

Measuring the Fifth Structure Function in ${}^2\text{H}(\vec{e}, e'p)n$, 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 ${}^2\text{H}(\vec{e}, e'p)n$ at $Q^2 \approx 1 \text{ (GeV/c)}^2$.

- 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.

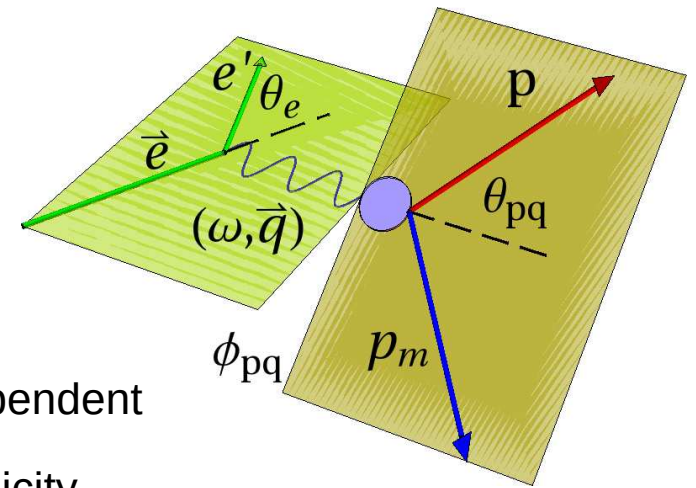
- Extract the helicity asymmetry from the ϕ_{pq} -dependent moments in each $\vec{p}_m = \vec{q} - \vec{p}_p$ bin.

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

beam helicity

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

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



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 energy
- 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 (σ_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.

