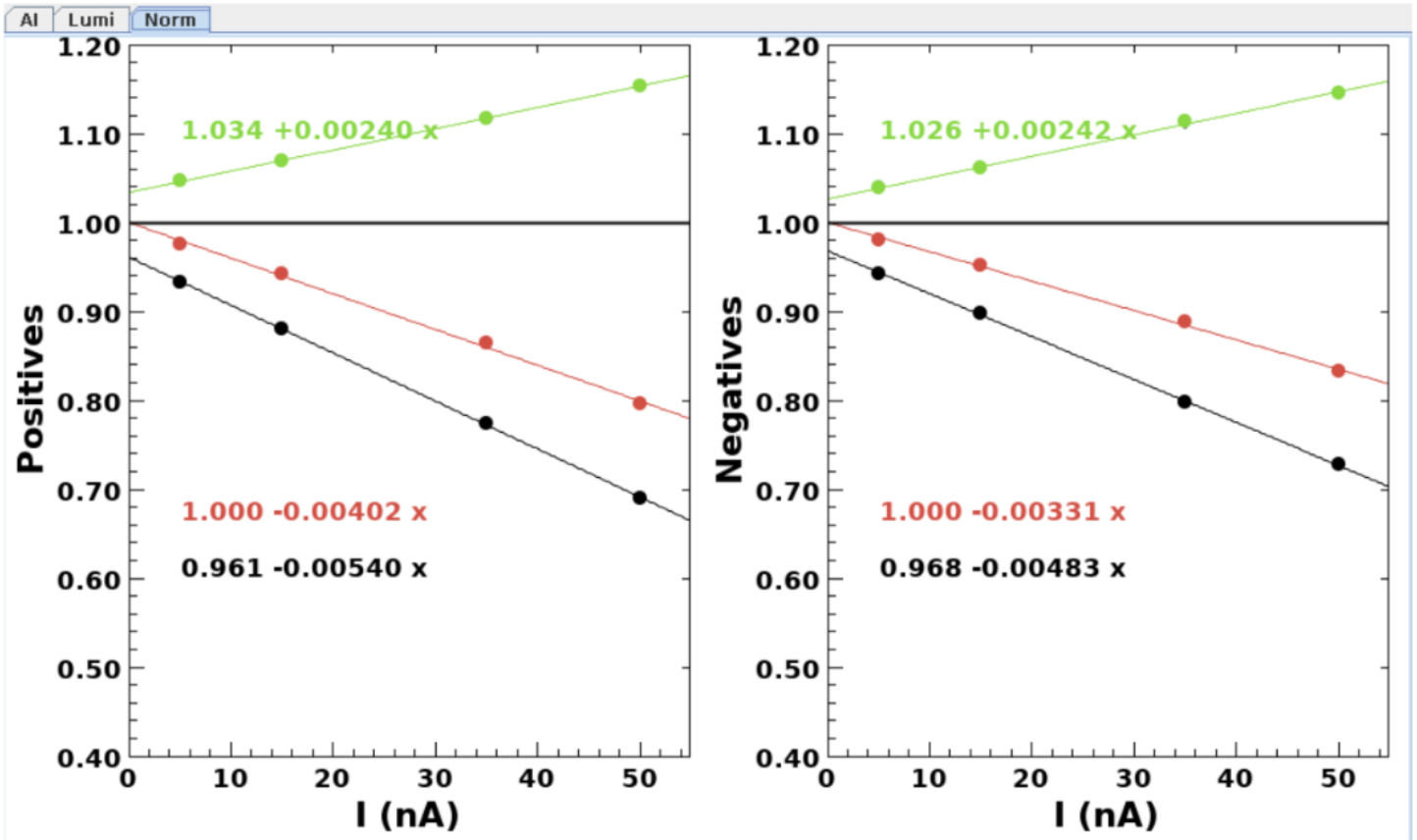
Luminosity dependence of RGB data 1

RGB Pass 2 Review

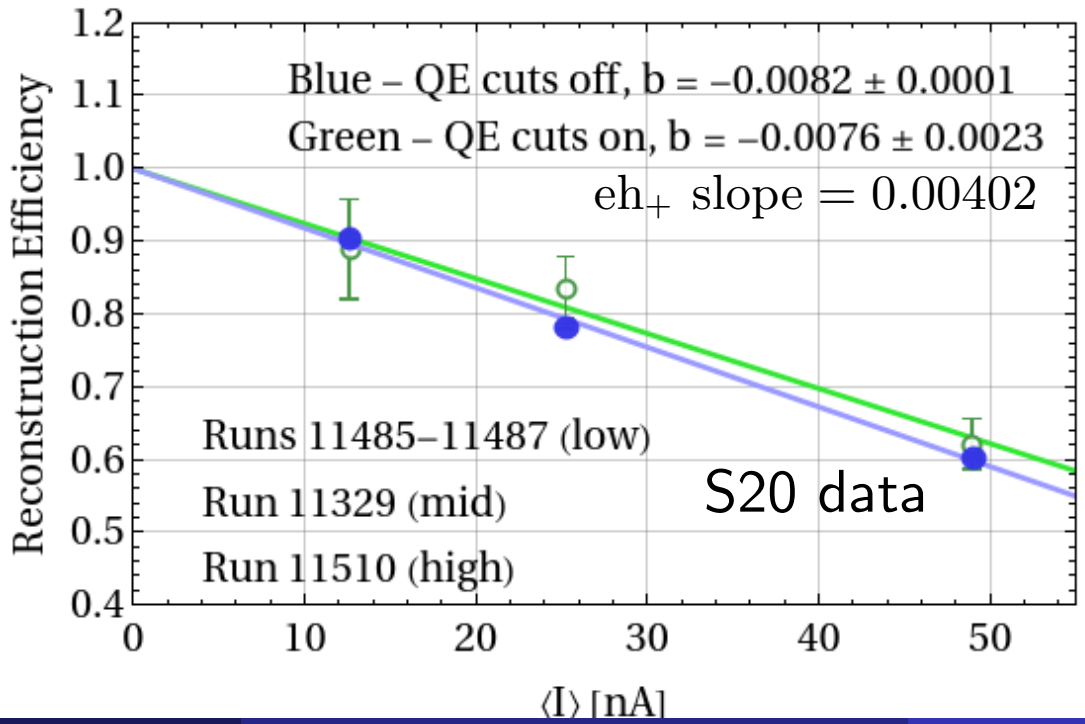


Normalized yields of eh+/-

Conventional
AI-assisted
Ratio

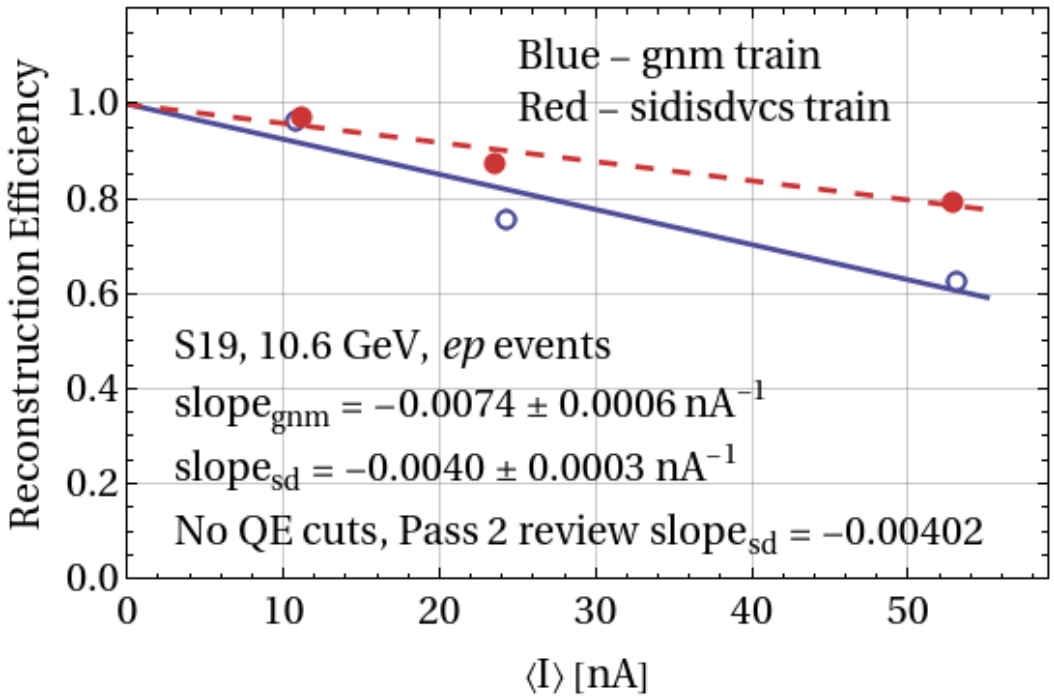
Luminosity dependence of RGB data - gmn train 2

1. Check luminosity effects on G_M^n analysis (gnm train).
2. Series of cuts to select quasi-elastic (QE) *ep* events.
   1. Cut on calculated beam energy from electron and nucleon angles.
   2. In-plane cut ($\Delta\phi$).
   3. Angle between $\vec{q}$ and nucleon momentum (θ_{pq}).
3. Remove QE cuts to get more *ep* events.
4. Slope is steeper than the previous slide (sidisdvcs train).

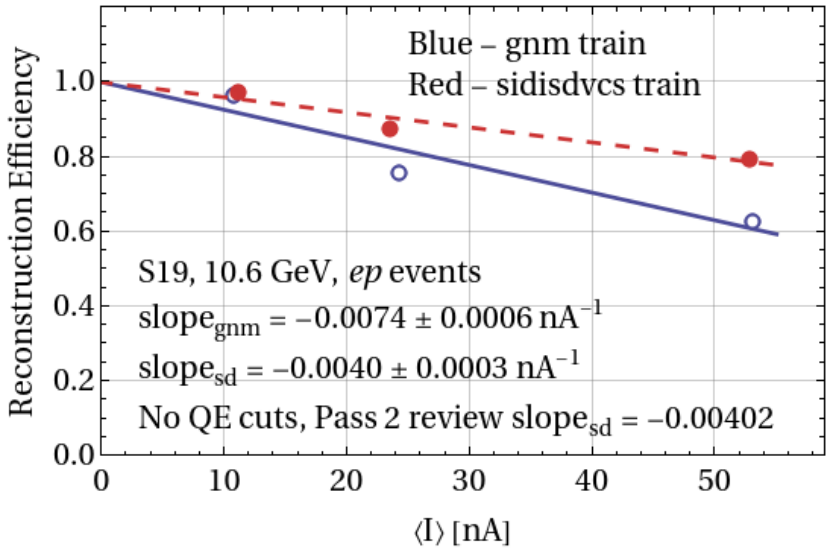


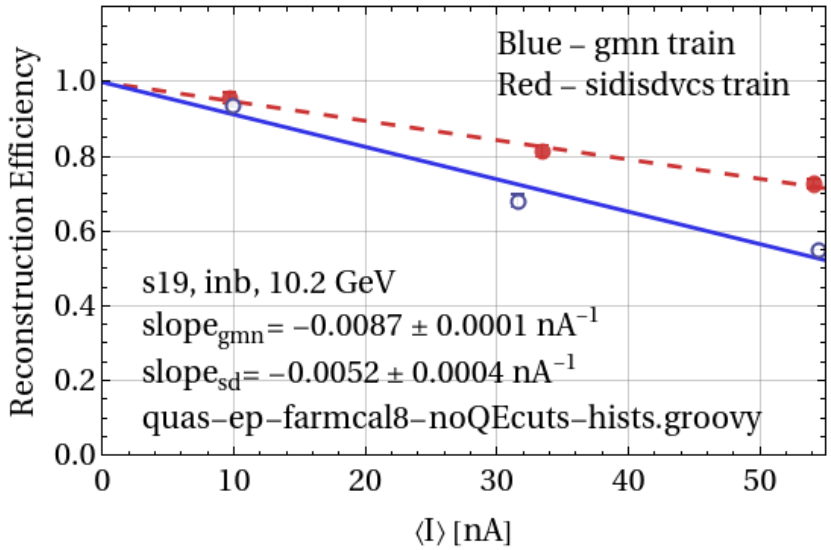
Luminosity dependence of RGB data - sidisdvcs 3

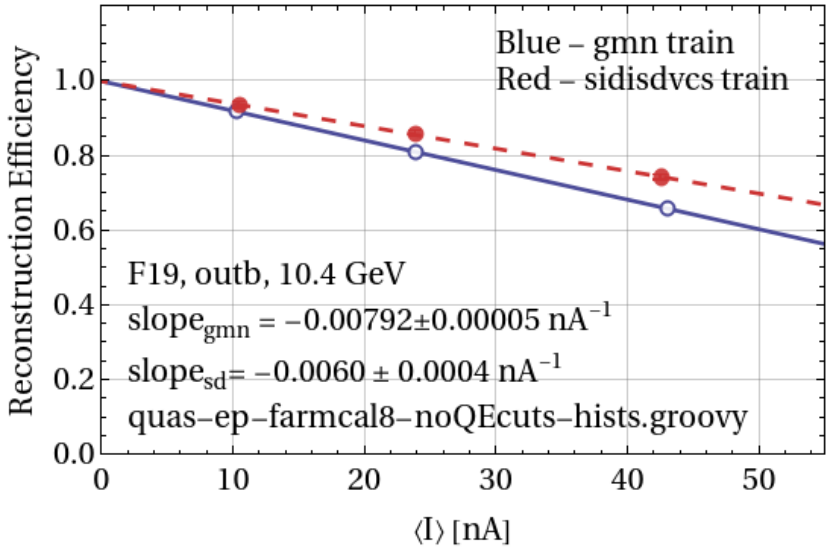
1. Steeper slope of reconstruction efficiency with luminosity observed for *ep* events from gnm train compared with eh_+ slope for pass 2 review.
2. Investigate differences between *ep* final states with different kinematics.
3. Compare final state from gnm (*ep*, no pions) and sidisdvcs (has protons, pions) trains.
4. Plot below is a comparison of *ep* events from different trains, spring 2019, 10.6 GeV, runs 6157, 6371, 6378.

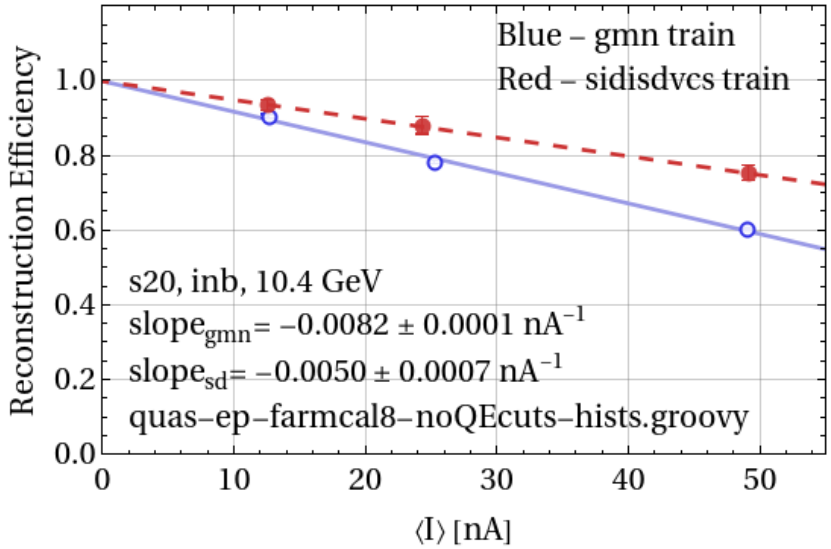


Comparison of gmn and sidisdvcs trains 4









Comparison of Slopes for gmn and sidisdvcs trains 5

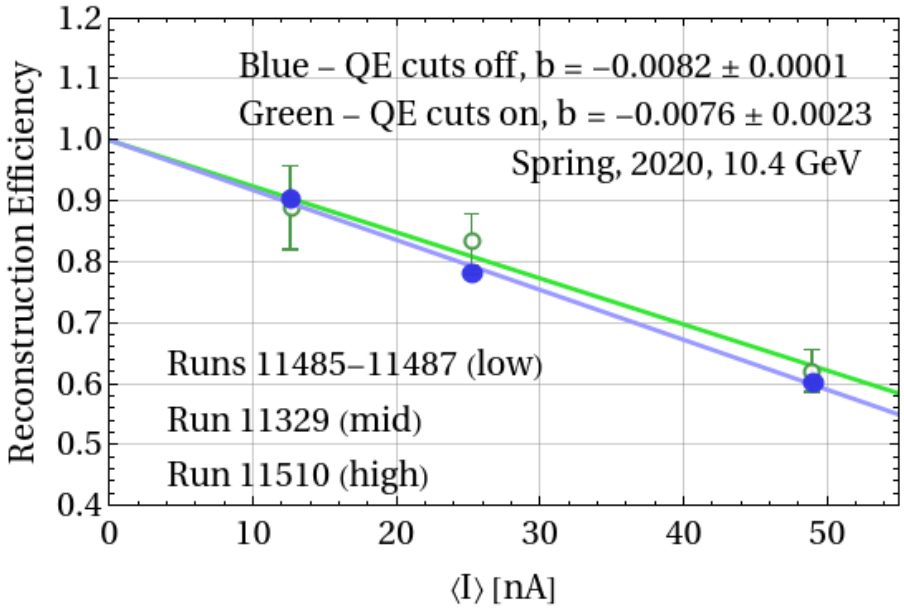
	sidisdvcs	gmn	$\mathrm{E_{beam}[GeV]}$
Spring, 2020	$-0.0050 \pm 0.0007\ nA^{-1}$	$-0.0082 \pm 0.0001\ nA^{-1}$	10.4
Fall, 2019	$-0.0060 \pm 0.0004\ nA^{-1}$	$-0.0079 \pm 0.0001\ nA^{-1}$	10.4
Spring, 2019	$-0.0052 \pm 0.0004\ nA^{-1}$	$-0.0087 \pm 0.0001\ nA^{-1}$	10.2
Spring, 2019	$-0.0040 \pm 0.0003\ nA^{-1}$	$-0.0074 \pm 0.0001\ nA^{-1}$	10.6

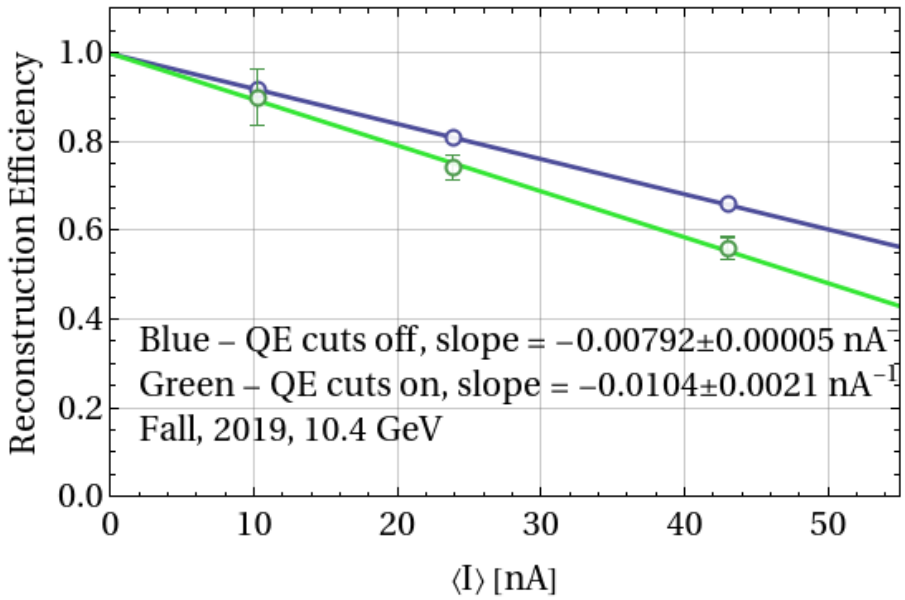
Weighted averages:

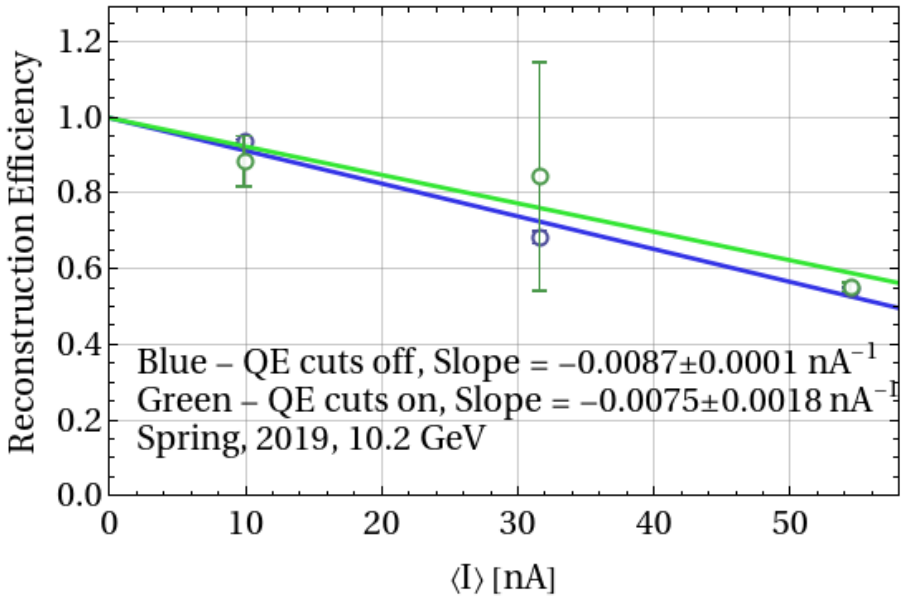
For sidisdvcs train: $\langle b \rangle = 0.0049 \pm 0.0002\ nA^{-1}$

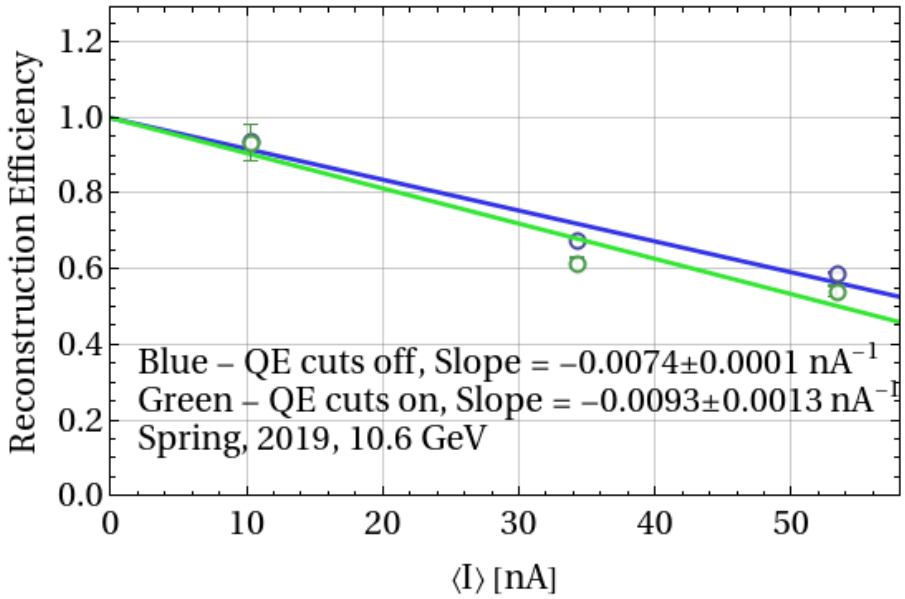
For gmn train: $\langle b \rangle = 0.00805 \pm 0.00005\ nA^{-1}$

Comparison of QE on and off (gmn train) 6









Comparison of Slopes for QE on and off 7

	QE cuts on	QE cuts off	$\mathrm{E_{beam}[GeV]}$
Spring, 2020	$-0.0076 \pm 0.0023\ nA^{-1}$	$-0.0082 \pm 0.0001\ nA^{-1}$	10.4
Fall, 2019	$-0.0104 \pm 0.0021\ nA^{-1}$	$-0.0079 \pm 0.0001\ nA^{-1}$	10.4
Spring, 2019	$-0.0075 \pm 0.0018\ nA^{-1}$	$-0.0087 \pm 0.0001\ nA^{-1}$	10.2
Spring, 2019	$-0.0093 \pm 0.0013\ nA^{-1}$	$-0.0074 \pm 0.0001\ nA^{-1}$	10.6

Weighted averages:

For QE cuts on: $\langle b \rangle = 0.0087 \pm 0.0014\ nA^{-1}$

For QE cuts off: $\langle b \rangle = 0.00805 \pm 0.00005\ nA^{-1}$

Extracting average beam currents 8

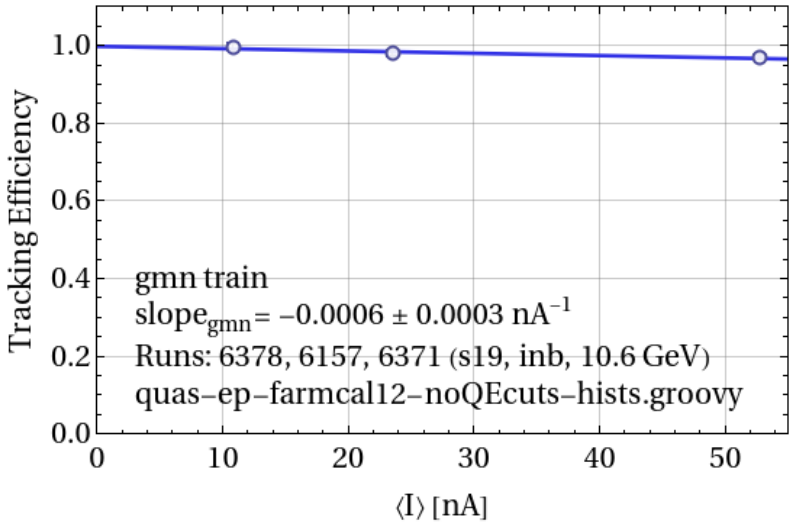
1. Use NB method to get the current at frequent intervals - Get ungated Faraday cut reading in RUN::config bank which records integrated current since last time the bank was written out.
2. Get the timestamp from Trigger Interface board in RUN::config.
3. Divide by the time since the last recording of RUN::config bank.
4. Require the current exceed a threshold of 1 nA to remove beam trips.

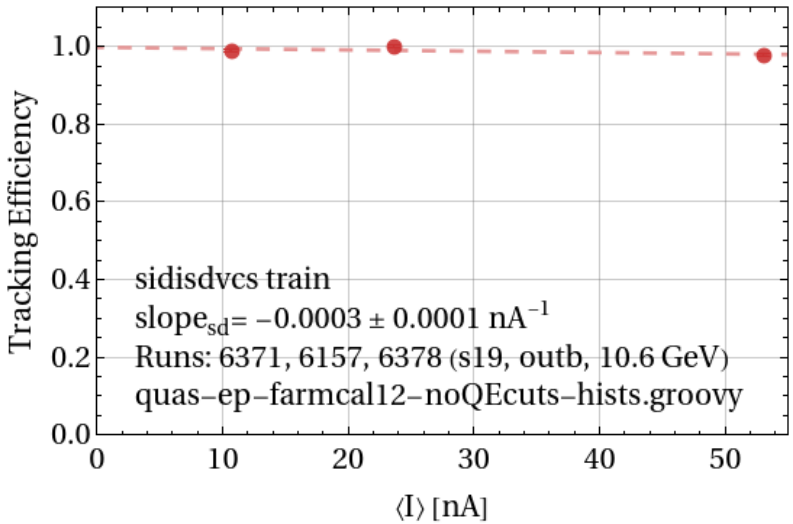
From CLAS12-NOTE 2020-005

1. $p_{\pm} > 0.4\ \mathrm{GeV/c}$
2. $|\chi 2PID| < 5$, $|\chi 2| < 10|$
3. Reject tracks with FTOF Panel 2 - don't see any.
4. Vertex $-15 < v_z < 5\ cm$ in RGA. RGB had $-13 < v_z < 12\ cm$ for inbending.
5. fiducial cuts

Backup Slides

Changed minimum electron momentum cut and luminosity slope now ≈ 0!





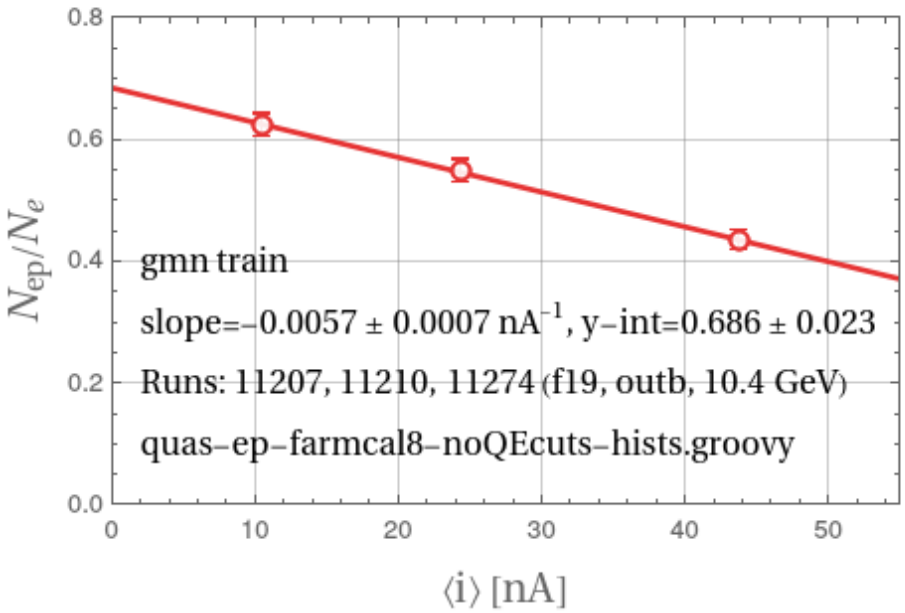
G_M^n yaml file

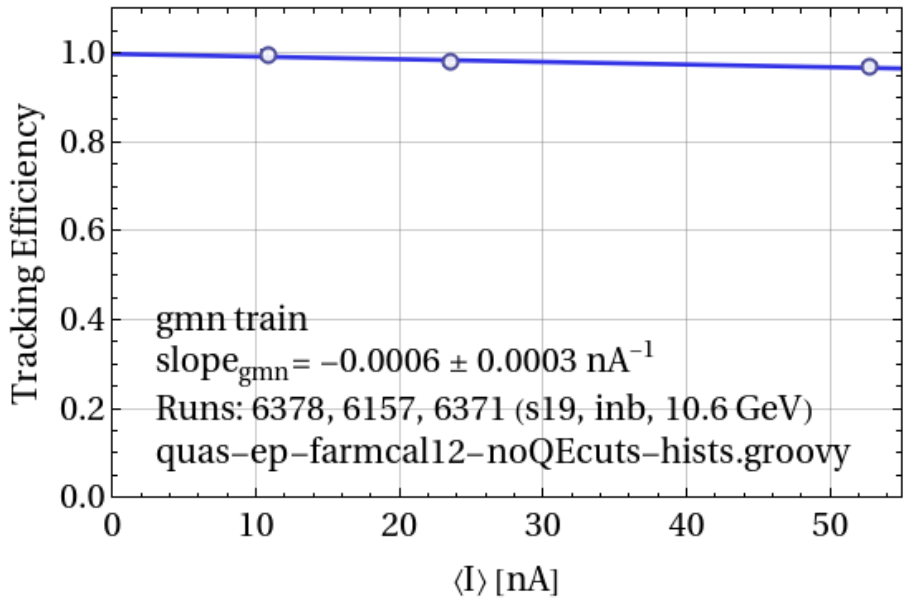
```
########################################################## GMn
    gmn1:
      id: 2
      forward: 11:Xn
      beamEnergy: 10.410
      targetPDG: 2112
      electron: Q2>0.95 && W<2 && vz>-25 && vz<20
    gmn2:
      id: 2
      forward: 11:2212:Xn
      beamEnergy: 10.410
      targetPDG: 2212
      electron: Q2>0.95 && W<2 && vz>-25 && vz<20
```

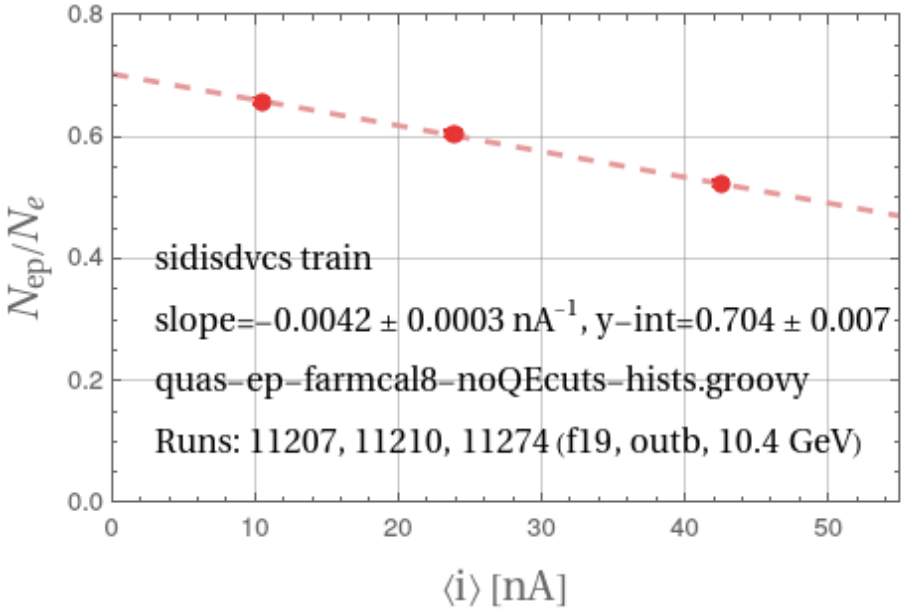
sidisdvcs yaml file

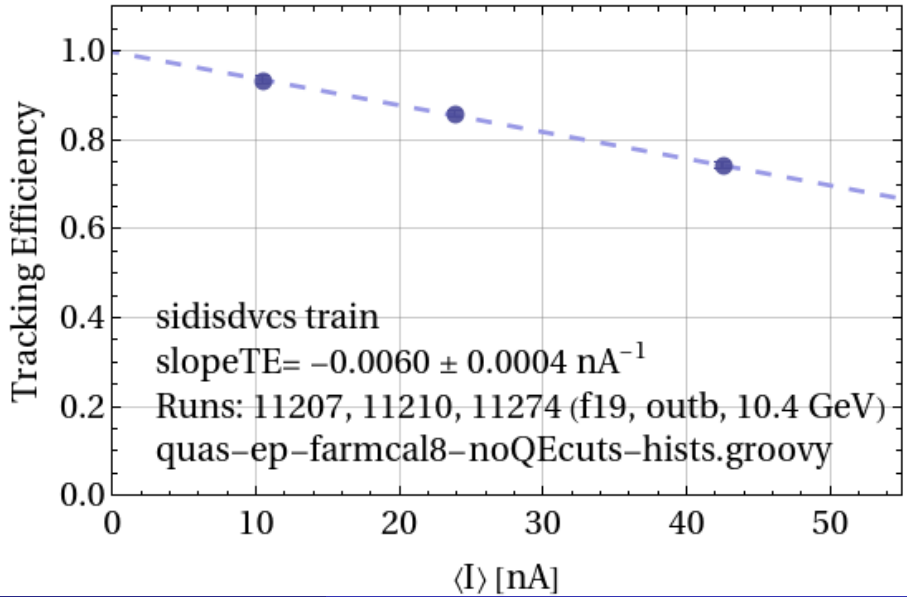
```
################################################## sidisdvcs
    sidisdvcs:
      id: 4
      forward: 11:X+:X-:Xn
      beamEnergy: 10.410
      targetPDG: 2112
      electron: Q2>0.95 && W>1.95 && p>1 && vz>-25 && vz<20
```

Recent (May 2, 2025) Results

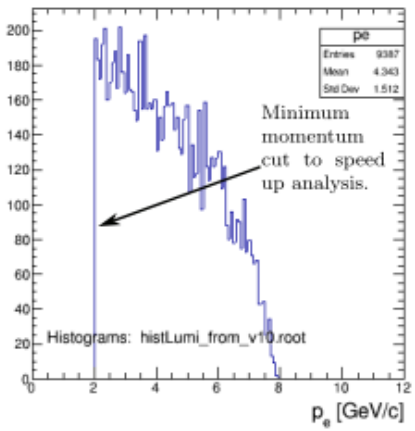


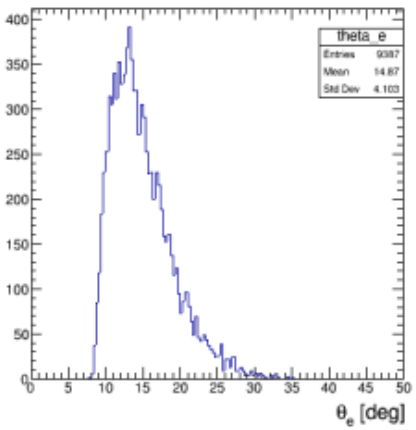


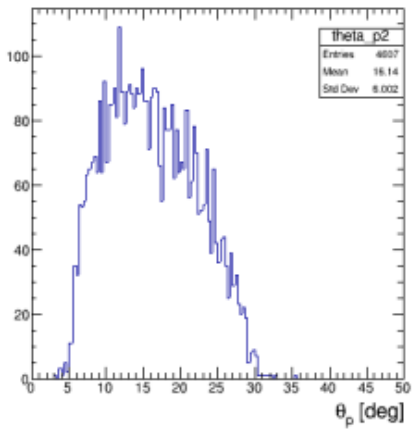


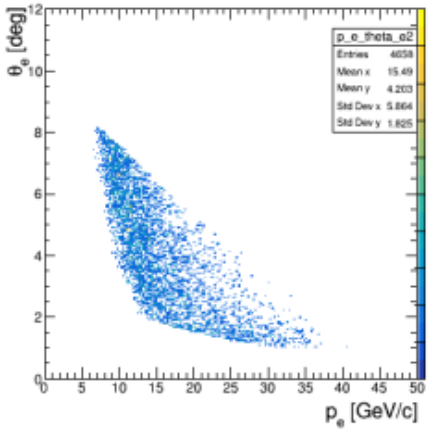


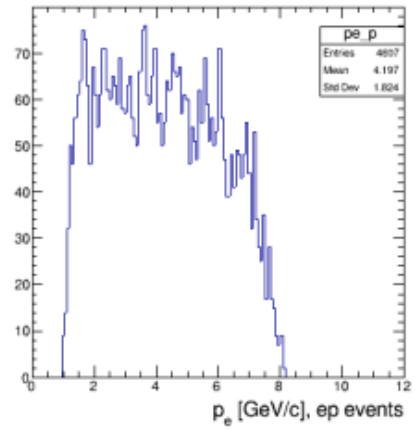
Kinematic distributions for *ep* events

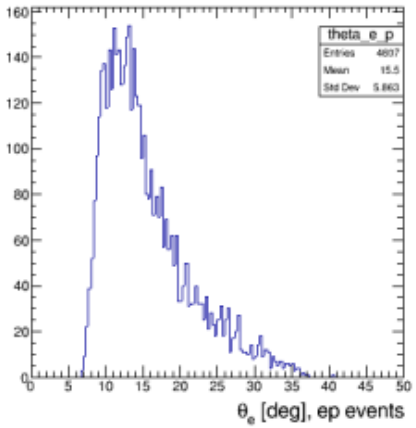


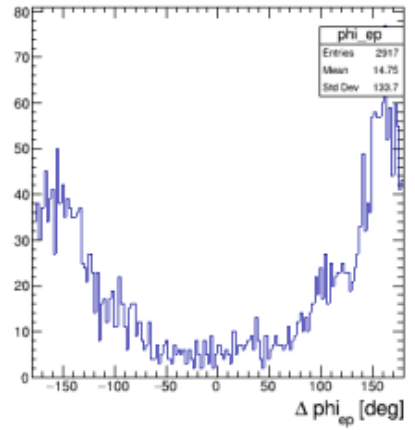


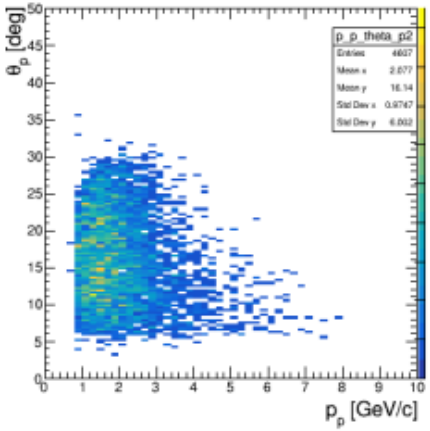




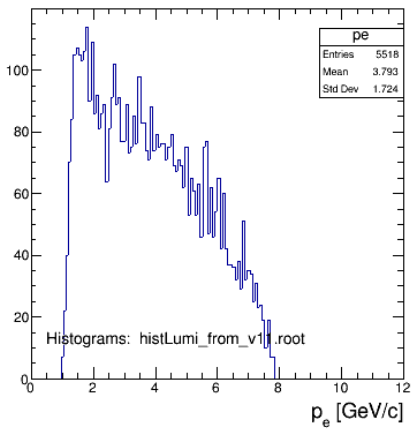


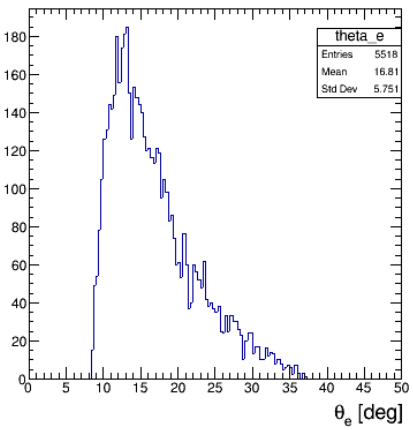


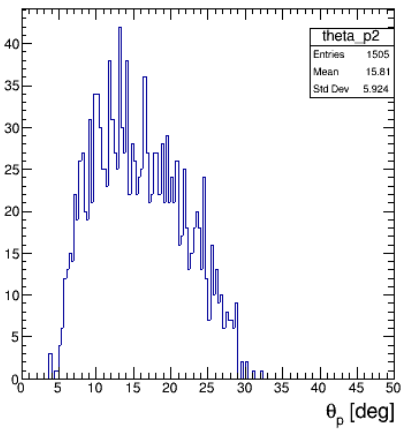


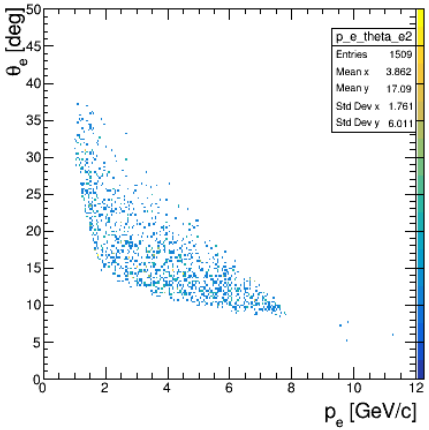


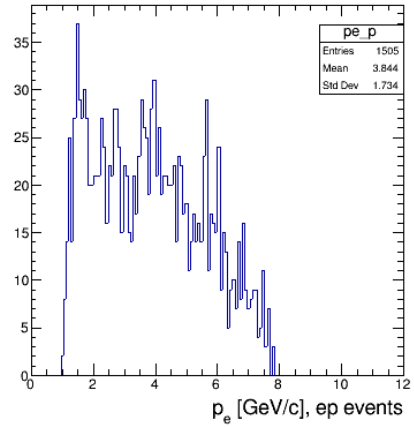
Revised distributions for *ep* events (gmn train, S19) 16

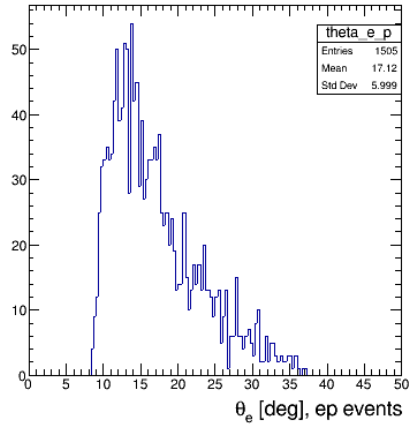


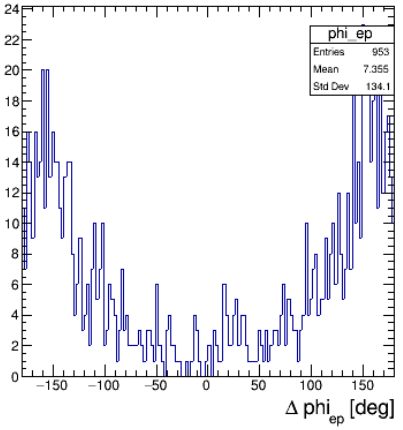


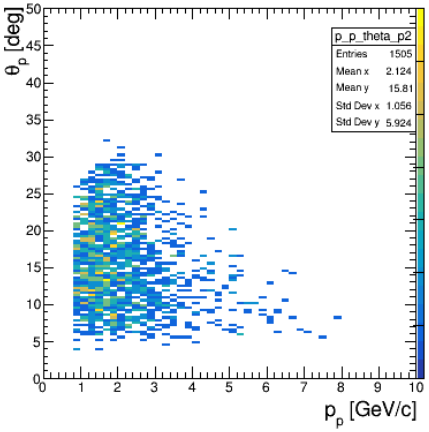




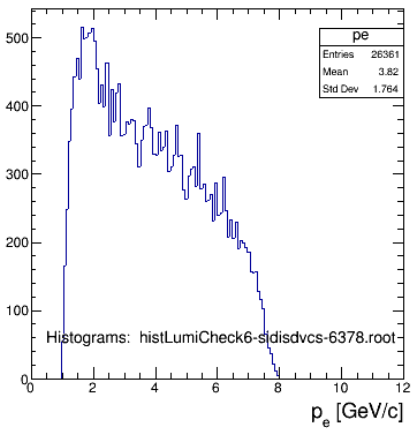


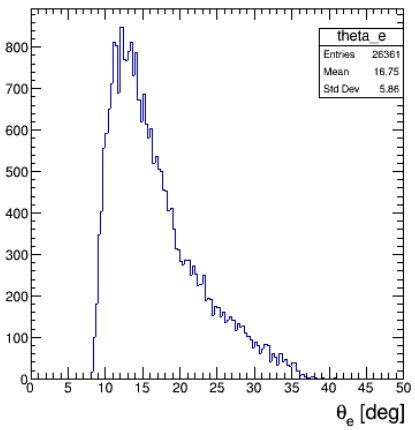


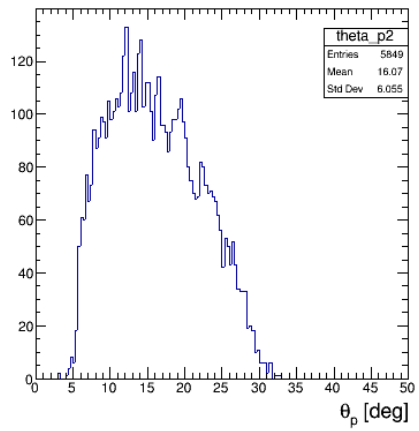


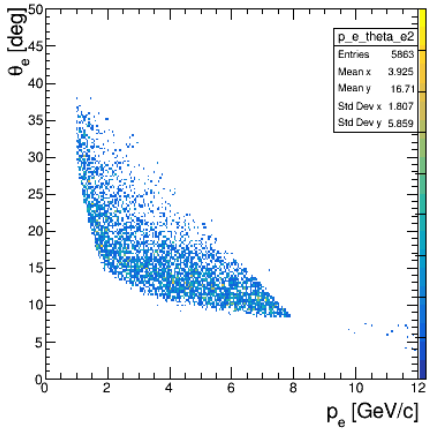


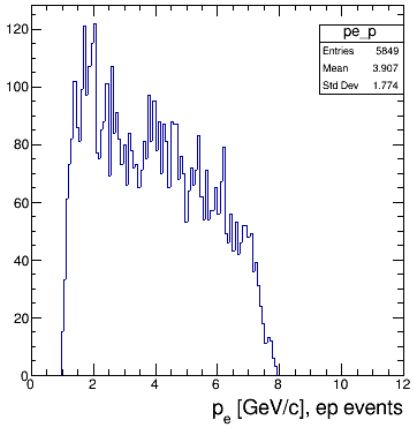
Revised distributions for *ep* events (sidisdvcs trains, S19)17

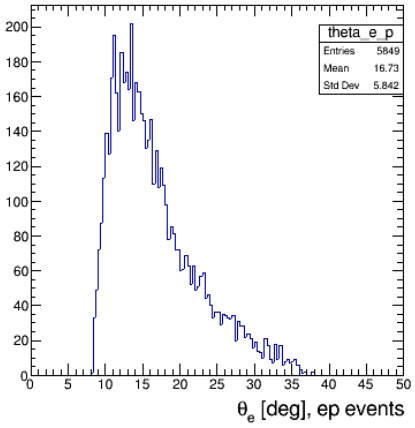


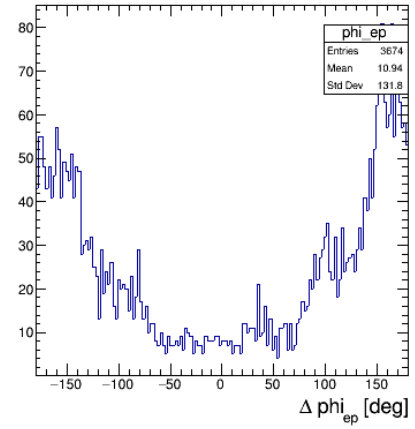


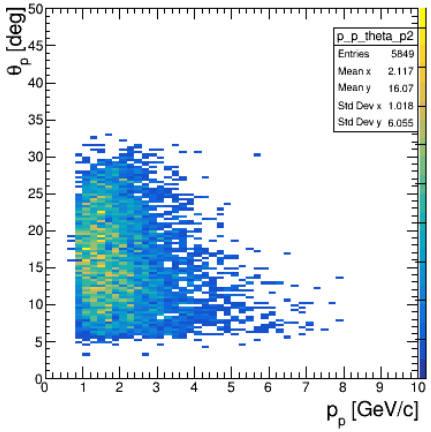




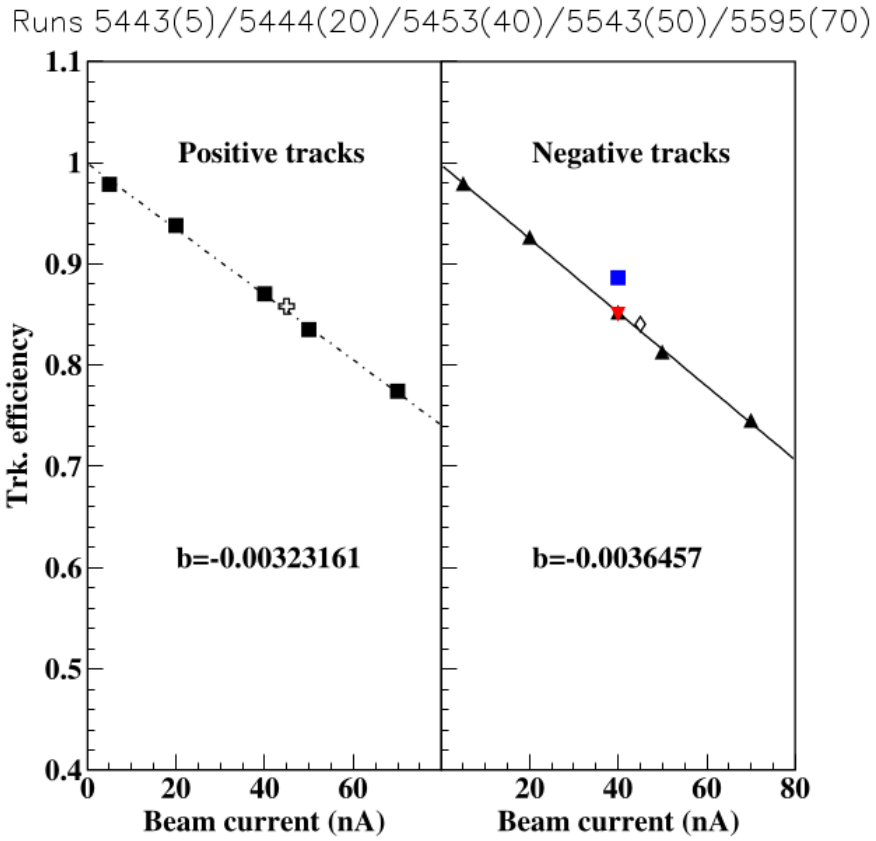




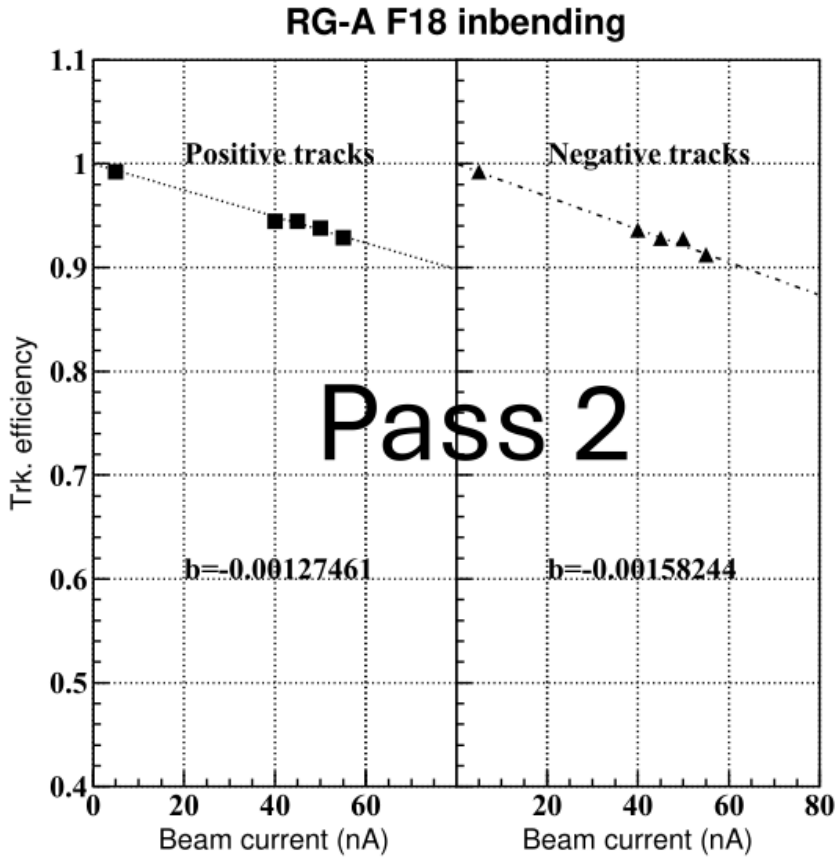




Luminosity dependence of $N_{eh\pm}/N_e$, RG-A Data



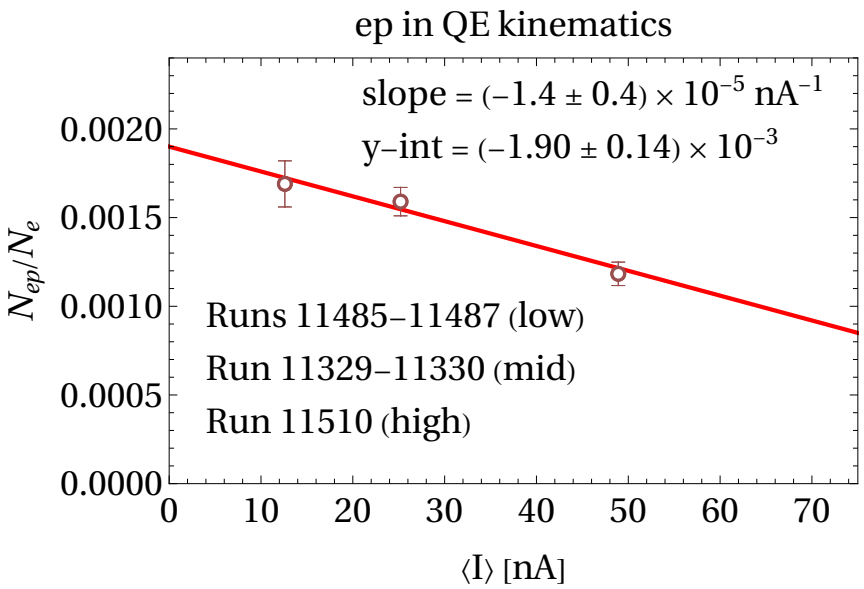
CLAS12-NOTE 2020-005

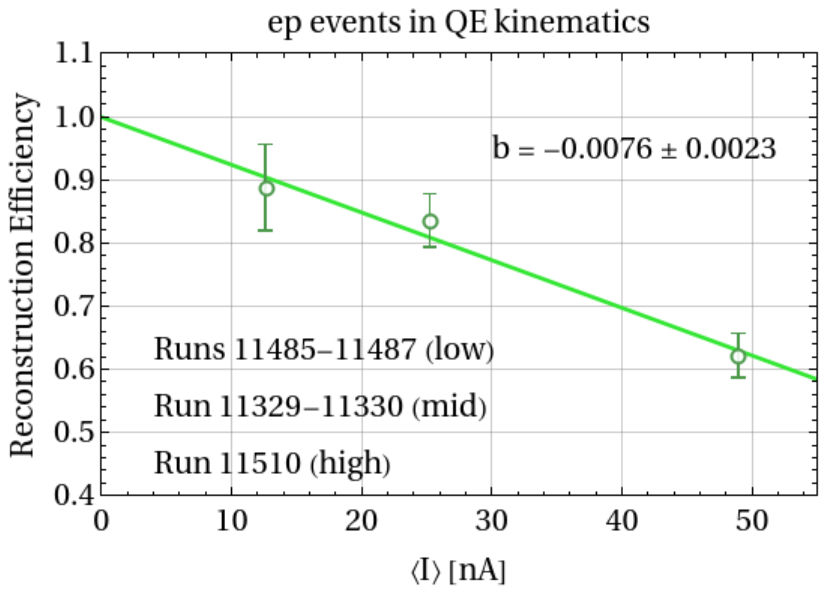


S.Stepanyan, RG-B, 9/7/24

Luminosity dependence of RGB data, QE cuts on (S20) 19

RGB N_{ep}/N_e luminosity dependence with QE cuts on - beam energy calculated from particle angles, θ_{pq}, and $\Delta\phi$.





Luminosity dependence of RGB data, QE cuts off (S20) 20

RGB N_{ep}/N_e luminosity dependence with QE cuts off - dropped cuts on beam energy calculated from particle angles, θ_{pq}, and $\Delta\phi$.