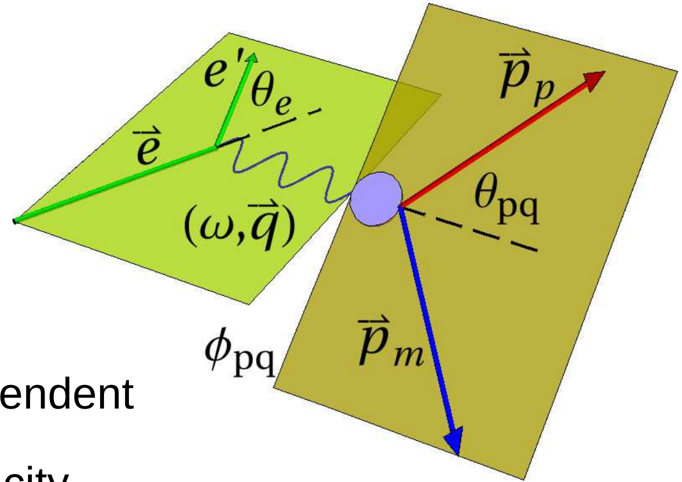
# Measuring the Fifth Structure Function in $^2\mathrm{H}(\vec{e}, e'p)n$, Gilfoyle et al.

- Establish baseline for the hadronic model; deuteron an essential testing ground.
- Fifth structure function is a little-studied part of the deuteron response function sensitive to final state interaction (FSI) and the $NN$ interaction - imaginary part of the quasielastic LT interference term (fifth structure function) of $^2\mathrm{H}(\vec{e}, e'p)n$ at $Q^2 \approx 1\ (\mathrm{GeV/c})^2$.
- The cross section is

$$\frac{d^3\sigma}{d\omega d\Omega_e d\Omega_p} = \sigma_L + \sigma_T + \sigma_{LT}\cos(\phi_{pq}) + \sigma_{TT}\cos(2\phi_{pq}) + h\sigma'_{LT}\sin(\phi_{pq})$$

where $h = \pm 1$ for different beam helicities.




- Extract the helicity asymmetry from the $\phi_{pq}$-dependent moments in each $\vec{p}_m = \vec{q} - \vec{p}_p$ bin.

beam helicity

$$\langle \sin\phi_{pq} \rangle_\pm = \frac{\int_{-\pi}^{\pi} \sigma^\pm \sin\phi_{pq} d\phi_{pq}}{\int_{-\pi}^{\pi} \sigma^\pm d\phi_{pq}} = \pm \frac{\sigma'_{LT}}{2(\sigma_L + \sigma_T)} = \pm \frac{A'_{LT}}{2}$$

- Get rid of a sinusoidally-varying background by taking the difference of the

$$\langle \sin\phi_{pq} \rangle_+ - \langle \sin\phi_{pq} \rangle_- = \left( \frac{A'_{LT}}{2} + \alpha_{acc} \right) - \left( -\frac{A'_{LT}}{2} + \alpha_{acc} \right) = A'_{LT}$$

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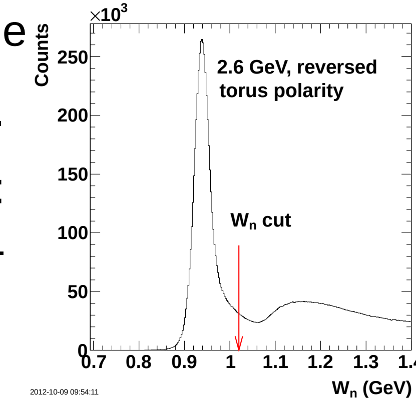
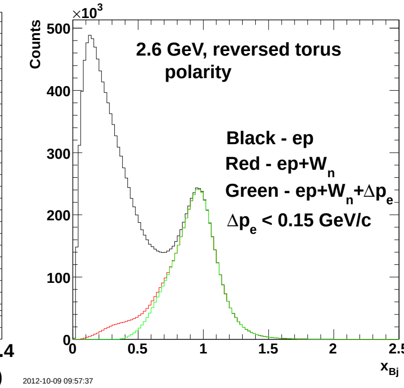
# Analysis and Results

- Data from the E5 run period in Hall B: $E = 2.56$ GeV with normal and reversed torus polarity to reach lower $Q^2$. Higher beam ene




- Dual $LH_2 - LD_2$ target; $P_e = 0.74 \pm 0.02$.
- Standard selection cuts and corrections: fiducial cuts, CC photoelectrons, momentum corrections, ...
- Quasielastic (QE) electron selection:
  - Cut on residual $epX$ mass $3\sigma_n$ below pion threshold ($\sigma_n$ is neutron width).
  - Radiative tail cut corrected with EXCLURAD.
- Consistency tests: GSIM, $A'_{LT}$ at $p_m \approx 0$, fits versus $\langle \sin \phi_{pq} \rangle_\pm$, beam helicity.
- Systematic uncertainties extracted.
- Similar $A'_{LT}$ for both data sets; Jeschonnek and Van Orden calculation does well at low-$Q^2$, but gets too deep a dip at higher $Q^2$.
- Analysis note nearly done.