

2019 JLAB USERS ORGANIZATION MEETING

Deeply Virtual Compton Scattering at 10.6 GeV with CLAS12 at Jefferson Lab

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Tuesday, June 25, 2019

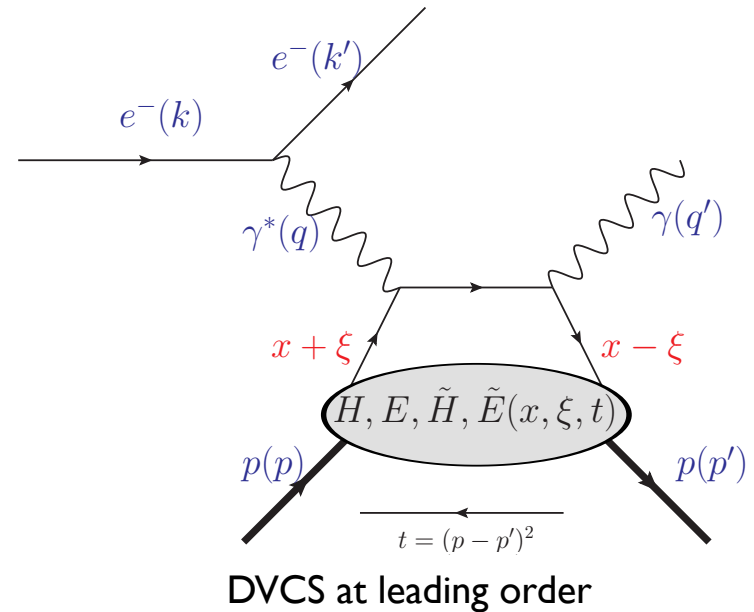


DVCS Physics Motivation

Deeply Virtual Compton Scattering

- GPDs appear in the DVCS amplitude through Compton Form Factors (CFF) such as:

$$\mathcal{H} = \int_{-1}^1 H(x, \xi, t) \left(\frac{1}{\xi - x - i\epsilon} - \frac{1}{\xi + x - i\epsilon} \right) dx$$



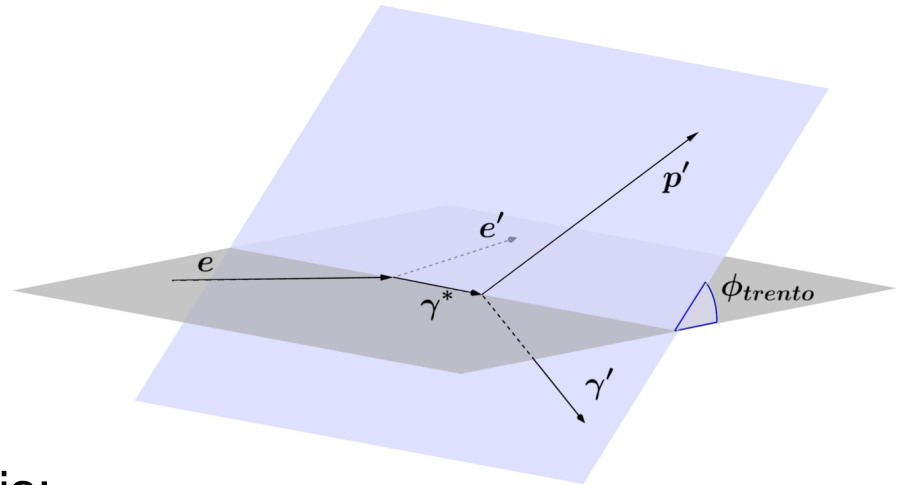
Generalized Partons Distributions (GPDs)

- **Tomography** of the nucleon
- Contribution of quark orbital angular momentum to the **proton spin**

Beam-spin asymmetry

- Extraction of GPDs from DVCS with polarized lepton beam and unpolarized target
- Photon lepton production
beam-spin asymmetry:

$$A_{LU} = \frac{\sigma^+ - \sigma^-}{\sigma^+ + \sigma^-}$$



- At leading order the asymmetry is:

$$A_{LU} = \frac{A \sin(\phi)}{1 + B \cos(\phi)}$$

$$A = \frac{s_1^{\mathcal{I}}}{\kappa c_0^{BH} + c_0^{\mathcal{I}}} \quad B = \frac{\kappa c_1^{BH} + c_1^{\mathcal{I}}}{\kappa c_0^{BH} + c_0^{\mathcal{I}}}$$

combinations of CFF

$$s_1^{\mathcal{I}} \propto \text{Im}(F_1 \mathcal{H} + \xi(F_1 + F_2) \tilde{\mathcal{H}} - \frac{t}{4M^2} F_2 \mathcal{E})$$

Selection and exclusivity cuts

Final state with:

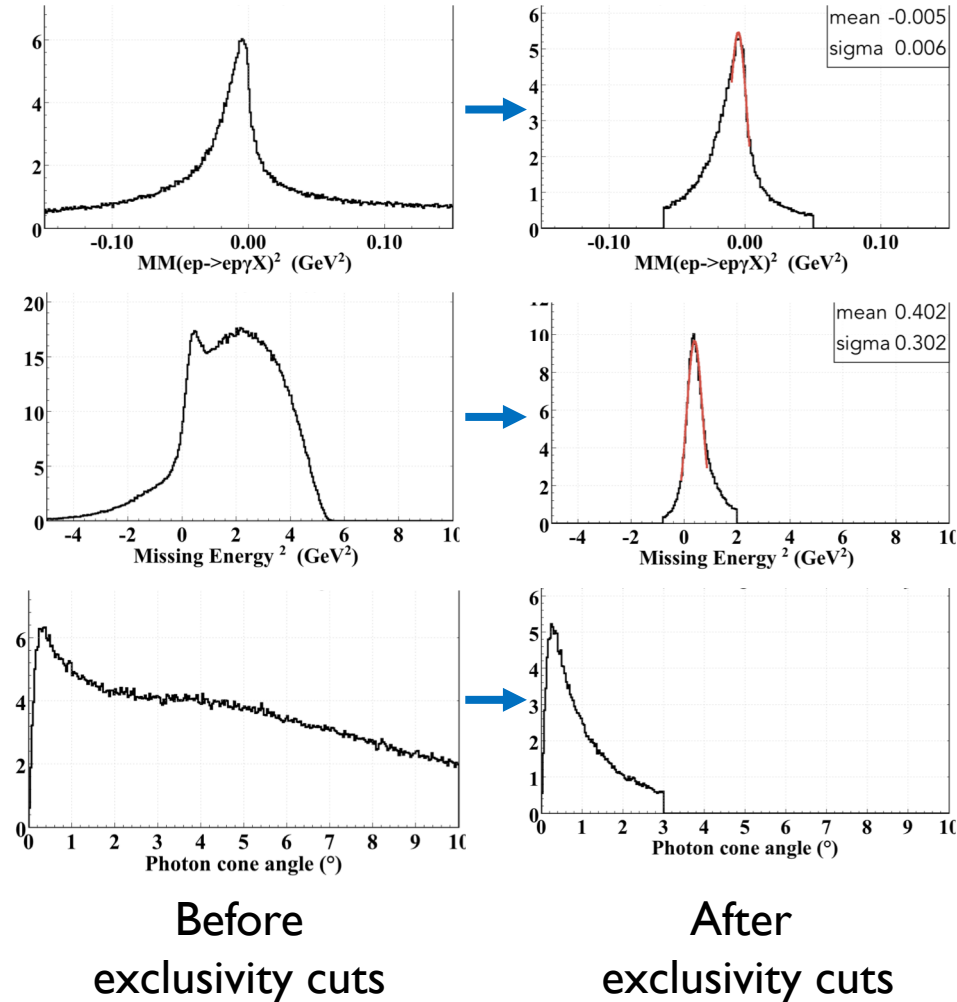
- High energy **electron**
- High energy **photon**
- **Proton**
- $Q^2 > 1 \text{ GeV}^2$
- $W^2 > 4 \text{ GeV}^2$

Selection of exclusive DVCS events:

- **Missing mass** $ep \rightarrow ep\gamma X$
- **Missing energy** $ep \rightarrow ep\gamma X$
- **Cone angle**: angle between measured and exclusive missing photon

π^0 **contamination** $ep \rightarrow ep\pi^0 \rightarrow ep\gamma\gamma$

- Different methods have been implemented



First look at beam-spin asymmetry

Preliminary asymmetry:

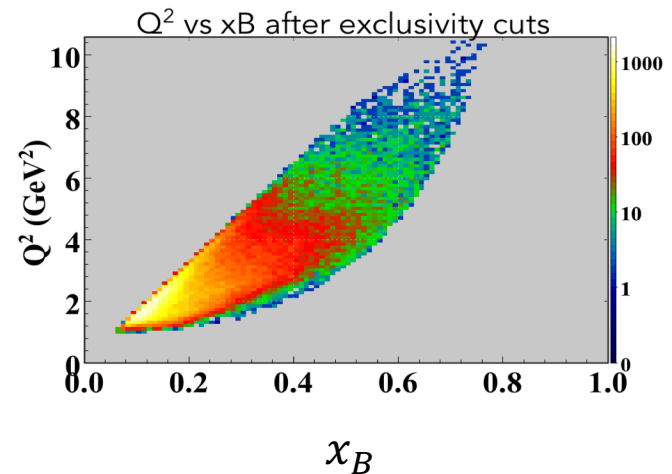
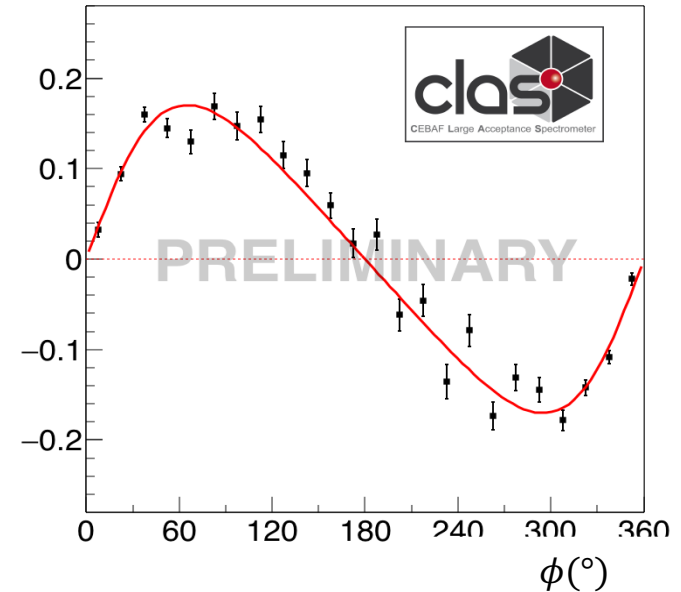
$$A_{LU} = \frac{1}{P} \frac{N^+(\phi) - N^-(\phi)}{N^+(\phi) + N^-(\phi)}$$

P polarization

N^+ / N^- number of events with helicity + / -

- Background not yet subtracted
- Integrated over all kinematic domain (average $Q^2 = 2.5 \text{ GeV}^2$, $x_B = 0.22$)

Raw Beam-Spin Asymmetry $ep \rightarrow ep\gamma$



Conclusion

- **Preliminary asymmetry** has been extracted
- **Less than 2% of the data** to be collected is shown here
- **Ongoing work** to study cuts, background and systematical effects

Raw Beam-Spin Asymmetry $ep \rightarrow e\gamma$

