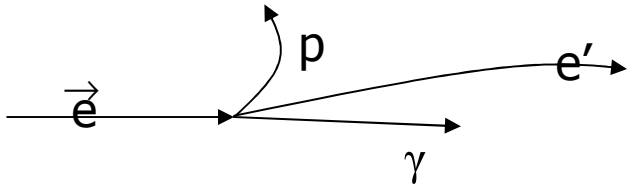
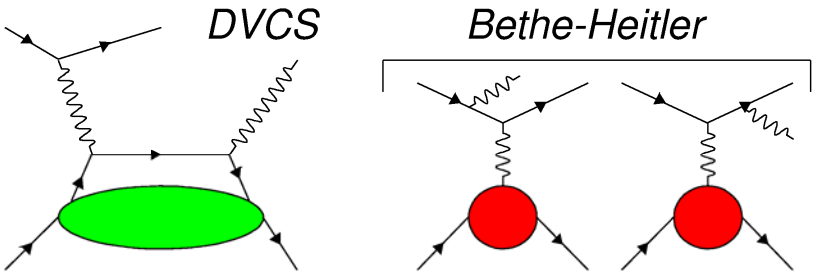
DVCS Beam Spin Asymmetry results from CLAS

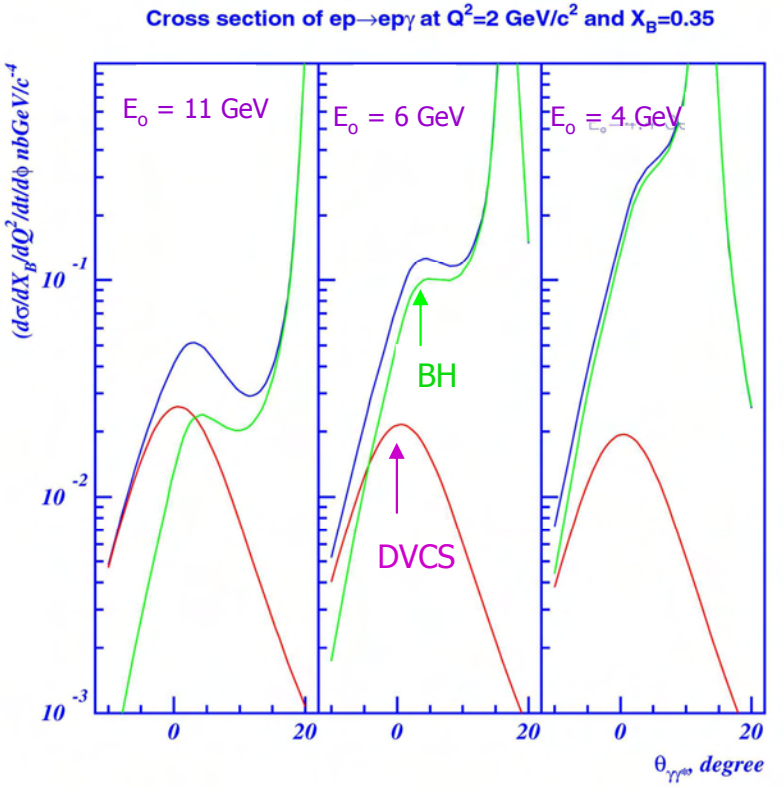
- ✓ Motivation and First Observations of DVCS/BH Interference
- ✓ Preliminary CLAS results
- ✓ Preliminary E1-DVCS results
- ✓ Summary

R. Niyazov (JLAB)

DVCS at JLAB







$$\frac{d^4\sigma}{dQ^2 dx_B dt d\phi} \sim |T^{DVCS} + T^{BH}|^2$$

$$T^2 = \left|T^{DVCS}\right|^2 + \left|T^{BH}\right|^2 + I$$

$$I = T_{DVCS} T^*_{BH} + T^*_{DVCS} T_{BH}$$

$$\sigma^+ - \sigma^- \propto \mathrm{Im}(T_{DVCS}) \times T_{BH} \propto (F_1 \mathrm{H} + k_1 (F_1 + F_2)\tilde{\mathrm{H}} + k_2 F_2 \mathrm{E}) \sin\phi$$

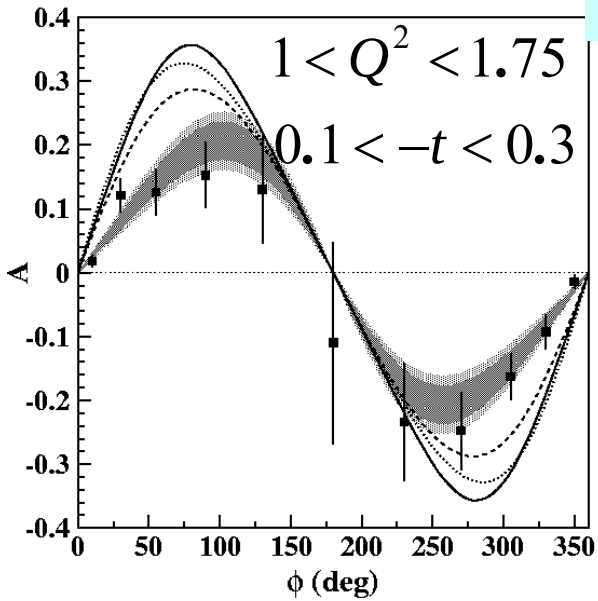
Kinematically suppressed

$$A_{LU} = \frac{\sigma^+ - \sigma^-}{\sigma^+ + \sigma^-} = \frac{\Delta\sigma}{2\sigma}$$

Pioneering Results on DVCS BSA

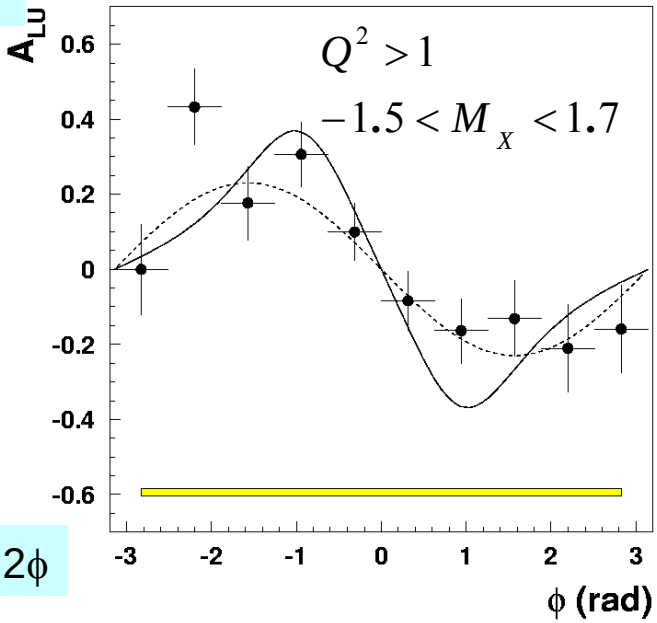
$$A_{LU} = \frac{1}{P} \cdot \frac{N_\gamma^+ - N_\gamma^-}{N_\gamma^+ + N_\gamma^-}$$

CLAS at 4.3 GeV



$A(\phi) = \alpha \sin\phi + \beta \sin 2\phi$

HERMES 27 GeV



- Asymmetry obtained :

$\alpha = 0.202 \pm 0.028^{stat} \pm 0.013^{sys}$

S. Stepanyan et al., PRL **87** (2001)

- Asymmetry obtained :

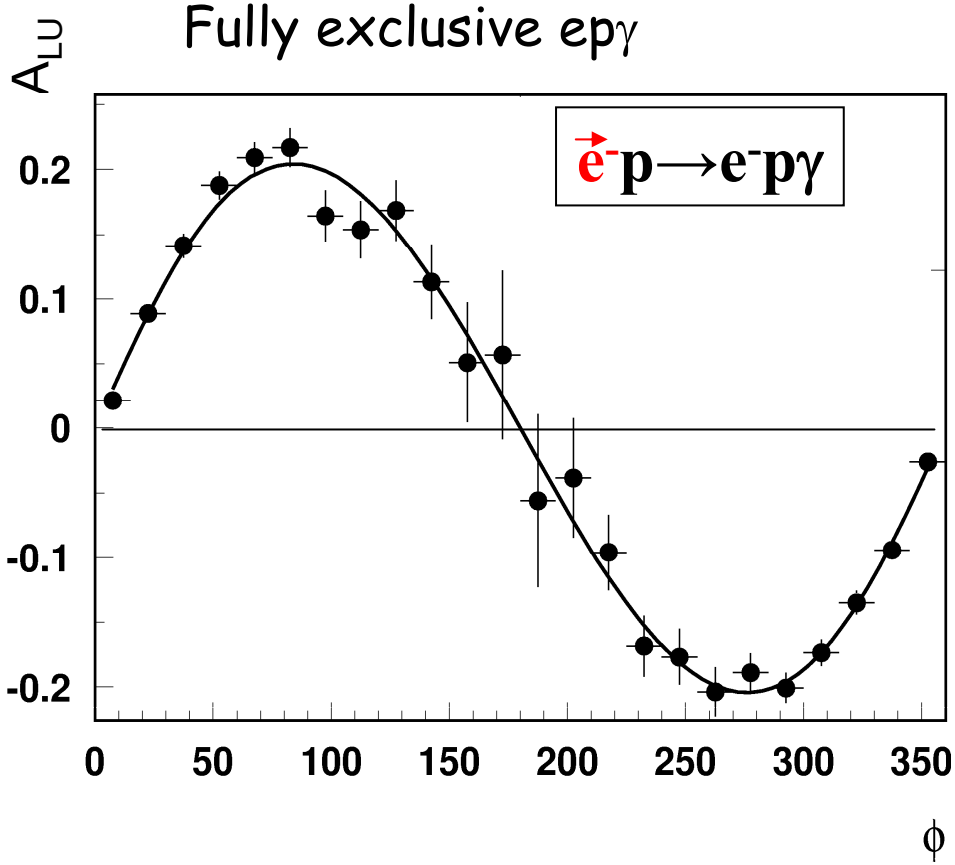
$\alpha = 0.23 \pm 0.04^{stat} \pm 0.03^{sys}$

A.Airapetian et al., PRL **87** (2001)

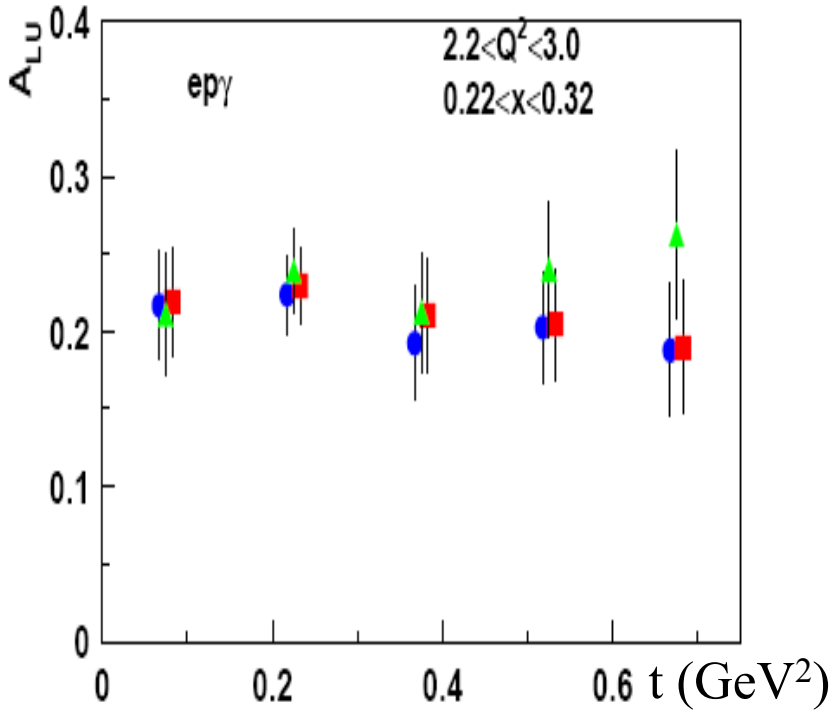
In 2001 HERMES and CLAS collaborations simultaneously measured DVCS beam spin asymmetry

DVCS Experiments CLAS e16 (5.7 GeV) and e1f (5.5 GeV)

Fully exclusive epγ



Sinϕ moment of A_{LU}



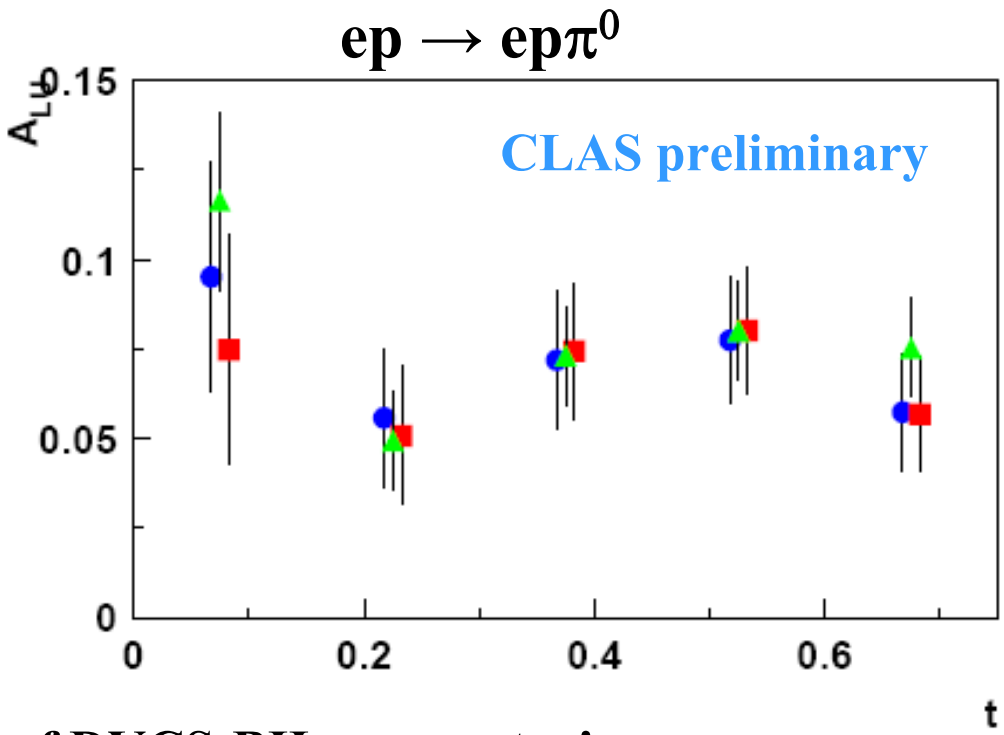
First high statistics DVCS/BH asymmetry

All three methods for exclusive epγ sample give the same result indicating no significance effects from acceptance.

π^0 - Beam cross section asymmetry

Main unknown in corrections of DVCS SSA is the π^0 beam SSA.

- Use **epγγ(π^0)** to estimate the contribution of π^0 in the **epγ** sample.

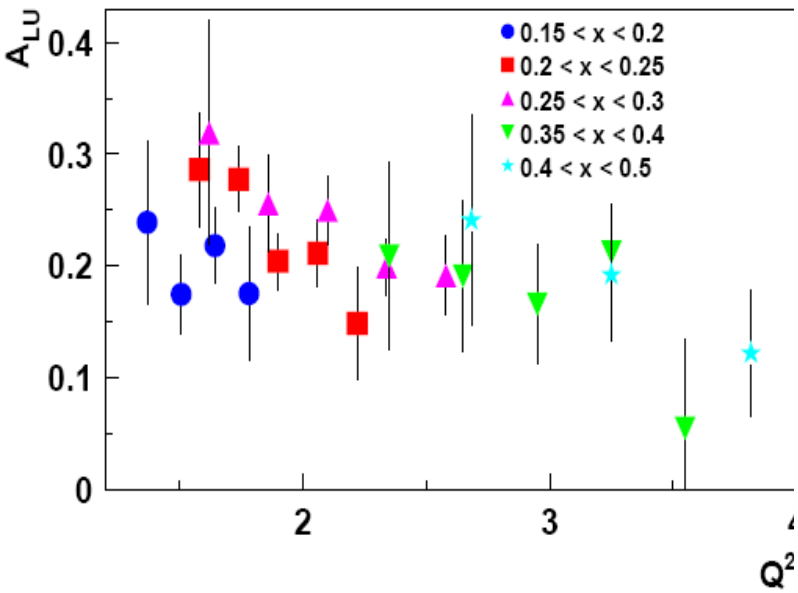


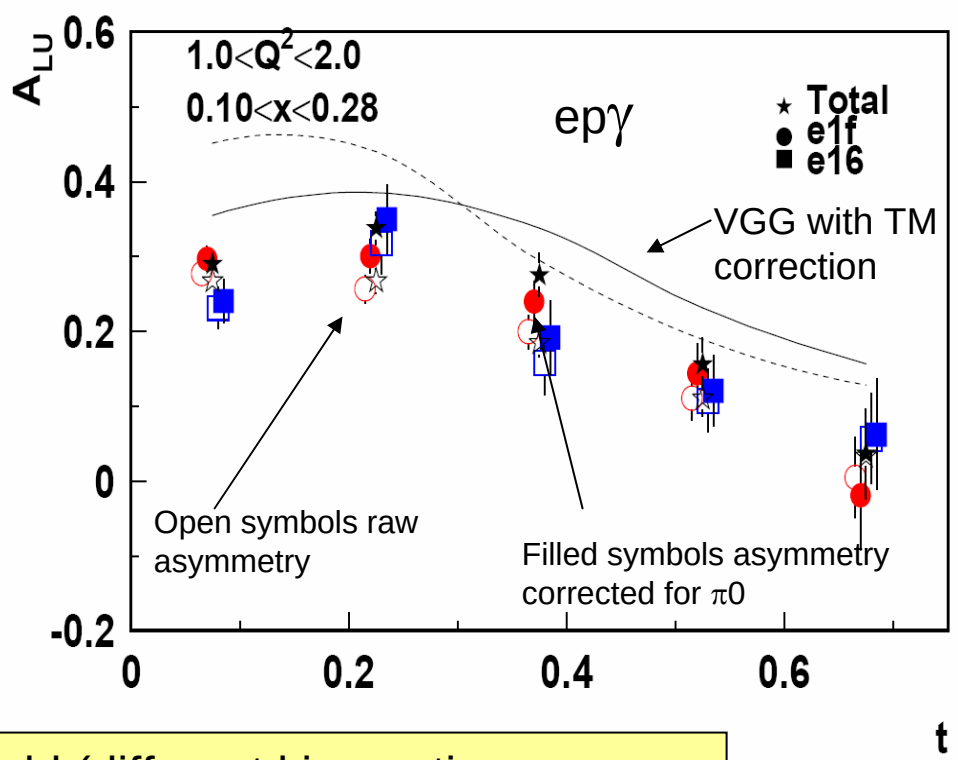
- **π^0 Asymmetry is ~ 1/3 of DVCS-BH asymmetry!**
- **We have to subtract this contamination from the DVCS sample**
- **Need to do MC simulation that reproduce the data to determine absolute contamination**

DVCS Experiments CLAS e16 (5.7 GeV) and e1f (5.5 GeV)

π^0 contribution in A_{LU} was subtracted out

PRELIMINARY



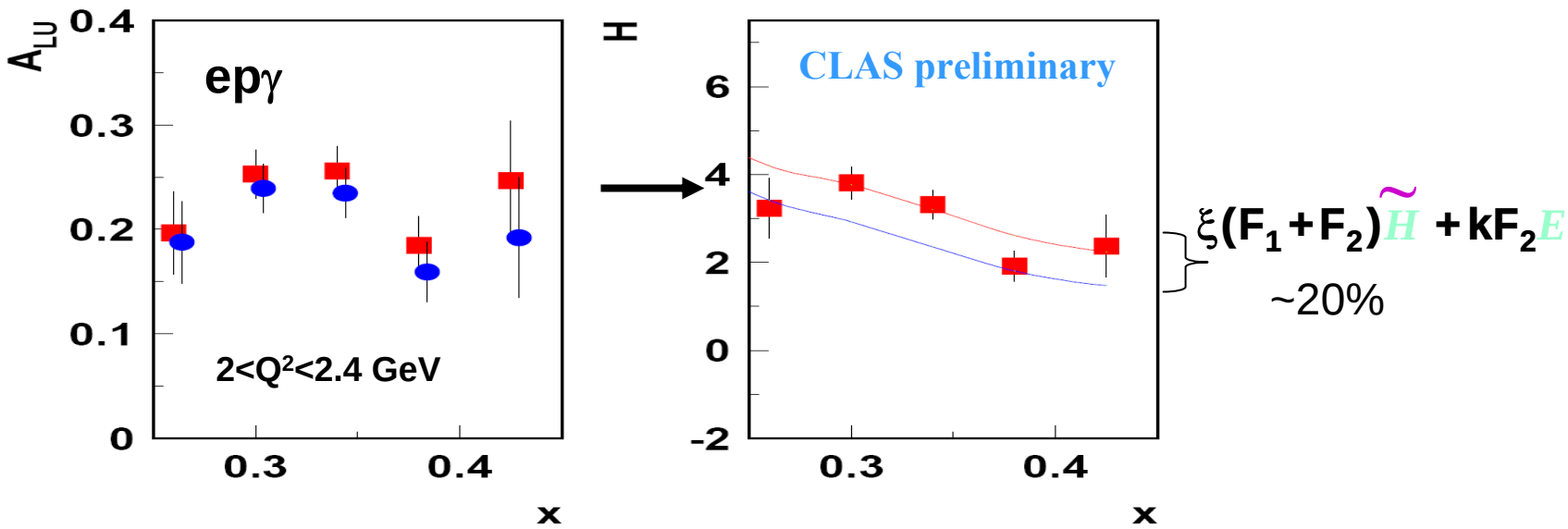


Two data sets with different torus field (different kinematic coverage) and beam energy are consistent.

Preliminary data for fully exclusive epγ is consistent with the ep data and consistent with GPD base predictions

First Extraction of GPD H from A_{LU} moment

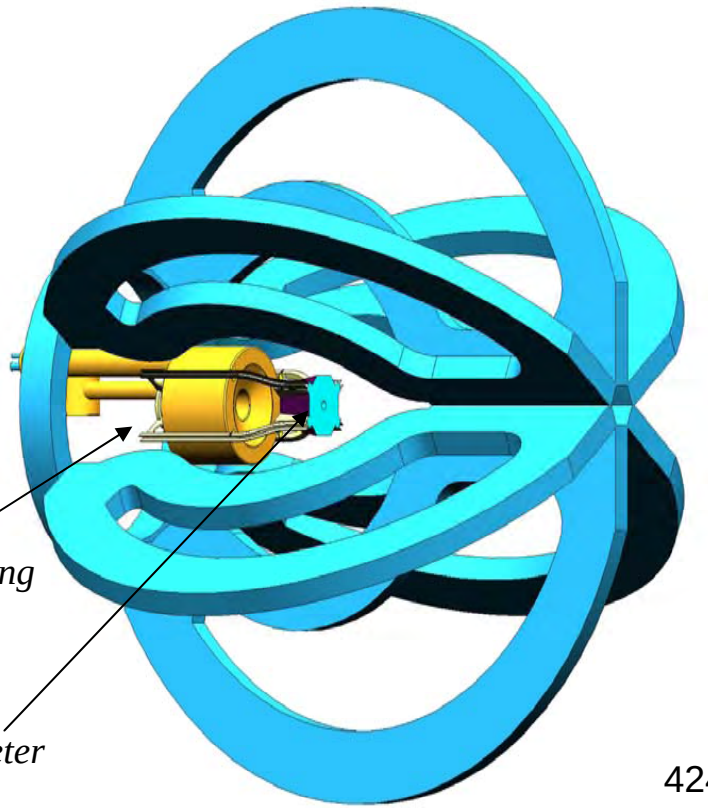
$$A_{LU}(x,t,Q^2,\phi) \approx \frac{c_{LU}(x,t,Q^2)}{c_0^{BH} + c_1^{BH}cos\phi + ...}\{\mathcal{H} + ...\}\sin\phi,$$



- Red [blue] points correspond to measured A_{LU} [un]corrected for π^0 (bin by bin)
- H stands for the ratio of the A_{LU} and pre-factor calculated for all events in a bin (averaged over ϕ)
- Curves are for a simple model for H (blue) and H+…(red)

Dedicated CLAS DVCS(e1dvcs) Experiment

→ Detection of 3 particles e, p, and γ in final state
→ Large kinematical coverage in Q^2, $x_{B,}$ and t

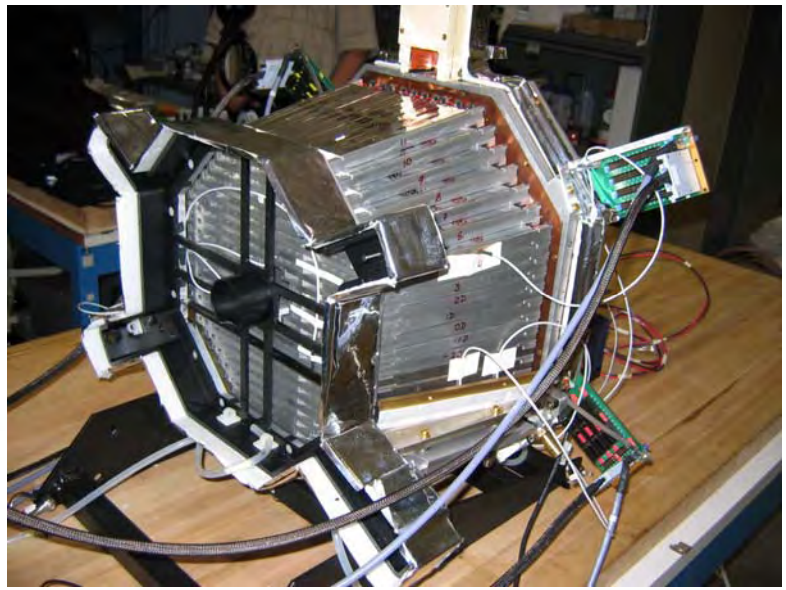


Superconducting Magnet

and

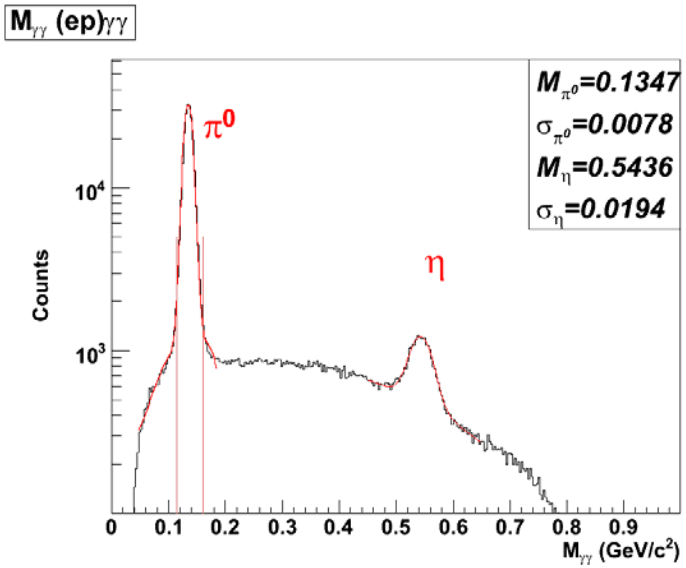
Inner Calorimeter (IC)

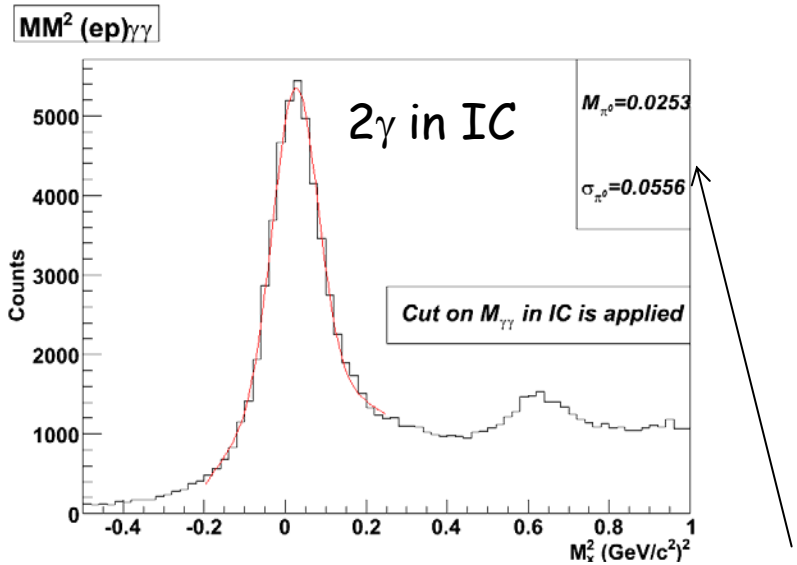
in a bore of CLAS



424 tapered lead-tungstate (PbWO4) crystals
APDs readout, temperature stabilization, low-noise preamplifiers

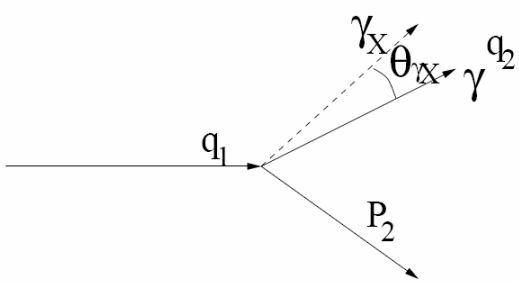
Dedicated CLAS DVCS (e1dvcs) Experiment

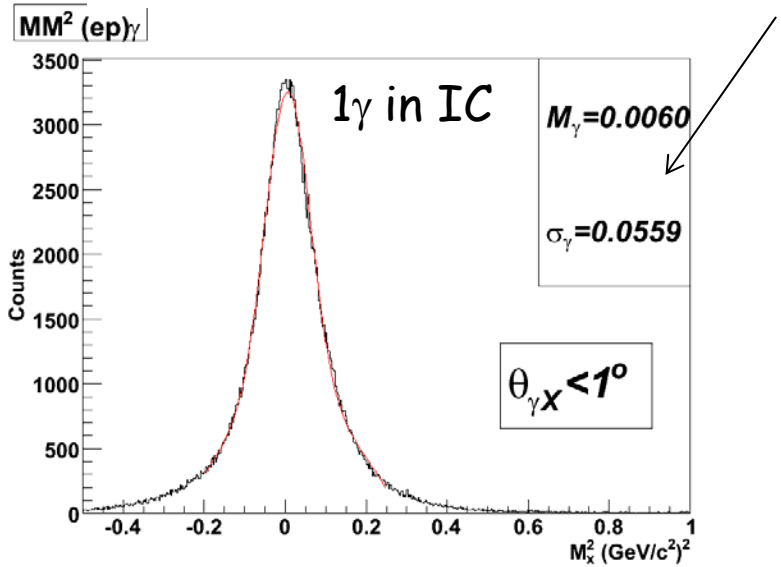




Consistent peak position and width

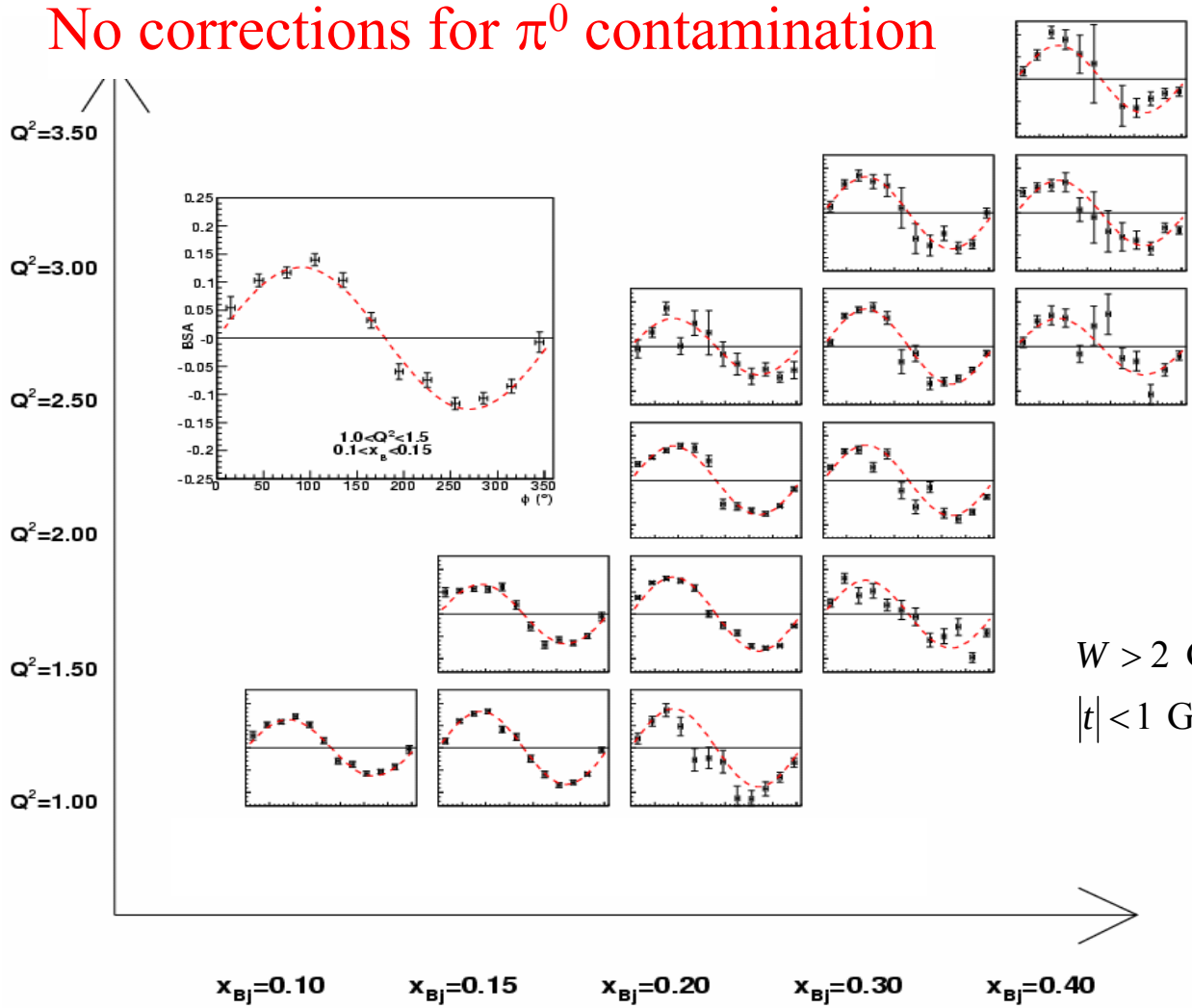
Cut on direction of the measured photon to select epγ





E1-DVCS Preliminary Results:Raw Asymmetries

No corrections for π^0 contamination



$W > 2$ GeV

$|t| < 1$ GeV^2

VERY PRELIMINARY

PHD project of *François-Xavier Girod*

Summary

- Beam Spin Asymmetry in DVCS is studied using a large volume of CLAS electroproduction data on hydrogen

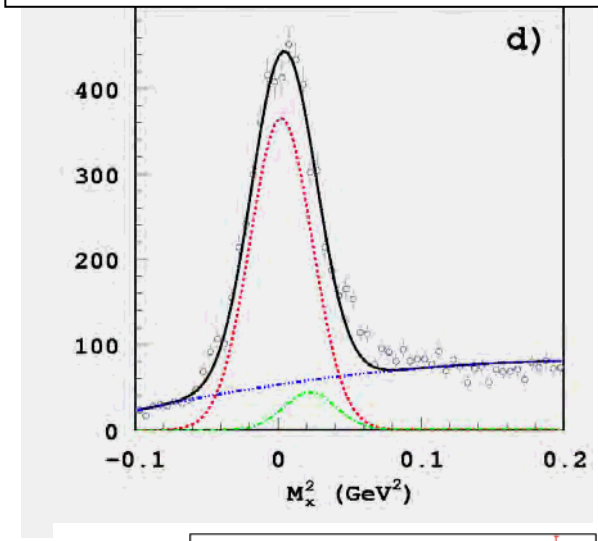
- DVCS analysis result from 4.2 GeV data set is already published
- Analysis of 4.8 GeV, 5.5 GeV and 5.7 GeV are completed and are in review for publication. First extraction of GPD H. Good agreement with model predictions for $Q^2>2$ GeV^2

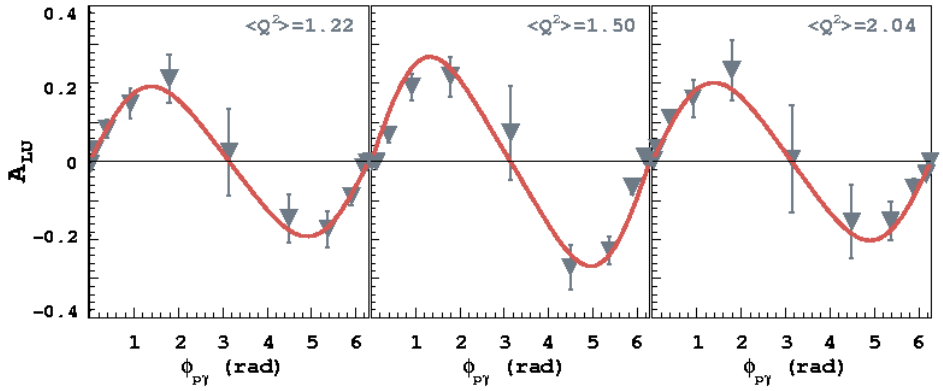
- A new dedicated CLAS/DVCS experiment took 40% data during March-May of 2005
- Both new additions to the CLAS detector, the Superconducting Solenoid and the Inner Calorimeter (IC), performed very well during the experiment

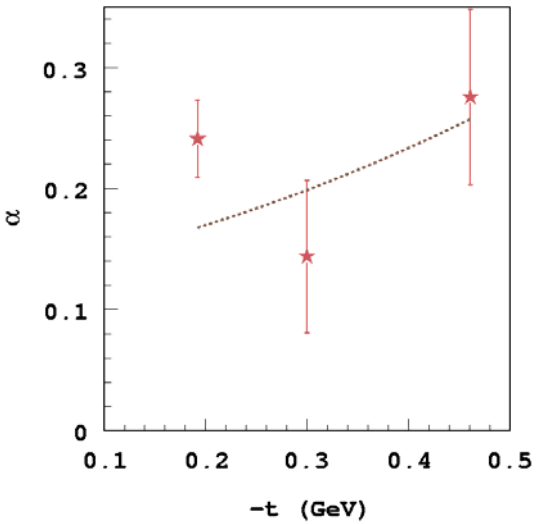
- Preliminary results from the dedicated experiment are ready and are very promising
- More studies underway for qualitative understanding of the background (mostly from π^0) and the acceptances

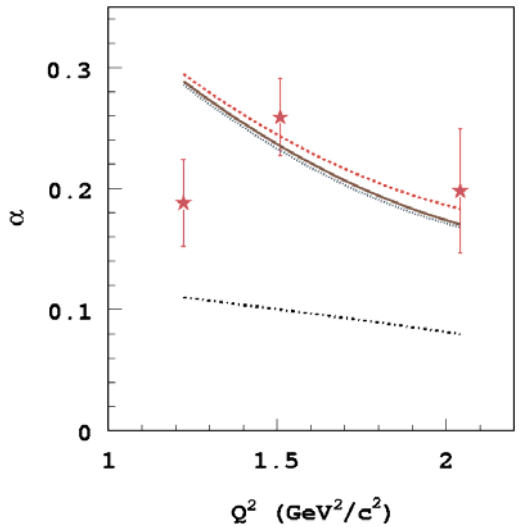
DVCS Experiments (CLAS/e1d 4.8 GeV)

Separation of a single γ and π^0 events was done by analyzing the line shape of the MM^2 distribution in each kinematical bin $ep \rightarrow epX$ (X= γ or π^0 or radiative background)





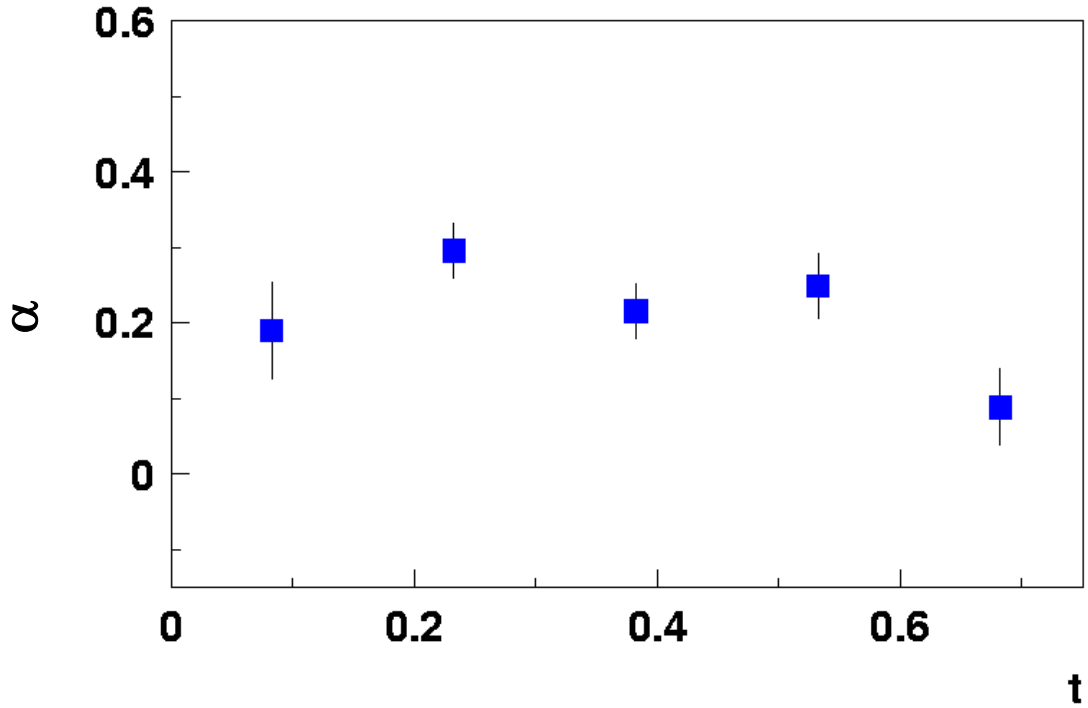




PRELIMINARY

E1-DVCS Preliminary Results

π^0 contamination is estimated from $ep\pi^0$ MC



$0.8<Q^2<4.6$

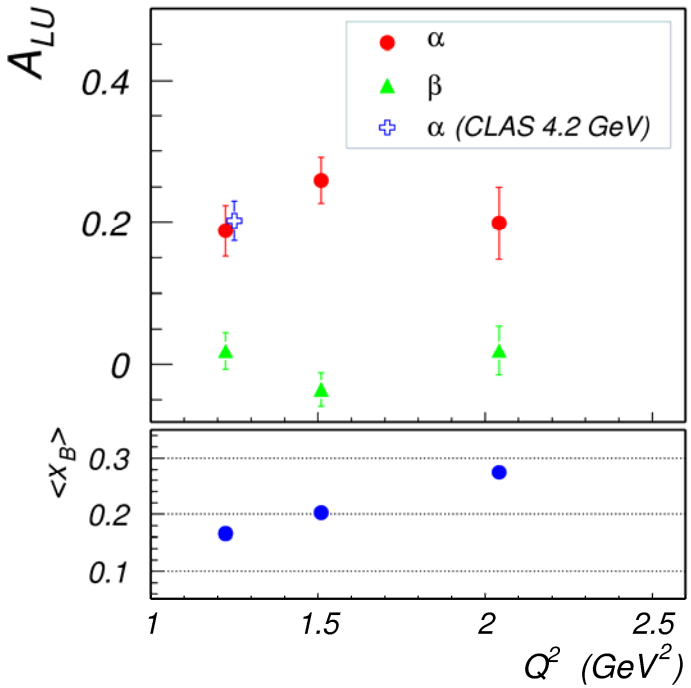
$0.12<X_B<0.57$

VERY PRELIMINARY

α is consistent with e16/e1f data

DVCS Experiments (CLAS/e1d)

G.Gavalian (CLAS 4.8 GeV)

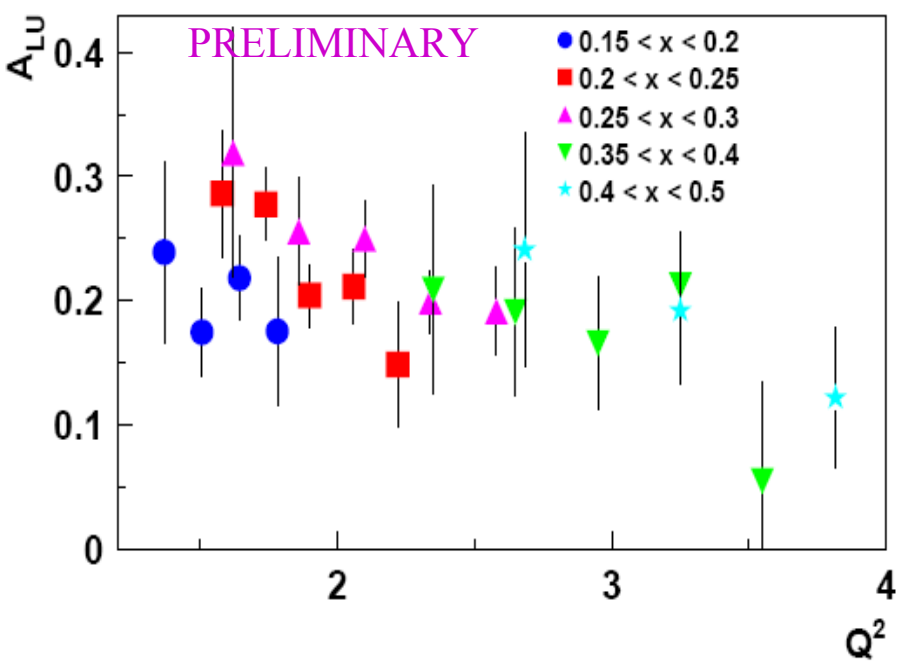


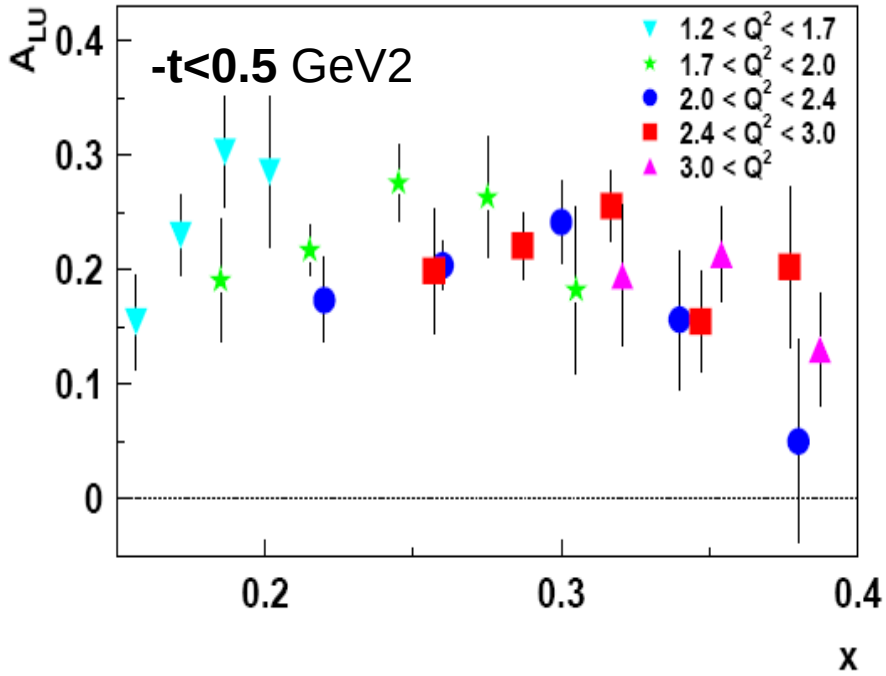
$$A_{LU} = \frac{1}{P} \cdot \frac{N_\gamma^+ - N_\gamma^-}{N_\gamma^+ + N_\gamma^-}$$

PRELIMINARY

Separation of a single γ and π^0 events was done by analyzing the line shape of the Mx^2 distribution in each kinematical bin $ep \rightarrow epX$ ($X = \gamma$ or π^0)

DVCS SSA kinematic dependences at 5.7 GeV



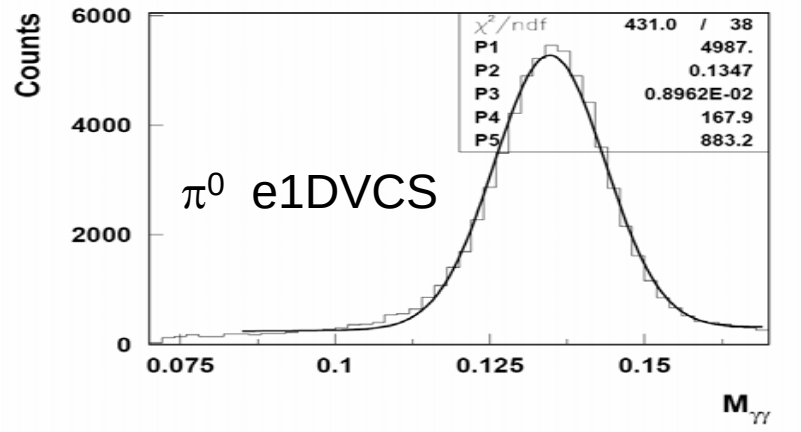


- Fine binning allows to observe the x and Q2 dependence
- Preliminary data for fully exclusive epg is consistent with the ep data and consistent with GPD base predictions

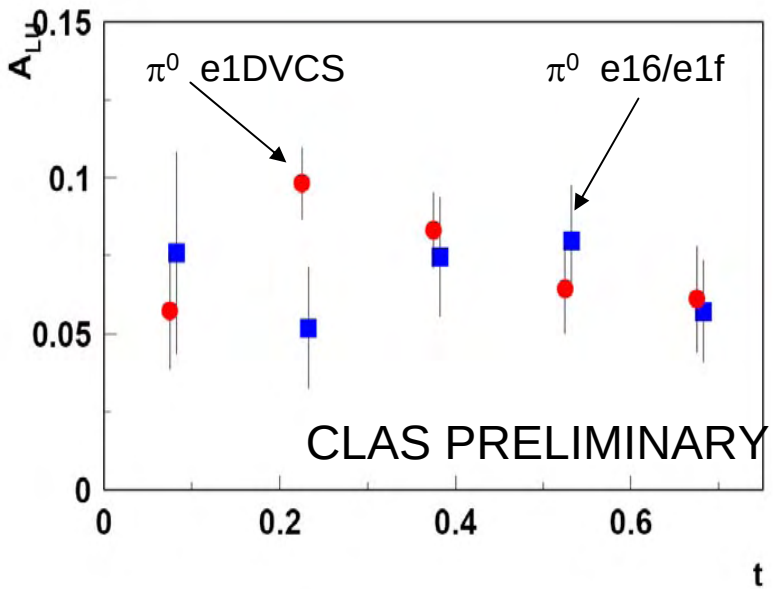
Need realistic GPD models to perform fits

Harut Avakian

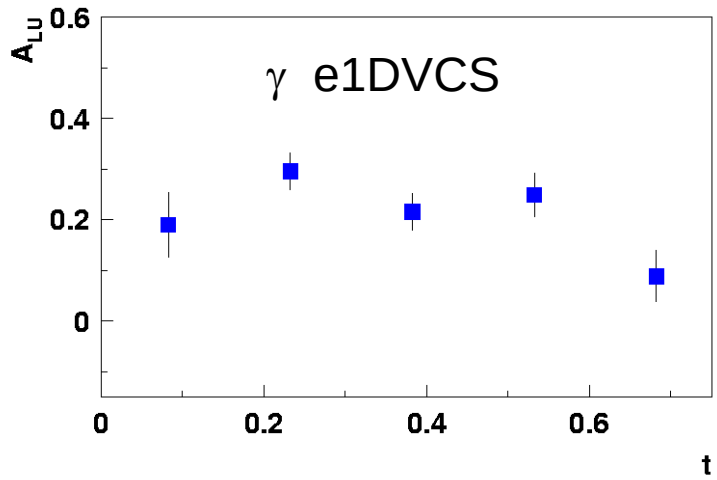
Dedicated CLAS DVCS (e1dvcs) Experiment



Improves significantly the epγ and in particular the ep$\gamma\gamma$ samples at low t



BSA is consistent with e16/e1f data



PRELIMINARY

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