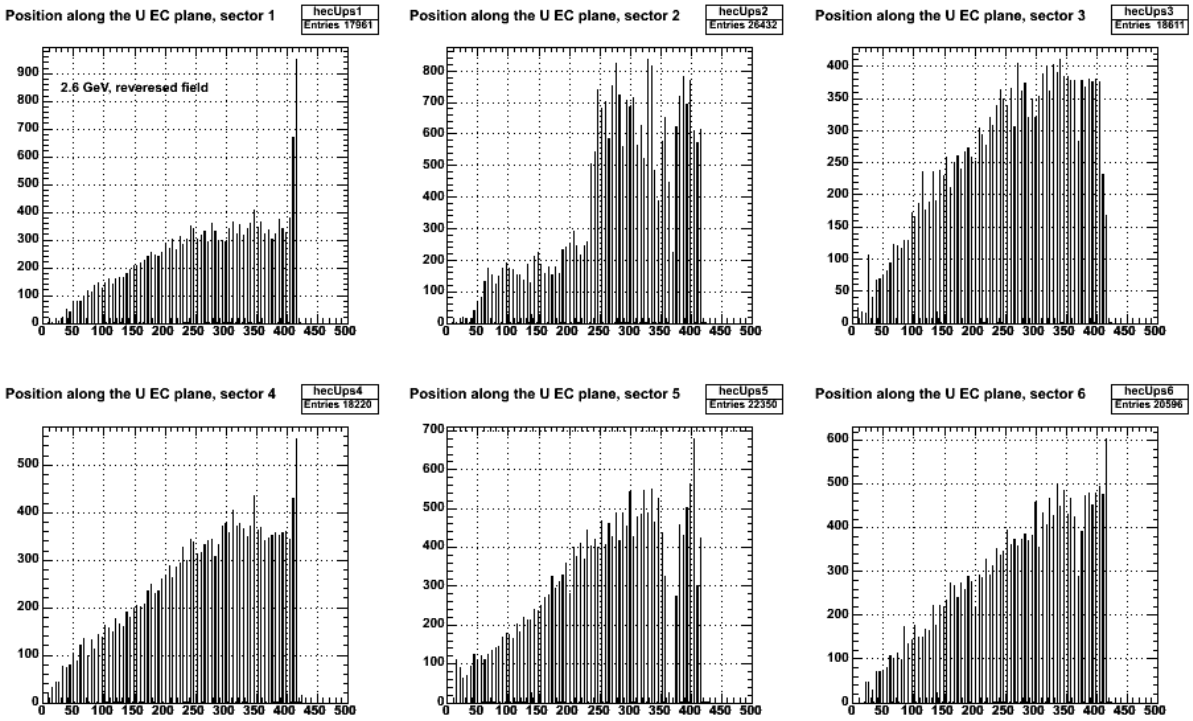


Fig 7. U spectra by sector. Cuts: 1 or fewer hits for all strips, 2.6r.

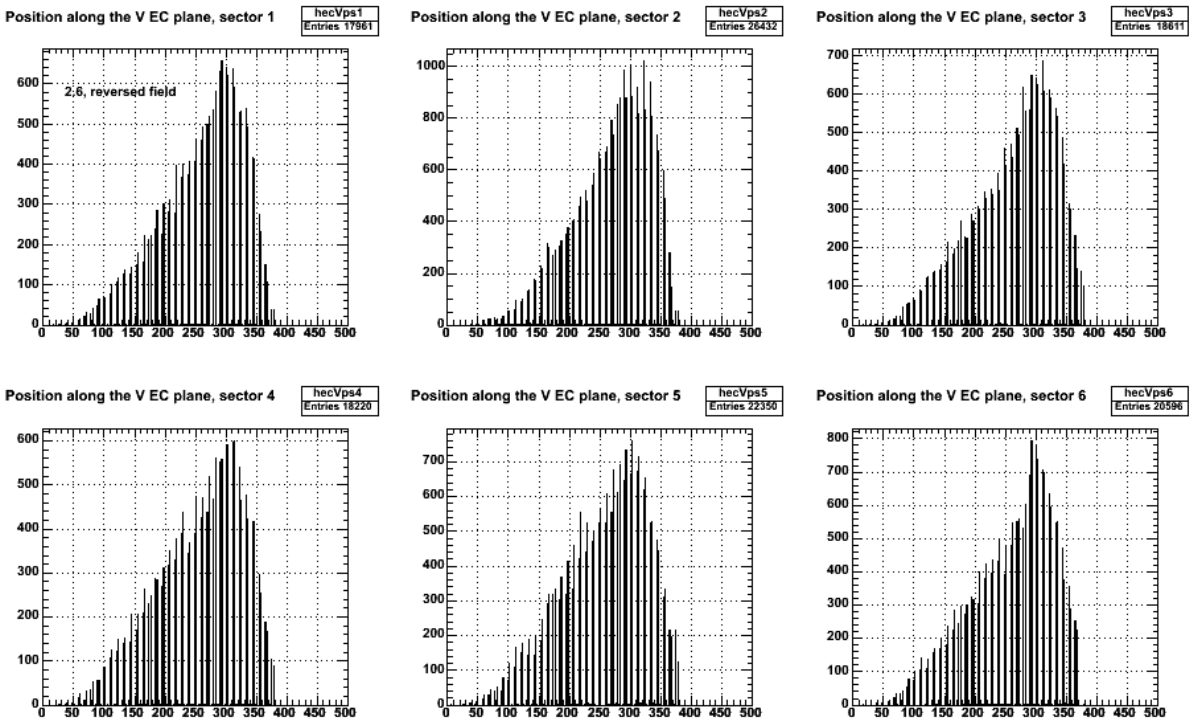


Fig 8. V spectra by sector. Cuts: 1 or fewer hits for all strips, 2.6r.

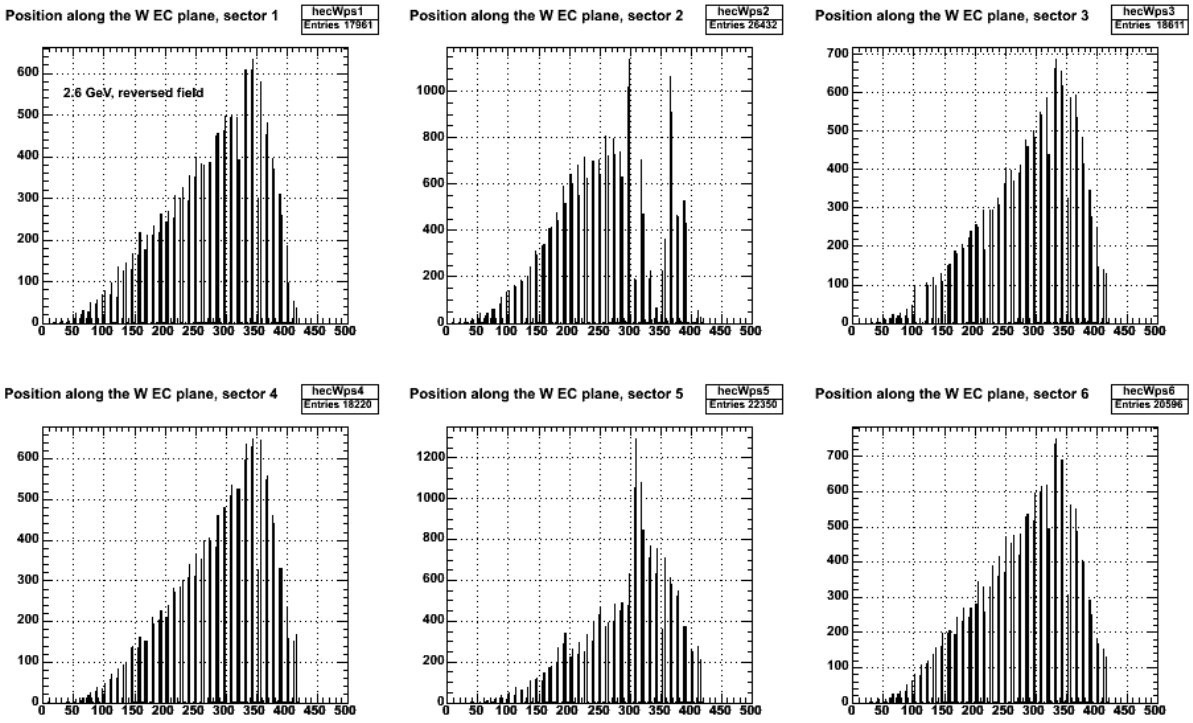


Fig 9. W spectra by sector. Cuts: 1 or fewer hits for all strips, no EC outer signal, 2.6r.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 145 - First 12 GeV simulation results (gpg)

[Modified Fri Jan 26 16:00:09 2007 (GMT) gpg]

YIPPEEE! First results from 12 GeV simulations.

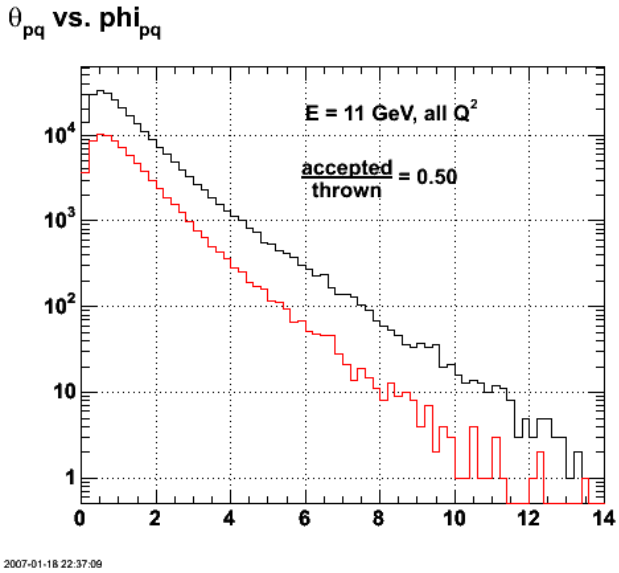


Fig 1. Comparison of theta_pq for thrown and accepted events.

Click here to view the object (ROOT CINT macro for fig 1) you uploaded.

Click here to view the object (ROOT histogram file for thrown events for fig 1.) you uploaded.

Click here to view the object (ROOT histogram file for accepted events for fig 1.) you uploaded.

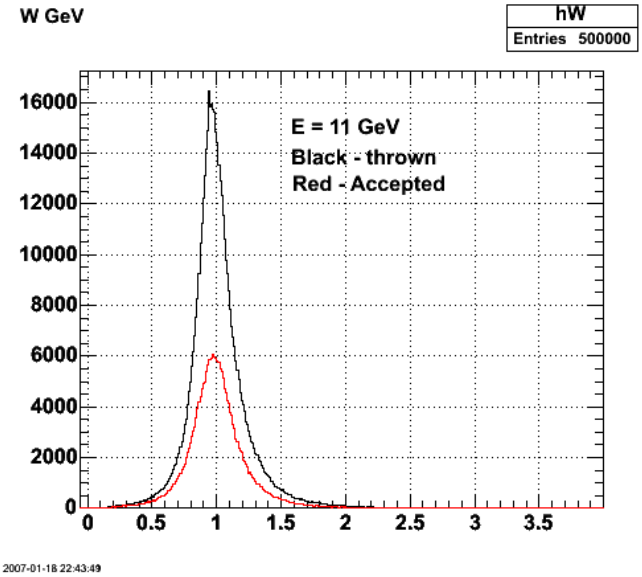


Fig 2. Comparison of W spectra for quasielastic events on deuterium for 11 GeV.

Click here to view the object (ROOT CINT macro for fig 2.) you uploaded.

Effect of multiplying the smearing functions for momentum, theta, and phi for each particle in the final state by a factor of 10.

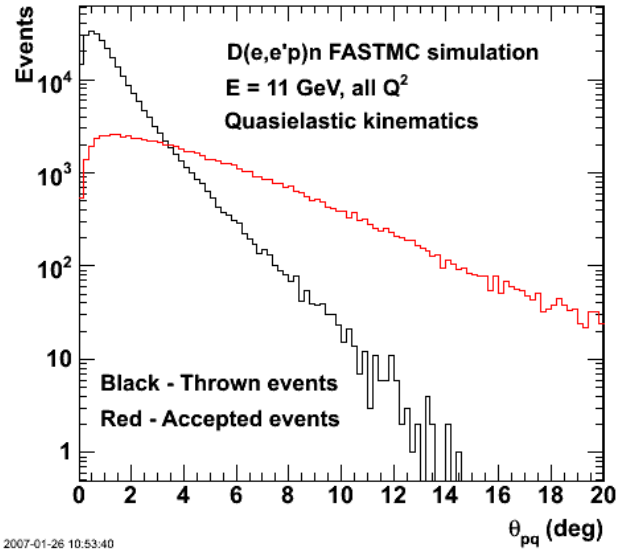


Fig 3. Comparison of theta_pq for thrown and accepted events after increasing all the smearing functions by a factor of 10.

Click here to view the object (ROOT CINT macro for fig 3) you uploaded.

Click here to view the object (ROOT histogram file for accepted events for fig 3) you uploaded.

Click here to view the object (OOT histogram file for thrown events for fig 3) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 146 - Effect of N=2 veto (gpg)

[Modified Tue Feb 6 03:24:19 2007 (GMT) gpg]

I am investigating the effect of requiring no more than two particles in the final state.

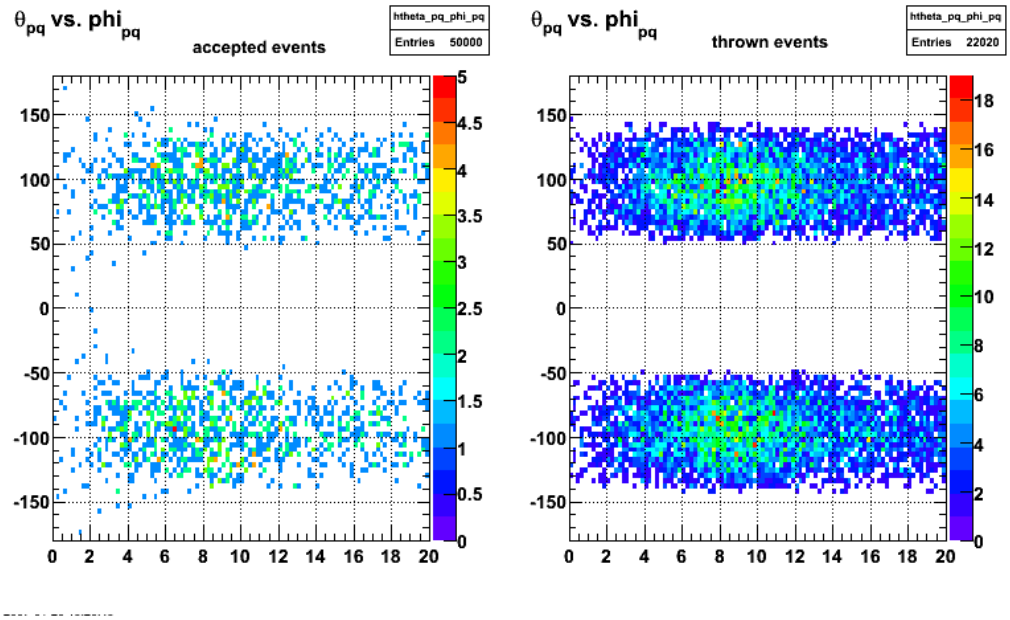


Fig 1. Effect of FASTMC on theta_pq and phi_pq with N=2 requirement turned off.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (EVNT banks for fig 1) you uploaded.

Click here to view the object (PART banks for fig 1) you uploaded.

Effect of FASTMC on theta_pq angdist.

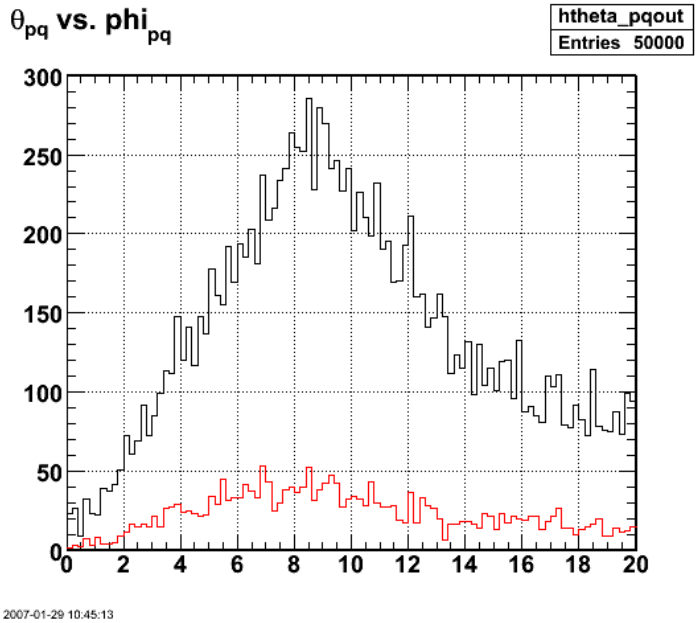


Fig 2. Comparison of thrown and accepted events on theta_pq angdist. There is a mistake here. The angdist for the thrown events has the N=2 requirement turned on while the angdist for the accepted events has the N=2 requirement turned off.

Click here to view the object (ROOT macro for fig 2) you uploaded.

Short run comparing the thrown and accepted events for the W spectra where we require that the events have no more than an electron and proton in the final

state.

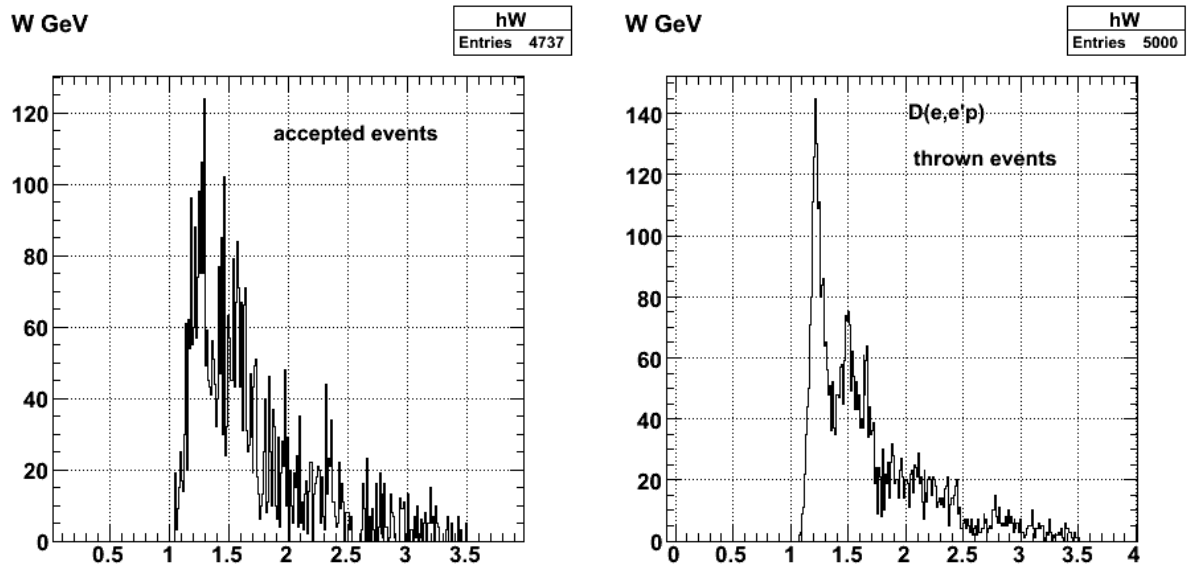


Fig 3. Comparison of thrown and accepted events.

Click here to view the object (ROOT macro for fig 3) you uploaded.

Click here to view the object (ROOT histogram file for accepted events.) you uploaded.

Click here to view the object (ROOT histogram file for thrown events) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 147 - more calculations from Sabine (gpg)

[Modified Mon Feb 12 21:41:00 2007 (GMT) gpg]

This is the latest calculation from Sabine. It looks less like the data than her previous calculation. The solid, green, curve is averaged over the Q2 distribution for the 2.6r data. The dashed, green curve is for Q2=1.1 GeV2.

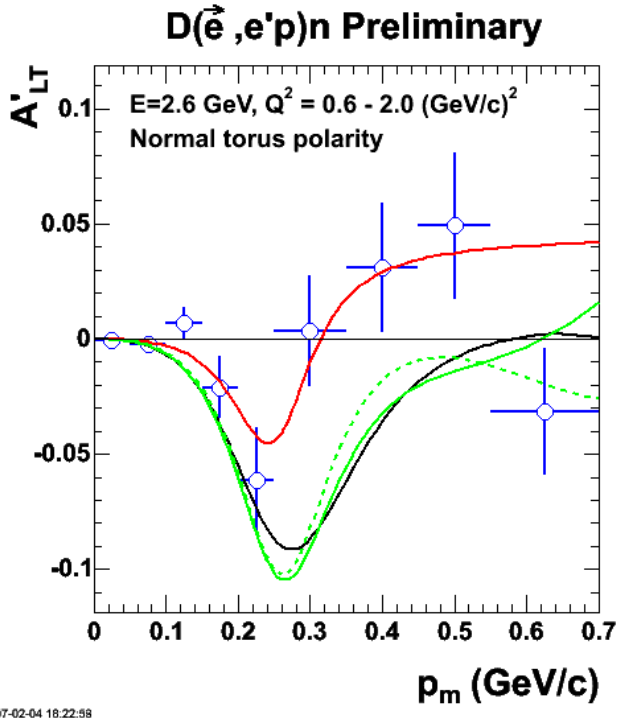


Fig 1. Comparison of different calculations with the 2.6n data. The black curve is a Q2-averaged Arenhoevel calculation, the red one is the Sabine calculation for Q2=1.1 GeV2 from the fall, 2006 DNP meeting, the solid, green curve is the recent (2/07), Q2-averaged from Sabine, and the green, dashed curve is the recent (2/07) one for Q2=1.1 GeV2 from Sabine.

Click here to view the object (ROOT macro for fig 1) you uploaded.

email from SJ after asking why the big change. see entry 317 in E5 elog.

```
Hello Jerry,

  It's good to hear from you! Your first question has an easy answer: my
Q2 is positive, while Bill's Q2 is negative. He just likes to use this
definition...

  The second question - what changed? - has also an answer - it's the NN
amplitude parametrization.  I have included some of my comments on this
from my previous e-mail below. We could talk on the phone this week, too.
Today and tomorrow don't work at all, but Wednesday afternoon (after 3pm)
and Thursday would be ok. Just let me know.

Cheers,
Sabine

   The main difference between the different calculations are the
different NN parameters I used as input for my code, to calculate the
final state interactions. The results I sent you earlier were obtained
using an average of the T = 1 GeV NN parameters obtained from
proton-nucleus Glauber scattering. However, your highest Q2 actually
leads to T = 0.8 GeV, so I have now adjusted these parameters to match
your kinematics. I think/hope that I warned you about this fact a while
ago. If you look at the plot called atlpqsq15.ps, you can see the
difference between three parametrizations. Two of them are based on
proton-nucleus Glauber analyses, one on a phase shift analysis. The
Glauber analysis ignored the double spin flip terms in the NN amplitude,
and it is reasonable to assume that some of the double spin-flip effects
are "absorbed" into the fitted parameters. As I also ignore the double
spin-flip terms in my code, I think the Glauber parameters are more
consistent. The phase shift analysis includes all NN amplitudes, also the
double spin-flips. I still only use the central and spin-orbit part in my
calculations, so I'm somewhat philosophically inconsistent doing so.
Using the phase shift analysis NN paramters seems to lead to a much lower
(slightly negative) result for larger missing momenta.
```

So, why do I not simply use just the Glauber version of the NN parameters? Well, that doesn't seem to exist for the low energies of your kinematics...So, why don't I include the double spin-flip terms to consistently use all parts of the NN amplitude from the phase shift analysis? That's the right thing to do, I'll work on it, it will take me a little while.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 148 - final response to question 9 (gpg)

[Modified Fri Feb 9 15:44:17 2007 (GMT) gpg]

```
9) EC neutron efficiency is obtained separately for each "superpixel" (12
scintilator strips) while in SC for each separate stintillator paddle.
Can the averaging over 12 strips in EC wash out single paddle problems?
How did you check this?
```

We looked at the distribution of pi+'s in the EC which are used to tag the neutrons in the neutron detection efficiency measurement. If the pion efficiency is uniform across the EC, then we expect the efficiency of the neutrons will also be uniform. The first three plots below show the U, V, and W distributions for positive pions at 2.6 GeV with reversed torus polarity. The reversed polarity data are better for this comparison because the pi+'s strike the entire face of the EC. For normal torus polarity settings portions of the EC see very few pi+s. We required that all events have no more than one strip firing for each EC view (U, V, or W) to focus on minimum ionizing particles. As a result all of the events in Figs 1-3 are single-pixel EC events which we bin in EC strip number for each view.

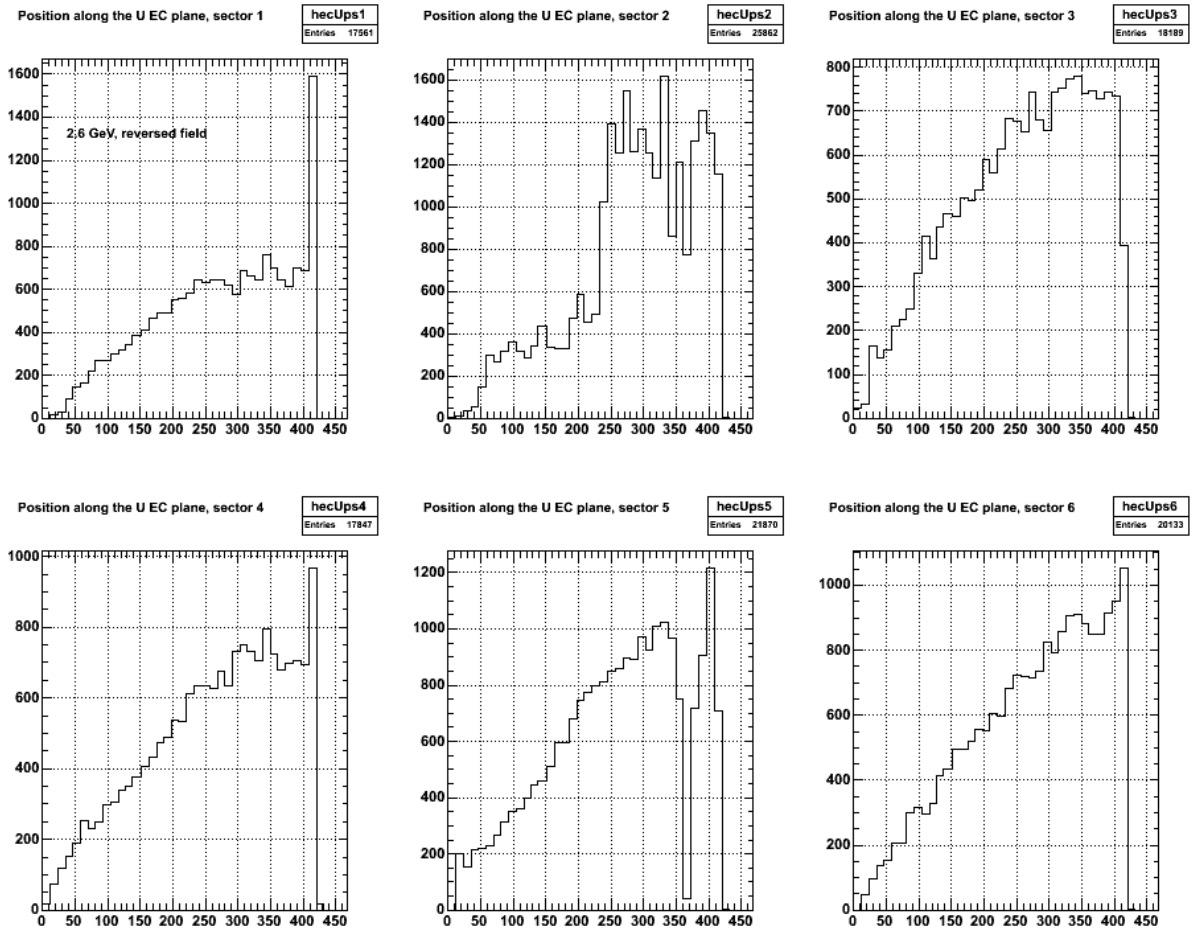


Fig 1. Distribution of counts in the U-view of the EC for single-pixel pi+ events for the 2.6-GeV, reversed torus polarity data.

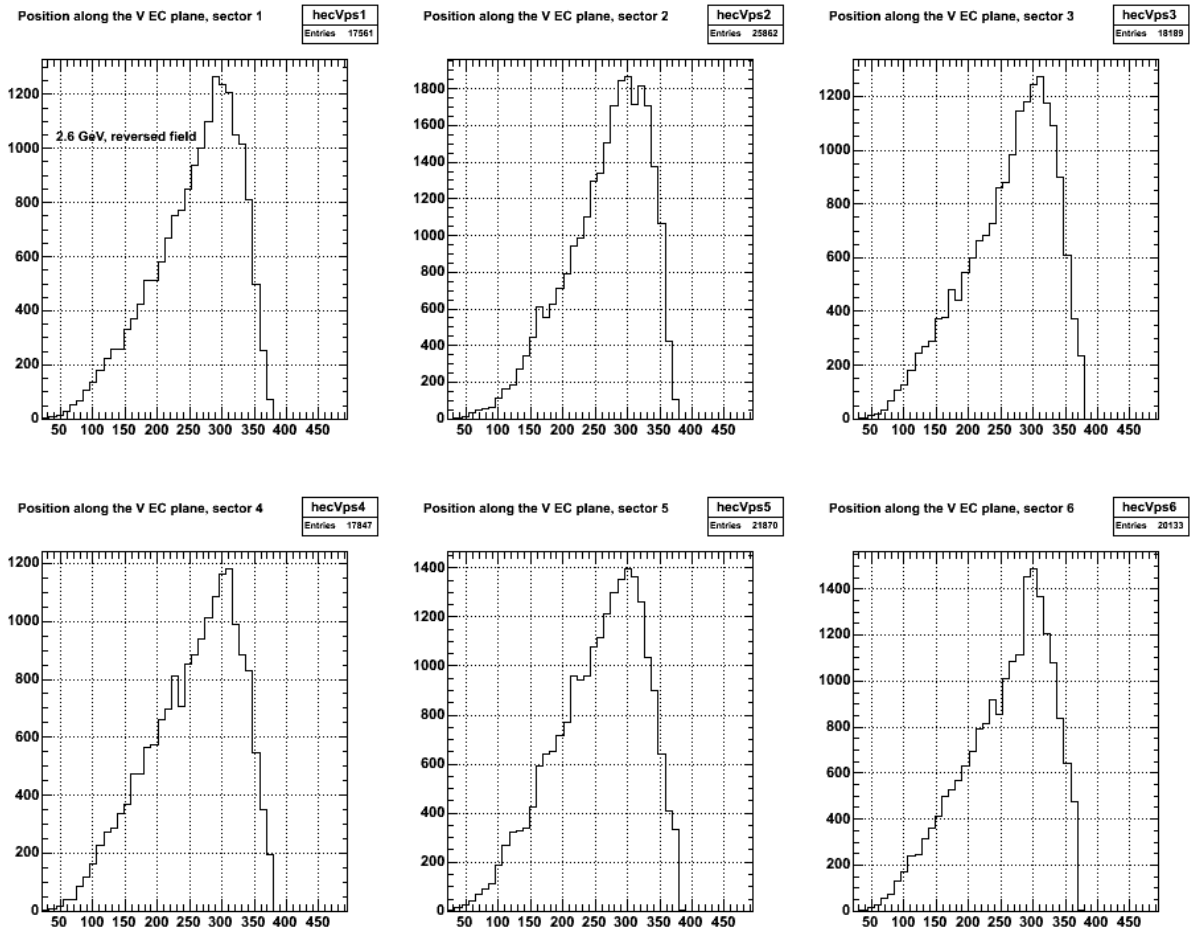


Fig 2. Distribution of counts in the V-view of the EC for single-pixel pi+ events for the 2.6-GeV, reversed torus polarity data.

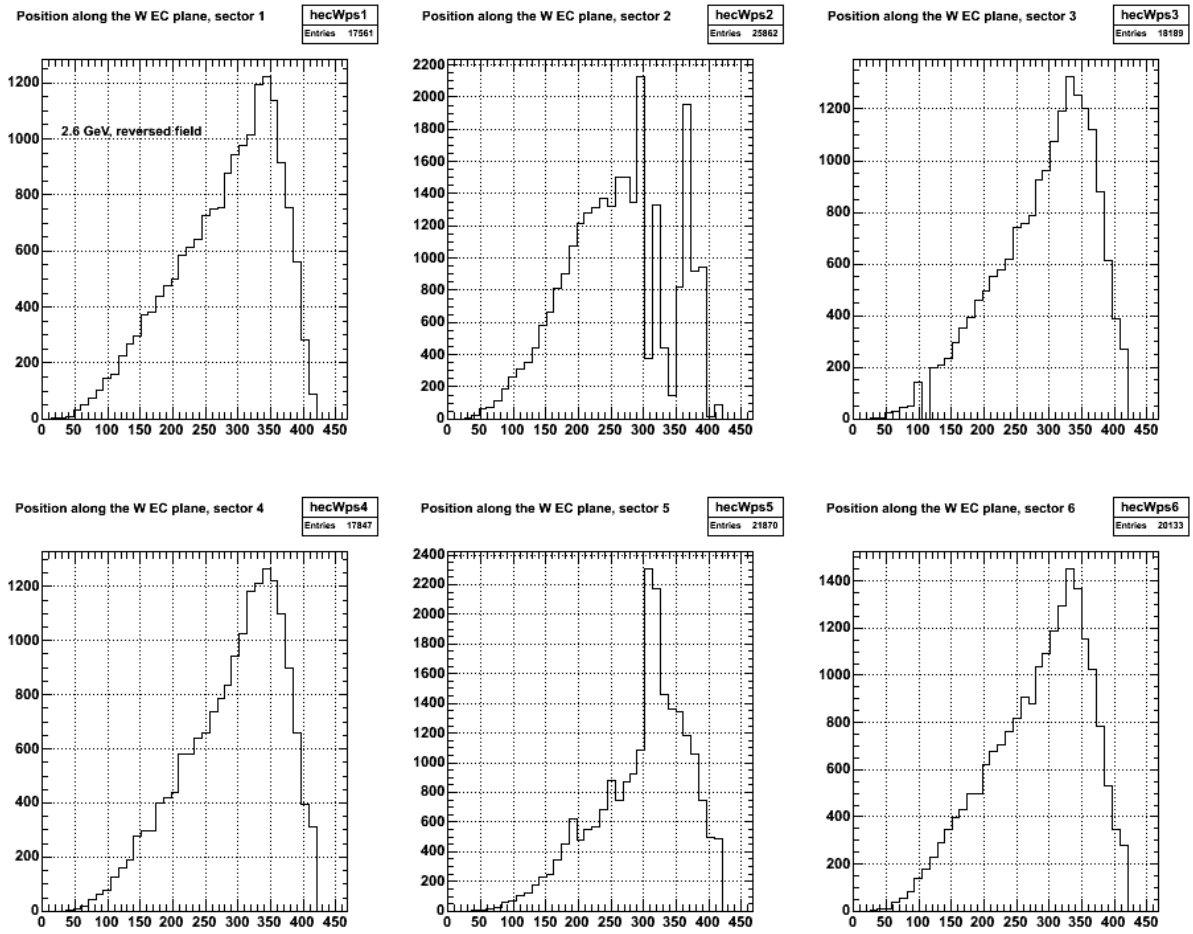


Fig 3. Distribution of counts in the W-view of the EC for single-pixel pi+ events for the 2.6-GeV, reversed torus polarity data.

Figs 1-3 show the count rates for each EC strip in each view and broken down by sector. Some significant variations from sector to sector and strip to strip can be seen. For example, sector 2 in Figure 3 (W view) shows 'holes' (low-efficiency components) among strips in the range 25-30. To test the effect of these inefficiencies on our results, we repeated the extraction of GMn from the 4.2-GeV data excluding sector 2 from the analysis. The results are shown in Figure 4. Leaving sector 2 out has little effect on GMn.

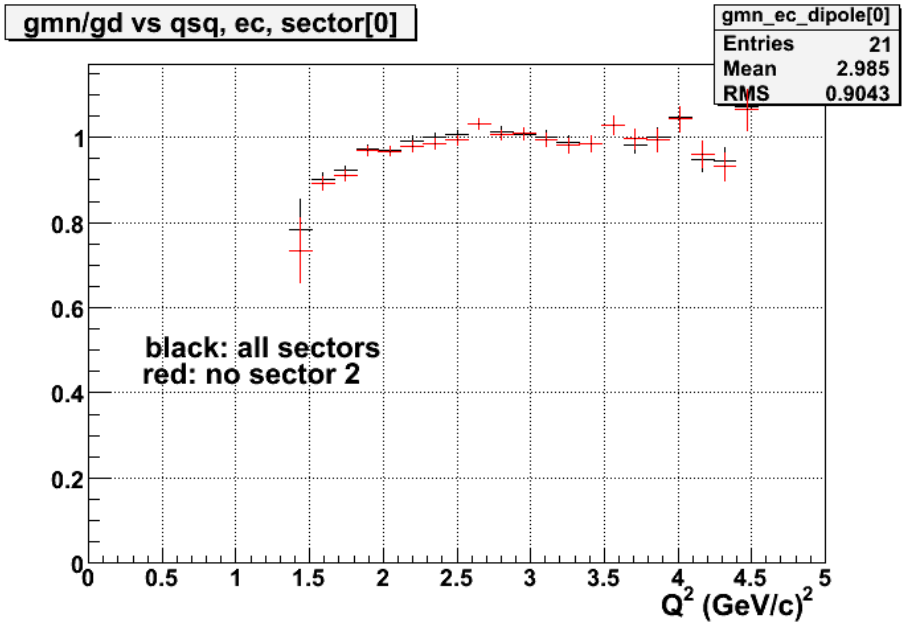


Fig 4. Neutron magnetic form factor extracted with sector 2 excluded.

To make a more global test of the effect of inefficiences on GMn we excluded all super-pixels whose efficiencies varied by more than 10% from the average for the sector as a whole. The results are shown in Figure 5. Again there is little effect on GMn.

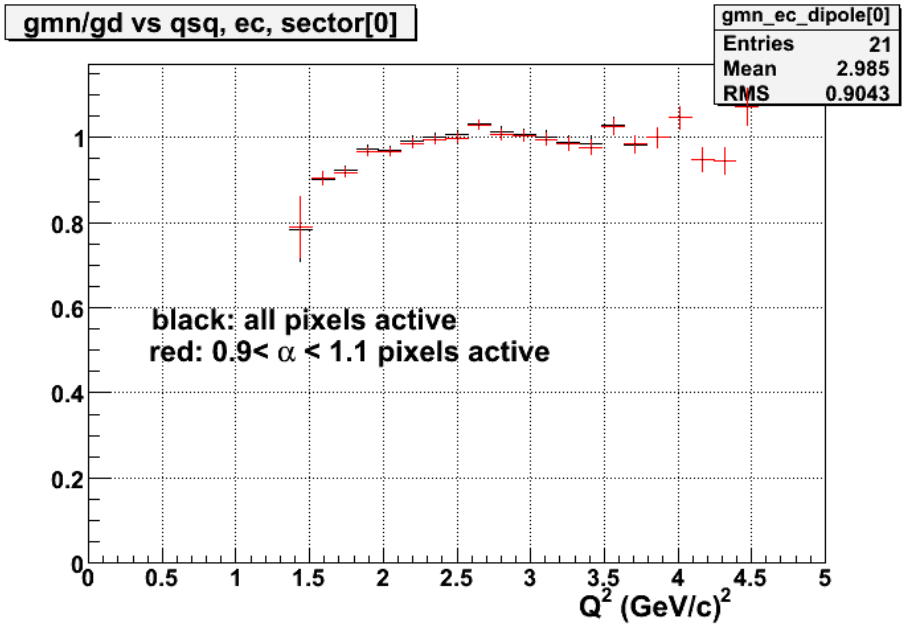


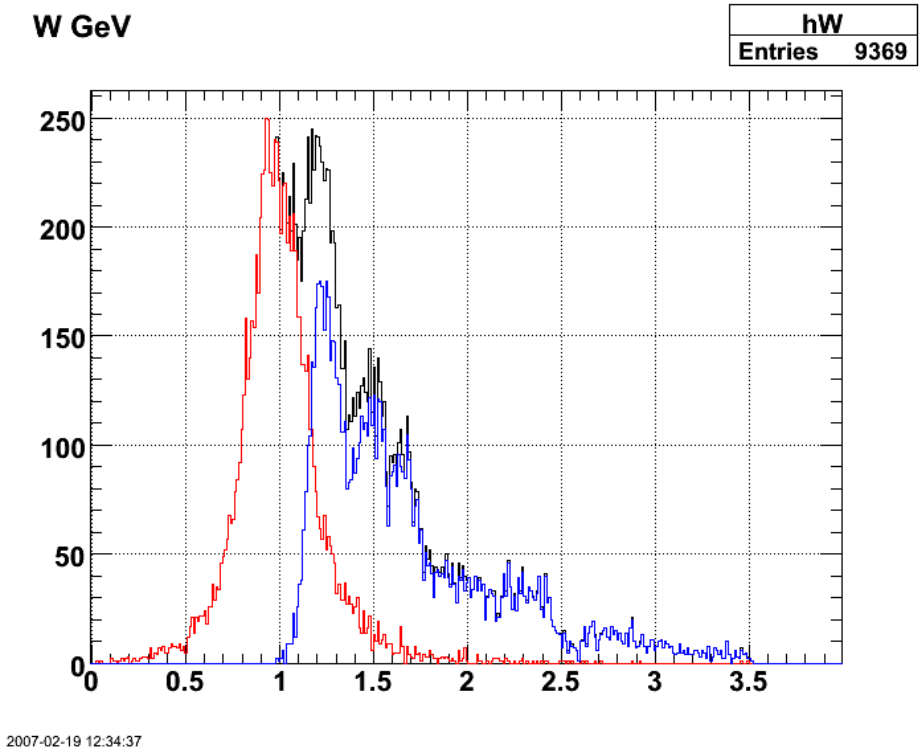
Fig 5. Neutron magnetic form factor extracted without super-pixels whose efficiency varied by more than 10% from the value for the entire sector.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 149 - Combined Inelastic and QE results (gpg)

[Modified Mon Feb 19 17:49:59 2007 (GMT) gpg]

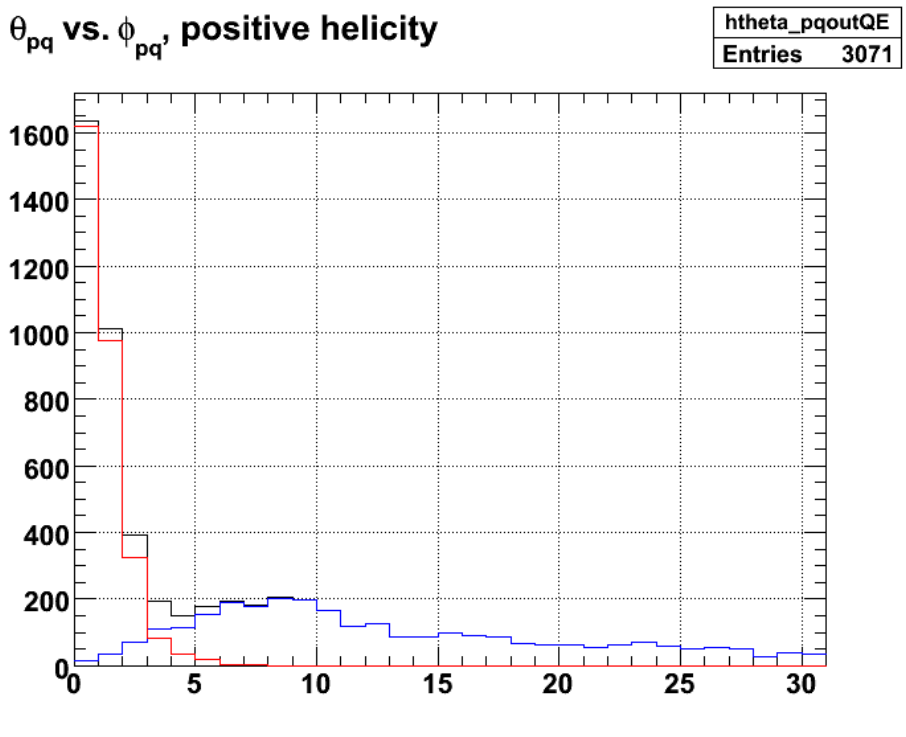
First results for simulations of inelastic events are here with the input files.



2007-02-19 12:34:37

Fig 1. W spectrum with combined spectra for QE (from queeg) and inelastic (from genev) events

Click here to view the object (ROOT macro for fig 1) you uploaded.



2007-02-19 12:42:17

Fig 2. Angular distributions for combined QE and inelastic events.

Click here to view the object (ROOT macro for Fig 2) you uploaded.

Click here to view the object (tar file with input files for figs 1-2) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 150 - testing genevD simulations (gpg)

[Modified Tue Feb 27 03:07:15 2007 (GMT) gpg]

The following are test of the genevD simulation and analysis. Plots 1-10 are done with genevD. Plots 11-12 are with genev.

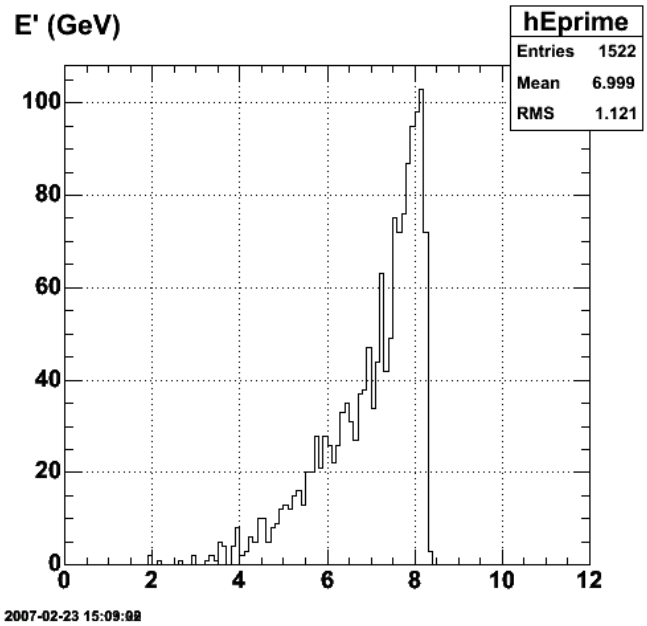


Fig 1. E' spectrum with Fermi motion commented out.

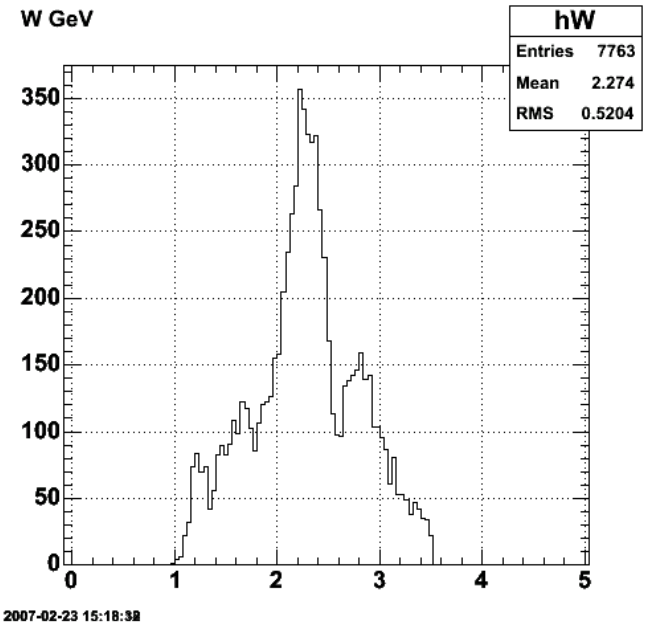


Fig 2. W spectrum from genevD with Fermi motion turned off.

Click here to view the object (ROOT histogram file for fig 1-2) you uploaded.

Turn the Fermi motion back on. This looks awful and awfully wrong. The peak in the Hulthen distribution is at about 0.04 GeV/c, but E' is getting kicks about about 1 GeV/c!

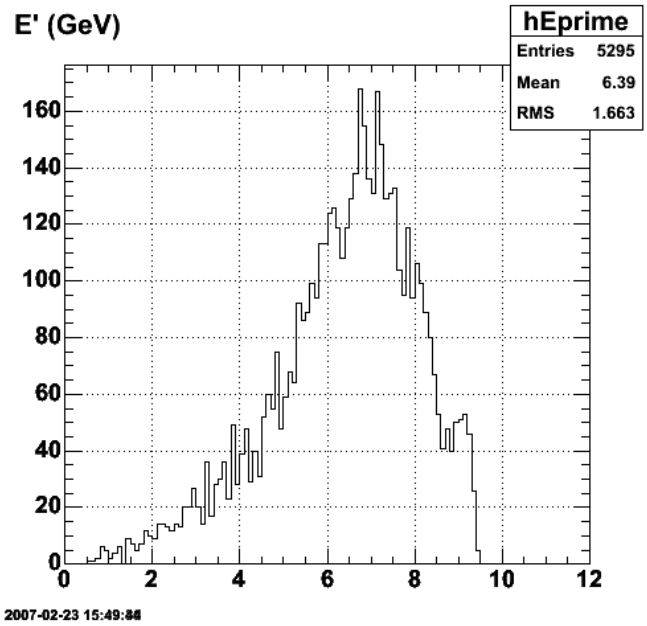


Fig 3. Same as fig 1 with fermi motion back on.

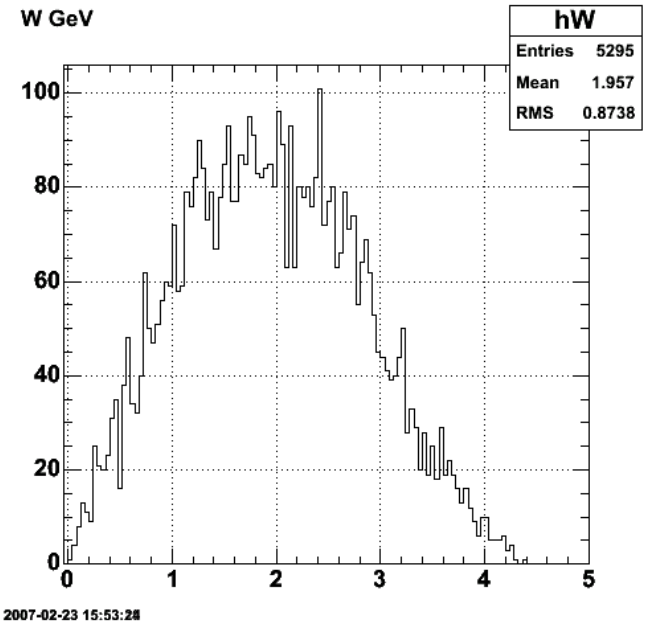


Fig 4. Same as Fig 2 with Fermi motion turned on.

Click here to view the object (ROOT histogram file for fig 3-4) you uploaded.

Fix some bugs and it looks better.

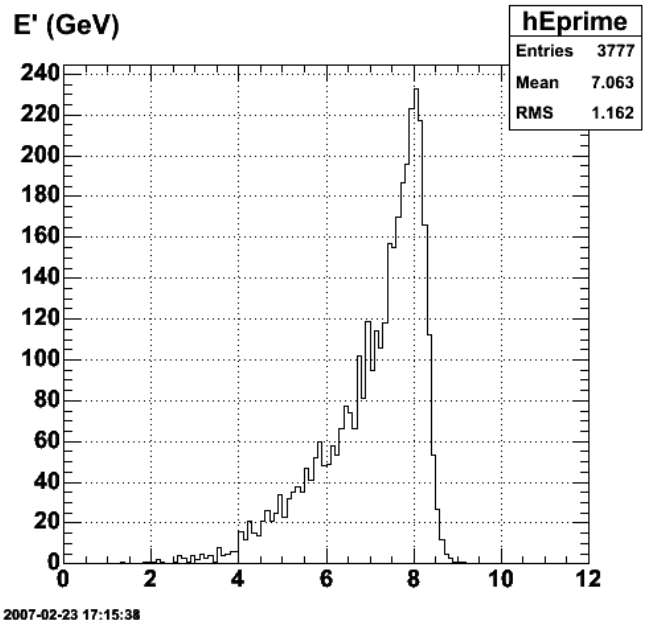


Fig 5. Same as fig 3 with bugs fixed

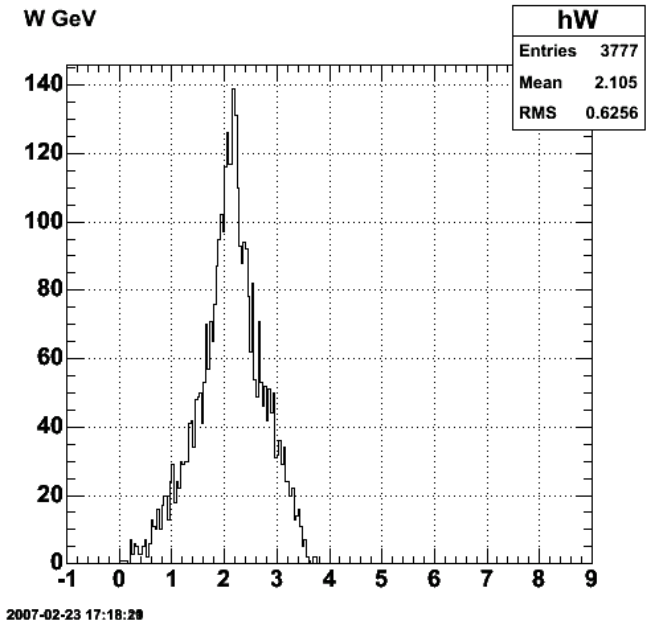


Fig 6. Same as fig 4 with bugs fixed

The W spectrum look increasingly odd. Try setting the inputs so only one exit channel is used and make it the delta. I get the following which looks the same.

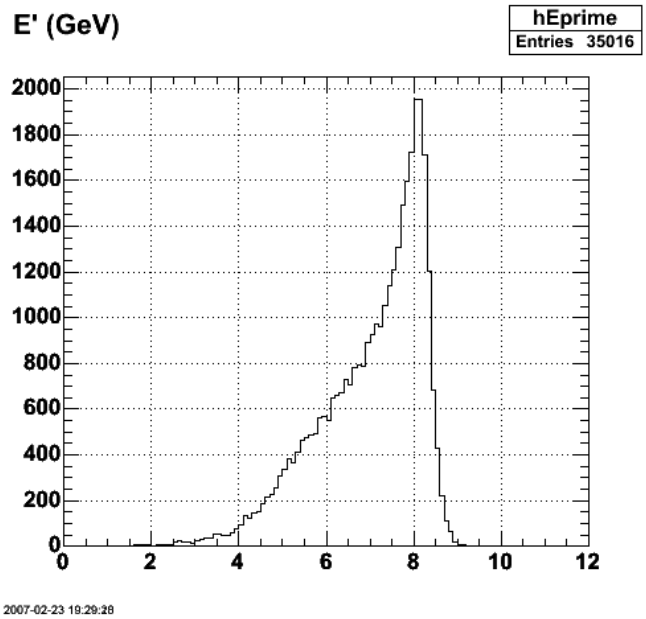


Fig 7. Same as fig 5 with just one input channel (#2 V_Gamma + P ---> P + PI0)

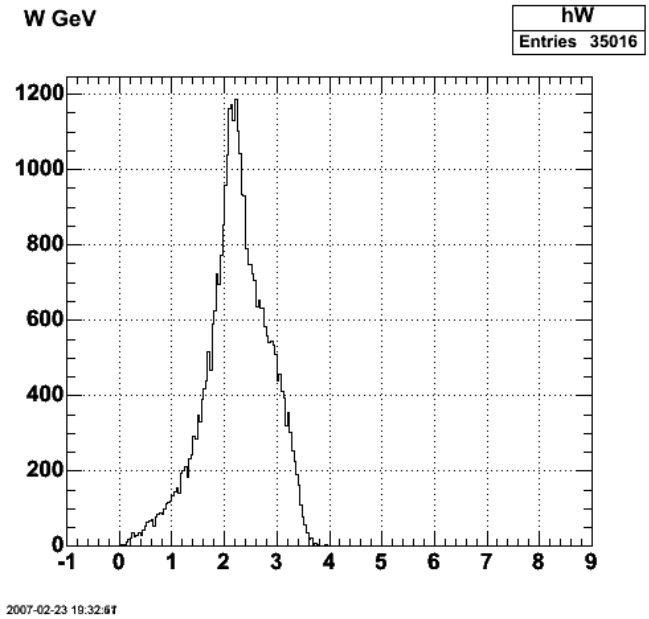


Fig 8. Same as fig 6 with only 2) V_Gamma + P ---> P + PI0 channel in genev.

Click here to view the object (ROOT histogram file for figs 7-8) you uploaded.

Take a look at the PART bank results. They are not different.

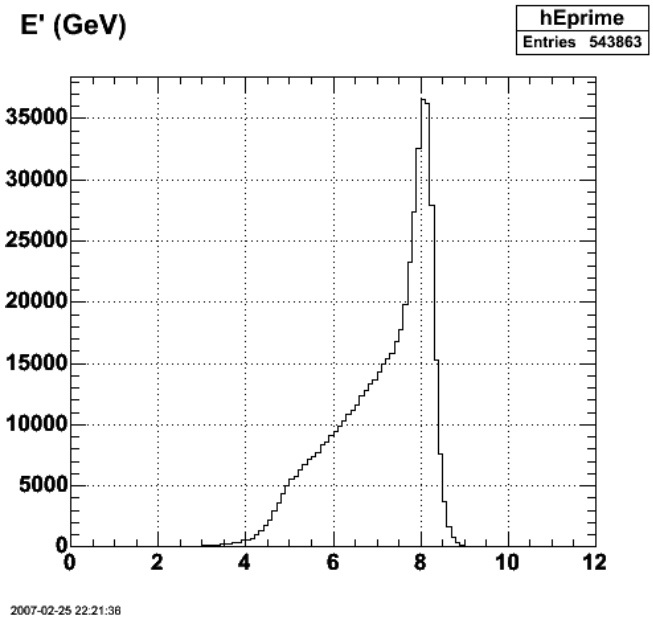


Fig 9. Same as fig 7 for PART bank.

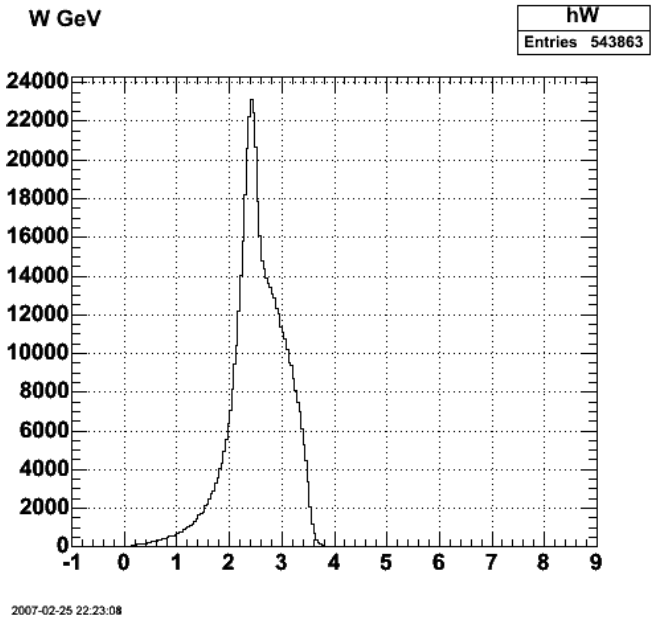


Fig 10. Same as fig 8 for PART bank.

Click here to view the object (ROOT macro for fig 9-10.) you uploaded.

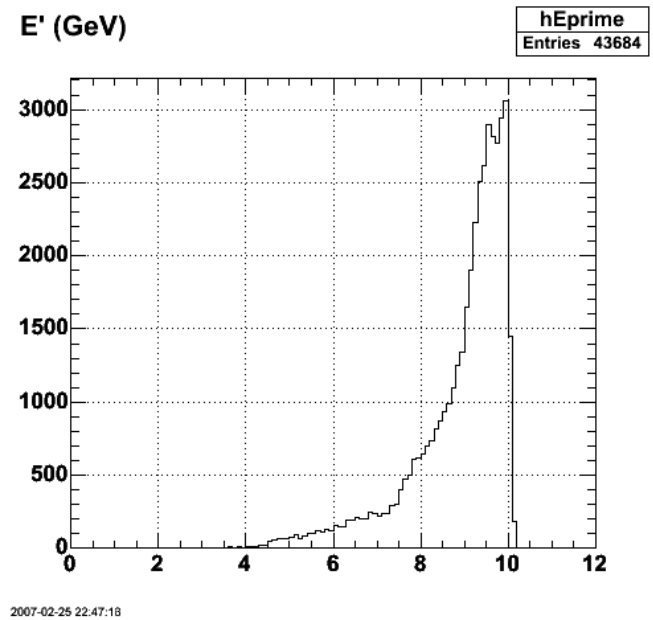


Fig 11. E' spectra from genev with same input file.

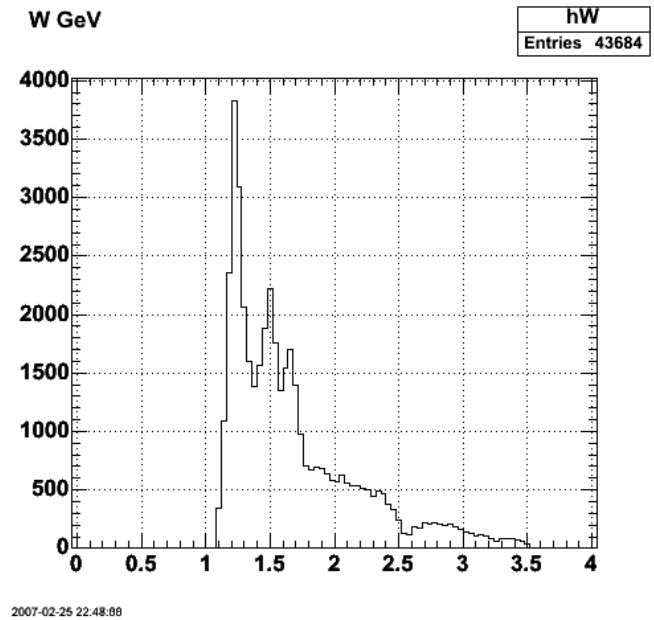


Fig 12. W spectrum from genev.

Click here to view the object (ROOT macro for figs 11-12) you uploaded.

Things above look weird. It turns out I had a parameter set in the genevD input file so that there was a minimum energy transfer (omega) of 25% of the beam energy. This created some weird kinematic constraints that disappeared when I mad that constraint small (1%). See the results below. The number of events that gets through FASTMC is now much smaller.

```
run my ROOT on node 0 for FASTMC ntuple analysis.
  ****************************************
  *                                      *
  *        W E L C O M E  to  R O O T    *
  *                                      *
  *   Version   4.00/08       9 July 2004   *
  *                                      *
  *  You are welcome to visit our Web site  *
  *          http://root.cern.ch         *
  *                                      *
  ****************************************

Compiled for linux with thread support.

CINT/ROOT C/C++ Interpreter version 5.15.138, May 23 2004
```

```
Type ? for help. Commands must be C++ statements.
Enclose multiple statements between { }.
Welcome to my Root stuff.

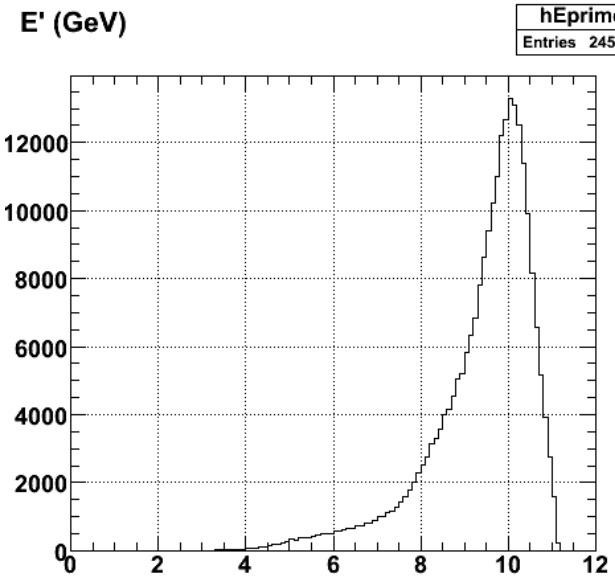
Processing /scratch/gilfoyle/sim12/0/run_gmn.C...
filename: clasev2.e11.000cl12conf0.root.
Overriding momentum corrections.
nentries=10000
Ebeam=11
Triggers:10000, electrons: 344, ep events:288, epn events:7,
          epn2 events:7,lost electrons:0.
eprimep=0 eprimeppi0=0
Mon Feb 26 17:03:10 EST 2007
Mon Feb 26 17:03:10 EST 2007

run my ROOT on node 0 for PART bank analysis.
  ****************************************
  *                                      *
  *       W E L C O M E  to  R O O T      *
  *                                      *
  *   Version   4.00/08       9 July 2004   *
  *                                      *
  *  You are welcome to visit our Web site  *
  *          http://root.cern.ch           *
  *                                      *
  ****************************************

Compiled for linux with thread support.

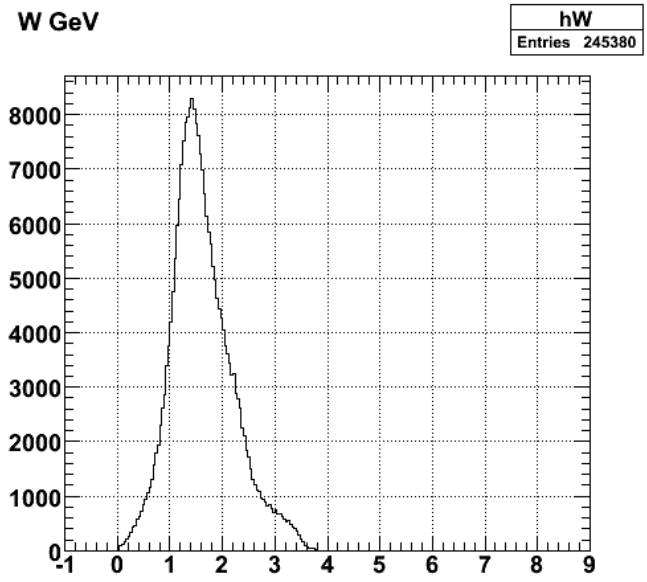
CINT/ROOT C/C++ Interpreter version 5.15.138, May 23 2004
Type ? for help. Commands must be C++ statements.
Enclose multiple statements between { }.
Welcome to my Root stuff.

Processing /scratch/gilfoyle/sim12/0/run_part.C...
filename: nt10outpart12.root.
nentries=10000
Triggers:10000, electrons: 10000, ep events:10000, epn events:348,
          epn2 events:348,lost electrons:0.
Mon Feb 26 17:03:11 EST 2007
```



2007-02-26 17:22:18

Fig 13. E' spectra from genev with modified input file to get rid of threshold on omega, fermi motion on, PART bank.



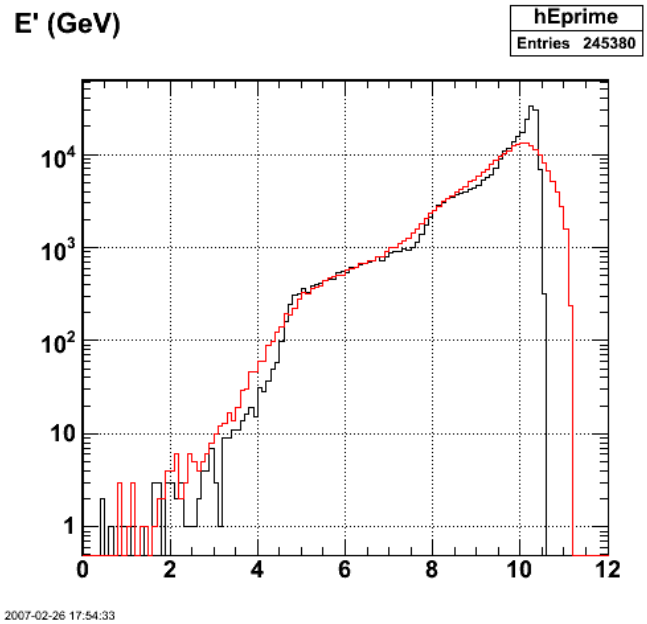
2007-02-26 17:25:12

Fig 14. W spectrum from genev with modified input file to get rid of threshold on omega, fermi motion on, PART bank.

Click here to view the object (EVNT ROOT histogram file.) you uploaded.

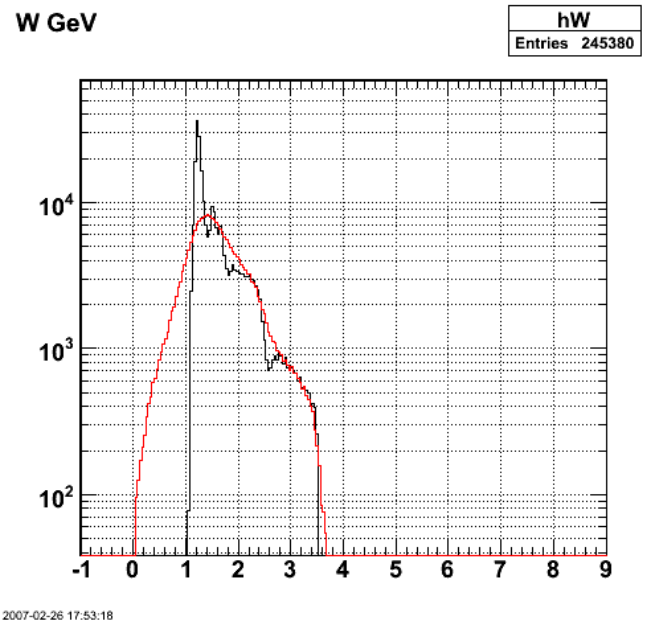
Click here to view the object (PART ROOT histogram file for figs 13-14.) you uploaded.

Now turn off the Fermi motion and compare with the previous results.



2007-02-26 17:54:33

Fig 15. Same as Figure 13 with Fermi motion off (black curve) compared with Fermi motion on (red curve) from Fig 13.



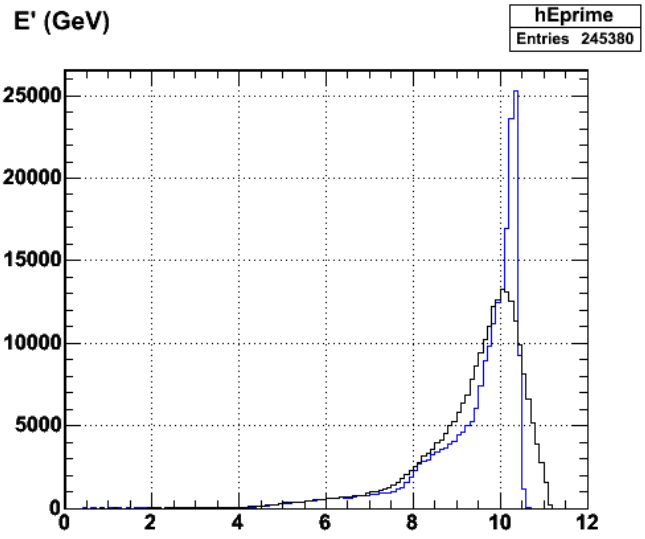
2007-02-26 17:53:18

Fig 16. Same as Figure 14 with Fermi motion off (black curve) compared with Fermi motion on (red curve) from Fig 14.

Click here to view the object (EVNT ROOT histogram file for Fig 15.) you uploaded.

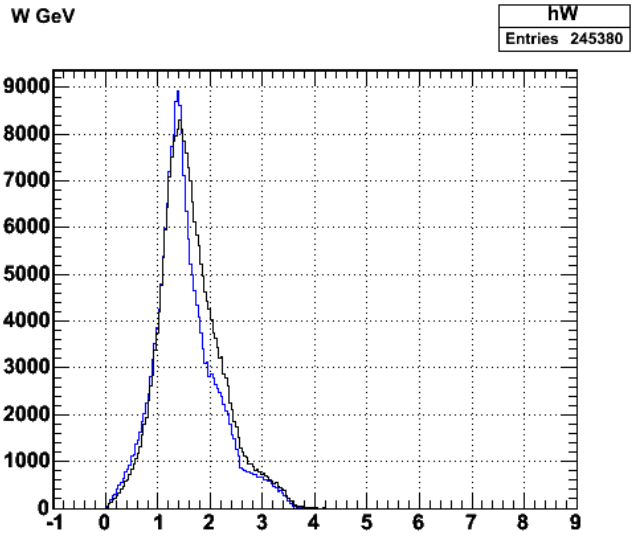
Click here to view the object (PART ROOT histogram file for figs 15-16.) you uploaded.

I found a bug in genevD. I had turned off some of the Fermi motion code to test the code with the Fermi motion off and didn't turn stuff back on. The black histograms below correspond to the red ones above in Fig 15-16.



2007-02-26 21:59:34

Fig 17. E' spectra from genev with modified input file to get rid of threshold on omega, fermi motion on, PART bank. The red curve is before I fixed a bug in the Fermi motion code. The blue histogram is after the fix.



2007-02-26 21:57:26

Fig 18. W spectrum from genev with modified input file to get rid of threshold on omega, fermi motion on, PART bank. The red curve is before I fixed a bug in the Fermi motion code. The blue histogram is after the fix.

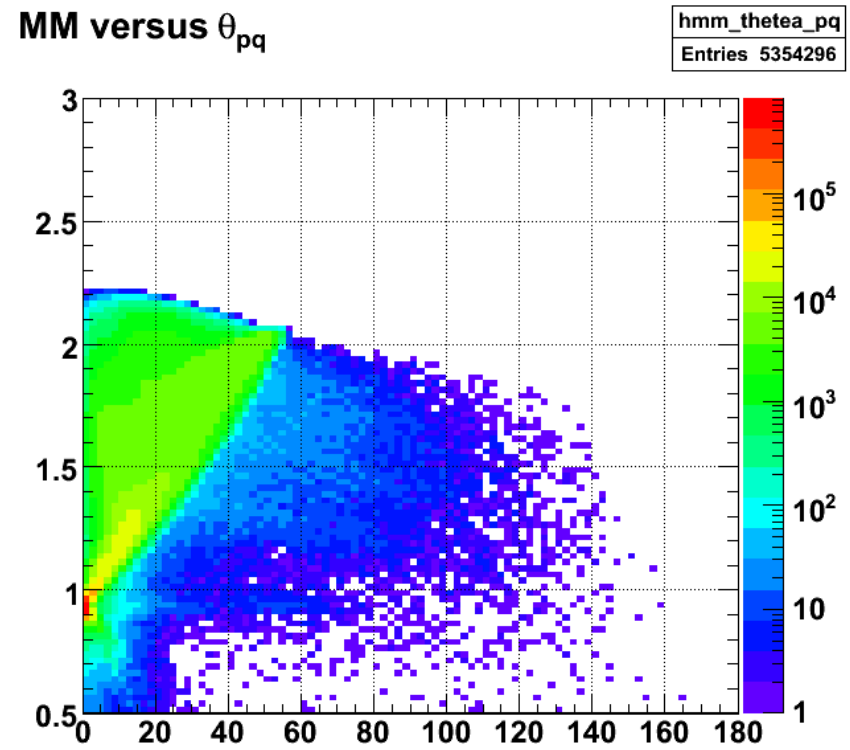
Click here to view the object (PART bank for blue histograms in fig 17-18.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 151 - MM-theta_pq plots (gpg)

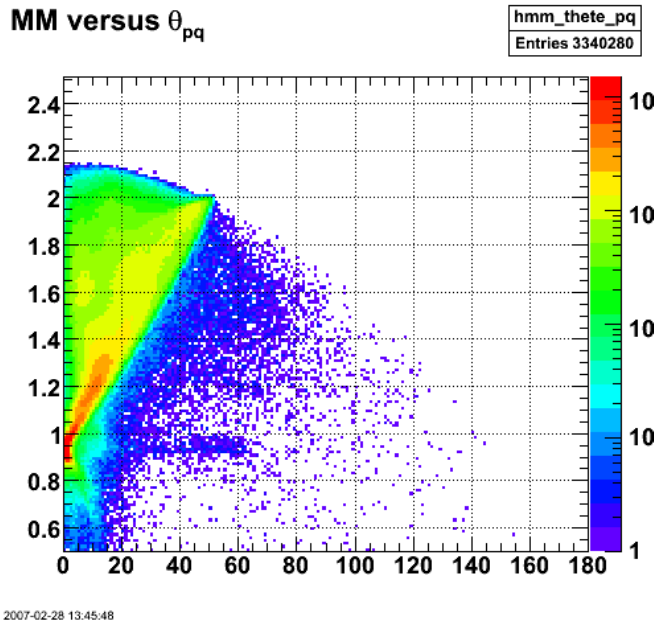
[Modified Wed Feb 28 18:46:57 2007 (GMT) gpg]

Plots for CAN.



2007-02-28 11:04:55

Fig 1. 2.6n data set



2007-02-28 13:45:48

Fig 2. 2.6n data set with different bin sizes

Click here to view the object (ROOT histogram file for Fig 2) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 152 - QE+inelastic plots for GMn (gpg)

[Modified Wed Mar 14 17:53:00 2007 (GMT) gpg]

Plots below show combination of simulation from queeg and genevD.

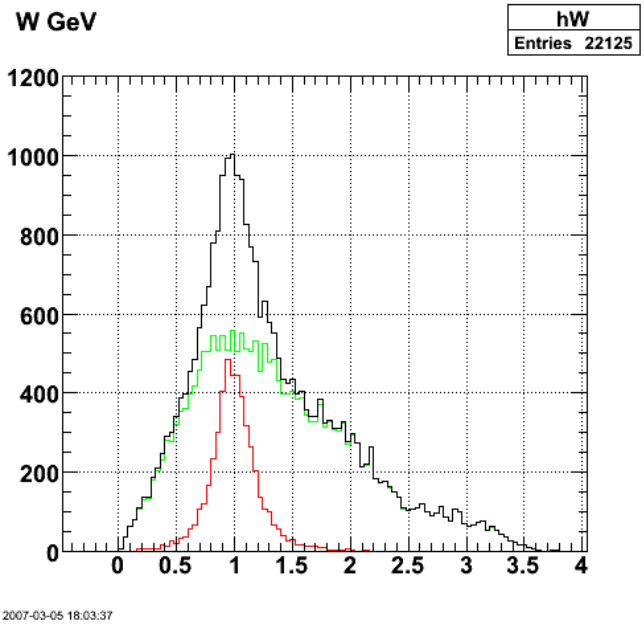


Fig 1. W spectrum - red is QE, green is inelastic, black is the sum.

Click here to view the object (Tarred, gzipped archive for fig 1) you uploaded.

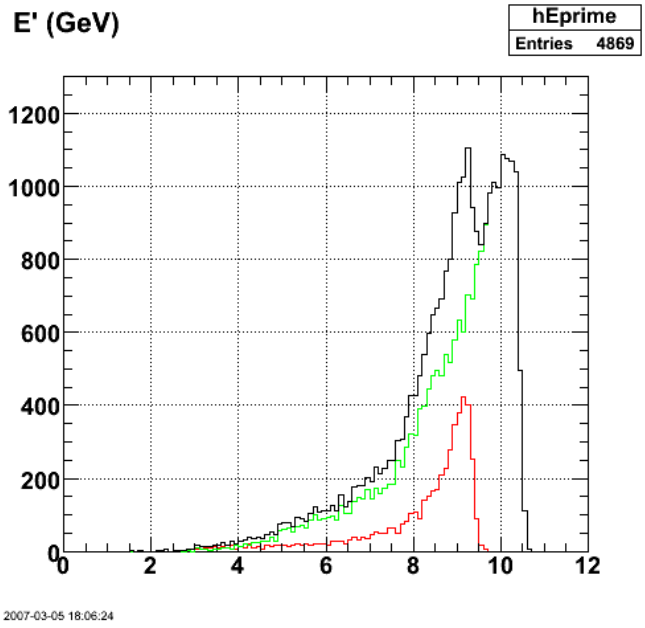


Fig 2 Energy transfer spectra. Same curves as Figure 1. This looks messed up since there are inelastic events with less energy transfer (larger E') than the QE events. Is this an angle problem. Does genev go to smaller angles than queeg?

ROOT line commands used to change directories and make the above plots are below.

```
TFile *hfile1 = new  TFile("evntQEsummed.root");
TFile *hfile2 = new  TFile("evntgenevsummed.root");
TFile *hfile3 = new  TFile("evntsummed.root");


hfile1.cd()
hEprime->SetLineColor(2);
```

```
hEprime->Draw()
hfile2.cd()
hEprime->SetLineColor(3);
hEprime->Draw("same")
hfile3.cd()
hEprime->SetLineColor(1);
hEprime->Draw("same")


hfile1.cd()
hW->SetLineColor(2);
hW->Draw()
hfile2.cd()
hW->SetLineColor(3);
hW->Draw("same")
hfile3.cd()
hW->SetLineColor(1);
hW->Draw("same")
```

Turn off the Fermi smearing and the W spectrum looks qualitatively correct, but the E' spectrum still looks screwy even after I lowered the minimum angle in QUEEG.

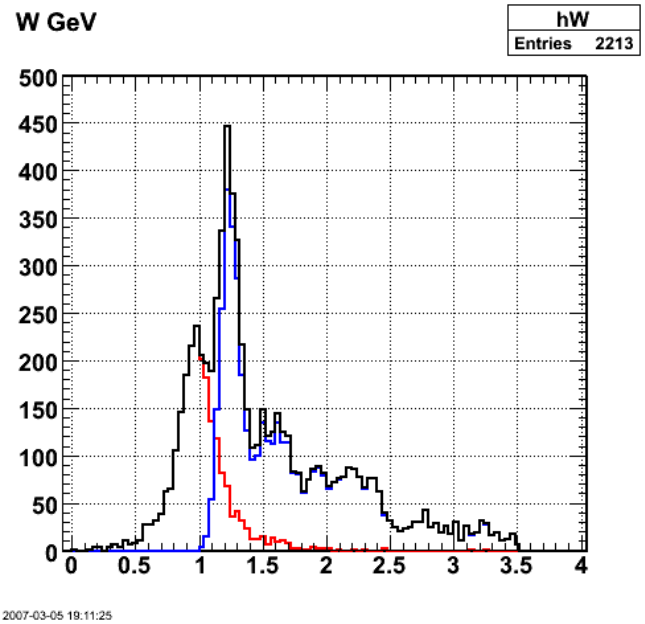


Fig 3. W spectrum with Fermi smearing turned off.

The problem with the E' spectrum was that there were 'hidden' restrictions on the angular range of the proton and neutron cross section arrays that were used to generate the electron angles. When I lowered those from 10 deg to 5 deg things looks much better. See figures below. The Fermi motion is turned off for the inelastic events, but is still on for the quasi-elastic events.

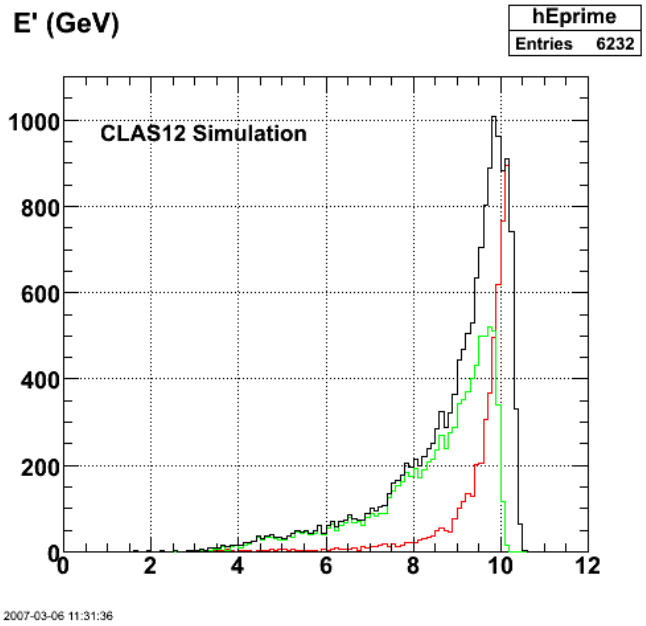


Fig 4. E' spectrum with lower minimum angle for proton and neutron cross section arrays.

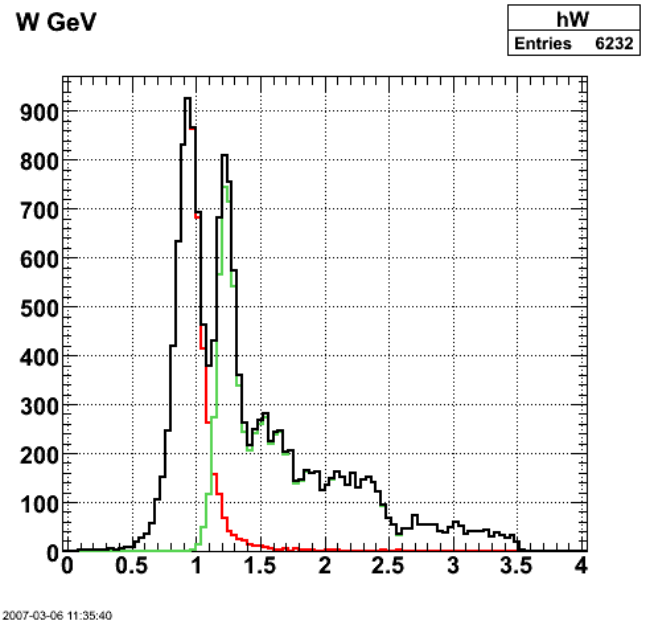


Fig 5. W spectrum with lower minimum angle for proton and neutron cross section arrays.

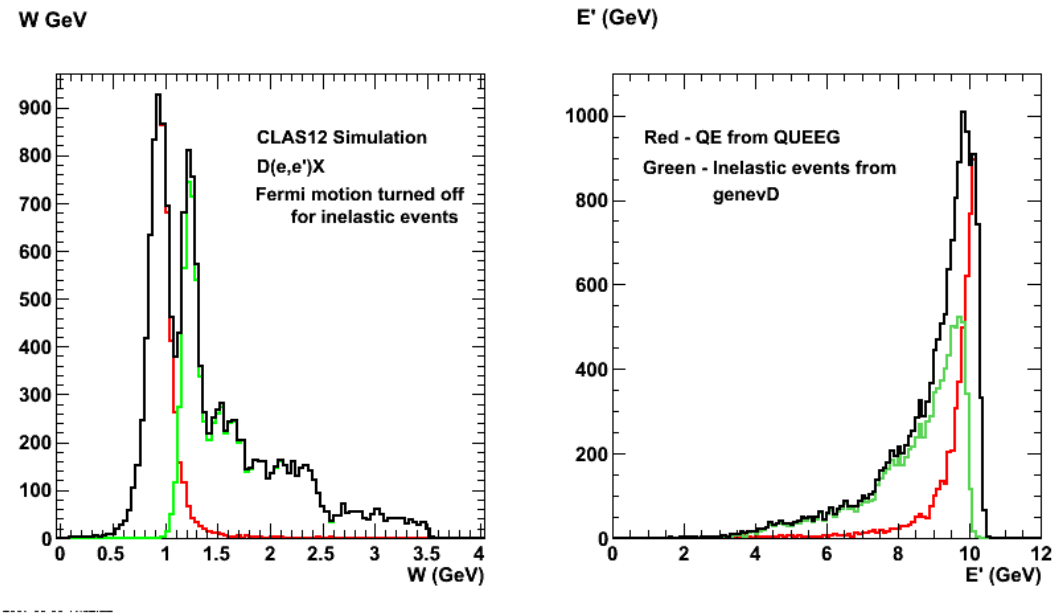


Fig 6. Pretty version of previous two plots.

Click here to view the object (ROOT CINT macro for Fig 6.) you uploaded.

Click here to view the object (Compressed archive of histograms for Figs 4-6) you uploaded.

Turn on the Fermi motion. The W spectrum is not peaking at the delta, but at a smaller W. Is this normal?

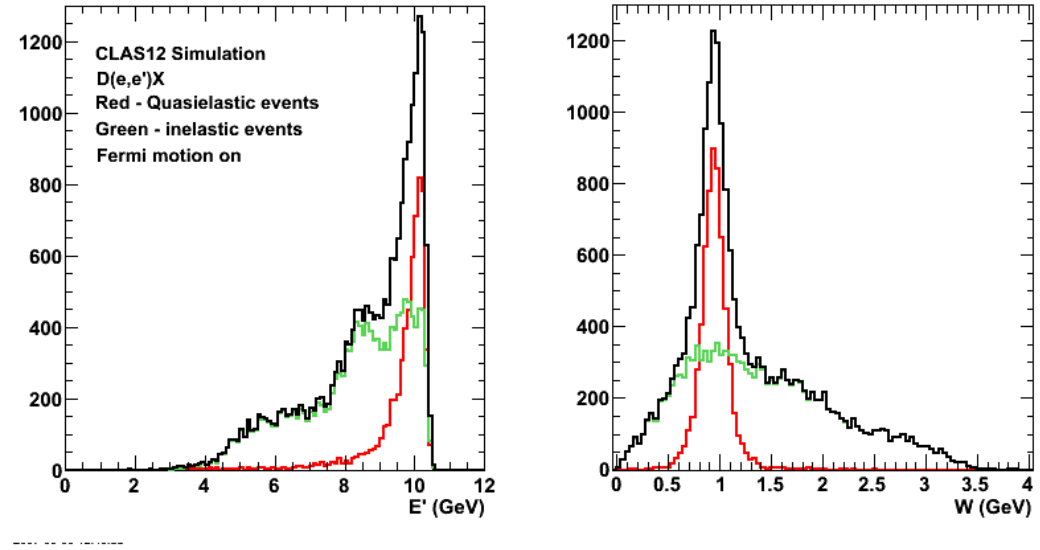


Fig 7. W and E' spectra with Fermi motion turned on.

Click here to view the object (Archive of histogram files for Fig 7) you uploaded.

Set the THE and PHI angles in the call to LUROBO to zero and get the following. There is little change which may be good news.

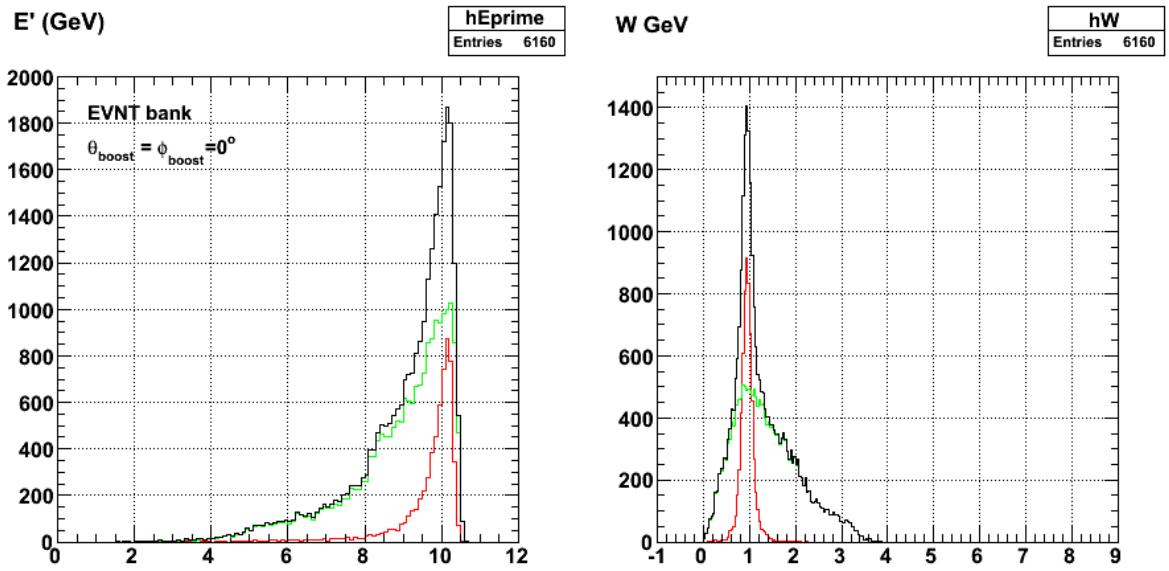


Fig 8. W and E' spectra with Fermi motion turned on, but the rotation angles in the boost (call to LUROBO) are set to zero.

Click here to view the object (Archive for Fig 8) you uploaded.

The PART bank results are shown below. The peak in the inelastic events is back at 1.3 GeV or so. This means that FASTMC really does a number on the inelastic kinematics!

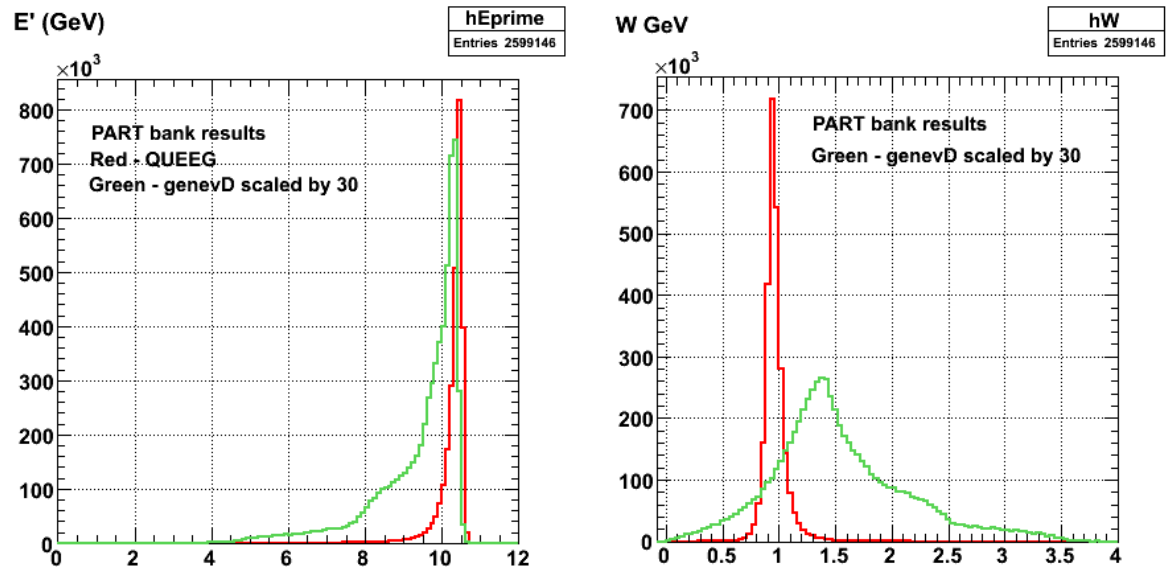


Fig 9. Same as Fig 8 for PART bank.

Lower the beam energy to 4.2 GeV so we can compare the simulations with the E5 data. The results are shown in Fig 10. The inelastic spectrum seems WORSE?! It should have become more narrow, but it looks just as crappy as before or even worse. The quasielastic events look narrower which is what is supposed to happen.

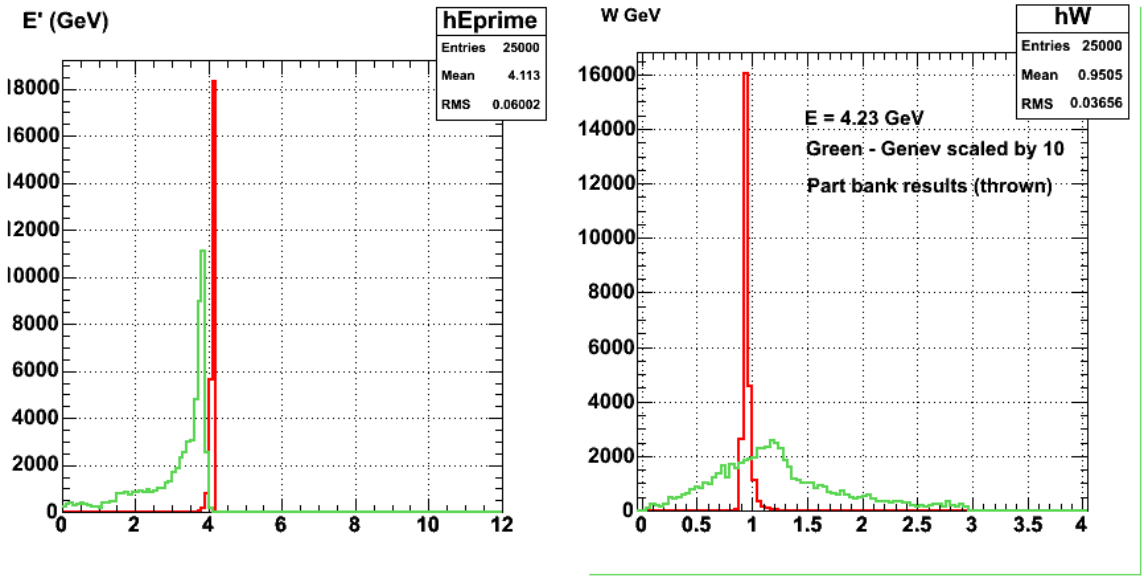


Fig 10. W and E' spectra with Fermi motion turned on, PART bank, and E=4.23 GeV beam energy, but the rotation angles in the boost (call to LUROBO) are set to zero.

Click here to view the object (Archive for fig 10.) you uploaded.

The above W distribution looks crappy. For the thrown events put in all the standard electron selection cuts and get the following results which looks much better.

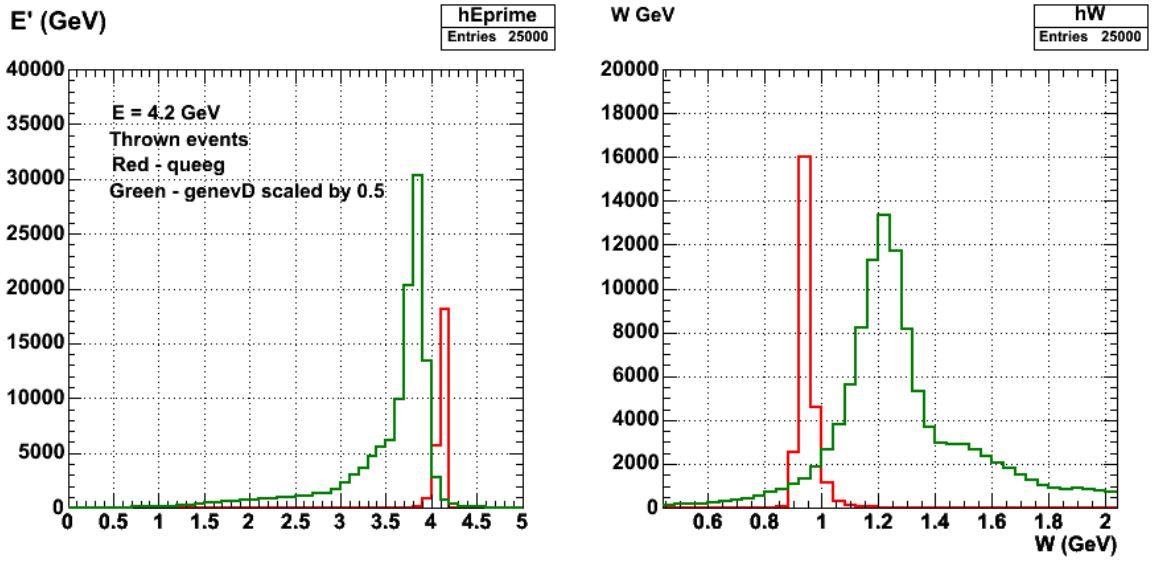


Fig 11. W and E' spectra with Fermi motion turned on, PART bank, and E=4.23 GeV beam energy, but the rotation angles in the boost (call to LUROBO) are set to zero.

Next, put a minimum Q2=0.5 GeV2 requirement. Things should get a wee bit wider. They get much worse.

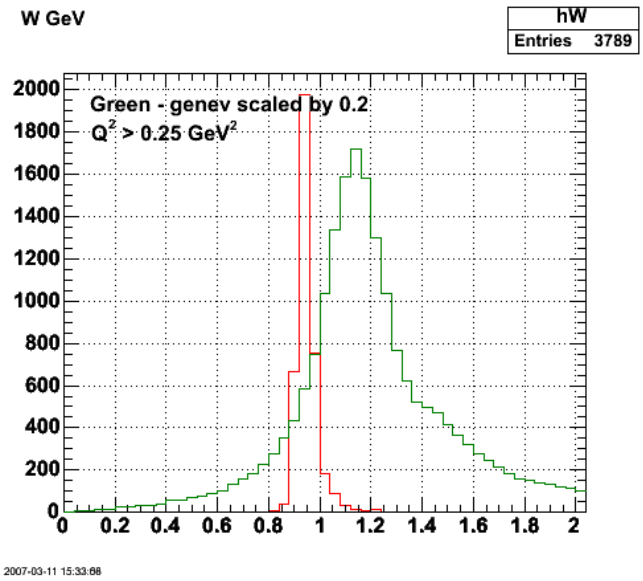


Fig 12. Same as Fig 11, with a threshold on Q2. This degrades the W spectrum considerably??!!

Click here to view the object (Archive for Fig 12) you uploaded.

Turn off the fermi motion and things look fine. So its the fermi motion simulation that is just killing things.

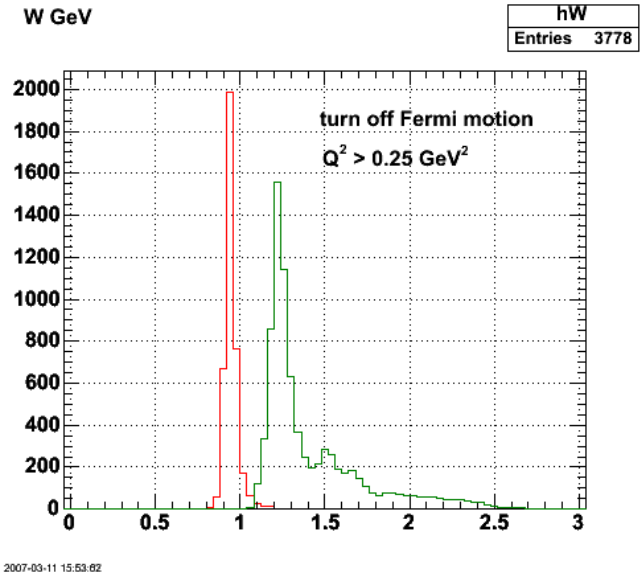


Fig 13. Same as fig 12 with Fermi motion turned off.

Click here to view the object (Archive for fig 13) you uploaded.

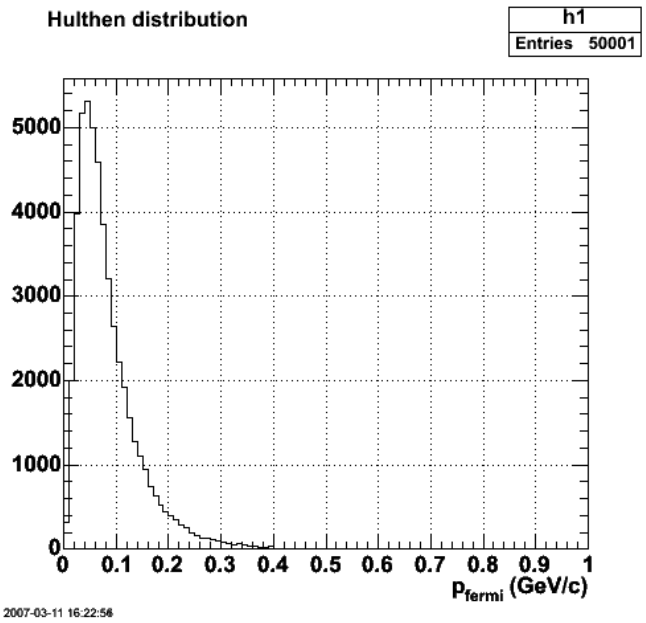


Fig 14. Test of the Hulthen distribution used to generate a random value of the Fermi momentum.

Click here to view the object (hist2.C ROOT macro for fig 14) you uploaded.

Click here to view the object (input file for Fig 14.) you uploaded.

After much programing of genevD, get the following.

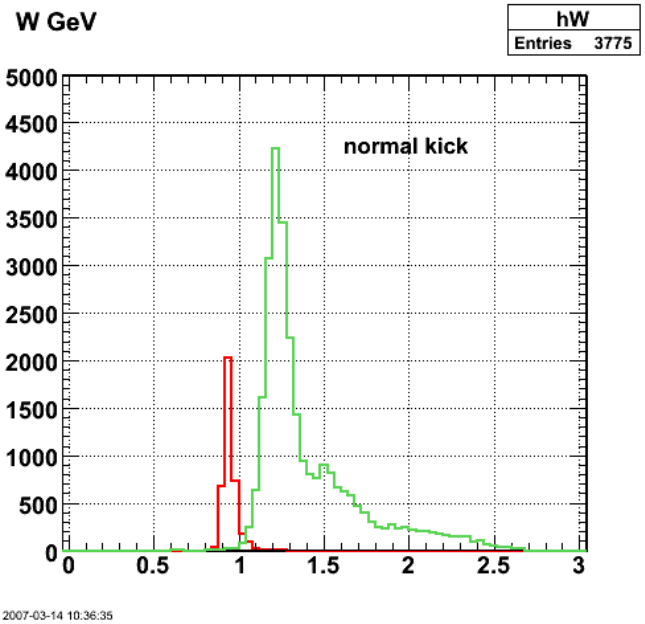


Fig 15. W spectrum after major changes to genevD. With Q2>0.25 GeV2.

Click here to view the object (Archive for fig 15) you uploaded.

The plot above shows the effect of the Fermi motion is smaller than I expected. I've gone from the effect being too large to being too small. I increased the size of the momentum kick in genevD by a factor of 10 to see if there is a discernible effect to make sure that things are not turned off. They are NOT! See the next figure.

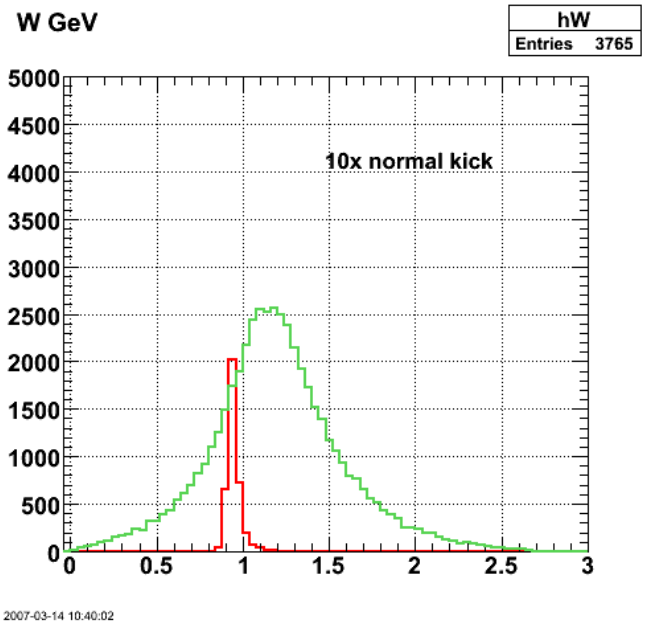


Fig 16. W spectrum after major changes to genevD and multiplying the fermi momentum by a factor of 10. With Q2>0.25 GeV2.

Click here to view the object (Archive for Fig 16.) you uploaded.

Another test. Turn off the Fermi motion by setting the beta vector components to zero and leave everything else the same. The W spectrum does get more narrow so maybe I am doing this right.

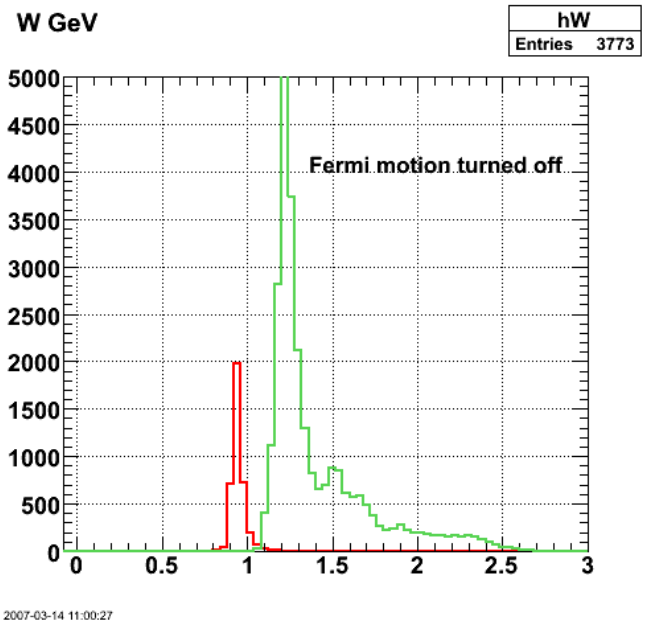


Fig 17. W spectrum after major changes to genevD and turning the Fermi motion off. With Q2>0.25 GeV2.

Click here to view the object (Archive for fig 17) you uploaded.

One of the expectations is that the width of the W distribution for each final state will get larger as Q2 increases. The plot below shows the separate W distributions for quasi-elastic and inelastic final states for different Q2 ranges. Each distribution's width seems to increase with Q2. I will run this longer with more statistics to nail it down. The calculation is 'normal' (Fermi motion turned on with the accepted Hulthen distribution for the nucleon momentum). The 2D plot shows the Q2 dependence of W for the summed distribution.

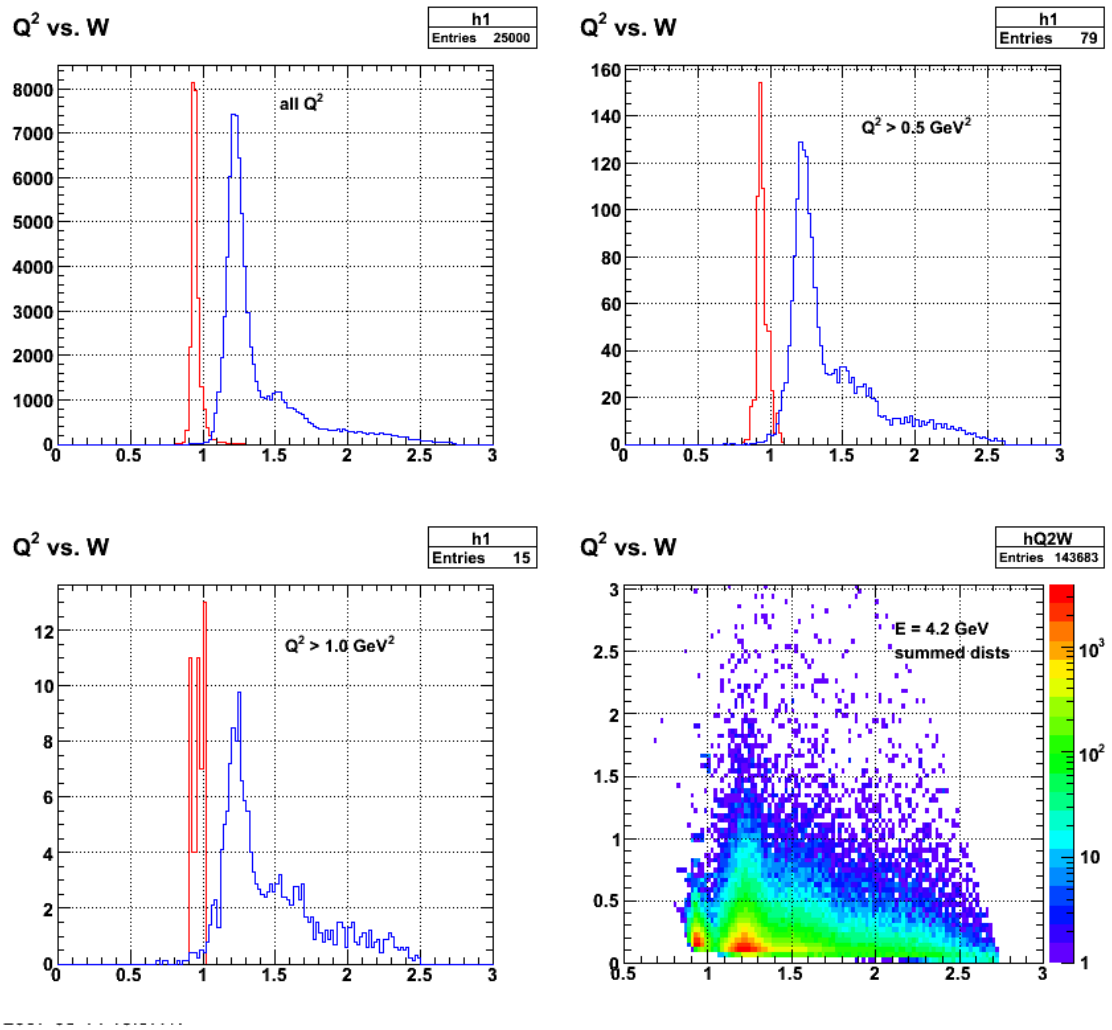


Fig 18. Q2 dependence of W spectra. The inelastic (blue) distributions are scaled to fit on the plot.

Click here to view the object (Archive for fig 18) you uploaded.

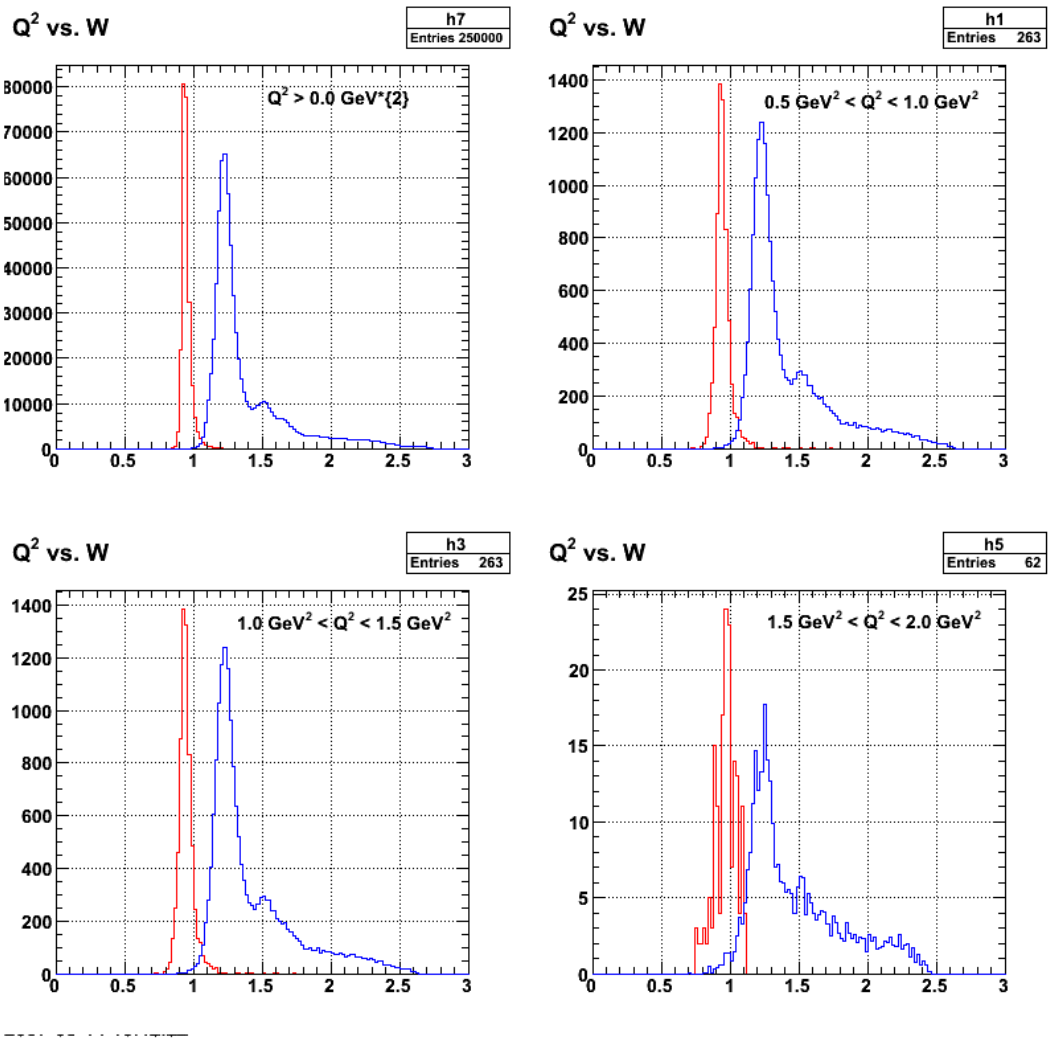


Fig 19. Better statistics version of Fig 18.

Click here to view the object (ROOT CINT macro for fig 19) you uploaded.

Click here to view the object (Archive for fig 19) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 153 - GMn12 angular distributions (gpg)

[Modified Tue Mar 6 19:05:56 2007 (GMT) gpg]

Now look at some of the angular distributions. The first figure compares the thrown (PART bank) and accepted (EVNT bank) angular distributions. The very interesting thing here is the phi_pq-dependence of the inelastic events. They peak at phi_pq = +/- 180 deg leaving a large region in phi_pq with low background. If this holds up it will help a lot getting rid of the inelastic background. This is with Fermi motion turned on, but with THE=PHI=0 in LUROBO.

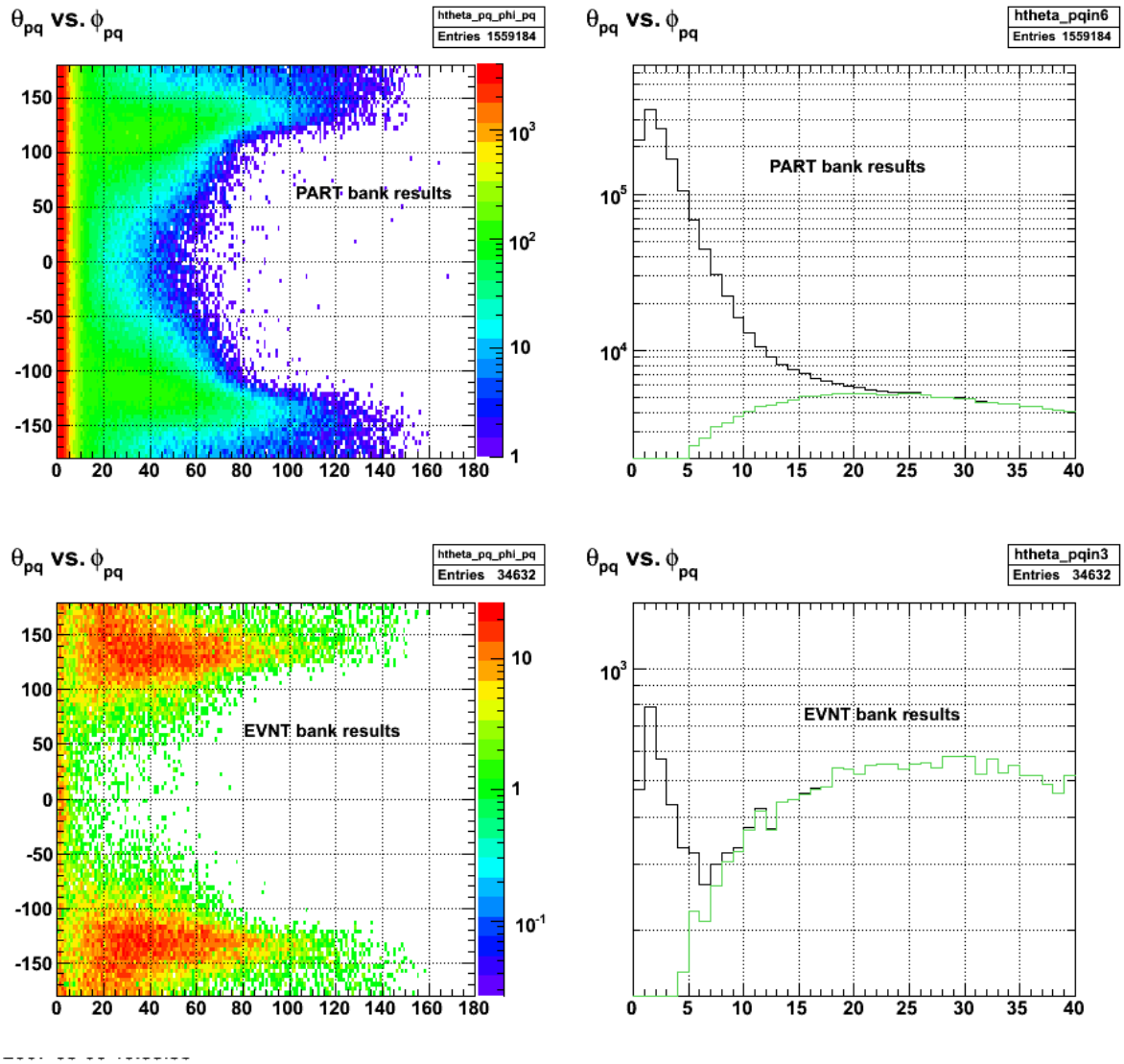


Fig 1. Comparison of thrown and accepted angular distributions.

Click here to view the object (Archive for fig 1.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 154 - Relationship between p_m and theta^cm_pq (gpg)

[Added Wed Mar 7 16:23:08 2007 (GMT) gpg]

The calculations that we have from Arenhoevel are functions of theta^cm_pq, but it is sometimes useful to plot his results as a function of the missing momentum, p_m. The relationship between theta^cm_pq and p_m is described in a paper by Sabine Jeschonnek and others (Phys. Rev. C 66, 044003 (2002). A summary of the relationship is shown in the figures below. The first table is a list of definitions of the kinematic variables. The next two figures display the equations needed to relate theta^cm_pq to p_m and vice versa.

Figure 1. Definitions of kinematic variables.

Figure 2. Equations for calculation. The masses m1 and m2 are the masses of the proton and neutron and m is the average of those masses.

Figure 3. Expression used for W here.

One can also see the relationship between p_m and theta^cm_pq in the data. The figure below is one such example for Q2=0.8-0.9 GeV2 and xBJ = 0.95-1.05 (Bjorken x). The width of the distribution at high p_m and theta^cm_pq is due to the finite bin size. The black and brown curves show the upper and lower limits of theta^cm_pq at a given value of p_m for this Q2 and xBJ bin. They nicely mark the limits of the spread in the data. At low theta^cm_pq the distribution in p_m extends to higher p_m than one can account for from the finite bin size in Q2 and xBJ. For theta^cm_pq=0 this width reflects the longitudinal momentum of the 'spectator' neutron in the deuteron when the virtual photon strikes the proton.

Figure 4. Theta$^{cm}_{pq}$ vs. p_m

We expect that the helicity asymmetry ALTp should go to zero at theta^cm_pq=0 and p_m=0. Some recent results show some significant deviations from this expection. See entry 190. If we look at the same distribution shown in Figure 4, but expanded about p_m=0 and theta^cm_pq=0 we get the following results. At theta^cm_pq there are very few events and these are likely due to events shifted down in theta^cm_pq due to the resolution of CLAS.

Figure 5. Expanded view of theta^cm_pq vs. p_m near the origin.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 155 - Plots for CAN - MM vs. theta_pq (gpg)

[Modified Thu Mar 8 03:34:53 2007 (GMT) gpg]

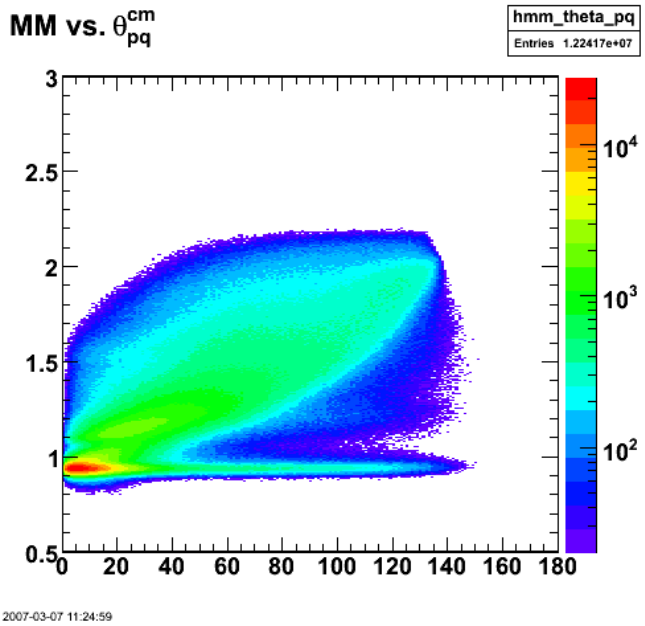


Fig 1. 2.6r MM vs. theta_pq_CM. Used a minimum threshold of 20.

Click here to view the object (2.6r histogram file for fig 1.) you uploaded.

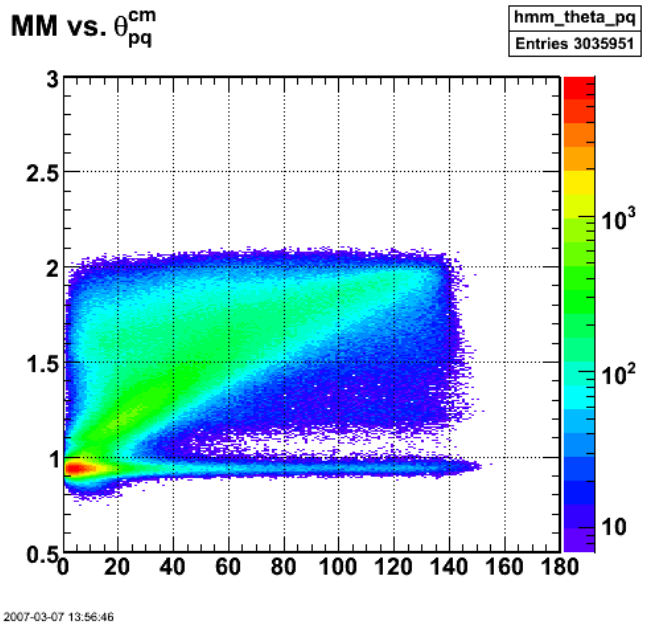


Fig 2. 2.6n MM vs. theta_pq_CM. Used a minimum threshold of 7 (same ratio to maximum counts in a bin).

Click here to view the object (2.6n ROOT histogram file for Fig 2.) you uploaded.

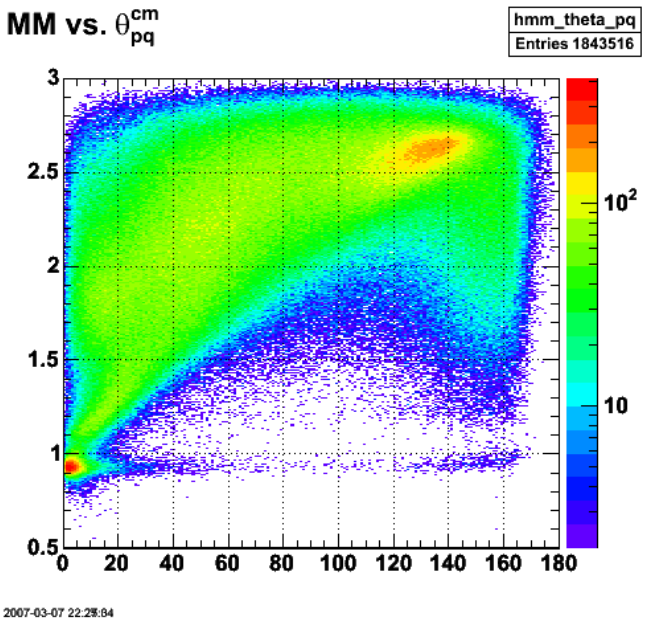


Fig 3. 4.2n MM vs. theta_pq_CM. Used a minimum threshold of 2.

Click here to view the object (4.2n histogram file for fig 3.) you uploaded.

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Jerry Gilfoyle's Enotebook page 156 - gmnsim test (gpg)

[Modified Tue Mar 13 20:57:12 2007 (GMT) gpg]

More tests.

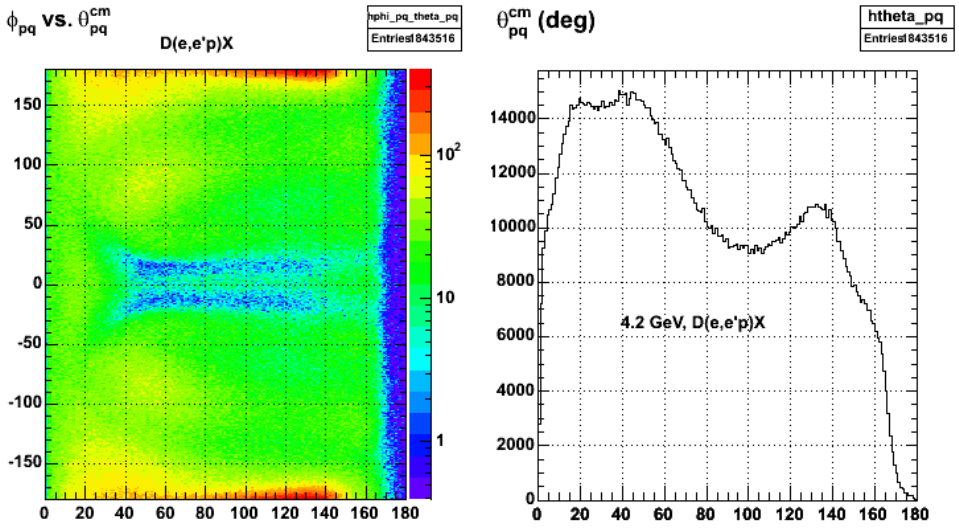

Fig 1. For epX events.

Click here to view the object (ROOT histogram file for fig 1.) you uploaded.

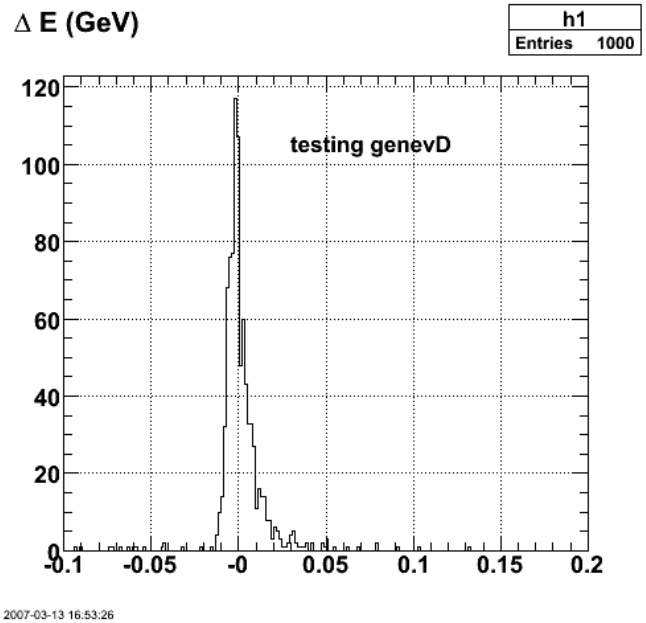

Fig 1. Test of algorithm for enforcing momentum and energy conservation after the return boost. It plots a histogram of the difference between the initial and final energies after the return boost.

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Jerry Gilfoyle's Enotebook page 157 - Angle cut at 4 GeV (gpg)

[Modified Fri Mar 16 03:10:26 2007 (GMT) gpg]

Below is an initial look at the effect of the angle cut on the W spectrum.

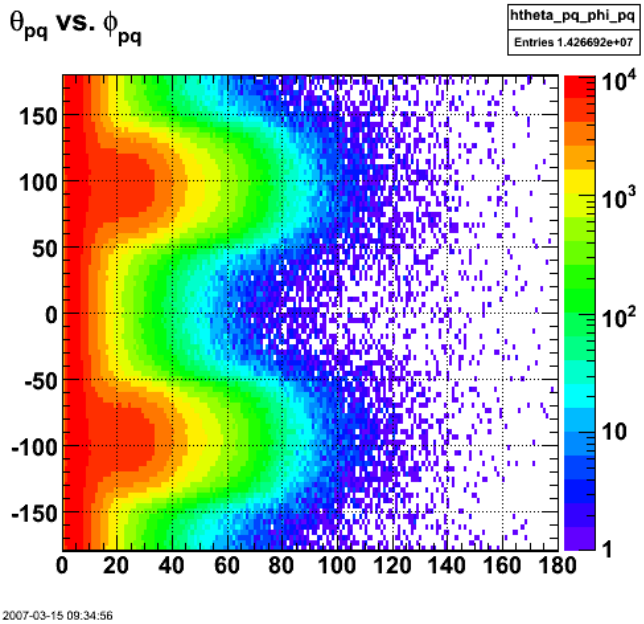


Fig 1. Angular distribution of ep events

Click here to view the object (Archive for fig 1) you uploaded.

Fig 2 shows the nature of the problem. The quasielastic peak has been scaled down so that it is small relative to the inelastic distribution. We want to test the effect of the angle cut on theta_pq at reducing the background under the QE peak.

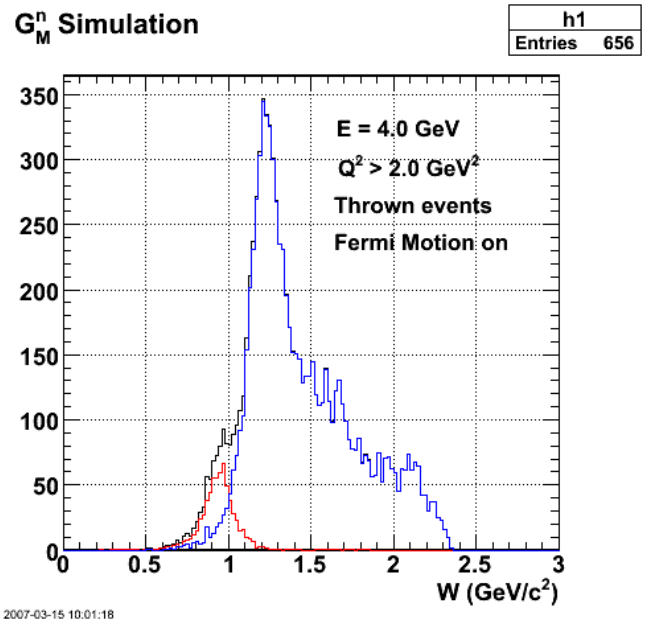


Fig 2. W spectrum for Q2>2.0 GeV(roughly the range of the 4.2-GeV, E5 data).

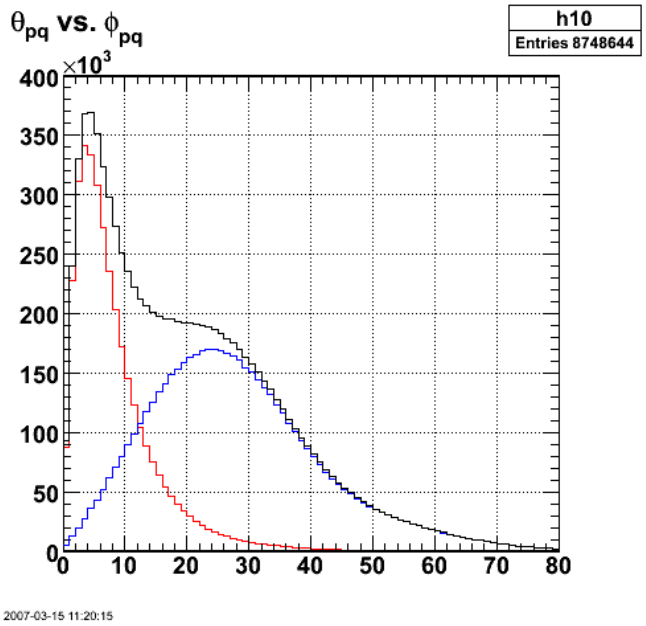


Fig 3. Angular distributions

Click here to view the object (ROOT macro for fig 3) you uploaded.

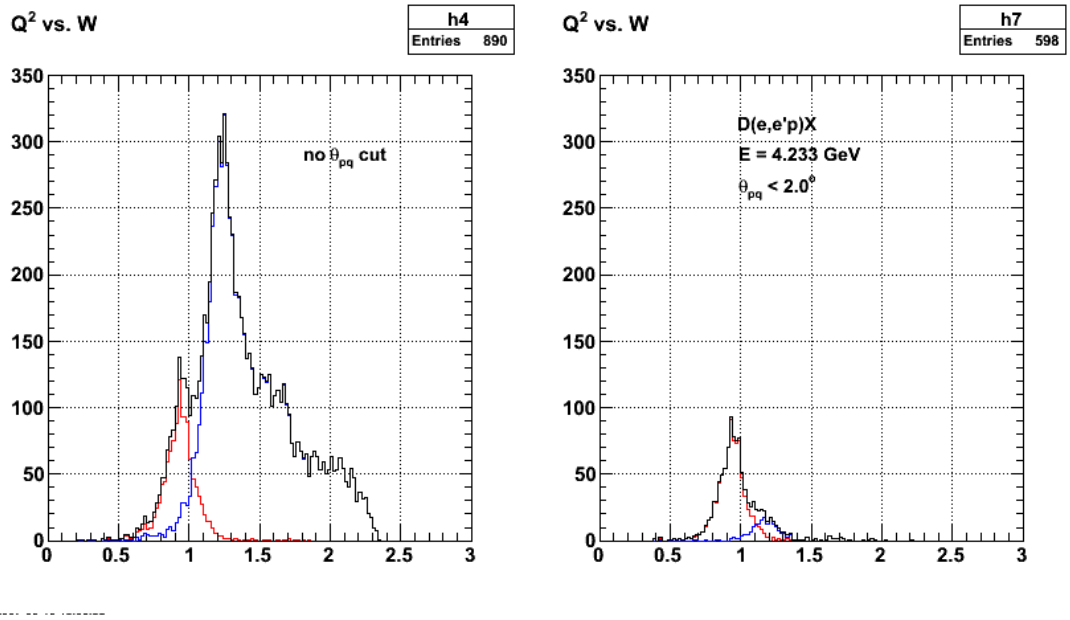


Fig 4. Effect of theta_pq cut on W for Q2 > 2 GeV2.

Click here to view the object (ROOT macro for fig 4) you uploaded.

Click here to view the object (Archive for fig 4) you uploaded.

Code to make Fig 4.

```
chmin=50
chmax=125
hfile1.cd()
TH1D *h4 = (TH1D*)hQ2Wc->ProjectionX("h4",chmin,chmax);
h4->SetLineColor(2);
h4->Scale(0.4);
h4->SetMaximum(350);
h4->Draw()
hfile2.cd()
TH1D *h5 = (TH1D*)hQ2Wc->ProjectionX("h5",chmin,chmax);
h5->SetLineColor(4);
h5->Scale(1.0)
h5->Draw("same")
```

```
TH1F *h6 = new TH1F("h6","G_{M}^{n} Simulation",150,0.0,3.0);
h6.Add(h4,h5,1.0,1.0);
h6->Draw("same")

-----------------------------------------------------

chmin=50
chmax=125
hfile1.cd()
TH1D *h7 = (TH1D*)hQ2Wb->ProjectionX("h7",chmin,chmax);
h7->SetLineColor(2);
h7->Scale(0.4);
h7->SetMaximum(350);
h7->Draw()
hfile2.cd()
TH1D *h8 = (TH1D*)hQ2Wb->ProjectionX("h8",chmin,chmax);
h8->SetLineColor(4);
h8->Scale(1.0)
h8->Draw("same")



TH1F *h9 = new TH1F("h9","G_{M}^{n} Simulation",150,0.0,3.0);
h9.Add(h7,h8,1.0,1.0);
h9->Draw("same")
```

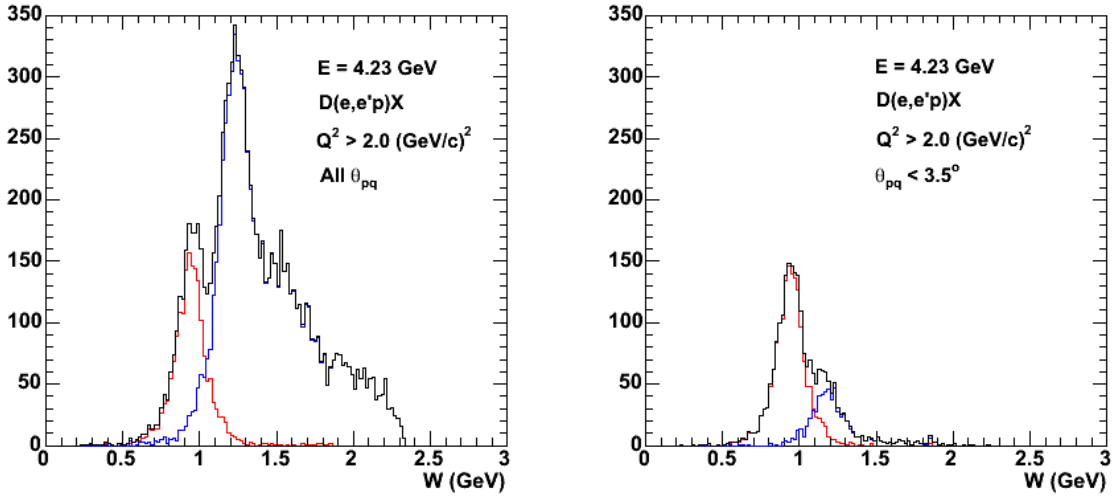


Fig 5. Same as Fig 4, but with the same theta_pq cut used in the D5 analysis by JL.

Click here to view the object (ROOT macro for fig 5) you uploaded.

Click here to view the object (Archive for fig 5) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 158 - GMn12sim (gpg)

[Modified Fri Mar 16 04:12:21 2007 (GMT) gpg]

In preparation for submitting a proposal to the next PAC for beam time to measure GMn at 12 GeV, we have been developing a simulation to study data rates, predict uncertainties, and test the proposed analysis techniques. The simulation builds as much as possible on existing software and consists of two main pieces.

1. Simulation of the quasi-elastic scattering off protons and neutrons in deuterium. This is a modified (slightly) version of Jeff's QUEEG program. Since it uses the Galster parameterization for the cross section, there appears to be no inherent problem with performing the calculation at higher energies and Q2. The modifications have been to make the angular limits in the code consistent with CLAS12 (e.g., minimum scattered electron angle). QUEEG12 already has a model of the Fermi motion of the nucleons.
2. Simulation of the inelastic events with the GENEV program originally from the Genova group. This code was written to study electroproduction of (among other things) pions from a proton target via delta and higher-W resonances. These events form the background beneath the quasi-elastic peak that is the main focus of the GMn measurement. According to Raffaella DeVita, there appears to be no serious problems with running the code at higher energy, except the Q2 dependence of some of the pion production channels is not correct. The code does not include the Fermi motion of the nucleons in deuterium. This is a significant drawback so we have spent the last few weeks putting in a model of the Fermi motion into GENEV. We call the modified code genevD. Our approach is analogous to what Jeff used in QUEEG though the implementation is different. We follow the these steps to simulate the Fermi motion.
    1. The nucleon momentum inside the deuteron is chosen from the Hulthen distribution shown in Figure 1 below. The direction is taken randomly in the azimuthal angle phi and in the cosine of the polar angle theta. This last step leaves out an important effect. The 'effective' energy of the beam on the struck nucleon is higher or lower depending on the direction of the Fermi motion. Nucleons moving toward the incoming beam see a higher energy. Nucleons moving away from the beam see a lower energy. The cross section depends on the beam energy and we are, at the moment, ignoring this effect. We would like to come up with a parameterization of the inelastic cross section as a function of the energy transfer nu and the scattering angle theta or a parameterization of the delta cross section since much of the background under the quasi-elastic peak will come from the delta. There is a Brasse parameterization for delta production off the proton (F.W.Brasse et. al., Nucl. Phys. B110, 413 (1976)), but apparently nothing on the neutron.

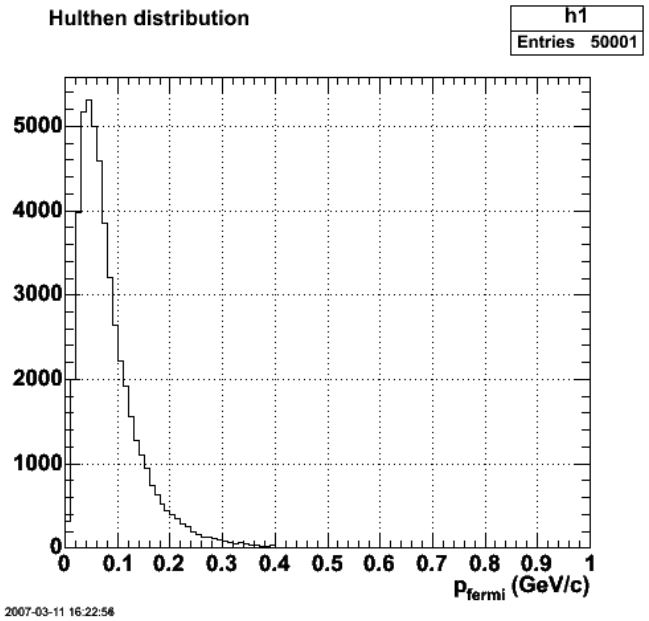


Fig 1. Distribution of nucleon momentum inside the deuteron.

    2. Once we have the Fermi momentum vector, we boost the electron beam 4-momentum to the nucleon rest frame using a routine called LUROBO in the JETSET library. We then rotate the frame of the boosted electron so the beam 3-momentum vector lies along the z axis. In this nucleon rest frame we calculate the incoming electron energy.
    3. The code then proceeds as usual, but with a different 'beam' energy for each event. It generates 4-momenta for the scattered electron, nucleon, and pion and photons (in the case of the pi0). The data are stored in a COMMON block (yes, it's in FORTRAN) that is accessible to the JETSET routines.
    4. We then reverse the procedure in part A above. We perform the reverse rotation of the nucleon rest frame and make the opposite boost using the routine LUROBO again. The routine performs the boost on all the particles in the event.
    5. At the end we are left with the scattered electron, nucleon, pion, and photons in the lab frame.
3. Running each code is controlled from a Perl script. The user has to decide how many events of each type (quasi-elastic or inelastic) is wanted.

To test the effect of the Fermi motion we did some calculations at 4.2 GeV so that we can compare them with our observations of the E5 data. The plots below show the results for the thrown events. The accepted events are those that make in through the FASTMC program for CLAS12. Figure 2 shows the W distribution at 4.2 GeV for the quasi-elastic and inelastic events. The relative number of events in each region is an arbitrary choice here. The Q2 range is for all Q2 > 0.25 GeV2. The quasi-elastic peak is narrow. The delta peak is clearly visible along with higher-W events. There is a small overlap between the two regions.

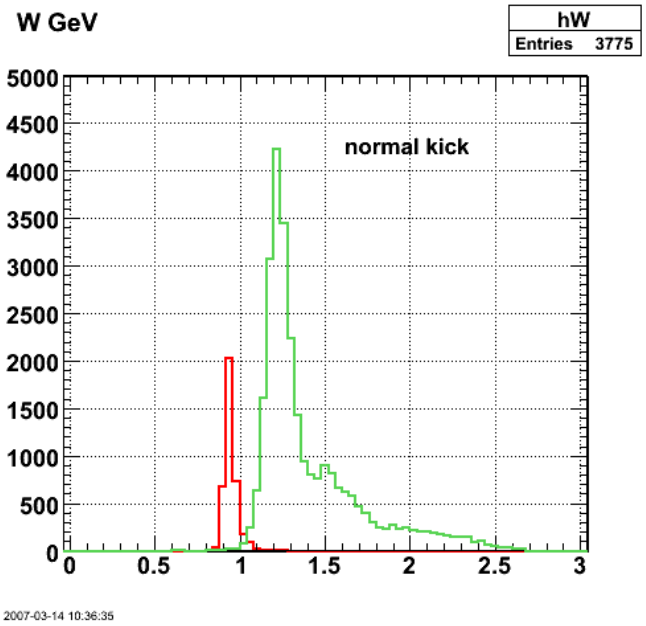


Fig 2. Separate W spectra for thrown events at 4.2 GeV for quasi-elastic and inelastic events.

Figure 3 shows the same spectra as Figure 2, but now with the Fermi motion turned off for the inelastic events only. The delta peak is more narrow and even the limited overlap with the quasi-elastic peak has been reduced.

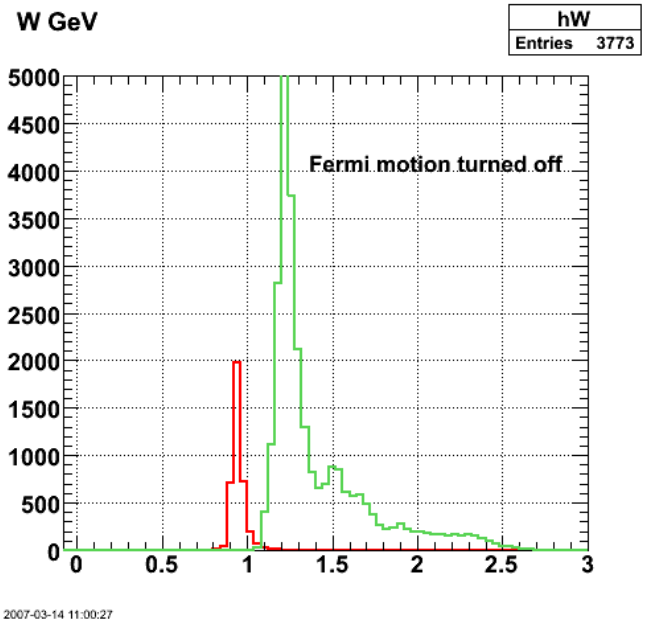
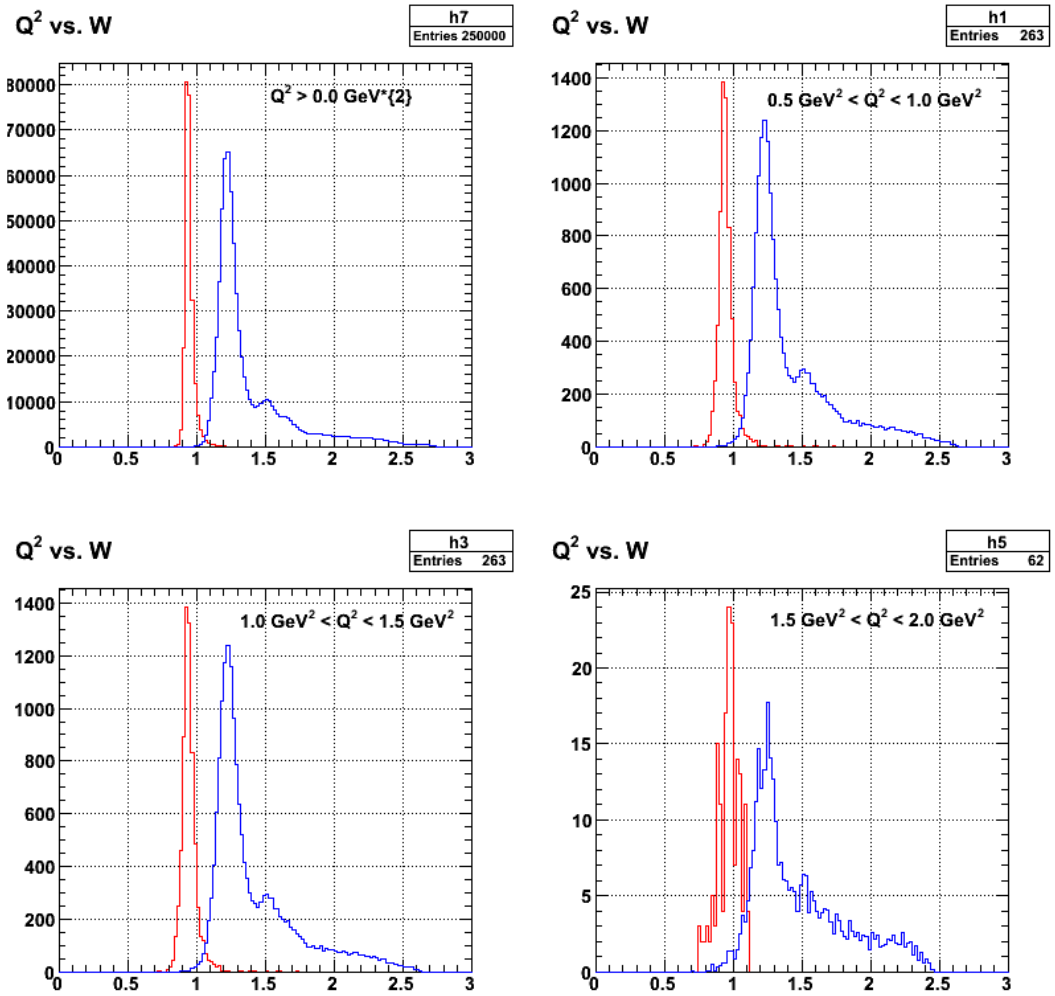


Fig 3. Same as Figure 2, but with the Fermi motion turned off for the inelastic events only.

We expect that as Q2 increases the effect of the Fermi motion will grow. To test our code we did a new calculation with a different quasi-elastic-inelastic ratio and looked at the W spectra in a series of Q2 bins. The results are shown in Figure 4. The overlap between the two regions gradually increases as Q2 goes up.



W spectra for thrown events at 4.2 GeV and Fermi motion turned on. Each panel corresponds to a different Q2 range.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 159 - Parameterization of the Inelastic Cross Section (gpg)

[Modified Thu May 3 20:38:45 2007 (GMT) gpg]

Note: See revisions to weighting functions starting below fig 7 below. See entry 343 in the E5 logbook for the latest versions.

In the last week, we have unearthed a couple of ways to parameterize the inelastic cross section for the p(e,e'p)X reaction. One is by Brasse, et al., (Nucl. Phys. B110 413 (1976)) and the other is by Paul Stoler (Phys. Rev. D 44, 73 (1991)). The Brasse, et al. one is not well-suited to our purposes, because it cuts off at W=1.1 GeV and where the cross section is still not zero. We would like to get the inelastic cross section as low in W as possible where it forms the background under the quasielastic peak. The Stoler parameterization is shown in figure 1.

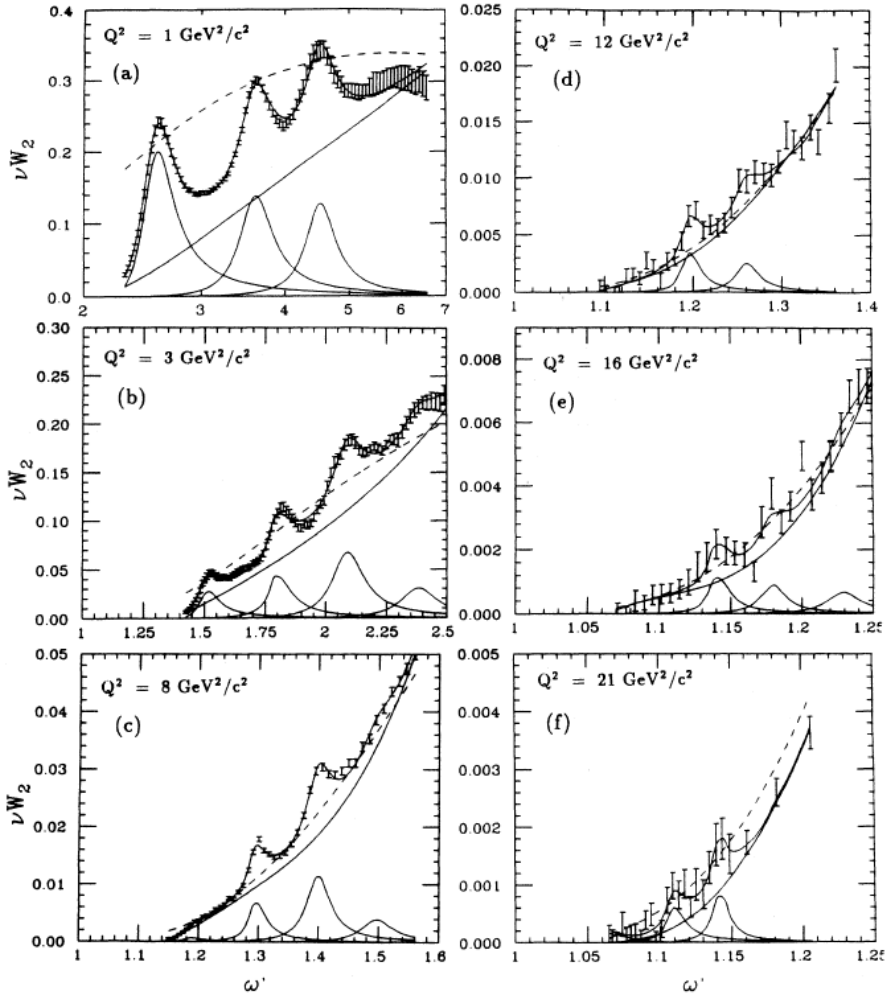


FIG. 1. Examples of spectra of inclusive (e,e') data as a function of ω', where $\omega'=\omega+M^2/Q^2$. M is the nucleon mass and $\omega=2M\nu/Q^2$. (a) and (b): the data were reconstructed from parameters in Ref. [18] (c)–(f): SLAC data from Refs. [14]–[17]. The solid curves are the result of least-squares fits to the data. The lower curves are the contributions from the individual resonances. The dashed curves are the extrapolation of the data from the scaling region using an empirical relation given in Ref. [3].

Figure 1. Figure from Stoler article.

He assumes the longitudinal part of the cross section is zero and then fits a set of resonances plus background to the data (largely taken at SLAC). The resonant fit parameters are shown in the table below taken from a review article by him (Phys. Reports 226 103 (1993)).

Q^2 (GeV^2)	A_T (GeV$^{-1/2}$)	δA_T (GeV$^{-1/2}$)	G_T	δG_T	G_T/G_{dip}	$\delta(G_T/G_{dip})$	source
0.9	0.170	0.0013	0.647	0.0051	1.109	0.0087	[Br-76]
1.9	0.0813	0.0018	0.213	0.0047	0.959	0.021	[Br-76]
2.4	0.0606	0.0017	0.141	0.0041	0.904	0.026	[Br-76]
2.4	0.0610	0.0011	0.142	0.0026	0.909	0.017	SL E133
2.9	0.0464	0.0016	0.098	0.0034	0.847	0.029	[Br-76]
2.9	0.0482	0.0006	0.102	0.0012	0.880	0.011	SL E89
2.9	0.0457	0.0017	0.097	0.0036	0.835	0.031	[Br-76]
3.9	0.0288	0.0012	0.053	0.0022	0.740	0.031	SL E133
3.9	0.0283	0.0015	0.052	0.0028	0.727	0.040	[Br-76]
3.9	0.0273	0.0016	0.050	0.0029	0.701	0.041	[Br-76]
5.9	0.0127	0.0008	0.019	0.00120	0.543	0.035	SL E133
7.8	0.0052	0.0013	0.0067	0.0016	0.321	0.079	SL E133
7.9	0.0055	0.0011	0.0070	0.0014	0.344	0.067	SL E89
8.6	0.0069	0.0007	0.0085	0.0009	0.488	0.052	SL E89
9.6	0.0071	0.0017	0.0083	0.0020	0.582	0.14	SL E19
9.8	0.0026	0.0014	0.0030	0.0016	0.221	0.12	SL E133
1.0	0.163	0.012	0.55	0.034	1.062	0.067	[Ha-79]
2.0	0.072	0.005	0.186	0.012	0.903	0.057	[Ha-79]
3.0			0.089	0.005	0.805	0.0430	[Ha-79]

Figure 2. Table taken from Stoler review article.

The parameters for the non-resonant background are apparently not available until Paul can find out where the Department VAX is now. I talked to him about this and we can just read the points off the figure and regenerate the curves.

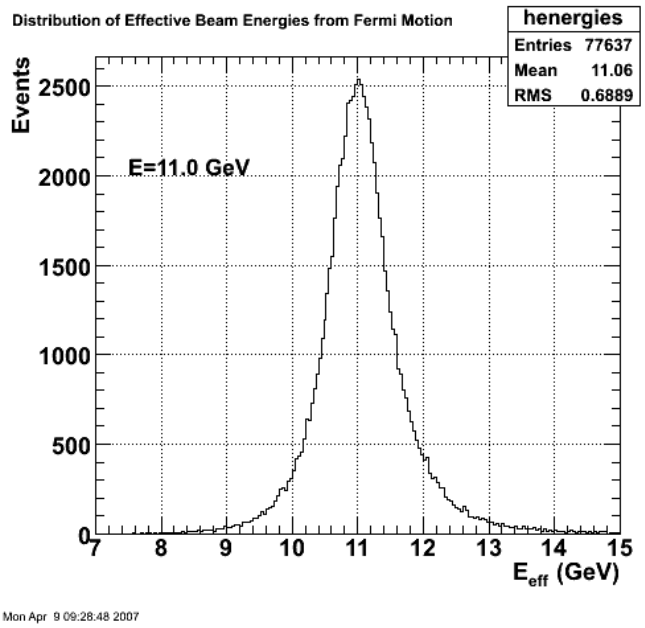


Fig 3. Distribution of effective beam energies due to Fermi motion in the deuteron from genevD.

Click here to view the object (ROOT macro for fig 3) you uploaded.

Click here to view the object (input file for fig 3) you uploaded.

The plot above shows the distribution of effective beam energies in genevD for Ebeam=11 GeV when cos(thetaN) and p_fermi (the Fermi momentum and direction of the nucleon) are chosen at random. I need the integral from the inelastic cross section parameterization over the range Ebeam +/- 3*sigma or 8.9 - 13.1 GeV. The range of the integral was W2: 0.05->2.5 GeV, theta: 7-40 degs. See the results below.

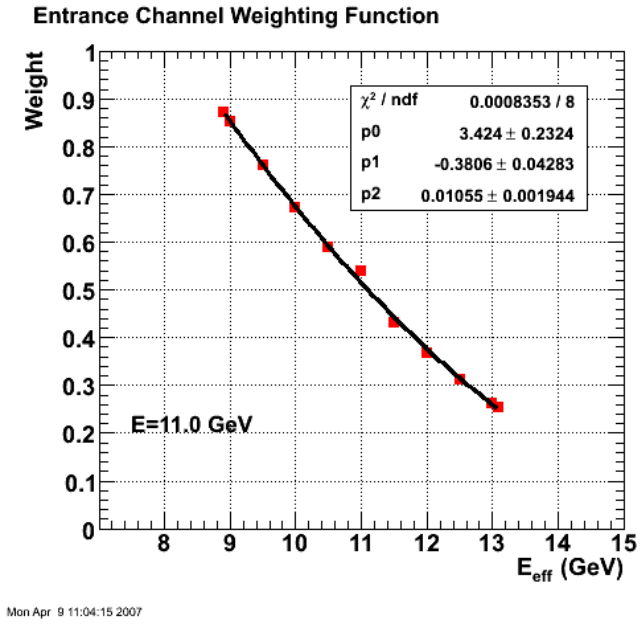


Fig 4. Effective energy dependence of the weighting function.

Click here to view the object (ROOT macro for fig 4.) you uploaded.

Click here to view the object (Mathematica notebook used to generate integrals used in Fig 4.) you uploaded.

EEkkk!!! I left out the sin(theta) factor when I did the integrals for the previous plot. The corrected plot, ROOT macro, and Mathematica notebook are below.

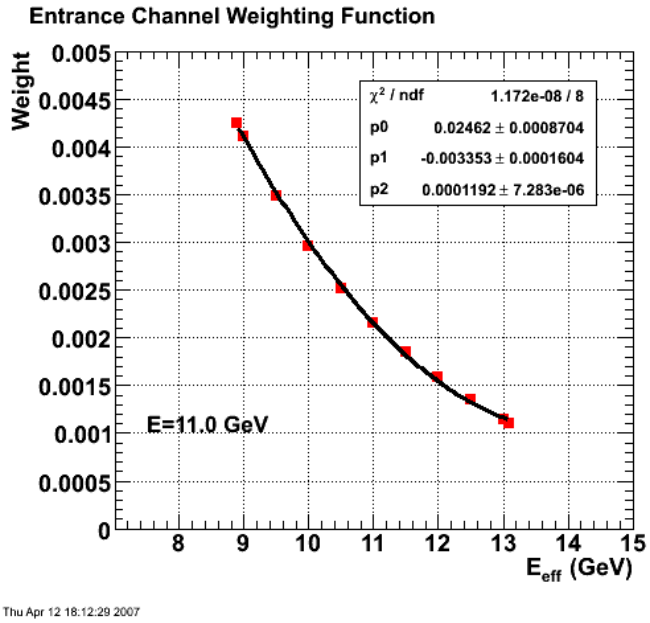


Fig 5. Effective energy dependence of the weighting function with corrected integration.

Click here to view the object (Mathematica notebook for Fig 5) you uploaded.

Click here to view the object (ROOT macro for fig 5) you uploaded.

The next step is to get the effective beam energy as a function of momentum and polar angle of the Fermi momentum of the nucleon inside the deuteron. That function is shown in the left panel of the figure below where the surface is a function of p_fermi taken from the Hulthen distribution and cos(theta) where theta is the polar angle of the moving nucleon. For each point in this surface, we then calculate the weight using the fitted curve from the figure above.

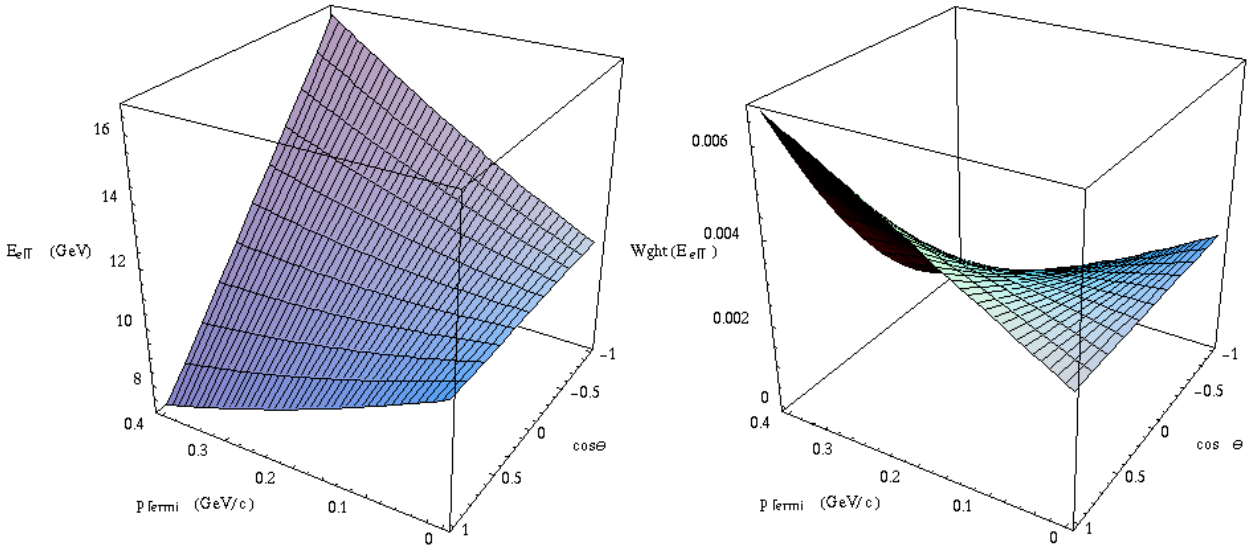


Fig 6. The left panel shows the dependence of the effective beam energy as a function of the magnitude of the Fermi momentum p_fermi and cos(theta) where theta is the polar angle of the moving nucleon. The right panel shows the dependence of the weight function taken from the previous figure also as a function of p_fermi and cos(theta).

The right panel in the previous figure is the weight associated with the variation of the cross section with the effective beam energy. We still need to include the effect of the distribution of momenta due to the Fermi motion of the nucleon. We do that by multiplying the weight in the right panel of the previous figure by the Hulthen distribution and obtain the following.

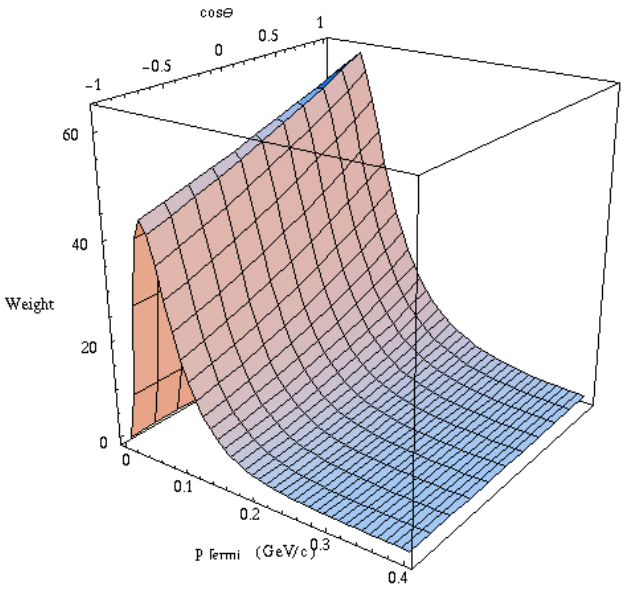


Fig 7. Weighting function for the Fermi motion.

This function is now incorporated into genevD. To choose the Fermi momentum and direction we pick three numbers at random; (1) The Fermi momentum is chosen in the range 0-0.4 GeV/c, (2) cos(theta) is chosen in the range -1 to 1, and (3) a weight is chosen in the range from zero to the maximum of the weight function in Figure 7. If this random weight is less than the weight function at that value of p_Fermi and cos(theta), then p_fermi and cos(theta) are kept and the code continues. If the random weight is greater than the weight function, that triple (p_Fermi, cos(theta), and the random weight) is thrown out and another three random numbers are chosen. The process is repeated until we get an acceptable choice of p_fermi and cos(theta).

The weight function is calculated in genevD with a Fortran, CERNLIB function called FINT. A grid of points representing the weighting function is stored in several arrays and the CERNLIB function interpolates to find the value of the surface. This has been coded into genevD and we are testing things now. One of the tests we have done is to compare the weighting function calculated with FINT and one calculated with Mathematica using the same grid of points. The results are shown in the table below. For most of the points, Mathematica and FINT are in close agreement (much less than 1%, but there are two points in the table where the difference grows to 1.5%. At the moment, we don't think this is very serious. The test was done with an earlier version of the calculation so the actual values of the weighting function have changed, but the agreement between FINT and Mathematica is encouraging.

FINT	Mathematica	delta	(delta/ave)*100
882.90979	882.035	0.87479	0.0991
5495.36084	5473.02	22.3408	0.4074
306.636047	305.635	1.00107	0.3270
9134.56445	9127.83	6.73445	0.0738
12692.9258	12887.2	-194.27	-1.519
11662.8789	11665.3	-2.4211	-0.021
4581.19385	4575.57	5.62385	0.1228
5014.6333	4937.21	77.4233	1.5560
6258.04395	6238.09	19.9540	0.3194

There were several problems associated with the analysis above of the weighting function. The plot below shows a revised weighting function versus the effective beam energy. The cos(theta) is not quite the one we want for the CLAS12 acceptance.

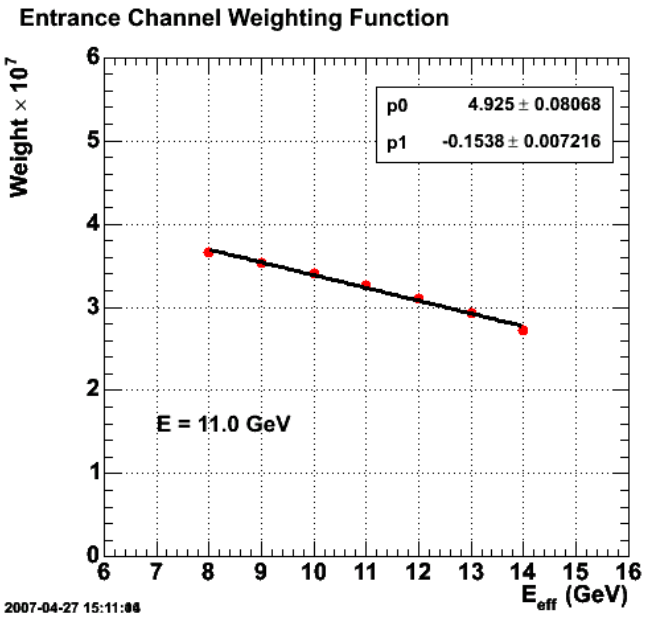


Fig 8. Revised entrance-channel weighting function. Compare with fig 4.

Click here to view the object (ROOT macro for fig 4.) you uploaded.

Click here to view the object (compressed, tar file with notebooks used in creating fig 7.) you uploaded.

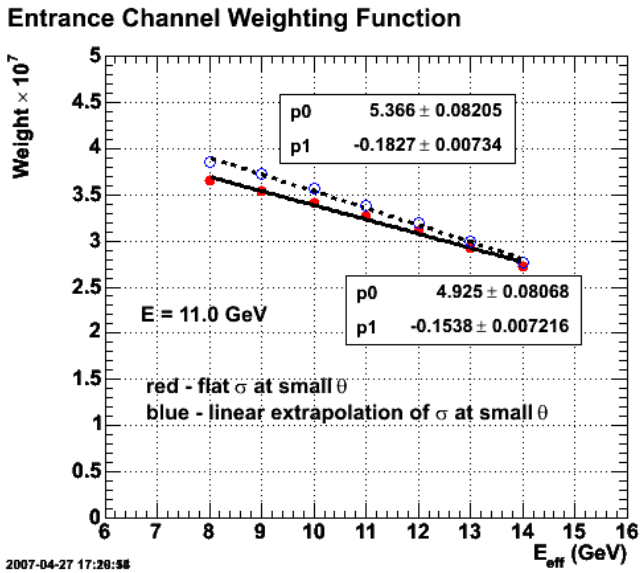


Fig 9. Comparison of weighting functions with different methods for extrapolating the cross section at small angles.

Click here to view the object (ROOT macro for Fig 9) you uploaded.

Click here to view the object (updated ROOT macro for fig 9) you uploaded.

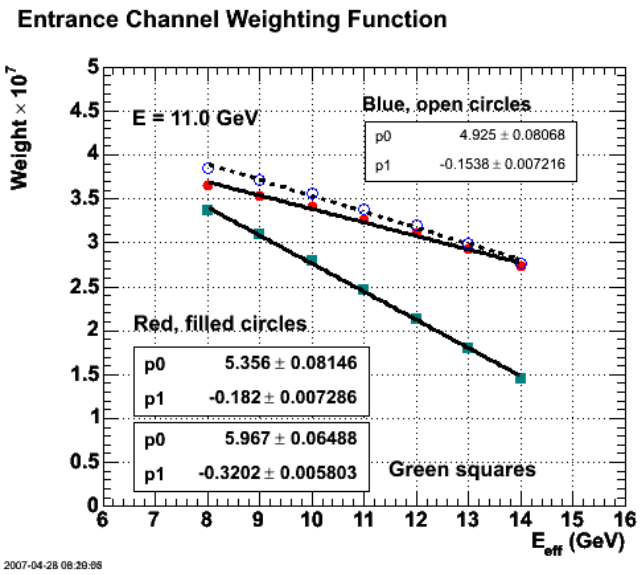


Fig 10. Same as fig 9 with curve with angular range of 5 deg - 40 deg for CLAS12.

Click here to view the object (ROOT macro for fig 10) you uploaded.

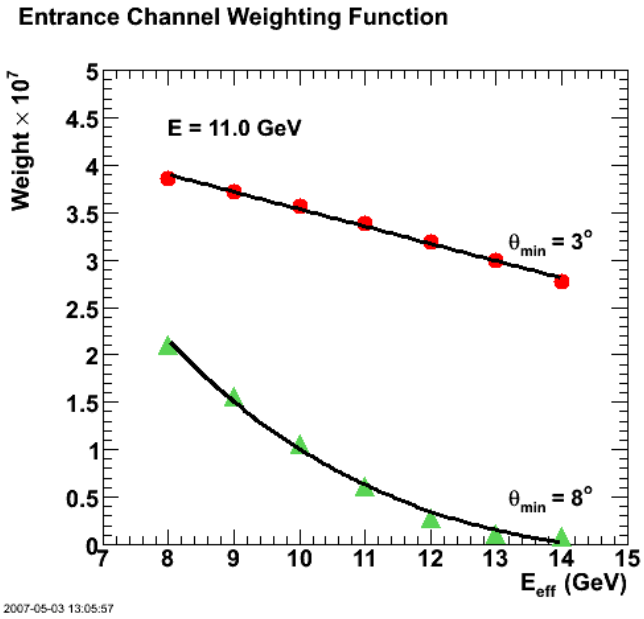


Fig 10b. Now get the minimum angle of CLAS12 for electrons correct.

Click here to view the object (ROOT macro for fig 10b) you uploaded.

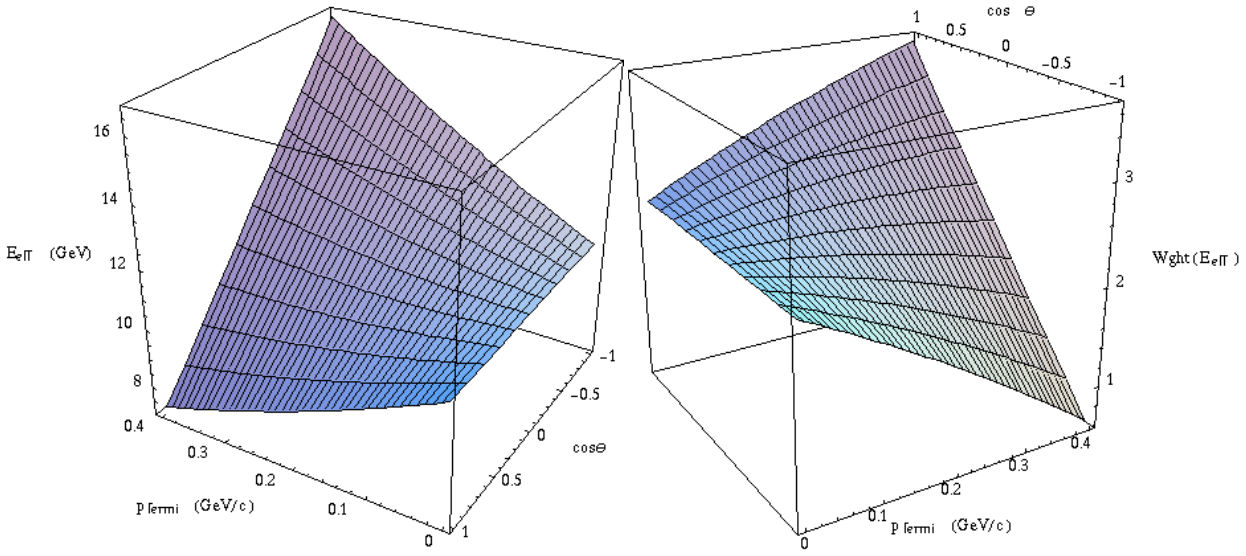


Fig 11. The left panel shows the dependence of the effective beam energy as a function of the magnitude of the Fermi momentum p_fermi and cos(theta) where theta is the polar angle of the moving nucleon. The right panel shows the dependence of the weight function taken from the previous figure also as a function of p_fermi and cos(theta).

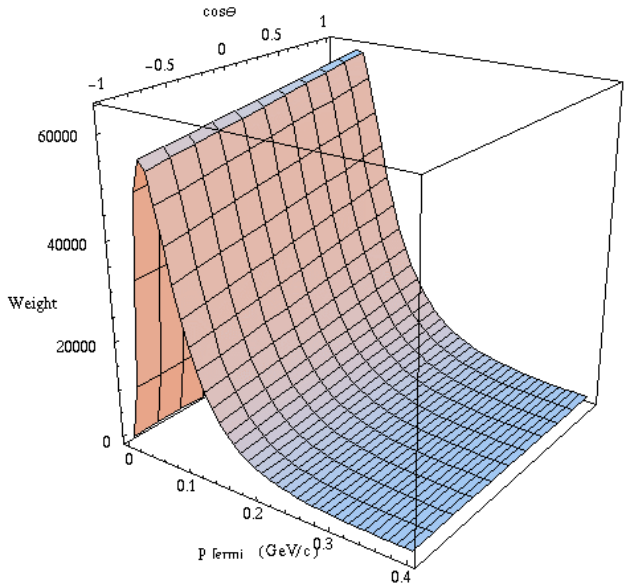


Fig 11. Weighting function for the Fermi motion.

Fig 12. Updated, corrected weighting function for the Fermi motion.

Click here to view the object (gzipped, tar archive of Mathematica notebooks used to create the Eeff dependence of the weighting function. To run them use inelasticInputs1.nb first and then run the notebooks for the individual effective beam energies.) you uploaded.

Getting the entrance-channel weighting function for gmnsim.

```
1. run inelasticInputs1.nb to get the cross section (really nu*W_2) as a function
of omega' at a bunch of Q2.

2. For each effective beam energy run the appropriate notebook inelasticN.0M.nb
where N is the effective beam energy and M is a letter a,b,c,... representing the
version. Pick the highest version.

3. Collect the weights from each Mathematica notebook and plot and fit it in the ROOT
macro EeffWgtn.C where n is the version number (6 is the highest on 5/3/07).
```

4. Put the fit results into wghtGrid2.nb to calculate the grid of points that are needed as input to FINT, the CERNLIB routine that we use to get the weight in genevD.

5. Edit the grid of points from wghtGrid2.nb to fit fortran format and substitute them into the function weight or weight2 in genevD.f

6. remake genevD_Linux.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 160 - stuff for kg and rb (gpg)

[Modified Mon Apr 9 20:37:03 2007 (GMT) gpg]

Here is stuff for kristen.

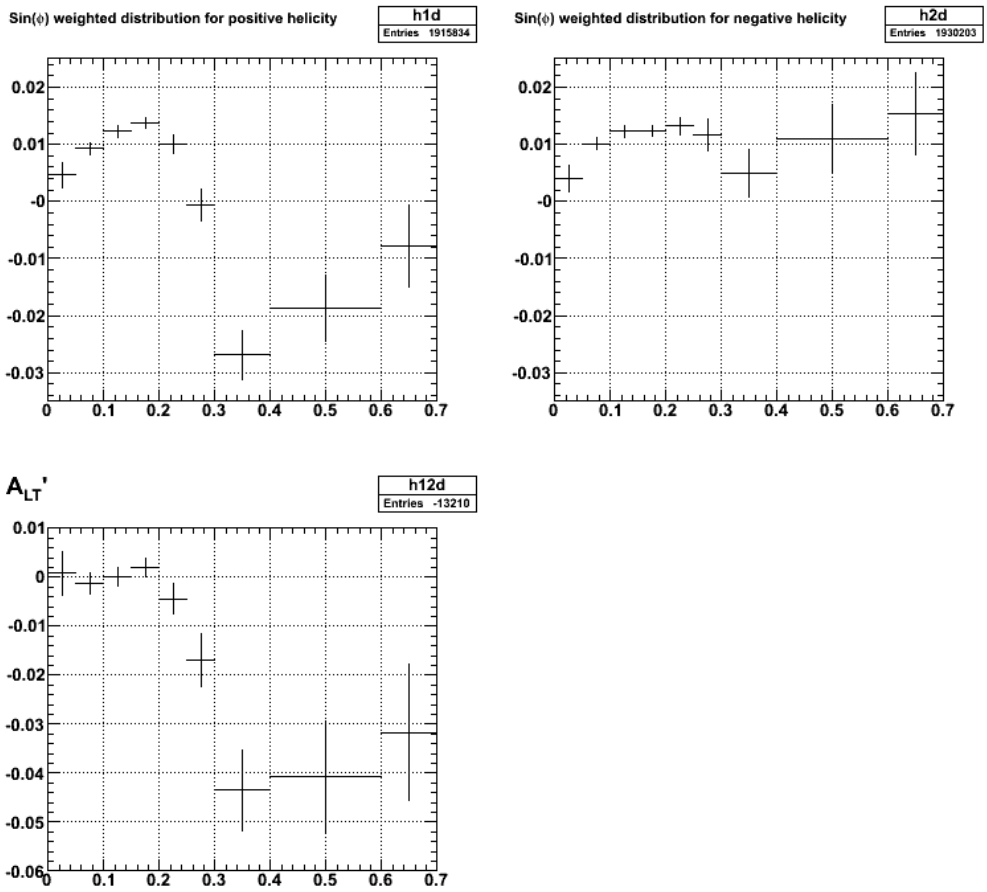
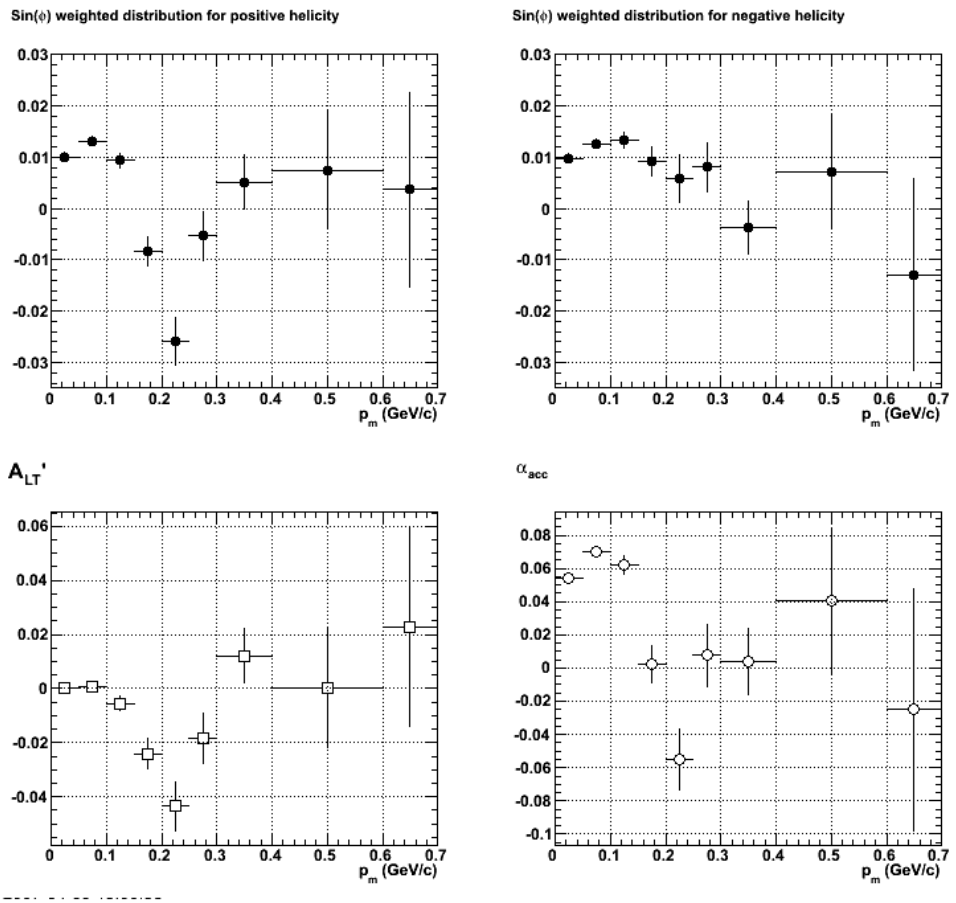


Fig 1. Plot of for both bema helicities and then the difference to eliminate the backgroudn asymmetry.

Click here to view the object (ROOT macro for Fig 1) you uploaded.

Click here to view the object (ROOT histogram file for Fig 1.) you uploaded.

KG plot.

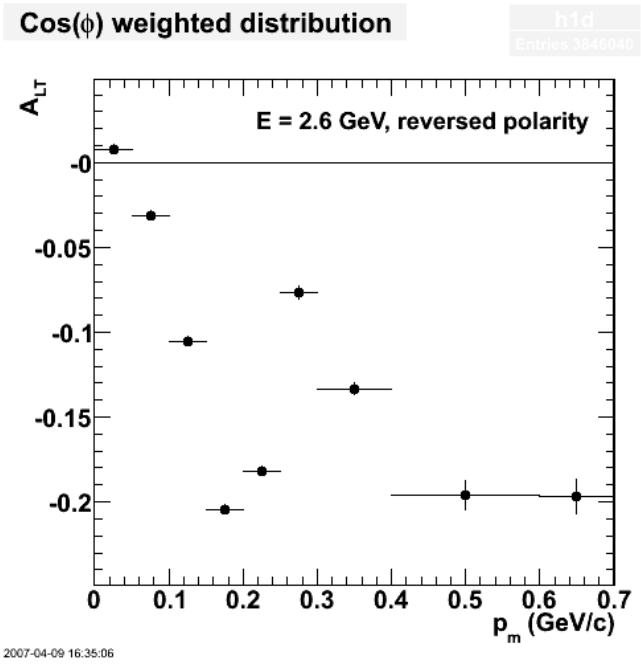


Replacement for Fig 8 in KG paper

Click here to view the object (ROOT macro for previous fig) you uploaded.

Click here to view the object (ROOT histogram file for previous fig.) you uploaded.

Data plot for rusty.



ALT plot for 2.6r for rusty.

Click here to view the object (ROOT macro for above plot) you uploaded.

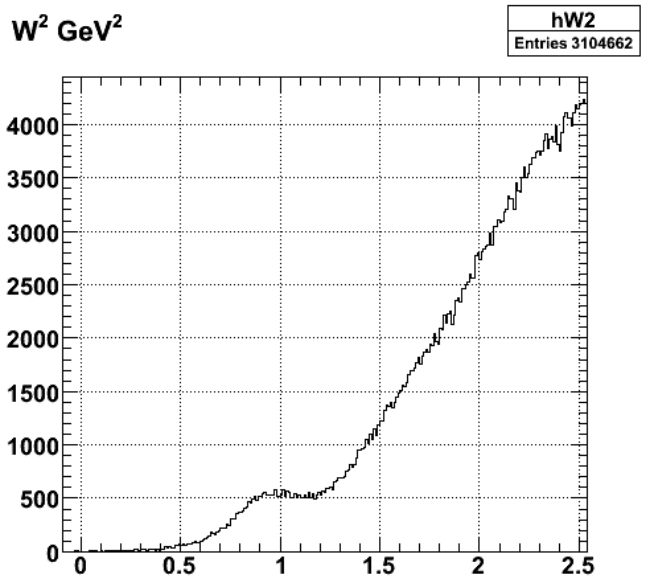
Click here to view the object (ROOT histogram file for above plot.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 161 - QE-inelastic ratio (gpg)

[Modified Wed May 9 16:21:37 2007 (GMT) gpg]

We need to set the ratio of quasielastic to inelastic events in the GMn@12GeV simulation. Here we will use the data to guide us. We will get the ratio from the 4.2-GeV, E5 data with Q2 > 2.0 GeV2. The Q2 cut is used to make the kinematic range more like what is available in the simulation. We have inelastic data down to Q2 = 1.0 GeV2, but there could be problems due to the entrance-channel, effective-energy effect created by the Fermi motion in the simulation.

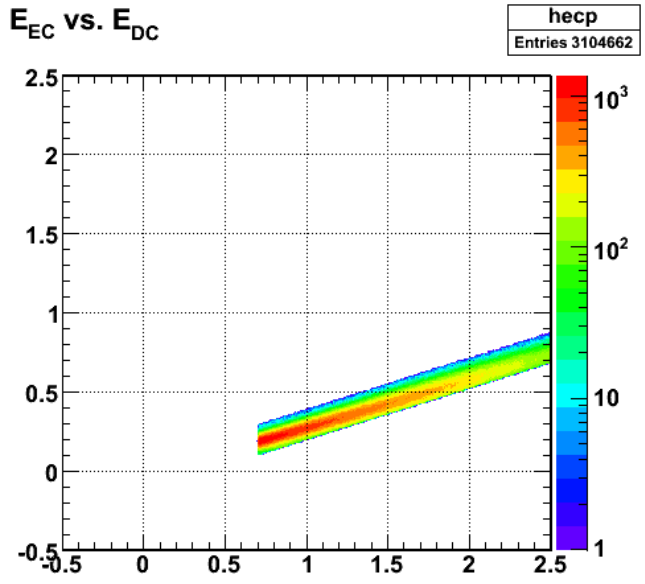


2007-05-01 09:10:09

Fig 1. W2 spectrum of he 4.2 GeV electron singles events with no Q2 cut.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (ROOT histogram file for fig 1) you uploaded.



2007-05-01 11:35:02

Fig 2. Sampling fraction cut from same analysis run as fig 1.

Click here to view the object (Archive with 4.2-GeV gmnsim run with Q2 > 1.5 GeV2 and QE:In = 1000:4000 for each node.) you uploaded.

Now do a simulation for 11 GeV.

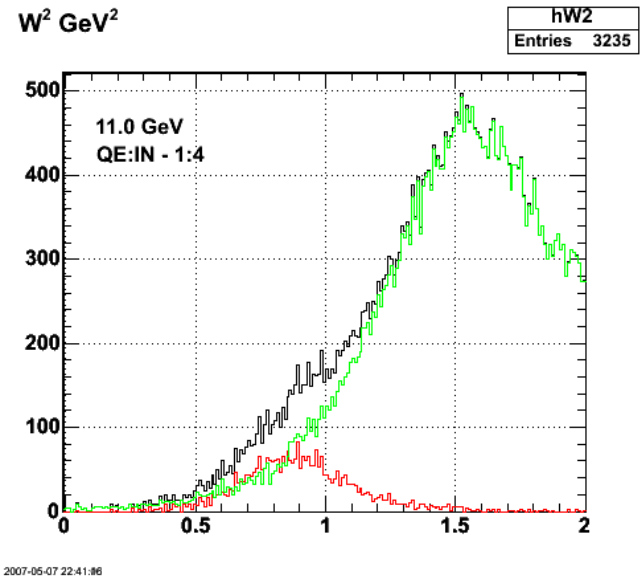


Fig 2. Simulation of W2 spectrum for 11 GeV.

Click here to view the object (ROOT macro for fig 2) you uploaded.

Click here to view the object (ROOT histogram file used for fig 2.) you uploaded.

Click here to view the object (Mathematica notebook and input files used to integrate the cross section over Q2.) you uploaded.

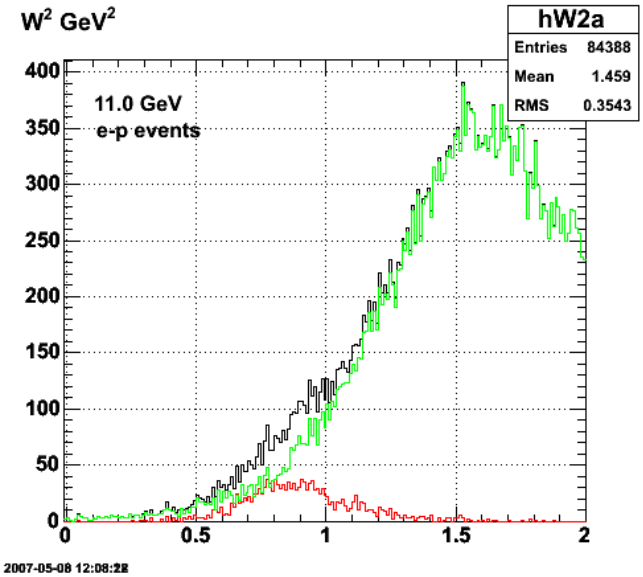


Fig 3. Simulation of W2 spectrum for e-p concidences at 11 GeV.

Click here to view the object (ROOT macro for fig 3) you uploaded.

Click here to view the object (tar file containing archive of ROOT histogram files used in figs 2-3) you uploaded.

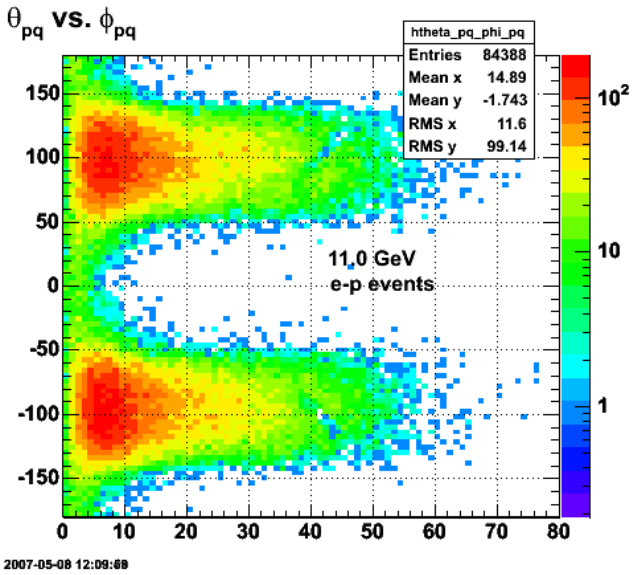


Fig 4. Plot of phi_pq vs. theta_pq. Note the regions where the inelastic contribution peaks in phi_pq while the QE contribution appears to be independent of phi_pq.

Click here to view the object (ROOT histogram file for fig 4) you uploaded.

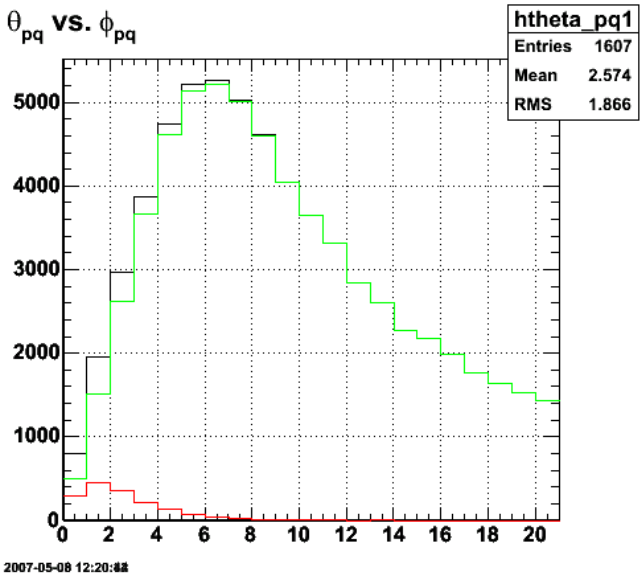


Fig 5. theta_pq distribution for QE, IN, and QE+IN.

Click here to view the object (ROOT macro for fig 5.) you uploaded.

Now set the theta_pq cut at 3.5 deg.

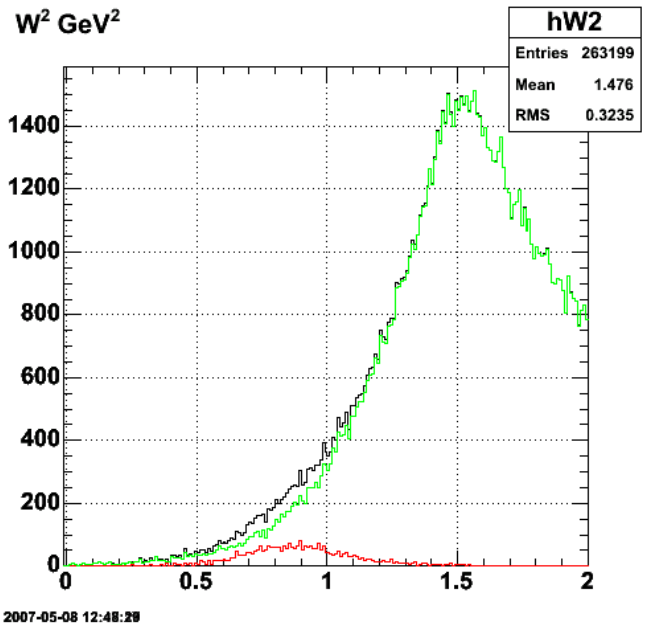


Fig 6. W2 spectrum for electron singles.

Click here to view the object (ROOT macro for fig 6) you uploaded.

Click here to view the object (tar archive for root hists in fig 6.) you uploaded.

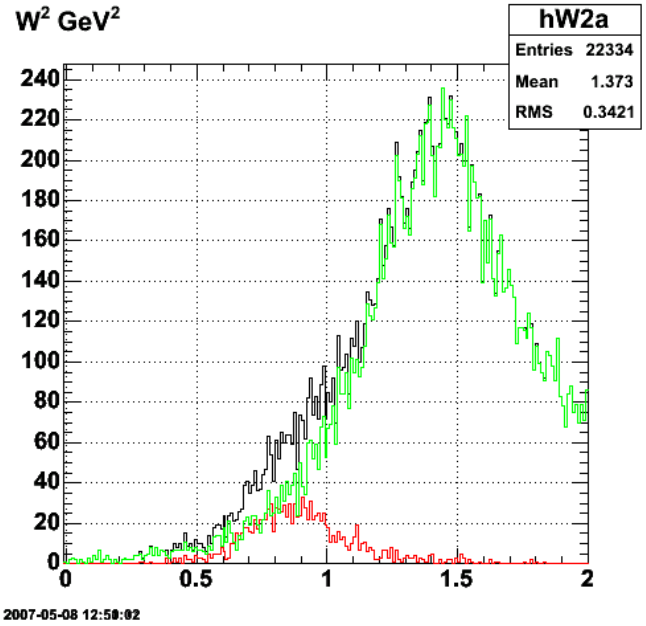


Fig 7. Effect of theta_pq < 3.5 deg cut on W2 spectrum. Yukkk!

Click here to view the object (ROOT histogram file for fig 7) you uploaded.

Set theta_pq_cut=2 deg.

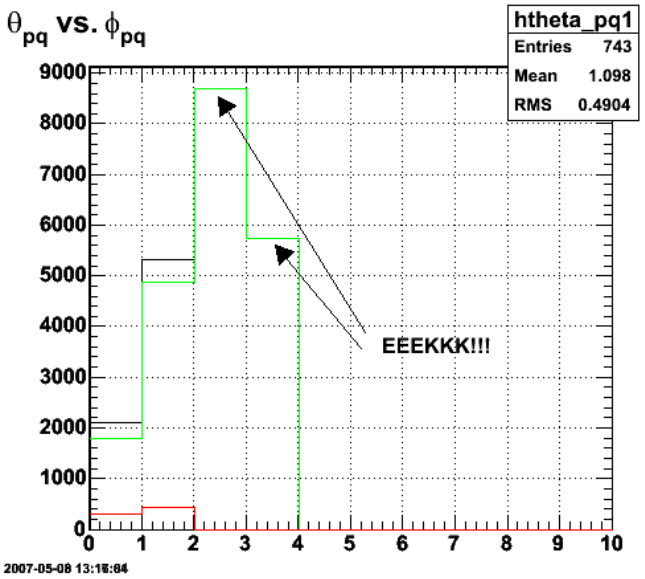


Fig 8. !!!!!

Click here to view the object (ROOT macro for fig 8) you uploaded.

The problem above was created by bugs in the Perl scripts that were not deleting old files and properly replacing them with new ones.

The plots below show the W2 spectrum and theta_pq distribution at 11 GeV. We had expected that the W2 QE peak would get wider, but this effect is extreme! At the same time we expected the theta_pq angular distribution to be more narrowly focused at small angles which is exactly what we see here.

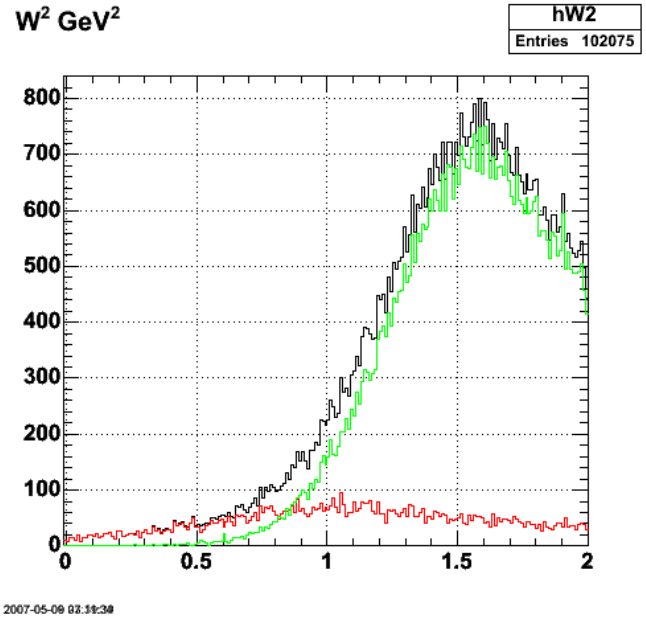


Fig 9. W2 spectrum for Q2=12-14 GeV2 for both QE and IN simulations. The IN simulations (green curve) have the Fermi motion turned off.

Click here to view the object (ROOT macro for fig 9.) you uploaded.

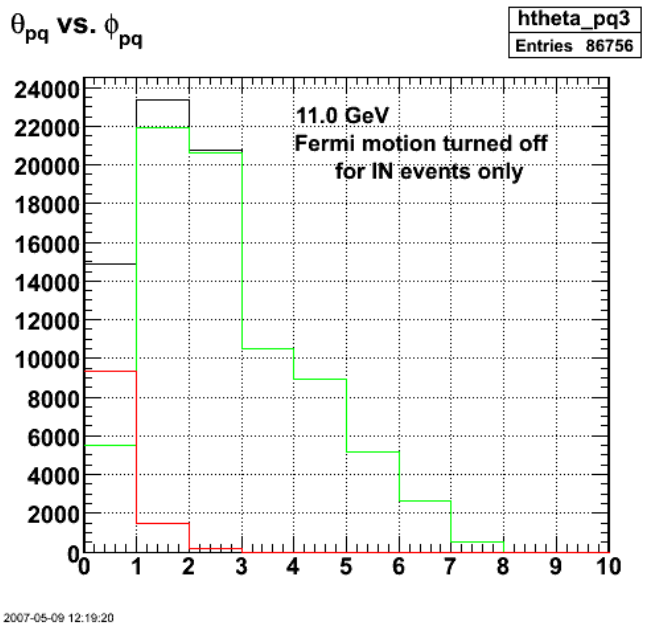


Fig 10. Angular distribution of theta_pq for QE and IN events. The Fermi motion has been turned off in the IN events (green curve), but the Fermi motion is still on in the QE events (red curve).

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 162 - QE selection (gpg)

[Modified Thu May 10 13:32:27 2007 (GMT) gpg]

Study of selecting QE events at 12 GeV. The decay channels chosen for genevD are the following.
C 2) V_Gamma + P ---> P + PI0
Fig1 shows the effect of the theta_pq cut on the W2 spectrum for e-p coincidences. The QE peak sits under a vary large background, but the theta-pq cut chops down a huge amount of the inelastic cross section.

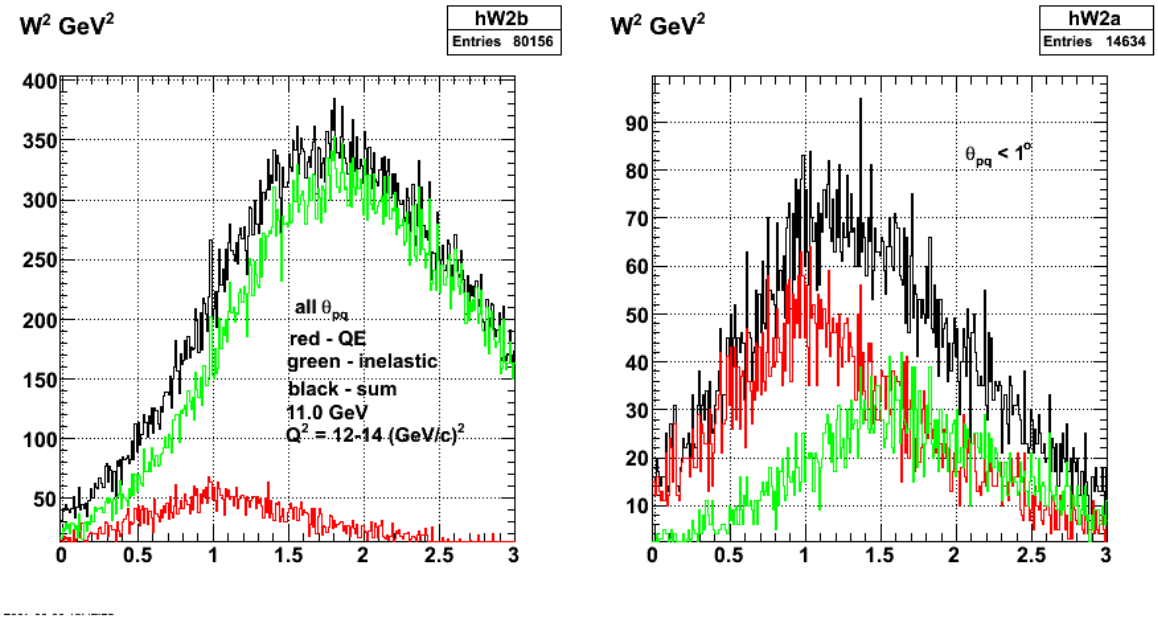


Fig 1. Comparison of W2 spectra with (right) and without (left) the theta_pq cut for 11-GeV, Q2=12-14 GeV2.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (tar archive of ROOT files for fig 1) you uploaded.

Fig 1 is for eD->epX events. Now try limiting them to just eD->Epn events.

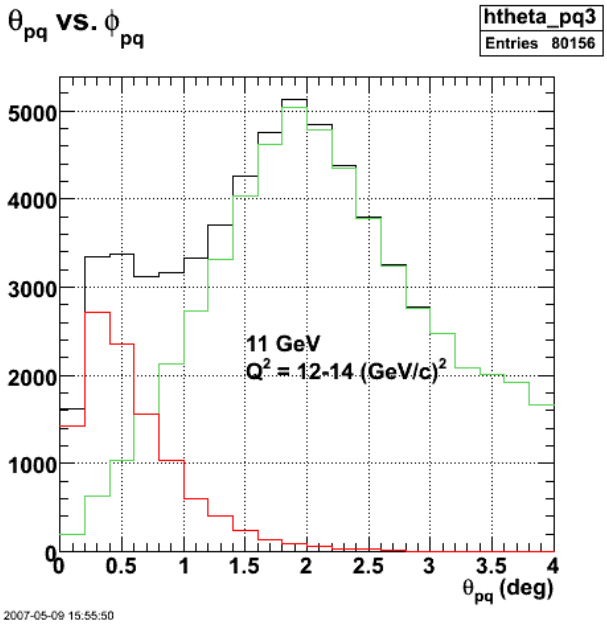


Fig 2. Angular distribution of theta_pq for QE, inelastic, and QE+inelastic.

Click here to view the object (ROOT macro for fig 2) you uploaded.

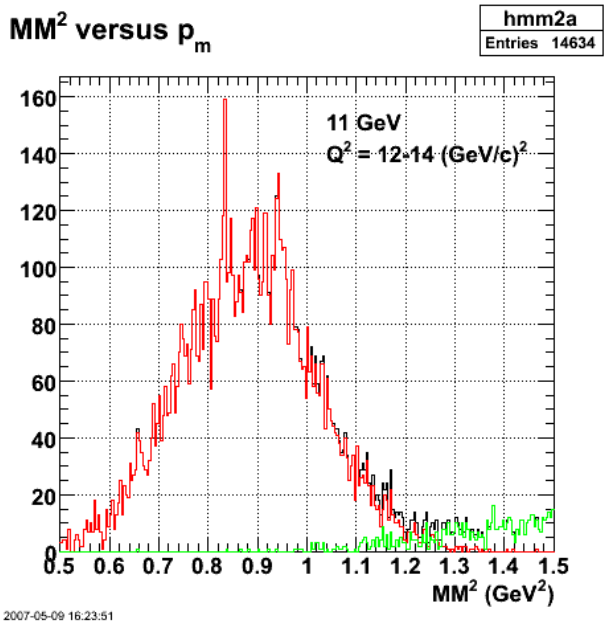


Fig 3. Missing mass spectrum for ep events.

Now put the mm2, neutron cut on along with the theta_pq cut and things look GOOOOD!!!! YEEEEHAAA!!

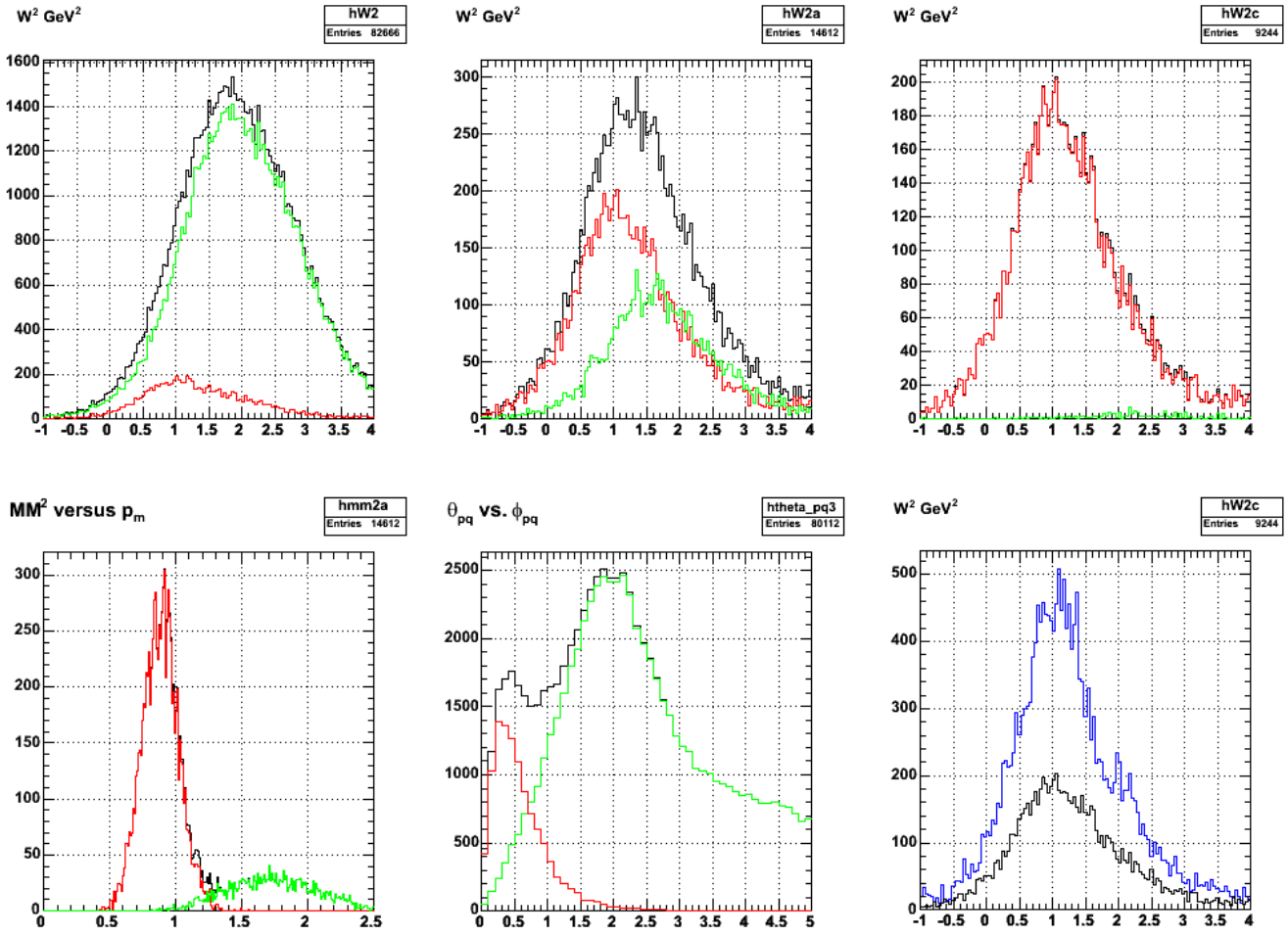


Fig 4. Results for Q2=12-14 GeV2 with various cuts.

Click here to view the object (ROOT macro for fig 4) you uploaded.

Click here to view the object (tar archive for fig 4) you uploaded.

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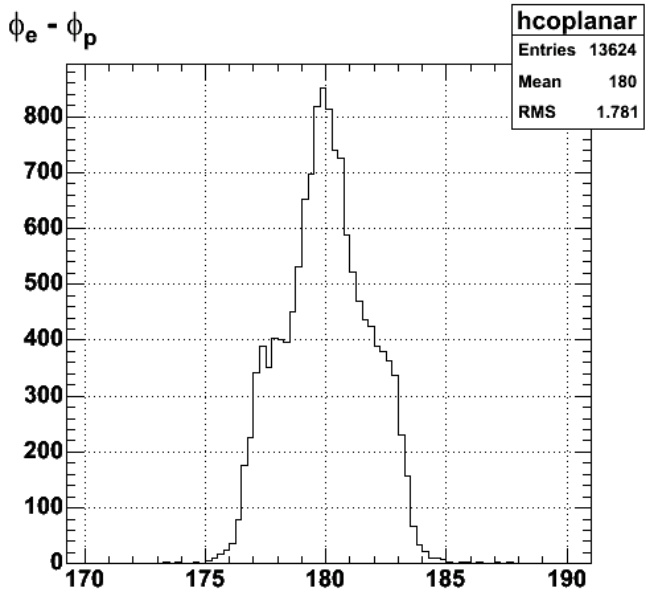
Jerry Gilfoyle's Enotebook page 163 - Coplanarity angle (gpg)

[Modified Tue May 15 04:55:58 2007 (GMT) gpg]

Using the coplanarity angle to isolate QE events from inelastic.



2007-05-14 18:59:48

Fig 1. Coplanarity angle distribution for ep events with QE cut turned on.

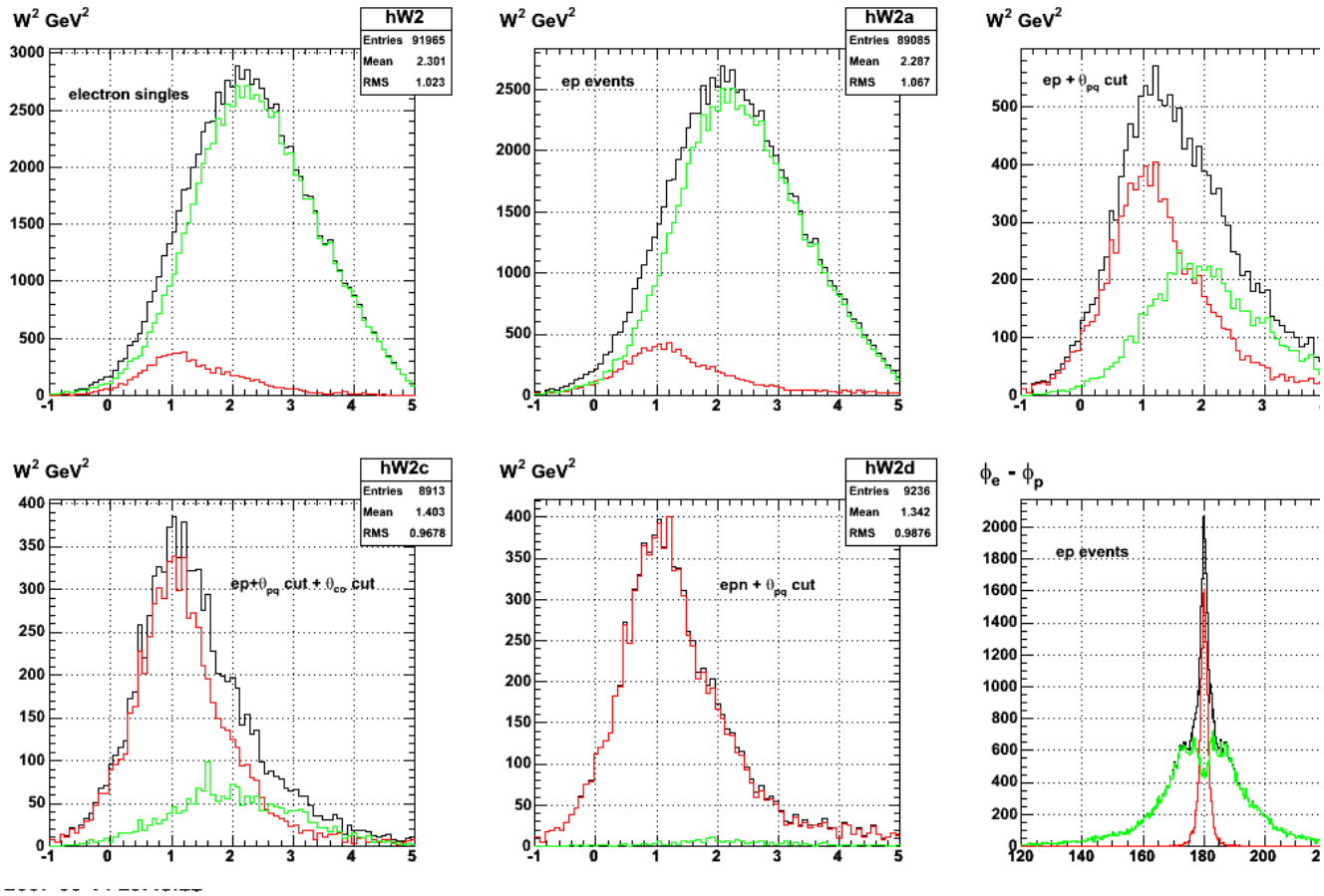


Fig 2. Effect of different cuts on W2 spectrum. Note the difference between fig 1 and the lower right panel. Something is screwy in fig 1

Click here to view the object (ROOT macro for fig 2.) you uploaded.

Click here to view the object (tar archive for fig 2) you uploaded.

Now require ep events to have e+p and nothing else.

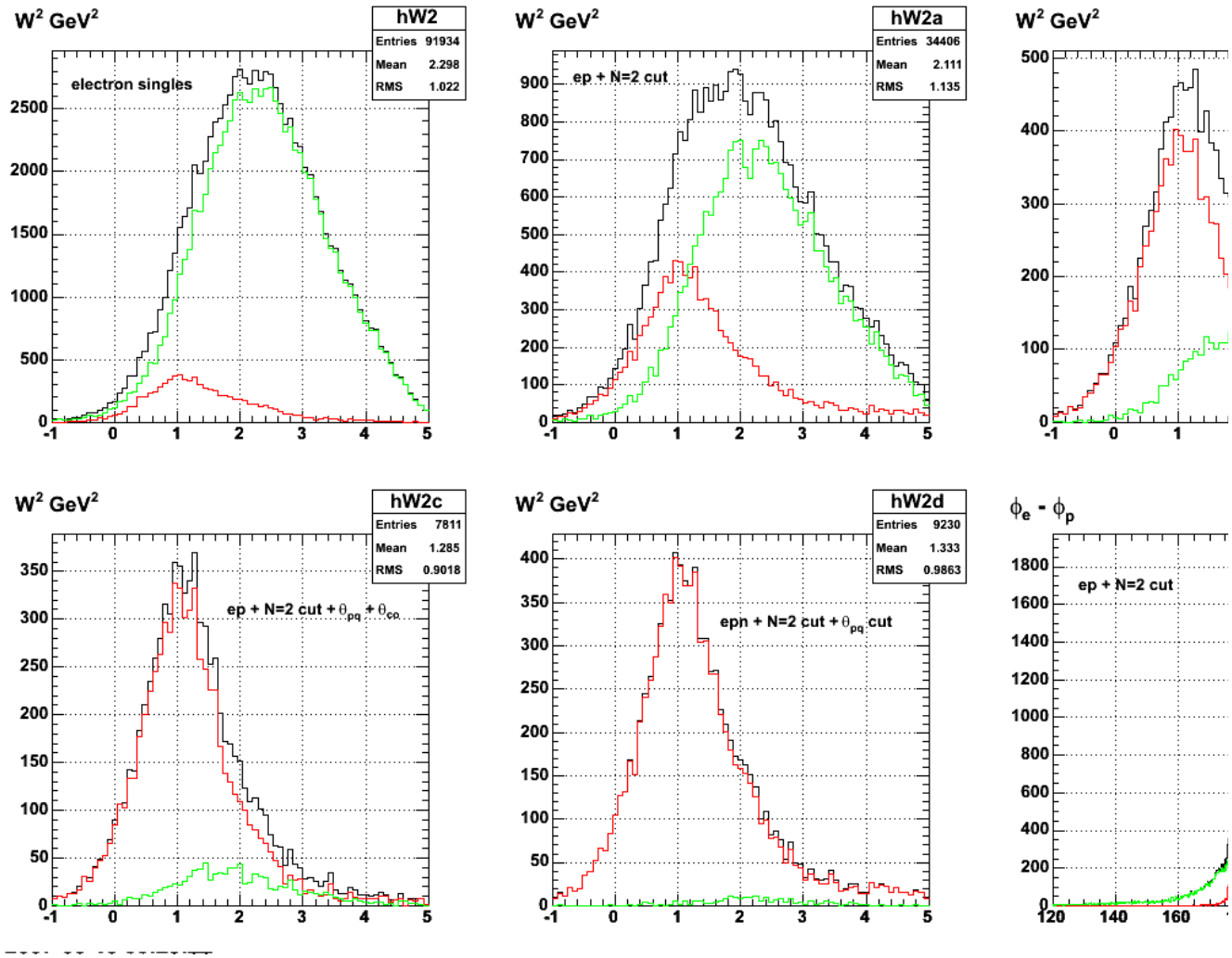


Fig 3. Same as fig 2, but now turn on the requirement that there be N=2 particles in the final state and no more.

Click here to view the object (ROOT macro for fig 3) you uploaded.

Click here to view the object (tar archive for fig 3) you uploaded.

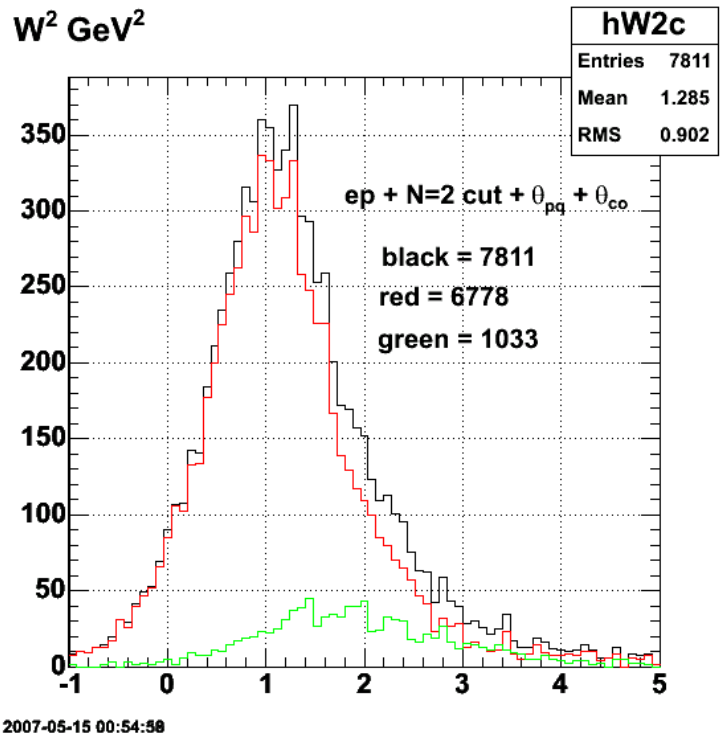


Fig 4. Integrate the histograms in the lower, left panel of fig 3

Click here to view the object (ROOT macro for fig 3) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 164 - Previous W2/E' results (gpg)

[Modified Thu May 17 22:34:49 2007 (GMT) gpg]

Plot below to show what happens to the QE peak at high energy and Q2. The reference is Phys. Rev. Lett., 49, p. 1139 (1082).

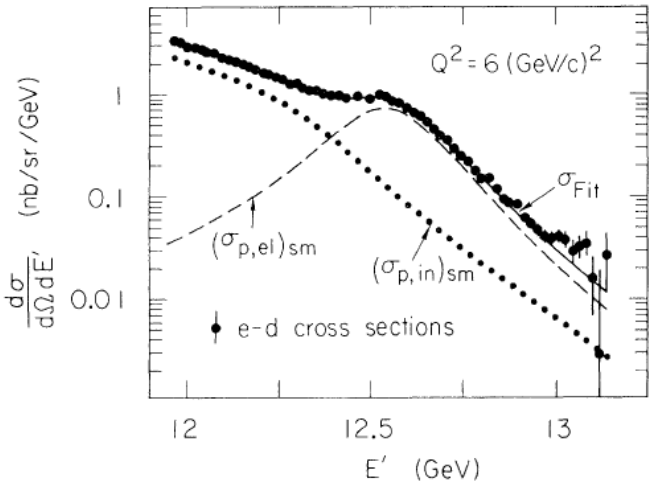


FIG. 1. The cross section for e–d scattering at incident energy $E = 15.742$ GeV vs scattered-electron energy E' at 10°. The dashed (dotted) curve is the smeared elastic (inelastic) e–p cross section obtained with method II and the Paris potential (Ref. 9). The solid curve is the result of a linear least-squares fit of the other two curves to the e–d cross section as described in the text. All cross sections are radiatively corrected.

E' distribution at 10 GeV.

Q2	Ebeam
10.0	21.0
8.0	18.5
6.0	15.7
4.0	12.6
2.5	9.8

See next entry for more on this run for W2=6-7 GeV2 and IN/QE=28.

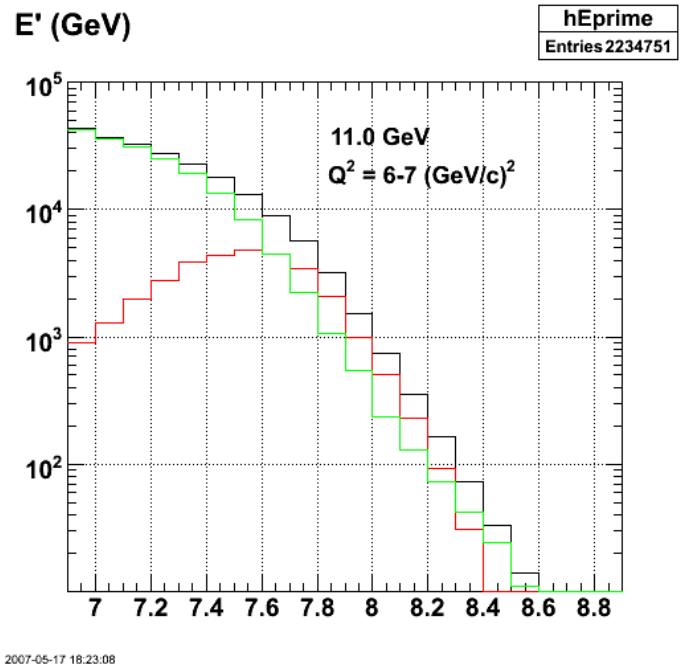


Fig 2. Our simulation of E' compared with Fig 1 from SLAC.

Click here to view the object (ROOT macro for fig 2) you uploaded.

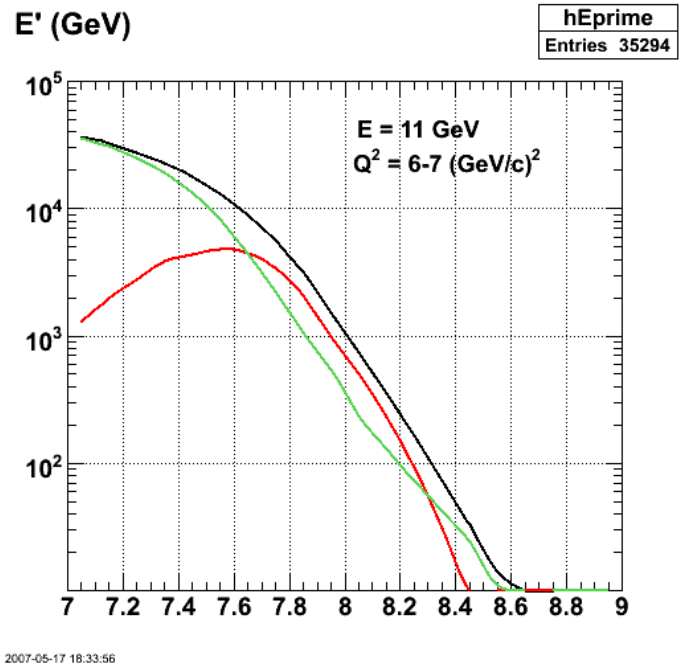


Fig 3. Prettier version of fig 2

Click here to view the object (ROOT macro fig fig 3) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 165 - More realistic ratios (gpg)

[Modified Wed May 23 03:33:28 2007 (GMT) gpg]

Now try putting in more realistic ration of IN:QE using the Mathematica notebooks inelasticInputs2.nb and xsec2.nb. The first plot below shows the results for the upper limit W2<4.0 GeVs for getting the ratio of IN:QE so the input values are the following submitted to 10 nodes in the cluster.

```
N(QE) = 5,300
N(IN) = 720,000
```

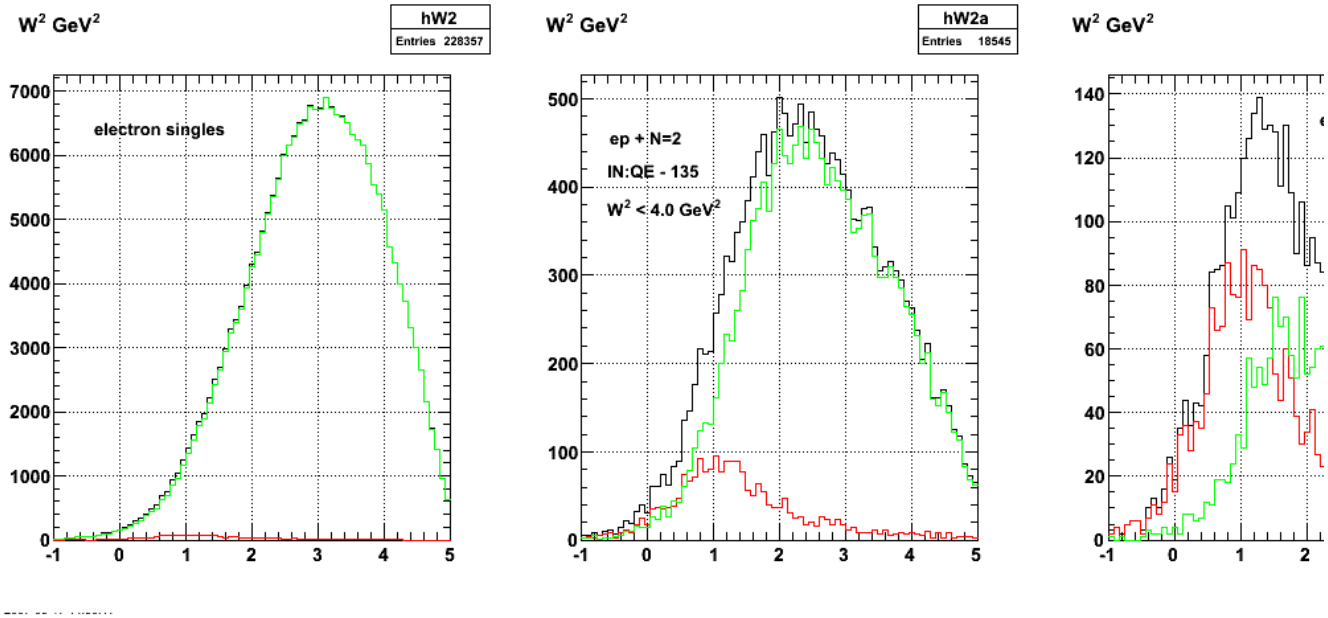


Fig 1. Effect of cuts for GMn.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (tar archive for fig 1) you uploaded.

Now in getting the QE:IN ratino integrate over W2<3.0 GeV2.

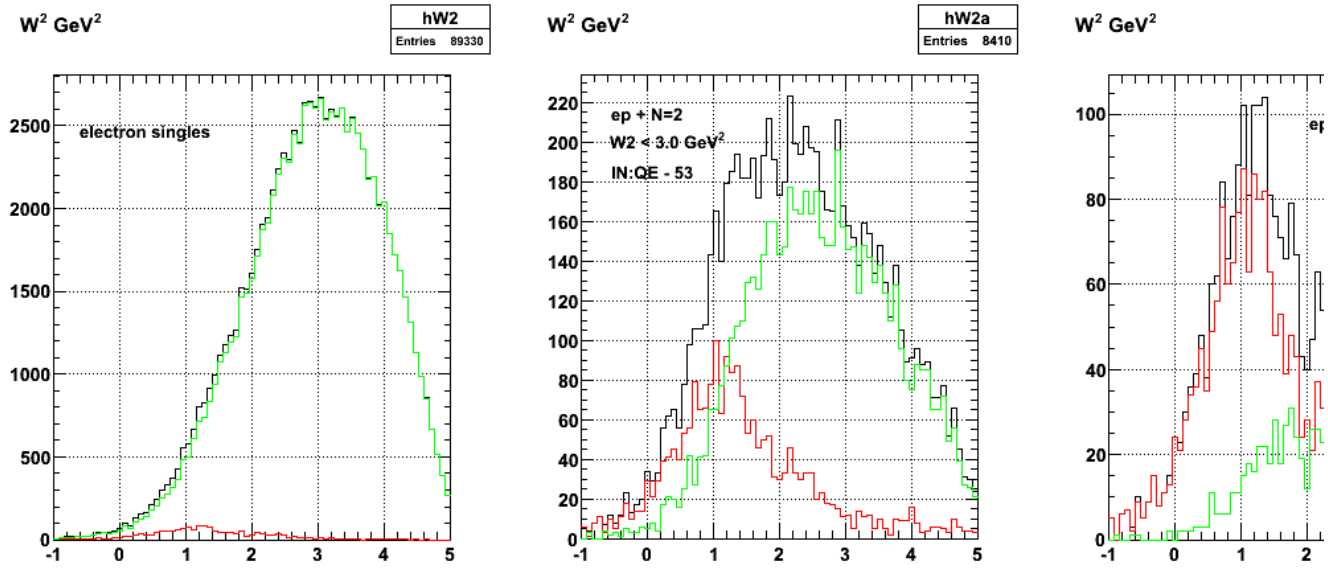


Fig 2. Same as fig 1 with W2 < 3 GeV2 in generating the QE:IN ratio.

Click here to view the object (tar archive for fig 2) you uploaded.

Click here to view the object (ROOT macro for fig 2) you uploaded.

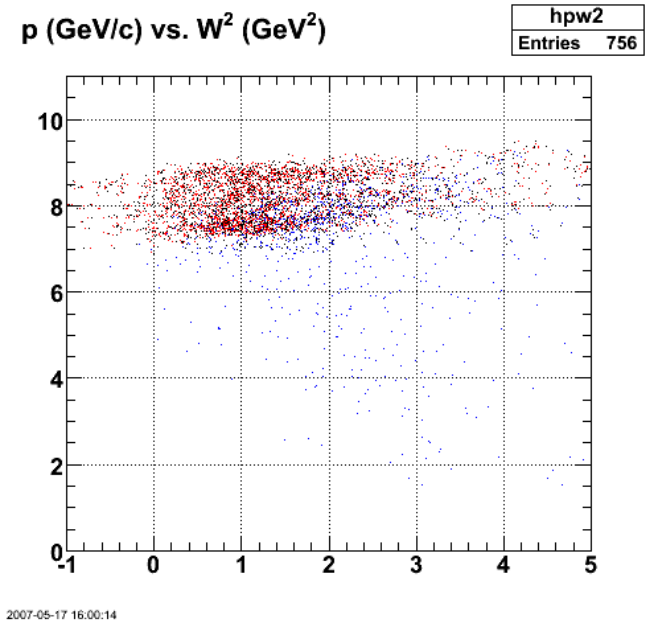


Fig 3.

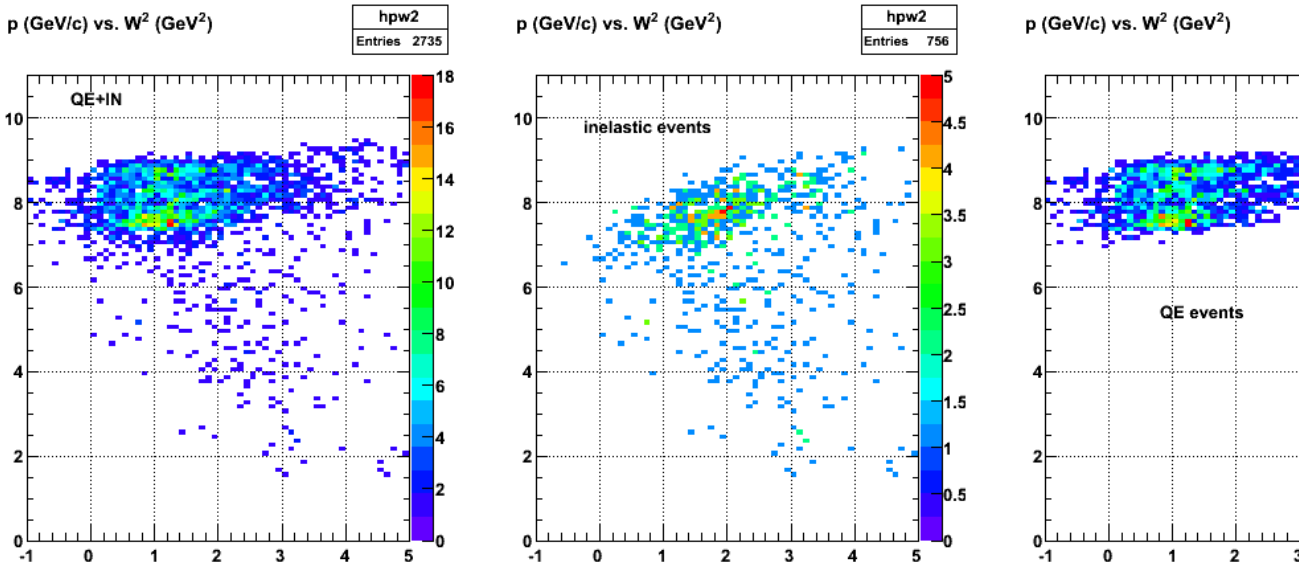


Fig 4.

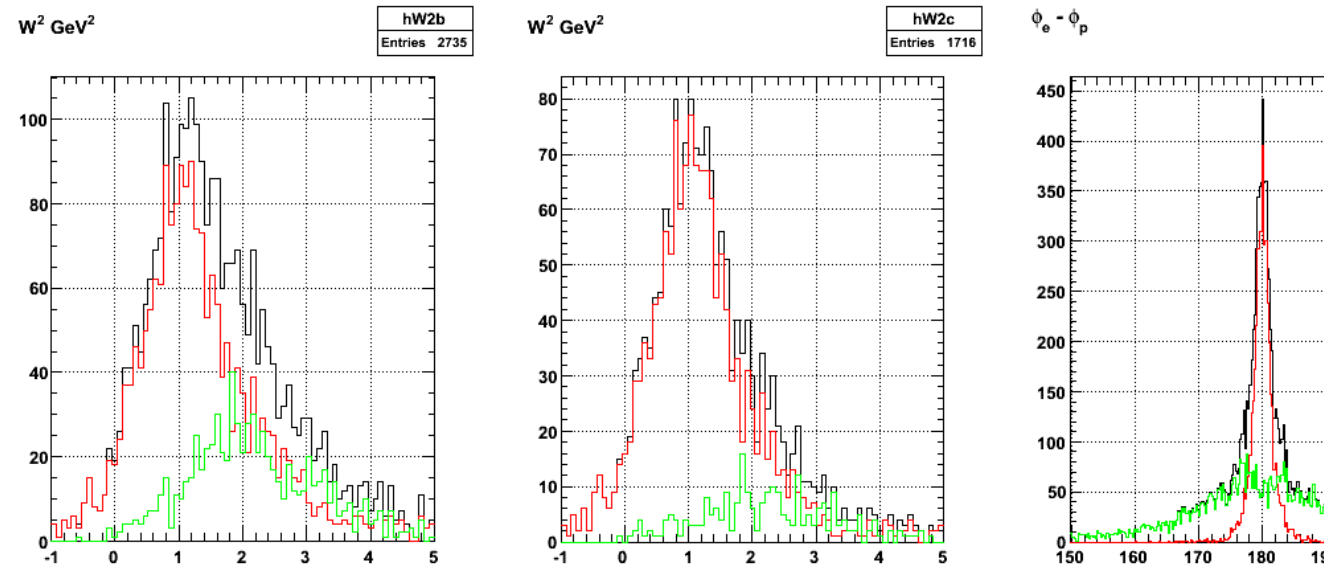


Fig 5. Effect of coplanarity cut.

Click here to view the object (ROOT macro for fig 5) you uploaded.

For Q2=6-7 GeV2 we get the following results. I reduced the statistics by a factor of five to get it done sooner and because there is still tons of counts. the command was

```
submit_gmnsim.pl 10000 300000 1
```

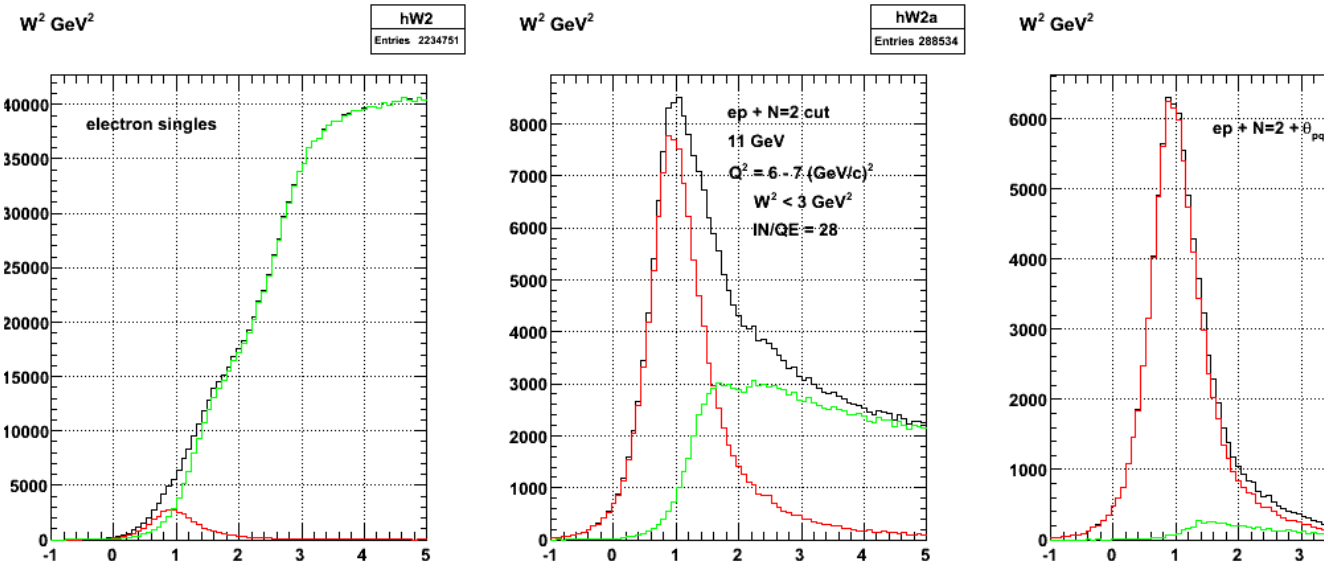


Fig 6. QE selection for Q2=6-7 GeV2

Click here to view the object (ROOT macro for fig 6) you uploaded.

Click here to view the object (tar archive for fig 6) you uploaded.

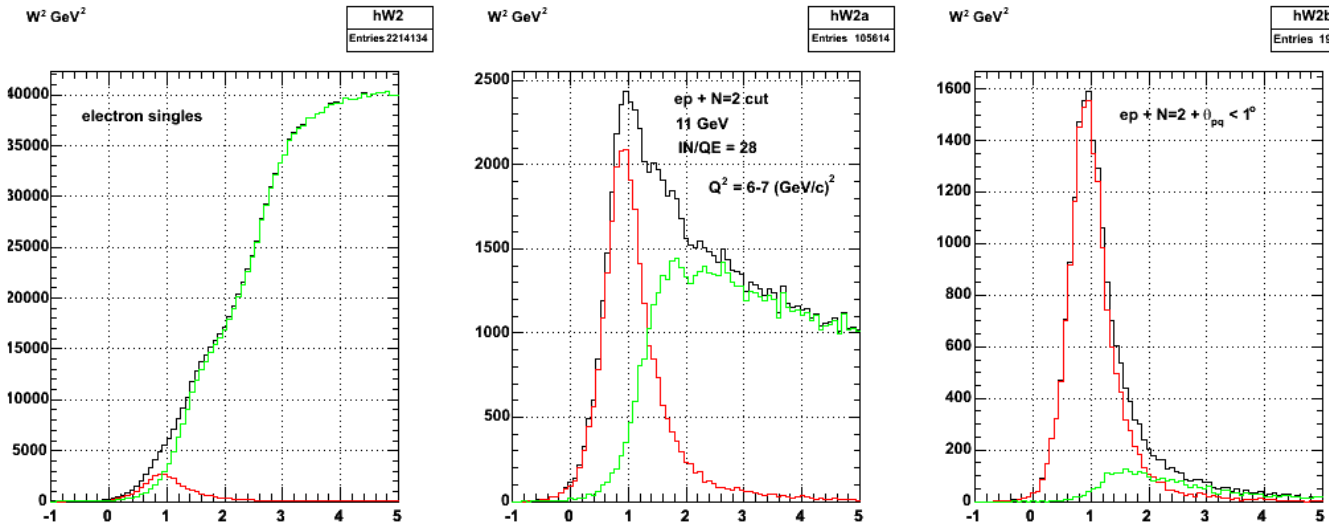


Fig 7. Replacement for fig 6 because I didn't have the Q2 cut right for the two left-hand panels.

Click here to view the object (ROOT macro for fig 7 you uploaded.

Click here to view the object (tar archive for fig 7) you uploaded.

Now I have tp tink. The 'N=2' cut in fig 7 excluded ep->e'pn events and anything with a third particle in the final state beyond the e'p. I think this is what I actually want, but below I look at events like that OR if the third particle is a neutron.

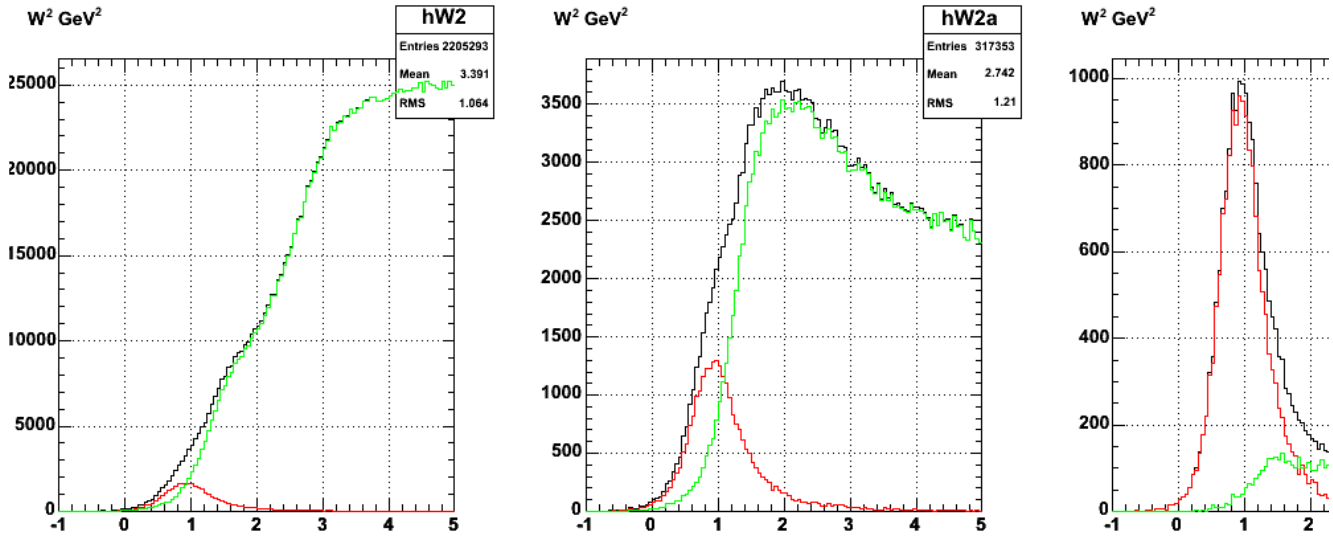


Fig 8. Same as fig 7 but with the addition that the 'N=2' cut now includes 'N=3' events with a neutron to make an epn final state.

Click here to view the object (ROOT macro for fig 8) you uploaded.

Click here to view the object (tar archive for fig 8) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 166 - theta_pq effect (gpg)

[Modified Mon May 21 22:09:05 2007 (GMT) gpg]

Study the effect of the theta_pq cut for selecting quasielastic events. Set the theta_pq cut at the last QE bin that is greater than the IN count.

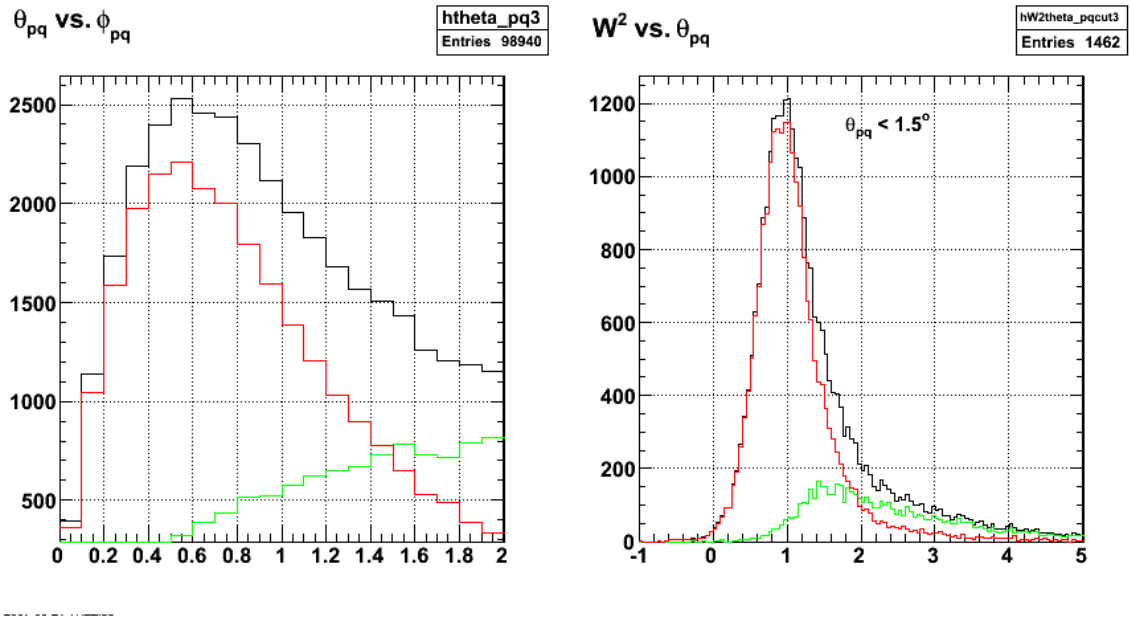
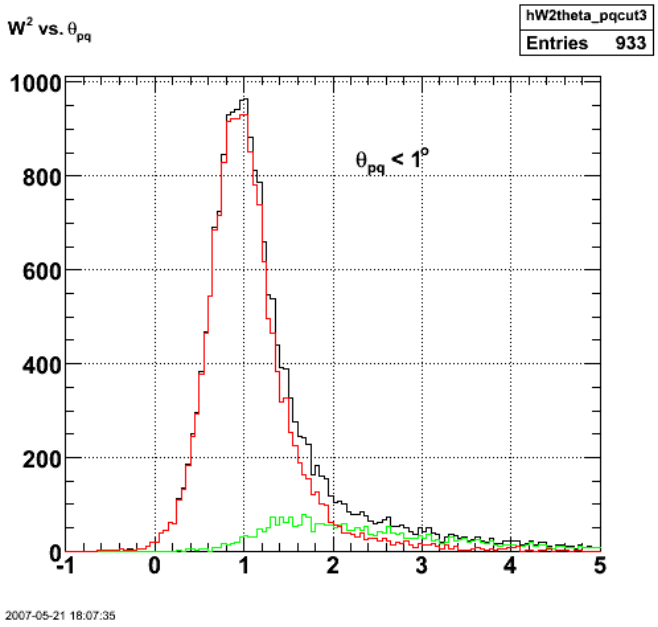


Fig 1. Angular distributions of theta_pq for ep+N=2 events (left panel) and W2 spectrum with theta_pq cut=1.5 deg.

Click here to view the object (Fig 1. ROOT macro for fig 1) you uploaded.

Click here to view the object (tar archive for fig 1) you uploaded.



Same as fig 1 with theta_pq < 1 deg.

Click here to view the object (ROOT macro for fig 2) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 167 - Acceptance vs. Q2 (gpg)

[Modified Wed May 23 12:44:45 2007 (GMT) gpg]

The plot below is the product of a long run to see the acceptance. The ntuples and histogram files are stored in

`/home/gilfoyle/gmn/sim/run/savedRuns/save1`

.

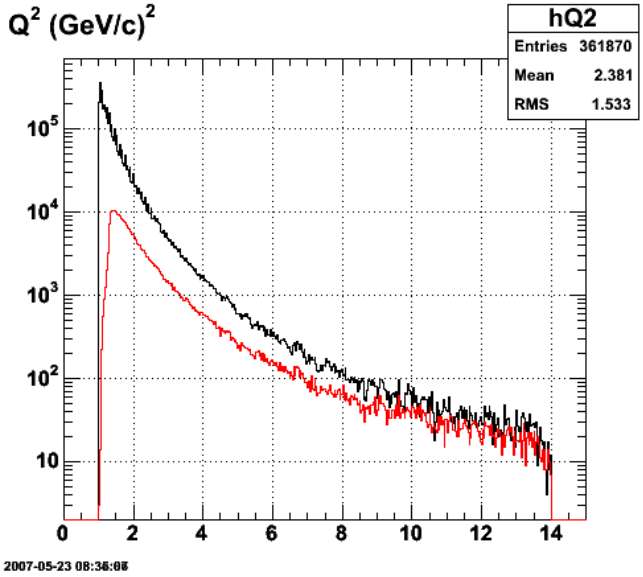


Fig 1. Comparison of thrown (black) versus accepted (red) events for electron singles in FASTMC.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (tar archive for fig 1) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 168 - Troubles after turning on neutrons (gpg)

[Modified Tue May 29 20:07:53 2007 (GMT) gpg]

The W2 spectra and angular distributions looks much worse now that I have put the neutron code into FASTMC. This is for Q2=6-7 GeV2.

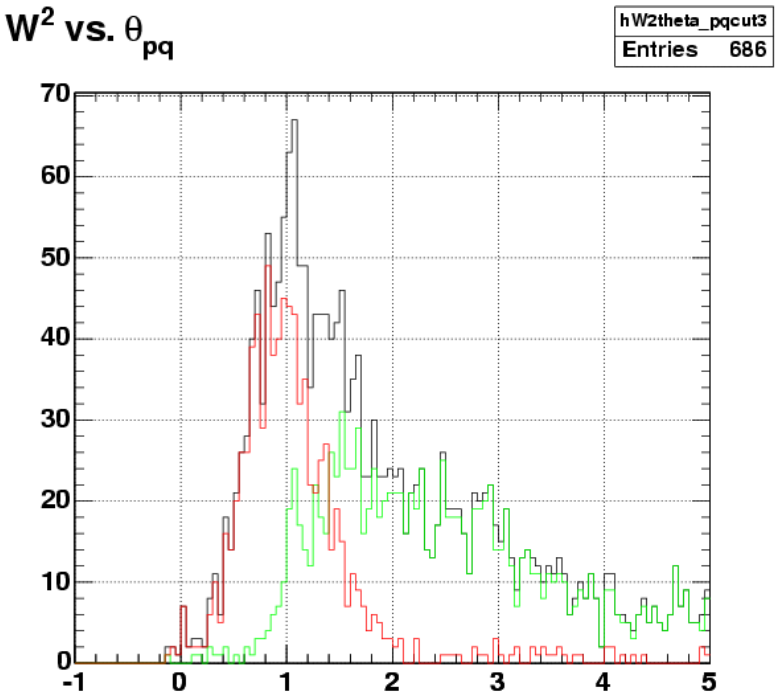


Fig 1. With ep+N=2+theta_pq cuts where N=2 is strict (no more than e+p in final state).

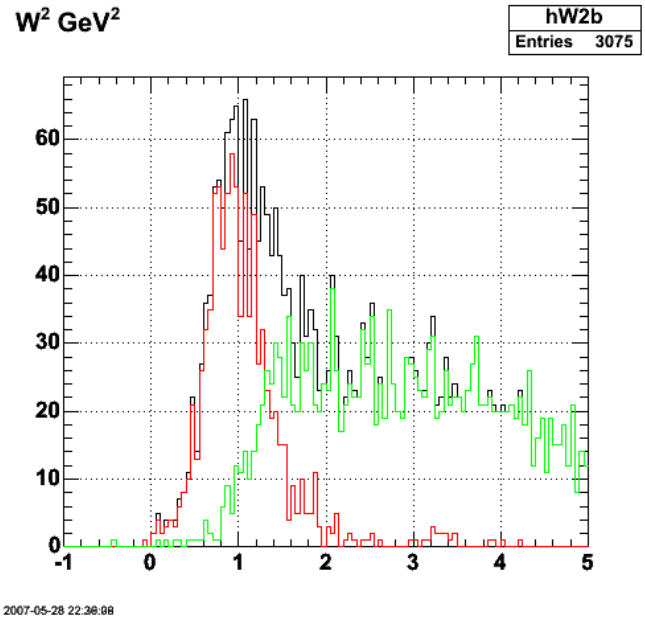


Fig 2. Same as fig 1, but now N=2 is for e+p+X where X could nothing, pions, etc.

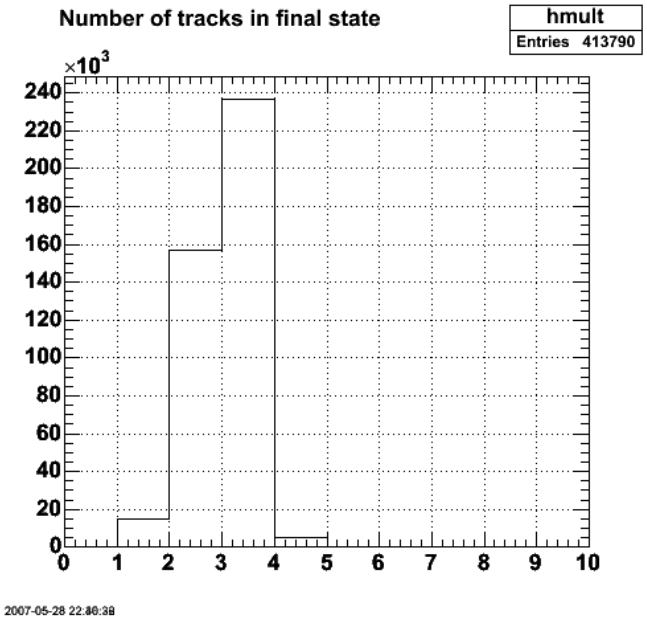


Fig 3. Multiplicity of events with at least an electron.

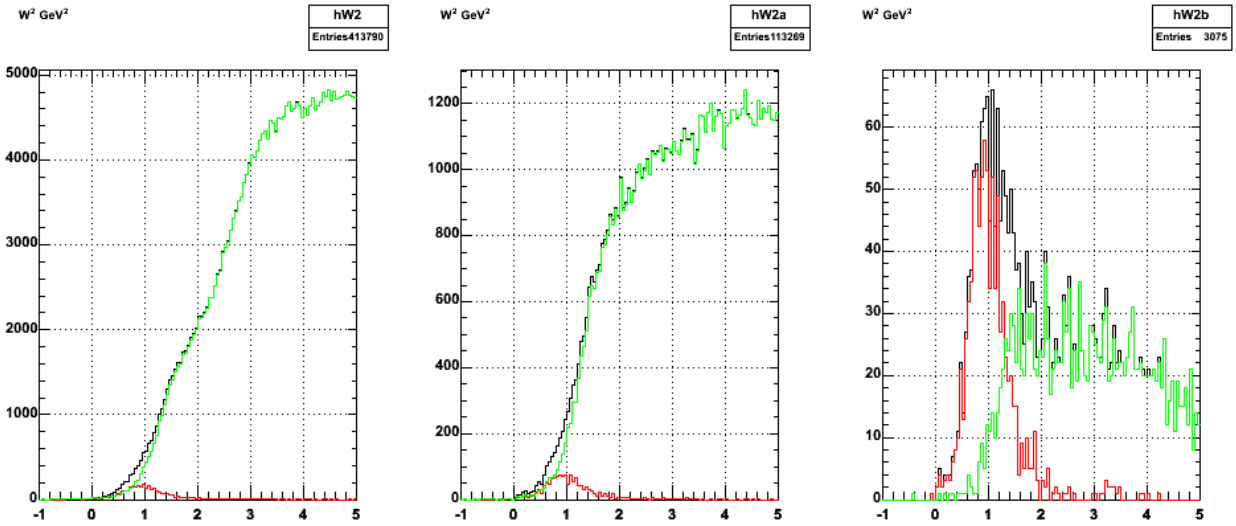


Fig 4. Effect of cuts. The N=2 cut is far less effective now for reasons that are mysterious.

Click here to view the object (ROOT macro for fig 4) you uploaded.

Click here to view the object (tar archive for fig 4) you uploaded.

I have put the N=2 cut back on so that ep events must have 2 particles and no others. This reduces the inelastic background by about 90% which is consistent with previous results. There is still more inelastic background than before, but that may be caused by the fact that I did not have good control over the true ratio of QE to inelastic. The way to check that ratio is with the thrown events. The number of events for QE and IN chosen at run time can be very different from the proper one because events go down the beam pipe, at too large an angle, ... The bad news is that my previous results had too small a ratio of IN to QE. However, the comaprison with the 10 GeV SLAC results seems to imply that even those ratios are conservative.

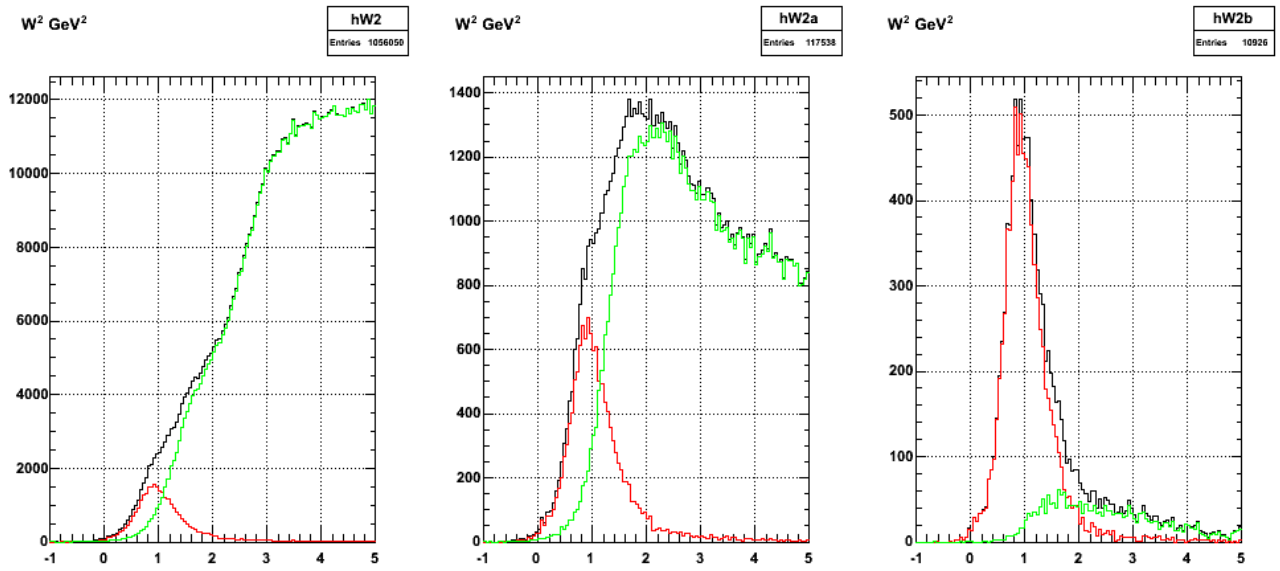


Fig 5. 11 GeV, IN:QE = 14:1, W2 < 3 GeV2. left - singles, middle - ep+ strict N=2 cut, right - ep + N=2 cut + theta_pq cut (1 deg).

Click here to view the object (ROOT macro for fig 5) you uploaded.

Click here to view the object (tar archive for fig 5) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 169 - Detecting Neutrons (gpg)

[Modified Tue May 29 21:19:17 2007 (GMT) gpg]

First attempt at looking at neutrons. They look ok after getting things working in the previous entry.

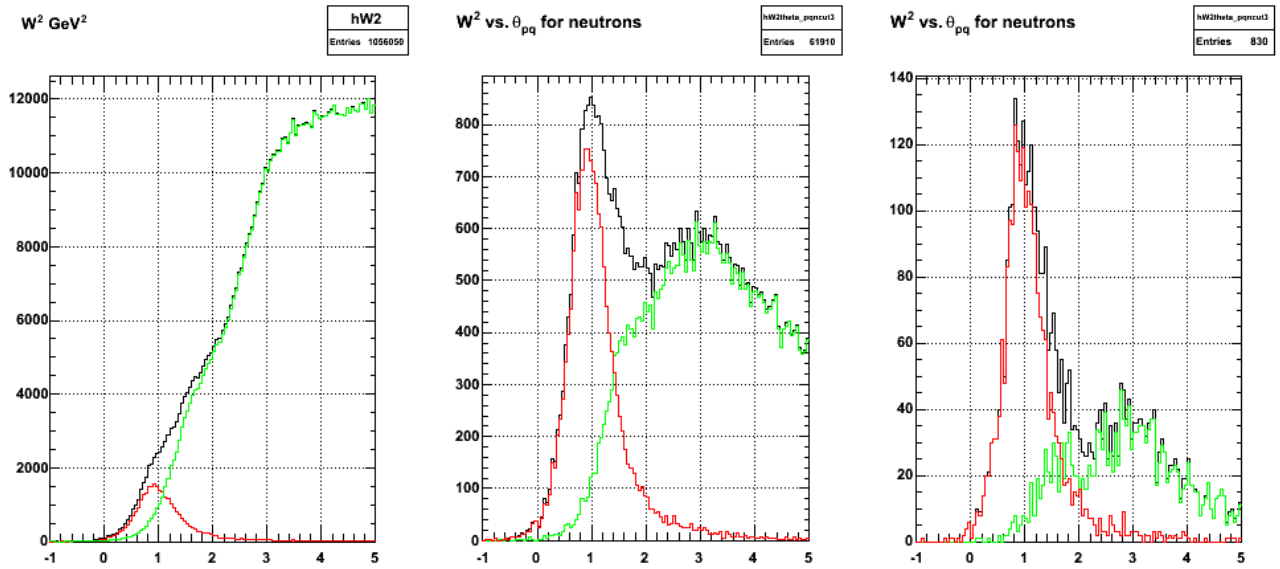


Fig 1. Effect of cuts on QE selection for neutrons - 11 GeV, Q2 = 6-7 GeV2, left panel - singles, middle panel - ep + strict N=2 cut, right panel - ep + stric N=2 + theta_pq cut = 1 deg.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (tar archive for fig 1) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 170 - Final proton plots (gpg)

[Modified Wed May 30 04:54:52 2007 (GMT) gpg]

Here is my first pass at final, high-statistics plots of the QE selection for protons. I want plots showing the singles spectra, with the theta_pq cut on with the loose N=2 cut, and then with the strict N=2 cut. Submission command is the following.

```
submit_gmnsim.pl 30000 520000 1
```

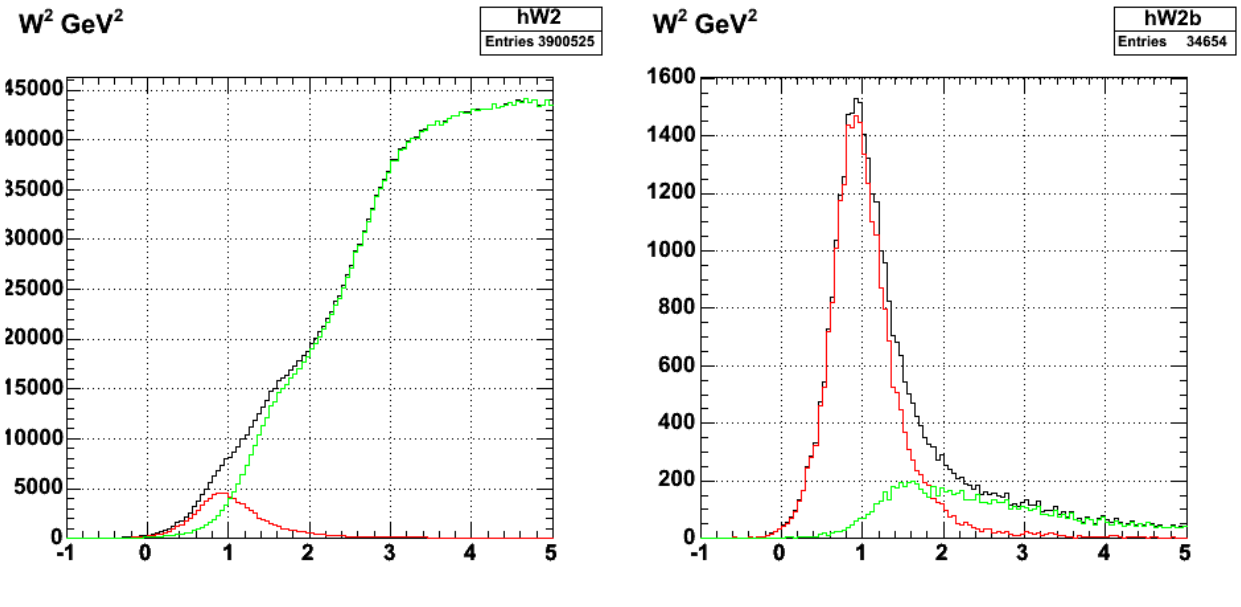


Fig 1. 11-GeV, Q2=6-7 GeV2, strict N+2 cut.

Click here to view the object (ROOT macro for Fig 1) you uploaded.

Click here to view the object (tar archive for fig 1) you uploaded.

Now generate the same plots with the loose N=2 cut that will allow ep events with additional particles typically pions and/or photons.

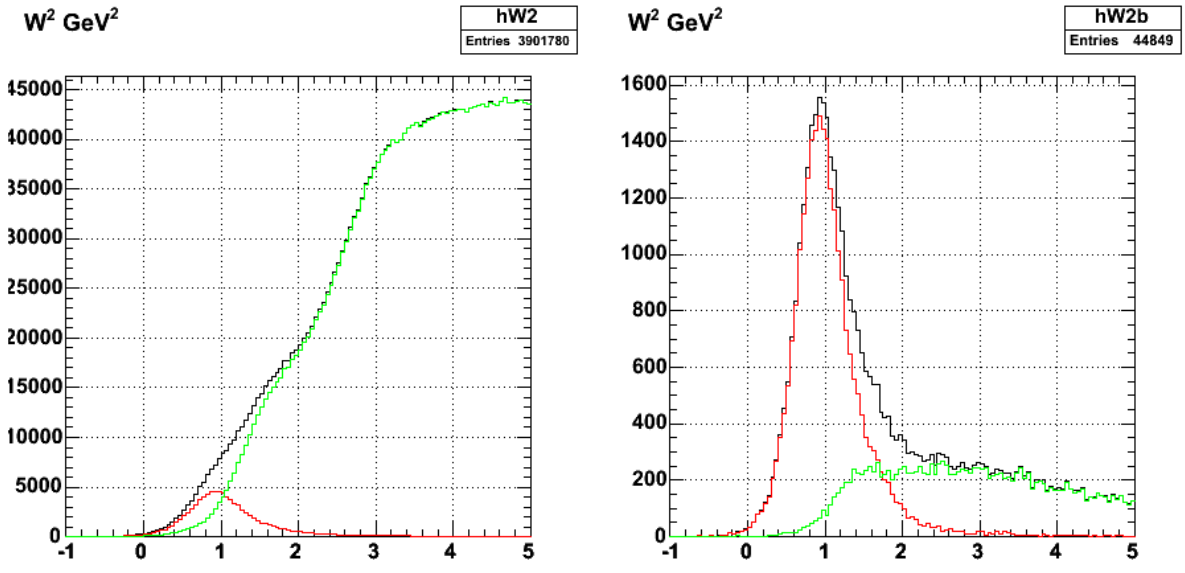
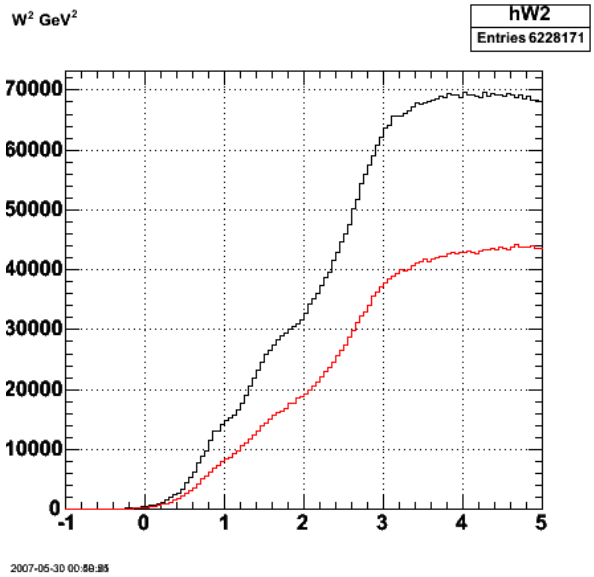


Fig 2. Same as fig 1 with loose N=2 cut.

Click here to view the object (ROOT macro for fig 2) you uploaded.

Click here to view the object (tar archive for fig 2) you uploaded.

Comparison of W2 spectra in singles to get idea of acceptance.



W2 spectra for thrown events (black) and accepted events (red).

Click here to view the object (ROOT macro for fig3) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 171 - Acceptance plots (gpg)

[Modified Sun Jun 17 20:45:42 2007 (GMT) gpg]

Plots of CLAS12 acceptance.

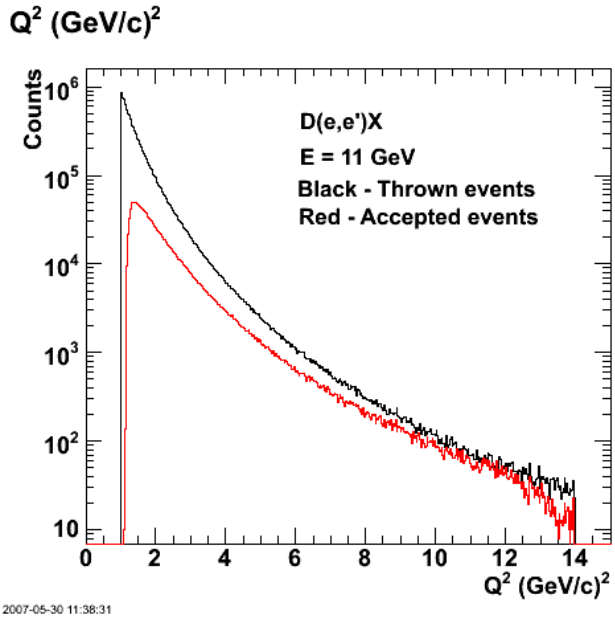


Fig 1. CLAS electron singles acceptance.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (EPS version of fig 1) you uploaded.

Click here to view the object (tar archive for fig 1) you uploaded.

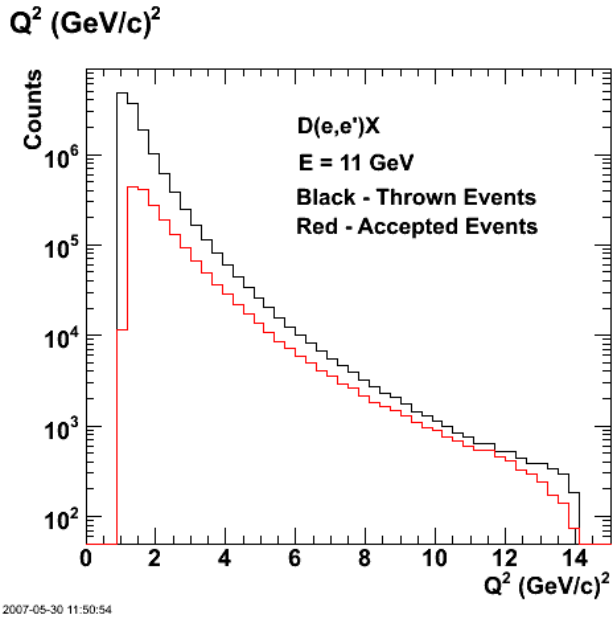


Fig 2. Smoothed version of fig 1

Click here to view the object (EPS version of fig 2) you uploaded.

Click here to view the object (ROOT macro for fig 2) you uploaded.

Plot of D(e,e'p)n acceptance.

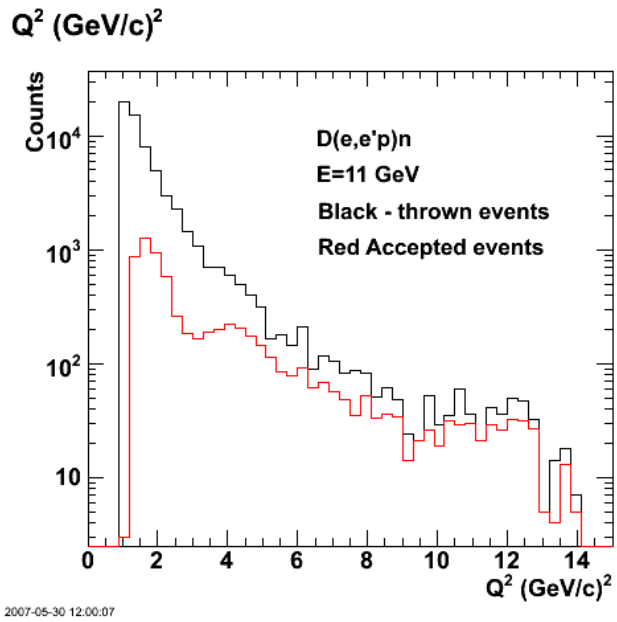


Fig 3. D(e,e'p)n acceptance as labeled.

Click here to view the object (ROOT macro for fig 3) you uploaded.

Click here to view the object (EPS file for fig 3) you uploaded.

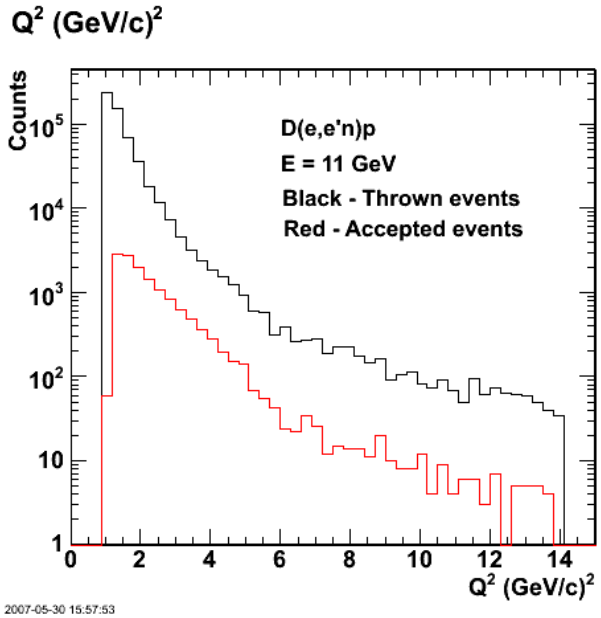


Fig 4. D(e,e'n)p acceptance as labeled.

Click here to view the object (ROOT macro for fig 4) you uploaded.

Click here to view the object (EPS version of fig 4) you uploaded.

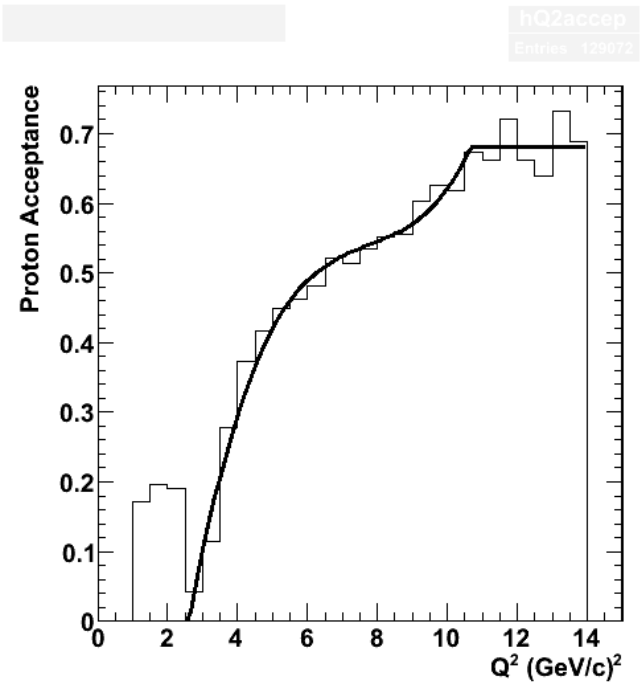


Fig 5. Proton acceptance with fit. The fit came from the comparison of the generated and accepted proton events as a function of Q2 (see next plot). The fit was done withOUT Sumw2 errors. See log-07-jun-17 for details.

Click here to view the object (ROOT macro) you uploaded.

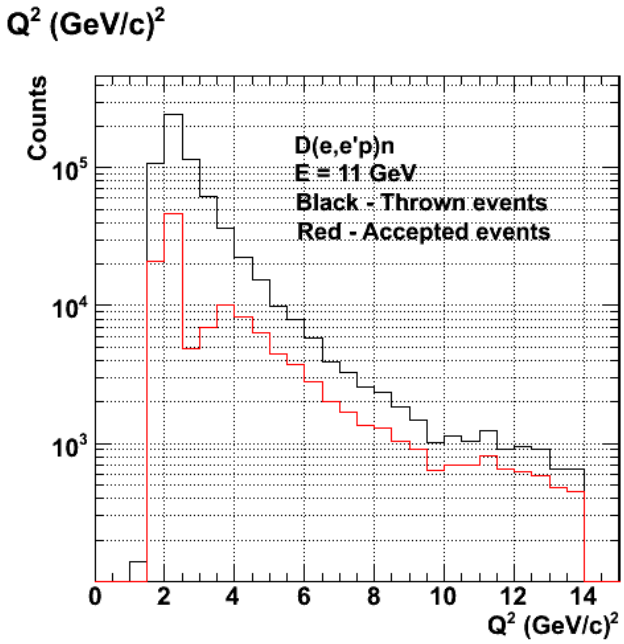


Fig 6. Comparison of the generated and accepted proton events as a function of Q2.

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 172 - Neutron angular resolution problem (gpg)

[Modified Mon Jun 4 23:50:04 2007 (GMT) gpg]

Information on neutron angular resolution. See previous entry for histogram file.

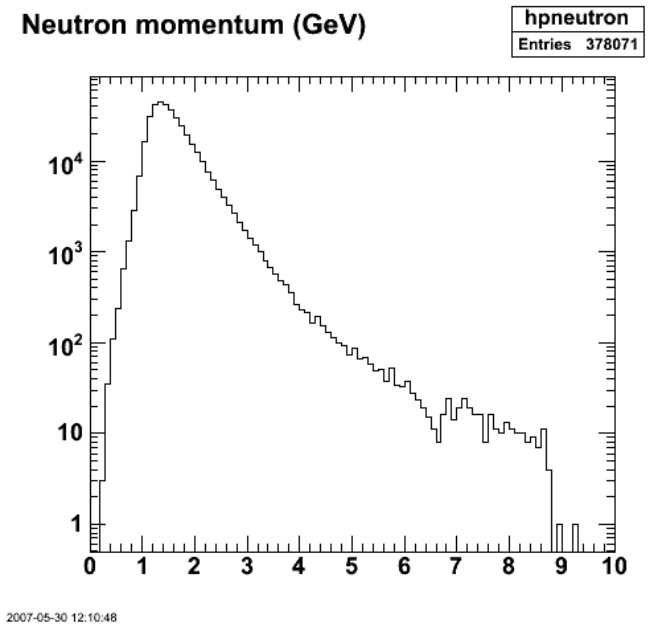


Fig 1. Neutron momentum distribution for all Q2.

Click here to view the object (ROOT macro for fig 1) you uploaded.

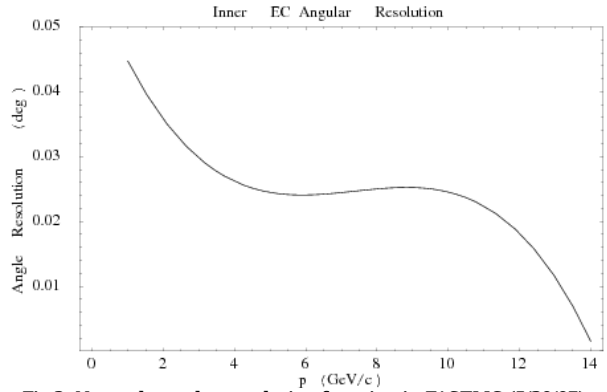


Fig 2. Neutral angular resolution function in FASTMC (5/30/07).

Click here to view the object (Mathematica notebook for Fig 2.) you uploaded.

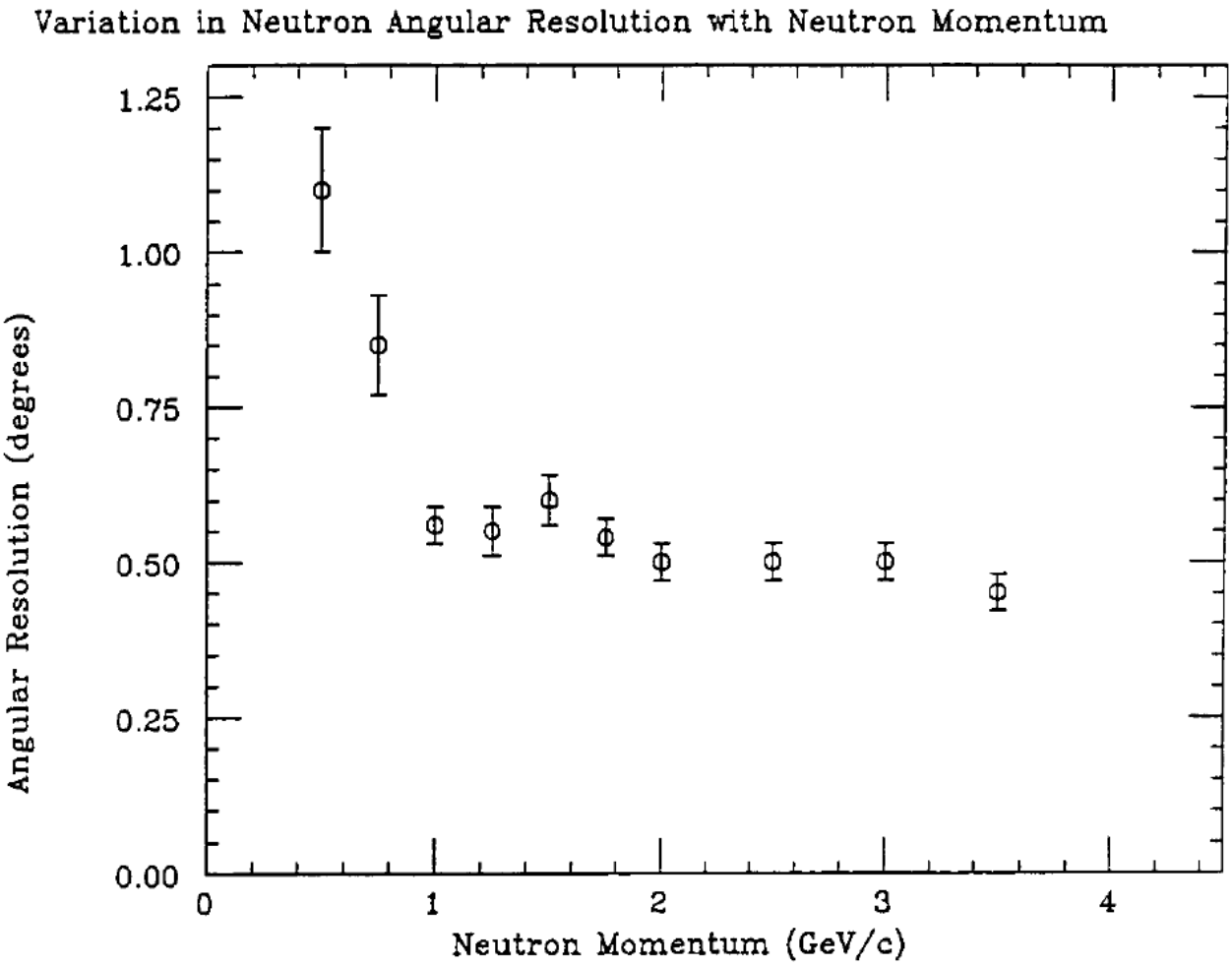


Fig 3. Neutron angular resolution for E94-017 and CLAS EC.

The theta_pq angdists for thrown and accepted events are below. This is BAD news!!!!

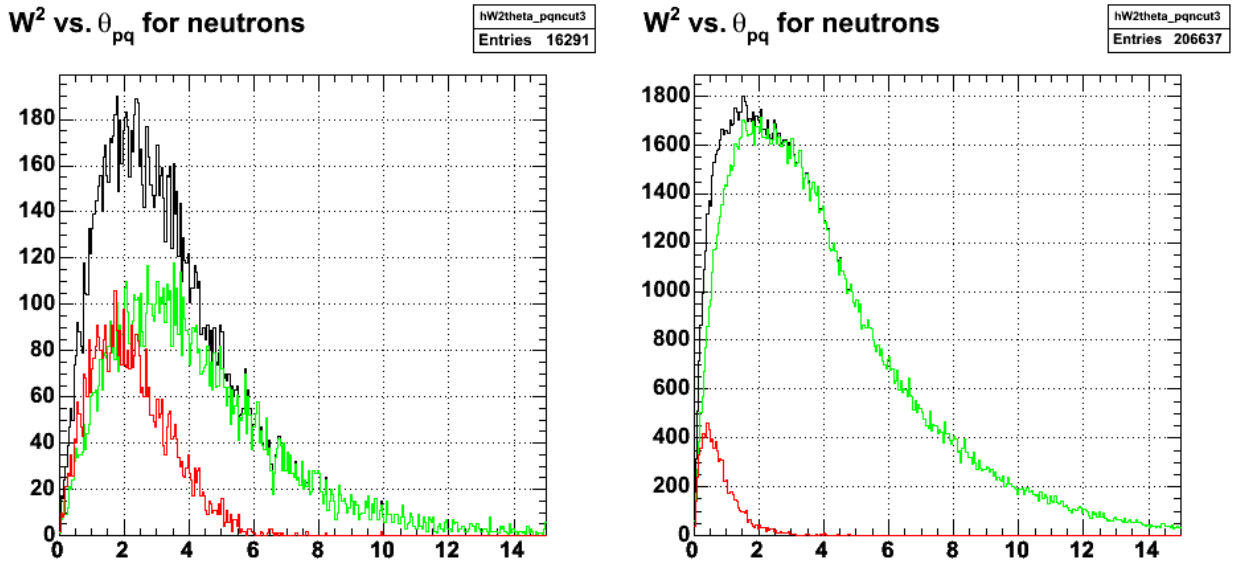


Fig 4. Comparison of theta_pq angdist for thrown (right) and accepted (left) events for Q2 = 6-7 GeV2. The strict N=2 cut is turned ON for the accepted events.

Click here to view the object (ROOT macro for fig 4) you uploaded.

Click here to view the object (tar archive for fig 4) you uploaded.

Now try using the ratio of nonresonant, inelastic background to quasielastic extracted from Bosted paper (PRD 58, 032003) in BostedRates.nb in rates sub-directory. The ratio of thrown QE events to thrown IN events is 3.38 as extracted in BostedRates.nb. The result is in the right panel below. The command used was submit_gmnsim.pl 7500 10000 1.

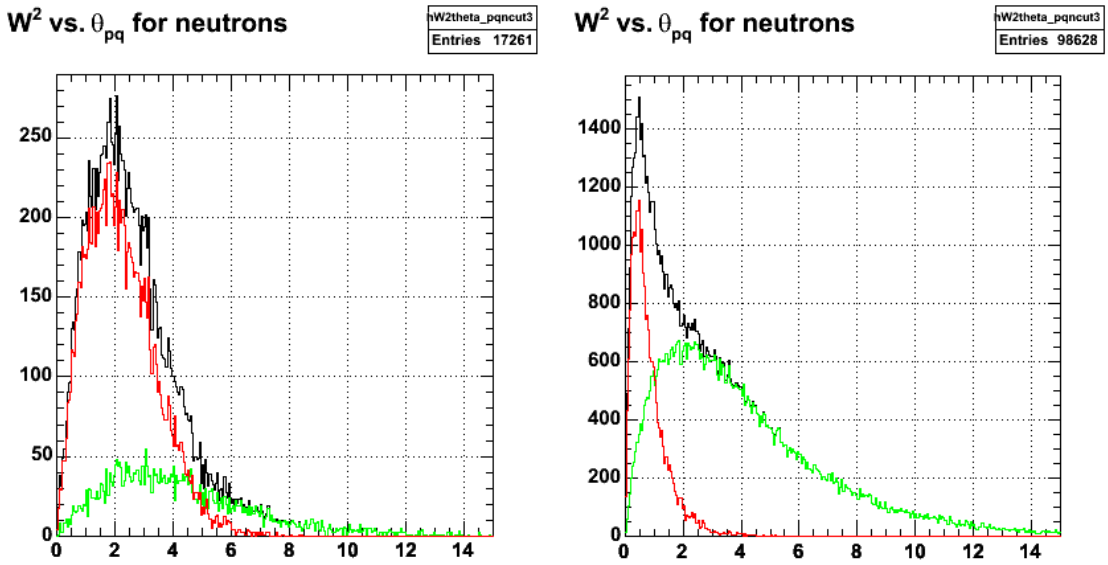


Fig 5. Q2=6-7 GeV2 (submit_gmnsim.pl 7500 10000 1)

Click here to view the object (ROOT macro for Fig 5) you uploaded.

Click here to view the object (tar archive for fig 5) you uploaded.

Now apply the QE cut, theta_pq < 4 deg and project out to get the W2 spectra. **Note! I think there is a problem with the right-hand panel in the next figure.**

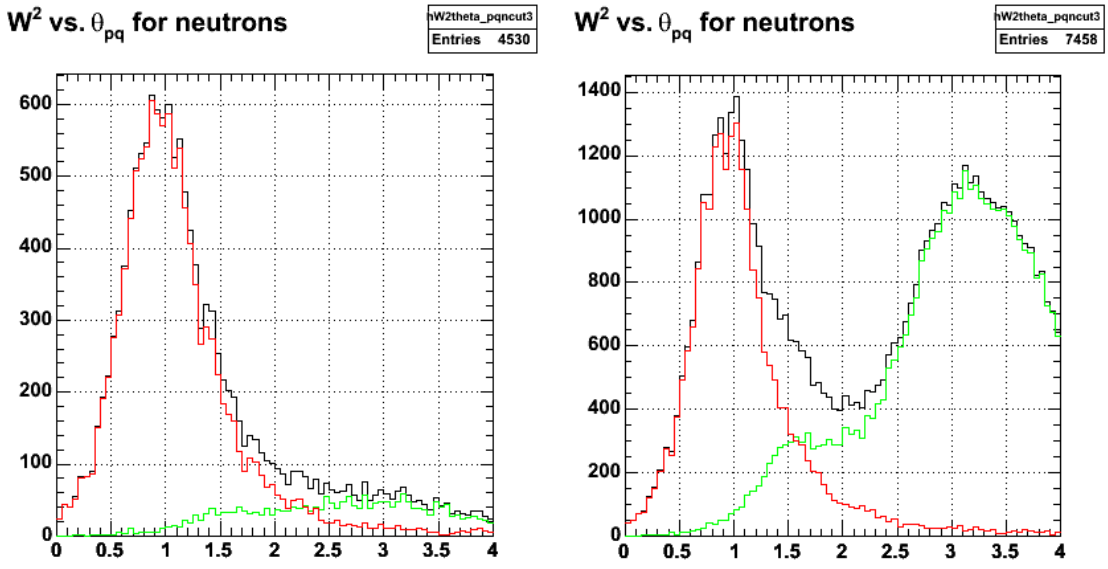


Fig 6. W2 spectra associated with fig 5 and previous simulation. Right side is thrown events with theta_pq < 4 deg. Left side is accepted events with strict N=2 cut and theta_pq < 4 deg.

Click here to view the object (ROOT macro for fig 6) you uploaded.

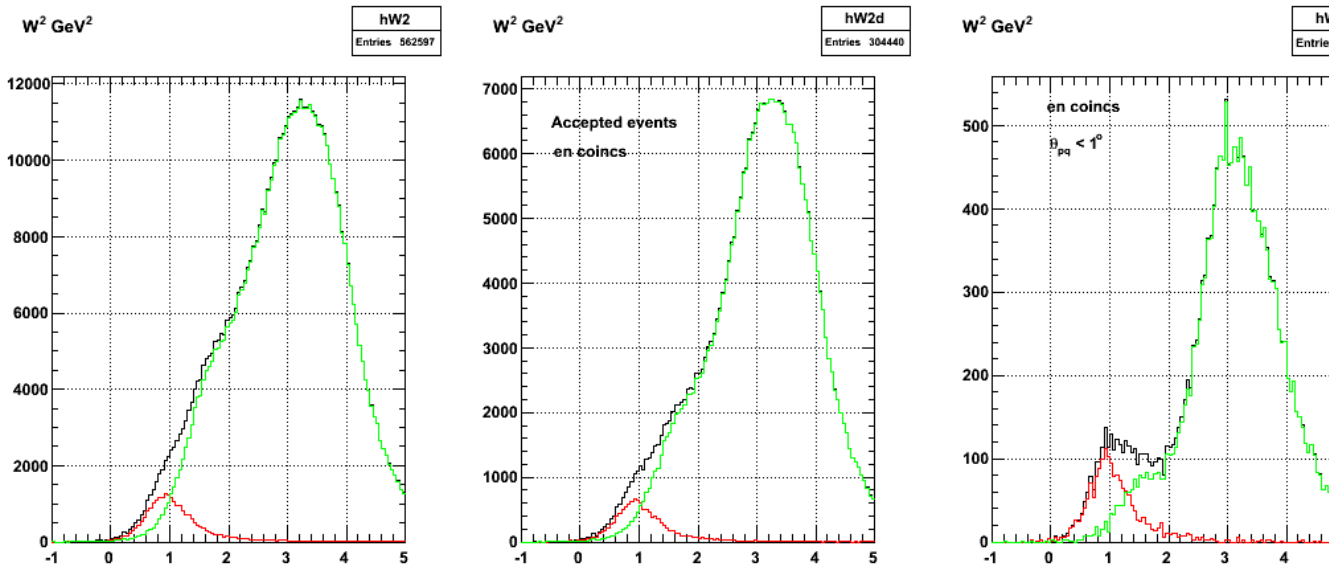


Fig 7. W2 spectra for neutrons (submit_gmnsim.pl 7500 80000 1)

Click here to view the object (ROOT macor for fig 7) you uploaded.

Click here to view the object (tar archive for fig 7) you uploaded.

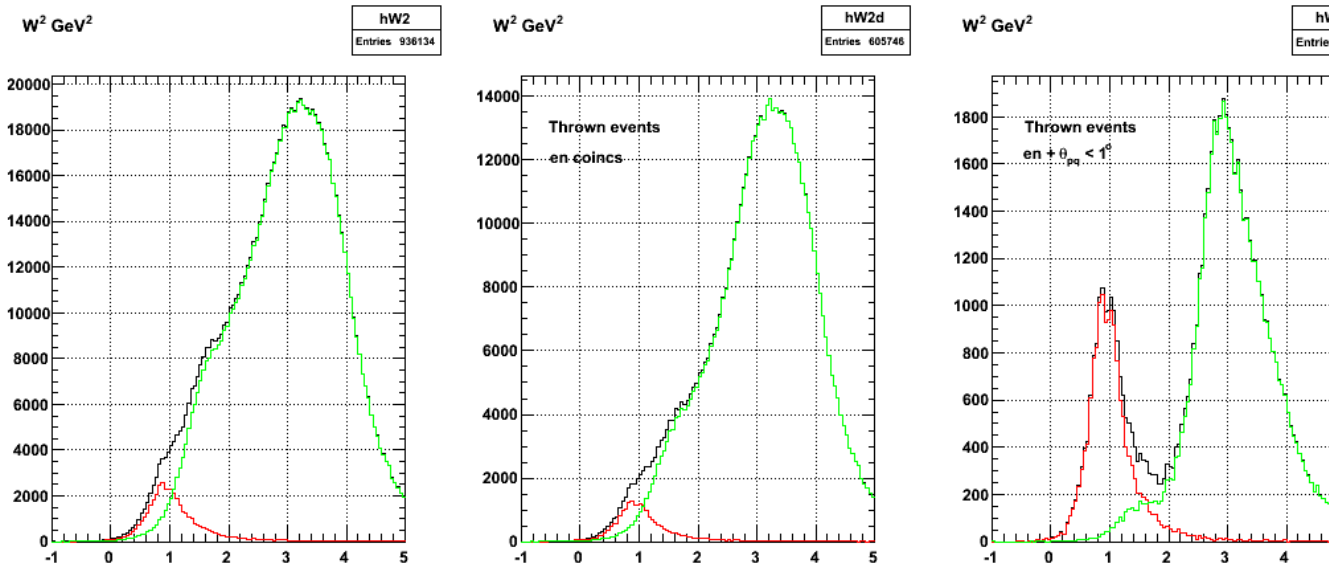


Fig 8. Same as fig 7 for thrown events.

Click here to view the object (ROOT macro for fig 8) you uploaded.

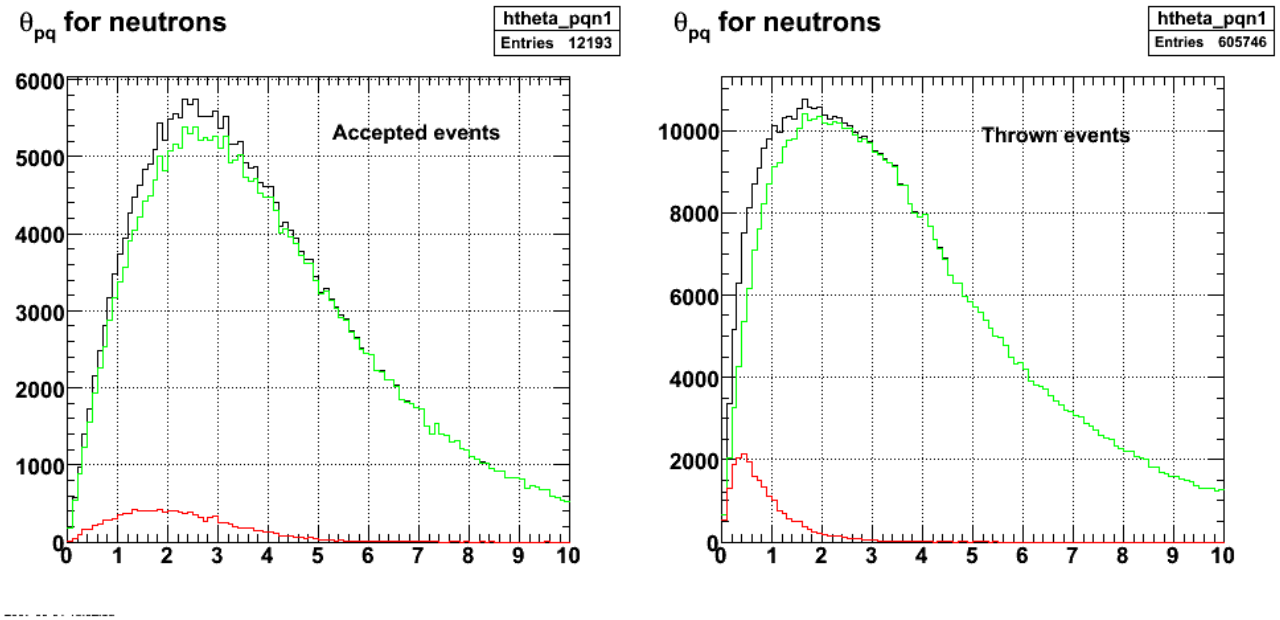


Fig 9. Theta_pq distributions for accepted (left) and thrown (events).

Click here to view the object (ROOT macro fof fig 9) you uploaded.

Now turn the theta_pq cut up to 4 deg.

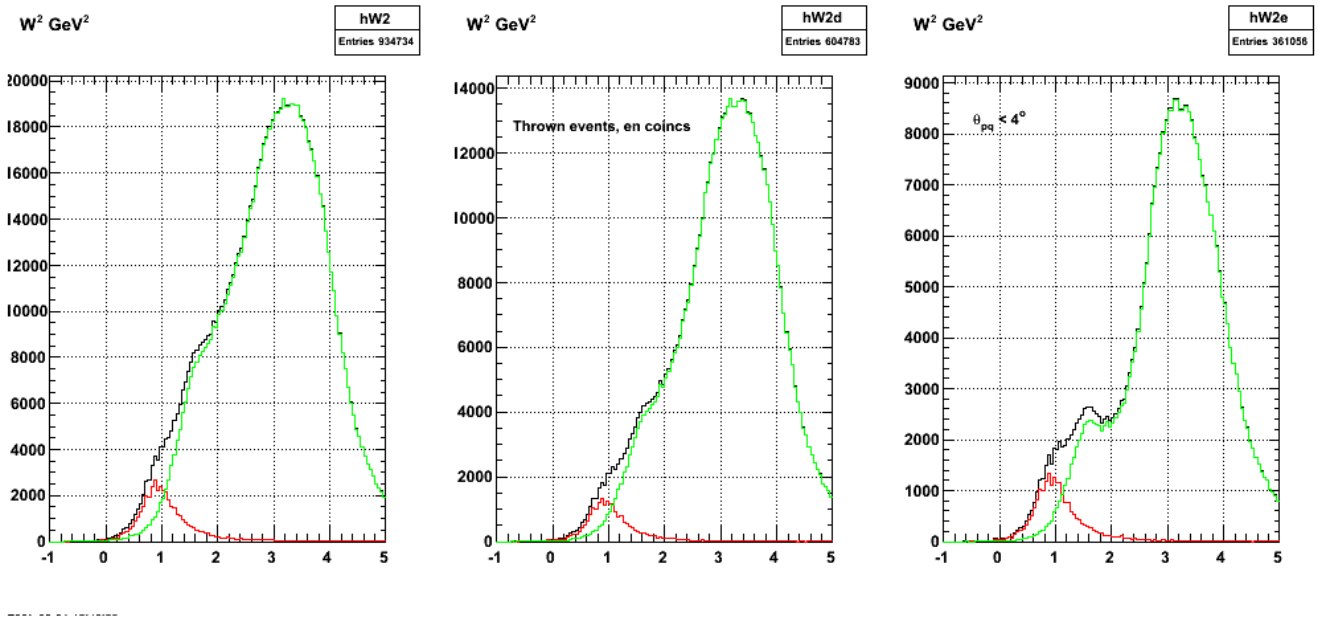
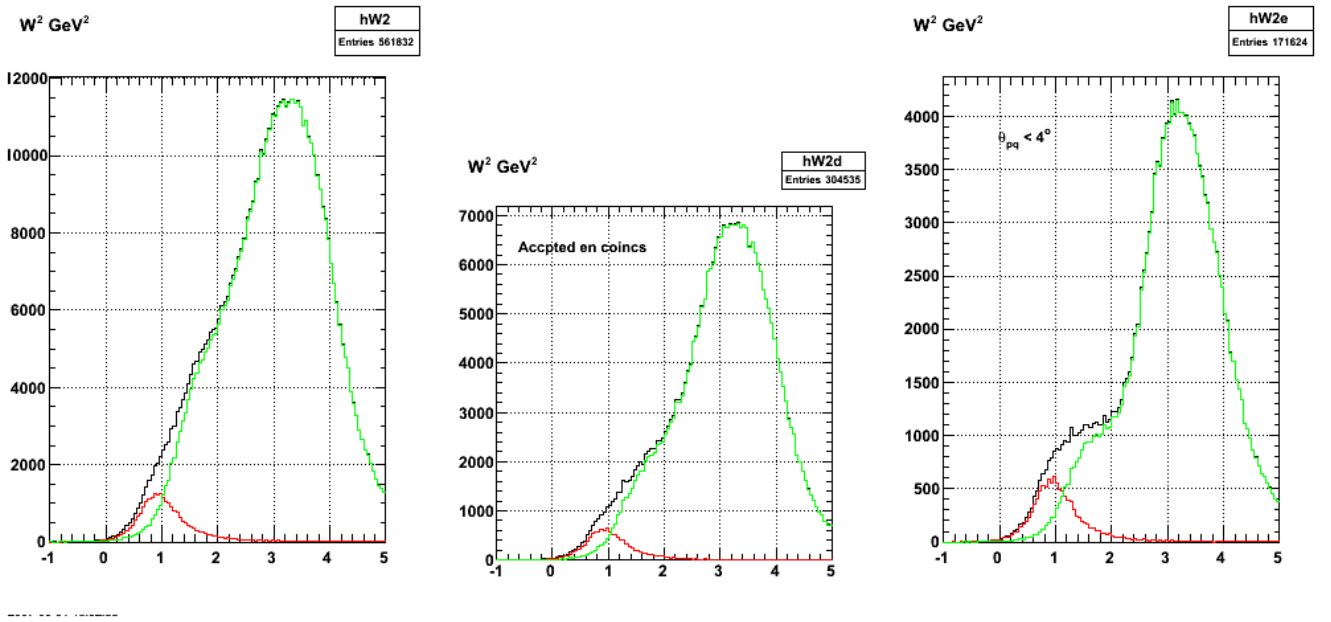


Fig 10. Thrown events W2 dists.

Click here to view the object (ROOT macro for fig 10) you uploaded.

Click here to view the object (tar archive for fig 10) you uploaded.



Npw put on the N=2 cut. The results are disappointing.

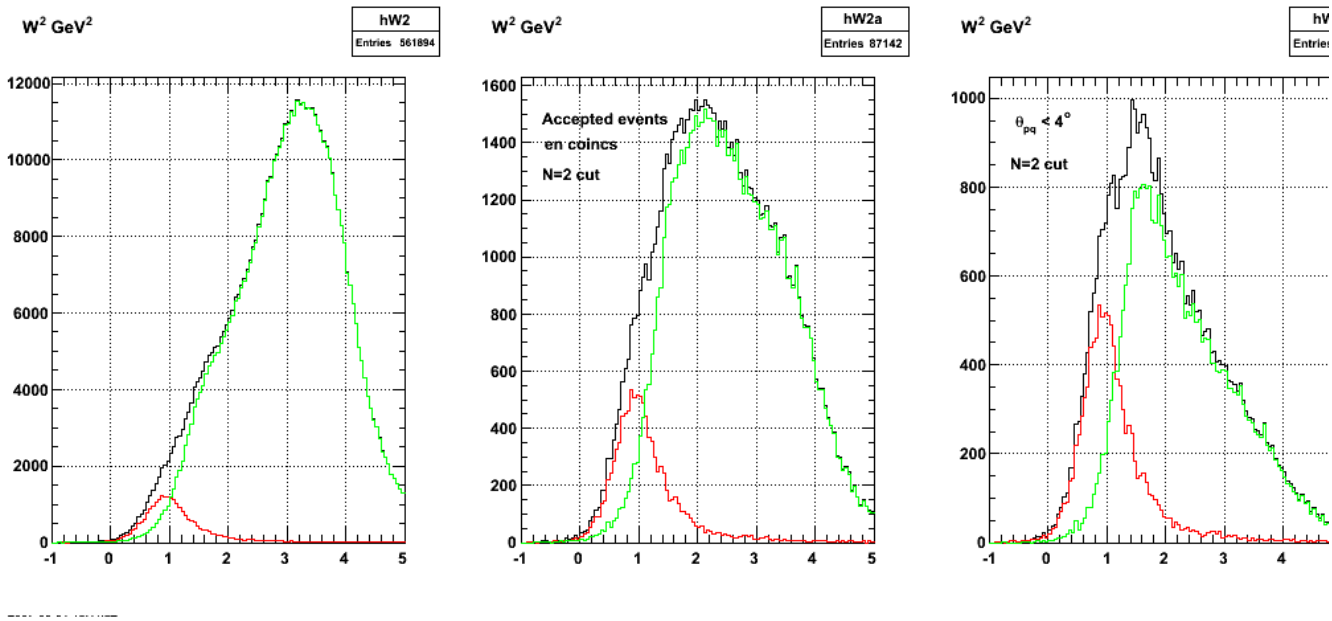


Fig 11. W2 distributions with N=2 cut added.

Click here to view the object (ROOT macro fog fig 11) you uploaded.

Click here to view the object (tar archive for fig 11) you uploaded.

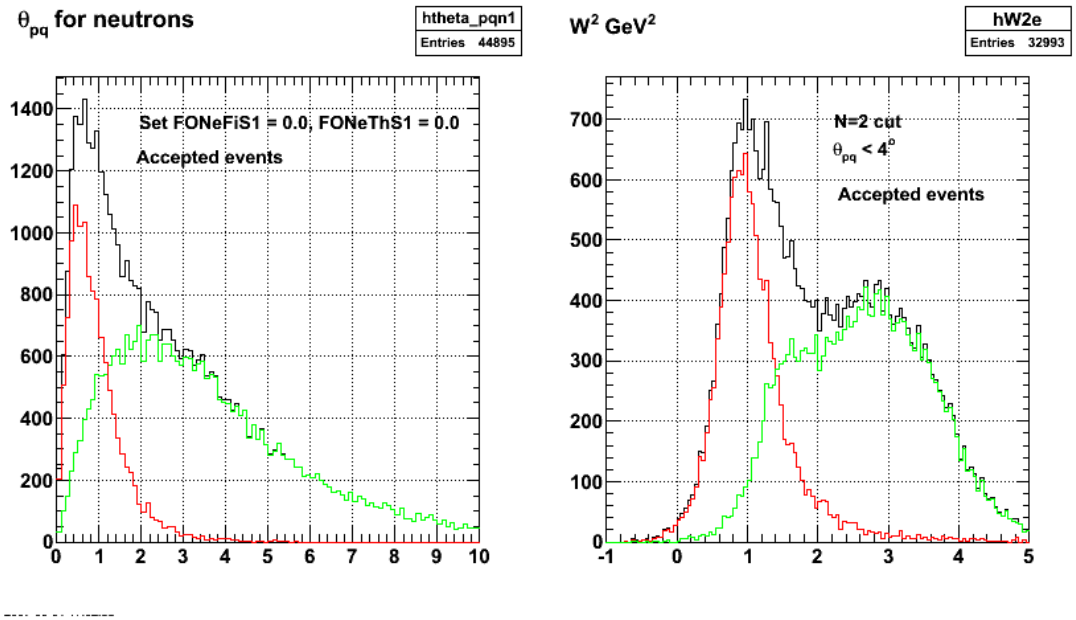


Fig 12. Now turn off the neutral resolutions and keep theta_pq < 4 deg.

Click here to view the object (ROOT macro for fig 12) you uploaded.

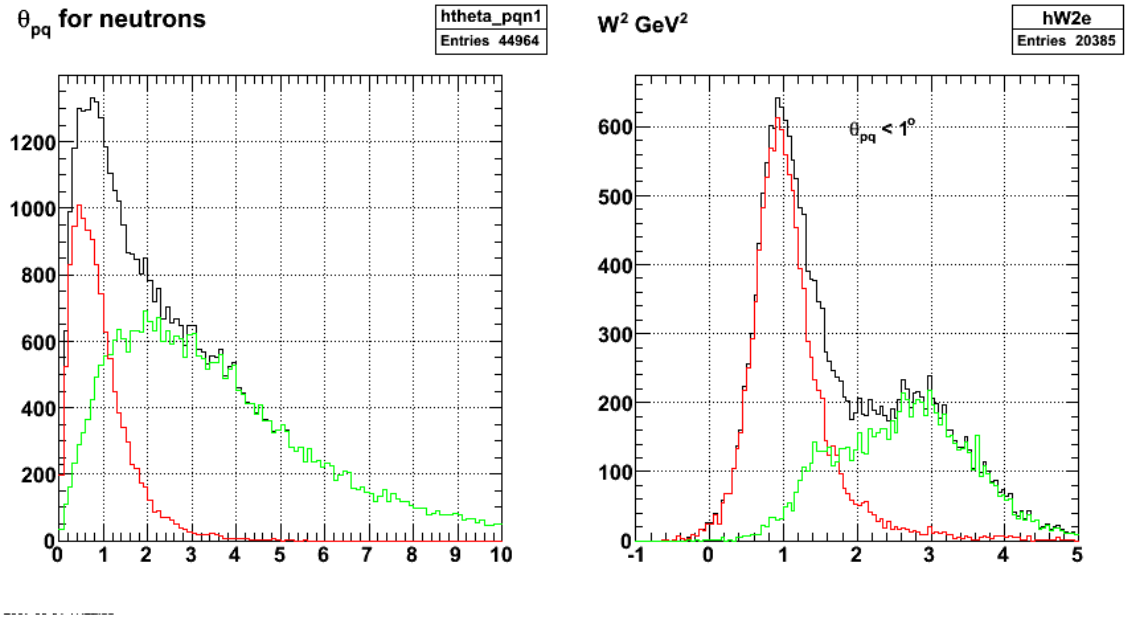


Fig 13. Same as fig 12 with theta_pq < 1 deg now.

Click here to view the object (ROOT macro for fig 13) you uploaded.

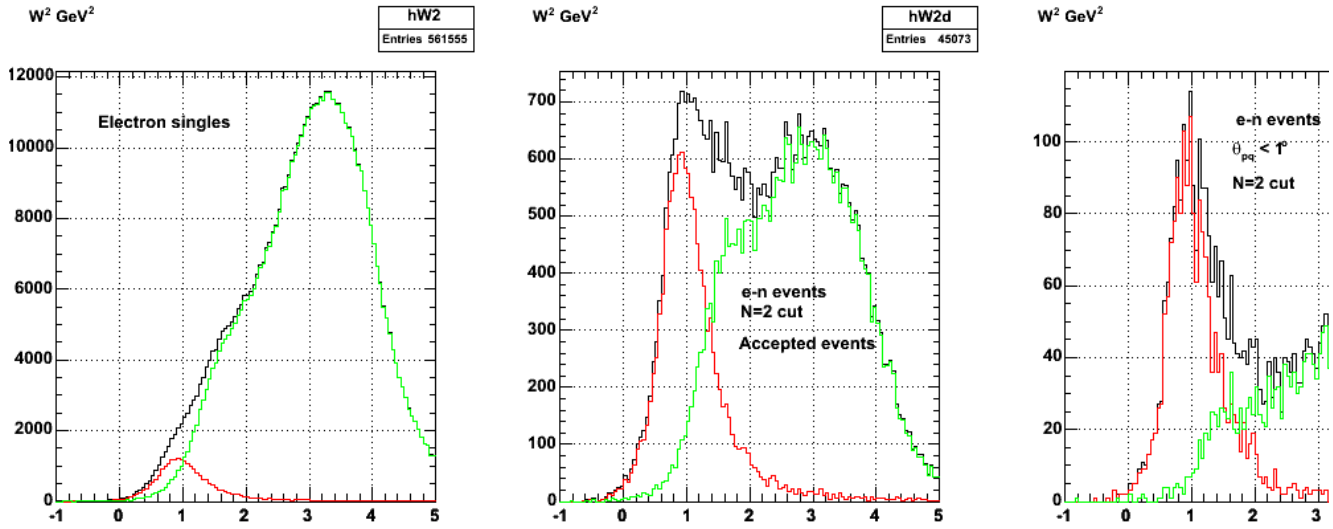
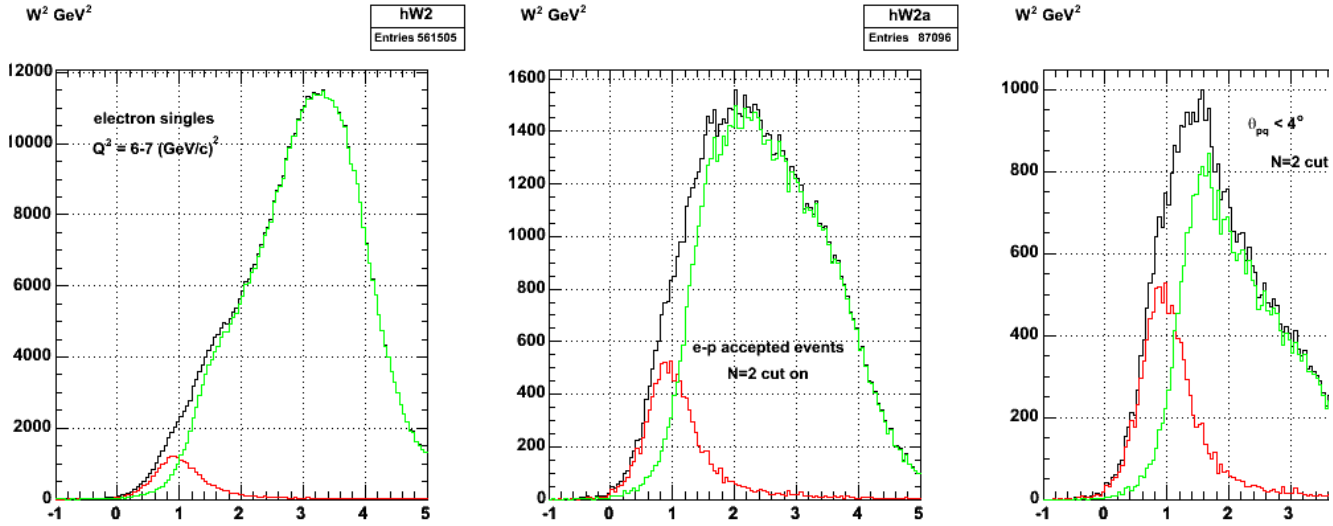


Fig 14. N=2 on, theta_pq < 1 deg, submit_gmnsim 7500 80000 1

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tar file) you uploaded.



Same as previous figure for protons

Click here to view the object (ROOT macro) you uploaded.

Investigating the angular resolution in FASTMC.

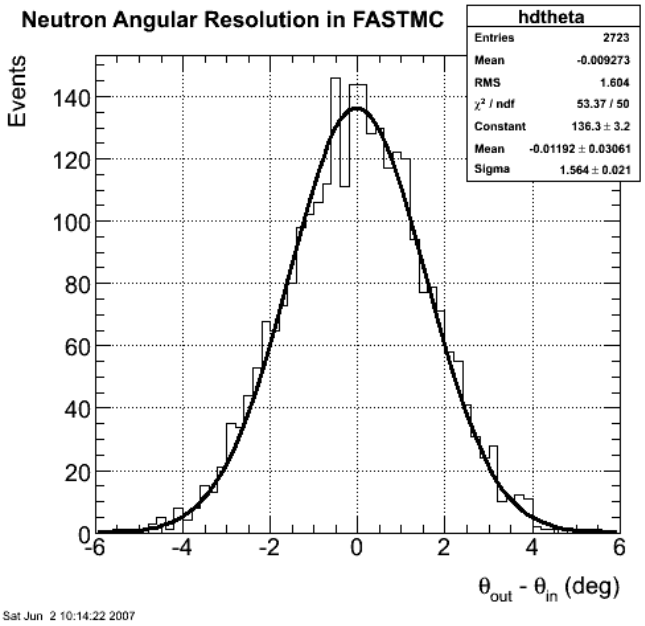


Fig 15. Angular resolution for neutrons in FASTMC.

Click here to view the object (ROOT macro for fig 15) you uploaded.

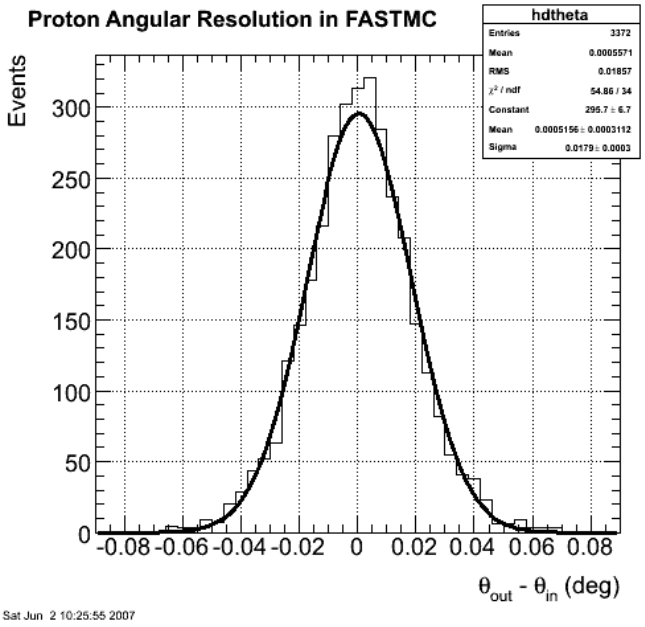
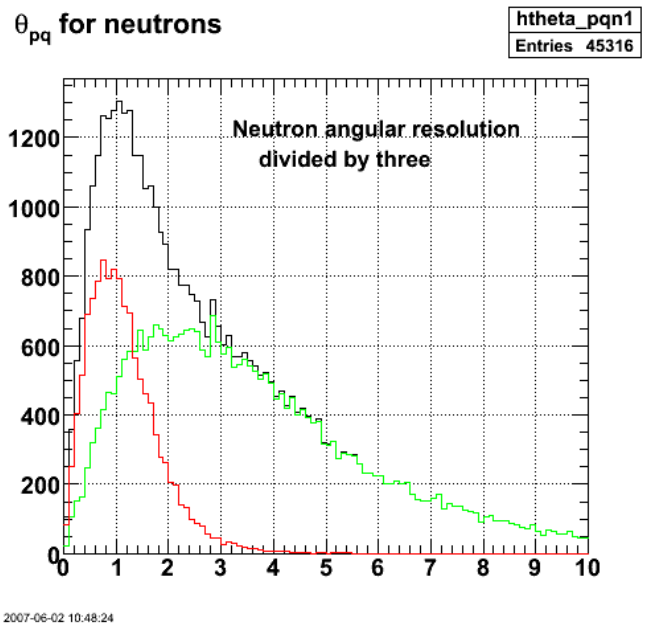


Fig 16. Angular resolution for protons

Click here to view the object (ROOT macro for fig 16) you uploaded.

The angular resolution for neutrons in the EC is (according to Stepan) about 0.5 deg. Natasha is running GSIM this weekend to get a better idea of what it should be. The theta resolution above is about 1.5 deg which is probably not exactly the right comparison. The 0.5 deg should be the sum in quadrature of the theta and phi resolutions. Assuming they are the same (standard assumption for CLAS12 at this point), then I am getting a resolution of 2.1 deg not 0.5 deg! This would nicely account for the width of the neutron theta_pq distribution. Below is theta_pq for neutrons with the width reduced by a factor of three.



2007-06-02 10:48:24

Fig 17. Effect of reducing the theta resolution (opps! but not the phi resolution by a factor of three.

Click here to view the object (ROOT macro for 17) you uploaded.

Damn!! Natasha gets exactly what I see in FASTMC. See fig 15 above.

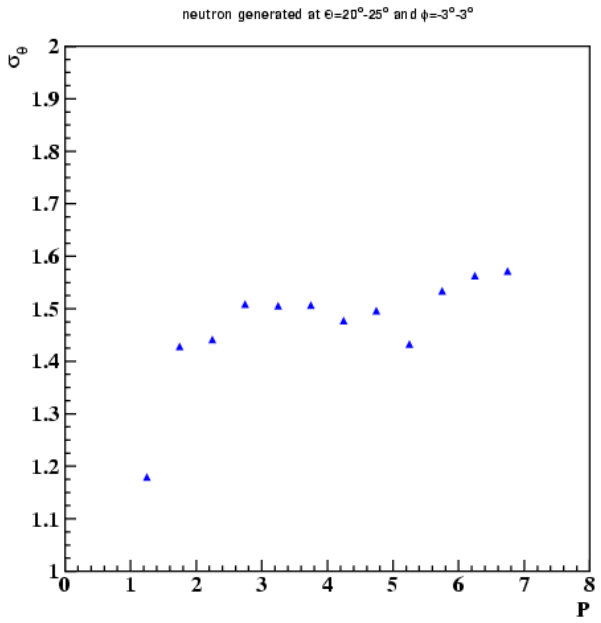


Fig 18. CLAS12 EC angular resolution for neutrons from Natasha.

Click here to view the object (PS version of fig 18) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 173 - Selecting Quasielastic Neutron events at 12 GeV (draft E5 entry) (gpg)

[Modified Sat Jun 2 14:48:24 2007 (GMT) gpg]

One of the requirements for the ratio method is to select quasielastic proton and neutron events. For protons, we have shown there is good separation between the quasielastic events and the inelastic background (see entry 353) using the requirements that theta_pq be less than some small angles (about 1 deg for 11 GeV) and that no more than two particles be detected in the final state. This second requirement is an addition to the cuts made for E5. Here we investigate the selection of quasielastic neutron events from the D(e,e'n)p reaction. Events are simulated in the same manner as in entry 353 (QUEEG for quasielastic neutrons and genevD for inelastic events) and the results are shown in Figure 1. The left-hand panel shows the W2 spectra inclusive electrons for quasielastic only (red), inelastic only (green), and the sum. The quasielastic contribution is small as in the proton case and is largely lost in the background. The middle panel shows the same spectra, but now requiring a neutron in the final state. There is still a very large background under the quasielastic peak. All of the plots below are for Q2 = 6-7 GeV2 and a beam energy of 11 GeV.

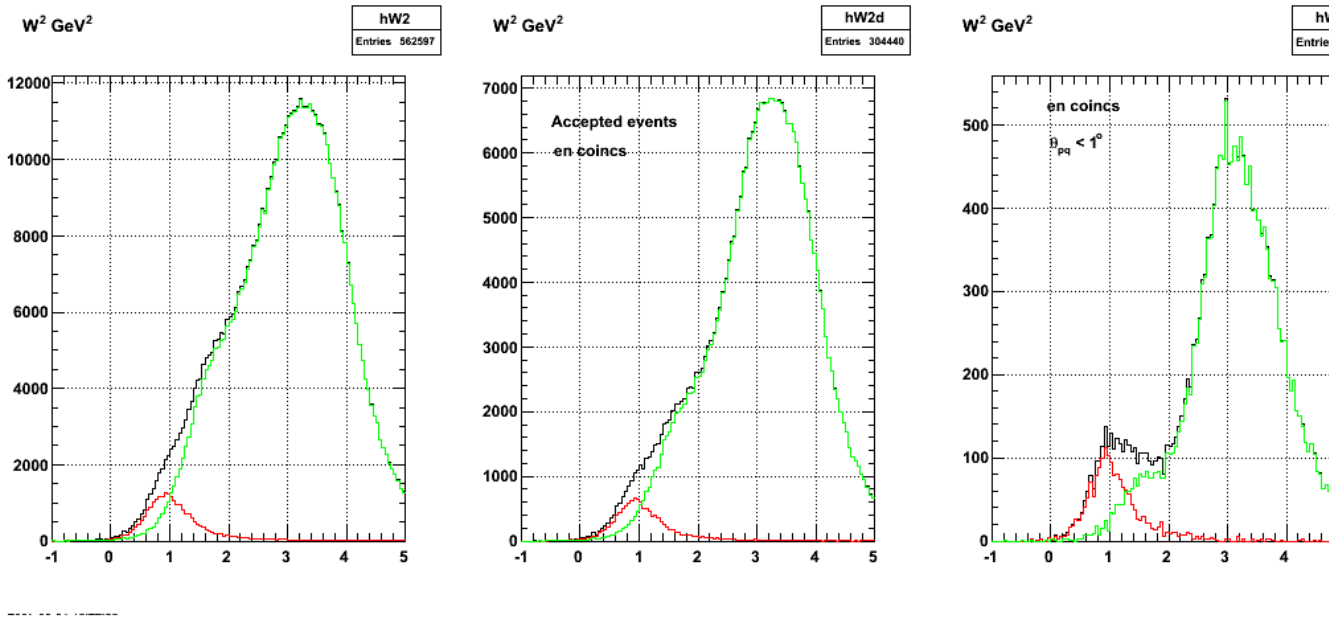


Fig 1. W2 distribution for electron singles {left-hand panel), e-n coincidences {middle panel}, and e-n coincidences with theta_pq<1 deg (right-and panel). In each plot the red curve represents quasielastic events, the green is the inelastic contribution, and black is the sum.

To reduce the inelastic background in the right-hand panel of Fig 1 we have required that the final state have only the two detected particles (e and n) and no others. These other particles are usually pions or photons from the inelastic reactions. The effect of this cut is shown in Fig 2. It reduces the inelastic background by about a factor of ten.

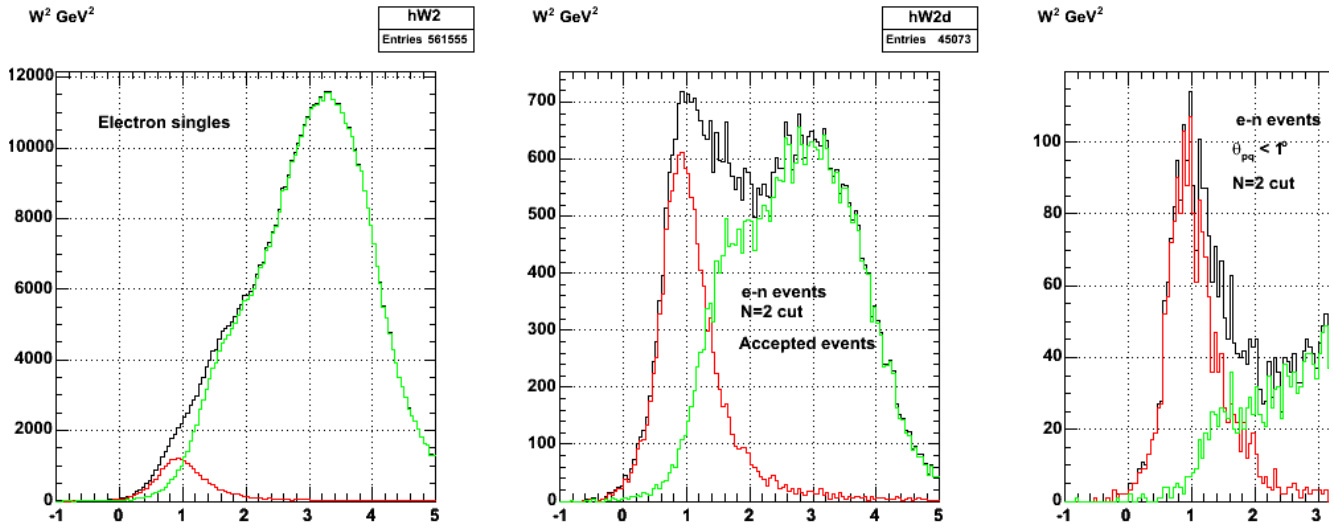


Fig 2. Same as Figure 1 (the right-hand panels are exactly the same) except the middle and left-hand panels also require an electron and neutron in the final state and no other particles (N=2 cut).

Click here to view the object (ROOT macro for Fig 2.) you uploaded.

Click here to view the object (tar archive for Fig 2.) you uploaded.

There is however, a concern here. Note that the number of quasielastic events that pass the theta_pq cut is small. Compare the red histograms in the middle and left-hand panels of Figs 1-2. This is due to the fact that the lower angular resolution of the EC has spread out the angular distribution of the quasielastic events and many are now falling outside the cut. This is NOT the case for protons where we can rely on the tracking to get high-resolution angle information. To show this explicitly, we show the angular distribution of theta_pq in Fig 3. The left-hand panel is for accepted events that have passed through the full simulation including FASTMC. The right-hand panel shows quasielastic events that were thrown and do not show the effects of smearing in FASTMC. The smeared, quasielastic angular distribution is much wider. Its peak is at theta_pq=2 deg versus 0.5 deg for the thrown distribution. The 1-deg theta_pq cut used in the analysis for Figs 1-2 was cutting out a large portion of the quasielastic events. To capture the full distribution the theta_pq cut should be more like 4 deg.

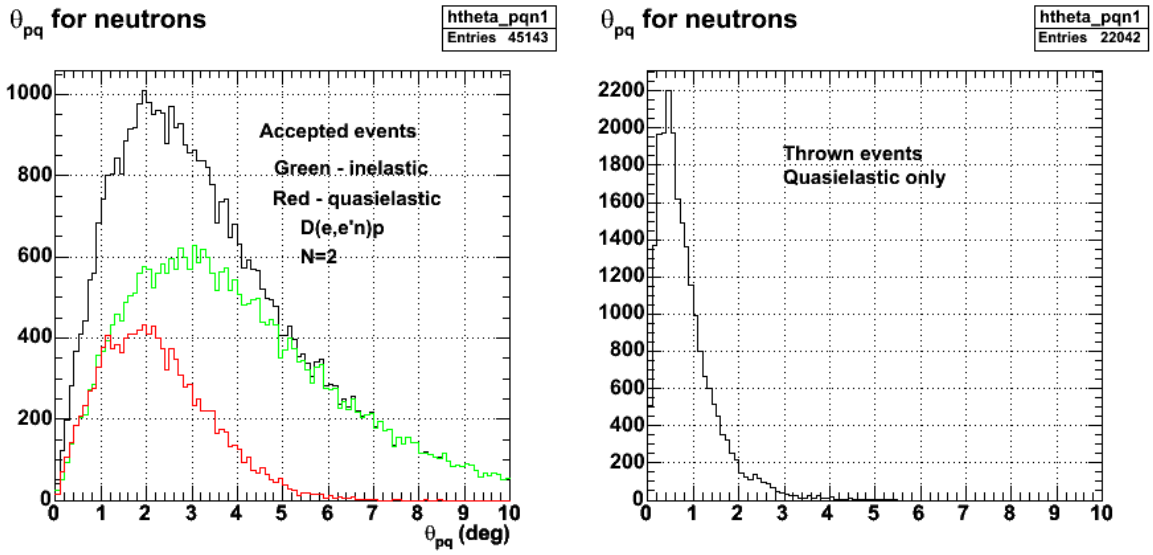


Fig 3. The left-hand panel shows the angular distribution of theta_pq for accepted quasielastic events (red histogram), inelastic (green), and their sum (black). The right-hand panel shows the angular distribution of thrown quasielastic events.

The effect of increasing the theta_pq cut to 4 deg is shown in Fig 4. The histograms are the same as in Fig 2 (the 'N=2' cut is on in Fig 4) except the theta_pq cut has been raised to 4 deg in the right-hand panel.

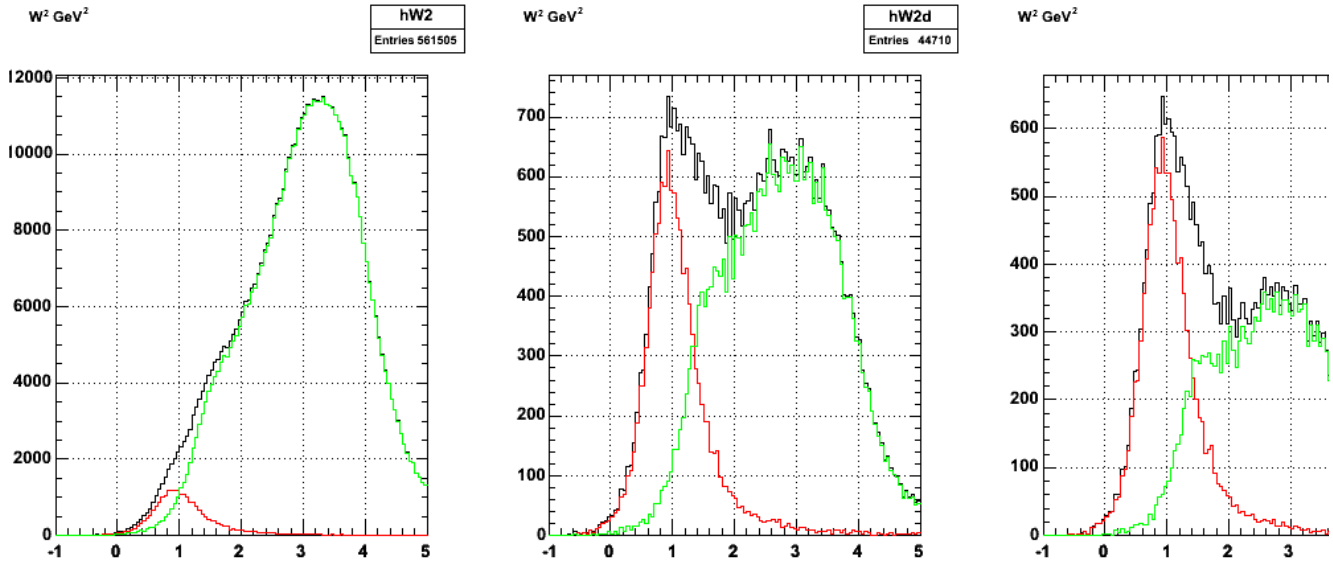


Fig 4. Same as Fig 2 with theta_pq < 4 deg instead of 1 deg.

The effect of a 4-deg theta_pq cut on the selection of quasielastic proton events is shown in Fig 5. Compare these results with entry 353.

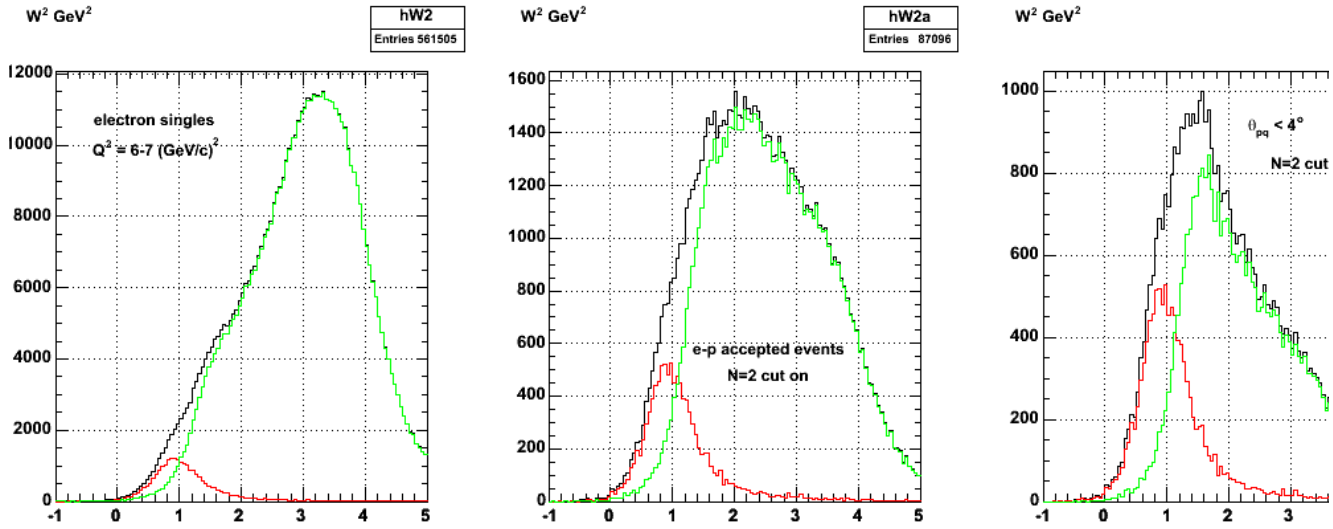


Fig 5. Same as Fig 4 except for protons instead of neutrons.

Click here to view the object (ROOT macro for Fig 5) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 174 - Neutron calibration reaction (gpg)

[Modified Tue Jun 5 02:21:36 2007 (GMT) gpg]

We have begun investigating the p(e,e'pi+)n reaction used to measure the neutron detection efficiency. The first results shown here are with the Fermi motion for deuterium still turned on.

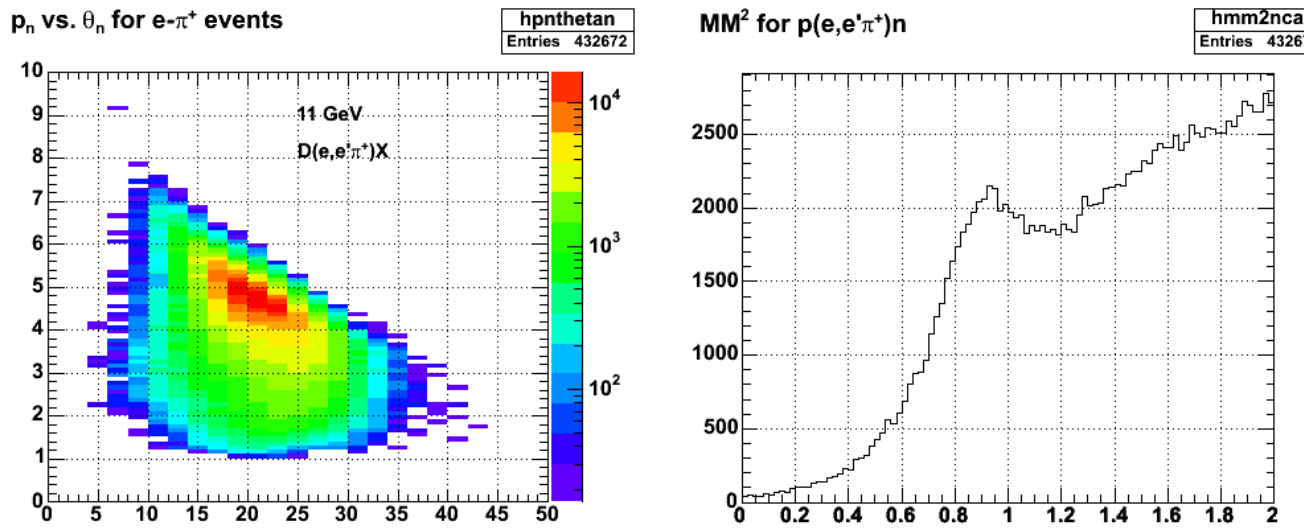


Fig 1. MM2 plot and p-theta plots for the nde calibration reaction. Q2 = 6-7 GeV2.

Click here to view the object (ROOT macro) you uploaded.

Now do things properly with the MM2 cut on the p_n-theta_n 2D plot. This is for 10^6 throws in the submit command.

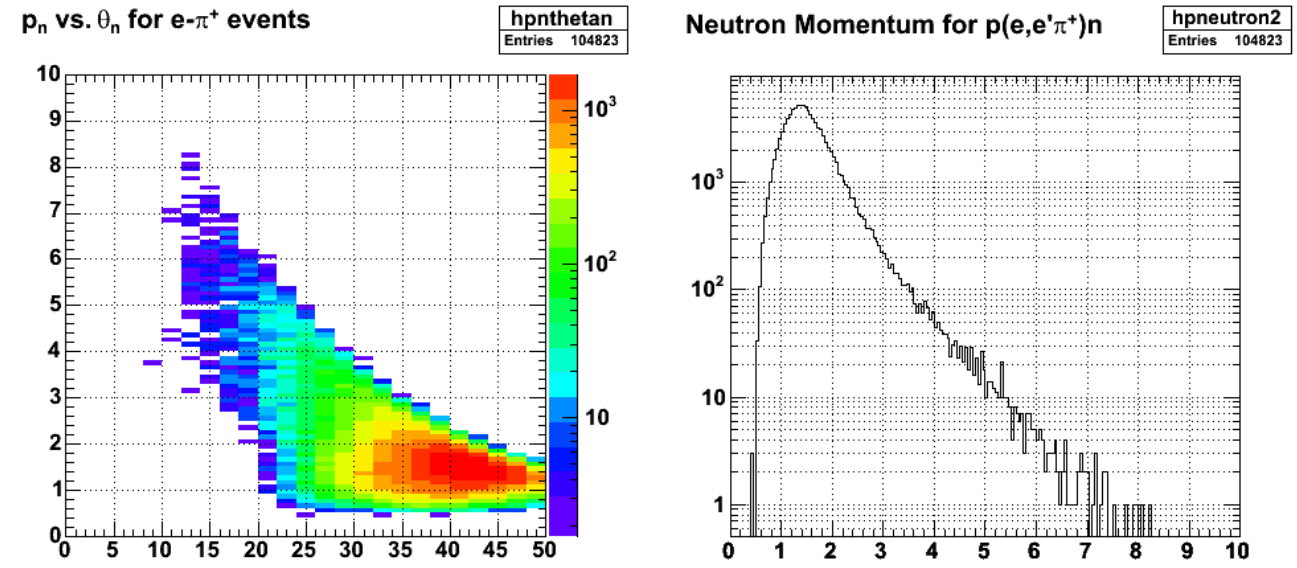


Fig 2. All Q2.

Click here to view the object (tar archive for fig 2 done with submit_gmnsim.pl 0 1000000 1) you uploaded.

Click here to view the object (tar archive for another run to add to the histograms for fig 2. done with submit_gmnsim.pl 0 700000 1) you uploaded.

Click here to view the object (tar archive for another run to add to the histograms for fig 2. done with submit_gmnsim.pl 0 700000 1) you uploaded.

Click here to view the object (tar archive for another run to add to the histograms for fig 2. done with submit_gmnsim.pl 0 700000 1) you uploaded.

Click here to view the object (tar archive for another run to add to the histograms for fig 2. done with submit_gmnsim.pl 0 700000 1) you uploaded.

Click here to view the object (tar archive for another run to add to the histograms for fig 2. done with submit_gmnsim.pl 0 700000 1) you uploaded.

Click here to view the object (tar archive for another run to add to the histograms for fig 2. done with submit_gmnsim.pl 0 700000 1) you uploaded.

The following runs are for Q2 > 7 GeV2.

Click here to view the object (tar archive for another run to add to the histograms for Q2>7 GeV2 done with submit_gmnsim.pl 0 700000 1) you uploaded.

Click here to view the object (tar archive for another run to add to the histograms for Q2>7 GeV2 done with submit_gmnsim.pl 0 700000 1) you uploaded.

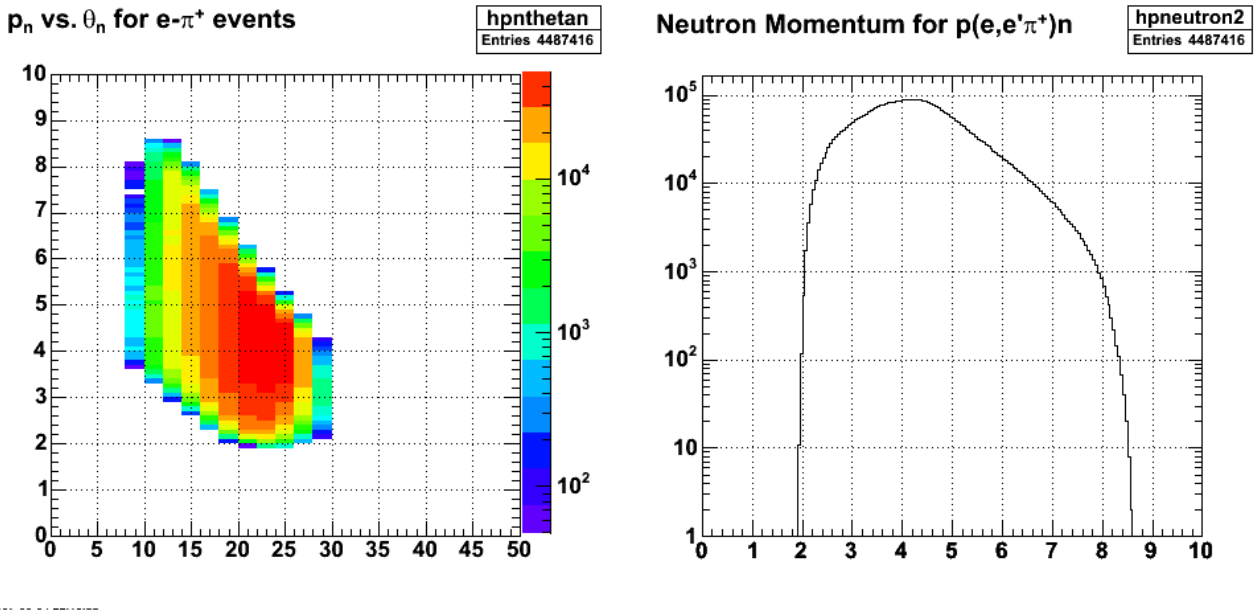


Fig 3. Q2 > 7 GeV2

Click here to view the object (ROOT macro) you uploaded.

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Jerry Gilfoyle's Enotebook page 175 - Neutron calibration acceptance (gpg)

[Modified Mon Jun 4 17:11:31 2007 (GMT) gpg]

Results below for acceptance for p(e,e'pi+)n.

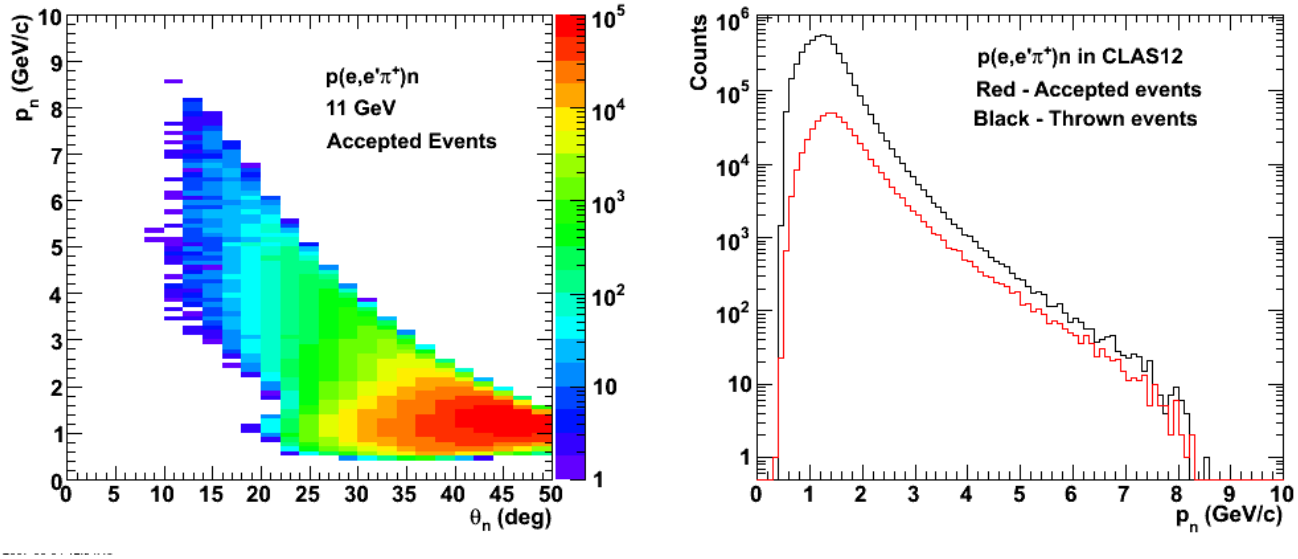


Fig 1. Acceptance of (e,e'pi+)n.

Click here to view the object (ROOT macro for fig 1) you uploaded.

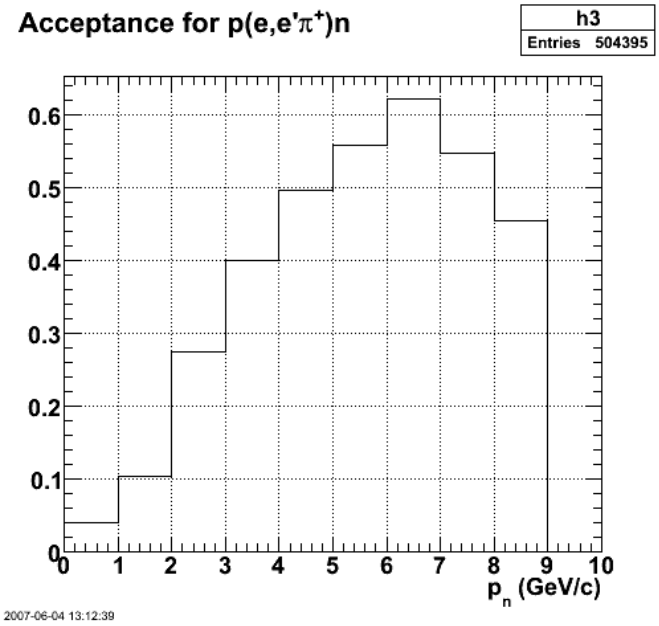


Fig 2. Acceptance from right panel of fig 1

Click here to view the object (ROOT macro for fig 2) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 176 - Neutron Detection Efficiency systematic uncertainty (gpg)

[Modified Sun Jun 10 00:56:12 2007 (GMT) gpg]

To get some idea of the systematic uncertainty in the neutron detection efficiency I have generated a Monte Carlo simulation of the nde. I then fit the simulated data with a very different mathematical function and then compare the two results by taking the ratio of R generated for each nde function incorporated into FASTMC.

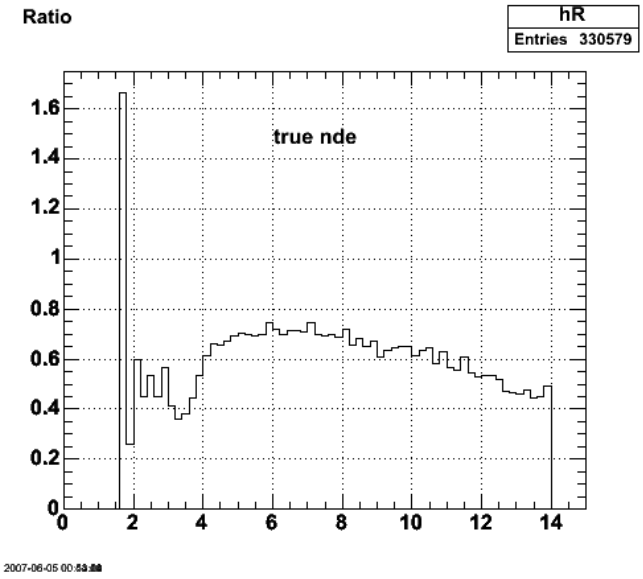


Fig 1. R = e-n/e-p with 'true' nde function.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (tar archive of hisotgrams with 'true' nde in FASTMC.) you uploaded.

Long run with true nde.

Click here to view the object (tar archive with true nde done with submit_gmnsim.pl 1000000 0 1) you uploaded.

Click here to view the object (tar archive with fitted nde done with submit_gmnsim.pl 1000000 0 1) you uploaded.

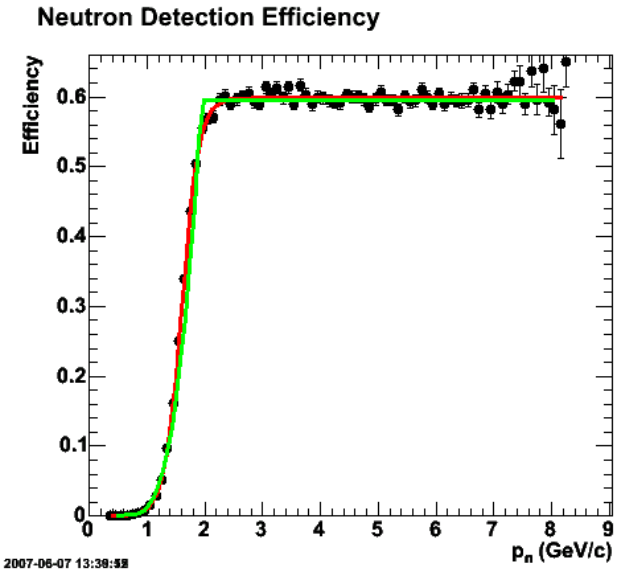


Fig 2. Fits to simulated NDE data.

Click here to view the object (ROOT macro for fig 2) you uploaded.

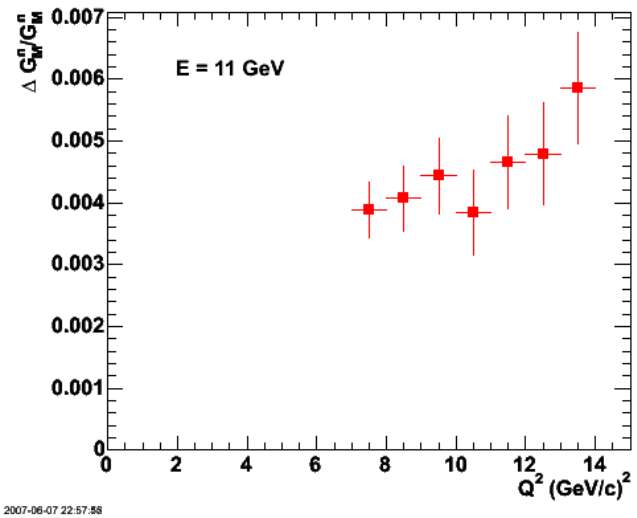


Fig 3. Comparison of relative uncertainty in GMn for true and fitted NDEs in analysis code.

Click here to view the object (ROOT macro for fig 2) you uploaded.

Code for fig 3. Use in gmn/nde/uncertainty

```
--------------------------------

TH1F *hp = new TH1F("hp","R",15,0,15);
hp->Sumw2()
TH1F *hn = new TH1F("hn","R",15,0,15);
hn->Sumw2()
TH1F *hnpfitted = new TH1F("hnpfitted","R",15,0,15);
hnpfitted->Sumw2()
TH1F *hnptrue = new TH1F("hnptrue","R",15,0,15);
hnptrue->Sumw2()

TFile *hfile1 = new TFile("NDEfitted1/evntsummed.root");
hfile1.cd()

hp->Add(hQ2ep1,1)
hn->Add(hQ2en1,1)

TFile *hfile2 = new TFile("NDEfitted2/evntsummed.root");
hfile2.cd()

hp->Add(hQ2ep1,1)
hn->Add(hQ2en1,1)

hnpfitted->Divide(hn,hp,1,1);


-----

TH1F *hp = new TH1F("hp","R",15,0,15);
hp->Sumw2()
TH1F *hn = new TH1F("hn","R",15,0,15);
hn->Sumw2()
TH1F *hnp = new TH1F("hnp","R",15,0,15);
hnp->Sumw2()

TFile *hfile11 = new TFile("NDEtrue1/evntsummed.root");
hfile11.cd()

hp->Add(hQ2ep1,1)
hn->Add(hQ2en1,1)

TFile *hfile12 = new TFile("NDEtrue2/evntsummed.root");
hfile12.cd()

hp->Add(hQ2ep1,1)
hn->Add(hQ2en1,1)

TFile *hfile13 = new TFile("NDEtrue3/evntsummed.root");
hfile13.cd()

hp->Add(hQ2ep1,1)
hn->Add(hQ2en1,1)

TFile *hfile14 = new TFile("NDEtrue4/evntsummed.root");
hfile14.cd()

hp->Add(hQ2ep1,1)
hn->Add(hQ2en1,1)
```

```
hnptrue->Divide(hn,hp,1,1);

hnptrue->Draw()

-----

TH1F *hRdiff = new TH1F("hRdiff","R",15,0,15);
hRdiff->Add(hnpfitted,hnptrue,1,-1);

TH1F *hRave = new TH1F("hRave","R",15,0,15);
hRave->Add(hnpfitted,hnptrue,0.5,0.5);

TH1F *hRunc = new TH1F("hRunc","R",15,0,15);
hRunc->Sumw2();
hRunc->Divide(hRdiff,hRave,1,1);

TH1F *hGMnunc = new TH1F("hGMnunc","R",15,0,15);
hGMnunc->Sumw2();
hGMnunc->Divide(hRdiff,hRave,0.5,1);
```

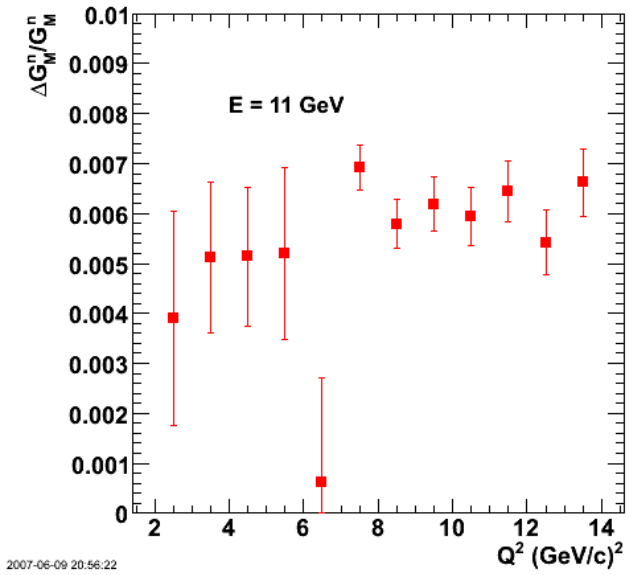


Fig 4. Full Q2 range.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (EPS version) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 177 - Draft of elog entry on systematic uncertainty due to NDE parameterization (gpg)

[Modified Fri Jun 8 03:34:28 2007 (GMT) gpg]

The uncertainty in the parameterization of the neutron detection efficiency is the largest single source of uncertainty in the GMn measurement. To estimate that uncertainty in the proposal we have done the following.

1. We start with function that will describe the neutron detection efficiency (NDE) at least qualitatively. However, we decided to avoid a simple polynomial because that is the function that was used to fit the NDE in Jeff's thesis since that could bias the result. We chose to use the function

   ```
   nde = S*(1 - (1/(1+exp(x-r0)/a)))
   ```

   where S is the plateau in NDE for p_n > 2 GeV/c, r0 is a constant representing the position in p_n of the middle of the increasing portion of the NDE, and a controls the slope of the NDE in the increasing NDE region. The points in Figure 1 fall along this curve.

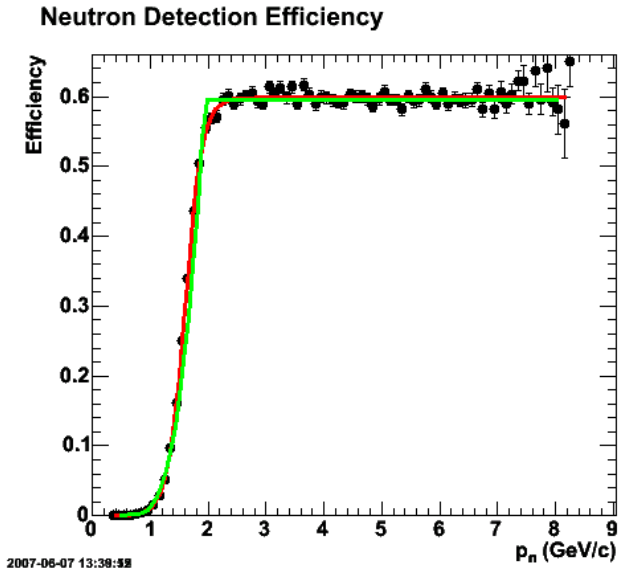


Fig 1. Monte Carlo simulation of the neutron detection efficiency along with two fits to the simulated data.

2. We use the distribution of measured neutrons as a function of momentum and the assumed NDE function from above to obtain the number of neutrons as a function of momentum. The square root of this number gives us the uncertainty in that neutron momentum bin.
3. Monte Carlo events are thrown in each momentum bin with a Gaussian distribution with the centroid and width from the previous step.
4. We fit the distribution with the original source NDE given above (which simply recovers the original parameters) and with a third-order polynomial in p_n with a plateau (we will refer to this as the JL function). The results are shown in Figure 1. Notice the small differences between the red curve (original source NDE) and the green one (JL curve). We chose the original source function so that it would have the same features as the measured neutron detection efficiency, but would NOT make a perfect fit to the simulated NDE.
5. We then do two calculations. In both we use the source NDE function above to throw the events. In one calculation we use the functional form of the original source NDE to correct the neutron yield for the NDE in the analysis. In the second calculation we use the fitted JL function from step 4 in the analysis code to correct the neutron yield for the NDE. We still use the original source NDE function to throw the events.
6. Last, we calculate R=e-n/e-p for each case, take the difference between the two and divide by the average of the two ratio measurements. The result is shown in Figure 2 for the relative uncertainty on GMn. The error bars are statistical ones from the Monte Carlo calculation. The difference in the two parameterizations of the NDE is roughly constant with Q2 and less than 0.5%.

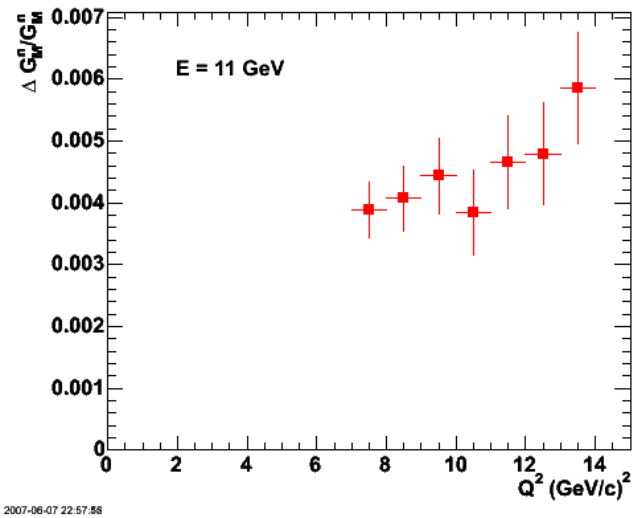


Fig 2. Relative uncertainty in GMn between the two forms of the neutron detection efficiency in the analysis.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 178 - Final neutron plots (gpg)

[Modified Mon Jun 18 19:06:34 2007 (GMT) gpg]

Neutron plots. Firs tis done with

```
submit_gmnsim.pl 15000 50000 1
```

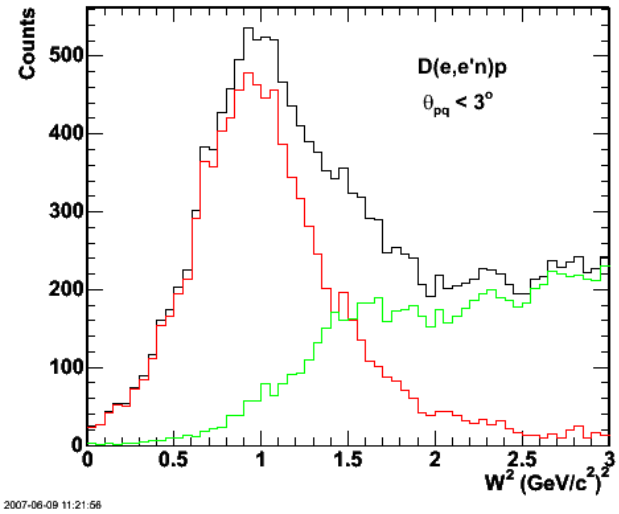


Fig 1. theta_pq, N=2 cuts

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (EPS version) you uploaded.

Click here to view the object (tar archive) you uploaded.

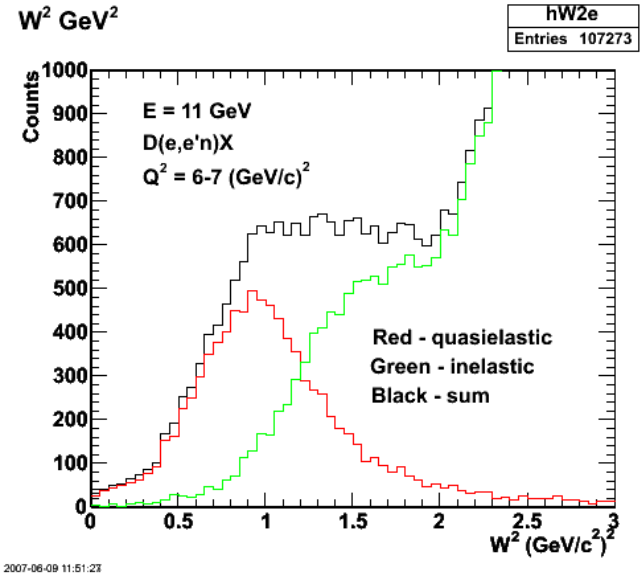


Fig 2. theta_pq and no N=2

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (EPS version) you uploaded.

Click here to view the object (tar archive) you uploaded.

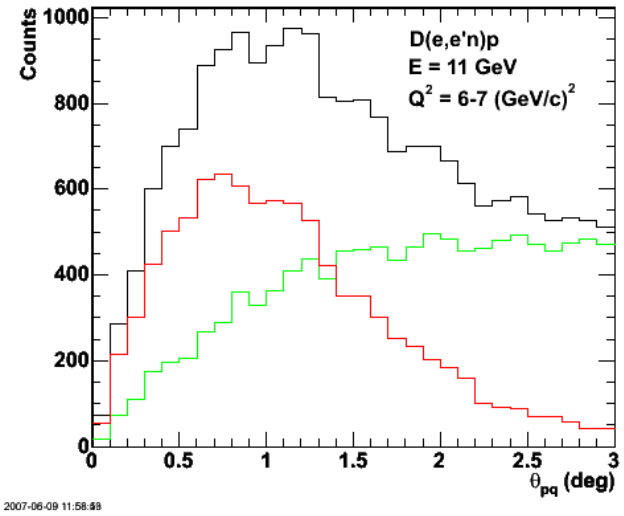


Fig 3, theta_pq angdist for N=2 cut. see fig 1 for histogram file.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (EPS file) you uploaded.

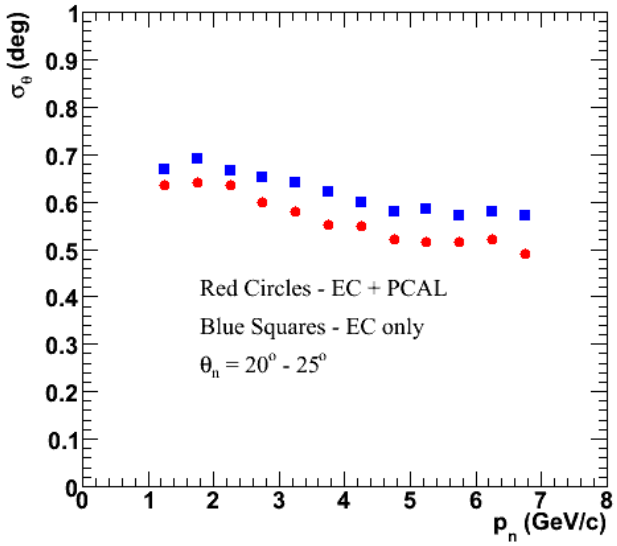


Fig 4. Final version of neutron angular resolution from Natasha.

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 179 - Neutron acceptance (gpg)

[Modified Mon Jun 18 22:53:27 2007 (GMT) gpg]

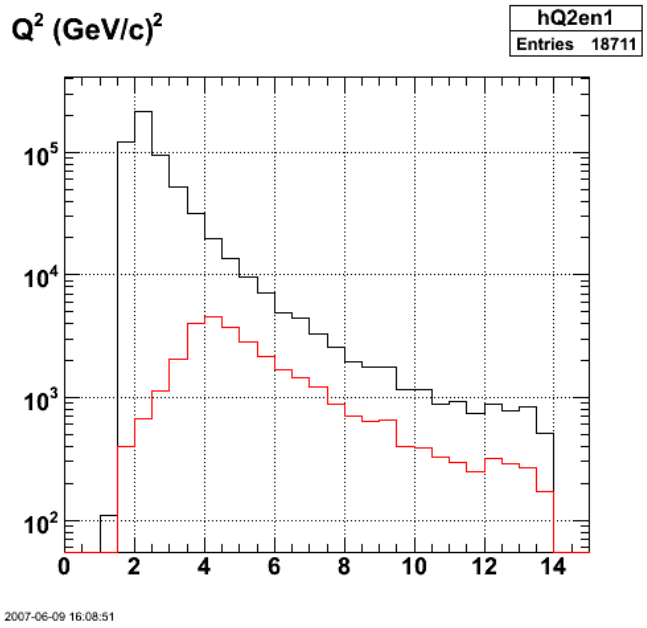


Fig 1. D(e,e'n)p acceptance. Includes NDE.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tar archive) you uploaded.

Now turn off the NDE and get the following.

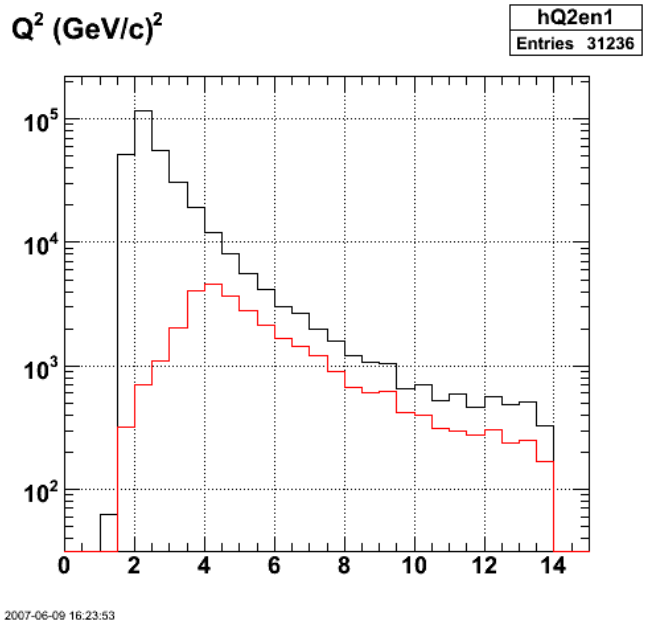


Fig 2. D(e,e'n)p acceptance withOUT NDE.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tar archive) you uploaded.

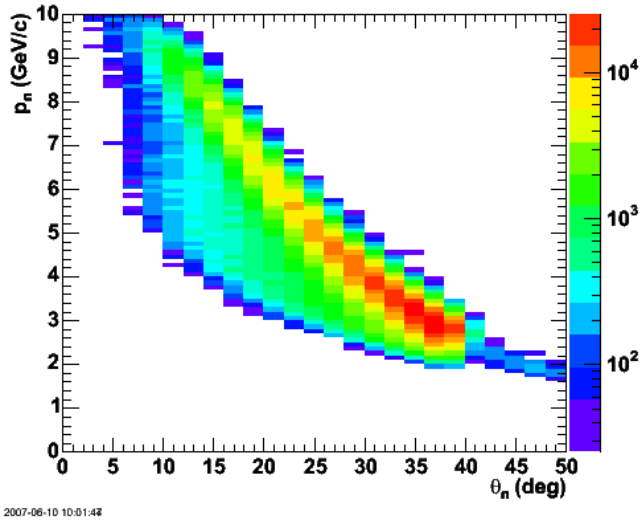


Fig 3. Acceptance for neutrons in terms of p_n and theta_n.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (EPS file) you uploaded.

Click here to view the object (tar archive) you uploaded.

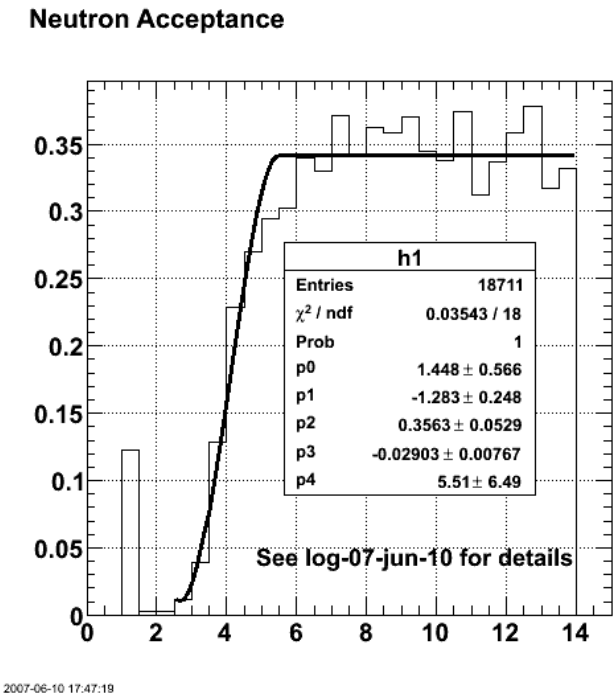
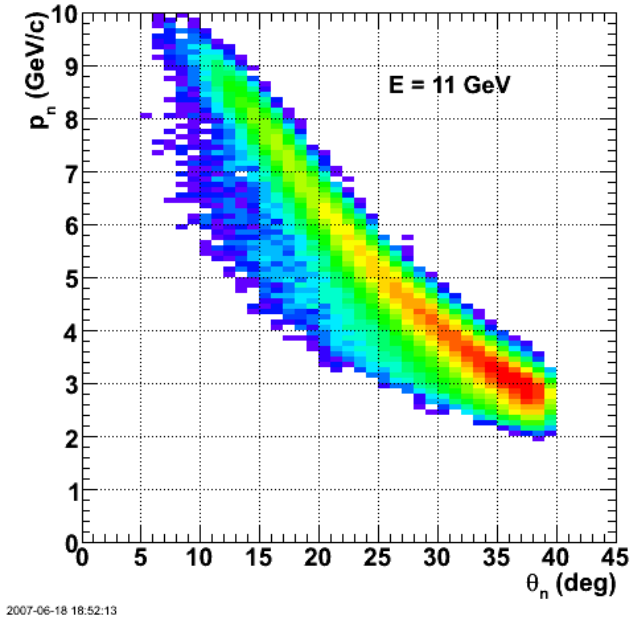


Fig 4. Acceptance for neutrons as a function of Q2. Notice there are events at less than 5 deg which is outside the CLAS12 acceptance. This is because the smearing is done after the acceptance check.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT macro used for fig 4 and contains the thrown and accepted Q2 distributions.) you uploaded.



2007-06-18 18:52:13

Fig 5. Cleaned up version of neutron acceptance.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tar archive) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 180 - QE selection (gpg)

[Modified Tue Jul 17 02:18:50 2007 (GMT) gpg]

Some tests of our ability to select QE events.

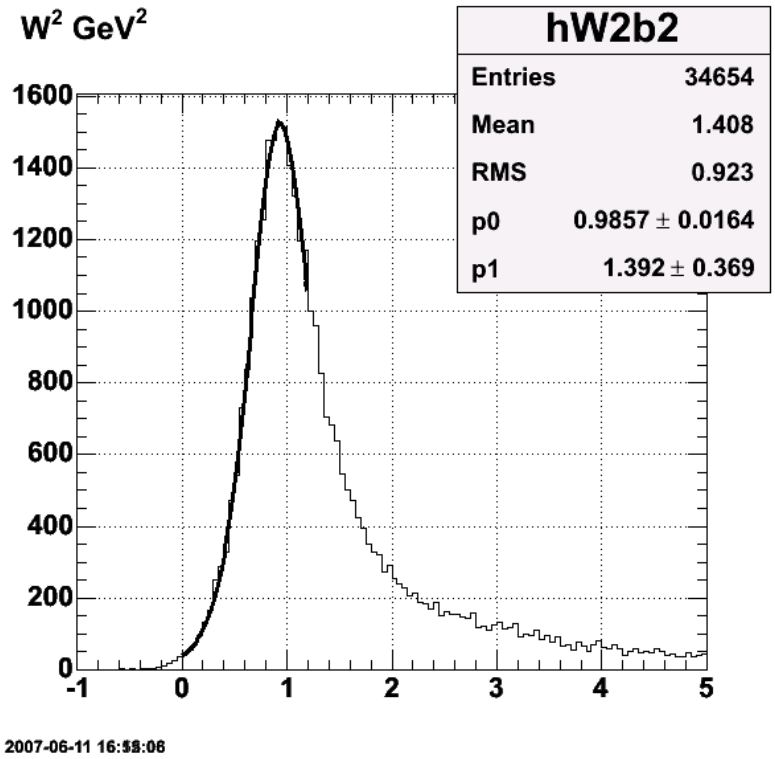


Fig 1. Fit to the summed proton W2 spectrum for Q2=6-7 GeV2.

Click here to view the object (ROOT macro) you uploaded.

From my log for June 11, 2007.

```
this may have worked..

Double_t f6(Double_t *x,Double_t *par)
{
  Double_t arg = 0, arg2 = 0, arg3 = 0, peak1, peak2, bckgnd, fitval;

arg = x[0];
arg2 = arg - 0.938273;
arg3 = arg - 0.9187;

peak1 = 642.9*exp( -pow(arg2,2)/(2*0.3873*0.3873));
peak2 = 825.2*exp( -pow(arg3,2)/(2*pow(0.2336,2)));

bckgnd = 3.573 - 32.104*arg + 94.49*pow(arg,2);

fitval = par[0]*(peak1+peak2) + par[1]*bckgnd;


return fitval;
}


root [38] gROOT->Reset()
root [39] .L f6.C
root [40] TF1 *f6 = new TF1("f6",f6,0.0,1.2,2)
root [41] f6->SetParameters(1,1);
root [42] f6->Draw()
root [43] hW2b2->Fit("f6","r")
 FCN=23.3289 FROM MIGRAD    STATUS=CONVERGED      33 CALLS          34 TOTAL
                     EDM=4.8417e-22    STRATEGY= 1      ERROR MATRIX ACCURATE
  EXT PARAMETER                                   STEP         FIRST
  NO.   NAME      VALUE            ERROR          SIZE      DERIVATIVE
   1  p0           9.85709e-01   1.63988e-02   1.83942e-05  -1.93143e-09
   2  p1           1.39234e+00   3.69100e-01   4.14012e-04  -1.50171e-10
(Int_t)0
root [44]

What worked?
```

```
1. Combination of two gaussians with the parameters picked to reproduce the QE W2 spectra ALONE!

2. Make sure you get reduced chisquare about 1.0.

3. Polynomial fit to the IN W2 spectra also ALONE.

4. Combine the two line shapes to fit the summed spectrum.

QE part = 0.986 +/- 0.016
IN part = 1.39 +/- 0.37

these are consistent with one.

Need better stats to push down the undertainty.
```

Now do the neutrons.

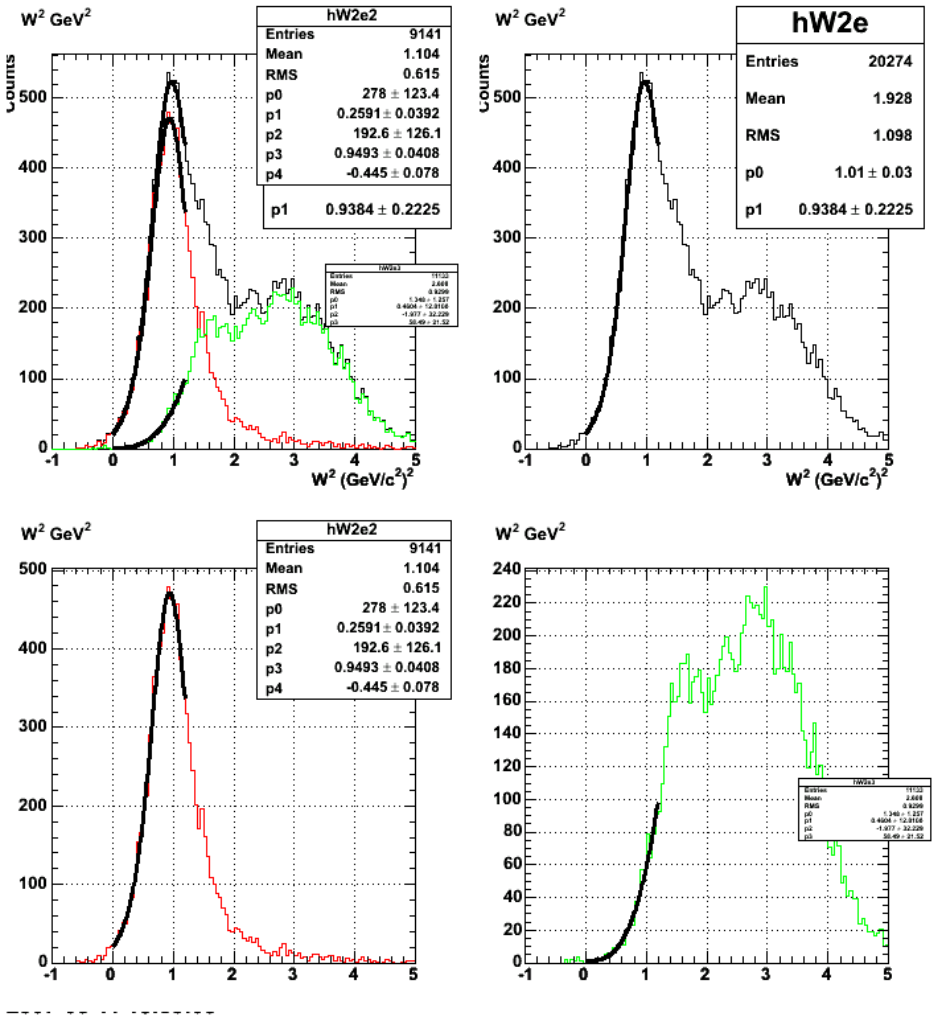


Fig 2. Same as above, but for neutrons. WE actually get better than 1% with these statistics.

Click here to view the object (ROOT macro) you uploaded.

Extend this a but further. To be more realistic, instead of using the QE and IN W2 spectra that are essentially added to give the summed spectra fitted above, I used the QE and IN spectra I obtained after putting a MM2 cut on the neutron mass (for D(e,e'p)n). At least now I am using lineshapes that are not just given, but actually extracted from the analysis. The results are encouraging as shown below. see log-07-jun-12 for more details. Done with

```
submit_gmnsim.pl 60000 200000 1
```

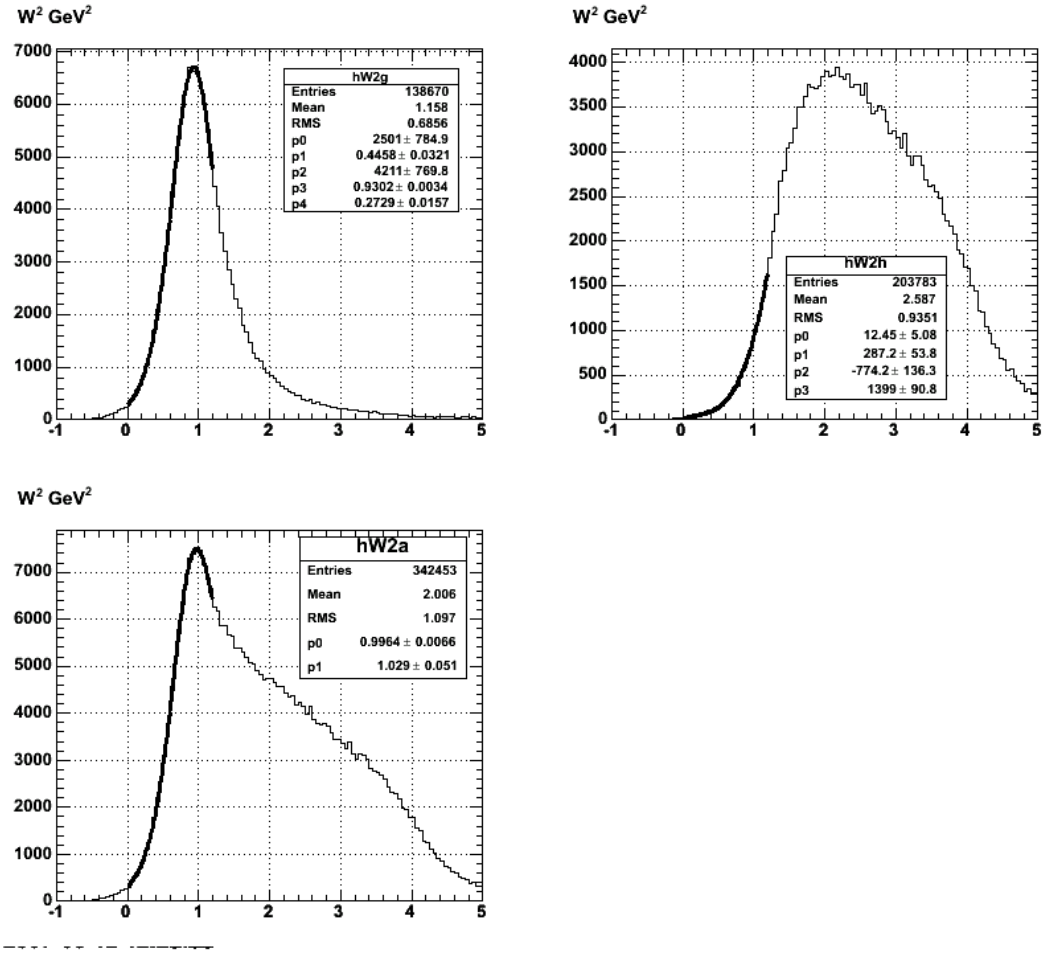


Fig 3. Fitting the W22 spectra to extract the QE events for D(e,e'p)n using lineshapes after applying the MM2 cut to separate QE and IN events.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tar archive) you uploaded.

The previous analysis was on the W2 spectrum WITHOUT the theta_pq cut turned on. This analysis should be done with the theta_pq on so we get hte following.

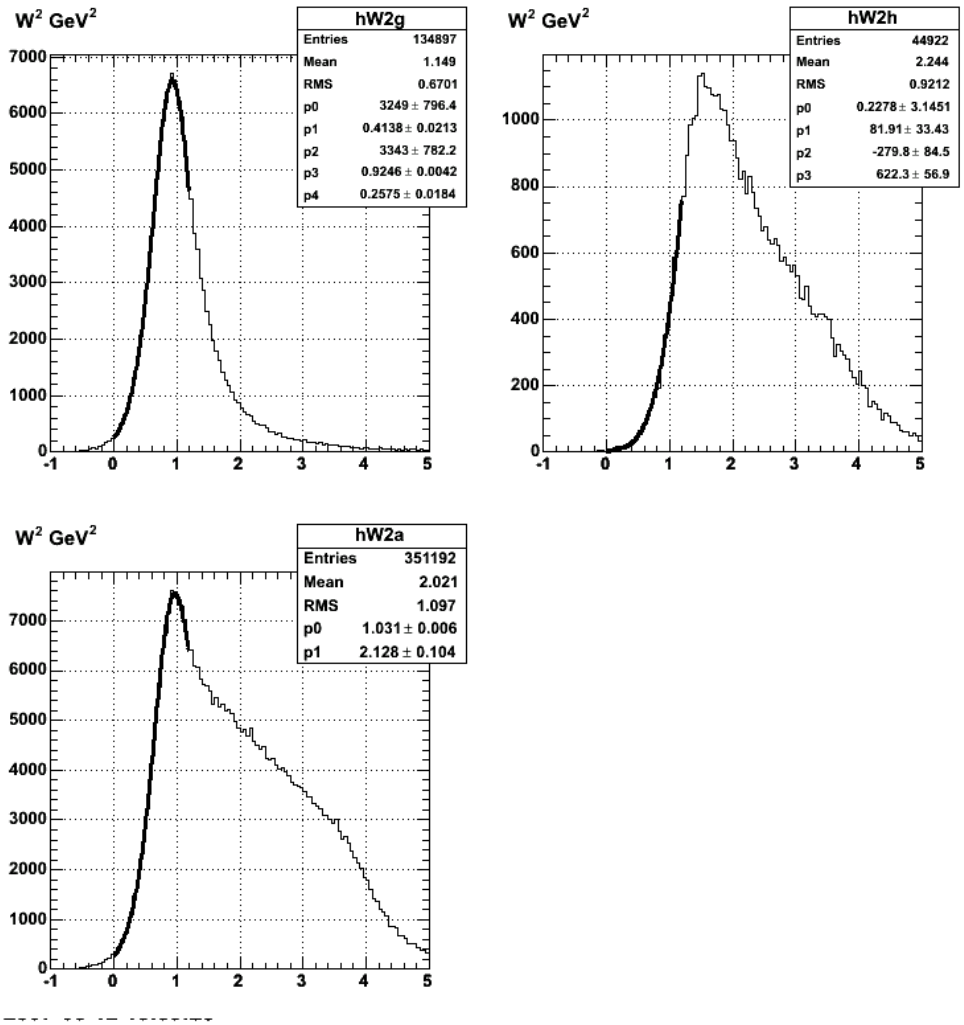


Fig 4. Same as fig 3, but with theta_pq cut on.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tar archive) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 181 - theta_pq systematic uncertainty (gpg)

[Modified Tue Jun 12 04:07:37 2007 (GMT) gpg]

Do the test on the systematic uncertainty due to the position of the theta_pq cut the same way as JL. Take the accepted value of the cut, calculate R and then vary the cut by +/- 10% (3.0 deg -> 2.7 deg and 3.3 deg)

Use. submit_gmnsim.pl 30000 100000 1

Files are stored in gmn/theta_pq/run100/

```
 fSumw[13]=1.06691, x=6.25, error=0.00642035
 fSumw[14]=0.973681, x=6.75, error=0.00672075
```

for theta_pq = 3.3 deg, opps it's still 3 deg.

```
 fSumw[13]=1.06691, x=6.25, error=0.00642035
 fSumw[14]=0.973681, x=6.75, error=0.00672075
 fSumw[15]=0, x=7.25, error=0
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 182 - Impact of changing theta_pq cut (gpg)

[Modified Sat Jun 16 21:31:24 2007 (GMT) gpg]

To test how changing the theta_pq cut will effect the quasielastic peak and how it will suppress the inelastic background I generated the following figures. Compare fig 1 with fig 1 in entry 178. Done with

```
submit_gmnsim.pl 7000 40000 1
```

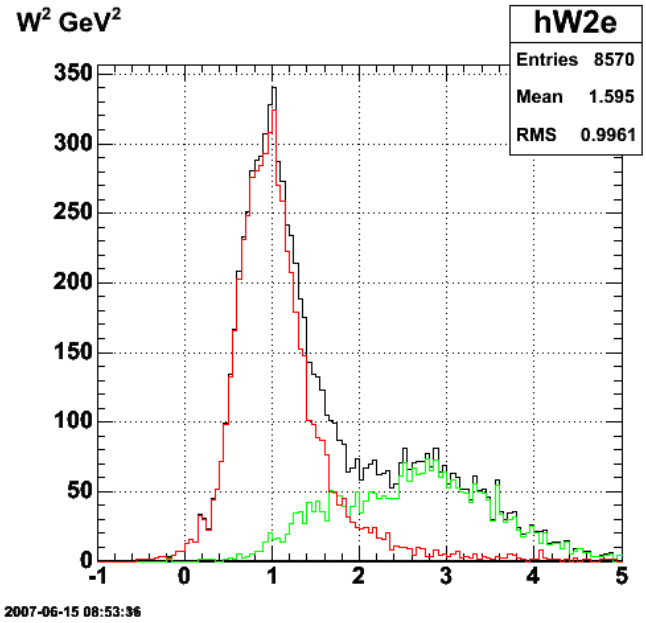


Fig 1. W2 spectrum with theta_pq < 1.5 deg.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Fig 2. theta_pq angdists for fig 1.) you uploaded.

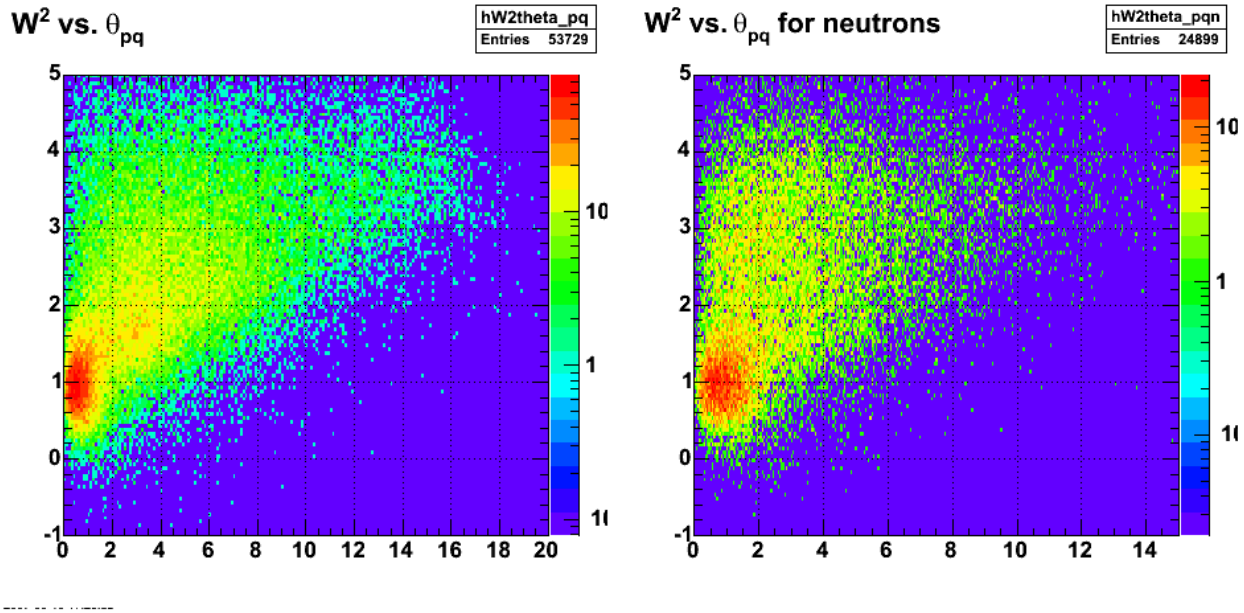


Fig 2. Comparison of proton (left) and neutron (right) W2 vs. theta_pq spectra.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tar archive) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 183 - Effect of theta_pq cut (gpg)

[Modified Mon Jun 18 15:34:43 2007 (GMT) gpg]

Vary the theta_pq cut and look at the W2 spectra for protons. Integrate over W2 = 0.0-1.2 GeV2 and plot as a function of maximum theta_pq. See log-07-jun-16 for details.

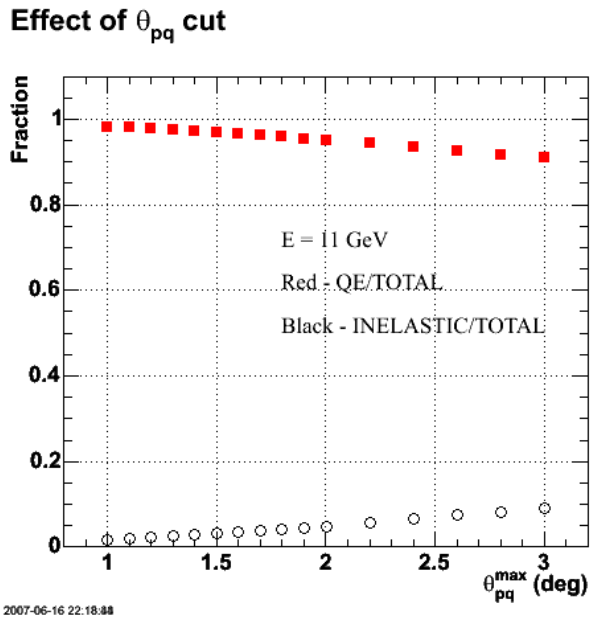


Fig 1, Dependence of fraction of QE/TOTAL and INELASTIC/TOTAL as a function of the maximum theta_pq.

Click here to view the object (theta_pqlimit1.C to make fig 1) you uploaded.

Click here to view the object (tar archive for fig 1) you uploaded.

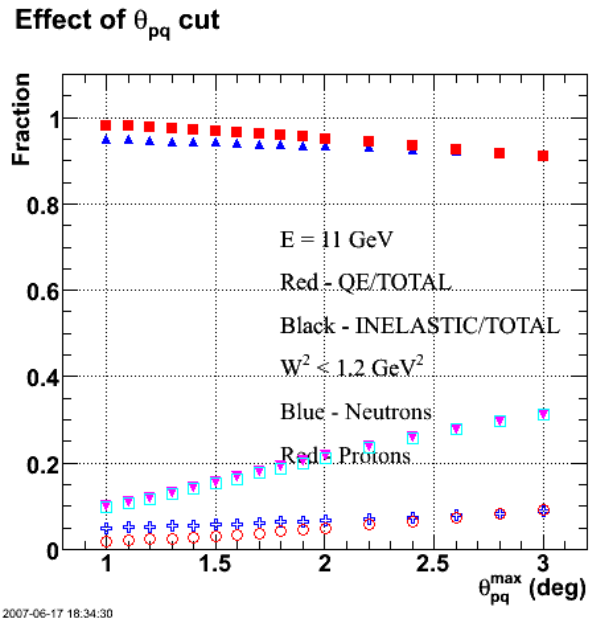


Fig 2. Put everything on the plot.

Click here to view the object (ROOT macro) you uploaded.

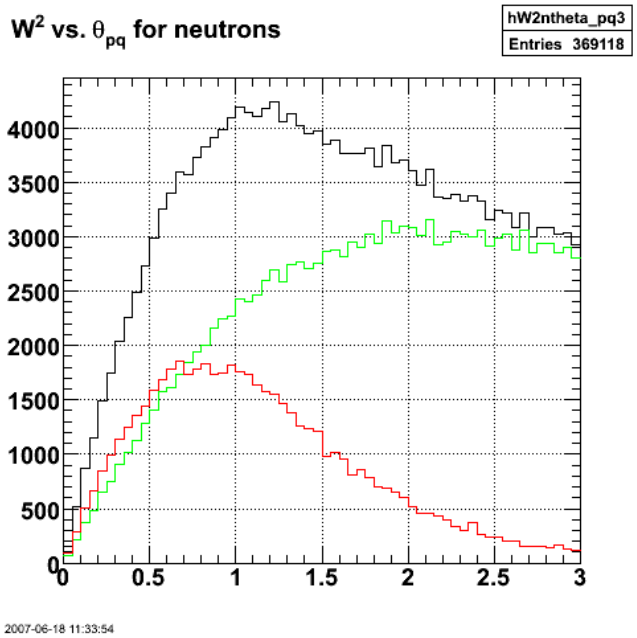


Fig 3. Theta_pq dist for this simulation. The amount of IN is way too high and inconsistent with previous results. See figs 18-19 in proposal. Rerun the simulation with 'submit_gmnsim.pl 50000 333000 1'.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 184 - Production length extraction (gpg)

[Modified Fri Jul 13 19:04:26 2007 (GMT) gpg]

Results are shown below for extracting the production length from the EG2 data.

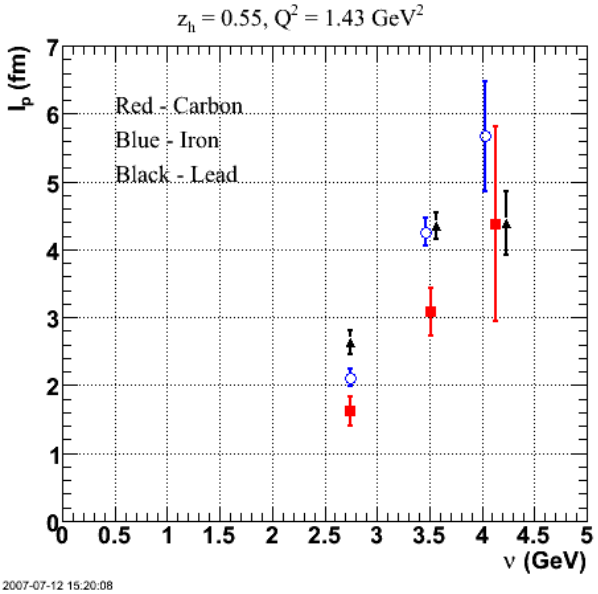


Fig 1. Comparison of production length for carbon, iron, and lead for the labeled kinematics. The iron and lead points at nu = 3.5 and nu = 4.1 GeV have been displaced horizontally so they can be seen more clearly. See Mathematica notebooks below for details.

Click here to view the object (ROOT macro for Fig 1.) you uploaded.

Click here to view the object (Mathematica notebook for carbon production length.) you uploaded.

Click here to view the object (Mathematica notebook for iron production length.) you uploaded.

Click here to view the object (Mathematica notebook for lead production length.) you uploaded.

Click here to view the object (Text file with data used in the notebooks above.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 185 - Question 6 in GMn CAN response 2 (gpg)

[Modified Fri Jul 27 20:42:42 2007 (GMT) gpg]

In response to the CAN review committee's second round of comments, consider the following response to question number 8. The width of a gaussian fit to the D(e,e'p)X reaction in the range W2= 0.75-0.96 GeV2 is 0.13 GeV2 for the data at 4.2 GeV and 0.12 GeV2 for the GSIM simulation.

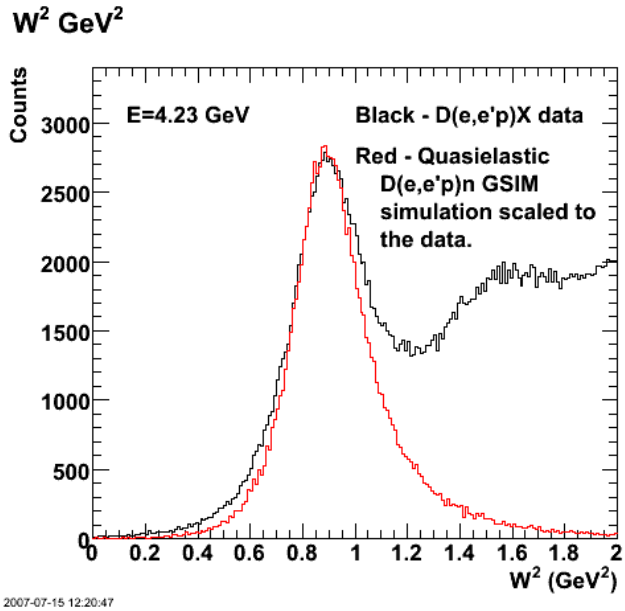


Fig 1. Comparison of the width of the W2 distribution for the measured D(e,e'p)X reaction (black histogram) and a GSIM simulation of the quasielastic D(e,e'p)n reaction (red histogram scaled to the data).

Click here to view the object (EPS version of Fig 1.) you uploaded.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (ROOT macro used to generate fig 1 from input files.) you uploaded.

Click here to view the object (zipped archive of input files for fig 1) you uploaded.

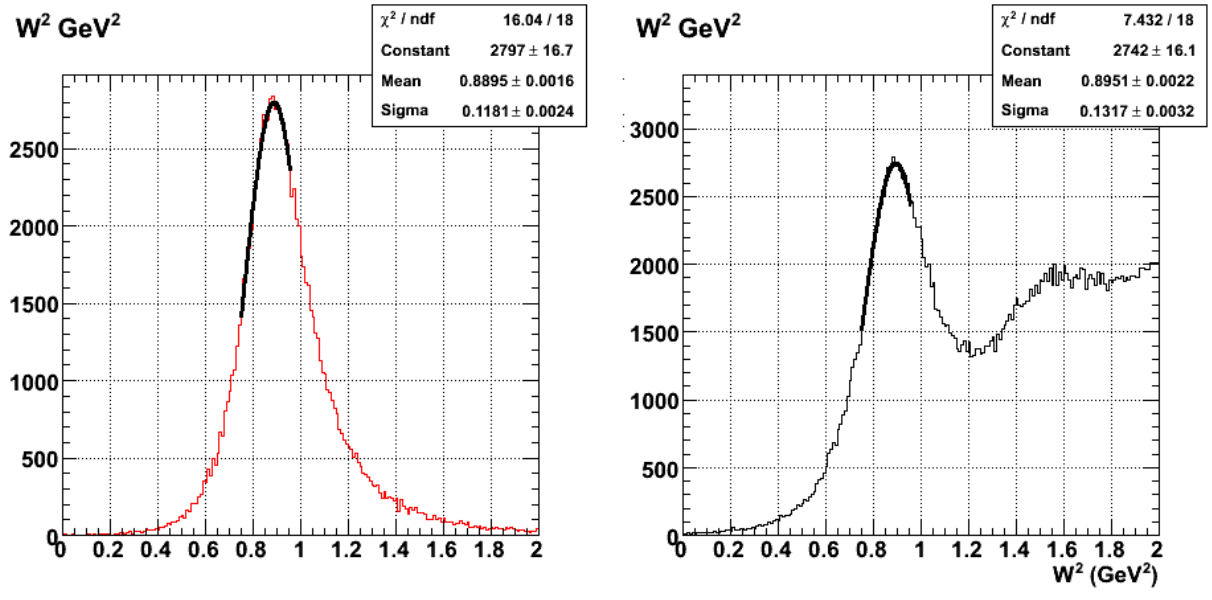


Fig 2. Gaussian fits to the peak of the W2 spectrum for the GSIM calculation (left panel, red histogram) and the data (right panel, black histogram) at 4.2 GeV.

Click here to view the object (ROOT macro for fig 2) you uploaded.

Now the 2.6-GeV data.

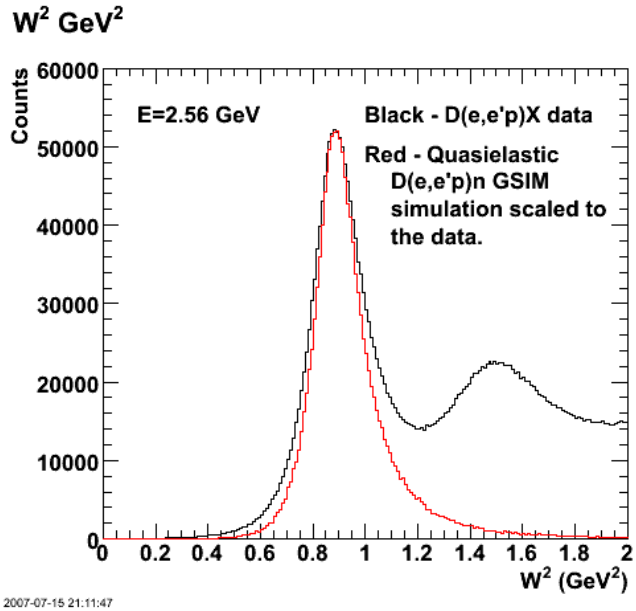


Fig 3. Comparison of the width of the W2 distribution for the measured D(e,e'p)X reaction (black histogram) and a GSIM simulation of the quasielastic D(e,e'p)n reaction (red histogram scaled to the data).

Click here to view the object (ROOT macro for fig 2) you uploaded.

Click here to view the object (ROOT macro for fig 3 from input files.) you uploaded.

Click here to view the object (gzipped tar file with inputs for previous ROOT macro) you uploaded.

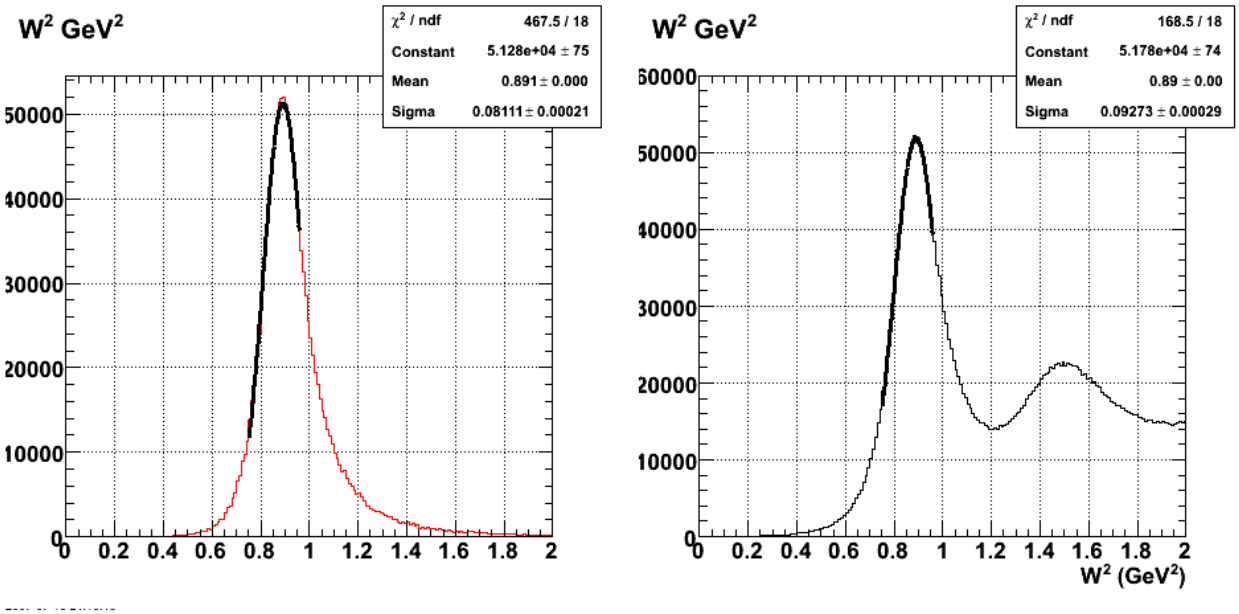
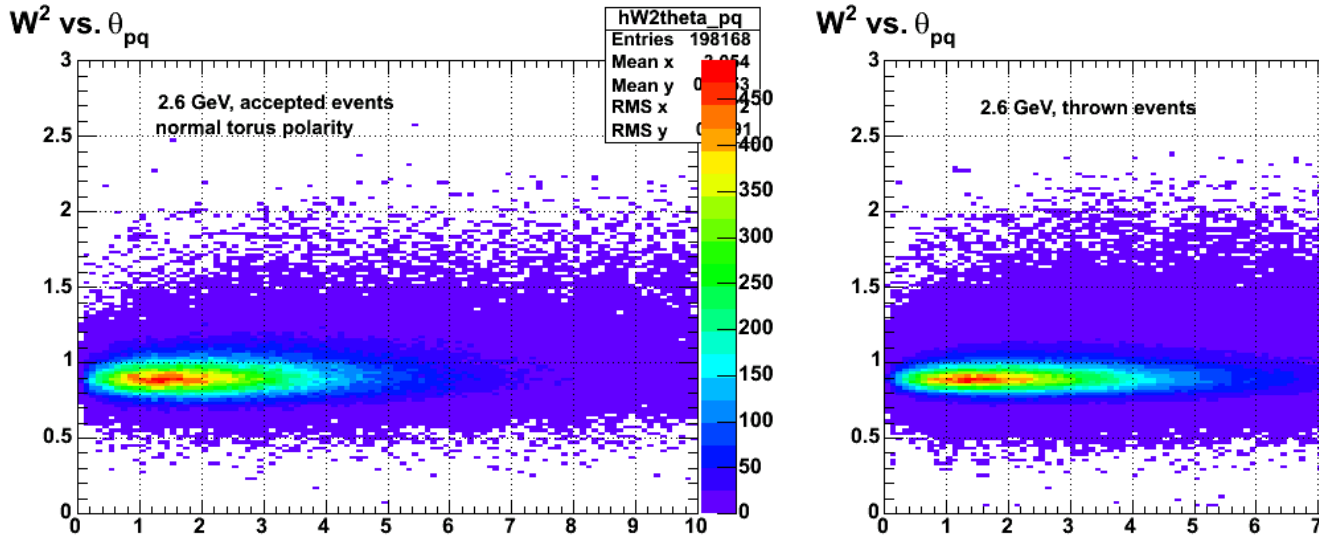


Fig 4. Gaussian fits to the data (right-hand panel, black histogram), and the GSIM calculation (left-hand panel, red histogram) at 2.6 GeV.

Click here to view the object (ROOT macro for fig 4) you uploaded.



W2 vs. theta_pq for 2.6 GeV, normal polarity. This is for theta_pq in the lab.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tar archive of evnt and part banks) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 186 - Getting the inelastic background (gpg)

[Modified Wed Jul 18 02:16:56 2007 (GMT) gpg]

Below are some efforts to fit the inelastic background in hopes of subtracting it out to get the quasielastic production.

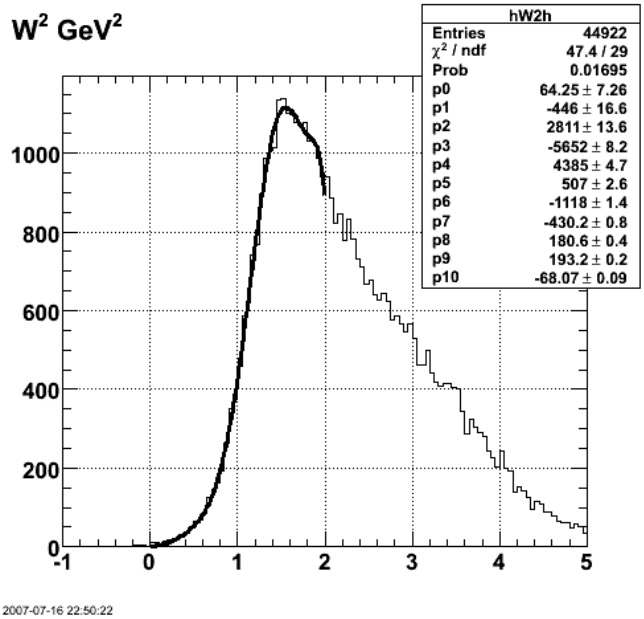


Fig 1. Using a really big polynomial doesn't do a great job.

Click here to view the object (ROOT macro fir fig 1.) you uploaded.

Click here to view the object (tar archive of input files for fig 1 from entry 170, second archive.) you uploaded.

Another attempt with the following function.

```
Double_t f10(Double_t *x,Double_t *par)
{
Double_t arg = 0, fitval, delta;

arg = x[0];

// delta = arg - par[0];
// fitval = par[1]*delta + par[2]*pow(delta,2) + par[3]*pow(delta,3) + par[4]*pow(delta,4) +
//                        par[5]*pow(delta,5) + par[6]*pow(delta,6);

// change the form to force the function to be zero at W2=0.0 like the simulation.

// fitval = par[0]*pow(arg,par[1])*exp(-par[2]*(arg-par[3])) + par[4]*pow(arg,par[5]) +
//          par[6]*exp(-pow(arg - par[7],2)*par[8]);

fitval = par[0]*pow(arg,par[1])*exp(-par[2]*(arg-par[3])) + par[4]*pow(arg,par[5]);

return fitval;
}
```

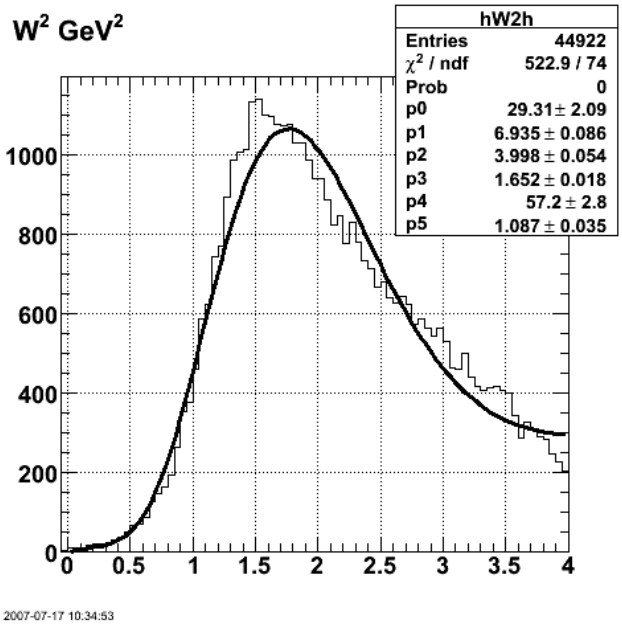


Fig 2. Use the exponentional function above. See log-07-jul-17.

Click here to view the object (tar archive of run 1 from submit_gmnsim.pl 30000 520000 1) you uploaded.

Click here to view the object (tar archive of run 2 from submit_gmnsim.pl 60000 1040000 1) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 187 - Extracting QE sum (Jerry Gilfoyle)

[Modified Tue Jul 24 21:11:36 2007 (GMT) Jerry Gilfoyle]

In preparation for the PAC talk, I am investigating ways to subtract the inelastic background under the QE peak or fit the QE peak. Summary so far:

1. Used a MM2 cut to separate QE and inelastic events. Fitted the low W2 end of the inelastic spectrum to characterize the shape of the background. Fitted the full range of the W2 spectrum for the QE spectrum. Took these two curves and then used a single scale factor multiplying each curve to fit the W2 spectrum for eD->epX. See entry 180 for more details and log-07-jun-11. This worked for protons at the 1.5% level. I don't know what is the statistical uncertainty for the QE peak.
2. Do a large-statistics run to see if we can reduce the uncertainty. Also, if I try to fit the inelastic spectrum up to higher W2 than in entry 180, I fail to get a good fit. Try just using the spectrum itself as the 'curve'. I screwed up and set the MM2 cut range too large (MM2 < 1.2 GeV2) so I have to redo the large-statistics run. Damn!! The plot below shows the MM2 spectrum with an approximate theta_pq cut on it (actually used a projection on the MM2-p_m plot and guessed where the QE cut should go).

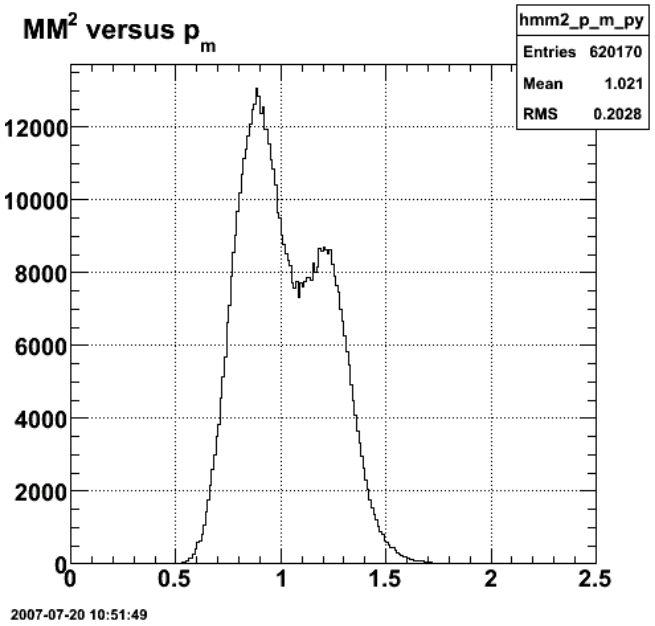
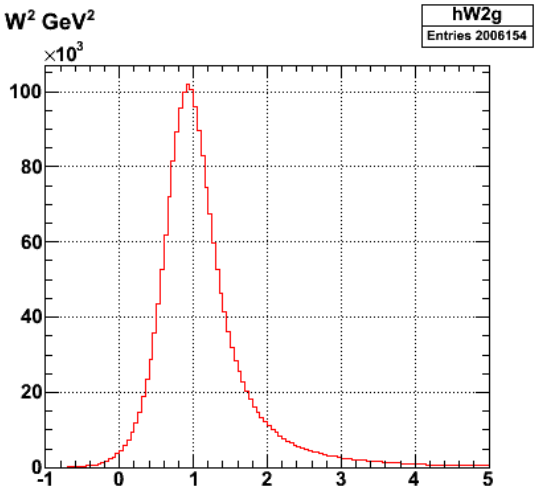
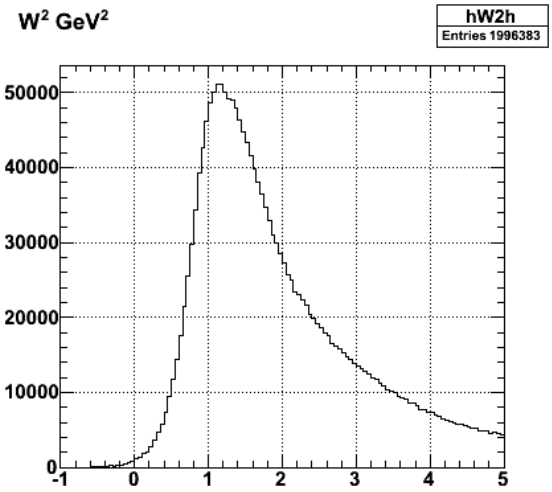
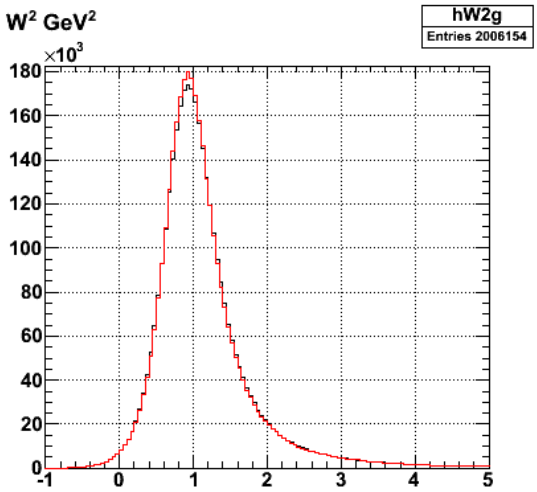


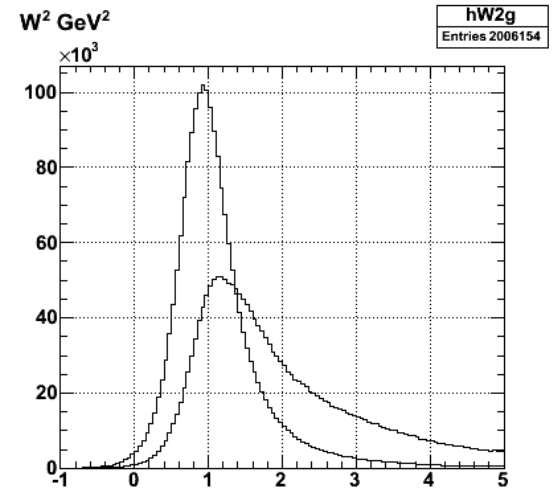
Fig 1. Missing mass squared spectrum.

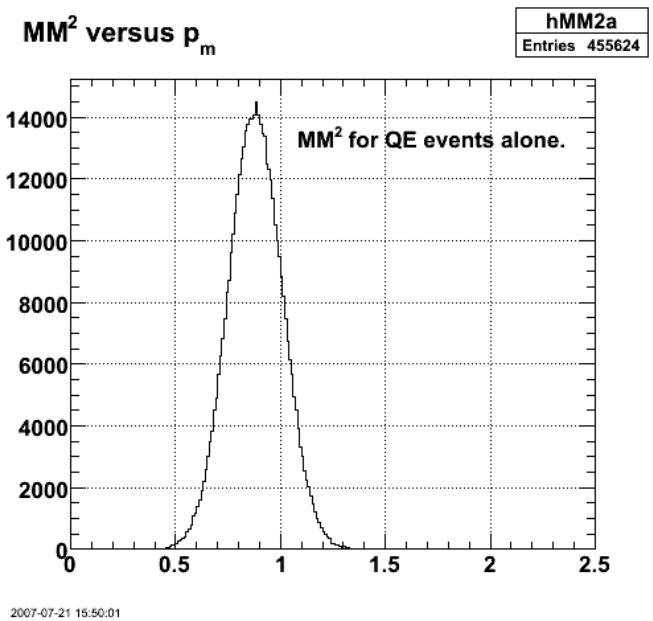
3. Compare entries 178 and 182 and 183 to see the effect of shrinking theta_pq to reduce the background in the W2 spectrum under the QE neutrons.











2007-07-21 15:50:01

Fig 3. Shows the problem with the MM2 cut. The MM2 distribution is very wide so the cut I'm using throws out lots of events especially at high W2

so the W2 distribution with the cut is significantly different from the one in the uncut W2 distribution.

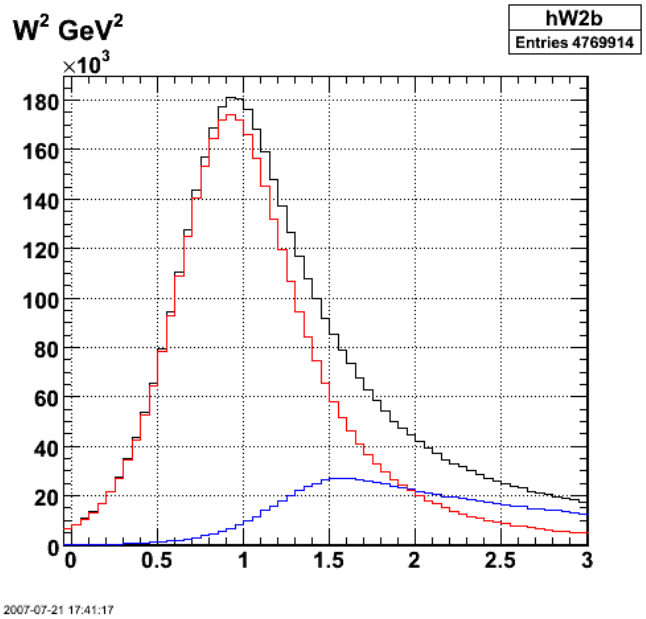


Fig 4. Realistic statistics for Q2 = 6-7 GeV2, theta_pq cut = 3 deg.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (gzipped tar file of histograms.) you uploaded.

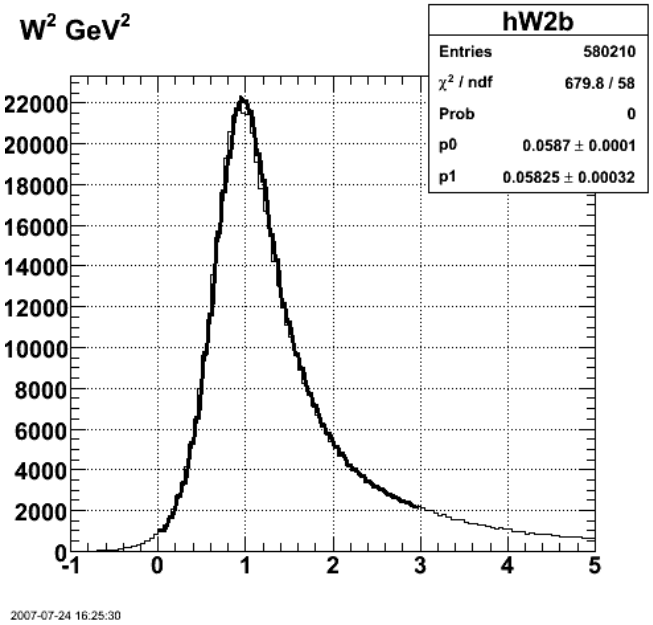


Fig 5. Fit of the individual, high-stats QE and IN W2 spectra to a low-stats run.

Click here to view the object (ROOT macro) you uploaded.

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Jerry Gilfoyle's Enotebook page 188 - PAC talk (gpg)

[Modified Fri Jul 27 18:50:41 2007 (GMT) gpg]

PAC talk (7/27/07 14:50).

Click here to view the object (reduced version) you uploaded.

Click here to view the object (talk1) you uploaded.

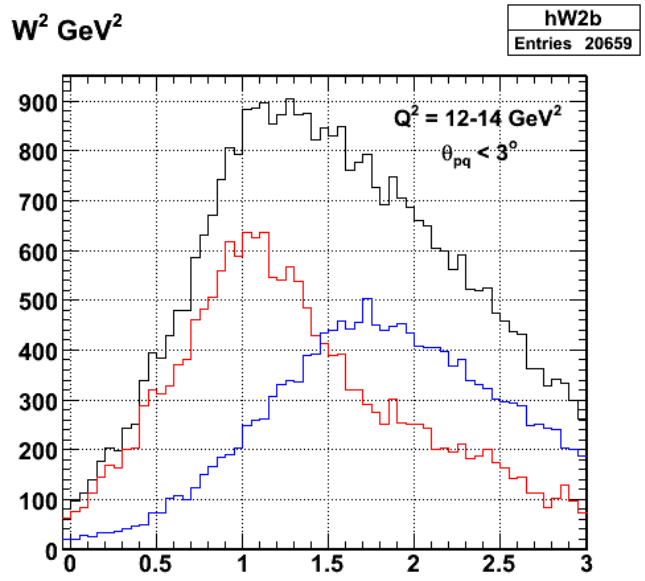
DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 189 - Q2=12-14 GeV2 (gpg)

[Modified Fri Aug 3 18:18:01 2007 (GMT) gpg]

To see the limits I am looking at the separation of the QE from the background at the last Q2 bin. Done with the following command.

```
submit_gmnsim.pl 7000 40000 1
```

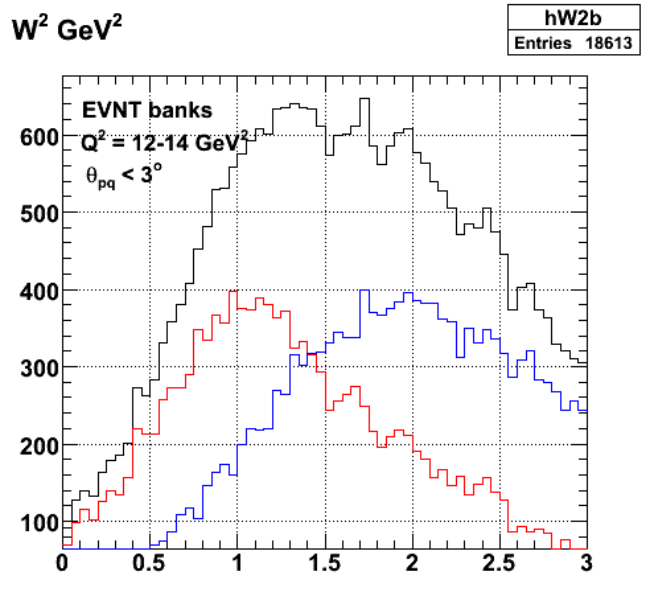


2007-07-29 22:07:52

Fi g1. W2 comparison for QE (red), inelastic (blue) and toal (black) for Q2=12-14 GeV2 from PART banks.

Click here to view the object (ROOT macro for figs 1-2) you uploaded.

Click here to view the object (tar archive with inputs for fig 1) you uploaded.



2007-07-29 22:22:28

Fig 2. Same as fig 1 for evnt bank.

Click here to view the object (ROOT macro) you uploaded.

Now reduce the theta_pq limit from 3 deg to 1.5 deg.

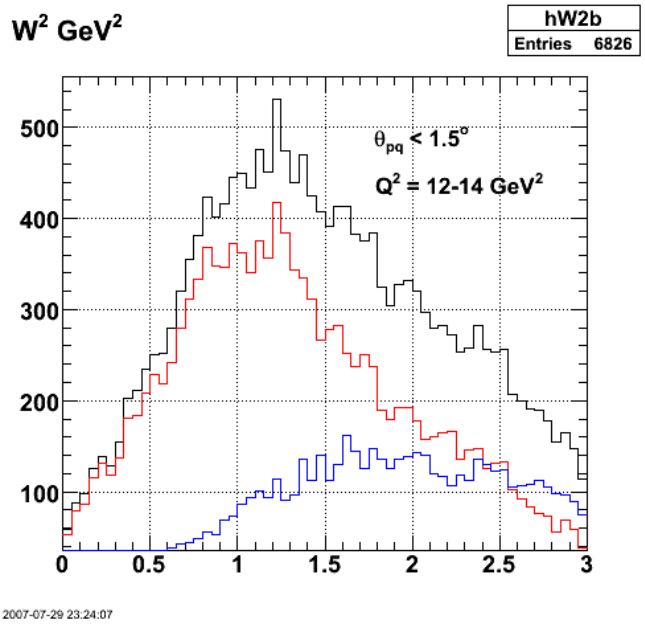


Fig 3. Same as fig 2 for theta_pq < 1.5 deg.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tar archive for fig 3) you uploaded.

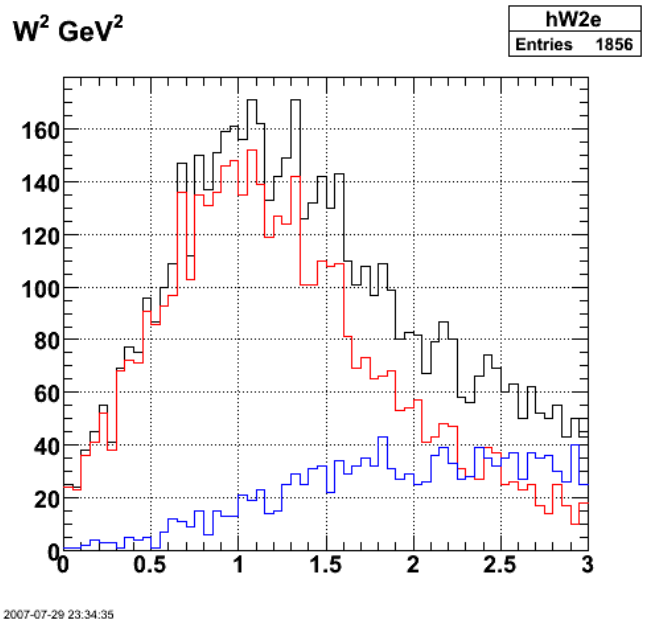


Fig 4. Same as figure 3 for neutrons.

Click here to view the object (ROOT macro) you uploaded.

Now set theta_pq < 1 deg.

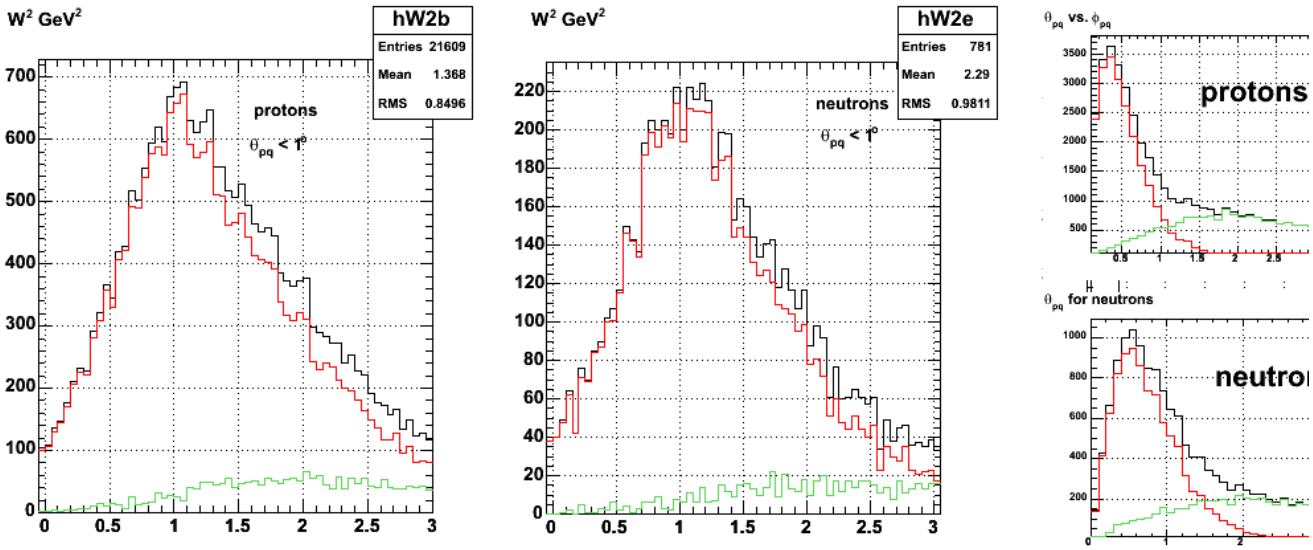


Fig 5. Effect of lowering theta_pq cut to theta_pq < 1 deg. Compare with figs 1-4

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tar archive for fig 5) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 190 - W2 cut effect (gpg)

[Modified Mon Jul 30 17:17:00 2007 (GMT) gpg]

A study of the effect of changing the W2 cut in the QE event selection on the ratio of neutron to protone vents (e-n/e-p).

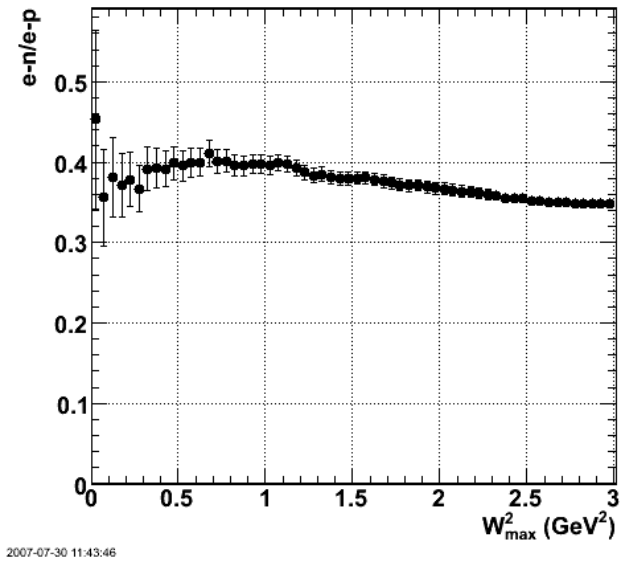


Fig 1. Ratio of e-n/e-p events from FASTMC for Q2=12-14 GeV2 and E=11 GeV.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tar archive for fig 1) you uploaded.

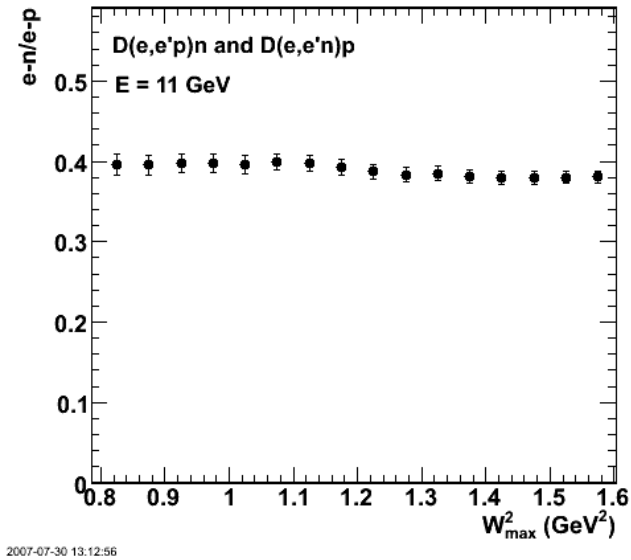


Fig 2. Same as fig 1 focused on the central region of the W2 peak.

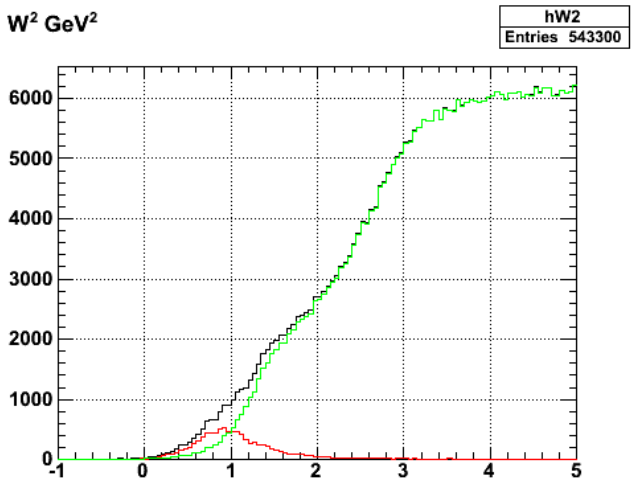
Click here to view the object (W2limit.C ROOT macro for figs 1-2) you uploaded.

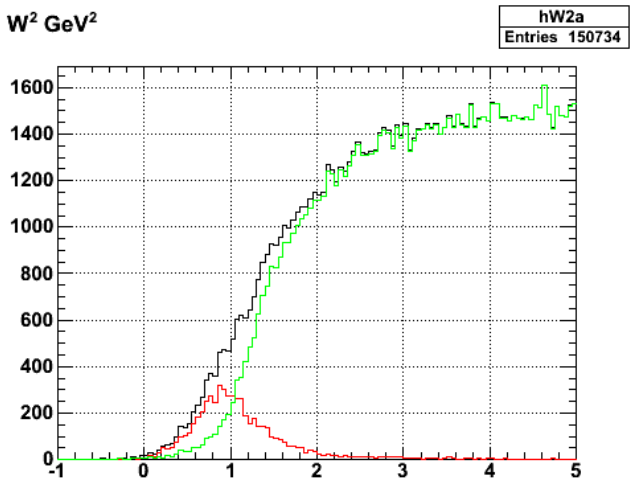
DOE 2000 Electronic Notebook

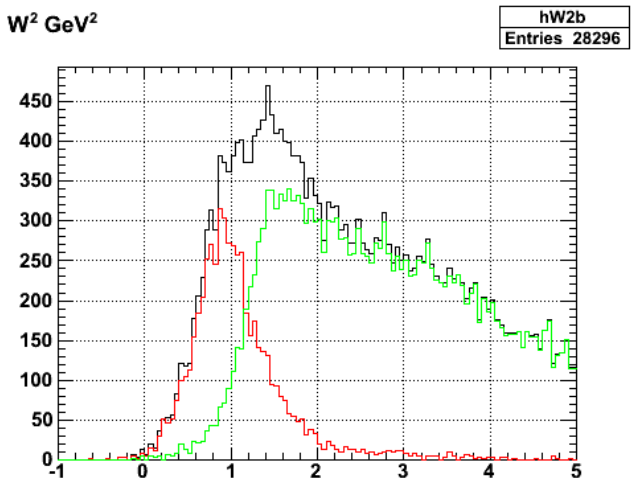
Jerry Gilfoyle's Enotebook page 191 - VK plot (gpg)

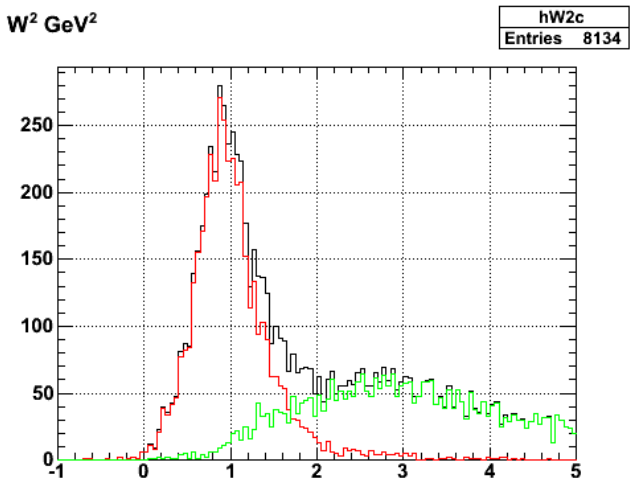
[Modified Sun Aug 5 17:15:16 2007 (GMT) gpg]

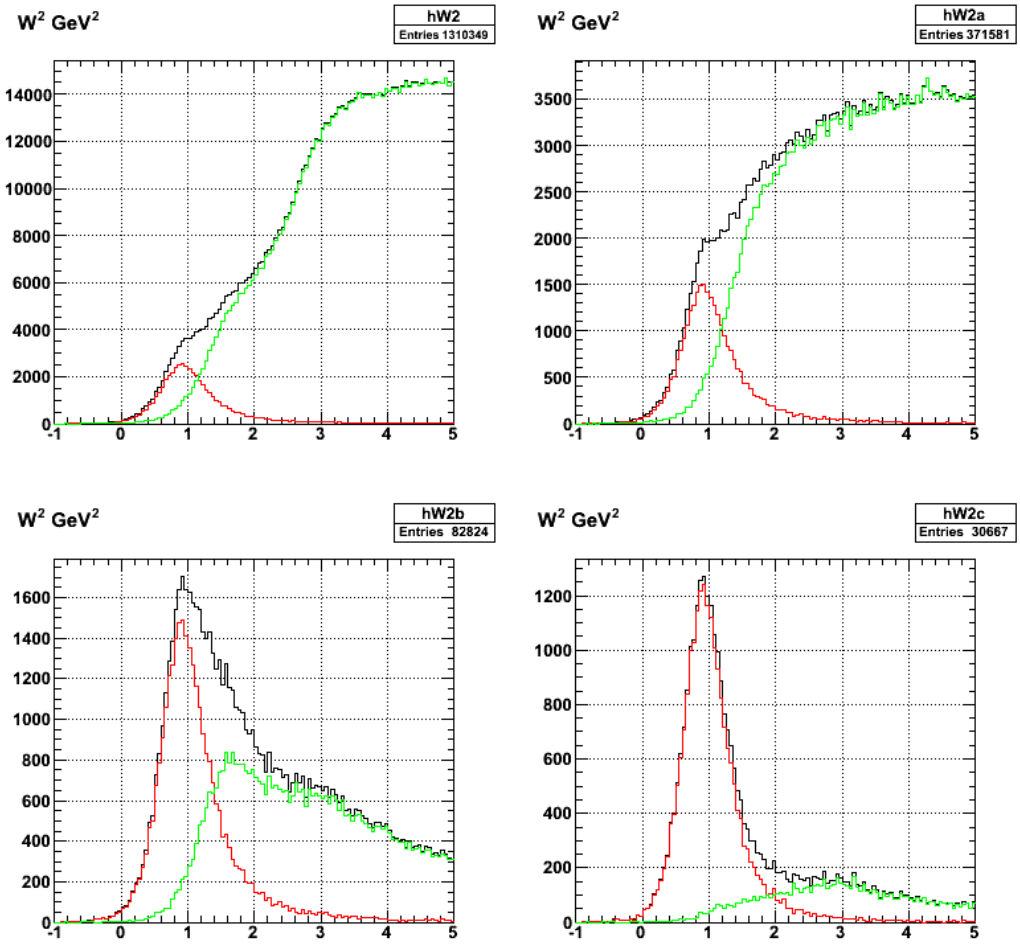
VK plot.





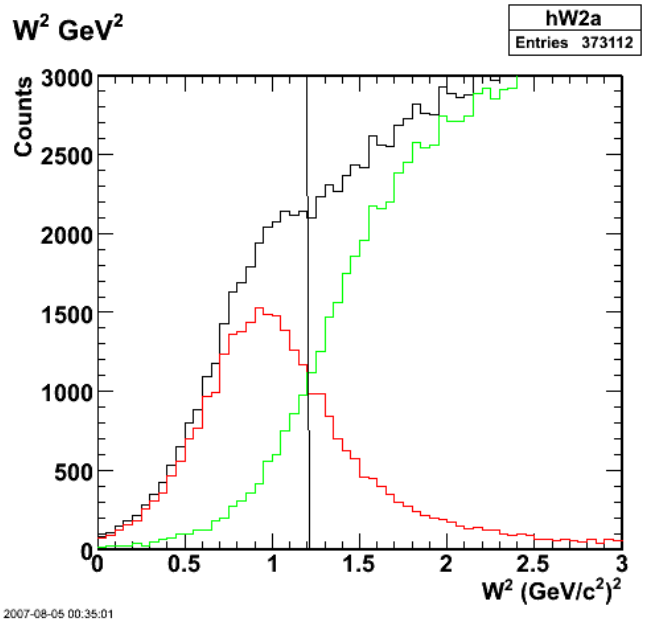






same as above for > submit_gmnsim.pl 16000 125000 1

Click here to view the object (ROOT macro) you uploaded.

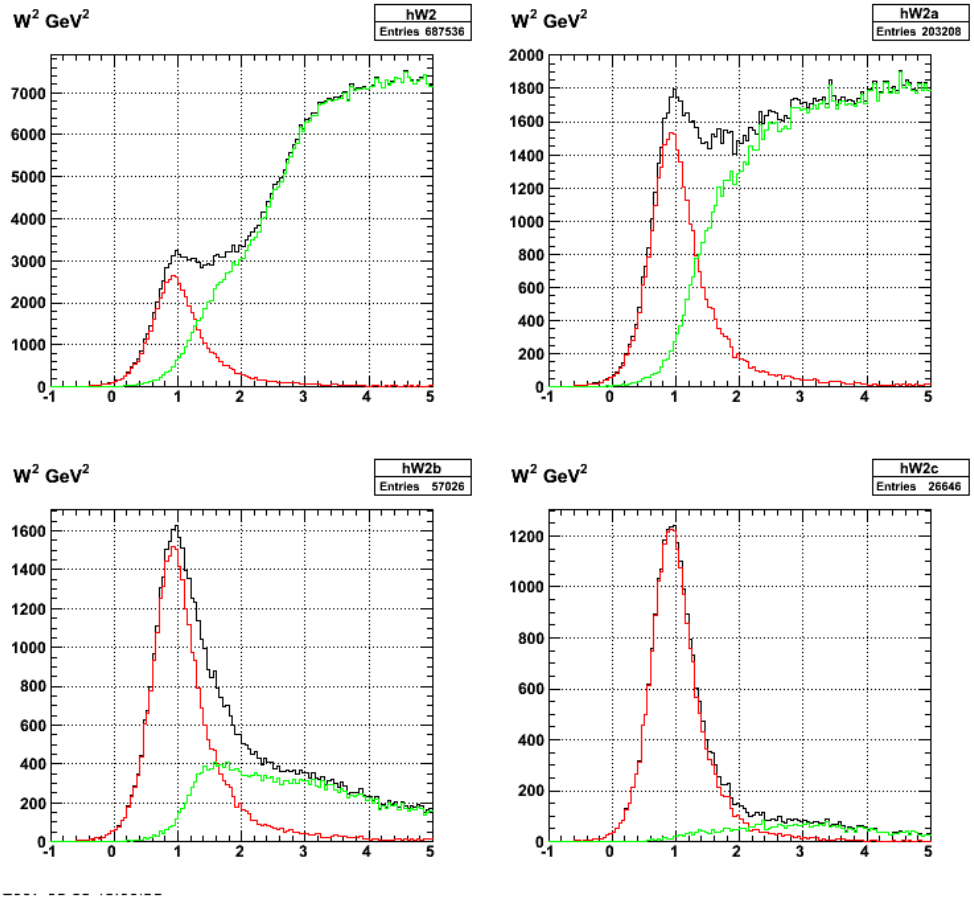


Final VK plot.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tar archive) you uploaded.

Played around some more with the ratio of QE to IN, but the previous result is the correct one.



Same as above using submit_gmnsim.pl 16600 63000 1

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tar archive) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 192 - GMn review question 6 (gpg)

[Modified Sat Aug 18 02:43:44 2007 (GMT) gpg]

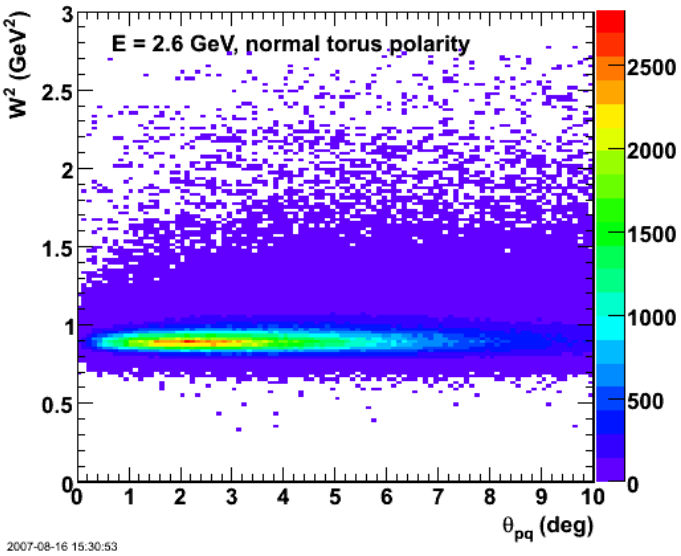


Fig. E = 2.6 GeV, normal polarity QE events only

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (ROOT histogram file for fig 1) you uploaded.

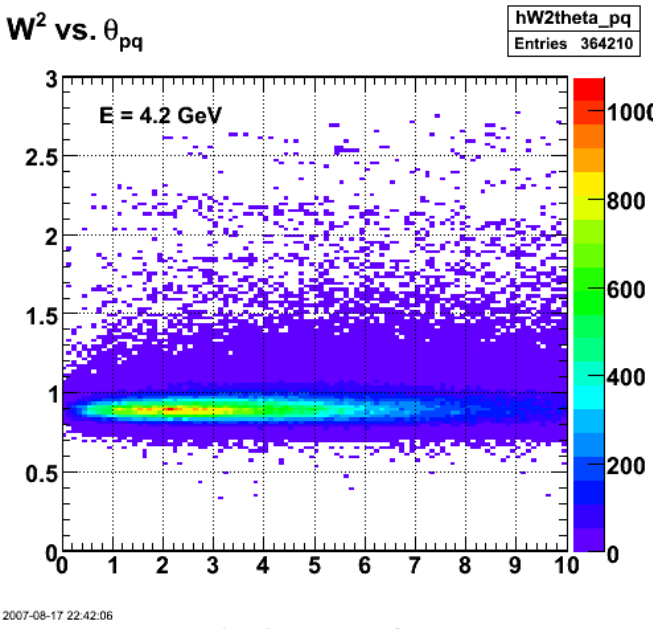


Fig 2. Same as fig 1 for 4.2 GeV with Q2=0.1-0.5 GeV2

Click here to view the object (ROOT histogram file for fig 2) you uploaded.

Click here to view the object (OOT histogram file for fig 2) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 193 - rate issue (gpg)

[Modified Wed Oct 3 15:07:48 2007 (GMT) gpg]

Below is a comparison of the cross section calculation between Jeff amd me. See entry 386 in the E5 elog for more details.

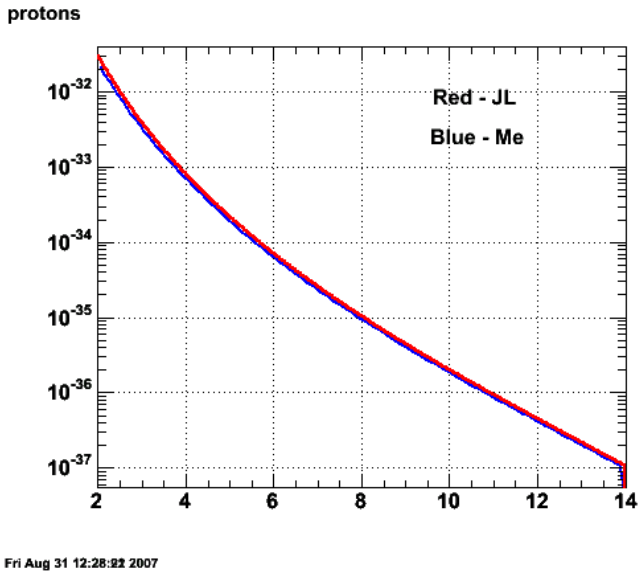


Fig 1. Comparison of JL calculation of the cross section with what is in the Mathematica notebook.

Click here to view the object (ROOT macor for fig 1) you uploaded.

Plots of effect of the disaster.

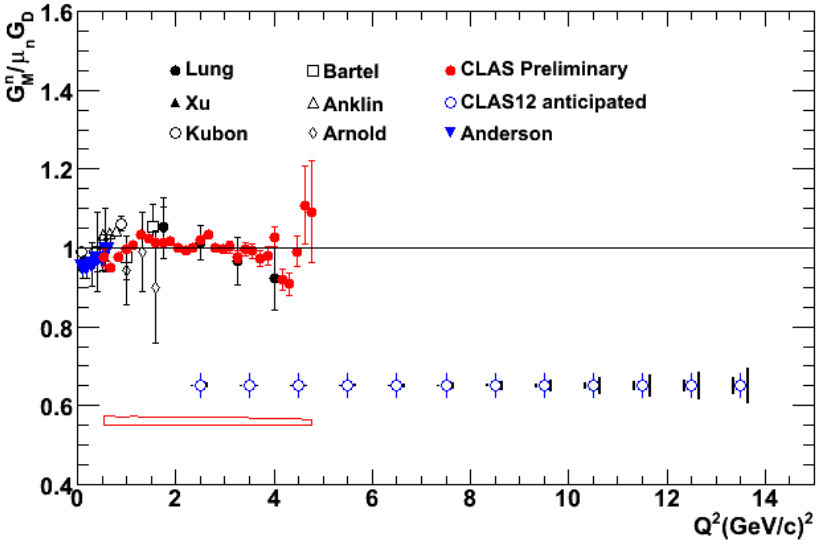


Fig 2. Plot of anticipated GMn12 data with statistical errors before (left) and after (right) the correction.

Click here to view the object (ROOT macro for fig 2) you uploaded.

Click here to view the object (Mathematica notebook for corrected run stats.) you uploaded.

Click here to view the object (tar archive of inputs for fig 2.) you uploaded.

In Fig 2 I forgot to include the factor of one-half because GMn is proportional to the square root of the e-n/e-p ratio. When I include that things look acceptable.

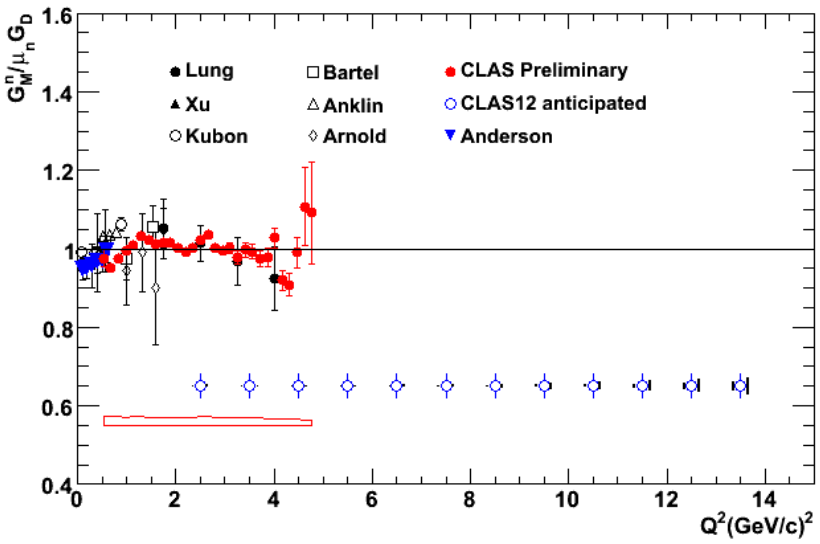


Fig 3. Plot of anticipated GMn12 data with statistical errors before (left) and after (right) the correction. Include the effect of taking the square root of the e-n/e-p ratio to extract GMn.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (revised ROOT macro for Fig 3. See fig 2 for inputs.) you uploaded.

My numbers

Q	proton %uncertainty	neutron %uncertainty	%uncertainty in ratio	%uncertainty in GMn	R	ΔR/R
2.5	0.0018111319836199384	0.0028316462726597816	0.0033613121954913874	0.0016806560977456935	0.40909314176033174	0.0033613121954913874
3.5	0.0008755879049246007	0.0013418322806376033	0.001602238449361194	0.000801119224680597	0.4257974305536943	0.001602238449361194
4.5	0.0012726849648807342	0.0019283508554217134	0.0023104683597572006	0.0011552341798786003	0.43558179209254777	0.0023104683597572006
5.5	0.001957399394076074	0.0029440006517583097	0.0035353291537681087	0.0017676645768840544	0.4420619096658019	0.003535329153768109
6.5	0.0031048930305215985	0.004645458105293922	0.005587543446647527 5	0.0027937717233237637	0.446720816867058	0.005587543446647527 5
7.5	0.0046506558343782 01	0.0069306635128453 53	0.008346418178962 87	0.004173209089481435	0.4502759740061804	0.008346418178962 87
8.5	0.0066606804599731294	0.009894962640245317	0.011927906347792911	0.0059639531738964555	0.4531154606944949	0.011927906347779291
9.5	0.009203817994663303	0.013637656652750 67	0.016452840017976 74	0.008226420008989 37	0.4554666044408988	0.016452840017978736
10.5	0.012349124306528557	0.018258058518755508	0.022042177115983 69	0.011021088557991846	0.4574705435292815 7	0.022042177115983 69
11.5	0.016164217526115607	0.023853105012816202	0.028814103265311253	0.014407051632655625	0.4592186546375 81	0.028814103265311 253
12.5	0.020713179832768058	0.030514327286244383	0.036880346914266 25	0.018440173457133124	0.4607718634433 66685	0.036880346914266 25
13.5	0.026053782972148 21	0.038323861544839 31	0.046341320340143 67	0.023170660170071834	0.4621713896502677	0.046341320340143 66

Q	proton %error	neutron %error	%error in ratio	%error in GMn
2.5	0.0018111	0.0028316	0.0033613	0.0016807
3.5	0.0008756	0.0013418	0.0016022	0.0008011
4.5	0.0012727	0.0019284	0.0023105	0.0011552
5.5	0.0019574	0.0029440	0.0035353	0.0017676
6.5	0.0031049	0.0046455	0.0055875	0.0027938
7.5	0.0046507	0.0069307	0.0083464	0.0041732
8.5	0.0066607	0.0098950	0.0119279	0.0059640
9.5	0.0092038	0.0136377	0.0164528	0.0082264
10.5	0.0123491	0.0182581	0.0220422	0.0110211
11.5	0.0161642	0.0238531	0.0288141	0.0144071
12.5	0.0207132	0.0305143	0.0368803	0.0184402
13.5	0.0260538	0.0383239	0.0463413	0.0231707

Q	σ(b) protons	σ(b) neutrons	θ (deg)	2πσΔcosθ protons	2πσΔcosθ neutrons	proton rate
2.5	1.0034206507675168e-8	4.1049250652968e-9	8.792620086723062	3.3739993395393314e-10	1.3802799901094293e-10	16.869996697696656
3.5	1.6944344213899 71e-9	7.2148582286958 53e-10	10.707306491941003	6.38107986856562e-11	2.7170474121931467e-11	3.19053993428281
4.5	4.063865803754162e-10	1.77014594962286e-10	12.517400308650656	1.7257381848421384e-11	7.517001312360792e-12	0.8628690924210692
5.5	1.212906322087076e-10	5.3617968498753696e-11	14.295987775165354	5.8528405235868656e-12	2.5873178588262016e-12	0.29264202617934326
6.5	4.1993611962704507e-11	1.8759420639177616e-11	16.09155552902746	2.3228507768752544e-12	1.0376657965059939e-12	0.11614253884376272
7.5	1.6165782366678317e-11	7.279063400728016e-12	17.943678698290498	1.0353476324015233e-12	4.661921636145888e-13	0.051767381620076165
8.5	6.728104592917463e-12	3.0486082122205427e-12	19.89042383908441	5.047512449366 46e-13	2.287105928855881e-13	0.025237562246832296
9.5	2.9674581135887285e-12	1.3515780708168534e-12	21.973340883460164	2.6434953664196785e-13	1.2040238583984206e-13	0.01321747683209839
10.5	1.365863859067581e-12	6.248424819946482e-13	24.242297877731854	1.4683928894251592e-13	6.717464932398598e-14	0.007341964447125796
11.5	6.477826138108916e-13	2.9747386742486 26e-13	26.761686687439763	8.570481560892437e-14	3.935725104774771e-14	0.004285240780446218
12.5	3.129098911043542e-13	1.4418007361401427e-13	29.619915641410667	5.219405583540612e-14	2.404955236794721e-14	0.0026097027917703058
13.5	1.5215449456289547e-13	7.03214541936675e-14	32.94565873768762	3.298929351878713e-14	1.5246707629158417e-14	0.0016494646759393564

BQ results.

Q^2	dsig/dom_p	dsig/dom_n	theta	sig*om_p (b)	sig*om_n (b)	rate_p (/s)	rate_n (/s)
2.5	1.008 E - 08	4.042 E - 09	8.8	4.047 E - 10	1.605 E - 10	20.23258	8.02390

3.5	1.701 E - 09	7.131 E - 10	10.7	7.090 E - 11	2.958 E - 11	3.54480	1.47911
4.5	4.080 E - 10	1.754 E - 10	12.5	1.851 E - 11	7.940 E - 12	0.92532	0.39698
5.5	1.218 E - 10	5.325 E - 11	14.3	6.155 E - 12	2.688 E - 12	0.30776	0.13441
6.5	4.215 E - 11	1.866 E - 11	16.1	2.414 E - 12	1.068 E - 12	0.12069	0.05338
7.5	1.623 E - 11	7.249 E - 12	17.9	1.067 E - 12	4.766 E - 13	0.05337	0.02383
8.5	6.752 E - 12	3.039 E - 12	19.9	5.174 E - 13	2.328 E - 13	0.02587	0.01164
9.5	2.978 E - 12	1.348 E - 12	22.0	2.698 E - 13	1.222 E - 13	0.01349	0.00611
10.5	1.370 E - 12	6.238 E - 13	24.2	1.494 E - 13	6.799 E - 14	0.00747	0.00340
11.5	6.499 E - 13	2.972 E - 13	26.8	8.696 E - 14	3.976 E - 14	0.00435	0.00199
12.5	3.139 E - 13	1.441 E - 13	29.6	5.283 E - 14	2.425 E - 14	0.00264	0.00121
13.5	1.526 E - 13	7.031 E - 14	33.0	3.331 E - 14	1.535 E - 14	0.00167	0.00077

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Jerry Gilfoyle's Enotebook page 194 - review committee round 2, question 2 (gpg)

[Modified Wed Oct 10 14:39:55 2007 (GMT) gpg]

Below are some intermediate results for answering question 2 of round 2 of GMn review committee. this is follow-up to WKB stuff in entry 393 of E5 elog.

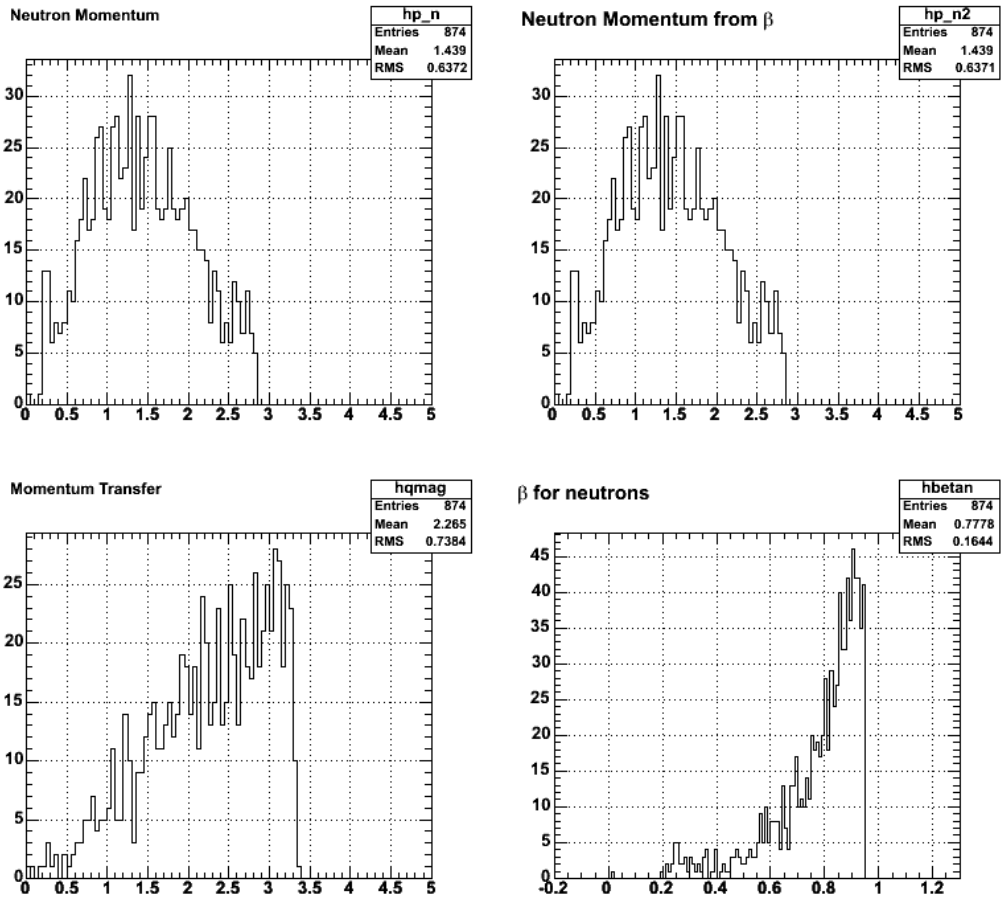

Fig 1. Plot of various momentum and beta spectra. Why is qmag so different from p_n?

Click here to view the object (ROOT macro for fig 1) you uploaded.

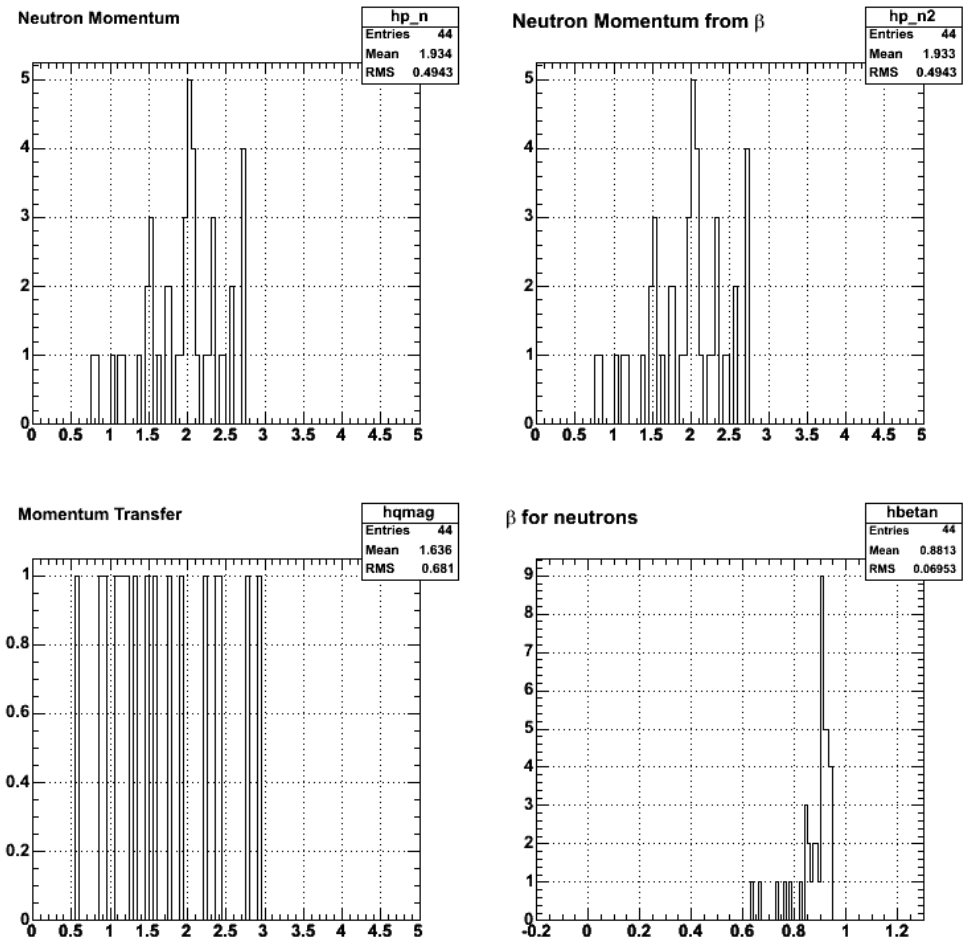

Fig 2. Same as fig 1 with theta_pq cut turned on.

Click here to view the object (ROOT macro for fig 2) you uploaded.

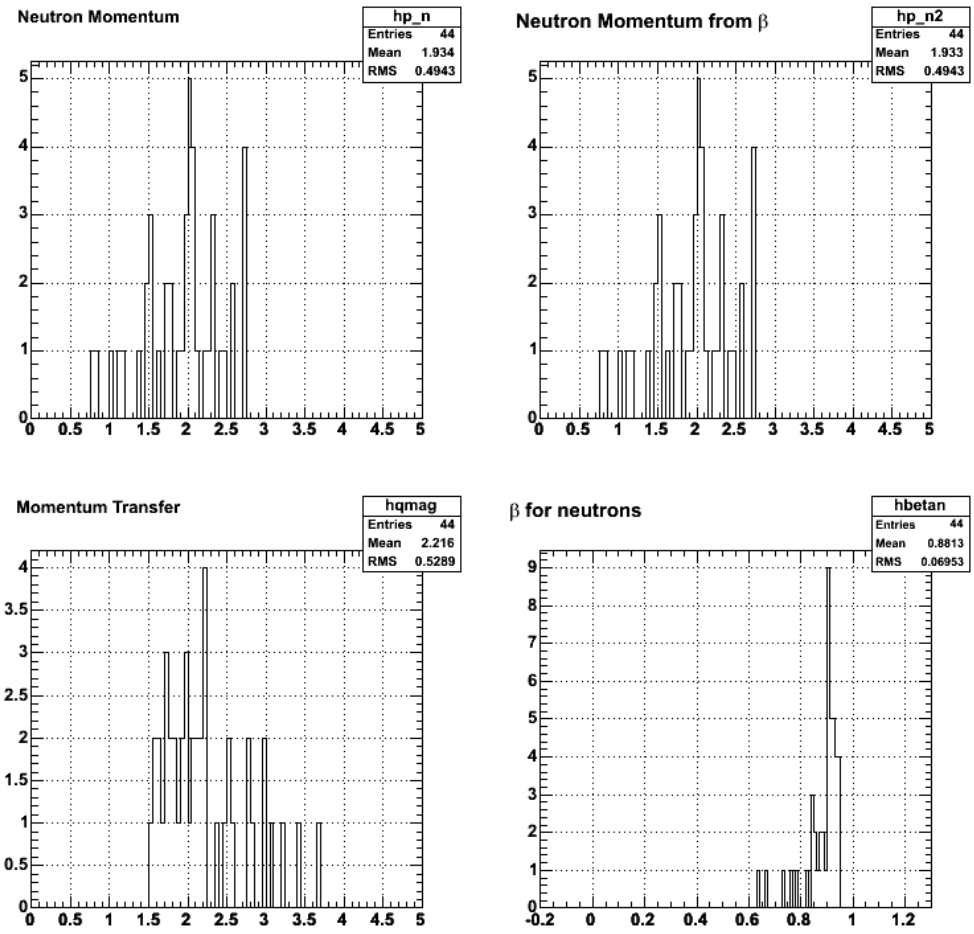

Fig 3. Fix qmag and keep theta_pq cut on.

Click here to view the object (ROOT macro) you uploaded.

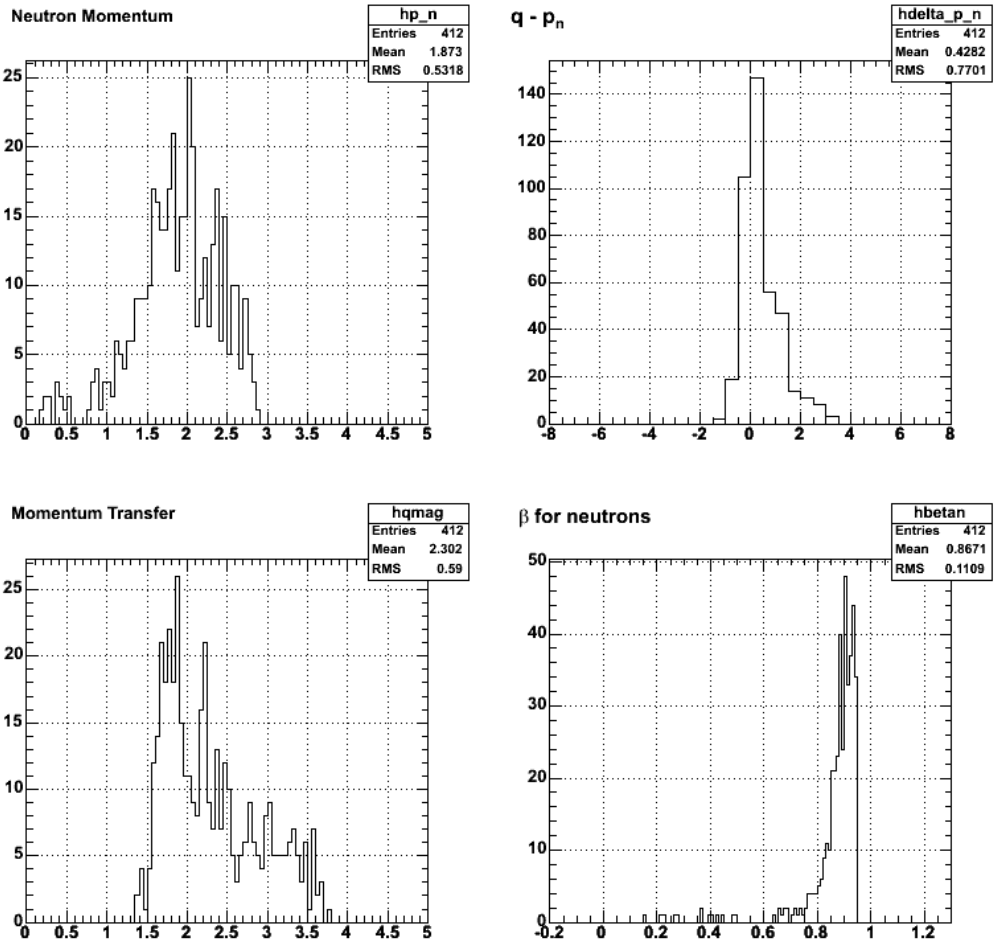

Fig 4. Same as fig 3 with more data.

Click here to view the object (ROOT macro) you uploaded.

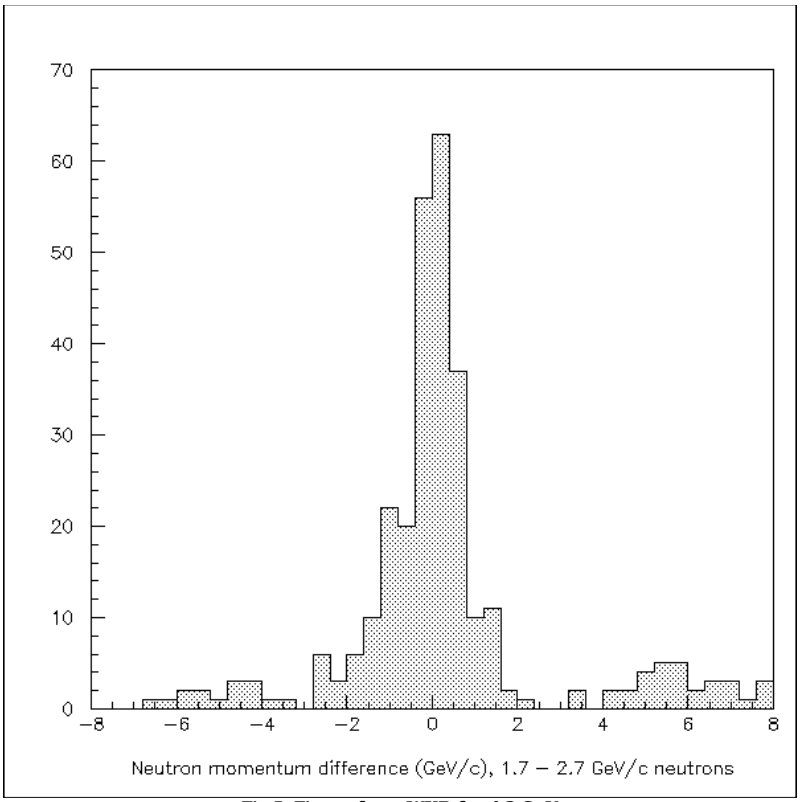

Fig 5. Figure from WKB for 4.2 GeV

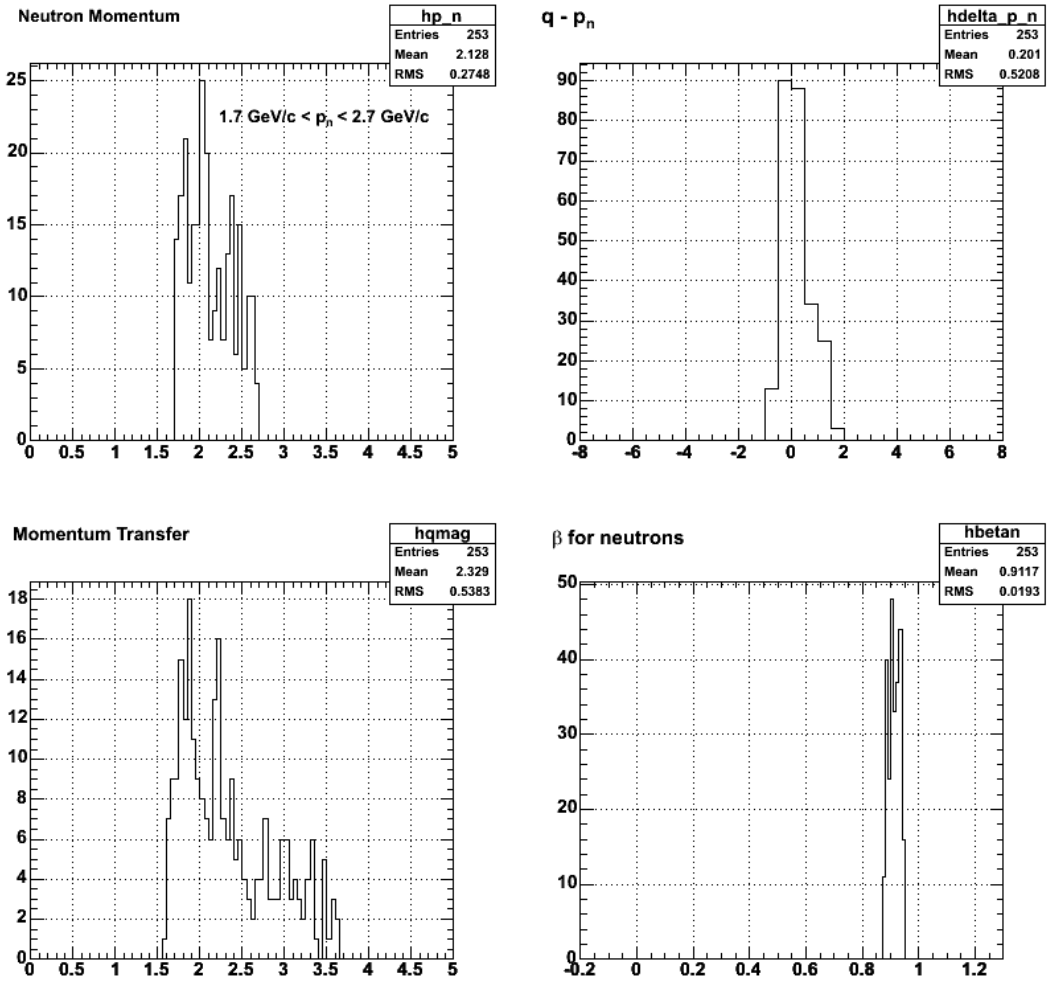

Fig 6. Now put the p_n cut on like will uses.

Click here to view the object (ROOT macro) you uploaded.

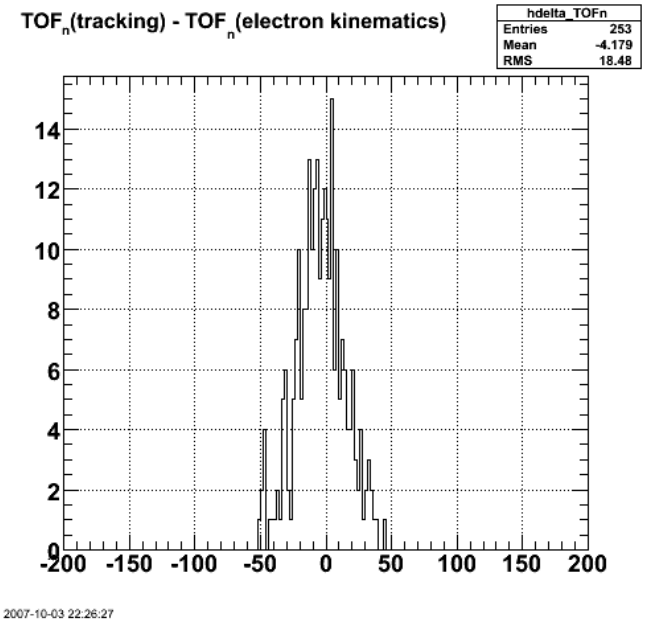

Fig 7. Difference between TOF calculated using beta from tracking and beta for the neutron calculated using the 3-momentum transfer q from the

electron kinematics. Used the path length ec_r for the EC in both cases, theta_pq cut, and resricted 1.7 GeV/c < p_n < 2.7 GeV/c.

Click here to view the object (ROOT macro) you uploaded.

I had turned off a bunch of cuts for use with FASTMC and I forgot to turn them back on for the gmn data analysis. The revised results are in the next figure. The biggest effect now is there are fewer counts.

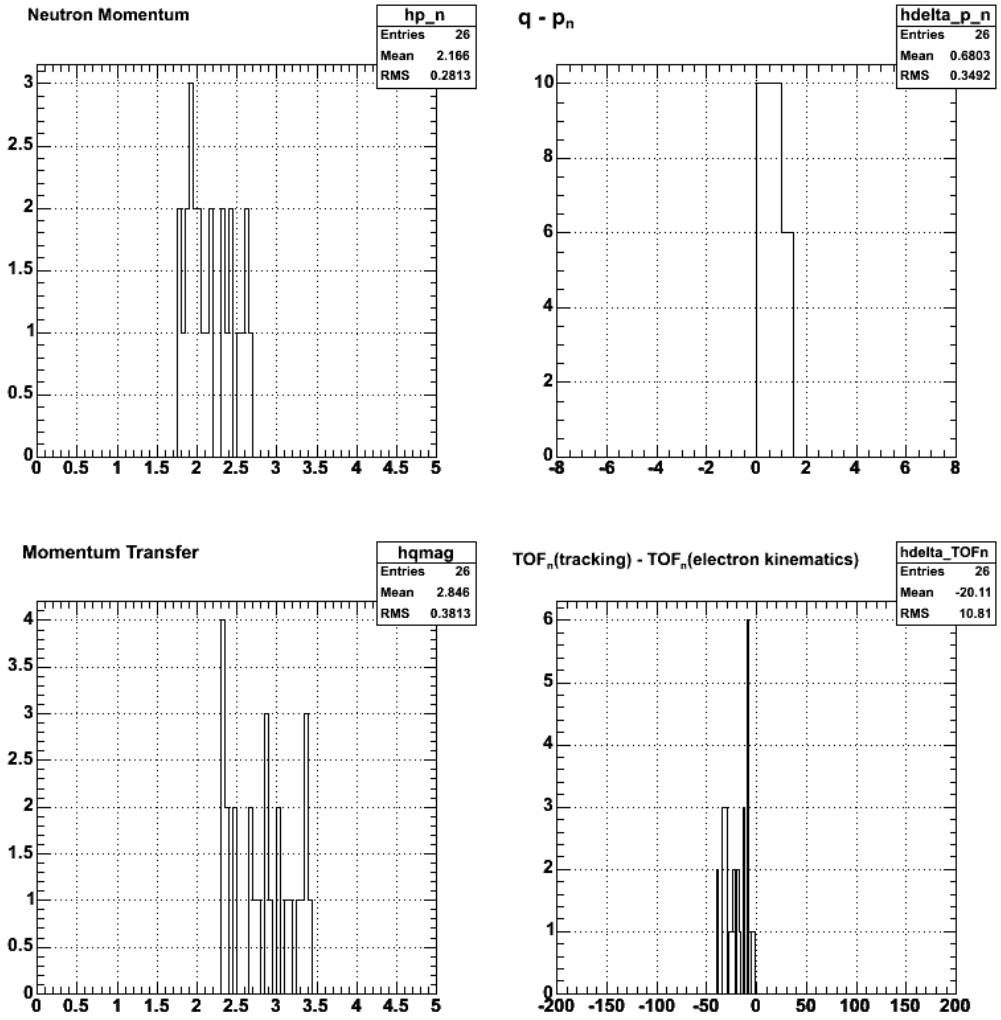

Fig. 8 Same as Fig 7 with all the normal cuts on.

Click here to view the object (ROOT macro) you uploaded.

Now turn off the electron fiducial cuts.

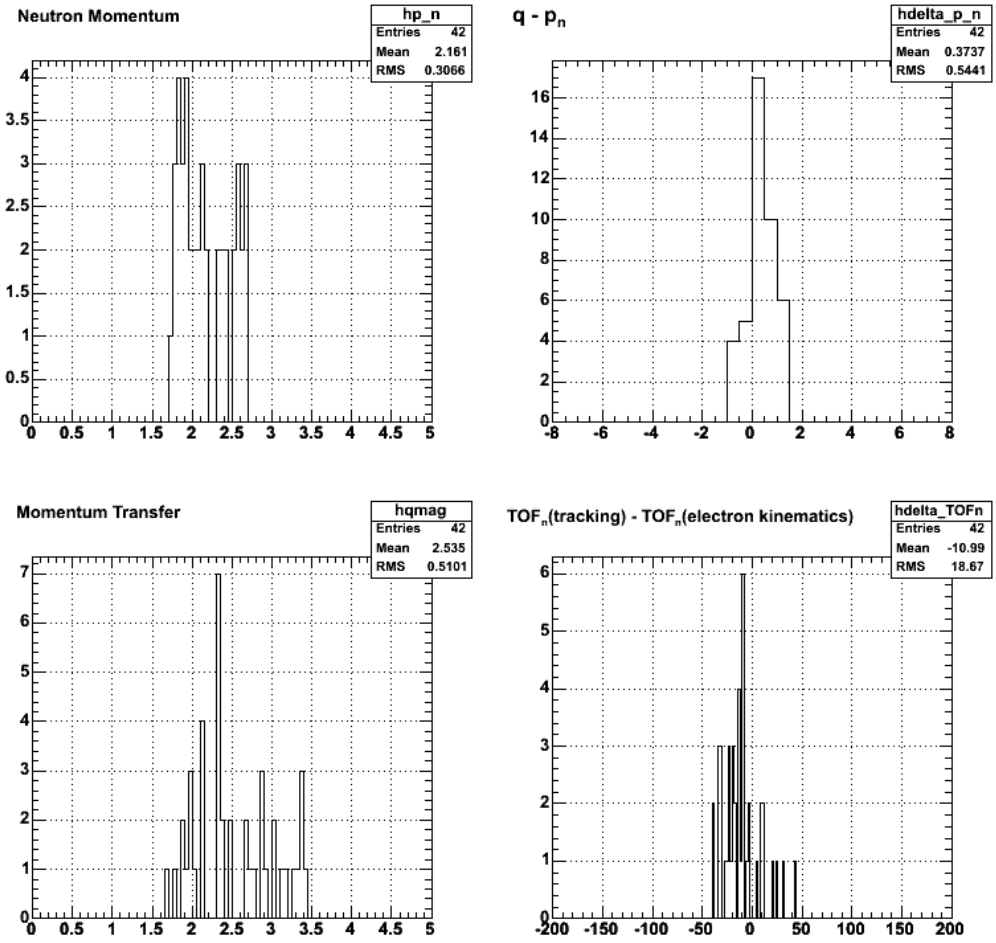

Fig. 9 Same as Fig 8 with the electron fiducial cuts turned off.

Click here to view the object (ROOT macro) you uploaded.

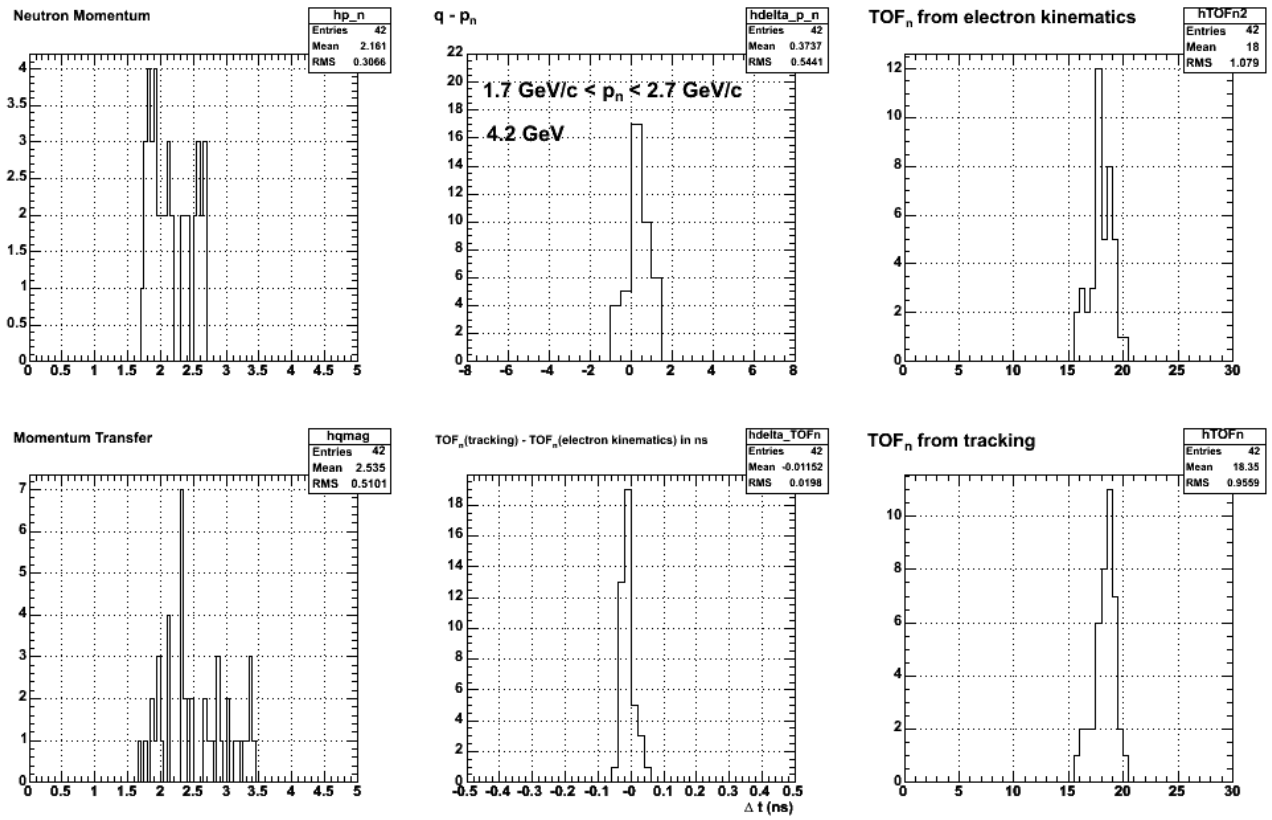

Fig 10. Same as fig 9 with TOF spectra added.

Click here to view the object (ROOT macro) you uploaded.

OK! Fix the stupid mistakes and the delta_TOF spectrum now looks more reasonable with a width comparable to the width in the delta_tof figure in the CAN.

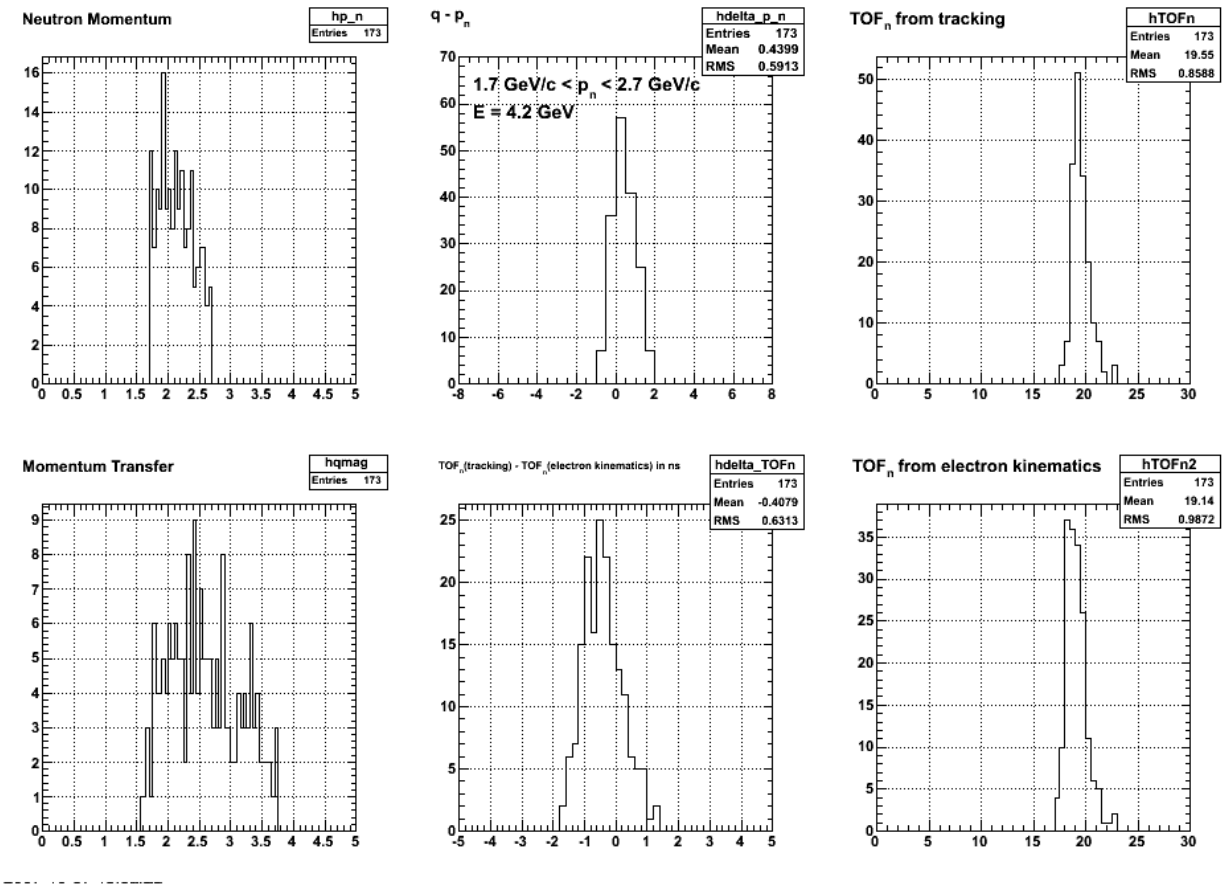

Fig 11. Same as 10 with corrections to scale for delta TOF spectrum.

Click here to view the object (Histogram file) you uploaded.

Click here to view the object (ROOT macro) you uploaded.

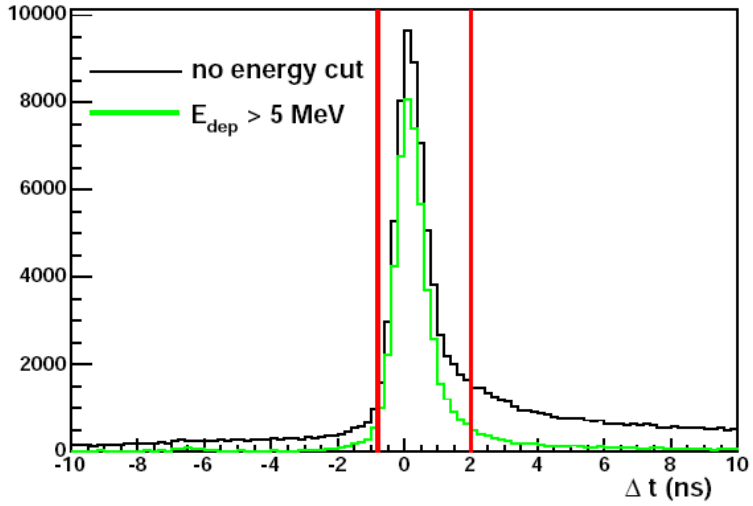

Figure 2.16: The Δt distribution for candidate neutron events in the SC. The black curve shows Δt before application of the E_{dep} cut. The green curve shows Δt after the E_{dep} cut. The cuts applied are shown in red. The data shown are a sample from the 2.5 GeV data set.

Fig 12 delta_TOF for neutrons from the calibration reaction at 2.6 GeV.

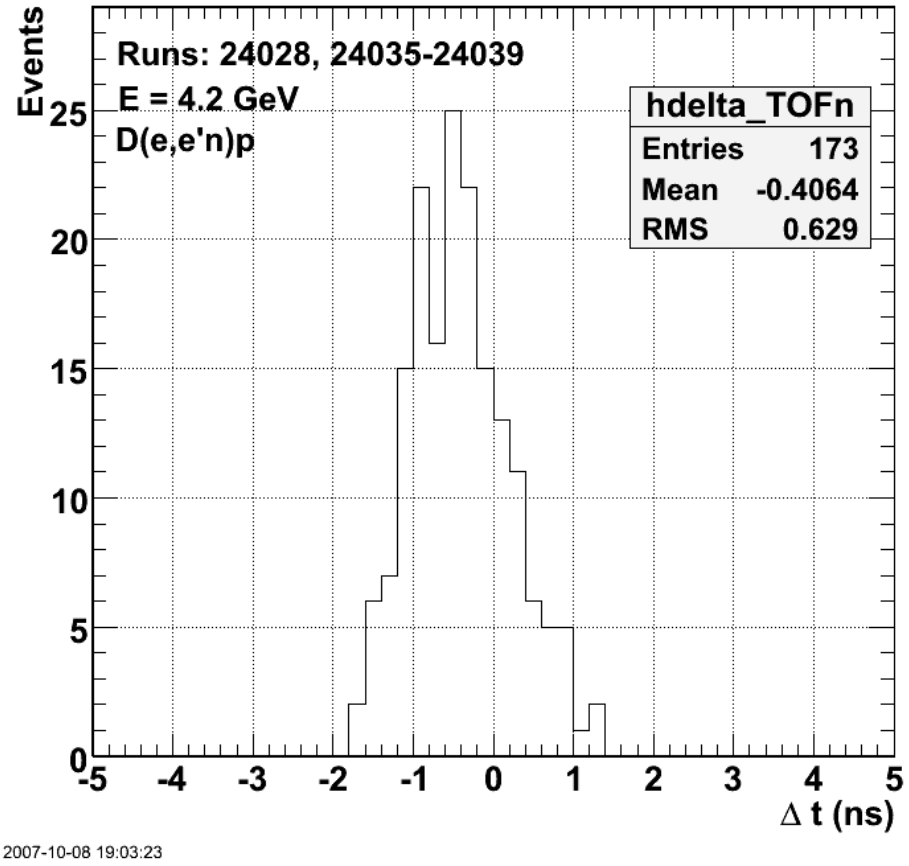

Fig 13. Final 4.2n delta_t plot.

Click here to view the object (ROOT macro) you uploaded.

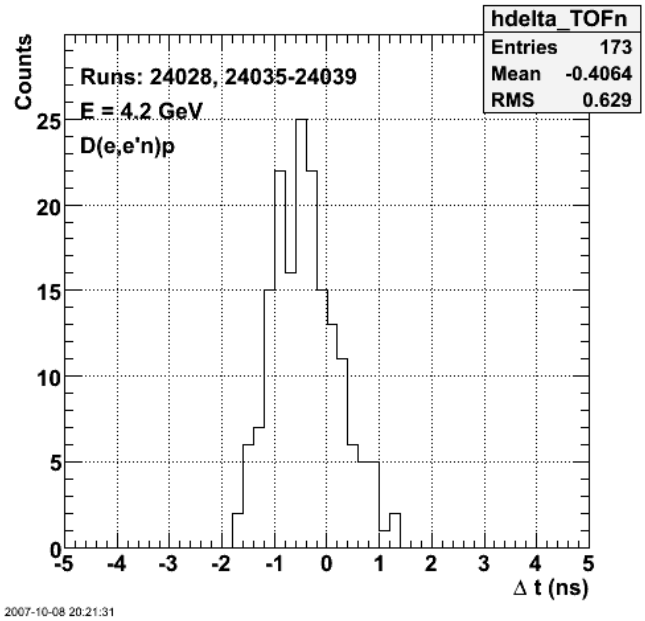

Fig 14. Second final 4.2 n plot.

Click here to view the object (ROOT macro dt4.2n.C) you uploaded.

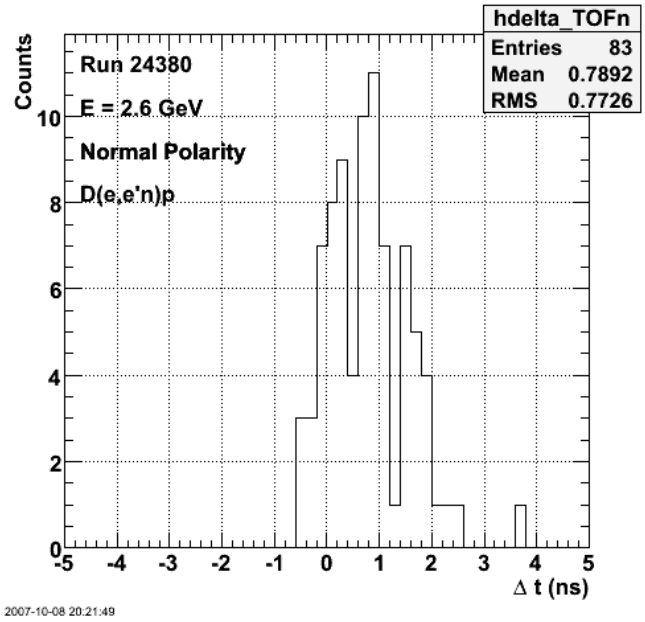

Fig 15. Final (?) 2.6n plot.

Click here to view the object (ROOT macro dt2.6n.C) you uploaded.

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Jerry Gilfoyle's Enotebook page 195 - final delta_t plots (gpg)

[Modified Wed Oct 10 16:04:58 2007 (GMT) gpg]

Final plots of the delta_t spectra including events from EC and SC.

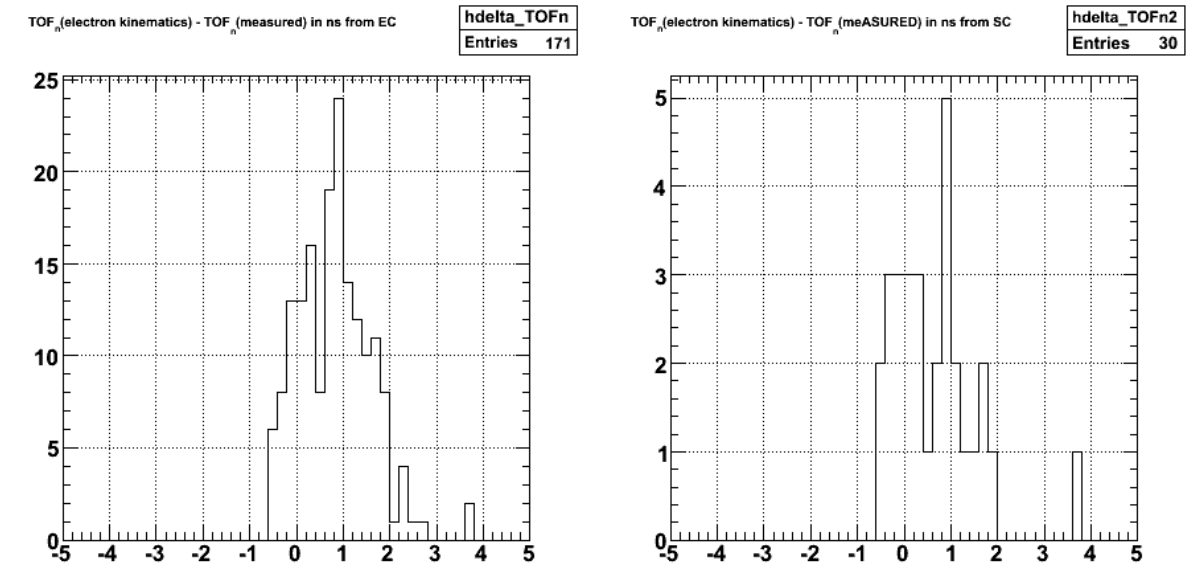

Fig 1. EC (left) and SC (right) results for 2.6 GeV

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

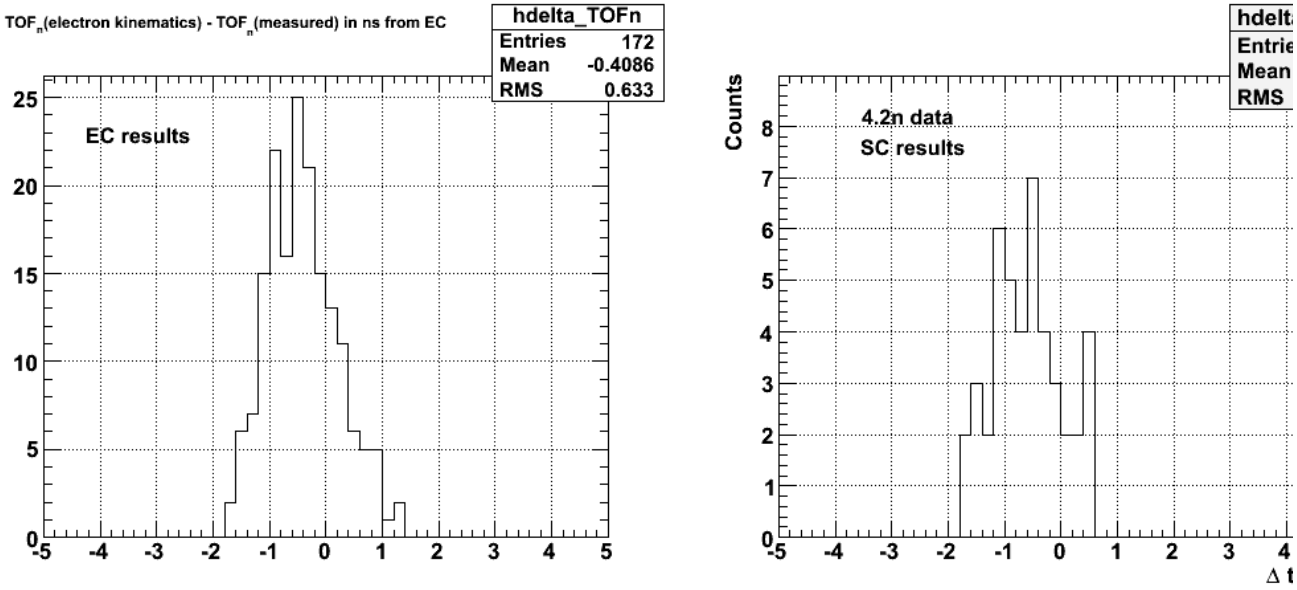

Fig 2. EC (left) and SC (right) results for 4.2 GeV

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

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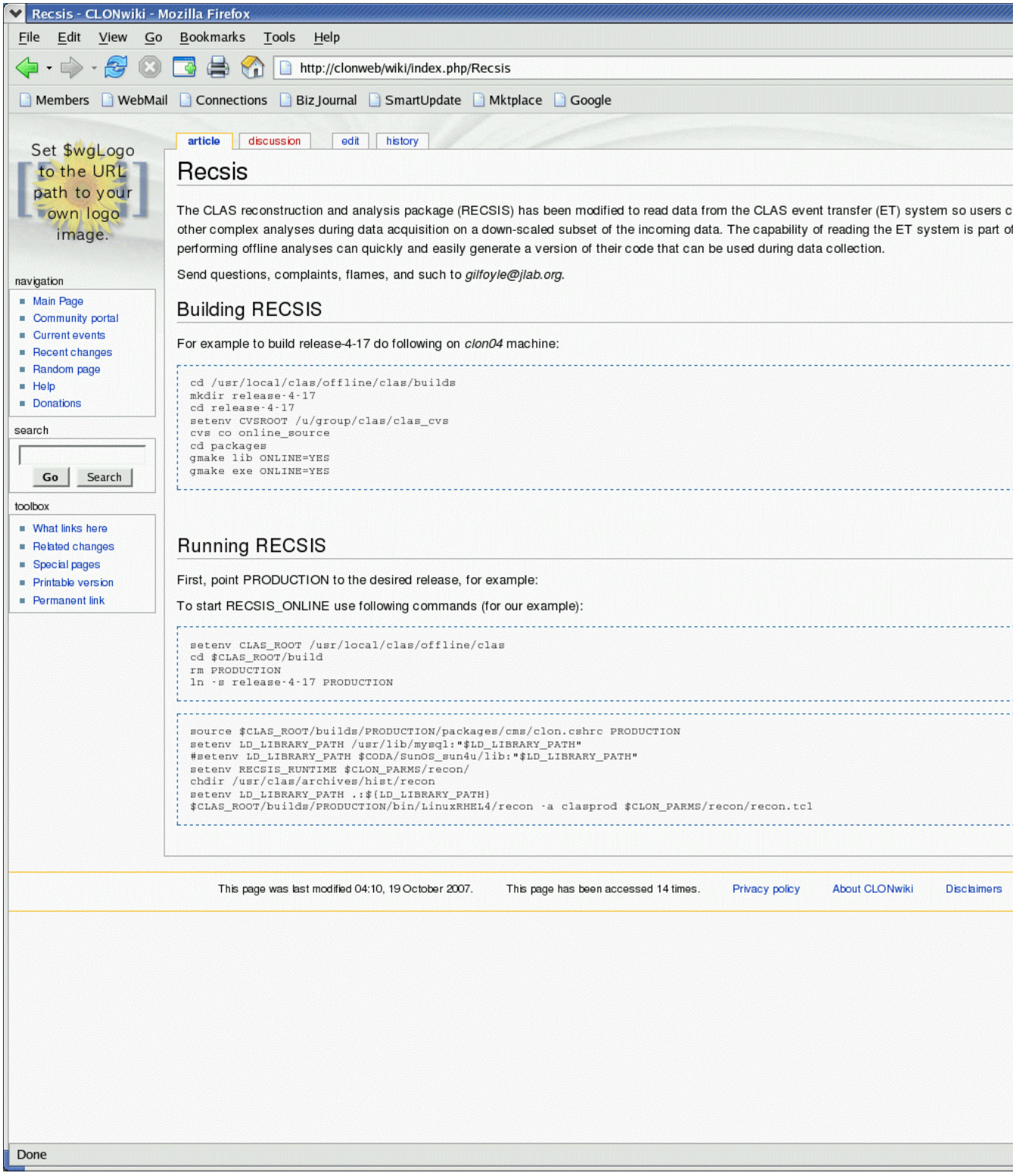
Jerry Gilfoyle's Enotebook page 196 - online recsis (gpg)

[Modified Fri Nov 2 14:46:47 2007 (GMT) gpg]

Wiki for online recsis.



DOE 2000 Electronic Notebook

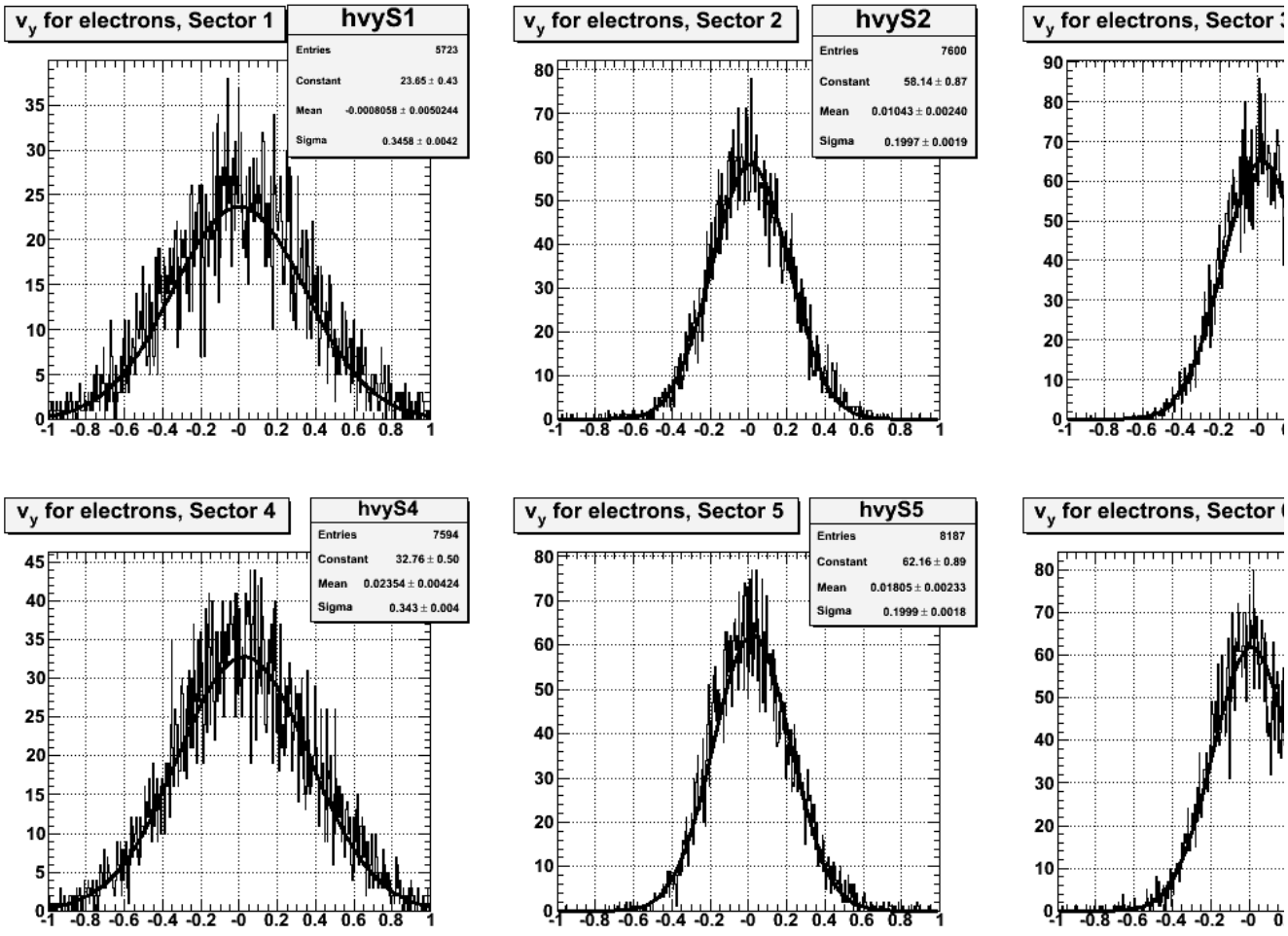
Jerry Gilfoyle's Enotebook page 197 - KG stuff (gpg)

[Modified Tue Dec 18 21:28:39 2007 (GMT) gpg]

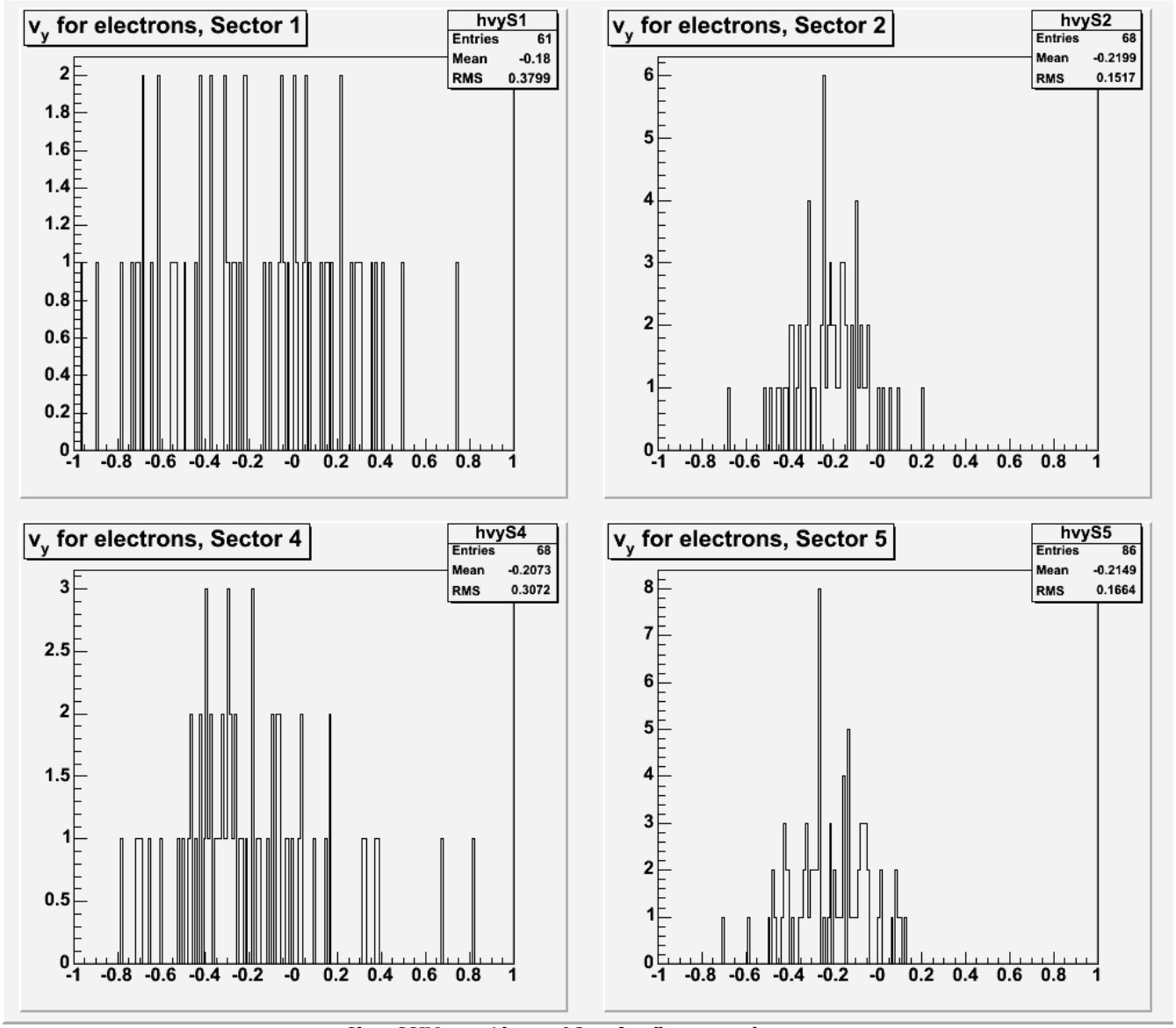
Stuff for KG analysis for senior seminar.

Click here to view the object (v_y shifts by sector for 11/16/07) you uploaded.

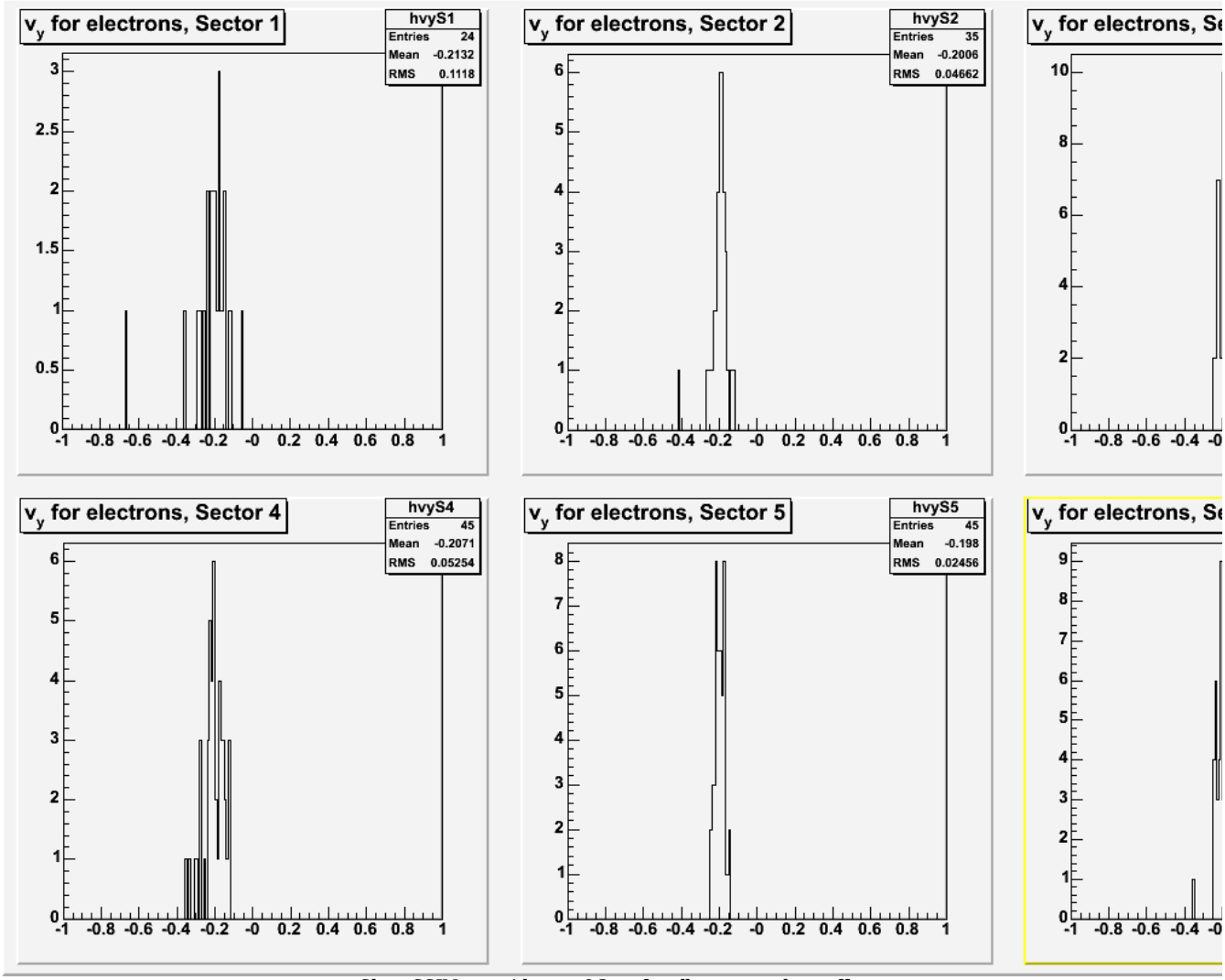
Click here to view the object (ROOT macro) you uploaded.



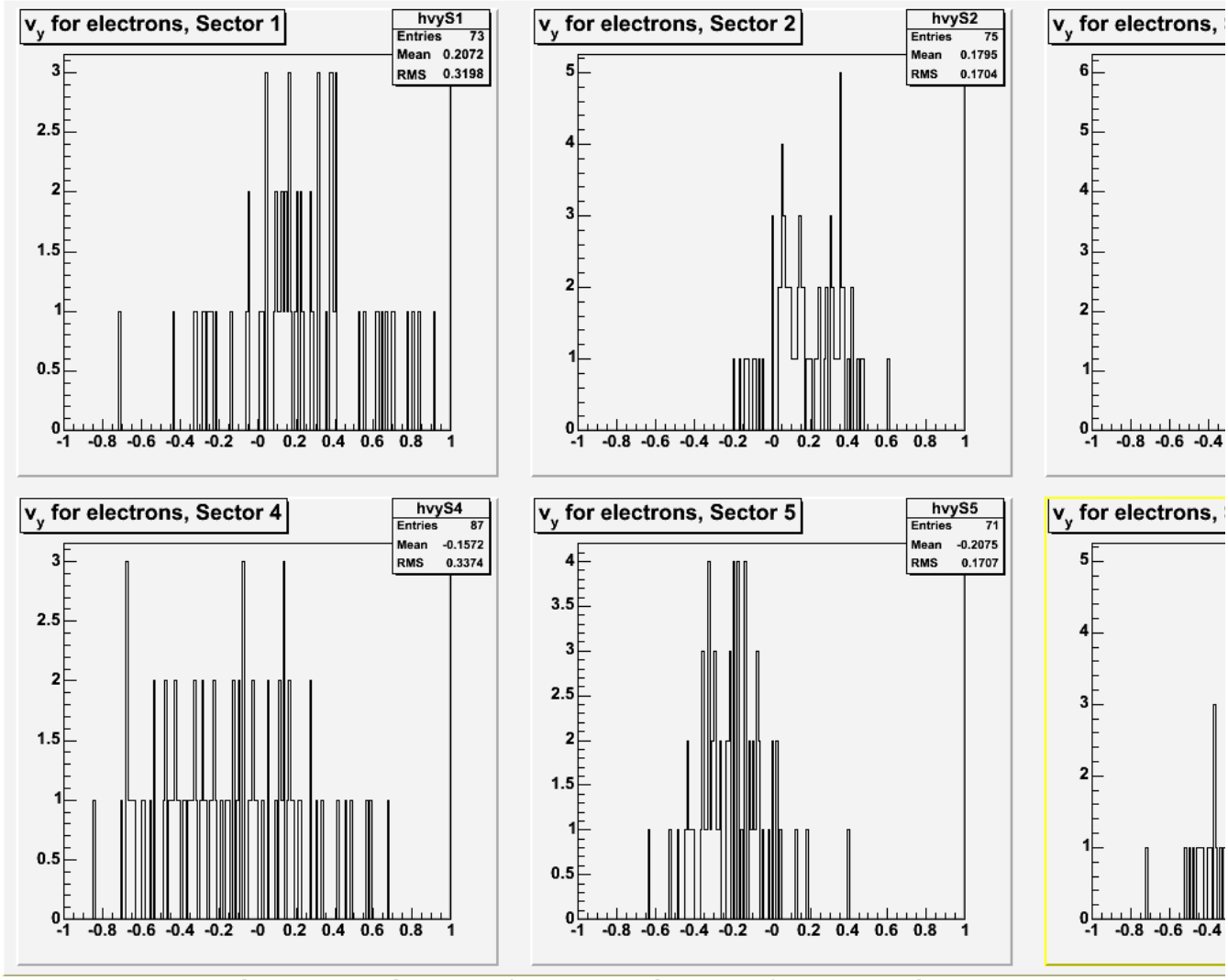
plot



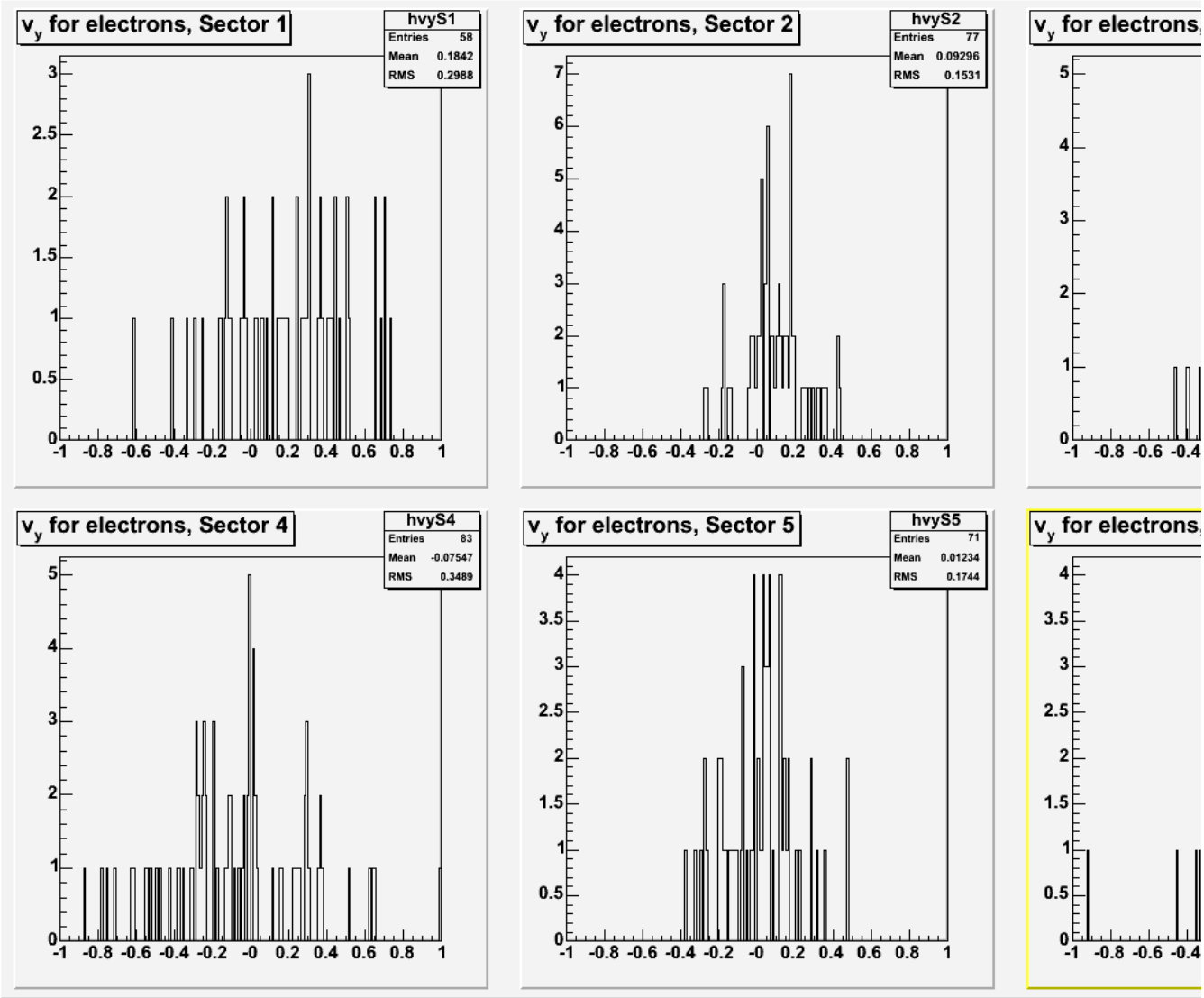
Short GSIM run with vy = -0.2 cm for all sectors and gpp on.



Short GSIM run with vy = -0.2 cm for all sectors and gpp off.



Short GSIM run with vy = 0.2 cm for sectors 1-3 and vy = -0.2 cm for sectors 4-6 and gpp on.



Short GSIM run with vy shifts set to observed values and gpp on. (Double_t vyshift[6] = {0.187,0.087,-0.068,-0.072,0.0001,-0.090})

%%%

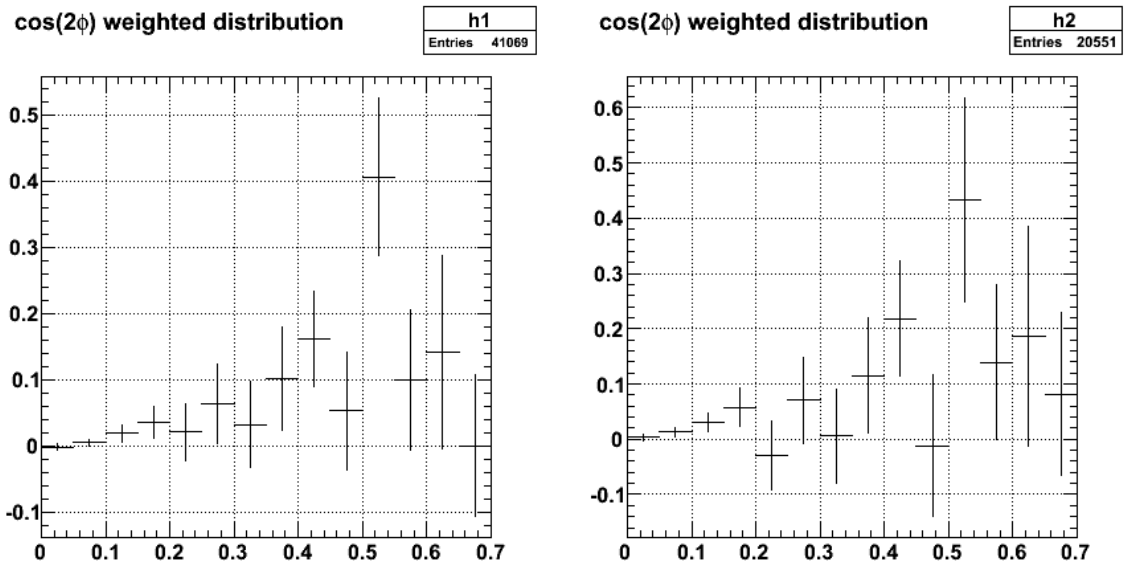


Fig 6. Comparison of ATT from the 4.2-GeV data set for two different sets of cuts (hp_m_cos_sphi_wght2 on the left, hp_m_cos_sphi_wght on the right).

Click here to view the object (Root macro for fig 6) you uploaded.

Click here to view the object (Root histogram file for fig 6.) you uploaded.

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Jerry Gilfoyle's Enotebook page 198 - First look at low-Q2 R problem (gpg)

[Modified Fri Jan 18 19:58:05 2008 (GMT) gpg]

The plots below show a very preliminary look at the low-Q2 GMn R. They reproduce qualitatively the problem Jeff saw at the lowest Q2 (see fig 1 and entry 375 in E5 elog) where it appears that we are losing proton events. However, the quantitative agreement is not great (see Fig 2). It almost appears as if my spectra are shifted one bin (about 0.15 GeV2) higher than Jeff's.

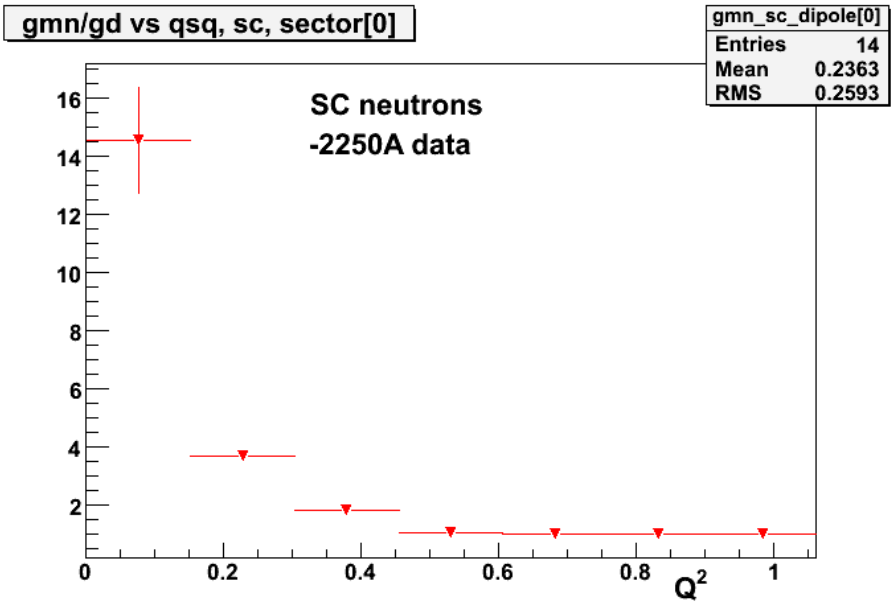


Fig 1. Plot from entry 375 in E5 elog from JL showing problem at low Q2 for 2.6r data.

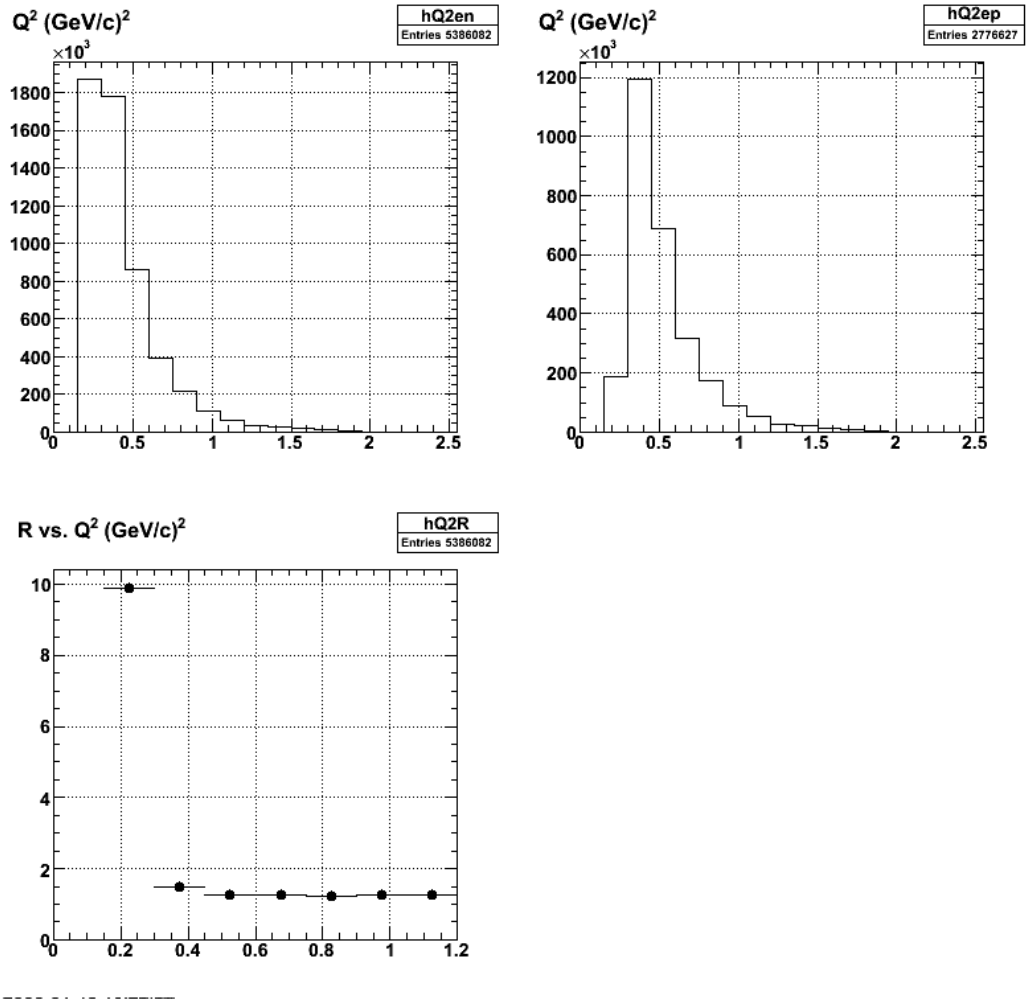


Fig 2. Preliminary look at R at low Q2. No efficiency or Fermi corrections; just raw spectra divided to get R.

Click here to view the object (ROOT macro for fig 2.) you uploaded.

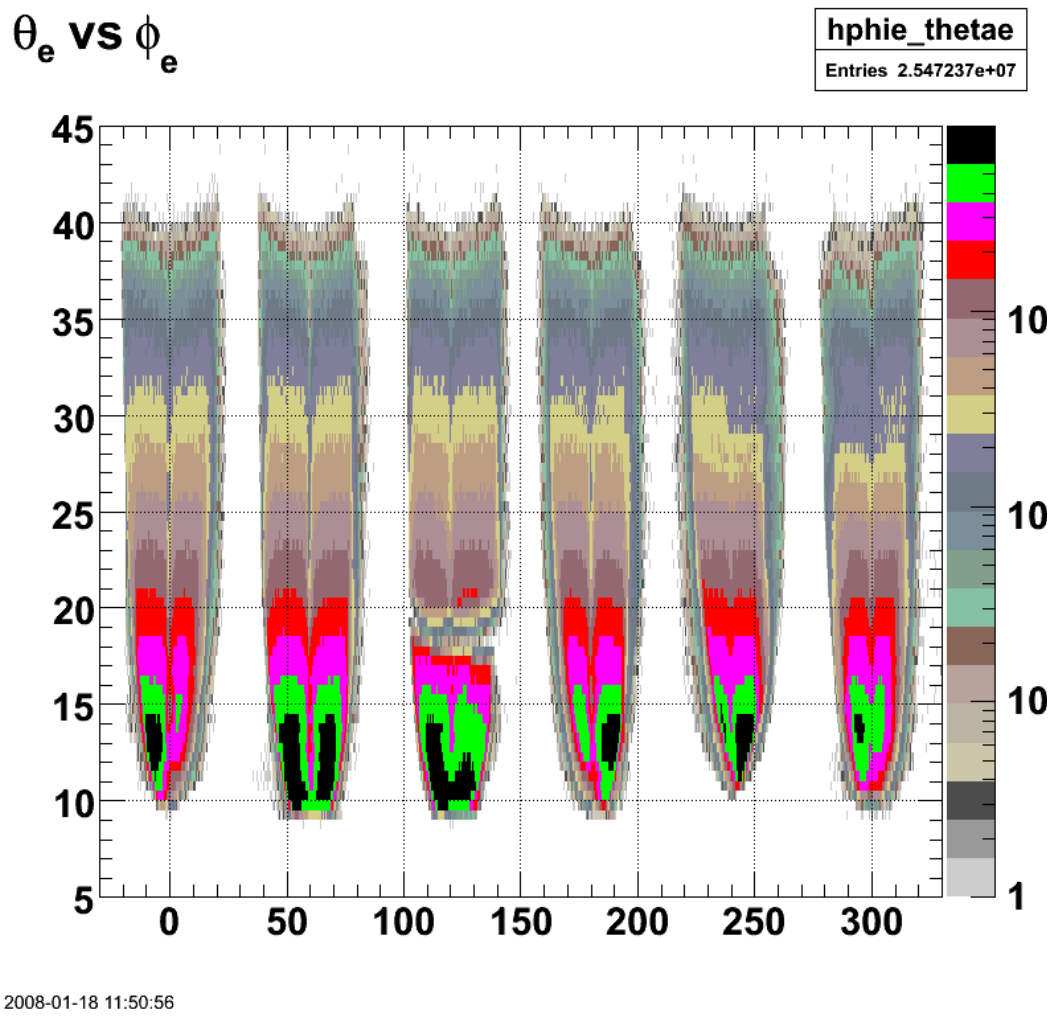


Fig 3. The canyon.

Click here to view the object (ROOT macro for fig 3) you uploaded.

Turn off the electron fiducial cuts just for the e-p events and you get the following. Many more e-p events get in at lower Q2 and there is not a dip in this region any more.

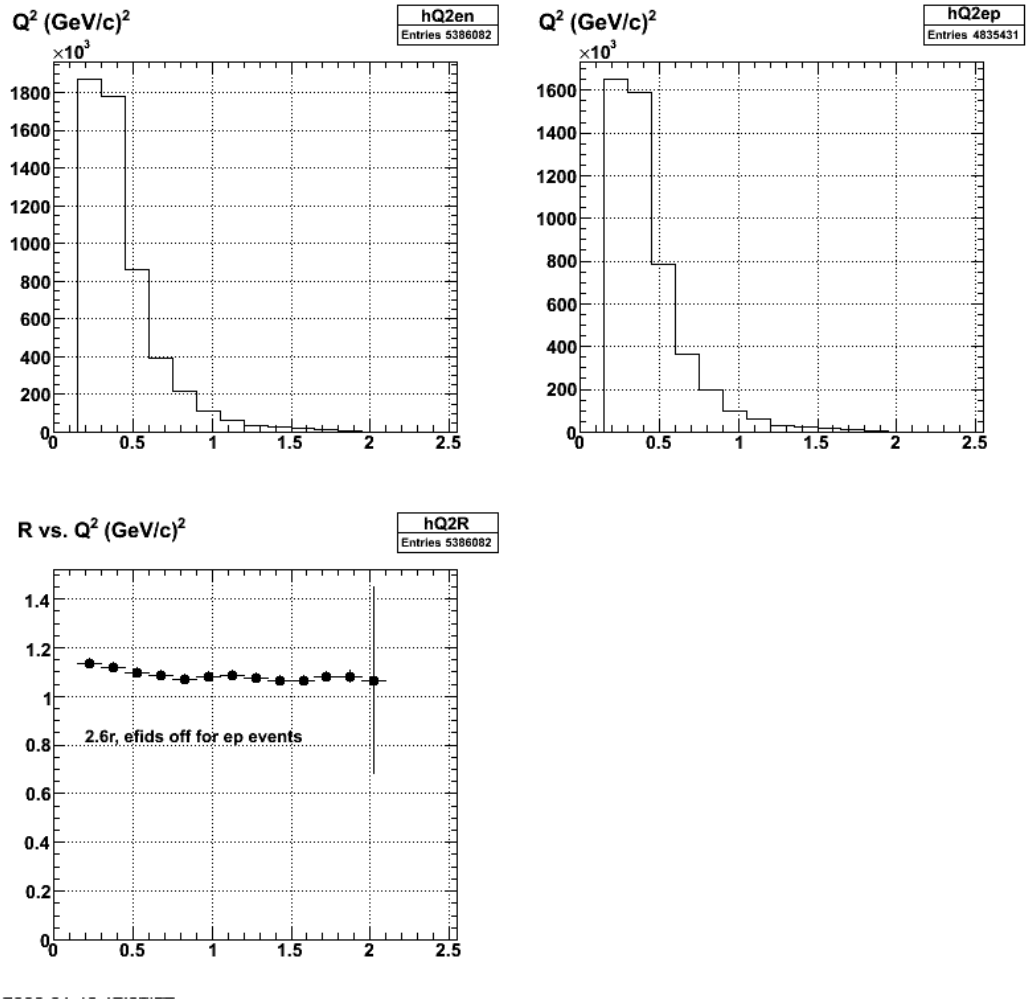


Fig 4. Effect of turning off electron fiducial cut only on e-p (and not e-n) events.

Click here to view the object (ROOT macro for fig 4) you uploaded.

EEEEEKKKKK! None of the analysis done above had the electron fiducial cuts turned on for the e-n events so Fig 4 is the best comparison. It does not show the sharp rise at low Q2, but does not extend down as far as JL's spectra.

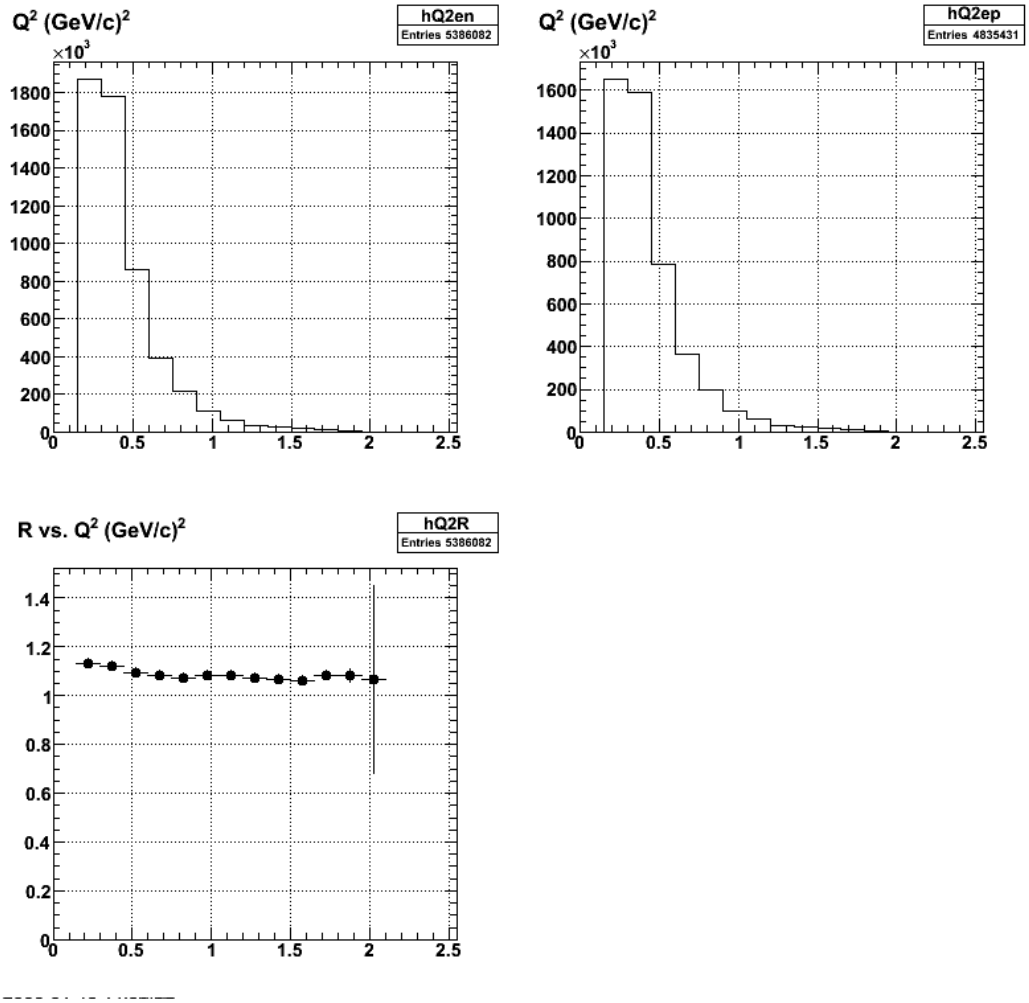


Fig 5. Effect of canyon cut - virtually no effect.

Click here to view the object (ROOT macro for fig 5) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 199 - KD sim12 plots (gpg)

[Modified Wed Jan 30 19:26:33 2008 (GMT) gpg]

First plots from Kirill for his senior seminar.

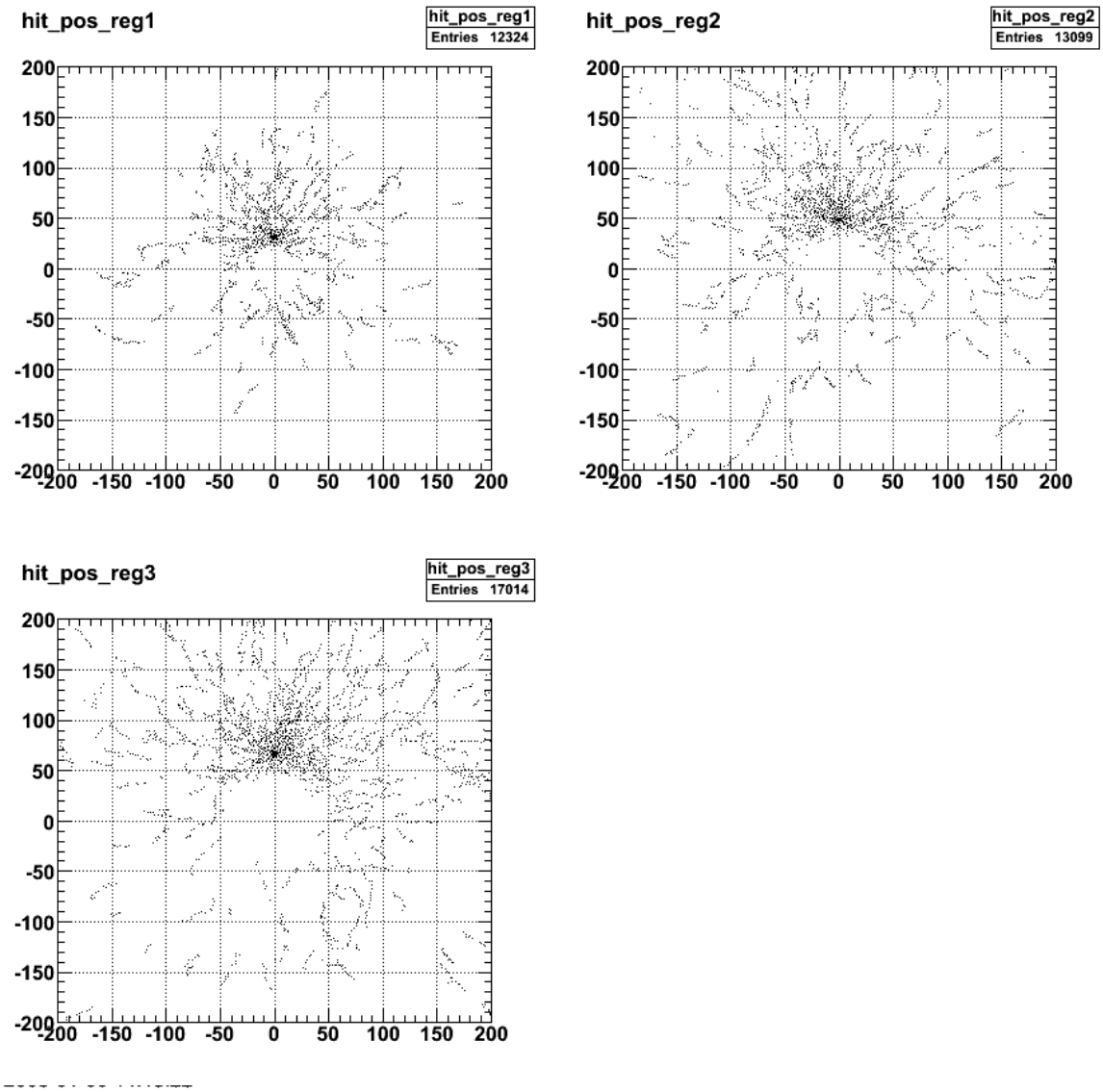


Fig 1. Plot of hit position for different regions for electrons at a fixed momentum.

Click here to view the object (ROOT macro for fig 1.) you uploaded.

Click here to view the object (Root histogram file for fig 1.) you uploaded.

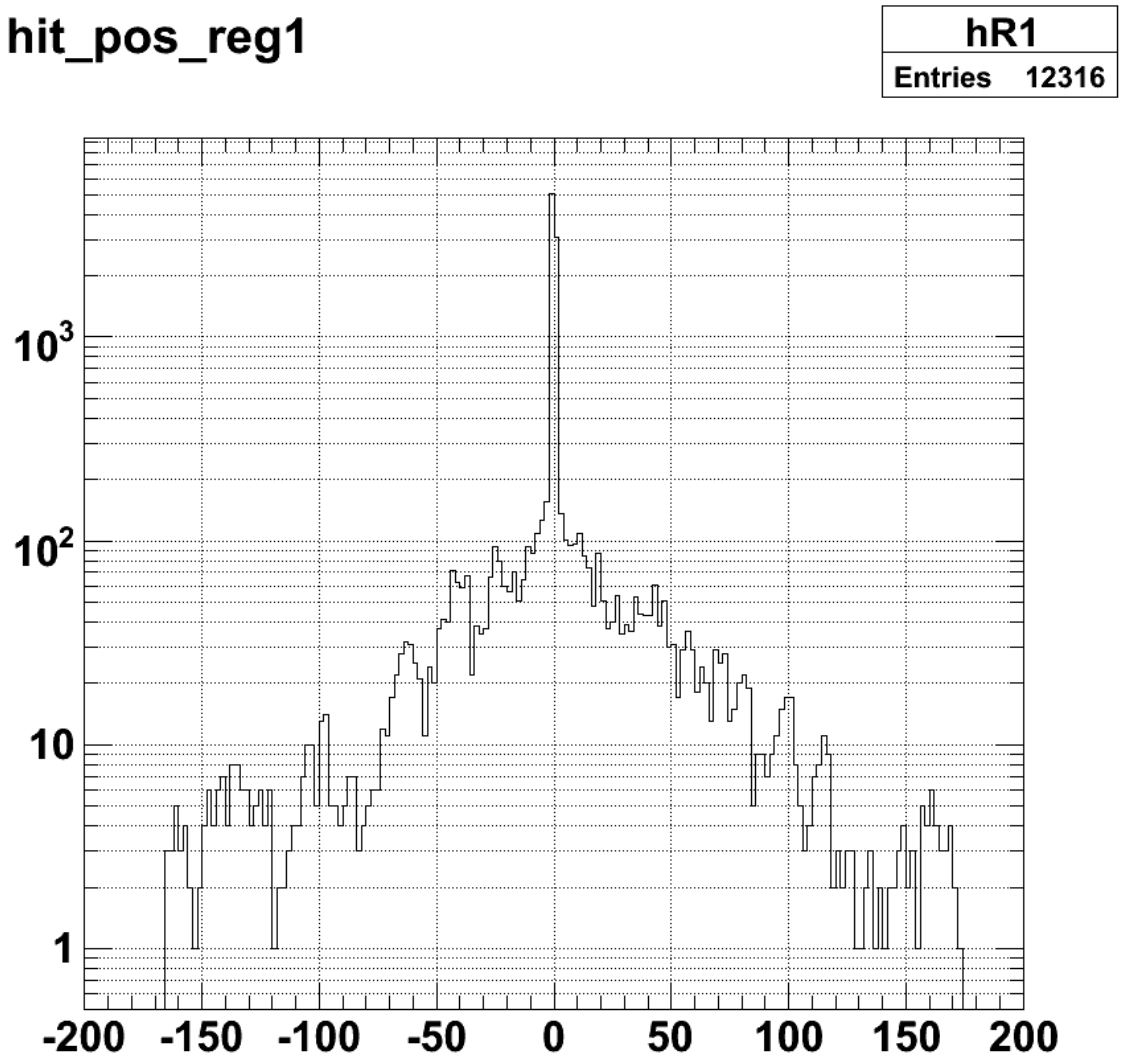


Fig 2. Projection along x axis for region 1.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 200 - EOD checks including proton mass wings (gpg)

[Modified Tue Mar 15 02:04:22 2011 (GMT) gpg]

Huh!!!??

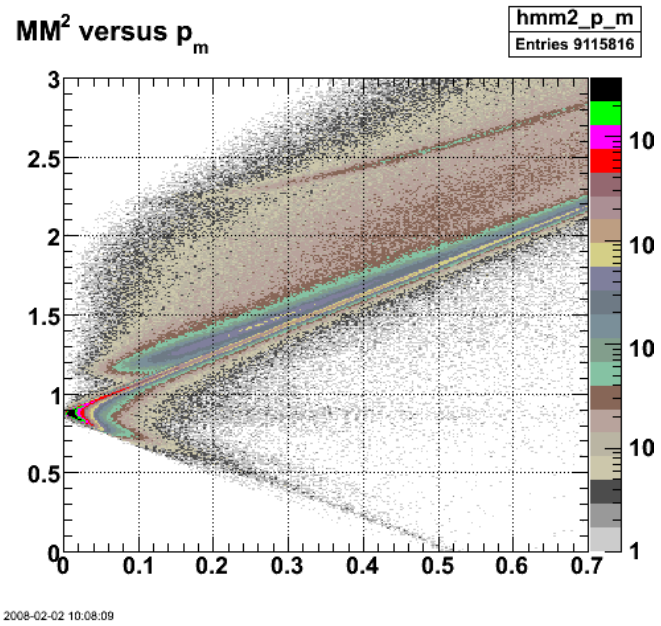


Fig 1. MM2 vs p_m

I did not reset the jneutron index in the code which created an indexing problem and misalignment of the momenta.

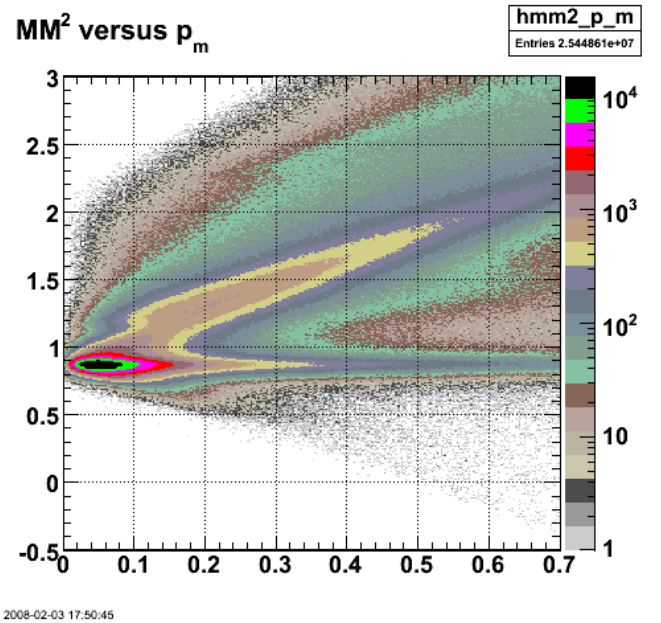


Fig 2. MM2 vs. missing momentum p_m for 2.6r with the usual cuts OFF.

Click here to view the object (ROOT histogram file for fig 2) you uploaded.

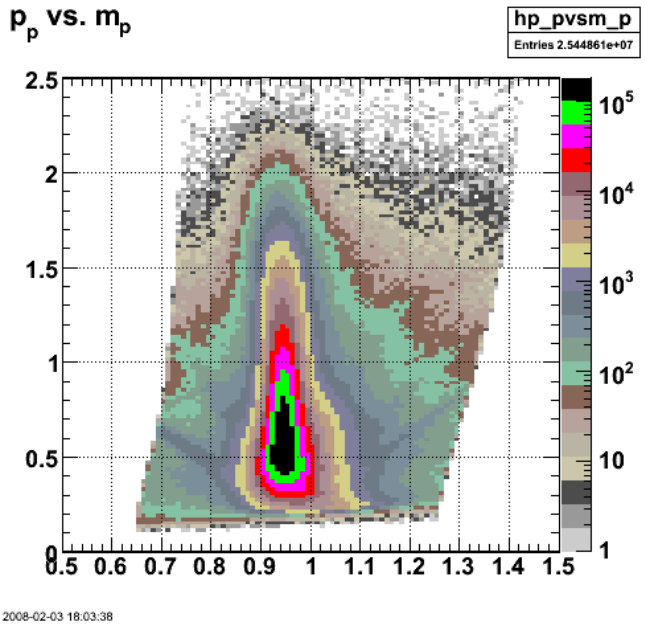


Fig 3. p_p vs. m_p plot showing the famous mass 'wing' due to (i think) events where the wrong beam bucket was chosen for the final timing calculation.

Turn on all the normal cuts include efids and pfids.

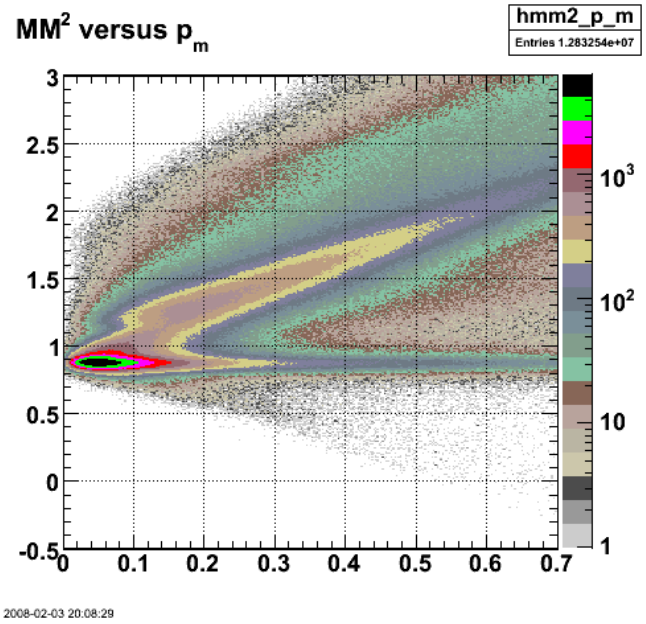


Fig 4. MM2 vs. missing momentum p_m for 2.6r with the usual cuts turned ON.

Click here to view the object (ROOT histogram file for fig 4.) you uploaded.

Turn on the proton mass cut 0.88-1.02 GeV/c2.

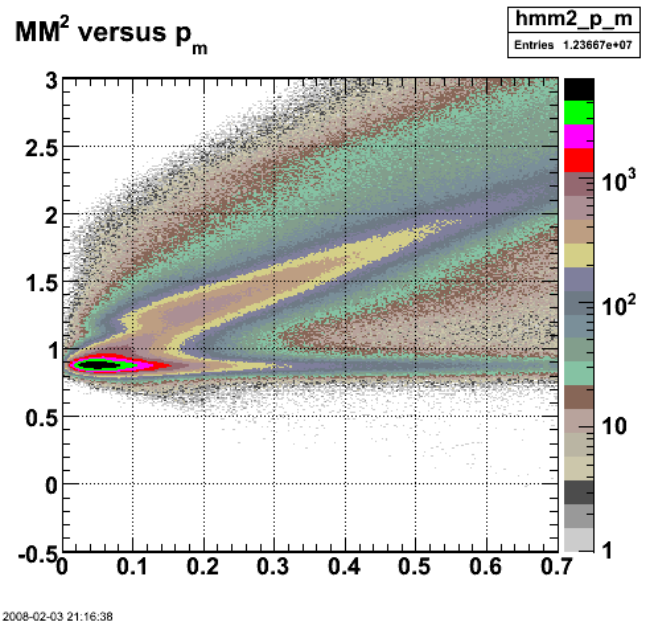


Fig 5. MM2 vs. missing momentum p_m for 2.6r with the usual cuts turned ON and the proton mass trange of 0.88-1.02 GeV/c2.

Put a narrow cut on the proton mass 0.92-0.97 GeV/c2.

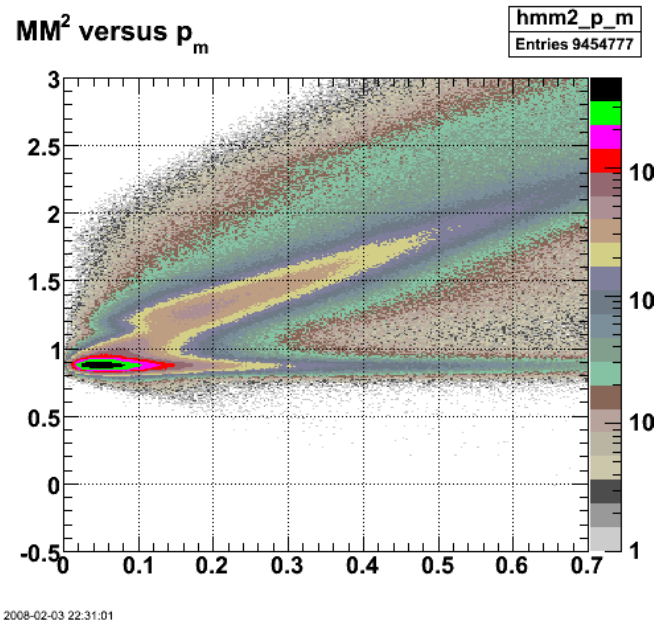


Fig 6. MM2 vs. missing momentum p_m for 2.6r with the usual cuts turned ON and the proton mass trange of 0.92-0.97 GeV/c2.

Click here to view the object (ROOT histogram file for fig 6.) you uploaded.

Now do the 2.6n data set with all the same cuts as the previous analysis for fig 6.

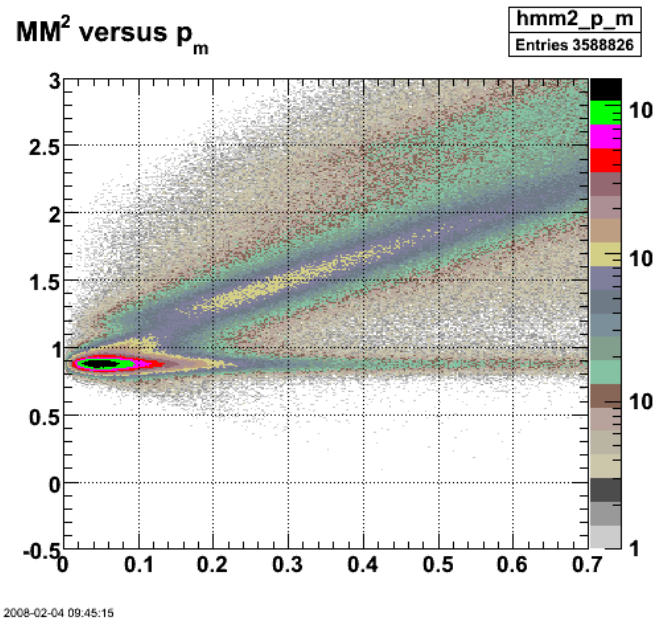


Fig 7. MM2 vs. missing momentum p_m for 2.6n with the usual cuts turned ON and the proton mass trange of 0.92-0.97 GeV/c2.

Click here to view the object (Root histogram file for fig 7.) you uploaded.

Now do 4.2 with all the same cuts as fig 7.

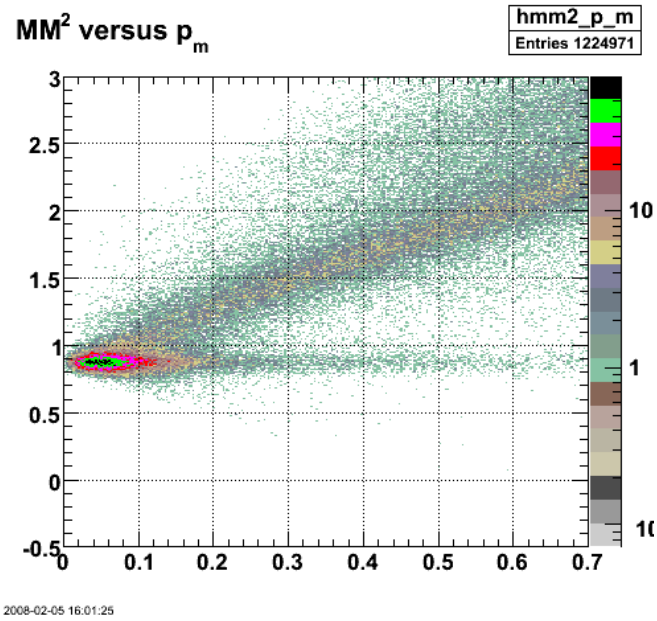


Fig 8. MM2 vs. missing momentum p_m for 4.2n with the usual cuts turned ON and the proton mass range of 0.92-0.97 GeV/c2.

Click here to view the object (Root histogram file for fig 8.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 201 - GMn Neutrons (gpg)

[Modified Fri Feb 29 21:45:00 2008 (GMT) gpg]

Below is my first look at the neutron spectra as part of extracting GMn from the lowest Q2. The EC goes out to 45 deg and the break between the EC and LAC is clear in the right-hand panel. There is no cuts on these spectra like theta_pq < 3 deg to isolate QE events.

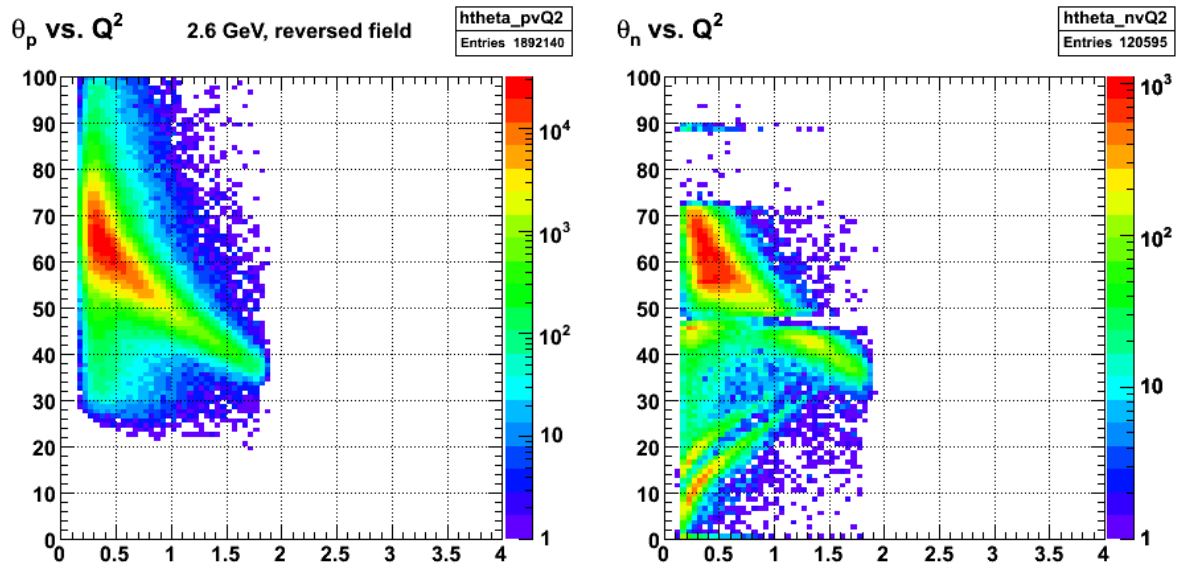


Fig 1. Nucleon angle versus Q2 for 2.6r.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Project out the angular distribution for each nucleon.

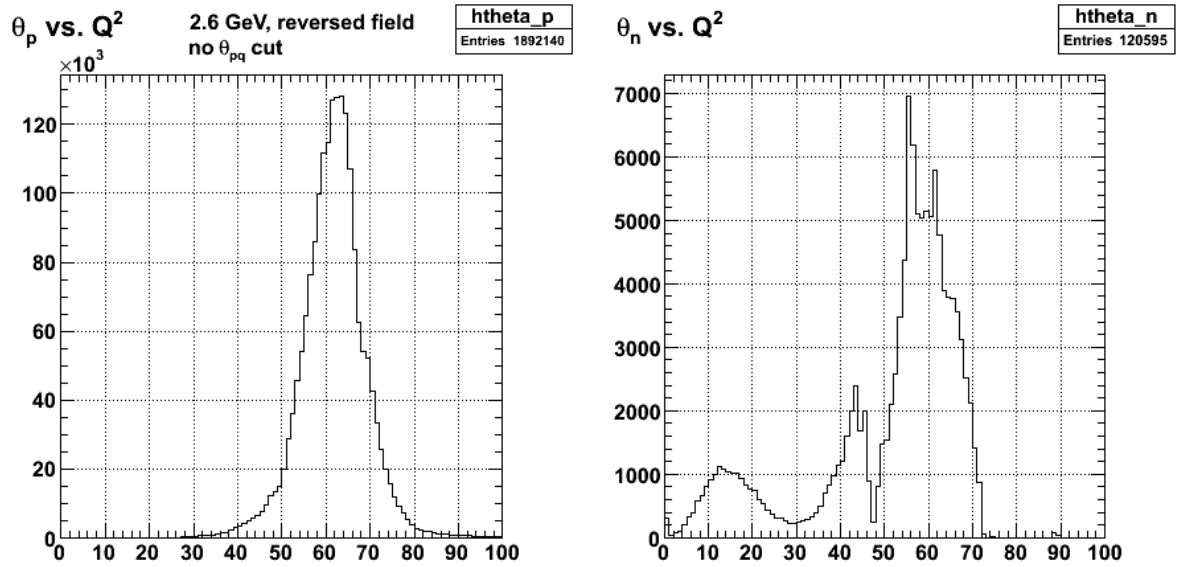


Fig 2. Angular distribution of nucleons. No QE cut.

Theta_pq for neutrons and protons. First, cuts on protons.

```
if (ep_event &&
    target_walls_ep &&
    quasielastic_cut &&
    //dip_cut &&
    //delta_cut &&
```

```
    good_electron_fiducial &&
    good_electron_EC_fiducial &&
    good_electron_EC_trk_coords_fiducial &&
    good_proton_fiducial &&
    good_egiyan_threshold &&
    good_proton_mass &&
    good_photoelectrons) {

    ep_count++;
    htheta_pvQ2->Fill(Q2,theta_p_deg);
    hp_pvsm_p->Fill(mass_p,p_p);
    hmm2_p_m->Fill(missing3vec_mag,mm2);
    htheta_pq_phi_pq->Fill(theta_pq*180/pi,phi_pq*180/pi);
    hp_pqparallel->Fill(p_pqparallel);
    hp_pqperp->Fill(p_pqperp);
    hp_p->Fill(p_p);
    hQ2ep->Fill(Q2);
    hp_pvtheta_p->Fill(theta_p_deg,p_p);
    hthetap_pq->Fill(theta_pq*180/pi);

}
```

Next cuts on neutrons.

```
// electron-neutron coincidences.

if (en_event &&
    target_walls_e &&
    //quasielastic_cut &&
    good_electron_EC_fiducial &&
    good_electron_EC_trk_coords_fiducial &&
    good_egiyan_threshold &&
    good_photoelectrons) {

    htheta_nvQ2->Fill(Q2,theta_n_deg);
    hQ2en->Fill(Q2);
    hp_n->Fill(p_n);
    hp_nvtheta_n->Fill(theta_n_deg,p_n);
    hthetan_pq->Fill(thetan_pq*180/pi);
} // end of en coincs.
```

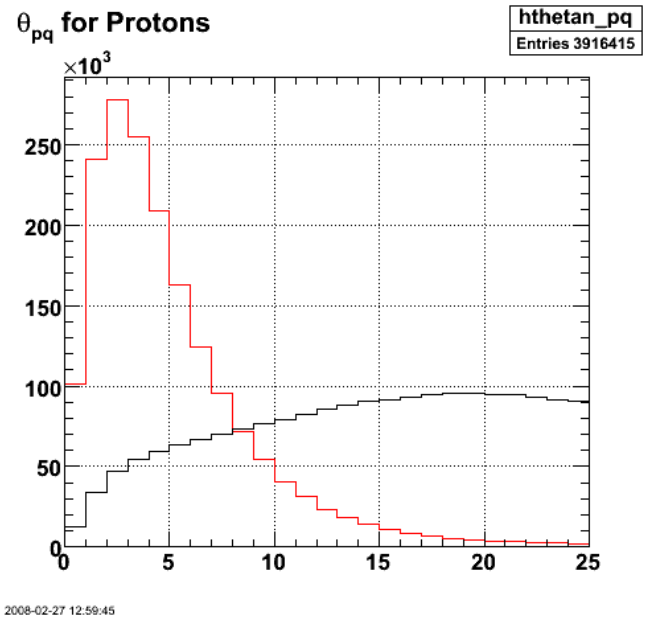


Fig 3. theta_pq for neutrons (black) and protons (red).

Click here to view the object (ROOT macro for fig 3) you uploaded.

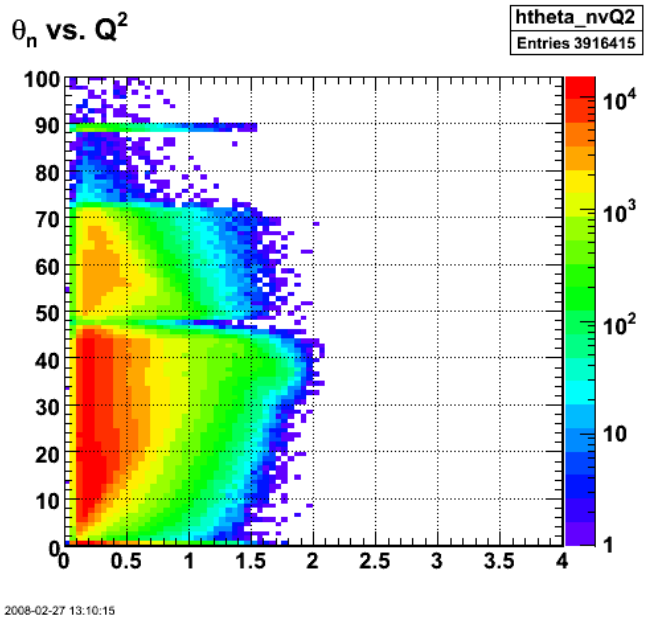


Fig 4.
Proton and neutron scattering angle versus Q2 with no QE cuts.

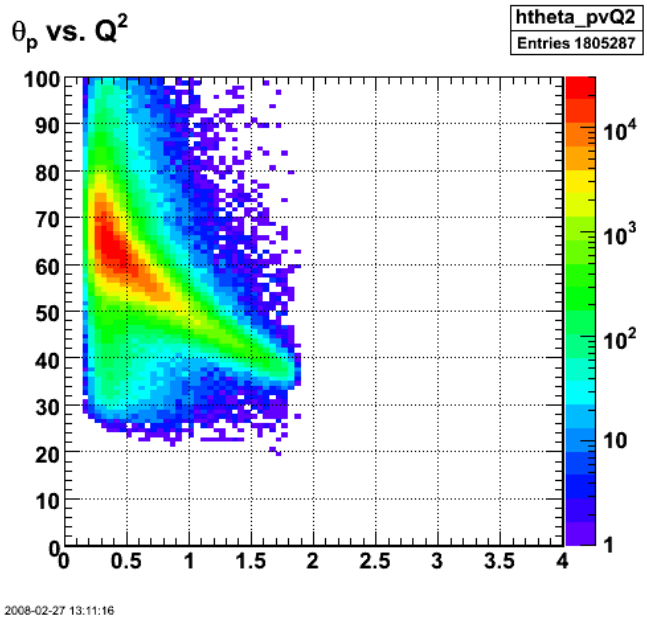


Fig 5.

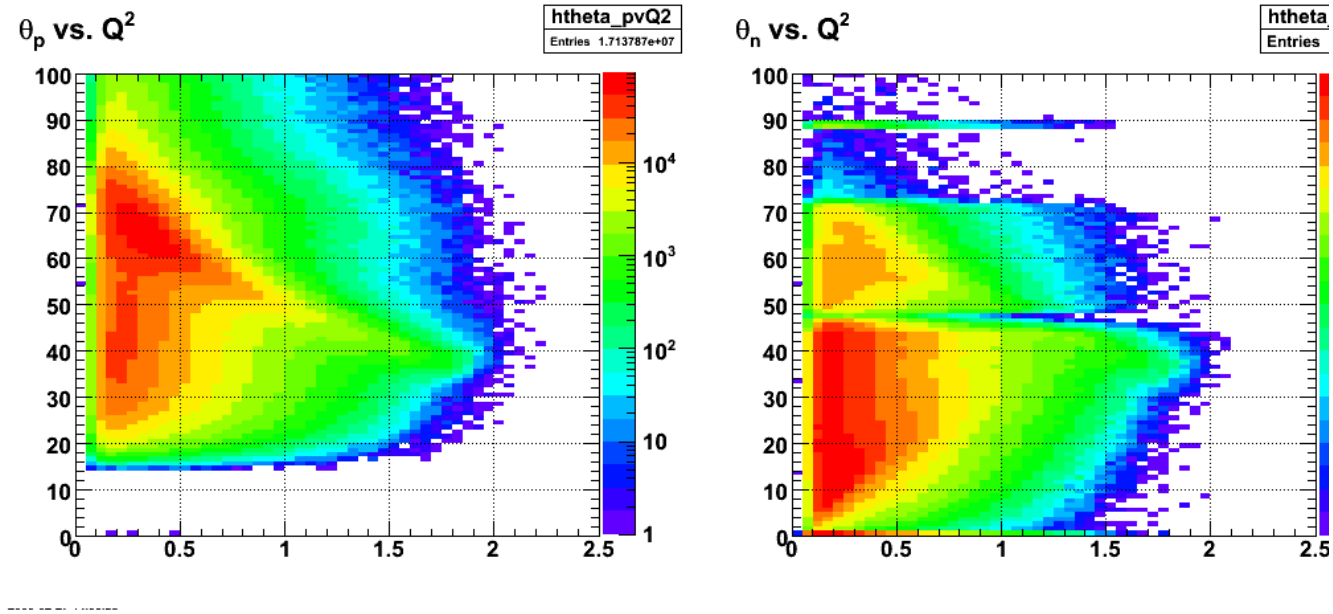


Fig 6. Proton and neutron scattering angle versus Q2 with no QE cuts for 2.6r.

Click here to view the object (ROOT macro for fig 6.) you uploaded.

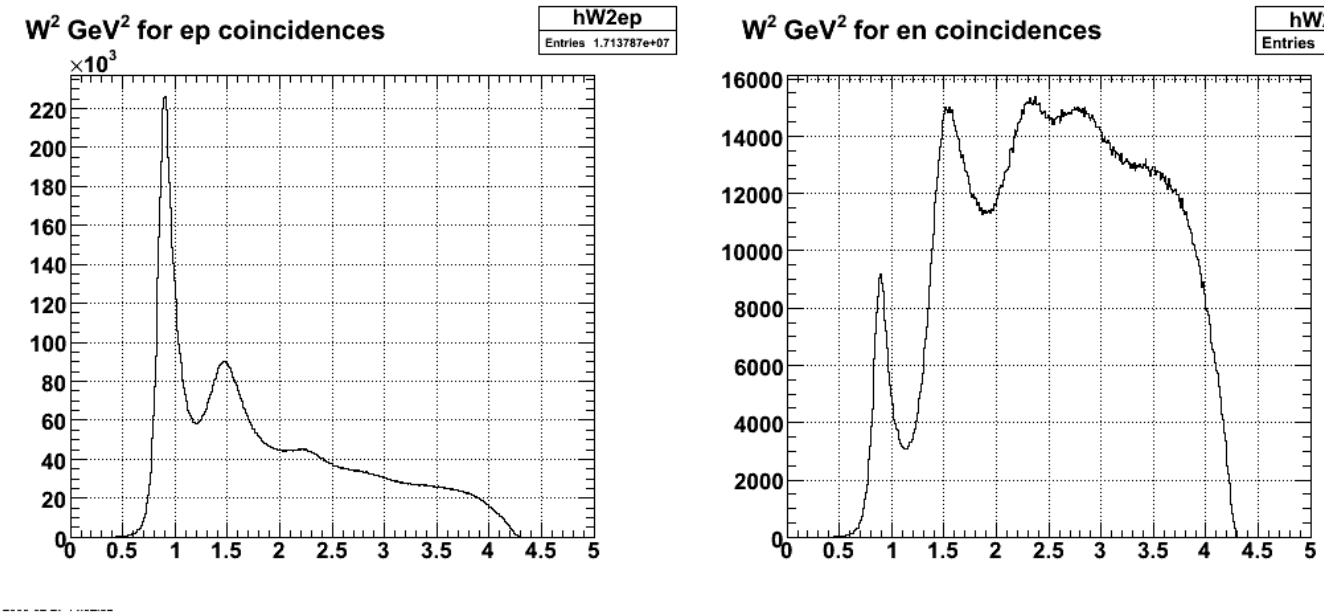


Fig 7. W2 spectra from electrons with proton coincidences (left) and neutrons (right panel).

Now turn on the theta_pq QE cut for neutrons and protons.

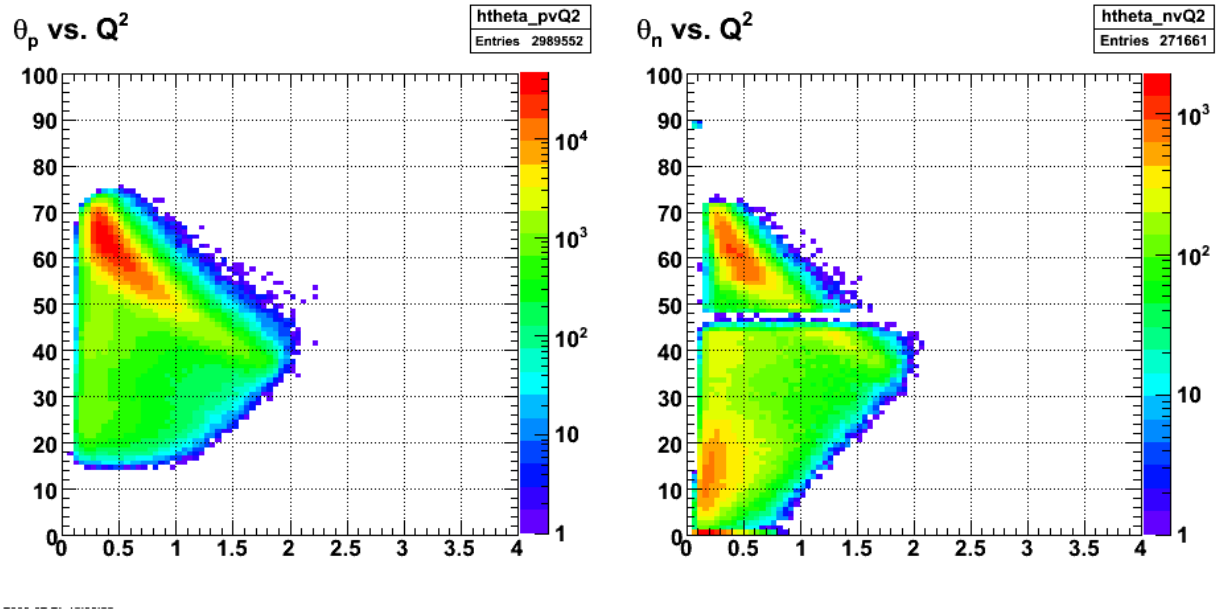


Fig 8. Proton (left) and neutron (right) scattering angle versus Q2 with QE cuts for 2.6r.

Click here to view the object (ROOT macro for fig 8) you uploaded.

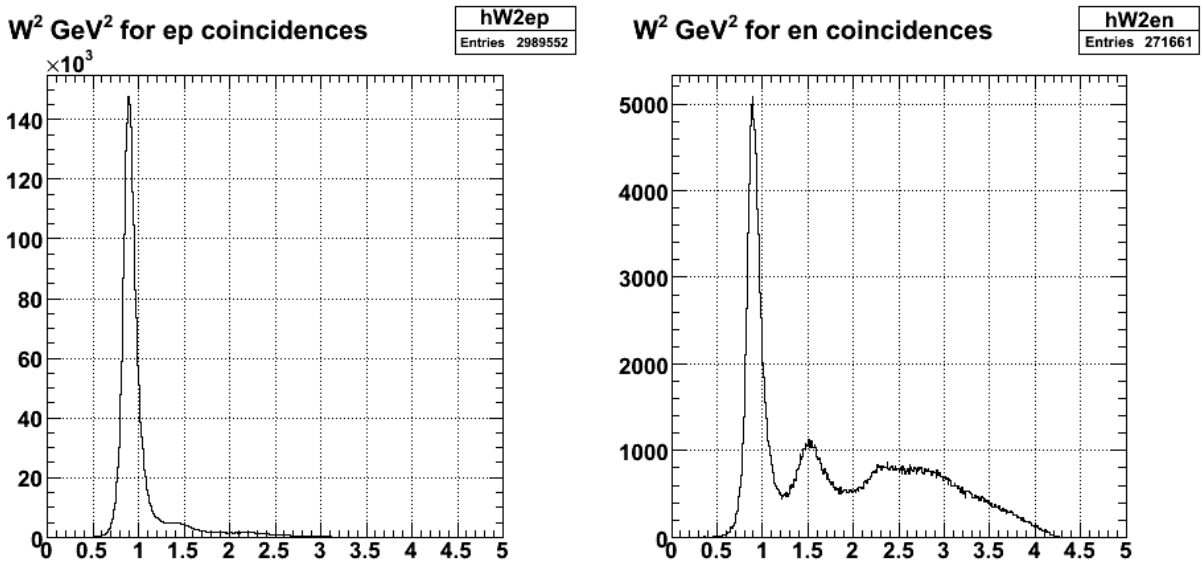


Fig 9. W2 spectra for protons (left) and neutrons (right) with theta_pq QE cut turned on for 2.6r.

Click here to view the object (ROOT macro for fig 9) you uploaded.

Click here to view the object (ROOT histogram file for figs 8-9) you uploaded.

Now turn on theta_pq QE cut and W2 < 1.2 GeV2 cut.

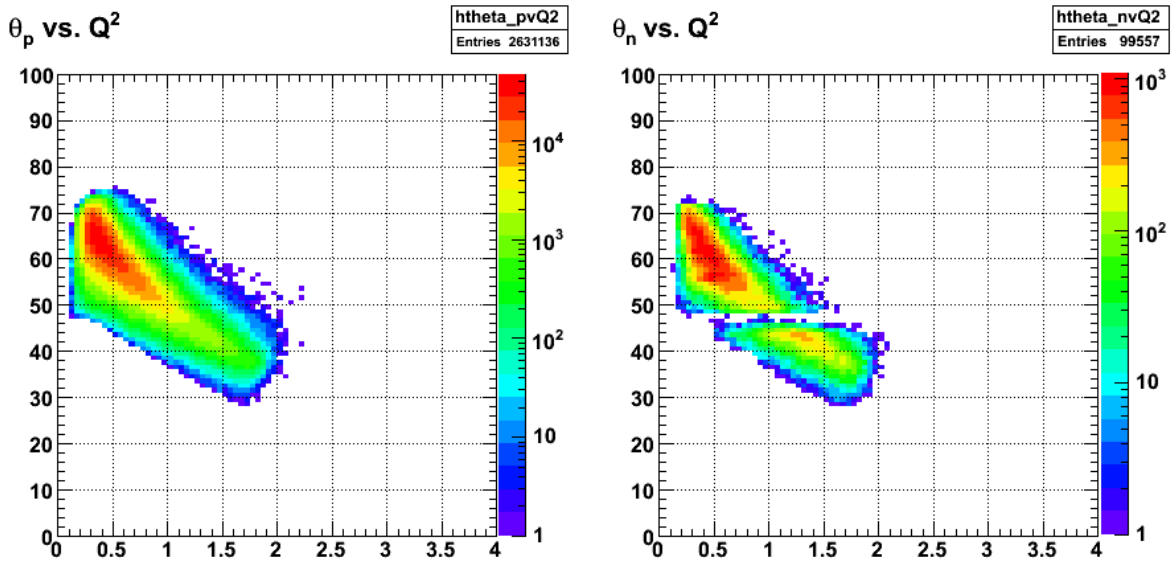


Fig 10. Proton (left) and neutron (right) scattering angle versus Q2 with QE cuts (theta_pq and W2 < 1.2 GeV2) for 2.6r.

Click here to view the object (ROOT macro for fig 10) you uploaded.

Why so many more protons??

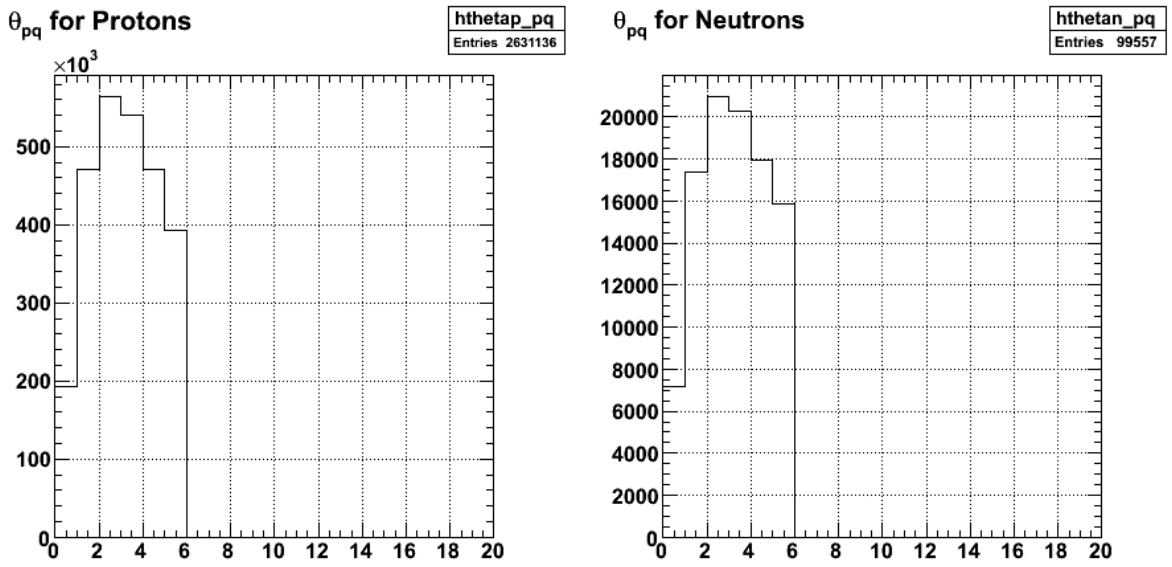


Fig 11. Angular distributions for protons (left) and neutrons (right) with QE cuts (theta_pq and W2 < 1.2 GeV2).

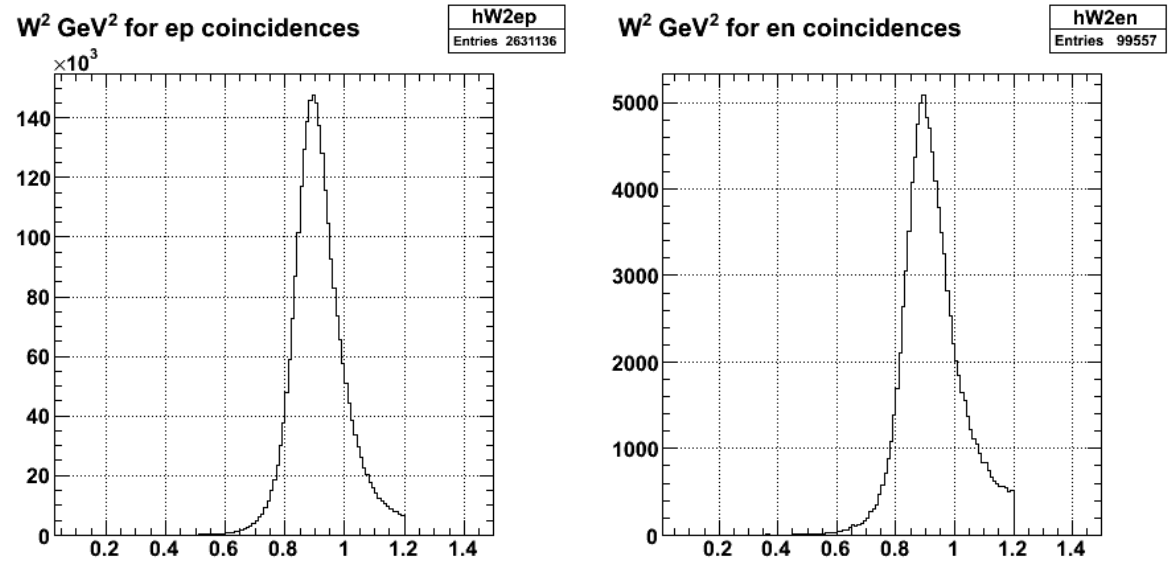


Fig 12. Comparison of W2 spectra for protons (left) and neutrons (right). Notice the high-W2 shoulder is larger on the neutrons than the protons.

Click here to view the object (ROOT macro for fig 12) you uploaded.

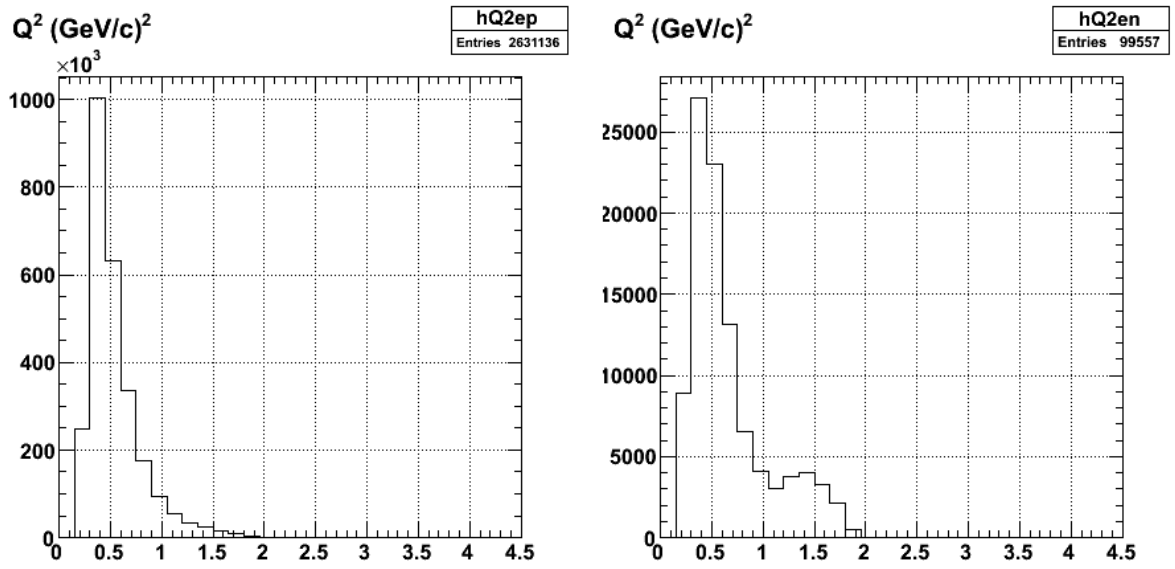


Fig 13. Q2 distribution for ep (left) and en (right) events.

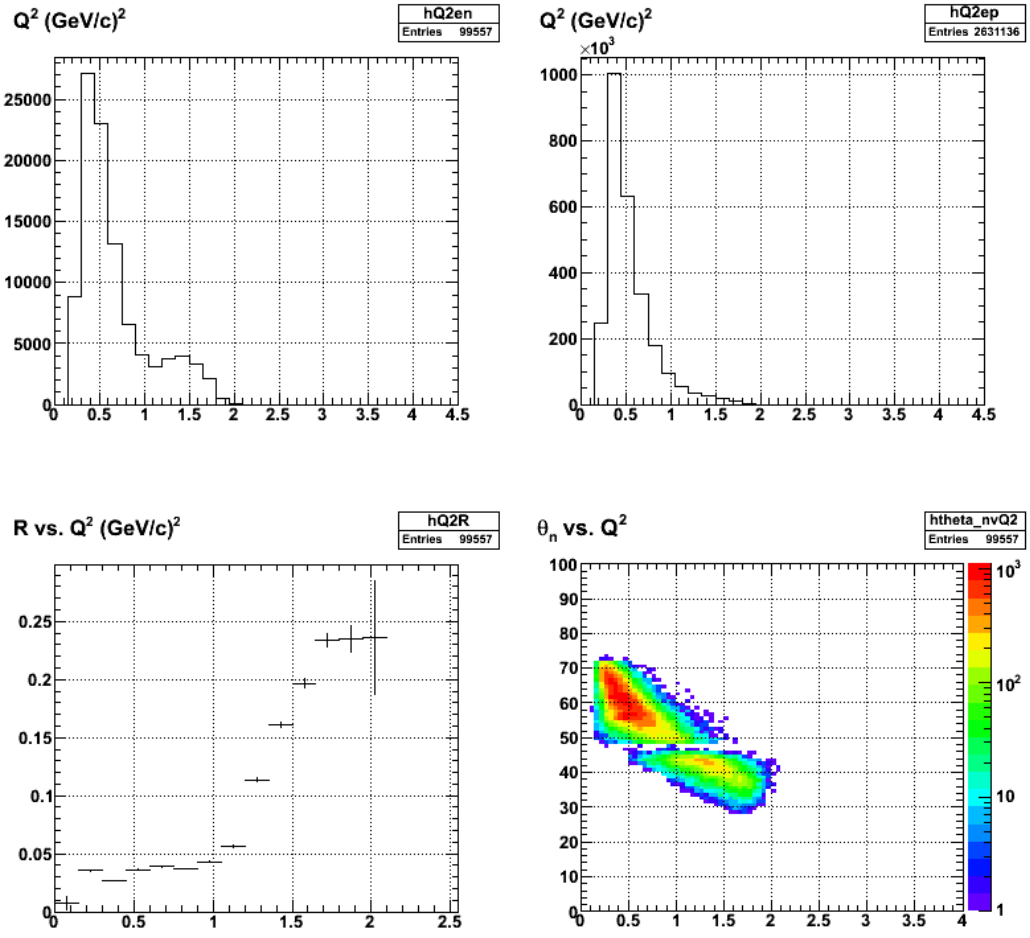


Fig 14. First calculation of R. Notice the change as you go from events for LAC to EC.

Click here to view the object (ROOT macro for fig 14.) you uploaded.

Click here to view the object (ROOT histogram file for figs 10-14.) you uploaded.

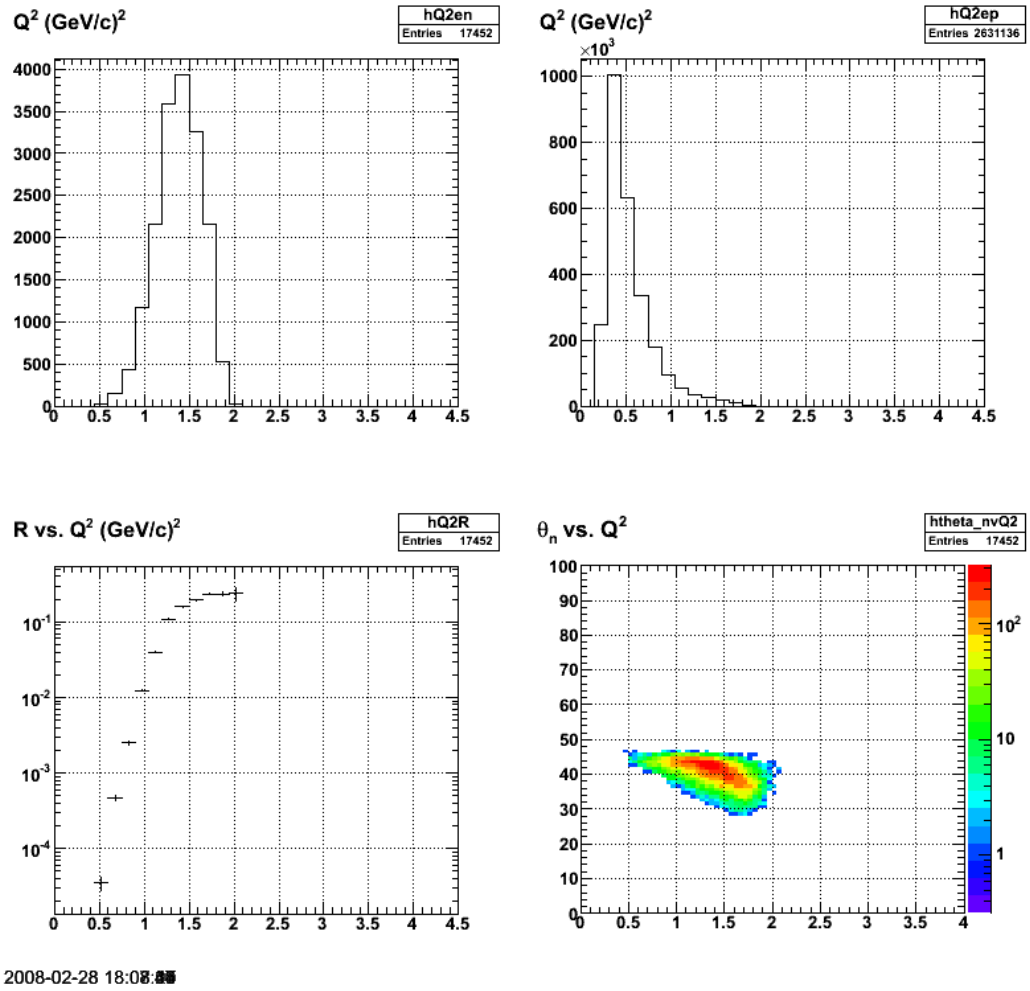
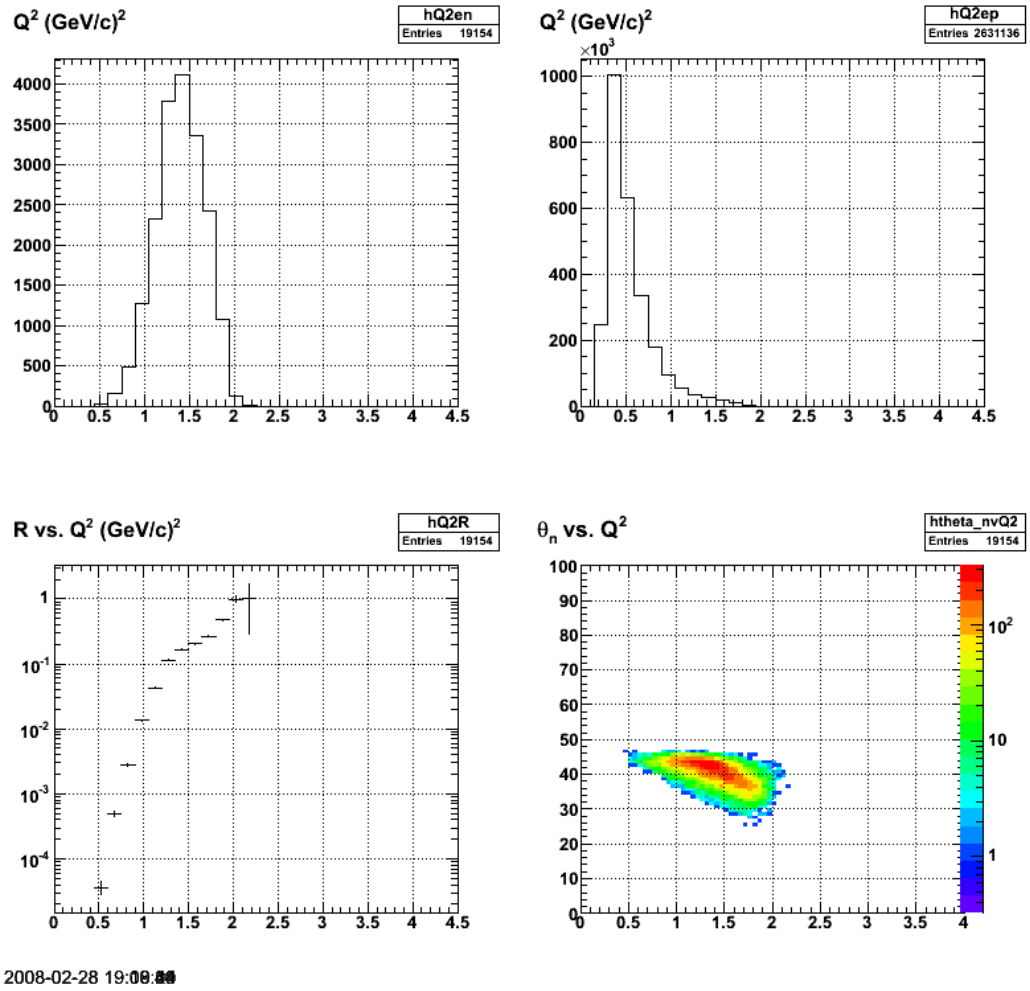


Fig 15. Calculation of R without any LAC events.

Click here to view the object (ROOT macro for fig 15) you uploaded.

The data do not reach all the way down close to Q2=0 like they do for JL's so try removing a bunch of cuts from the requirements for the histograms.

```
/* if (en_event && */
/*     good_W2en && */
/*     good_neutronEC && */
/*     target_walls_e && */
/*     good_thetan_pq  && */
/*     good_electron_EC_fiducial && */
/*     good_electron_EC_trk_coords_fiducial && */
/*     good_egiyan_threshold && */
/*     good_photoelectrons) { */
if (en_event &&
    good_W2en &&
    good_neutronEC &&
    target_walls_e &&
    good_thetan_pq) {
```



2008-02-28 19:09:40

Fig 16. Same as Fig 15 with reduced cuts shown above.

Click here to view the object (ROOT madro for fig 16) you uploaded.

The last change didn't do much so use the LAC with the same cuts.

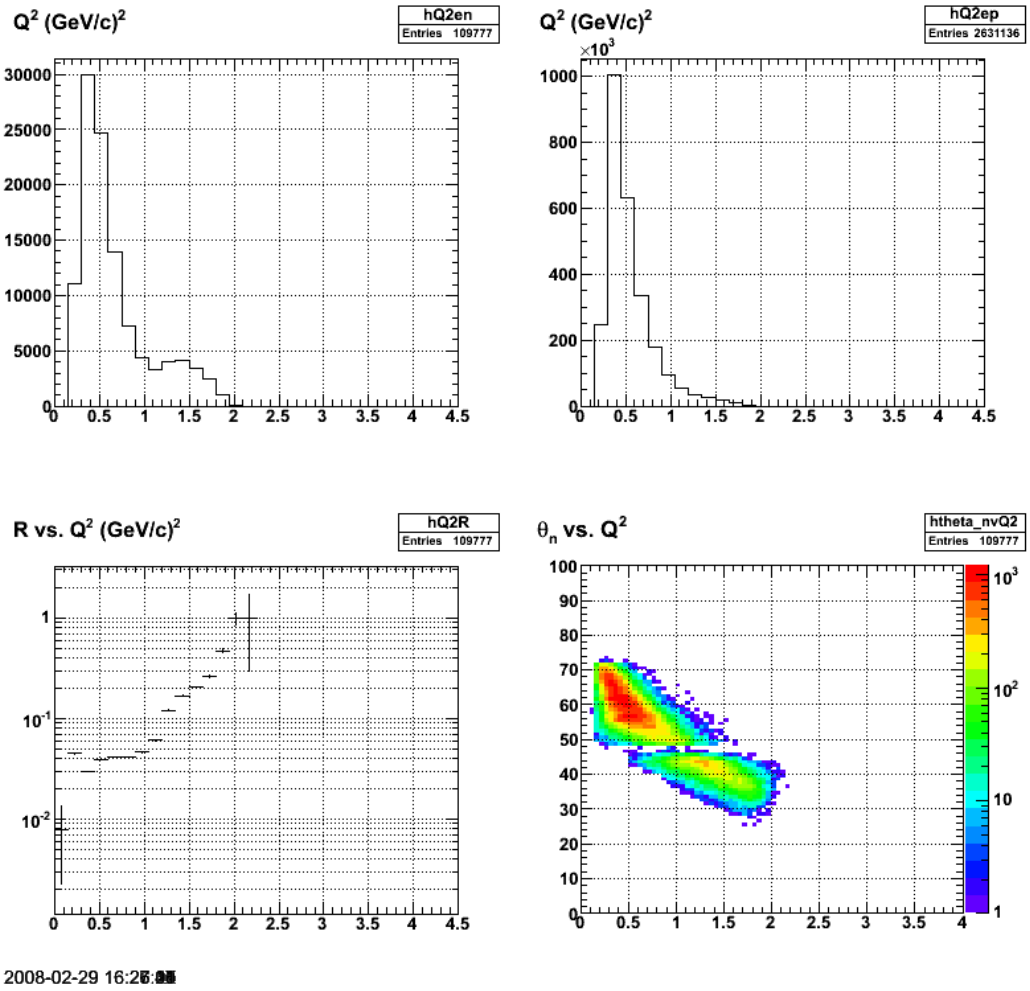
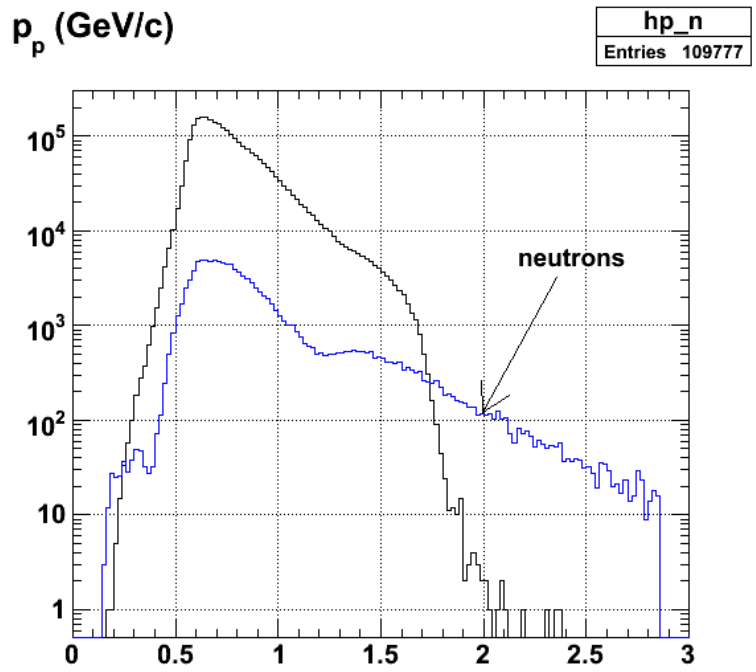


Fig 17. Same as figs 16 with the LAC turned on.

Click here to view the object (ROOT macro for fig 16) you uploaded.

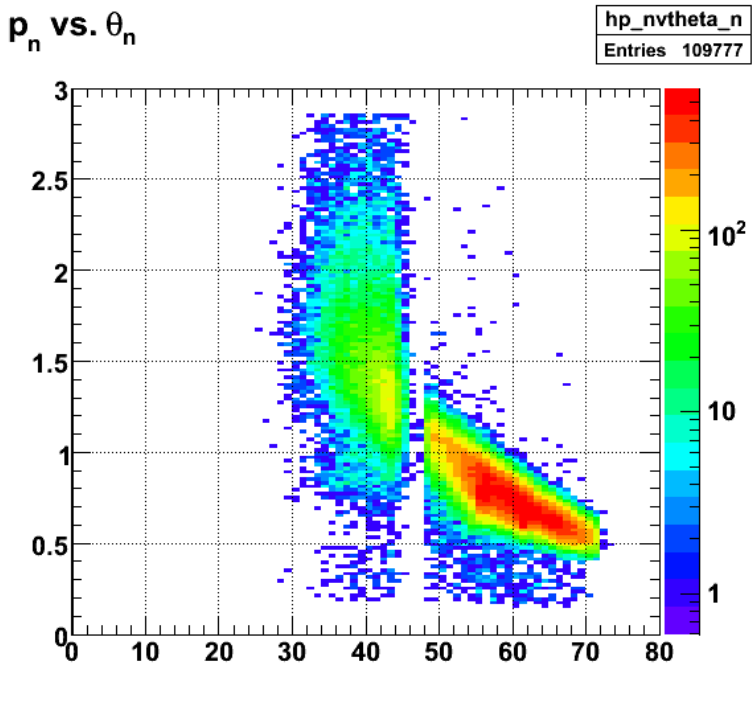
Click here to view the object (ROOT histogram file for fig 16) you uploaded.

Look st some of the features of the neutrons from the data analyzed for fig 17.



2008-02-29 16:38:47

Fig 18 Neutron(blue) and proton (black) momentum spectra with GMn QE cuts.



2008-02-29 16:42:22

Fig 19. Neutron momentum vs. neutron angle with GMn QE cuts.

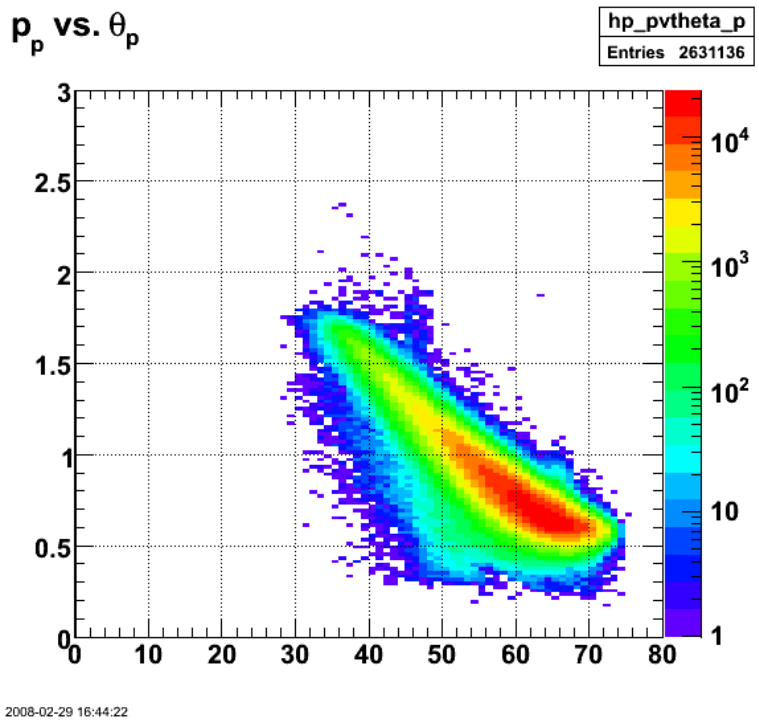


Fig 20. Same as fig 19 for protons.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 202 - GMn sims (gpg)

[Modified Tue Feb 12 04:22:30 2008 (GMT) gpg]

Some tests on queeg and the GMn sims motivated by JLs low acceptance.

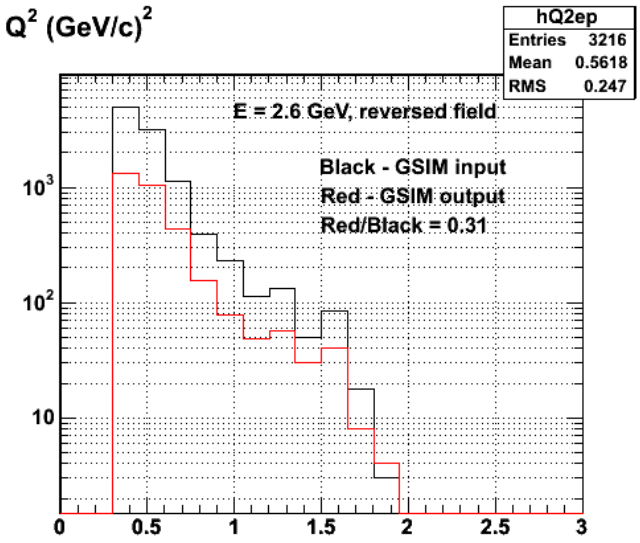


Fig 1. Comparison of GIM inputs and outputs for Q2 distribution for ep coincidences.

Click here to view the object (ROOT macro for fig 1.) you uploaded.

Get some neutrons in the picture. There are fewer e-p events because I still have fiducial cuts and target cuts and such on the proton events.

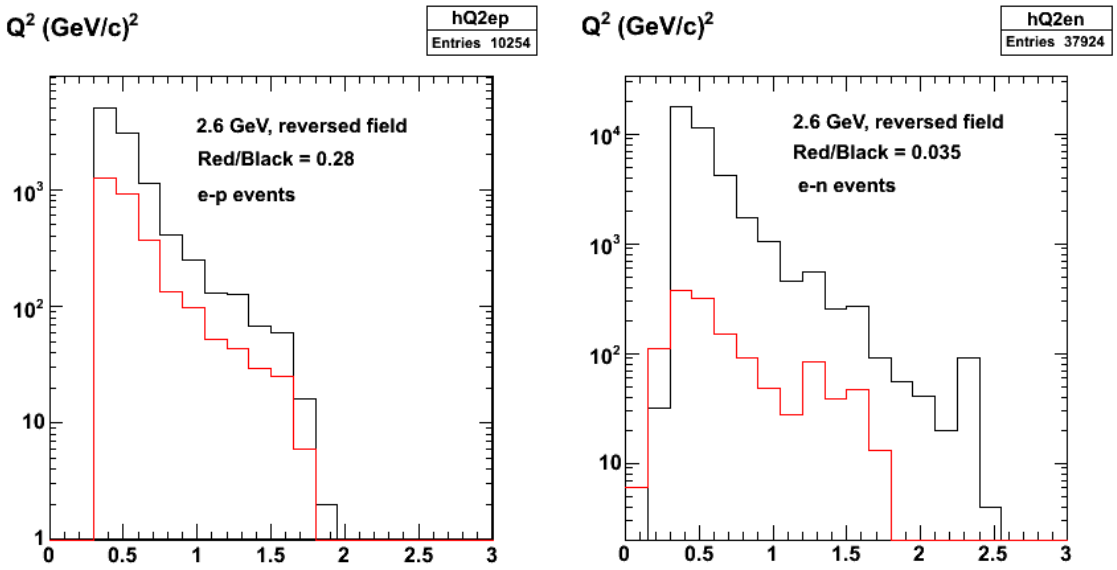


Fig 2. Comparison of e-p events (left-hand side) and e-n events (right-hand side) for 2.6 GeV, reversed field.

Click here to view the object (ROOT macro for fig 2) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 203 - GMn R (gpg)

[Modified Fri Apr 25 15:24:46 2008 (GMT) gpg]

First pass at using JL codes to analyze 2.6r data including LAC results. Some code first.

```
TFile infile ("gmnout2.6r1.root")
infile.ls()
TTree *mytree=qe_output_tree
mytree->Draw("qsq>>hqsq(12,0,2)")
mytree->Draw("qsq>>hqsq_p(24,0,2)","type==1")
mytree->Draw("qsq>>hqsq_n(24,0,2)","type==2","e0")
TH1F *hR = new TH1F("hR","R vs. Q^{2}",24,0,2)
hR->Divide(hqsq_n,hqsq_p,1,1)
hR->SetMaximum(0.1)
hR->SetMinimum(0.0)
hR->GetXaxis()->SetRange(1,12)
hR->Draw("e0")
```

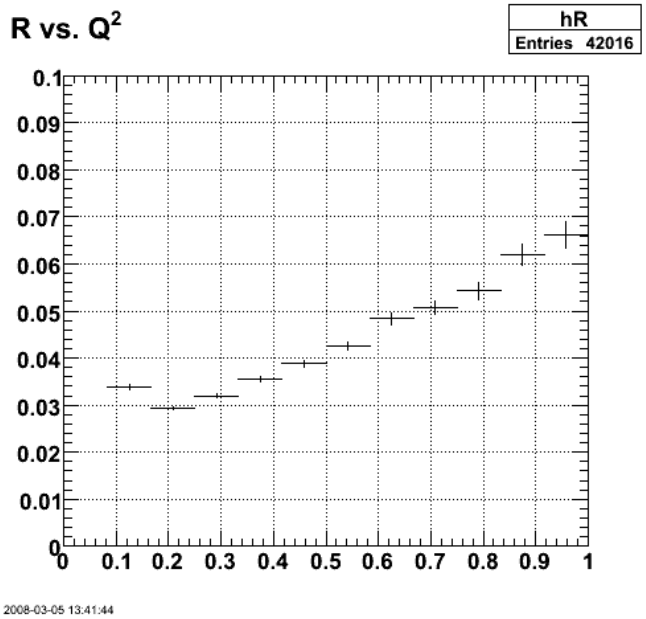


Fig 1. Raw GMn R for 2.6r. this is the ratio of e-n/e-p with no acceptance matching, correcting for detector efficiency, etc.

Click here to view the object (ROOT macro for gif 1) you uploaded.

Running JL code to extract GMn R. First, make the root file from the raw bos files.

```
../../bin/Linux/qe_ana -f gmnin.dat -o gmntest.root >& gmnout1.log
```

Click here to view the object (log file for 08-mar-08 test run.) you uploaded.

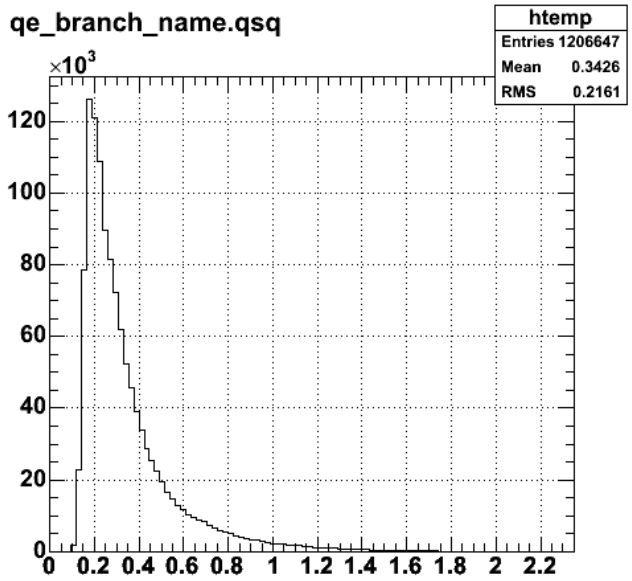


Fig 2. Q2 distribution for singles events. Data go down to Q2 = 0.1 GeV2

Process ntuple in JL code where it does detector efficiency correction, etc. Why is there a cutoff at Q2=0.5 GeV2???

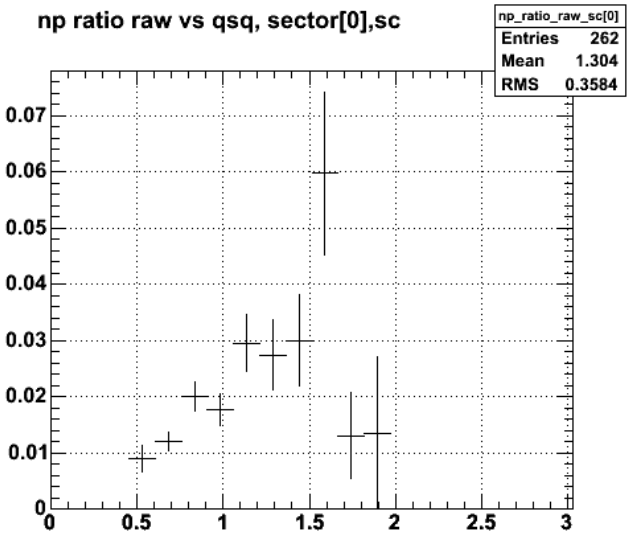


Fig 3. 'Raw' e-n/e-p ratio after processing in JL code.

The raw neutron distribution in the EC after processing.

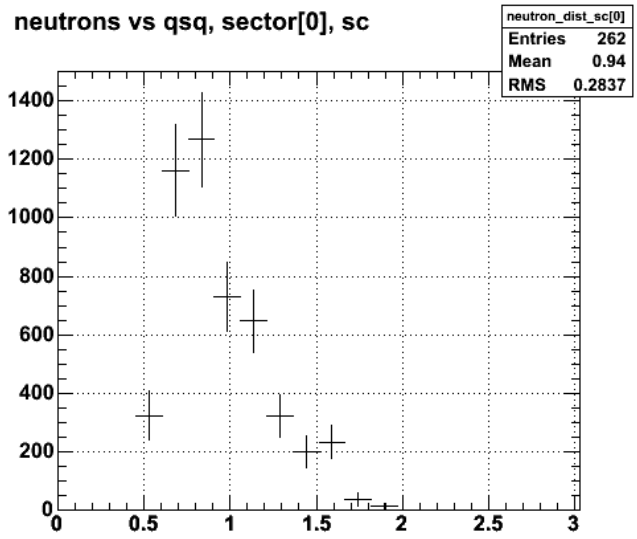


Fig 4. Raw neutron distribution.

Start putting on cuts on the Q2 distribution from the ntuple. first Q2 distribution with a neutron.

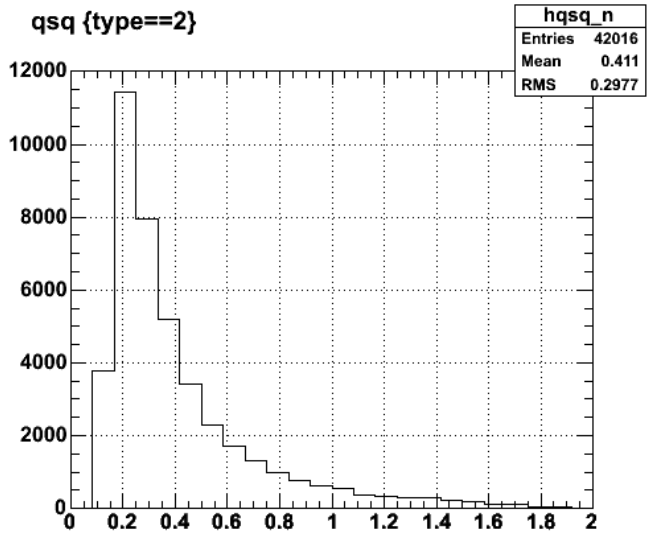
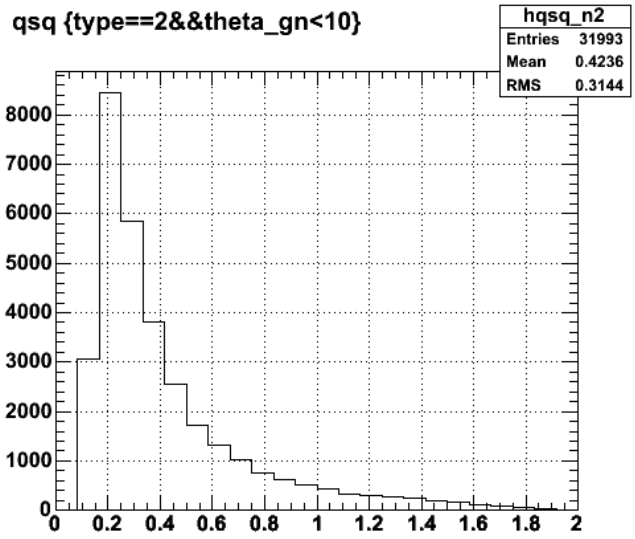


Fig 5. Q2 distribution from gmntest.root with a neutron in the final state.



Run the analysis for more events. Use runs 24519-24520.

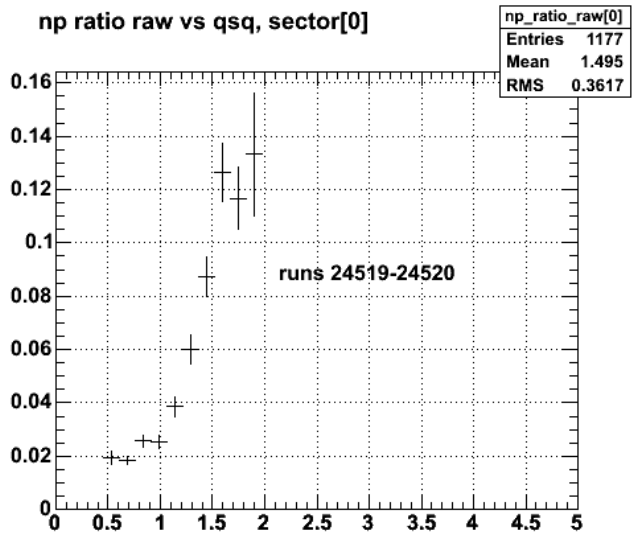


Fig 6. Raw np ratio for runs 24519-24520. Compare with fig 3.

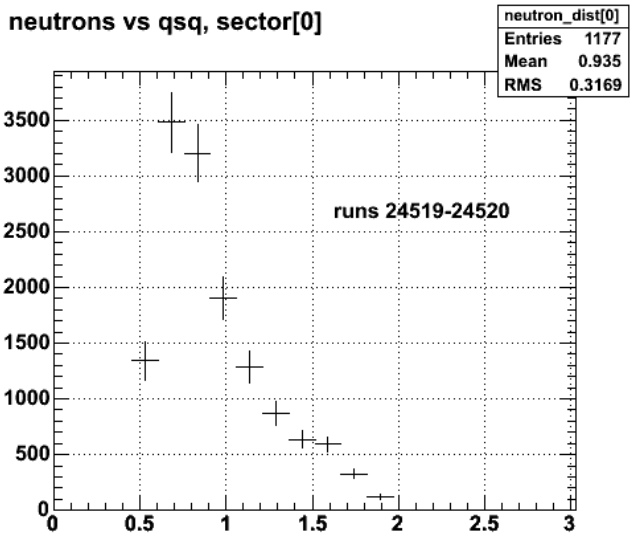


Fig 7. Raw neutron distribution.

Click here to view the object (Log file for previous 2 plots (figs 6-7).) you uploaded.

Click here to view the object (ROOT histogram file for figs 6-7.) you uploaded.

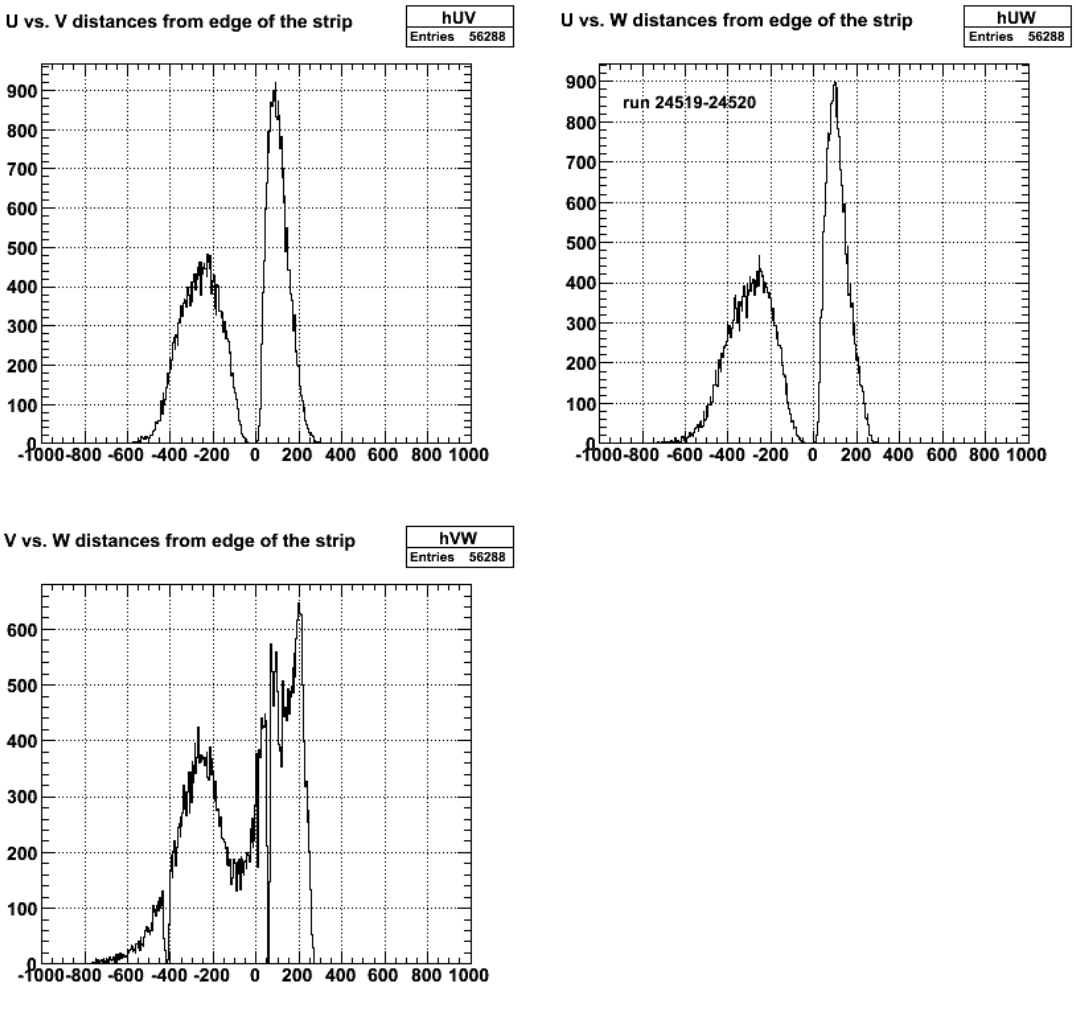


Fig 8. Distributions of distances from edge for UV, VW, and UW combinations.

Click here to view the object (ROOT macro for fig 8) you uploaded.

Click here to view the object (ROOT histogram file for fig 8) you uploaded.

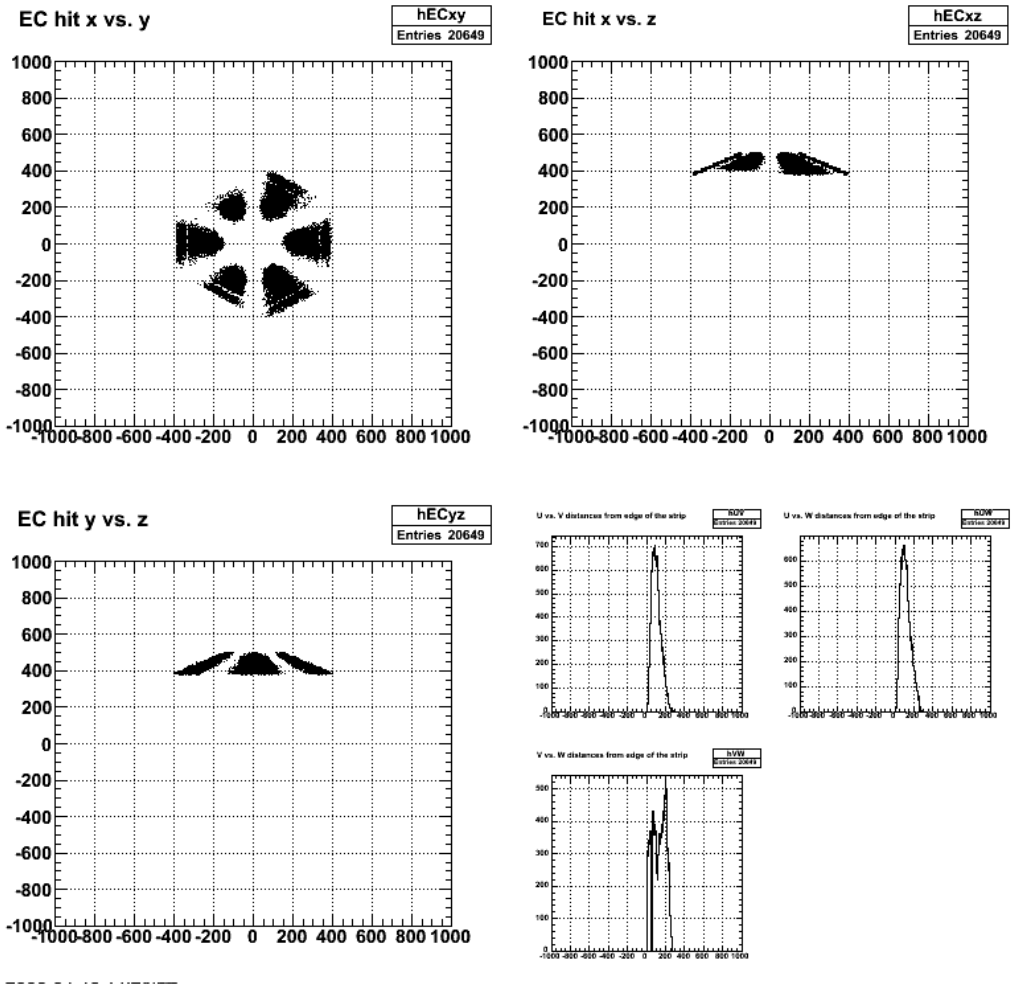


Fig 9. distribution of events in the calorimeter and in the EC strips.

Click here to view the object (ROOT macro for fig 9.) you uploaded.

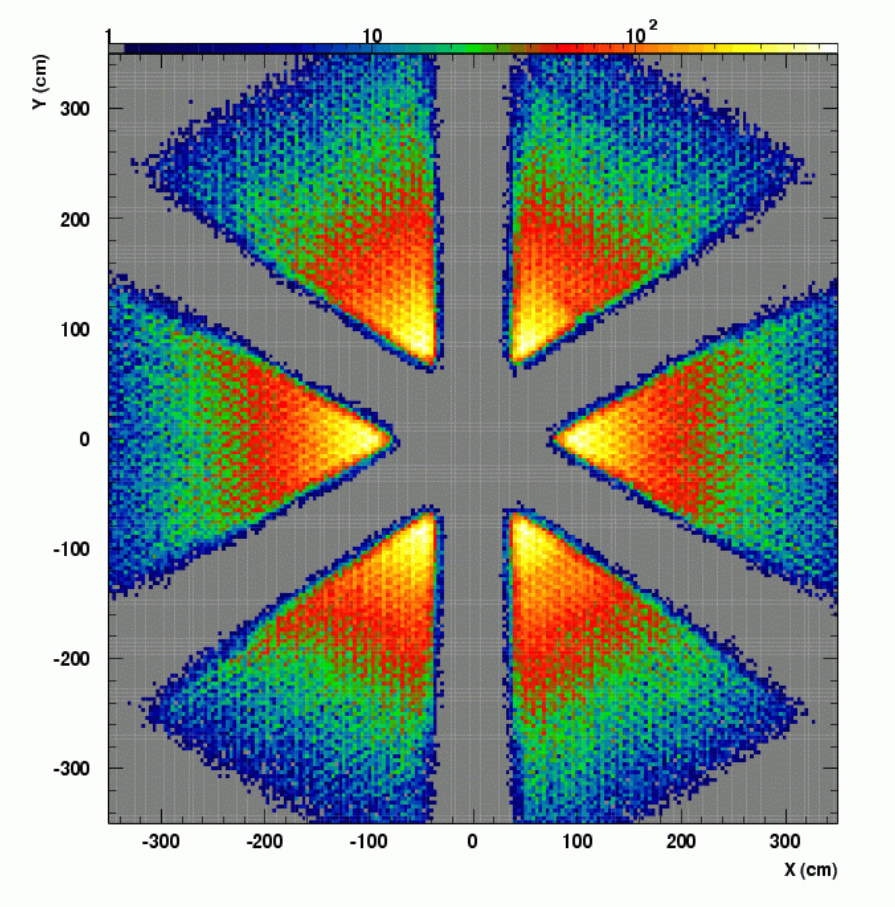


Fig 10. EC geometry

Try turning on the cut which removes the events if the EC pixel has inadequate efficiency.

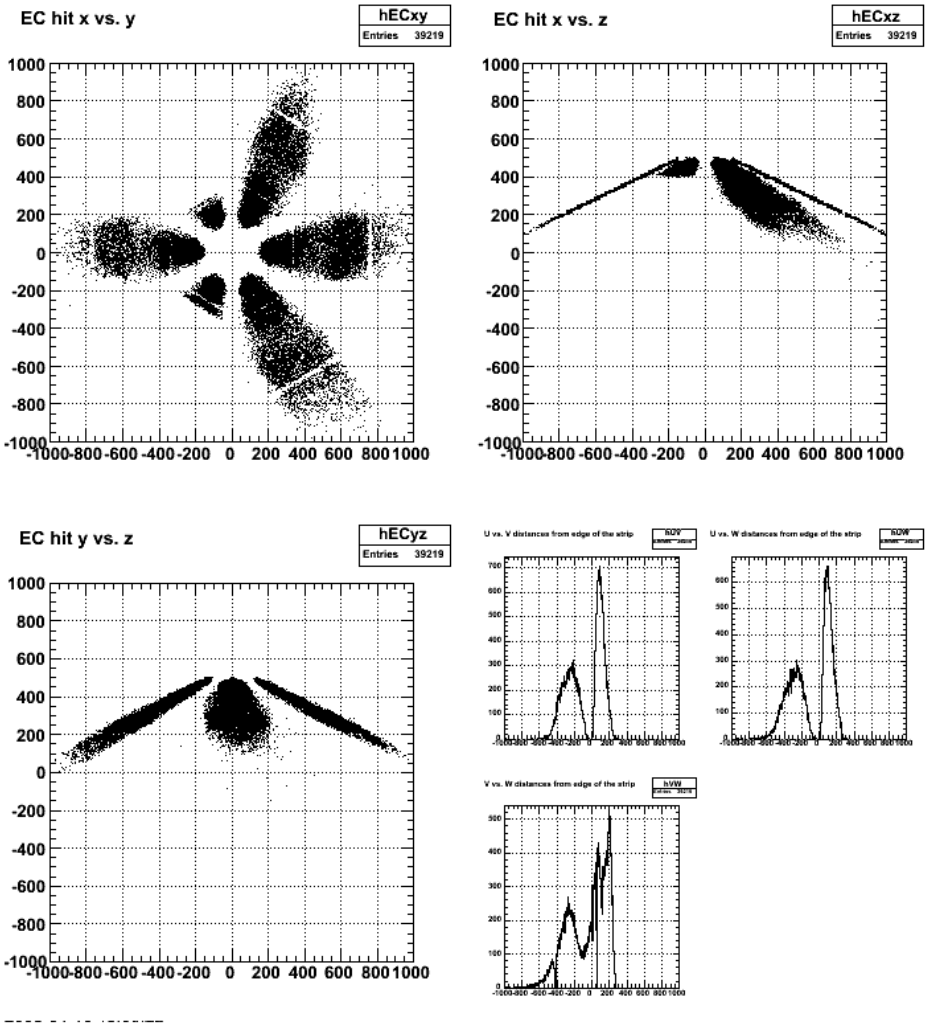


Fig 11. Same as fig 9 with cut on EC pixel efficiency removed

Click here to view the object (ROOT macro for Fig 11) you uploaded.

Still have the threshold problem at Q2 = 0.5 GeV2!!!

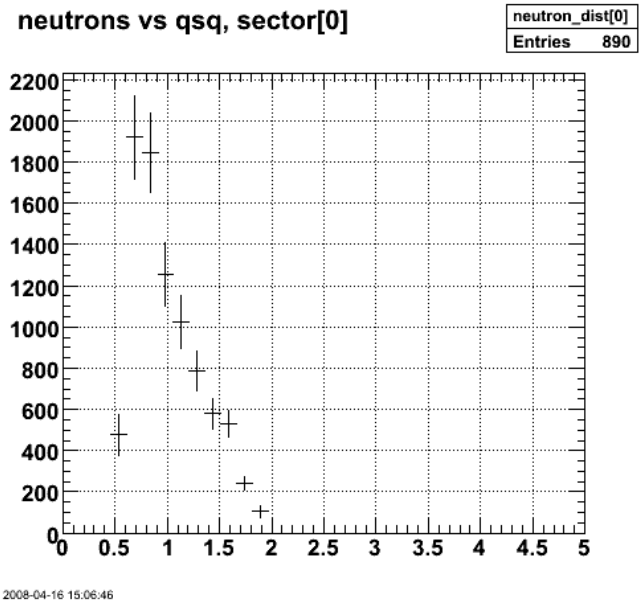


Fig 12. Neutron distribution for all sectors with EC efficiency cut off.

Click here to view the object (ROOT macro for Fig 12) you uploaded.

Modify the cuts so that everything with Q2 < 0.5 GeV2 gets in.

```
if(qe_in.type == qe_NEUTRON){
  if(use_ec == true_){
    //cout << "found an EC neutron! check_cuts and check_fiducial= " << check_cuts(qe_in,EC) << " " << check_fiducial(qe_in,EC) << " !" << endl;
    if (qe_in.qsq < 0.5) cout << "Q2=" << qe_in.qsq  << " check_cuts and check_fiducial= " << check_cuts(qe_in,EC) << " "
                              << check_fiducial(qe_in,EC) << " !" << endl;
    if((check_cuts(qe_in,EC)==true_ && check_fiducial(qe_in,EC)==true_) || (qe_in.qsq < 0.5)){
      ec_hit = ec_geom->calc_xyz(vert,nucleon3);
      ec_pix = ec_geom->xyz2pixel(ec_hit);
```

Now see lots of events.

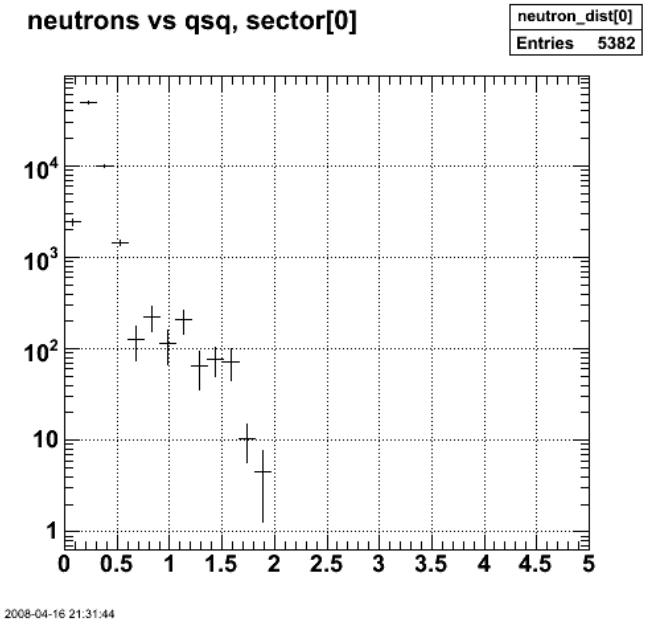


Fig 13. Effect of letting all Q2< 0.5 GeV2 events in.

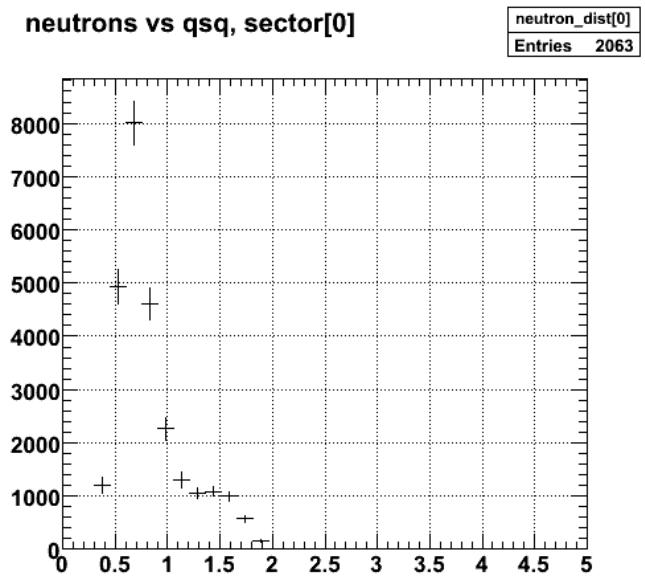
Click here to view the object (ROOT macro for fig 13) you uploaded.

In examining the log files it is clear that the code is picking the wrong polarity for the torus current. after adding the following stuff to my .cshrc file things get better.

```
# for GMn analysis

setenv CLAS_CALDB_RUNINDEX calib_user.RunIndexe5
setenv RUN_INDEX calib_user.RunIndexe5
```

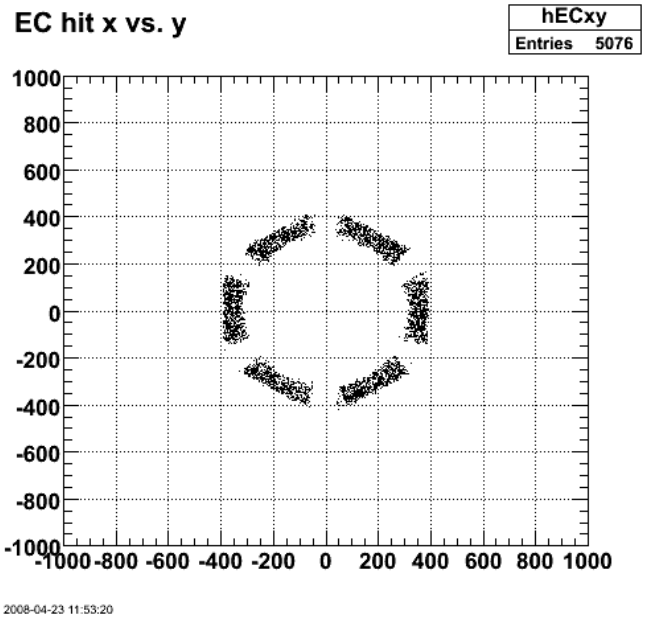
In particular, the torus current in now usually correct in the outputs from the SDA and other CLAS routines. There are a number of places where is still is positive when it should be negative. In printing out the torus current from the functions in JL's code, it is now clear there are still problems. The C++ structure qe_in which it looks like JL's code gets from the ntuple created in the event selection phase has a member qe_in.Itorus which is still positive. I arbitrarily set this value to negative in JL's code to see the effect and I now see events below Q2 = 0.5 GeV2. See plots below.



2008-04-23 11:45:13

Fig 14. Neutron distribution with Itorus set to negative in JL code qe_ana.

Click here to view the object (ROOT macro for fig 14) you uploaded.



2008-04-23 11:53:20

Fig 15. Effect of reversing polarity on EC positions.

Click here to view the object (ROOT macro for fig 15) you uploaded.

Click here to view the object (ROOT histogram file for Fig 14-15) you uploaded.

SUCCESS!!!!? I had not properly run the event selection code before running the event histograming code with with the proper environment variables to locate the correct run index. Once doing that I get the following results. I am surprised at the small number of events. Having the right torus current seems to have reduced the number of events.

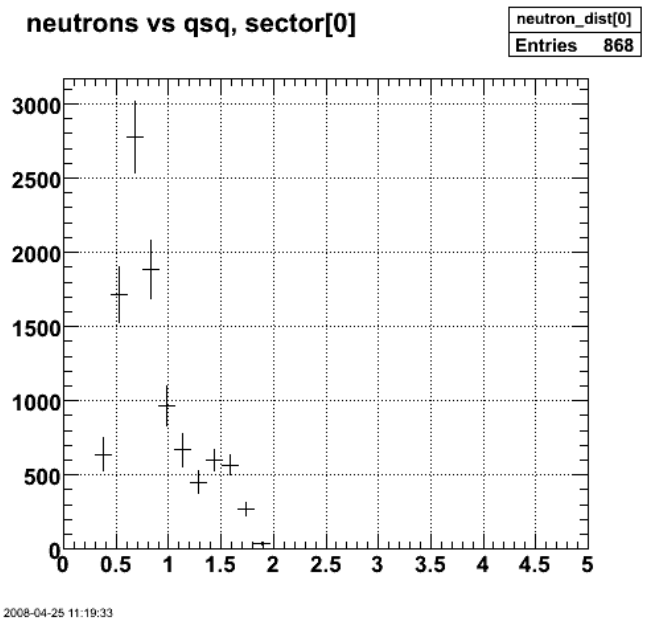


Fig 16. Neutron distribution with correct torus polarity in the event selection and the histograming.

Click here to view the object (ROOT macro for Fig 16) you uploaded.

Click here to view the object (ROOT histogram file for fig 16) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 204 - GMn R2 (gpg)

[Modified Tue Apr 29 00:17:18 2008 (GMT) gpg]

Now that the code appears to be working take a look at the behavior of neutrons and protons as functions of momentum and theta to try and figure out the low-Q2 problems in the e-n/e-p ratio that JL sees (see entries 375 and 381 in E5 log). Fig 1 shows the momentum and angle dependence for neutrons and protons with the fiducial cuts (check_fiducial) and the quasielastic cut on theta_pq (check_cuts).

All of the analysis below is based on runs 24519-24520. Some plots are fulls analysis of both of these and some are partial analysis of these runs.

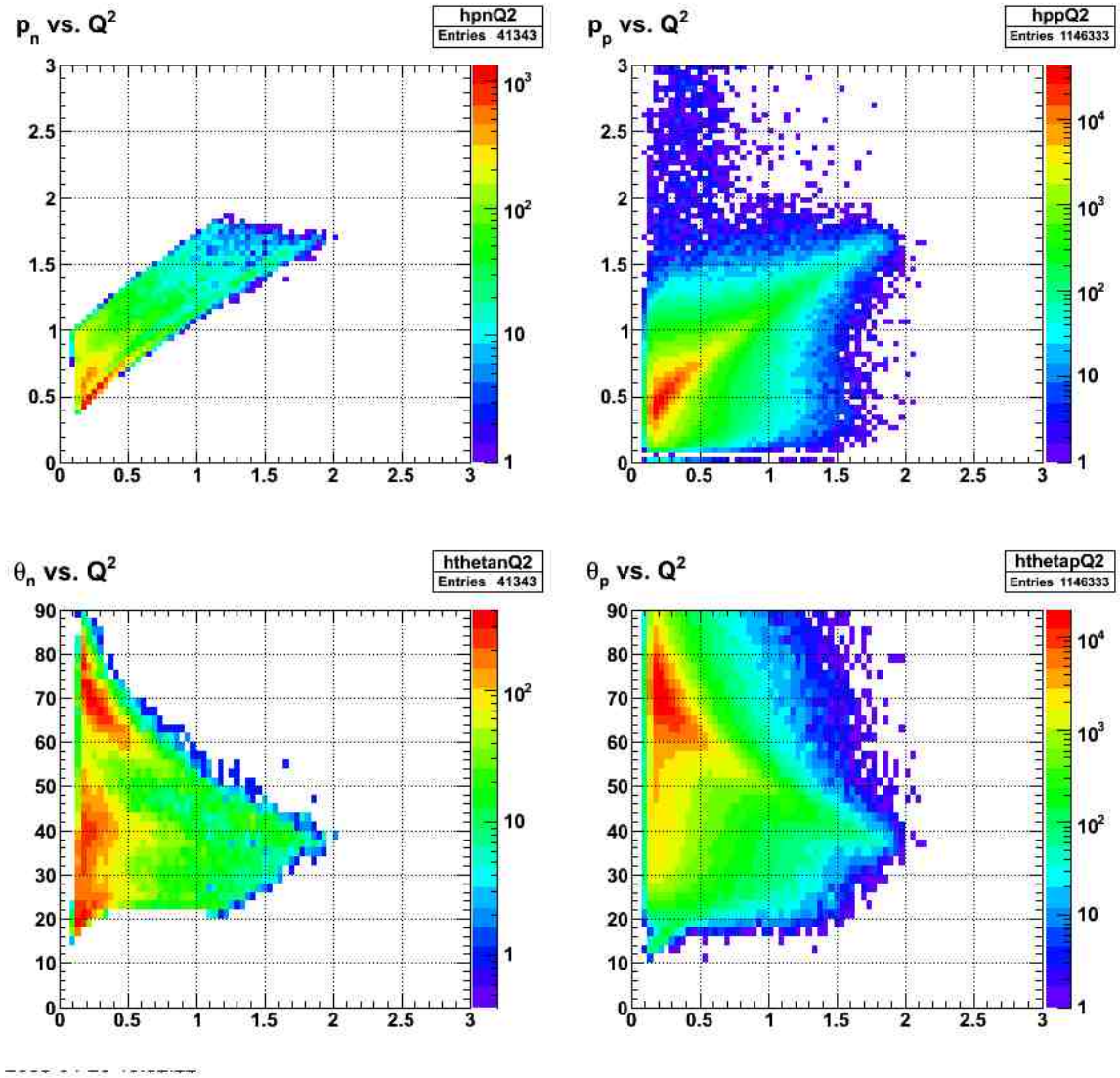


Fig 1. Momentum and angle dependence for neutrons (left) and protons (right) for 2.6r from qe_ana.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (ROOT histogram file for fig 1) you uploaded.

Now turn on check_cuts and check_fiducial and get Fig 2. What is that nasty thing for Q2 < 0.5 GeV2?

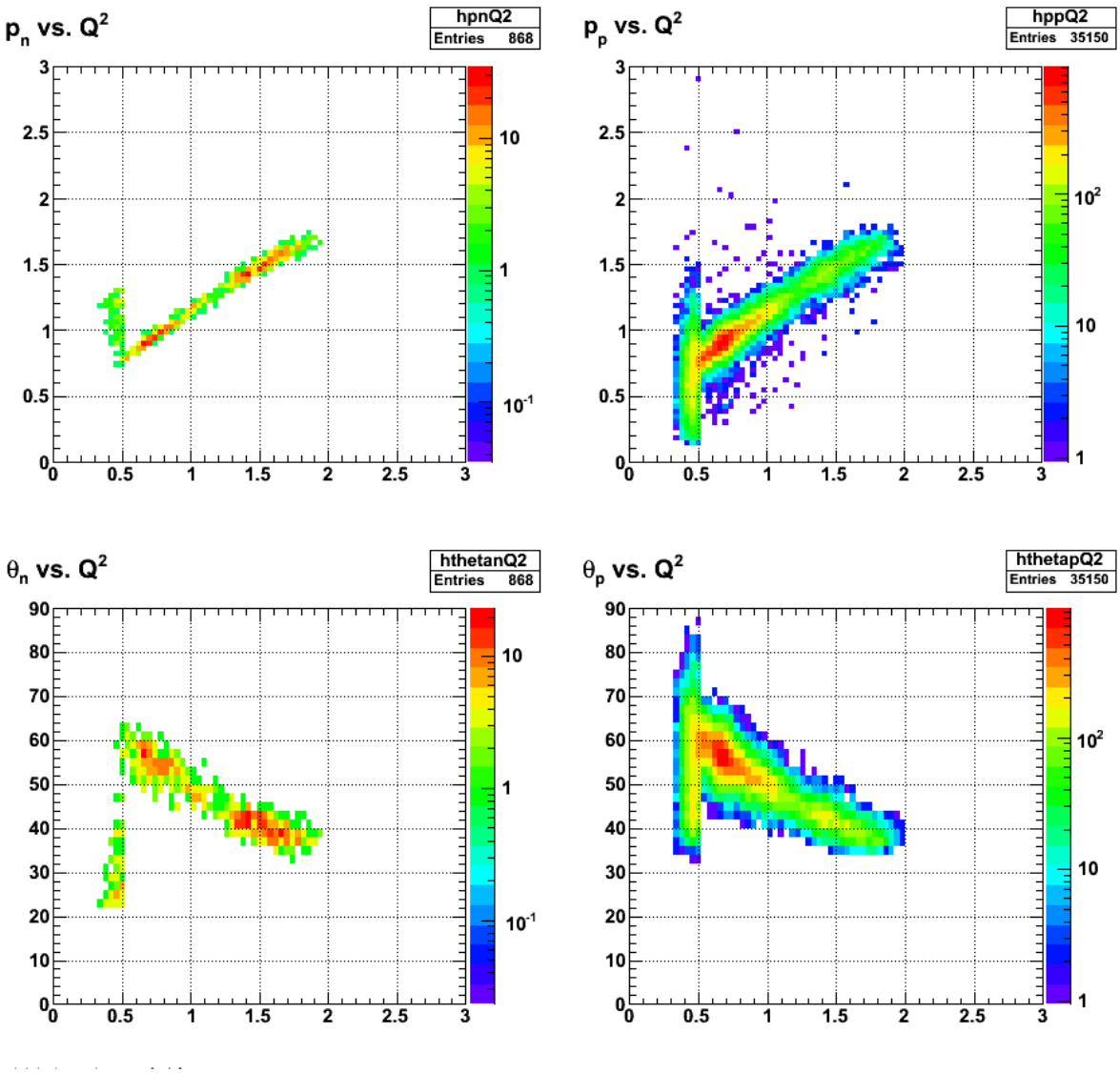


Fig 2. Momentum and angle dependence for neutrons (left) and protons (right) for 2.6r from qe_ana. The results are for all detectors (ec, lac, sc) and with check_cuts and check_fiducials turned on.

Click here to view the object (ROOT macro for fig 2) you uploaded.

Now turn off the SC in the analysis that fills the hists.

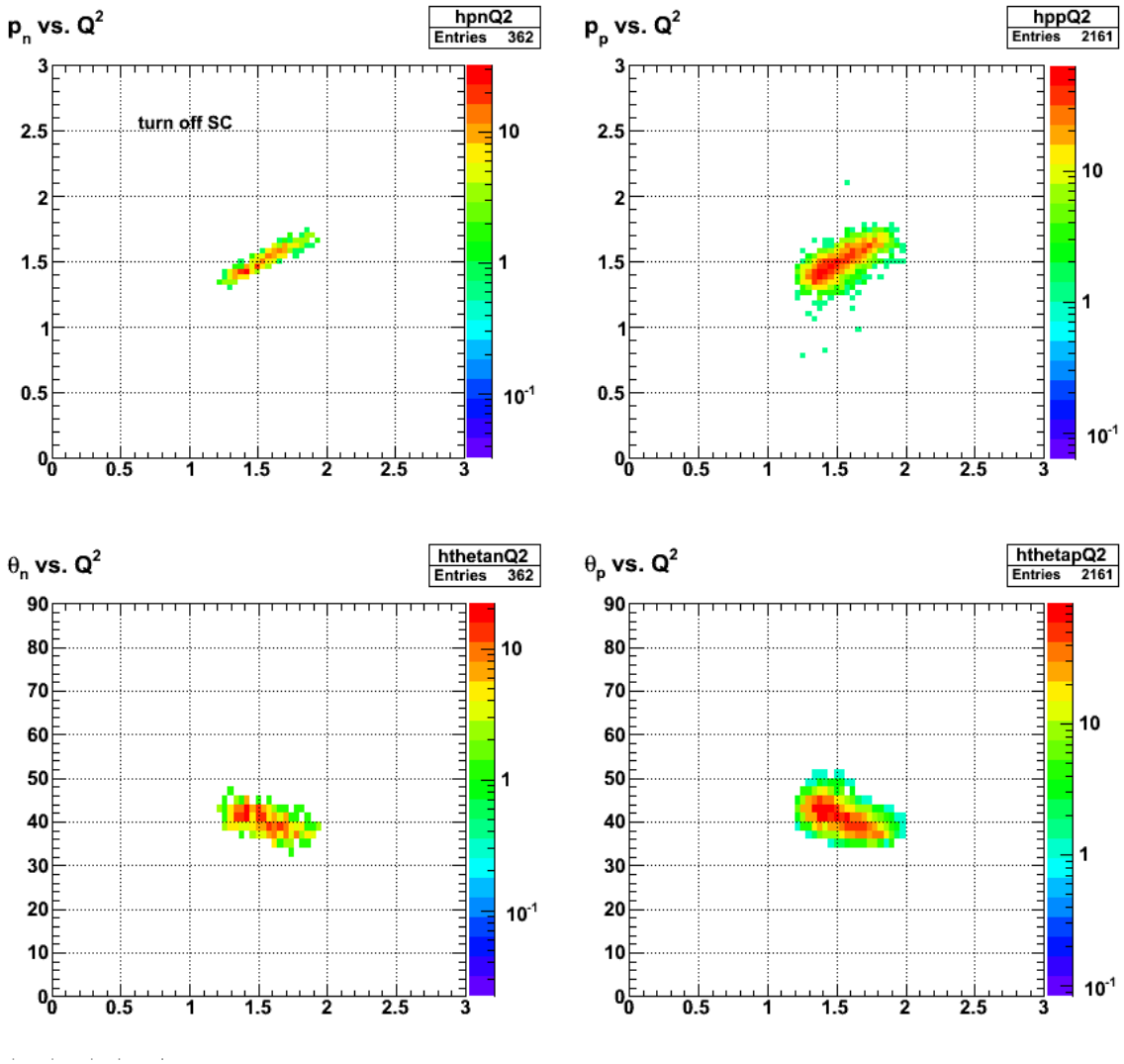


Fig 3. Momentum and angle dependence for neutrons (left) and protons (right) for 2.6r from qe_ana. The results are for all detectors (ec and lac; sc is off) and with check_cuts and check_fiducials turned on.

Click here to view the object (ROOT macro for Fig 3) you uploaded.

Turning off the LAC has no effect on the results in Fig 3. I was suspicious that the weirdness below Q2= 0.5 GeV2 was due to the efficiency so I set the weight to 1.0 for all events with little change.

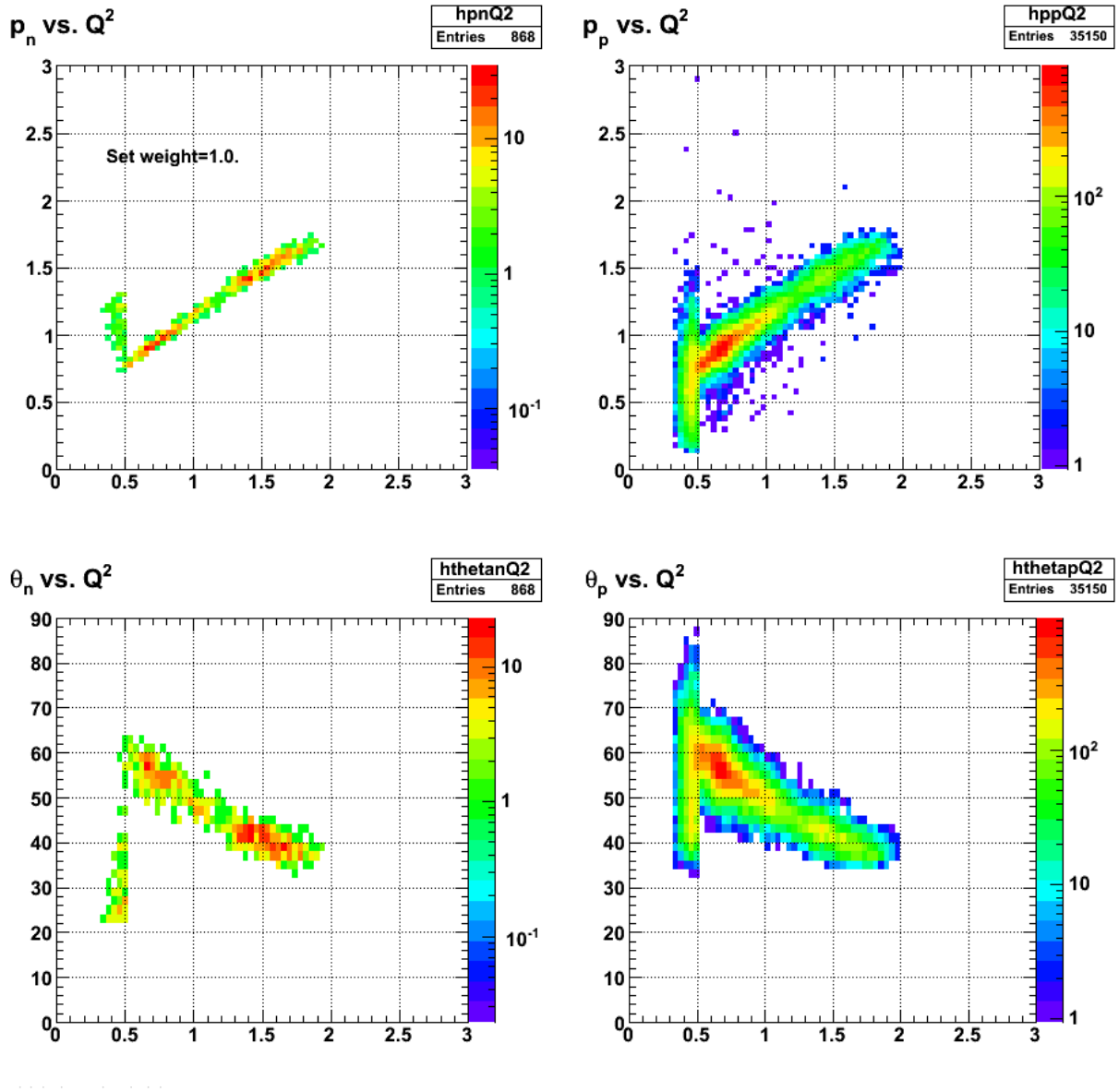


Fig 4. Momentum and angle dependence for neutrons (left) and protons (right) for 2.6r from qe_ana. The results are for all detectors (ec and lac; sc is off) and with check_cuts and check_fiducials turned on and weight = 1.0

Click here to view the object (ROOT macro for fig 4) you uploaded.

Set the weight=1/nde in the 2D histograms and see if there is any significant difference. There is not.

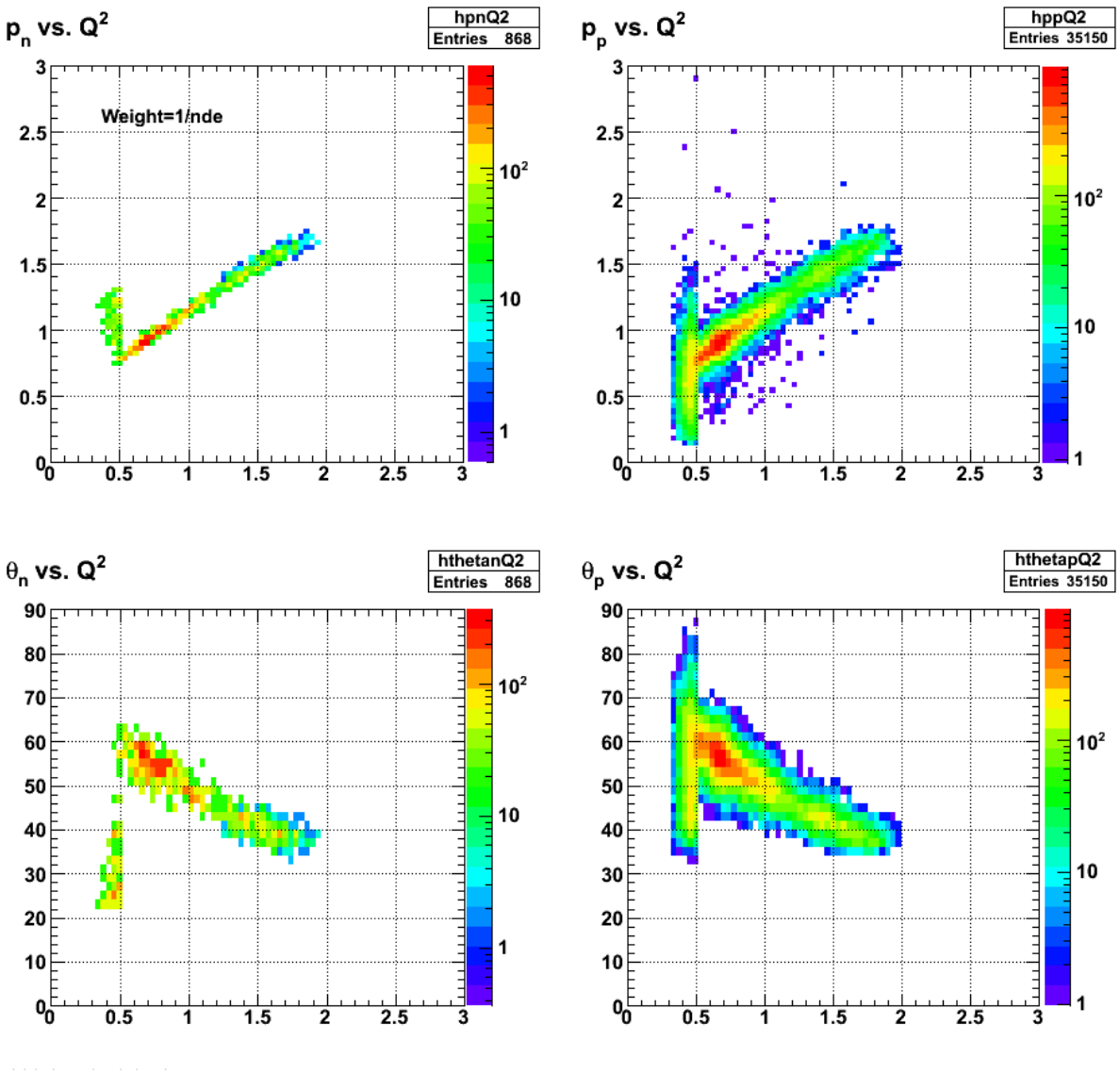


Fig 5. Momentum and angle dependence for neutrons (left) and protons (right) for 2.6r from qe_ana. The results are for all detectors (ec and lac; sc is off) and with check_cuts and check_fiducials turned on and weight = 1/nde.

Click here to view the object (ROOT macro for fig 5) you uploaded.

The problem is clearly in the SC so start looking at the SC alone.

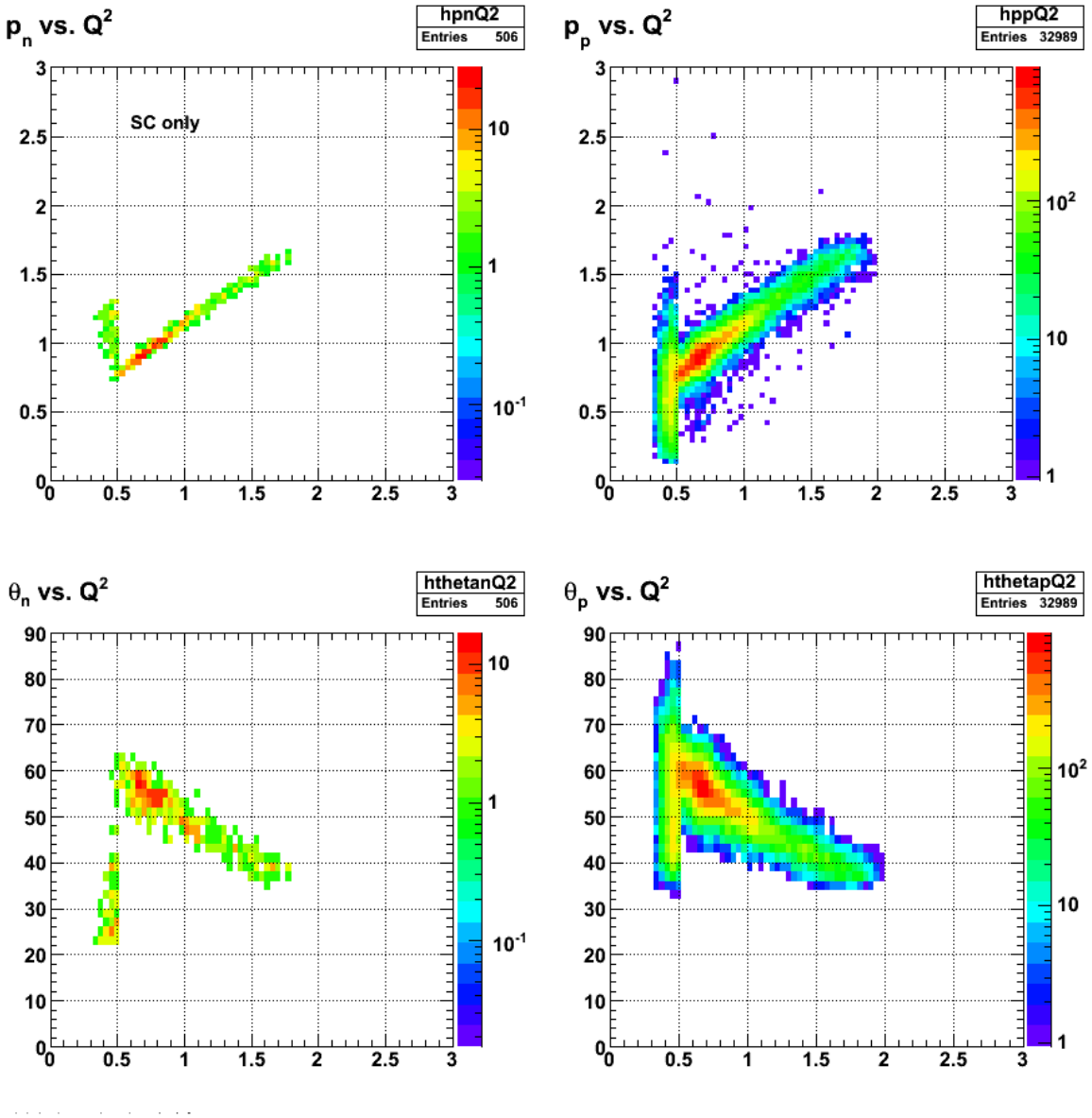


Fig 6. Momentum and angle dependence for neutrons (left) and protons (right) for 2.6r from qe_ana. The results are for all detectors (ec and lac; sc is off) and with check_cuts and check_fiducials turned on and weight = 1.0, SC only.

Click here to view the object (ROOT macro for fig6) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 205 - low-Q2 issues (gpg)

[Modified Thu May 8 14:25:20 2008 (GMT) gpg]

The plots below are the result of my studies to understand the strange behavior of the GMn R for Q2 < 0.5 GeV2. See the entries 351, 352, and 388 for a discussion of JL's and WKB's analysis.

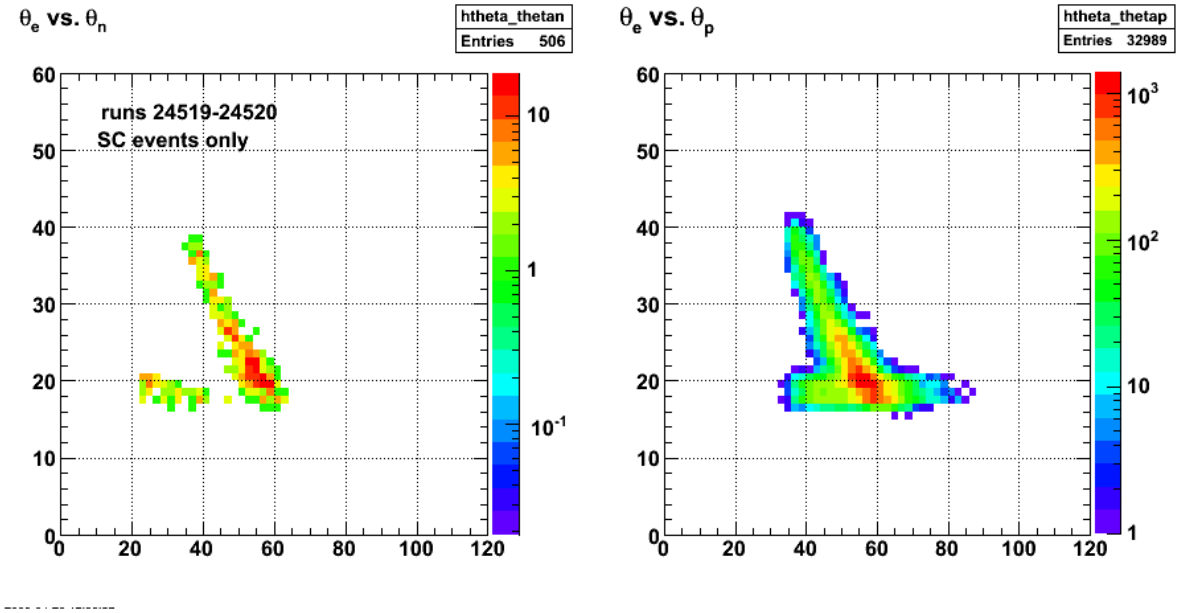


Fig 1. Effect of electron acceptance on neutrons (left) and protons (right).

Click here to view the object (ROOT macro for fig 1) you uploaded.

After talking to Jeff I find out that the angle-only, QE analysis is being used in qe_ana, but should be turned off. I thought this method was better, but Jeff says it caused problems. Check the elog entry on this. When I comment out the angle-only QE analysis, then I see events down to Q2=0.1 GeV2. See Fig 2.

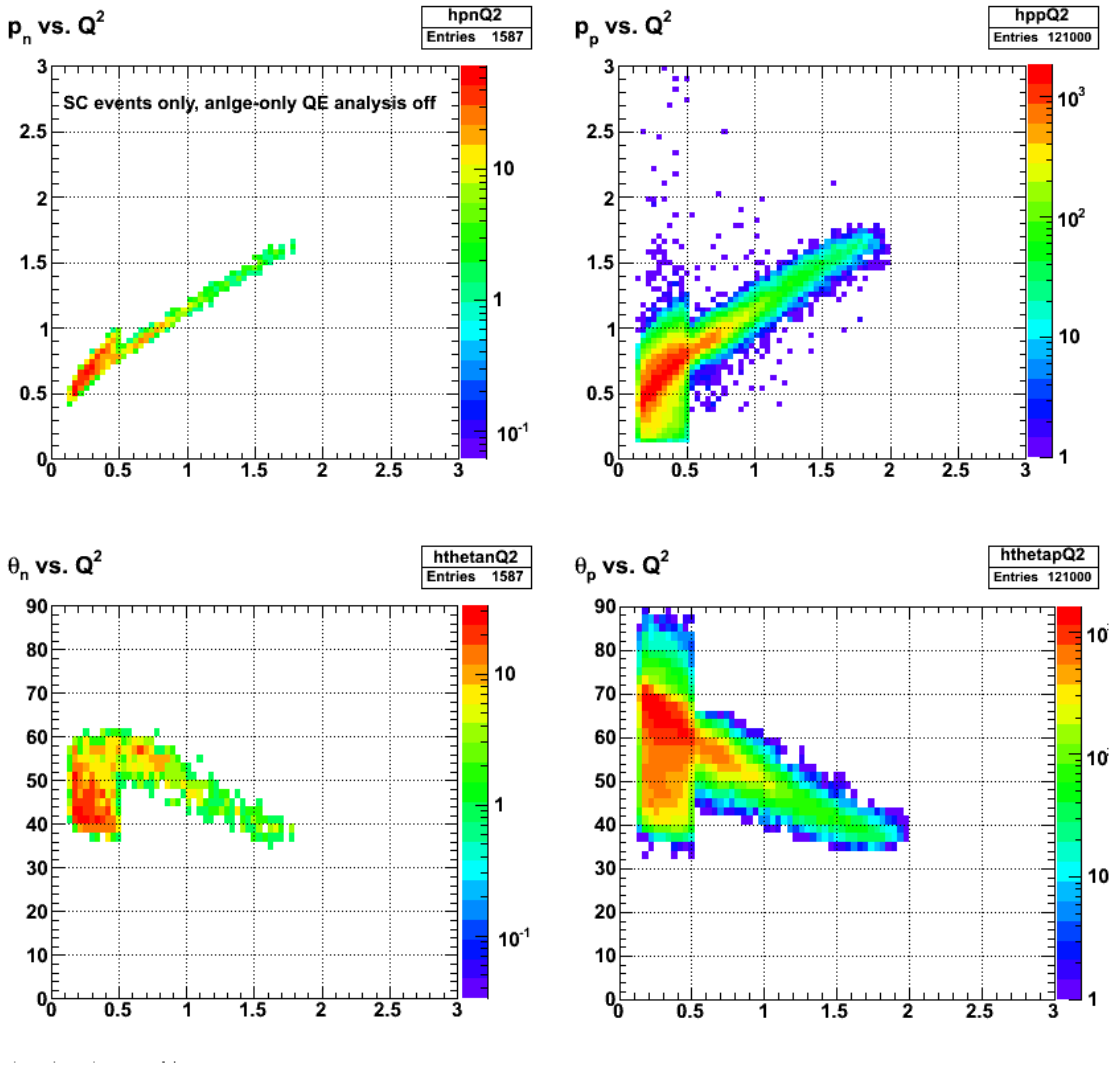


Fig 2. Momentum and angle dependence on Q2 for 2.6r, qe_ana, SC only, check_cuts and check_fiducials on, and angle-only QE analysis turned OFF.

Click here to view the object (ROOT macro for fig 2) you uploaded.

Click here to view the object (ROOT histogram file for fig 2) you uploaded.

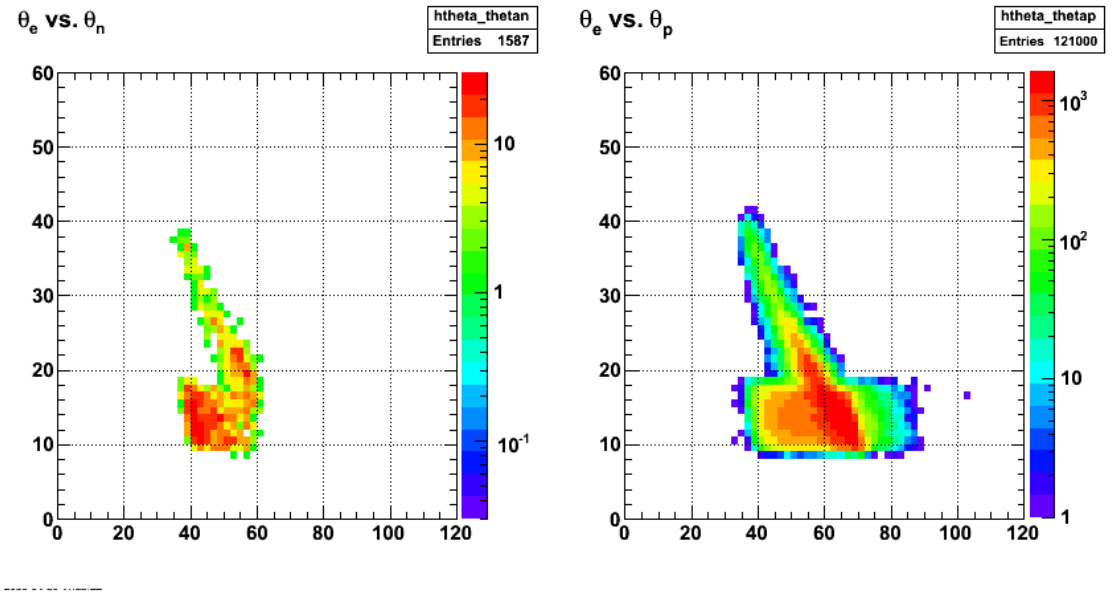


Fig 3. Same as fig 1 with angle-only QE analysis turned OFF.

Click here to view the object (ROOT macro for fig 3) you uploaded.

Put a cut around the peak at low hadron angle amd theta_e = 10-20 deg and look at the features of the events in that region.

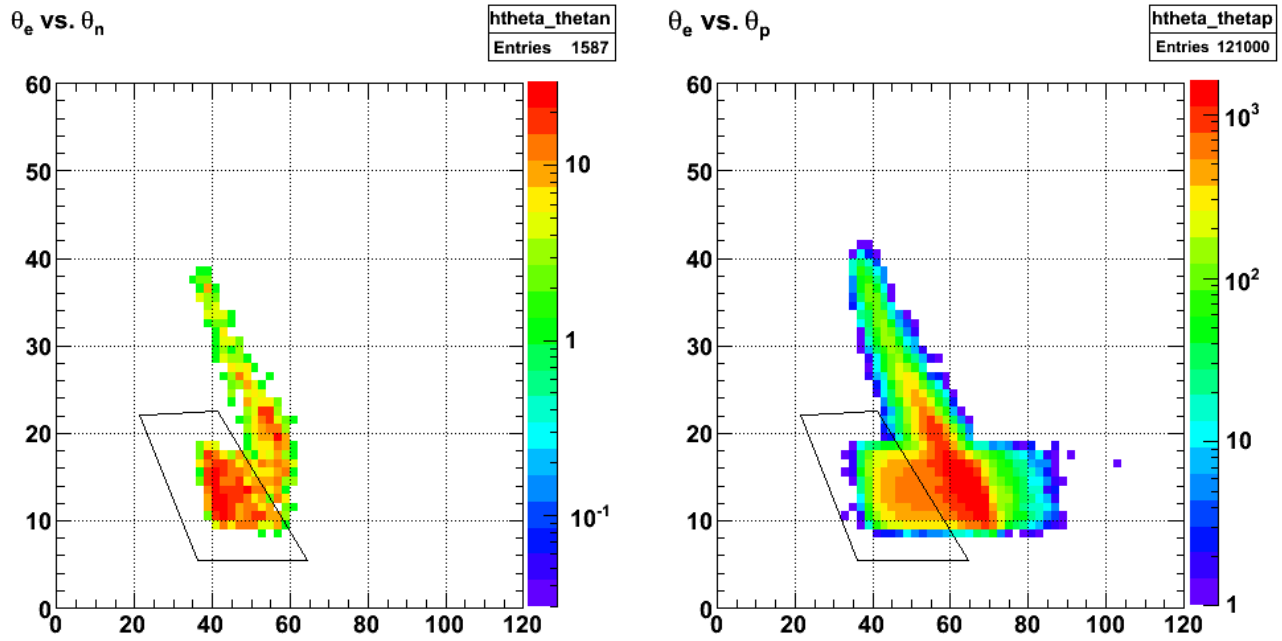


Fig 4. Plot showing the 2D gate.

Click here to view the object (ROOT macro for fig 4) you uploaded.

Why is there so much stuff at large W2? It should be eliminated by the W2 cut at W2=1.2 GeV2.

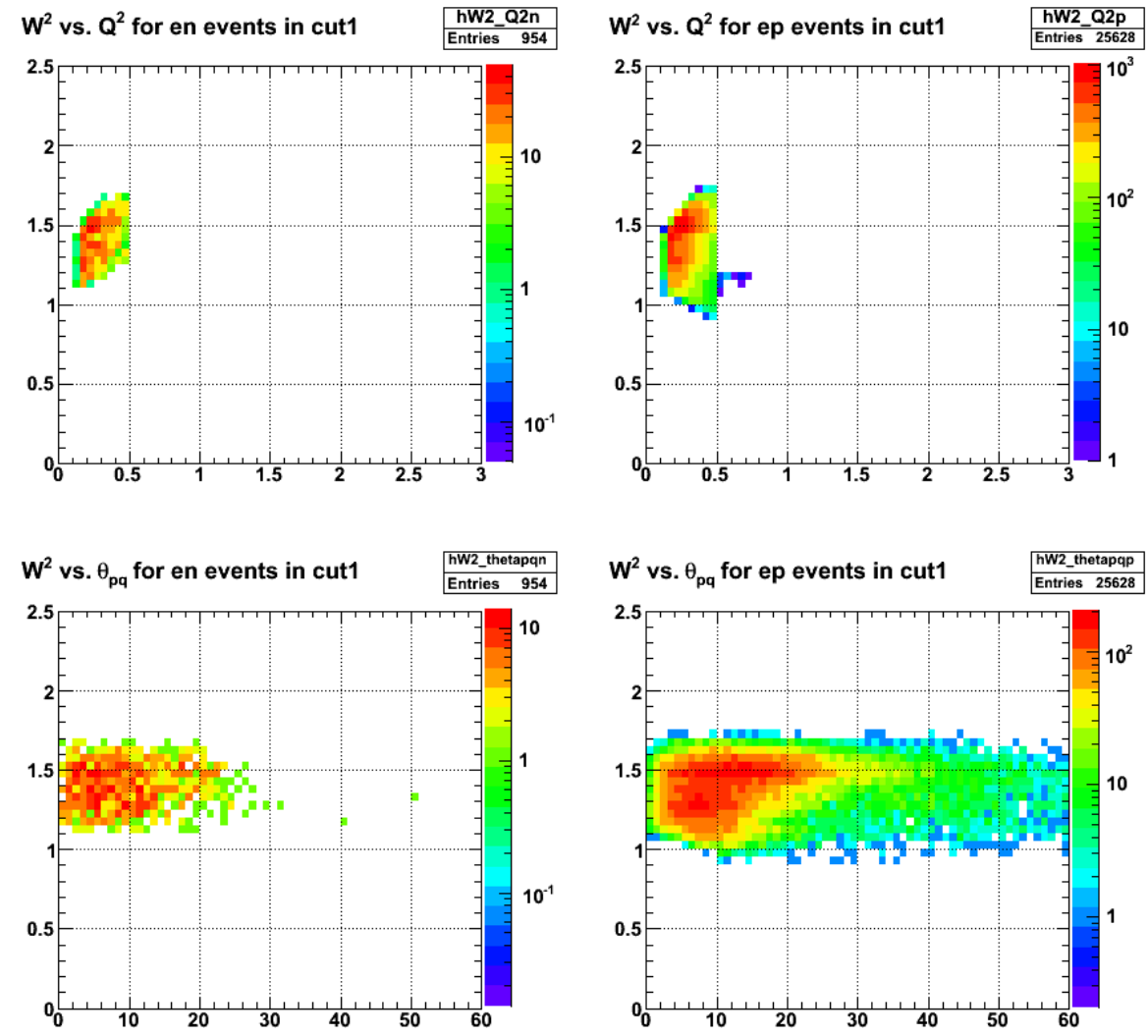
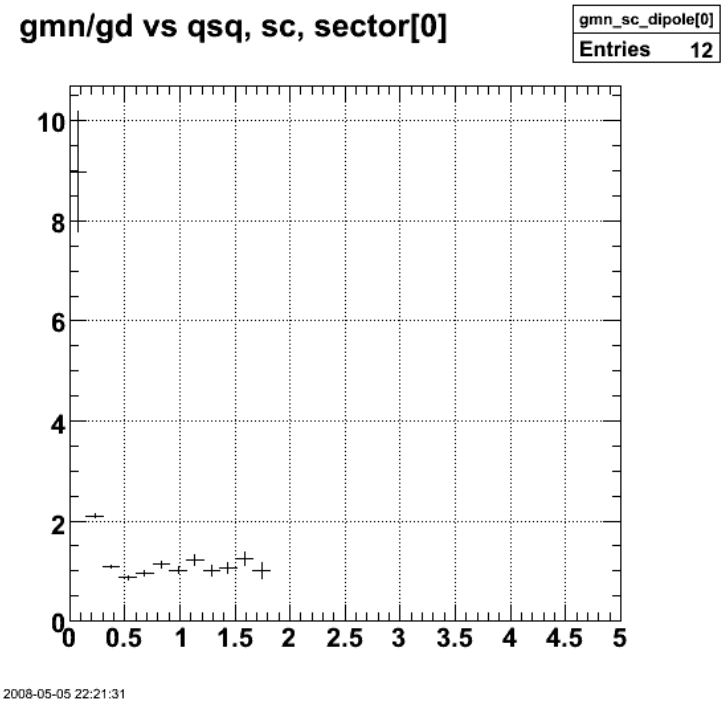


Fig 5. W2 vs. Q2 (top row) and W2 vs. theta_pq (bottom row) for neutrons (left column) and proton (right column).

Click here to view the object (ROOT macro for fig 5) you uploaded.

Click here to view the object (ROOT histogram file for fig 5) you uploaded.

Fig 6. shows the problems with GMn extracted from the SC at low Q2. It should be roughly about one and it's rocketing upward.



2008-05-05 22:21:31

Fig 6. Reduced GMn at 2.6r from the SC.

Click here to view the object (ROOT macro for fig 6) you uploaded.

The check_cuts function was turned off (essentially) for Q2 < 0.5 GeV2. Redo the analysis with the lower limit on check_cuts changed from 0.5 GeV2 to 0.0 GeV2.

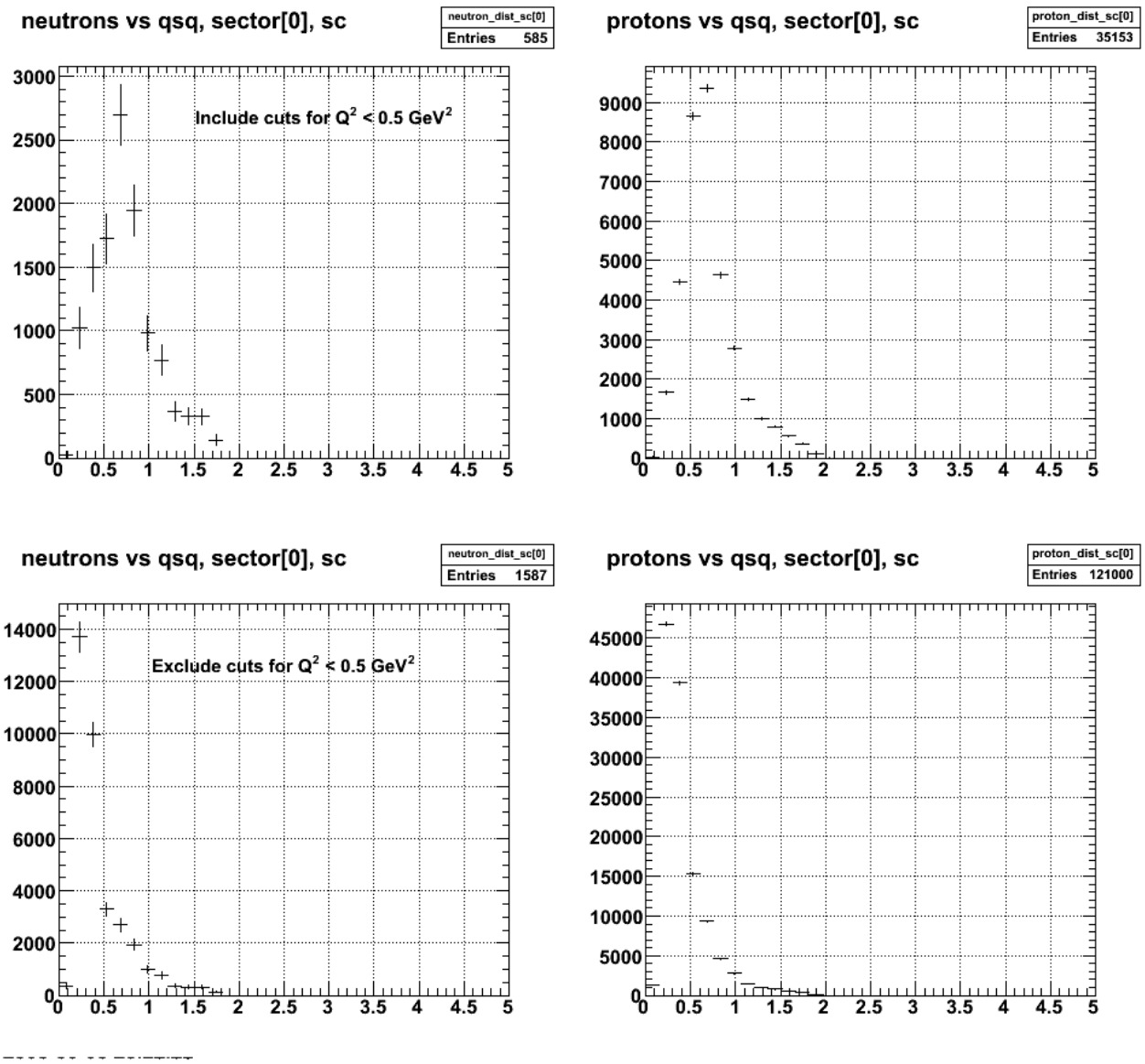


Fig 7. Neutron (left) and proton (right) distributions with fix in (top row) and fix out (bottom row).

Click here to view the object (ROOT macro for fig 7) you uploaded.

!!!!!!!!!!????????????????????????????????? Turning on the low-Q2 cuts actual makes the reduced GMn go UP!!

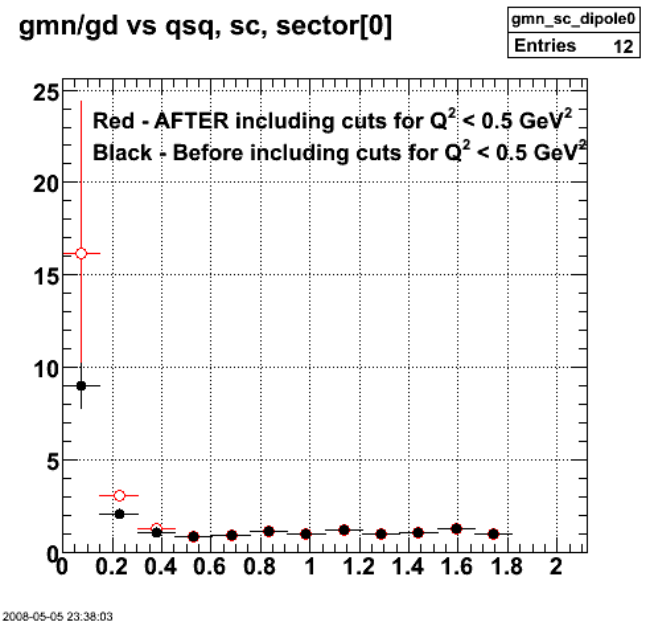


Fig 8. Effect of including cuts for Q2 < 0.5 GeV2 on reduced GMn (red) for 2.6r data. Black points are from previous analysis where cuts where turned off for Q2 < 0.5 GeV2.

Click here to view the object (ROOT macro for fig 8) you uploaded.

Click here to view the object (ROOT histogram file for fig 8.) you uploaded.

'Fix' the problem with turning off the cuts for Q2 < 0.5 GeV2 and start looking at things. We want to optimize the cuts for this region. The 595-event plots are from events that are outside cut1. The 646-event plots are for all events.

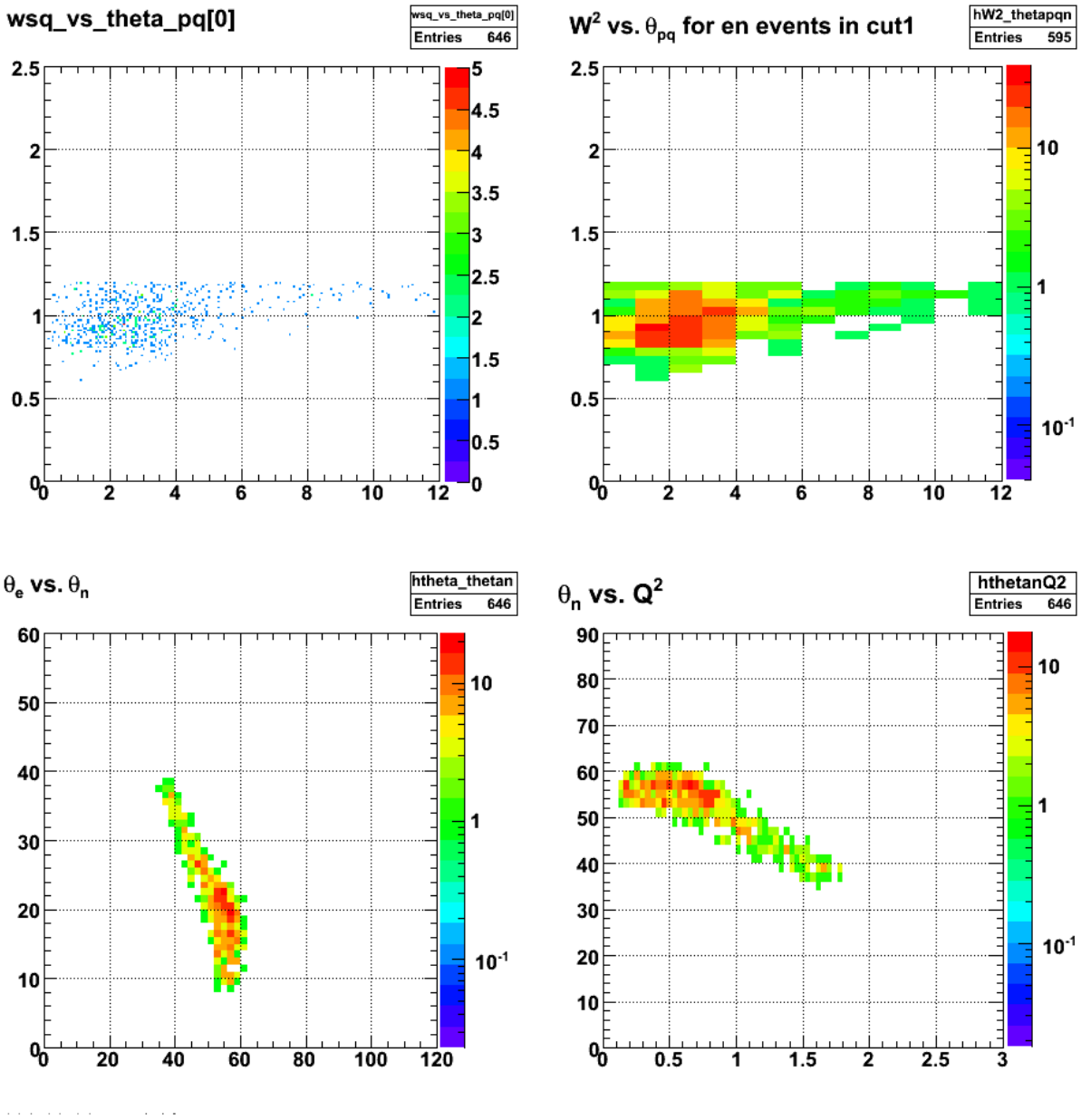


Fig 9. Neutrons a 2.6r.

Click here to view the object (ROOT macro for fig 9) you uploaded.

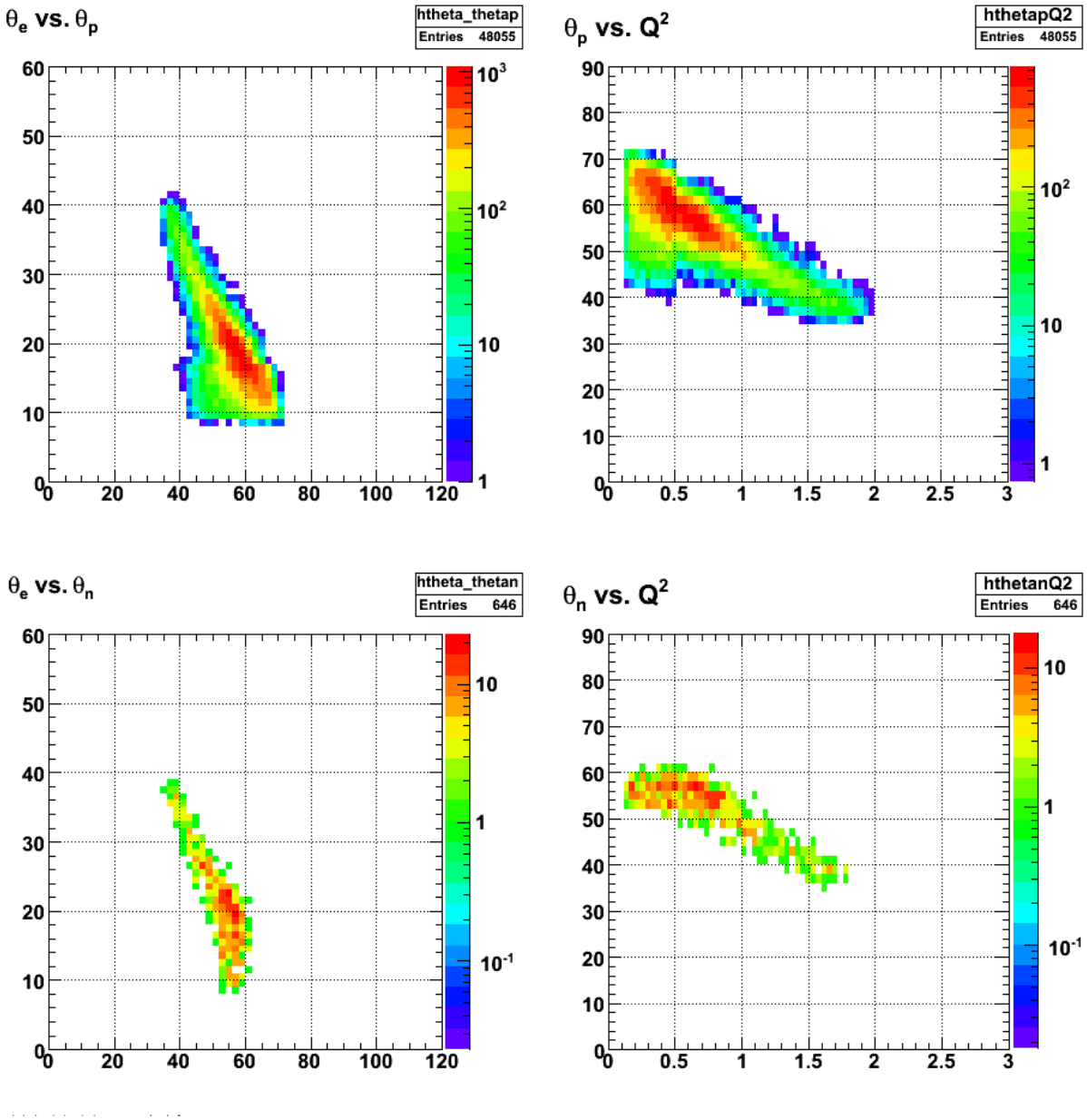


Fig 10. Compare neutrons (bottom row) with protons (top row). Why is there such a disparity in the number of neutrons versus protons???

Click here to view the object (ROOT macro for fig 10) you uploaded.

The difference in the number of events is real. The difference in the distribution of neutrons versus protons (i.e. fig ?) is much less because the efficiency is smaller for the neutrons in the SC so each event counts more. The plot below shows the theta_e versus theta_N weighted by 1/det eff.

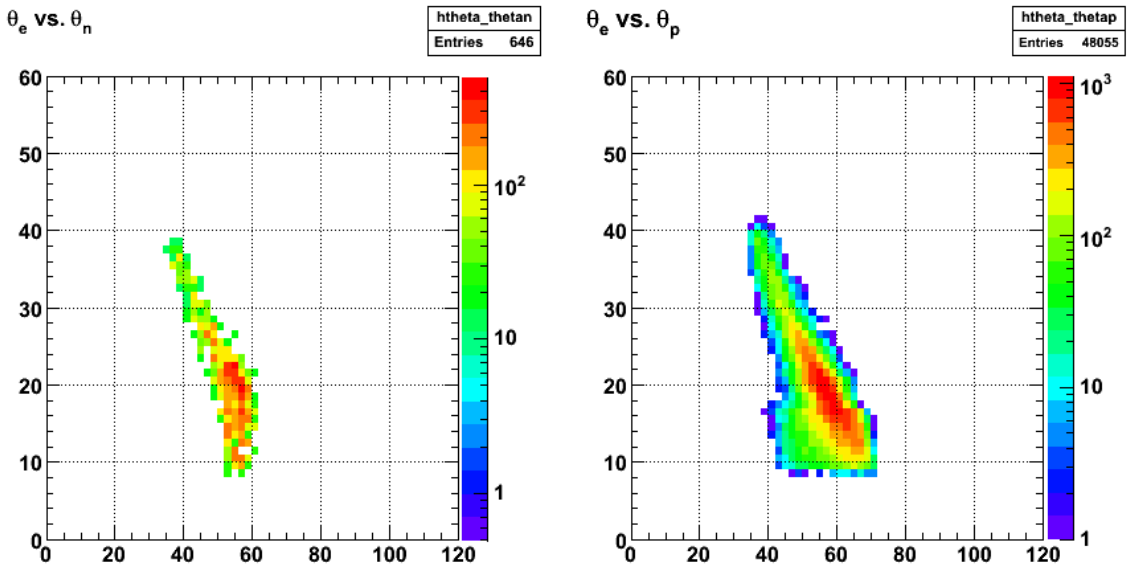


Fig 11. Electron angle versus nucleon angle for neutrons (left) and protons (right).

Click here to view the object (ROOT macro for fig 11.) you uploaded.

The distributions in Fig 11. have two major problems. They should look roughly the same since the acceptance matching is turned on. Thus, the apparent cutoff in the neutrons at theta_n = 60 deg is a mystery. Also the width of the proton distribution is greater than expect. There should be a tighter correlation between theta_e and theta_p. There is some difference between the neutrons and protons that needs to be explained. The plot below shows the theta_pq distribution.

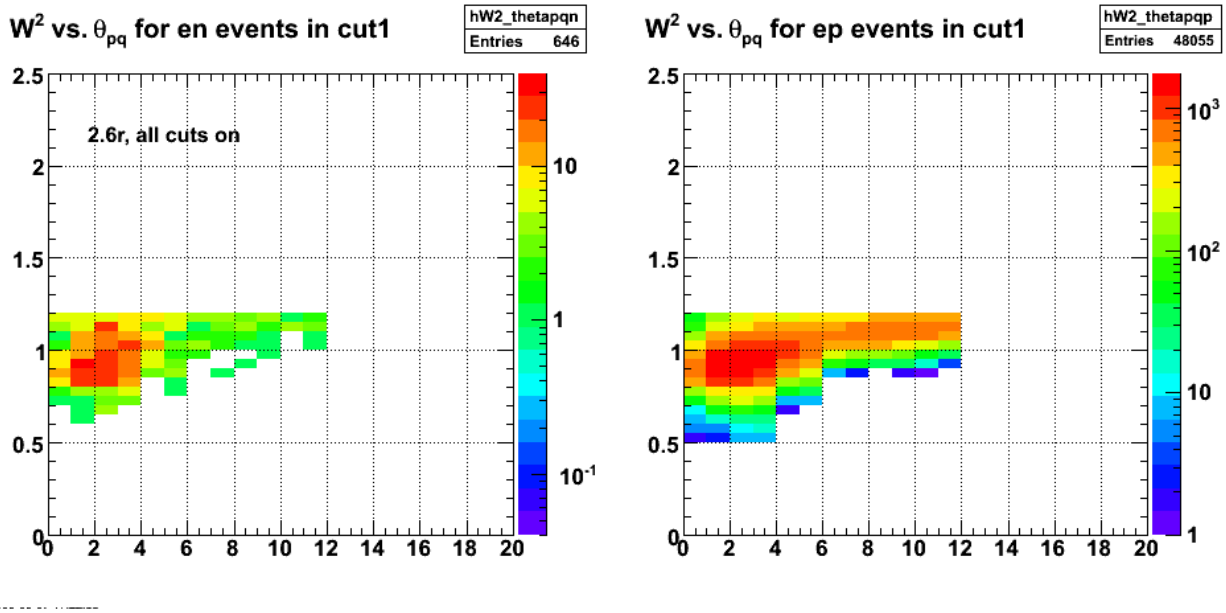


Fig 12. W2 vs. theta_pq for neutrons (left) and protons (right). The upper limit on theta_pq appears to be too large. The title is wrong. These events do NOT have the cut1 cut on.

Click here to view the object (ROOT macro for fig 12) you uploaded.

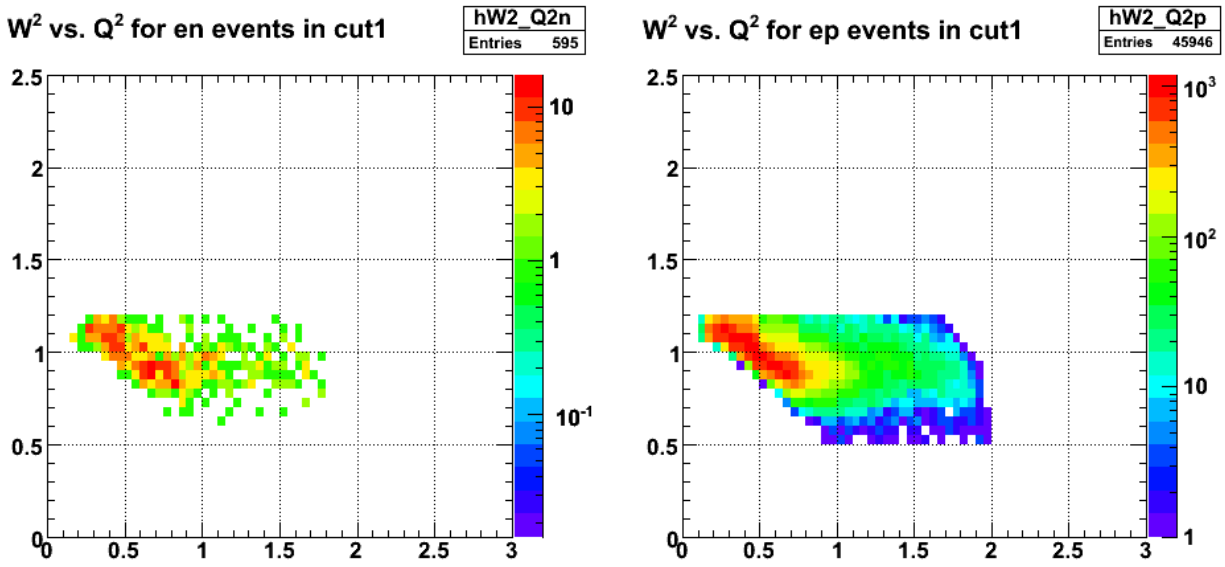


Fig 13. The inadequate correlation of electron and neutron kinematics may be seen here. However, this is for two electron quantities!! The upper limit on theta_pq is the same as the previous figure - 12 deg.

Click here to view the object (ROOT macro for fig 14) you uploaded.

Reduce the upper limit on theta_pq from 12 deg to 8 deg and there is a small decrease in the low theta_p background and not much else.

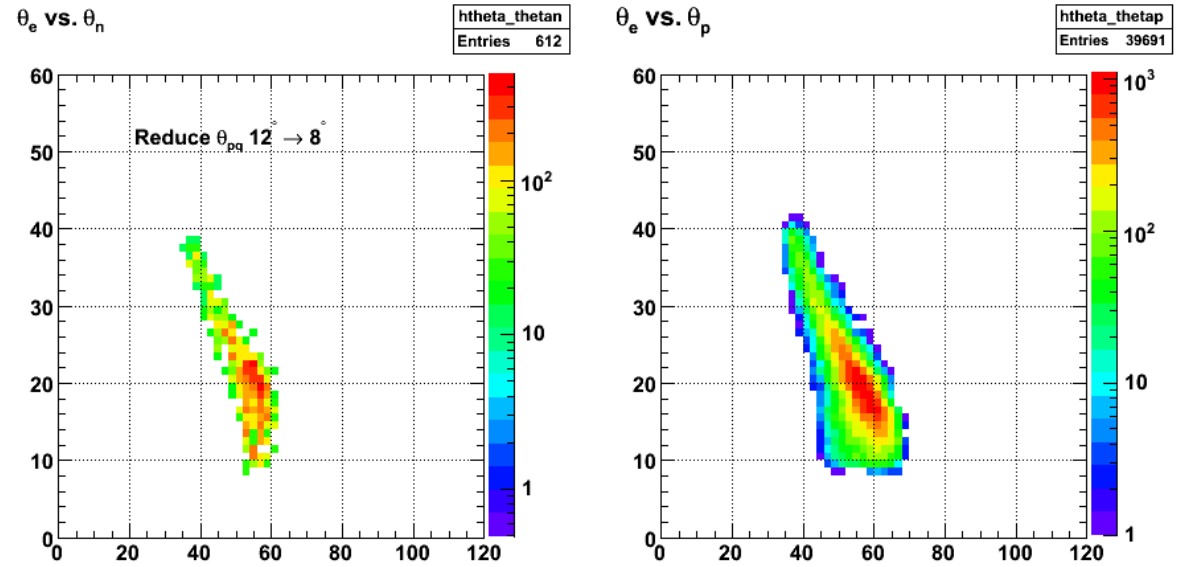


Fig 14. Same as 11 with upper limit on theta_pq = 8 deg.

Click here to view the object (ROOT macro for fig 14) you uploaded.

Turn off the check_cuts and check_fiducial functions and get the following. Notice there appears to be a similar quasielastic band in the range theta_N = 60 deg -80 deg for both protons and neutrons. What creates the 60-deg neutron cutoff. Of course, this is all a bit backward since the problem with the GMn is too many neutrons at low Q2.

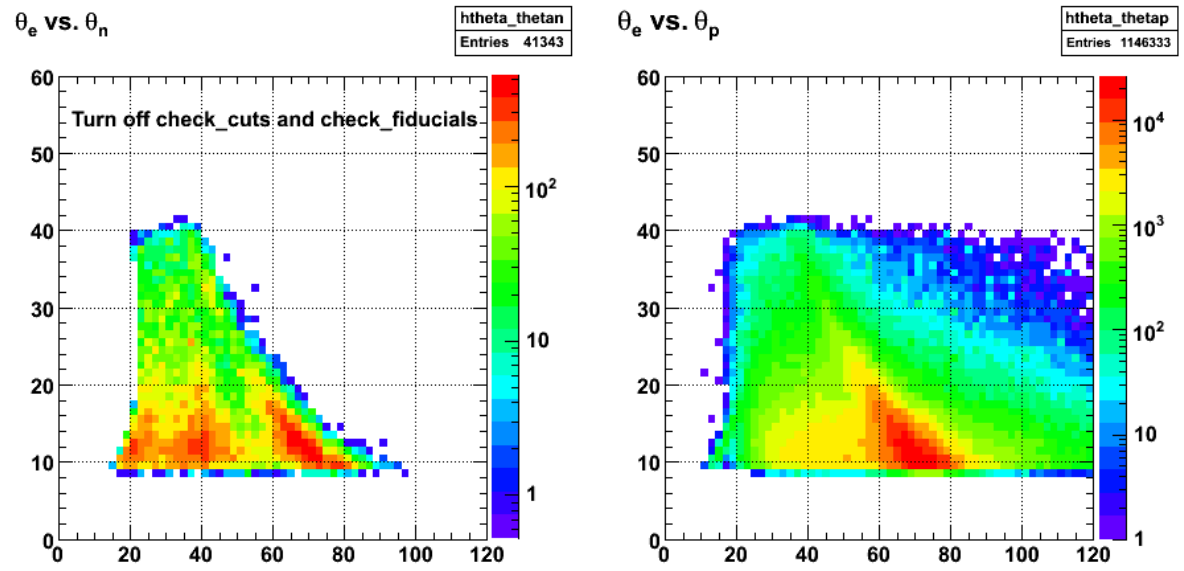


Fig 15. Same as Fig 14 except the check_cuts and check_fiducial tests are turned off.

Click here to view the object (ROOT macro for fig 15) you uploaded.

Now turn on JUST check_cuts_2250r. This makes it look like the 60-deg, neutron cutoff is in check_fiducials.

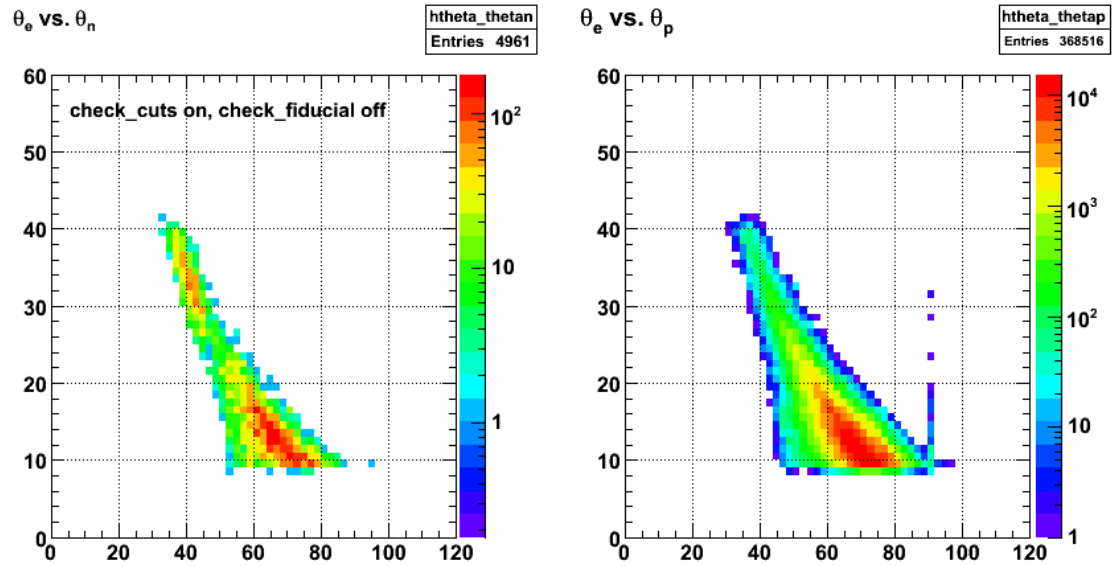


Fig 16. Same as Fig 15 with check_cuts turned on.

Click here to view the object (ROOT macro for fig 16) you uploaded.

Now turn off check_cuts and turn on check_fiducial. It looks like I can tighten up the theta_pq upper limit and the W2 cut.

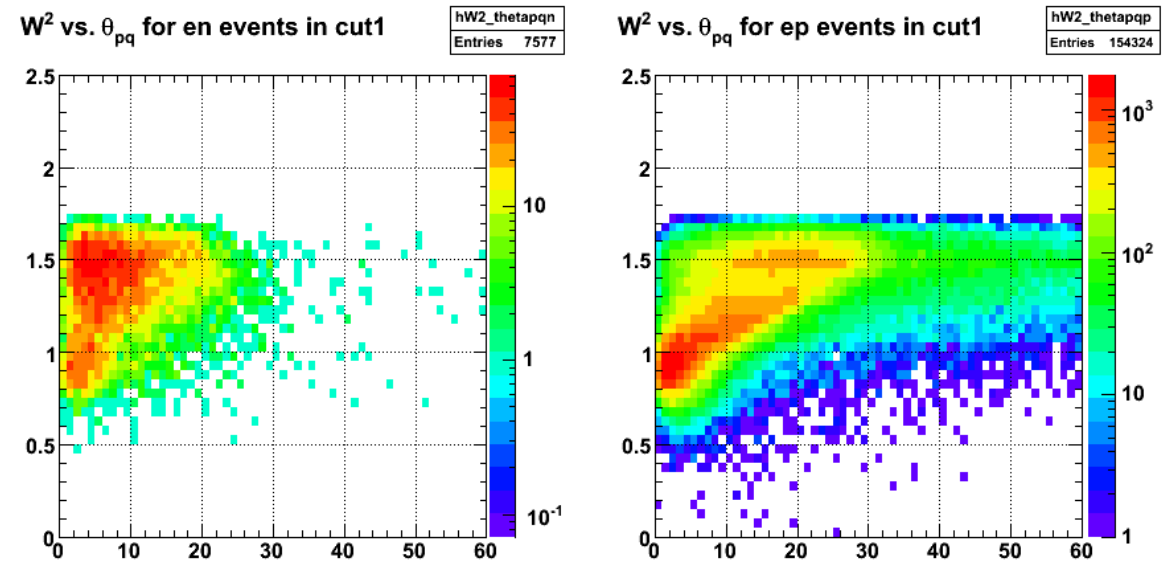


Fig 17. W2 versus theta_pq for neutrons (left) and protons (right).

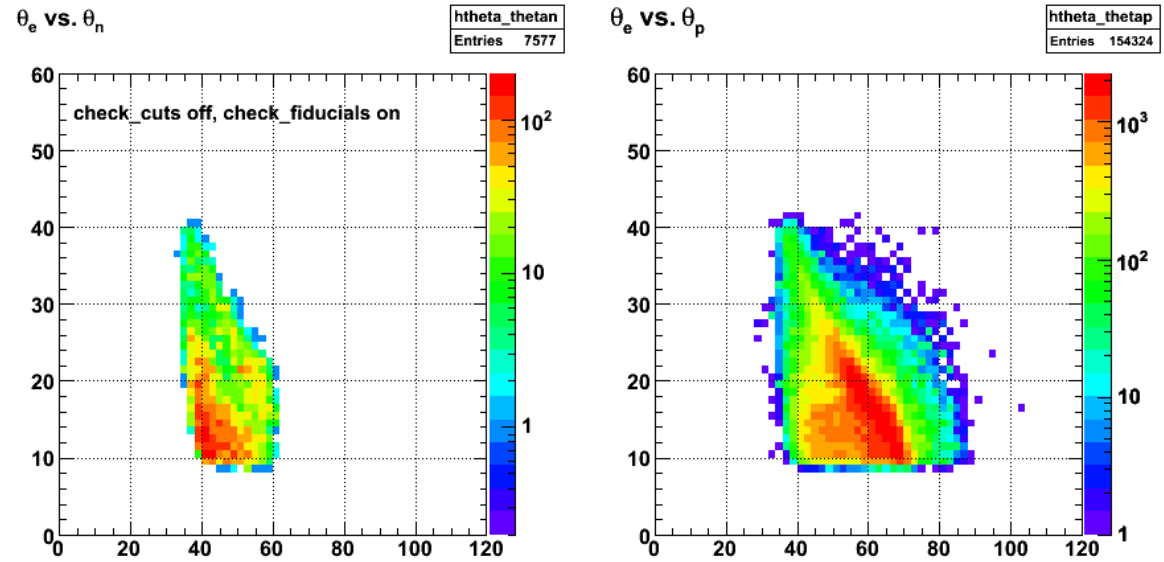


Fig 18. Same as fig 14-16 with check_cuts OFF and check_fiducials ON. The cutoff at neutron theta_pq ~ 60 deg is clear.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 206 - draft of E5 entry (gpg)

[Modified Thu May 8 16:37:00 2008 (GMT) gpg]

I have begun looking at the 2.6-GeV reversed field data. If you recall, in the last episode we had been faced with a low-Q2 explosion in the reduced GMn for Q2 < 0.5 GeV2. This was shown by Jeff in entry 375 and other places and I reproduce a version below in Fig 1 for the SC only and for now just two data runs (24519-24520).

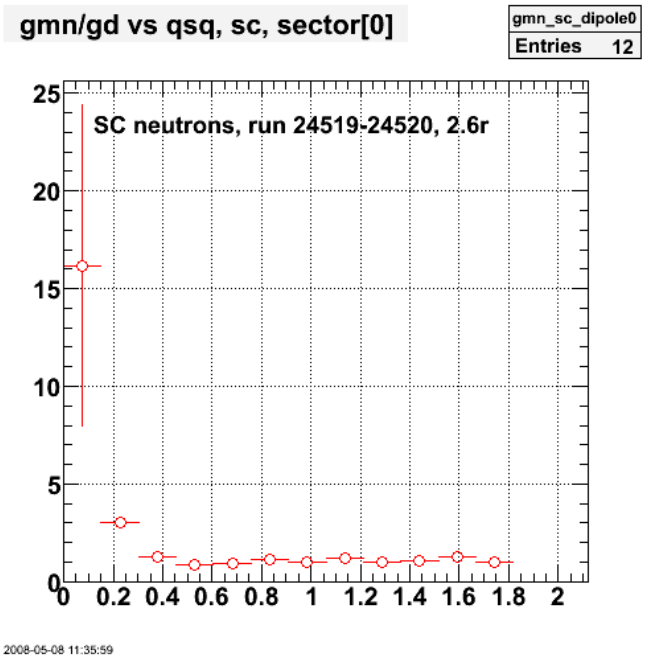


Fig 1. Reduced GMn for 2.6-GeV, reversed-field data for SC only.

All of the plots below are for SC data only, runs 24519-24520, 2.6-GeV, and reversed field. To understand what may be causing the rapid rise at low Q2, I began looking a variety of quantities. To check the theta_pq cut used to extract quasielastic events consider Fig 2. The left-hand-side shows W2 versus theta_pq for neutrons with the maximum theta_pq set to 12 deg. This distribution looks reasonable. The right-hand-side shows the same distribution except for protons. Here it looks like there may be inelastic events leaking in at theta_pq = 8-12 deg. Jeff has used a maximum of 6 deg for the higher Q2 analysis (Q2 > 0.5 GeV2) so I have lowered the maximum theta_pq to 8 deg.

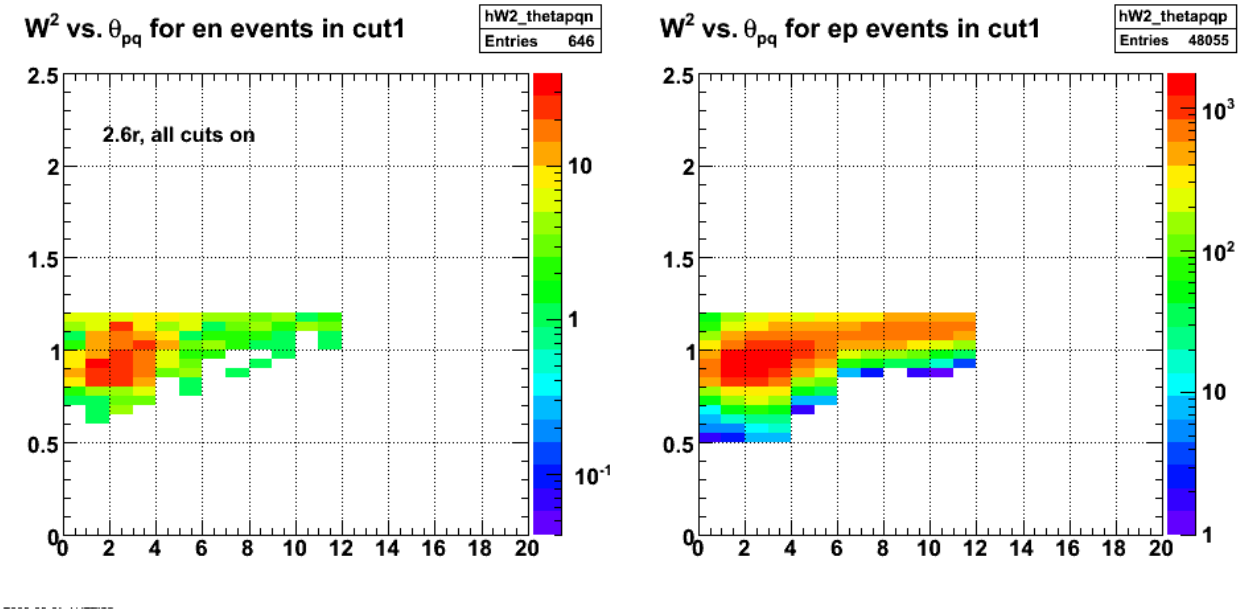


Fig 2. W2 versus theta_pq for neutrons (left) and protons (right).

Fig 3 shows the electron angle versus the nucleon angle for neutrons (left) and protons (right). The maximum theta_pq is 8 deg. The neutron distribution on the left-hand side has a mysterious cutoff at theta_n = 60 deg that is not apparent in the proton distribution on the right-hand side. This is disturbing since both

distributions should cover the same kinematic range due to the acceptance matching. More below.

The proton distribution looks anomalously broad. This may be a result of a too-large, maximum theta_pq. I will investigate possibility that in a future entry.

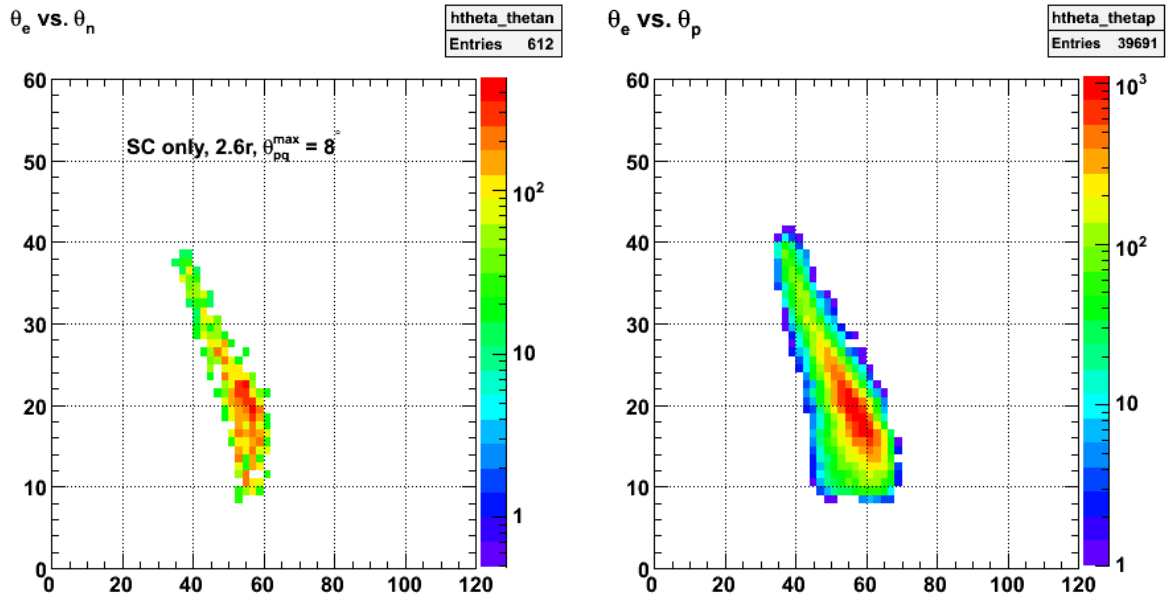


Fig 3. Electron angle versus nucleon angle for neutrons (left) and protons (right) for SC events, 2.6-GeV, reversed field data.

To investigate the mysterious cutoff in the neutron angle I turned some of the cuts off and redid the analysis. Fig 4 is the same as Fig 3, but I have turned off the function check_fiducial in Jeff's code. There are two important tests on the data in Jeff's code. The first is the function check_fiducial which does the acceptance matching and other stuff like tests for bad proton paddles in the SC, the track vertex position, and the number of photoelectrons. The second data test is the function check_cuts. This function checks that theta_pq is in the proper range and tests for bad wires, wrong neutron paddle, minimum neutron edep in the SC, ... The function check_cuts does the quasielastic selection. For Fig 4, check_cuts was turned on and check_fiducial was turned off.

The 60-deg cutoff in the neutron angle has disappeared and the neutron and proton distributions are, at least, qualitatively similar.

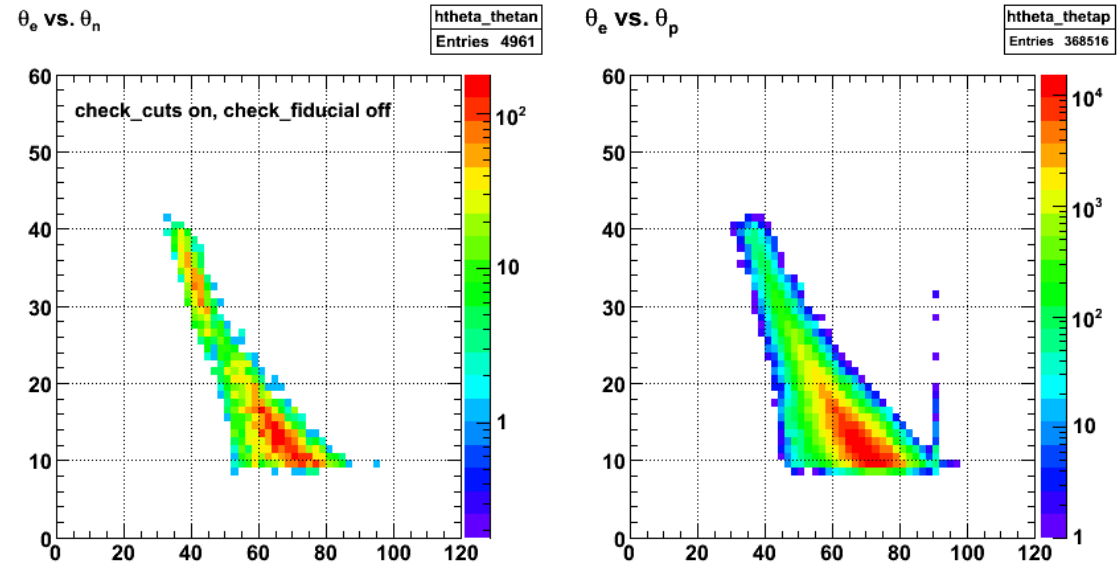


Fig 4. Same as Fig 3 with check_fiducials OFF and check_cuts ON.

To localize the problem more clearly I then turned check_cuts off and turned check_fiducials on. The results are shown in Fig 5 which is the same as Fig 4 with check_cuts now off and check_fiducials on. Since we no longer select quasielastic events, the distributions are not as well correlated, but the 60-deg cutoff in the neutron angle is apparent.

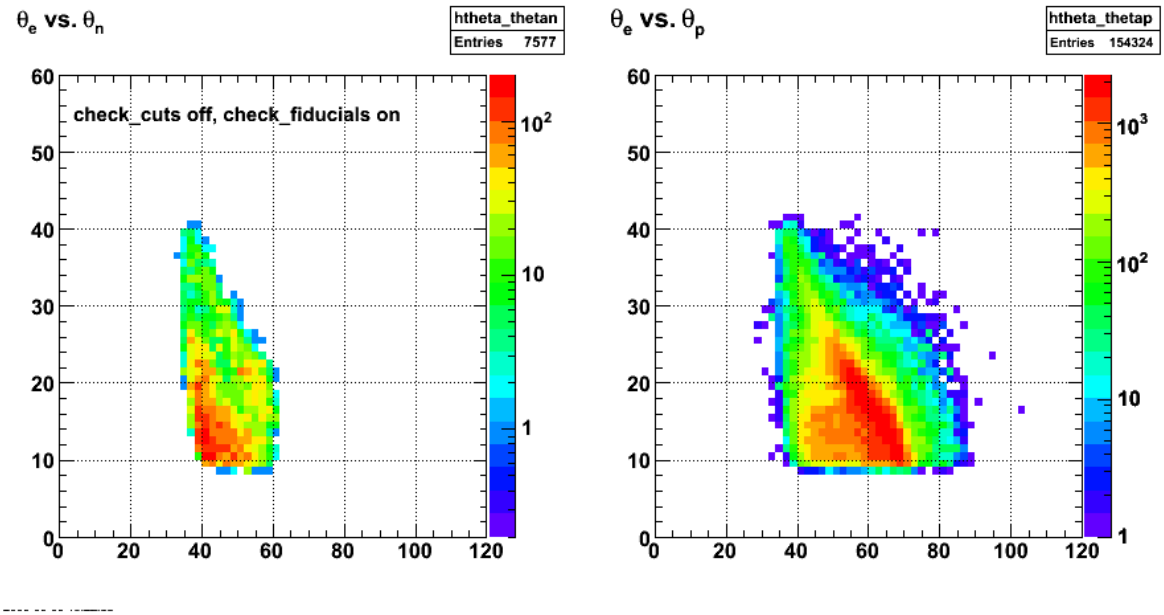


Fig 5. Same as Fig 3-4 with check_fiducials ON and check_cuts OFF.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 207 - Angle cutoff problem (gpg)

[Modified Thu May 22 15:44:22 2008 (GMT) gpg]

Investigation of the apparent cutoff in the neutron acceptance at theta_n = 60 deg.

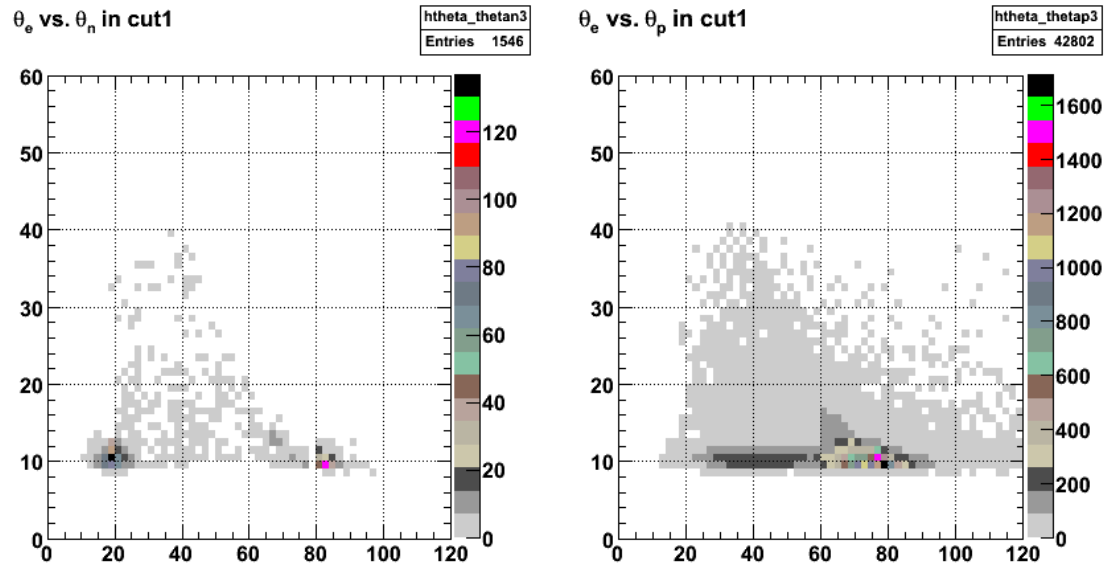


Fig 1. Comparison of spectra for events where the swimming of the track missed the acceptance.

Click here to view the object (ROOT macro for fig 1) you uploaded.

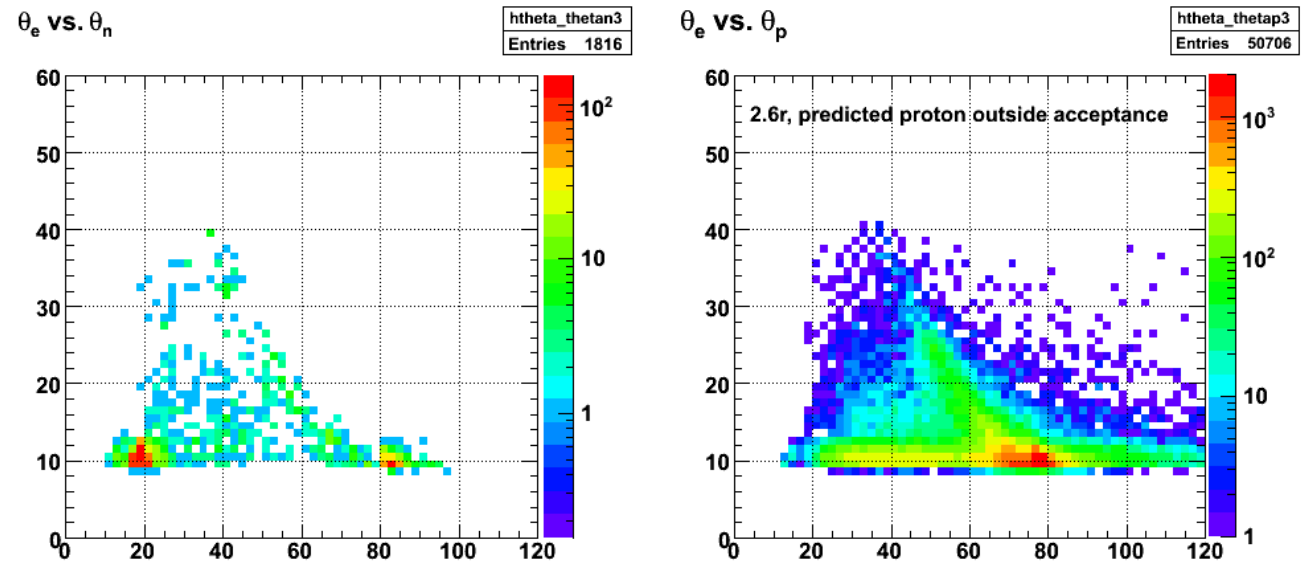


Fig 2. A few more statistics than fig 1.

Click here to view the object (ROOT macro for fig 2) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 208 - Q2 distributions amd ALTp with efids on and off. (gpg)

[Modified Mon May 26 17:06:38 2008 (GMT) gpg]

Below is a tar files with electron singles distributions of Q2 with efids on and off.

Click here to view the object (tar files with electron singles distributions of Q2 with efids on and off.) you uploaded.

Click here to view the object (ROOT histogram file for 2.6-GeV normal polarity used for Q2 distribution.) you uploaded.

Click here to view the object (Root macro for 2.6-GeV normal polarity Q2 distribution.) you uploaded.

Click here to view the object (Root macro for 2.6-GeV reversed polarity Q2 distribution) you uploaded.

Click here to view the object (Root macro for all run conditions Q2 distribution) you uploaded.

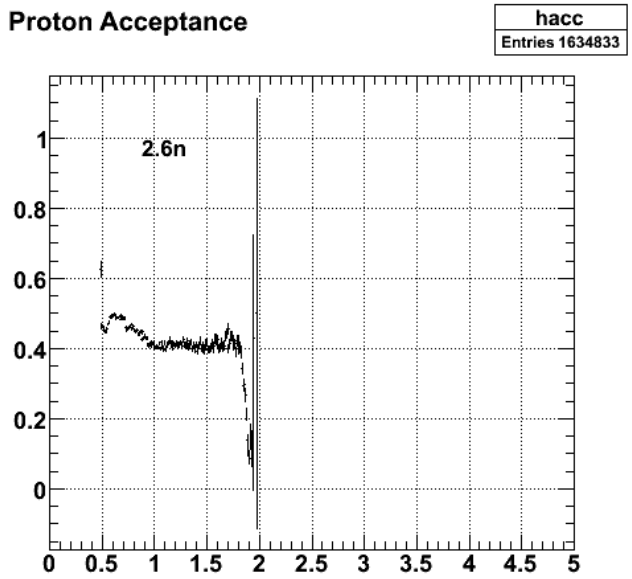
Click here to view the object (tar archive of ALTp data files with efids on and off for 2.6n and 2.6r.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 209 - Low Q2 problem (gpg)

[Modified Thu Jun 5 20:34:01 2008 (GMT) gpg]

More attempts to understand the low-Q2 problem.



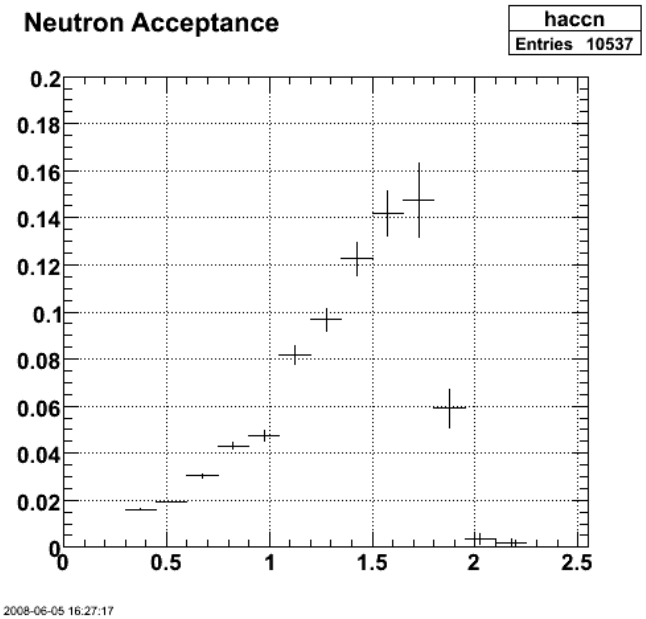
2008-06-05 00:26:54

Plot of acceptance from GSIM for ep events at 2.6n. Used histogram files from bothrun30 simulation.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (Mathematica notebook with study of cross sections.) you uploaded.

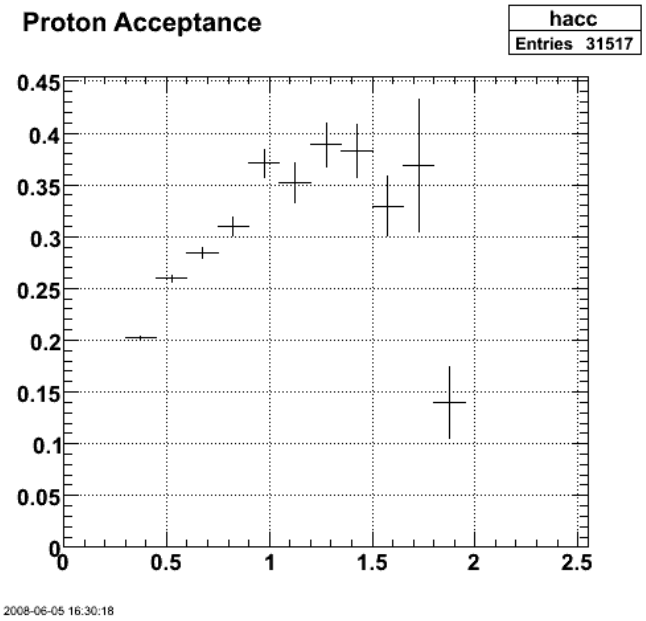
Run GSIM with efids and pfids off for 2.6 GeV, reversed field, and QE, ep and en events.



2008-06-05 16:27:17

GSIM Neutron Acceptance for 2.6r.

Click here to view the object (ROOT macro for fig 2.) you uploaded.



GSIM proton Acceptance for 2.6r.

Click here to view the object (ROOT macro for fig 3) you uploaded.

Click here to view the object (suumed.tar file containing the histrograms for figs 2-3) you uploaded.

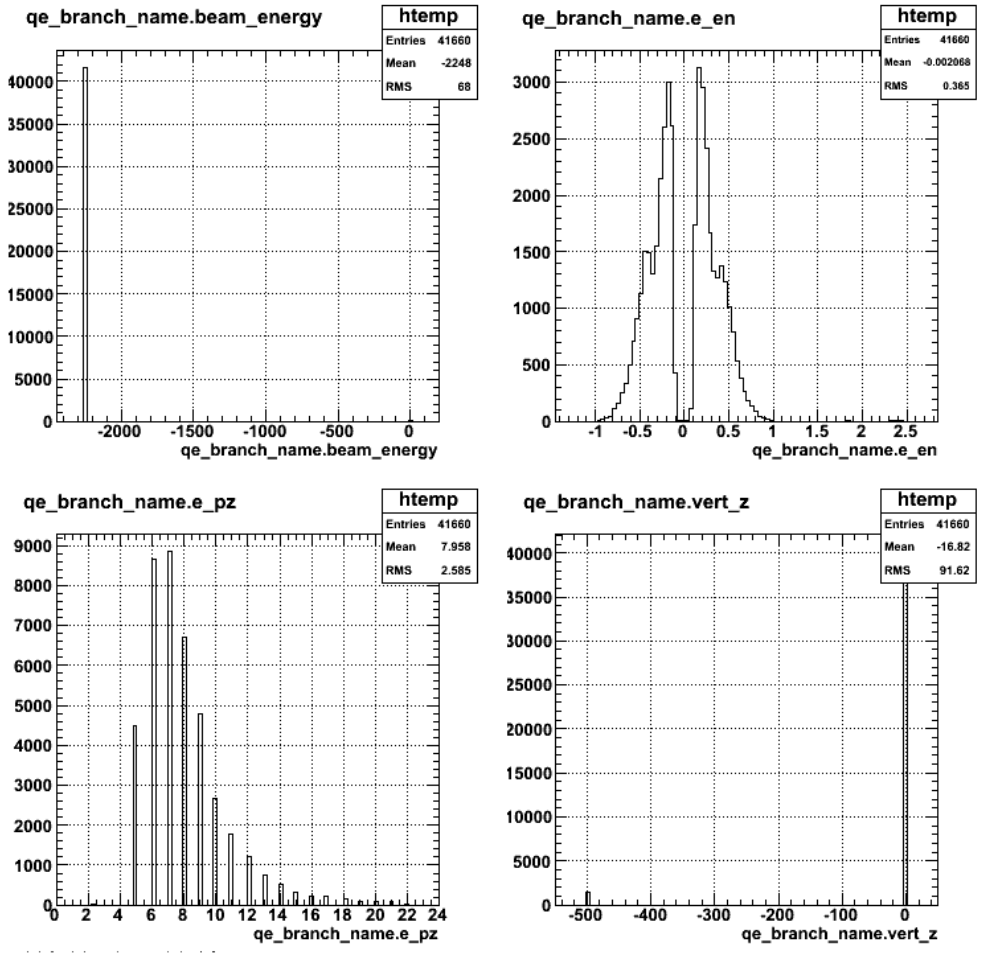
DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 210 - Software crisis continues (gpg)

[Modified Fri Jun 13 19:06:28 2008 (GMT) gpg]

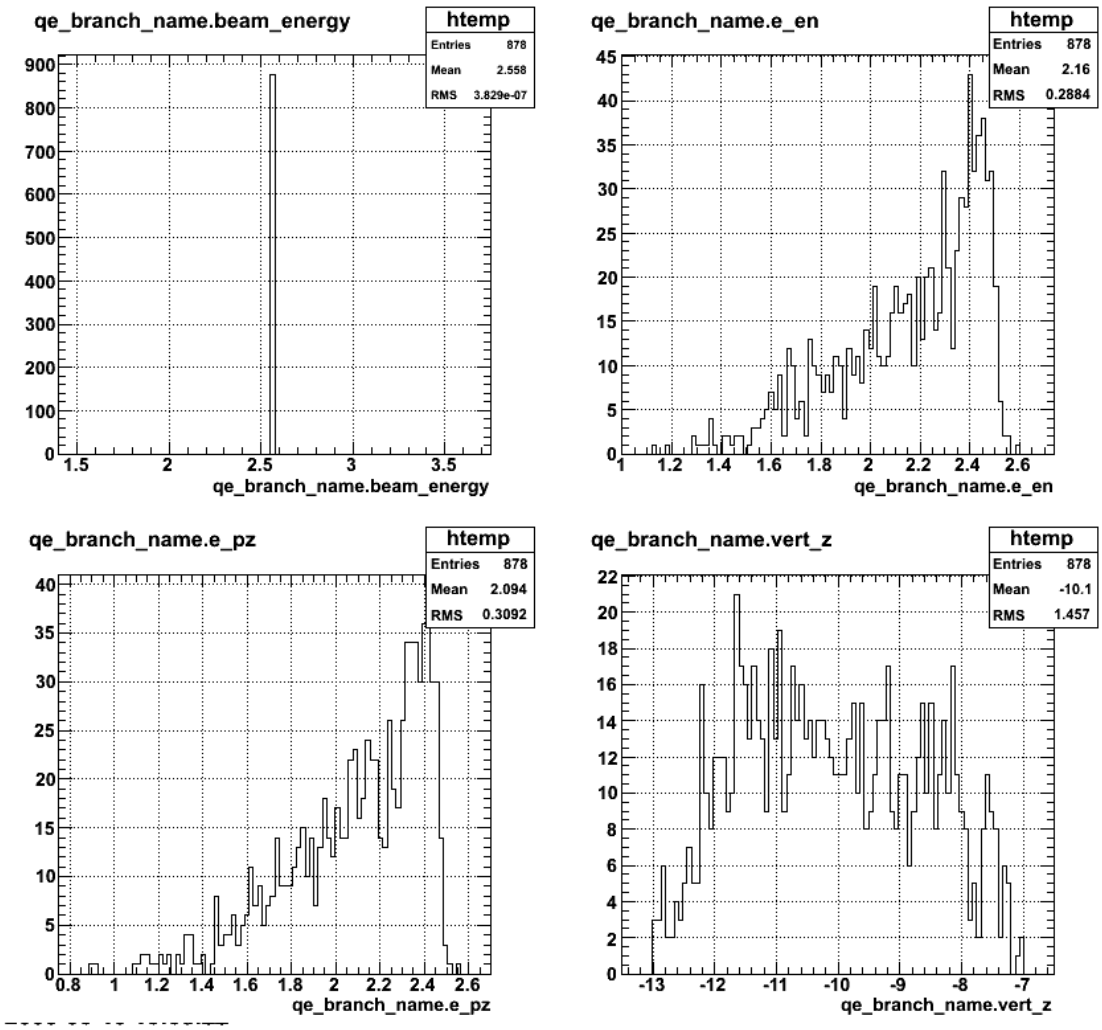
I am having terrible problems getting qe_ana working on the JLab farm with the recent versions of root. After several days of not being able to run qe_ana without crashing (see log files for 6/10/08-6/13/08) I was able to get it to run on the farm. It spit out lots of unhappy messages at the end, but still produced an output file (a step in the right direction). Unfortunately, the data in the root file is crap! See below.
Command on qe_ana. User root 5.15-00

```
qe_ana -M 5000 -f /home/gilfoyle/research/gmn/run/jsubMakeNtuples/E5clas_024517.A0.B00.dat -o E5clas_024517.A0.B00.root
```



Problems in root file after filtering with qe_ana.

Switch bakc to root 5.08-00 and get the following.



Same as fig 1 with root 5.08.

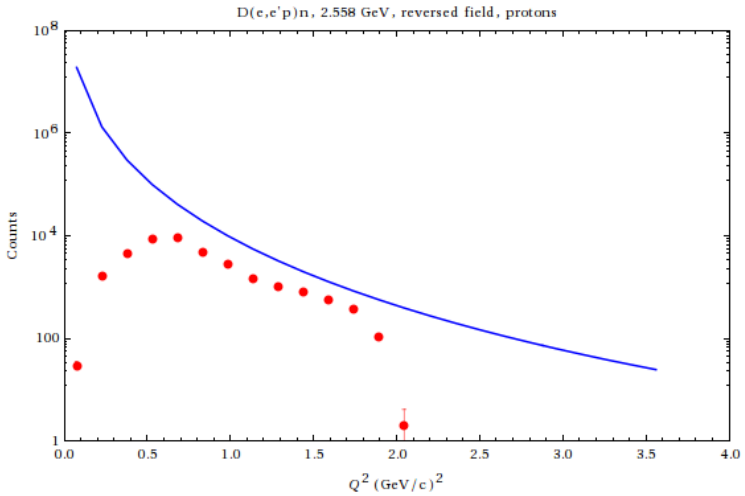
DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 211 - Elastic scattering calculations. (gpg)

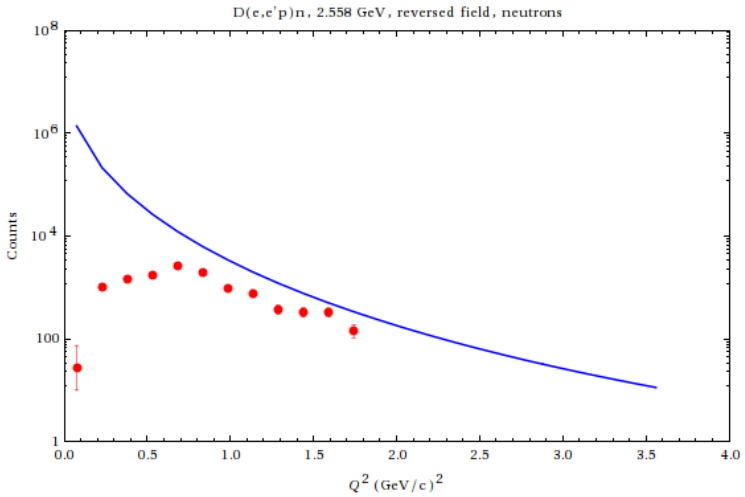
[Modified Fri Jun 13 20:52:09 2008 (GMT) gpg]

Attempt at comparing elastic scattering counts with QE counts for neutrons and protons to investigate the low-Q2 problem in R.

Q2 (GeV2)	e-p(calc)/e-p(data)	e-n(calc)/e-n(data)
0.075	63,429	49,951
0.227	788	210
0.379	66	45
0.530	11	15
0.682	4	5



PLot 1. Comparison of the calculated number of counts in the QE peak with the measured ones for run 24519-24520.



Plot 2. Comparison of the calculated number of neutron counts in the QE peak with the measured ones for run 24519-24520.

Click here to view the object (Mathematica notebook for figs 1-2) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 212 - Fifth structure function tests (gpg)

[Modified Fri Jun 27 19:52:25 2008 (GMT) gpg]

Matt Jordan's results for ALTp are inconsistent with my previous results so try to reproduce the old results here.

Click here to view the object (ntuple file clas_024376.a9.b00.root from 2004 (old data file).) you uploaded.

Click here to view the object (root histogram file from eod5root) you uploaded.

Check the beam charge asymmetry by making a histogram of the values of the helicity bit. There appears to be a small, but statistically significant difference between the two helicities. This might account for the offset at zero that we see in Matt's stuff.

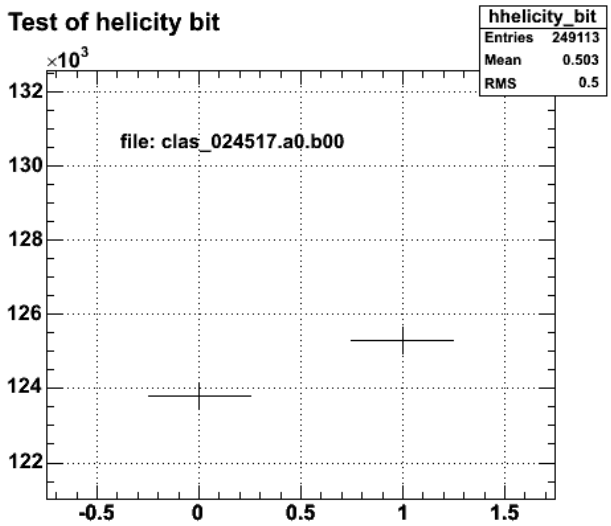


Fig 1. Beam helicities for run 24517 (2.6r).

Click here to view the object (ROOT macro for fig 1.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 213 - Inelastic phi dependence (gpg)

[Modified Tue Jul 1 20:39:03 2008 (GMT) gpg]

Here is a log of the study of the phi dependence of inelastic events.
Response from Will to my email

```
Hi,

I'm in Chile. It's getting chilly here...

My gut instinct says the phi dependence you see is a large mistake in genev. I would look to see if you see anything
like this in the data we already have. There should be a constant+sin(phi)+sin(2phi) dependence, or something like that,
but I doubt it is such a sharp separation and I expect it is much less sharp at 11 GeV than at 4 GeV. I'm guessing they
just did something very primitive in the event generator, for delta production.

If I'm wrong, and it's a real effect, then yes, I think it's something we should cut on.

For more input, you could ask the authors of genev, or turn off all except delta production, or ask Hovanes or Kyungseon.

Thanks,

- Will


Jerry Gilfoyle wrote:
> Hi Will,
>
>    Hope things are going well in Chile or wherever you are at the moment. A few weeks ago I had a
conversation with Bogdan Wojtsekhowski about the accuracy that we can measure R at the highest Q2 bin
in the 12-GeV GMn proposal. For the requested running time we found (after my mistakes got corrected)
that there will be about 500 events collected in the range Q2 -13-14 GeV2. Bogdan thinks it is unrealistic
to expect we will be able to get adequate separation of the quasielastic (QE) and inelastic (IN) events
in this last Q2 bin because the angular resolution for the neutrons limits our ability to use the theta_pq
cut as effectively as we can for separating the QE and IN proton events. Also, we use a W2 cut
(W2 < 1.2 GeV2) to get rid of additional IN events and at higher Q2 this cut will remove more and more QE
events because the width of the QE peak increases. We all knew about this issues, but I have decided to
take a closer look at them over the last few weeks with one of the undergrads working for me this summer.

>    One of the ideas I had was based on something I saw last summer. We use the code GENEV to calculate
the angles, energies, and topologies of the inelastic events. We use Jeff's QUEEG for the quasielastic
events. The attached figure shows distributions of phi_pq versus theta_pq for the quasielastic events
(left-hand panel), inelastic ones (middle panel), and the combined events (right-hand panel). For the
QE events there is no dependence on phi_pq and most of them are at theta_pq < 1.5 deg. No surprise
there. The interesting thing is the phi_pq dependence of the inelastic events. The spectrum is dominated
by the two large lobes centered at phi_pq = ± 90 deg and reach a maximum width of about ± 30 deg. The
plots are for the range Q2 = 6-7 GeV2. We started the study here just so we could check it against what
we did last summer as a test. What the middle panel tells me is that we could use a cut on phi_pq,
say ±(90 ± 20 deg) to reduce the inelastic background. We would lose some QE events, but the reduction
in the IN background would be larger. My student is currently working on the Q2 = 13-14 GeV2 simulations.
Anyway, I was wondering what you thought of this idea? Have you come across it before? In using the
ratio method to measure GMn we've only used the theta_pq information because the QE events are
independent of phi_pq. At the higher Q2, the inelastic dependence on phi_pq may give us another tool
to reduce the background. Let me know what you think.
```

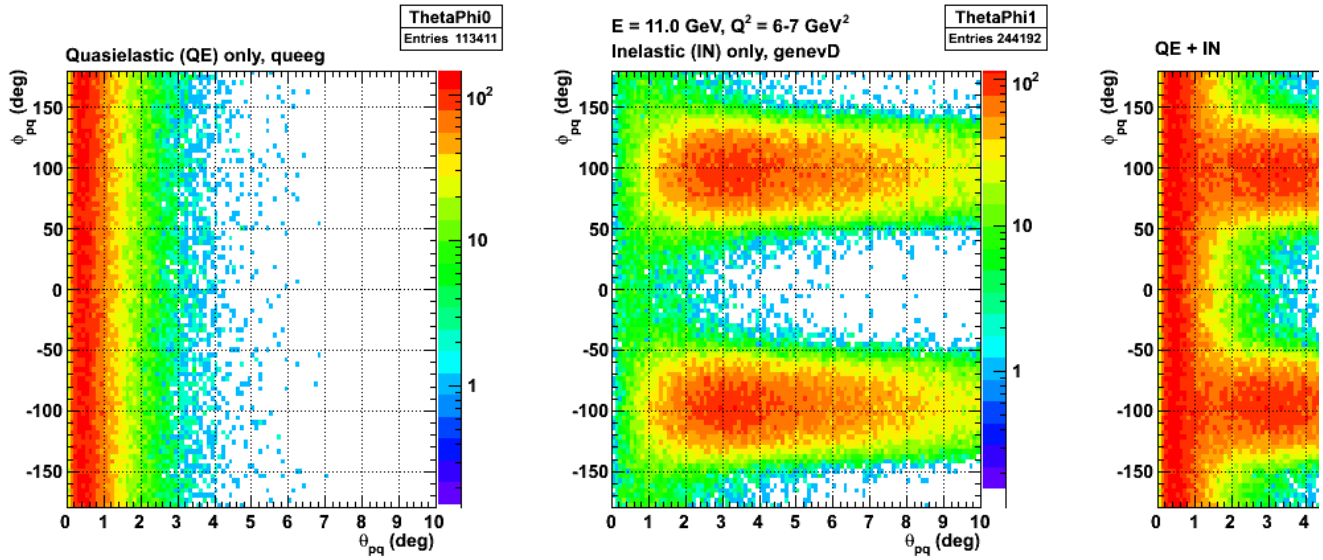


Fig 1. Plot I sent to Will.

Plot from a recent eod run for epn events with the QE cut ON. hhmm! try this with no QE or epn cuts.

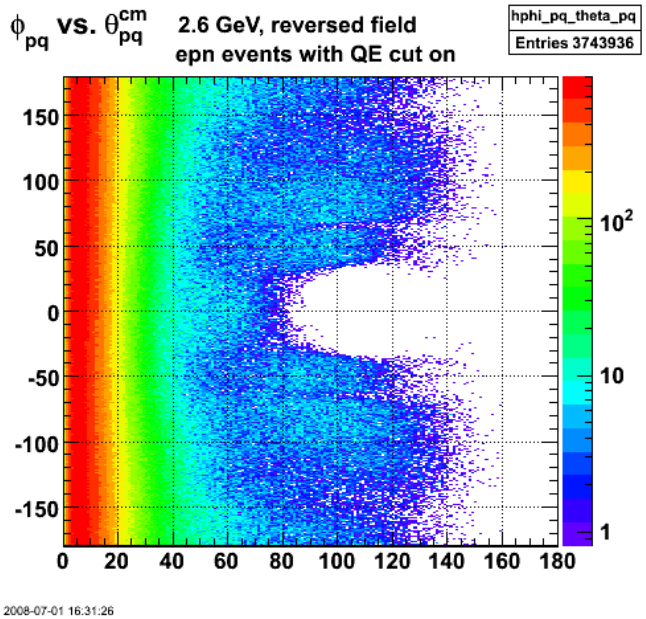


Fig 2. lot from a recent eod run for epn events with the QE cut ON at 2.6r.

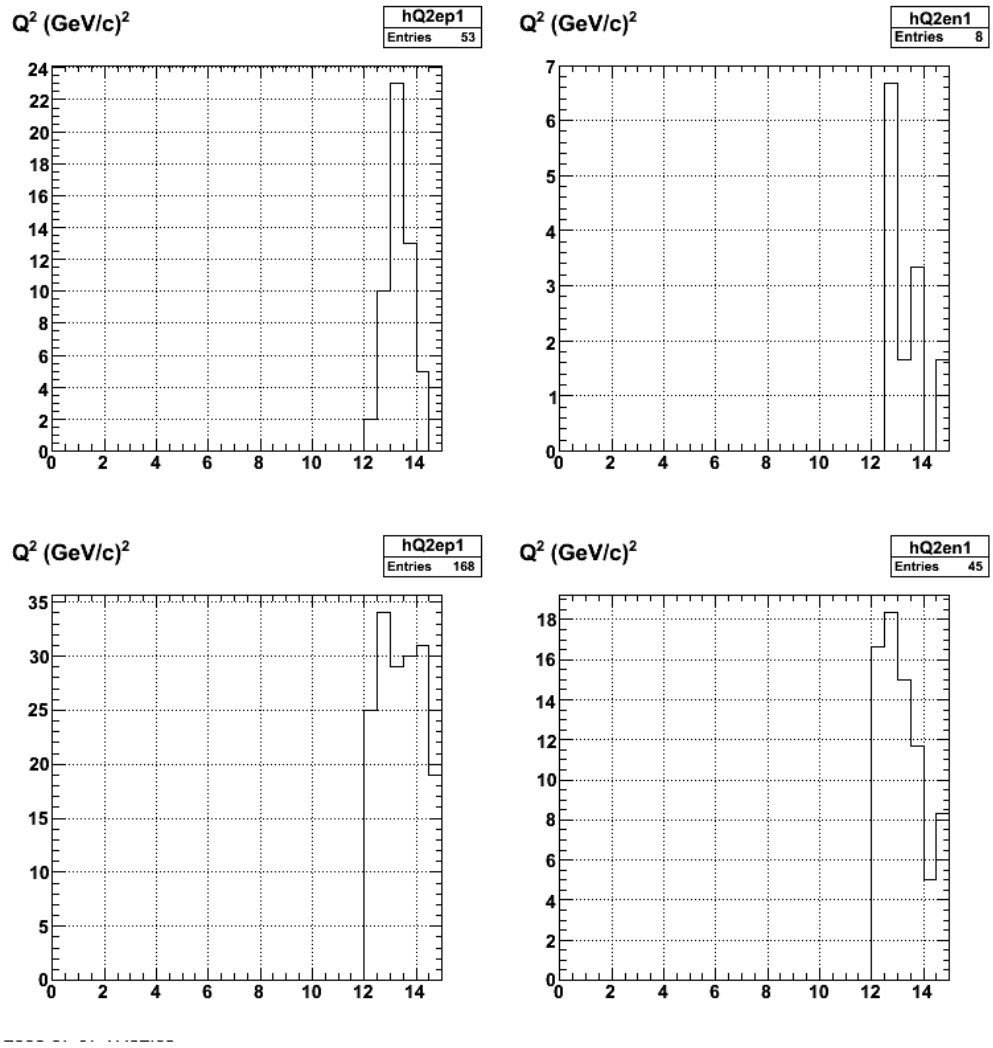
Click here to view the object (ROOT macro for fig 2) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 214 - testing FASTMC at 13-14 GeV2 (gpg)

[Modified Mon Jul 7 23:49:33 2008 (GMT) gpg]

Testing FASTMC at 13-14 GeV2.



Starting point.

Code used to generate Fig 1.

```
TFile *f1 = new TFile("evntgenevsummed.root")
TFile *f2 = new TFile("evntQEsummed.root")

f1.cd()
c1_1.cd()
hQ2ep1->Draw()
c1_2.cd()
hQ2en1->Draw()
f2.cd()
c1_3.cd()
hQ2ep1->Draw()
c1_4.cd()
hQ2en1->Draw()
```

Click here to view the object () you uploaded.

Now run it 10 times as long. This looks ok.

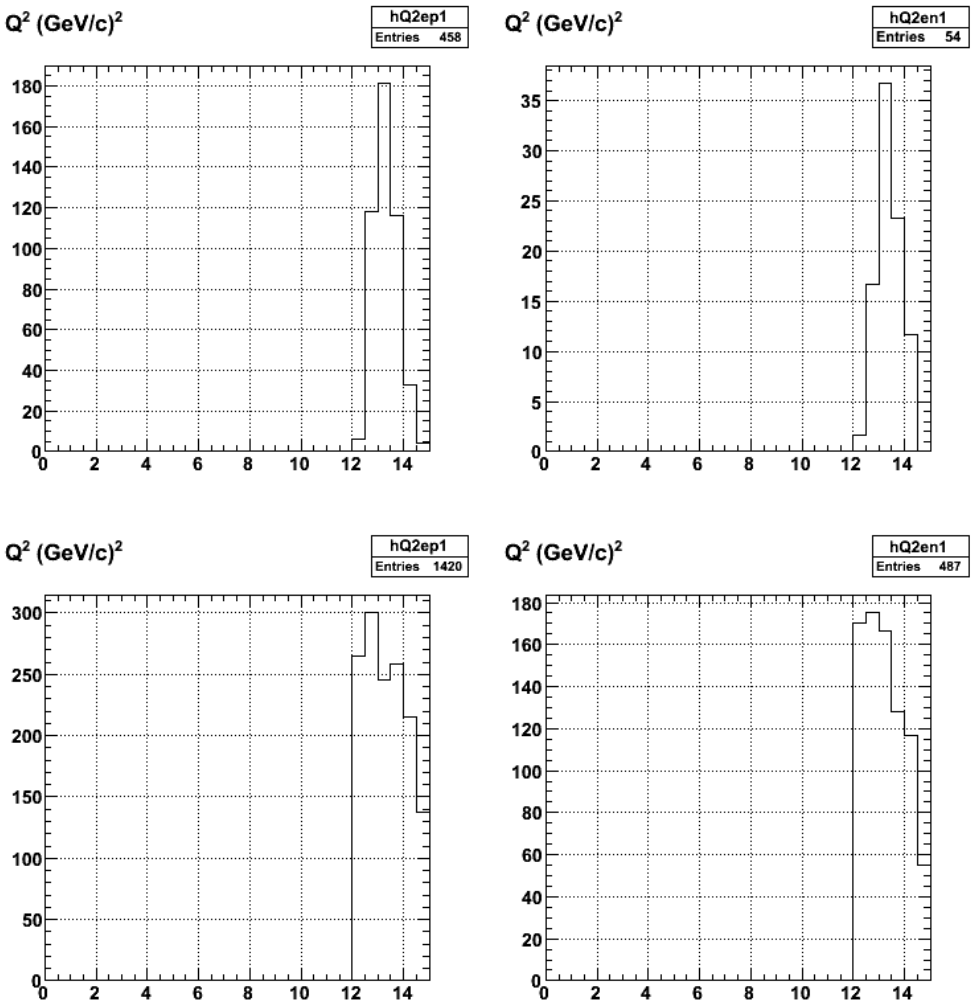


Fig 2. Results when I run it 10 times as long. This looks ok.

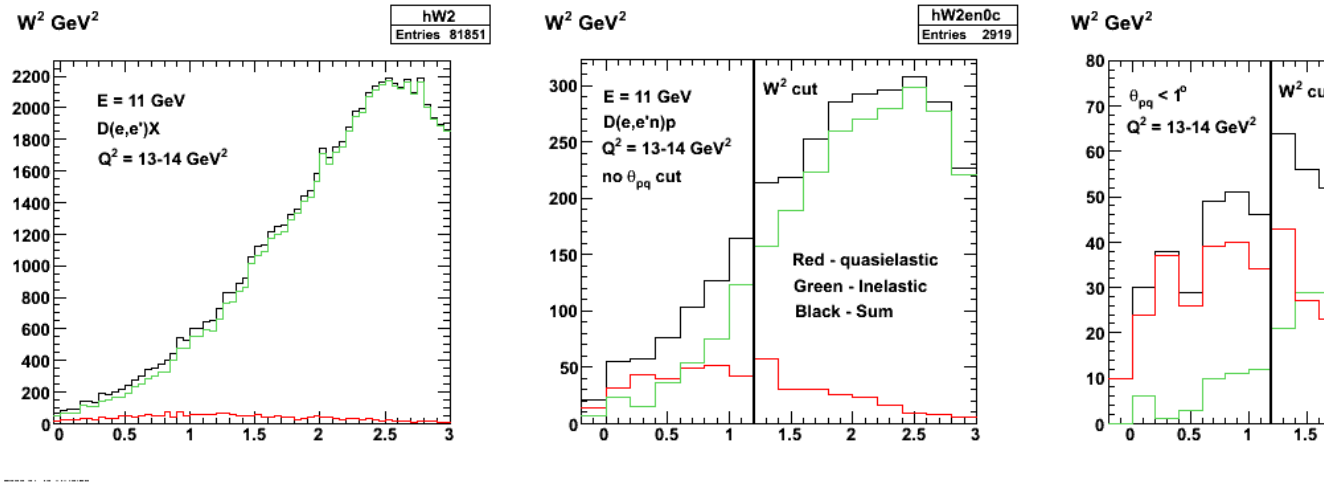
Click here to view the object () you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 215 - FastMC results for Q2 = 13 -14 GeV2 (gpg)

[Modified Thu Jul 10 16:26:14 2008 (GMT) gpg]

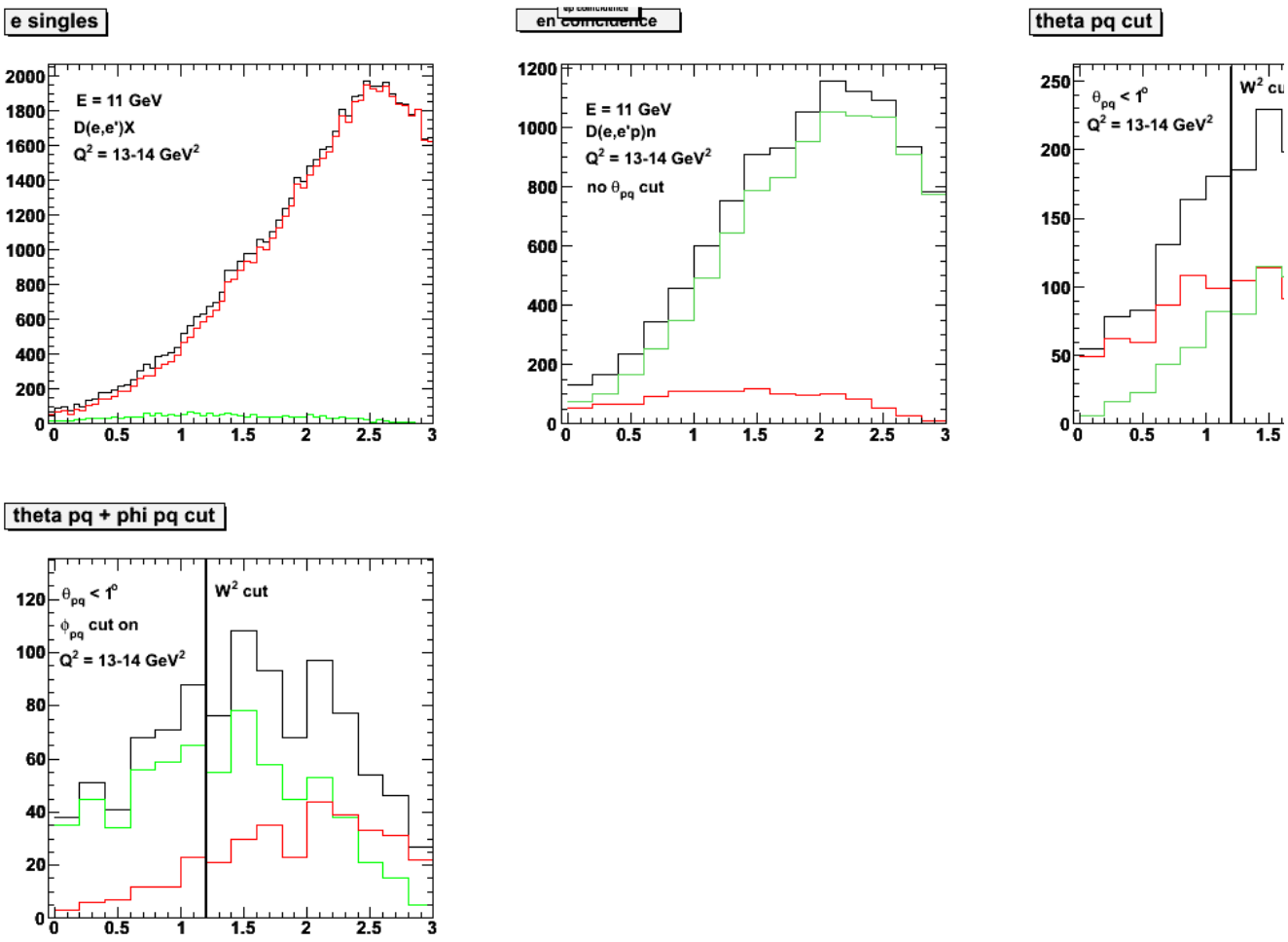
Below are results of Mark Moog's calculations for the 12-GeV GMn proposal in the range Q2 = 13-14 GeV2, the highest Q2 bin from the proposal.



Comparison of W2 spectra for neutrons with different cuts for Q2 = 13-14 GeV2.

Click here to view the object (ROOT macro for fig 1.) you uploaded.

For protons, it's more difficult because there are more inelastic protons finding their way in the W2 spectra.



Same as Figure 1, but for protons and the effect of the phi_pq cut is added.

Click here to view the object (ROOT macro for fig 2) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 216 - Fermi Correction for CAN (gpg)

[Modified Mon Aug 18 02:04:02 2008 (GMT) gpg]

I first did the fermi correction calculation at 4 GeV to see if I got the same thing as JL in entry 398 in the E5 elog. For the following command,

```
nice /home/gilfoyle/gmn/ana.6GeV/bin/LinuxRHEL3/qe_ana  -M 1000 -n 24023 -L -f /home/gilfoyle/gmn/run/simrun1.dat -r -a -v /home/gilfoyle/gmn/run/result
```

I get the following result which is reasonably similar to JL's result (at least enough to go on to 2.6 GeV).

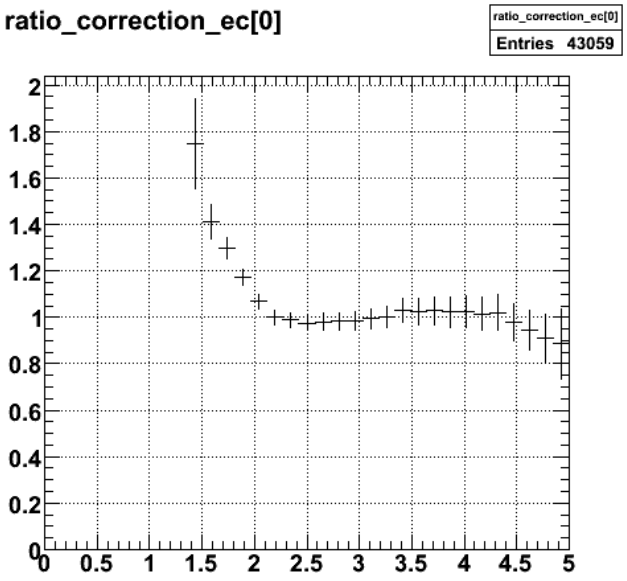


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Fig 1. Fermi correction for the EC at 4.2 GeV using the above command.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (Histogram file for fig 1.) you uploaded.

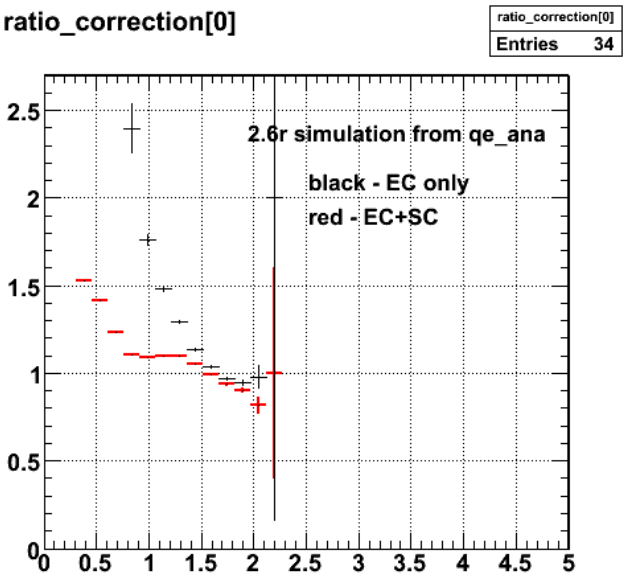

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Fig 2. Fermi correction simulation for 2.6r.

Click here to view the object (ROOT macro for fig 2) you uploaded.

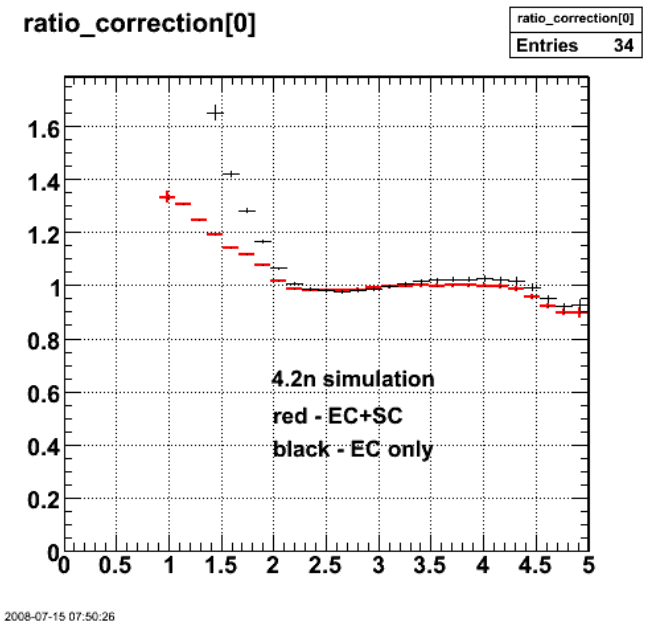


Fig 3. Fermi correction simulation for 4.2n.

Click here to view the object (ROOT macro for fig 3) you uploaded.

I discovered that there were limits on the electron angle that were set for 11 GeV values and not the ones for 4.2 GeV. Redo the calculations with the following commands. 2.6n command file

```
PROJECT: e5a
TRACK: analysis
JOBNAME:  GPGfermi26n1
COMMAND: /home/gilfoyle/gmn/ana.6GeV/bin/LinuxRHEL3/qe_ana  -M 10000 -n 24380 -L
-f /home/gilfoyle/gmn/run/simrun26n.dat -r -a
-v /home/gilfoyle/gmn/run/results/fermi_correction26n2\.root
+ec /home/gilfoyle/gmn/run/det_eff/nde.2gev.08.01.07.histo.root.ec
+sc /home/gilfoyle/gmn/run/det_eff/nde.2gev.08.01.07.histo.root.sc
+prot /home/gilfoyle/gmn/run/det_eff/pde.2gev.newlist.05.02.07.histo.root
+lac /home/gilfoyle/gmn/run/det_eff/nde.2gev.08.01.07.histo.root.lac
MEMORY: 500 MB
```

2.6r command file.

```
PROJECT: e5a
TRACK: analysis
JOBNAME:  GPGfermi26r1
COMMAND: /home/gilfoyle/gmn/ana.6GeV/bin/LinuxRHEL3/qe_ana  -M 10000 -n 24572 -L
-f /home/gilfoyle/gmn/run/simrun26r.dat -r -a
-v /home/gilfoyle/gmn/run/results/fermi_correction26r2.root
+ec /home/gilfoyle/gmn/run/det_eff/nde.2gevrev.07.10.07.histo.root.ec
+sc /home/gilfoyle/gmn/run/det_eff/nde.2gevrev.07.10.07.histo.root.sc
+prot /home/gilfoyle/gmn/run/det_eff/pde.2gev.rev.05.06.07.histo.root
+lac /home/gilfoyle/gmn/run/det_eff/nde.2gev.08.01.07.histo.root.lac
MEMORY: 500 MB
```

4.2n command file.

```
PROJECT: e5a
TRACK: analysis
JOBNAME:  GPGfermi42nc
COMMAND: /home/gilfoyle/gmn/ana.6GeV/bin/LinuxRHEL3/qe_ana  -M 10000 -n 24023 -L
-f /home/gilfoyle/gmn/run/simrun42n.dat -r -a
-v /home/gilfoyle/gmn/run/results/fermi_correction42n2.root
+ec /home/gilfoyle/gmn/run/det_eff/e5_nde_4gev_0608_histo.root.ec
+sc /home/gilfoyle/gmn/run/det_eff/e5_nde_4gev_0608_histo.root.sc
+prot /home/gilfoyle/gmn/run/det_eff/e5_pde_4gev_0603_histo.root
+lac /home/gilfoyle/gmn/run/det_eff/nde.2gev.08.01.07.histo.root.lac
MEMORY: 500 MB
```

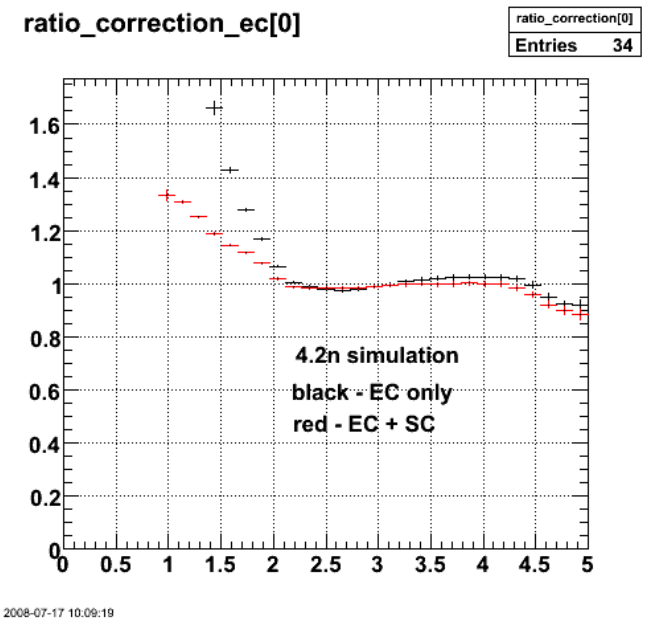


Fig 4. Redone Fig 3 with proper angle limits in QE event generator. There is no apparent change.

Click here to view the object (ROOT macro for fig 4) you uploaded.

Click here to view the object (ROOT histogram file for fig 4) you uploaded.

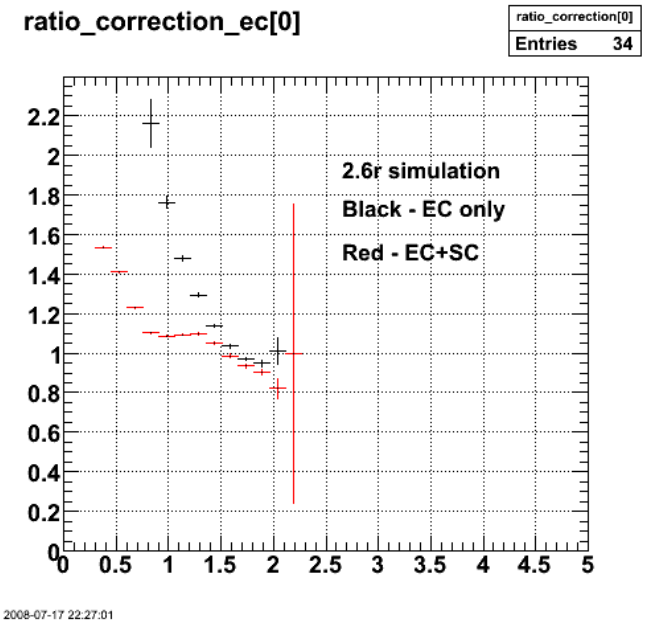


Fig 5. Fermi correction for EC only and EC+SC for 2.6r.

Click here to view the object (ROOT macro for fig 5) you uploaded.

Click here to view the object (ROOT histogram file for fig 5) you uploaded.

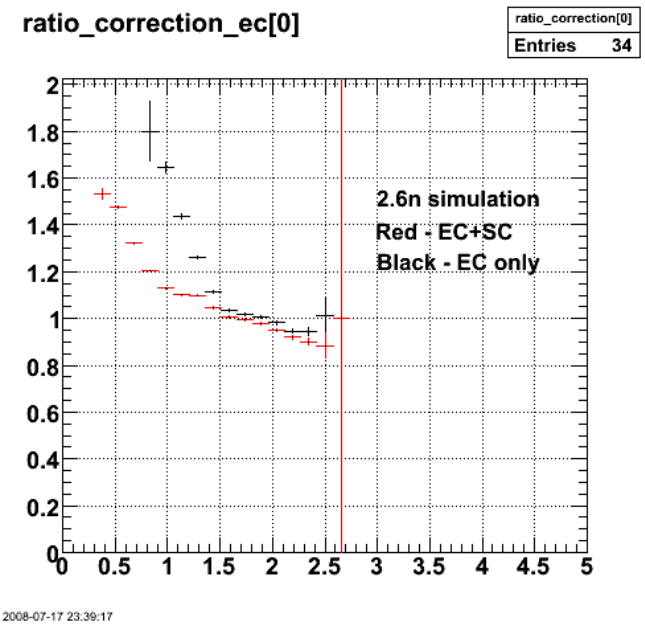


Fig 6. Fermi correction for EC only and EC+SC for 2.6n.

Click here to view the object (ROOT macro for fig 6) you uploaded.

Click here to view the object (ROOT histogram file for fig 6.) you uploaded.

Now smear the simulated electron scattering angle using the CLAS resolution of 4 mrad and randomly picking a change in the electron scattering angle from a flat distribution. Results are shown below.

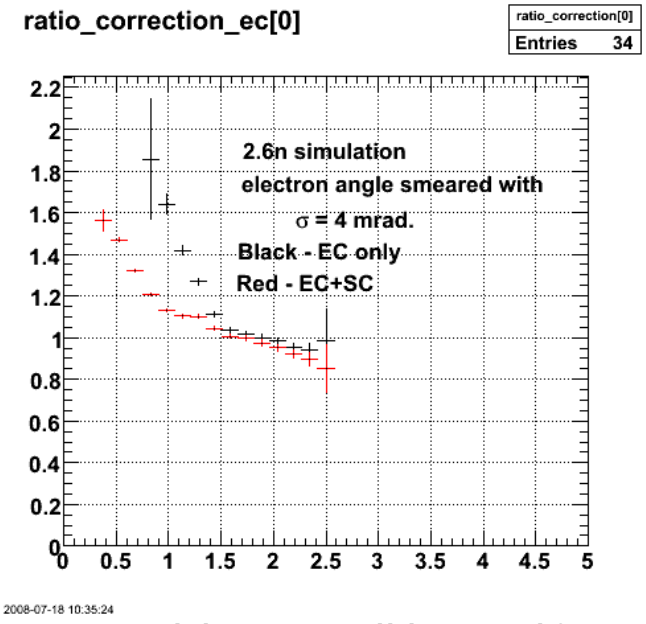


Fig 7. 2.6n with electron smearing added. Compare with fig 6.

Click here to view the object (ROOT macro for fig 7) you uploaded.

Click here to view the object (ROOT histogram file for fig 7) you uploaded.

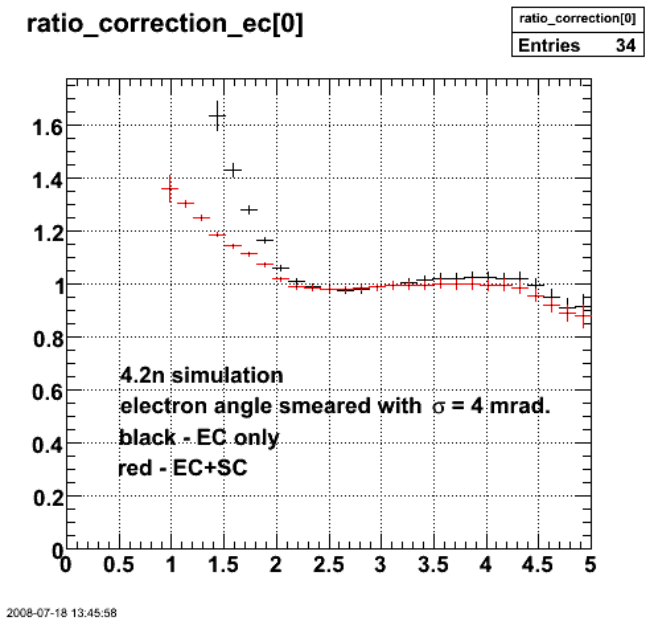


Fig 8. 4.2n with electron smearing added. Compare with fig 4

Click here to view the object (ROOT macro for fig 8) you uploaded.

Click here to view the object (Root histogram file for fig 8.) you uploaded.

I have started working on the Fermi correction calculations to finish off the analysis note. The first plot below shows the same calculation as shown in Fig 1 by Jeff. The plots are very similar, but the correction factor is higher at the low Q2 in Fig 2 than at the same Q2 in Fig 1. The difference between the smeared and unsmeared distributions is much the same.

Fig 2. Calculation of the Fermi correction to R for the 4.2-GeV data. Compare with Fig 1.

Difference between the Fermi correction to R for the smeared and unsmeared electron angle for the 4.2-GeV data.

The results for the 2.6-GeV data set are shown below. There are some significant differences between the ratio correction for the EC between the calculation in Fig 3. and the calculation in the analysis note (compare Fig 3 below with Fig 2.62 in he analysis note). This is under study. The effect of the electron angle smearing is again very small.

Fig 3. Fermi correction with and without smearing for 2.6 GeV, normal polarity data.

Fig 4. Difference between the ratio correction for EC neutrons with and without electron angle smearing for 2.6 GeV, normal polarity.

Numbers for 2.6n. Data are from Lachniet file for final results and difference between smeared and unsmeared 2.6n calculation are in the last column.

Q2	GMn	Stat error	Sys error	Smearing error
0.984848	0.995306	0.00800311	0.0214045	0.00732 +/- 0.0510036
1.13636	1.00728	0.00785473	0.0245978	0.01613 +/- 0.0262338
1.28788	1.03186	0.0072034	0.0219763	0.00747 +/- 0.0167404
1.43939	1.02284	0.00667009	0.02001	0.00092 +/- 0.0131165
1.59091	1.01265	0.00653109	0.0194181	0.00071 +/- 0.0129768
1.74242	1.0136	0.00662985	0.0192848	0.00111 +/- 0.0141158
1.89394	1.01669	0.00635229	0.0193804	0.00432 +/- 0.0153583
2.04545	1.00001	0.00649555	0.0211262	0.00166 +/- 0.017585
2.19697	0.991865	0.00712071	0.0211519	0.00531 +/- 0.021044
2.34848	1.0016	0.00836382	0.021443	0.00656 +/- 0.0365464
2.5	1.02119	0.00985659	0.0225447	0.02905 +/- 0.169484
2.65152	1.03442	0.0107656	0.0221549	
2.80303	1.00121	0.0113388	0.0212338	
2.95455	0.995414	0.0122915	0.0212774	
3.10606	1.00185	0.0142447	0.0206032	
3.25758	0.977922	0.0154287	0.0197722	
3.40909	0.996698	0.01718	0.020221	
3.56061	0.991829	0.0184284	0.0181868	
3.71212	0.974237	0.0202512	0.0184637	
3.86364	0.979143	0.0230183	0.0177399	
4.01515	1.02848	0.0252436	0.017951	
4.16667	0.919278	0.0264864	0.0172476	
4.31818	0.907946	0.029367	0.0165242	
4.4697	0.990253	0.038589	0.0168603	
4.62121	1.10739	0.0988585	0.0142526	
4.77273	1.09205	0.130194	0.0142246	

Run the simulation longer and use binomial statistics in calculating the neutron and proton 'found' fractions and get the following.

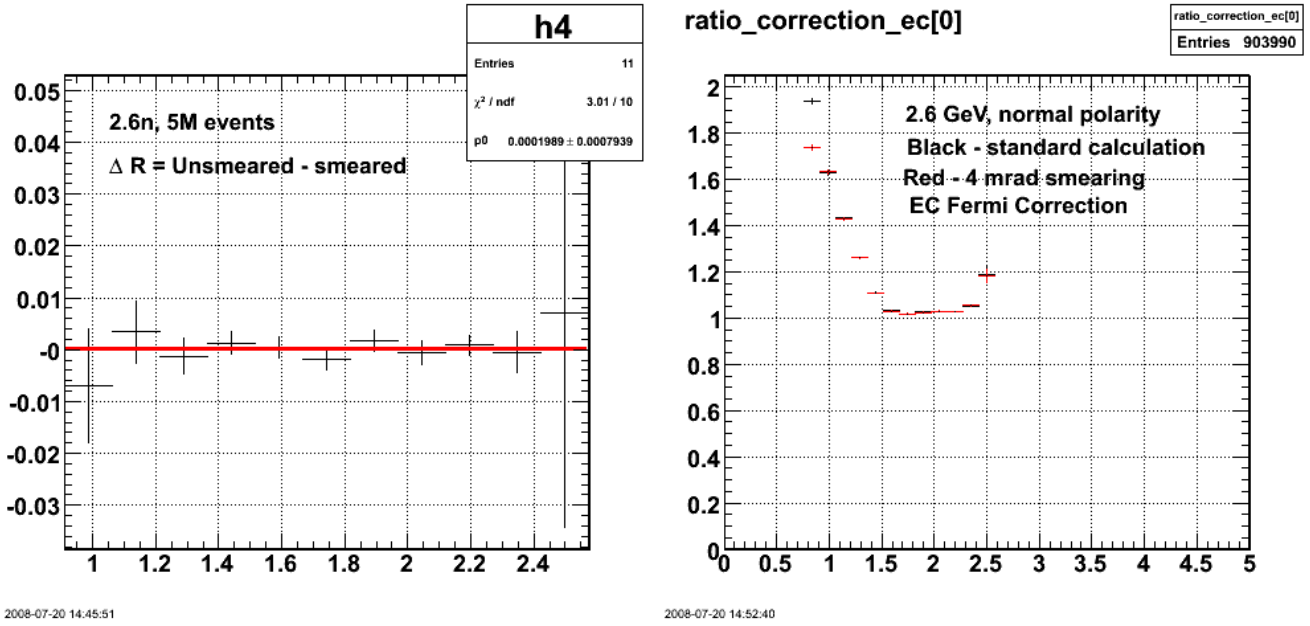


Fig 5. Delta_R after implementing binomial statistics (lhs) and comparison of Fermi correction simulation with smearing off (black) and on (red) (lhs). The 0.82-GeV2 point has been left off the fit on the lhs.

Click here to view the object (ROOT macro for lhs fig 5) you uploaded.

Click here to view the object (ROOT histogram file for fig 5 with unsmeared events.) you uploaded.

Click here to view the object (ROOT histogram file for fig 5 with smeared scattered electron angle events.) you uploaded.

Click here to view the object (ROOT macro for rhs of Fig 5.) you uploaded.

ROOT has an option for doing binomial statistics so use that and run it again. The spectrum for delta_R looks the same as before, but now the point at 0.8 GeV2 now agrees with the other points??!! All I did was change one of the options on two histograms??? I suspect that I may have had an indexing problem in Fig 5 above. After repeated simulations (see below) the difference between the smeared and unsmeared has gone away.

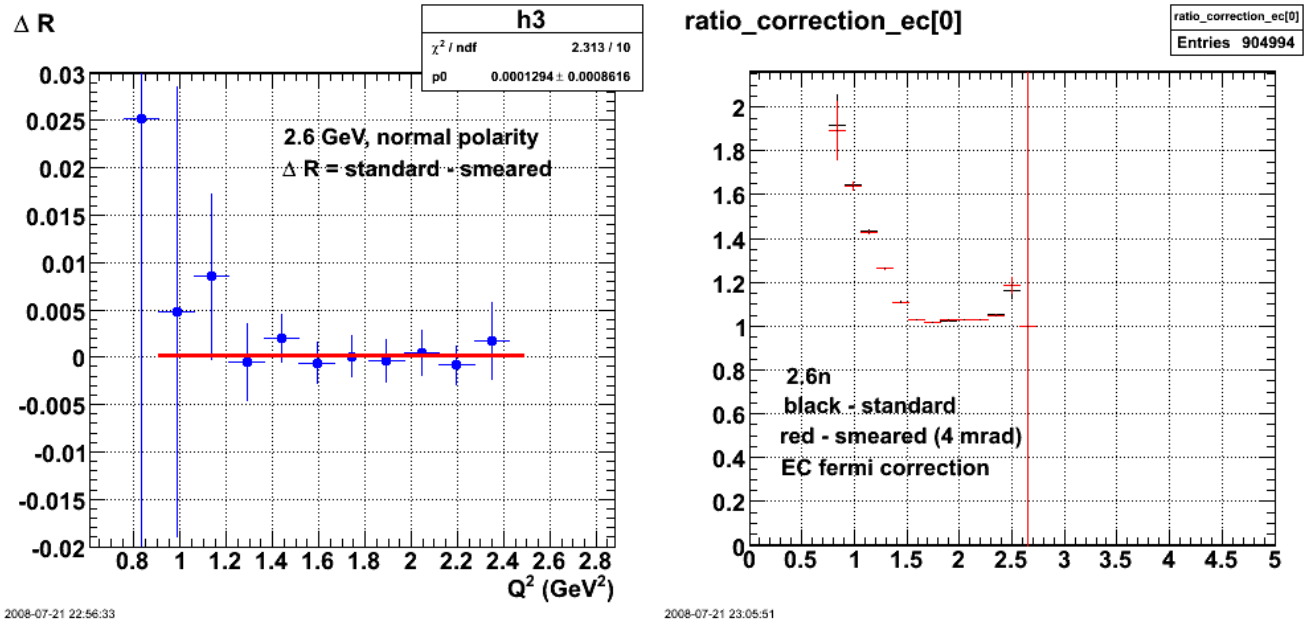


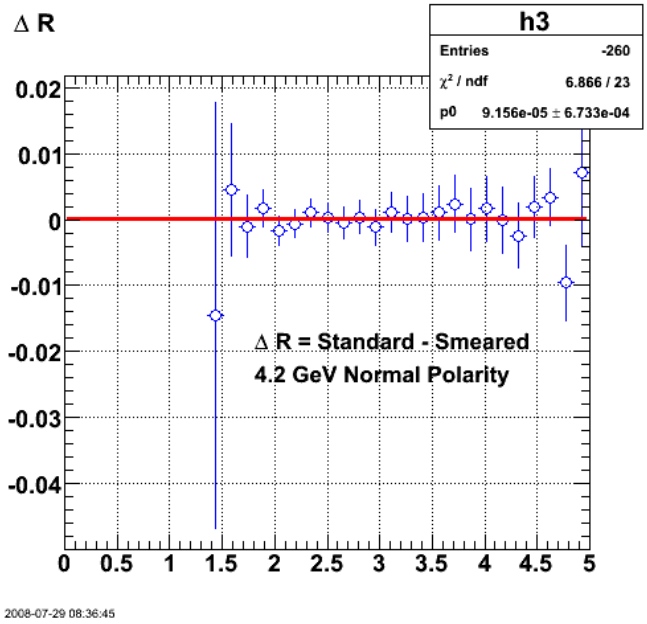
Fig 6. Difference in Fermi correction for EC with smearing off and on for 2.6n (lhs) and comparison of EC fermi correction with smearing off (black) and on (red) in the rhs.

Click here to view the object (ROOTmacro for lhs of Fig 6.) you uploaded.

Click here to view the object (ROOT macro for rhs of Fig 6.) you uploaded.

Click here to view the object (ROOT histogram file for fig 6 with standard analysis.) you uploaded.

Click here to view the object (ROOT histogram file for fig 6 with smeared electron angle analysis.) you uploaded.



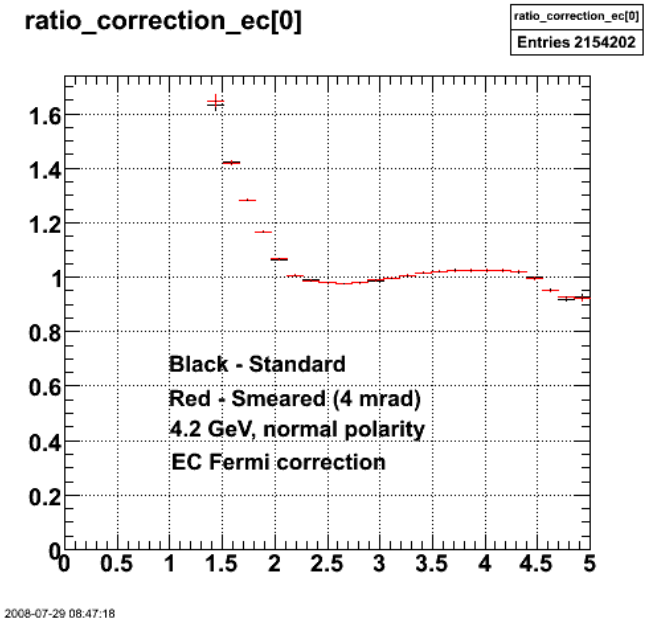


Fig 7. Difference in Fermi correction for EC with smearing off and on for 4.2n (lhs) and comparison of EC fermi correction with smearing off (black) and on (red) in the rhs.

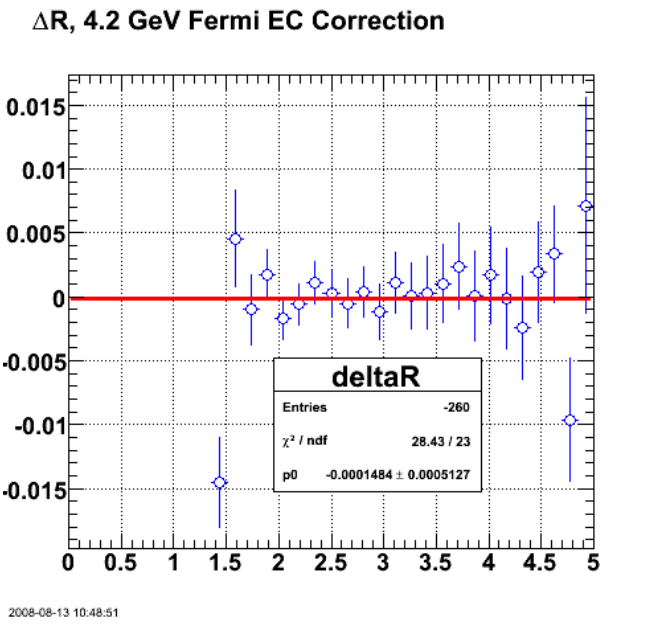
Click here to view the object (ROOT macro for fig 7 (lhs)) you uploaded.

Click here to view the object (ROOT macro for rhs of Fig 7.) you uploaded.

Click here to view the object (ROOT histogram file for fig 7 for standard analysis.) you uploaded.

Click here to view the object (OOT histogram file for fig 7 for smeared analysis.) you uploaded.

Use Baysian errors instead of binomial ones. Click here to view the object (ROOT macro for getting Baysian uncertainties.) you uploaded. When I fit a constant using MINUIT to the difference between the smeared and unsmeared EC Fermi corrections, then I get a reduced chi-square of about one as expected. This is good though the uncertainties on the differences are now a mixture of Bayesian and Poisson statistics. The problem now is that the lowest Q2 point (where the Bayesian statistics have the greatest effect) is many standard deviations away from zero. I don't believe this is real since as I increase the throws in the simulation, that difference has been going down. Leave this as a mystery for now.



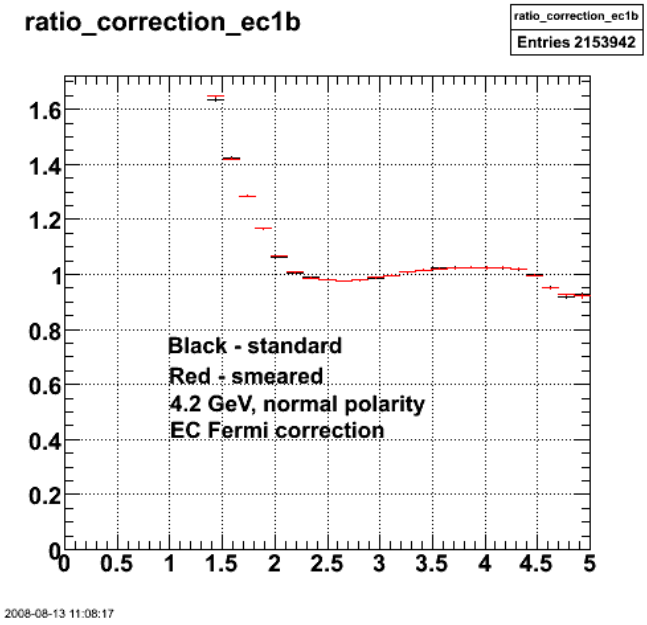


Fig 8. Same as l.h.s of Fig 7 except using Bayesian errors. **Same as r.h.s. of Fig 7.**

Click here to view the object (ROOT macro for L.h.s. of Fig 8.) you uploaded.

Click here to view the object (PDF file describing Baysian errors.) you uploaded.

Click here to view the object (ROOT macro for r.h.s. of Fig 8.) you uploaded.

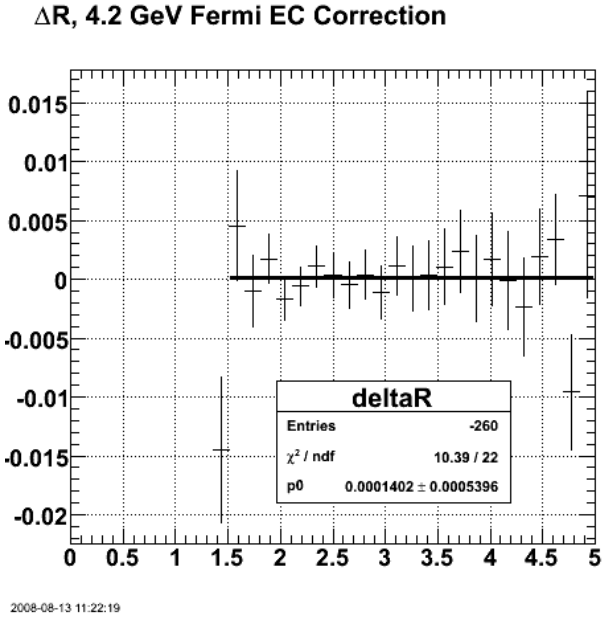
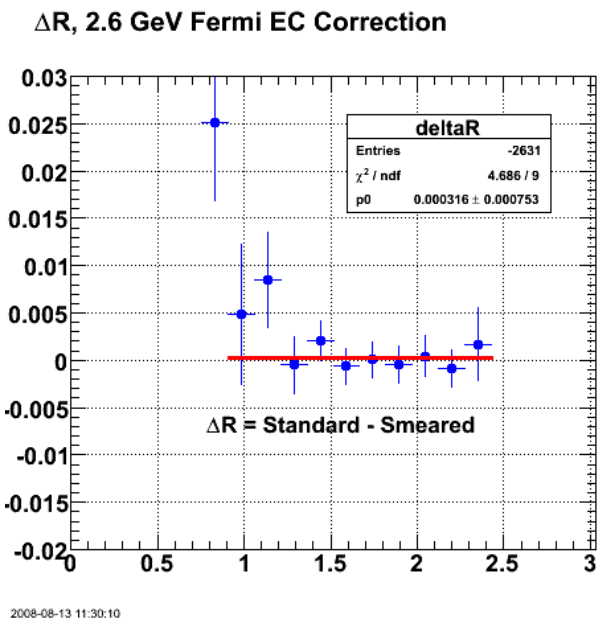


Fig 9. Check the effect of excluding the low-Q2 point.



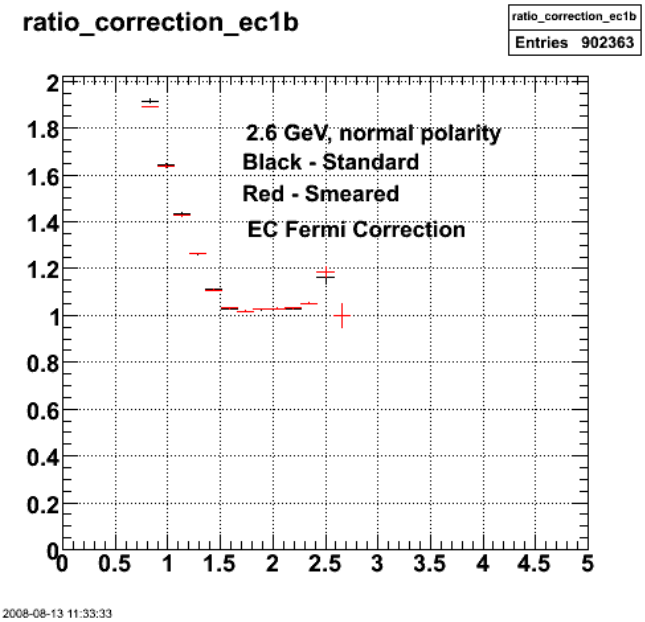


Fig 10. Same as lhs of fig 8 for 2.6n. **Same as rhs of Fig 8 for 2.6n.**

Click here to view the object (ROOT macro for lhs of fig 10) you uploaded.

Click here to view the object (ROOT macro for rhs of Fig 10) you uploaded.

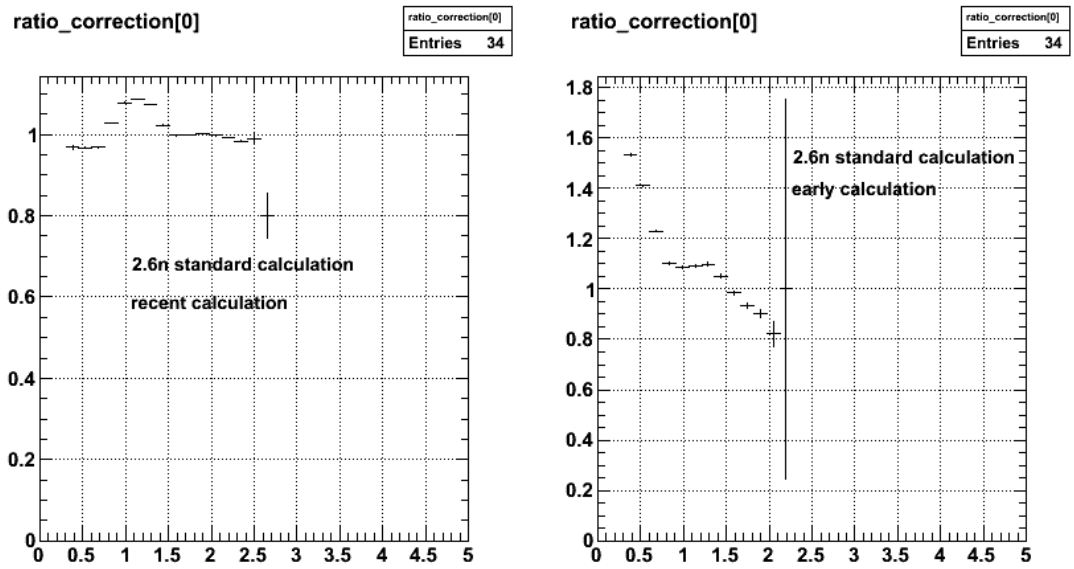


Fig 11. There is now a problem with the recent simulations. The left panel shows a recent simulation and the right panel shows an earlier one. The rhs (from Fig 4 above) agrees with JL's thesis so it is likely the correct one. Have to figure out how I screwed up JL's code.

Click here to view the object (ROOT macro for fig 11.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 217 - New results from Sabine and Wally (gpg)

[Modified Mon Jul 28 02:54:00 2008 (GMT) gpg]

The plots below show recent calculations from Sabine and Wally Van Orden. Sabine suggested using the calculations with the cutoff equal to 1.0 as the best one.

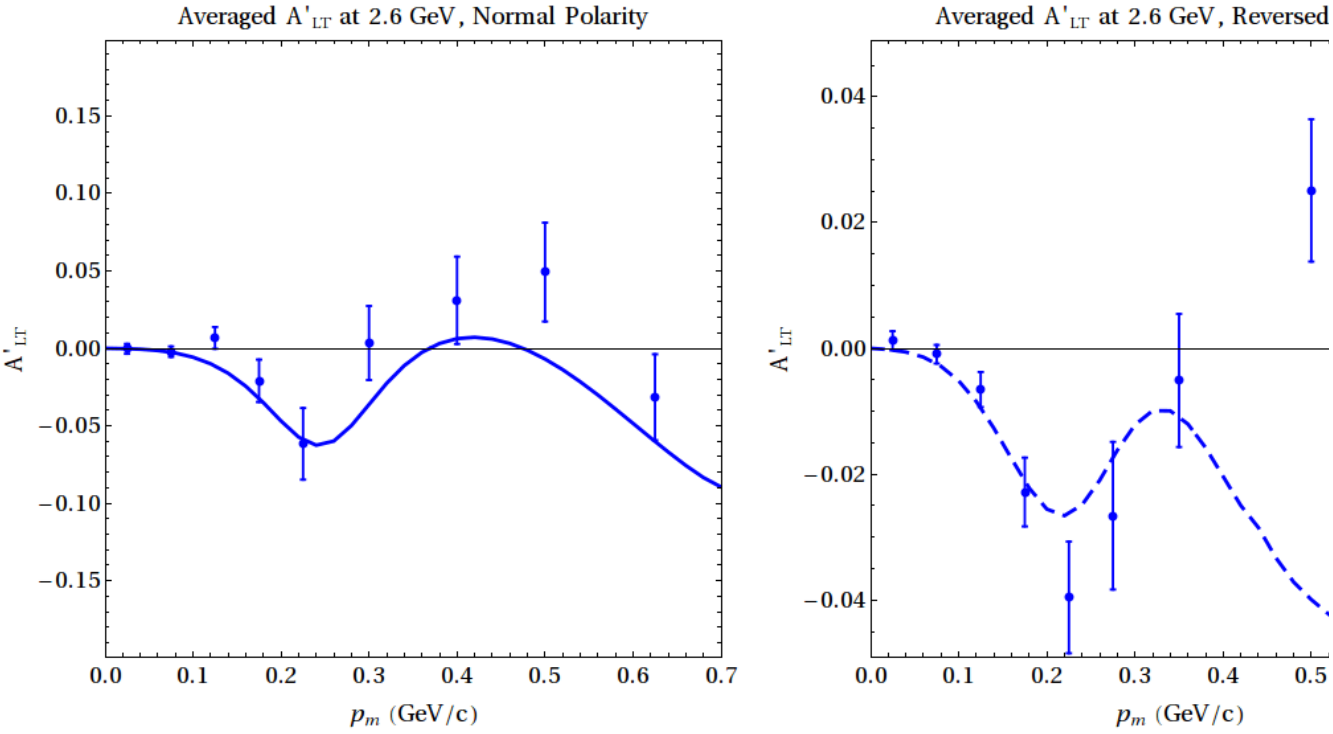


Fig 1. Plot of the 2.6-GeV, normal polarity results (lhs) for ALTp with SHWVO calculation with cutoff=1.675 GeV and same for 2.6-GeV, reversed polarity (rhs).

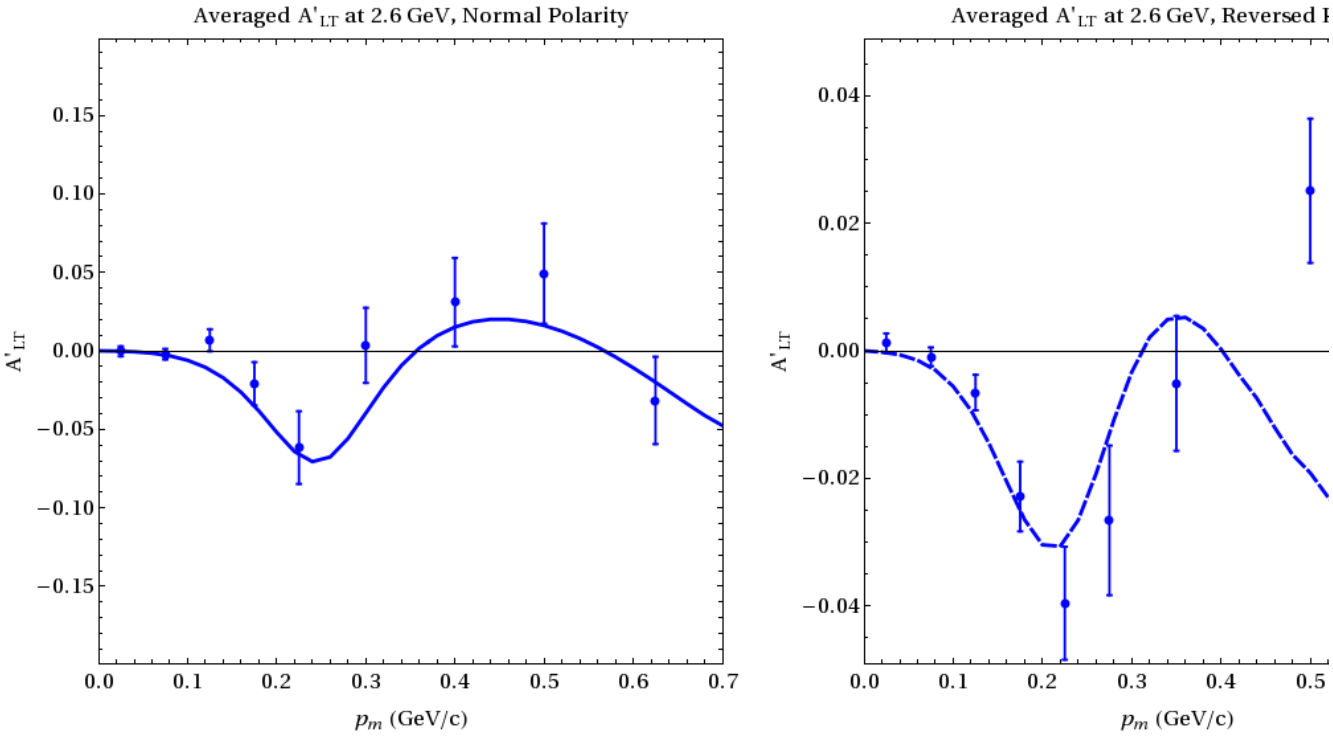
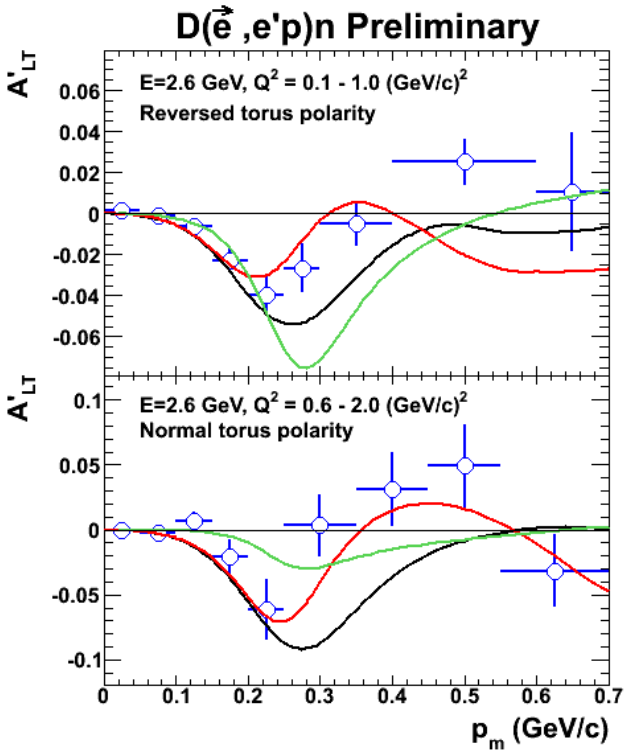


Fig 2. Same as Fig 1 with cutoff = 1.0 GeV.

ROOT version.



Same as Fig 2 in ROOT form.

Click here to view the object (ROOT macro for fig 3.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 218 - Final delta_R results for CAN (gpg)

[Modified Mon Aug 18 15:56:12 2008 (GMT) gpg]

The committee requested several plots related to the effect of the electron angular resolution as described in the excerpt from the final review below.

```
2. Before final approval he requested the following items.

2.a. The GSIM simulations of the measurement in entry 410 of the E5 elog
should be added to the analysis note.

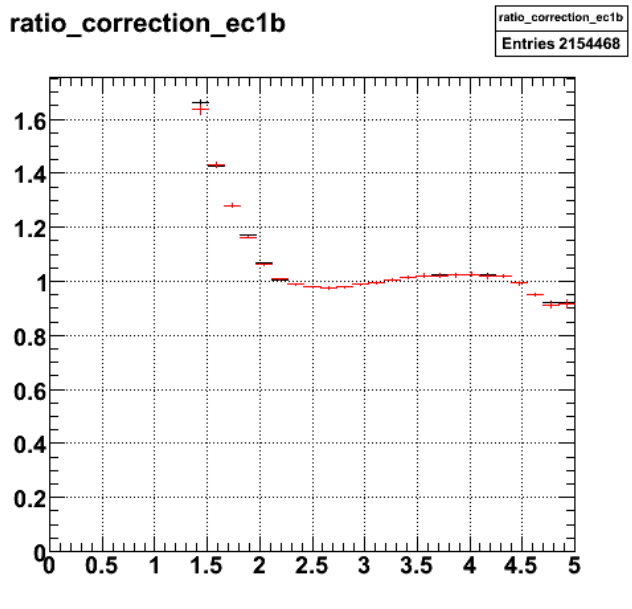
2.b. Fit the SC neutron detection efficiency in Fig 3 of entry 410 with
a modified function (i.e. fewer terms in the polynomial) and calculate
the SC Fermi correction.

2.c. Add the measured proton efficiency to the simulated one in Fig 1 of
entry 410.

2.d. Calculate the Fermi correction for the 2.6-GeV data with the
smeared electron angular resolution as we did for the 4.2-GeV data in
Figure 1 of entry 398 in the E5 elog.

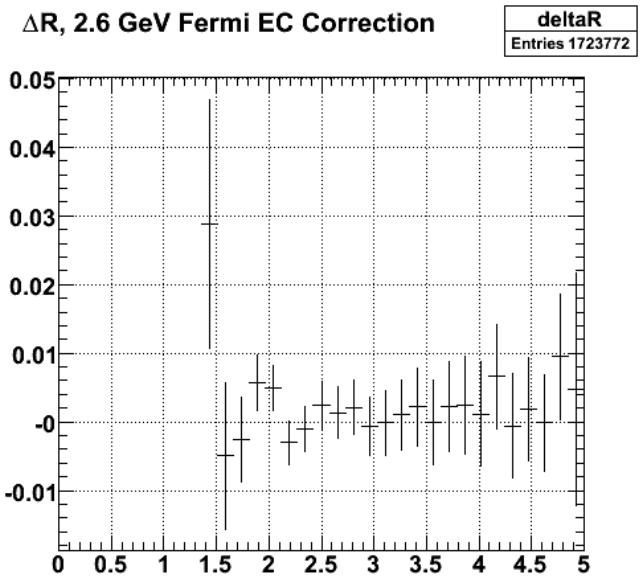
2.e. Take the difference between the Fermi corrections with unsmeared
and smeared electron angles (see entry 398 and 2.d) as an additional
systematic uncertainty. This result would be added in quadrature to the
existing systematic uncertainty.
```

Below are the plots for the CAN to satisfy the committee on items 2d-2e.



2008-08-18 10:24:45

Fig 1. Comparison of EC Fermi correction with standard simulation (black) and with electron smearing (red) for 4.2n.



2008-08-18 10:27:25

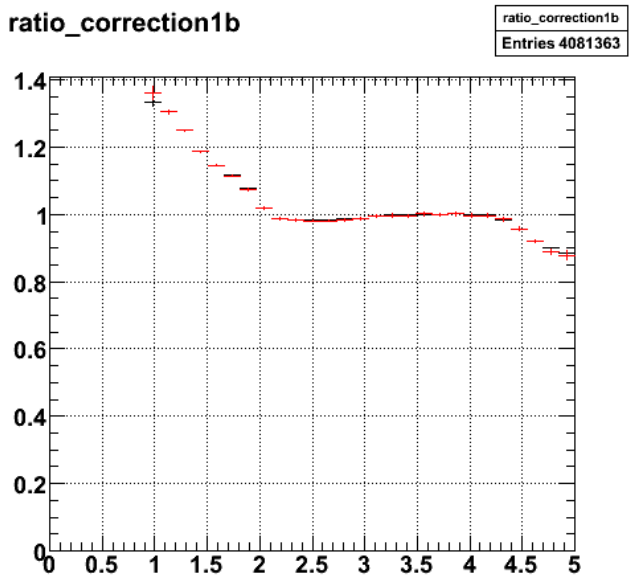
Fig 2. Difference between the standard and smeared Fermi corrections for 4.2n EC.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (ROOT macro for fig 2) you uploaded.

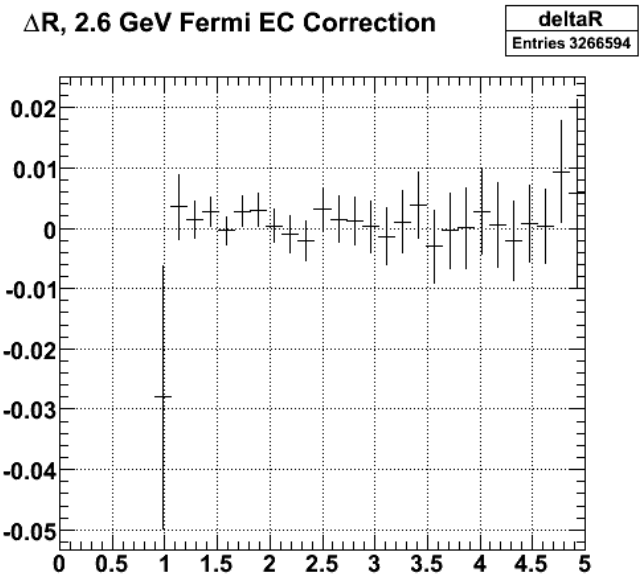
Click here to view the object (ROOT histogram file with standard simulation for figs 1-4) you uploaded.

Click here to view the object (ROOT histogram file for smeared simulation for figs 1-4) you uploaded.



2008-08-18 10:34:28

Fig 3. Comparison of SC Fermi correction with standard simulation (black) and with electron smearing (red) for 4.2n.

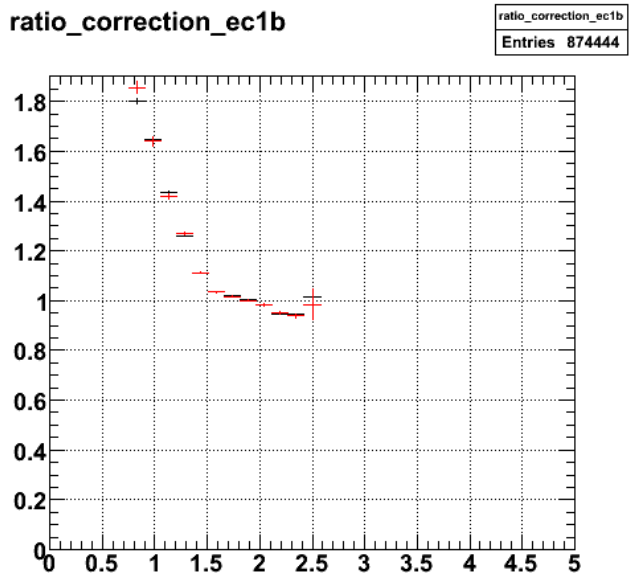


2008-08-18 10:35:32

Fig 4. Difference between the standard and smeared Fermi corrections for 4.2n SC.

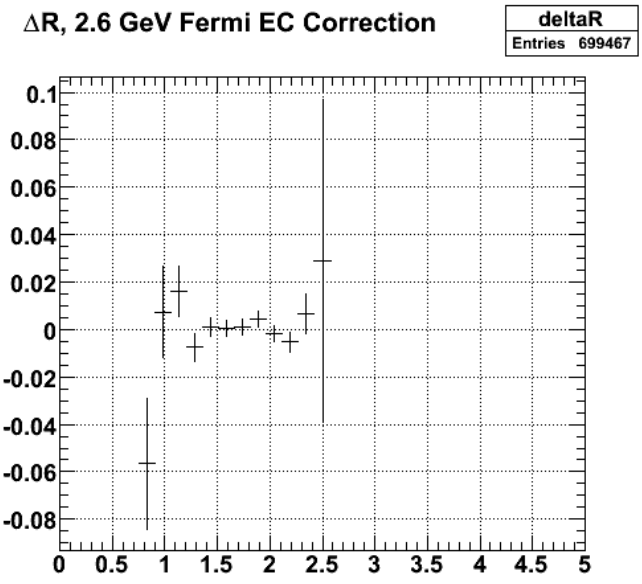
Click here to view the object (ROOT macro for fig 3) you uploaded.

Click here to view the object (ROOT macro for fig 4) you uploaded.



2008-08-18 11:21:52

Fig 5. Comarison of EC Fermi correction with standard simulation (black) and with electron smearing (red) for 2.6n.



2008-08-18 11:24:31

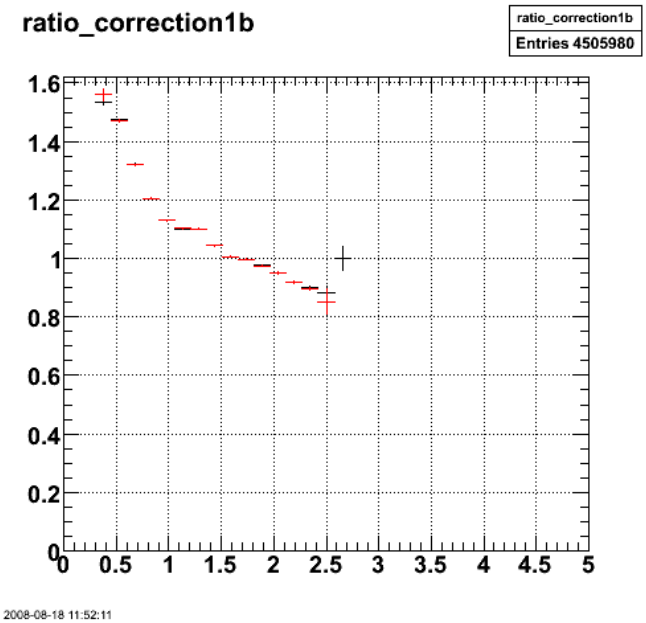
Fig. 6 Difference between the standard and smeared Fermi corrections for 2.6n EC.

Click here to view the object (ROOT macro for fig 5) you uploaded.

Click here to view the object (ROOT macro for fig 6) you uploaded.

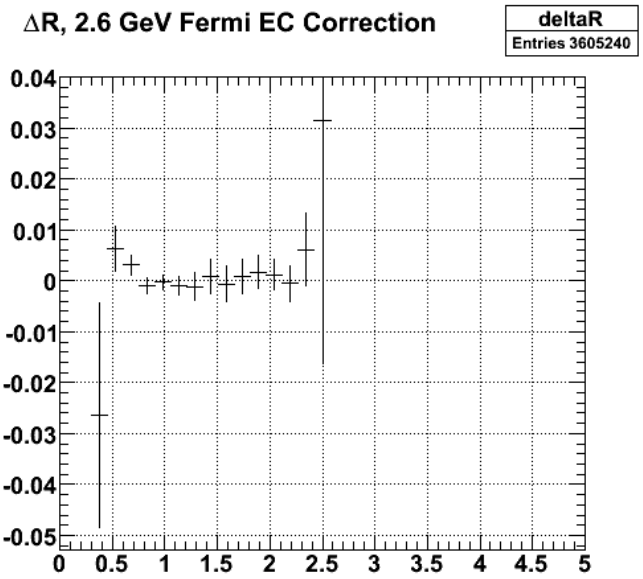
Click here to view the object (ROOT histogram file for standard simulation for 2.6n for figs 5-8.) you uploaded.

Click here to view the object (ROOT histogram file for smeared simulation for 2.6n for figs 5-8.) you uploaded.



2008-08-18 11:52:11

Fig 7. Comparison of SC Fermi correction with standard simulation (black) and with electron smearing (red) for 2.6n.



2008-08-18 11:50:34

Fig 8. Difference between the standard and smeared Fermi corrections for 2.6n SC.

Click here to view the object (ROOT macro for fig 7) you uploaded.

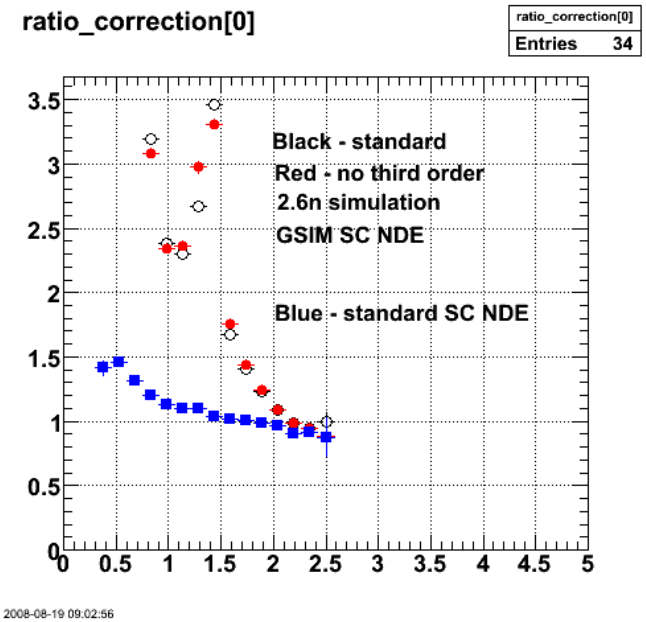
Click here to view the object (ROOT macro for fig 8) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 219 - Changing polynomial on GSIM SC NDE (gpg)

[Modified Mon Sep 8 20:23:31 2008 (GMT) gpg]

The results below are to satisfy item 2b in the final version of the GMn CAN. I used the GSIM calibration file which gives wacky fitting results which leads, in turn, to silliness in the Fermi correction.



2008-08-19 09:02:56

Fig 1. Comparison of the 2.6n Fermi correction using different polynomials for the GSIM SC NDE.

Click here to view the object (ROOT macro for fig 1) you uploaded.

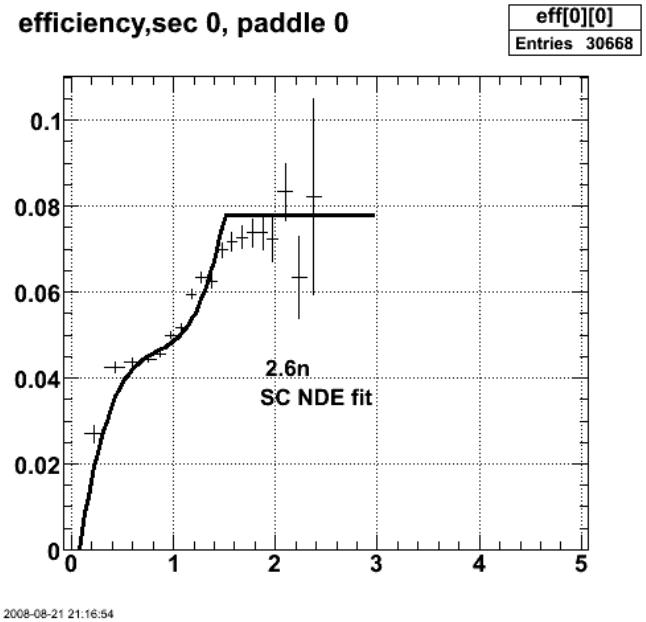
Click here to view the object (ROOT histogram file of GMn simulation using GSIM SC NDE and standard polynomial fit.) you uploaded.

Click here to view the object (ROOT histogram file of GMn simulation using GSIM SC NDE and reducing the polynomial fit by one order.) you uploaded.

Click here to view the object (ROOT histogram file of GMn simulation using standard SC NDE file and standard fit.) you uploaded.

Click here to view the object (log file for qe_ana output using all gsim calibration files.) you uploaded.

Use the shape of the curve for the global SC NDE from the data and just scale it for the simulation. The data-based SC NDE is in Fig 2.

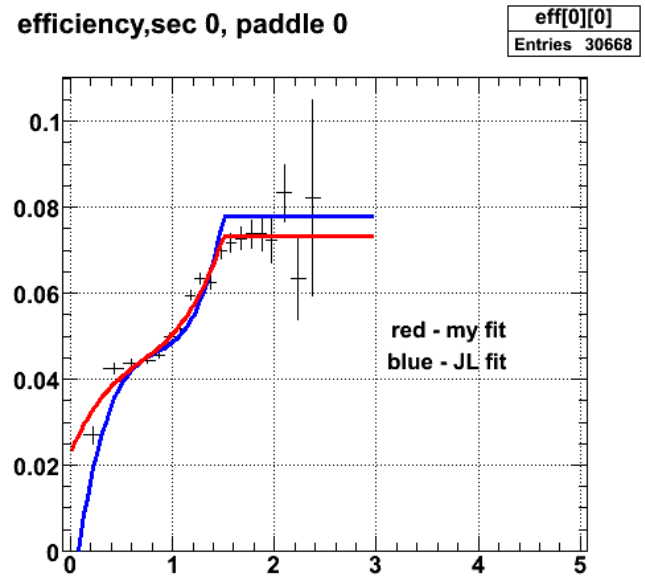


2008-08-21 21:16:54

Fig 2. Global SC NDE calibration data and fit with the plateau point fixed at pn = 1.5 GeV/c.

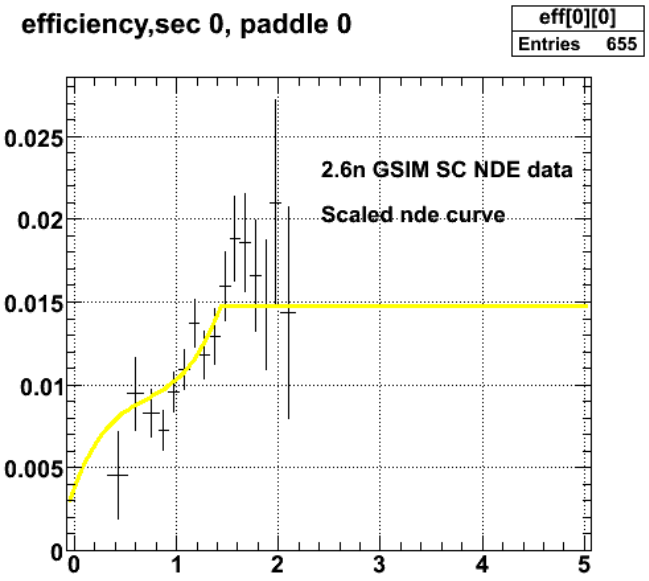
Click here to view the object (ROOT macro for Fig 2.) you uploaded.

Click here to view the object (ROOT histogram file nde.2gev.08.01.2007.histo,root.sc.root used for fig 2.) you uploaded.



2008-08-21 22:07:43

Fig 3. Comparison of my fit to JL. The parameters are noticeable different, but the curve is the same.



2008-08-21 22:39:09

Fig 4. GSIM SC NDE calibration data fitted with scaled curve from measured SC NDE for 2.6n

Click here to view the object (ROOT macro for Fig 4) you uploaded.

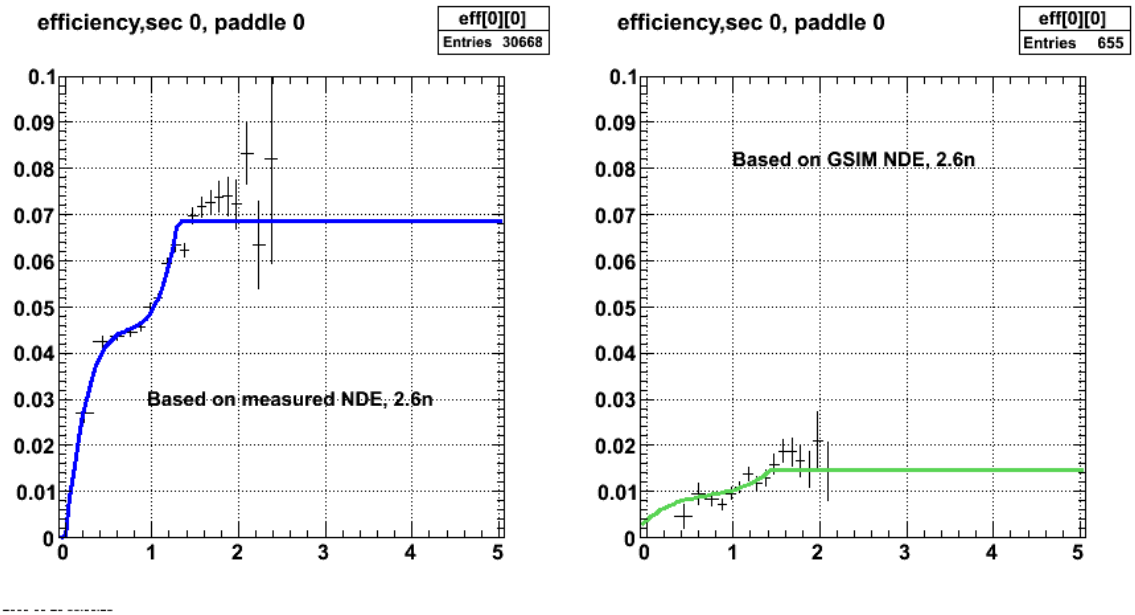


Fig 5. Comaprison of NDE from measurements (lhs) and GSIM (rhs) for 2.6n.

Click here to view the object (ROOT macro for Fig 5.) you uploaded.

The strange behavior of the Fermi correction for the GSIM calculation is due to wide variations in the scale factor from sector to sector and paddle to paddle. To smooth these out (and still be within the letter of the law of the final committee review) I used the summed NDE curve (Fig 3 of entry 410 in E5 elog) for all the GSIM NDE fits and obtained the following result which is much more reasonable than previous ones.

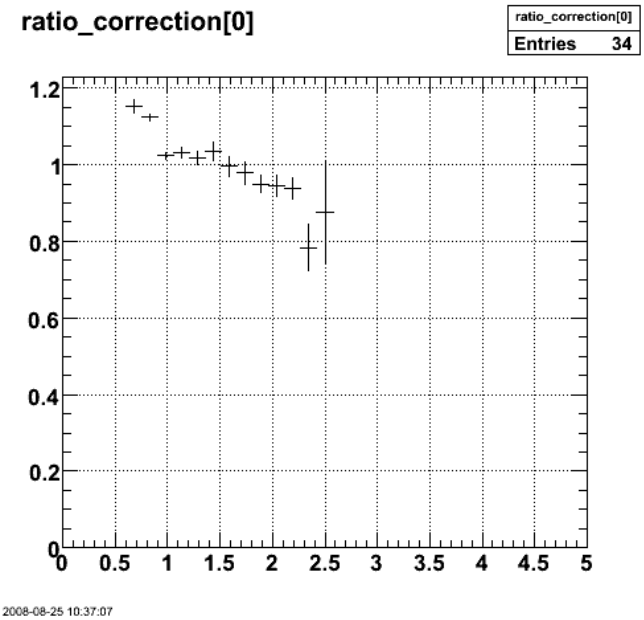
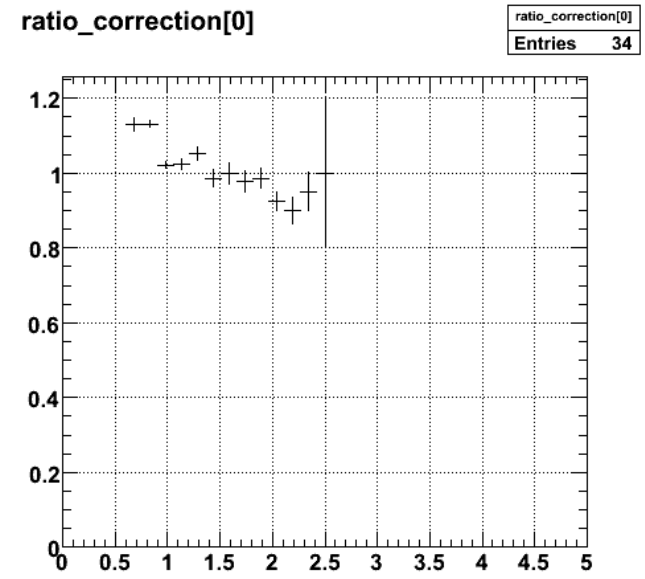


Fig 6. 2.6n, GSIM Fermi correction with fixed GSIM NDE for all paddles and sectors. The parameter values were fixed at the best fit values.

Now let the parameters vary and fix the overall scale factor to 1.0 and things look consistent.

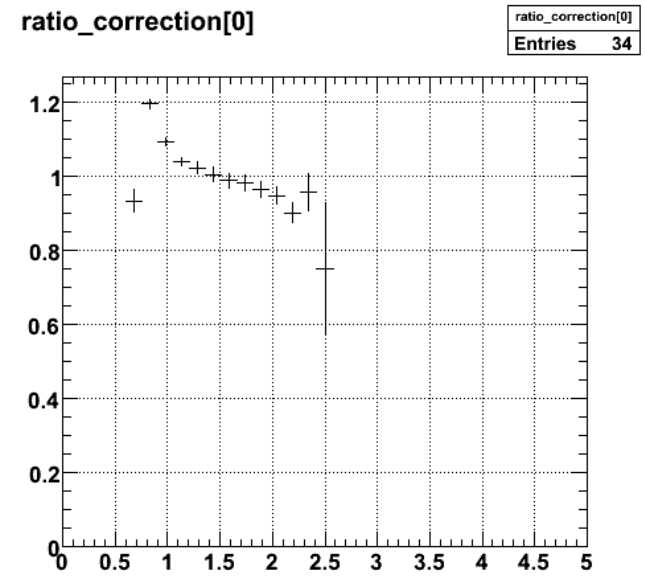


2008-08-25 10:48:20

Fig 7. Same as Fig 6 with all parameters varied except scale = 1.0.

Click here to view the object (ROOT macro for fig 7) you uploaded.

Now fix the coefficient for the 3rd order term to zero and fit the NDE spectrum.



2008-08-25 11:04:31

Fig 8. Same as fig 7 with the 3rd-order term coefficient set to zero in the fit.

Click here to view the object (ROOT macro for fig 8) you uploaded.

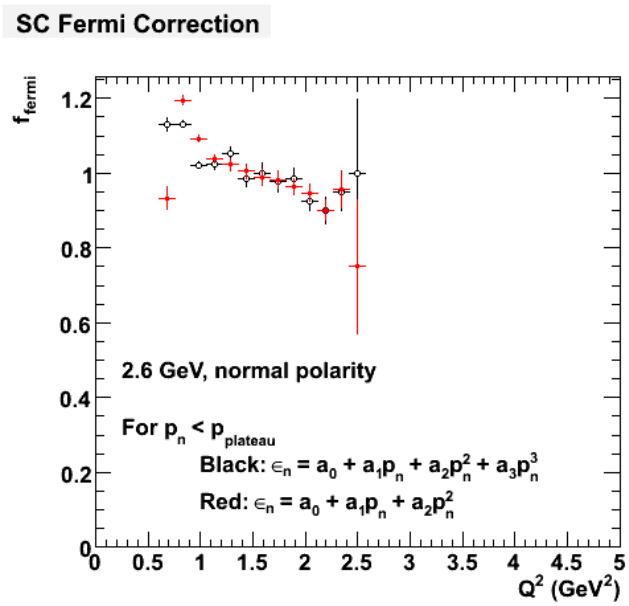


Fig 9. SC Fermi correction for 2.6n with third-order polynomial below the plateau in the SC NDE (black points) and for a second-order polynomial (red points).

Click here to view the object (ROOT macro changingPolynomial1.C for Fig 9) you uploaded.

The two calibration curves used in the Fermi correction calculation look like the following. One is a third-order polynomial with a plateau. The other is a second-order polynomial with a plateau. The third-order polynomial has a kink due to the dip in the SC NDE shown in Fig 10. This occurs at a neutron momentum of about p_n = 0.9 GeV/c which in quasielastic kinematics corresponds to Q2 of around 0.7 GeV2.

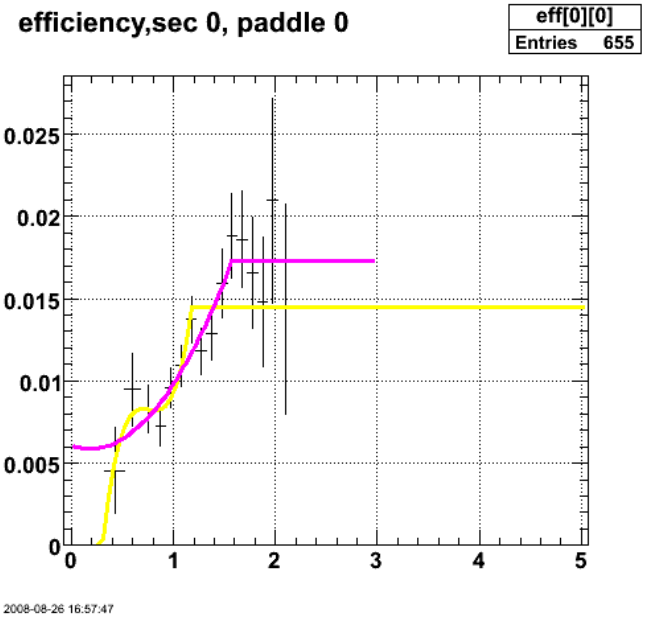


Fig 10. Comparison of SC NDE curves using 2nd and 3rd order polynomials in the fits.

Click here to view the object (ROOT macro for fig 10) you uploaded.

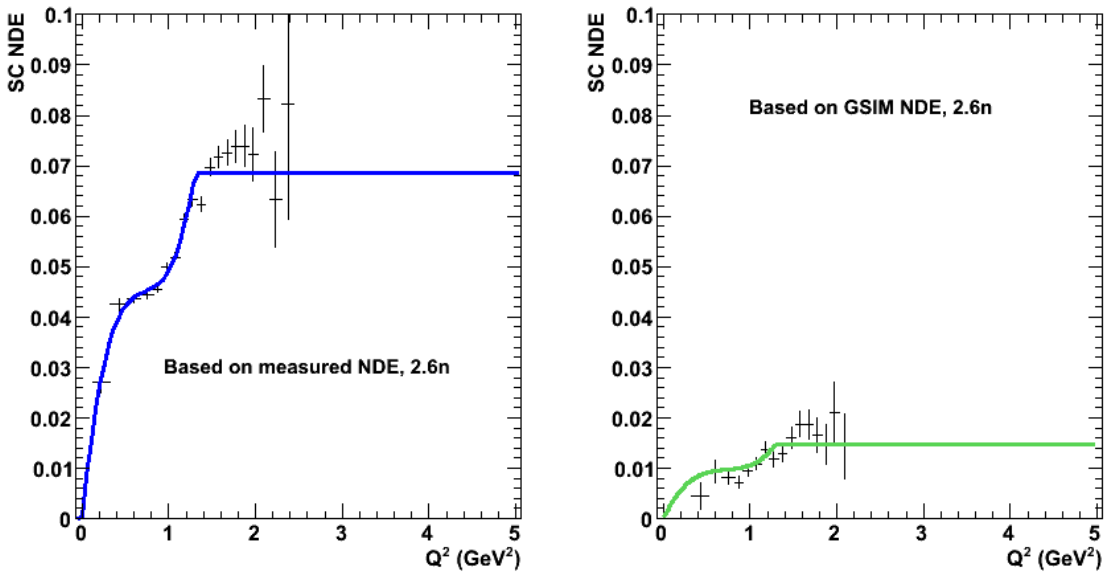


Fig 11. Comparison of the measured SC NDE (lhs) and GSIM SC NDE (rhs) for 2.6n. The GSIM SC NDE results were fitted with the same curve (third-order polynomial plus plateau and using the same coefficients) that fit the measured SC NDE on the lhs and then scaled to fit the GSIM SC NDE on the rhs.

Click here to view the object (ROOT macro for fig 11) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 220 - PDE plot for CAN (gpg)

[Modified Thu Aug 21 02:13:44 2008 (GMT) gpg]

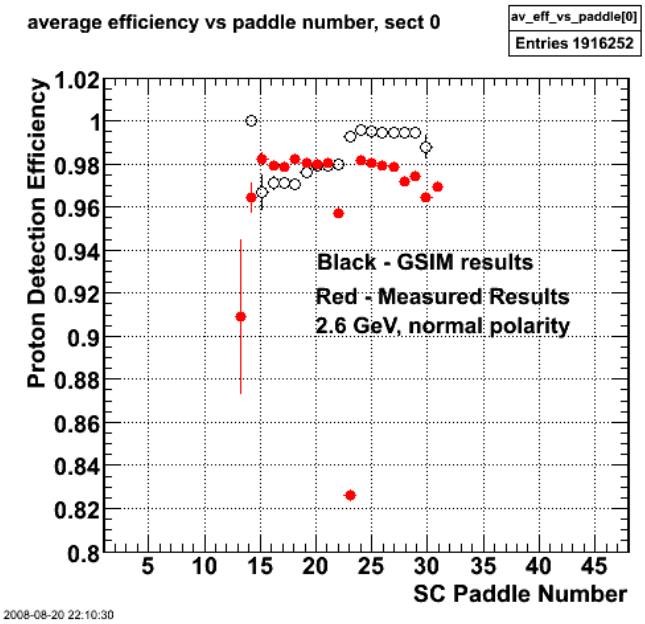


Fig 1. Comparison of PDE for all sectors for GSIM (black) and the measured results (red) for the 2.6-GeV data.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (ROOT histogram file for 2.6n, GSIM PDE (pde.gsim.2gev.histo.root)) you uploaded.

Click here to view the object (ROOT histogram file for the measured, 2.6-GeV, normal polarity, PDE (pde.2gev.rev.05.06.07.histo.root)) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 221 - Impact of theta_pq cut (Jerry Gilfoyle)

[Modified Wed May 27 03:47:50 2009 (GMT) Jerry Gilfoyle]

To answer the question raised by Sebastian Kuhn on the effectiveness of the theta_pq cut for the E5 analysis I made some calculations of the W2 spectra using the QUEEG/GENEV event generator. The plots below are for the output of the event generator and have not been processed through GSIM.

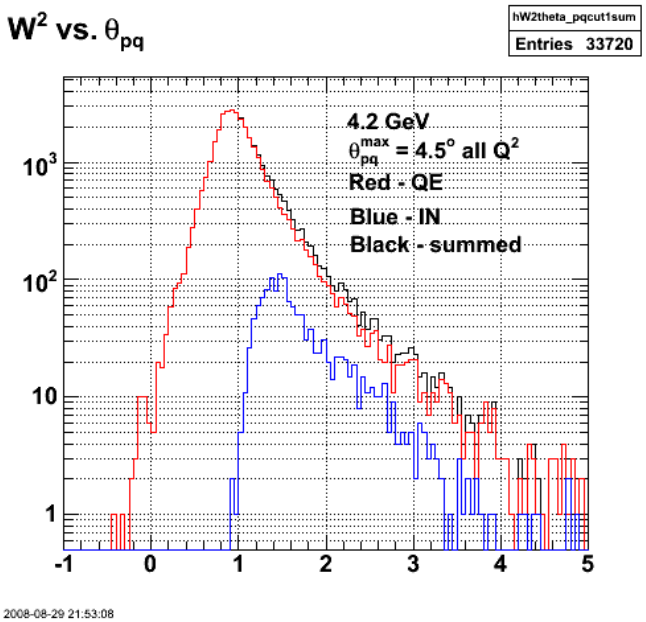
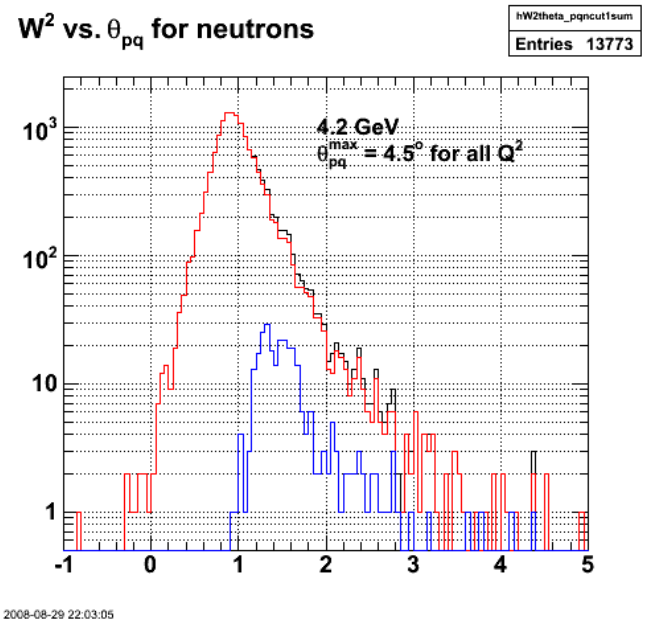


Fig 1. W2 spectrum for ep events for 4.2 GeV.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (Tared, gsipped, ROOT histogram files for fig 1) you uploaded.



Same as Fig 1 for neutrons

Click here to view the object (ROOT macro for fig 2) you uploaded.

Now get the W2 spectrum for protons and neutrons for all Q2 and 4.2 GeV using the different theta_pq cut for different Q2 bins. See log got 9/1/08. The ratio of QE:In is 1:1.

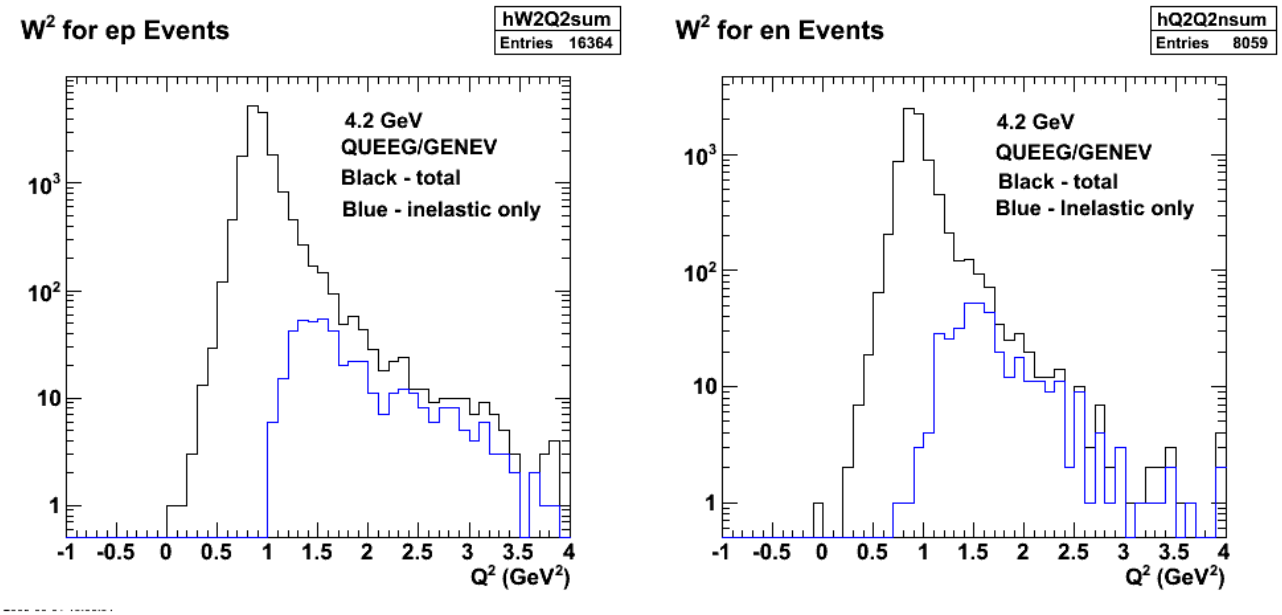


Fig 3. W2 spectra for 4.2 GeV with variable theta_pq cut for different Q2 bins.

Click here to view the object (ROOT macro for fig 3) you uploaded.

Click here to view the object (archive of histogram files for fig 3) you uploaded.

Use the Mathematica code to get the ratio of QE:IN = 1:25 for W2max = 4 GeV2.

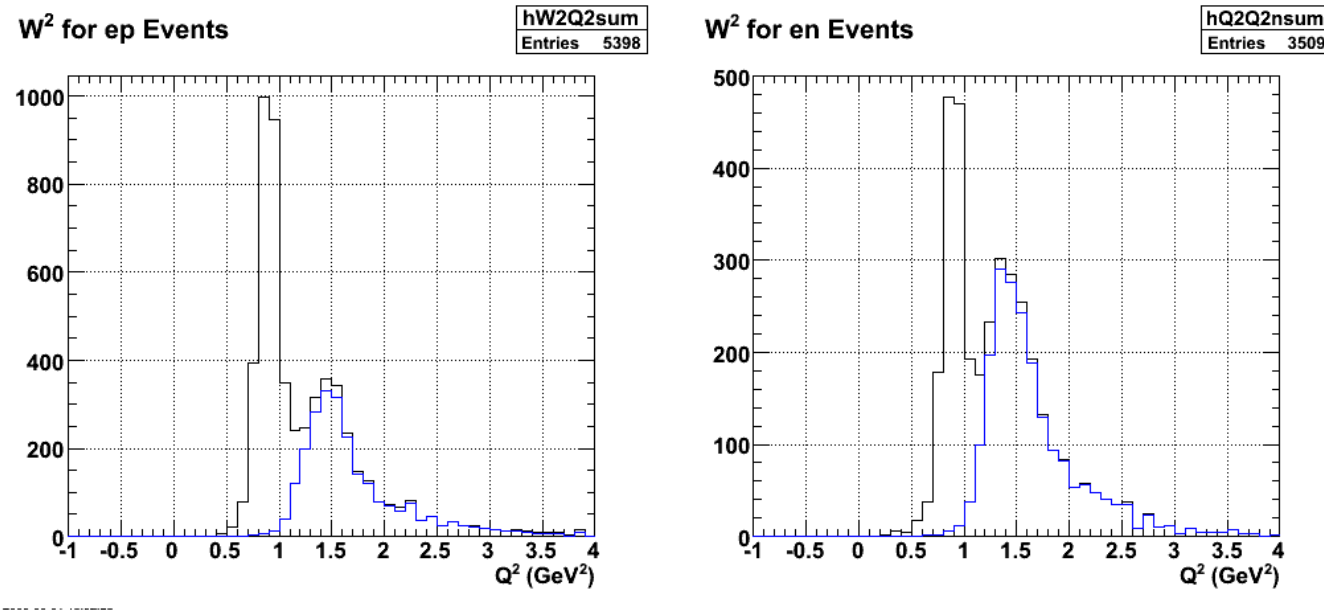


Fig 4. W2 spectra for 4.2 GeV with variable theta_pq cut for different Q2 bins and QE:IN of 1:25.

Click here to view the object (ROOT macro for fig 4.) you uploaded.

Click here to view the object (archive of histogram files for fig 4) you uploaded.

I think the number of IN events is way too high. Below is the ep spectrum from JL.

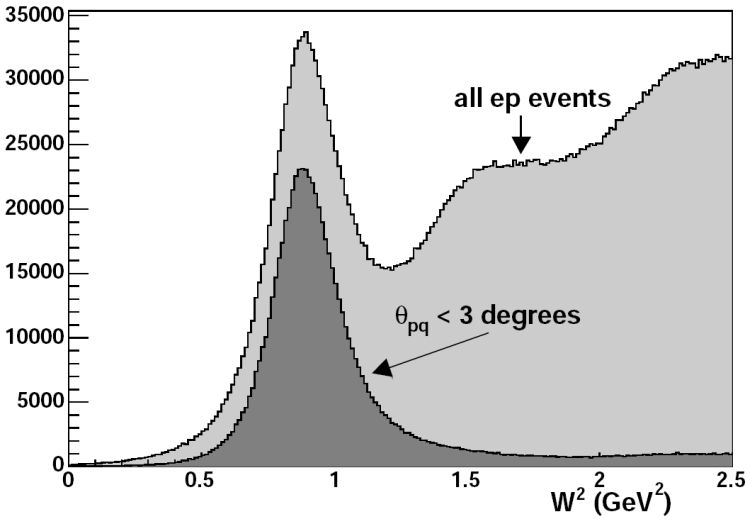


Fig 5. W2 spectrum for 4.2-GeV ep events from JL.

Here are my results integrated over all angles.

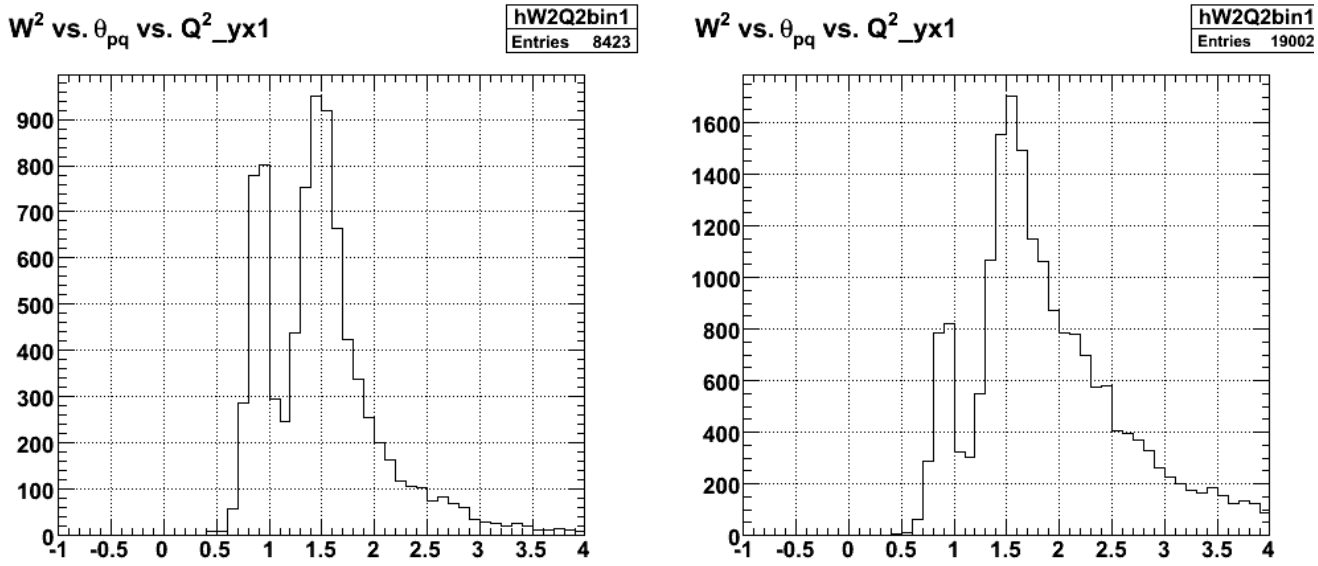


Fig 6. W2 spectra for protons (left) and neutrons (right) with no theta_pq cut.

Tune the ratio of QE:IN to get something that resembles fig 5 and get the following which looks much better.

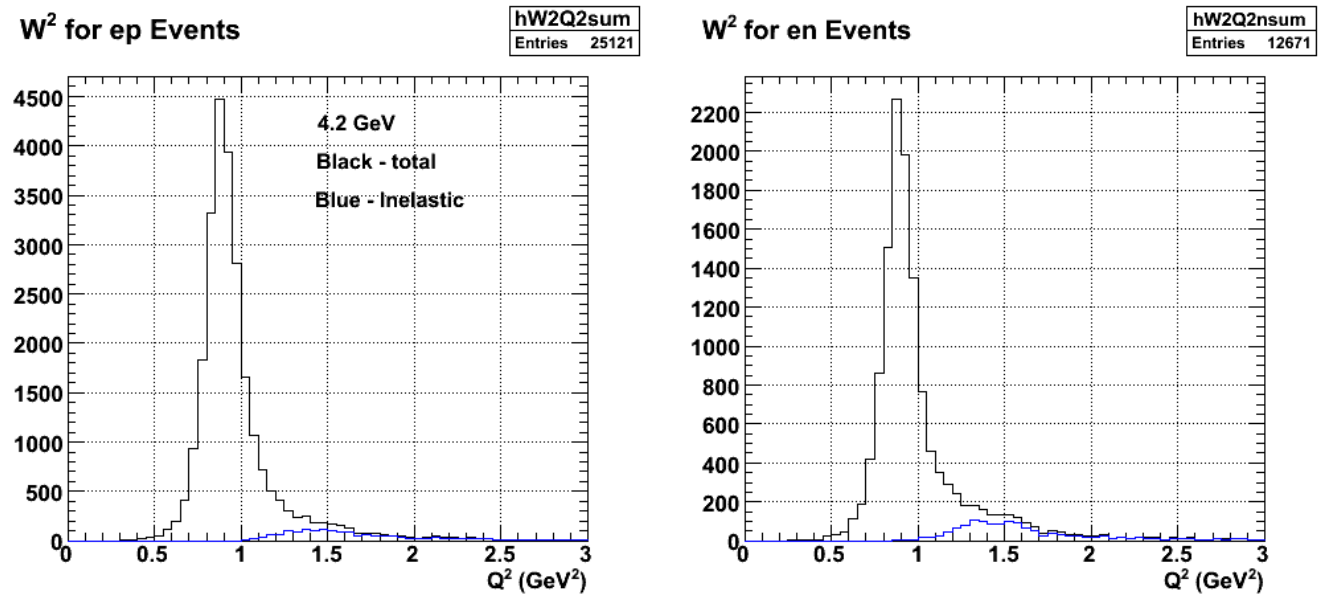


Fig 7. W2 spectra for ep (left) and en (right) events with theta_pq cut turned on. The command for the calculations was submit_gmnsim.pl 3200 10000 1

Click here to view the object (ROOT macro for fig 7) you uploaded.

Click here to view the object (archive for fig 7) you uploaded.

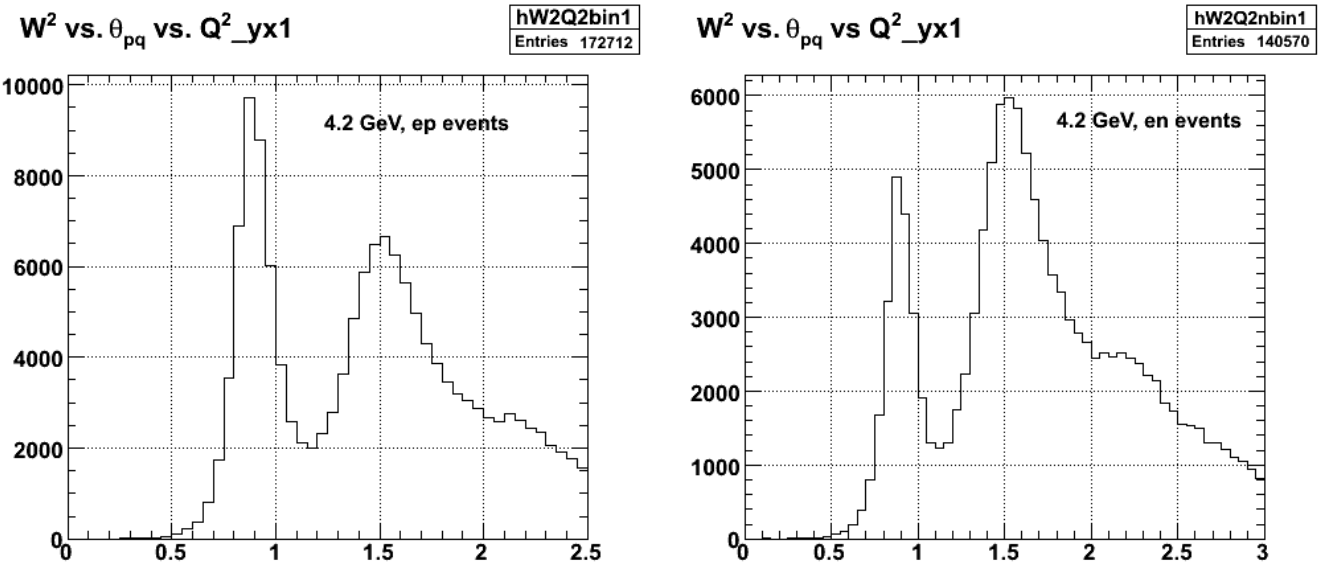


Fig 8. Same as Fig 7 with no theta_pq cut.

Click here to view the object (ROOT macro for fig 8) you uploaded.

Add A Gaussian of average zero and width 0.12 GeV2 to the W2 spectra to get them to resemble the data more without putting everything through GSIM. Use 'submit_gmnsim.pl 3200 9600 1' and channels 1-15 in GENEV.

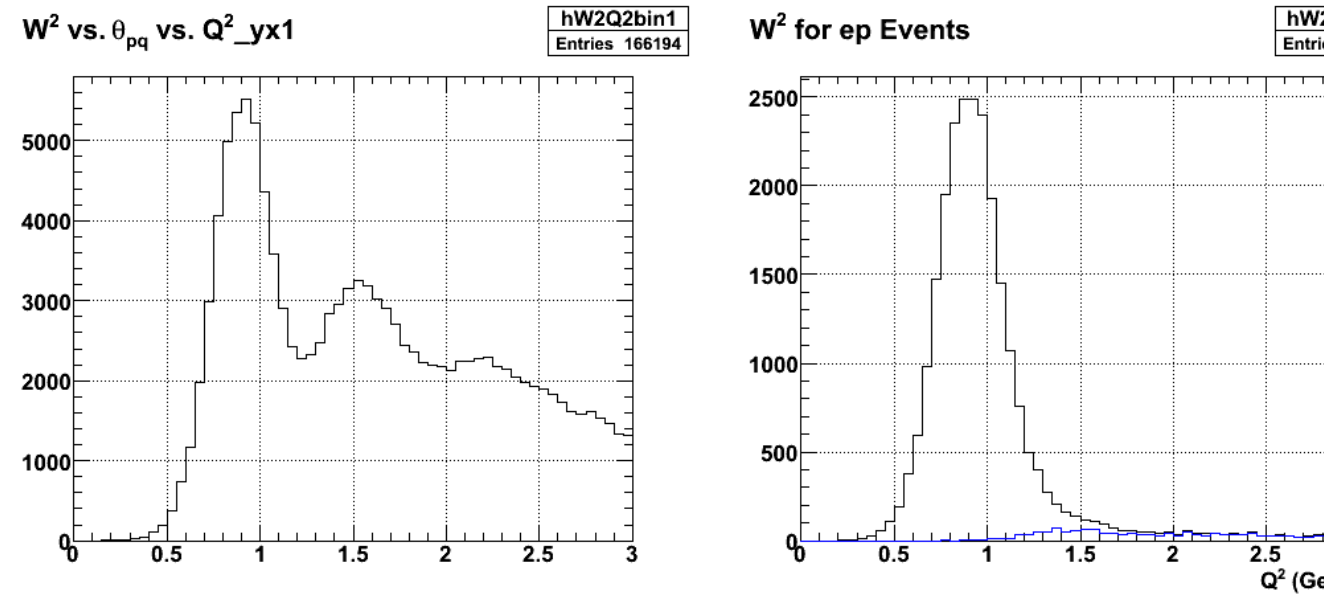


Fig 9. ep W2 spectra without (lhs) and with (rhs) theta_pq cut.

Click here to view the object (ROOT macro for fig 9) you uploaded.

Click here to view the object (ROOT archive of histograms for fig 9) you uploaded.

Now use submit_gmnsim.pl 3200 9600 1 + channels 1-15

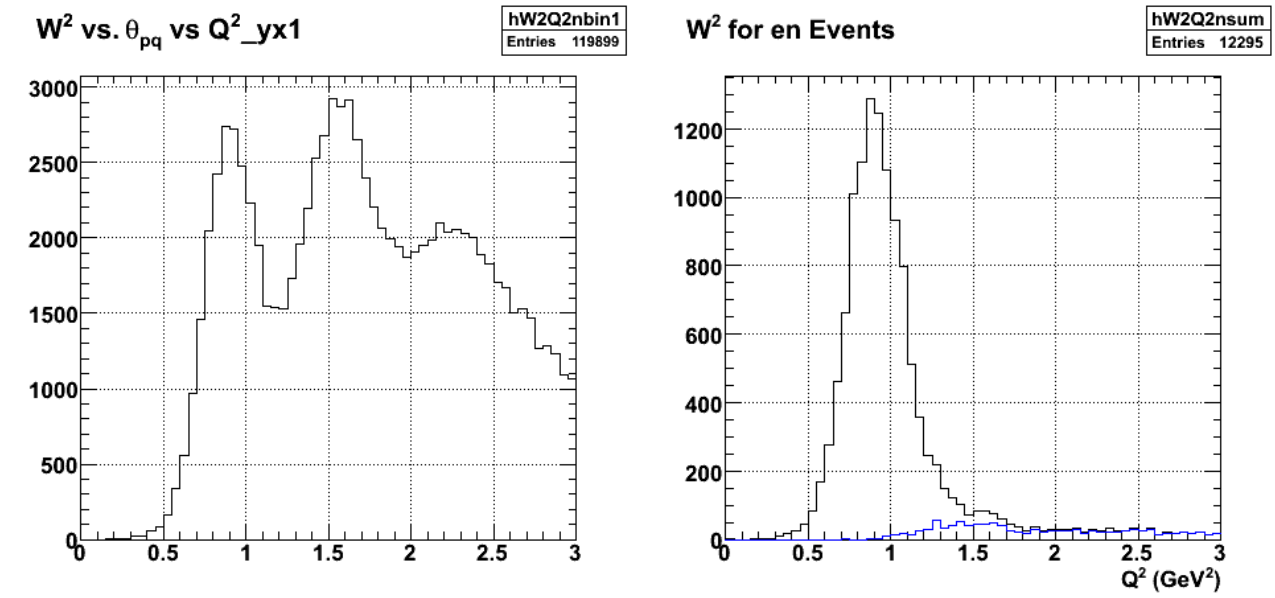


Fig 10. Like fig 9 except for neutrons.

Click here to view the object (ROOT macro for fig 10) you uploaded.

Effect of previous calculations on the ratio.

```
protons:

root [101] hW2Q2sum->Integral(1,24)
(const Double_t)2.07170000000000000e+04
r

root [112] hW2Q2sumIN->Integral(1,24)
(const Double_t)9.60000000000000000e+01
r

neutrons:

root [101] hW2Q2nsum->Integral(1,24)
```

```
(const Double_t)1.00960000000000000e+04
r
root [111] hW2Q2nsumIN->Integral(1,24)
(const Double_t)9.20000000000000000e+01
r
simulated en/ep = 10096/20717 = 0.48733

true en/ep = 10004/20621 = 0.48514

simulated/true = 1.0045 -> 0.45% effect!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

REMEMBER THAT IN GMn THE EFFECT ON THE SYSTEMATIC UNCERTAINTY WILL BE HALF THE EFFECT HERE!!!

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 222 - Selecting Quaielastic events. (Jerry Gilfoyle)

[Modified Tue Sep 2 14:52:57 2008 (GMT) Jerry Gilfoyle]

The first plot shows the effect of the theta_pq cut on the 4.2-GeV, ep data. To make an estimate of the inelastic background in the quasielastic region we have run the QUEEG/GENEV event generator and obtained the following results.

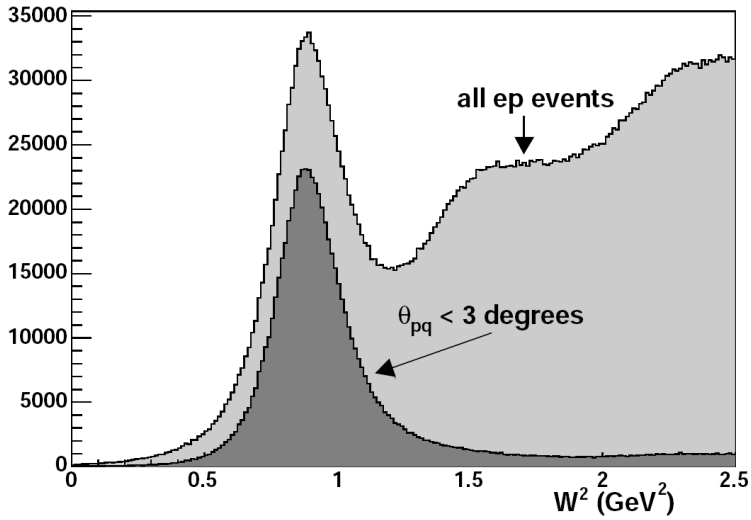


Fig 1. Measured W^2 spectrum for 4.2-GeV ep events for ep events with the theta_pq cut on and off.

We adjusted the relative amounts of quasielastic (QE) and inelastic (IN) to be consistent with the measured W^2 spectrum in Fig 1. The spectra here are more narrow than the measured ones, but they do not include the CLAS resolution and other effects.

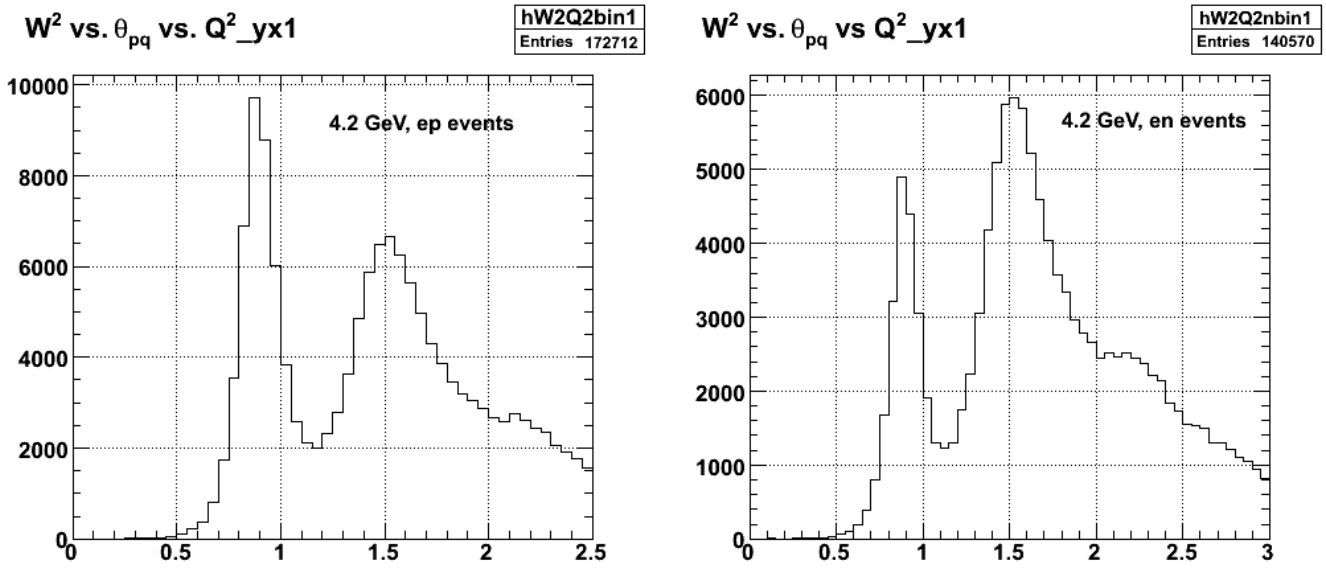


Fig 2. Simulated W^2 spectrum for 4.2-GeV ep events for *ep* events (left-hand panel) and *en* events (right-hand panel).

Now turn on the theta_pq cut. The cut used in the analysis is different for different Q2 bins. The maximum theta_pq cuts used are listed below.

Q2 range	maximum theta_pq
1.0-1.5	4.5
1.5-2.0	4.0
2.0-2.5	3.5
2.5-3.0	3.0
3.0-4.5	2.5

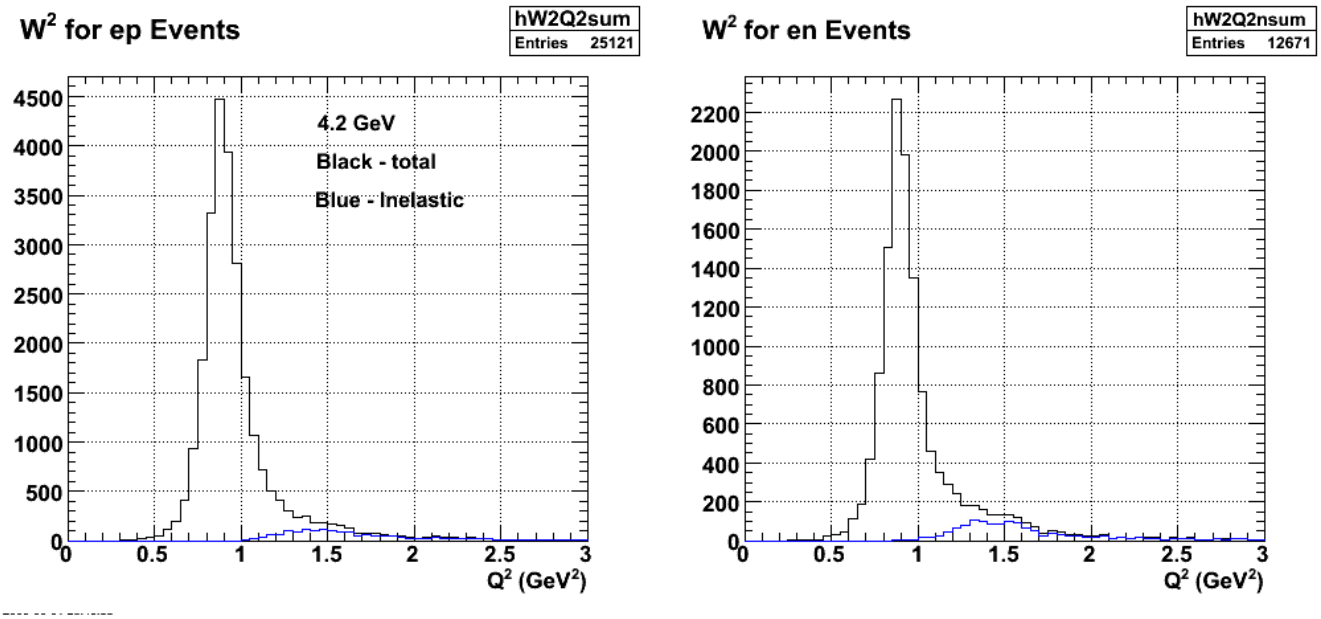


Fig 3. Simulated W^2 spectra for ep (left) and en (right) events with theta_pq cut turned on. The blue histograms are the inelastic contribution.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 223 - More smearing tests. (gpg)

[Modified Wed Sep 10 19:33:55 2008 (GMT) gpg]

Jeff do a cone in theta and phi when he did the smearing. I will do the same to see if there is a significant change.

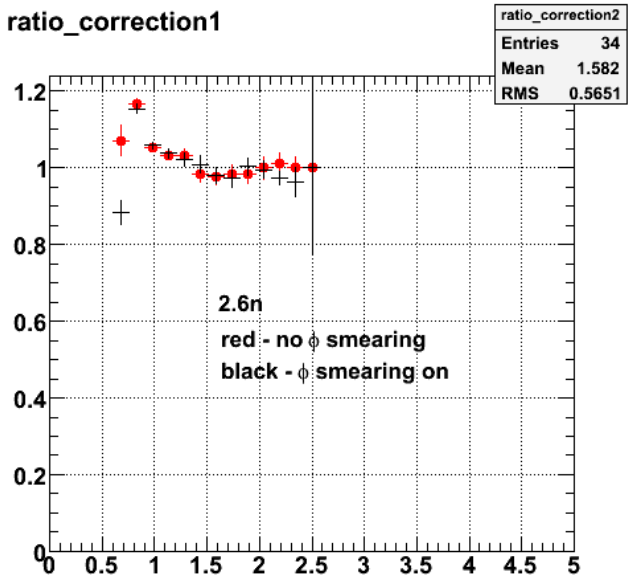


Fig 1. Comparison of SC Fermi correction with phi smearing on (black) and off (red). Electron theta smearing is on. Fixed seed is used in TRandom3

Click here to view the object (ROOT macro for fig 1.) you uploaded.

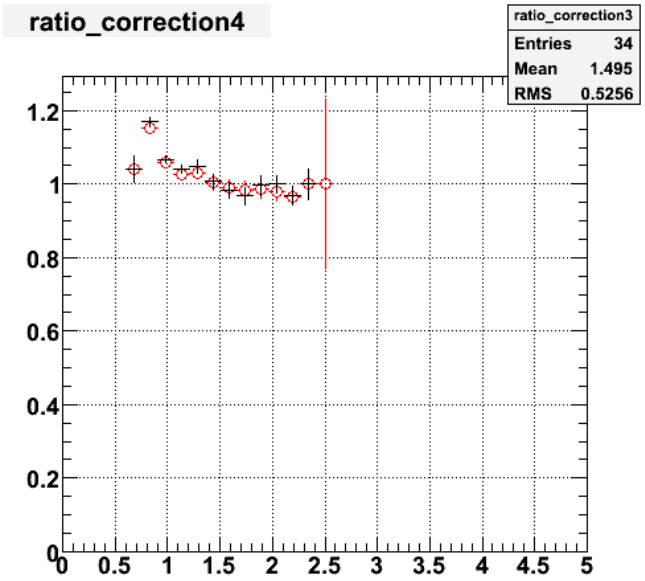


Fig 2. Comparison of SC Fermi correction with phi smearing on (black) and off (red). Electron theta smearing is on. Seed = 0 in TRandom3.

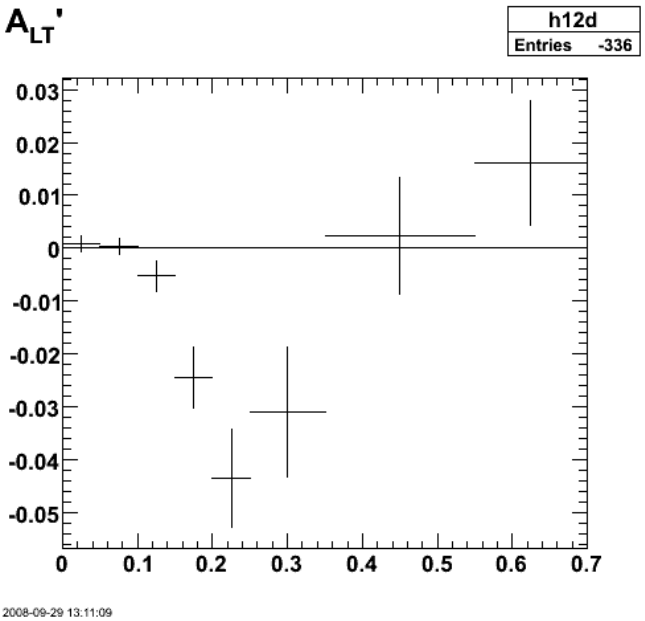
Click here to view the object (ROOT macro for fig 2.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 224 - Impact of proton momentum corrections (gpg)

[Modified Wed Oct 1 12:23:34 2008 (GMT) gpg]

First regenerate ALTp for the 2.6r data.



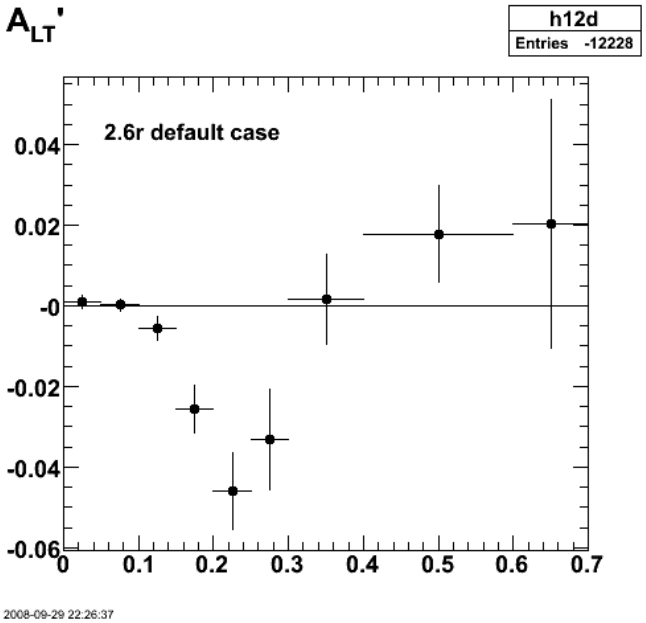
2008-09-29 13:11:09

Fig 1. ALTp for 2.6r with original bins. The binning of the above plot is not correct.

Click here to view the object (ROOT macro for fig 1.) you uploaded.

Opps! Used different bins from my standard set for 2.6r. The proper ones are the following.

```
2.6r bins: Double_t p_m_bin_edges[13]={0.0,0.05,0.10,0.15,0.20,0.25,0.30,0.40,0.60,0.7,1.0,1.5,2.0};
2.6n bins: Double_t p_m_bin_edges[13]={0.0,0.05,0.10,0.15,0.20,0.25,0.35,0.45,0.55,0.7,1.0,1.5,2.0};
```



2008-09-29 22:26:37

Fig 2. Default 2.6r case using JL electron momentum corrections.

Click here to view the object (ROOT macro for fig 2) you uploaded.

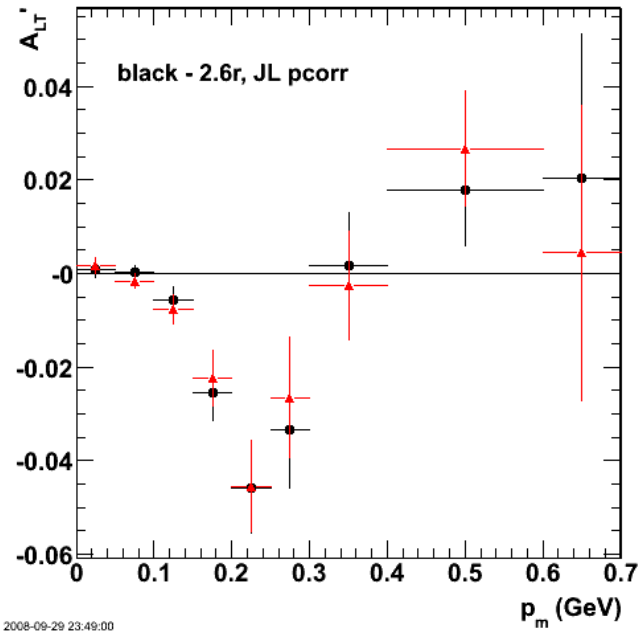


Fig 3. ALTp for 2.6r with default case from fig 2 plus results using Pitt electron momentum corrections.

Click here to view the object (ROOT macrof for fig 3) you uploaded.

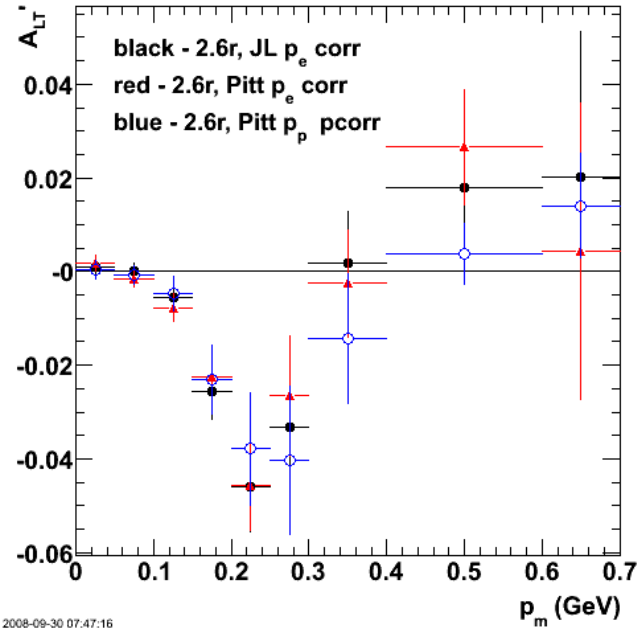


Fig 4. Now turn on the Pitt momentum corrections for the protons.

Click here to view the object (ROOT macro for fig 4) you uploaded.

The effect of the proton momentum corrections is larger than I expected at large p_m. The effect is small where the statistics are good.

Click here to view the object (ROOT histogram file for fig 4) you uploaded.

Check that I can recover the original ALTp results (green points below). Seems to work.

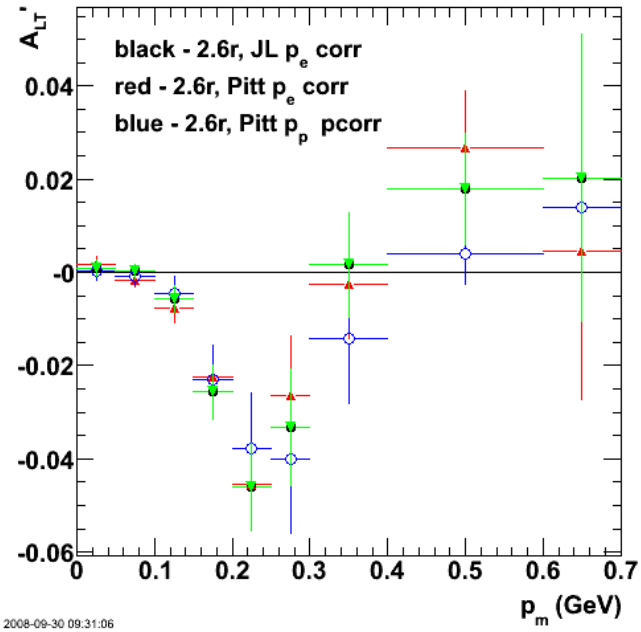


Fig 5. Check on ALTp. Green points should agree with Fig 1 and they do.

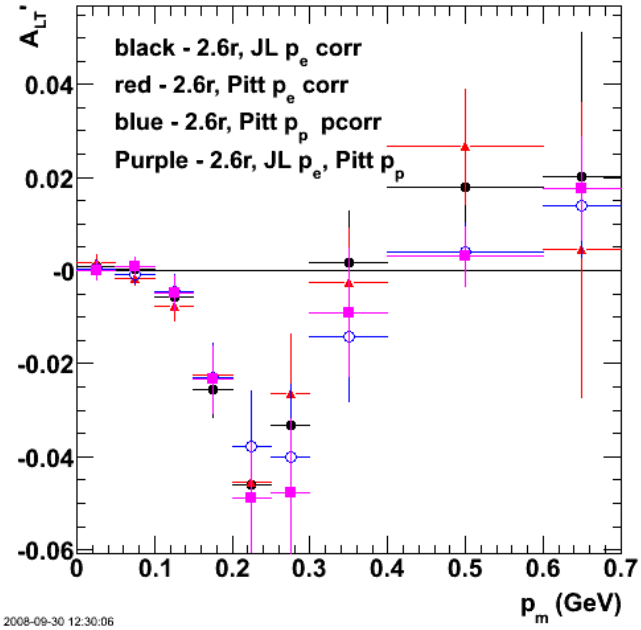
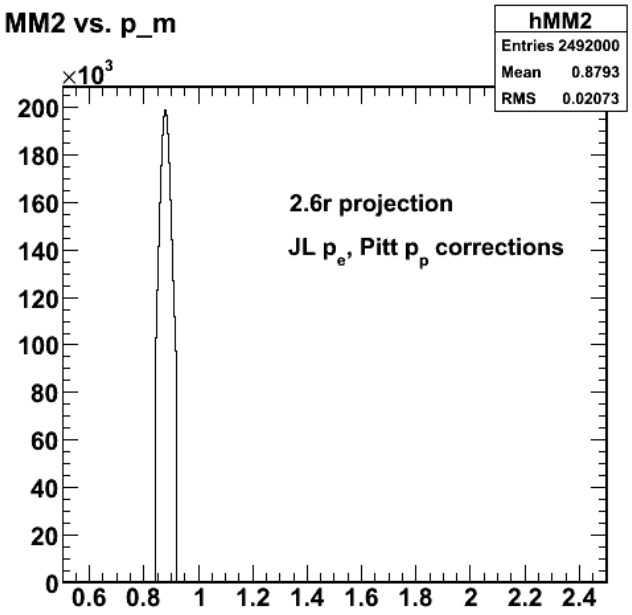


Fig 6. Added points using JL electron pcorr and Pitt proton pcorr to previous plots.

Click here to view the object (ROOT macro for fig 6) you uploaded.

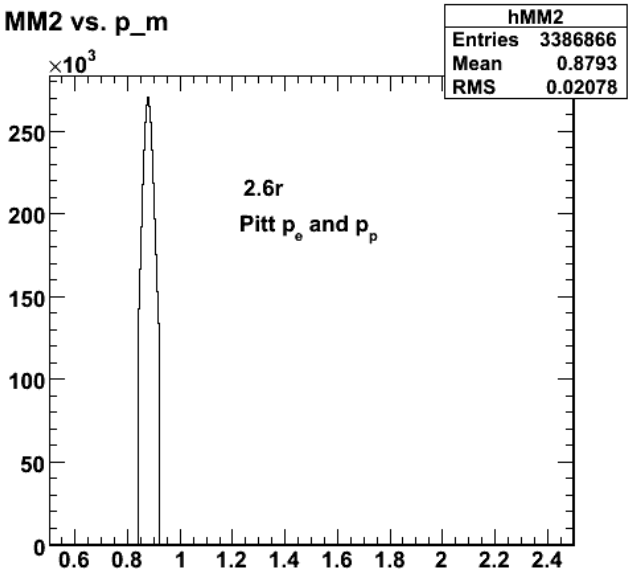
To pick out



2008-09-30 16:29:38

Fig 7. Test of momentum corrections for JL P-e and Pitt p_p momentum corrections.

Now try Pitt p_e and p_p.



2008-09-30 18:13:15

Fig 8. Test of momentum corrections for Pitt P-e and p_p momentum corrections.

Click here to view the object (ROOT macro for fig 8) you uploaded.

Click here to view the object (ROOT histogram file for fig 8) you uploaded.

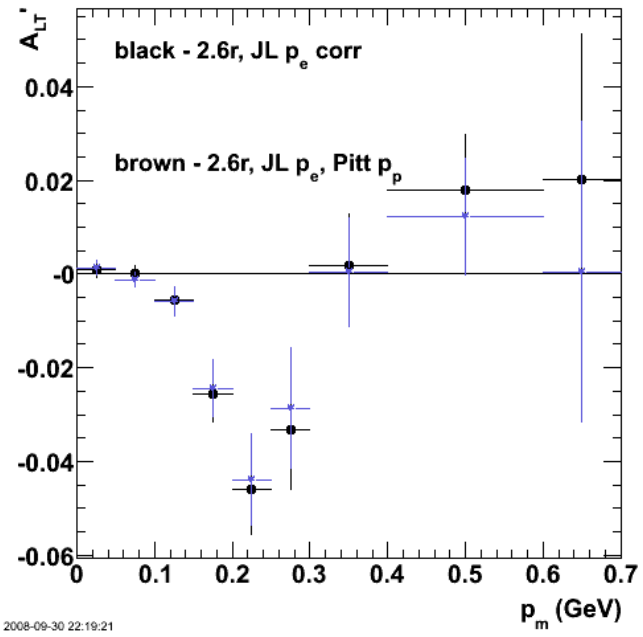


Fig 9. Effect of turning on the Pitt proton corrections with the caps on.

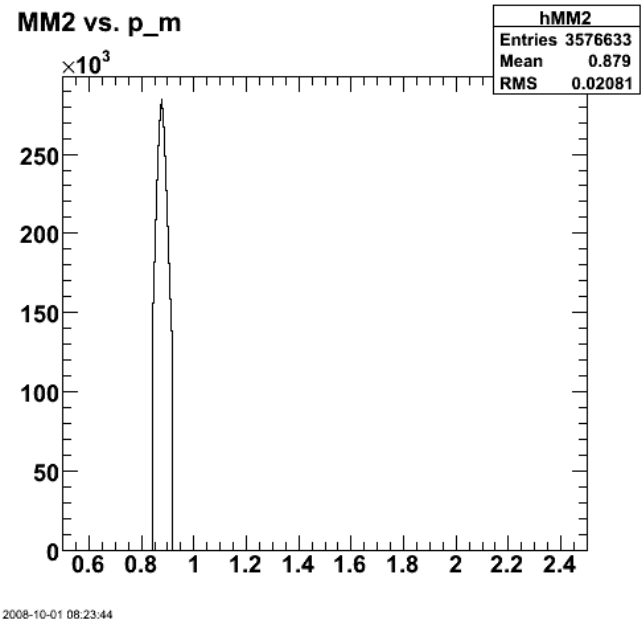


Fig 9. MM2 spectrum for JL p_e and no p_p corrections.

Click here to view the object (ROOT macro for fig 9) you uploaded.

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Jerry Gilfoyle's Enotebook page 225 - GMn NDE for all 3 datasets (gpg)

[Modified Wed Oct 8 03:25:38 2008 (GMT) gpg]

Below is a plot of the neutron detection efficiency from JL for all three datasets. See log-08-oct-07 for the input code including the input files used.

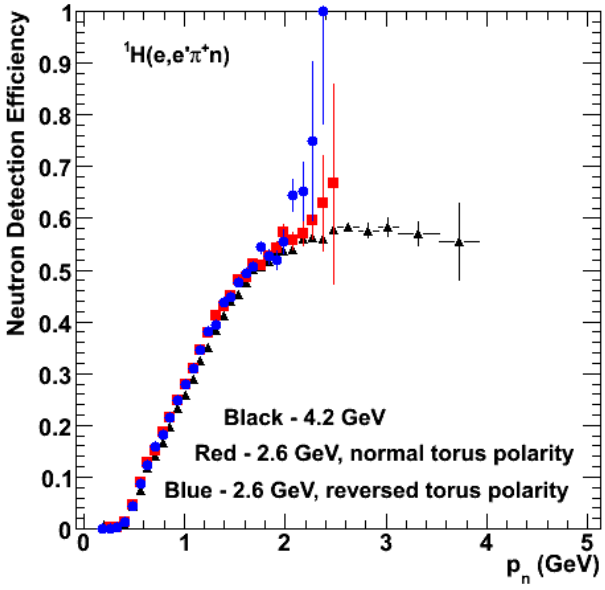


Fig 1. Plot of NDE for all three datasets.

Click here to view the object (ROOT macro for fig 1) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 226 - EOD uncertainties on ALTp (gpg)

[Modified Fri Oct 10 20:29:33 2008 (GMT) gpg]

The first plot is the default version of the 2.6r ALTp.

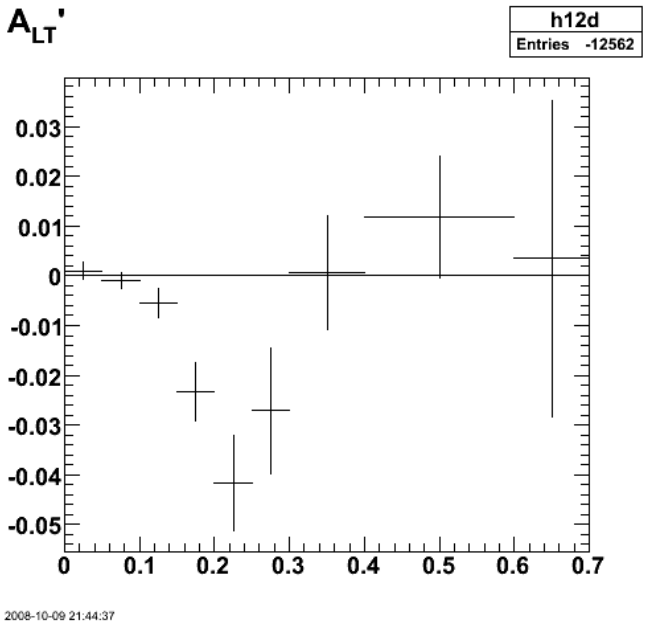


Fig 1. Default ALTp for 2.6r.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file for fig 1) you uploaded.

Cuts for histograms used to construct ALTp.

```
if (epn_event &&
    target_walls_ep &&
    quasielastic_cut &&
    //good_electron_fiducial &&
    //good_proton_fiducial &&
    good_electron_EC_fiducial &&
    good_electron_EC_trk_coords_fiducial &&
    good_egiyan_threshold &&
    good_photoelectrons) {
```

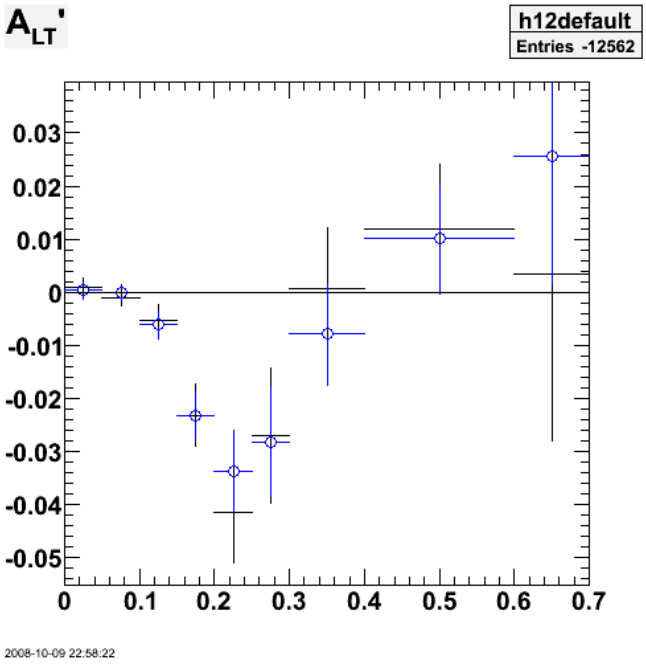


Fig 2. Default for 2.6r and 10% increase in width (blue).

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file for fig 2) you uploaded.

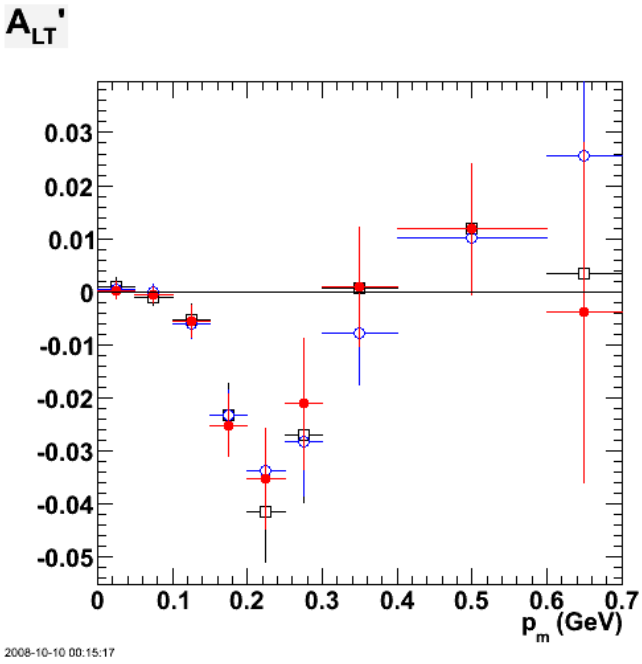


Fig 3. 2.6r default (black), 10% increase in width (blue), 10% downwared shift (red).

Click here to view the object (ROOT macro for Fig 3: 2.6r default (black), 10% increase in width (blue), 10% downwared shift (red).) you uploaded.

Click here to view the object (ROOT histogram file for fig 3) you uploaded.

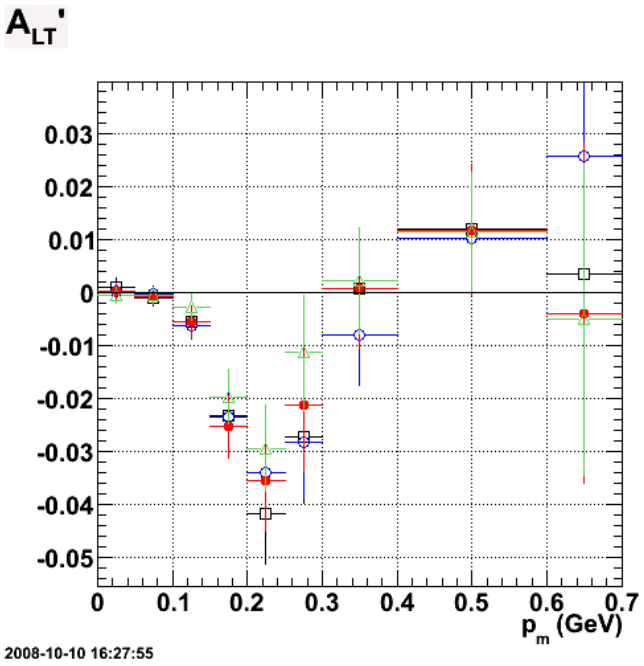


Fig 4. 2.6r default (black), 10% increase in width (blue), 10% downwared shift (red), 0.9-1.0 GeV cut (green).

Click here to view the object (ROOT macro) you uploaded.

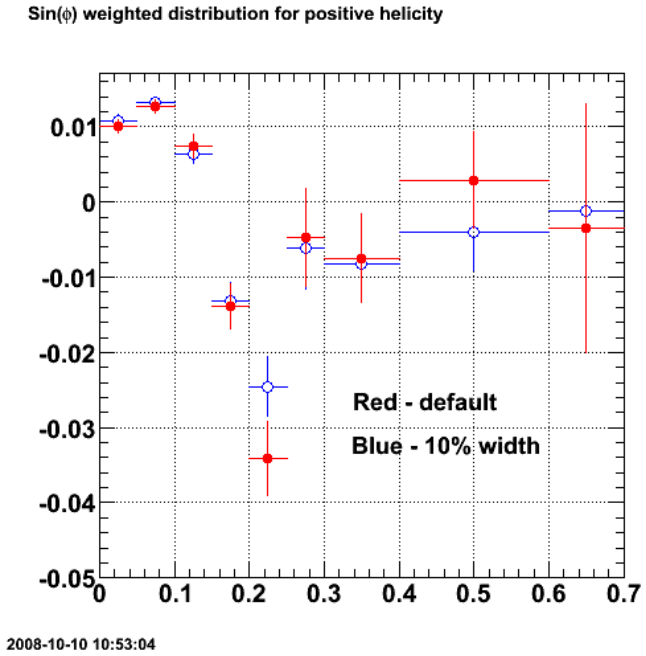
Click here to view the object (ROOT histogram file for fig 4) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 227 - Getting the W uncertainty for 2.6r (gpg)

[Modified Thu Oct 16 03:20:38 2008 (GMT) gpg]

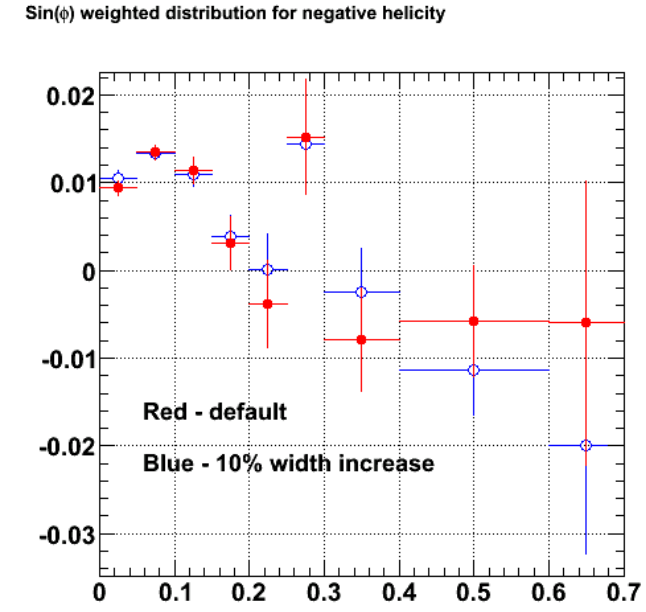
Consider the inputs to ALTp to get the uncertainty.



2008-10-10 10:53:04

Fig 1. + for default and 10% width increase at 2.6r.

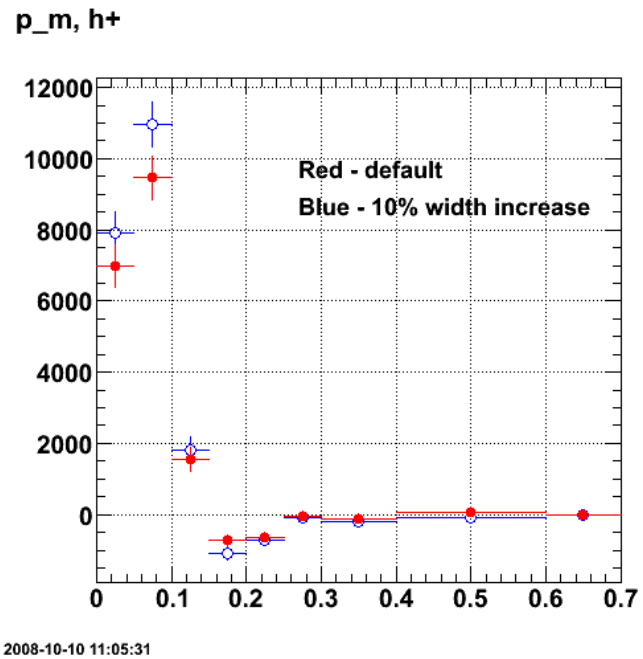
Click here to view the object (ROOT macro) you uploaded.



2008-10-10 11:00:02

Fig 2. - for default and 10% width increase at 2.6r.

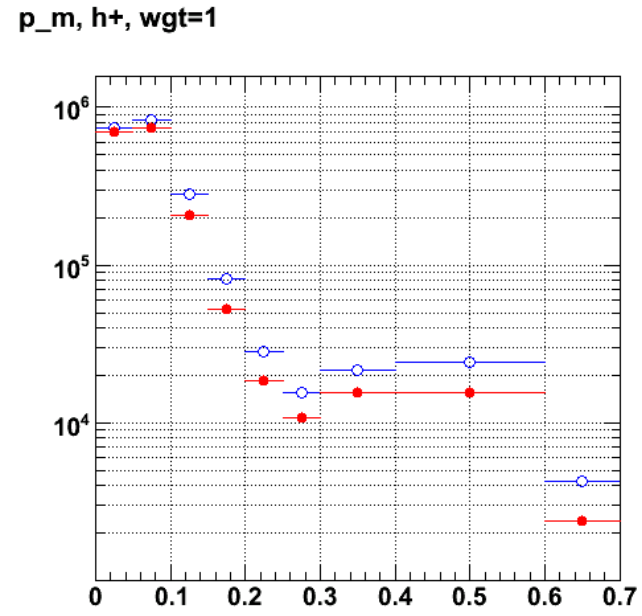
Click here to view the object (ROOT macro) you uploaded.



2008-10-10 11:05:31

Fig 3. Summed sin(phi_pq) for h=+, 2.6r.

Click here to view the object (ROOT macro) you uploaded.



2008-10-10 11:14:42

Fig 4. Positive helicity histograms with defferent W cuts.

Click here to view the object (ROOT macro) you uploaded.

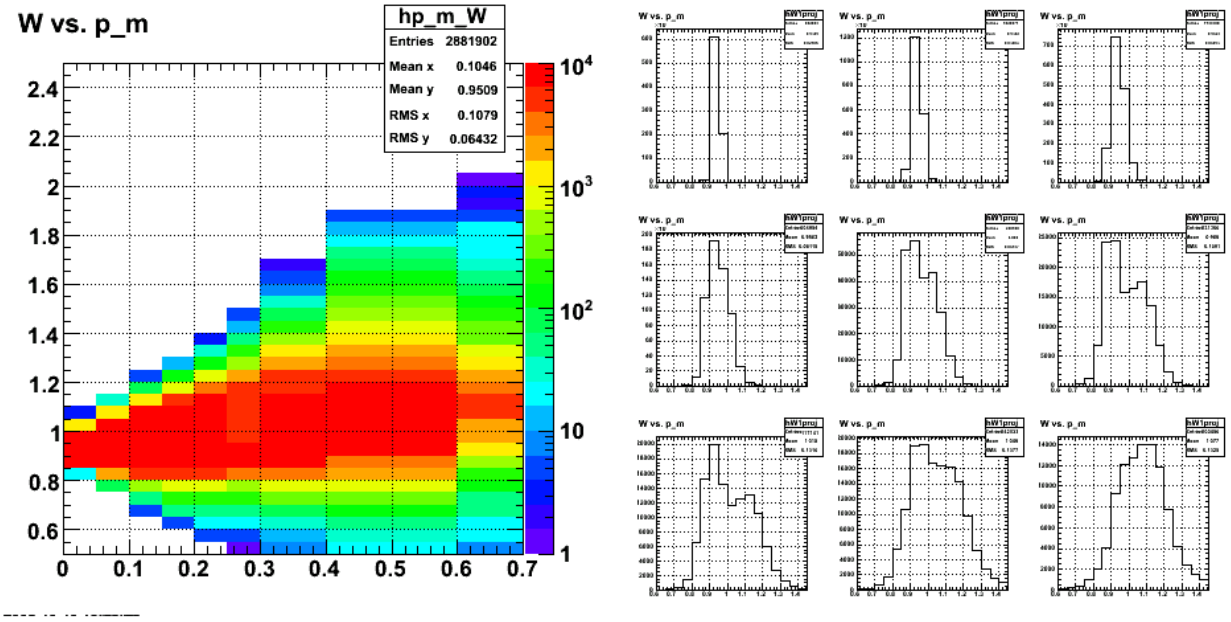


Fig 5. Plot of W vs. p_m and individual W spectra for p_m bins.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

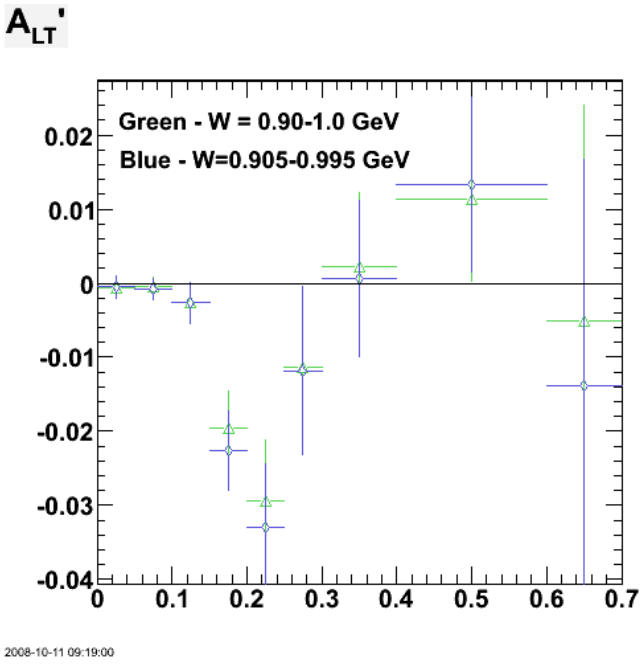


Fig 6. More tuning of the W cut to get it to a stable region where the 10% shift doesn't change things drastically.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

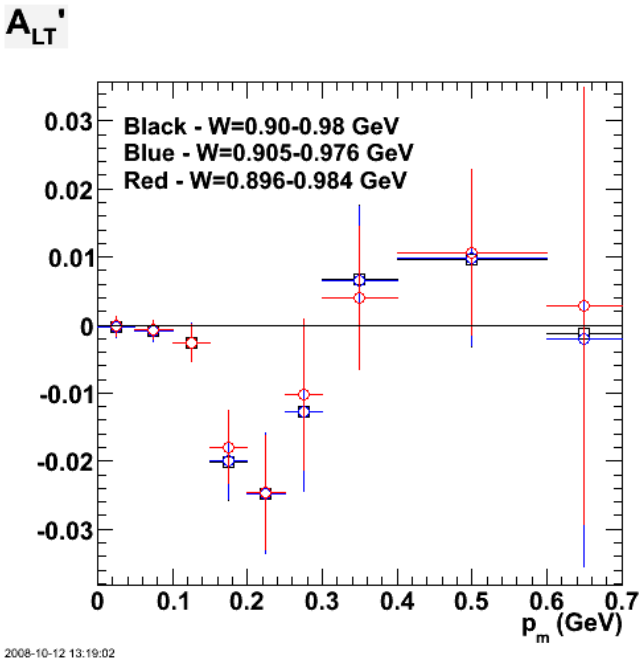


Fig 7. Result for ALTp at 2.6r for W =0.90-0.98 +/- 10%.

Click here to view the object (ROOT macro 2.6r4.C for fig 7.) you uploaded.

Click here to view the object (ROOT histogram file for 10% increase) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 228 - Getting ALTp from 2D W histogram (gpg)

[Modified Mon Oct 13 02:50:46 2008 (GMT) gpg]

Make a 2D histogram of W versus p_m and use these to get ALTp and try different ranges on W.

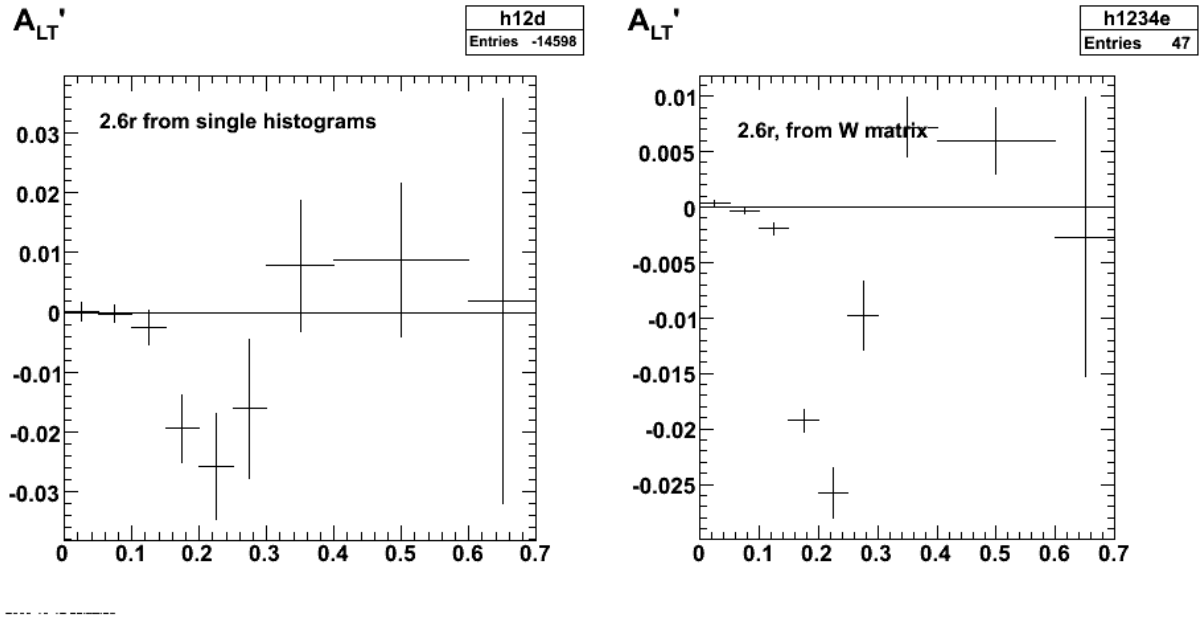


Fig 1. Comparison of ALTp from usual method (lhs) and using the W vs. p_m 2D histogram.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 229 - Getting MM2 uncertainty for 2.6r (gpg)

[Modified Sun Oct 19 02:56:38 2008 (GMT) gpg]

Using the W = 0.90-0.98 GeV cut from two entries ago, I get the following results for ALTp using the standard value MM2 = 0.84-0.92 GeV2 for the 2.6r data set. I increased the width to MM2 = 0.836-0.924 GeV2 to calculate the systematic uncertainty.

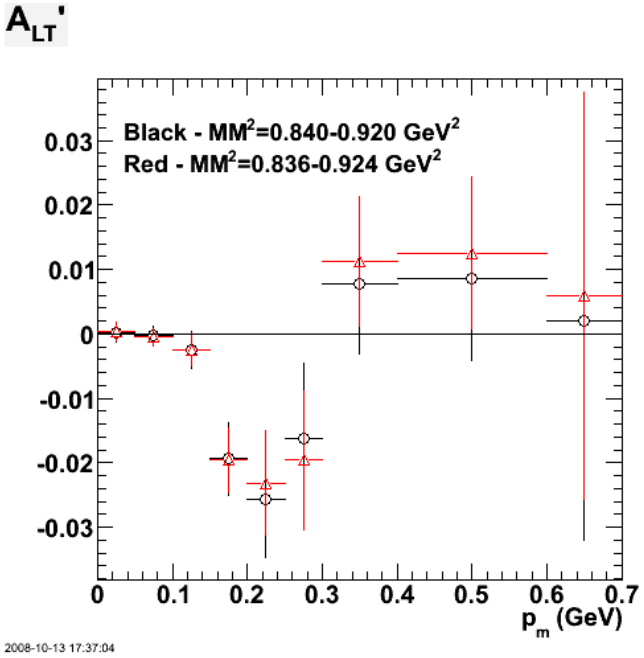


Fig 1. Effect of increasing the width of the MM2 cut on ALTp.

Click here to view the object (ROOT macro for Fig 1.) you uploaded.

Click here to view the object (ROOT histogram file for increased MM2 width extraction of ALTp.) you uploaded.

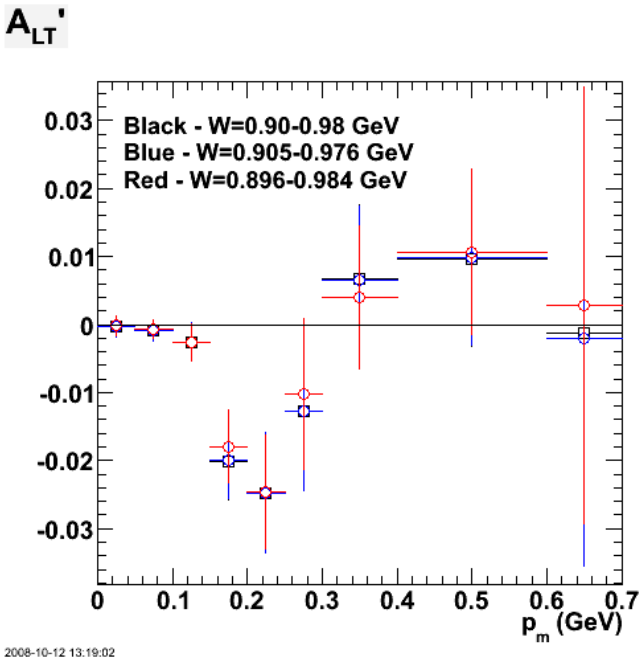


Fig 2. Effect of increasing the width of the W cut on ALTp. See entry 227 for more details.

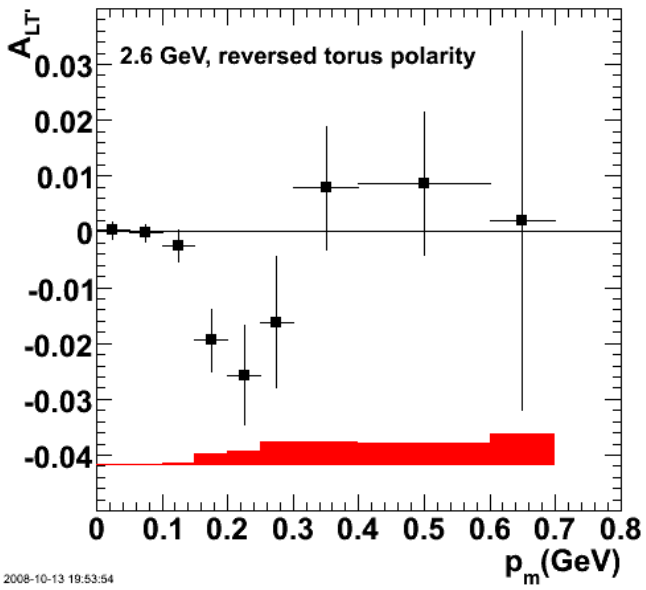


Fig 3. 2.6 ALTp with systematic uncertainty band. See log-08-oct-13

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 230 - Getting W and MM2 uncertainty for 2.6n (gpg)

[Modified Sun Oct 19 02:53:09 2008 (GMT) gpg]

Get the uncertainty on the 2.6n ALTp by increasing the width of the W cut by 10%. Use the same cuts as the previous 2.6r analysis.

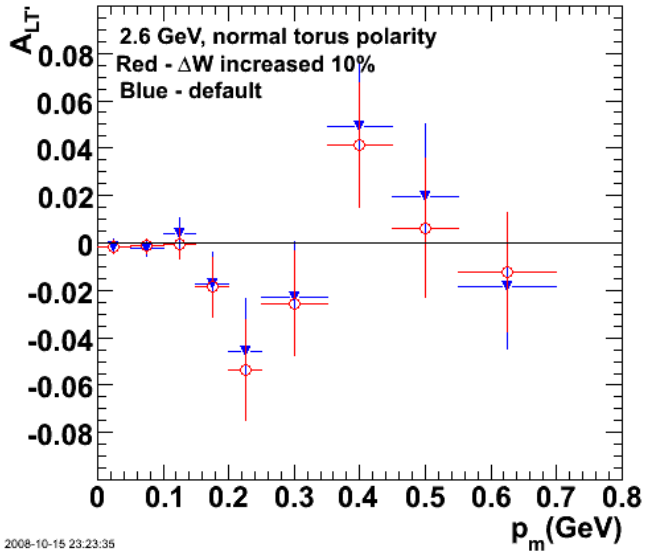


Fig 1. Effect of increasing W width by 10% on 2.6n ALTp.

Click here to view the object (ROOT macro for fig 1) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

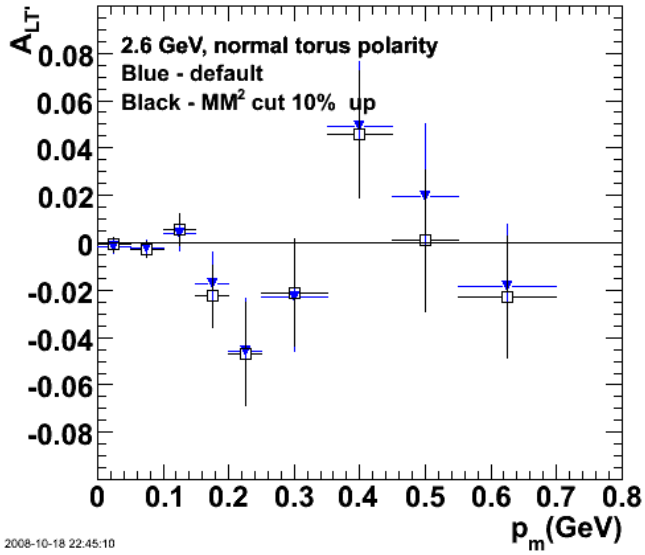


Fig 2. Effect of increasing MM2 width by 10% on 2.6n ALTp.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file for MM2 test.) you uploaded.

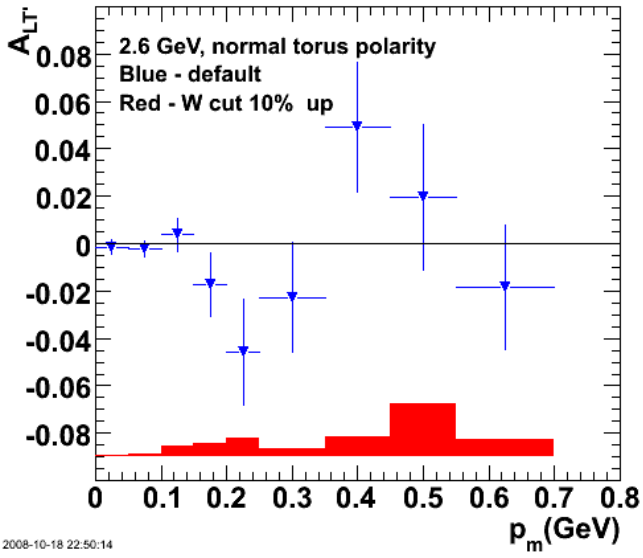


Fig 3. Error band for 2.6n.

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 231 - Fits for 11-GeV, Q2 = 13-14 GeV2 (gpg)

[Modified Mon Oct 20 18:31:13 2008 (GMT) gpg]

The plot below shows the FastMC proton results for the Oakland poster of Mark Moog.

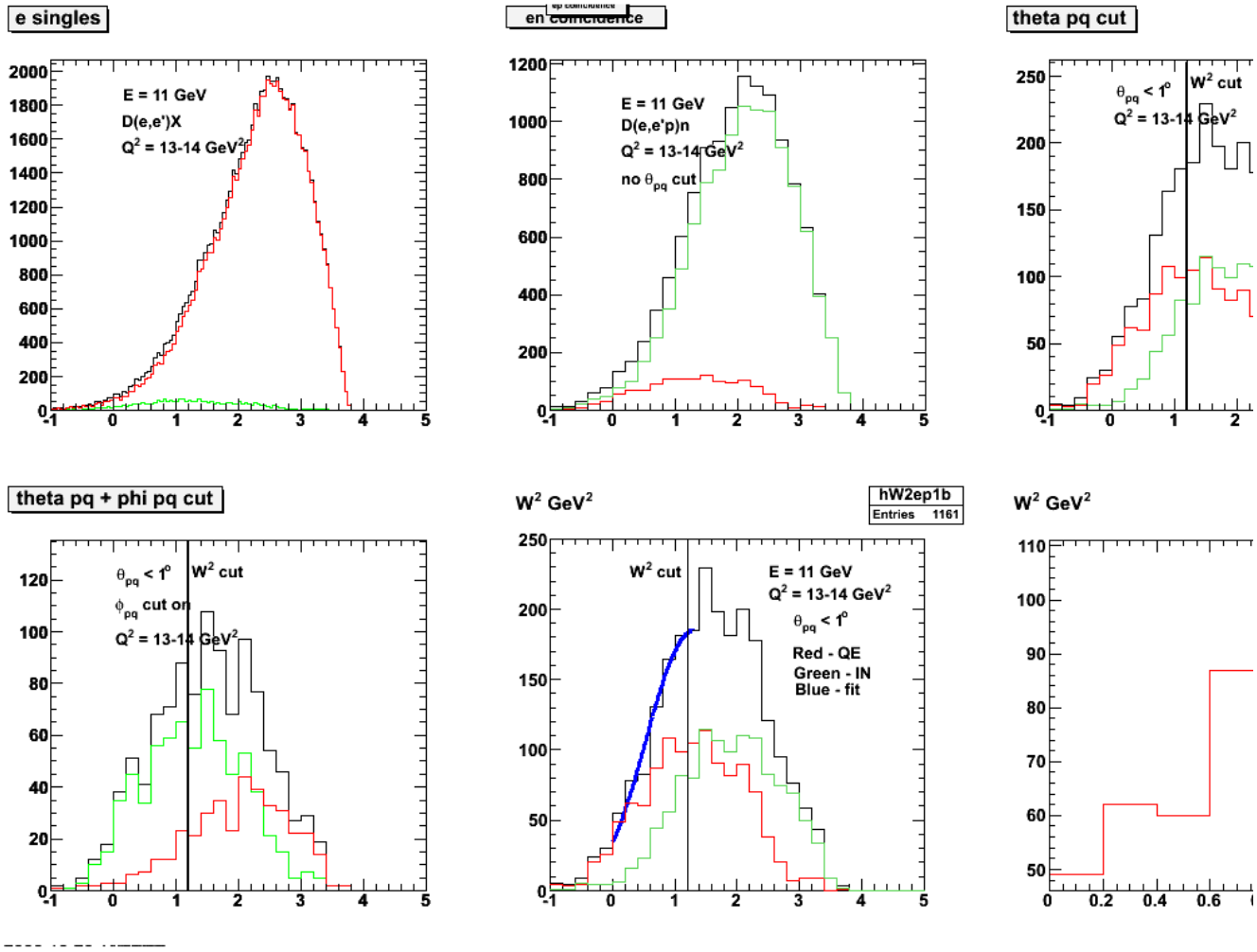


Fig 1. Everything for the Q2=13-14 GeV2 e-p analysis.

Click here to view the object (ROOT macro for Fig 1.) you uploaded.

Results from fitting (see log-08-oct-20). I used a fit to the high-statistics run to get the curves for the inelastic (2nd order polynomial) and QE (gaussian) spectra. The parameters for each of these fits were fixed and then the two curves combined in the final fit with an overall coefficient for each curve.

```
using protons3b.C. fit curves are from fits to protons1.C from entry 78 in my group's elog.

.x protons3b.C
can1_5->cd()
hW2ep1->Draw()
TF1 *f3 = new TF1("f3","[0]*(458.68*exp(-pow(x-1.09458,2)/(2*pow(0.639524,2)))) + [1]*(70.4383 + (223.286*x) + (423.566*x*x))",0.0,1.3);
f3->SetParameter(0,1);
f3->SetParameter(1,1);
hW2ep1->Fit("f3","R");

root [10] hW2ep1->Fit("f3","R");
 FCN=6.92123 FROM MIGRAD    STATUS=CONVERGED      35 CALLS          36 TOTAL
                     EDM=2.54123e-22    STRATEGY= 1      ERROR MATRIX ACCURATE
  EXT PARAMETER                                   STEP         FIRST
  NO.   NAME      VALUE            ERROR          SIZE      DERIVATIVE
   1  p0           2.82481e-01   3.47098e-02   1.71252e-05  -9.07618e-10
   2  p1           5.80461e-02   2.24708e-02   1.10867e-05  -4.40616e-10

root [15] hW2ep1b->GetXaxis()->SetRange(6,12)
root [16] hW2ep1b->Draw()
```

```
root [17] hW2ep1b->Integral(6,12)
(const Double_t)5.70000000000000000e+02
root [18]

root [19] 570*0.2
(const double)1.14000000000000000e+02
r

true number of counts = 570
fitted number of counts = 605 +/- 74  use just the uncertainty on the parameter (0.0347/0.2825).
```

Now do the neutrons.

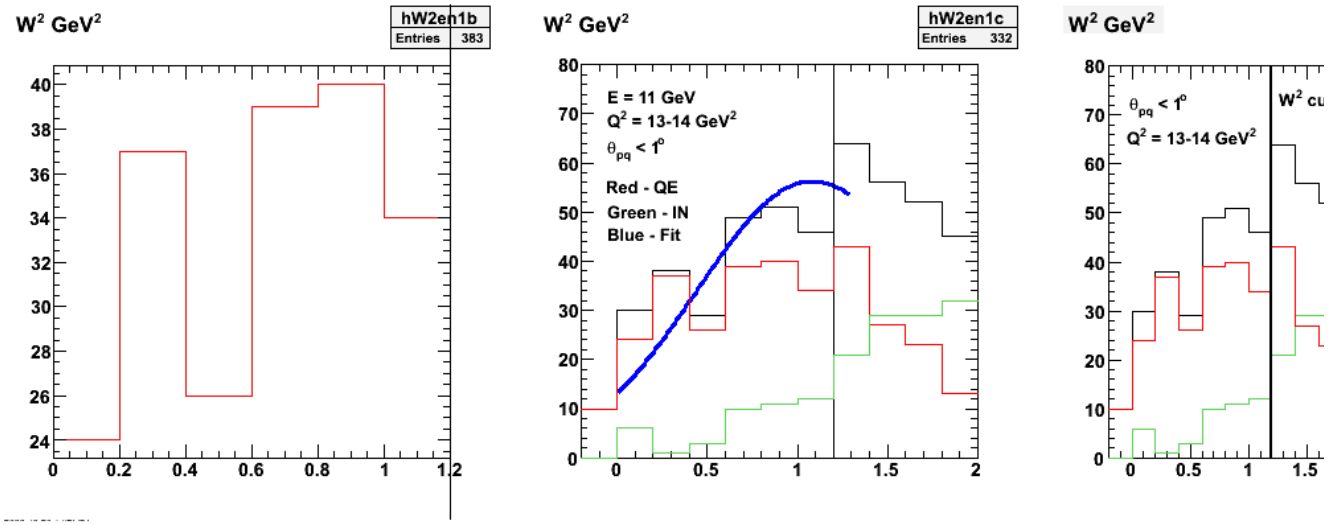


Fig 2. Most things for the Q2=13-14 GeV2 e-n analysis.

Click here to view the object (ROOT macro) you uploaded.

Other plots for neutrons.

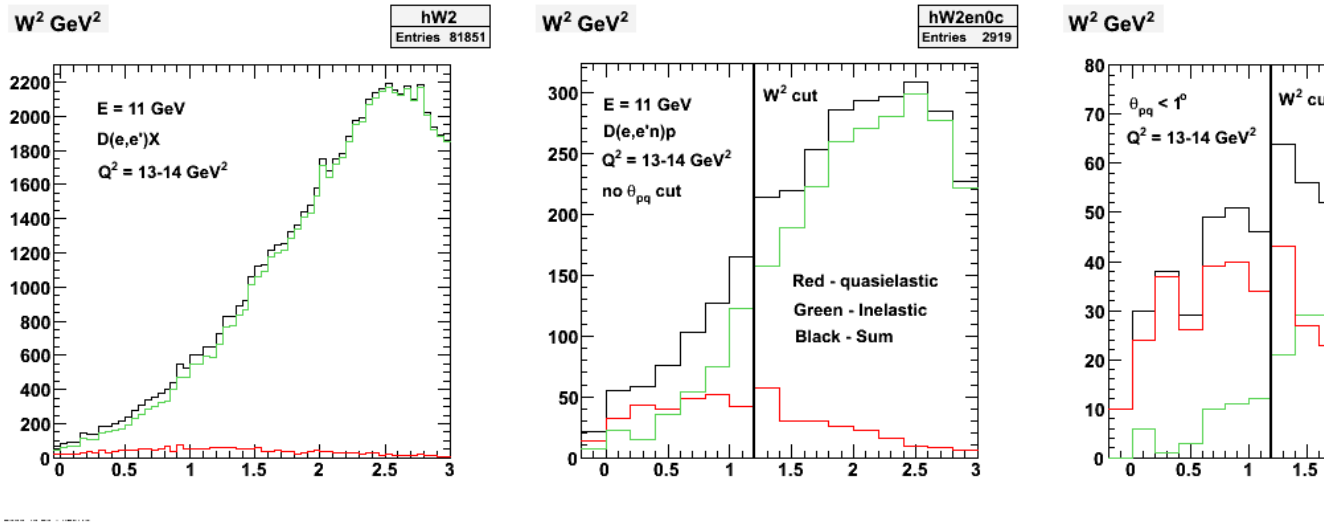


Fig. 3. Other plots of neutrons.

Click here to view the object (ROOT macro) you uploaded.

Results from log-08-oct-20

```
now use neutrons3.C, the low-stats run and fit it with the shapes from the hi-stats run.

hW2en1->Draw();
TF1 *f3 = new TF1("f3","[0]*(141.261*exp(-pow(x-1.04855,2)/(2*pow(0.621376,2)))) + [1]*(22.8969 + (61.8642*x) + (91.839*x*x))",0.0,1.3);
f3->SetParameter(0,1);
f3->SetParameter(1,1);
hW2en1->Fit("f3","R")

root [52] hW2en1->Draw();
root [53] TF1 *f3 = new TF1("f3","[0]*(141.261*exp(-pow(x-1.04855,2)/(2*pow(0.621376,2)))) + [1]*(22.8969 + (61.8642*x) + (91.839*x*x))",0.0,1.$
root [54] f3->SetParameter(0,1);
root [55] f3->SetParameter(1,1);
root [56] hW2en1->Fit("f3","R")
 FCN=15.7547 FROM MIGRAD    STATUS=CONVERGED      36 CALLS          37 TOTAL
```

```
                    EDM=9.88667e-22    STRATEGY= 1      ERROR MATRIX ACCURATE
  EXT PARAMETER                                   STEP         FIRST
  NO.   NAME      VALUE            ERROR          SIZE      DERIVATIVE
   1  p0           3.73350e-01   7.15649e-02   4.62716e-05   4.79872e-10
   2  p1           1.82468e-02   5.69949e-02   3.68511e-05   1.32560e-09
(Int_t)(0)
r
root [64] hW2en1b->GetXaxis()->SetRange(6,11)
root [65] hW2en1b->Integral(6,11)
(const Double_t)2.00000000000000000e+02
r

true number of counts = 200 in the range 0.0 < W2 < 1.2
fitted number of counts = 226 +/- 43
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 232 - Addition of nucleon spectators to gmn12 simulation (gpg)

[Modified Thu Dec 11 20:37:35 2008 (GMT) gpg]

Added the spectator nucleon to the gnm12 simulation for Jixie.

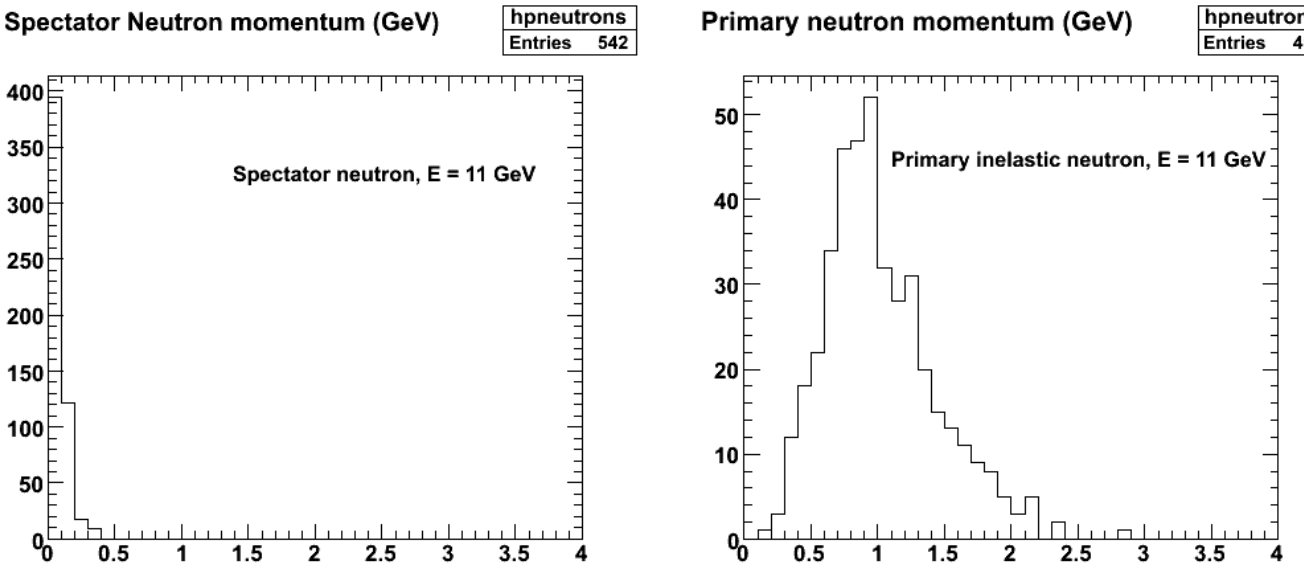


Fig. 1 Momentum spectra of spectator neutron (lhs) and primary neutron (rhs) from genevD.

Click here to view the object (ROOT macro) you uploaded.

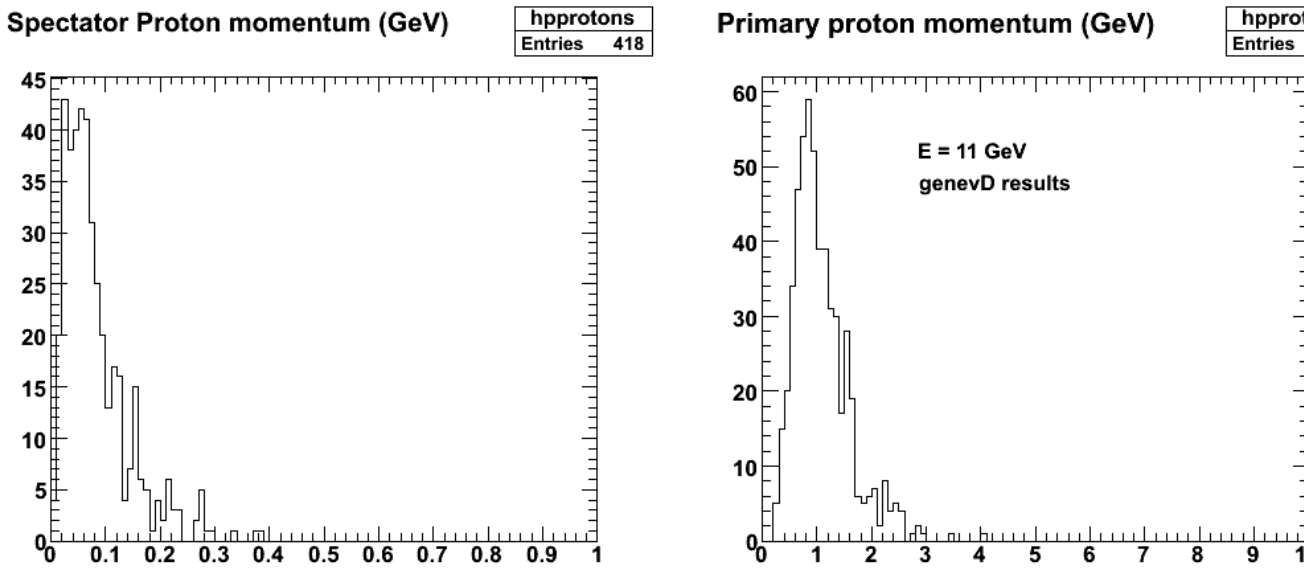


Fig. 2 Momentum spectra of spectator proton (lhs) and primary proton (rhs) from genevD.

Click here to view the object (ROOT macro) you uploaded.

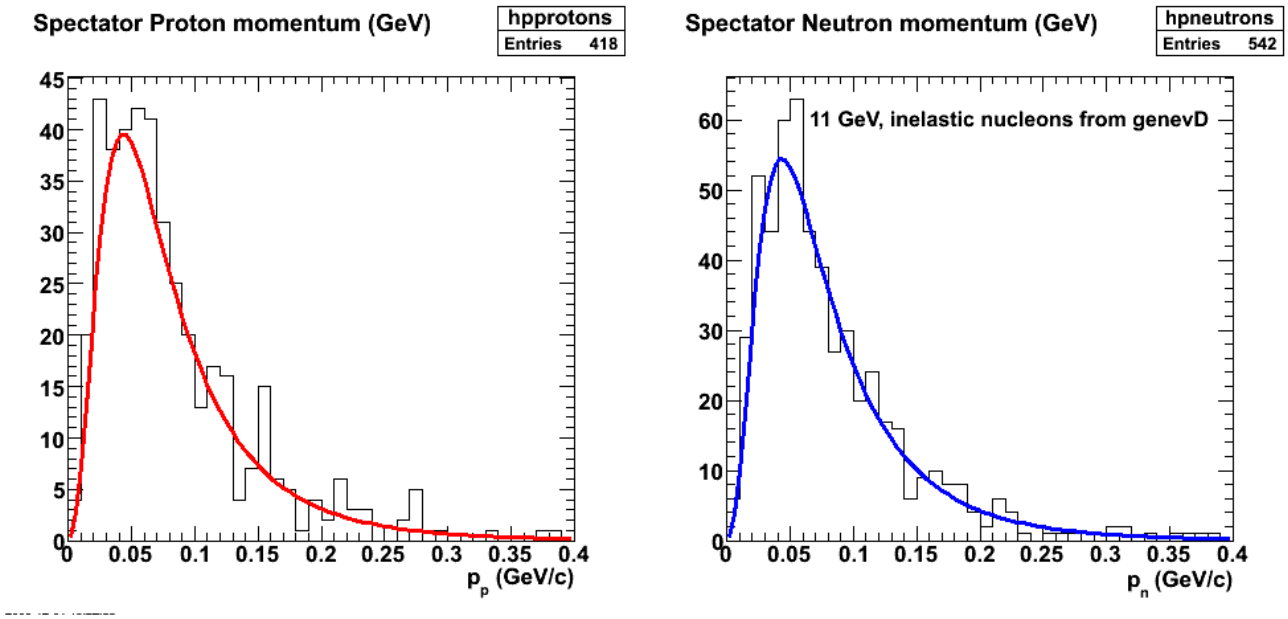


Fig 3. Comparison of spectator nucleon momenta with Hulthen distribution roughly normalized to the peak value.

Click here to view the object (ROOT macro) you uploaded.

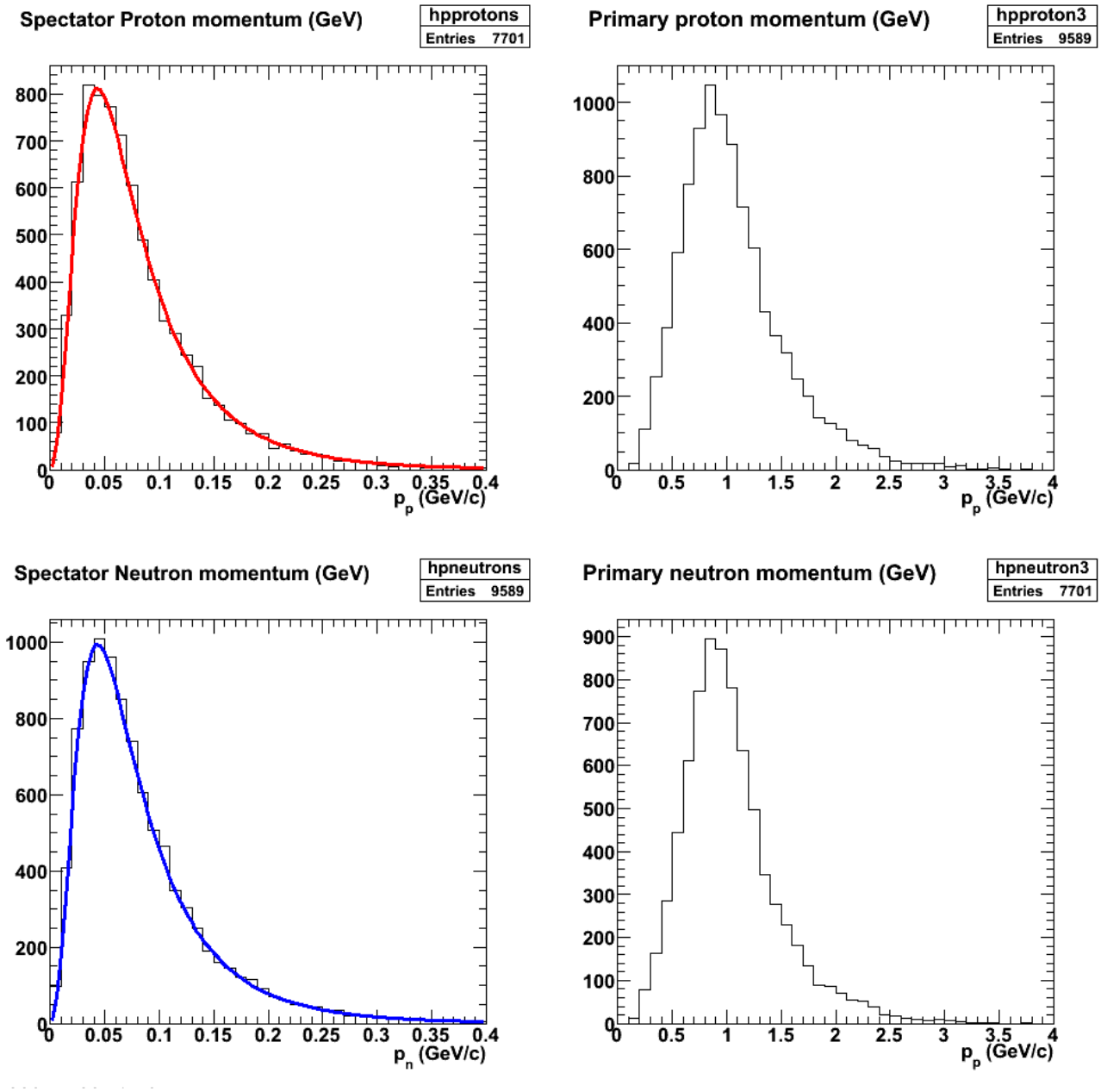


Fig 4. Momentum spectra for neutrons and protons, primary and spectator for 11 GeV, full cluster run. The curves are the Hulthen distribution roughly normalized to the mode of each spectrum.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (archive for histograms (.tgz)) you uploaded.

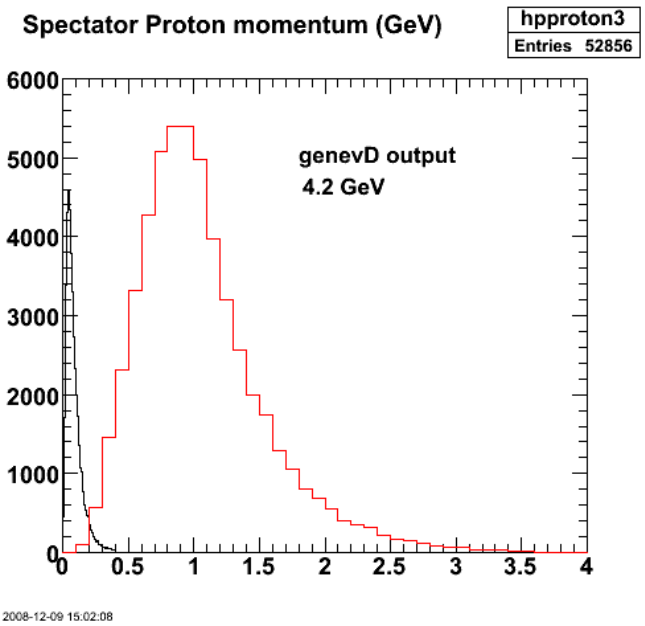


Fig 5. Comparison of momenta for primary protons and spectator protons for 4.2 GeV from genevD.

Click here to view the object (ROOT macro) you uploaded.

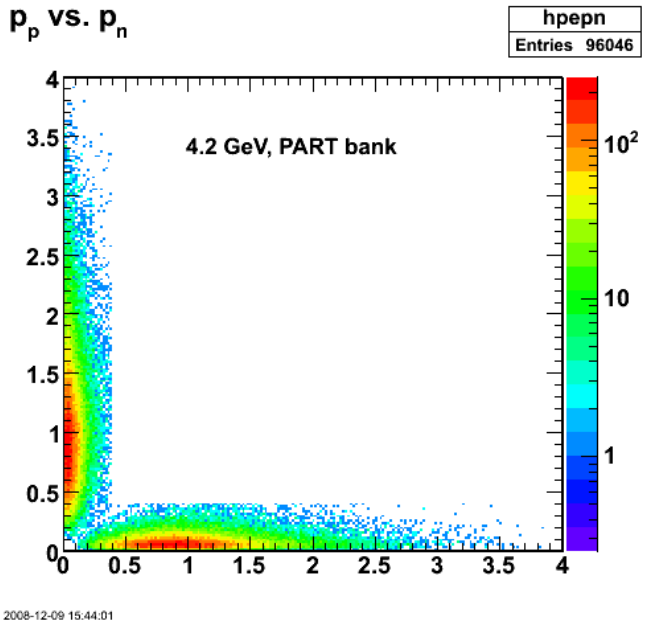


Fig 6. 2D plot of proton versus neutron momenta.

Click here to view the object (ROOT macro) you uploaded.

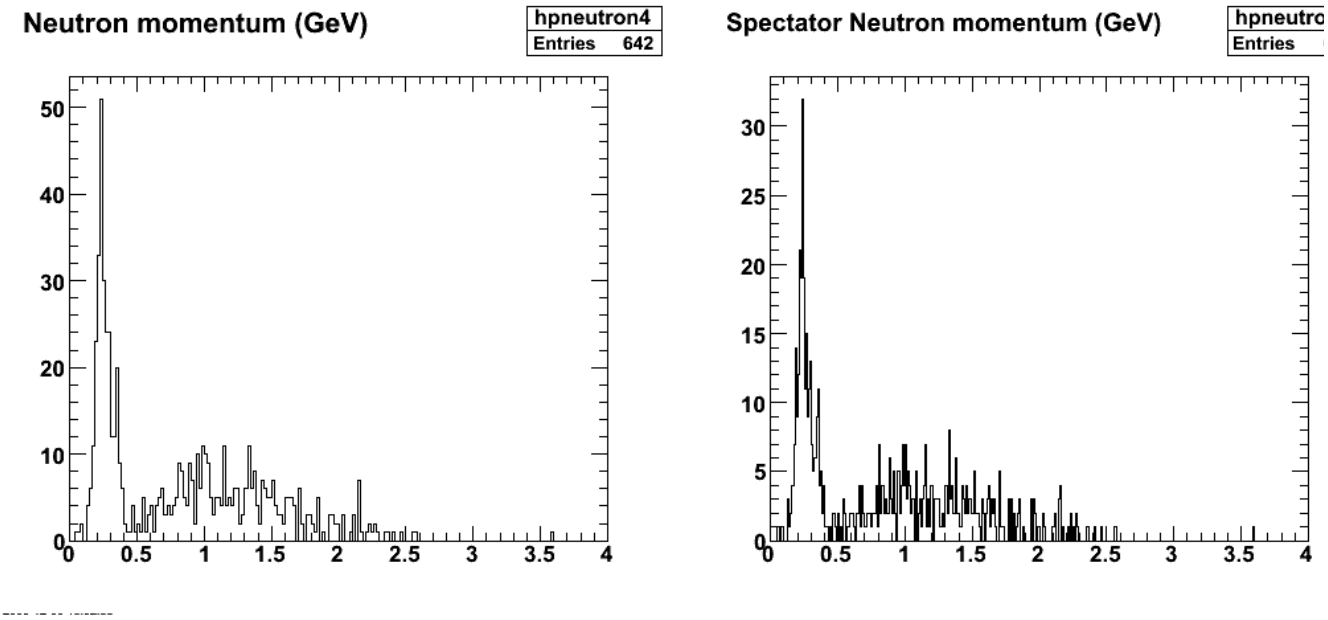


Fig 7. Comparison of neutron momentum spectra for 4.2 GeV EVNT bank.

Click here to view the object (ROOT macro) you uploaded.

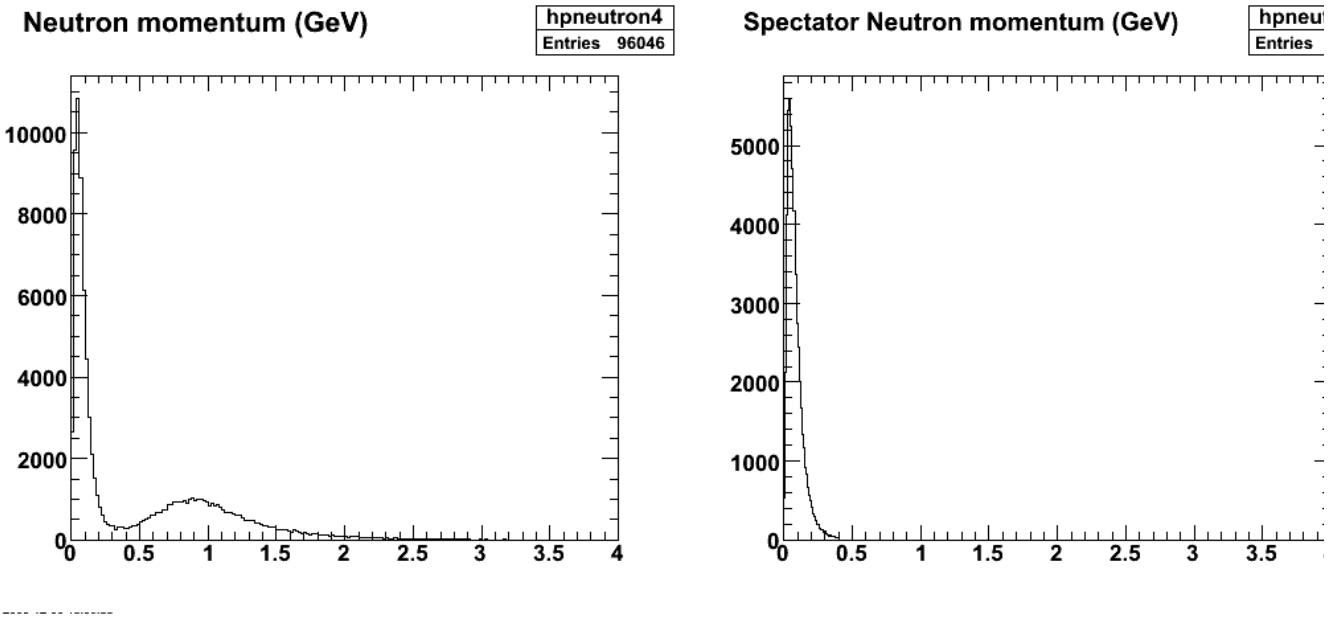


Fig 8. Same as fig 7 for PART bank.

Make the selection of e-n and e-p events consistent for the PART and EVNT banks and things are now more consistent.

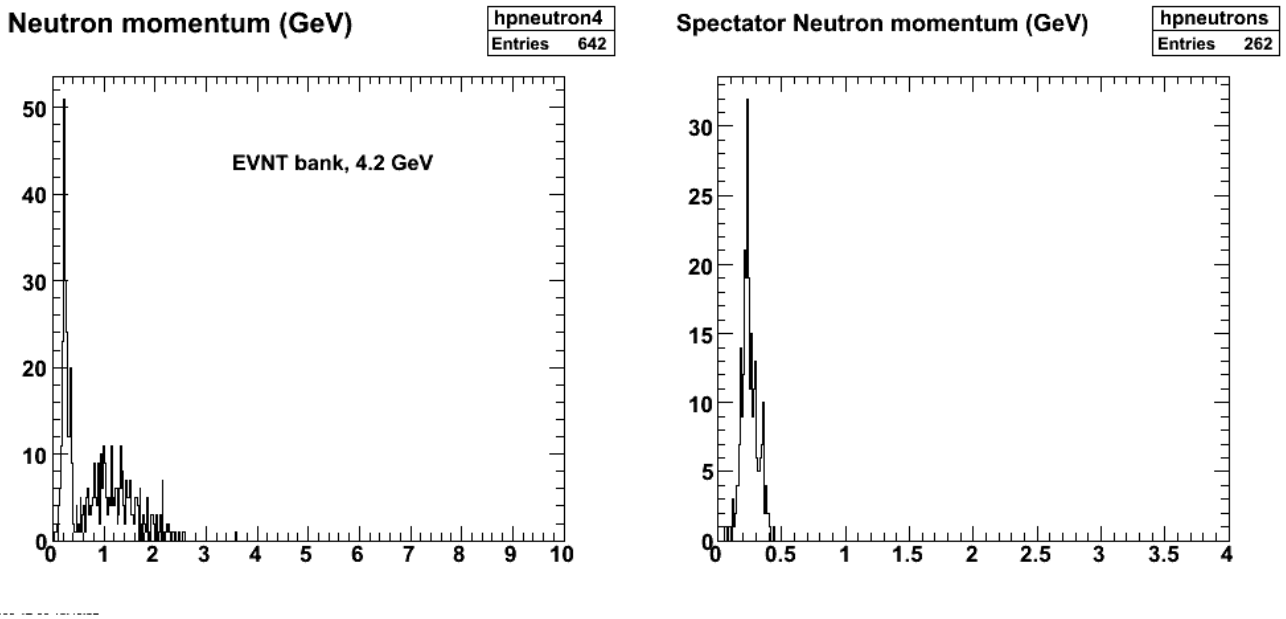


Fig. 9. Comparison of neutron momentum spectra for 4.2 GeV EVNT bank after making e-n and e-p event selection consistent with the PART bank analysis. Compare with Fig 7..

Click here to view the object (ROOT macro) you uploaded.

Now add the spectator momentum to the quasielastic part of the simulation.

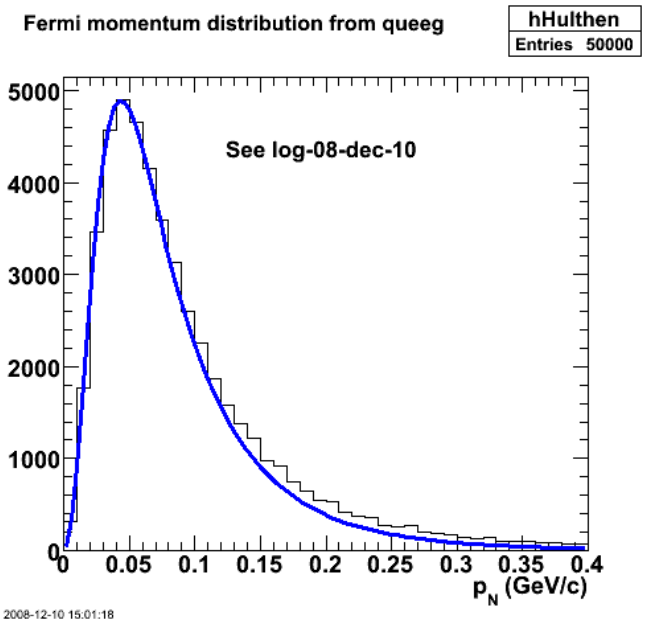


Fig 10. Fermi momentum from queeg for 11 GeV. Curve is from genev, I don't understand the small difference at higher nucleon momentum, but will investigate.

Click here to view the object (ROOT macro) you uploaded.

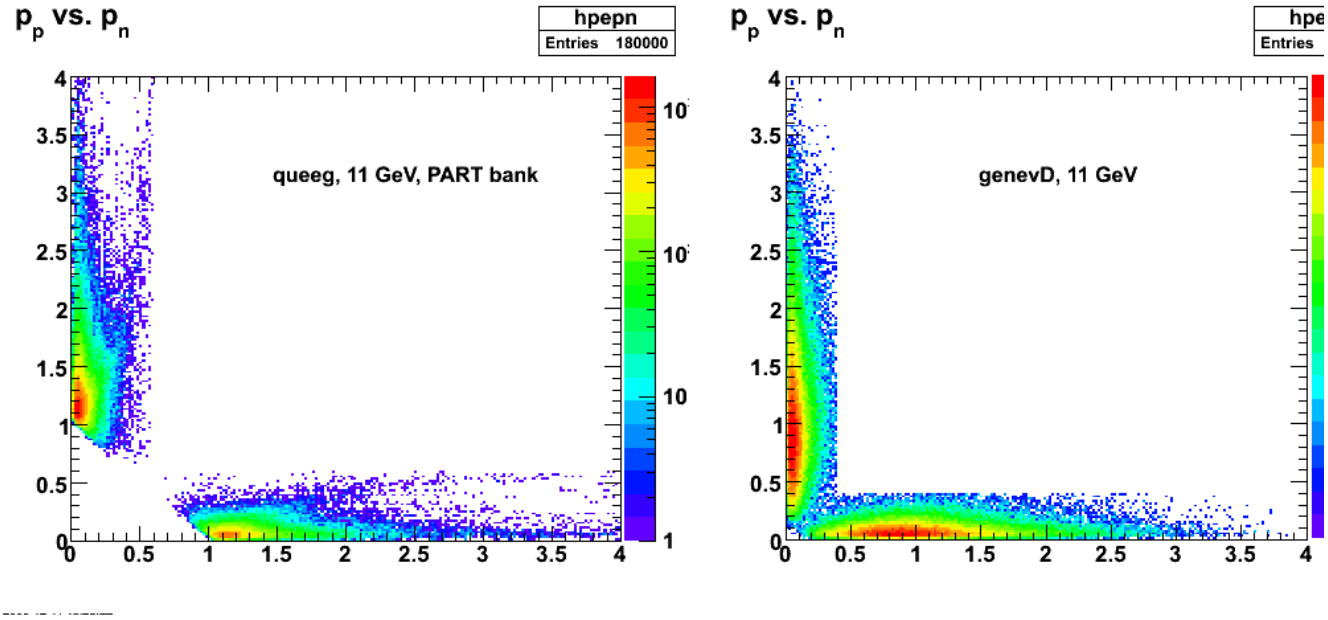


Fig. 11. Comparison of p_p vs. p_n for the PART bank for QE (lhs) and inelastic (rhs) events.

Click here to view the object (ROOT macro) you uploaded.

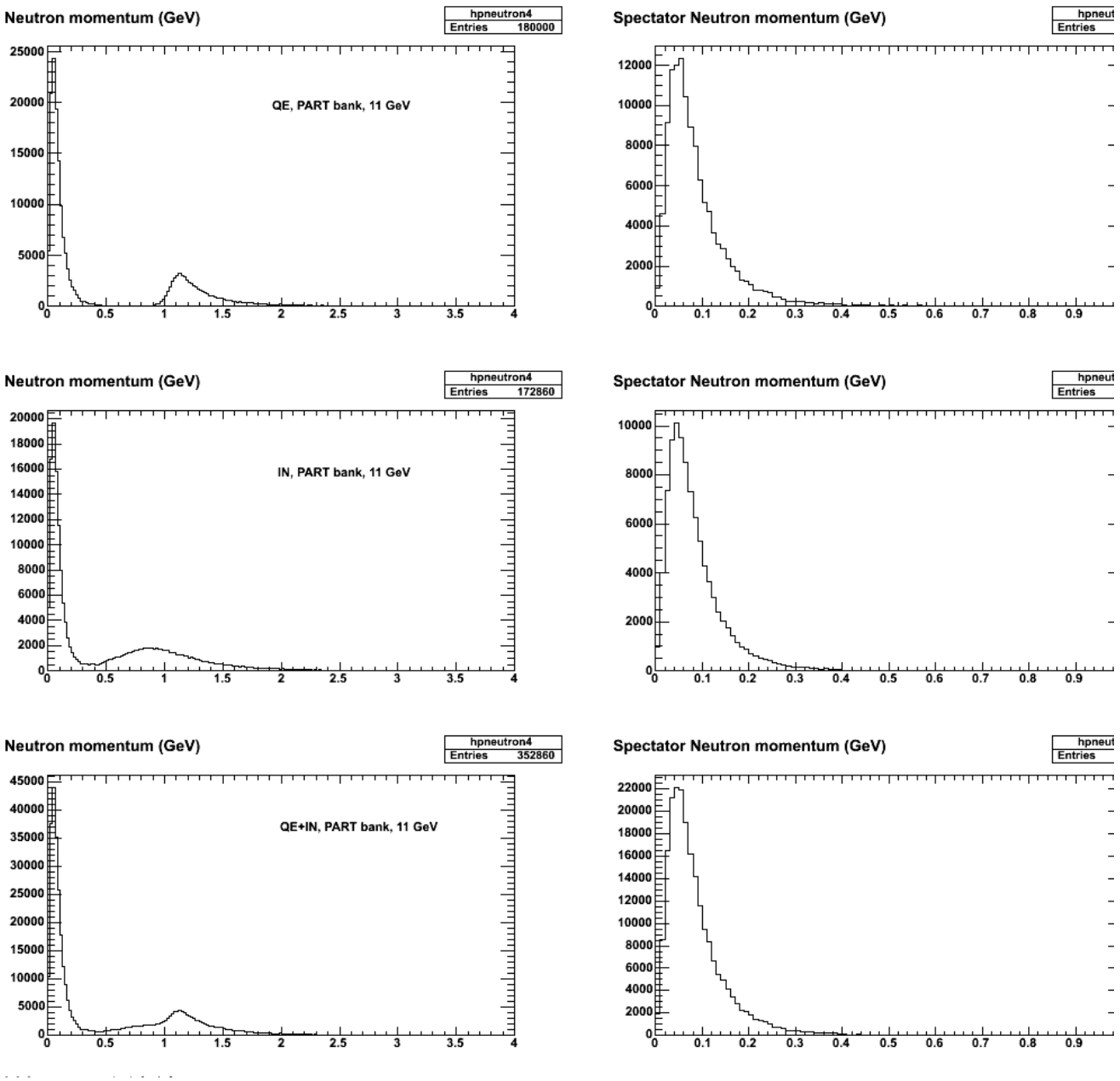


Fig. 12. PART bank for QE and IN for 11 GeV.

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 233 - Addition of nucleon spectators to gmn12 simulation (gpg)

[Modified Thu Dec 4 00:16:49 2008 (GMT) gpg]

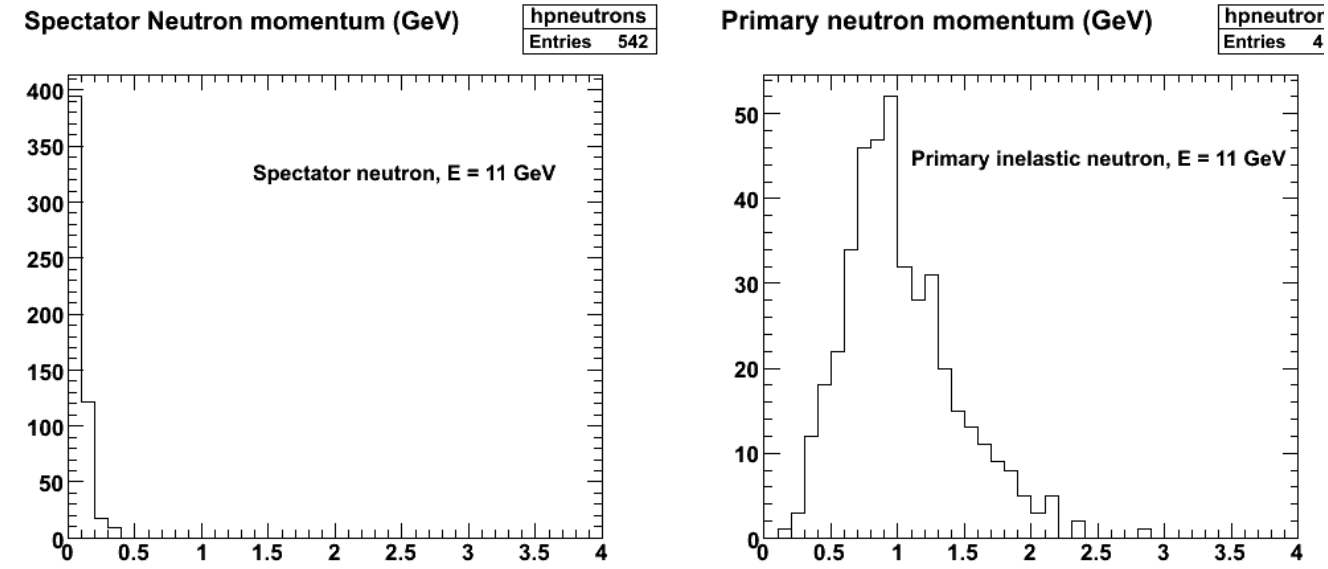


Fig. 1 Momentum spectra of spectator neutron (lhs) and primary neutron (rhs) from genevD.

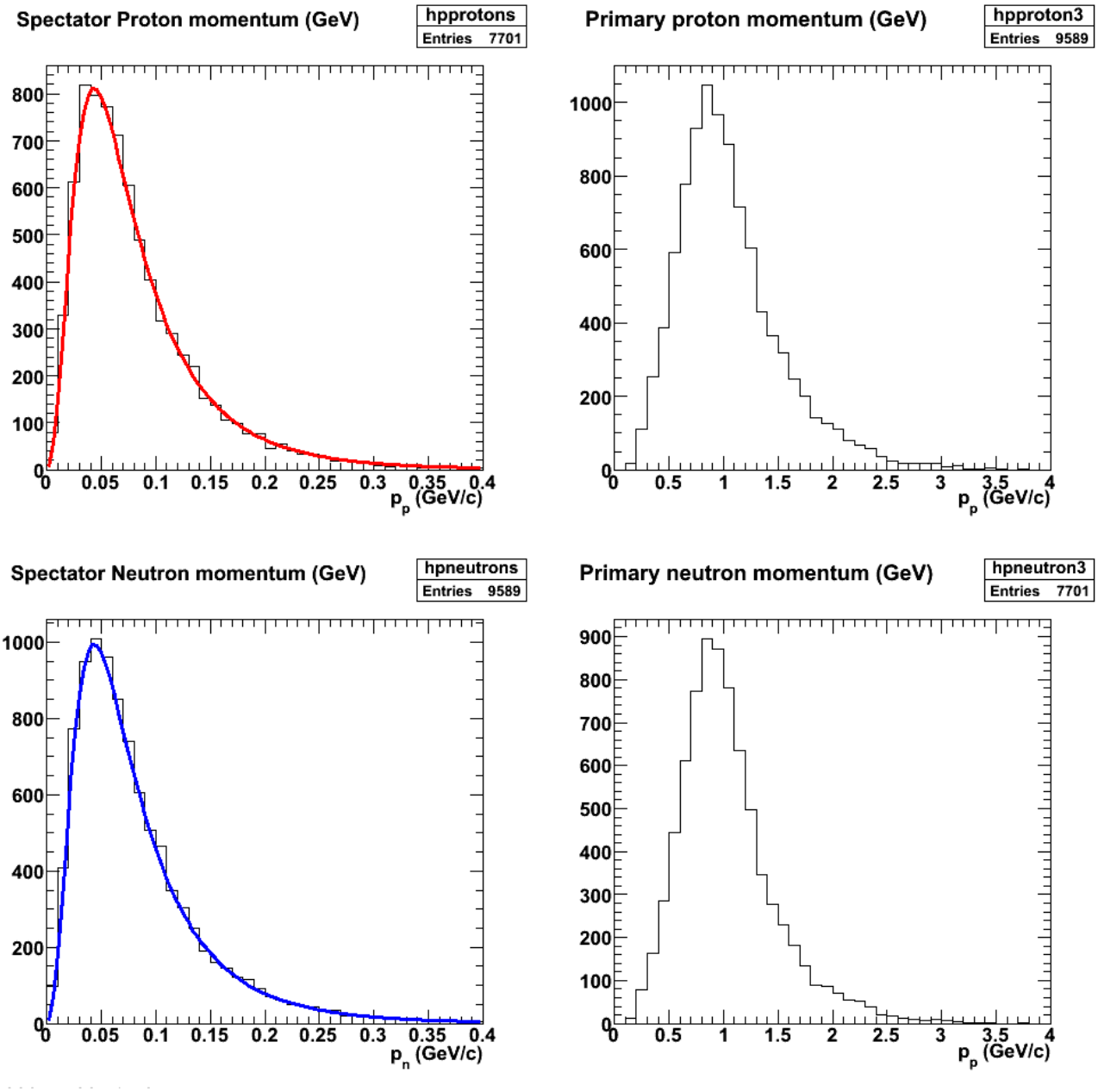


Fig 2. Comparison of momentum spectra for neutrons and protons, primary and spectator.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 234 - Dsim plots for Q2=1.75-2.25 GeV2 (gpg)

[Modified Fri Jan 16 23:26:37 2009 (GMT) gpg]

Plots below will be used for CLAS Note. First set shows Q2 distribution for summed PART bank (left), summed genevD PART bank (middle), and summed queeg PART bank (right). Why is there a high Q2 tail on the queeg results?

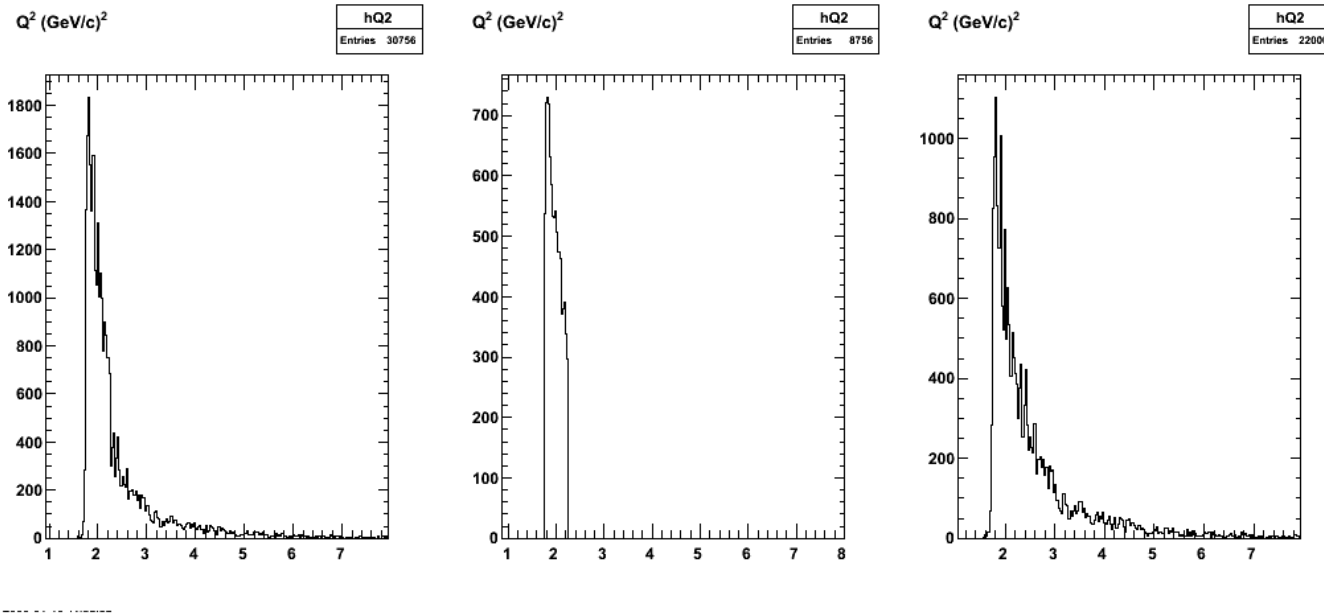


fig 1. Comparison of Q2 distributions for summed PART bank (left), summed genevD PART bank (middle), and summed queeg PART bank (right).

It appears QUEEG does not use the upper limit on the electron scattering angle in selecting that quantity. I modified the code to look like the following in the function Jqe_ana_calc::get_electron_angle in the file Jqe_ana_calc.cpp.

```
 if(htype == NEUTRON){
  e_axis = neutron_restframe_xsec->GetXaxis();
  ebin = e_axis->FindBin(E_rf);
  projy = neutron_restframe_xsec->ProjectionY("",ebin,ebin);
  // gpg. add code here to put upper limit on electron angle.
  while(angle theta_max_rf){
    angle = projy->GetRandom();
  }
  //cout << "e-n, electron angle=" << angle << endl;
} else if(htype == PROTON){
  e_axis = proton_restframe_xsec->GetXaxis();
  ebin = e_axis->FindBin(E_rf);
  projy = proton_restframe_xsec->ProjectionY("",ebin,ebin);
  icounter = 0;
  // gpg. add code here to put upper limit on electron angle.
  while(angle theta_max_rf){
    angle = projy->GetRandom();
    icounter++;
  }
  //cout << "e-p, electron angle=" << angle << " E_rf=" << E_rf << " counter=" << icounter << endl;
} else{
  angle = 0;
}
```

Click here to view the object (ROOT macro) you uploaded.

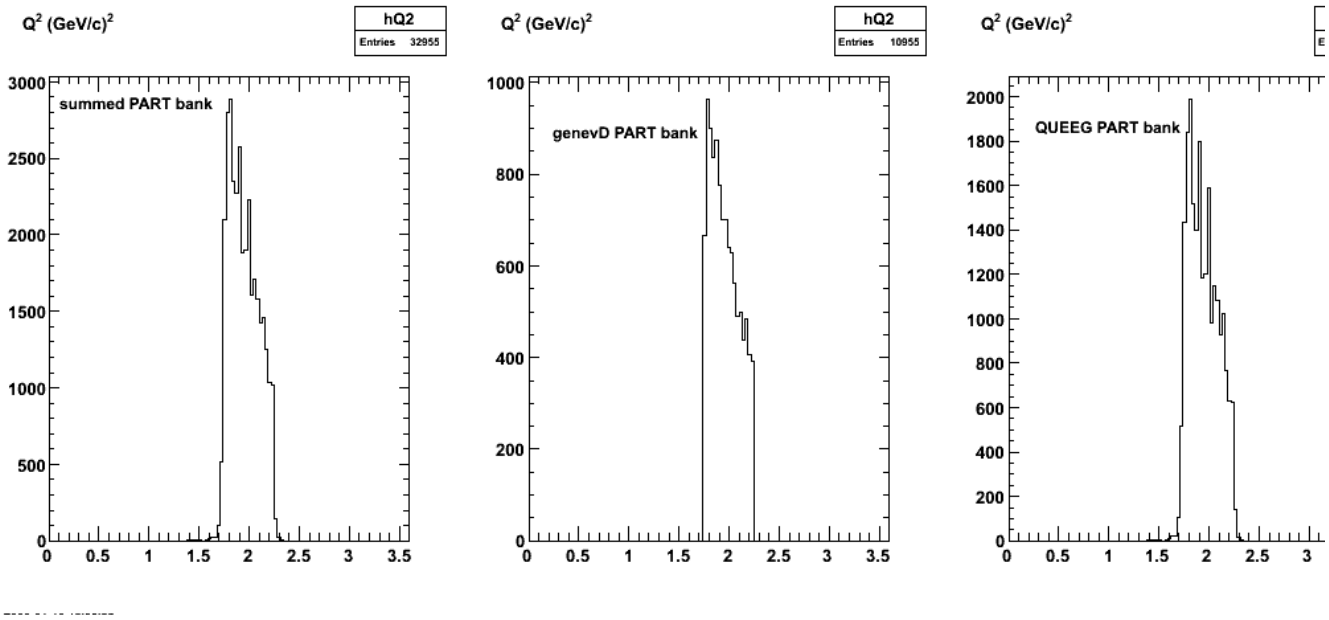


Fig.2 Same as Fig 1 after changes to queeg.

Click here to view the object (ROOT macro) you uploaded.

Check results of running with reasonable IN:QE ration of 13.7:1.0 and get the following. Why are the single bin fluctuations for the QE events (left panel) so large? They are statistically significant.

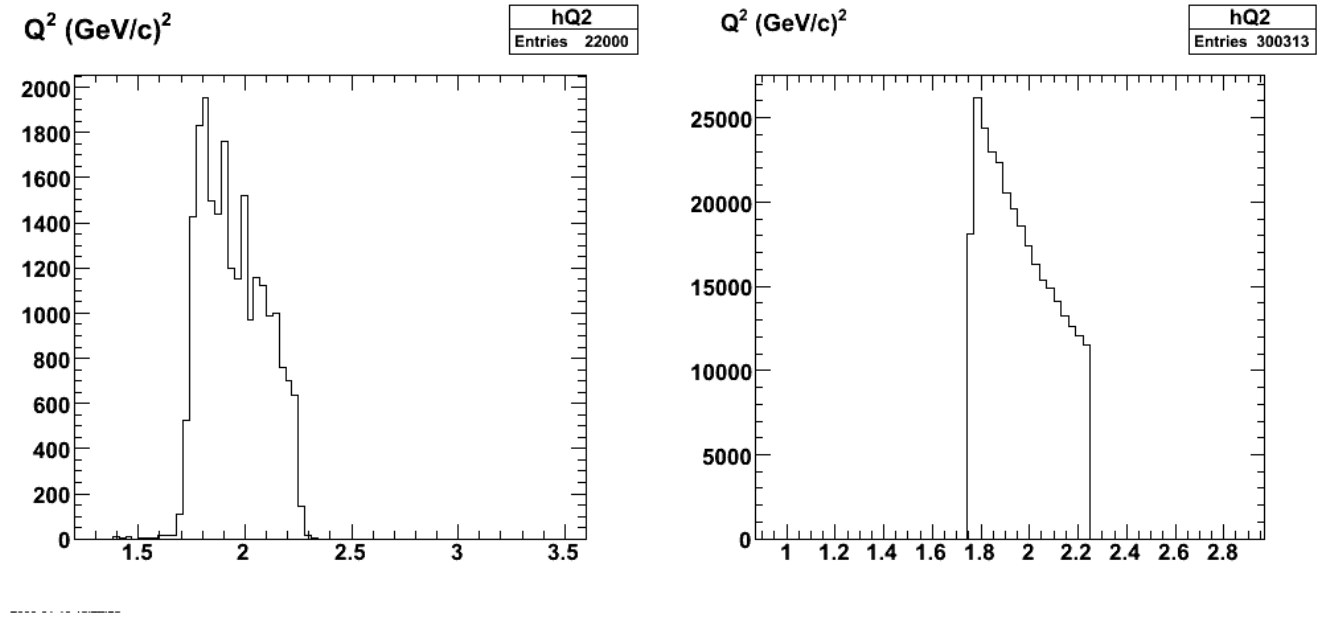


Fig 3.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 235 - Dsim for 4.2 GeV (gpg)

[Modified Fri Jan 23 15:33:12 2009 (GMT) gpg]

Make some W2 plots for comparison with the E5, 4.2 GeV data. Results below are for the PART bank and Dsim.

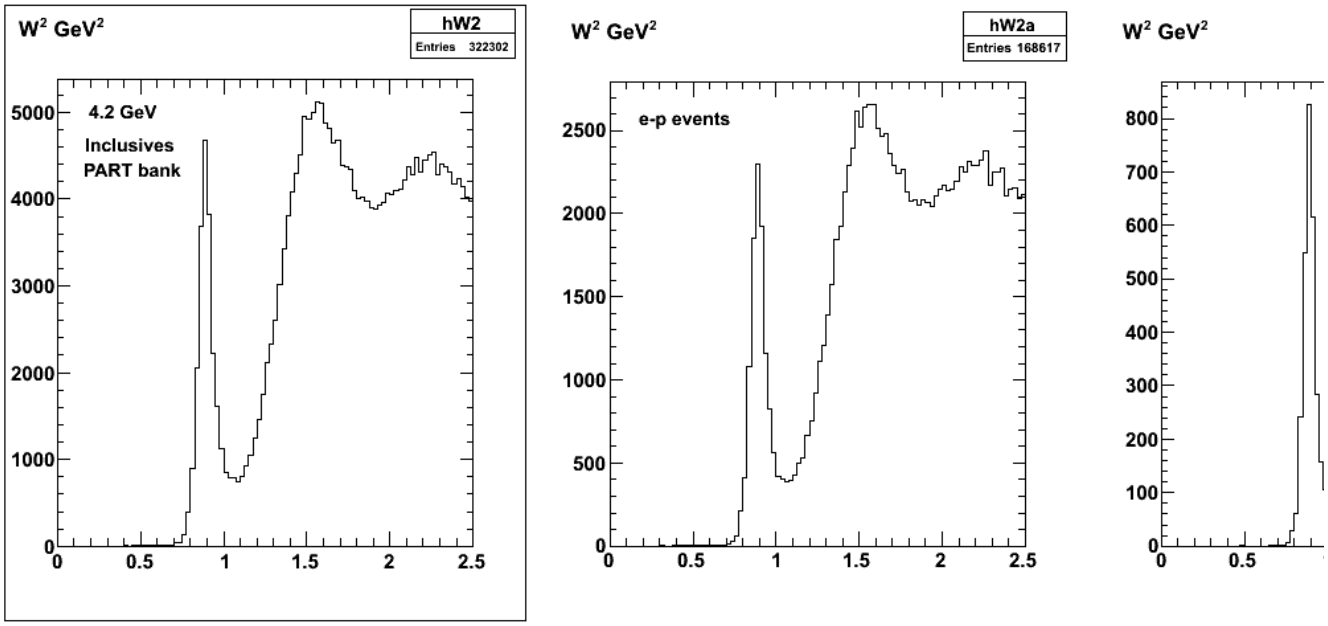


Fig 1. W2 distributions for electon inclusives (left-hand panel), e-p coincidences (middle panel), and e-p coincidences with the theta_pq cut turned on (right-hand panel) at (probably) 3 deg.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (tarred, gzipped archive for fig 1.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 236 - Checking Dsim with 4.2 GeV data (gpg)

[Modified Fri Jan 23 19:16:53 2009 (GMT) gpg]

Generate some spectra from the 4.2 GeV E5 data for comparison with Dsim results. Initially things look quite bad. See JL figure in the PAC32 talk and compare plots of ep W2 spectra. My spectra have many more inelastic events; the delta peak is washed out and the QE peak has lots of background. Turning on the theta_pq cut improves things, but it still looks weird. See fig 2 below. The first plot shows the proton mass spectrum. I think I need a cut here to clean things up.

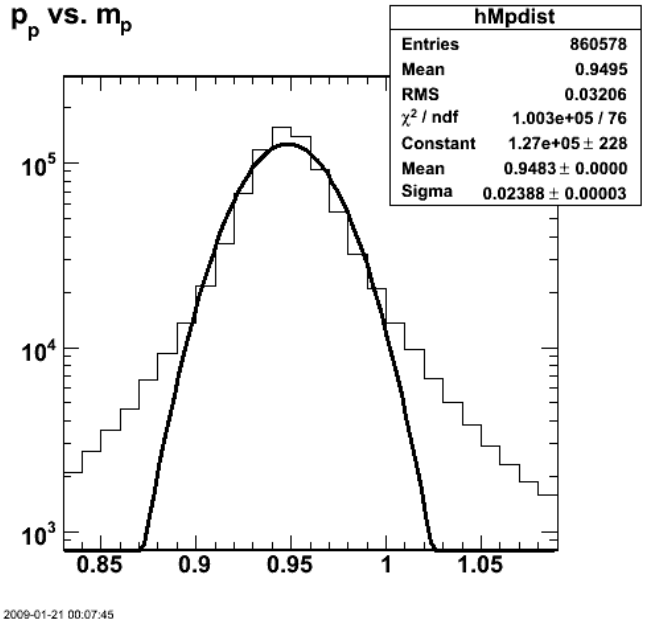


Fig 1. Proton mass spectrum. See log-09-jan-20 for more details.

Check the proton mass.

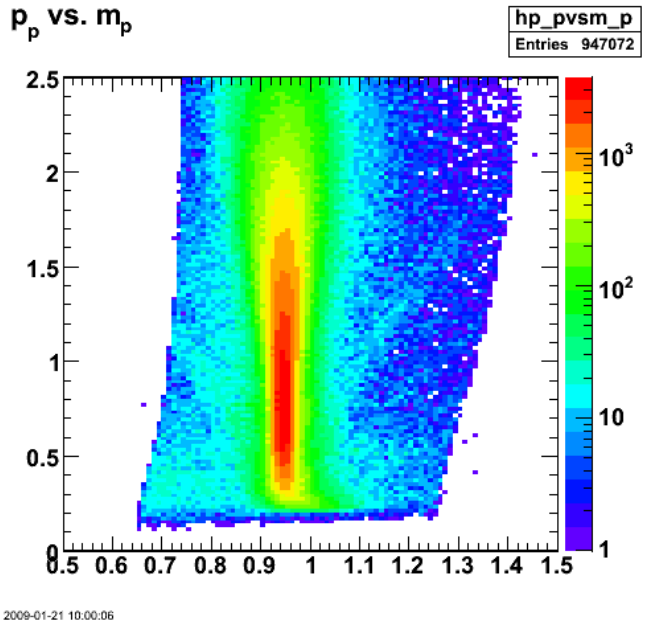


Fig 2. Proton mass calculated from the measured momentum and beta for 4.2 GeV.

Click here to view the object (ROOT macro) you uploaded.

Turn on cut on proton mass and there is little improvement. I notice the following plot. Why is there such a high threshold on Q2 in the QE region?

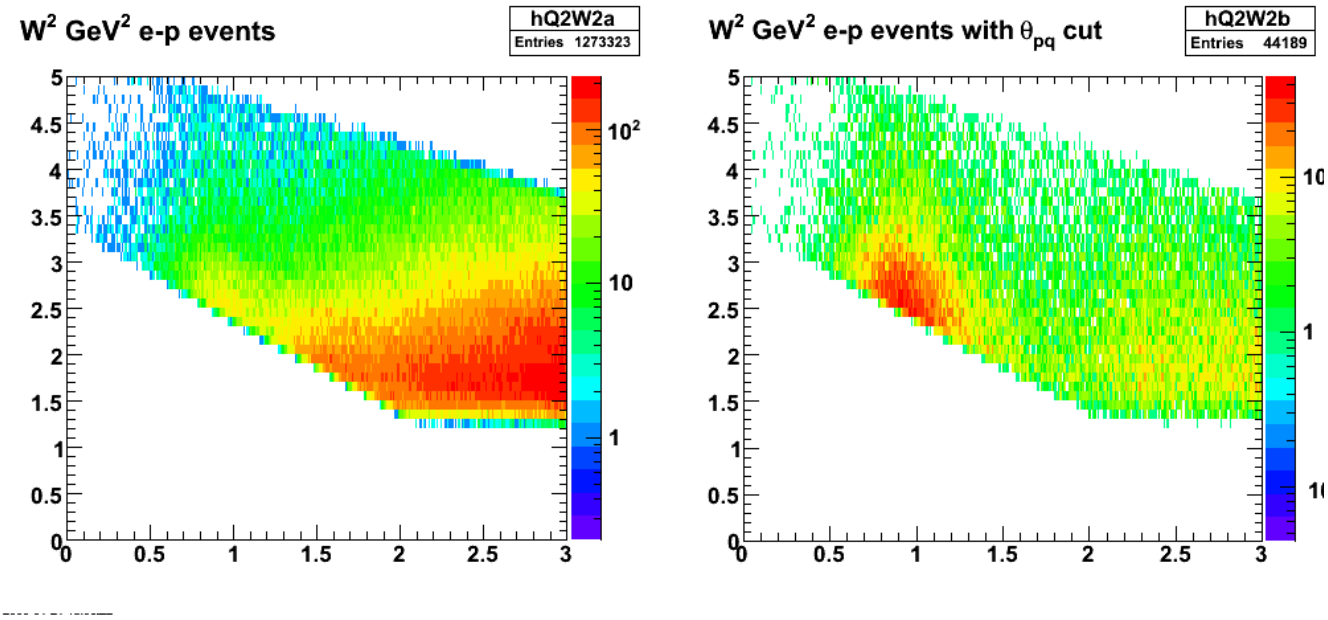


Fig 3. Q2 vs. W2 for 4.2 GeV.

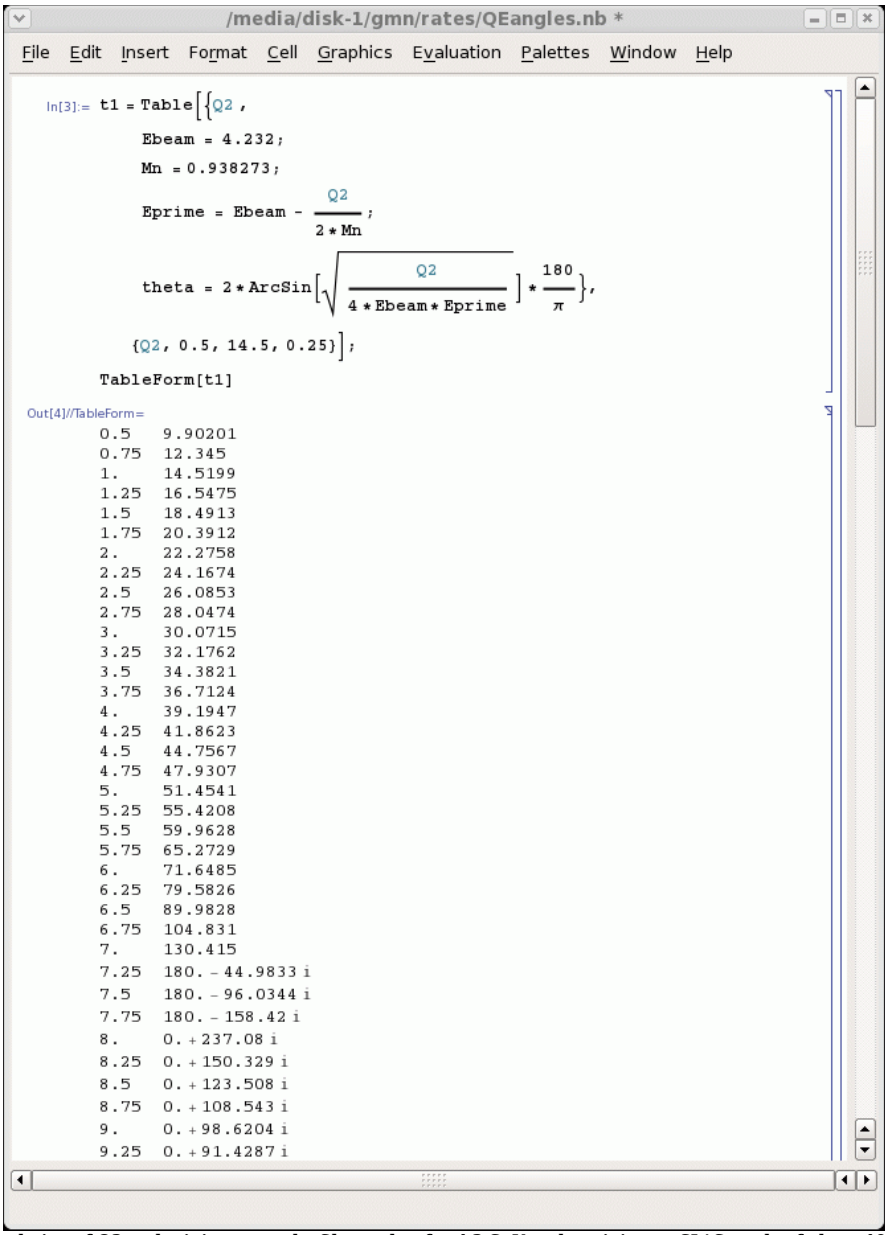


Fig 4. Mathematica calculation of Q2 and minimum angle. Shows that for 4.2 GeV and a minimum CLAS angle of about 10 deg, we should see QE events at much lower Q2.

Turn off efids and things work! I reproduce the shape of JL's thesis plot.

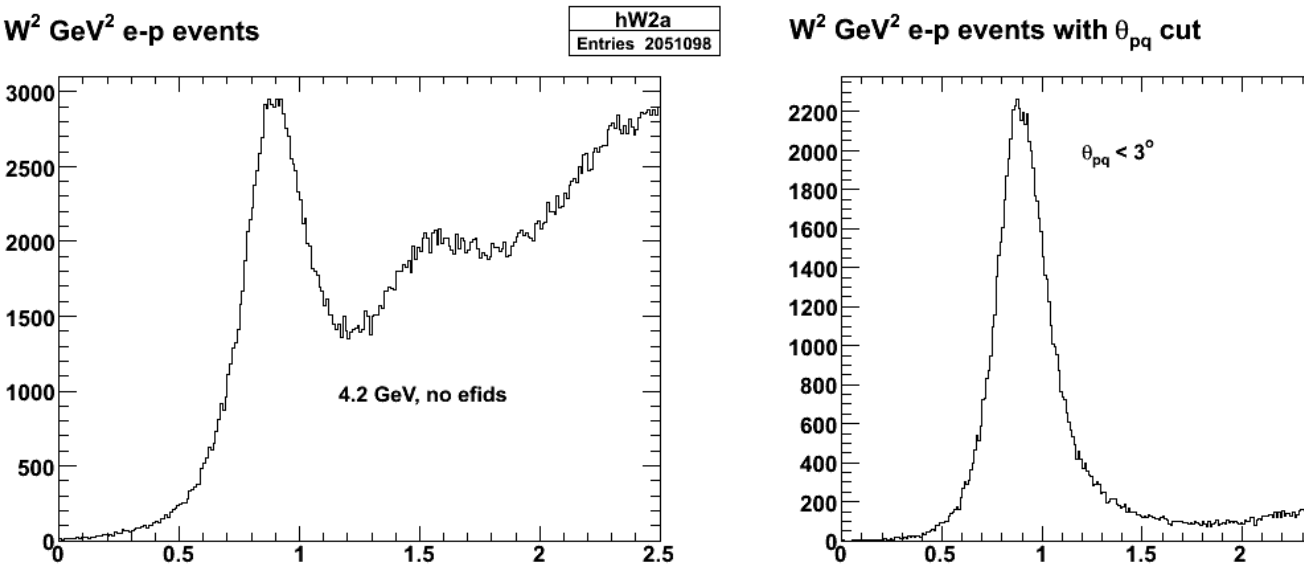


Fig 5. W2 for ep events with theta_pq cut off (left) and on (right). The shape agrees with JL, but I have many fewer events???

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Cuts used:

```
if (ep_event &&
    target_walls_ep &&
    //1 good_e_p_vertex &&
    //3 good_electron_fiducial &&
    good_electron_EC_fiducial &&
    good_electron_EC_trk_coords_fiducial &&
    good_proton_fiducial &&
    good_egiyan_threshold &&
    good_mass_p &&
    //2 good_sampling_fraction &&
    good_photoelectrons) {

  ep_count++;
  hp_pvsm_p->Fill(mass_p,p_p);
  hmm_theta_pq->Fill(theta_pq_CM*180/pi,mm);
  hphi_pq_theta_pq->Fill(theta_pq_CM*180/pi,phi_pq*180/pi);

  if ( phi_e_deg < -30) {
    hQ2b->Fill(Q2,phi_e_deg+360);
  } else {
    hQ2b->Fill(Q2,phi_e_deg);
  }
  hW2a->Fill(W2_corr);
  hQ2W2a->Fill(W2_corr,Q2);
  hMp->Fill(mass_p);
}
```

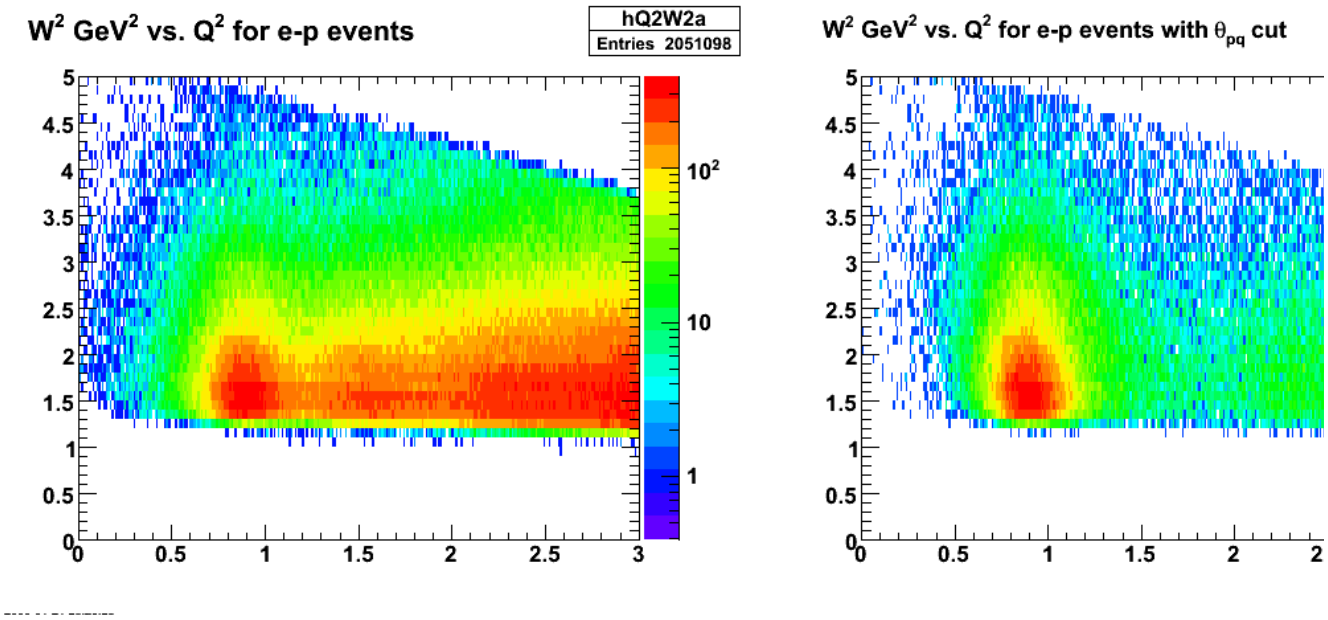


Fig 6. Effect of efids (compare with fig 3) and theta_pq (compare left and right hand plots).)

Click here to view the object (Root macro) you uploaded.

Turn off pfids (along with the efids) and the number of events doubles!!!

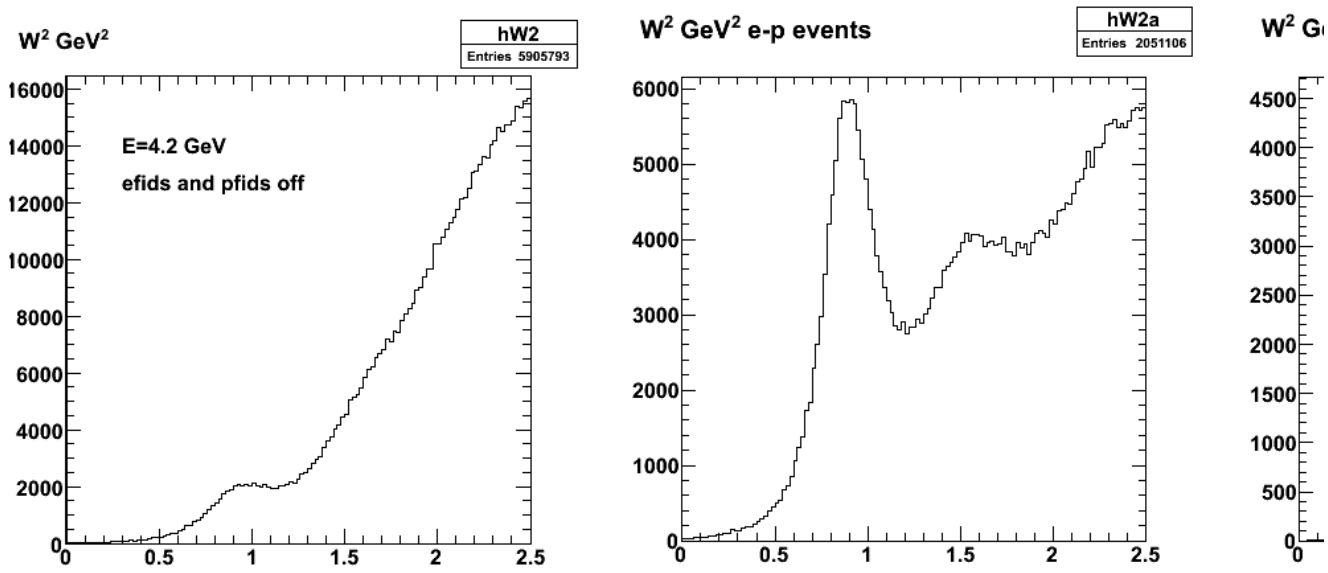


Fig 7. Inclusives (left panel), e-p events without theta_pq (middle panel), and e-p coincidences with theta_pq = 3 deg (right panel).

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Compare the PART bank dsim with the 4.2-GeV E5 data. The PART bank is much narrower because it doesn't have the detector resolution. It looks like there may be too much delta and not enough of the higher mass resonances in genev, but that is a detail I don't think I have time to worry about.

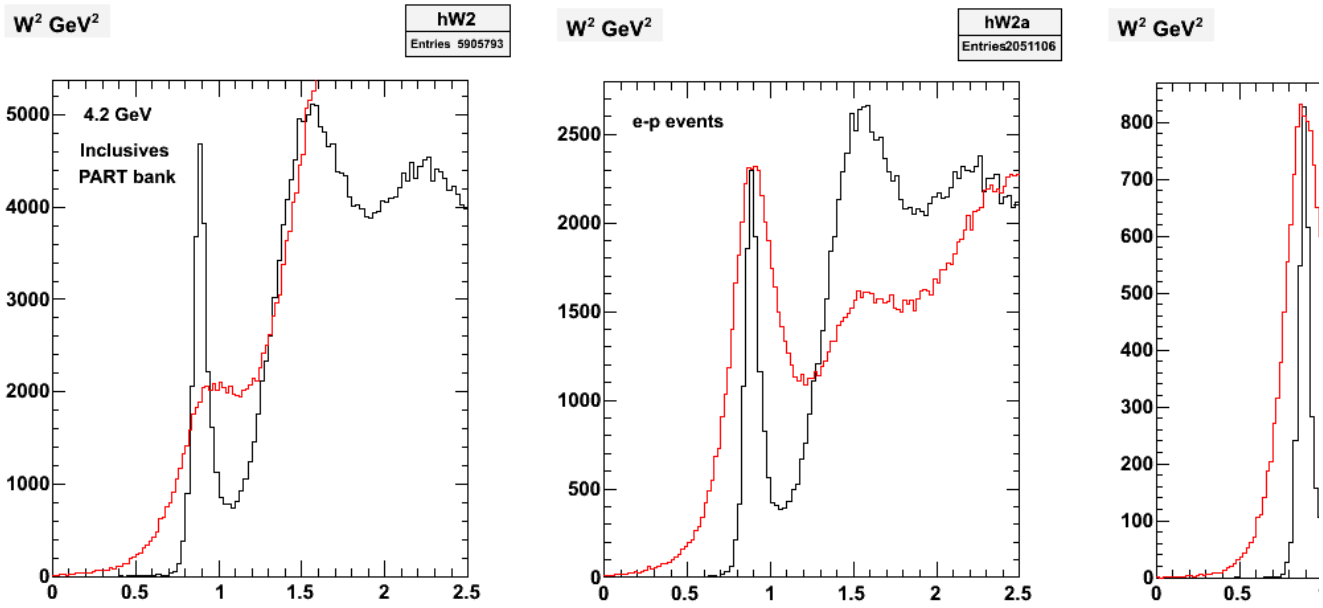


Fig. 8. Compare the PART bank dsim with the 4.2-GeV E5 data.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 237 - Phi_pq dependence of inelastic events (gpg)

[Modified Fri Jan 23 19:27:18 2009 (GMT) gpg]

I saw something last summer in the phi_pq dependence of the inelastic events when Mark Moog was working on the gmn12 simulations. In genev, there appeared to be a strong phi dependence to the inelastic events that I thought could be exploited to reduce the inelastic backgrounds. I mentioned this to wkb who thought is was likely to be a mistake. Having the E5, 4.2 GeV data in hand at the moment I took a look. See the figure below. The middle panel shows results from Dsim. There are some clear peaks in the phi_pq dependence at +/- 90 deg and their theta_pq angular distribution extends down inside the theta_pq cut. Thus, we would be able to put phi_pq cuts on the data to reduce the inelastic contamination of the quasielastic peak.

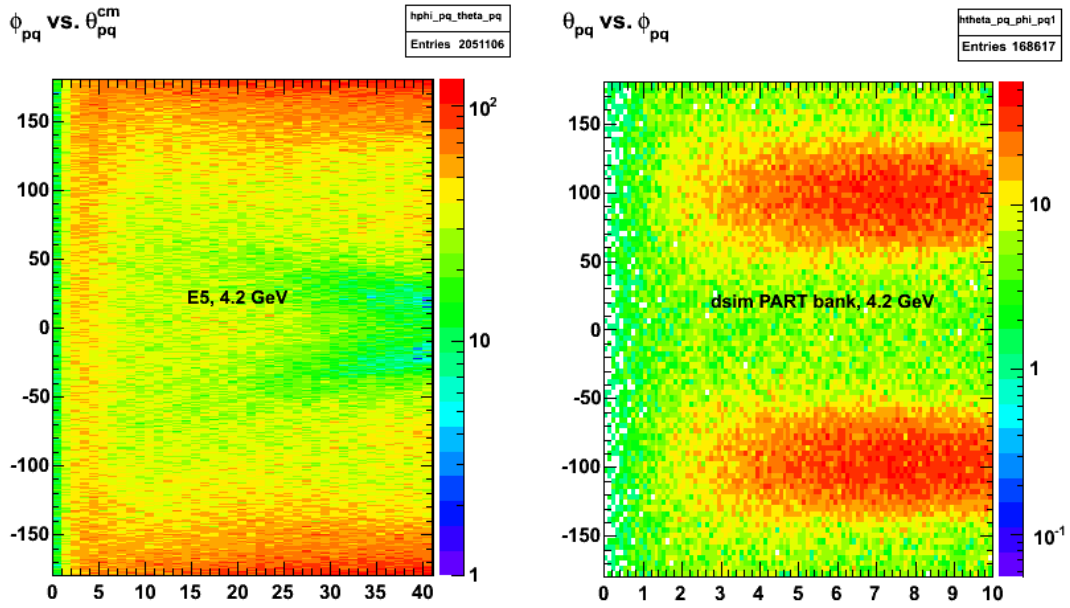


Fig 1. Comparison of phi_pq vs theta_pq of the E5, 4.2-GeV data (left panel) and Dsim at 4.2 GeV (middle panel). The label on the middle panel is backwards. It is really phi_pq vs. theta_pq.

Click here to view the object (ROOT macro) you uploaded.

The data also show a clear phi_dependence, but it's way different from genev. I don't understand this difference, but we clearly see a phi_pq peak in the inelastics at 180 deg. Add cut on phi_pq to 4.2-GeV analysis and get the following curve; not much of an improvement at a cost of losing about half the events.

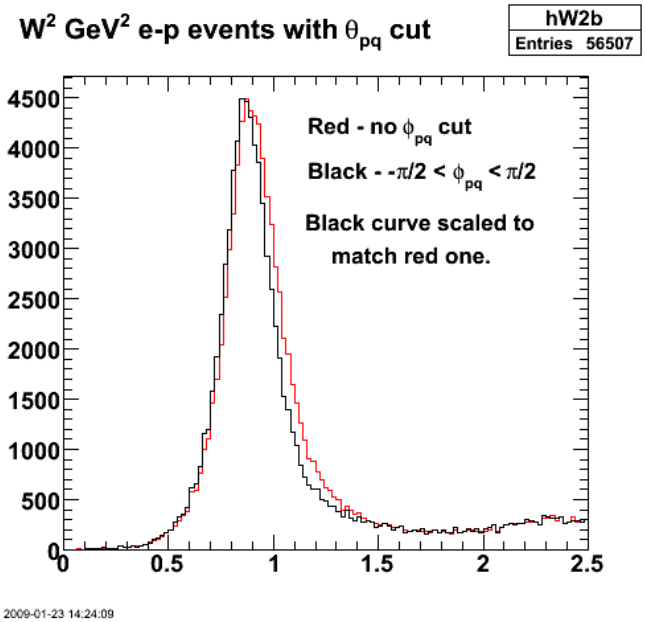


Fig 2. Comparison of W2 spectra with 'standard' cuts (no fids) and with added phi_pq cut (-90 deg < phi_pq < 90 deg).

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 238 - Testing Dsim at 11 GeV (gpg)

[Modified Thu Jan 29 05:14:05 2009 (GMT) gpg]

Comparison of W2 spectra from Dsim with SLAC data.

Fig 1. Inclusive W2 spectra compared with measured results from SLAC E133.

Click here to view the object (Root macro) you uploaded.

```
genevout.bos    ! BOS file name
5000            ! events number 50000
11.0            ! Ebeam (GeV)
0.03            ! omega_min/Eo
0.99            ! omega_max/Eo
8.0             ! teta_min electron (degrees)
40.             ! teta_max electron (degrees)
1               ! flag to fix Q2 (1=read Qmin,Qmax; 0=ignore them)
7.4             ! Q2min         WARNING!! If Q2 and W flags are  BOTH=1extraction
8.4             ! Q2max         is made in Q2,W bin; elsewere in Omega,theta bin
1               ! flag to fix W (1=read Wmin,Wmax; 0=ignore them)
0.0             ! Wmin (GeV)
2.000           ! Wmax (GeV)
0               ! flag to fix phi of e- (1=read phi_min,phi_max; 0=ignore them)
0               ! phi_min (degrees)
180             ! phi_max (degrees)
15              ! number of activated channels channels
1,2,3,4,5,6,7,8,9,10,11,12,13,14,15         ! channels ID (in one line, ID separeted by a comae.g 1,3,4 ...)
1               ! 0/1 LUND file no/yes
genev.lund      ! lund file name
0               ! Flag Rho ds/dt (0=ds/dt true; 1=uniform 2=flat 3=fixed angle)
0               ! Flag decay Rho (0=flat 1=realistic)
3375.           ! current of torus (real number)
0               ! code for generation according to cuts (1=eppi+ inside cuts, etc., default 0)
0.3             ! Target radius (default 0)
4.0             ! Target length (default 0)
0.              ! Target offset in z (default 0)
0               ! Radiative Mode (1-radiative(no stagling) 2-radiative with stagling(e1 target)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C
C 2pi -> 5,6,7,11,12,15,16,19,21,22,27
C
C
C 16 channels  on proton: 1,2,5,6,7,11,12,15,16,19,21,22,25,27,28,29
C                  CHANNEL ID
C
C         1) V_Gamma  +  P  --->  N  +  PI+
C         2) V_Gamma  +  P  --->  P  +  PI0
C         3) V_Gamma  +  N  --->  P  +  PI-
C         4) V_Gamma  +  N  --->  N  +  PI0
C
C         5) V_Gamma  +  P  --->  DELTA++ +  PI-
C         6) V_Gamma  +  P  --->  DELTA+  +  PI0
C         7) V_Gamma  +  P  --->  DELTA0  +  PI+
C         8) V_Gamma  +  N  --->  DELTA+  +  PI-
C         9) V_Gamma  +  N  --->  DELTA0  +  PI0
C        10) V_Gamma  +  N  --->  DELTA-  +  PI+
C        11) V_Gamma  +  P  --->  RHO0  +  P
C        12) V_Gamma  +  P  --->  RHO+  +  N
C        13) V_Gamma  +  N  --->  RHO-  +  P
C        14) V_Gamma  +  N  --->  RHO0  +  N
C        15) V_Gamma  +  P  --->  P  +  PI   +  PI-
C        16) V_Gamma  +  P  --->  N  +  PI0  +  PI+
C        17) V_Gamma  +  N  --->  N  +  PI+  +  PI-
C        18) V_Gamma  +  N  --->  P  +  PI0  +  PI-

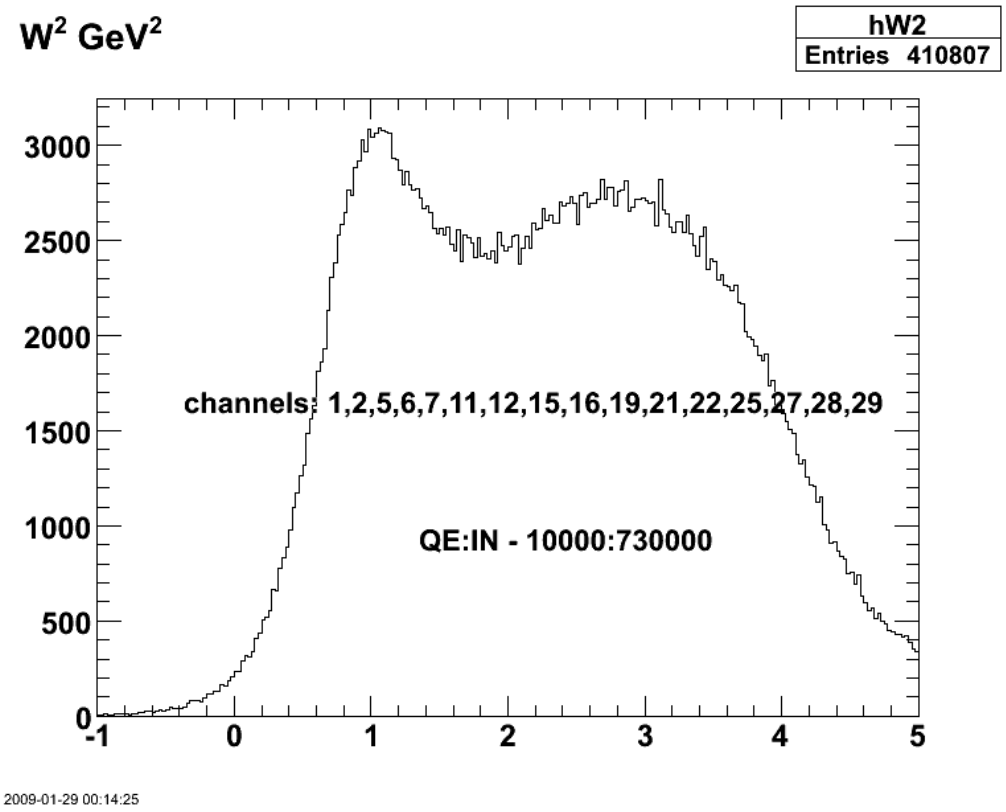
C        19) V_Gamma  +  P  --->  OMEGA  +  P
C        20) V_Gamma  +  N  --->  OMEGA  +  N
C        21) V_Gamma  +  P  --->  P  +  PI+  +  PI-  +  PI0
C        22) V_Gamma  +  P  --->  N  +  PI+  +  PI+  +  PI-
C        23) V_Gamma  +  N  --->  N  +  PI+  +  PI-  +  PI0
C        24) V_Gamma  +  N  --->  P  +  PI+  +  PI-  +  PI-
C        25) V_Gamma  +  P  --->  PHI  +  P
C        26) V_Gamma  +  N  --->  PHI  +  N

c        27) V_gamma  +  p  --->  pi+  +  pi+  +  pi-  +  pi-  +  p
c
c        28) V_gamma  +  p  --->  pi+  +  pi+  +  pi-  +  pi-  +  pi0  +  p
c        29) V_gamma  +  p  --->  pi+  +  pi+  +  pi+  +  pi-  +  pi-  +  n
c
c        30) V_gamma  +  p  --->  P + PI+ + PI- (MODEL)
c
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

Line up the low W2 part of the SLAC spectrum with the Dsim result. The Dsim inelastic cross section is rising too rapidly with W2.

Fig 2. Comparison of W2 spectra for SLAC E133 and Dsim.

Click here to view the object (Root macro) you uploaded.



2009-01-29 00:14:25

Fig 3. Testing genev channels.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 239 - Responses to GMn referee reports (gpg)

[Modified Wed Feb 4 20:46:44 2009 (GMT) gpg]

from Mathematica (see paper1/prl3/calcsForRefs.nb)

weighted average = 1.008 +/- 0.002

same as minuit results in root.

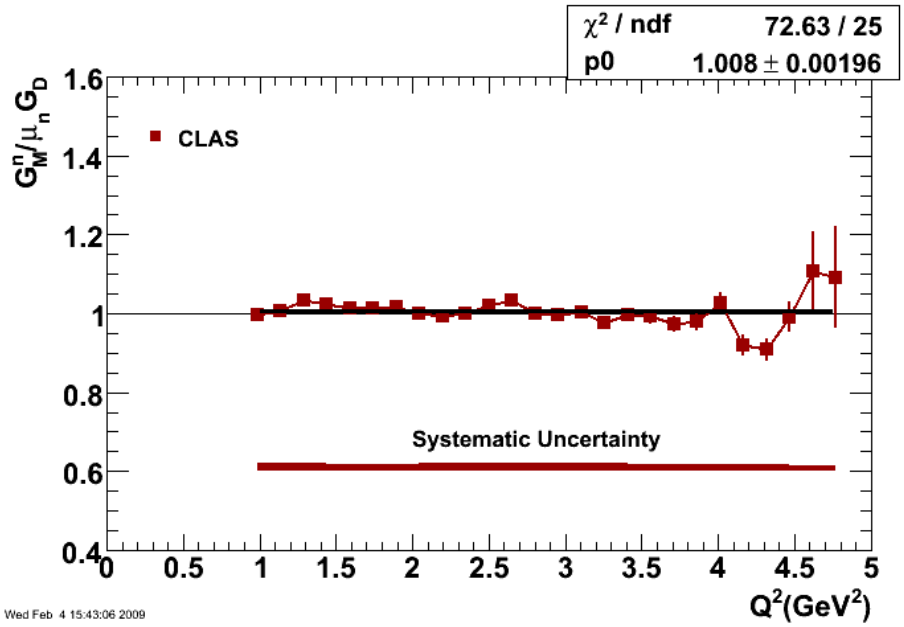


Fig 1. Flat line fit to reduced GMn.

Click here to view the object (ROOT macro for fig 1.) you uploaded.

Click here to view the object (Mathematica notebook with calculations for the question on the fluctuations in the reduced GMn and other questions in the referees's reports.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 240 - Streamlining QUEEG Makefiles (Jerry Gilfoyle)

[Modified Tue Apr 28 14:48:41 2009 (GMT) Jerry Gilfoyle]

Prior to putting QUEEG under CVS I want to streamline the make system so that when building myqueeg12gev it will automatically go to the other areas and remake any libraries that have been modified. This creates some problems described below.

eeekk!!!!!!!!!!!!!!!!

```
1. pscm1:nde> touch Jnde_pars.cpp
2. pscm1:nde> make
3. get the following.

pscm1:nde> today ../obj/Linux/
total 12484
-rw-rw-r--    1 gilfoyle gilfoyle   167132 Apr 28 11:36 Jnde_pars.o     <---- New! Good!
-rw-rw-r--    1 gilfoyle gilfoyle   404884 Apr 28 11:36 ec_nde_select.o
-rw-rw-r--    1 gilfoyle gilfoyle   401984 Apr 27 19:46 queeg.o
-rw-rw-r--    1 gilfoyle gilfoyle   448004 Apr 27 19:44 Jqe_ana_calc.o
-rw-rw-r--    1 gilfoyle gilfoyle   567632 Apr 27 19:44 Jqe_ana_histo.o
-rw-rw-r--    1 gilfoyle gilfoyle   447408 Apr 27 19:44 Jqe_ana_select.o
-rw-rw-r--    1 gilfoyle gilfoyle   439888 Apr 27 19:44 qe_ana.o
-rw-rw-r--    1 gilfoyle gilfoyle   399048 Apr 27 19:43 Jpde_eff.o

Jnde_pars.o is input to libNdePars.so in Makefile

$(LIB)libNdePars.so: $(OPTH)Jnde_pars.o $(OPTH)ndeparsDict.o
        @echo "Generating libNdePars.so."
        $(LD) $(SOFLAGS) -O $(OPTH)Jnde_pars.o $(OPTH)ndeparsDict.o -o $(LIB)libNdePars.so


4. trouble! libNdePars.so is not updated!!!????????

pscm1:nde> today ../lib/Linux/
total 13636
-rw-rw-r--    1 gilfoyle gilfoyle  7192954 Apr 28 11:36 libnde_main.a
-rwxrwxr-x    1 gilfoyle gilfoyle   239590 Apr 28 11:30 libScEvent.so*
-rwxrwxr-x    1 gilfoyle gilfoyle   240537 Apr 28 11:22 libLacEvent.so*
-rwxrwxr-x    1 gilfoyle gilfoyle   298482 Apr 28 11:22 libLacPars.so*
-rwxrwxr-x    1 gilfoyle gilfoyle   299006 Apr 28 11:19 libNdePars.so*  <--- Not updated!!
-rw-rw-r--    1 gilfoyle gilfoyle   402390 Apr 28 11:05 libqueeg.a
```

Click here to view the object (Modified makefile with the problem described above) you uploaded.

Click here to view the object (Original Makefile from JL with no changes.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 241 - Jerry Miller email (Jerry Gilfoyle)

[Modified Thu May 21 22:22:55 2009 (GMT) Jerry Gilfoyle]

Plots and fits for GMn for Jerry Miller.

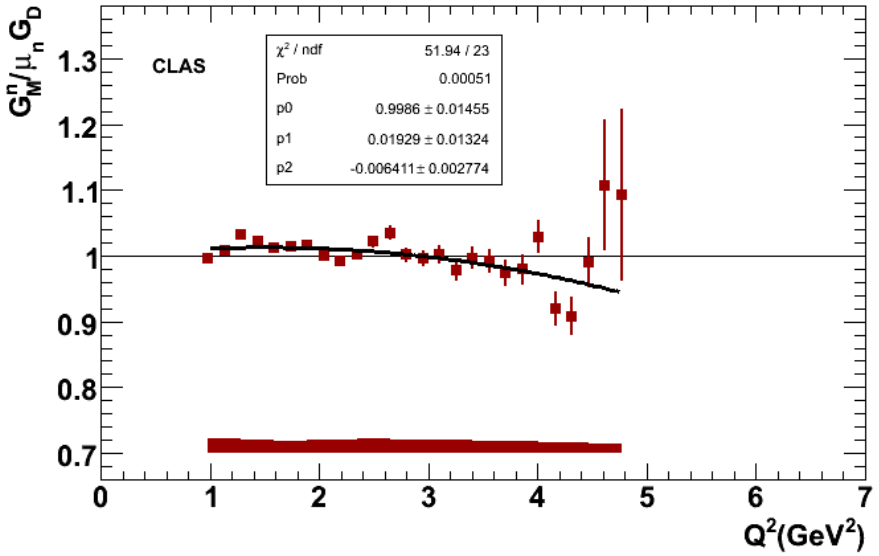


Fig 1. Simple polynomial fit to CLAS GMn data.

Click here to view the object (ROOT macro for fig 1) you uploaded.

The reduced chisquare is large for the fit above. Add the systematic and statistical errors in quadrature and the reduced chisquare is now too small. This is not unexpected since the systematic uncertainties include effects (i.e. the proton cross section uncertainty) that are really scale uncertainties and would move the entire data set up or down together and other uncertainties which are point-to-point variations like the NDE which vary significantly from one Q2 to the next. Adding the systematic uncertainties to the statistical ones in quadrature is only partially correct (and partially wrong).

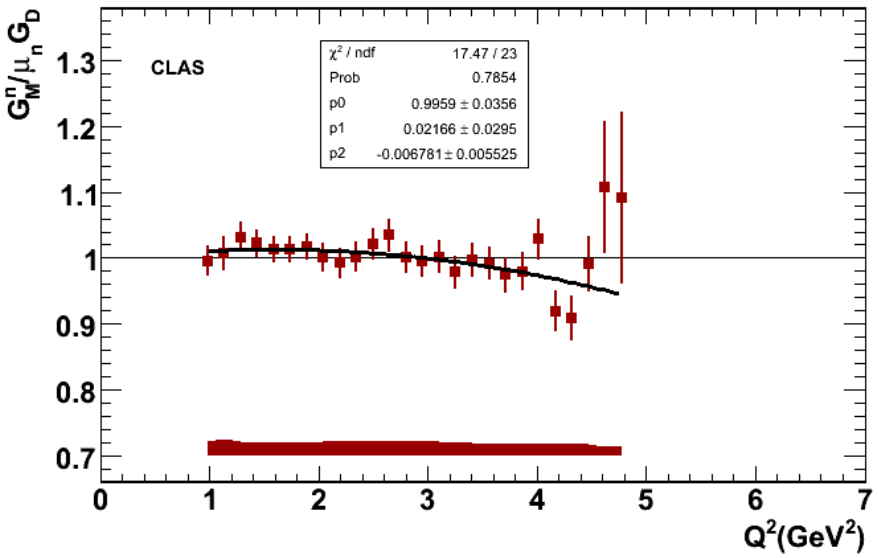


Fig 2. Simple polynomial fit to CLAS GMn data with systematic and statistical uncertainties added in quadrature. Note the good agreement between the parameters for the fits in figs 1-2.

Choosing the order of the polynomial. Using a second order polynomial achieves and adequate reduced chisquare and is appropriately smooth over the Q2 range of the data. Adding more terms improves the reduced chisquare, but I start getting variations in the curves that are not smooth enough.

```
statistical uncertainties only.

order of polunomial    chi2/ndf
0                      73/25
1                      57/24
2                      52/23
3                      52/22
4                      50/21
5                      36/20
6                      36/19
7                      35/18
8                      30/17

add statistical and systematic errors in quadrature and refit.

order of polunomial    chi2/ndf
0                      26/25
1                      19/24
2                      17/23
3                      17/22
4                      17/21
5                      14/20
6                      14/19
7                      12/18
8                      12/17
```

Click here to view the object (ROOT macro for fig 2) you uploaded.

Are the CLAS GMn results consistent with the dipole? Yes. See plots below.

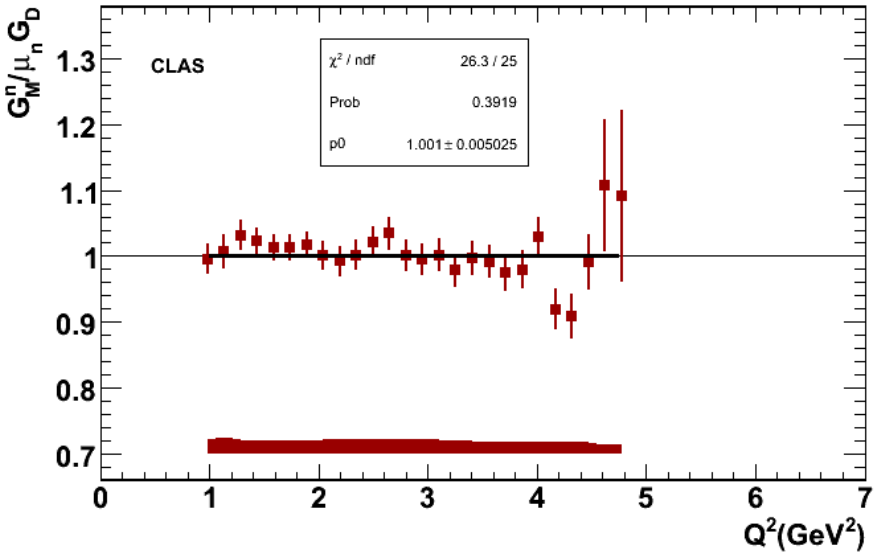


Fig 3. CLAS GMn results are consistent with GMn=mu_n*G_D.

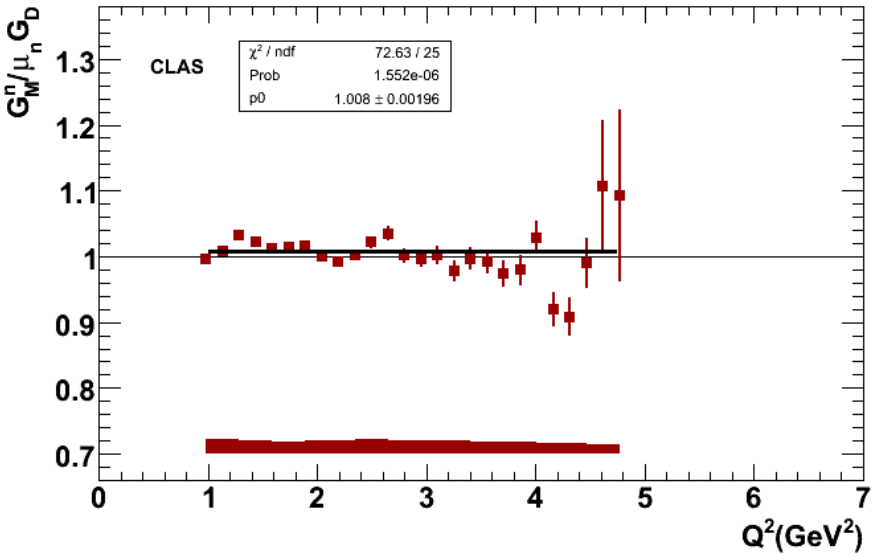


Fig 4. CLAS GMn results are consistent with GMn=mu_n*G_D within the 2% systematic error.

Jerry Miller email below.

Jerry, I do need such an analytic fit. However, while your fit goes through the data points, it will have a huge effect on my results, for probably spurious reasons. your fit for GMn goes to a constant at very large Q2. This means a delta function charge density at the origin. You can get an equally good fit, that assumes the asypototic quark counting form by using Kelly's forumla which is almost as simple as yours. an even simpler interpretation of your data would be to use a dipole. this would make the neutron charge density more negative at the center. i will take a look at your paper as soon as i can.

jerry

```
* Simple parametrization of nucleon form factors.*
J.J. Kelly  (Maryland U. ) . Dec 2004.
Published in *Phys.Rev.C70:068202,2004*.
```

First make a plot of the Kelly parameterization of GMn and compare with the CLAS data.

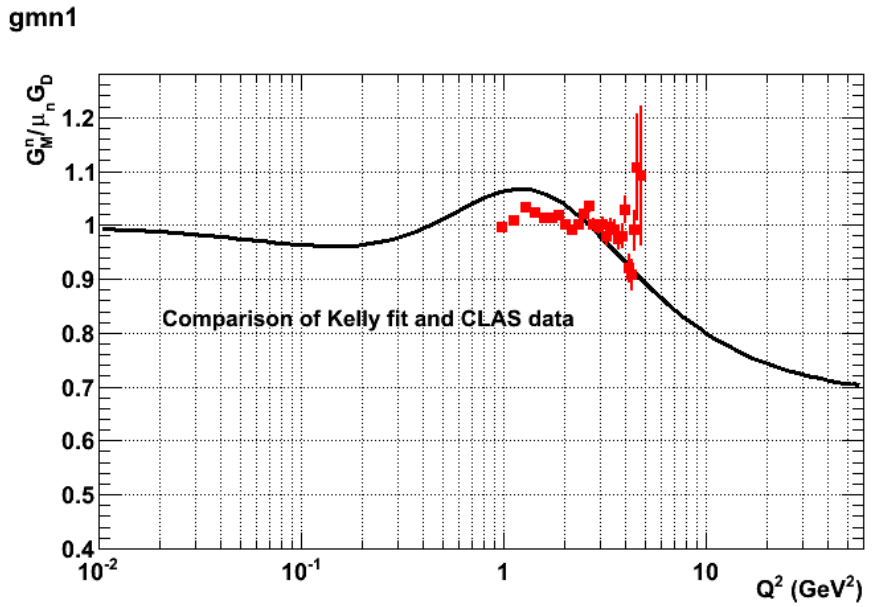


fig 5. Comparison of of the Kelly parameterization of GMn and the CLAS data.

Click here to view the object (Root macro) you uploaded.

Root code used for above plot of Kelly parameterization.

```
// Macro kelly1.C
Double_t gmn1(Double_t *x, Double_t *par)
```

```
{
   float Mp=0.938, mun=1.91;
   Float_t xx =x[0];
   float tau=xx/(4*pow(Mp,2));
   Double_t f = pow(1+(xx/0.71),2)*(par[0] + par[1]*tau)/(1 + par[2]*tau + par[3]*pow(tau,2) + par[4]*pow(tau,3));
   return f;
}
void gmn1plot()
{
   TF1 *f1 = new TF1("f1",gmn1,0.01,60,5);
   f1->SetParameters(1.0,2.33,14.72,24.20,84.1);
   f1->GetYaxis()->SetTitle("G_{M}^{n}/#mu_{n}");
   f1->GetXaxis()->SetTitle("Q^{2} (GeV^{2})");
   f1->SetMinimum(0.4);
   f1->Draw();
}
```

Now use the same function in the Kelly parameterization on the CLAS data.

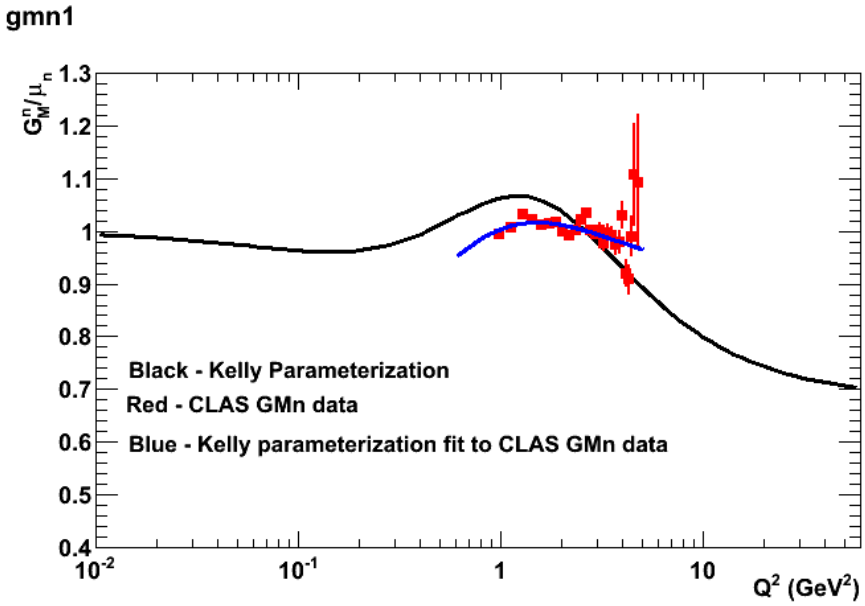


Fig 6. Comparison of Kelly fit and fit of the same function to the CLAS GMn data.

Click here to view the object (Root macro) you uploaded.

Fit results.

```
 FCN=48.8565 FROM MIGRAD    STATUS=CONVERGED     335 CALLS         336 TOTAL
                     EDM=4.00876e-11    STRATEGY= 1      ERR MATRIX NOT POS-DEF
  EXT PARAMETER                APPROXIMATE        STEP         FIRST
  NO.   NAME      VALUE            ERROR          SIZE      DERIVATIVE
   1  a0           1.00000e+00     fixed
   2  a1           9.80683e+04   2.56752e+03   6.56812e-01  -3.96230e-08
   3  b1           1.58882e+05   1.20908e+04   6.62364e+00   4.27210e-09
   4  b2           6.66868e+05   5.07300e+04   1.25602e+01   1.71211e-09
   5  b3           2.70453e+06   8.21349e+04   1.66669e+01   7.37052e-10
```

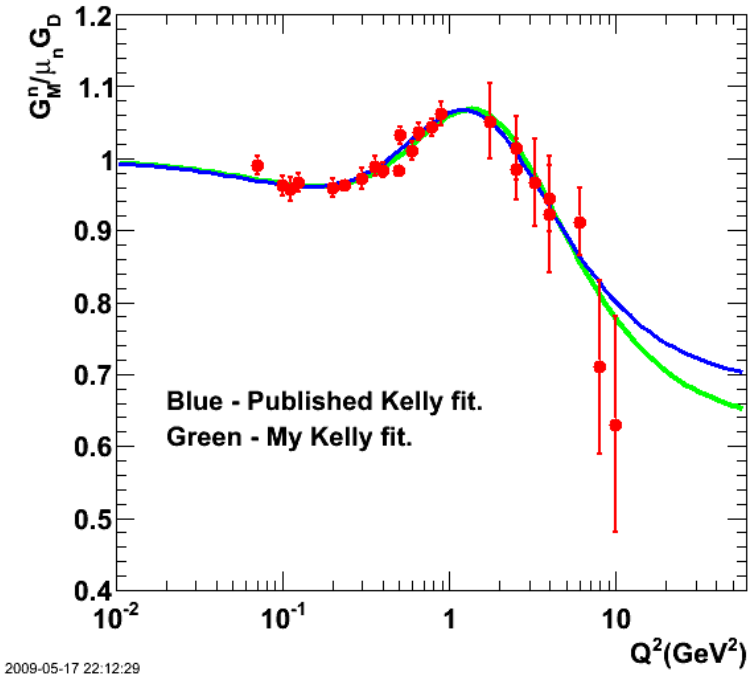


Fig 6. Comparison of Kelly fit and my fit for GMn. There are significant differences in the parameters, but the curves are similar until you get out past the data.

Click here to view the object (Root macro) you uploaded.

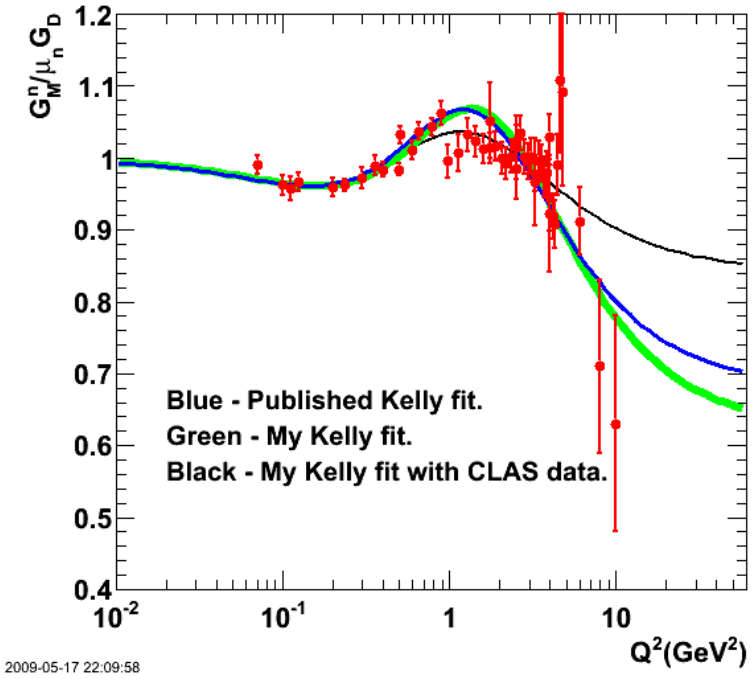


Fig 7. Comparison of fits to reduced GMn data.

Click here to view the object (Root macro) you uploaded.

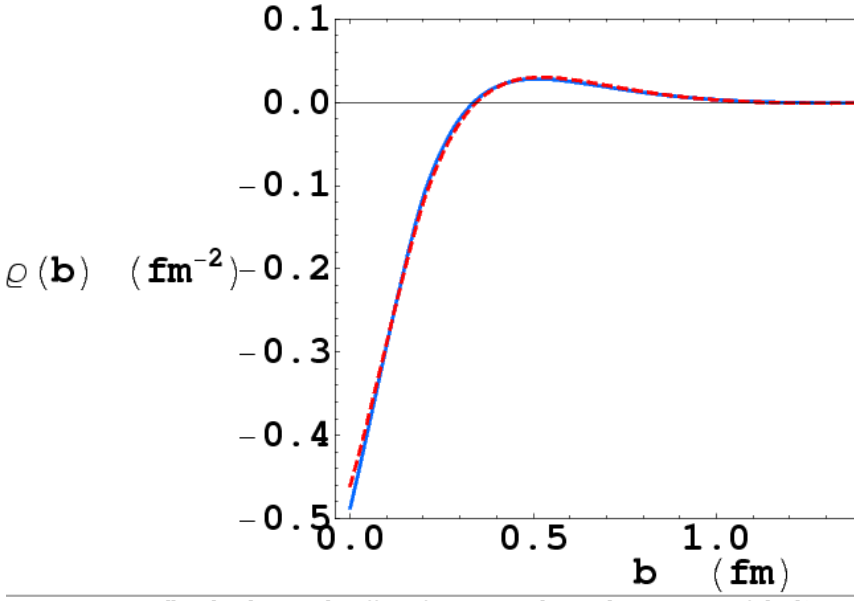


Fig 8. Jerry Miller plot showing the effect of CLAS GMn data on his extraction of rho(b).

Click here to view the object (eps file of Jerry Miller plot showing the effect of CLAS GMn data on his extraction of rho(b).) you uploaded.

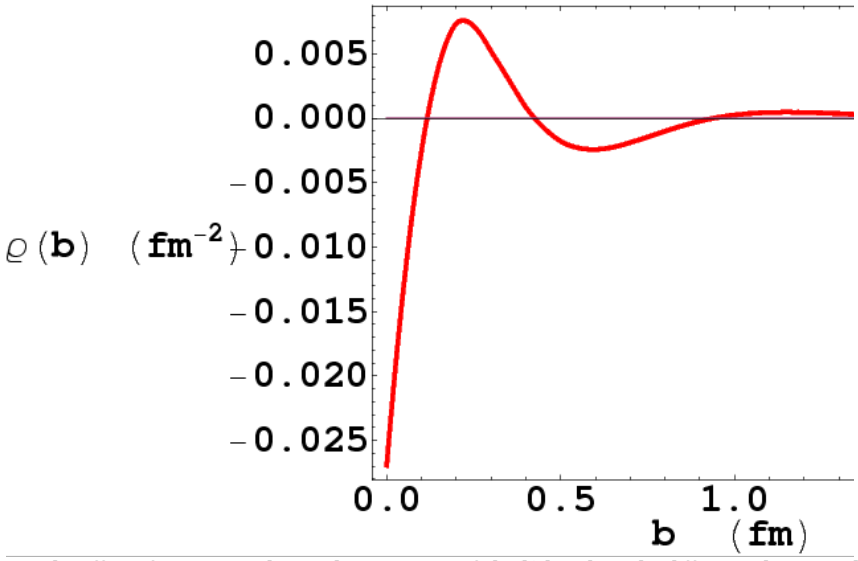


Fig 9. erry Miller plot showing the effect of CLAS GMn data on his extraction of rho(b) by taking the difference between rho(b) from the world data + CLAS data - rho(b) from the world data (i.e. the Jim Kelly fit).

Click here to view the object (eps file of Jerry Miller plot showing the effect of CLAS GMn data on his extraction of rho(b) by taking the difference between rho(b) from the world data + CLAS data - rho(b) from the world data (i.e. the Jim Kelly fit).) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 242 - Checking ALTp (gpg)

[Modified Thu Jun 25 13:38:20 2009 (GMT) gpg]

resurrecting ALTp analysis to complete it.

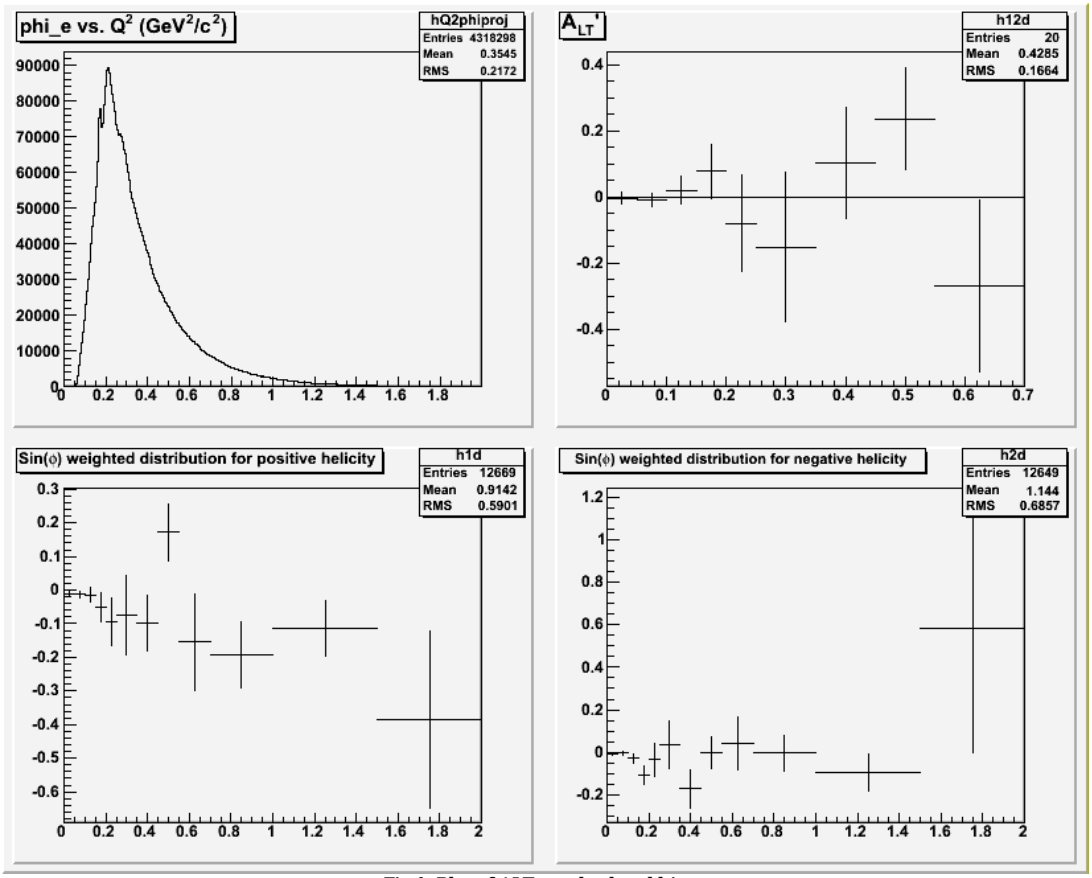


Fig 1. Plot of ALTp and related hists.

Click here to view the object (ROOT macor) you uploaded.

Code for ALTp

```
if (epn_event &&
    target_walls_ep &&
    quasielastic_cut &&
    //good_electron_fiducial &&
    //good_proton_fiducial &&
    //good_egiyan_threshold &&
    //good_electron_EC_fiducial &&
    //good_electron_EC_trk_coords_fiducial &&
    //good_sampling_fraction &&
    good_photoelectrons) {

  hp_m_W->Fill(missing3vec_mag,W1_corr);
  if(helicity_bit == 0) {
    hp_m_sin_phi_wghtplus4_W->Fill(missing3vec_mag,W1_corr,sinphi_weight);
    hp_m_unwghtplus4_W->Fill(missing3vec_mag,W1_corr);
  }
  if(helicity_bit == 1) {
    hp_m_sin_phi_wghtminus4_W->Fill(missing3vec_mag,W1_corr,sinphi_weight);
    hp_m_unwghtminus4_W->Fill(missing3vec_mag,W1_corr);
  }
}
```

Code for inclusives.

```
if (e_event &&
    target_walls_e &&
    //good_electron_fiducial &&
    //quasielastic_cut &&
    //Q2 < 0.5 &&
```

```
      //good_electron_fiducial &&
      //good_egiyan_threshold  &&
      //good_electron_EC_fiducial &&
      //good_electron_EC_trk_coords_fiducial &&
      //good_sampling_fraction &&
      good_photoelectrons
      ) {

      hW2->Fill(W2_corr);
      if ( phi_e_deg < -30) {
        hQ2a->Fill(Q2,phi_e_deg+360);
      } else {
        hQ2a->Fill(Q2,phi_e_deg);
      }
}
```

Add cut on QE events to inclusive Q2 dist and it drastically reduces the number of events.

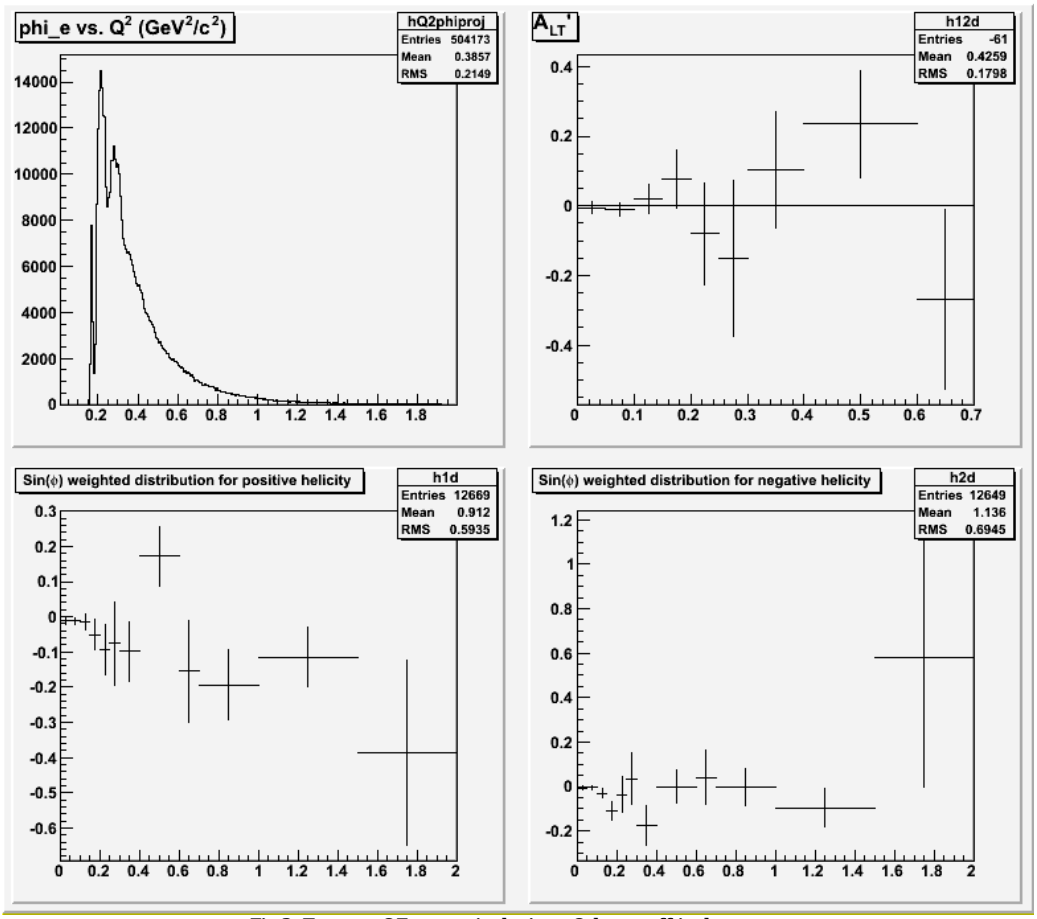


Fig 2. Turn on QE cut on inclusives. Other stuff is the same.

Click here to view the object (ROOT macro) you uploaded.

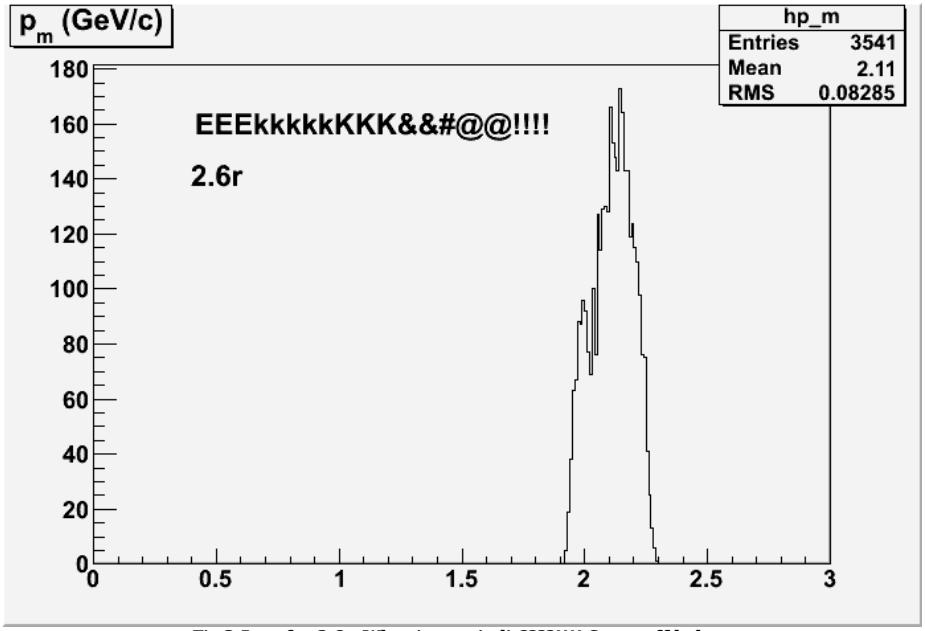
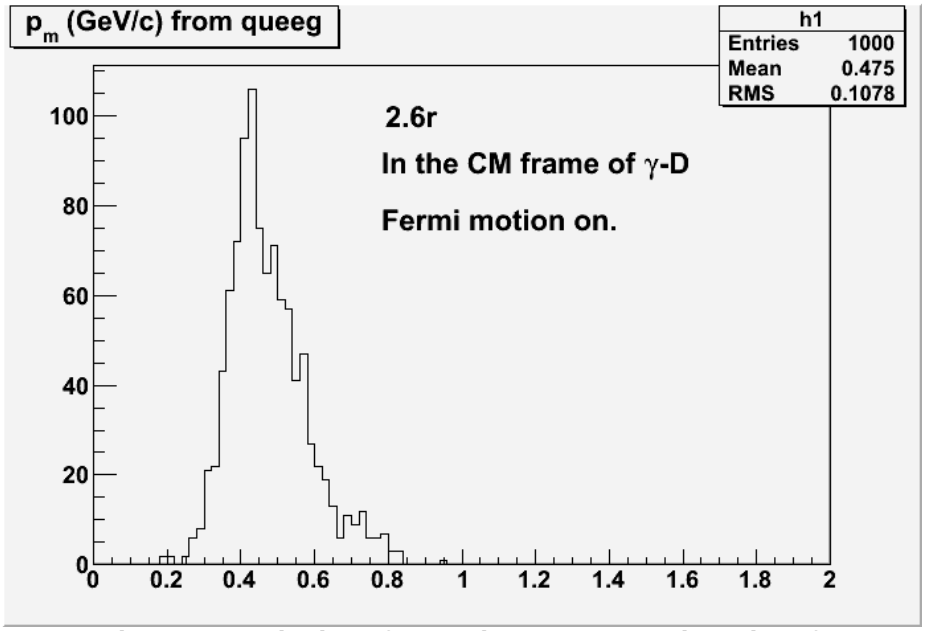


Fig 2.5 p_m for 2.6r. What is up wit dis????!!!! See stuff below.

Checking queeg.



2.6 Nucleon momentum distribution for 2.6r with Fermi motion turned on in the cm frame.

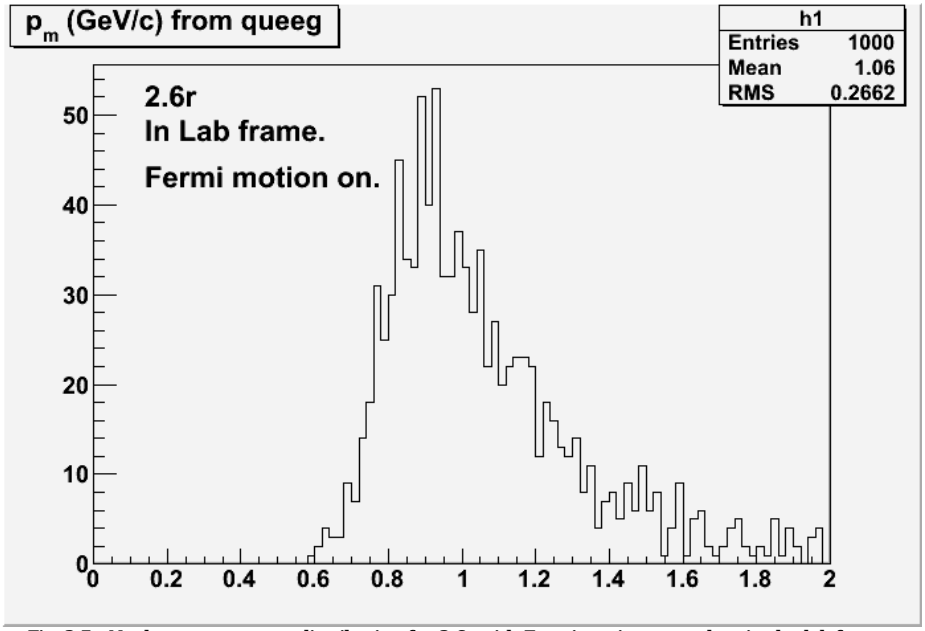


Fig. 2.7 - Nucleon momentum distribution for 2.6r with Fermi motion turned on in the lab frame.

Checking queeg. Plots below are for pfermi=0.0.

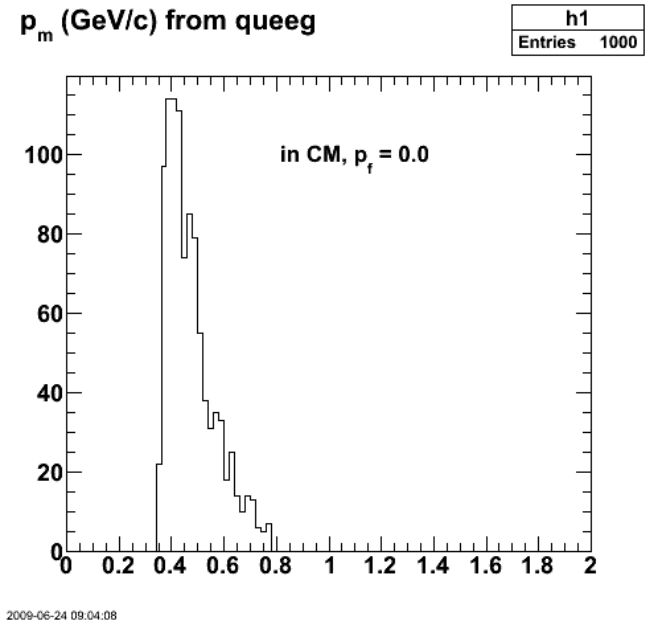


Fig 3. Nucleon momentum in the CM frame.

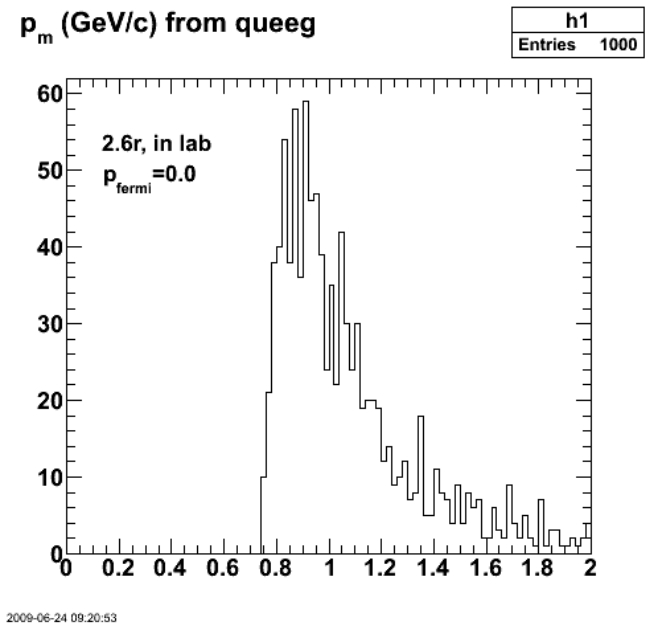


Fig 4. Nucleon momentum in the LAB frame.

Checking eod5c.C. It turns out the problem was that I had added some neutron analysis (ed2en) to study some GMn related issues and that was mucking up the p_m spectrum. I haven't figured out the details yet, but turning off the ed2en function gives me the following results for p_m.

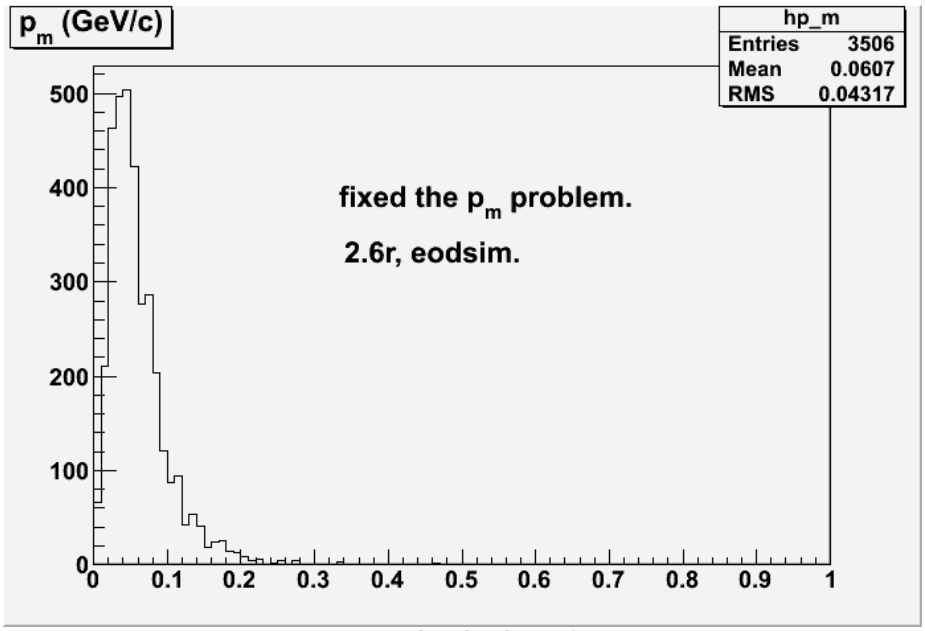


Fig 5. Corrected p_m distribution for 2.6r.

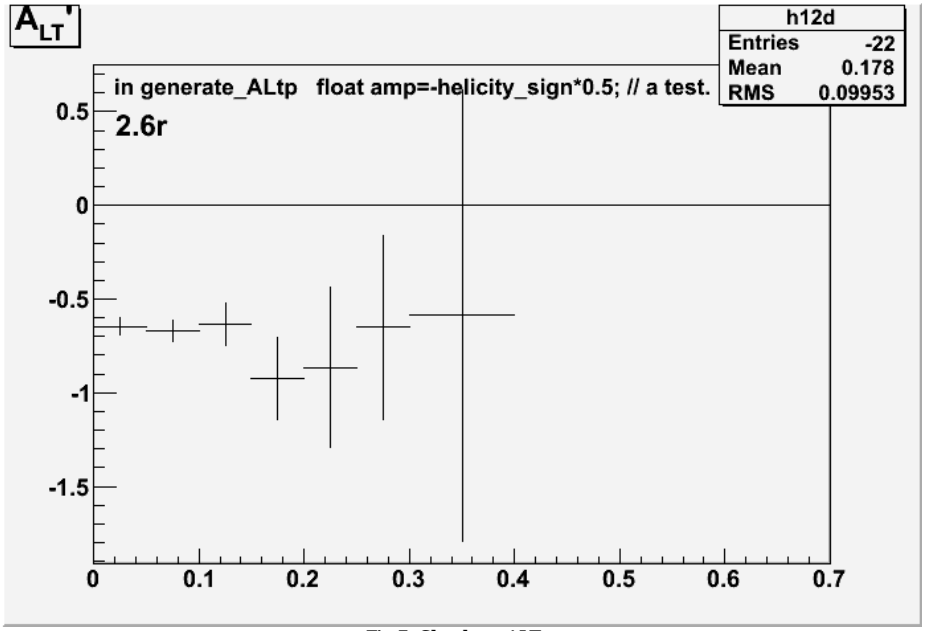


Fig 7. Check on ALTp.

```
root [20] h12d->Print("all")
TH1.Print Name  = h12d, Entries= -22, Total sum= -4.97841
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.645046, x=0.025, error=0.0476134
 fSumw[2]=-0.669286, x=0.075, error=0.0558014
 fSumw[3]=-0.636978, x=0.125, error=0.112385
 fSumw[4]=-0.926204, x=0.175, error=0.218768
 fSumw[5]=-0.865887, x=0.225, error=0.428779
 fSumw[6]=-0.650729, x=0.275, error=0.488753
 fSumw[7]=-0.584277, x=0.35, error=1.20987
 fSumw[8]=0, x=0.5, error=0
 fSumw[9]=0, x=0.65, error=0
 fSumw[10]=0, x=0.85, error=0
 fSumw[11]=0, x=1.25, error=0
 fSumw[12]=0, x=1.75, error=0
 fSumw[13]=0, x=2.08333, error=0
root [21]
```

Put in a fixed value for ALTp and things look good.

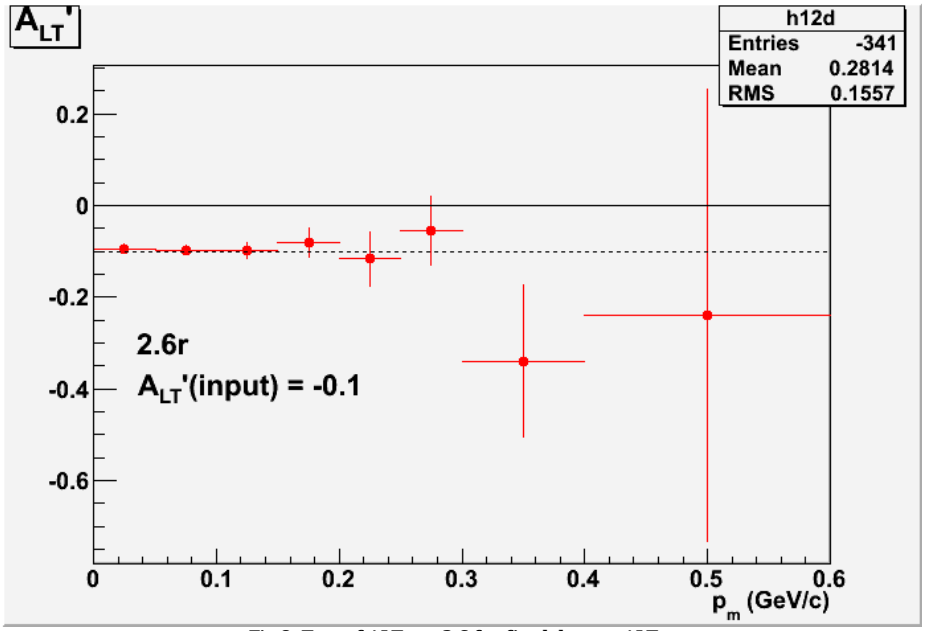


Fig 8. Test of ALTp at 2.6 for fixed, known ALTp.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

queeg command:

```
system("bpsh $NODE /home/gilfoyle/bin/Linux/myqueeg  -o queegsim.dat -E 2.558 -I 2250. -N $NEVNT -F 0.5 -R >> /scratch/gilfoyle/e5/sim_log${NODE} 2>&1");
```

```
root [79] h12d ->Print("all")
TH1.Print Name  = h12d, Entries= -341, Total sum= -1.1198
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.0961105, x=0.025, error=0.00730686
 fSumw[2]=-0.097381, x=0.075, error=0.00845579
 fSumw[3]=-0.0973601, x=0.125, error=0.0177545
 fSumw[4]=-0.0809599, x=0.175, error=0.0325667
 fSumw[5]=-0.115823, x=0.225, error=0.0588377
 fSumw[6]=-0.0543607, x=0.275, error=0.0759222
 fSumw[7]=-0.338873, x=0.35, error=0.164749
 fSumw[8]=-0.238936, x=0.5, error=0.49418
 fSumw[9]=0, x=0.65, error=0
 fSumw[10]=0, x=0.85, error=0
 fSumw[11]=0, x=1.25, error=0
 fSumw[12]=0, x=1.75, error=0
 fSumw[13]=0, x=2.08333, error=0
root [80]
```

Test the simulation with Calina's fit to the 2.6r data. Note that I had the sign wrong!!

The function

```
  float top = (-0.0652557*pow(pfermi2,2)) + (0.503095*pow(pfermi2,4));
  float bottom = 1 + (-11.0388*pfermi2) + (36.0937*pow(pfermi2,2)) + (-126.685*pow(pfermi2,4)) + (256.143*pow(pfermi2,6));
  float amp = -helicity_sign*top/bottom;
```

```
root [31] h12d->Print("all")
TH1.Print Name  = h12d, Entries= -7986, Total sum= 0.153707
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=0.00164308, x=0.025, error=0.00119103
 fSumw[2]=0.000755774, x=0.075, error=0.00140182
 fSumw[3]=0.00239838, x=0.125, error=0.00284316
 fSumw[4]=0.0221362, x=0.175, error=0.00535747
 fSumw[5]=0.0290465, x=0.225, error=0.00924209
 fSumw[6]=0.005432, x=0.3, error=0.0126138
 fSumw[7]=-0.0437412, x=0.45, error=0.024967
 fSumw[8]=0.136036, x=0.625, error=0.112876
 fSumw[9]=0, x=0.85, error=0
 fSumw[10]=0, x=1.125, error=0
 fSumw[11]=0, x=1.375, error=0
 fSumw[12]=0, x=1.75, error=0
 fSumw[13]=0, x=2.08333, error=0
root [32]
```

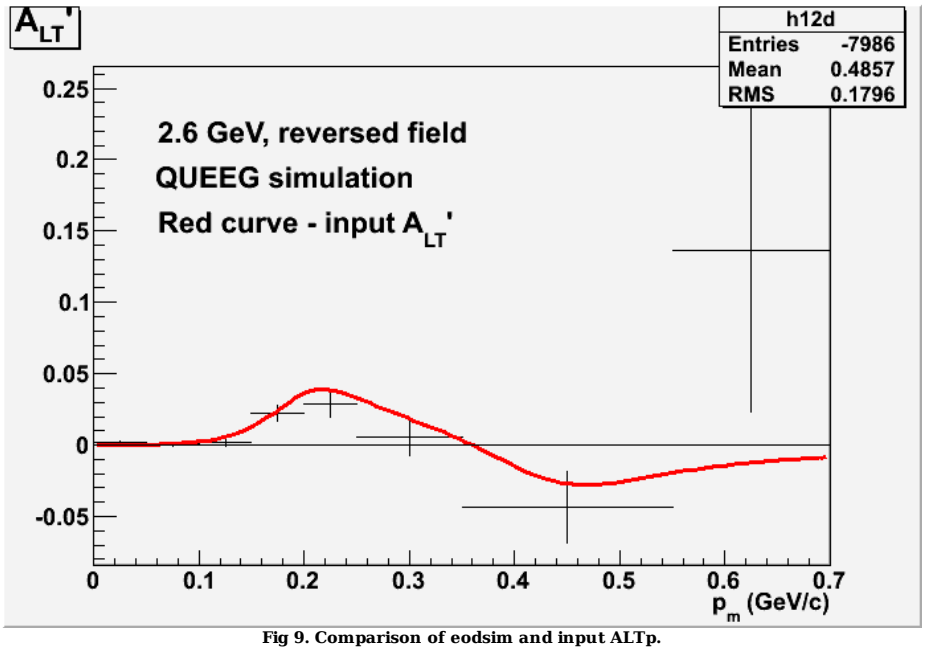


Fig 9. Comparison of eodsim and input ALTp.

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 243 - Checking Calina's Cut (gpg)

[Modified Wed Jul 8 14:58:02 2009 (GMT) gpg]

Tests for Calina's cut on p_m to speed up the simulation of ALTp at large missing momentum.

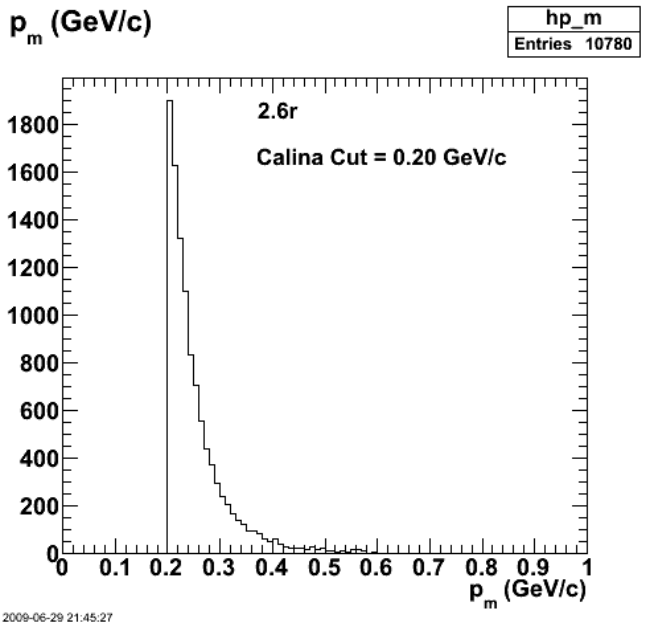


Fig 1. Missing momentum spectrum from test of Calina's cut.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Now run queeg with cc=0.15 for the Calina's fit to ALTp. Note that I have the choice of the helicity backwards to be consistent with the previous test here.

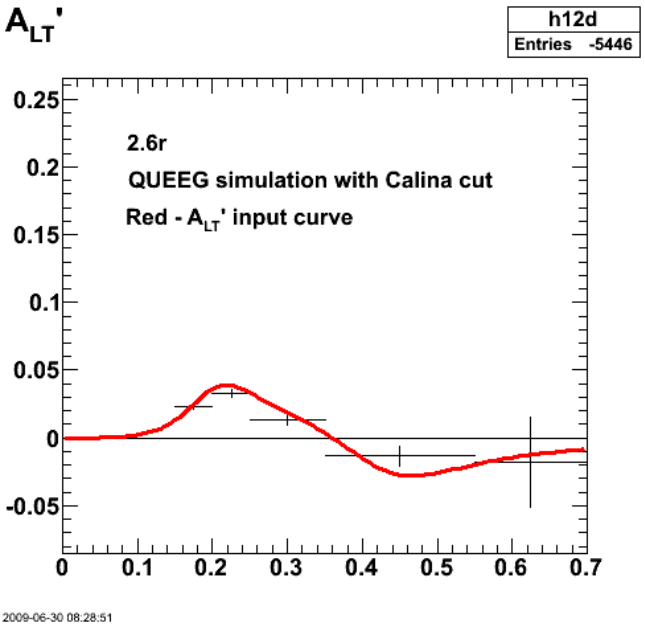


Fig 2. Comparison of input curve and simulated ALTp with Calina cut on.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

```
root [39] h12d->Print("all")
```

```
TH1.Print Name  = h12d, Entries= -5446, Total sum= -0.431304
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=0, x=0.025, error=0
 fSumw[2]=0, x=0.075, error=0
 fSumw[3]=-0.469957, x=0.125, error=0.52729
 fSumw[4]=0.023199, x=0.175, error=0.00158953
 fSumw[5]=0.0328378, x=0.225, error=0.0027468
 fSumw[6]=0.0136708, x=0.3, error=0.00373849
 fSumw[7]=-0.0130323, x=0.45, error=0.00735302
 fSumw[8]=-0.018022, x=0.625, error=0.0334181
 fSumw[9]=0, x=0.85, error=0
 fSumw[10]=0, x=1.125, error=0
 fSumw[11]=0, x=1.375, error=0
 fSumw[12]=0, x=1.75, error=0
 fSumw[13]=0, x=2.08333, error=0
root [40]
```

Now turn on GSIM and check the cut's effect on the p_m spectrum. It looks like the spread in p_m is reasonably small so this approach may work.

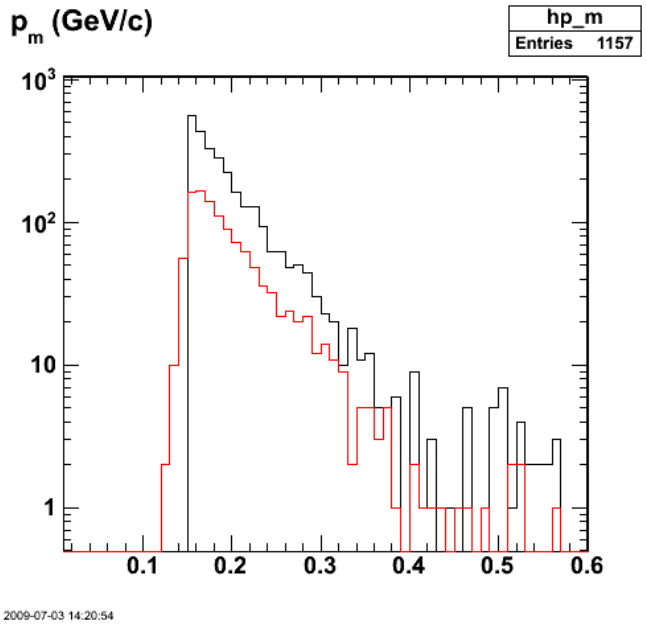


Fig 3. Comparison of p_m spectra for GSIM inputs (black histogram) and after processing through GSIM (red curve) for 2.6r.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file for PART banks) you uploaded.

Click here to view the object (Root histogram file for EVNT banks) you uploaded.

First production run.

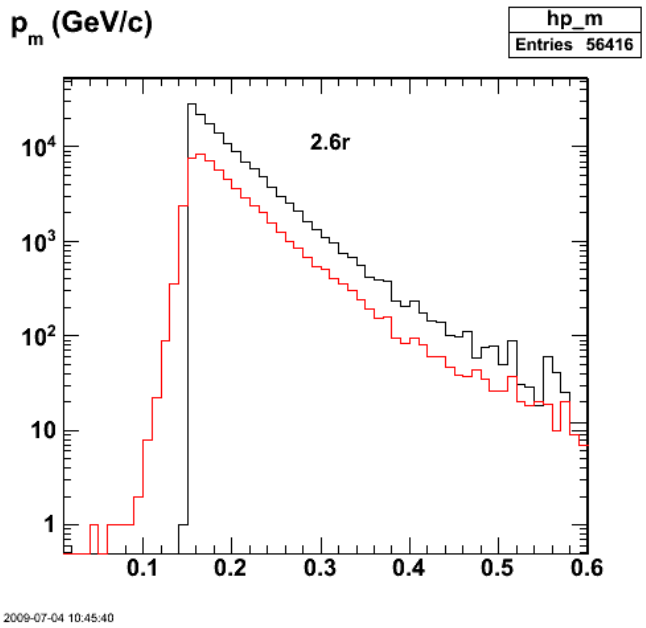


Fig 4. Test of first production run which is a longer version of fig 3.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file for EVNT banks) you uploaded.

Click here to view the object (Root histogram file for PART banks) you uploaded.

```
first production run

# set the number of events.
# for 60,000 events (plus the same number for the other helicity) and it takes 13.75 hrs.
#$NEVNT=54000;
$NEVNT=50000;
# number of loops while waiting for recsis in batch to get done. see line 163.
# time to reconstruct gpp data with recsis: 23 minutes for 60,000 thrown events. sleep
# 60 sec per loop.
#$NLOOPS=400;
$NLOOPS=35;
```

Second production run using the same number of GSIM events.

Click here to view the object (Root histogram file for EVNT banks) you uploaded.

Click here to view the object (Root histogram file for PART banks) you uploaded.

Checking stats on MC runs 1-2.

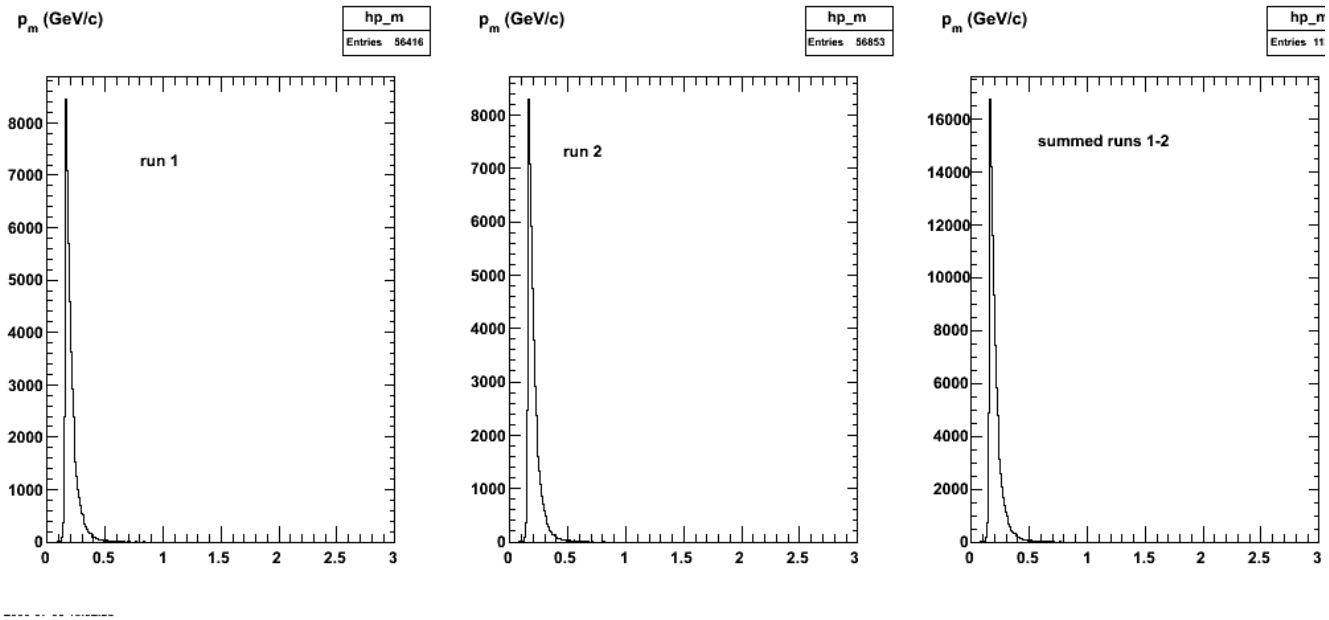


Fig 5. Checking stats on MC runs 1-2.

Disk use stats for MC prod run 2.

```
Source file 30: sim_parthistshpos51.root
pscm1:results> duc
Node 0: /dev/hda1              18G   12G  5.1G  71% /scratch
Node 1:
Node 2: /dev/hda1              18G   12G  5.3G  70% /scratch
Node 3:
Node 4:
Node 5: /dev/hda1              18G  3.4G   14G  20% /scratch
Node 6:
Node 7:
Node 8:
Node 9:
Node 10: /dev/hda1              18G   11G  6.2G  64% /scratch
Node 11:
Node 12: /dev/hda1              18G   12G  5.5G  69% /scratch
Node 13:
Node 14:
Node 15:
Node 16: /dev/hda1              18G  9.1G  7.9G  54% /scratch
Node 17:
Node 18:
Node 19:
Node 20:
Node 21:
Node 22:
Node 23:
Node 24:
Node 25: /dev/hda1              18G  8.9G  8.1G  53% /scratch
Node 26:
Node 27:
Node 28:
Node 29:
Node 30:
Node 31: /dev/hda1              18G   14G  3.6G  80% /scratch
Node 32: /dev/hda1              18G  9.0G  8.1G  53% /scratch
Node 33:
Node 34: /dev/hda1              18G   16G  1.5G  92% /scratch
Node 35: /dev/hda1              18G  7.1G   10G  42% /scratch
Node 36:
Node 37:
Node 38:
Node 39:
Node 40:
Node 41:
Node 42:
Node 43: /dev/hda1              18G  8.7G  8.4G  51% /scratch
Node 44: /dev/hda1              18G  7.2G  9.8G  43% /scratch
Node 45:
Node 46:
Node 47: /dev/hda1              18G  6.9G   11G  41% /scratch
Node 48:
Node 49:
Node 50: /dev/hda1              36G   17G   18G  50% /scratch
Node 51: /dev/hda1              36G   15G   20G  43% /scratch
pscm1:results> more ../postsim.pl
#!/usr/bin/perl
```

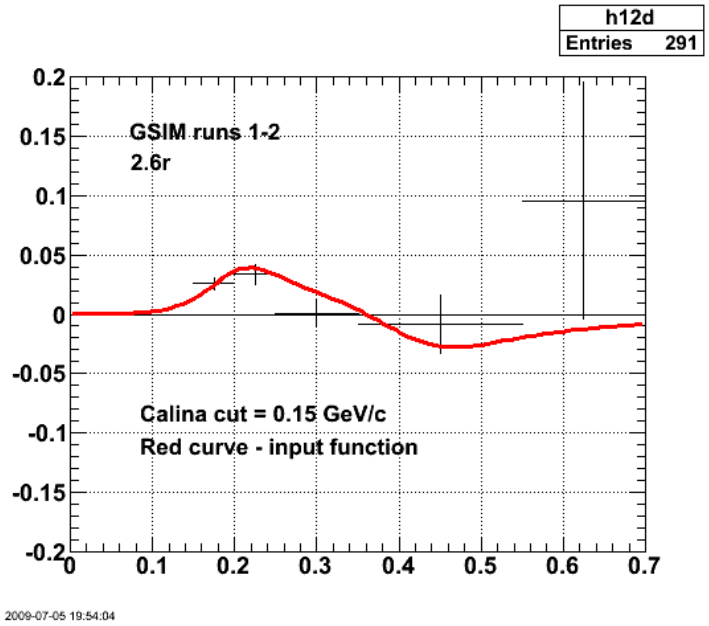


Fig 6. Comparison of ALTp from gsim runs 1-2 and input ALtp (EVNT bank).

Click here to view the object (Root macro) you uploaded.

Third production run using the same number of gsim events.

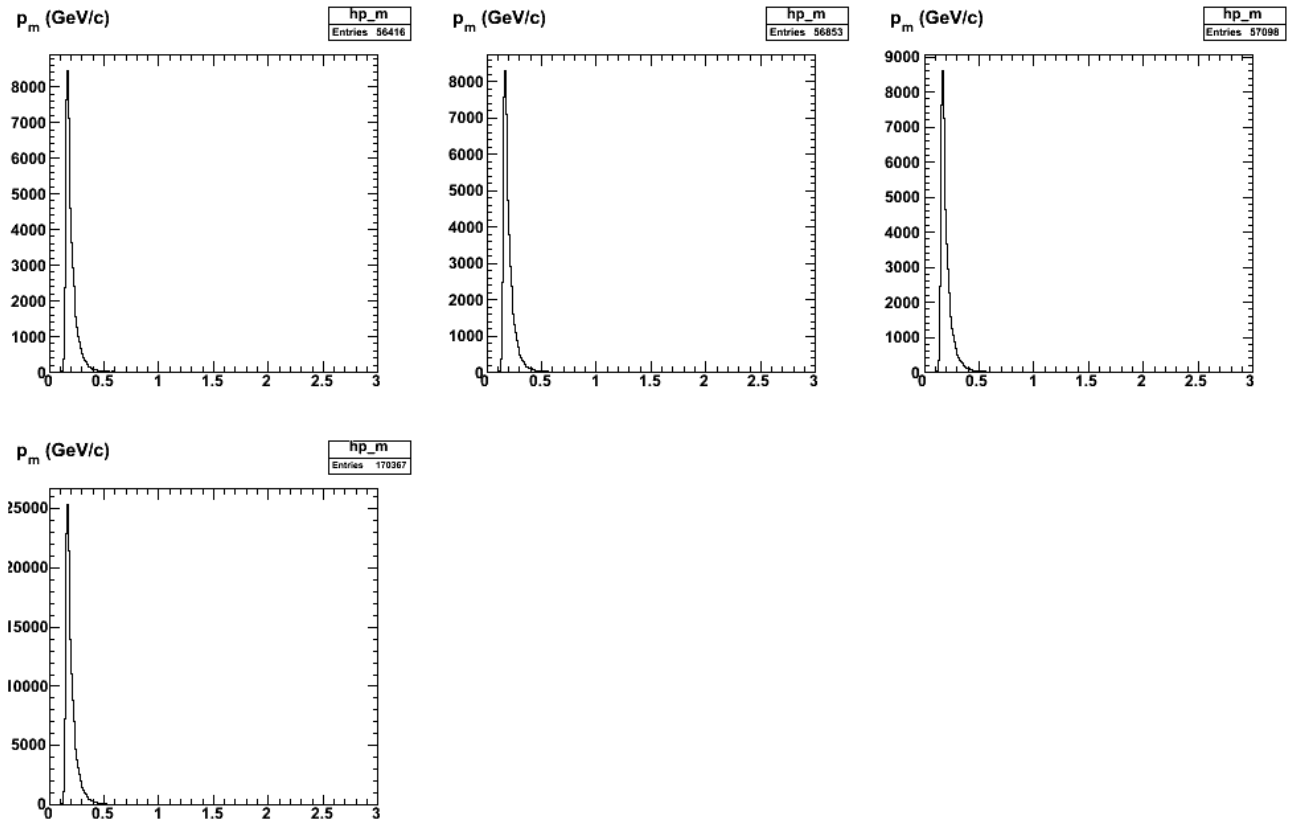


Fig 7. Check on gsim production run 3 for 2.6r. Top row is runs 1-3 from left ot right. Bottom row is sum.

Click here to view the object (Root histogram file for EVNT banks) you uploaded.

Click here to view the object (Root histogram file for PART banks) you uploaded.

Click here to view the object (Root macro) you uploaded.

ALTp for runs 1-3. Some of the bins suddenly look low. Perhaps some simulation runs did not work for one of the helicities. I found this for run 5, but I did not check runs 3-4.

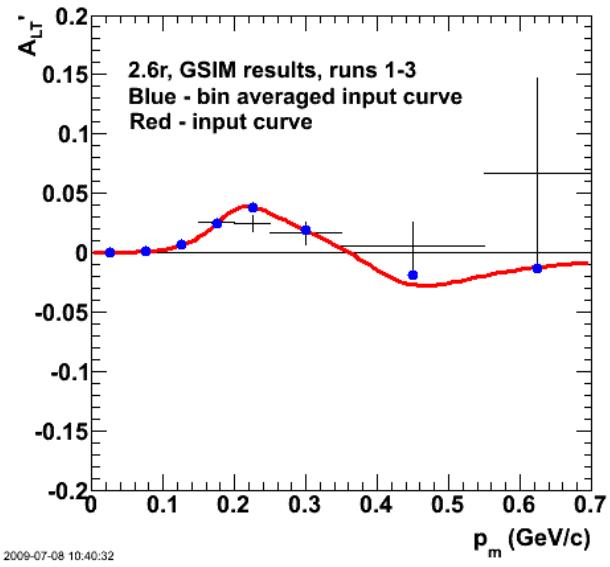


Fig 7.1 ALTp for runs 1-3. Some of the bins suddenly look low. Perhaps some simulation runs did not work for one of the helicities.

Click here to view the object (ROOT macro) you uploaded.

Fourth 2.6r prod run. ALTp looks weird.

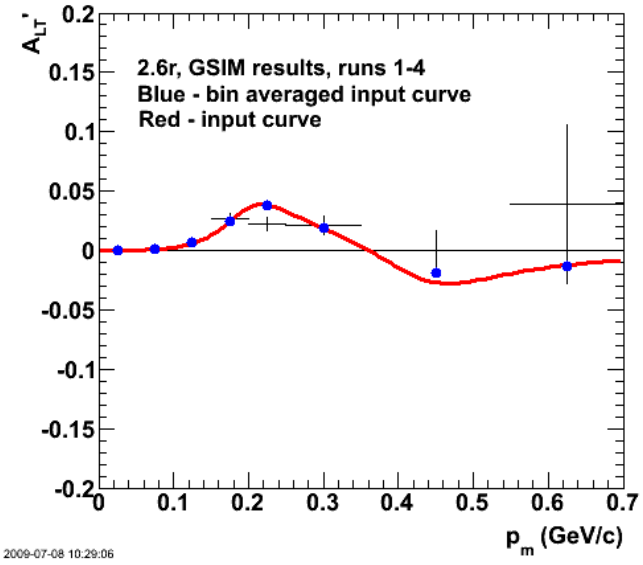


Fig 8. ALTp for 2.6r prod runs 1-4. Threshold = 0.15. 2nd good bin looks low!

Click here to view the object (ROOT macro) you uploaded.

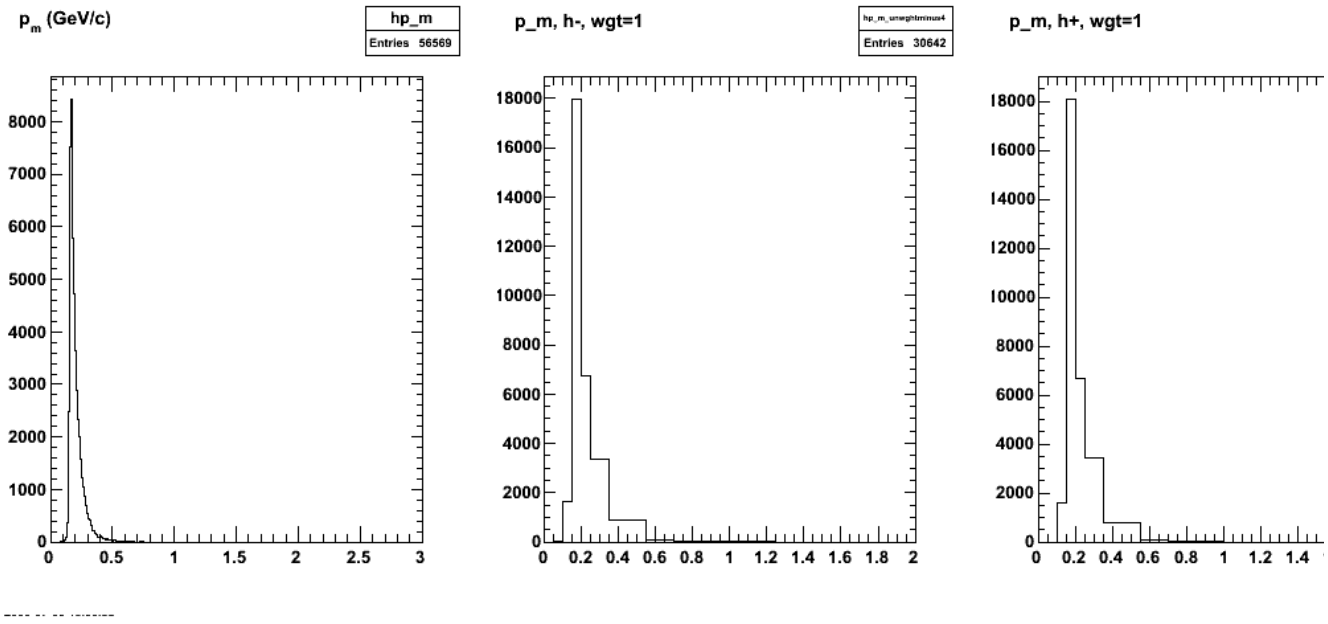


Fig 9. Check run 2.6r prod run 4.

Click here to view the object (ROOT macro) you uploaded.

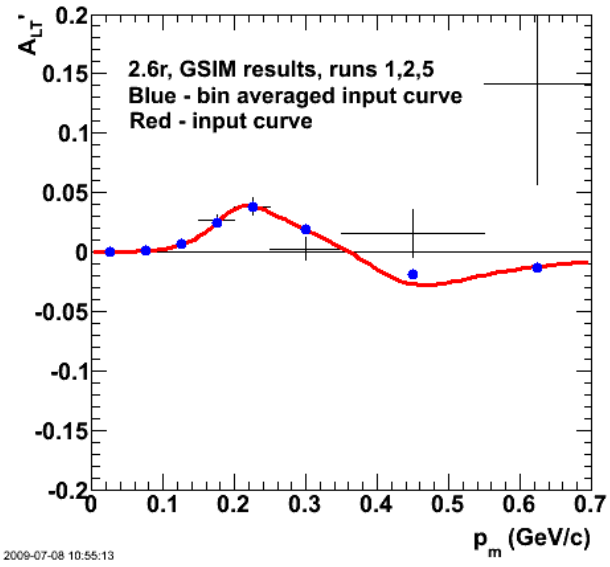


Fig 10. Just use runs 1,2,5 to extract ALTp. Things look better.

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 244 - Testing gemc with electrons and neutrons (gpg)

[Modified Wed Jul 15 02:40:48 2009 (GMT) gpg]

First tests of gemc for electrons and neutrons generated from the internal gemc event generator.

First electrons.

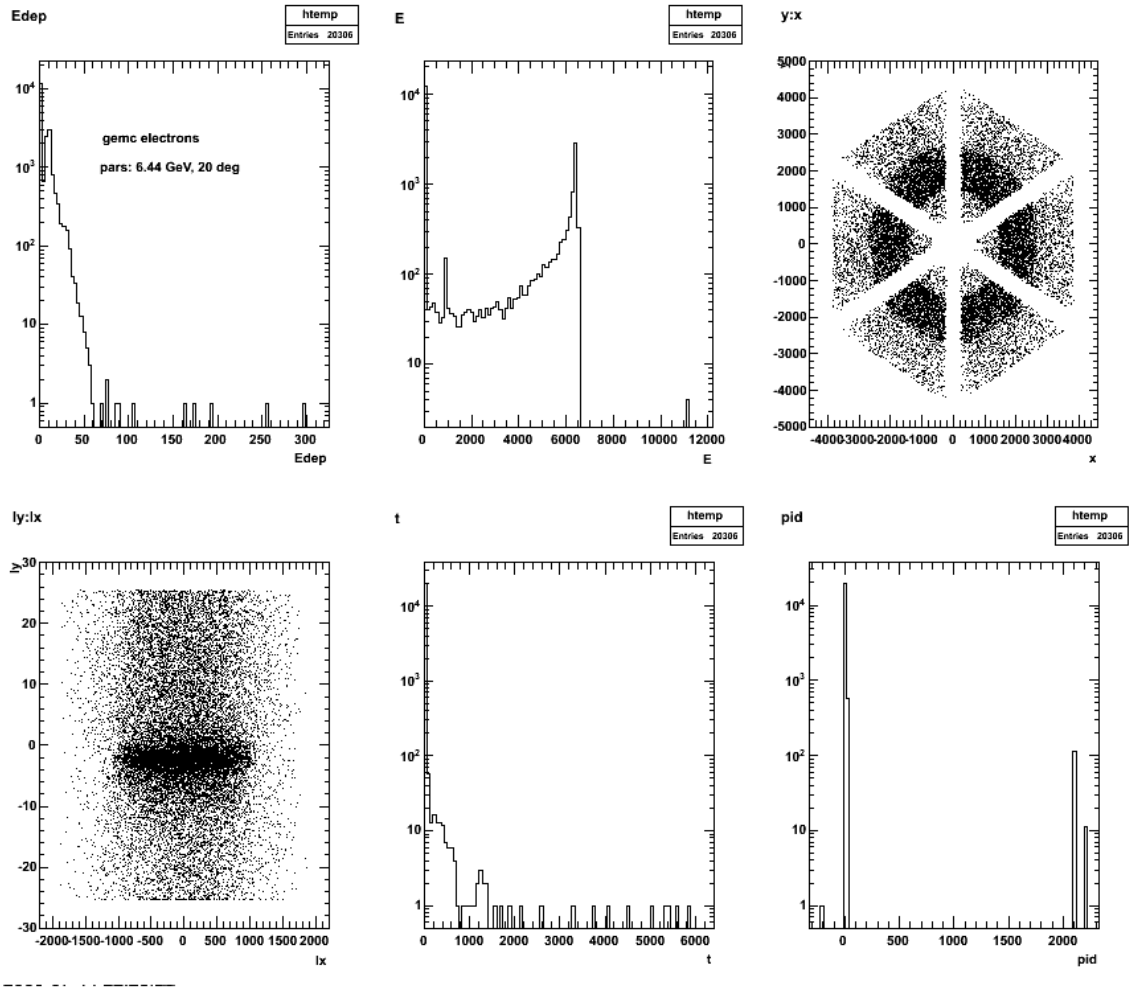


Fig 1. Electron results.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root Tree file.) you uploaded.

Now neutrons.

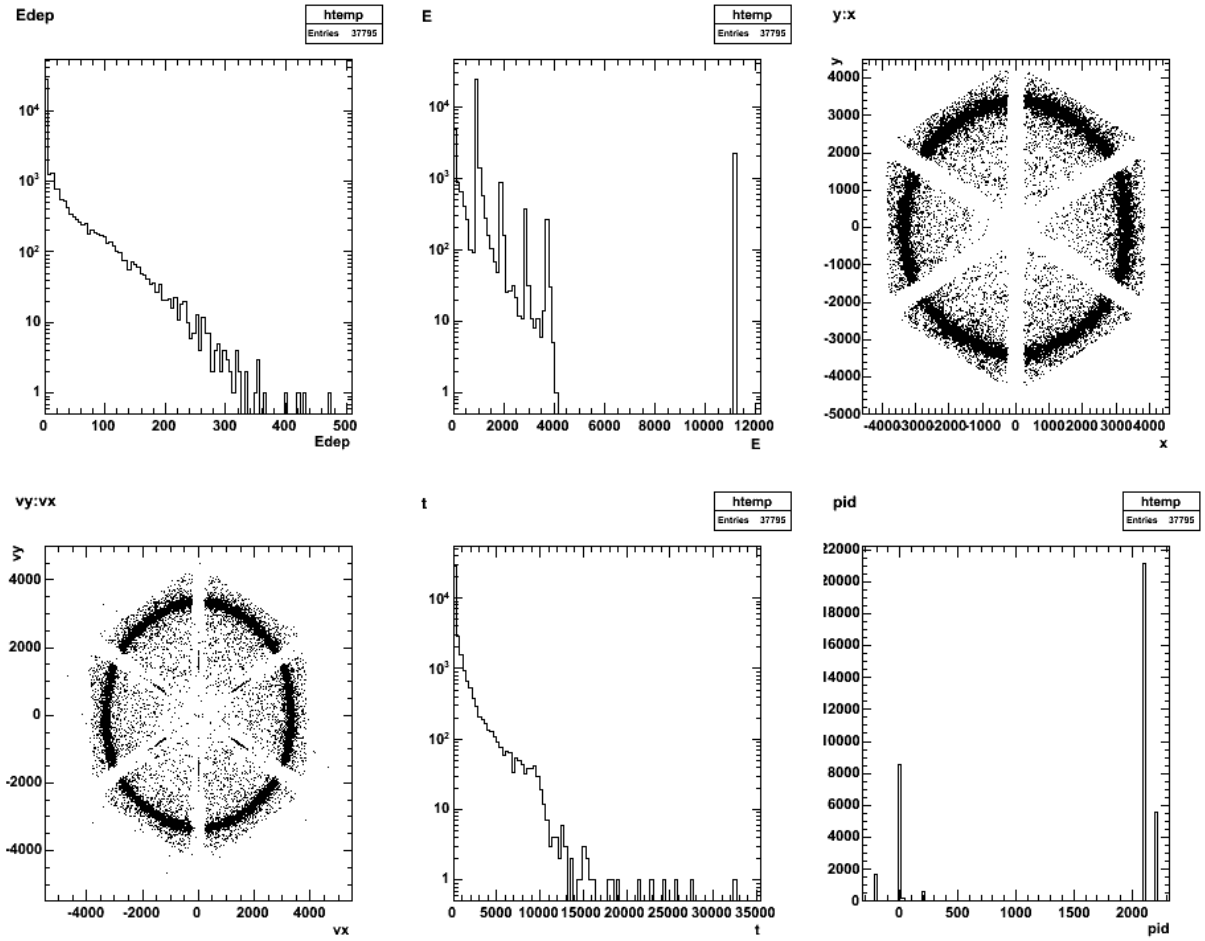


Fig 2. Neutron results.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (log file.) you uploaded.

Click here to view the object (Root Tree file.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 245 - First study of neutron efficiency in CLAS12 TOF (gpg)

[Modified Wed Aug 5 02:10:27 2009 (GMT) gpg]

Socrat was modified to produce a histogram file containing histograms of the neutron momentum calculated from the electron information and assuming elastic scattering. Electrons were randomly distributed in the range θ_e = 20-30 deg with energies appropriate for 11-GeV electrons scattering from neutrons. No attempt was made to consider the Fermi motion. There are just two histograms in the file each with different requirements. Below is a plot of the neutron momentum distribution for found events (black) and reconstructed ones (red). Found here means an event where forward tracking was successful (ForwardTrack==1) so we have a good electron. Reconstructed here means we have a good electron AND a hit in the otofp1a that is within 10 deg of the direction expected for the neutron based on the electron information. Based on 5000 thrown events.

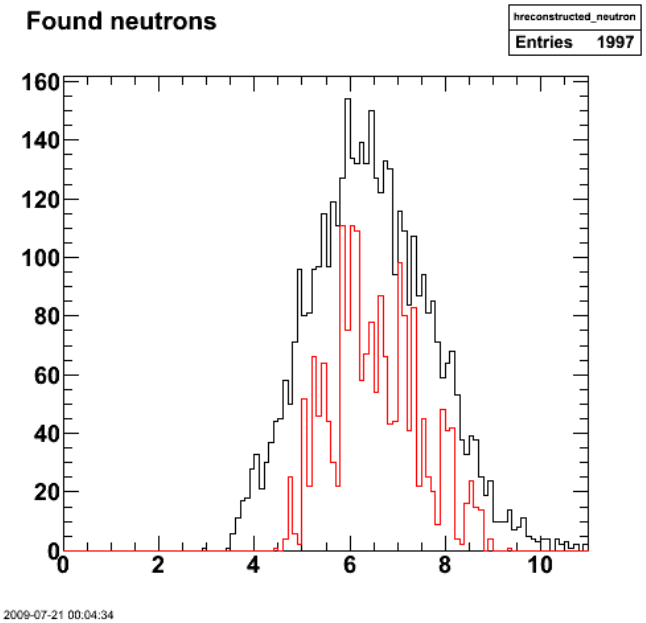


Fig 1. Momentum spectrum of found neutrons (black) and reconstructed ones (red). The rapid changes in the reconstructed neutron momentum are puzzling!!

Click here to view the object (Root macro to make Fig 1.) you uploaded.

Click here to view the object (Root histogram file used for Fig 1.) you uploaded.

Click here to view the object (Root Tree file produced by Socrat.) you uploaded.

Other information used in the analysis.

Click here to view the object (Socrat.opt file.) you uploaded.

Click here to view the object (Large (14 MByte) event file used as input to Socrat. File is in root format (en_results.root) and was produced with gemc_evio2root from en_results.ev generated by gemc) you uploaded.

Socrat ran at wildly changing speeds while analyzing the simulation results. The runtime output from Socrat is shown below.

```
**************************************************
Socrat loaded the following inputs from the option file:
Forward tracking will be run
Geant mode: 1
Geant file is: /home/gilfoyle/research/gemc/run/en_results.root
----- Additional parameters -----
Number of events to be processed: 1500
Kalman Filter mode: 1
Fill the output root tree: 1
Energy cut for the DC is 100 eV
Energy cut for the SVT is 20 keV
Energy cut for the CTOF is 1 MeV
1st wire in DC has +6 degrees angle
DC ministagger is 500 microns
Torus polarity is 1
**************************************************
reading torus field map (can take several minutes)...
now reading solenoid field map...
seed is 1248140587
200  (elapsed time: 234s, i.e. 1170ms per event)
400  (elapsed time: 252s, i.e. 630ms per event)
600  (elapsed time: 281s, i.e. 468.333ms per event)
800  (elapsed time: 298s, i.e. 372.5ms per event)
1000  (elapsed time: 316s, i.e. 316ms per event)
1200  (elapsed time: 333s, i.e. 277.5ms per event)
1400  (elapsed time: 351s, i.e. 250.714ms per event)
```

```
1600  (elapsed time: 368s, i.e. 230ms per event)
1800  (elapsed time: 2105s, i.e. 1169.44ms per event)
WARNING!! Too many track candidates in DC: 56 (max is 50) - event 1814 discarded
2000  (elapsed time: 2122s, i.e. 1061ms per event)
2200  (elapsed time: 2140s, i.e. 972.727ms per event)
2400  (elapsed time: 2157s, i.e. 898.75ms per event)
2600  (elapsed time: 2200s, i.e. 846.154ms per event)
WARNING!! Too many track candidates in DC: 70 (max is 50) - event 2616 discarded
2800  (elapsed time: 2218s, i.e. 792.143ms per event)
3000  (elapsed time: 2235s, i.e. 745ms per event)
3200  (elapsed time: 2256s, i.e. 705ms per event)
WARNING!! Too many track candidates in DC: 56 (max is 50) - event 3253 discarded
3400  (elapsed time: 2276s, i.e. 669.412ms per event)
3600  (elapsed time: 3399s, i.e. 944.167ms per event)
3800  (elapsed time: 3417s, i.e. 899.211ms per event)
4000  (elapsed time: 3434s, i.e. 858.5ms per event)
4200  (elapsed time: 3494s, i.e. 831.905ms per event)
4400  (elapsed time: 4318s, i.e. 981.364ms per event)
4600  (elapsed time: 4335s, i.e. 942.391ms per event)
4800  (elapsed time: 7982s, i.e. 1662.92ms per event)
5000  (elapsed time: 8000s, i.e. 1600ms per event)
*****************************************************
The root output tree has been created and filled
```

Sebastien notices that the magnetic field maps were not being read in correctly. Now the plot looks like this.

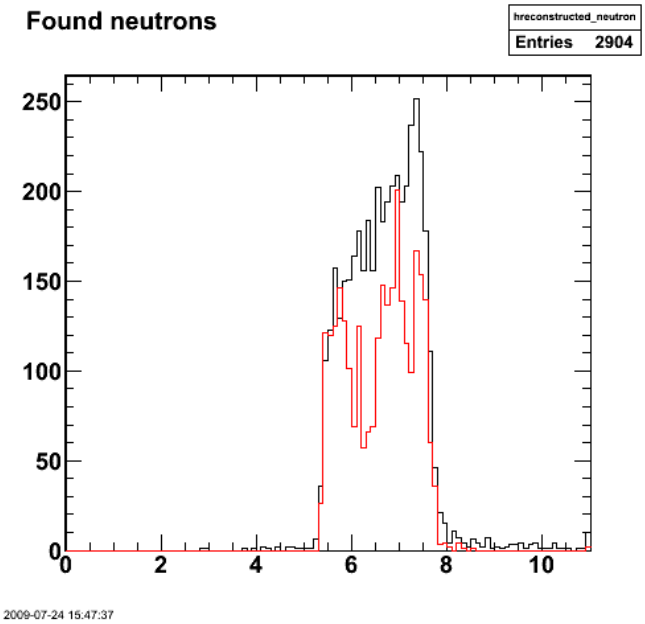


Fig 2. After redoing the analysis with the right magnetic field files.

Why is there a bin with more reconstructed than found neutrons??? Why are there so many reconstructed neutrons relative to the found ones. From CLAS6, we only expect about 8-10% efficiency.

Effect of reading in the correct magnetic field map.

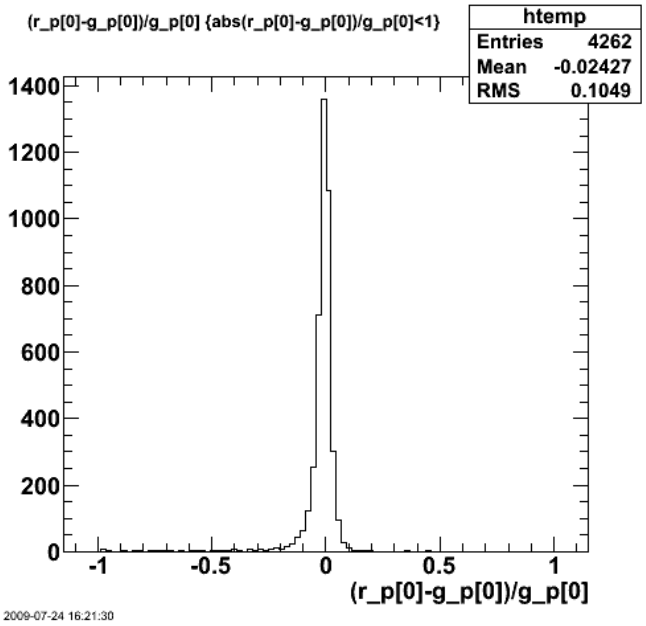


Fig 3. Momentum resolution from Socrat with the correct magnetic field. using the command T->Draw("(r_p[0]-g_p[0])/g_p[0]","abs(r_p[0]-g_p[0])/g_p[0]<1")

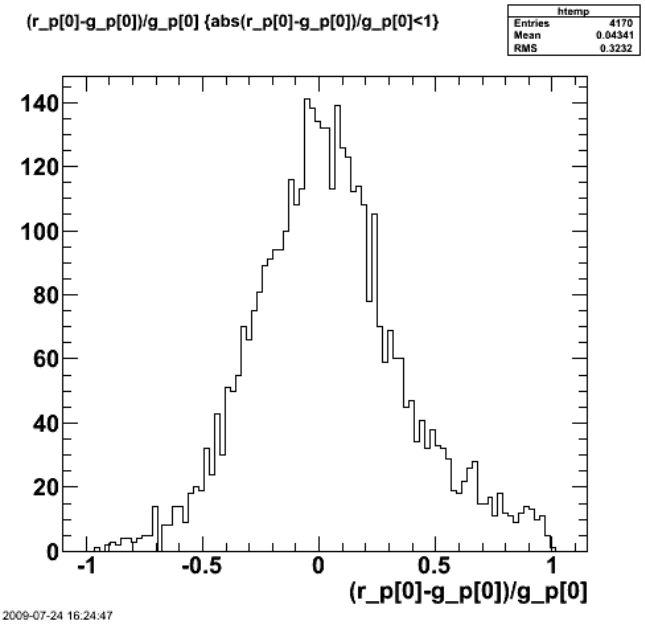


Fig 4. Momentum distribution with the wrong magnetic field map.

Fix the identification of found neutrons by identifying events where the predicted neutron position (derived from the electron information only) lies within the face of OTOFP1A.

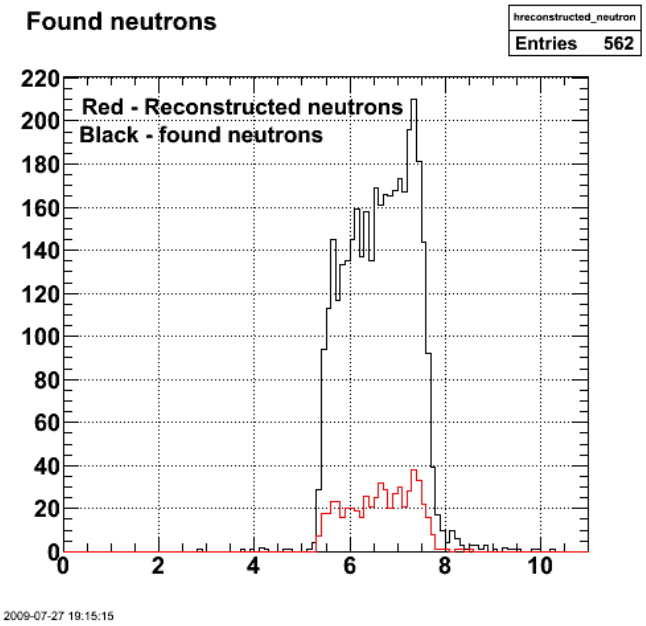


Fig 4. Corrected neutron momentum spectra. For elastic e-n scattering with θ_e = 20-30 deg and Ebeam=11 GeV.

Click here to view the object (ROOT macro) you uploaded.

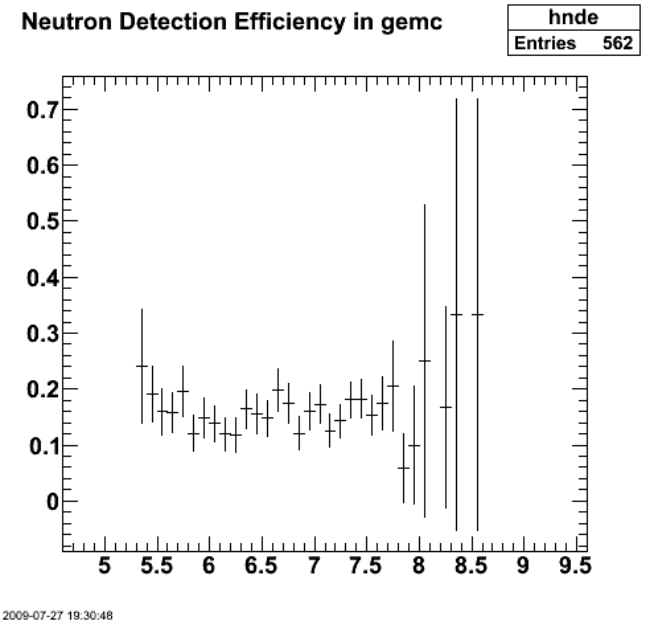


Fig 5. NDE for 11 GeV

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

For comparison consider the results from the CLAS6 GMn measurement below.

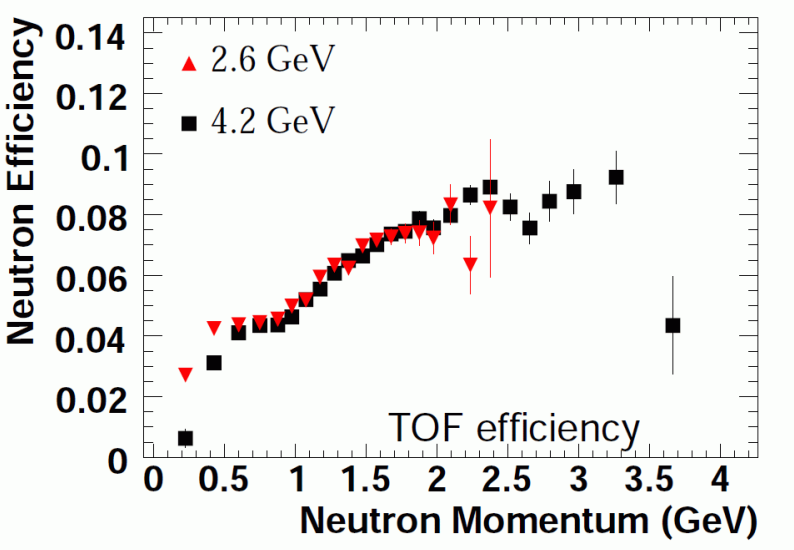


Fig 6. CLAS6 neutron detection efficiency measured with the p(e,e'pi+n) reaction.

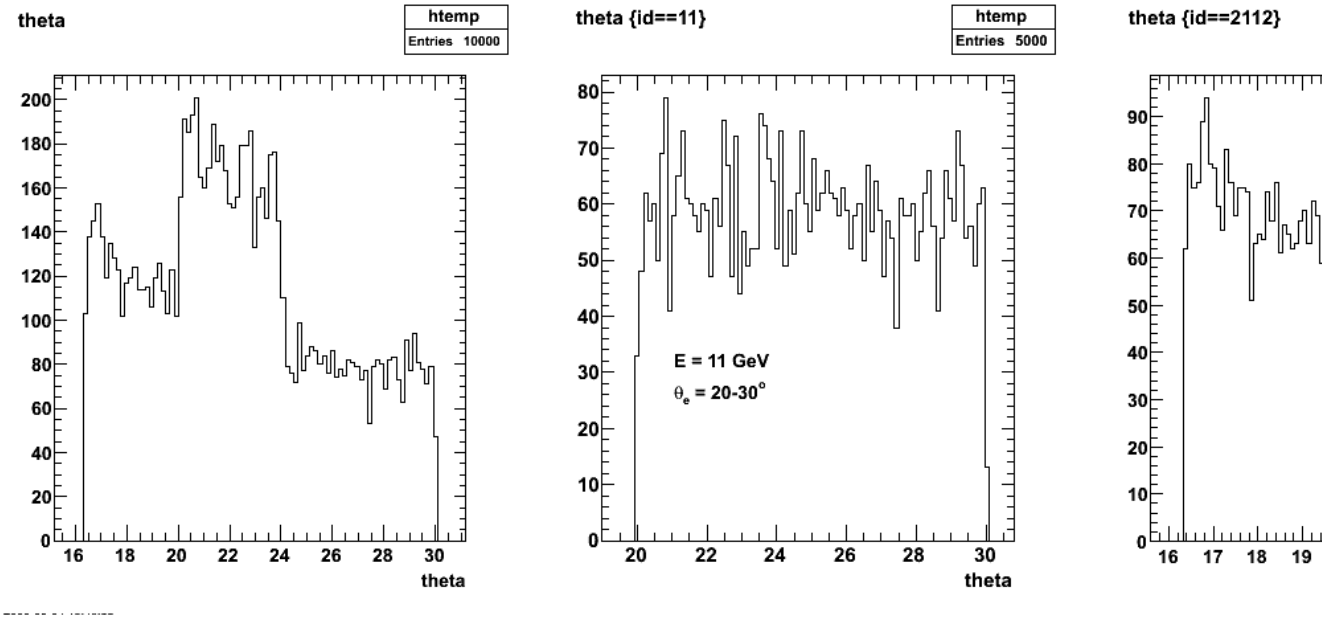
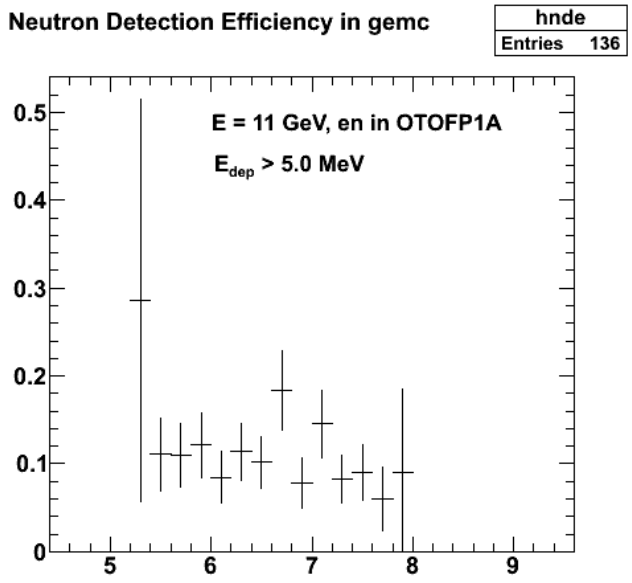


Fig 7. Angular distribution for electrons and neutrons to go along with Figs 4-5.

Add a cut on Edep to reduce the photon background and get the following. Note that NDE goes down to about 0.1 which is closer to the CLAS6 result and the range of neutron momentum has shrunk.



2009-08-04 16:58:19

Fig 8. Same as figure 5 with bigger bins (2x) and with a cut Edep>5 MeV.

Click here to view the object (Root macro) you uploaded.

Now do a long (N=50000) run.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 246 - TOF P1A positions (gpg)

[Modified Fri Jul 24 15:41:16 2009 (GMT) gpg]

Using files listed below to get positions of otofp1a.

```
gpgl:otof> pwd
/usr/local/gemc/production/database_io/clas12/geo/otof
gpgl:otof> dir
total 40
-rw-r--r-- 1 root root  3513 2009-06-18 11:35 ftof_counters_feb08.txt   <--- using this one.
-rw-r--r-- 1 root root    98 2009-06-18 11:35 geo_table_commands
-rwxr-xr-x 1 root root   293 2009-06-18 11:35 go_table*
-rw-r--r-- 1 root root   939 2009-06-18 11:35 panel1a.txt
-rw-r--r-- 1 root root  2186 2009-06-18 11:35 panel1b.txt
-rw-r--r-- 1 root root   202 2009-06-18 11:35 panel2.txt
-rwxr-xr-x 1 root root 14384 2009-06-18 11:35 tof_outer_build.pl*
```

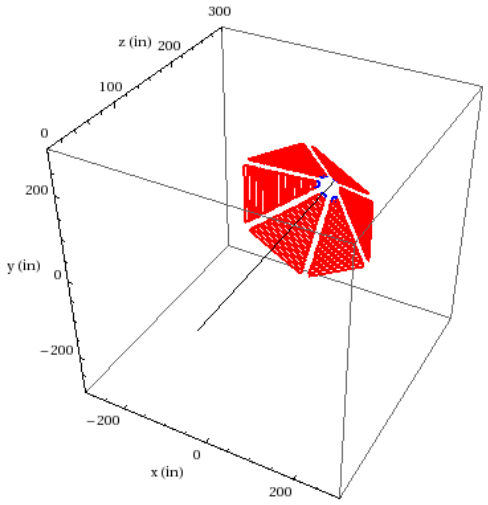


Fig 1. Plot of the otofp1a paddles using files mentioned above.

Click here to view the object (Mathematica notebook) you uploaded.

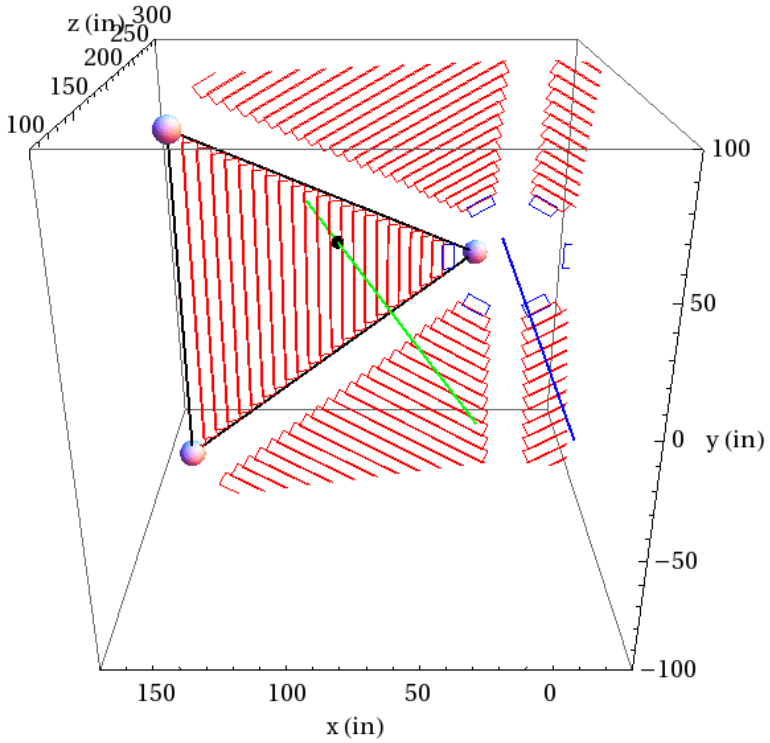
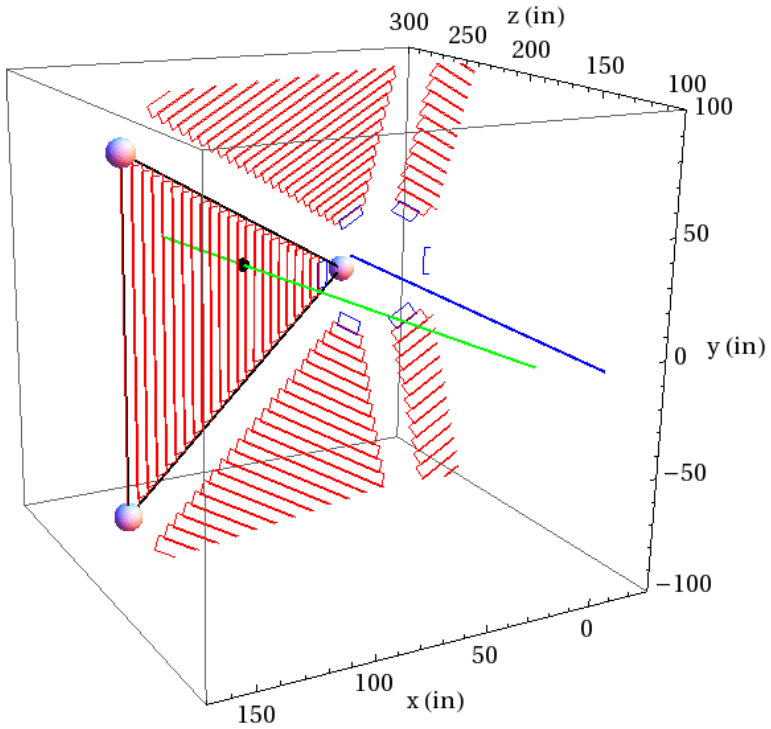


Fig 2. Plot showing the straight track and the intersection point with the TOF. The colored spheres mark out the triangle that encloses the OTOF. The black sphere is the intersection of the neutron tracks and the plane of the OTOFP1A.

Click here to view the object (Mathematica notebook) you uploaded.



DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 247 - MM2 systematic uncertainty (gpg)

[Modified Wed Aug 12 13:04:43 2009 (GMT) gpg]

Checking on Matt's work on the MM2 systemtatic uncertainty and to get some nice plots.

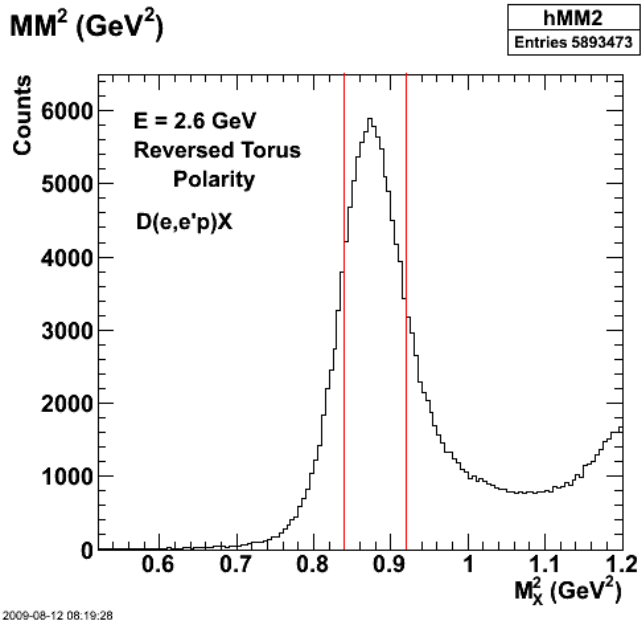


Fig 1. MM2 spectrum for 2.6r data with default MM2 cut.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

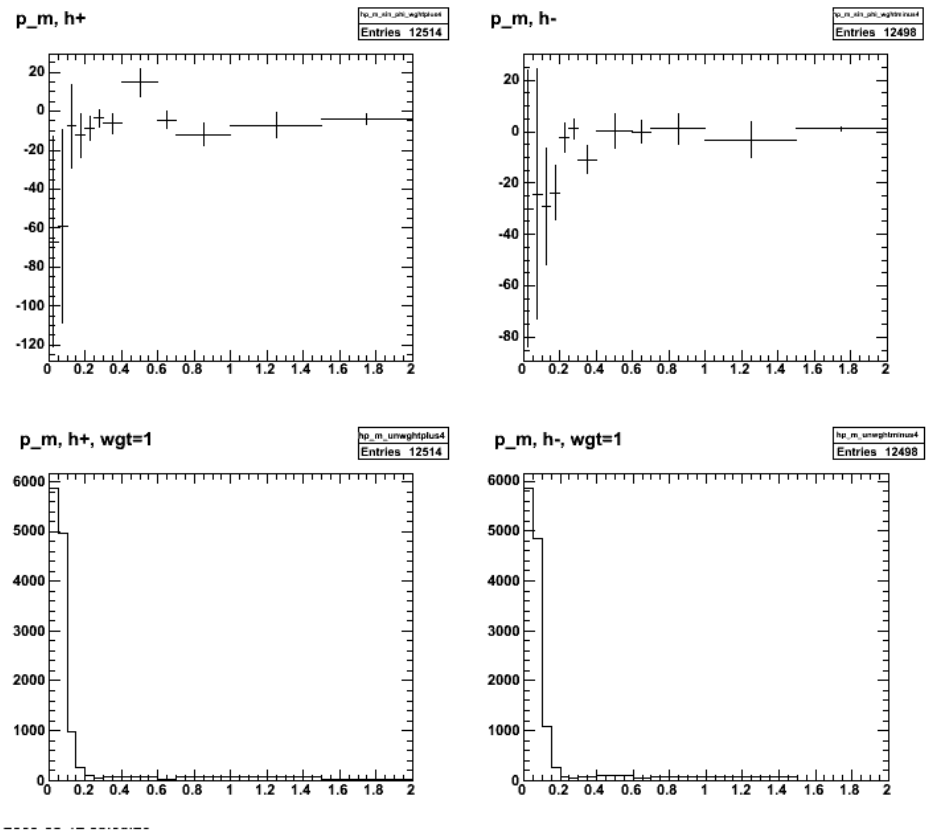


Fig 2. INputs to fig 1.

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 248 - Checking 2.6r ALTp (gpg)

[Modified Mon Aug 17 18:14:01 2009 (GMT) gpg]

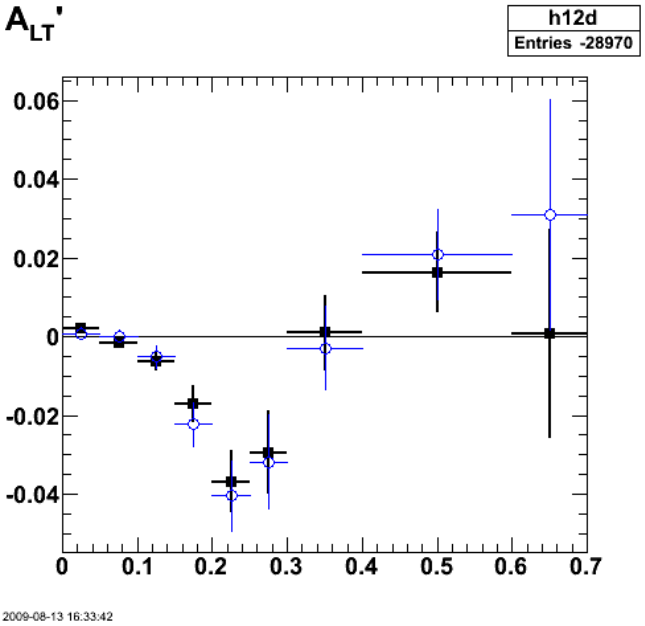


Fig 1. ALTp with efids and pfids off and comparison of ALTp at 2.6r with different MM2 cuts for the neutron. Blue is optimum value and black is the same center, but 50% wider.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Click here to view the object (Gzipped tar file of eod5c directory.) you uploaded.

Values for MM2 cuts (optimum and test for systematic uncertainty).

```
Double_t neutron_mm2_lo = 0.84, neutron_mm2_hi = 0.92;  // default values
Double_t neutron_mm2_lo2 = 0.82, neutron_mm2_hi2 = 0.94;  // test systematic uncertainty.
```

Cuts for fig 1.

```
      if (epn_event &&
          target_walls_ep &&
          quasielastic_cut &&
          //good_electron_fiducial &&
          //good_proton_fiducial &&
          good_egiyan_threshold &&
          good_electron_EC_fiducial &&
          good_electron_EC_trk_coords_fiducial &&
          //good_sampling_fraction &&
          good_photoelectrons) {

        epn_count++;
        if(helicity_bit == 0) {
          hp_m_sin_phi_wghtplus4->Fill(missing3vec_mag,sinphi_weight);
          hp_m_unwghtplus4->Fill(missing3vec_mag);
        }
        if(helicity_bit == 1) {
          hp_m_sin_phi_wghtminus4->Fill(missing3vec_mag,sinphi_weight);
          hp_m_unwghtminus4->Fill(missing3vec_mag);
        }
      }
```

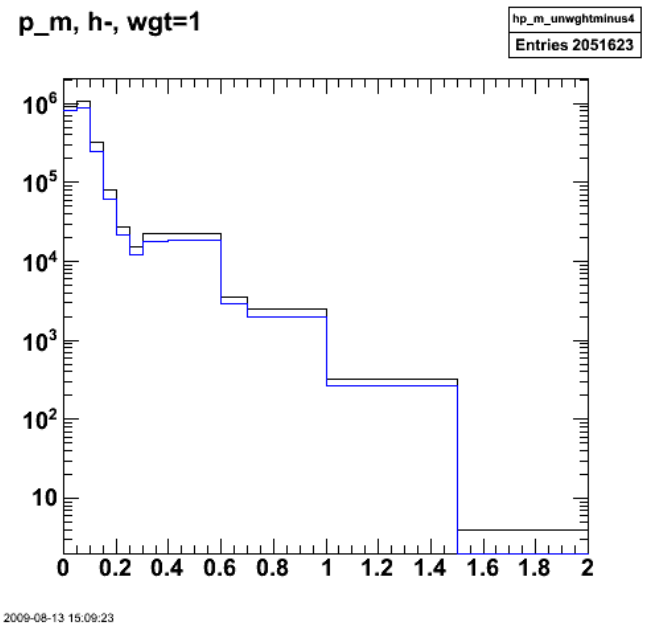


Fig 2. Comparison of normal weighted helicity spectra with two different choices for MM2 cuts.

Systematic Uncertainty on the MM2 cut to select neutrons.

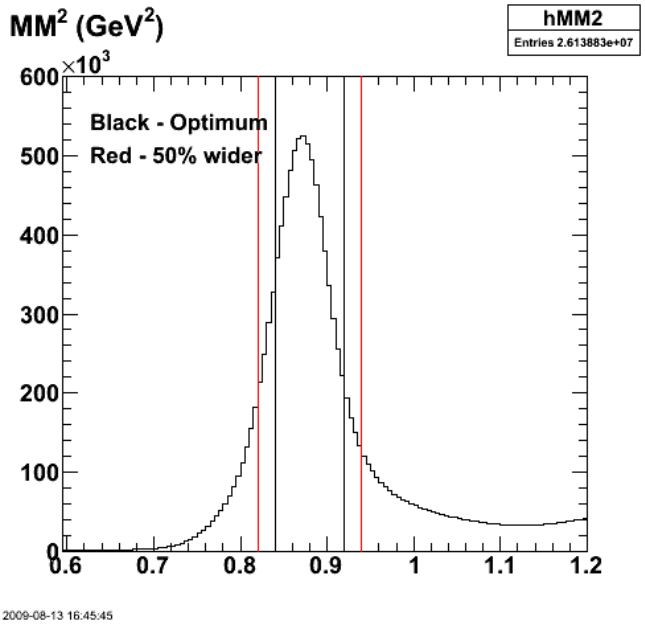


Fig 3. Position of MM2 neutron cut for optimum (black) and wide (choices).

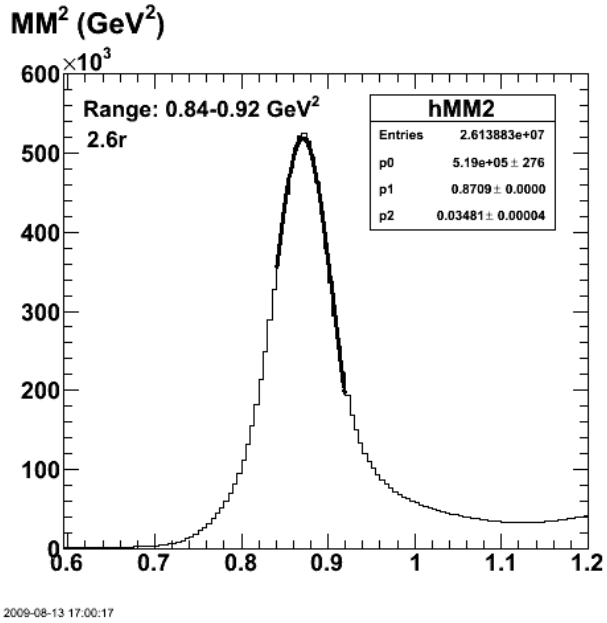


Fig 4. Fit to the peak over the same range as the MM2 neutron cut..

Click here to view the object (ROOT macro) you uploaded.

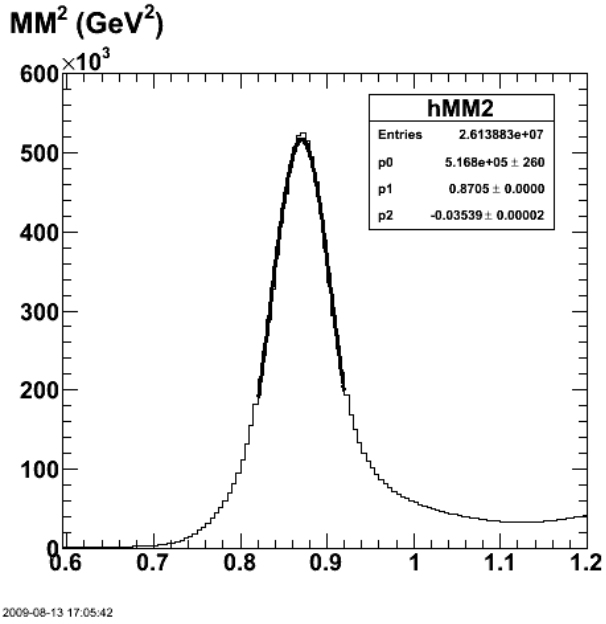


Fig 5. Symmetric fit to MM2 peak.

Click here to view the object (ROOT macro) you uploaded.

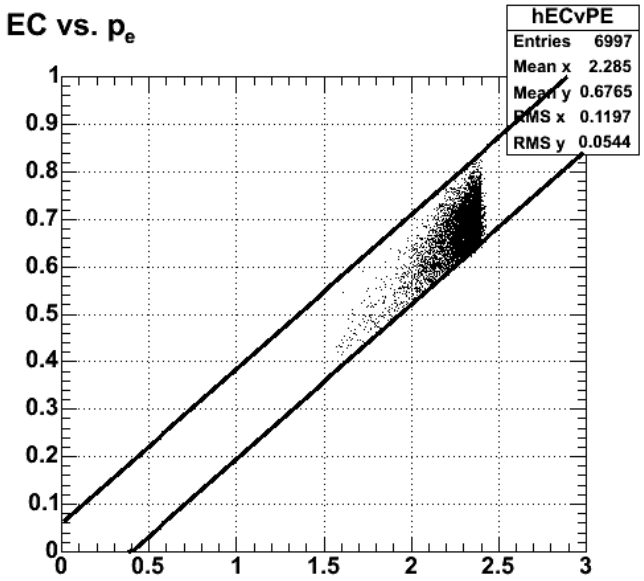


Fig 6. Check on the WKB version of the sampling fraction cut.

Click here to view the object (ROOT macro) you uploaded.

Toy around with a symmetric MM2 neutron cut.

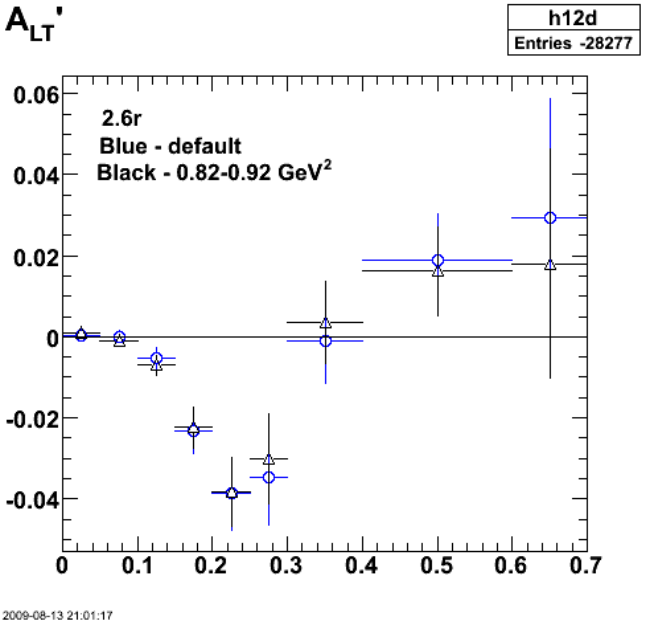


Fig 7. 2.6 with default MM2 (0.84-0.92 GeV2) and larger, symmetric cut (0.82-0.92 GeV2).

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Tuned the MM2 neutron cut. See the plot for the labelling.

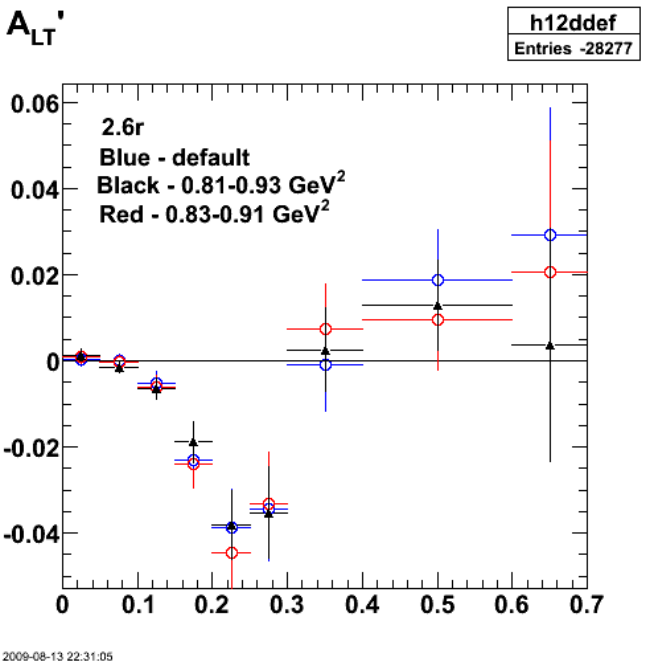


Fig 8. Comparison of different MM2 neutron cut ranges. Use the red one MM2 = 0.83-0.91 GeV2

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Next check some wider limits on the deuterium target. Default values first with new MM2 range.

```
//Double_t deuterium_upstream = -11.5, deuterium_downstream = -8.0;  // default
Double_t deuterium_upstream = -12.2, deuterium_downstream = -7.8;  // wide ones
```

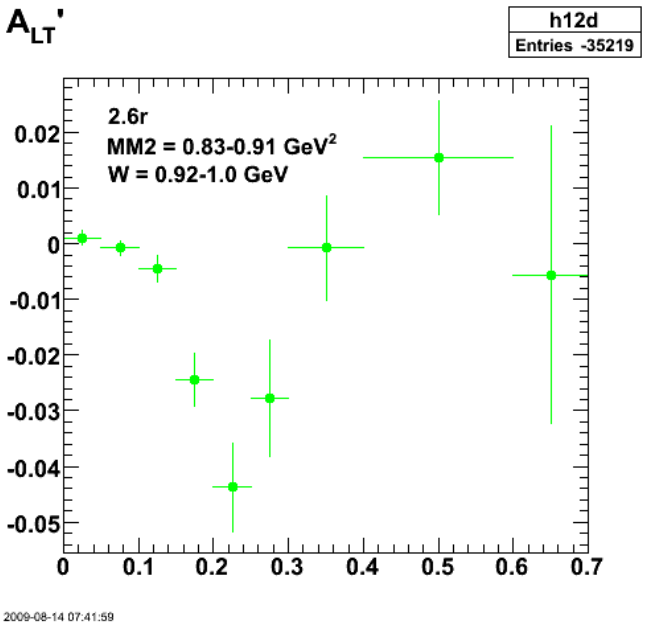


Fig 9. Default W value with new wider z vertex range.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

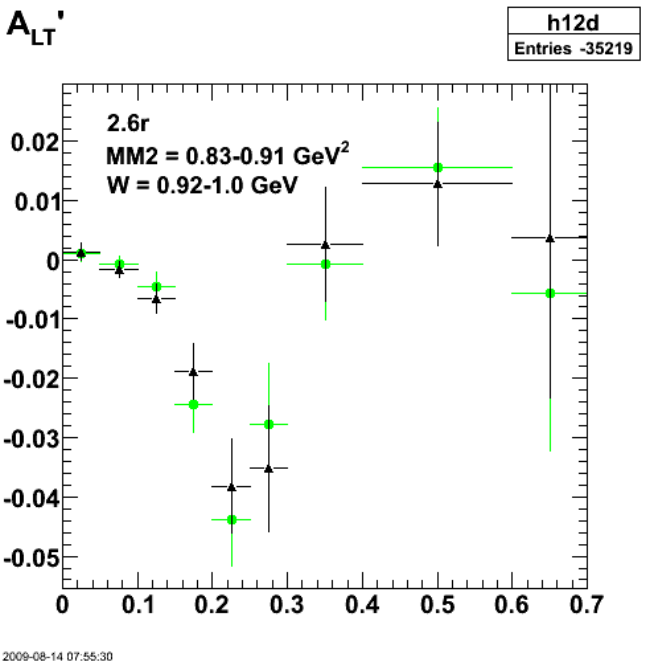


Fig 10. Effect of change from old vz range (black) to new (green). Not much difference so keep the old range.

Test the effect of changes to the W range.

```
Double_t W_QE_lo=0.92, W_QE_hi=1.0;
Double_t W_QE_lo2=0.88, W_QE_hi2=1.0;
```

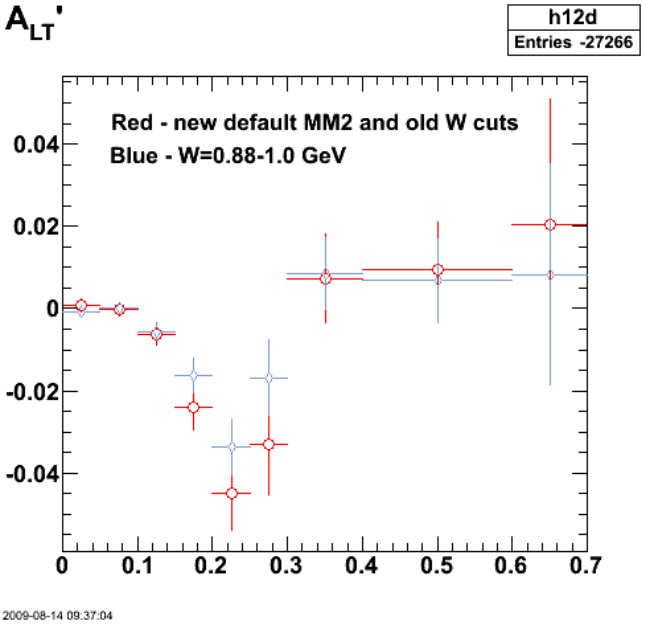


Fig 11. Effect of changing the W range.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Looking over the W dependence of ALTp slide for 2.6n from an old talk, it looks like I could use the W range 0.88-1.04 GeV. However, the plot below shows this range may be too wide.

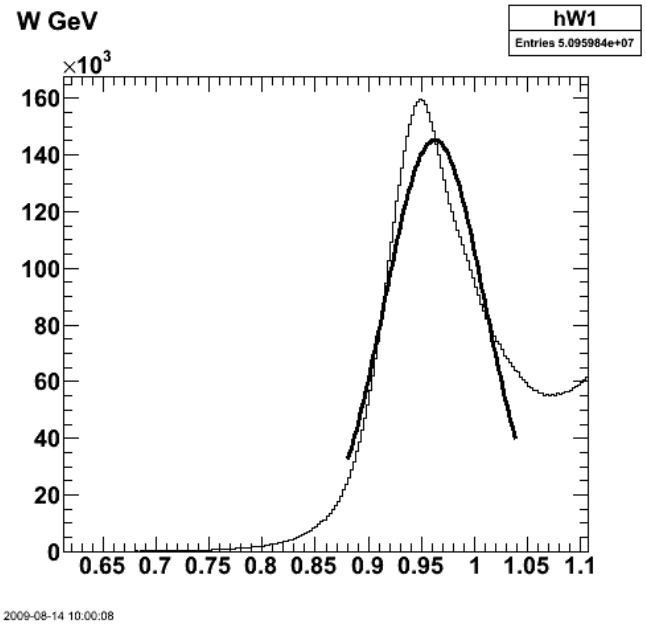


Fig 12. Testing the W range.

Click here to view the object (ROOT macro) you uploaded.

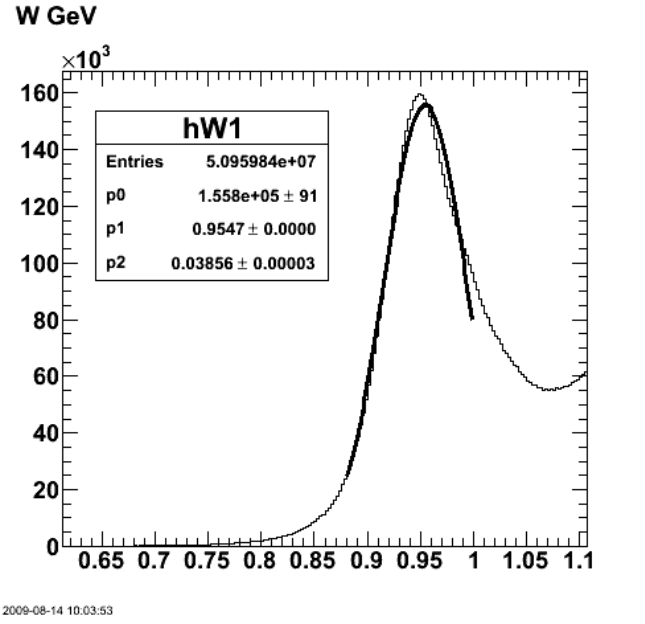


Fig 12. Reduce the W range to 0.88-1.0 GeV

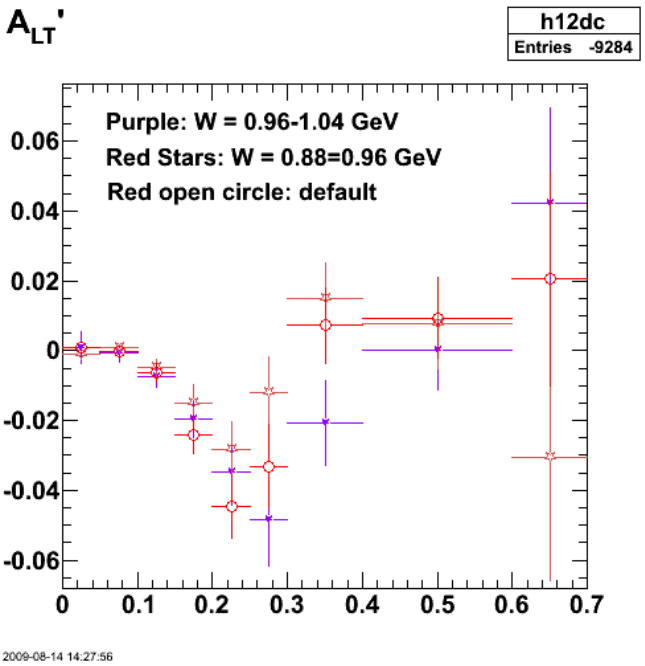


Fig 13. Comparison of ALTp for different W ranges.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

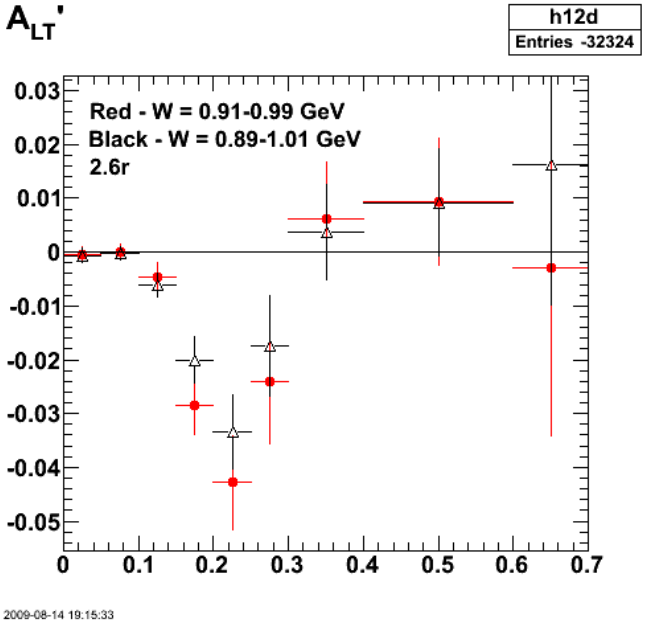


Fig 14. Final (?) results for tuning the W range.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

The W spectrum for choosing the W range. I think we can simply say, we picked the central region of the pick going about halfway down each side (to zero on the low-W side and the dip on the high-W side). Setting the W value is certain within about 10% so Matt's results are fine. The wide W range shown here is just too wide even by eye.

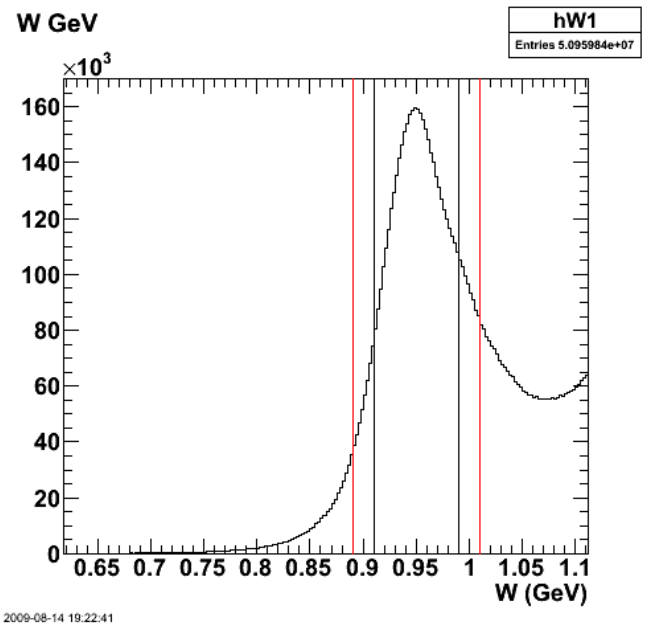


Fig 15. W spectrum showing the position of the W limits. Histogram file is the same as figure 14.

Click here to view the object (ROOT macro) you uploaded.

Now try shrinking the W range a bit to see what happens. It looks like the statistics are a big effect here. Use Matt's results.

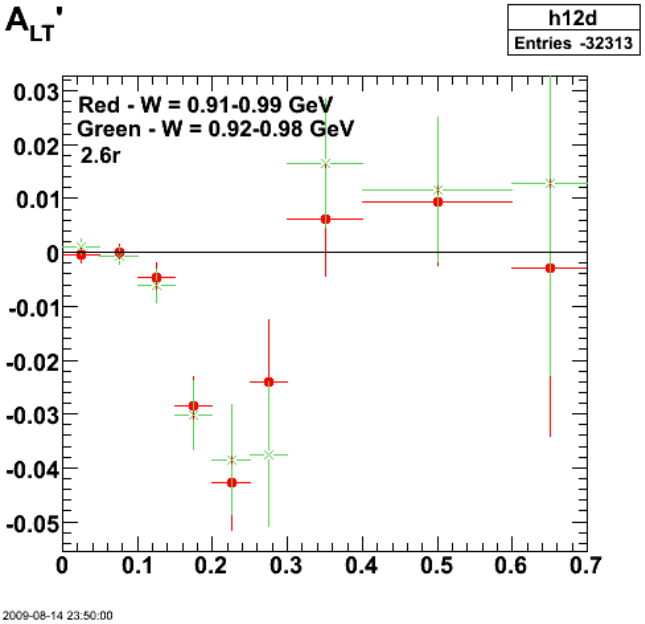


Fig 16. Try shrinking the W range and it has kind of a typical effect.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

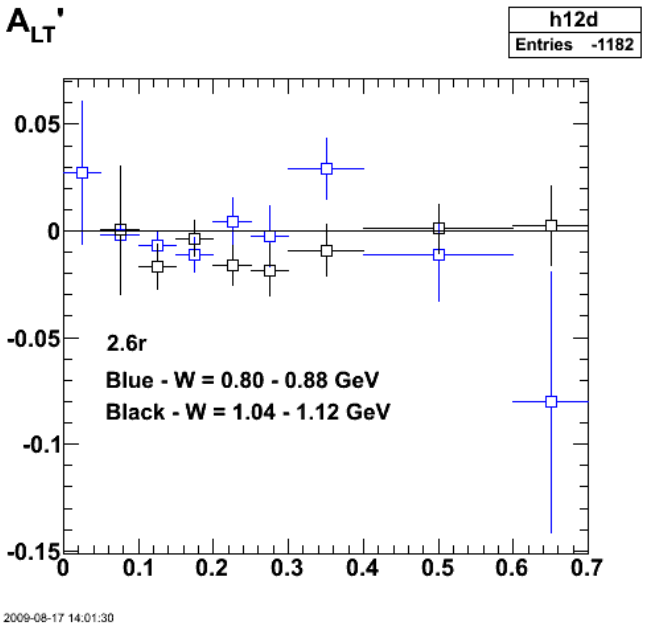


Fig 17. Comparison of ALTp for W ranges far above and below the central peak to show how the dip at $p_m \approx 0.2$ GeV/c disappears.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 249 - Final(?) results for Calina cut for 2.6r (gpg)

[Modified Thu Sep 10 22:36:21 2009 (GMT) gpg]

The results below are based on GSIm results stored in eod/sim/calina/.

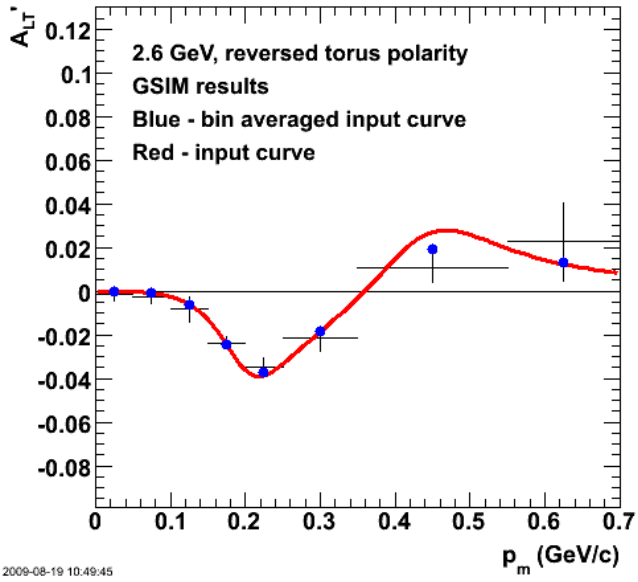


Fig 1. GSIM results for runs 1-12.

Click here to view the object (sumsim.C root macro for fig 1. Stored in eod/sim/calina/analysis.) you uploaded.

I did some more runs and modified the scripts to run two jobs per node to take advantage of the dual CPUs. This did NOT increase the run time for each calculation.

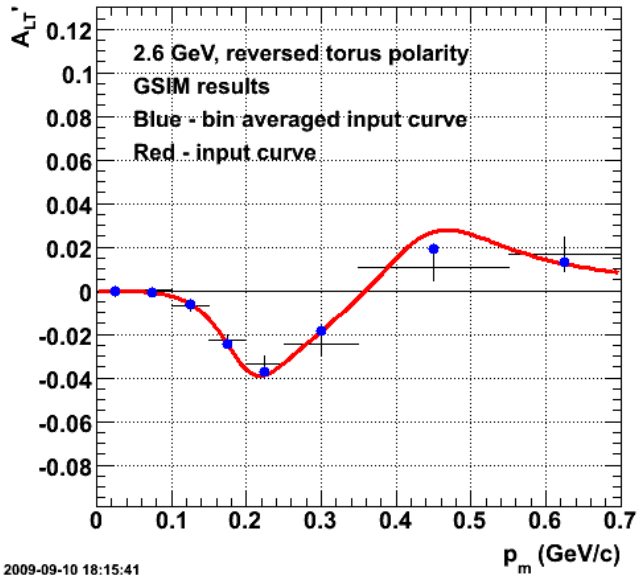


Fig 2. Updated version of fig 1 (runs 1-22).

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 250 - Checking 2.6n ALTp MM2 and W cut and uncertainties (gpg)

[Modified Fri Sep 4 15:03:27 2009 (GMT) gpg]

First get the systematic uncertainty due to the quasielastic cut. See the Mathematica notebook eod/uncs/ALTpUncertainties26n.nb for the final results.

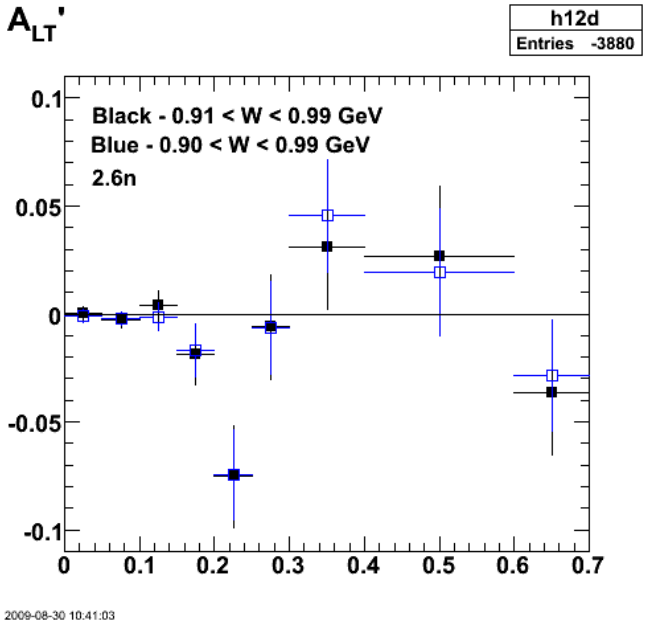


Fig 1. Comparison of 2.6n ALTp for systematic uncertainty of QE cut.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Now test the MM^2 cut used to select the neutron in the final state.

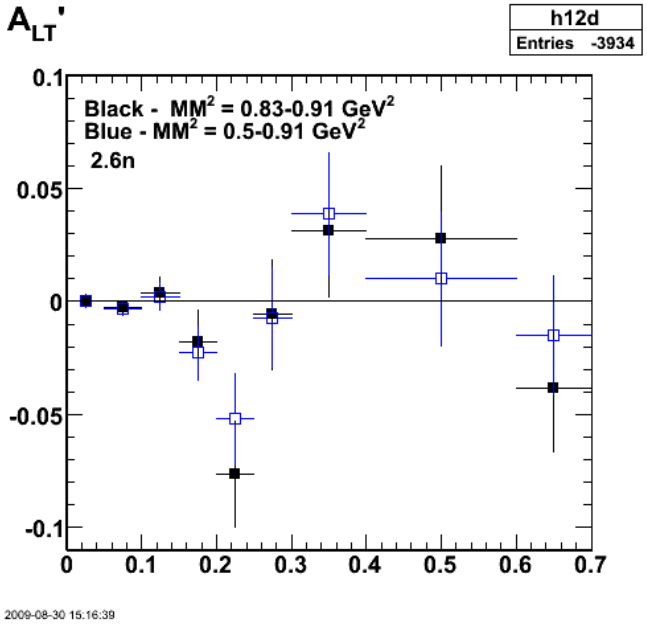


Fig 2. Comparison of ALTp with different MM2 cuts.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

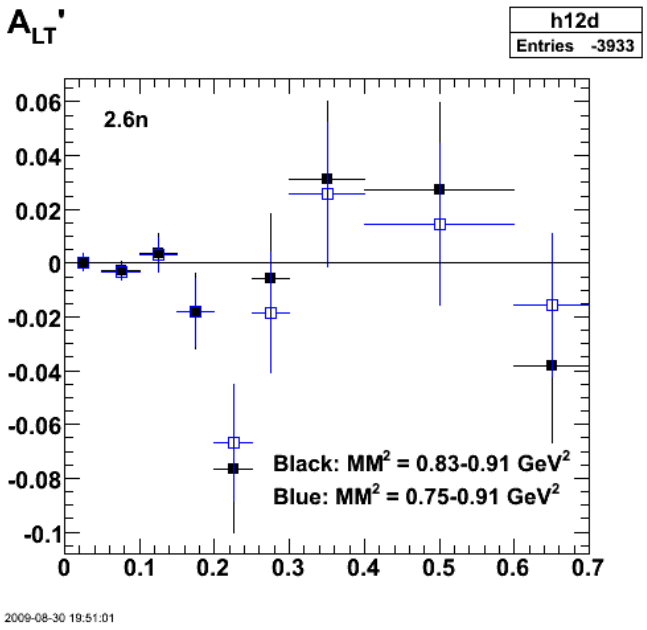


Fig 3. Effect of lowering the lower limit on MM2 cut.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

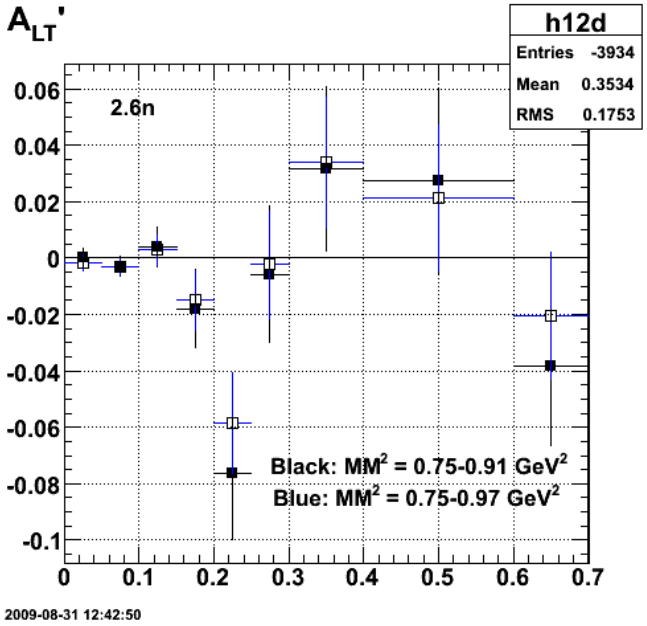


Fig 4. Test new wider range for the MM2 cut. Note the lower limit on the Black MM2 is WRONG! It should be 0.83 GeV2.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

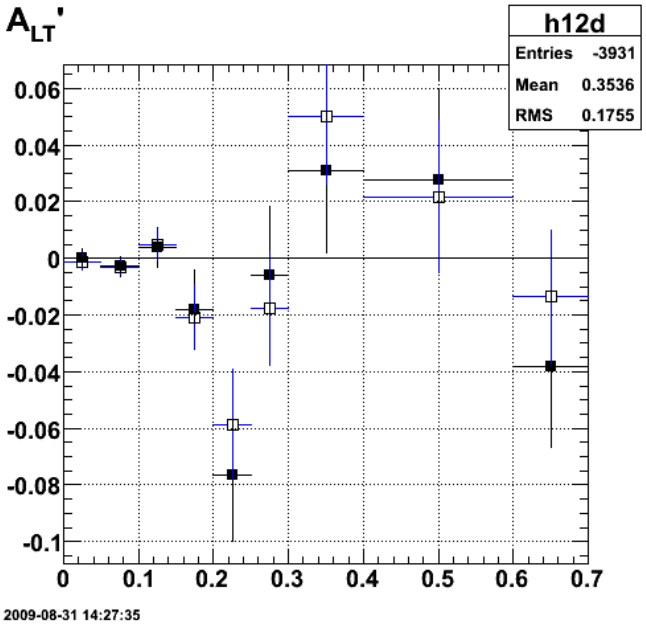


Fig 5. Test new upper limit on MM2 cut.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

The last two plots show little difference between ALTp for MM2 < 0.97 GeV2 or MM2 < 0.94 GeV2 so pick MM2 < 0.97 GeV2.

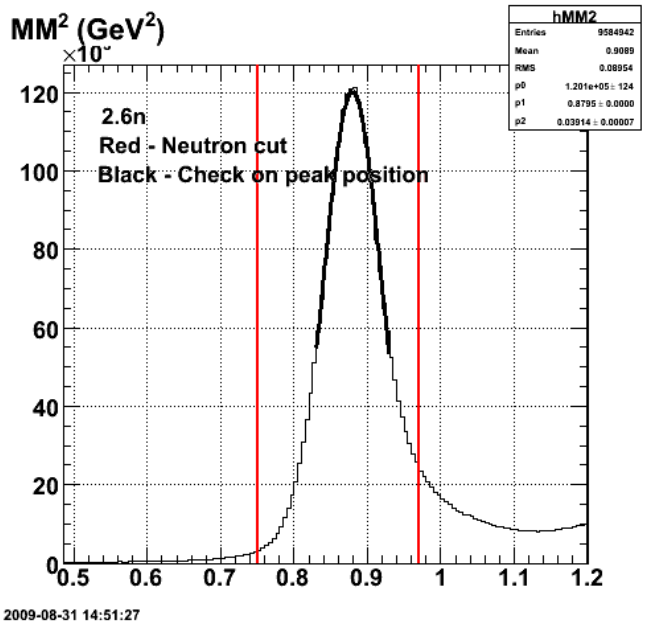


Fig 6. MM2 plot showing new MM2 cut (MM2 = 0.75-0.97 GeV2) and fit used to determine the centroid of the peak.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Now shrink the size of the MM2 cut by 10% and get the systematic uncertainty.

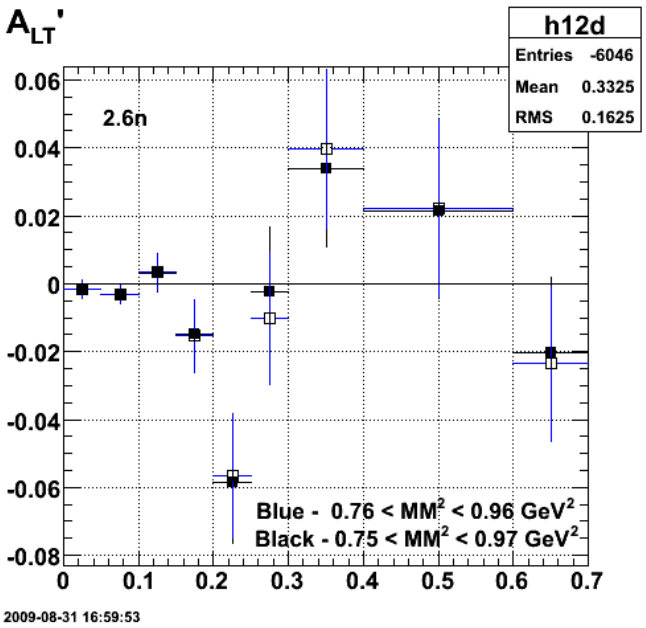


Fig 7. Comparison of ALTp with MM2 shrunk by 10% to get the change used for the systematic uncertainty (blue points).

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Results of taking the difference between the points in fig 7.

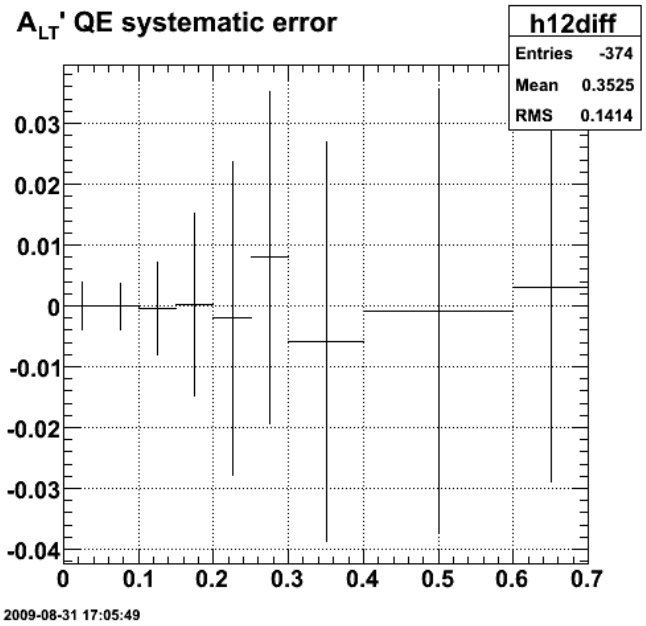


Fig 8. Difference between standard and 10%-smaller-MM2-cut.

Click here to view the object (ROOT histogram file) you uploaded.

I screwed up the systematic uncertainty calculation for the 2.6n MM2 ALTp. I reduced the width of the window by 1/6 instead of 1/10. The plot below shows the comparison with the correct range for MM2 (0.756 -> 0.964 GeV2) and the default range (0.75 -> 0.97 GeV2).

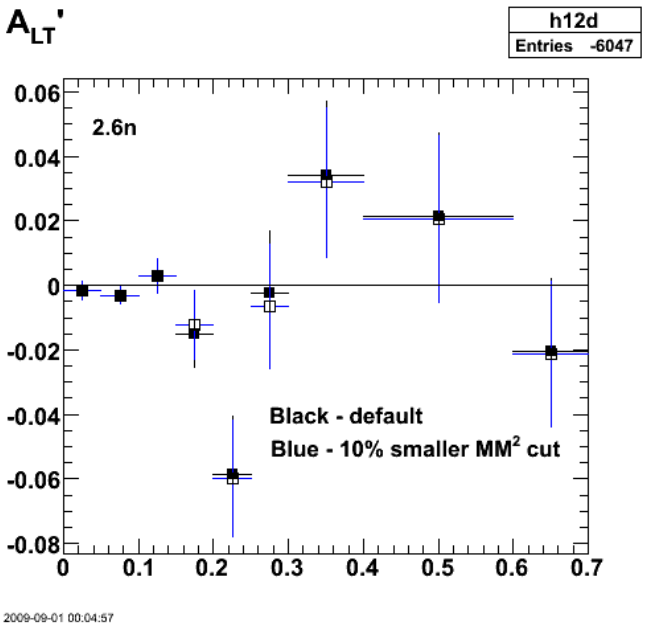


Fig 9. Comparison of ALTp for 2.6n between the default values (black) and ones with a 10% smaller MM2 cut (blue).

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

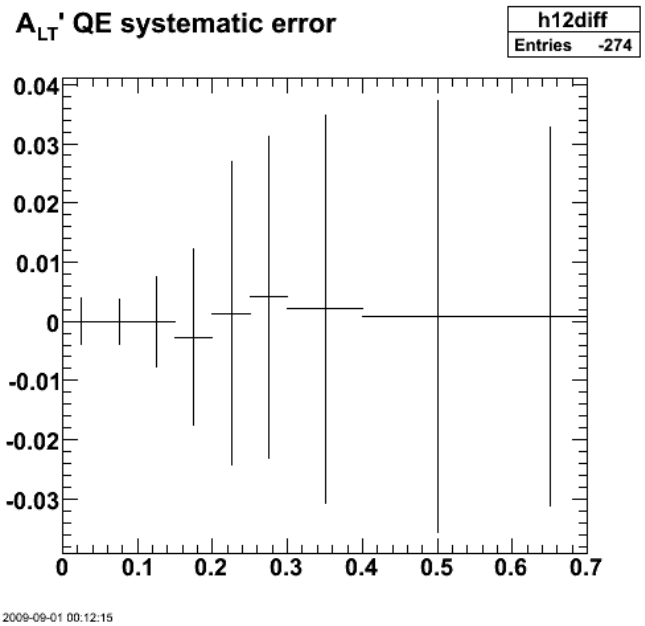


Fig 10. Difference between the default ALTp and with the 10%-smaller-MM2 cut.

Click here to view the object (Root macro) you uploaded.

Numbers for Fig 10.

```
h12diff->Print("all")
TH1.Print Name  = h12diff, Entries= -274, Total sum= 0.0127645
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=1.71692e-05, x=0.025, error=0.00389874
 fSumw[2]=-7.10781e-05, x=0.075, error=0.00375903
 fSumw[3]=-0.000104326, x=0.125, error=0.00751991
 fSumw[4]=-0.00266462, x=0.175, error=0.0149186
 fSumw[5]=0.00133526, x=0.225, error=0.0255873
 fSumw[6]=0.00412141, x=0.275, error=0.0271704
 fSumw[7]=0.00205137, x=0.35, error=0.0327671
 fSumw[8]=0.000832865, x=0.5, error=0.036392
 fSumw[9]=0.00086749, x=0.65, error=0.0319774
 fSumw[10]=-0.00430327, x=0.85, error=0.030909
 fSumw[11]=0.0043112, x=1.25, error=0.0544894
 fSumw[12]=0.00637105, x=1.75, error=0.199317
```

```
 fSumw[13]=0, x=2.08333, error=0
root [44]
```

Now study the effect of increasing the width of the W cut by 10%.

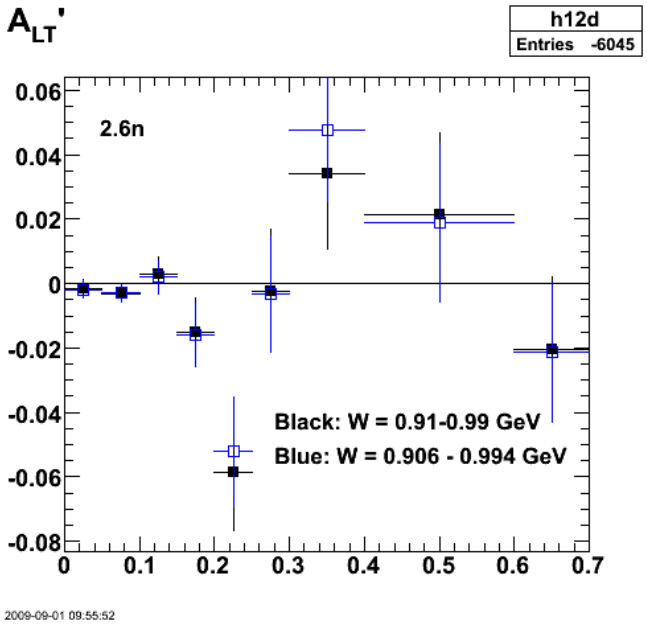


Fig 11. Effect of increasing the width of the W cut by 10%.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

The difference between the two extractions of ALTp.

```
root [46] h12diff->Print("all")
TH1.Print Name  = h12diff, Entries= 727, Total sum= -0.0370267
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=0.000323651, x=0.025, error=0.00384308
 fSumw[2]=-0.000157504, x=0.075, error=0.00367358
 fSumw[3]=0.000984767, x=0.125, error=0.00729457
 fSumw[4]=0.000814839, x=0.175, error=0.01446
 fSumw[5]=-0.00629463, x=0.225, error=0.0248252
 fSumw[6]=0.0009482, x=0.275, error=0.026402
 fSumw[7]=-0.013727, x=0.35, error=0.0318571
 fSumw[8]=0.00224737, x=0.5, error=0.0355519
 fSumw[9]=0.000955978, x=0.65, error=0.0311939
 fSumw[10]=0.00597822, x=0.85, error=0.0300711
 fSumw[11]=0.00745918, x=1.25, error=0.0529804
 fSumw[12]=-0.0365597, x=1.75, error=0.194492
 fSumw[13]=0, x=2.08333, error=0
```

I suspect the large difference between the default value for ALTp and the value after increasing the width of the W cut seen in Fig 11 for x=0.225 is a fluctuation so I will decrease the width of the W cut and average the two results.

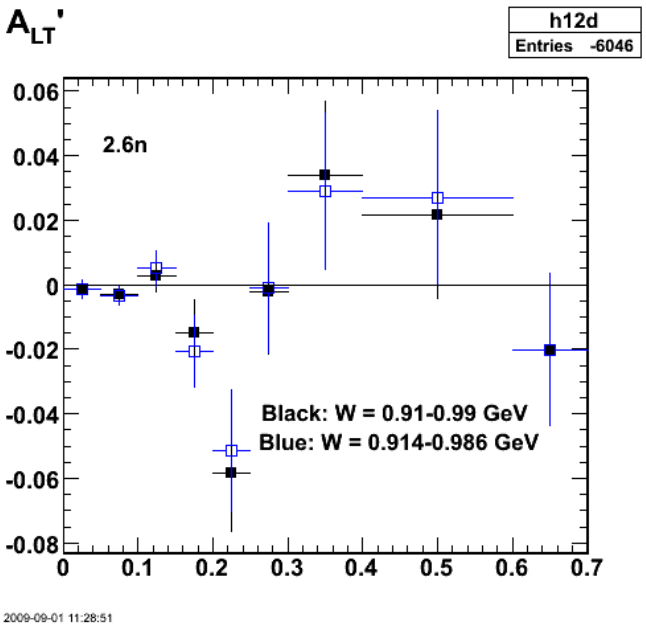


Fig 12. Comparison of default ALTp at 2.6n with width of W cut decreased by 10%.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

```
root [44] h12diff->Print("all")
TH1.Print Name  = h12diff, Entries= -222, Total sum= -0.0464251
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.000243433, x=0.025, error=0.00396215
 fSumw[2]=0.000299538, x=0.075, error=0.00383329
 fSumw[3]=-0.00218812, x=0.125, error=0.00767404
 fSumw[4]=0.00576314, x=0.175, error=0.0152109
 fSumw[5]=-0.00706281, x=0.225, error=0.0261553
 fSumw[6]=-0.0014195, x=0.275, error=0.0278245
 fSumw[7]=0.00497224, x=0.35, error=0.0333959
 fSumw[8]=-0.0054954, x=0.5, error=0.0371879
 fSumw[9]=-0.000281587, x=0.65, error=0.032617
 fSumw[10]=0.00213538, x=0.85, error=0.0315363
 fSumw[11]=-0.00548225, x=1.25, error=0.0554255
 fSumw[12]=-0.0374223, x=1.75, error=0.202566
 fSumw[13]=0, x=2.08333, error=0
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 251 - Uncertainties for 2.6n ALTp (gpg)

[Modified Fri Sep 4 15:02:34 2009 (GMT) gpg]

Investigate the systematic uncertainties associated with the cuts used to select epn events for the 2.6-GeV, normal-torus-polarity data. See the Mathematica notebook eod/uncs/ALTpUncertainties26n.nb for the final results. Cuts studied are the following.

```
table 7: photoelectron > 0
table 6: electron trk fid > 0
table 5: electron EC fid = 0  table refer to MJ's Mathematica notebook for 2.6r
table 4: egiyan thresold = 0
table 3: target wall

      if (epn_event &&
          target_walls_ep &&
          quasielastic_cut &&
          //good_electron_fiducial &&
          //good_proton_fiducial &&
          good_egiyan_threshold &&
          good_electron_EC_fiducial &&
          good_electron_EC_trk_coords_fiducial &&
          //good_sampling_fraction &&
          good_photoelectrons) {
```

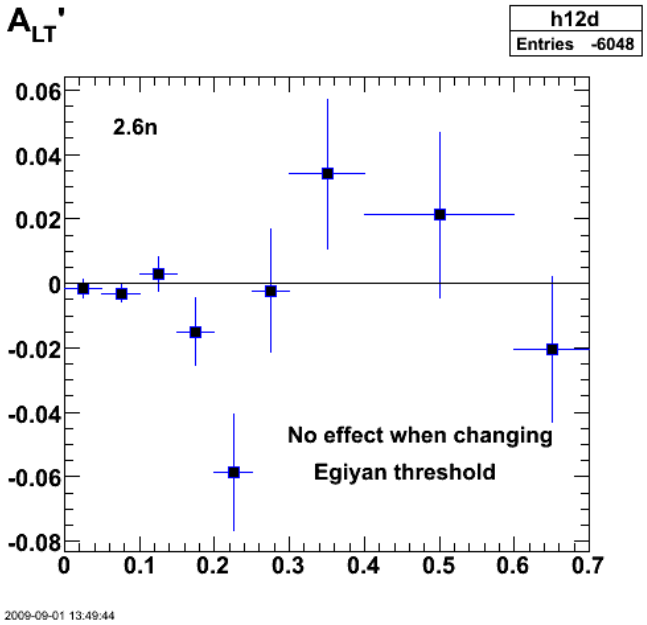


Fig 1. Effect of Egiyan cut: none. All the points are exactly the same with the egiyan threshold set at 708 (default) or 778 (expanded).

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Study effect of photoelectron cut.

```
   Double_t photoelectron_threshold = 25.0, photoelectron_threshold2 = 22.0, photoelectron_threshold3 = 27.0;
```

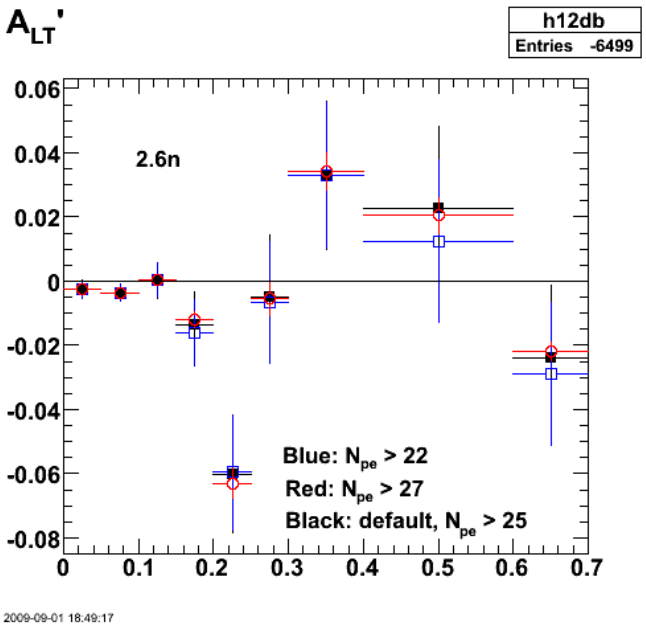


Fig 2. Effect of changing the minimum required number of photoelectrons*10.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Values:

```
photoelectron_threshold = 25.0

root [81] h12d->Print("all")
TH1.Print Name  = h12d, Entries= -6225, Total sum= 0.179906
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.00251481, x=0.025, error=0.00276401
 fSumw[2]=-0.00357707, x=0.075, error=0.00265854
 fSumw[3]=3.46709e-05, x=0.125, error=0.00529779
 fSumw[4]=-0.013696, x=0.175, error=0.0105181
 fSumw[5]=-0.0601622, x=0.225, error=0.0180461
 fSumw[6]=-0.00492777, x=0.275, error=0.0191869
 fSumw[7]=0.032836, x=0.35, error=0.0231114
 fSumw[8]=0.0227109, x=0.5, error=0.025688
 fSumw[9]=-0.023756, x=0.65, error=0.0225639
 fSumw[10]=-0.0286656, x=0.85, error=0.0217984
 fSumw[11]=-0.0474327, x=1.25, error=0.0382427
 fSumw[12]=0.309056, x=1.75, error=0.141431
 fSumw[13]=0, x=2.08333, error=0

photoelectron_threshold2 = 22.0

root [82] h12db->Print("all")
TH1.Print Name  = h12db, Entries= -6499, Total sum= 0.148404
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.00268873, x=0.025, error=0.00273644
 fSumw[2]=-0.00355502, x=0.075, error=0.0026316
 fSumw[3]=0.000386147, x=0.125, error=0.00524177
 fSumw[4]=-0.0161417, x=0.175, error=0.0104079
 fSumw[5]=-0.0595912, x=0.225, error=0.0178761
 fSumw[6]=-0.00644698, x=0.275, error=0.0189856
 fSumw[7]=0.0329526, x=0.35, error=0.0228436
 fSumw[8]=0.0125007, x=0.5, error=0.0254469
 fSumw[9]=-0.0290681, x=0.65, error=0.0223017
 fSumw[10]=-0.0212933, x=0.85, error=0.021627
 fSumw[11]=-0.0482346, x=1.25, error=0.038107
 fSumw[12]=0.289584, x=1.75, error=0.140527
 fSumw[13]=0, x=2.08333, error=0

photoelectron_threshold3 = 27.0


root [83] h12dc->Print("all")
TH1.Print Name  = h12dc, Entries= -6184, Total sum= 0.183756
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.00245733, x=0.025, error=0.000529286
 fSumw[2]=-0.00365193, x=0.075, error=0.000522869
 fSumw[3]=0.000500219, x=0.125, error=0.000896563
 fSumw[4]=-0.0119383, x=0.175, error=0.00242314
 fSumw[5]=-0.0629718, x=0.225, error=0.00470548
 fSumw[6]=-0.00555747, x=0.275, error=0.00509709
 fSumw[7]=0.0341347, x=0.35, error=0.00565729
 fSumw[8]=0.0204235, x=0.5, error=0.00544295
 fSumw[9]=-0.0219259, x=0.65, error=0.00279248
 fSumw[10]=-0.0248378, x=0.85, error=0.00376989
 fSumw[11]=-0.0472991, x=1.25, error=0.00670825
```

```
fSumw[12]=0.309337, x=1.75, error=0.0671307
fSumw[13]=0, x=2.08333, error=0
```

Now do the effect of increasing and decreasing the EC track fiducial cut by +/- 10%.

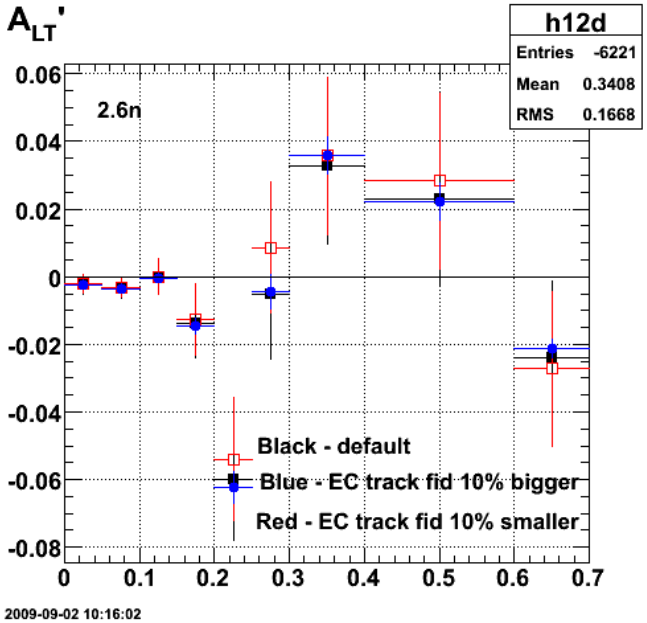


Fig 3. Effect on ALTp of +/- 10% change in the cut on the EC track fiducial.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

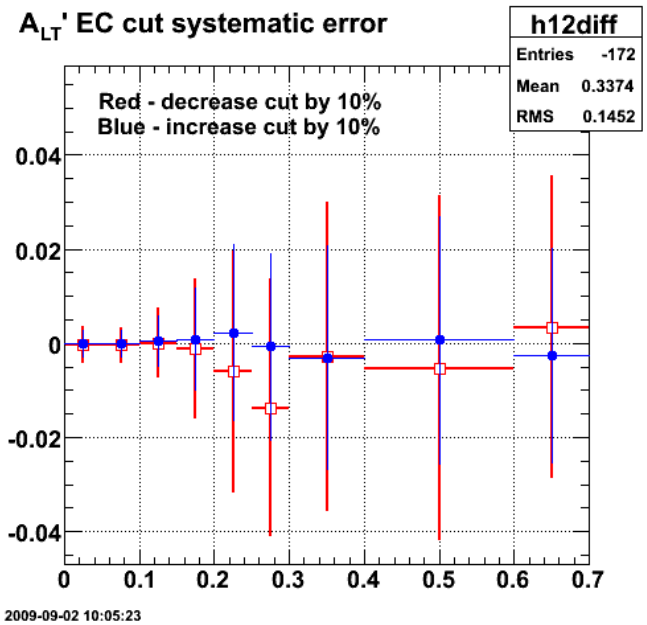


Fig 4. Difference between default ALTp at 2.6n and +/- 10% change in EC track fiducial. Compare with fig 3.

Click here to view the object (ROOT histogram file) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 252 - 2.6n EC track coordinate, EC sampling fraction, and EC pion threshold cuts. (gpg)

[Modified Thu Sep 10 01:53:36 2009 (GMT) gpg]

Now do the effect of increasing and decreasing the EC track fiducial cut by +/- 10%. See the Mathematica notebook eod/uncs/ALTpUncertainties26n.nb for the final results.

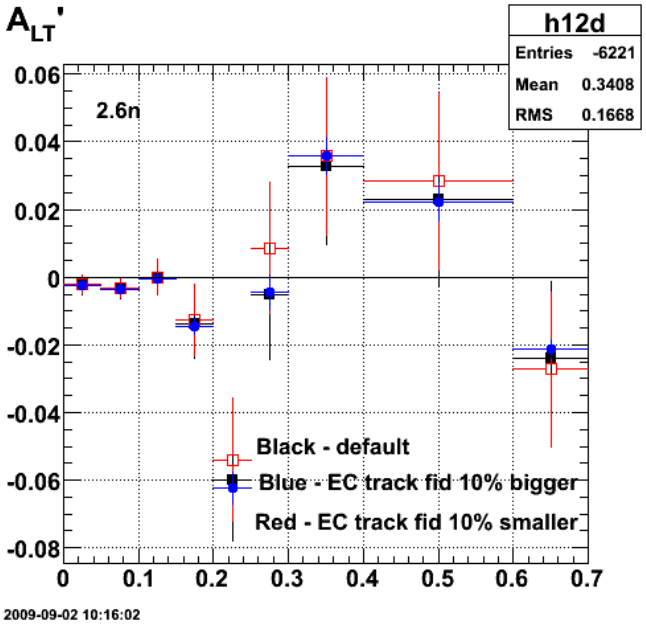


Fig 1. Effect on ALTp of +/- 10% change in the cut on the EC track fiducial.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

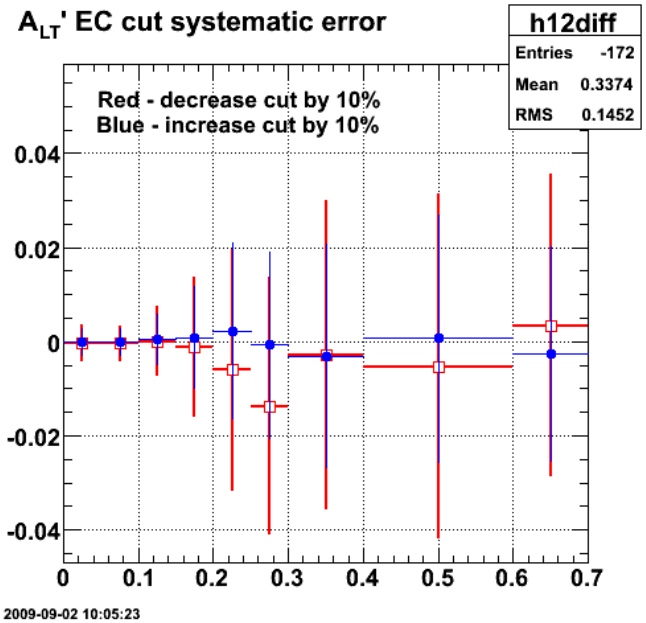


Fig 2. Difference between default ALTp at 2.6n and +/- 10% change in EC track fiducial. Compare with fig 1.

Click here to view the object (ROOT histogram file) you uploaded.

The effect of reducing the size of the EC track coordinate cut for the 5th data point (pm=0.275 GeV/c) is pronounced. Checking the cut on the EC track coordinate.

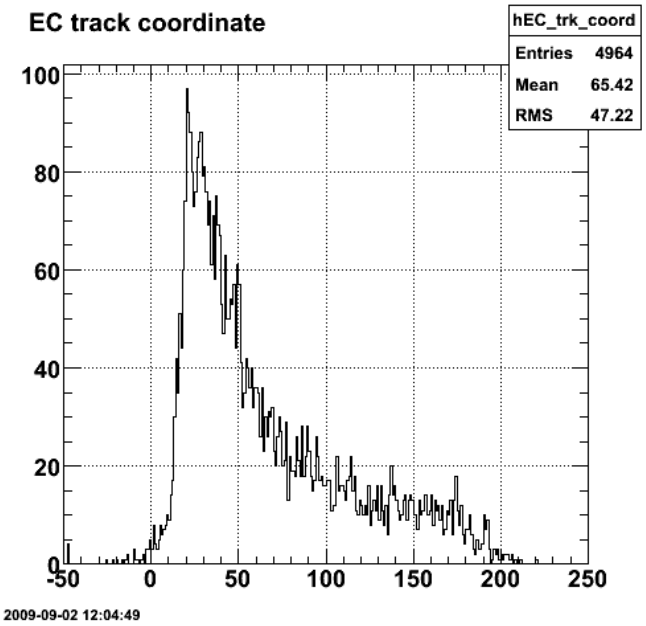


Fig 3. Default spectrum of EC_fiducial_cut - EC track coordinate.

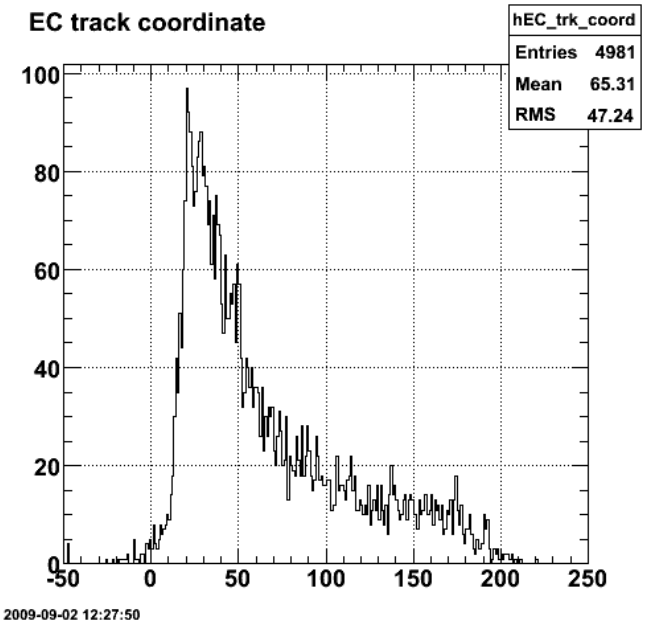


Fig 4. Turned off EC fiducial cuts and get much the same thing.

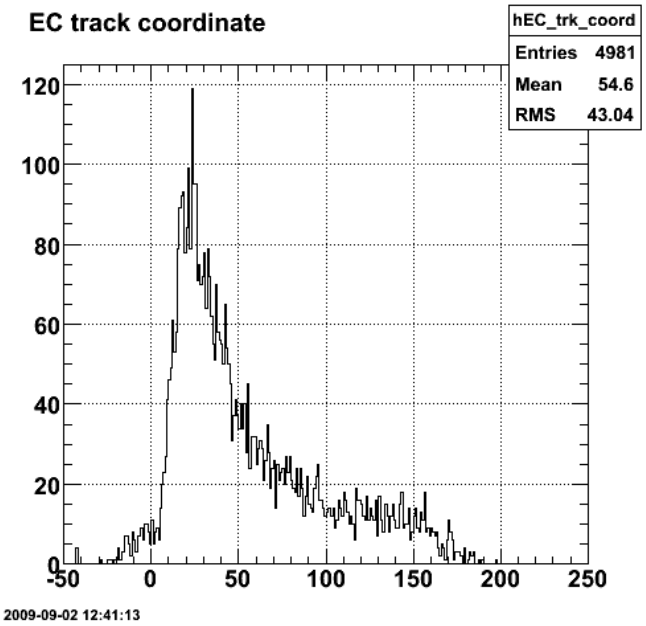


Fig 5. Same as Fig 4, but now use 90% of the EC_fiducial_cut value. Not much change.

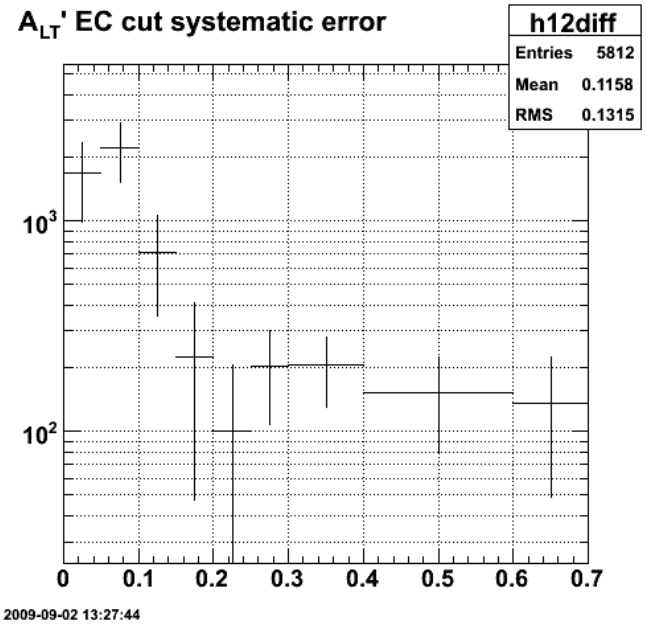


Fig 6. Difference between default EC track coordinate cut and 90% value cut.

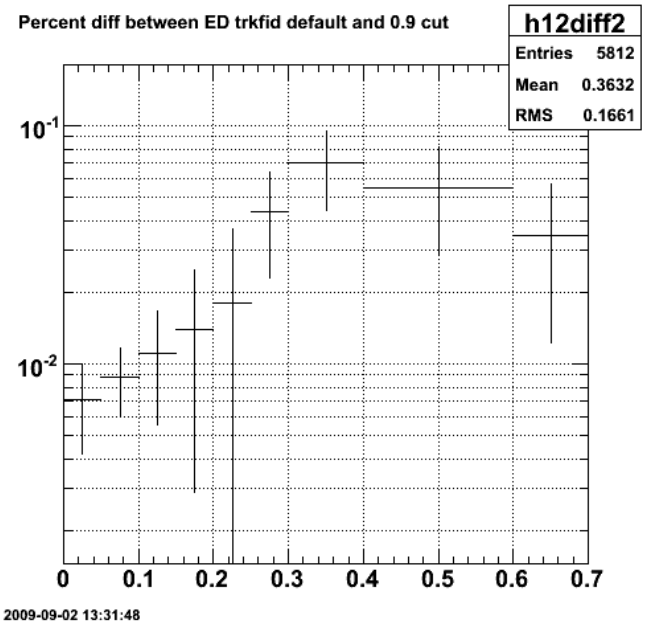
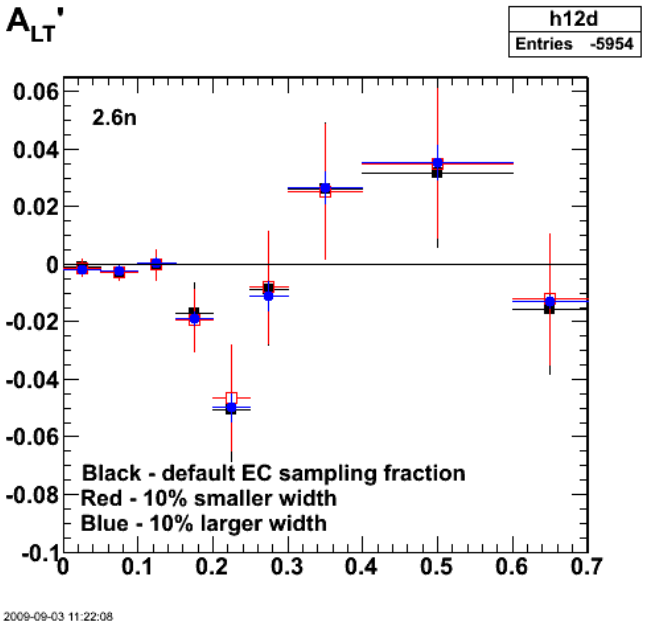


Fig 7. Same as fig 6, but divided by the default histogram for hp_m_unwghtplus4.

There appears to be no obvious problems with that bin so get the uncertainty by taking the difference between the values for ALTp and dividing by two. Now investigate the effect of the EC sampling fraction and changing its width by +/- 10%.



Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Numerical results.

```
root [58] h12d->Print("all")
TH1.Print Name  = h12d, Entries= -5954, Total sum= 0.196025 <-- default
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.00113904, x=0.025, error=0.00275885
 fSumw[2]=-0.00260103, x=0.075, error=0.00265301
 fSumw[3]=-6.26198e-05, x=0.125, error=0.00528926
 fSumw[4]=-0.0171383, x=0.175, error=0.0105058
 fSumw[5]=-0.0505203, x=0.225, error=0.01802
 fSumw[6]=-0.00872526, x=0.275, error=0.0191987
 fSumw[7]=0.0260211, x=0.35, error=0.0230392
 fSumw[8]=0.0314281, x=0.5, error=0.0256864
 fSumw[9]=-0.0157908, x=0.65, error=0.0224817
 fSumw[10]=-0.0232003, x=0.85, error=0.0217426
 fSumw[11]=-0.0431268, x=1.25, error=0.0381966
 fSumw[12]=0.30088, x=1.75, error=0.140833
```

```
 fSumw[13]=0, x=2.08333, error=0
root [59] h12db->Print("all")
TH1.Print Name  = h12db, Entries= -5762, Total sum= 0.198908 <-- smaller width
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.00122201, x=0.025, error=0.0027925
 fSumw[2]=-0.00270416, x=0.075, error=0.00268681
 fSumw[3]=-0.000225012, x=0.125, error=0.00535608
 fSumw[4]=-0.0195509, x=0.175, error=0.0106345
 fSumw[5]=-0.0464288, x=0.225, error=0.0182839
 fSumw[6]=-0.00800641, x=0.275, error=0.0194606
 fSumw[7]=0.0251982, x=0.35, error=0.0233379
 fSumw[8]=0.0350537, x=0.5, error=0.0260228
 fSumw[9]=-0.0121037, x=0.65, error=0.0227502
 fSumw[10]=-0.0222129, x=0.85, error=0.0220456
 fSumw[11]=-0.0441052, x=1.25, error=0.0386293
 fSumw[12]=0.295215, x=1.75, error=0.143472
 fSumw[13]=0, x=2.08333, error=0
root [60] h12dc->Print("all")
TH1.Print Name  = h12dc, Entries= -6225, Total sum= 0.174709 <-- larger width
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.00202497, x=0.025, error=0.00051769
 fSumw[2]=-0.00244224, x=0.075, error=0.000518801
 fSumw[3]=0.00059748, x=0.125, error=0.000883984
 fSumw[4]=-0.0187613, x=0.175, error=0.00235036
 fSumw[5]=-0.0497841, x=0.225, error=0.00487491
 fSumw[6]=-0.0111032, x=0.275, error=0.0050664
 fSumw[7]=0.0266206, x=0.35, error=0.00549226
 fSumw[8]=0.0355125, x=0.5, error=0.00595996
 fSumw[9]=-0.013058, x=0.65, error=0.00209647
 fSumw[10]=-0.0228335, x=0.85, error=0.00393
 fSumw[11]=-0.0458025, x=1.25, error=0.00650628
 fSumw[12]=0.277788, x=1.75, error=0.0616815
 fSumw[13]=0, x=2.08333, error=0
root [61]
```

Now test the effect of a +/- 10% change on the EC pion threshold on the electron.

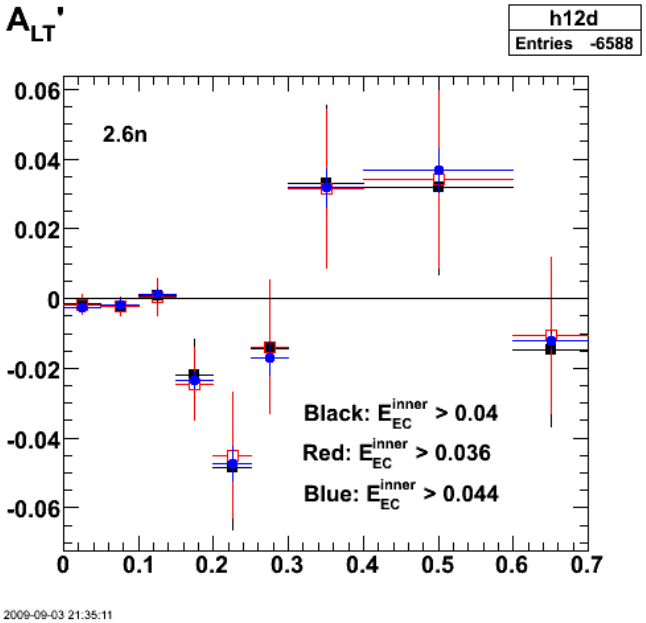


Fig 8. Comparison of ALTp for a variation of the EC pion threshold by +/- 10%.

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Click here to view the object (Root histogram file) you uploaded.

```
root [56] h12d->Print("all")
TH1.Print Name  = h12d, Entries= -6588, Total sum= 0.13183 <-- default EC_pion_threshold = 0.40;
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.00157692, x=0.025, error=0.00270861
 fSumw[2]=-0.00224735, x=0.075, error=0.00260478
 fSumw[3]=0.000668894, x=0.125, error=0.00519523
 fSumw[4]=-0.0218615, x=0.175, error=0.0103173
 fSumw[5]=-0.0484418, x=0.225, error=0.0176843
 fSumw[6]=-0.0141757, x=0.275, error=0.0188387
 fSumw[7]=0.0328792, x=0.35, error=0.0226165
 fSumw[8]=0.0319814, x=0.5, error=0.0252203
 fSumw[9]=-0.0146211, x=0.65, error=0.0220643
 fSumw[10]=-0.0206088, x=0.85, error=0.0213274
 fSumw[11]=-0.0394064, x=1.25, error=0.0372883
 fSumw[12]=0.22924, x=1.75, error=0.134932
 fSumw[13]=0, x=2.08333, error=0

 root [57] h12db->Print("all")
TH1.Print Name  = h12db, Entries= -6346, Total sum= 0.130504 <-- EC_pion_threshold = 0.36;
 fSumw[0]=0, x=-0.0833333, error=0
```

```
 fSumw[1]=-0.00166052, x=0.025, error=0.00274173
 fSumw[2]=-0.00237275, x=0.075, error=0.002638
 fSumw[3]=0.000446352, x=0.125, error=0.00526052
 fSumw[4]=-0.024407, x=0.175, error=0.0104417
 fSumw[5]=-0.0449534, x=0.225, error=0.0179406
 fSumw[6]=-0.0139204, x=0.275, error=0.0191015
 fSumw[7]=0.0315148, x=0.35, error=0.0229138
 fSumw[8]=0.0341789, x=0.5, error=0.0255432
 fSumw[9]=-0.0106401, x=0.65, error=0.0223351
 fSumw[10]=-0.017712, x=0.85, error=0.0216241
 fSumw[11]=-0.0410695, x=1.25, error=0.037708
 fSumw[12]=0.2211, x=1.75, error=0.137277
 fSumw[13]=0, x=2.08333, error=0

root [58] h12dc->Print("all")
TH1.Print Name  = h12dc, Entries= -6836, Total sum= 0.109782 <-- EC_pion_threshold = 0.44;
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.00243402, x=0.025, error=0.000503578
 fSumw[2]=-0.00201853, x=0.075, error=0.000508667
 fSumw[3]=0.00119847, x=0.125, error=0.000884347
 fSumw[4]=-0.0232968, x=0.175, error=0.00228745
 fSumw[5]=-0.047374, x=0.225, error=0.00480814
 fSumw[6]=-0.0171742, x=0.275, error=0.00482407
 fSumw[7]=0.0317653, x=0.35, error=0.00539808
 fSumw[8]=0.0367009, x=0.5, error=0.00613897
 fSumw[9]=-0.0122494, x=0.65, error=0.00199086
 fSumw[10]=-0.0203107, x=0.85, error=0.00347319
 fSumw[11]=-0.0444213, x=1.25, error=0.0062541
 fSumw[12]=0.209397, x=1.75, error=0.0507231
 fSumw[13]=0, x=2.08333, error=0
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 253 - Systematic Uncertainties for 2.6n from MM^2 and QE W cut (gpg)

[Modified Wed Sep 9 18:24:52 2009 (GMT) gpg]

Use the +/- 10% method the the MM2 cut to select neutrons and the W cut to select quasielastic events. See the Mathematica notebook eod/uncs /ALTpUncertainties26n.nb for the final results.

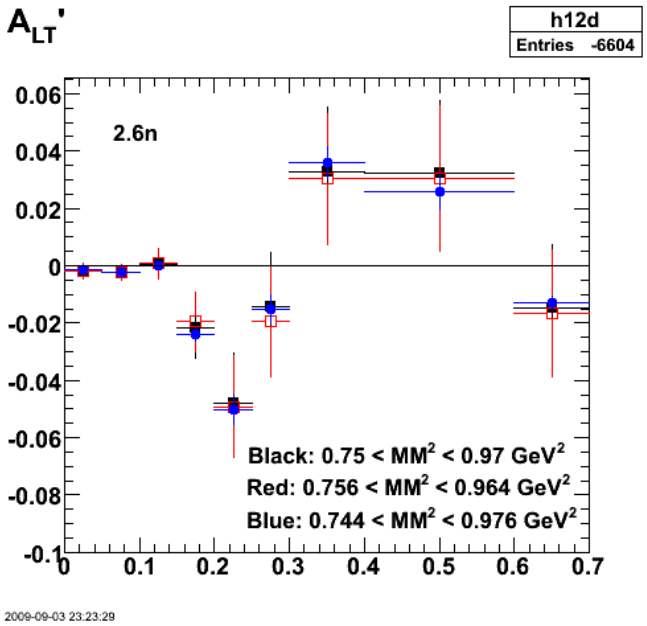

Fig 1. Comparison of ALTp for +/- 10% change in the width of the MM2 cut to select neutrons. Note the +/- 10% was calculated from the old width of the MM2 cut (opps!) and not the one shown in the plot.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

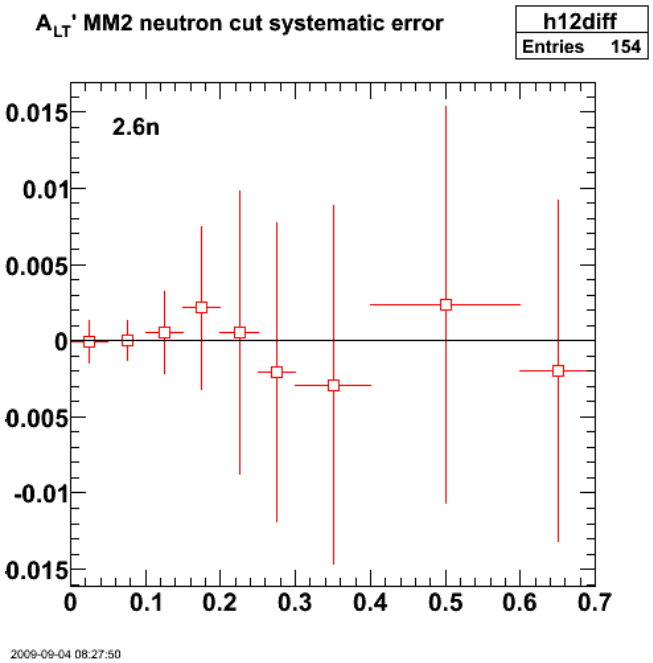

Fig 2. Systematic uncertainty due to +/-10% variation on width of MM2 cut ((hi-lo)/2). Goes with Fig 1.

Click here to view the object (Root macro) you uploaded.

Now do the +/- 10% thing on the W cut used to select quasielastic events.

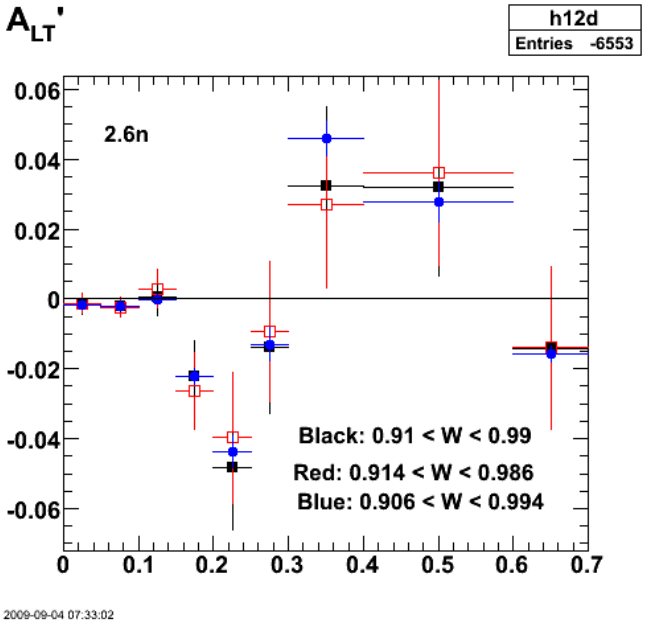

Fig 3. Comparison of ALTp for +/-10% change in the width of the W cut to select quasielastic events.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

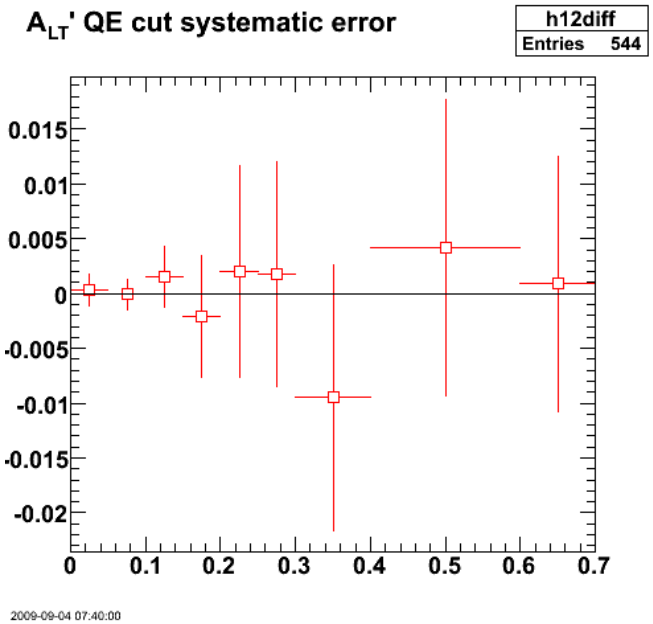

Fig 4. delta_ALTp for +/- 10% test of QE cut (divided by two).

Click here to view the object (Root macro) you uploaded.

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Jerry Gilfoyle's Enotebook page 254 - 3/4-final ALTp with systematic uncertainties for 2.6n (gpg)

[Modified Thu Mar 3 23:50:08 2011 (GMT) gpg]

For the 2.6n data from the previous 3-4 elog entries.

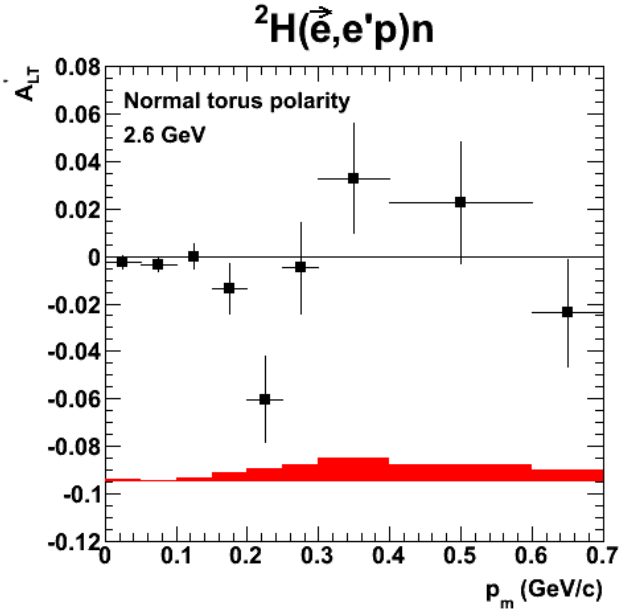

Fig 1. Final (as of 9/4/09) ALTp for 2.6n with systematic uncertainties.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Mathematica notebook for systematic uncertainties for 2.6n.) you uploaded.

Click here to view the object (tarred, gzipped archive of the eod5c area used to generate the 2.6n results. Unfortunately, I didn't remember to do this until after I had switched over to the 2.6r data. The only changes to the codes are those changes as detailed on the Spiderwulf website.) you uploaded.

Revised version (10/2/09).

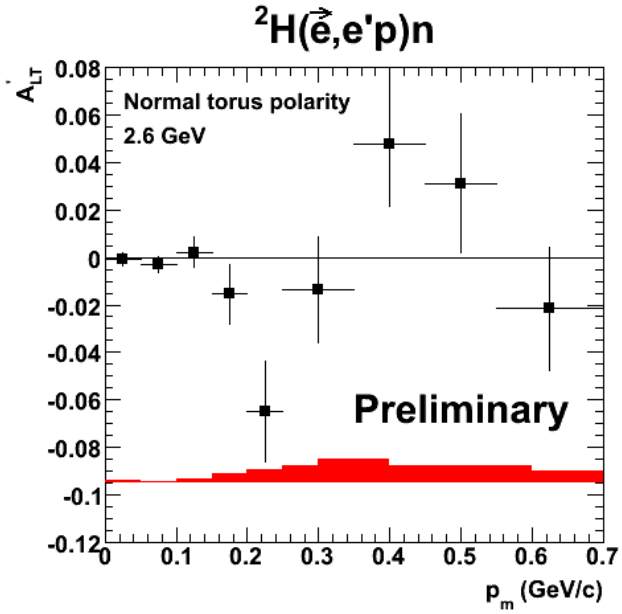

Fig 2. Revised version of fig 1 (10/2/09).

Click here to view the object (ROOT macro) you uploaded.

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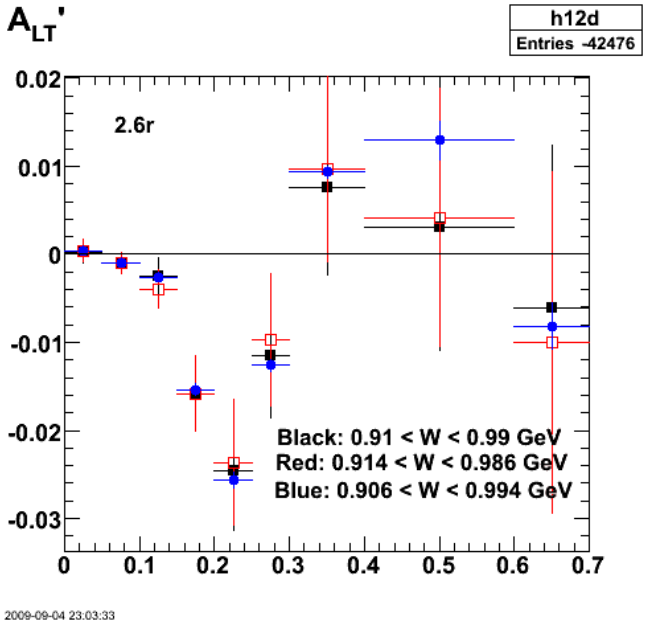
Jerry Gilfoyle's Enotebook page 255 - Systematic Uncertainties for 2.6r from MM2 and QE W cut (gpg)

[Modified Sat Sep 5 13:11:16 2009 (GMT) gpg]

Now go through the sequence with the 2.6r data. Note the very small error bars for the enlarged size of the cut.



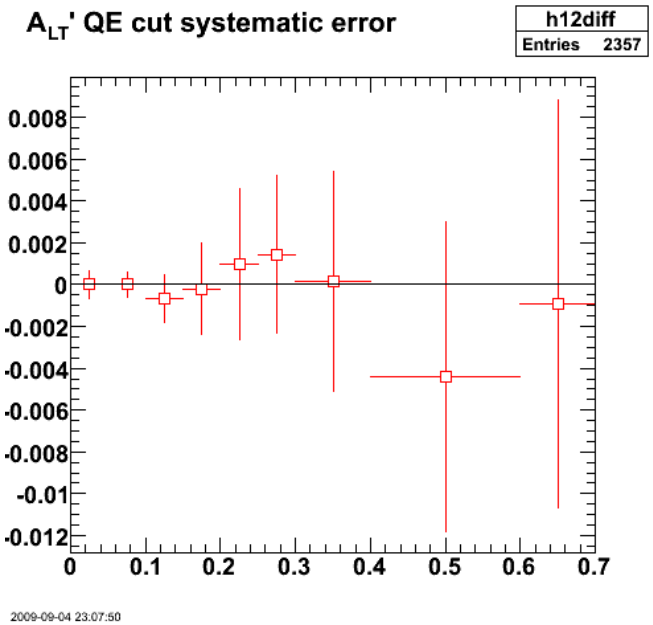
2009-09-04 23:03:33

Fig 1. Effect of reducing the W cut to select quasielastic events by 110% (red) and increasing it by 10% (blue).

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Get the systematic uncertainty by calculating dALTp = (ALTp(90% of cut) - ALTp(110% of cut))/2.



2009-09-04 23:07:50

Fig 2. Systematic error on QE cut.

Click here to view the object (Root macro) you uploaded.

Numbers for the systematic uncertainty.

```
root [68] h12diff->Print("all")
TH1.Print Name  = h12diff, Entries= 2357, Total sum= -0.0678137
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=1.77246e-05, x=0.025, error=0.000672345
 fSumw[2]=1.92085e-07, x=0.075, error=0.000611737
 fSumw[3]=-0.000671847, x=0.125, error=0.00111831
 fSumw[4]=-0.000208141, x=0.175, error=0.00217293
 fSumw[5]=0.000981814, x=0.225, error=0.00361064
 fSumw[6]=0.00144367, x=0.275, error=0.00375242
 fSumw[7]=0.00016165, x=0.35, error=0.00526416
 fSumw[8]=-0.0043764, x=0.5, error=0.00741502
 fSumw[9]=-0.000933798, x=0.65, error=0.00975665
 fSumw[10]=0.00388887, x=0.85, error=0.0158541
 fSumw[11]=-0.00304918, x=1.25, error=0.0439001
 fSumw[12]=-0.0650683, x=1.75, error=0.272108
 fSumw[13]=0, x=2.08333, error=0
```

Now do the MM^2 cut.

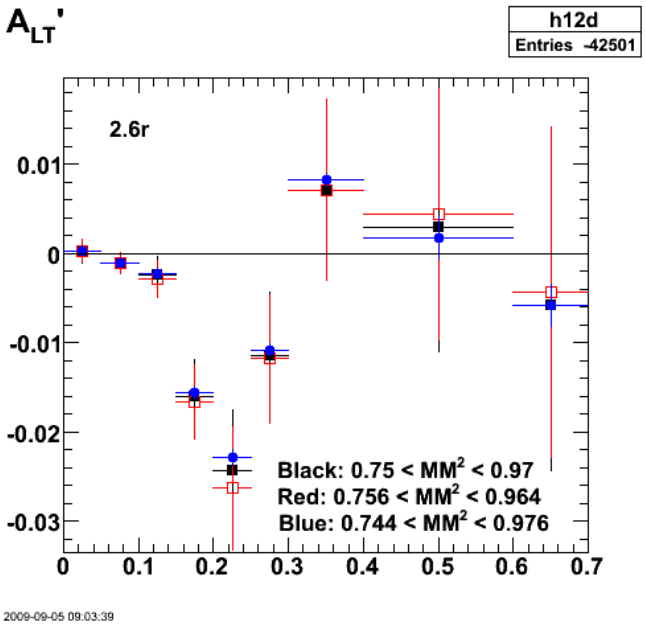


Fig 3. Systematic uncertainty on MM2 cut using +/- 10% method.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

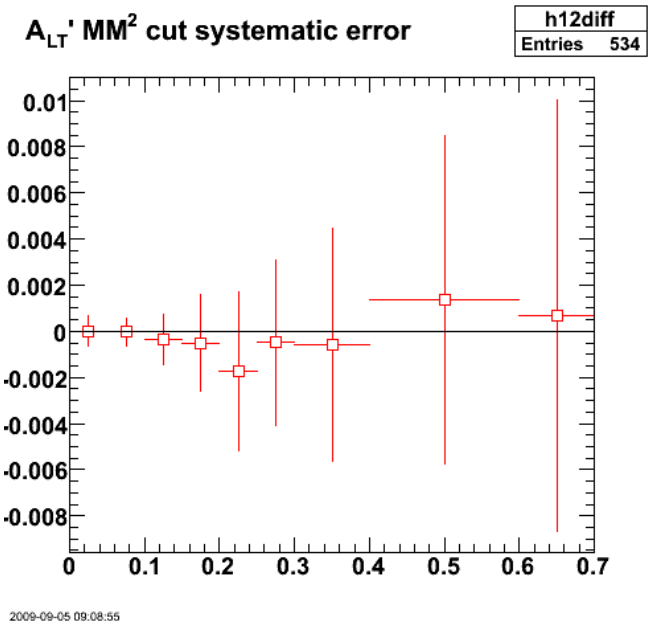


Fig 4. delta_ALTp for 2.6r and MM2 cut based on Fig 3.

Click here to view the object (Root macro) you uploaded.

Numerical results.

```
root [78] h12diff->Print("all")
TH1.Print Name  = h12diff, Entries= 534, Total sum= -0.00232464
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=1.07847e-05, x=0.025, error=0.000653051
 fSumw[2]=-2.66748e-05, x=0.075, error=0.000590163
 fSumw[3]=-0.000350482, x=0.125, error=0.00107581
 fSumw[4]=-0.000500052, x=0.175, error=0.00208811
 fSumw[5]=-0.00172326, x=0.225, error=0.00345676
 fSumw[6]=-0.000488938, x=0.275, error=0.0035931
 fSumw[7]=-0.000561034, x=0.35, error=0.00504994
 fSumw[8]=0.00136699, x=0.5, error=0.00713466
 fSumw[9]=0.000684101, x=0.65, error=0.00933667
 fSumw[10]=-0.000885788, x=0.85, error=0.0151564
 fSumw[11]=0.000149719, x=1.25, error=0.0422286
 fSumw[12]=0, x=1.75, error=0.278877
 fSumw[13]=0, x=2.08333, error=0
```

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Jerry Gilfoyle's Enotebook page 256 - Systematic uncertainties on ALTp for 2.6r data for EC_{etot} and EC pion threshold. (gpg)

[Modified Sun Sep 6 23:05:59 2009 (GMT) gpg]

Now do the systematic uncertainties on ALTp for 2.6r data for EC_{etot} and EC pion threshold using the +/- 10% method.

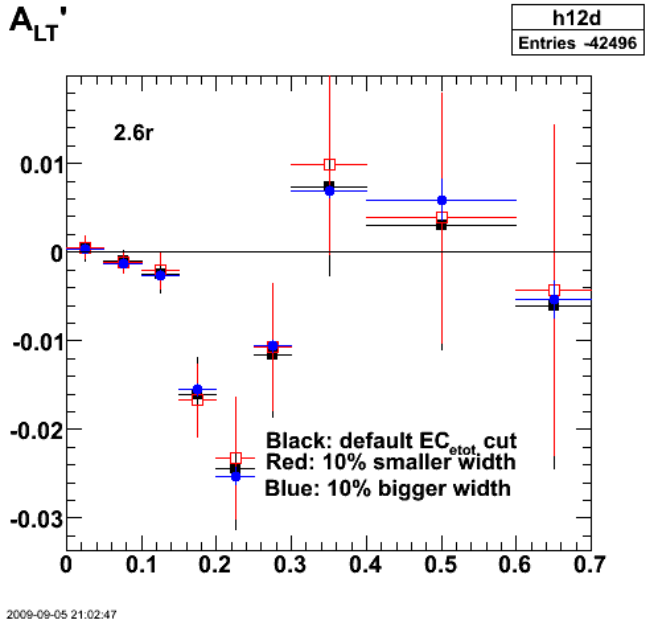


Fig 1. Systematic uncertainty on the EC_{etot} cut (i.e., the sampling fraction).

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Get the systematic uncertainty by calculating dALTp = (ALTp(90% of cut) - ALTp(110% of cut))/2.

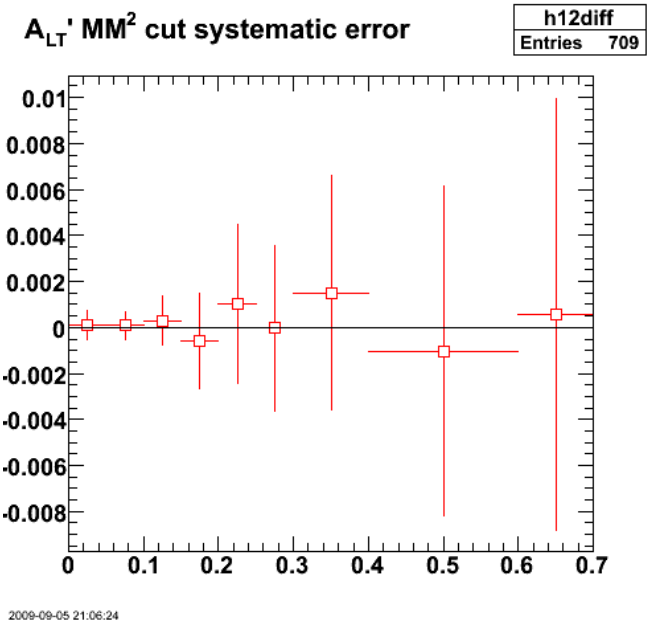


Fig 2. Plot of differences divided by two from fig 1 for 2.6r. The label on the plot is WRONG!!!

Click here to view the object (Root macro) you uploaded.

```
TH1.Print Name  = h12diff, Entries= 709, Total sum= 0.0170277
 fSumw[0]=0, x=-0.0833333, error=0
```

```
 fSumw[1]=0.000103621, x=0.025, error=0.000659424
 fSumw[2]=8.90847e-05, x=0.075, error=0.000594029
 fSumw[3]=0.000297173, x=0.125, error=0.00107925
 fSumw[4]=-0.000593074, x=0.175, error=0.00208806
 fSumw[5]=0.00101165, x=0.225, error=0.00346466
 fSumw[6]=-1.69771e-05, x=0.275, error=0.00360403
 fSumw[7]=0.00150222, x=0.35, error=0.00507999
 fSumw[8]=-0.00102033, x=0.5, error=0.00716573
 fSumw[9]=0.000570933, x=0.65, error=0.0093646
 fSumw[10]=0.00641637, x=0.85, error=0.0152564
 fSumw[11]=0.00866699, x=1.25, error=0.0422658
 fSumw[12]=0, x=1.75, error=0.278877
 fSumw[13]=0, x=2.08333, error=0
root [69]
```

Now do the EC pion threshold cut.

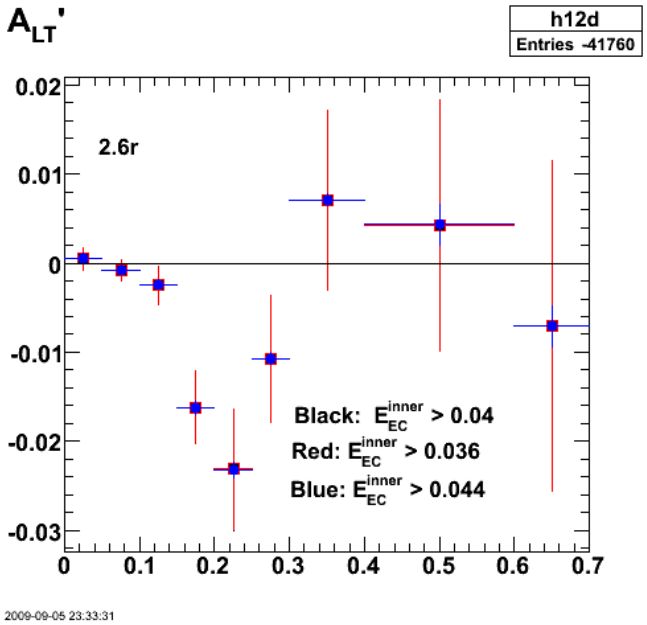


Fig 3. ALTp for variation in EC pion threshold of +/- 10% for 2.6r.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Now get the difference between the different values of the EC pion threshold.

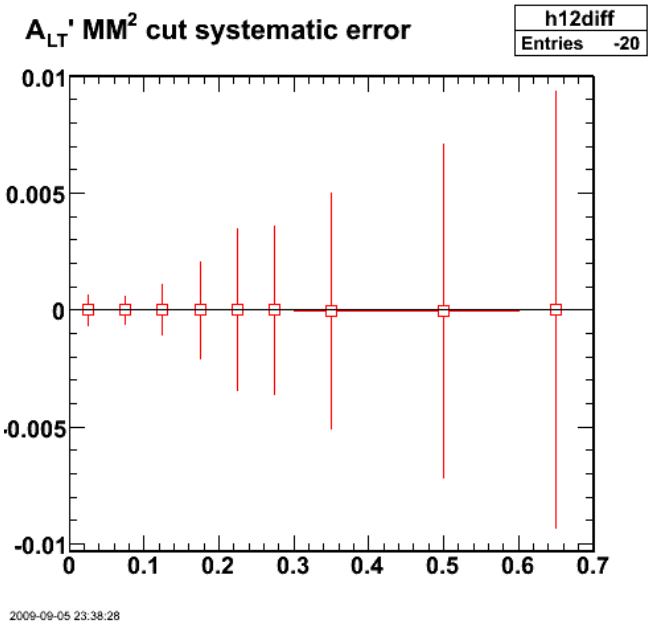


Fig 4. Difference for fig3.

Click here to view the object (Root macro) you uploaded.

```
TH1.Print Name  = h12diff, Entries= -20, Total sum= 0.000202318
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=5.53815e-06, x=0.025, error=0.000655673
 fSumw[2]=-8.06563e-06, x=0.075, error=0.000590844
 fSumw[3]=1.55158e-06, x=0.125, error=0.00107358
 fSumw[4]=-4.05032e-06, x=0.175, error=0.00207353
 fSumw[5]=3.1855e-05, x=0.225, error=0.00343957
 fSumw[6]=-2.31666e-06, x=0.275, error=0.00358083
 fSumw[7]=-2.94212e-05, x=0.35, error=0.00504912
 fSumw[8]=-4.09745e-05, x=0.5, error=0.00713307
 fSumw[9]=0, x=0.65, error=0.00933891
 fSumw[10]=0.000248201, x=0.85, error=0.0151978
 fSumw[11]=0, x=1.25, error=0.0421989
 fSumw[12]=0, x=1.75, error=0.278877
 fSumw[13]=0, x=2.08333, error=0
```

The size of the effect of changing the EC pion threshold for the 2.6r data is much less than for the 2.6n data. Just as a quick check I increase the upper limit on the cut bu 100% (instead of the usual 10%). I get a large (though not a factor 10) increase in the difference between the 90% value and the 200% value. Seems to be ok.

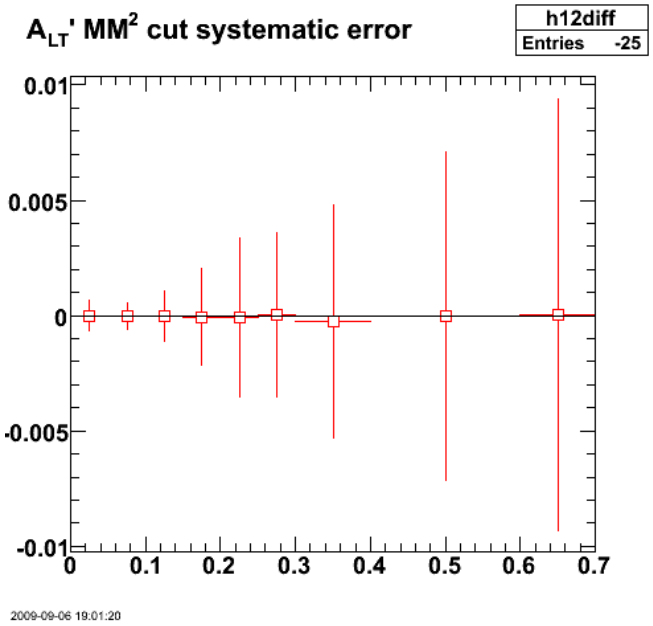


Fig 5. Difference between 90% of accepted value of the EC pion threshold and 200% of the EC pion threshold and then divide this difference by two.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Numerical values:

```
root [68] h12diff->Print("all")
TH1.Print Name  = h12diff, Entries= -25, Total sum= -0.0006715
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-1.11989e-06, x=0.025, error=0.000655643
 fSumw[2]=-3.09739e-05, x=0.075, error=0.000590829
 fSumw[3]=-2.90282e-05, x=0.125, error=0.00107359
 fSumw[4]=-5.27157e-05, x=0.175, error=0.00207356
 fSumw[5]=-9.53795e-05, x=0.225, error=0.00343951
 fSumw[6]=3.54541e-05, x=0.275, error=0.00358081
 fSumw[7]=-0.000269045, x=0.35, error=0.00504997
 fSumw[8]=-1.67412e-05, x=0.5, error=0.00713267
 fSumw[9]=4.17633e-05, x=0.65, error=0.00933904
 fSumw[10]=0.00025274, x=0.85, error=0.0151993
 fSumw[11]=-0.000506453, x=1.25, error=0.0421881
 fSumw[12]=0, x=1.75, error=0.278877
 fSumw[13]=0, x=2.08333, error=0
```

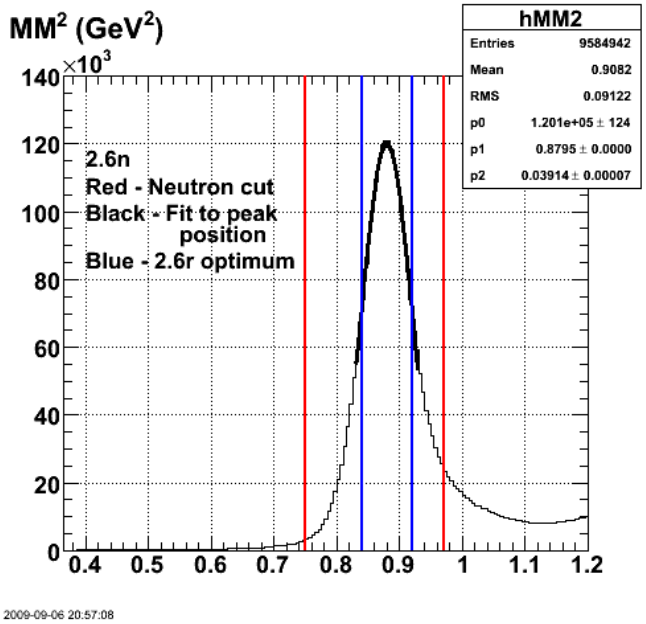
DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 257 - Comparing ALTp with different MM2 cuts (gpg)

[Modified Fri Sep 11 18:38:24 2009 (GMT) gpg]

The magnitude of the dip in ALTp for the 2.6r data set is significantly shallower using the 2.6n cuts than it was before. The biggest difference appears to be the MM2 cut to select neutrons in the final state. The W cut to select QE events is nearly the same for both data sets (0.91-0.99 GeV for 2.6n and 0.92-1.0 GeV for 2.6r). Compare the MM2 distributions for each data.

For the 2.6n data.

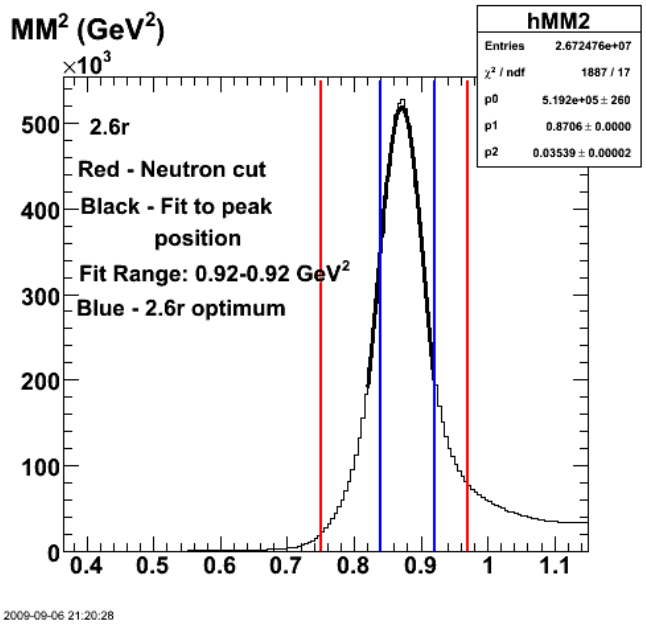


2009-09-06 20:57:08

Fig 1. 2.6n MM2 distribution: red lines are the cut used in the analysis, blue lines are the previous 2.6r limits, and the black curve is a fit used to find the peak which is 0.88 GeV2 as expected.

Click here to view the object (Root macro) you uploaded.

For the 2.6r data.



2009-09-06 21:20:28

Fig 2. 2.6r Results for a fit centered on MM2 = 0.87 GeV2 instead of 0.88 GeV2 because that is the peak of the neutron distribution. The fit range is 0.82-0.92 (not 0.92-0.92).

Click here to view the object (Root macro) you uploaded.

Now test ALTp for different MM2 ranges. First do 2.6r data. The statistical significance is poor, but the dip in ALTp pretty clearly goes away outside the central MM2 region.

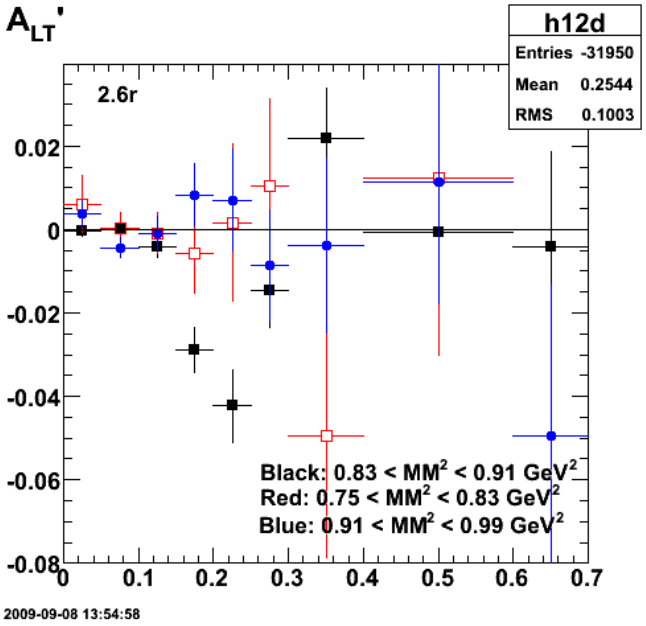


Fig 3. Comparison of ALTp for the 2.6r data and different ranges of the MM2 cuts used to select neutrons in the final state.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Now do the 2.6n data. The statistics are again lousy outside the central region. The dip may be diminished outside the central region, but we can't tell with these statistics. Note that the range used for the MM2 for the 2.6n data in Fig 4. was 0.83 < MM2 < 0.91 GeV2 which is centered on the MM2 peak for the 2.6r data, but is NOT centered on the MM2 for the 2.6n data. Redo the analysis below with 0.84 < MM2 < 0.92 GeV2.

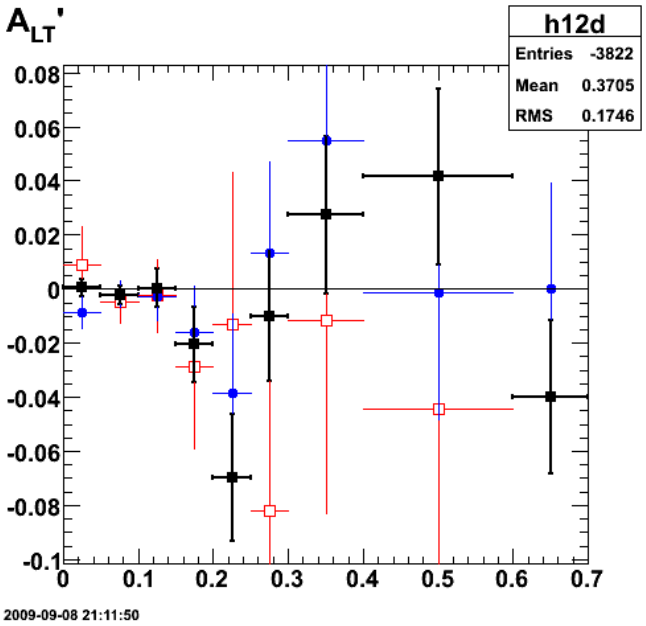


Fig 4. Comparison of ALTp for the 2.6n data and different ranges of the MM2 cuts used to select neutrons in the final state.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

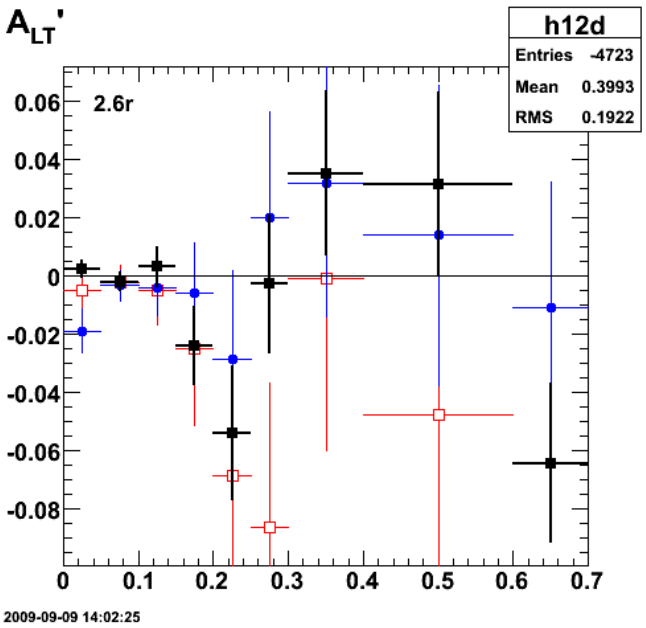


Fig 5. Comparison of ALTp for the 2.6n data and different ranges of the MM2 cuts used to select neutrons in the final state with the range on the MM2 cuts shifted up by 0.01 GeV2 so the 2.6n central region is symmetric about the MM2 peak. Done with with 0.84 < MM2 < 0.92 GeV2.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Note the significant change in the magnitude of the dip just by shifting the position of the MM2 cut up by a small amount. The cut went from 0.83< MM2 < 0.91 GeV2 to 0.84 < MM2 < 0.92 GeV2. This is odd especially since I showed in previous entries that the magnitude was fairly robust to large changes in the limits of the MM2. The difference here is that the magnitude of the dip in those studies was about 0.05 which is about the value for the range 0.84< MM2 < 0.92 GeV2 while the magnitude is about 0.07 for the range 0.83< MM2 < 0.91 GeV2. Perhaps this large magnitude is a fluke. Apply the +/- 10% method to the uncertainty in this cut to see what happens.

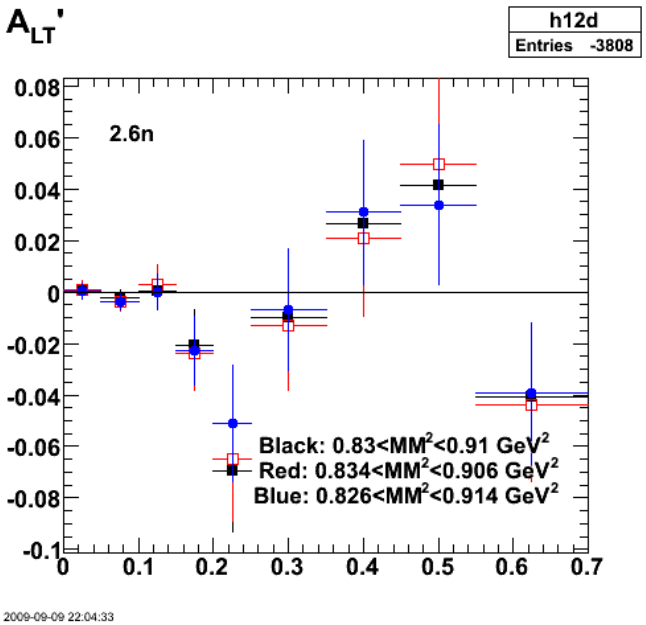


Fig 6. Comparison of ALTp with +/- 10% change in width of MM2 cut.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Numerical results.

```
h12diff->Print("all")
TH1.Print Name  = h12diff, Entries= 164, Total sum= 0.00675735
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=0.000368365, x=0.025, error=0.00224707
 fSumw[2]=-0.000144824, x=0.075, error=0.00240579
```

```
fSumw[3]=0.00151325, x=0.125, error=0.00506739
fSumw[4]=-0.000469266, x=0.175, error=0.00991158
fSumw[5]=-0.00682342, x=0.225, error=0.0167205
fSumw[6]=-0.00309434, x=0.275, error=0.0173378
fSumw[7]=-0.00502307, x=0.35, error=0.0206008
fSumw[8]=0.00776812, x=0.5, error=0.0230232
fSumw[9]=-0.00228899, x=0.65, error=0.0201836
fSumw[10]=0.00167342, x=0.85, error=0.0196586
fSumw[11]=-0.0196888, x=1.25, error=0.0357383
fSumw[12]=0.0329669, x=1.75, error=0.131227
fSumw[13]=0, x=2.08333, error=0
```

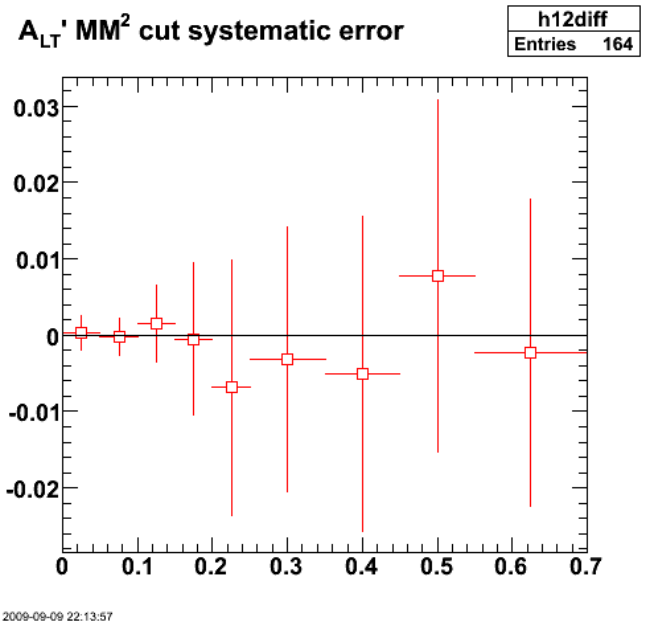


Fig 7. Use Fig 6 results and calculate (ALTp(90%) - ALTp(110%))/2 to get delta_ALTp.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 258 - Changes to gsim scripts (gp)

[Modified Tue Sep 8 18:37:55 2009 (GMT) gp]

I have changed the scripts for Calina's gsim calculations so that the submit_eod.pl scripts will submit two jobs to each node (one per CPU) so we can take advantage of each CPU. The plot below shows ALTp calculated with this new script. Within statistics and after examining the log files, the runs seem fine and the calculations were done in the same amount of time as when we submitted one job per node.

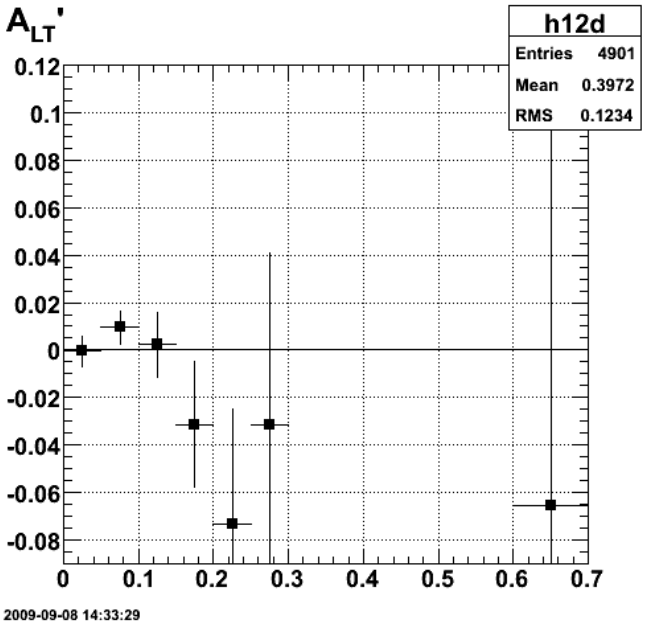


Fig 1. ALTp for 2.6n gsim calculation with new scripts.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Archive of root files and log files for gsim run.) you uploaded.

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Jerry Gilfoyle's Enotebook page 259 - Change the bins for 2.6r (gpg)

[Modified Fri Sep 11 01:51:55 2009 (GMT) gpg]

Just to make switching back and forth between data sets I (belatedly) decided to have the same set of bins for 2.6n and 2.6r. I think I can get away with using the same values for the uncertainties since it only effects the last two bins which have large statistical uncertainties anyway.

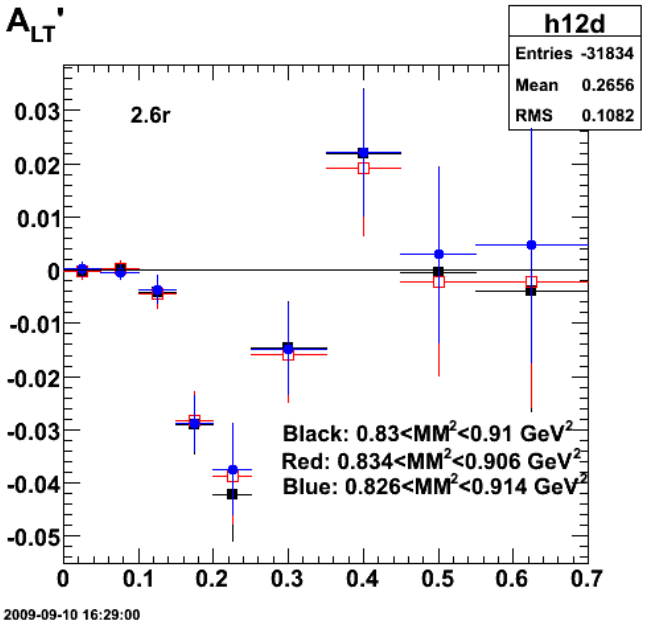

Fig 1. Comparison of ALTp with +/- 10% changes in the width of the MM2 cut.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

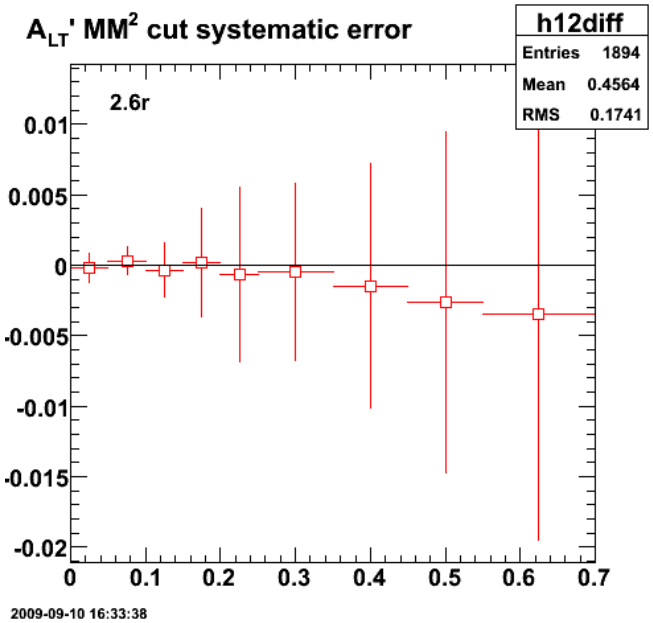

Fig 2. systematic uncertainty for Fig 1.

Click here to view the object (ROOT macro) you uploaded.

Numerical results.

```
root [67] h12d->Print("all")
TH1.Print Name  = h12d, Entries= -31834, Total sum= -1.34326
```

```
fSumw[0]=0, x=-0.0833333, error=0
fSumw[1]=-0.000296018, x=0.025, error=0.0014453
fSumw[2]=-7.14851e-05, x=0.075, error=0.00138495
fSumw[3]=-0.00413917, x=0.125, error=0.00270134
fSumw[4]=-0.0290363, x=0.175, error=0.00539806
fSumw[5]=-0.0422154, x=0.225, error=0.00873048
fSumw[6]=-0.0147156, x=0.3, error=0.008828
fSumw[7]=0.0219385, x=0.4, error=0.0122024
fSumw[8]=-0.000504992, x=0.5, error=0.0170207
fSumw[9]=-0.00400481, x=0.625, error=0.0226518
fSumw[10]=-0.0328821, x=0.85, error=0.0378815
fSumw[11]=-0.112351, x=1.25, error=0.103481
fSumw[12]=-1.12498, x=1.75, error=1.31145
fSumw[13]=0, x=2.08333, error=0
```

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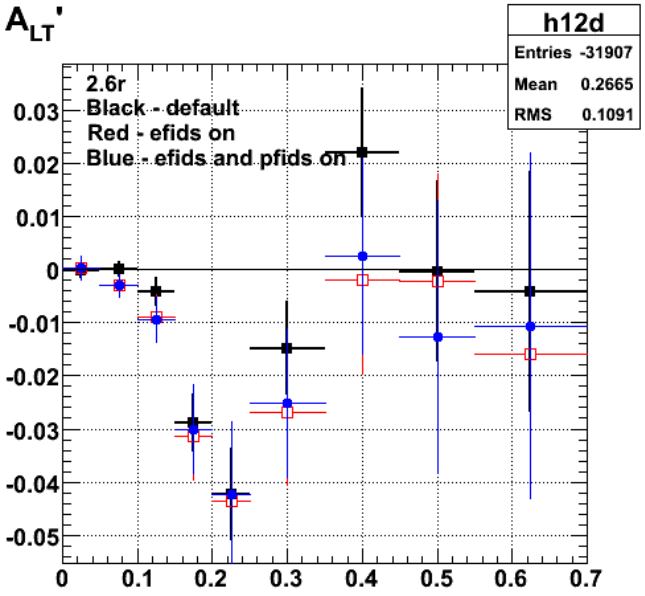
Jerry Gilfoyle's Enotebook page 260 - Effect of fiducial cuts after bin change for 2.6r (gpg)

[Modified Fri Mar 4 14:22:23 2011 (GMT) gpg]

Test the effect of turning on the electron and proton fiducial cuts for the 2.6r data. There is a surprisingly large effect that was not seen before.

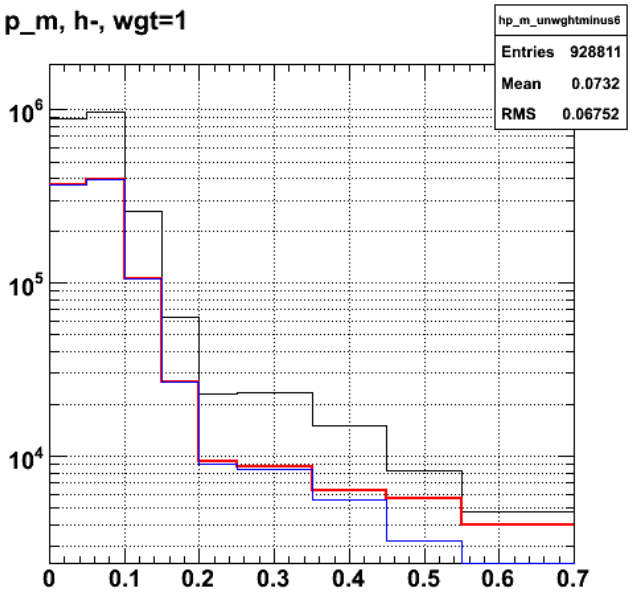


2009-09-11 13:58:51

Fig 1. Comparison of 2.6r ALTp with efids on (red) and efids+pfids (blue).

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.



2009-09-11 14:11:26

Fig 2. Effect on fiducial cuts on distribution of events used to extract ALTp.

Click here to view the object (ROOT macro) you uploaded.

It looks like 1/2->3/4 of the events are lost when the fiducials are turned on.

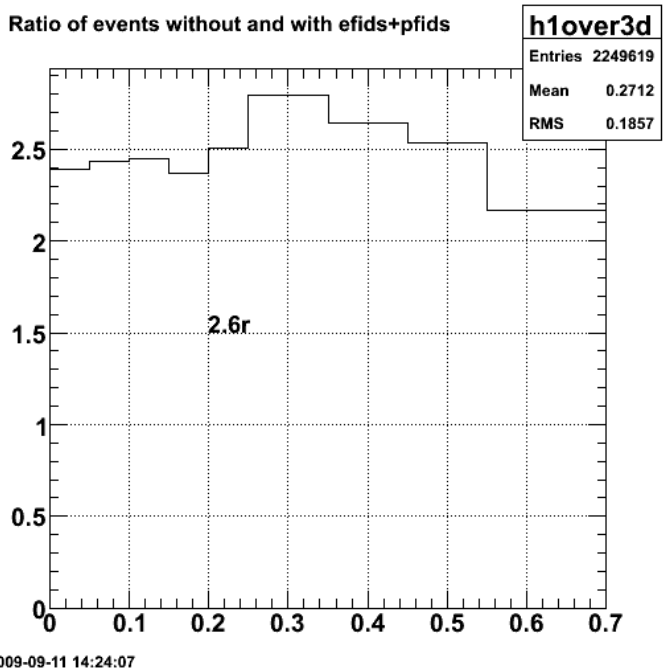


Fig 3. Ratio of events without and with efids+pfids as a function of p_m for 2.6r.

Click here to view the object (ROOT macro) you uploaded.

This is very different from my previous results (see entry 109) so let's explore the parameter space a bit more. First change the MM2 cut.

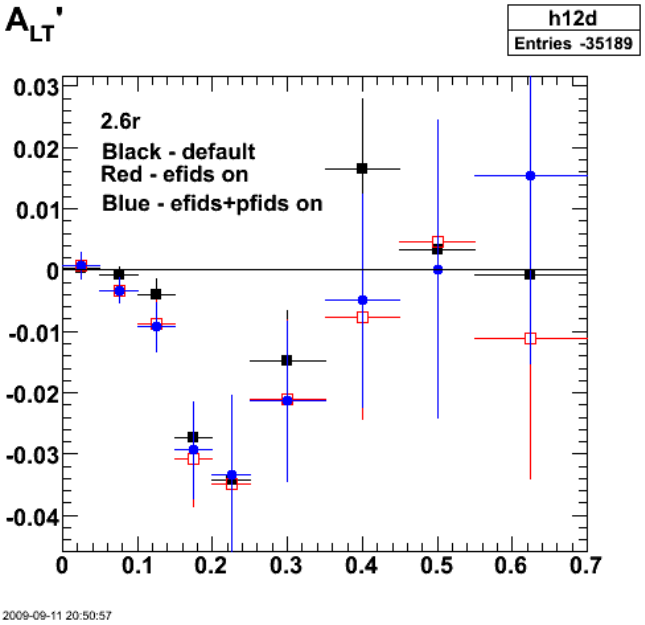


Fig 4. Effect of fiducial cuts for 2.6r. Notice the dip is much smaller.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

```
Double_t neutron_mm2_lo = 0.82, neutron_mm2_hi = 0.92;  // test 9/11/09
Double_t W_QE_lo=0.91, W_QE_hi=0.99;  // default values
```

Compare fig 1 results with old results with efids and pfids turned off from entry 109 in the elog.

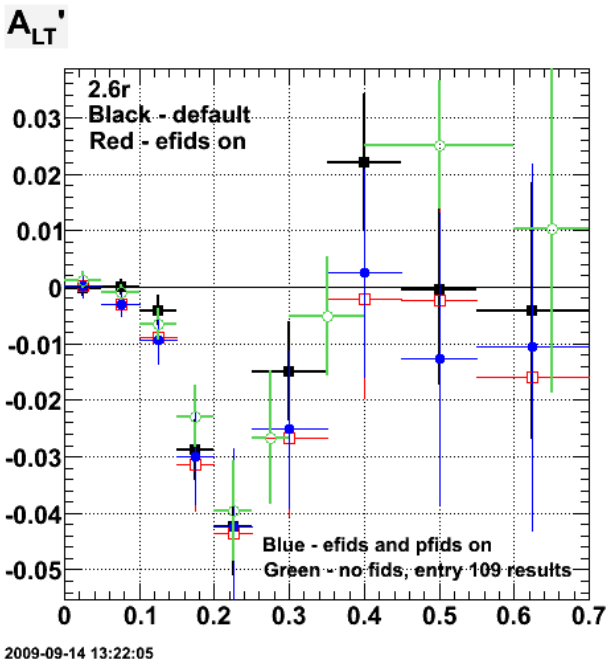


Fig 5. Add old results from entry 109 for no fids in 2.6r to fig 1.

Click here to view the object (ROOT macro) you uploaded.

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Jerry Gilfoyle's Enotebook page 261 - W spectra (gpg)

[Modified Fri Sep 11 20:47:58 2009 (GMT) gpg]

Checking the W spectra and the QE cut. The higher Q2 data (2.6n) has a wider (by 50%) W distribution which is expected. Both have peaks that are high 0.95 GeV instead of 0.939 GeV (see 9/11/09 elog or numbers on plot).

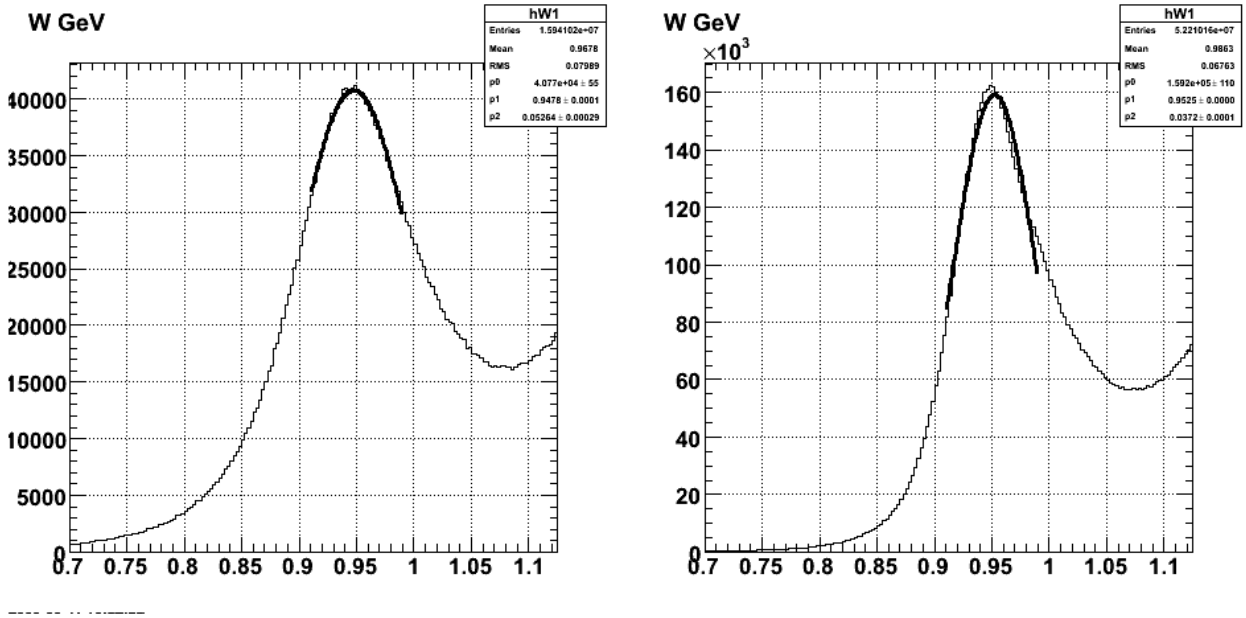

Fig 1. Comparison of W spectra for 2.6n (left) and 2.6r (right) with fits to the central peak region. Fit is over range used for QE cut (W=0.91-0.99 GeV).

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (W26n.root for left-hand panel) you uploaded.

Click here to view the object (W26r.root for right-hand panel.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 262 - Difference between fids and nofids (2.6r) (gpg)

[Modified Wed Sep 30 14:02:22 2009 (GMT) gpg]

To see how different things are when I turn on the efids and pfids, I want to figure out the difference between ALTp with fids on and off (easy) with the proper uncertainties (not so easy). I can't just take the difference between the two extractions of ALTp and sum the uncertainties in quadrature because the data sets are not independent. The ALTp with no fids has many (about half) of the same data points the ALTp with fids has. I have to recast the problem in terms of independent measures of ALTp. In other words break each histogram like hp_m_unwghtplus4 into the sum of two histograms; one with efids and pfids on and another for events that are excluded (i.e. at least one of the efid+pfid cuts fails).

To get started create all the appropriate histograms with uncertainties added in quadrature. Then get ALTp with fids off and compare it in fig 1 with ALTp derived by adding ALTp(efids+pfids) with ALTp(no efid OR no pfid). It works!

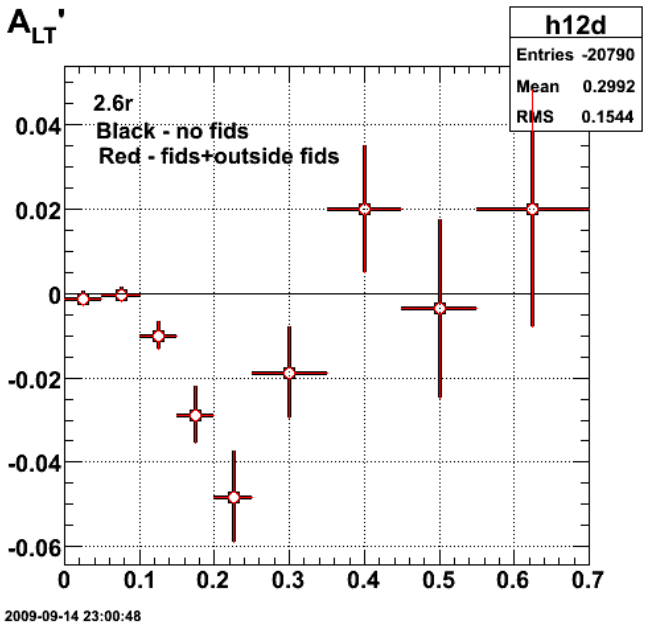

Fig 1. Comparison of ALTp(nofids) (black) with ALTp(efid+pfid) + ALTp(no efid OR no pfid) (red). This is only a partial statistics for for the 2.6r data set.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Calculate the difference between ALTp(fids on) and ALTp(fids off). Do NOT use the uncertainties calculated from ROOT. Get them by hand by treating ALTp(fids off) as the sum of ALTp(fids on) + ALTp(outside fids). The results is shown below for a partial analysis of the 2.6r data. All the points are consistent with zero within the error bars though there appears to be a bias toward negative results (fids on is a bit larger than fids off). The linear fit shown gives a slope that is just a wee bit more (in magnitude) than its uncertainty. I proclaim ALTp(fids off) = ALTp(fids on) for the 2.6r data!!!!

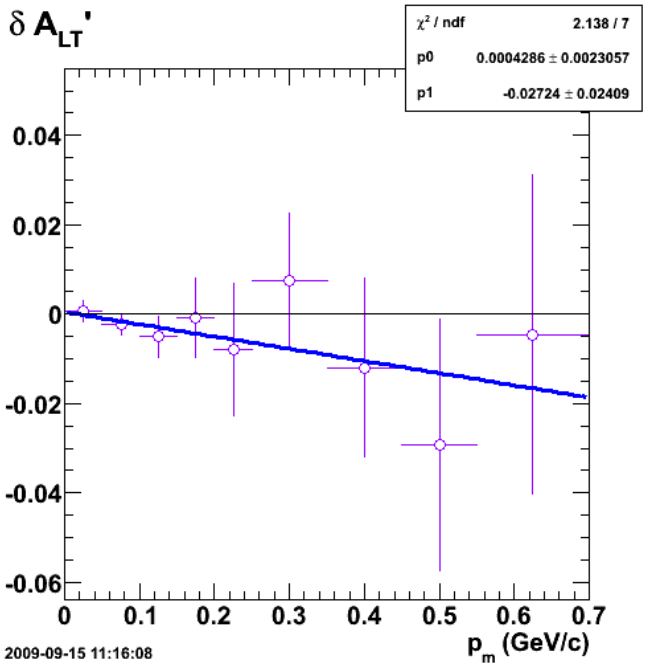

Fig 2. Plot of dALTp = ALTp(fids off) - ALTp(fids on) for 2.6r.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Click here to view the object (ROOT macro for calculating dALTp +/- ddALTp from the histogram file.) you uploaded.

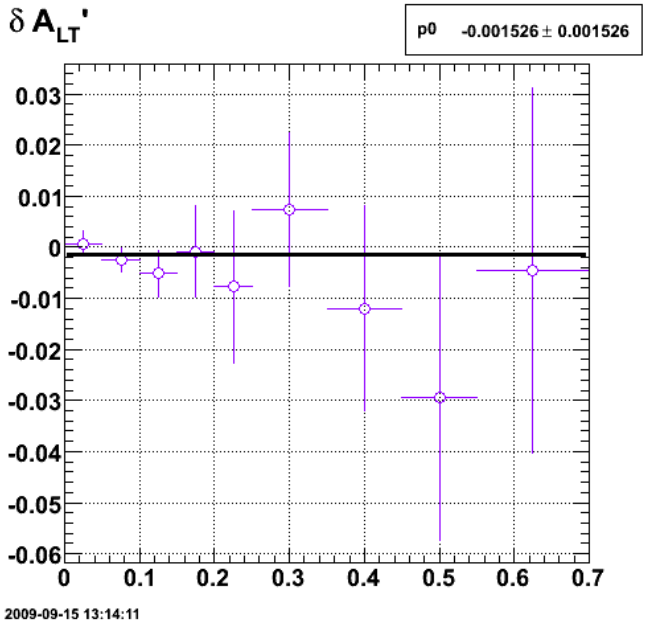

Fig 3. Same as fig 2, but use a constant value to fit the data and get something consistent with zero.

Click here to view the object (ROOT macro) you uploaded.

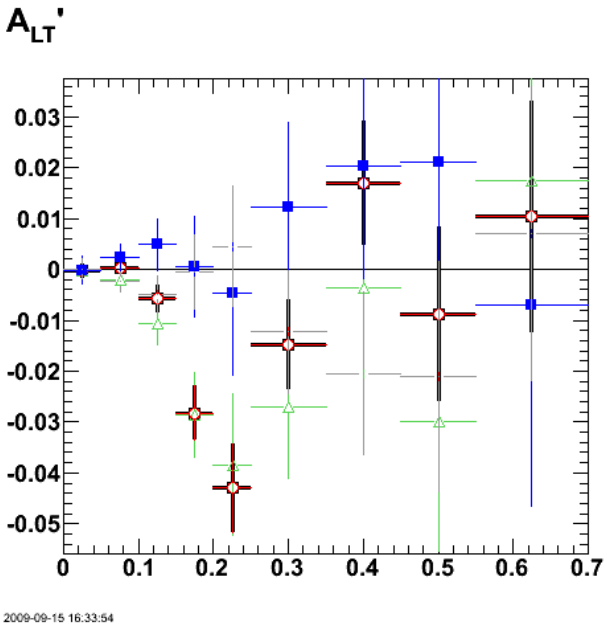

Fig 4. Same as fig 1 for the full 2.6 data set. Unfortunately there are some noticeable differences at large p_M with respect to the previous standard a few entries ago??? It's possible I had a different MM2 cut (0.84-0.92 instead of 0.83-0.91 GeV2)

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

The new default numbers from Fig 4.

```
   root [2] h12d->Print("all")
TH1.Print Name  = h12d, Entries= -32291, Total sum= -1.5223
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.000273283, x=0.025, error=0.0014448
 fSumw[2]=0.000293187, x=0.075, error=0.00138465
 fSumw[3]=-0.00576073, x=0.125, error=0.00270168
 fSumw[4]=-0.0282113, x=0.175, error=0.00539681
 fSumw[5]=-0.0429169, x=0.225, error=0.00871653
 fSumw[6]=-0.0147256, x=0.3, error=0.00882204
 fSumw[7]=0.016845, x=0.4, error=0.0122086
 fSumw[8]=-0.00882103, x=0.5, error=0.0170585
 fSumw[9]=0.0103378, x=0.625, error=0.0226742
 fSumw[10]=-0.0221136, x=0.85, error=0.0378622
 fSumw[11]=-0.139062, x=1.25, error=0.103949
 fSumw[12]=-1.2879, x=1.75, error=1.30677
 fSumw[13]=0, x=2.08333, error=0
root [3]
```

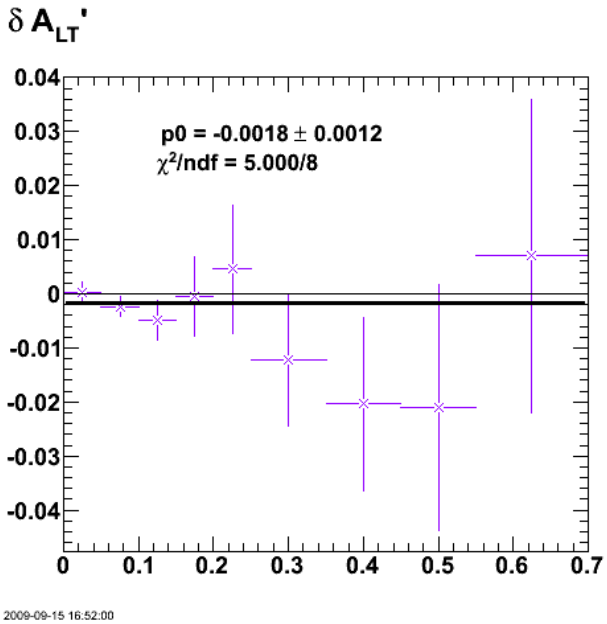

Fig 5. Fit to #delta ALTp for 2.6r.

Click here to view the object (ROOT macro) you uploaded.

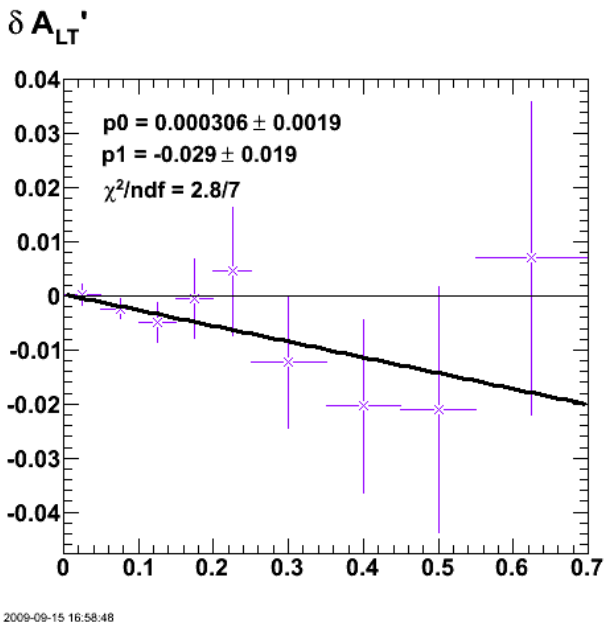

Fig 6. Same as fig 5 with a linear fit.

Click here to view the object (ROOT macro) you uploaded.

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Jerry Gilfoyle's Enotebook page 263 - Checking changes in ALTp for 2.6r (gpg)

[Modified Fri Mar 4 14:42:08 2011 (GMT) gpg]

Comparing entries 262 and 260 it looks like ALTp has changed over time. I suspect that I had changed some parameters like the MM2 cut. Most of the difference is in the large p_m points. The plot below shows a re-analysis of the 2.6r data which agrees with the 2.62-GeV results along with the histogram file AND an archive of the analysis code and parameters used to get the data.

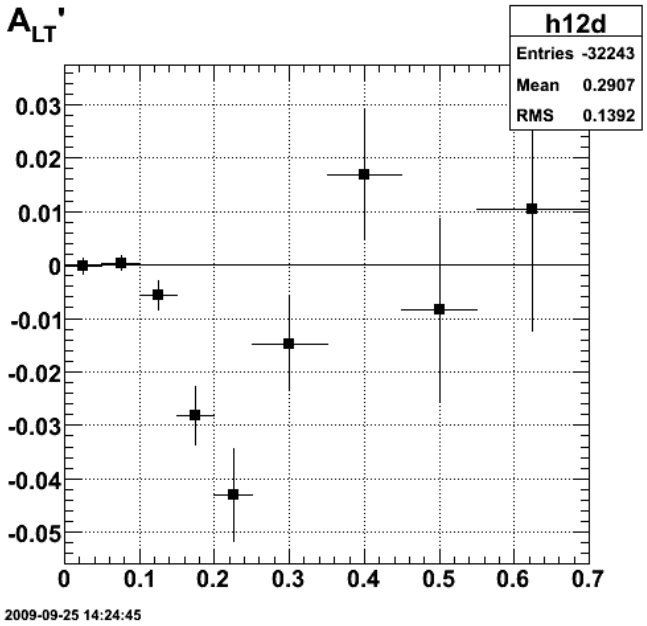

Fig 1. ALTp for 2.6r data.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Click here to view the object (tar archive of analysis software) you uploaded.

```
root [22] h12d->Print("all")
TH1.Print Name  = h12d, Entries= -32243, Total sum= -1.5211
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.000239265, x=0.025, error=0.00144487
 fSumw[2]=0.000328069, x=0.075, error=0.0013847
 fSumw[3]=-0.00575003, x=0.125, error=0.00270174
 fSumw[4]=-0.0282343, x=0.175, error=0.0053968
 fSumw[5]=-0.0429971, x=0.225, error=0.0087163
 fSumw[6]=-0.0147469, x=0.3, error=0.00882195
 fSumw[7]=0.0168395, x=0.4, error=0.0122084
 fSumw[8]=-0.00835061, x=0.5, error=0.0170589
 fSumw[9]=0.0103378, x=0.625, error=0.0226742
 fSumw[10]=-0.0213306, x=0.85, error=0.0378654
 fSumw[11]=-0.139062, x=1.25, error=0.103949
 fSumw[12]=-1.2879, x=1.75, error=1.30677
 fSumw[13]=0, x=2.08333, error=0
root [23]
```

Do the analysis again from the stage of copying over the data files and I get not quite exactly, but very close to the values above.

```
root [22] h12d->Print("all")
TH1.Print Name  = h12d, Entries= -32249, Total sum= -1.52108
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.000265877, x=0.025, error=0.00144486
 fSumw[2]=0.000326257, x=0.075, error=0.00138471
 fSumw[3]=-0.00575321, x=0.125, error=0.00270175
 fSumw[4]=-0.0282439, x=0.175, error=0.00539683
 fSumw[5]=-0.0430834, x=0.225, error=0.00871647
 fSumw[6]=-0.0147421, x=0.3, error=0.00882197
 fSumw[7]=0.0168491, x=0.4, error=0.0122086
 fSumw[8]=-0.00820726, x=0.5, error=0.0170588
 fSumw[9]=0.0103306, x=0.625, error=0.0226727
 fSumw[10]=-0.0213306, x=0.85, error=0.0378654
 fSumw[11]=-0.139062, x=1.25, error=0.103949
 fSumw[12]=-1.2879, x=1.75, error=1.30677
 fSumw[13]=0, x=2.08333, error=0
```

A plot for checking things.

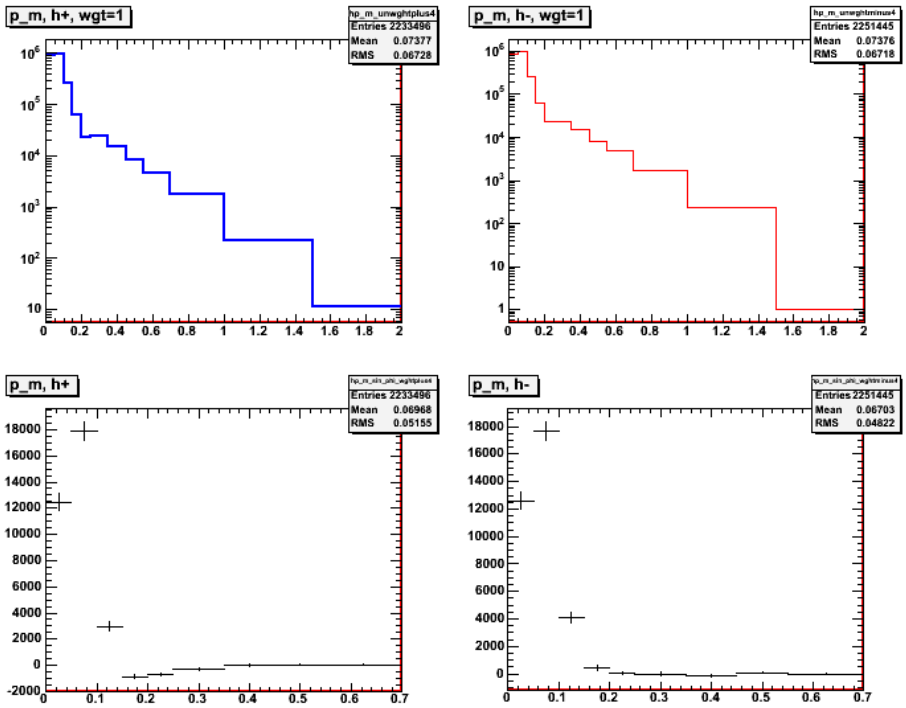

Fig 2. Some plots for checking things.

Click here to view the object (Root macro) you uploaded.

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Jerry Gilfoyle's Enotebook page 264 - Checking effect of MM2 cut and fids and nofids on 2.6n (gpg)

[Modified Fri Oct 2 17:14:12 2009 (GMT) gpg]

First check the default ALTp. The results in figs 1-2 include the correction to the electron fiducial cut function discussed in figs 3-4 below.

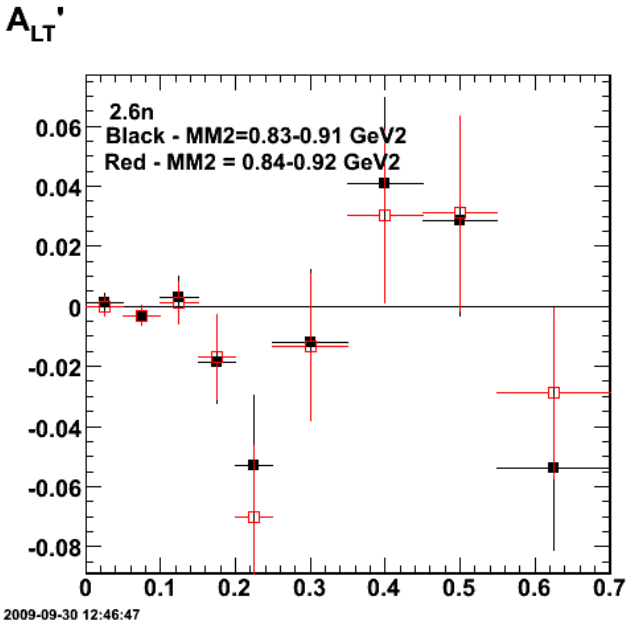


Fig 1. Comparison of effect of different MM2 ranges. Fids off. I suspect the labels are backwards so the red points are MM2=0.83-0.91 GeV2.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Click here to view the object (Archive of root analysis code for 09-sep-30) you uploaded.

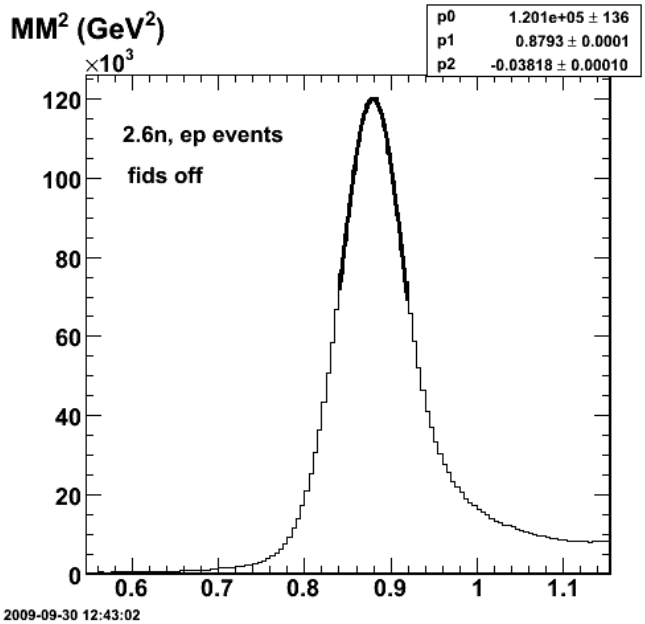


Fig 2. MM2 distribution for 2.6n with fit. Note the peak is at MM2 = 0.88 GeV2 as expected.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Q2 distribution comparison is shown in fig 3. What is the spike at low Q2 in the fids-on distribution? I saw this a long time ago and thought it was fixed. See

entry 37 and 40. Damn! More stuff to do.

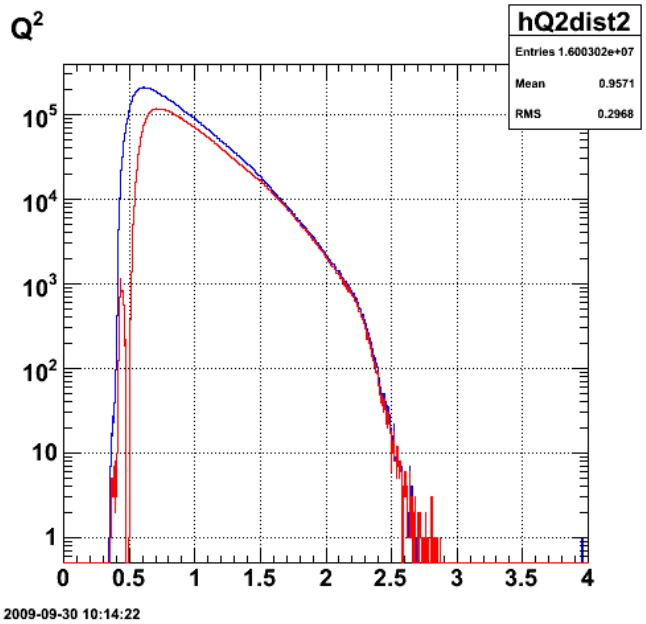


Fig 3. Comparison of electron singles Q2 distribution with fids off and on.

There was a line in the electron fiducal cut function that was commented out that I put back in and it fixed the problem.

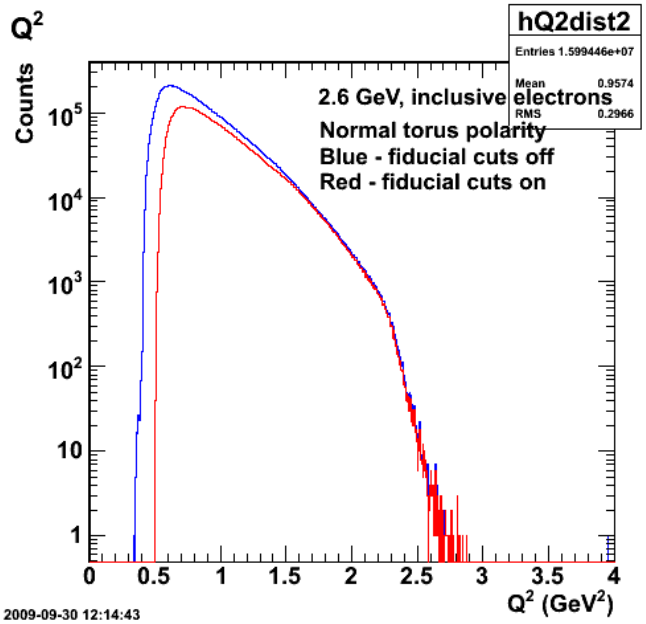


Fig 3. Q2 distribution with corrected electron fiducial cut function.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Now check the effect of turning on the efids and pfids. This effect is to magnify the dip and the default value is only about -0.05 instead of -0.07 which I expected from previous results. HMMMMM???

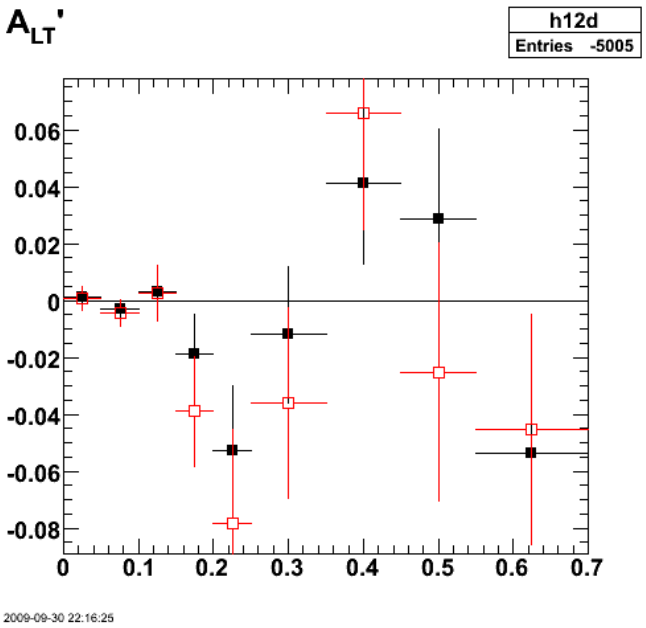


Fig 4. Comparison of ALTp at 2.6n with fids off (black) and on (red).

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

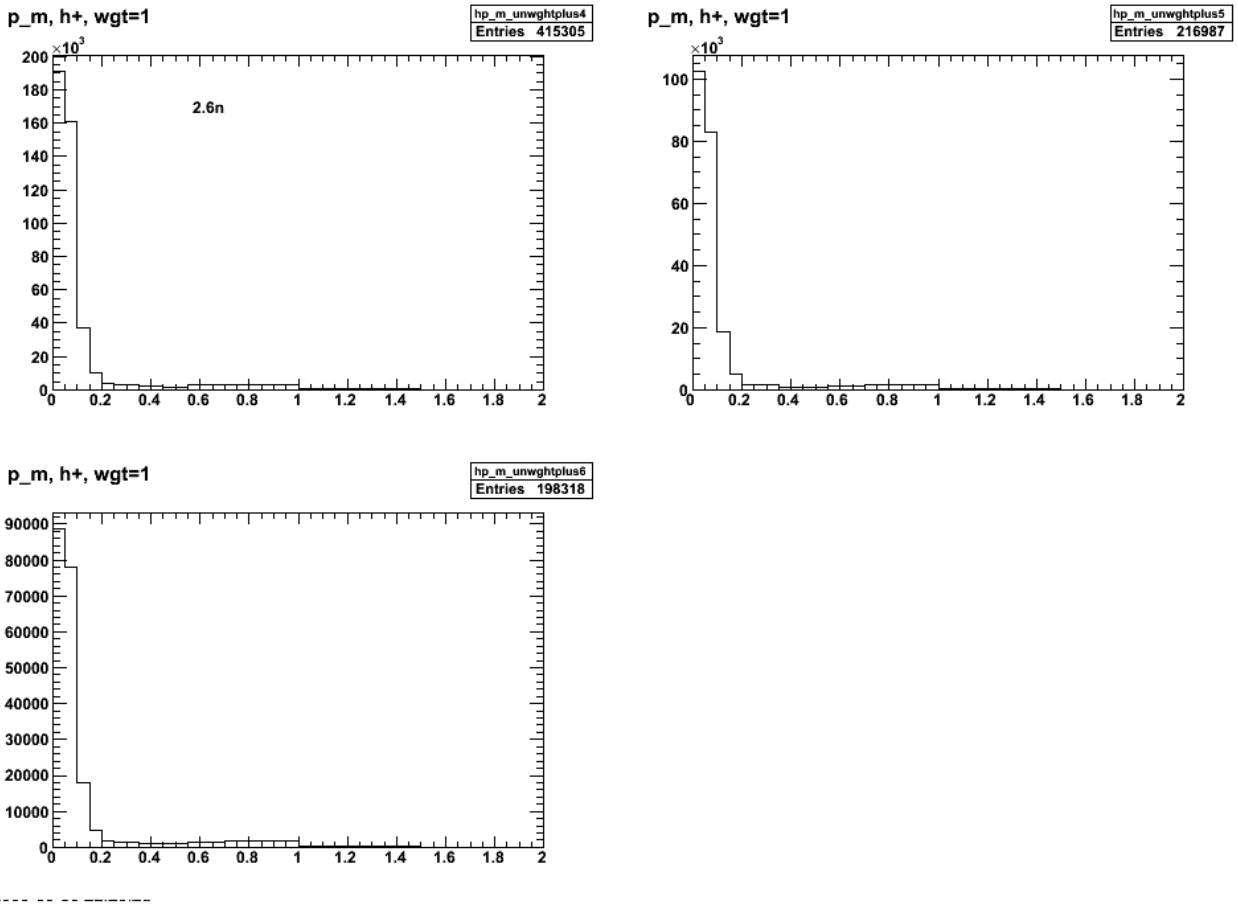
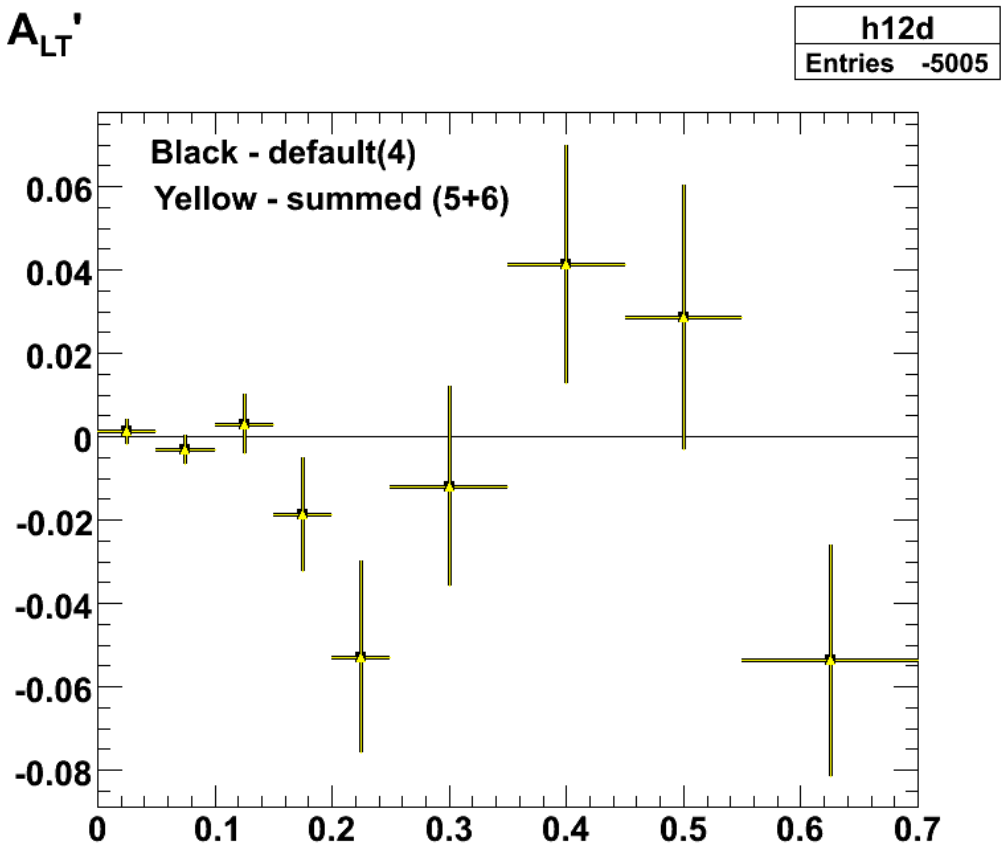


Fig 5. hp_m_unwghtplus4,5,6 hists. 4=5+6 Opps! I thought it was 5=4+6???

The Opps in the caption was the problem. The agreement is now perfect.



2009-09-30 22:34:09

Fig 5. Comparing ALTp from hist 4 and hists 5+6. The agreement is excellent.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

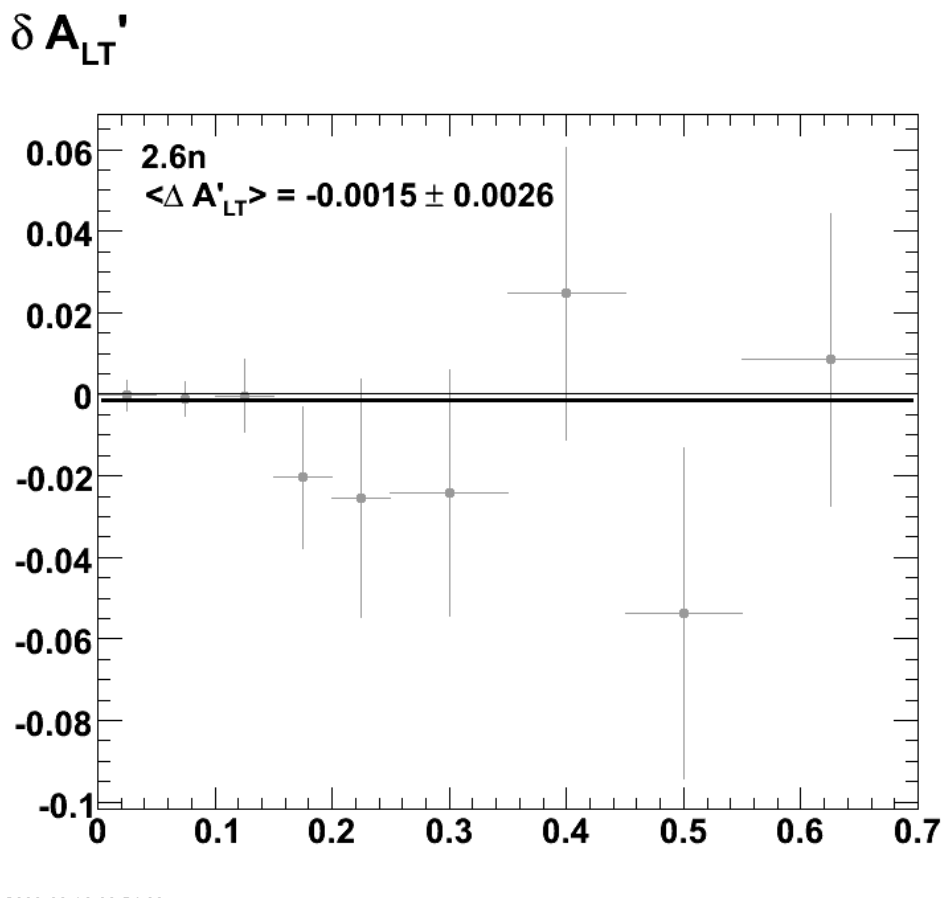


Fig 6. Difference between ALTp with fids on and off and with proper uncertainties.

Click here to view the object (Root macro) you uploaded.

Check that MM2=0.83-0.91 gives the 'deep' dip in ALTp. It does!

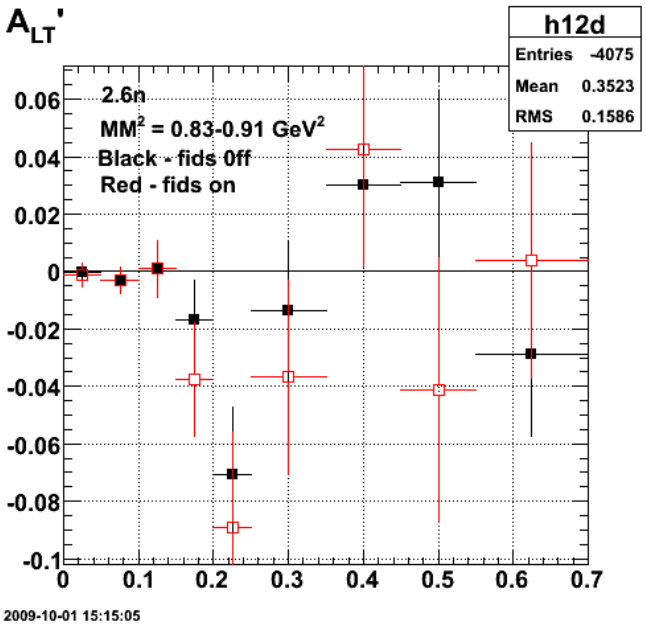


Fig 7. Comparison of ALTp with MM2=0.83-0.91 GeV2 and with fids off (black) and on (red).

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

The MM2 is not symmetric about the peak. It would be nice if it was so play with this for a bit.

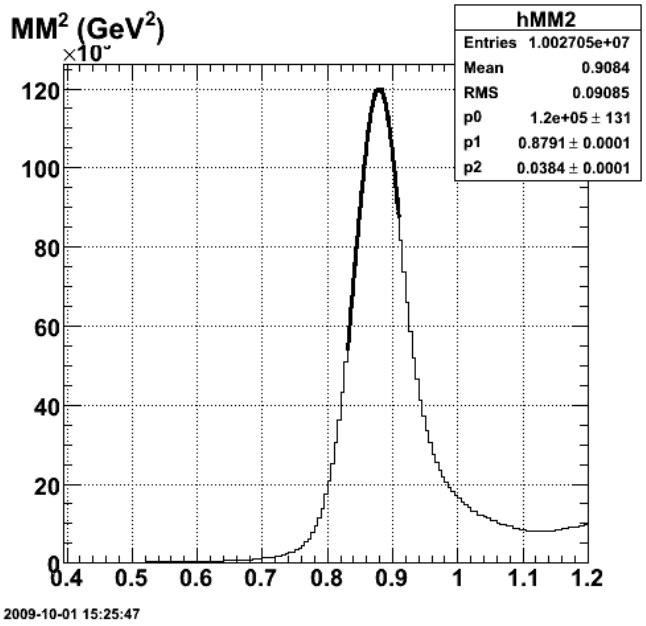


Fig 8. MM2 distribution with fit over the range used for the MM2 cut.

Click here to view the object (ROOT macro) you uploaded.

Scan the MM2 peak to see what happens to ALTp.

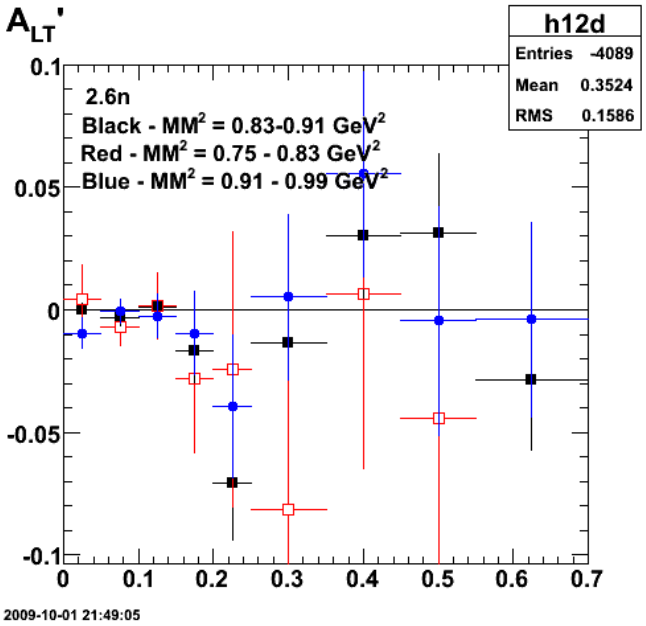


Fig 9. ALTp for different regions of MM2 for 2.6n.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Extending the MM2 cut from 0.83-0.91 to 0.83-0.93 can be justified because it makes the cut symmetric about the peak, its 25% wider then the 2.6r cut, but the 2.6n peak is about 10% anyway so this may compensate for that. The fit to this MM2 region is shown below.

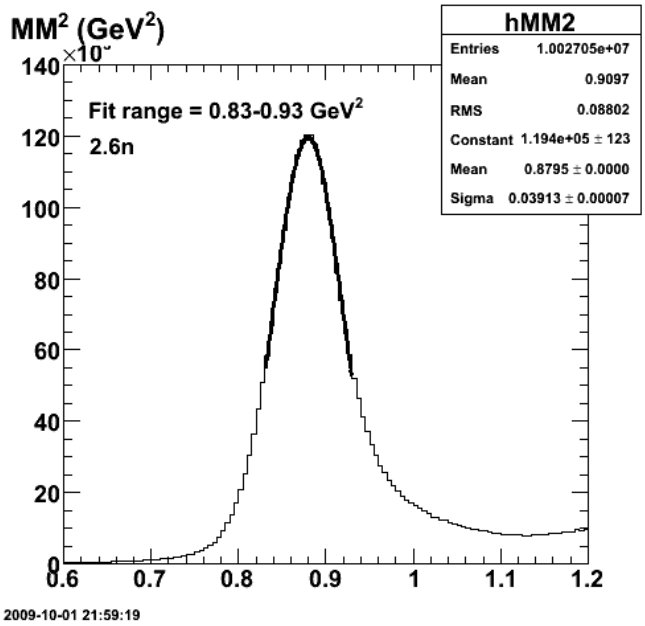


Fig 10. MM2 fit for same analysis as fig 9 with new ranges on the central MM2 fit.

Click here to view the object (ROOT macro) you uploaded.

Scan ALTp using the new value for the central MM2 cut range. See the next fig. Notice that for the region in MM2 above the central region (blue) that ALTp is now about two sigma away from zero, unlike the results for the other two MM2 ranges (red and black). This may be a hint that we are getting into a region (the 'dip') where high-lying states (the #Delta ?) which are not required to be zero at pm=0 (I think) are starting to have an effect. Notice the magnitude of the dip is a bit smaller than with MM2=0.83-0.91 GeV2, but not too much.

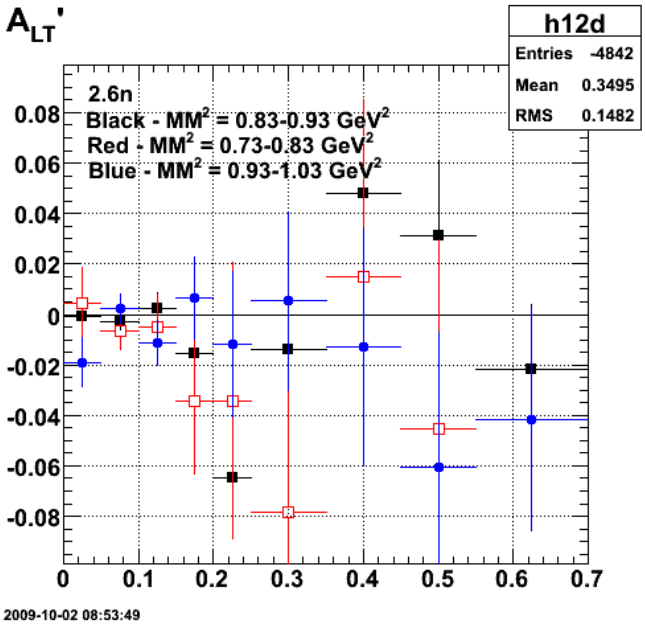


Fig 11. Comparison of ALTp at 2.6n for different MM2 ranges.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Now check the effect of turning the fids off. It looks like the effect is zero within the error bars.

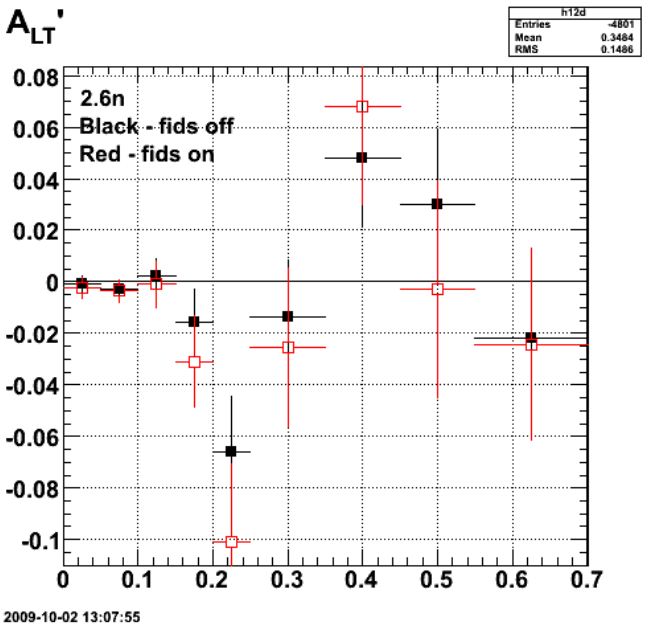


Fig 12. Comparison of ALTp with fids off (black) and on (red) for 2.6n.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Click here to view the object (Gzipped tar archive of eo5c area) you uploaded.

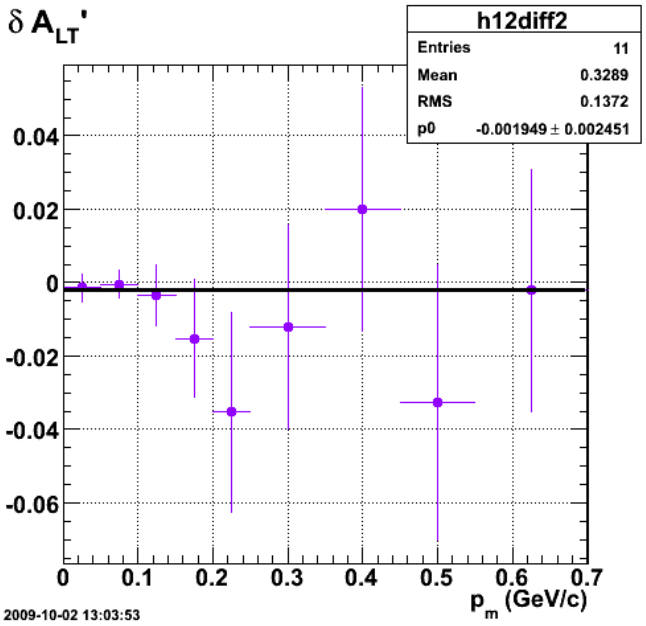


Fig 13. Difference in ALTp between fids on and fids off for 2.6n with proper uncertainties.

Click here to view the object (ROOT macro) you uploaded.

Listing of points with fids off and on.

```
root [87]
root [87] h12d->Print("all")
TH1.Print Name  = h12d, Entries= -4801, Total sum= 0.108216
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.000767497, x=0.025, error=0.00293752
 fSumw[2]=-0.00308308, x=0.075, error=0.00309841
 fSumw[3]=0.00251781, x=0.125, error=0.00647214
 fSumw[4]=-0.0155529, x=0.175, error=0.0126139
 fSumw[5]=-0.0658396, x=0.225, error=0.0213122
 fSumw[6]=-0.0134805, x=0.3, error=0.0221704
 fSumw[7]=0.0479541, x=0.4, error=0.0264859
 fSumw[8]=0.0299775, x=0.5, error=0.0294076
 fSumw[9]=-0.0220621, x=0.625, error=0.0257854
```

```
 fSumw[10]=-0.0139745, x=0.85, error=0.0249921
 fSumw[11]=-0.0474189, x=1.25, error=0.0457014
 fSumw[12]=0.209946, x=1.75, error=0.163947
 fSumw[13]=0, x=2.08333, error=0
root [88] h12db->Print("all")
TH1.Print Name  = h12db, Entries= -2202, Total sum= -0.291869
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.00224381, x=0.025, error=0.00400801
 fSumw[2]=-0.00353225, x=0.075, error=0.00429182
 fSumw[3]=-0.000993328, x=0.125, error=0.00904308
 fSumw[4]=-0.0308426, x=0.175, error=0.0178645
 fSumw[5]=-0.101136, x=0.225, error=0.0302635
 fSumw[6]=-0.0254983, x=0.3, error=0.0307467
 fSumw[7]=0.0677854, x=0.4, error=0.0375263
 fSumw[8]=-0.00269632, x=0.5, error=0.0420646
 fSumw[9]=-0.0242308, x=0.625, error=0.0372583
 fSumw[10]=-0.0254057, x=0.85, error=0.0363671
 fSumw[11]=-0.15508, x=1.25, error=0.0650416
 fSumw[12]=0.0120054, x=1.75, error=0.255075
 fSumw[13]=0, x=2.08333, error=0
root [89]
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 265 - gemc EC (gpg)

[Modified Wed Nov 11 17:22:26 2009 (GMT) gpg]

Some initial explorations of gemc and the EC geometry.

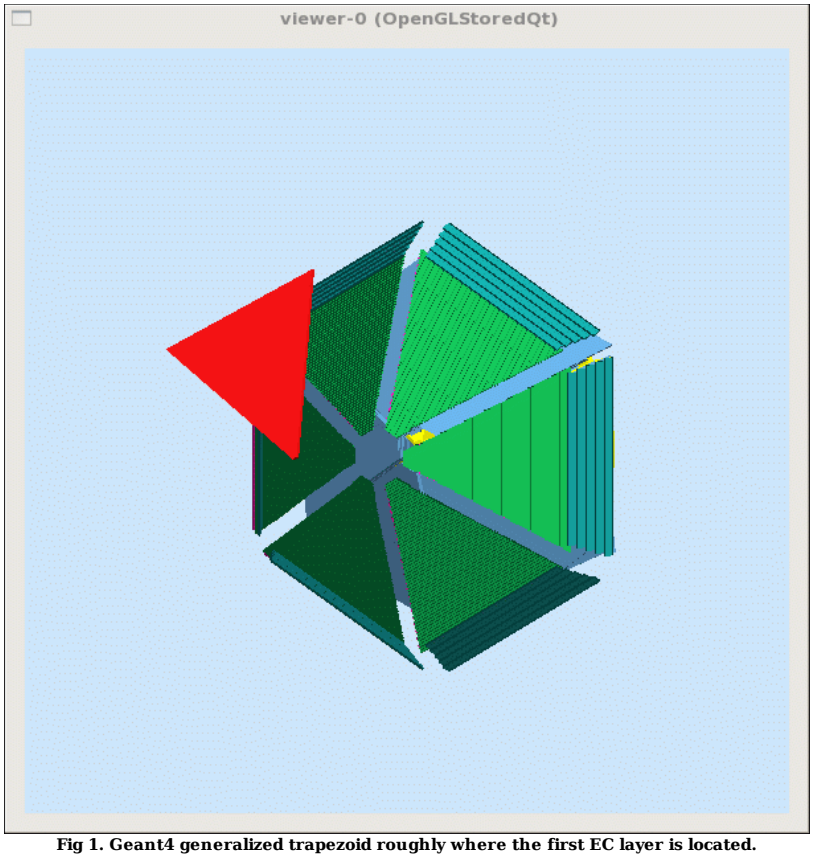


Fig 1. Geant4 generalized trapezoid roughly where the first EC layer is located.

Create a wireframe box to hold the EC lead and scintillator layers. Put in the first scintillator and roughly position the mother box in the correct position by eye. Need to get the full geometry.

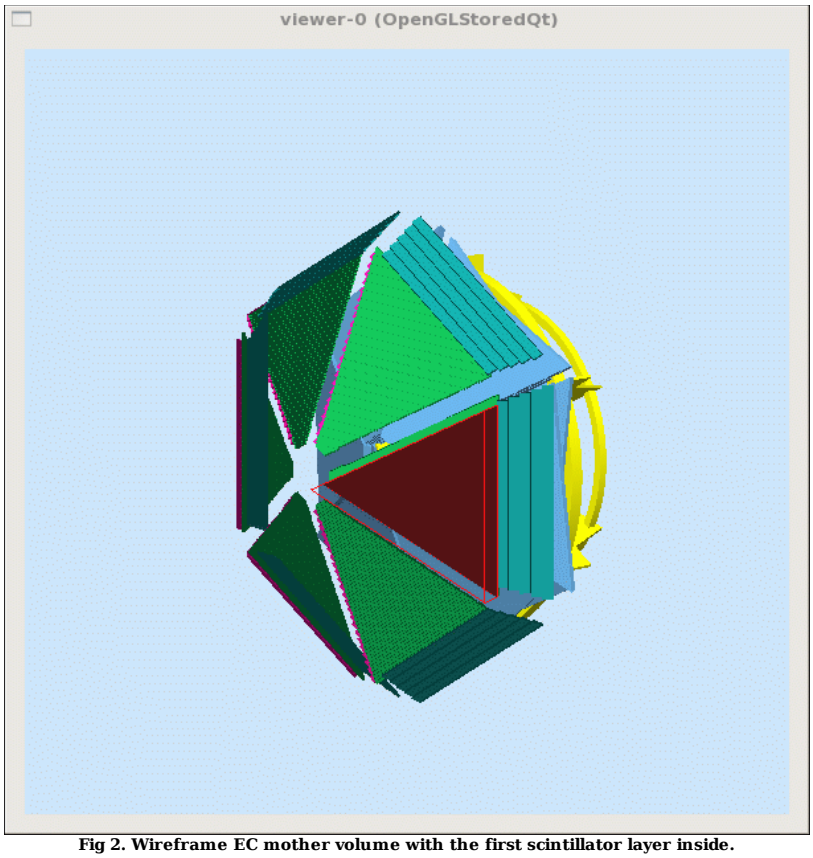


Fig 2. Wireframe EC mother volume with the first scintillator layer inside.

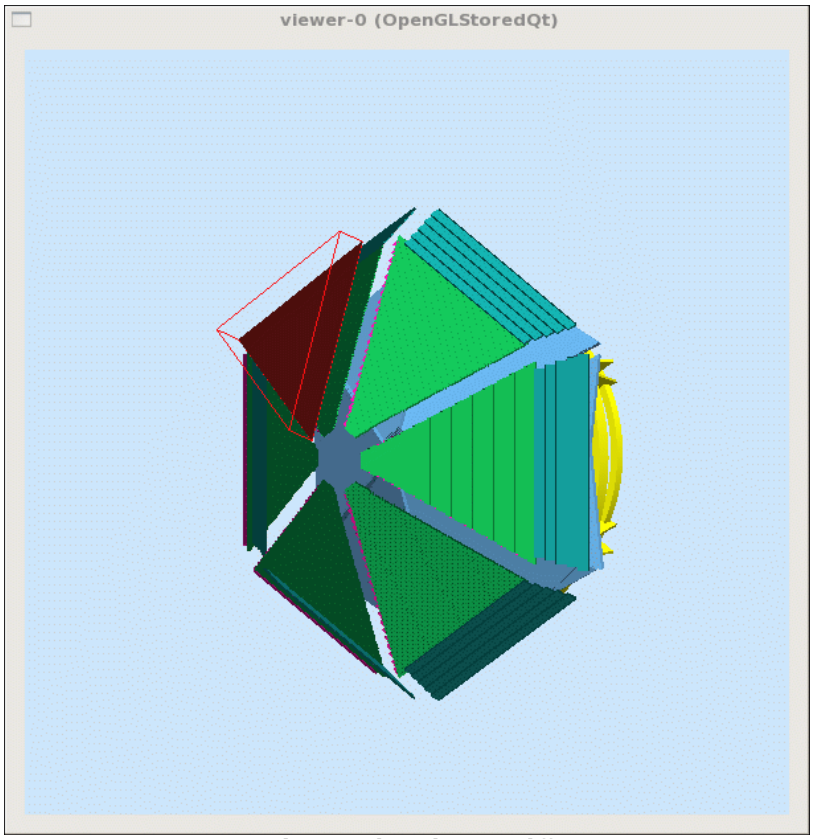


Fig 3. Position the EC mother volume in a different sector.

Now use the sector mother volume instead of the root one. The EC mother volume was positioned in the sector coordinate system meaning the following.

```
x = 0 so the midplane of the sector coincides with the midplane of the detector.
y = perpendicular distance from scintillator closest to the beam to the beam.
z = desired distance from CLAS12 target - 5.0m
```

The individual scintillators and lead sheets were then placed inside the mother volume with the following coordinated.

```
z - points outward from the target and perpendicular to the face. Origin is in the center of the volume.
y - coincides with the midplane of the ideal detector.
x - points to the left looking out from the target.
```

Fig 4 shows the wireframe EC mother volume (red lines) reproduced in each sector. The blue material is the scintillator.

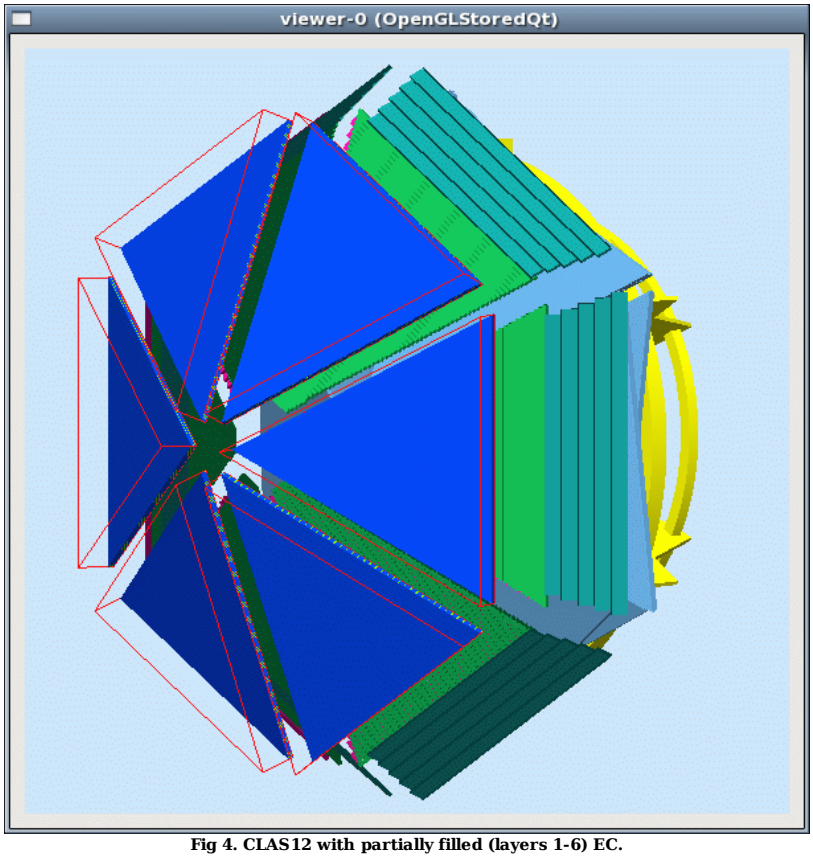


Fig 4. CLAS12 with partially filled (layers 1-6) EC.

Zooming in on one of the ECs from the side shows layers 1-6 of scintillator and layers 2-6 of lead.

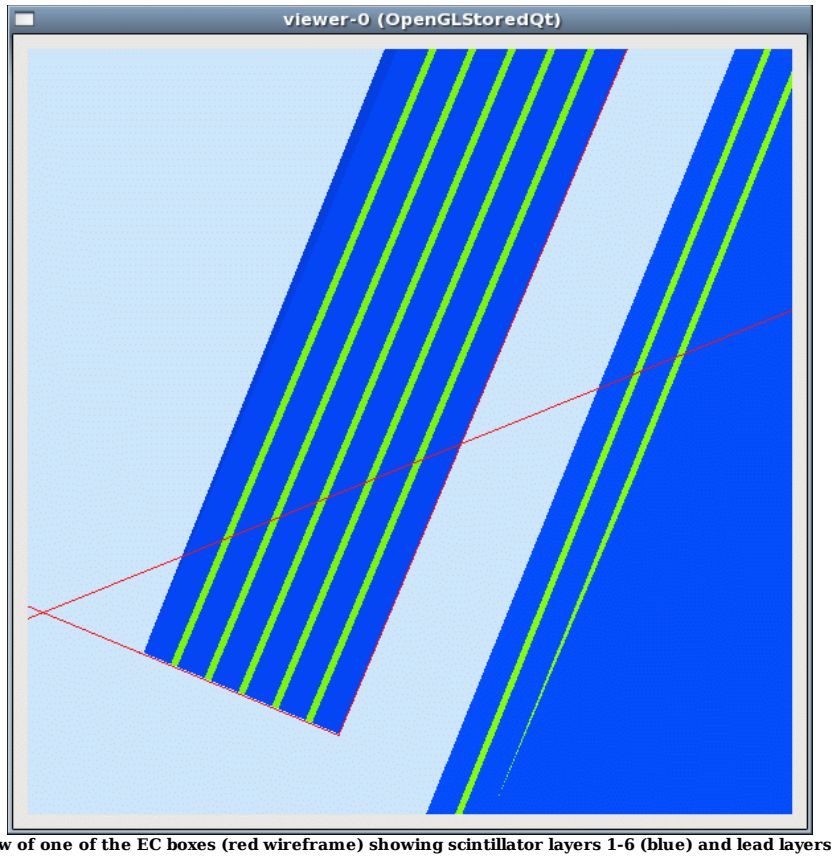


Fig 5. Side view of one of the EC boxes (red wireframe) showing scintillator layers 1-6 (blue) and lead layers 2-6 (green).

Click here to view the object (Perl script for generating GEANT4 volumes for Figs 4-5.) you uploaded.

Listing of the positions for the scintillator (left column) and the lead layers (right-hand column).

```
{
 {-236.43, -230.239},
 {-224.049, -217.858},
 {-211.668, -205.477},
 {-199.287, -193.096},
 {-186.906, -180.715},
 {-174.525, -168.334},
 {-162.144, -155.953},
 {-149.763, -143.572},
 {-137.382, -131.191},
 {-125.001, -118.81},
 {-112.62, -106.429},
 {-100.239, -94.048},
 {-87.8575, -81.667},
 {-75.4765, -69.286},
 {-63.0955, -56.905},
 {-50.7145, -44.524},
 {-38.3335, -32.143},
 {-25.9525, -19.762},
 {-13.5715, -7.381},
 {-1.1905, 5.},
 {11.1905, 17.381},
 {23.5715, 29.762},
 {35.9525, 42.143},
 {48.3335, 54.524},
 {60.7145, 66.905},
 {73.0955, 79.286},
 {85.4765, 91.667},
 {97.8575, 104.048},
 {110.238, 116.429},
 {122.619, 128.81},
 {135.001, 141.191},
 {147.382, 153.572},
 {159.763, 165.953},
 {172.143, 178.334},
 {184.525, 190.715},
 {196.906, 203.096},
 {209.287, 215.477},
 {221.667, 227.858},
 {234.049, 240.239}
}
```

Put in all 39 layers of scintillator and 38 layers of lead. We still have to put in the projective geometry. Here I have assumed each layer is the same size.

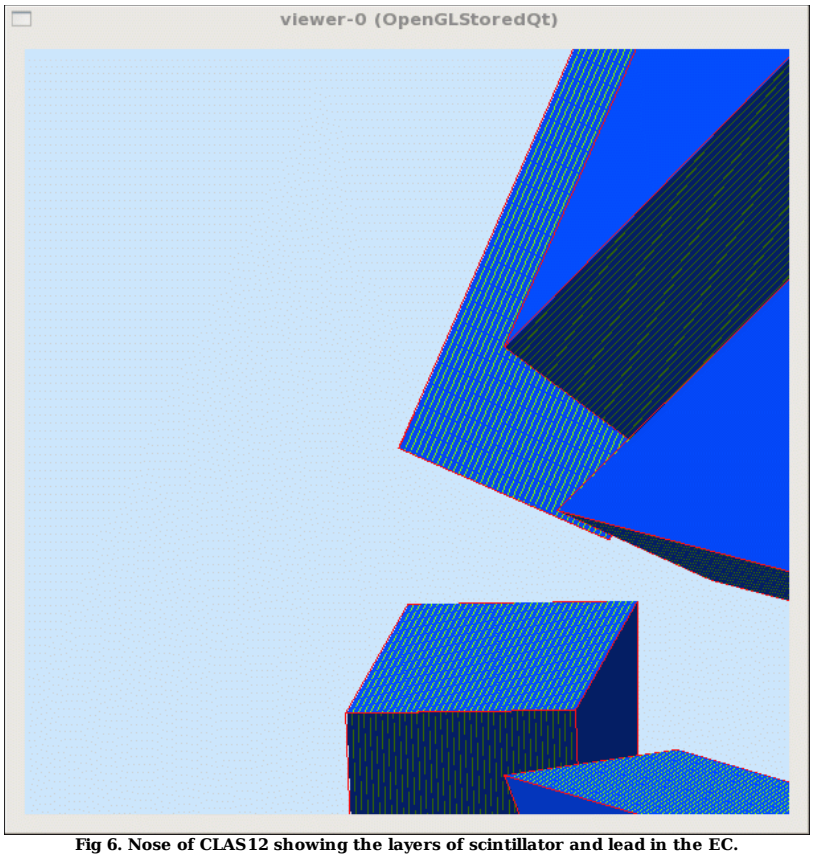


Fig 6. Nose of CLAS12 showing the layers of scintillator and lead in the EC.

Click here to view the object (Perl script for creating the input to the MYSQL geometry database) you uploaded.

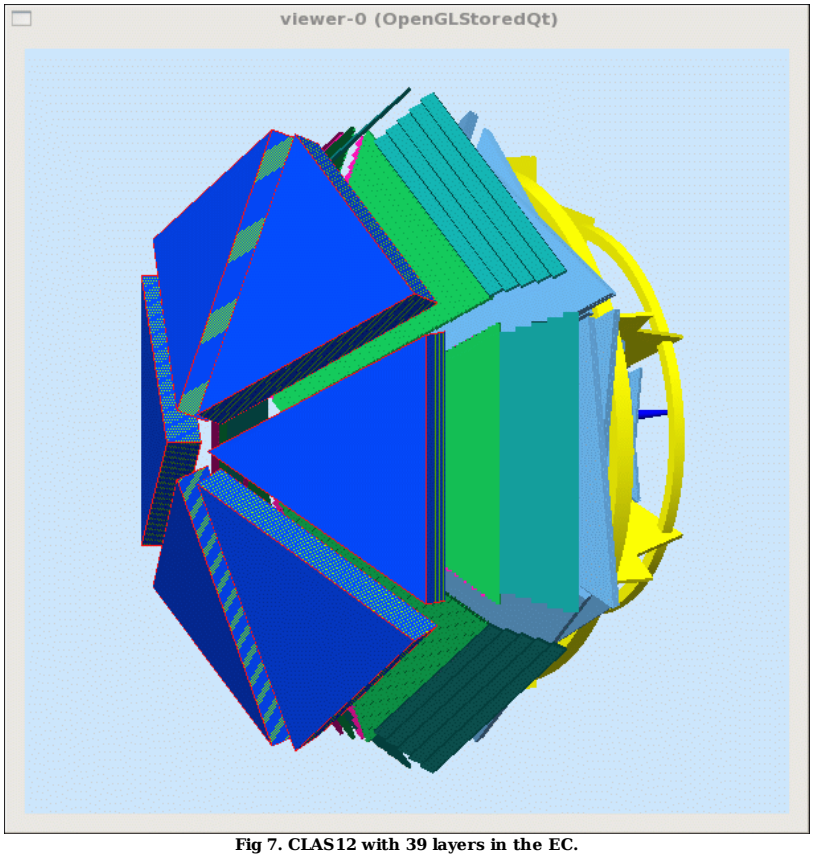


Fig 7. CLAS12 with 39 layers in the EC.

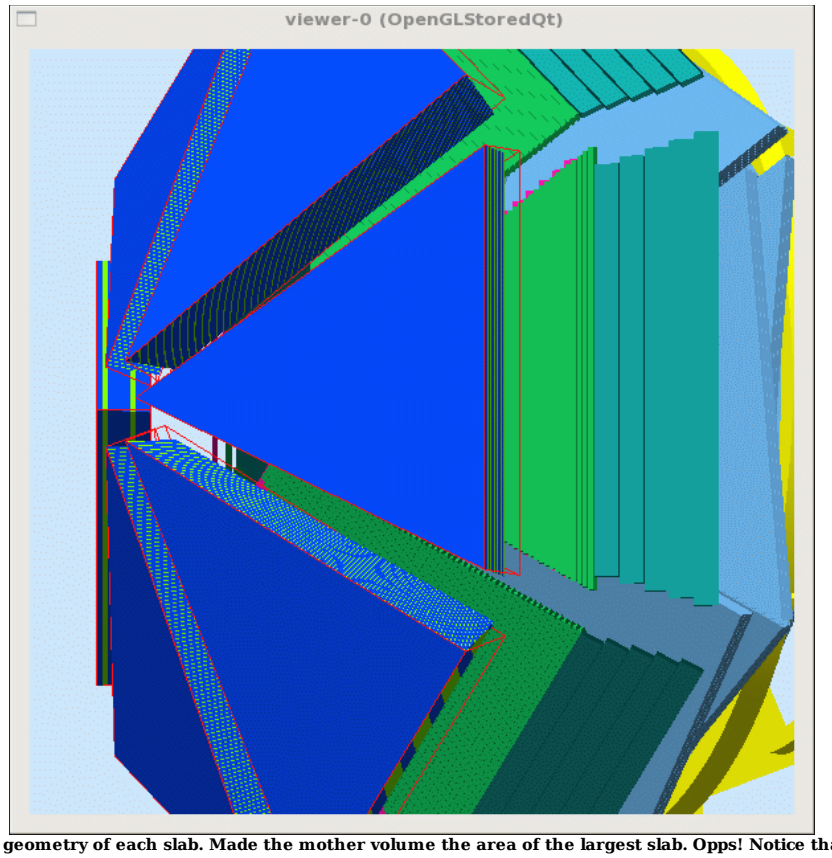


Fig 8. Put in the projective geometry of each slab. Made the mother volume the area of the largest slab. Opps! Notice that the width of the box on the side away from the beam is too narrow.

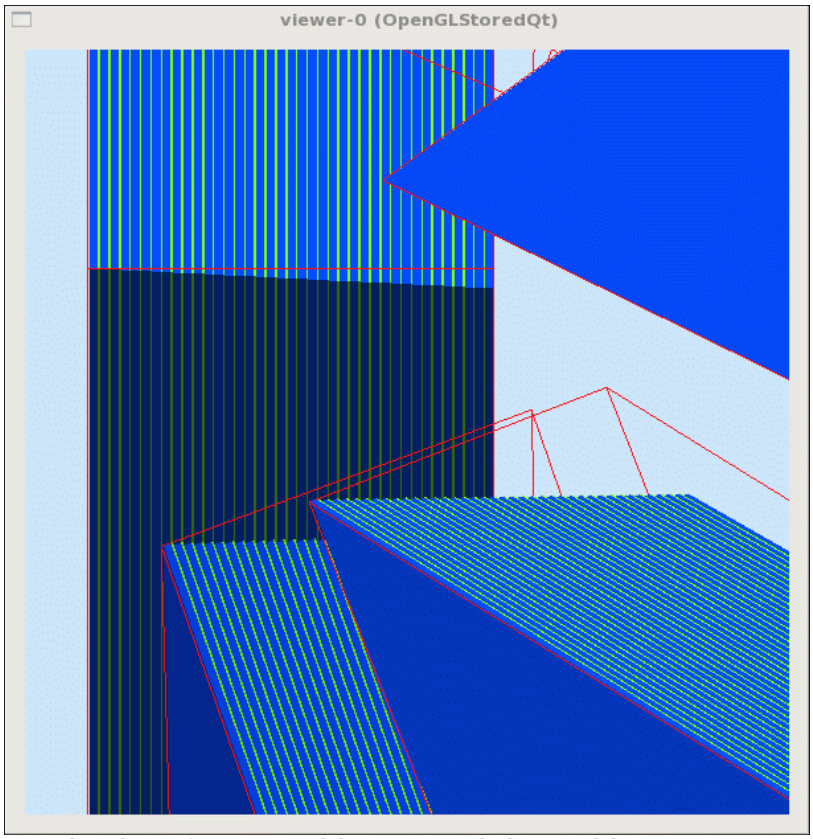


Fig 9. Enlarged view of region around the nose to see the layers and the projective geometry.

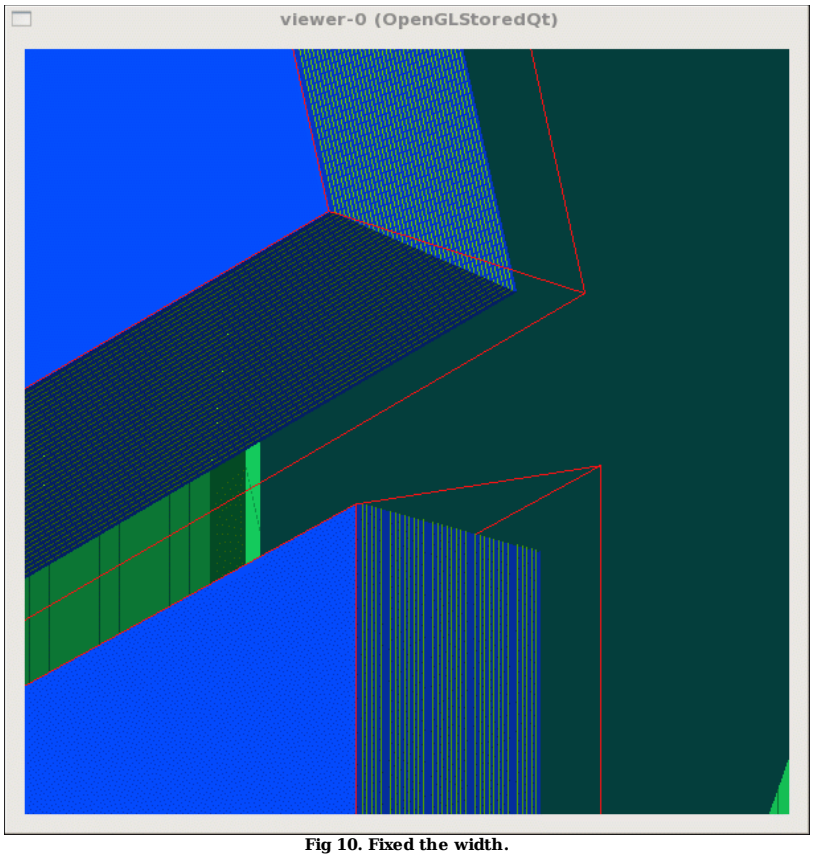


Fig 10. Fixed the width.

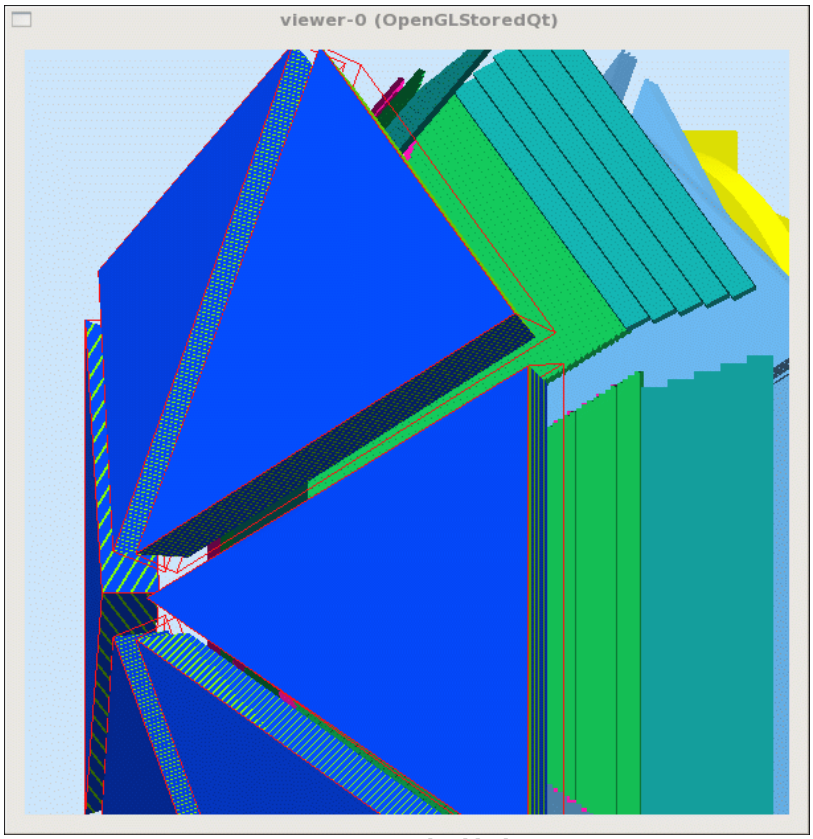


Fig 11. Corrected width plot.

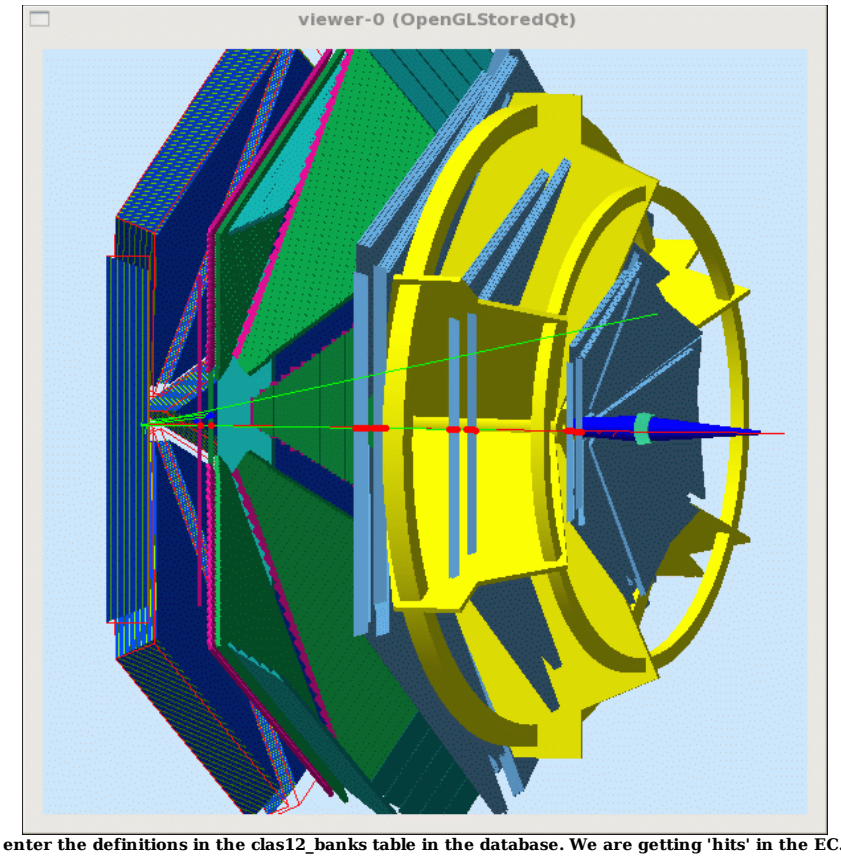


Fig 12. Define the EC and enter the definitions in the clas12_banks table in the database. We are getting 'hits' in the EC. The event shown is about a 9 GeV electron at theta = 15 deg.

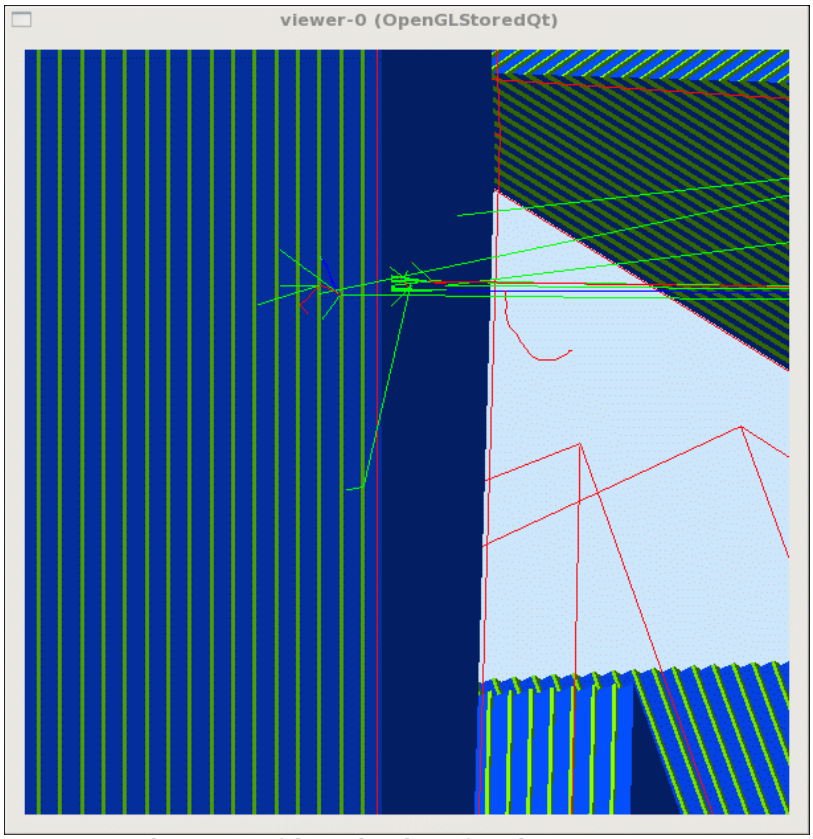


Fig 13. Close-up view of the track in the EC from the same event as Fig 12.

The data definitions for Figs 12-13 are below.

```
mysql> select * from EC;
+------+------+------+-----------+-----------------------------------------+
| name | id   | type | activated | description                             |
+------+------+------+-----------+-----------------------------------------+
| ETot |    1 |    1 |         1 | Total Energy Deposited                  |
|    |    2 |    1 |         1 | Average global x position               |
|    |    3 |    1 |         1 | Average global y position               |
|    |    4 |    1 |         1 | Average global z position               |
|  |    5 |    1 |         1 | Average local x position                |
|  |    6 |    1 |         1 | Average local y position                |
|  |    7 |    1 |         1 | Average local z position                |
|    |    8 |    1 |         1 | Average time                            |
| pid  |    9 |    1 |         1 | Particle ID                             |
| vx   |   10 |    1 |         1 | x coordinate of primary vertex          |
| vy   |   11 |    1 |         1 | y coordinate of primary vertex          |
| vz   |   12 |    1 |         1 | z coordinate of primary vertex          |
| E    |   13 |    1 |         1 | Energy of the track at the entrance point |
| mpid |   14 |    1 |         1 | Mother  Particle ID                     |
| mvx  |   15 |    1 |         1 | x coordinate of mother vertex           |
| mvy  |   16 |    1 |         1 | y coordinate of mother vertex           |
| mvz  |   17 |    1 |         1 | z coordinate of mother vertex           |
| ADC  |   20 |    0 |         1 | ADC                                     |
| TDC  |   22 |    0 |         1 | TDC                                     |
+------+------+------+-----------+-----------------------------------------+
19 rows in set (0.00 sec)
```

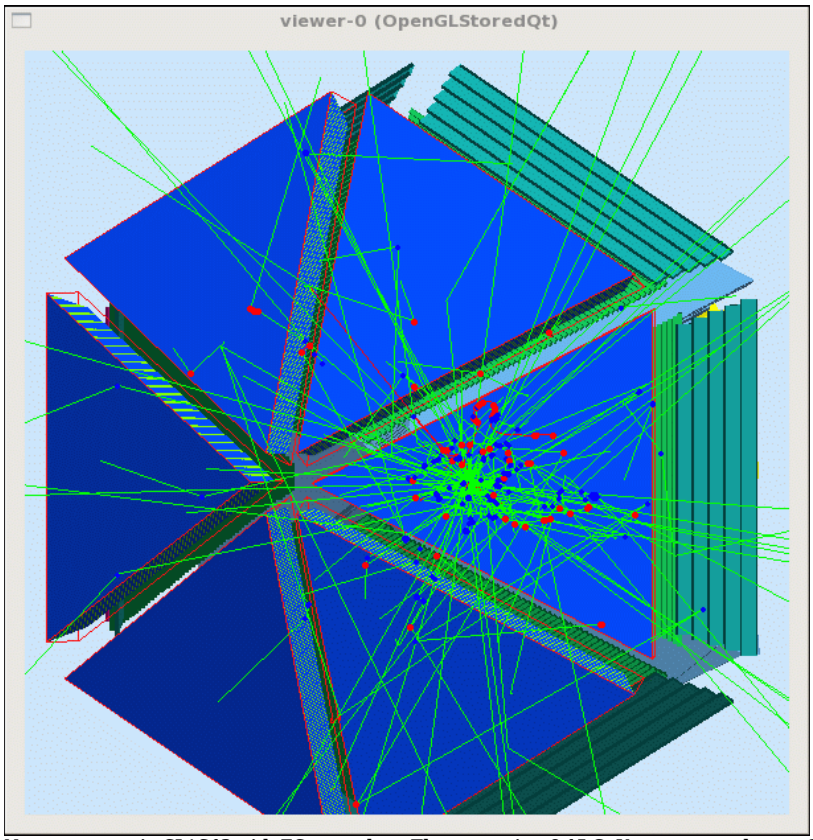


Fig 14. Neutron event in CLAS12 with EC turned on. The events is a 9.15 GeV neutron at theta = 25 deg.

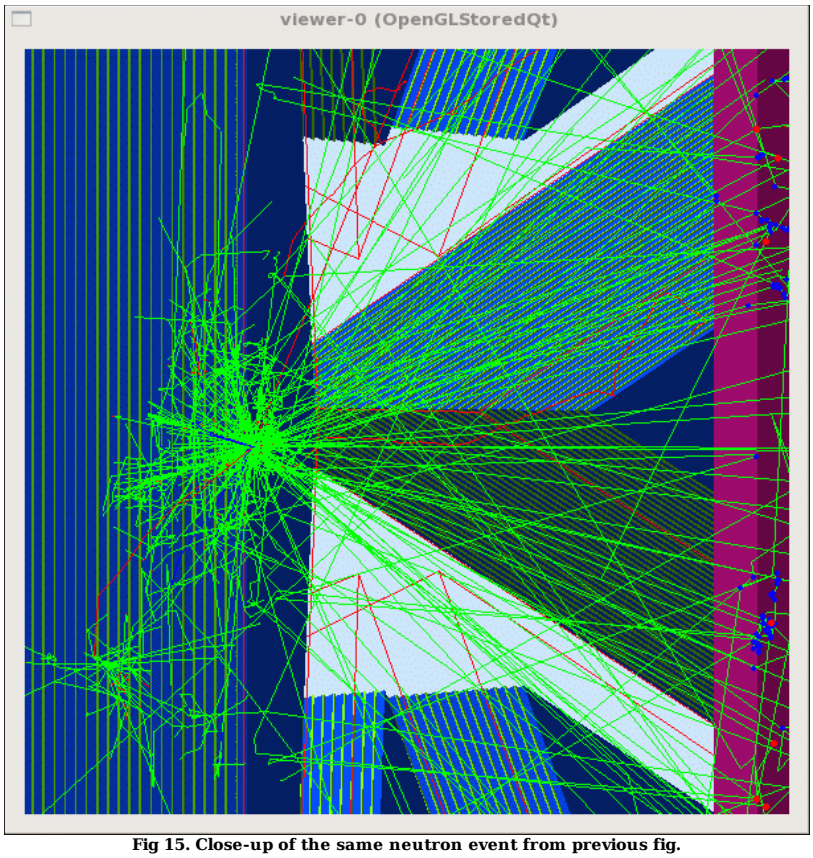


Fig 15. Close-up of the same neutron event from previous fig.

First histograms from gemc after modifying gemc_evio2root to convert EC events.

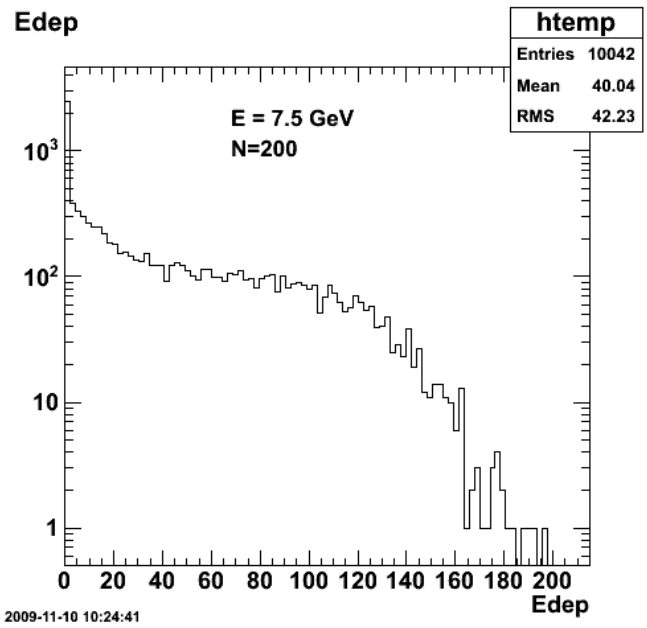


Fig 16. Energy deposited by 7.5 GeV electrons in the EC at a fixed angle.

Click here to view the object (ROOT macro) you uploaded.

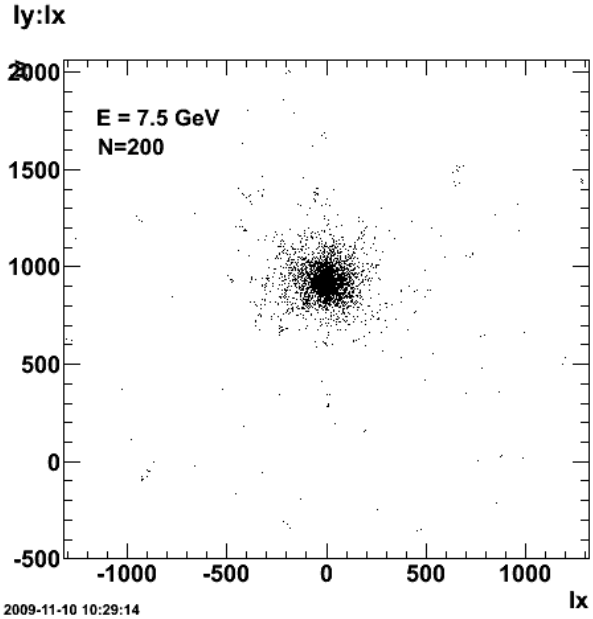


Fig 17. Local x and y positions in the EC for 7.5-GeV electrons at a single fixed angle.

Click here to view the object (ROOT macro) you uploaded.

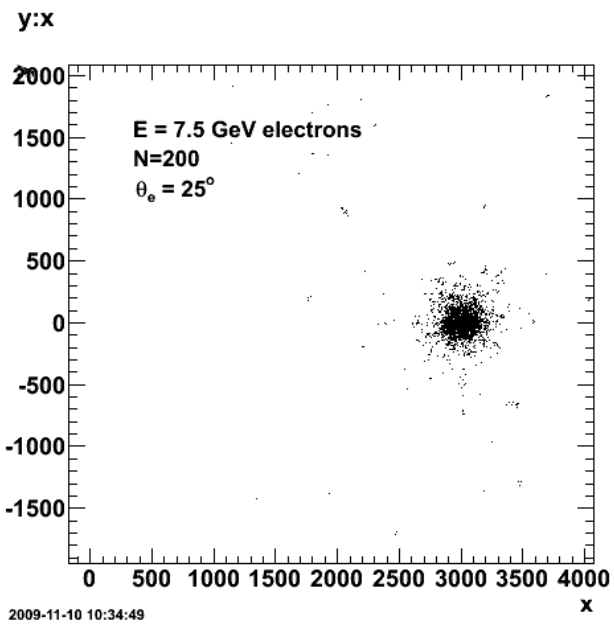


Fig 18. Global x and y for 7.5-GeV electrons at fixed (theta=25 deg) angle.

Click here to view the object (ROOT macro) you uploaded.

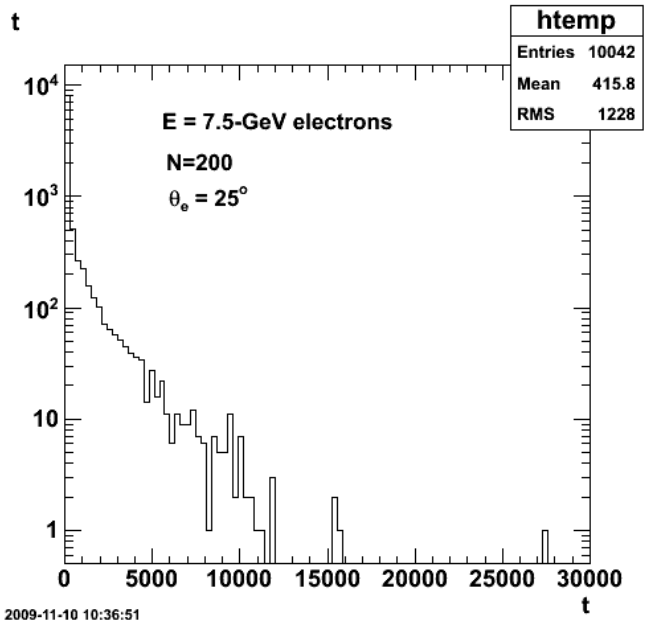


Fig 19. Timing signal for 7.5-GeV electrons at #theta_e = 25 deg.

Click here to view the object (ROOT macro) you uploaded.

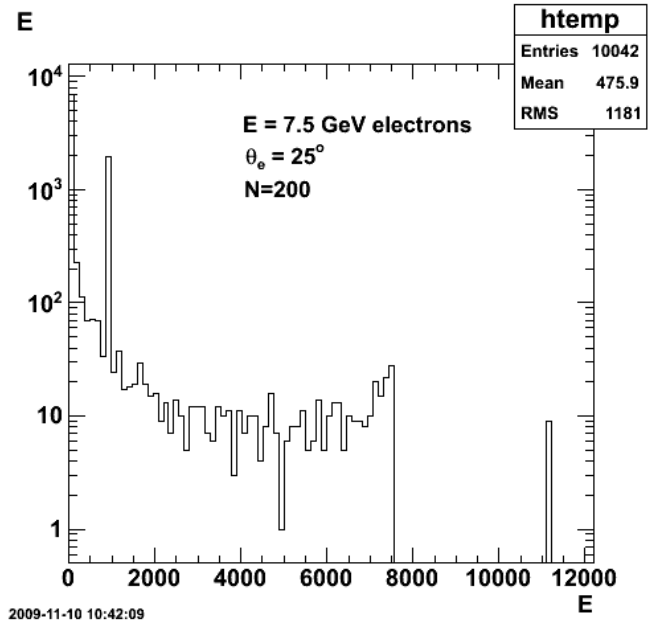


Fig 20. Total energy signal from gemc for 7.5-GeV electrons in the EC.

Click here to view the object (ROOT macro) you uploaded.

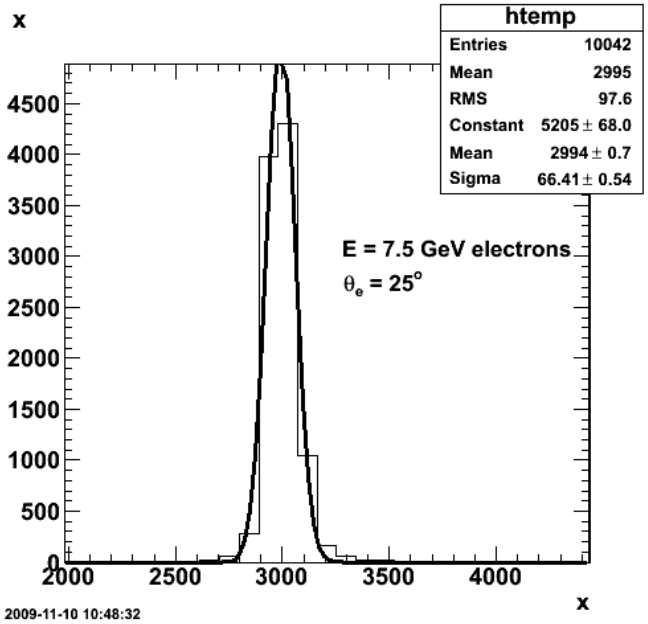


Fig 21. Distribution of 7.5-GeV electron global x position.

Click here to view the object (ROOT macro) you uploaded.

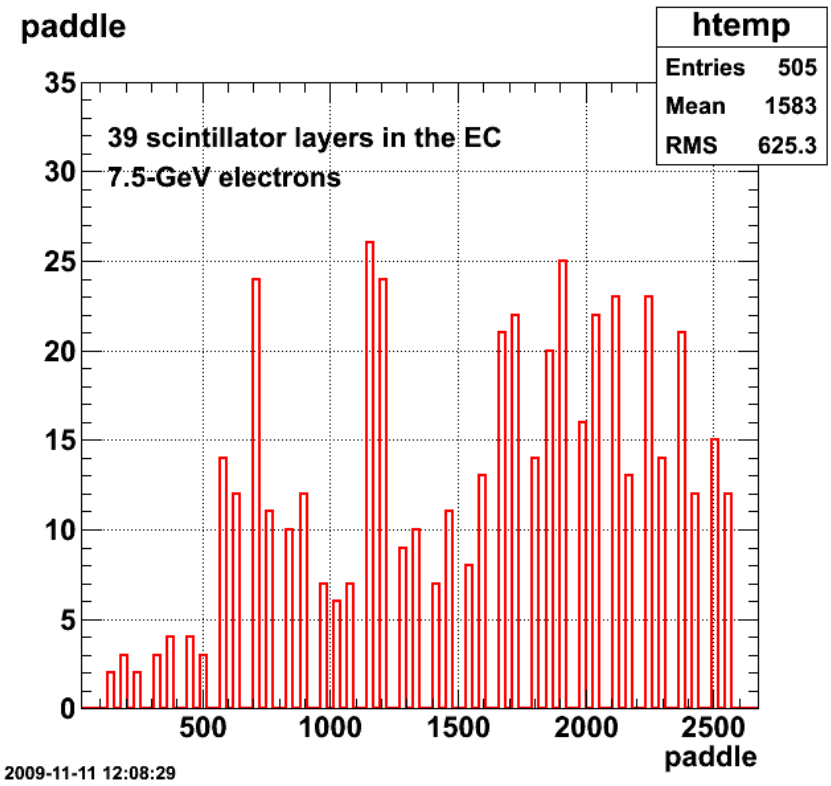


Fig 22. Output of 'paddle' in Root Tree.

Click here to view the object (ROOT macro) you uploaded.

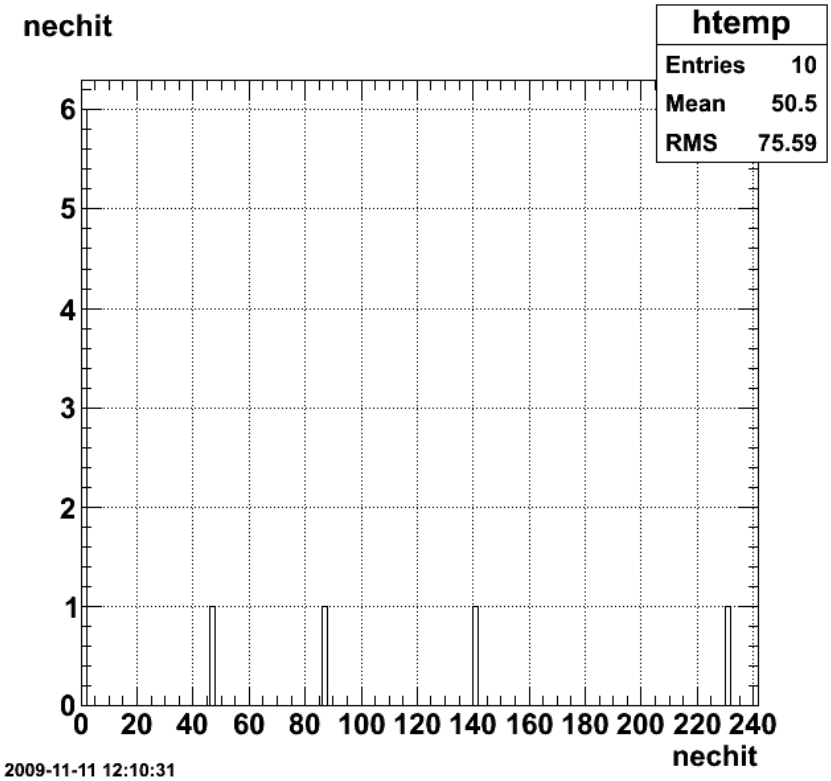


Fig 23. Spectrum of ecnhit for 7.5-GeV electron with no spread in position or energy or direction and no luminosity effects.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (run2.pl input file) you uploaded.

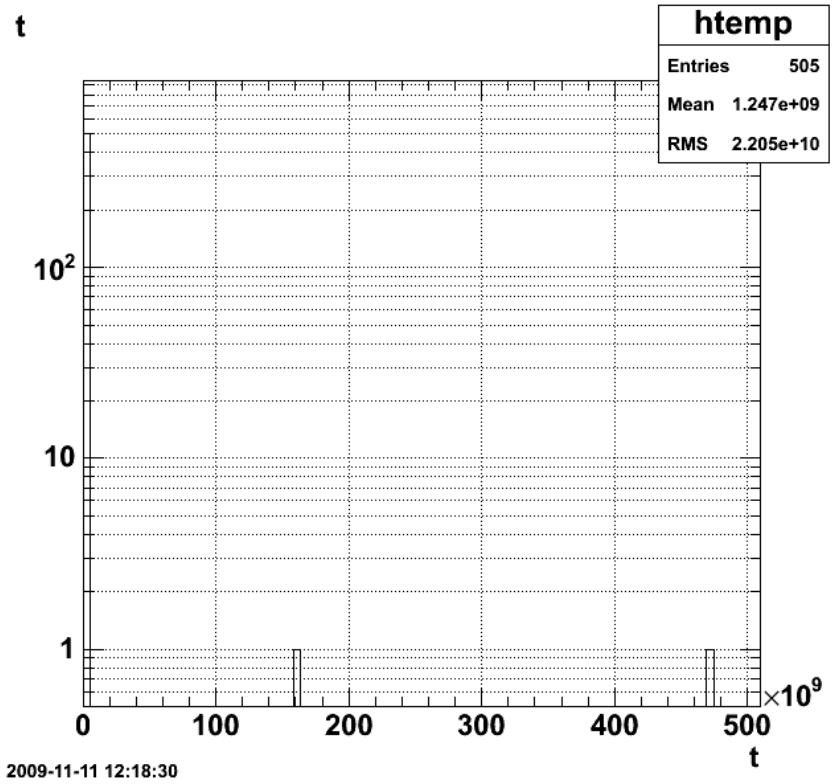


Fig 24. Time signal from EC in gemc.

Click here to view the object (ROOT macro) you uploaded.

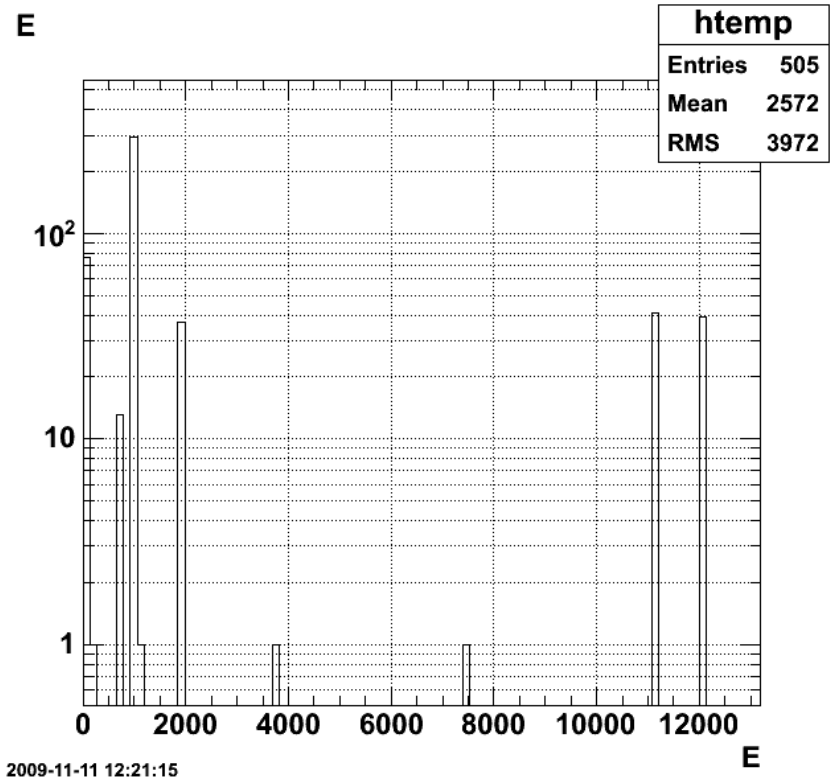


Fig 25. E signal from EC.

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 266 - 2.6n Calina simulation (gpg)

[Modified Wed Oct 7 14:09:48 2009 (GMT) gpg]

Interim results from the 2.6n simulation using Calina's account.

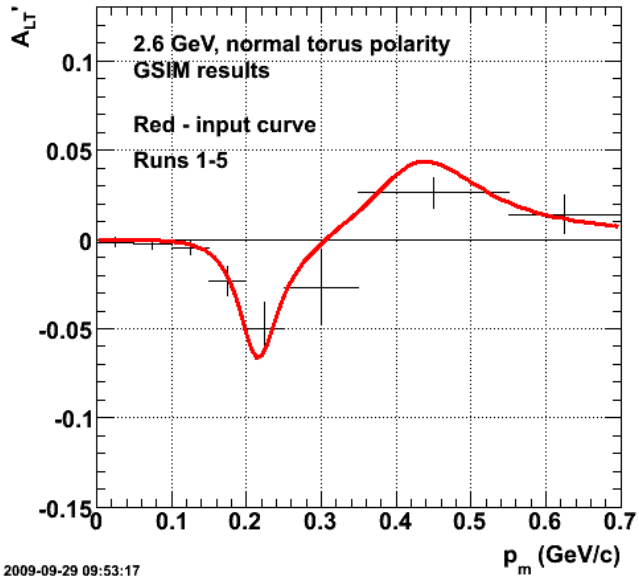


Fig 1. Calina sum for runs 1-5 for 2.6n.

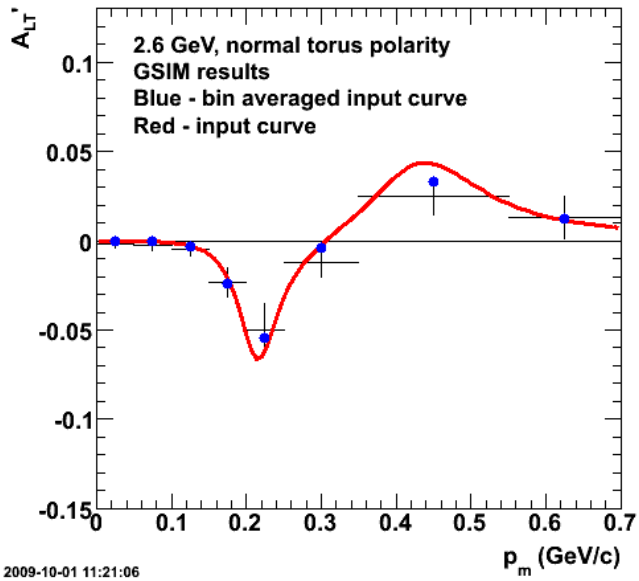


Fig 2. Same as fig 1 for runs 1-6.

Click here to view the object (ROOT macro) you uploaded.

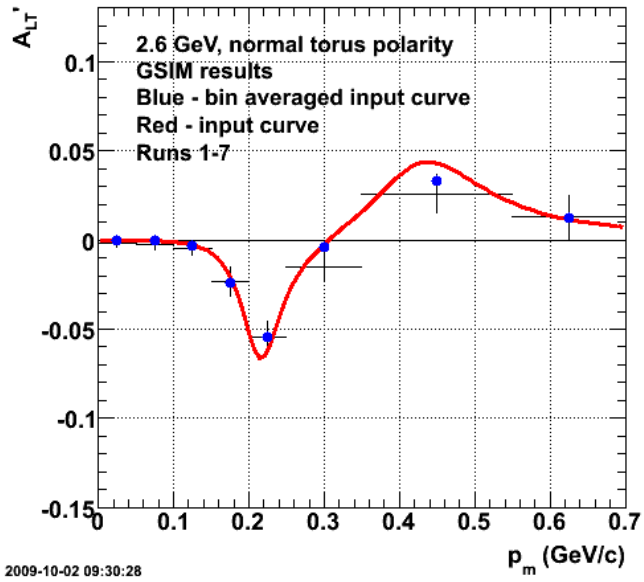


Fig 3. Same as fig 1 for runs 1-7.

Click here to view the object (ROOT macro) you uploaded.

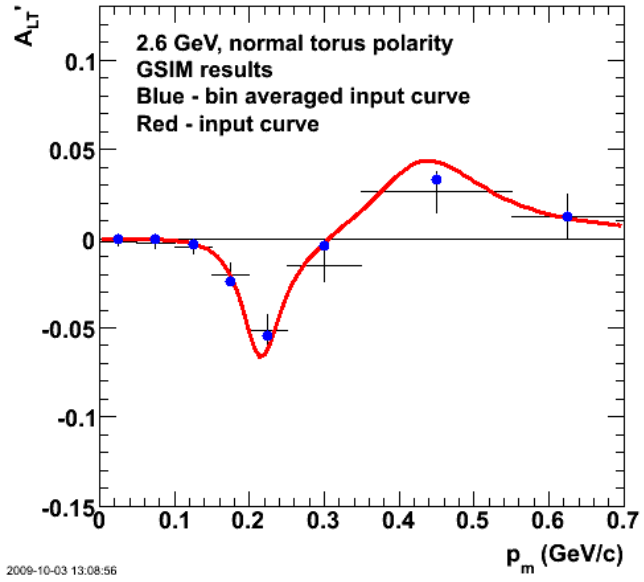


Fig 4. runs 1-8.

Click here to view the object (Root macro) you uploaded.

```
TH1.Print Name  = h12d, Entries= 0, Total sum= -0.0564667
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.00145496, x=0.025, error=0.00235343
 fSumw[2]=-0.0028764, x=0.075, error=0.00244604
 fSumw[3]=-0.00449972, x=0.125, error=0.00412293
 fSumw[4]=-0.0201862, x=0.175, error=0.00637997
 fSumw[5]=-0.0512007, x=0.225, error=0.00865467
 fSumw[6]=-0.0148769, x=0.3, error=0.00902681
 fSumw[7]=0.0262296, x=0.45, error=0.0114296
 fSumw[8]=0.0123986, x=0.625, error=0.0124952
 fSumw[9]=0, x=0.85, error=0
 fSumw[10]=0, x=1.125, error=0
 fSumw[11]=0, x=1.375, error=0
 fSumw[12]=0, x=1.75, error=0
 fSumw[13]=0, x=2.08333, error=0
root [2] Info in : GIF file ./c1.gif has been created
Info in : C++ Macro file: c1.C has been generated
```

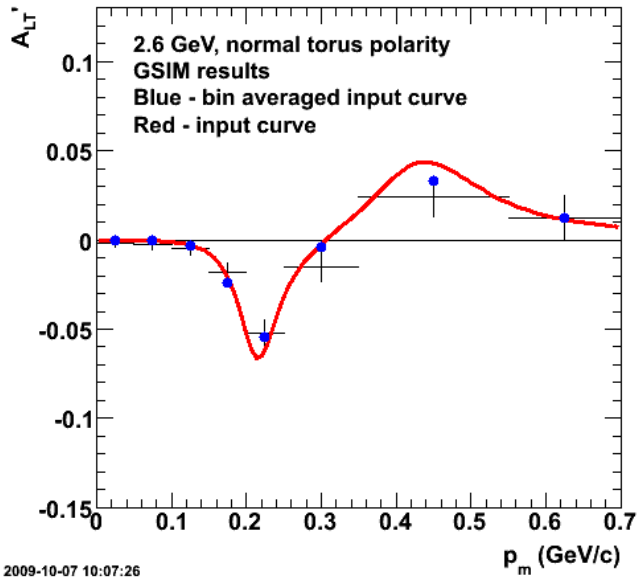


Fig 5. Runs 1-9

Click here to view the object (ROOT macro) you uploaded.

```
h12d->Print("all")
TH1.Print Name  = h12d, Entries= 0, Total sum= -0.0572047
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.00145496, x=0.025, error=0.00235343
 fSumw[2]=-0.0028764, x=0.075, error=0.00244604
 fSumw[3]=-0.00449972, x=0.125, error=0.00412293
 fSumw[4]=-0.0180941, x=0.175, error=0.00491733
 fSumw[5]=-0.0525072, x=0.225, error=0.00775401
 fSumw[6]=-0.0148221, x=0.3, error=0.00870277
 fSumw[7]=0.0244815, x=0.45, error=0.0115014
 fSumw[8]=0.0125683, x=0.625, error=0.0126069
 fSumw[9]=0, x=0.85, error=0
 fSumw[10]=0, x=1.125, error=0
 fSumw[11]=0, x=1.375, error=0
 fSumw[12]=0, x=1.75, error=0
 fSumw[13]=0, x=2.08333, error=0
root [2]
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 267 - Systematic uncertainty on 2.6r ALTp (gpg)

[Modified Fri Oct 2 14:16:08 2009 (GMT) gpg]

Final (as of 10/02/09) uncertainties for 2.6-GeV, reversed torus field ALTp.

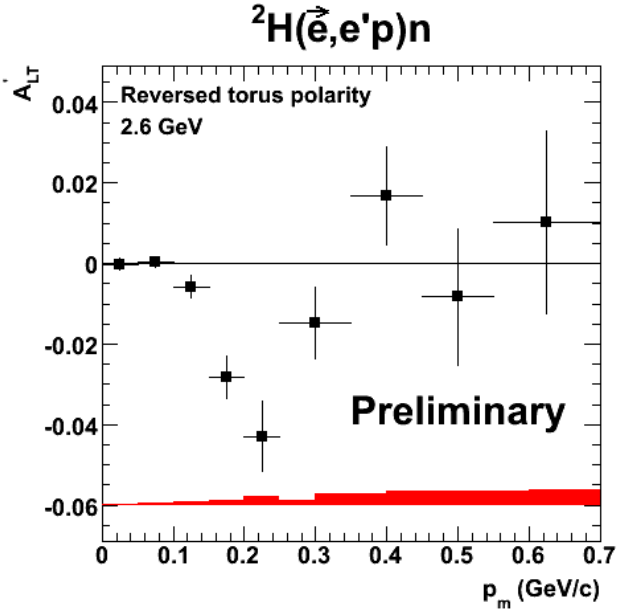


Fig 1. 2.6r ALTp with systematic uncertainty bar graph. Error bars on points are statistical only.

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 268 - Another round of W scans for 2.6n (gpg)

[Modified Sun Oct 4 16:32:11 2009 (GMT) gpg]

After tuning the MM2 cut, redo the W scan in a simpler way than I did before for the final (?) plot for the CAN.

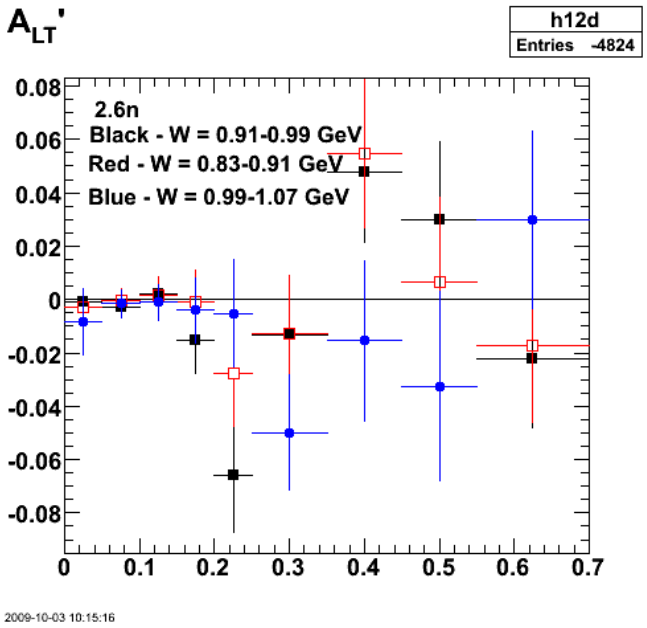


Fig 1. Comparison of ALTp for differenct W regions for the 2.6n data and MM2=0.83-9.93 GeV2.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

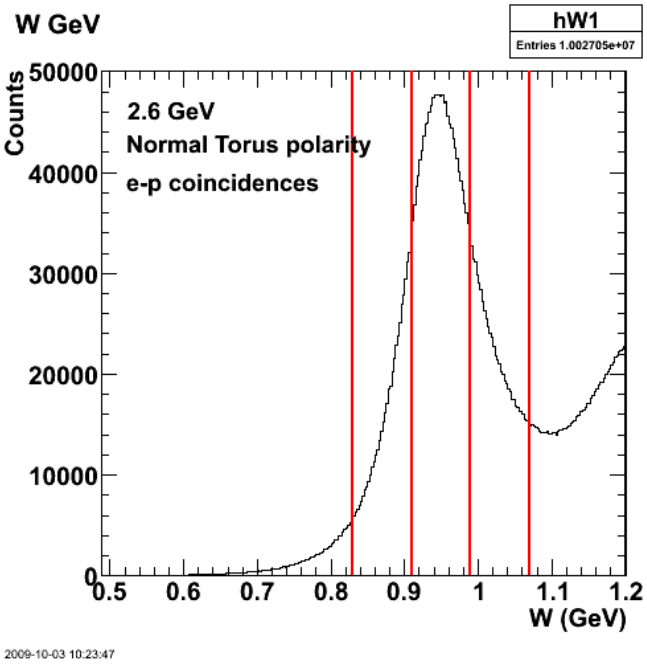


Fig 2. W spectrum showing position of cuts for 2.6n.

Click here to view the object (Root macro) you uploaded.

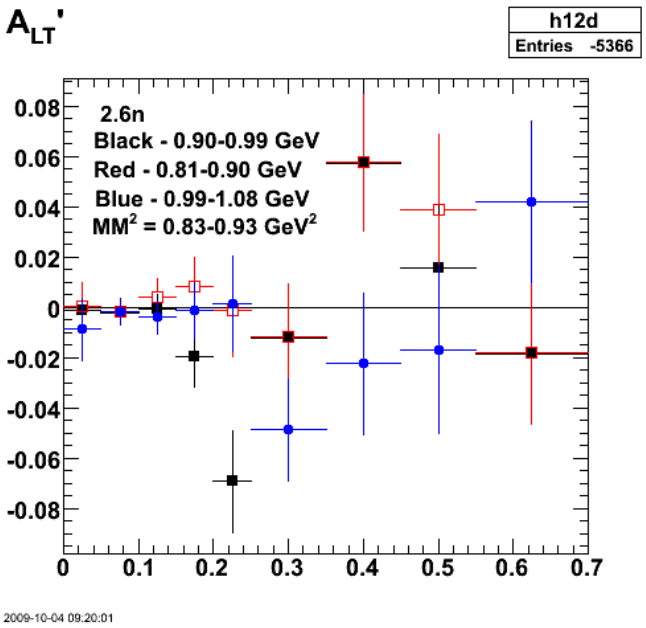


Fig 3. Modified W scan with new values of W (see entry 269 for W distribution) for 2.6n.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 269 - Checking W range for both data sets. (gpg)

[Modified Sat Oct 3 17:33:12 2009 (GMT) gpg]

Check how the W cut looks imposed on the W spectrum for e-p events.

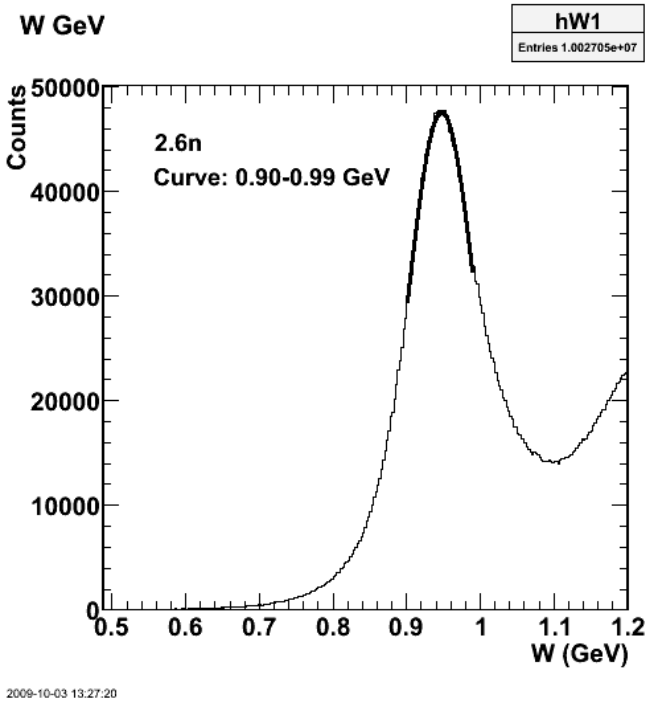


Fig 1. Modified cut to 0.90-0.99 for 2.6n.

Click here to view the object (Root macro) you uploaded.

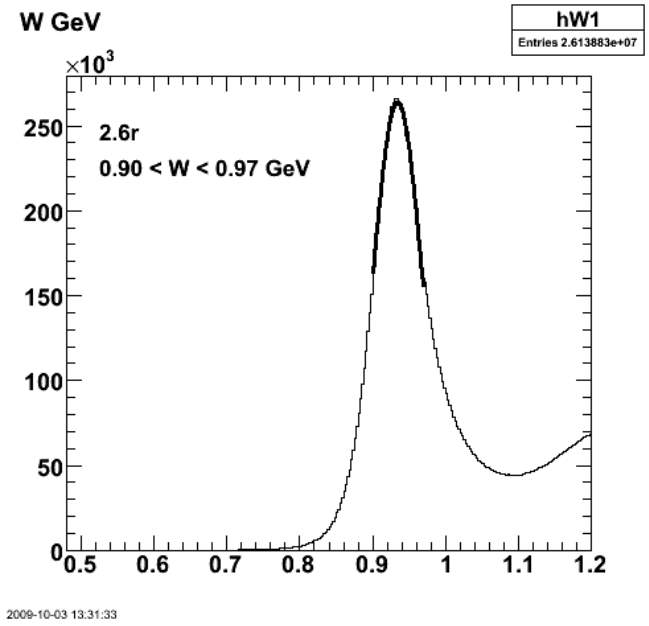


Fig 2. Modified cut to 0.90-0.97 GeV for 2.6r.

Click here to view the object (Root macro) you uploaded.

```
root [9] hW1->Fit("fit1","r")
 FCN=1392.59 FROM MIGRAD    STATUS=CONVERGED     172 CALLS         173 TOTAL
                     EDM=0.000744666    STRATEGY= 1      ERROR MATRIX ACCURATE
```

```
  EXT PARAMETER                                   STEP         FIRST
  NO.   NAME      VALUE            ERROR          SIZE      DERIVATIVE
   1  p0           2.63884e+05   1.51455e+02   1.91796e+00  -3.36611e-04
   2  p1           9.34207e-01   2.50337e-05   4.55596e-07  -9.01626e+01
   3  p2          -3.43586e-02   4.72259e-05   5.97524e-07   4.55183e+02
(Int_t)(0)
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 270 - Effect of fiducials on 2.6n with new W cut (gpg)

[Modified Sun Oct 4 16:55:32 2009 (GMT) gpg]

After changing the W cut from 0.91-0.99 to 0.90-0.99, redo the fiducials on/off test.

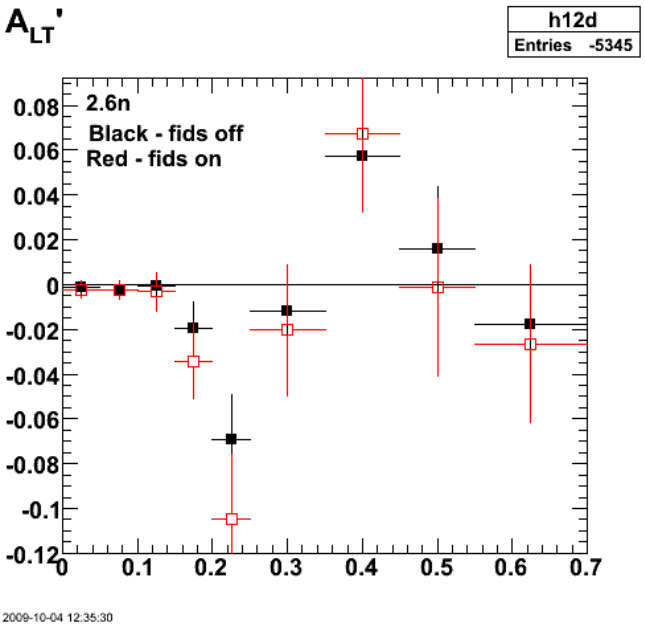


Fig 1. Comparison of ALTp with fiducial cuts off (black) and on (red).

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Click here to view the object (Gzipped tar archive for eod5c/ on 10-oct-09.) you uploaded.

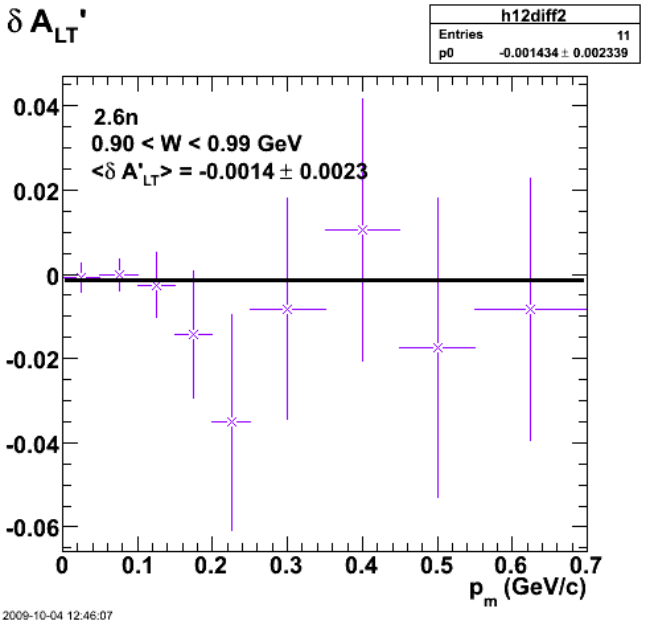


Fig 2. Difference between ALTp with fids off and on and proper error bars for 2.6n and new W cut (0.90-0.99 GeV).

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 271 - W and MM2 cut uncertainties on 2.6n with new W and MM2 ranges (gpg)

[Modified Mon Oct 5 03:03:48 2009 (GMT) gpg]

Measure the uncertainty due to the W cut on the 2.6n data with W = 0.90-0.99 GeV and MM2=0.83-0.93 GeV2.

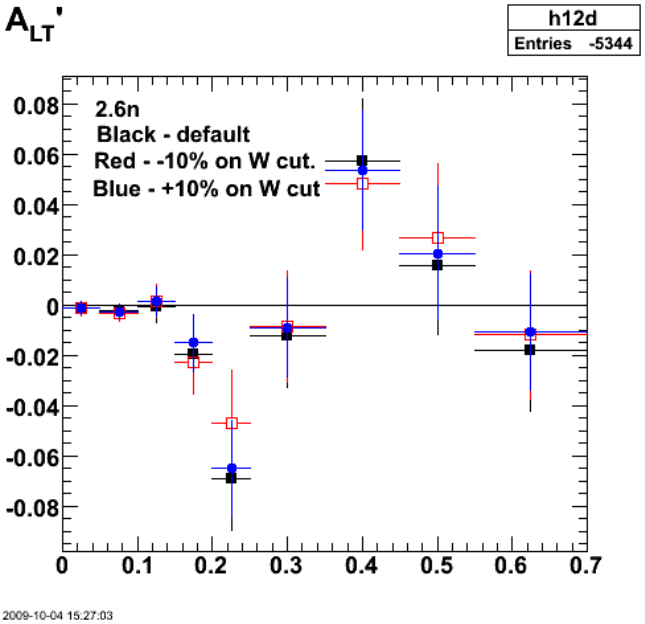


Fig 1. Comparison of ALTp with default and +\- 10% on the width of the W cut.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

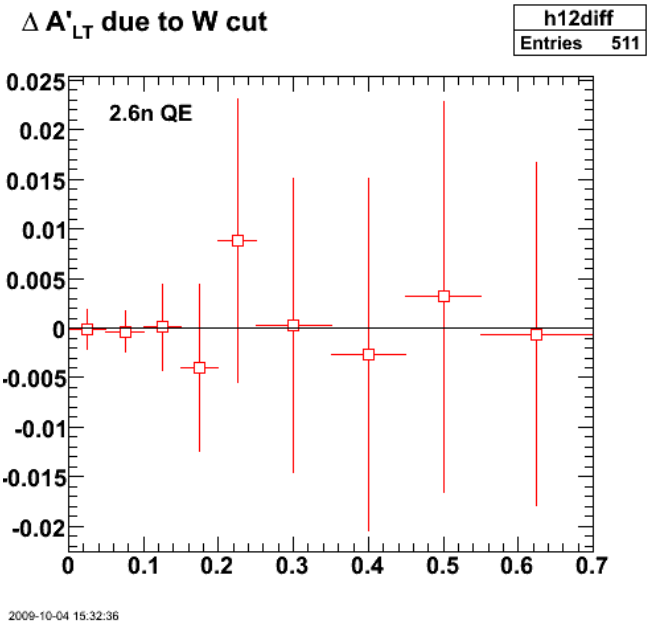


Fig 2. Uncertainty on ALTp due to W, QE cut for 2.6n.

Click here to view the object (Root macro) you uploaded.

Numerical results.

```
root [63] h12diff->Print("all");
TH1.Print Name  = h12diff, Entries= 511, Total sum= 0.0241421
```

```
fSumw[0]=0, x=-0.0833333, error=0
fSumw[1]=-0.000122858, x=0.025, error=0.00201371
fSumw[2]=-0.000338821, x=0.075, error=0.00209315
fSumw[3]=0.000134421, x=0.125, error=0.0043369
fSumw[4]=-0.00399802, x=0.175, error=0.00843514
fSumw[5]=0.00879509, x=0.225, error=0.0142746
fSumw[6]=0.000257204, x=0.3, error=0.0148628
fSumw[7]=-0.00263983, x=0.4, error=0.0177237
fSumw[8]=0.00315224, x=0.5, error=0.0197416
fSumw[9]=-0.000612627, x=0.625, error=0.0173028
fSumw[10]=-0.00221183, x=0.85, error=0.0168876
fSumw[11]=0.00789178, x=1.25, error=0.0311102
fSumw[12]=0.0138354, x=1.75, error=0.112644
fSumw[13]=0, x=2.08333, error=0
```

Now do the uncertainty due to the MM2 cut on the 2.6n data with W = 0.90-0.99 GeV and MM2=0.83-0.93 GeV2.

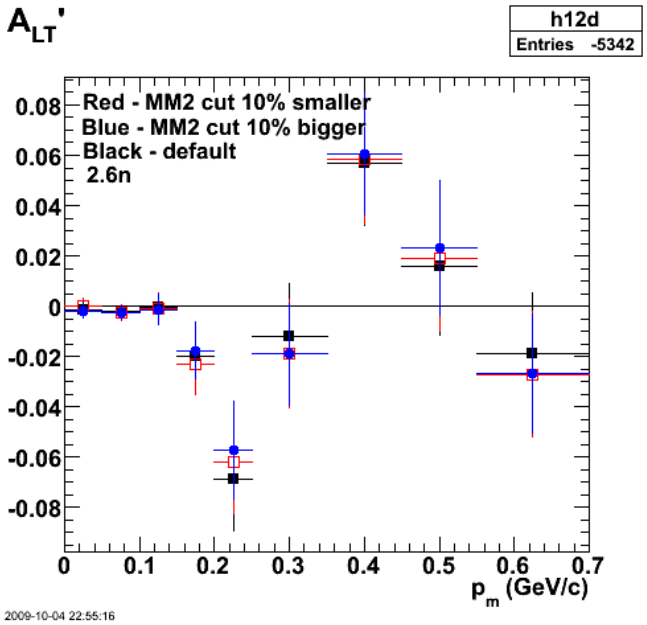


Fig 3. Comparison of ALTp with +/-10% change in the MM2 cut width for 2.6n.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

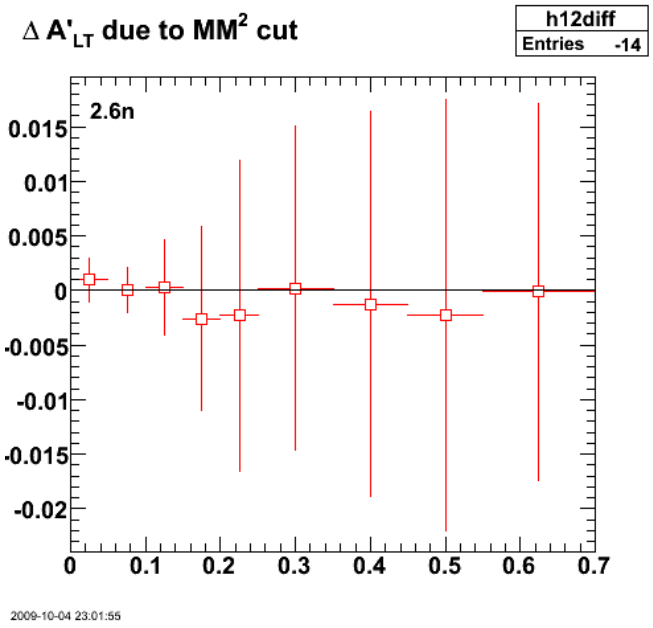


Fig 4. Uncertainty on ALTp due to MM2 cut for 2.6n.

Click here to view the object (Root macro) you uploaded.

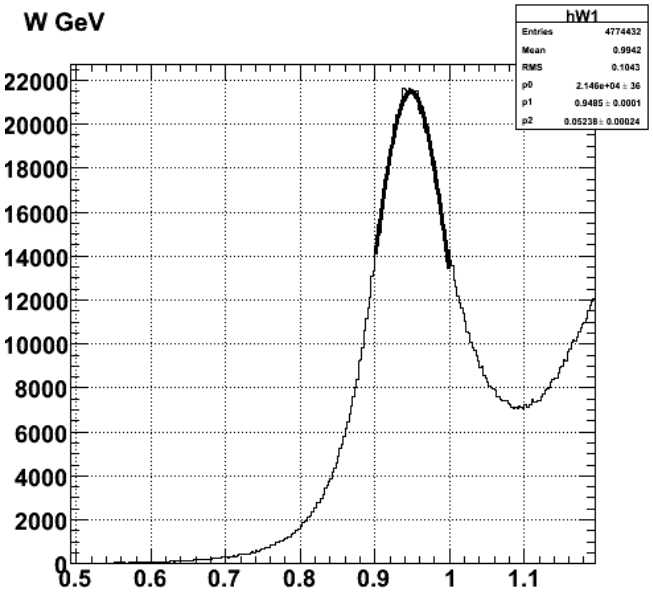
```
root [63] h12diff.Print("all")
TH1.Print Name  = h12diff, Entries= -14, Total sum= -0.0163646
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=0.000985414, x=0.025, error=0.00201178
 fSumw[2]=3.61027e-05, x=0.075, error=0.00208797
 fSumw[3]=0.000292067, x=0.125, error=0.0043292
 fSumw[4]=-0.00261482, x=0.175, error=0.00842625
 fSumw[5]=-0.00228367, x=0.225, error=0.0142443
 fSumw[6]=0.000200704, x=0.3, error=0.0148186
 fSumw[7]=-0.00124308, x=0.4, error=0.0176483
 fSumw[8]=-0.00225241, x=0.5, error=0.0197113
 fSumw[9]=-0.000141027, x=0.625, error=0.017285
 fSumw[10]=0.0073783, x=0.85, error=0.0168582
 fSumw[11]=-0.0086102, x=1.25, error=0.0310934
 fSumw[12]=-0.00811196, x=1.75, error=0.113332
 fSumw[13]=0, x=2.08333, error=0
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 272 - GRRRR! Used wrong momentum corrections for 2.6n (gpg)

[Modified Fri Oct 9 13:54:45 2009 (GMT) gpg]

For the last set of analysis of the 2.6n data I had the momentum corrections for the 2.6r data. Redo it all! Well MM2, W, and fids stuff. Damn!!!!!

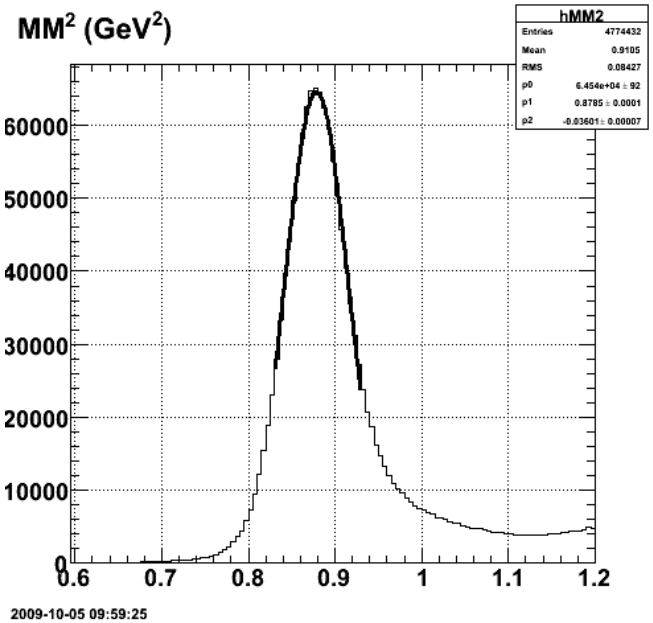


2009-10-05 09:52:27

Fig 1. W distribution for 2.6n with correct momentum corrections. It now looks like the appropriate W range should be 0.90-1.0 GeV instead of 0.90-0.99 GeV as I had.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.



2009-10-05 09:59:25

Fig 2. MM2 distribution for 2.6n with propre momentum corrections. Distribution is a bit narrower so we may be able to shrink the range.

Click here to view the object (ROOT macro) you uploaded.

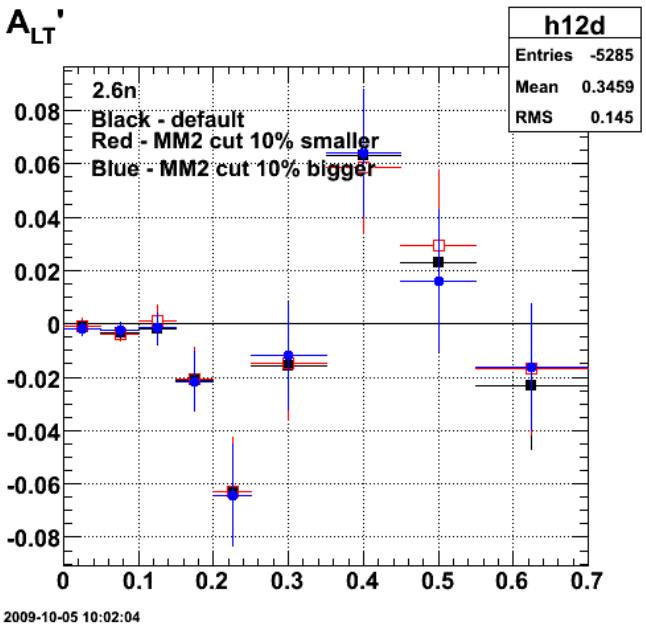


Fig 3. Comparison of ALTp for 2.6n with proper momentum corrections and with+/- 10% change in width of the MM2 cut.

Click here to view the object (ROOT macro) you uploaded.

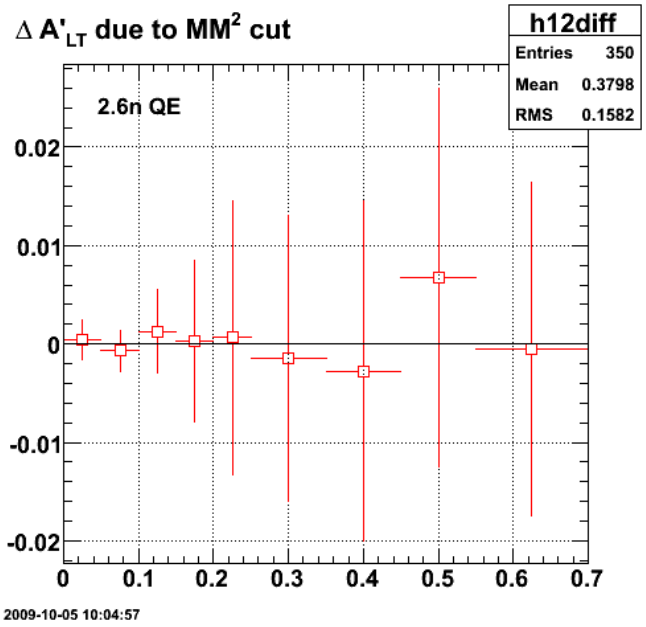


Fig 4. Systematic uncertainty due to MM2 cut on 2.6n ALTp.

Click here to view the object (ROOT macro) you uploaded.

Numerical results for systematic uncertainty due to MM2 cut on ALTp with propoer momentum corrections.

```
root [145] h12diff->Print("all")
TH1.Print Name  = h12diff, Entries= 350, Total sum= 0.0081267
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=0.00047184, x=0.025, error=0.00199706
 fSumw[2]=-0.000698866, x=0.075, error=0.00203524
 fSumw[3]=0.00128085, x=0.125, error=0.00418714
 fSumw[4]=0.000271462, x=0.175, error=0.00816516
 fSumw[5]=0.000672635, x=0.225, error=0.0139183
 fSumw[6]=-0.00148335, x=0.3, error=0.0144917
 fSumw[7]=-0.00275626, x=0.4, error=0.0172784
 fSumw[8]=0.00674628, x=0.5, error=0.0192681
 fSumw[9]=-0.000481756, x=0.625, error=0.0169713
 fSumw[10]=0.00341004, x=0.85, error=0.016463
 fSumw[11]=-0.0171757, x=1.25, error=0.0298873
 fSumw[12]=0.0178696, x=1.75, error=0.113041
 fSumw[13]=0, x=2.08333, error=0
```

Redo with wider W cut first (0.90 < W < 1.0 GeV). It noticeably shrinks the size of the dip.

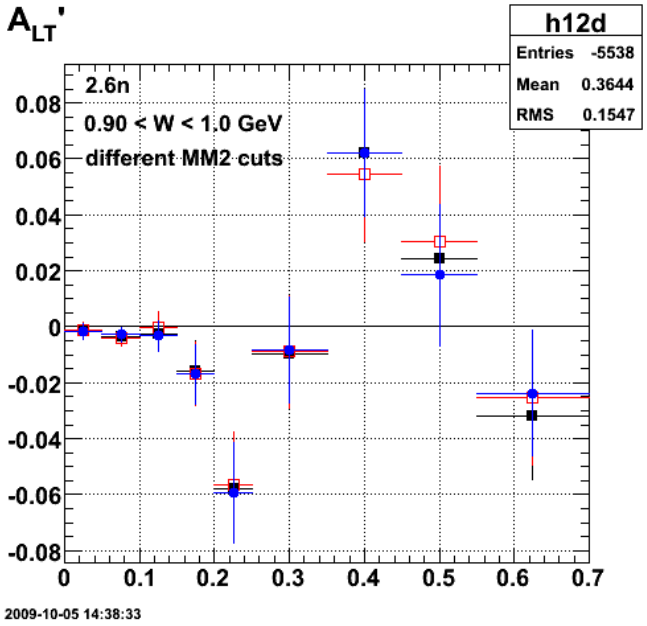


Fig 5. Effect of W = 0.90-1.0 GeV.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Refit the W distribution. The curve below is asymmetric, but the range is symmetric about the nucleon mass.

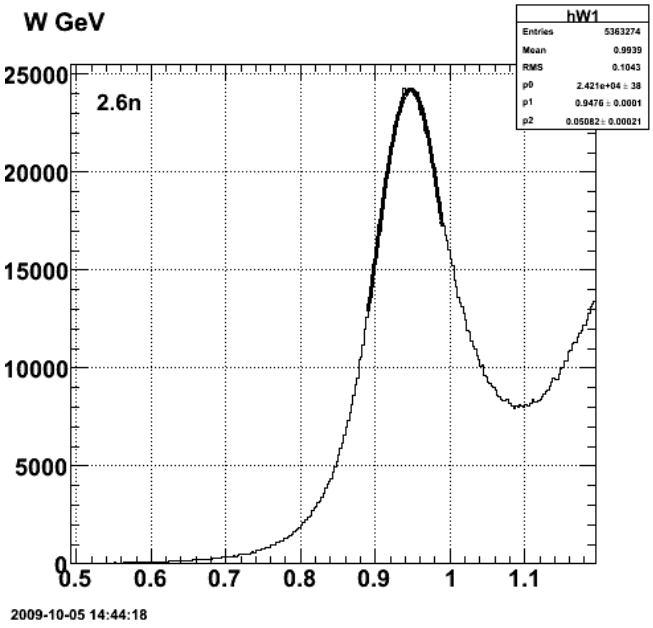


Fig 6a. W distribution for next scan with fitted curve.

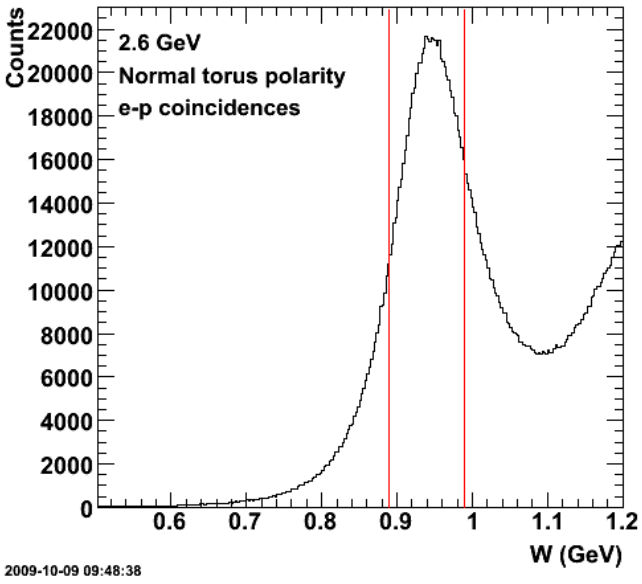


Fig 6b. W distribution with lines.

Click here to view the object (ROOT macro) you uploaded.

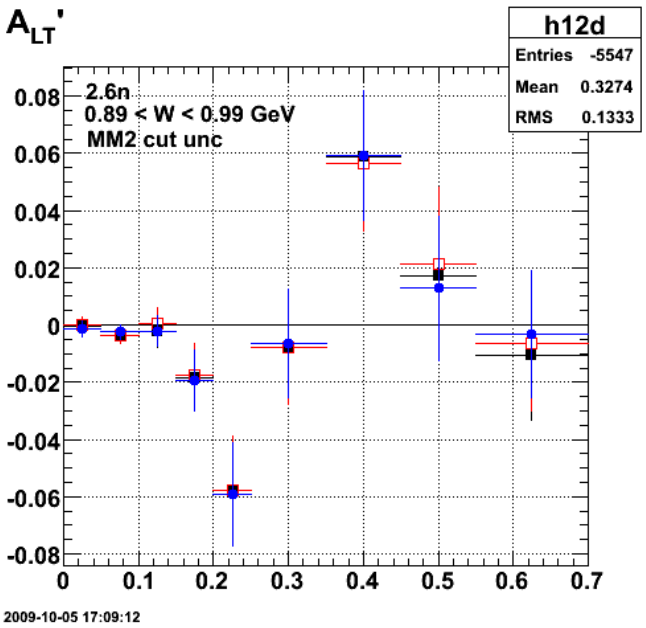


Fig 7. MM2 uncertainty test for 2.6n and 0.89 < W < 0.99 GeV.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

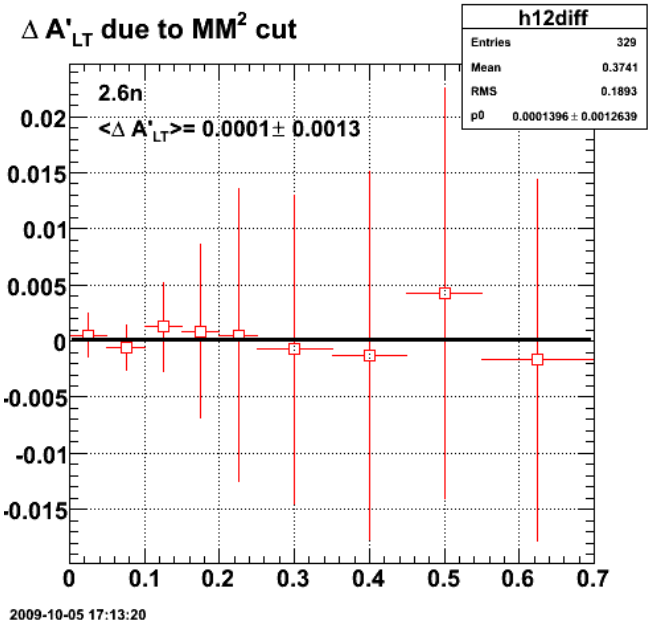
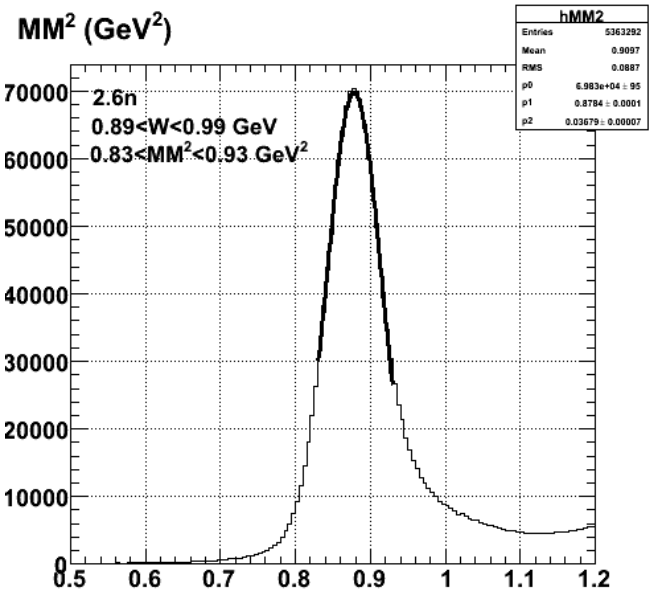


Fig 8. Systematic Uncertainty on 2.6n, ALTp from MM2 cut (+/- 10% change on the width of the cut).

Click here to view the object (ROOT macro) you uploaded.

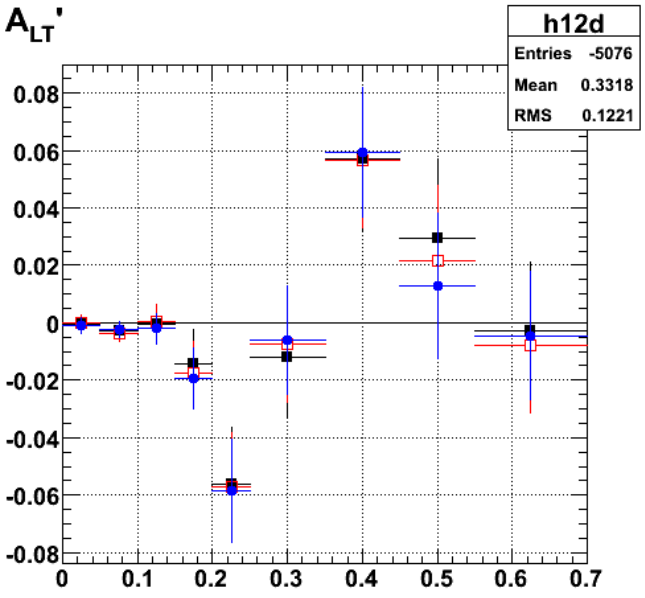


2009-10-05 17:19:53

Fig 9. The MM2 distribution looks good for 2.6n and 0.89< W <0.99 GeV.

Click here to view the object (ROOT macro) you uploaded.

The width of the gaussian fit in fig 9 is about 0.04 GeV2 while I used a width of 0.10 GeV2 for the cut. Reduce the width of the cut to about 1 sigma and see what happens to the depth of the dip. It actually shrinks it a bit more, but we now have defensible widths and positions for the MM2 and W cuts.



2009-10-05 21:08:56

Fig 10. Comparison of ALTp for 2.6n with 0.89< W <0.99 GeV and 0.84< MM2 <0.92 GeV2 for the default and +/- 10% for the other two MM2 ranges.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

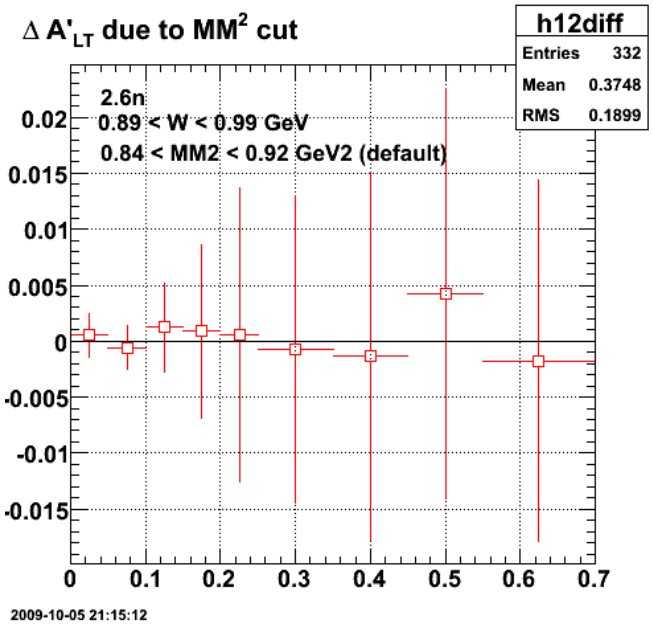


Fig 11. Systematic uncertainty for 2.6n for MM2 and 0.89 < W < 0.99 GeV and 0.84 < MM2 < 0.92 GeV2 (default).

Click here to view the object (ROOT macro) you uploaded.

Numerical results:

```
h12diff.Print("all")
TH1.Print Name  = h12diff, Entries= 332, Total sum= 0.00649018
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=0.000545441, x=0.025, error=0.00195269
 fSumw[2]=-0.000588538, x=0.075, error=0.00195383
 fSumw[3]=0.00126635, x=0.125, error=0.00397219
 fSumw[4]=0.000891591, x=0.175, error=0.00772371
 fSumw[5]=0.000575742, x=0.225, error=0.0130894
 fSumw[6]=-0.000719198, x=0.3, error=0.0137185
 fSumw[7]=-0.00128506, x=0.4, error=0.0164161
 fSumw[8]=0.00425363, x=0.5, error=0.0183394
 fSumw[9]=-0.00174463, x=0.625, error=0.0161462
 fSumw[10]=0.00503877, x=0.85, error=0.0157407
 fSumw[11]=-0.0184509, x=1.25, error=0.028817
 fSumw[12]=0.016707, x=1.75, error=0.10914
 fSumw[13]=0, x=2.08333, error=0
```

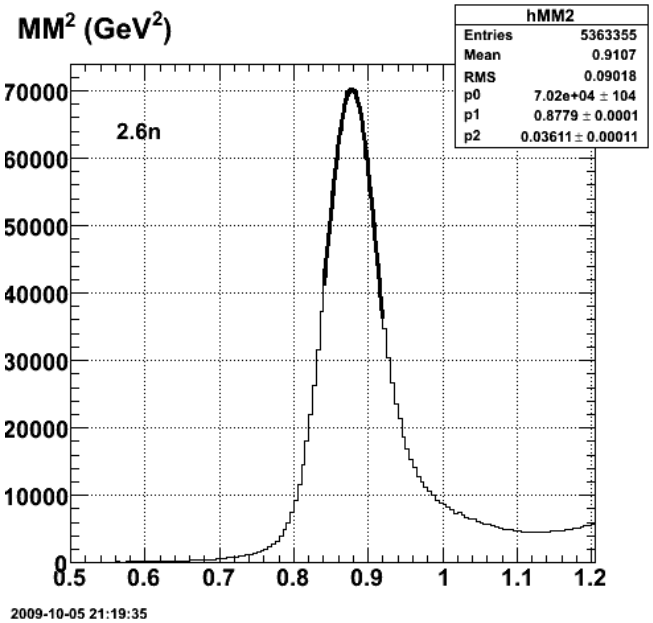


Fig 12. MM2 distribution showing range of MM2 cut for 2.6n.

Click here to view the object (ROOT macro) you uploaded.

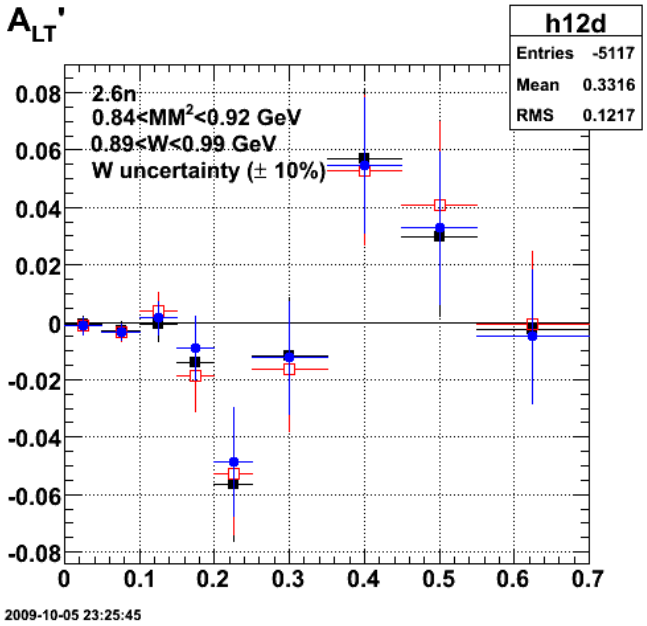


Fig 13. Comparison of ALTp for 2.6n for W uncertainty.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

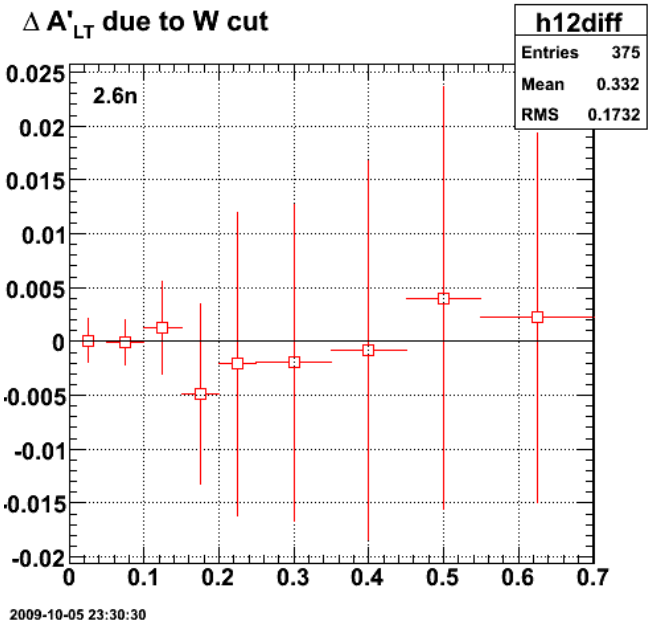


Fig 14. W uncertainty for 2.6n.

Click here to view the object (ROOT macro) you uploaded.

```
root [68] h12diff.Print("all")
TH1.Print Name  = h12diff, Entries= 375, Total sum= 0.0424784
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=0.000101157, x=0.025, error=0.00205537
 fSumw[2]=-0.00011472, x=0.075, error=0.00210018
 fSumw[3]=0.00130619, x=0.125, error=0.00429142
 fSumw[4]=-0.00485682, x=0.175, error=0.0083217
 fSumw[5]=-0.00210295, x=0.225, error=0.0141151
 fSumw[6]=-0.00194613, x=0.3, error=0.0146721
 fSumw[7]=-0.000865284, x=0.4, error=0.0175809
 fSumw[8]=0.00402355, x=0.5, error=0.0195758
 fSumw[9]=0.0022068, x=0.625, error=0.0171773
 fSumw[10]=-6.04857e-05, x=0.85, error=0.0168209
 fSumw[11]=-0.0076325, x=1.25, error=0.0310736
 fSumw[12]=0.0524196, x=1.75, error=0.120232
 fSumw[13]=0, x=2.08333, error=0
```

w

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 273 - Effect of fiducial cuts on revised 2.6n results (gpg)

[Modified Tue Oct 6 14:48:54 2009 (GMT) gpg]

After catching the problem with the wrong momentum corrections described in the previous entry, check the effect of the electron and proton fiducial cuts.

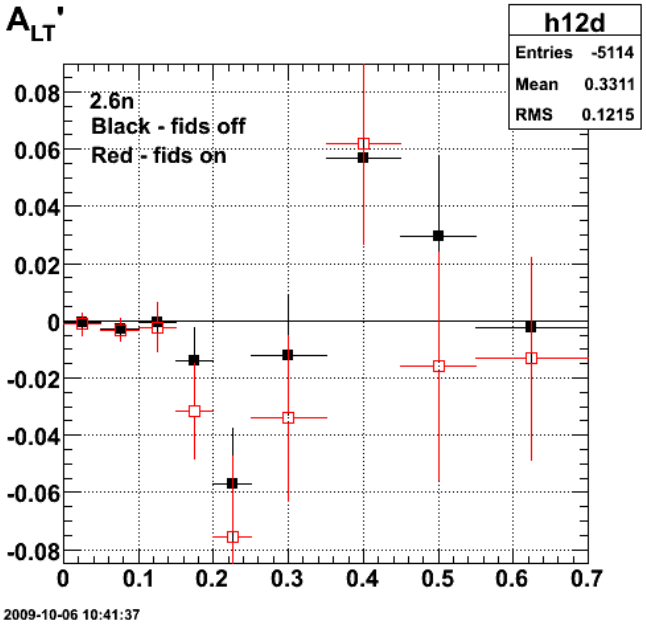


Fig 1. Comparison of 2.6n, ALTp with fids off (black) and on (red) using W=0.89-0.99 GeV and MM2=0.84-0.92 GeV2.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

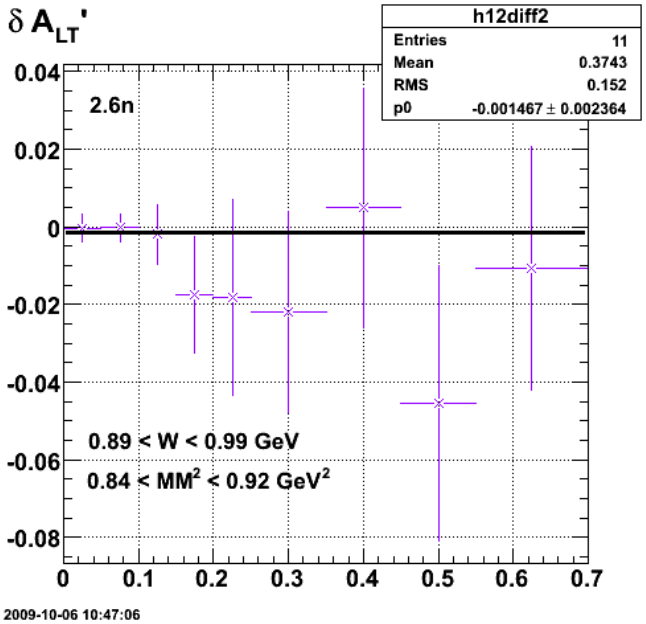


Fig 2. Difference between ALTp with fids off and on for 2.6n (revised).

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 274 - MM2 and W scans around the peaks for 2.6n (gpg)

[Modified Wed Oct 7 18:58:16 2009 (GMT) gpg]

Investigate the persistence of the dip in ALTp for 2.6n around the MM2 peak. The statistics for the region below the peak is so bad, we can't really say much. For the region about the peak, the dip is shallower and may be consistent within statistics with going away.

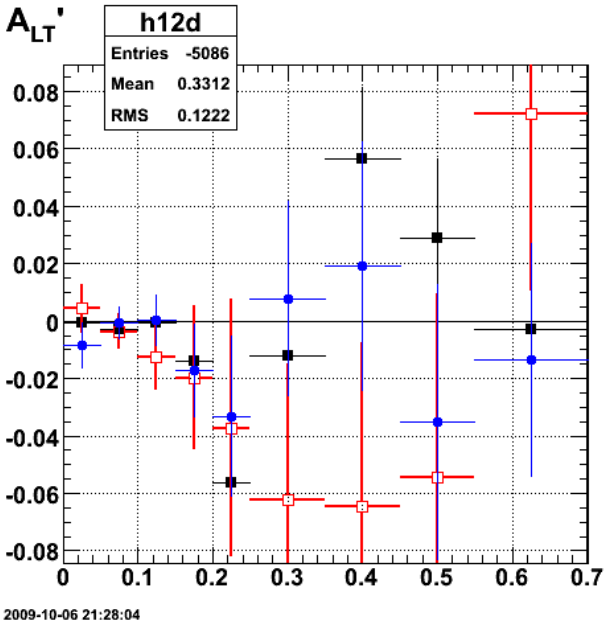


Fig 1. Comparison of ALTp for 2.6n about and below the MM2 neutron peak. Compare with fig 3 below.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

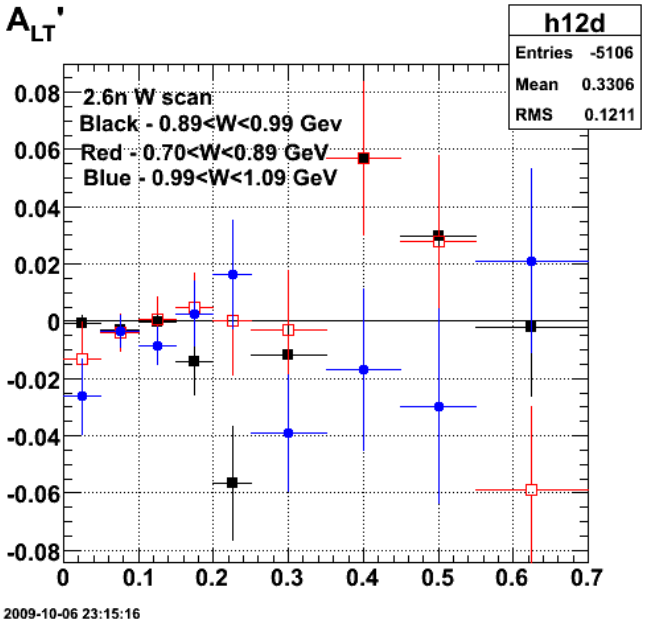


Fig 2. W scan for 2.6n ALTp shows the dip disappears for W ranges off the QE peak.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Redo the MM2 scan with larger ranges for the off-peak analysis to improve the statistics. The results look good. The dip goes away above and below the peak.

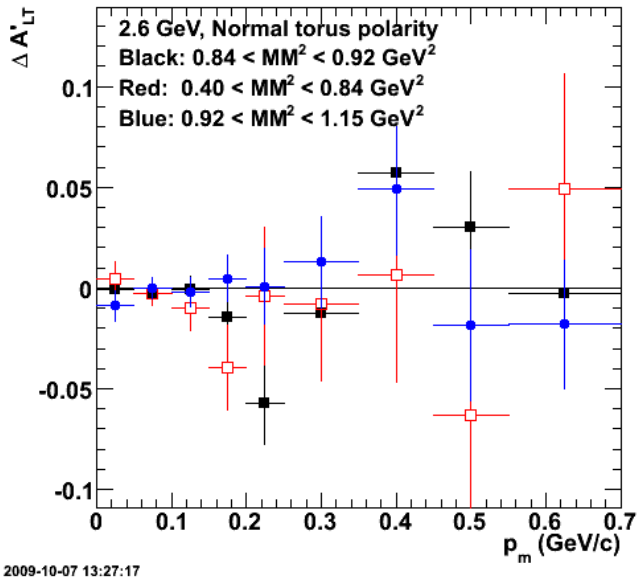


Fig 3. Comparison of ALTp for 2.6n about and below the MM2 neutron peak with wider ranges than used in Fig 1.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Click here to view the object (Gzipped, tar archive of root analysis code for 10-oct-06) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 275 - Summary of changes to 2.6n and 2.6r results (gpg)

[Modified Sat Oct 10 19:19:15 2009 (GMT) gpg]

Summary of changes to 2.6n results over the last two days.

New values of the QE and neutron cuts: 0.89 GeV < W < 0.99 GeV, QE cut
0.84 GeV2 < MM2 < 0.92 GeV2, neutron cut

W distribution with fit: 272.6a
W distribution with lines for cut: 272.6b
dMM2: 272.7-8
MM2 distribution with fit: 272.9
dMM2 again (oopps): 272.10-11
MM2 distribution again (oops): 272.12
dW: 272.13-14
fids off/on: 273.1-2
MM2 scan results: 274.3
W scan results:274.2

Summary of changes to 2.6r results.

New values of the QE and neutron cuts: 0.89 GeV < W < 0.99 GeV, QE cut
0.83 GeV2 < MM2 < 0.91 GeV2, neutron cut

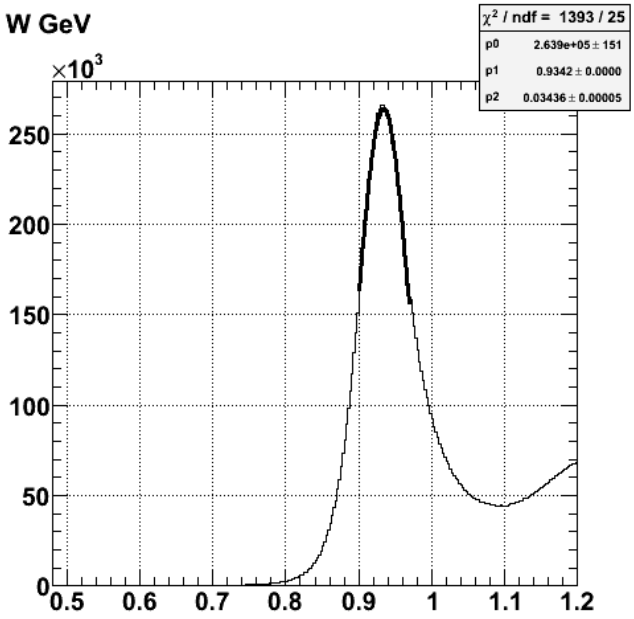
W distribution with lines for cut: 276.6
dMM2:
MM2 distribution with fit: 276.2
dMM2 again (oopps):
MM2 distribution again (oops):
dW:
fids off/on:
MM2 scan results: 276.7
W scan results:

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 276 - Last (?) pass on 2.6r (see entry 279) (gpg)

[Modified Thu Oct 22 19:25:31 2009 (GMT) gpg]

Get the W and MM2 distributions and ranges in preparation for another 2.6r pass.

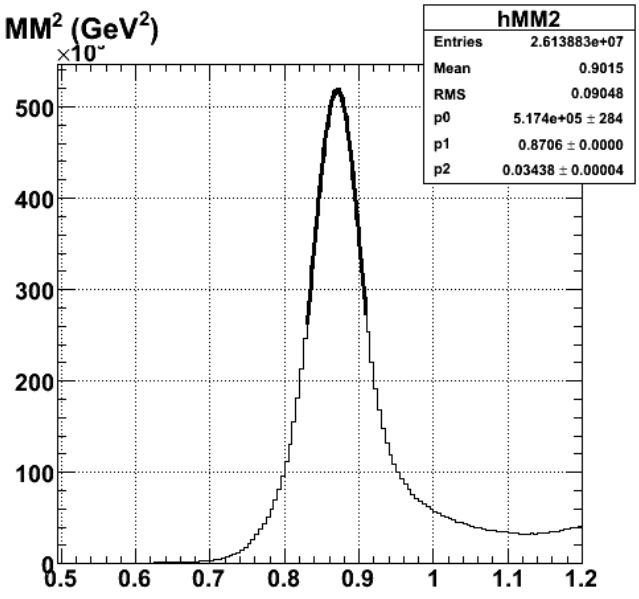


2009-10-07 14:53:34

Fig 1. W distribution with fit over the W cut range of 0.90-0.97 GeV.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

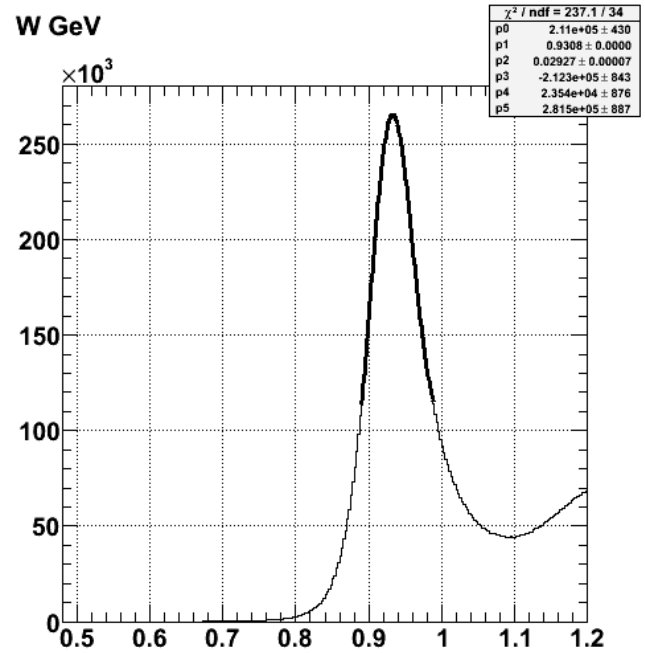


2009-10-07 15:05:29

Fig 2. MM2 distribution for 2.6r with fit over the range MM2 = 0.83-0.91 GeV2.

Click here to view the object (ROOT macro) you uploaded.

The dip shrinks by 25% with the above W cut (the MM2 cut is the same as I had before). See entry 263. Use the same W cut as 2.6n (0.89<0.99 GeV). The entry 263 cut is 0.91<0.99 GeV which looks too asymmetric to be defensible.

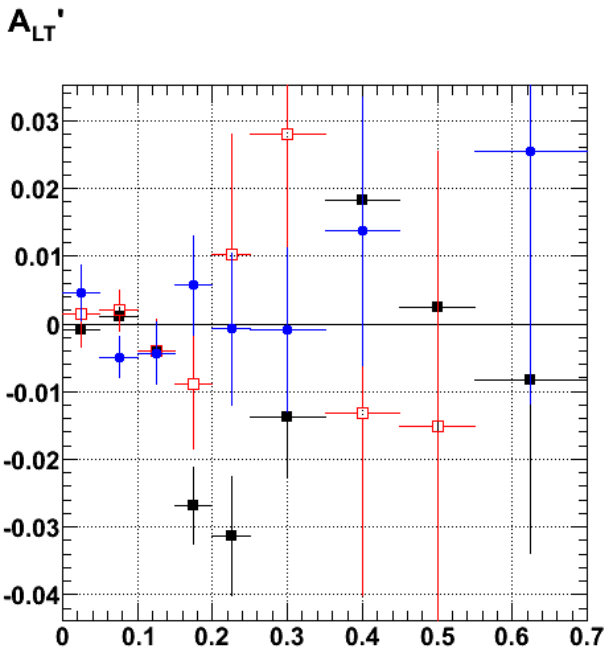


2009-10-07 22:42:22

Fig 3. Shrinking dip.

Click here to view the object (Root macro) you uploaded.

The incredible shrinking dip.



2009-10-07 22:45:45

Root macro

Click here to view the object (Root histogram file) you uploaded.

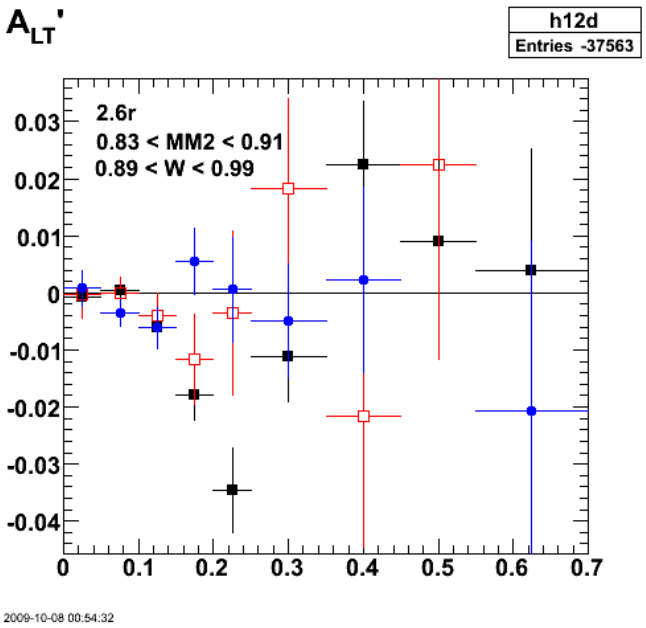


Fig 4. Change the W cut and it doesn't change the depth of the dip by much.

Click here to view the object (Root macro) you uploaded.

Go back to the old asymmetric cut and see if I can reproduce the 4.2% dip. It does. See next plot.

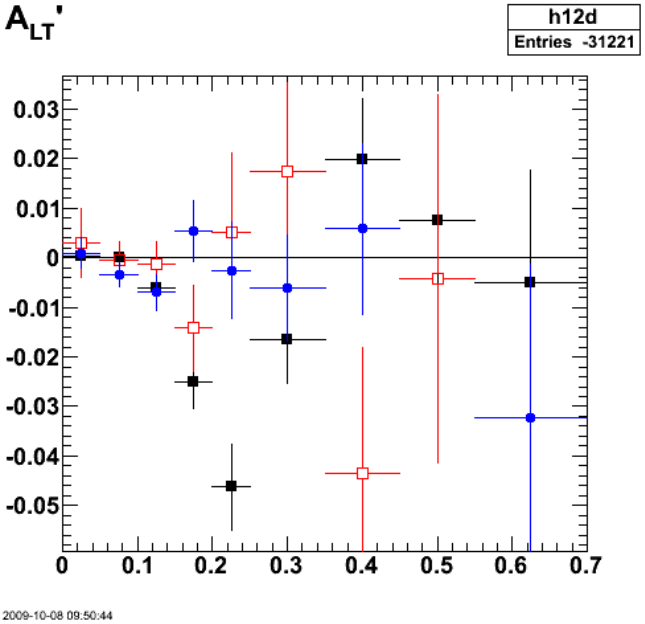


Fig 5. 2.6r ALTp MM2 scan with 0.91 < W < 0.99 GeV and 0.84 < MM2 < 0.92 GeV2 (black), 0.4 < MM2 < 0.84 (red), and 0.92 < MM2 < 1.15 (blue).

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

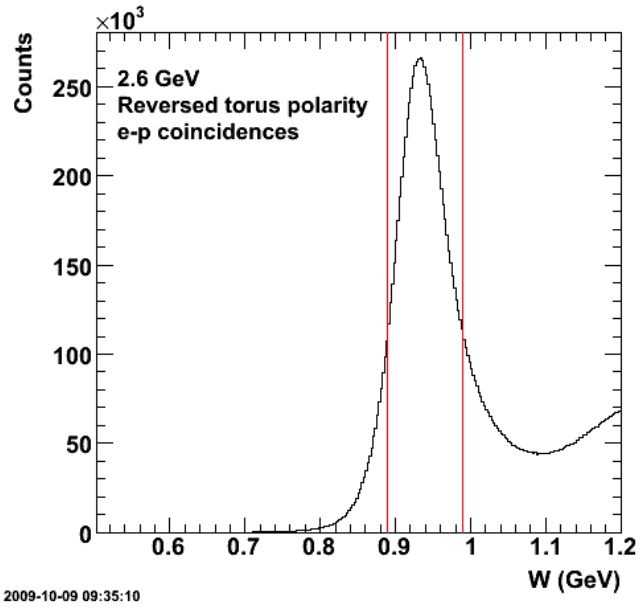


Fig 6. Final(?) version of W plot for 2.6r.

Click here to view the object (ROOT macro) you uploaded.

MM2 scan with revised W cut (0.89 < W < 0.99 GeV).

```
Double_t neutron_mm2_lo = 0.83, neutron_mm2_hi = 0.91;  // 2.6r default values
Double_t neutron_mm2_lo2 = 0.40, neutron_mm2_hi2 = 0.83;  // test systematic uncertainty.
Double_t neutron_mm2_lo3 = 0.91, neutron_mm2_hi3 = 1.15;  // test systematic uncertainty.
```

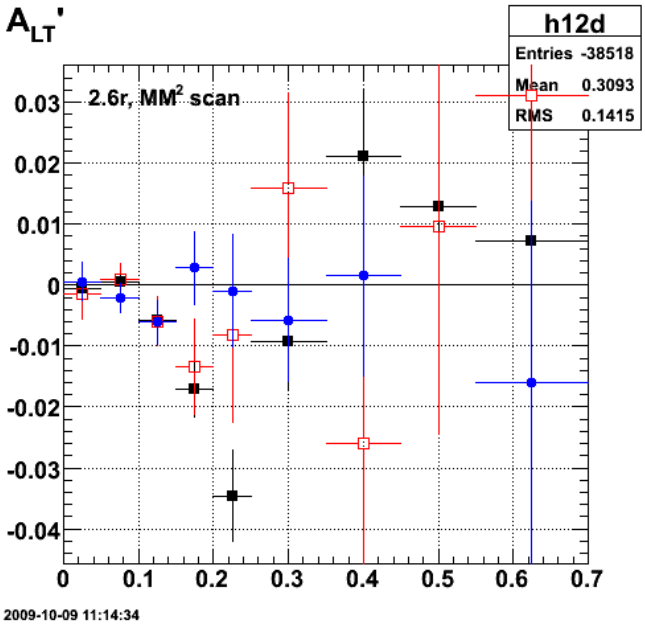


Fig 7. Comparison of 2.6r ALTp for different MM2 cuts.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

W scan with revised default W cut (0.89 < W < 0.99 GeV).

```
Double_t W_QE_lo=0.89, W_QE_hi=0.99;  // 2.6r 09-oct-07 - 10:48
Double_t W_QE_lo2=0.70, W_QE_hi2=0.89;
Double_t W_QE_lo3=0.99, W_QE_hi3=1.10;
```

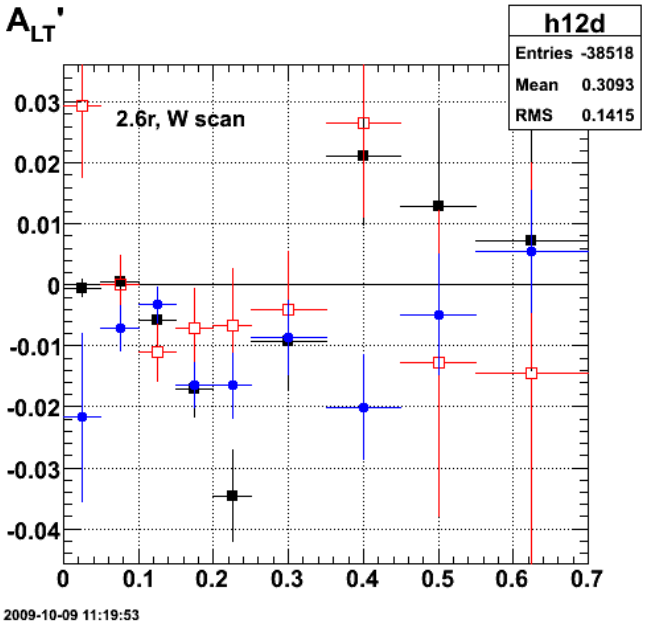


Fig 8. Comparison of 2.6 ALTp with different W ranges.

Click here to view the object (ROOT macro) you uploaded.

Fig 9. Comparison of 2.6r ALTp for default(black) and #pm 10% in the size of the MM^{2} cut.

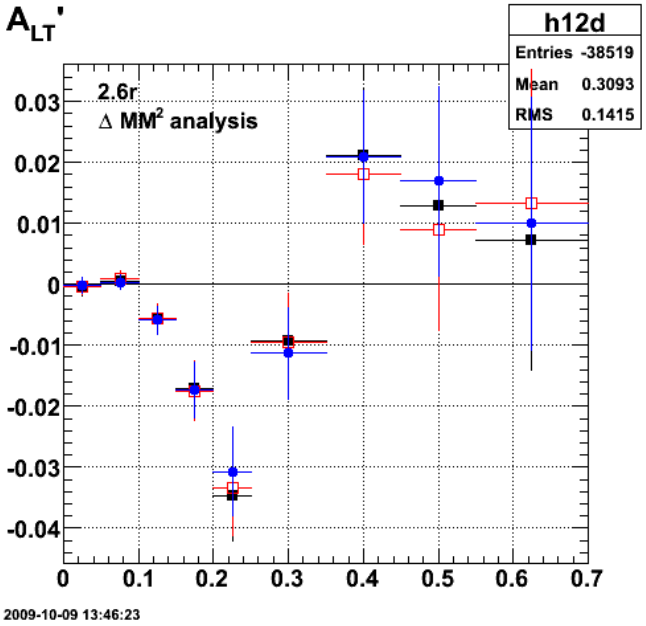


Fig 9. Comparison of 2.6r ALTp for default(black) and #pm 10% in the size of the MM^{2} cut.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Click here to view the object (Gzipped tar archive of eo5c area) you uploaded.

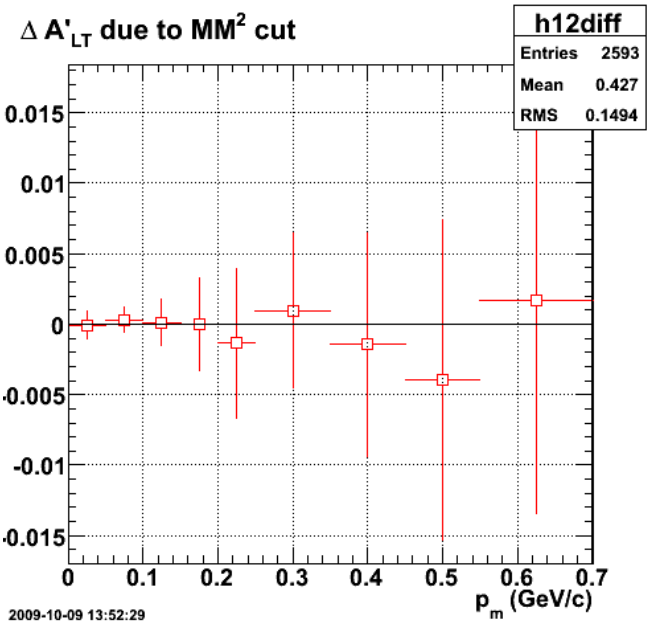


Fig 10. Uncertainty due to MM2 cut for 2.6r ALTp.

Click here to view the object (ROOT macro) you uploaded.

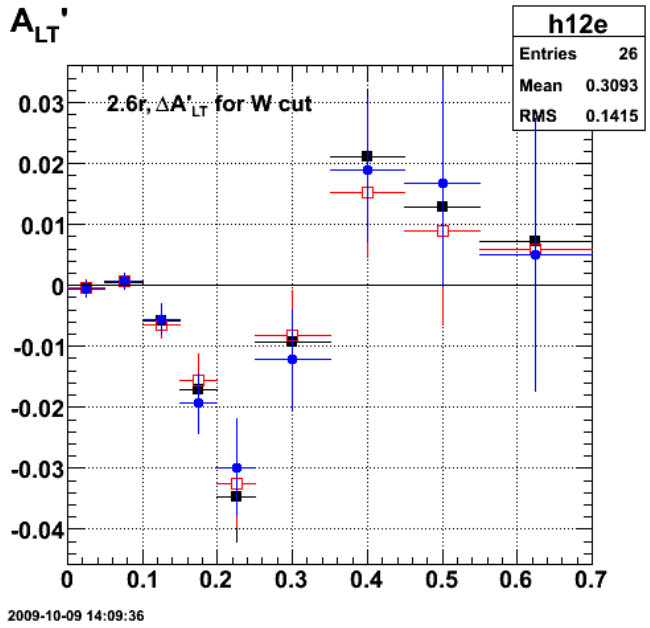


Fig 11. Uncertainty due to W cut for 2.6r.

Click here to view the object (ROOT macro) you uploaded.

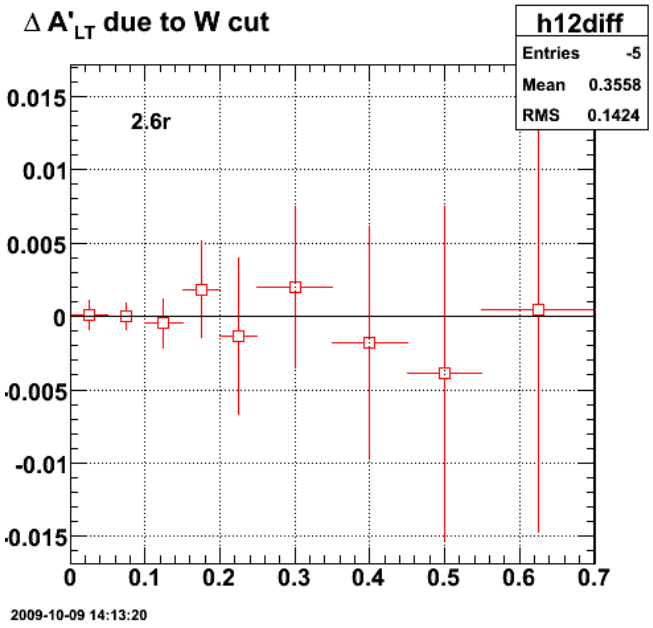


Fig 12. Uncertainty due to W cut for 2.6r ALTp.

Click here to view the object (ROOT macro) you uploaded.

Now test the effect of the fiducial cuts.

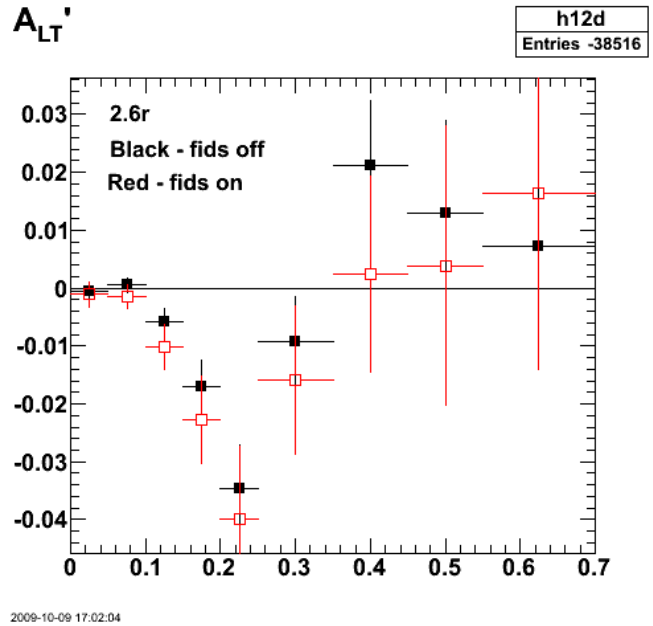


Fig 13. Comparison of ALtp for 2.6r with fids off (black) and on (red).

Click here to view the object (ROOT macro) you uploaded.

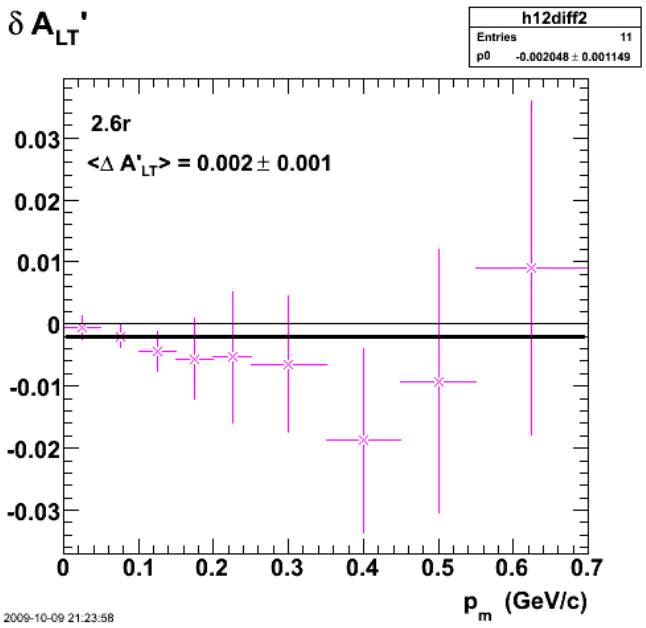


Fig 14. Difference between 2.6r ALTp with and without fiducial cuts on.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 277 - Variation of 2.6r ALTp dip and W cut (gpg)

[Modified Fri Oct 9 14:28:03 2009 (GMT) gpg]

We have studied the variation of the ALTp dip in the 2.6r data as we change the limits of the W cut for 0.83 < MM2 < 0.91. The results are shown below. The left column is the bin number and W for the low-W limit; the next column is the bin number and W for the high-W limit; the right-hand column is the value of ALTp and its uncertainty in the fifth bin (p_m0.20-0.25 GeV/c). See log-09-oct-09 for the Root commands and elog entry 276 (fig 6).

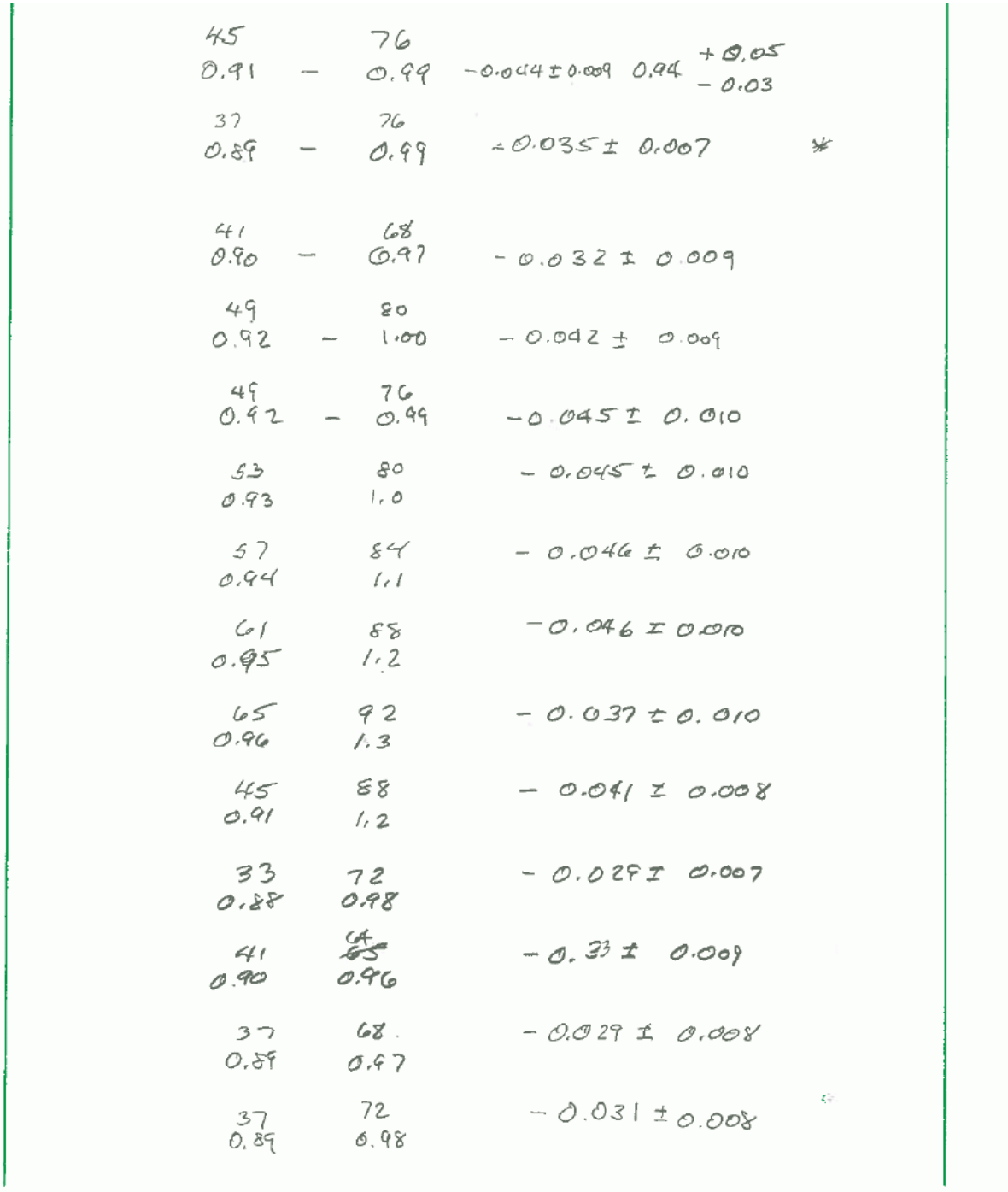


Fig 1. Table of dependence of the ALTp dip in the 2.6r data with changes in the W cut.

Click here to view the object (PDF version of fig.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 278 - NDE differences for GMn (gpg)

[Modified Sat Oct 10 20:28:38 2009 (GMT) gpg]

Following up and John Schiffer questions during my ANL seminar, I have calculated the difference between the 2.6-GeV and 4.2-GeV EC NDE. See the plot below. There is a 1-2% difference between the two. This can be explained in the following way.

1. The efficiency curves are from two different beam energies.
2. So for a neutron of the same momentum p_n, it will strike different parts of CLAS for the two beam energies.
3. This difference is consistent with some of the super-pixel-to-super-pixel variation seen in the sector-by-sector efficiency measurements.

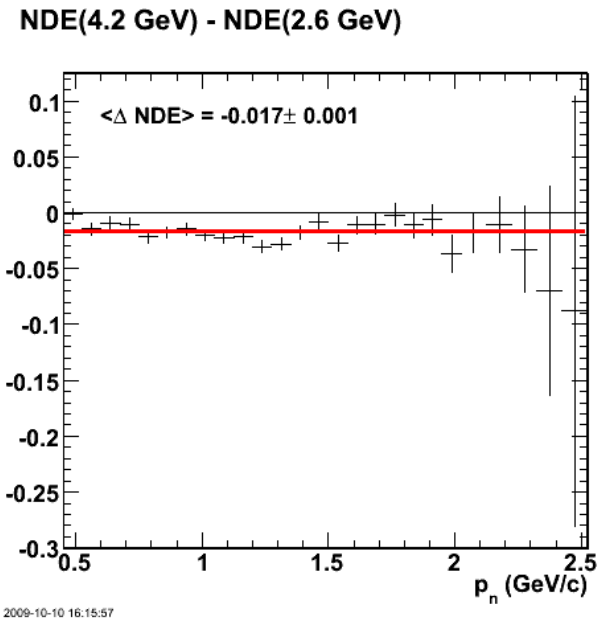


Fig 1. Difference between the EC neutron detection efficiencies for 4.2 and 2.6 GeV.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root macro 2.6nECnde1.C for 2.6-GeV, EC NDE.) you uploaded.

Click here to view the object (Root macro 4.2nECnde1.C for 4.2-GeV, EC NDE.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 279 - Effect of Mp cut on 2.6r (gpg)

[Modified Fri Oct 23 01:41:33 2009 (GMT) gpg]

I did not have the proton mass cut on in the previous analysis (dumb ass). This cut is needed to clean up the wings on the mass distribution that are presumably due to misidentified beam buckets. See entry 200.

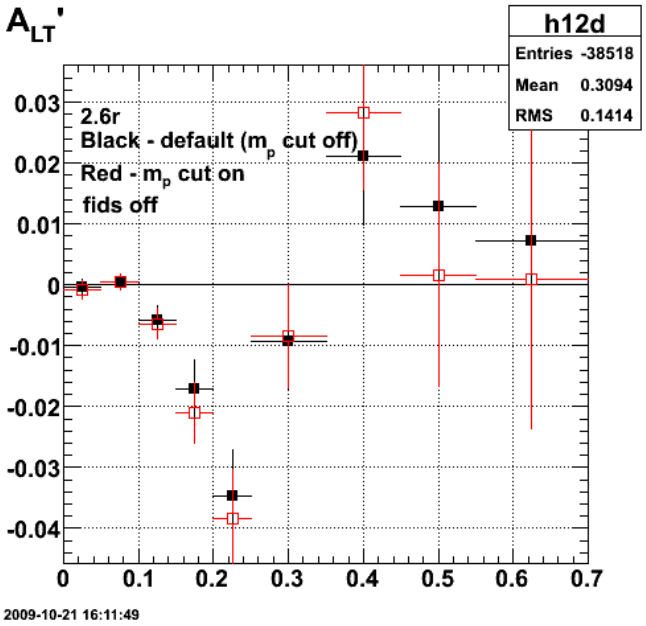


Fig 1. Effect of turn on the m_p cut.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

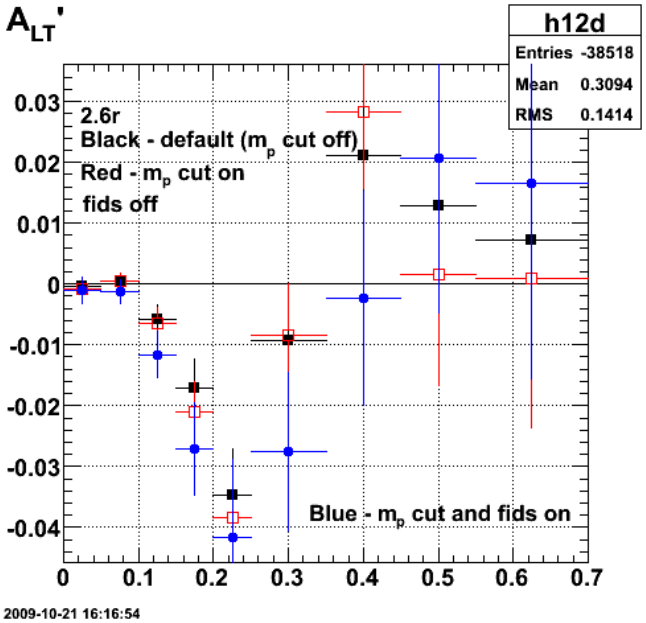


Fig 2. Add in a comparison with m_p cut on and fids on. It has a drastic effect on the uncertainties which grow by about a factor of 2.

Click here to view the object (ROOT macro) you uploaded.

Now start working through the 2.6r cuts. Next plot is a the same as Fig 2., but I notice the fids on results are a little different?? Not enough to worry about now. Wait, the cuts were not consistent for the different histograms. Rerun and replot for Figs after Fig 4.

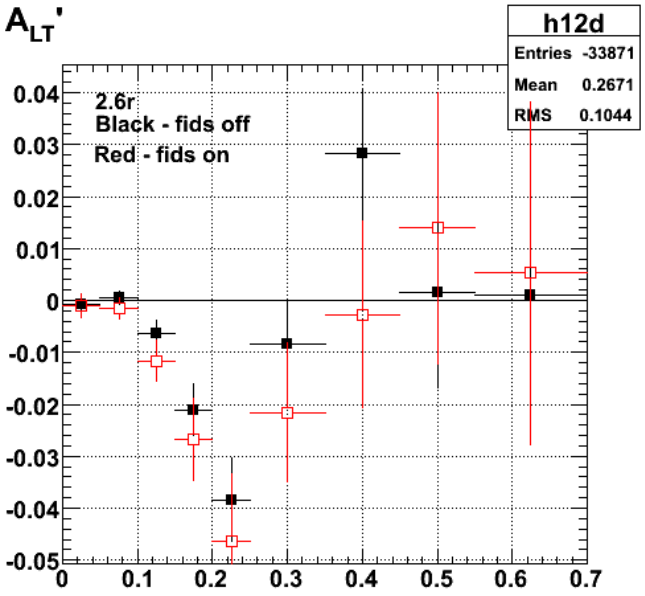


Fig 3. Comparison of fids on (red) and off (black) with mp cut turned on.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

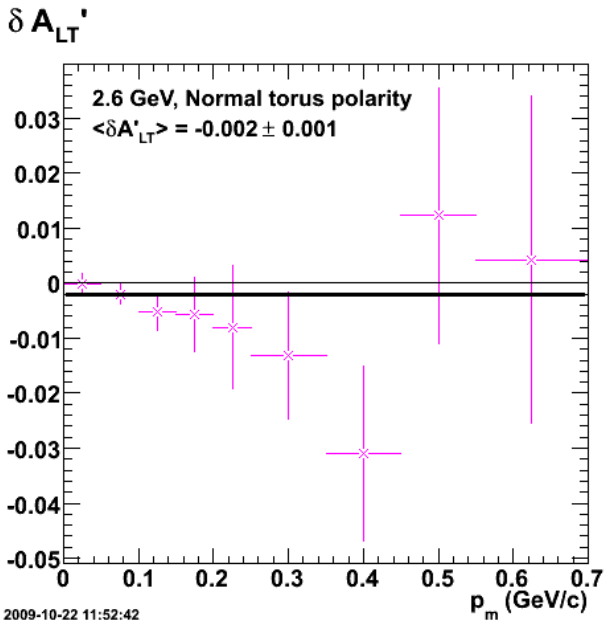


Fig 5. Difference between ALTp with fids on and off.

Click here to view the object (ROOT macro) you uploaded.

Now with proper cuts and mp cut on.

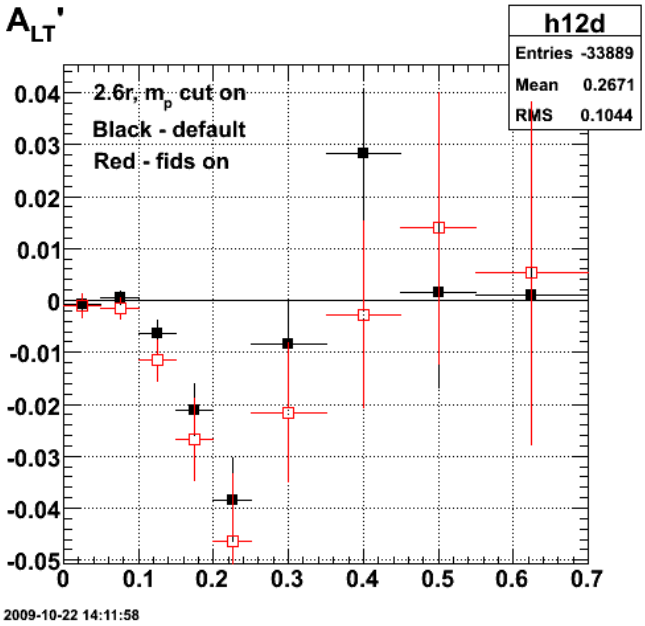


Fig 6. Comparison of fids off (black) and fids on (red) for 2.6r with Mp cut on.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

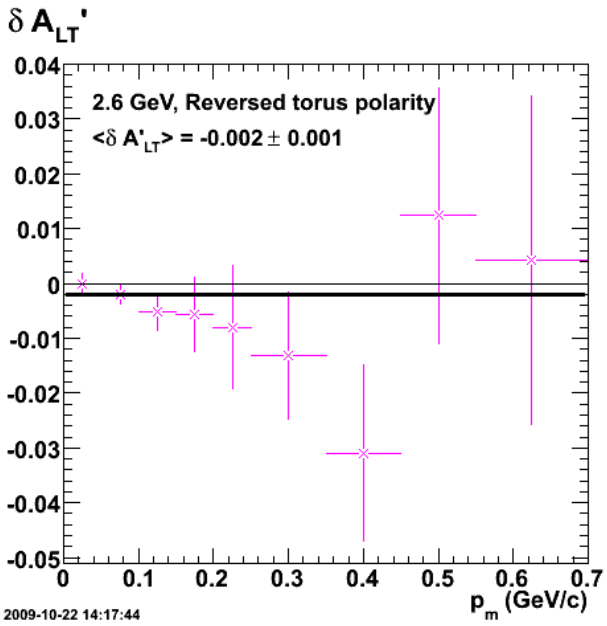


Fig 7. Difference between ALTp with fids on and off for 2.6r and Mp cut on.

Click here to view the object (ROOT macro) you uploaded.

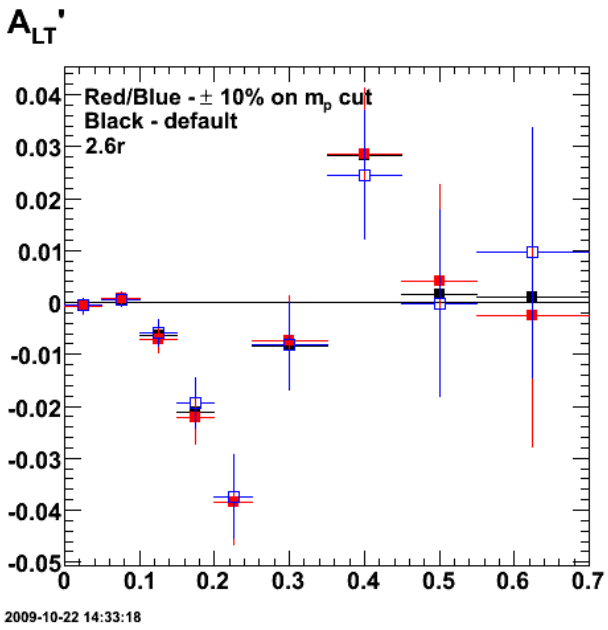


Fig 8. Effect of +/- 10% change in Mp cut on 2.6r.

Click here to view the object (ROOT macro) you uploaded.

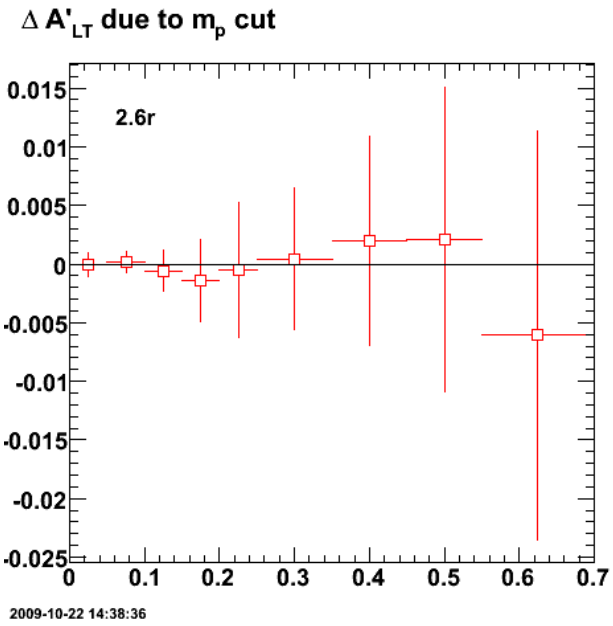


Fig 9. Systematic uncertainty due to Mp cut for 2.6r.

Click here to view the object (ROOT macro) you uploaded.

Numerical results for fig 9.

```
root [213] h12diff->Print("all")
TH1.Print Name  = h12diff, Entries= 701, Total sum= 0.0133163
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-4.92976e-05, x=0.025, error=0.00102191
 fSumw[2]=0.000177528, x=0.075, error=0.000926491
 fSumw[3]=-0.000606453, x=0.125, error=0.00174488
 fSumw[4]=-0.00141439, x=0.175, error=0.00351939
 fSumw[5]=-0.000508308, x=0.225, error=0.00571558
 fSumw[6]=0.000435713, x=0.3, error=0.00600671
 fSumw[7]=0.0019981, x=0.4, error=0.00892931
 fSumw[8]=0.00208852, x=0.5, error=0.013018
 fSumw[9]=-0.00608641, x=0.625, error=0.0174584
 fSumw[10]=0.0118041, x=0.85, error=0.0287079
 fSumw[11]=0.0054772, x=1.25, error=0.0775294
 fSumw[12]=0, x=1.75, error=0.282111
 fSumw[13]=0, x=2.08333, error=0
```

Now do the MM2 scan with the Mp cut on.

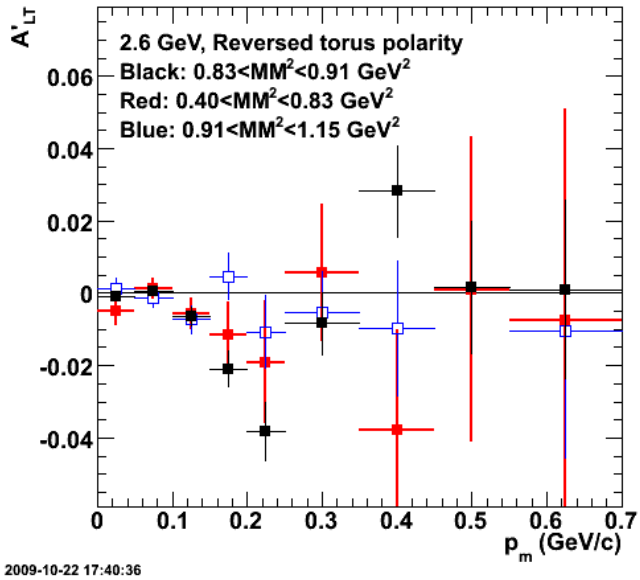


Fig 10. Scan of the MM2 range for 2.6r.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

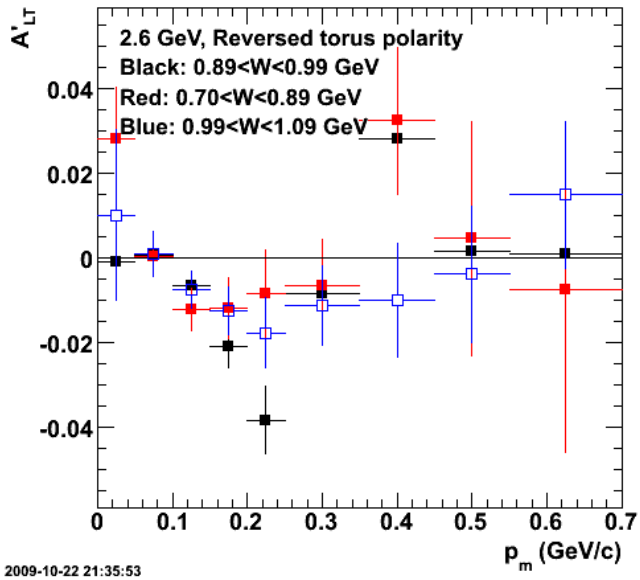


Fig 11. W scan for 2.6r with Mp cut.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

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Jerry Gilfoyle's Enotebook page 280 - Effect of Mp cut on 2.6n (gpg)

[Modified Sun Oct 25 01:49:48 2009 (GMT) gpg]

Add the Mp cut to the mix and see how things change. The dip is deeper.

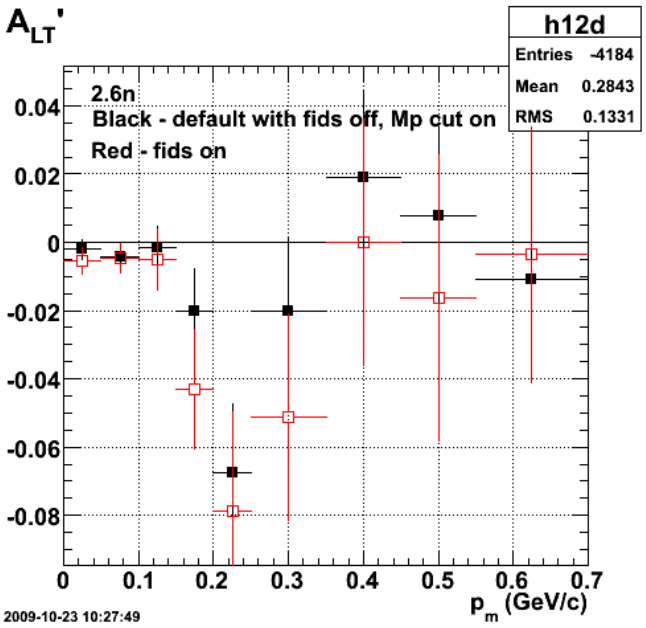


Fig 1. Comparison of ALTp with (red) and without (black) fiducial cuts. Mp cut is on. 2.6n.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

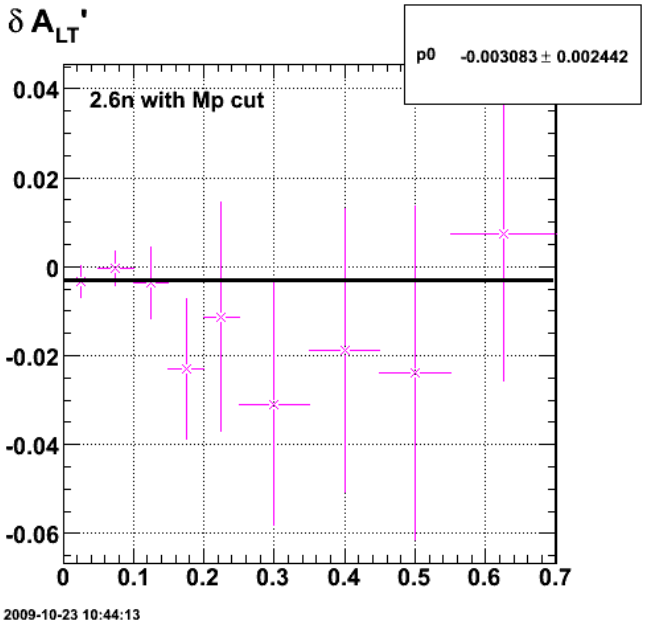


Fig 2. Effect of fiducial cuts on ALTp for 2.6n with Mp cut.

Click here to view the object (ROOT macro) you uploaded.

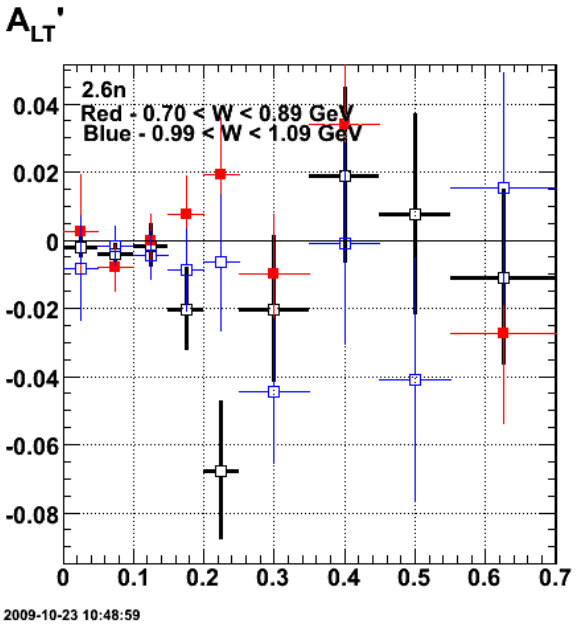


Fig 3. W scan for 2.6n and Mp cut on.

Click here to view the object (ROOT macro) you uploaded.

Damn!!!!!!!!!! I left out the e-p vertex cut of 1.5 cm. Add that in and rerun. It looks like it has almost no effect. See next plot.

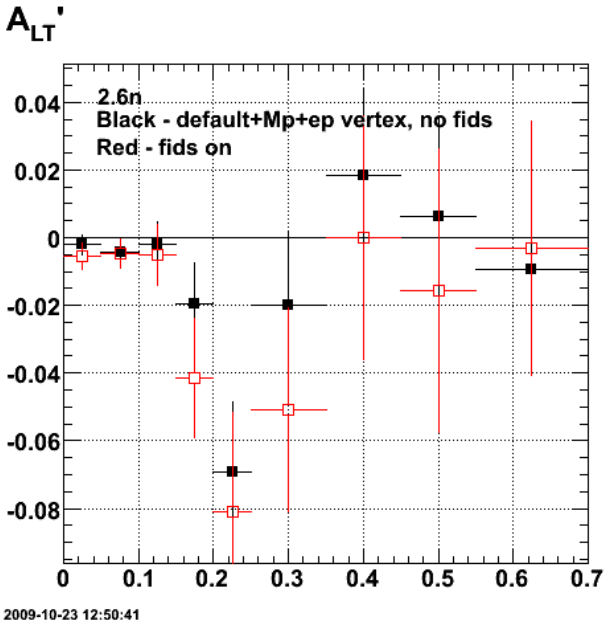


Fig 4. Comparison of ALTp for the 2.6n data with fids off (black) and on (red) with e-p vertix cut added to previous analysis above.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

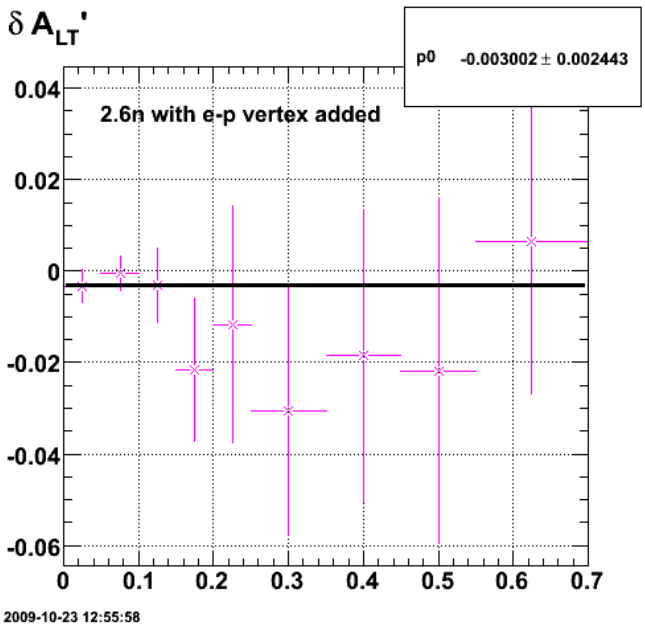


Fig 5. Effect of fiducial cuts on 2.6n ALTp with e-p vertex cut added.

The W scan looks nearly identical.

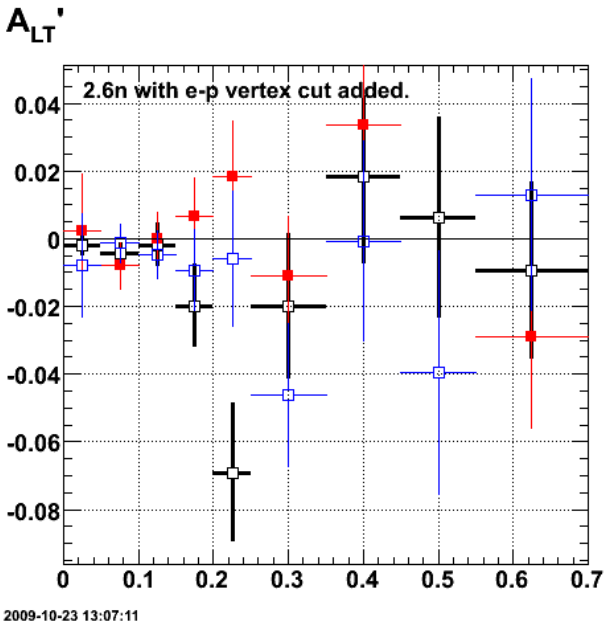


Fig 6. W scan for 2.6n with e-p vertex cut turned on. There is almost no change.

Click here to view the object (ROOT macro) you uploaded.

Next do MM2 scan and get W uncertainty from histogram file.

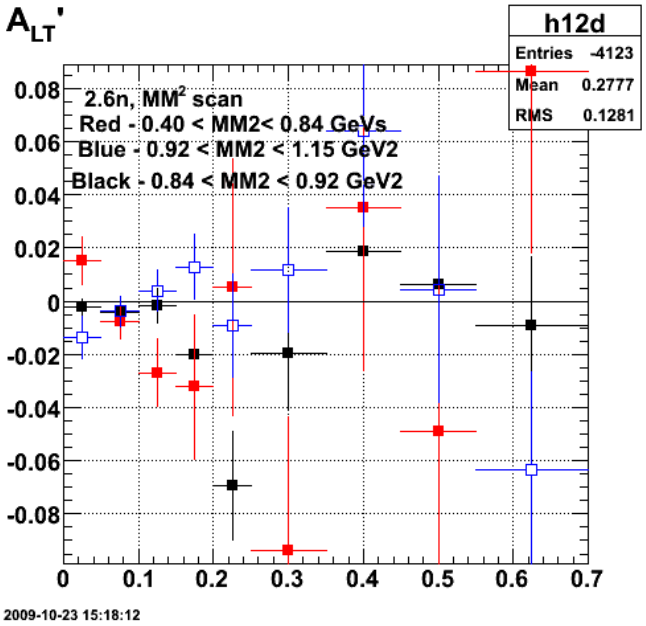


Fig 6. MM2 scan for 2.6n with Mp cut and ep vertex cut.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Uncertainty on W with Mp and e-p vertex cut turned on.

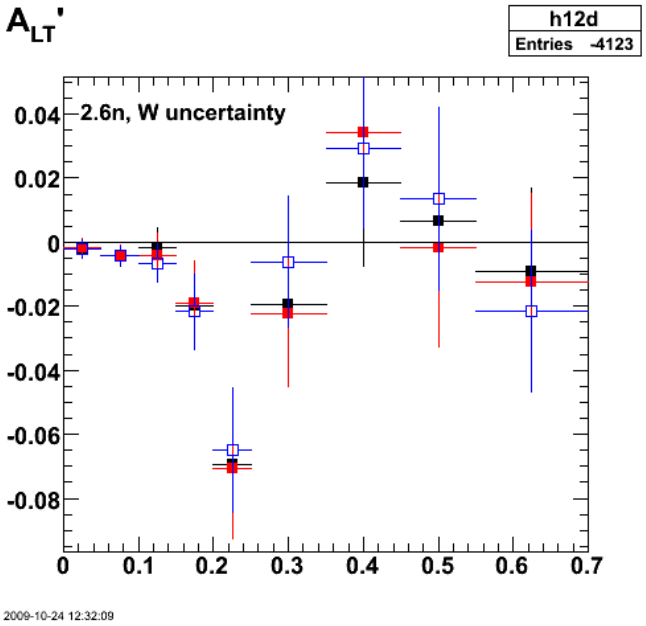


Fig 7. W uncertainty for 2.6n using +/- 10% on the width of the cut..

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

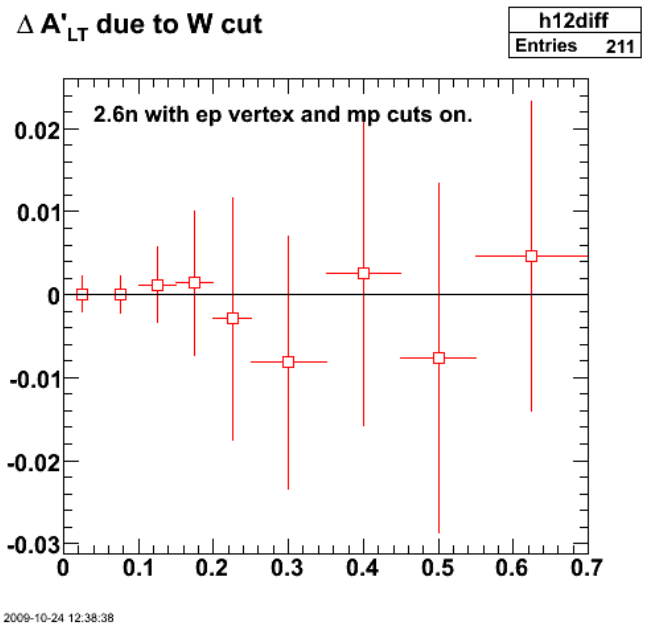
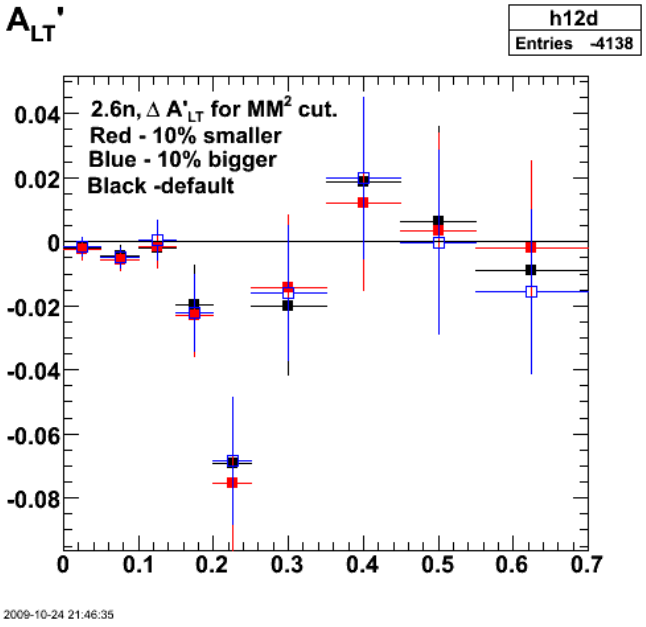


Fig 8. Uncertainty on W for 2.6n data with Mp and ep vertex cuts on.

Click here to view the object (Root macro) you uploaded.

Numerical results.

```
h12diff->Print("all")
TH1.Print Name  = h12diff, Entries= 211, Total sum= -0.0218875
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=9.68543e-05, x=0.025, error=0.00209534
 fSumw[2]=3.13208e-05, x=0.075, error=0.00218994
 fSumw[3]=0.00121285, x=0.125, error=0.00451446
 fSumw[4]=0.00139521, x=0.175, error=0.00872688
 fSumw[5]=-0.00291169, x=0.225, error=0.0145628
 fSumw[6]=-0.00817443, x=0.3, error=0.0152374
 fSumw[7]=0.00261268, x=0.4, error=0.0184309
 fSumw[8]=-0.00757452, x=0.5, error=0.0210507
 fSumw[9]=0.00466693, x=0.625, error=0.0186108
 fSumw[10]=-0.00732556, x=0.85, error=0.0190182
 fSumw[11]=-0.0248223, x=1.25, error=0.0359525
 fSumw[12]=0.0189051, x=1.75, error=0.148385
 fSumw[13]=0, x=2.08333, error=0
root [106]
```



Fiug 9. Comparison of 2.6n ALTp for scan for dALTp for MM2 cut.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

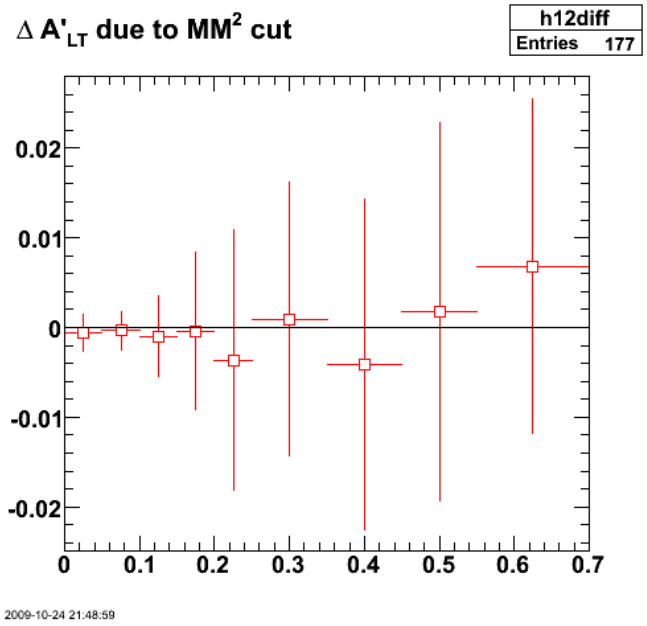


Fig 10. Systematic uncertainty at 2.6n for MM2 cut on ALtp.

Click here to view the object (Root macro) you uploaded.

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Jerry Gilfoyle's Enotebook page 281 - MM2 accuracy for 2.6n (gpg)

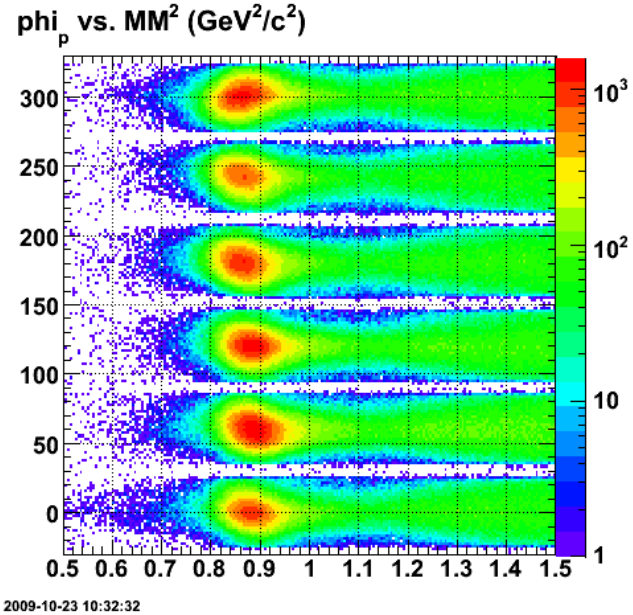
[Modified Mon Oct 26 02:17:49 2009 (GMT) gpg]

Check the accuracy of MM2 for the 2.6n data. The cuts on it are the following.

```
if (ep_event &&
    target_walls_ep &&
    //1 good_e_p_vertex &&
    good_electron_fiducial &&
    good_proton_fiducial &&
    //quasielastic_cut &&
    good_egiyan_threshold &&
    good_EC_pion_threshold &&
    good_electron_EC_fiducial &&
    good_electron_EC_trk_coords_fiducial &&
    good_mass_p &&
    good_EC_etot &&
    //good_sampling_fraction &&
    good_photoelectrons) {

  hW1b->Fill(W1);

  if (phi_p_deg < -30) {
      hphiMM2->Fill(mm2,phi_p_deg+360);
  } else {
      hphiMM2->Fill(mm2,phi_p_deg);
  }
```



2009-10-23 10:32:32

Fig 1. phi_p versus MM2 for 2.6n for e-p events.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Break down the MM2 neutron peak sector-by-sector. We are using the Pitt method momentum corrections.

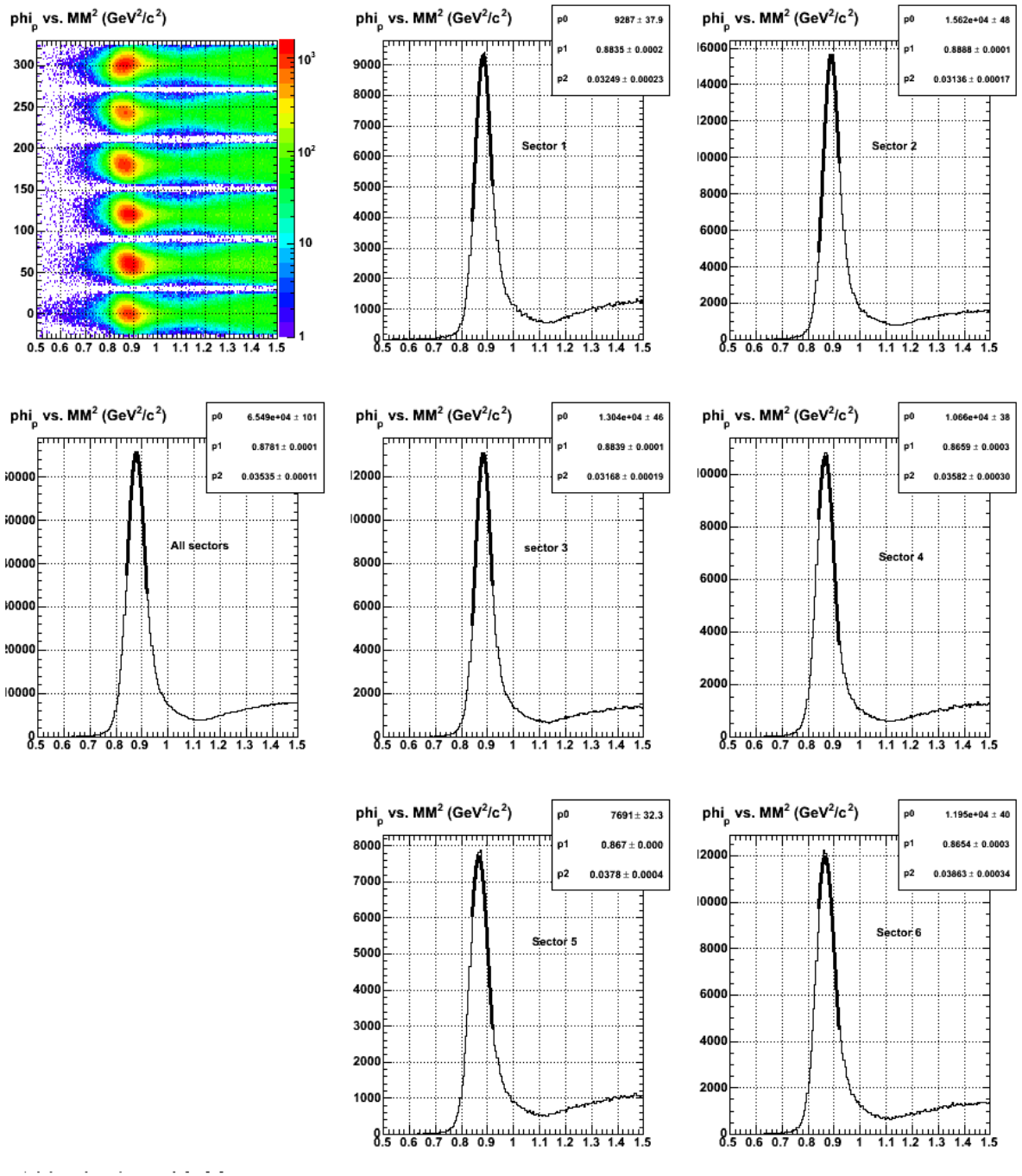


Fig 2. Get fits to the neutron, MM2 peak for each sector for 2.6n.

Click here to view the object (ROOT macro) you uploaded.

A table of the results.

Sector	MM2 (GeV2)	dMM2 (GeV2)	% diff	(0.88278 expected)
1	0.884	0.032	-0.14	
2	0.889	0.031	-0.70	
3	0.884	0.032	-0.14	
4	0.866	0.036	1.9	
5	0.867	0.038	1.8	
6	0.865	0.039	2.0	
all	0.878	0.035	0.54	

Now turn off the proton momentum corrections.

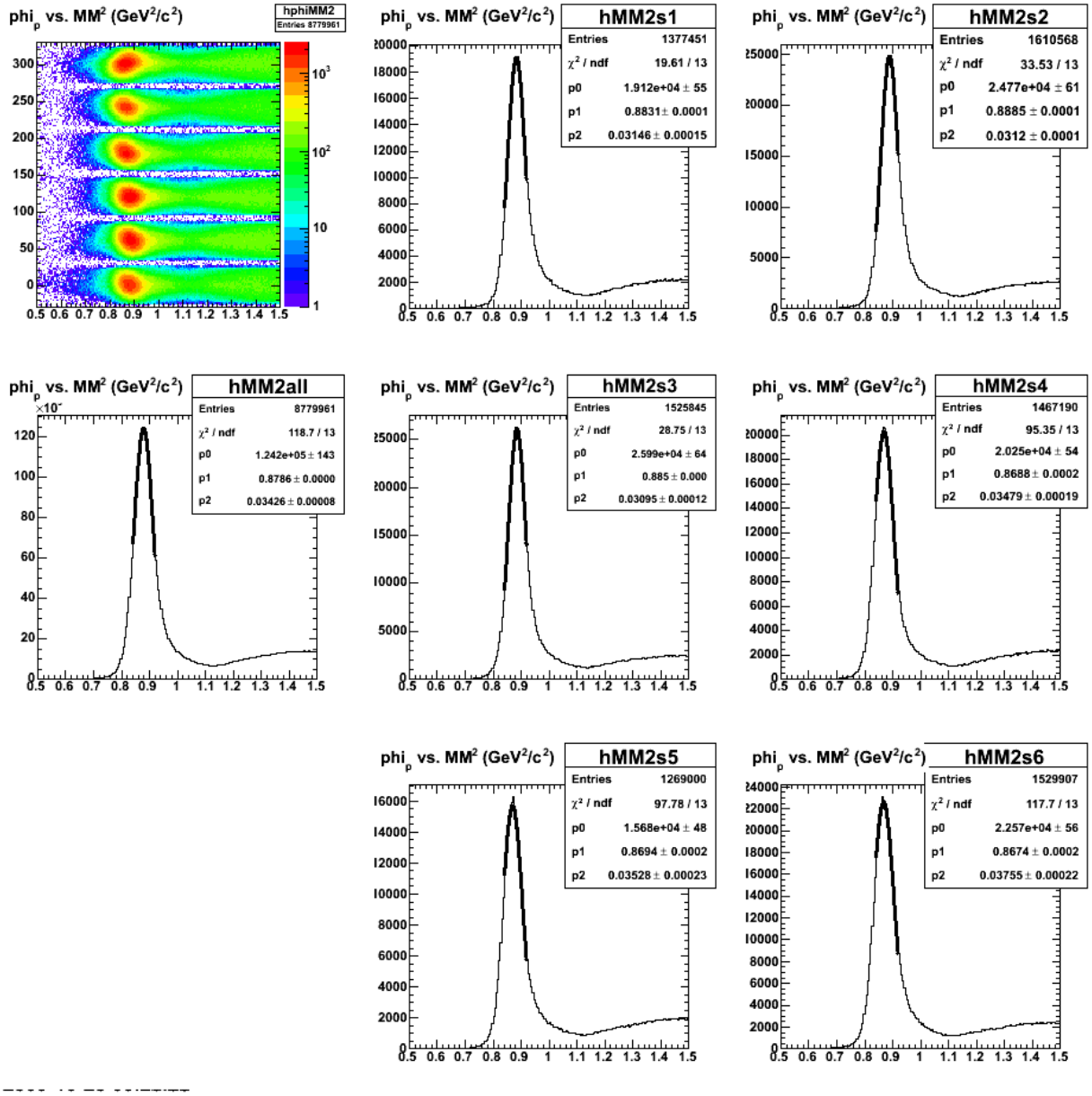


Fig 3. Test of proton momentum corrections with proton momentum corrections turned off for 2.6n.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Put in the shifts to the proton momentum to get the MM2 peak right for 2.6n.

```
// 2.6n MM2 and W(QE) cut parameters.
Double_t neutron_mm2_lo = 0.84, neutron_mm2_hi = 0.92;  // 2.6n default values
Double_t W_QE_lo=0.89, W_QE_hi=0.99;  // 2.6n 09-oct-05
//Double_t pcorrgpg26n[6]={1.0,1.0,1.0,1.0,1.0,1.0};
Double_t pcorrgpg26n[6]={1.0,0.9957,1.0,1.0118,1.0111,1.0124};
```

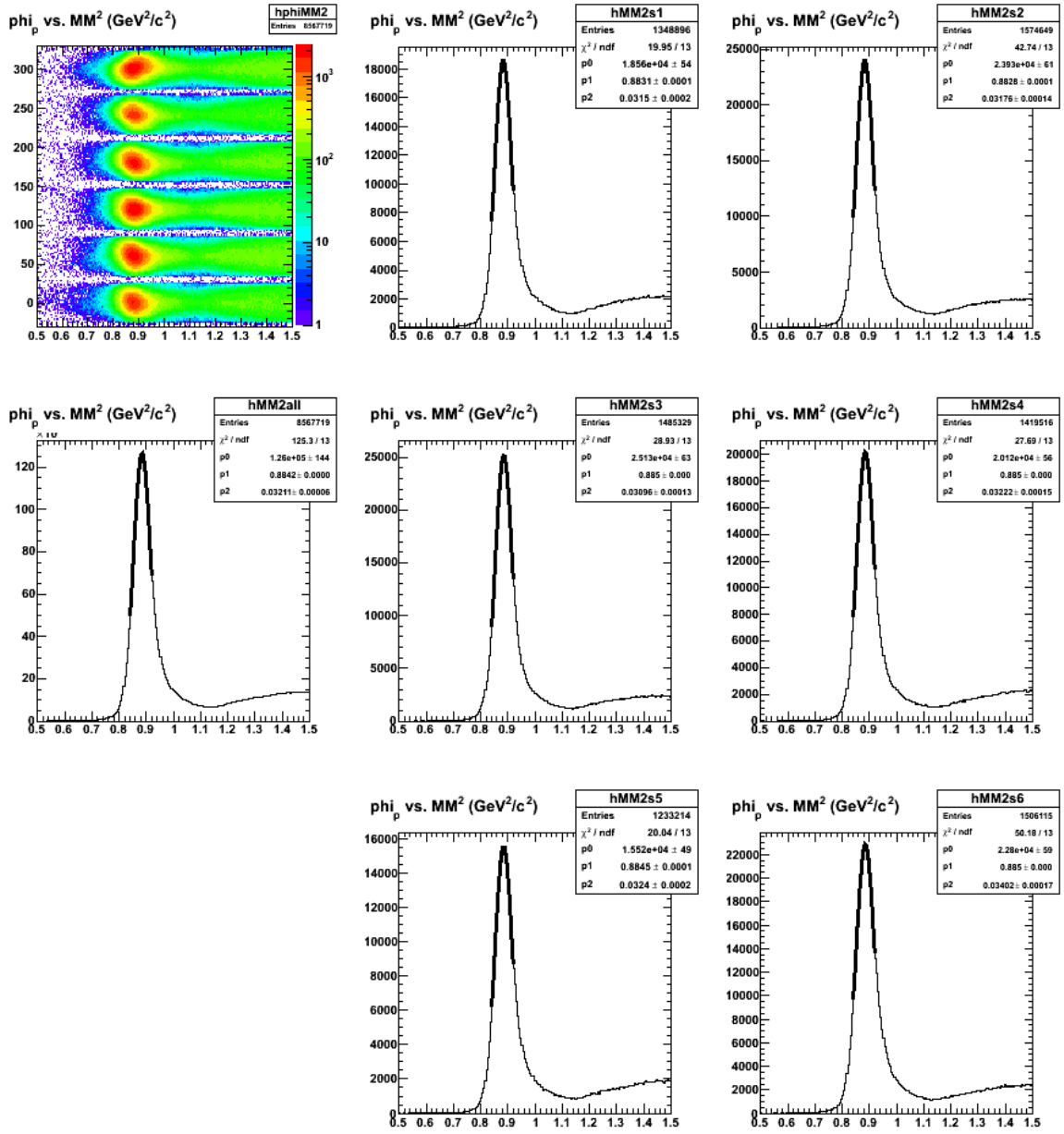


Fig 4. MM2 spectra by sector for 2.6n with shifts in to correct the MM2 peak in each sector. The proton momentum is divided by the numbers above.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Table of results"

(0.88278 expected)

	Before			After		
Sector	MM2 (GeV2)	dMM2 (GeV2)	% diff	MM2 (GeV2)	dMM2 (GeV2)	% diff
1	0.884	0.032	-0.14	0.8831	0.0315	-0.04
2	0.889	0.031	-0.70	0.8828	0.0318	-0.02
3	0.884	0.032	-0.14	0.885	0.0310	-0.30
4	0.866	0.036	1.9	0.885	0.0322	-0.30
5	0.867	0.038	1.8	0.8845	0.0324	-0.19
6	0.865	0.039	2.0	0.885	0.0340	-0.30
all	0.878	0.035	0.54	0.8842	0.032	-0.13

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 282 - Effect of additional 2.6n proton momentum correction (gpg)

[Modified Mon Oct 26 18:32:40 2009 (GMT) gpg]

Add the new scale factor to correct the sector-by-sector proton momentum described in Fig 4 of entry 281. Compare ALTp before and after applying the additional correction to the proton momentum to scale it to match the neutron peak in the MM2 spectrum for 2.6n. The calculations are done with Mathematica notebook in the link below.

Click here to view the object (Mathematica notebook for calculating MM2.) you uploaded.

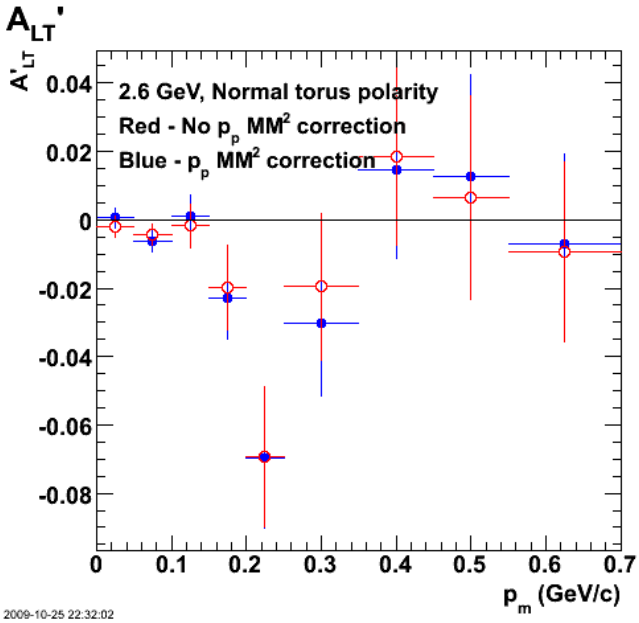
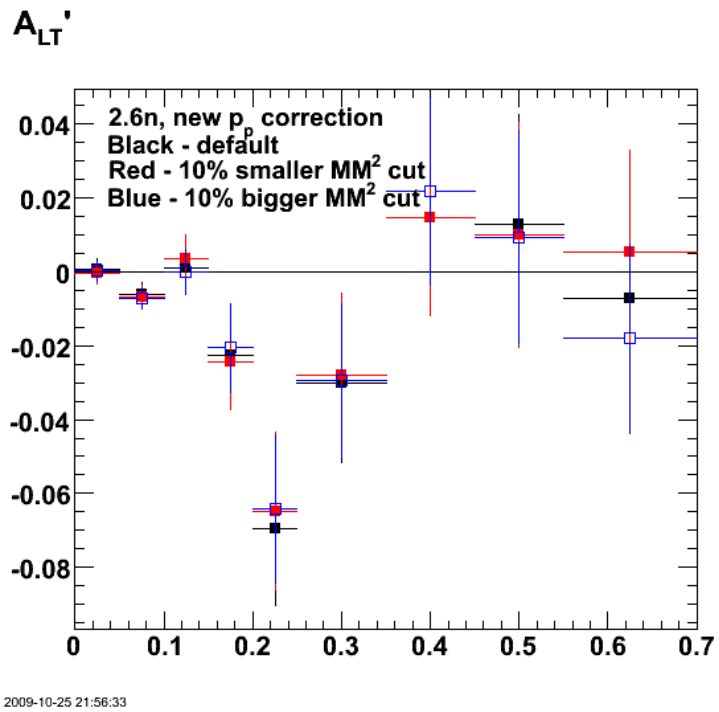


Fig 1. Comparison of ALTp for 2.6n with proton momentum correction on (blue) and off (red).

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

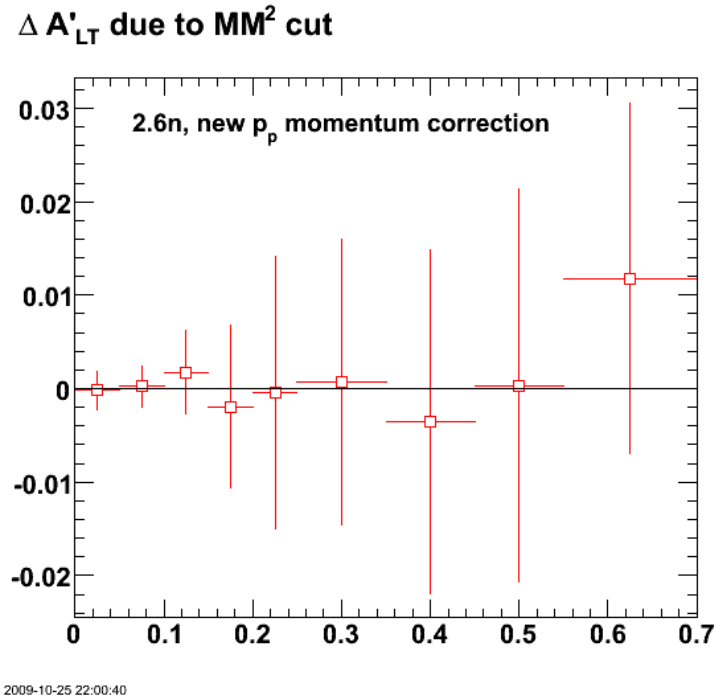
Do the MM2 systematic uncertainty next.



2009-10-25 21:56:33

Fig 2. Comparison of 2.6n ALTp for smaller and bigger MM2 cuts to get systematic uncertainty.,

Click here to view the object (Root macro) you uploaded.



2009-10-25 22:00:40

Fig 3. Systematic uncertainty on ALTp from MM2 cut at 2.6n.

Click here to view the object (Root histogram file) you uploaded.

```
root [4] h12diff->Print("all")
TH1.Print Name  = h12diff, Entries= 343, Total sum= 0.0692128
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.000188566, x=0.025, error=0.00207505
 fSumw[2]=0.000239229, x=0.075, error=0.00217567
 fSumw[3]=0.00175786, x=0.125, error=0.00447915
 fSumw[4]=-0.00191059, x=0.175, error=0.00869502
 fSumw[5]=-0.000362441, x=0.225, error=0.0145753
 fSumw[6]=0.000692334, x=0.3, error=0.0152302
 fSumw[7]=-0.00346878, x=0.4, error=0.0183924
```

```
 fSumw[8]=0.000337807, x=0.5, error=0.0209732
 fSumw[9]=0.0117623, x=0.625, error=0.018749
 fSumw[10]=-0.00301432, x=0.85, error=0.0189576
 fSumw[11]=-0.000585593, x=1.25, error=0.03555
 fSumw[12]=0.0639536, x=1.75, error=0.152182
 fSumw[13]=0, x=2.08333, error=0
root [5]
```

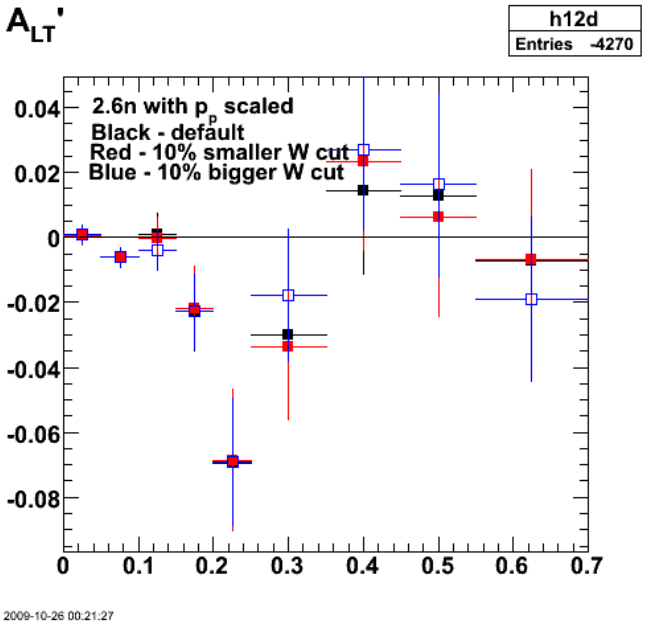


Fig 4. Comparison of ALTp at 2.6n for systematic uncertainty due to W cut.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

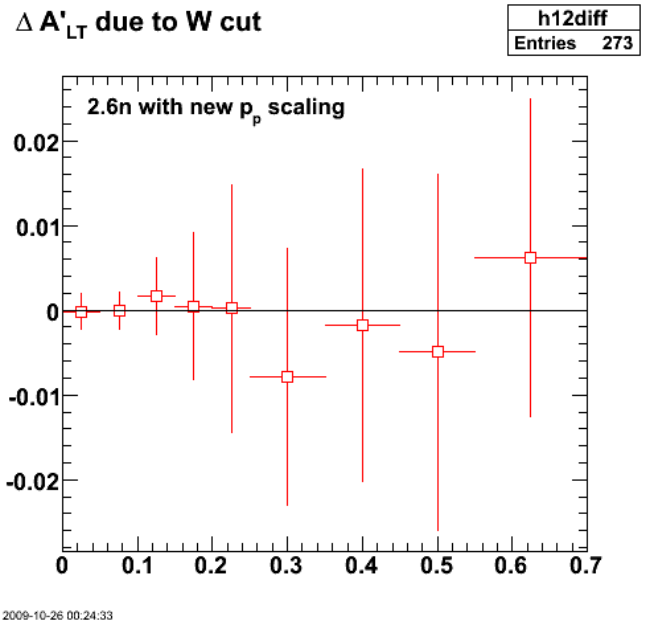


Fig 5. Systematic uncertainty on ALTp for 2.6n due to W cut.

Click here to view the object (Root macro) you uploaded.

Numerical results for systematic uncertainty on 2.6n ALTp due to W cut.

```
TH1.Print Name  = h12diff, Entries= 273, Total sum= -0.0299732
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=-0.000131424, x=0.025, error=0.00207342
 fSumw[2]=-5.29666e-06, x=0.075, error=0.00217793
 fSumw[3]=0.00168758, x=0.125, error=0.00448623
 fSumw[4]=0.000485789, x=0.175, error=0.00869641
 fSumw[5]=0.000199504, x=0.225, error=0.0146004
```

```
fSumw[6]=-0.00782046, x=0.3, error=0.0151707
fSumw[7]=-0.00182568, x=0.4, error=0.0184016
fSumw[8]=-0.00496604, x=0.5, error=0.0209341
fSumw[9]=0.00617078, x=0.625, error=0.0187171
fSumw[10]=-0.0061705, x=0.85, error=0.0190151
fSumw[11]=-0.0207332, x=1.25, error=0.0355719
fSumw[12]=0.00313571, x=1.75, error=0.153686
fSumw[13]=0, x=2.08333, error=0
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 283 - MM2 Accuracy for 2.6r (gpg)

[Modified Tue Oct 27 19:47:02 2009 (GMT) gpg]

Now do the same thing we did on the 2.6n data in entry 281. First get the centroid of the angular distribution for the scattered electron. The Mathematica notebook used to get the correction factors is below.

Click here to view the object (Mathematica notebook for calculating MM2.) you uploaded.

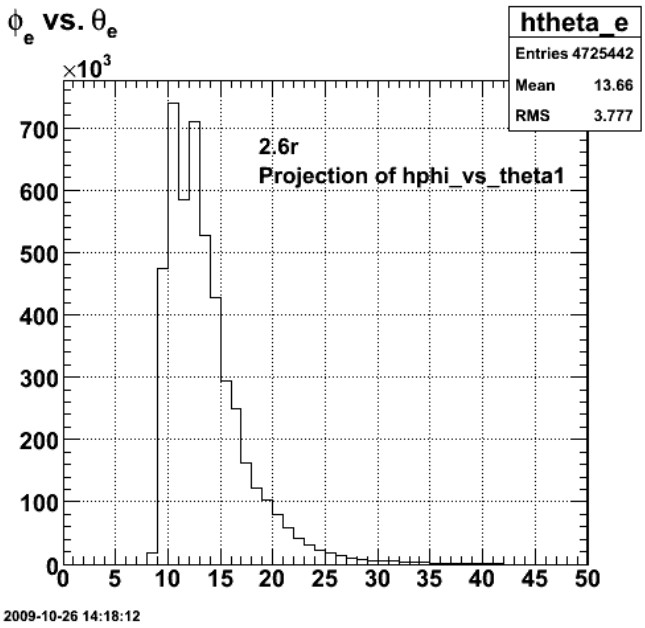


Fig 1. Angular distribution of scattered electron for 2.6r.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

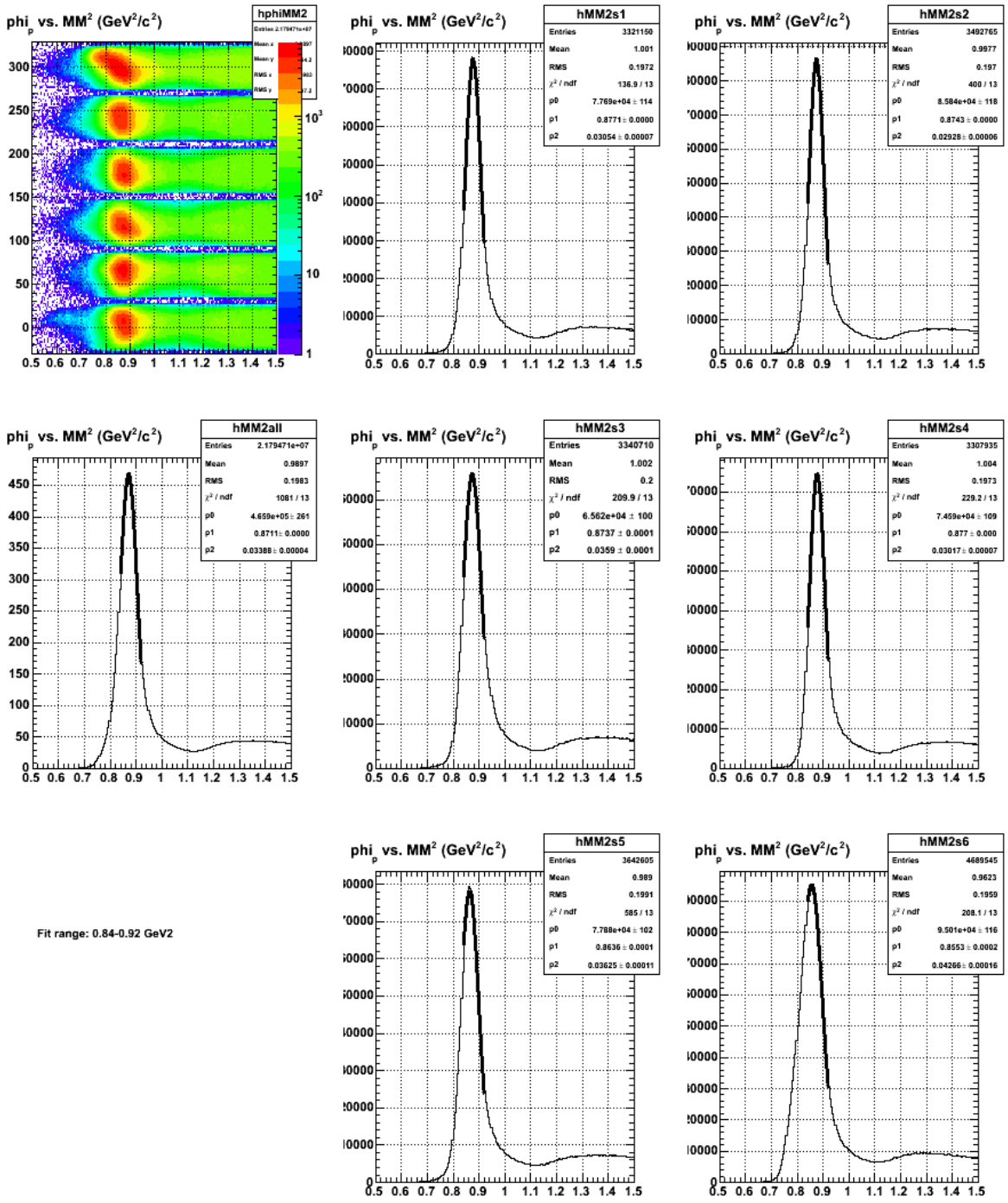


Fig 2. Comparison of 2.6n (note 2.6n) fit range and MM2 cut range for 2.6r results (which uses 8.83-0.92 GeV2 for the MM2 cut). This makes the disagreement with the data and the fit range look worse.

Click here to view the object (ROOT macro) you uploaded.

I applied the shift to the proton momentum to improve the agreement between the peak in the MM2 spectra and the expected neutron value of 0.88278 GeV2. Things look good for sectors 1-5. Sector 6 shows a dramatic (a factor of 4-5) drop in the number of events and the peak is still far from the expected value. A mystery??!!

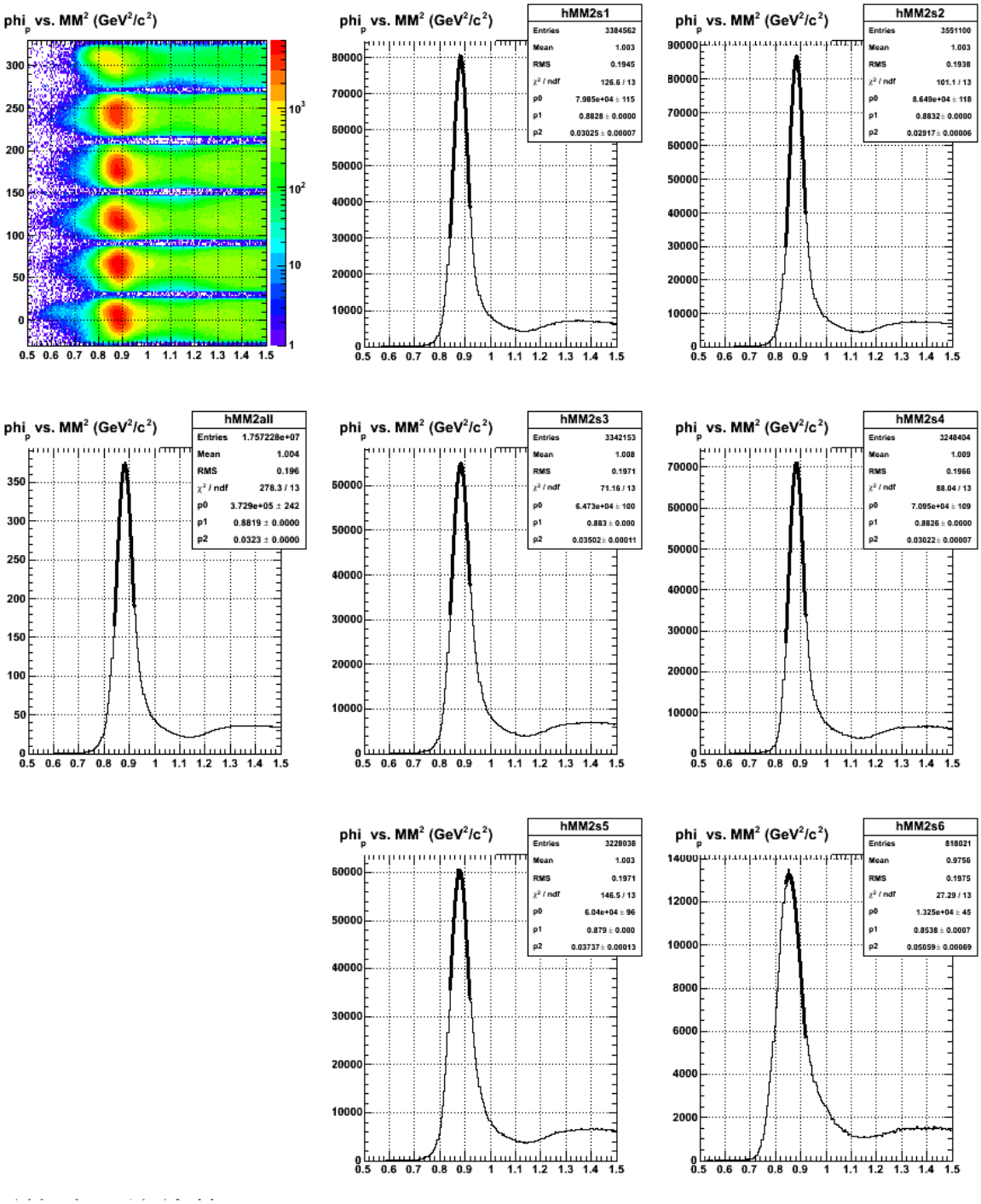


Fig 3. MM2 spectra sector-by-sector with proton momntum shifts in place. Note the weirdness of sector 6.

Click here to view the object (ROOT macro) you uploaded.

The sector 6 problem is due to the mass_p cut. For the first 100000 events in /clas_024381.a00.b00.root I get 105 sector 6 events with the mass_p cut on and 522! with it off!

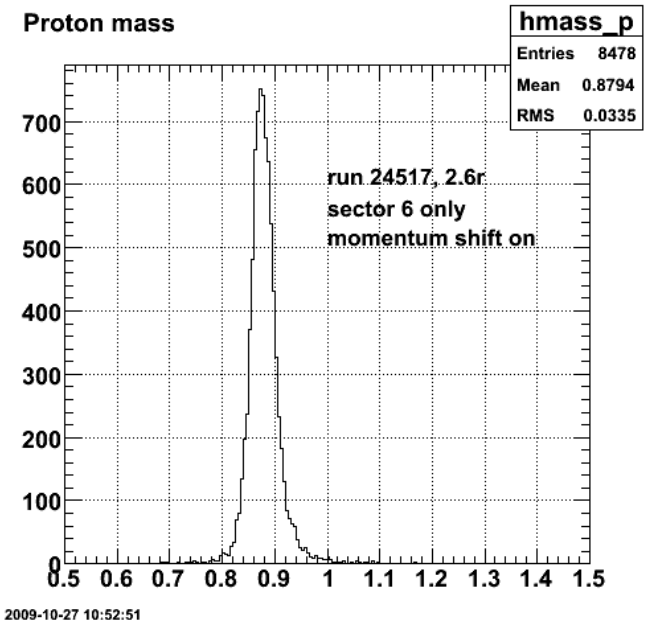


Fig 7a. Proton mass with p_p shift on.

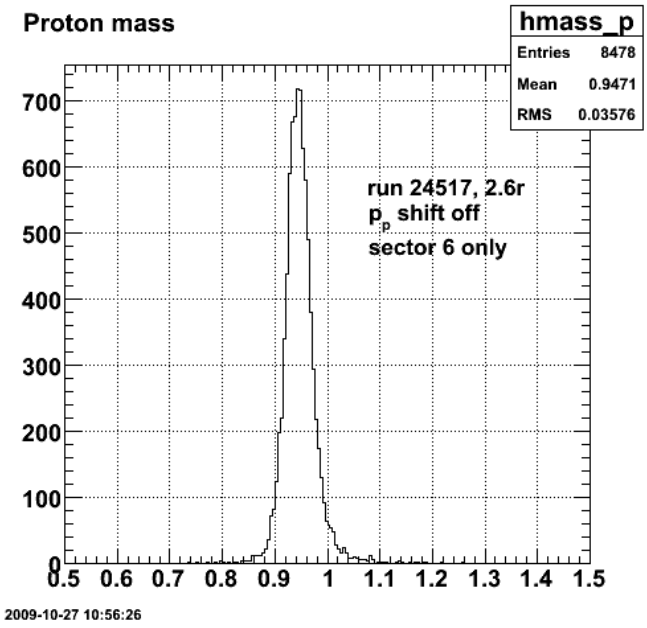


Fig 7b. Proton mass with p_p shift off.

Do not use the shifted proton momentum for the mass_p cut and things look ok. Hmm. The mass of the proton generated from tracking looks ok but is off for the MM2. When I fix the proton momentum so I get the correct MM2, the proton mass is off. Does this mean there is a problem with the proton angle measurement??

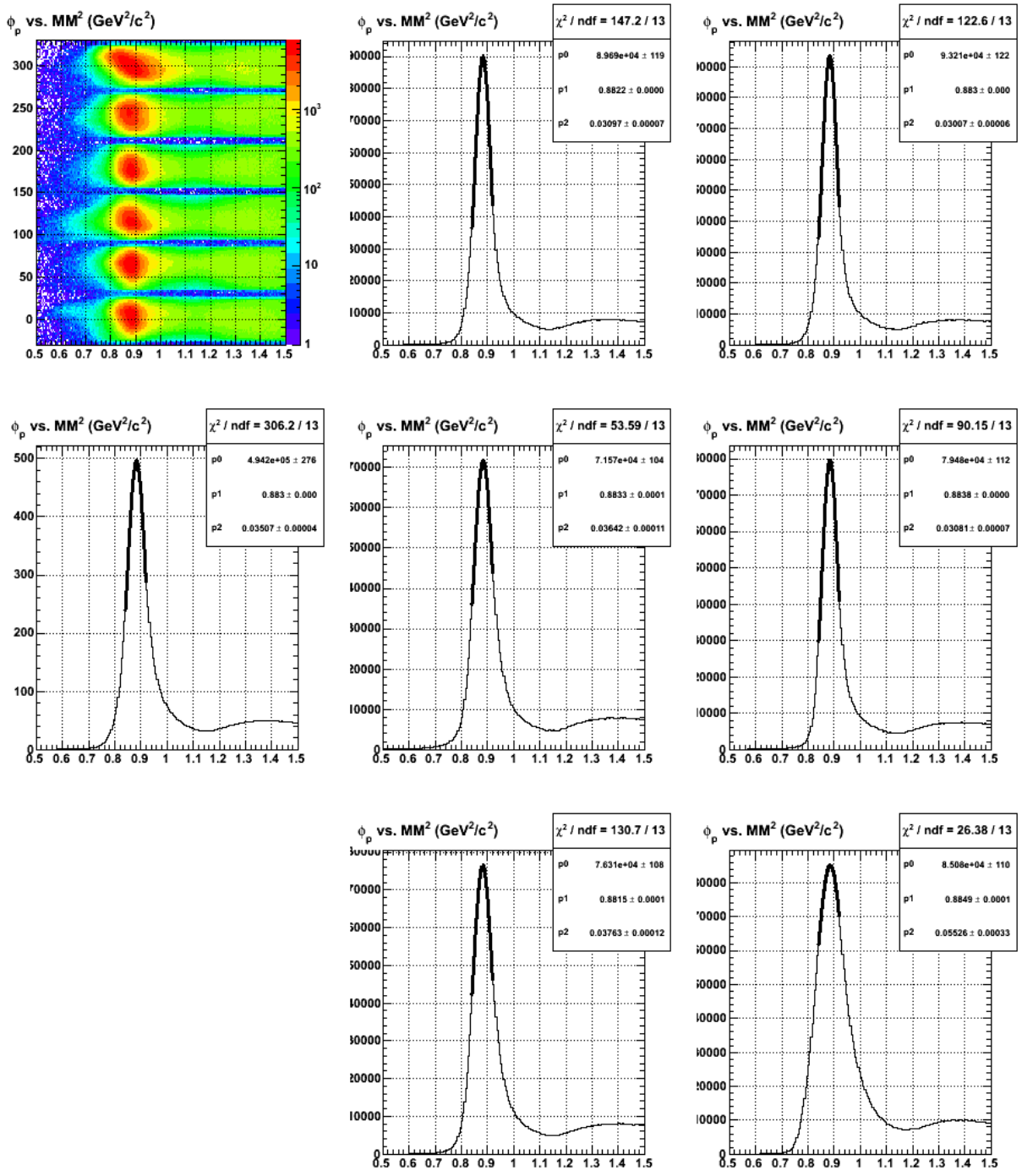


Fig 8. MM2 comparison sector-by-sector after turning off the proton momentum shift for the proton mass cut.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 284 - Effect of proton momentum correction on 2.6r (gpg)

[Modified Wed Nov 4 17:13:53 2009 (GMT) gpg]

After adding the scaling, fudge factor to the proton momentum to make the MM2 come out better we look at our old favorites to see if there are significant changes. The magnitude of ALTp at the dip decreased by about 8%.

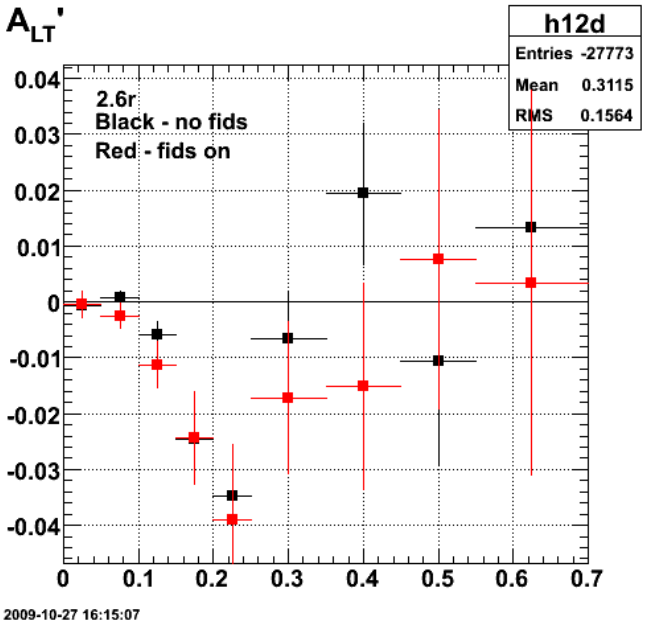


Fig 1. Comparison of 2.6r, ALTp with fids off (black) and on (red) after including the proton momentum shift to correct the MM2.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

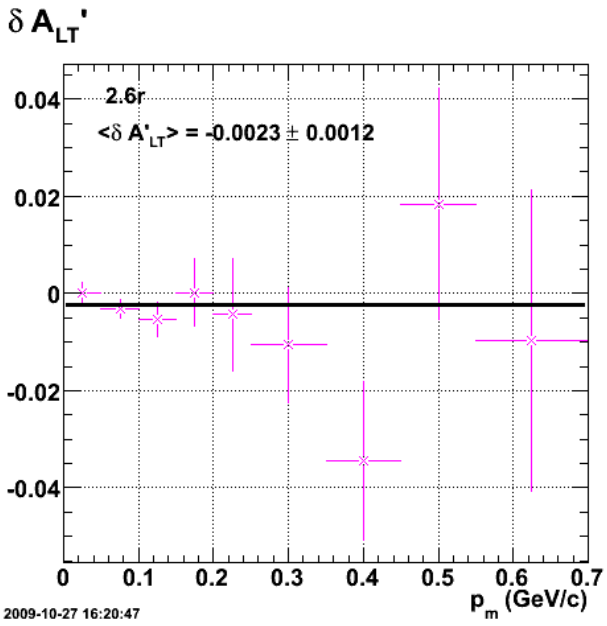
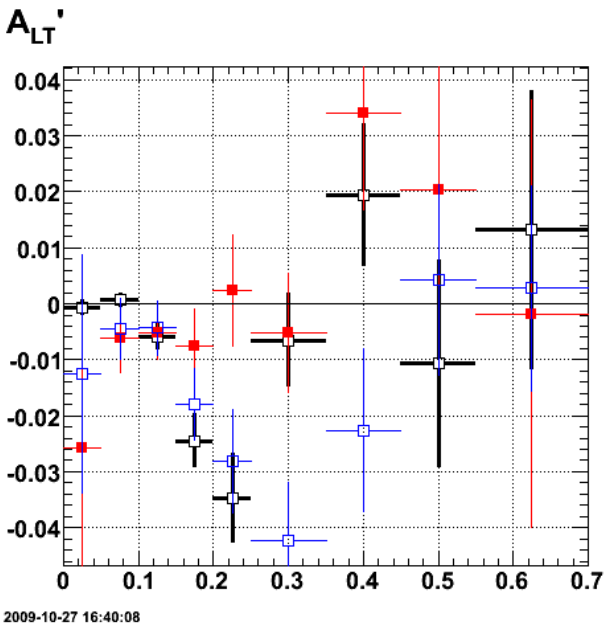


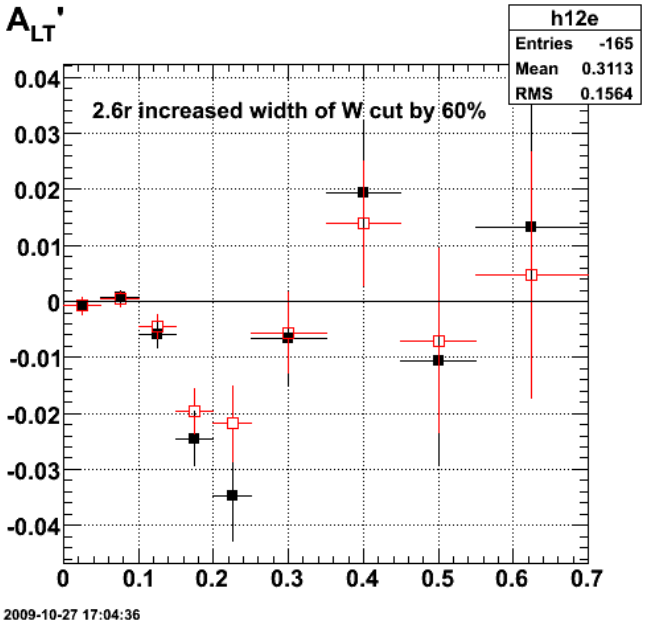
Fig 2. Difference between fids on and off for 2.6 ALTp after putting in proton momentum correction.

Do the W scan next. The low-W scan shows the dip disappearing, but for the hi-W region, the dip in ALTp has increased! This is likely du to the large width of the sector 6 data. Try excluding that from the scan.



2009-10-27 16:40:08

Fig 3. W scan of 2.6r with proton momentum correction in.



2009-10-27 17:04:36

Fig 4. Increase the width of the W cut by 60% to see if we can see the bigger dip seen in Fig 3. It doesn't appear??

Click here to view the object () you uploaded.

When I slide the cut up in W, the big broad dip appears!

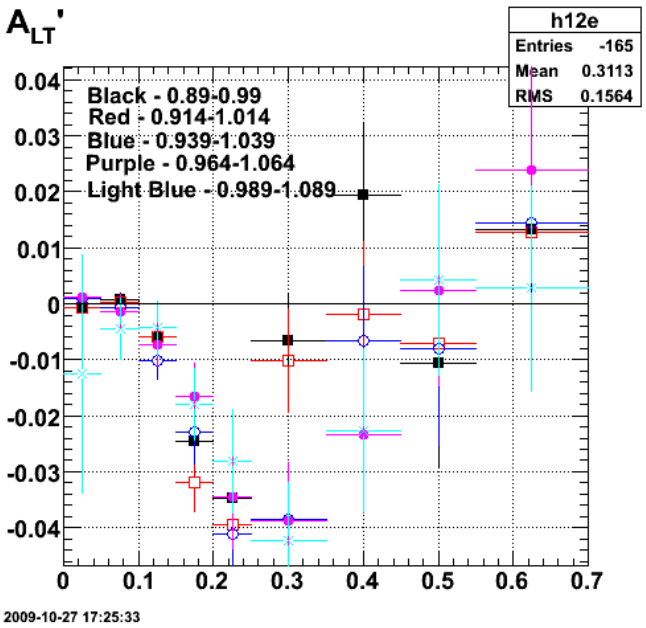


Fig 5. Scan of the W cut to reveal a large, broad dip on the high-W side of the neutron peak!!!

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 285 - test (Jerry Gilfoyle)

[Modified Wed Nov 4 16:14:02 2009 (GMT) Jerry Gilfoyle]

test

test again.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 286 - Recovering Back to the 2.6r Future (gpg)

[Modified Mon Nov 23 14:45:50 2009 (GMT) gpg]

I had a long page dealing with the broad, deep, dip at the high-W side of the 2.6r dip that has magically appeared when I scan at higher W. That page was lost when I hit a quota limit on the DOE2000 elog. The broad, deep dip was not seen before. Actually it was. See entry 88, Fig 11, top panel. I wasn't careful enough. See also entries 57, 117, 118, 119.

Below shows the W spectrum for 2.6r and the new W scan with a wider W cut to define QE events. The script sumbins.C was used to generate Fig 1b from the TH3D histograms of p_m vs. W vs. MM2. I believe, but I'm not absolutely sure the next figure excluded sector 6.

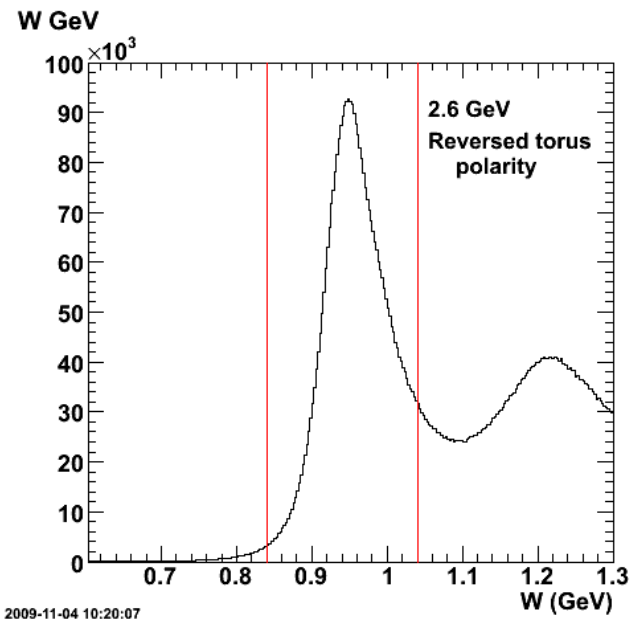


Fig 1a. W spectrum for 2.6r showing new W cut.

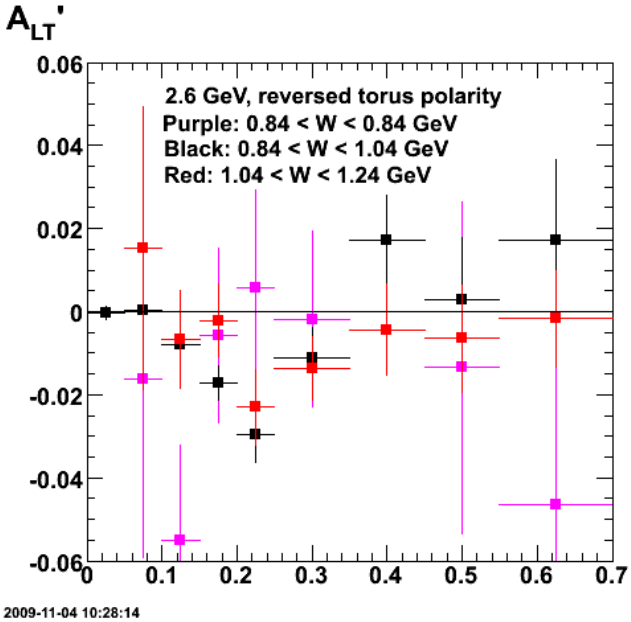


Fig 1b. W scan for 2.6r with new, wider W cut and using the sumbins.C macro to get ALTp from TH3D histograms.

Click here to view the object (Root macro sumbins.C used to make Fig 1b from TH3D histograms.) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

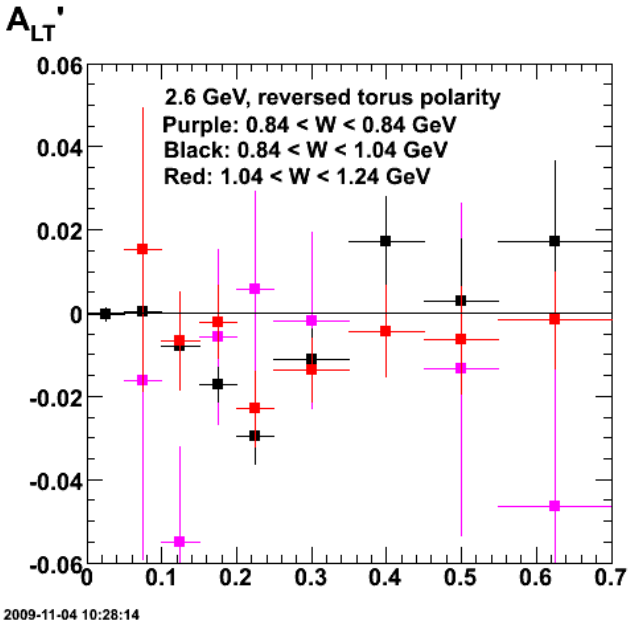


Fig 2. Earlier version of Fig 1b: W scan for 2.6r with new, wider W cut and using the sumbins.C macro to get ALTp from TH3D histograms.

Click here to view the object (ROOT macro) you uploaded.

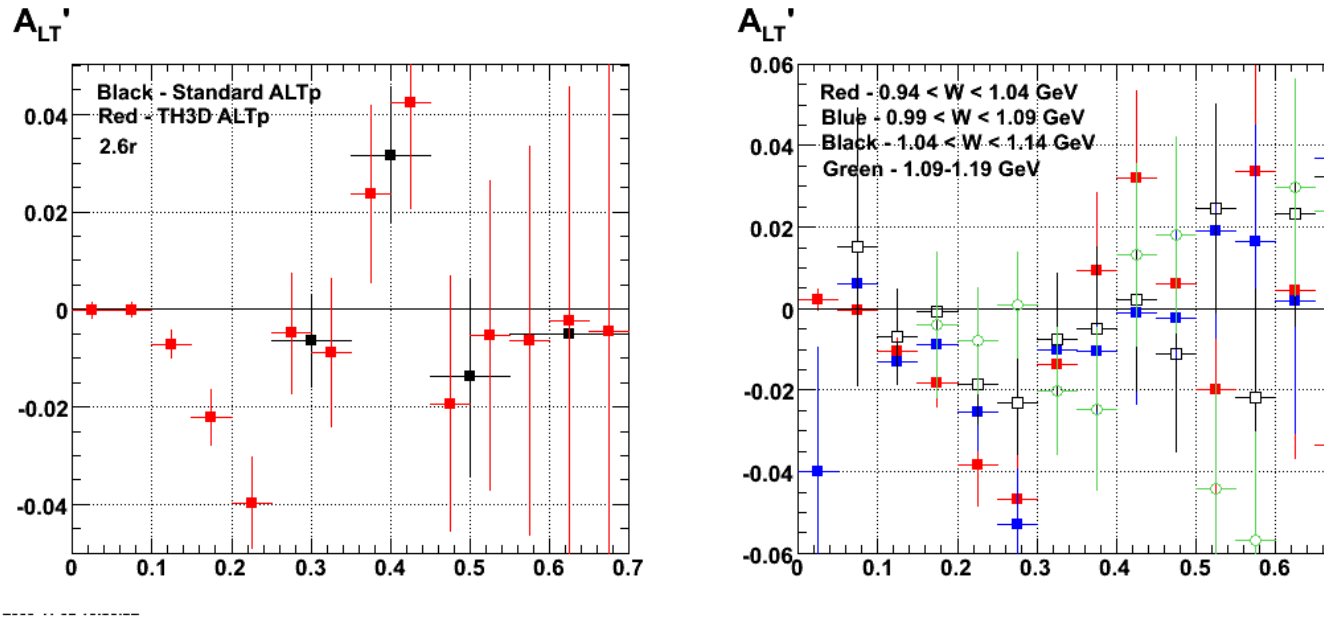


Fig 3. Comparison of ALTp for different W cut ranges.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

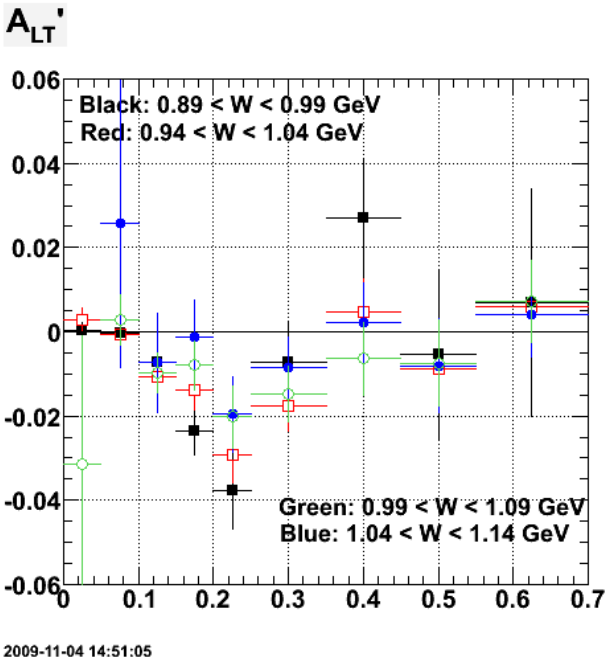


Fig 4. More comparisons of ALTp.

Click here to view the object (ROOT macro) you uploaded.

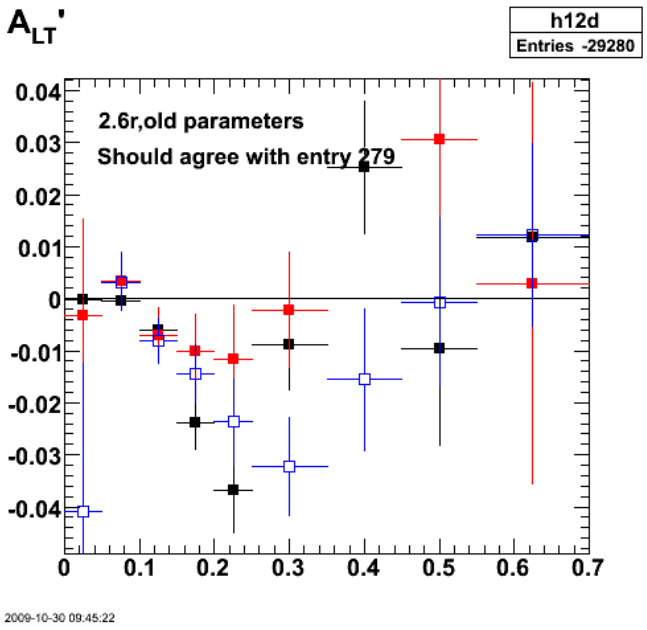


Fig 5. Latest version of 2.6r ALTp.

Click here to view the object (ROOT macro) you uploaded.

The stuff below this line EXCLUDED sector 6. Sector 6 has a much broader MM2 distribution than the other sectors of CLAS.

My latest thought is to keep the W range narrow (0.89-0.99 GeV) and show ALTp clearly in the dip region (W=1.04-1.14 GeV) and in the low-W region. See next plot which I know for sure excludes sector 6.

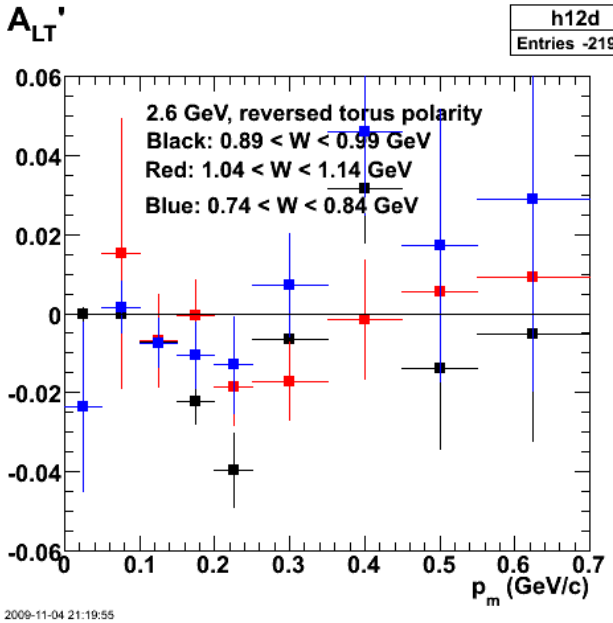


Fig 6a. W scan for 2.6r. The high-W scan is centered on the dip (no sector 6).

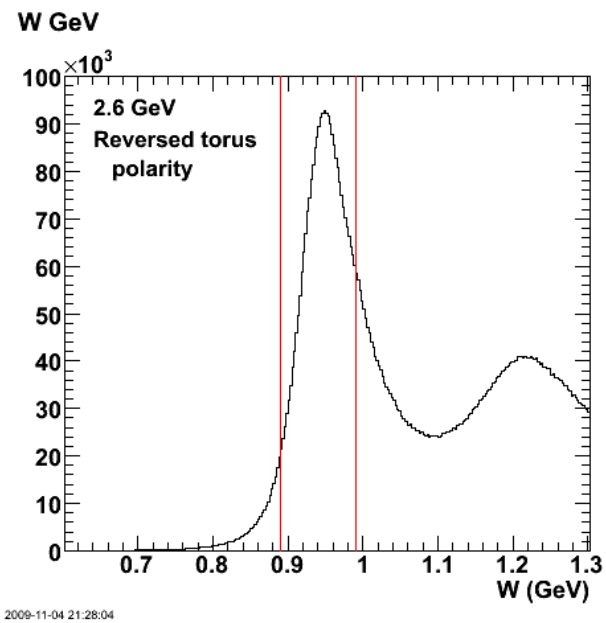


Fig 6b. W distribution for 2.6r with W cut marked in red (no sector 6).

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

The plot below compares ALTp vs. p_m for 2.6r and different W ranges. The black squares are the default ALTp with 0.89 < W < 0.99 GeV. Moving just outside this region (red, open squares) there is a new dip at p_m=0.3 GeV/c for 0.99 < W < 1.04 GeV. Notice also the lowest p_m bin. There are very few counts in this bin (huge uncertainty) which is indicative of inelastic processes. I have seen this in the past when I looked at ALTp in the dip region. This points to the possibility that the origin of the new dip is an inelastic process and not associated with the quasielastic peak. Continuing higher in W, the next region (blue, open circles and 1.04 < W < 1.09 GeV) shows the same behavior; large dip at p_m = 0.3 GeV/c and no counts near p_m = 0 GeV/c. There is a big change in the next region (green, solid squares and 1.09 < W < 1.14 GeV). The large dip disappears! Perhaps this is evidence of an interference between a large, quasielastic amplitude and a small, inelastic one. The large QE amplitude amplifies the small inelastic region where the QE amplitude is large and the effect disappears as we

move out of the QE region.

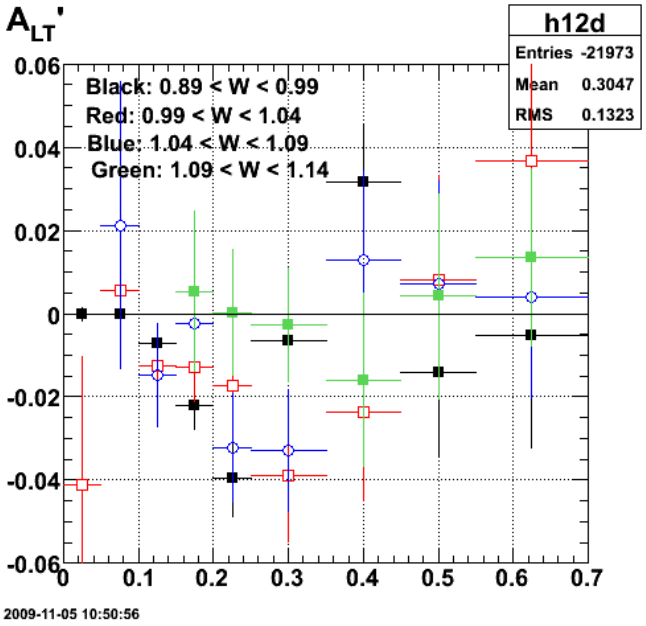


Fig 7. Comparison of 2.6r ALTp for different W ranges showing the rapid change approaching the dip region.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT macro sumbins.c used to generate variable bin ALTp from TH3D histograms.) you uploaded.

The last plot shows what happens for 1.14 < W < 1.19 GeV. Basically there are no counts and ALTp is consistent with zero over the full p_m range.

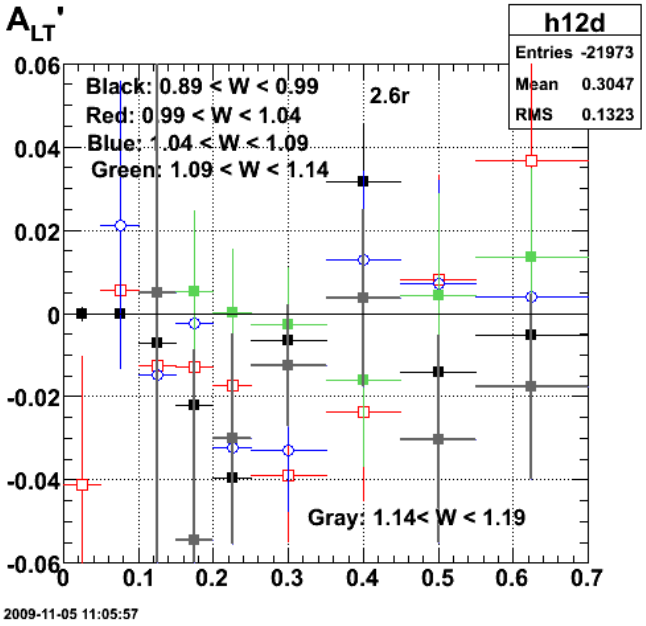


Fig 8. Check one more high-W region of 2.6r ALTp.

Click here to view the object (ROOT macro) you uploaded.

The stuff below this line INCLUDES sector 6.

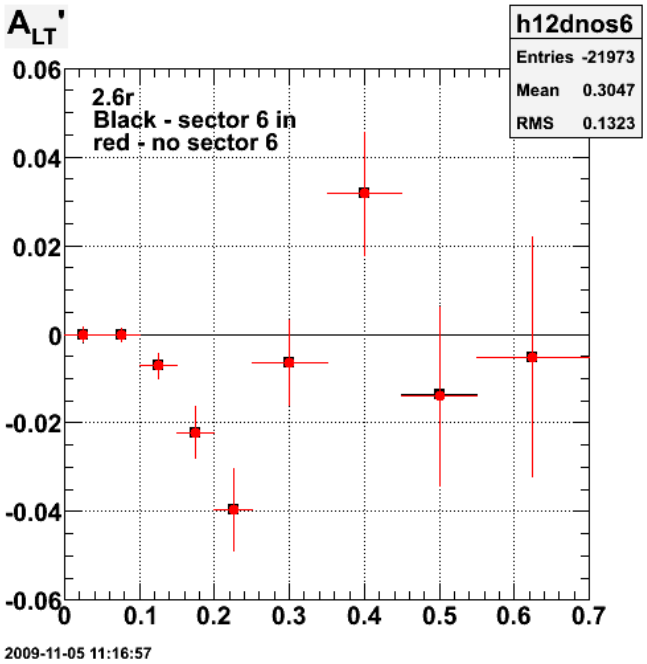


Fig 9. Comparison of 2.6r ALTp with (black) and without (red) sector 6.

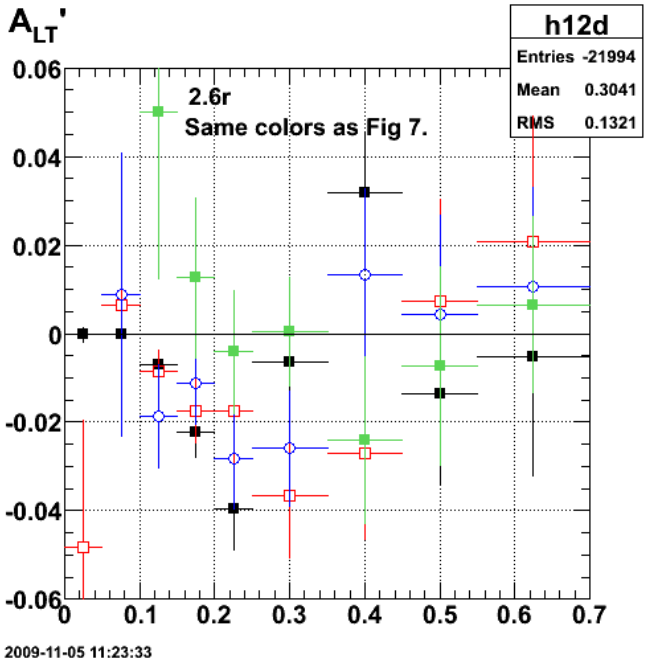
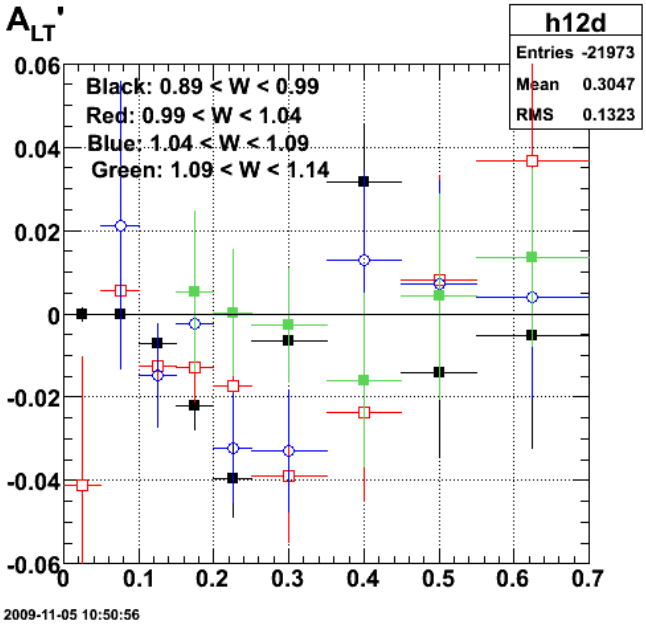


Fig 10. Comparison of ALTp for different W ranges. Get color scheme from Fig 7. Same results as with sector 6 out.



F10b. Copy of fig 7 for comaprison with the left-hand panel.

Click here to view the object (Root macro sumbins.C used to make Fig 1b from TH3D histograms.) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Parameters:

```
// 2.6r MM2 and W(QE) cut parameters.
Double_t neutron_mm2_lo = 0.83, neutron_mm2_hi = 0.91;  // 2.6r default values without proton momentum shift.
//Double_t neutron_mm2_lo = 0.84, neutron_mm2_hi = 0.92;  // 2.6r default values after proton momentum shift.
Double_t W_QE_lo=0.89, W_QE_hi=0.99;  // 2.6r 09-oct-07 - 10:48
//Double_t pcorrgpg26r[6]={1.0089, 1.01346,1.01429,1.00903,1.03003,1.077};
Double_t pcorrgpg26r[6]={1.0,1.0,1.0,1.0,1.0,1.0};

// 2.6n MM2 and W(QE) cut parameters.
//Double_t neutron_mm2_lo = 0.84, neutron_mm2_hi = 0.92;  // 2.6n default values
//Double_t W_QE_lo=0.89, W_QE_hi=0.99;  // 2.6n 09-oct-05
//Double_t pcorrgpg26n[6]={1.0,1.0,1.0,1.0,1.0,1.0};
```

```
Double_t pcorrgpg26n[6]={1.0,0.9957,1.0,1.0118,1.0111,1.0124};

// MM2 and W(QE) scan values.
Double_t neutron_mm2_lo2 = 0.844, neutron_mm2_hi2 = 0.916;  // test MM2 systematic uncertainty. */
Double_t neutron_mm2_lo3 = 0.836, neutron_mm2_hi3 = 0.924;  // test MM2 systematic uncertainty. */
/* Double_t neutron_mm2_lo2 = 0.40, neutron_mm2_hi2 = 0.84;  // MM2 scan */
/* Double_t neutron_mm2_lo3 = 0.92, neutron_mm2_hi3 = 1.15;  // MM2 scan */

/* Double_t W_QE_lo2=0.895, W_QE_hi2=0.985;  // W uncertainty */
/* Double_t W_QE_lo3=0.885, W_QE_hi3=0.995;  // W uncertainty */
Double_t W_QE_lo2=0.70, W_QE_hi2=0.89;  // W scan
Double_t W_QE_lo3=0.99, W_QE_hi3=1.09;  // W scan
```

The plot below shows the 2.6n results from June, 2005 presented at the working group meeting.

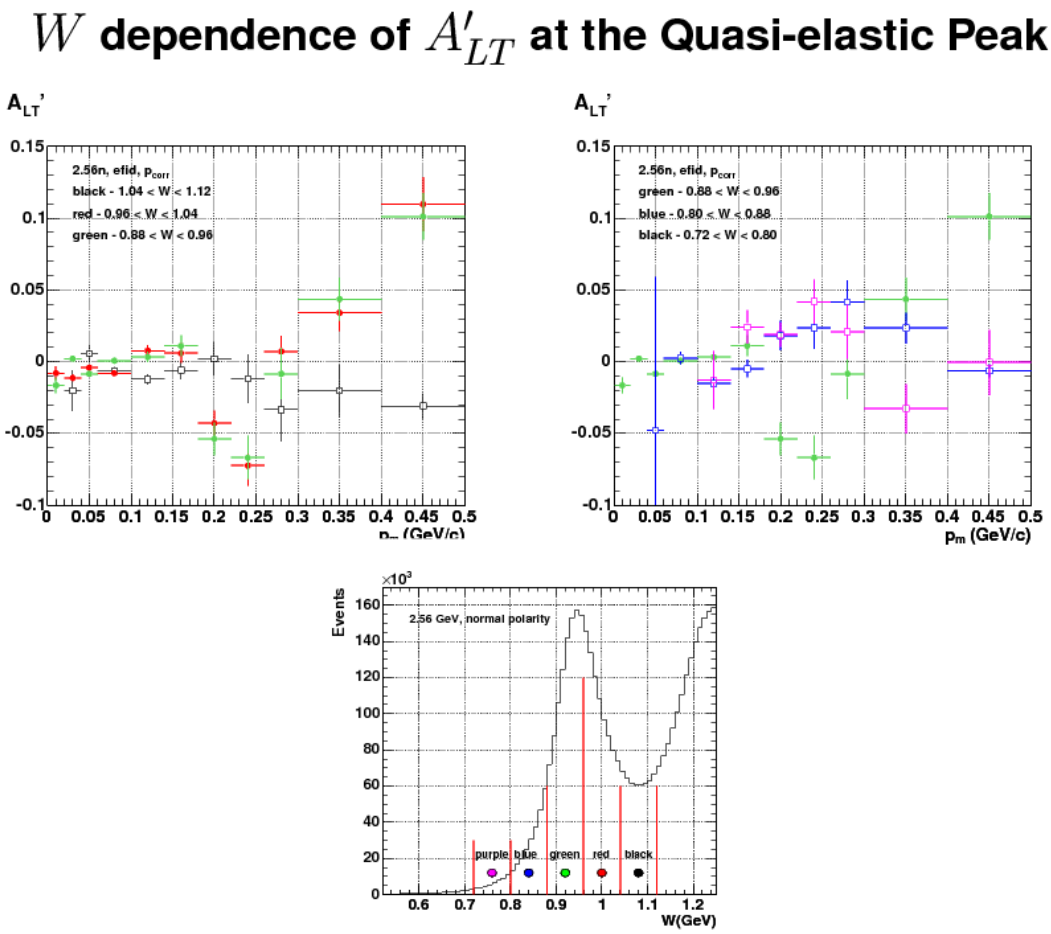


Fig 11. Copy of plot from June, 2005 talk at the working group meeting. See research page.

Notebook page 287 has been deleted.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 288 - Effect of fiducial cuts on 2.6r W spectrum (gpg)

[Modified Mon Nov 9 03:16:04 2009 (GMT) gpg]

The plots below is a somewhat random observation of the effect of fiducial cuts on the 2.6r data. The left-hand panel shows the W spectrum with the electron and proton fiducial cuts turned on. The right-hand panel shows the same thing with those cuts turned off. There are, not surprisingly, many more events in the left-hand plot, but the shape is also different. the proportion of QE to inelastic events is much larger with the fiducial cuts off. This is likely due to the lower limit on the Q2 distribution for the no-fiducial-cut results. Lower Q2 usually means more QE events and a smaller fraction of inelastic events.

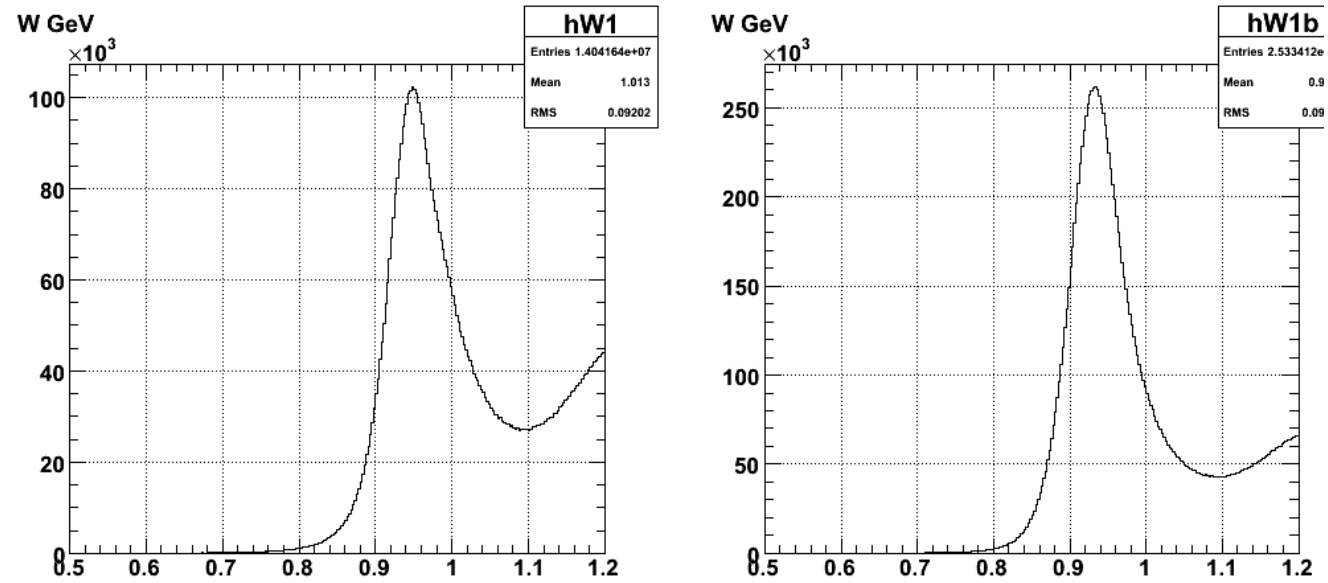


Fig 1. Comparison of W spectra with fiducial cuts on (left panel) and off (right panel) for 2.6r.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 289 - MM2 and W uncertainties for 2.6r (gpg)

[Modified Mon Nov 9 19:17:50 2009 (GMT) gpg]

Use the TH3D histograms to now get the uncertainties on MM2 and W.

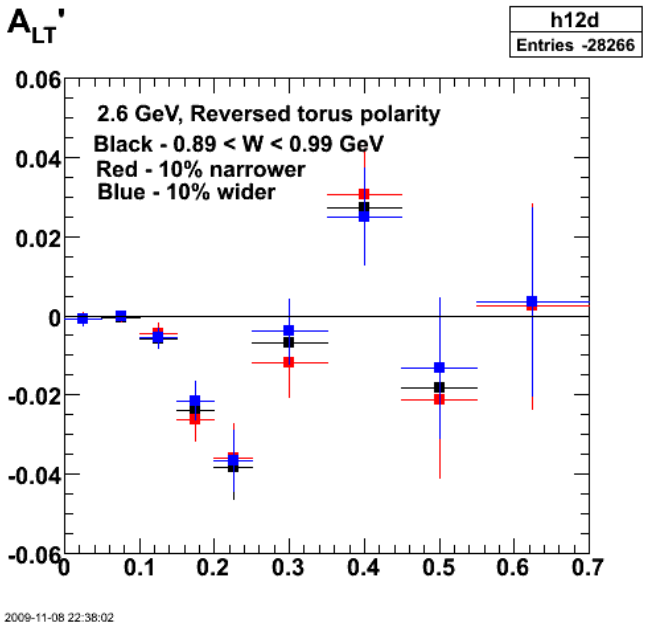


Fig 1. Comparison of 2.6r ALTp for +/- 10% change in width of W cut.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Click here to view the object (gzipped, tar file for 09-nov-06 version of eod5c area.) you uploaded.

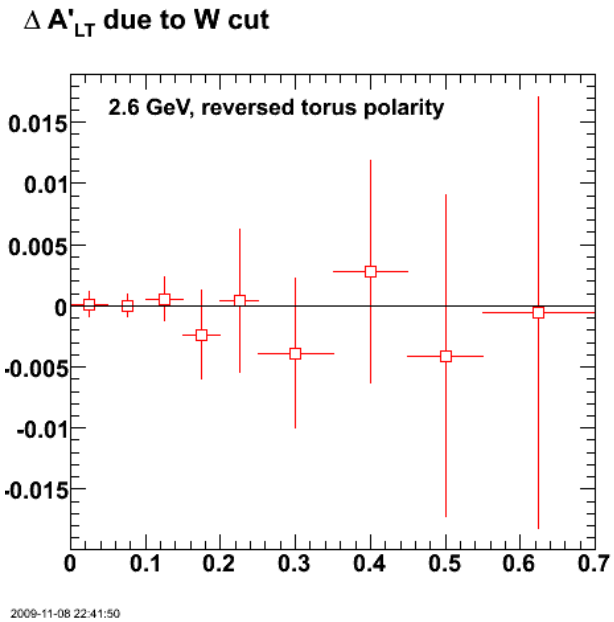


Fig 2. Uncertainty on W cut for 2.6r.

Numerical results for 2.6r W uncertainty:

```
root [47] h12diff->Print("all");
TH1.Print Name  = h12diff, Entries= 0, Total sum= -0.00700034
 fSumw[0]=0, x=-0.0833333, error=0
 fSumw[1]=9.72437e-05, x=0.025, error=0.00102385
```

```
 fSumw[2]=1.49344e-05, x=0.075, error=0.000939772
 fSumw[3]=0.000535909, x=0.125, error=0.0017846
 fSumw[4]=-0.00234639, x=0.175, error=0.00358321
 fSumw[5]=0.000432014, x=0.225, error=0.00580845
 fSumw[6]=-0.00387925, x=0.3, error=0.00608228
 fSumw[7]=0.00280579, x=0.4, error=0.0090594
 fSumw[8]=-0.00411233, x=0.5, error=0.0131505
 fSumw[9]=-0.000548271, x=0.625, error=0.0176066
 fSumw[10]=0, x=0.85, error=0
 fSumw[11]=0, x=1.25, error=0
 fSumw[12]=0, x=1.75, error=0
 fSumw[13]=0, x=2.08333, error=0
root [48]
```

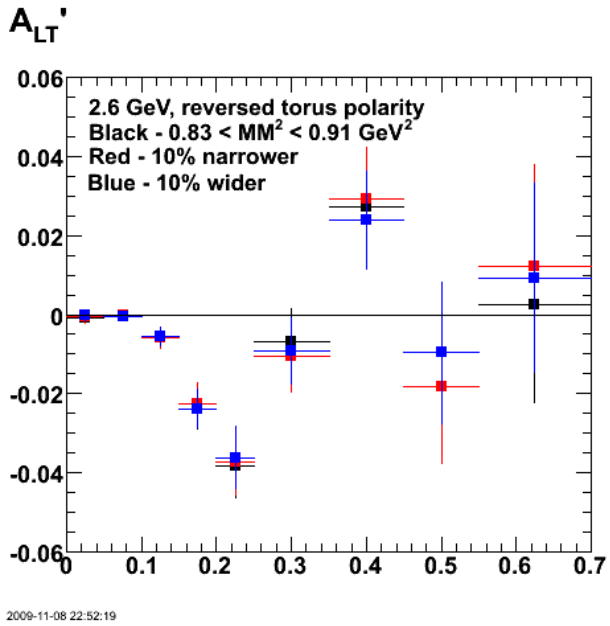


Fig 3. Conmparison of 2.6r ALTp for +/- 10% change in the width of the MM2 cut.

Click here to view the object (Root macro) you uploaded.

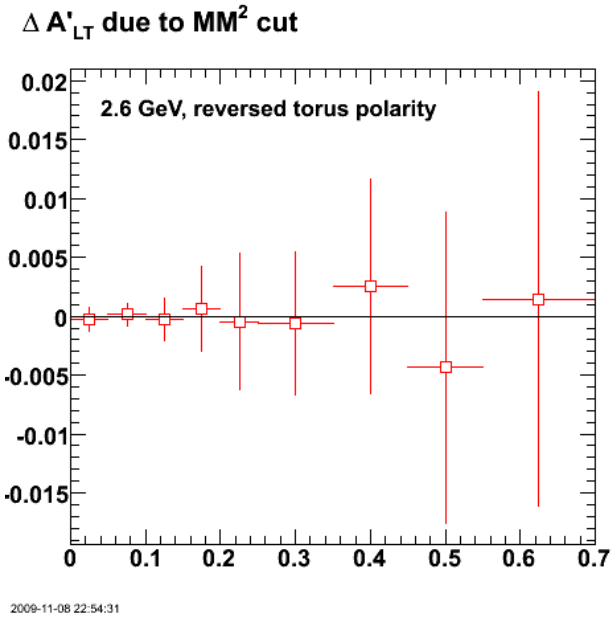


Fig 4. Uncertainty on ALTp due to MM2 cut for 2.6r.

Click here to view the object (Root macro) you uploaded.

Numerical results for 2.6r MM2 uncertainty:

```
h12diff->Draw()
root [70] h12diff->Print("all")
TH1.Print Name  = h12diff, Entries= 0, Total sum= -0.0012109
 fSumw[0]=0, x=-0.0833333, error=0
```

```
 fSumw[1]=-0.000272627, x=0.025, error=0.00102886
 fSumw[2]=0.000148672, x=0.075, error=0.000941474
 fSumw[3]=-0.000228678, x=0.125, error=0.00178476
 fSumw[4]=0.000598071, x=0.175, error=0.00358346
 fSumw[5]=-0.000456158, x=0.225, error=0.00580856
 fSumw[6]=-0.000630951, x=0.3, error=0.00609513
 fSumw[7]=0.00253614, x=0.4, error=0.00906983
 fSumw[8]=-0.00435557, x=0.5, error=0.0131901
 fSumw[9]=0.00145019, x=0.625, error=0.0176054
 fSumw[10]=0, x=0.85, error=0
 fSumw[11]=0, x=1.25, error=0
 fSumw[12]=0, x=1.75, error=0
 fSumw[13]=0, x=2.08333, error=0
root [71]
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 290 - Electron Plots for CLAS12 software EC talk (gpg)

[Modified Wed Nov 18 19:12:08 2009 (GMT) gpg]

Plots below for the CLAS12 software meeting on Nov 18, 2009.

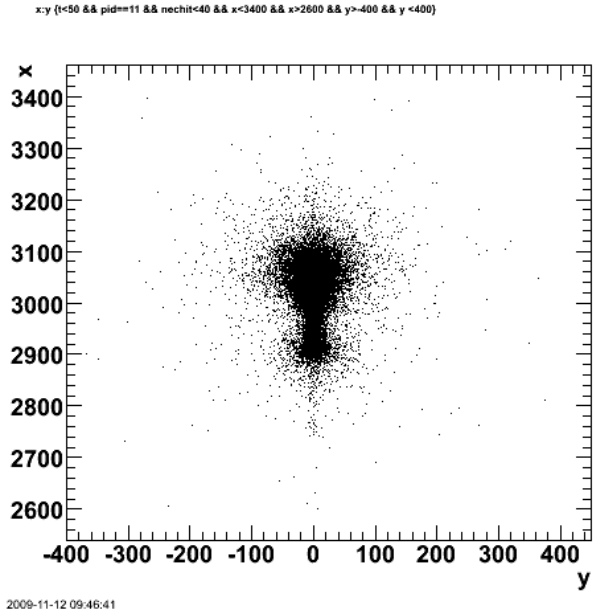


Fig 1. Transverse position plot for 7.5-GeV electrons.

Click here to view the object (Root macro) you uploaded.

Generated with the following command.

```
ecT->Draw("x:y","t<50 && pid==11 && nechit<40 && x<3400 && x>2600 && y>-400 && y <400")
```

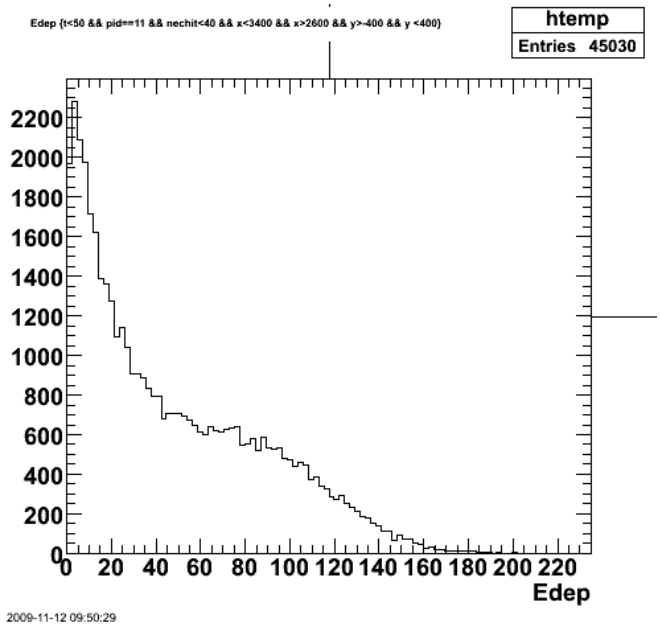


Fig 2. Deposited energy for electrons.

Click here to view the object (Root macro) you uploaded.

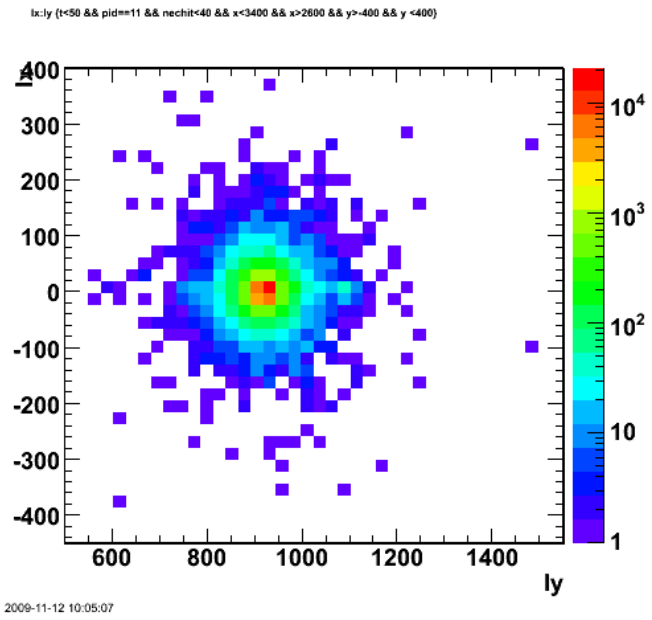


Fig 3. Electron position in local, transverse corrdinates

Click here to view the object (Root macro) you uploaded.

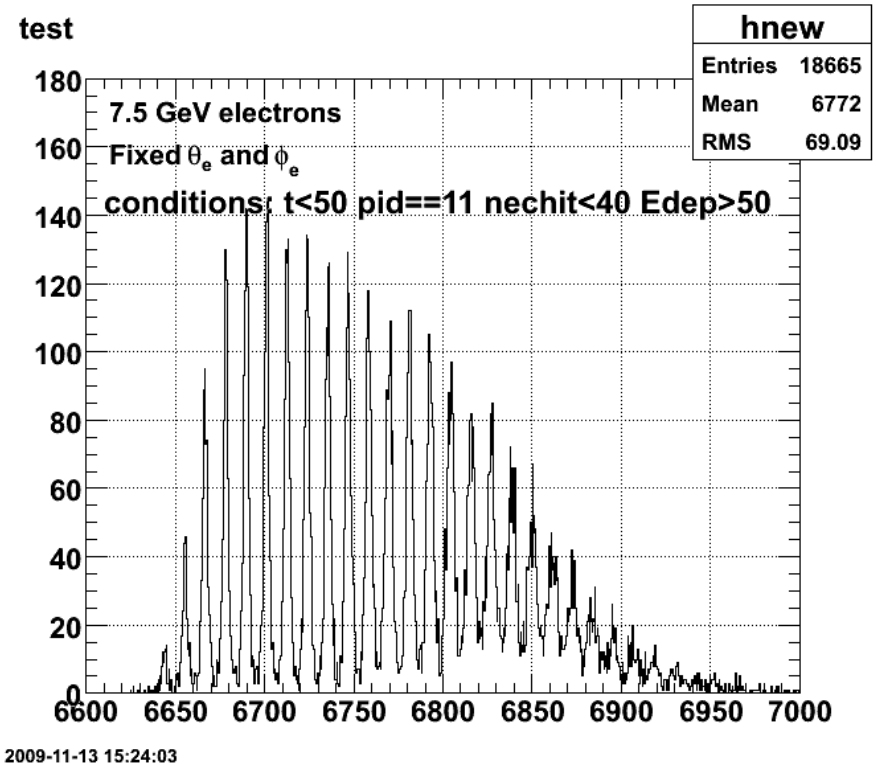


Fig 4. Distribution of position in Z for electrons.

Click here to view the object (ROOT macro) you uploaded.

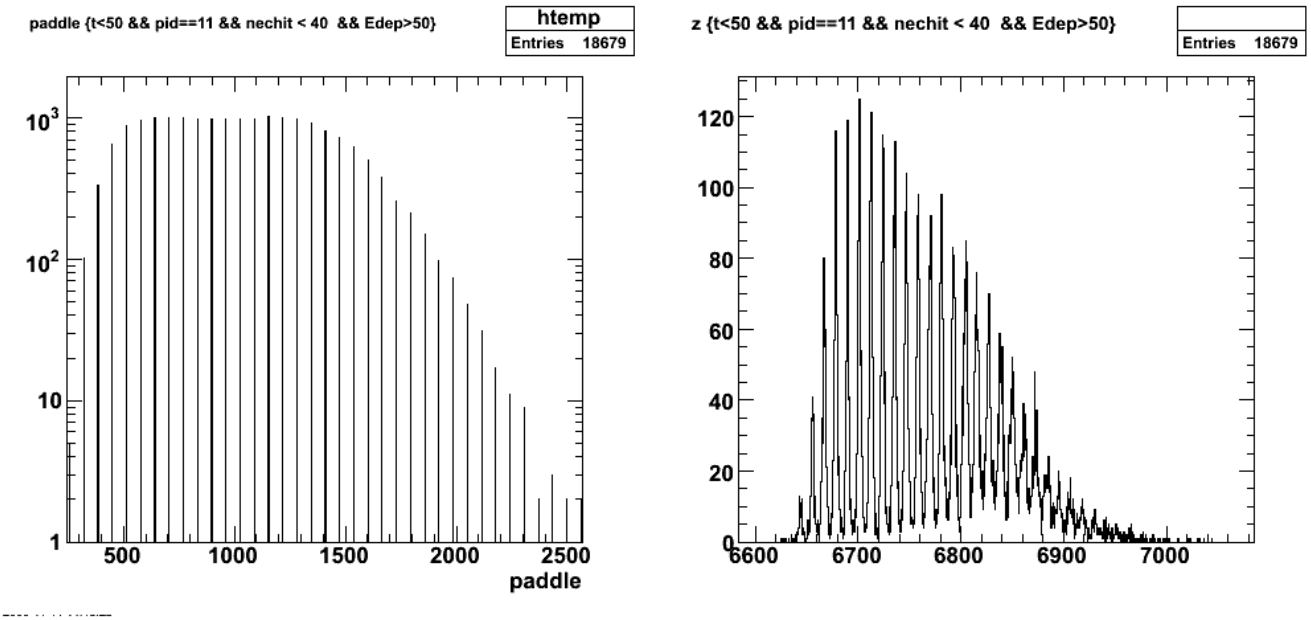


Fig 5. Comparison of paddle and global z distributions for electrons.

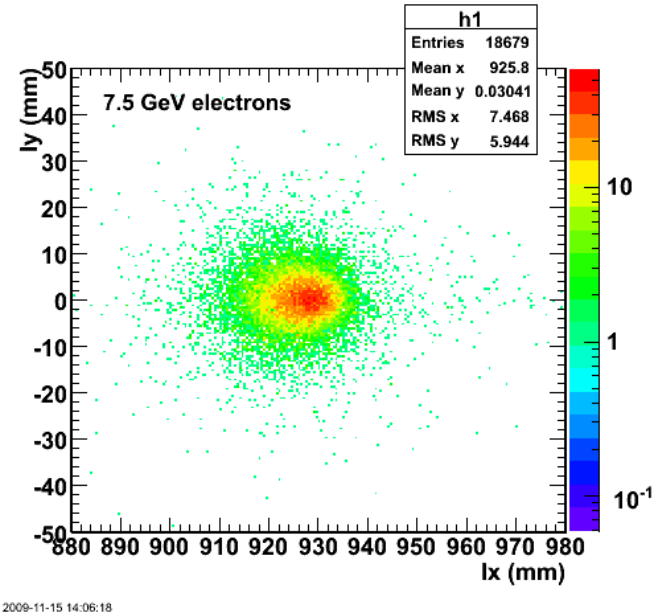


Fig 6. local y vs. x.

Click here to view the object (Root macro) you uploaded.

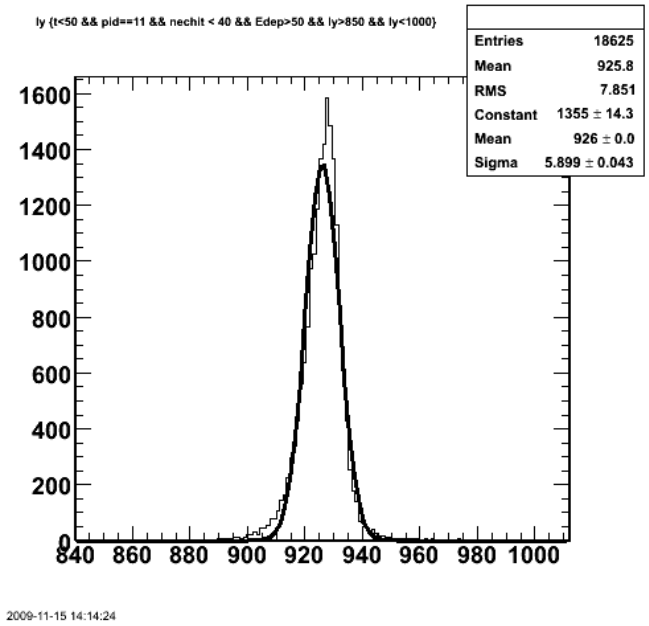
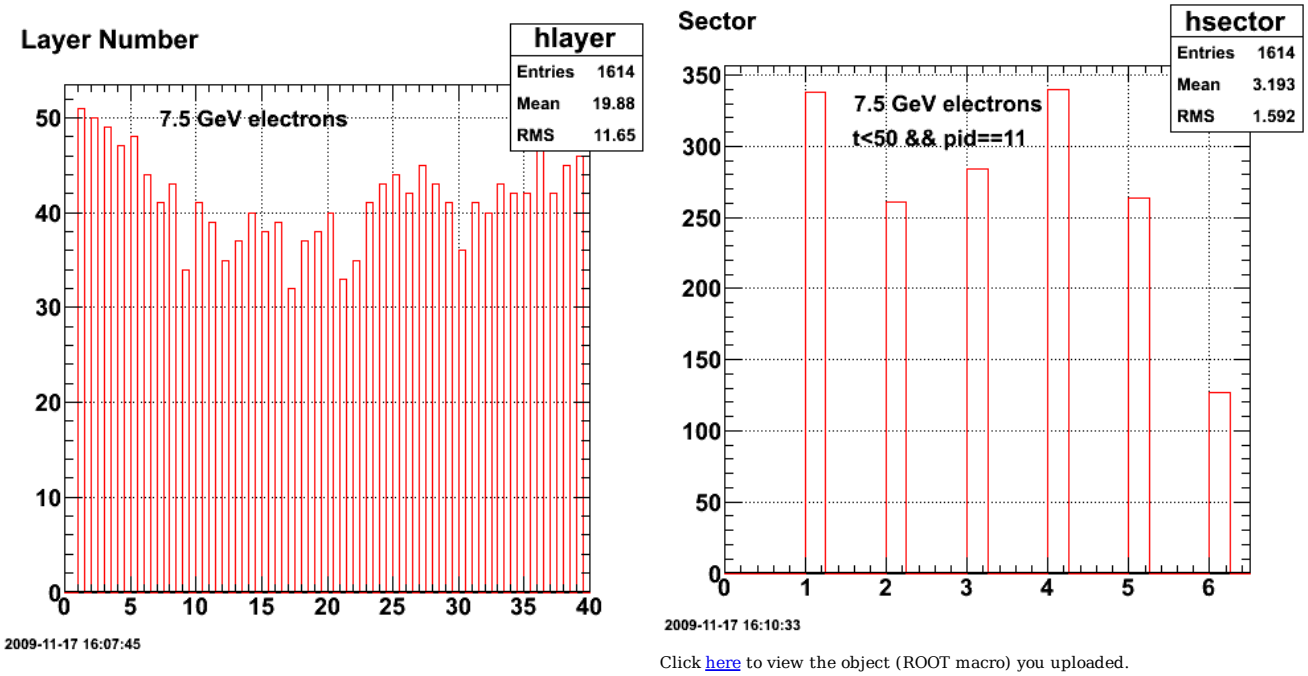


Fig 7. Transverse distribution of the cluster for 7.5 GeV electrons.

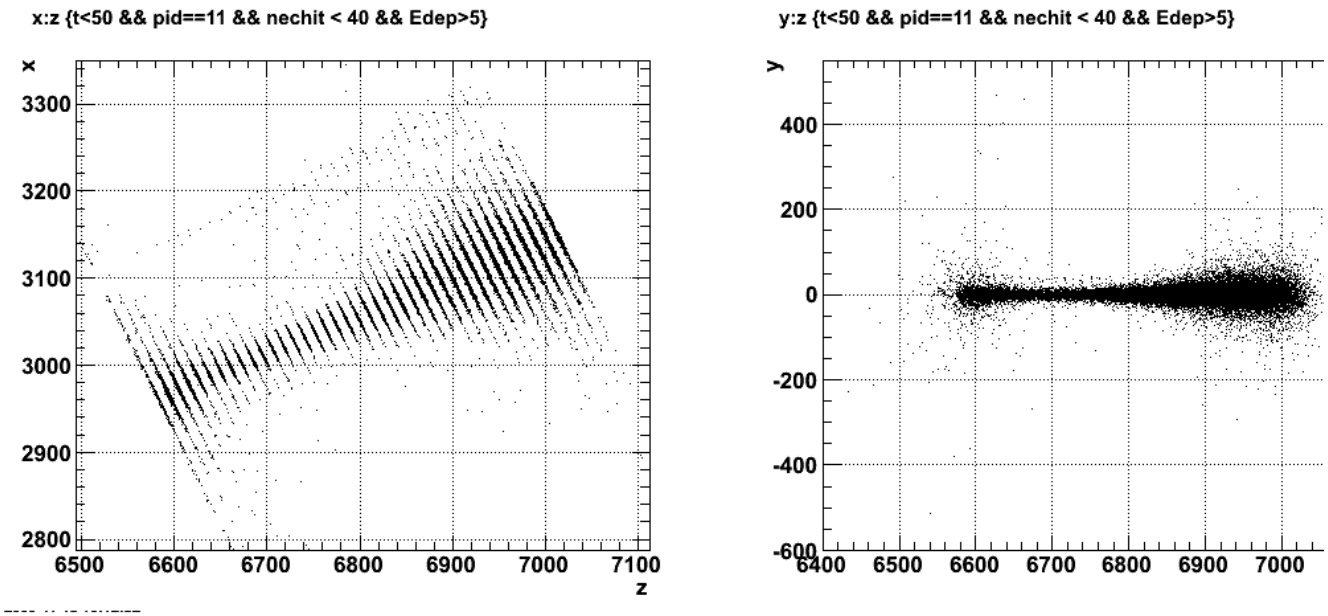
Click here to view the object (Root macro) you uploaded.



Click here to view the object (ROOT macro) you uploaded.

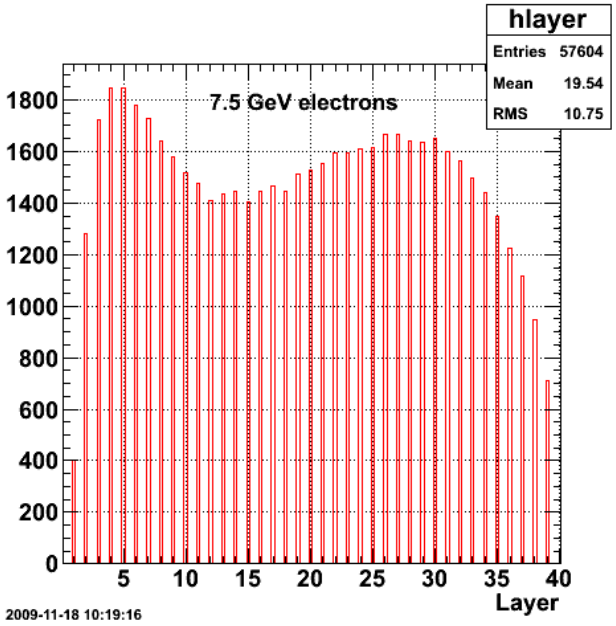
Fig 8. First plots with layer and sector.

Results for electrons from ECe_results2.root which has the sector and layer information.

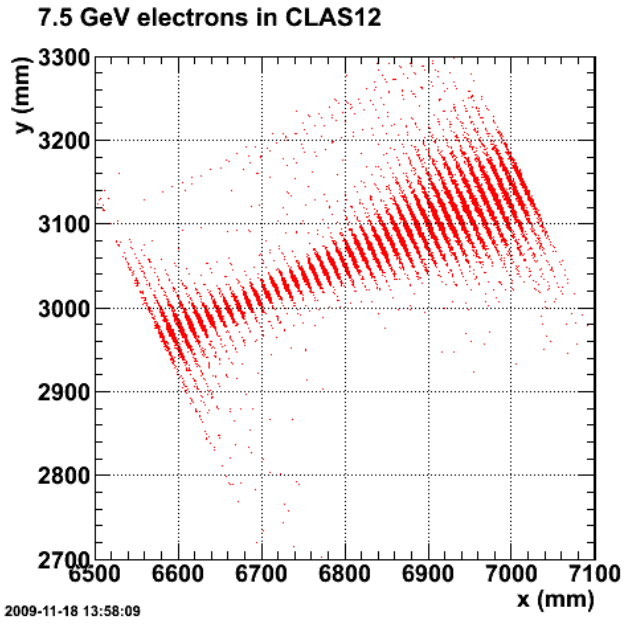


Click here to view the object (ROOT macro) you uploaded.

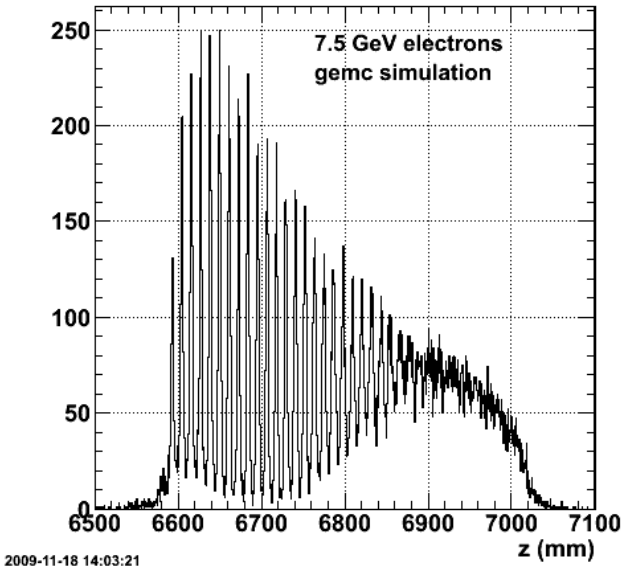
Click here to view the object (Root Tree file) you uploaded.



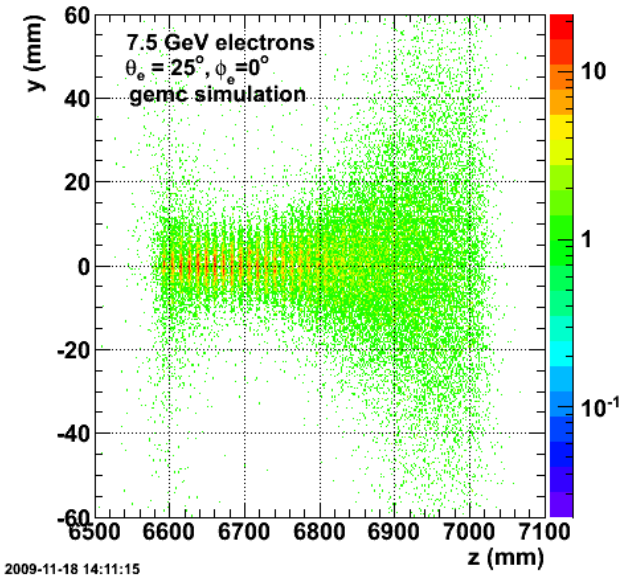
Click here to view the object (ROOT macro) you uploaded.



Click here to view the object (ROOT macro) you uploaded.



Click here to view the object (ROOT macro) you uploaded.



Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 291 - Neutron Plots for CLAS12 software EC talk (gpg)

[Modified Wed Nov 18 04:17:42 2009 (GMT) gpg]

Plots for the CLAS12 Software meeting talk.

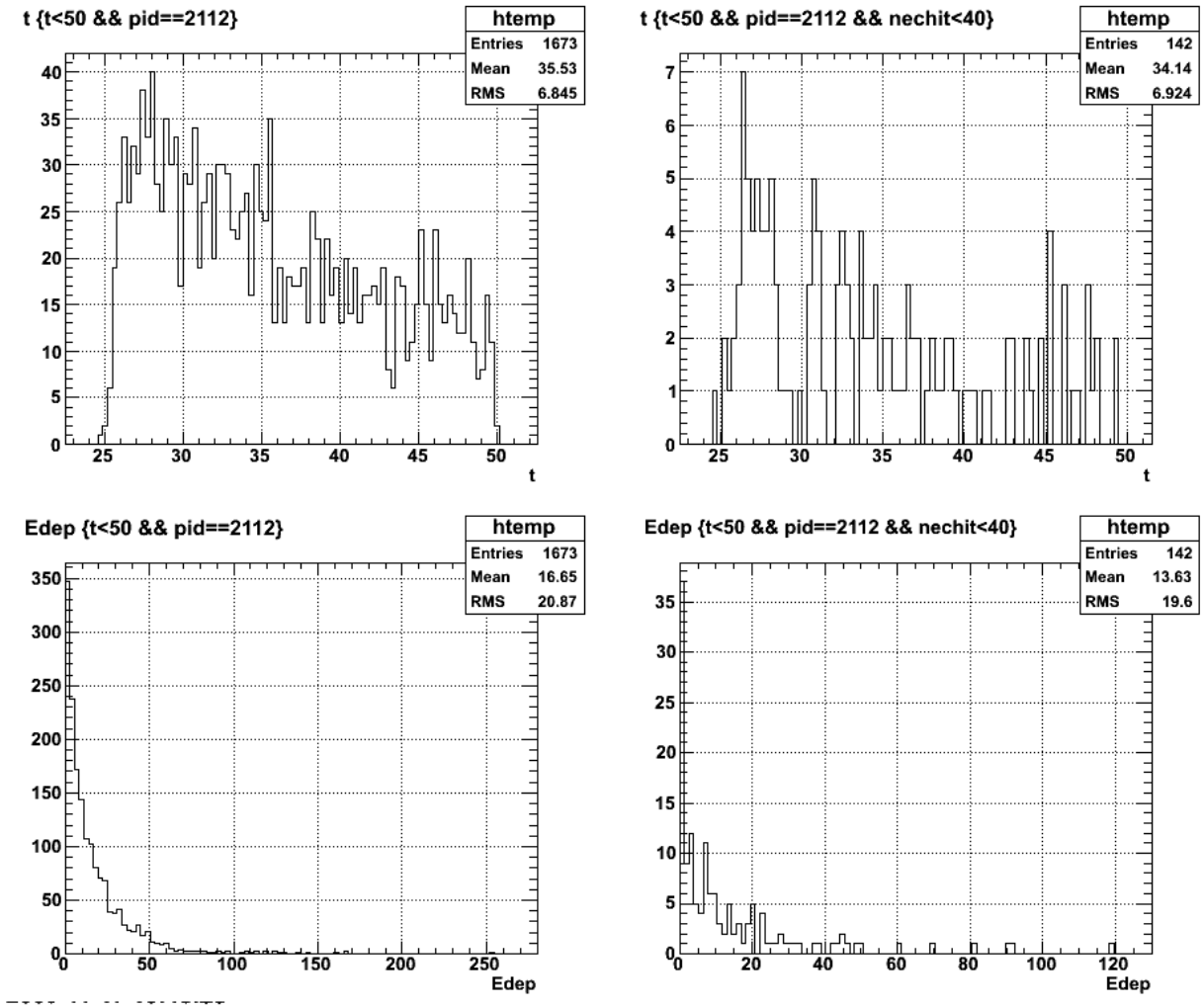


Fig 1. Neutron plots.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

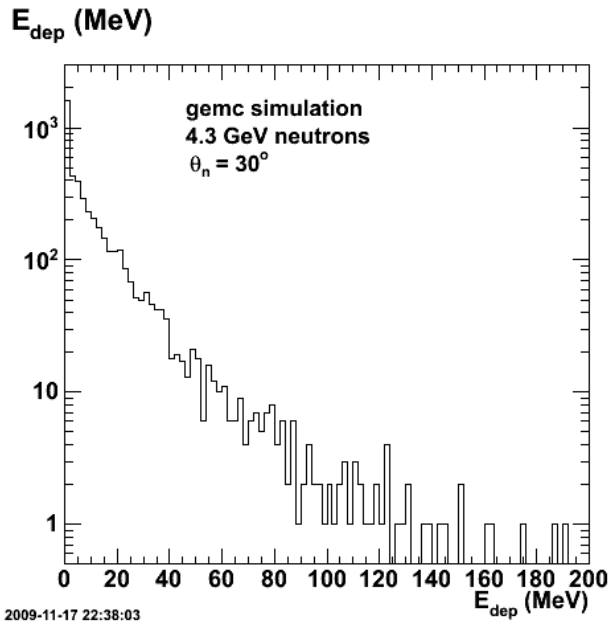


Fig 2. Deposited energy for neutrons.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

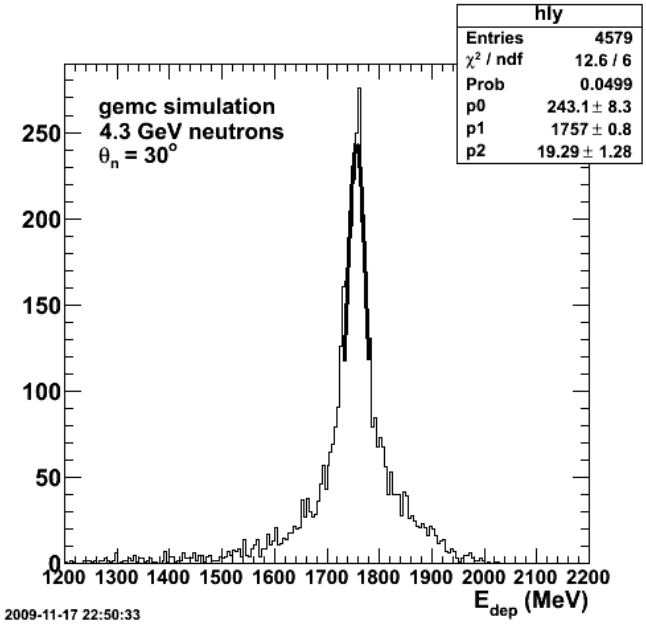


Fig 3. Transverse position (ly) for neutrons.

Click here to view the object (ROOT macro) you uploaded.

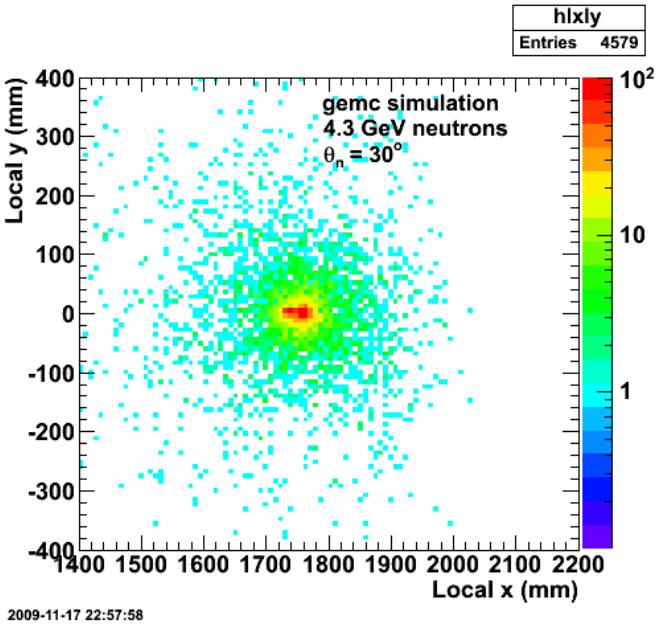


Fig 4. Local transverse position.

Click here to view the object (ROOT macro) you uploaded.

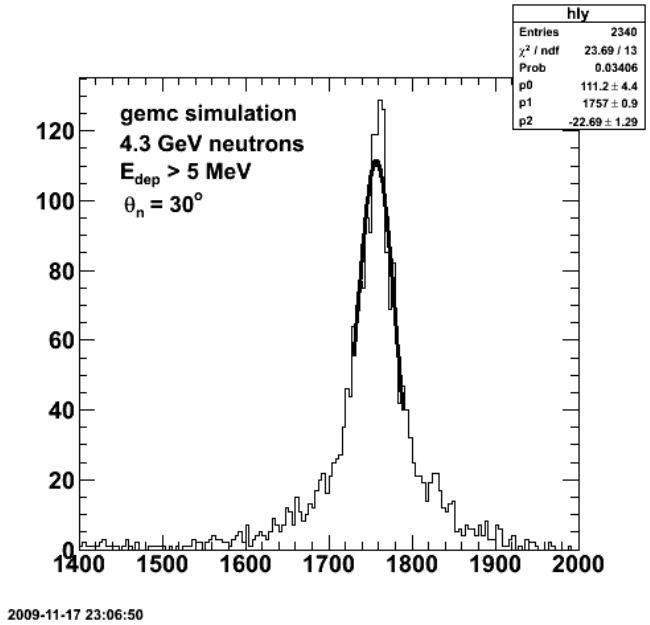


Fig 5. Transverse position (ly) for neutrons with Edep>5 eV.

Click here to view the object (ROOT macro) you uploaded.

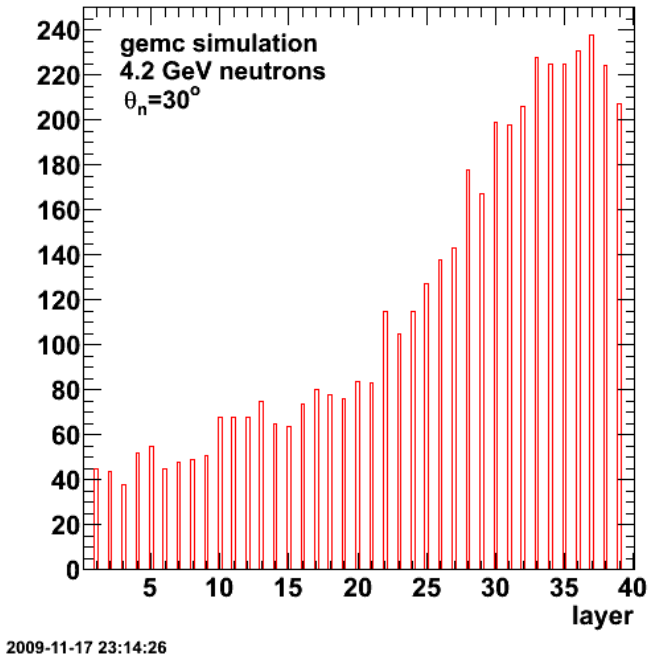


Fig 6. Layers for neutrons.

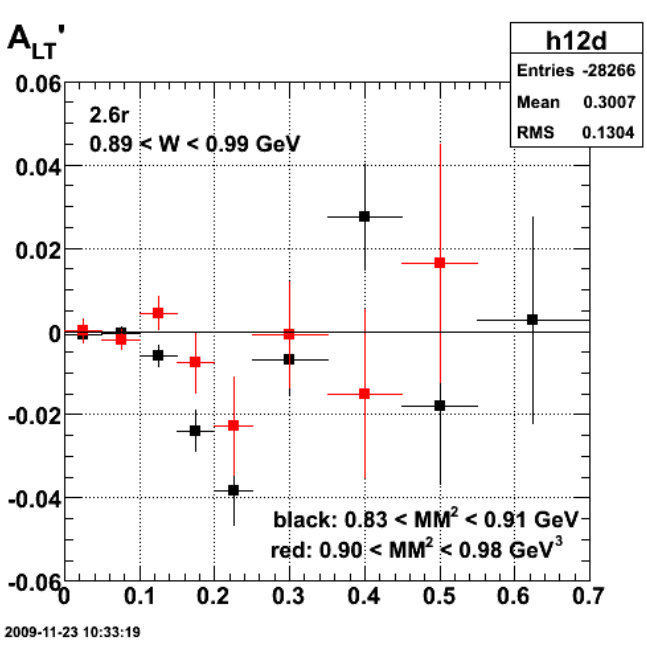
Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 292 - Dependence of ALTp on MM2 for 2.6r (gpg)

[Modified Sat Nov 28 00:58:58 2009 (GMT) gpg]

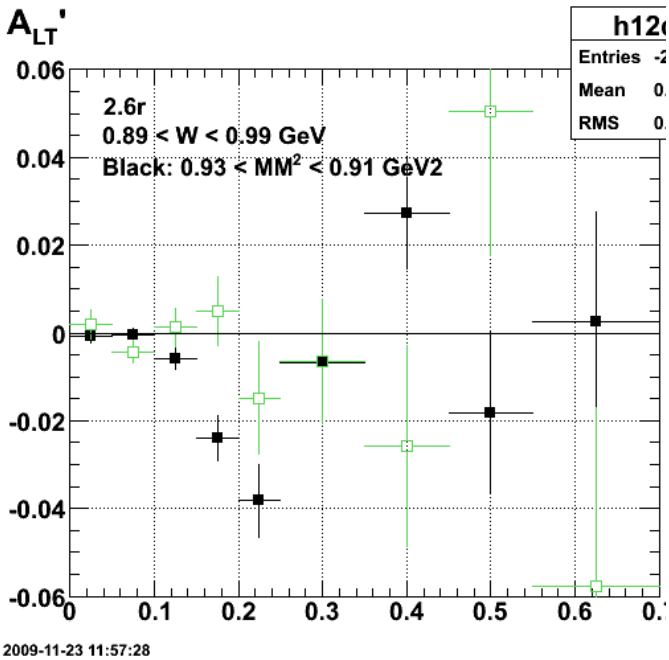
A last (?!) study of the dependence of ALTp on the MM2 cut. Use the optimum W cut (0.89 < W < 0.99 GeV). The conclusion here is that for the optimum W cut, ALTp drops off rapidly as we move above or below the neutron peak in the MM2 distribution. The first plot shows a comparison of the default ALTp with a different MM2 range to agree with fig 5 in entry 119.



2009-11-23 10:33:19

Fig 1. Comparison of the default ALTp with a variation in the MM2 cut. See below for a revised figure.

Click here to view the object (ROOT macro) you uploaded.



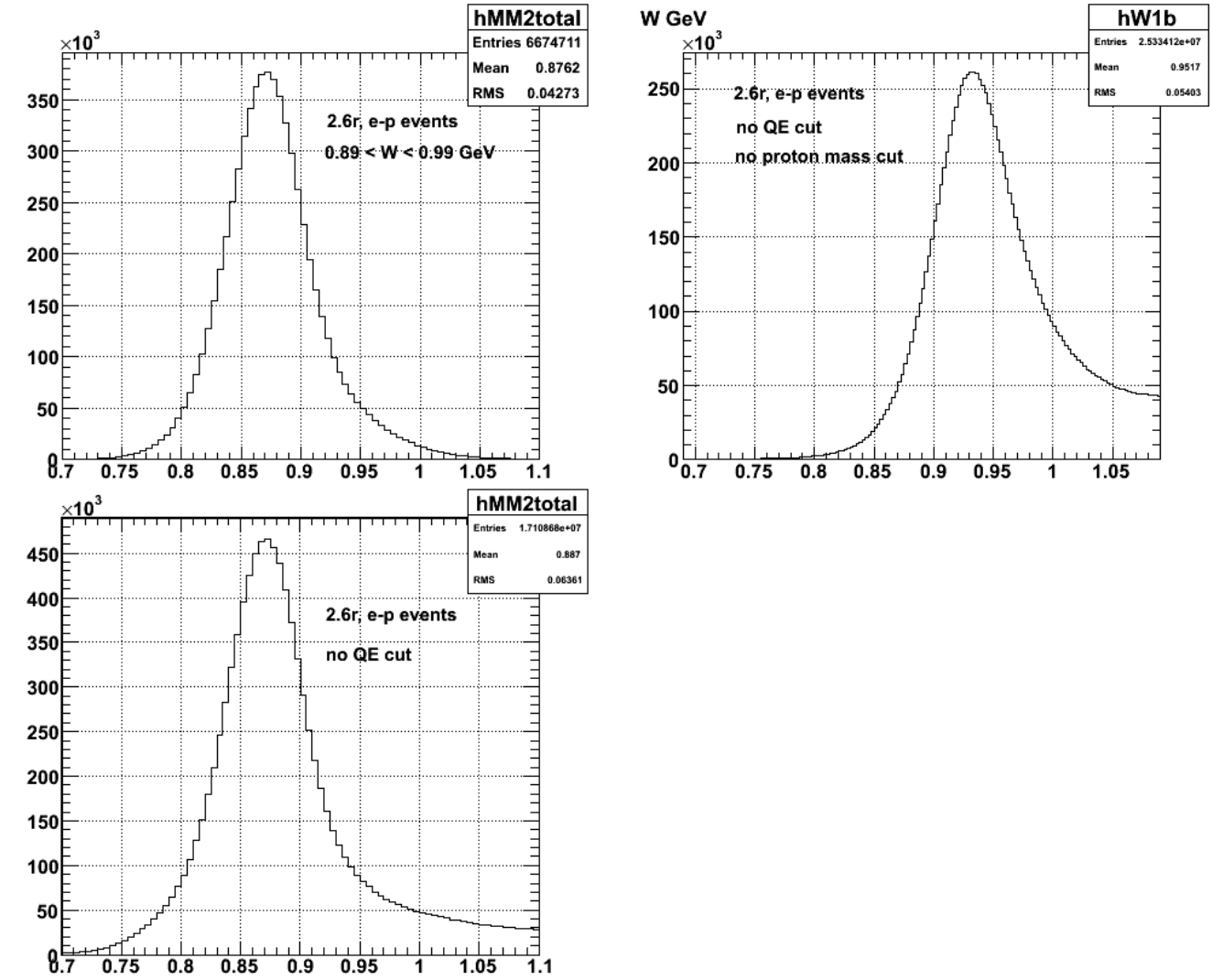
2009-11-23 11:57:28

Move the MM2 cut a bit higher to avoid overlapping the default MM2 range for 2.6r. The MM2 range for the green points is 0.91-0.99 GeV2

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

The results in the l.h.s. of fig 1 are consistent with entry 119, but seem to be at odds with my results studies of ALTp. However, the rogue dip is seen when I vary W NOT MM2. Plots below show the MM2 distribution with the QE cut on and off. The difference between the two plots with no QE cut is due to the different bin size (the hMM2total histogram has bins that are twice as large as the hW1b histogram so each bin has about half the number of counts) and hW1b has no proton mass cut that narrows the proton definition and reduces the inelastic tail at high MM2..

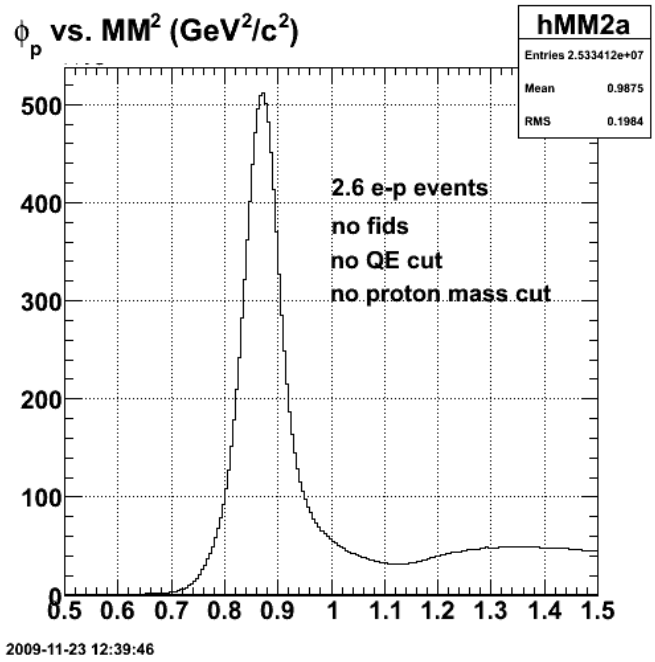


2009-11-23 11:36:08

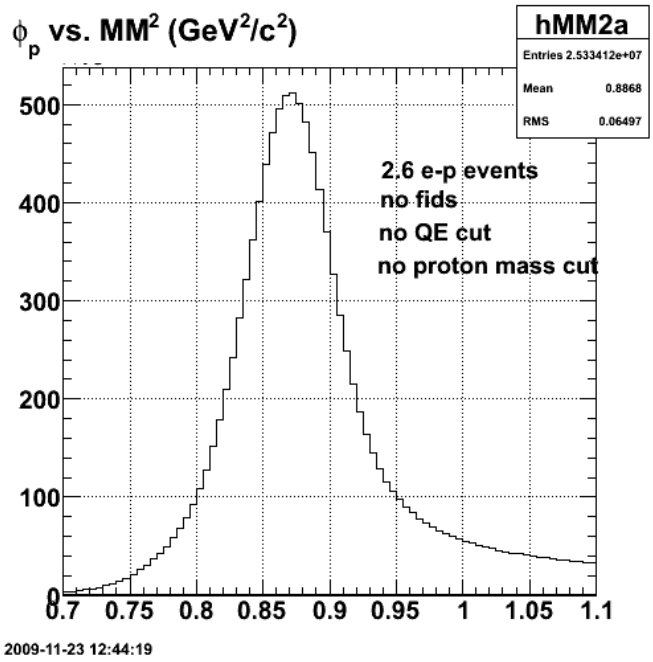
Fig 2. MM2 distributions. QE cut is 0.89 < W < 0.99 GeV.

Click here to view the object (ROOT macro) you uploaded.

Dumb Ass!! I put the W plot in the upper right-hand panel instead of the MM2 for comparison. Show the appropriate MM2 plot below.



MM2 dependence for 2.6r.



MM2 distribution from #phi vs. MM2 distribution.

Click here to view the object (ROOT macro) you uploaded.

Do the plot for the MM2 region below the neutron peak.

Click here to view the object (ROOT macro) you uploaded.

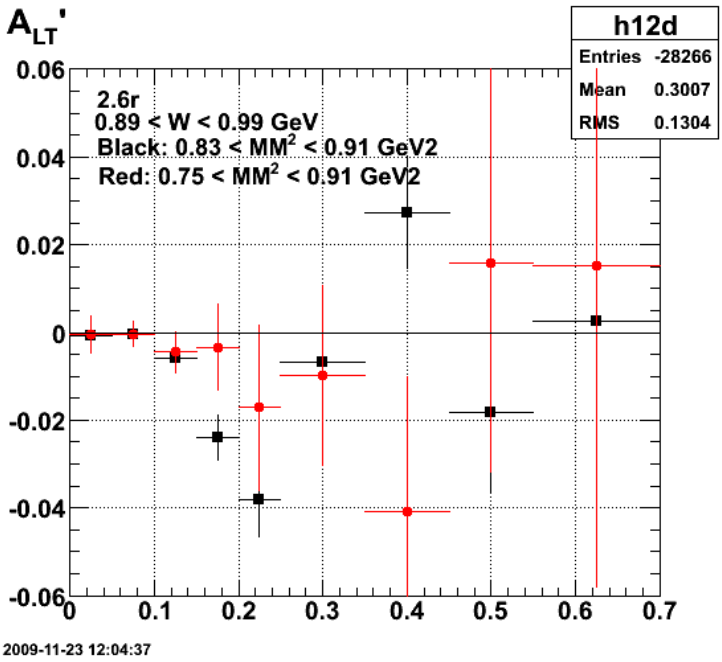
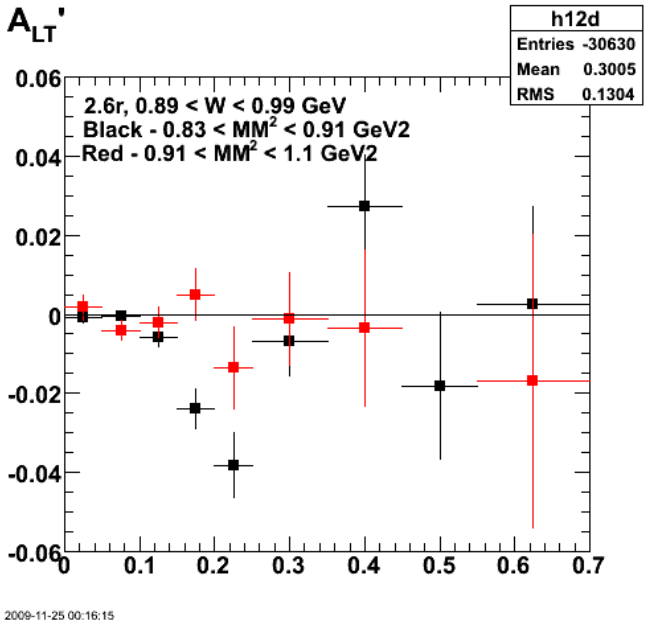


Fig 3. Comparison of the default ALTp with a variation in the MM2 cut at low neutron mass. The MM2 range is 0.75-0.83 GeV2 NOT 0.75-0.91 GeV2.

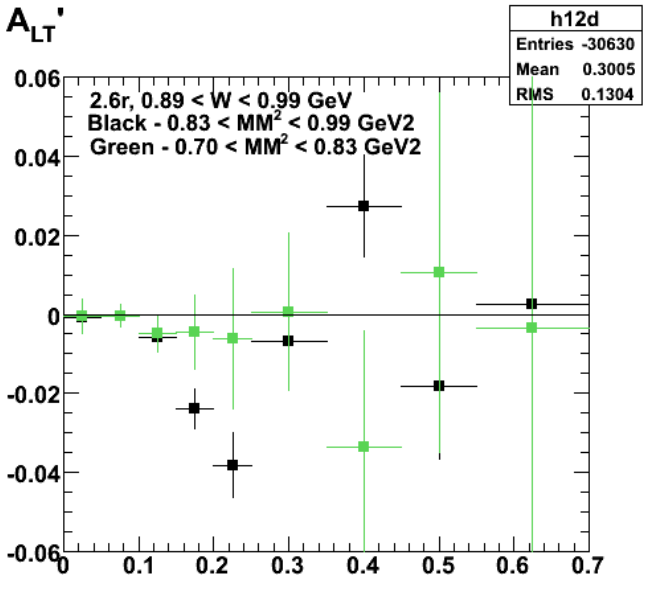
Click here to view the object (ROOT macro) you uploaded.



2009-11-25 00:16:15

Fig 4. Comparison of 2.6r ALTp with a revised high-MM2 range to be consistent with other plots and the CAN. The missing, sixth point is 0.061 +/- 0.029

Click here to view the object (Root macro) you uploaded.



2009-11-25 00:11:32

Fig 5. Comparison of 2.6r ALTp with revised low-MM2 range. The upper limit on the default ALTp is 0.91 GeV/c NOT 0.99 GeV.

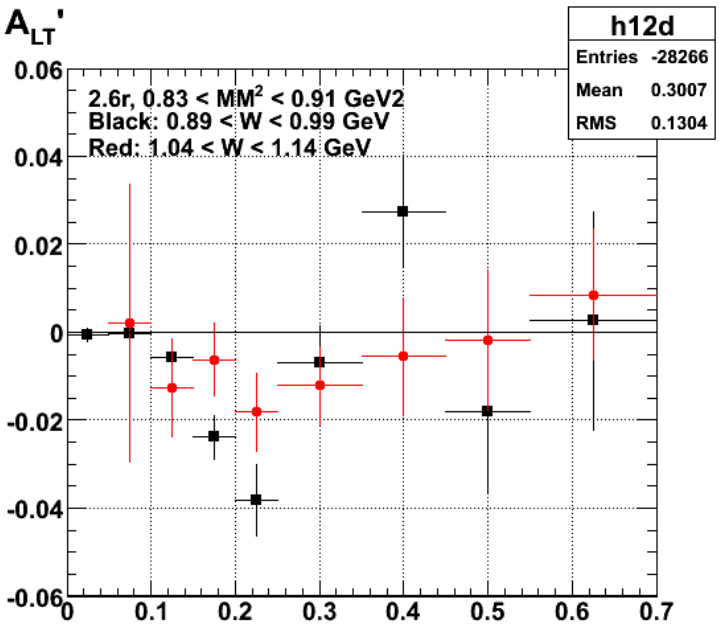
Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 293 - Dependence of ALTp on W for 2.6r (gpg)

[Modified Wed Nov 25 05:00:04 2009 (GMT) gpg]

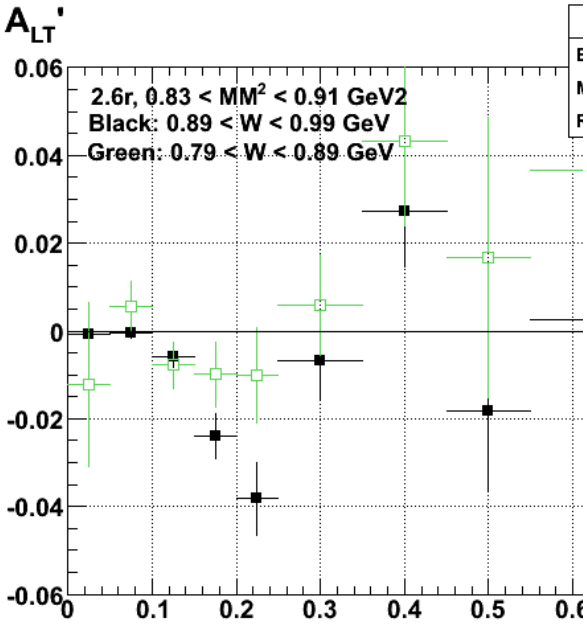
Now fix the MM2 cut at 0.83 < MM2 < 0.91 GeV2 and vary the W cut. This is where I should see the rogue dip.



2009-11-23 12:26:59

Fig 1. Comparison of ALTp for the default QE cut and for high W for 2.6r.First bin is 0.893786 +/- 0.698912 which does not show up on the plot.

Click here to view the object (ROOT macro) you uploaded.



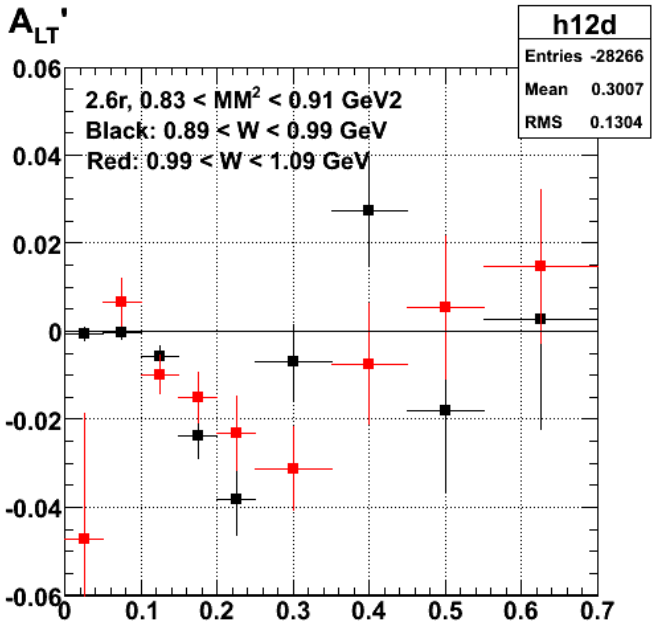
2009-11-23 12:22:12

Fig 2. Comparison of ALTp for the default neutron cut on MM2 an 2.6r. Revised version is below.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

The rogue dip.



2009-11-23 13:05:57

Fig 3. Comparison of ALTp for default (black) and for the W range just above the QE cut showing the rogue dip.

Click here to view the object (ROOT macro) you uploaded.

Now add plots of W spectra to illustrate cut ranges. The difference in scales can be explained because the l.h.s of fig 4 has half the bin width in GeV and does not have the extra proton mass cut applied to clean up the mass of the proton.

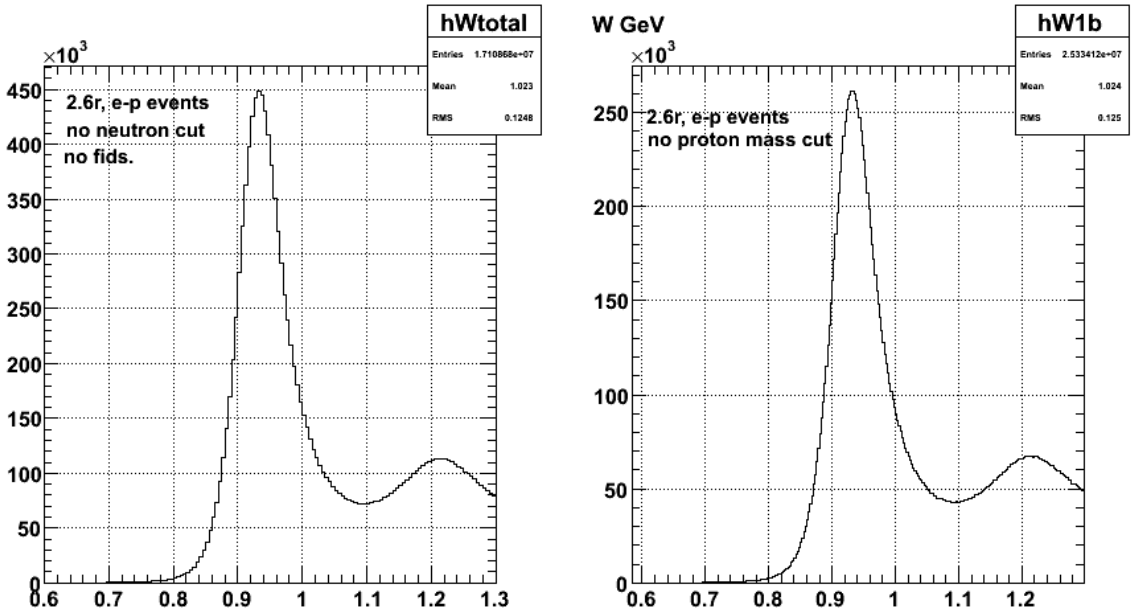


Fig 4. Comparison of W spectra projected out of 3D histogram and from 1D histogram in eod5.C.

Click here to view the object (ROOT macro) you uploaded.

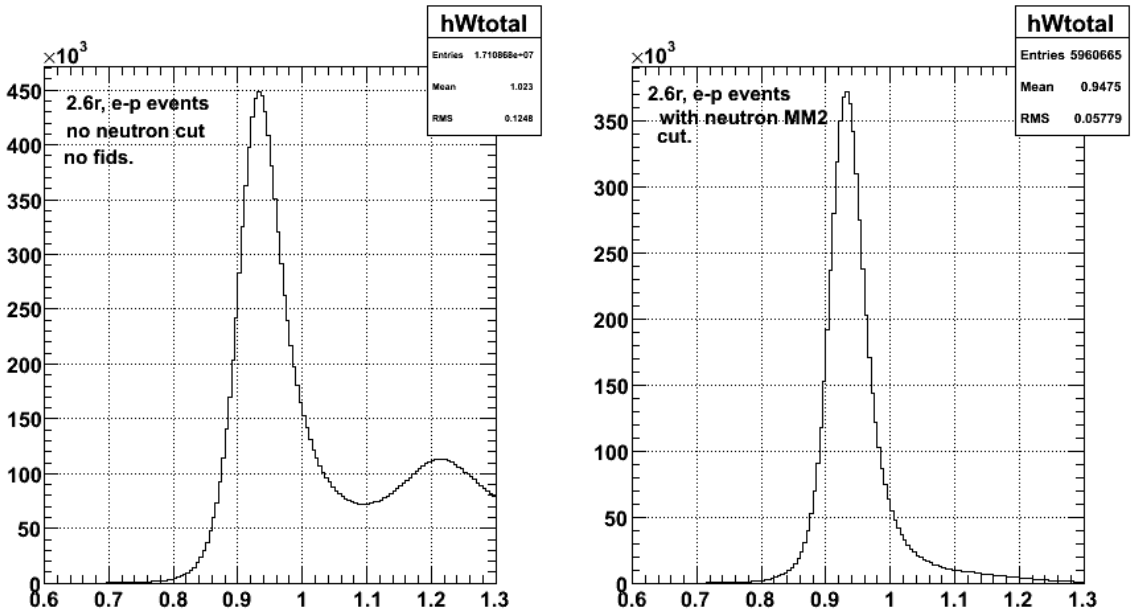


Fig 5. Comparison of W spectra with (r.h.s.) and without (l.h.s.) MM2 neutron cut.

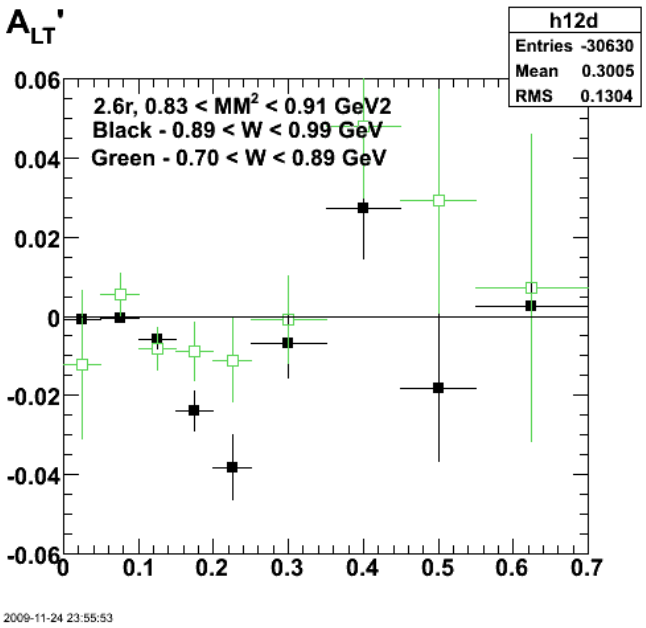


Fig 6. Comaprison of 2.6r ALTp for default W range and the region below the QE cut. Revised version of fig 2.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 294 - Dependence of ALTp on MM2 for 2.6n (gpg)

[Modified Sat Nov 28 00:47:11 2009 (GMT) gpg]

Now do a study of the MM2 dependence of ALT for 2.6n so the scans are consistent with the 2.6r results in the previous entries. There are small differences between ALTp and previous results. I ran this with the MM2 momentum corrections turned off so I am rerunning the analysis with those corrections turned on to see if there is any difference. This difference is a bit perplexing. Turning off the MM2 momentum corrections and things look almost exactly as they did before. See below for revised plots.

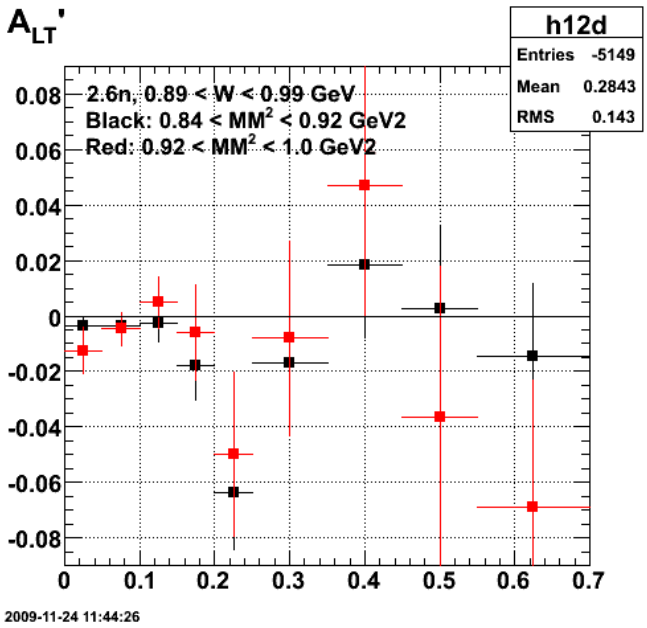


Fig 1. Comparison of 2.6n ALTp with optimum MM2 and MM2 above the neutron peak.

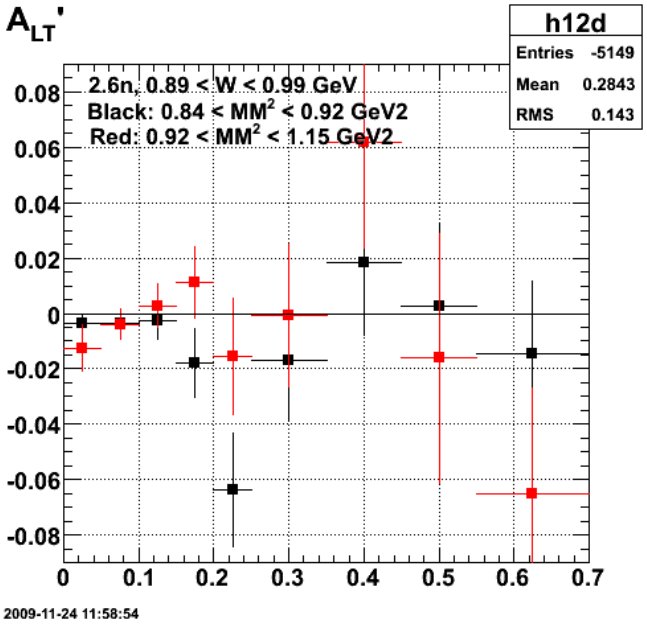


Fig 2. Revised the range of the upper MM2 scan. Opps! The true range for the red points is 0.92-1.1 GeV2

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Click here to view the object (ROOT macro) you uploaded.

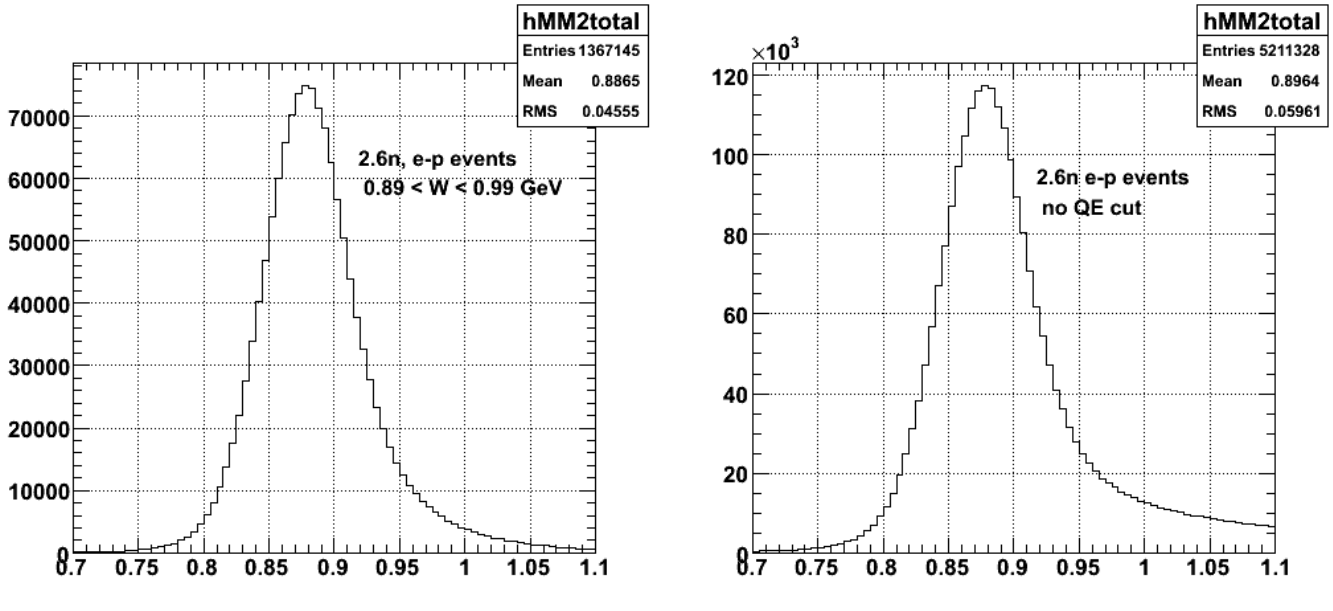
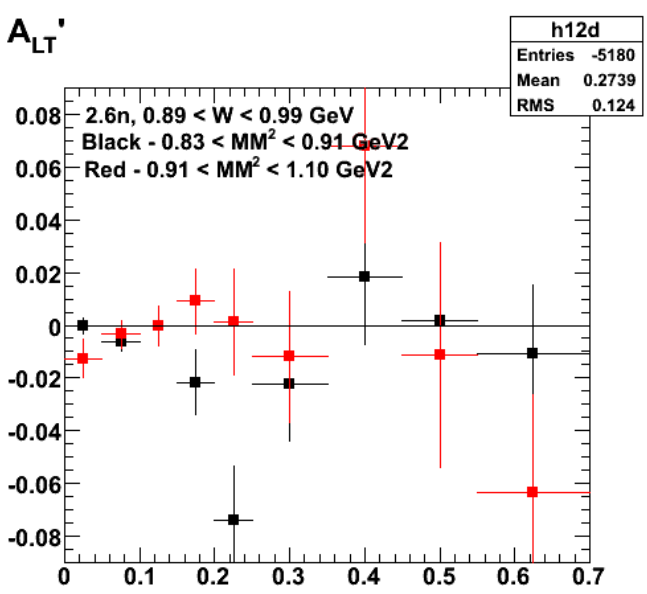


Fig 3. MM2 distribution with QE cut on (lhs) and off (rhs).

Click here to view the object (ROOT macro) you uploaded.



2009-11-25 00:26:53

Fig 4. Revised comparison of 2.6n ALTp with high-MM2 region (red). The default MM2 region is really 0.84-0.92 GeV2 and the high-MM2 region is 0.92-1.1 GeV2 NOT what is labelled on the plot.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

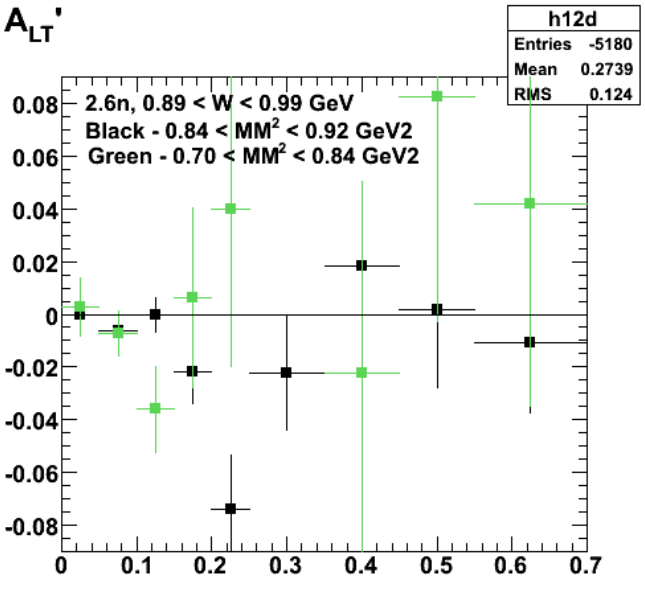


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Fig 5. Revised comparison of 2.6n ALTp with low-MM2 region. The missing fifth point is -0.12 +/- 0.06.

Click here to view the object (Root macro) you uploaded.

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Jerry Gilfoyle's Enotebook page 295 - Dependence of ALTp on W for 2.6n (gpg)

[Modified Wed Nov 25 04:41:02 2009 (GMT) gpg]

Now do the W scan for 2.6n.

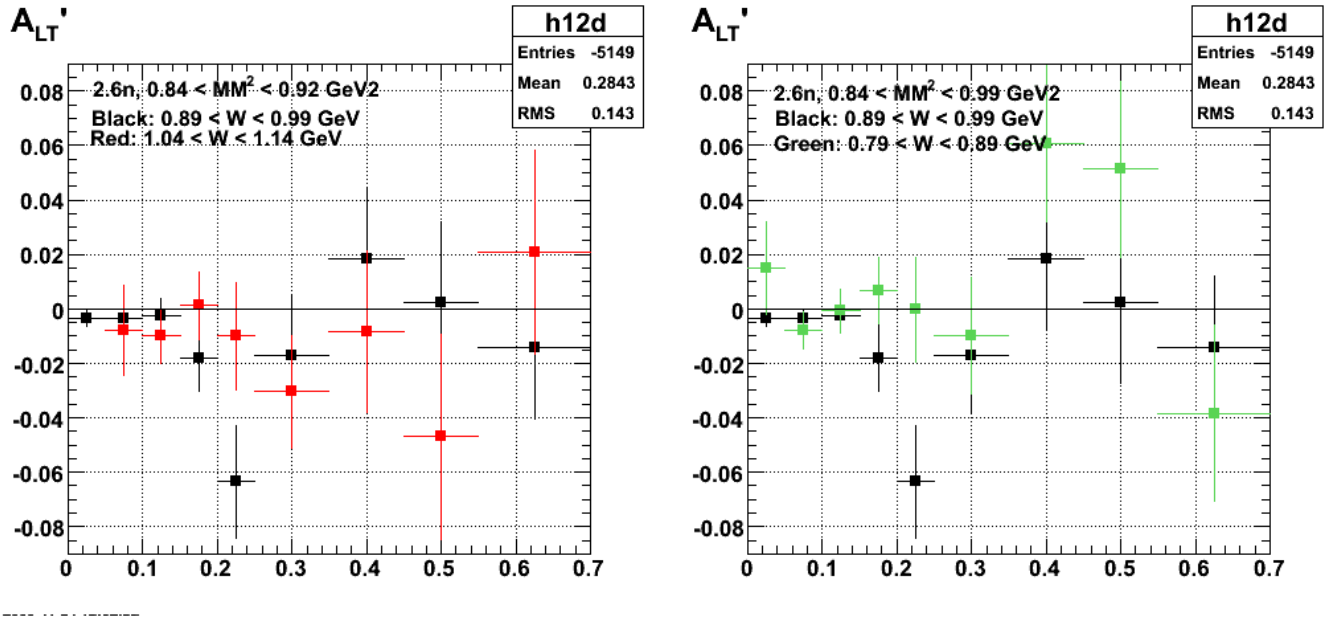


Fig 1. Scans of W for 2.6n above and below the QE peak.
The lowest red, p_m on the lhs is off scale and is 0.2 +/- 0.2.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

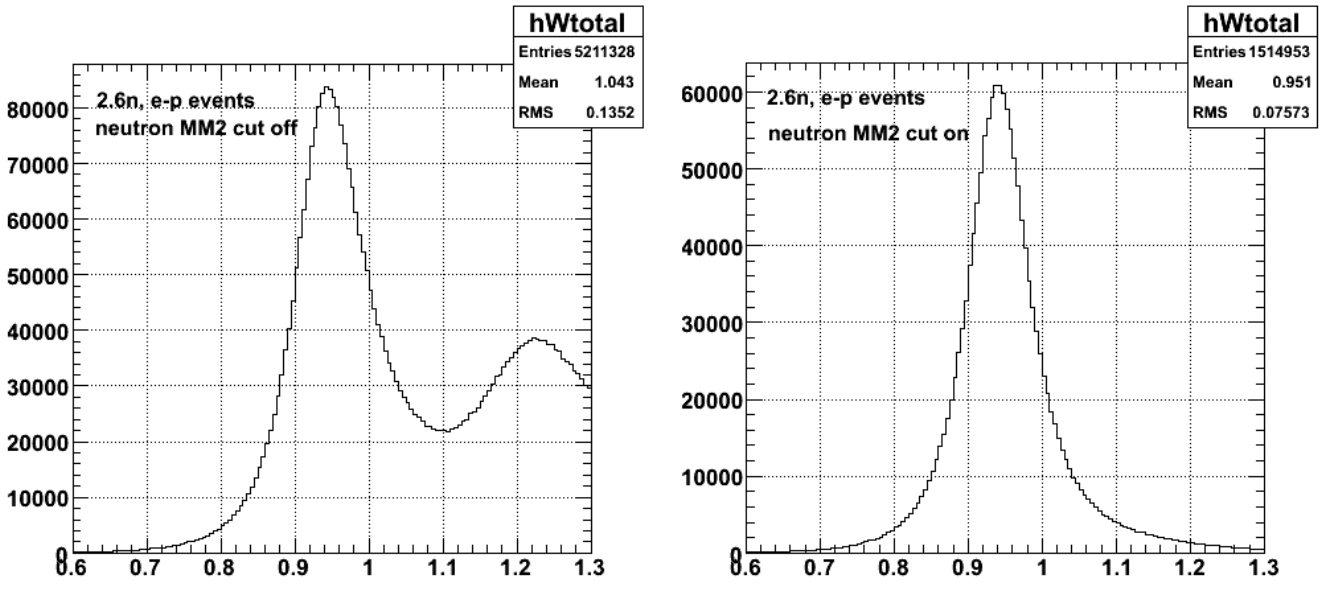
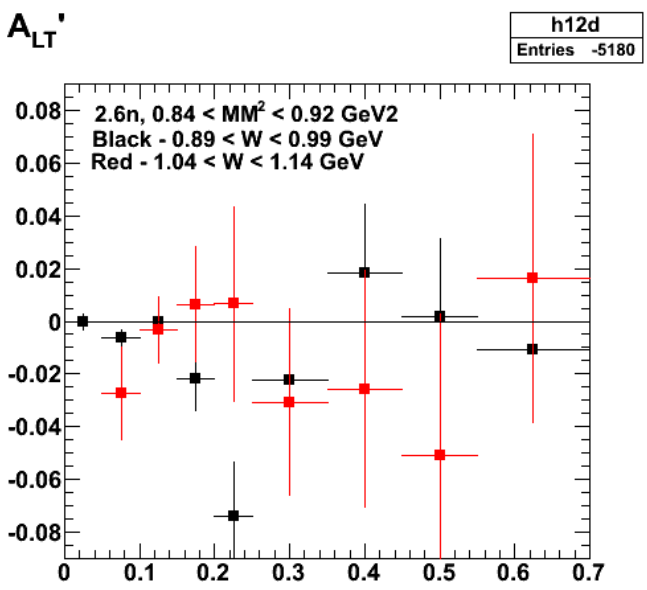


Fig 2. W spectra with neutron MM2 cut off (left) and on (right).

Click here to view the object (ROOT macro) you uploaded.

Recall the problem from the previous entry that ALTp looks a little different. I suspect the effect of the MM2 momentum correction. Re-analyze the data and it looks closer to the previous results especially at small pm. See entry 282. Results are below. The W spectra above are still usable in the CAN.

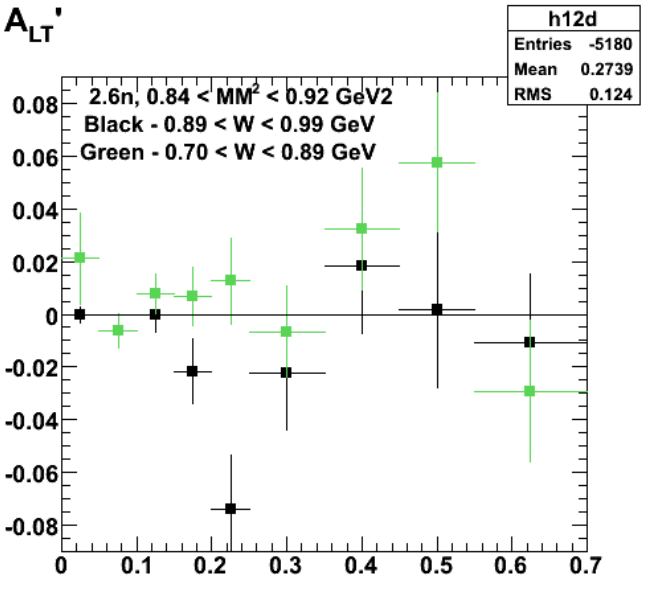


2009-11-24 18:47:46

Fig 4. Comparison of 2.6n ALTp with optimum MM2 and MM2 above the neutron peak. The lowest pm point is 0.5 +/- 0.2 which is suspicious and justifies excluding these data from ALTp for QE kinematics.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.



2009-11-24 23:28:25

Fig 5. Comparison of 2.6n ALTp for default (black) and low W side of QE peak.

Click here to view the object (Root macro) you uploaded.

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Jerry Gilfoyle's Enotebook page 296 - Systematics of GMn (gpg)

[Modified Thu Dec 3 16:49:44 2009 (GMT) gpg]

The first plot below shows the kelly fit to the GMn data including the CLAS6 data.

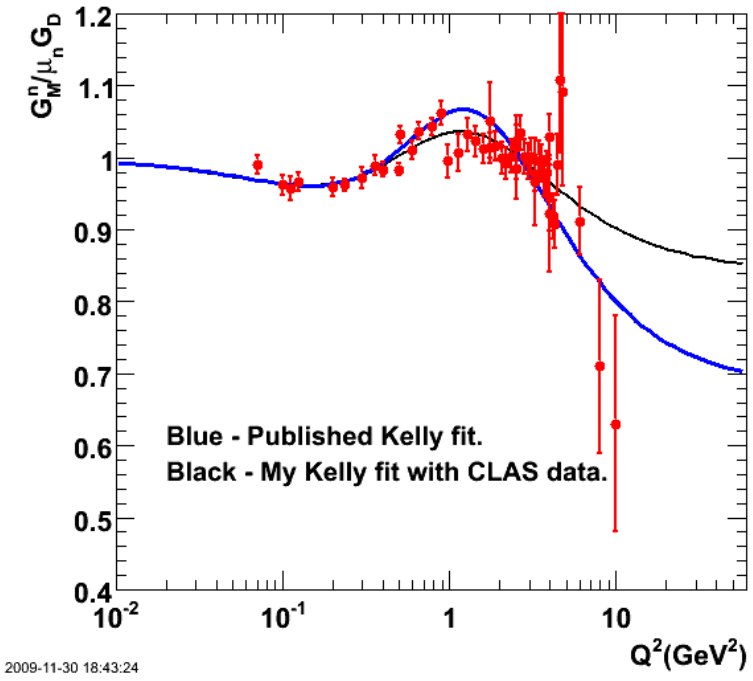


Fig 1. Effect of CLAS6 data on GMn systematics and Kelly fit.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (kelly3.C - root macro for fitting the GMn data.) you uploaded.

Click here to view the object (kellydata4.dat - data file used by kelly3.C) you uploaded.

Fit results for 50 data points (reduced chi-square = 53/(50-4) = 1.2:

```
 FCN=52.8335 FROM MIGRAD    STATUS=CONVERGED     175 CALLS         176 TOTAL
                     EDM=1.11051e-12    STRATEGY= 1  ERROR MATRIX UNCERTAINTY   2.2 per cent
  EXT PARAMETER                                   STEP         FIRST
  NO.   NAME      VALUE            ERROR          SIZE      DERIVATIVE
   1  a0           1.00000e+00     fixed
   2  a1           5.67910e+00   2.45971e+00   5.62196e-06  -1.44494e-05
   3  b1           1.82395e+01   2.93796e+00   8.52301e-06  -8.22959e-06
   4  b2           5.76231e+01   1.97045e+01   3.87078e-05   2.97935e-07
   5  b3           1.65855e+02   6.65421e+01   1.44184e-04   8.03867e-07
```

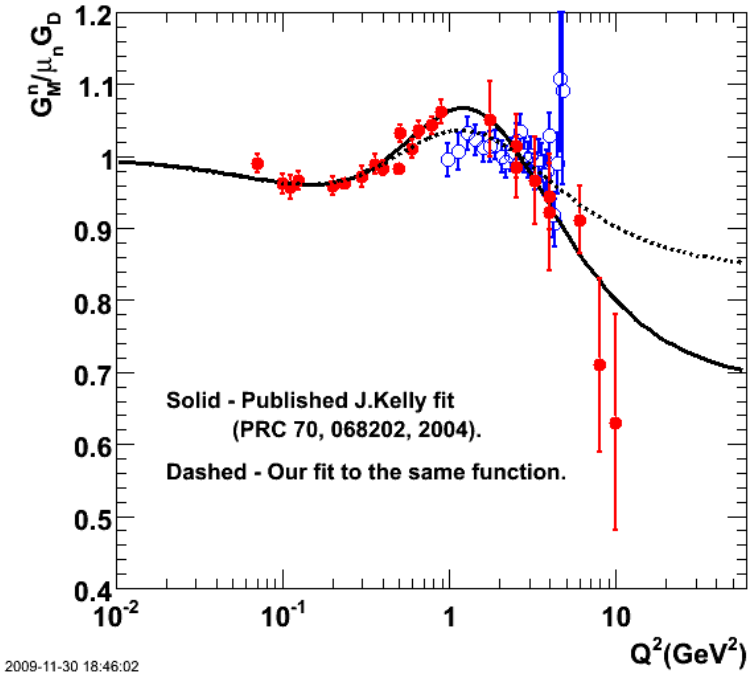


Fig 2. Same as fig 1 with CLAS6 data in blue.

Click here to view the object (Root macro) you uploaded.

Revised run statistics using the new kelly fit for GMn (including CLAS6 data) for BW. Used Galster for GEn.

Q	Proton rate	Neutron rate	Proton Counts	Proton %uncertainty	Neutron Counts	Neutron %uncertainty
2.5	0.015664321722917665	0.08305886259449724	30451.441429351937	0.005730546917102231	161466.4288837026	0.002488621678161966
3.5	0.7436092074672637	0.1129929820280193	1.4455762993163604e6	0.0008317244918892214	219658.3570624695	0.002133664514996589
4.5	0.33951432963795236	0.09111144719816003	660015.8568161794	0.0012309001233995697	177120.65335322308	0.0023761037363663217
5.5	0.1407088701242661	0.04137929373538244	273538.0435215733	0.0019120142814848112	80441.34702158345	0.0035258215899679184
6.5	0.06075673926118189	0.015973606424833562	118111.1011237376	0.0029097430585896446	31052.69088987644	0.005674797645884274
7.5	0.0281939814923666	0.006971331435340405	54809.100021160666	0.004271433648775024	13552.268310301746	0.00859001662467308
8.5	0.014347604117582345	0.0033429103927020963	27891.742404580076	0.005987729564105466	6498.617803412874	0.012404792441487898
9.5	0.008162158623623237	0.001727581662076561	15867.236364323571	0.007938699340905417	3358.4187510768343	0.017255699812087803
10.5	0.005004376963136809	0.0009491331997316755	9728.508816337955	0.010138573678583956	1845.1149402783772	0.02328028470973622
11.5	0.00291240611659749	0.0005488516233467236	5661.71749066552	0.013290028199854649	1066.9675557860305	0.030614304193453925
12.5	0.0017689870724477215	0.00033156186318235054	3438.9108688383703	0.017052558187748524	644.5562620264894	0.03938851285488918
13.5	0.0011151639847727889	0.00020804270160632458	2167.8787863983016	0.021477439393163354	404.43501192269497	0.0497250956618184

Revised run statistics using the new kelly fit for GMn (including CLAS6 data) and the Kelly fits for GMp and GEp and Galster for GEn.

2

Q	Proton rate	Neutron rate	Proton Counts	Proton %uncertainty	Neutron Counts	Neutron %uncertainty
2.5	0.016775697691450382	0.08305886259449724	32611.956312179544	0.0055374723930396025	161466.4288837026	0.002488621678161966
3.5	0.786127185725518	0.1129929820280193	1.5282312490504067e6	0.000808919793063151	219658.3570624695	0.002133664514996589
4.5	0.34853755731287195	0.09111144719816003	677557.011416223	0.0012148623643900628	177120.65335322308	0.0023761037363663217
5.5	0.13908402074148044	0.04137929373538244	270379.33632143796	0.0019231504070286172	80441.34702158345	0.0035258215899679184
6.5	0.057595152083243006	0.015973606424833562	111964.9756498244	0.0029885388439405544	31052.69088987644	0.005674797645884274
7.5	0.0255972017319269	0.006971331435340405	49760.960166865894	0.004482864625380265	13552.268310301746	0.00859001662467308
8.5	0.012477445821784686	0.0033429103927020963	24256.154677549428	0.006420798239428488	6498.617803412874	0.012404792441487898
9.5	0.006806105696310663	0.001727581662076561	13231.069473627927	0.008693657471756017	3358.4187510768343	0.017255699812087803
10.5	0.004007097232882635	0.0009491331997316755	7789.797020723843	0.011330183126847297	1845.1149402783772	0.02328028470973622
11.5	0.0022431423740827783	0.0005488516233467236	4360.668775216921	0.015143401950706611	1066.9675557860305	0.030614304193453925
12.5	0.0013129012820024056	0.00033156186318235054	2552.280092212676	0.01979410335039789	644.5562620264894	0.03938851285488918
13.5	0.000798964970003407	0.00020804270160632458	1553.187901686623	0.02537394536961676	404.43501192269497	0.0497250956618184

Run statistics in CLAS12 GMn proposal.

Q^2 $(GeV/c)^2$	Proton Rate (s^{-1})	Neutron Rate (s^{-1})	Proton Counts	Proton Error	Neutron Counts	Neutron Error	$\frac{\delta G_M^n}{G_M^n}$
2.5	0.016	0.081	3.0×10^4	0.0057	1.6×10^5	0.0025	0.0031
3.5	0.74	0.12	1.4×10^6	0.00083	2.3×10^5	0.0021	0.0011
4.5	0.34	0.098	6.6×10^5	0.0012	1.9×10^5	0.0023	0.0013
5.5	0.14	0.046	2.7×10^5	0.0019	8.9×10^4	0.0033	0.0019
6.5	0.061	0.018	1.2×10^5	0.0029	3.5×10^4	0.0053	0.0030
7.5	0.028	0.0081	5.5×10^4	0.0043	1.6×10^4	0.0080	0.0045
8.5	0.014	0.0040	2.8×10^4	0.00607	7.7×10^3	0.011	0.0064
9.5	0.0082	0.0021	1.6×10^4	0.0079	4.0×10^3	0.016	0.0088
10.5	0.0050	0.0012	9.7×10^3	0.010	2.2×10^3	0.021	0.012
11.5	0.0029	0.00068	5.7×10^3	0.013	1.3×10^3	0.028	0.015
12.5	0.0018	0.00041	3.4×10^3	0.017	8.0×10^2	0.035	0.020
13.5	0.0011	0.00026	2.2×10^3	0.021	5.0×10^2	0.044	0.025

Table 3: Rates and statistical uncertainties for quasielastic scattering.

Fig 2. Run statistics in CLAS12 GMn proposal.

The next plot shows a comparison of the Kelly fits before and after adding the CLAS6 GMn data (like fig 1) and the Kelly fit to the GMp data. This comparison was motivated by the comment in the Albrecico paper that adding the CLAS6 GMn data to the world's data made the GMn fit look more like GMp. It certainly does not look like that here??!!

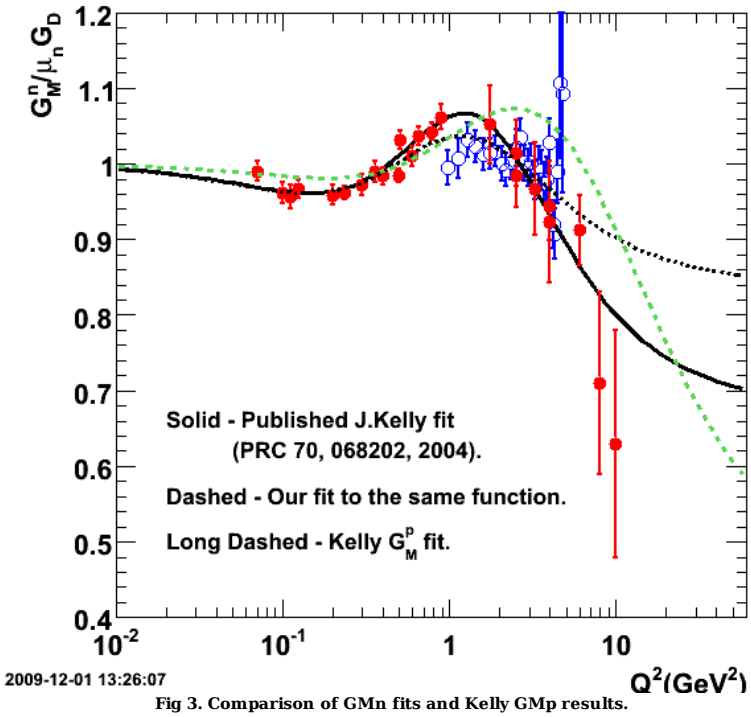


Fig 3. Comparison of GMn fits and Kelly GMp results.

Click here to view the object (ROOT macro) you uploaded.

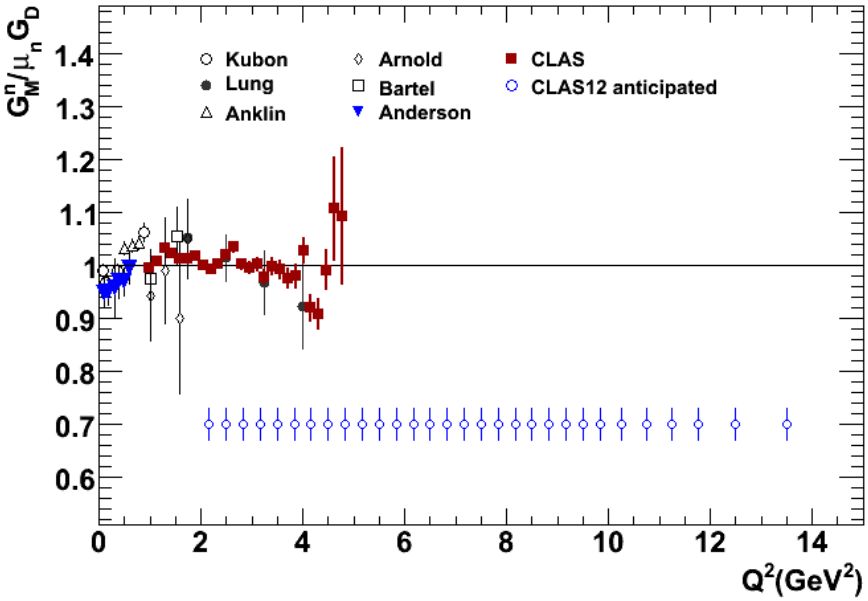


Fig 4. Revised plot of anticipated CLAS12 GMn data with smaller bins at lower Q2.

Click here to view the object (ROOT macro) you uploaded.

Q^2	Proton rate	Neutron rate	Proton Counts	Proton %uncertainty	Neutron Counts	Neutron %uncertainty	uncertainty in GMn
2.16667	0.00942112	0.0720786	18314.7	0.00738925	140121.	0.00267146	0.00392867
2.5	0.00476094	0.0362942	9255.27	0.0103945	70555.9	0.00376473	0.00552765
2.83333	0.188165	0.0254102	365793.	0.00165342	49397.5	0.00449933	0.00239675
3.16667	0.263634	0.0408762	512505.	0.00139685	79463.4	0.00354745	0.00190628
3.5	0.238497	0.0521938	463638.	0.00146862	101465.	0.00313937	0.00173295
3.83333	0.191131	0.0544178	371558.	0.00164054	105788.	0.00307455	0.00174243
4.16667	0.145933	0.0503868	283694.	0.00187748	97952.	0.00319516	0.00185297
4.5	0.10909	0.0432369	212071.	0.0021715	84052.5	0.00344925	0.00203794
4.83333	0.0808496	0.0350841	157172.	0.00252239	68203.5	0.0038291	0.00229262
5.16667	0.0597958	0.0271232	116243.	0.00293303	52727.5	0.00435493	0.00262527
5.5	0.0442973	0.0199357	86113.9	0.00340772	38754.9	0.00507968	0.00305842
5.83333	0.0329448	0.0143374	64044.8	0.00395147	27871.9	0.00598986	0.00358791
6.16667	0.0246357	0.0104772	47891.9	0.0045695	20367.6	0.00700696	0.00418264
6.5	0.018544	0.0077679	36049.6	0.00526684	15100.8	0.00813767	0.00484668
6.83333	0.0140639	0.00583556	27340.3	0.00604781	11344.3	0.00938881	0.00558403
7.16667	0.0107559	0.00443701	20909.5	0.00691558	8625.55	0.0107673	0.00639843
7.5	0.00830198	0.00341113	16139.	0.00787156	6631.24	0.0122801	0.0072932
7.83333	0.00647252	0.0026493	12582.6	0.00891487	5150.24	0.0139343	0.00827104
8.16667	0.00510133	0.00207709	9916.99	0.0100418	4037.87	0.0157371	0.00933398
8.5	0.00406785	0.00164278	7907.89	0.0112453	3193.56	0.0176955	0.0104832
8.83333	0.00328428	0.0013099	6384.64	0.012515	2546.44	0.0198168	0.0117189
9.16667	0.00268649	0.00105244	5222.53	0.0138376	2045.95	0.0221081	0.0130408
9.5	0.00222741	0.000851634	4330.08	0.0151968	1655.58	0.0245768	0.0144479
9.83333	0.00187236	0.00069376	3639.87	0.0165751	1348.67	0.02723	0.015939
10.25	0.00230282	0.00109679	4476.68	0.0149459	2132.15	0.0216566	0.0131566
10.75	0.00170374	0.00082398	3312.07	0.017376	1601.82	0.0249858	0.0152169
11.25	0.00127609	0.000626659	2480.73	0.0200775	1218.22	0.0286508	0.0174927
11.75	0.000966761	0.000482016	1879.38	0.0230671	937.039	0.0326679	0.0199955
12.5	0.0013129	0.000331562	2552.28	0.0197941	644.556	0.0393885	0.0220412
13.5	0.000798965	0.000208043	1553.19	0.0253739	404.435	0.0497251	0.0279125

Fig 5. CLAS12 GMn run statistics assuming Kelly fit results for GMp and GEp, Galster for GEn, and my kelly-like fit for GMn. Used variable bins.

Click here to view the object (Mathematica notebook) you uploaded.

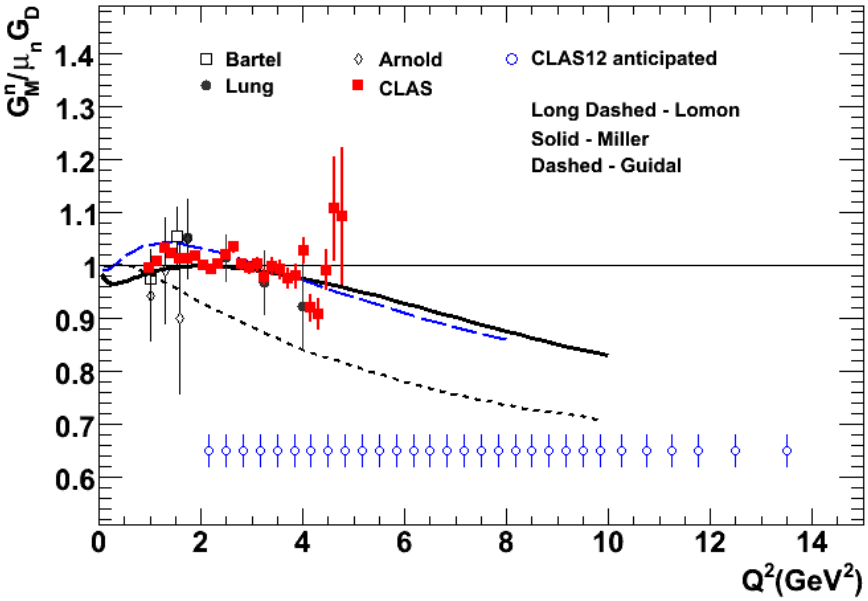


Fig 6. Updated plot of anticipated CLAS12 GMn data.

Click here to view the object (ROOT macro) you uploaded.

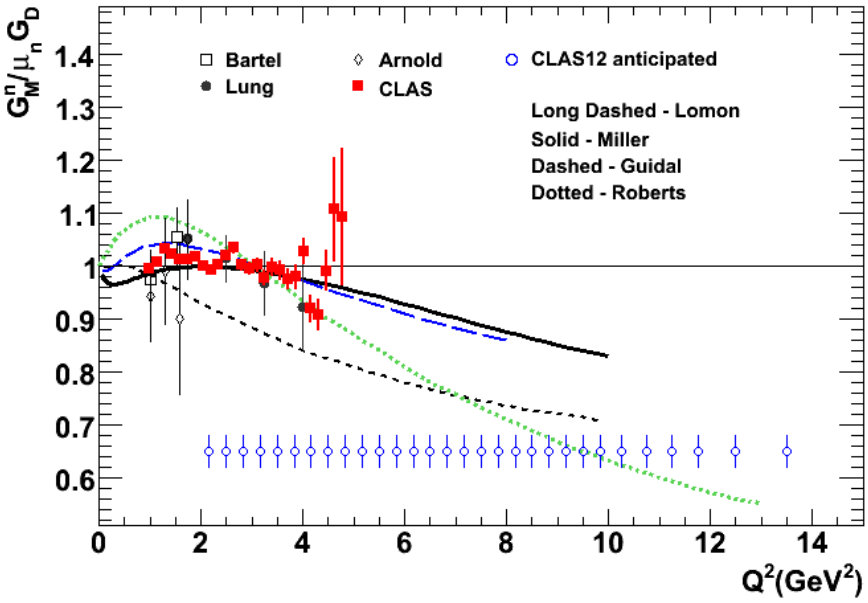


Fig 7. New anticipated CLAS12 data and Craig Roberts curve.

Click here to view the object (Root macro) you uploaded.

Throw out the first four points in Fig 7 because there is no neutron acceptance in that range.

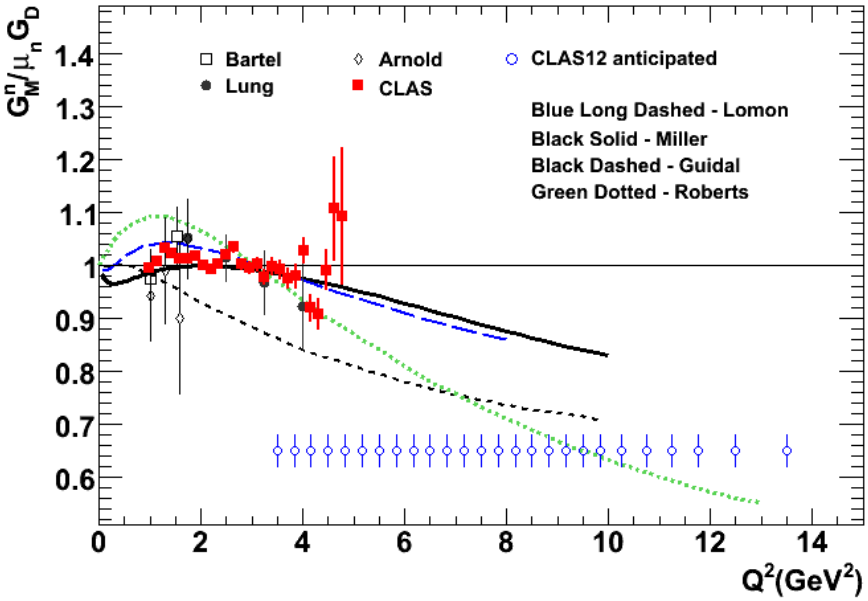


Fig 8. Same as Fig 7 with low-Q2 points removed because of acceptance/detection efficiency effects.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 297 - GEn/GMn (gpg)

[Modified Tue Dec 1 14:24:29 2009 (GMT) gpg]

Study of GEn/GMn for update. The first plot shows the ratio mu_n*GEn/GMn assuming the dipole for GMn and Galster for GEn.

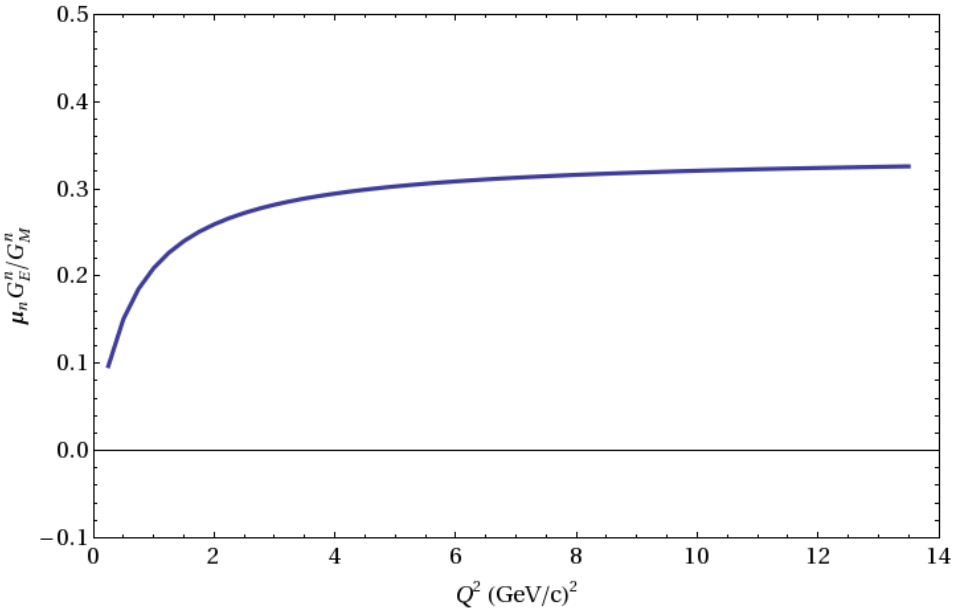


Fig 1. GEn/GMn plot.

Click here to view the object (Mathematica notebook) you uploaded.

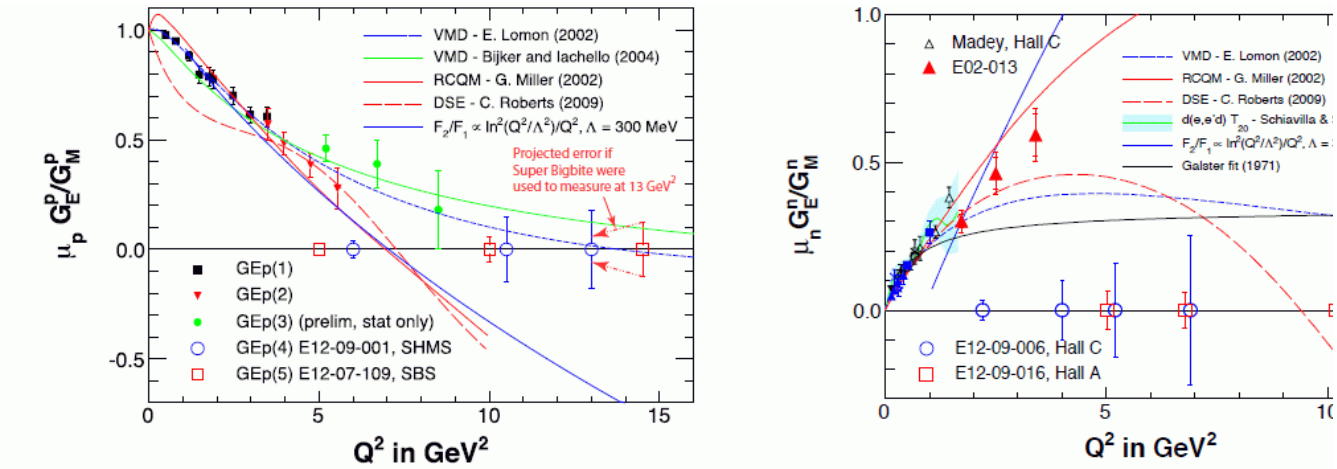
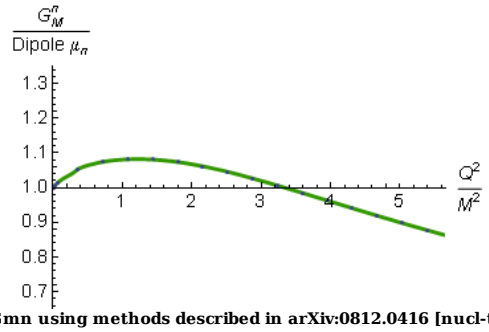


Fig. 1. Shown are existing data and projected errors for measurements of the ratios of tl and magnetic form factors of the proton (left panel) and neutron (right panel). The errors for the measurements made within the Super Bigbite project are shown by the squares. On the left panel are shown the published results of GEp(1)[1], GEp(2)[8], pr results from GEp(3)[9], the proposed points of GEp(4) with SHMS in a 90-day run[10] projected results of GEp(5) in a 60-day run[11]. To emphasize the larger statistical power of ten) of GEp(5), we indicate on the figure the size of the error bars that would be using SBS to run at 13 GeV^2. On the right-hand panel, for G_E^n/G_M^n, we show publis including those due to Madey and coworkers[12], and preliminary results of GEn(1) (E(We also show the projected errors of GEn(2)[14], which is part of the Super Bigbite pro E12-09-006[15] with SHMS (open blue points). Note that at roughly 7 GeV^2, the highes the SHMS experiment, GEn(2) achieves an error four times smaller, and with one quar running time. This illustrates the $\times 50$ advantage in Figure-of-Merit of GEn(2) over t experiment.

Fig 2. Plot from Kees paper showing predictions for GEn/GMn.

Click here to view the object (Kees paper with fig 2 plot in PDF.) you uploaded.



Plot from Craig Roberts of reduced Gmn using methods described in arXiv:0812.0416 [nucl-th], Few Body Syst. 46 (2009) pp. 1-36.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 298 - Fraction of events within W2 cut for CLAS12 GMn (gpg)

[Modified Wed Dec 2 18:09:46 2009 (GMT) gpg]

Plots inspired by Bogdan W. for fraction of events that are within the W2 cut on the W2 spectrum of events after the theta_pq and hermiticity cuts.

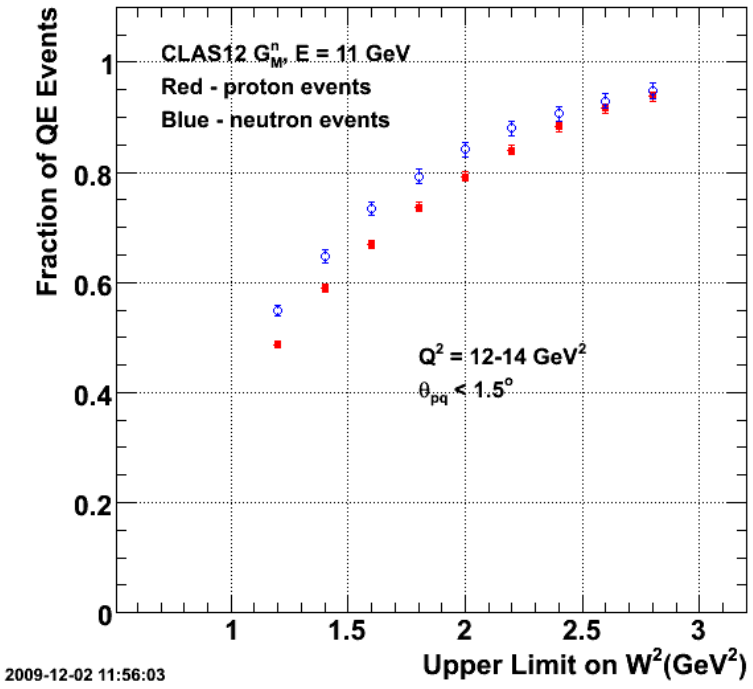


Fig 1. Fraction of proton (red) and neutron (blue) events that survive the W2 cut after the QE cut on theta_pq and the hermiticity cut.

Click here to view the object (QEfraction.C root macro.) you uploaded.

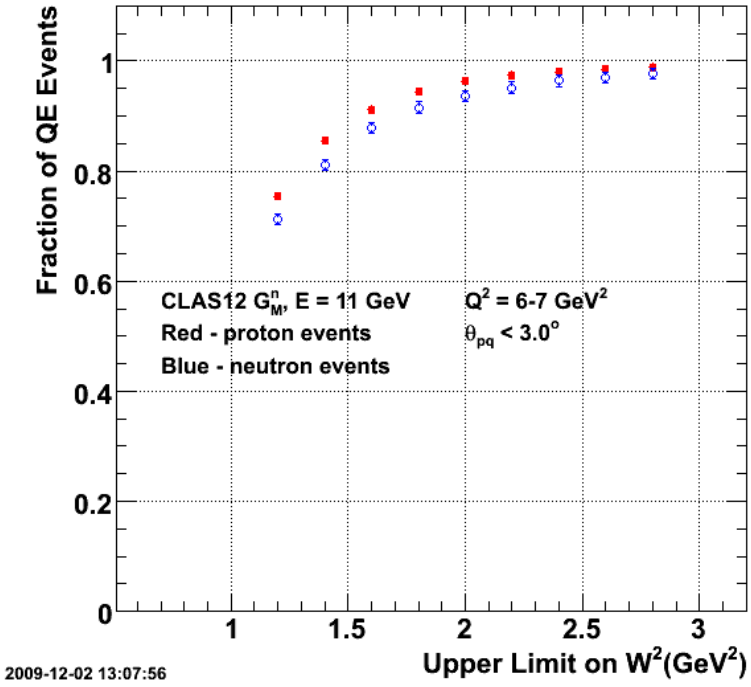


Fig 2. Same as fig 1 except for Q2 = 6-7 GeV2.

Click here to view the object (Q2fractionMidQ2.C root macro.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 299 - Update plots (gpg)

[Modified Tue Dec 15 21:37:48 2009 (GMT) gpg]

Stuff below is generated for the GMn update and for Hall A Gmn proposal with Bogdan W.

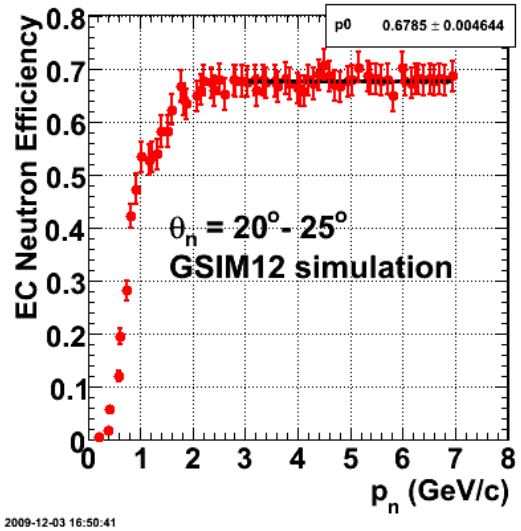


Fig 1. NDE for CLAS12.

Click here to view the object (ROOT macro) you uploaded.

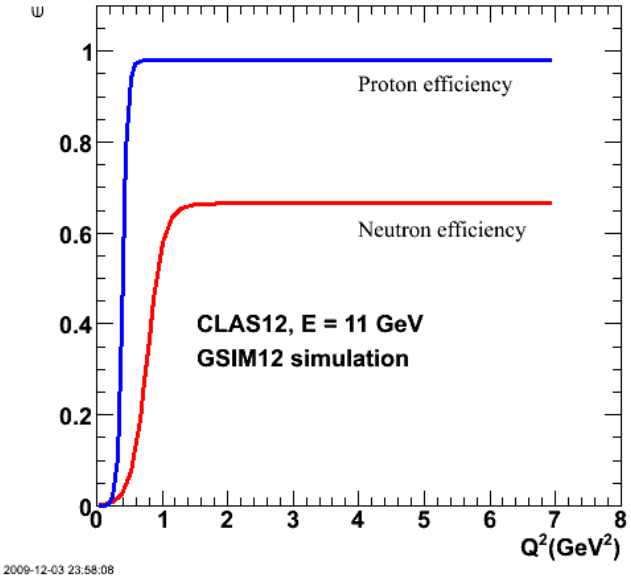


Fig 2. Neutron (blue) and proton (red) efficiency plots for CLAS12.

Click here to view the object (Root macro) you uploaded.

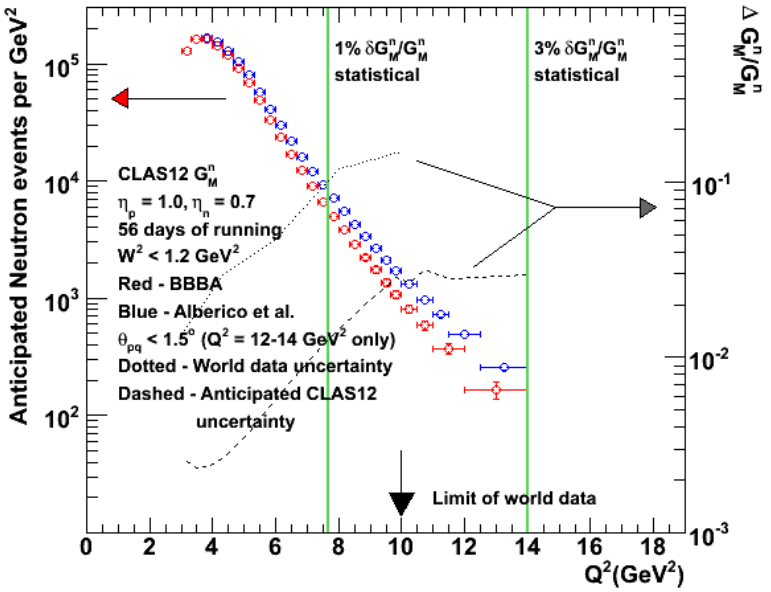


Fig 3. Run statistics plot for Hall A proposal and CLAS12 GMn update.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (worldUncertainties2.C root macro) you uploaded.

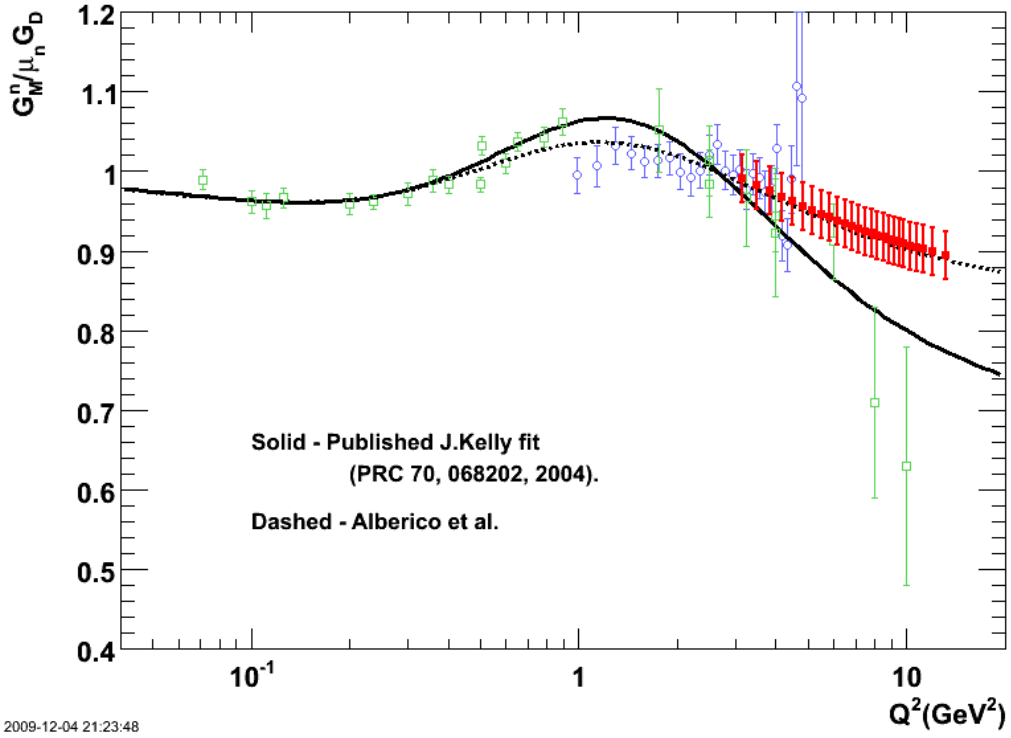


Fig 4. New 'anticipated data' plot.

Click here to view the object (Root macro) you uploaded.

Below is a tarred, zipped file containing histograms of the inelastics for Q2=12-14 GeV2 which show a factor of five drop in the number of IN events when the hermiticity cut is turned on. I ran this with way too many QE events so I am going to rerun the simulations with just QE events to speed things up.

Click here to view the object (gzipped tar archive of good IN hists.) you uploaded.

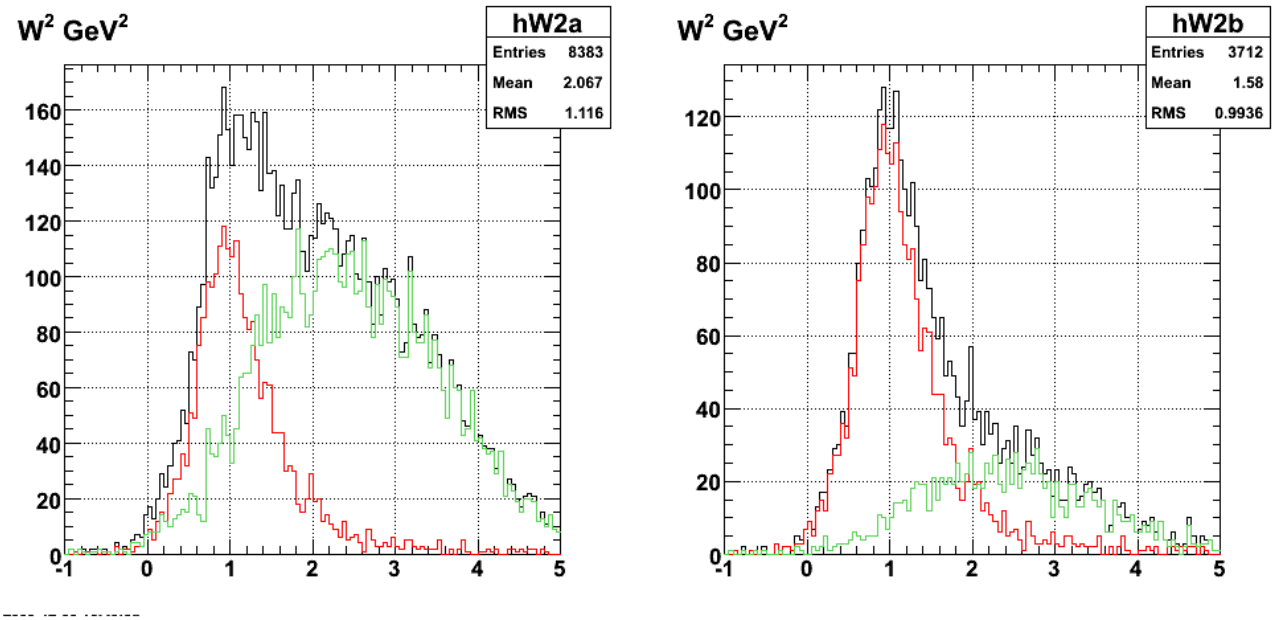


Fig 5. Progression of cuts to select QE events. Used submit_gmnsim.pl 700 50000 1, theta_pq < 1.5 deg.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Gzipped tar archive) you uploaded.

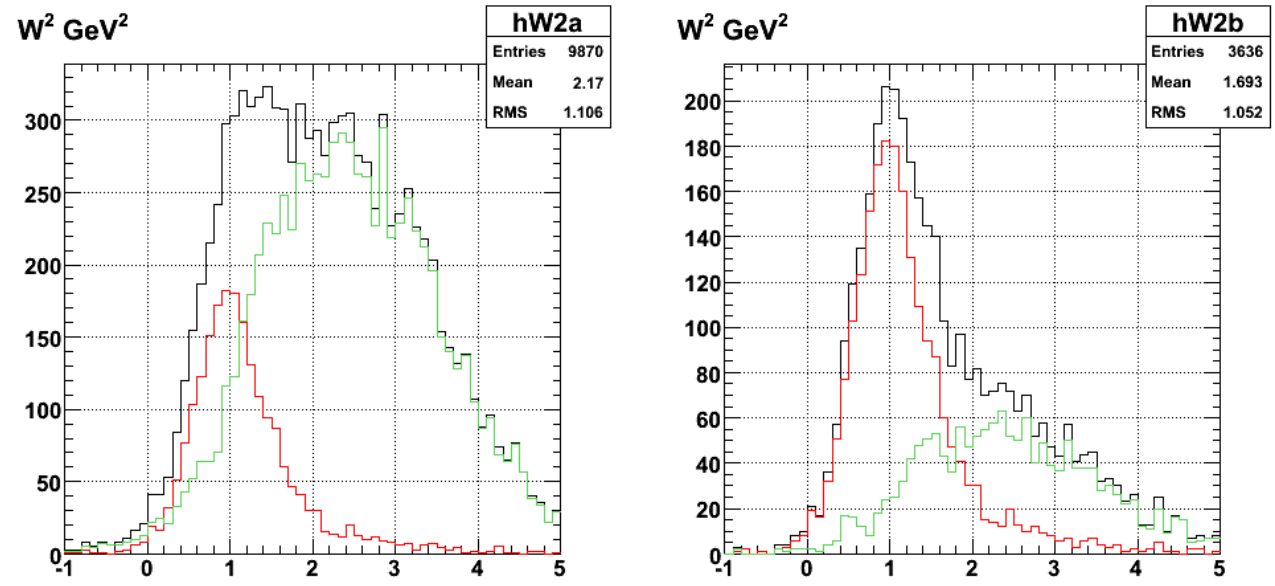


Fig 6. Progression of cuts to select QE events. Used submit_gmnsim.pl 600 50000 1, theta_pq < 1.5 deg.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Gzipped tar archive) you uploaded.

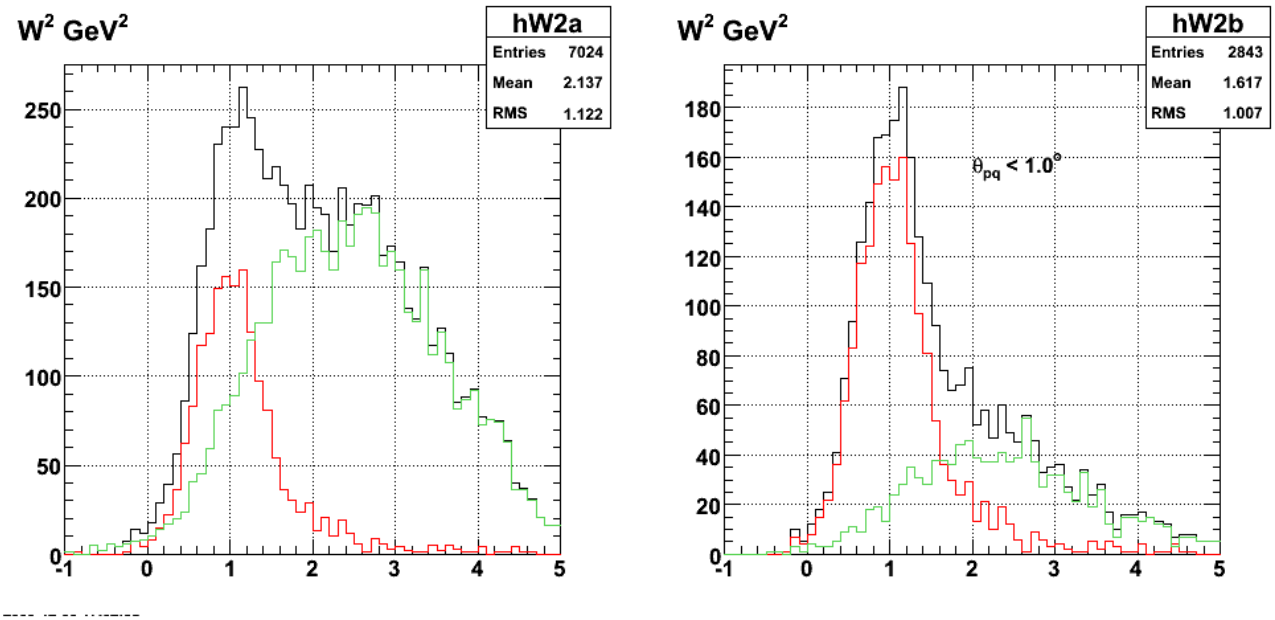


Fig 7. Progression of cuts to select QE events. Used submit_gmnsim.pl 600 50000 1, theta_pq < 1.0 deg.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Gzipped tar archive) you uploaded.

Now do this for submit_gmnsim.pl 1100 50000 1.

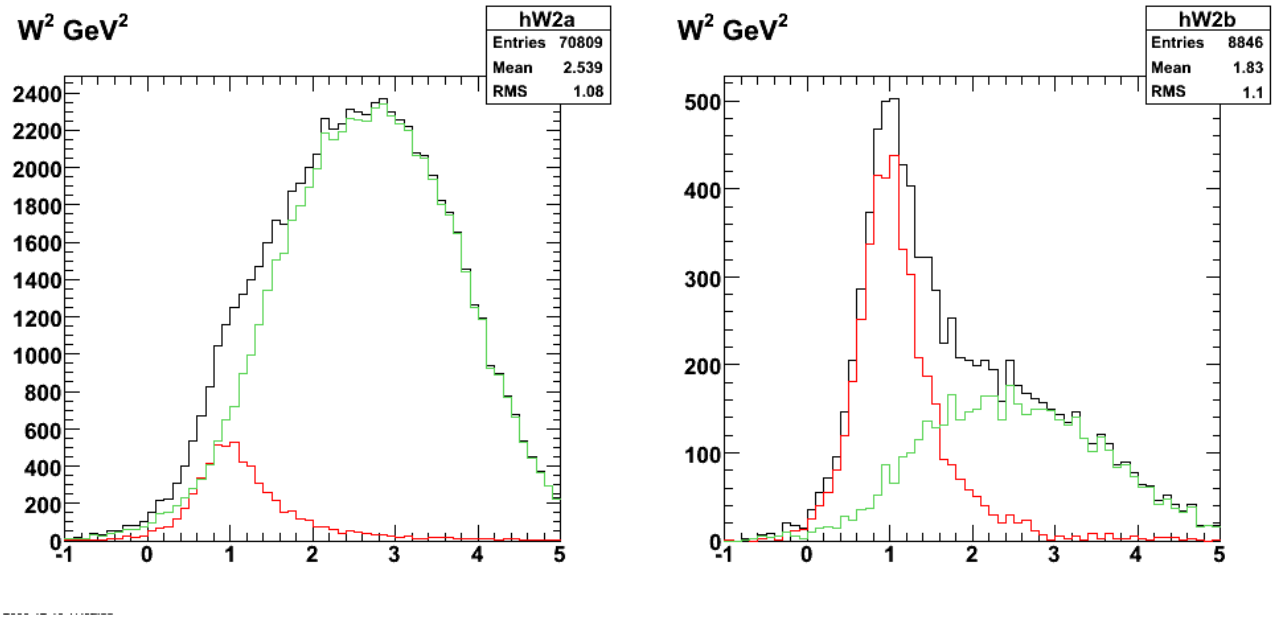


Fig 8. Progression of cuts to select QE events. Used submit_gmnsim.pl 1100 50000 1, theta_pq < 1.0 deg, F = 0.33.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (gzipped tar archive) you uploaded.

Had the wrong value of the theta_pq cut above (it was 1 deg and I wanted 1.5 deg).

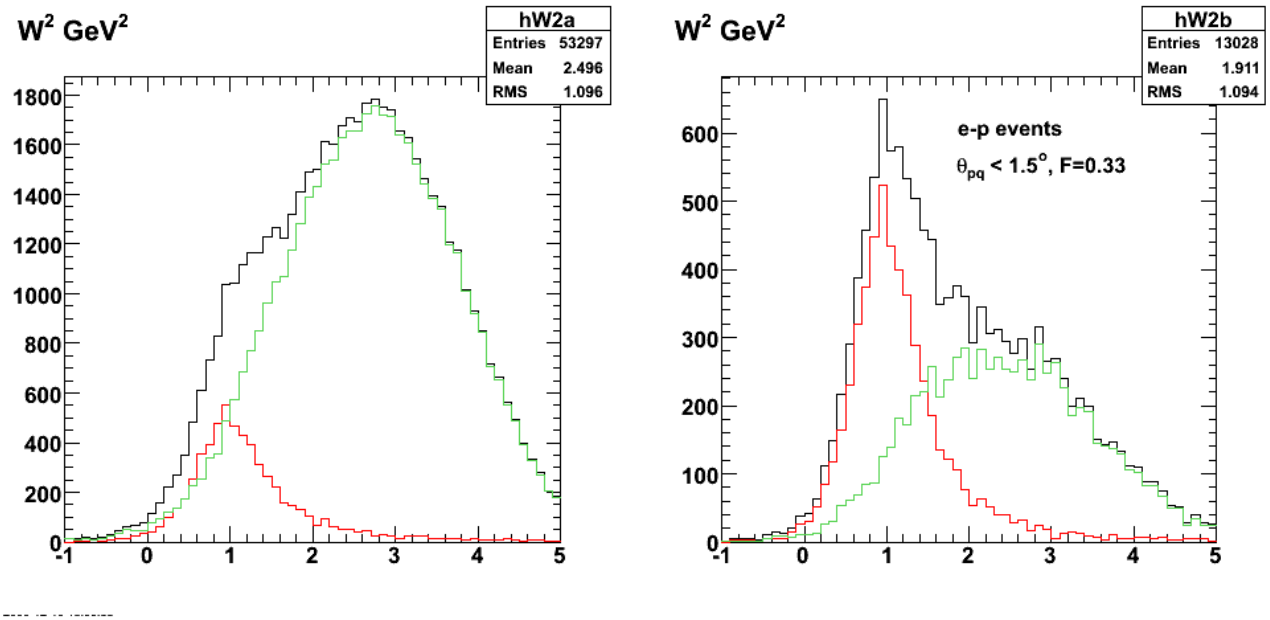


Fig 9. Progression of cuts to select QE e-p events. Used submit_gmnsim.pl 1100 50000 1, theta_pq < 1.5, F=0.33

Click here to view the object (Root macro) you uploaded.

Click here to view the object (gzipped tar archive) you uploaded.

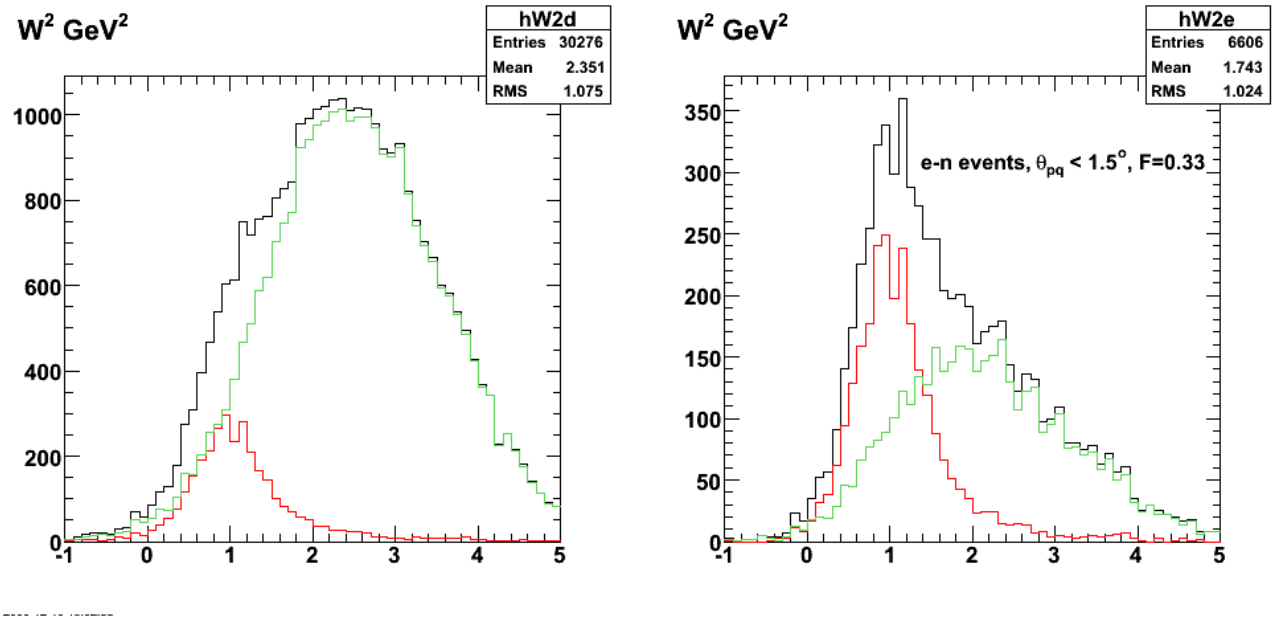


Fig 10. Progression of cuts to select QE e-n events. Used submit_gmnsim.pl 1100 50000 1, theta_pq < 1.5, F=0.33

Click here to view the object (Root macro) you uploaded.

Increase the amount of inelastic events to make it more realistic.

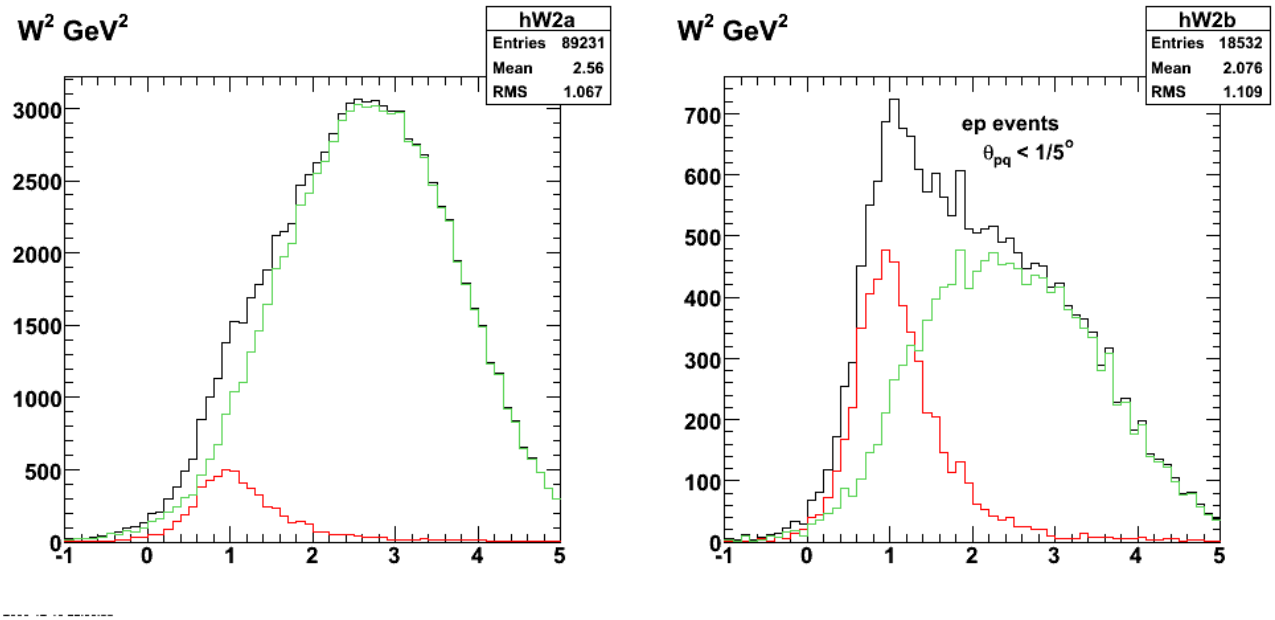


Fig 11. Progression of cuts to select QE e-p events. Used submit_gmnsim.pl 1100 200000 1, theta_pq < 1.5, F=0.33

Click here to view the object (Root macro) you uploaded.

Click here to view the object (gzipped tar archive) you uploaded.

Ratio of integrals.

```
ep events

in/total no hermiticity cut: 0.33
in/total hermiticity cut on: 0.10

en events

in/total no hermiticity cut: 0.45
in/total hermiticity cut on: 0.13
```

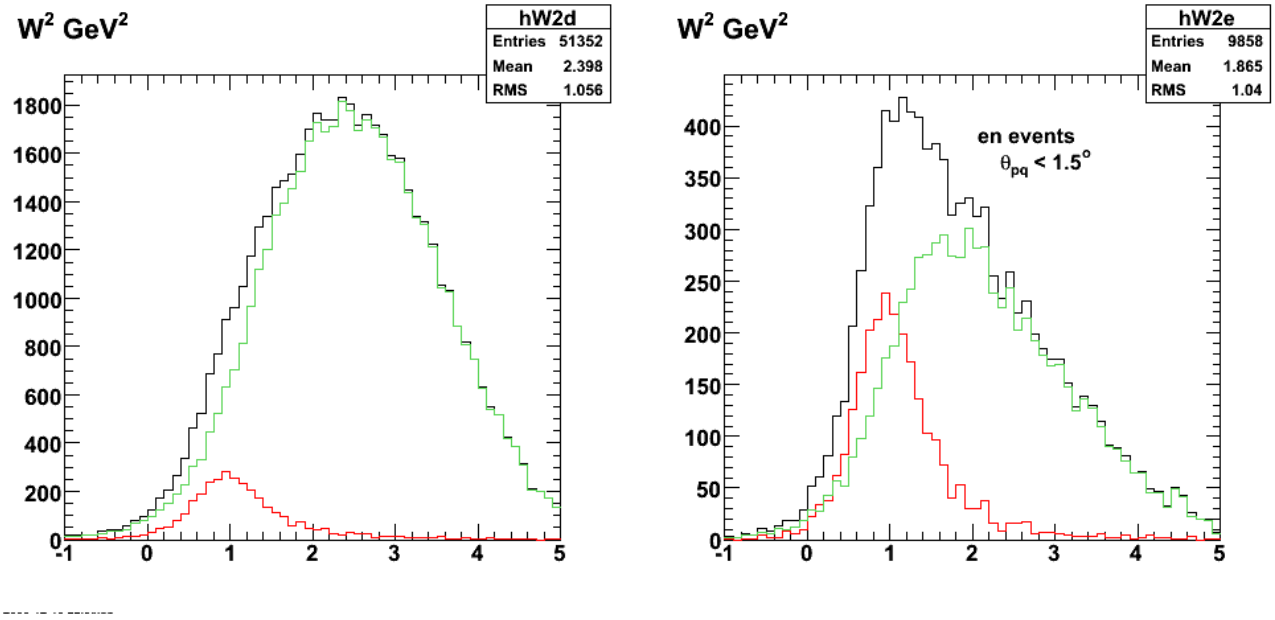


Fig 12. Progression of cuts to select QE e-n events. Used submit_gmnsim.pl 1100 200000 1, theta_pq < 1.5, F=0.33

Click here to view the object (Root macro) you uploaded.

Study of the theta_pq behavior. First 'raw' angular distributions.

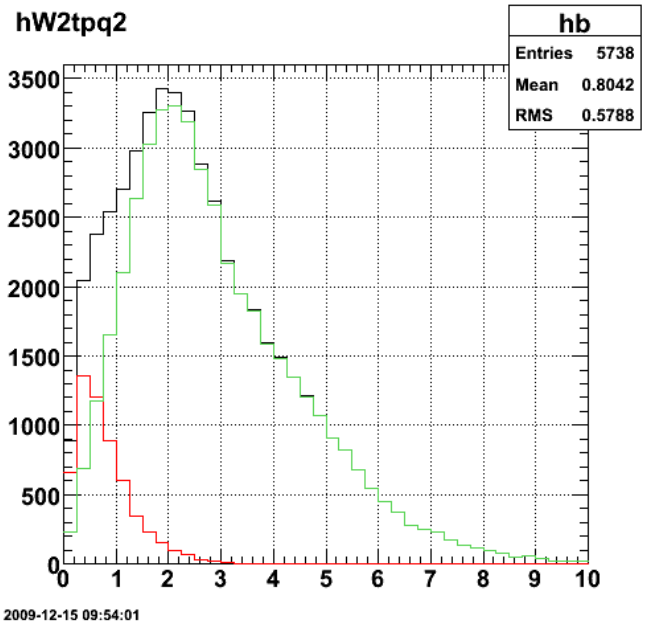


Fig 13. Angular distribution with no hermiticity cut for ep events and submit_gmnsim.pl 1100 200000 1, theta_pq < 1.5, F=0.33.

Problem!!! I have to manually set the Q2 range in myqueeg to agree with genevD.inp which is set to 11.5-14.5 GeV2.

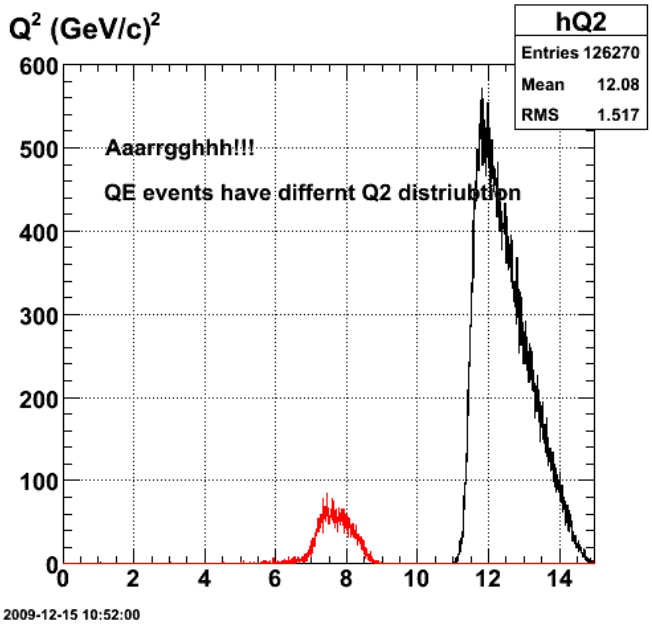


Fig 13. Problem with Q2 ranges for queeg and genevD. Red is QE, black is inelastic.

QE peak progression after fixing the wrong-Q2-range problem with the QE events discovered above.

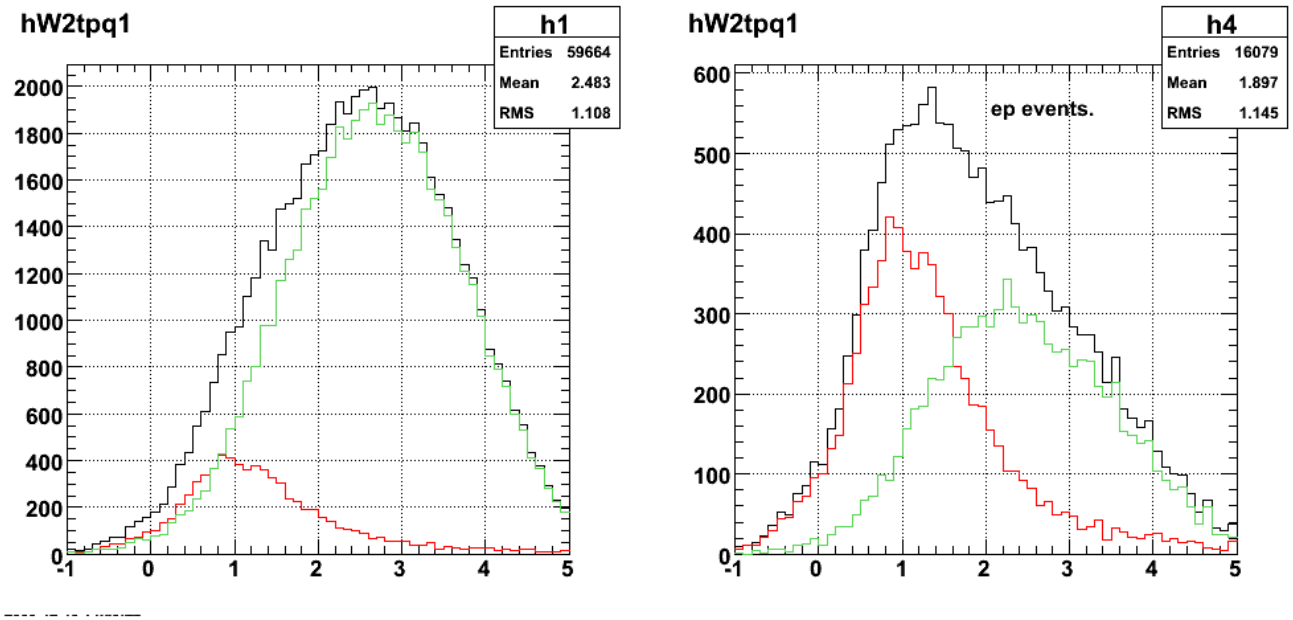


Fig 14. Progression of cuts to select QE e-p events. Used submit_gmnsim.pl 1100 200000 1, theta_pq < 1.5, F=0.33

Click here to view the object (ROOT macro) you uploaded.

Now turn on sharp Q2 cut for 12-14 GeV2.

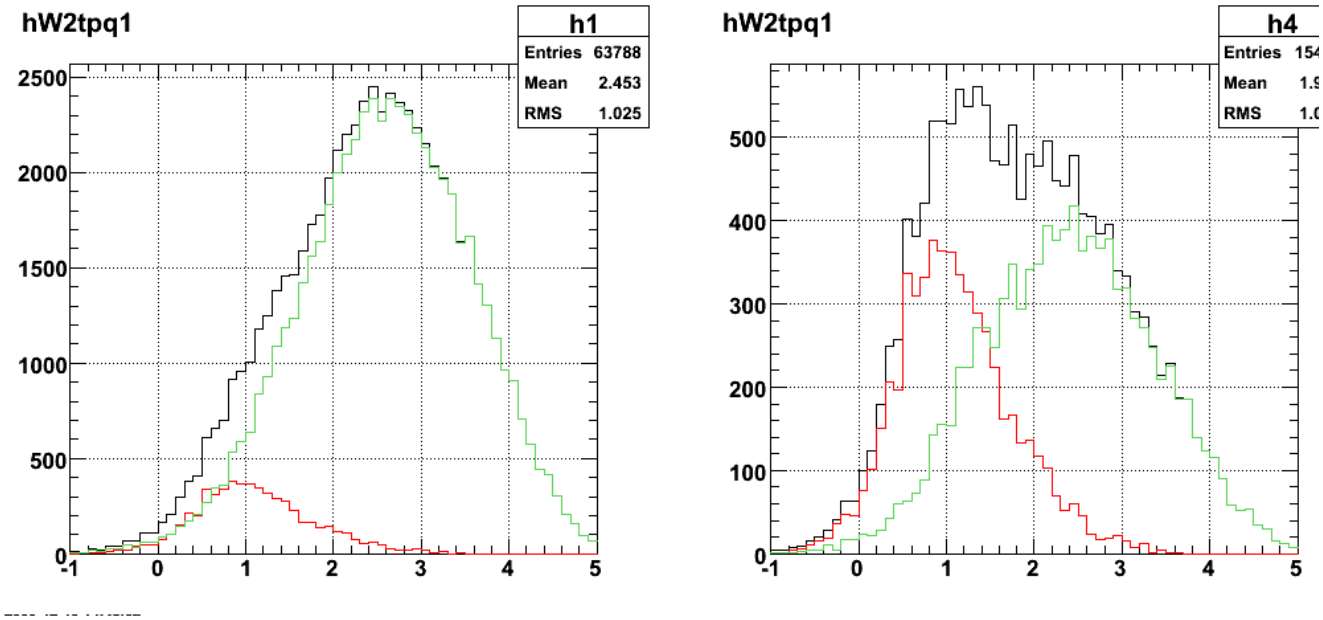


Fig 15. Progression of cuts to select QE e-p events. Used submit_gmnsim.pl 1100 200000 1, theta_pq < 1.5, F=0.33

increase the proportion of IN events.

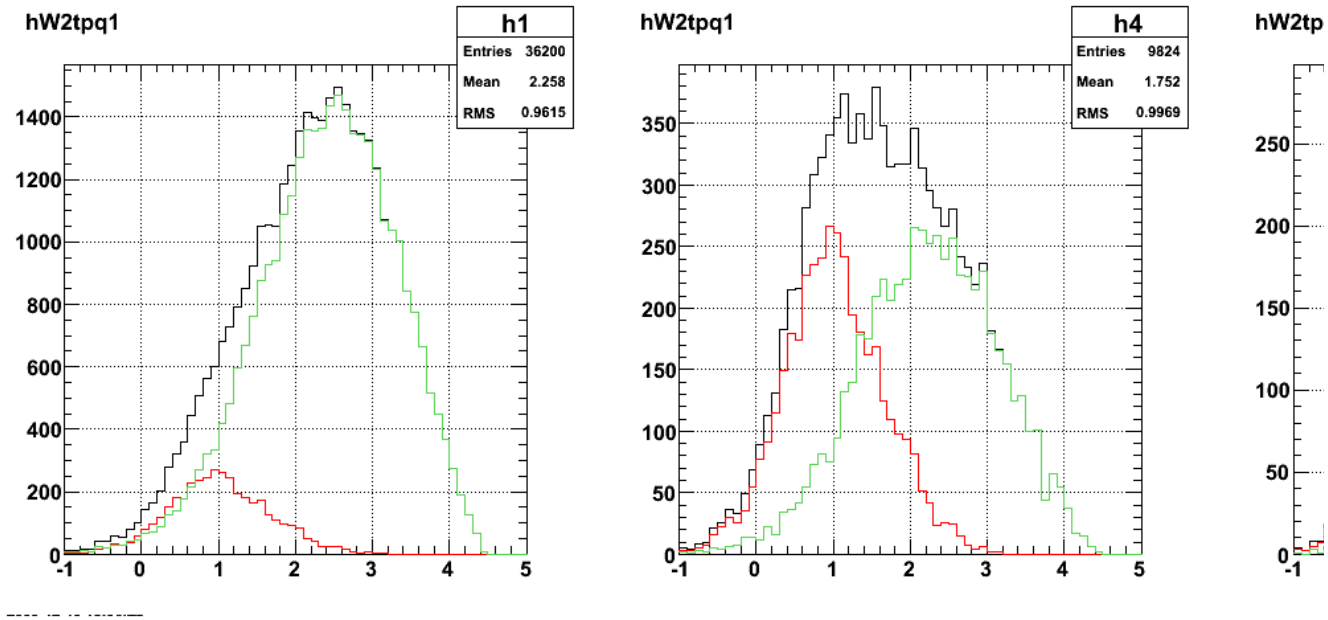


Fig 16. Progression of cuts to select QE e-p events. Used submit_gmnsim.pl 1100 325000 1, theta_pq < 1.5, F=0.33

Click here to view the object (ROOT macro) you uploaded.

maojor ooppss!! genevD was halting prematurely when it encountered a particle that was unknown to it. these turned out to be kaons (K+,K-,Kshort,Klong). i added the code to handle these and reran it.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 300 - Effect of changing exit channels in genevD (gpg)

[Modified Thu Dec 17 02:49:24 2009 (GMT) gpg]

Just cause I have nothing better to do and no deadlines are breathing down my neck, I decided to look at the effect of changing the composition of the decay channels chosen in genevD and set in genev_template.inp. I tried turning everything on and rediscovered what I dimly remember from two years ago. The first plot shows the standard set.

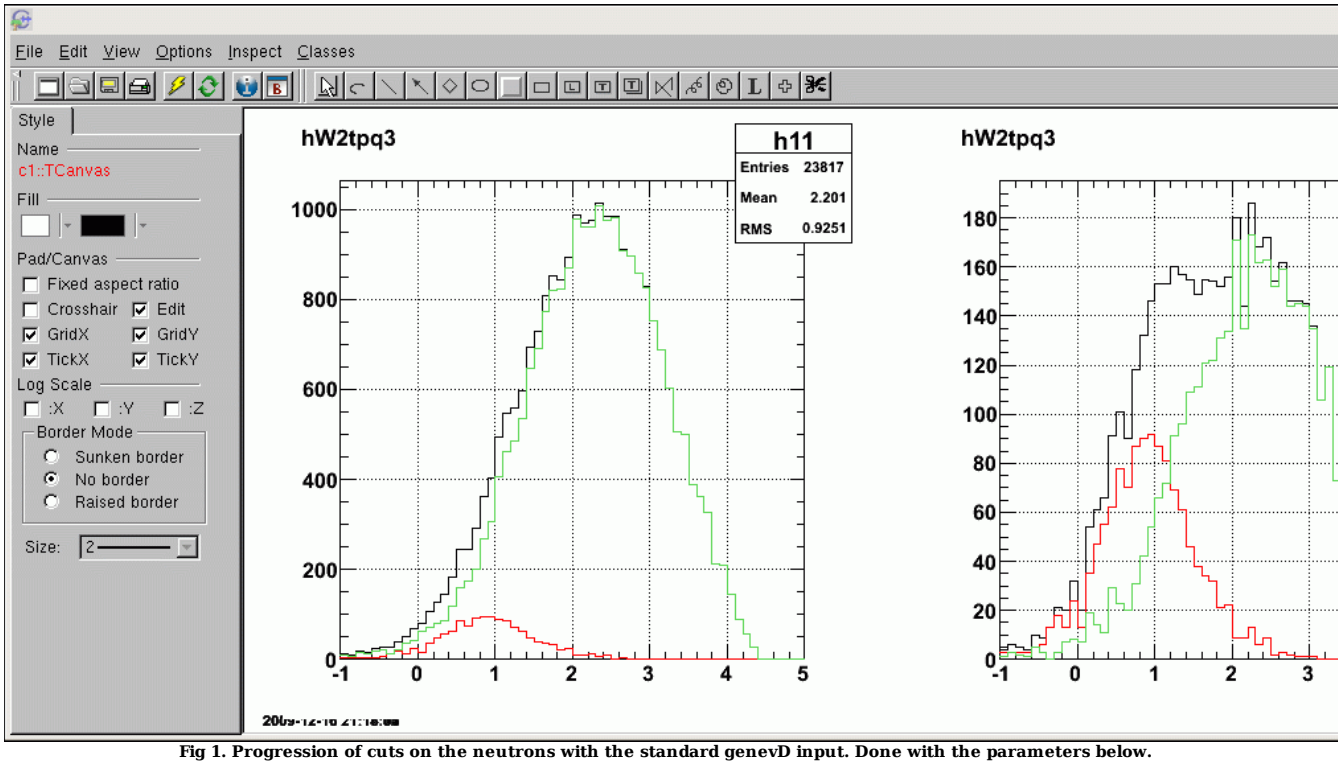


Fig 1. Progression of cuts on the neutrons with the standard genevD input. Done with the parameters below.

```
submit_gmnsim.pl 1000 23000 1

15              ! number of activated channels
1,2,5,6,7,11,12,15,16,19,21,22,27,28,29           ! channels ID (in one line, ID separated by a comma.g 1,3,4 ...)
```

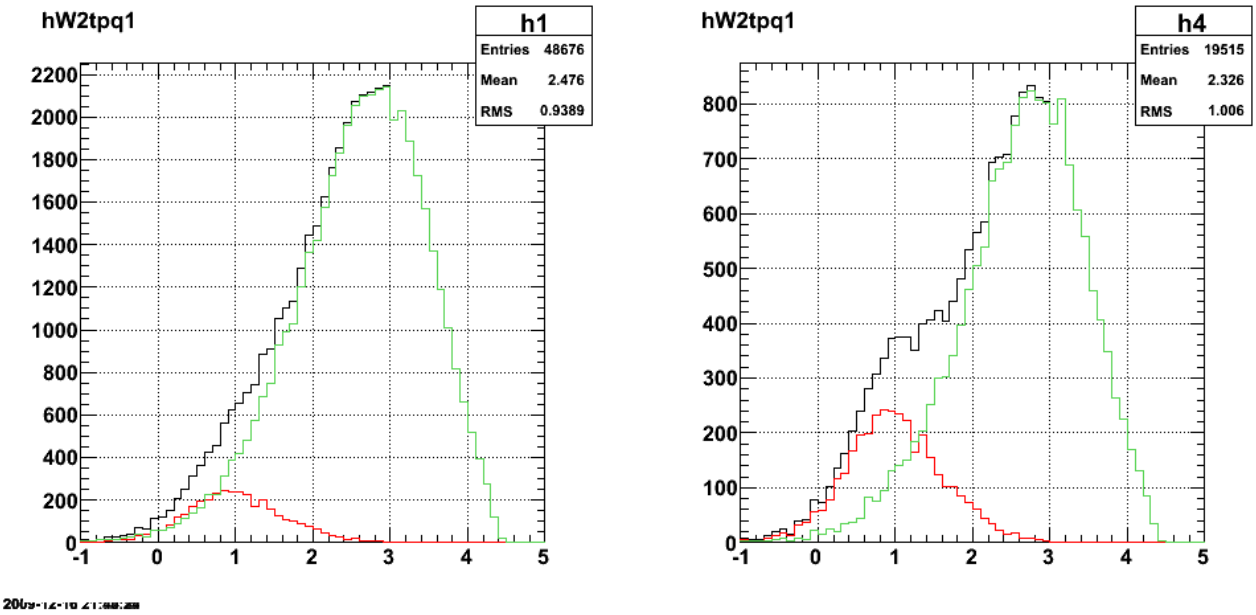


Fig 2. Turn everybody except the strangeness-producing decay channels cause they screw things up (see elog 09-dec-16).

```
submit_gmnsim.pl 1000 23000 1

27              ! number of activated channels
1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,27,28,29           ! channels ID (in one line, ID separated by a comma.g 1,3,4 ...)
```

The conclusions seems to be as before. The inelastic cross section in the standard set rises more rapidly with W2 than when I turn all the channels on (except the strangeness-producing ones). With the everybody-on settings I do get more inelastic events which may be because the multiplicity is higher so the number of events that gets through FastMC12 is larger. Go back to the standard set.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 301 - Progression of cuts plot for update (gpg)

[Modified Sun Jan 3 03:03:08 2010 (GMT) gpg]

After the problem with the strangeness-producing channels in genevD, I redo the progression of cuts plots for the update. The first pair of plots is a test run before I do a real long run to get good statistics. Look to the bottom of this entry for the final results.

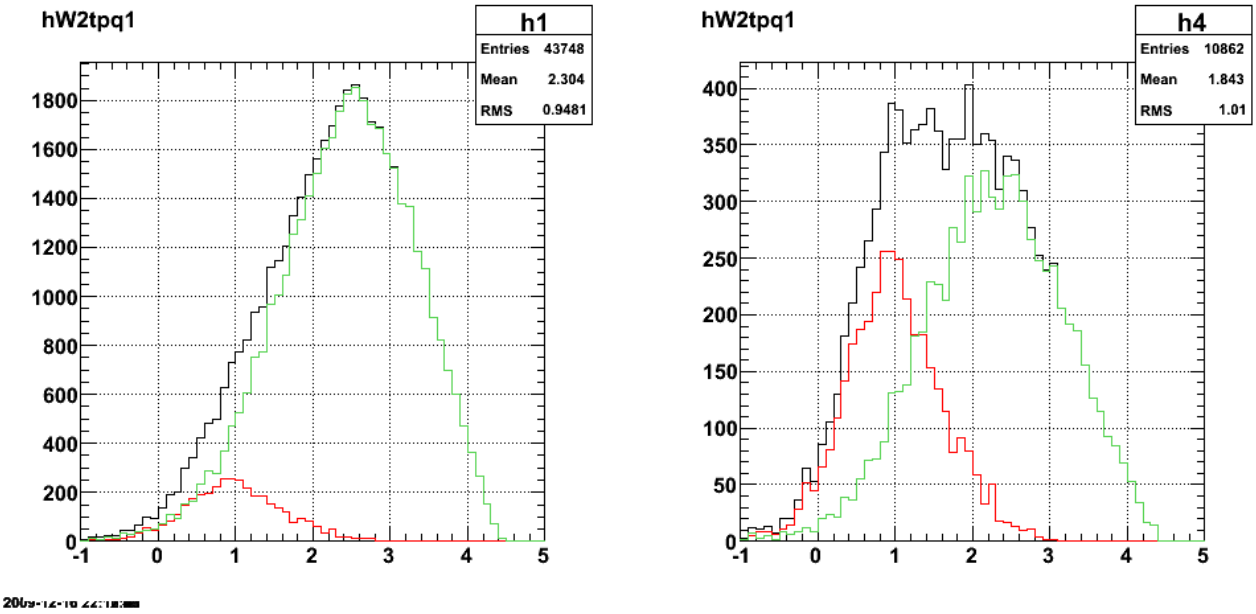


Fig 1. Progression of cuts for ep events using submit_gmnsim.pl 1100 23000 1, theta_pq < 1.5, F=0.33.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Gzipped tar archive) you uploaded.

Integrals:

```
root [150] inNocut
(Float_t)8.8900000000000000e+02
root [151] totalNocut
(Float_t)3.2150000000000000e+03
root [152] fracNocut
(Float_t)2.7651631832122802 7e-01


root [158] inCut
(Float_t)1.6200000000000000e+02
root [159] totalCut
(Float_t)2.4880000000000000e+03
root [160] fracCut
(Float_t)6.5112538635730743 4e-02
root [161]
```

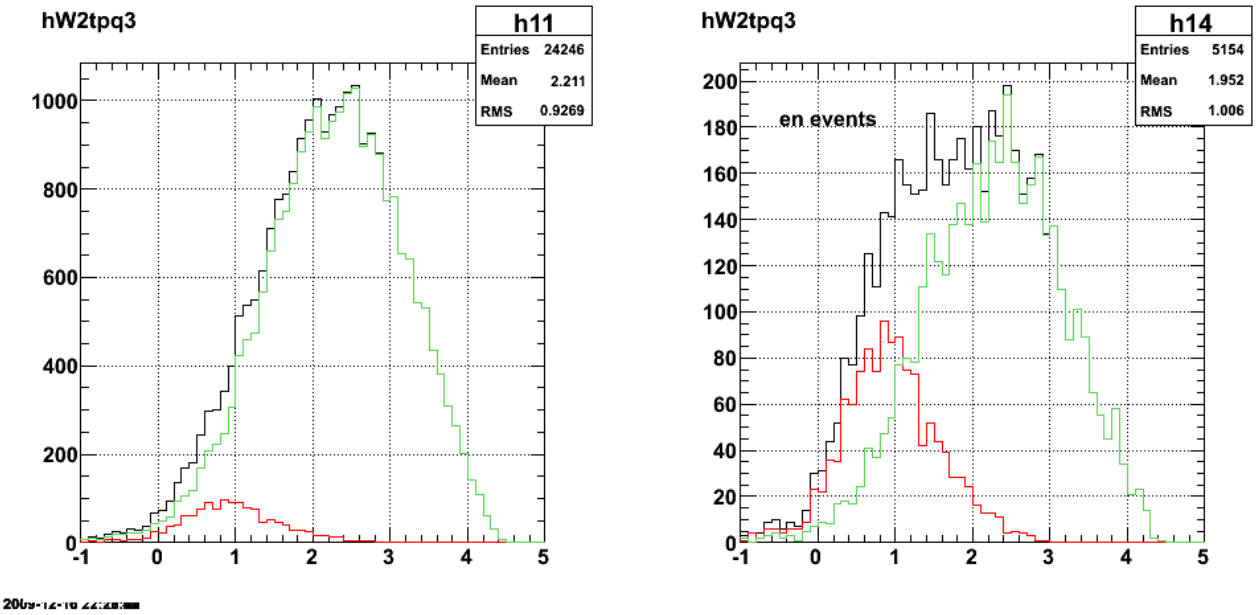


Fig 2. Progression of cuts for en events using submit_gmnsim.pl 1100 23000 1, theta_pq < 1.5, F=0.33.

Click here to view the object () you uploaded.

```
root [210] inNocut
(Float_t)4.58000000000000000e+02
root [211] totalNocut
(Float_t)1.31900000000000000e+03
root [212] fracNocut
(Float_t)3.47232758998870850e-01


root [218] inCut
(Float_t)4.70000000000000000e+01
root [219] totalCut
(Float_t)9.08000000000000000e+02
root [220] fracCut
(Float_t)5.17621152102947235e-02
```

Now do the big stats version.

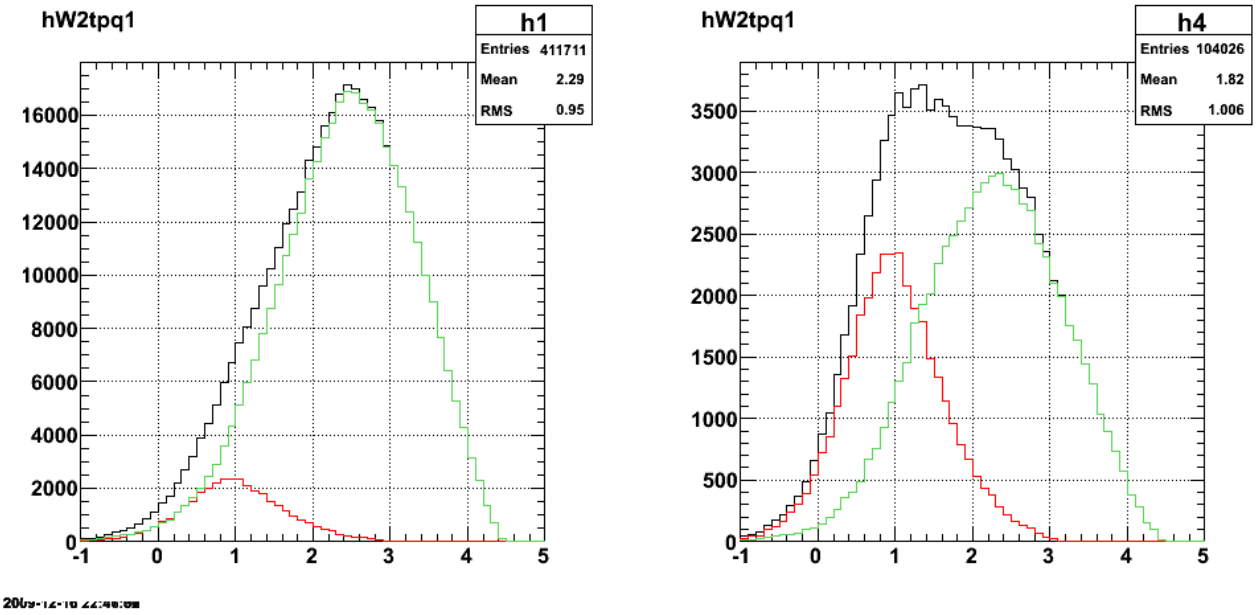


Fig 3. Same as fig 1 with 10x more events.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Gzipped tar archive) you uploaded.

```
root [58] inNocut
(Float_t)8.61400000000000000e+03
root [59] totalNocut
(Float_t)3.12260000000000000e+04
root [60] fracNocut
(Float_t)2.75859862565994263e-01


root [66] inCut
(Float_t)1.82800000000000000e+03
root [67] totalCut
(Float_t)2.44280000000000000e+04
root [68] fracCut
(Float_t)7.48321563005447388e-02
```

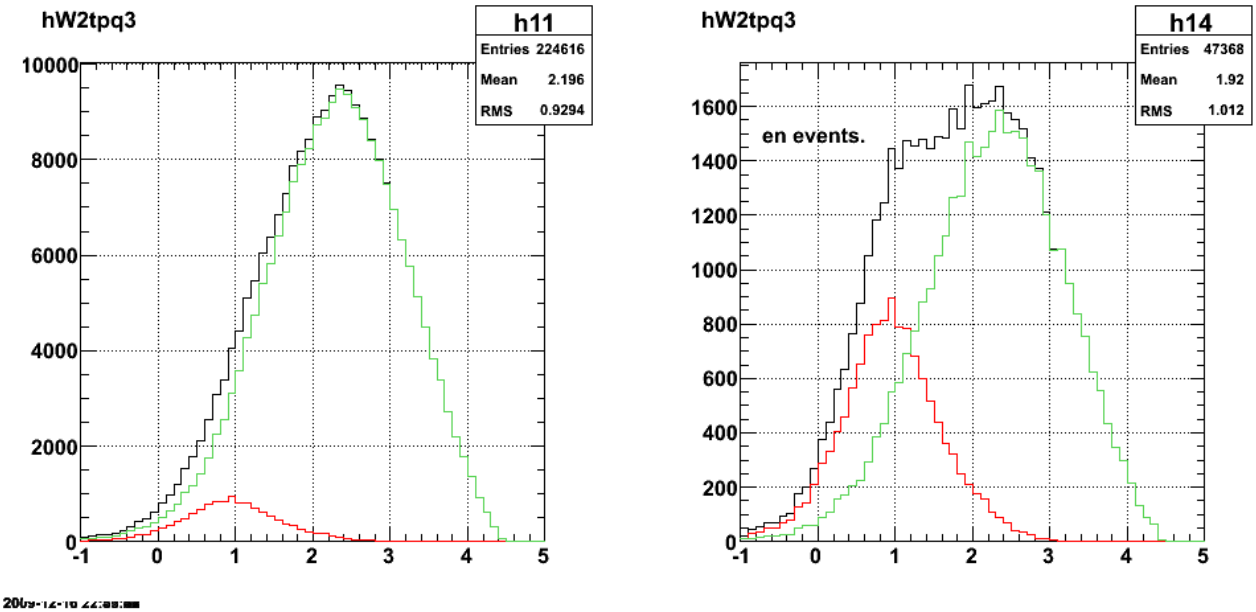


Fig 4. Same as fig 2 with 10x more events.

Click here to view the object (ROOT macro) you uploaded.

```
root [120] inNocut
(Float_t)4.19400000000000000e+03
root [121] totalNocut
(Float_t)1.25320000000000000e+04
root [122] fracNocut
(Float_t)3.34663271903991699e-01
root [123]


root [128] inCut
(Float_t)5.78000000000000000e+02
root [129] totalCut
(Float_t)8.90400000000000000e+03
root [130] fracCut
(Float_t)6.49146437644958496e-02
root [131]
```

My choice for the QE/IN ratio does not reproduce the fraction of inelastic events with W2<1.2 GeV2 (0.12) that I used in the draft of the update. To be consistent with that result I increased the proportion of inelastic events. See below.

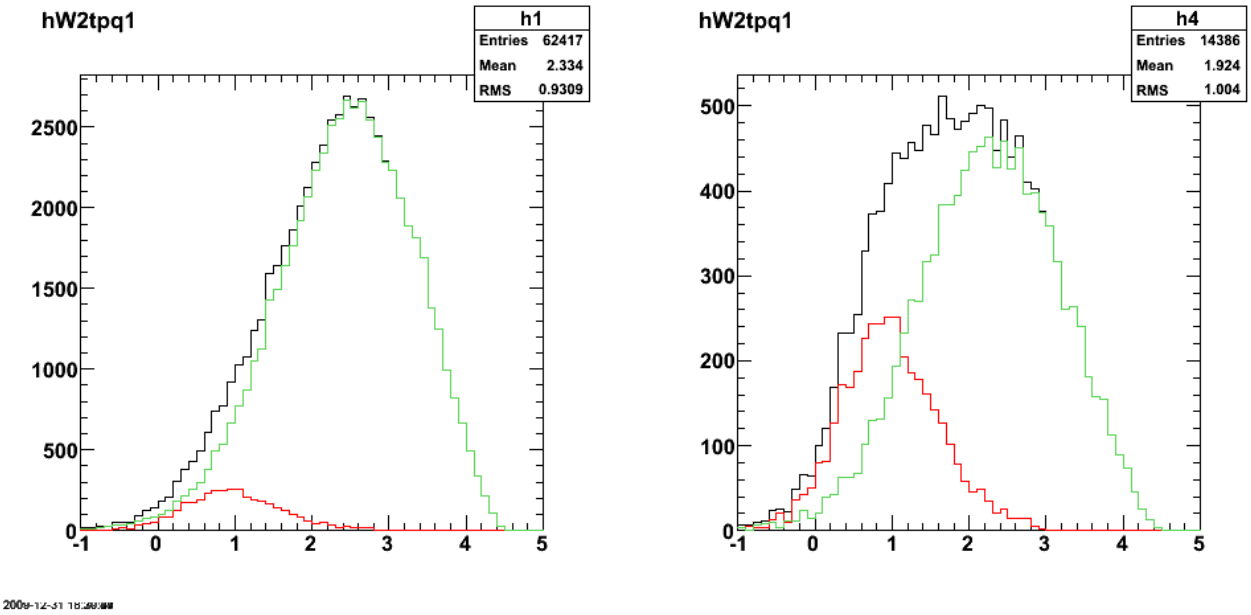


Fig 5. Same as Fig 3 for ep events, but run with submit_gmnsim.pl 1100 36000 1, theta_pq < 1.5 deg, F=0.33.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (gzipped tar archive) you uploaded.

Integrals:

```
root [56] inNocut
(Float_t)1.33700000000000000e+03
root [57] totalNocut
(Float_t)3.76200000000000000e+03
root [58] fracNocut
(Float_t)3.55396062135696411e-01

root [64] inCut
(Float_t)2.74000000000000000e+02
root [65] totalCut
(Float_t)2.69900000000000000e+03
root [66] fracCut
(Float_t)1.01519078016281128e-01
```

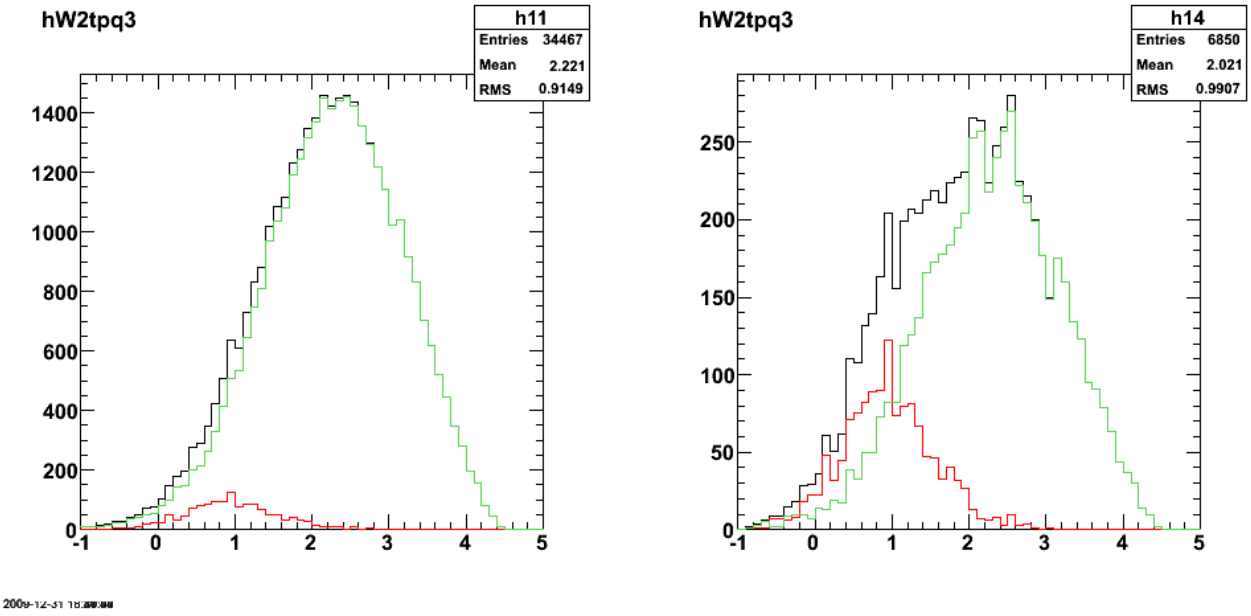


Fig 6. Same as Fig 4 for en events, but run with submit_gmnsim.pl 1100 36000 1, theta_pq < 1.5 deg, F=0.33.

Click here to view the object (Root macro) you uploaded.

Integrals:

```
root [116] inNocut
(Float_t)6.40000000000000000e+02
root [117] totalNocut
(Float_t)1.54100000000000000e+03
root [118] fracNocut
(Float_t)4.15314733982086182e-01

root [124] inCut
(Float_t)9.40000000000000000e+01
root [125] totalCut
(Float_t)9.95000000000000000e+02
root [126] fracCut
(Float_t)9.44723635911941528e-02
```

Redo the previous calculations with 10x as many events.

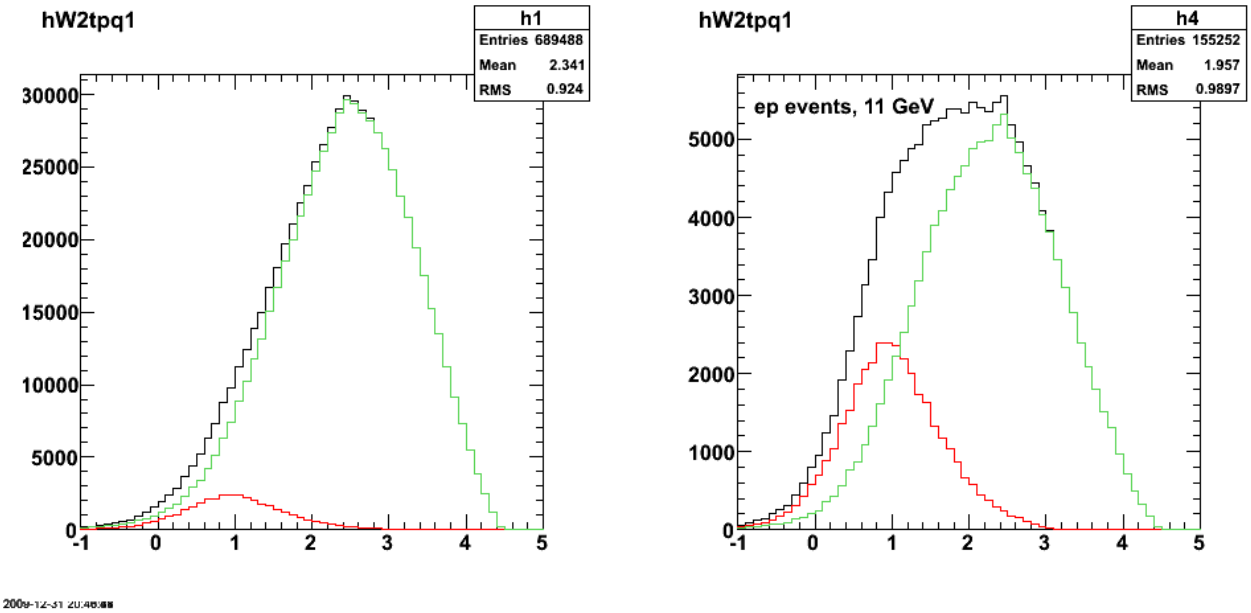


Fig 7. Same as Fig 5 for ep events, but run with submit_gmnsim.pl 11000 400000 1, theta_pq < 1.5 deg, F=0.33.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (gzipped tar archive) you uploaded.

Integrals:

```
root [56] inNocut
(Float_t)1.48380000000000000e+04
root [57] totalNocut
(Float_t)3.78490000000000000e+04
root [58] fracNocut
(Float_t)3.92031490802764893e-01


root [64] inCut
(Float_t)3.07700000000000000e+03
root [65] totalCut
(Float_t)2.60780000000000000e+04
root [66] fracCut
(Float_t)1.17992177605628967e-01
```

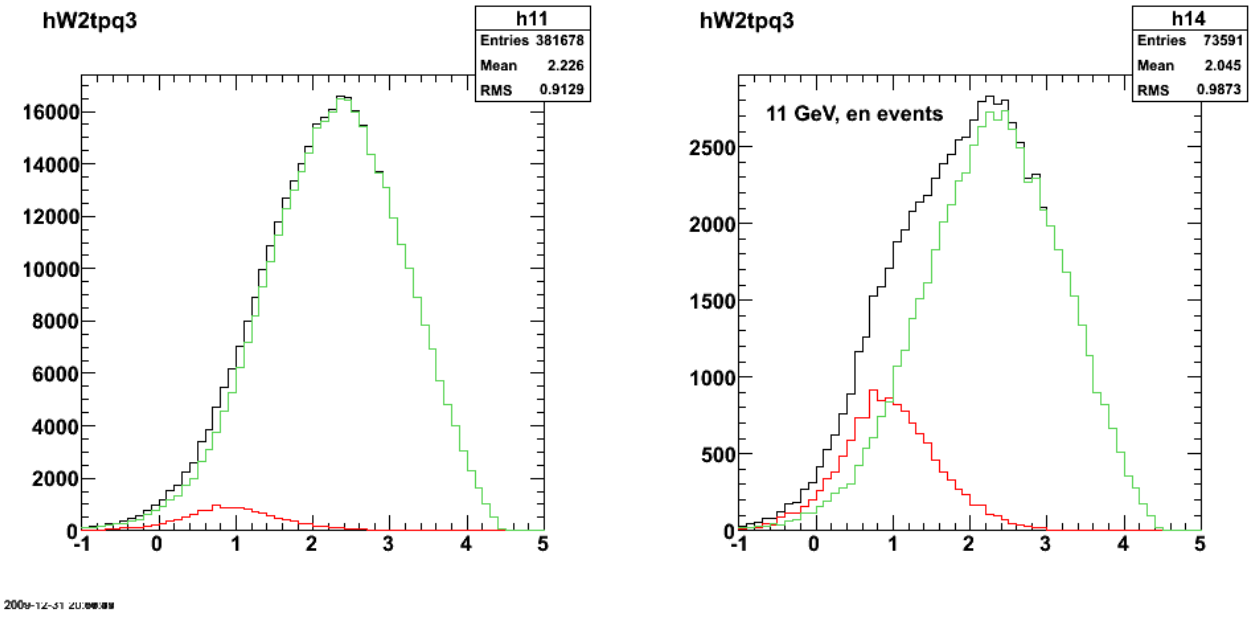


Fig 8. Same as Fig 6 for en events, but run with submit_gmnsim.pl 11000 400000 1, theta_pq < 1.5 deg, F=0.33.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (gzipped tar archive) you uploaded.

Integrals for en events:

```
root [118] inNocut
(Float_t)7.10500000000000000e+03
root [119] totalNocut
(Float_t)1.56660000000000000e+04
root [120] fracNocut
(Float_t)4.53529924154281616e-01


root [126] inCut
(Float_t)9.85000000000000000e+02
root [127] totalCut
(Float_t)9.53600000000000000e+03
root [128] fracCut
(Float_t)1.03292785584926605e-01
```

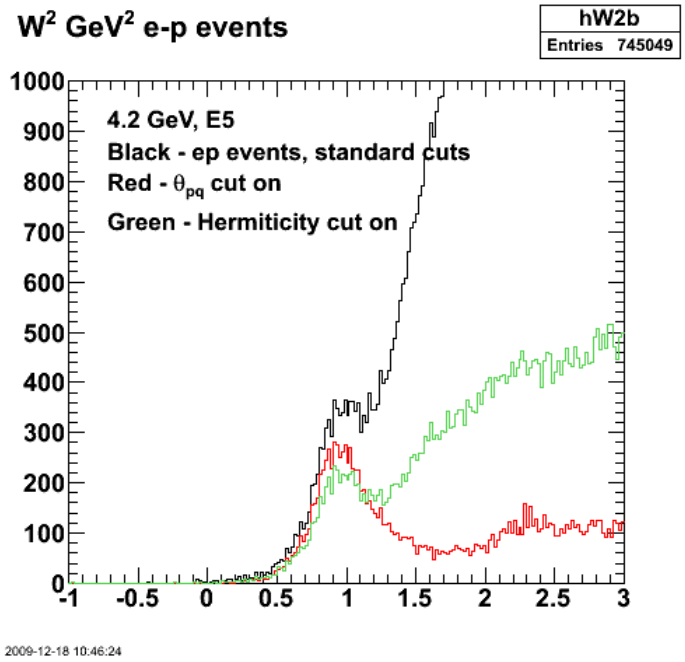
The Hall A GMn proposal will claim to use a very restrictive theta_pq cut to isolate the QE events. Some of their W2 spectra with theta_pq < 0.5 deg show this could work so I want to see how we can reduce the inelastic background by reducing the theta_pq cut relative to the examples above in Figs 7-8. First redo the analysis of Figs 7-8 requiring theta_pq < 1.0 deg.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 302 - Testing Hermiticity cut on 4.2-GeV, E5 data (gpg)

[Modified Thu Dec 24 19:11:51 2009 (GMT) gpg]

Kawtar suggested looking at the E5 data to test the effect of the hermiticity cut.



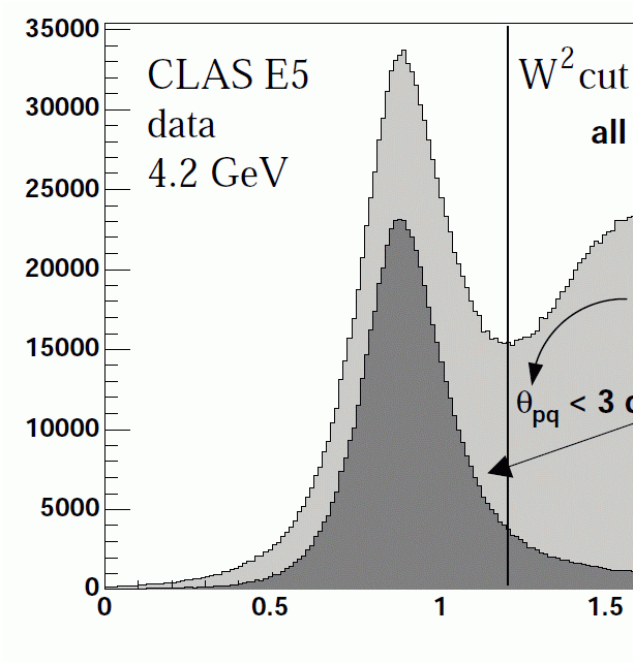


Fig 1. Left panel: effect of theta_pq and hermiticity cuts alone. **Right panel: effect of theta_pq+hermiticity plots (I think (probabl**

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

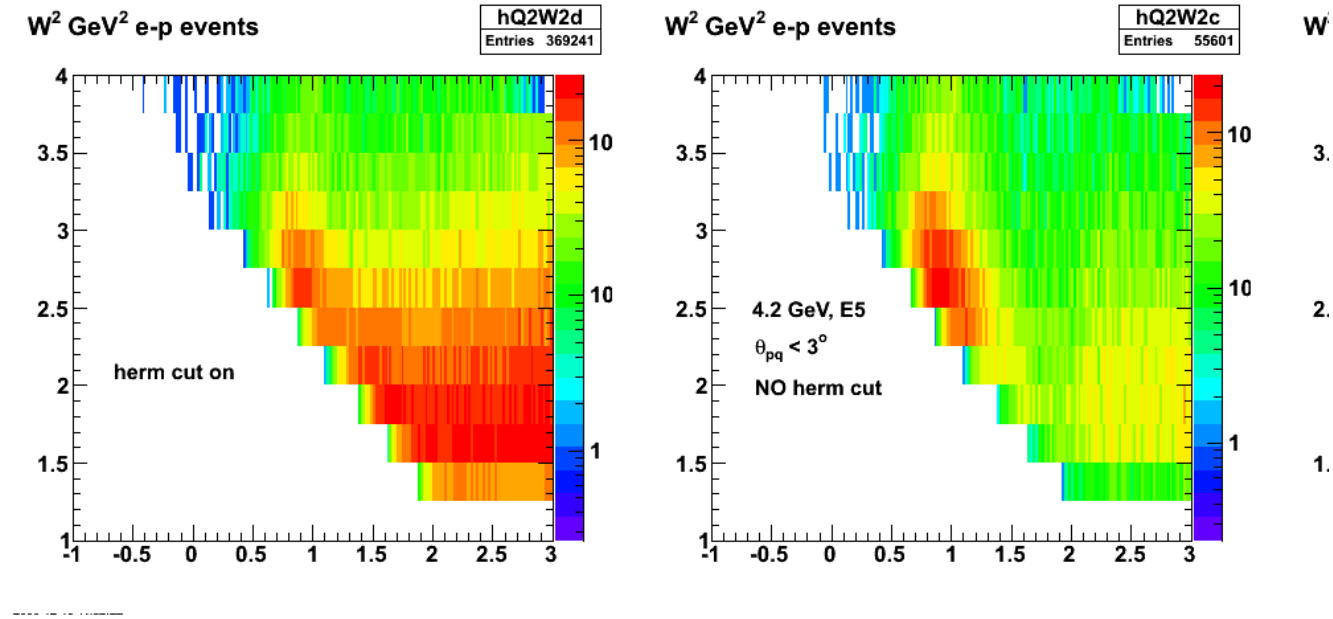


Fig 2. Comparison of Q2 vs W2 for three sets of cuts. Notice the QE cut is cut out of the low Q2 region almost entirely. This may be due to my fiducial cuts which JL did not use.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

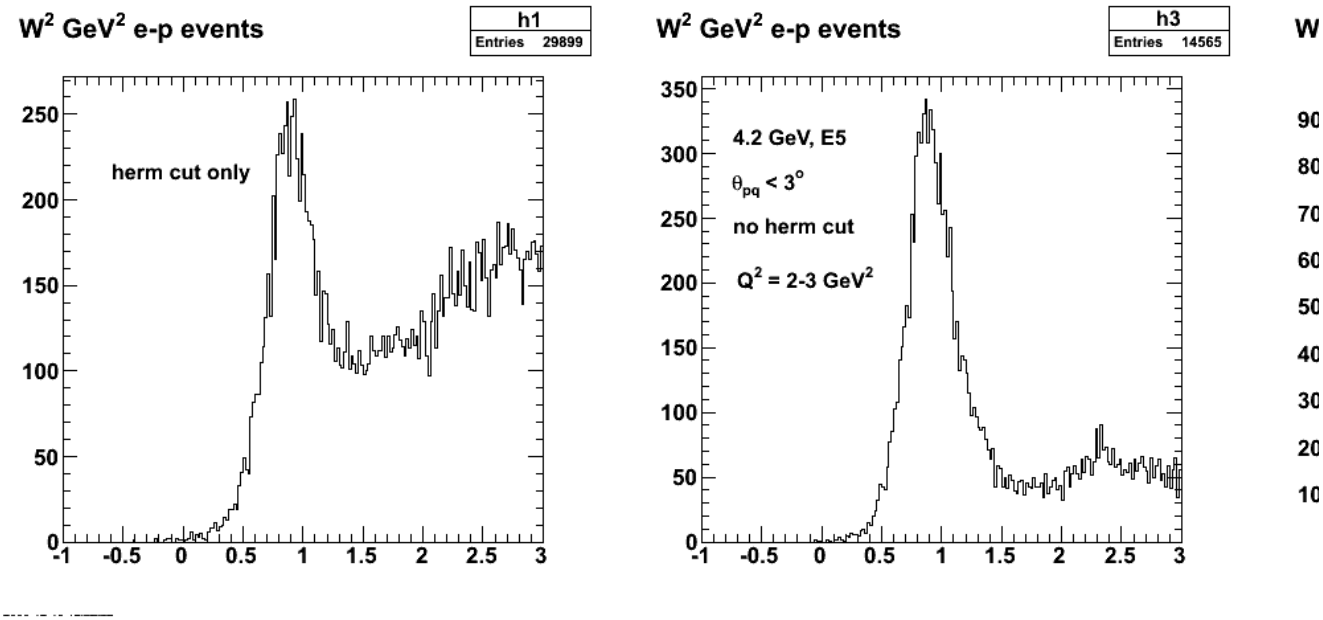


Fig 3. Projections along the W2 axis for Q2=3-4 GeV2.

Click here to view the object (ROOT macro) you uploaded.

Turn off efids and pfids and things look more JLish. In the left-hand panel there is a big drop in the QE pick when I turn on the hermiticity cut. I don't understand this. In the simulations there is no effect on the QE pick which makes sense. this does not!?????????????????????????? Yes it is! See below.

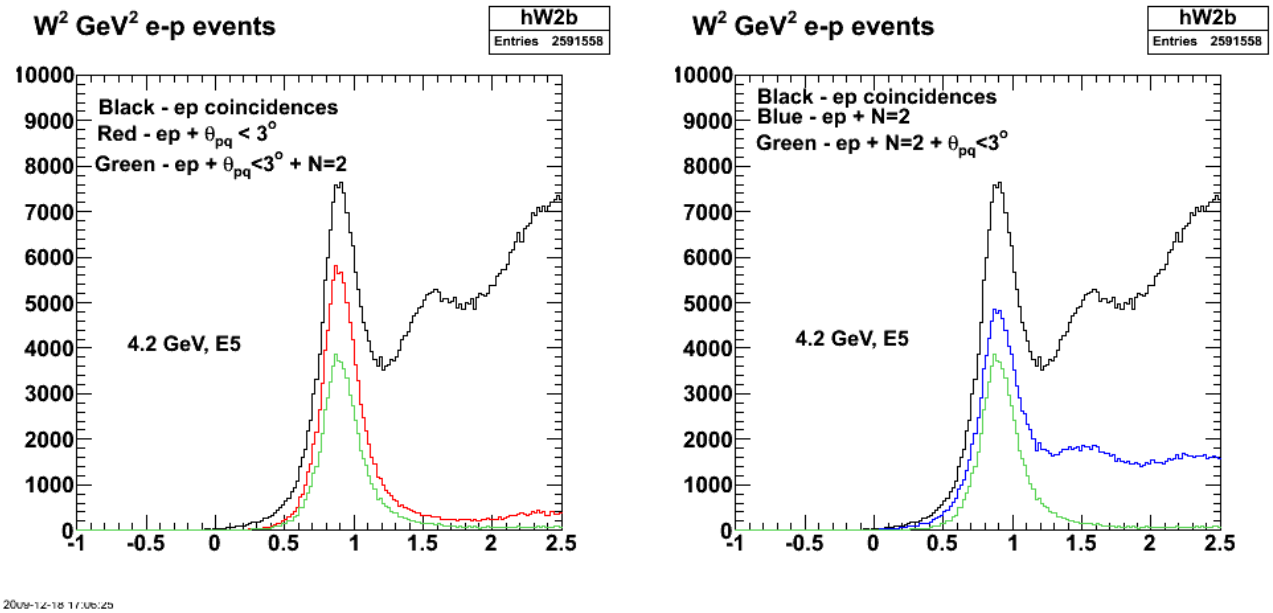


Fig 4. Comparison of various cuts on the W2 spectra for the 4.2-GeV data. Fiducial cuts for electrons and protons are turned off.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Yeehaa! The plot below shows the W2 spectrum for several sets of combinations and cuts. The big point is that when I add together the hists for theta_pq+hermiticity (green) with epn (gray) cuts, the QE peak matches the theta_pq only spectrum (red), but is noticeably less for the inelastic region. The number of counts is still smaller than JL.

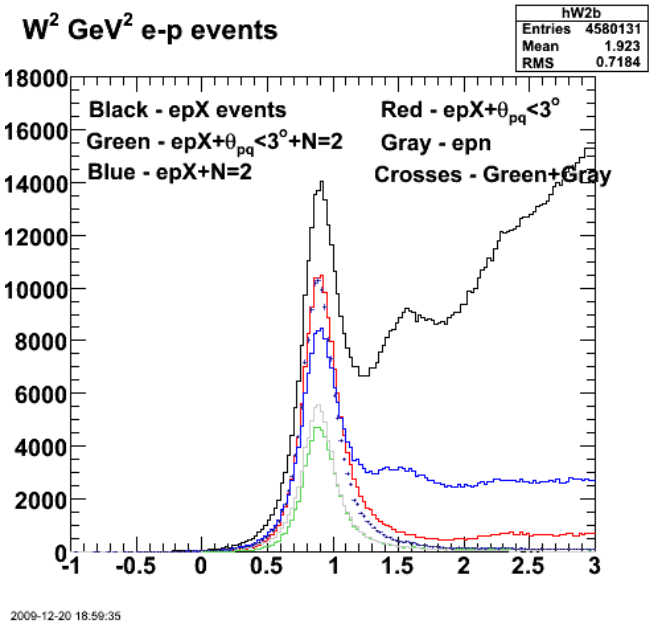


Fig 4. Comparison of various cuts for the W2 spectra for the 4.2-GeV data. Fiducial cuts and other cuts are off to reproduce the number of counts.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

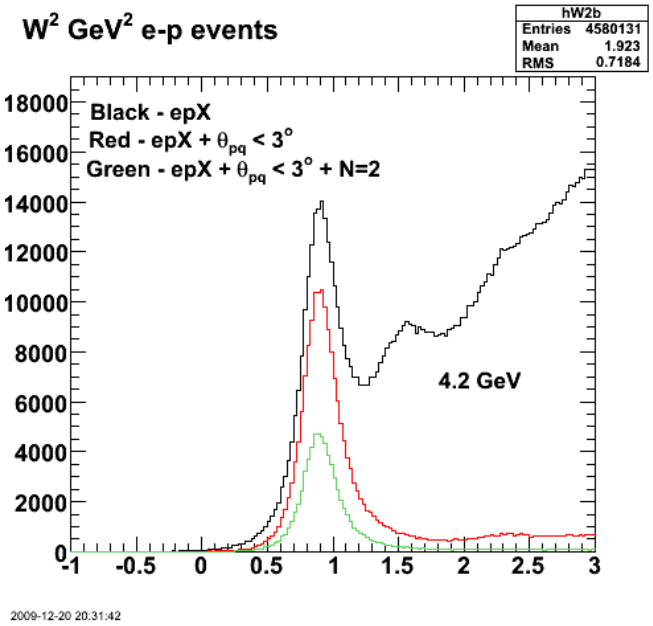
Cuts used:

```
    if (ep_event &&
        target_walls_ep &&
        //good_e_p_vertex &&
        //good_electron_fiducial &&
        //good_proton_fiducial &&
        //quasielastic_cut &&
        //good_egiyan_threshold &&
        //good_EC_pion_threshold &&
        good_electron_EC_fiducial &&
        //good_electron_EC_trk_coords_fiducial &&
        //good_mass_p &&
        good_EC_etot &&
        //good_gamma_theta_pq &&
        (gpart == 2) &&
        //good_sampling_fraction &&
        good_photoelectrons) {

      hW2d->Fill(W2_corr);
      hQ2W2d->Fill(W2_corr,Q2);

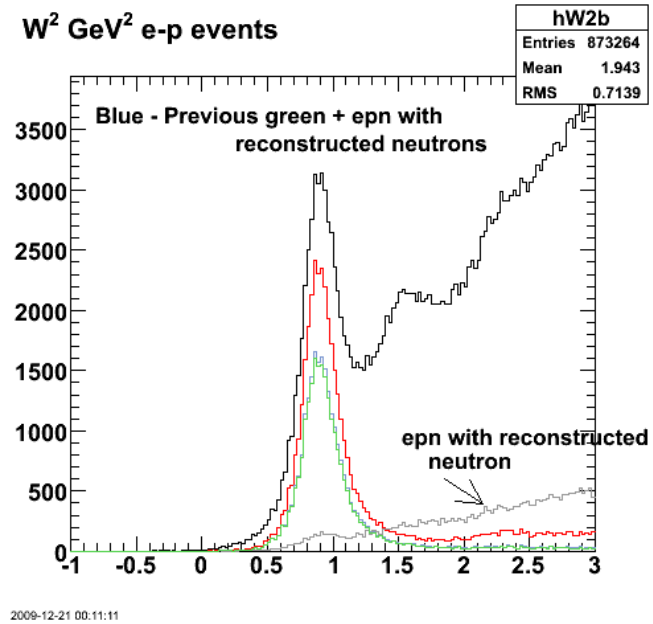
  }
```

Plots to show KH and WKB.



2009-12-20 20:31:42

Based on previous plot.



2009-12-21 00:11:11

Fig 5. Looking for missing QE events lost with hermiticity cut.

Click here to view the object (Root macro) you uploaded.

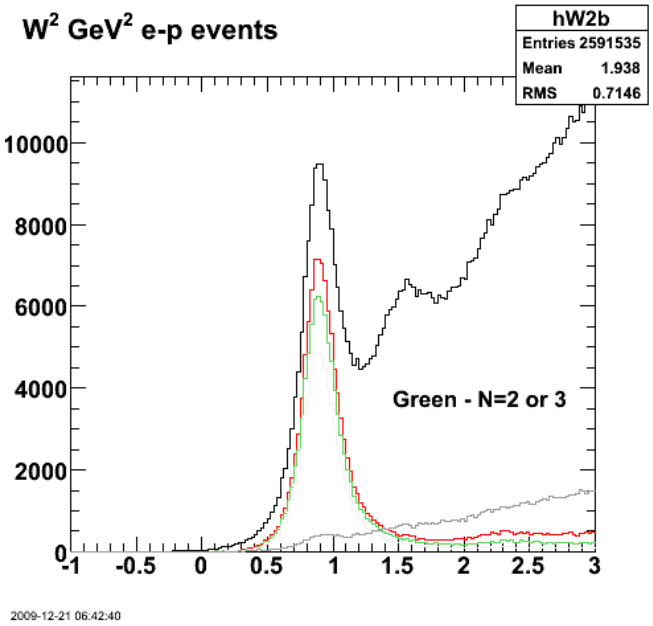


Fig 6. OR N=2 and N=3 and we recover most of the missing QE events.

Click here to view the object (Root macro) you uploaded.

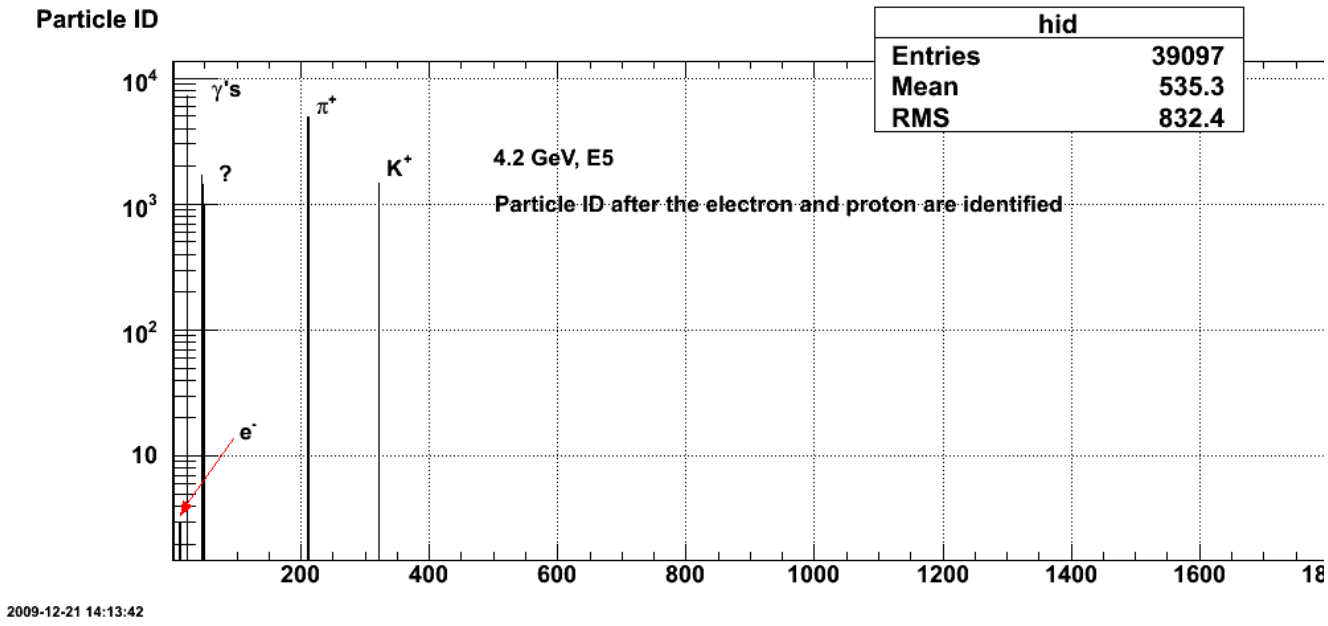
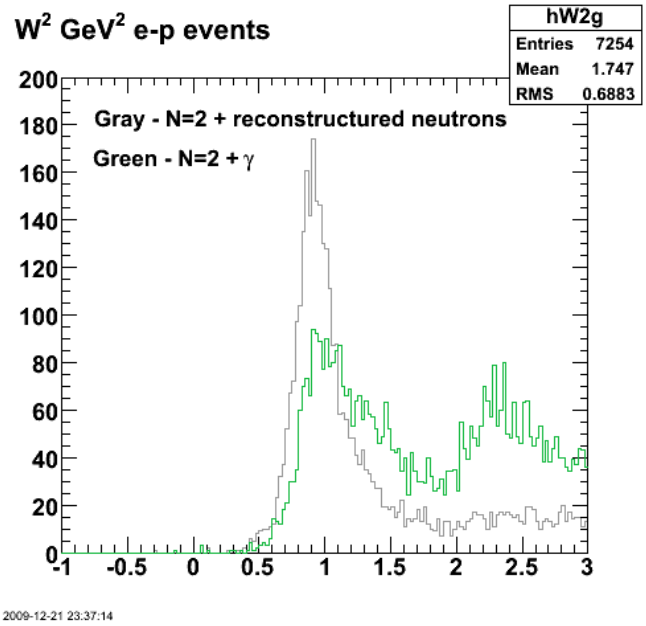


Fig 7. Distribution of particle IDs (PDG convention) for ep events excluding leading electron and proton.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

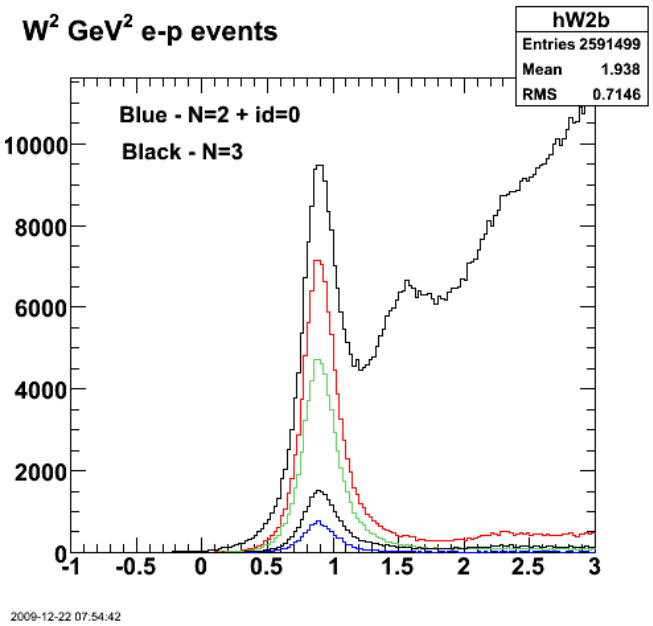
Look at W2 spectrum for ep events with N=2 or N=3 and require the third particle to be a photon or a neutron. There isn't much there.



2009-12-21 23:37:14

Fig 8. Looking for the missing QE events. W2 spectrum for ep events with N=2 or N=3 and require the third particle to be a photon or a neutron. There isn't much there.

Click here to view the object (Root macro) you uploaded.



2009-12-22 07:54:42

Fig 9. Looking for the missing QE events.

Click here to view the object (Root macro) you uploaded.

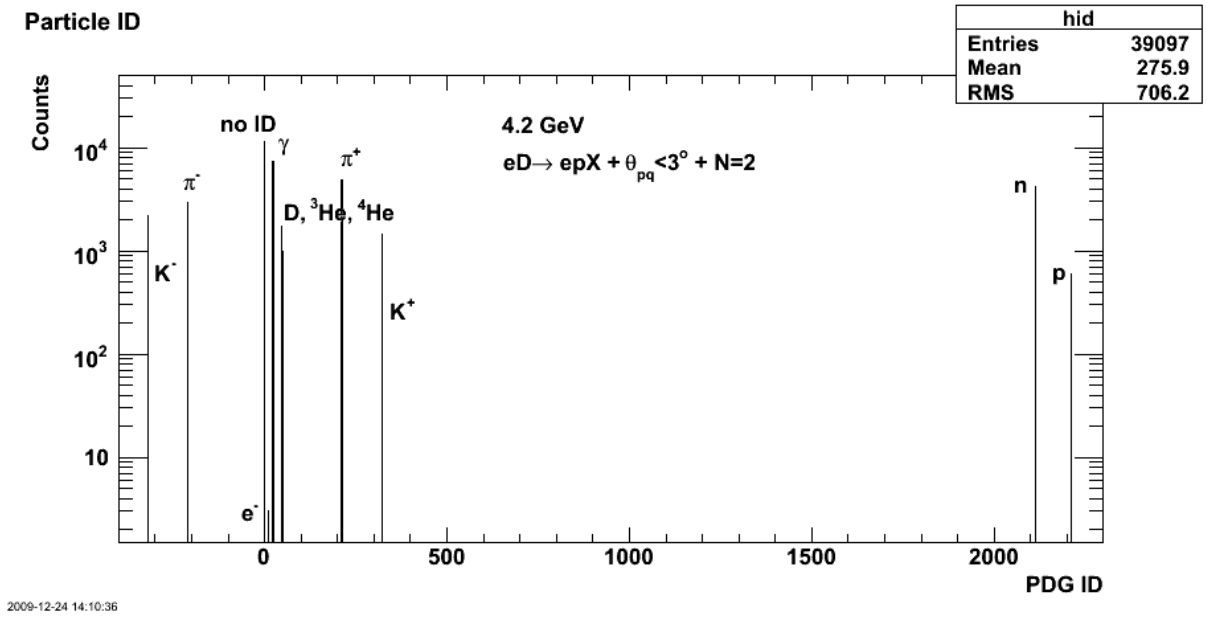


Fig 9. The missing QE events by PDG ID.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 303 - 4.2-GeV analysis in preparation for update presentation (gpg)

[Modified Sun Dec 27 00:45:40 2009 (GMT) gpg]

In order to prepare for the PAC update talk Kawtar suggested that I look at the effect of the hermiticity cut on the E5 data. The θ_{pq} cut removes most of the inelastic events from the W2 spectrum, but we could still study the impact of the hermiticity cut by turning off the &thetas$_{pq}$ cut. With that in mind, I first decided to look at what happens when I add the hermiticity cut to the θ_{pq} cut. Below are the results of a recent analysis of the 4.2-GeV, E5 data. The left-hand panel in Fig 1 shows the effect first of the θ_{pq} cut (red histogram) followed by the addition of the hermiticity cut (veto events with N>2 where N is the number of tracks). The surprise here is that the hermiticity cut removes about half of the quasielastic (QE) events. In the right-hand panel modifying the hermiticity cut from N>2 to N>3 restores most of the lost QE events.

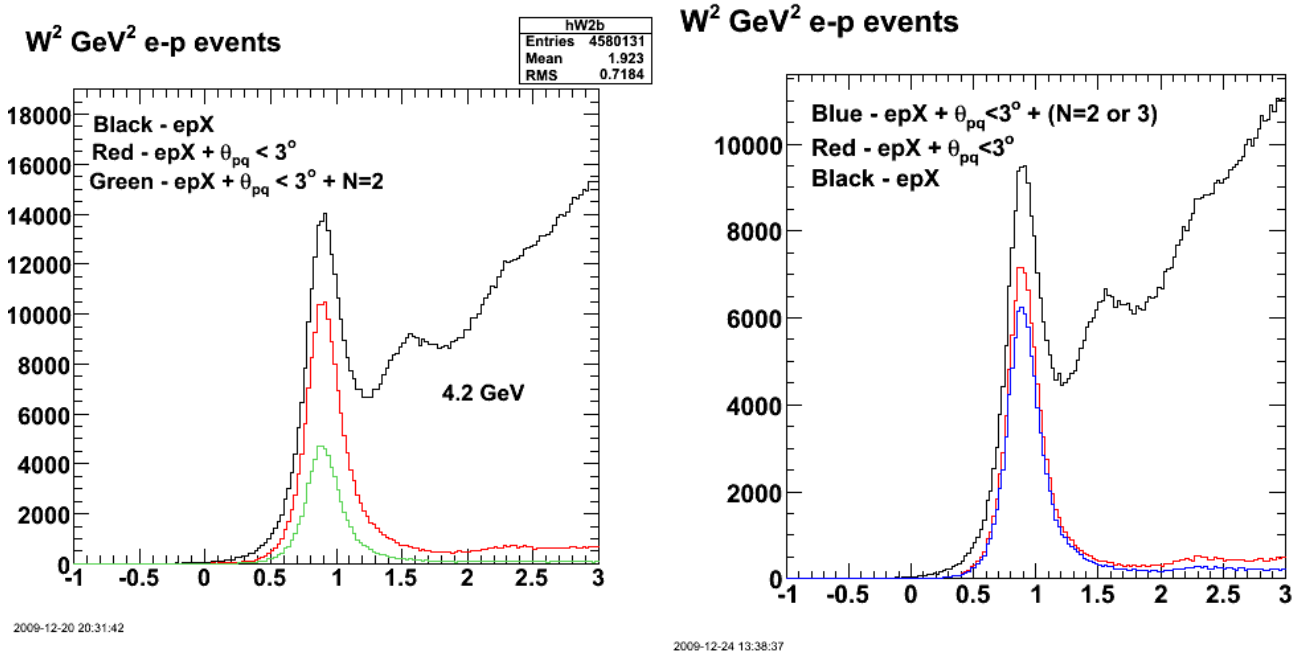


Fig 1. The left-hand panel shows the effect of the θ_{pq} cut on the W2 distribution for epX events (red) followed by adding the hermiticity cut (no N > 2 tracks). The right-hand panel shows the W2 distribution if the hermiticity cut is changed to a veto of events with the number of tracks N>3 (blue).

To understand the source of these apparent N>2, QE events consider the next plot. It shows the value of the particle ID excluding the electron and proton. The numbers use the PDG convention for meaning except the ones in the 40's which use a geant convention. The most prominent species the id=0 one which means the particle was not identified though this likely a real track. There is also a large number of photons (from radiative events perhaps) and neutrons (real epn events!).

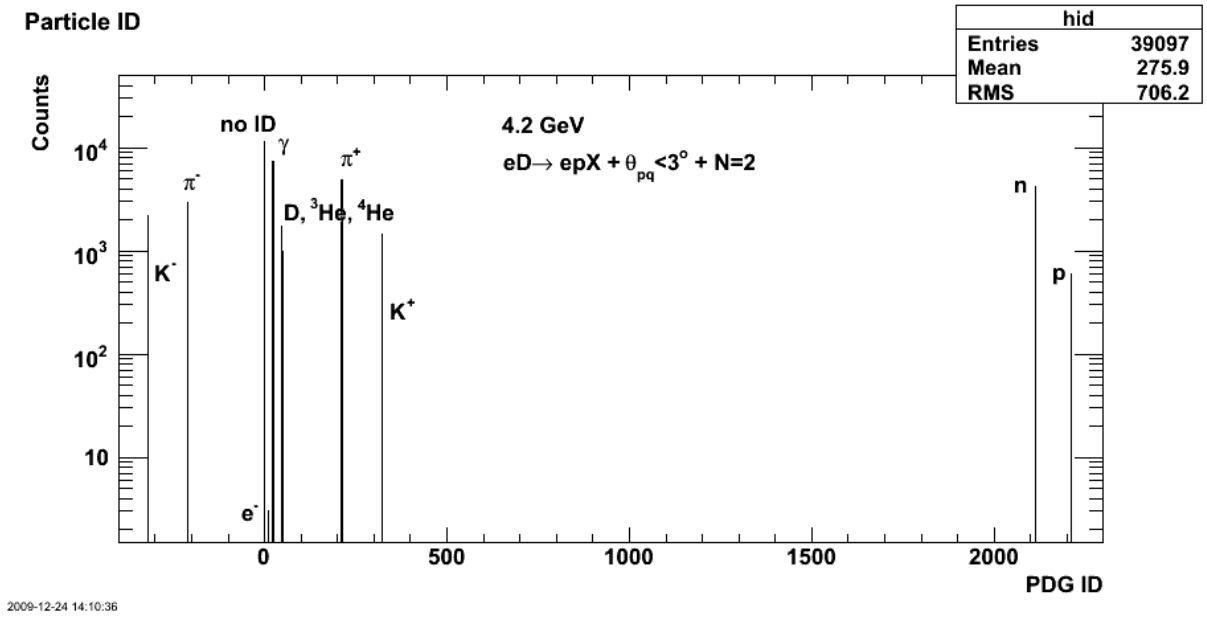
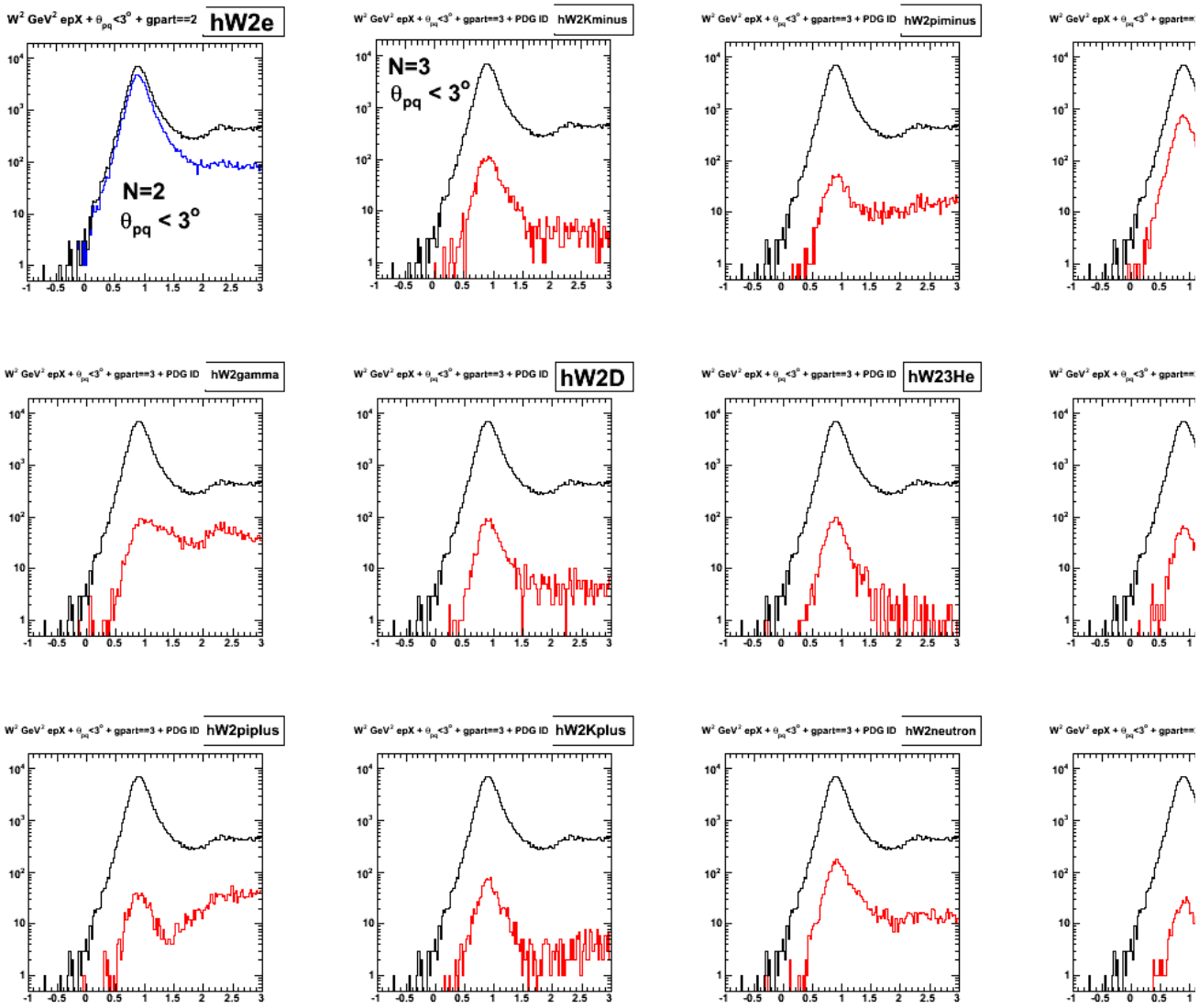


Fig 2. Distribution of PDG ID numbers for N>2 events excluding the electron and proton.

Taking this further I show the next figure which is the W2 distribution for all the different particles seen in Fig 2. The most prominent one is the one with id=0 (unidentified tracks) which makes up most of the missing events (peak at about 800 events). Nevertheless, there are seven other channels (K-,K+,neutron, proton, D, 3He, 4He) that show a significant QE peak and low inelastic background with a peak of about 100 events or less). Coincidences with things like K+ are presumably random coincidences. This 'large' of random events is surprising to me,



2009-12-25 23:03:02

Fig 3. W2 distribution for N=3 events and broken down by particle species. The black histogram in each case is W2 distribution for epX events with just the θ_{pq} cut. The upper, left-hand panel shows the results for epX events with the θ_{pq} and the N=2 cut. All the other panels show W2 for N=3, epX events with the labelled particle and the θ_{pq} cut.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Add the histograms for the 'good' random channels excluding the id=0 histogram and you get about the same number of events. See fig. below.

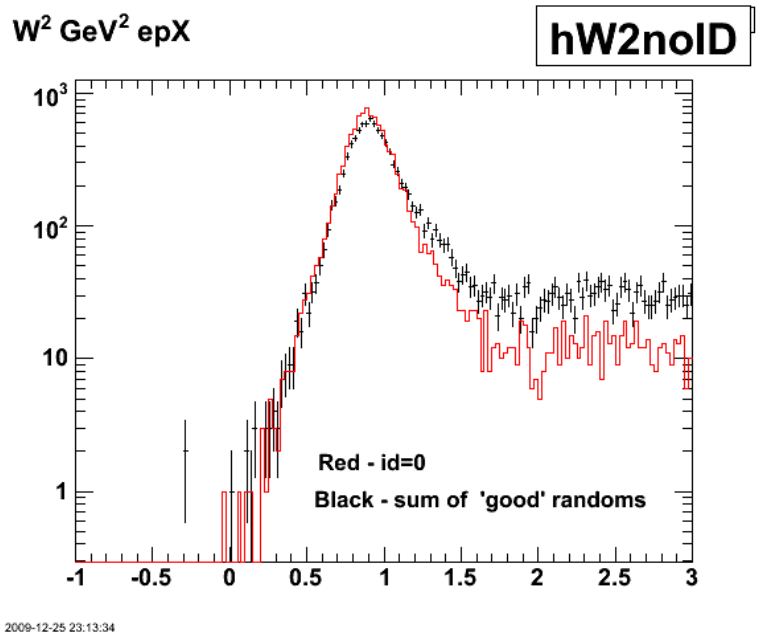


Fig 4. Comparison of W2 distributions for N=3, id=0 events (red) with the sum of histograms for channels (K-,K+,neutron, proton, D, 3He, 4He) and N=3.

Click here to view the object (Root macro) you uploaded.

Now take the N=2 events and add in the N=3 events from the top 8 channels (K-,K+,neutron, proton, D, 3He, 4He, and id=0) and we recover most of the events lost to the N=2 cut (red/black = 0.82, blue/black=0.64).

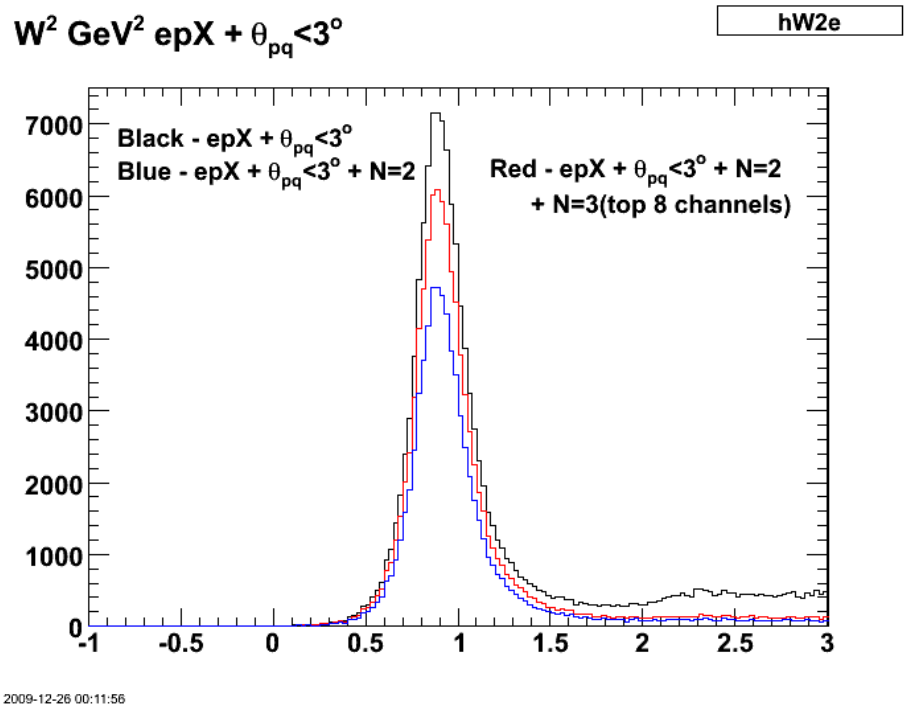
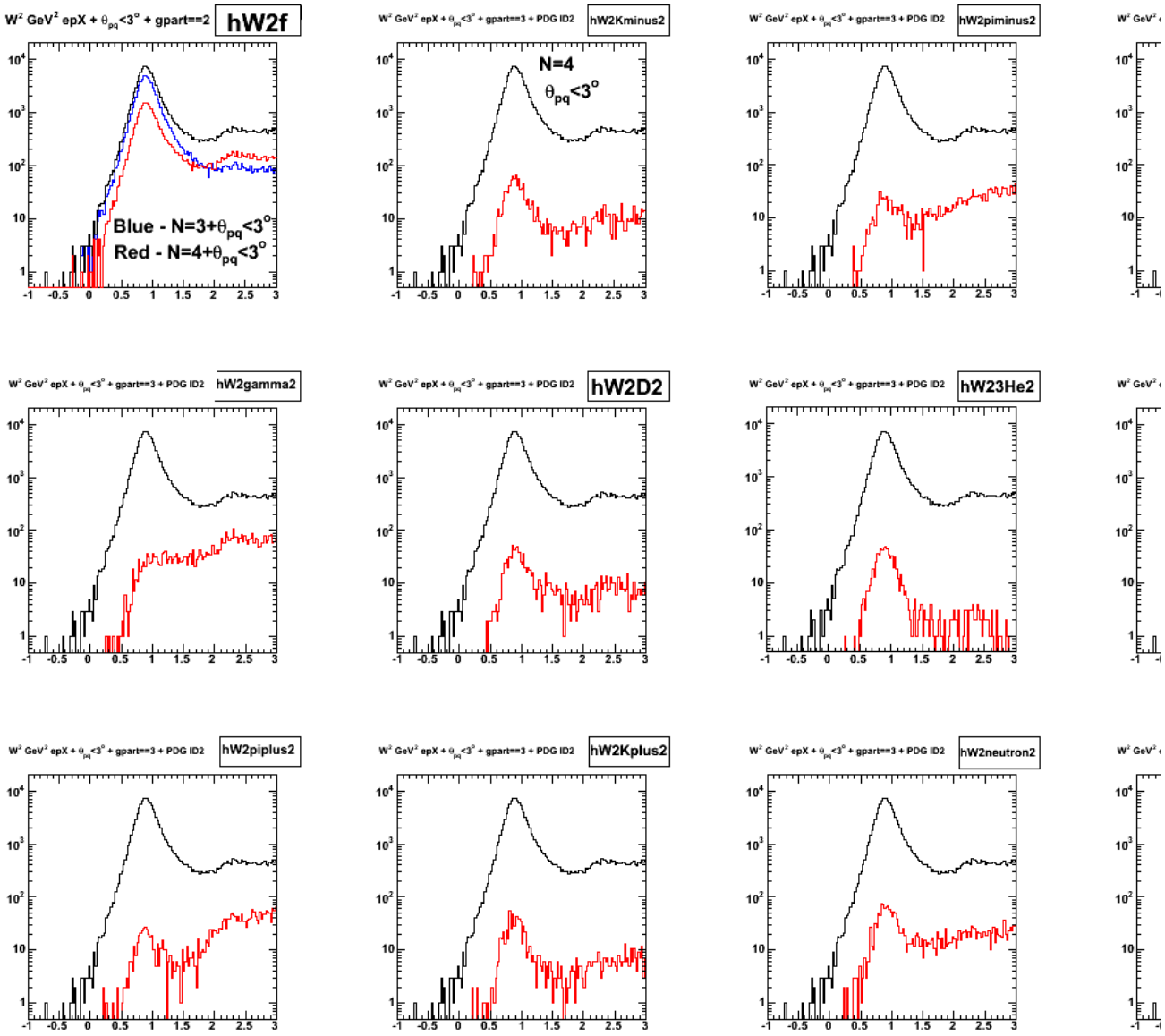


Fig 5. Comparison of W2 for θ_{pq} cut only (black) with the N=2 cut (blue) and the N=2+N=3(K-,K+,neutron, proton, D, 3He, 4He, and id=0)

Now look at the next level of coincidences (N=3).



2009-12-26 00:36:58

Fig 6. Effect of requiring N=4 and θ_{pq}<3 deg. The labelling is wrong. It should be gpart==4, not gpart==3.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Now add up the 'good' channels for N=3 with the id=0 channel for N=4.

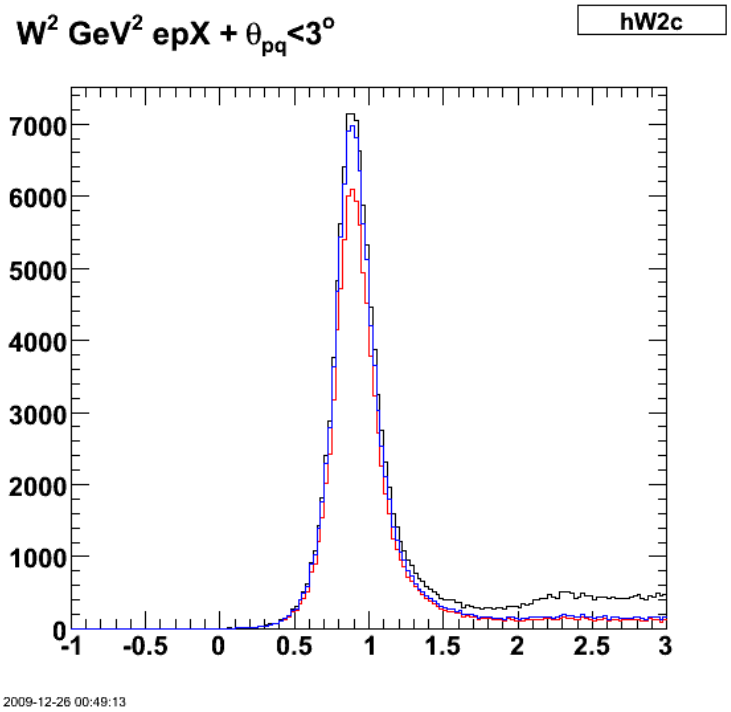


Fig 7. Finding more of the missing QE events. Add up the 'good' N=3 channels with the id=0 + N=4 channel and recover 0.94 of the θ_{pq} cut results.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file, same as for previous figure) you uploaded.

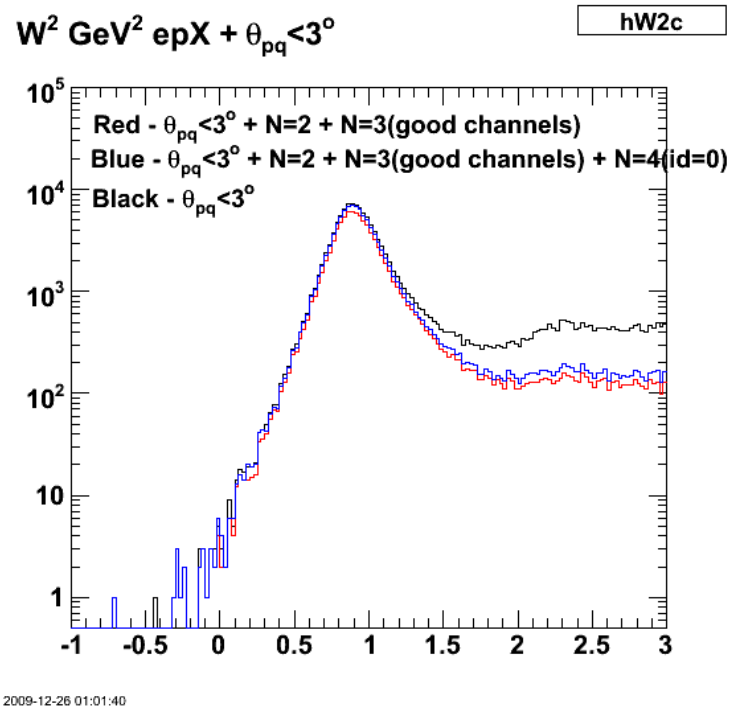


Fig 8. Semi-log plot of previous fig.

Click here to view the object (Root macro) you uploaded.

Integral results:

```
root [381] hW2c->Integral(1,108)
(const Double_t)1.06672000000000000e+05
root [382] hW2sum->Integral(1,108)
(const Double_t)8.79390000000000000e+04
root [383] hW2sum2->Integral(1,108)
```

```
(const Double_t)9.98240000000000000e+04
```

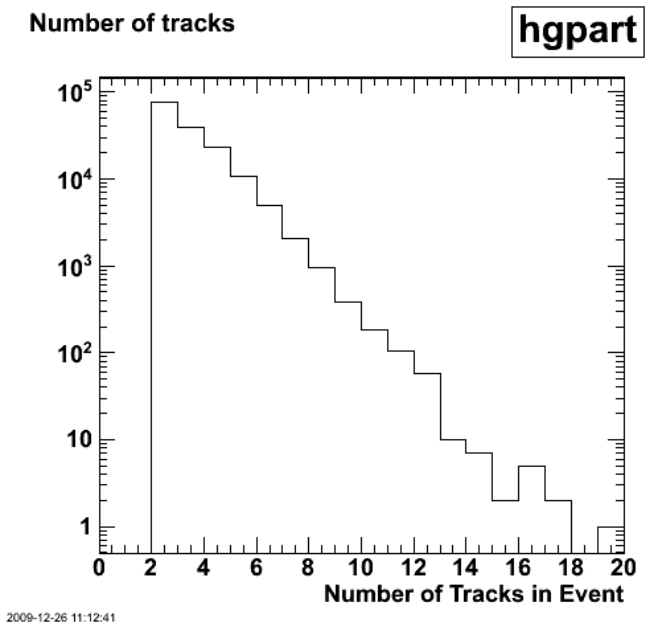


Fig 9. Distribution of the number of tracks in each event. Require ep events so gpart >= 2.

Now consider the effect of the hermiticity cut without the θ_{pq} cut. The goal here is to demonstrate the power of the hermiticity cut for removing inelastic events even though it is not needed at these low 4-momentum transfers. The first plot below (Fig 10) shows in the left-hand panel the W2 distribution for epX events (black), epX+θ_{pq}<3 deg events (red), and epX + N=2 events (green). Heer the hermiticity cut has already reduced the size of the QE peak below what we would obtain for the θ_{pq} cut alone. In analogy with what I did above, I added the results of the hermiticity cuts for N=2 and N=3 together to obtain the blue histogram in the left-hand panel. It is not clear here that this improves things. The QE peak now exceeds the result using just the θ_{pq} cut, but the background is noticeably larger and may well account for the increase in the QE peak with the N=(2 or 3) cut versus just the N=2 cut in the left-hand panel.

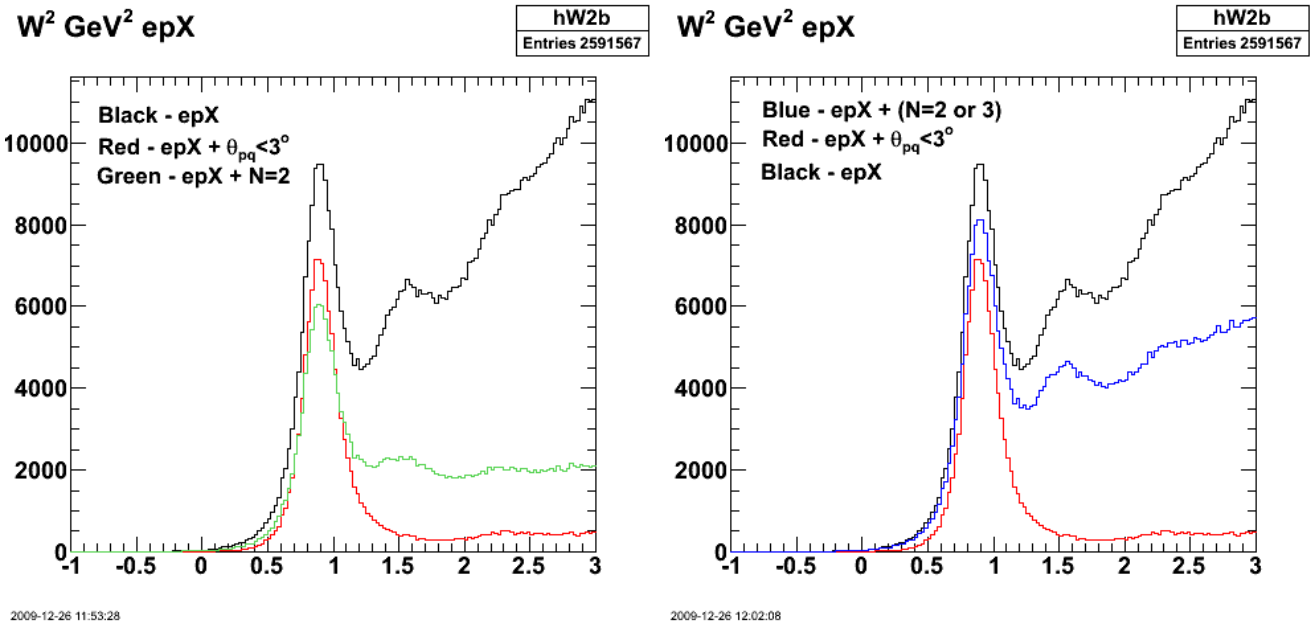


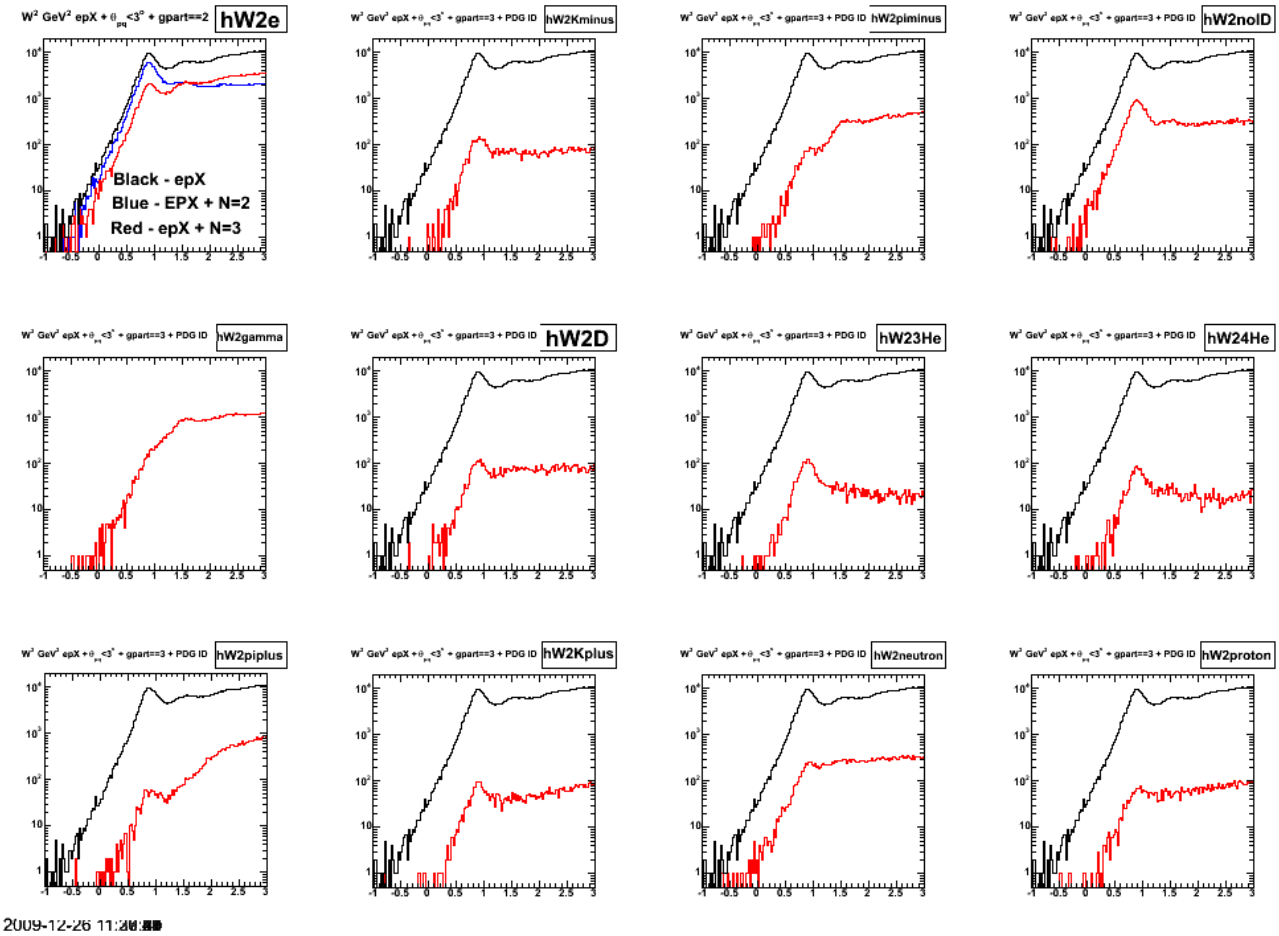
Fig 10. Comparison of W2 distributions in the left-hand panel for epX events (black), epX+θ_{pq}<3 deg (red), and epX+N=2 (green). In the right-hand panel we show the W2 distribution for epX+(N=2 or N=3) events (blue).

Click here to view the object (ROOT macro for the left-hand panel only) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

The next plot (Fig 11) shows the W2 distributions for a variety of cuts. In the upper, left-hand panel we compare the distribution for epX events with no hermiticity cut (black) to the distribution for the N=2, hermiticity cut (blue). The number of QE events appears to go down, but there is a greater drop in the number of inelastic events. Applying the N=3, hermiticity cut gives the red histogram. Here the effect is much less dramatic. In fact, the shape is roughly the

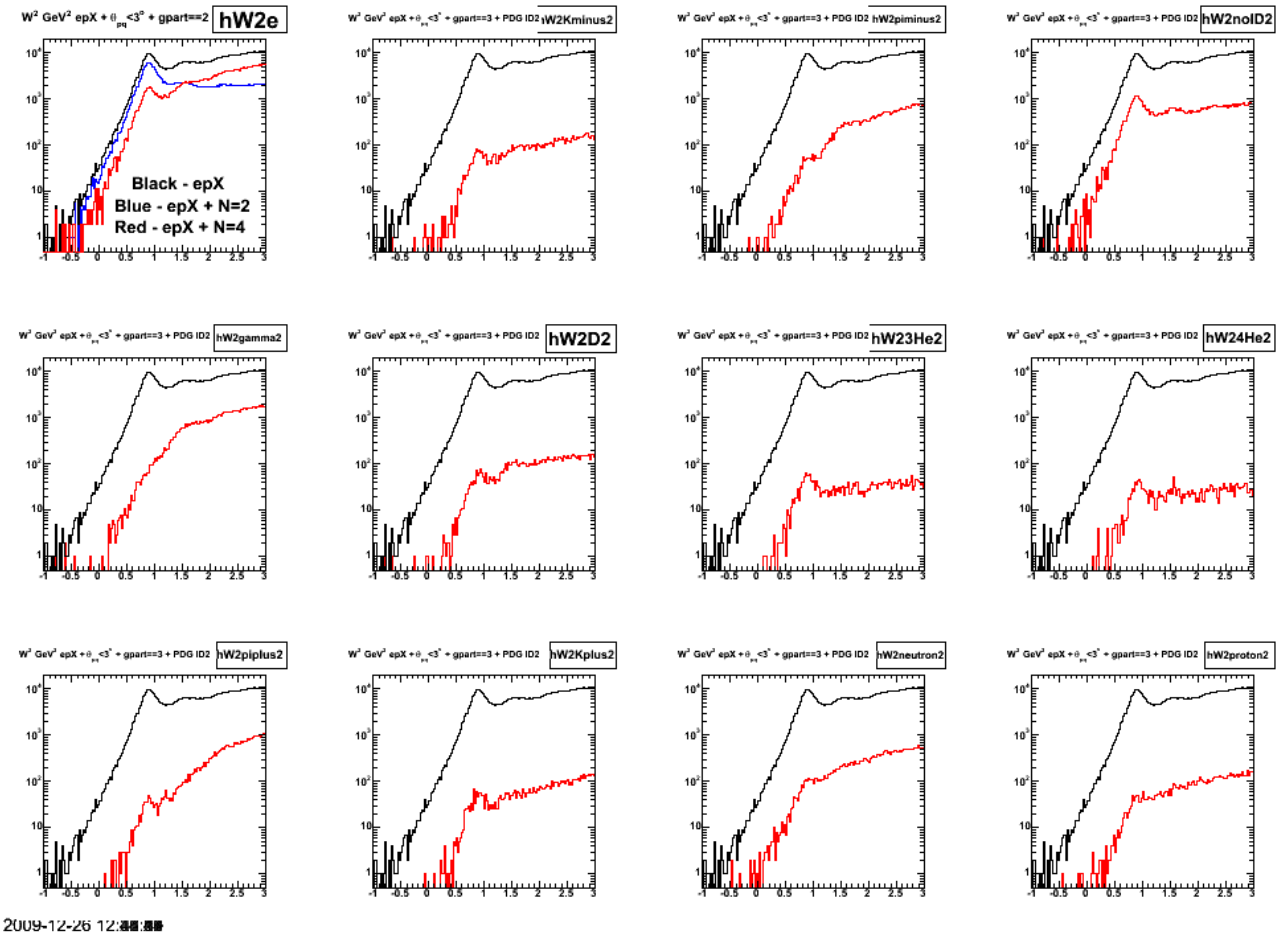
same across the W2 range. The channels that show the most prominent QE peak are K-, id=0, D, 3He, 4He, and K+. Unlike the results above (Fig 3 and Fig 6) where we also had the θ_{pq} cut on, the proton and neutron channels do not show a very distinct QE peak.



2009-12-26 11:28:48

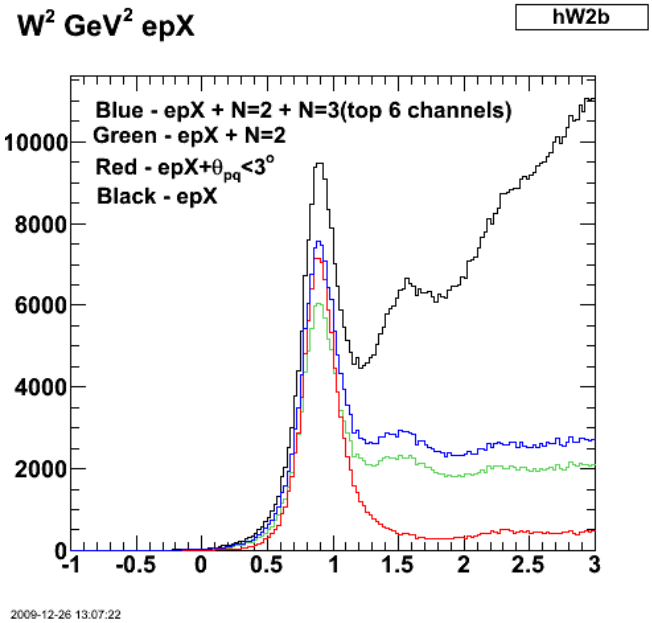
Fig 11. Comparison of epX events and epX+N=3 events. The upper left-hand panel also shows the results for epX+N=2 events.

Now look at the distributions for epX+N=4 events since these made up a significant (about10%) contribution when I had the θ_{pq} cut also turned on. These W2 distributions do not have the prominent QE peak like they did when I had the θ_{pq} cut turned on so I won't bother adding them to the N=2+N=3 distribution.



2009-12-26 12:

Fig 12. Comparison of epX events and epX+N=4 events. The upper left-hand panel also shows the results for epX+N=2 events.



2009-12-26 13:07:22

Fig 13. Comparison of W2 distribution for epX events (black), epX + θ_{pq}<3 deg (red), epX + N=2 (green), and epX + N=2 + N=3(top 6 channels).

Click here to view the object (ROOT macro) you uploaded.

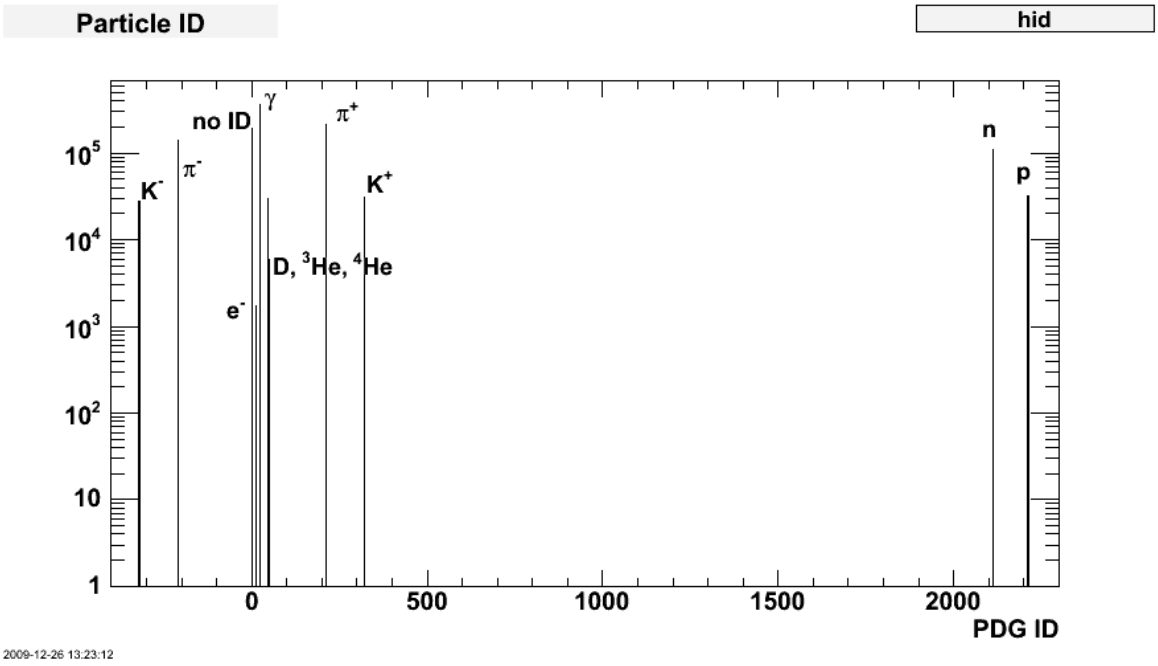


Fig 14. Distribution of PDG ID numbers for N>2 events excluding the electron and proton.

Click here to view the object (ROOT macro) you uploaded.

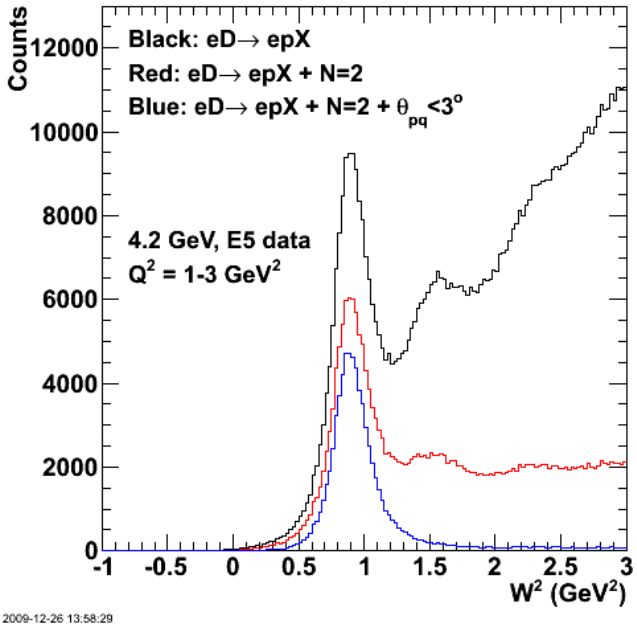
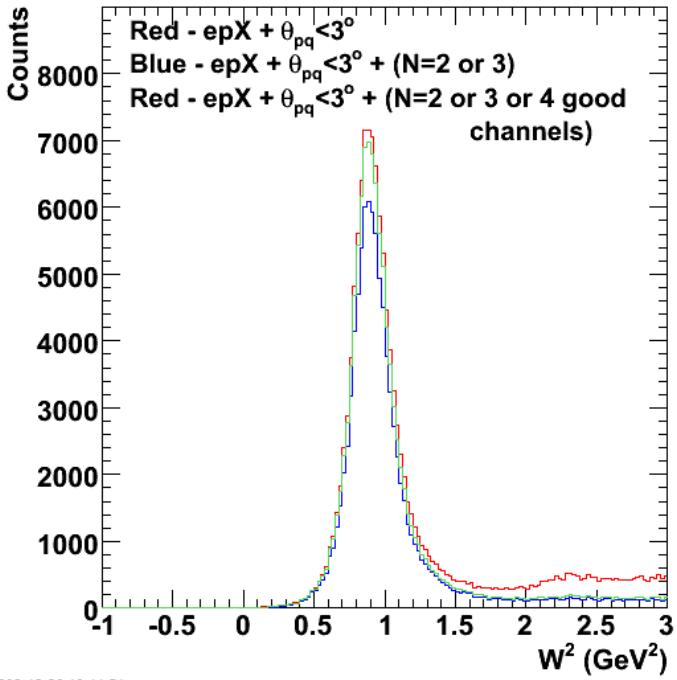


Fig 15. Plot for PAC35 update.

Click here to view the object (ROOT macro) you uploaded.



2009-12-26 19:44:54

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 304 - Testing the hermiticity cut on the E5 data. (Jerry Gilfoyle)

[Modified Sun Dec 27 01:07:22 2009 (GMT) Jerry Gilfoyle]

At Kawtar's suggestion I have investigated the effect of the hermiticity cut on the 4.2-GeV, E5 data set. I don't think we need to put this in the update or in the main presentation, but it would be good to be prepared for questions from the PAC. In our presentations of the impact of the hermiticity cut we usually show the effect of the θ_{pq} cut first followed by applying the hermiticity cut. For the E5 data, we know the θ_{pq} cut does an excellent job reducing the inelastic background by itself so here I show the effect of the hermiticity cut first and then apply the θ_{pq} cut. The inelastic background in Fig 1 under the black histogram is dramatically reduced by requiring two particles (e-p) in the final state. In the region W2<1.2 GeV2, the number of background events is reduced by a factor of three in going from the black histogram (no hermiticity or θ_{pq} cut) to the red one (hermiticity cut turned on). This drop is roughly consistent with our simulation results at higher Q2. I could redo our simulations at this Q2, but that would require using GSIM instead of FastMC12 to compare with the E5 data (which is a big job). The hermiticity cut sharply reduces the inelastic background even at lower (< 5GeV2) even though it is not needed in that Q2 range.

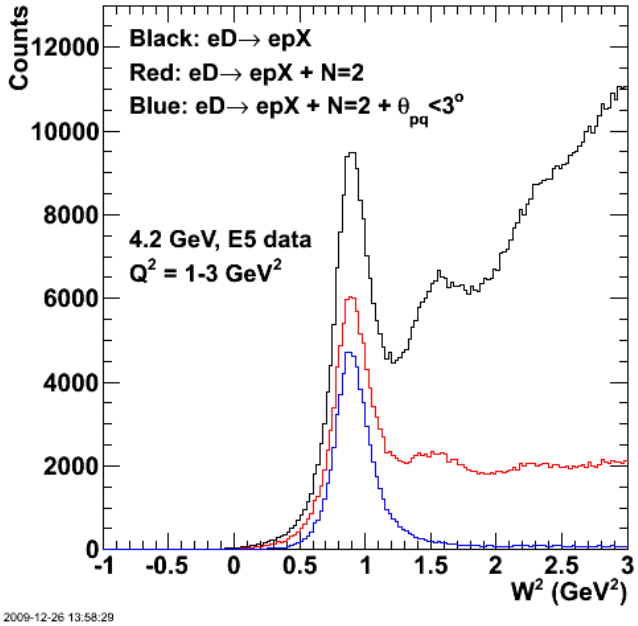
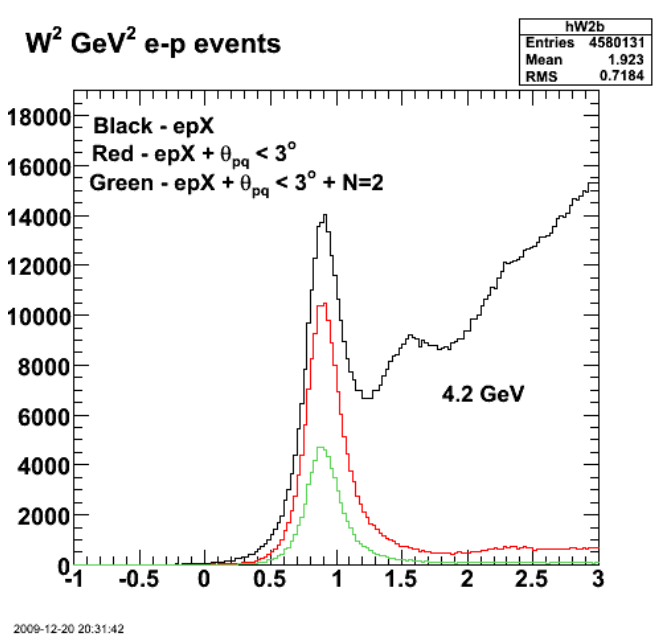


Fig 1. Plot for PAC35 update showing W2 distribution without hermiticity or θ_{pq} cut (black), with just the hermiticity cut (red), and with both hermiticity and θ_{pq} cuts.

Now for the 'bad' news. The plots below compare the effect of the θ_{pq} + hermiticity cuts with just the θ_{pq} cut alone. The left-hand panel in Fig 2 shows the effect first of the θ_{pq} cut alone (red histogram) followed by the addition of the hermiticity cut (green histogram) where we veto events with N>2 where N is the number of tracks. The surprise here is that the hermiticity cut removes more than half of the quasielastic (QE) events. In the right-hand panel modifying the hermiticity cut from N>2 to N>3 restores most of the lost QE events, i.e. we include ep events with another particle in the final state. The number of epX events with X=neutron is small so the disparity in the number of events between the red and green histograms in the left-hand panel of Fig 2. does not seem to be due to quasielastic epn events. This would imply we have a significant number of random coincidences associated with the ep events. Notice also there are differences between the plots in the number of events for nominally the same conditions. I have been stuggling with some dying nodes in my cluster and will try and get those distributions consistent with one another in the next couple of weeks.



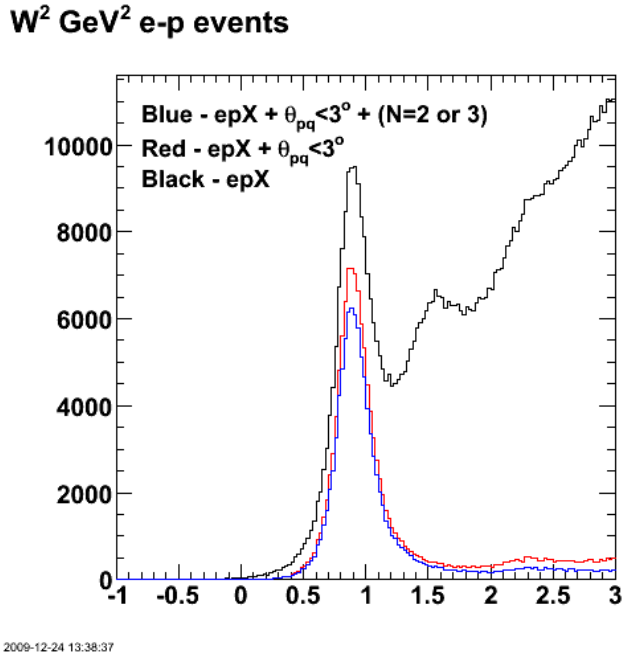


Fig 2. The left-hand panel shows the effect of the θ_{pq} cut on the W2 distribution for epX events (red) followed by adding the hermiticity cut (no N > 2 tracks). The right-hand panel shows the W2 distribution if the hermiticity cut is changed to a veto of events with the number of tracks N>3 (blue).

Next I went searching for the lost QE events. To make a long story short, I looked at the different final channels for N=3 and N=4 particles in the final state. If I astutely choose those final states and add them to the green histogram in the left-hand panel of Fig 2, I can get back to 94% of the red histogram (which has only the θ_{pq} cut and not the hermiticity cut). The results are shown in Fig 3. The red histogram is for epX events with the θ_{pq} cut alone. The blue histogram shows the results for epX events + θ_{pq}<3 deg + (N=2 or N=3). The green histogram shows the results epX events + θ_{pq}<3 deg + (N=2 or N=33('best' channels) or N=4('best' channels)). 'Best' here is determined by looking at the W2 distribution for a particular final state (e.g. epK+) and picking out the channels with prominent quasielastic peaks. Applying the hermiticity cut is going to be more complicated than we originally thought and will require a better understanding of the random coincidences.

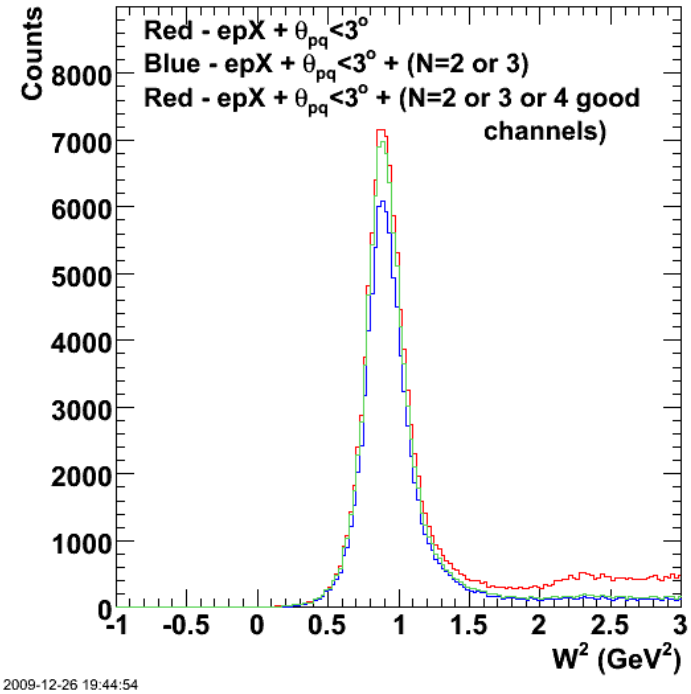


Fig 3. Finding more of the missing QE events. The red histogram is for epX events with the θ_{pq} cut alone. The blue histogram shows the results for epX events + θ_{pq}<3 deg + (N=2 or N=3). The green histogram shows the results epX events + θ_{pq}<3 deg + (N=2 or N=3('best' channels) or N=4('best' channels))

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 305 - Effect of reducing the θ_{pq} on the inelastic background (gpg)

[Modified Mon Jan 4 16:27:59 2010 (GMT) gpg]

The first two plots below show the starting point for this study. Figs 1-2 show the progression of cuts from Fig 7-8 of entry 301 for θ_{pq}<1.5 deg along with the results of integrating over the range -1 < W2 < 1.2 GeV2.

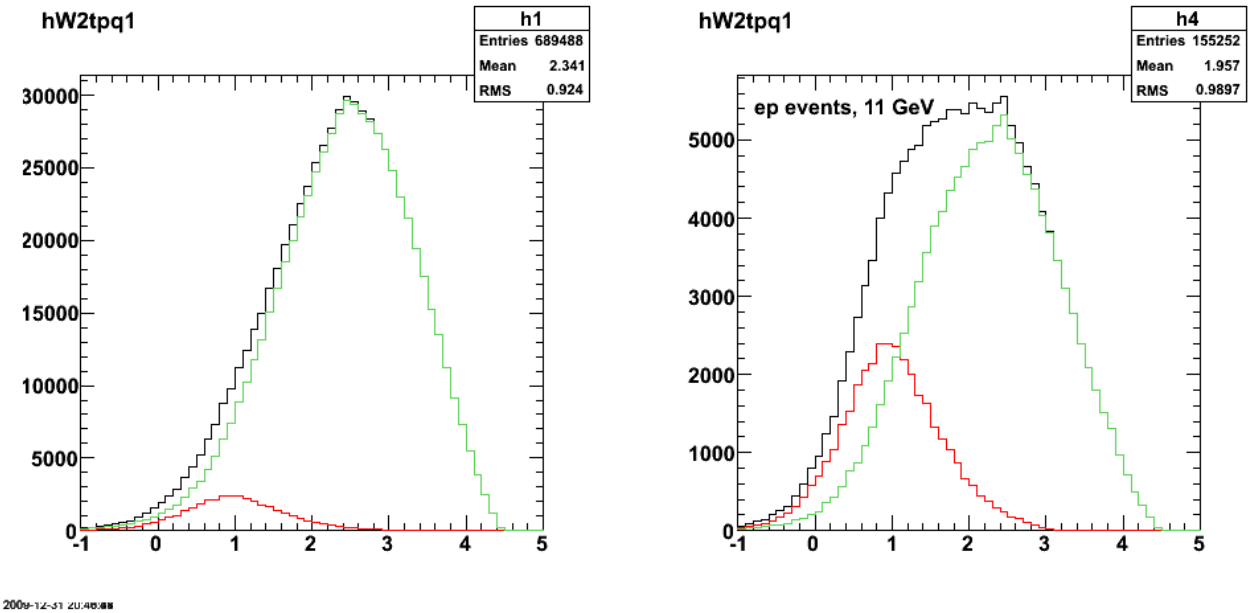


Fig 1. Same as Fig 5 in entry 301 for ep events, but run with submit_gmnsim.pl 11000 400000 1, theta_pq < 1.5 deg, F=0.33.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (gzipped tar archive) you uploaded.

Integrals:

```
root [56] inNocut
(Float_t)1.48380000000000000e+04
root [57] totalNocut
(Float_t)3.78490000000000000e+04
root [58] fracNocut
(Float_t)3.92031490802764893e-01


root [64] inCut
(Float_t)3.07700000000000000e+03
root [65] totalCut
(Float_t)2.60780000000000000e+04
root [66] fracCut
(Float_t)1.17992177605628967e-01
```

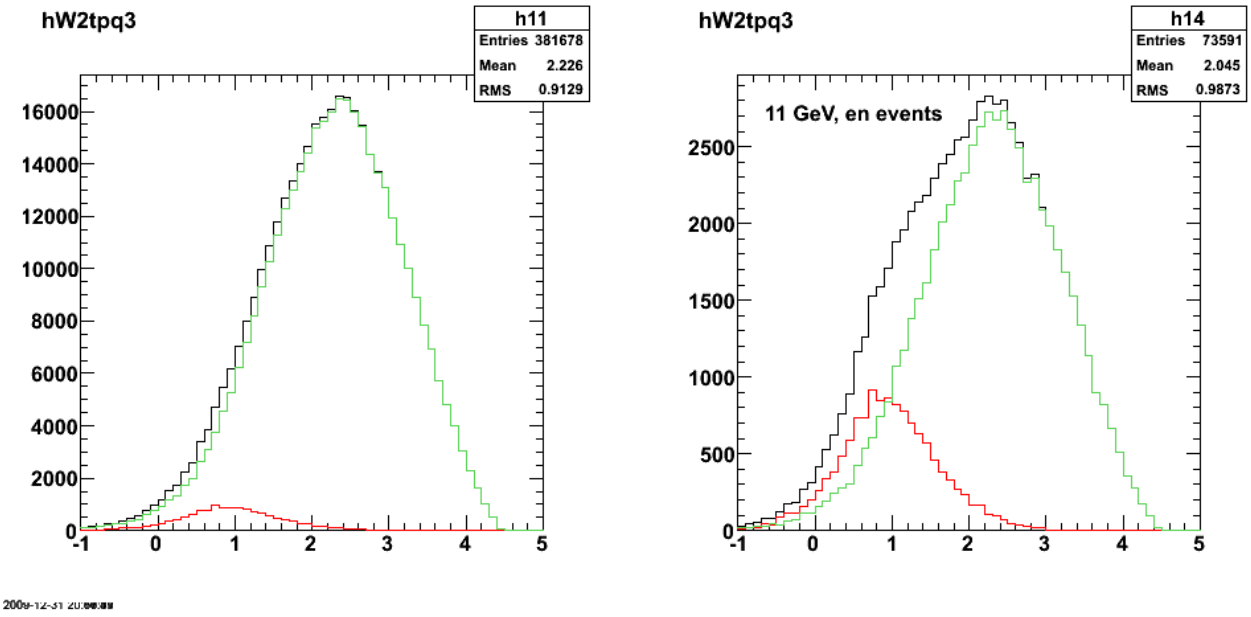


Fig 2. Same as Fig 6 in entry 301 for en events, but run with submit_gmnsim.pl 11000 400000 1, theta_pq < 1.5 deg, F=0.33.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (gzipped tar archive) you uploaded.

Integrals for en events:

```
root [118] inNocut
(Float_t)7.10500000000000000e+03
root [119] totalNocut
(Float_t)1.56660000000000000e+04
root [120] fracNocut
(Float_t)4.53529924154281616e-01


root [126] inCut
(Float_t)9.85000000000000000e+02
root [127] totalCut
(Float_t)9.53600000000000000e+03
root [128] fracCut
(Float_t)1.03292785584926605e-01
```

Redo the above sim just to check things.

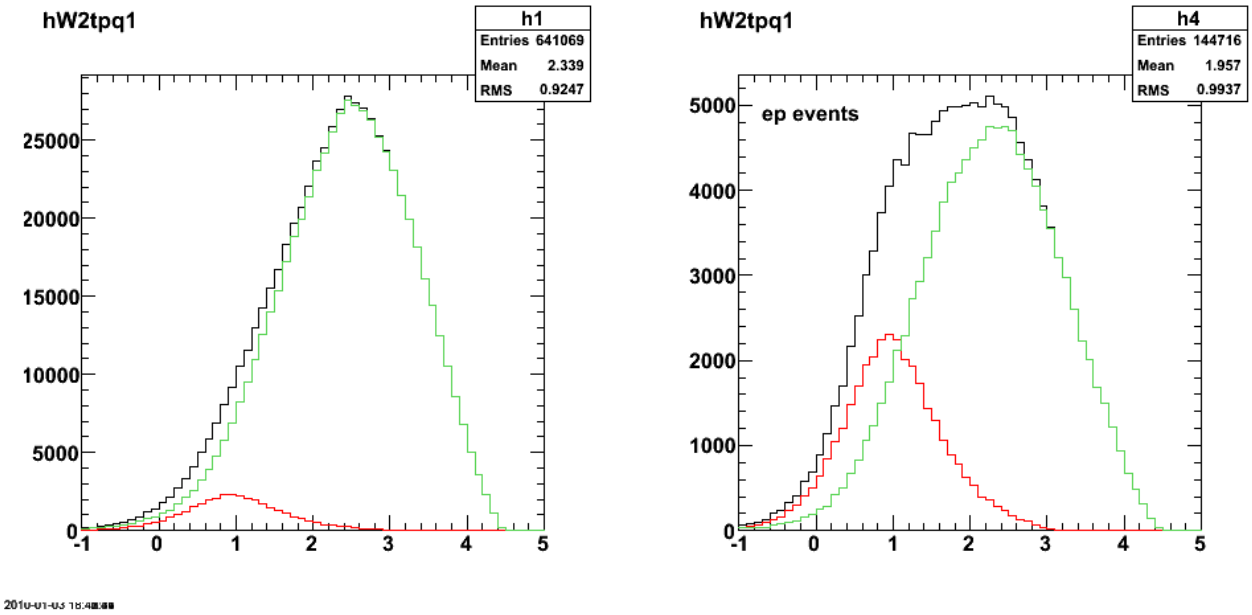


Fig 3. Do the progression of cuts for ep events (redo of fig 1). Run with submit_gmnsim.pl 11000 400000 1, theta_pq < 1.5 deg, F=0.33.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (gzipped tar archive) you uploaded.

Integrals:

```
root [56] inNocut
(Float_t)1.37780000000000000e+04
root [57] totalNocut
(Float_t)3.54730000000000000e+04
root [58] fracNocut
(Float_t)3.88408094644546509e-01

root [138] inCut
(Float_t)2.83200000000000000e+03
root [139] totalCut
(Float_t)2.45190000000000000e+04
root [140] fracCut
(Float_t)1.15502260625362396e-01
```

Now tighten the theta_pq cut.

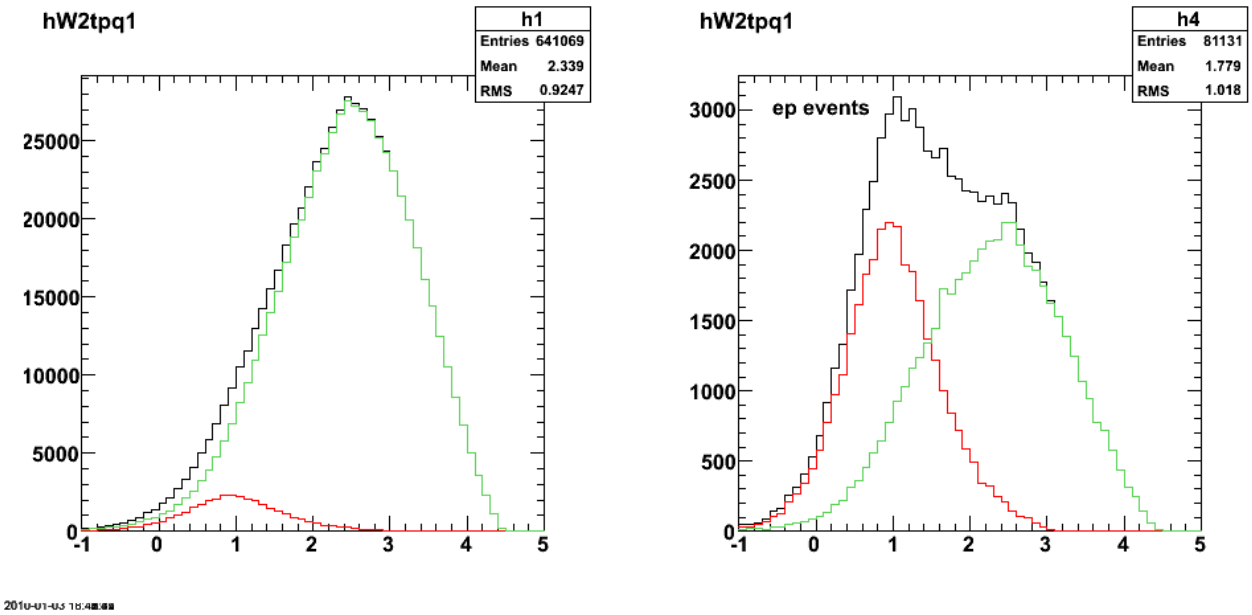


Fig 4. Same as fig 3 with theta_pq < 1 deg.

Click here to view the object (ROOT macro) you uploaded.

Integrals:

```
root [94] inNocut
(Float_t)6.07900000000000000e+03
root [95] totalNocut
(Float_t)2.64150000000000000e+04
root [96] fracNocut
(Float_t)2.30134397745132446e-01

root [102] inCut
(Float_t)1.39300000000000000e+03
root [103] totalCut
(Float_t)2.17250000000000000e+04
root [104] fracCut
(Float_t)6.41196742653846741e-02
```

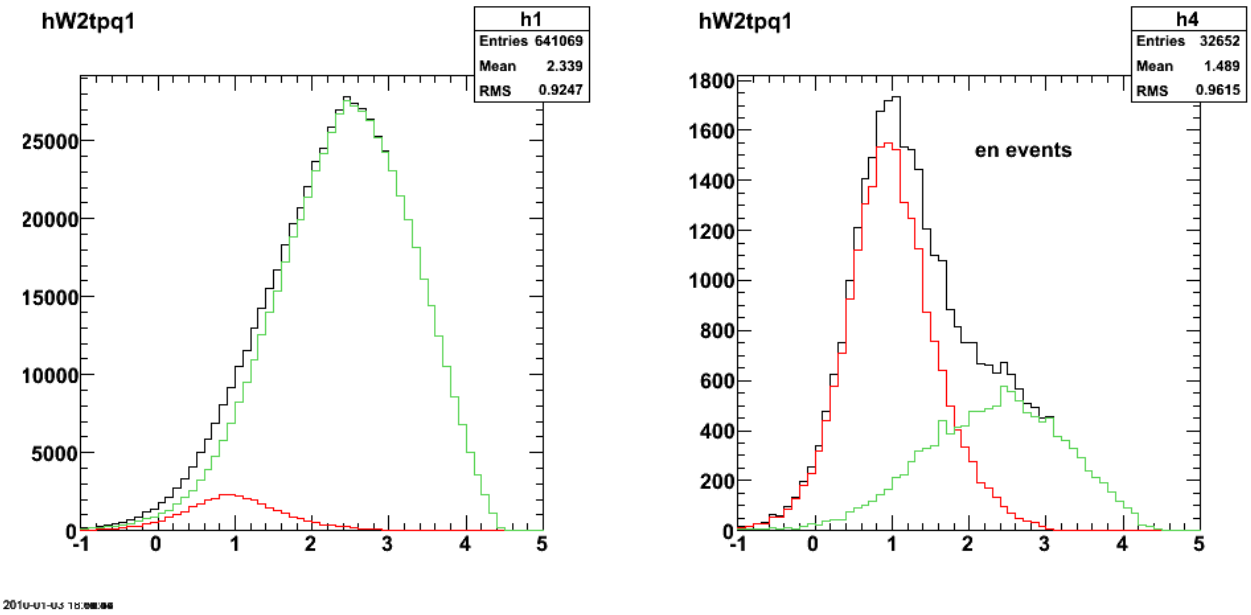


Fig 5. Same as fig 3 with theta_pq < 0.5 deg. These are ep events, not en events as labeled on the plot.

Click here to view the object (Root macro) you uploaded.

Integrals:

```
root [174] inNocut
(Float_t)1.37100000000000000e+03
root [175] totalNocut
(Float_t)1.48660000000000000e+04
root [176] fracNocut
(Float_t)9.22238677740097046e-02

root [182] inCut
(Float_t)3.41000000000000000e+02
root [183] totalCut
(Float_t)1.38320000000000000e+04
root [184] fracCut
(Float_t)2.46529784053564072e-02
```

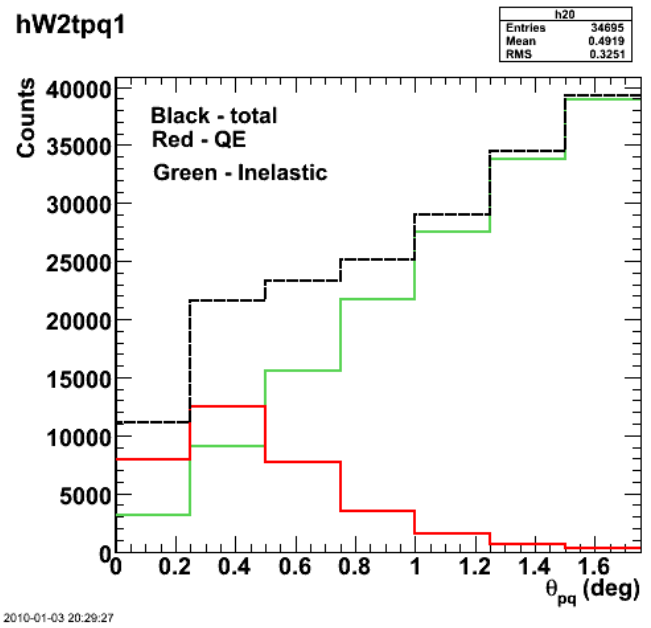


Fig 6. Angular distributions of QE (red), inelastic (green), and total (black) events for previous plots for ep events.

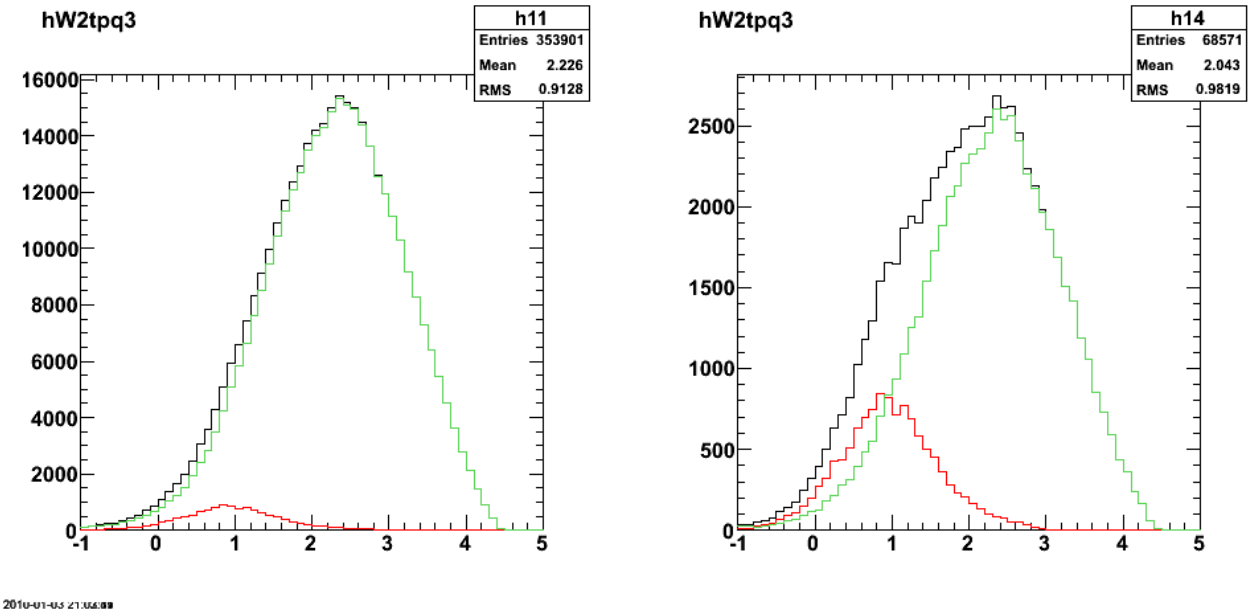


Fig 7. Do the progression of cuts for en events (redo of fig 2). Run with submit_gmnsim.pl 11000 400000 1, theta_pq < 1.5 deg, F=0.33.

Click here to view the object (Root macro) you uploaded.

Integrals:

```
root [56] inNocut
(Float_t)6.61000000000000000e+03
root [57] totalNocut
(Float_t)1.45260000000000000e+04
root [58] fracNocut
(Float_t)4.55046117305755615e-01

root [64] inCut
(Float_t)8.31000000000000000e+02
root [65] totalCut
(Float_t)8.73900000000000000e+03
root [66] fracCut
(Float_t)9.50909703969955444e-02
```

Now reduce θ_{pq} to 1.0 deg.

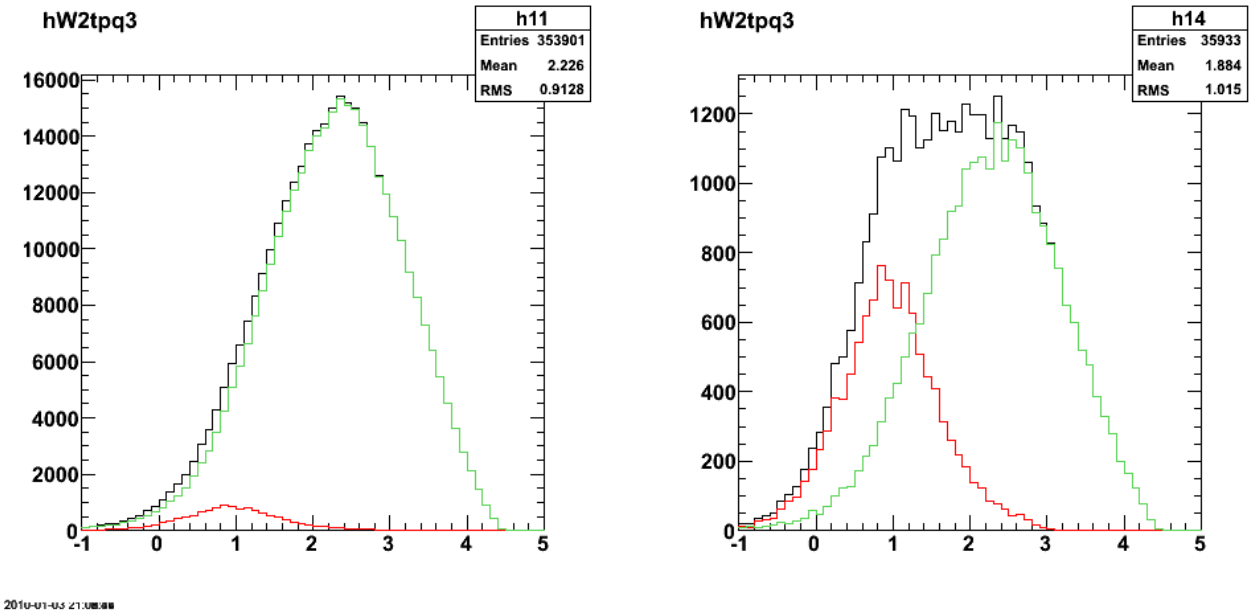


Fig 8. Do the progression of cuts for en events (redo of fig 7). Run with submit_gmnsim.pl 11000 400000 1, theta_pq < 1.0 deg, F=0.33.

Click here to view the object (Root macro) you uploaded.

Integrals:

```
root [100] inNocut
(Float_t)2.94100000000000000e+03
root [101] totalNocut
(Float_t)1.00090000000000000e+04
root [102] fracNocut
(Float_t)2.93835550546646118e-01

root [108] inCut
(Float_t)4.10000000000000000e+02
root [109] totalCut
(Float_t)7.47400000000000000e+03
root [110] fracCut
(Float_t)5.48568367958068848e-02
```

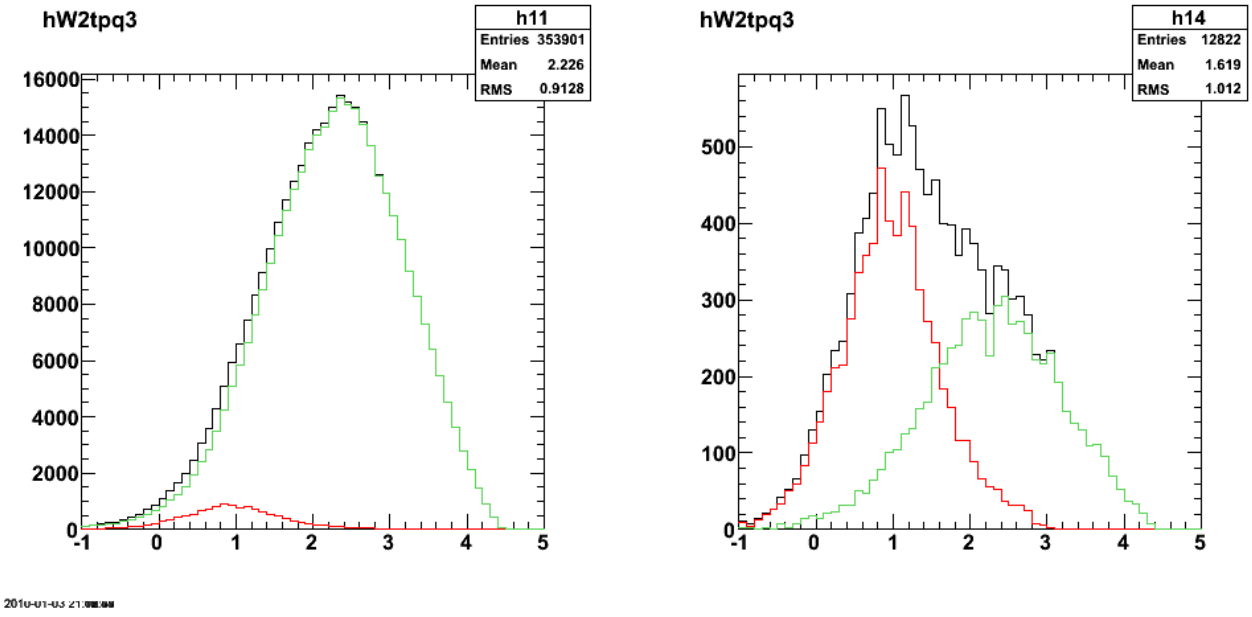


Fig 9. Do the progression of cuts for en events (redo of fig 8). Run with submit_gmnsim.pl 11000 400000 1, theta_pq < 0.5 deg, F=0.33.

Click here to view the object (Root macro) you uploaded.

```
root [144] inNocut
(Float_t)7.52000000000000000e+02
root [145] totalNocut
```

```
(Float_t)4.95800000000000000e+03
root [146] fracNocut
(Float_t)1.51674062013626099e-01

root [152] inCut
(Float_t)9.80000000000000000e+01
root [153] totalCut
(Float_t)4.30000000000000000e+03
root [154] fracCut
(Float_t)2.27906983345746994e-02
```

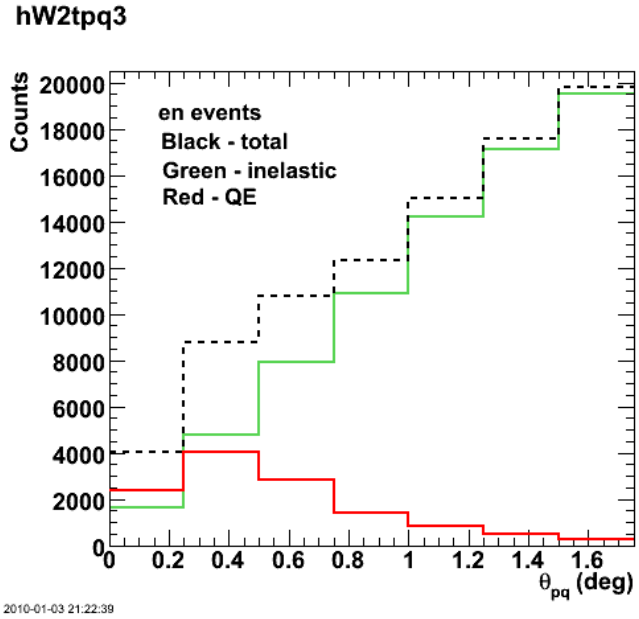


Fig 10. Angular distributions of QE (red), inelastic (green), and total (black) events for previous plots for en events.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 306 - Investigating the N=3 tracks for the hermiticty cut (gpg)

[Modified Wed Jan 6 20:54:05 2010 (GMT) gpg]

Let's look at the properties of the tracks that have ID=0 and come with the QE ep events in the 4.2-GeV data set. The first plot on tle left-hand side below shows the distribution of charges for tracks with N=3 and ID=0. There are lots of tracks with all three charges so there is little reason to filter there.

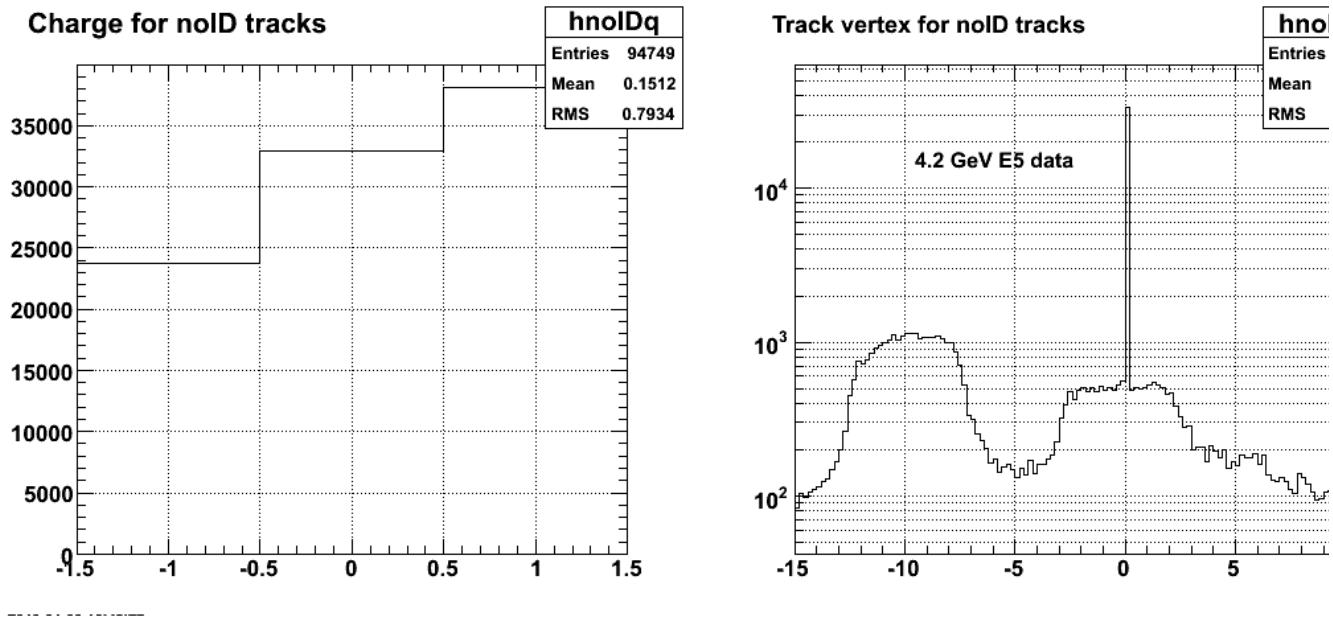


Fig 1. Charge distribution (left-hand panel) and vertex distribution for tracks from events with N=3 and have e+p. The right-hand panel shows the vertex distribution for the same events.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

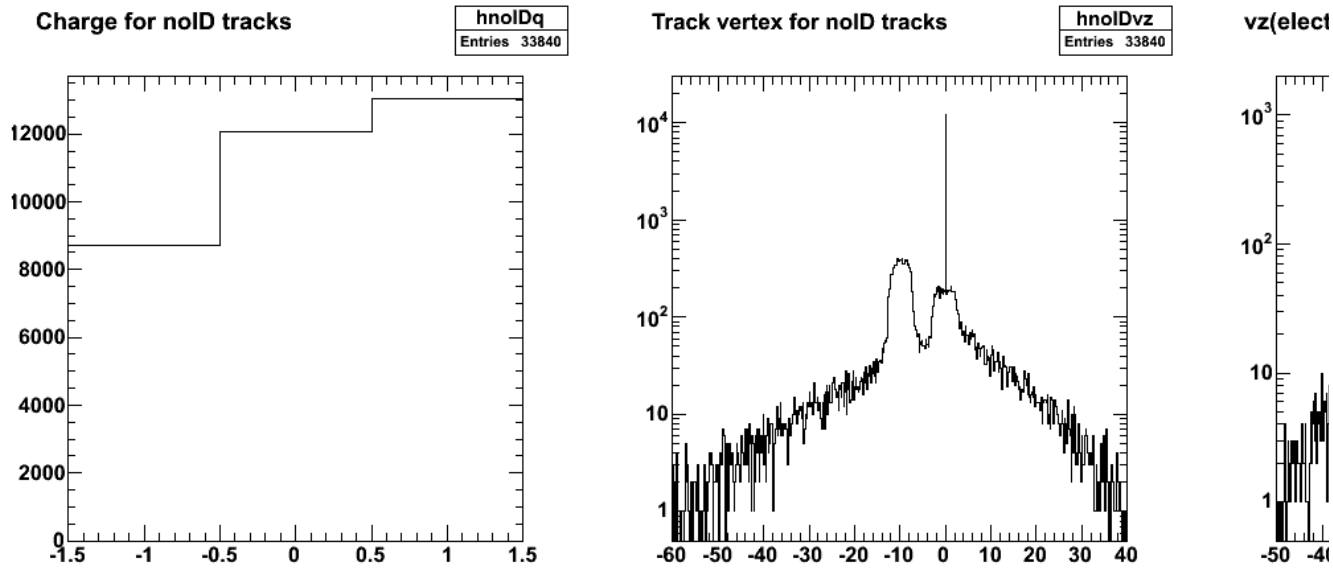


Fig 2. More plots of study of 'bad' N=3 events.

Click here to view the object (ROOT macro) you uploaded.

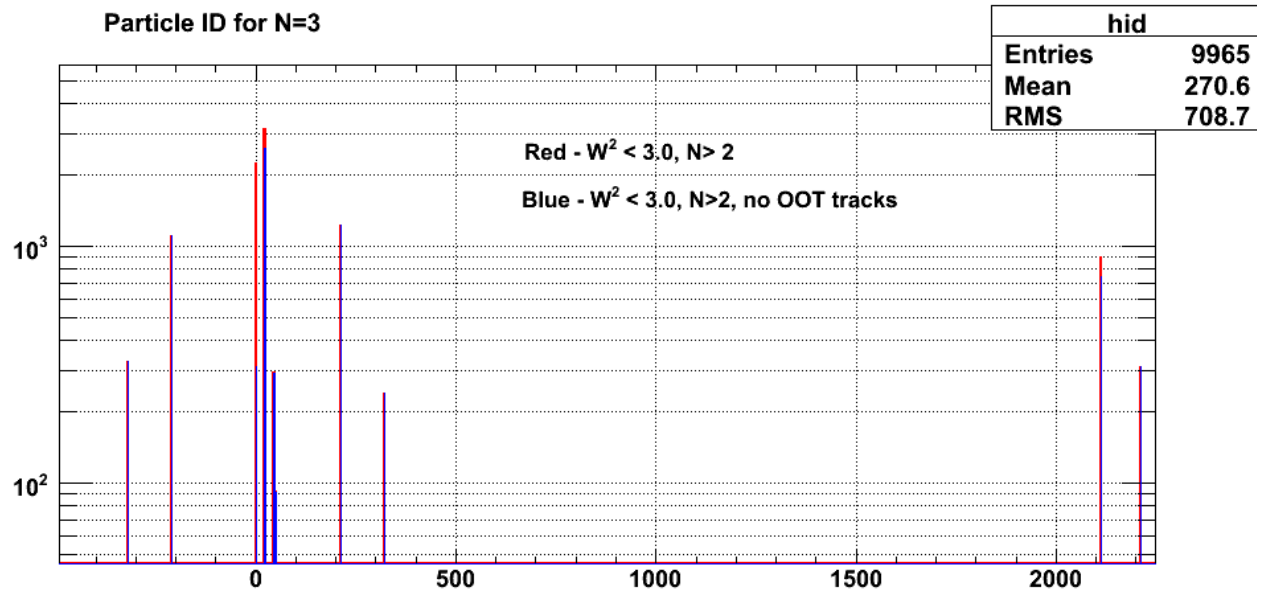
Click here to view the object (ROOT histogram file) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 307 - Study out-of-time tracks (gpg)

[Modified Wed Jan 20 15:15:49 2010 (GMT) gpg]

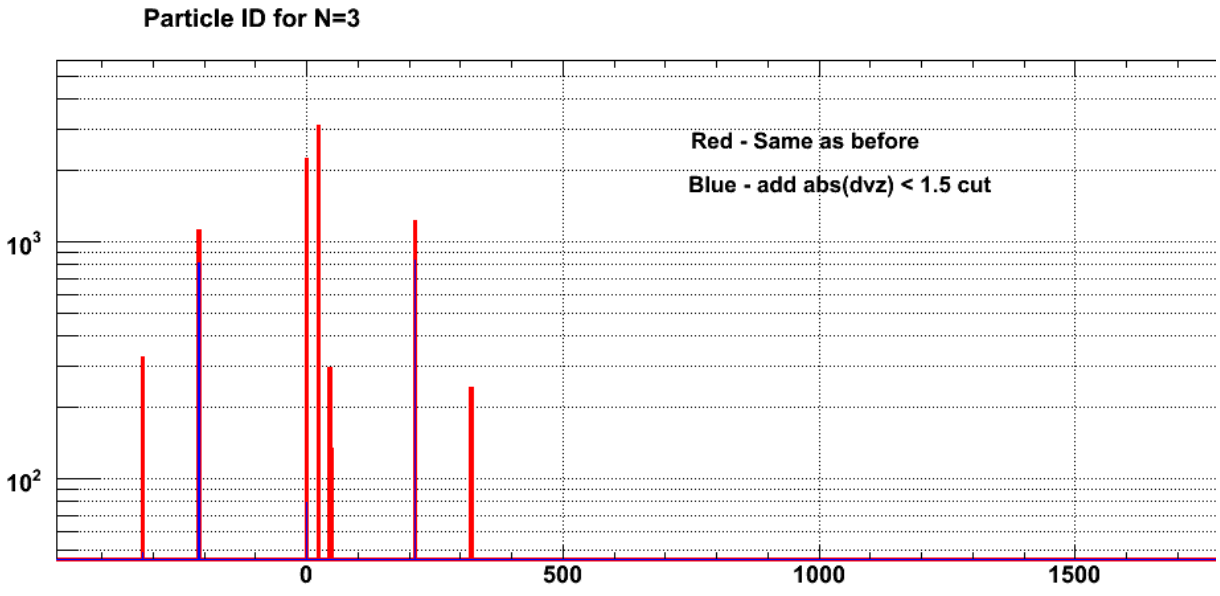
It looks like their may be a lot of out-of-time tracks (status = 0 for the track in the evnt bank. This is due to tracks from a previous or later beam bucket where the electron was undetected, but the proton (most likeley) or pi+ left a track. The first plot shows the effect of turning on the requirement that abs(status)>0 so there should be no out-of-time tracks in the blue histogram. Most of the ID=0 tracks disappear, but large fractions of the other final states remain.



2010-01-11 23:20:01

Fig 1. Distribution of PDG particle IDs for the third and higher tracks (not the electron or proton track) for W2<3.0 GeV2 and other, standard ep cuts.

Click here to view the object (ROOT macro) you uploaded.



2010-01-11 23:43:08

Fig 2. Same as Fig 1, but now add the requirement abs(dvz)<1.5 cm where dvz = vz[jelectron]-vz[iparticle] which is the distance between the vertices of the electron and the N>2 track.

Click here to view the object (ROOT macro) you uploaded.

Consider the plot below. Upper left and Upper right panels compare the W2 distribution for several different cuts. The lower left looks at the difference between phi for the electron and phi for the N>2 tracks. The wide peak at Î"Î¸ = 180 deg may be a sign of ghost tracks according to Stepan associated with the proton. The peak at 0 deg may be ghosts associated with the electron. The lower right panel shows the Î† angle of the N>2 tracks. The large peak near zero is

unexplained.

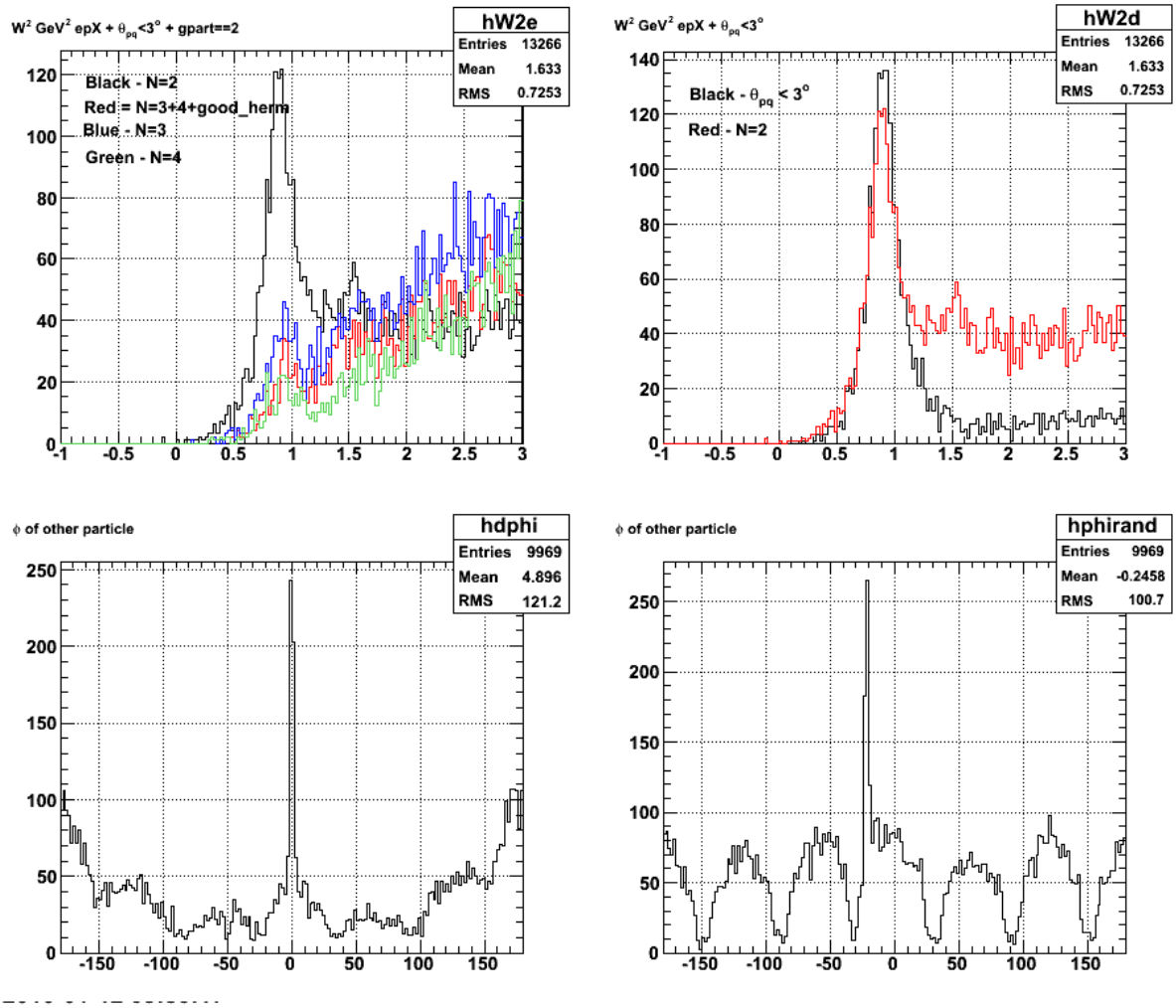


Fig 3. Lots of stuff. See text.

Click here to view the object (ROOT macro) you uploaded.

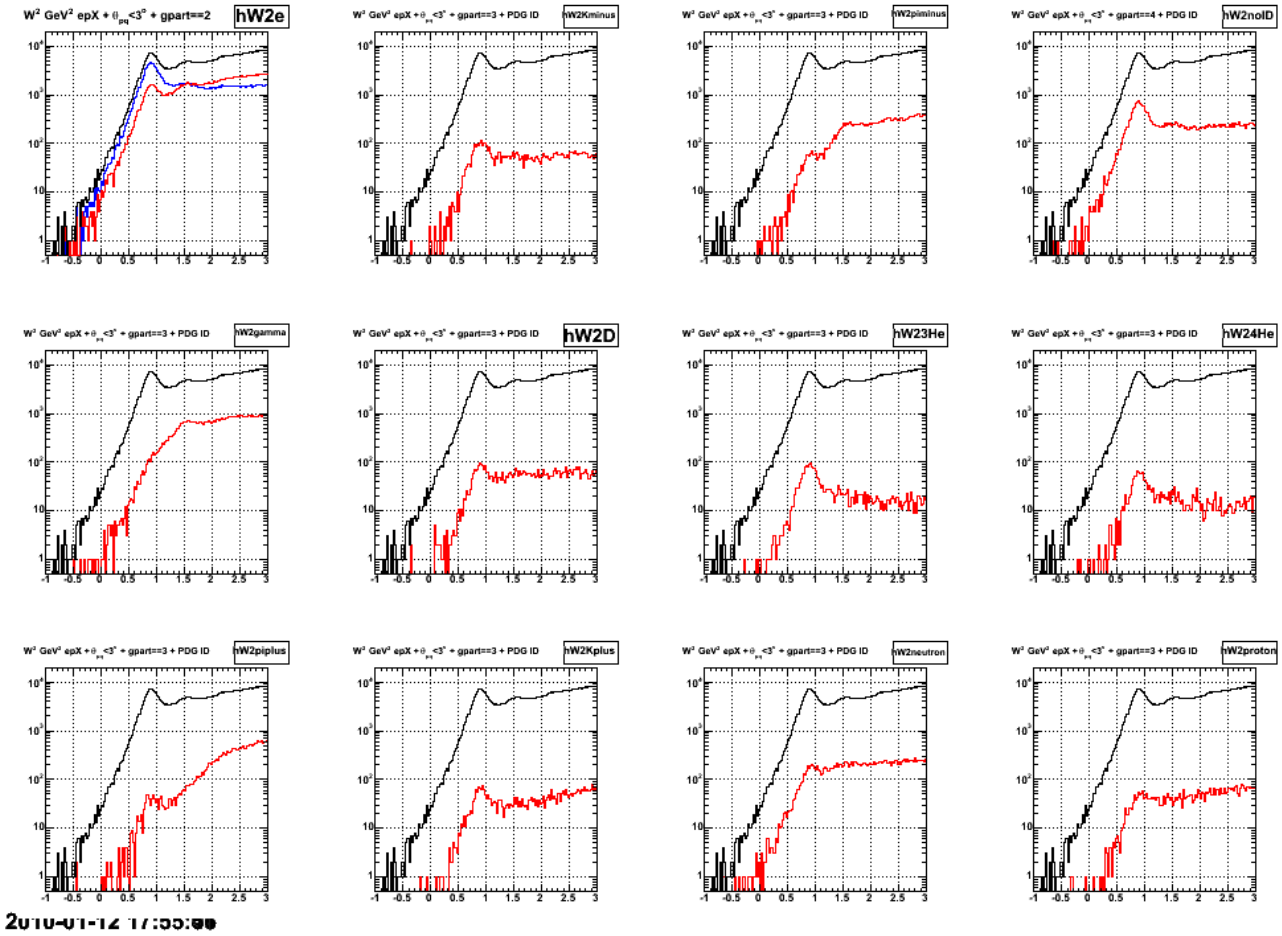


Fig 3. W2 dists for N=3 events.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

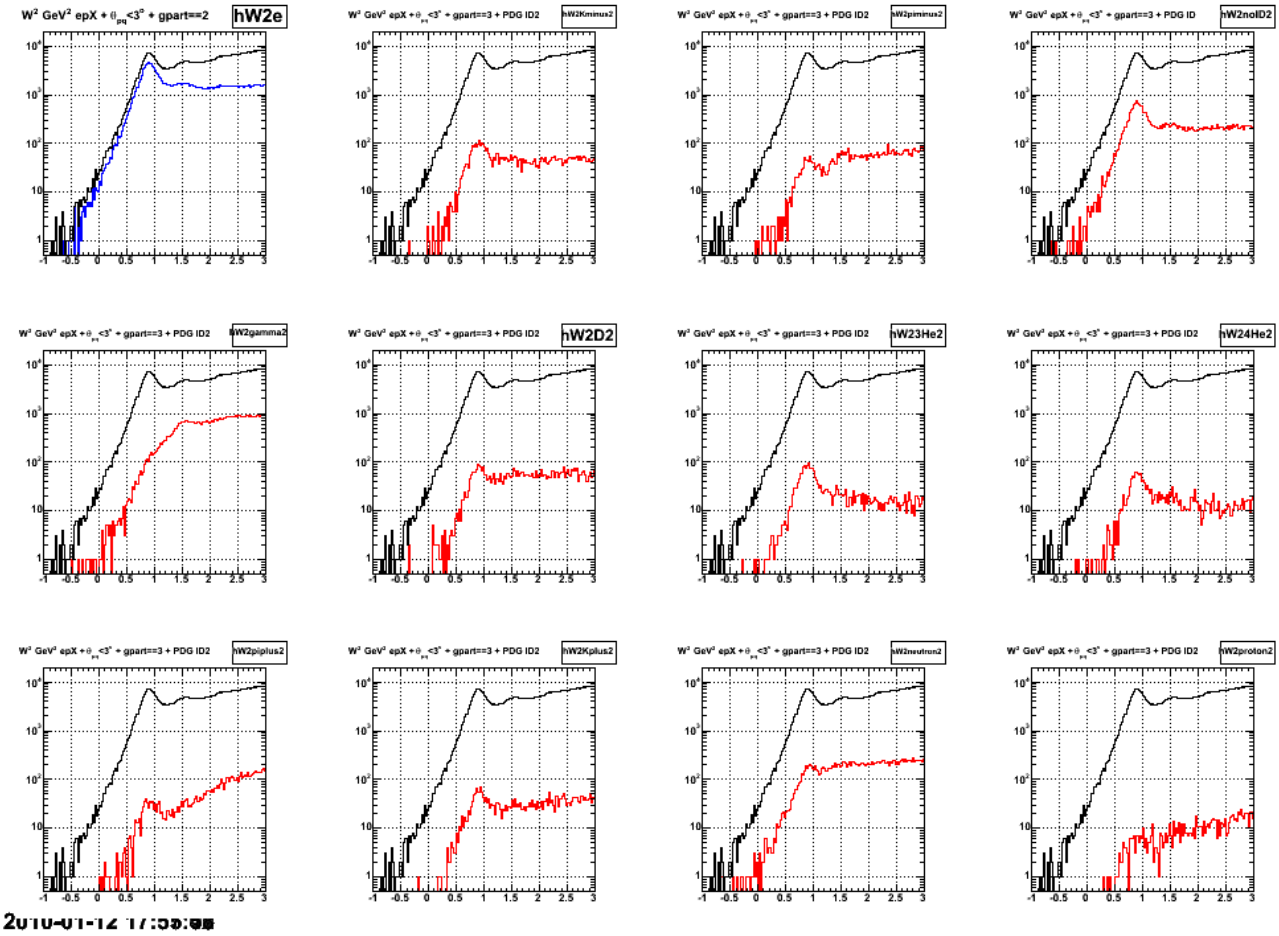


Fig 4. Now add a requirement that the track is out-of-time or outside the vertex region.

Click here to view the object (ROOT macro) you uploaded.

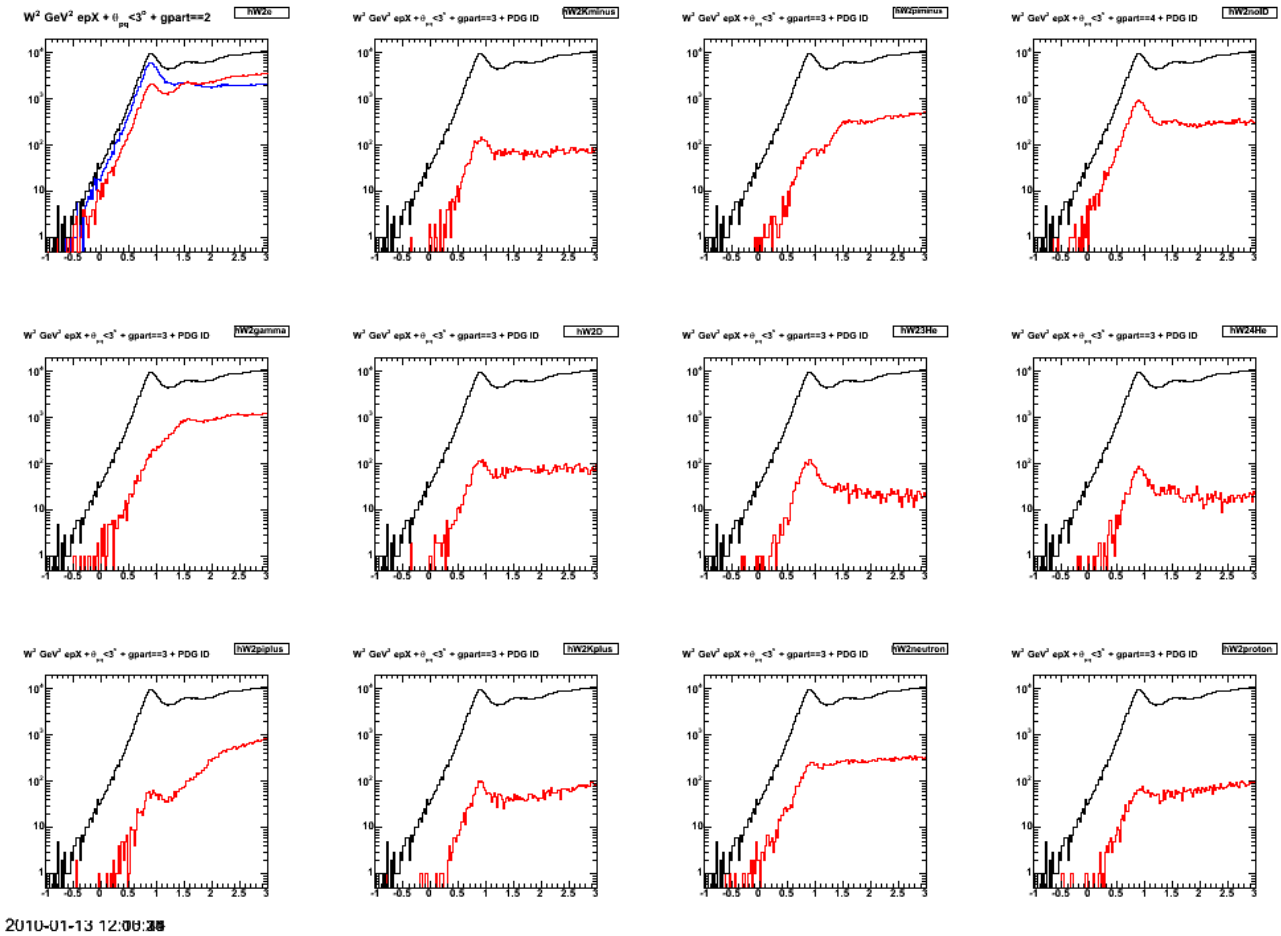
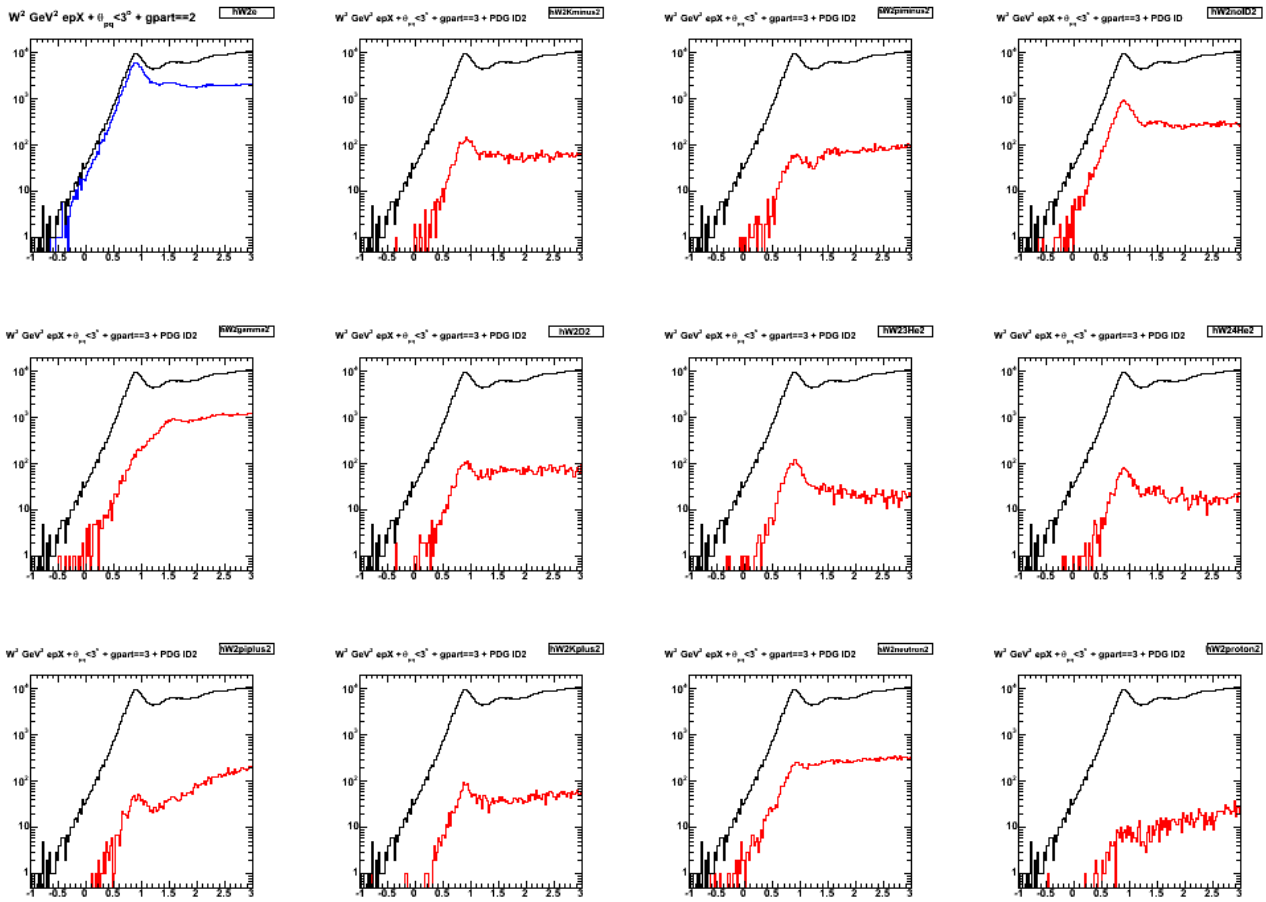


Fig 5. W2 spectra for N=3 events for a more complete run to get more of the statistics.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.



2010-01-13 12:05:08

Fig 6. W2 spectra for N=3 events for a more complete run to get more of the statistics with the added requirement (gpart==3 && ((abs(dvz)>e_p_vz_hi) || (abs(status_track)==0)))

Click here to view the object (ROOT macro) you uploaded.

In the next plot I add up the histograms from fig 6 above (red hist) which includes events with N=3, third track is out-of-time (OOT), and its vertex is more than 1.5 cm away from the electron vertex. This histogram has lots of inelastic events at high W2 and using the W2 dists in fig 6 as a guide exclude the gamma hist from fig 6 in the sum. This gives me the black curve which has fewer inelastics and close to the same number of QE events. The blue curve is the result for requiring N=2 and the green requires theta_pq < 3 deg only.

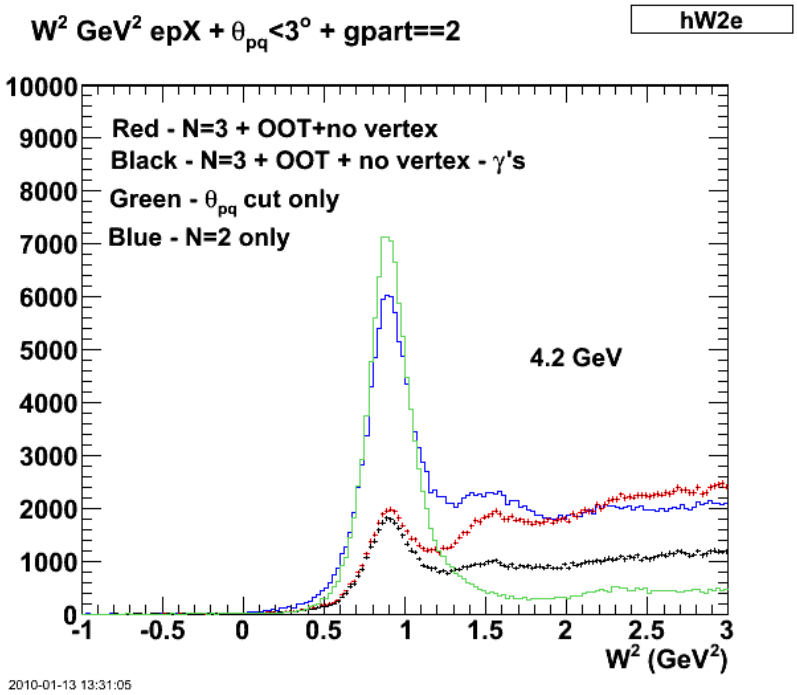


Fig 7. Adding up this histograms. See text just above.

Click here to view the object (ROOT macro) you uploaded.

Add up the 'N=3 + OOT + no-vertex - gammas' distributions and add them to the N=2 and compare with the theta_pq only dist. The summed histoggram now exceeds the theta_pq-only one which it should, but probably by not enough. Ultimately I need to compare the theta_pq-only with theta_pq+summed histogram and hopefully get the same number of QE events.

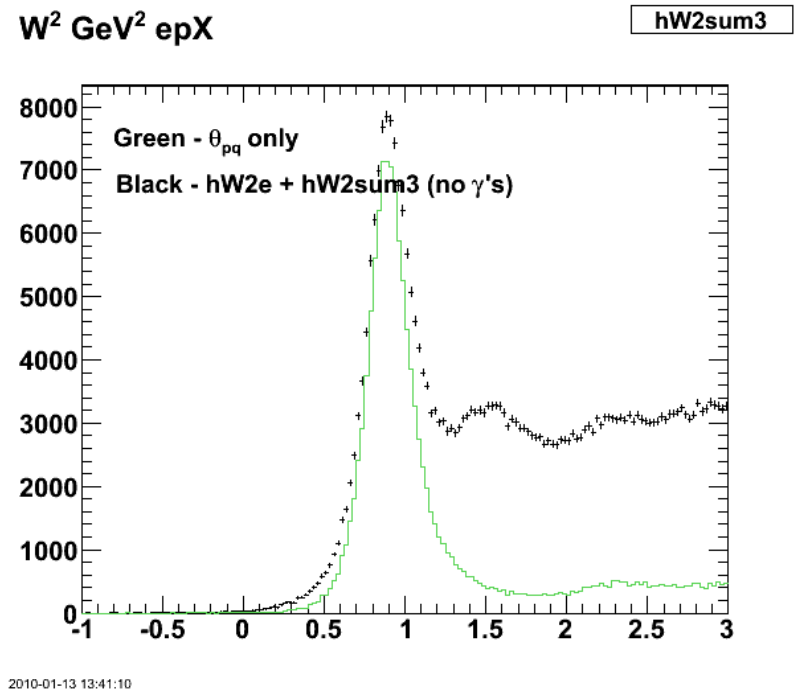


Fig 8. Comparison of theta_pq-only events and the ones from N=2 + N=3 should have beens!!

Click here to view the object (ROOT macro) you uploaded.

Get the full 148 runs into the data; same analysis as above.

Click here to view the object (ROOT histogram file) you uploaded.

The plot below shows some neat results. The black histogram is W2 with just the $\hat{I}_{,pq}$ cut and no hermiticity cut. We want to reproduce the size of the QE peak with the hermiticity cut turned on so we are confident it is not distorting things. We also want to reduce the inelastic background at higher Q2. We know from before that setting the hermiticity cut to N=2, we lose a large fraction of the QE events. This is the red histogram in the plot which requires $\hat{I}_{,pq}$< 3 deg and N=2'. The loss of QE events that occurs when the hermiticity (N=2) cut is turned on is due to a broad definition of what is a track in SEB. I opened up the hermiticity cut to include events with N>2 + (out-of-time tracks) + (dvz > 1.5 cm) where dvz is the difference between the electron vertex and the vertex of the extra track. These are all tracks that are not associated with the e-p events so we don't want them in the sample and we don't want them to veto the e-p event. The W2 distribution for these events is the set of blue points. When I add these 'opened up' hermiticity cut points (blue) with the original 'N=2' points (red) I get the green points in the figure. These closely match the black histogram which is just the $\hat{I}_{,pq}$ points near the QE peak and are about a factor of two less in the inelastic region at higher W2. The black points are W2 for events with 'N=2" and 'N>2', but no $\hat{I}_{,pq}$ cut.

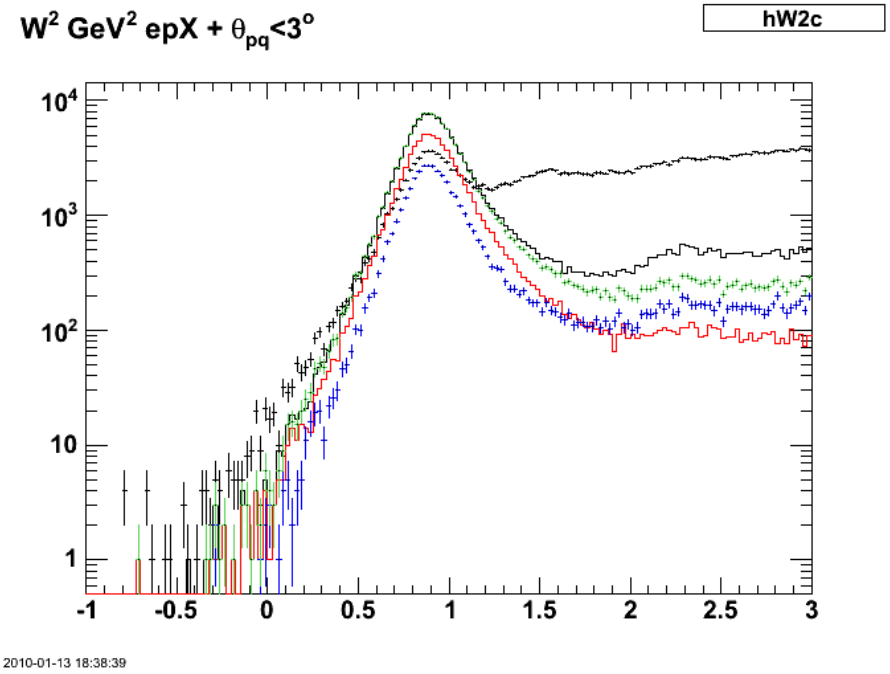


Fig 9. Starting to get things reasonable. See text above.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

Use the gpart>2 in the analysis and described just above so we catch all the ep with additional tracks that are out-of-time or out of the vertex cut.

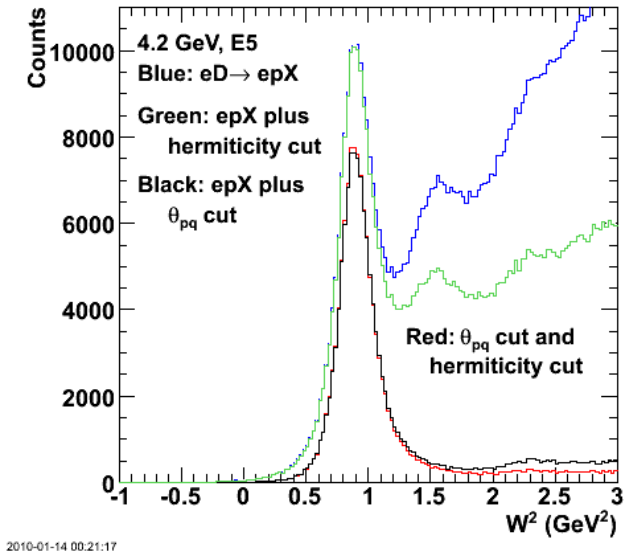


Fig 10. See text below.

Click here to view the object (Root macro) you uploaded.

1. For the CLAS6 data, the hermiticity cut is not needed. This cut reduces the already small inelastic background (compare black and red histograms).
2. Without requiring $\hat{I}_{,pq}$ < 3 deg, the hermiticity cut still dramatically reduces the inelastic background (compare blue and green histograms).}
3. Hermiticity cut here includes ep events with additional out-of-time tracks or ones that fall outside the vertex cut (1.5 cm).

BIG STUPID!!! The problem with the previous plot is that there are more QE events when I apply the $\hat{I}_{,pq}$ cut + hermiticity cut than when I apply the $\hat{I}_{,pq}$ cut alone. This makes no sense. The problem is that I was generating the W2 spectra in coincidence with a wide range of particles and then adding then together. If I had more than two additional tracks beyond the ep tracks and there were two or more of those tracks that had out-of-time tracks and failed the vertex cut, then I was double (and higher) counting. This is why I was getting two many events when I applied the modified hermiticity cut. The next plot shows this more clearer where I now required any track with N>2 and did not use N=3 || N=4 || ...

GGGAAAGGGHHHH!!!!!

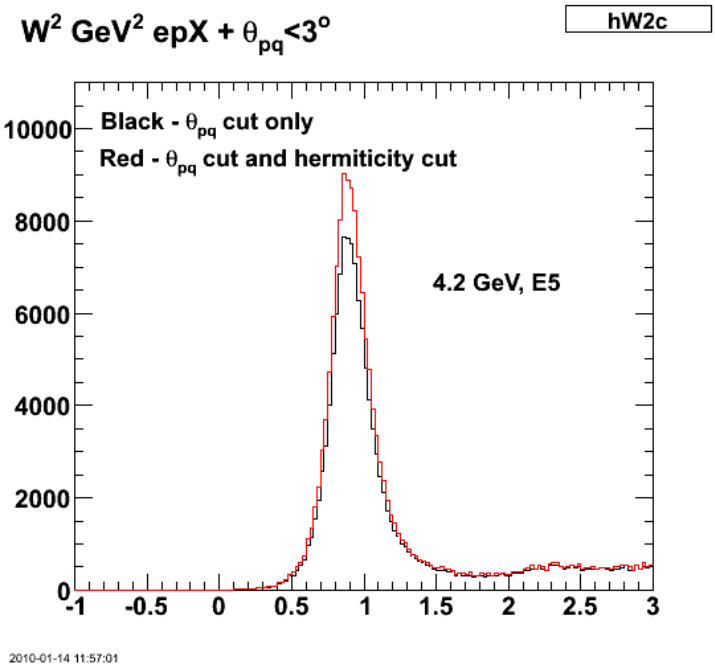


Fig 11. Comparison of W2 with $\hat{I}_{,pq}$ cut only (black) and with added hermiticity cut. See text above.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

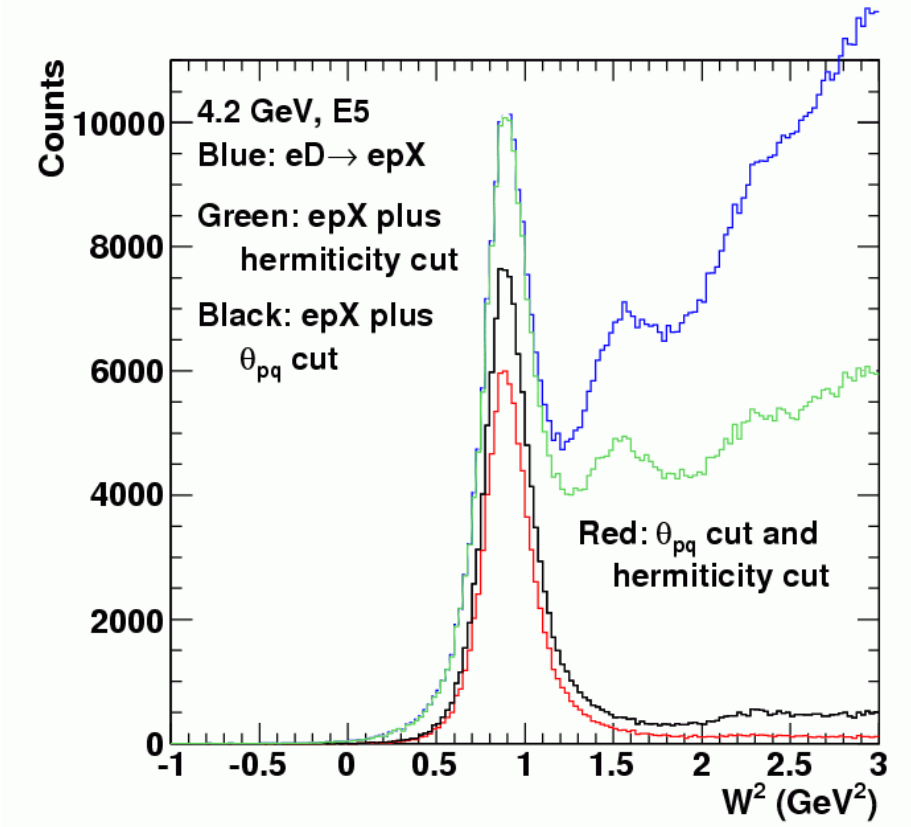


Fig 11b. Plot I sent to Will and Kawtar with corrected version of plot above showing a 20% loss of QE events when I use theta_pq + N=2 + N>2(OOT and wrong vz tracks)

Click here to view the object (ROOT macro) you uploaded.

Study the properties of the events that pass the theta_pq+modified hermiticity cut.

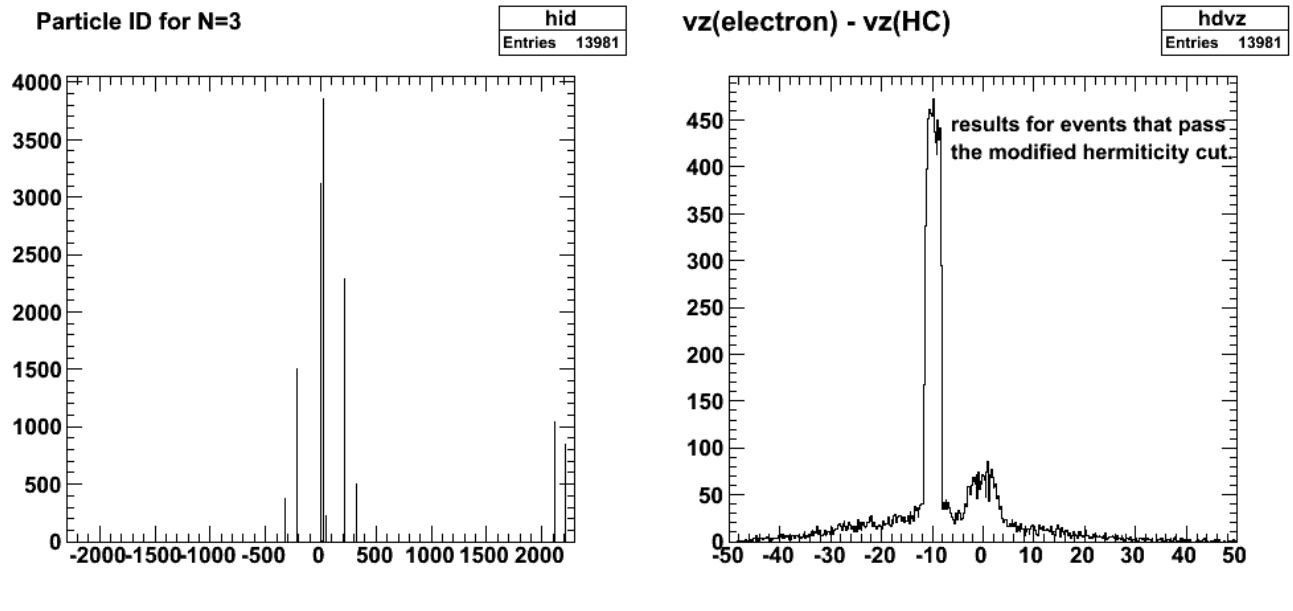


Fig 12. Left panel shows the distribution of PDG ODs that pass theta_pq + modified HC. Right-hand panel shows the distribution of vz(electron) - vz(track) for N>2 tracks that pass theta_pq + modified HC.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

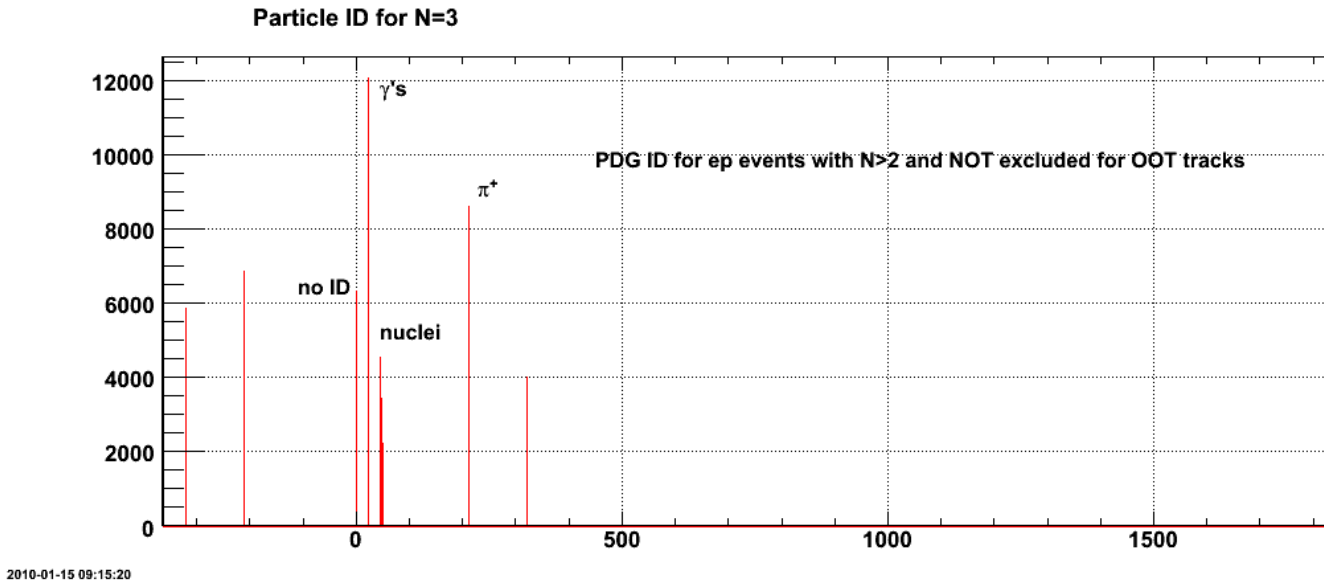


Fig 13. Look at the PDG ID for ep events that are thrown out because of additional tracks that are not OOT.

There are lots of pions and gammas in the above plot infiltrating the ep events. There is also a significant number of noIDs still. Need to look at W2 for these different final states.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

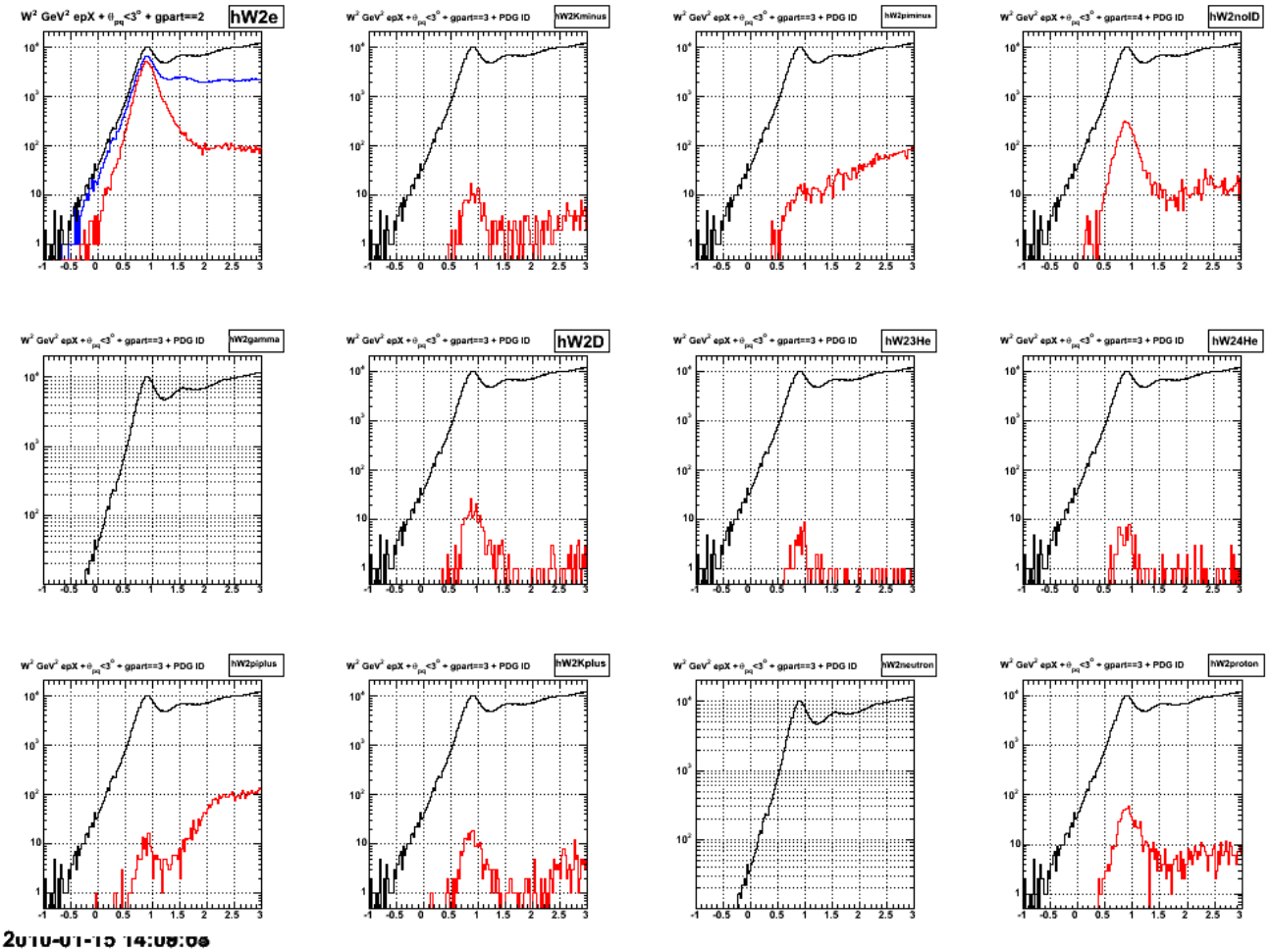
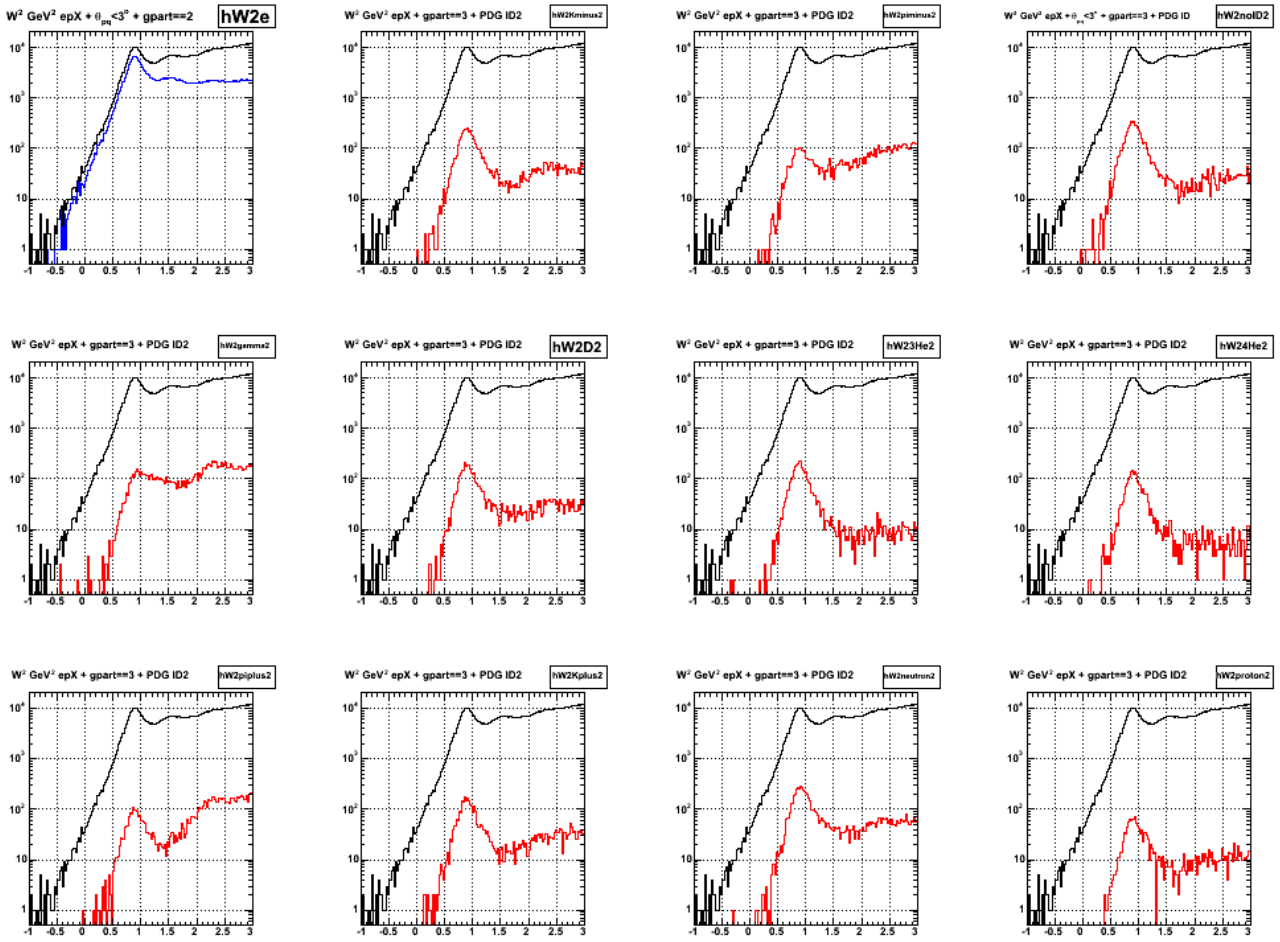


Fig 14. W2 distributions for events that pass the vertex cut and are removed from the ep sample. Note the large number of noID, QE tracks.

Click here to view the object (ROOT macro) you uploaded.

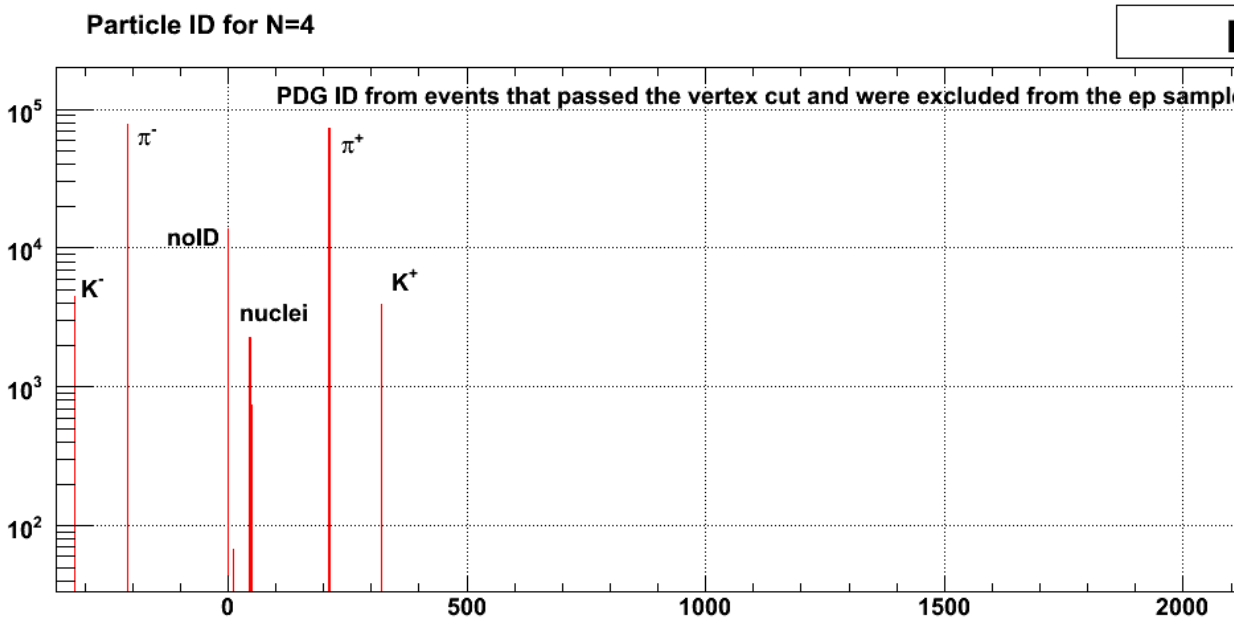
Click here to view the object (ROOT histogram file) you uploaded.



2010-01-15 14:08:00

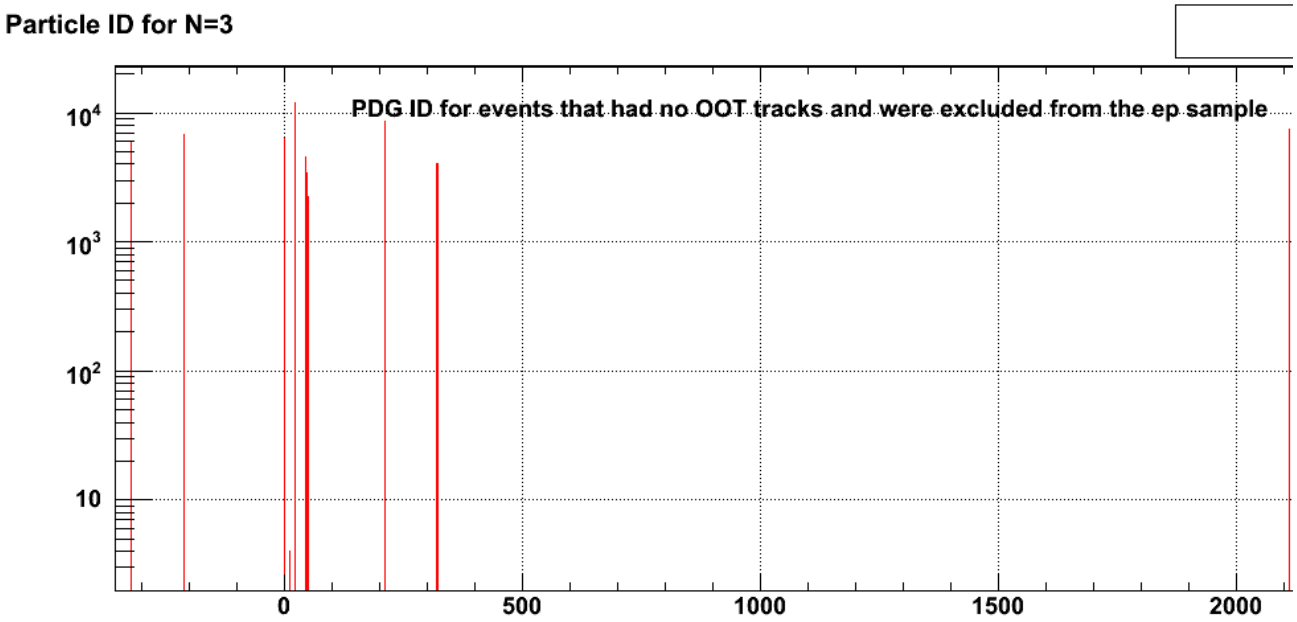
Fig 15. W2 distribution for events that that have no out-of-time tracks and are removed from the ep sample. Note again the large number of noID, QE tracks.

Click here to view the object (ROOT macro) you uploaded.



2010-01-15 14:28:52

Fig 16. PDG ID distribution for events excluded from the ep sample by the vertex cut. There are still a significant number of noID and proton events, but we are now dominated by the pions.



2010-01-15 14:33:12

Fig 17. PDG ID distribution for events excluded from the ep sample by the out-of-time track cut.

Click here to view the object (ROOT macro) you uploaded.

Now look at all of the events that get removed from the ep sample because they satisfy the vertex cut OR do not have any out-of-time tracks (small blue histogram below).

Maybe this is starting to get close. Below is the plot where I correctly(?) applied the N>2 + OOT + vertex cut. It shows the events for N=2, N>2 + OOT + vertex that were included in the sample (green), the ones excluded (blue), and the sum of N=2 + N>2 + OOT + vertex (red). Compare with the results for the theta_pq cut only (black).

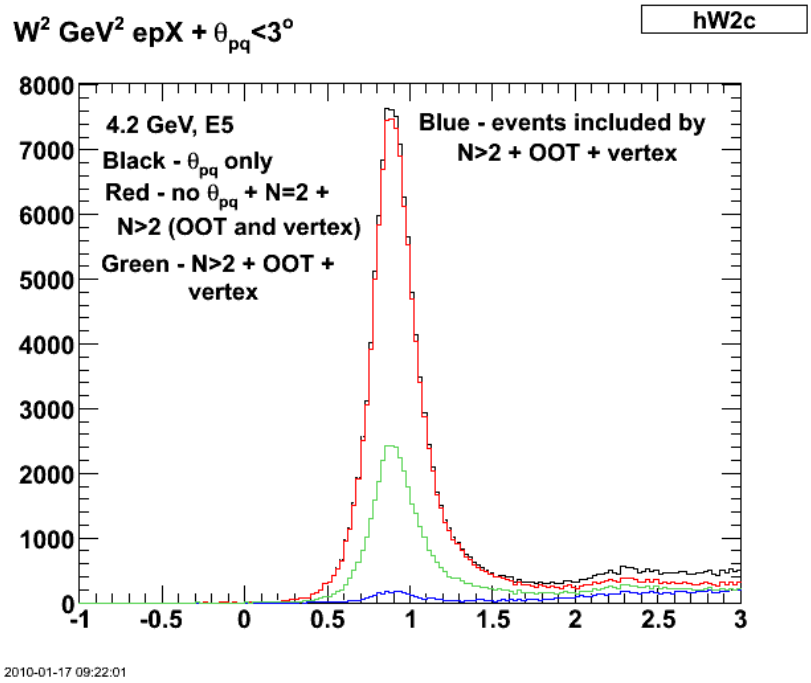


Fig 18. See text above.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

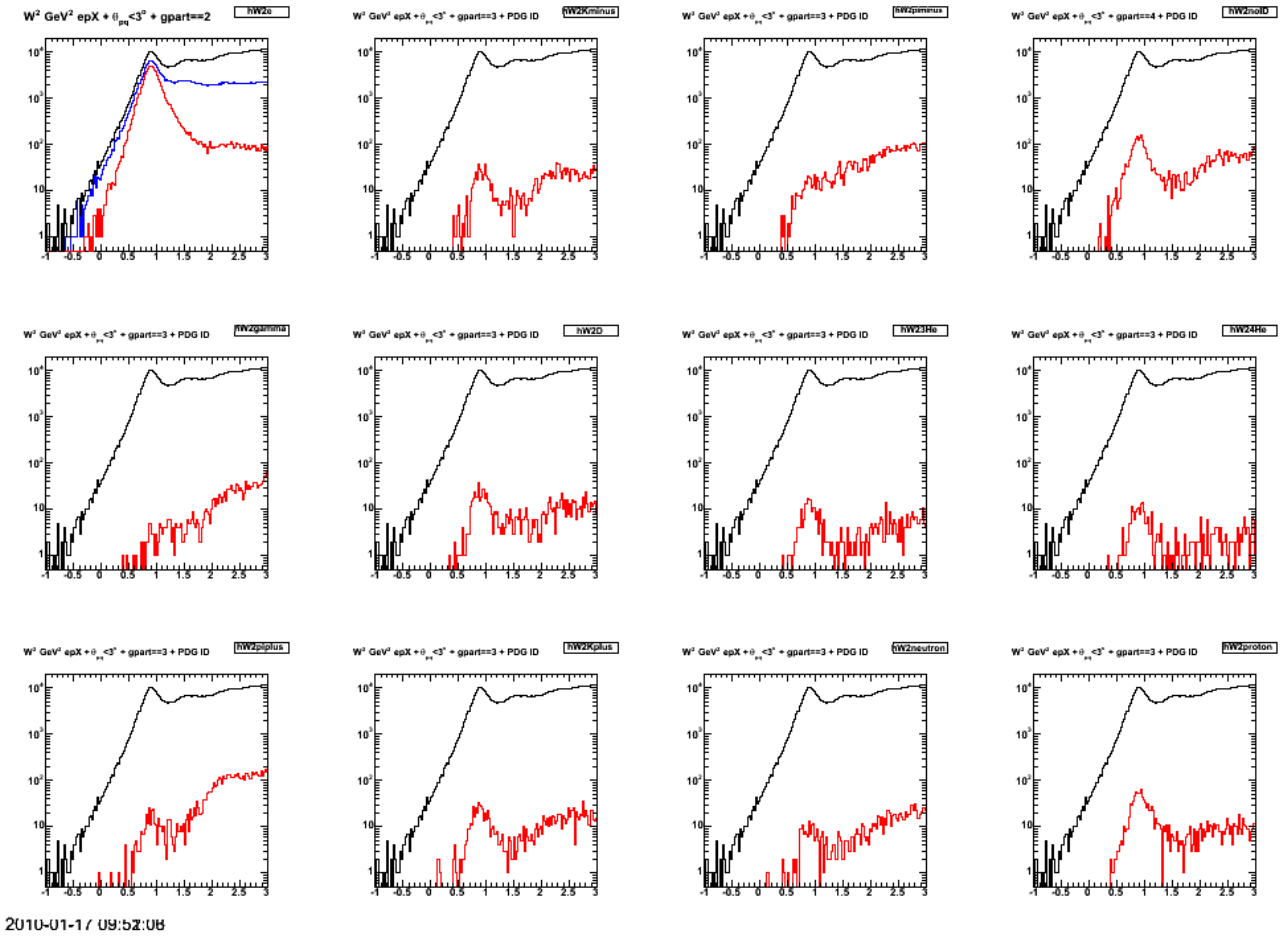
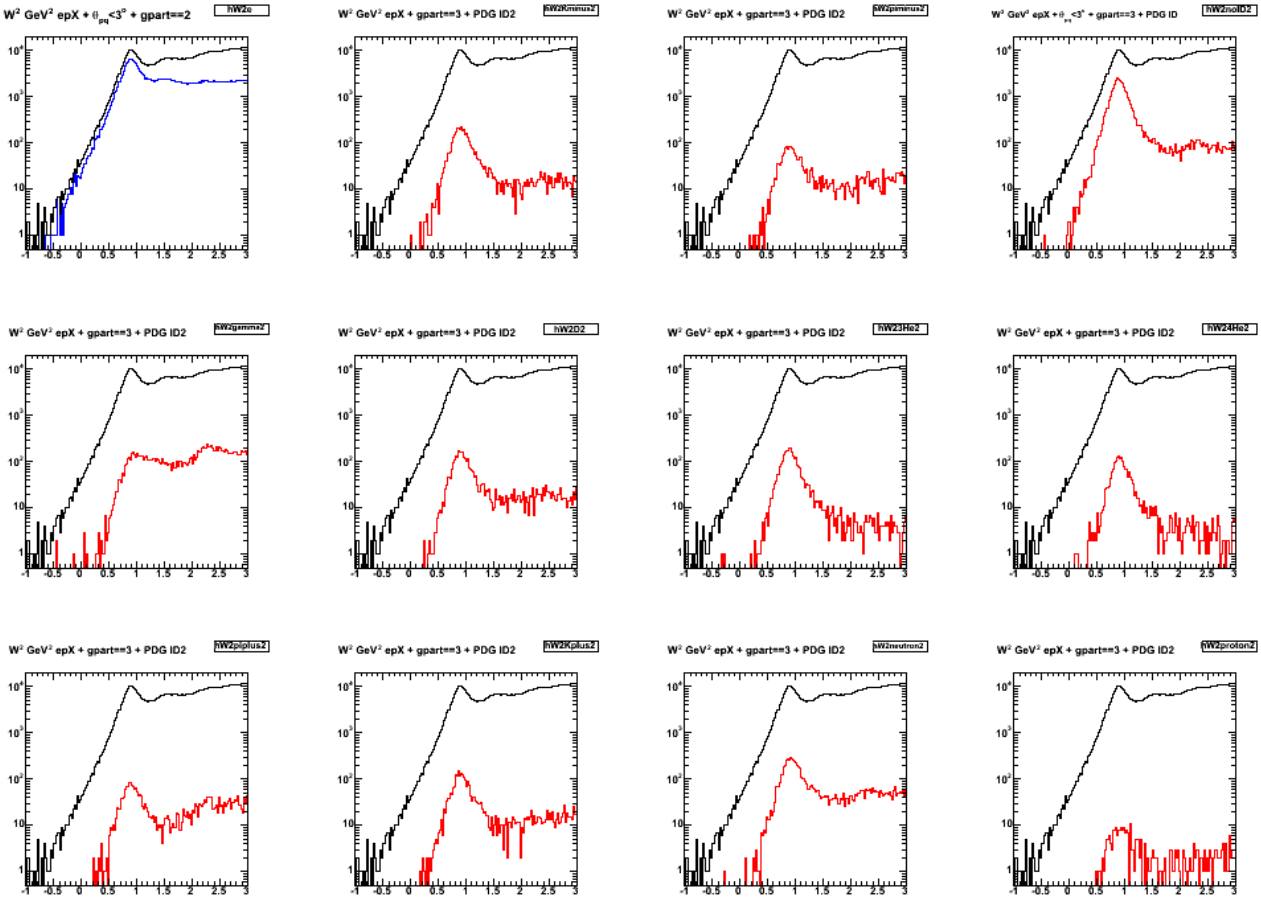


Fig 19. W2 distribution for events that were excluded from the ep sample because they were NOT and OOT and satisfied the vertex cut.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.



2010-01-17 11:03:38

Fig 20. W2 distribution for events that were included in the ep sample because each extra track after the ep tracks was either out-of-time or outside the vertex cut.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Now include the N>2 OOT + outside vertex events AND all the photons.

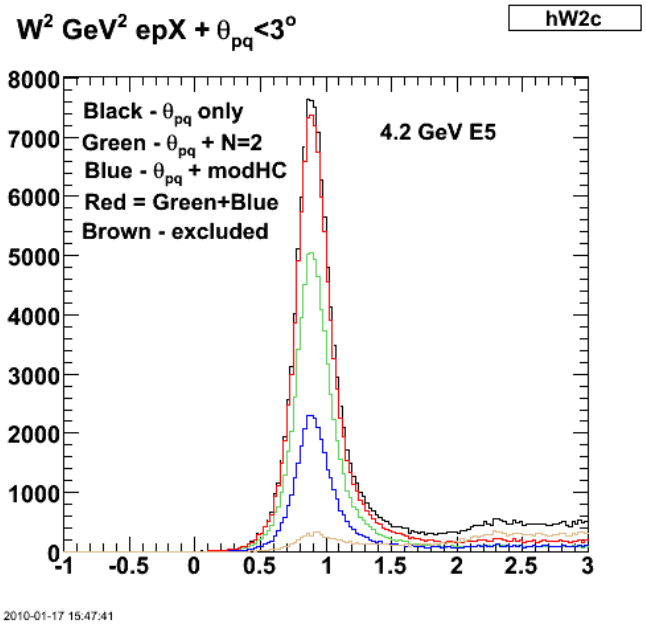


Fig 21. Same as fig 20, but also exclude N>2 photons as well. For W2 < 1.2 GeV2 red/black = 0.95.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 308 - Background inelastic events subtraction (gpg)

[Modified Wed Jan 20 15:18:49 2010 (GMT) gpg]

In preparation for the update talk I studied again the background subtraction of the inelastic events. I cheated like crazy to do this, but it's a start. My method is the following.

1. Fit the QE and inelastic spectra separately for the Q2=12.5-14 GeV2 bin just using a gaussian in each case and over the range W2= -1->5 GeV2. The simulated data I used are in gmn/background/bgnd1.C which is a long statistics run.
2. Do another, low statistics run (actually I used the same command I used to generate the histograms in bgnd1.C and then used the output from just node 0). Fit the results with the gaussians from step 1 scaled by a factor. The two factors (one for QE gaussian and one for the inelastic gaussian) are the only parameters.
3. Some results are below. The coefficient in front of each gaussian should be 0.217=4372/20167 which is the ratio of the number of events in the low-statistics W2 spectrum to the number of events in the W2 used to generate the original fits (see 1). Things are not too crazy until the upper limit on the range of the fit gets small (W2<1.2 GeV2). At this point we are not fitting beyond the peak in the distribution and the fit coefficient uncertainties get very large. With a 'reasonable' choice of the upper limit on W2, the results for the background fit are within 10% of expected value which is within our stated uncertainty in the update. I still have to think about how valid this result is????? Presumably with real data we would use a gemc simulation tuned to various parts of our data (i.e. get the W2 distribution for QE ep events using a missing mass cut to eliminate more of the background, get the W2 distribution for inelastic events using a coplanarity cut to eliminate the QE events, ...) to get the shapes of the QE and inelastic W2 distributions. We then fit these results like I just did with a single coefficient for each component.

   See log entry for 10-jan-19 for more details.

```
sample     coefficient       coefficient/0.217     W2 range
QE         0.186 +/- 0.005   0.86                  -1 -> 5 GeV2
IN         0.272 +/- 0.008   1.26

QE         0.195 +/- 0.006   0.90                  -1 -> 2 GeV2
IN         0.229 +/- 0.008   1.06

QE         0.195 +/- 0.008   0.90                  -1 -> 1.6 GeV2
IN         0.229 +/- 0.040   1.06

QE         0.170 +/- 0.012   0.78                  -1 -> 1.2 GeV2
IN         0.479 +/- 0.103   2.21
```

4. Next fit the high-stats simulations of the QE and inelastic events with a different function. Use a chi-square distribution defined in the following way in ROOT.

```
TF1 *fit12 = new TF1("fit12","[0]*( 462.993*((x+1)**4.28753)*exp(-(x+1)**2/1.63897) ) + [1]*( 5.89402*((x+1)**6.48052)*exp(-(x+1)**2/2.91073) )",·
```

   Next, use the function above to fit a low-stats W2 spectrum containing both QE and inelastic events. Some fit results are below too.

```
sample     coefficient       coefficient/0.217     W2 range
QE         0.188 +/- 0.005   0.87                  -1 -> 5 GeV2
IN         0.273 +/- 0.008   1.26

QE         0.197 +/- 0.006   0.87                  -1 -> 2 GeV2
IN         0.228 +/- 0.019   1.05

QE         0.196 +/- 0.007   0.90                  -1 -> 1.6 GeV2
IN         0.239 +/- 0.034   1.10
```

   See plot below for fit example.

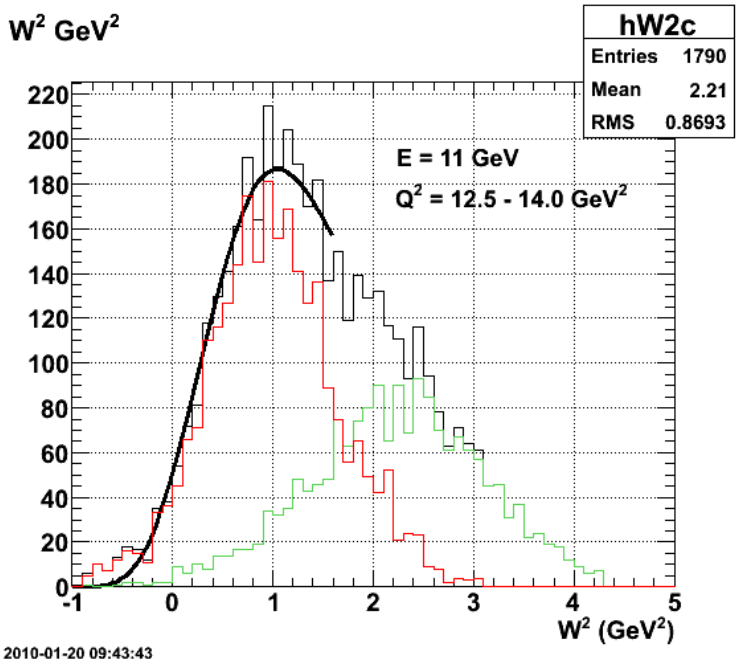


Fig 1. Fit results using chi-square distribution. See log entry log-10-jan-19 for fit results.

Click here to view the object (ROOT macro) you uploaded.

5. Now calculate the integrals and compare with the actual histogram for the inelastic contribution. This looks quite good, but then again it should since we fit with curves derived from the same simulation.

Function	Range (W2)	Integral	Histogram	% diff
chi-square	-1->1.6	41.8	41.1	1.7
gaussian	-1-<1.6	41.0	41.1	0.2
chi-square	-1->2.0	68.5	70.3	2.5
gaussian	-1->2.0	68.7	70.3	2.3

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 309 - Hermiticity of CLAS12 (Mac question) (gpg)

[Modified Fri Jan 29 01:19:54 2010 (GMT) gpg]

In the preparation for the update talk, Mac made the comment that the hermiticity cut looked too good. There was no effect on the QE peak which is true because we treated the inelastic and QE events completely separately. There are no 'true' background events where a QE event has additional, background tracks. Instead, we studied this question by looking at events with this type of background in the 4.2 GeV, E5 data. See entries 302-304, 306-307 in elog. The second point was that it was highly effective, i.e. it reduced the inelastic background by a factor of 5-10 (depending on W2) when applied without the θ_{pq} cut which is a much greater effect than when the same technique is applied to the 4.2-GeV, E5 data. See entries 302-304, Fig 11b in entry 307. Will speculated that the effect is due to the greater hermiticity of the CLAS12 relative to CLAS6. To study this, first look at the cross section effects. There may simply be many more events with three-particle or more final states for E = 11 GeV and Eq2 = 12.5-14.0 GeV2 so the hermiticity will have a bigger effect. We look at FastMC12, but at low (4.2 GeV) beam energy and small Q2. If the hermiticity cut is still very effective, then that would support the higher-hermiticity of CLAS12 as the answer. If the effectiveness of the hermiticity cut drops a lot, then that would support the larger-number-of-three-particle-or-more-final-states at large Q2 hypothesis.

Below are the results for the default 11 GeV calculation.

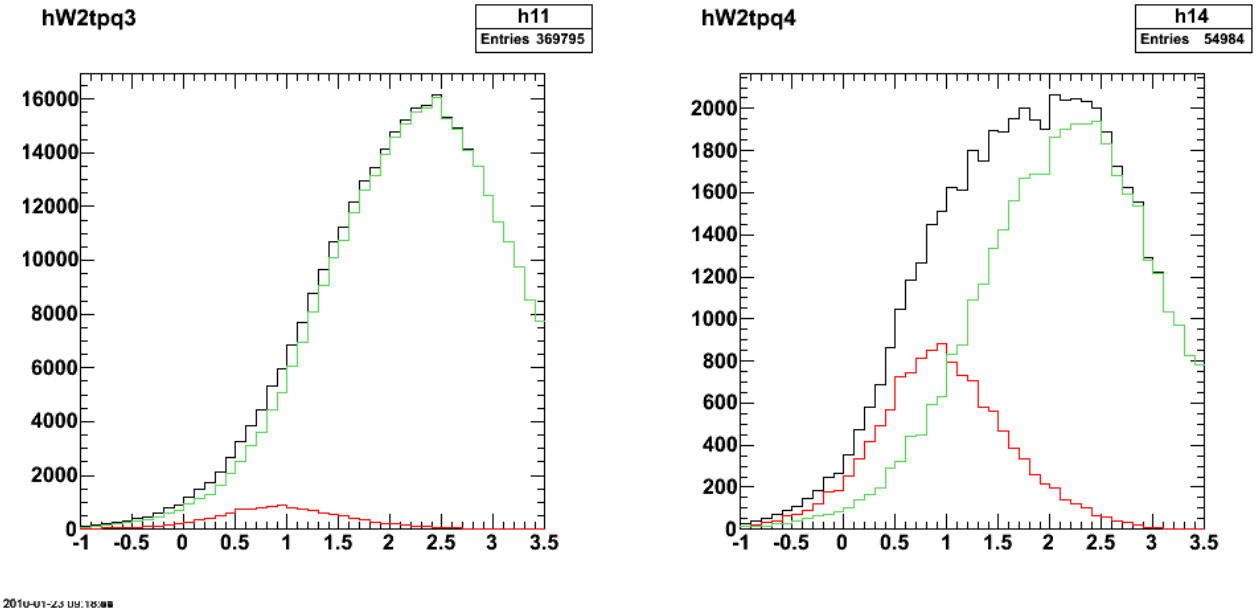


Fig 1. en events for 11 GeV, Q2=12.5-14 GeV2. Use submit_gmnsim.pl 11000 400000 1 to run with θ_{pq} < 1.5 deg, F=0.33.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Gzipped tar file of results) you uploaded.

Click here to view the object (Gzipped tar file of gmn/sim/root directory.) you uploaded.

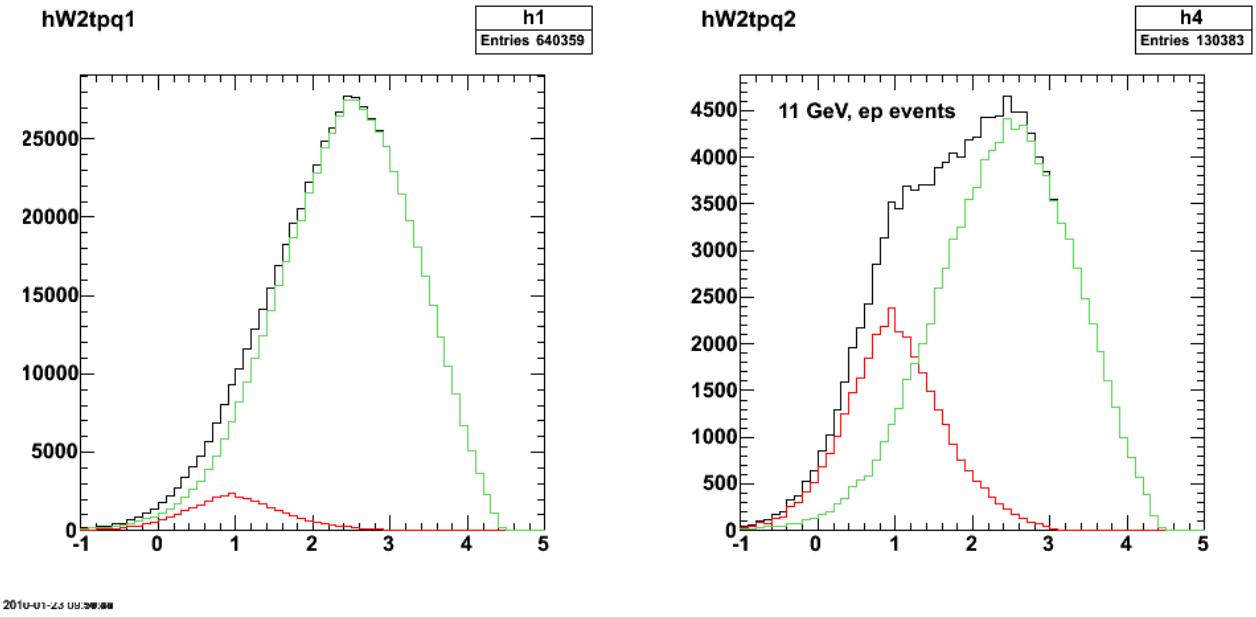


Fig 2. ep vents for 11 GeV, Q2=12.5-14 GeV2. Use submit_gmnsim.pl 11000 400000 1 to run with θ_{pq} < 1.5 deg, F=0.33.

Click here to view the object (ROOT macro) you uploaded.

First results showing effect of hermiticity and θ_{pq} cuts at E=4.2 GeV and Q2=1-3 GeV2 using FastMC12.

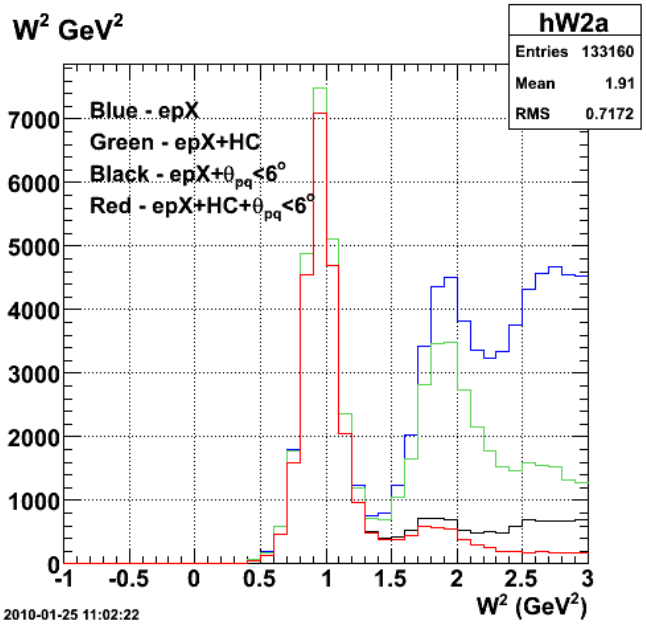


Fig 3. Comparison of W2 for different cuts showing effect of hermtiticity, theta_pq , and combined cuts.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Gzipped tar archive) you uploaded.

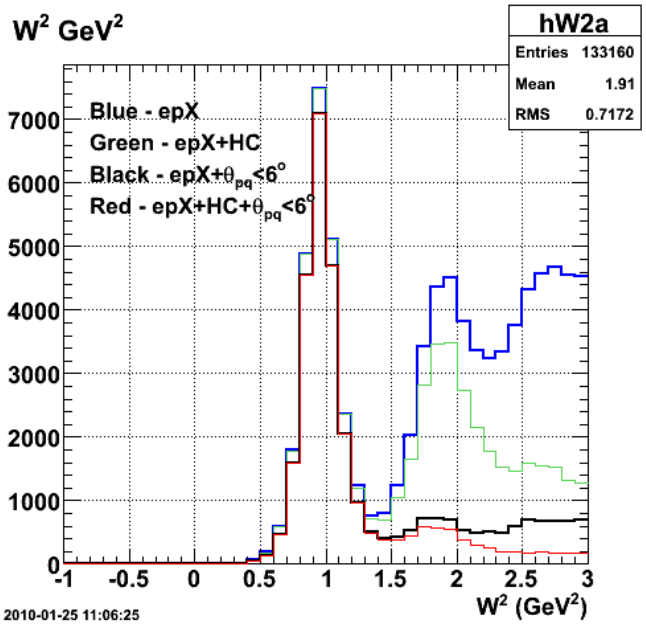


Fig 4. Same as fig 3 with underlying histograms made wider to be visible.

Change the theta_pq cut to 3 deg as in the clas6 e5 data.

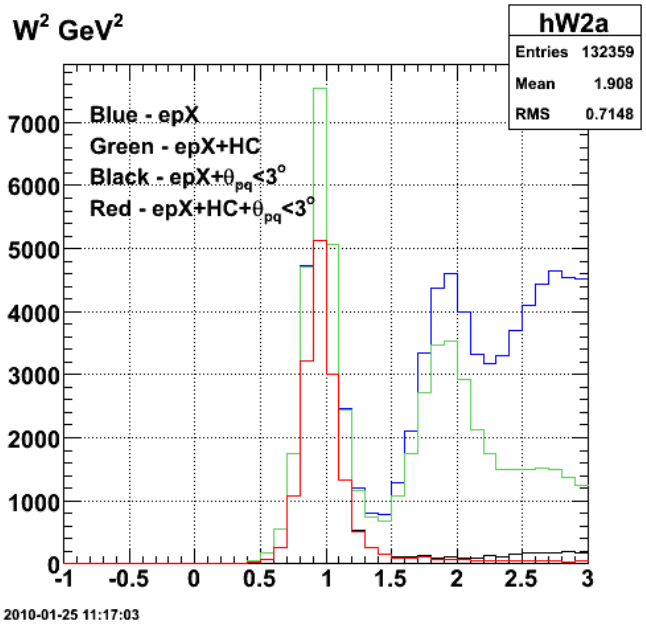


Fig 5. Same as figs 3-4 with $\theta_{pq} < 3$ deg.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Gzipped tar archive) you uploaded.

Figures 3-5 show the effect of the θ_{pq} and hermiticity cuts calculated using queeg-genevD-FastMC12 for the same kinematics (Q2 and Ebeam) as the E5 data shown in entry 307 (e.g. fig 11b). At the lower beam energy the calculation of the impact of the hermiticity cut is vastly reduced compared to its effect at higher Q2 as shown in Figs 1-2. After discussing with Mac we think the cause of this effect is the much smaller acceptance for the background events (pi+/-/0 mostly) in CLAS12 at lower Q2 and beam energy. As an example consider the plots below. The first (fig 6) shows the e-pi0 acceptance for E = 11 GeV, Q2 = 12 GeV2 as a function of pi0 momentum vs. pi0 angle in the lab in degrees. This is what we would expect for the CLAS12 GMn measurement at the high Q2 end. Filenames for following plots are qsq2.ps and qsq12.ps.

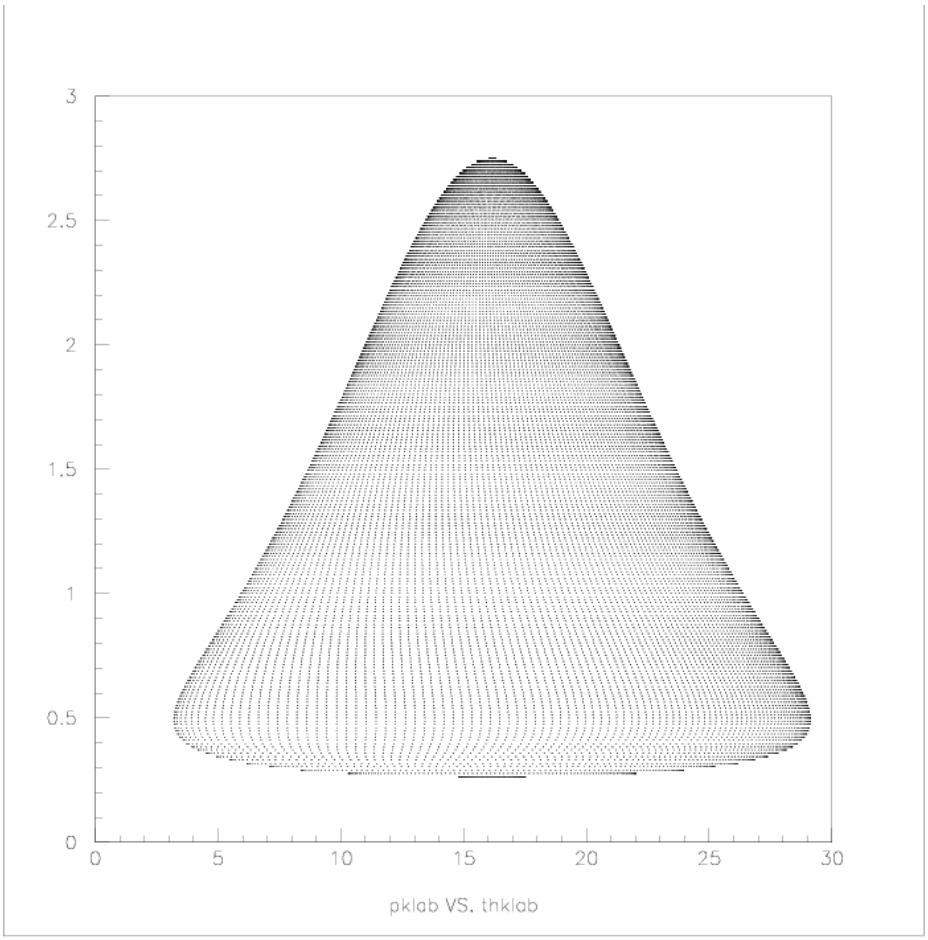


Fig 6. Geometric acceptance of CLAS12 for e-pi0 at E = 11 GeV, Q2 = 12 GeV2.

The next figure (fig 7) shows the same CLAS12 e-pi0 acceptance, but now for E = 5 GeV and Q2 = 1.2 GeV2. Notice that the accepted momentum range is much reduced and the 'hole' at forward angles and small momentum. We are not doing as well detecting pi0's. If the efficiency/acceptance of pi0's is diminished relative to the high E/Q2 kinematics, then the hermiticity cut will not be as effective. This is what is seen in the FastMC12 simulation.

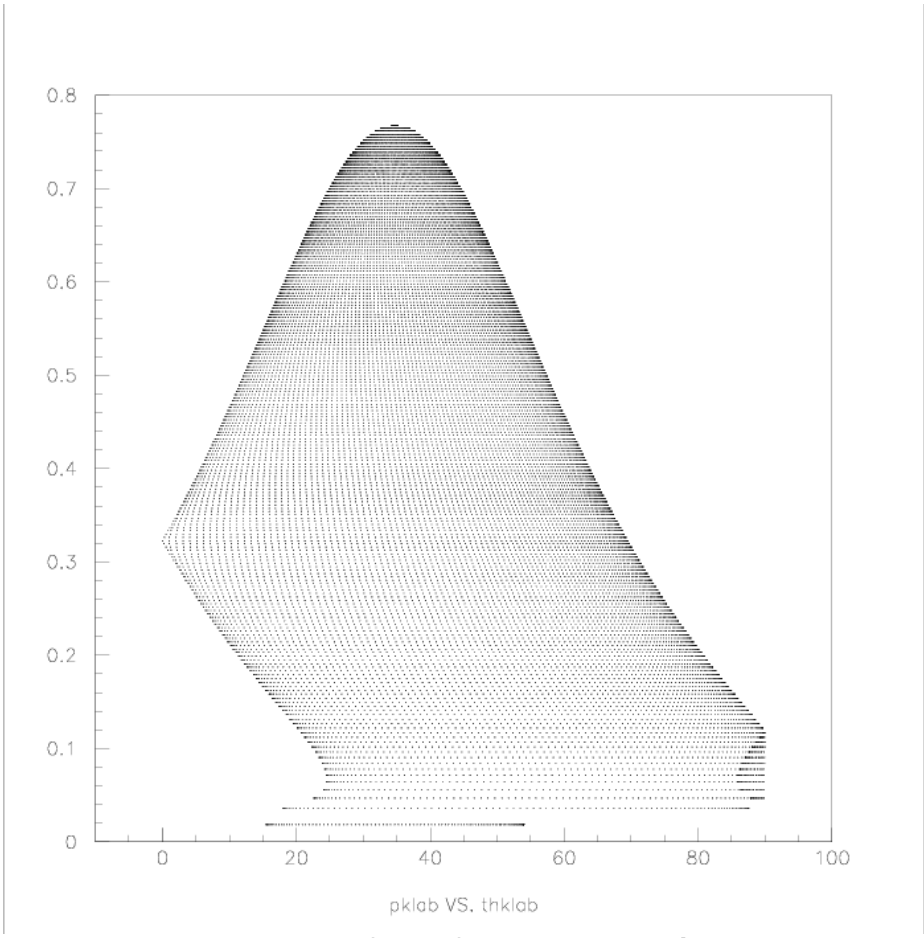


Fig 7. Geometric acceptance of CLAS12 for e-pi0 at E = 5 GeV and Q2 = 1.2 GeV2.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 310 - Fix EC position in gemc (gpg)

[Modified Fri Feb 5 13:26:24 2010 (GMT) gpg]

In going back over the geometry for the EC, I found an error. The position of the mother volume was defined with this command in

`/u/home/gilfoyle/gemc/production/database_io/clas12/geo/ec/ec_build.pl`

. $detector{"pos"} = "0*mm 2156.71*mm 1957.8*mm"; where the first number is the position of the center of the mother volume in the x direction (transverse to the beamline), the second number corresponds to the perpendicular distance from the beamline to the center of the mother volume which we have picked to be in the y direction, and the third number is the position of the center of the mother volume along the beam line from the CLAS12 target minus the infamous 5.0 m. For the third number I previously had 2217.23*mm which is the perpendicular distance from the CLAS12 target to the upstream face of the EC. First figure below is the old, incorrect (?) geometry.

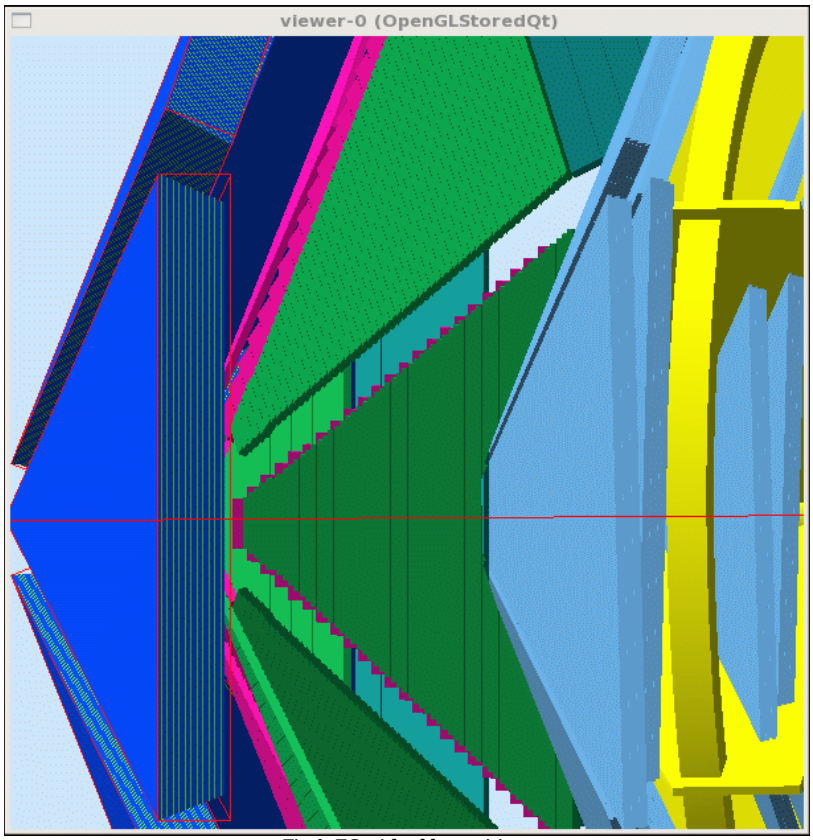


Fig 1. EC with old z position.

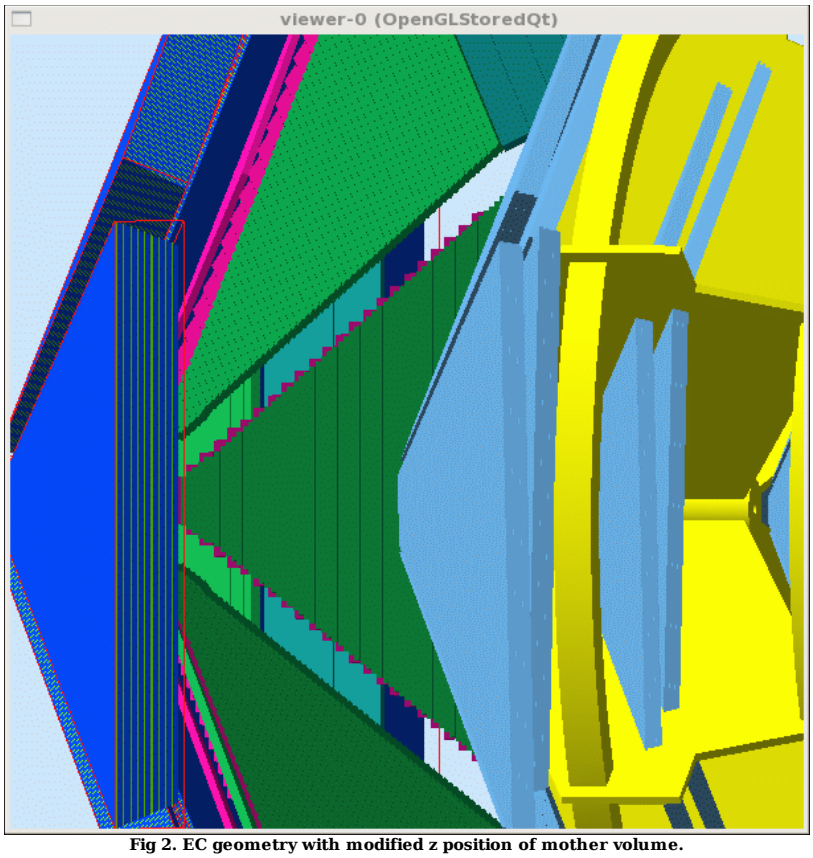


Fig 2. EC geometry with modified z position of mother volume.

Click here to view the object (Perl script ec_build.pl for 2/4/10 18:45.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 311 - Putting in clipped off lead sheets in EC (gpg)

[Modified Tue Feb 9 20:48:30 2010 (GMT) gpg]

Every third lead layer in the CLAS6 EC is cut off by an arbitrary amount. This requires changing the positioning of each layer in the mother volume. First save the old ec_build.pl before I start hacking the Perl script.

```
#!/usr/bin/perl -w
#
# Perl sctipt used to generate a file (EC.txt) that is an input to the shell script go_table which
# puts the EC geometry in the mysql database for gemc to use.

# load libraries

use strict;
use lib ("$ENV{GEMC}/database_io");
use geo;
use geo qw($pi);

use Getopt::Long;
use Math::Trig;

# local quantities.

my $envelope = 'EC';
my $file     = 'EC.txt';

my $rmin = 1;
my $rmax = 1000000;

my %detector = ();    # hash (map) that defines the gemc detector
$detector{"rmin"} = $rmin;
$detector{"rmax"} = $rmax;

my $inches   = 2.54;
my $NUM_BARS = 10;

# general EC parameters first. Many of these are described in technical paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6EC

my $dlead = 2.381;                                          # thickness of lead layers in mm.
my $dscint= 10.0;                                           # thickness of scintillator layers in mm.
my $tantheta = 1.95325;                                     # tangent of angle between sides of EC.
my $nlayers = 39;                                           # number of scintillator layers.
my $ECangle = 25.0;                                         # angle of EC face to a line perpendicular to the beamline.
my $totaldepth = ($nlayers-1)*($dscint+$dlead) + $dscint;   # total thickness of lead and scintillator. There are 38 lead layers.

# every third layer of lead is truncated at the vertex on the beam side. The length of the section of lead that is cut off is measured
# from the vertex of the triangle on the beam side along the y-axis bisecting the face of the triangle. Remeber there are only 38 layers of
# lead starting between scintillators 1 and 2.

my @beamVertexCut=(0, 0, 1.440, 0, 0, 1.448, 0, 0, 1.455, 0, 0, 1.462, 0, 0, 1.0, 0, 0, 1.0, 0, 0, 1.0
```

```
$detector{"mother"}      = "sector";
$detector{"description"} = "Forward Calorimeter";
$detector{"pos"}         = "ECcenterx*mm ECcentery*mm ECcenterz*mm";
$detector{"rotation"}    = "$ECangle*deg 0*deg 0*deg";
$detector{"color"}       = "ff1111";
$detector{"type"}        = "G4Trap";
$detector{"dimensions"}  = "${pDzmom}*mm ${pThetamom}*deg ${pPhimom}*deg ${pDy1mom}*mm ${pDx1mom}*mm ${pDx2mom}*mm ${pAlp1mom}*deg ${pDy2mom}*mm ${pDx3m
$detector{"material"}    = "Air";
$detector{"mfield"}      = "no";
$detector{"ncopy"}       = 1;
$detector{"pMany"}       = 1;
$detector{"exist"}       = 1;
$detector{"visible"}     = 1;
$detector{"style"}       = 0;
$detector{"sensitivity"} = "no";
$detector{"hit_type"}    = "";
$detector{"identifiers"} = "";

print_det(\%detector, $file);

# now start to do the alternating layers of scintillator and lead. Set up inputs first.

my $i;
my $subname;
my $submother = "EC";;
my $description;
my $pos;
my $rotation = "0*deg 0*deg 0*deg";
my $color = "0147FA";
my $type = "G4Trap";
my $dimensions;
my $material ="Air";
my $mfield = "no";
my $ncopy = 1;
my $pMany = 1;
my $exist = 1;
my $visible = 1;
my $style = 1;
my $sensitivity = "no";
my $hit_type = "";
my $identifiers = "";

my $z0scint;
my $z0lead;

# a scintillator layer first. set the G4Trap parameters.

my $pDx1   = 0.001;
my $pDx2   = (xplus(1) - xminus(1))/2.0;
my $pDz    = $dscint/2.0;
my $pTheta = 0;
my $pPhi   = $pTheta;
my $pDy1   = (yplus(1) - yminus(1))/2;
my $pDy2   = $pDy1;
my $pDx3   = $pDx1;
my $pDx4   = $pDx2;
my $pAlp1  = $pTheta;
my $pAlp2  = $pTheta;

$i = 1;
$subname = "make_EClayerScint${i}";
$description ="Forward Calorimeter scintillator layer ${i}";
$z0scint = -$totaldepth/2 + ($i - 1)*($dscint + $dlead) + $dscint/2; # z position of upstream face of scintillator in local coordinate system.
$pos = "0*mm 0.0*mm ${z0scint}*mm";

$detector{"name"}        = $subname;
$detector{"mother"}      = "EC";
$detector{"description"} = $description;
$detector{"pos"}         = $pos;
$detector{"rotation"}    = $rotation;
$detector{"color"}       = "0147FA";
$detector{"type"}        = "G4Trap";
$detector{"dimensions"}  = "${pDz}*mm ${pTheta}*deg ${pPhi}*deg ${pDy1}*mm ${pDx1}*mm  ${pDx2}*mm  ${pAlp1}*deg ${pDy2}*mm ${pDx3}*mm  ${pDx4}*mm  ${pAl
$detector{"material"}    = "Scintillator";
$detector{"mfield"}      = "no";
$detector{"ncopy"}       = 1;
$detector{"pMany"}       = 1;
$detector{"exist"}       = 1;
$detector{"visible"}     = 1;
$detector{"style"}       = 1;
$detector{"sensitivity"} = "EC";
$detector{"hit_type"}    = "EC";
$detector{"identifiers"} = "sector ncopy 0 layer manual $i paddle manual 1";

print_det(\%detector, $file);

# loop over the remaining lead-scintillator layers.

for ($i = 2; $i < $nlayers+1; $i++) {

# lead layer

    $subname = "EClayerLead${i}";
    $description = "Forward Calorimeter lead layer ${i}";
    $z0lead = -$totaldepth/2 + ($i - 2)*($dscint + $dlead) + $dscint/2 + ($dscint+$dlead)/2; # z position of upstream face of lead in local coordinate s
    $pos = "0*mm 0.0*mm ${z0lead}*mm";

    $pDz = $dlead/2.0;
    $pDy1 = (yplus($i) - yminus($i))/2;
    $pDx2 = (xplus($i) - xminus($i))/2;
```

```
    $pDy2 = $pDy1;
    $pDx4 = $pDx2;

    $detector{"name"}        = $subname;
    $detector{"mother"}      = $submother;
    $detector{"description"} = $description;
    $detector{"pos"}         = $pos;
    $detector{"rotation"}    = $rotation;
    $detector{"color"}       = "7CFC00";
    $detector{"type"}        = "G4Trap";
    $detector{"dimensions"}  = "${pDz}*mm ${pTheta}*deg ${pPhi}*deg  ${pDy1}*mm ${pDx1}*mm  ${pDx2}*mm  ${pAlp1}*deg  ${pDy2}*mm ${pDx3}*mm  ${pDx4}*mm
    $detector{"material"}    = "Lead";
    $detector{"mfield"}      = "no";
    $detector{"ncopy"}       = 1;
    $detector{"pMany"}       = 1;
    $detector{"exist"}       = 1;
    $detector{"visible"}     = 1;
    $detector{"style"}       = 1;
    $detector{"sensitivity"} = "no";
    $detector{"hit_type"}    = "";
    $detector{"identifiers"} = "";

    print_det(\%detector, $file);

# scintillator layer. only parameter changes are in pos and pDz.

    $subname = "make_EClayerScint${i}";
    $description ="Forward Calorimeter scintillator layer ${i}";
    $z0scint = -$totaldepth/2 + ($i - 1)*($dscint + $dlead) + $dscint/2; # z position of upstream face of lead in local coordinate system.
    $pos = "0*mm 0.0*mm ${z0scint}*mm";

    $pDz = $dscint/2.0;

    $detector{"name"}        = $subname;
    $detector{"mother"}      = $submother;
    $detector{"description"} = $description;
    $detector{"pos"}         = $pos;
    $detector{"rotation"}    = $rotation;
    $detector{"color"}       = "0147FA";
    $detector{"type"}        = "G4Trap";
    $detector{"dimensions"}  = "${pDz}*mm ${pTheta}*deg ${pPhi}*deg ${pDy1}*mm ${pDx1}*mm  ${pDx2}*mm  ${pAlp1}*deg  ${pDy2}*mm ${pDx3}*mm  ${pDx4}*mm
    $detector{"material"}    = "Scintillator";
    $detector{"mfield"}      = "no";
    $detector{"ncopy"}       = 1;
    $detector{"pMany"}       = 1;
    $detector{"exist"}       = 1;
    $detector{"visible"}     = 1;
    $detector{"style"}       = 1;
    $detector{"sensitivity"} = "EC";
    $detector{"hit_type"}    = "EC";
    $detector{"identifiers"} = "sector ncopy 0 layer manual $i paddle manual 1";

    print_det(\%detector, $file);

   }

sub yplus {
    # calculates the top of the triangular active area of the EC (at large scattering angle)
    # for the requested layer. see paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeometry.pdf
    my $layer = $_[0];
    my $yplus = 1899.56 + 4.5419*($layer - 1);
    return $yplus;
}

sub yminus {
    # calculates the beam-side vertex of the triangular active area of the EC (at small scattering angle)
    # for the requested layer. see paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeometry.pdf
    my $layer = $_[0];
    my $yminus = -1829.74 - 4.3708*($layer - 1);
    return $yminus;
}

sub xplus {
    # calculates the maximum, positive x value of the edge of the triangular, active area of the EC for this layer.
    # see paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeometry.pdf
    my $layer = $_[0];
    my $xplus = (yplus($layer) - yminus($layer))/$tantheta;
    return $xplus;
}

sub xminus {
    # calculates the minimum, negative x value of the edge of the triangular, active area of the EC for this layer.
    # see paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeometry.pdf
    my $layer = $_[0];
    my $xminus = (yminus($layer) - yplus($layer))/$tantheta;
    return $xminus;
}
```

Version of ec_build.pl as of 2/9/10, 9:56 am.

```
#!/usr/bin/perl -w
#
# Perl sctipt used to generate a file (EC.txt) that is an input to the shell script go_table which
# puts the EC geometry in the mysql database for gemc to use.
```

```
# load libraries

use strict;
use lib ("$ENV{GEMC}/database_io");
use geo;
use geo qw($pi);

use Getopt::Long;
use Math::Trig;

# local quantities.

my $envelope = 'EC';
my $file     = 'EC.txt';

my $rmin = 1;
my $rmax = 1000000;

my %detector = ();    # hash (map) that defines the gemc detector
$detector{"rmin"} = $rmin;
$detector{"rmax"} = $rmax;

my $inches   = 2.54;
my $NUM_BARS = 10;

# general EC parameters first. Many of these are described in technical paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECg

my $dlead = 2.381;                                          # thickness of lead layers in mm.
my $dscint= 10.0;                                           # thickness of scintillator layers in mm.
my $tantheta = 1.95325;                                     # tangent of angle between sides of EC at large scattering angle (angles opposite the beams
my $gamma1 = $pi - 2*atan($tantheta);                       # angle between sides of EC at small scattering angle.
my $nlayers = 39;                                           # number of scintillator layers.
my $ECangle = 25.0;                                         # angle of EC face to a line perpendicular to the beamline.
my $totaldepth = ($nlayers-1)*($dscint+$dlead) + $dscint;   # total thickness of lead and scintillator. There are 39 scintillator layers and 38 lead la

# every third layer of lead is truncated at the vertex on the beam side. The length of the section of lead that is cut off is measured
# from the vertex of the triangle on the beam side along the y-axis bisecting the face of the triangle. Remember there are only 38 layers of
# lead starting between scintillators 1 and 2. Units are mm.

my @beamVertexCut=(0, 0, 1.440, 0, 0, 1.448, 0, 0, 1.455, 0, 0, 1.462, 0, 0, 1.0, 0, 0, 1.0, 0, 0, 1.0
```

```
$detector{"identifiers"} = "";

print_det(\%detector, $file);

# now start to do the alternating layers of scintillator and lead. Set up inputs first.

my $i;
my $subname;
my $submother = "EC";;
my $description;
my $pos;
my $rotation = "0*deg 0*deg 0*deg";
my $color = "0147FA";
my $type = "G4Trap";
my $dimensions;
my $material ="Air";
my $mfield = "no";
my $ncopy = 1;
my $pMany = 1;
my $exist = 1;
my $visible = 1;
my $style = 1;
my $sensitivity = "no";
my $hit_type = "";
my $identifiers = "";

my $x0scint;
my $y0scint;
my $z0scint;
my $x0lead;
my $y0lead;
my $z0lead;

# a scintillator layer first. set the G4Trap parameters.

my $pDx1   = 0.001;
my $pDx2   = (xplus(1) - xminus(1))/2.0;
my $pDz    = $dscint/2.0;
my $pTheta = 0;
my $pPhi   = $pTheta;
my $pDy1   = (yplus(1) - yminus(1))/2;
my $pDy2   = $pDy1;
my $pDx3   = $pDx1;
my $pDx4   = $pDx2;
my $pAlp1  = $pTheta;
my $pAlp2  = $pTheta;

$i = 1;
$subname = "make_EClayerScint${i}";
$description ="Forward Calorimeter scintillator layer ${i}";
$z0scint = -$totaldepth/2 + ($i - 1)*($dscint + $dlead) + $dscint/2; # z position of upstream face of scintillator in local coordinate system.
$pos = "0*mm 0.0*mm ${z0scint}*mm";

$detector{"name"}        = $subname;
$detector{"mother"}      = "EC";
$detector{"description"} = $description;
$detector{"pos"}         = $pos;
$detector{"rotation"}    = $rotation;
$detector{"color"}       = "0147FA";
$detector{"type"}        = "G4Trap";
$detector{"dimensions"}  = "${pDz}*mm ${pTheta}*deg ${pPhi}*deg ${pDy1}*mm ${pDx1}*mm  ${pDx2}*mm  ${pAlp1}*deg ${pDy2}*mm ${pDx3}*mm  ${pDx4}*mm  ${pAl
$detector{"material"}    = "Scintillator";
$detector{"mfield"}      = "no";
$detector{"ncopy"}       = 1;
$detector{"pMany"}       = 1;
$detector{"exist"}       = 1;
$detector{"visible"}     = 1;
$detector{"style"}       = 1;
$detector{"sensitivity"} = "EC";
$detector{"hit_type"}    = "EC";
$detector{"identifiers"} = "sector ncopy 0 layer manual $i paddle manual 1";

print_det(\%detector, $file);

# loop over the remaining lead-scintillator layers.

for ($i = 2; $i < $nlayers+1; $i++) {

# lead layer

    $subname = "EClayerLead${i}";
    $description = "Forward Calorimeter lead layer ${i}";
    $x0lead = 0.0; # x position of upstream face of lead in local coordinate system.
    $y0lead = $beamVertexCut[$i-2]/2; # y position of upstream face of lead in local coordinate system.
    $z0lead = -$totaldepth/2 + ($i - 2)*($dscint + $dlead) + $dscint/2 + ($dscint+$dlead)/2; # z position of upstream face of lead in local coordinate s
    $pos = "${x0lead}*mm ${y0lead}*mm ${z0lead}*mm";

    $pDz = $dlead/2.0;
    $pDy1 = (yplus($i) - (yminus($i)-$beamVertexCut[$i-2]))/2;
    $pDy2 = $pDy1;
    $pDx1 = $beamVertexCut[$i-2]*tan($gamma1/2);
    $pDx3 = $pDx1;
    $pDx2 = (xplus($i) - xminus($i))/2;
    $pDx4 = $pDx2;

    $detector{"name"}        = $subname;
    $detector{"mother"}      = $submother;
    $detector{"description"} = $description;
    $detector{"pos"}         = $pos;
    $detector{"rotation"}    = $rotation;
```

```
    $detector{"color"}       = "7CFC00";
    $detector{"type"}        = "G4Trap";
    $detector{"dimensions"}  = "${pDz}*mm ${pTheta}*deg ${pPhi}*deg  ${pDy1}*mm ${pDx1}*mm  ${pDx2}*mm  ${pAlp1}*deg  ${pDy2}*mm ${pDx3}*mm  ${pDx4}*mm
    $detector{"material"}    = "Lead";
    $detector{"mfield"}      = "no";
    $detector{"ncopy"}       = 1;
    $detector{"pMany"}       = 1;
    $detector{"exist"}       = 1;
    $detector{"visible"}     = 1;
    $detector{"style"}       = 1;
    $detector{"sensitivity"} = "no";
    $detector{"hit_type"}    = "";
    $detector{"identifiers"} = "";

    print_det(\%detector, $file);

# scintillator layer. only parameter changes are in pos and pDz.

    $subname = "make_EClayerScint${i}";
    $description ="Forward Calorimeter scintillator layer ${i}";
    $x0scint = 0.0; # x position of upstream face of scintillator in local coordinate system.
    $y0scint = 0.0; # y position of upstream face of scintillator in local coordinate system.
    $z0scint = -$totaldepth/2 + ($i - 1)*($dscint + $dlead) + $dscint/2; # z position of upstream face of lead in local coordinate system.
    $pos = "${x0scint}*mm ${y0scint}*mm ${z0scint}*mm";

    $pDz = $dscint/2.0;

    $detector{"name"}        = $subname;
    $detector{"mother"}      = $submother;
    $detector{"description"} = $description;
    $detector{"pos"}         = $pos;
    $detector{"rotation"}    = $rotation;
    $detector{"color"}       = "0147FA";
    $detector{"type"}        = "G4Trap";
    $detector{"dimensions"}  = "${pDz}*mm ${pTheta}*deg ${pPhi}*deg ${pDy1}*mm ${pDx1}*mm  ${pDx2}*mm  ${pAlp1}*deg  ${pDy2}*mm ${pDx3}*mm  ${pDx4}*mm
    $detector{"material"}    = "Scintillator";
    $detector{"mfield"}      = "no";
    $detector{"ncopy"}       = 1;
    $detector{"pMany"}       = 1;
    $detector{"exist"}       = 1;
    $detector{"visible"}     = 1;
    $detector{"style"}       = 1;
    $detector{"sensitivity"} = "EC";
    $detector{"hit_type"}    = "EC";
    $detector{"identifiers"} = "sector ncopy 0 layer manual $i paddle manual 1";

    print_det(\%detector, $file);

   }

# end of main program. function definitions follow.

sub yplus {
    # calculates the top of the triangular active area of the EC (at large scattering angle)
    # for the requested layer. see paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeometry.pdf
    my $layer = $_[0];
    my $yplus = 1899.56 + 4.5419*($layer - 1);
    return $yplus;
}

sub yminus {
    # calculates the beam-side vertex of the triangular active area of the EC (at small scattering angle)
    # for the requested layer. see paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeometry.pdf
    my $layer = $_[0];
    my $yminus = -1829.74 - 4.3708*($layer - 1);
    return $yminus;
}

sub xplus {
    # calculates the maximum, positive x value of the edge of the triangular, active area of the EC for this layer.
    # see paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeometry.pdf
    my $layer = $_[0];
    my $xplus = (yplus($layer) - yminus($layer))/$tantheta;
    return $xplus;
}

sub xminus {
    # calculates the minimum, negative x value of the edge of the triangular, active area of the EC for this layer.
    # see paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeometry.pdf
    my $layer = $_[0];
    my $xminus = (yminus($layer) - yplus($layer))/$tantheta;
    return $xminus;
}
```

Starting to look good. The clipped lead is a small, but visible effect in plot below.

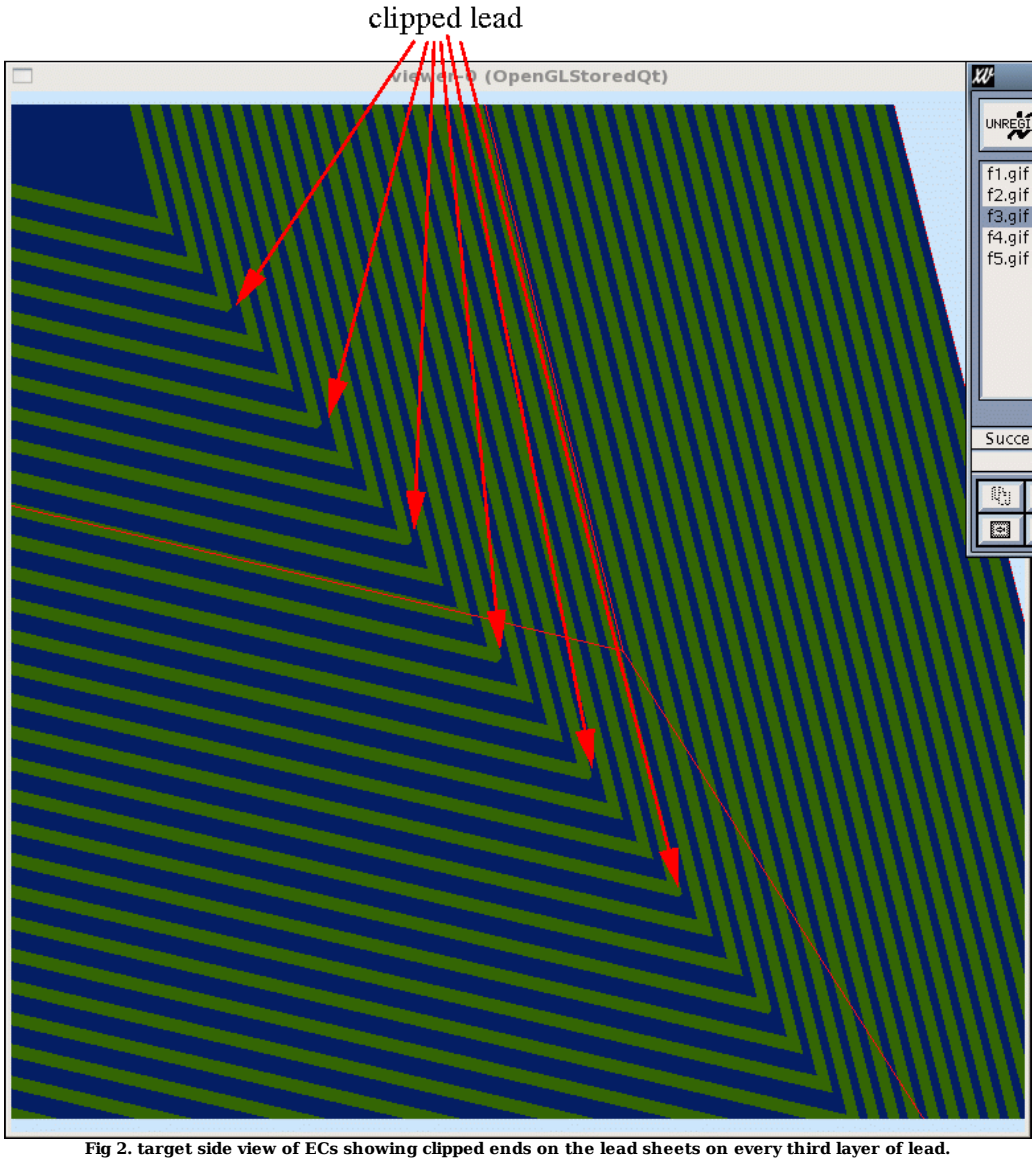


Fig 2. target side view of ECs showing clipped ends on the lead sheets on every third layer of lead.

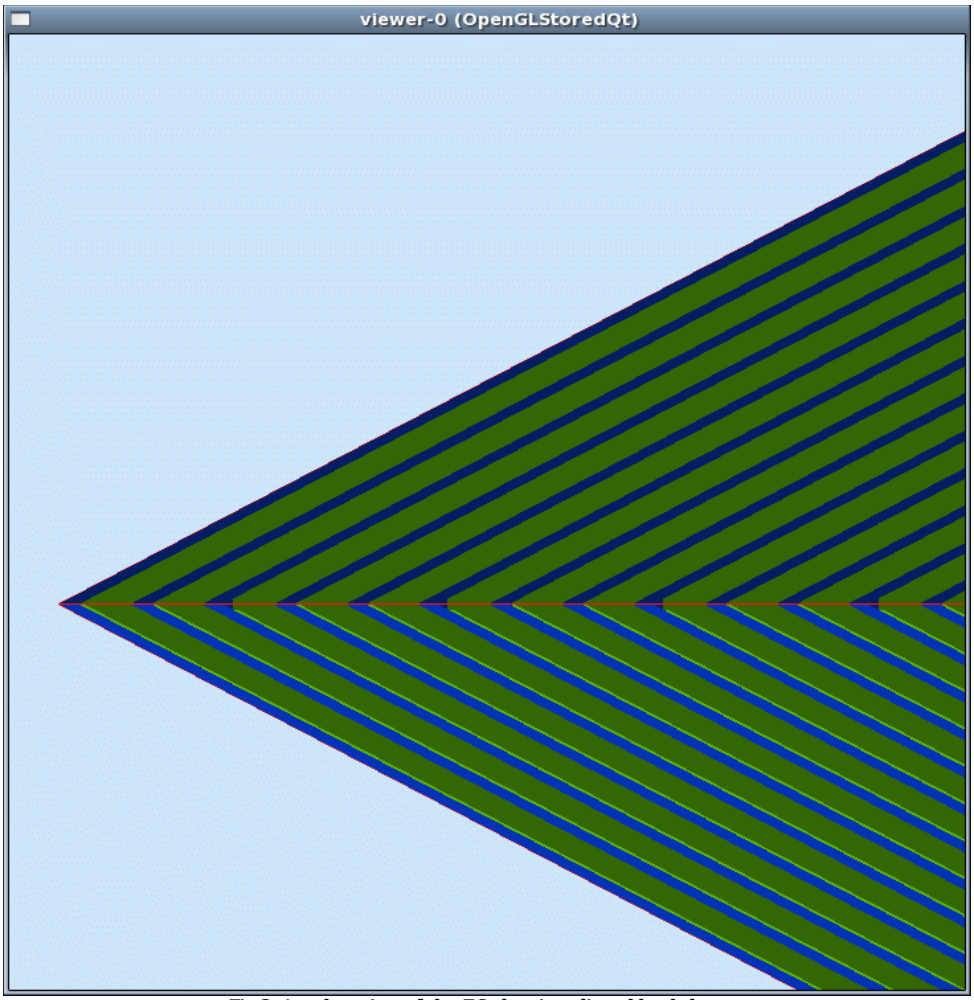


Fig 3. Another view of the EC showing clipped lead sheets.

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Jerry Gilfoyle's Enotebook page 312 - Strips and digitization of EC events in gemc (gpg)

[Modified Wed Feb 24 02:18:56 2010 (GMT) gpg]

The plot below shows an early plot of events in the EC simulated with gemc after putting in the strips and digitizing the ADC and TDC.

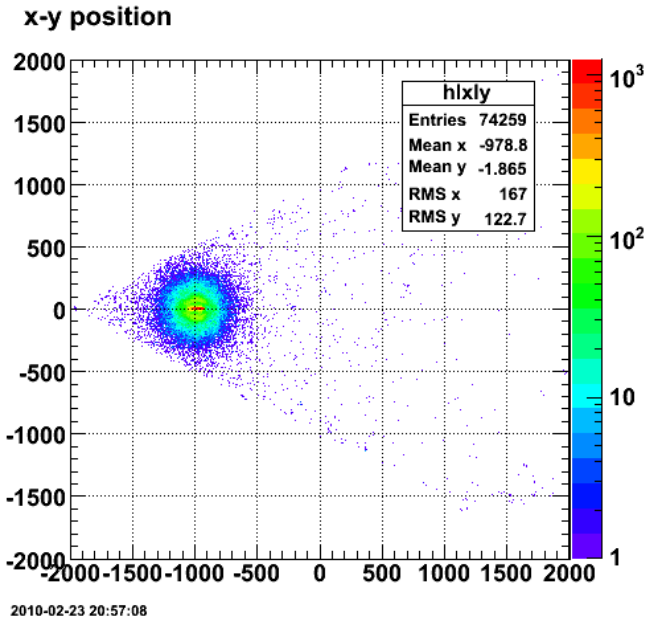


Fig 1. Local x versus local y. What do I only see hits in a single sector (because it's all local coordinates so the events from different sectors are plotted on top of each other)? The electrons are 8 GeV at θ = 10 deg, φ = 0 deg.

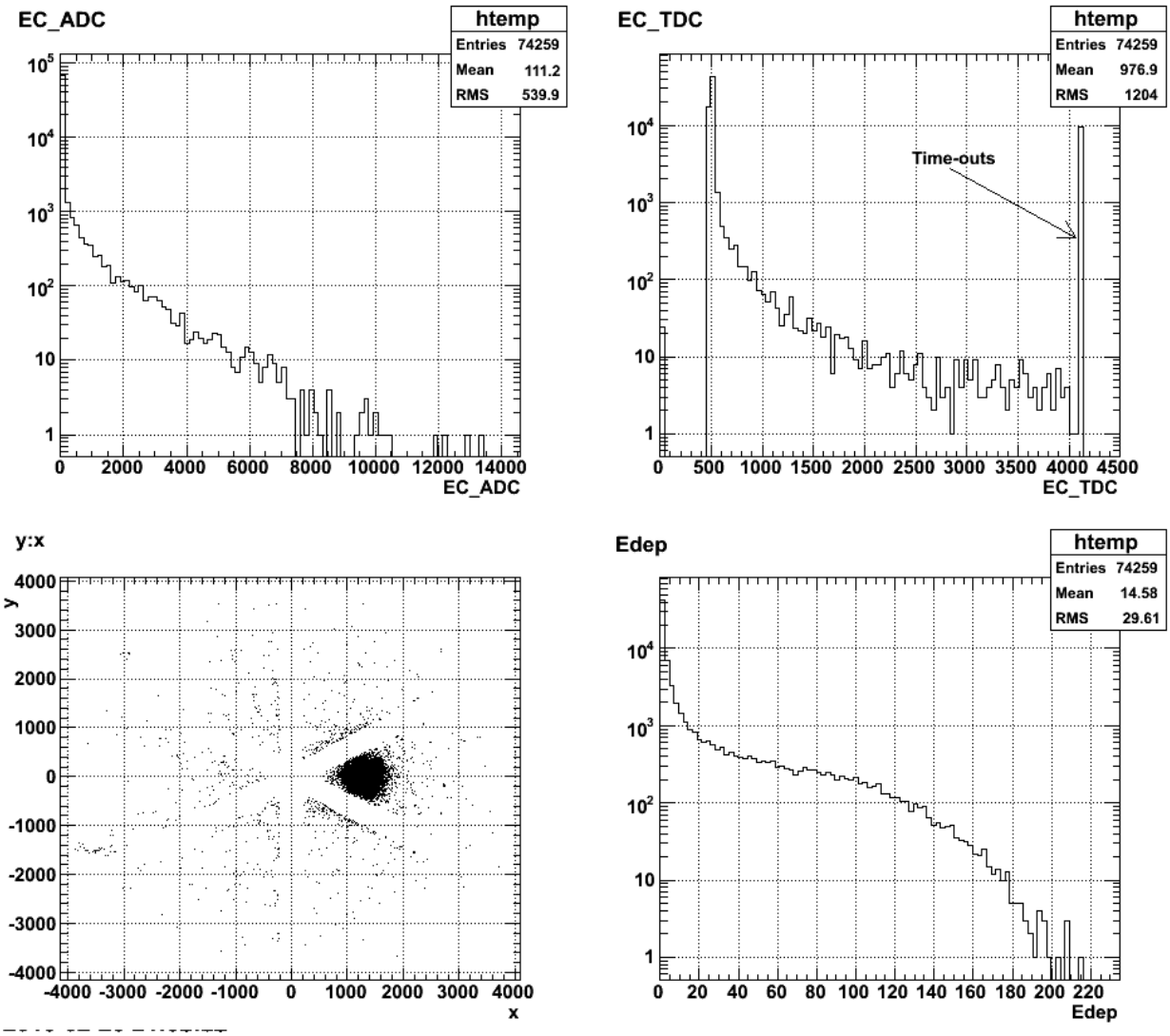


Fig 2. Plots of run with 500 events.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Root Tree file) you uploaded.

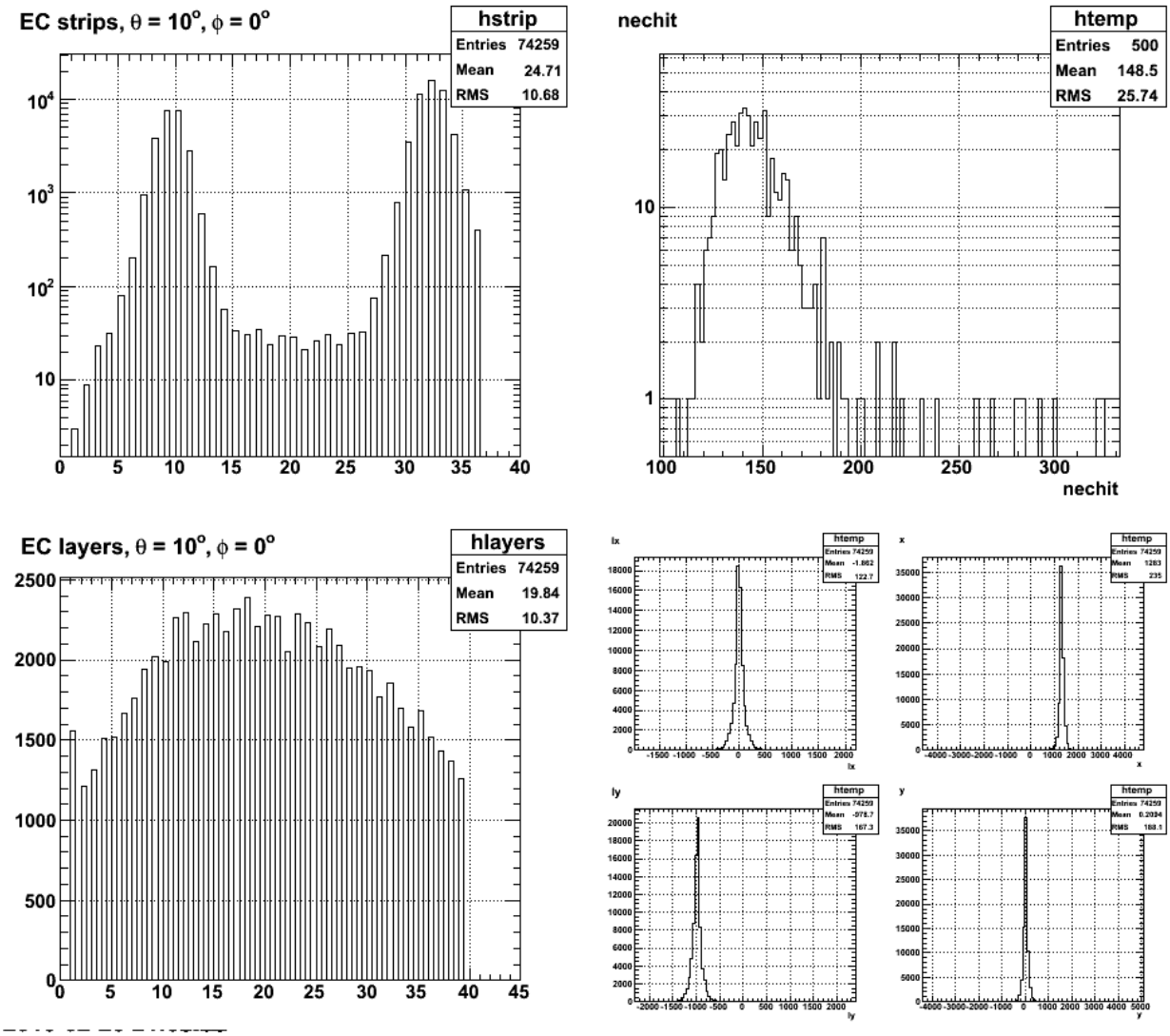


Fig 3. More groovy plots of the EC simulations.

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 313 - Systematic uncertainty due to radiative effects (gpg)

[Modified Wed Feb 24 02:53:56 2010 (GMT) gpg]

To estimate the effect of radiative corrects on the ALTp analysis I am investigating the difference in the EXCLURAD calculations for different helicities. The hope is that the difference between the between the radiative corrections for the two helicities is very small so that in the asymmetry (which is essentially a ratio), any differences will cancel.

First calculation using the output of deep to get the standard results for each helicity. Code is below.

```
c now translate these structure functions into the form used by
c Afanasev et al. the notation here is taken from Gross and
c Dmitrasinovic, PR C40, 2479 and J.Adam, et al nucl-th/0204068.
c see notebook eod7.

        Md2 = (Md)**2
        W2MeV = W**2
        W2 = (W*1.0e-03)**2

        MdMeV = 1.876*10**3
        nu = omega_l
cgpg        xqL = sqrt(Q2 + xnu**2)
        Ebeam = E_beam_gev*1000
        Eprime = Ebeam - nu
cgpg        xthetae = 2.0*asin( sqrt(Q2/(4*Ebeam*Eprime)) )
        thetae = theta_e_deg*pi/180
cgpg        xW2mev = W2*10**6
        pcm = 0.5*sqrt(W2MeV - (4*Mn*Mn))
        factor1 = Q2/(4*pi*MdMeV*q_l*q_l)
        sigmaMott = alpha*cos(thetae/2)/
     1                 (2*Ebeam*sin(thetae/2)*sin(thetae/2))
        sigmaMott = sigmaMott**2
        recoil = Eprime/Ebeam
        zeta2 = (q_l**2/Q2)*(tan(thetae/2))**2
        sT = 0.5 + zeta2
        sLT = -0.5*sqrt(1 + zeta2)
        convert2mb = 38809*10
        xsigma = pcm*sigmaMott*factor1*recoil*(R_L + sT*R_T +
     1          R_TT + sLT*R_LT)*convert2mb

        wvoN0 = pcm*sigmaMott*factor1
        epsilon = 1 + 2*(1 + (nu*nu/Q2))*tan(thetae/2)
        epsilon = 1/epsilon
        aaN0 = alpha*Eprime*(W2MeV - MdMeV**2)/
     1                  (2*pi*Ebeam*2*MdMeV*Q2*(1-epsilon))

        convert2GeV = 1000

cgpg convert to the form used by Andrei Afanasev.

        sig_L = convert2mb*convert2GeV*wvoN0*R_L/(aaN0*epsilon)
        sig_T = convert2mb*convert2GeV*wvoN0*sT*R_T/(aaN0)
        sig_LT = -convert2mb*convert2GeV*wvoN0*sLT*R_LT/
     1                       (aaN0*sqrt(epsilon*(1+epsilon)*0.5))
        sig_TT = -convert2mb*convert2GeV*wvoN0*R_TT/(2*aaN0*epsilon)
c
cgpg change sign in the term below for different helicities.
c
        sig_LTp = convert2mb*convert2GeV*wvoN0*R_LTp/(aaN0*sqrt(epsilon*(1-epsilon)*0.5))
```

The results of this calculation show no difference at all in the the radiative correction for the different helicities. See Mathematica notebook.

Click here to view the object (Mathematica notebook) you uploaded.

Test the code. First, print out some values of exclurad for sigL, sigT, and sigLTp

```
  16879050.   19067036.   0.
  108731008.   119338696.   0.
  16488101.   18676500.   5.47704389E-08   <---------- sigLTp is very small.
  108731008.   119338696.   0.
  17059246.   19246854.  -5.47976526E-08
  108731008.   119338696.   0.
  16770037.   18958102.   0.
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 314 - EC geometry version 1.0 (gpg)

[Modified Thu Feb 25 16:33:21 2010 (GMT) gpg]

Below is the Perl script used to define the EC geometry in terms of layers only. Breaking the EC and digitizing is done in gemc (see ECprocessID and ECprocessHit). Grouping/ganging together the layers into inner and outer layers will be done next.

Click here to view the object (ec_build.pl file used to define the geometry.) you uploaded. The same file is shown below.

Click here to view the object (tar file with all the versions of ec_build.pl on 10/2/25.) you uploaded.

```
#!/usr/bin/perl -w
#
# Perl sctipt used to generate a file (EC.txt) that is an input to the shell script go_table which
# puts the EC geometry in the mysql database for gemc to use.

# load libraries

use strict;
use lib ("$ENV{GEMC}/database_io");
use geo;
use geo qw($pi);
use Getopt::Long;
use Math::Trig;

# local quantities.

my $envelope = 'EC';
my $file     = 'EC.txt';
my $rmin = 1;
my $rmax = 1000000;

my %detector = ();    # hash (map) that defines the gemc detector
$detector{"rmin"} = $rmin;
$detector{"rmax"} = $rmax;

my $inches   = 2.54;
my $NUM_BARS = 10;

# general parameters first. Many of these are described in technical paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeom

my $dlead = 2.381;                                      # thickness of lead layers in mm.
my $dscint= 10.0;                                       # thickness of scintillator layers in mm.
my $tantheta = 1.95325;                                 # tangent of angle between sides of EC at large scattering angle (angles opposite the beams
my $gamma1 = $pi - 2*atan($tantheta);                   # angle between sides of EC at small scattering angle.
my $nlayers = 39;                                       # number of scintillator layers.
my $ECangle = 25.0;                                     # angle of EC face to a line perpendicular to the beamline.
my $totaldepth = ($nlayers-1)*($dscint+$dlead) + $dscint;    # total thickness of lead and scintillator. There are 39 scintillator layers and 38 lead la
my $L0 = 5103.2;                                        # length of perpendicular line at origin of local EC mother volume that passes through the
my $L1 = 7217.23;                                       # length of perpendicular line at origin of local EC mother volume that passes through the
my $MUoffset = 5000.0;                                  # the CLAS12 target is at +5m in the gemc coordinates.

# every third layer of lead is truncated at the vertex on the beam side. The length of the section of lead that is cut off is measured
# from the vertex of the triangle on the beam side along the y-axis bisecting the face of the triangle. Remember there are only 38 layers of
# lead starting between scintillators 1 and 2. Units are mm.

my @beamVertexCut=(0.001, 0.001, 1.440, 0.001, 0.001, 1.448, 0.001, 0.001, 1.455, 0.001, 0.001, 1.462, 0.001, 0.001, 1.0, 0.001, 0.001, 1.0, 0.001, 0.0(

# Mother Volume. describe variables first.
#
# description of parameters for Geant4 G4Trap volume.
#
# pDx1   Half x length of the side at y=-pDy1 of the face at -pDz
# pDx2   Half x length of the side at y=+pDy1 of the face at -pDz
# pDz    Half z length
# pTheta Polar angle of the line joining the centres of the faces at -/+pDz
# pPhi   Azimuthal angle of the line joining the centre of the face at -pDz to the centre of the face at +pDz
# pDy1   Half y length at -pDz
# pDy2   Half y length at +pDz
# pDx3   Half x length of the side at y=-pDy2 of the face at +pDz
# pDx4   Half x length of the side at y=+pDy2 of the face at +pDz
# pAlp1  Angle with respect to the y axis from the centre of the side (lower endcap)
# pAlp2  Angle with respect to the y axis from the centre of the side (upper endcap)
#
# Note on pAlph1/2: the two angles have to be the same due to the planarity condition.
#
# all numbers are in mm or deg as specified in the $detector{"dimensions"} statement.

my $pDx1mom   = 0.001;  # should be zero, but that makes gemc crash.
my $pDx2mom   = (xplus($nlayers) - xminus($nlayers))/2;
my $pDzmom    = $totaldepth/2.0;
my $pThetamom = 0;
my $pPhimom   = $pThetamom;
my $pDy1mom   = (yplus($nlayers) - yminus($nlayers))/2.0;
my $pDy2mom   = $pDy1mom;
my $pDx3mom   = $pDx1mom;
my $pDx4mom   = $pDx2mom;
my $pAlp1mom  = $pThetamom;
my $pAlp2mom  = $pThetamom;

# Geant4 places volumes at the center and relies on 'half-widths' to describe the proportions of the volume. The origin in the
# EC documentation (paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeometry.pdf) is not at
# the geometric center so we calculate that point here as the geometric center of the upstream face of the EC. Units are mm.
```

```
# some useful quantities.
my $ECanglerad = $ECangle*$pi/180;
my $dm = $L0 + (yplus($nlayers) + yminus($nlayers))/(2*tan($ECanglerad));

my $ECcenterx = 0;
my $ECcentery = $dm*sin($ECanglerad);
my $ECcenterz = $dm*cos($ECanglerad) + ($L1 - $dm)/cos($ECanglerad) - $MUoffset;

$detector{"name"}        = "EC";
$detector{"mother"}      = "sector";
$detector{"description"} = "Forward Calorimeter";
$detector{"pos"}         = "${ECcenterx}*mm ${ECcentery}*mm ${ECcenterz}*mm";
$detector{"rotation"}    = "$ECangle*deg 0*deg 0*deg";# pure rotation about the geometric center of EC mother volume.
$detector{"color"}       = "ff1111";
$detector{"type"}        = "G4Trap";
$detector{"dimensions"}  = "${pDzmom}*mm ${pThetamom}*deg ${pPhimom}*deg ${pDy1mom}*mm ${pDx1mom}*mm ${pDx2mom}*mm ${pAlp1mom}*deg ${ pDy2mom}*mm ${pDx3
$detector{"material"}    = "Air";
$detector{"mfield"}      = "no";
$detector{"ncopy"}       = 1;
$detector{"pMany"}       = 1;
$detector{"exist"}       = 1;
$detector{"visible"}     = 1;
$detector{"style"}       = 0;
$detector{"sensitivity"} = "no";
$detector{"hit_type"}    = "";
$detector{"identifiers"} = "";

print_det(\%detector, $file);

# now start to do the alternating layers of scintillator and lead. Set up inputs first.

my $i;
my $subname;
my $submother = "EC";;
my $description;
my $pos;
my $rotation = "0*deg 0*deg 0*deg";
my $color = "0147FA";
my $type = "G4Trap";
my $dimensions;
my $material ="Air";
my $mfield = "no";
my $ncopy = 1;
my $pMany = 1;
my $exist = 1;
my $visible = 1;
my $style = 1;
my $sensitivity = "no";
my $hit_type = "";
my $identifiers = "";

my $x0scint;
my $y0scint;
my $z0scint;
my $x0lead;
my $y0lead;
my $z0lead;

# a scintillator layer first. set the G4Trap parameters.

my $pDx1   = 0.001;  # should be zero, but that makes gemc crash.
my $pDx2   = (xplus(1) - xminus(1))/2.0;
my $pDz    = $dscint/2.0;
my $pTheta = 0;
my $pPhi   = $pTheta;
my $pDy1   = (yplus(1) - yminus(1))/2;
my $pDy2   = $pDy1;
my $pDx3   = $pDx1;
my $pDx4   = $pDx2;
my $pAlp1  = $pTheta;
my $pAlp2  = $pTheta;

# fill the Geant4 description of the volume and write the results into the file.

$i = 1;
$subname = "EClayerScint${i}";
$description ="Forward Calorimeter scintillator layer ${i}";
$z0scint = -$totaldepth/2 + ($i - 1)*($dscint + $dlead) + $dscint/2;
$pos = "0*mm 0.0*mm ${z0scint}*mm";

$detector{"name"}        = $subname;
$detector{"mother"}      = "EC";
$detector{"description"} = $description;
$detector{"pos"}         = $pos;
$detector{"rotation"}    = $rotation;
$detector{"color"}       = "0147FA";
$detector{"type"}        = "G4Trap";
$detector{"dimensions"}  = "${pDz}*mm ${pTheta}*deg ${pPhi}*deg ${pDy1}*mm ${pDx1}*mm  ${pDx2}*mm  ${pAlp1}*deg ${pDy2}*mm ${pDx3}*mm  ${pDx4}*mm  ${pAl
$detector{"material"}    = "Scintillator";
$detector{"mfield"}      = "no";
$detector{"ncopy"}       = 1;
$detector{"pMany"}       = 1;
$detector{"exist"}       = 1;
$detector{"visible"}     = 1;
$detector{"style"}       = 1;
$detector{"sensitivity"} = "EC";
$detector{"hit_type"}    = "EC";
$detector{"identifiers"} = "sector ncopy 0 layer manual $i strip manual 36";
```

```
print_det(\%detector, $file);

# loop over the remaining lead-scintillator layers.

for ($i = 2; $i < $nlayers+1; $i++) {

# lead layer

    $subname = "EClayerLead${i}";
    $description = "Forward Calorimeter lead layer ${i}";
    $x0lead = 0.0; # x position of upstream face of lead in local coordinate system.
    $y0lead = $beamVertexCut[$i-2]/2; # y position of upstream face of lead in local coordinate system.
    $z0lead = -$totaldepth/2 + ($i - 2)*($dscint + $dlead) + $dscint/2 + ($dscint+$dlead)/2; # z position of upstream face of lead in local coordinate s
    $pos = "${x0lead}*mm ${y0lead}*mm ${z0lead}*mm";

    $pDz = $dlead/2.0;
    $pDy1 = (yplus($i) - yminus($i) - $beamVertexCut[$i-2])/2;
    $pDy2 = $pDy1;
    $pDx1 = $beamVertexCut[$i-2]*tan($gamma1/2);
    $pDx3 = $pDx1;
    $pDx2 = (xplus($i) - xminus($i))/2;
    $pDx4 = $pDx2;
    $pTheta = 0;
    $pPhi   = $pTheta;
    $pAlp1  = $pTheta;
    $pAlp2  = $pTheta;

    $detector{"name"}        = $subname;
    $detector{"mother"}      = $submother;
    $detector{"description"} = $description;
    $detector{"pos"}         = $pos;
    $detector{"rotation"}    = $rotation;
    $detector{"color"}       = "7CFC00";
    $detector{"type"}        = "G4Trap";
    $detector{"dimensions"}  = "${pDz}*mm ${pTheta}*deg ${pPhi}*deg  ${pDy1}*mm ${pDx1}*mm  ${pDx2}*mm  ${pAlp1}*deg  ${pDy2}*mm ${pDx3}*mm  ${pDx4}*mm
    $detector{"material"}    = "Lead";
    $detector{"mfield"}      = "no";
    $detector{"ncopy"}       = 1;
    $detector{"pMany"}       = 1;
    $detector{"exist"}       = 1;
    $detector{"visible"}     = 1;
    $detector{"style"}       = 1;
    $detector{"sensitivity"} = "no";
    $detector{"hit_type"}    = "";
    $detector{"identifiers"} = "";

    print_det(\%detector, $file);

# scintillator layer

    $subname = "EClayerScint${i}";
    $description ="Forward Calorimeter scintillator layer ${i}";
    $x0scint = 0.0; # x position of upstream face of scintillator in local coordinate system.
    $y0scint = 0.0; # y position of upstream face of scintillator in local coordinate system.
    $z0scint = -$totaldepth/2 + ($i - 1)*($dscint + $dlead) + $dscint/2;
    $pos = "${x0scint}*mm ${y0scint}*mm ${z0scint}*mm";

    $pDz = $dscint/2.0;
    $pDy1 = (yplus($i) - yminus($i))/2;
    $pDy2 = $pDy1;
    $pDx1 = 0.001;
    $pDx3 = $pDx1;
    $pDx2 = (xplus($i) - xminus($i))/2;
    $pDx4 = $pDx2;
    $pTheta = 0;
    $pPhi   = $pTheta;
    $pAlp1  = $pTheta;
    $pAlp2  = $pTheta;

    $detector{"name"}        = $subname;
    $detector{"mother"}      = $submother;
    $detector{"description"} = $description;
    $detector{"pos"}         = $pos;
    $detector{"rotation"}    = $rotation;
    $detector{"color"}       = "0147FA";
    $detector{"type"}        = "G4Trap";
    $detector{"dimensions"}  = "${pDz}*mm ${pTheta}*deg ${pPhi}*deg  ${pDy1}*mm ${pDx1}*mm  ${pDx2}*mm  ${pAlp1}*deg  ${pDy2}*mm ${pDx3}*mm  ${pDx4}*mm
    $detector{"material"}    = "Scintillator";
    $detector{"mfield"}      = "no";
    $detector{"ncopy"}       = 1;
    $detector{"pMany"}       = 1;
    $detector{"exist"}       = 1;
    $detector{"visible"}     = 1;
    $detector{"style"}       = 1;
    $detector{"sensitivity"} = "EC";
    $detector{"hit_type"}    = "EC";
    $detector{"identifiers"} = "sector ncopy 0 layer manual $i strip manual 36";

    print_det(\%detector, $file);

   }

# end of main program. function definitions follow.

sub yplus {
    # calculates the top of the triangular active area of the EC (at large scattering angle)
    # for the requested layer. see paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeometry.pdf
    my $layer = $_[0];
    my $yplus = 1899.56 + 4.5419*($layer - 1);
    return $yplus;
```

```
}

sub yminus {
    # calculates the beam-side vertex of the triangular active area of the EC (at small scattering angle)
    # for the requested layer. see paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeometry.pdf
    my $layer = $_[0];
    my $yminus = -1829.74 - 4.3708*($layer - 1);
    return $yminus;
}

sub xplus {
    # calculates the maximum, positive x value of the edge of the triangular, active area of the EC for this layer.
    # see paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeometry.pdf
    my $layer = $_[0];
    my $xplus = (yplus($layer) - yminus($layer))/$tantheta;
    return $xplus;
}

sub xminus {
    # calculates the minimum, negative x value of the edge of the triangular, active area of the EC for this layer.
    # see paper by Ralph Minehart at http://www.jlab.org/~gilfoyle/CLAS12software/CLAS6ECgeometry.pdf
    my $layer = $_[0];
    my $xminus = (yminus($layer) - yplus($layer))/$tantheta;
    return $xminus;
}
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 315 - Transverse size of EC shower in gemc (gpg)

[Modified Fri Feb 26 18:20:23 2010 (GMT) gpg]

In the first physics study of the EC, I show here plots of the width of the distribution of the EC shower in the different views for p = 8 GeV electrons at θ = 10 deg, φ = 0 deg.

Click here to view the object (Root Tree file for the plots below) you uploaded.

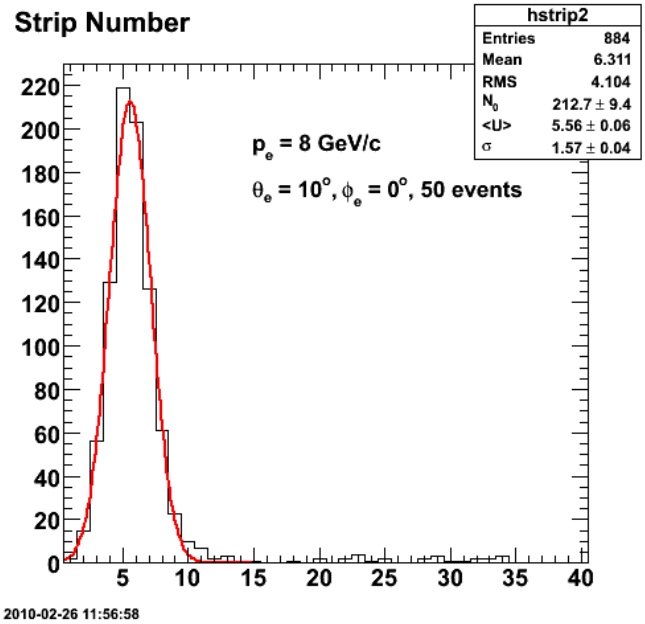


Fig 1. Results for the U strips and all layers/stacks and Edeps.

Click here to view the object (ROOT macro) you uploaded.

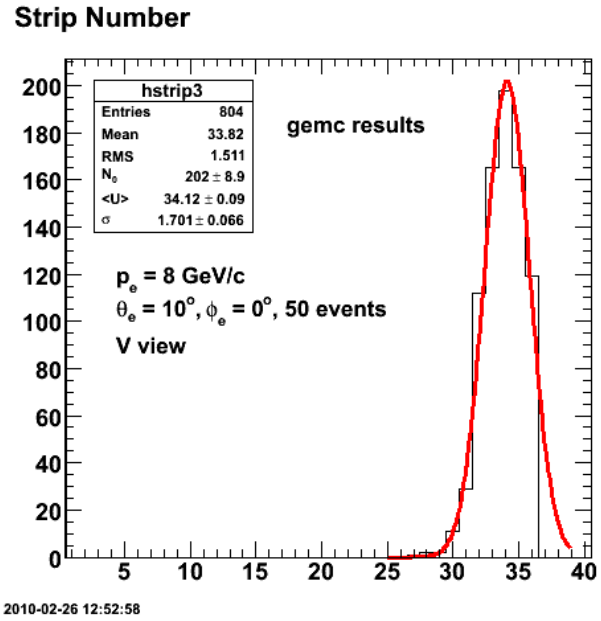


Fig 2. Same as fig 1 for V view.

Click here to view the object (ROOT macro) you uploaded.

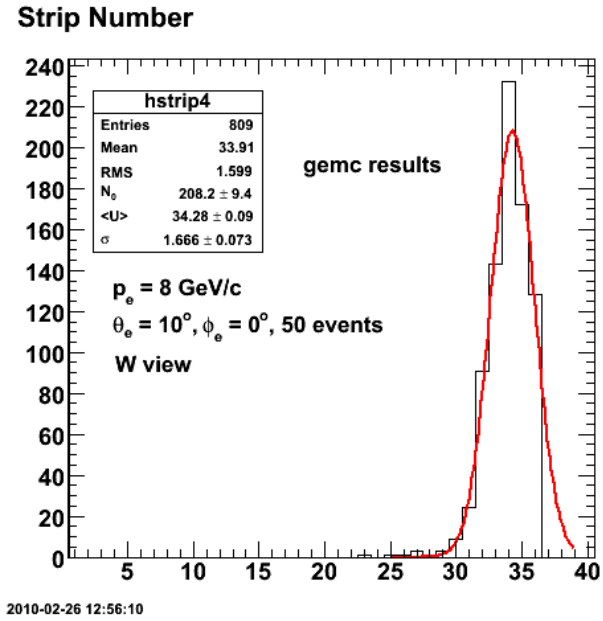


Fig 3. Same as fig2 1-2 for W view.

Click here to view the object (ROOT macro) you uploaded.

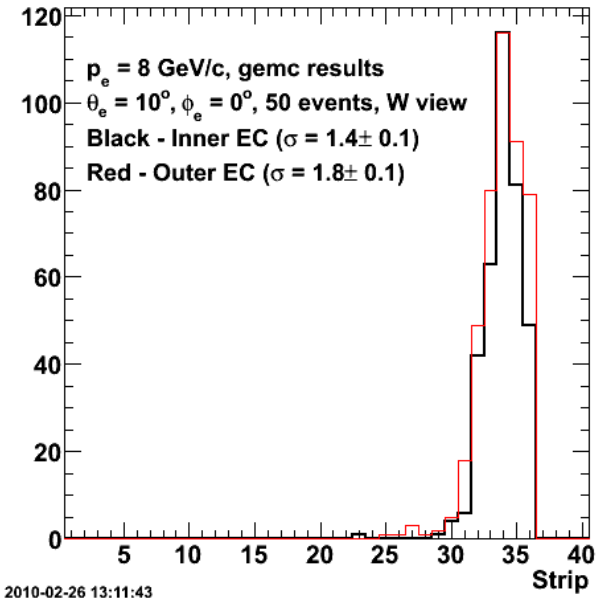


Fig 4. Widths of W strip distributions for inner and outer EC.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 316 - Sampling Fraction in EC (gpg)

[Modified Thu Mar 11 13:11:30 2010 (GMT) gpg]

Investigate the sampling fraction in the gemc EC simulation in the following way.

1. Extract histogram of Edeps for N=50 electron events using the following command to run gemc(for 2 GeV)

   ```
   gemc -gcard=modified2.gcard -DATABASE=user_geometry -BANK_DATABASE=user_banks -N=50 -BEAM_P="e-, 2.0*GeV, 10.0*deg, 0*deg" -OUTPUT="evio, EC1.ev"
   ```

   Then in root:

   ```
   TFile *f1 = new TFile("EC1.root")
   TH1D *hEdep1 = new TH1D("hEdep1","E_{dep} for electrons",180,0,180)
   ecT->Draw("Edep>>hEdep1","t<100 && pid==11 && Edep>0 && lx>-100 && lx<100 && ly>-1200 && ly<-800")
   ```

2. This distribution holds all the Edep in all the hits for the 50 electrons so take the product (number of events in each bin)*(energy of bin) and sum over all bins. For N=1 this would just be the total deposited energy of the electron so for N=50 divide by 50.
3. this is now the average deposited energy per electron so divide this number by the original electron energy (2 GeV or 4 GeV)

I did this for p = 8 GeV and got f=E/p =0.242. For p = 2 GeV I got f=0.245 (see Figs 1-2). The calculates are below.

Click here to view the object (Mathematica notebook) you uploaded.

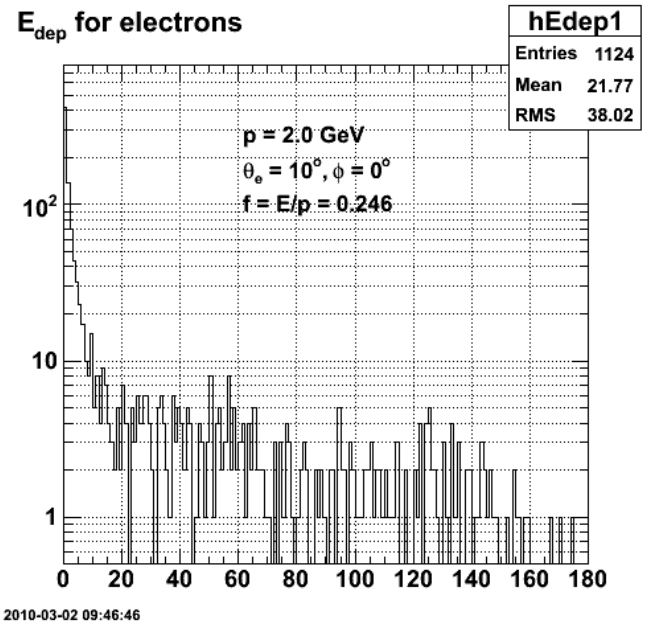


Fig 1. Distribution of deposited energy for p=2 GeV electrons.

Click here to view the object (ROOT macro) you uploaded.

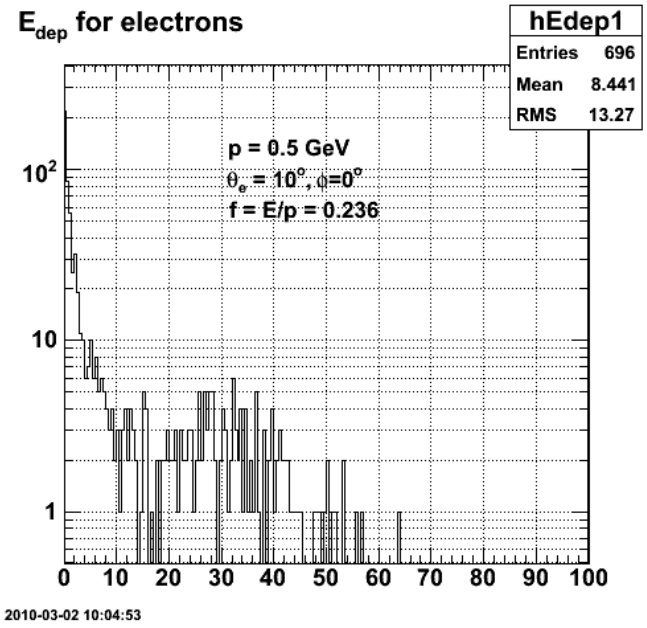


Fig 2. Same as fig 1 for p = 0.5 GeV.

Click here to view the object (ROOT macro) you uploaded.

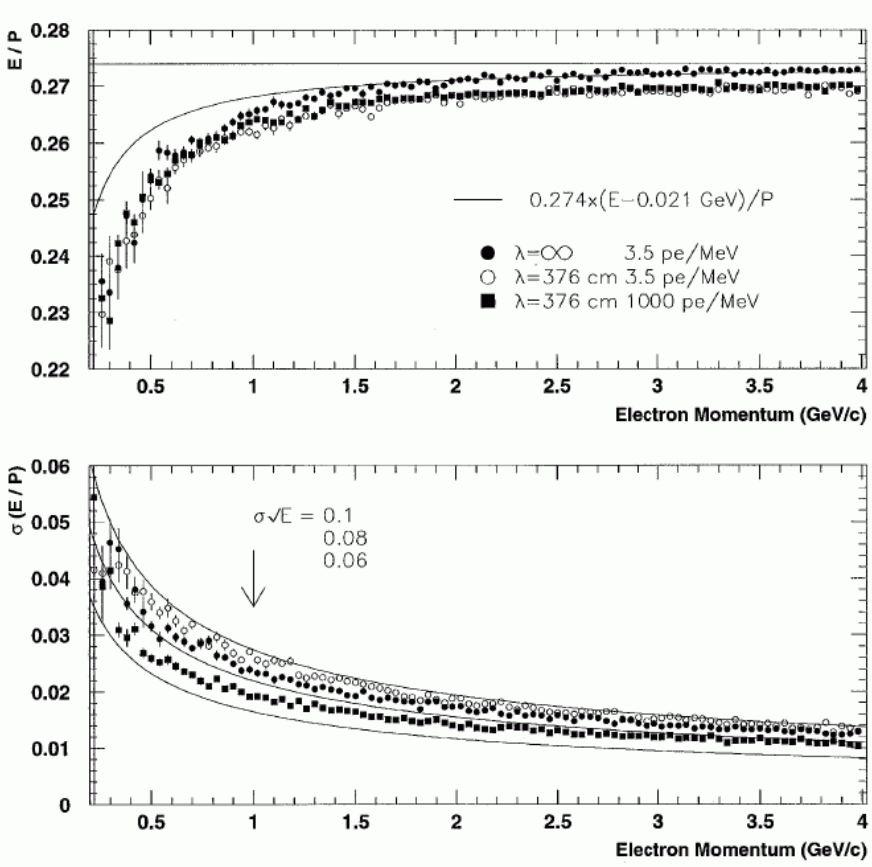


Fig. 9. GEANT prediction for sampling fraction (E/p) and resolution σ of EC module. Top panel: Ratio of reconstructed energy E to electron momentum p versus p. Symbols denote simulations run under different assumptions about scintillator attenuation length λ and light yield. Curve shows expected E/p from upstream $\mathrm{d}E/\mathrm{d}x$ losses. Bottom panel: $\sigma(E/p)$ versus p. Curves assume resolution varies as $a/\sqrt{E}$, where $a = 0.1$, 0.08 and 0.06.

Fig 3. Results for the EC from geant3 in EC NIM paper (Nuclear Instruments and Methods in Physics Research A 460 (2001) 239}265).

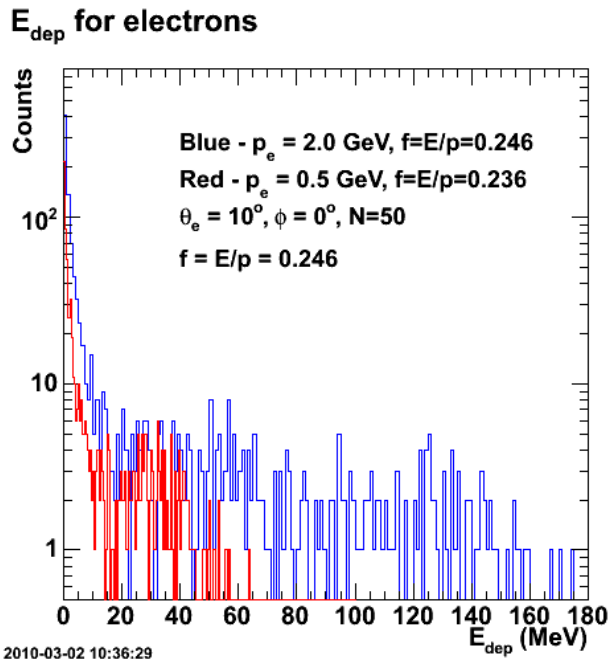


Fig 3. Comparison of distribution of E_{dep} for two electron momenta.

Click here to view the object (ROOT macro) you uploaded.

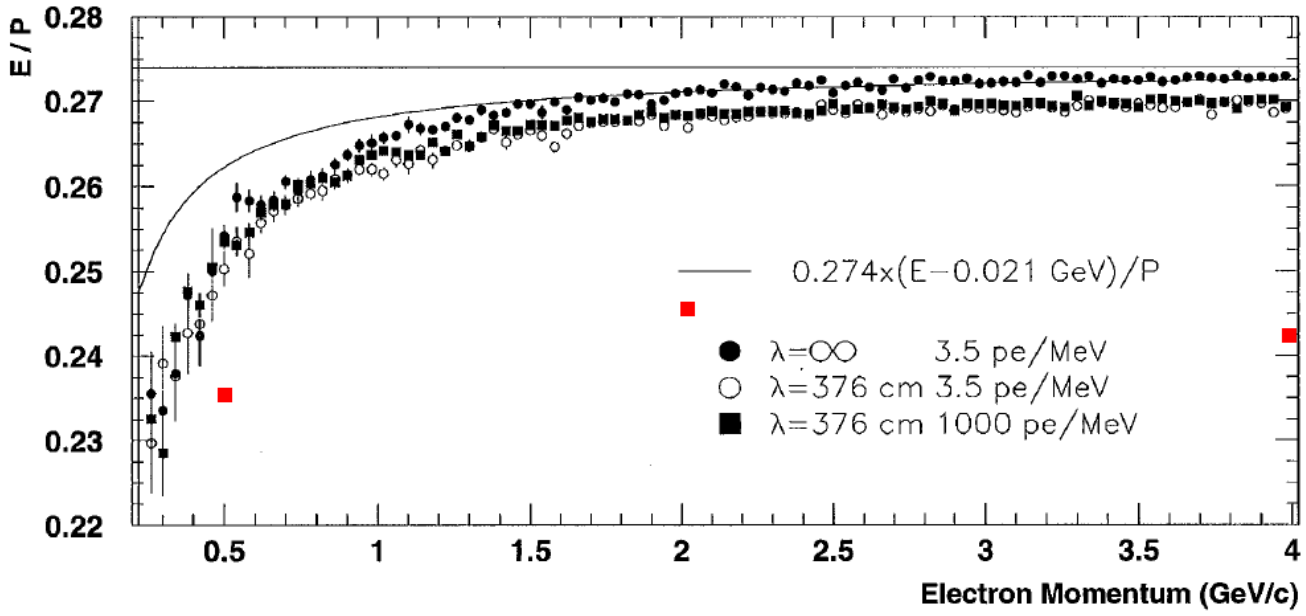


Fig 4. Comparison of sampling fraction extracted here and the results from the EC NIM paper using geant3.

Now scan the sampling fraction and generate the plot in root.

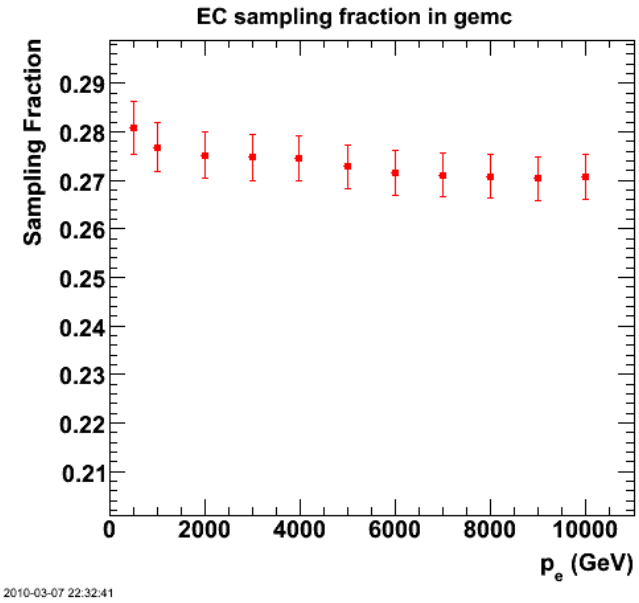


Fig 5. Electron momentum dependence of sampling fraction from gemc ntuples. See log-10-mar-07.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root macro for calculating the sampling fraction (samplingFraction5.C).) you uploaded.

Click here to view the object (tar archive of Root trees used in the analysis.) you uploaded.

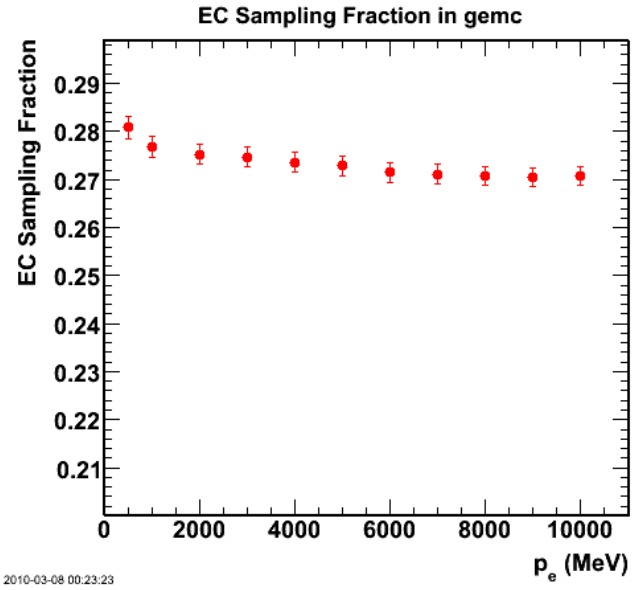


Fig 6. Same as figure 5, but use binomial errors where delta^2 = variance = p*(1-p)*N*Edep^2 instead of delta^2 = variance = N*Edep^2.

Click here to view the object (Root macro) you uploaded.

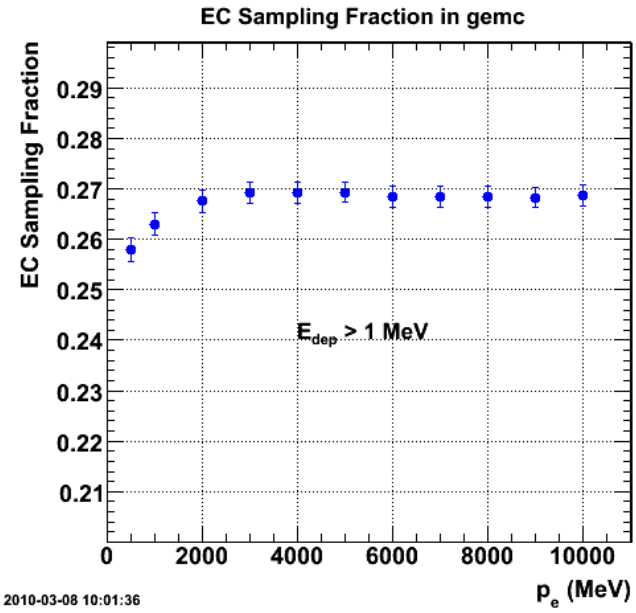


Fig 7. Require an energy threshold in the energy deposited in the EC and you get the turn-down at low electron momentum. Otherwise, this is the same as Figure 6.

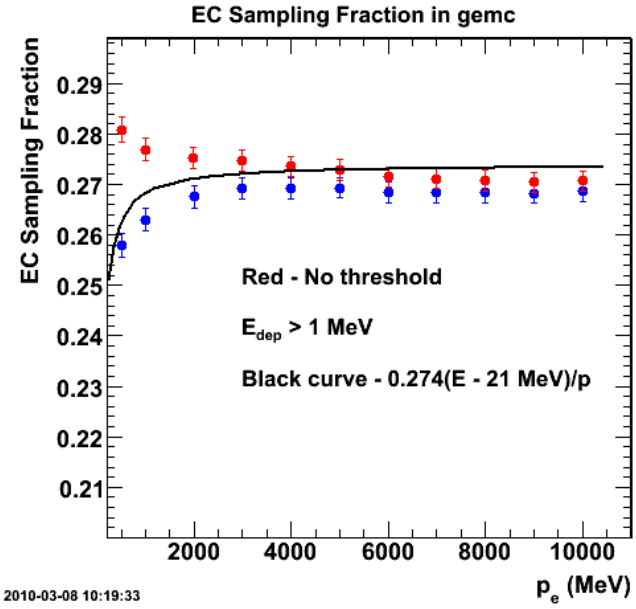


Fig 8. Combine Figs 6-7 for comparison.

Click here to view the object (ROOT macro) you uploaded.

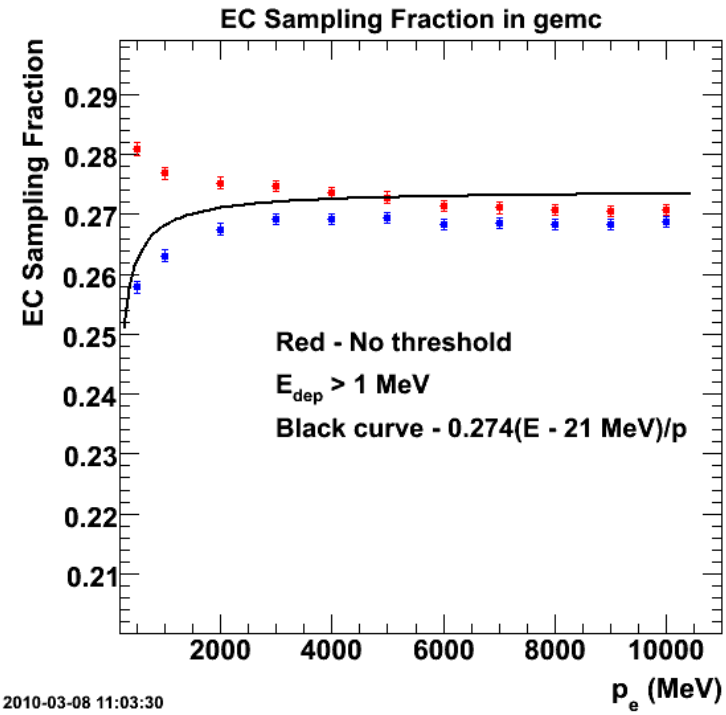


Fig 9. After talking with Stepan and Hovannes, the uncertainties still look to be too large on each point. Just for fun, throw in another binomial factor in the variance (p*(1-p)) and it looks better, but still not great.

Click here to view the object (ROOT macro) you uploaded.

Neither of the above approaches give reasonable uncertainties. Follow Hovanes's suggestion to generate the distribution of total E = sun(all Edeps) for many events and take the centroid and width. That seems to work and gives much smaller uncertainties.

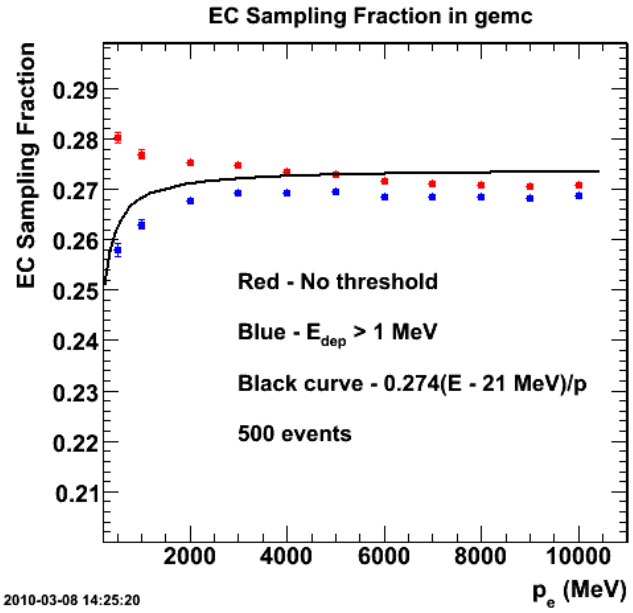


Fig 10. Sampling Fraction with uncertainties based on the distribution of Etotal for many events at each electron momentum.

Click here to view the object (ROOT macro) you uploaded.

Now put in the attenuation in the scintillator.

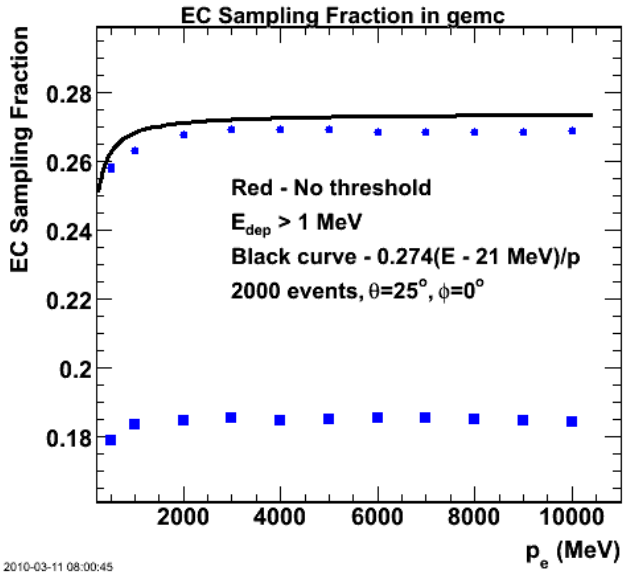


Fig. 11. Effect of attenuation length. This is much larger than expected from the EC NIM paper (see plots above), but it may be explainable because these are all events at a single angle and thus a nearly fixed, large attenuation.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (tar archive of Root Tree files) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 317 - Resolution in gemc and comparison with GSIM (gpg)

[Modified Tue Mar 9 17:10:50 2010 (GMT) gpg]

Calculate the resolution by collecitng histograms of sampling fraction as a function of electron momentum. Use the RMS width at the resolution. See the plots below.

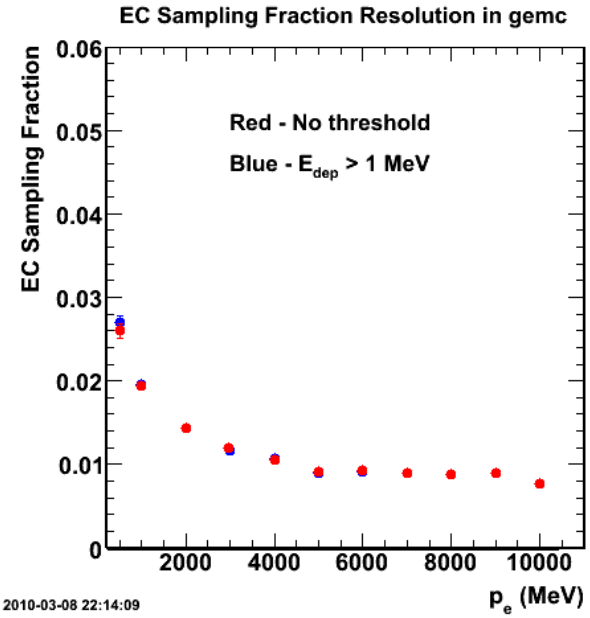
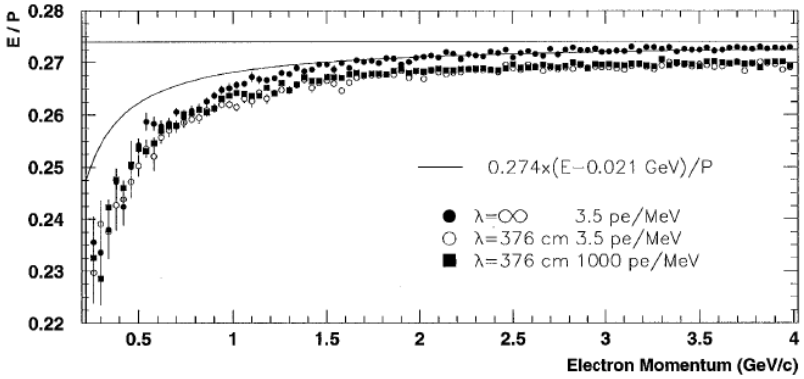
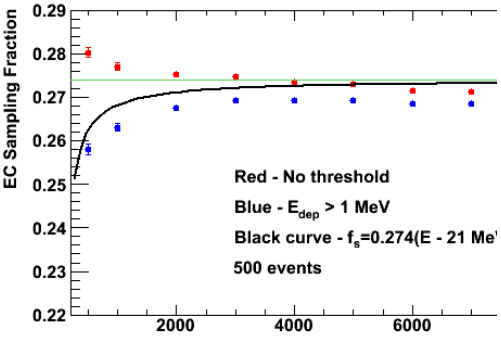
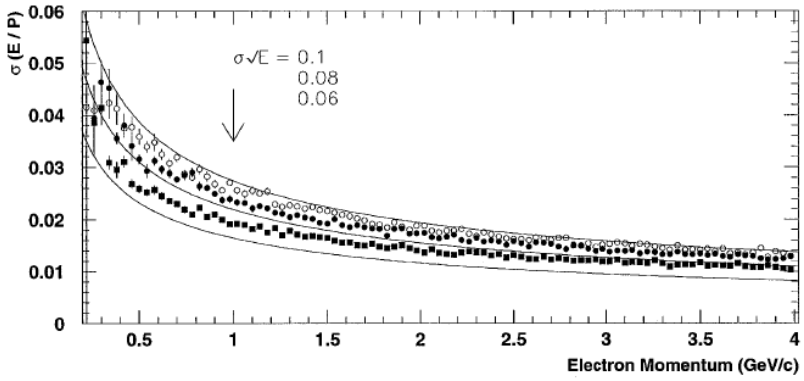
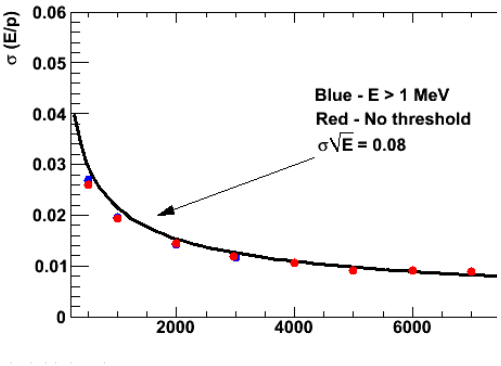


Fig 1. Resolution as a function of p_e with no threshold and with Edep > 1.0 MeV.









Sampling fraction and resolution from EC NIM paper. **Sampling fraction and resolution fro**

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 318 - Position resolution in gemc (gpg)

[Modified Tue Mar 9 03:12:45 2010 (GMT) gpg]

Use a similar setup to the previous entry, use electrons at theta=25 deg, phi = 0 deg, and no field (so the electron strikes the face of the EC at a right angle). Project out ly vs. lx and get the width of the central region. See the plot.

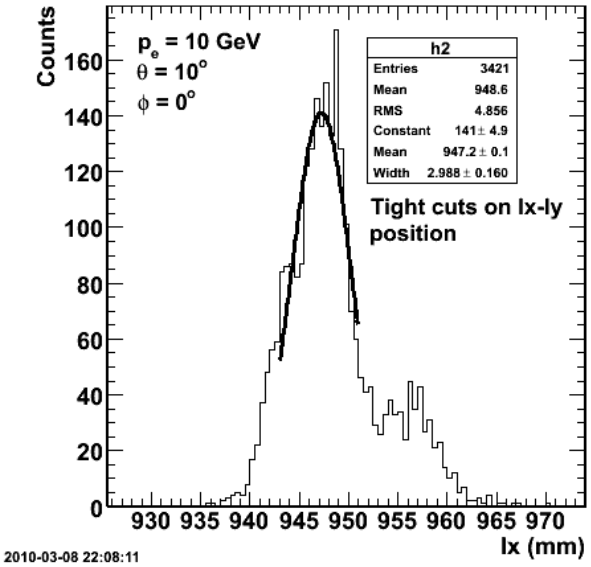


Fig 1. Resolution in lx for p_e = 10 GeV/c electrons.

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 319 - Position resolution, shower size, and Plots for Collaboration meeting (gpg)

[Modified Tue Mar 16 20:18:16 2010 (GMT) gpg]

Use a similar setup to the previous entry, use electrons at theta=25 deg, phi = 0 deg, and no field (so the electron strikes the face of the EC at a right angle). Project out ly vs. lx and get the width of the central region. See the plot.

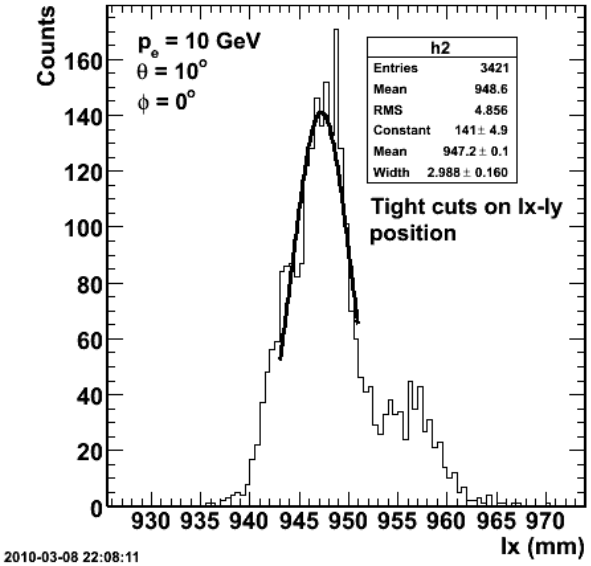


Fig 1. Resolution in lx for p_e = 10 GeV/c electrons.

Click here to view the object (ROOT macro) you uploaded.

Plots below for the Collaboration meeting next week. The expectation is that 95% of the energy of the shower lies within 2 cm of the hit according to the EC NIM paper.

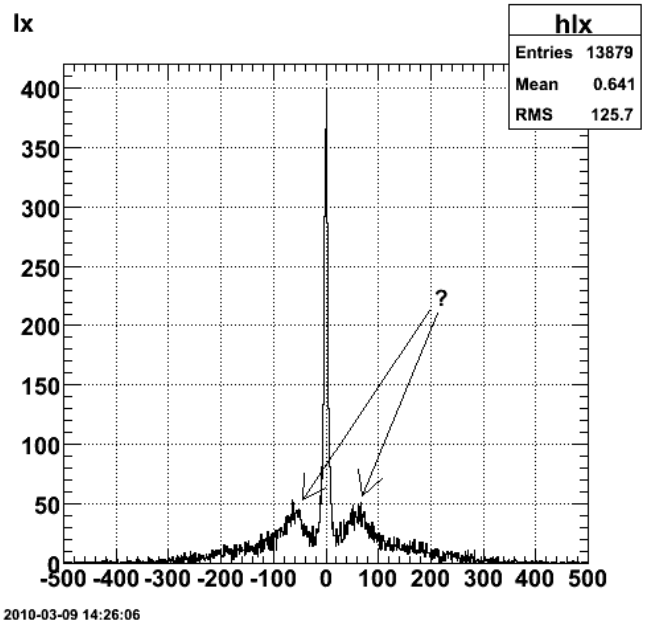


Fig 2. What are those side peaks?

```
TH1D *hlx = new TH1D("hlx","lx",1000,-500,500)
      ecT->Draw("lx>>hlx","t<50")
```

Stepan thinks we are seeing the effect of the strips in the EC. The side peaks are at +/- 70 mm which is about the width of the pixels in the EC. This makes sense

because we are projecting down onto the x axis. The pixels in the EC are horizontal triangles with the vertex at the top or bottom. Even with a uniform distribution of events you would get peaks when you did the projection because there is more area to project down the center of the triangle than on the edges. Imagine a triangle like the one below. Break it up into vertical strips and calculate the area of each strip.

The area will increase as you go from left to right until you reach the apex of and then the area will go down again. The area of these strips multiplied by the average occupancy (number of events) on each strip will give you the projection of the number of events along the horizontal (i.e. x) axis. Even a uniform distribution then will have a peak in the middle.

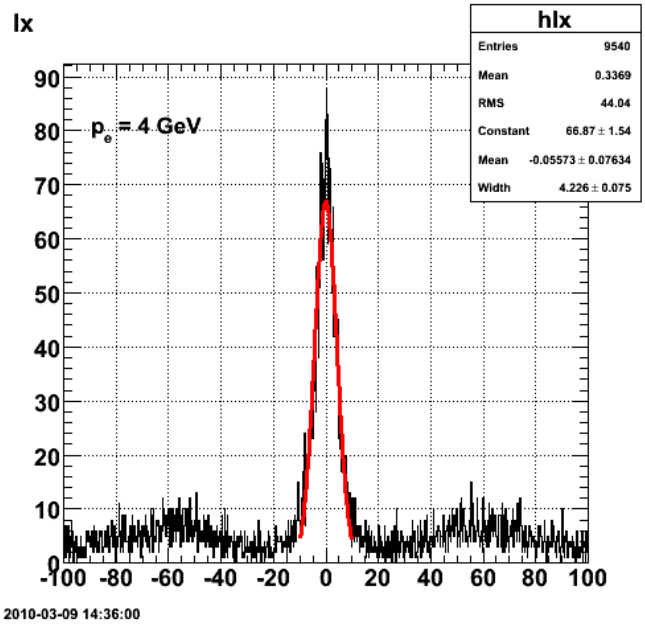


Fig 3. Fit results for width of shower.

Click here to view the object (ROOT macro) you uploaded.

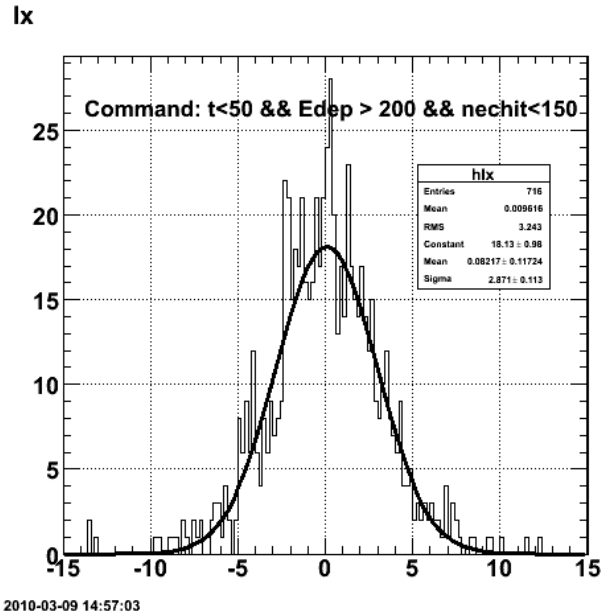


Fig 4. Trying to squeeze down the transverse size.

The EC NIM paper says that the transverse width of the shower is +/- 2cm and contains 95% of the shower. I assume this means the energy of the shower (see plots above). I make a plot of the energy deposited in the EC as a function of lx (see below). For a threshold of 5 MeV, I get the 95% for p_e=4 GeV (see energyDist1.C for the Root code).

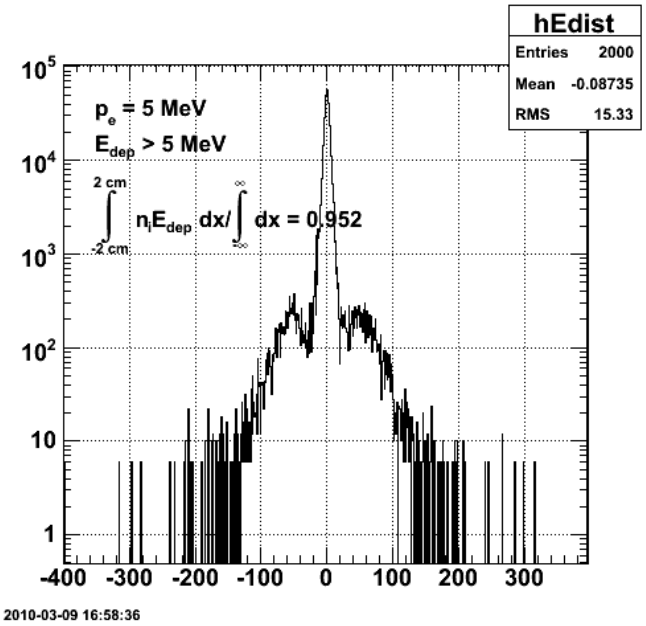


Fig 5. Distribution of total deposited energy as a function of lx.

Click here to view the object (ROOT macro) you uploaded.

Integral of deposited energy for fig 5.

```
root [48] float low=hEdist->Integral(1,979)
root [49] float mid=hEdist->Integral(980,1020)
root [50] float hi=hEdist->Integral(1021,2000)
root [51] mid/(low+mid+hi)
(double)9.52039148017112202e-01
```

One of the questions I had in working through all this was that if I fit the distribution above and get a width, how is that width (which is projected onto the x axis) related to the 2D width. Doing the Mathematica integral below it appears there is no difference in the width.

$$\text{In[30]:=}\quad \int_{-\infty}^{+\infty} \text{Exp}\left[-\frac{x^2+y^2}{2*s1^2}\right] dy$$

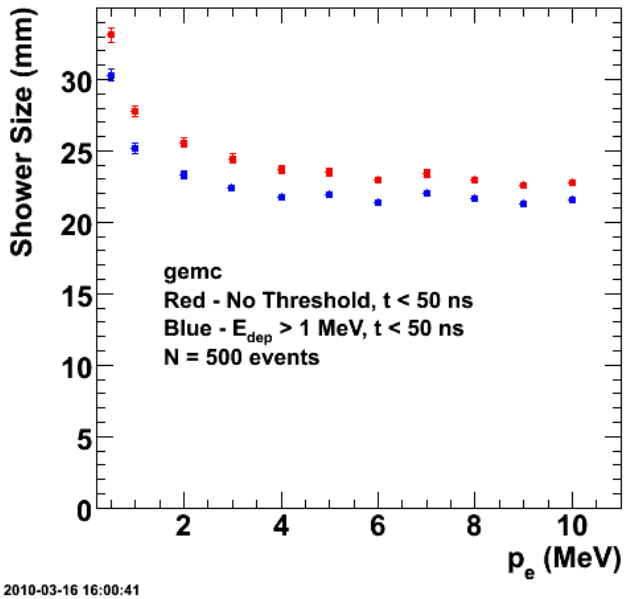
$$\text{Out[30]=}\quad \text{If}\left[\text{Re}\left[s1^2\right] > 0,\ \frac{e^{-\frac{x^2}{2\,s1^2}}\sqrt{2\,\pi}}{\sqrt{\frac{1}{s1^2}}},\ \text{Integrate}\left[e^{-\frac{x^2+y^2}{2\,s1^2}},\ \{y,\ -\infty,\ \infty\},\ \text{Assumptions} \to \text{Re}\left[s1^2\right] \le 0\right]\right]$$

Integral of a 2D gaussian over one dimension leaves you with a gaussian of the same width.

Click here to view the object (ROOT macro Edist1.C used for the above analysis.) you uploaded.

Click here to view the object (Mathematica notebook for above result.) you uploaded.

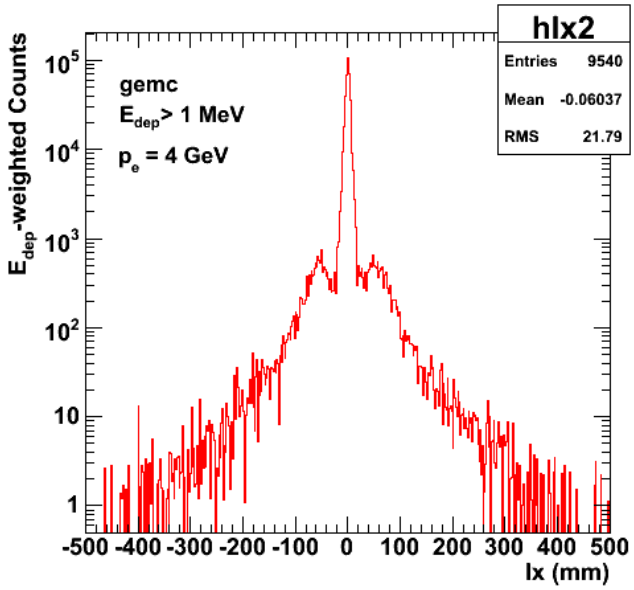
See log entry for March 16, 2010 for notes on generating following plot of shower size RMS and uncertainty for CLAS12 software talk.



2010-03-16 16:00:41

Fig 6. Shower size (RMS) for electrons at θ=25 deg, φ = 0 deg.

Click here to view the object (ROOT macro) you uploaded.



2010-03-16 16:17:10

Fig 7. Distribution of local x position for Edep-weighted hits.

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DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 320 - EIC BEC plots (gpg)

[Modified Wed Apr 21 03:54:32 2010 (GMT) gpg]

Some preliminary attempts to see Bose-Einstein Correlations in pythia simulations for p_e=3 GeV/c and p_{ion}=-60 GeV/c.

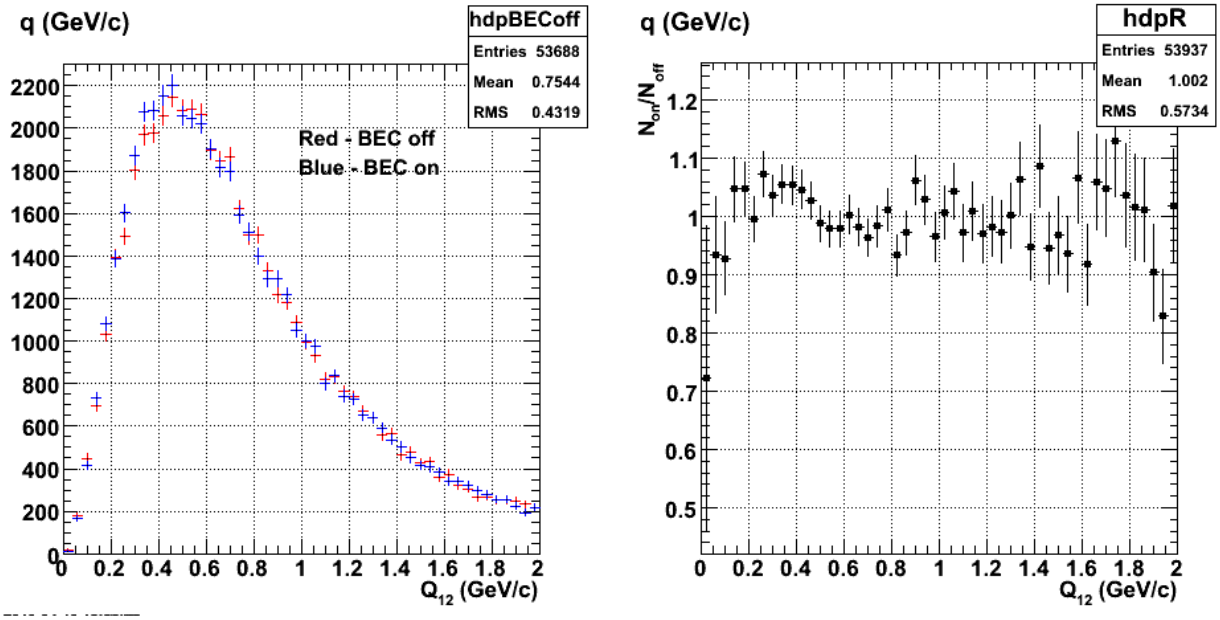


Fig 1. Comparison of simple spectra (lhs) and ratio of spectra (rhs) with BEC turned on (blue) and turned off (red).

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (Fortran code for eic calculation) you uploaded.

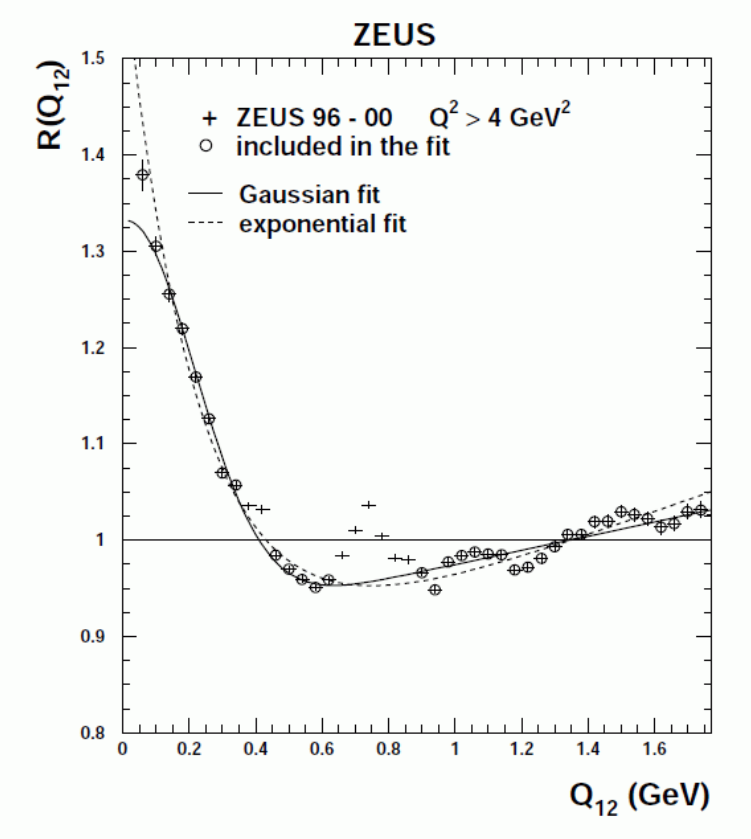


Fig 2. Plot from Zeus, arXiv:hep-ex/0311030v2.

Put in the ZEUS beam and we see the effect!!!!! Strange problem: the code hangs after about 1300 events for the BEC on case.

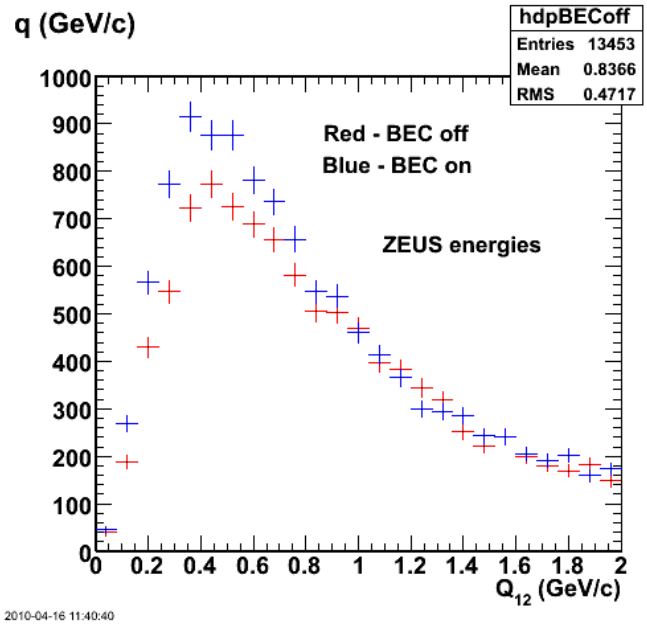


Fig 3. Comparison of spectra from pythia BEC simulation at ZEUS energies.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (gzipped tar archive) you uploaded.

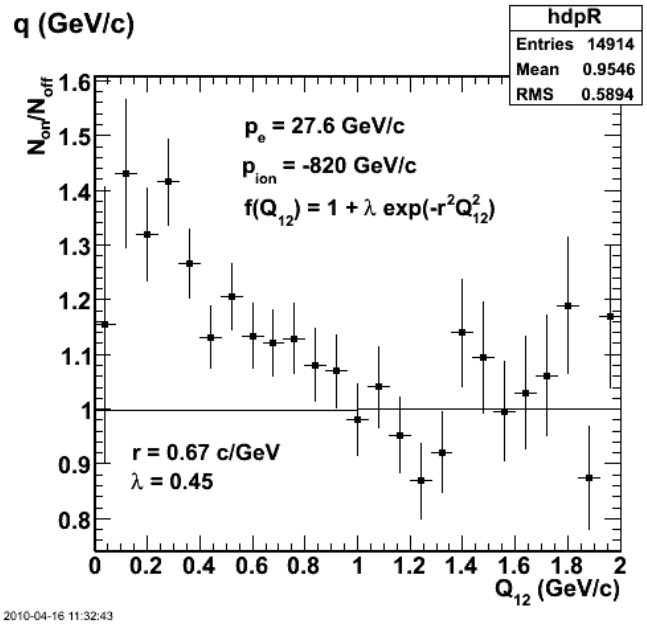


Fig 4. Correlation function for ZEUS energies.

Click here to view the object (Root macro) you uploaded.

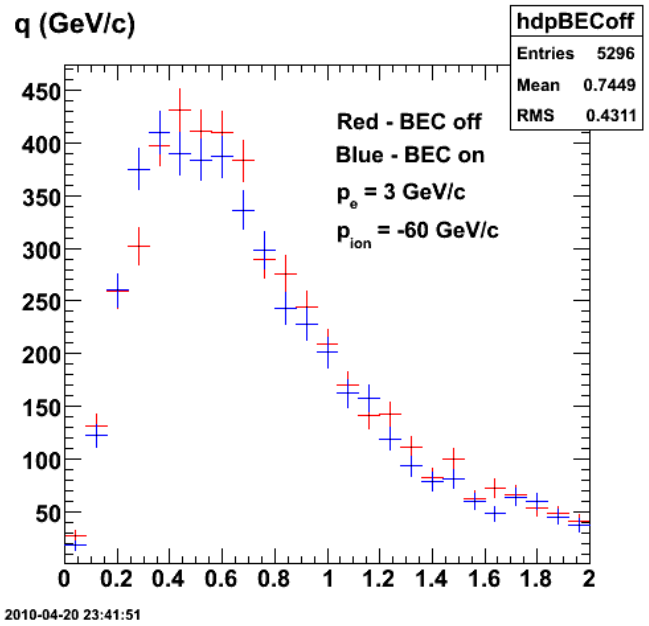


Fig 5. Comparison of spectra from pythia BEC simulation at EIC energies.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (gzipped tar archive) you uploaded.

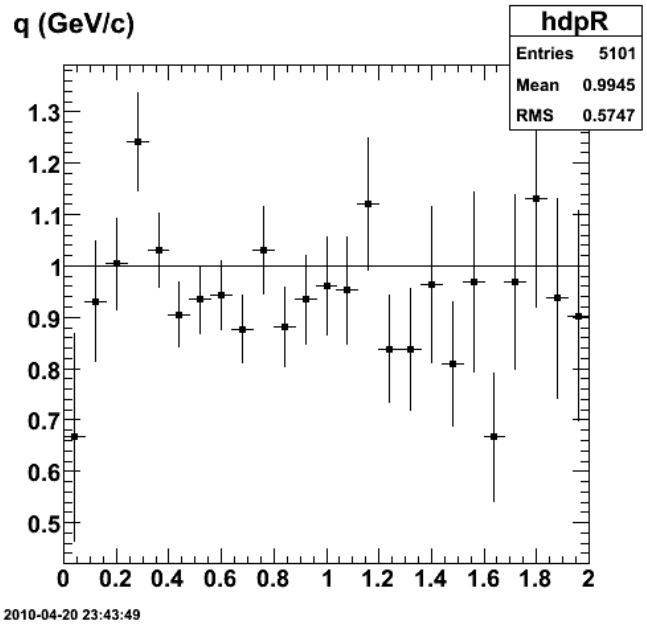


Fig 6. Correlation function for EIC energies.

Click here to view the object (ROOT macro) you uploaded.

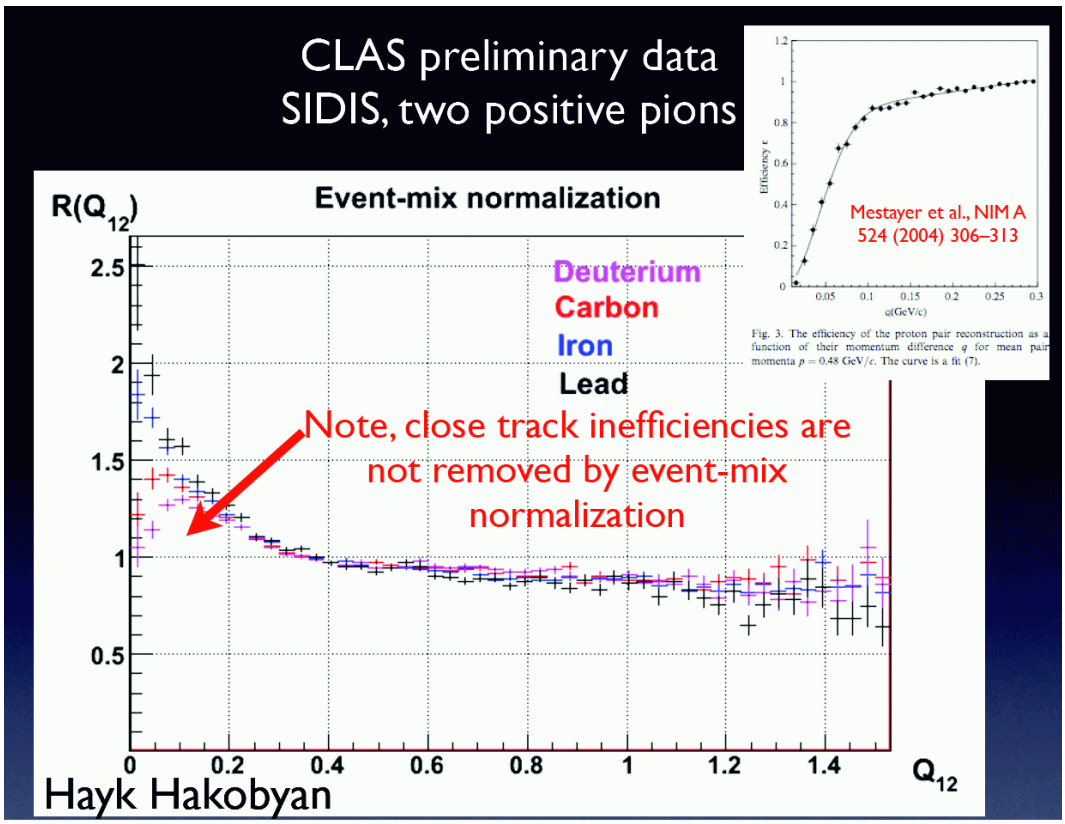


Fig 7. Extraction of correlation function from CLAS6 EG2 data.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 321 - First Look at Bose-Einstein Correlations at the EIC. (gpg)

[Modified Wed Aug 11 22:32:28 2010 (GMT) gpg]

The measurement of Bose-Einstein Correlations (BEC) at the EIC could enable us to extract the source size of an excited color string and possibly gain information on the tension in the string. One way to study BECs is to look at correlations in the relative momentum between two identical particles. The correlation coefficient is defined as the ratio of the relative momentum spectrum between, say, two pi0's divided by the same spectrum with any correlations removed. Experimentally, this 'no-correlations' spectrum has to be generated with some care, but here we will be using simulation where we can easily turn the correlations on and off. These correlations have been observed at ZEUS (and other places) and we use some of that work to guide our studies here. For this study we looked at two-pion momentum correlations using the Pythia event generator. It turns out that Pythia version 6.4 comes with the capability to turn on these correlations.

To start the first figure below shows the correlation function measured at ZEUS from ep events. The data sample used consisted mostly (about 80%) of pion tracks.

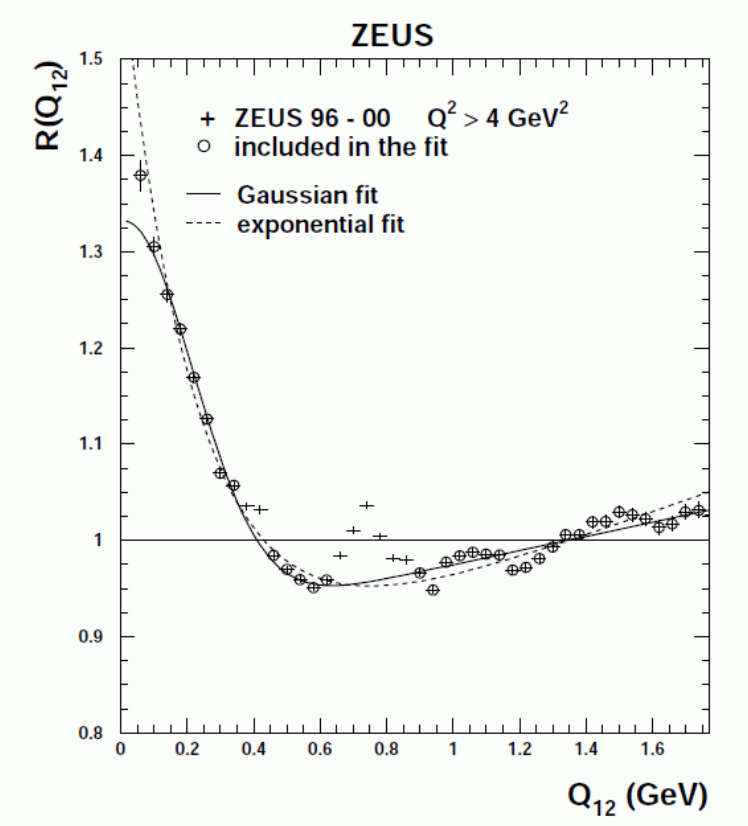


Fig 1. Plot from Zeus, arXiv:hep-ex/0311030v2 and Phys.Lett.B583:231-246,2004.

To test the BEC part of Pythia we used the ZEUS kinematics (see Figure 2) and the average value of the BEC parameters from the ZEUS paper. We extracted the relative momentum from all pairs of pions in each event and generated histograms with BEC on and off (left-hand side of Figure 2). We used the Gaussian BEC simulation and the parameters shown in Figure 2. To get the correlation function we simply divided the BEC-on histogram by the BEC-off one. We did not run the simulation for very long, but we see a clear correlation at low relative momentum with a shape qualitatively similar to the ZEUS results. The pythia simulation is broader (crosses zero at &Deltap = 1 GeV/c instead of 0.4 GeV/c for the ZEUS data), but we this is a very simple analysis at this stage.

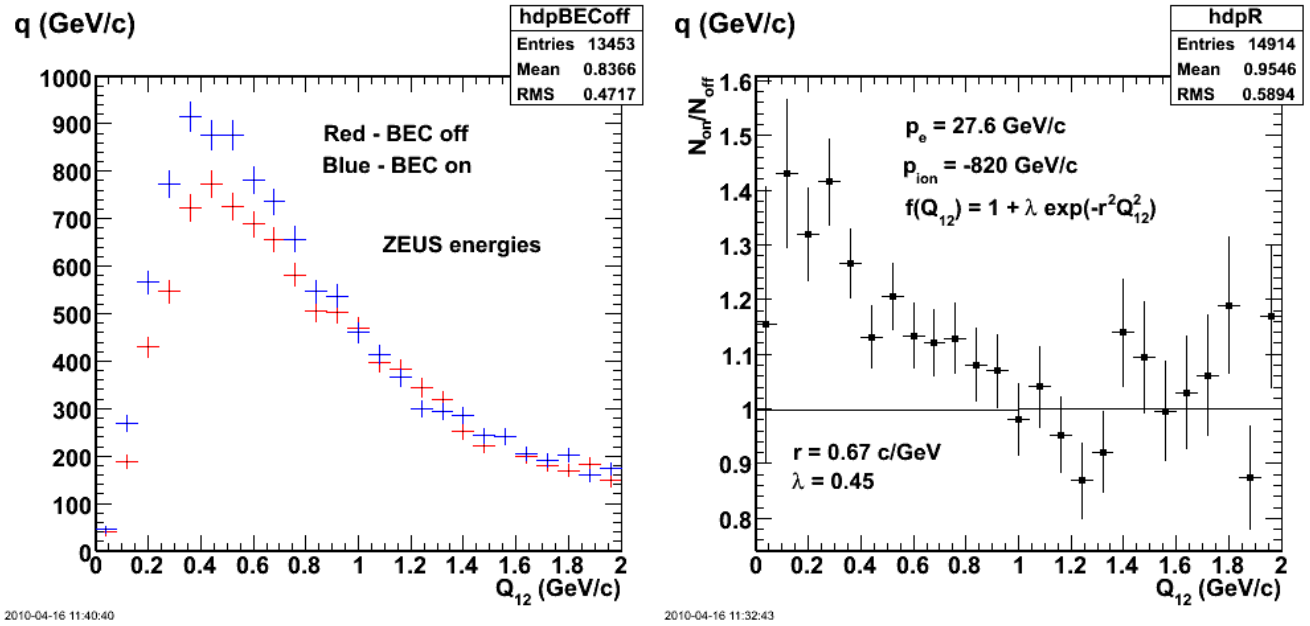


Fig 2. Comparison of spectra from pythia BEC simulation at ZEUS energies (left panel) and correlation function for ZEUS energies (right panel).

Next, we took the same parameters and used possible EIC momenta for the electron and ion beams and did the same simulation. The results are shown in Figure 3. The correlation at small relative momentum has largely disappeared. This case is a much lower energies than the ZEUS so perhaps there is simply not enough energy to produce the large number of mesons needed to see this effect. This is a bit surprising since Hayk has observed a significant correlation among pion pairs in the EG2 data set at even lower energy transfers (See Figure 4.

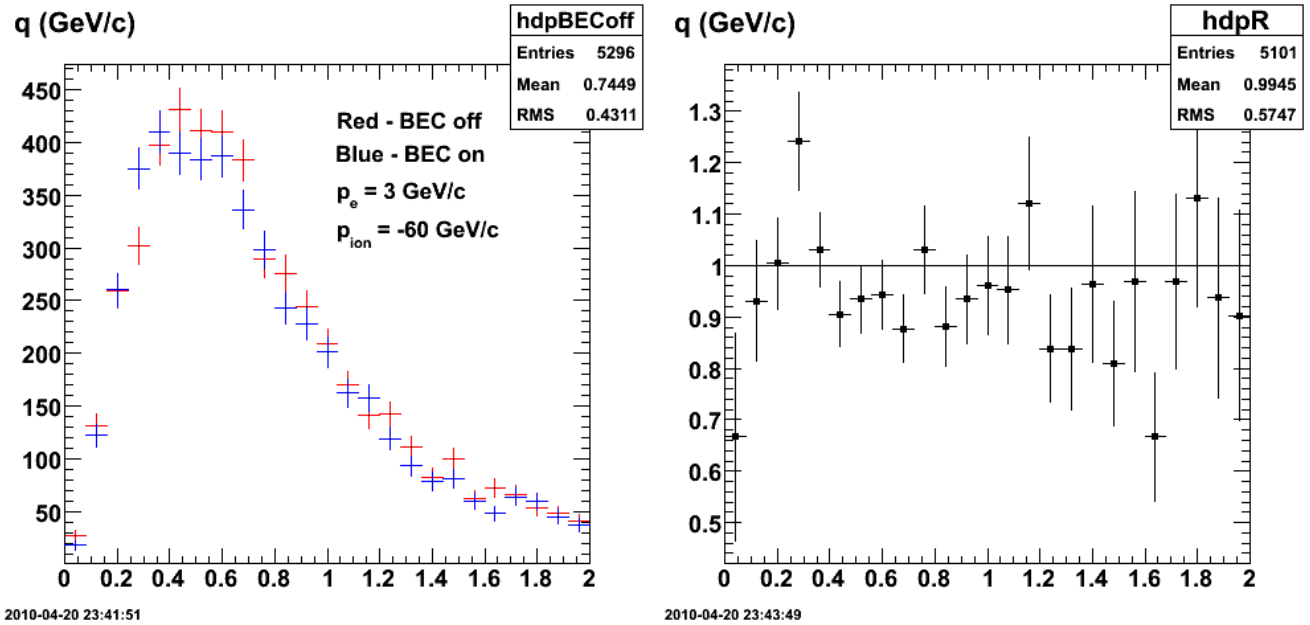


Fig 3. Comparison of spectra from pythia BEC simulation at EIC energies (left panel) and correlation function for EIC energies (right panel). Pythia parameters are the same as in Figure 2 except the incoming momenta.

Correlations from pi+-pi+ were extracted from the CLAS6 EG2 data and show a significant positive correlation at low relative momentum, but are hampered by the close-track inefficiencies in CLAS6.

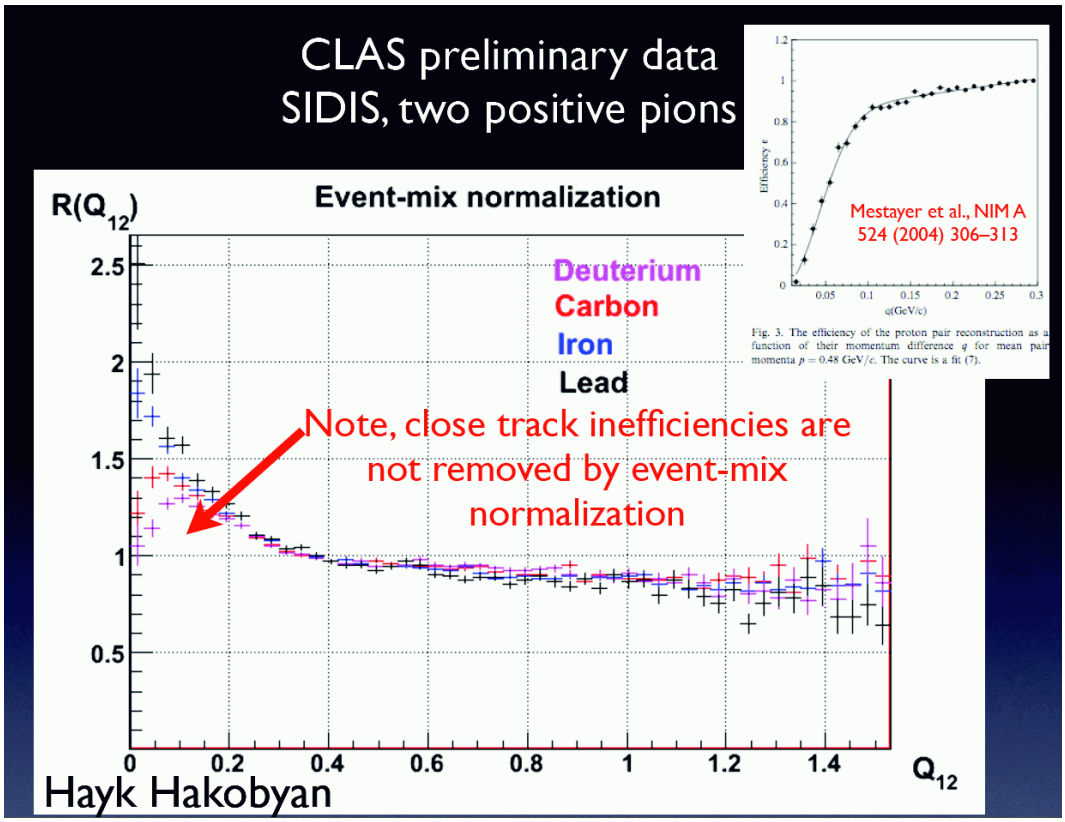
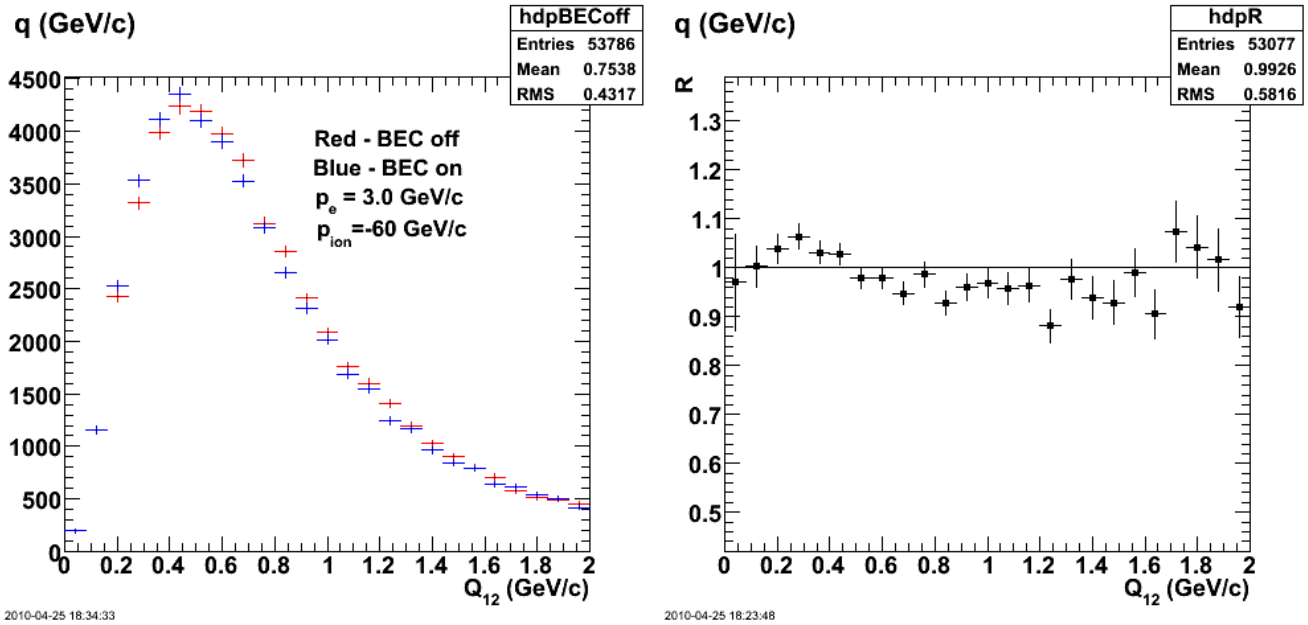


Fig 4. Extraction of correlation function from CLAS6 EG2 data.

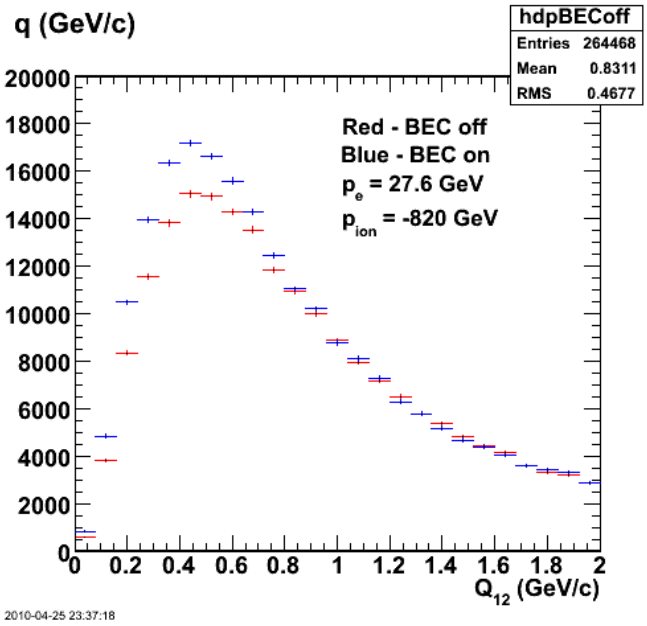
Run it for 20000 events.



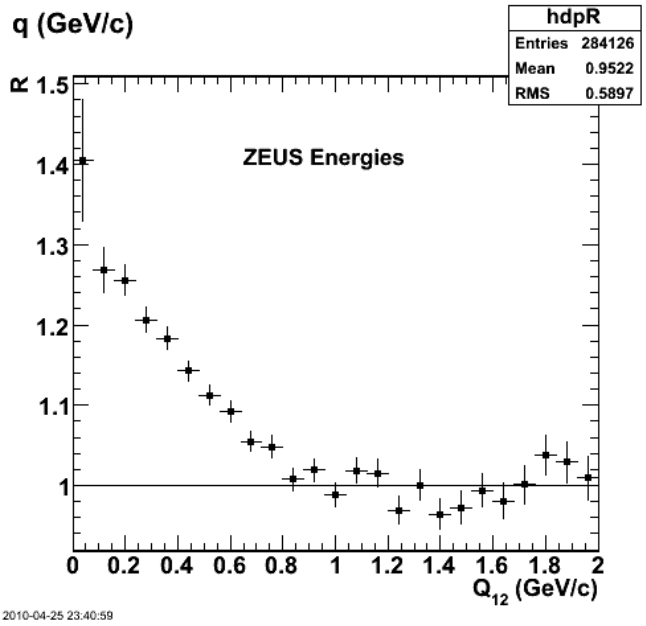
Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Fig 5. Comparison of spectra from pythia BEC simulation at EIC energies (left panel) and correlation function for EIC energies (right panel). Pythia parameters are the same as in Figure 3.

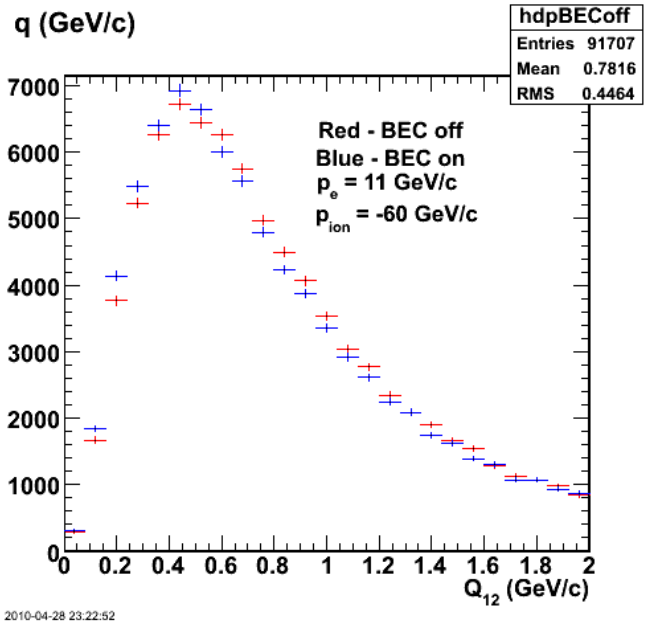


Click here to view the object (Root macro) you uploaded.

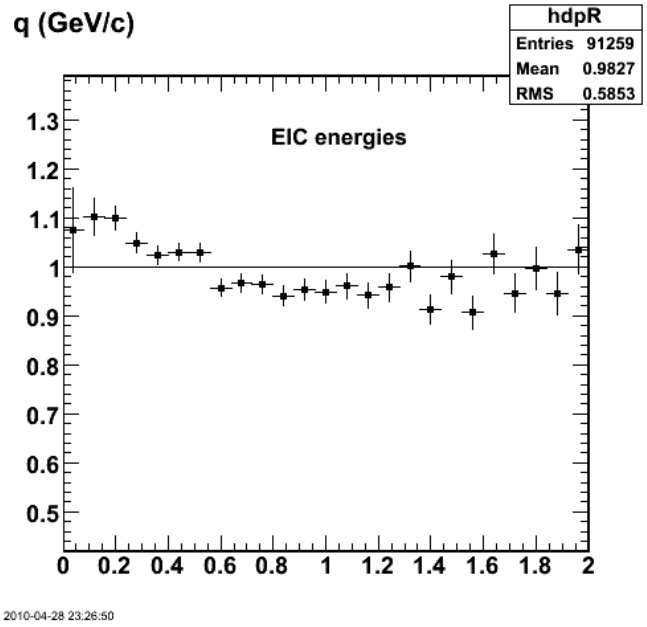


Click here to view the object (Root macro) you uploaded.

Fig 6. Comparison of spectra from pythia BEC simulation at EIC energies (left panel) and correlation function for EIC energies (right panel). Pythia parameters are the same as in Figure 2.

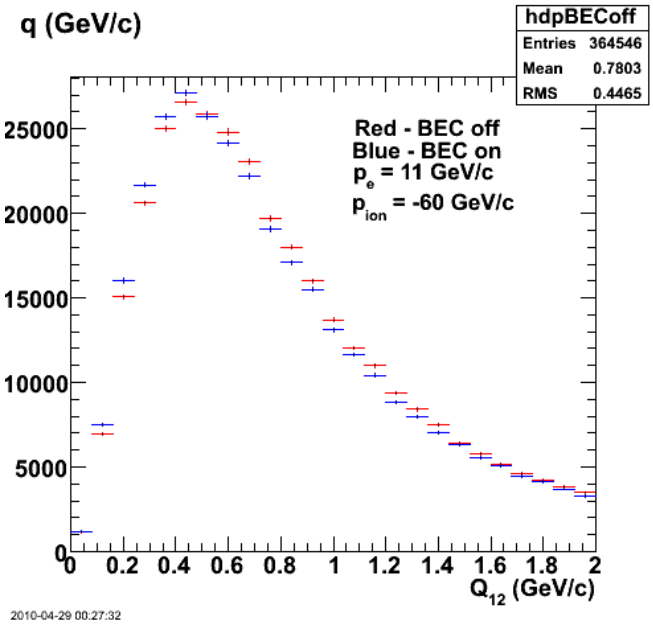


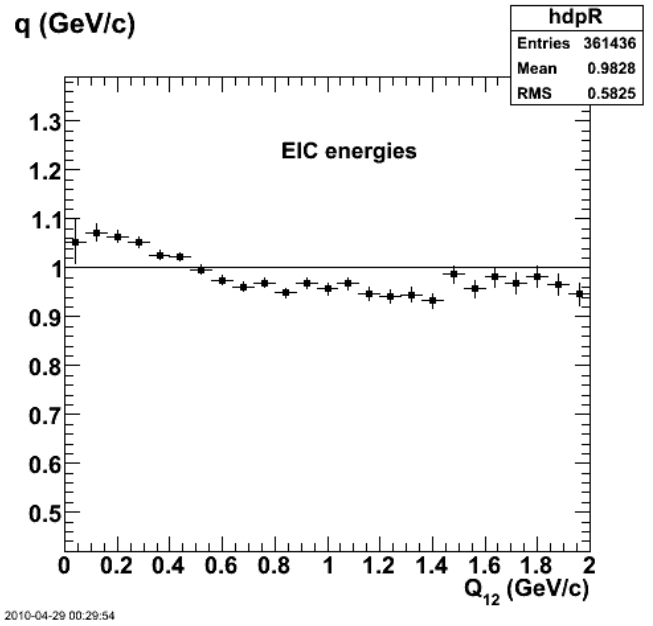
Click here to view the object (Root macro) you uploaded.



Click here to view the object (Root macro) you uploaded.

Fig 7. Comparison of spectra from pythia BEC simulation at EIC energies with p_e= 11 GeV/c (left panel) and correlation function for EIC energies (right panel). Pythia parameters are the same as in Figure 2 except for electron beam energy.



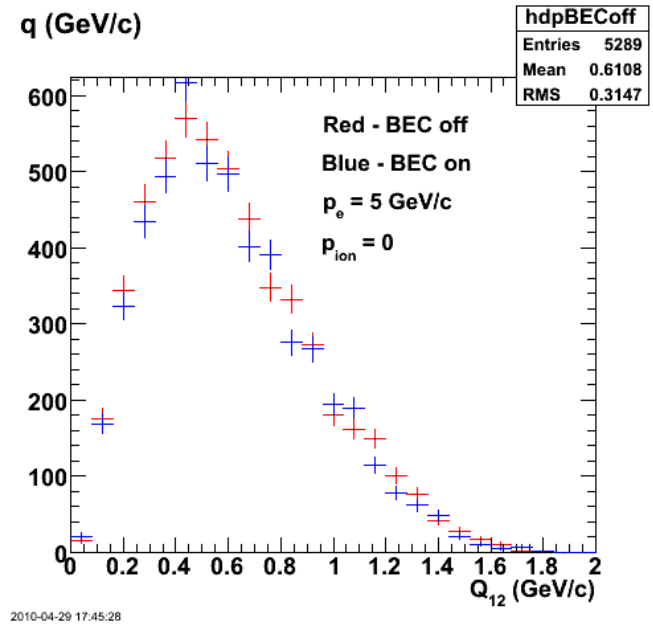


Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root macro) you uploaded.

Fig 7. Comparison of spectra from pythia BEC simulation at EIC energies with p_e= 11 GeV/c (left panel) and correlation function for EIC energies (right panel). Pythia parameters are the same as in Figure 2 except for electron beam energy.

Modify the data statements in the pythia common blocks to get a lower threshold so we can run pythia at eg2 energies.



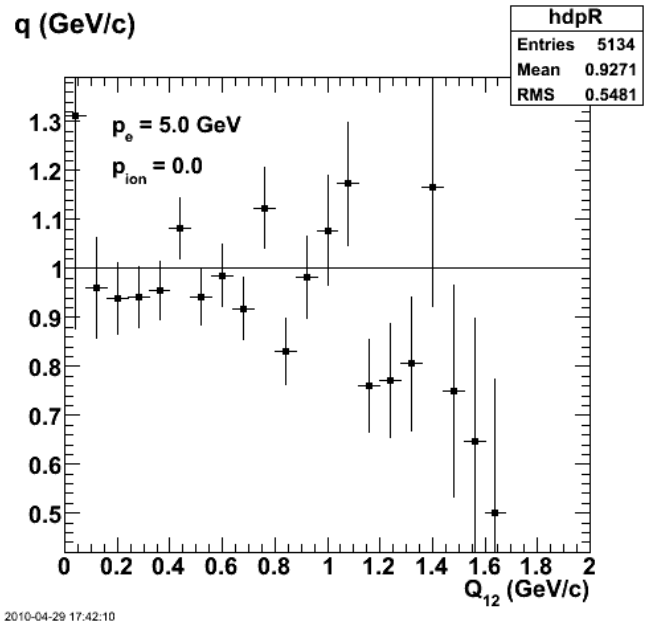
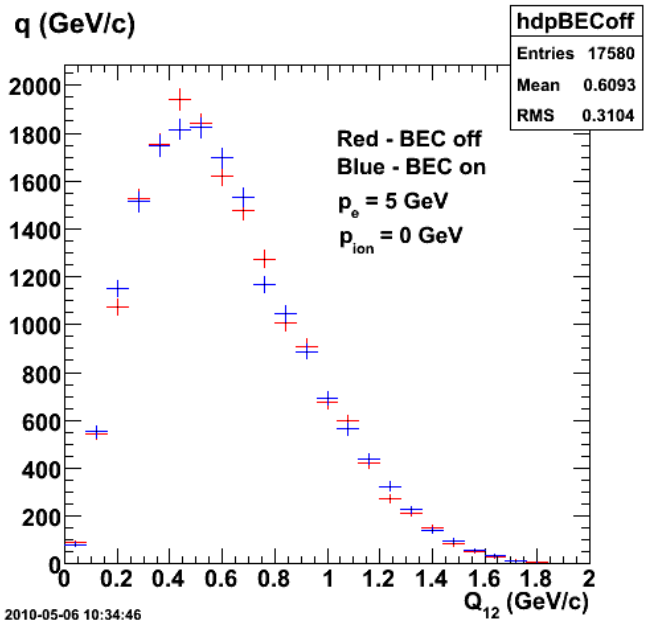


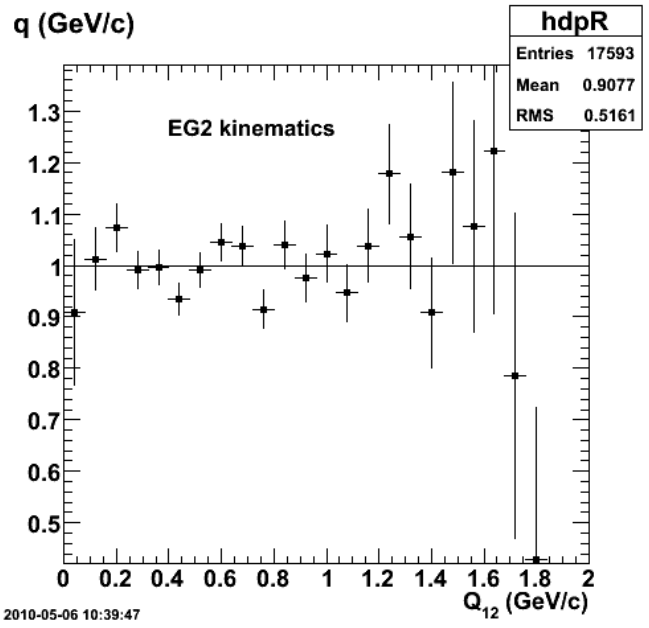
Fig 8. Comparison of spectra from pythia BEC simulation at EG2 energies with pe= 5 GeV/c (left panel) and correlation function (right panel). Pythia parameters are the same as in Figure 2 except for the electron beam energy.

Click here to view the object (tar archive with first round of data files used in fig 8.) you uploaded.

Better statistics for Fig 8 analysis.



Click here to view the object (ROOT macro) you uploaded.



Click here to view the object (ROOT macro) you uploaded.

Fig 9. Comparison of spectra from pythia BEC simulation at EG2 energies with pe= 5 GeV/c (left panel) and correlation function (right panel). Pythia parameters are the same as in Figure 2 except for the electron beam energy. Same as Fig 8 with better stats.

Click here to view the object (tar archive with inputs for fig 9.) you uploaded.

I take a first look at the Q2 dependence of pythia and there is an anomalous peak at Q2=0. It is not from Q2<0 events and the plot below shows there are many events with very small Q2. Q2 here was calculated from the square of the magnitude of the transferred photon which is particle 4 in the pythia event record.

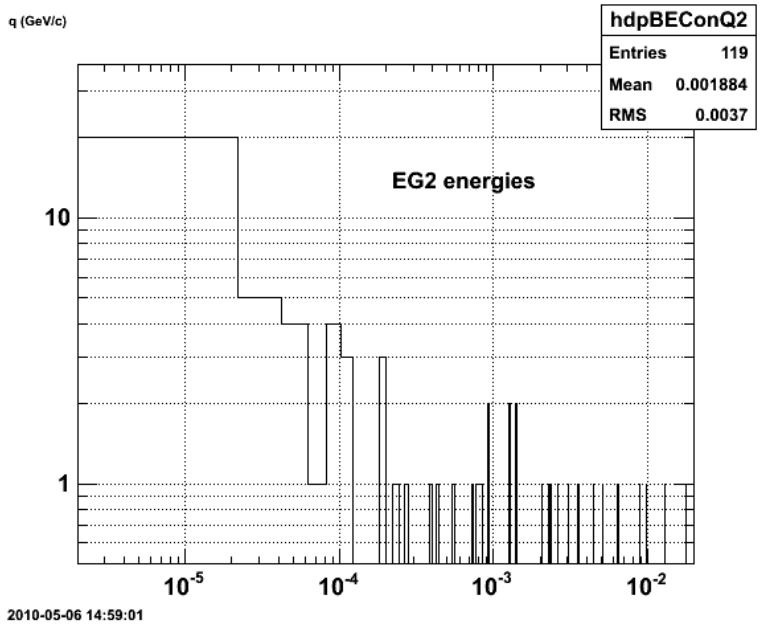


Fig 10. Log-Log plot of Q2 distribution showing the large peak at very low (but >0) Q2. It is not clear where this is from, but remove it from the data. Horizontal axis is Q2 (GeV2).

Click here to view the object (ROOT macro) you uploaded.

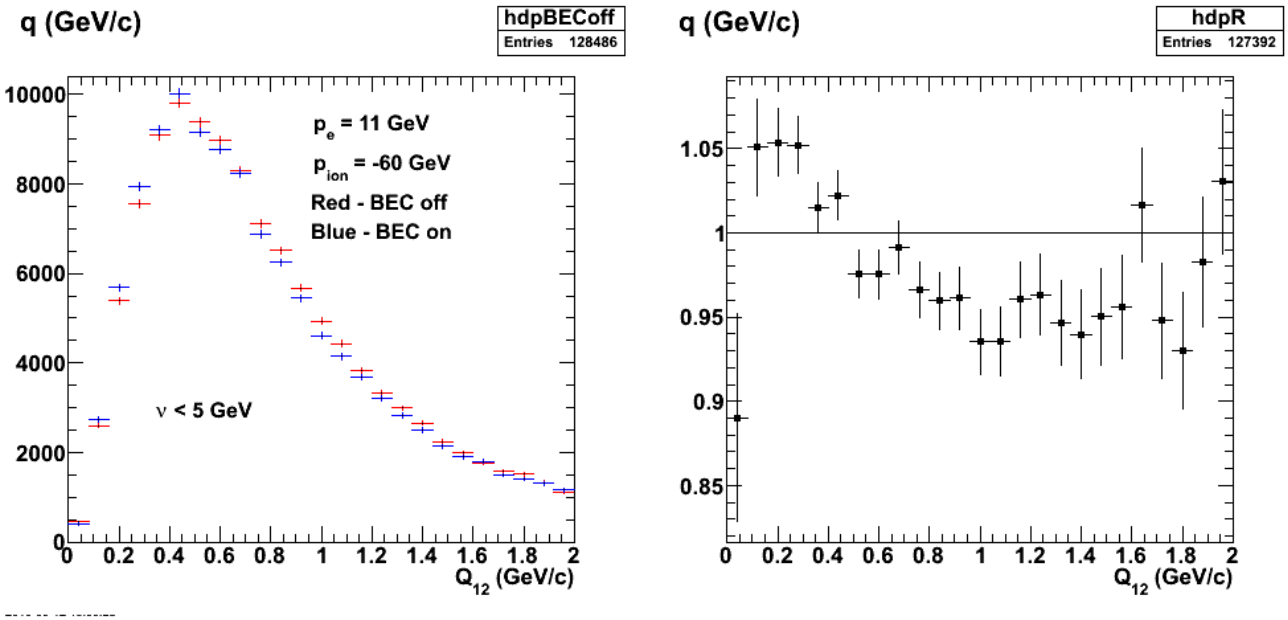


Fig. 11 Apply cut on maximum energy transfer at EIC kinematics. Effect on correlation is mostly on reducing statistics.

Click here to view the object (ROOT macro) you uploaded.

Click here to view the object (gzipped, tar file with event from simulation above.) you uploaded.

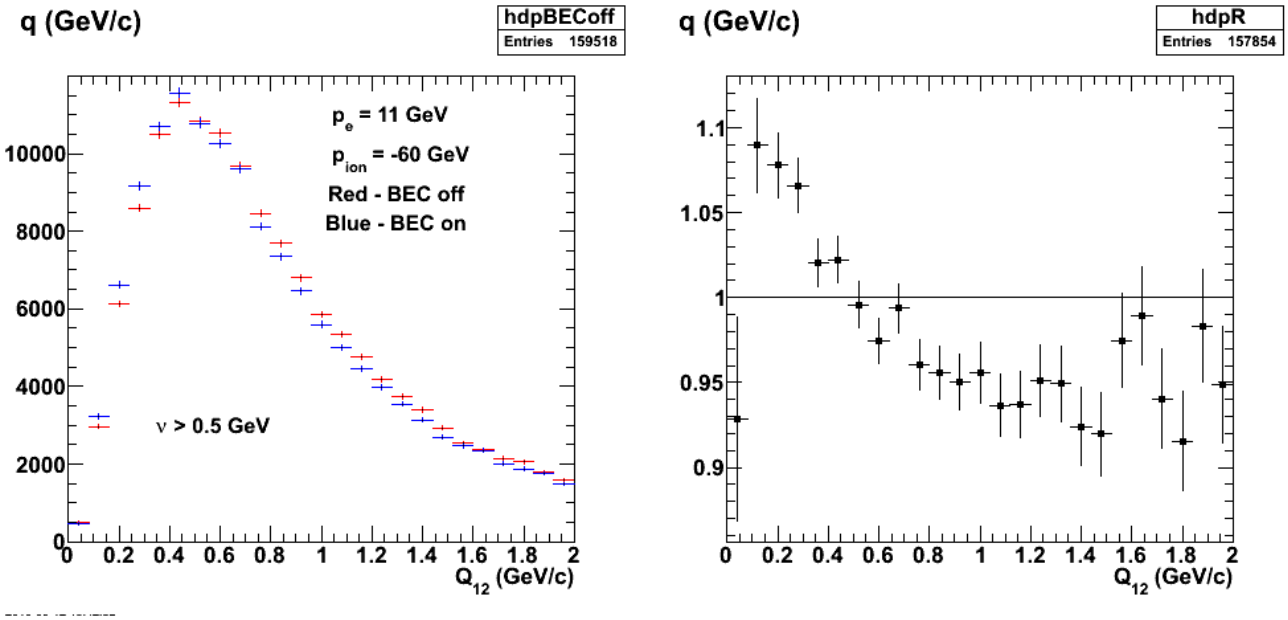


Fig 11. Minimum energy transfer cut.

Click here to view the object (ROOT macro) you uploaded.

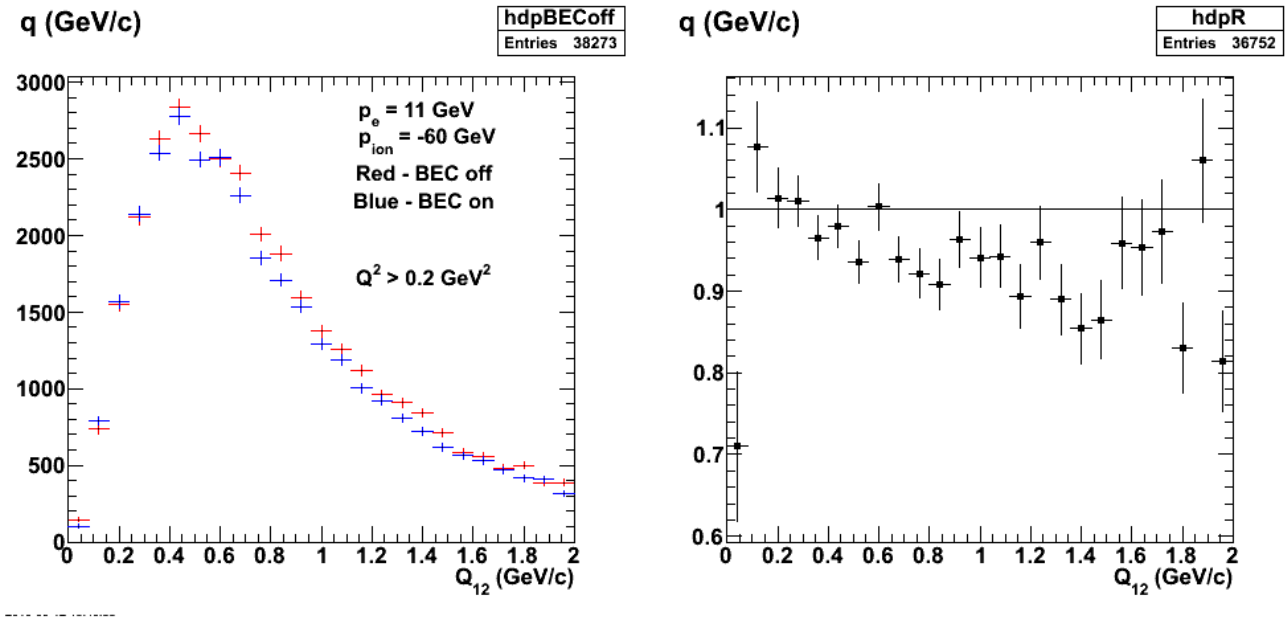


Fig 12. Minimum Q2 cut applied.

Click here to view the object (ROOT macro) you uploaded.

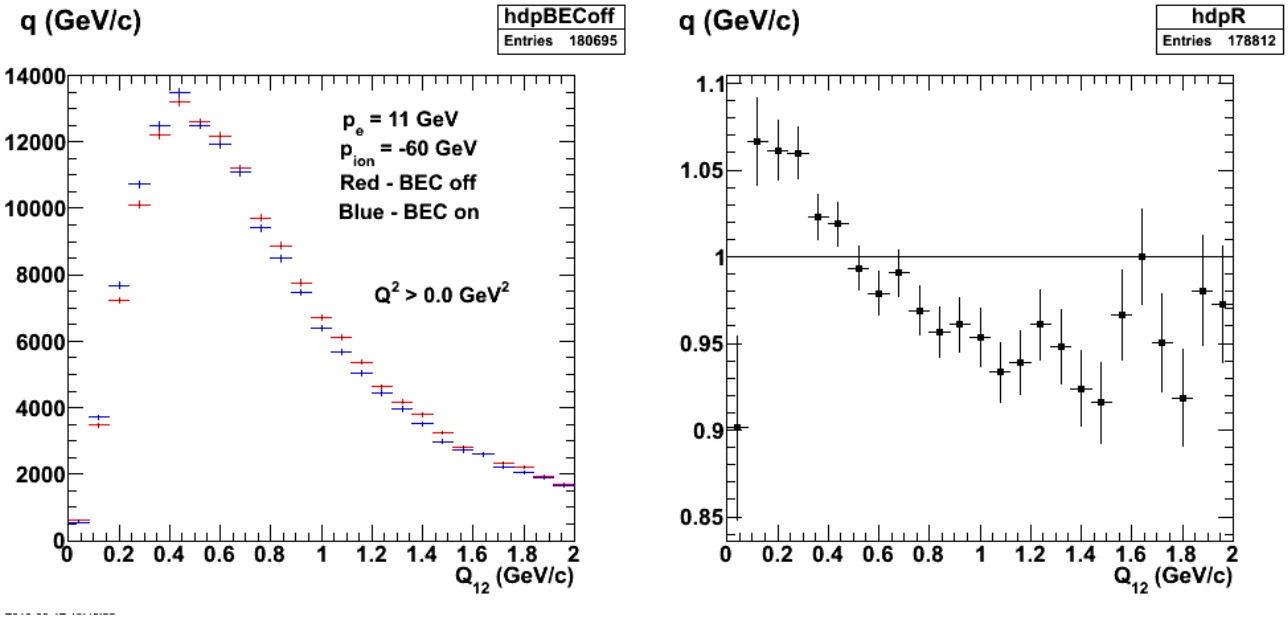


Fig 13. No cuts.

Click here to view the object (ROOT macro) you uploaded.

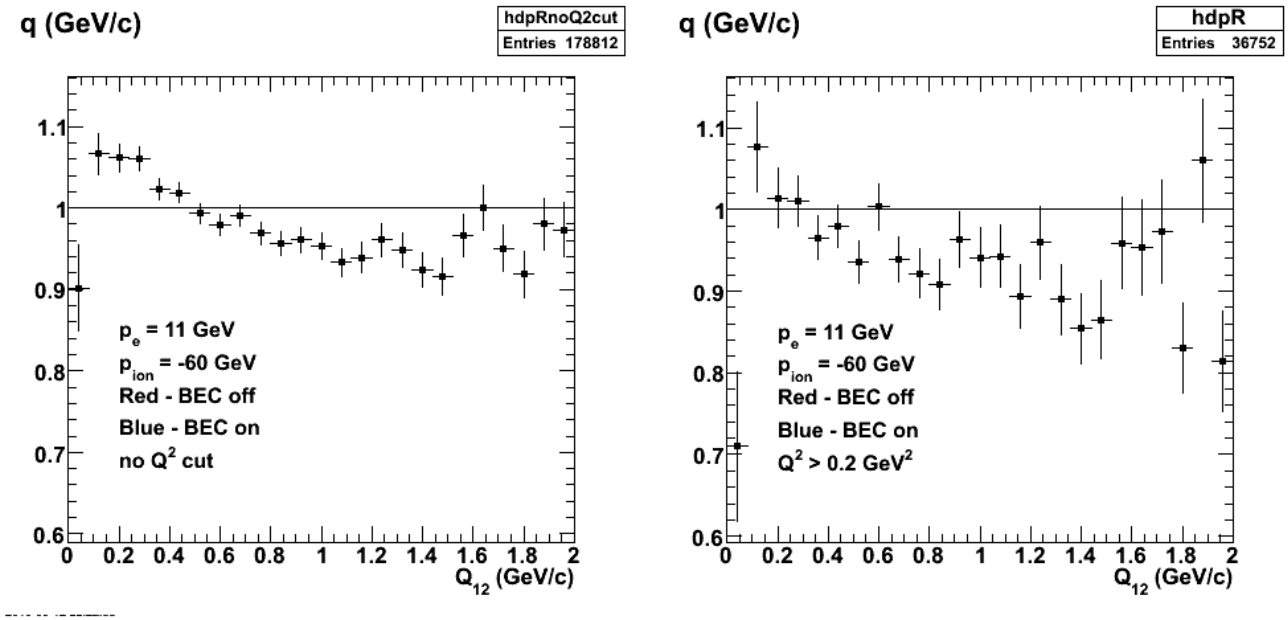


Fig 14. Combine some of the plots above to compare the correlation functions with the Q2 cut off (left) an don (right).

Click here to view the object (Root macro) you uploaded.

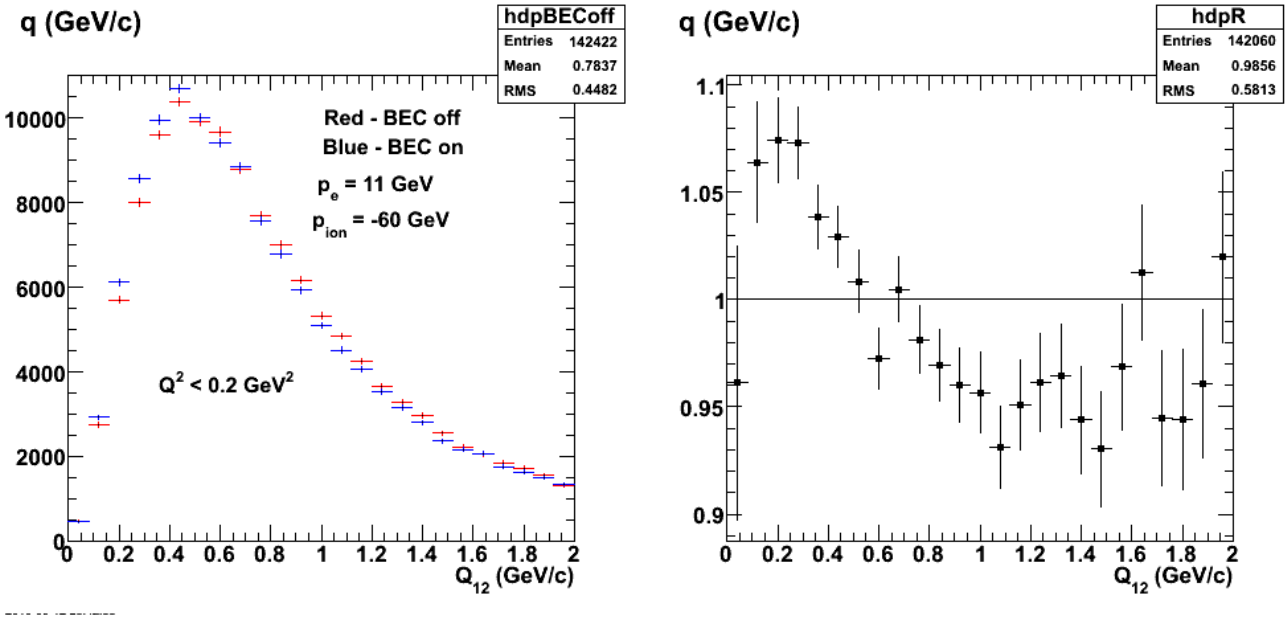


Fig 15. Upper limit on Q2 shows most of the correlation is concentrated at low Q2.

Click here to view the object (ROOT macro) you uploaded.

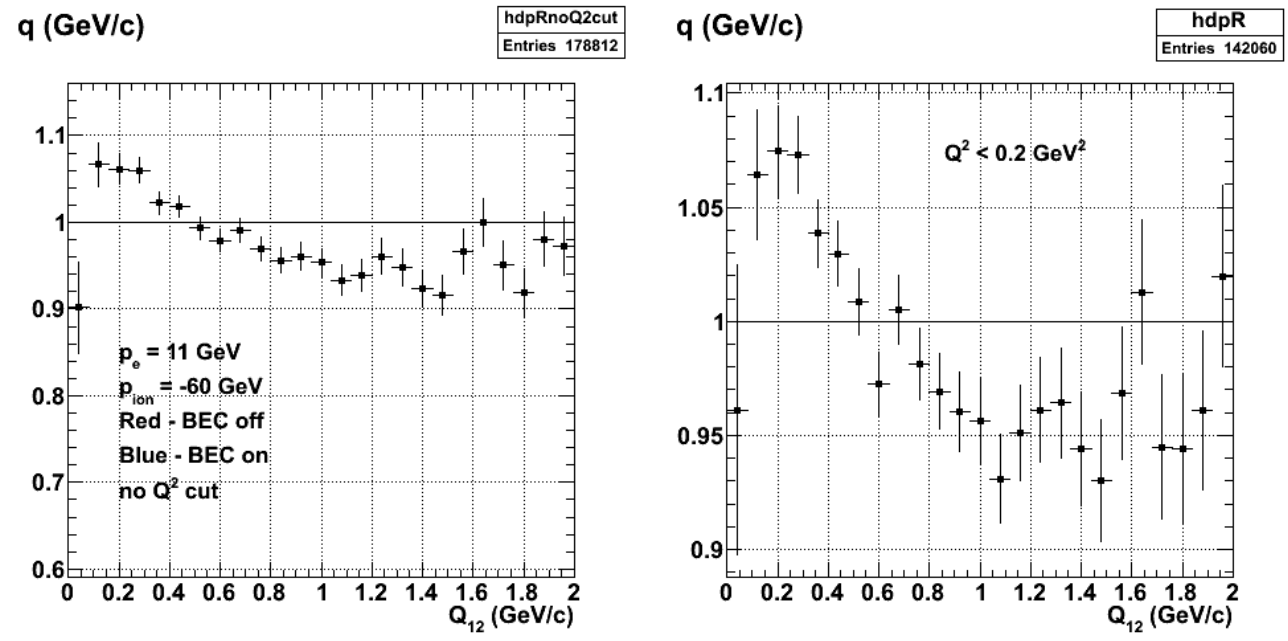


Fig 16. Comparison with no Q2 cut and low-Q2 only cut.

Click here to view the object (ROOT macro) you uploaded.

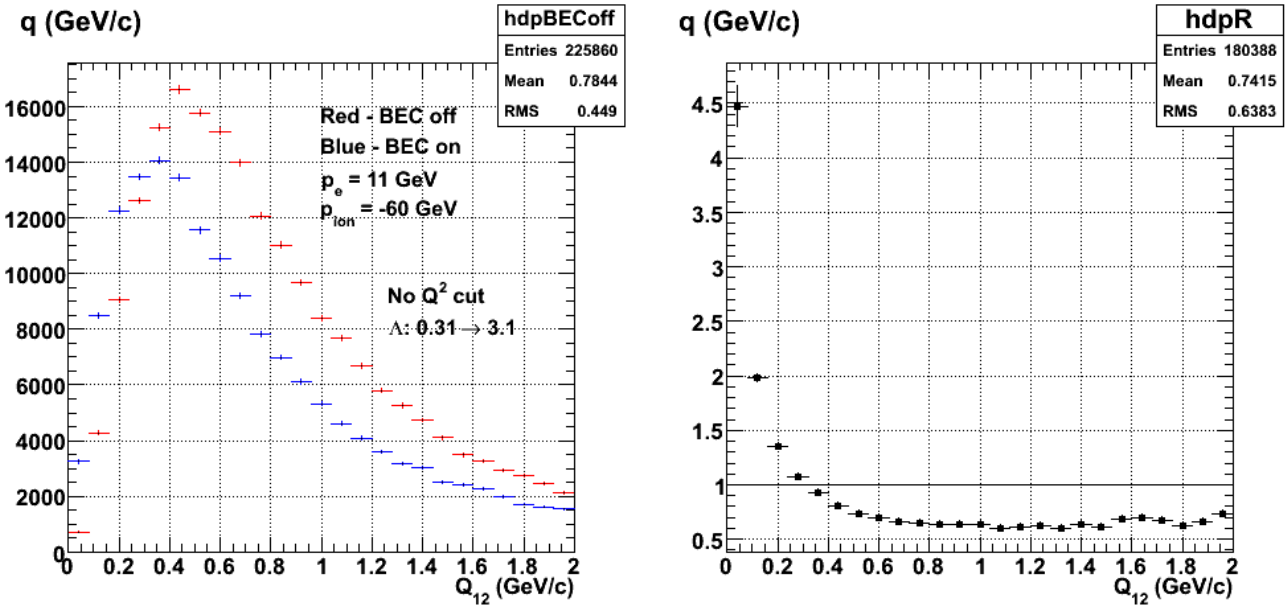


Fig 17. Study of effect of increasing Λ by a factor of 10 (0.31->3.1) which controls the amount of correlations in the data sample.

Some progress on seeing correlations at JLab6 energies.

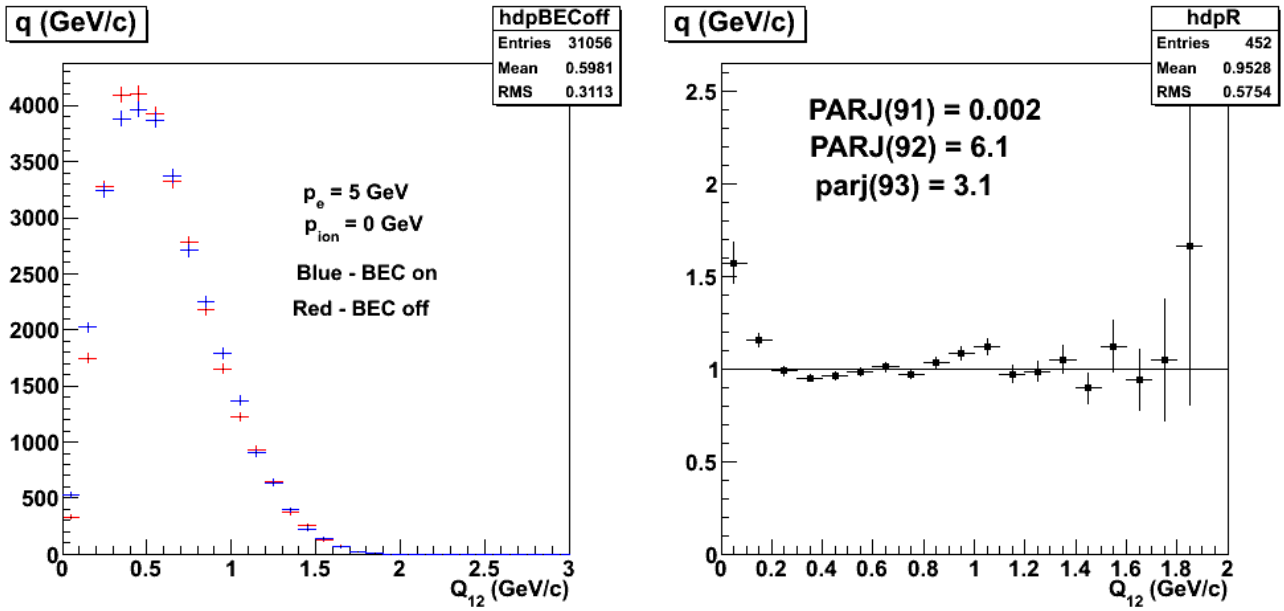


Fig 18. An attempt to see correlations at jlab6 kinematics. The correlations are not as high or as wide as Hayk's results above.

Click here to view the object (Root macro) you uploaded.

Now use the same parameters as the ones above to see what happens at EIC kinematics. We see a very large correlation!!!

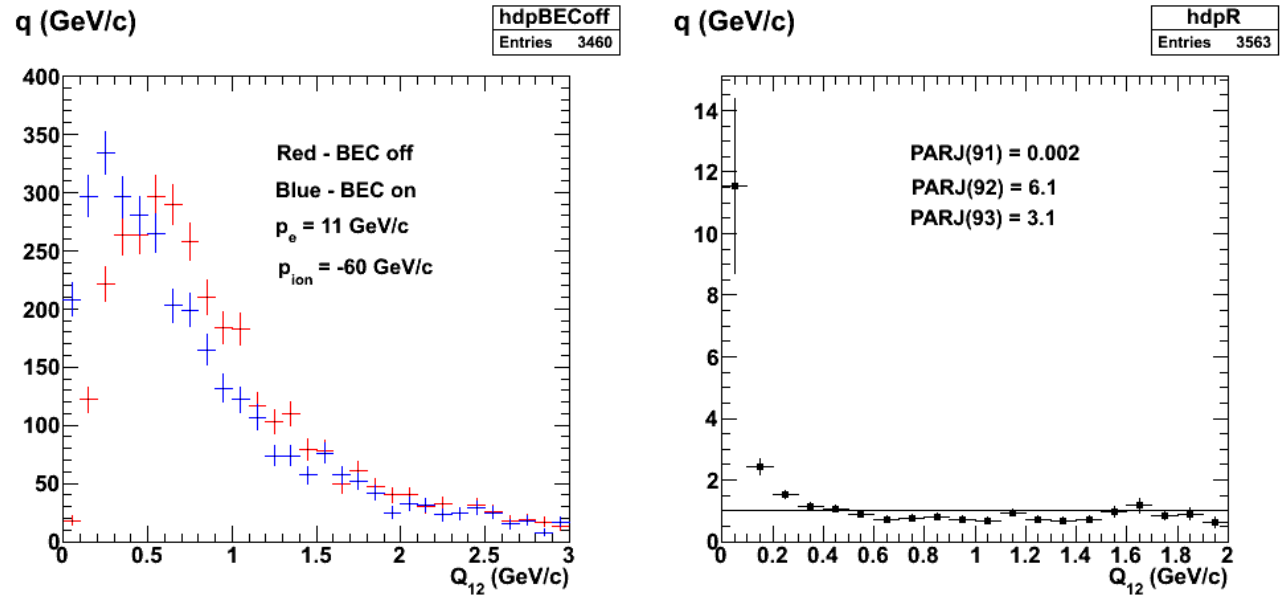


Fig 19. Use parameters from run for fig 18, but now at EIC kinematics.

Click here to view the object (Root macro) you uploaded.

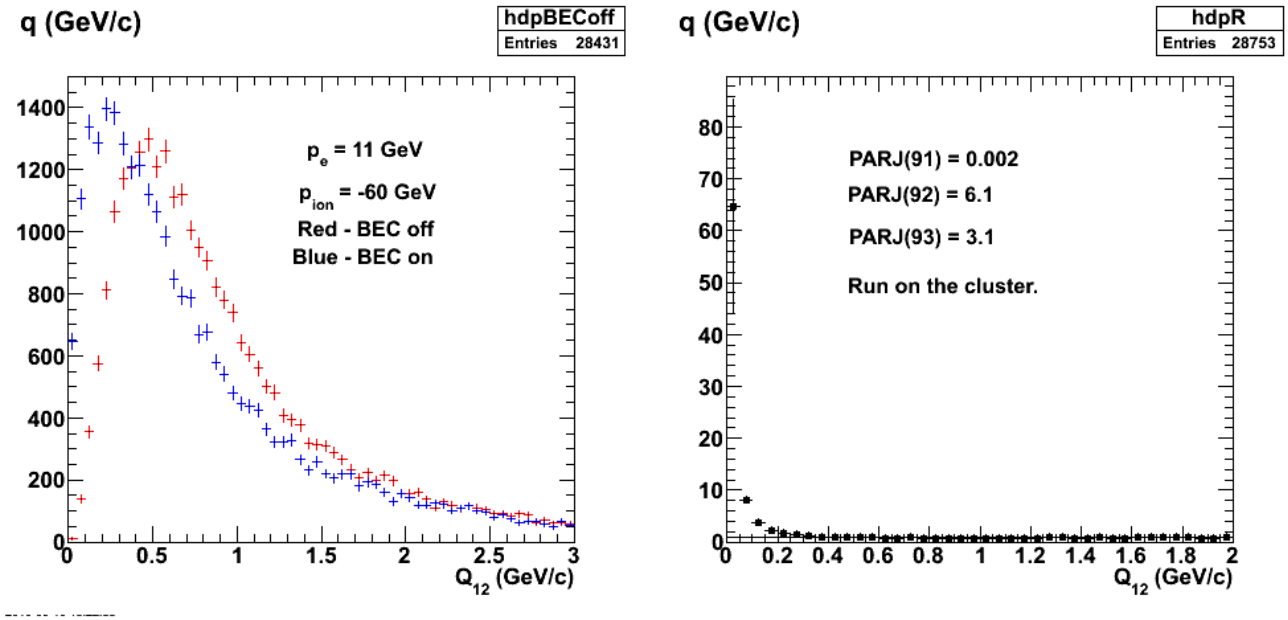


Fig 20. Same as Figure 19, but run on the cluster to get more events.

Click here to view the object (Root macro) you uploaded.

Changing the size of the correlation (PARJ(92)) to 8.1 had no observable effect on R(Q12). Changing the width (PARJ(93)) to 1.1 has no observable effect. Changing the correlation (PARJ(92)) then to 1.1 has a BIG effect!! See next plot.

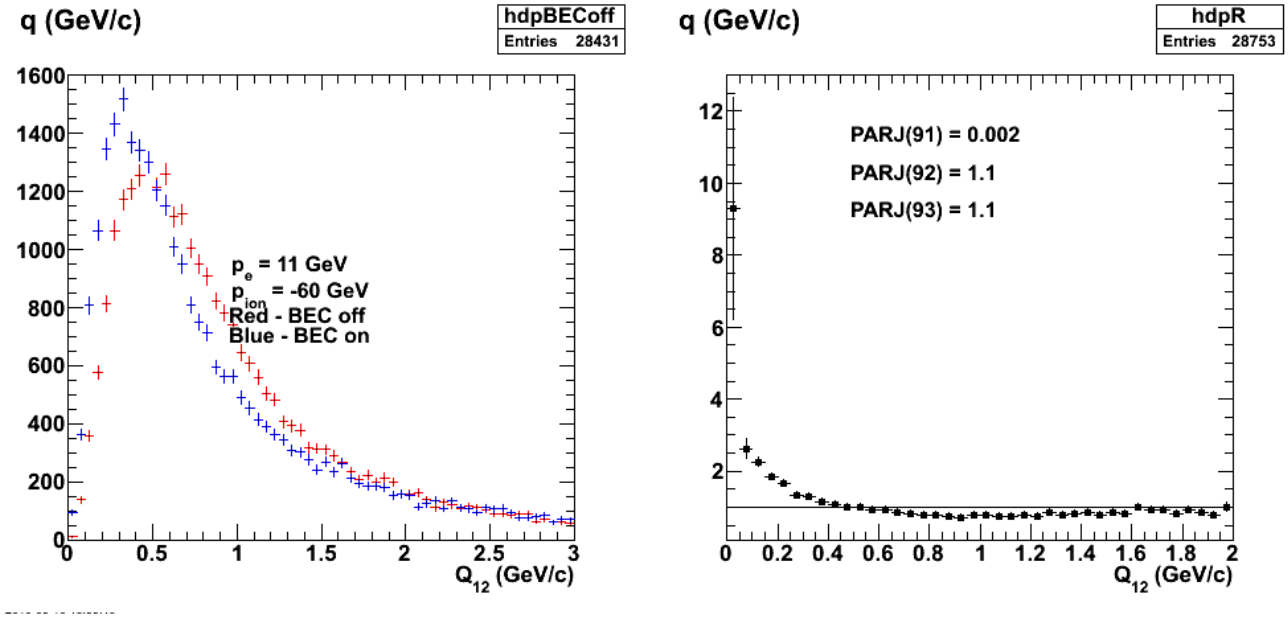


Fig 21. Futzing with the parameters.

Click here to view the object (Root macro) you uploaded.

Check previous CLAS6 results with cluster run and things agree when I get the statistics big enough (200 jobs with 6000 events each).

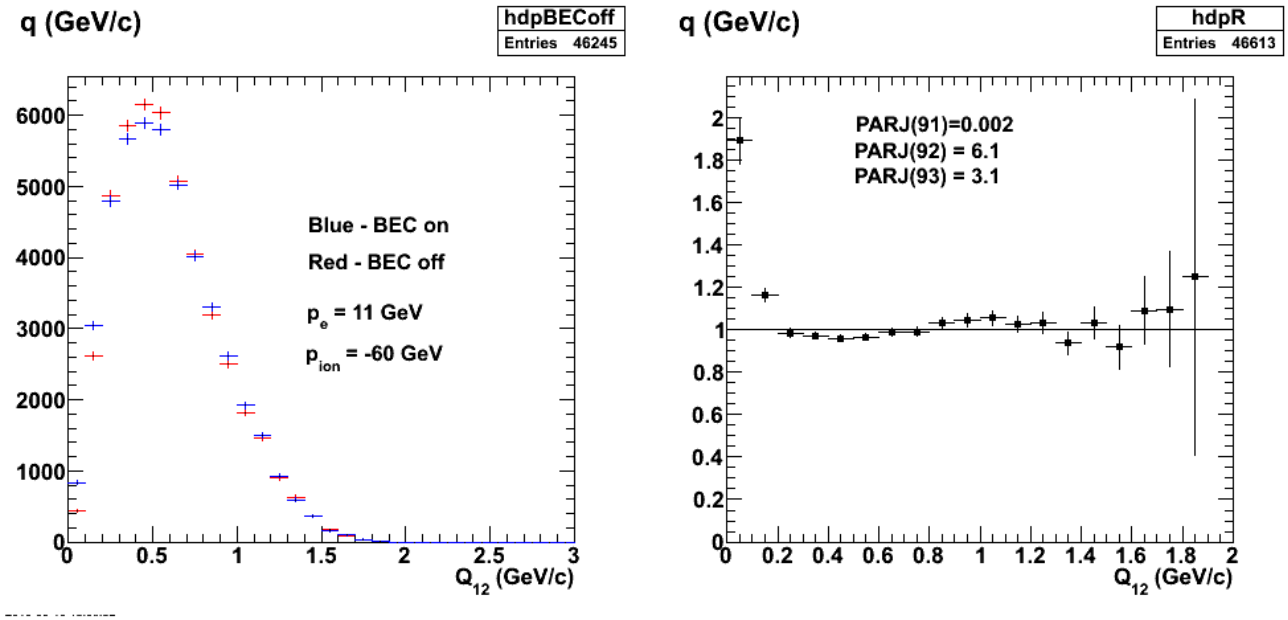


Fig 22. Reproducing CLAS6 results with cluster.

Click here to view the object (Root macro) you uploaded.

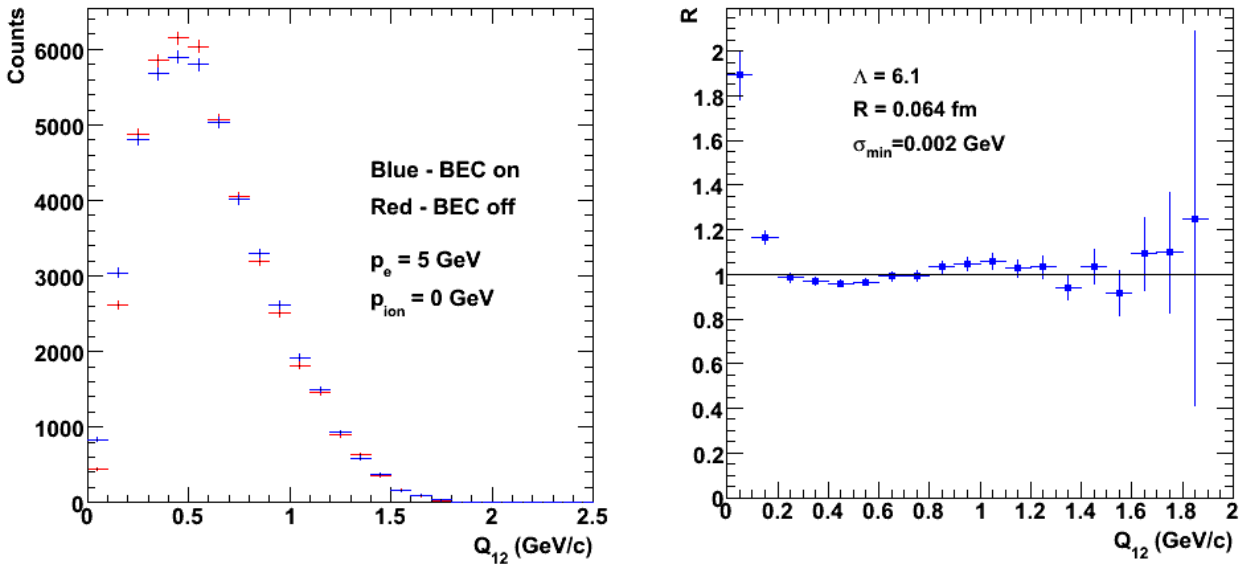


Fig 22a. Cleaner version of Fig 22. Used the exponential form of the parameterization.

Click here to view the object (ROOT macro) you uploaded.

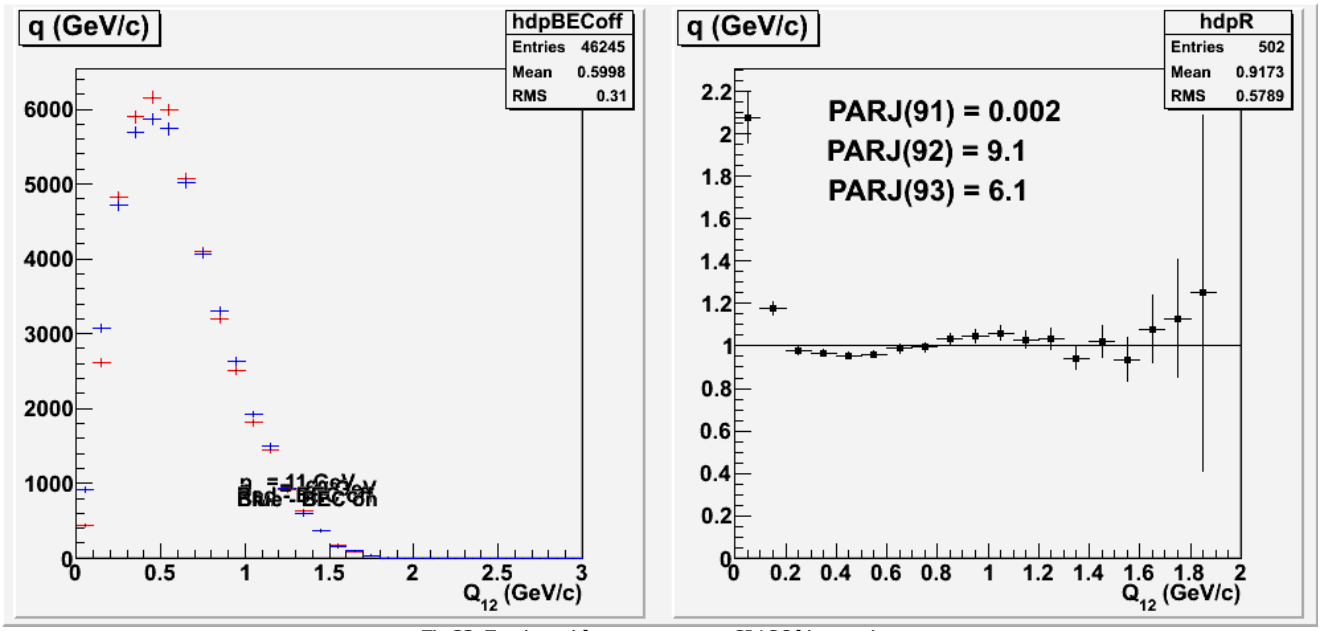


Fig 23. Futzing with parameters at CLAS6 kinematics.

Click here to view the object (Root macro) you uploaded.

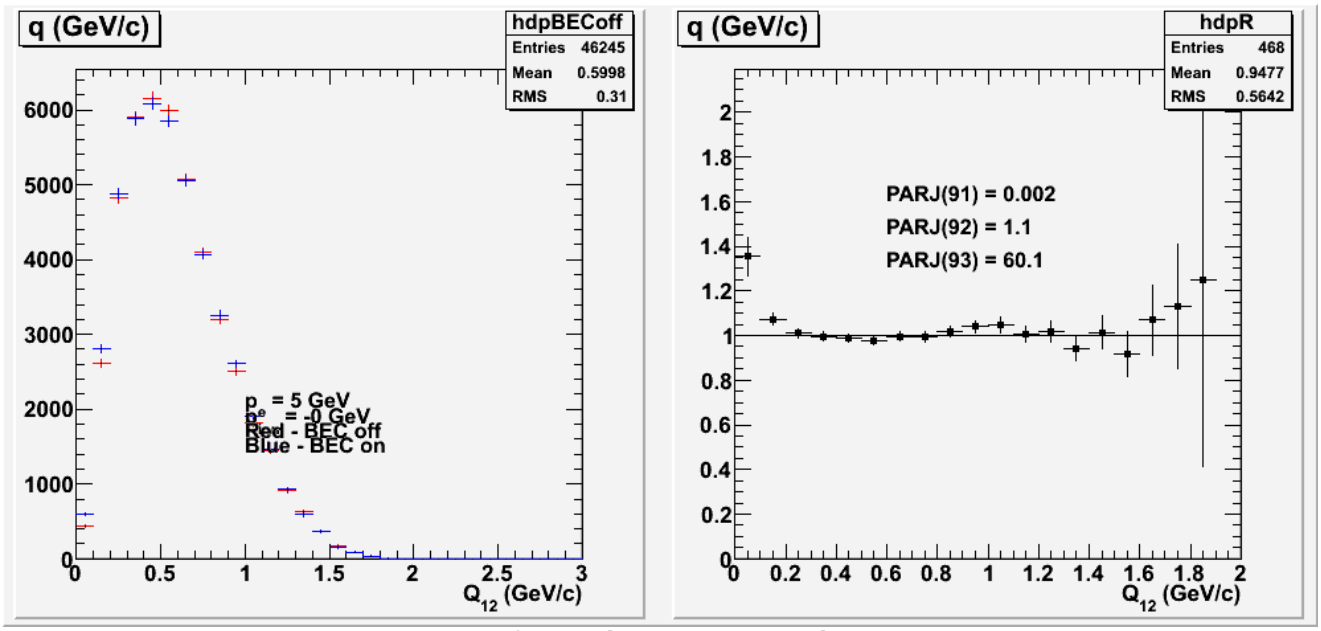


Fig 24. More futzing with parameters at CLAS6 kinematics.

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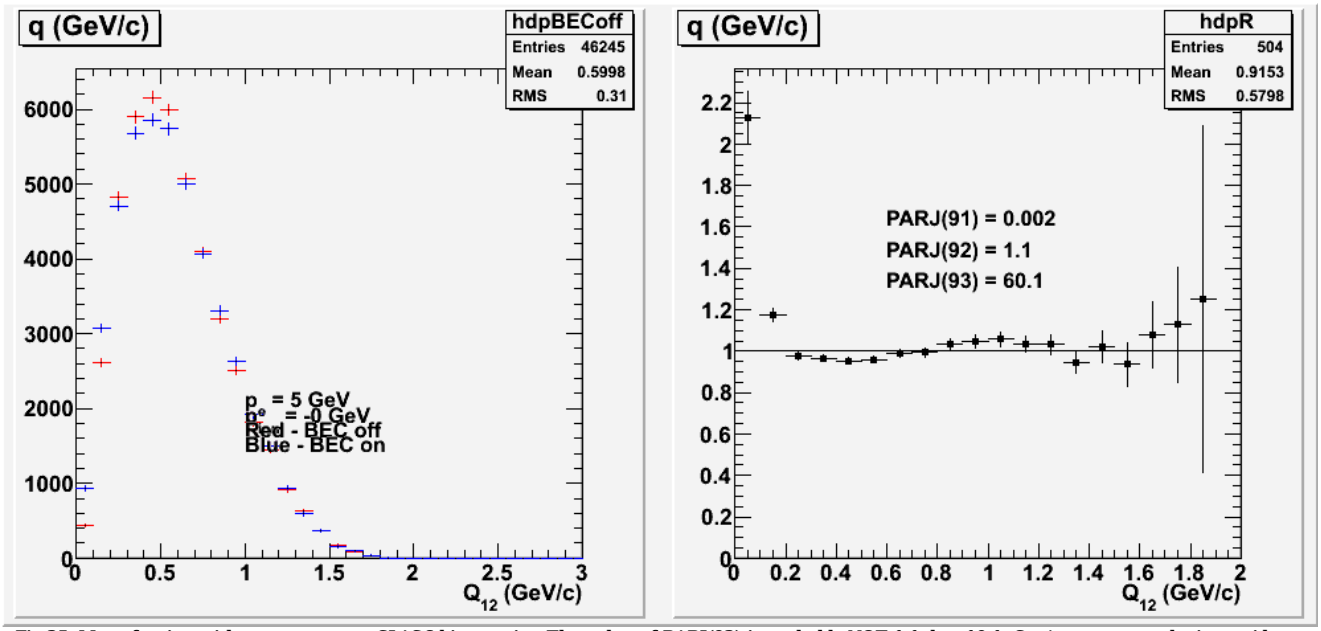


Fig 25. More futzing with parameters at CLAS6 kinematics. The value of PARJ(92) is probably NOT 1.1, but 10.1. Can't seem to make it as wide as observed by Hayk. Try exponential form next.

Click here to view the object (Root macro) you uploaded.

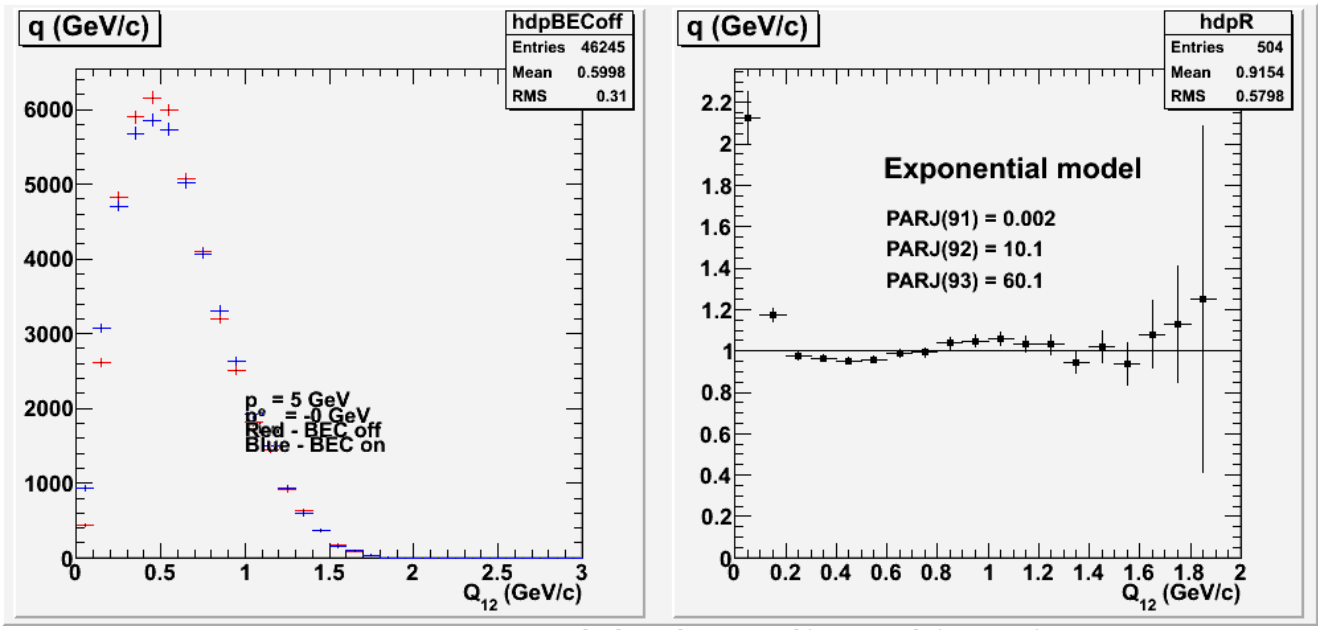


Fig 26. Same parameters as previous plot, but with exponential form instead of gaussian form.

Click here to view the object (Root macro) you uploaded.

Take the parameters from Figs 22-22a where we tried to reproduce Hayk's CLAS6 results (with limited success, we get the value of the correlation at Q12=0, but can't reproduce the width) and apply them at EIC energies. The higher energy amplifies the maximum value of the correlation, but has little effect on the width of the distribution.

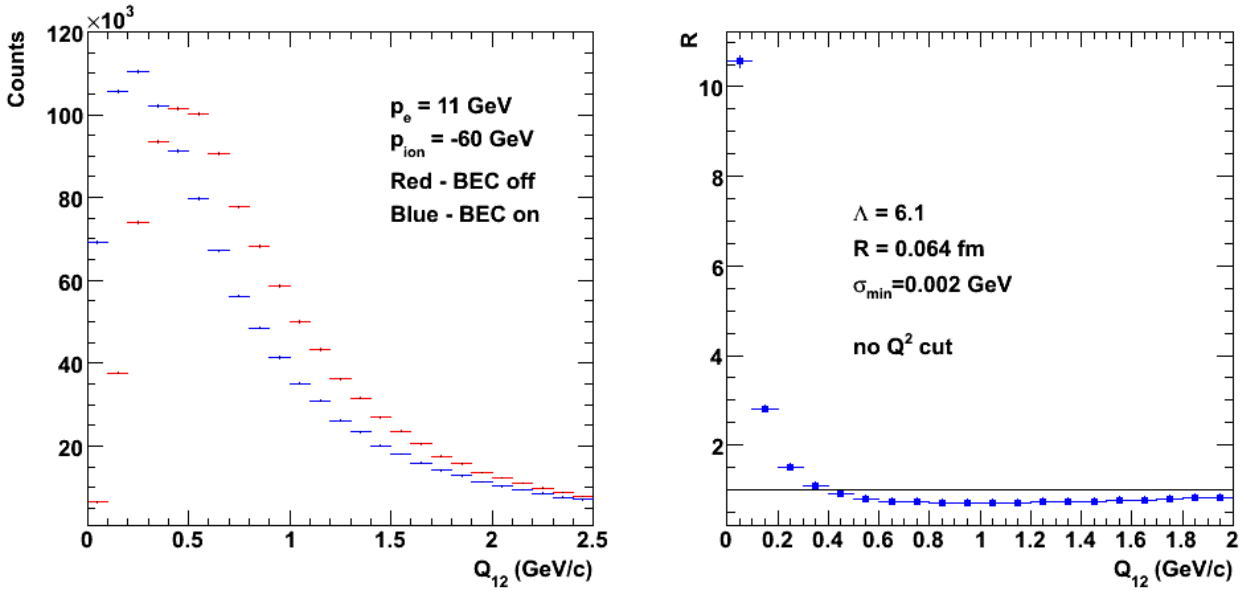


Fig 27. Use pythia parameters from figs 22-22a for CLAS6 kinematics and run them at EIC kinematics. Used the exponential form of the parameterization.

Click here to view the object (ROOT macro) you uploaded.

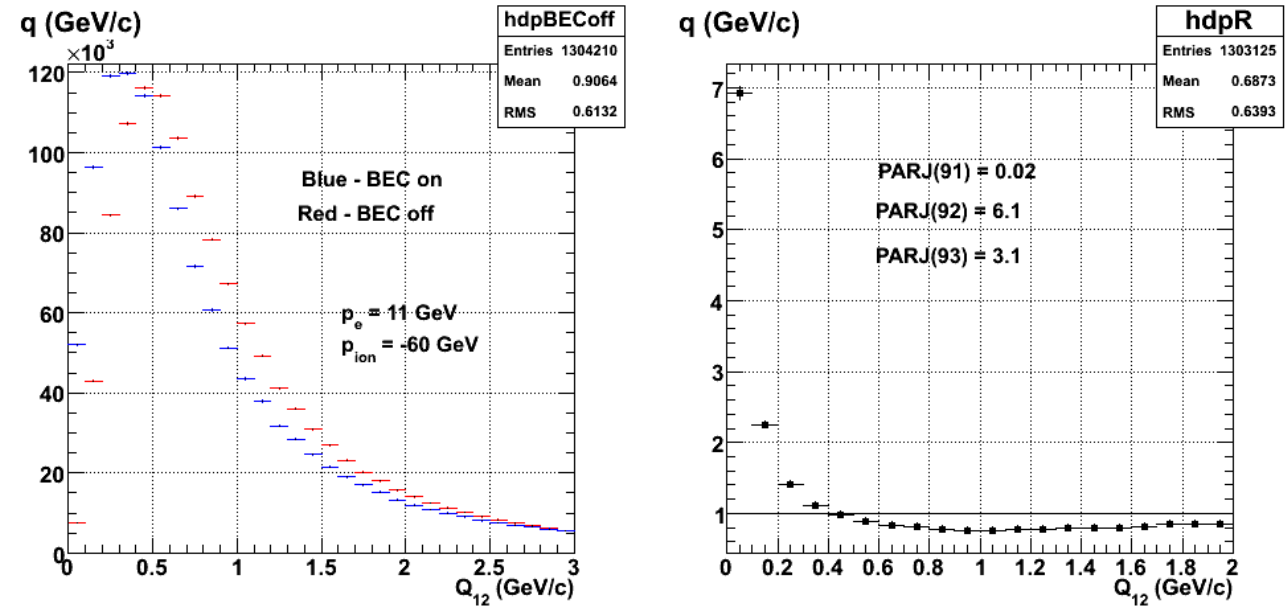


Fig 28. Study the effect of increasing PARJ(91) back to the default value. The maximum correlation at S12=0 decreasees, but the rest of the shape stayes much the same.

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 322 - eod: checking effect of radiative corrections (gpg)

[Modified Tue Apr 27 18:59:35 2010 (GMT) gpg]

I expect that the radiative corrections to the asymmetry will be small because we are looking at the ratio of cross sections and the measured asymmetry is only about +/- 5%. Results are below for runs with EXCLURAD. I found that changing the size of the sigma_LTp had absolutely no effect out to the number of significant digits used by EXCLURAD. I then changed the other response functions to test for any effect and did see small changes.

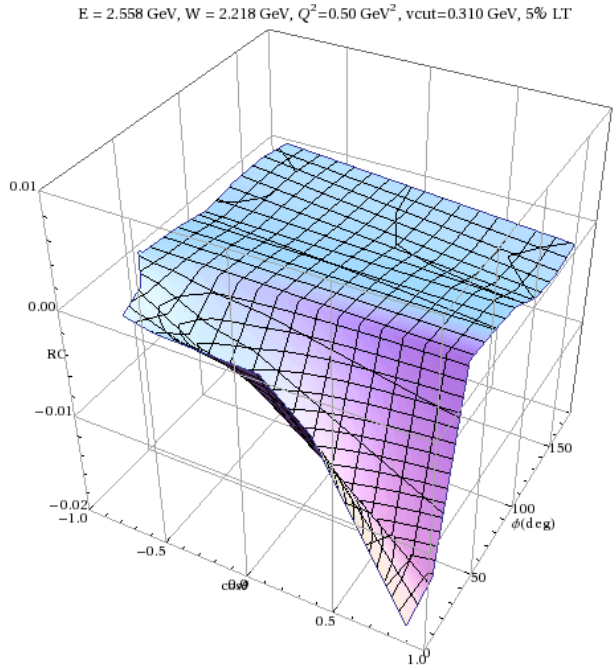


Fig 1. Plot of the average difference in the radiative comparison with a 5% increase in sigma_LT.

Click here to view the object (Mathematica notebook) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 323 - Radiative Corrections for Fifth Structure Function Analysis (gpg)

[Modified Wed May 12 02:44:36 2010 (GMT) gpg]

I have been operating under the assumption that the radiative corrections (RCs) to the helicity asymmetry will be small like the GMn corrections and I would treat them as a small addition to the systematic uncertainty. It appears that is not the case. I have noticed for some time that when I arbitrarily change the size of the R_LTp response function in the deep.f code used in my d(e,e'p)n version of EXCLURAD there is no change in the RC. After much anguish, trials and tribulations this week and discussions with Andrei I now realize the effect could be significant. Some results are shown in the table below. The columns are e1 (ignore), W, Q2, cscm_input(i),phicm_input(i), silar(1)/sibar(1),silar(2)/sibar(2), (silar(2)/sibar(2))/(silar(1)/sibar(1)) (see exclurad.f for definitions.

```
Ratio results:  0.00  2.00  0.50  0.98 15.00  1.0013  1.0064  1.0051
Ratio results:  0.00  2.00  0.50  0.93 15.00  0.9715  0.9741  1.0027
Ratio results:  0.00  2.00  0.50  0.88 15.00  0.9582  0.9602  1.0021
Ratio results:  0.00  2.00  0.50  0.78 15.00  0.9407  0.9432  1.0026
Ratio results:  0.00  2.00  0.50  0.68 15.00  0.9245  0.9288  1.0046
Ratio results:  0.00  2.00  0.50  0.58 15.00  0.9077  0.9141  1.0071
Ratio results:  0.00  2.00  0.50  0.48 15.00  0.8922  0.8999  1.0086
Ratio results:  0.00  2.00  0.50  0.38 15.00  0.8801  0.8870  1.0078
Ratio results:  0.00  2.00  0.50  0.28 15.00  0.8721  0.8745  1.0028
Ratio results:  0.00  2.00  0.50  0.18 15.00  0.8674  0.8579  0.9891
Ratio results:  0.00  2.00  0.50  0.08 15.00  0.8652  0.8101  0.9364
Ratio results:  0.00  2.00  0.50  0.04 15.00  0.8649  0.7263  0.8398
```

The last column shows the ratio of the RC for the polarized part of the cross section to the RC for the unpolarized part. At forward angles the difference is less than 1%, but grows to 14% near 90 degrees. In the analysis we will have to average this ratio over the missing momentum bin and then divided the measured asymmetry by that bin-averaged ratio. See entry 154 for the connection between missing momentum and θ_{pq}.

The code is available in the tar archive at the end of this paragraph. This version includes calculations for both the polarized and unpolarized RCs thoough care must be taken with the polarized cross sections. The response functions from WVO's deep code for the imaginary part of the L_T interference (R_LTp) are about 15-16 orders of magnitude smaller than the longitudinal and transverse response functions (R_L and R_T). It appears this befuddles the integration routines and they never converge in a reasonable amount of time. You can turn off the polarized calculation by setting ipolmax=1 in exclurad.f. I found it helpful to merely set the value of R_LTp to something large and calculate the RC from that. This is actually ok since there is only one term here in the polarized RC. The RC depends only on the shape, i.e. the angular distribution of the cross section and not it's size. I found you could multiply R_LTp by any reasonable value and there was no change in the RC. Andrei agreed this was appropriate behavior. We see the same thing with the unpolarized RC when we set all the response functions to zero except one. In other words set all the response functions to zero except R_T. Calculate the RC and then multiply R_T by 10 and you get the same answer for the RC.

Click here to view the object (tar archive of EXCLURAD with polarized RC.) you uploaded.

Below is my list of observations on EXCLURAD.

1. R_LTp is many orders of mangitude smaller in the van orden model so it has no effect.
2. When I include R_LTp in the calculation it looks like the integration breaks in qqtll and never converges.
3. Resetting sig_LTp to something large like 0.5*sig_T enables the integration to converge.
4. Changes to the size of sig_LTp STILL have no effect on the radiative correction.
5. Even using sig_LTp = 100.0*sig_T*cos(thetac) and sig_LTp = 0.1*sig_T*cos(thetac) has no effect.
6. The radcor is still sensitive to changes in the other response functions.
7. The sig_T test: (1) turn off all the response functions except sig_T and get radcor. (2) Multiply sig_T by something large like 100. (3) There should be no change in the RC. This IS seen.
8. Use just sig_T again, but now turn on a factor of cos(thetac). RC should change and IT DOES.
9. It looks like the unpolarized correction is independent of size, but not cos(thetac). How do we add those up??? We don't!! There are seperate RCs for the polarized and unpolarized cases. For the fifth structure function analysis we are taking the ratio of the polarized cross section to the unpolarized. We will take the ratio of the polarized RC to the unpolarized RC and divide this into the asymmetry ALTp.

The plot below shows the results for W = 2.0 GeV, Q2 = 0.5 GeV which corresponds to quasielastic scattering of d(e,e'p)n. The ratio is the polarized, full-calculation RC divided by the same calculation for the unpolarized cross section.

OOPPSS! The plot below is wrong due to an indexing problem. I was using the leading log approximation in the RC calculation which makes no distinction between polarized and unpolarized cross sections so the plot should have been flat with a constant value of one. When I went back and checked the original input file that was true. See Fig 2 for a revised (and correct) calculation.

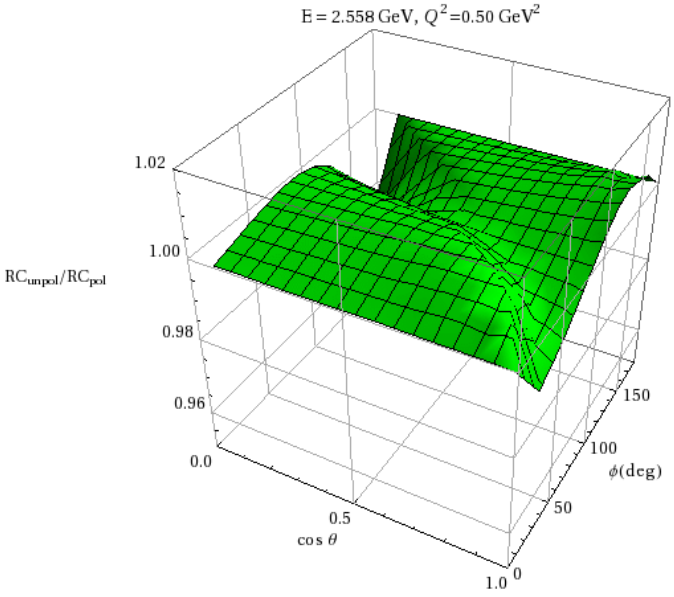


Fig 1. Ratio of polarized to unpolarized radiative corrections for W = 2.0, Q2=0.5 GeV2 d(e,e'p)n (QE kinematics). NOTE: The label on the vertical axis is wrong!

Click here to view the object (Mathematica notebook for above result.) you uploaded.

Fix the indexing problem that messed up Fig 1 and get the result below. The RC for ALTp now appears to be large especially at small angles where the precision is high!!! I hope this correction doesn't screw things up!!

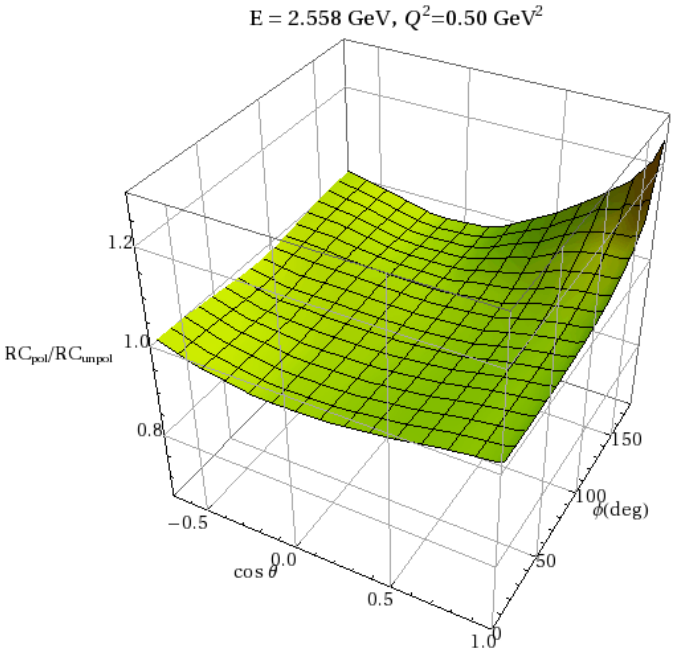


Fig 2. Ratio of polarized to unpolarized radiative corrections for W = 2.0, Q2=0.5 GeV2 d(e,e'p)n (QE kinematics). This plot replaces Fig 1.

Click here to view the object (Mathematica notebook for above result.) you uploaded.

Click here to view the object (Mathematica notebook) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 324 - Problems with Mathematica Interpolation (gpg)

[Modified Tue May 11 20:36:48 2010 (GMT) gpg]

In going from Mathematica 7.0 on my laptop and at Richmond to v6 at JLab, the 3D interpolation doesn't seem to work right any more. The first plot shows a combined ListPointPlot3D showing the points in the array plus the ListPlot3D. The points all appear to sit on the surface.

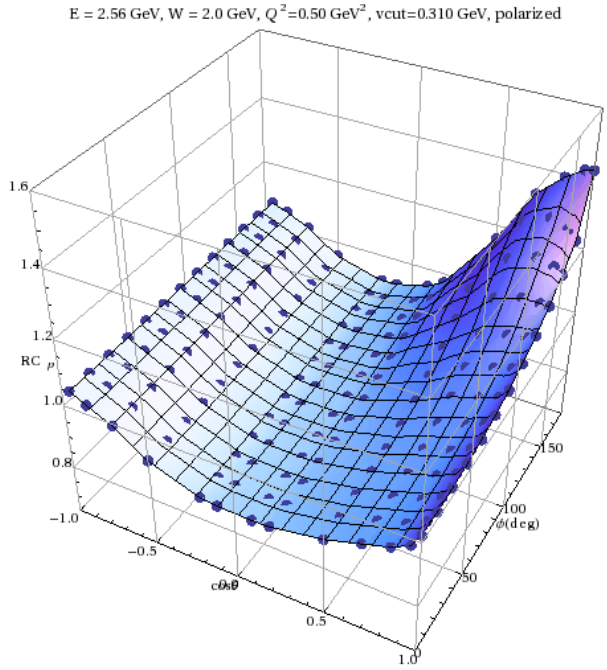


Fig 1. Overlay of the original array of points plotted with ListPointPlot and the surface made with ListPlot.

Now I create a set of points with the x and y meanings reversed in order to use the interpolation function in Mathematica. The first element of each ordered triplet is treated as the 'x' value which is fixed and the 'y' value varies. I use that array in the interpolation function and it appears to work except is looks like the cos(θ) sequence is reversed! A BUG???!! See RCsystUncertainty13b.nb.

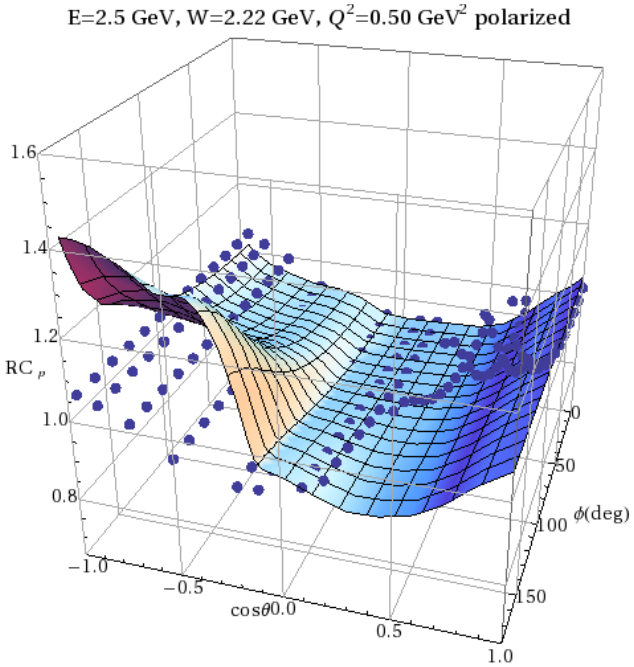


Fig 2. Overlay of points with x and y values reversed and plotted with the surface produced by interpolating that array!!

Next, I multiply the cos(θ) value by -1 and I get something that is qualitatively like the points, but shows significant differences.

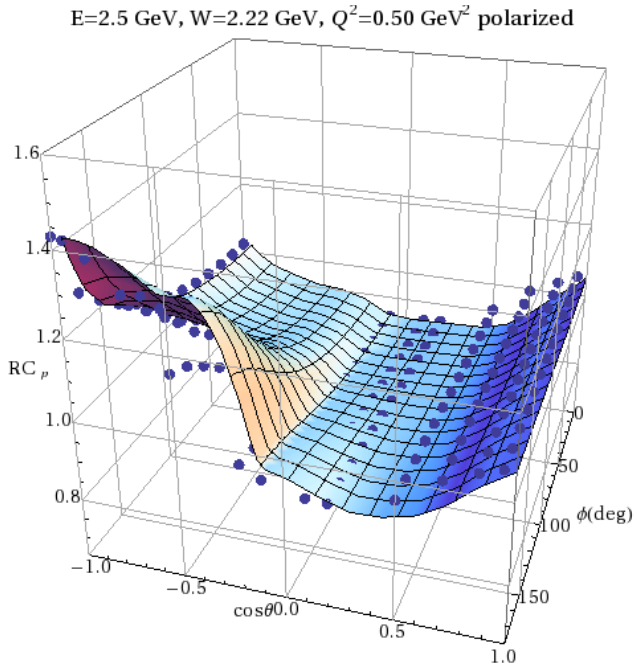


Fig 3. Overlay of REVERSED cosθ points with interpolated surface based on UNREVERSED points!!

The plots I generated recently at home or at school yesterday look ok. See RCsystUncertainty13.nb.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 325 - Draft of tutorial stuff for CSW (gpg)

[Modified Mon May 24 00:15:20 2010 (GMT) gpg]

Below is a draft of the material I will put on the CLAS12 software wiki.

Some sample commands:

1. How to change geometry using the database.
    a. Go to /home/clas/gemc/production/database_io/clas12/geo/ec. If you don't have this try "svn checkout https://clas12svn.jlab.org/repos/trunk/clas12/gemc/production".
    b. Edit ec_build.pl.
    c. Run go_table.
    d. Run gemc with the following command. The input file modified2.gcard is available here.

```
gemc -gcard=modified2.gcard -DATABASE=user_geometry -BEAM_P="e-, 8.0*GeV, 10.0*deg, 0*deg"
```

2. Effects of turning magnetic field on and off. The input file modified2.gcard is available here.
    a. Run gemc with the following command.

```
gemc -gcard=modified2.gcard -BEAM_P="e-, 8.0*GeV, 10.0*deg, 0*deg"
```

    b. Now turn the field off by adding the -NO_FIELD option.

```
gemc -gcard=modified2.gcard -BEAM_P="e-, 8.0*GeV, 10.0*deg, 0*deg" -NO_FIELD=all
```

3. Effect of changing electron momentum and spread. The input file modified2.gcard is available here.

    Vary the values for options -BEAM_P, -SPREAD_P, -SPREAD_V.

```
gemc -gcard=modified2.gcard -BEAM_P="e-, 8.0*GeV, 20*deg, 0*deg" -SPREAD_P="0.2*GeV, 2*deg, 18*deg" -SPREAD_V="(0.1, 0.1, 2.5)cm"
```

4. Effects of changing the luminosity. The input file modified2.gcard is available here.

    Vary the values for options -LUMI_P, -LUMI_V, and -LUMI_EVENT.

```
gemc -gcard=modified2.gcard -LUMI_P="e-, 11*GeV, 0, 0" -LUMI_V="(0, 0, -10)cm" -LUMI_EVENT="2000, 124*ns, 2*ns"
```

5. Using a different event generator with the LUND format. The input file modified2.gcard is available here.

```
gemc -gcard=modified2.gcard -BEAM_P="e-, 8.0*GeV, 20*deg, 0*deg" -SPREAD_P="0.2*GeV, 2*deg, 18*deg" -INPUT_GEN_FILE="LUND,ep_event.lund"
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 326 - Tests of eod exclurad calculations (gpg)

[Modified Thu Jun 3 21:25:06 2010 (GMT) gpg]

The results below are for QE kinematics for Q2= 0.5 GeV2, Ebeam=2.6 GeV.

Comparison of unpolarized RC_{bst} calculated by taking the ratio of σ^{unpol}_{best} with σ^{unpol}_{Born} with the result directly from exclurad. First plot is calculated from the individual cross sections and the second is from the direct output of exclurad. They agree with one another.

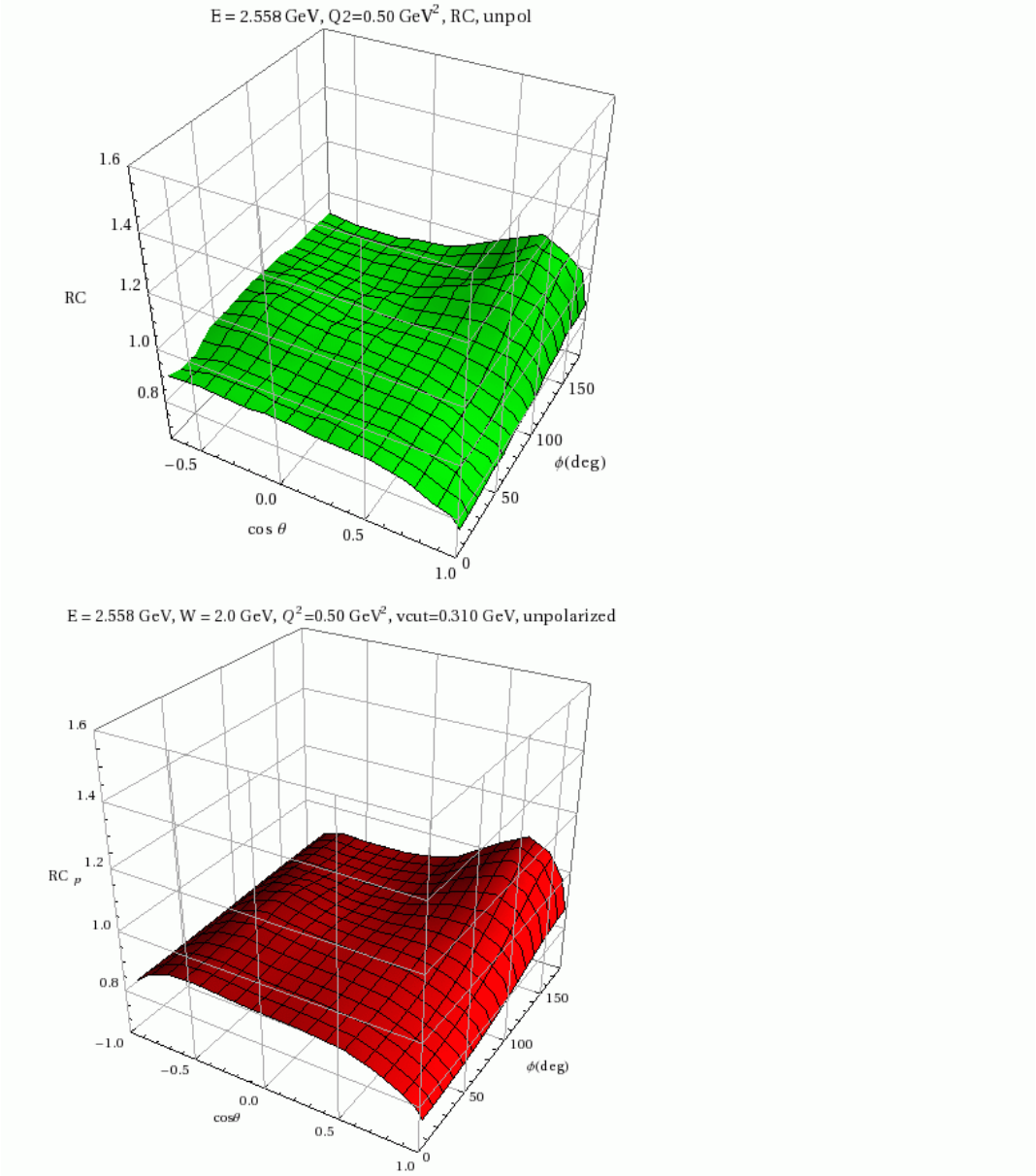
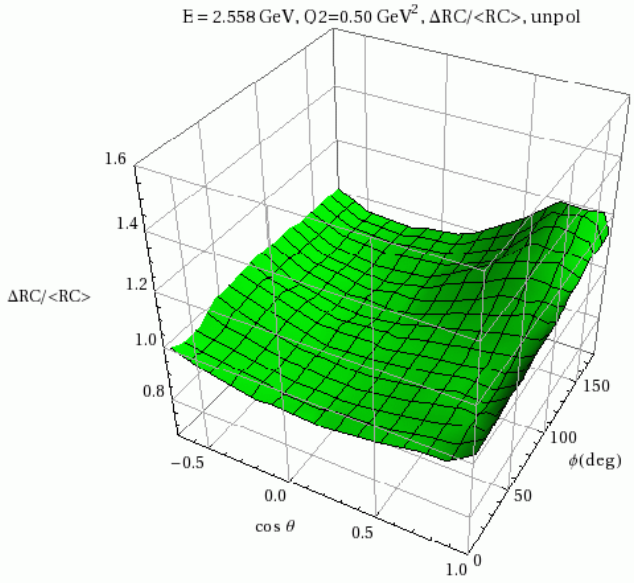


Fig 1. Comparison of RC directly from EXCLURAD and calculated from the cross sections for the unpolarized, 'best' calculation.

Comparison of unpolarized RC_{ll} calculated by taking the ratio of σ_{ll}^{pol} with σ_{Born}^{pol} with the result directly from exclurad. First plot is calculated from the individual cross sections and the second is from the direct output of exclurad. The plots are mislabelled as unpolarized. They agree with each other.



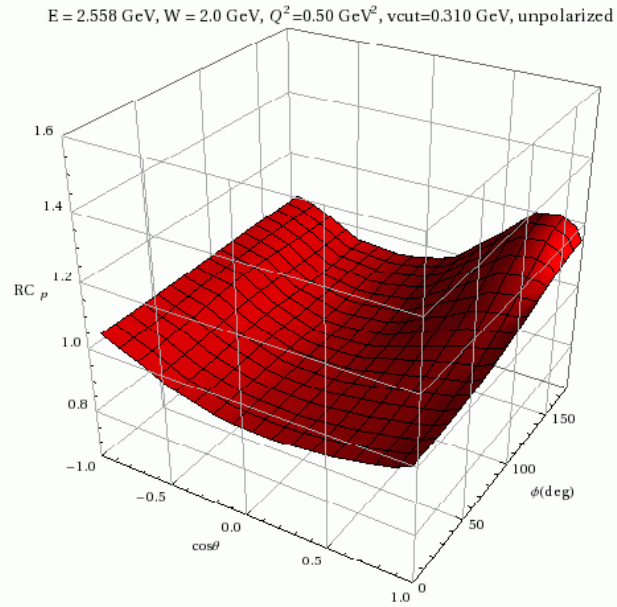
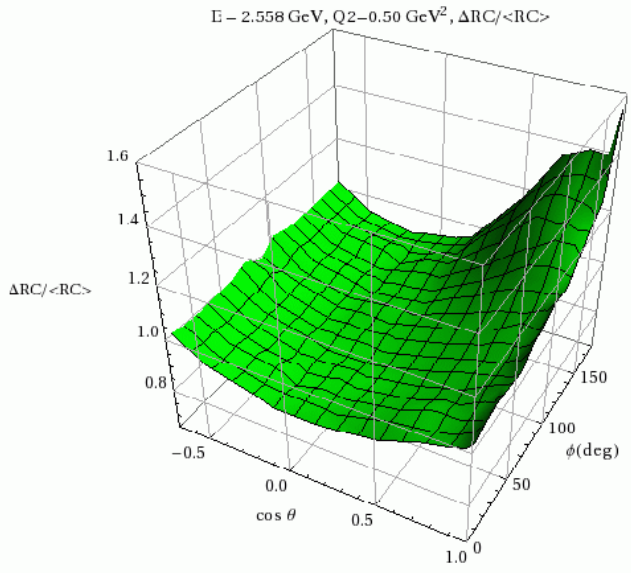


Fig 2. Same as Fig 1 except now with unpolarized, leading-log calculation.

Comparison of polarized RC_{ll} calculated by taking the ratio of σ_{ll}^{pol} with σ_{Born}^{pol} with the result directly from exclurad. First plot is calculated from the individual cross sections and the second is from the direct output of exclurad.



Plot from RCsystUncertainty14.nb showing the polarized leading log RC. It agrees with the previous plot.

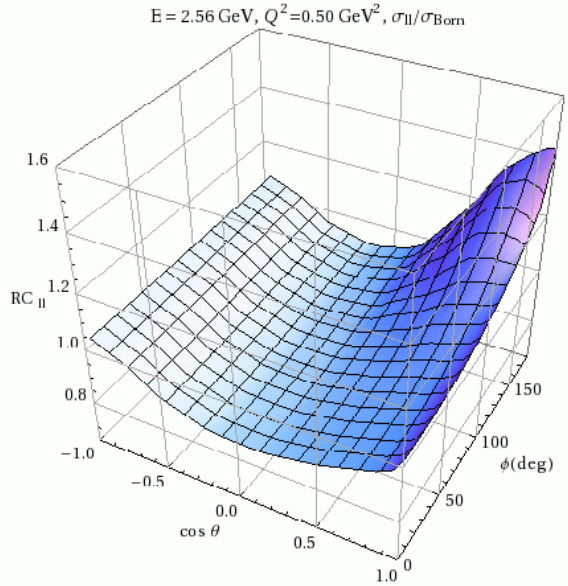


Fig 3. Same as Figs 1-2 now with polarized, leading-log calculations.

Click here to view the object (Mathematica notebook RCsysUncertaintyAJ.nb) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 327 - Behavior of RC calculations (gpg)

[Modified Tue Jun 8 00:05:39 2010 (GMT) gpg]

The problem here is that the ratio of unpolarized to polarized RCs varies enough that is will effect the extraction of ALTp. See Fig 2 in entry 323 and the right-hand panel of Fig 1. At Andrei's suggestion, I am looking at the behavior of the cross section calculations used in EXCLURAD. The large magnitudes in the ratio of the polarized to unpolarized RCs is worrisome so we are trying to understand where the effect comes from. The plots below show the cross section of the polarized cross section from DEEP (Figs 1-2), for the unpolarized cross section and the Born cross section.

Looking over the figures, the polarized cross section is dropping rapidly in the region at forward polar angles ($\cos\theta_{pq} \sim 1$) and large azimuthal angles ($\varphi_{pq} \sim 180$ deg). See Fig 1a. In contrast, the unpolarized cross section is rising rather comparatively gently in that region. See Fig 3. Perhaps this difference creates the large (20%) disparity in the ratio of the RC corrections seen in entry 323 and Fig 1b.

After discussions with Andrei, our conclusion is the following.

1. For $\cos\theta_{pq} \sim 1$, we will effectively average over the full φ_{pq} range. We typically have the first bin at $p_m < 0.05$ GeV/c which corresponds to $\theta_{pq} < 6$ deg and $\cos\theta_{pq} > 0.994$. See entry on Sabine's formulas relating θ_{pq} and p_m.
2. The asymmetry in that first bin (and several after) is close to zero so any change will be small.
3. The effect of the large ratio for $\cos\theta_{pq} \sim 1$ and $\varphi_{pq} \sim 180$ will be reduced in the averaging and will mulitply a small number for the asymmetry. The overall effect on our results will likely be vanishingly small. For the 2.6r ALTp results in entry 248, ALTp = 0.0008 +/- 0.0015. The calculation of the average effect of the RC_{pol}/RC_{unpol} dependence in that first bin (i.e. for $\cos\theta_{pq} = 0.99$) is 1.02 (see here) which changes ALTp by a negligible amount.

Click here to view the object (Mathematica notebook for calculations below.) you uploaded.

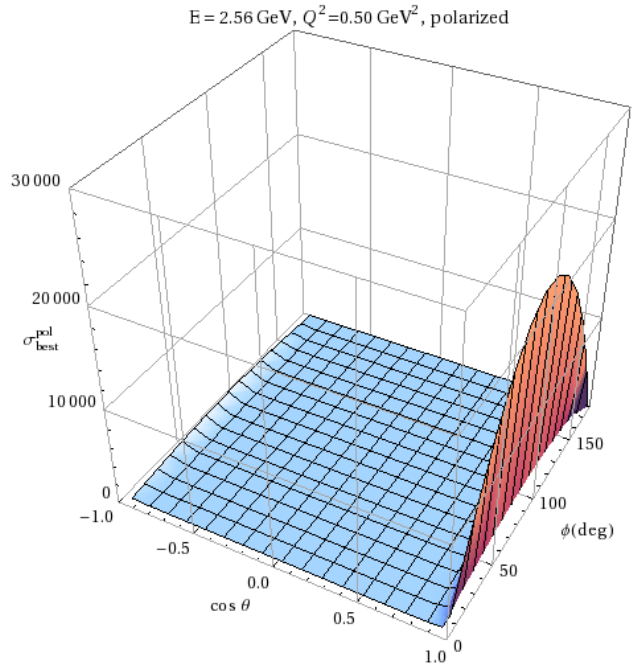


Fig 1a. Full calculation of the polarized cross section.

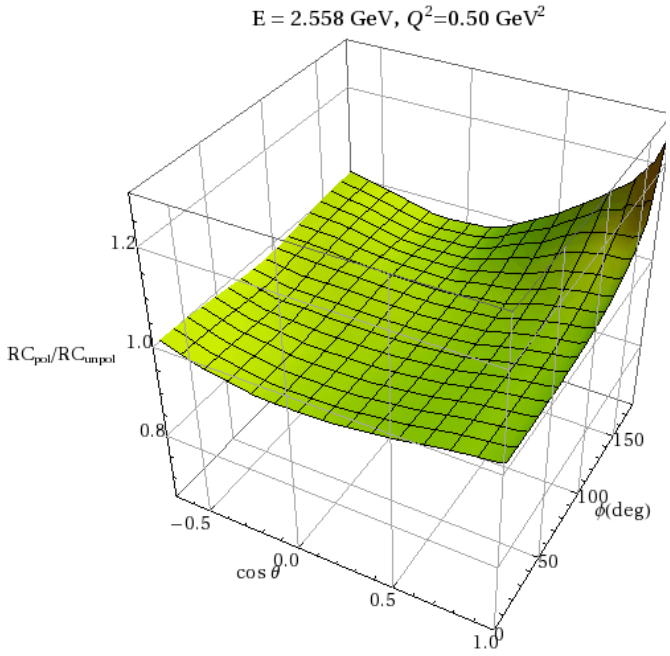


Fig 1b. RC(pol)/RC(unpol) for W = 2.0, Q2=0.5 GeV2 d(e,e'p)n (QE kinematics).

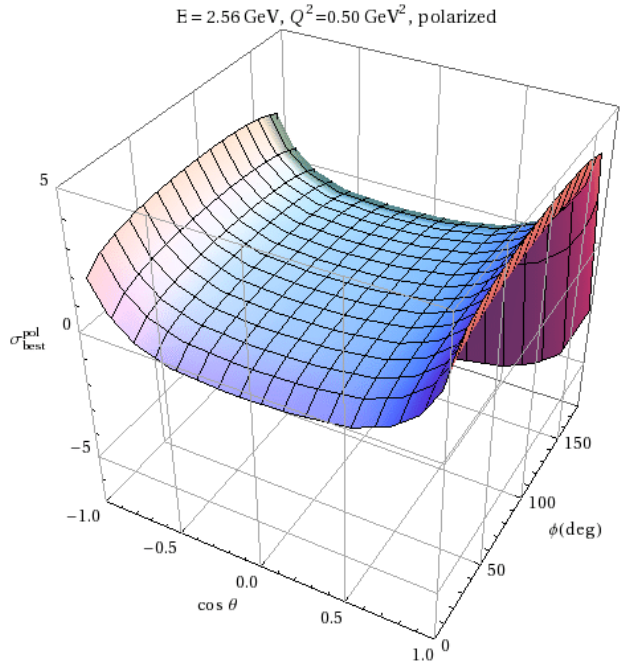


Fig 2. Same as Fig 2 on a log scale.

Unpolarized σ's next.

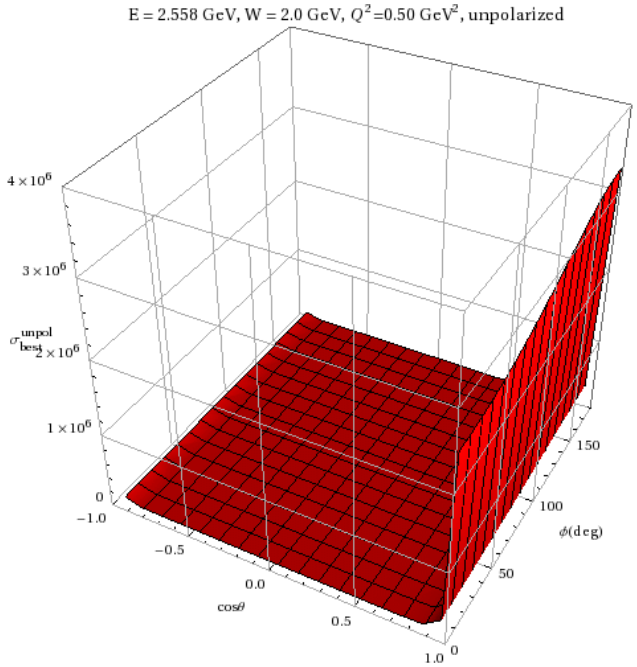


Fig 3. Full calculation of the unpolarized cross section.

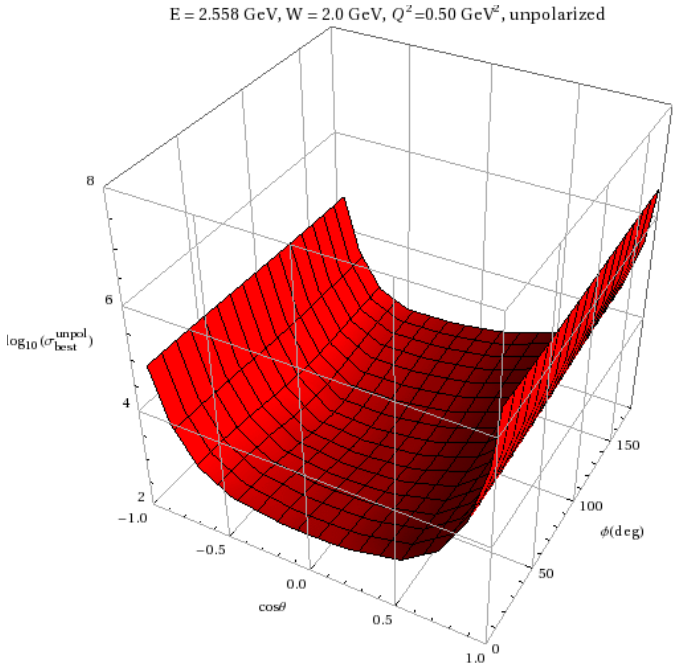


Fig 4. Same as Fig 3 on a common log scale.

Born cross section next.

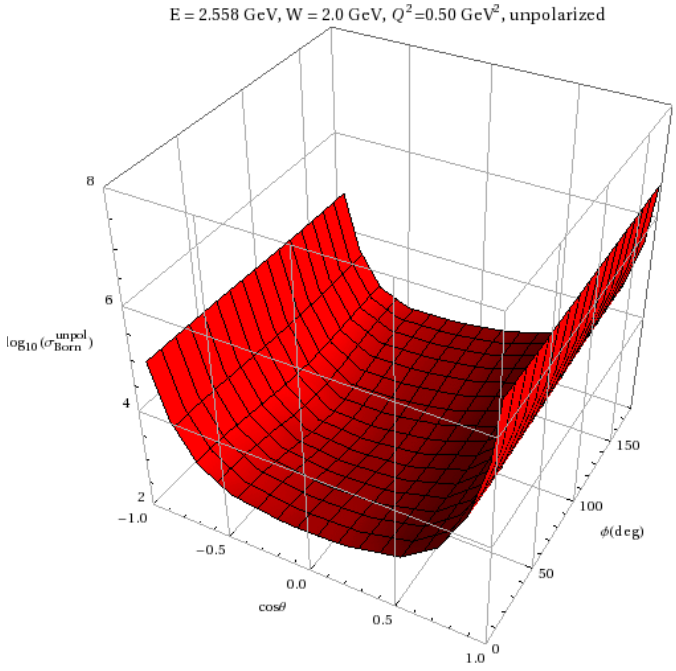


Fig 5. Unpolarized Born cross section.

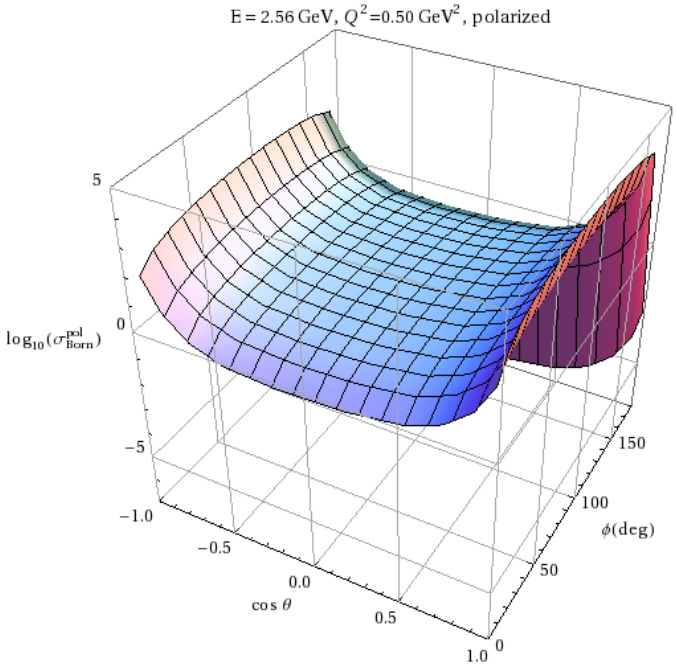


Fig 6. Polarized Born cross section.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 328 - Speed test of new cluster (gpg)

[Modified Fri Jun 18 14:17:42 2010 (GMT) gpg]

We have used EXCLURAD to test the speed of the new cluster. First results below show the speed on the old cluster.

Old cluster: Inputs for calculation.

```
pscm1:input> more input20.dat
 4       ! 1: AO 2: maid98  3: maid2000 4: deep
 0       ! 0: Full, 1: Factorizable and Leading log
 2.558   ! bmom - lepton momentum
 0.0     ! tmom - momentum per nucleon
 1       ! lepton - 1 electron, 2 muon
 2       ! ivec - detected hadron (2) proton always
 0.310   ! vcut - cut on v.(0.) if no cut,negative-v
 18
 2.004 2.004 2.004 2.004 2.004 2.004 2.004 2.004 2.004         2.004 2.004 2.004 2.004 2.004 2.004 2.004 2.004 2.004 2.004
 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5        0.5   0.5   0.5   0.5   0.5 0.5
 0.995 0.99  0.95  0.85 0.80 0.75 0.70 0.65 0.60        0.50  0.20  0.10  -0.1 -0.2   -0.5   -0.7  -0.85  -0.95
 175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.
```

Start of calculation.

```
 pscm1:exclurad> more rc_log20
Tue Jun  8 15:16:47 EDT 2010
CASE=20 NODE=25 INPUT FILE=input20.dat
Copy the input file.
Tue Jun  8 15:16:47 EDT 2010
/scratch/gilfoyle/exclurad/20
run exclurad.
```

End of calculation

```
results: 2  2.0040  0.5000  0.9526 -0.9500   175.00  0.8446 0.10E+01  1.0702
Ratio results:    2.00    0.50   -0.95  175.00  1.0562  1.0702  1.0133
Wed Jun  9 03:50:12 EDT 2010
```

Total time to run of 12 hours, 33 min. Click here to view the object (tar archive made with: pscm1:exclurad> tar cvf exclurad.old1.tar run/* wvo_protonALTp/* /scratch/gilfoyle/exclurad/rc_log*) you uploaded.

New cluster: Copied everything over from pscm1, rebuilt exclurad on pscm2 and ran it on one core per input.Input file first.

```
pscm2:run> more input/input19.dat
 4       ! 1: AO 2: maid98  3: maid2000 4: deep
 0       ! 0: Full, 1: Factorizable and Leading log
 2.558   ! bmom - lepton momentum
 0.0     ! tmom - momentum per nucleon
 1       ! lepton - 1 electron, 2 muon
 2       ! ivec - detected hadron (2) proton always
 0.310   ! vcut - cut on v.(0.) if no cut,negative-v
 18
 2.004 2.004 2.004 2.004 2.004 2.004 2.004 2.004 2.004         2.004 2.004 2.004 2.004 2.004 2.004 2.004 2.004 2.004 2.004
 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5        0.5   0.5   0.5   0.5   0.5 0.5
 0.995 0.99  0.95  0.85 0.80 0.75 0.70 0.65 0.60        0.50  0.20  0.10  -0.1 -0.2   -0.5   -0.7  -0.85  -0.95
 175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.  175.
pscm2:run>
```

Start of calculation.

```
wtmp begins Thu May 20 07:39:16 2010
It is now Mon Jun 14 18:10:01 CDT 2010.
CASE=19 INPUT FILE=input/input19.dat Running on physics02.cluster.
I was given the following slots to run:
physics02
It is now Mon Jun 14 18:10:01 CDT 2010.
rm: cannot remove `/tmp/gilfoyle/exclurad/19': No such file or directory

Starting. ******************************
```

End of calculation.

```
Ratio results:    2.00    0.50   -0.95  175.00  1.0562  1.0702  1.0133

Done!. ********************************

It is now Mon Jun 14 20:13:04 CDT 2010.
```

Total time of 2 hours, 3 min for an increase in speed of a factor of 6. Click here to view the object (tar archive made with: tar cvf exclurad.new.1.tar run/* wvo_protonALTp/*) you uploaded.

Get the same thing using the following qsub command.

```
system("qsub -l nodes=1:ppn=1 -j oe -o $logfile run_exclurad_on_node.sh \n");
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 329 - Production plots of RC calculations (gpg)

[Modified Mon Feb 21 17:37:53 2011 (GMT) gpg]

The plots below are from the new cluster and have more points to improve the resolution of the RC calculation. Plots show the wire plot and the surface plot for polarized and unpolarized RCs and the ratio. All are for the full calculation. Compare Figure 1 with Fig 1b of entry 327.

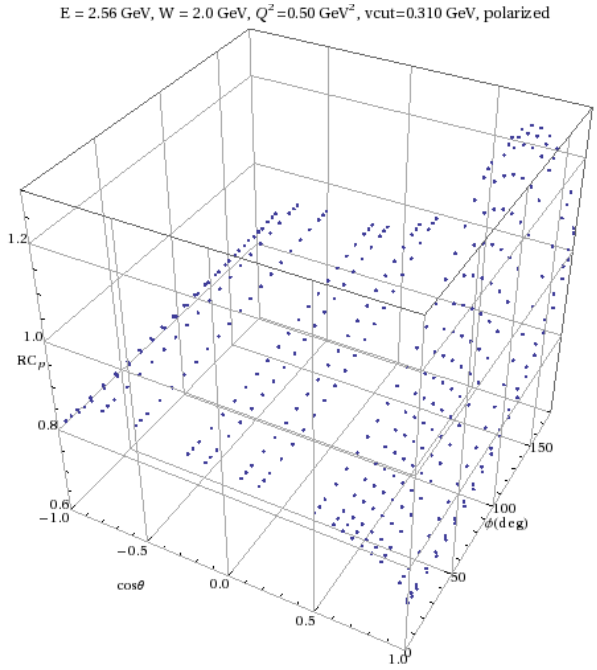
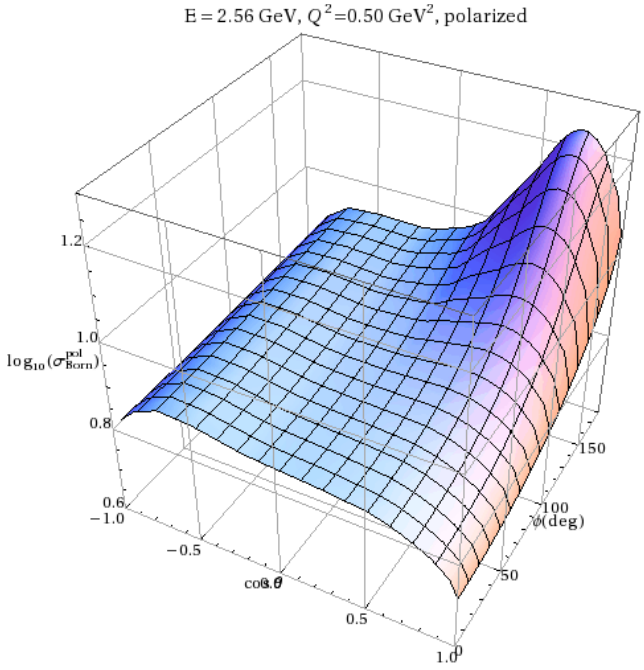


Fig 1. Point plot of polarized RC.



Surface plot polarized RC, full calculation.

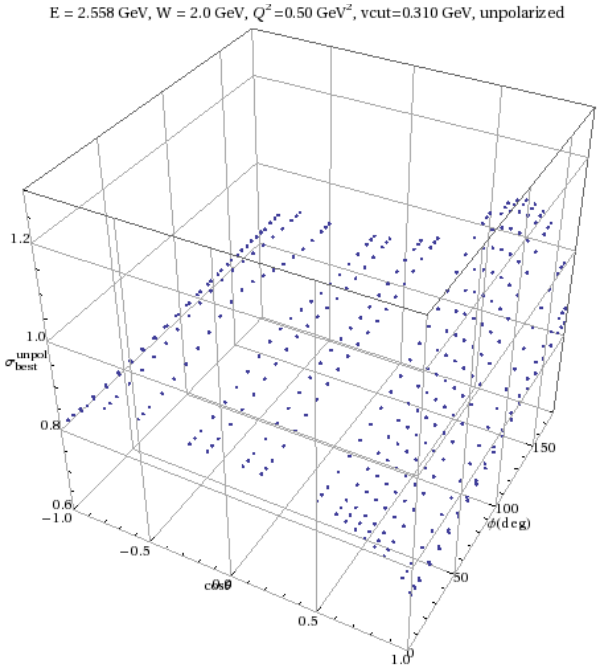
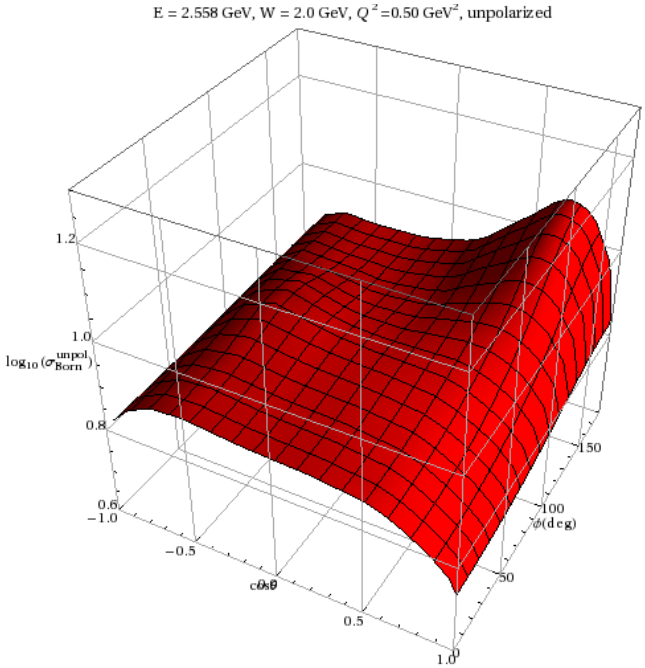


Fig 2. Point plot of unpolarized RC, full calculation.



Surface plot unpolarized RC, full calculation.

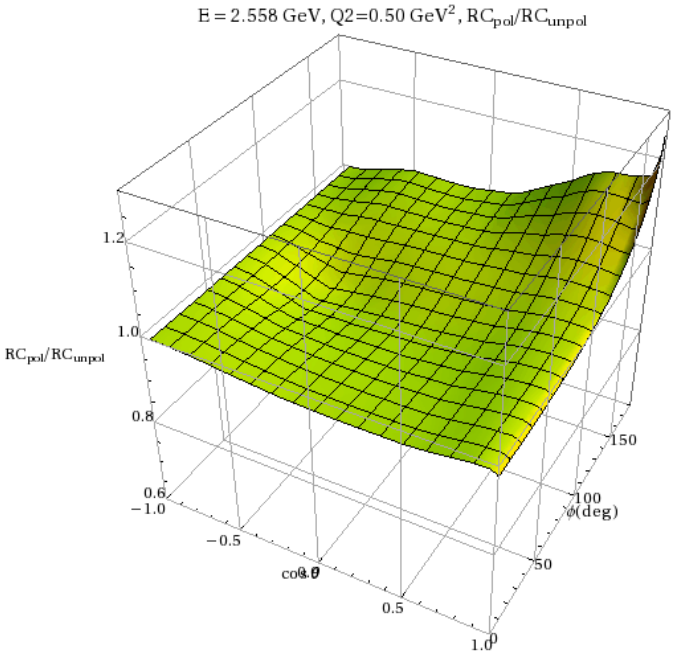


Fig 3. Ratio of polarized to unpolarized RCp.

Click here to view the object (Mathematica notebook) you uploaded.

Add more points to these kinematics and plot.

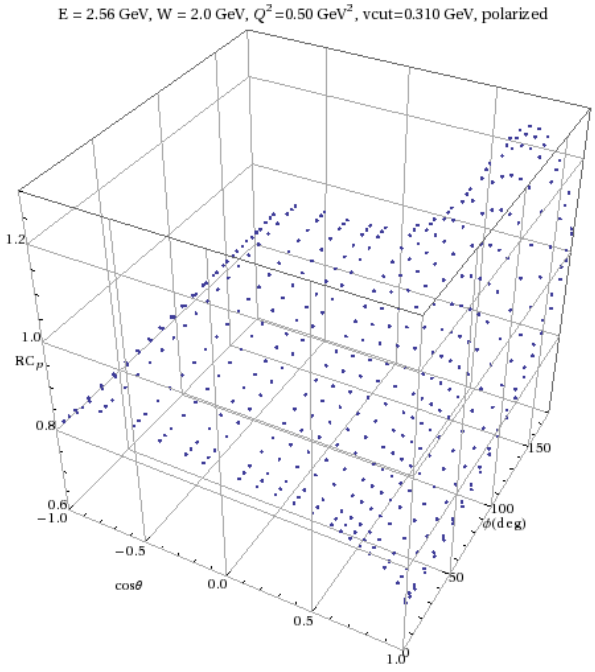
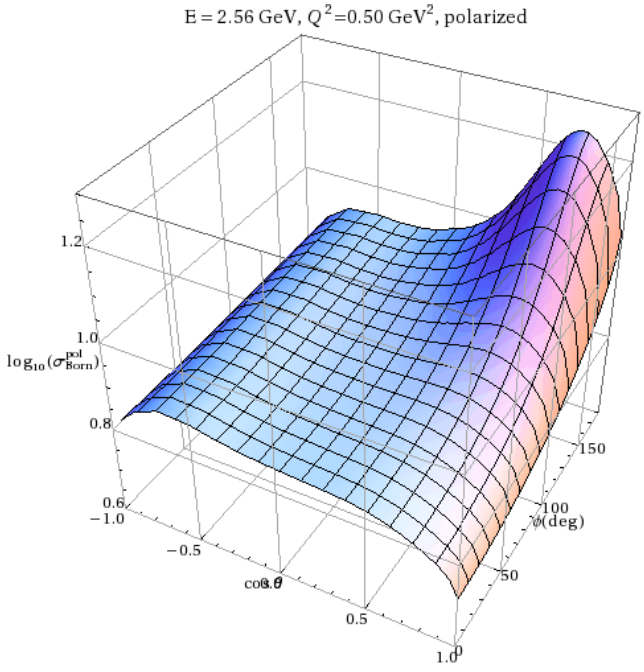


Fig 4. Point plot of polarized RC.



Surface plot polarized RC, full calculation.

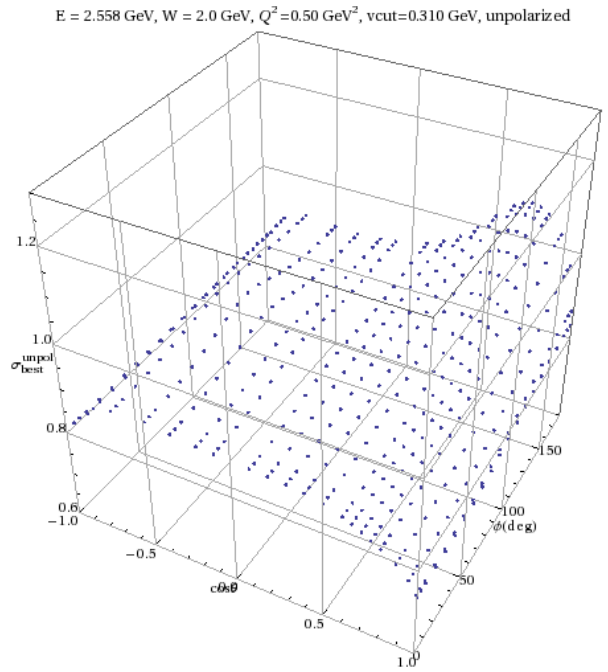
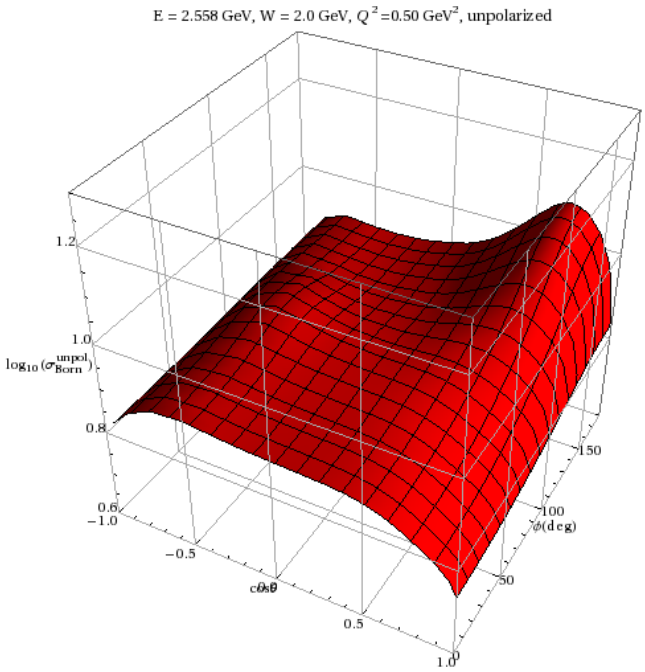


Fig 5. Point plot of unpolarized RC, full calculation.



Surface plot unpolarized RC, full calculation.

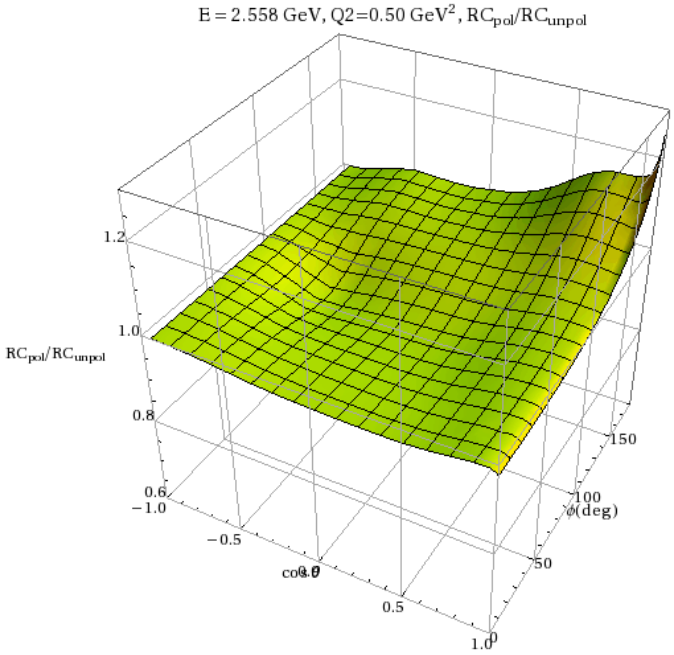
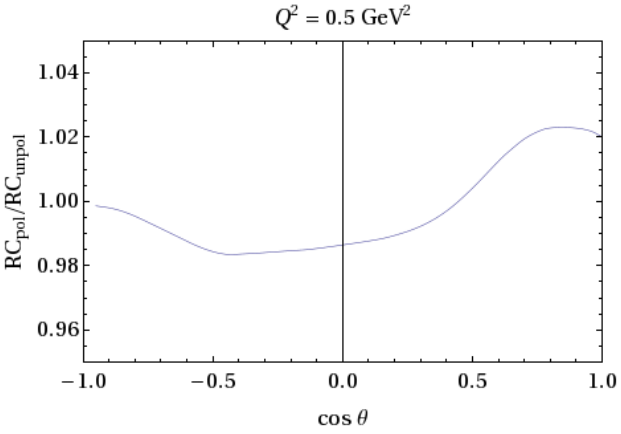


Fig 6. Ratio of polarized to unpolarized RCp, full calculation.



Average of RC_{pol}/RC_{unpol} ratio, full calculation.

Click here to view the object (Mathematica notebook) you uploaded.

Now go to Q2=1.5 GeV2, W=2.24 GeV. **

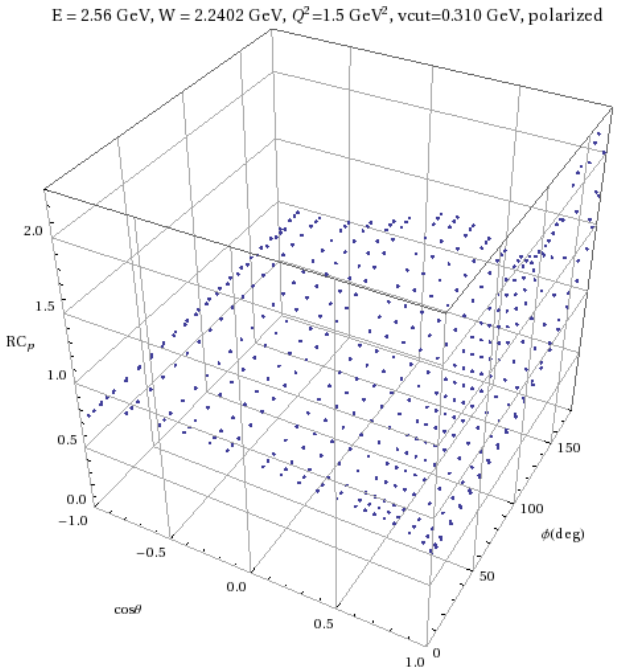
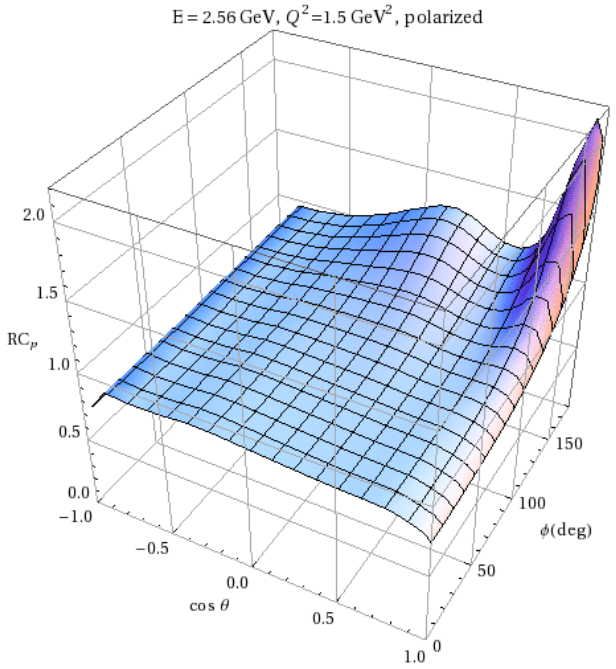


Fig 7. Point plot of polarized RC, full calculation.



Surface plot polarized RC, full calculation.

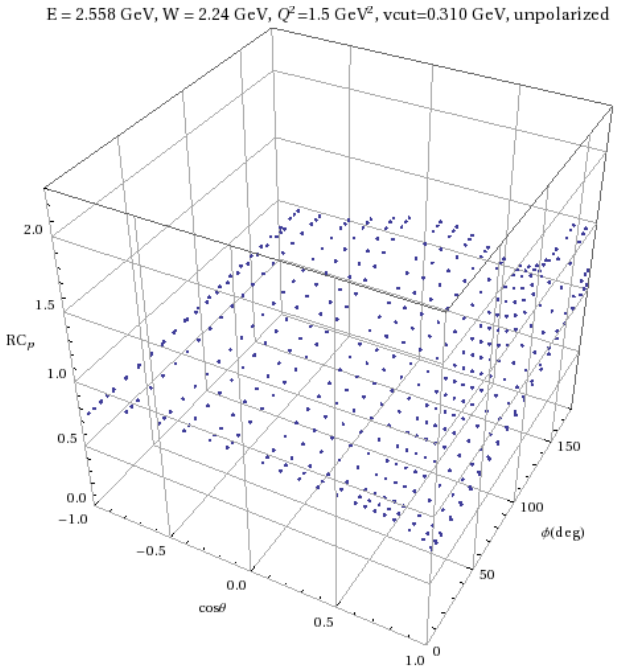
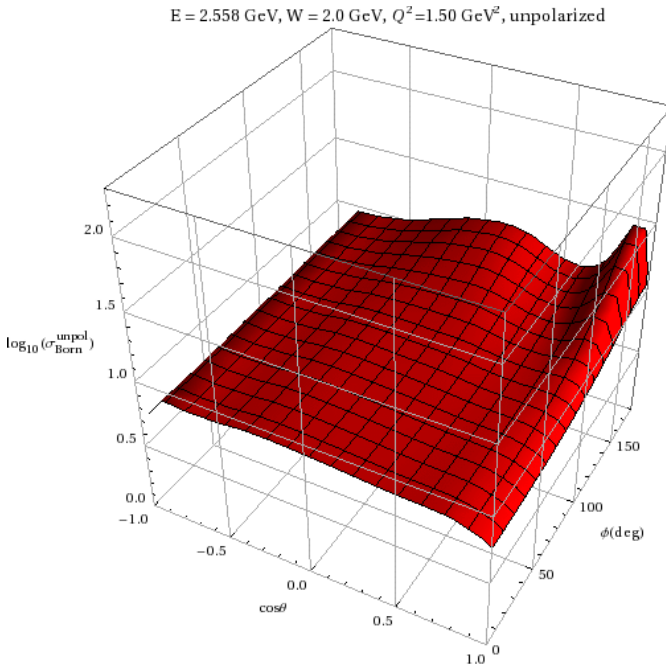
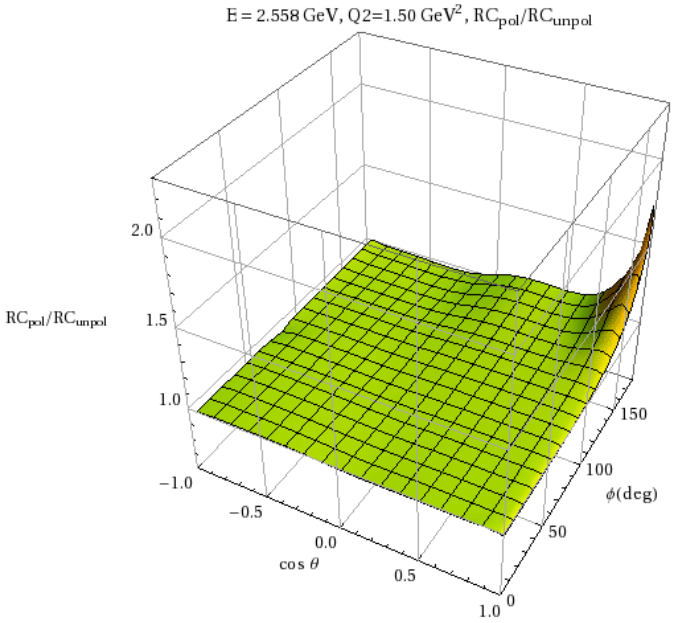
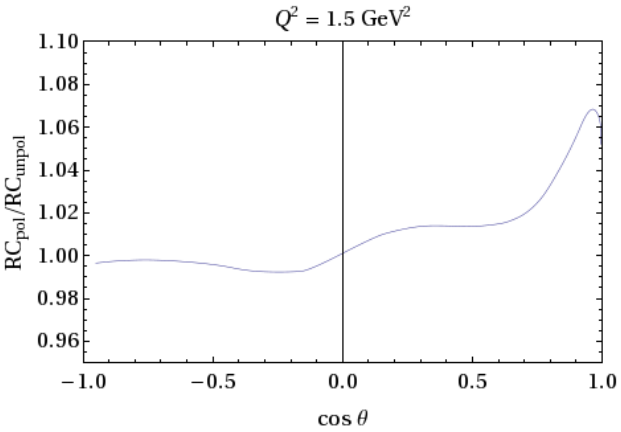


Fig 8. Point plot of unpolarized RC, full calculation



Surface plot unpolarized RC, full calculation.





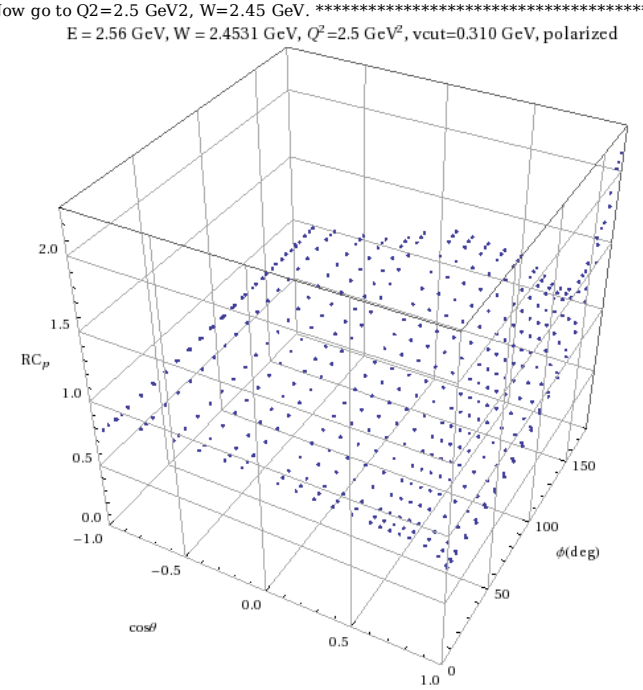
Average of RC_{pol}/RC_{unpol}, full calculation.

Fig 9. Ratio of polarized to unpolarized RCp.

Click here to view the object (Mathematica notebook) you uploaded.

Click here to view the object (tar achive) you uploaded.

Now go to Q2=2.5 GeV2, W=2.45 GeV. **********



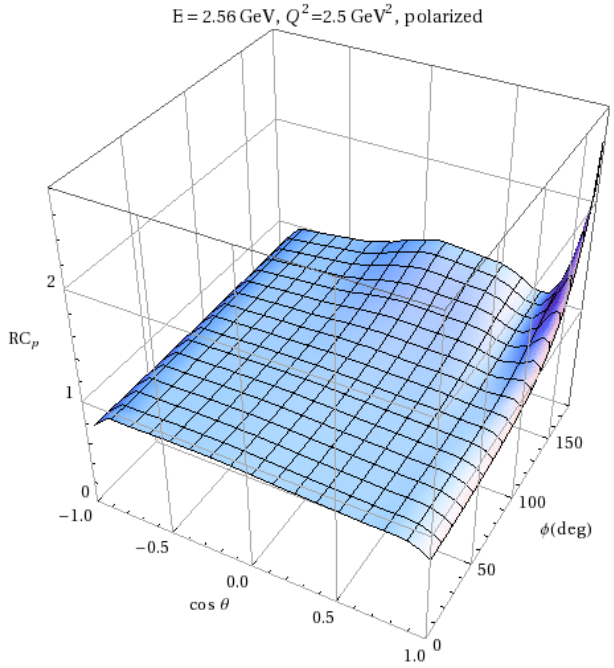


Fig 10. Point plot of polarized RC, full calculation.

Surface plot polarized RC, full calculation.

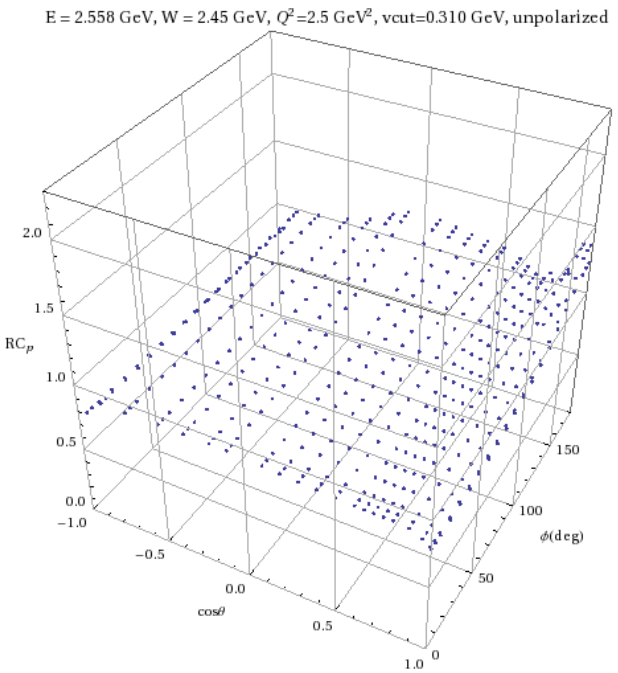
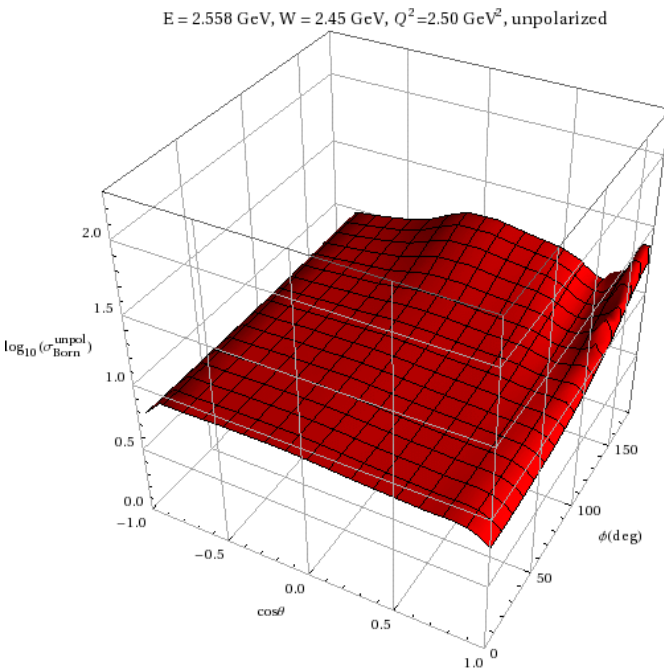


Fig 11. Point plot of unpolarized RC, full calculation.



Surface plot unpolarized RC, full calculation.

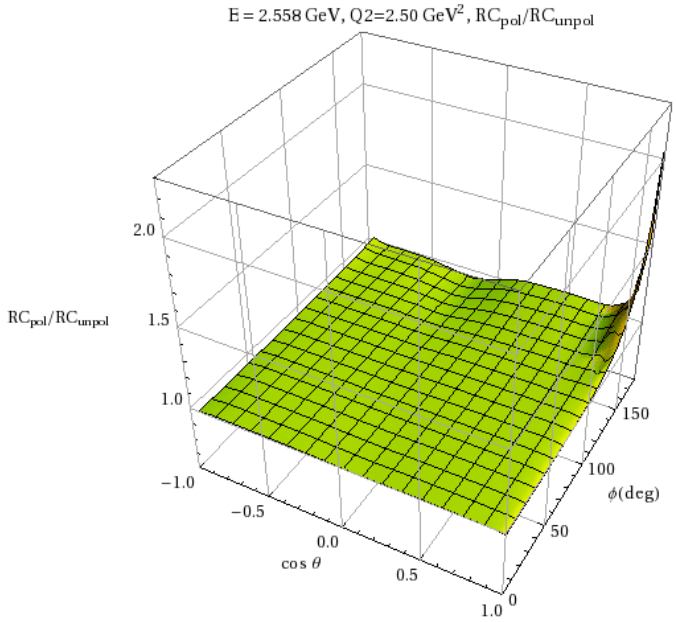
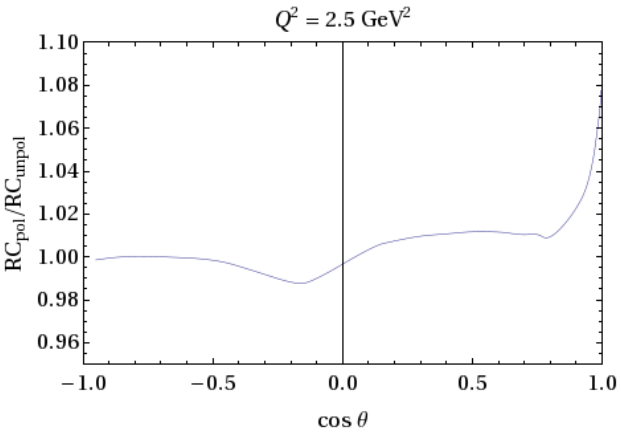


Fig 12. Ratio of polarized to unpolarized RCp.



Average of RC$_{pol}$/RC$_{unpol}$ ratio, full calculation.

Click here to view the object (Mathematica notebook) you uploaded.

Click here to view the object (tar achive) you uploaded.

Now do Q2=1.0 GeV2, W=2.13 GeV. **

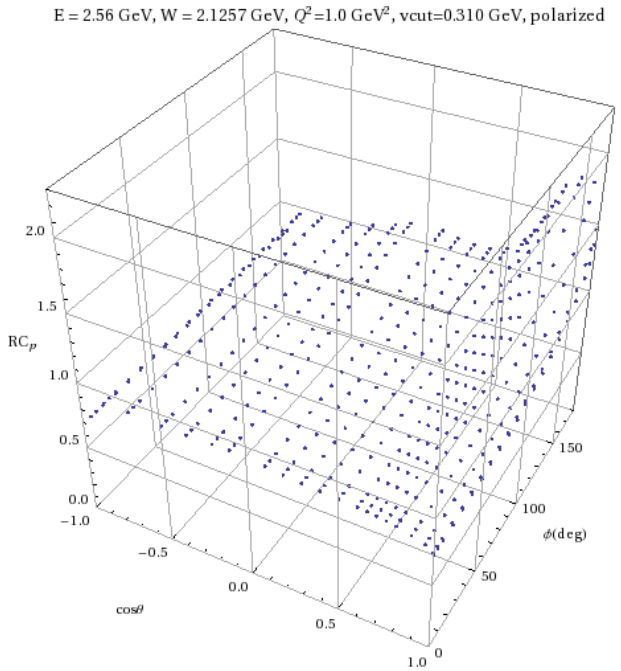
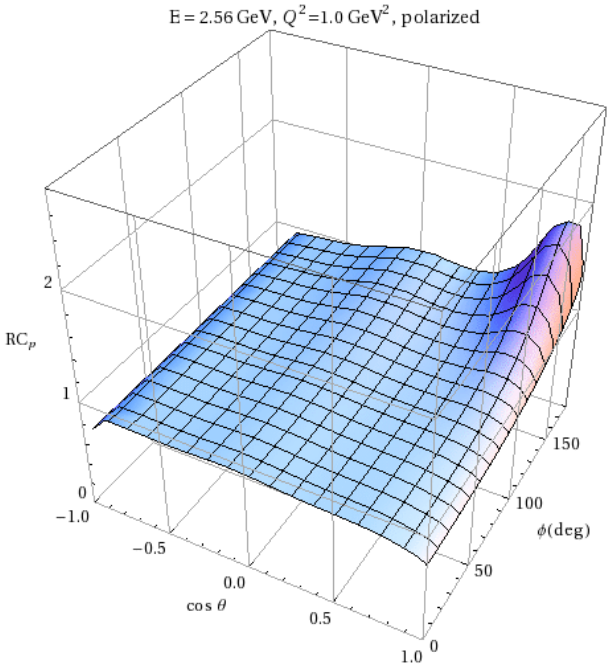


Fig 13. Point plot of polarized RC, full calculation.



Surface plot polarized RC, full calculation.

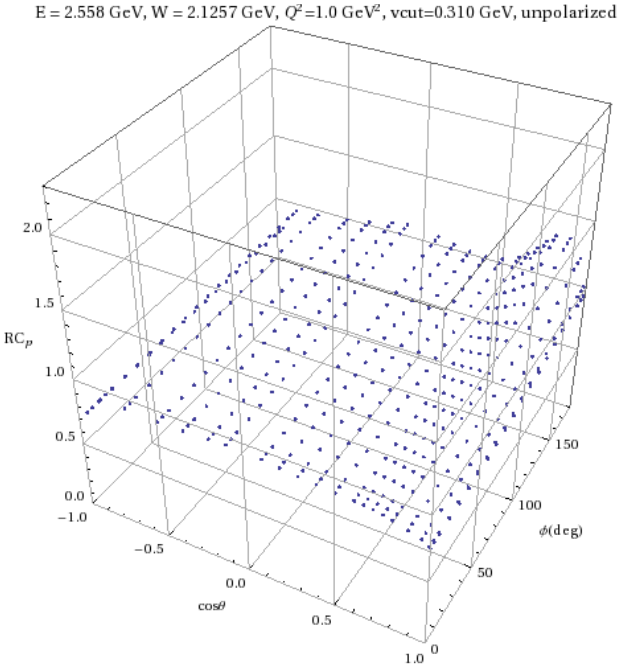
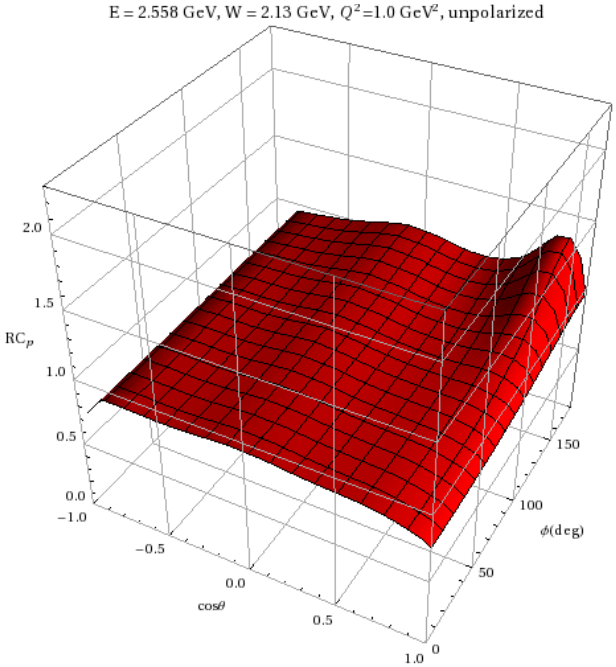
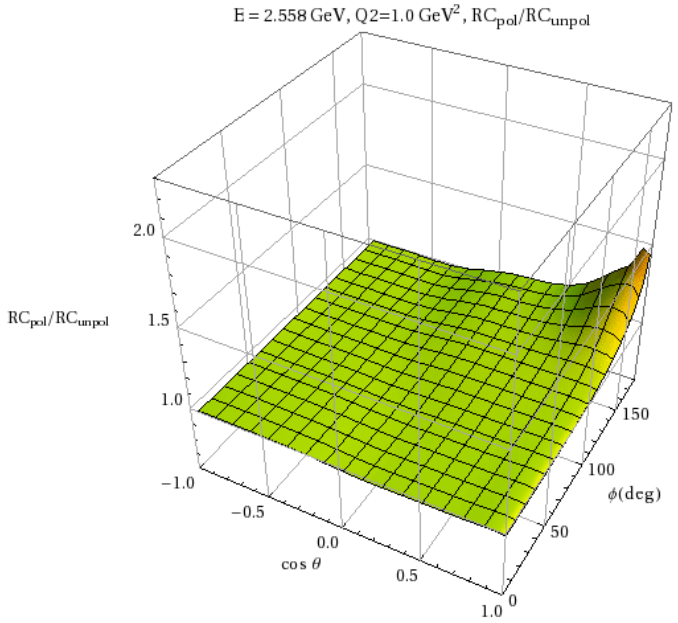
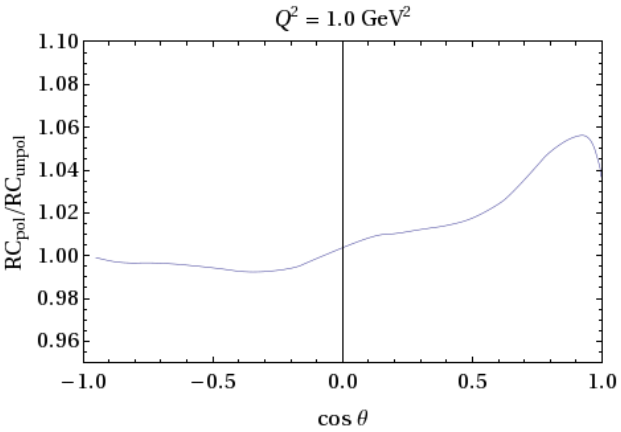


Fig 14. Point plot of unpolarized RC, full calculation.



Surface plot unpolarized RC, full calculation.





Average of RC$_{pol}$/RC$_{unpol}$ ratio, full calculation.

Fig 15. Ratio of polarized to unpolarized RCp.

Click here to view the object (Mathematica notebook) you uploaded.

Click here to view the object (tar achive) you uploaded.

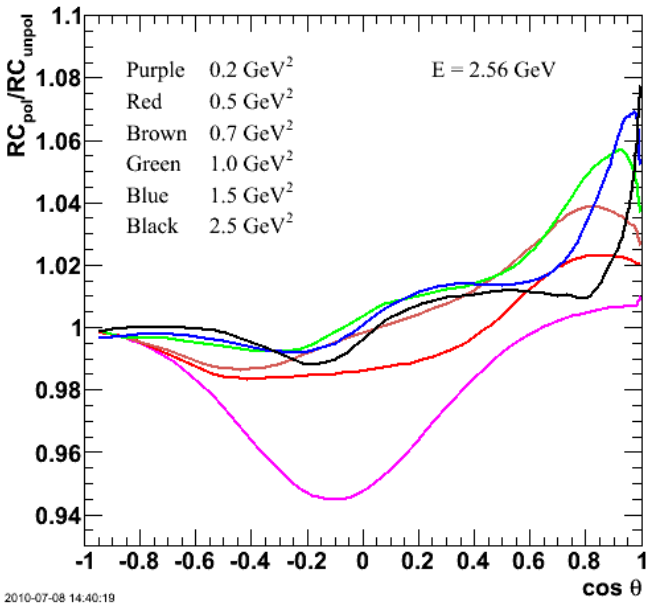


Fig 16. Combined plot of all six curves. See below for remaining Q2 calculations.

Click here to view the object (RCaverages1.C, root file used for fig 16.) you uploaded.

Click here to view the object (0.5 GeV2, Mathematica notebook(??)) you uploaded.

Now do Q2=0.2 GeV2, W=1.93 GeV. **

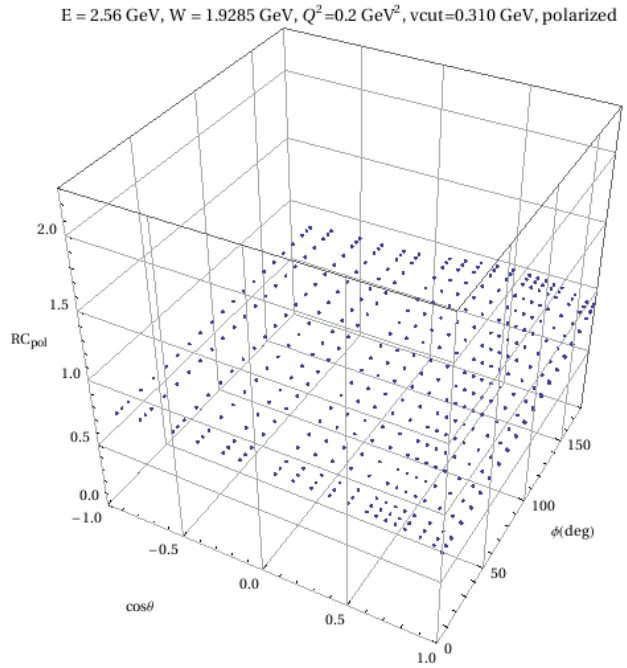
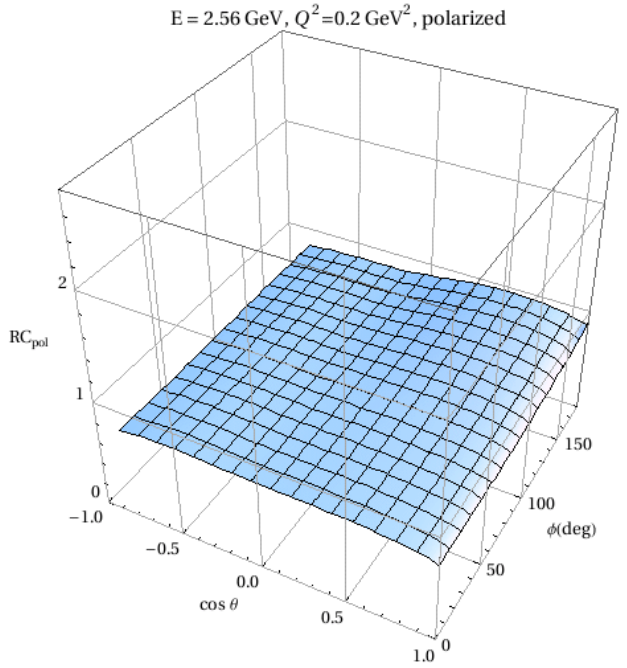


Fig 17. Point plot of polarized RC, full calculation.



Surface plot polarized RC, full calculation.

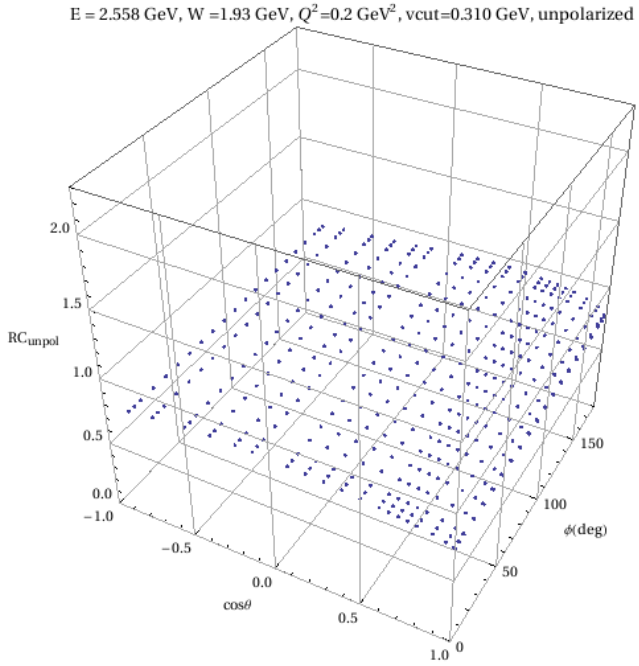
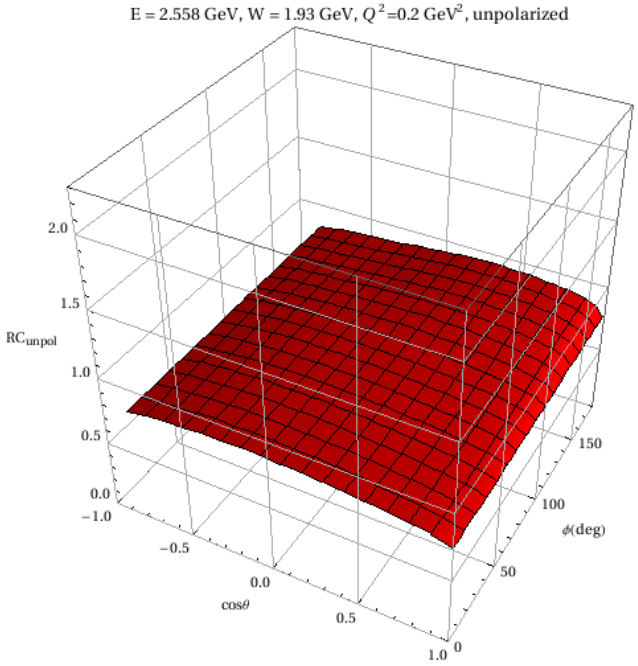
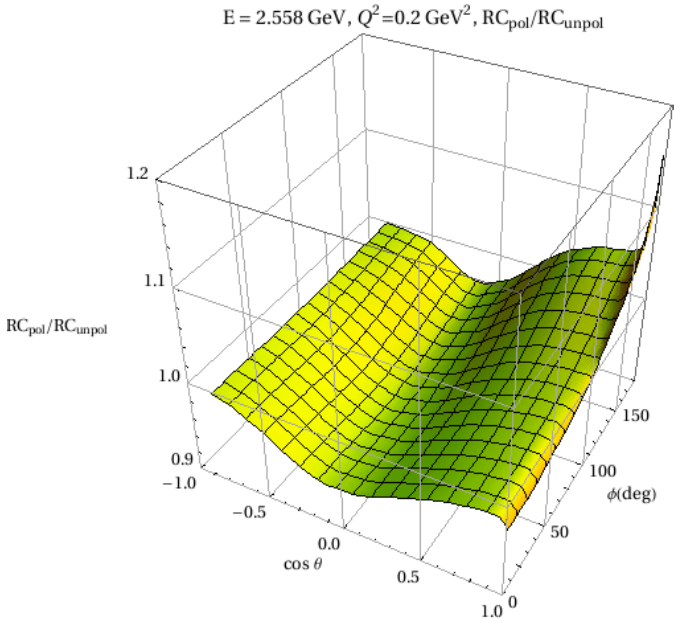
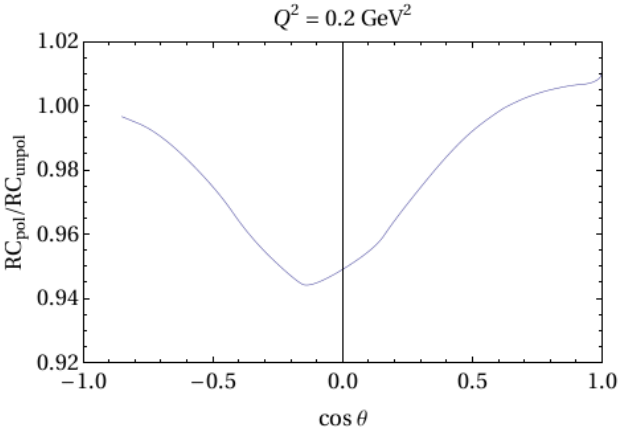


Fig 18. Point plot of unpolarized RC, full calculation.



Surface plot unpolarized RC, full calculation.





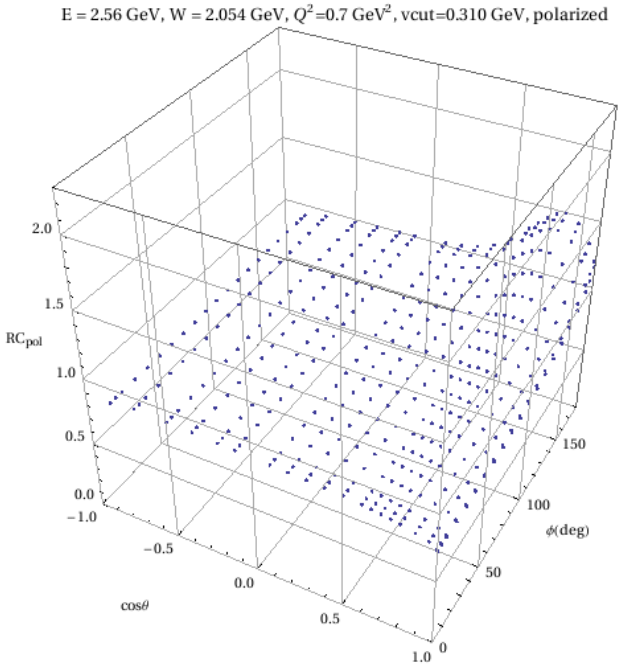
Average of RC_{pol}/RC_{unpol} ratio, full calculation.

Fig 19. Ratio of polarized to unpolarized RCp.

Click here to view the object (Mathematica notebook) you uploaded.

Click here to view the object (tar archive) you uploaded.

Now do Q2=0.7 GeV2, W=2.054 GeV. **



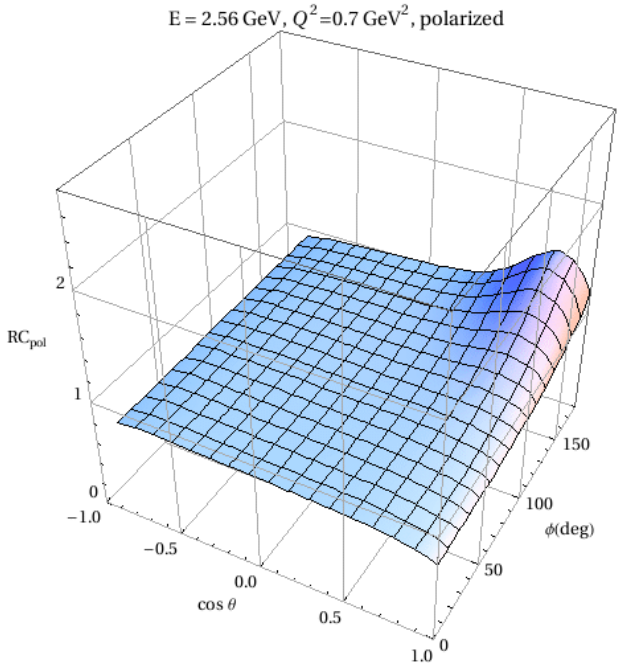


Fig 20. Point plot of polarized RC, full calculation.

Surface plot polarized RC, full calculation.

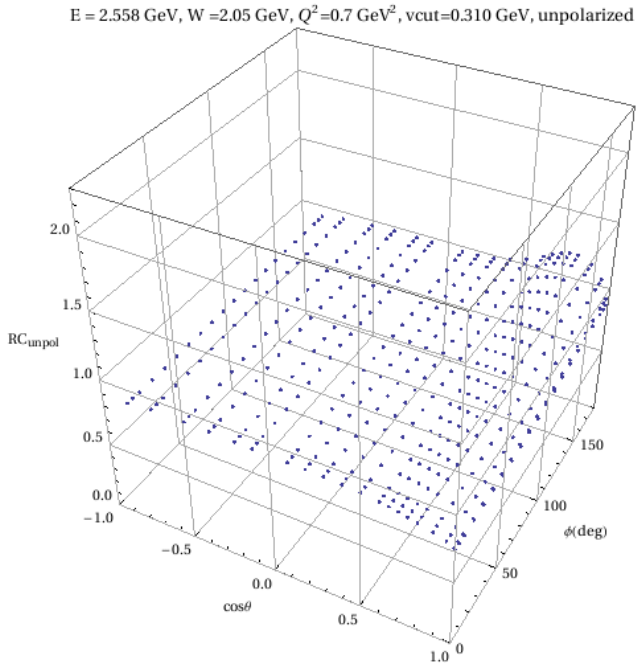
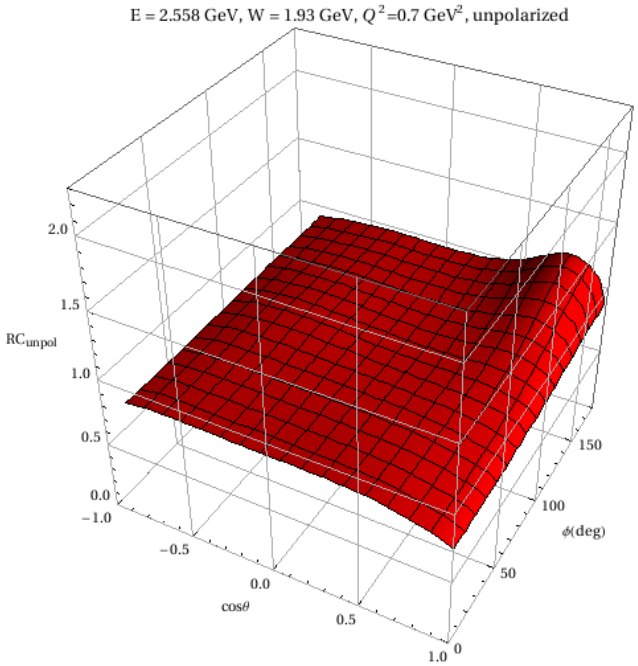


Fig 21. Point plot of unpolarized RC, full calculation.



Surface plot polarized RC, full calculation.

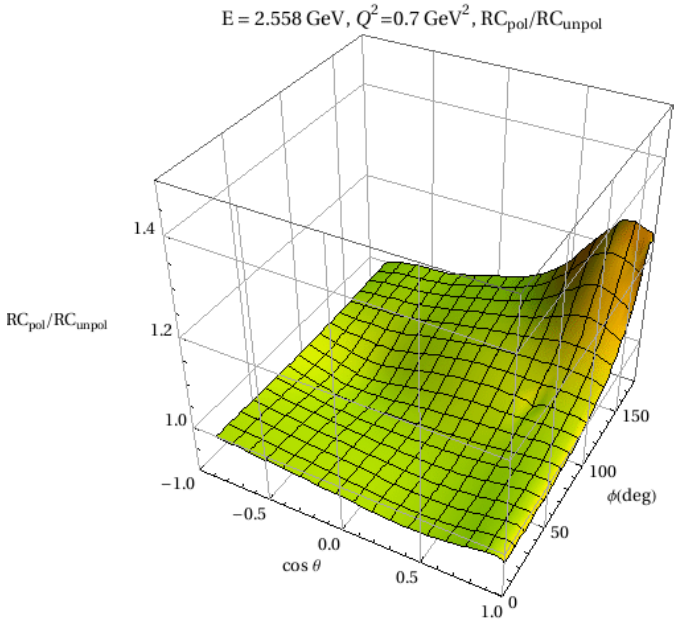
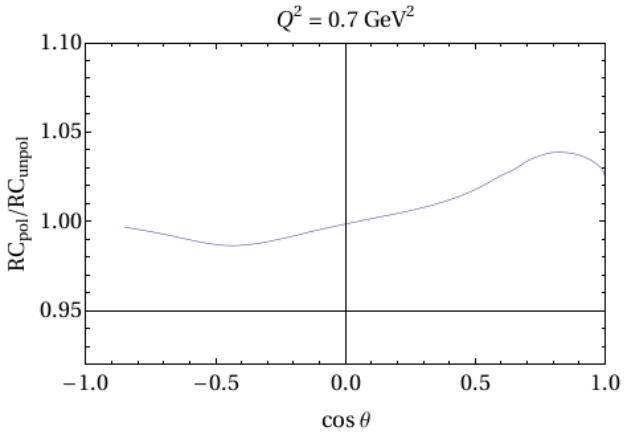


Fig 22. Ratio of polarized to unpolarized RCp.



Average of RC_{pol}/RC_{unpol} ratio, full calculation.

Click here to view the object (Mathematica notebook) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 330 - Testing the new form of the EC geometry. (gpg)

[Modified Fri Aug 6 17:33:18 2010 (GMT) gpg]

Below is a test of the ec_build.pl script used for generating the EC geometry for gemc. The new version takes a more sensible approach to the geometry by casting it a form which generates the geant4 inputs for G4Trap directly instead of using the Ralph Minehart version from CLAS6. The table below compares the output from the old ec_build.pl (left column) with the new version (right column) for a few of the layers.

Old version of ec_build.pl

```
gpg3:tmp> /media/flash/gemc/ECgeom/ecgeo.pl     <---- new stuff??
/media/flash/gemc/ECgeom/ecgeo.pl: Permission denied.
gpg3:tmp> cp /media/flash/gemc/ECgeom/ecgeo.pl .
gpg3:tmp> ecgeo.pl
Subroutine getXval redefined at ecgeo.pl line 181.
Subroutine getYval redefined at ecgeo.pl line 186.
Subroutine getDistance redefined at ecgeo.pl line 190.
L1 =7217.23
MO =864.55972863863
Geant4 G4trap values for Layer 1----------------------------
pDx1 =0
pDx2 =1909.27940611801
pDx3 =0
pDx4 =1909.27940611801
pDy1 =1864.65
pDy2 =1864.65
pDz = 5
Origin Offset = 0

Geant4 G4trap values for Layer 2----------------------------
pDx1 =0
pDx2 =1913.84241648534
pDx3 =0
pDx4 =1913.84241648534
pDy1 =1869.10635
pDy2 =1869.10635
pDz = 5
Origin Offset = 0.171100000000024

.....

Geant4 G4trap values for Layer 37----------------------------
pDx1 =0
pDx2 =2073.54777934212
pDx3 =0
pDx4 =2073.54777934212
pDy1 =2025.0786
pDy2 =2025.0786
pDz = 5
Origin Offset = 6.15959999999995

Geant4 G4trap values for Layer 38----------------------------
pDx1 =0
pDx2 =2078.11078970946
pDx3 =0
pDx4 =2078.11078970946
pDy1 =2029.53495
pDy2 =2029.53495
pDz = 5
Origin Offset = 6.33069999999998
```

New version of ec_build.pl.

```
Geant4 G4trap values for Layer 1----------------------------
pDx1 =0.001
pDx2 =1909.27940611801
pDx3 =0.001
pDx4 =1909.27940611801
pDy1 =1864.65
pDy2 =1864.65
pDz = 5
Geant4 G4trap values for Layer 2----------------------------
pDx1 =0.001
pDx2 =1913.84241648534
pDx3 =0.001
pDx4 =1913.84241648534
pDy1 =1869.10635
pDy2 =1869.10635
pDz = 5


Geant4 G4trap values for Layer 37-------------------------
pDx1 =0.001
pDx2 =2073.54777934212
pDx3 =0.001
pDx4 =2073.54777934212
pDy1 =2025.0786
pDy2 =2025.0786
pDz = 5
Geant4 G4trap values for Layer 38-------------------------
pDx1 =0.001
pDx2 =2078.11078970946
pDx3 =0.001
pDx4 =2078.11078970946
pDy1 =2029.53495
pDy2 =2029.53495
pDz = 5
pscm2:ec>
```

Click here to view the object (Old version of ec_build.pl (left-hand columns)) you uploaded.

Click here to view the object (New version (called ecgeo.pl) of calculations for ec_build.pl (right-hand column).) you uploaded.

The results above are fine, but we have not optimized the representation of the EC geometry in ec_build.pl. We start doing that now. The plot below and the associated version of ec_build.pl are our starting point.

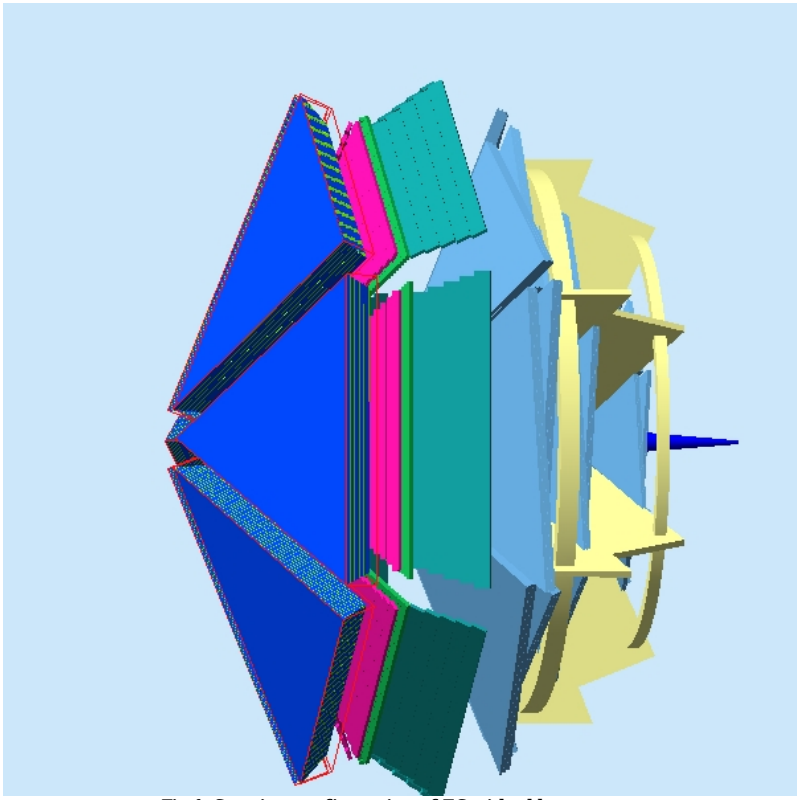


Fig 1. Starting configuration of EC with old geometry.

Click here to view the object (ec_build.pl) you uploaded.

Now fire a geantino track at the vertex of the scintillator layer 1 closest to the beamline. Plot below was generated with the following command.

```
gemc -gcard=modified.gcard -DATABASE=user_geometry -N=2 -BEAM_P="geantino, 8*GeV, 4*deg, 0.0*deg" -NO_FIELD=all
```

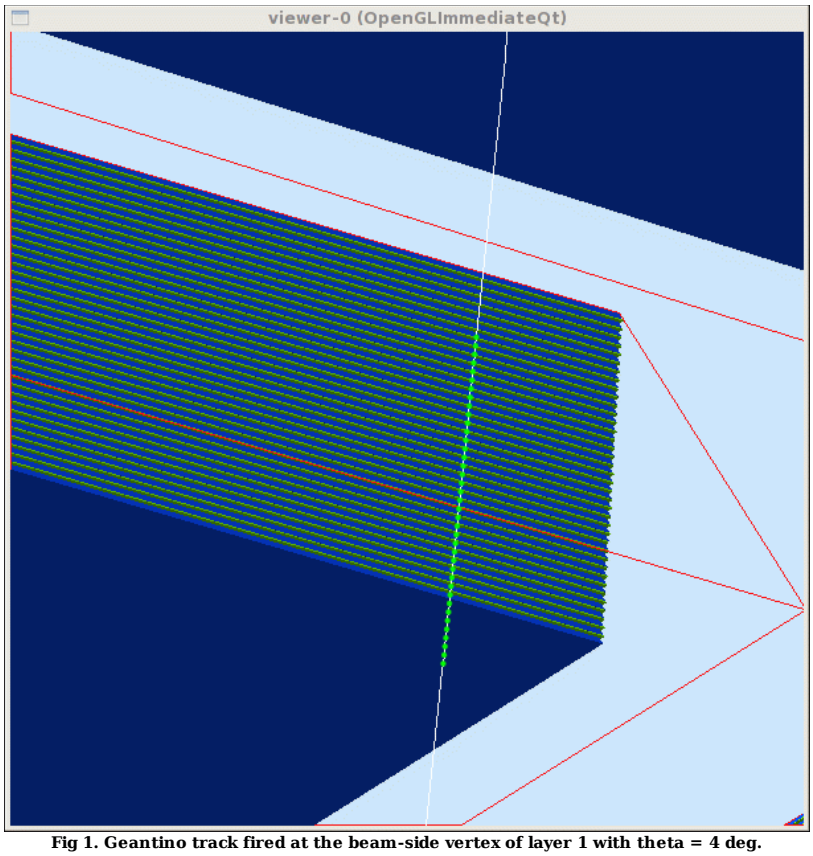


Fig 1. Geantino track fired at the beam-side vertex of layer 1 with theta = 4 deg.

Plot below was generated with the following command.

```
gemc -gcard=modified.gcard -DATABASE=user_geometry -N=2 -BEAM_P="geantino, 8*GeV, 3.99999*deg, 0.0*deg" -NO_FIELD=all
```

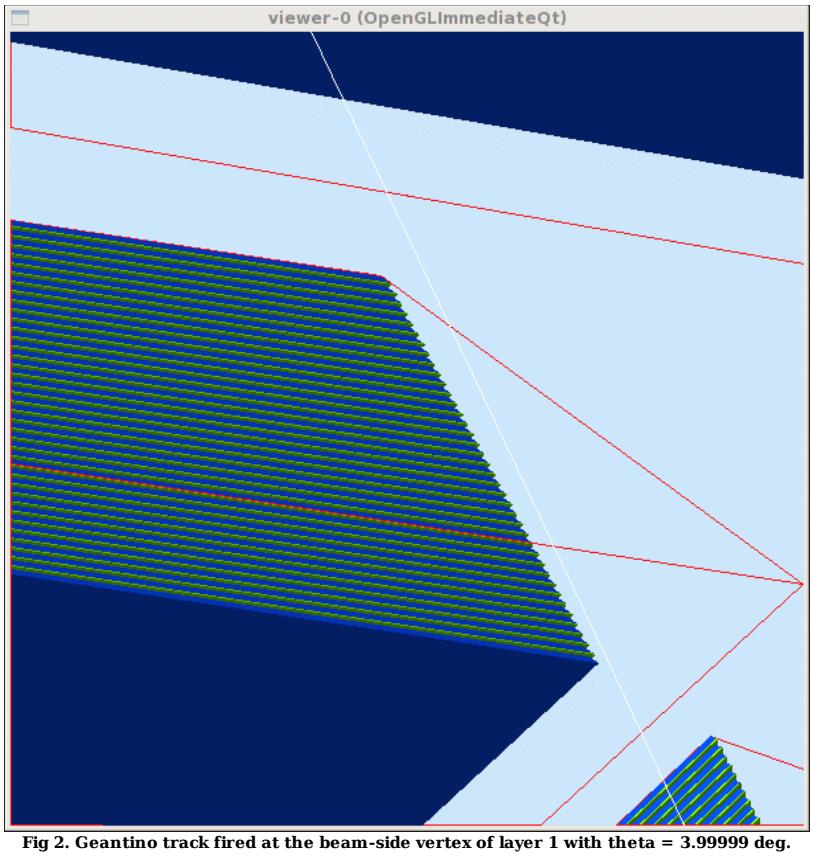


Fig 2. Geantino track fired at the beam-side vertex of layer 1 with theta = 3.99999 deg.

Now set the polar angle at the minimum value of the angle in layer 1 (at the beam-side vertex). Geantinos were generated with the following command.

```
gemc -gcard=modified.gcard -DATABASE=user_geometry -N=2 -BEAM_P="geantino, 8*GeV, 3.6886*deg, 0.0*deg" -NO_FIELD=all
```

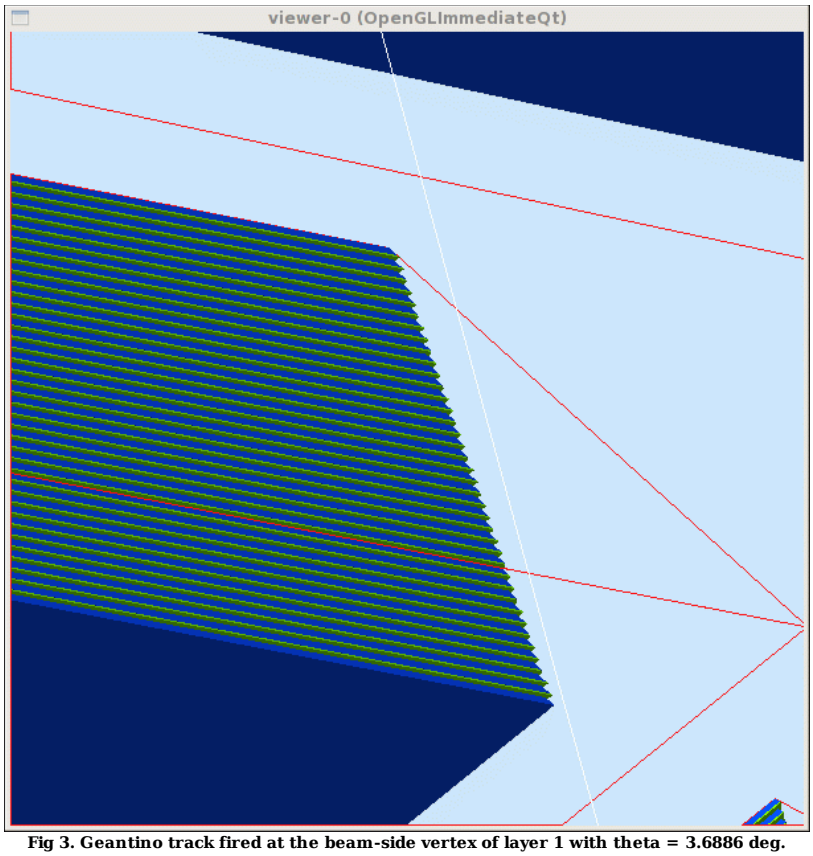


Fig 3. Geantino track fired at the beam-side vertex of layer 1 with theta = 3.6886 deg.

It looks like we can't specify angles with greater than 1 deg of precision for the internal event generator. Try using the LUND format input files to get the precise angles. At the expected minimum of θ we get lots of hits.

```
        1  1.  1.  0 -1 0.0     0.0     0.8804  9.037   4.816
  1 -1.    1   11  0  0    0.3860    0.0       5.9876    6.0000    0.0005      0.0000    0.0000 0.0000
```

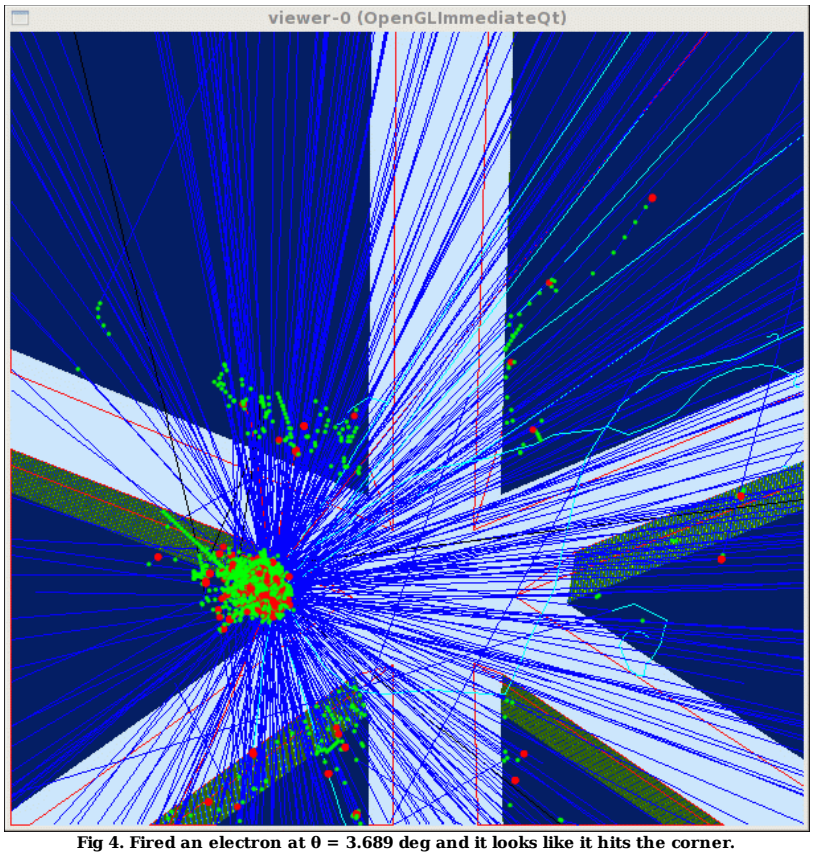


Fig 4. Fired an electron at θ = 3.689 deg and it looks like it hits the corner.

AT θ = 3.5 de we get hits. At θ = 2.5 deg no hits. At θ = 3.0, the track appears to just graze the first layer. See next plot.

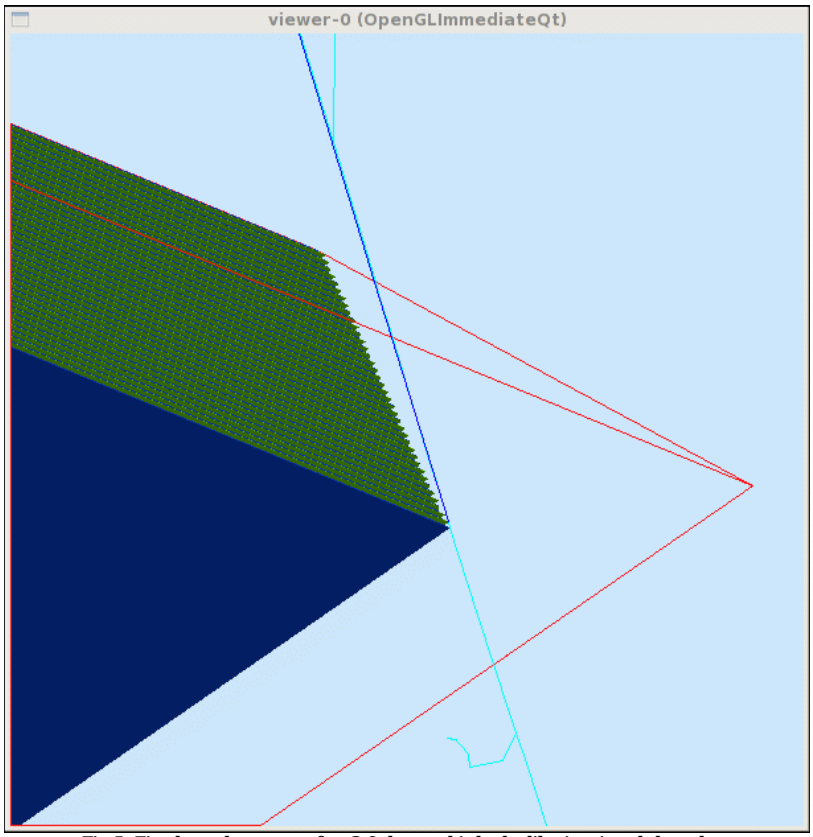


Fig 5. Fired an electron at θ = 3.0 deg and it looks like it missed the edge.

Appears to hit at θ = 3.25 deg.

```
        1  1.  1.  0 -1 0.0     0.0     0.8804  9.037   4.816
  1 -1.     1   11  0  0     0.0567    0.0       0.9984    1.0000    0.0005      0.0000    0.0000 0.0000  no hits
```

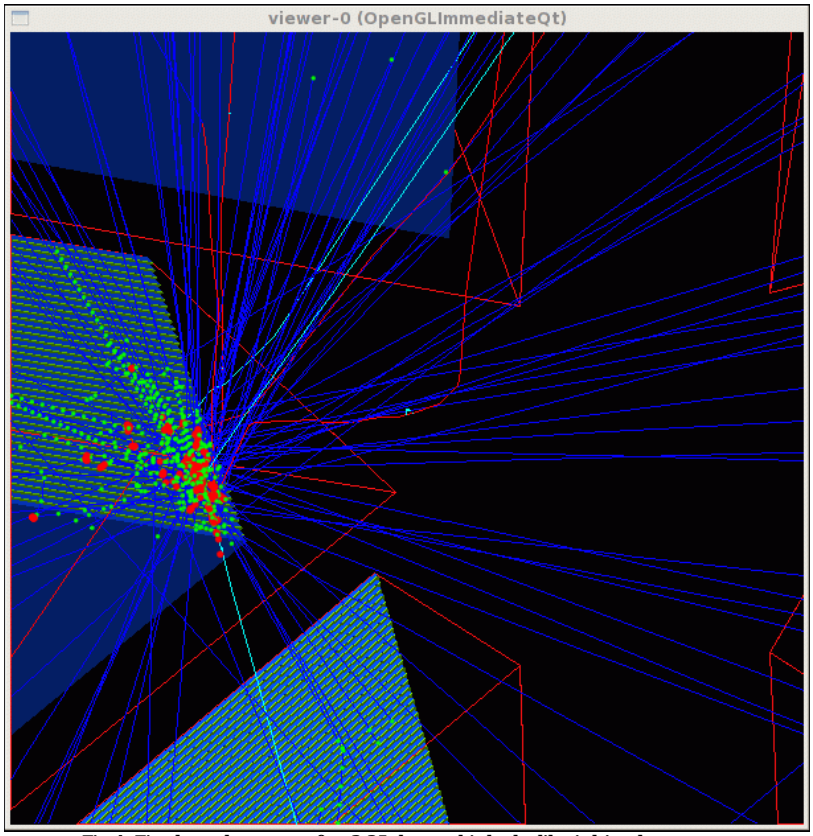


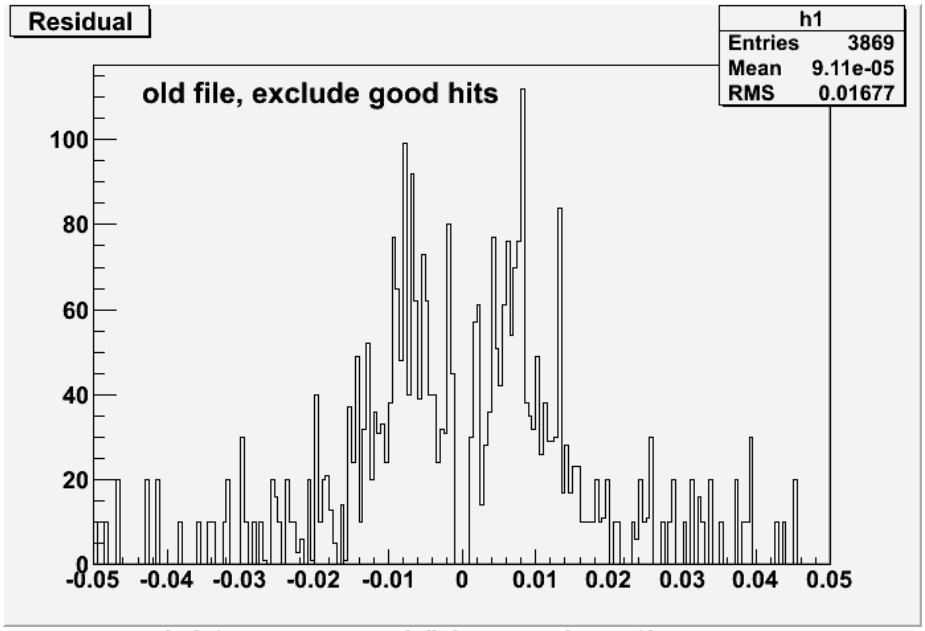
Fig 4. Fired an electron at θ = 3.25 deg and it looks like it hits the corner.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 331 - Track Reconstruction with Socrat (gpg)

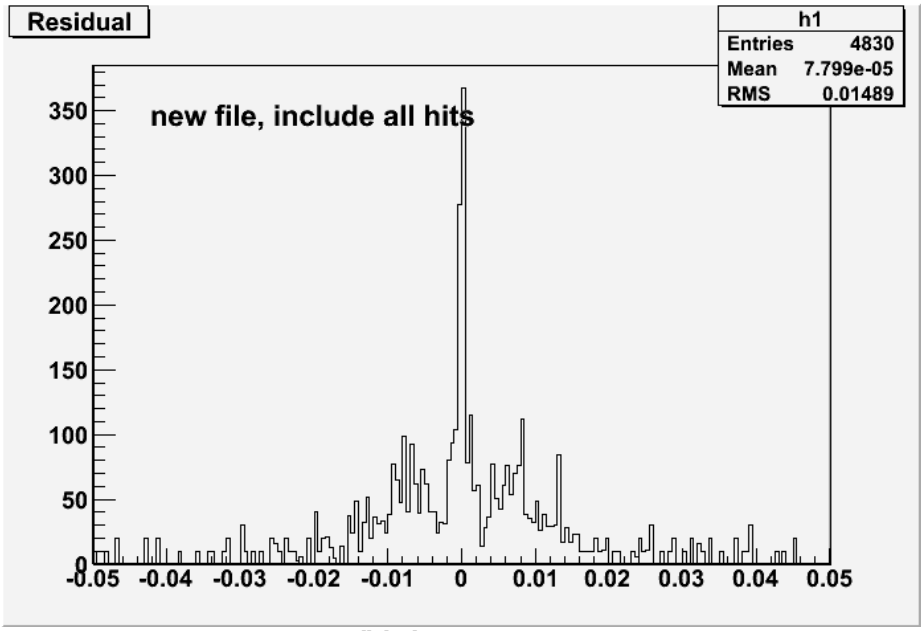
[Modified Tue Aug 3 14:44:27 2010 (GMT) gpg]

Plots generated trying to debug electron reconstruction problem with Socrat and recent gemc sims.



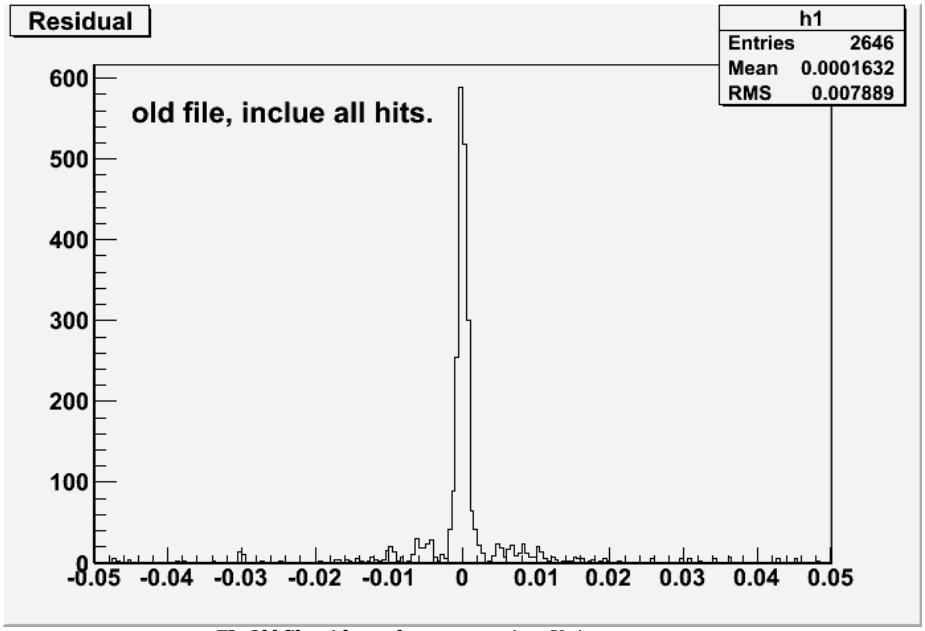
F1. Residuals for new gemc run. Labelled wrong. Its the new file. Units are meters.

Click here to view the object (Root macro) you uploaded.



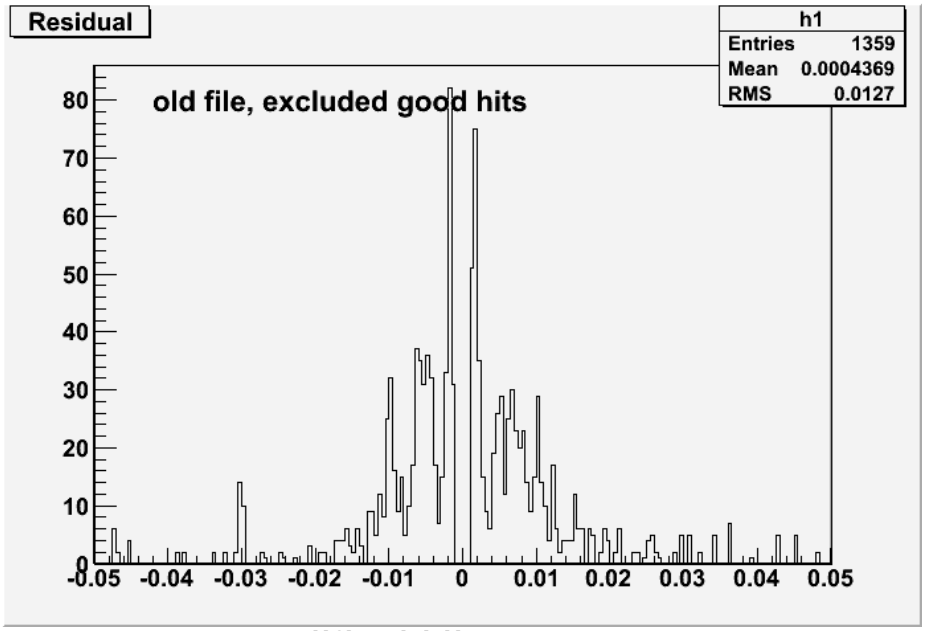
F2. Let all the hits in. Units are meters.

Click here to view the object () you uploaded.



F3. Old file with good reconstruction. Units are meters.

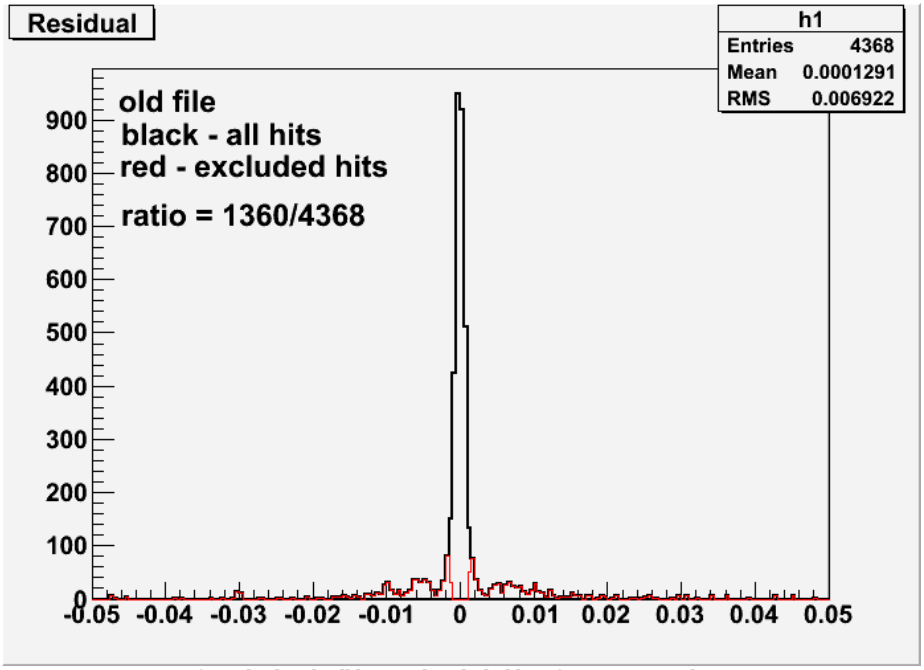
Click here to view the object (Root macro) you uploaded.



F4. Old file, excluded hits. Units are meters.

Click here to view the object (Root macro) you uploaded.

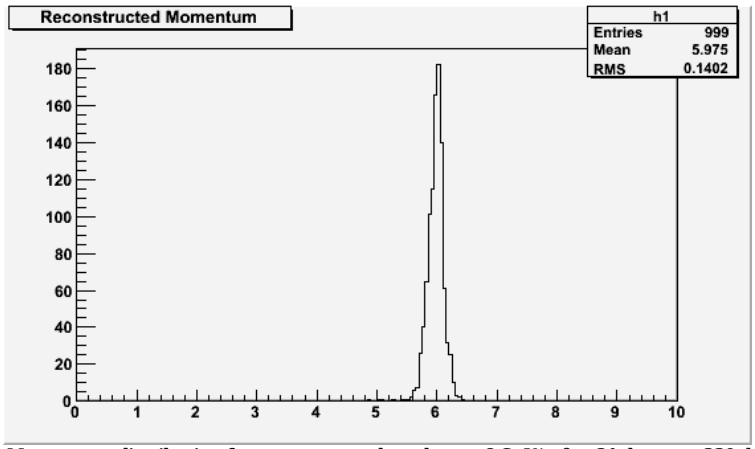
Comparing Figs 3-4 above there are channels where the 'all hits' analysis has fewer events that the 'excluded hits' analysis which makes no sense. Check this by extracting the hits from a single analysis run. The plot below shows this and it looks correct. The problem in figs 3-4 was likely pilot error as usual.



f5. Direct comparison of residual with all hits and excluded hits from same analysis run. Units are meters.

Click here to view the object (Root macro) you uploaded.

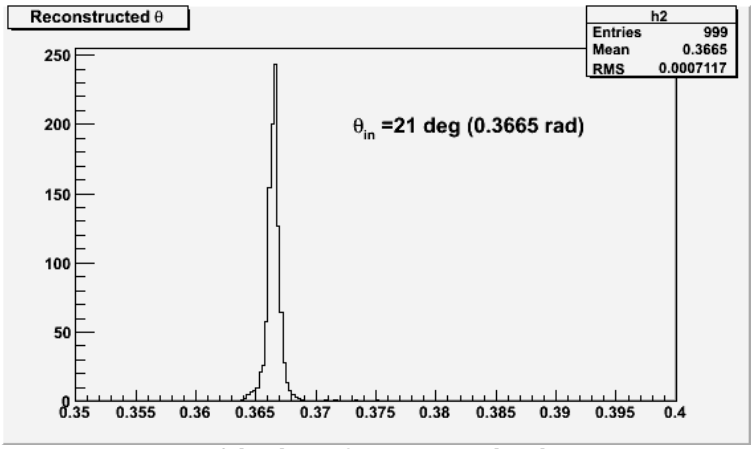
Results from internal event generator in Socrat.



F6. Momentum distribution for reconstructed tracks. p= 6 GeV/c, θ = 21 deg, φ = 230 deg.

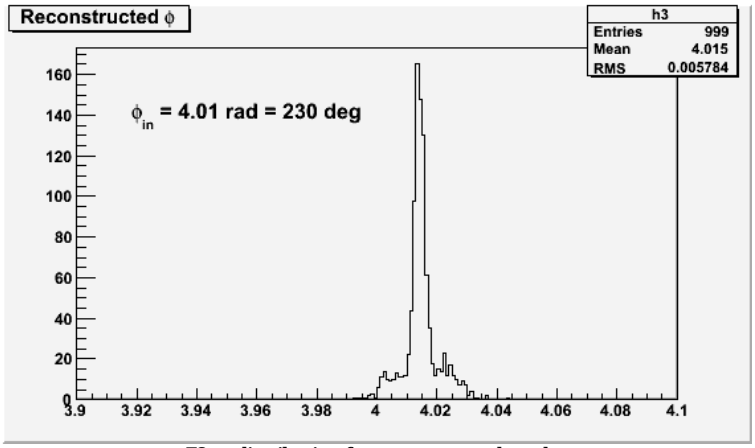
Click here to view the object (Input file Socrat.opt for plot above.) you uploaded.

Click here to view the object (Root tree file) you uploaded.



F7. θ distribution for reconstructed tracks.

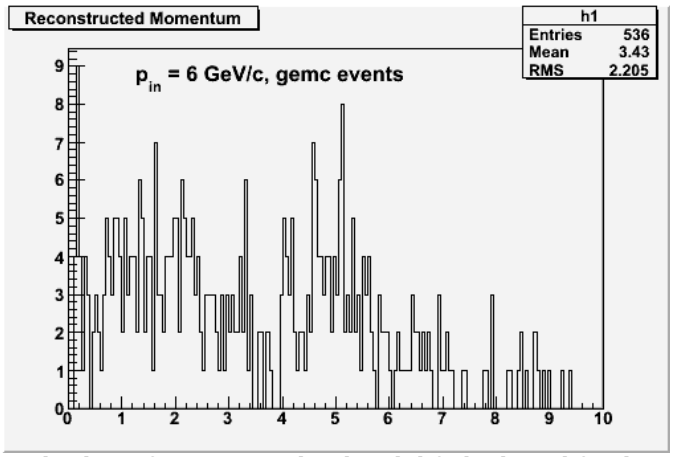
Click here to view the object (Root macro) you uploaded.



F8. φ distribution for reconstructed tracks.

Click here to view the object (Root macro) you uploaded.

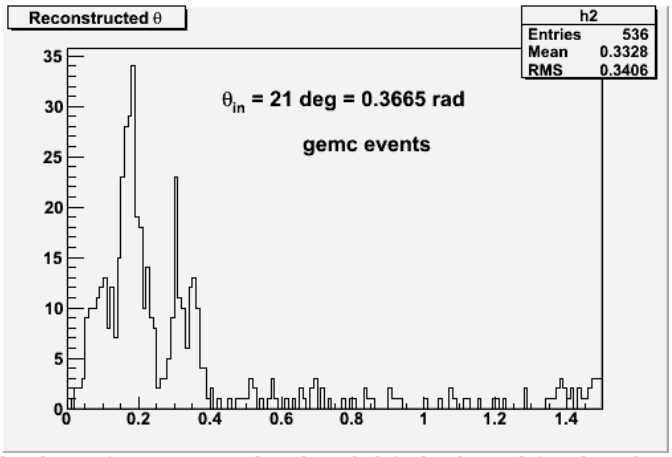
Results from gemc event generator in Socrat.



F9. Momentum distribution for reconstructed tracks with default value on left-right ambiguity cut.

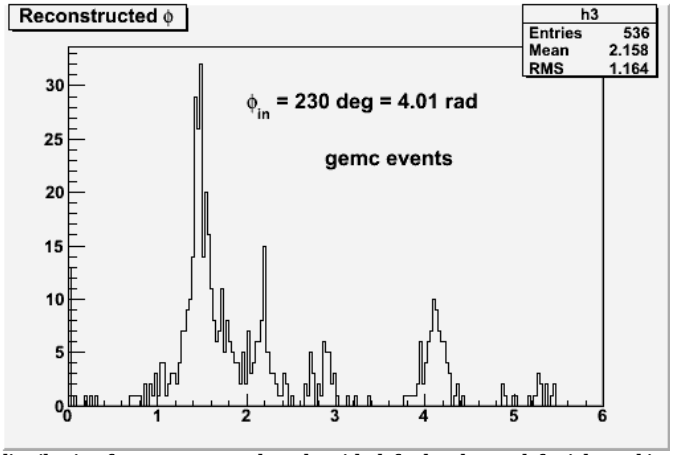
Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root tree file) you uploaded.



F10. θ distribution for reconstructed tracks with default value on left-right ambiguity cut.

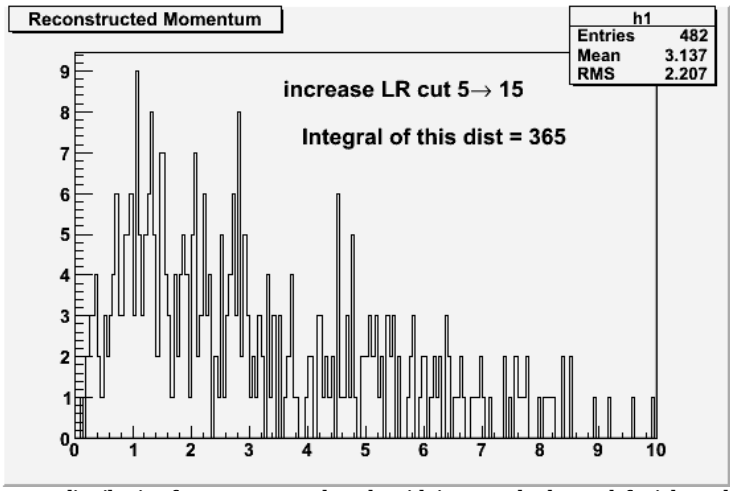
Click here to view the object (Root macro) you uploaded.



F11. φ distribution for reconstructed tracks with default value on left-right ambiguity cut.

Click here to view the object (Root macro) you uploaded.

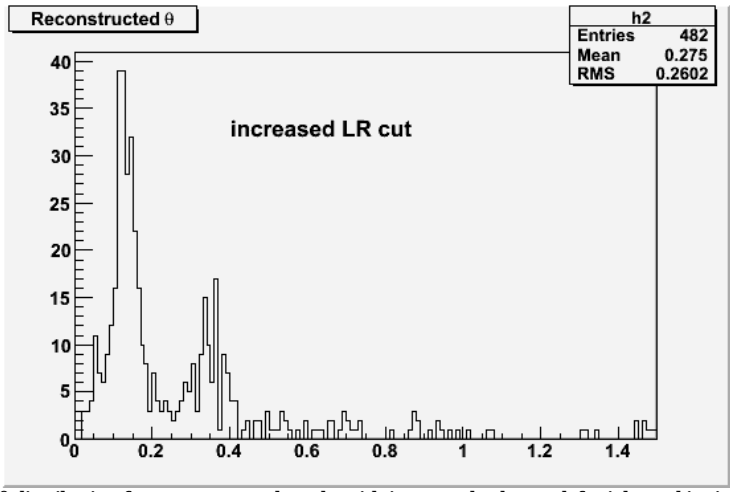
Change the value of the L-R cut from 5->15 in SolveLR.h line 55.



F12. Momentum distribution for reconstructed tracks with increased value on left-right ambiguity cut.

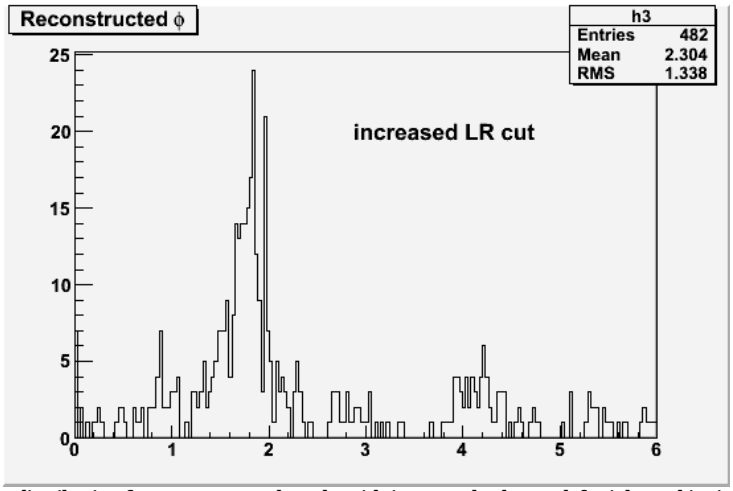
Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root tree file) you uploaded.



F13. θ distribution for reconstructed tracks with increased value on left-right ambiguity cut.

Click here to view the object (Root macro) you uploaded.

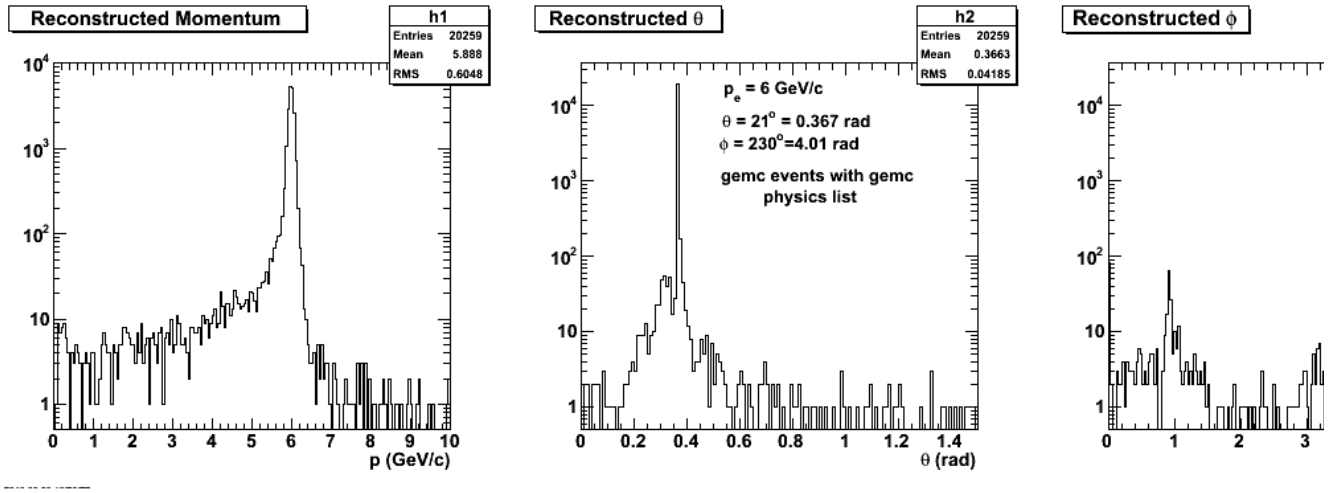


F14. φ distribution for reconstructed tracks with increased value on left-right ambiguity cut.

Click here to view the object (Root macro) you uploaded.

Set -USE_PHYSICSL=gemc in the gemc command and things look good!!!!!!!!!!!!!!!!!!!!!!! Plot below shows results for reconstructed momentum, θ, and φ as shown above. The number of throws was 20000 so it looks like Socrat tried to make some noise into tracks maybe. The widths are significantly larger than the widths using the internal Socrat event generator, but these can likely be cleaned up by getting rid of the outliers in the distributions below. Used the following command to generate the events.

```
gemc -gcard=modified2.gcard -N=20000 -BEAM_P="e-, 6.0*GeV, 21.0*deg, 230.0*deg" -OUTPUT="evio, results.ev" -PRINT_EVENT=50 -USE_QT=0 -USE_PHYSICSL=gemc
```



F15. Distribution of reconstructed p, θ, and φ for events generated with gemc and analyzed with C++ Socrat.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 332 - Testing new cluster in Richmond (gpg)

[Modified Wed Sep 15 15:50:29 2010 (GMT) gpg]

Do some tests to check the cluster is ok so we can pay advanced clustering. Look at exclurad before and after the move. The out put files (that will be the input to Mathematica) look nearly identical.

```
-----

now test quark after hte move.

cat results/* > radcorW2.05Q20.7ap.dat

grep unpol radcorW2.05Q20.7ap.dat | cut -b 14-80 | more >  radcorW2.05Q20.7unpol.ap.dat
grep -v unpol radcorW2.05Q20.7ap.dat | cut -b 14-80 >  radcorW2.05Q20.7pol.ap.dat

scp quark.richmond.edu:/home/gilfoyle/eod/exclurad/run/radcorW2.05Q20.7pol.ap.dat .
scp quark.richmond.edu:/home/gilfoyle/eod/exclurad/run/radcorW2.05Q20.7unpol.ap.dat .



there are differences in only four lines out of 420 in the polarized files; no differences for the unpolarized files.

gpg3:exclurad>
gpg3:exclurad> diff radcorW2.05Q20.7pol.ao.dat radcorW2.05Q20.7pol.ap.dat
14c14
<   2.0540  0.7000  0.9280  0.1000     1.00  0.8783 0.10E+01  0.8892
---
>   2.0540  0.7000  0.9280  0.1000     1.00  0.8235 0.10E+01  0.8892
84c84
<   2.0540  0.7000  0.9280  0.8800    30.00  0.7910 0.10E+01  0.9725
---
>   2.0540  0.7000  0.9280  0.8800    30.00  0.3059 0.10E+01  0.9725
383c383
<   2.0540  0.7000  0.9280  0.9500   175.00  1.2849 0.10E+01  1.5523
---
>   2.0540  0.7000  0.9280  0.9500   175.00  1.9952 0.10E+01  1.5523
403c403
<   2.0540  0.7000  0.9280  0.9500   179.00  1.3343 0.10E+01  1.6201
---
>   2.0540  0.7000  0.9280  0.9500   179.00  1.8441 0.10E+01  1.6201
gpg3:exclurad>

gpg3:exclurad> wc -l radcorW2.05Q20.7pol.ap.dat
420 radcorW2.05Q20.7pol.ap.dat
gpg3:exclurad>



gpg3:exclurad> diff radcorW2.05Q20.7unpol.ao.dat radcorW2.05Q20.7unpol.ap.dat
gpg3:exclurad> wc -l radcorW2.05Q20.7unpol.ap.dat
420 radcorW2.05Q20.7unpol.ap.dat
gpg3:exclurad>
```

Run pythia as a test. The existing results are used to generate the following plots. Run with presumably (?) the following.

```
gfortran -g -fbounds-check eic2.f pythia6409.o -o eic2
submit_pythia.pl 400 5000
```

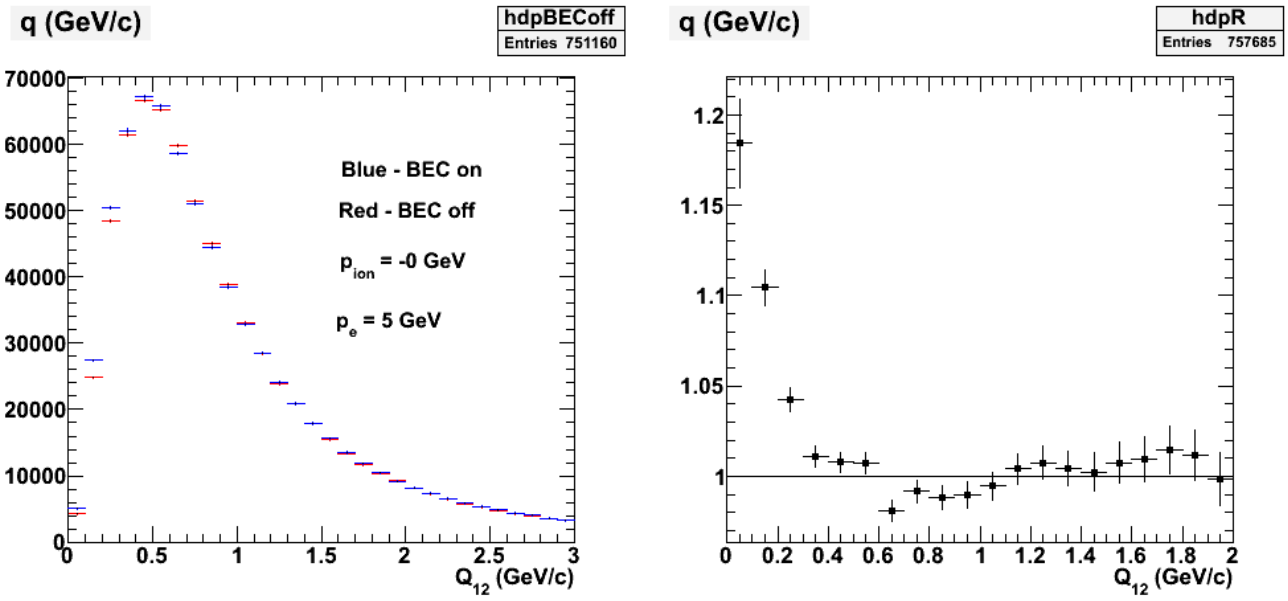


Fig 1. Plot of pythia results from files existing on the cluster from before the move. Used dphist2.C.

Click here to view the object (Root macro) you uploaded.

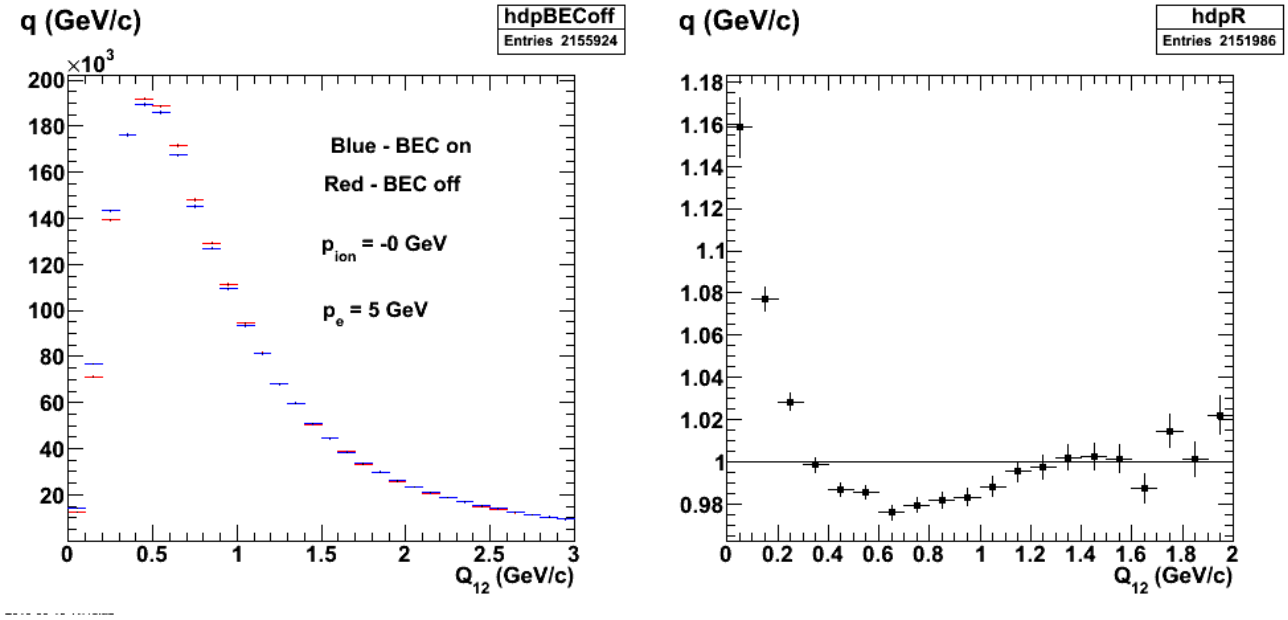


Fig 2. Same as fig 1, but run after the move from KC to richmond.

Click here to view the object (Root macro) you uploaded.

The plot below is a comparison of the old results (red) and new (black). There is a statistically significant difference between the two, but I am not completely convinced the new run is exactly the same as the old run. I may have used a different command for this old run (I got it out of my notes so it is not assured the command was exactly the same).

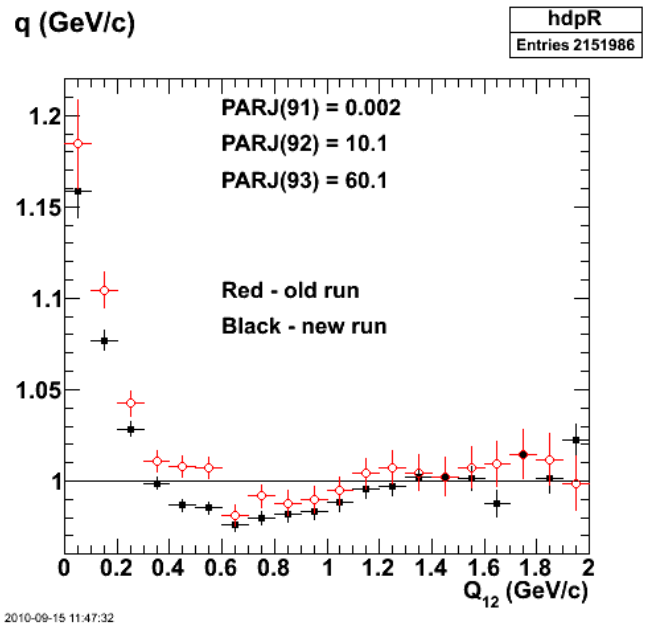


Fig 3. Comparison of R for old and new runs.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 333 - Testing effect of shape of BEC (gpg)

[Modified Wed Sep 22 16:07:44 2010 (GMT) gpg]

The following are attempts to see any effect associated with different longitudinal and tranverse shapes of the BEC source. For Fig 1 the following parameters were used. There is little difference between this and the previous version that had no source asymmetry as shown in Fig 2 and entry 332.

The results below are ALL for EIC kinematics with p_e=11 GeV and p_{ion}=-60 GeV. Ignore the labelling on the plots.

```
c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             PARJ(91) = 0.02
             PARJ(92) = 0.8
             PARJ(93) = 0.2
             PARJ(94) = 0.0
c            PARJ(95) = 0.02
c            PARJ(96) = 0.02

c parameters to vary the longitudinal and transverse size of the BEC.

             MSTJ(2)=4
             PARJ(22)=3.0

          endif
```

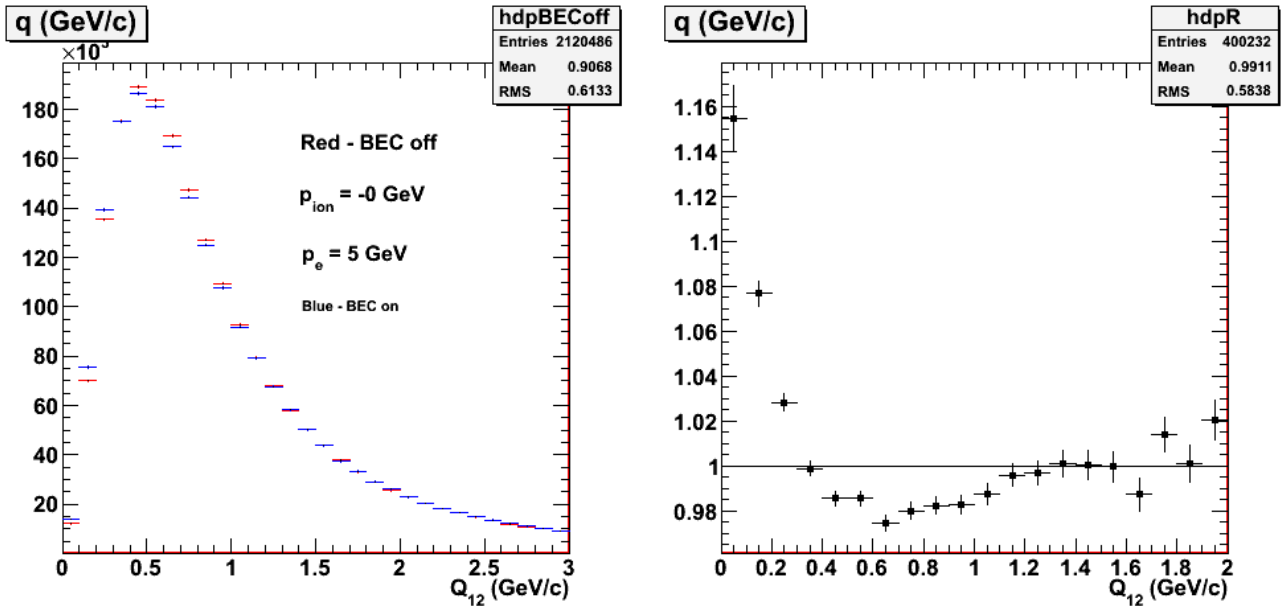


Fig 1. R with different parameters to change the BEC source shape.

Click here to view the object (Root macro) you uploaded.

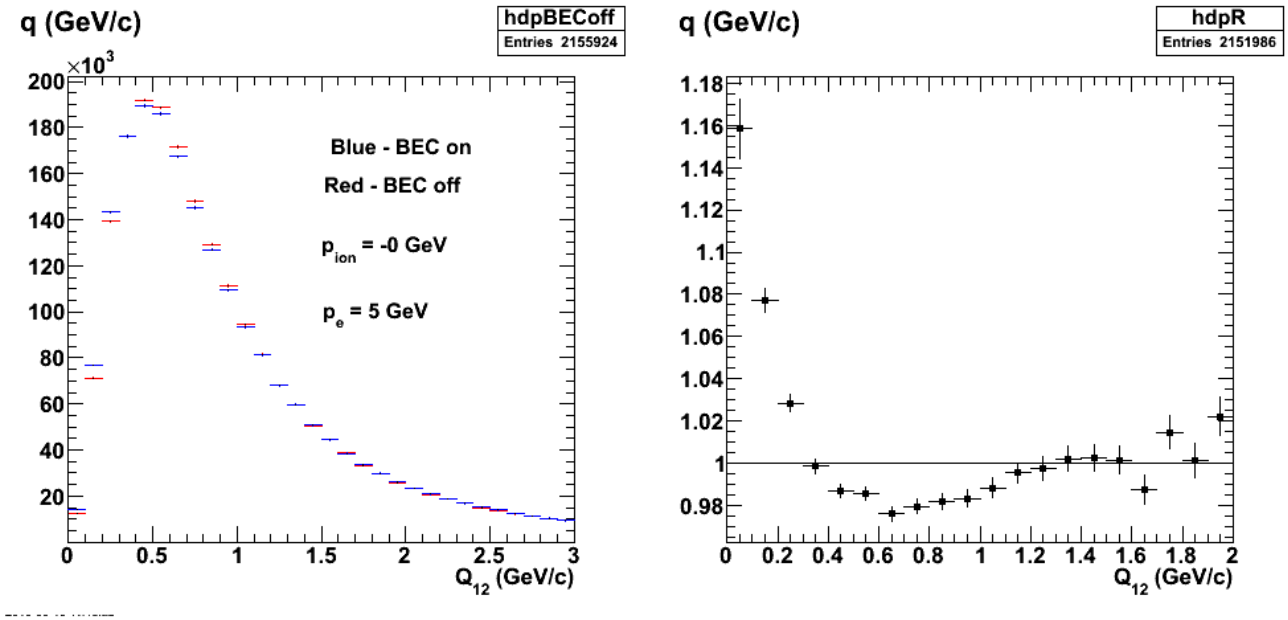


Fig 2. Same as fig 1, but run after the move from KC to richmond.

Click here to view the object (Root macro) you uploaded.

Apply different relative momenta for transverse and longitudinal directions.

```
c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             PARJ(91) = 0.02
             PARJ(92) = 0.8
             PARJ(93) = 0.2
             PARJ(94) = 0.0
c            PARJ(95) = 0.02
c            PARJ(96) = 0.02

c parameters to vary the longitudinal and transverse size of the BEC.

             MSTJ(1)=2
             MSTJ(2)=4
             PARJ(22)=10.0

          endif
```

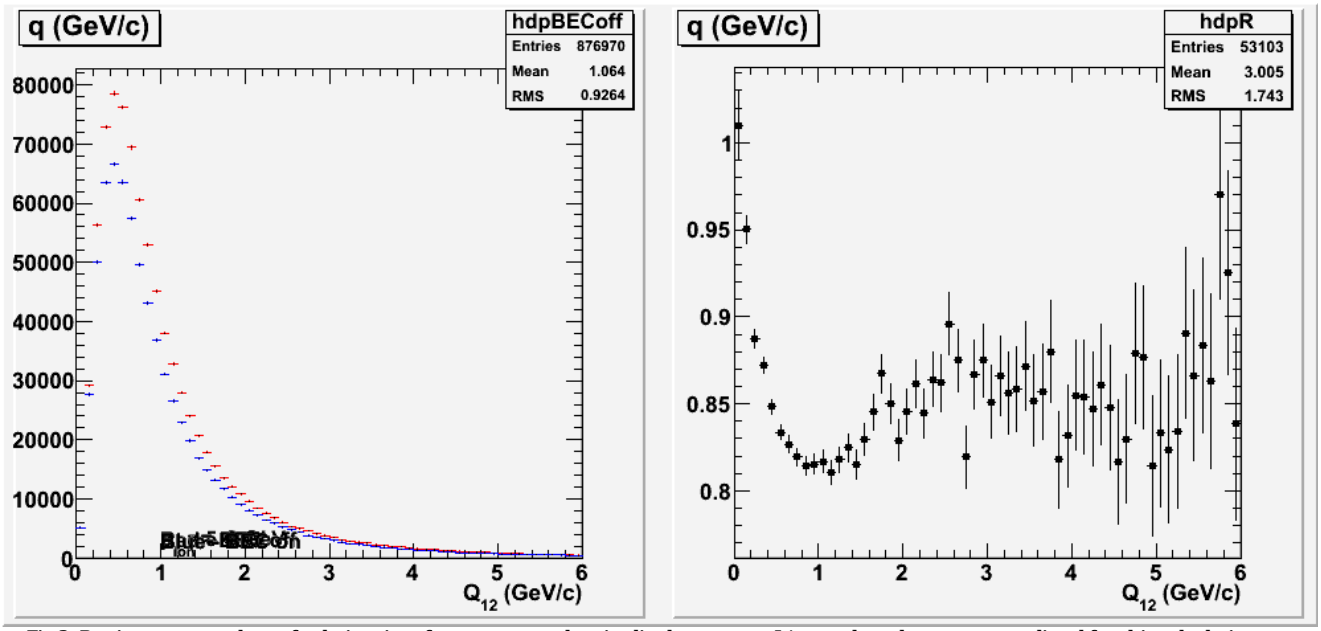


Fig 3. Put in extreme values of relative size of transverse vs. longitudinal momenta. It's not clear the parameters listed for this calculation are correct. I had hoped to reproduce the narrow R distribution, but could not using the listed parameters.

Click here to view the object (Root macro) you uploaded.

Use a less extreme value for the ratio of transverse to longitudinal momenta.

```
c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             PARJ(91) = 0.02
             PARJ(92) = 0.8
             PARJ(93) = 0.2
             PARJ(94) = 0.0
c            PARJ(95) = 0.02
c            PARJ(96) = 0.02

c parameters to vary the longitudinal and transverse size of the BEC.

             MSTJ(1)=2
             MSTJ(2)=4
             PARJ(22)=1.5

          endif
```

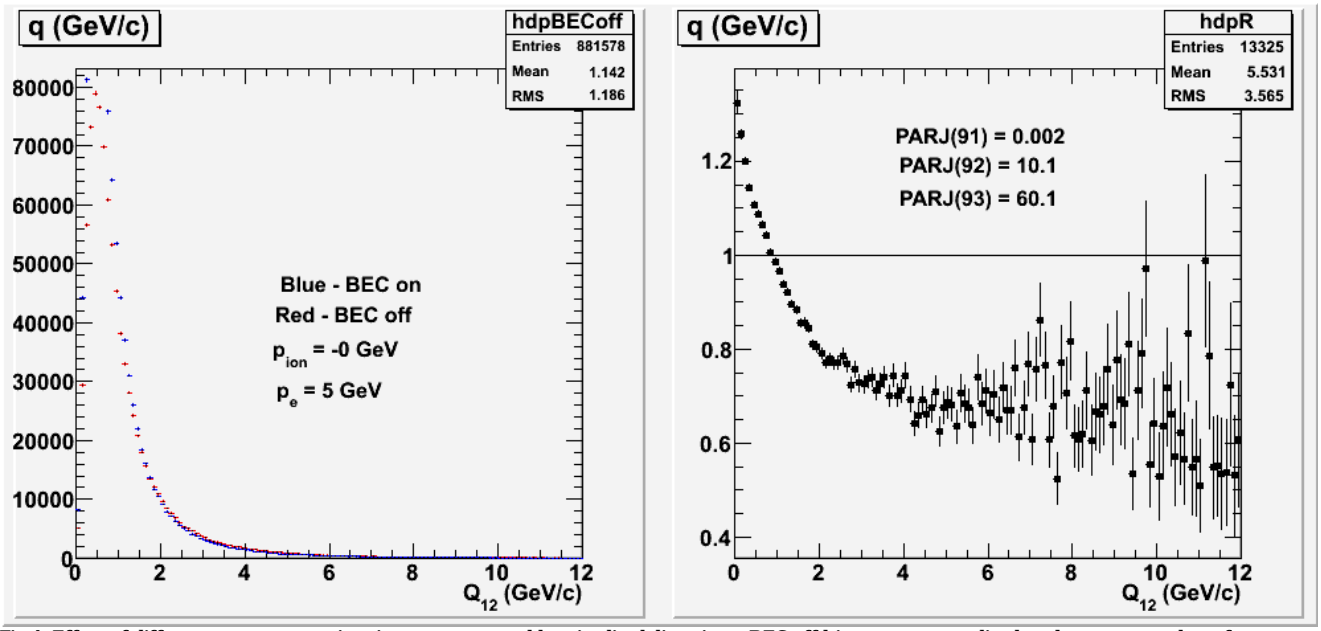


Fig 4. Effect of different momentum sizes in transverse and longitudinal directions. BEC off histogram normalized to the same number of events as BEC on.

Use an algorithm where the 'jet' comes from a single quark which is more consistent with our eg2 view of what is happening.

```
c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             PARJ(91) = 0.02
             PARJ(92) = 0.8
             PARJ(93) = 0.2
             PARJ(94) = 0.0
c            PARJ(95) = 0.02
c            PARJ(96) = 0.02

c parameters to vary the longitudinal and transverse size of the BEC.

             MSTJ(1)=2
             MSTJ(2)=2
             PARJ(22)=1.5

          endif
```

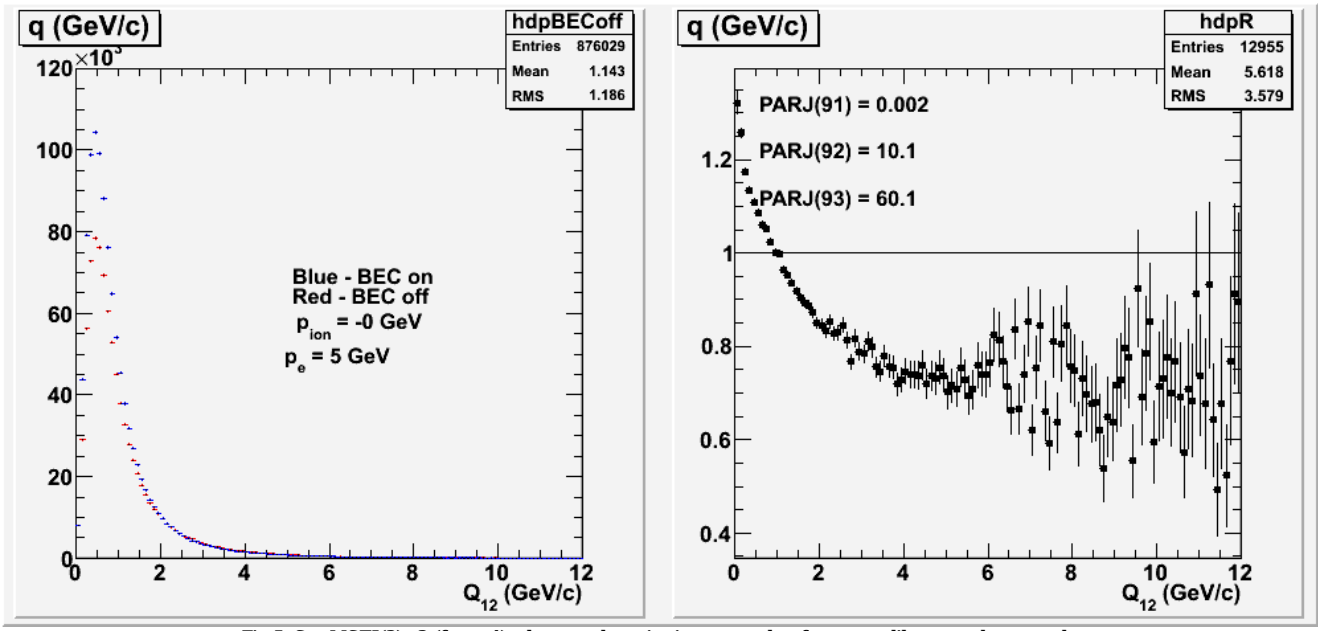


Fig 5. Set MSTJ(2)=2 (from 4) where a gluon jet is assumed to fragment like a random quark.

Click here to view the object () you uploaded.

Put in momentum imbalance compensation. The calculations above had no explicit conservation of any kind. See documentation for MSTJ(3) in pythia manual.

```
c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             PARJ(91) = 0.02
             PARJ(92) = 0.8
             PARJ(93) = 0.2
             PARJ(94) = 0.0
c            PARJ(95) = 0.02
c            PARJ(96) = 0.02

c parameters to vary the longitudinal and transverse size of the BEC.

             MSTJ(1)=2
             MSTJ(2)=2
             MSTJ(3)=1
             PARJ(22)=1.5

          endif
```

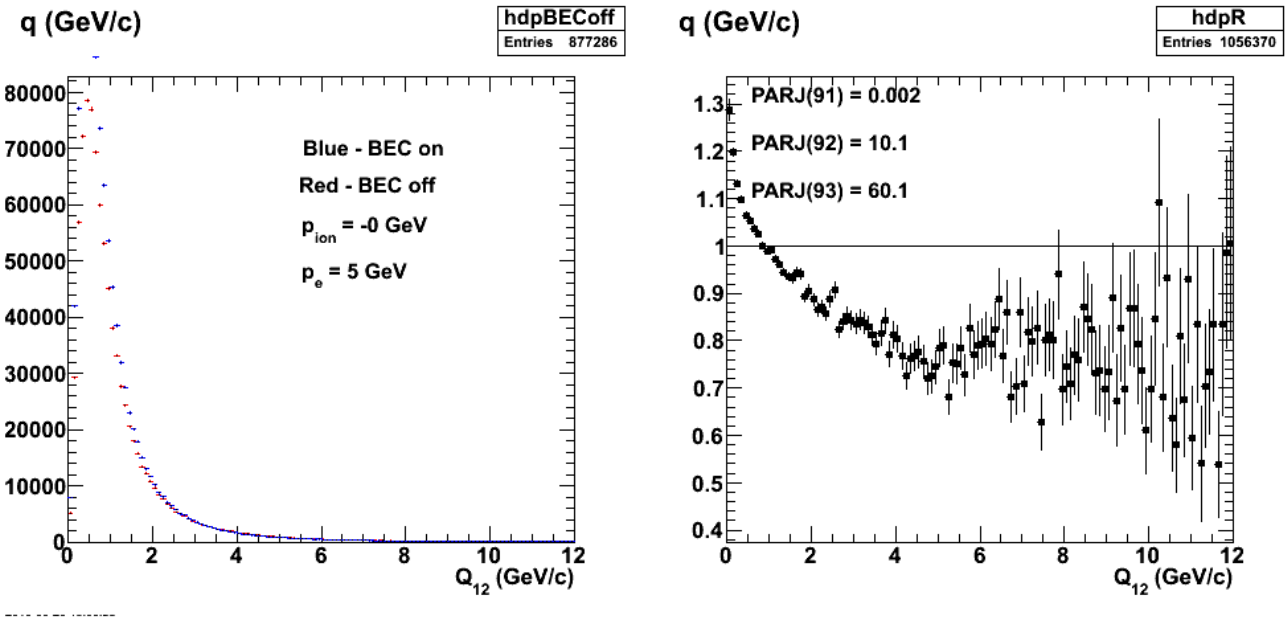


Fig 6. SetMSTJ(3)=1 (default=0) to put in momentum imbalance compensation.

Click here to view the object (Root macro) you uploaded.

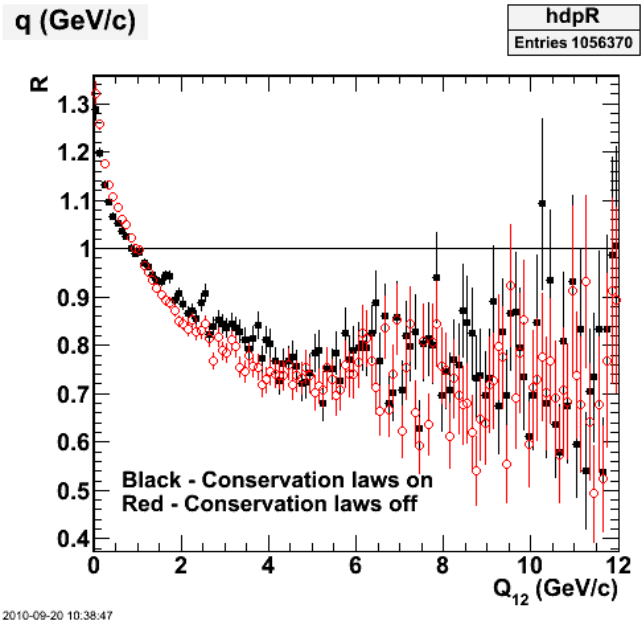


Fig 7. Effect of including energy, momentum, and flavor conservation in BEC calculations using MSTJ(3)=1.

Click here to view the object (Root macro) you uploaded.

Turn off the asymmetric fragmentation and compare with the original calculation in fig 1 using the Lund model (i.e.MSTJ(1)=1 instead of 2.

```
c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             PARJ(91) = 0.02
             PARJ(92) = 0.8
             PARJ(93) = 0.2
             PARJ(94) = 0.0
c            PARJ(95) = 0.02
```

```
c            PARJ(96) = 0.02

c parameters to vary the longitudinal and transverse size of the BEC.

             MSTJ(1)=1
             MSTJ(2)=2
             MSTJ(3)=1
             PARJ(22)=1.5

          endif
```

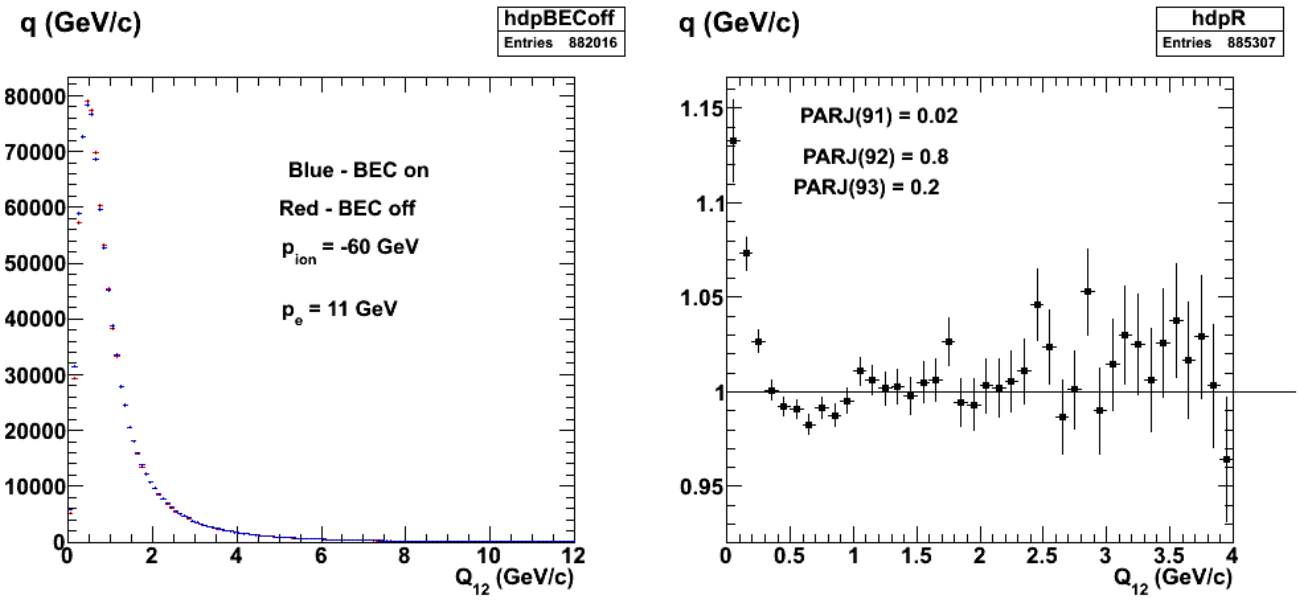


Fig 8. Turn off asymmetric emission to compare with Lund model results in Fig 1.

Click here to view the object (Root macro) you uploaded.

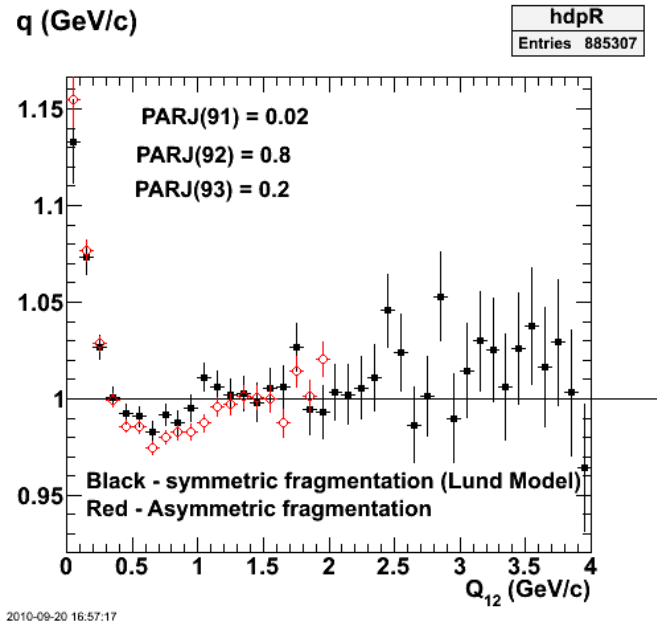


Fig 9. Check on reporducing the Lund model.

Click here to view the object (Root macro) you uploaded.

Set the asymmetry to zero and compare with Lund results above.

```
c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
```

```
            MSTJ(54) = 2
            MSTJ(55) = 0
            MSTJ(56) = 0
            MSTJ(57) = 1

            PARJ(91) = 0.02
            PARJ(92) = 0.8
            PARJ(93) = 0.2
            PARJ(94) = 0.0
c           PARJ(95) = 0.02
c           PARJ(96) = 0.02

c parameters to vary the longitudinal and transverse size of the BEC.

            MSTJ(1)=2
            MSTJ(2)=2
            MSTJ(3)=1
            PARJ(22)=1.0

         endif
```

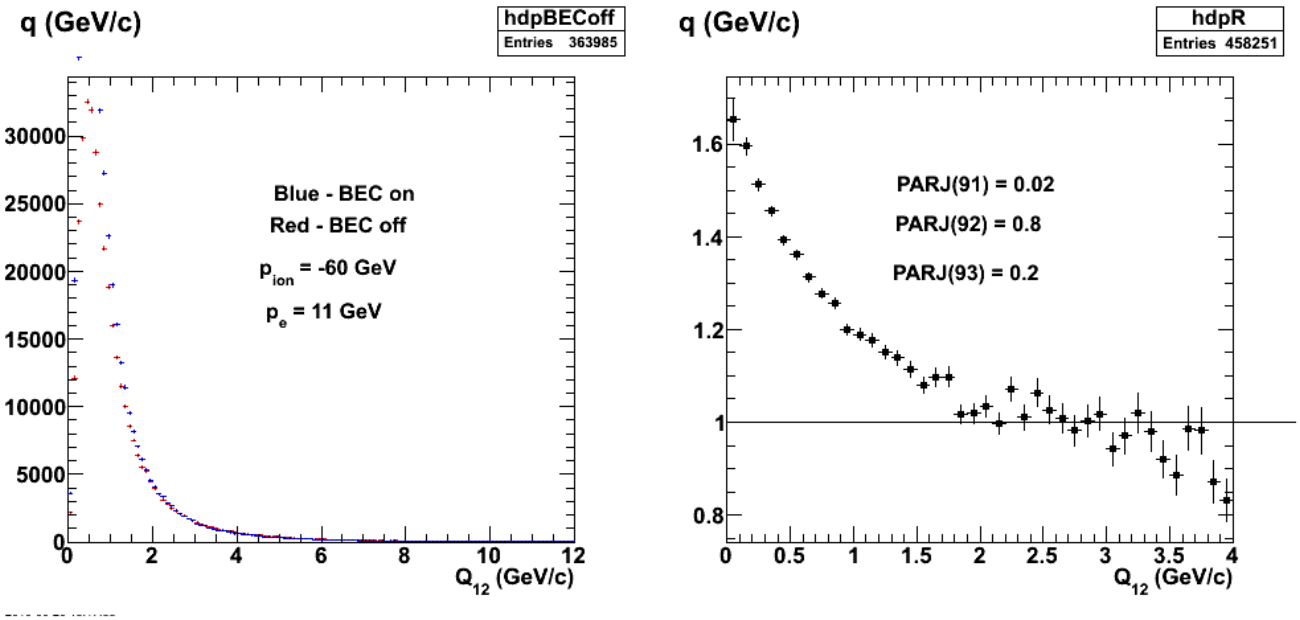


Fig 10. Set the asymmetry to zero

Click here to view the object (Root macro) you uploaded.

Try and reproduce some of the plots above where the width of the correlation region is much smaller.

```
c turn on BEC parameters

         if (BECswitch .eq. '2') then
            print *,'Setting Parameters for BEC.'
            MSTJ(51) = 1
            MSTJ(52) = 3
            MSTJ(53) = 0
            MSTJ(54) = 2
            MSTJ(55) = 0
            MSTJ(56) = 0
            MSTJ(57) = 1

            PARJ(91) = 0.02
            PARJ(92) = 0.8
            PARJ(93) = 0.12
            PARJ(94) = 0.0
c           PARJ(95) = 0.02
c           PARJ(96) = 0.02

c parameters to vary the longitudinal and transverse size of the BEC.

            MSTJ(1)=2
            MSTJ(2)=2
            MSTJ(3)=1
            PARJ(22)=10.0

         endif
```

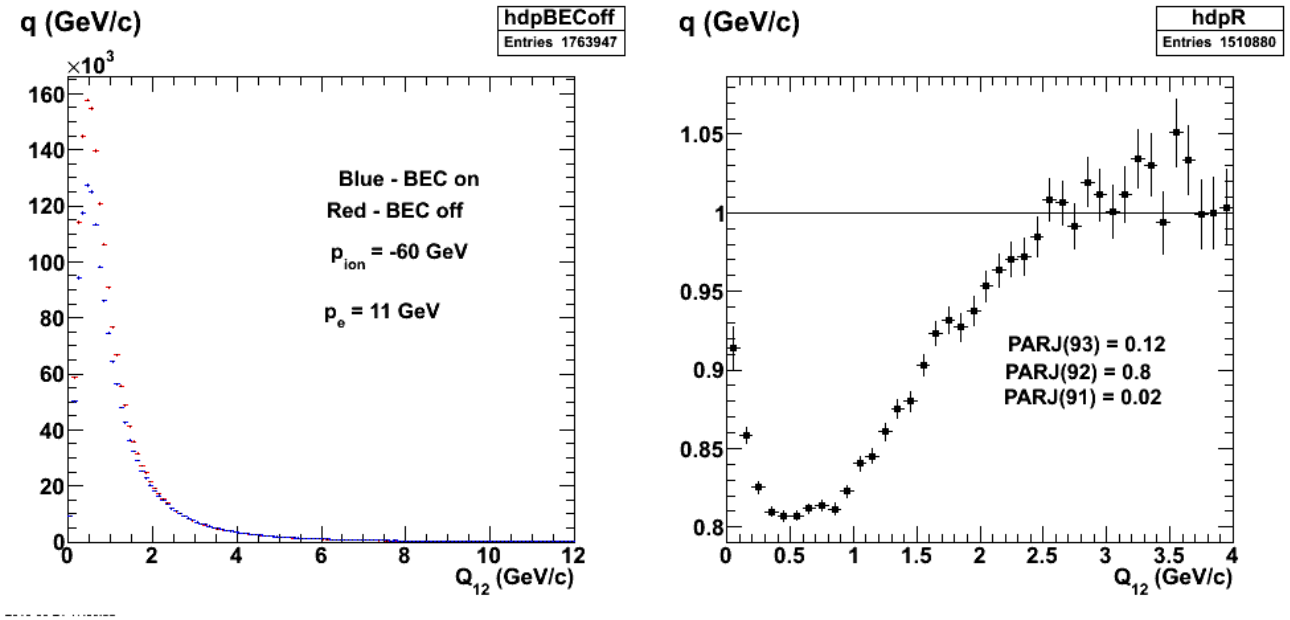


Fig 11. Try and get a narrow distribution like the results above when I used the Lund model, but using the user inputs.

Click here to view the object (Root macro) you uploaded.

A bit of a summary: Turning on the independent fragmentation scheme in pythia (and turning off the Lund model) creates very broad R distributions that do not look like the data from the LHC, ZEUS, or EG2. The independent fragmentation scheme does allow you to have an asymmetric momentum distribution (transverse versus longitudinal) which is, I believe, something we would like to observe at the EIC. It would be good to tune the independent fragmentation parameters to resemble the Lund model results for symmetric fragmentation, but I am having no success at doing that.

Another try at getting a narrow R distribution with independent fragmentation.

```
c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             PARJ(91) = 0.02
             PARJ(92) = 0.08
             PARJ(93) = 0.12
             PARJ(94) = 0.0
c            PARJ(95) = 0.02
c            PARJ(96) = 0.02

c parameters to vary the longitudinal and transverse size of the BEC.

             MSTJ(1)=2
             MSTJ(2)=4
             MSTJ(3)=1
             PARJ(22)=1.5
             PARJ(43)=0.05

          endif
```

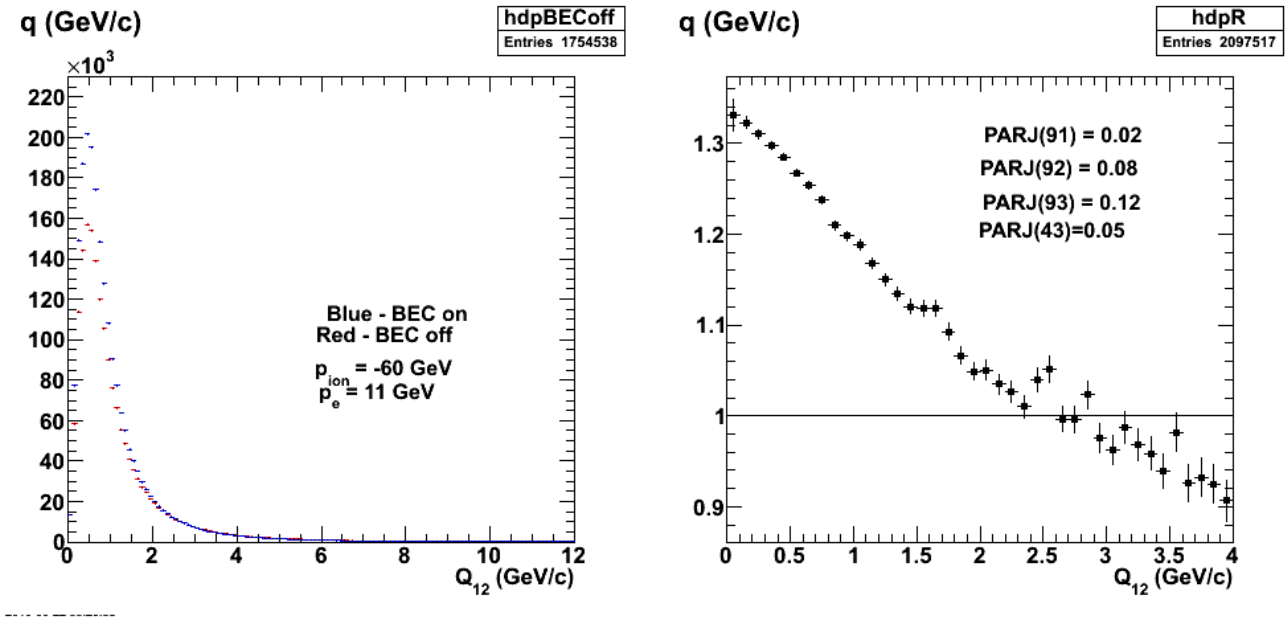


Fig 12. Take a shot at adjusting the *a* and *b* of the symmetric Lund fragmentation scheme. Make *a* real small.

Click here to view the object (Root macro) you uploaded.

Now make *a* real big.

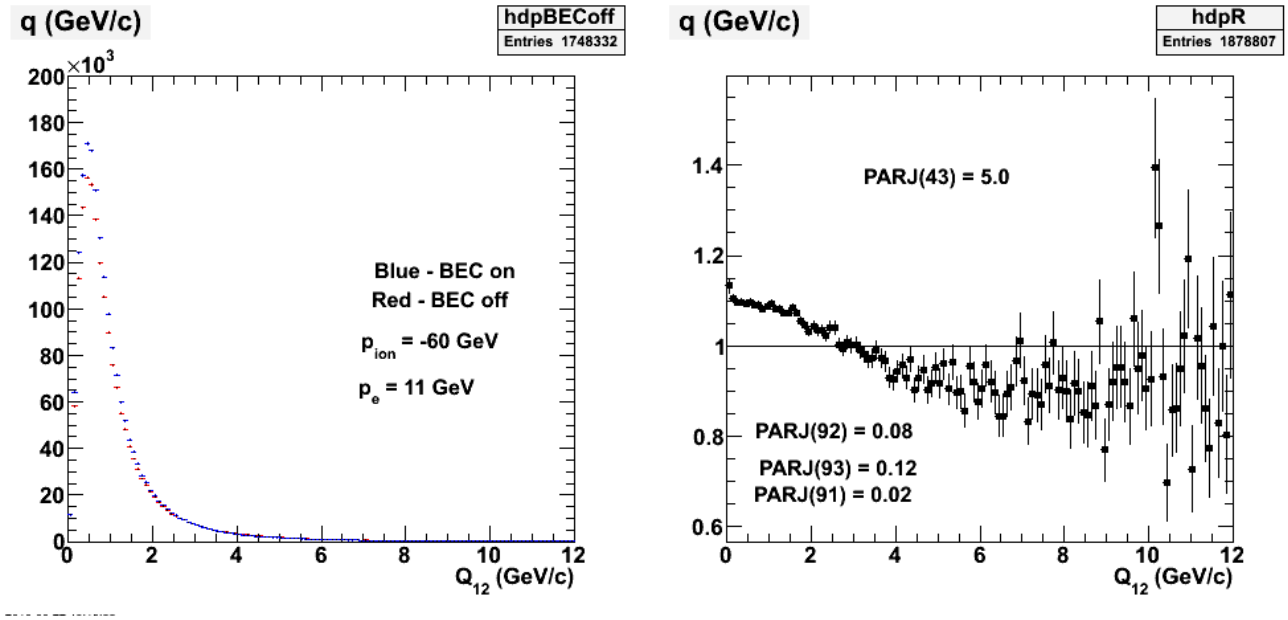


Fig 13. Make *a* real big.

Click here to view the object (Root macro) you uploaded.

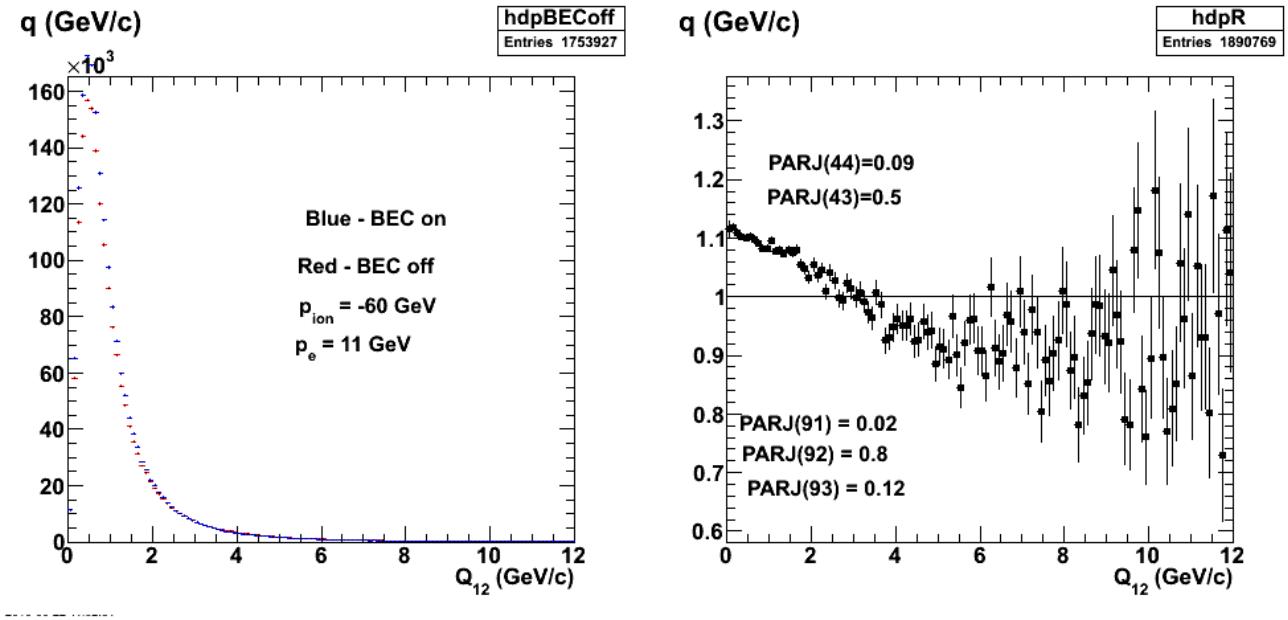


Fig 14. Mkae *b* real small.

Click here to view the object (Root macro) you uploaded.

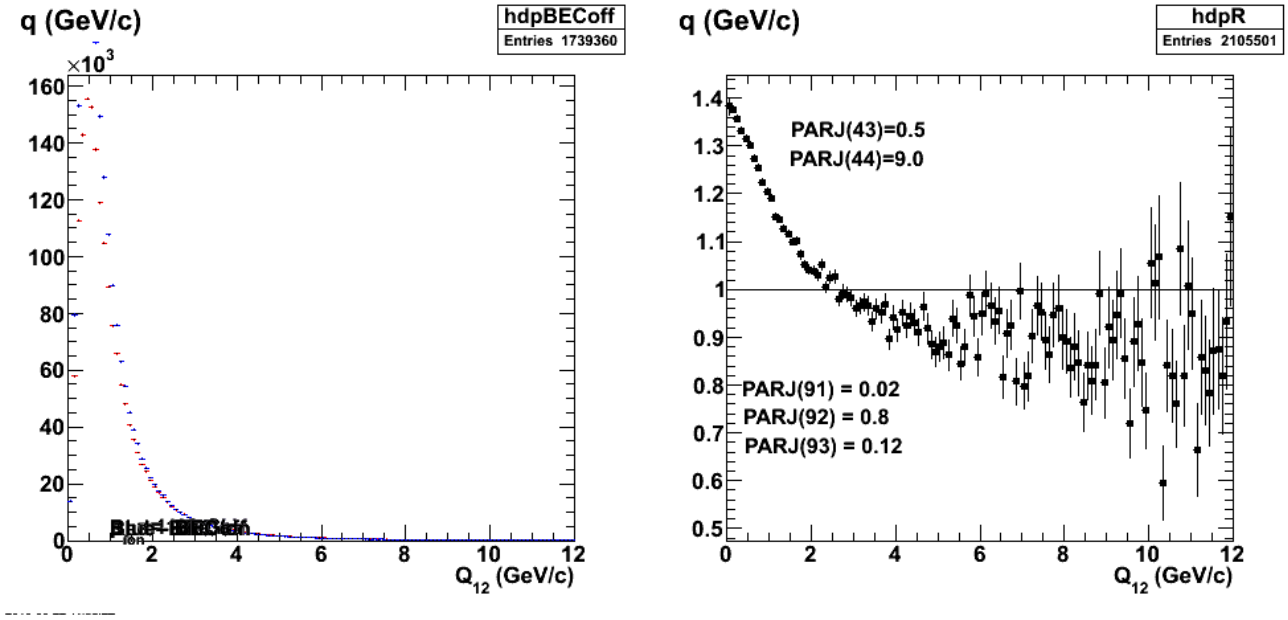


Fig 15. Make *b* real big.

Click here to view the object (Root macro) you uploaded.

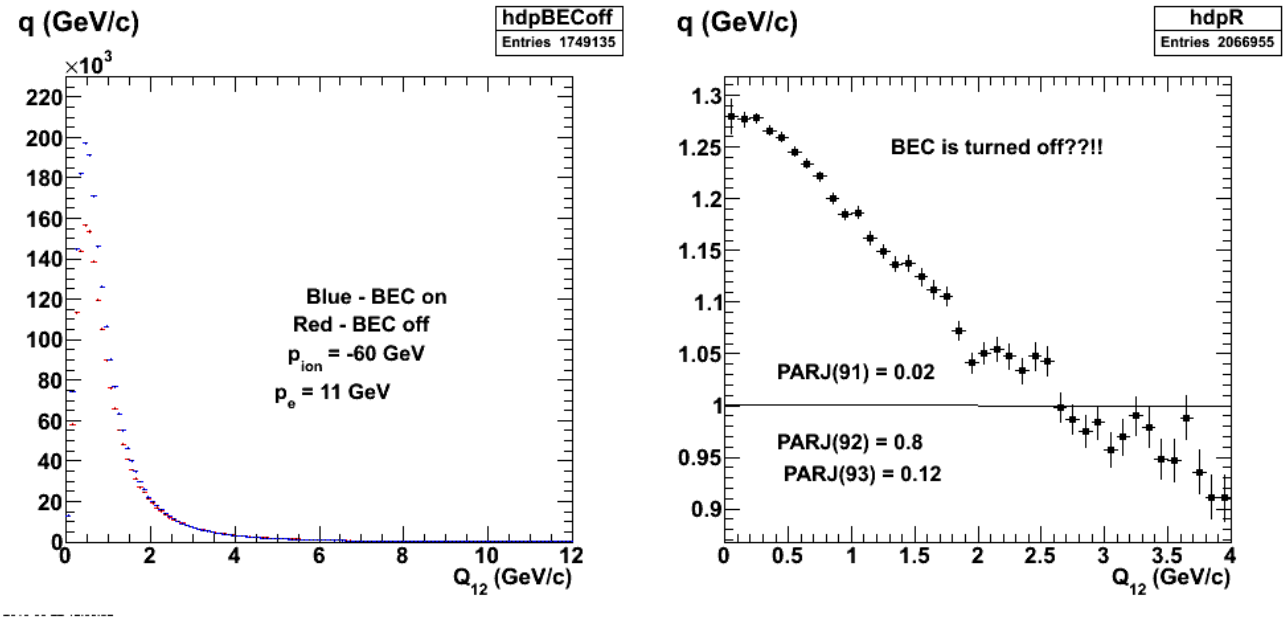


Fig 16. Turn off BEC and there is still a corrleation!!

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 334 - Effect of fragmentation asymmetry on BEC Correlation Function (GPG)

[Modified Fri Oct 1 17:03:34 2010 (GMT) GPG]

The plots below were done after discovering the bug in the analysis code discussed in the previous entry. The hope here is that by varying the asymmetry of the momentum distribution of the gluon fragmentation function, we can some observable effect.

```
c turn on independent fragmentation parameters to vary the longitudinal and transverse size of the BEC.

             MSTJ(1)=2
             MSTJ(2)=4
             MSTJ(3)=1
             PARJ(22)=1.0
             PARJ(43)=0.5
             PARJ(44)=0.9

c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             PARJ(91) = 0.02
             PARJ(92) = 0.8
             PARJ(93) = 0.12
c            PARJ(94) = 0.0
c            PARJ(95) = 0.02
c            PARJ(96) = 0.02

          else
             print *,'No BEC.'
          endif
```

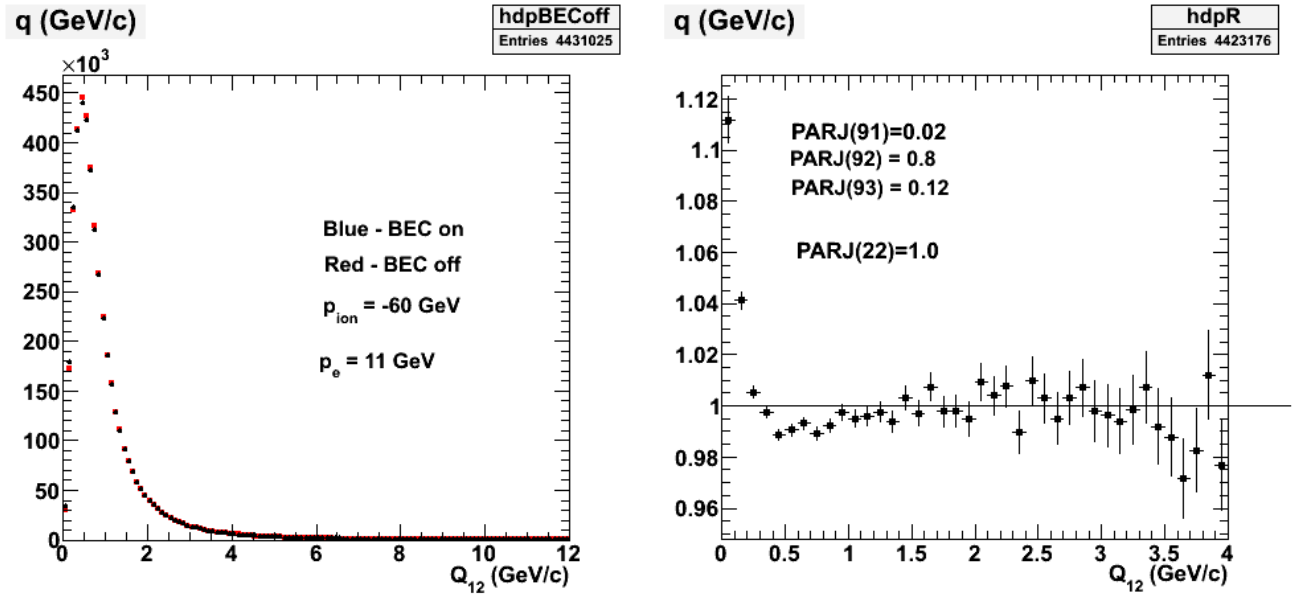


Fig 1. Correlation function with PARJ(22)=1.0 (no asymmetry).

Click here to view the object (Root macro) you uploaded.

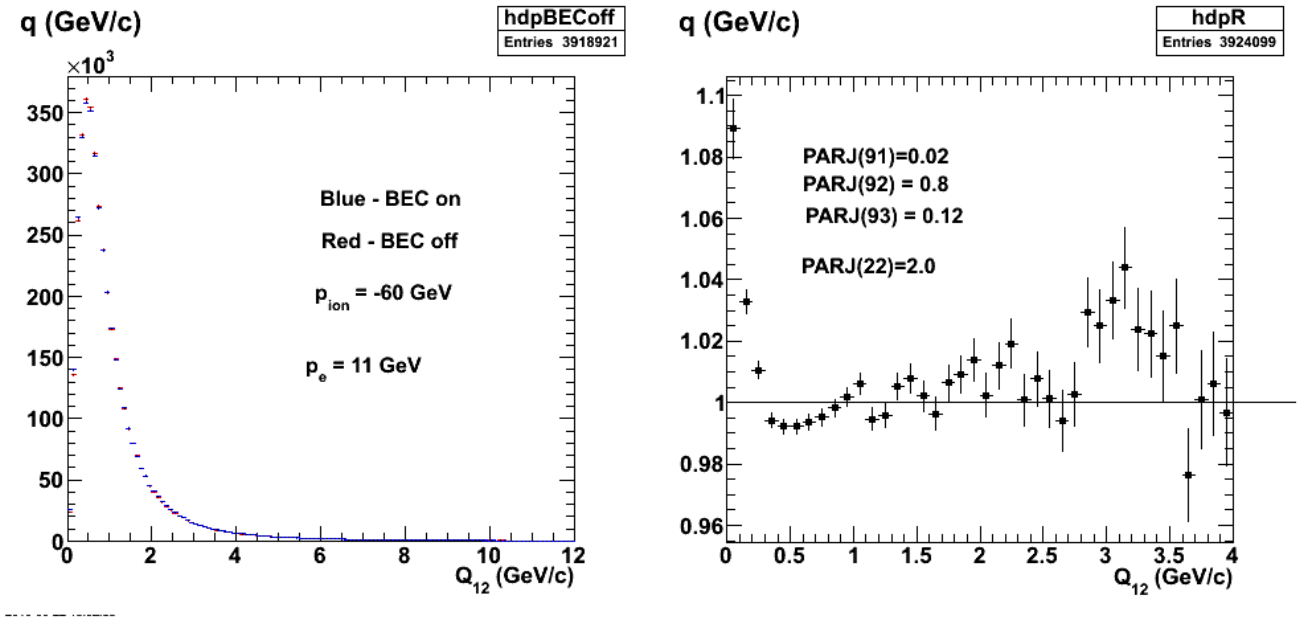


Fig 2. Correlation function with PARJ(22)=2.0.

Click here to view the object (Root macro) you uploaded.

The fragmentation asymmetry appears to have no effect.

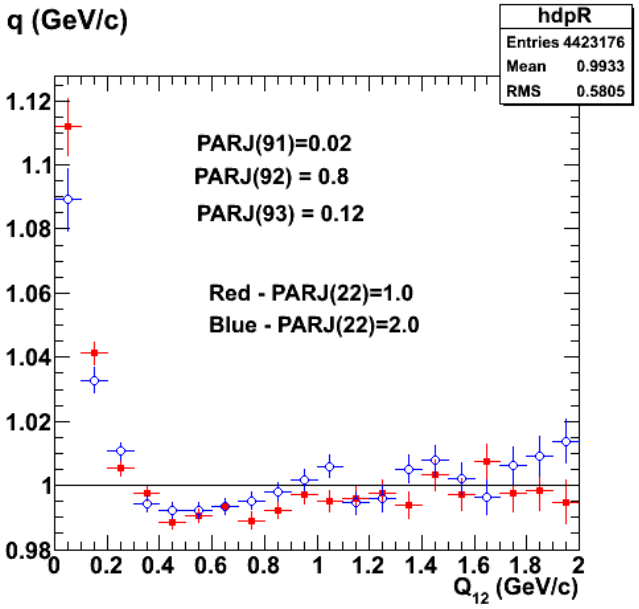


Fig 3. Comparison of R with different momentum asymmetries.

Click here to view the object (Root macro) you uploaded.

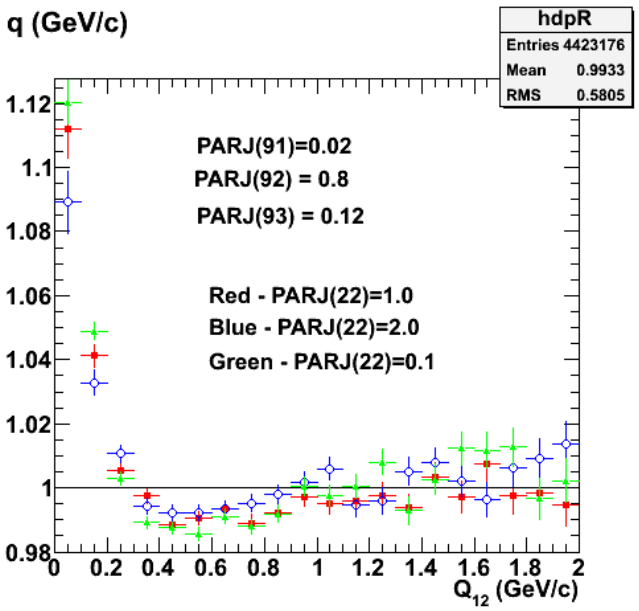


Fig 4. Now shrink the asymmetry.

Click here to view the object (Root macro) you uploaded.

Now go back to the ZEUS parameters and do the ZEUS kinematics.

```
c turn on independent (MSTJ(1)=2) fragmentation parameters to vary the longitudinal and transverse size of the BEC.

            MSTJ(1)=1
c
c following parameters used for independent fragmentation.
c
c             MSTJ(2)=4
c             MSTJ(3)=1
c             PARJ(22)=0.1
c             PARJ(43)=0.5
c             PARJ(44)=0.9

c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             lambda=0.9
             R=0.9

             PARJ(91) = 0.02
             PARJ(92) = lambda
             PARJ(93) = 0.2/R
c            PARJ(94) = 0.0
c            PARJ(95) = 0.02
c            PARJ(96) = 0.02

          else
             print *,'No BEC.'
          endif
```

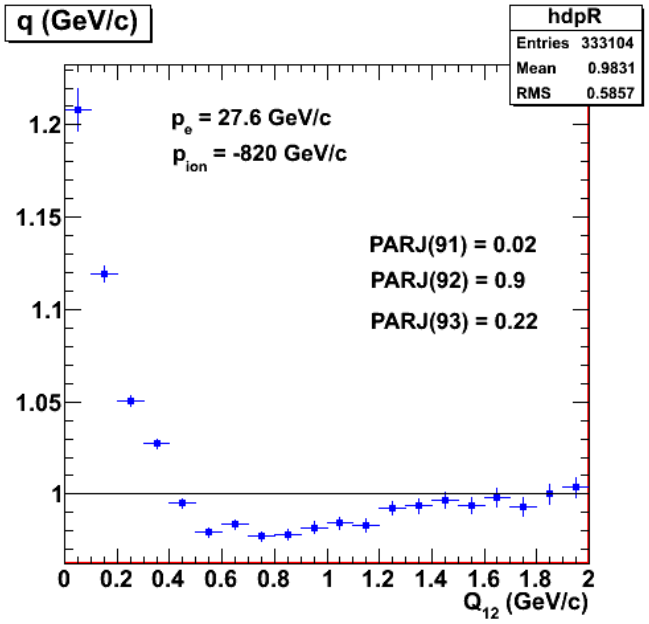


Fig 5. Using ZEUS parameters for exponential BEC, pythia looks like the data.

Click here to view the object (Root macro) you uploaded.

Now go to EIC kinematics with the same parameters for the BEC.

```
c turn on independent (MSTJ(1)=2) fragmentation parameters to vary the longitudinal and transverse size of the BEC.

            MSTJ(1)=1
c
c following parameters used for independent fragmentation.
c
c             MSTJ(2)=4
c             MSTJ(3)=1
c             PARJ(22)=0.1
c             PARJ(43)=0.5
c             PARJ(44)=0.9

c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             lambda=0.9
             R=0.9

             PARJ(91) = 0.02
             PARJ(92) = lambda
             PARJ(93) = 0.2/R
c            PARJ(94) = 0.0
c            PARJ(95) = 0.02
c            PARJ(96) = 0.02

          else
             print *,'No BEC.'
          endif
```

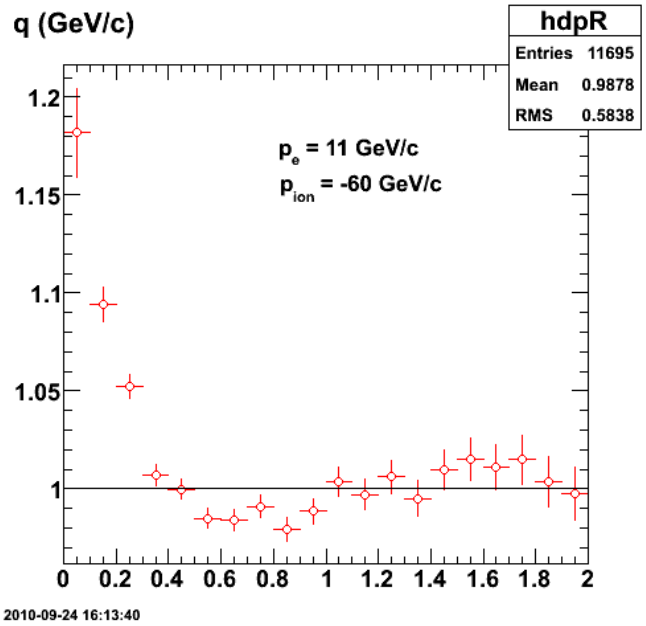


Fig 6. Correlation function at EIC kinematics with ZEUS BEC parameters.

Click here to view the object (Root macro) you uploaded.

Now go to CLAS6 kinematics. The BEC paramters are the same as the code in the previous two examples so I won't reproduce them here. The correlation has gone away in contradiction of Hayk's EG2 results. Is this a pythia problem? supposedly pythia uses a soft process (fragmentation) to produce the correlations which should be independent of Q2.

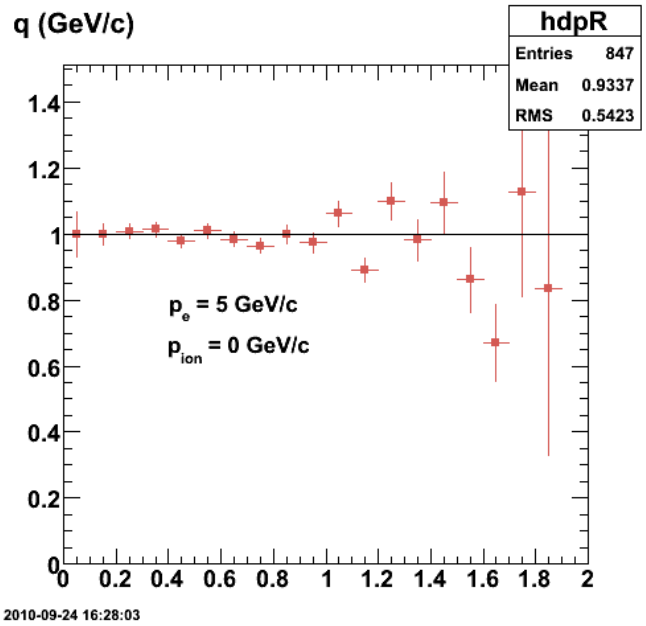


Fig 7. All hints of a correlation disappear at CLAS6 energies which is inconsistent with Hayk's results.

Click here to view the object (Root macro) you uploaded.

Set the FRAME option to FIXT in PYINIT to check pythia for running with a stationary target. In the calculations above I used 3MOM which corresponds to collider frame and set the momenta of the ion to zero for stationary targets. The results (shown below) are the same; no correlation.

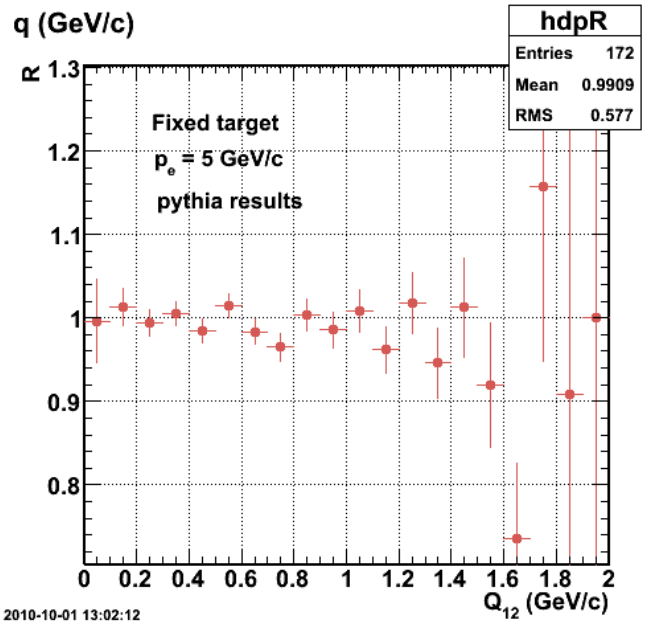


Fig 8. Run pythia with FIXT option in PYINIT and get the same result.

Click here to view the object (root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 335 - Study of transverse and longitudinal source size in Pythia (gpg)

[Modified Tue Oct 12 21:31:24 2010 (GMT) gpg]

Here we study the transverse/longitudinal properties of the BECs by boosting to the Longitudinal Center of Mass System (see eic3.f for the code). We use EIC kinematics (p_e=11 GeV, p_{ion}=-60 GeV) and the following input.

```
c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 0
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             lambda=0.9
             R=0.9

             PARJ(91) = 0.02
             PARJ(92) = lambda
             PARJ(93) = 0.2/R
c            PARJ(94) = 0.0
c            PARJ(95) = 0.02
c            PARJ(96) = 0.02

          else
             print *,'No BEC.'
          endif
```

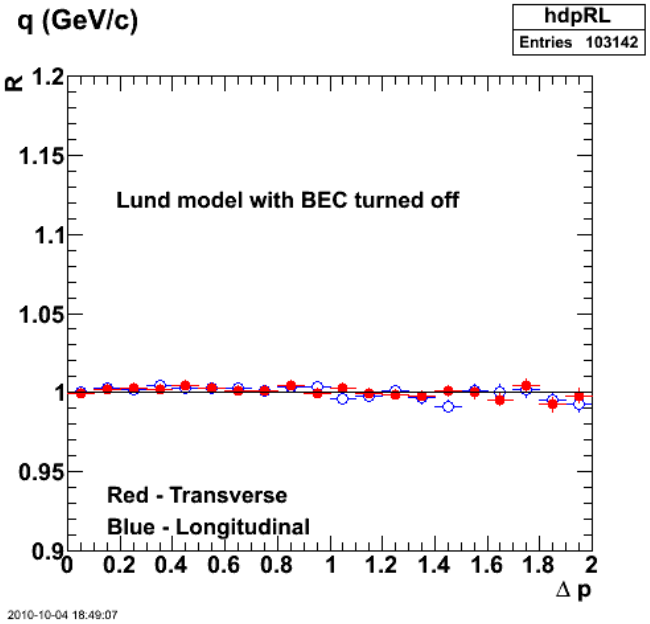


Fig 1. Run pythia with MSTP(51)=0 which turns off the BEC to check that things are ok.

Click here to view the object (Root macro) you uploaded.

Now turn on the BEC correlations and we get a pretty plot. The width of the longitudinal correlation is larger than the transverse one which has a larger incoherency.

```
c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             lambda=0.9
             R=0.9
```

```
               PARJ(91) = 0.02
               PARJ(92) = lambda
               PARJ(93) = 0.2/R
c              PARJ(94) = 0.0
c              PARJ(95) = 0.02
c              PARJ(96) = 0.02

            else
               print *,'No BEC.'
            endif
```

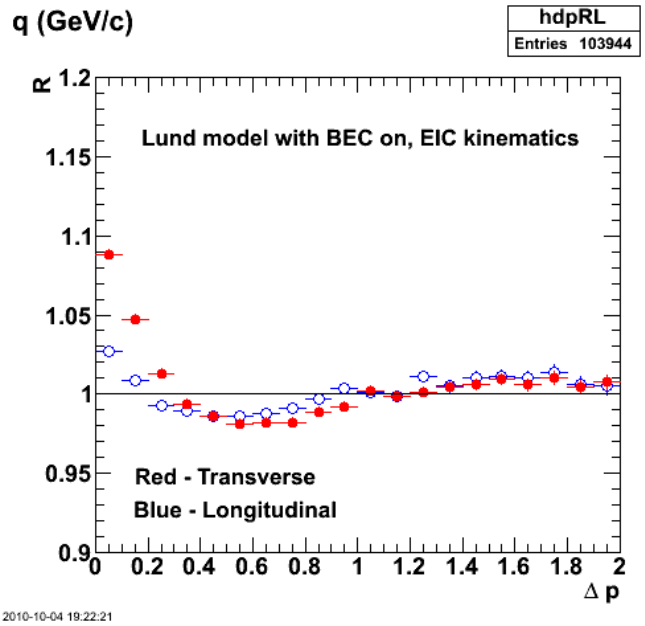


Fig 2. Now turn on the BEC and there is a spectacular difference between the transvers and longitudinal parts.

Click here to view the object (Root macro) you uploaded.

Now go to the independent fragmentation scheme. Start with symmetric LT momentum distributions.

```
c turn on independent (MSTJ(1)=2) fragmentation parameters to vary the longitudinal and transverse size of the BEC. MSTJ=1 -> Lund model.

               MSTJ(1)=2
c
c following parameters used for independent fragmentation.
c
               MSTJ(2)=4
               MSTJ(3)=1
               PARJ(22)=1.0
               PARJ(43)=0.5
               PARJ(44)=0.9

c turn on BEC parameters

            if (BECswitch .eq. '2') then
               print *,'Setting Parameters for BEC.'
               MSTJ(51) = 1
               MSTJ(52) = 3
               MSTJ(53) = 0
               MSTJ(54) = 2
               MSTJ(55) = 0
               MSTJ(56) = 0
               MSTJ(57) = 1

               lambda=0.9
               R=0.9

               PARJ(91) = 0.02
               PARJ(92) = lambda
               PARJ(93) = 0.2/R
c              PARJ(94) = 0.0
c              PARJ(95) = 0.02
c              PARJ(96) = 0.02

            else
               print *,'No BEC.'
            endif
```

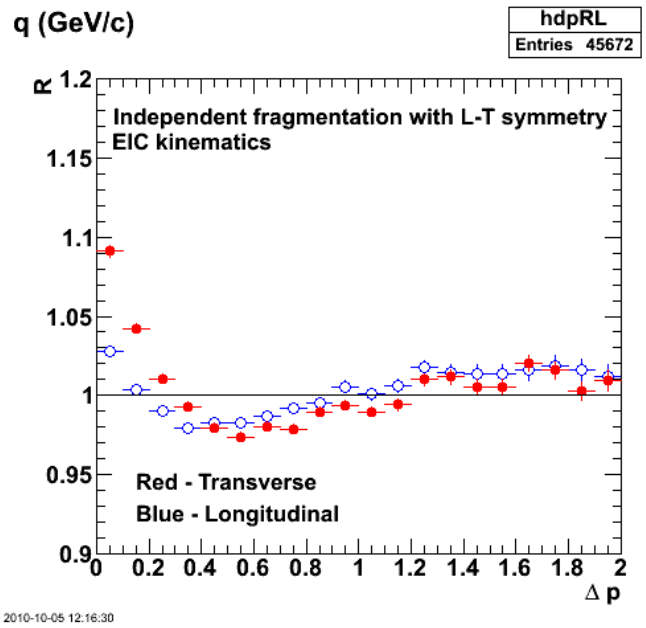


Fig 3. Comparison of R for L and T in LCMS and with independent fragmentation (IF) and symmetric L-T momentum distributions at EIC kinematics (p_e=11 GeV, p_{ion}=-60 GeV.

Click here to view the object (Root macro) you uploaded.

Now decrease the momentum asymmetry parameter by a factor of ten (PARJ(22)= 1.0->0.1).

```
c turn on independent (MSTJ(1)=2) fragmentation parameters to vary the longitudinal and transverse size of the BEC. MSTJ=1 -> Lund model.

             MSTJ(1)=2
c
c following parameters used for independent fragmentation.
c
             MSTJ(2)=4
             MSTJ(3)=1
             PARJ(22)=0.1
             PARJ(43)=0.5
             PARJ(44)=0.9

c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             lambda=0.9
             R=0.9

             PARJ(91) = 0.02
             PARJ(92) = lambda
             PARJ(93) = 0.2/R
c            PARJ(94) = 0.0
c            PARJ(95) = 0.02
c            PARJ(96) = 0.02

          else
             print *,'No BEC.'
          endif
```

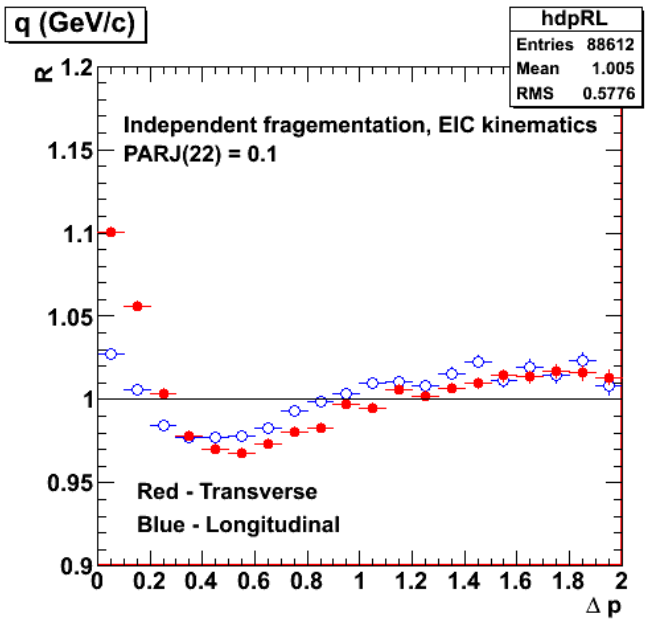


Fig 4. Drastically reduce the momentum asymmetry factor and there is little effect.

Click here to view the object (Root macro) you uploaded.

Same as above except make PARJ(22)=10.0 which is ten times bigger than the default value.

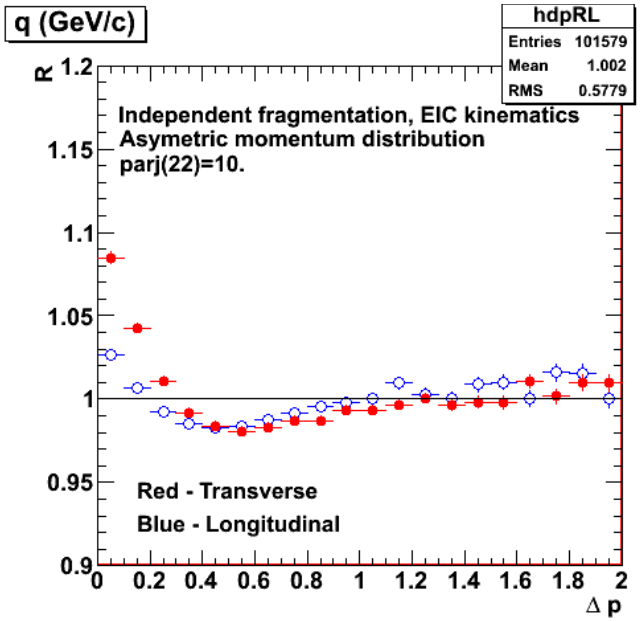


Fig 5. Drastically increase the asymmetry factor and there is still very little effect.

I am worried that I have not interpreted the definition of the LCMS correctly. It may be that the z-axis in the LCMS is along the direction of the 3-momentum transfer while I had assumed before it was along the jet axis which for a two-pion event would be the direction of the sum of the individual pion momenta. Below I have modified eic3.f to use this different definition and get drastically different looking correlations functions. These don't look like anything in the literature so I am guessing my first interpretation of the LCMS is the correct one.

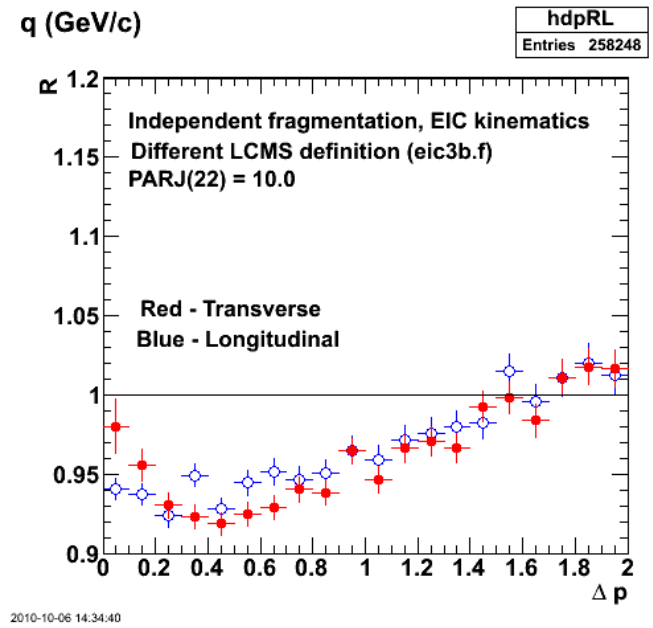


Fig 6. Same parameters as fig 5, but now with the redefined/re-interpreted LCMS.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (eic3b.f - Fortran code for running pythia for fig above.) you uploaded.

Redo the calculation for Figure 5 since I forgot to save the root macro.

```
             MSTJ(1)=2
c
c following parameters used for independent fragmentation.
c
             MSTJ(2)=4
             MSTJ(3)=1
             PARJ(22)=10.0
             PARJ(43)=0.5
             PARJ(44)=0.9

c turn on BEC parameters

          if (BECswitch .eq. '2') then
             print *,'Setting Parameters for BEC.'
             MSTJ(51) = 1
             MSTJ(52) = 3
             MSTJ(53) = 0
             MSTJ(54) = 2
             MSTJ(55) = 0
             MSTJ(56) = 0
             MSTJ(57) = 1

             lambda=0.9
             R=0.9

             PARJ(91) = 0.02
             PARJ(92) = lambda
             PARJ(93) = 0.2/R
c            PARJ(94) = 0.0
c            PARJ(95) = 0.02
c            PARJ(96) = 0.02
```

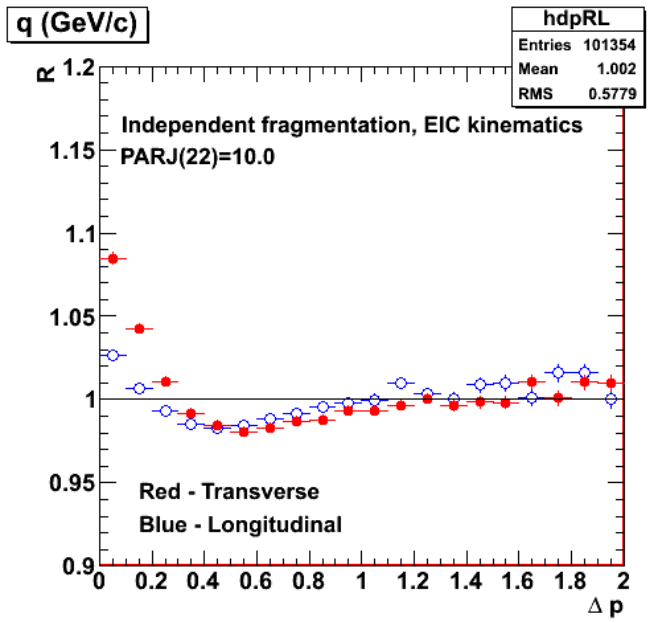
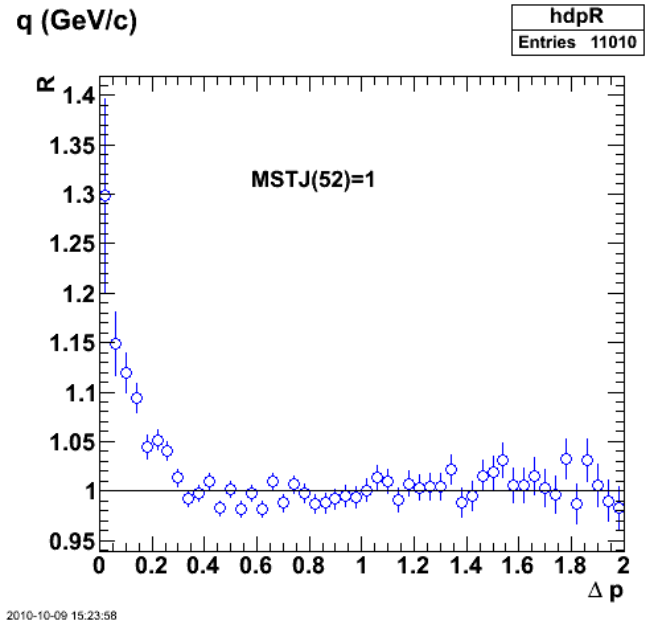
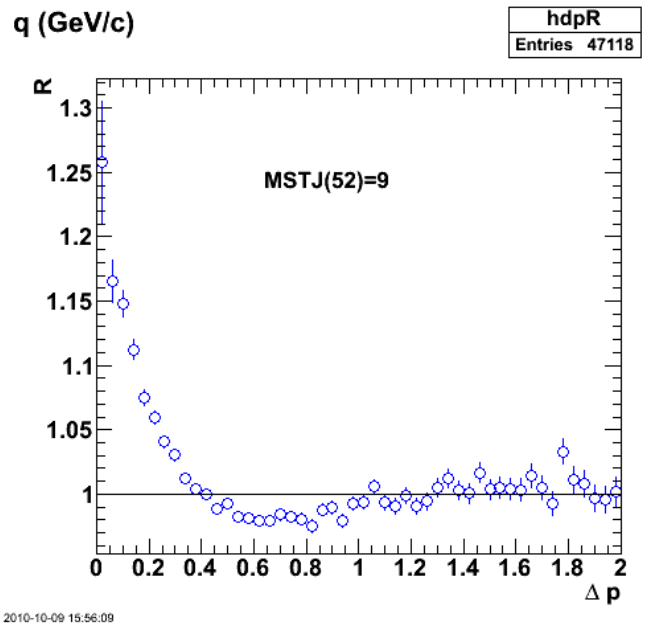


Fig 7. Same as figure 5, but I remembered to save the root macro this time.

Click here to view the object (Root macro) you uploaded.

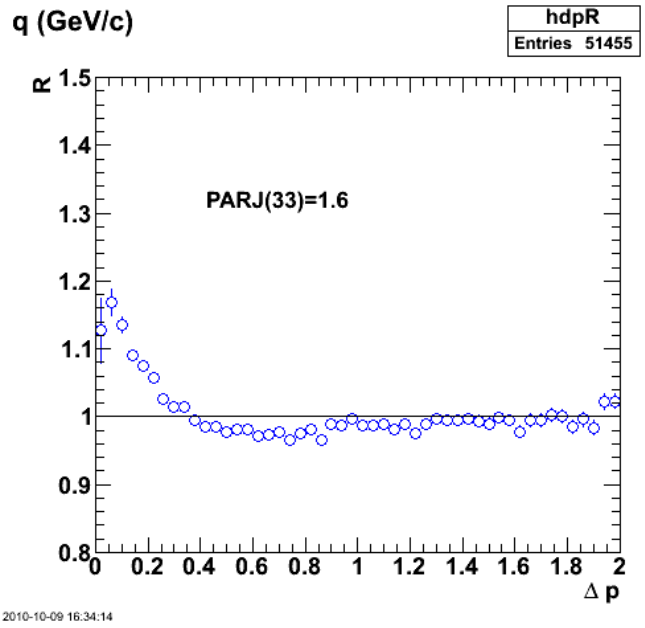


Click here to view the object (Root macro) you uploaded.



2010-10-09 15:56:09

Click here to view the object (Root macro) you uploaded.



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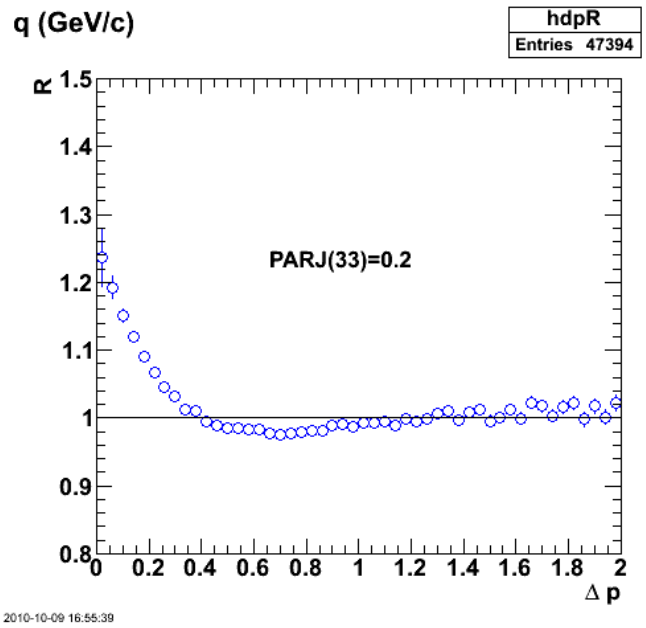
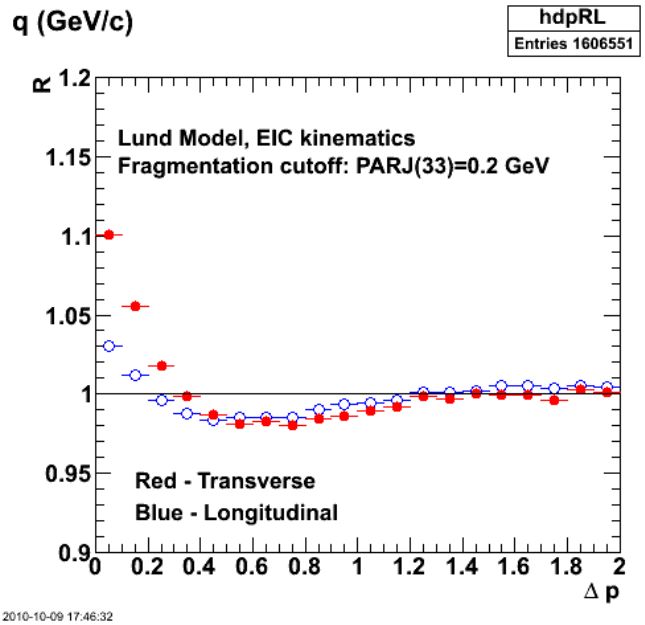


Click here to view the object (Root macro) you uploaded.



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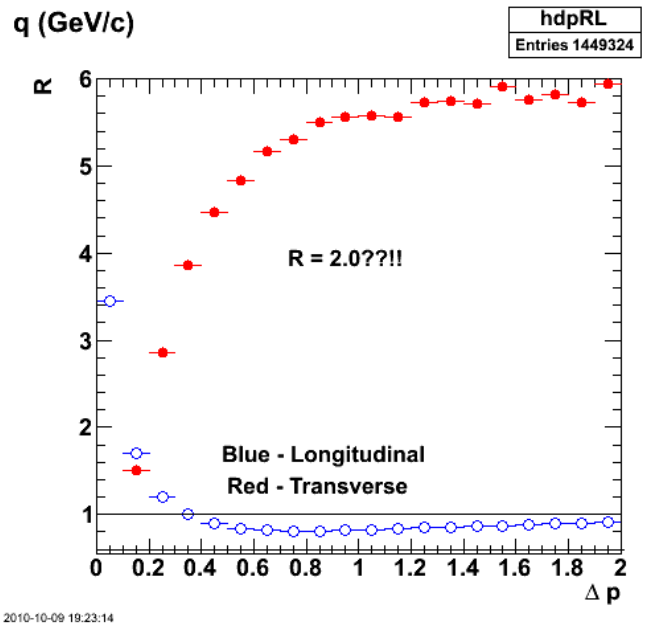


Click here to view the object (Root macro) you uploaded.

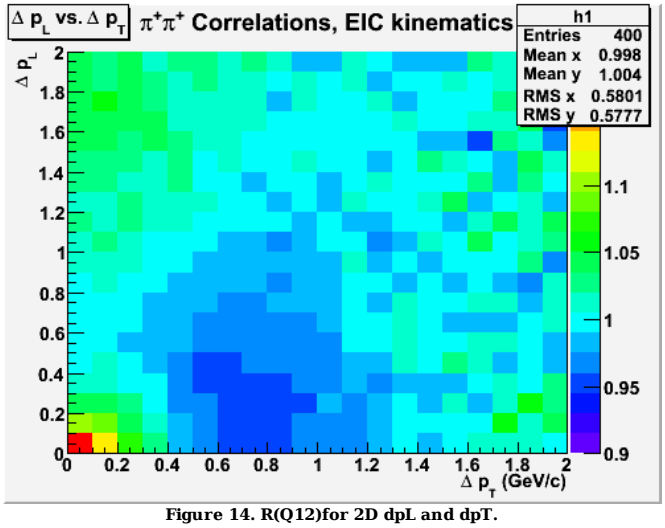


Figure 14. R(Q12)for 2D dpL and dpT.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 336 - Study of TOF NDE (gpg)

[Modified Fri Nov 19 20:55:19 2010 (GMT) gpg]

Take a renewed look at the TOF NDE for Mark Moog's DNP poster for fall, 2010. First look at the results are shown below. Clearly there are problems with the analysis in Socrat. This problem was seen before in entry 245.

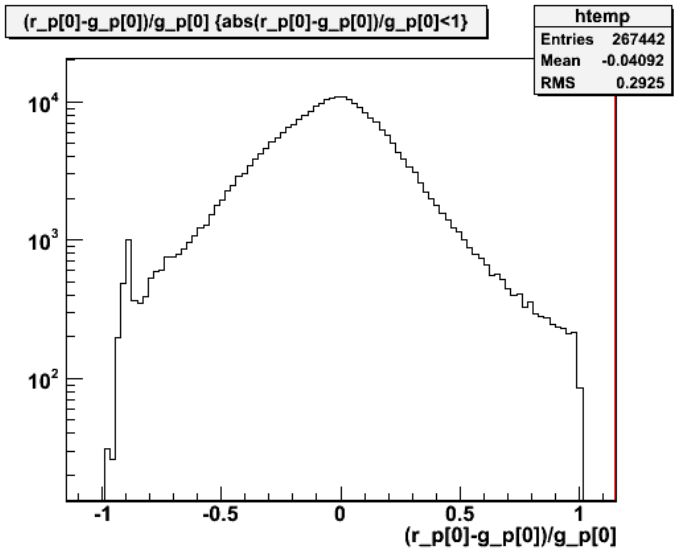


Fig 1. Momentum resolution in Socrat.

Click here to view the object (Root macro) you uploaded.

I moved all of the moog software for Scorat over to may area and changed the location of the torus field map in Read_TorusFM.h to /home/gilfoyle/nde/moog/run and ran a gemc output file on my directory on the master. It worked!!! The only hint from Socrat there was a problem was that I did not see the progress outputs as the file was read. No other warnings. That sucks. The resolution plot is below.

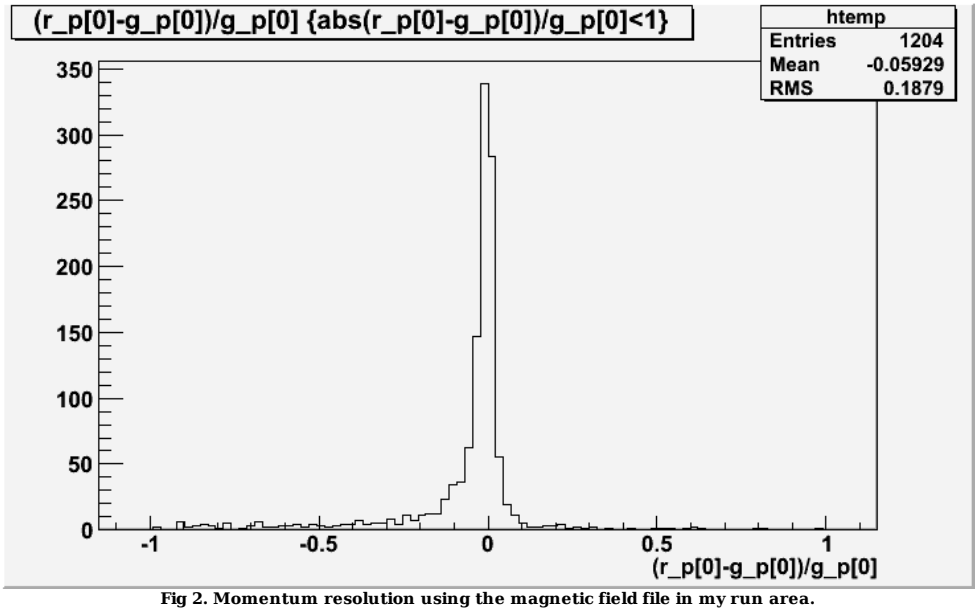


Fig 2. Momentum resolution using the magnetic field file in my run area.

Click here to view the object (Root macro) you uploaded.

Make massive changes to MM code to get it to reproduce the analysis I did from August, 2009. I abandoned Trees and inserted some histograms into Socrat.cxx. It seems to work.

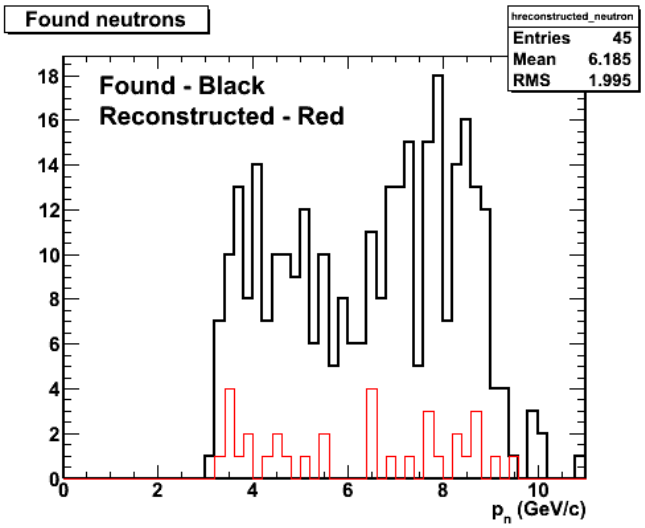
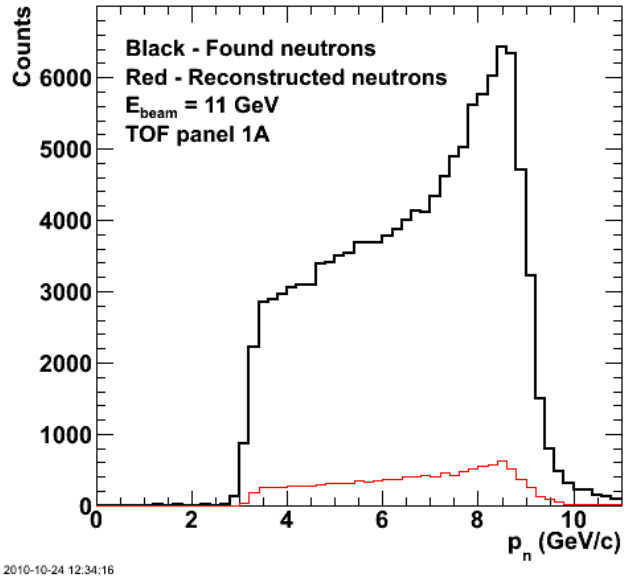


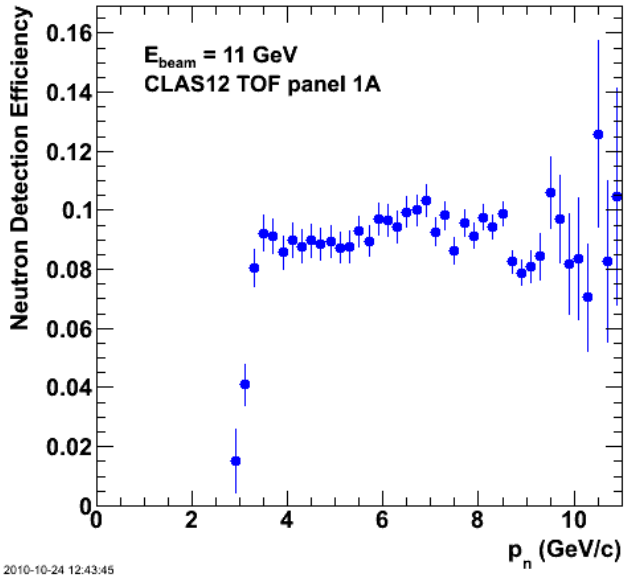
Fig 3. Comparison of found neutron tracks (black) with reconstructed ones (red). The ratio of events is 45/319.

Click here to view the object (Root macro) you uploaded.

Do a full stats simulation and get the following. It looks reasonable.



Click here to view the object (Root macro for lhs) you uploaded.



Click here to view the object (Root macro for rhs) you uploaded.

Fig 4. Final plots for MM for tofp1a of momentum spectrum (lhs) and NDE (rhs).

Random views.

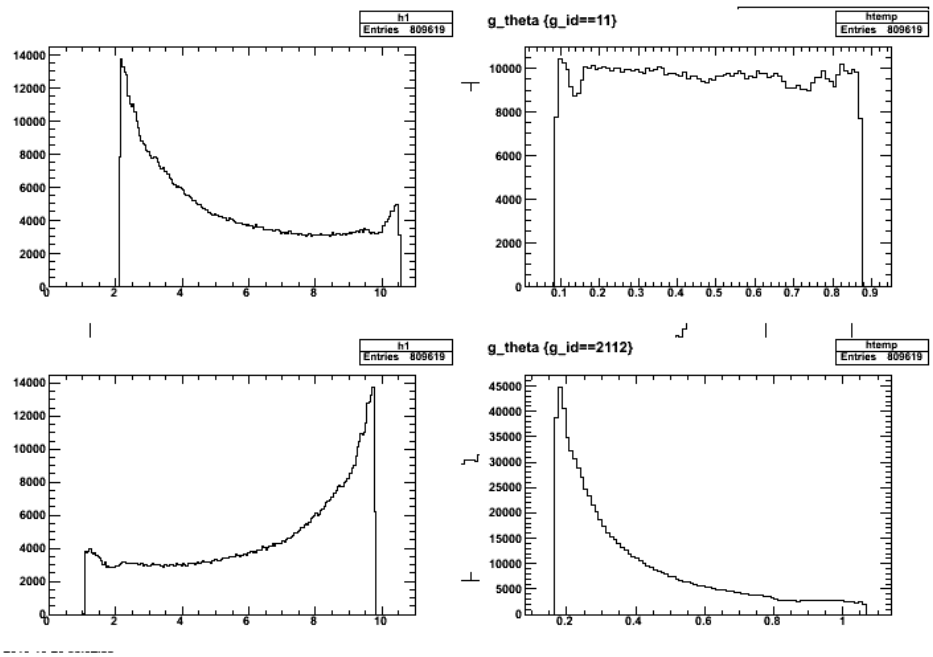


Fig 5. electrons on top row, neutrons on bottom. momentum in left column, theta in right.

Click here to view the object (Root macro) you uploaded.

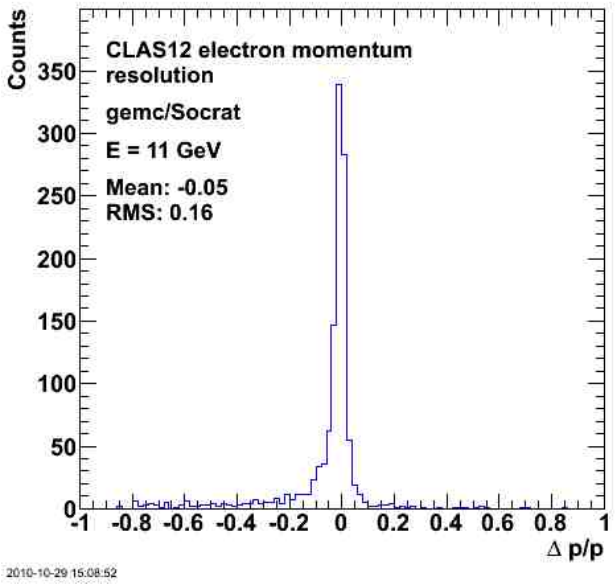


Fig 6. Prettier version of momentum resolution figure (fig 2).

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Backup tarfile of code used for above analysis.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 337 - Elastic Kinematics (gpg)

[Modified Wed Aug 24 19:50:31 2011 (GMT) gpg]

An entry with some plots and formulas that I keep having to look up for elastic kinematics for the gmn project. The first two plots show the elastic electron energy as a function of electron angle θ for E = 11 GeV. The *Mathematica* notebook is at the link after figure 2.

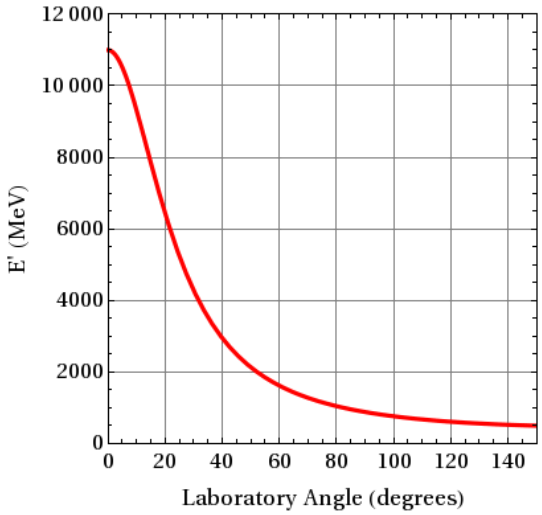


Figure 1. Electron energy as a function of electron scattering angle for 11 GeV beam.

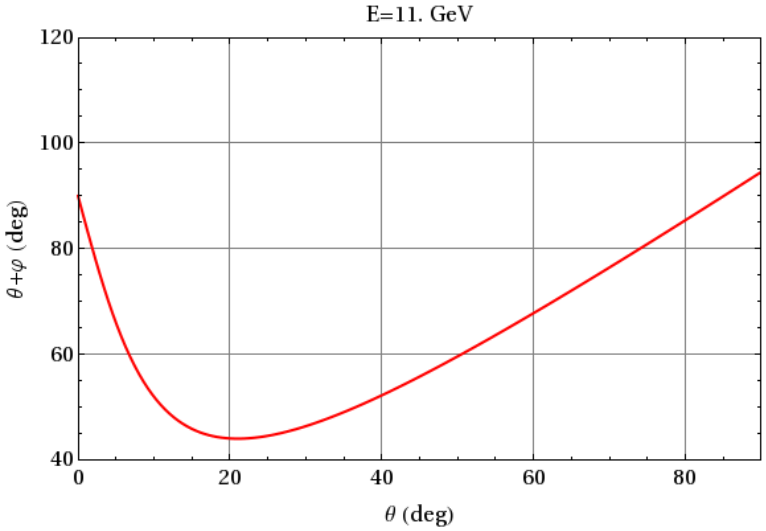
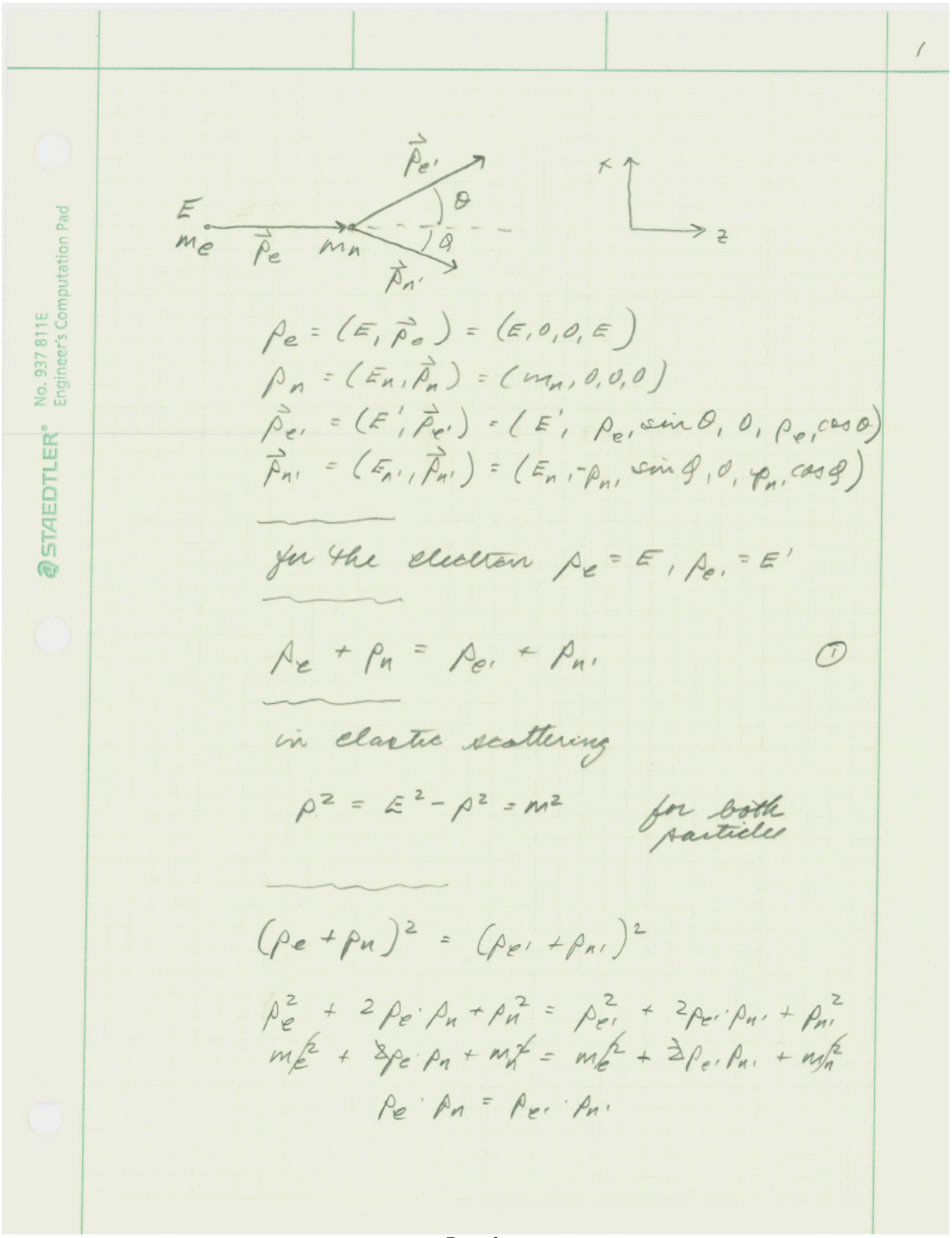


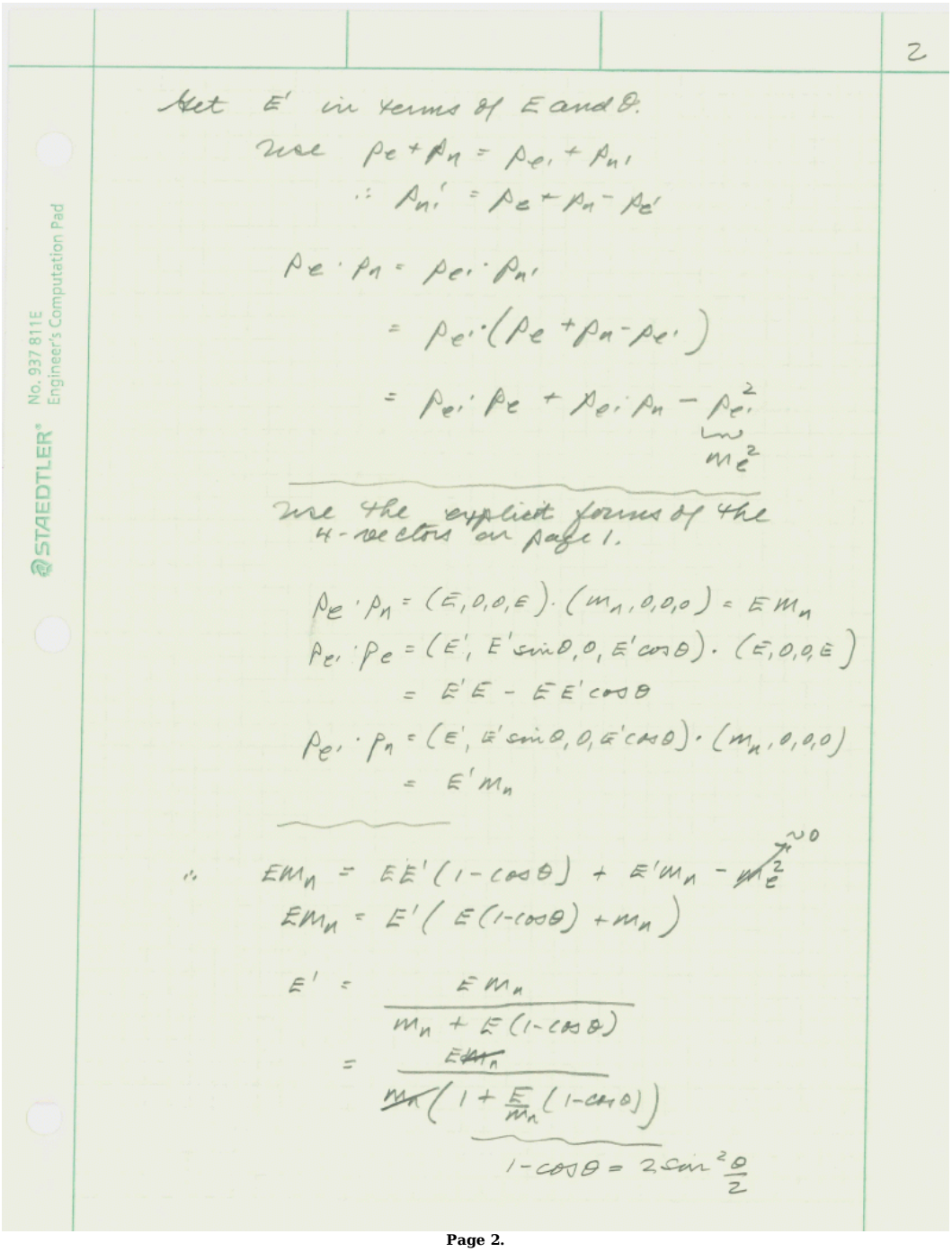
Figure 2. Sum of the electron (θ) and neutron (φ) scattering angles as a function of &theta.

Click here to view the object (*Mathematica* notebook for calculations above.) you uploaded.

Click here to view the object (PDF version of scanned pages below.) you uploaded. Derivation of the formulas used in the calculations above is below.


STAEDTLER No. 937 811E Engineer's Computation Pad
1
E
m_e
$\vec{p}_e$
m_n
$\vec{p}_{e'}$
$\vec{p}_{n'}$
θ
θ
x
z
$p_e = (E, \vec{p}_e) = (E, 0, 0, E)$
$p_n = (E_n, \vec{p}_n) = (m_n, 0, 0, 0)$
$p_{e'} = (E', \vec{p}_{e'}) = (E', p_{e'} \sin\theta, 0, p_{e'} \cos\theta)$
$p_{n'} = (E_{n'}, \vec{p}_{n'}) = (E_{n'}, -p_{n'} \sin\phi, 0, p_{n'} \cos\phi)$
for the electron $p_e = E$, $p_{e'} = E'$
$p_e + p_n = p_{e'} + p_{n'}$ (1)
in elastic scattering
$p^2 = E^2 - p^2 = m^2$ for both particles
$(p_e + p_n)^2 = (p_{e'} + p_{n'})^2$
$p_e^2 + 2 p_e \cdot p_n + p_n^2 = p_{e'}^2 + 2 p_{e'} \cdot p_{n'} + p_{n'}^2$
$m_e^2 + 2 p_e \cdot p_n + m_n^2 = m_e^2 + 2 p_{e'} \cdot p_{n'} + m_n^2$
$p_e \cdot p_n = p_{e'} \cdot p_{n'}$

Page 1.



2

Get E' in terms of E and θ.

Use $p_e + p_n = p_{e'} + p_{n'}$

$\therefore p_{n'} = p_e + p_n - p_{e'}$

$p_e \cdot p_n = p_{e'} \cdot p_{n'}$

$= p_{e'} \cdot (p_e + p_n - p_{e'})$

$= p_{e'} \cdot p_e + p_{e'} \cdot p_n - p_{e'}^2$ ($p_{e'}^2 = m_e^2$)

Use the explicit forms of the 4-vectors on page 1.

$p_e \cdot p_n = (E, 0, 0, E) \cdot (m_n, 0, 0, 0) = E m_n$

$p_{e'} \cdot p_e = (E', E' \sin\theta, 0, E' \cos\theta) \cdot (E, 0, 0, E)$

$= E'E - EE' \cos\theta$

$p_{e'} \cdot p_n = (E', E' \sin\theta, 0, E' \cos\theta) \cdot (m_n, 0, 0, 0)$

$= E' m_n$

$\therefore E m_n = EE'(1 - \cos\theta) + E' m_n - \cancel{m_e^2}^{\sim 0}$

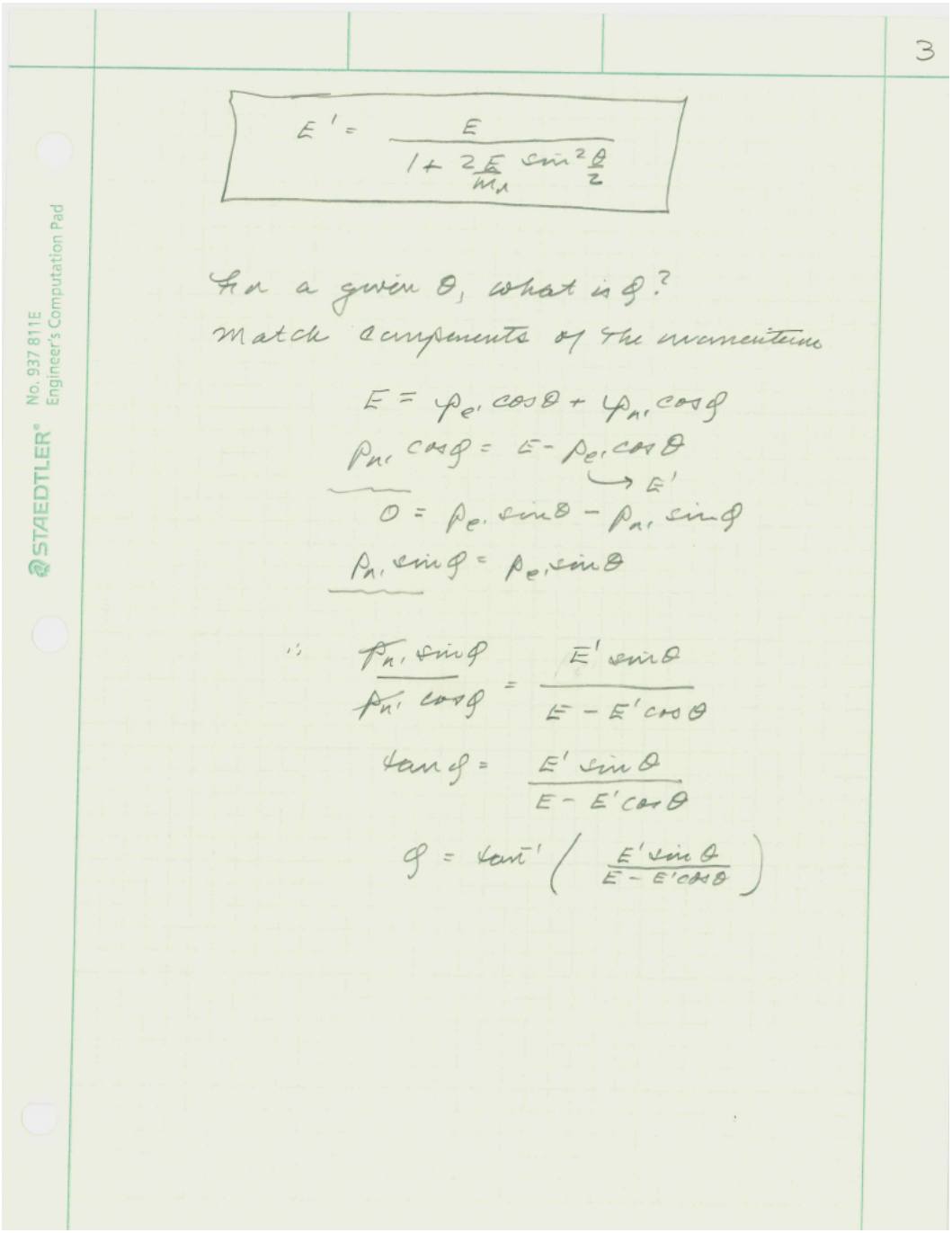
$E m_n = E'(E(1 - \cos\theta) + m_n)$

$E' = \dfrac{E m_n}{m_n + E(1 - \cos\theta)}$

$= \dfrac{E \cancel{m_n}}{\cancel{m_n}\left(1 + \frac{E}{m_n}(1 - \cos\theta)\right)}$

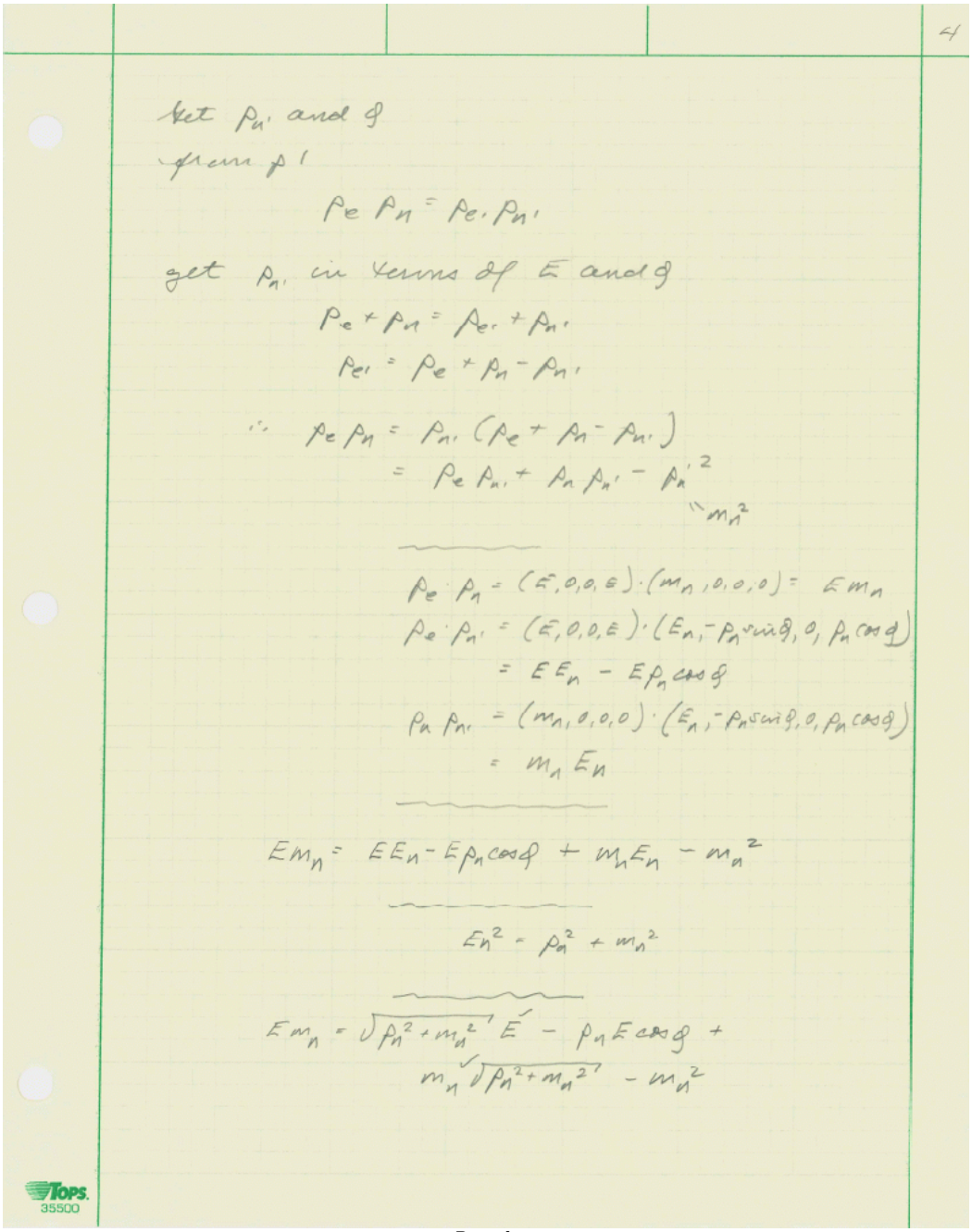
$1 - \cos\theta = 2\sin^2\frac{\theta}{2}$

Page 2.



Page 3.

Now get the neutron/proton momentum in terms of the beam energy E and the neutron/proton angle.



4

Get $p_{n'}$ and ϕ

from p'

$$p_e p_n = p_e \cdot p_{n'}$$

get $p_{n'}$ in terms of E and ϕ

$$p_e + p_n = p_{e'} + p_{n'}$$

$$p_{e'} = p_e + p_n - p_{n'}$$

$$\therefore \quad p_e p_n = p_{n'}(p_e + p_n - p_{n'})$$

$$= p_e p_{n'} + p_n p_{n'} - p_{n'}^2$$

$$= m_n^2$$

$$p_e \cdot p_n = (E, 0, 0, E) \cdot (m_n, 0, 0, 0) = E m_n$$

$$p_e \cdot p_{n'} = (E, 0, 0, E) \cdot (E_n, -p_n \sin\phi, 0, p_n \cos\phi)$$

$$= E E_n - E p_n \cos\phi$$

$$p_n p_{n'} = (m_n, 0, 0, 0) \cdot (E_n, -p_n \sin\phi, 0, p_n \cos\phi)$$

$$= m_n E_n$$

$$E m_n = E E_n - E p_n \cos\phi + m_n E_n - m_n^2$$

$$E_n^2 = p_n^2 + m_n^2$$

$$E m_n = \sqrt{p_n^2 + m_n^2}\, E - p_n E \cos\phi + m_n \sqrt{p_n^2 + m_n^2} - m_n^2$$

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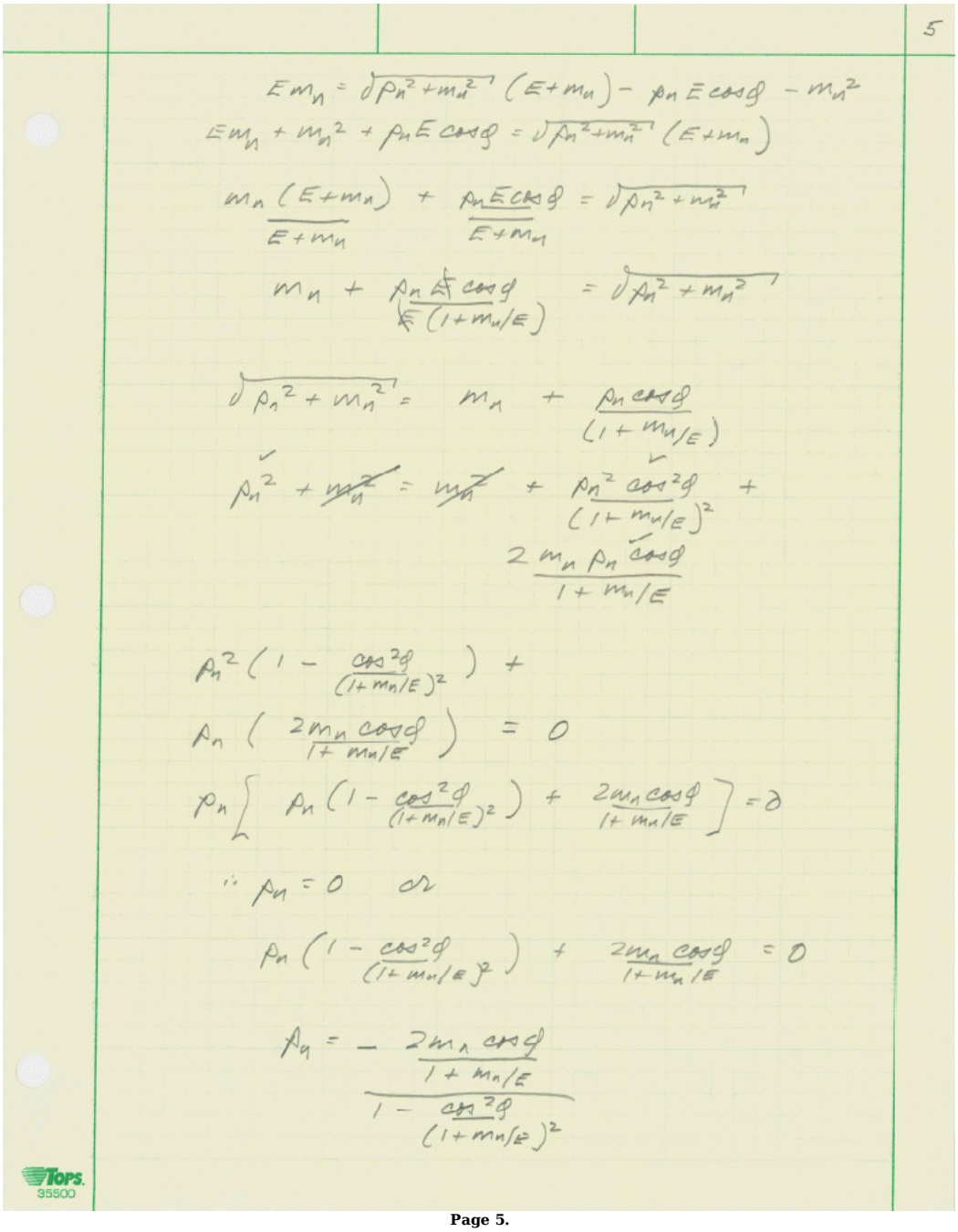
Page 4.



$$E m_n = \sqrt{p_n^2 + m_n^2}\,(E + m_n) - p_n E \cos\phi - m_n^2$$

$$E m_n + m_n^2 + p_n E \cos\phi = \sqrt{p_n^2 + m_n^2}\,(E + m_n)$$

$$\frac{m_n (E + m_n)}{E + m_n} + \frac{p_n E \cos\phi}{E + m_n} = \sqrt{p_n^2 + m_n^2}$$

$$m_n + \frac{p_n \cos\phi}{(1 + m_n/E)} = \sqrt{p_n^2 + m_n^2}$$

$$\sqrt{p_n^2 + m_n^2} = m_n + \frac{p_n \cos\phi}{(1 + m_n/E)}$$

$$p_n^2 + m_n^2 = m_n^2 + \frac{p_n^2 \cos^2\phi}{(1 + m_n/E)^2} + \frac{2 m_n p_n \cos\phi}{1 + m_n/E}$$

$$p_n^2 \left(1 - \frac{\cos^2\phi}{(1 + m_n/E)^2}\right) + p_n \left(\frac{2 m_n \cos\phi}{1 + m_n/E}\right) = 0$$

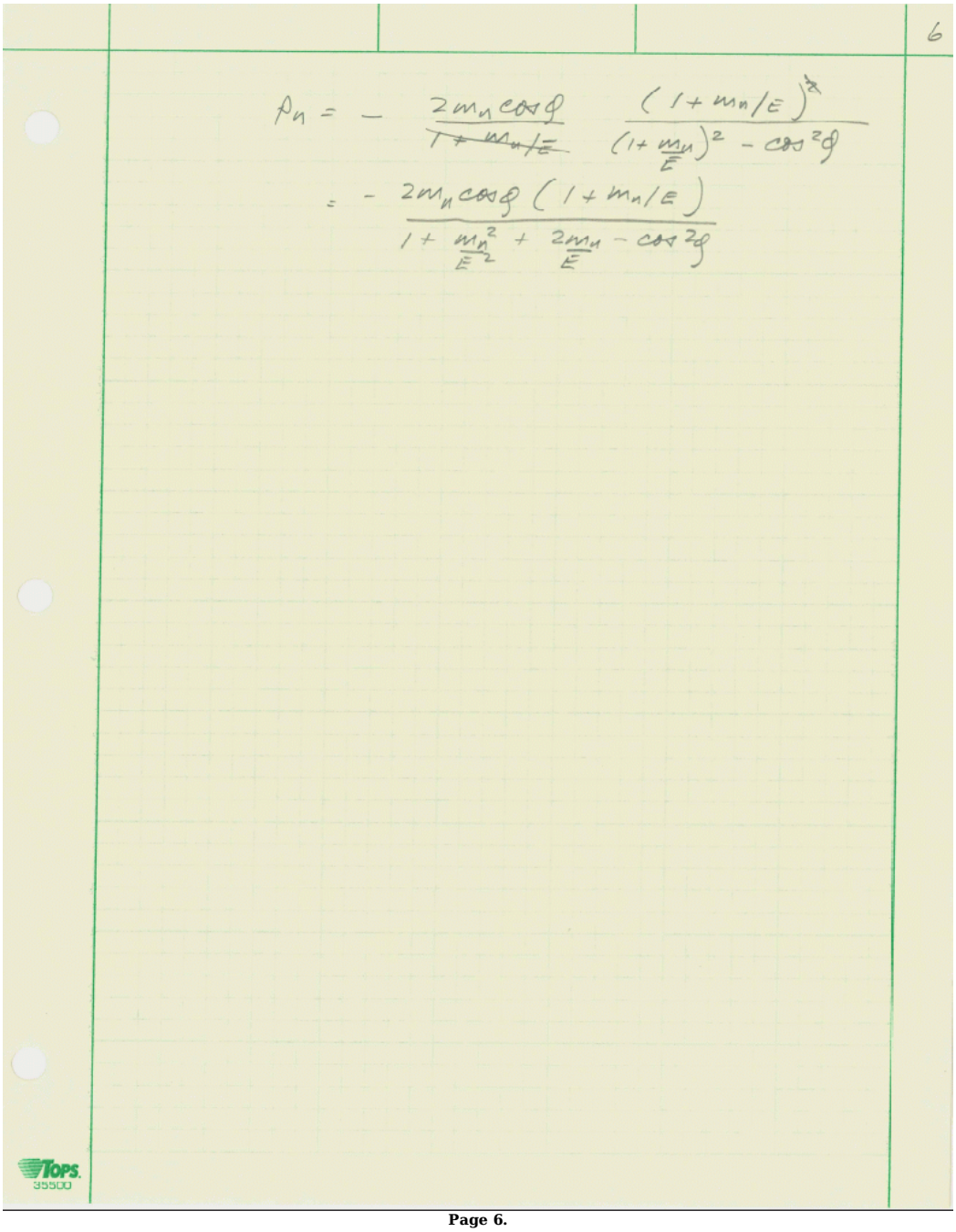
$$p_n \left[p_n \left(1 - \frac{\cos^2\phi}{(1 + m_n/E)^2}\right) + \frac{2 m_n \cos\phi}{1 + m_n/E} \right] = 0$$

$$\therefore p_n = 0 \quad \text{or}$$

$$p_n \left(1 - \frac{\cos^2\phi}{(1 + m_n/E)^2}\right) + \frac{2 m_n \cos\phi}{1 + m_n/E} = 0$$

$$p_n = - \frac{\dfrac{2 m_n \cos\phi}{1 + m_n/E}}{1 - \dfrac{\cos^2\phi}{(1 + m_n/E)^2}}$$

Page 5.


6
$p_n = -\frac{2m_n\cos\phi}{1+m_n/E}\,\frac{(1+m_n/E)^2}{(1+\frac{m_n}{E})^2-\cos^2\phi}$
$= -\frac{2m_n\cos\phi\,(1+m_n/E)}{1+\frac{m_n^2}{E^2}+\frac{2m_n}{E}-\cos^2\phi}$

Page 6.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 338 - NDE γ distribution (gpg)

[Modified Fri Dec 24 18:11:12 2010 (GMT) gpg]

Study the behavior of the NDE γ distribution. We typically require γ < 10 deg between the direction of the found neutron (determined from the electron information and the assumption of QE scattering from the neutron) to call a hit a QE neutron. It appears the neutrons all have zero deposited energy while the electron has a deposited energy of around 10 MeV.

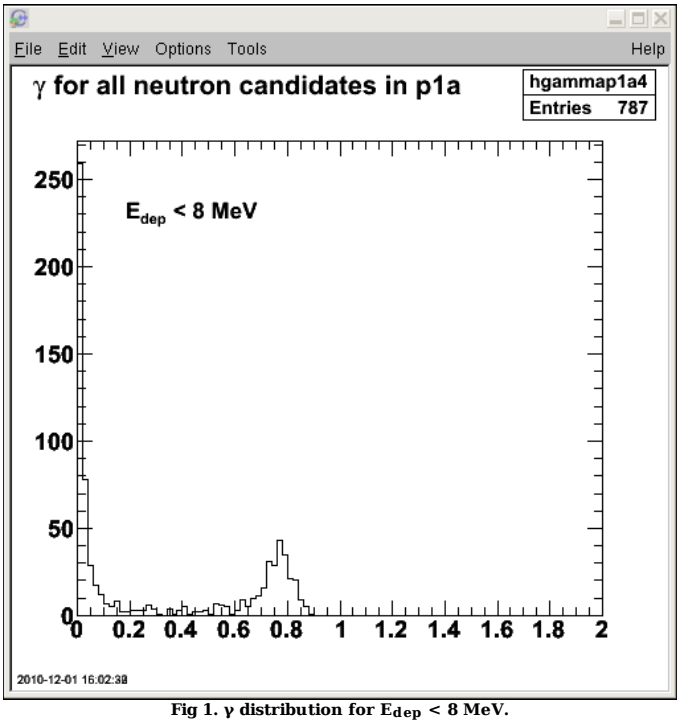


Fig 1. γ distribution for E_{dep} < 8 MeV.

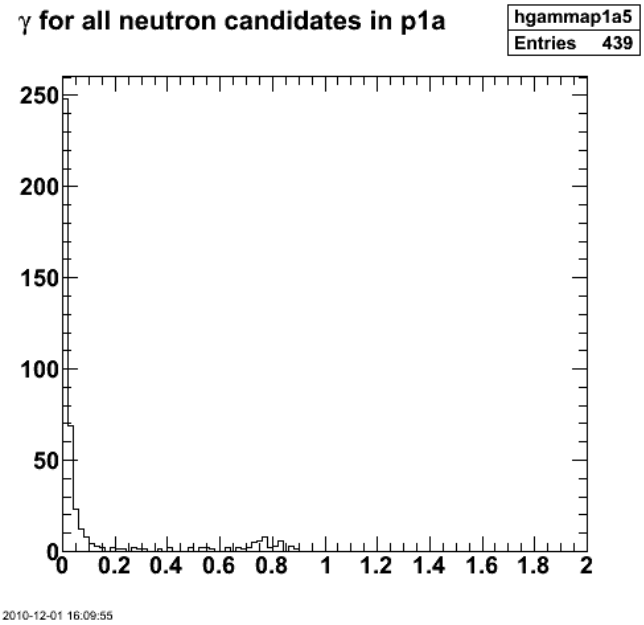


Fig 2. Effect of requiring the the TOF hit to be in the same sector as the found neutron.

Click here to view the object (ROOT macro) you uploaded.

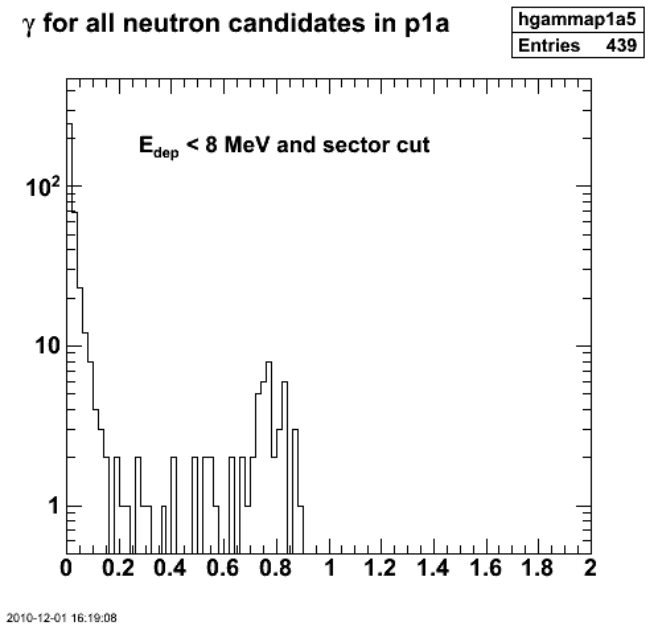


Fig 3. Better version of previous plot.

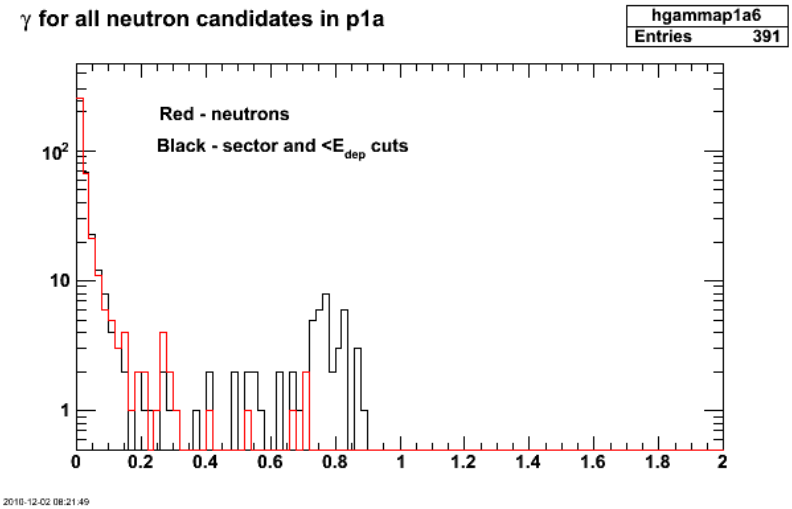


Fig 4. Comparison of γ distribution with $_{dep}$ and sector cuts with MC selection of known neutrons.

Click here to view the object (Root macro) you uploaded.

Better version of things now using the proper Edep cut. For limited statistics the next fig shows the total number of hists that survive the Edep cut (there are lots and lots of Edep=0 hits that get eliminated) in black and there is a peak likely due to electron hits. It's a peak at about the angle of the electron relative to the neutron hits. The red curve shows the γ distribution requiring the Edep cut and the hit has to be in the sector of the neutron predicted from QE scattering of the neutron. The blue curve shows the γ distribution requiring Edep and using the MC information to require the hit be a neutron. We are overestimating the number of neutrons in the sample!!??

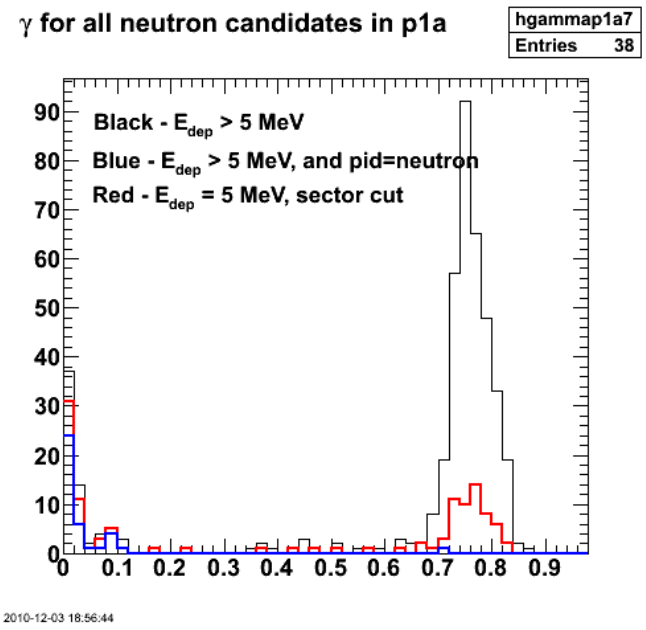
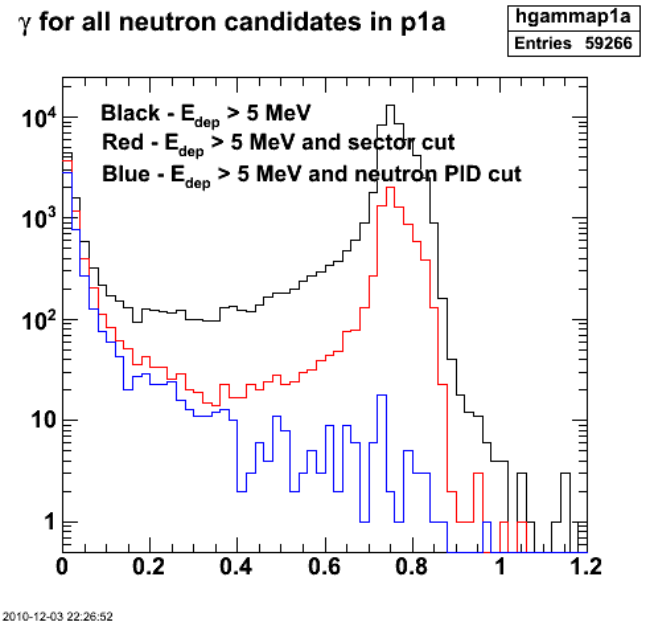


Fig 5. γ distribution for various cuts described above.

Click here to view the object (ROOT macro) you uploaded.



Same as figure 5 with more statistics.

Click here to view the object (Root macro) you uploaded.

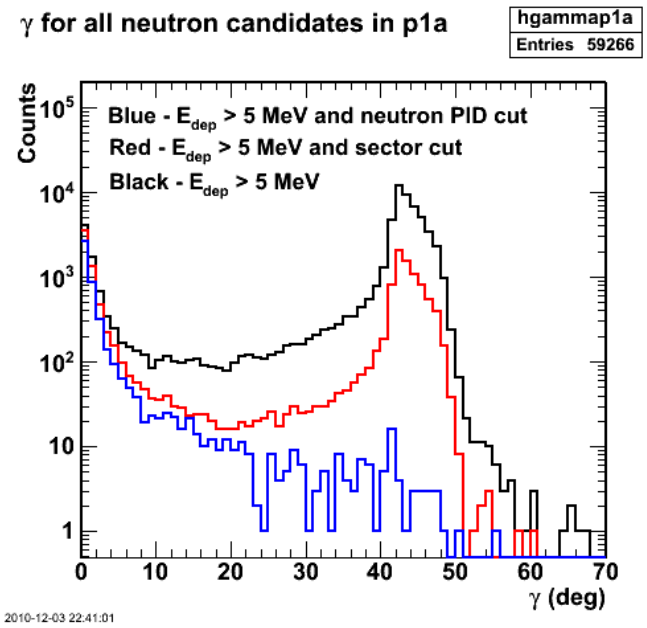


Fig 6. Prettified version of fig 5.

Click here to view the object (Root macro) you uploaded.

Now generate plots of CX vs. Cy as done in CN2001-006 and 1998-014. First plots shows θ for found neutrons. Why do I see counts all the way down to zero.

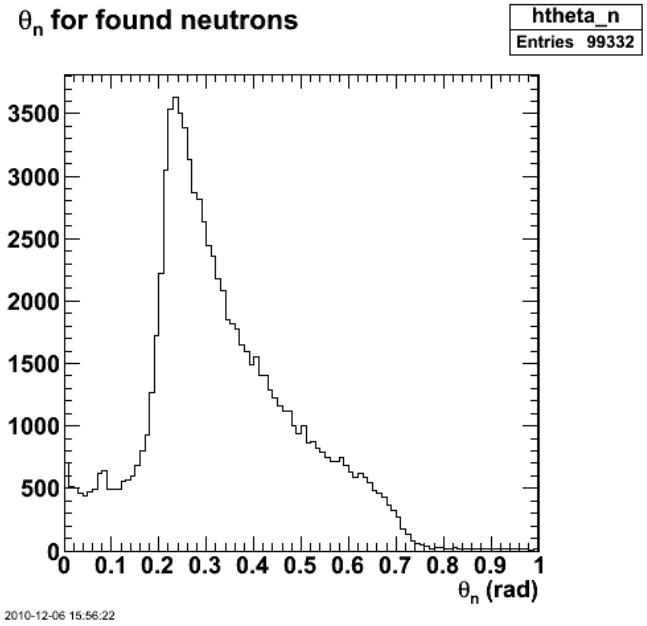


Fig 7. θ for found neutrons.

Click here to view the object (ROOT macro) you uploaded.

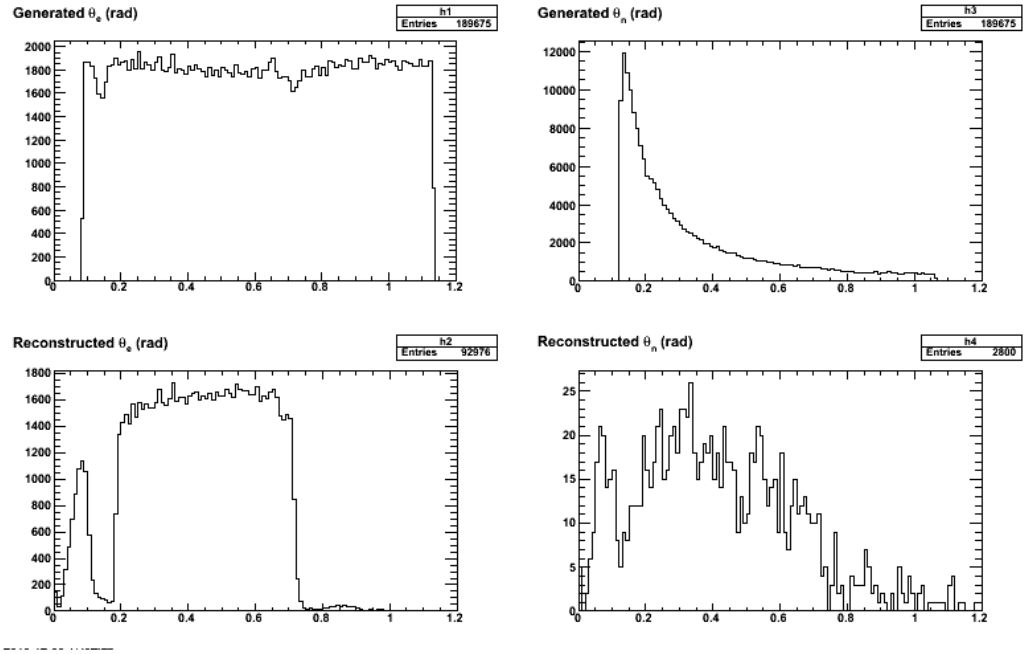


Fig 8. Checking things.

Click here to view the object (ROOT macro) you uploaded.

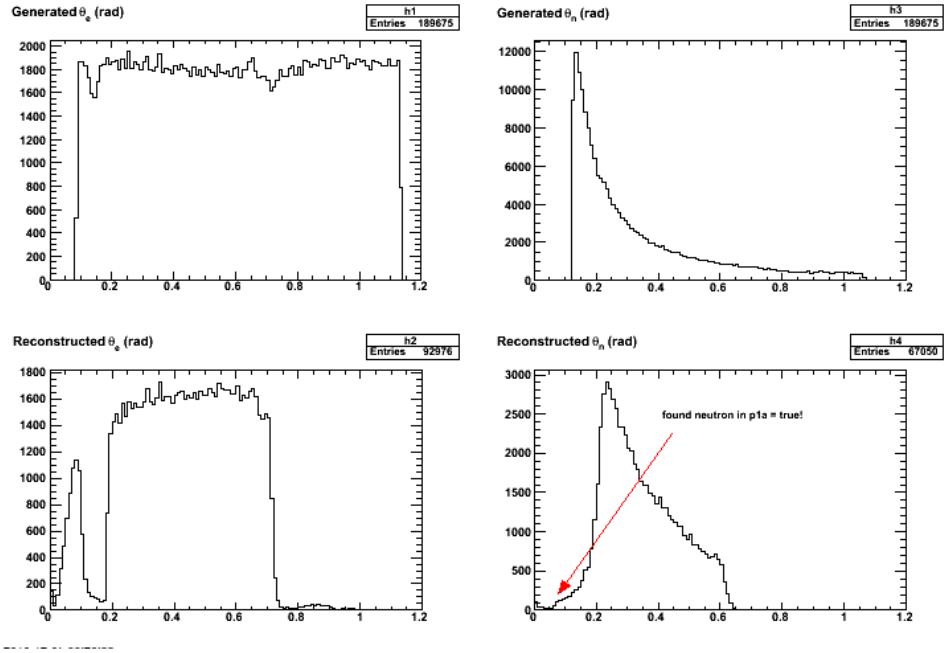


Fig 9. Checking things. Lower right generated with 'neutronTracking->Draw("r_thetan>>h4","neu_found_p1a==1")'.

Click here to view the object (ROOT macro) you uploaded.

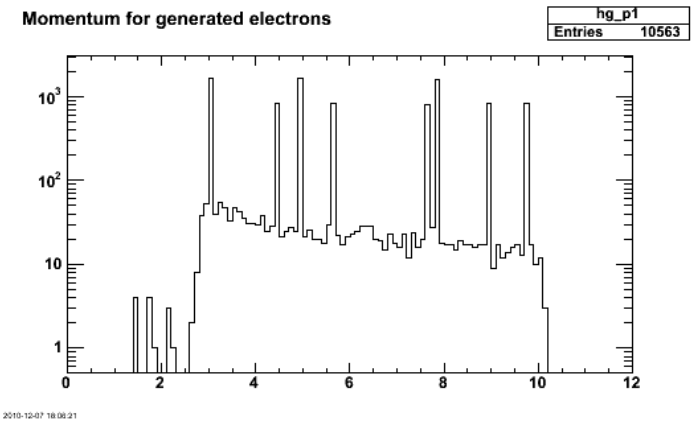


Fig 10. Add electron tracking results and generated information to neutronTracking tree and check things. What are the spikes? events with crap??

Spikes were caused by me setting the number of events in Socrat to a test value of 1000 when there were only 200 events in the gemc output file.

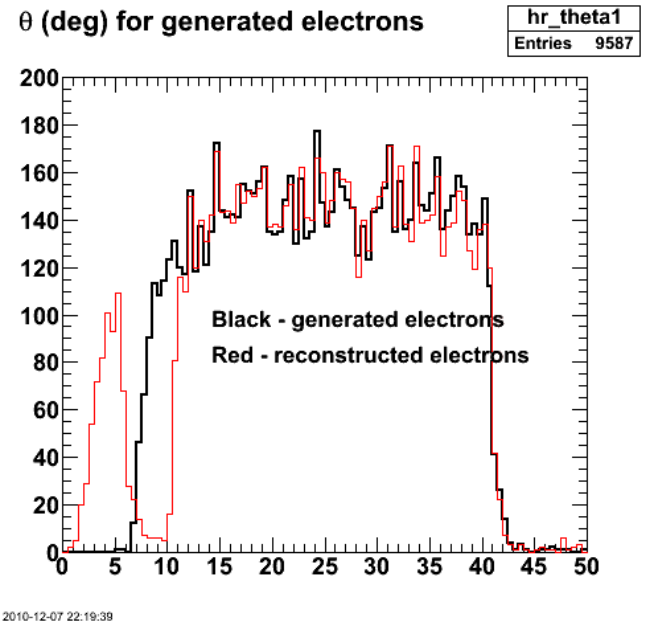


Fig 11. Comparison of angular distributions of electrons generated from the MC (black) and reconstructed by Socrat (red). There is an obvious problem at small angles and there are angle bins where the efficiency is greater than one.

Click here to view the object (Root macro) you uploaded.

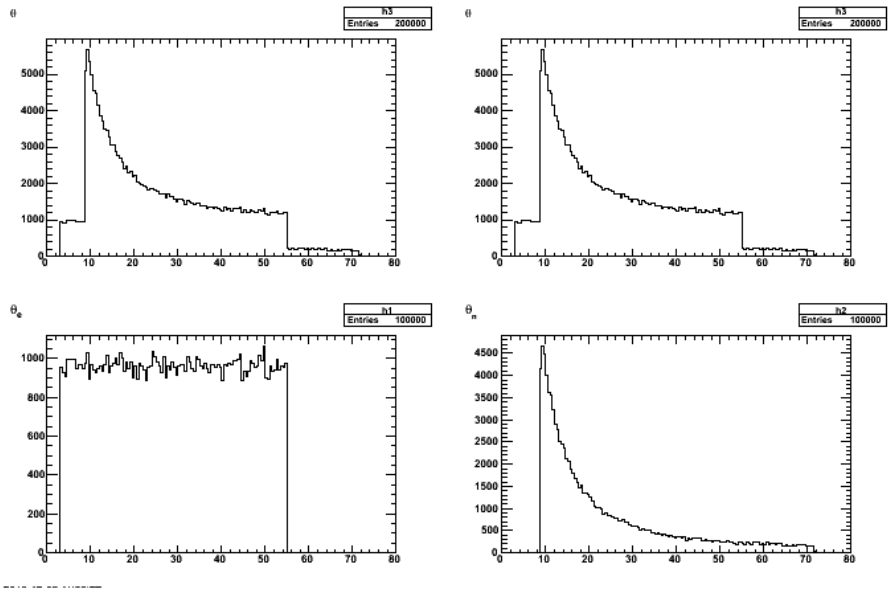


Fig. 12 Generated input to gemc. The low angle cut on the neutron angle is due to the upper limit on the electron angle.

Click here to view the object () you uploaded.

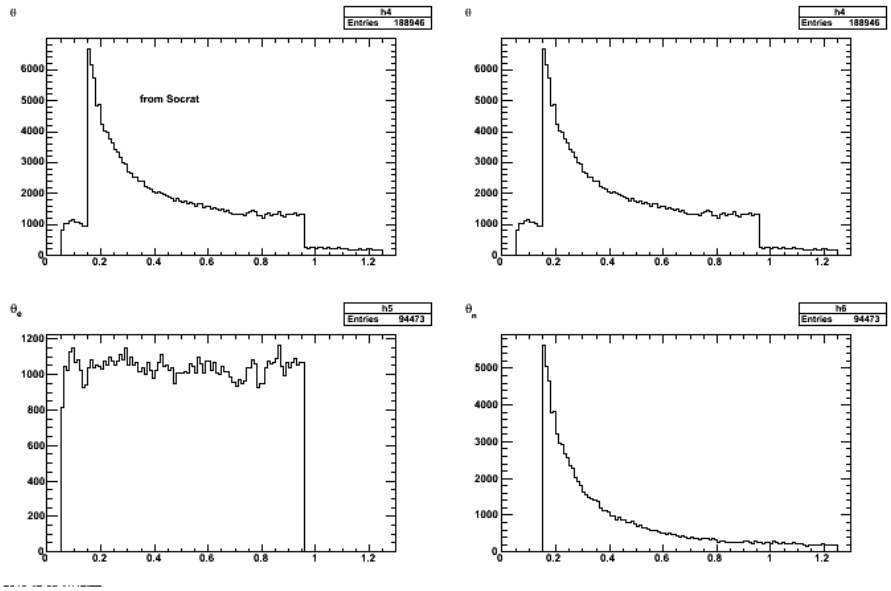


Fig 12. Generated input from Socrat.

The weird peak in the electron angular distribution at forward angles seems to be an artifact of Socrat. See the upper-right plot of p_e vs θ_e in Fig 13 where there is a large blob of events at small angles with momentum greater than the beam momentum. It also appears the minimum electron angle is larger than I thought; out at about 11 deg.

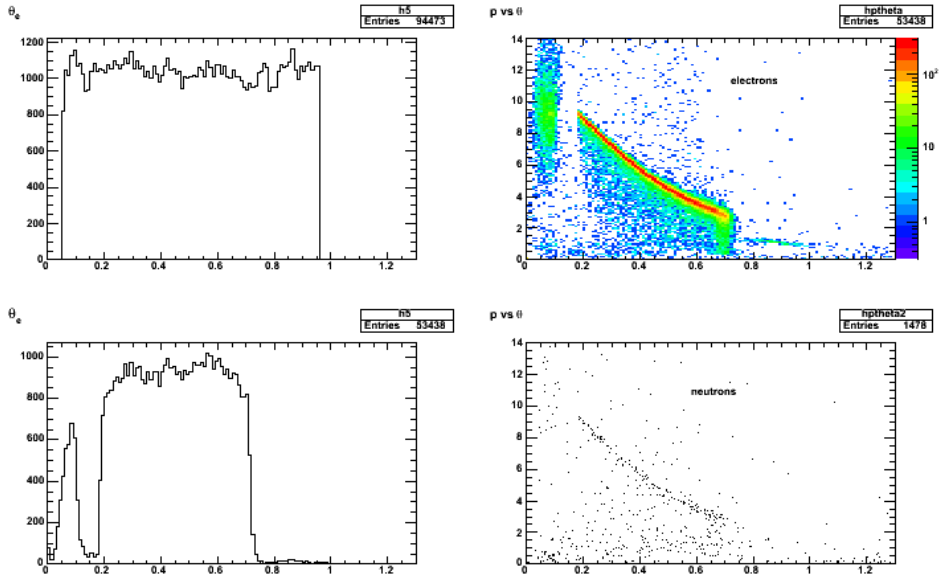


Fig 13. Continuing study of weirdness in Socrat.

Click here to view the object (ROOT macro) you uploaded.

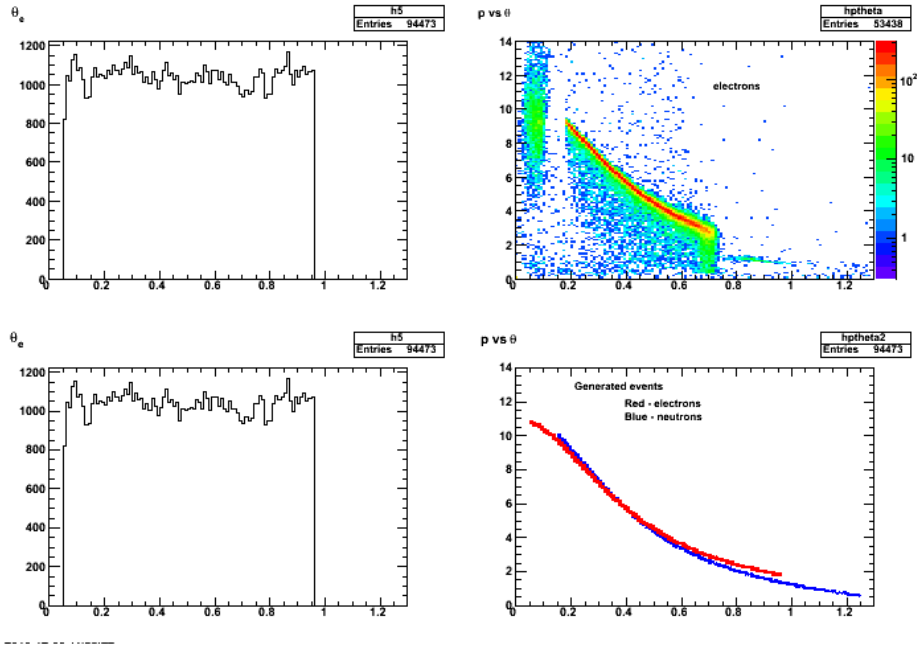


Fig 15. Check the generated momentum vs. θ dists.

Click here to view the object (ROOT macro) you uploaded.

What is the effect of turning off the FST and reversing the torus polarity? Not much it turns out. The weird group looks relatively smaller, but it's still clearly there.

```
// Use the Forward Tracker (1) or not (0)
FST use 0
```

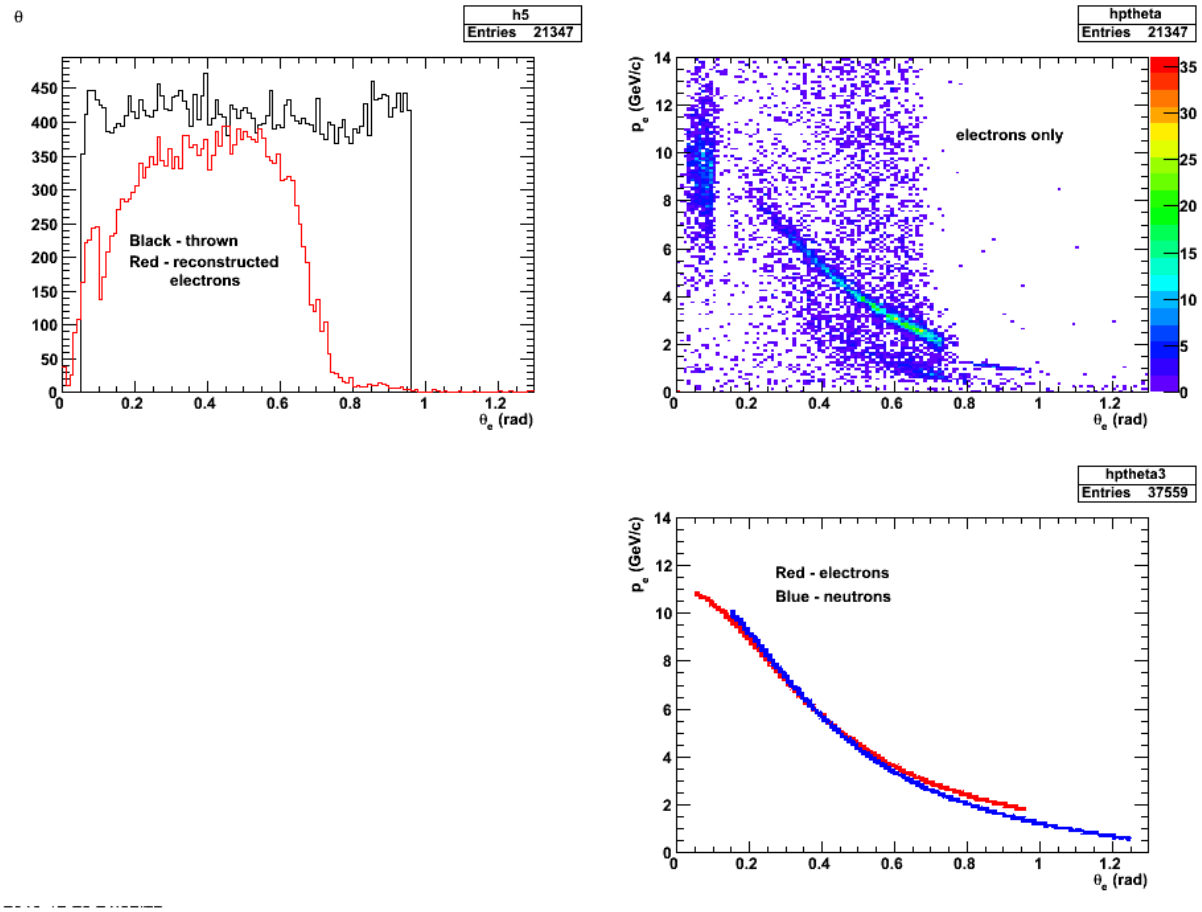


Fig 16. Effect of turning off FST and reversing the torus polarity.

Click here to view the object (ROOT macro) you uploaded.

Now do it with FST off and torus polarity normal (electrons inbending). Looks the same as before. No effect due to FST????

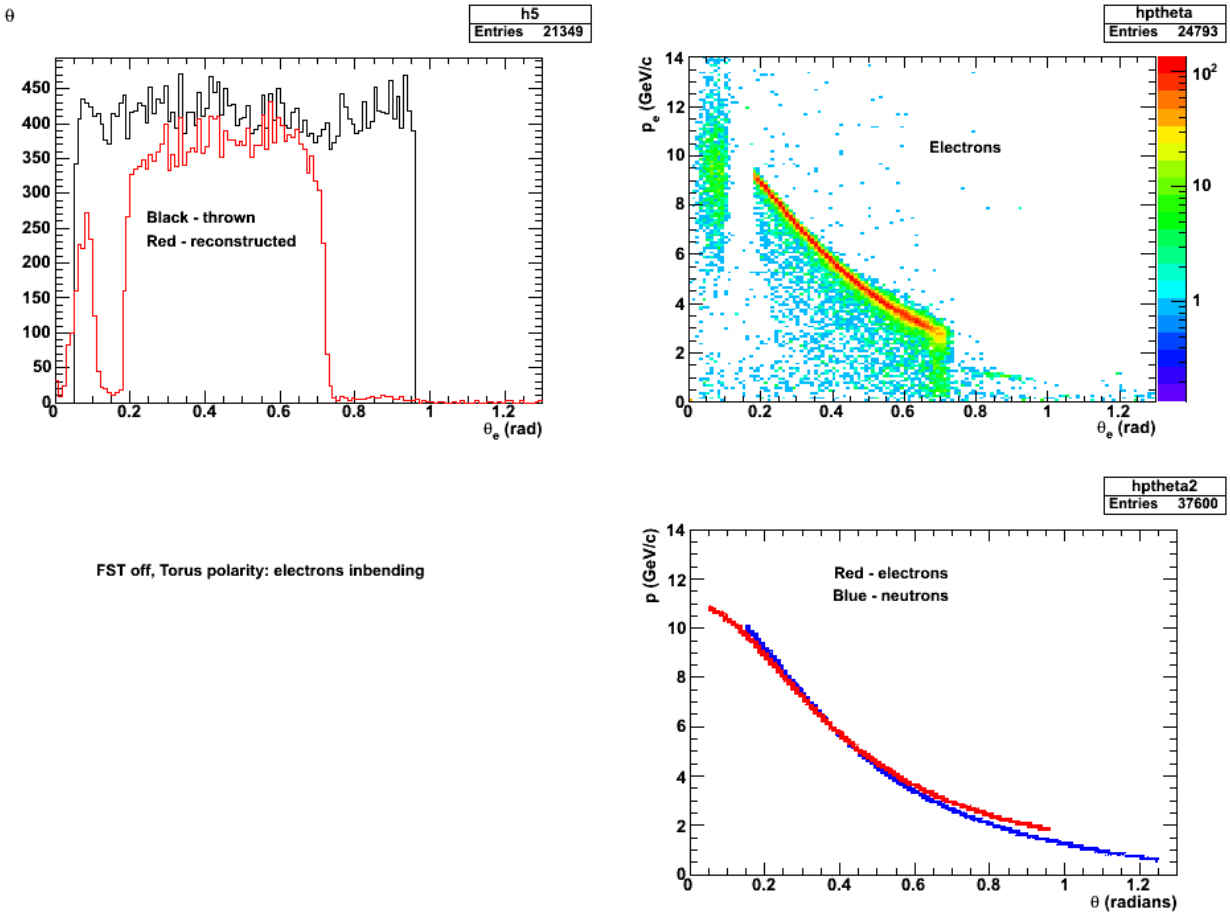


Fig 17. FST off and torus polarity normal (electrons inbending)

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 339 - NDE angular distributions (gpg)

[Modified Tue Jan 4 21:47:36 2011 (GMT) gpg]

Now check the angular distributions for neutrons and electrons. Figs 1-6 are in the previous entry. Now generate plots of CX vs. Cy as done in CN2001-006 and 1998-014. First plots shows θ for found neutrons. Why do I see counts all the way down to zero.

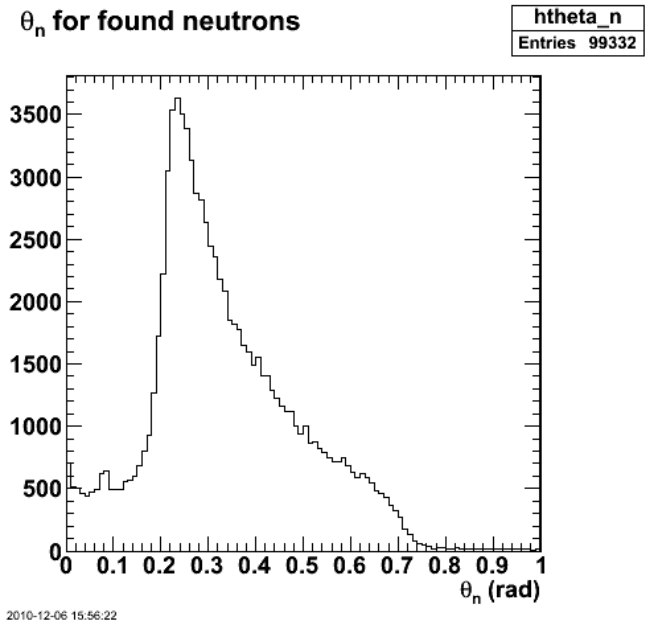


Fig 7. θ for found neutrons.

Click here to view the object (ROOT macro) you uploaded.

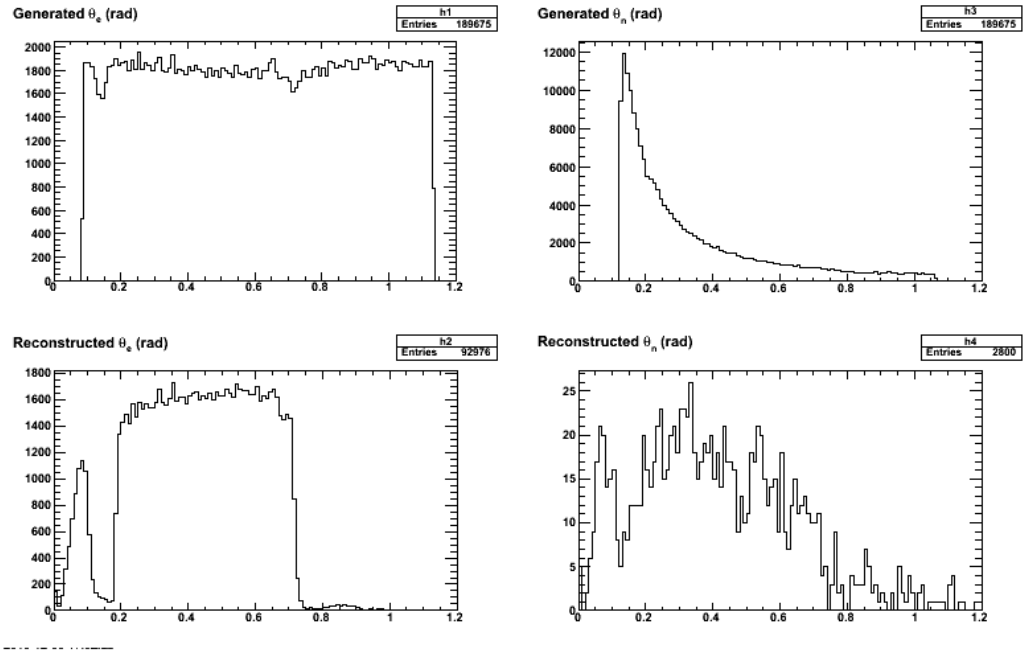


Fig 8. Checking things.

Click here to view the object (ROOT macro) you uploaded.

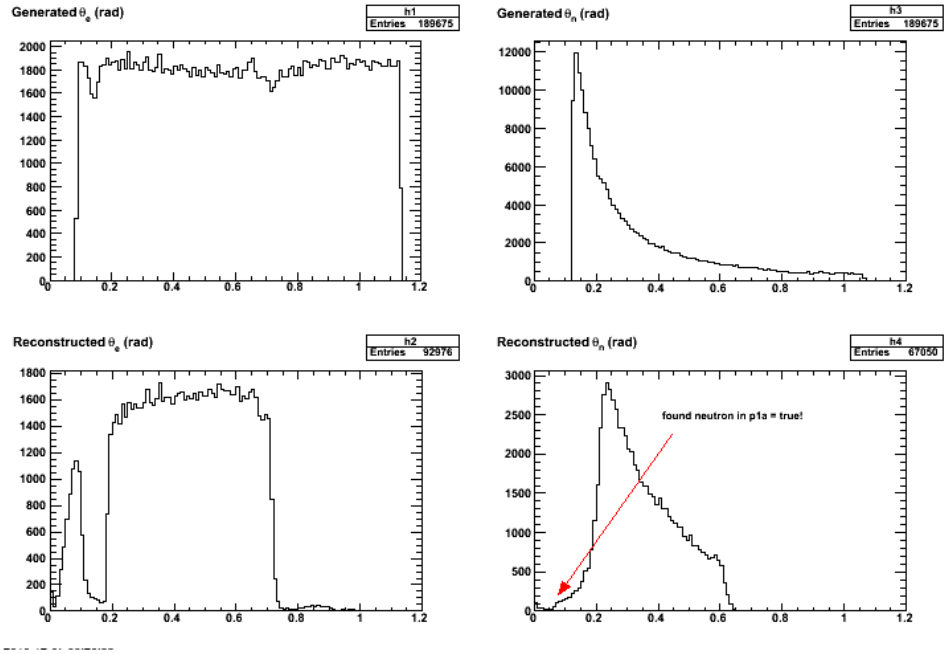


Fig 9. Checking things. Lower right generated with 'neutronTracking->Draw("r_thetan>>h4","neu_found_p1a==1")'.

Click here to view the object (ROOT macro) you uploaded.

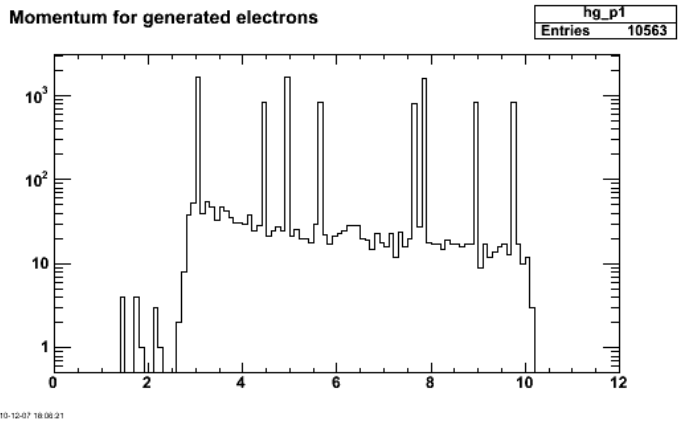


Fig 10. Add electron tracking results and generated information to neutronTracking tree and check things. What are the spikes? events with crap??

Spikes were caused by me setting the number of events in Socrat to a test value of 1000 when there were only 200 events in the gemc output file.

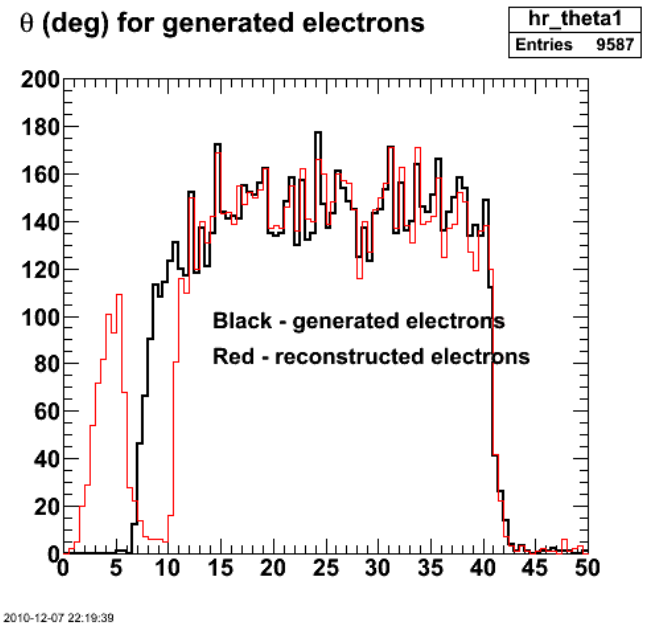


Fig 11. Comparison of angular distributions of electrons generated from the MC (black) and reconstructed by Socrat (red). There is an obvious problem at small angles and there are angle bins where the efficiency is greater than one.

Click here to view the object (Root macro) you uploaded.

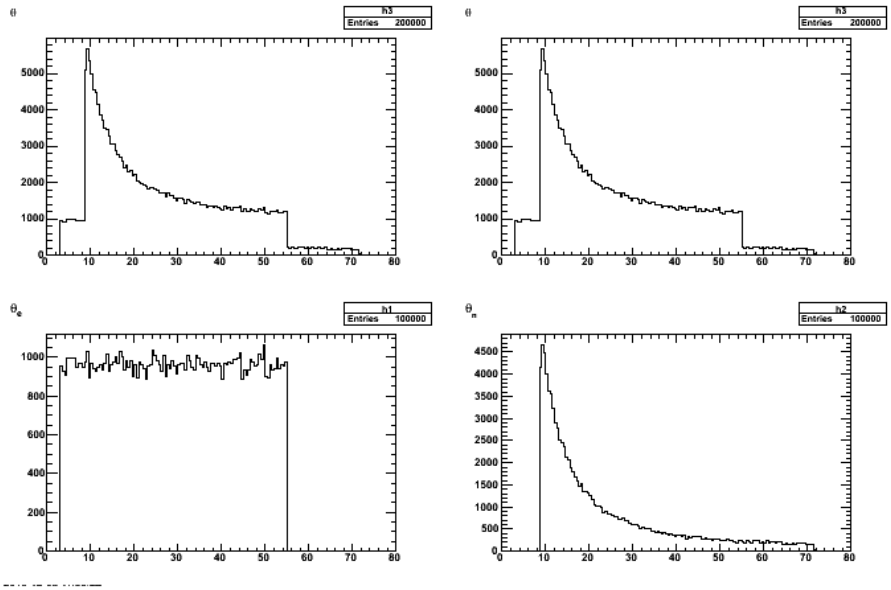


Fig. 12 Generated input to gemc. The low angle cut on the neutron angle is due to the upper limit on the electron angle.

Click here to view the object () you uploaded.

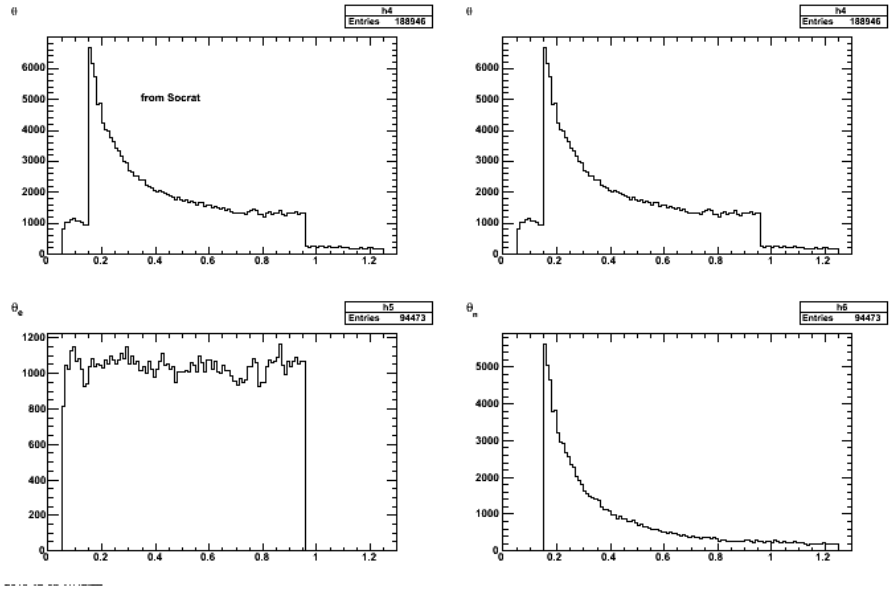


Fig 12. Generated input from Socrat.

The weird peak in the electron angular distribution at forward angles seems to be an artifact of Socrat. See the upper-right plot of p_e vs θ_e in Fig 13 where there is a large blob of events at small angles with momentum greater than the beam momentum. It also appears the minimum electron angle is larger than I thought; out at about 11 deg.

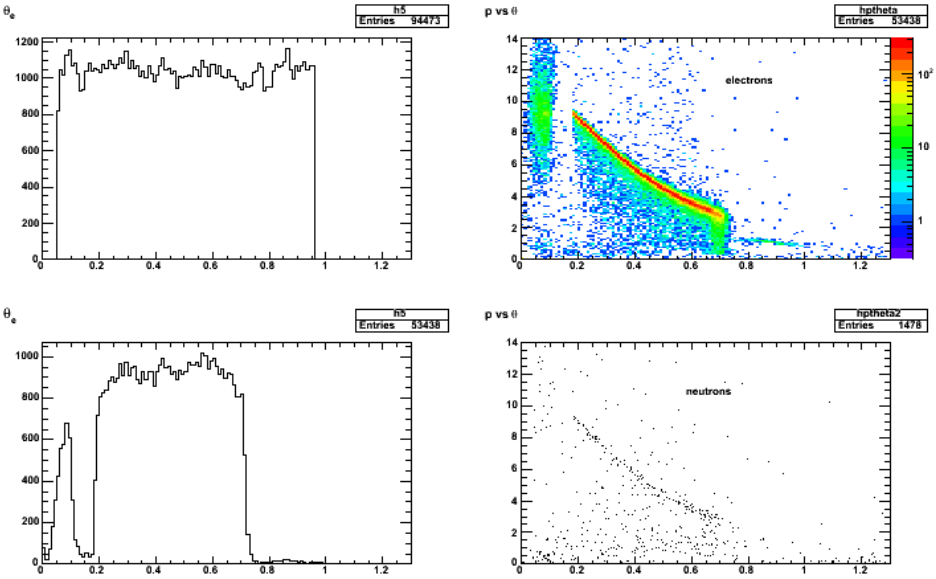


Fig 13. Continuing study of weirdness in Socrat.

Click here to view the object (ROOT macro) you uploaded.

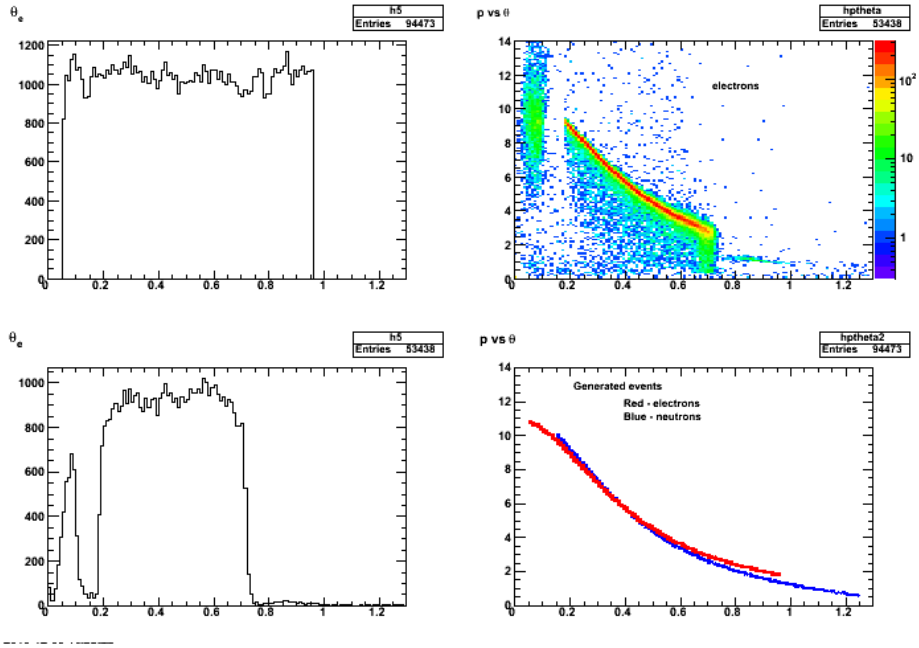


Fig 15. Check the generated momentum vs. θ dists.

Click here to view the object (ROOT macro) you uploaded.

The upper-left panel in Fig 16. shows the generated electron momentum vs. θ_e for reconstructed electrons with $\theta_e < 0.15$ rad. The anomalous peak appears to be coming from those very-forward events.

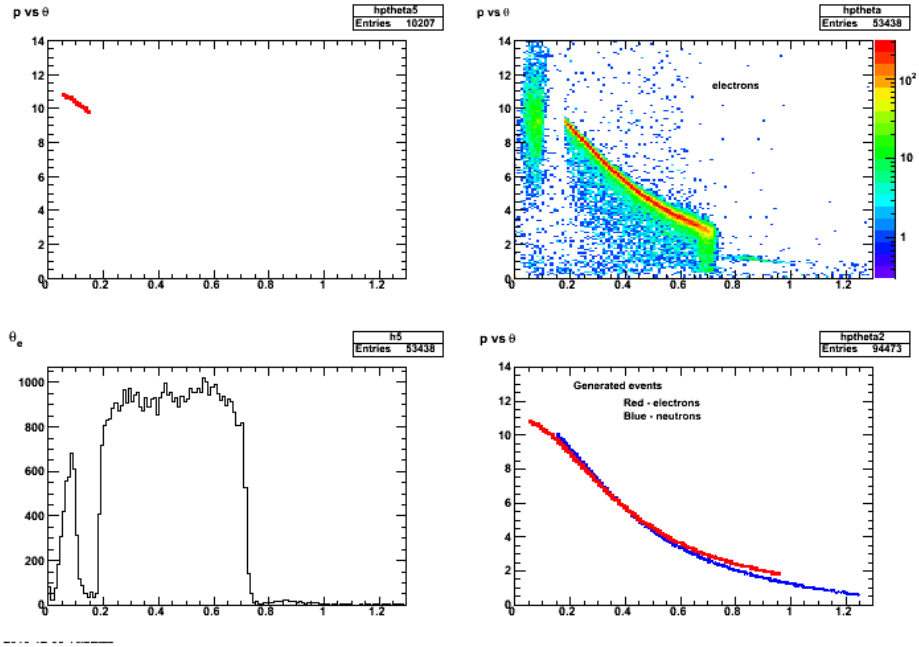


Fig 16.

Click here to view the object (ROOT macro) you uploaded.

Effect of requiring hits in the TOFs gets rid of the forward-angle wacko electron hits. I still don't understand why the 'good' events only go down to θ_e=0.2 rad (11 deg)?? This is presumably for the 'standard' torus polarity which is electrons inbending.

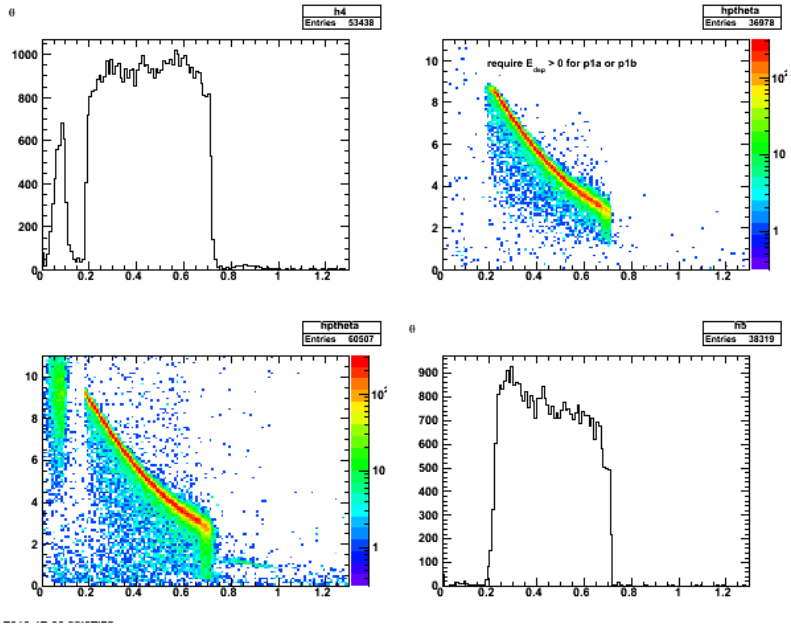


Fig 17. Effect of requiring hits in TOF p1a or p1b panels.

Click here to view the object (ROOT macro) you uploaded.

Try the reversed polarity to see what happens then. Forgot to put in plots, but saw the screwy, small-angle peak was not as well separated from the higher-angle group. These may be saying that reversed field will smear out the small-angle stuff at this stage of the reconstruction.

Put some cuts on the energy deposited in the OTOF1a and OTOF1b and things are cleaned up substantially at the cost of losing about 90% of the events. It also shows the minimum electron angle is about 11 deg which is much larger than expected. Turning off the g_id==11 requirement brings in a few more events (total = 3151 vs. 2813).

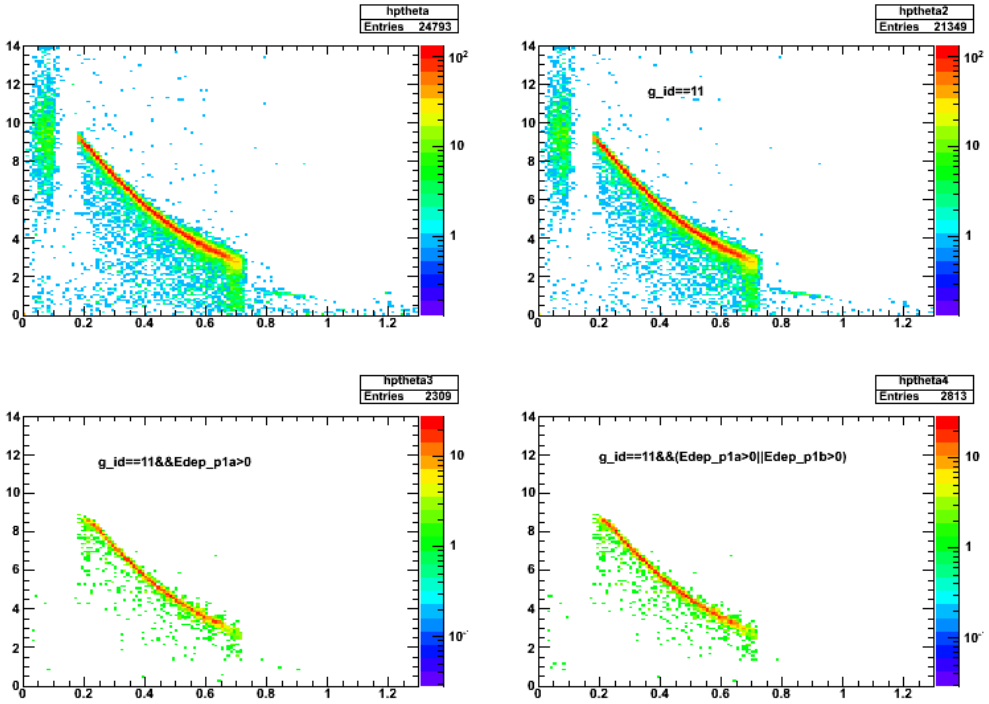


Fig 18. Comparison of momentum vs. θ_e for various cuts.

Click here to view the object (ROOT macro) you uploaded.

Now include the thrown electrons in the upper, left panel. It still looks like we are cutting off electrons below 11 deg which corresponds to a minimum Q2=3.7 GeV2. That is still ok for the GMn overlaps with the CLAS6 measurement.

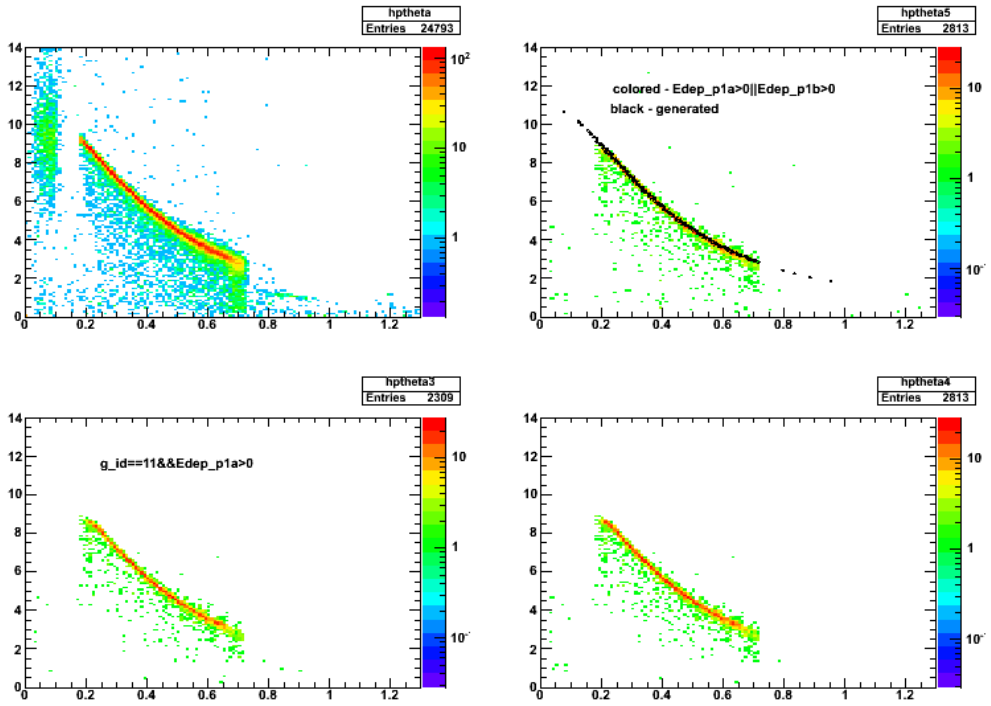


Fig 19. Same comparison as in fig 18 with the thrown electrons included in the upper left panel.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 340 - Precision Tests for BEC (gpg)

[Modified Thu Dec 16 16:28:46 2010 (GMT) gpg]

I want to get some idea of the ability to distinguish between correlation functions with different values of the source size r. The uncertainty on the fits in the ZEUS ep paper are very small; about 1-3%. I have taken some of the correlation functions from the talk and fitted them with the ZEUS function and get larger uncertainties with lower statistics in the fits. The left-hand panel below is the correlation function ($\pi^+\pi^+$) without separation into LT parts. The right-hand panel is the correlation function for the longitudinal part and r=0.73 in the inputs.

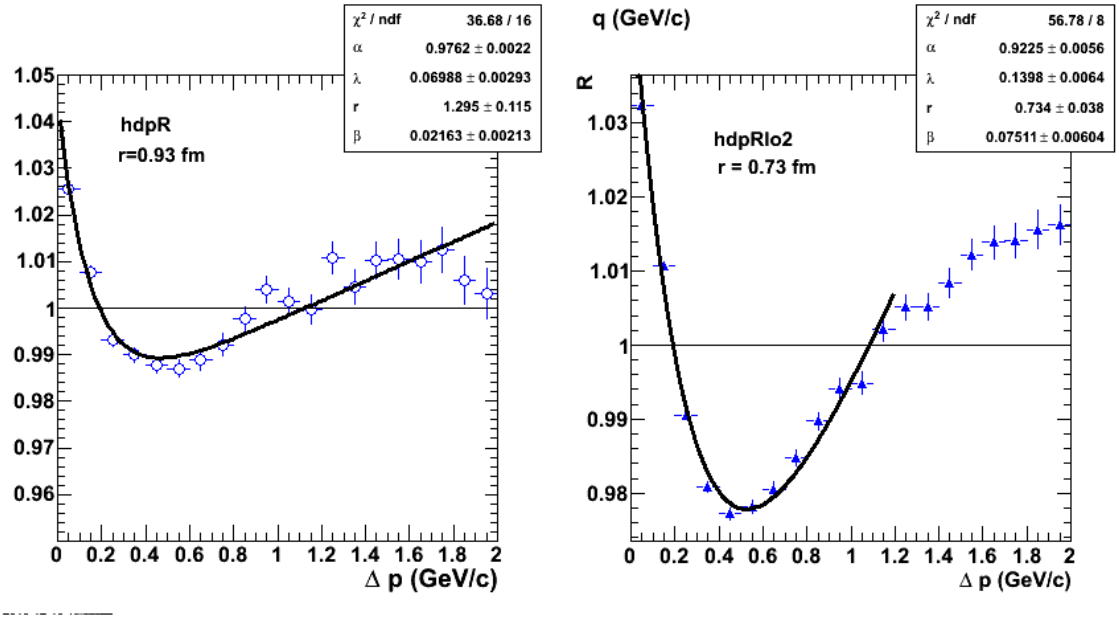


Fig 1. Comparison of two different correlation functions and their fits.

Click here to view the object (ROOT macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 341 - NDE for E_{dep} > 33 MeV (jerry)

[Modified Fri Jan 28 19:57:13 2011 (GMT) jerry]

Below are plots for all three TOF panels of the neutron detection efficiency.

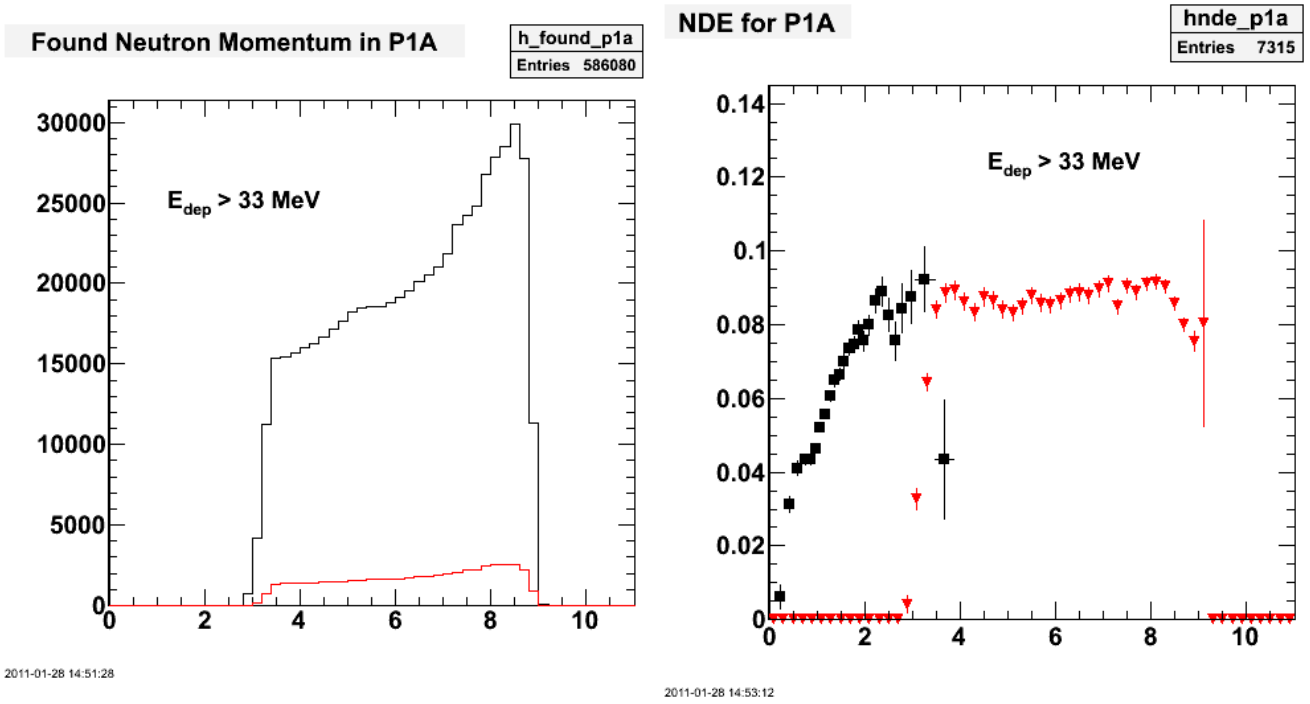


Fig 1. Histograms of found (black) and reconstructed (red) histograms (left-hand panel) and NDE (right-hand panel).

Click here to view the object (Root macro for lhs) you uploaded.

Click here to view the object (Root macro for rhs) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 342 - Building gemc (gpg)

[Added Thu Feb 3 03:46:43 2011 (GMT) gpg]

summary of gemc build on gpg4.

as root %%%%

```
.... takes a long time

setenv PATH /usr/local/Trolltech/Qt-4.7.1/bin:$PATH
setenv LD_LIBRARY_PATH /usr/local/Trolltech/Qt-4.7.1/lib/:$LD_LIBRARY_PATH



3. geant4

yum install libXmu.x86_64

setenv G4SYSTEM Linux-g++
setenv G4ROOT /usr/local/geant/
setenv G4SYSTEM $G4ROOT
setenv G4VERSION geant4.9.3.p02
setenv G4WORKDIR /usr/local/geant/geant4.9.4
setenv G4INSTALL /usr/local/geant/geant4.9.4
setenv G4UI_BUILD_QT_SESSION 1
setenv G4UI_USE_QT 1
setenv G4VIS_BUILD_OPENGLQT_DRIVER 1
setenv G4VIS_USE_OPENGLQT 1
setenv G4LIB /usr/local/geant//geant4.9.4/lib
setenv G4VIS_BUILD_OPENGLX_DRIVER 1
setenv G4VIS_USE_OPENGLX 1
setenv G4VIS_BUILD_DAWN_DRIVER 1
setenv G4VIS_USE_DAWN 1
setenv G4UI_BUILD_OI_SESSION 1
setenv G4UI_USE_OI 1
setenv G4UI_BUILD_OIX_SESSION 1
setenv G4UI_USE_OIX 1
setenv G4UI_BUILD_RAYTRACERX_SESSION 1
setenv G4UI_USE_RAYTRACERX 1
setenv G4LISTS_BASE /usr/local/geant/geant4.9.4/source/physics_lists
setenv G4LEVELGAMMADATA /usr/local/geant/data/PhotonEvaporation2.0
setenv G4RADIOACTIVEDATA /usr/local/geant/data/RadioactiveDecay3.2
setenv G4LEDATA /usr/local/geant/data/G4EMLOW6.9
setenv G4NEUTRONHPDATA /usr/local/geant/data/G4NDL0.2
setenv NeutronHPCrossSections /usr/local/geant/data/G4NDL3.13
setenv G4ABLADATA /usr/local/geant/data/G4ABLA3.0

setenv QTLIB /usr/local/Trolltech/Qt-4.7.1/lib/
setenv QTINC /usr/local/Trolltech/Qt-4.7.1/include
setenv QTHOME/usr/local/Trolltech/Qt-4.7.1/
setenv PKG_CONFIG_PATH $QTDIR/lib/pkgconfig
setenv LD_LIBRARY_PATH ${QTDIR}/lib:${LD_LIBRARY_PATH}
set path = ($QTDIR/bin $path)
setenv PATH /usr/local/Trolltech/Qt-4.7.1/bin:$PATH
setenv LD_LIBRARY_PATH /usr/local/Trolltech/Qt-4.7.1/lib/:$LD_LIBRARY_PATH

setenv CLHEP_BASE_DIR /usr/local/clhep/2.1.0.1/install
setenv EVIO /usr/local/evio/

--------------------

now do it

cd $G4INSTALL/source
make


4. scons

yum install scons


5. mysql

in /usr/local/

mkdir mysql
cd msql
ln -s /usr/include/mysql/ include
ln -s /usr/lib64/mysql/ lib
setenv MYSQL /usr/local/mysql



6. evio

yum install expat-devel.x86_64
yum install expatmm.x86_64
yum install expatmm-devel.x86_64
yum install expat.x86_64
yum install perl-XML-Parser.x86_64

pwd
/usr/local
svn co https://clas12svn.jlab.org/repos/trunk/clas12/evio

cd evio
setenv EVIO /usr/local/evio

root-gpg4:/> cd /usr/local/evio/
root-gpg4:evio> scons



7. python stuff
```

```
svn checkout https://clas12svn.jlab.org/repos/trunk/clas12/scons_scripts/

setenv PYTHONPATH /usr/local/scons_scripts/

svn co https://wikis.dtic.upf.edu/svn/clam/trunk/CLAM/scons/sconstools/qt4.py  - failed

get qt4.py from http://trac.assembla.com/hydrogen/browser/trunk/

root-gpg4:Tool> pwd
/usr/lib/scons/SCons/Tool
root-gpg4:Tool> dir qt*
-rw-r--r--. 1 root root 13252 Aug 17 02:02 qt.py
-rw-r--r--. 2 root root  9475 Aug 23 14:01 qt.pyc
-rw-r--r--. 2 root root  9475 Aug 23 14:01 qt.pyo
root-gpg4:Tool> cp /home/gilfoyle/Downloads/qt4.py .


8. gemc

svn checkout https://clas12svn.jlab.org/repos/trunk/clas12/gemc/production
cd production

scons
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 343 - RC correction for ALTp (gpg)

[Modified Fri Mar 25 20:42:20 2011 (GMT) gpg]

Starting collecting results for RC correction to ALTp. Since the correction appears to be significant and different and varies with Ï† for the polarized and unpolarized parts of the cross section, then I have to put in the correction on each separately. (1) The first step is to generate the 2D surfaces (functions of cosÎ¸ and Ï†) for polarized and unpolarized at many different Q2 values. The first plot below shows the surfaces for polarized RC correction for Q2=0.2 GeV2 (red) and Q2=0.5 GeV2 (blue). Mathematica notebooks for separate Q2 calculations are below fig 1.

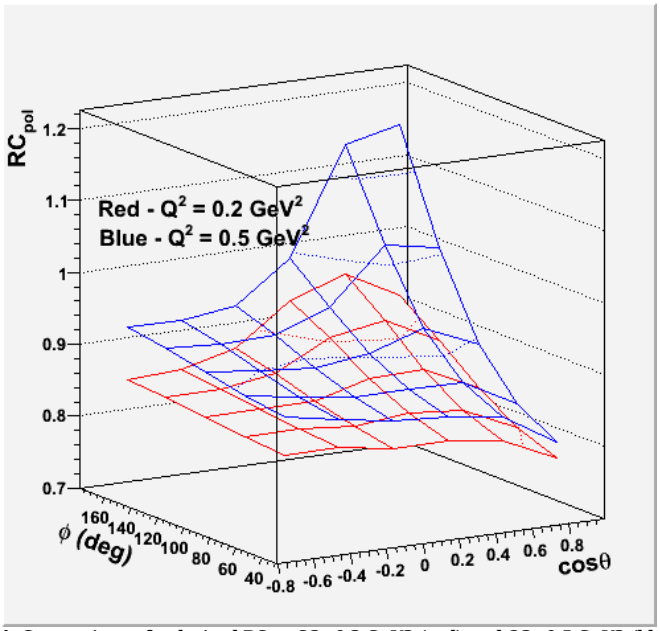


Fig 1. Comparison of polarized RC at Q2=0.2 GeV2 (red) and Q2=0.5 GeV2 (blue).

Click here to view the object (Mathematica notebook) you uploaded.

Click here to view the object (Mathematica notebook) you uploaded.

Click here to view the object (Root macro) you uploaded.

First pass at re-analysis of ALTp for 2.6r with and without the RC.

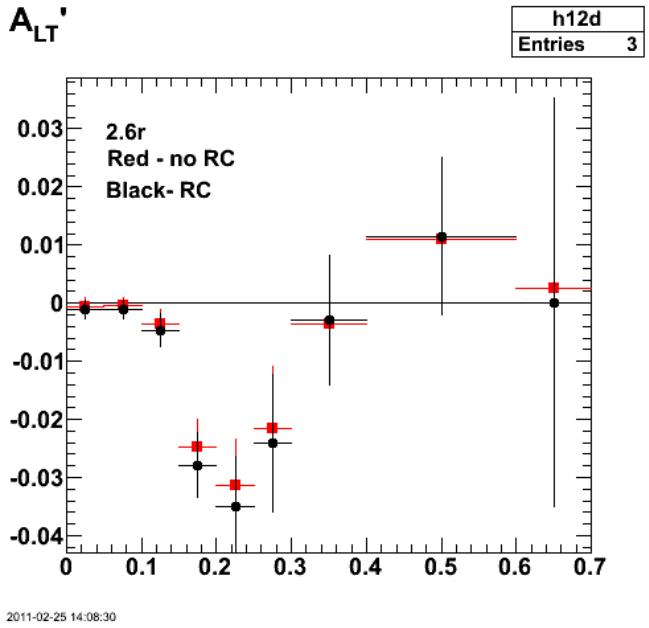


Fig 2. Comparison of ALTp for no RC (red), constant RC (blue, hidden by red), and exclurad RC (black.

Click here to view the object (Root macro) you uploaded.

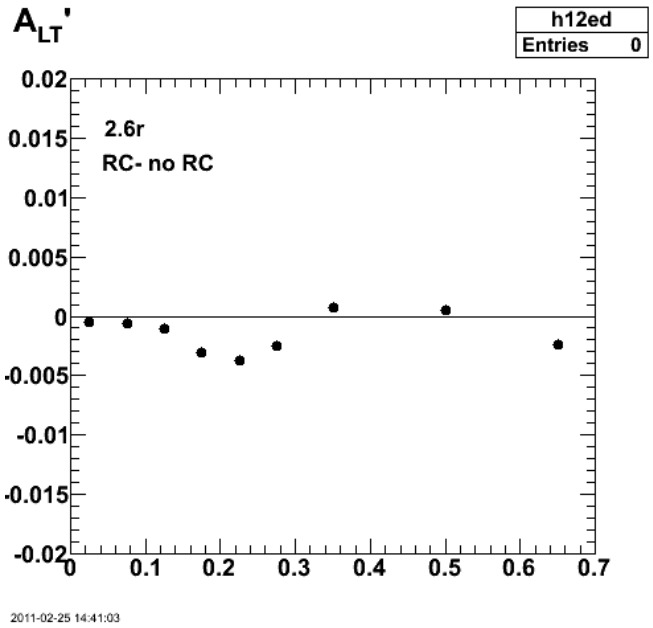


Fig 3. Difference between ALTp with RC on and RC off. I will probably take half this value and add it to the systematic uncertainty.

Click here to view the object (Root macro) you uploaded.

Get the bins for 2.6r correct.

Click here to view the object (Fig 4. Same as 2 with corrected pm bins.) you uploaded.

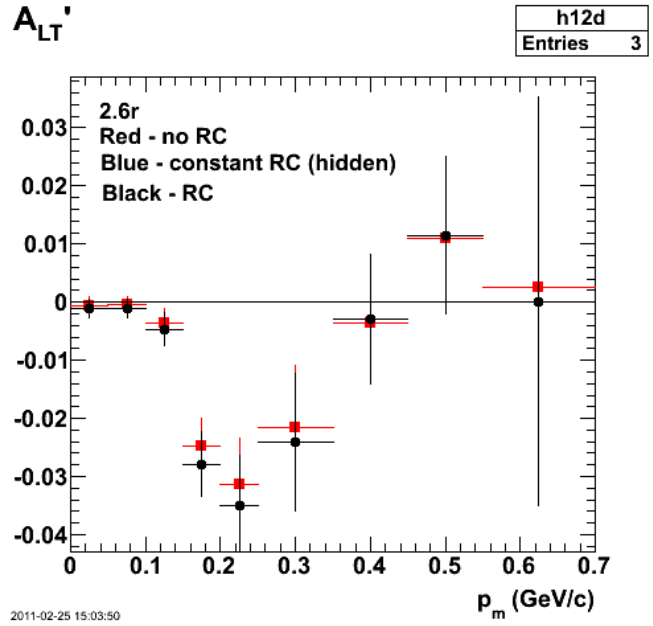


Fig 4. Same as 2 with corrected pm bins.

Click here to view the object (Root macro) you uploaded.

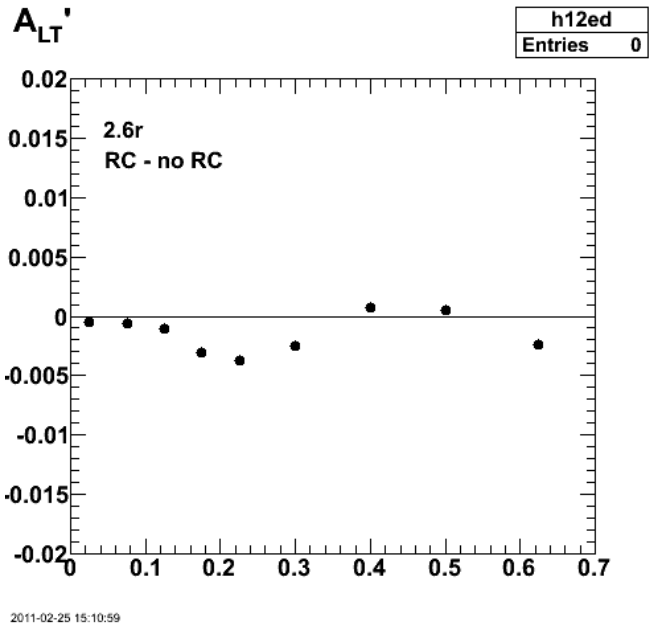


Fig. 5. Same as fig 3 with corrected pm bins

Click here to view the object (Root macro) you uploaded.

Click here to view the object (ROOT histogram file) you uploaded.

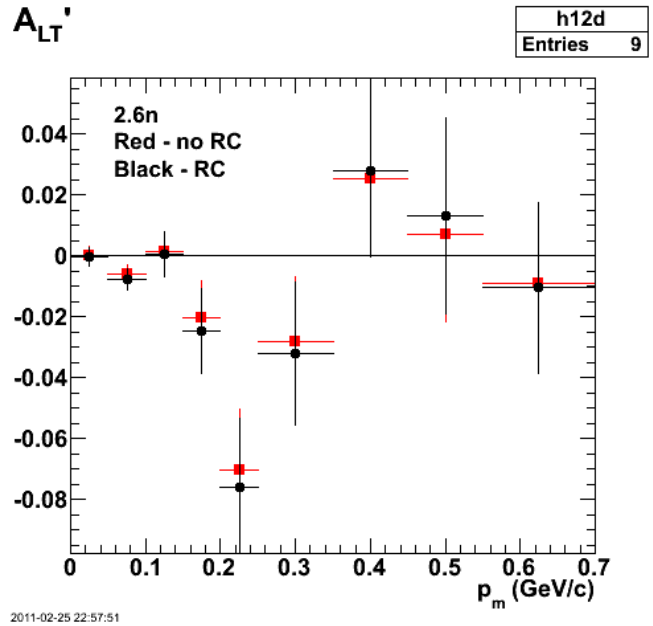


Fig 6. Comparison of ALtp at 2.6n with RC on (black) and off (red).

Click here to view the object (Root macro) you uploaded.

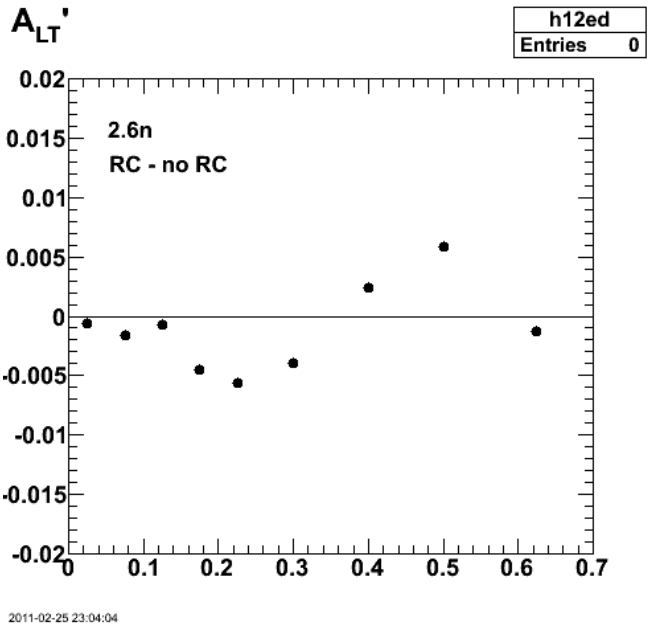


Fig 7. Effect of RC.

Click here to view the object (Root macro) you uploaded.

First full version of eod5.h which contains the function to fill the 3D histogram used fro interpolating.

Click here to view the object (eod5.h as of 3/23/11) you uploaded.

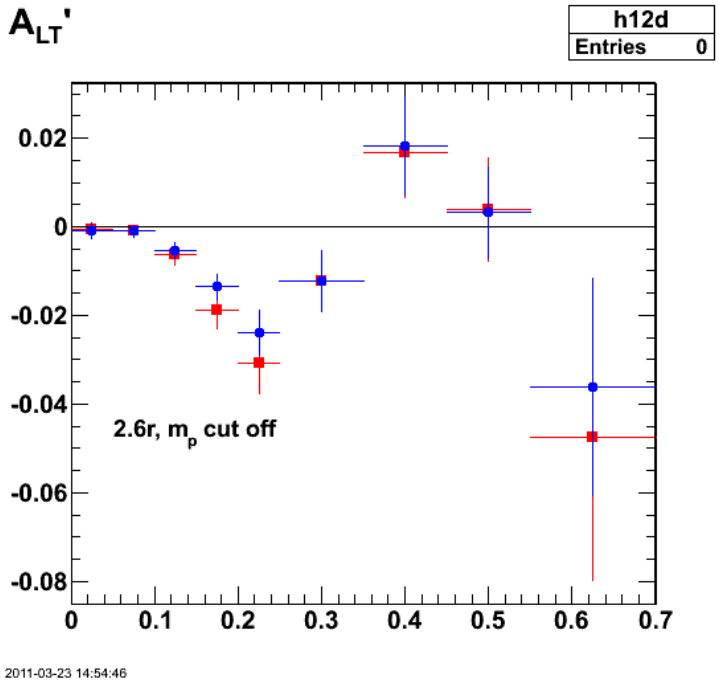


Fig 8. Effect of RC for full calculation. There is a significant effect on the dip.

Click here to view the object (Root macro) you uploaded.

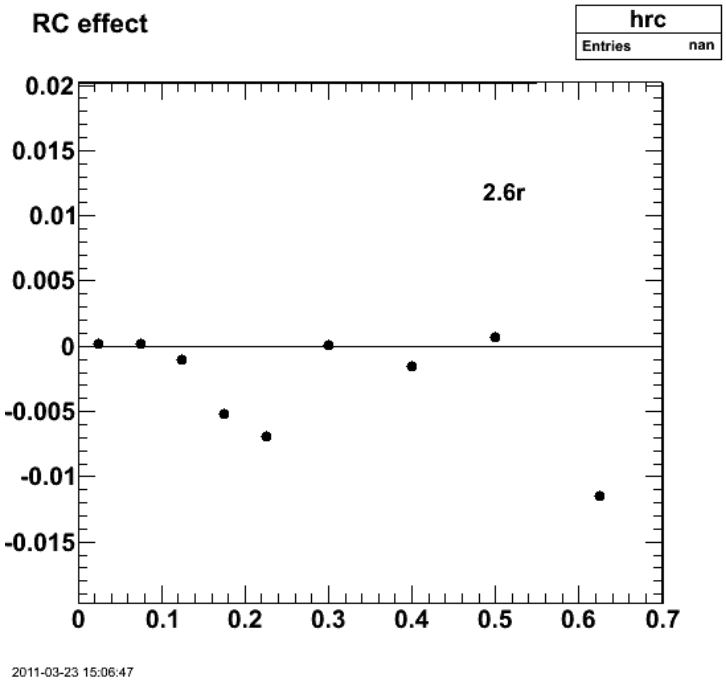


Fig 9. Effect of full RC.

Improve the way the analysis code deals with angles and Q2 outside the region of the calculation and get the following. The dip, if anything looks more shallow and now it appears that ALTp is negative at low pm.

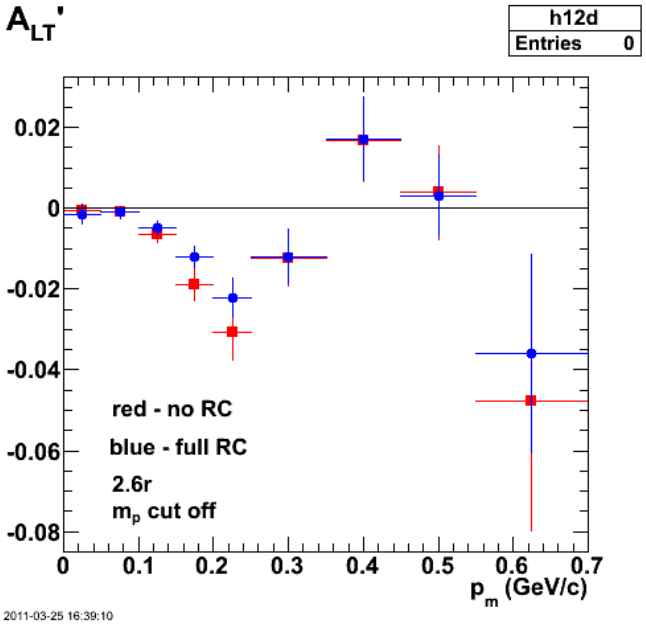


Fig 10. Effect of full calculation with improved handling of events outside the kinematic range of the RC calculation.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 344 - Low p_m asymmetry for 2.6r (gpg)

[Modified Fri Mar 4 03:25:36 2011 (GMT) gpg]

The plot below shows ALTp at small pm where is should go to zero.

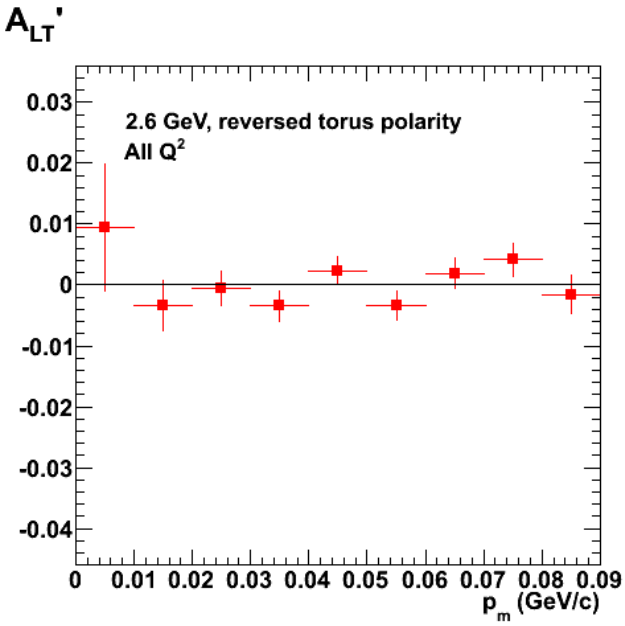


Fig 1. Low pm dist for 2.6r.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 345 - Comparison of 2.6r old and new (gpg)

[Modified Wed Apr 20 15:15:56 2011 (GMT) gpg]

I want to compare the default version of the asymmetries with my current analysis for 2.6r just to make sure things are consistent. Plot below shows this comparison. Things are very close for the high-stats, low-pm results and there is a small difference at large pm.

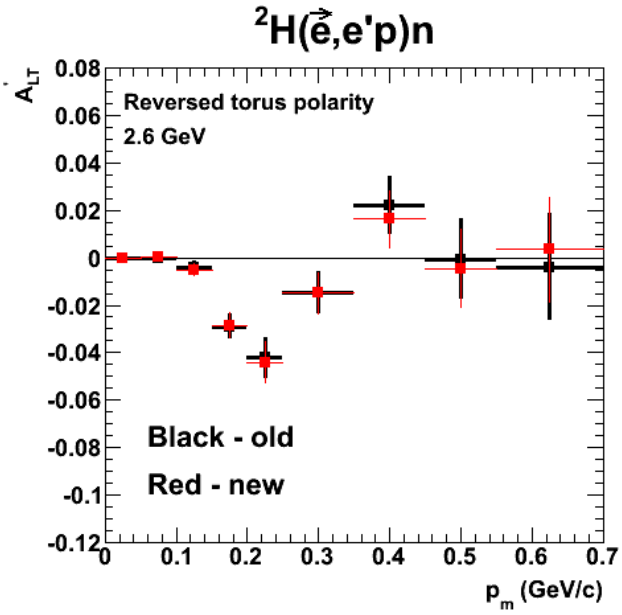


Fig 1. 2.6r comparison.

Click here to view the object (Root macro) you uploaded.

The parameters used in user_eod5.h are listed below.

```
//
//  important parameters of the analysis.
//
Double_t Me = 0.000511;
Double_t Mp = 0.938272;
Double_t Mn = 0.93956533;
Double_t Mpi = 0.1396;
Double_t Md =1.875;
Double_t Ebeam  = 2.55814;
Double_t deuterium_upstream = -11.5, deuterium_downstream = -8.0;  // default
//Double_t neutron_mm2_lo = 0.84, neutron_mm2_hi = 0.92;  // old default values up to 8/12/09
//Double_t neutron_mm2_lo = 0.83, neutron_mm2_hi = 0.91;  // new default values up to 8/31/09
//Double_t neutron_mm2_lo = 0.75, neutron_mm2_hi = 0.97;  // new default values
Double_t neutron_mm2_lo = 0.83, neutron_mm2_hi = 0.91;  // new default values for 2.6r
//Double_t neutron_mm2_lo = 0.83, neutron_mm2_hi = 0.91;  // new default values for 2.6n
//Double_t neutron_mm2_lo = 0.84, neutron_mm2_hi = 0.92;  // test 9/11/09

Double_t W_QE_lo=0.91, W_QE_hi=0.99;  // default values
```

From other entries in the elog (275, 276, and 279), the lower limit on the W cut should be 0.89 instead of 0.91. Entry 270 has the 2.6n archive of the analysis code. Rerun the analysis with Wmin=0.89 GeV and things change significantly. Sigh!! I can't believe I got this wrong.

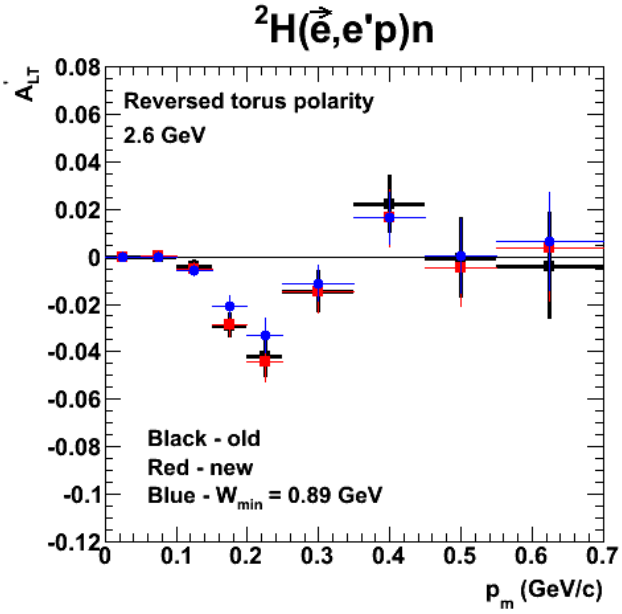


Fig 2. Add the result of the corrected lower limit on W.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 346 - Test sampling fraction cut choices (gpg)

[Modified Tue May 24 19:06:20 2011 (GMT) gpg]

The plot below shows the sampling fraction cuts from the e1 run period (black) and the e5 from jeff lachniet (red).

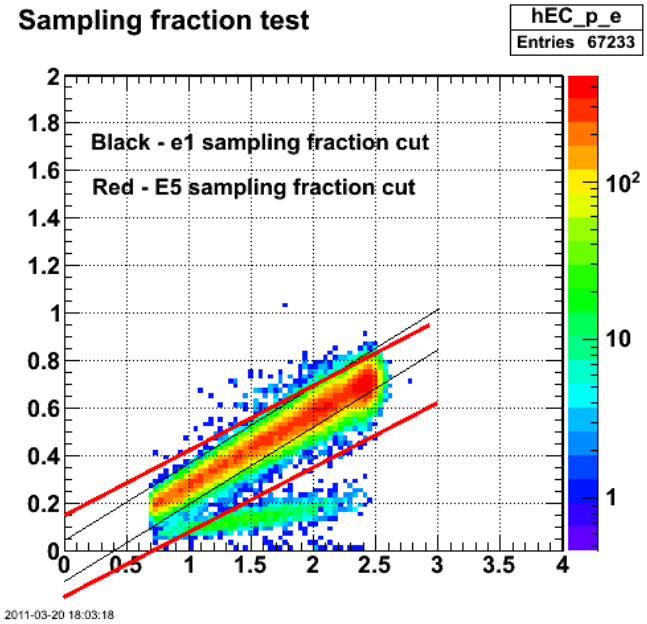


Fig 1. Sampling fraction cut for 2.6r.

Click here to view the object (Root macro) you uploaded.

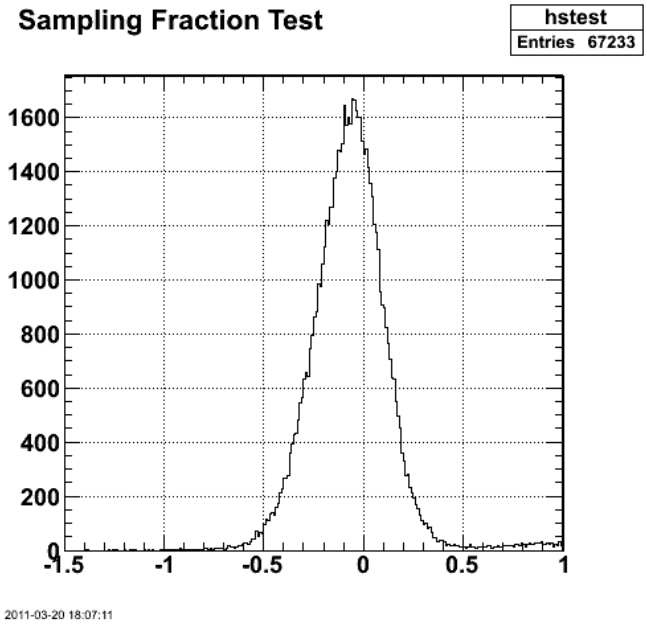


Fig 2. stest plot used to apply e5 sampling fraction cut.

Click here to view the object (Root macro) you uploaded.

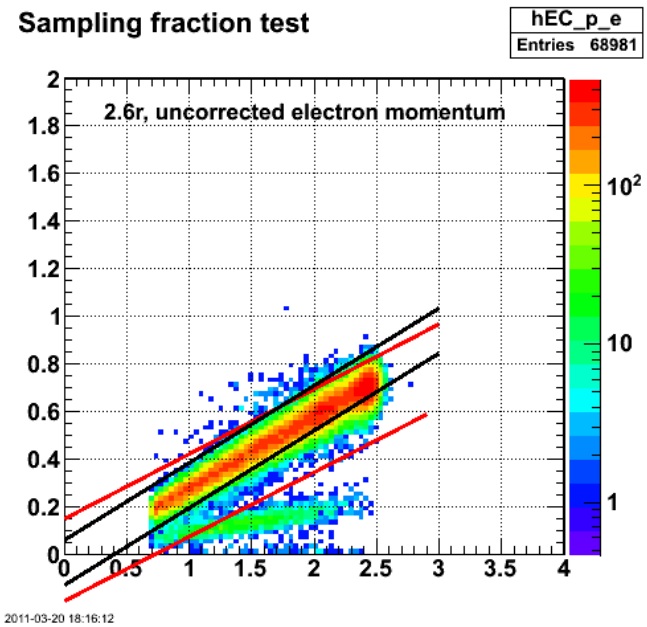


Fig 3. Check it with uncorrected electron momentum.

Click here to view the object (Root macro) you uploaded.

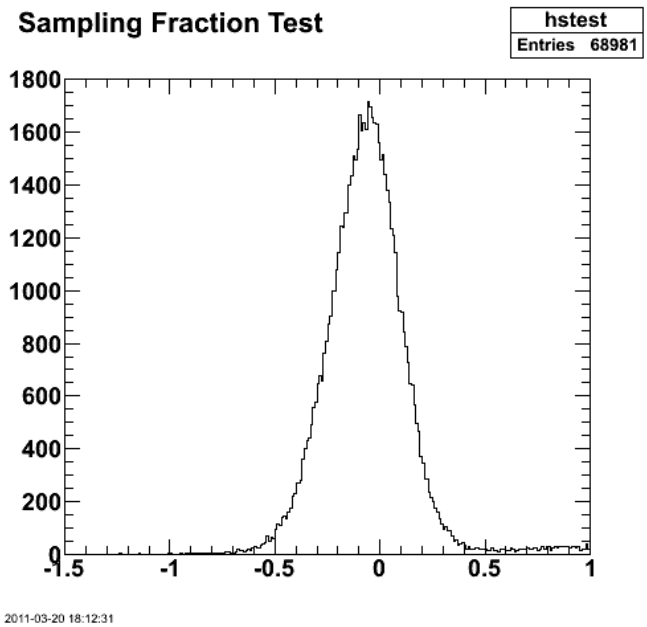


Fig 4. hstest with uncorrected electron momentum

Click here to view the object (Root macro) you uploaded.

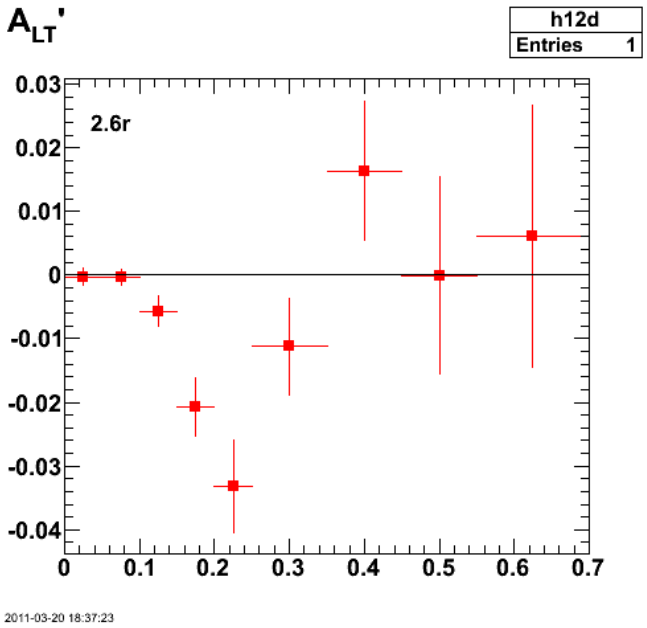


Fig 5. ALtp for today.

Click here to view the object (Root macro) you uploaded.

I was not drawing the lachniet sampling fraction cut lines properly in figs 1-4 above. That was corrected in the plots below. It clearly seems that I need different limits on the cut as drawn in the figure. The red lines are the old limits from jeff and the brown ones are the new ones.

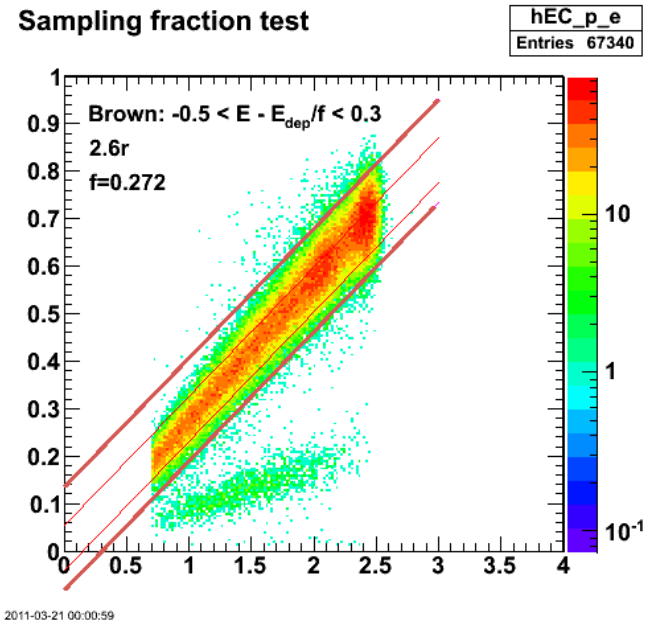


Fig 5. Sampling fraction cut with wider range (-0.5->+0.3).

Click here to view the object (Root macro) you uploaded.

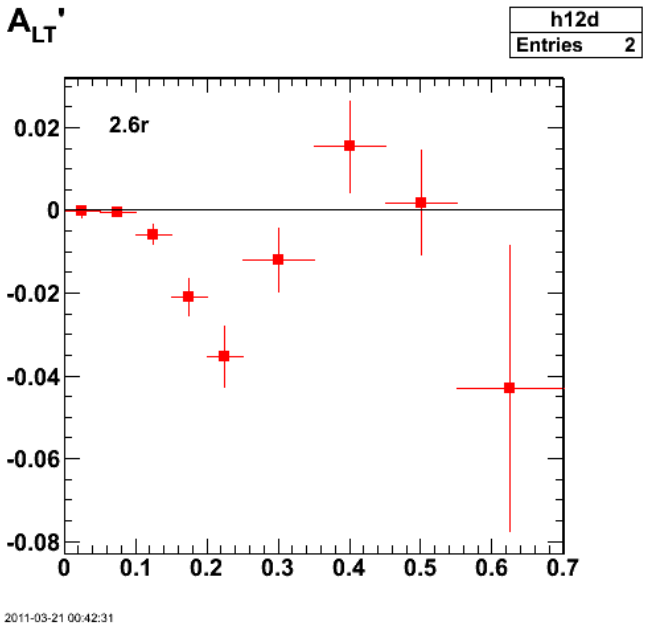


Fig 6. ALTp with wider sampling fraction cut.

Click here to view the object (Root macro) you uploaded.

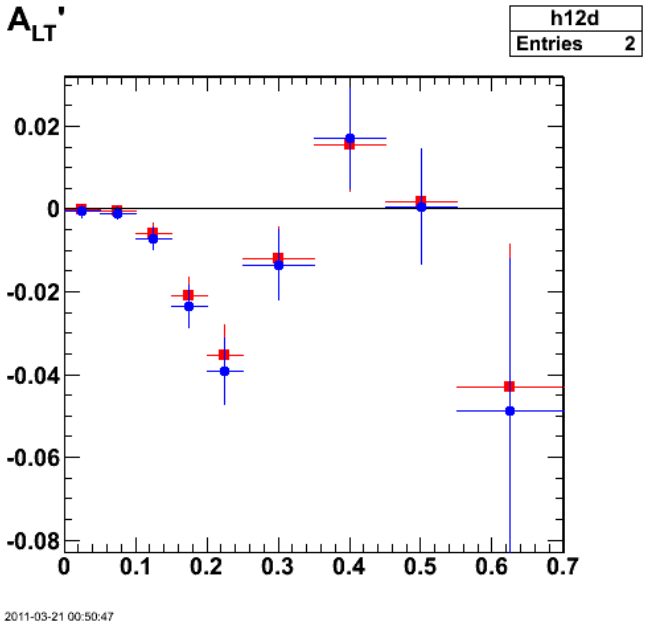


Fig 7. Effectof RC on ALTp.

Click here to view the object (Root macro) you uploaded.

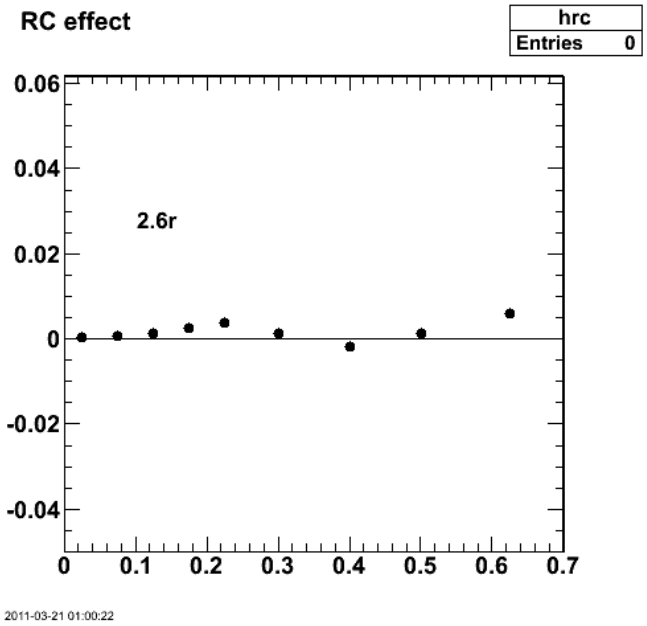


Fig 8. Effect of RC

Click here to view the object (Root macro) you uploaded.

test.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 347 - Proton Mass cut (gpg)

[Modified Tue Mar 22 12:19:01 2011 (GMT) gpg]

I am reexamining the proton mass cut. The current default values are

```
Double_t mass_p_lo=0.90, mass_p_hi=0.996; // default 10/20/09
```

which appear to be tight in Fig 1. (red lines) so I will make them larger to capture more statistics (black lines).

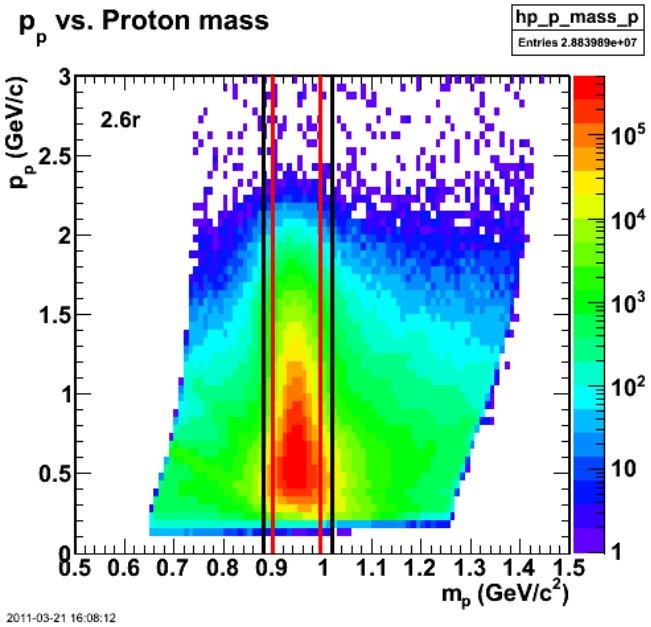


Fig 2. Proton mass cut. See entry 200 for more.

Click here to view the object (Root macro) you uploaded.

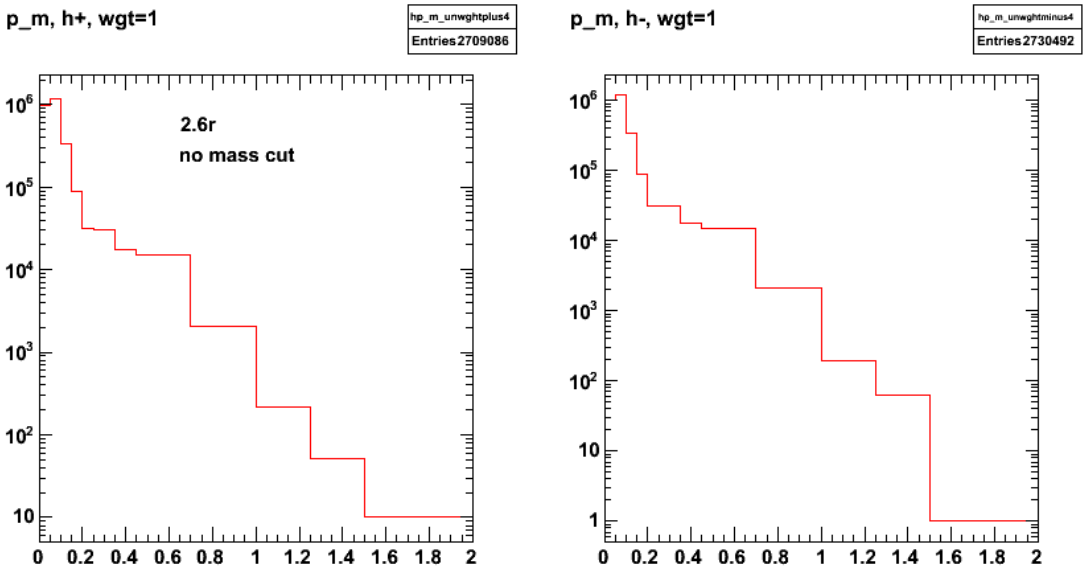


Fig 2. To set the context; unweighted missing momentum spectra for +/- helicities.

Click here to view the object (Root macro) you uploaded.

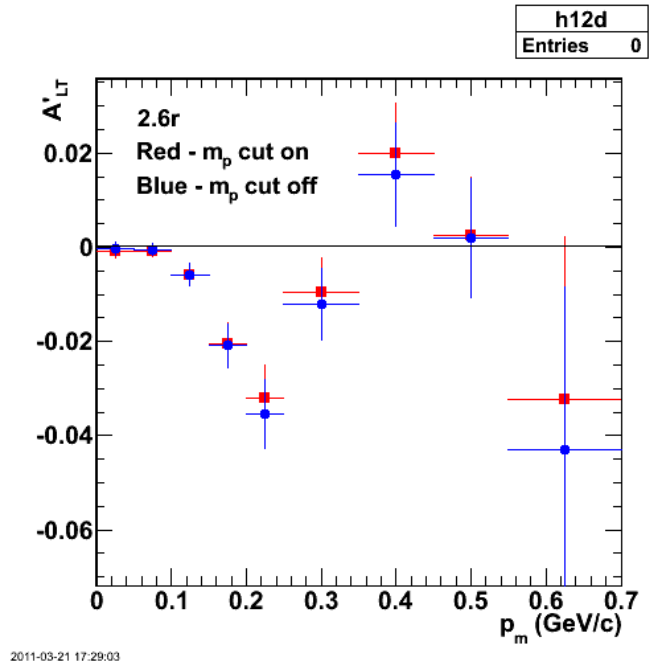


Fig 3. Effect on ALTp of turing on proton mass cut. It weakens the asymmetry which is the opposite of previous results.

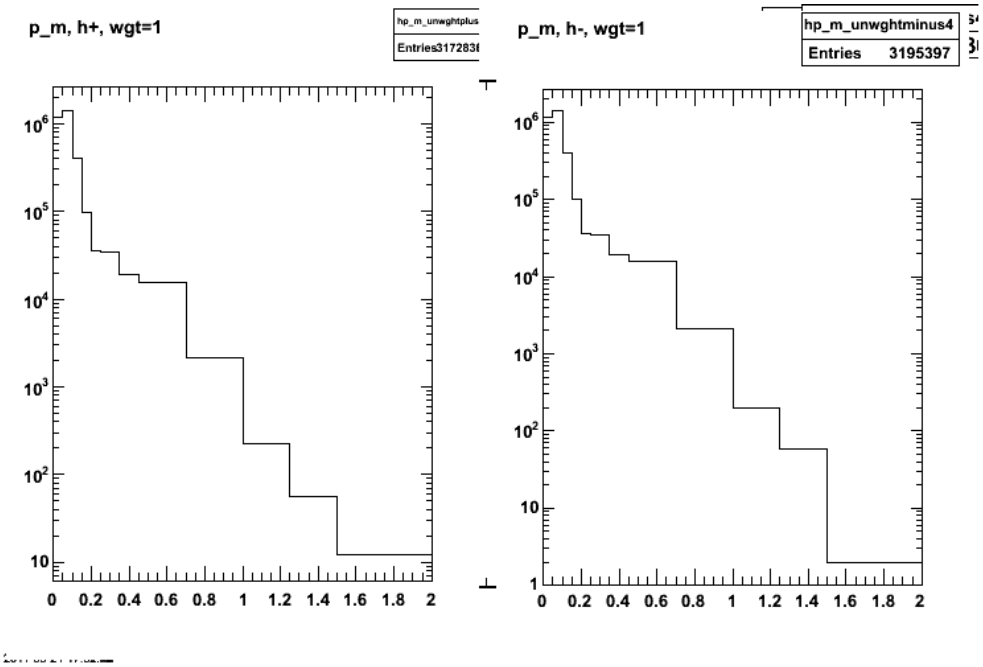


Fig 4. Comparison of unweighted p_m spectra. Notice that the number of events went UP??!! How can that be. Rerun the analysis with just the m_p cut removed.

Click here to view the object (Root macro) you uploaded.

Rerun the exact same analysis code with mp cut commented out and things look sane. The likely problem was that I was using the old sampling fraction cut. ALTp dip does get a tiny bit deeper.

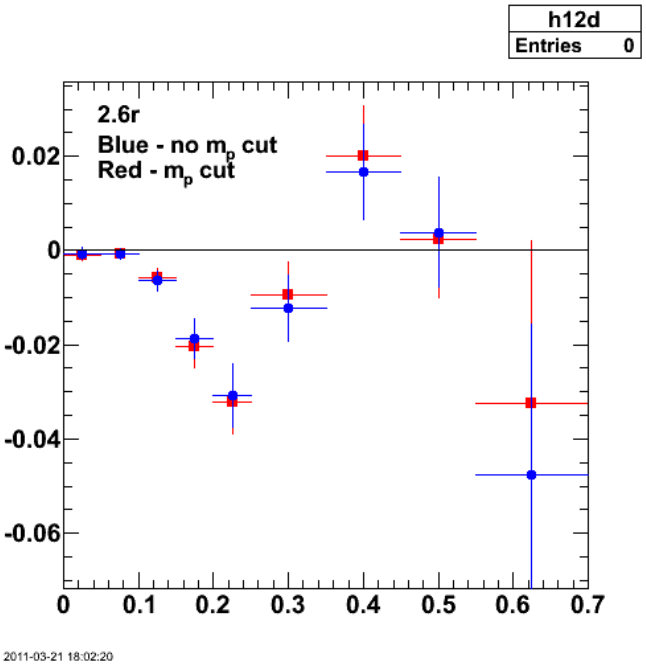


Fig 5. Comparison of ALTp with (red) and without (blue) proton mass cut.

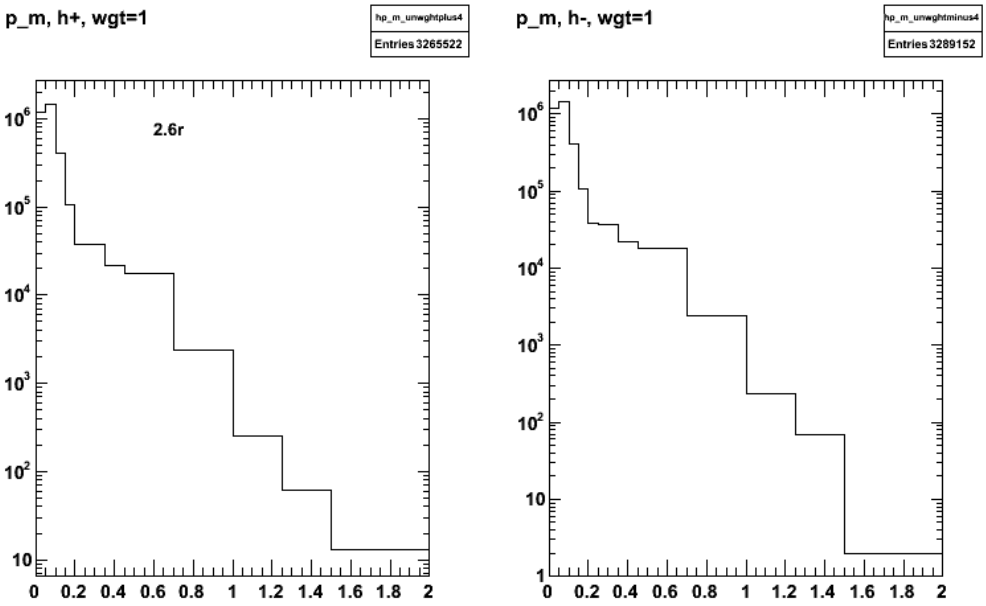


Fig 6. Comparison of unweighted p_m spectra. These now look reasonable in comparison with the same spectra with the proton mass cut turned on in fig 4.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 348 - Setting up DOE2000 elog (gpg)

[Modified Wed May 25 20:03:41 2011 (GMT) gpg]

Installing DOE2000 (ENOTE).

```
1. Installed XAMPP (xampp-linux-1.7.4.tar) from http://www.apachefriends.org/en/xampp-linux.html and extracted it to /opt

2. Downloaded enote from http://www.csm.ornl.gov/~geist/enote/zips/enote1_12.tar and untar it in /opt/lampp/htdocs.

3. Placed the two .pl files from enote1.12/cgi-bin in /opt/lampp/cgi-bin.

root-gpg4:cgi-bin> cp ../htdocs/enote1.12/cgi-bin/enote112.pl .
root-gpg4:cgi-bin> cp ../htdocs/enote1.12/cgi-bin/enotelib.pl .
root-gpg4:cgi-bin> pwd
/opt/lampp/cgi-bin



4. Placed the rest of the files from enote1.12 into /opt/lampp/htdocs

root-gpg4:enote1.12> pwd
/opt/lampp/htdocs/enote1.12
root-gpg4:enote1.12> dir
total 28
drwxr-sr-x. 2 8149 gopher  4096 May 23 22:14 cgi-bin/
-rw-r--r--. 1 8149 gopher  3339 Feb  3  2004 enote1_12_readme.txt
drwxr-sr-x. 4 8149 gopher  4096 Feb  3  2004 html/
-rw-r--r--. 1 8149 gopher 12669 Feb  3  2004 install.txt



5. Added the ExecCGI option to the cgi-bin directory in /opt/lampp/etc/httpd.conf

#
# "/opt/lampp/cgi-bin" should be changed to whatever your ScriptAliased
# CGI directory exists, if you have that configured.
#

    AllowOverride None
#    Options None       <---- comment this out.
    Options ExecCGI     <---- add this.
    Order allow,deny
    Allow from all





6. Allowed access from all in the file /opt/lampp/etc/extra/httpd-xampp.conf

#
# New XAMPP security concept
#

        Order deny,allow
#  default is to have the following 4 lines uncommented and not have the Allow from all line.
#       Deny from all
#       Allow from ::1 127.0.0.0/8 \
#               fc00::/7 10.0.0.0/8 172.16.0.0/12 192.168.0.0/16 \
#               fe80::/10 169.254.0.0/16
        Allow from all        <---- this is the change.

        ErrorDocument 403 /error/XAMPP_FORBIDDEN.html.var





7. Changed the variables in /opt/lampp/cgi-bin/enote112.pl to reflect the paths of the required files.

---

$main::notebook{'gpg'} = {(
  'dir'   => '/opt/lampp/htdocs/enote1.12/html/gpg/',
  'title' => "Jerry Gilfoyle's Notebook",
  )};

# Example of how to specify additional notebooks
#$main::notebook{'data'} = {(
#  'dir'   => 'c:/httpd/root/enote1.12/html/instrument/',
#  'title' => "Raw Instrument Data Notebook"
#  )};

$main::nb = 'gpg';


---
```

```
##############################################################################
#
#  Section 3: General configuration flags and variables
#
##############################################################################

#  Set to 1 if flock() exists (server is Unix), to 0 otherwise (Windows/Mac).
$main::flock = 0;

#  Directory of the shared notebook library routines 'enotelib.pl'.
$main::libdir = '/opt/lampp/cgi-bin';           <--- change this
```

8. Comment out the following (lines 79-90) in the lampp config file (/opt/lampp/lampp)to NOT check for 32-bit compatibility.

```
# XAMPP is currently 32 bit only
#case `uname -m` in
#       *_64)
#       if /opt/lampp/bin/php -v > /dev/null 2>&1
#       then
#               :
#       else
#               $de && echo "XAMPP gibt es zur Zeit nur als 32-Bit Applikation. Bitte verwende eine 32-Bit Kompatibilitaetsbibliothek fuer Dein System.'
#               $de || echo "XAMPP is currently only availably as 32 bit application. Please use a 32 bit compatibility library for your system."
#               exit
#       fi
#       ;;
#esac
```

9. Make a symbolic link in /opt/lampp/htdocs to the enote112.pl script in /opt/lampp/cgi-bin/ so perl finds the right script.

```
root-gpg4:htdocs> ln -s /opt/lampp/cgi-bin/enote112.pl enote112.pl
root-gpg4:htdocs> pwd
/opt/lampp/htdocs
root-gpg4:htdocs> dir
total 800
drwxr-sr-x. 4   8149 gopher   4096 Feb  3  2004 enote1.12/
lrwxrwxrwx. 1 root   root       30 May 23 23:14 enote112.pl -> /opt/lampp/cgi-bin/enote112.pl
-rw-r--r--. 1 root   root   768000 May 23 22:14 enote1_12.tar
-rw-r--r--. 1 root   root    30894 May 11  2007 favicon.ico
-rw-r--r--. 1 root   root      256 Feb  5  2009 index.php
drwxr-xr-x. 2 nobody root     4096 Jul 15  2009 webalizer/
drwxr-xr-x. 7 root   root     4096 Jan  7 03:48 xampp/
```

10. Get selinux set up properly.

```
yum install selinux-policy.noarch

yum install setools

setsebool -P allow_execstack on
```

takes a while.

11. Start up the deamon.

```
/opt/lampp/lampp start

root-gpg4:htdocs> /opt/lampp/lampp start
Starting XAMPP for Linux 1.7.4...
XAMPP: Starting Apache with SSL (and PHP5)...
XAMPP: Starting MySQL...
XAMPP: Starting ProFTPD...
XAMPP for Linux started.
```

12. Symbolic link to fix Sendmail.pm problem (see below for more details).

```
root-gpg4:i686-linux>  pwd
/opt/lampp/lib/perl5/5.10.1/i686-linux
```

```
root-gpg4:i686-linux>  ln -s /usr/share/perl5/Mail/Sendmail.pm Sendmail.pm    <-- had to create the target directory
                                                                                   and copy the file into it.
```

13. Change the file names in all the input files in /opt/lampp/htdocs/enote1.12/html/gpg/. This was done
using grep, cut, etc (see below) with macros in emacs to create a file with lines like the following.

```
grep text index.lst | grep -v - | cut -b 5-15 > changename.sh

some lines from changenames.sh

sed 's|clasweb.jlab.org/cgi-bin/ENOTE/enote.pl|gpg4.richmond.edu/cgi-bin/enote112.pl|'  1090005.403 > hold.txt; rm 1090005.403 ; mv hold.txt 1090005.403
sed 's|clasweb.jlab.org/cgi-bin/ENOTE/enote.pl|gpg4.richmond.edu/cgi-bin/enote112.pl|'  1090203.732 > hold.txt; rm 1090203.732 ; mv hold.txt 1090203.732
sed 's|clasweb.jlab.org/cgi-bin/ENOTE/enote.pl|gpg4.richmond.edu/cgi-bin/enote112.pl|'  1090247.767 > hold.txt; rm 1090247.767 ; mv hold.txt 1090247.767

There was a line for each file that contained the base entry. Then execute 'source changena,es.sh'.
```

14. Set the permissions.

```
root-gpg4:gpg> pwd
/opt/lampp/htdocs/enote1.12/html/gpg

root-gpg4:gpg> chmod o+w 1*
root-gpg4:gpg> chmod o+w .
root-gpg4:gpg> chmod o+w index.lst
```

15. Turn on the www(http) service with the gui.

```
run

system-config-firewall

from root. running from the menu made it crash.
```

16. Set up the passwords.

```
htpasswd -c /opt/lampp/passwords/users gilfoyle
chmod 644 /opt/lampp/passwords/users
chmod 644 /opt/lampp/cgi-bin/.htaccess

create .htaccess in /opt/lampp/cgi-bin

gpg4:cgi-bin> more .htaccess
AuthType Basic
AuthName "elog password"
AuthUserFile /opt/lampp/passwords/users
require valid-user

edit httpd.conf

   #
    # AllowOverride controls what directives may be placed in .htaccess files.
    # It can be "All", "None", or any combination of the keywords:
    #   Options FileInfo AuthConfig Limit
    #
    #AllowOverride None
    # since XAMPP 1.4:
    #gpg AllowOverride All
    AllowOverride AuthConfig   <---- line 237

#
# "/opt/lampp/cgi-bin" should be changed to whatever your ScriptAliased
# CGI directory exists, if you have that configured.
#

    #gpg AllowOverride None
    AllowOverride AuthConfig    <---- line 356
    Options ExecCGI
    Order allow,deny
    Allow from all
```

17. Turn on VPN if you are outside UR or JLab. Go to this in your browser.

```
http://gpg4.richmond.edu/cgi-bin/enote112.pl
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 349 - RC corrections for 2.6r ALTp (gpg)

[Modified Thu May 26 17:03:49 2011 (GMT) gpg]

Copied from ELOG entry.

Starting collecting results for RC correction to ALTp. Since the correction appears to be significant and different and varies with phi for the polarized and unpolarized parts of the cross section, then I have to put in the correction on each separately. (1) The first step is to generate the 2D surfaces (functions of cos(theta) and phi) for polarized and unpolarized at many different Q2 values. The first plot below shows the surfaces for polarized RC correction for Q2=0.2 GeV2 (red) and Q2=0.5 GeV2 (blue). Mathematica notebooks for separate Q2 calculations are below fig 1.

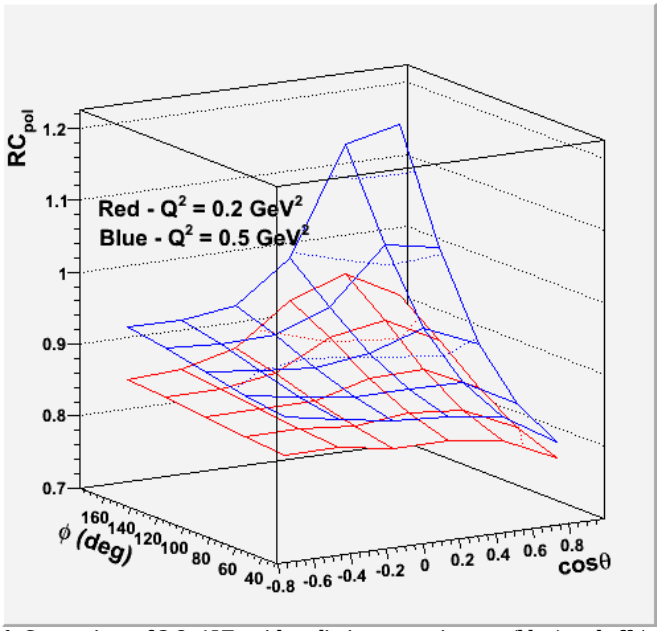


Fig 1. Comparison of 2.6r ALTp with radiative corrections on (blue) and off (red).

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Mathematica notebook) you uploaded.

Click here to view the object (Mathematica notebook) you uploaded.

First pass at re-analysis of ALTp for 2.6r with and without the RC.

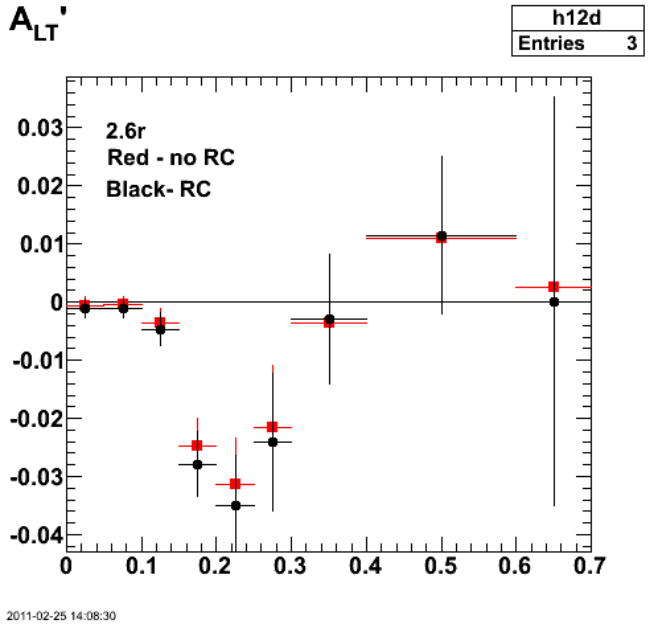


Fig 2. Comparison of ALTp for no RC (red), constant RC (blue, hidden by red), and exclurad RC (black.

Click here to view the object (Root macro) you uploaded.

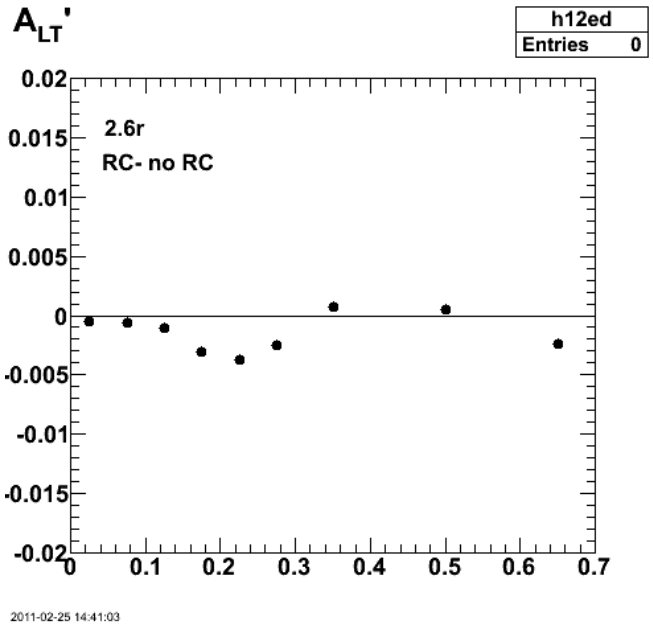


Fig 3. Difference between ALTp with RC on and RC off. I will probably take half this value and add it to the systematic uncertainty.

Click here to view the object (Root macro) you uploaded.

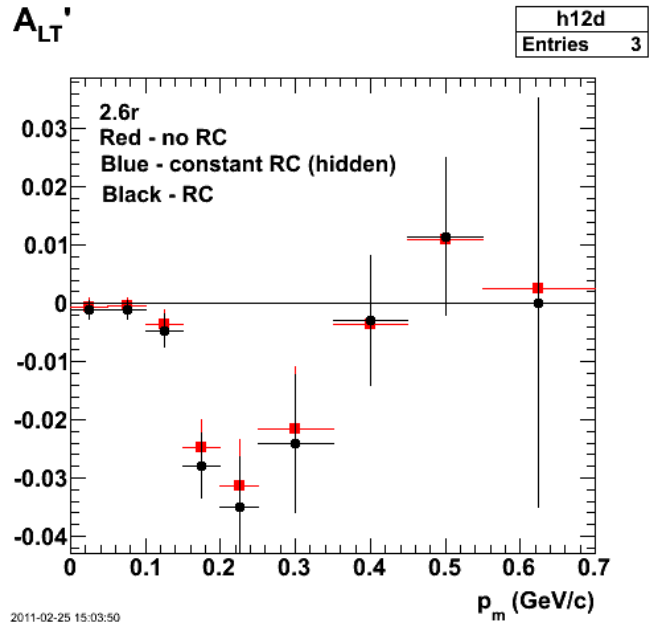


Fig 4. Same as 2 with corrected pm bins.

Click here to view the object (Root macro) you uploaded.

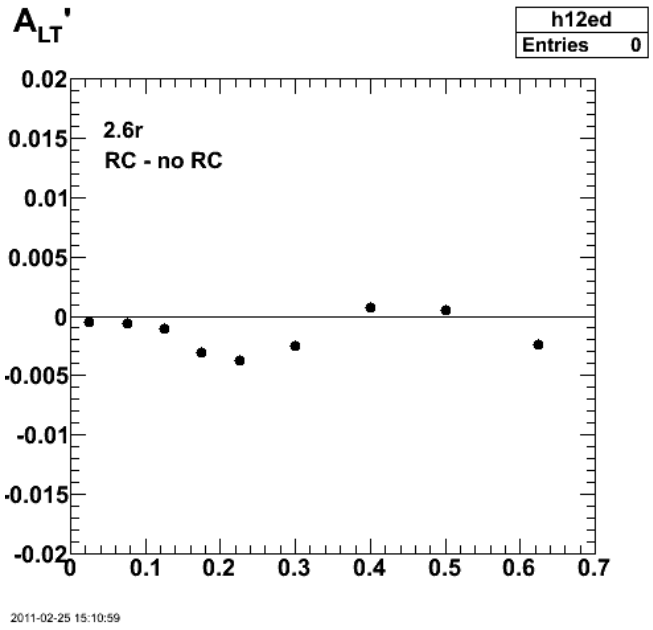


Fig. 5. Same as fig 3 with corrected pm bins

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

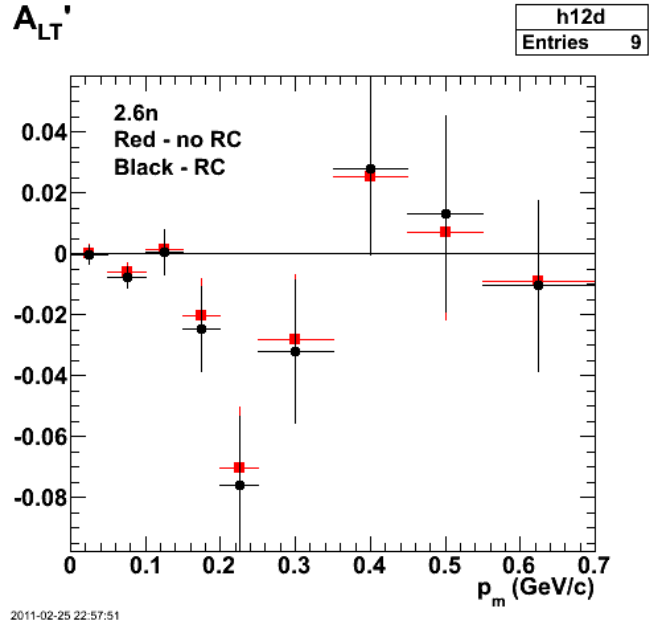


Fig 6. Comparison of ALtp at 2.6n with RC on (black) and off (red).

Click here to view the object (Root macro) you uploaded.

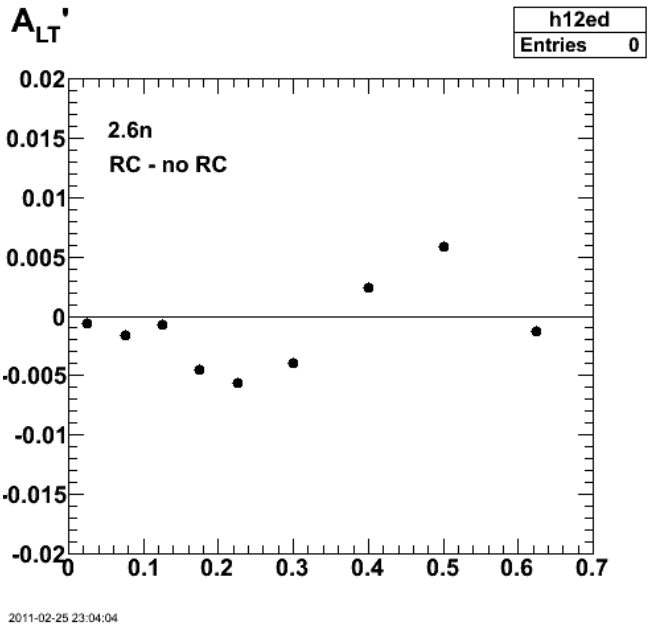


Fig 7. Effect of RC.

Click here to view the object (Root macro) you uploaded.

First full version of eod5.h which contains the function to fill the 3D histogram used for interpolating. File is attached.

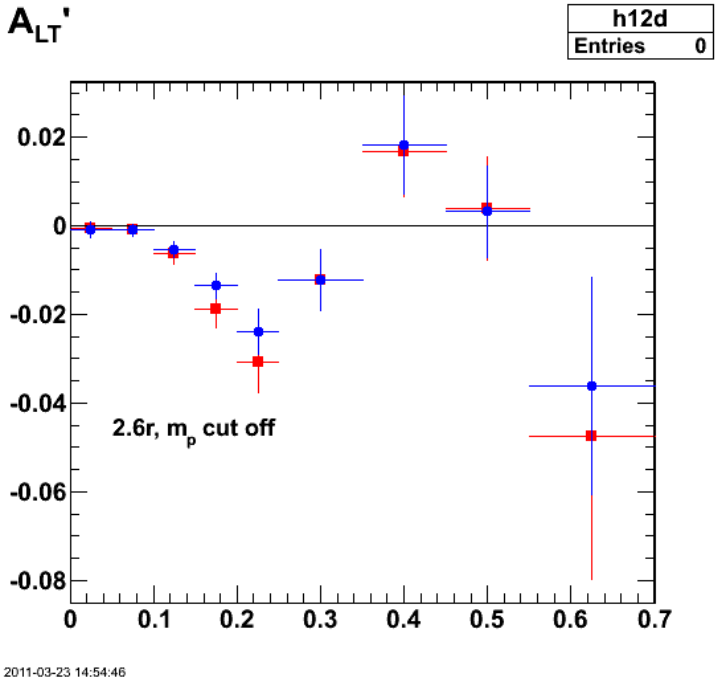


Fig 8. Effect of RC for full calculation. There is a significant effect on the dip.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root analysis code) you uploaded.

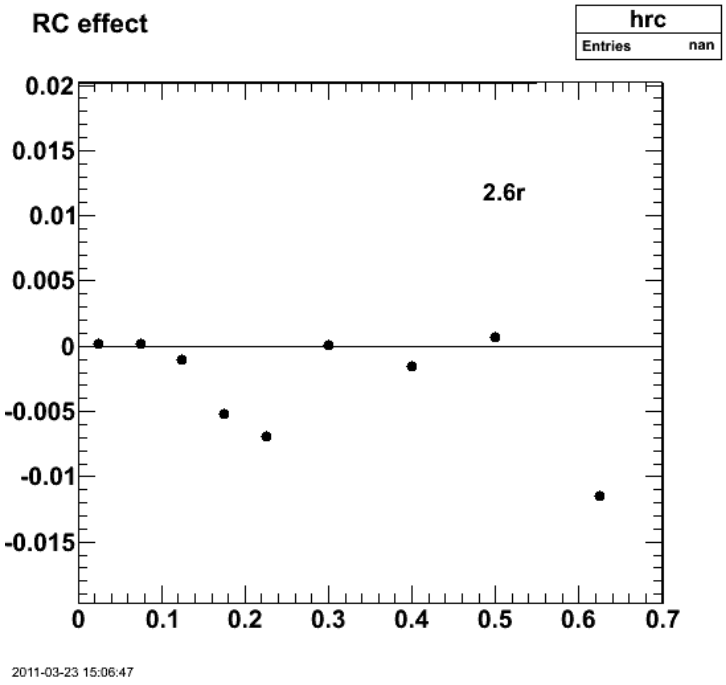


Fig 9. Effect of full RC.

Improve the way the analysis code deals with angles and Q2 outside the region of the calculation and get the following. The dip, if anything looks more shallow and now it appears that ALTp is negative at low pm.

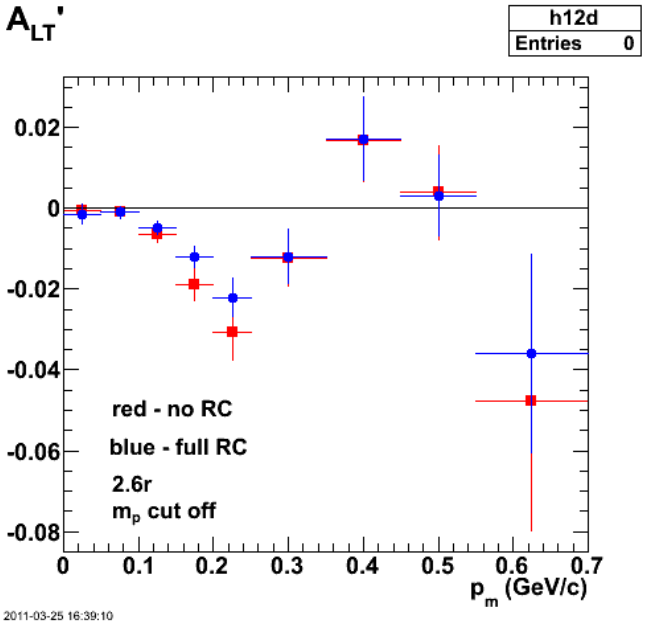


Fig 10. Effect of full calculation with improved handling of events outside the kinematic range of the RC calculation.

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Jerry Gilfoyle's Enotebook page 350 - List of ELOG entries. (gpg)

[Modified Thu May 26 17:07:10 2011 (GMT) gpg]

The graphic below shows the list of ELOG entries made when enote was dead.

Jerry Gilfoyle's elog, Page 1 of 1

New | Find | Select | Import | Config | Help

Full | Summary | Threaded

ID	Date	Author	Type	Subject	
1	Fri Apr 8 18:34:55 2011	gpg	EoD	RC corrections for 2.6r ALTp	Starting col to ALTp. Sin be significa
2	Mon Apr 11 14:57:15 2011	gpg	EoD	Testing RC on 2.6r	I'm getting the correct stuff becaus
3	Tue Apr 12 22:55:25 2011	gpg	Calculation	RC check	Use the same surfaces sho to try to un
4	Wed Apr 13 15:31:53 2011	gpg	EoD	ALTp(phi) method.	Check the RC with the cor plot is my o
5	Sun Apr 17 00:07:44 2011	gpg	EoD	testing 2.6r RC correction for pm = 0.20-0.25 GeV/c	Print out th RC for 2.6r entry 3 it l
6	Mon Apr 18 08:44:34 2011	gpg	EoD	Results of fixes to 2.6r RC application	After fixing the RCs we r plot shows t
7	Wed Apr 20 00:12:31 2011	gpg	EoD	turn on 2.5r mp cut	Turn on the eliminate th versus mass
8	Wed Apr 20 11:34:55 2011	gpg	EoD	Effect of RC and mp cut on 2.6n ALTp	Now get ALTp on/off. RC e comparing wi
9	Sun Apr 24 20:43:28 2011	gpg	EoD	Effect of efids/pfids with mp and RC on 2.6n	Now check th I am rethink off in the a
10	Mon Apr 25 23:20:32 2011	gpg	EoD	Testing the 2.6n, no-fids analysis	Compare fids order to get since the tw
11	Wed Apr 27 14:24:14 2011	gpg	EoD	testing the 2.6r no-fids analysis.	First compar with fids on [center]
12	Sat Apr 30 11:24:15 2011	gpg	EoD	Doing 2.6r delta_ALTp correctly	As I think a previous ent In order to
13	Sat Apr 30 13:19:21 2011	gpg	EoD	Do 2.6n delta_ALTp correctly.	Now do the 2 described in the enhanced
14	Sun May 1 13:31:33 2011	gpg	EoD	Enhancing 2.6n statistics	Series of ch to increase off the QE a
15	Sun May 1 22:47:47 2011	gpg	EoD	Mp cut uncertainty for 2.6r	Get ALTp wit entry (7). F RC is on her
16	Mon May 2 10:30:14 2011	gpg	EoD	Mp cut uncertainty for 2.6n	Get ALTp wit entry (8). F RC is on her
17	Tue May 17 13:48:49 2011	gpg	GMn	Ratio of triggers to simulated QE events	In preparati for CLAS12 w of simulated
18	Sun May 22 12:44:58 2011	gpg	EoD	Non/Noff ratio	For the Anal a relationsh ALTp and efi

List of my ELOG entries.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 351 - Testing RC on 2.6r (gpg)

[Modified Thu May 26 21:45:52 2011 (GMT) gpg]

I'm getting analysis results that don't have the correct histograms. Am I picking up old stuff because it is not getting deleted or copied over on the remote nodes.

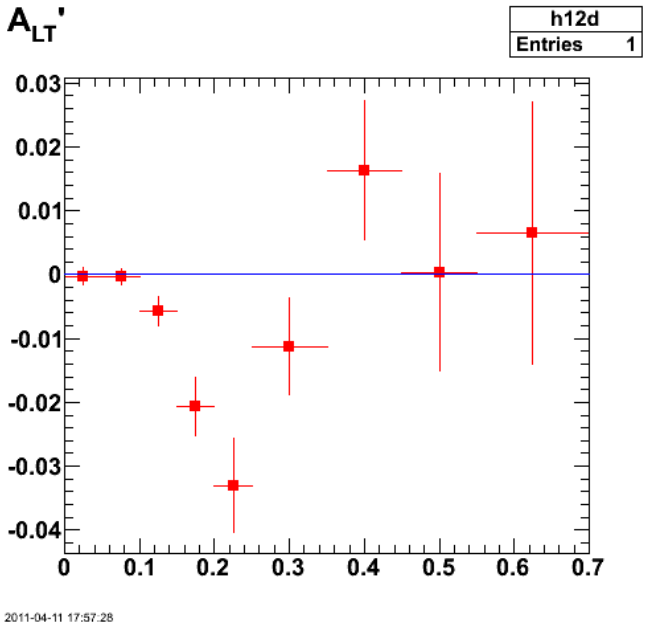

Fig 1. 2.6r ALTp results from weird software without the correct histograms. No RC or mproton cut here.

I was using an old summed histogram file on my jump drive. Dumb ass!!! For the RC in the plot below, I fixed the Q2 of the RC to 0.2 for ALL Q2 to study the effect.

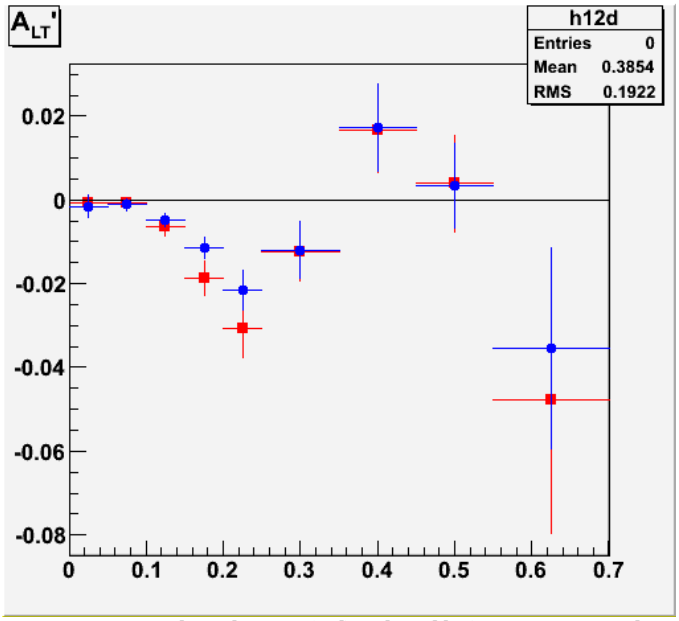

Fig 2. 2.6r ALTp results with no RC (red) and RC (blue). No mproton cut here.

```
root [48] h12d->Print("all")
TH1.Print Name = h12d, Entries= 0, Total sum= -0.433306
fSumw[0]=0, x=-0.0833333, error=0
fSumw[1]=-0.000662838, x=0.025, error=0.00123831
fSumw[2]=-0.000788116, x=0.075, error=0.00112941
fSumw[3]=-0.00638511, x=0.125, error=0.00212678
fSumw[4]=-0.0187597, x=0.175, error=0.00417807
```

```
fSumw[5]=-0.0308538, x=0.225, error=0.00670649
fSumw[6]=-0.0123007, x=0.3, error=0.00696001
fSumw[7]=0.016738, x=0.4, error=0.0100897
fSumw[8]=0.00386686, x=0.5, error=0.0115847
fSumw[9]=-0.0476025, x=0.625, error=0.0320616
fSumw[10]=-0.120948, x=0.85, error=0.0985166
fSumw[11]=-0.041732, x=1.25, error=0.183443
fSumw[12]=-0.173878, x=1.75, error=0.836799
fSumw[13]=0, x=2.08333, error=0
root [49]

root [49] h12drc->Print("all")
TH1.Print Name = h12drc, Entries= -2147483648, Total sum= -nan
fSumw[0]=0, x=-0.0833333, error=0
fSumw[1]=-0.0015292, x=0.025, error=0.00258506
fSumw[2]=-0.00108174, x=0.075, error=0.00137557
fSumw[3]=-0.00474079, x=0.125, error=0.00158357
fSumw[4]=-0.0116048, x=0.175, error=0.00252901
fSumw[5]=-0.0215142, x=0.225, error=0.00466062
fSumw[6]=-0.0119468, x=0.3, error=0.00669498
fSumw[7]=0.0172354, x=0.4, error=0.0104223
fSumw[8]=0.0033234, x=0.5, error=0.0101547
fSumw[9]=-0.0355011, x=0.625, error=0.0239272
fSumw[10]=-0.0941731, x=0.85, error=0.075464
fSumw[11]=-nan, x=1.25, error=-nan
fSumw[12]=0, x=1.75, error=0
fSumw[13]=0, x=2.08333, error=0
root [50]
```

Between Figs 2-3 I discovered a mistake in the analysis code. I was using the wrong set of bin edges in eod5.C. This whole project has been plagued by me being not careful enough with all the parameters of the analysis. I must be more careful in the future. I believe that is why there are small variations from one analysis run to another when they are many months apart.

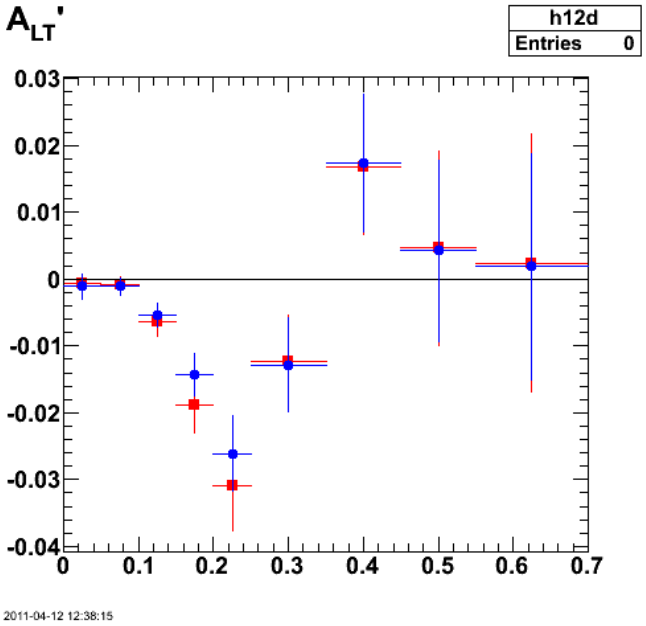

Fig 2. 2.6r ALTp results with no RC (red) and RC (blue). No mproton cut here.

The idea her is a quick check that something pathological is not going on. I would expect small changes in the RC'ed histograms. If they were exactly the same, then we would clearly be doing something wrong. They look reasonable.

```
root [41] h12drc->Print("all")
TH1.Print Name = h12drc, Entries= -2147483648, Total sum= -nan
fSumw[0]=0, x=-0.0833333, error=0
fSumw[1]=-0.00111812, x=0.025, error=0.00187484
fSumw[2]=-0.00106966, x=0.075, error=0.00125545
fSumw[3]=-0.00533771, x=0.125, error=0.00180441
fSumw[4]=-0.0142932, x=0.175, error=0.00308683
fSumw[5]=-0.0260945, x=0.225, error=0.00563691
fSumw[6]=-0.0128527, x=0.3, error=0.00707295
fSumw[7]=0.0173806, x=0.4, error=0.0102801
fSumw[8]=0.00425221, x=0.5, error=0.0135756
fSumw[9]=0.00189875, x=0.625, error=0.0169098
fSumw[10]=-0.0401318, x=0.85, error=0.0277206
fSumw[11]=-nan, x=1.25, error=-nan
fSumw[12]=0, x=1.75, error=0
fSumw[13]=0, x=2.08333, error=0
root [42] h12d->Print("all")
TH1.Print Name = h12d, Entries= 0, Total sum= -0.371692
fSumw[0]=0, x=-0.0833333, error=0
fSumw[1]=-0.000662838, x=0.025, error=0.00123831
fSumw[2]=-0.000788116, x=0.075, error=0.00112941
fSumw[3]=-0.00638511, x=0.125, error=0.00212678
fSumw[4]=-0.0187597, x=0.175, error=0.00417807
fSumw[5]=-0.0308538, x=0.225, error=0.00670649
fSumw[6]=-0.0123007, x=0.3, error=0.00696001
```

```
fSumw[7]=0.016738, x=0.4, error=0.0100897
fSumw[8]=0.00462182, x=0.5, error=0.0144669
fSumw[9]=0.00238207, x=0.625, error=0.0193408
fSumw[10]=-0.0476025, x=0.85, error=0.0320616
fSumw[11]=-0.104204, x=1.25, error=0.0868248
fSumw[12]=-0.173878, x=1.75, error=0.836799
fSumw[13]=0, x=2.08333, error=0
root [43]
```

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Jerry Gilfoyle's Enotebook page 352 - RC check (gpg)

[Modified Thu May 26 21:49:20 2011 (GMT) gpg]

Use the same routines in root to generate surfaces showing the ratio of pol/unpol RC to try to understand the large effect at pm=0.25 GeV/c in the previous entry.

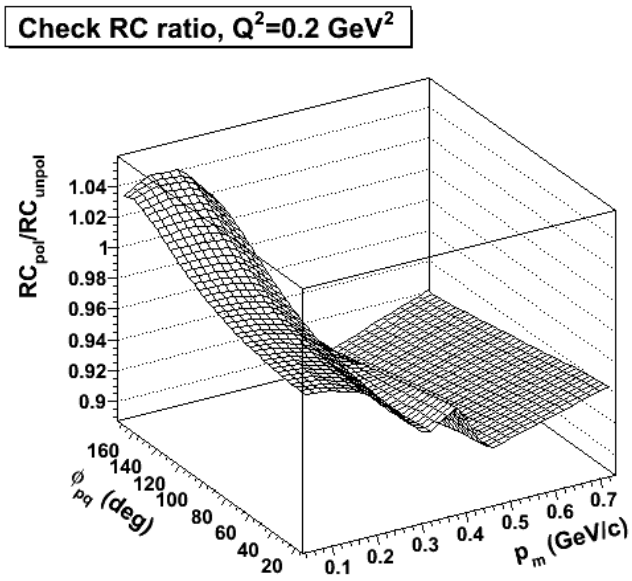

Fig 1. Ratio RCpol/RCunpol for Q2=0.2 GeV2. The range of the correction is about 0.9-1.04; much less than the 30% effect seen in the previous entry.

Click here to view the object (Root macro) you uploaded.

That was the low end of the Q2 range now look at the high end.

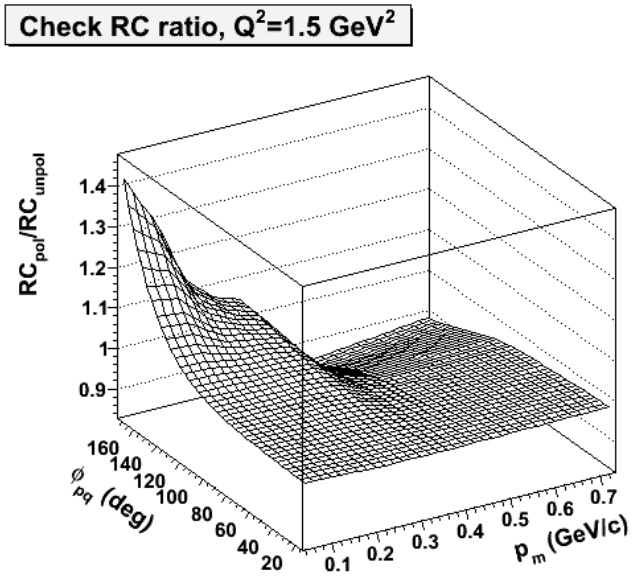

Fig 2. Ratio RCpol/RCunpol for Q2=1,5 GeV2. The correction is large at low pm and high phi. However, for pm~0.2 GeV/c the effect is about 10-15% which is much less than observed in the previous entry.

Click here to view the object (ROOT macro) you uploaded.

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Jerry Gilfoyle's Enotebook page 353 - ALTp(phi) method. (gpg)

[Modified Thu May 26 21:52:19 2011 (GMT) gpg]

Check the RC by first looking at ALTp(phi) with the correction off and on. The first plot is my old, old results.

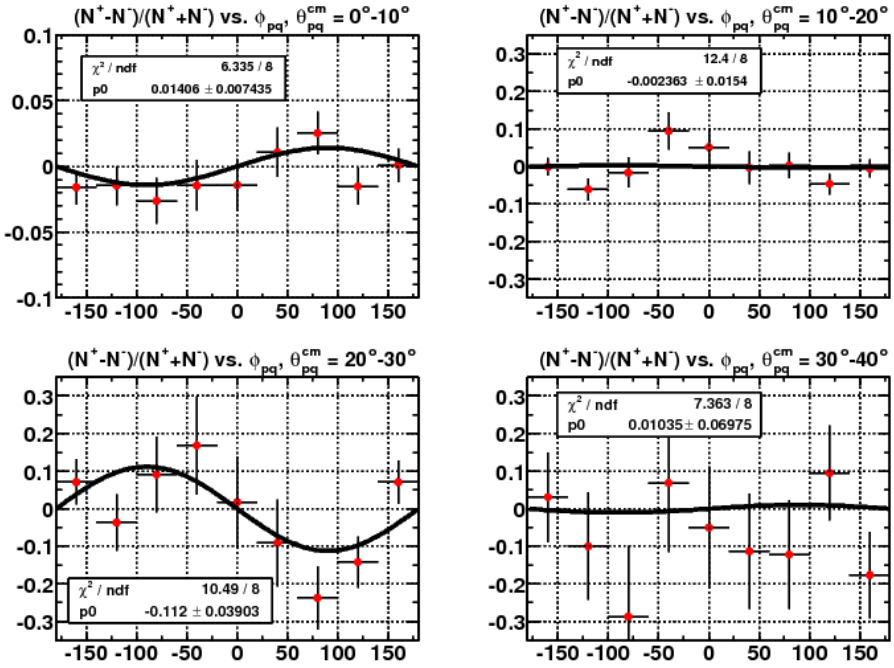

Fig 1. Analysis of phi dependence of of ALTp to extract amplitudes.

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Jerry Gilfoyle's Enotebook page 354 - testing 2.6r RC correction for pm = 0.20-0.25 GeV/c (gpg)

[Modified Thu May 26 22:01:03 2011 (GMT) gpg]

Print out the ratio of the polarized to unpolarized RC for 2.6r and pm=0.20-0.25 GeV/c. From entry 3 it looks like I should get very few events with this ratio being greater than about 1.10-1.15 which is much less than the observed effect (about 1.5 on average) of the RC correction on ALTp (see entry 2). Fig 1 shows the ratio which looks weird. I don't understand the sharp structures around ratio = 1.0.

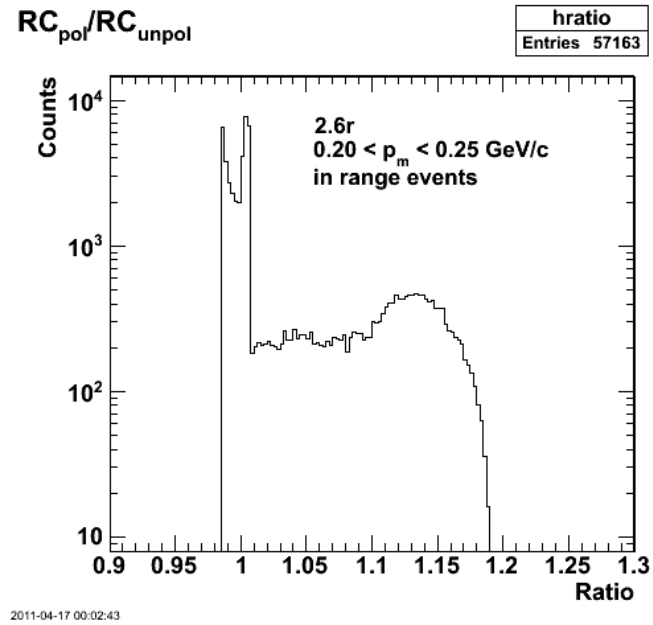

Fig 1. Histogram of pol/unpol ratio event-by-event for pm=0.20-0.25 for 2.6r.

Click here to view the object (Root macro) you uploaded.

Fixed the cut on the Q2 range which should have been 0.0 GeV2 (it was 0.2 GeV2) and saw an increase in the number of events from 57k to 67k, but apparently no big change in the shape.

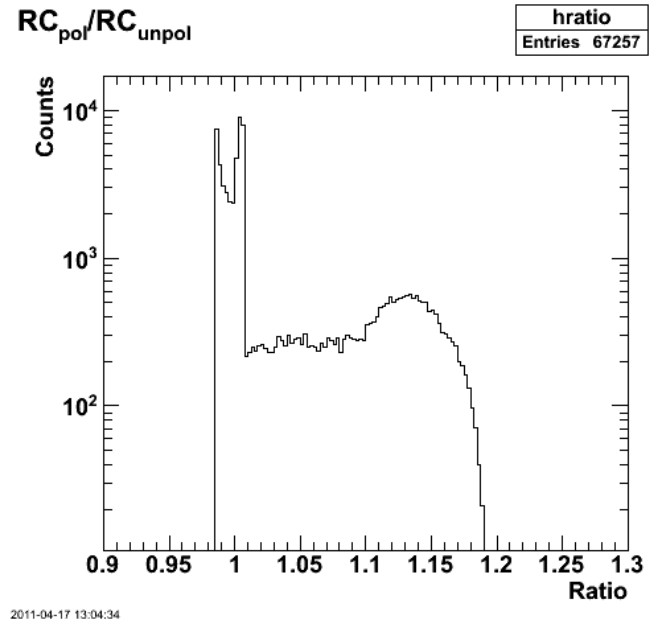

Fig 2. Same as Fig 1 with histogram of pol/unpol ratio event-by-event for pm=0.20-0.25 for 2.6r. Fixed the cut on the Q2 range.

Getting lots of these!!??

```
Error in : Cannot interpolate outside histogram domain.
Error in : Cannot interpolate outside histogram domain.
Error in : Cannot interpolate outside histogram domain.
```

Fixed the above by using the proper Q2 range in the limits of the interpolation of the TH3D histogram. After cleaning that up, I get the following for the 2.6r, in-range RCs for pm=0.2-0.25 GeV/c which is starting to look reasonable.

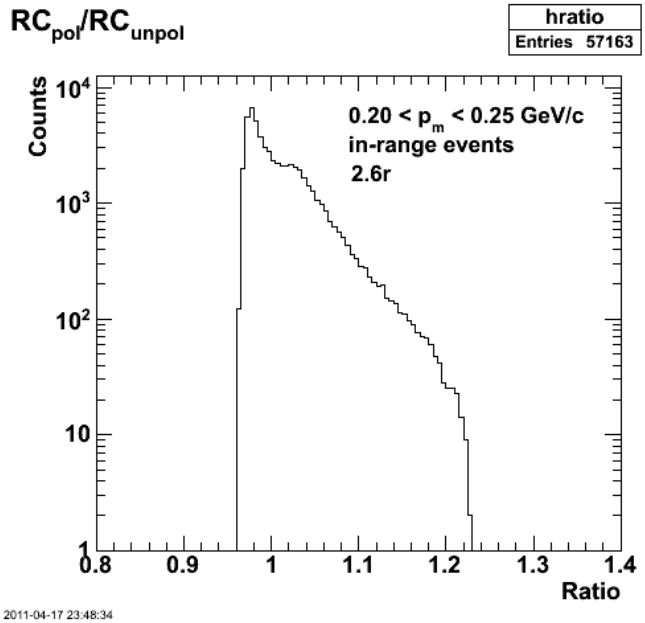

Fig 3. Same as Figs 1-2 with histogram of pol/unpol ratio event-by-event for pm=0.20-0.25 for 2.6r. Really fixed the cut on the Q2 range this time.

Click here to view the object (Root macro) you uploaded.

For events with pm, phi, or Q2 outside the range of the RC calculation I use the closest value of the same parameter that is in the range of the calculation, i.e. for pm < 0.035 GeV/c, I set pm=0.035 GeV/c and use that value to calculate the RC. REsults for the out-or-range events is shown in fig 4.

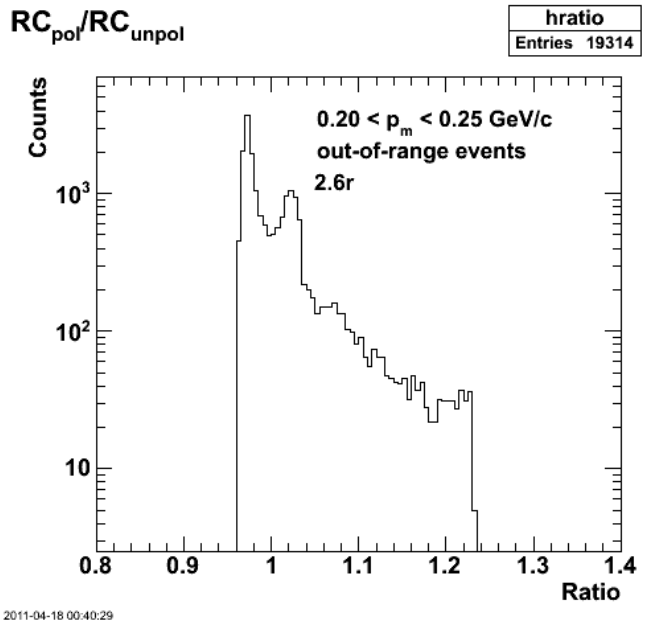

Fig 4. Same idea as figs 1-3, but now for events that are outside the range of the RC calculation.

Click here to view the object (Root macro) you uploaded.

The structures in fig 3-4 are (shoulder in fig 3 at pm~1.04 GeV/c, peak in fig 4 at pm~1.02), I am guessing, due to 'large' accumulations of events in different kinematic regions.

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Jerry Gilfoyle's Enotebook page 355 - Results of fixes to 2.6r RC application (gpg)

[Modified Fri May 27 02:00:23 2011 (GMT) gpg]

After fixing the bugs in the code applying the RCs we redo the asymmetry ALTp. The first plot shows the effect is now very small consistent; consistent with the results on the distribution of RC studied in entry 5. Replaces previous results which showed a significant effect due to typos in the code. The mistake in the code was that I had

```
hp_m_unwghtplus8->Fill(missing3vec_mag/RCunpolCorr);
```

instead of the correct version (dropped the comma and the one).

```
hp_m_unwghtplus8->Fill(missing3vec_mag,1/RCunpolCorr);
```

This typo resulted in syntactically correct code which inadvertently shrank the missing momentum. Regions (e.g. pm=0.20-0.25 GeV/c) with large ALTp had strength pushed to lower pm (and shrank) while regions with small ALTp were not effected much unless strength from the high-ALTp regions flowed into it. This explains the downward shift in the first few pm bins and the large effect on the size of ALTp right where the asymmetry was largest. At large pm (>0.25 GeV/c) there was not much there to start with and no large-ALTp regions fed those bins. The effect on ALTp is shown below.

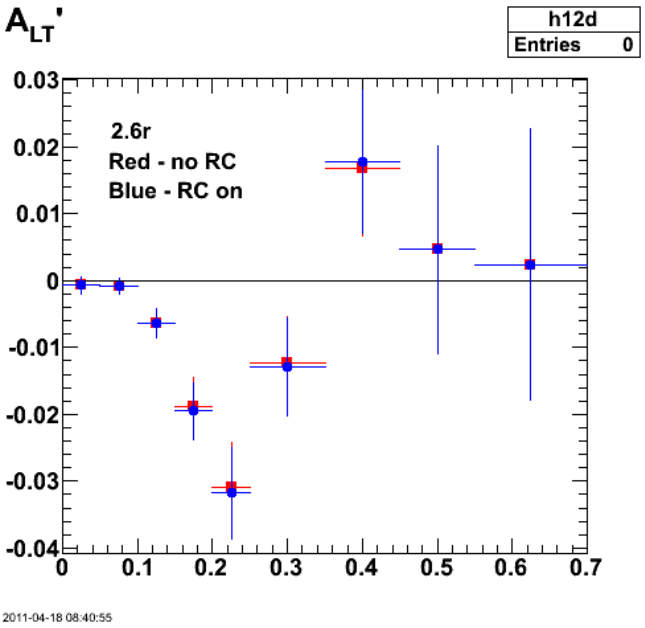

Fig 1. Comparison of ALTp for 2.6r with RC on (blue) and RC off (red) showing the fall effect of the RC.

```
Printout of results:
root [43] h12d->Print("all")
TH1.Print Name = h12d, Entries= 0, Total sum= -0.371692
fSumw[0]=0, x=-0.0833333, error=0
fSumw[1]=-0.000662838, x=0.025, error=0.00123831
fSumw[2]=-0.000788116, x=0.075, error=0.00112941
fSumw[3]=-0.00638511, x=0.125, error=0.00212678
fSumw[4]=-0.0187597, x=0.175, error=0.00417807
fSumw[5]=-0.0308538, x=0.225, error=0.00670649
fSumw[6]=-0.0123007, x=0.3, error=0.00696001
fSumw[7]=0.016738, x=0.4, error=0.0100897
fSumw[8]=0.00462182, x=0.5, error=0.0144669
fSumw[9]=0.00238207, x=0.625, error=0.0193408
fSumw[10]=-0.0476025, x=0.85, error=0.0320616
fSumw[11]=-0.104204, x=1.25, error=0.0868248
fSumw[12]=-0.173878, x=1.75, error=0.836799
fSumw[13]=0, x=2.08333, error=0
root [44] h12drc->Print("all")
TH1.Print Name = h12drc, Entries= -2147483648, Total sum= -nan
fSumw[0]=0, x=-0.0833333, error=0
fSumw[1]=-0.000727862, x=0.025, error=0.00123884
fSumw[2]=-0.000852668, x=0.075, error=0.00113173
fSumw[3]=-0.0064052, x=0.125, error=0.00214136
fSumw[4]=-0.0194926, x=0.175, error=0.00423646
fSumw[5]=-0.0317512, x=0.225, error=0.00685765
fSumw[6]=-0.0129147, x=0.3, error=0.00726191
fSumw[7]=0.0178129, x=0.4, error=0.0107186
fSumw[8]=0.00463557, x=0.5, error=0.0154756
fSumw[9]=0.00242145, x=0.625, error=0.0202342
fSumw[10]=-0.0485619, x=0.85, error=0.0329077
fSumw[11]=-nan, x=1.25, error=-nan
fSumw[12]=-nan, x=1.75, error=-nan
fSumw[13]=0, x=2.08333, error=0
root [45]
```

Now get the uncertainty on the RC by taking half the difference between ALTp with no RC minus ALTp with RC.

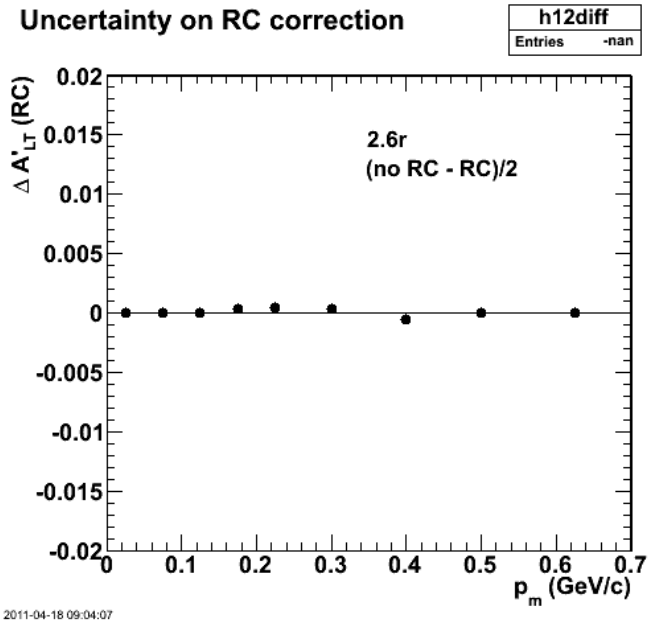

Fig 2. Uncertainty on RC correction; very small.

Click here to view the object (Root macro) you uploaded.

```
root [55] h12diff->Print("all")
TH1.Print Name = h12diff, Entries= -2147483648, Total sum= -nan
fSumw[0]=0, x=-0.0833333, error=0
fSumw[1]=3.25119e-05, x=0.025, error=0.000875803
fSumw[2]=3.2276e-05, x=0.075, error=0.000799435
fSumw[3]=1.00443e-05, x=0.125, error=0.00150902
fSumw[4]=0.000366476, x=0.175, error=0.00297506
fSumw[5]=0.000448691, x=0.225, error=0.00479595
fSumw[6]=0.000307044, x=0.3, error=0.00502934
fSumw[7]=-0.000537445, x=0.4, error=0.00736022
fSumw[8]=-6.87456e-06, x=0.5, error=0.0105923
fSumw[9]=-1.96868e-05, x=0.625, error=0.0139954
fSumw[10]=0.000479687, x=0.85, error=0.0229721
fSumw[11]=-nan, x=1.25, error=-nan
fSumw[12]=-nan, x=1.75, error=-nan
fSumw[13]=0, x=2.08333, error=0
root [56]
```

Put in the full set of pm-phi_pq surfaces for the proper set of Q2 values and get the following. The effect of the RC is small.

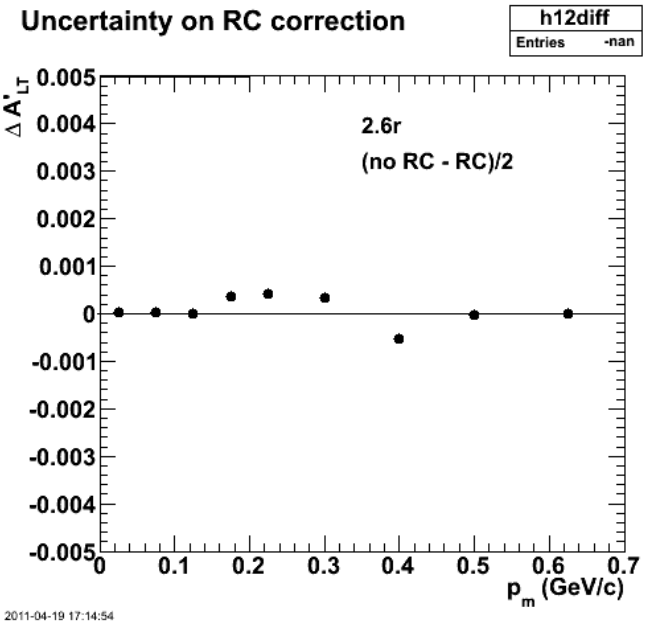

Fig 3. Comparison of 2.6r ALTp with RC off (red) and on (blue). Effect is small.

Click here to view the object (Root macro) you uploaded.

After putting in the full set of pm-phi_pq surfaces for each value of Q2 in the TH3D histogram I get the following results for the RC for 2.6r.

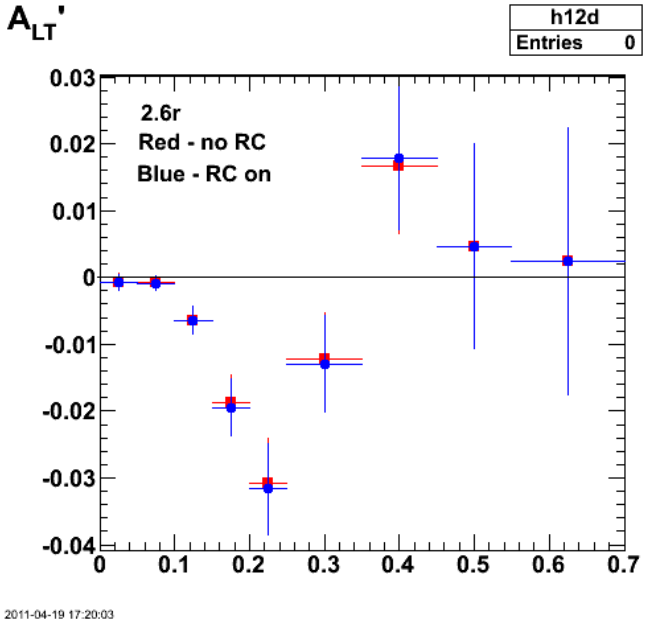

Fig 4. Uncertainty on the RC for 2.6r.

Click here to view the object (Root macro) you uploaded.

Check the distribution of RC factors for events in and out of the applicable range of the EXCLURAD calculation. Outside the range we just assign the out-of-range parameter the value of the nearest limit.

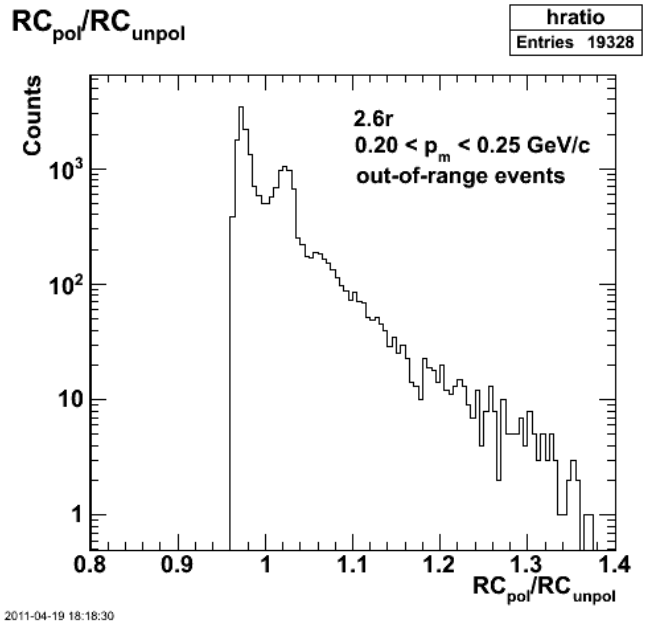

Fig 5. For 2.6r events that are outside the range of the RC calculation for EXCLURAD.

Click here to view the object (Root macro) you uploaded.

For in-range events there are more counts at low RCpol/RCunpol which accounts for the observation that ALTp has a larger amplitude (deeper dip) for pm=0.2-0.25 GeV/c.

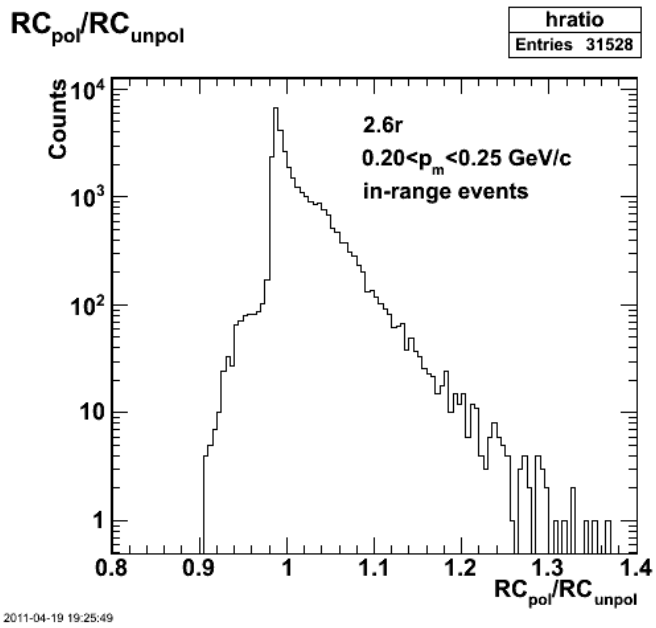

Fig 6. For 2.6r events that are in the range of the RC calculation for EXCLURAD.

Click here to view the object (Root macro) you uploaded.

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Jerry Gilfoyle's Enotebook page 356 - turn on 2.6r mp cut (gpg)

[Modified Fri May 27 03:49:15 2011 (GMT) gpg]

Turn on the proton mass cut that is used to eliminate the funky wings on the momentum versus mass distribution that are due to events associated with the wrong beam bucket.

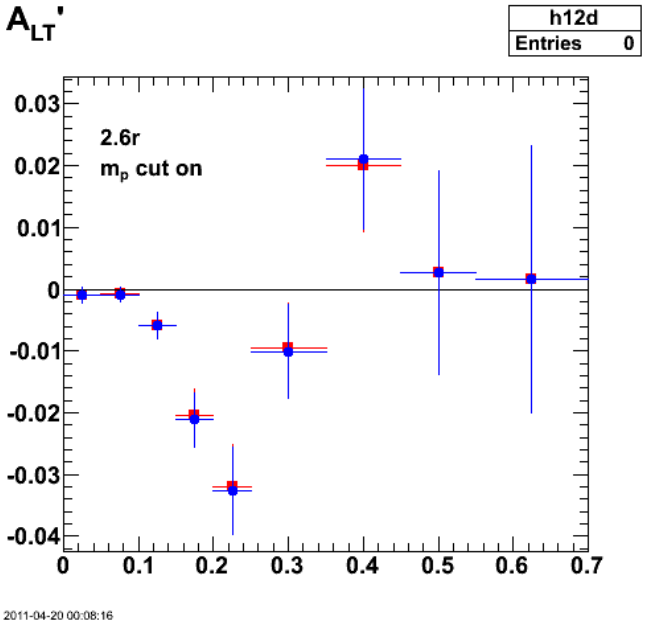

Fig 1. Comparison of ALTp for 2.6r with the Mp cut turned for RC on (blue) and off (red).

Click here to view the object (Root macro) you uploaded.

Compare results with no mp cut turned on and things look much the same except for pm = 0.3 GeV/c.

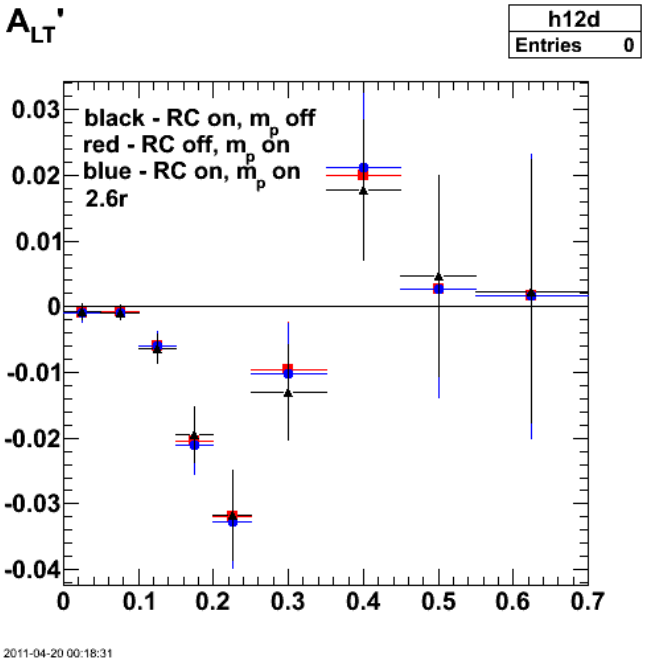

Fig 2. Comparison of mp cut on (red and blue), RC on (blue and black), and RC off (red).

Click here to view the object (ROOT macro) you uploaded.

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Jerry Gilfoyle's Enotebook page 357 - Effect of RC and mp cut on 2.6n ALTp (gpg)

[Modified Fri May 27 20:25:21 2011 (GMT) gpg]

Now get ALTp with mp cut on and compared RC on/off. RC effect is small; mp cut is small comparing with 2.6n ALTp in CAN.

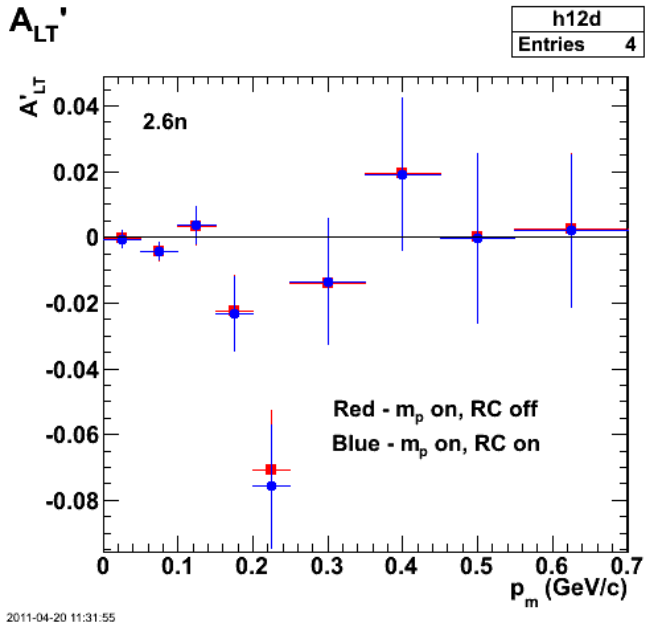

Fig 1. Comparison of ALTp with RC on (blue) and off (red). Both asymmetries have the mp cut on.

Click here to view the object (Root macro) you uploaded.

Turn off mp cut and check the results. First show 2.6n ALTp from the CAN draft.

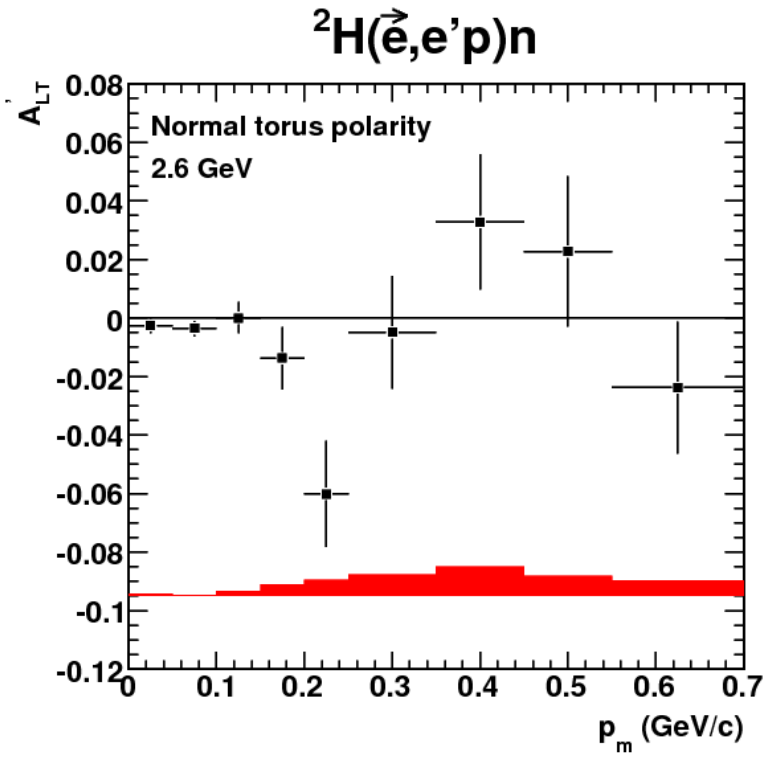

Fig 2. 2.6n ALTp from CAN draft.

Now get the latest results with no mp cut.

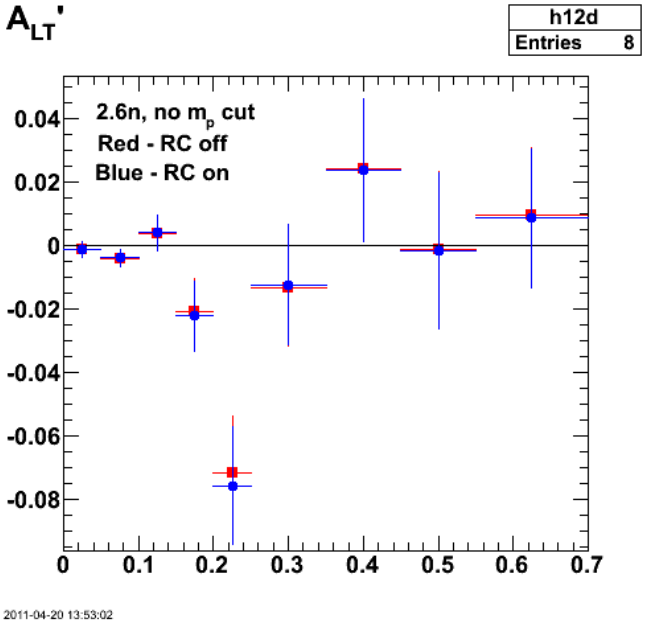

Fig 3. 2.6n ALTp with no mp cut and RC on (blue) and off (red).

Click here to view the object (Root macro) you uploaded.

The effect of the mp cut is VERY small.

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Jerry Gilfoyle's Enotebook page 358 - Effect of efids/pfids with mp and RC on 2.6n (gpg)

[Modified Thu Jun 2 11:14:36 2011 (GMT) gpg]

Now check the effect of the fiducial cuts. I am rethinking the argument to turn them off in the analysis. My thought is that we must trust that this asymmetry is special and we are really dividing by the same acceptance in the denominator. I believe (and will check this) that turning on the fiducials removes many low-Q2 event that fall outside the standard acceptance. Any difference between the fids on and fids off may be attributed to this difference in the Q2 distribution. There is no obvious way to check this since these excluded events are not included in the standard class acceptance. I may just punt the whole idea.

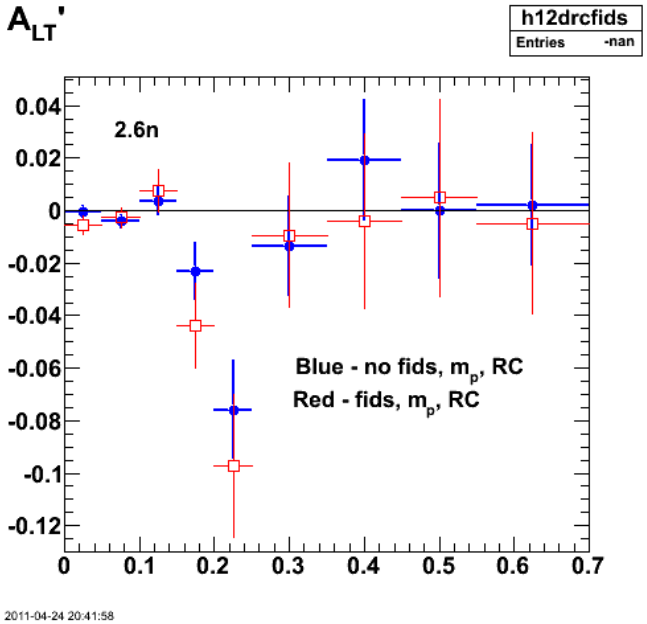

Fig 1. Comparison of ALTp for 2.6n with fids on (red) and off (blue).

Click here to view the object (Root macro) you uploaded.

Look at the difference between ALTp with and without fiducial cuts in Fig 2a. Can't do the uncertainties here yet because the two data sets are NOT independent. However, in Fig 2b we extract dALTp from the histograms with the fiducials turned on and the histograms of the events excluded by the fiducial cuts. These data sets are independent so we can calculate uncertainties for them (see below). The difference between the two distributions is not understood (Now it is, see below).

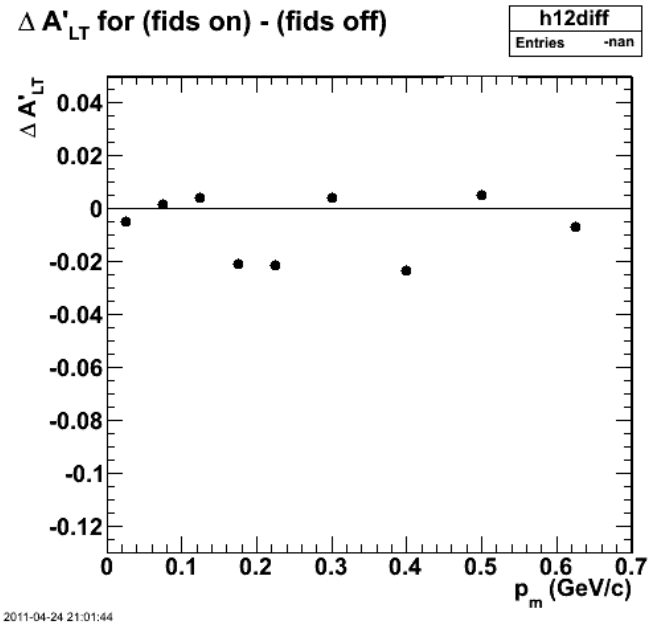

Fig 2a. Difference between 2.6n ALTp with and without efids/pfids as a function of pm.

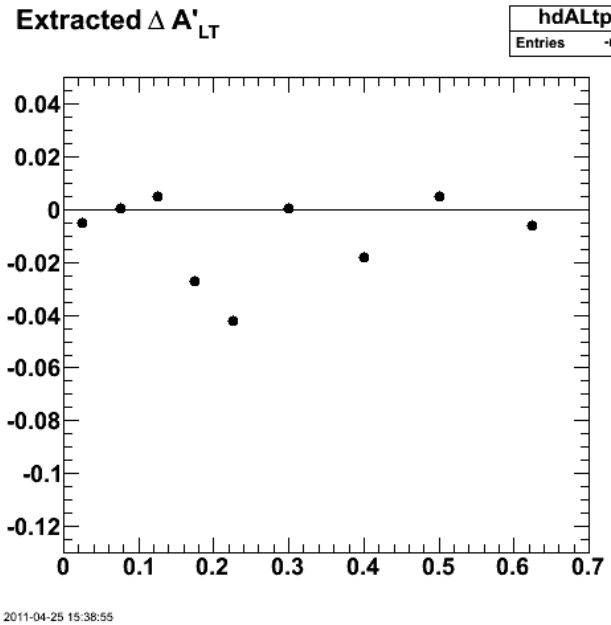

Fig 2b. Extracted difference between 2.6n ALTp with and without efids/pfids as a function of pm.

Click here to view the object (Root macro) you uploaded. Click here to view the object (Root macro) you uploaded.

Take a look at the different Q2 distributions with the fids on (red) and off (black). Fids on (red) is scaled by 1.8068.

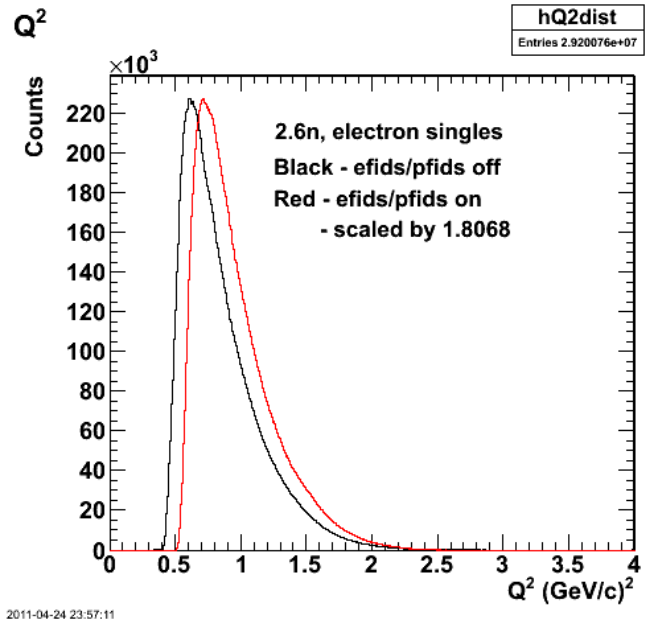

Fig 3. Comparison of electron singles vs. Q2 for 2.6n with fids on (red) and off (black). Fids on (red) is scaled up by 1.8068.

Click here to view the object (Root macro) you uploaded.

There are inadequate statistics to test the no-fids for the QE ALTp so turn off the QE requirement and maybe the proton requirement to see if we can get something to compare fids on/off with decent stats.

Extracted dALTp with uncertainties calculated with Sumw2() option in ROOT. See log-11-apr-25 for details.

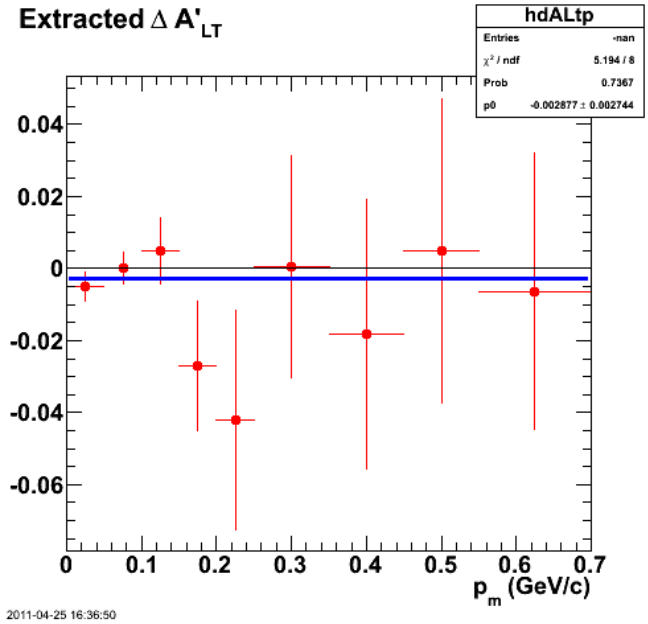

Fig 4. Extracted dALTp for 2.6n with mp, RC etc. and proper calculation of uncertainties.

Click here to view the object (Root macro) you uploaded.

The problem in Fig 2 was due to the fact that I left out the beam polarization correction for the extracted delta_ALTp. When I put that in I get perfect agreement.

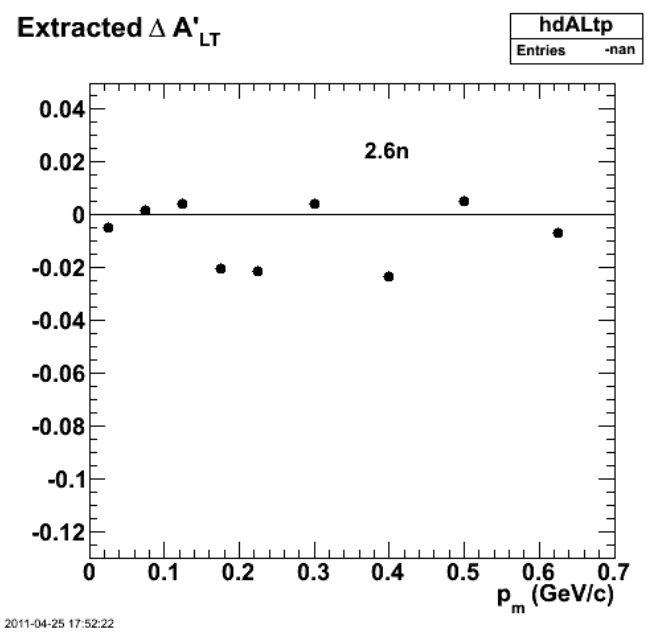

Fig 5a. Difference between 2.6n ALTp with and without efids/pfids as a function of pm (same as 2a).

Click here to view the object (Root macro) you uploaded.

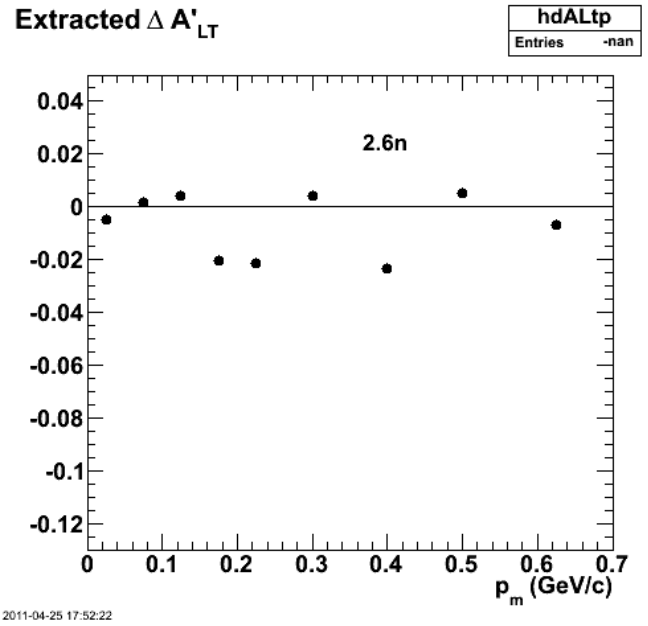

Fig 5b. Corrected version of extracted difference between 2.6n ALTp with and without efids/pfids as a function of pm. Compare with Fig 2b.

Click here to view the object (Root macro) you uploaded.

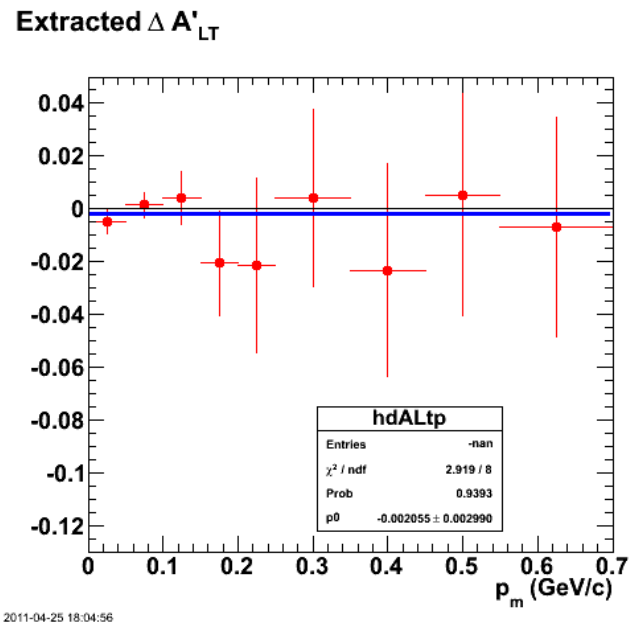

Fig 6. Corrected, extracted dALTp for 2.6n with mp, RC etc. and proper calculation of uncertainties.

Click here to view the object (Root macro) you uploaded.

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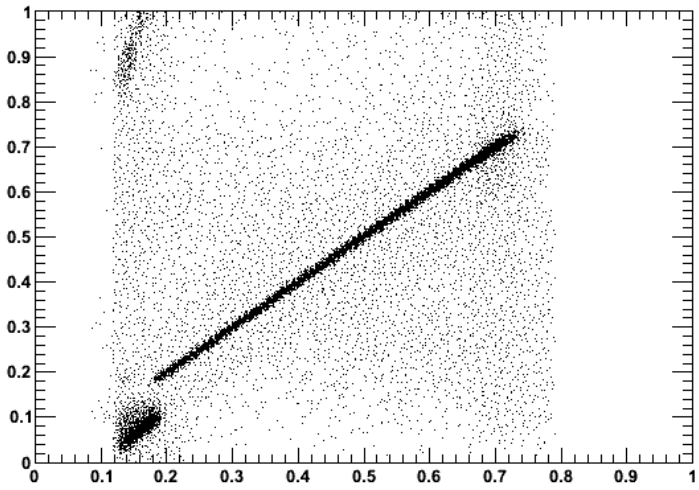
Jerry Gilfoyle's Enotebook page 359 - Generated vs Reconstructed Electron Theta (Mark Moog)

[Modified Thu Jun 2 11:23:04 2011 (GMT) Mark Moog]

This is a comparison of generated theta to reconstructed theta. It is very good which means if we calculate electron momentum using reconstructed theta, it will be very close to the generated electron momentum. Thus we can use this number to cut out electrons that have reconstructed momenta far from the theta derived momentum and instead of using generated momentum.

gen theta vs recon theta



2011-06-01 20:07:10

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 360 - Minimum electron angle in CLAS12 (gpg)

[Modified Thu Jun 2 17:28:55 2011 (GMT) gpg]

The results below were from a study using the interactive gemc. From log-11-jan-07,

```
look for hits in 3 DC superlayers and in tof

E' = 9.05 GeV,  theta = 9.0,  yes
E' = 9.05 GeV,  theta = 11.0,  yes
E' = 9.05 GeV,  theta = 7.0,  yes for DC, no for TOF
E' = 9.05 GeV,  theta = 7.5,  yes for DC, no for TOF
E' = 9.05 GeV,  theta = 7.6,  yes for DC, no for TOF
E' = 9.05 GeV,  theta = 7.7,  yes for DC, no for TOF
E' = 9.05 GeV,  theta = 7.8,  yes
E' = 9.05 GeV,  theta = 8.0,  yes

E' = 9.05 GeV,  theta = 5.0,  yes for DC R1+R2, no for R3, no for TOF see minimumElectronAngle3.gif
E' = 9.05 GeV,  theta = 6.0,  yes for DC R1+R2, 1 hit for R3, no for TOF
E' = 9.05 GeV,  theta = 7.0,  yes for DC R1+R2, 7 hits for R3, no for TOF
E' = 9.05 GeV,  theta = 4.0,  no hits in DC, no for TOF
E' = 9.05 GeV,  theta = 4.5,  1 hit in DC R1 only, no for TOF
```

Now study elastic scattering in CLAS12 with gemc to see where we start to lose the TOFs. The table below gives the E' as a function of &theta.

∂	E'	∂	E'	∂	E'	∂	E'
0.	11000.	3.	10826.3	6.	10337.	9.	9614.21
0.1	10999.8	3.1	10814.7	6.1	10316.2	9.1	9587.28
0.2	10999.2	3.2	10802.8	6.2	10295.	9.2	9560.21
0.3	10998.2	3.3	10790.5	6.3	10273.6	9.3	9532.99
0.4	10996.9	3.4	10777.9	6.4	10252.	9.4	9505.65
0.5	10995.1	3.5	10764.9	6.5	10230.1	9.5	9478.17
0.6	10992.9	3.6	10751.6	6.6	10208.	9.6	9450.56
0.7	10990.4	3.7	10738.	6.7	10185.6	9.7	9422.83
0.8	10987.5	3.8	10724.	6.8	10163.	9.8	9394.98
0.9	10984.1	3.9	10709.6	6.9	10140.2	9.9	9367.02
1.	10980.4	4.	10695.	7.	10117.1	10.	9338.94
1.1	10976.3	4.1	10680.	7.1	10093.8	10.1	9310.75
1.2	10971.8	4.2	10664.7	7.2	10070.3	10.2	9282.46
1.3	10967.	4.3	10649.1	7.3	10046.6	10.3	9254.07
1.4	10961.7	4.4	10633.1	7.4	10022.7	10.4	9225.57
1.5	10956.	4.5	10616.8	7.5	9998.55	10.5	9196.99
1.6	10950.	4.6	10600.2	7.6	9974.21	10.6	9168.31
1.7	10943.6	4.7	10583.4	7.7	9949.67	10.7	9139.54
1.8	10936.8	4.8	10566.2	7.8	9924.93	10.8	9110.69
1.9	10929.6	4.9	10548.6	7.9	9900.	10.9	9081.76
2.	10922.1	5.	10530.8	8.	9874.88	11.	9052.75
2.1	10914.2	5.1	10512.7	8.1	9849.58	11.1	9023.66
2.2	10905.9	5.2	10494.3	8.2	9824.1	11.2	8994.51
2.3	10897.2	5.3	10475.7	8.3	9798.44	11.3	8965.29
2.4	10888.2	5.4	10456.7	8.4	9772.61	11.4	8936.
2.5	10878.8	5.5	10437.4	8.5	9746.61	11.5	8906.65
2.6	10869.	5.6	10417.9	8.6	9720.45	11.6	8877.24
2.7	10858.9	5.7	10398.1	8.7	9694.12	11.7	8847.78
2.8	10848.4	5.8	10378.	8.8	9667.64	11.8	8818.26
2.9	10837.5	5.9	10357.6	8.9	9641.	11.9	8788.7
3.	10826.3	6.	10337.	9.	9614.21	12.	8759.09

Table 1. Energies and angles for elastic scattering for Ebeam=11 GeV

The plots below show gemc event displays for elastic scattering at a range of angles to see where we start to lose layers. We start losing the first TOF layer (which is panel p1b) in the θ=8.0-8.5 deg range. The second layer the electron can go through is p1a.

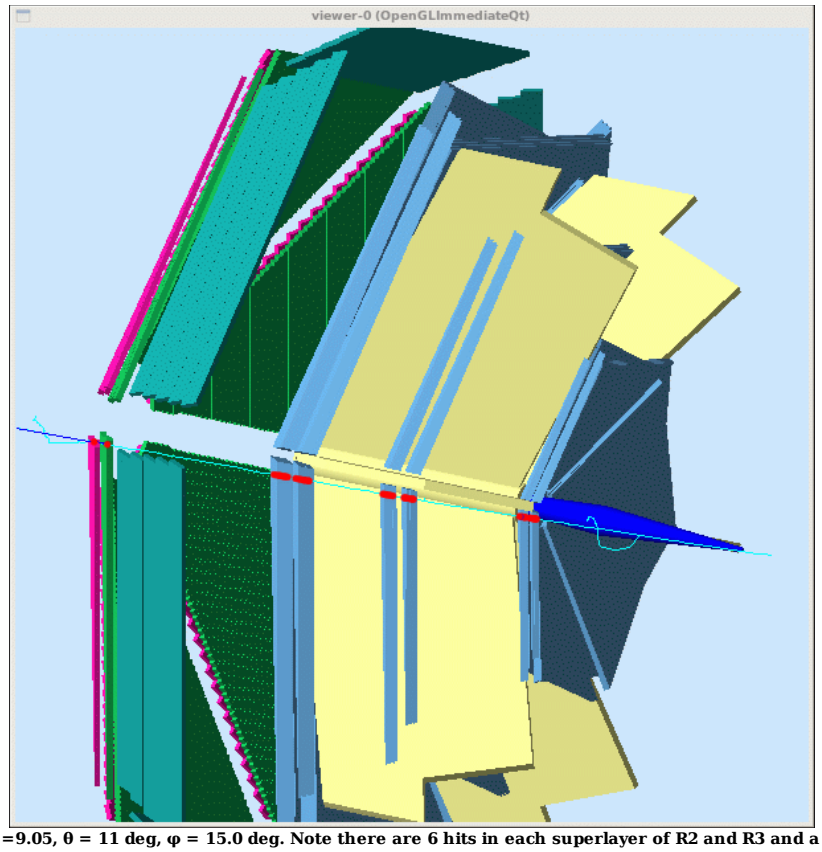


Fig 1. Gemc plot for E'=9.05, θ = 11 deg, φ = 15.0 deg. Note there are 6 hits in each superlayer of R2 and R3 and a hit on the scintillator.

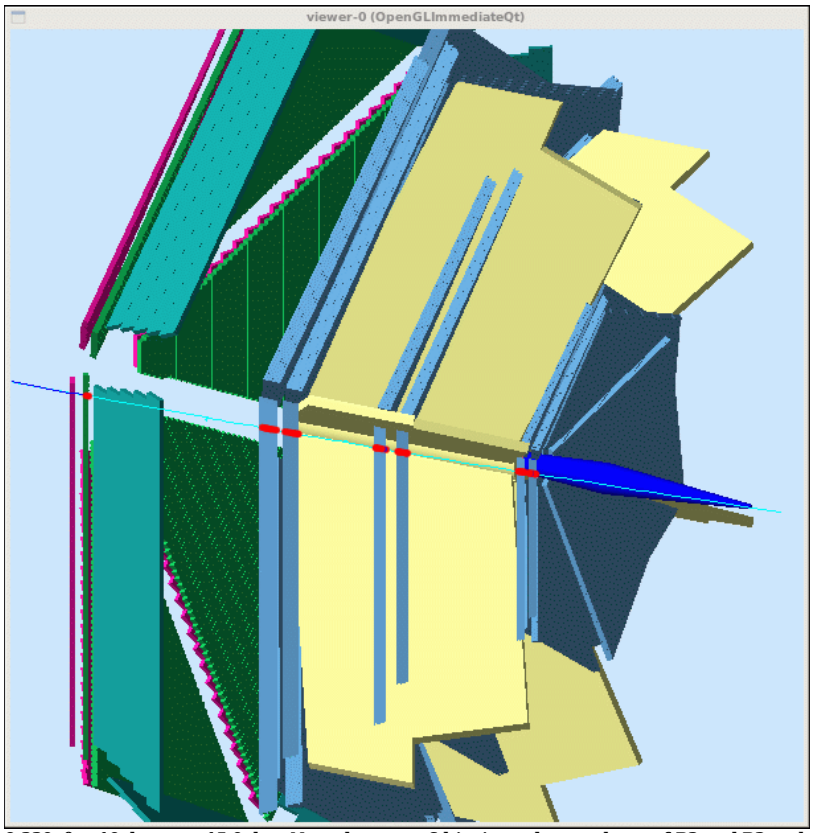


Fig 2. Gemc plot for E'=9.330, θ = 10 deg, φ = 15.0 deg. Note there are 6 hits in each superlayer of R2 and R3 and a hit on the scintillator.

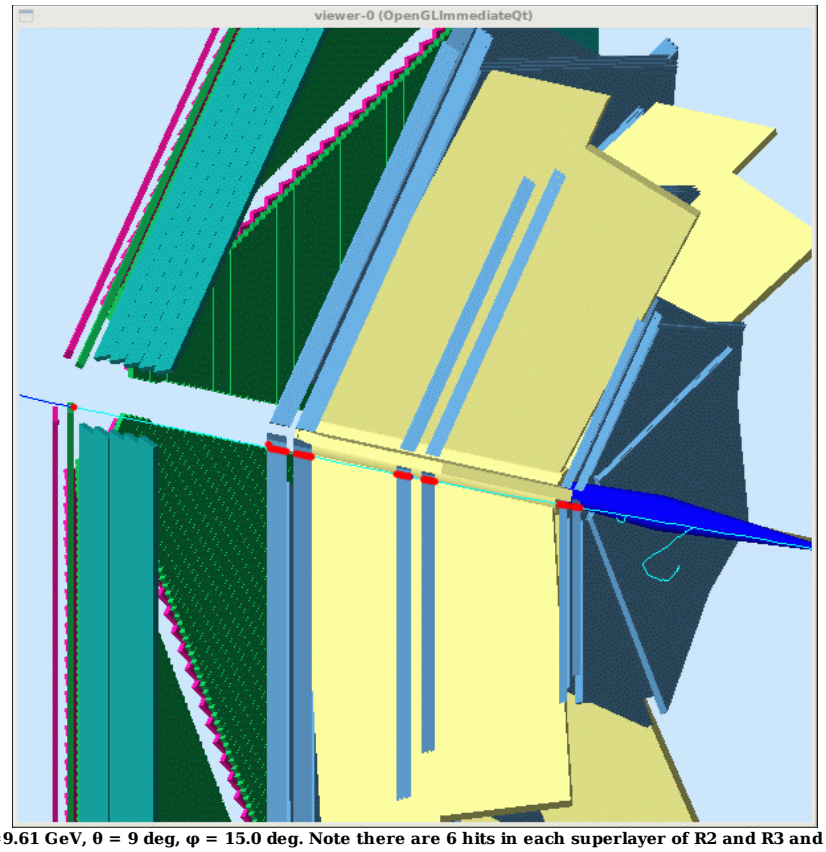


Fig 3. Gemc plot for E'=9.61 GeV, θ = 9 deg, φ = 15.0 deg. Note there are 6 hits in each superlayer of R2 and R3 and a hit on the scintillator.

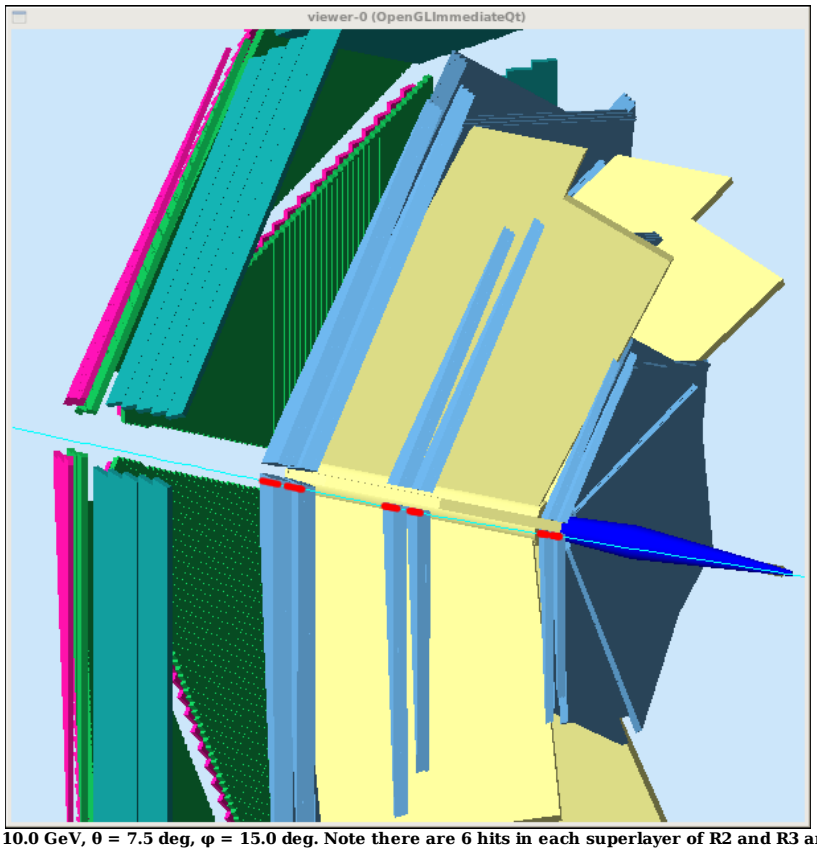


Fig 4. Gemc plot for E'=10.0 GeV, θ = 7.5 deg, φ = 15.0 deg. Note there are 6 hits in each superlayer of R2 and R3 and NO hits in the TOFs.

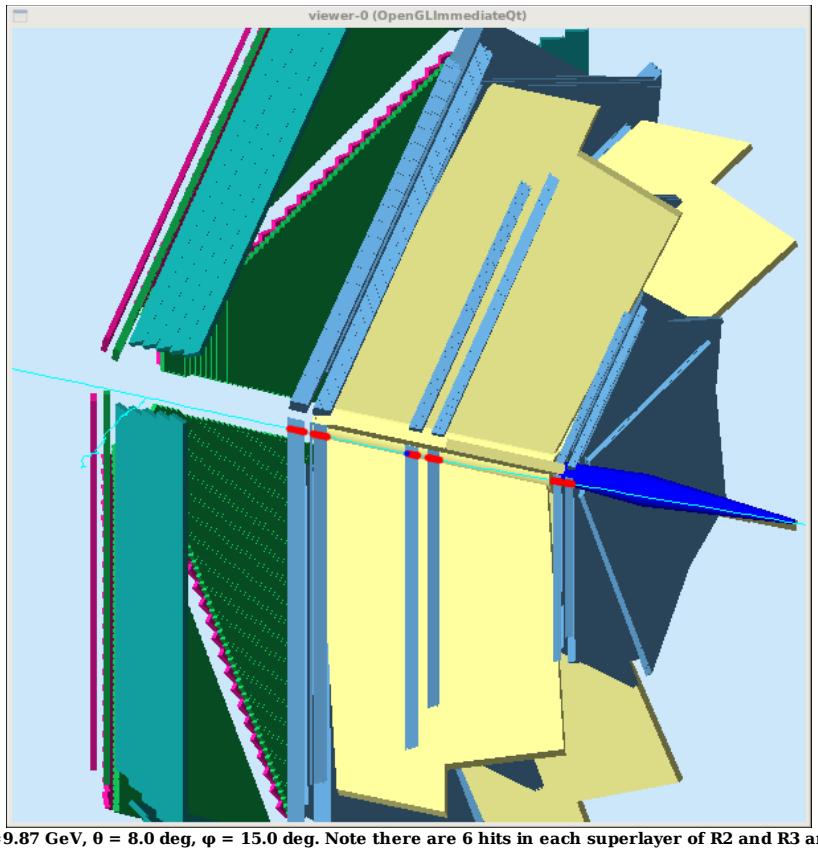


Fig 5. Gemc plot for E'=9.87 GeV, θ = 8.0 deg, φ = 15.0 deg. Note there are 6 hits in each superlayer of R2 and R3 and NO hits in the TOFs.

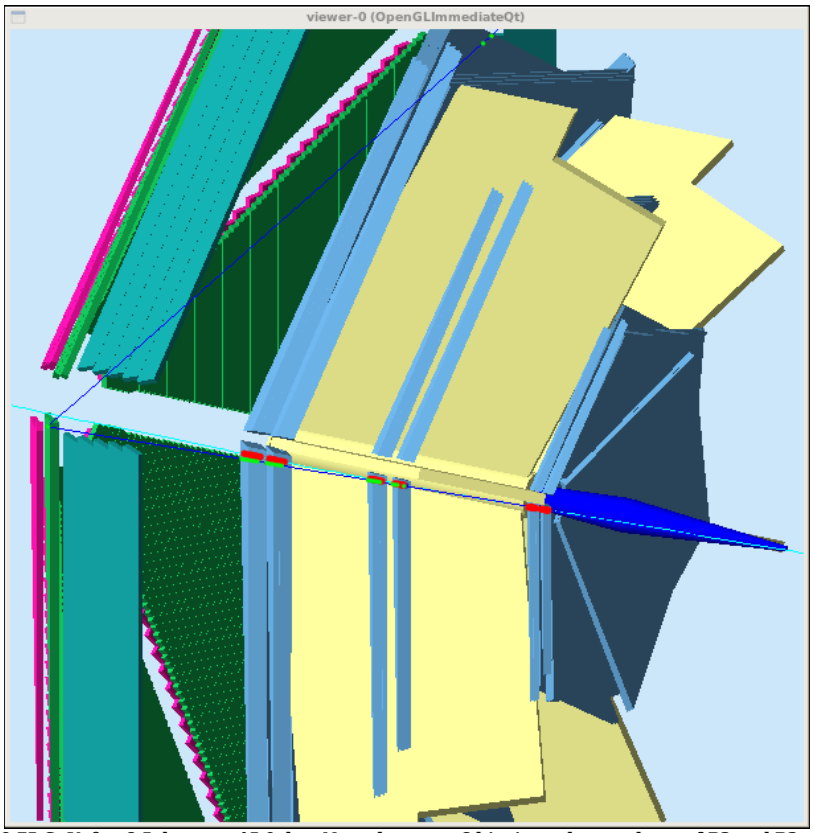


Fig 6. Gemc plot for E'=9.75 GeV, θ = 8.5 deg, φ = 15.0 deg. Note there are 6 hits in each superlayer of R2 and R3 and NO hits in the TOFs.

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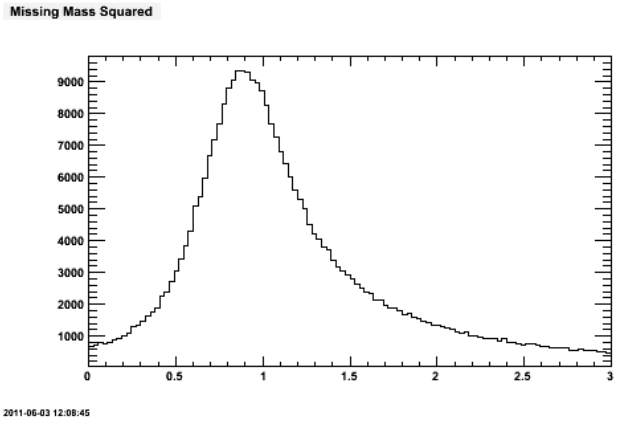
Jerry Gilfoyle's Enotebook page 361 - Missing Mass Squared (Mark Moog)

[Modified Fri Jun 3 16:09:04 2011 (GMT) Mark Moog]

Here is a plot of missing mass squared for electron neutron quasielastic collisions at 11 GeV



Click here to view the object (ROOT Macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 362 - Return to NDE - impact of Edep cut (gpg)

[Modified Mon Jun 13 16:41:51 2011 (GMT) gpg]

We are returning to our study of the neutron detection efficiency in CLAS12. The problem is the surprising sensitivity of the NDE to the cut we put on Edep. See Figs 1-2 below. In Fig 1 the Edep threshold was chosen so the NDE from CLAS12 TOF would agree with the value for E5. This sensitivity to the Edep threshold just doesn't look right.

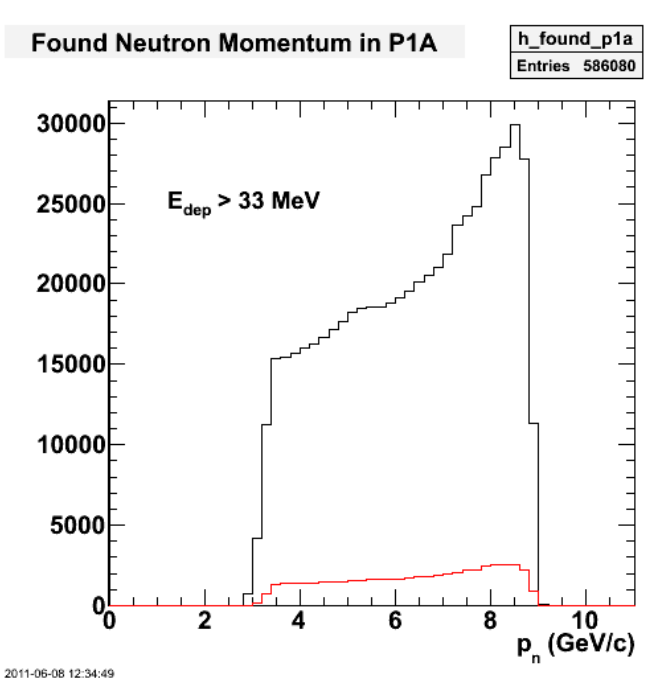


Fig 1a. Comparison of neutron momentum distribution for found and reconstructed neutrons.

Click here to view the object (Root macro) you uploaded.

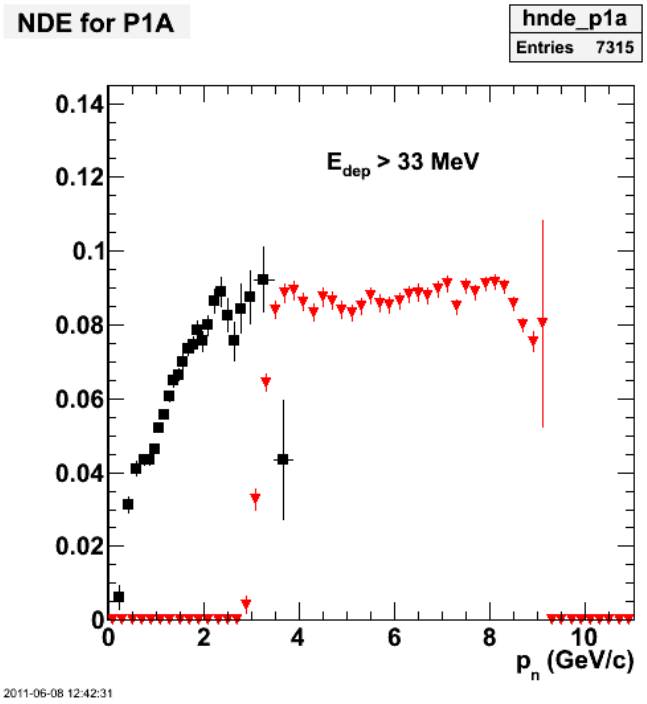


Fig 1b. Neutron detection efficiency extracted from the adjacent figure compared with E5 result.

Click here to view the object (Root macro) you uploaded.

Now turn the threshold down to the minimum so we take any hit at all and the NDE goes up dramatically. There is clearly something wrong with this approach.

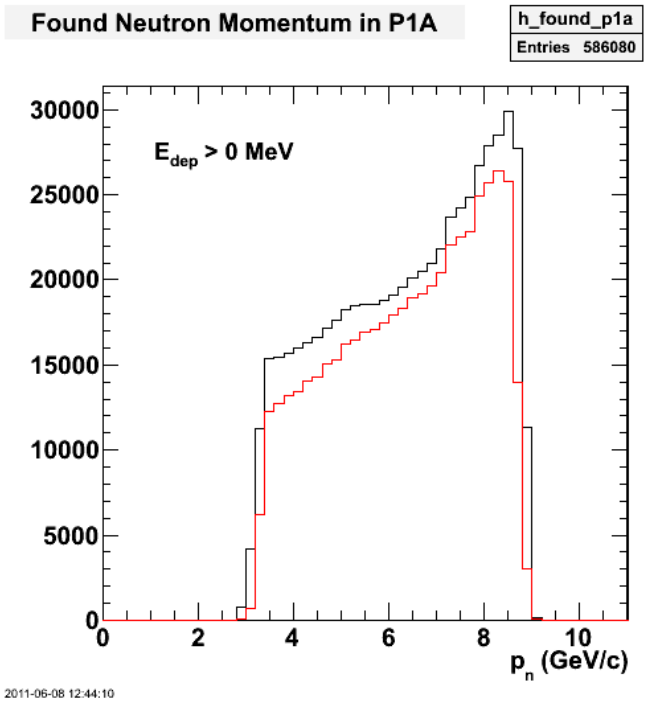


Fig 2a. Comparison of neutron momentum distribution for found and reconstructed neutrons with Edep > 0.

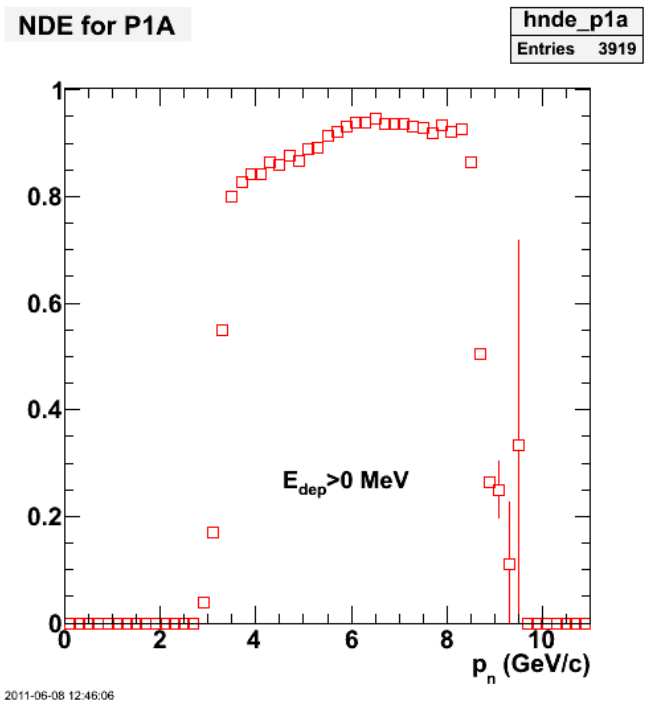


Fig 2b. Neutron detection efficiency extracted from the adjacent figure.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root macro) you uploaded.

Now look at various distributions of the NDE analysis at the place we left off last February. The selection of the neutrons was based on the following cuts.

```
neu_found_p1a[BestElectron] - a neutron has been found.
fabs(best_deltap)theta_emin - avoid electron tracks without full set of wire hits (10 deg).
r_theta[BestElectron]< gamma_cut - gamma cut (10 deg)
Edep_p1a[c] > edep_cut - Edep cut
```

Results are below for neutrons with Edep > 33 MeV in each scintillator layer.

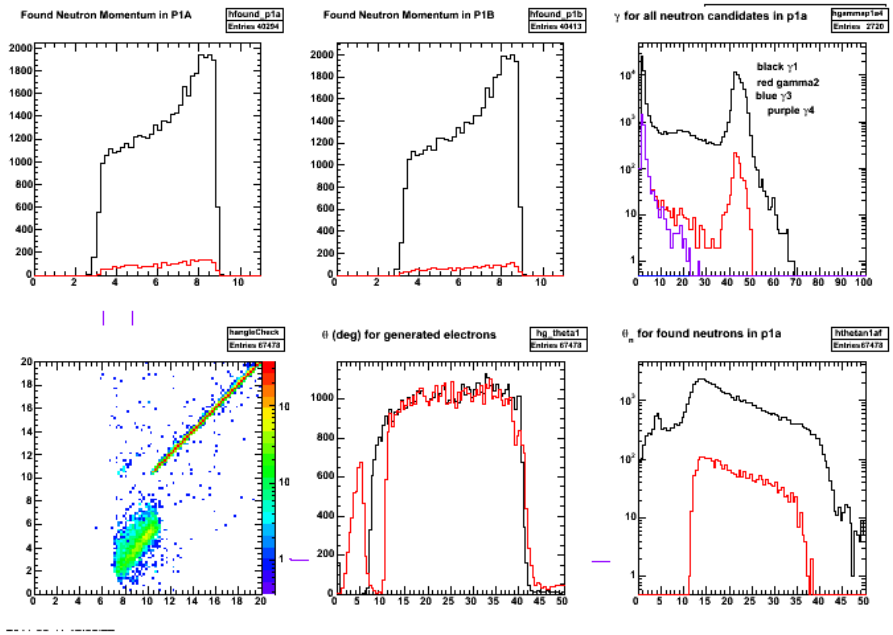


Fig 3. Results of NDE analysis for E_{dep}< 33 MeV, γ < 10 deg.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Analysis code) you uploaded.

Click here to view the object (Analysis code) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Now turn the Edep cut down to zero (see the effect above in 2b) and require a neutron using pid_p1a.

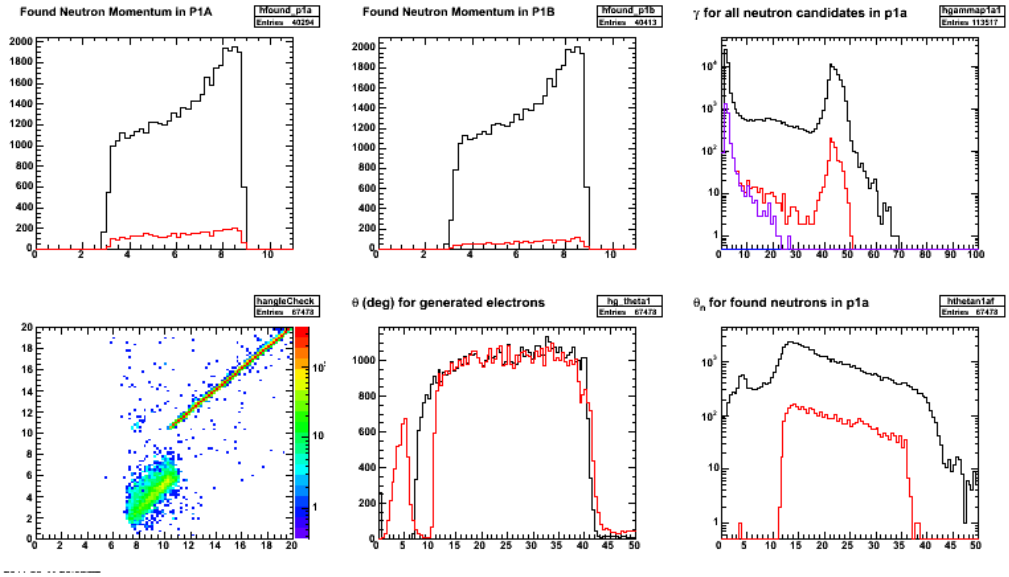


Fig 4. Results of NDE analysis for E_{dep} > 0 MeV, γ < 10 deg, and pid_p1a=2112.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Analysis code) you uploaded.

Click here to view the object (Analysis code) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Remove the γ cut and see what happens to NDE.

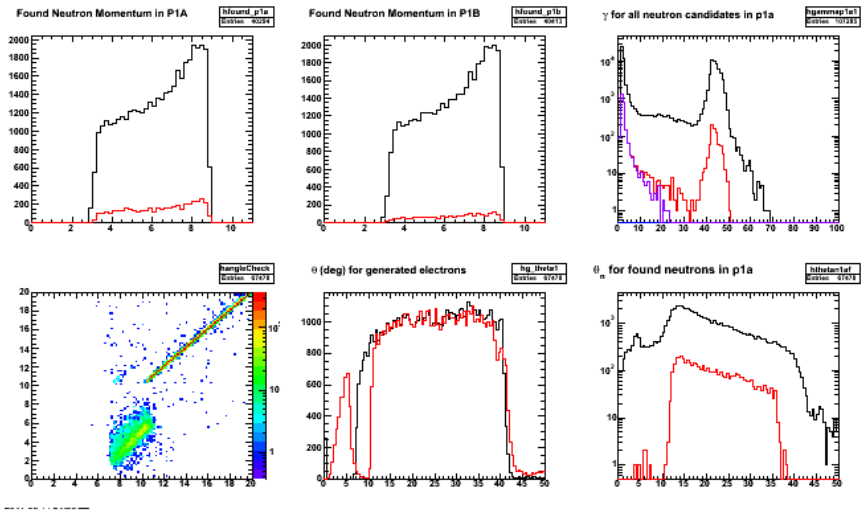


Fig 5. Results of NDE analysis for E_{dep} > 0 MeV and pid_p1a=2112 and no γ cut.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Analysis code) you uploaded.

Click here to view the object (Analysis code) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Now turn on ONLY the angle cut. Only did it for gammap1a and not the other panels.

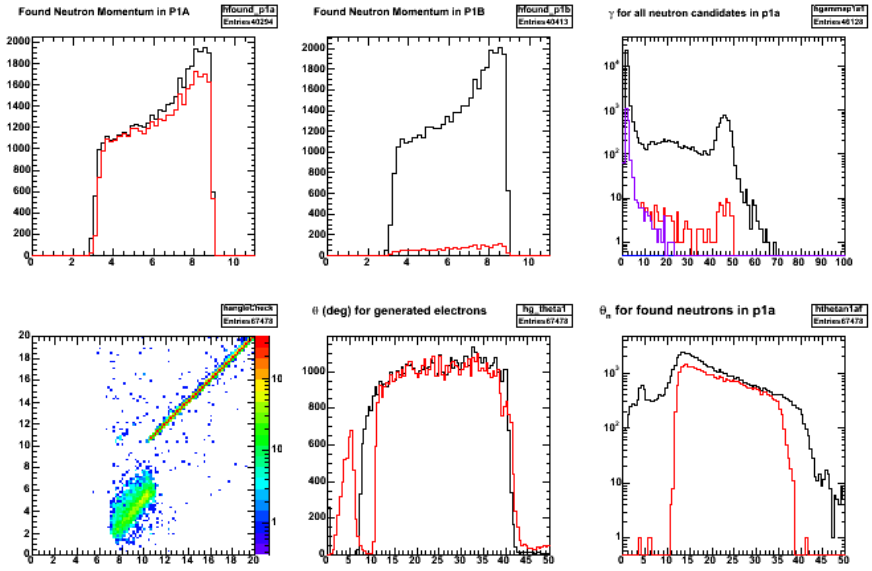


Fig 6. Results of NDE analysis for γ < 10 deg ONLY.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Analysis code) you uploaded.

Click here to view the object (Analysis code) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Now turn on the γ cut and just the Edep > 0 requirement. This is the closest we will have to the experimental situation modulo any threshold on the ADCs and TDCs of the TOFs.

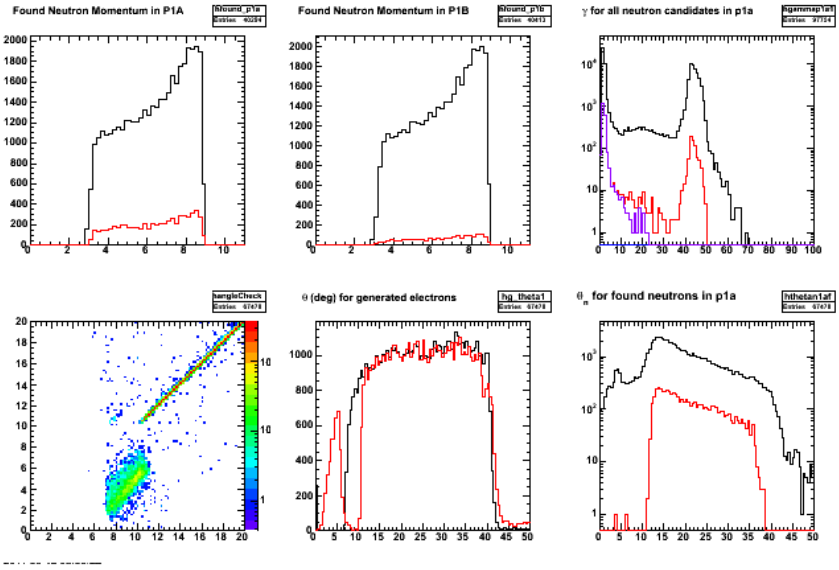


Fig 7. Results of NDE analysis for γ < 10 deg and E_{dep} > 0.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Analysis code) you uploaded.

Click here to view the object (Analysis code) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Now just require a neutron hit and the efficiency again goes close to 1.0.

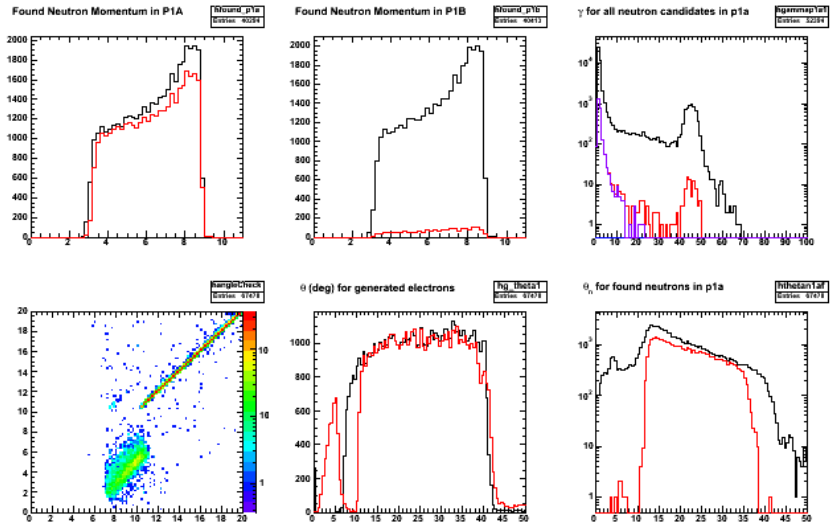


Fig 8. Results of NDE analysis for pid_p1a=2112 ONLY.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Analysis code) you uploaded.

Click here to view the object (Analysis code) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

Take a look at the efficiencies. A summary

1. Whenever there is no Edep cut the efficiency is close to one because there are always hits in the right spot of the TOF. In a real experiment those Edep=0 hits would never show up.
2. With the γ cut, $E_{dep} > 0$, and requiring pid=2212 we get an efficiency of about 0.10.
3. With the γ cut and Edep > 0 we get an efficiency of about 0.15. Why does it go up significantly with a less reliable cut? Are we picking up some background? From where? We only have QE neutrons in the generator.

   Part of the answer: With the PID cut off we get about half as many photon hits as neutron hits. Where are they from? Neutron rattling around inside the DCs? Look at the TDCs to see if I can seperate them.

   Particle species for no pid cut with γ and Edep cuts on.

```
TH1.Print Name  = hpid, Entries= 6069, Total sum= 6061
 fSumw[2090]=189, x=-210.5
 fSumw[2287]=1, x=-13.5
 fSumw[2288]=4, x=-12.5
 fSumw[2290]=32, x=-10.5
 fSumw[2312]=33, x=11.5
 fSumw[2314]=8, x=13.5
 fSumw[2315]=3, x=14.5
 fSumw[2323]=1729, x=22.5
 fSumw[2512]=154, x=211.5
 fSumw[2622]=3, x=321.5
 fSumw[4413]=3520, x=2112.5
 fSumw[4513]=385, x=2212.5
 fSumw[4601]=8, x=2300.5
```

   It appears most of the photons are associated with a neutron. See printout below. Is this from neutrons scattering off the DCs, target, etc? Notice there are also a few photons associated with electrons.

```
mpid=2112 pid=22 p=8.49654
mpid=2112 pid=22 p=3.45426
mpid=2112 pid=22 p=4.34283
mpid=11 pid=22 p=7.67739
mpid=2212 pid=22 p=6.81438
mpid=2112 pid=22 p=4.22207
mpid=2112 pid=22 p=8.49928
mpid=2112 pid=22 p=3.98117
mpid=2112 pid=22 p=4.75811
mpid=2112 pid=22 p=8.42016
mpid=2112 pid=22 p=6.34526
mpid=2112 pid=22 p=5.92532
mpid=2112 pid=22 p=7.66162
mpid=2112 pid=22 p=5.61032
mpid=111 pid=22 p=5.20469
mpid=2112 pid=22 p=7.48998
mpid=11 pid=22 p=7.01381
mpid=2112 pid=22 p=7.23226
mpid=11 pid=22 p=8.2364
mpid=2112 pid=22 p=7.85544
```

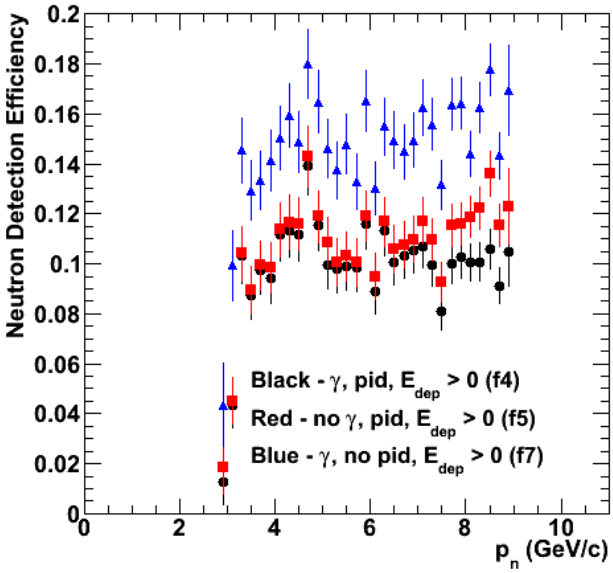


Fig 9. Comparison of NDE for different cut combinations using results above.

Click here to view the object (Root macro) you uploaded.

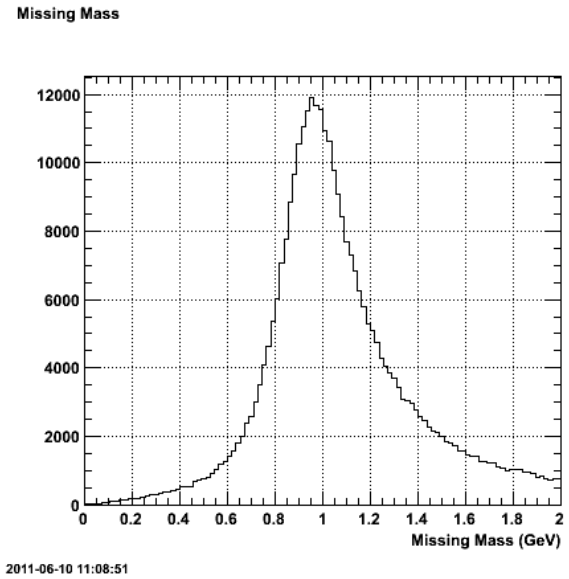
DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 363 - Missing Mass Update (Moog)

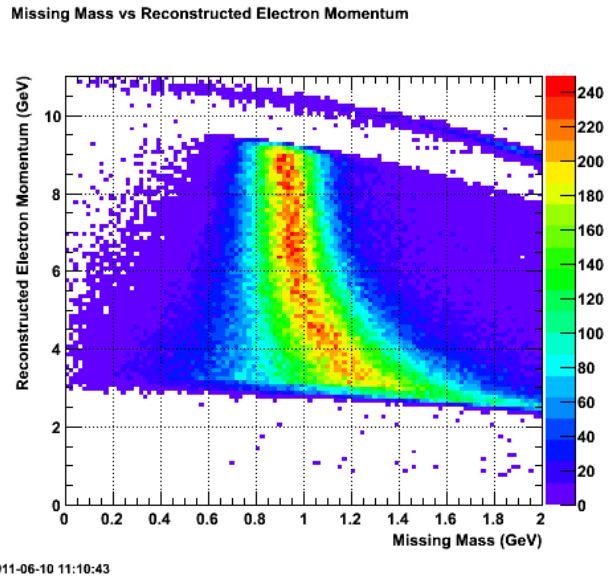
[Modified Sat Jun 18 15:01:58 2011 (GMT) Moog]

The missing mass plot is very wide, which is unexpected since the electron momentum plot isn't wide. After checking my missing mass calculation, I decided to see if missing mass had a dependency on some other variable (which it shouldn't.) First I looked at missing mass vs electron momentum and saw some sort of dependency.

Note added later (6/18/11): After comparing Δp/p distributions with JSocrat (see entry 364) it appears that distribution is consistent with JSocrat and with the results published in CLAS Note 2008-015 by Sebastien. We are calculating MM^2 correctly (I think) so the width of the MM^2 distribution is expected from the width of Δp/p. The curve in the plot of momentum versus missing mass is due to energy loss which is larger in percent at low momentum than at higher momentum. I haven't seen this in the E5 analysis because we use elastic scattering for the momentum corrections and that includes the energy loss correction.

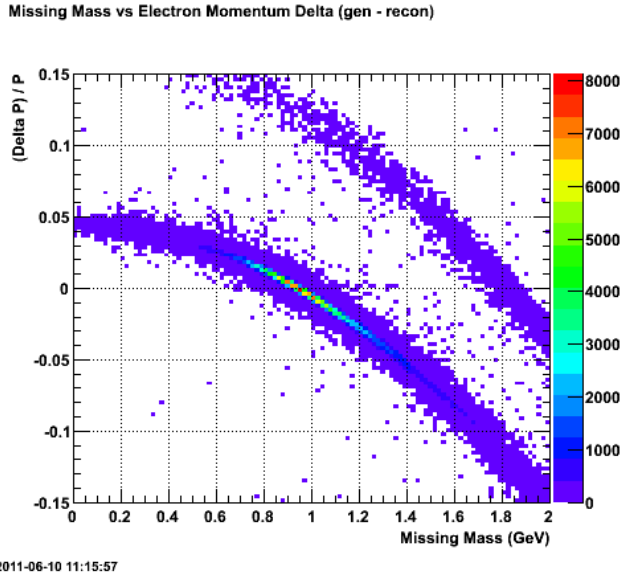


Click here to view the object (ROOT Macro) you uploaded.

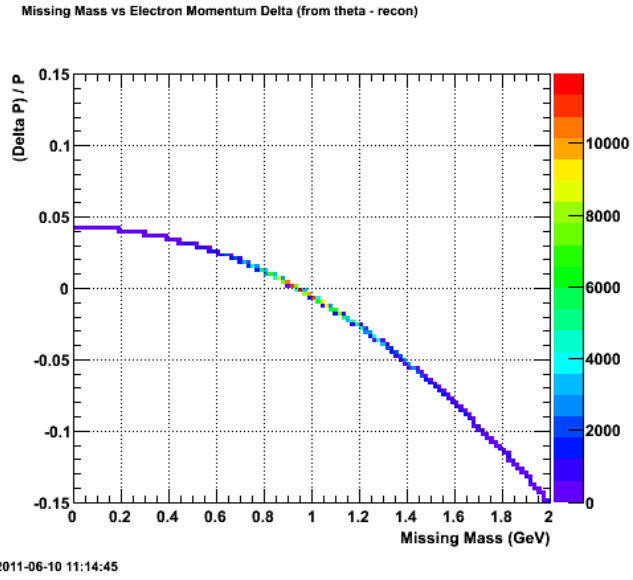


Click here to view the object (ROOT Macro) you uploaded.

Then I looked at missing mass against the generated momentum delta, (calculated with [reconstructed momentum - generated momentum] / generated momentum.) There is definitely a relationship. I next looked at the from theta momentum delta (calculated with [reconstructed momentum - momentum from reconstructed theta] / momentum from reconstructed theta.) There is a very clear one-to-one relationship here, and missing mass is very sensitive to changes in the from these momentum deltas.



Click here to view the object (ROOT Macro (gen delta)) you uploaded.



Click here to view the object (ROOT Macro) you uploaded.

Consider the following table. Many events have electron and neutron momenta that are very different from the expected values. The analysis here was done on an

generated event file that had 220 copies of the same event in the event generator input file. These events were then passed through gemc, gemc_evio2root, and Socrat. This is the Socrat output. The 'bad' events seem to be roughly correlated with a large number of hits in the DC; too many noise hits?

evnt	ndchit	id	g_p[0]	r_p	id	g_p[1]	r_pn
0	113	11	7.3311870	3.4838715	2112	4.5116191	7.7332105
1	98	11	7.3311870	7.2703302	2112	4.5116191	4.5576302
2	76	11	7.3311870	7.3591007	2112	4.5116191	4.4934949
3	99	11	7.3311870	3.7412031	2112	4.5116191	7.3668670
4	100	11	7.3311870	5.0882482	2112	4.5116191	6.3074744
5	221	11	7.3311870	0.0	2112	4.5116191	0.0
6	96	11	7.3311870	7.2930381	2112	4.5116191	4.5410714
7	85	11	7.3311870	7.3802024	2112	4.5116191	4.4766762
8	80	11	7.3311870	7.326378	2112	4.5116191	4.5150799
9	79	11	7.3311870	7.2708692	2112	4.5116191	4.5555307
10	77	11	7.3311870	7.3424668	2112	4.5116191	4.5046483
11	164	11	7.3311870	1.4103143	2112	4.5116191	9.7827315
12	87	11	7.3311870	1000	2112	4.5116191	1000
13	122	11	7.3311870	7.5083085	2112	4.5116191	4.3875479
14	76	11	7.3311870	6.5830650	2112	4.5116191	5.0711111
15	122	11	7.3311870	7.3320060	2112	4.5116191	4.5139142
16	94	11	7.3311870	6.9366837	2112	4.5116191	4.7997633
17	85	11	7.3311870	7.5321877	2112	4.5116191	4.3749086
18	76	11	7.3311870	7.4398984	2112	4.5116191	4.4371121
19	97	11	7.3311870	7.3714543	2112	4.5116191	4.4833744
20	93	11	7.3311870	7.1834355	2112	4.5116191	4.6185618
21	75	11	7.3311870	7.3232562	2112	4.5116191	4.5181468
22	111	11	7.3311870	7.4753885	2112	4.5116191	4.4123283
23	75	11	7.3311870	7.0450559	2112	4.5116191	4.7248660
24	74	11	7.3311870	7.4782856	2112	4.5116191	4.4087492

The input event in LUND format:

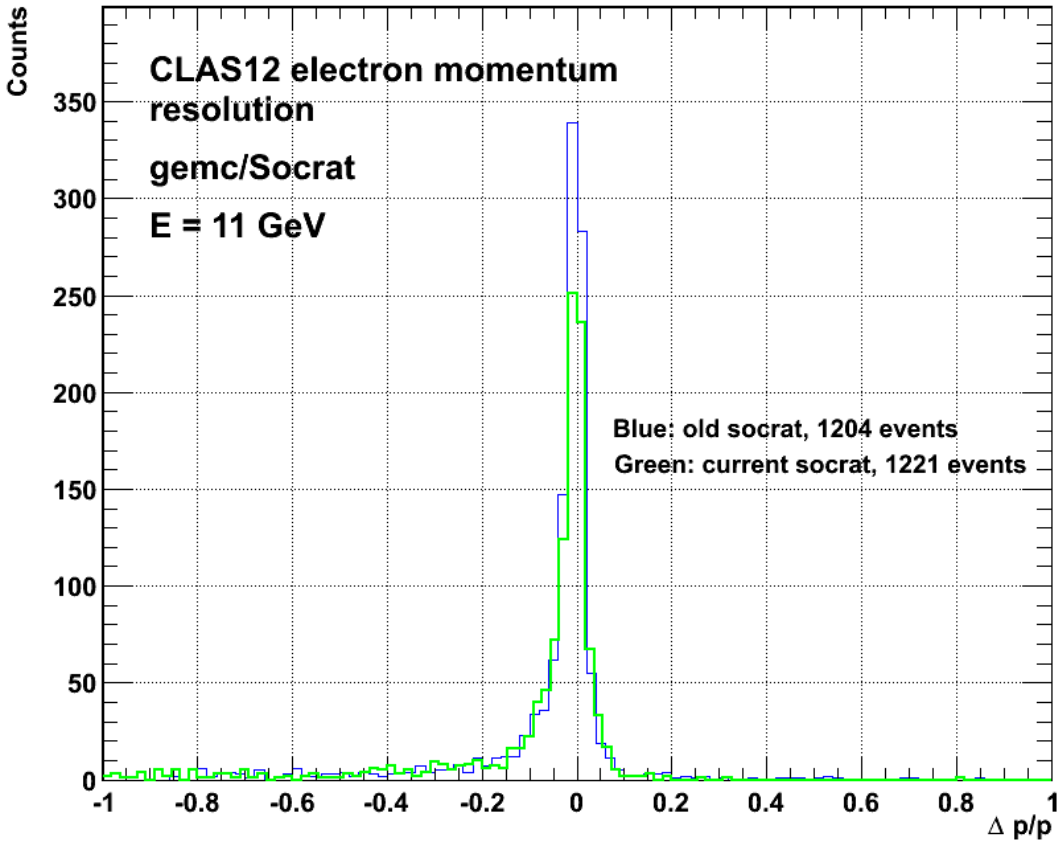
```
           2   1   0  0  0 1.000   0.334   0.883   6.894   3.669
0  -1    1   11  0  0    1.3393    1.6441    7.0178    7.3312    0.0005    0.0000    0.0000    0.0000
1   0    1 2112  0  0   -1.3393   -1.6441    3.9822    4.5116    0.9396    0.0000    0.0000    0.0000
```

The events with a large difference with the generated momentum however are not included in our usual analysis. We already exclude them with the Δ p/p < 0.10 cut. The correlation with the number of hits (ndchits) is very rough; event no. 13 in the table above has a large momentum difference but ndchits=76 which is typical for 'good' events.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 364 - Comparison of deltaP / P (Mark Moog)

[Modified Sat Jun 18 14:48:35 2011 (GMT) Mark Moog]



2011-06-13 14:21:18

Click here to view the object () you uploaded.

Agreed, but this is still too wide. The momentum resolution of CLAS12 should be about 5%. Actually, maybe not. The plot below shows the distribution and RCS value for the central peak. The large value of the RMS above was due to the high Δp/p tail. In the region of the central peak the value of the width is reasonable at about 3%.

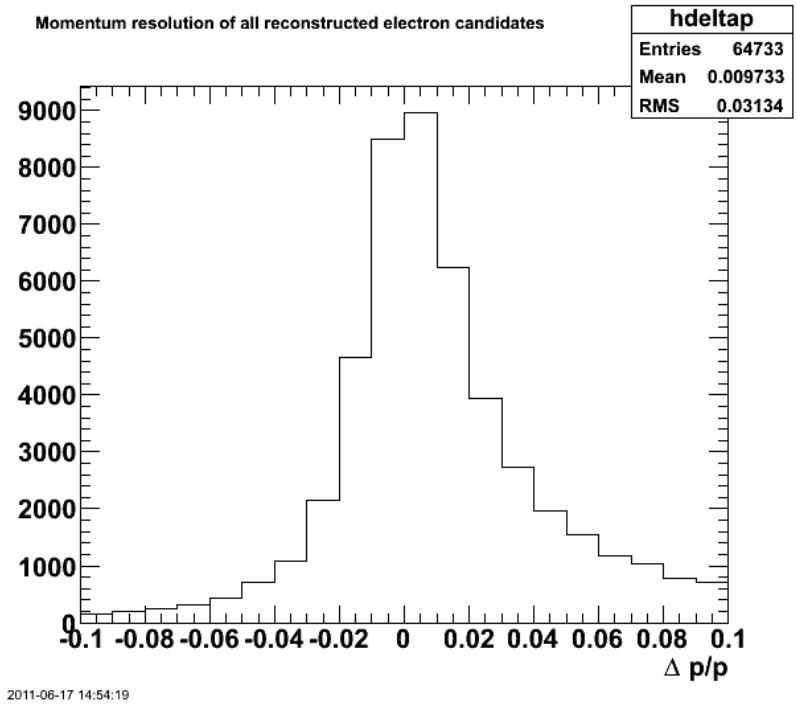


Fig 2a. Δp/p from long gemc run.

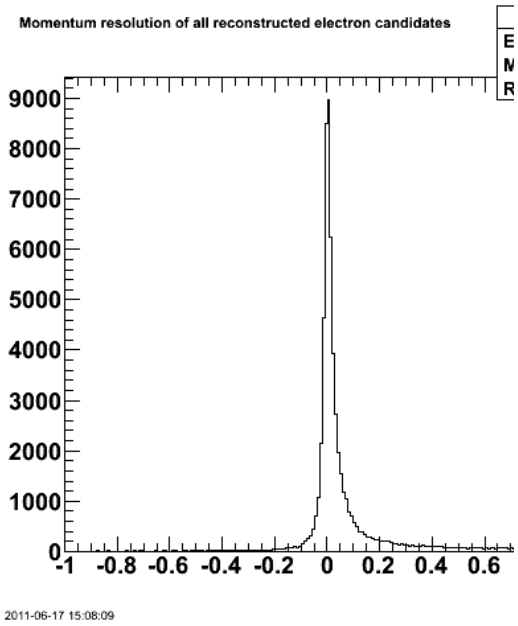


Fig 2b. Full range plot of 2a.

Click here to view the object (Root macro) you uploaded.

The plot below shows the distribution generated from the event file made of 220 copies of the same event that I generated for testing purposes. This is not the greatest, most consistent test, but the results are similar.

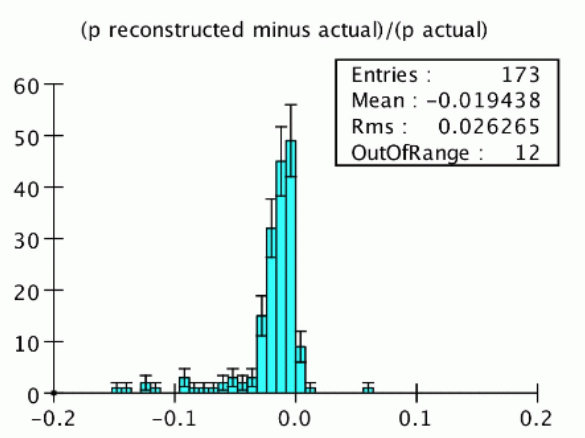


Fig 3. Distribution generated by Sebouh from the file with 220 copies of the same event.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 365 - Testing the 2.6n, no-fids analysis (gpg)

[Modified Wed Jun 15 03:22:00 2011 (GMT) gpg]

Compare fids on/off for ALTp with non QE in order to get more statistics. Use Q2=0.8-1.5 since the two Q2 distributions for 2.6n, fids on and fids off look similar. See fig 1. The right-hand panel has the fids on distribution scaled to match the high-Q2 drop and they look similar for Q2=0.5-1.5 GeV2.

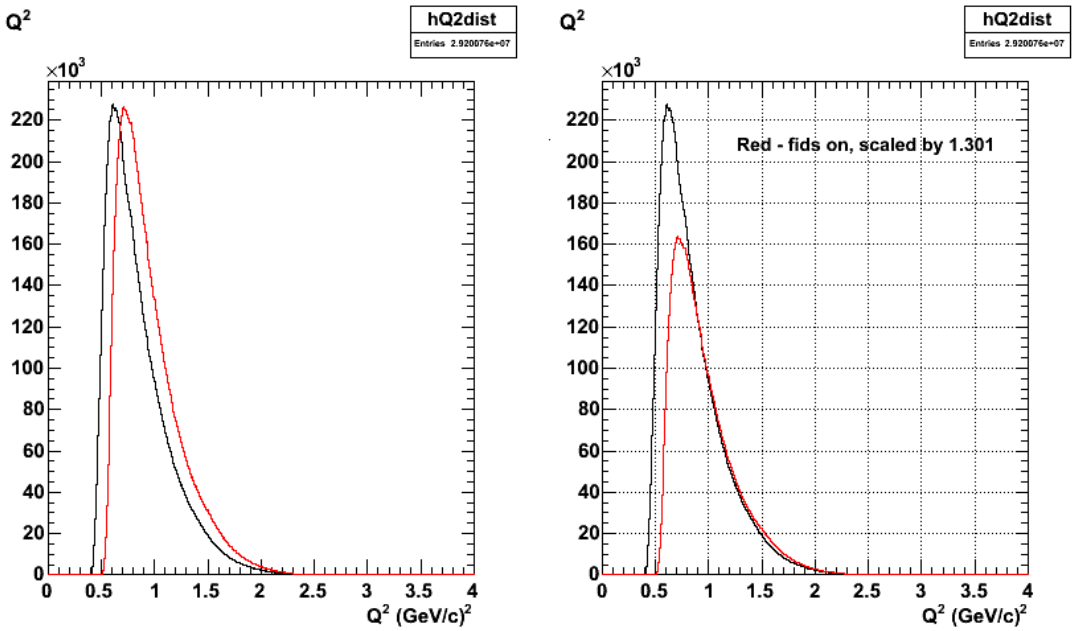


Fig 1. Comparison of Q2 distribution for fids on (red) and off (black) scaled to make the comparison easier.

Click here to view the object (Root macro) you uploaded.

Results from relaxing the QE requirement and cutting on Q2=0.8-1.5 GeV2. The asymmetry here is very small so this doesn't help.

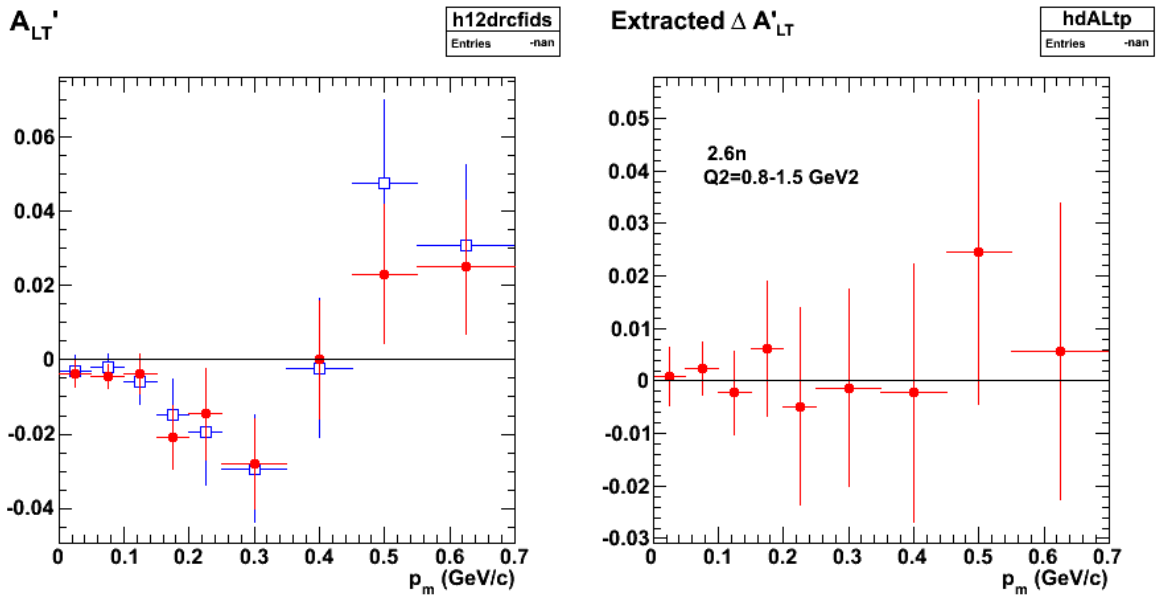


Fig 2. Helicity asymmetry for 2.6n with no QE cut and Q2=0.8-1.5 GeV2.

Click here to view the object (Root macro) you uploaded.

Now turn off the MM2 cut to isolate neutrons.

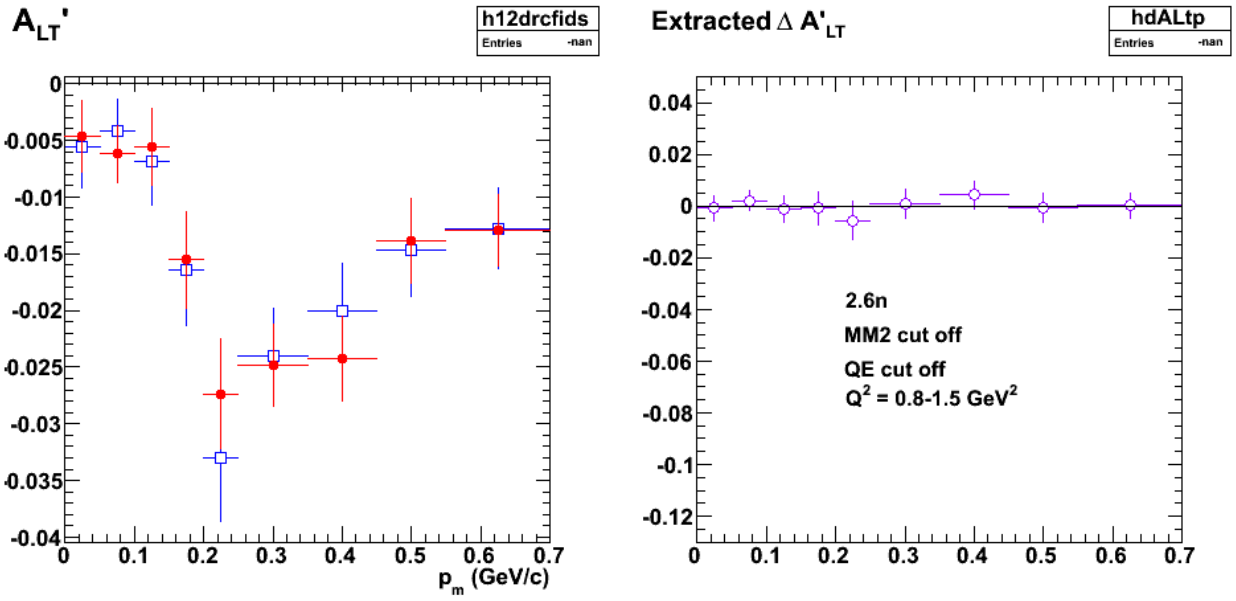


Fig 3. Same as fig 2 with MM2 neutron cut turned off. Fitting a straight line to dALTp I get p0 = 0.00019 +/- 0.0017 with chisq/ndf = 1.6/8.

Click here to view the object (Root macro) you uploaded.

Now turn off the RC because I am getting lots of outside-the-interpolation-range messages.

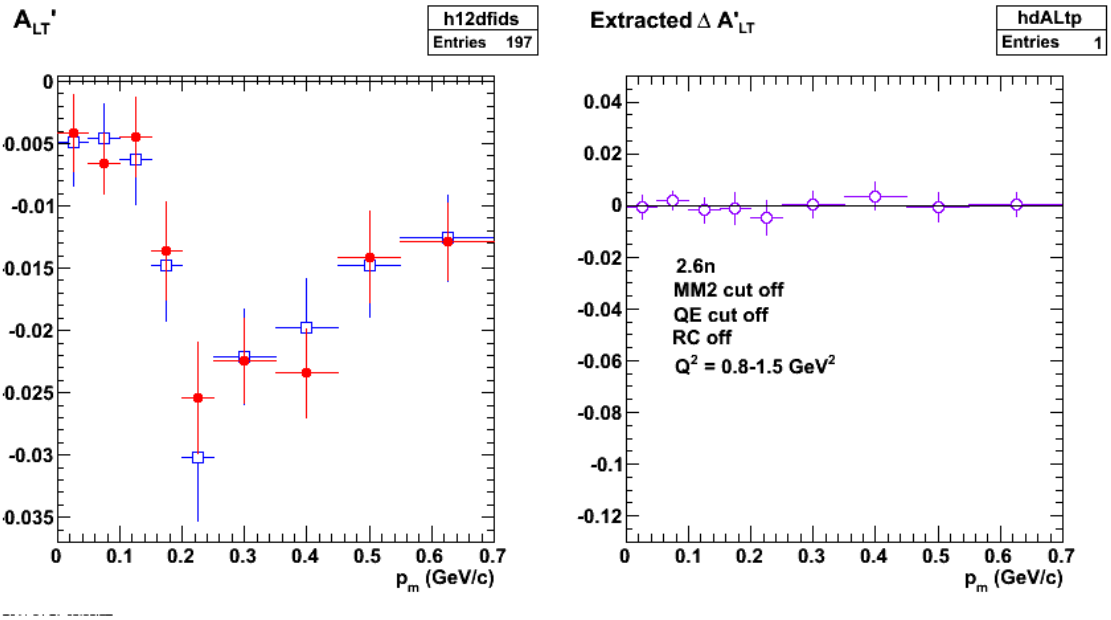


Fig 4. Same as fig 3 with RC off because of error messages.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Tar archive/backup of the analysis code eod5c is attached.) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 366 - testing the 2.6r no-fids analysis (gpg)

[Modified Sun Jun 19 16:39:45 2011 (GMT) gpg]

First compare the electron singles Q2 distribution with fids on and off.

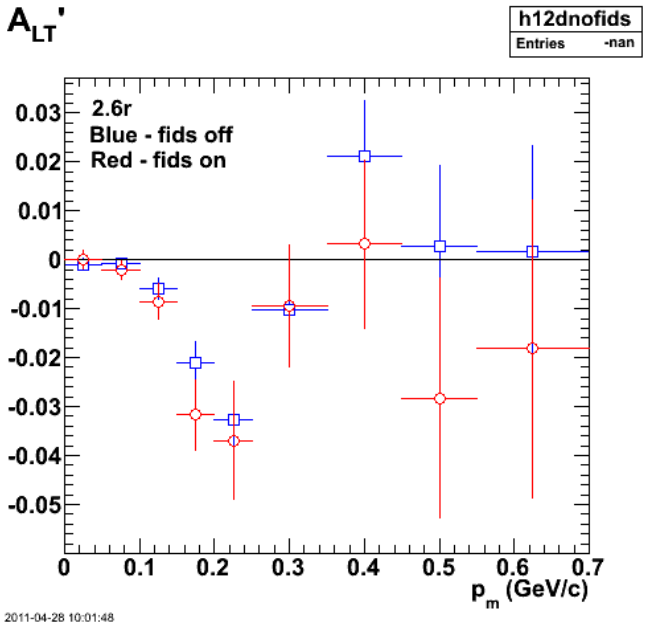


Fig 1. Comparison of 2.6r ALTp fir efids/pfids on (red) and off (blue).

Click here to view the object (Root macro) you uploaded.

Now look at the electron singles Q2 distribution for efids/pfids on/off. They both cover the same Q2 range! Left-hand panel shows unmodified distribution while right-hand panels shows the same distributions with the efids/pfids on distribution in red scaled by 1.81 to match the scale of the efids/pfids off.

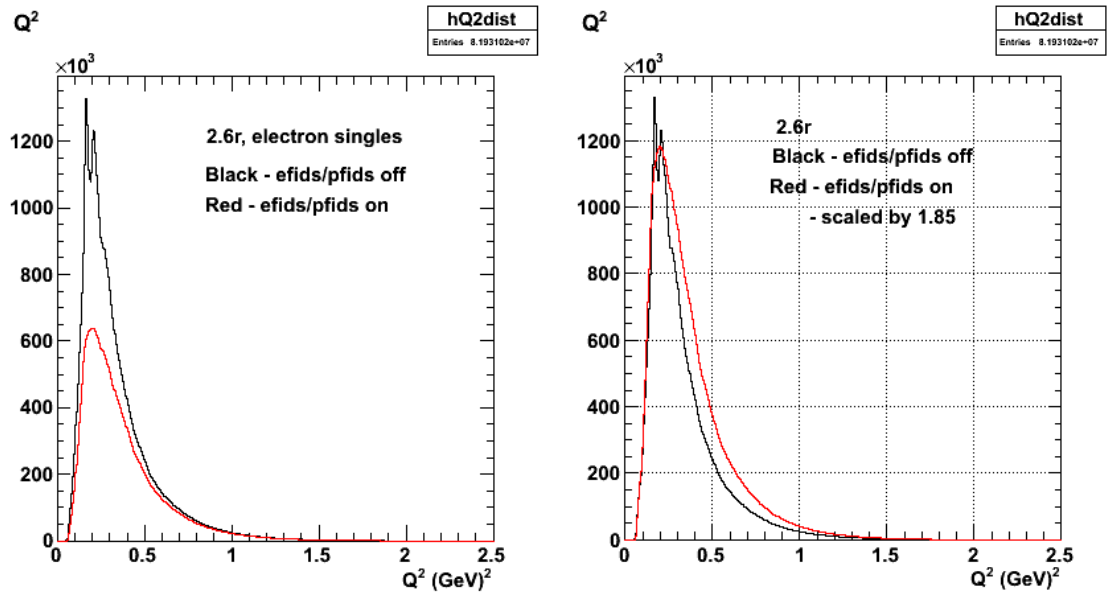


Fig 2. Comparison of electron Q2 distribution for 2.6r for efids/pfids on (red) and off (black).

Click here to view the object (Root macro) you uploaded.

Now compare ALTp with efids/pfids on and off. The difference between the two is consistent with zero (see fit results in right-hand panel of Fig 3), but the uncertainties are large. The uncertainties here were calculated by treating the no efid/pfid results as the sum of efids pfids on + events excluded by the fiducials. In this way we have two independent sets of events so we can use standard techniques for calculating the uncertainties.

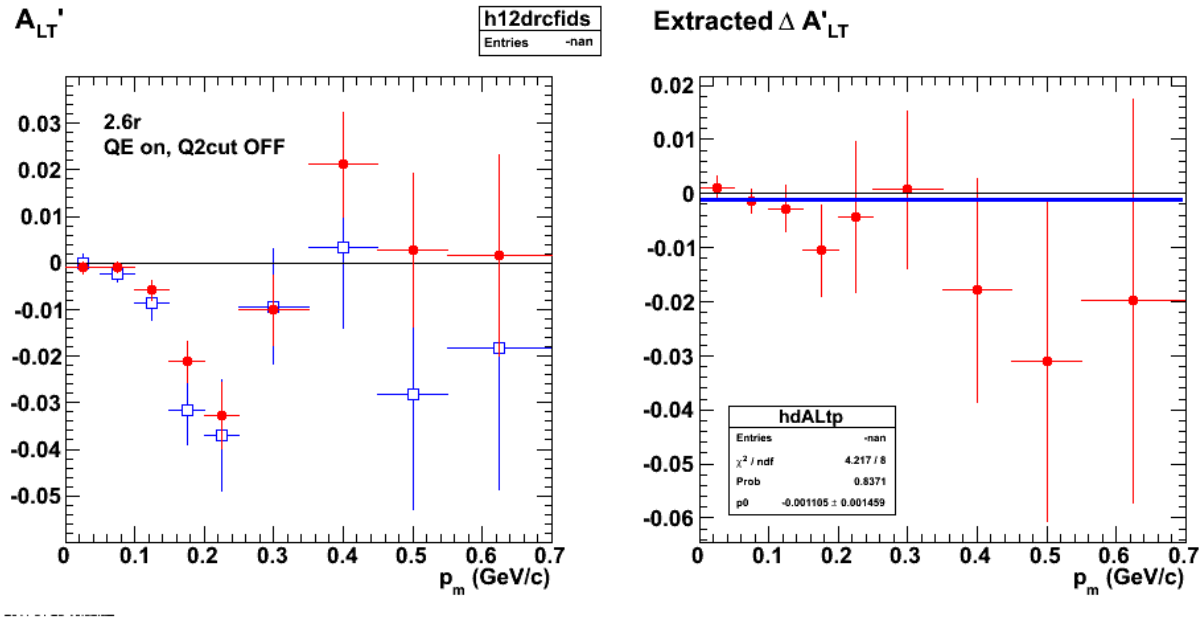


Fig 3. Comparison of ALTp with efids/pfids on (red) and off (blue) in the left-hand panel. The right-hand panel shows the difference between the two with uncertainties. Histogram file is listed below.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

To get more statistics in the comparison of ALTp with efids/pfids on/off turn off the QE cut for the ALTp histograms and set epn_event=true for all events.

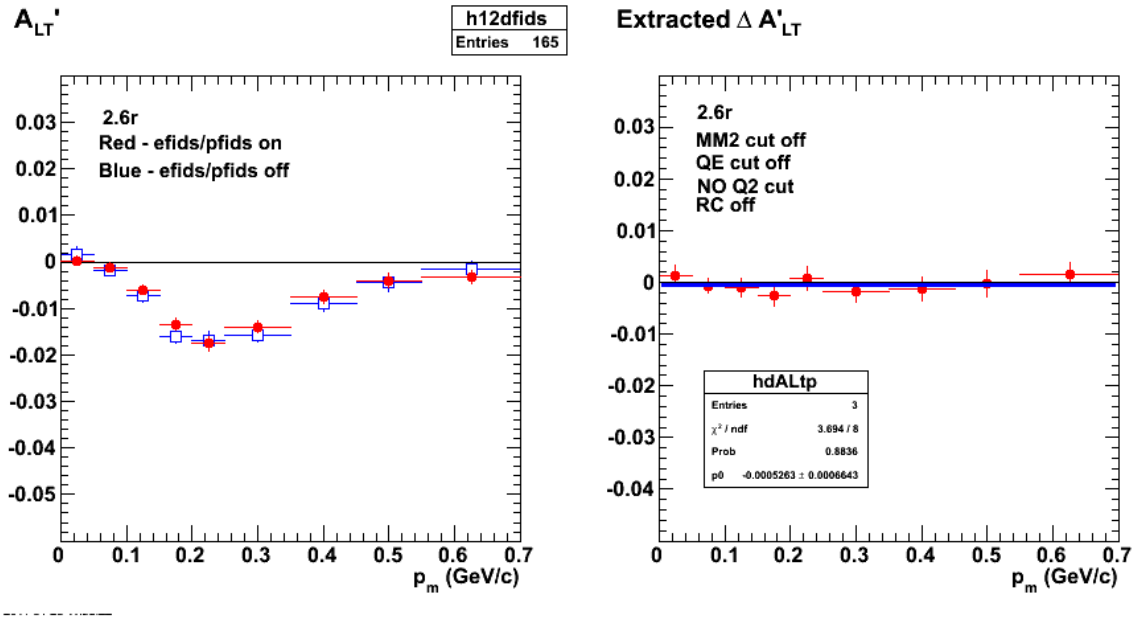


Fig 4. Helicity asymmetry (left-hand panel) for 2.6r with no QE cut, no MM2 cut, and no Q2 cut to improve statistics with efids/pfids off (blue) and on (red). The difference between those two distributions is shown in the right-hand panel. See below for histogram file.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 367 - Doing 2.6r delta_ALTp correctly (gpg)

[Modified Sun Jun 19 16:47:44 2011 (GMT) gpg]

As I think about the dALTp analysis from the previous entries I realized I did it wrong. In order to get the uncertainties correctly added together the quantities have to be from independent data sets. When I constructed the nofids ALTp using the sum of fids+out (where out means outside the efids/pfids cut) I violated that requirement. This summed distribution is manifestly NOT independent of the nofids distribution because it contains events that are in the nofids ALTp. When I calculate dALTp I have to use two, statistically independent data sets. The ones on hand are the fids and the out distributions so calculate the difference between those and then the uncertainties can be properly calculated.

Results below were extracted from histogram files in entry 11.

First calculate ALTp for fids, nofids, and out.

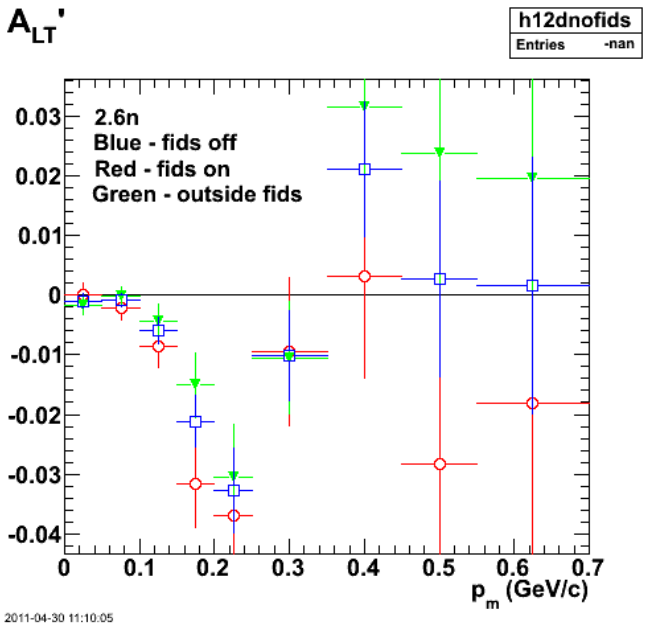


Fig 1. Comparison of 2.6r ALTp for fids on (red), fids off (blue), and outside fids (green).

Click here to view the object (Root macro) you uploaded.

Now calculate the difference dALTp between the fids on ALTp and the fids out ALTp for 2.6r. The results are not that different from the previous ones for the difference between ALTp with fids on and ALTp with fids off. That bodes well for when I enhance the stats.

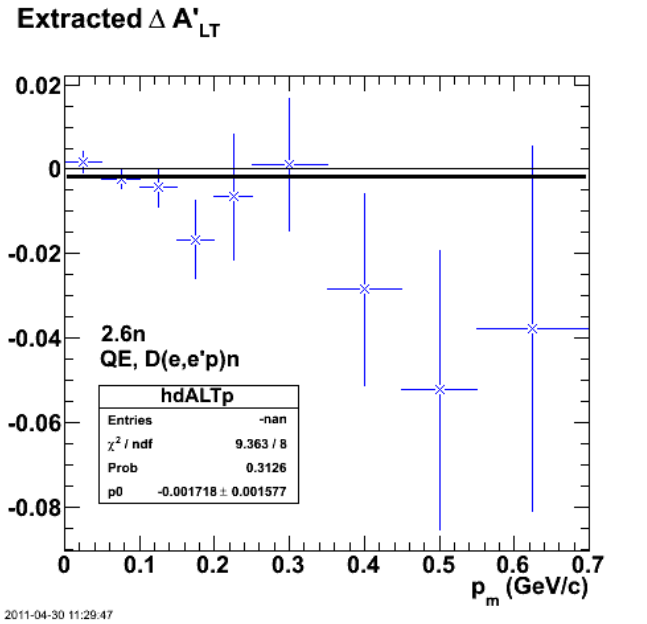


Fig 2. dALTp for 2.6r and QE events. Note: the label 2.6n on the plot is wrong.

Click here to view the object (Root macro) you uploaded.

Compare the asymmetries as in Fig 1, but now for fids on, fids off, fids out for no QE and MM2 cuts to enhance the statistics.

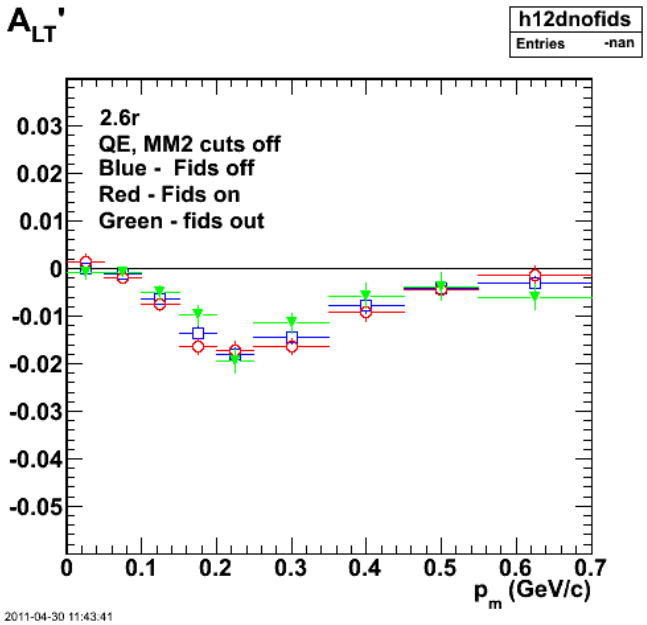


Fig 3. Comparison of ALTp for fids on (red), fids off (blue), and fids out (green) as in Fig 1.

Click here to view the object (Root macro) you uploaded.

Compare dALTp between fids on and fids out. The result is 1.3 sigma away from zero.

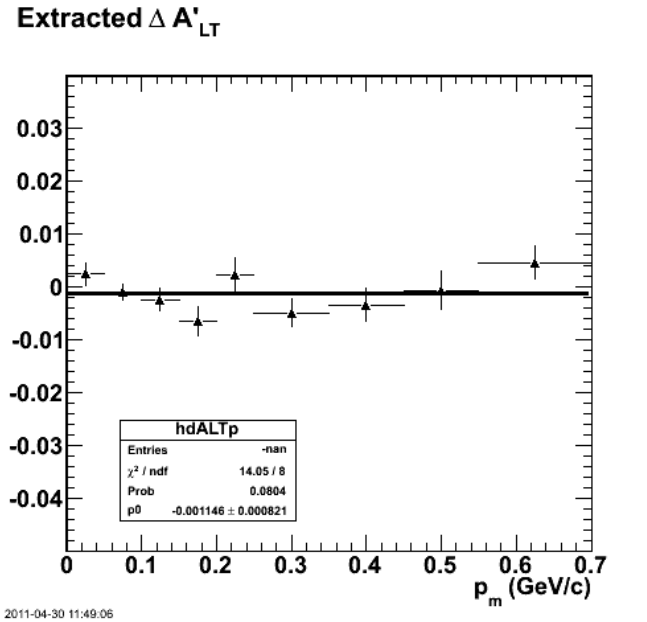


Fig 4. Same as fig 2 for 2.6r,but now with QE and MM2 cuts off.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 368 - Do 2.6n delta_ALTp correctly. (gpg)

[Modified Sun Jun 19 17:21:44 2011 (GMT) gpg]

Now do the 2.6n dALTp analysis correctly as described in the previous entry (12). Do the enhanced stats analysis right away (no QE, MM2 cuts with Q2=0.8-1.5 GeV2). The statistics are still rather lousy.

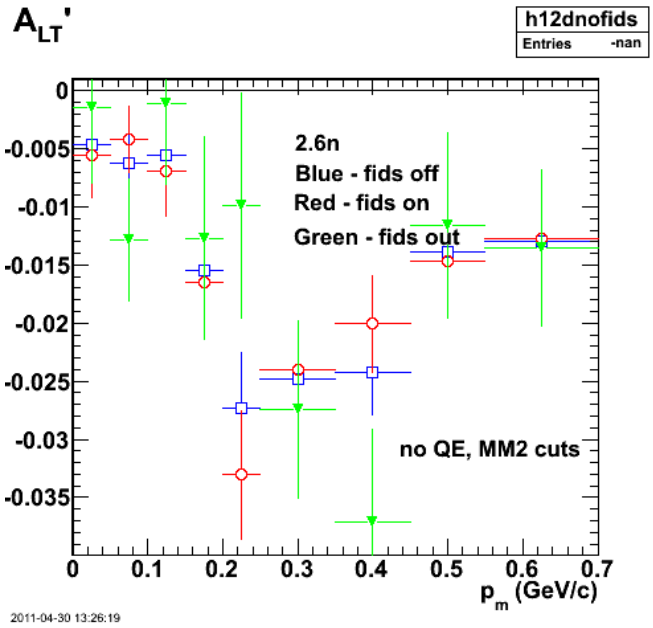


Fig 1a. Comparison of ALTp for efids on (red), fids off (blue), and outside the fids (green).

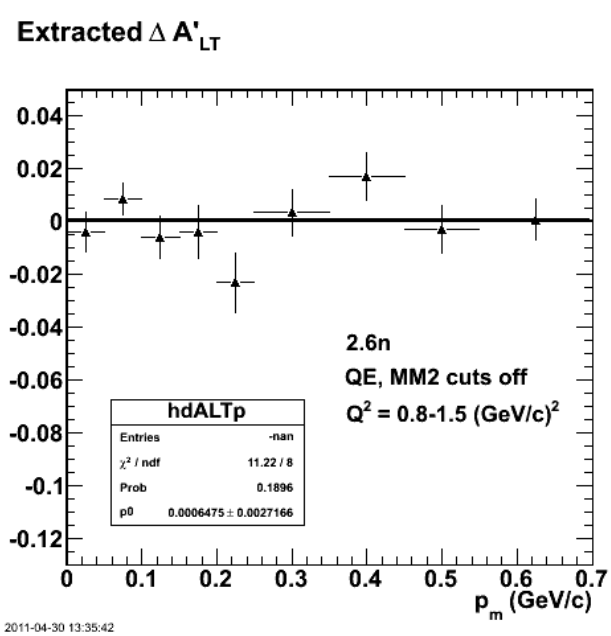


Fig 1b. dALTp for enhanced stats and 2.6n.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root macro) you uploaded.

Here is ALTp with the QE and MM2 cuts on.

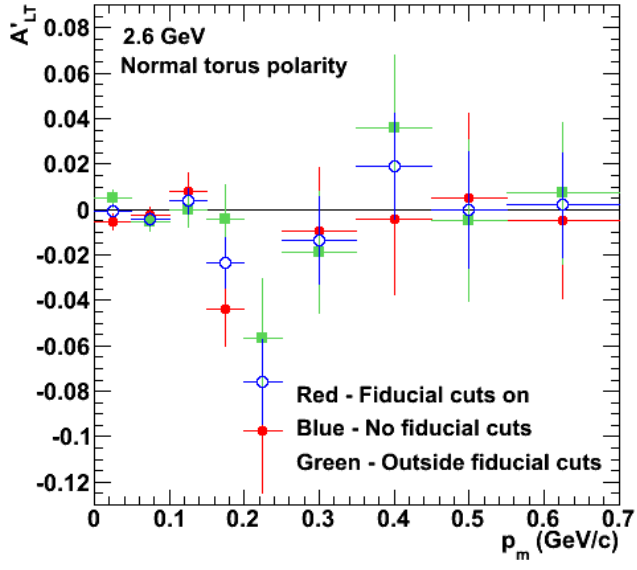


Fig 2a. ALTp for fids on (red), off (blue), and outside the fids (green).

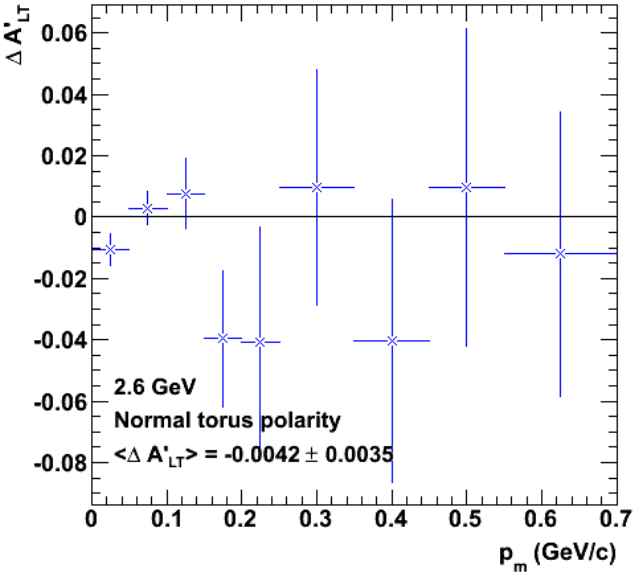


Fig 2b. dALTp for events with QE and MM2 cuts on and 2.6n.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 369 - Enhancing 2.6n statistics (gpg)

[Modified Sun Jun 19 17:39:37 2011 (GMT) gpg]

Series of changes to the cuts on the histograms to increase the statistics. Start by turning off the QE and MM2 neutron cut and increasing the range of the Q2 cut to 0.7-3.5 GeV2. Results for plus4 histogram are in Fig 1.

```
// electron-proton-neutron coincidences 1. fids off.

if (epn_event &&
    target_walls_ep &&
    good_e_p_vertex &&
    //good_electron_fiducial &&
    //good_proton_fiducial &&
    //quasielastic_cut &&
    Q2cut &&
    good_egiyan_threshold &&
    good_EC_pion_threshold &&
    good_electron_EC_fiducial &&
    good_electron_EC_trk_coords_fiducial &&
    good_mass_p &&
    good_sampling_fraction &&
    good_photoelectrons) {
```

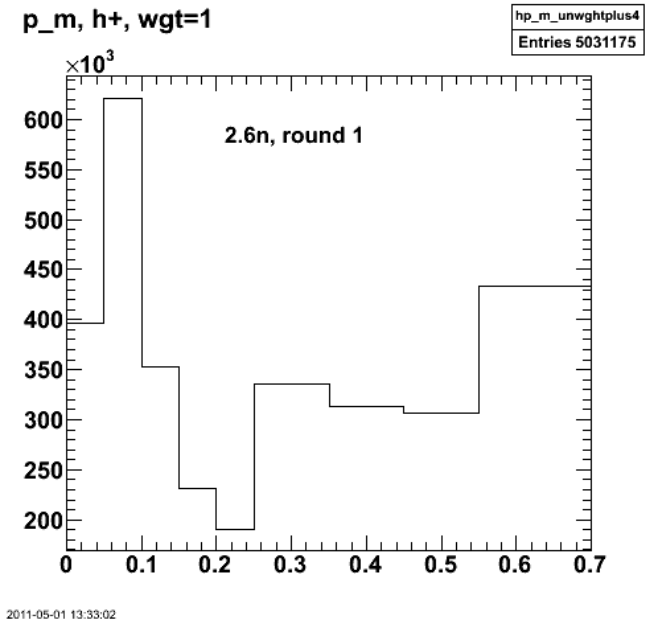


Fig 1. Round 1.

dALTp result:

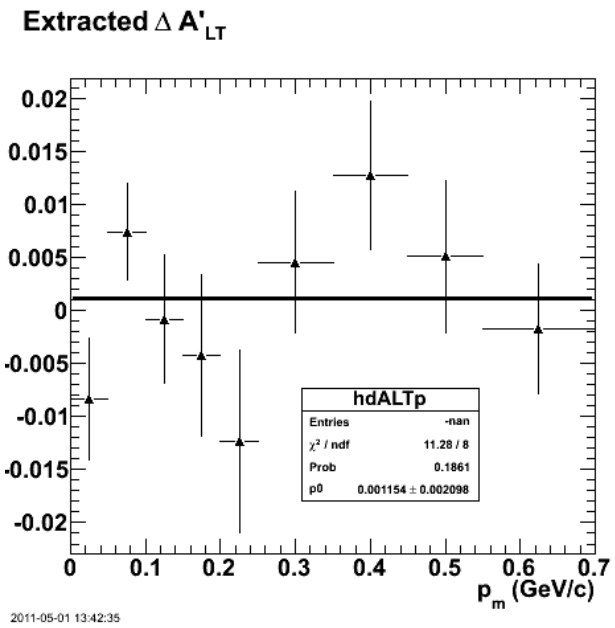


Fig 2. Round 1 (?) result.

Click here to view the object (Root macro) you uploaded.

Round 2.

```
// electron-proton-neutron coincidences 1. fids off.

if (epn_event &&
    target_walls_ep &&
    //good_e_p_vertex &&
    //good_electron_fiducial &&
    //good_proton_fiducial &&
    //quasielastic_cut &&
    Q2cut &&
    good_egiyan_threshold &&
    good_EC_pion_threshold &&
    //good_electron_EC_fiducial &&
    //good_electron_EC_trk_coords_fiducial &&
    //good_mass_p &&
    good_sampling_fraction) { // &&
    //  good_photoelectrons) {
```

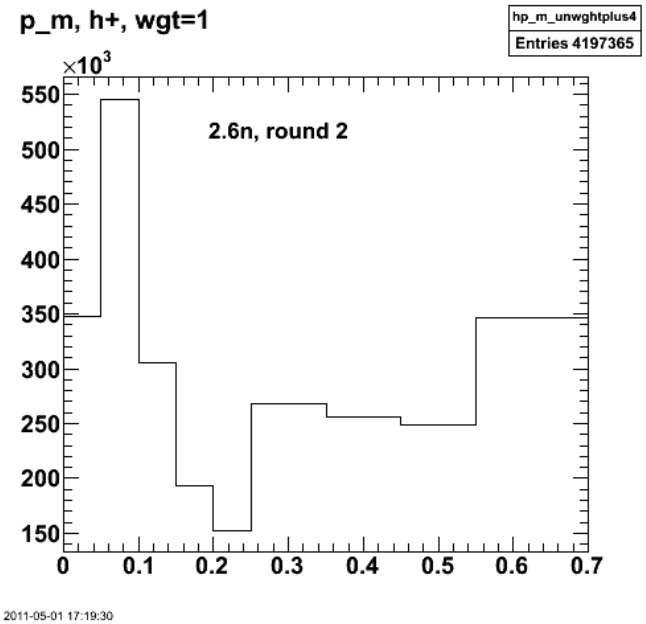


Fig 3. Round 2; test histogram. How could the number of events here go down???!!!

dALTp result:

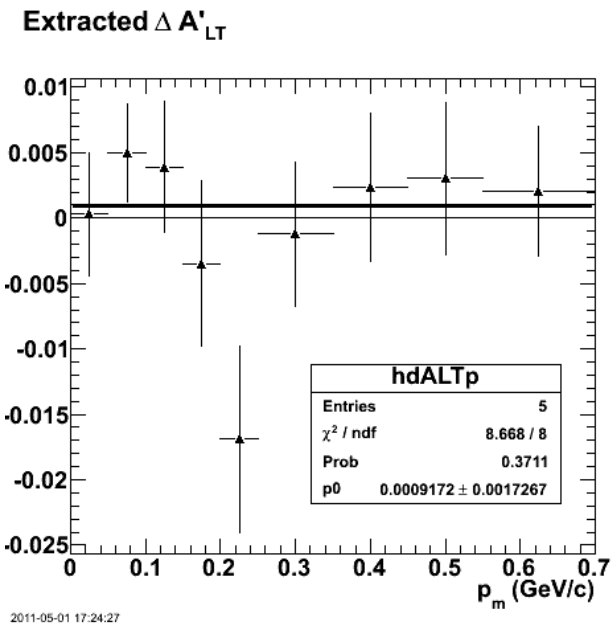


Fig 4. Round 2 result; the uncertainty is smaller - down to 0.0017.

Click here to view the object (Root macro) you uploaded.

Round 3.

```
// electron-proton-neutron coincidences 1. fids off.

if (epn_event &&
    target_walls_ep &&
    //good_e_p_vertex &&
    //good_electron_fiducial &&
    //good_proton_fiducial &&
    //quasielastic_cut &&
    Q2cut) {
    //good_egiyan_threshold &&
    //good_EC_pion_threshold &&
    //good_electron_EC_fiducial &&
    //good_electron_EC_trk_coords_fiducial &&
    //good_mass_p &&
    //good_sampling_fraction) { // &&
    //  good_photoelectrons) {
```

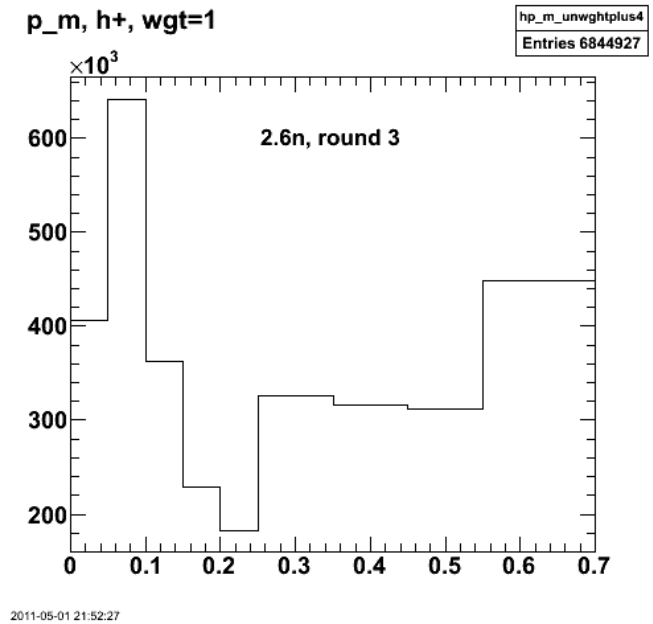


Fig 5. Round 3; test histogram. The number of events is larger as expected.

dALTp

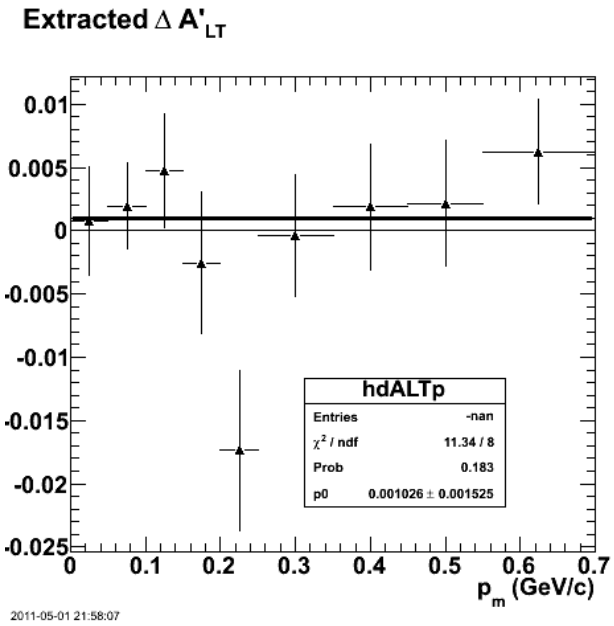


Fig 6. Round 2 result; the uncertainty again is smaller - down to 0.0015.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 370 - Mp cut uncertainty for 2.6r (gpg)

[Modified Sun Jun 19 17:44:09 2011 (GMT) gpg]

Get ALTp with Mp cut on and off from the previous entry (7). First plot ALTp for each set. RC is on here.

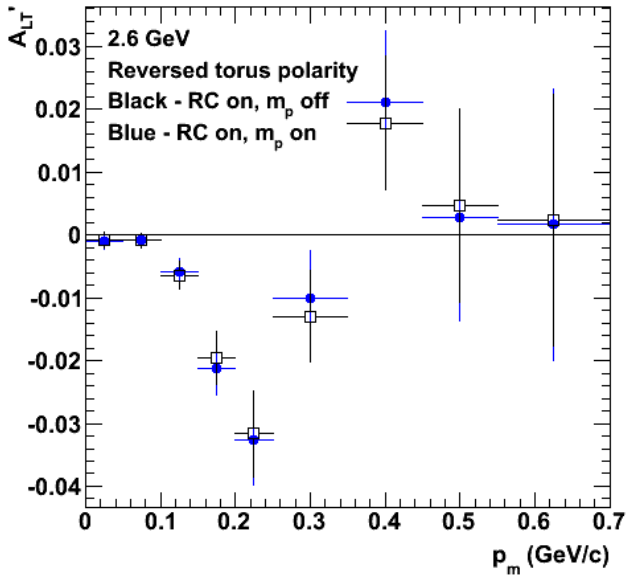


Fig 1. Comparison of ALTp with RC and and Mp cut on (blue) and off (black).

Click here to view the object (Root macro) you uploaded.

To get the uncertainty due to the Mp cut take half the difference between Mp cut on and Mp cut off.

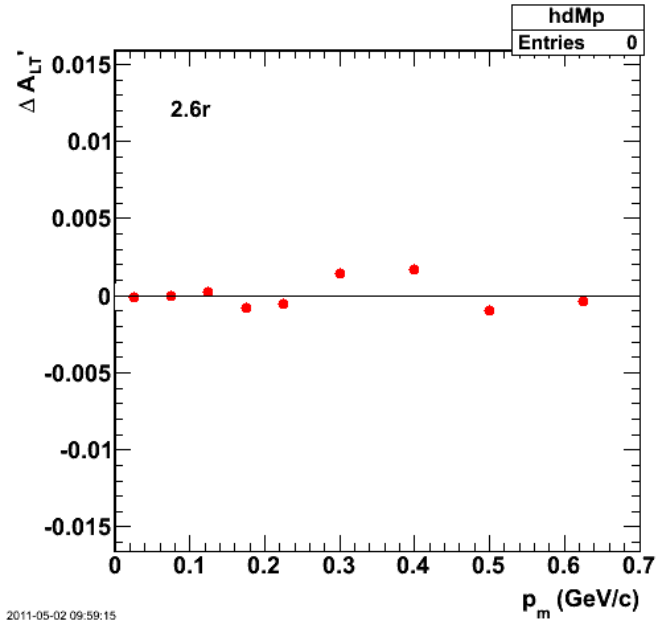


Fig 2. Uncertainty on ALTp due to 2.6r Mp cut.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 371 - Mp cut uncertainty for 2.6n (gpg)

[Modified Mon Jun 20 00:25:50 2011 (GMT) gpg]

Get ALTp with Mp cut on and off from the previous entry (8). First plot ALTp for each set. RC is on here.

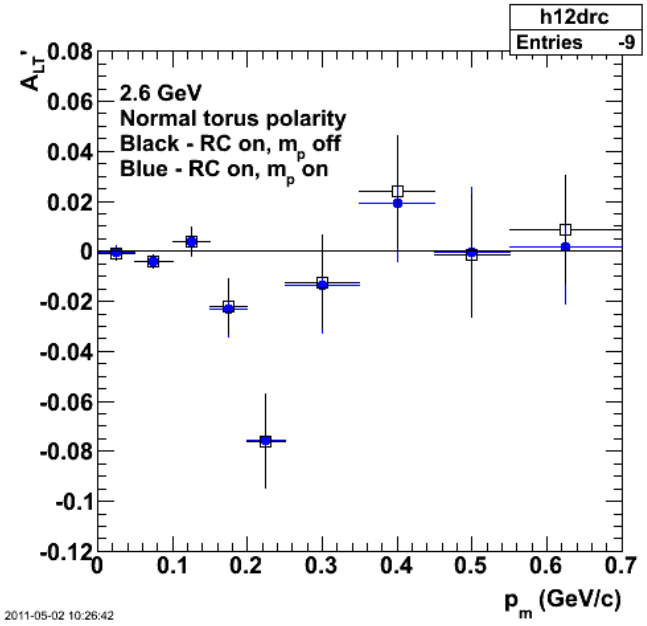


Fig 1. ALTp with Mp cut on (black) and off (blue) for 2.6n.

Click here to view the object (Root macro) you uploaded.

dALTp:

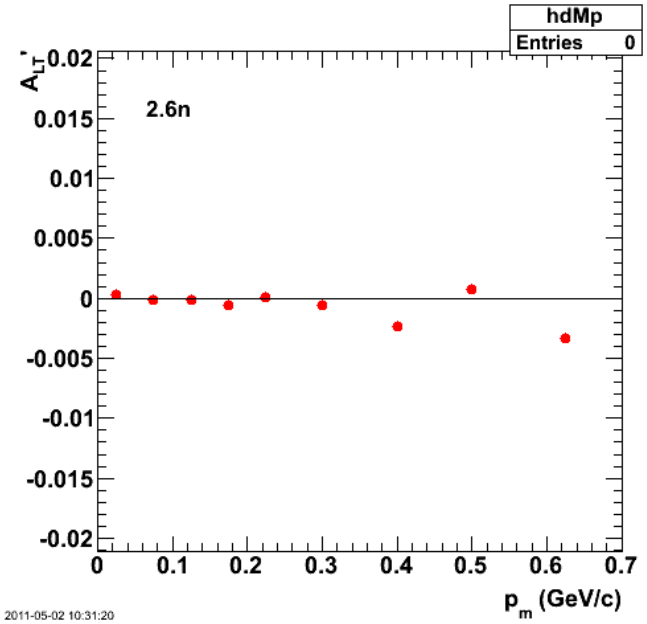


Fig 2. Uncertainty on ALTp due to 2.6n Mp cut.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 372 - Ratio of triggers to simulated QE events (gpg)

[Modified Mon Jun 20 00:31:08 2011 (GMT) gpg]

In preparation for the JLab IT readiness review for CLAS12 we need to estimate the ratio of simulated events to actual collected data. The old TDR for CLAS12 had a ratio of 4 simulated events for each collected one, but the recent estimate from Dennis Weygand is very different. Instead of 4:1 it is 1:5; a factor of 20 difference. For grins I estimated the number of QE simulated events versus data triggers for the E5 EOD analysis. The results are the following.

2.6n+2.6r triggers	2.6n+2.6r QE simulations
1.5*10^9	2.1*10^8

The ratio is simulated/collected is 0.13 versus Dennis' 0.2 which is not widely different especially since we could use more simulated events. The attached Mathematica notebook has more details. See also the following link for information on GMn. http://clasweb.jlab.org/rungroups/e5/

Click here to view the object (Mathematica file) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 373 - Non/Noff ratio (gpg)

[Modified Mon Jun 20 00:39:53 2011 (GMT) gpg]

For the Analysis Note I have come up with a relationship between the efids/pfids on ALTp and efids/pfids off ALTp. The relationship is

dALTp = ALTp(on) - ALTp(out) = (ALTp(on)-ALTp(off))/(1 - Non/Noff)

so I need the ratio of Non/Noff.

Data Set	h=+	h=-	file
2.6r	0.38	0.38	e11f3.root
2.6n	0.52	0.52	summed_hists-11-apr-25.root

Raw numbers are below. File e11f3.root is from entry 11 in the ELOG elog. File summed_hists-11-apr-25.root is from entry 9 in the ELOG elog.

Click here to view the object (File e11f3.root) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

```
------------------

2.6r with fids on:

hp_m_unwghtplus5  - no RC
hp_m_unwghtplus9  - with RC
hp_m_unwghtminus9

root [3] hp_m_unwghtplus5->Integral(1,20)
(const Double_t)1.21246000000000000e+06

root [5] hp_m_unwghtminus5->Integral(1,20)
(const Double_t)1.22227300000000000e+06

with fids off:

hp_m_unwghtplus4  - no RC
hp_m_unwghtplus8  - with RC

root [4] hp_m_unwghtplus4->Integral(1,20)
(const Double_t)3.17283600000000000e+06


plus - 1.212/3.173 = 0.382 +/- 0.001
minus - 1.222/3.195 = 0.382 +/- 0.001



------------------

2.6n with fids on:

root [13] hp_m_unwghtminus5->Integral(1,20)
(const Double_t)3.27762000000000000e+05

root [10] hp_m_unwghtplus5->Integral(1,20)
(const Double_t)3.26469000000000000e+05


fids off:

root [14] hp_m_unwghtminus4->Integral(1,20)
(const Double_t)6.34371000000000000e+05

root [12] hp_m_unwghtplus4->Integral(1,20)
(const Double_t)6.31799000000000000e+05

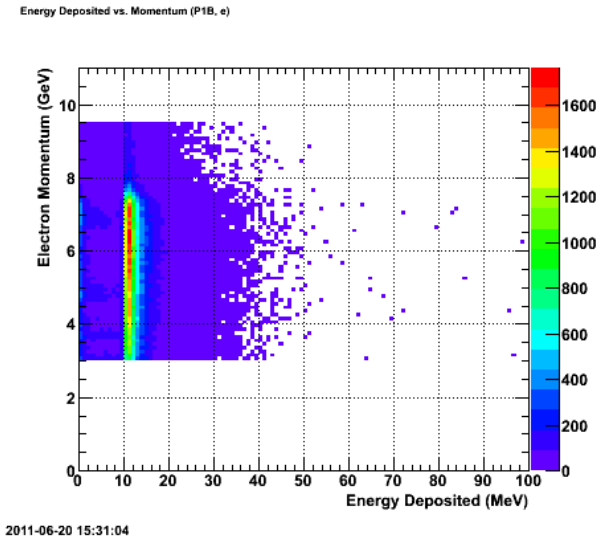
minus = 3.278/6.344 = 0.52
plus = 3.265/6.318 = 0.52
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 374 - Energy Deposited in P1B (Mark Moog)

[Modified Thu Jun 30 17:51:42 2011 (GMT) Mark Moog]

Current energy deposited info can be found here



There appears to be a cut at 10 MeV, but other than that energy deposited by the electron seems pretty uniform across all generated energies

Click here to view the object (Electron Edep ROOT Macro) you uploaded.

There is a drop, but not a cut at 10 MeV. See the next plot. Turn off everything in from of p1b; we need to understand this structure.

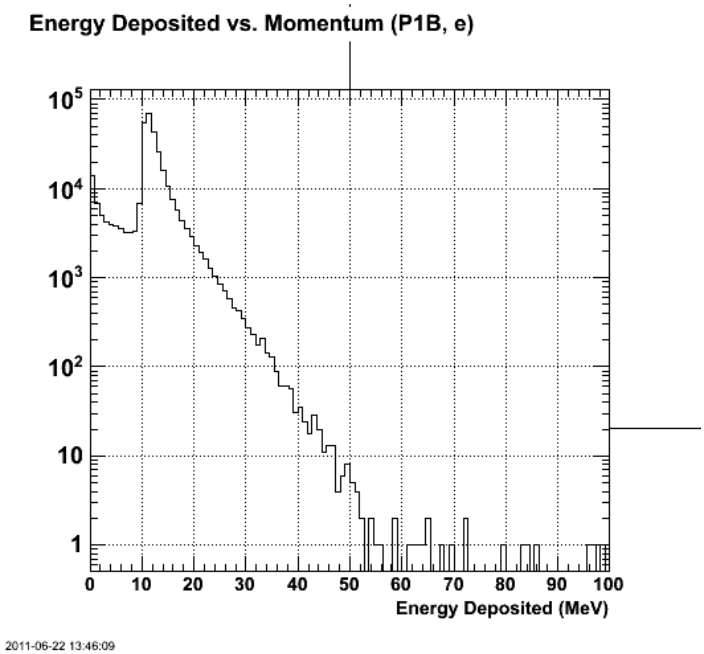


Fig 2. Projection of Fig 1. along the Edep axis.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 375 - Luminosity study (gpg)

[Modified Wed Jun 22 19:47:00 2011 (GMT) gpg]

To run gemc with the luminosity use the following command

```
gemc -gcard=modified.gcard -N=1 -BEAM_P="e-, 9.0*GeV, 25.0*deg, 0.0*deg" -USE_PHYSICSL=gemc -LUMI_P="e-, 11*GeV, 0*deg, 0*deg" -LUMI_EVENT="28200, 60*ns
```

where the bunch time is 2 ns, the time window for the forward TOF system is 60 ns (this is the sum of the electronics window, plus propagation times, and the particle/event (28200) is the product of the time window and the electron rate which is 4.7×10^{11} electrons/s for the CLAS12 luminosity of $10^{35} s^{-1} cm^{-2}$. The gemc picture of the background is below.

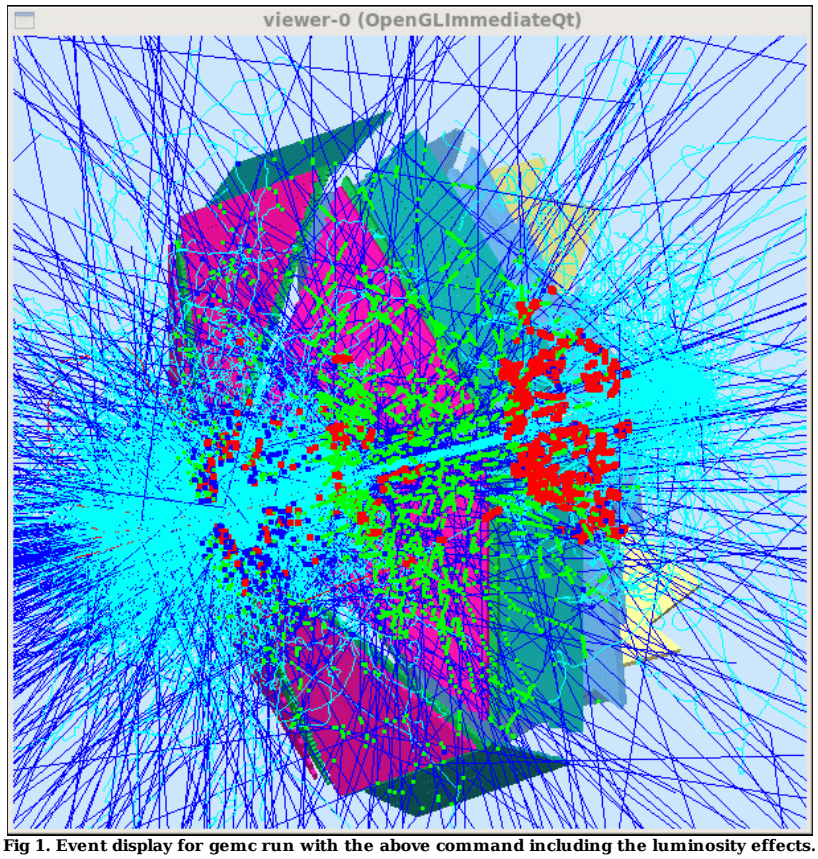


Fig 1. Event display for gemc run with the above command including the luminosity effects.

DOE 2000 Electronic Notebook

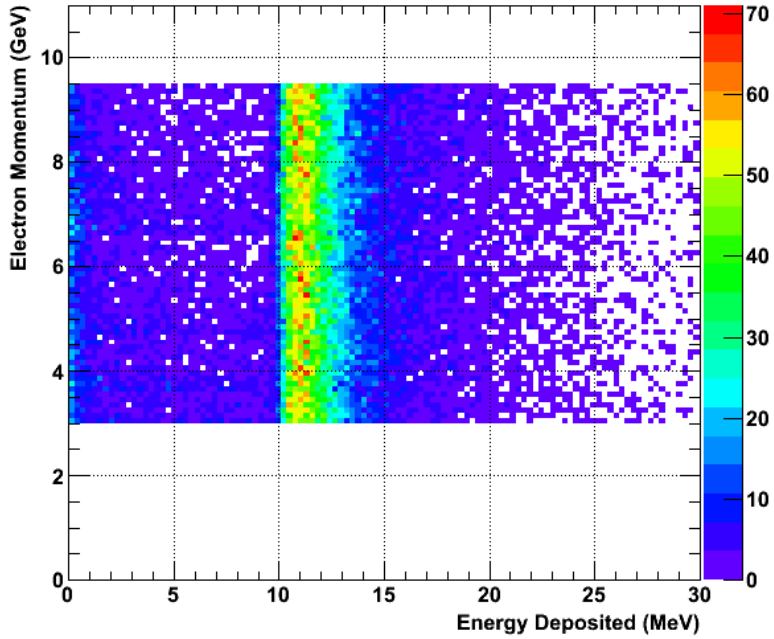
Jerry Gilfoyle's Enotebook page 376 - OTOF Energy Deposited Update (Mark Moog)

[Modified Thu Jun 30 17:51:32 2011 (GMT) Mark Moog]

Current energy deposited info can be found here

My previous plot is incorrect since it only shows energy deposited during found events. This makes it misleading and reduces the number of data points at higher electron energies. This is a plot of energy deposited vs. momentum for 50,000 electrons (no cuts at all) shot at 25 degrees theta with a phi range of 0 to 360, and a momentum range of 3.5 to 9.5. Luminosity was also set to 0 to eliminate background.

Energy Deposited vs. Momentum (P1B, e)

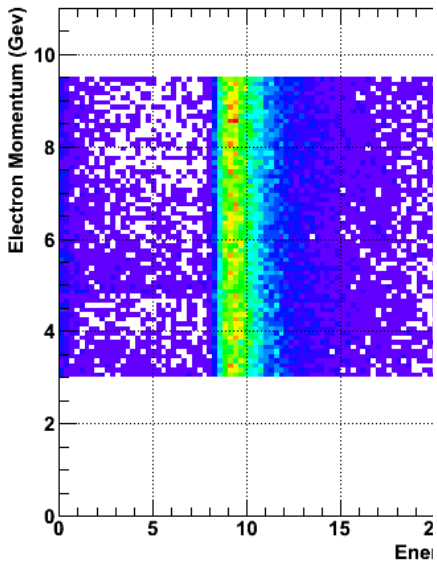


2011-06-23 11:44:32

Click here to view the object (electron root macro) you uploaded.

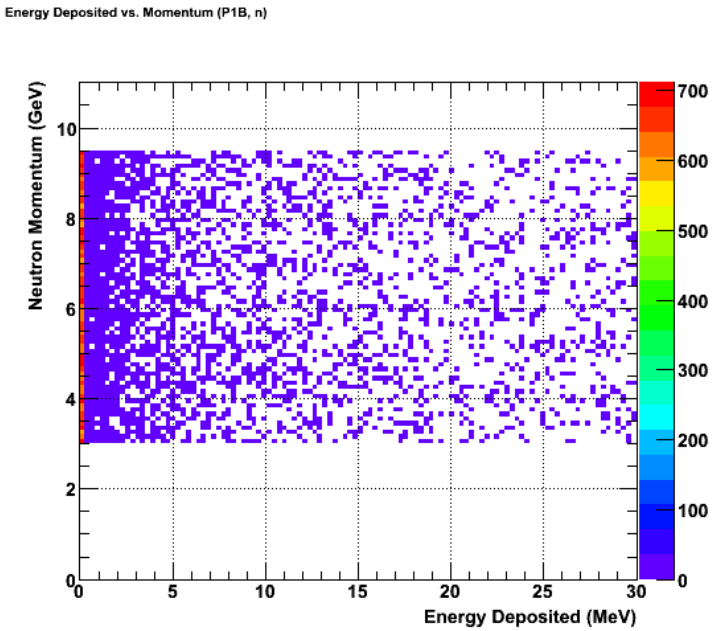
There still seems to be something going on at 10 MeV

Energy Deposited vs. Momentum (P1A, e)



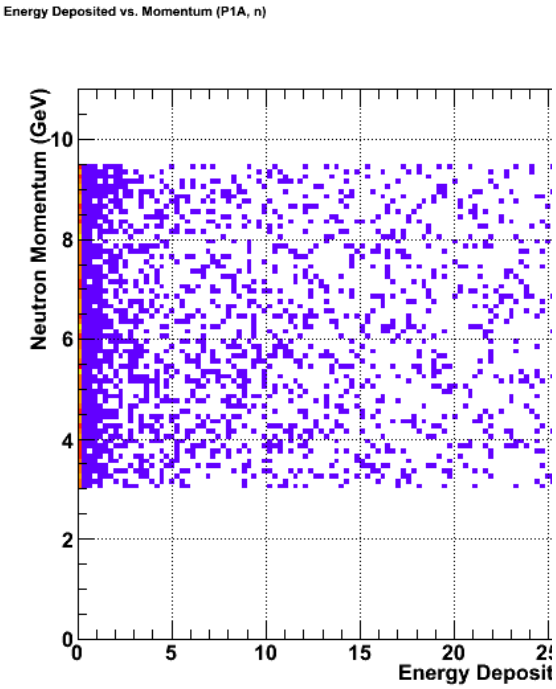
2011-06-23 13:17:08

Click here to view the object (electron p1a root macro) you



2011-06-23 12:00:16

Click here to view the object (neutron root macro) you uploaded.



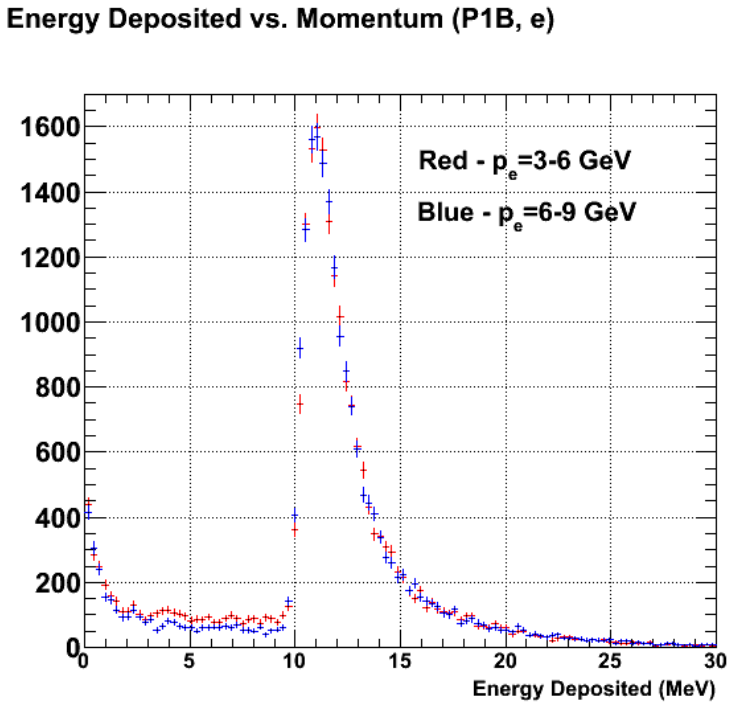
2011-06-23 12:10:53

Click here to view the object (neutron p1a) you uploaded.

The neutron deposits 0 MeV the vast majority of the time it passes through a panel

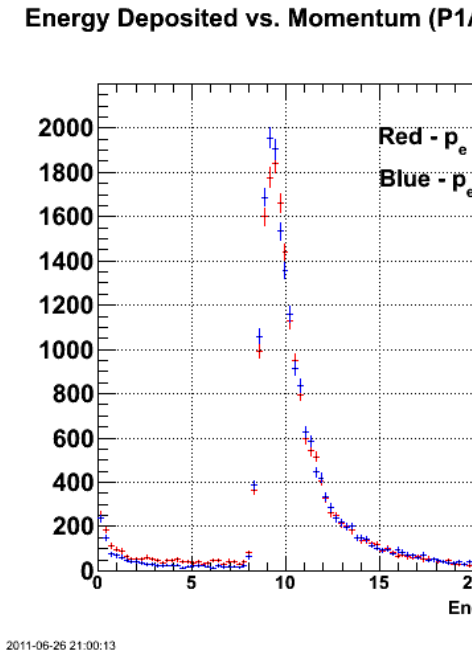
Click here to view the object (Here is the gCard I used) you uploaded.

Projections of Edep spectra. For Fig 3 below the electron, minimum ionizing peak is at 10 MeV and is largely independent of momentum.



2011-06-26 20:48:11

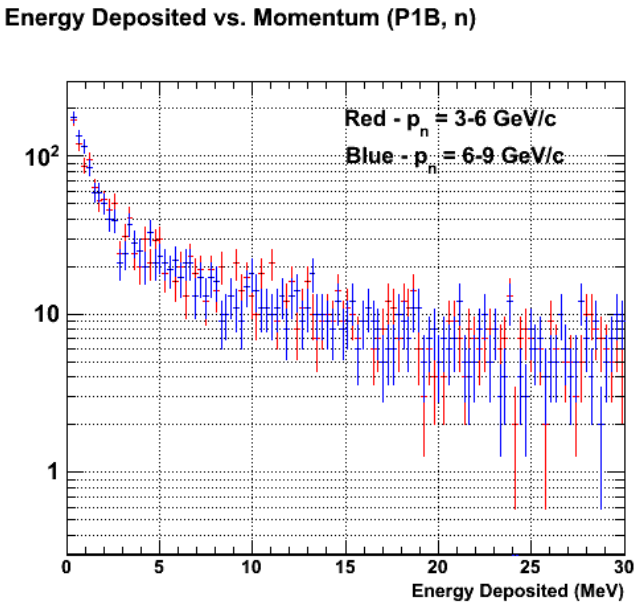
Click here to view the object (Root macro) you uploaded.



2011-06-26 21:00:13

Click here to view the object (Root macro) you uploaded.

Fig 3. Edep for electrons in FTOF panels p1b (left panel) and p1a (right panel) for the ranges noted. Both are for 50,000 events.



2011-06-26 21:32:42

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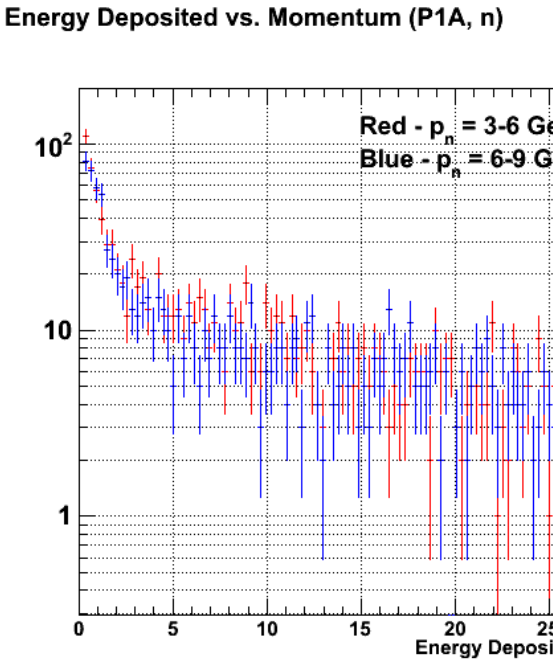


2011-06-26 21:38:20

Click here to view the object (Root macro) you uploaded.

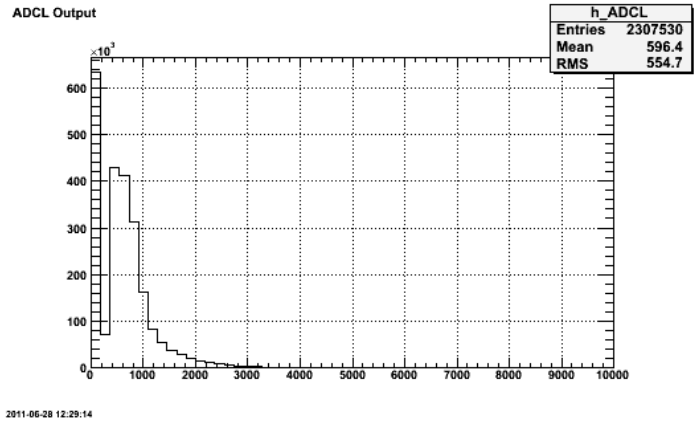
Fig 4. Edep for neutrons in FTOF panels p1b (left panel) and p1a (right panel) for the momentum ranges noted. Both are for 50,000 events.

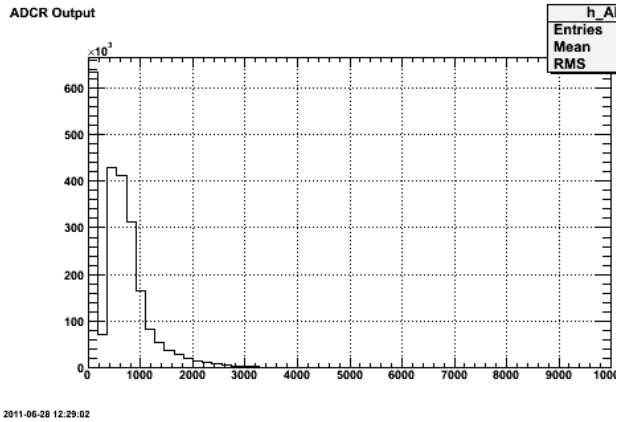
DOE 2000 Electronic Notebook

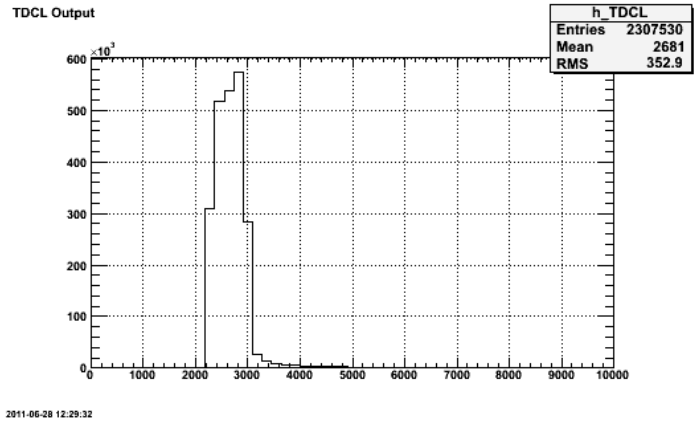
Jerry Gilfoyle's Enotebook page 377 - Testing ADC and TDC output (Mark Moog)

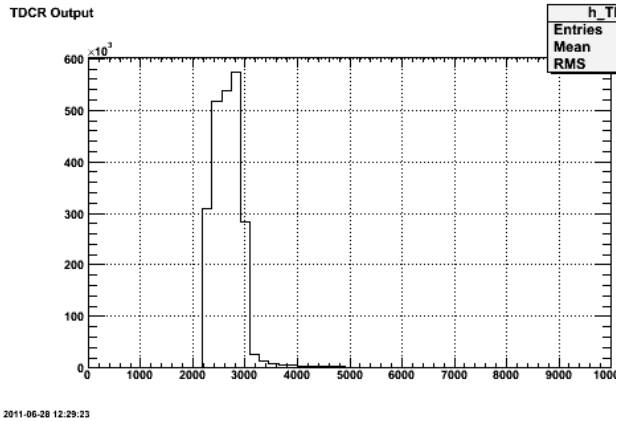
[Modified Tue Jun 28 20:23:05 2011 (GMT) Mark Moog]

These plots are from the energy deposited test I did, so they correspond to electrons of varying energies going through the otofs at 25 degrees.

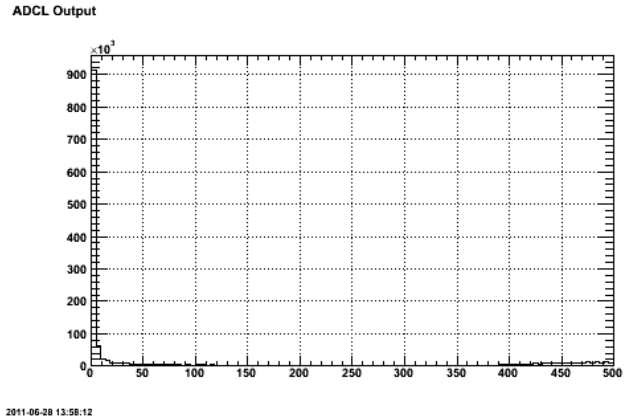




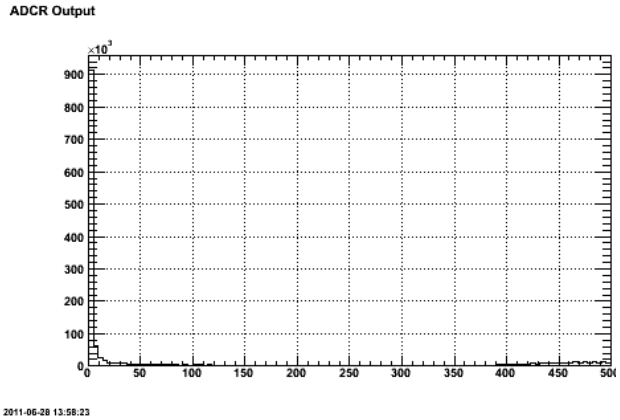




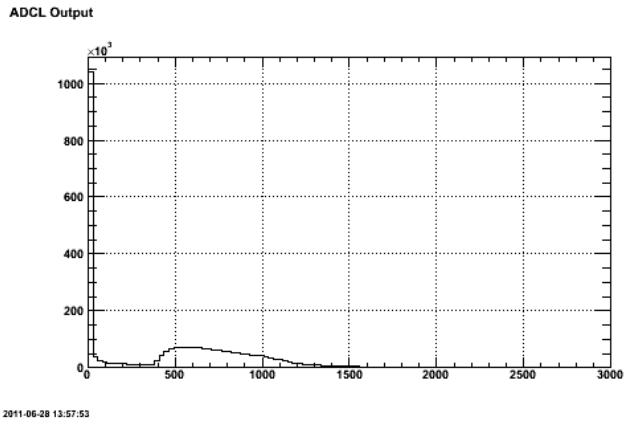
HERE ARE SOME NEW PLOTS OF THE TDC AND ADC



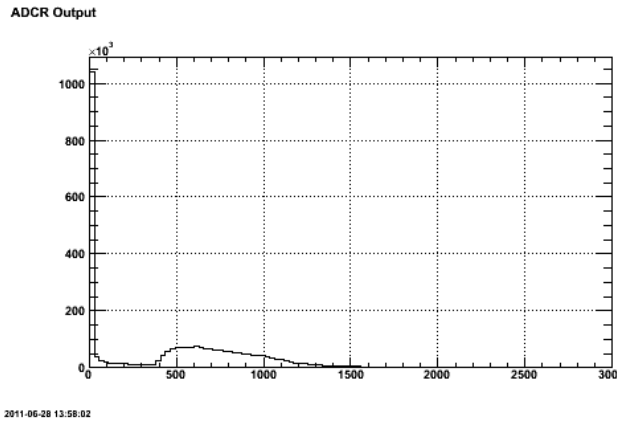
Zoomed in view on ADCL lower values



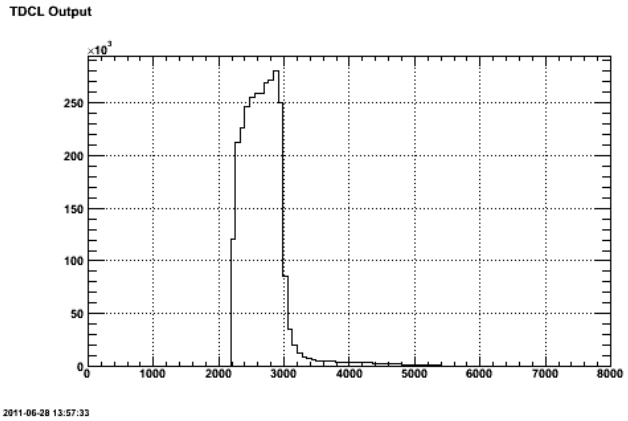
Zoomed in view on ADCR lower values



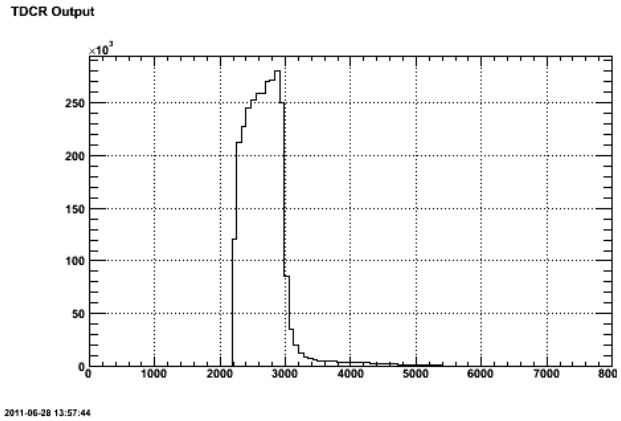
ADCL View With More Bins and Smaller Range



ADCR View With More Bins and Smaller Range



TDCL with more bins



TDCR with more bins

Click here to view the object (histogram file used to generate these plots) you uploaded.

Click here to view the object (summed tree file for neutrons) you uploaded.

DOE 2000 Electronic Notebook

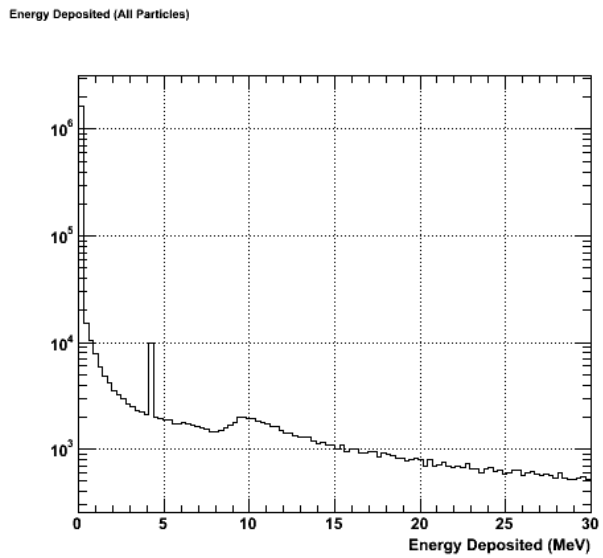
Jerry Gilfoyle's Enotebook page 378 - Updated Neutron Energy Deposited Info (Mark Moog)

[Modified Thu Jun 30 17:51:19 2011 (GMT) Mark Moog]

Current energy deposited info can be found here

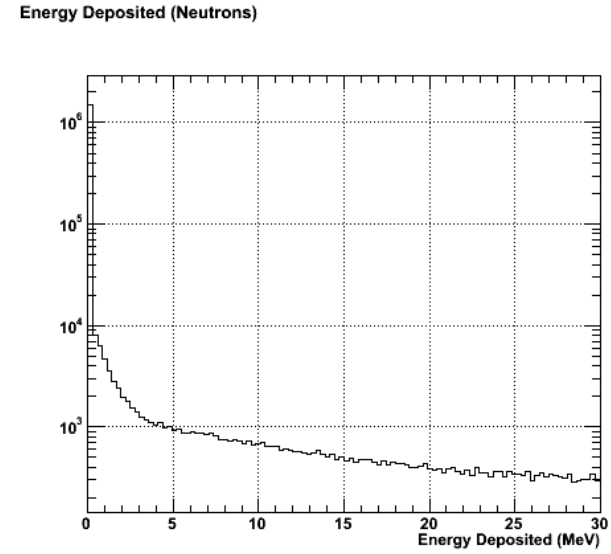
NEUTRONS IN P1A

root file



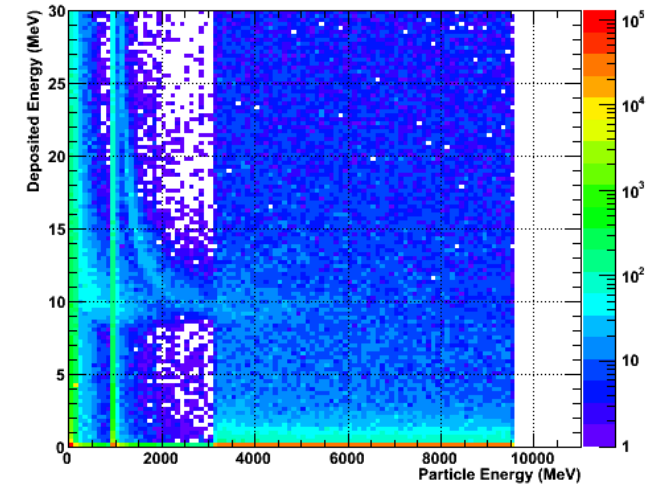
2011-06-28 14:43:33

Neutrons into P1A: Energy Deposited for All Particles



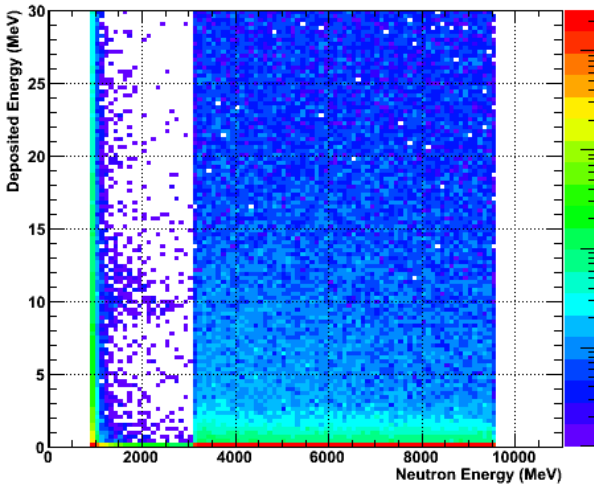
2011-06-28 14:44:00

Neutrons into P1A: Energy Deposited for Neutrons Only



2011-06-28 14:46:22

Neutrons into P1A: Energy Deposited vs Energy for All Particles

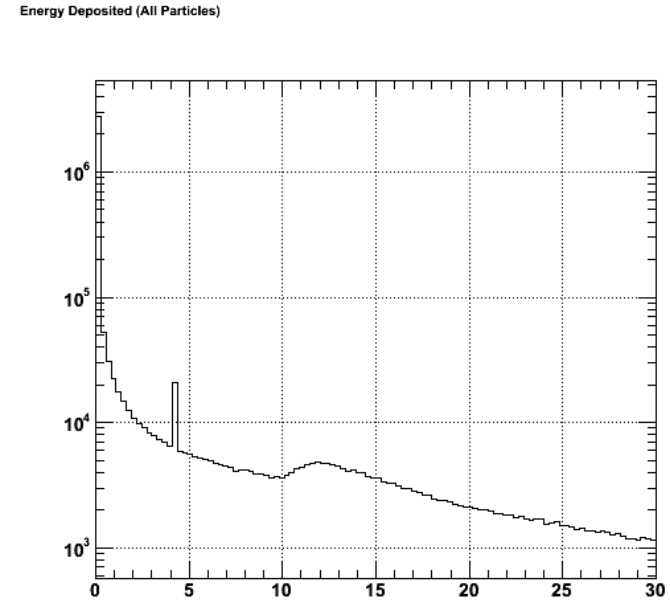


2011-06-28 14:48:28

Neutrons into P1A: Energy Deposited vs Energy for Neutrons Onl

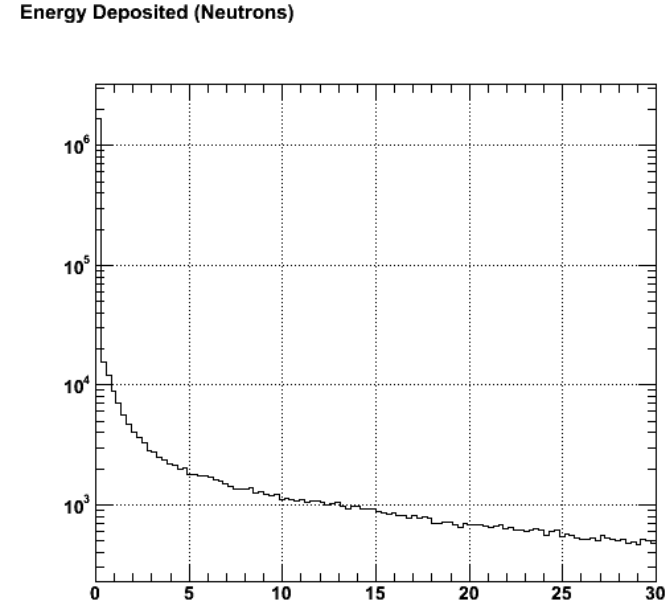
NEUTRONS IN P1B

Click here to view the object (root file) you uploaded.



2011-06-28 16:13:55

P1B: Edep all



2011-06-28 16:14:05

DOE 2000 Electronic Notebook

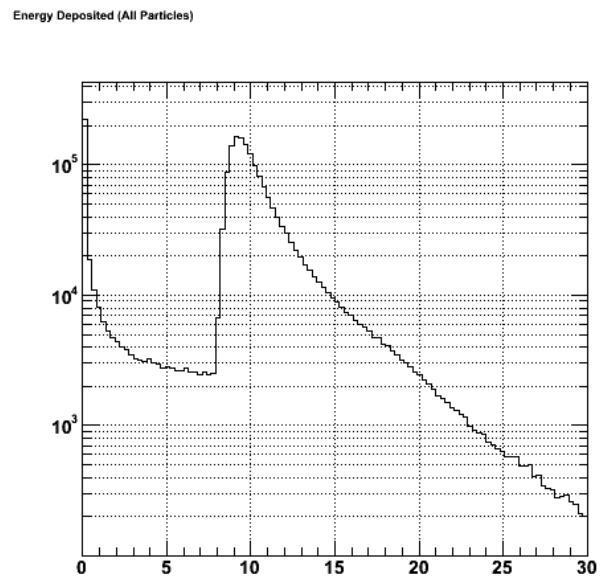
Jerry Gilfoyle's Enotebook page 379 - Updated Electron Deposited Energy Info (Mark Moog)

[Modified Thu Jun 30 17:51:05 2011 (GMT) Mark Moog]

Current energy deposited info can be found here

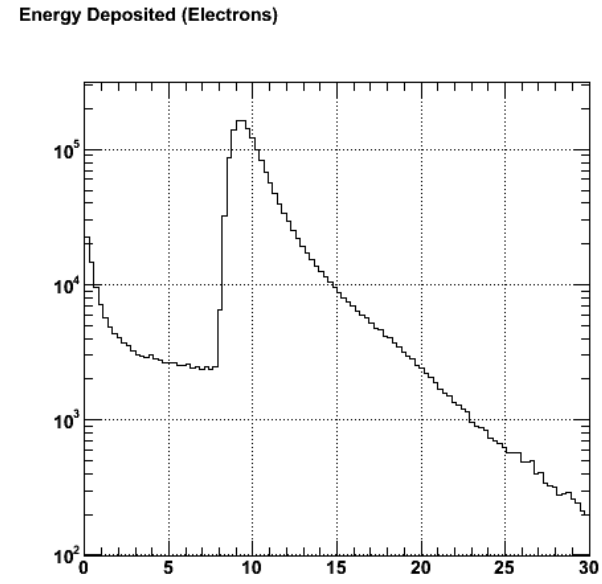
P1A

root file



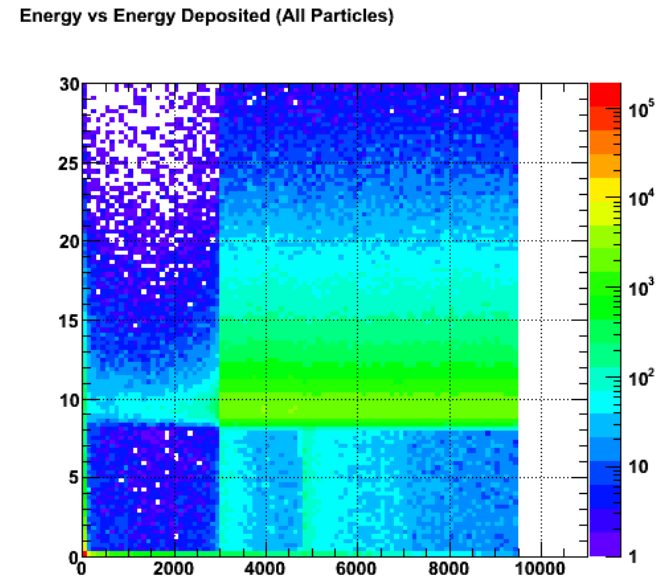
2011-06-28 15:32:31

P1A: Energy Deposited for All Particles



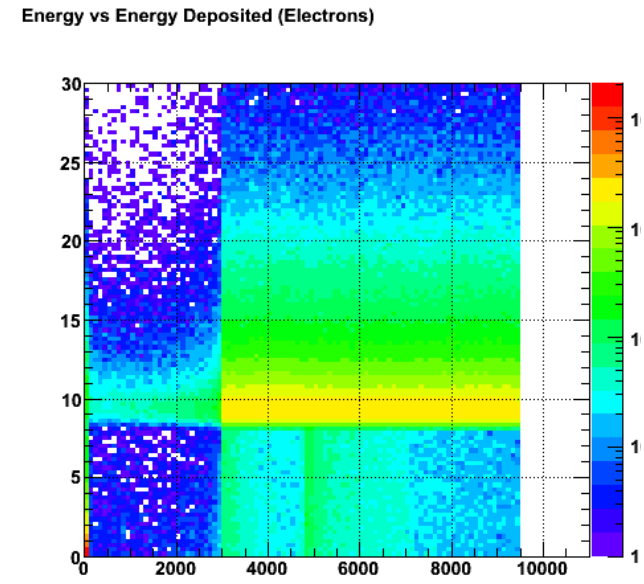
2011-06-28 15:32:43

P1A: Energy Deposited for Electrons Only



2011-06-28 15:33:34

P1A: Energy vs Energy Deposited for All Particles



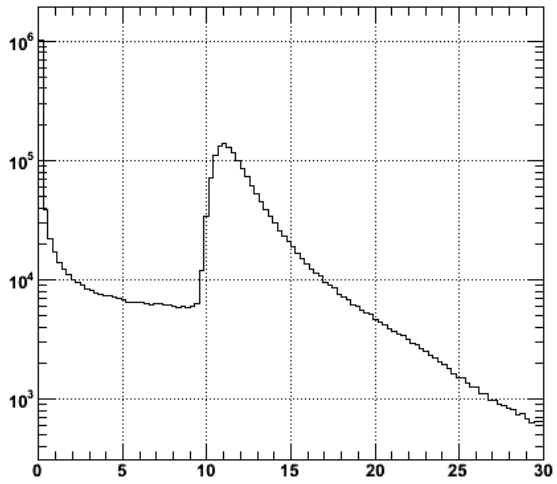
2011-06-28 15:34:09

P1A: Energy vs Energy Deposited for Electrons Only

P1B

root file

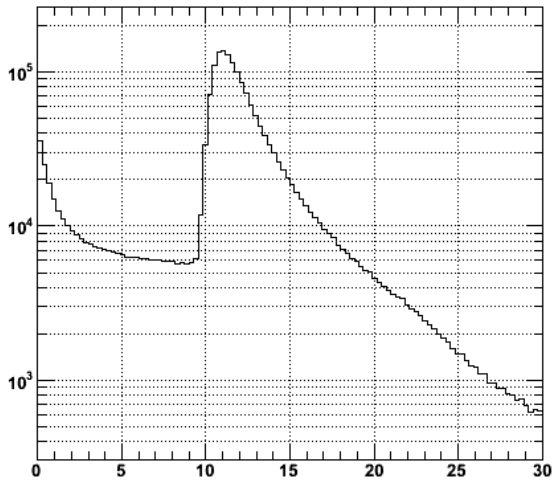
Energy Deposited (All Particles)



2011-06-28 15:54:00

P1B Energy Deposited for All Particles

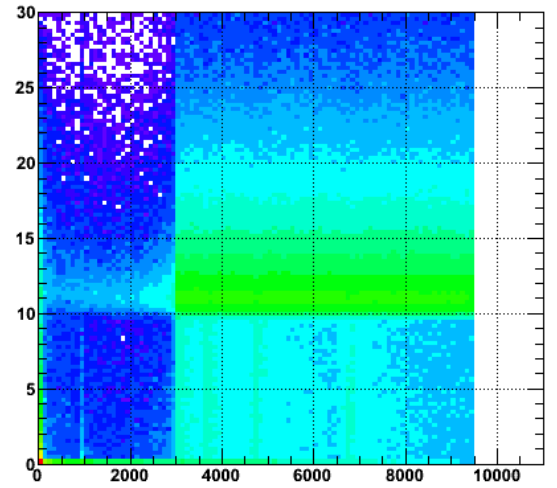
Energy Deposited (Electrons)



2011-06-28 15:54:13

P1B Energy Deposited for Just Electrons

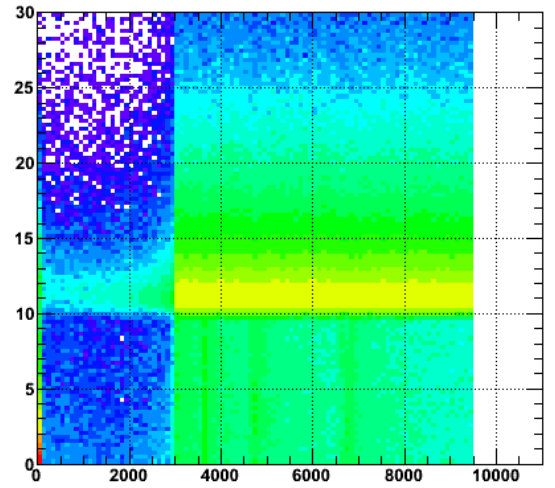
Energy vs Energy Deposited (All Particles)



2011-06-28 15:54:46

P1B: Energy vs Energy Deposited for All Particles

Energy vs Energy Deposited (Electrons)



2011-06-28 15:55:02

P1B Energy vs Energy Deposited for Electrons Only

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 380 - Even newer energy deposited info (for electrons) (Mark Moog)

[Modified Wed Jul 20 17:39:51 2011 (GMT) Mark Moog]

Here is the energy deposited information created with the following gemc commands:

For electrons in p1a/p1b:

```
/usr/local/jlab_software/gemc/production/gemc -USE_QT=0 -OUTPUT="evio,gemc_results.ev" -N=10000 -PRINT_EVENT=1000 -HALL_MATERIAL=Vacuum -gcard=$GCARD -l
```

For electrons in p2b:

```
/usr/local/jlab_software/gemc/production/gemc -USE_QT=0 -OUTPUT="evio,gemc_results.ev" -N=10000 -PRINT_EVENT=1000 -HALL_MATERIAL=Vacuum -gcard=$GCARD -l
```

For neutrons in p1a/p1b:

```
/usr/local/jlab_software/gemc/production/gemc -USE_QT=0 -OUTPUT="evio,gemc_results.ev" -N=10000 -PRINT_EVENT=1000 -HALL_MATERIAL=Vacuum -gcard=$GCARD -l
```

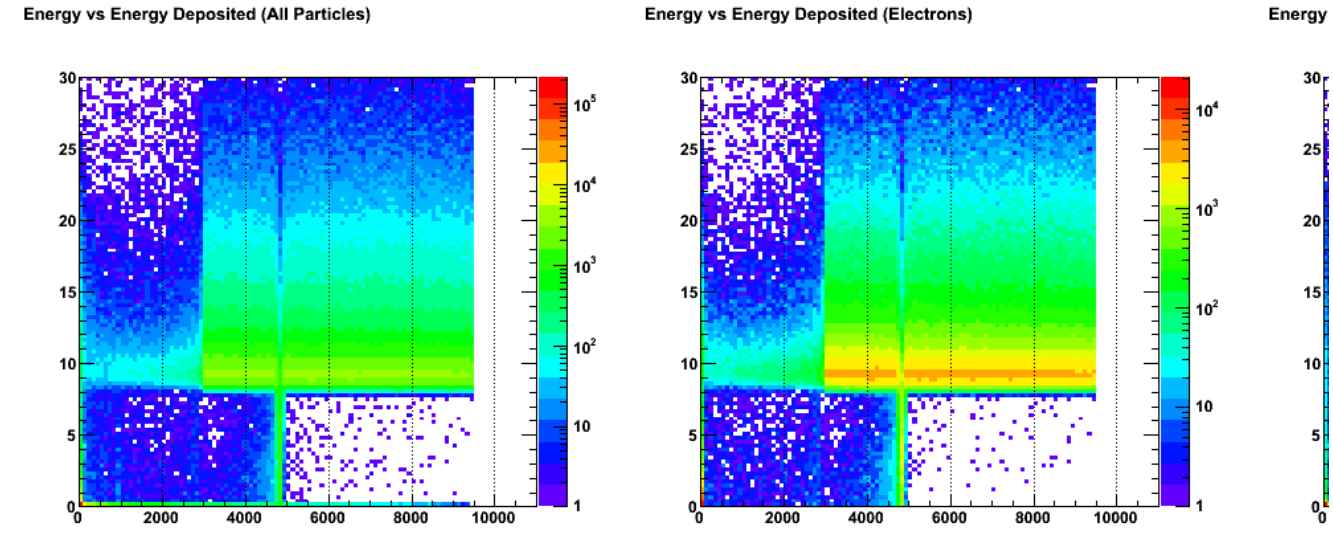
For neutrons in p2b:

```
/usr/local/jlab_software/gemc/production/gemc -USE_QT=0 -OUTPUT="evio,gemc_results.ev" -N=10000 -PRINT_EVENT=1000 -HALL_MATERIAL=Vacuum -gcard=$GCARD -l
```

The gcard used for electrons/neutrons in p1a can be found here

The gcard used for electrons/ neutrons in p1b/p2b can be found here

Fig 1. ELECTRON RESULTS



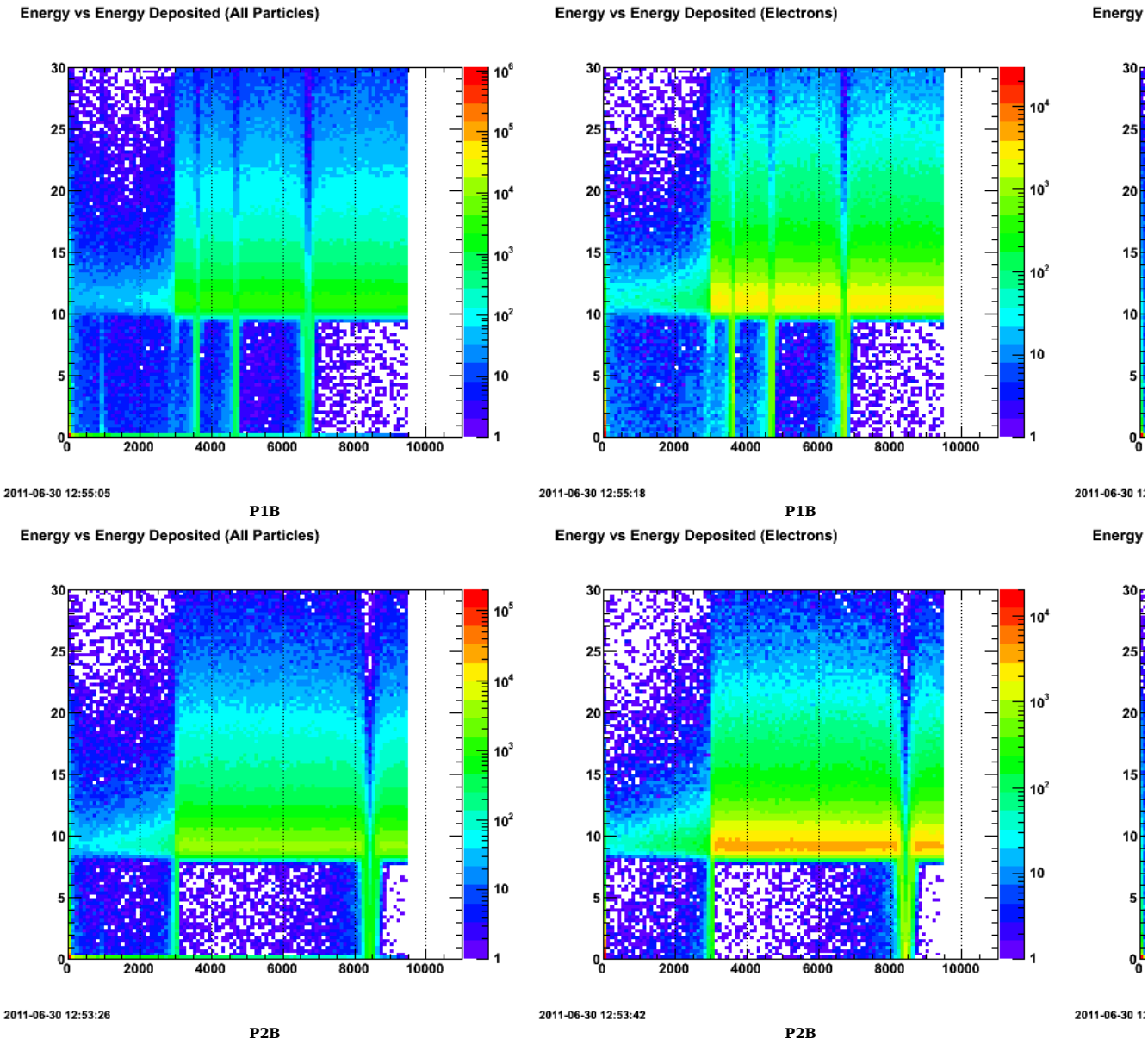
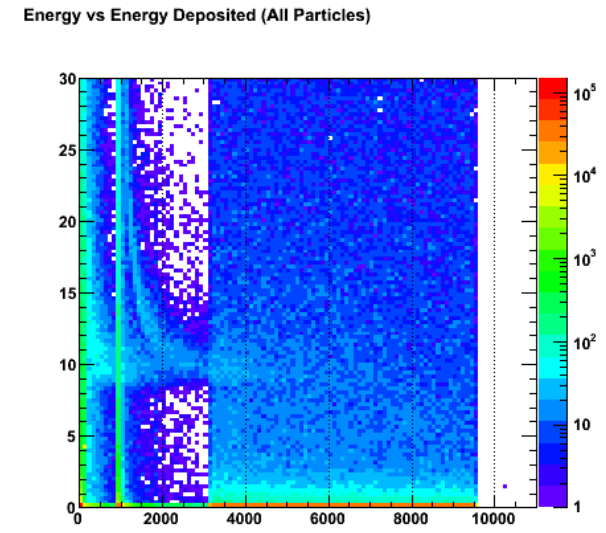
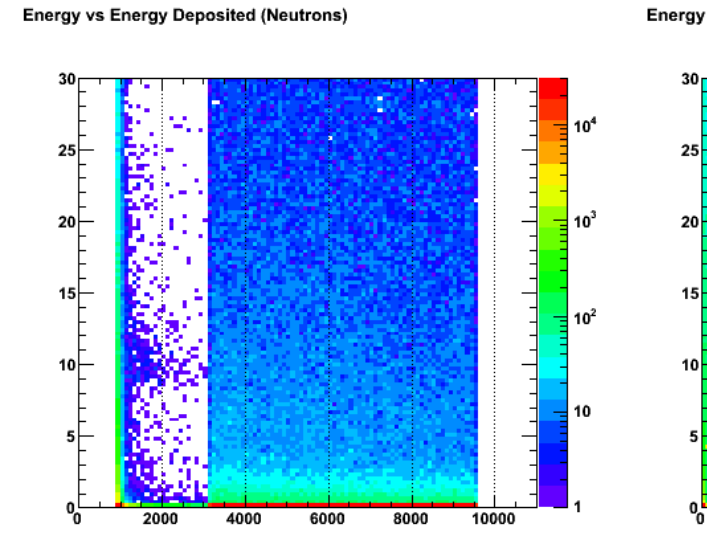


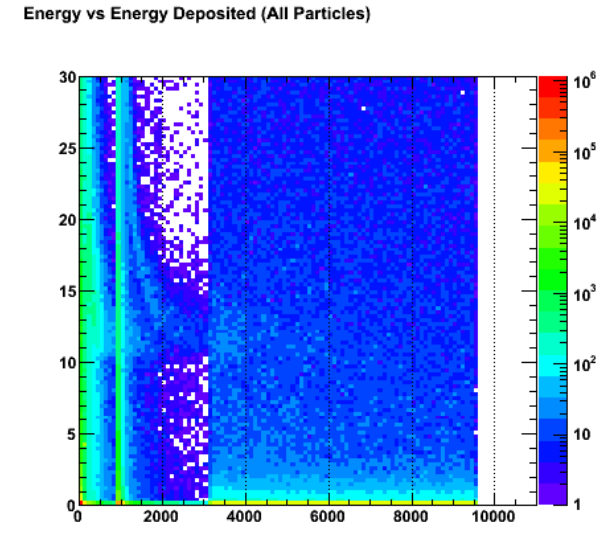
Fig 2. FOR NEUTRONS



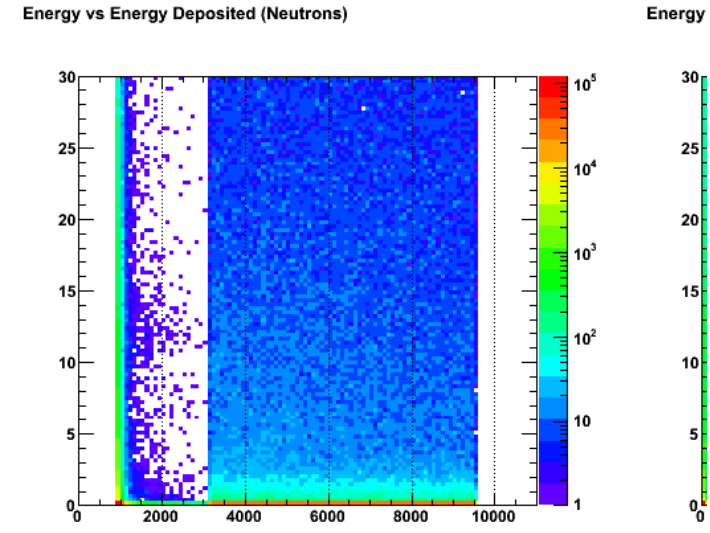
P1A



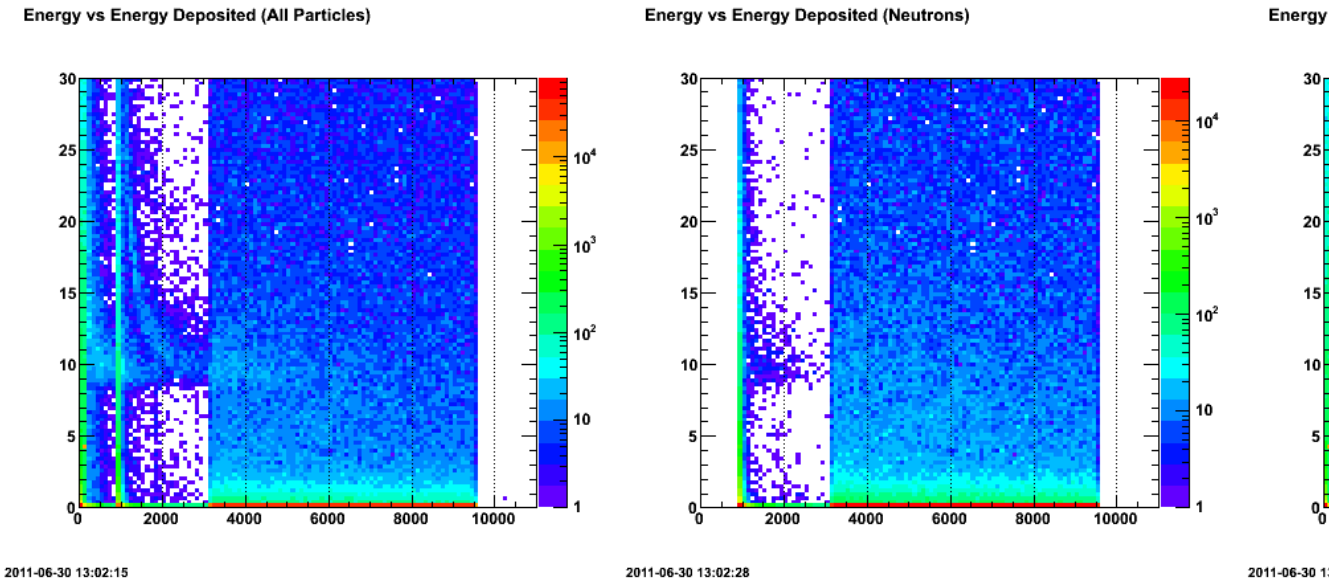
P1A



P1B



P1B



Click here to view the object (Neutrons P2B root histo file) you uploaded.

Click here to view the object (Neutrons P1B root histo file) you uploaded.

Click here to view the object (Neutrons P1A root histo file) you uploaded.

Click here to view the object (Electrons P2B root histo file) you uploaded.

Click here to view the object (Electrons P1B root histo file) you uploaded.

Click here to view the object (Electrons P1A root histo file) you uploaded.

Click here to view the object (ntuple file for neutrons in P2B i believe) you uploaded.

NOTE: There is a problem with several of the spectra below showing Edep with cuts on the energy (E) of the particle as it enters the geant4 volume. In particular, I did not have the binning correct and the cuts on E are not what I thought they were. The screaming, loud-and-clear, sign of this (that I missed) is that, for example, red histograms in the lower, right panels of Figs 4-5 show Edep greater than the maximum value of the energy allowed in the event. This can't happen. I have redone Figs 3-5; see Figs 7-8.

The explanation of the spectra is still valid.

To understand the shape of the deposited energy for electrons consider the following plot. This is for electrons fired at the center of the TOF panel p1a with a broad range of momenta. I used the ntuple file listed above. In the upper left panel Edep has the characteristic shape with a peak around 10 MeV due, we believe, to relativistic electrons that are minimum ionizing particles (MIPs) so they all dump about the same amount of energy in the scintillator. The counts below 10 MeV are likely due to low-energy Moeller electrons, etc knocked loose by the passing primary electron which then stop in the plastic; producing a range of Edep that goes down to zero. The upper right panel shows Edep vs. E where E is the energy of the electron as it enters the scintillator (check with MU). The ridge at Edep ~ 10 MeV from MIPs is clearly visible across a wide range of energies and there are very few events less than 10 MeV. All of these events are clusters at E ~ 0 MeV. When I project out the Edep for low-E events (E < 5 MeV) it captures almost all the events below the MIPs. When I project out events with E > 5 MeV I get almost all MIPs with few of the E < 5 MeV events.

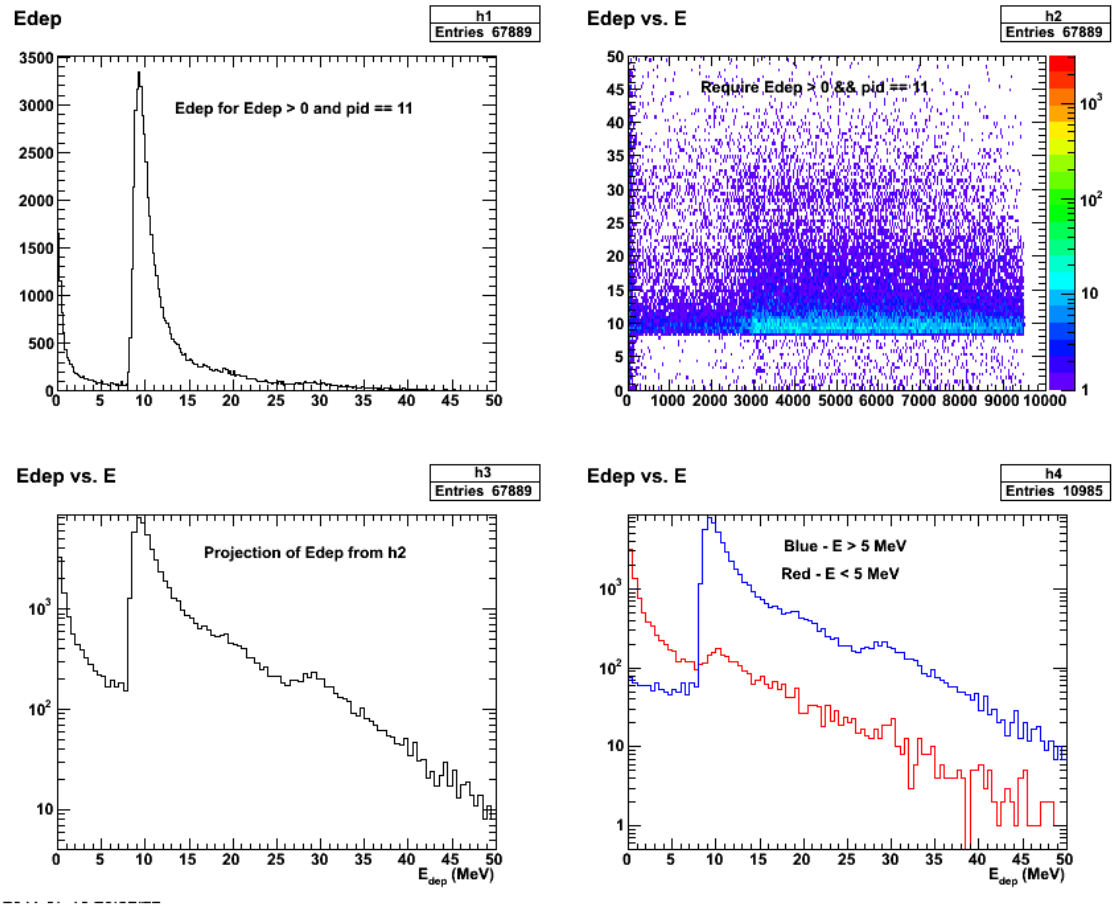


Fig 3. Plots of Edep, Edep vs. E, and projections of Edep for different E ranges (lower right panel). See text.

Click here to view the object (Root macro) you uploaded.

Do a better test on panel p1a with a single electron momentum (p = 6.25 GeV) and the separation between the primary electrons and Moellers becomes very clear (see plots in right-hand side of figure below. Generated with the following command on jlabl2.

```
gemc -USE_QT=0 -OUTPUT="evio, miptest.ev" -N=5000 -HALL_MATERIAL=Vacuum -gcard=p1a.gcard -USE_PHYSICSL=gemc -BEAM_P="e-,6.25*GeV, 25*deg, 0*deg" -SPREAI
```

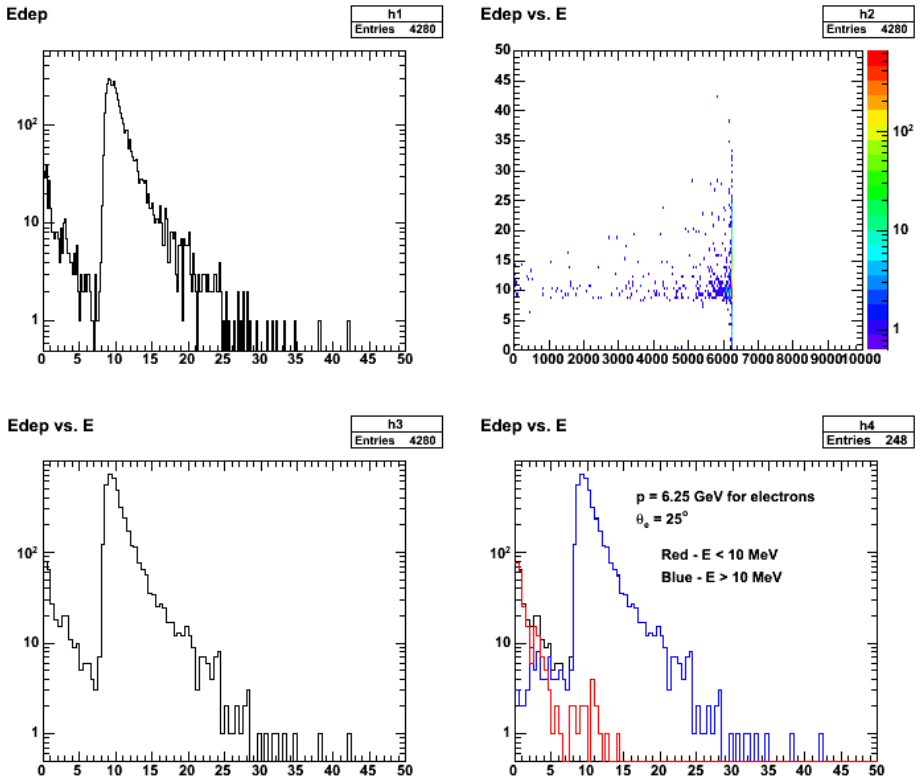


Fig 4. Plots for p1a of Edep, Edep vs. E, and projections of Edep for p_e=6.25 GeV/c at θ_e= 25 deg.

Click here to view the object (Root macro) you uploaded.

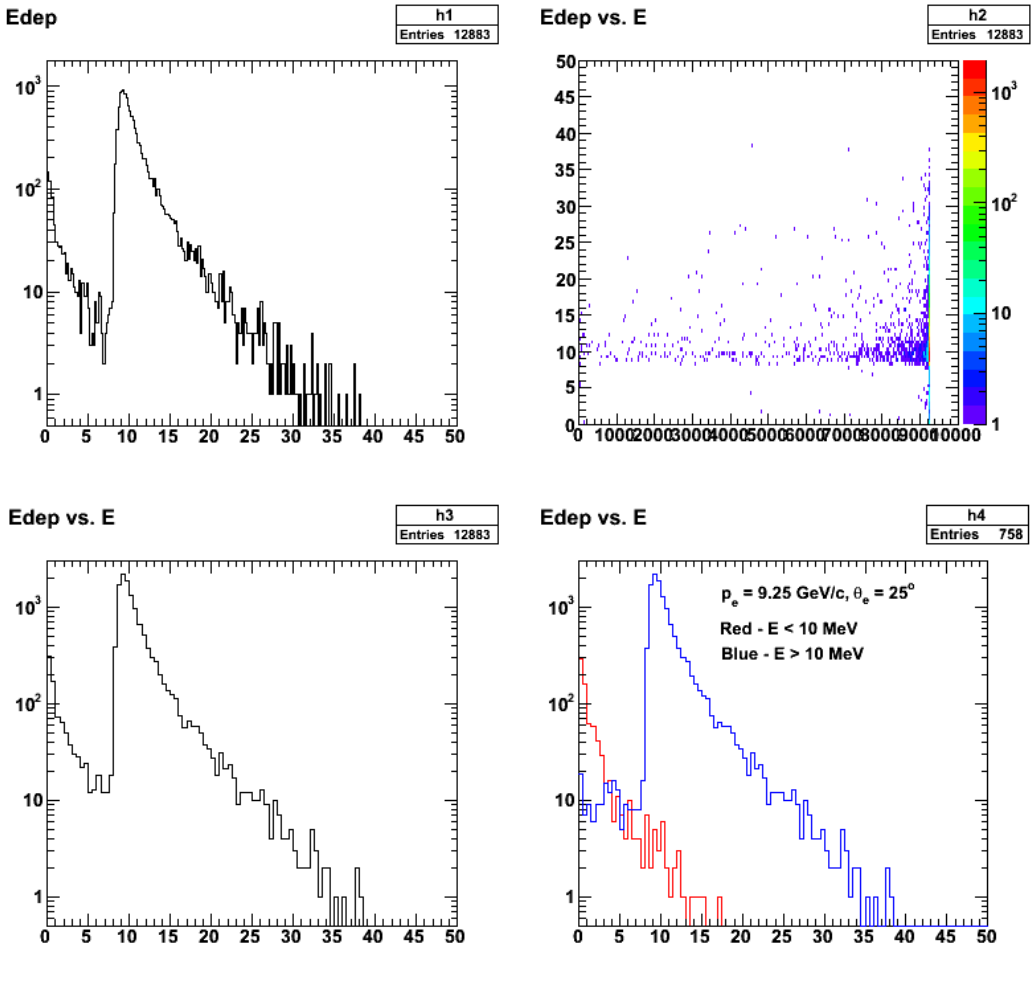


Fig 5. Plots for p1a of Edep, Edep vs. E, and projections of Edep for p_e=9.25 GeV/c at θ_e= 25 deg.

Click here to view the object (Root macro) you uploaded.

After talking with Elton on Wed (7/13/11) we now believe the low-Edep, high-E events are due to bremstrahlung. An electron enters the material, accelerates, and emits a forward-going photon carrying away most the initial electron momentum. Some of these electrons have energies below 10 MeV so they stop in the material producing a signal smaller than a MIP. The cross section for bremstrahlung is supposedly bigger than for backscattering (another source of low-Edep, high-E events). To get some idea of the numbers I looked in the PDG section on 'Passage of particles through matter.' At large y=k/E which is the ratio of the emitted, bremsstrahlung photon energy to the primary electron energy there is still a large cross section; about 0.5 barn! To get some idea of the backscatter cross section I assumed it was essentially elastic scattering off a proton and I get of the order of 10^-14 mb/sr for θ_e > 136 deg.

Click here to view the object (Bremsstrahlung calculations) you uploaded.

Click here to view the object (PDG - Passages of particles through matter) you uploaded.

The other mystery in the plots above is the small, but nonzero fraction of events in the tail just below the primary electron energy. Supposedly the hall has been pumped out (-HALL_MATERIAL=Vacuum) so I thought nothing should happen to the electron between the target the scintillator panel. This is wrong. Looking at several events interactively (see example below), some electrons emit bremsstrahlung photons before the electron reaches the TOF panel. This would account for those events.

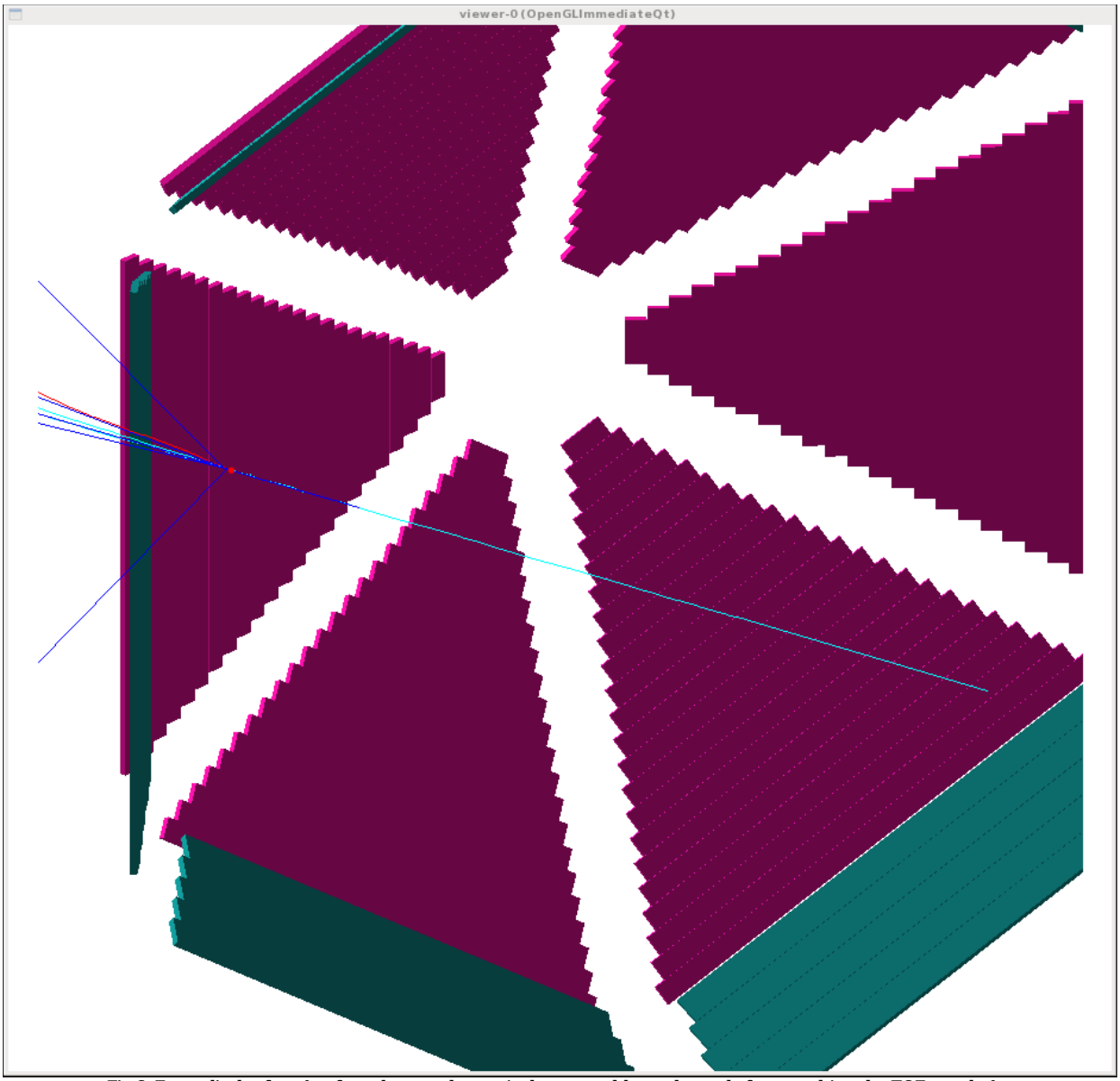


Fig 6. Event display for p1a of an electron that emits bremsstrahlung photon before reaching the TOF panel p1a.

Revised versions of Fig 4-5. Start with a plot which also shows the 2D plots. The lower, right-hand panel shows the Edep vs E spectrum at low Edep and E to see the linear dependence of between the two which makes sense since you can't deposit more energy than you bring into the volume.

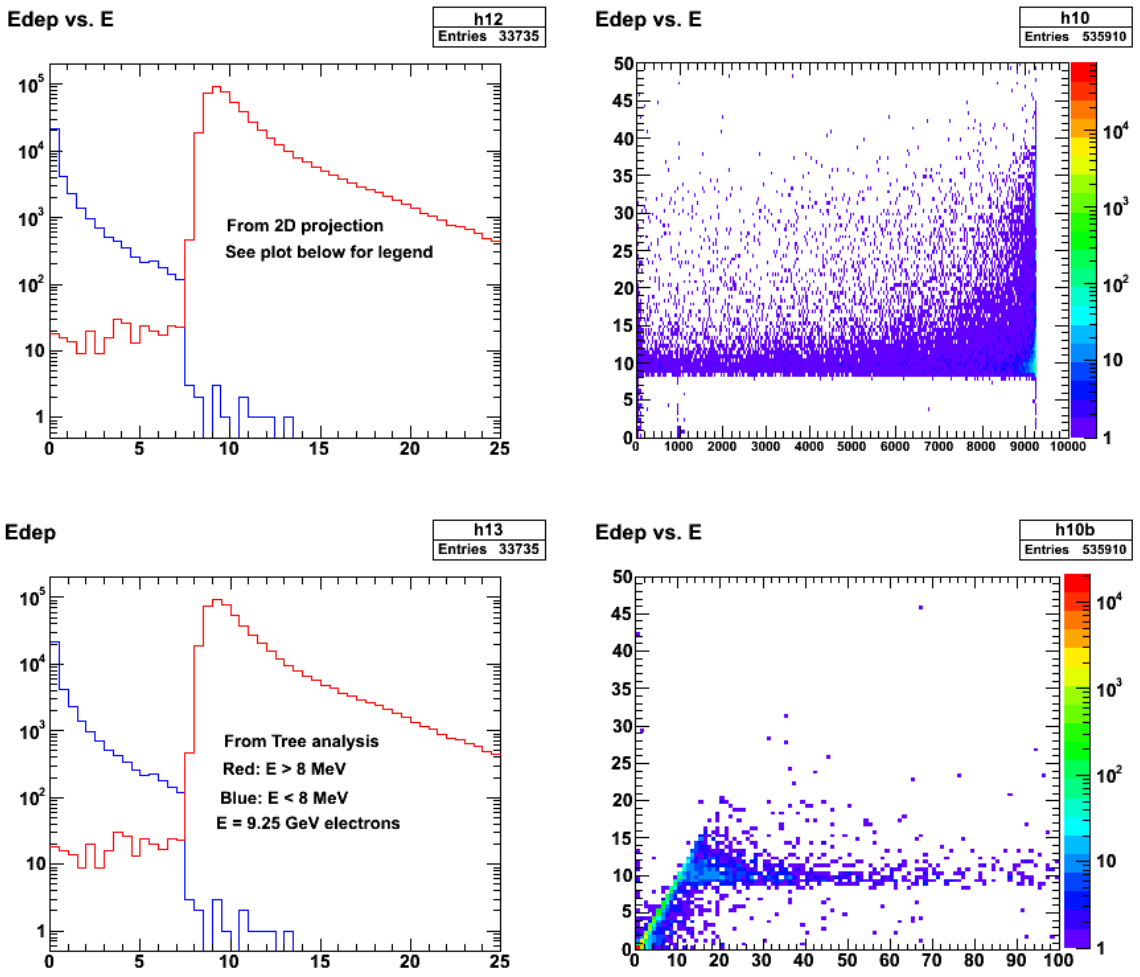


Fig 7. Plots of p1a for Edep determined two ways (left-hand panels) and the Edep vs. E plot at large and small scales (right-hand panels).

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root tree file) you uploaded.

Now do the same analysis with incident electron energy of 3.5 GeV which is near the quasielastic electron energy at the large-angle edge of p1a. For Edep we get almost exactly the same thing.

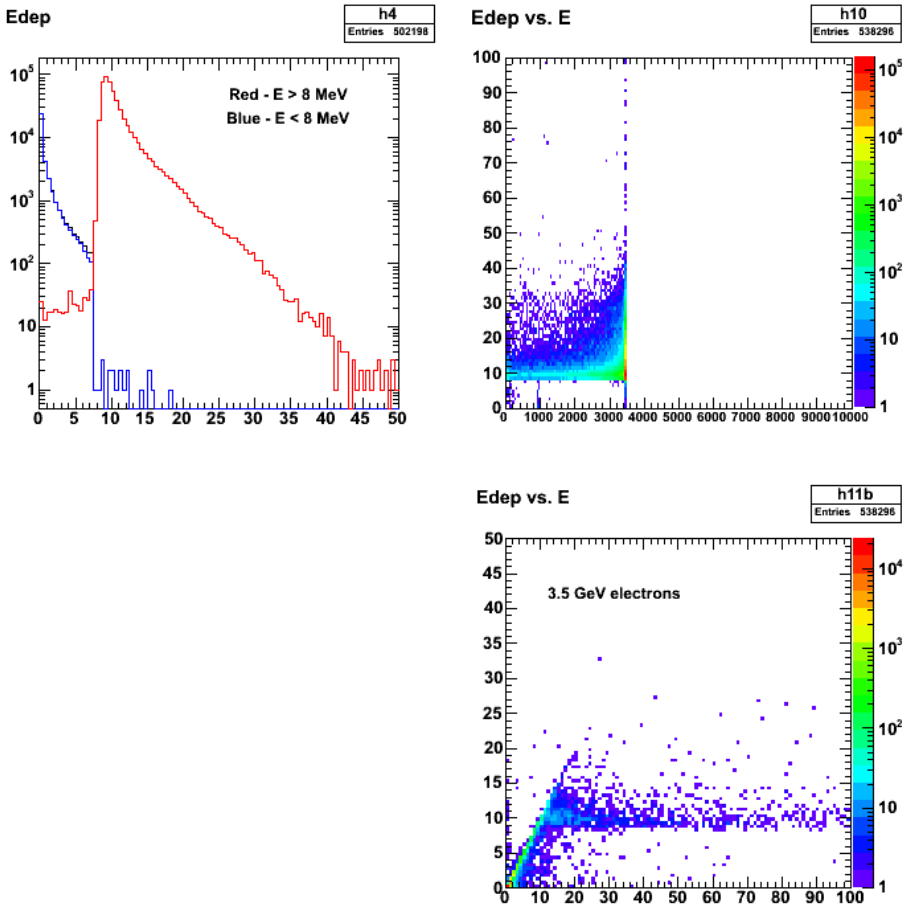


Fig 8. Plots of p1a for Edep and the Edep vs. E plot at large and small scales (right-hand panels).

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root tree file) you uploaded.

Now do panel 3.5 GeV p1b.

```
gemc -USE_QT=0 -OUTPUT="evio, miptest.ev" -N=500000 -PRINT_EVENT=20000 -HALL_MATERIAL=Vacuum -gcard=p1b.gcard -USE_PHYSICSL=gemc -BEAM_P="e-,3.5*GeV, 25
```

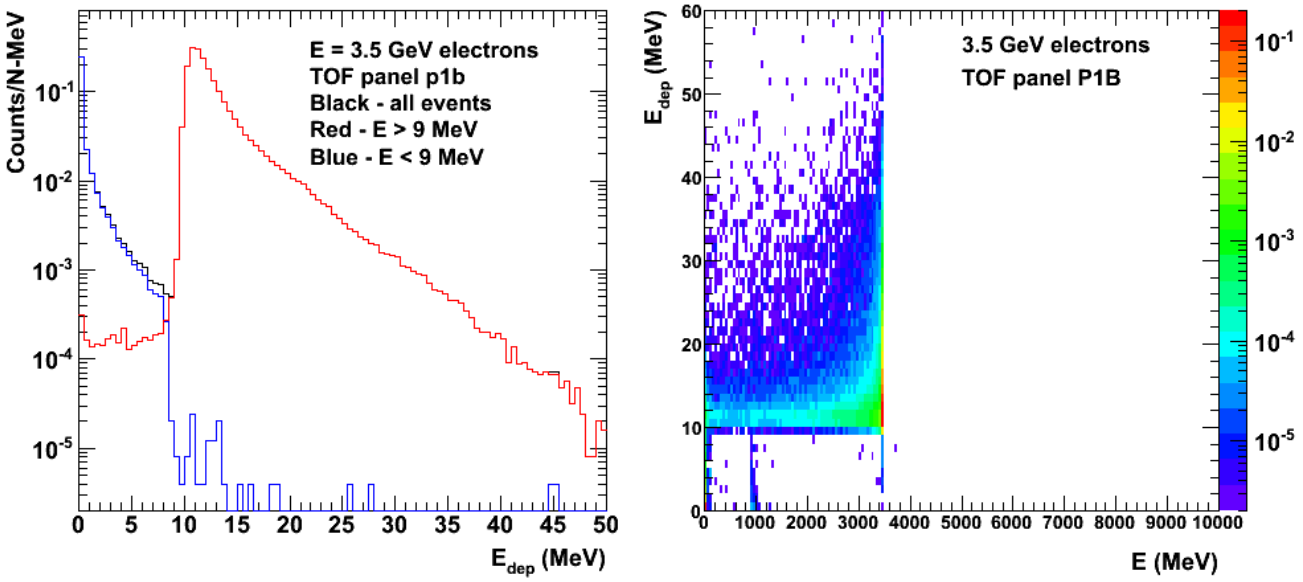


Fig 9. Plot of Edep and Edep vs. E for p1b and 3.5 GeV electrons.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root tree file) you uploaded.

Now do 9.25 GeV for panel p1b.

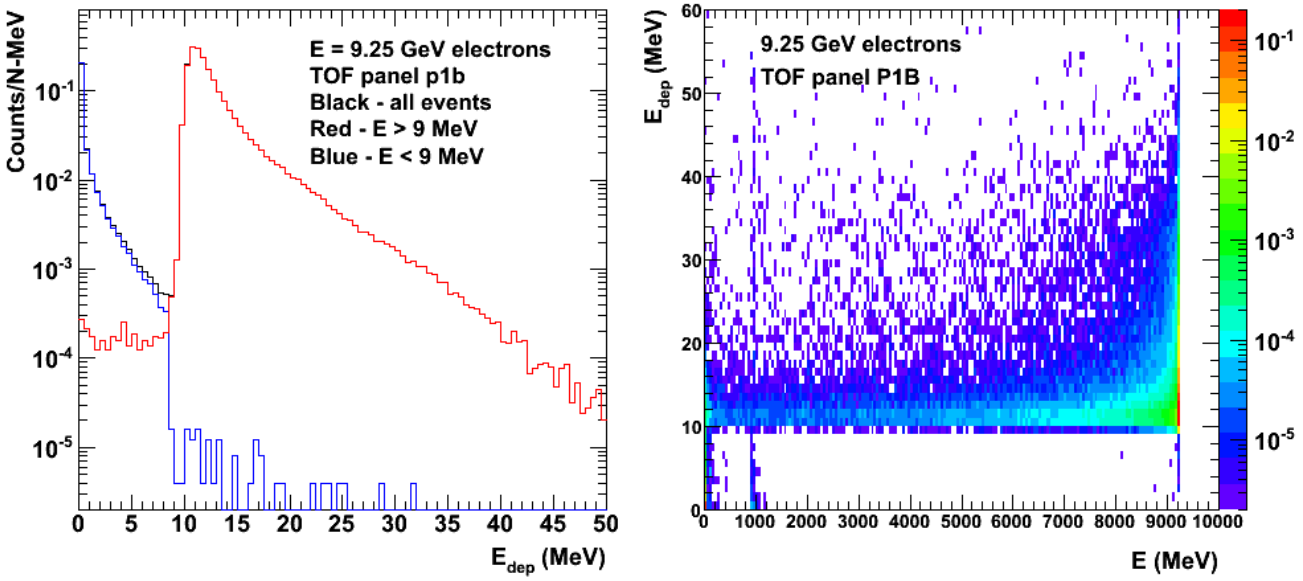


Fig 10. Plot of Edep and Edep vs. E for p1b and 9.25 GeV electrons.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root tree file) you uploaded.

Now do panel p2b.

```
gemc -USE_QT=0 -OUTPUT="evio, miptest.ev" -N=500000 -PRINT_EVENT=20000 -HALL_MATERIAL=Vacuum -gcard=p1a.gcard -USE_PHYSICSL=gemc -BEAM_P="e-,2.5*GeV, 5{
```


```
gemc -USE_QT=0 -OUTPUT="evio, miptest.ev" -N=500000 -PRINT_EVENT=20000 -HALL_MATERIAL=Vacuum -gcard=p1a.gcard -USE_PHYSICSL=gemc -BEAM_P="e-,2.5*GeV, 5{
```

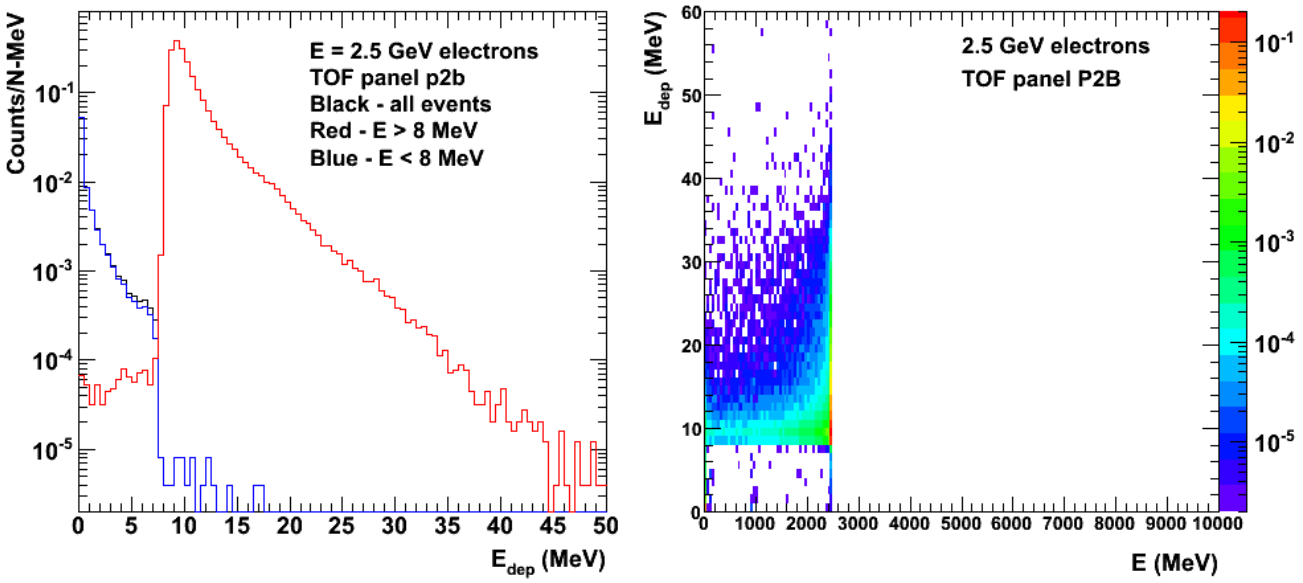


Fig 11. Plot of Edep and Edep vs. E for p2b and 2.5 GeV electrons.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root tree file) you uploaded.

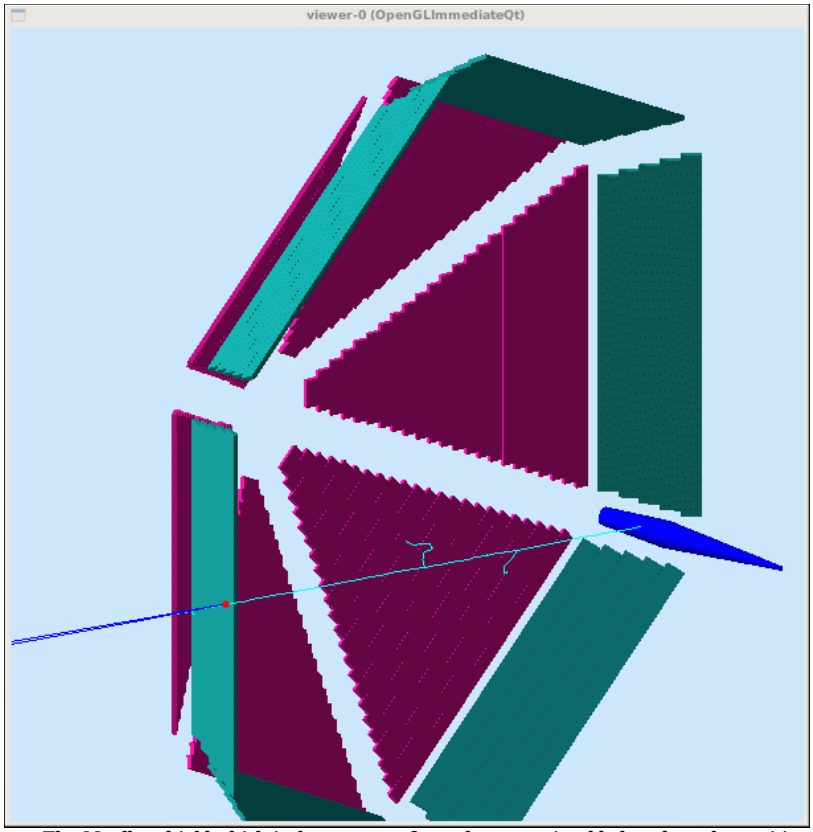


Fig 12. Event display for p2b test. The Moeller shield which is downstream from the target is added to show the position of the vertex used to get the incident electrons to strike the p2b panel at 90 degrees.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 381 - New TDC/ADC info (Mark Moog)

[Modified Thu Jun 30 17:47:56 2011 (GMT) Mark Moog]

Click here to view the object (Neutrons P2B root file) you uploaded.

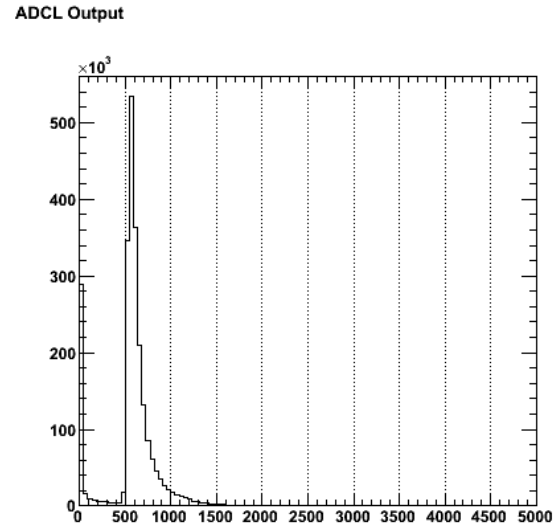
Click here to view the object (Neutrons P1B root file) you uploaded.

Click here to view the object (Neutrons P1A root file) you uploaded.

Click here to view the object (Electrons P2B root file) you uploaded.

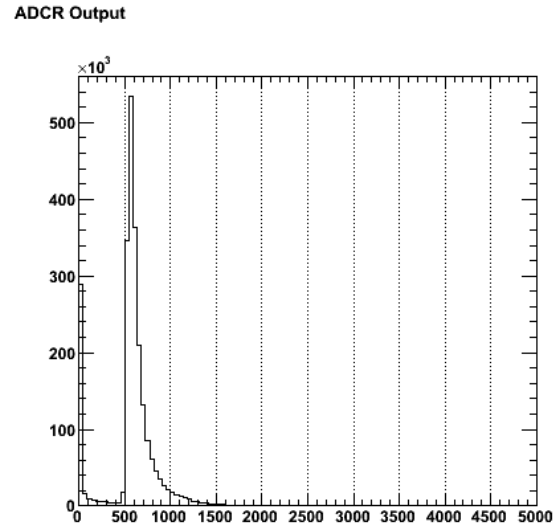
Click here to view the object (Electrons P1B root file) you uploaded.

Click here to view the object (Electrons P1A root file) you uploaded.



2011-06-30 12:57:41

Electrons P1A



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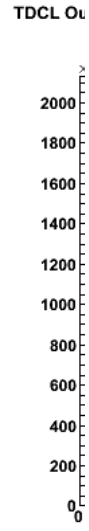
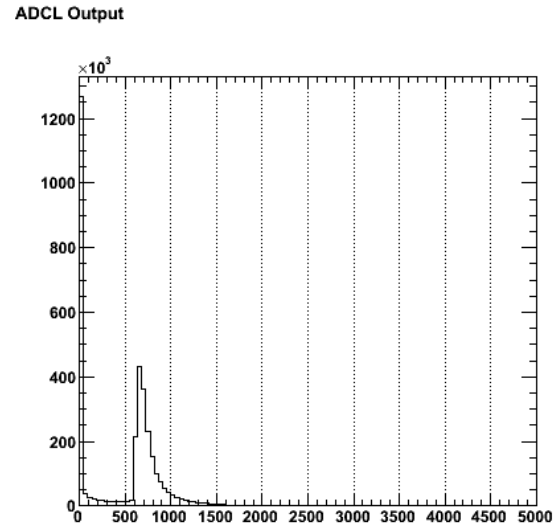
Electrons P1A



2011-06-30 1



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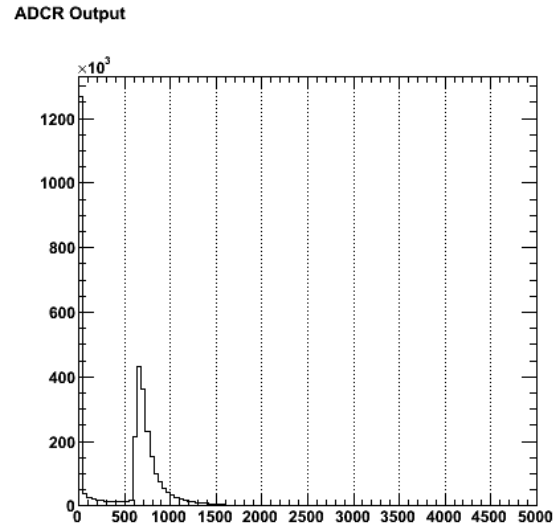
Electrons P1B



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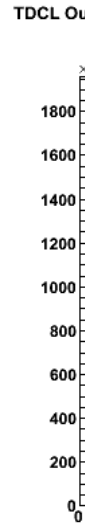
Electrons P1B



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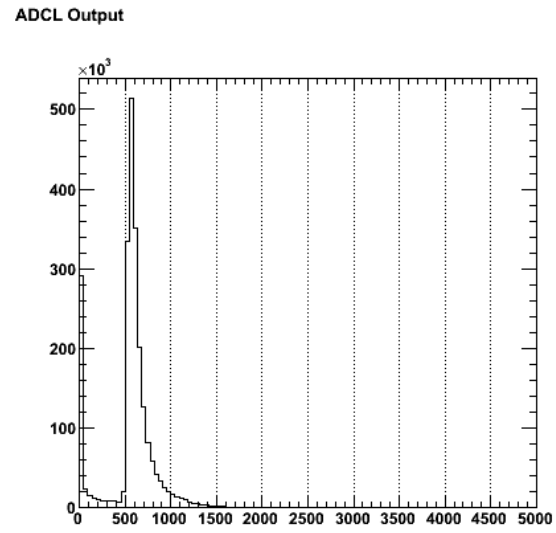

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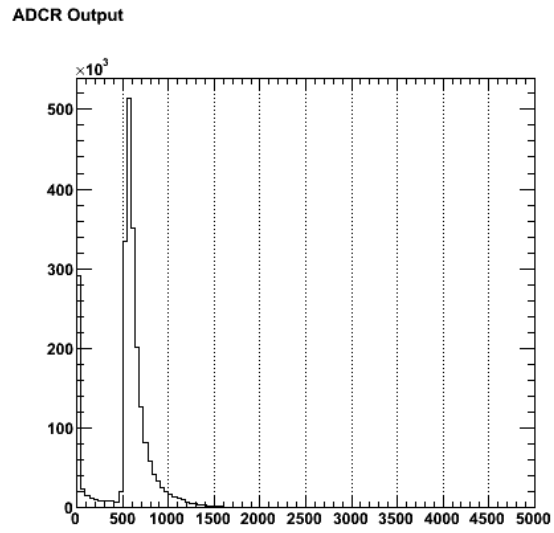

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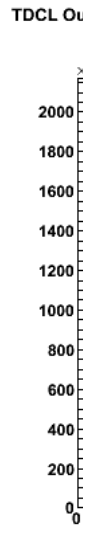
Electrons P2B



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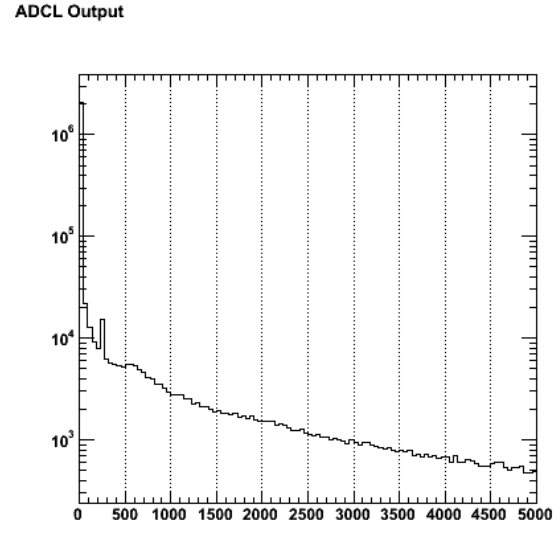
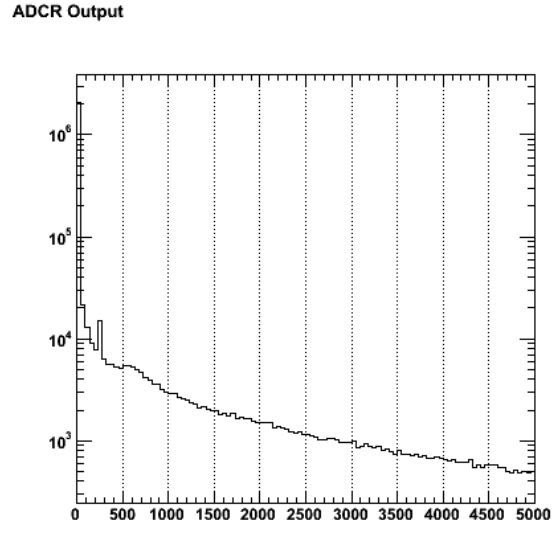


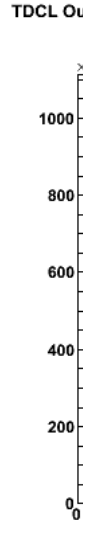
2011-06-30 12:59:42

Neutrons P1A

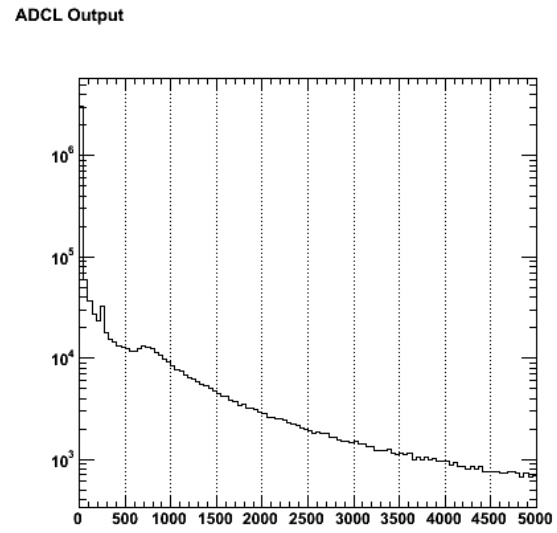


2011-06-30 12:59:54

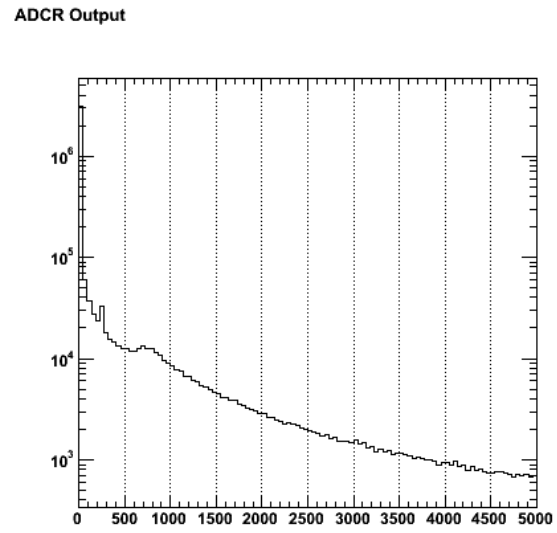
Neutrons P1A



2011-06-30 1



Neutrons P1B



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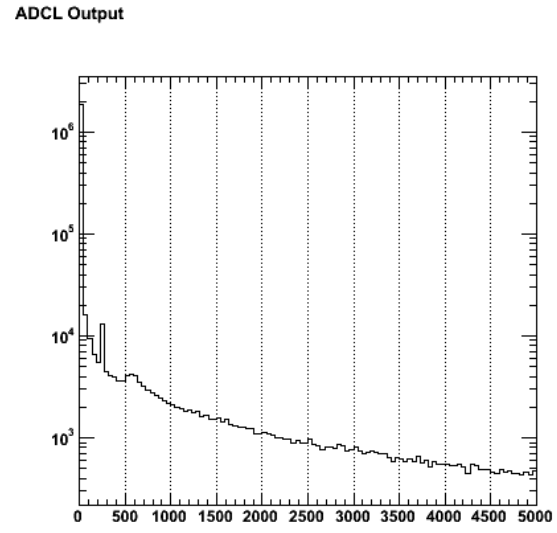
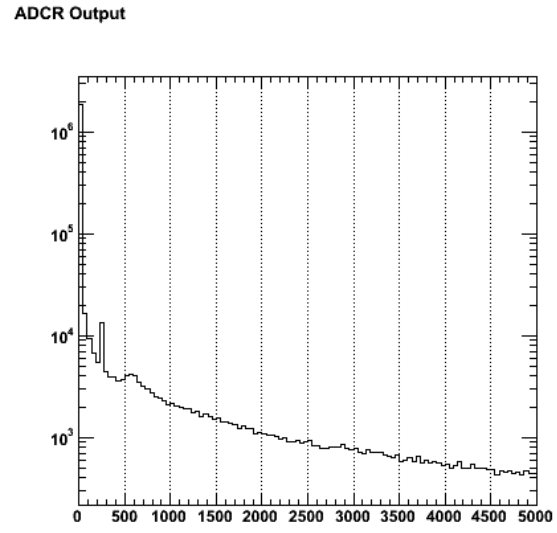


Neutrons P2B



Neutrons P2B

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 382 - Energy deposited info (for neutrons in p1a) (gpg)

[Modified Sun Jul 24 00:23:29 2011 (GMT) gpg]

Now do the same analysis as entry 380 for the neutrons. Fig 1 below shows the distributions of gemc E and Edep for neutrons with pn = 2.25 GeV/c fired at the center of the p1a panel at θ_n=25 deg so it strikes the scintillator at 90 deg. The 2D plot in the lower, left panel shows that most of the neutrons have the momentum they start with, but there is a mysterious peak at low E that we don't understand at this time. Perhaps these are neutrons knocked out by the primary neutron??

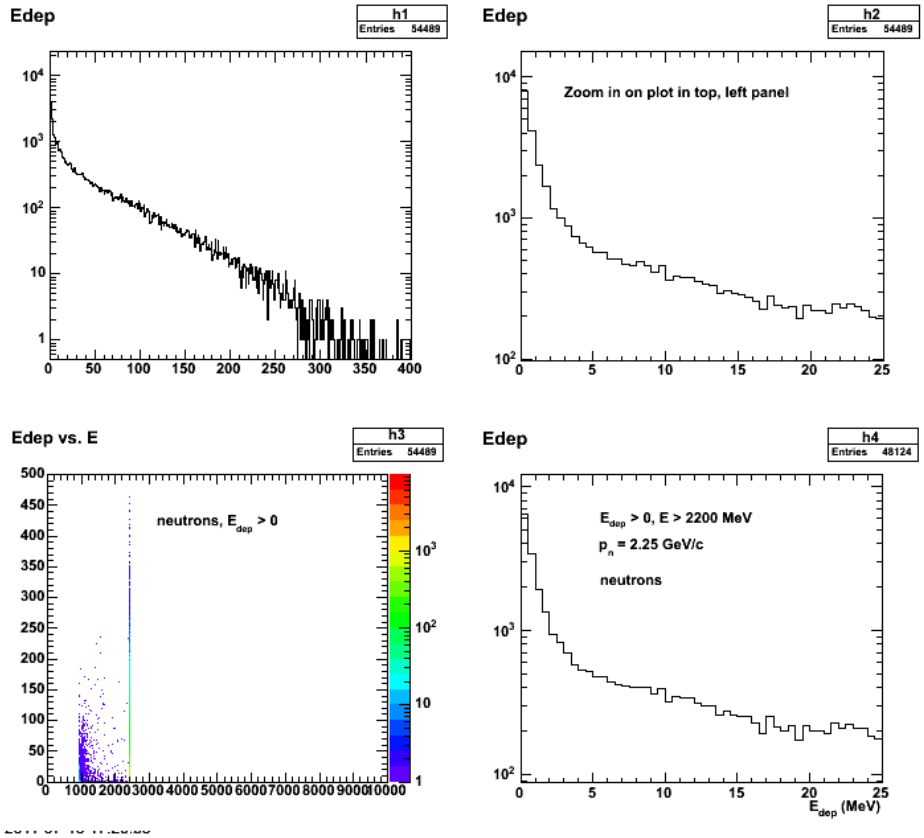


Fig 1. Plots for neutrons.

Click here to view the object (Root macro) you uploaded.

There is a sharp cutoff in the neutron energy in the top, right panel of Fig 2??? Dumb ass! This is the relativistic energy so the minimum is the neutron mass.

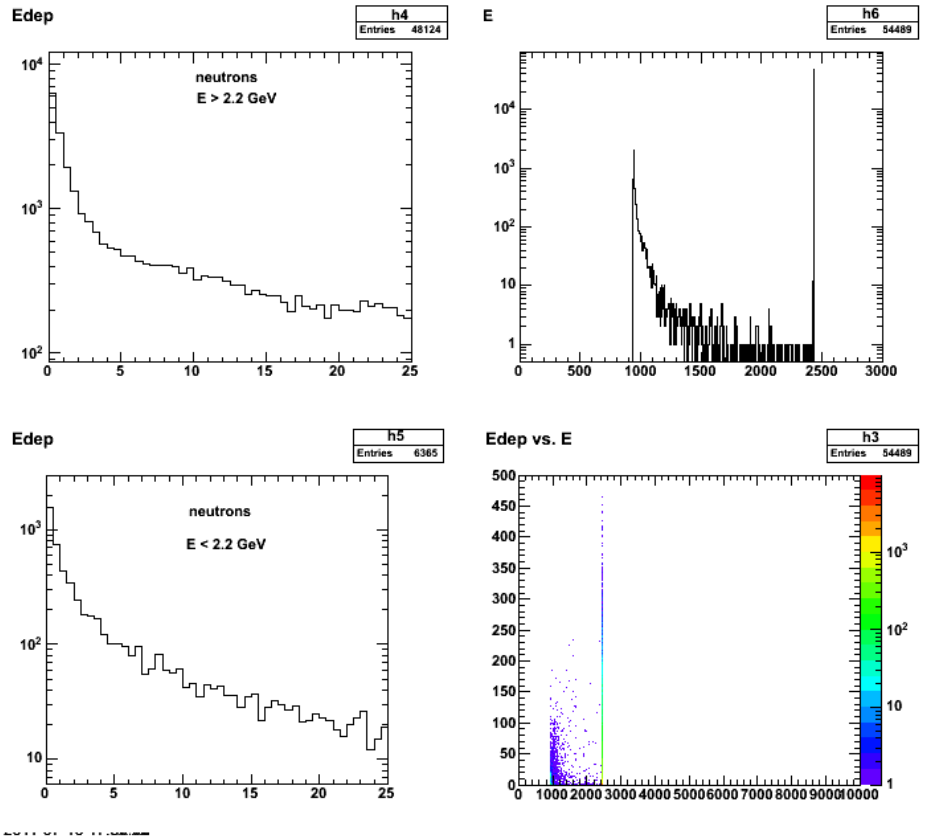


Fig 2. More neutron plots.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root ntuple file) you uploaded.

Now raise the incident neutron momentum. The neutron momenta above is close to the lower limit of the expected quasielastic neutron momentum for GMn12 and 9 GeV is close to the maximum.

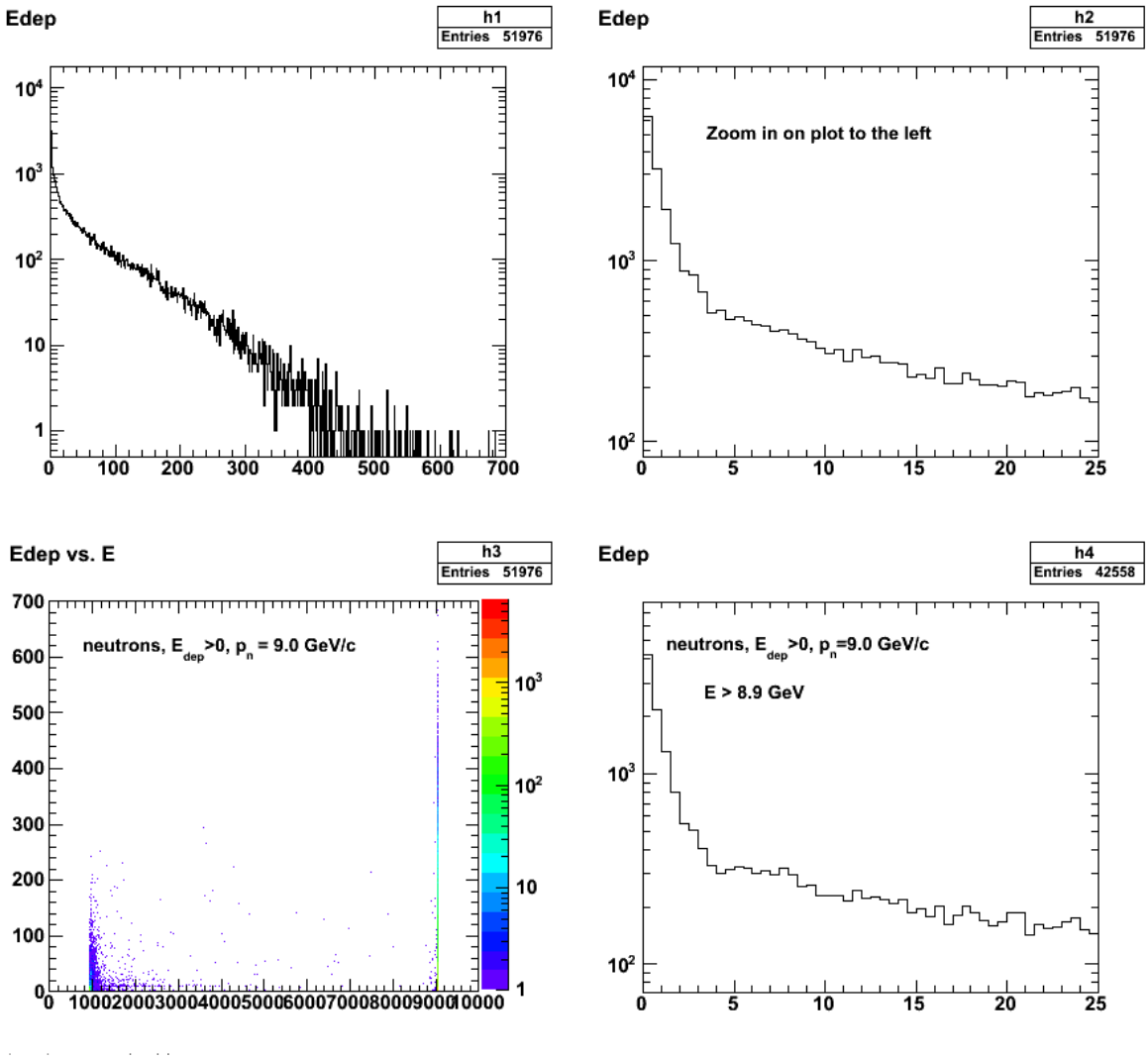


Fig 3. Same as fig 1 with pn = 9 GeV/c.

Click here to view the object (Root macro) you uploaded.

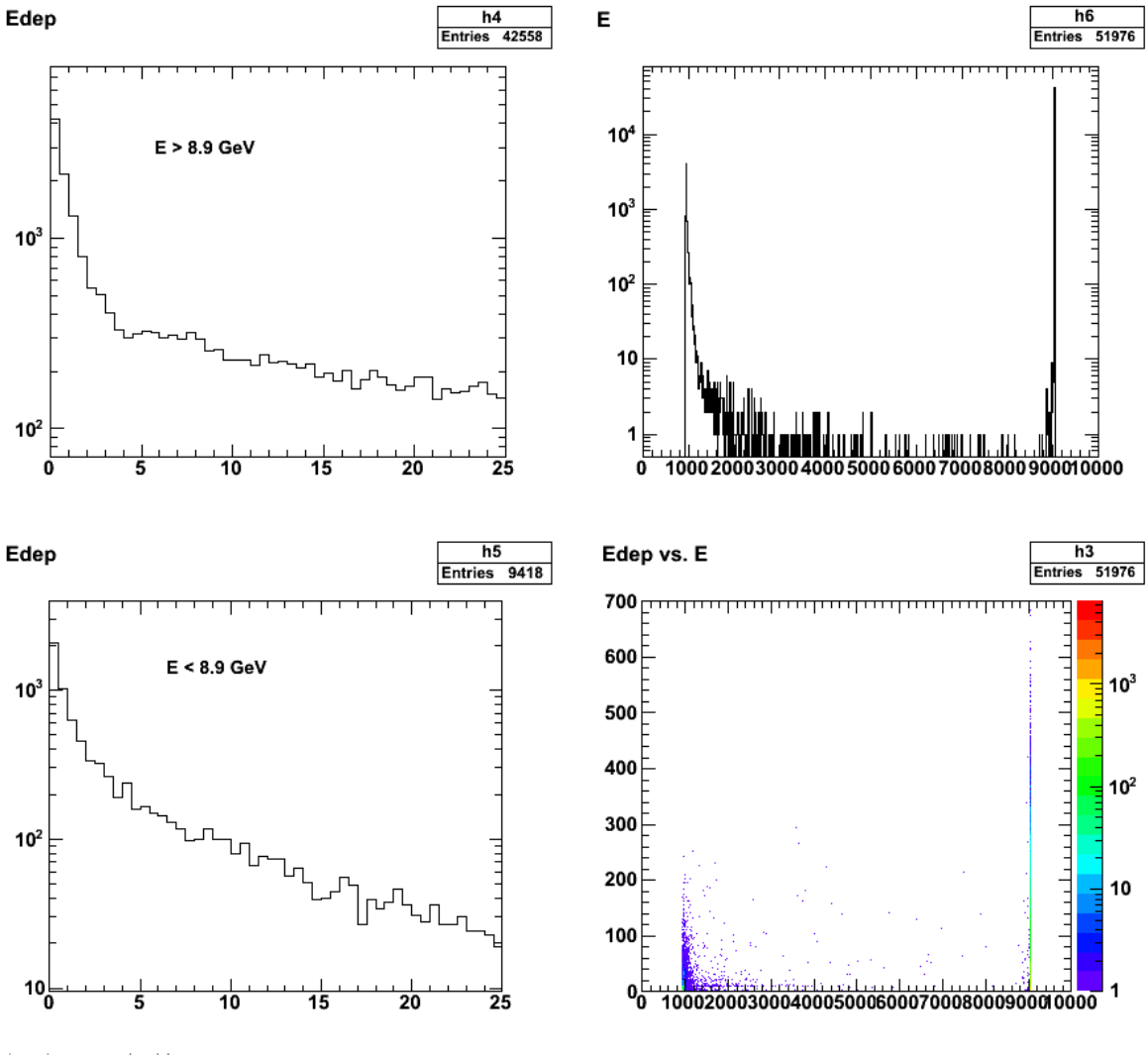


Fig 4. Same as Fig 2 for pn = 9 GeV/c.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root ntuple file with -N=500000) you uploaded.

For p_n= 9 GeV/c break down the Edep spectrum into its constituent parts. The spectrum is dominated by the high-momentum neutrons with some and low-E contributions from photons and pions.

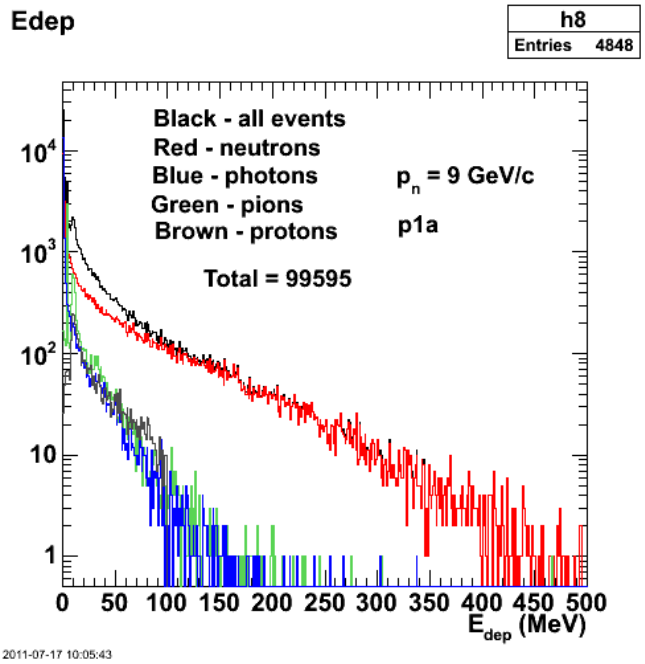


Fig 5. Breakdown of the contributions to the Edep spectrum for pn=9 GeV/c.

Click here to view the object (Root macro) you uploaded.

Some numbers from the Edep spectrum.

particle	PDG ID	N
protons	2212	4848
photons	22	20700
electrons	11	3619
positrons	-11	1939
anti-protons	-2212	0
anti-neutrons	-2112	0
π0	111	138
π+	211	4284
π-	-211	5541
neutrons	2112	51976
all	-	99595

The number of thrown neutrons used to get the results above is 500,000 so NDE = 51976/500000 = 0.104 +/- 0.005

Now get rid of the weird spikes like the one in the upper, left plot in the figure below. They are associated with the pion events. There are spikes at the π^0 and $\pi^{+/-}$ masses. Excluding them gets rid of the spikes. See logfile log-11-07-19 for commands. The bump at about 10 MeV in Edep is from minimum ionizing pions (see the Edep vs. Eplot at lower left below). The events with Edep less than minimum ionizing are likely from low-energy pions that stop in the scintillator, but their distribution looks pretty random at low-Edep and low-E.

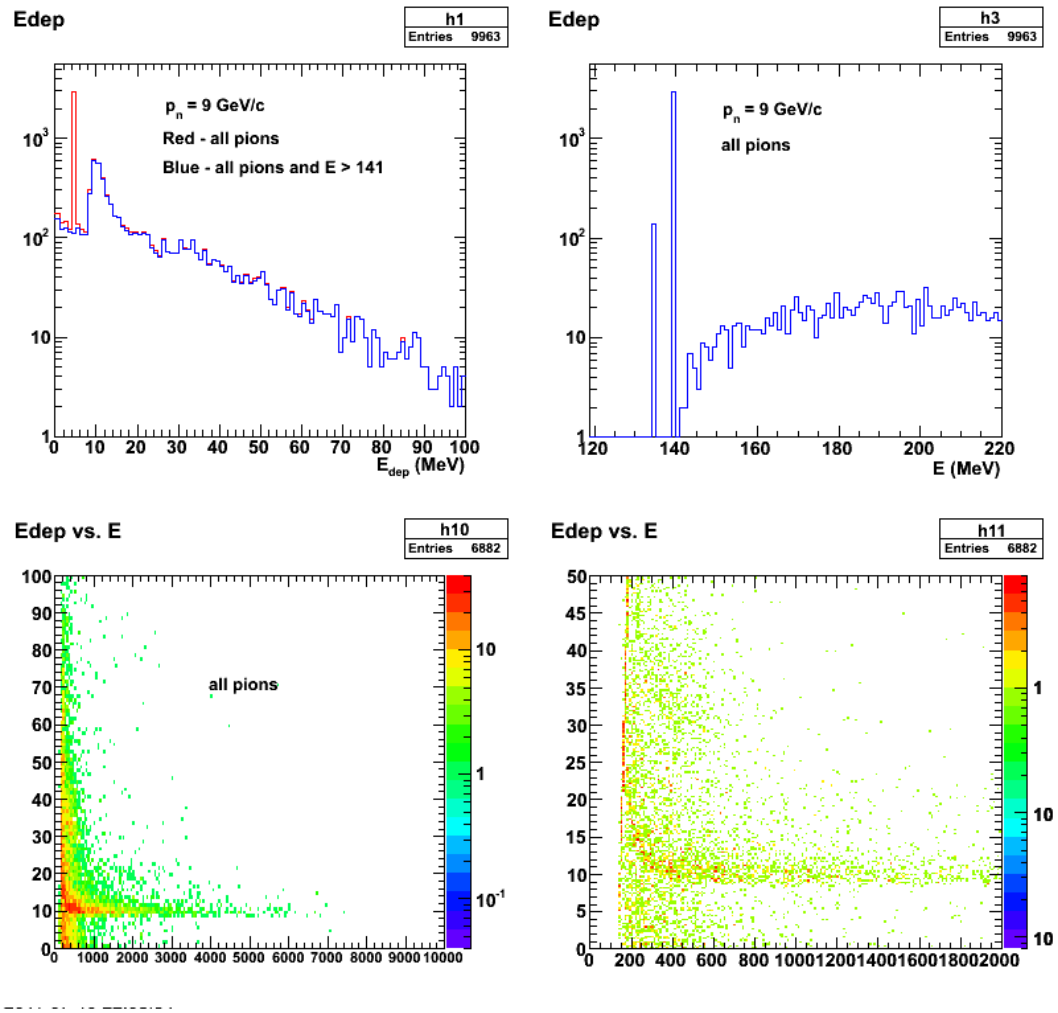


Fig 6. Pion production from neutrons.

Click here to view the object (Root macro) you uploaded.

Redo Fig 5 without the spikes.

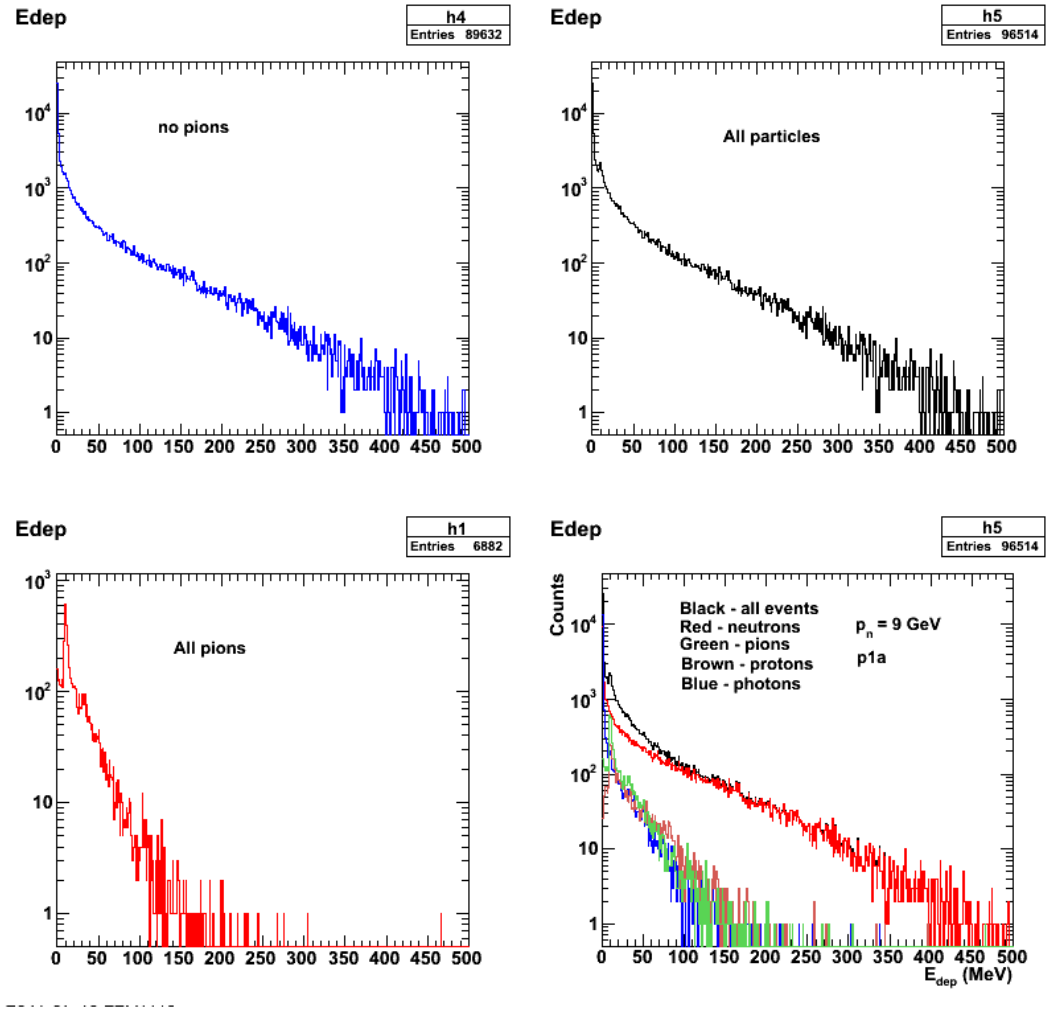


Fig 7. Redo Fig 5 without the spikes and plot some related spectra.

AArrgghh! FORGOT TO SAME STUFF!!!!

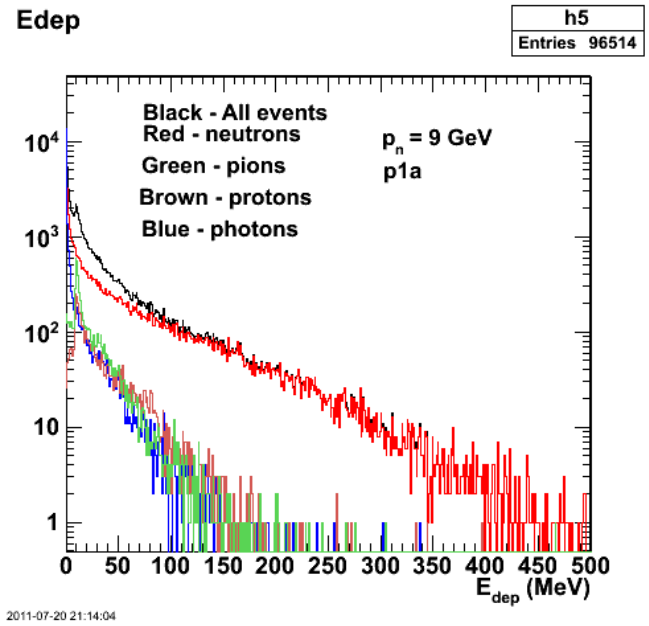


Fig 8. Redo lower, right panel of Fig 7 for CLAS-Note.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root tree file) you uploaded.

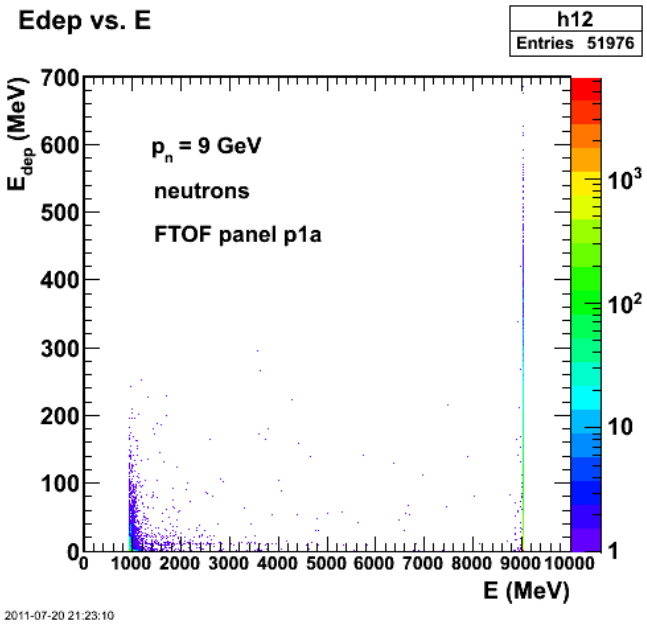


Fig 10. Plot of Edep and Edep vs. E for p1a and pn=9.0 GeV/c neutrons.

Click here to view the object (Root macro) you uploaded.

Now do pn = 3 GeV which corresponds to forward-angle electrons. Note also that we want to do just neutrals in the spectra so leave out protons, $\pi^{+/-}$.

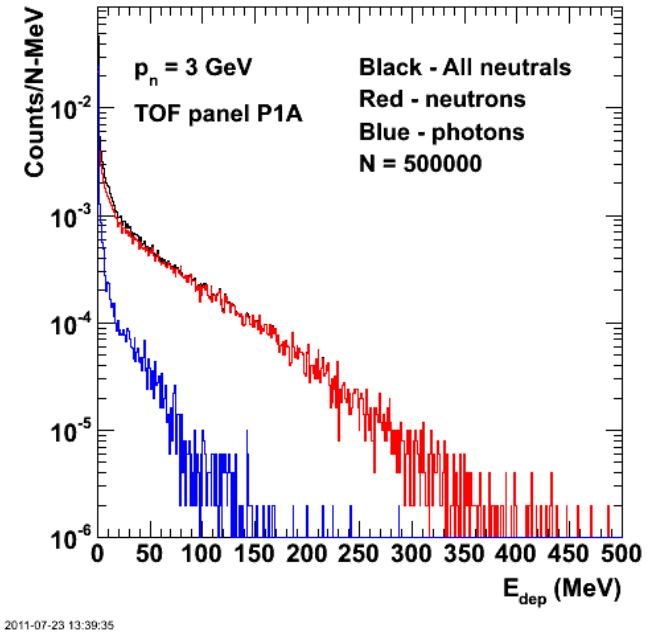


Fig 11. Edep for pn=3 GeV.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root tree file) you uploaded.

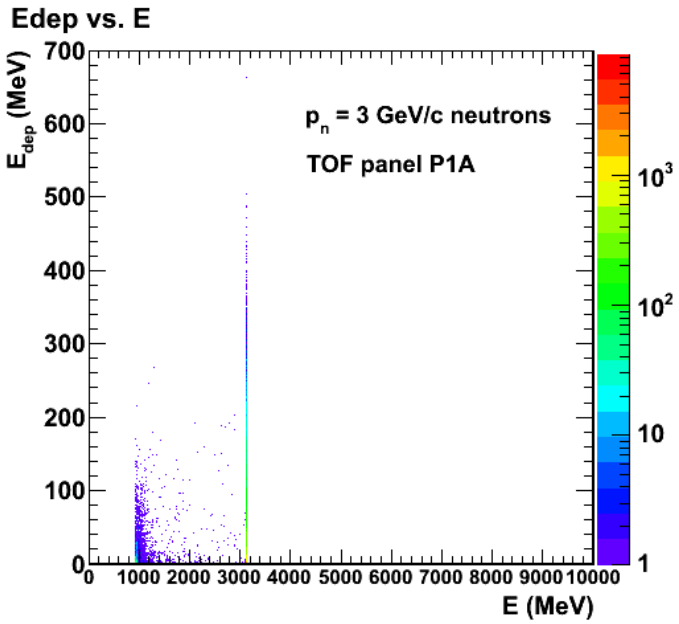
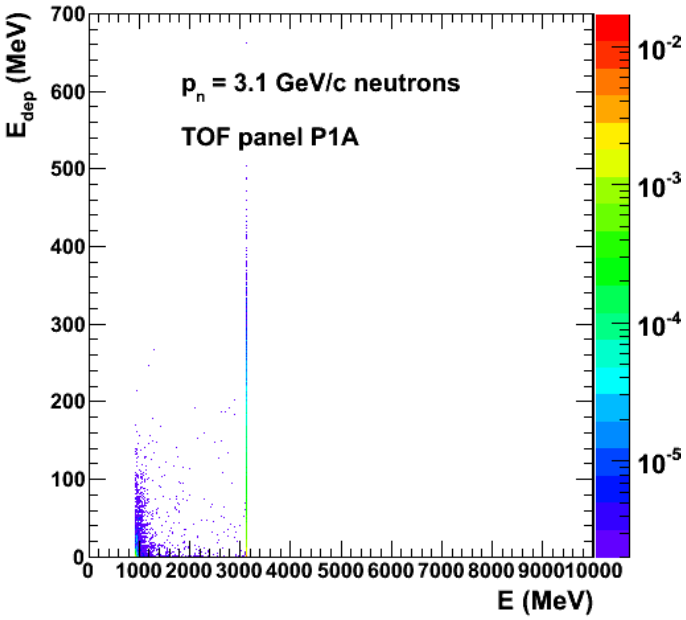


Fig 12. Edep vs E for pn = 3 GeV/c neutrons

Click here to view the object (Root macro) you uploaded.



2011-07-23 14:42:28

Fig 12b. Edep vs E for pn = 3.1 GeV/c neutrons.

Click here to view the object (Root macro) you uploaded.

Now do pn = 8 GeV/c (9 GeV/c above is too high).

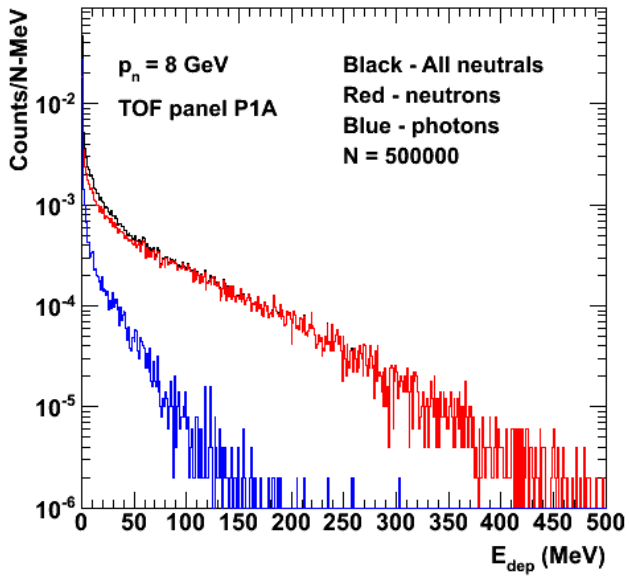


Fig 13. Edep for pn=8 GeV/c.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root tree file) you uploaded.

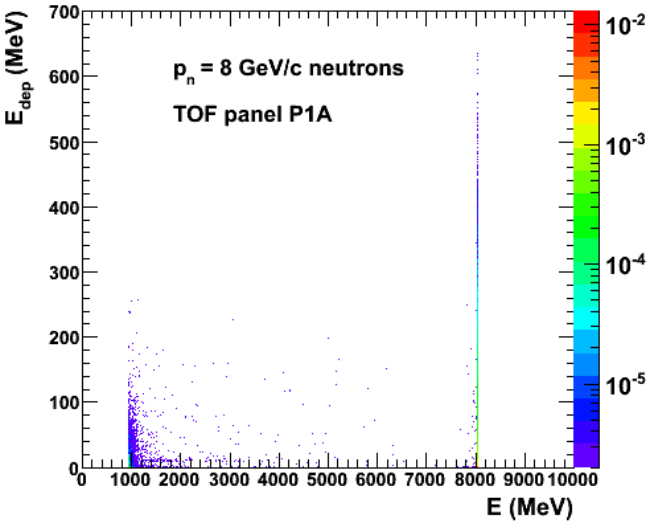


Fig 14.

Click here to view the object () you uploaded.

Plots.

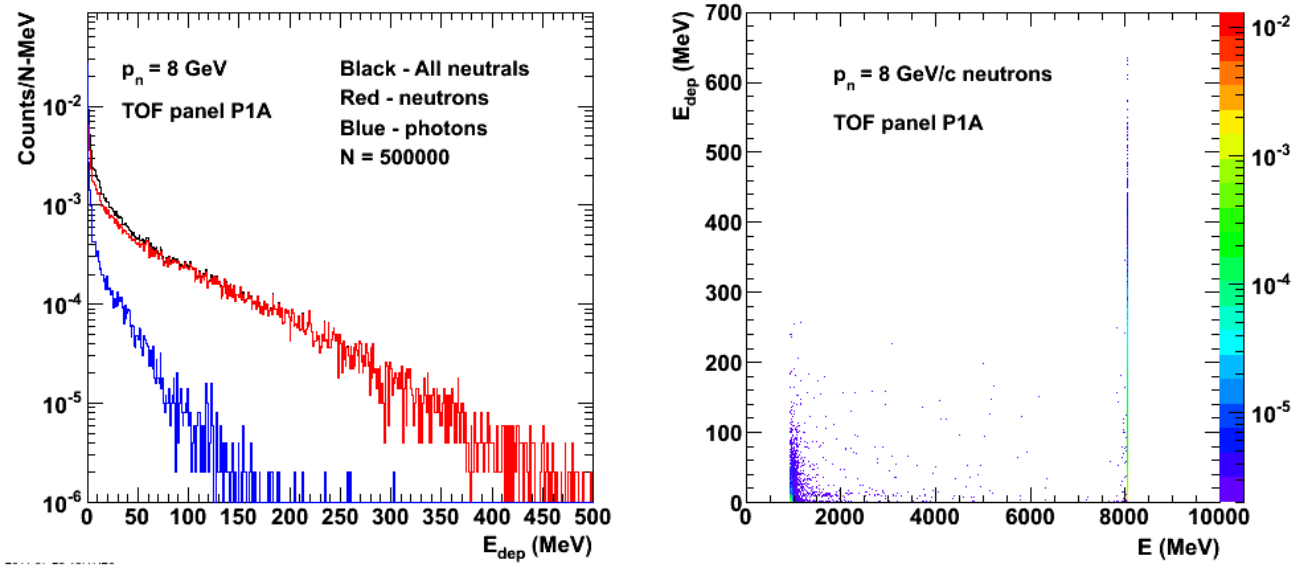


Fig 15. Neutron 8 GeV plots.

Click here to view the object (Root macro) you uploaded.

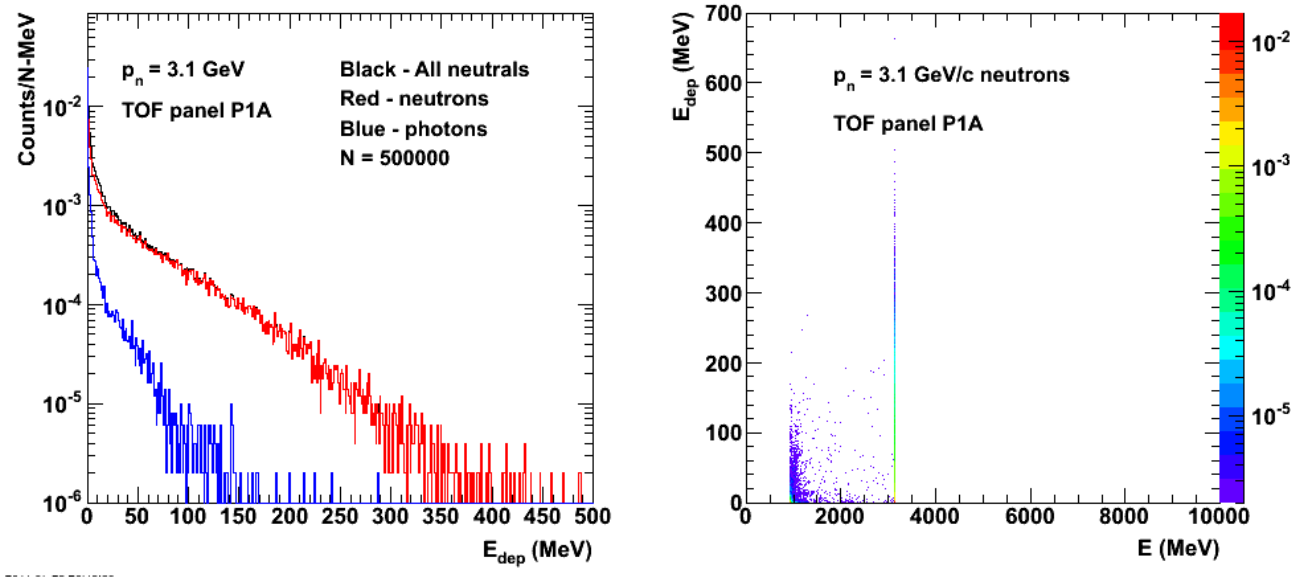


Fig 16. Neutron 3.1 GeV plots.

Click here to view the object (Root macro) you uploaded.

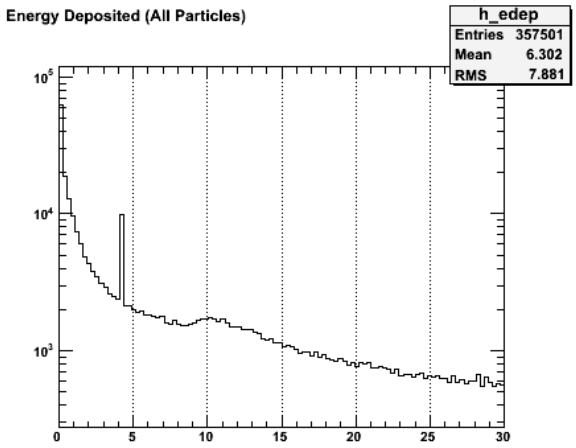
DOE 2000 Electronic Notebook

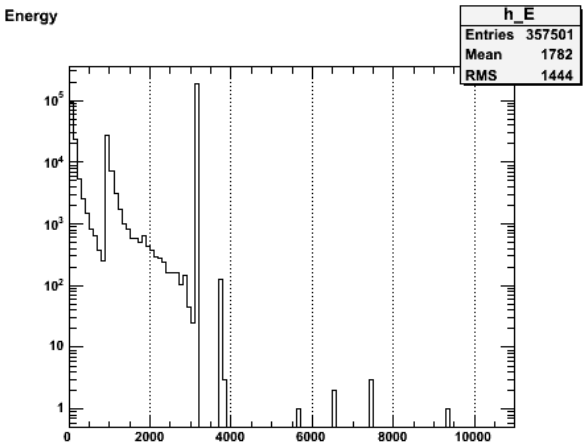
Jerry Gilfoyle's Enotebook page 383 - P1A Neutron Energy Deposited Study (Mark Moog)

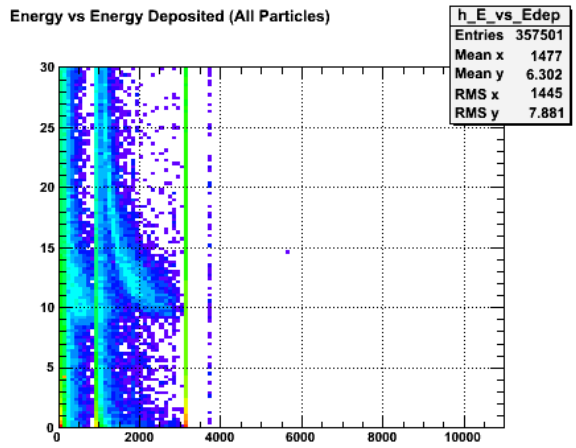
[Modified Sun Jul 24 00:55:32 2011 (GMT) Mark Moog]

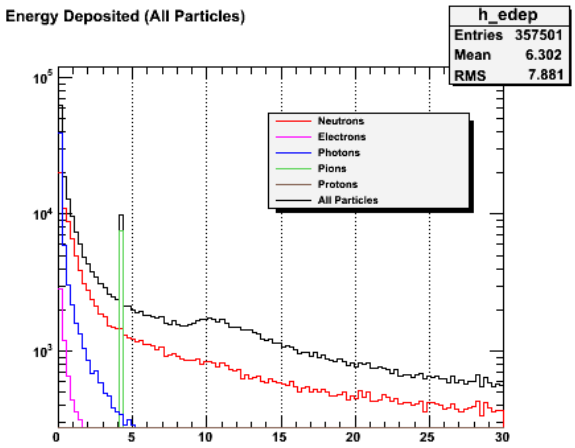
We want to understand the energy deposited distribution for electrons and neutrons going through the forward time of flight panels. The neutron detection efficiency of these panels is highly dependent on the energy deposited cut we put on hits in these panels, so understanding the energy deposited distribution is very important. To study the distribution we simulate electrons and neutrons traveling perpendicular to each panel through its center. To distinguish between different phenomena in the distribution we shoot electrons or neutrons of a single energy at one time. We decided to "bracket" the energy range electrons and neutrons will have, choosing to show the energy deposited distribution for the lowest energy electron or neutron that would travel through the panel due to quasi-elastic electron-neutron scattering, as well as the highest.

The plots below show the results of shooting 3GeV neutrons at p1a. This is the lower end of the neutron energy which will go through the panel due to elastic electron-neutron scattering. The peak in energy deposited is due to pions and is studied in more detail in a later entry.





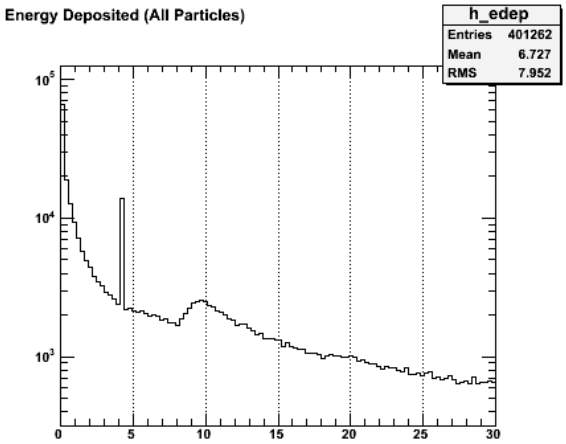


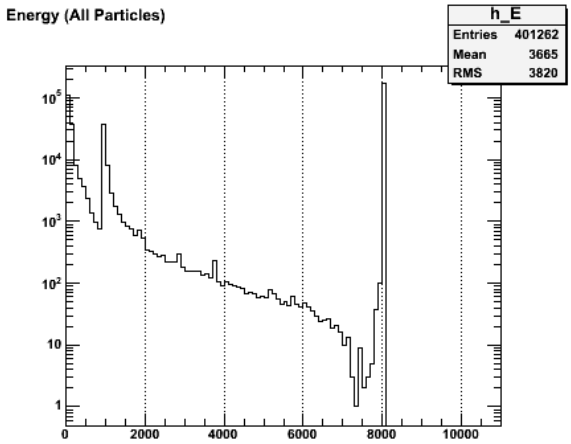


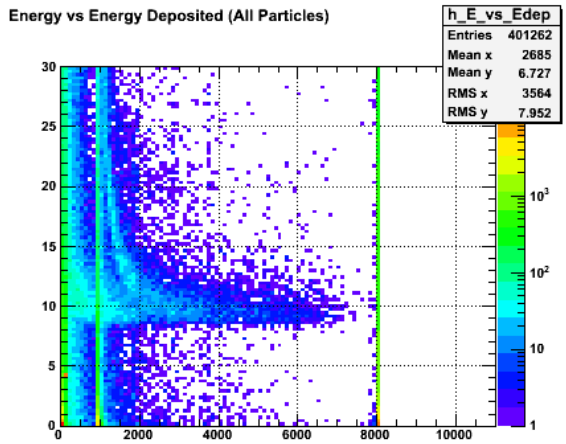
Click here to view the object (root macro) you uploaded.

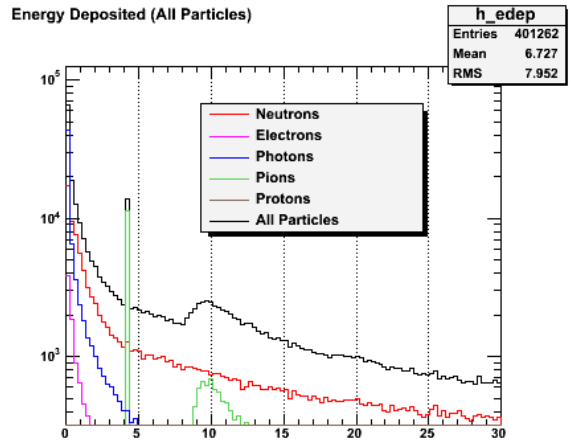
In the plots above there is a spike in energy deposited at about 4MeV. This spike is due to Pi+ and Pi- particles, and is currently not understood. There is also a peak in energy deposited around 10MeV. This is the minimum ionizing peak.In the energy plot there is a sharp spike at 3GeV, these are the neutrons we created. There are also spikes at other non-zero points corresponding to the rest mass of various particles.

The plots below show the results of shooting 8GeV neutrons at p1a. This is the upper end of the neutron energy which will go through the panel due to elastic electron-neutron scattering. The peak in energy deposited is due to pions and is studied in more detail in a later entry.









Click here to view the object (root macro) you uploaded.

In the plots above there is a spike in energy deposited at about 4MeV. This spike is due to Pi+ and Pi- particles, and is currently not understood. There is also a peak in energy deposited around 10MeV. This is the minimum ionizing peak, and it is more pronounced than when lower energy neutrons were used (since higher energy neutrons make more particles.) In the energy plot there is a sharp spike at 8GeV, these are the neutrons we created. There are also spikes at other non-zero points corresponding to the rest mass of various particles.

NOTE The final plots used for the neutron study of panel P1A are in the previous entry.

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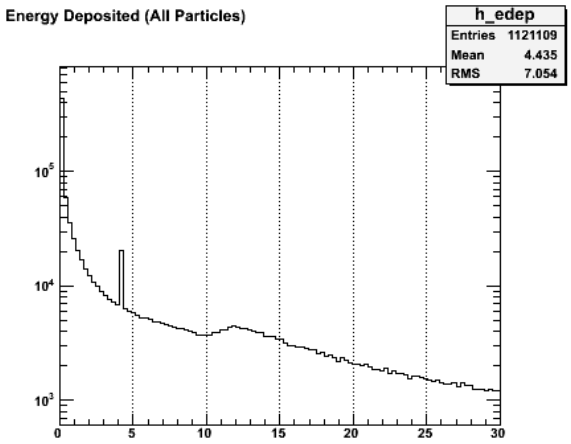
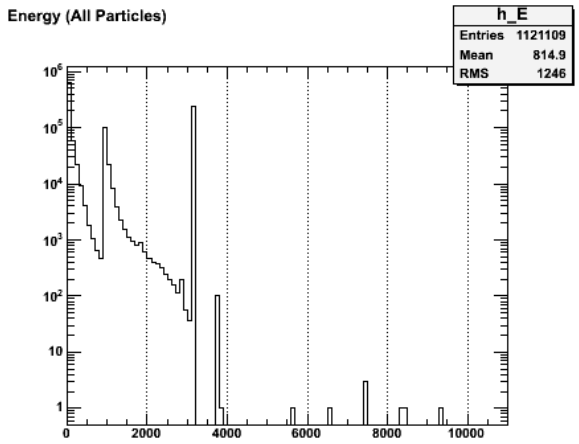
Jerry Gilfoyle's Enotebook page 384 - P1B Neutron Energy Deposited Study (Mark Moog)

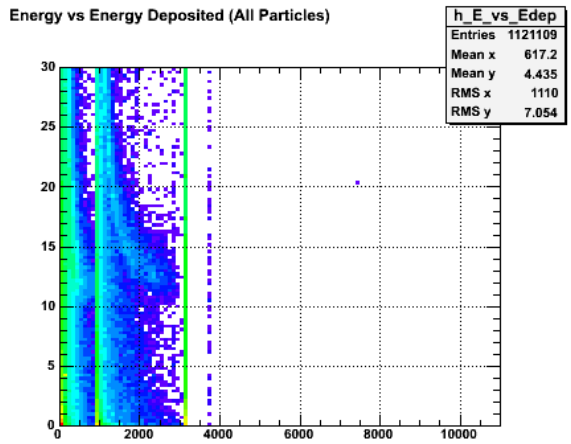
[Modified Sun Jul 24 03:53:09 2011 (GMT) Mark Moog]

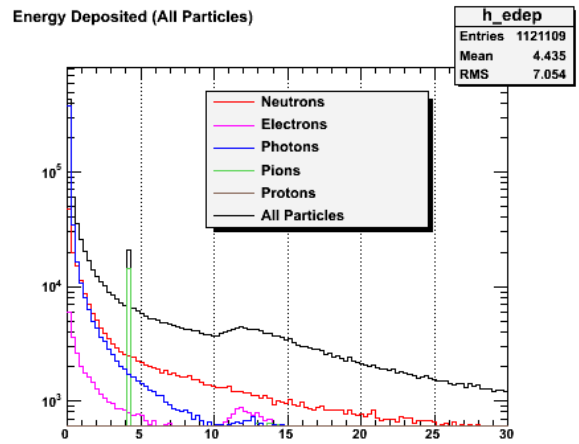
We want to understand the energy deposited distribution for electrons and neutrons going through the forward time of flight panels. The neutron detection efficiency of these panels is highly dependent on the energy deposited cut we put on hits in these panels, so understanding the energy deposited distribution is very important. To study the distribution we simulate electrons and neutrons traveling perpendicular to each panel through its center. To distinguish between different phenomena in the distribution we shoot electrons or neutrons of a single energy at one time. We decided to "bracket" the energy range electrons and neutrons will have, choosing to show the energy deposited distribution for the lowest energy electron or neutron that would travel through the panel due to quasi-elastic electron-neutron scattering, as well as the highest.

The plots below show the results of shooting 3GeV neutrons at p1b. This is the lower end of the neutron energy which will go through the panel due to elastic electron-neutron scattering. The peak in energy deposited is due to pions and is studied in more detail in a later entry.





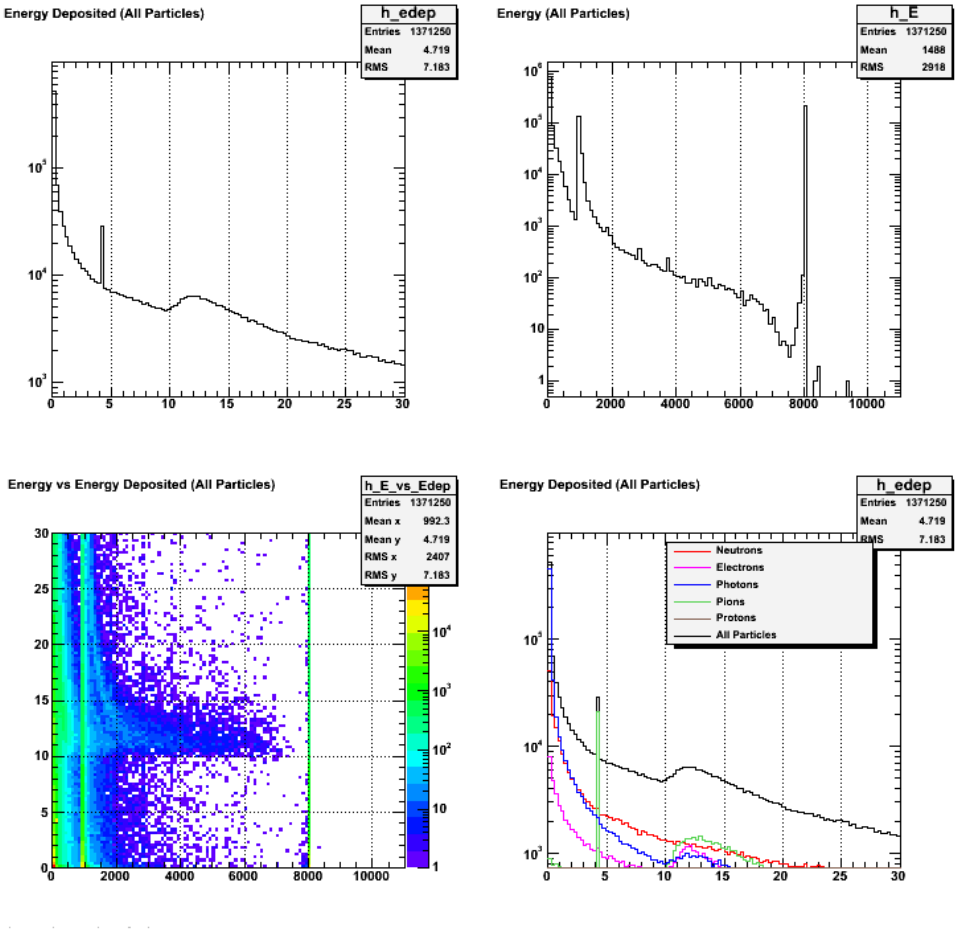




Click here to view the object (root macro) you uploaded.

In the plots above there is a spike in energy deposited at about 4MeV. This spike is due to Pi+ and Pi- particles, and is currently not understood. There is also a peak in energy deposited around 12MeV. This is the minimum ionizing peak, and it is a few MeV higher than the MIP in P1A since P1B is thicker. In the energy plot there is a sharp spike at 3GeV, these are the neutrons we created. There are also spikes at other non-zero points corresponding to the rest mass of various particles.

The plots below show the results of shooting 8GeV neutrons at p1b. This is the upper end of the neutron energy which will go through the panel due to elastic electron-neutron scattering. The peak in energy deposited is due to pions and isstudied in more detail in a later entry.



Click here to view the object (root macro) you uploaded.

In the plots above there is a spike in energy deposited at about 4MeV. This spike is due to Pi+ and Pi- particles, and is currently not understood. There is also a peak in energy deposited around 12MeV. This is the minimum ionizing peak, and it is a few MeV higher than the MIP in P1A since P1B is thicker. In the energy plot there is a sharp spike at 8GeV, these are the neutrons we created. There are also spikes at other non-zero points corresponding to the rest mass of various particles.

Now generate the plots for the CLAS-Note. Just get the two Edep plots at pn = 8.0 and 3.1 GeV/c. The Edep vs. E plots will look much the same.

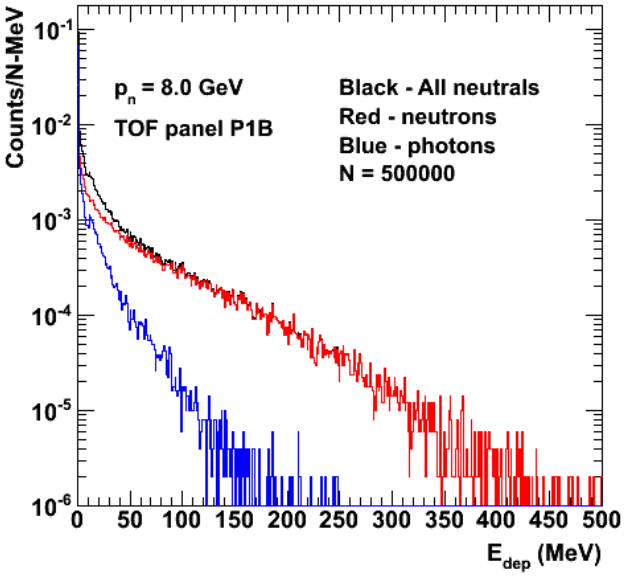


Fig 3. Edep for pn=8.0 GeV/c and p1b.

Click here to view the object (Root macro) you uploaded.

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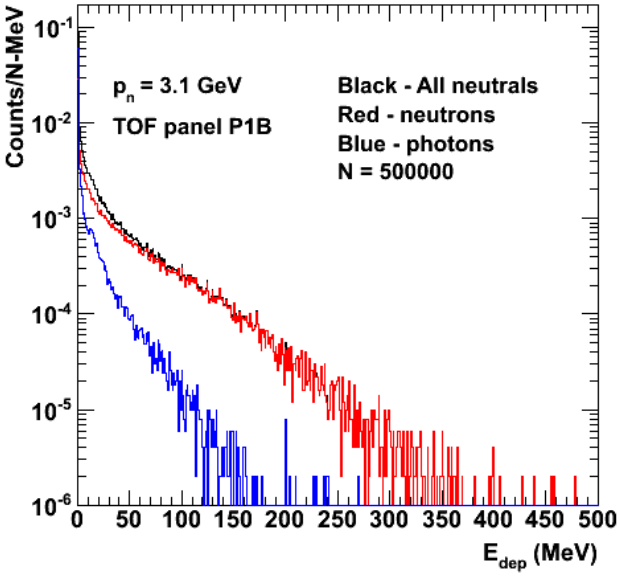

Fig 4. Edep for pn=3.1 GeV/c and p1b.

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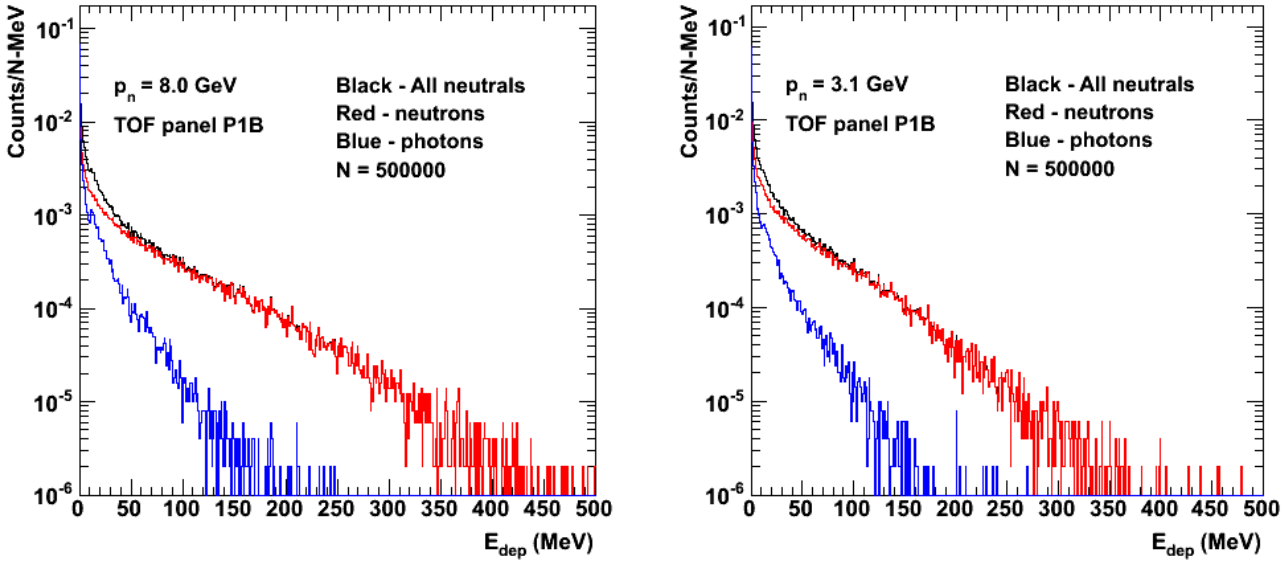

Fig 5. Combined two previous plots.

Click here to view the object (Root macro) you uploaded.

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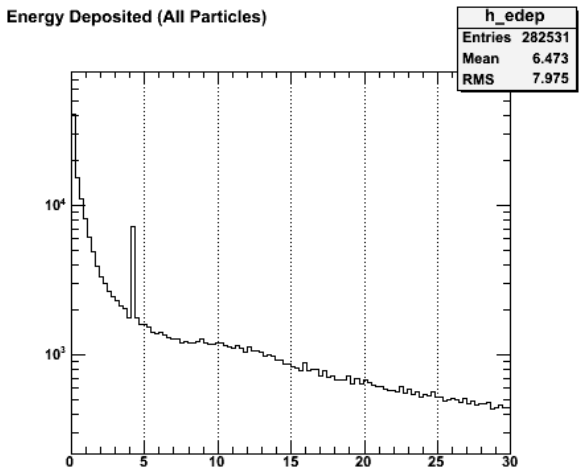
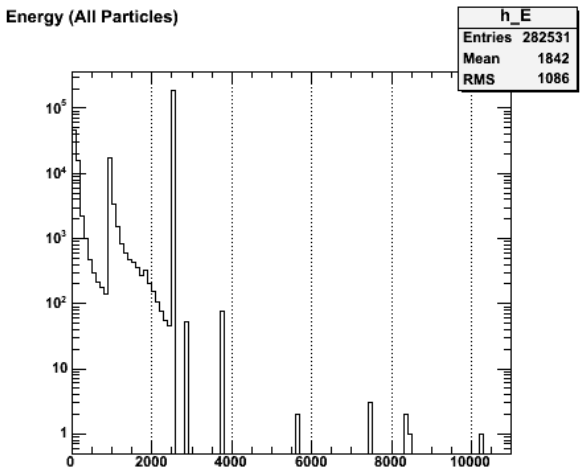
Jerry Gilfoyle's Enotebook page 385 - P2B Neutron Energy Deposited Study (Mark Moog)

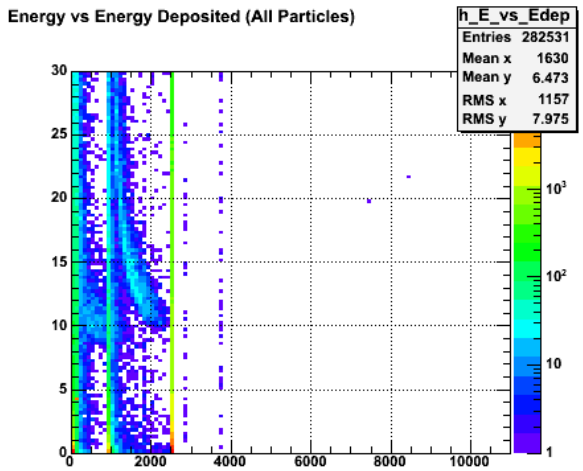
[Modified Mon Jul 25 02:57:03 2011 (GMT) Mark Moog]

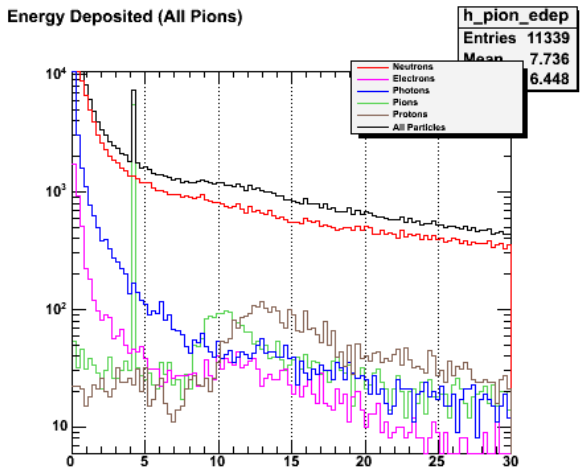
We want to understand the energy deposited distribution for electrons and neutrons going through the forward time of flight panels. The neutron detection efficiency of these panels is highly dependent on the energy deposited cut we put on hits in these panels, so understanding the energy deposited distribution is very important. To study the distribution we simulate electrons and neutrons traveling perpendicular to each panel through its center. To distinguish between different phenomena in the distribution we shoot electrons or neutrons of a single energy at one time. We decided to "bracket" the energy range electrons and neutrons will have, choosing to show the energy deposited distribution for the lowest energy electron or neutron that would travel through the panel due to quasi-elastic electron-neutron scattering, as well as the highest.

The plots below show 2.4GeV neutrons shot at P2B. Since P2B is mush smaller than P1A and P1B, a much smaller range of neutron momenta travel through it, so we only simulated one momentum. We had to move the event vertex up 213.7cm in the z direction and shoot at an angle of 58.8 degrees to be perpendicular to p2b.









Click here to view the object (root macro) you uploaded.

Click here to view the object (root tree file) you uploaded.

In the plots above there is a spike in energy deposited at about 4MeV. This spike is due to Pi+ and Pi- particles, and is currently not understood. There is also a peak in energy deposited around 10MeV. This is the minimum ionizing peak, and it is barely visible since 2.4GeV neutrons don't create many other particles (and the MIP is caused by non-neutron particles.) In the energy plot there is a sharp spike at 2.4GeV, these are the neutrons we created. There are also spikes at other non-zero points corresponding to the rest mass of various particles.

Plots for the CLAS-Note.

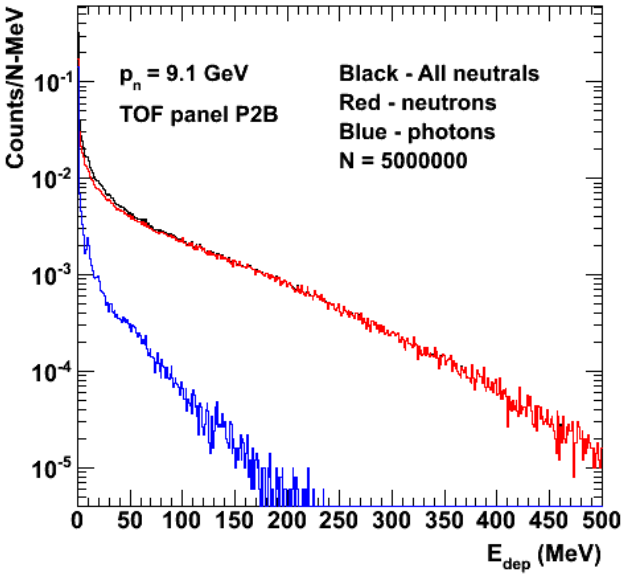


Fig 3. Edep for P2B at pn=9.1 GeV/c.

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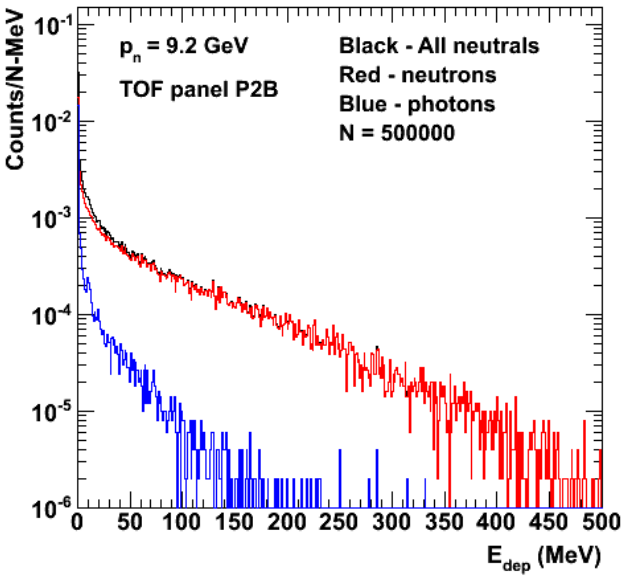

Fig 4. Same as Figure 3 with smaller N to be the same as the other pictures.

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Click here to view the object (Root tree file) you uploaded.

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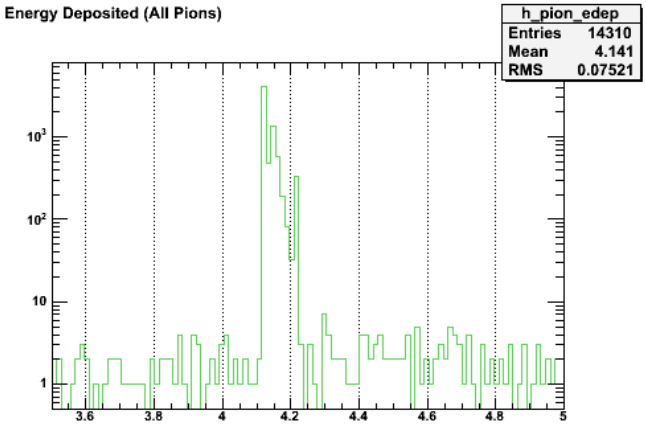
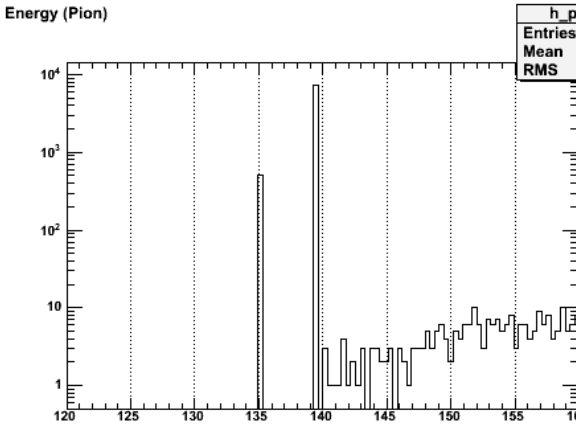
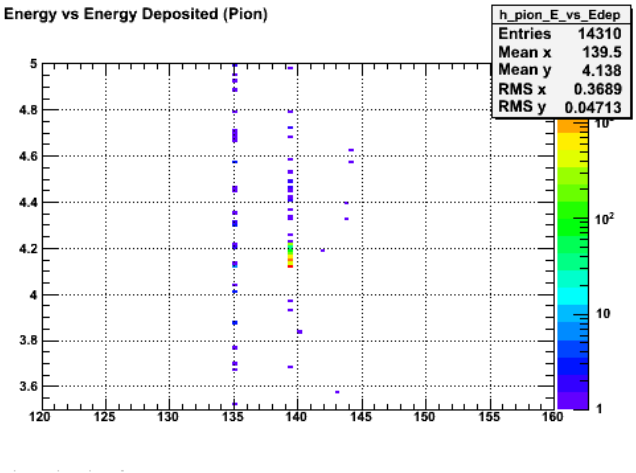
Jerry Gilfoyle's Enotebook page 386 - Pions in P2B (Mark Moog)

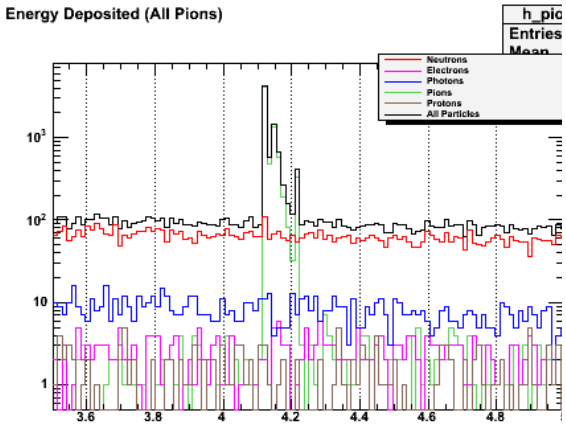
[Modified Wed Jul 20 21:19:59 2011 (GMT) Mark Moog]

We want to explain the mysterious peak of 4MeV in the energy deposited plot seen in previous entries(here, here, and here). This peak is caused by pions so we will take a closer look at how they are interacting with the forward time of flights. In the plots below we can see two spikes in the energy plot. One at the Pi0 rest mass, and one at the Pi+/Pi- rest mass. Looking at the Energy vs Energy Deposited plot and zooming in on the mysterious 4MeV spike we can see that it is due almost entirely to the Pi+ an Pi- particles.

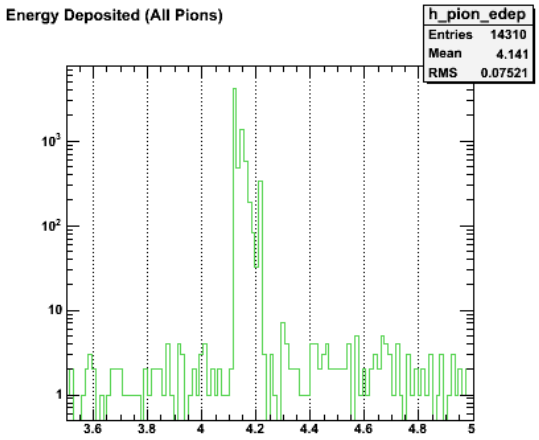


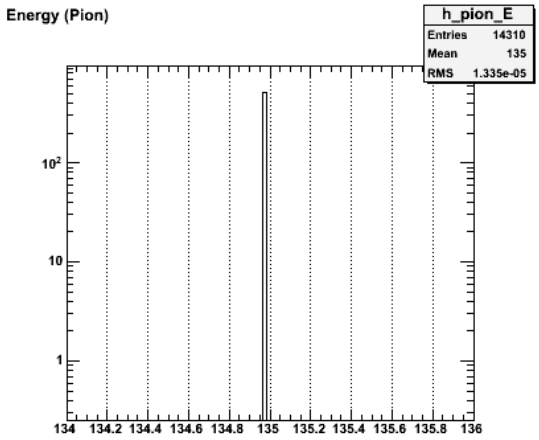


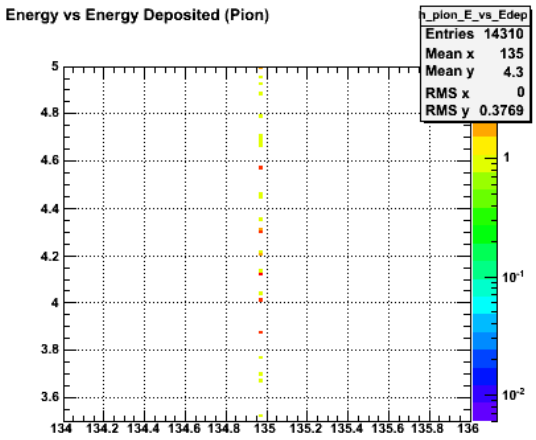


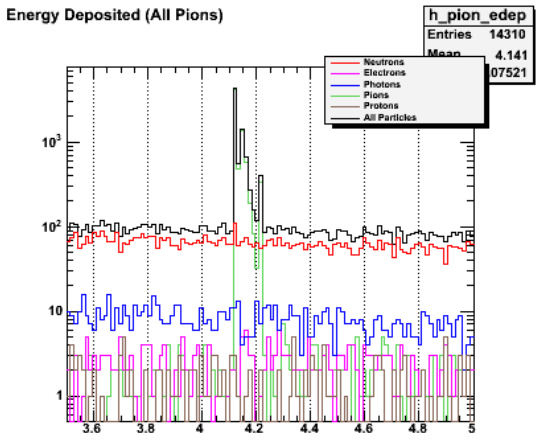


To see if the spikes at the Pi0 and Pi+ rest masses are actually spikes, and not very tight distributions, we zoom in on those energies. As you can see these are not tight distributions, they really are spikes.

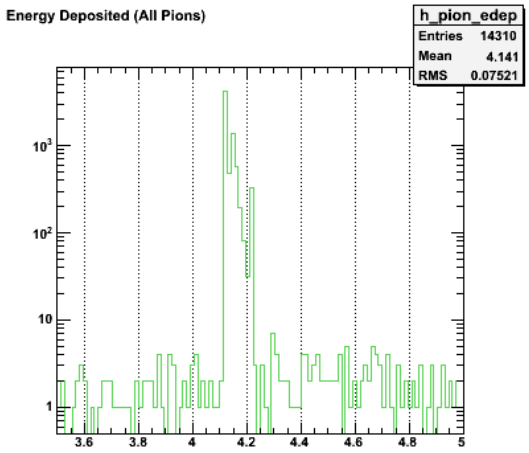


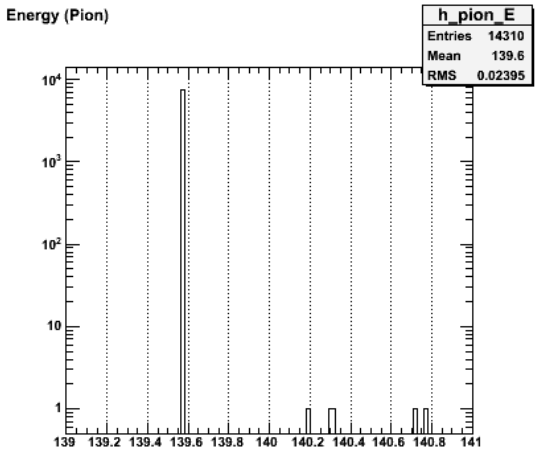


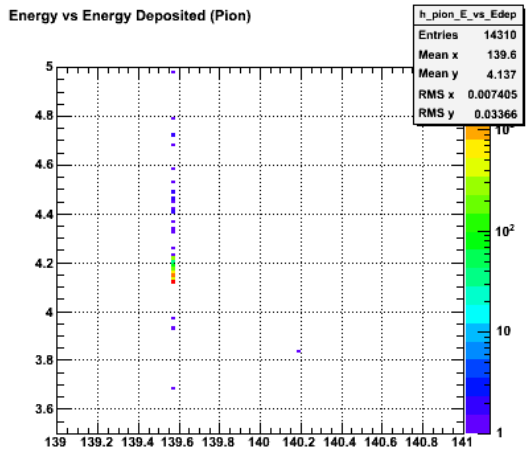


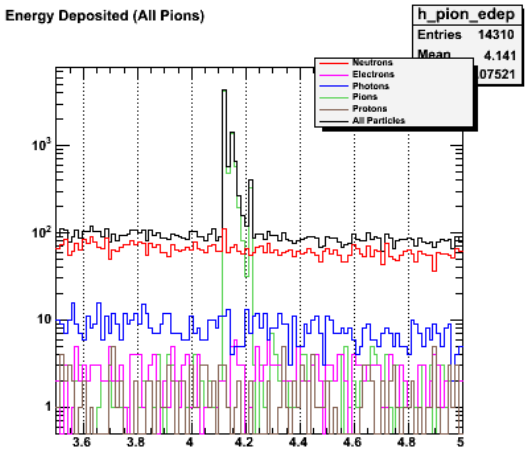


zoomed in on pi0 rest mass









zoomed in on pi+ rest mass

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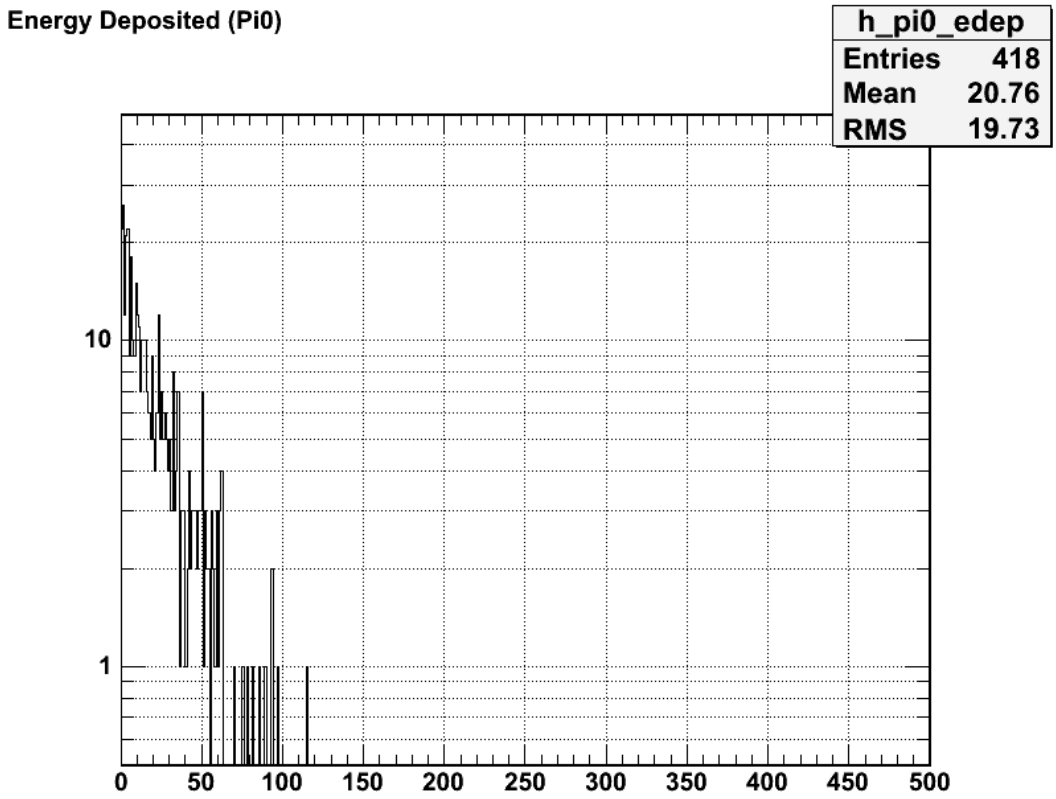
Jerry Gilfoyle's Enotebook page 387 - Pi0 vs Pi+ Study (Mark Moog)

[Modified Sat Jul 23 16:59:50 2011 (GMT) Mark Moog]

We want to explain the mysterious peak of 4MeV in the energy deposited plots of forward time of flight panels seen in previous entries(here, here, and here). This peak is caused by pions, and we took a closer look at them here. We saw both Pi0 and Pi+/Pi- in the plots, so now we will separate them and look at their individual contributions.

First we will look at the Pi0s. These particles decay into two photons in 10^-17 seconds (virtually immediately.) they should have no time to deposit energy, and yet some of them are depositing over 100MeV in P2B!



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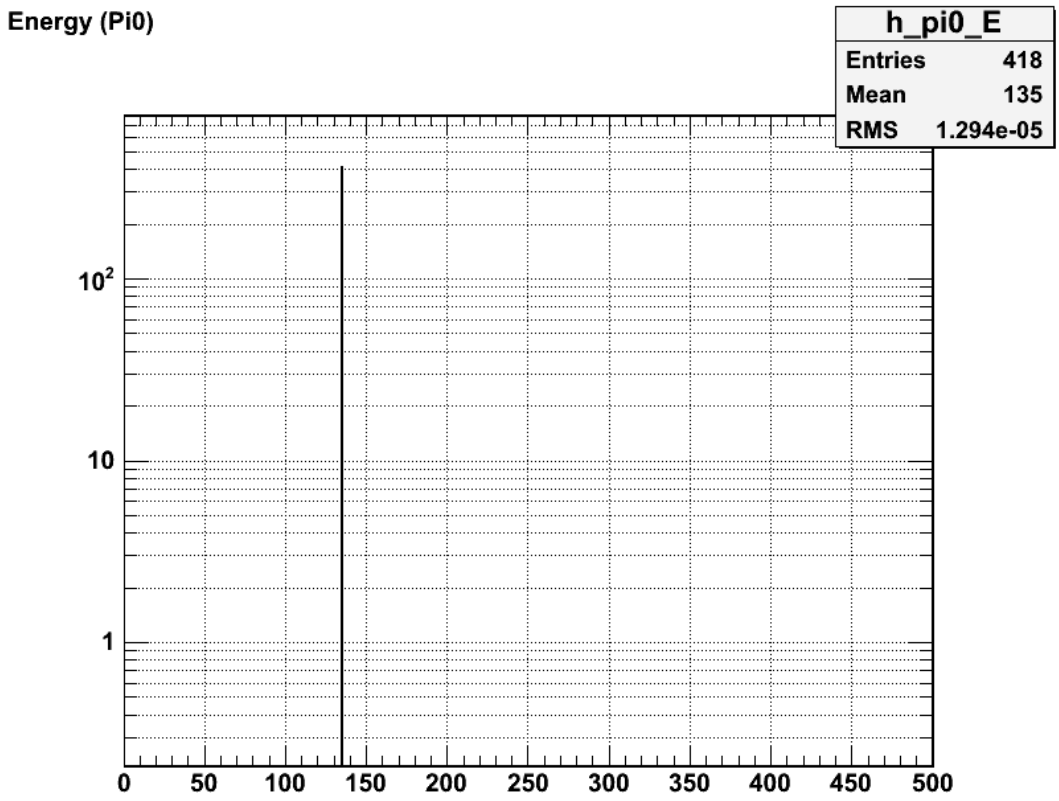
The fact that Pi0s are depositing energy in P2B seems even stranger when you look at the Pi0 energy distribution. They all have an energy of their rest mass, and thus have no kinetic energy, so how can they deposit energy in P2B?



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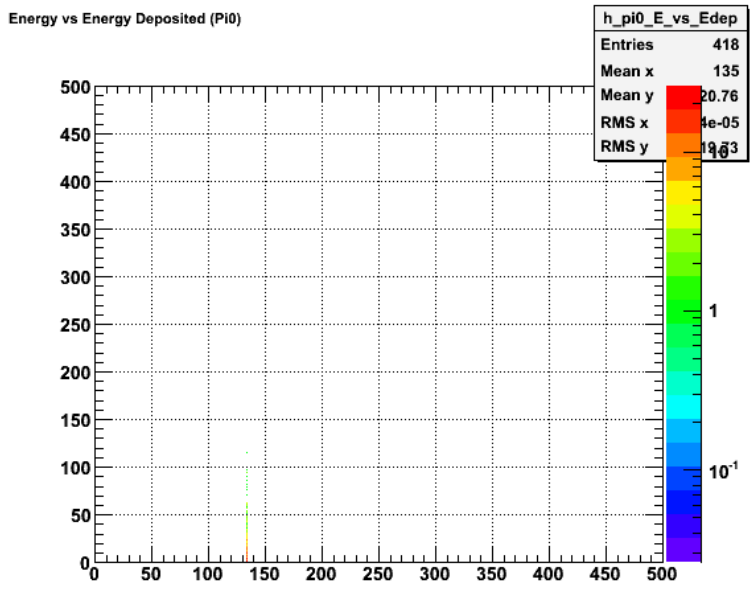
Since their energy plot is just a spike at the rest mass, the energy vs energy deposited plot contains little additional info.



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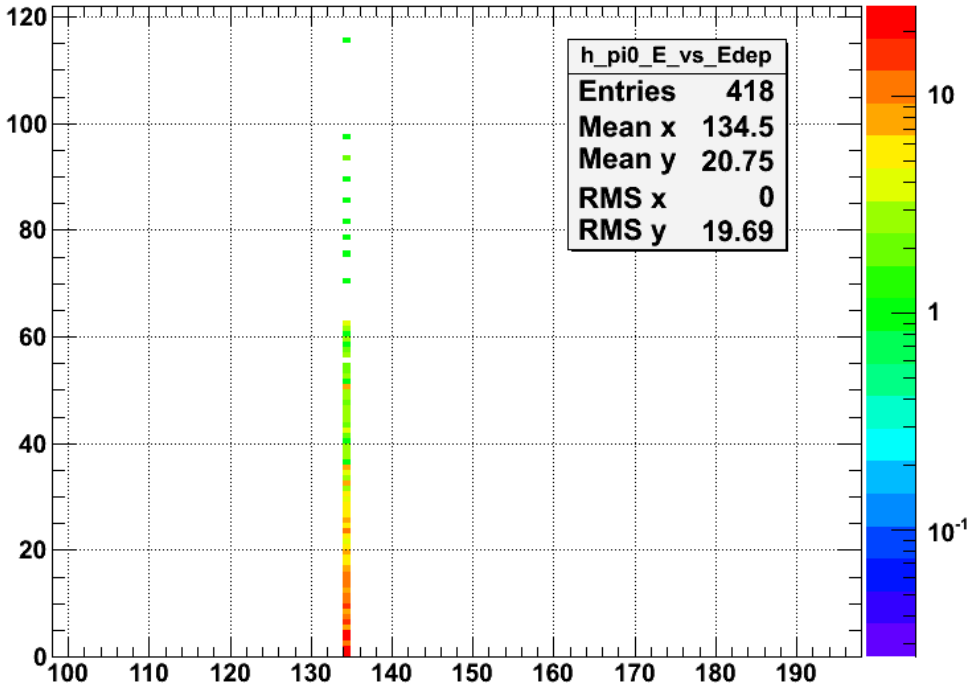
When we zoom in to the energy vs. energy deposited graph for Pi0 we can see that there is no spike at 4MeV. This spike must be due to just Pi+ and Pi-.

Energy vs Energy Deposited (Pi0)



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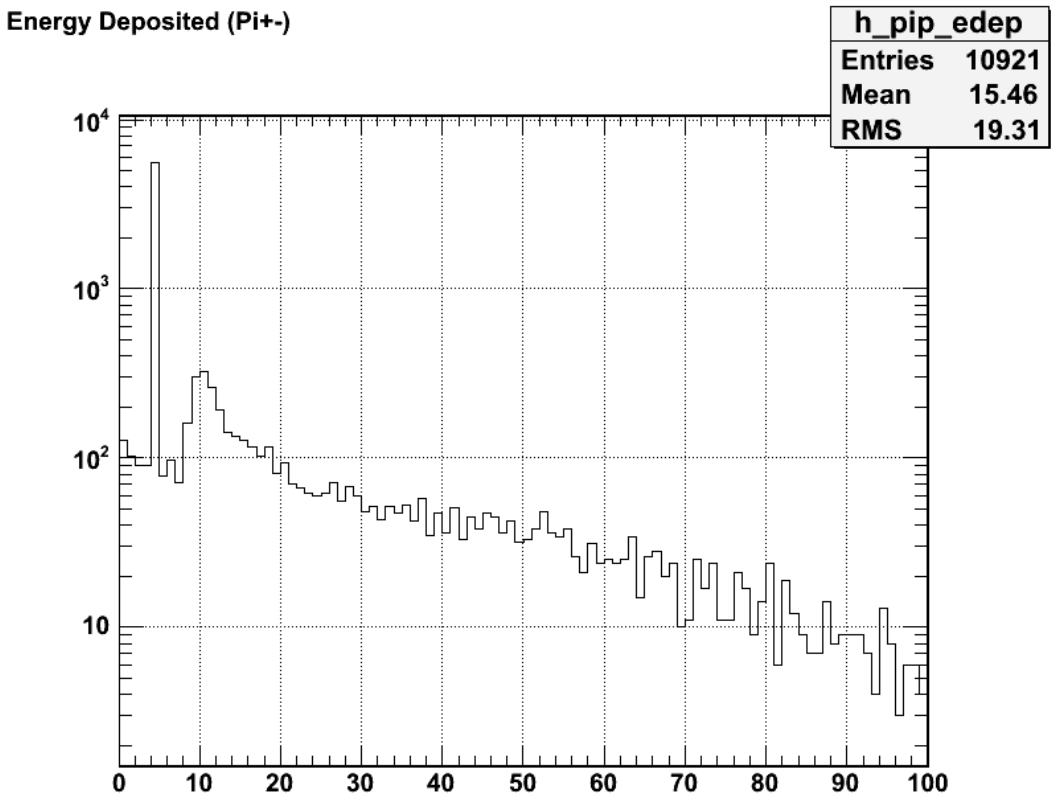
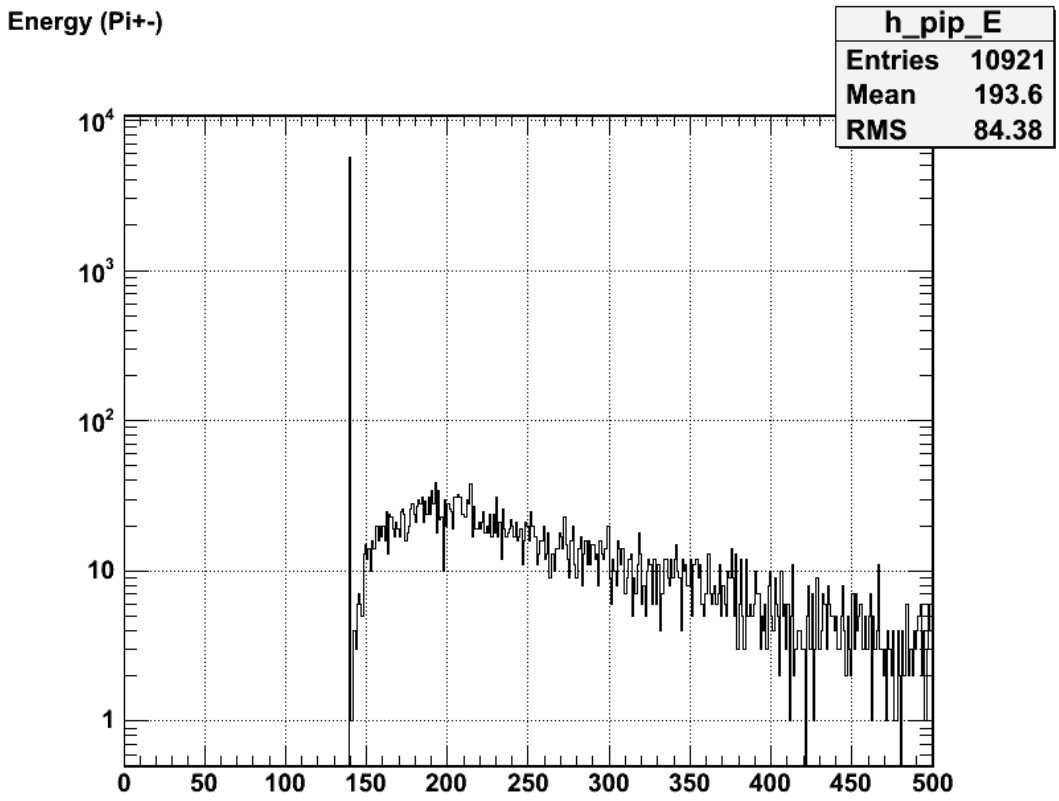
Looking at Pi+/Pi- energy deposited we can see some interesting features. First there is the 4MeV mystery spike. Then there is the minimum ionizing peak at 10MeV. Also notice that there are about 20 times more Pi+/Pi- than Pi0.



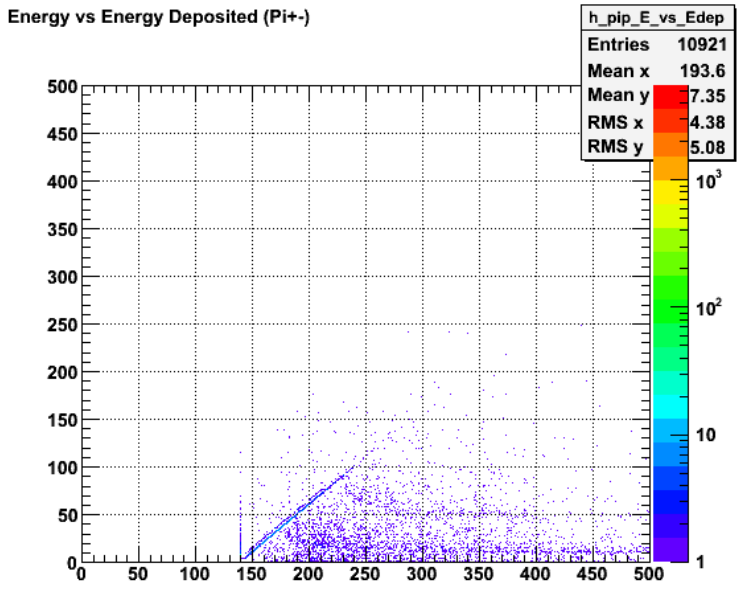
2011-07-20 16:06:41

For the Pi+/Pi- energy plot we can see the rest mass spike, along with a small distribution that peaks at 190MeV. This distribution probably contains the pions that make sense, but we still need to understand the rest mass spike.



2011-07-20 16:05:24

Below is a very intersting plot. We can see the rest mass spike, but we can also see a diagonal line of "stopped" pions. This diagonal line is created by pions which are stopped by the time of flight scintillator and deposit all of their kinetic energy. Any point above this diagonal corresponds to pions which deposit more than their kinetic energy (which seems strange.) Most pions are below this line, and these are pions which pass all the way through the scintillator. The rest mass spike is entirely above the diagonal (obviously.)

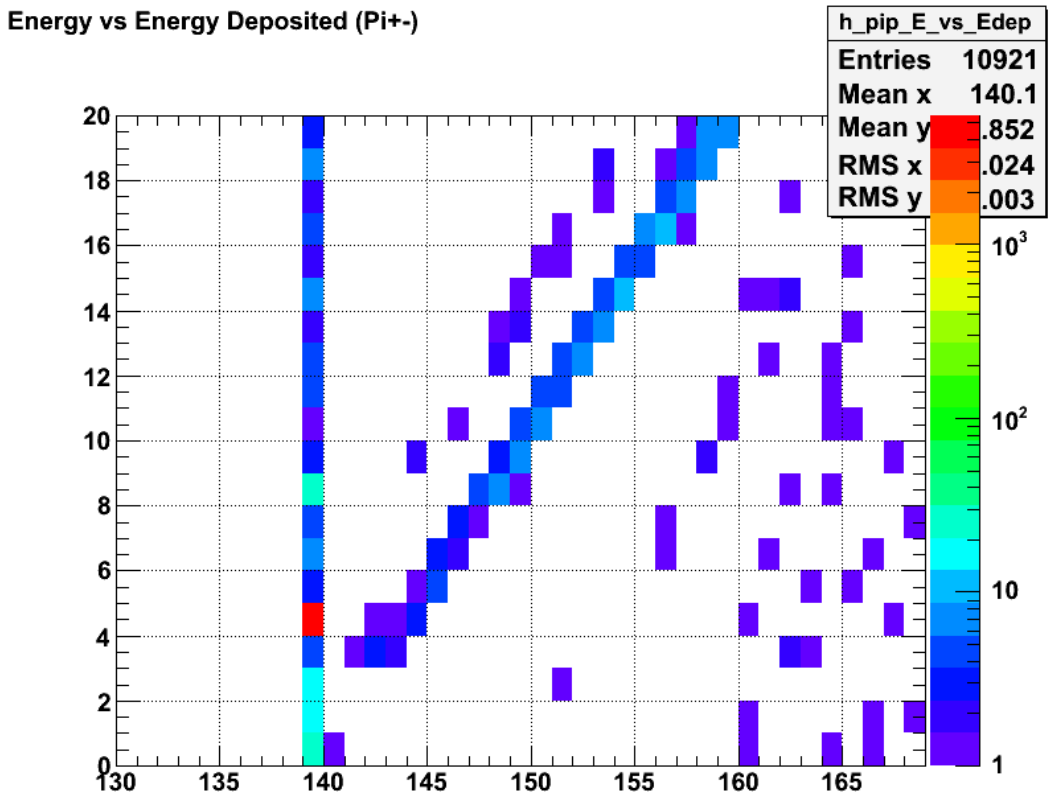


2011-07-20 16:08:51

Zooming in on the rest mass spike near the 4MeV mystery spike we see something interesting. The "stopped" pion diagonal doesn't start at (rest mass, 0) like one would assume, but instead starts around (rest mass + ~3, ~3). This probably means the minimum amount of energy a pion deposits in one step is 3MeV. If it was 4MeV then we might have an explaination of the mystery spike! but it isn't.....

Actually looking at the plot again, I would say that the diagonal does go all the way to (rest mass,0) but we don't have good enough statistics to fill it in. There

are many pions in the area around (rest mass, 0), just none connecting it to (rest mass + ~3, ~3) due to poor statistics.



2011-07-20 16:03:50

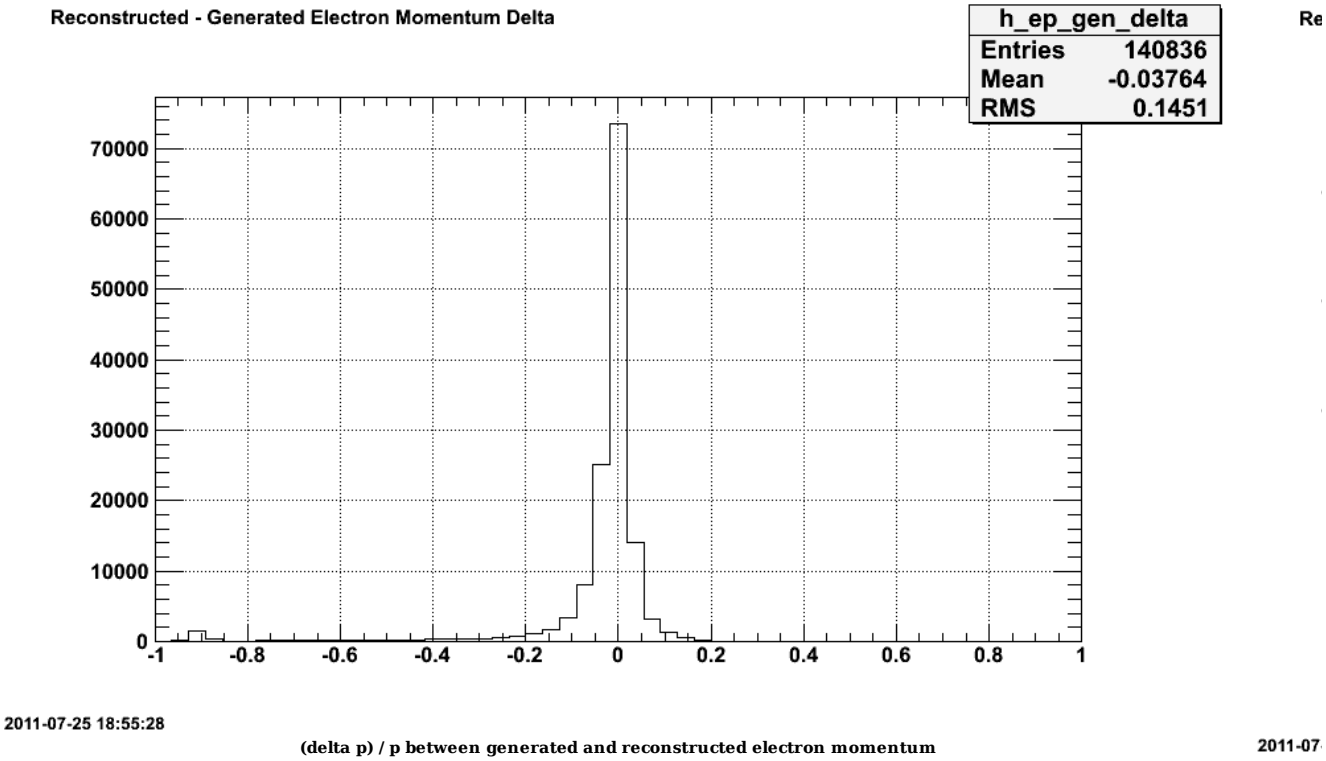
DOE 2000 Electronic Notebook

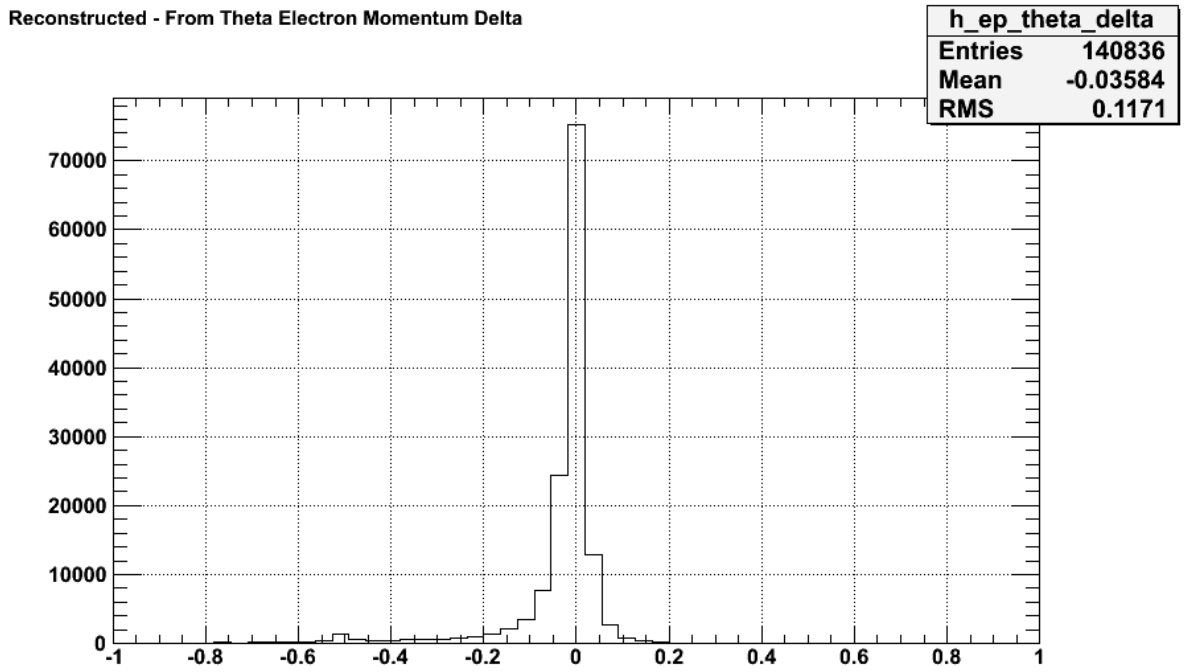
Jerry Gilfoyle's Enotebook page 388 - Generated Momentum and Theta Momentum Deltas (Mark Moog)

[Modified Tue Aug 2 17:58:45 2011 (GMT) Mark Moog]

Reconstruction isn't perfect, and we don't want to include poorly reconstructed events in our neutron detection efficiency calculation. To exclude poorly reconstructed events we can put a cut on the percentage difference of reconstructed and generated electron momentum. However, during an actual experiment we won't have access to the 'generated' electron momentum. Instead of using the generated electron momentum we will use the momentum calculated from the electron's theta scattering angle instead. This "from theta" momentum is the momentum the electron should have if it scatters elastically off a neutron at 11GeV at the reconstructed angle. This is a good repleacement for generated electron momentum since the scattering angle is reconstructed very accurately.

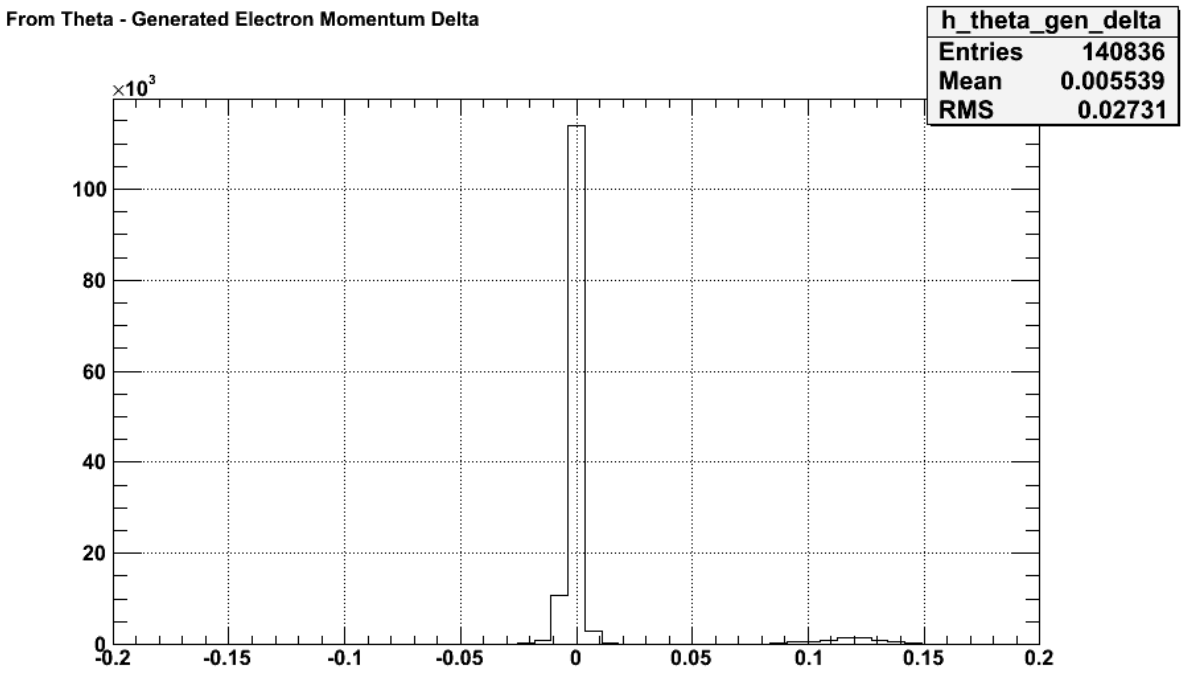
below next to each plot is the log scale version with more bins.





2011-07-25 18:55:37

(delta p) / p between "from theta" and reconstructed momentum



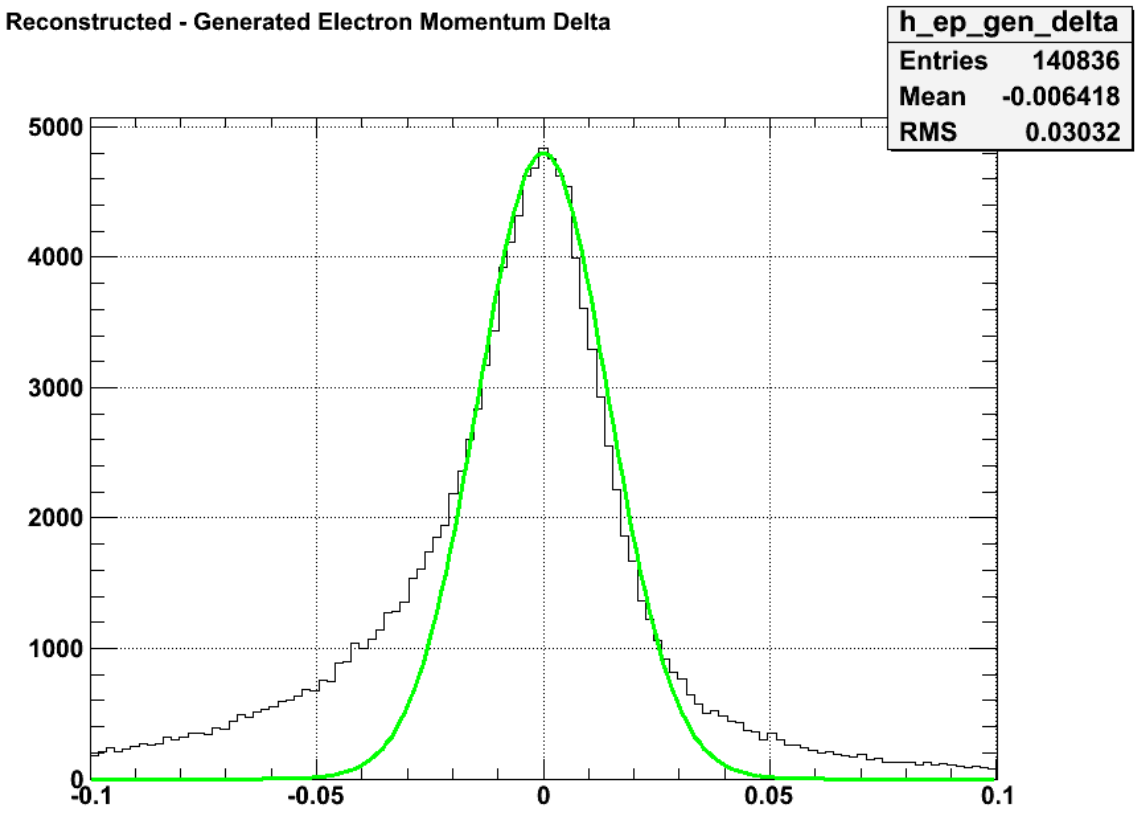
2011-07-25 18:55:48

(delta p) / p between "from theta" and generated momentum

Above the plot compares the percentage difference between the "from theta" electron momentum and the generated electron momentum. They are very close together, mostly within a couple of percent. However there is a lump at about 12% that I will look into further. I believe it is do to poor electron angle reconstruction at very small angles....

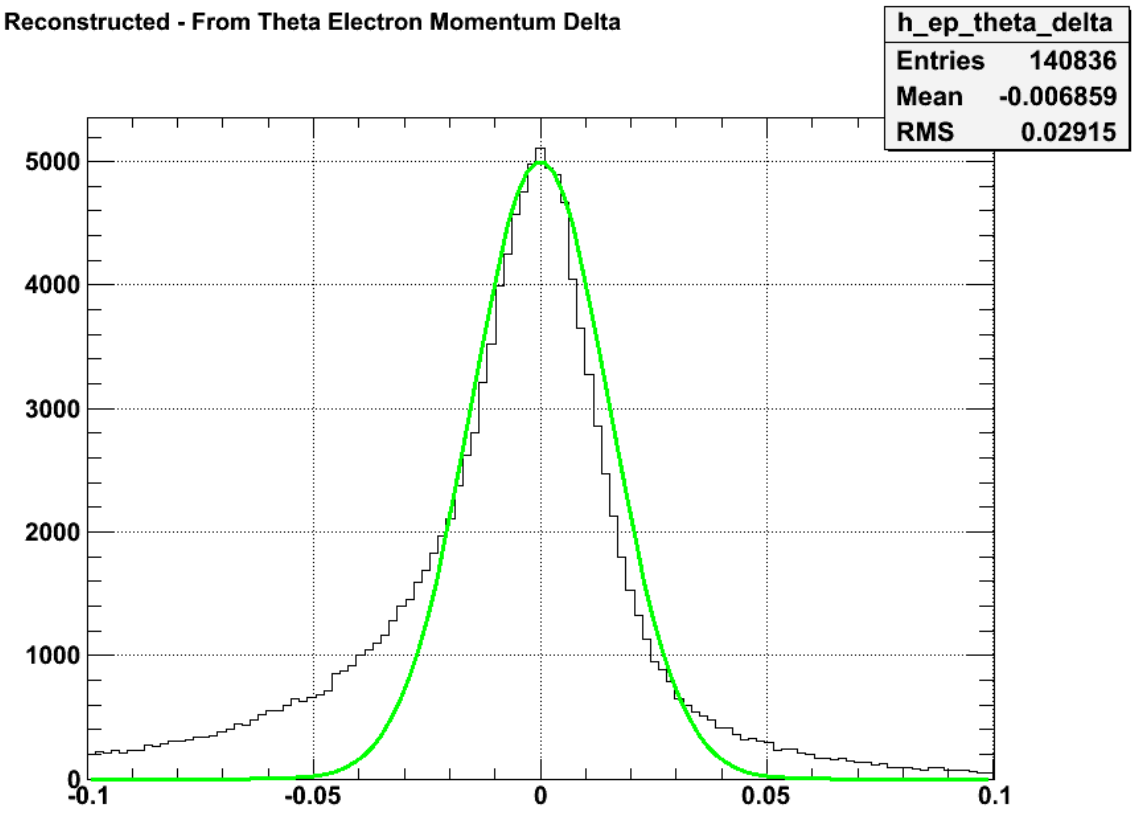
Click here to view the object (root histogram file) you uploaded.

Here are the generated and "from theta" (delta p) / p plots with fits



2011-07-26 14:27:08

Click here to view the object (gen delta root macro) you uploaded.



2011-07-26 14:29:43

Click here to view the object (theta delta root macro) you uploaded.

Comparison of the spectra above for Δ p/p using momentum derived from the reconstructed angles and the generated momentum.

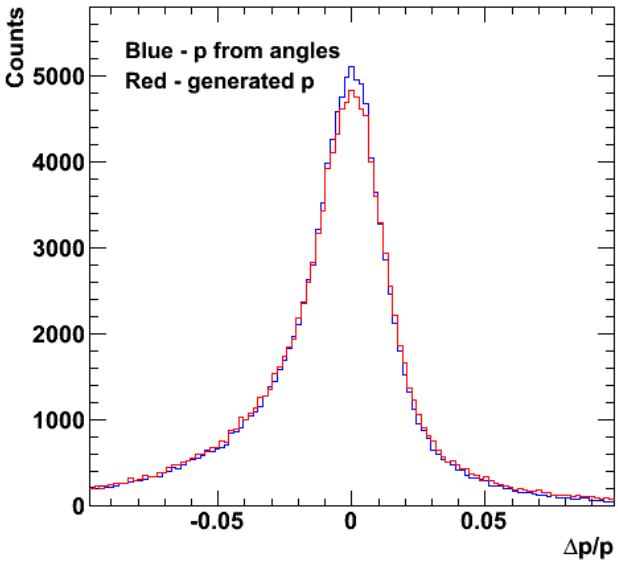
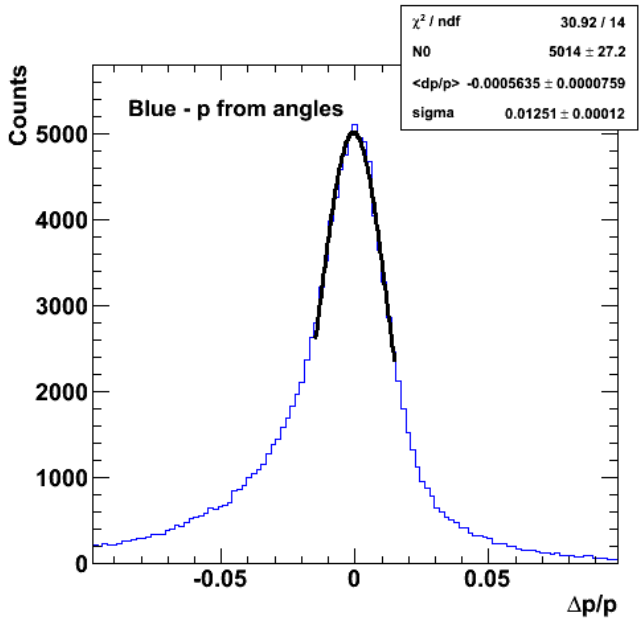


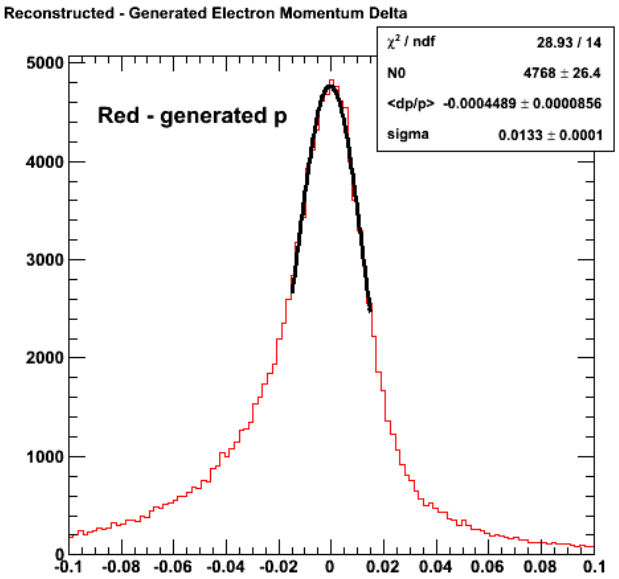
Fig 6. Comarison of Δp/p for momentum derived from the reconstructed angles and the generated momentum.

Click here to view the object (Root macro) you uploaded.

Fit results.



Click here to view the object (Root macro) you uploaded.



Click here to view the object (Root macro) you uploaded.

Fig 7. Fits to the Δp/p spectra.

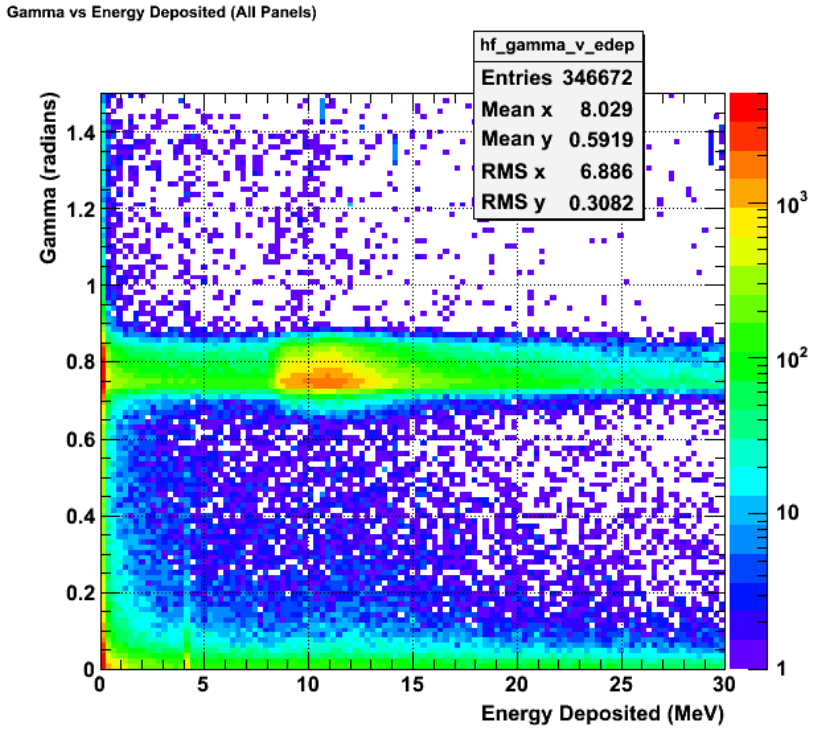
DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 389 - Gamma vs Energy Deposited Plots (Mark Moog)

[Modified Tue Jul 26 21:47:13 2011 (GMT) Mark Moog]

Below I have some gamma vs. energy deposited plots for quasielastic electron-neutron scattering at 11GeV over a large range of scattering angles (4-45 degrees). They are exactly what one would expect after studying gamma and energy deposited separately. There is no interesting dependency between the two.

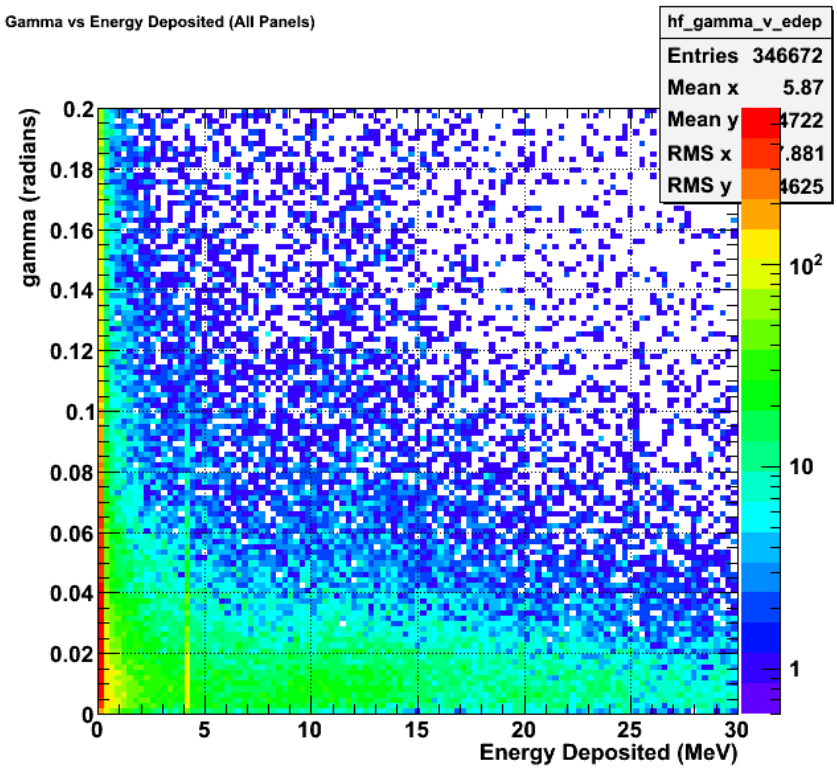
In this first plot you can see the electrons at about .8 radians and the neutrons around 0 radians as exected



2011-07-26 14:50:35

This plot contains all particles, both charged and neutral.

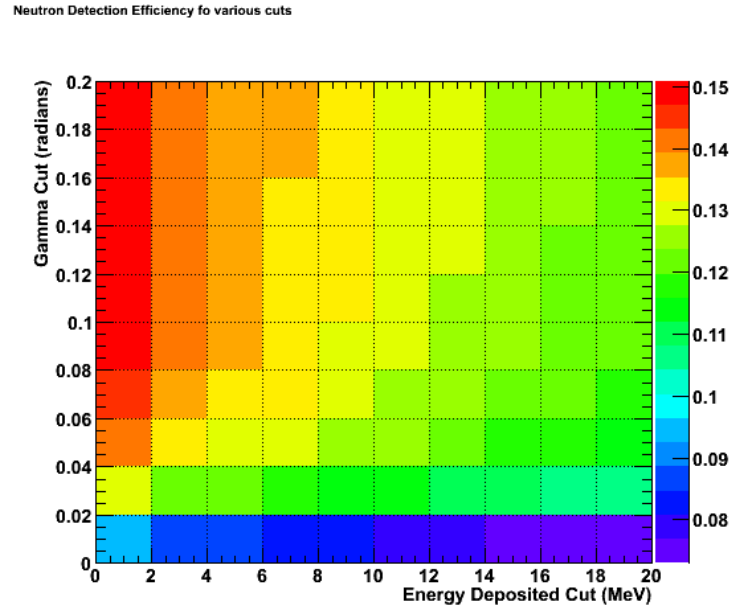
this is the same plot as above, but zoomed in onto the neutron gamma range



2011-07-26 14:55:21

This plot contains all particles, both charged and neutral.

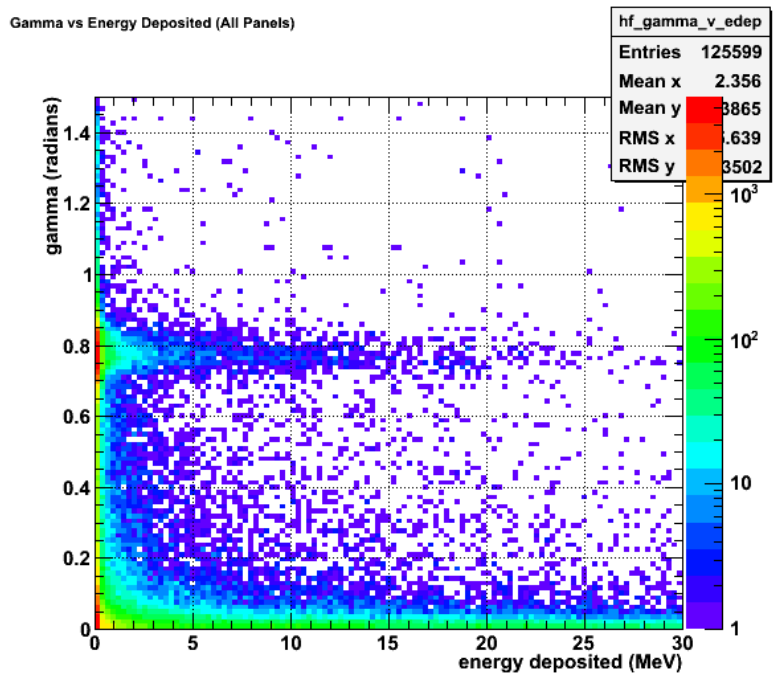
Finally I have the neutron detection efficiency at different combinations of energy deposited and gamma cuts. If the energy deposited cut is set to 0MeV and the gamma cut is set to .17 radians (about 10 degrees) I get a neutron detection efficiency of 17.3% +- 0.1



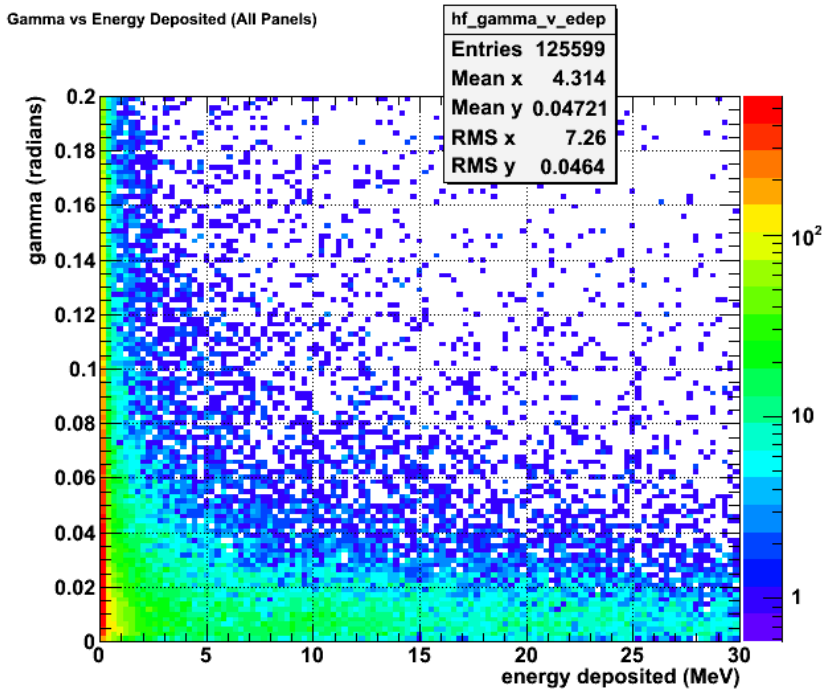
2011-07-26 16:59:20

Click here to view the object (root nde macro) you uploaded.

The plots Below are similar to the plots at the beginning of this entry, except the plots below only contain neutral particles.



2011-07-26 17:40:24
This plot only contains neutral particles. Click here to view the object (root macro) you uploaded.



2011-07-26 17:38:43
This plot only contains neutral particles. Click here to view the object (root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 390 - QE-Inelastic overlap (gpg)

[Modified Wed Aug 3 13:52:16 2011 (GMT) gpg]

Study the overlap of the QE and inelastic events to respond to BQ's questions about the W cut. Data plot is from entry 261.

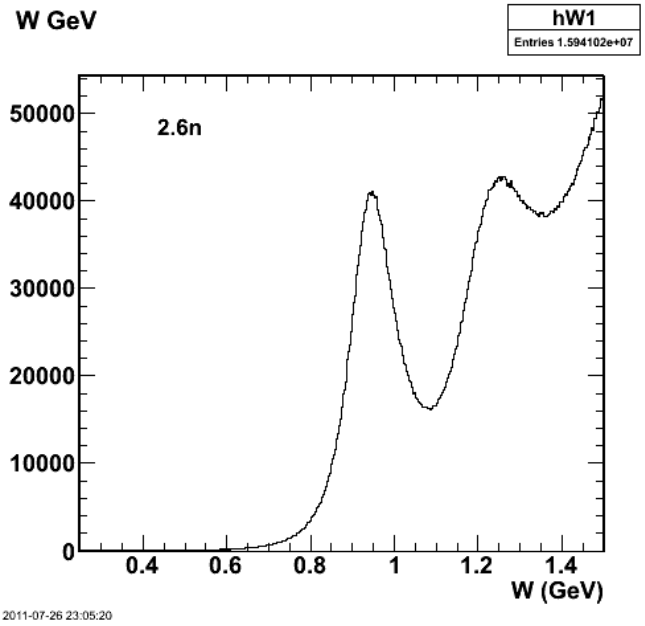


Fig 1. W spectrun for 2.6n.

Click here to view the object (Root macro) you uploaded.

Calculation of W spectrum using PART banks from queeg-genevD. Compare with data; the data are wider.

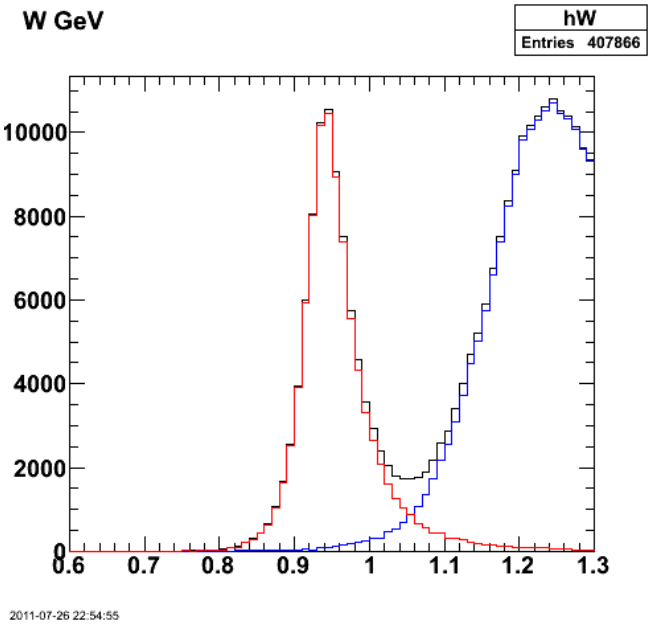


Fig 2. W distribution from queeg-genevD event generator.

Click here to view the object (Root macro) you uploaded.

A study of dip kinematics: What is the effective W for dip kinematics?

```
In Zhou paper (PRL 87, 172301): W = 1.01 GeV

In KJ thesis: W = 1.02 GeV
```

```
In Zhou (Recent Results ...): W = 1.01

In Lourie (PRL 56, 2364): W = 1.07 GeV

In nikhef (Dip1.pdf): W = 1.1 GeV for 12C
Ref:Physics Letters B, Volume 333, Issues 3-4, 4 August 1994, Pages 310-315

In Benhar and Meloni preprint: W=1.14 GeV for 12C
                               W=1.14 GeV for 16O
```

Get a decent comparison of QE+IN that looks like the data.

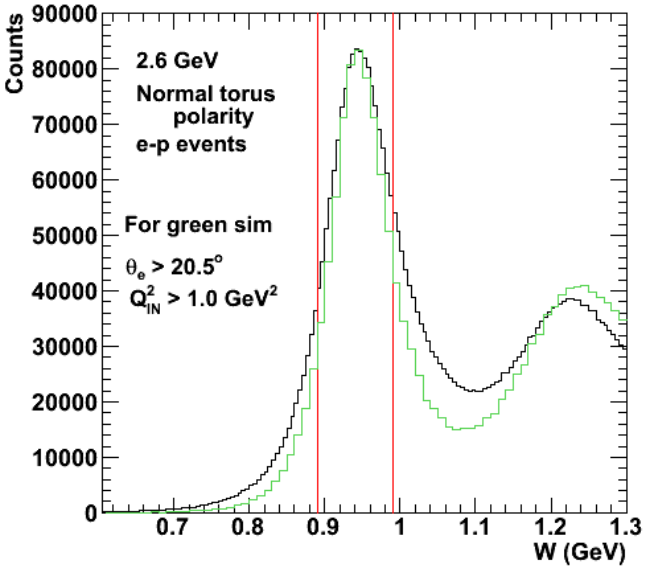
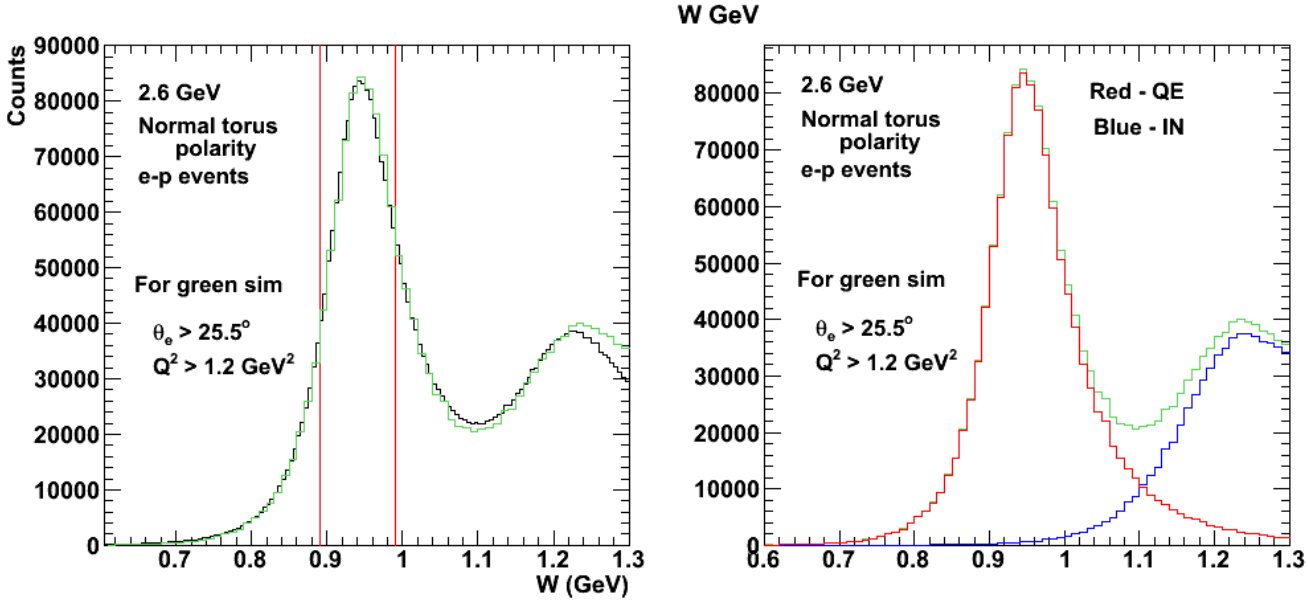


Fig 3. Try increasing Q2 to make the distributions wider in comparison with the e-p results.

Click here to view the object (Root macro) you uploaded.

Increase Q2 to spread things out more like the data. See part2 area in can3 for inputs.



Click here to view the object (Root macro) you uploaded. Click here to view the object (Root macro) you uploaded.

Fig 4. Comparison of QE+IN (from genevD) sim with 2.6n e-p data (left-hand panel). Composition of simulation (right-hand panel). The lower limit on the Q2 for the inelastic events is 1.5 GeV2 not 1.2 GeV2

Inputs for results in Fig 4.

```
in queeg

// 2.6 GeV running
  if(init_energy > 2){ //+3375A data
    theta_min_lab = jDEG2RAD*25.5;// should be 4.5
    theta_max_lab = jDEG2RAD*42.0;
  } else if(init_energy < 2 && Itorus>0){ //+2250A data
    theta_min_lab = jDEG2RAD*25.5;
    theta_max_lab = jDEG2RAD*42.0;
  } else if(init_energy < 2 && Itorus<0){ //-2250A data
    theta_min_lab = jDEG2RAD*25.5;
    theta_max_lab = jDEG2RAD*42.0;
  } else{
    cout << "error in scattering range selection" << endl;
    exit(0);
  }

in genevD

1.5             ! Q2min         WARNING!! If Q2 and W flags are  BOTH=1extraction
3.0             ! Q2max         is made in Q2,W bin; elsewere in Omega,theta bin
1               ! flag to fix W (1=read Wmin,Wmax; 0=ignore them)
0.0             ! Wmin (GeV)
2.000           ! Wmax (GeV)
```

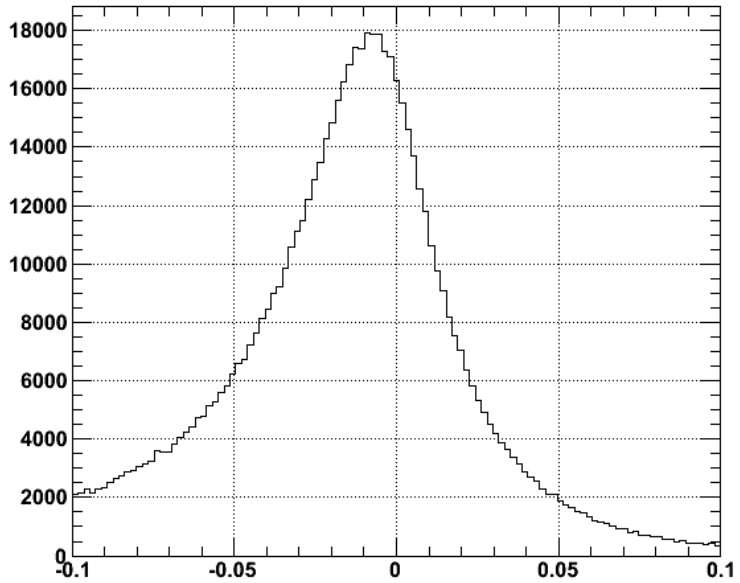
DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 391 - Momentum Resolution (Mark Moog)

[Modified Thu Aug 4 20:14:58 2011 (GMT) Mark Moog]

Below we show the difference in momentum resolution between low momentum electrons and high momentum electrons in quasi-elastic electron neutron scattering. The low momentum plots are for all electrons with a reconstructed momentum below 6GeV while the high momentum plots are for all other electrons. We show (delta p)/p for both generated - reconstructed and "from theta" - reconstructed deltas. There is a large difference in resolution between low momentum and high momentum electrons. This is probably due to the fact that Socrat doesn't include energy loss in its reconstruction of electron momentum, and energy loss has a much greater effect on low momentum electrons; they lose a larger fraction of their energy.

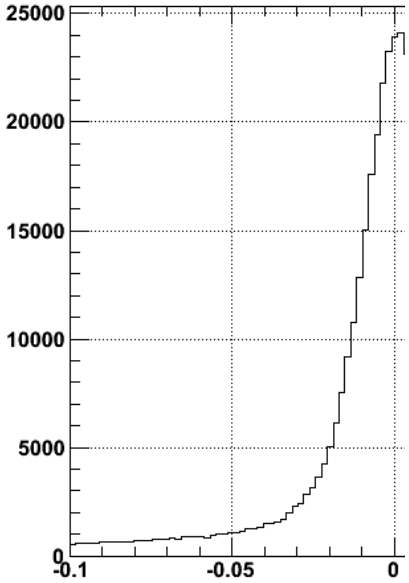
Reconstructed - Generated Electron Momentum Delta (Low)



2011-08-03 17:08:09

ROOT MACRO

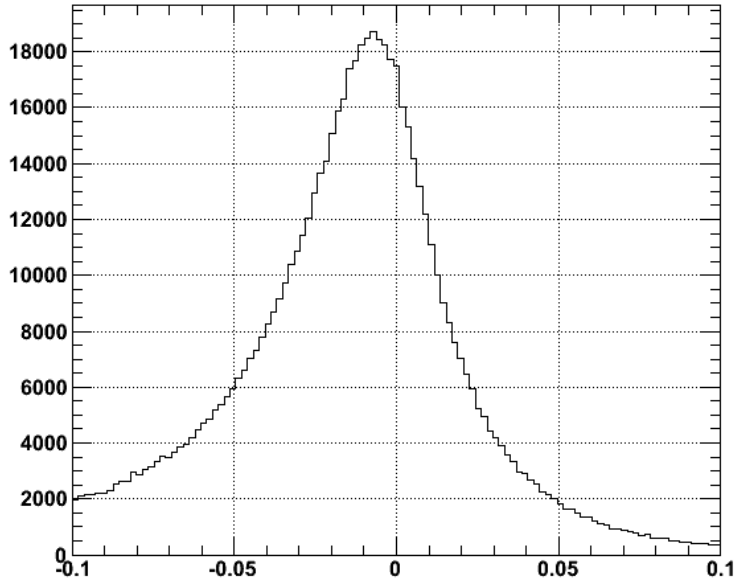
Reconstructed - Generated Electron Moment



2011-08-03 17:07:28

ROOT M

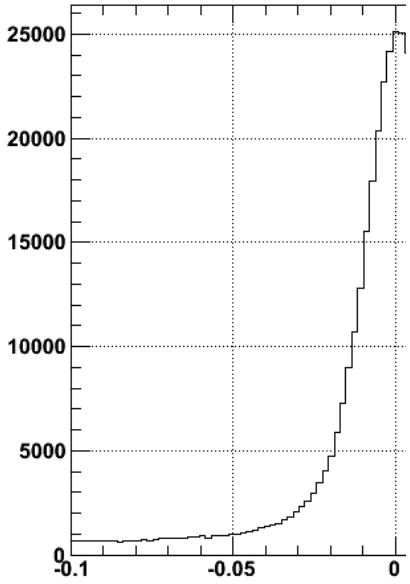
Reconstructed - From Theta Electron Momentum Delta (Low)



2011-08-03 17:08:21

ROOT MACRO

Reconstructed - From Theta Electron Momen



2011-08-03 17:09:05

ROOT M

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 392 - Edep threshold effect on NDE (gpg)

[Modified Sat Aug 6 21:27:55 2011 (GMT) gpg]

Get the Edep threshold first.

1. Use Fig 3.3 in Costy's thesis.
2. low edge of MIP peak is at 7 MeV in gemc simulation.
3. Low edge of MIP peak is at 13.5 mm from zero in Fig 3.3 of Costy's thesis. His units are ADC channel so use gemc sim to set the scale.
4. For threshold = 20 mV (used for production running), the lower limit on the Edep spectrum is 1 mm.
5. Therefore Edep > (1/13.5)*(7 MeV) = 0.52 MeV

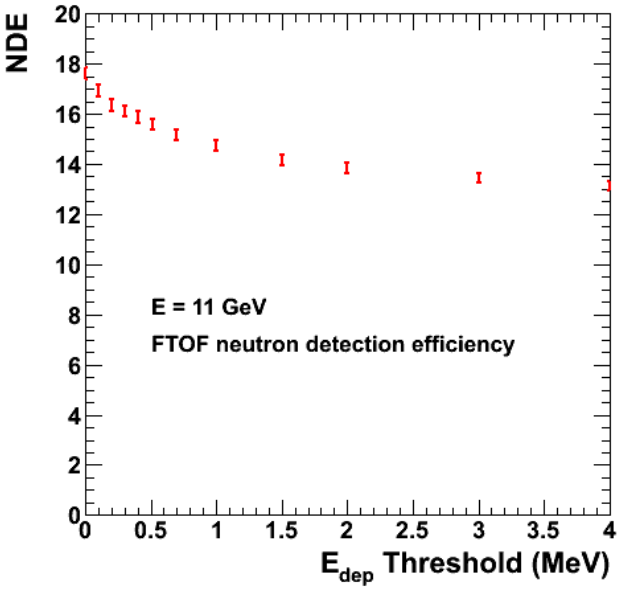
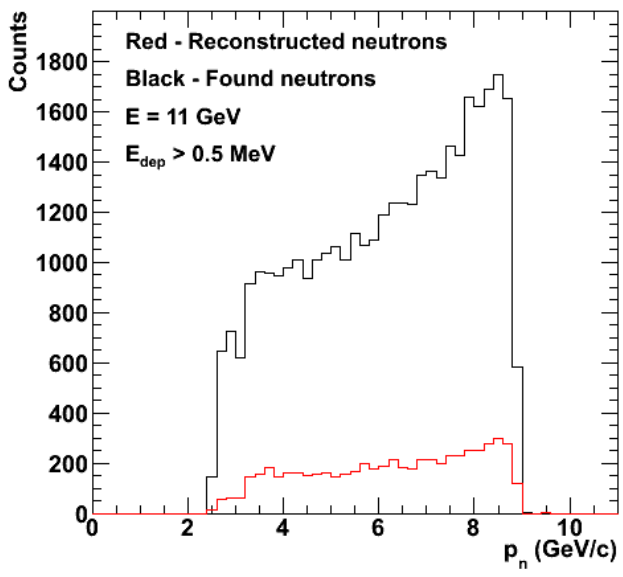
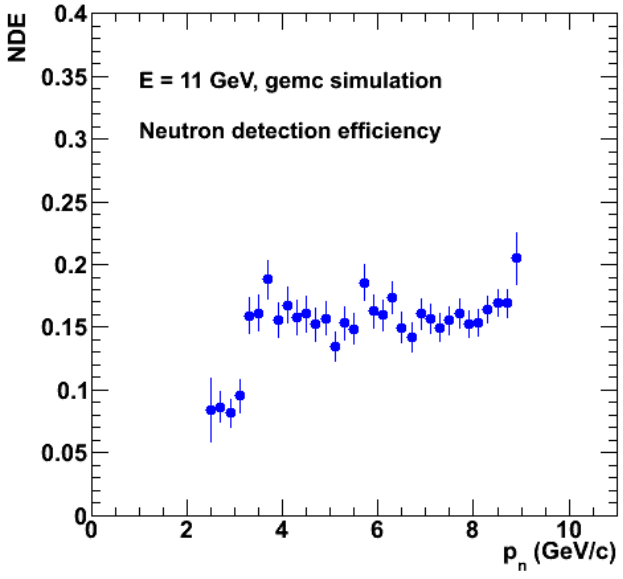


Fig 1. Dependence of NDE on changes to the Edep threshold. Raw data are below.

Click here to view the object (Root macro) you uploaded.



Click here to view the object (Root macro) you uploaded.



Click here to view the object (Root macro) you uploaded.

Fig 2. The left-hand panel shows a comparison of momentum distribution for found (black) and reconstructed (red) neutrons. The right-hand panels shows the NDE extracted from the left-hand panel distributions.

For edep_cut = 0.0

```
Total Neutrons Reconstructed:6524
 - P1A:    5157
 - P1B:    4984
 - P2B:    152
 - P1A and P1B: 0
-----------------------------------------
Total Neutrons Found: 37024
 - P1A only:    34927
 - P1B only:    34978
 - P2B:         1525
-----------------------------------------
Neutron Detection Efficiency: 17.621% +/- 0.24
 - P1A: 14.7651%
 - P1B: 14.249%
 - P2B: 9.96721 percent

tree file: summed_output1.root
```

Click here to view the object (Root histogram file) you uploaded.

For edep_cut = 0.52

```
  98000 events.
Finished creating initial histograms
Total Neutrons Reconstructed:5773
 - P1A:    4618
 - P1B:    4111
 - P2B:    137
 - P1A and P1B: 0
-----------------------------------------
Total Neutrons Found: 37024
 - P1A only:    34927
 - P1B only:    34978
 - P2B:         1525
-----------------------------------------
Neutron Detection Efficiency: 15.5926%  +/- 0.22
 - P1A: 13.2219%
 - P1B: 11.7531%
 - P2B: 8.98361 percent
Macro Complete

tree file: summed_output1.root
```

For edep_cut = 0.2

```
98000 events.
Finished creating initial histograms
Total Neutrons Reconstructed:6057
 - P1A:    4785
 - P1B:    4398
 - P2B:    144
 - P1A and P1B: 0
-----------------------------------------
Total Neutrons Found: 37024
 - P1A only:    34927
 - P1B only:    34978
 - P2B:         1525
-----------------------------------------
Neutron Detection Efficiency: 16.3597% +/- 0.23
 - P1A: 13.7%
 - P1B: 12.5736%
 - P2B: 9.44262 percent
Macro Complete
```

edep_cut = 0.1

```
Finished creating initial histograms
Total Neutrons Reconstructed:6263
 - P1A:    4936
 - P1B:    4584
 - P2B:    147
 - P1A and P1B: 0
-----------------------------------------
Total Neutrons Found: 37024
 - P1A only:    34927
 - P1B only:    34978
 - P2B:         1525
-----------------------------------------
Neutron Detection Efficiency: 16.9161% +/- 0.23
 - P1A: 14.1323%
 - P1B: 13.1054%
 - P2B: 9.63934 percent
Macro Complete
```

edep_cut = 0.3

```
Finished creating initial histograms
Total Neutrons Reconstructed:5963
 - P1A:    4729
 - P1B:    4285
```

```
 - P2B:    143
 - P1A and P1B: 0
-----------------------------------------
Total Neutrons Found: 37024
 - P1A only:    34927
 - P1B only:    34978
 - P2B:         1525
-----------------------------------------
Neutron Detection Efficiency: 16.1058% +/- 0.22
 - P1A: 13.5397%
 - P1B: 12.2506%
 - P2B: 9.37705 percent
Macro Complete
```

edep_cut = 0.4

```
Finished creating initial histograms
Total Neutrons Reconstructed:5875
 - P1A:    4680
 - P1B:    4194
 - P2B:    140
 - P1A and P1B: 0
-----------------------------------------
Total Neutrons Found: 37024
 - P1A only:    34927
 - P1B only:    34978
 - P2B:         1525
-----------------------------------------
Neutron Detection Efficiency: 15.8681% +/- 0.22
 - P1A: 13.3994%
 - P1B: 11.9904%
 - P2B: 9.18033 percent
Macro Complete
```

edep_cut = 0.7

```
Finished creating initial histograms
Total Neutrons Reconstructed:5615
 - P1A:    4535
 - P1B:    3987
 - P2B:    131
 - P1A and P1B: 0
-----------------------------------------
Total Neutrons Found: 37024
 - P1A only:    34927
 - P1B only:    34978
 - P2B:         1525
-----------------------------------------
Neutron Detection Efficiency: 15.1658%
 - P1A: 12.9842%
 - P1B: 11.3986%
 - P2B: 8.59016 percent
Macro Complete
```

edep_cut = 1.0

```
Finished creating initial histograms
Total Neutrons Reconstructed:5453
 - P1A:    4459
 - P1B:    3844
 - P2B:    127
 - P1A and P1B: 0
-----------------------------------------
Total Neutrons Found: 37024
 - P1A only:    34927
 - P1B only:    34978
 - P2B:         1525
-----------------------------------------
Neutron Detection Efficiency: 14.7283% +/- 0.21
 - P1A: 12.7666%
 - P1B: 10.9898%
 - P2B: 8.32787 percent
Macro Complete
```

edep_cut = 1.5

```
Finished creating initial histograms
Total Neutrons Reconstructed:5250
 - P1A:    4360
 - P1B:    3675
 - P2B:    119
 - P1A and P1B: 0
-----------------------------------------
Total Neutrons Found: 37024
 - P1A only:    34927
 - P1B only:    34978
 - P2B:         1525
-----------------------------------------
Neutron Detection Efficiency: 14.18% +/- 0.21
 - P1A: 12.4832%
 - P1B: 10.5066%
 - P2B: 7.80328 percent
Macro Complete
```

edep_cut = 2.0

```
Finished creating initial histograms
Total Neutrons Reconstructed:5118
 - P1A:    4296
 - P1B:    3549
 - P2B:    117
 - P1A and P1B: 0
-----------------------------------------
Total Neutrons Found: 37024
 - P1A only:    34927
 - P1B only:    34978
 - P2B:         1525
-----------------------------------------
Neutron Detection Efficiency: 13.8235% +/- 0.21
 - P1A: 12.2999%
 - P1B: 10.1464%
 - P2B: 7.67213 percent
Macro Complete
```

edep_cut = 3.0

```
Finished creating initial histograms
Total Neutrons Reconstructed:4978
 - P1A:    4203
 - P1B:    3402
 - P2B:    114
 - P1A and P1B: 0
-----------------------------------------
Total Neutrons Found: 37024
 - P1A only:    34927
 - P1B only:    34978
 - P2B:         1525
-----------------------------------------
Neutron Detection Efficiency: 13.4453% +/- 0.20
 - P1A: 12.0337%
 - P1B: 9.72611%
 - P2B: 7.47541 percent
Macro Complete
```

edep_cut = 4.0

```
Finished creating initial histograms
Total Neutrons Reconstructed:4857
 - P1A:    4127
 - P1B:    3294
 - P2B:    111
 - P1A and P1B: 0
-----------------------------------------
Total Neutrons Found: 37024
 - P1A only:    34927
 - P1B only:    34978
 - P2B:         1525
-----------------------------------------
Neutron Detection Efficiency: 13.1185% +/-
 - P1A: 11.8161%
 - P1B: 9.41735%
 - P2B: 7.27869 percent
Macro Complete
```

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 393 - How I run NDE calculations (Mark Moog)

[Modified Fri Aug 5 19:22:16 2011 (GMT) Mark Moog]

Here I will take you through the process of running NDE calculations using my event generator, gemc, Socrat, and my analysis code

The first step is to use a perl script I call submit_nde.pl. This basically takes another script called bSubmit, and sends it out to the nodes of the cluster. bSubmit then runs a series of programs to simulate quaielastic electron-neutron scattering and sends the results back to the head node. Submit_nde.pl contains variable:

num_jobs -- the number of jobs you want to submit (how many cores do you want to use)

events_per_job -- which is the number of events per job you submit. The total number of events simulated is num_jobs * events_per_job

theta_min -- the minimum theta angle an electron should have in the simulation. Since angle and momentum are related, this also effects the maximum momentum an electron will have

theta_spread -- the spread past the minimum angle over which electrons will scatter

Ebeam -- keep this at 11.0GeV

here is submit_nde.pl

submit_nde.pl copies the content of bSubmit.sh to a new file and enters the variables such as events_per_job and theta_min into the new file. this file is then submitted to a node and executed. The contents of the bSubmit.sh file are as follows

The first section of the file are variables which are used in the simulation. The important part of bSubmit is the sequence of code it executes at the end

Step 1: nElasticEventGenerator -- this generates quaielastic e(n) events to feed into gemc

Step 2: gemc --simulate the events in the detector

Step 3: evio2root -- convert gemc's output from evio to root

Step 4: Socrat -- reconstruct electrons and enter important neutron reconstruction info into a root file

After Socrat runs its output is transfered back to the head node where I run my final analysis code.

here is bSubmit.sh

Finally I run my analysis code. This consists of three components:

analyze.C -- this is the only code you should run directly. It sets the values for many variables used throughout the analysis and calls other routines. It is a root program and should be executed using the command 'root -xb analyze.C++'

neutronTracking.h and neutronTracking.C -- these files were generated automatically with root to loop through the events in the neutronTracking tree, and were then modified for NDE alaysis. They calculate the NDE for each panel, as well as total NDE and create a bunch of initial histograms in a file called hists.root. Tweaking the NDE calculations should be done here.

createHists.C -- this code manipulates the initial histograms to create the final histograms you would want.

Click here to view the object (analyze.C) you uploaded.

Click here to view the object (createHists.C) you uploaded.

Click here to view the object (neutronTracking.h) you uploaded.

Click here to view the object (neutronTracking.C) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 394 - No P1B NDE (gpg)

[Modified Mon Aug 8 11:56:12 2011 (GMT) gpg]

To test the accuracy of gemc and geant4 we ran the CLAS12 simulation for elastic neutron scattering with the P1B panel removed from the FTOF. This enables us to make a comparison with the E5 measurement of the NDE since the P1A and P2B panels are the same ones used in CLAS6. There is a dip at low neutron momentum (see Fig 1.) that is due to the small gap between the P1A and P2B panels. Fig 2. shows a neutron track that at -BEAM_P="neutron,3.29*GeV, 35.0*deg, 0*deg" that slips between the two FTOF panels. The gemc command is the following.

```
gemc -gcard=p1a.gcard -DBHOST=quark.richmond.edu -DBUSER=clasuser -BEAM_P="neutron,3.29*GeV, 35.0*deg, 0*deg"
```

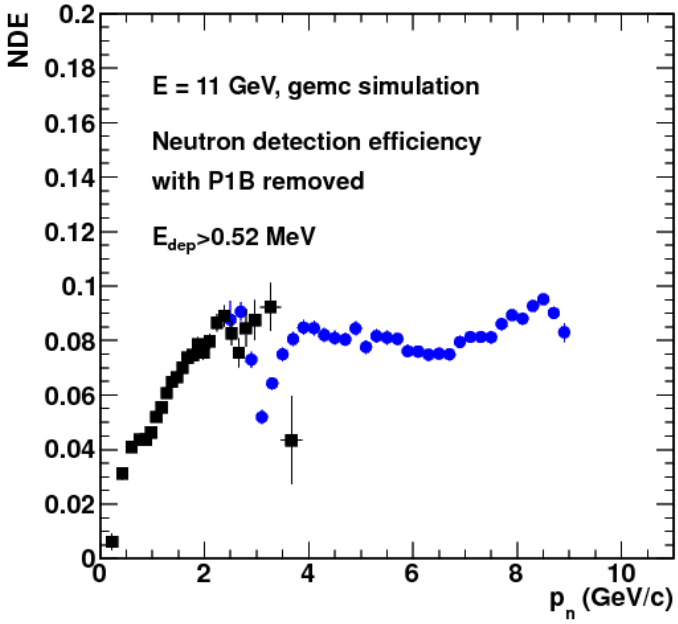


Fig 1. NDE for CLAS12 from gemc with panel P1B removed.

Click here to view the object (Root macro) you uploaded.

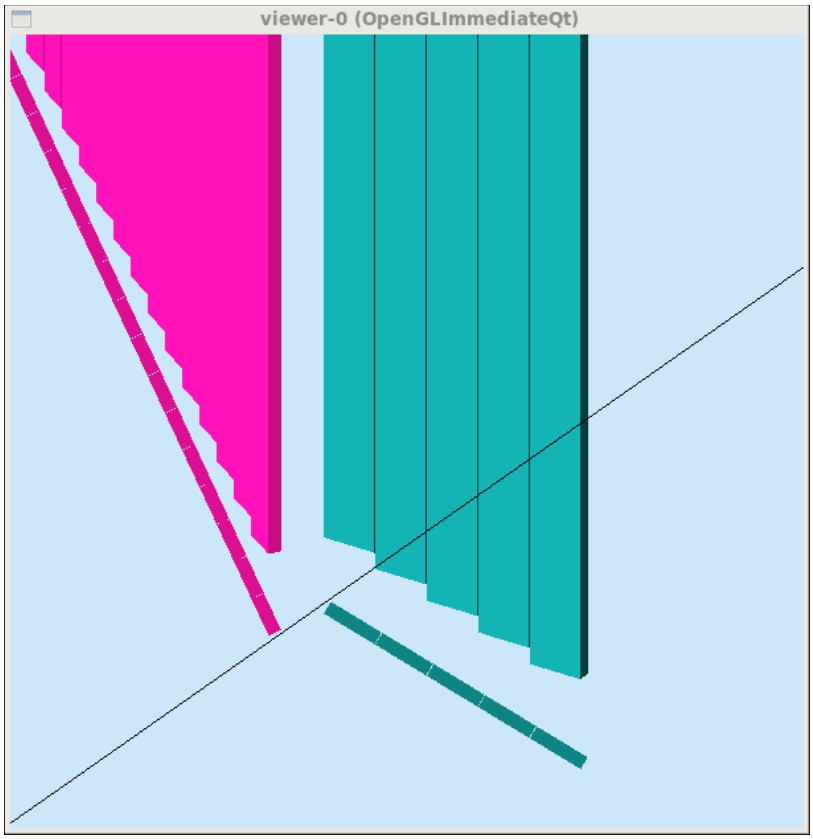


Fig 2. Neutron track from gemc showing $\theta_n=35^o$ track that does not strike either panel.

This gap will be covered by the new FTOF panel p1b.

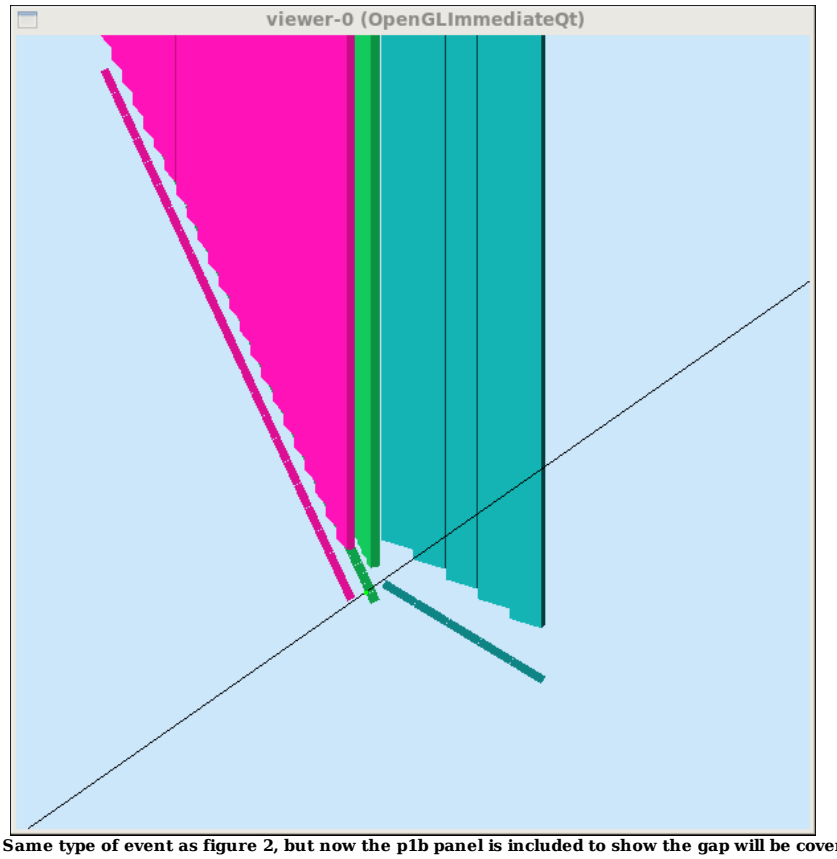


Fig3. Same type of event as figure 2, but now the p1b panel is included to show the gap will be covered.

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Jerry Gilfoyle's Enotebook page 395 - EC ADC (gpg)

[Modified Tue Aug 9 18:34:58 2011 (GMT) gpg]

The algorithm for turning deposited energy (Edep) in the EC and turning it into ADC channels was copied from gsim. Unfortunately, it looks like the value of the ADC is too small. See the two plots below.

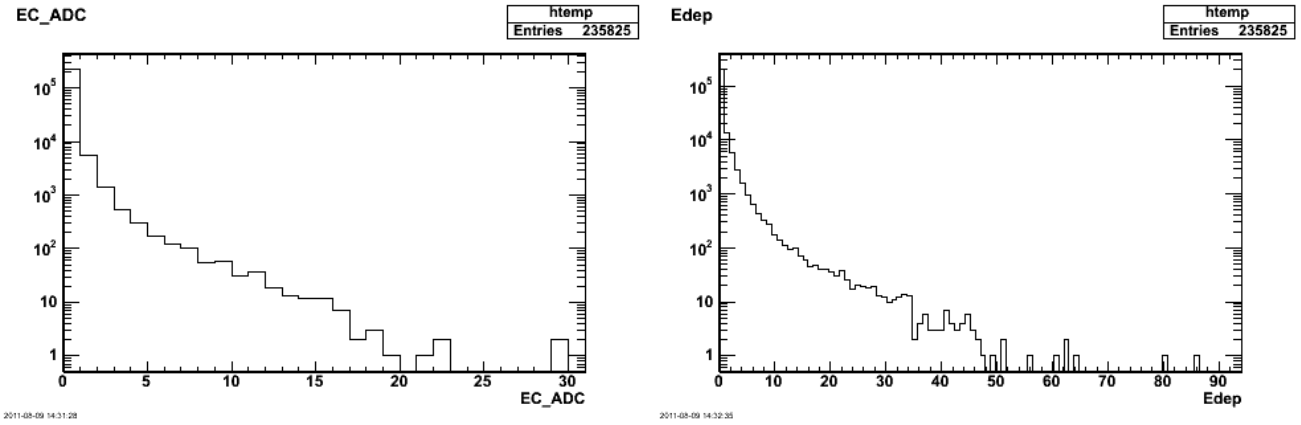


Fig 1. ADC histogram of the deposited energy for electrons (left-hand panel) and the histogram of the deposited energy (right-hand panel).

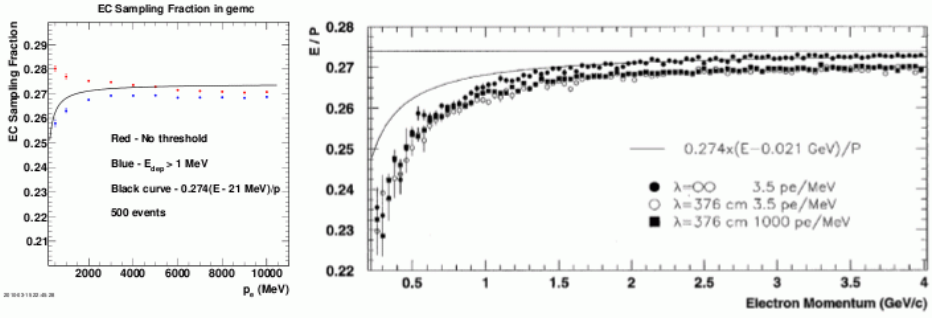
DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 396 - Update on CLAS12 EC sampling fraction (gpg)

[Modified Thu Aug 11 00:30:04 2011 (GMT) gpg]

Check and update the results for measuring the sampling fraction of the EC for CLAS12 using the gemc simulation.

1. CLAS6 results from EC NIM paper (NIM A460 (2001) 239-265) using GSIM.
2. Black curve in each plot based on ionization energy loss in materials preceding the EC.
3. Caveats: (1) electrons passed through different material, (2) $\vec{B}$ field off in the CLAS12 simulation and $\vec{B}$ field on in the CLAS6 simulation, (3) tracking used in CLAS6 simulation while Monte Carlo information used for CLAS12, (4) energy loss out the back, ...
4. Note different horizontal ranges.



gemc and GSIM sampling fractions are consistent to 10-15%.

Fig 1. Results shown at software meetings.

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Jerry Gilfoyle's Enotebook page 397 - Check on final 2.6n ALTp (gpg)

[Modified Thu Aug 11 18:56:25 2011 (GMT) gpg]

In responding to BQ's questions on the CAN check that I get consistent results for ALTp at 2.6n.

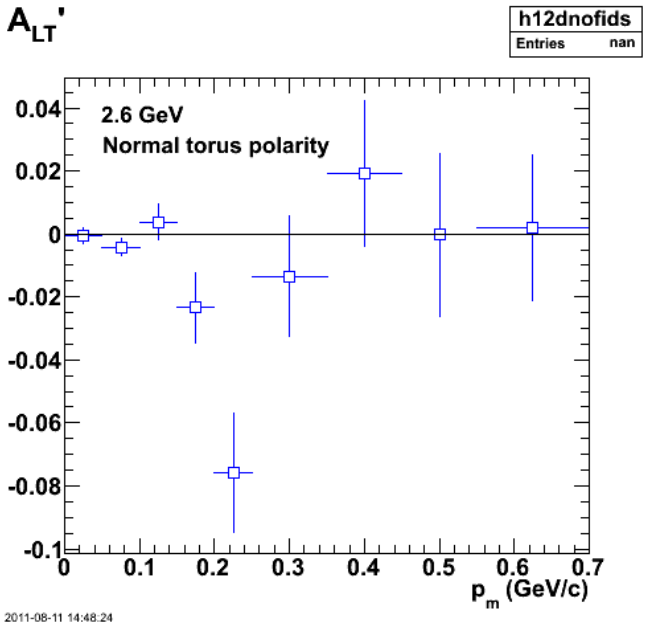


Fig 1. 2.6n ALTp final version with fids off, RC on.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (tarred, gzipped archive of root/eod5c and run/ directories immediately after generating the plot above.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 398 - Check on final 2.6r ALTp (gpg)

[Modified Fri Sep 2 17:55:21 2011 (GMT) gpg]

AS in the previous entry check on final ALTp results for 2.6r.

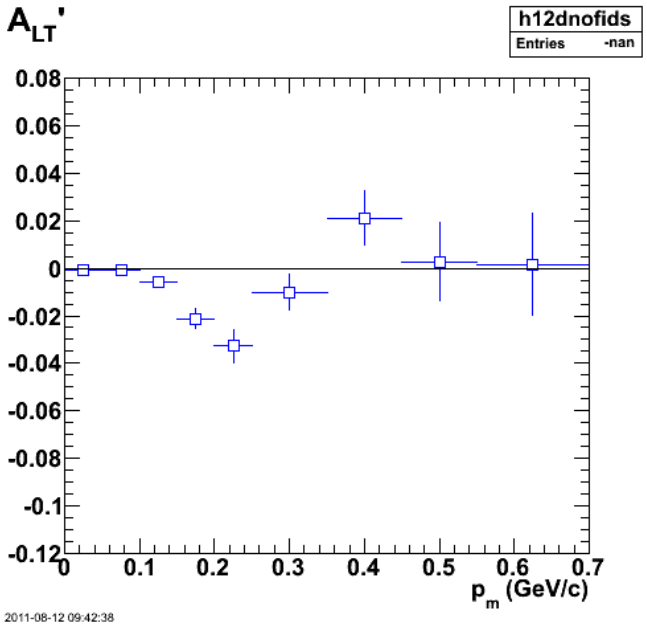


Fig 1. 2.6r ALTp final version with fids off, RC on.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (tarred, gzipped archive of root/eod5c and run/ directories immediately after generating the plot above.) you uploaded.

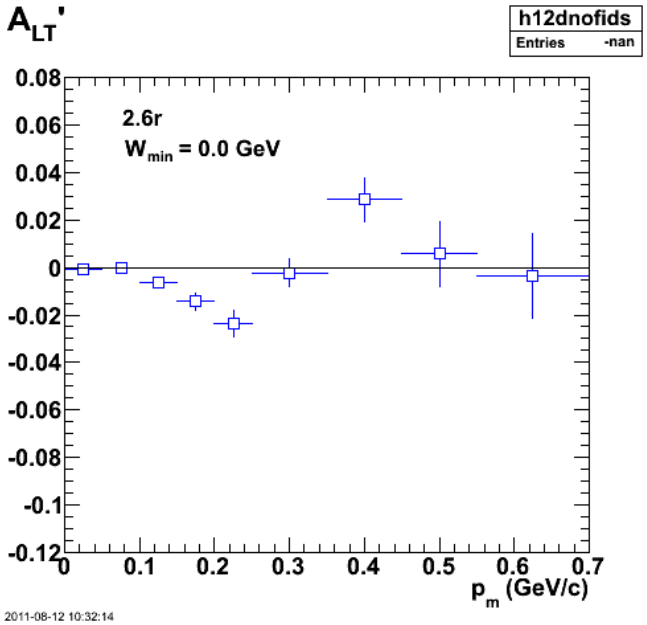


Fig 2. 2.6r ALTp final version with fids off, RC on, and Wmin=0.0.

Click here to view the object (Root macro) you uploaded.

Change the method for extracting QE events (see entry 400) to the Wvo method and compare with previous results. There is NO cut on xBJ here (see entry 400 again) so this is very encouraging.

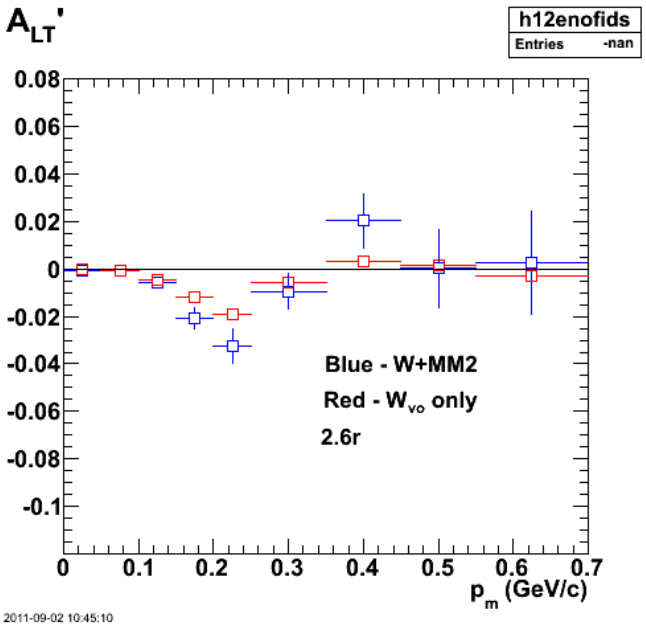


Fig. 3. 2.6r ALTp final version with fids off, RC on, and Wvo_min=0.0.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

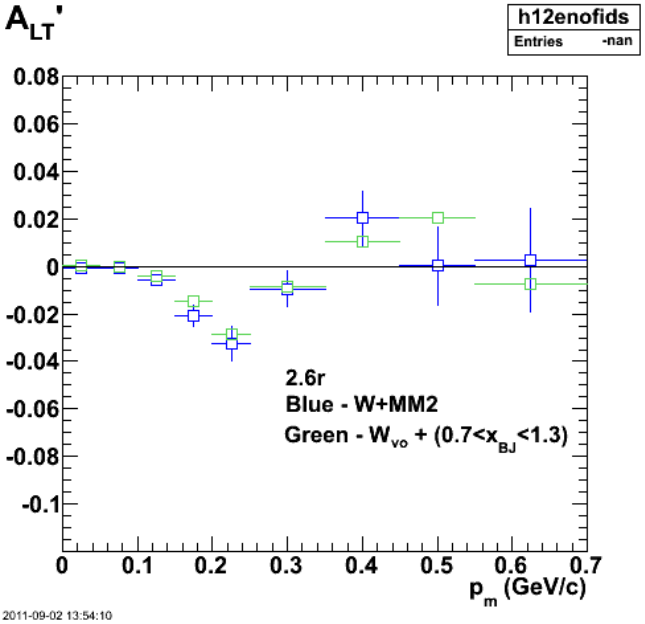


Fig 4. 2.6r ALTp final version with fids off, RC on, and Wvo_min=0.0.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (Root histogram file) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 399 - Impact of Edep threshold on sampling fraction (gpg)

[Modified Mon Aug 15 20:26:55 2011 (GMT) gpg]

Try to reproduce some of the past results on the sampling fraction for the EC using gemc and analysis of the hits results. The effect of the threshold is very different from my previous results that I have presented in talks. Damn. Fig 1 below used the root function sf3 defined in samplingFraction8.C on the results of a gemc simulation.

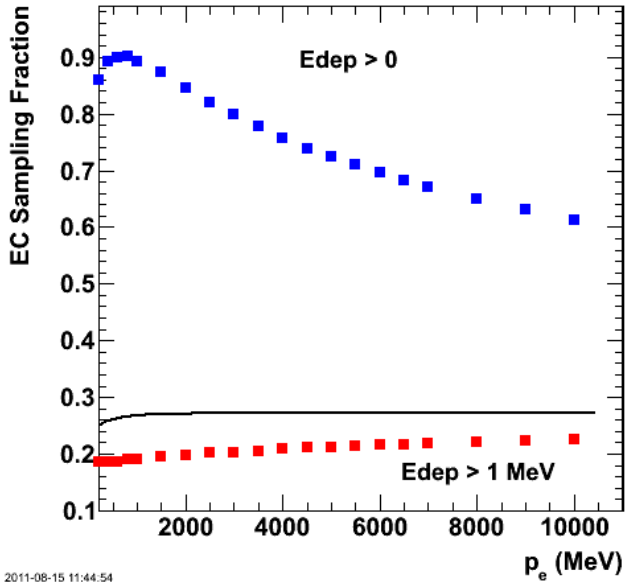


Fig 1. Sampling fraction for EC from gemc simulation using different Edep threshold. The black curve is the expected result which is consistent with past results.

Click here to view the object (Root macro) you uploaded.

I am seeing very different behavior in the eC than I saw before. The Edep spectrum looks very different. See entry 316 for more. The current Edep spectrum looks like the following. It does not have the long high Edep tail observed in entry 316.

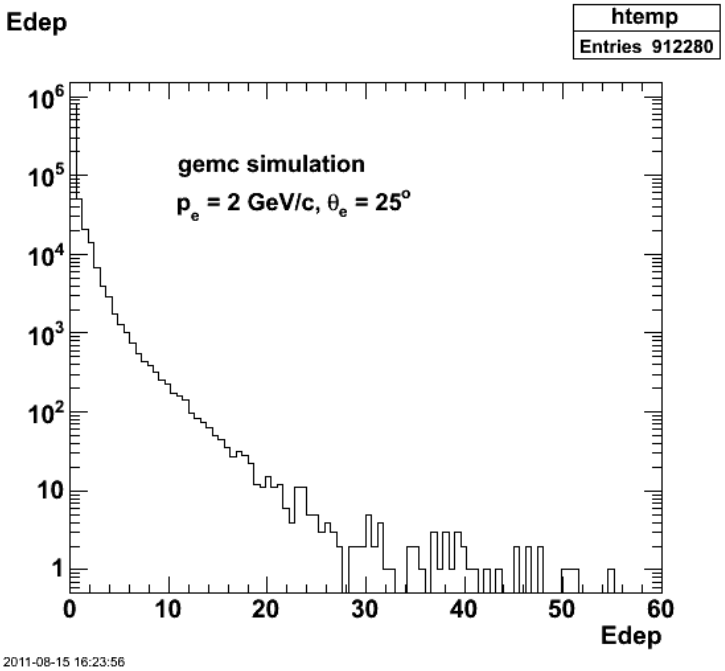


Fig 1. Edep for recent gemc run. Compare with entry 316.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 400 - W_{vo} study (gpg)

[Modified Tue Sep 20 22:07:33 2011 (GMT) gpg]

Try using WVO's formula for the residual mass in exclusive electron scattering to get at the QE events. His formula is the following with explanation from his email.

W_n=\sqrt(M_d^2-2 M_d E_p+m_n^2+2(M_d-E_p\)nu-Q^2 +2|\vec{p}||\vec{q}|\cos theta_{pq}}

Where M_d is the deuteron mass, m_n is the nucleon mass, E_p and \vec{p} are the energy and momentum of the detected nucleon, nu is the energy transfer, Q^2 is the negative of the square of the four-momentum transfer and theta_{pq} is the angle between the detected nucleon and the three-momentum transfer. In an ideal world with no experimental complications, there would be a sharp peak at W_n=m_n which would fall to zero and then start to rise at W_n=m_n+m_{pi}. Once this is done, the question of whether you are in the quasielastic region, the dip region, etc. Is determined by x. The expression you have used for W_n can be obtained by ignoring the binding energy of the deuteron using M_d=2 m_n and setting p=0. I have not examined your kinematics again to see if this is a good approximation, but it may be that using the correct expression would tighten things up a bit.

There are serious problems with my analysis below. The fix is finally reached for Figs. 14-15.

The plot below compares W and Wvo spectra for 2.6r. The main QE peak is significantly sharper for Wvo than W, but there appears to be more (???) background underneath the QE peak!

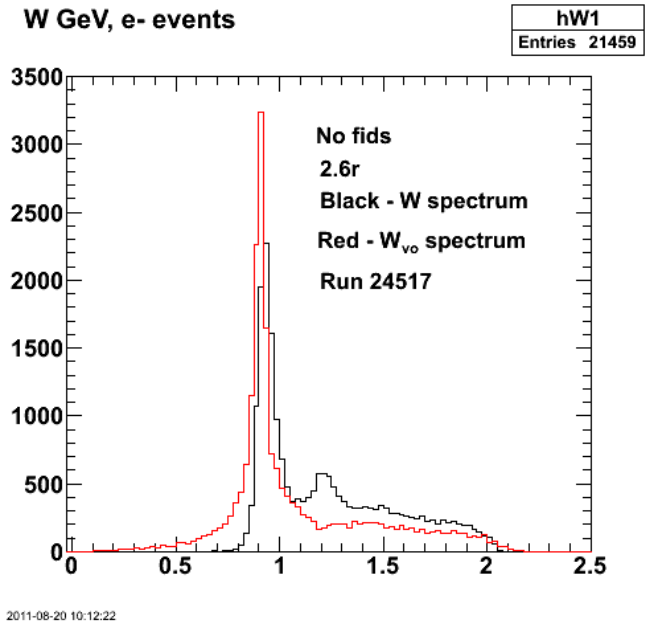


Fig 1. Comparison of W spectrum with Wvo.

Click here to view the object (Root macro) you uploaded.

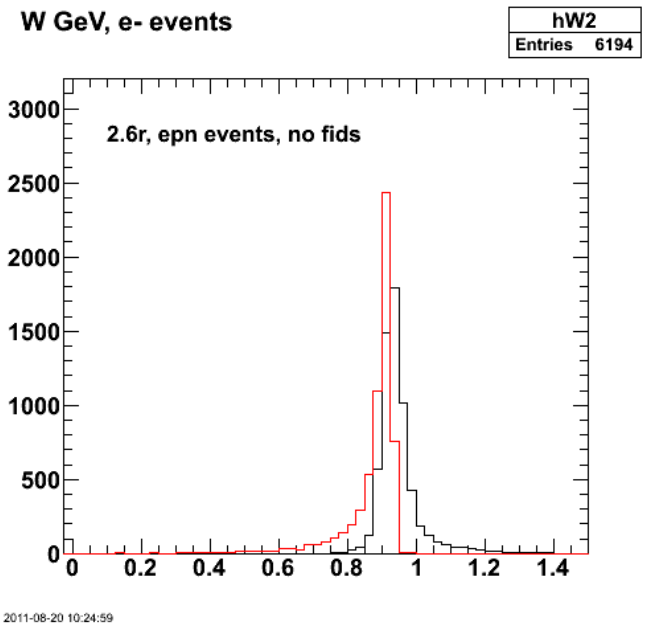


Fig 2. Now turn on neutron MM cut.

Click here to view the object (Root macro) you uploaded.

Plotting Fig 2 on a log scale, the low Wvo tail looks like the reflection of the high-W tail.

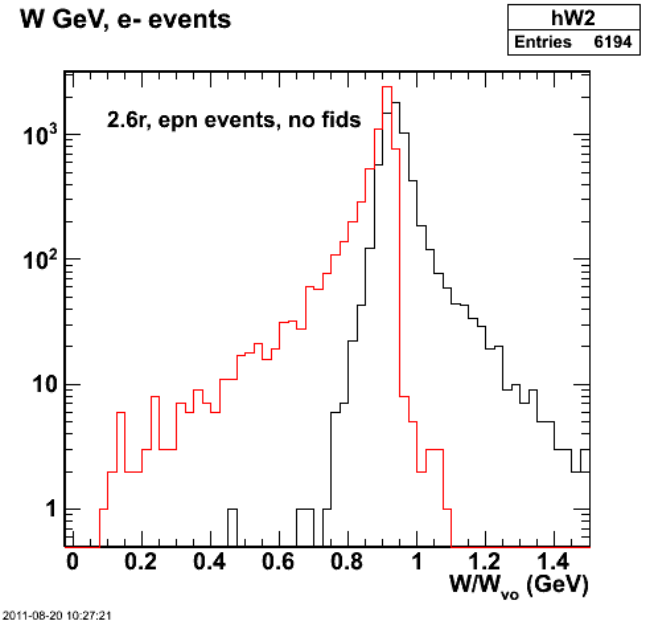


Fig 3. Same as fig 2, but on log scale.

Obvious problem with Eproton.

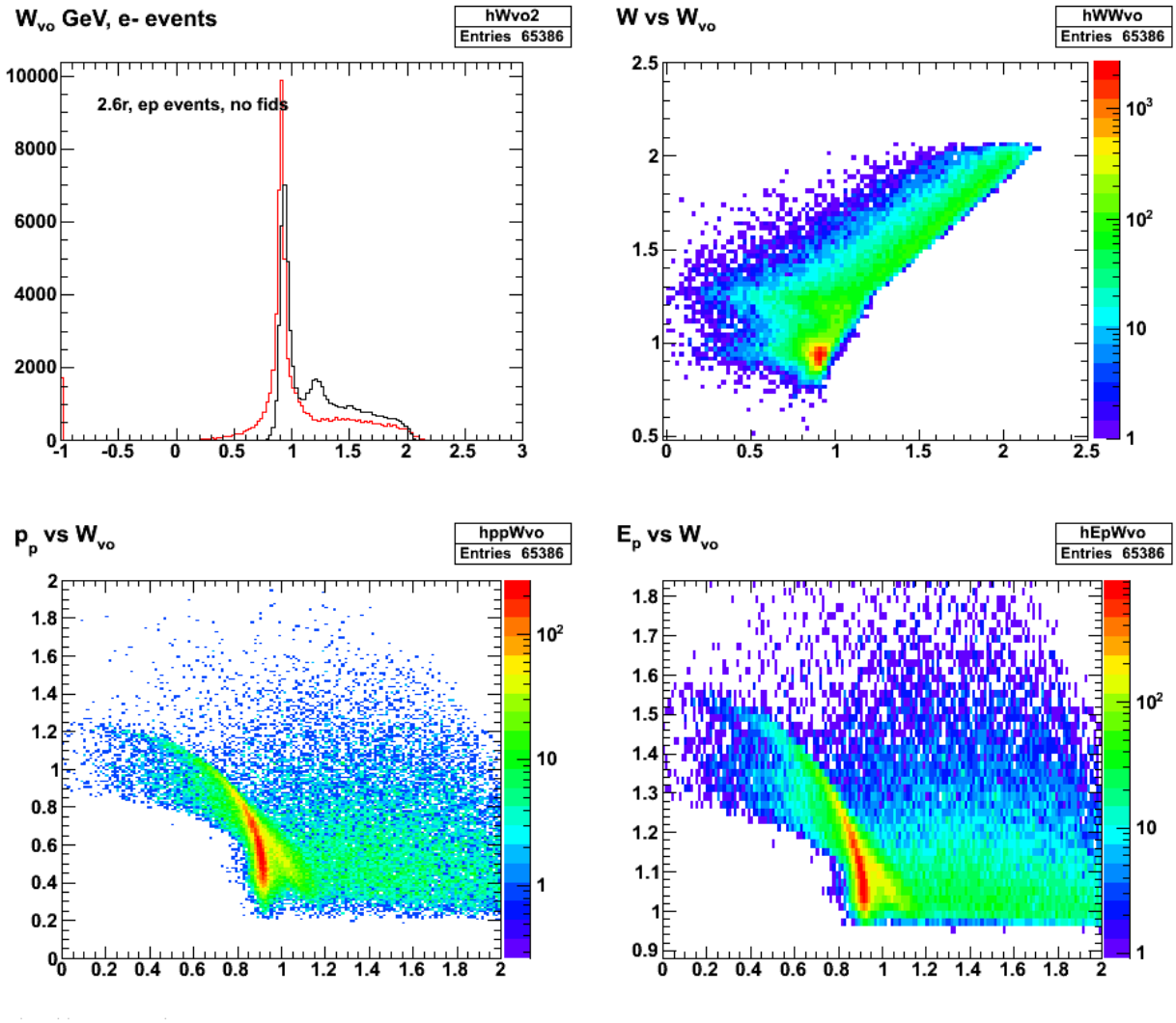


Fig 3. Dependence of Wvo on various quantities.

Click here to view the object (Root macro) you uploaded.

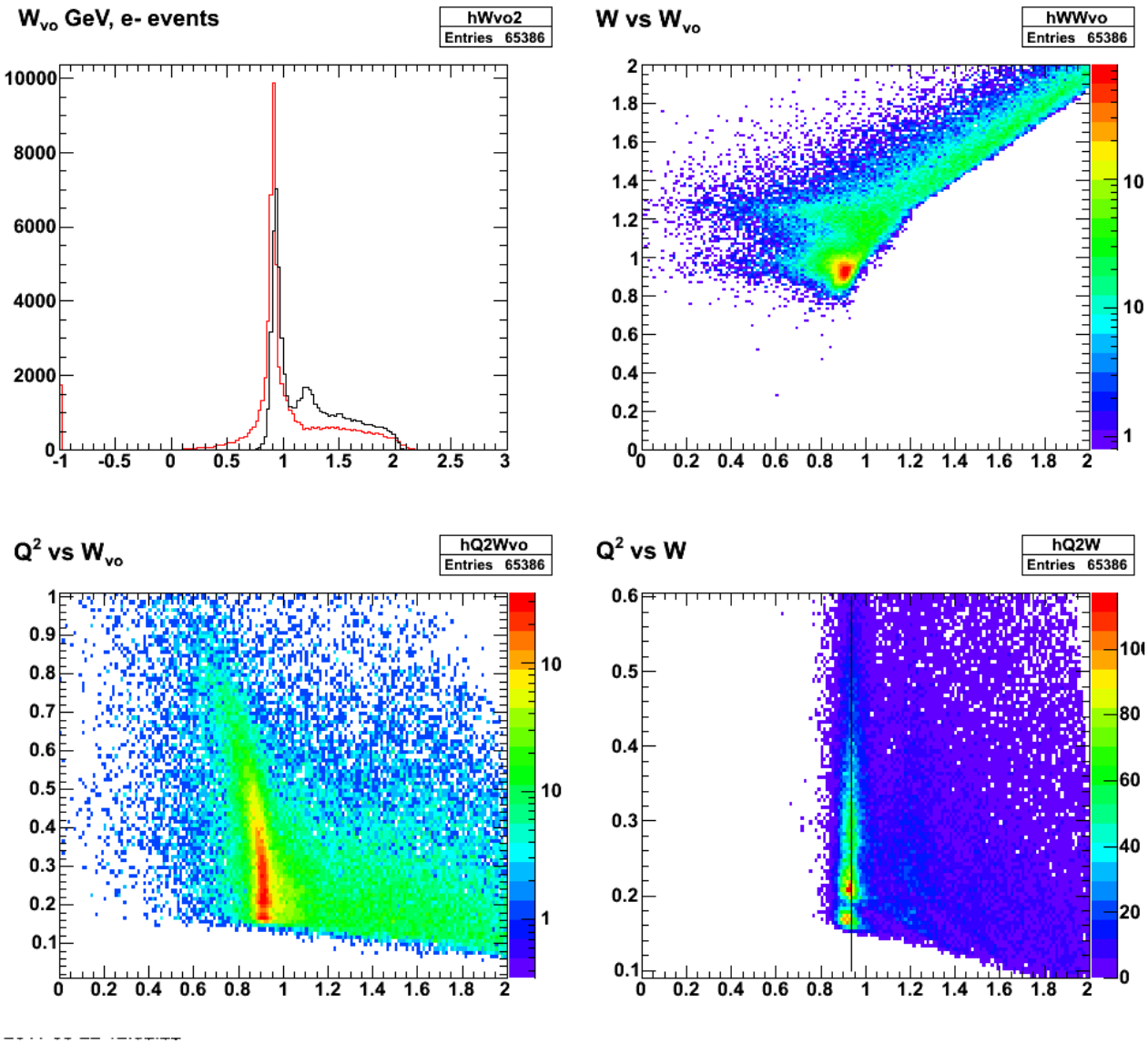


Fig 4. Look at Q2 dependence of W and Wvo.

Click here to view the object (Root macro) you uploaded.

Is this really due to proton energy loss. Calculate the proton momentum assuming QE scattering and a true neutron spectator. The plot below shows an asymmetric tail on the negative side of Δ p/p indicative of proton energy loss.

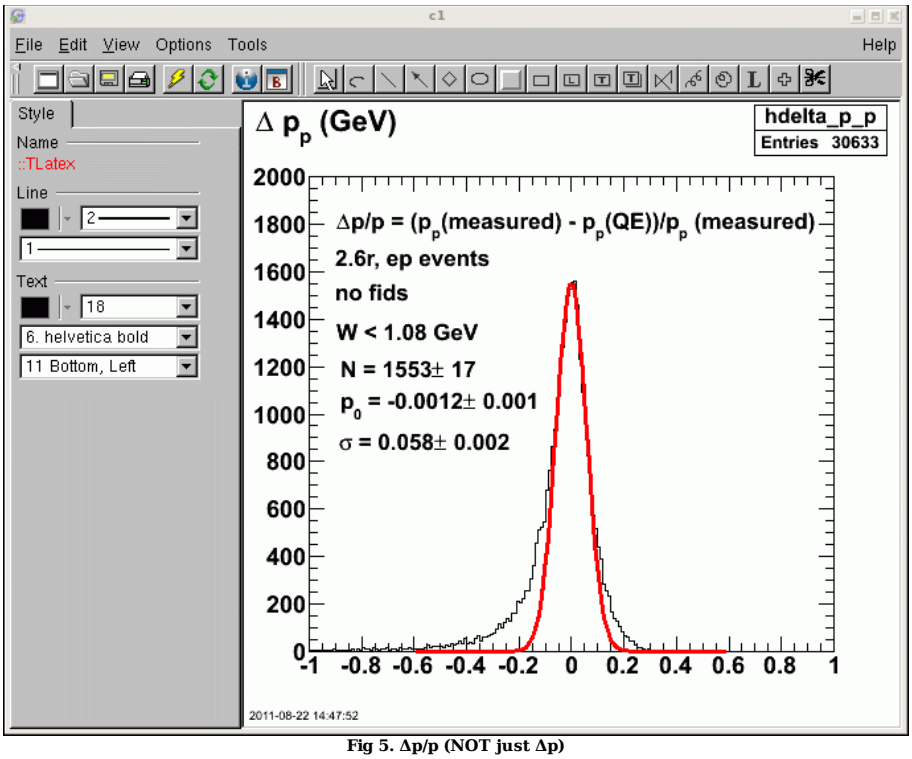
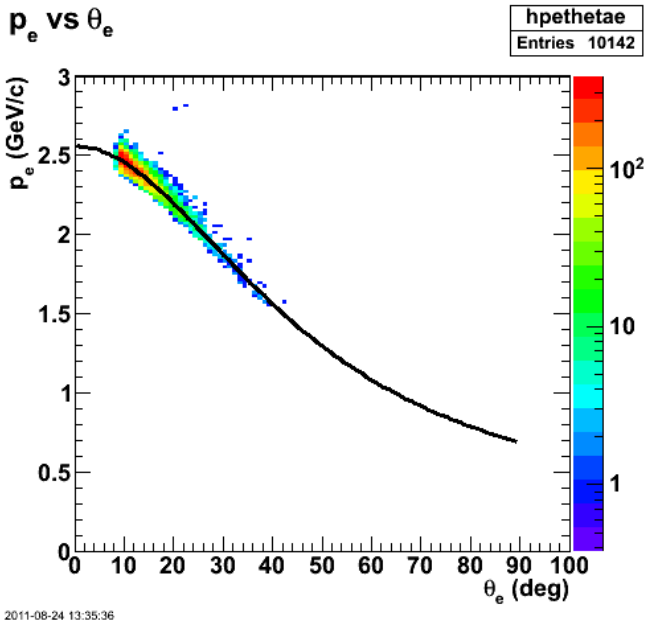
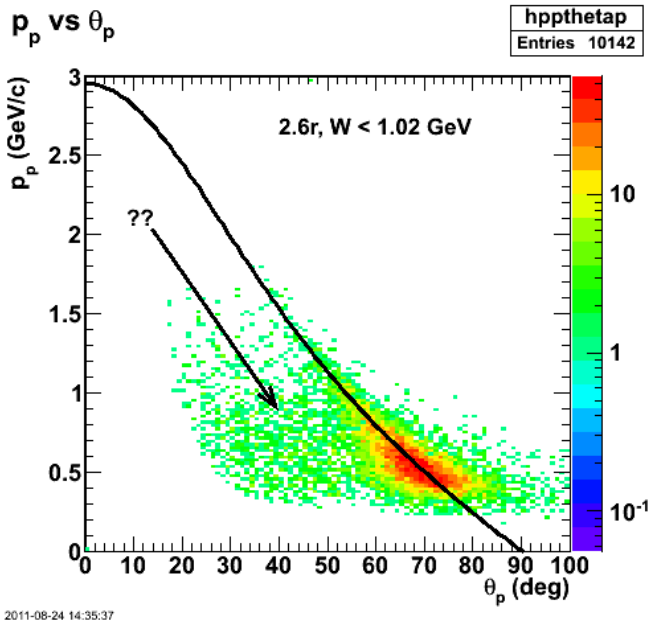


Fig 5. Δp/p (NOT just Δp)

Study the electron and proton elastic scattering from the proton target.



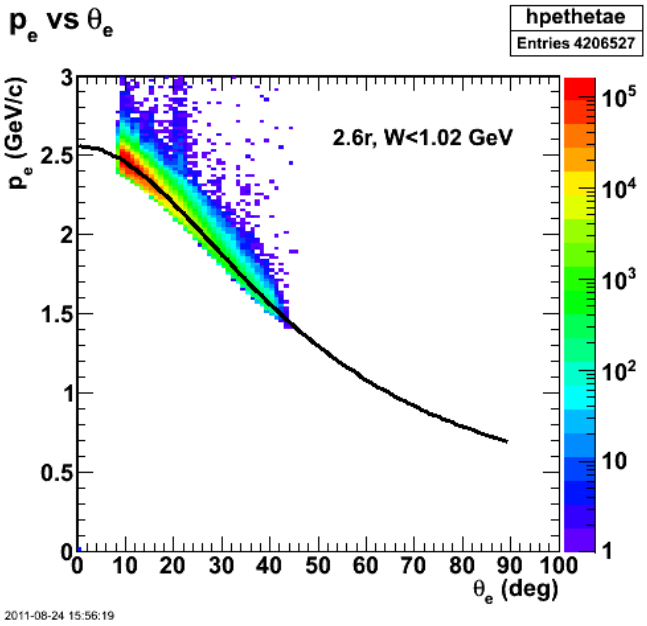
Click here to view the object (Root macro) you uploaded.



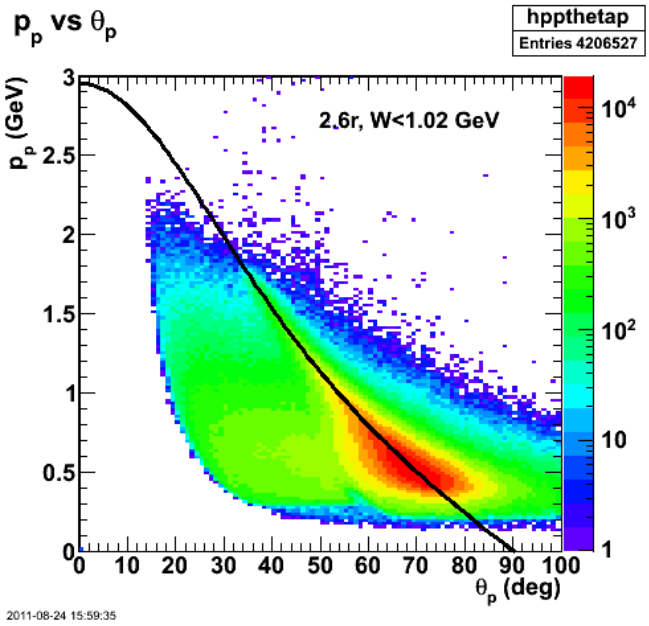
Click here to view the object (Root macro) you uploaded.

Fig 6. Momentum distribution of electrons (left-hand panel) and protons (right-hand panel) for 2.6r and W < 1.02 GeV.

Do the full 2.6r data set.



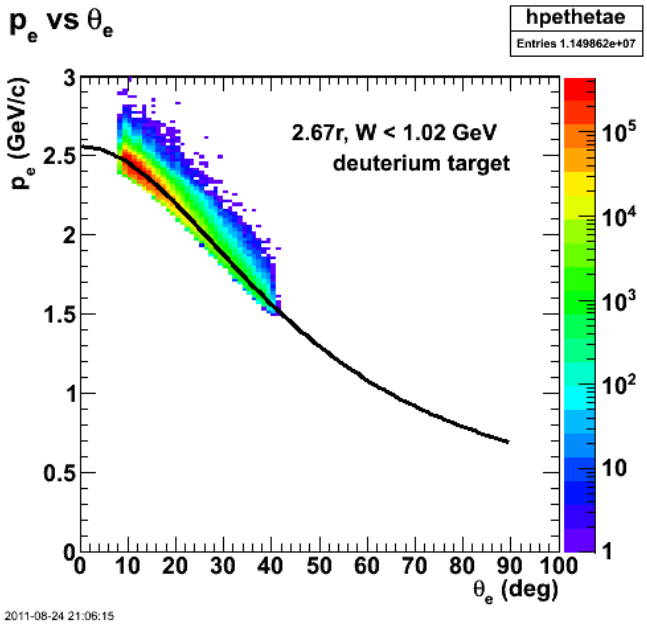
Click here to view the object (Root macro) you uploaded.



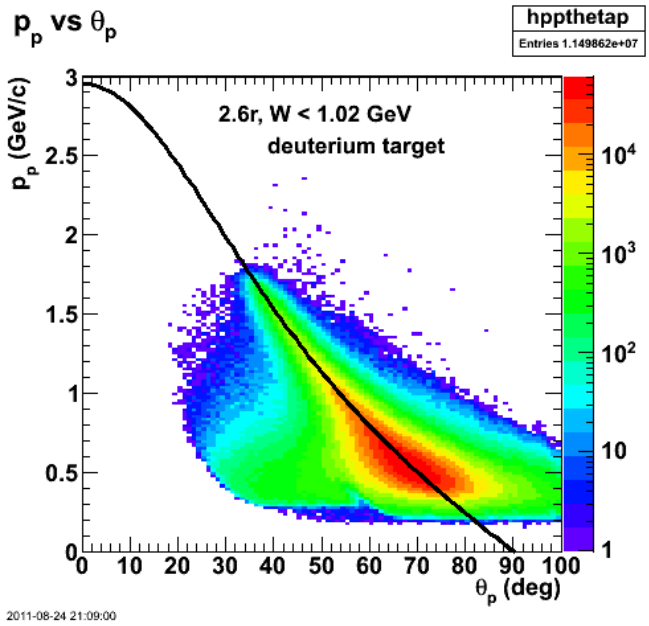
Click here to view the object (Root macro) you uploaded.

Fig 7. Momentum distribution as a function of scattering angle of electrons (left-hand panel) and protons (right-hand panel) for the full 2.6r data set, deuterium target, and W < 1.02 GeV.

Now go back to the deuterium target.



Click here to view the object (Root macro) you uploaded.



Click here to view the object (Root macro) you uploaded.

Fig 8. Momentum distribution as a function of scattering angle of electrons (left-hand panel) and protons (right-hand panel) for the full 2.6r data set, deuterium target, and W < 1.02 GeV.

I tried changing the sign on the Q2 term for Wvo, but that didn't fix things. I should have known since at low Ep in Fig ?? Wvo looks correct; it is about the nucleon mass. At higher Ep or p_p, Wvo is too small which could be caused by the calibration for p_p making the momentum too large so that in the formula for Wvo, I subtract off to much. If this is true, if I look at the difference p_p - p_meas where p_meas is the momentum from tracking and p_p is the momentum after corrections, then I should get a positive tail. What is more, if I plot p_p versus this difference, then the difference should increase with increasing p_p. Plot it and that is what I see.

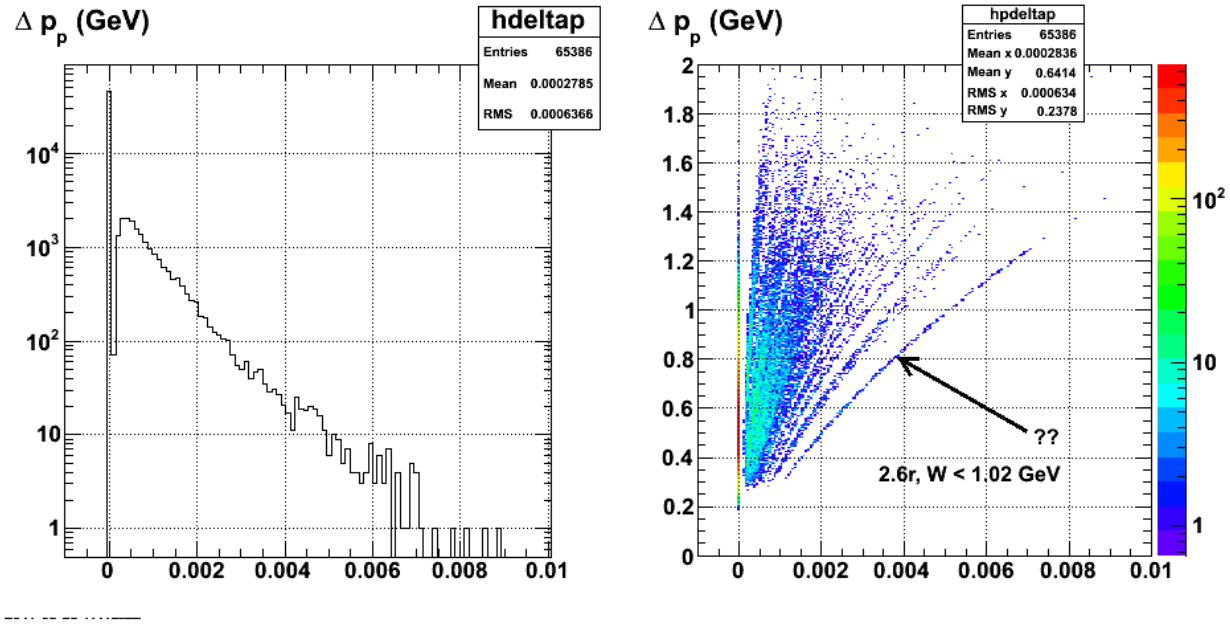


Fig 9. PLot of deltap = p_corr - p[proton] (left-hand panel) and p_corr versus deltap (right-hand panel).

Click here to view the object (Root macro) you uploaded.

The mystery with the previous results is that p_p looks ok when compared with the elastic scattering curve in Fig. 8.

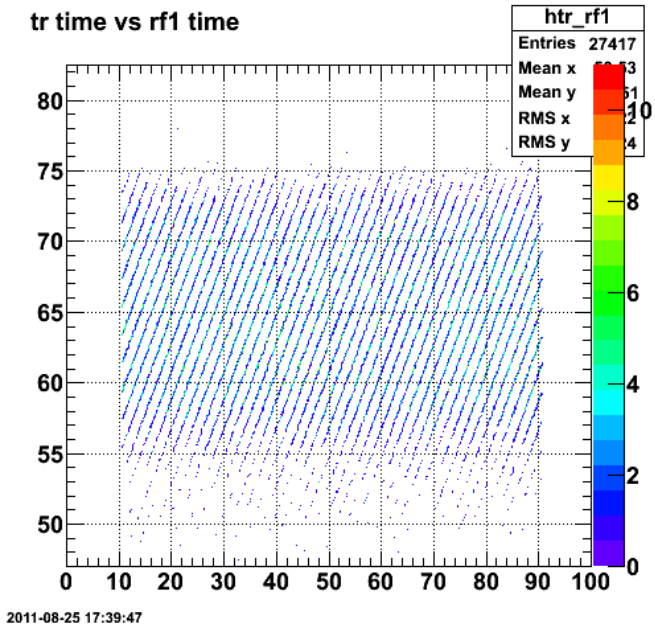


Fig 10. Look at some timing quantities.

Adding the MM2 cut reduces the number of events by a third, but only trims out the edges of the accepted epn events. The large region at lower proton momentum well below the QE expectation is little effected. This is a problem!!!

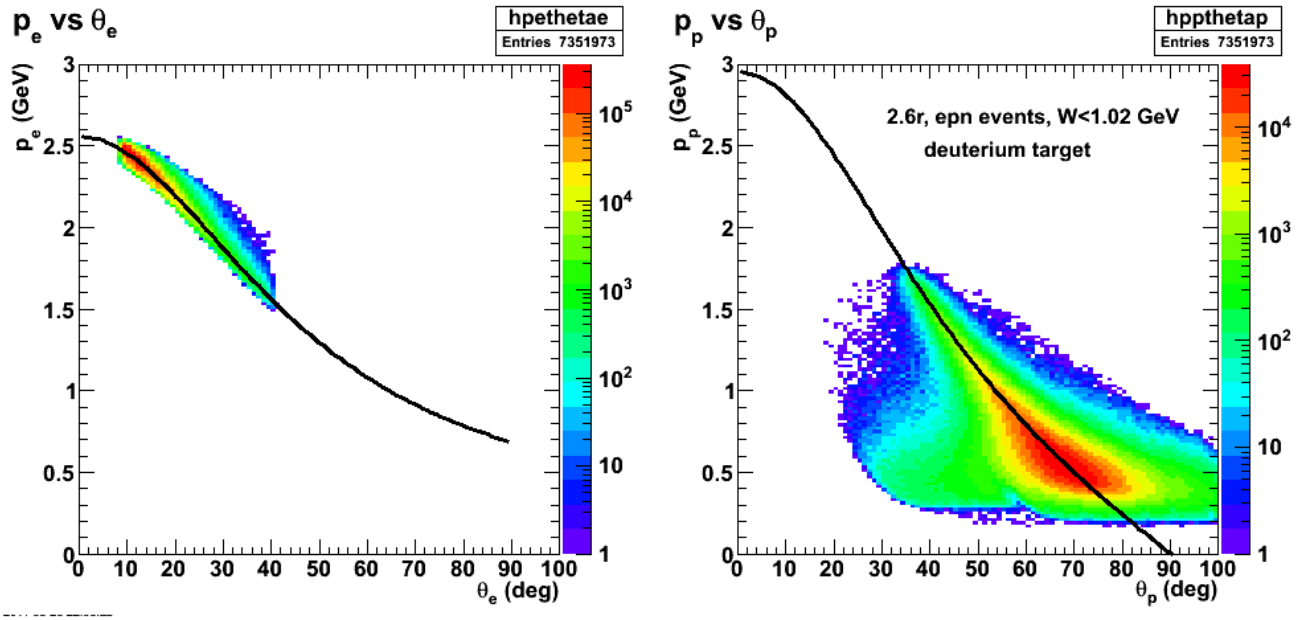


Fig 11. Momentum distribution as a function of scattering angle of electrons (left-hand panel) and protons (right-hand panel) for the full 2.6r data set, deuterium target, MM2 cut on neutron mass (epn events) and W < 1.02 GeV.

Click here to view the object (Root macro) you uploaded.

Check the MM2 dependence on Eproton. It looks ok.

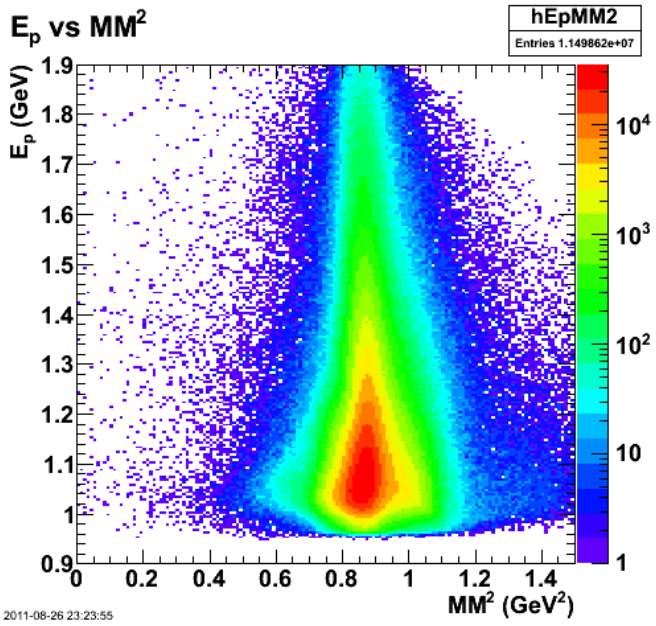


Fig 12. Eproton vs. MM2 for 2.6r, ep events, W<1.02 GeV, and deuterium target.

Click here to view the object (Root macro) you uploaded.

Put a bind of &pm 10 deg on the θ and it looks like it will capture the events we want and exclude the low-p_p lobes.

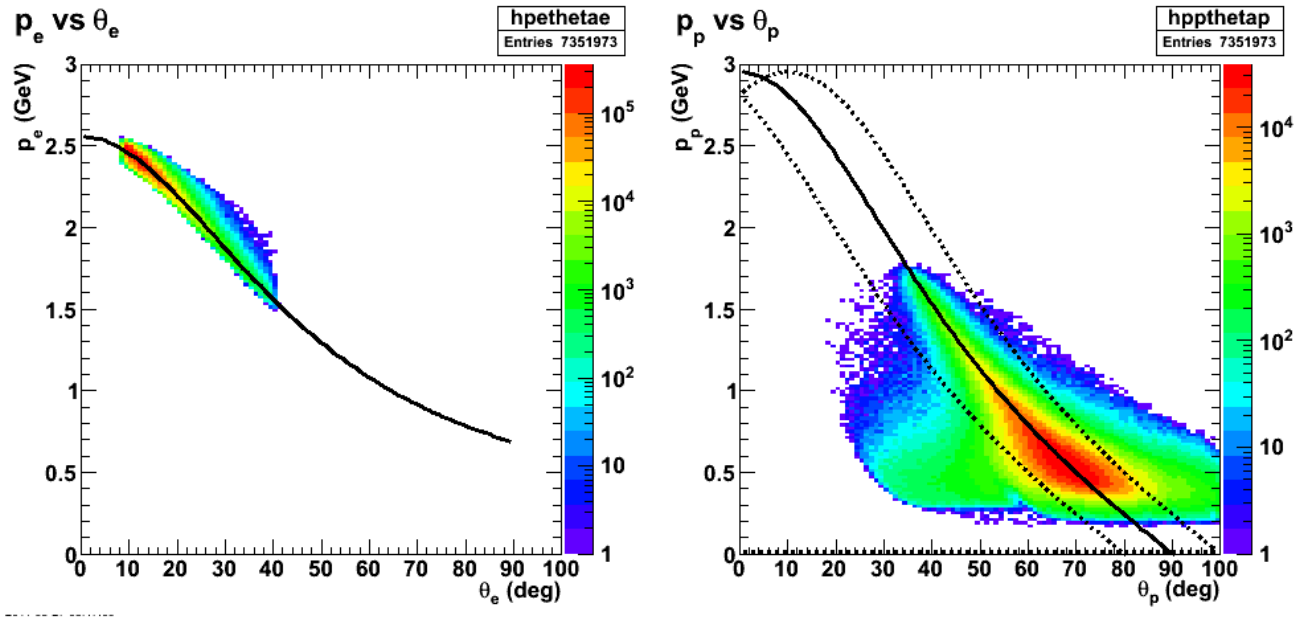


Fig 13. Momentum distribution as a function of scattering angle of electrons (left-hand panel) and protons (right-hand panel) for the full 2.6r data set, deuterium target, MM2 cut on neutron mass (epn events) and W < 1.02 GeV. Shows range of &pm 10 deg cut on θ_p around the QE angle.

Click here to view the object () you uploaded.

THE FIX Dumb ass me had a sign error in the calculation of the magnitude of the 3-momentum transfer. The correct equations are shown in the next figure. The 2D histogram of proton momentum p_p versus Wn/Wvo is in the following figure.

The mass of the residual left behind in the reaction $D(e,e'p)n$ is

$$W_n^2 = M_d^2 - 2M_dE_p + m_p^2 + 2(M_d - E_p)\nu - Q^2 + 2|\vec{p}_p||\vec{q}|\cos\theta_{pq} \qquad (1)$$

where

$M_d = 1.876$ GeV is the deuteron mass,

$m_p = 0.93827$ GeV is the proton mass,

p_p is the measured proton momentum,

$E_p = \sqrt{p_p^2 + m_p^2}$ is the proton energy,

$\nu = E - E'$ is the energy transfer where E is the beam energy and E' is the measured scattered electron energy,

$Q^2 = 4EE'\sin^2\frac{\theta}{2}$ is the square of the 4-momentum transfer where θ is the measured electron scattering angle,

$q = |\vec{q}| = \sqrt{Q^2 + \nu^2}$ is the 3-momentum transfer, and

θ_{pq} is the angle between the detected proton 3-momentum $\vec{p}_p$ and the 3-momentum transfer $\vec{q}$.

Fig 14. Definition of Wn/Wvo with all the ingredients.

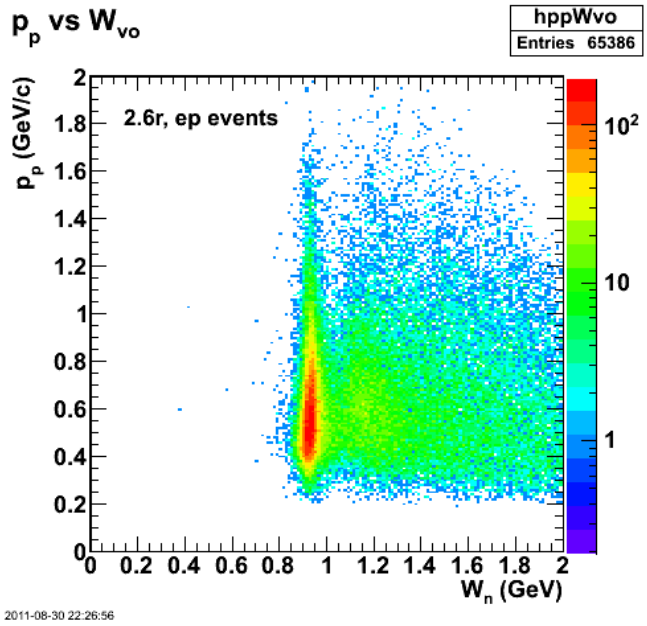
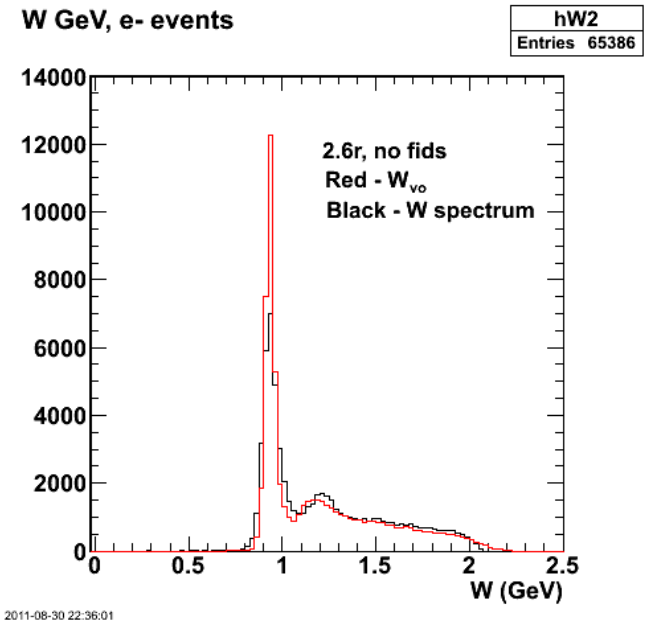


Fig 15. Wvo distribution corrected for small data sample.



Comparison of Wvo and W spectra.

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More improvements from Wvo which show it is narrower than W.

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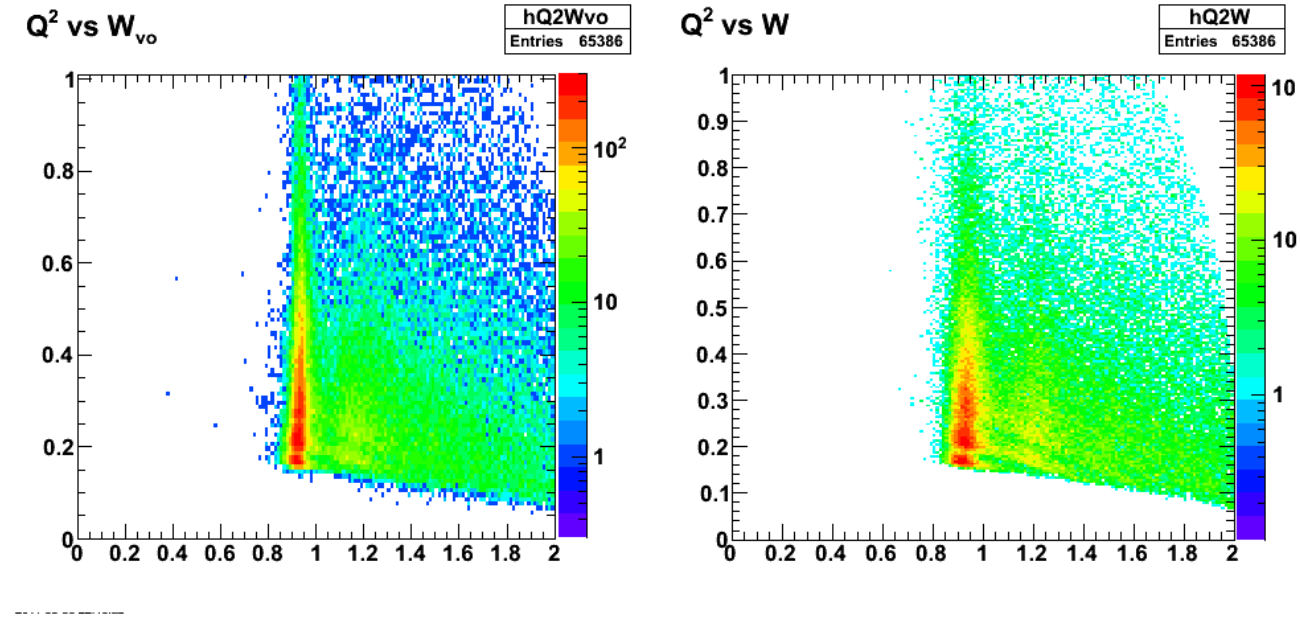

Fig 16. Comparison of Q2 versus Wvo (left-hand panel) and W (right-hand panel).

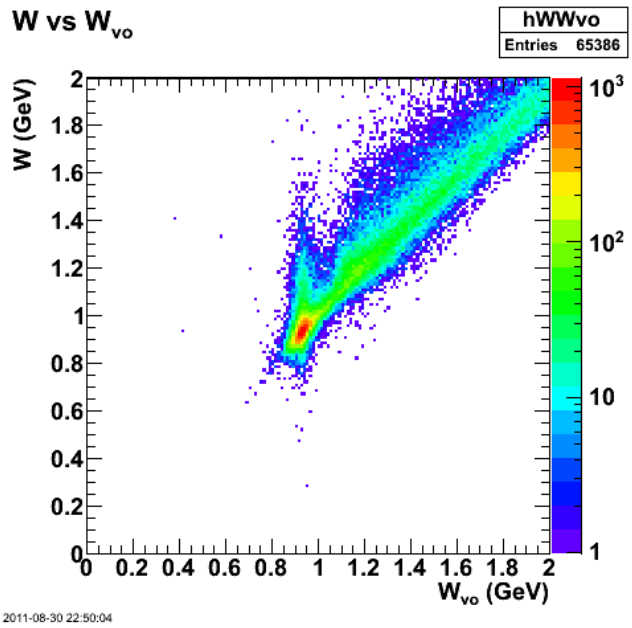

Fig 17. Another comparison of Wvo and W. Notice the high-W tail on the QE peak that will overlap with the dip region. Using Wvo moves those events into the main peak.

Use a cut Wvo < 1.05 GeV to see if things get cleaned up. The plot below shows p_p vs. theta_p. There are still many protons with momenta different from the QE expectation (black curve).

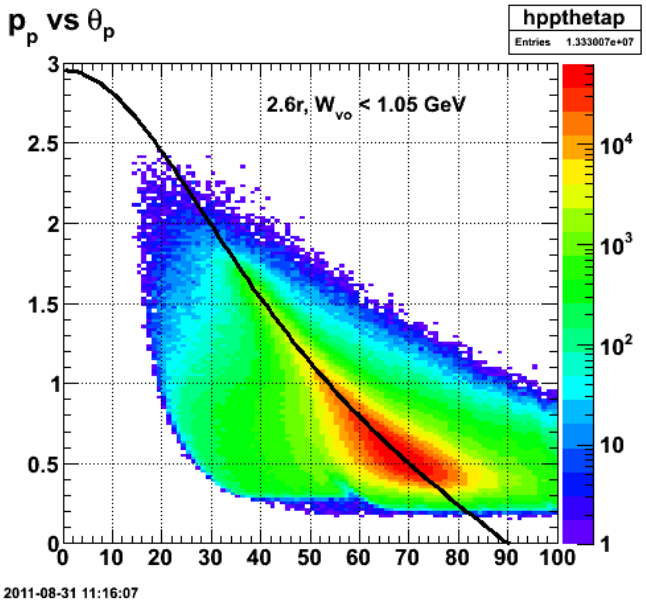

Fig 18. Momentum distribution as a function of scattering angle protons for the full 2.6r data set, deuterium target.

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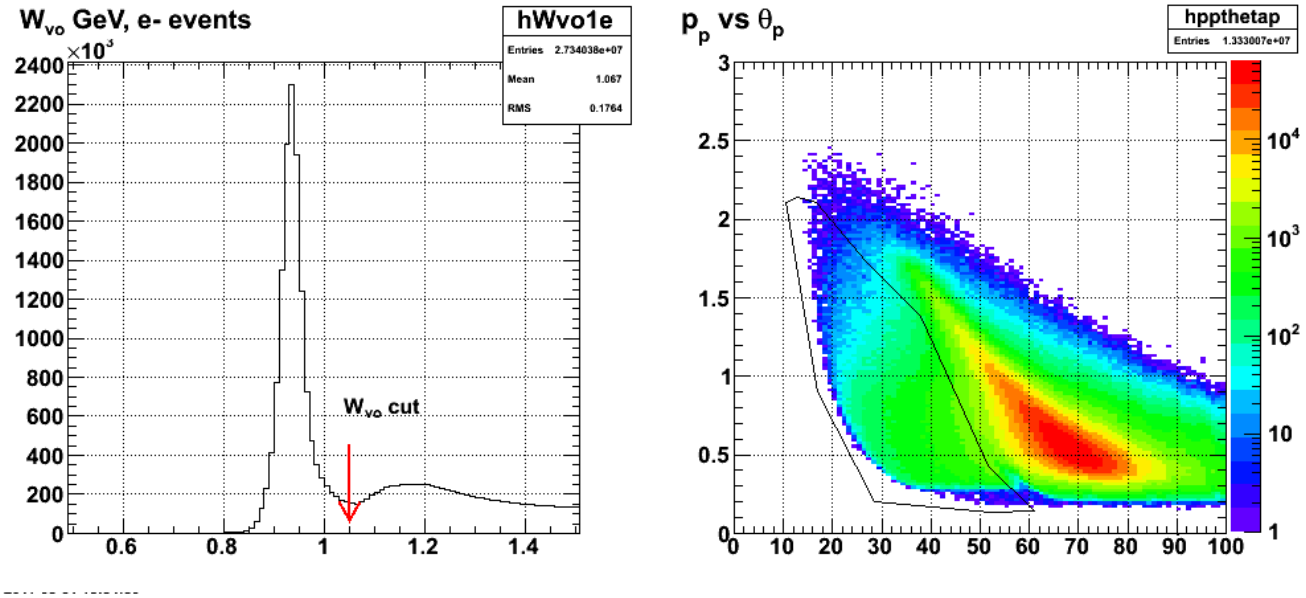

Fig 19. Stuff to show SS to understand what all the non-QE stuff is in the right-hand panel.

Click here to view the object (Root macro) you uploaded.

Get the width of the Wvo QE peak. I will use this to set the upper limit on the Wvo cut to select QE events. The idea is that in the ideal world with perfect experimental resolution, the QE peak in Wvo would be a spike/Dirac delta function at the neutron mass. The measured width of the peak is then a measure of the experimental uncertainty. There should be no inelastic contributions to the QE peak until we reach the mass of the neutron + pion system. That limit (0.939 GeV + 0.139 GeV = 1.078 GeV) will be smeared out by the experimental resolution. I will take the upper limit on the QE peak to be 3σ below the pion limit. The width of the peak below is about 0.02 GeV so the upper cut on Wvo will be 1.08 GeV - 3*0.02 GeV = 1.02 GeV.

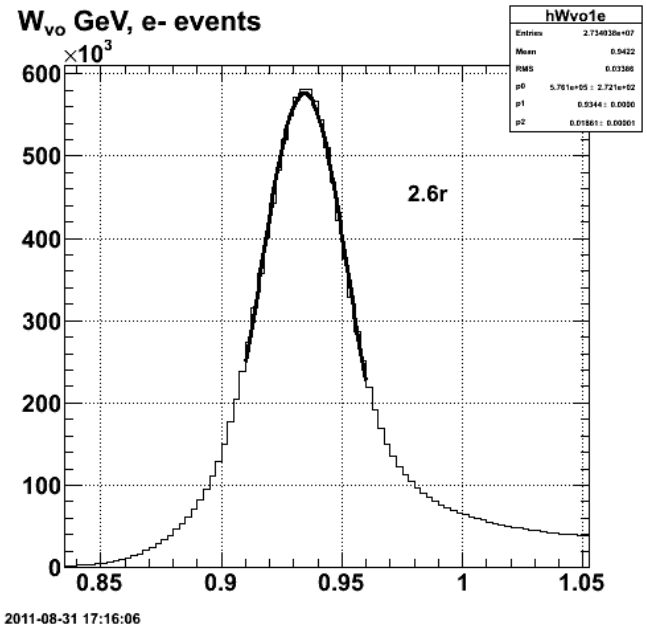

Fig 20. Fit to the QE peak in the Wvo spectrum to get the W resolution for CLAS.

Click here to view the object (Root macro) you uploaded.

Now look at xBJ. WVO says we can put a cut here to select QE events. The results below are depressing. The xBJ spectrum using the Wvo QE selection cut has more counts, but is much wider than the previous method using the W+MM2 cuts.

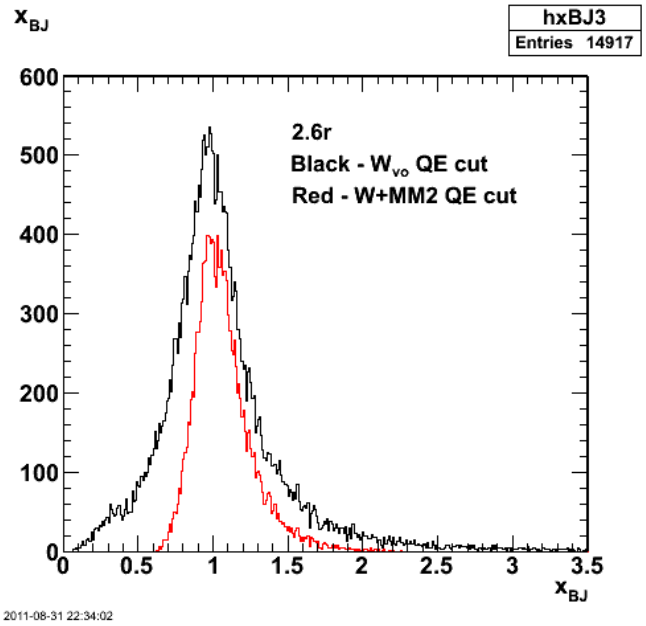

Fig 21. Comparison of Bjorken x spectra using two QE selection methods.

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What do I use for cuts on xBJ? or any other variable for that matter? y and ξ are shown below for ep coincidences and for ep events with the Wvo<1.02 GeV cut.

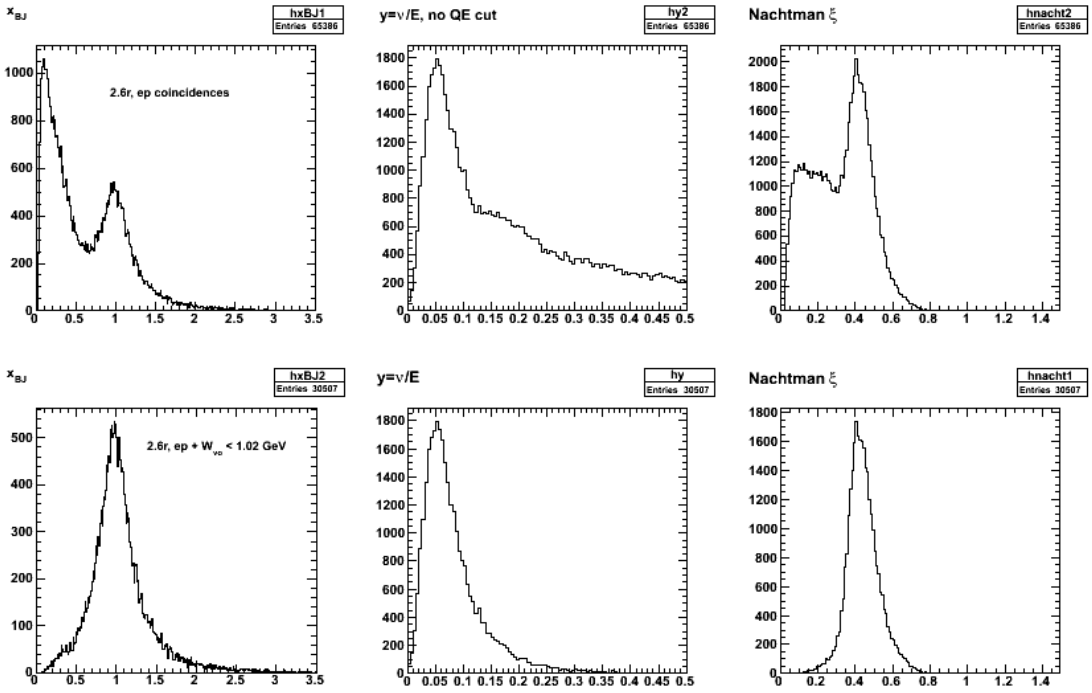

Fig 22. Different kinematic variables.

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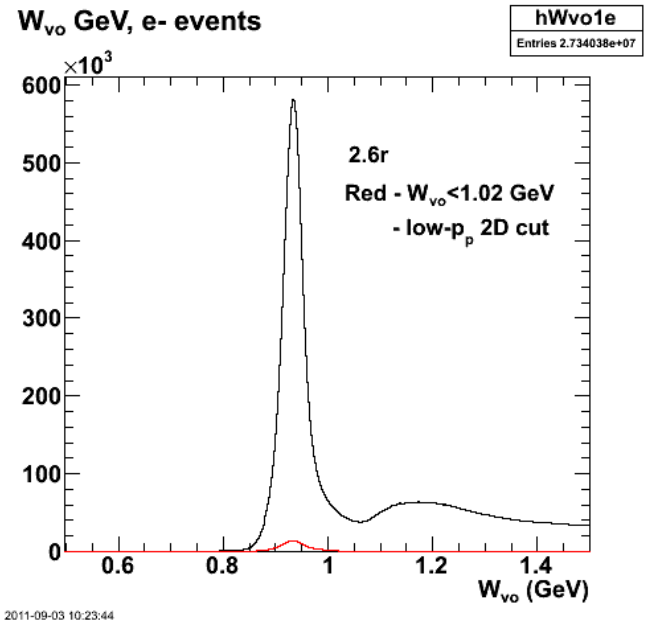
Stuff for WVO email.



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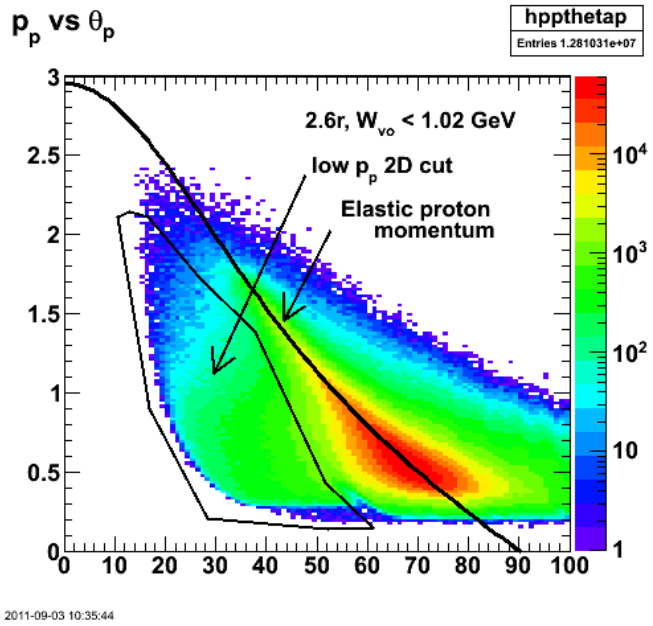

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Fig 23. Wvo spectrum (left-hand panel) for all ep events (black) and those inside the 2D low-p_p cut (red) shown in the right-hand panel.

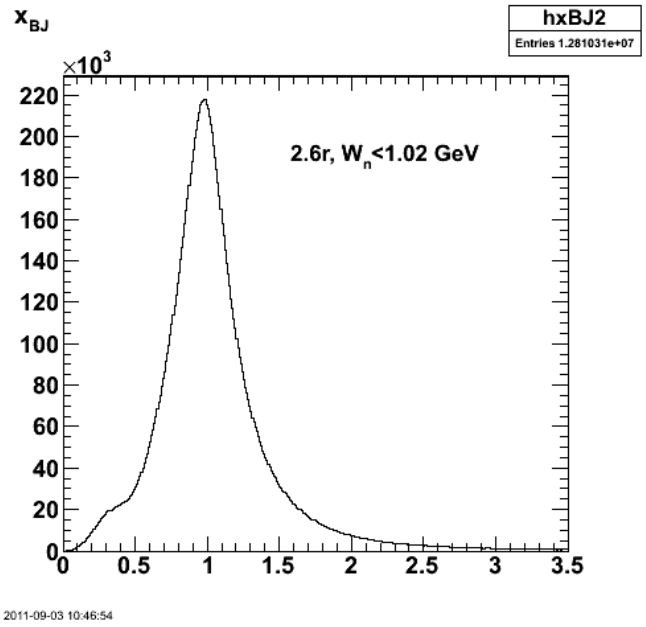

Fig 24. Spectrum of Bjorken x with Wvo<1.02 GeV.

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Get a similar/analogous cut on the electron momentum versus angle.

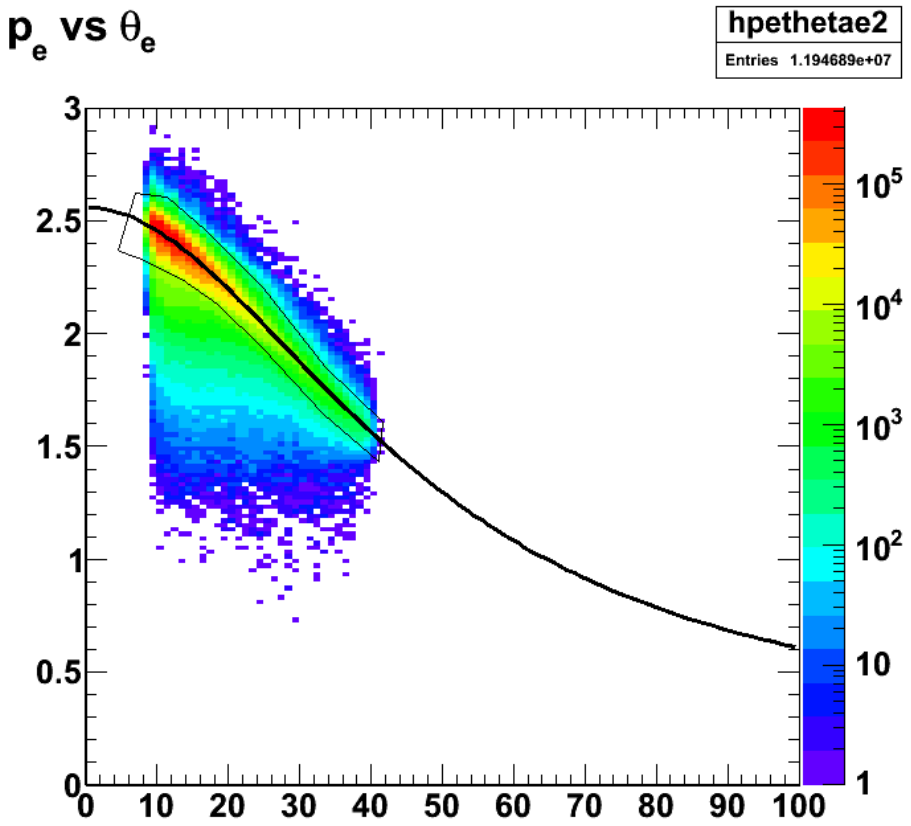

Fig 25. Distribution of momentum versus angle for the electron (left-hand-panel) with the QE 2D cut and

Click here to view the object (Root macro) you uploaded.

Looking at various things.

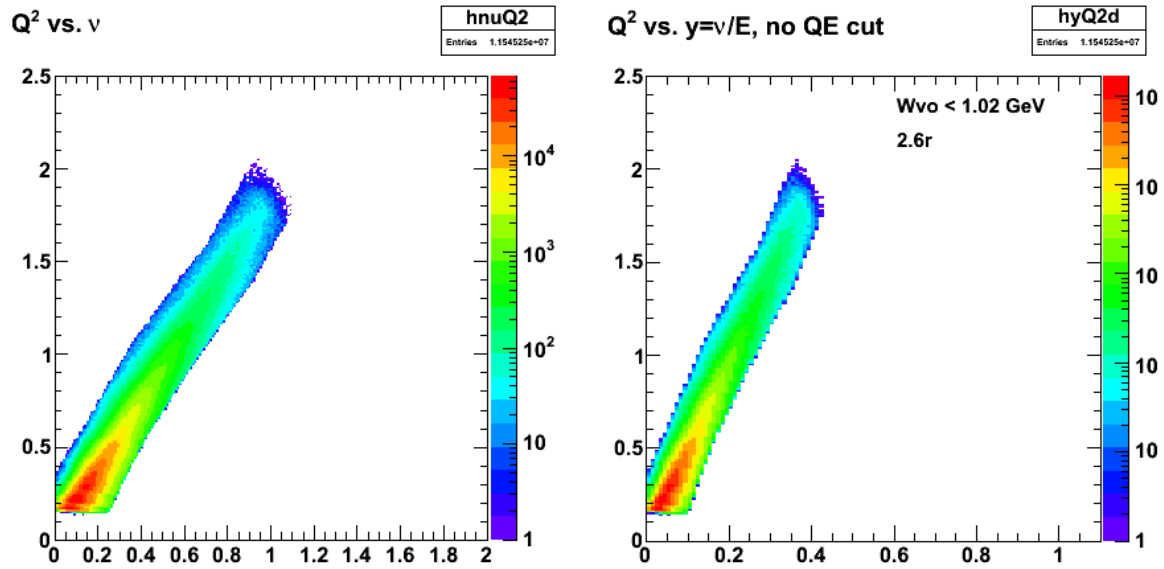

Fig 26. Looking at things somewhat randomly.

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DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 401 - 2D cut for QE events (gpg)

[Modified Tue Sep 20 21:44:13 2011 (GMT) gpg]

To select quasielastic events in d(e,e'p)n we start with the definition of the residual mass left behind in the reaction, i.e. the mass of the neutron or whatever else is left behind. Note this is more than the usual W spectrum calculated solely from the electron information. The equation is (barring my mistakes in translation from WVO) the following.

The mass of the residual left behind in the reaction $D(e,e'p)n$ is

$$W_n^2 = M_d^2 - 2M_dE_p + m_p^2 + 2(M_d - E_p)\nu - Q^2 + 2|\vec{p}_p||\vec{q}|\cos\theta_{pq} \qquad (1)$$

where

$M_d = 1.876$ GeV is the deuteron mass,

$m_p = 0.93827$ GeV is the proton mass,

p_p is the measured proton momentum,

$E_p = \sqrt{p_p^2 + m_p^2}$ is the proton energy,

$\nu = E - E'$ is the energy transfer where E is the beam energy and E' is the measured scattered electron energy,

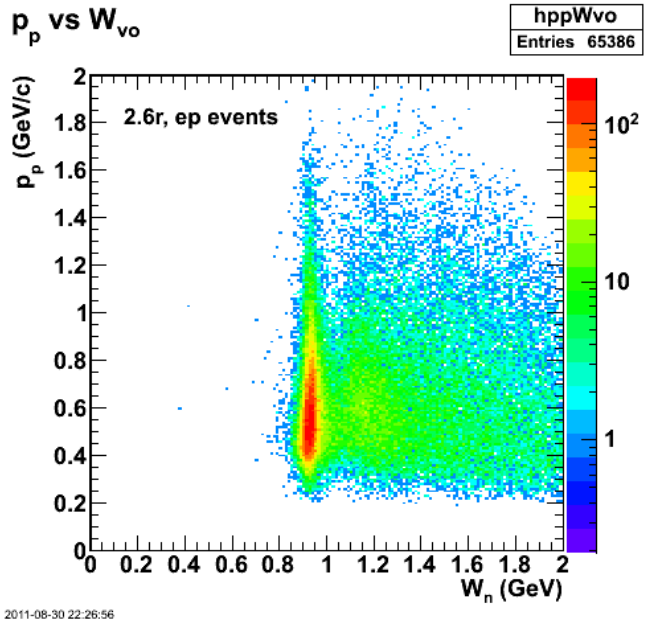
$Q^2 = 4EE'\sin^2\frac{\theta}{2}$ is the square of the 4-momentum transfer where θ is the measured electron scattering angle,

$q = |\vec{q}| = \sqrt{Q^2 + \nu^2}$ is the 3-momentum transfer, and

θ_{pq} is the angle between the detected proton 3-momentum $\vec{p}_p$ and the 3-momentum transfer $\vec{q}$.

Fig 1. Definition of Wn/Wvo with all the ingredients.

Now apply the equation for Wvo event-by-event to get the Wvo spectrum and compare it with the W spectrum calculated just with the electron information (right-hand panel in Fig. 2). The Wvo histogram (red) is narrower and there is a cleaner distinction between the QE events and higher energy transfer states like the resonances.



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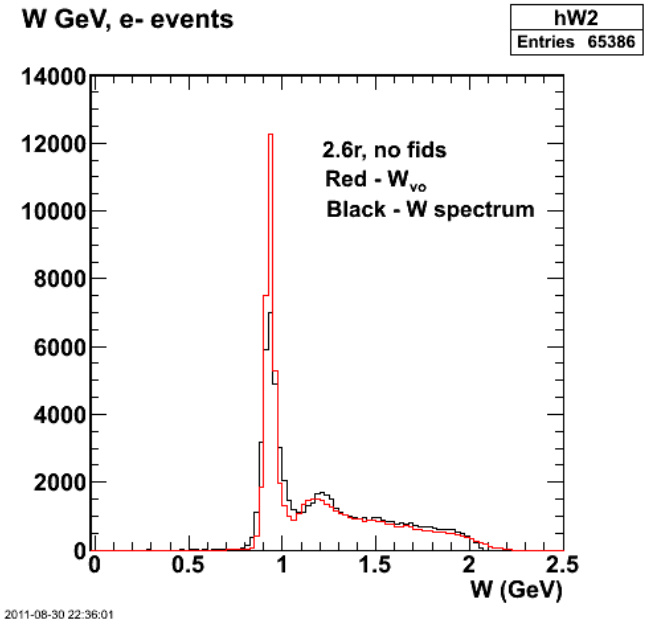

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Fig 2. 2D plot of proton momentum vs W_{vo} (left) and comparison of W and W_{vo} spectra (right).

Now generate the Bjorken x distribution with a cut on Wvo. The position of the cut is determined, first, from the sum of the neutron mass plus pion mass (0.94 + 0.14 GeV). If we had perfect resolution in CLAS and we require Wvo < 1.08, then we should only have final states with a single neutron. Since we do have non-zero resolution in CLAS, I estimated that resolution from the width of the neutron peak in the Wvo spectrum. This would be an infinitely narrow spike without the CLAS resolution spreading it out. I got a width of CLASres=0.03 GeV so I put the Wvo cut to select neutrons in final state at the following.

Wvo < Mproton + Mpion - 2*CLASres = 1.02 GeV.

The resulting distribution of Bjorken x is shown below. I am happy to see a peak at x=1 which should be the position of the QE events. I am perplexed by the width of that peak and because it goes very far above and below the x=1 peak. We expect that for a deuteron target x could be as large as x=2, but the spectrum hear goes well above that limit. What is pushing these events to high x??

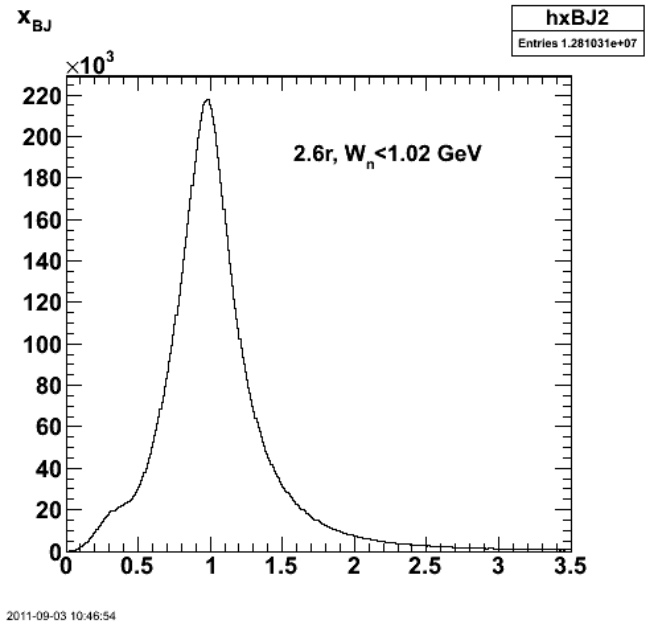

Fig 3. Spectrum of Bjorken x with Wvo<1.02 GeV.

To attempt to understand what is going on with the x spectrum in the figure above try using a 2D cut in root on the p_p (proton momentum) versus theta_p histogram to remove the weird events from the QE sample. Use the same method on the theta_e (electron momentum) versus theta_e. The plots are shown below. There is a clear QE ridge in both plots that coincides with a calculation of the momentum versus theta for elastic scattering of an electon off the proton (i.e. ignoring the Fermi motion of the nucleons in deuterium). What is the broad, flat background around the QE ridge? Radiative events? These events only make up 1-2% of the total, but get rid of them anyway by applying the two, 2-D cuts shown in the figure below and looking at Bjorken x again.

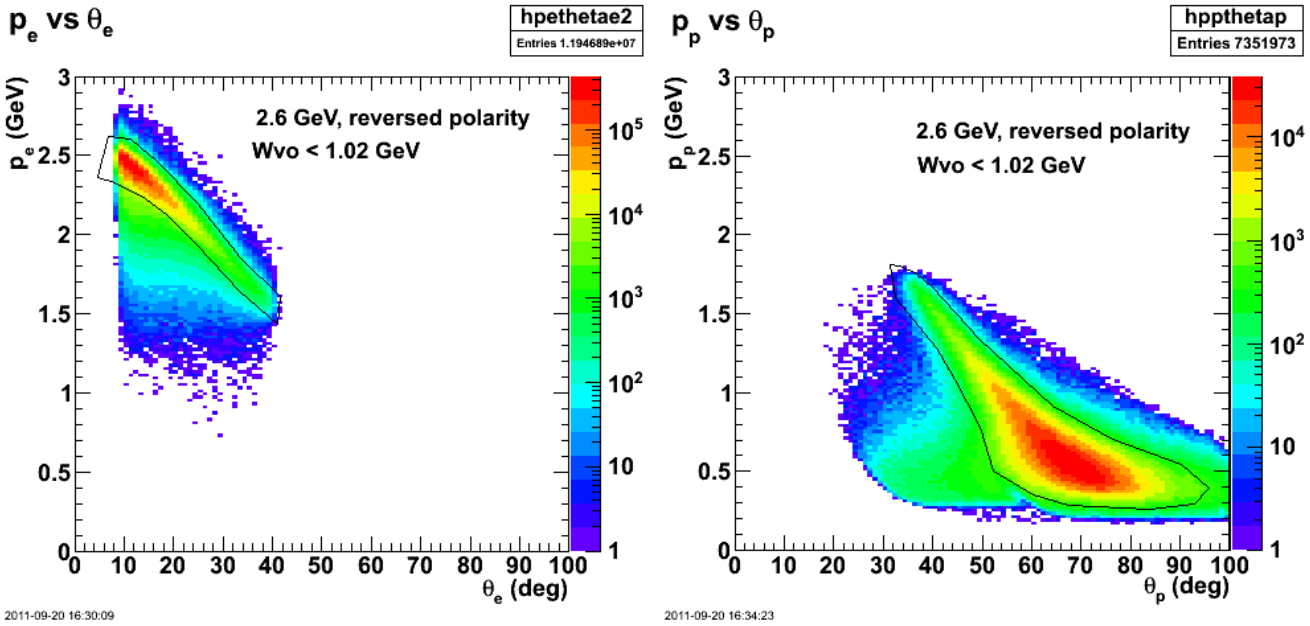

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Fig 4. Plot showing the cuts on electrons (left) and protons (right).

The impact on Bjorken x of adding the cuts on the electron/proton p vs theta plots is shown below. The black curve is the raw x spectrum for e-p coincidences. The blue curve now has the Wvo<1.02 GeV cut added so it is the same as Fig. 3. The red curve is x with Wvo<1.02 GeV and that the electron and proton satisfy the 2D cuts shown in Fig. 4. The events at low x are reduced (good news), but there is no effect on the high-x events???

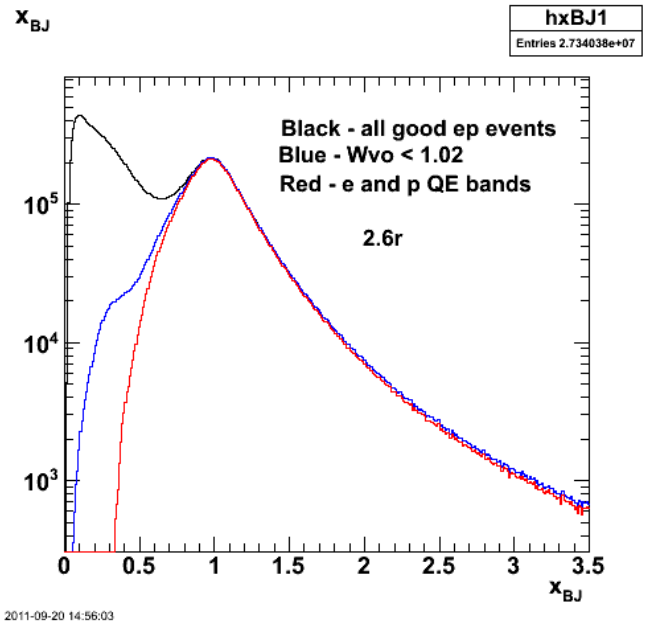

Fig 5. Effect of various cuts on the Bjorken x spectrum.

The number of events in the two distributions in Fig. 4 is different for the electron and proton events. They should be the same. Those two plots were generated at different times when I was futzing around with the cuts. Check them (see below) and they look ok.

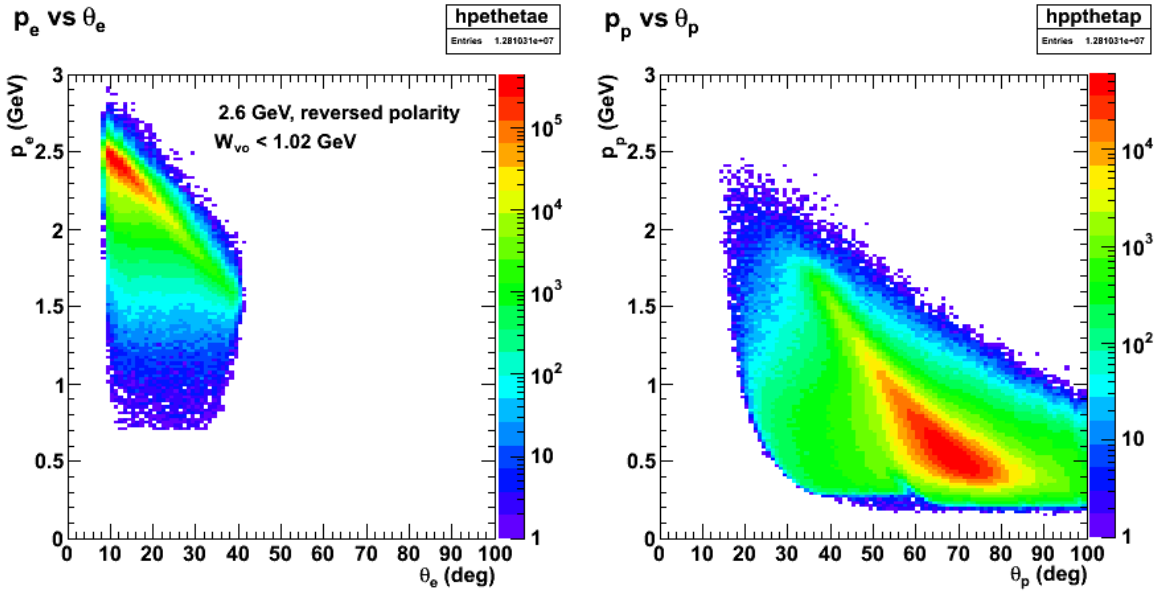

Fig 6. Check on the number of events in the 2D histograms of momentum versus scattering angle for electrons and protons.

Click here to view the object (Root macro) you uploaded.

The next step would be to put a cut on Bjorken x at the top of the peak, but how do we select the cuts. For the previous analysis I set narrow cuts (by eye and arbitrarily) and then scanned over the peak to see how it effected ALTp. We need a better procedure to justify our choice.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 402 - Checking Target Cuts (gpg)

[Modified Sat Oct 1 21:35:15 2011 (GMT) gpg]

At LW's suggestion I will look to make sure that we are eliminating the target windows which could account for the XBJ>2 events in the xBJ spectrum in the previous entry. First plot below looks ok. If anything I can expand the target cut for deuterium.

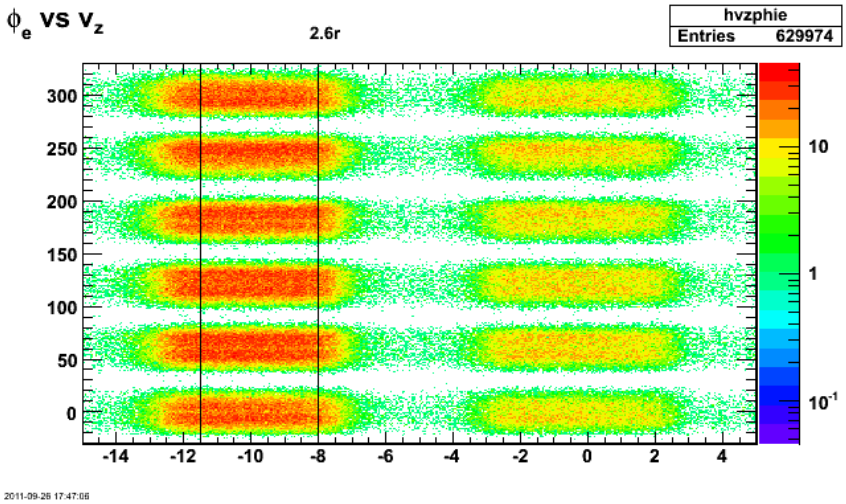

Fig 1. Vz for 2.6r electrons with all the other cuts off.

Click here to view the object (Root macro) you uploaded.

Look at the target position with different cuts.

```
if (e_event &&
    target_walls_e &&
    good_electron_fiducial &&
    //quasielastic_cut &&
    good_egiyan_threshold  &&
    good_EC_pion_threshold &&
    good_electron_EC_fiducial &&
    good_electron_EC_trk_coords_fiducial &&
    good_sampling_fraction &&
    good_photoelectrons
    ) {
```

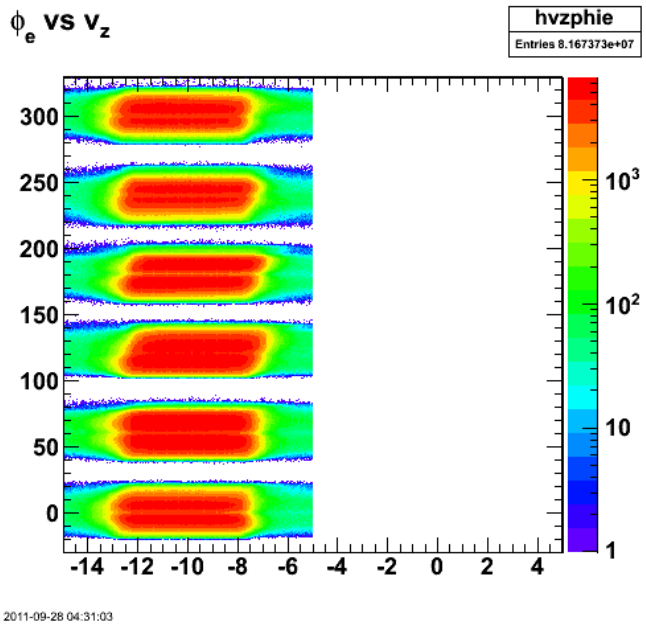

Fig 2. Ï†$_e$ vs. v_z for the above conditions.

Click here to view the object (Root macro) you uploaded.

Now turn off the electron fiducial cuts. The phi dependence is due to the electron beam not coming through in the center of CLAS at around 30 deg (according to Larry Weinstein).

```
if (ep_event &&
    target_walls_ep &&
    good_e_p_vertex &&
    //good_electron_fiducial &&
    //good_proton_fiducial &&
    //quasielastic_cut &&
    //Q2cut &&
    good_egiyan_threshold &&
    good_EC_pion_threshold &&
    good_electron_EC_fiducial &&
    good_electron_EC_trk_coords_fiducial &&
    good_mass_p &&
    good_sampling_fraction &&
    good_photoelectrons) {

  if (good_Wvo_quasielastic_cut) {
```

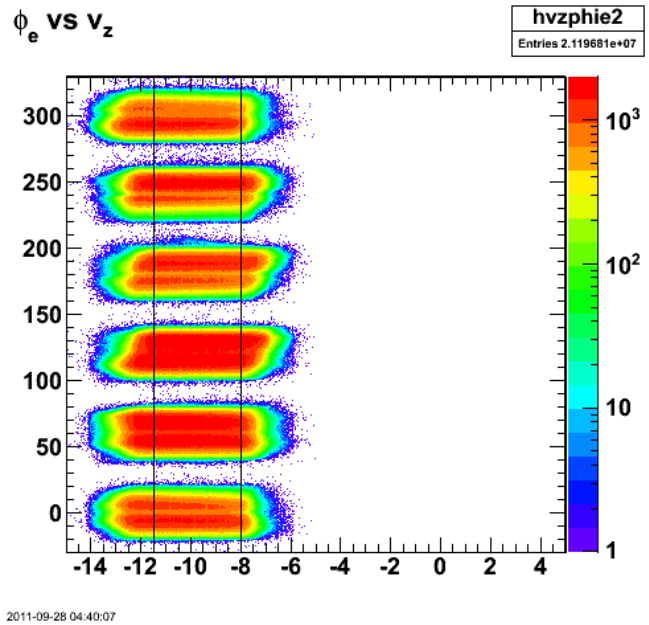

Fig 3. Another Ï†$_e$ vs. v_z for the above conditions.

Click here to view the object (Root macro) you uploaded.

Now look at the protons with the same conditions as the previous plot.

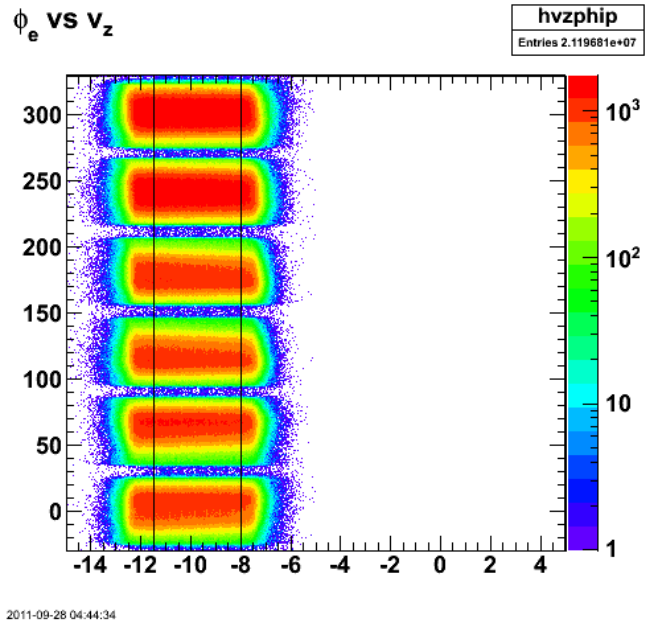

Fig 4. Another Ï†$_p$ vs. v_z for the above conditions.

Click here to view the object (Root macro) you uploaded.

Squeeze down the cuts on vz from -11.5-> -8 cm to -11.0 -> -9.5 cm for the deuteron target to see if the high-x events are suppressed. They aren't!!!

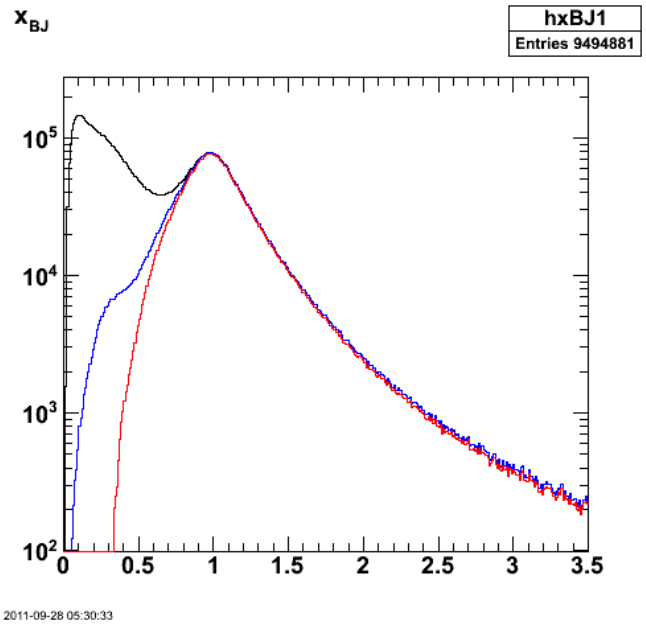

Fig 5. Bjorken x distributions for different cuts.

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Look at Q2 vs nu for the same set of events that produces the Bjorken x distribution shown in the previous email with the excess of events at x > 2.

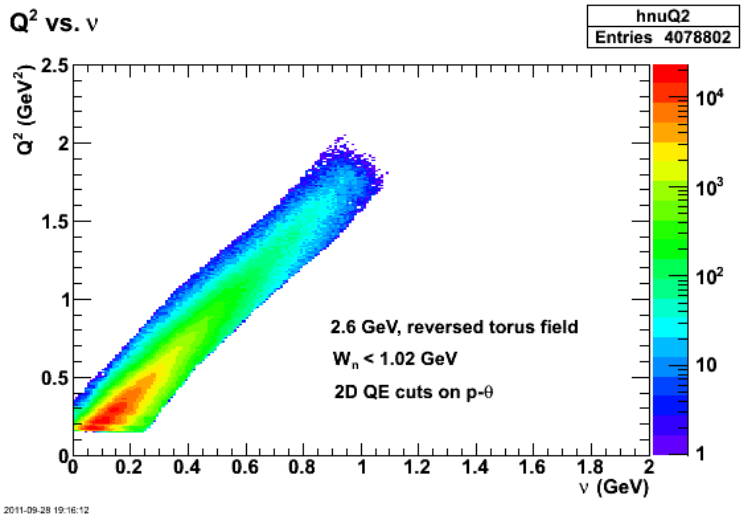

Fig 6. Q2 vs nu.

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Now require x>2 to see where the weird events are coming from.

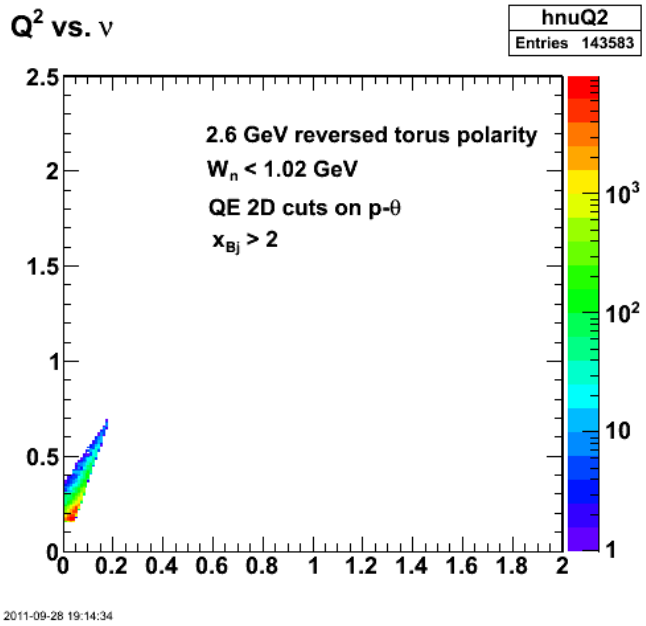

Fig 7. Q2 vs nu for x>2.

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Turn the fiducial cuts back on and things look pretty good now, but we've lost lots of events. The next plot is the same as fig 5 with the addition of the x distribution with fiducial cuts on.

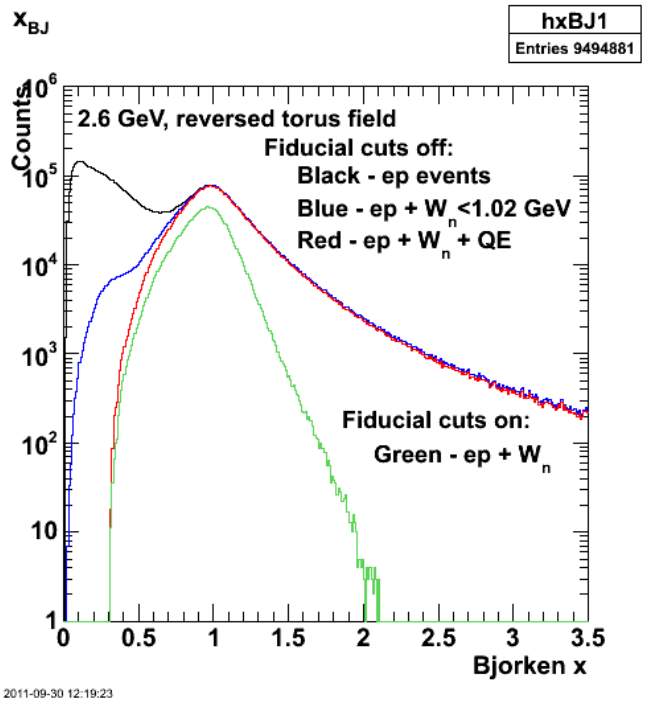


Fig 8. Comparison of x with fids off and various cuts and the effect of turning on the fids and using the Wvo cut on the residual mass.

Click here to view the object (Root macro) you uploaded.

As a check: same as figure 7 with fiducial cuts on. Almost everything went away.

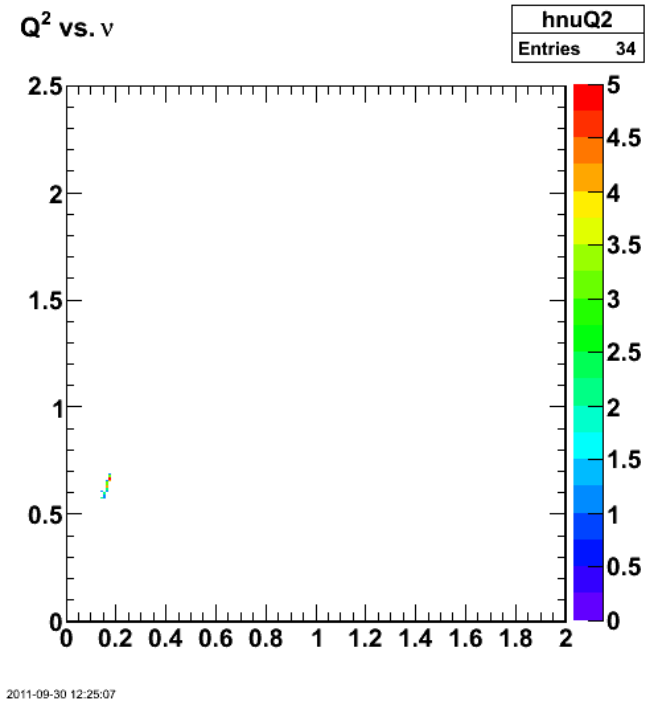


Fig 9. Same as fig 7 with fids on.

Click here to view the object (Root macro) you uploaded.

Now check the effect on ALTp. We turn ON the fids and use just the WVO cut and turn off the W+MM2 cut. The result is shown below. The depth of the dip is less, but the uncertainty has shrunk! This is presumably due to the fact that we are taking more events by integrating over the entire Bjorken x distribution. The shrinking of the dip needs to be studied with Wally to see how his calculation varies with x. The first result he sent for x=1.25 last week shows the depth shrinking. We will have to average over x and if the dip goes away then maybe we could put cuts on xBj. The standard ALTp does not agree with past results in entry 398, but the cuts for the deuterium target are different from the standard set.

Cuts for Fig 10 are:

```
if (ep_event &&
    target_walls_ep &&
    good_e_p_vertex &&
    good_electron_fiducial &&
    good_proton_fiducial &&
    good_Wvo_quasielastic_cut &&
    //good_xBJ_cut &&
    //Q2cut &&
    good_egiyan_threshold &&
    good_EC_pion_threshold &&
    good_electron_EC_fiducial &&
    good_electron_EC_trk_coords_fiducial &&
    good_mass_p &&
    good_sampling_fraction &&
    good_photoelectrons) {
```

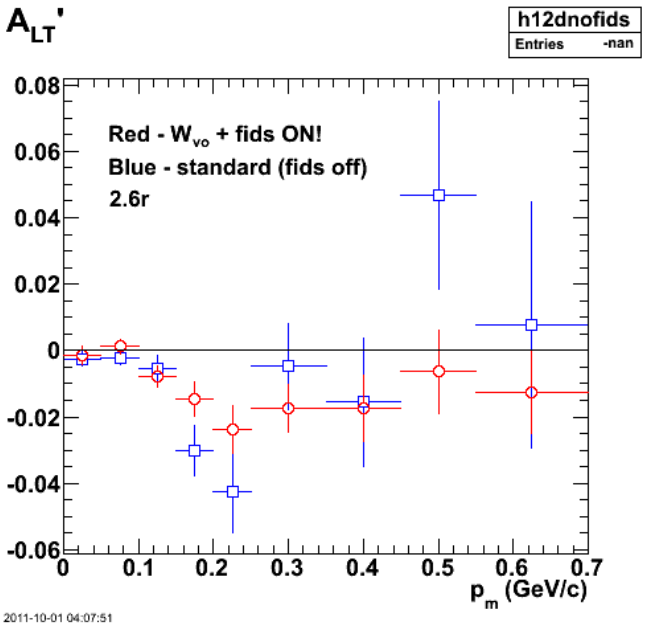


Fig 10. Comparison of old ALTp with new one with Wvo<1.02 GeV cut and fids on. RC calculations are on. Used the wrong deuterium target cut.

Click here to view the object (Root macro) you uploaded.

Reset the deuterium target cut to the default values and the comparison with the standard in entry 398 is close enough.

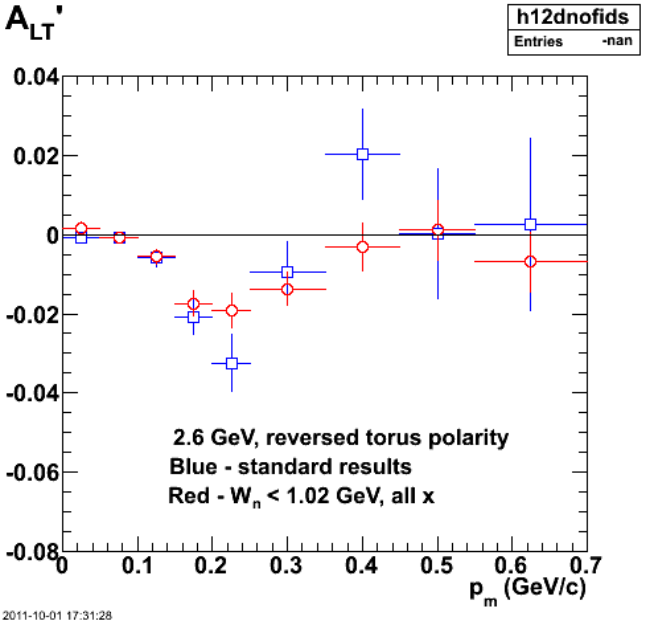


Fig 11. Comparison of old ALTp with new one with Wvo<1.02 GeV cut and fids on. RC calculations are on. Default deuterium target cut back in.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 403 - Comparing Missing Mass and Wvo (gpg)

[Modified Tue Oct 4 03:06:10 2011 (GMT) gpg]

The missing mass and the residual mass from WVO should be the same thing. I calculate them differently using the reconstructed 3-vectors to get the missing mass mX from d(e,e'p)X. For Wvo I use the formula that Wally worked out (see entry 401). The plot below shows they are very close to one another, but still differ by 0.1% or 10^-3 in the centroid and by about 4% in the RMS.

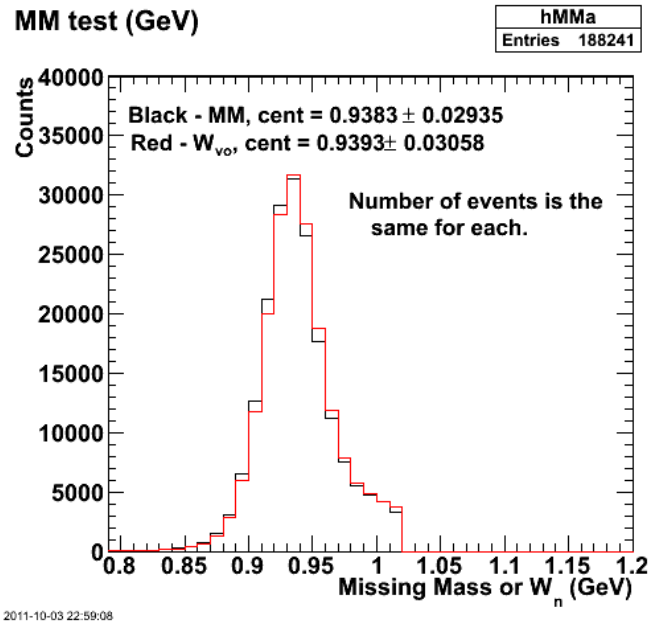


Fig 1. Comparison of missing mass and Wn from two different methods for 2.6r.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 404 - Questions on x>2 events (gpg)

[Modified Thu Oct 6 10:51:20 2011 (GMT) gpg]

LW has asked why the fiducial cuts have such a dramatic effect on the Bjorken x distribution. Trying to answer him I generate a few plots. The first one below shows there is something funny about the x>2 events where there is an overabundance of events in sector 3 relative to the other sectors. Mislaignment effect? Beam not going down the center?

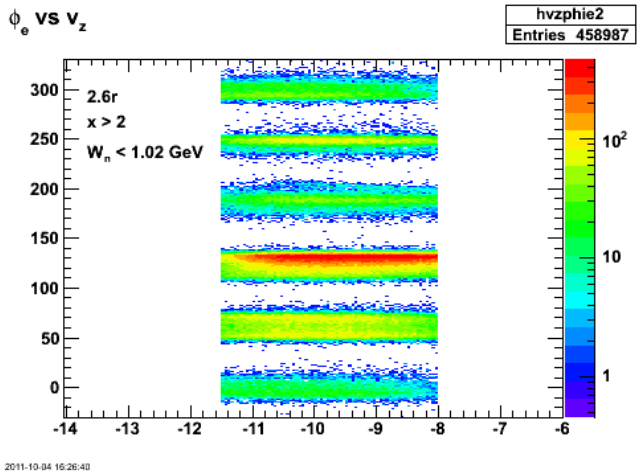


Fig 1. Electron φ versus vz for 2.6r, fids off, x>2.

Click here to view the object (Root macro) you uploaded.

Look at the same distribution for the proton.

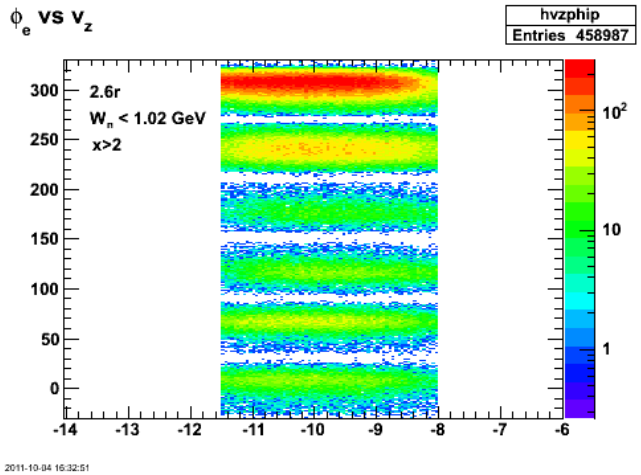


Fig 2. Same as fig 1 for protons.

Click here to view the object (Root macro) you uploaded.

What does the missing mass distribution look like? It's all low mass (MM2< 0.88 GeV2)!

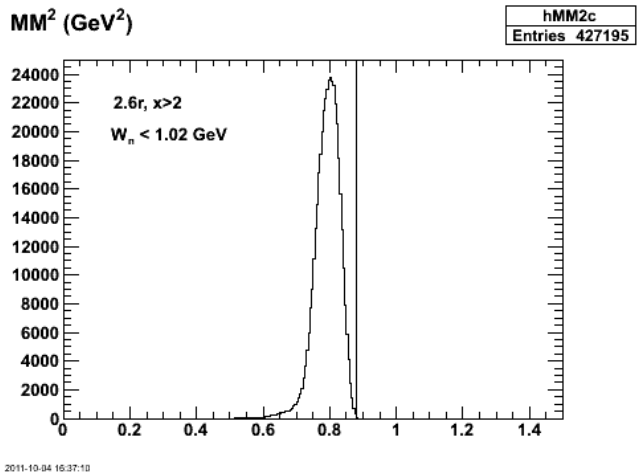


Fig 3. Mass distribution for x>2, 2.6r, Wn<1.02 GeV.

Click here to view the object (Root macro) you uploaded.

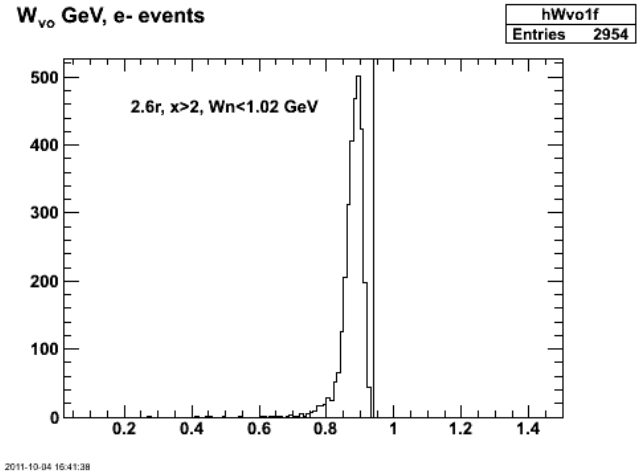


Fig 4. Same as Fig 3 for Wvo.

Click here to view the object (Root macro) you uploaded.

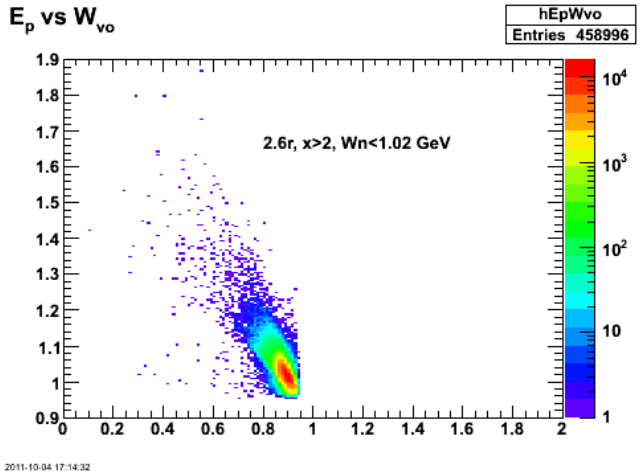


Fig 5. Energy versus Wn for protons, 2.6r, x>2, and Wn<1.02 GeV

Click here to view the object (Root macro) you uploaded.

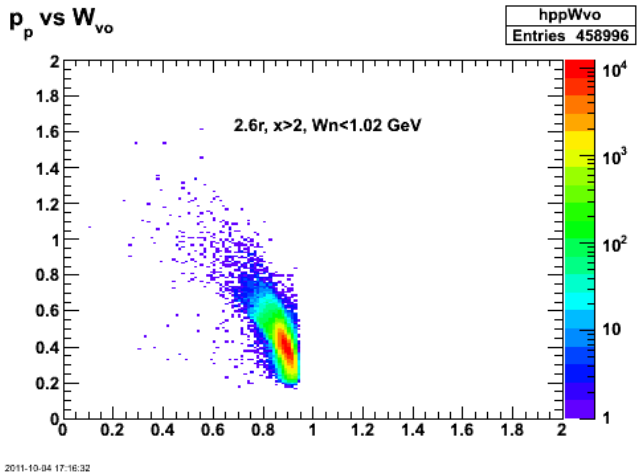


Fig 6. Same as Fig 5 for proton momentum instead of energy.

Click here to view the object (Root macro) you uploaded.

The plot above shows the proton momentum is too small at increasing p_p. I should have a straight ridge for Wn<1.02 GeV, but p_p is decreasing with decreasing Wn.

Now look at the electron.

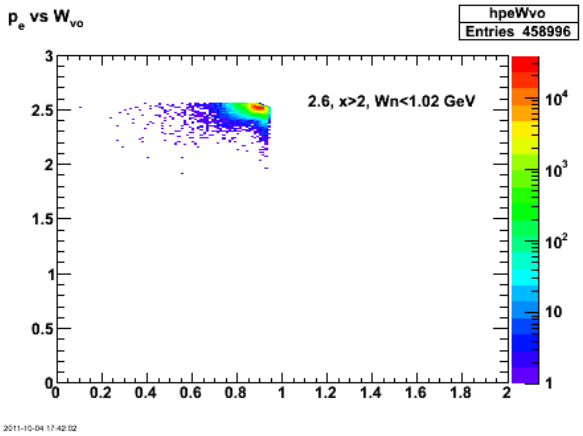


Fig 7. Same as Fig 6 for electrons.

Click here to view the object (Root macro) you uploaded.

Turn off the x>2 cuts and get the following. Where has the Wvo cut disappeared to??!! Dumb ASS! I filled the histogram outside the Wvo cut. I also turned off the fiducial cuts.

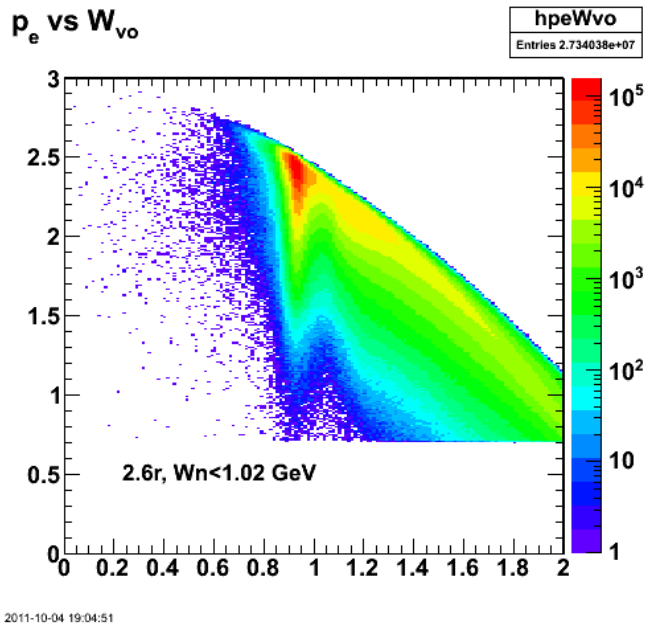


Fig 8. Same as Fig 6 with Bjorken x cut turned off.

Click here to view the object (Root macro) you uploaded.

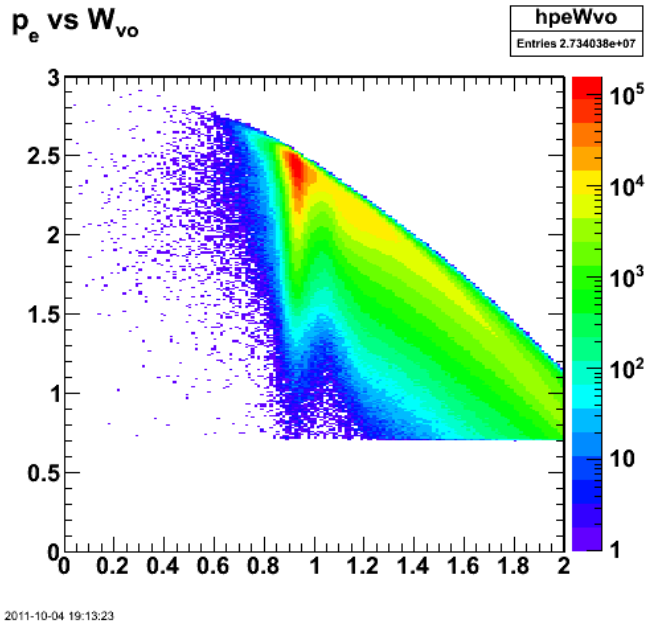
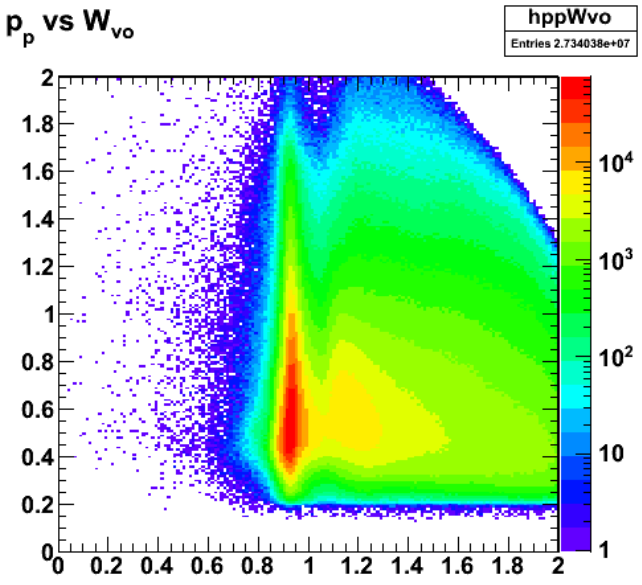


Fig 9. p_e vs. Wvo for electrons with fids off, Wvo cut off, Bjorken x cut off (lhs).

Click here to view the object (Root macro) you uploaded.
Turn on Wvo cut.



p_e vs. Wvo for protons with fids off, Wvo cut off, Bjorken x cut off (rhs).

Click here to view the object (Root macro) you uploaded.

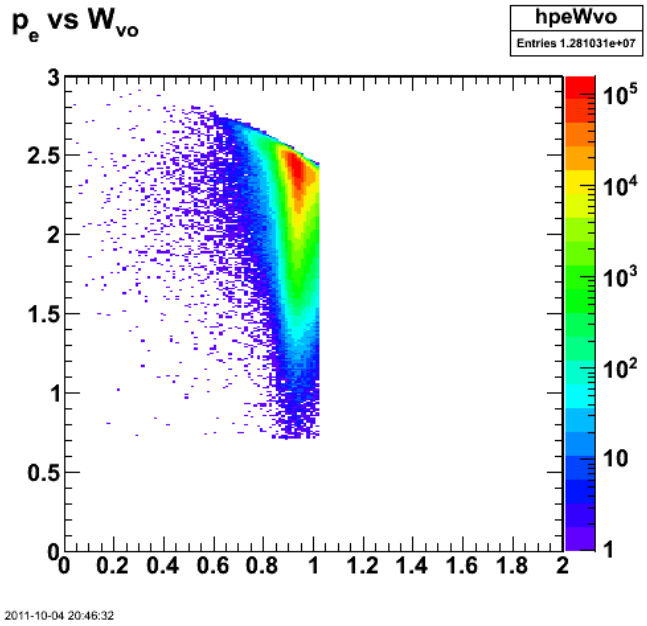
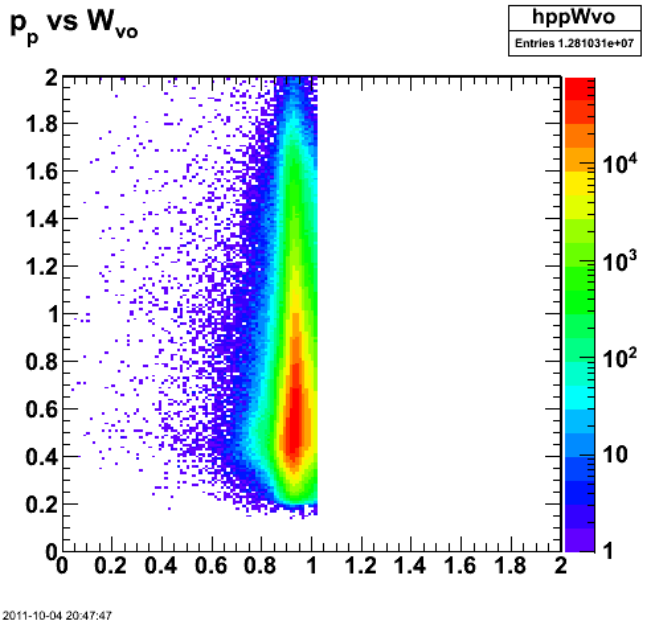


Fig 10. Now turn on Wvo cut.

Click here to view the object (Root macro) you uploaded.

Now require x>2.



Now show protons (rhs).

Click here to view the object (Root macro) you uploaded.

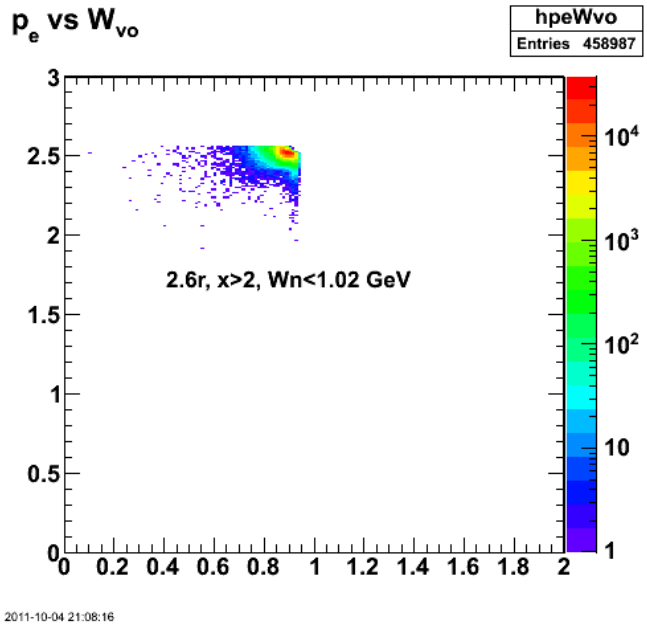
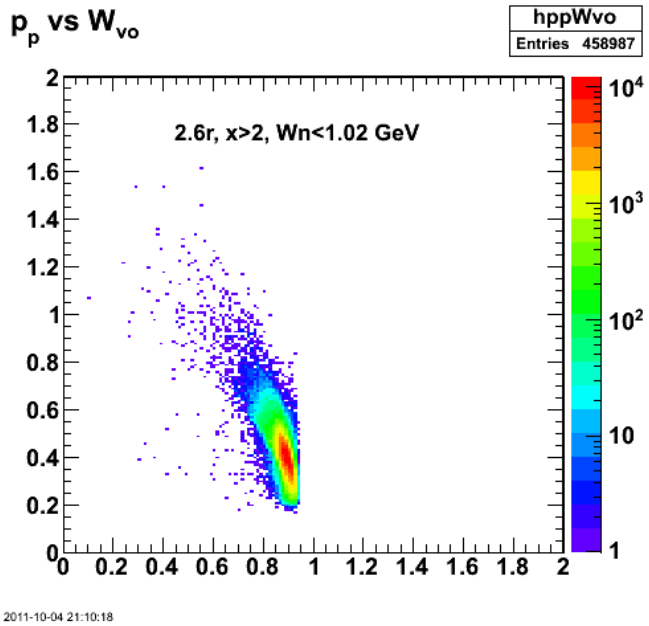


Fig 11. Same as fig 10 with x>2 required.

Click here to view the object (Root macro) you uploaded.

Leave the Wvo cut off to see the full effect of the x>2 cut.



Now for protons.

Click here to view the object (Root macro) you uploaded.

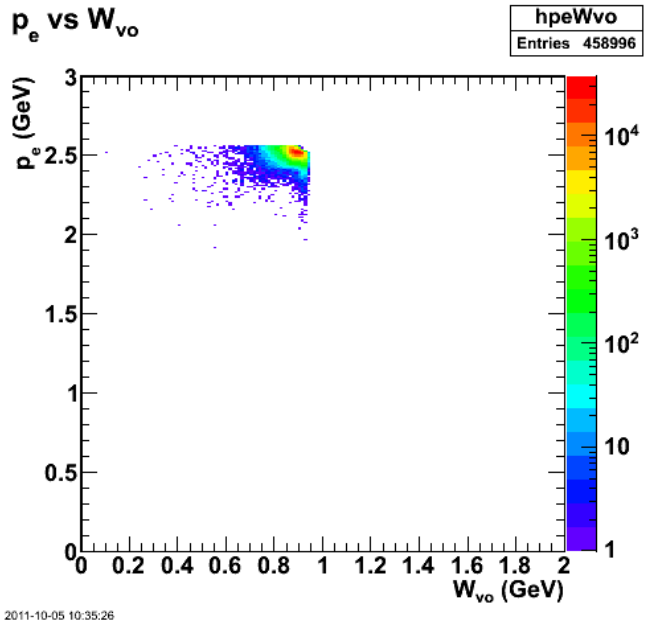
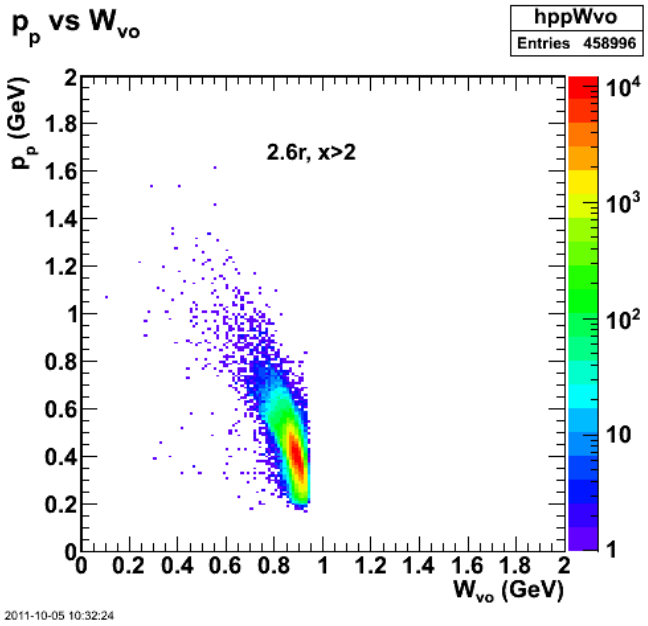


Fig 12. 2.6r with fids off, x>2, and no Wvo cut for electrons.

Click here to view the object (Root macro) you uploaded.

Investigate the transverse direction cosines and we see the same 'hot spot'.



Now for protons.

Click here to view the object (Root macro) you uploaded.

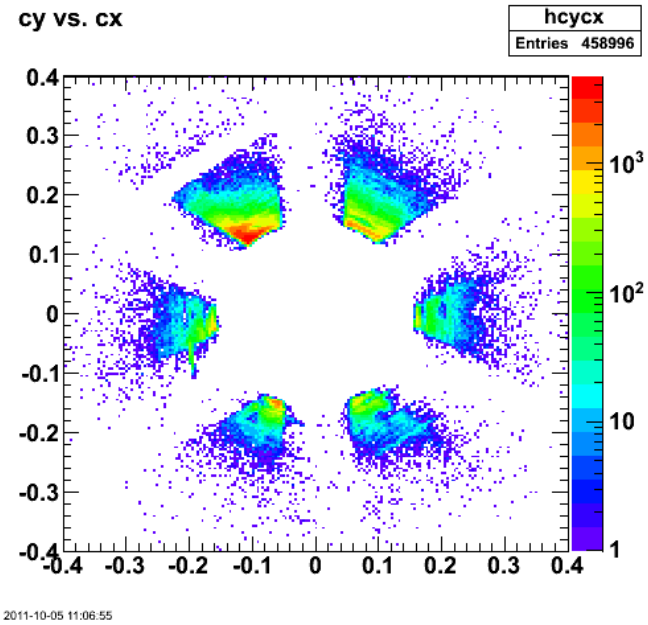


Fig 13. A plot of the transverse direction cosines for x>2, 2.6r, no fids and Wvo < 1.02 GeV shows the hot spot.

Click here to view the object (Root macro) you uploaded.

LW suggest φ_e versus θ_e.

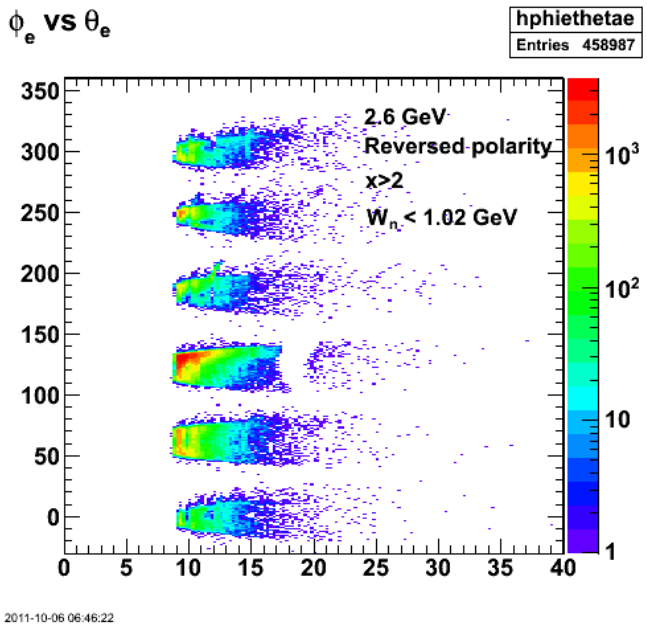


Fig 14. φ_e versus θ_e for 2.6r, x>2, Wn cut.

Click here to view the object (Root macro) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 405 - Checking on target configuration (gpg)

[Modified Sat Oct 15 17:31:33 2011 (GMT) gpg]

It looks like the parameters are too small for the target. Were the numbers in inches when they should have been converted to mm?

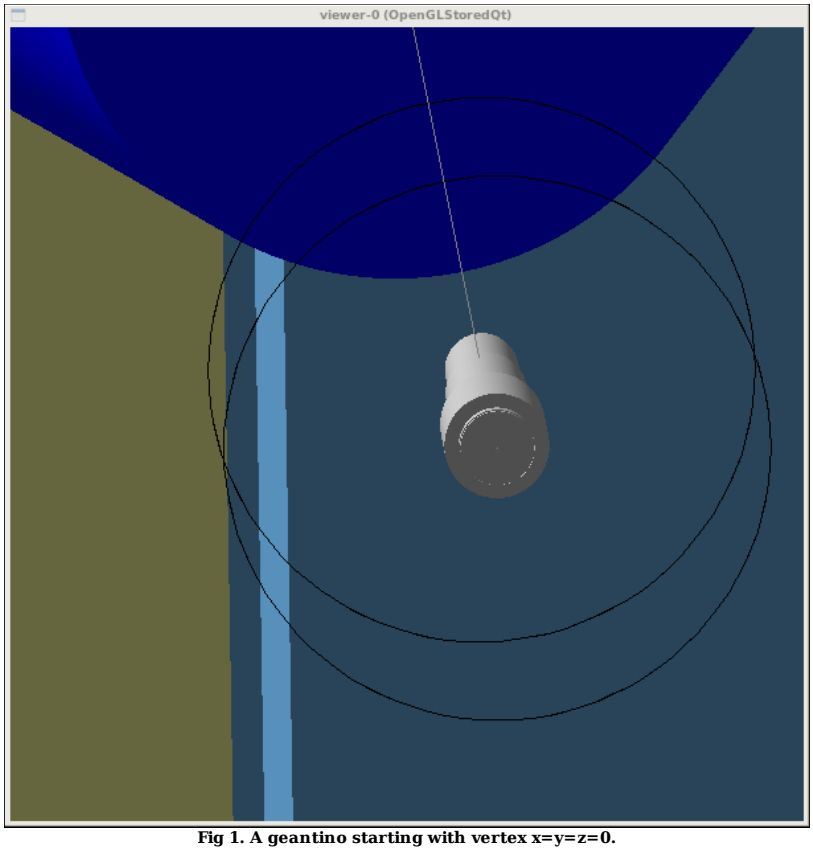


Fig 1. A geantino starting with vertex x=y=z=0.

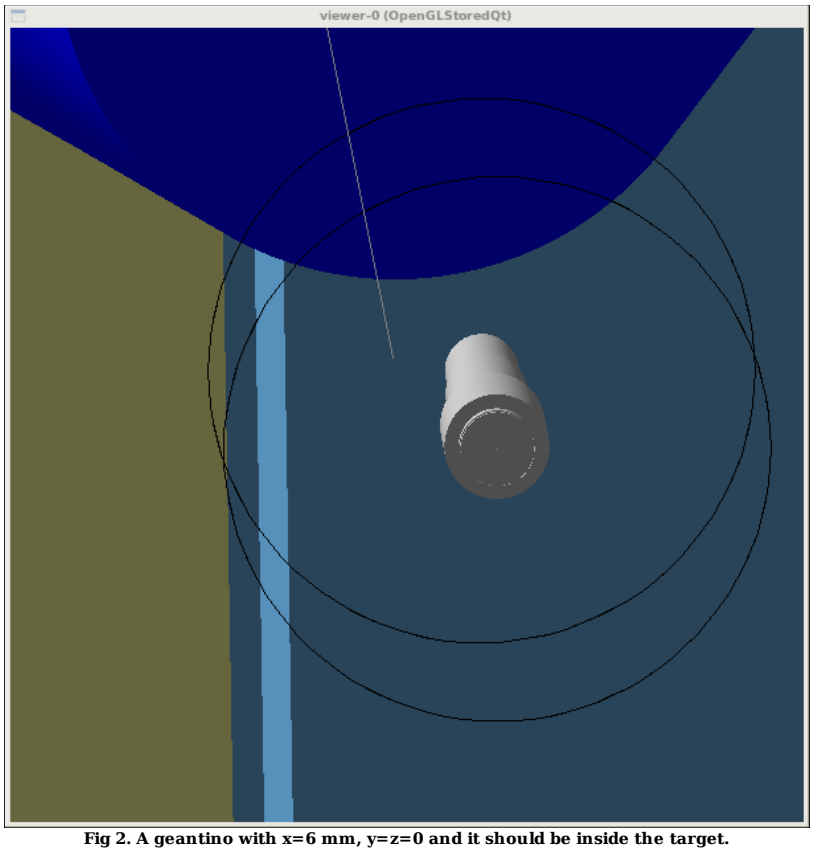


Fig 2. A geantino with x=6 mm, y=z=0 and it should be inside the target.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 406 - Comparison with WVO calculations averaged over x for 2.6r. (gpg)

[Modified Sun Oct 16 19:26:06 2011 (GMT) gpg]

Wally has sent me calculations for D(e,e'p)n at different Q2 and Bjorken x so I can now average over those calculations for comparison with the 2.6r results that are also averaged over x and Q2. The first plot shows a comparison of the ALTp data with the old cuts (W+MM2 and open circles) and the new ones (Wn+xBj and filled squares). The dip is shallower. The curves are SJ's from three years ago (solid red curve) which are averaged only over Q2 and for x=1 and WVO's recent ones (dashed red curve) that are averaged over Q2 and x. The surprising thing is that WVO's calculation has deeper dip since averaging over x tends to make the dip shallower since it is shallower away from x=1.0.

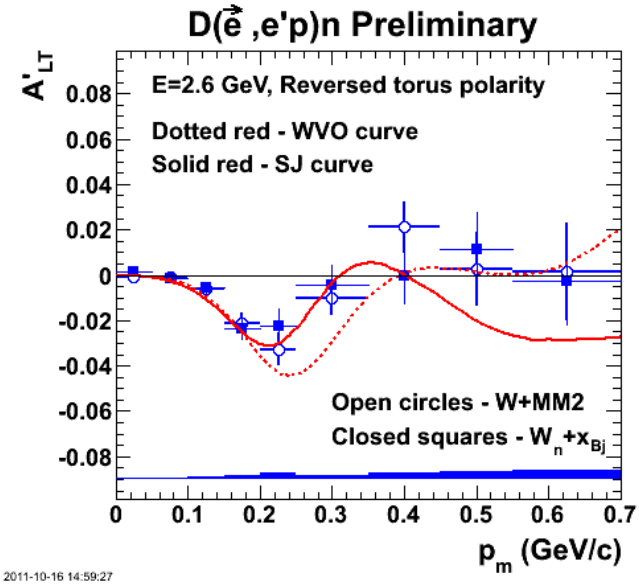


Fig 1. Comparison of ALTp data for 2.6r with old cuts and new and SJ's and WVO's calculation. See text.

Click here to view the object (Root macro) you uploaded.

Click here to view the object (gzipped tar file with code for the above analysis) you uploaded.

Click here to view the object (gzipped tar file with WVO calculations and Mathematica files for the above analysis.) you uploaded.

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 407 - Q^2-x distribution (gpg)

[Modified Thu Oct 20 17:52:43 2011 (GMT) gpg]

Is there anything I can learn from the distribution of Q2-x? This is motivated by the fact that WVOs calculation has kinematically forbidden regions and I want to see where they appear in the data. The line is the picture is drawn from the kinematics of the 'failed' WVO calculations which is well below the lower limits of the data. This may mean that I have to think harder about how I am averaging the WVO calculations.

The other weird thing is the structure in Q2 at low x. This clearly looks screwy!

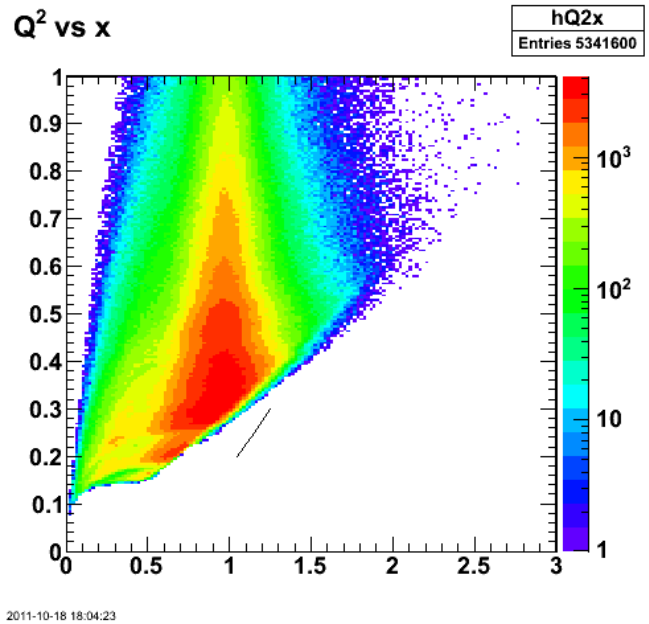


Fig 1. Q2-x for 2.6r with Wn cut turned on, fids on.

Click here to view the object (Root macro) you uploaded.

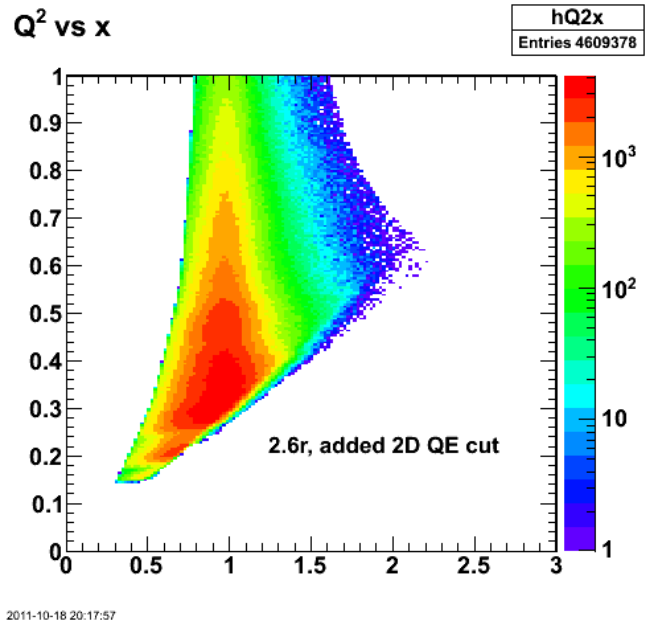


Fig 2. Same as Fig 1 with 2D QE cut added.

Click here to view the object (Root macro) you uploaded.

Look at ALTp with NO cut on x and with/without the 2D QE cuts. This doesn't look so bad!

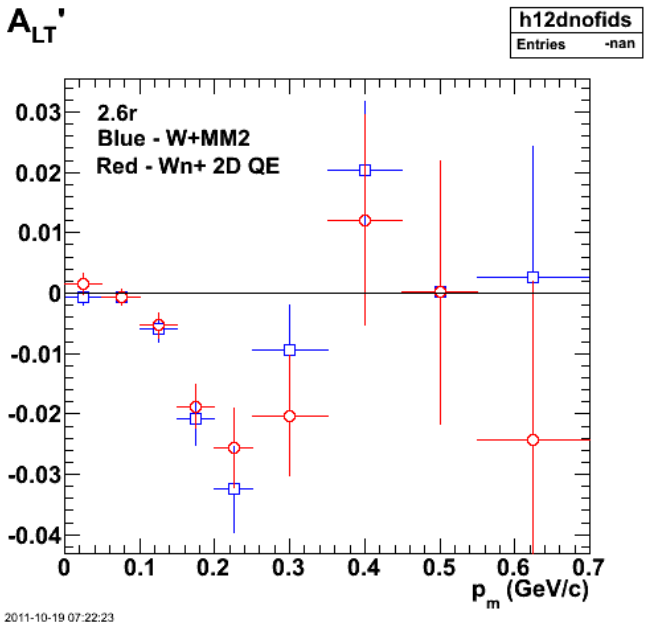
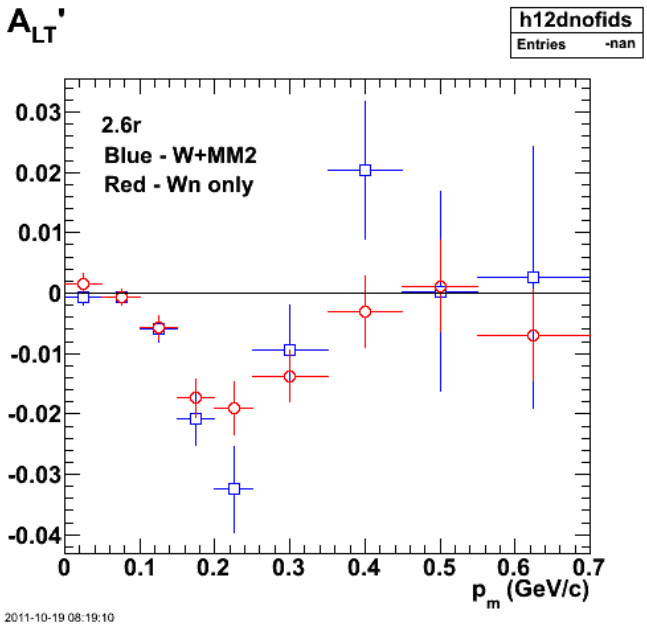


Fig 3. ALTp for cuts used to make Fig 2.

Click here to view the object (Root macro) you uploaded.



Turn off the 2D QE cut (right-hand panel)

Click here to view the object (Root macro) you uploaded.

Now look at the 2.6-GeV, normal torus polarity data. The problem is that without a narrow cut on QE events the dip that we see with the W+MM2 cuts disappears. Maybe we just so results for the 2.6r data? Or we study the evolution of ALTp with x and compare with the WVO and JVO calculations.

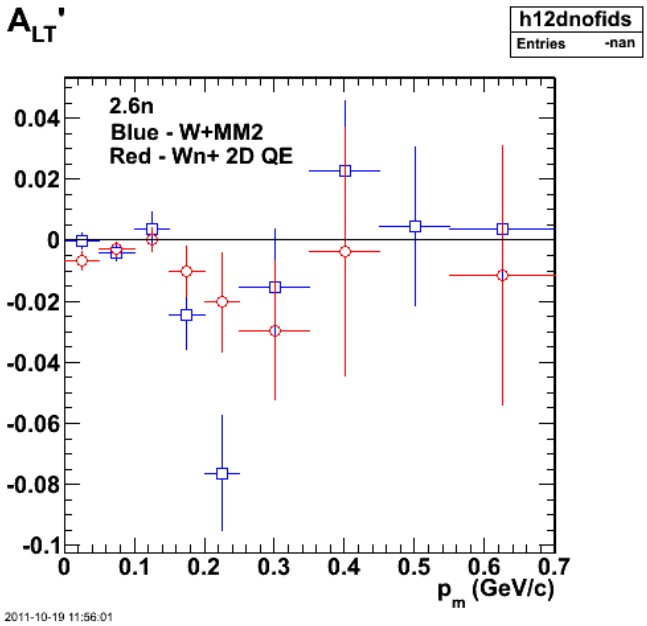
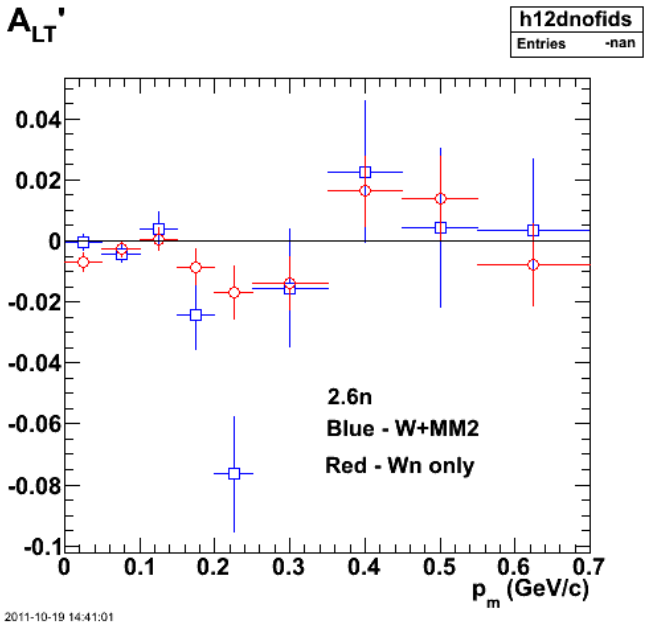


Fig 4. Comparison of standard ALTp with more recent QE cuts for 2.6n.

Click here to view the object (Root macro) you uploaded.



ALTp for 2.6n with the 2D QE cut turned off.

Click here to view the object (Root macro) you uploaded.

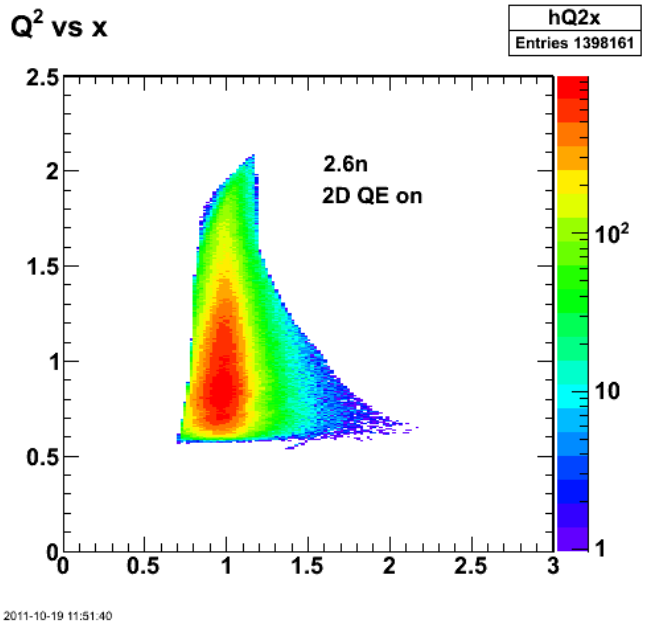


Fig 5. Q2-x distribution for 2.6n with Wn + 2D QE cut and nothing else on ALTp.

Click here to view the object (Root macro) you uploaded.

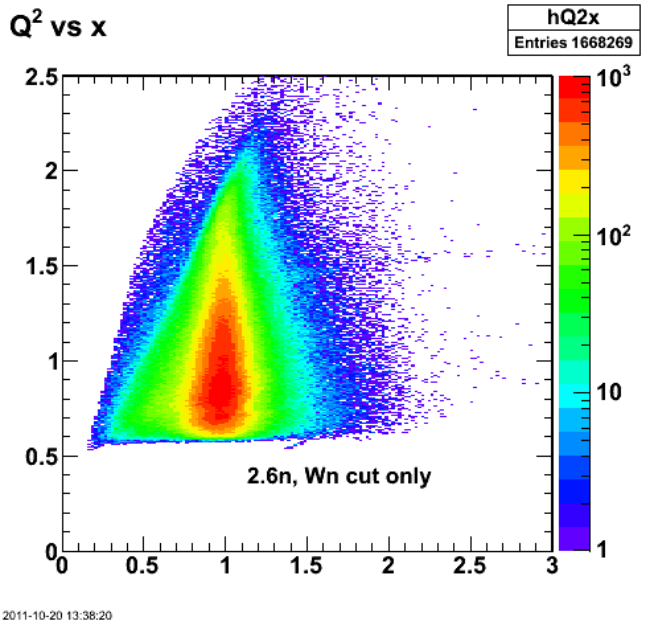


Fig 6. Q2-x distribution for 2.6n with Wn cut only.

Look at the distribution of xBJ versus p_m. It is now clear why the xBJ cut reduces the statistics. At higher p_m, the Bjorken x distribution becomes very wide so restricting x trows out lots of events.

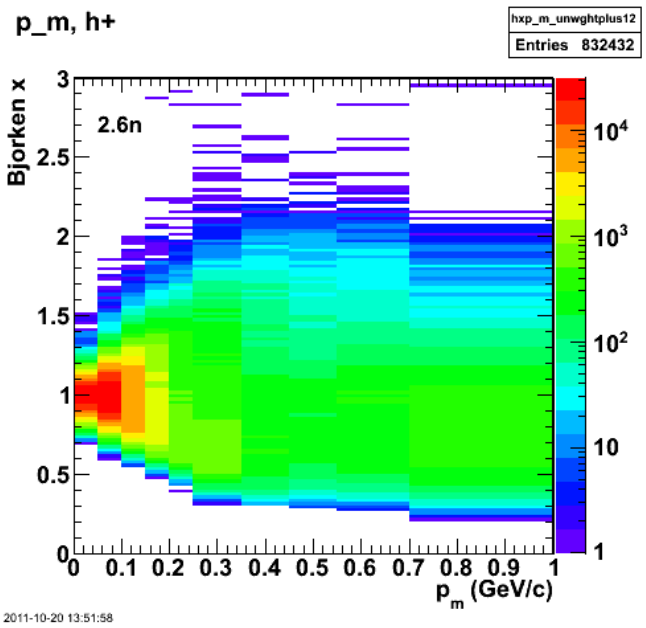


Fig 7. xBJ-p_m distribution for 2.6n with Wn cut on (no 2D QE cut).

DOE 2000 Electronic Notebook

Jerry Gilfoyle's Enotebook page 408 - Tracking results for GMn target (gpg)

[Modified Mon Oct 24 13:30:27 2011 (GMT) gpg]

Below are plots from Socrat showing generated vz and reconstructed vz for 6 GeV electrons. The resolution is crappy because the FST seems to be turned off. Toggling the parameters in Socrat.opt has no effect other than to make the reconstruction run longer. Leave this as a mystery to be solved alter.

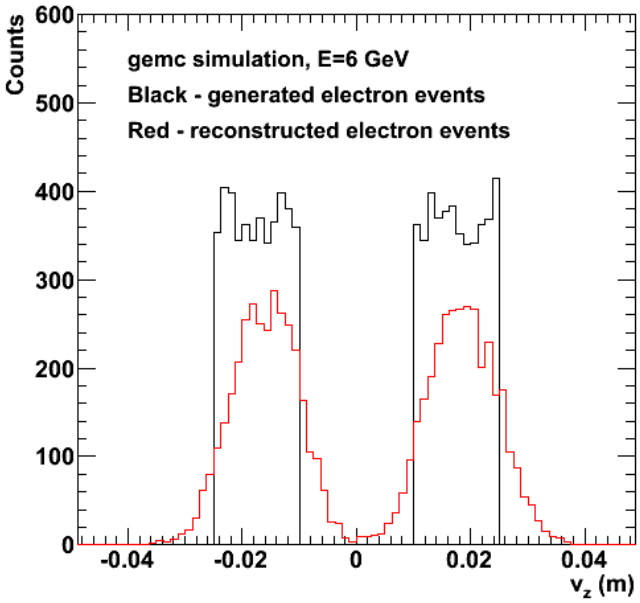


Fig 1. tracking results from Socrat for GMn target.

Click here to view the object (Root macro) you uploaded.

End of Notebook.