JLab: Present and Future

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IPN Orsay

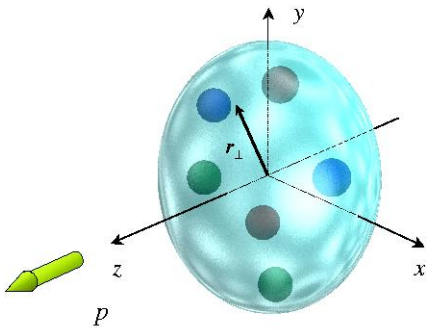
Fall meeting of the GDR PH-QCD – IPN Orsay - October 21, 2011

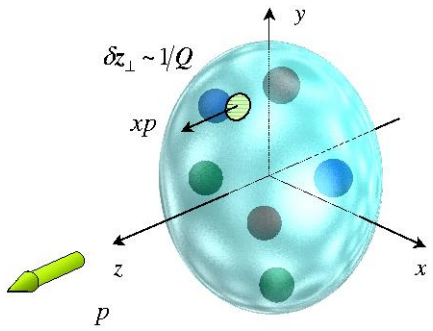
Outline

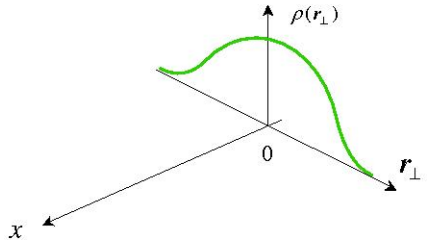
- Introduction
- Deeply Virtual Compton Scattering (DVCS)
- Deeply Virtual Meson Production (DVMP)
- GPD program at JLab 12 GeV
- Conclusions

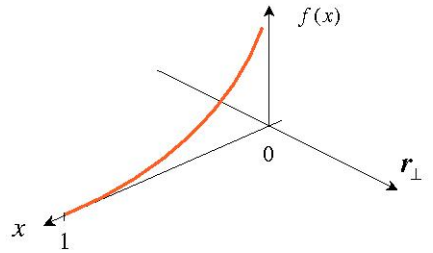
Generalized Parton Distributions (GPDs)

GPDs, accessible via exclusive reactions, provide a correlation between the transverse position and the longitudinal momentum of quarks in the nucleon

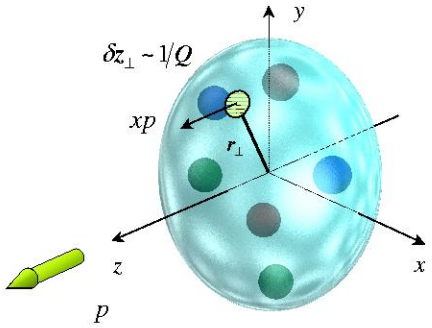


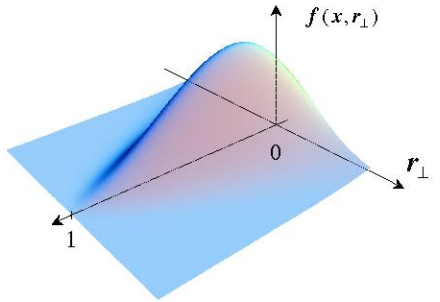






3D image of the nucleon





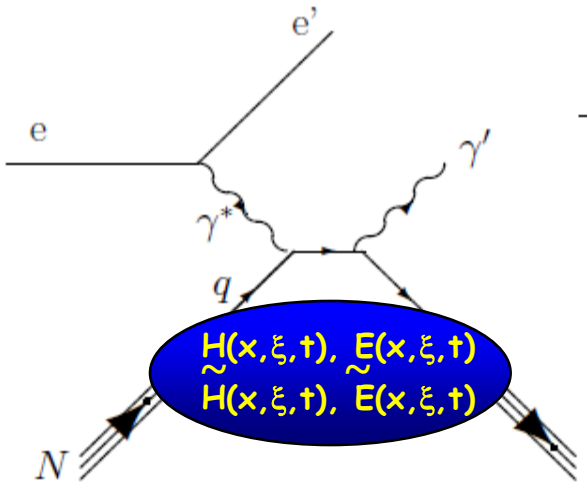
Form factors (Elastic scattering): transverse position of quarks in the nucleon

Parton distributions (Deep inelastic scattering): longitudinal momentum of quarks in the nucleon

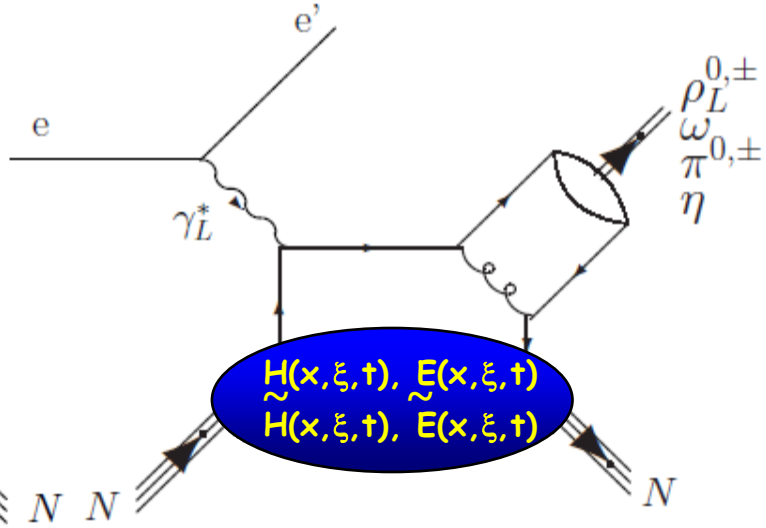
GPDs and exclusive reactions

"handbag" diagrams (high Q^2, small t, fixed x_B)

DVCS



DVMP



conserve nucleon spin

$H(x,\xi,t)$ $\tilde{H}(x,\xi,t)$

$E(x,\xi,t)$ $\tilde{E}(x,\xi,t)$

flip nucleon spin

Quark angular momentum (Ji's sum rule)

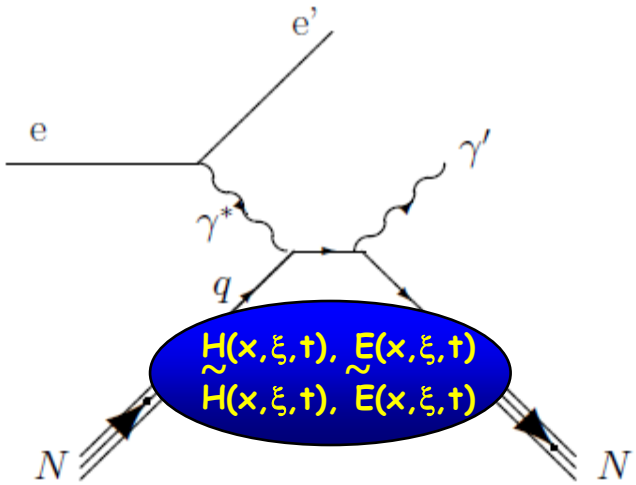
$$J^q = \frac{1}{2} - J^G = \frac{1}{2}\int_{-1}^{1} x dx \left[H^q(x,\xi,0) + E^q(x,\xi,0) \right]$$

X. Ji, Phy. Rev. Lett. 78, 610 (1997)

Deeply Virtual Compton Scattering (DVCS)

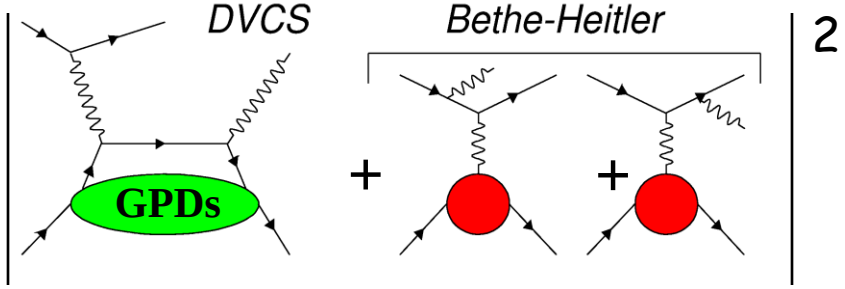
"handbag" diagram (high Q^2, small t, fixed x_B)

DVCS



BH fully calculable in QED

$\sigma(ep \to ep\gamma) =$



DVCS and Bethe-Heitler (BH) experimentally undistinguishable

interference between the 2 processes

$$\frac{d^4\sigma}{dQ^2 dx_B dt d\phi} \approx \left|T^{DVCS} + T^{BH}\right|^2 = \left|T^{DVCS}\right|^2 + \left|T^{BH}\right|^2 + I$$

with $\underbrace{I = T^{DVCS}T^{*BH} + T^{*DVCS}T^{BH}}_{\text{interference term}}$

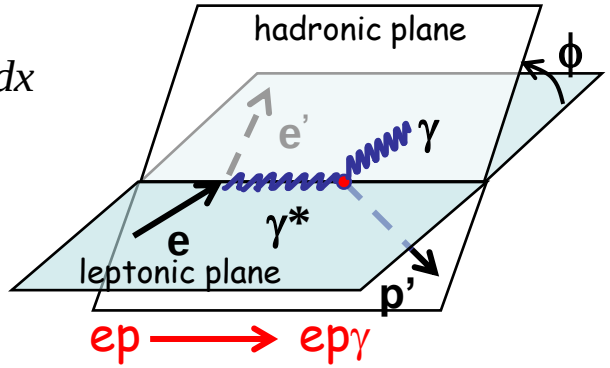
DVCS is the theoretically cleanest reaction allowing to access the GPDs

Extracting GPDs from DVCS observables

Compton Form Factors (CFFs)

$$Re\mathcal{H}_q = e_q^2 P \int_0^{+1} \left(H^q(x,\xi,t) - H^q(-x,\xi,t)\right)\left[\frac{1}{\xi - x} + \frac{1}{\xi + x}\right] dx$$

$$Im\mathcal{H}_q = \pi e_q^2 \left[H^q(\xi,\xi,t) - H^q(-\xi,\xi,t)\right]$$



Beam Spin Asymmetry : $A_{LU} = \dfrac{d\vec{\sigma} - d\overleftarrow{\sigma}}{d\vec{\sigma} + d\overleftarrow{\sigma}} = \dfrac{\Delta\sigma_{LU}}{d\vec{\sigma} + d\overleftarrow{\sigma}}$

$\xi = x_B/(2-x_B)$ $k = t/4M^2$

	Proton	Neutron
• Polarized beam, Unpolarized target	$Im\{\mathcal{H}_p, \tilde{\mathcal{H}}_p, \mathcal{E}_p\}$	$Im\{\mathcal{H}_n, \tilde{\mathcal{H}}_n, \mathcal{E}_n\}$
• Unpolarized beam, Longitudinally polarized target	$Im\{\mathcal{H}_p, \tilde{\mathcal{H}}_p\}$	$Im\{\mathcal{H}_n, \mathcal{E}_n, \tilde{\mathcal{E}}_n\}$
• Unpolarized beam, Transversely polarized target	$Im\{\mathcal{H}_p, \mathcal{E}_p\}$	$Im\{\mathcal{H}_n\}$
• Polarized beam, Longitudinally polarized target	$Re\{\mathcal{H}_p, \tilde{\mathcal{H}}_p\}$	$Re\{\mathcal{H}_n, \mathcal{E}_n, \tilde{\mathcal{E}}_n\}$

• Polarized beam, Unpolarized target

$$\Delta\sigma_{LU} \sim \sin\phi\ Im\{F_1\mathcal{H} + \xi(F_1+F_2)\tilde{\mathcal{H}} - kF_2\mathcal{E}\}d\phi$$

• Unpolarized beam, Longitudinally polarized target

$$\Delta\sigma_{UL} \sim \sin\phi\ Im\{F_1\tilde{\mathcal{H}} + \xi(F_1+F_2)(\mathcal{H} + x_B/2\mathcal{E}) - \xi k F_2\,\tilde{\mathcal{E}} + \ldots\}d\phi$$

• Unpolarized beam, Transversely polarized target

$$\Delta\sigma_{UT} \sim \cos\phi\ Im\{k(F_2\mathcal{H} - F_1\mathcal{E}) + \ldots..\}d\phi$$

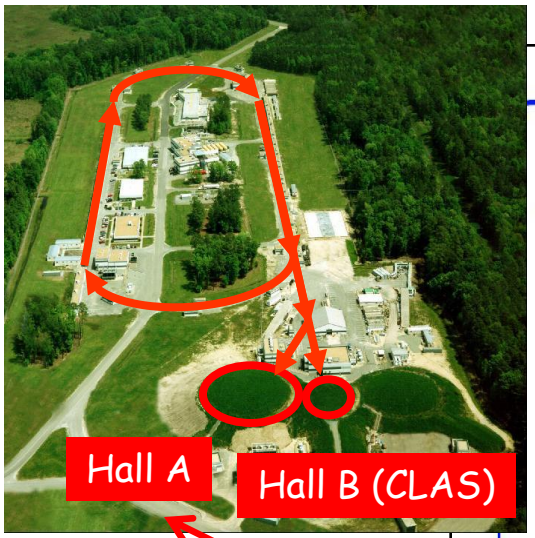
• Polarized beam, Longitudinally polarized target

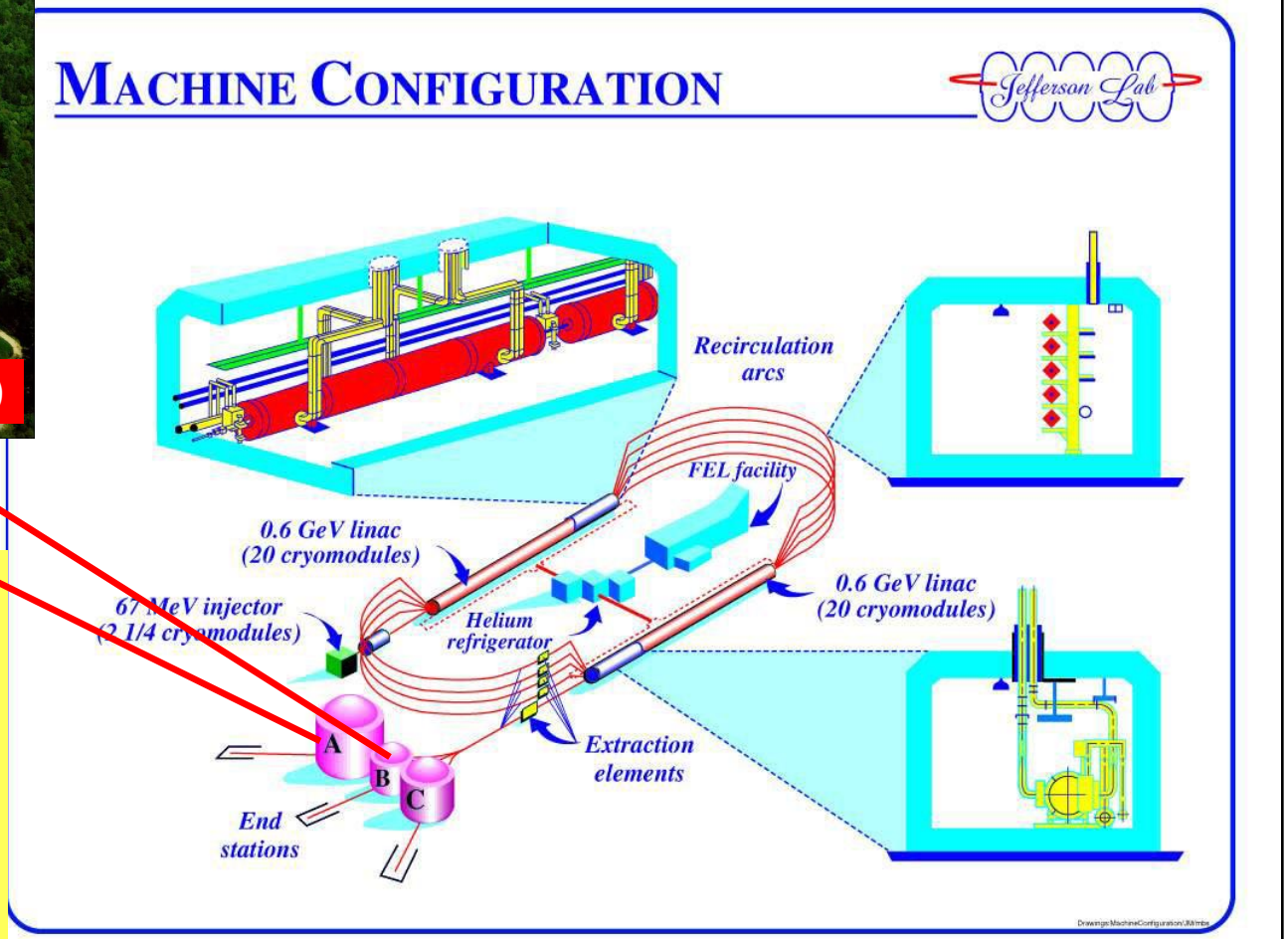
$$\Delta\sigma_{LL} \sim (A + B\cos\phi)\ Re\{F_1\tilde{\mathcal{H}} + \xi(F_1+F_2)(\mathcal{H} + x_B/2\mathcal{E})\ldots\}d\phi$$

Jefferson Lab (Newport News, Virginia, USA)

CEBAF : Continuous Electron Beam Accelerator Facility

Duty cycle ~100% E_{max}~6 GeV P_{max}~80%





Hall A: very high resolution but limited kinematic coverage

Hall B (CLAS): very large kinematic coverage but lower resolution and complex acceptance

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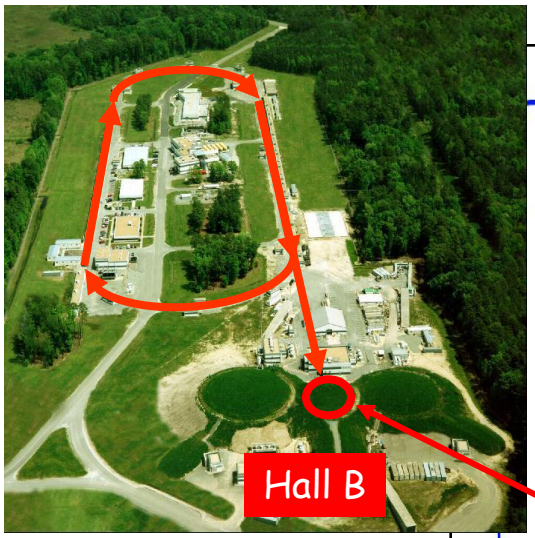
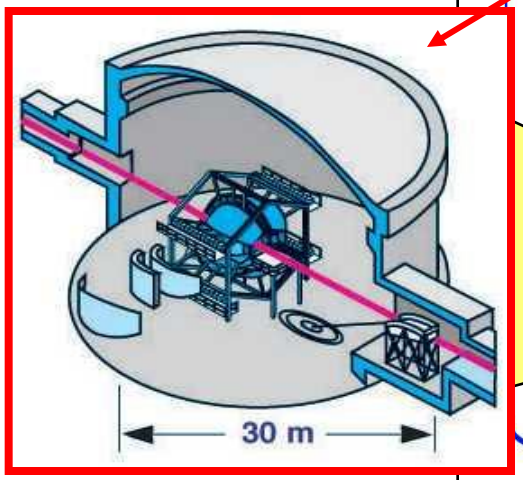
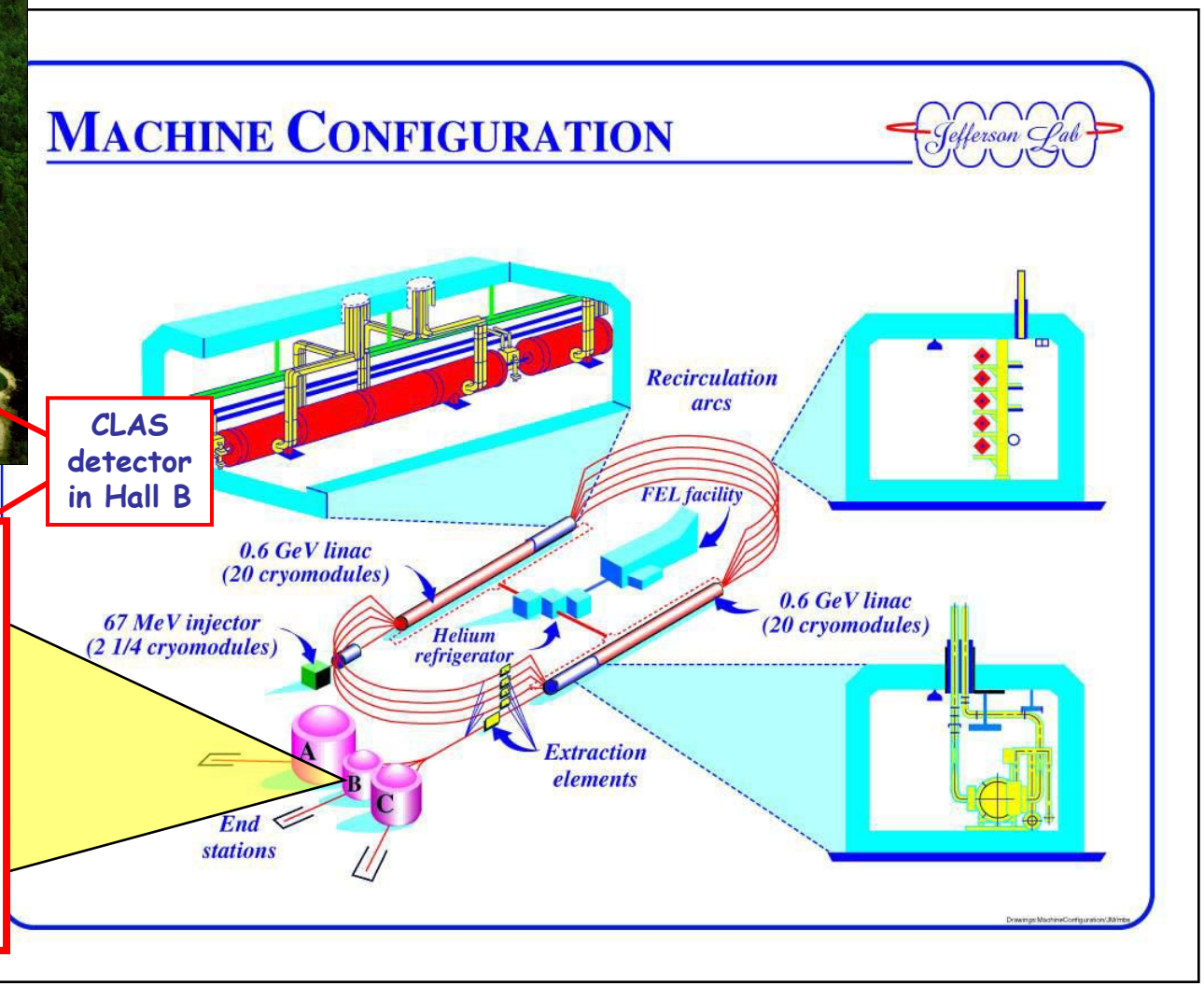
Duty cycle ~100% E_{max}~6 GeV P_{max}~80%



CLAS detector in Hall B

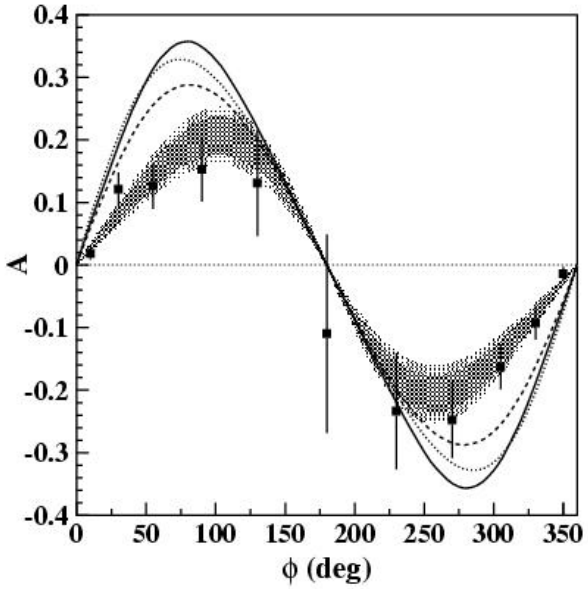




CLAS results on DVCS from non-dedicated experiments

DVCS Beam Spin (A_{LU}) and Longitudinal Target Spin (A_{UL}) asymmetries

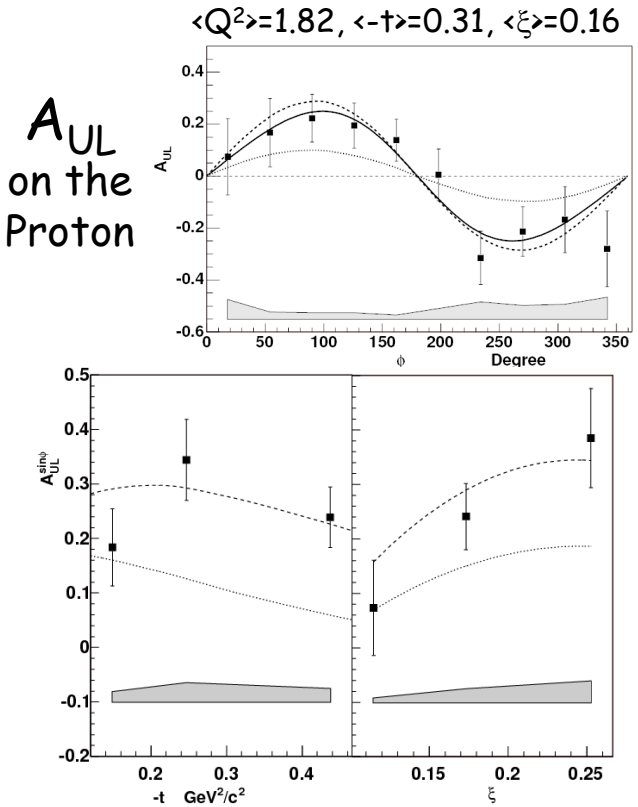
A_{LU} on the Proton



S. Stepanyan *et al.* (CLAS Collaboration), Phys. Rev. Lett. 87, 182002 (2001)

$$\Delta\sigma_{LU} \sim \sin\phi\ \mathrm{Im}\{F_1\mathcal{H} + \xi(F_1+F_2)\tilde{\mathcal{H}} - kF_2\mathcal{E}\}d\phi$$

A_{UL} on the Proton



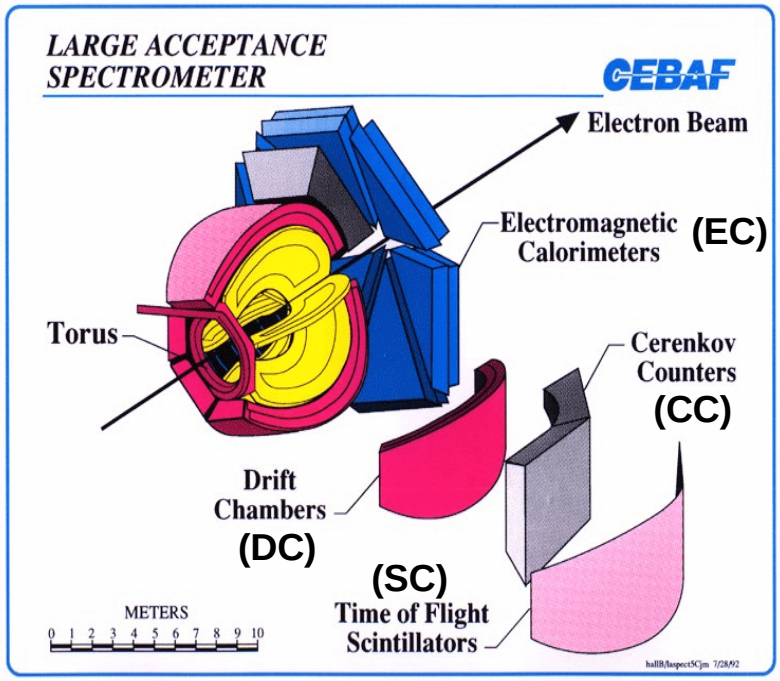
S. Chen et al. (CLAS Collaboration), Phys. Rev. Lett. 97, 072002 (2006)

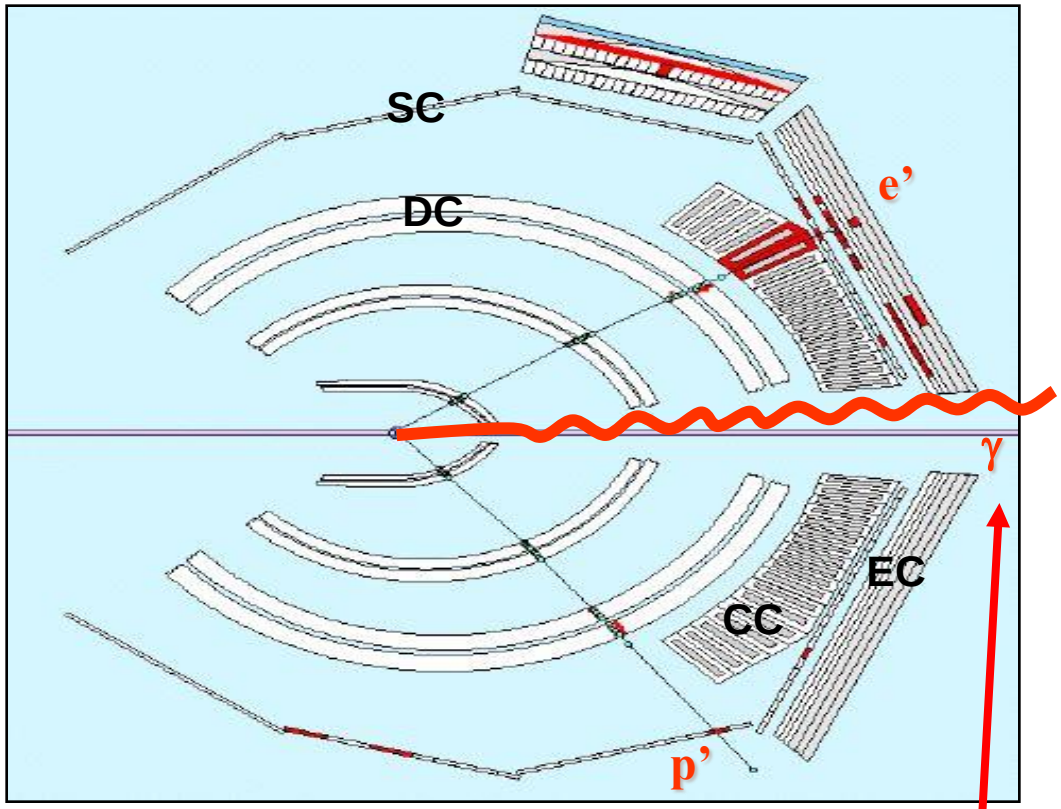
$$\Delta\sigma_{UL} \sim \sin\phi\ \mathrm{Im}\{F_1\tilde{\mathcal{H}} + \xi(F_1+F_2)(\mathcal{H} + x_B/2\mathcal{E}) - \xi kF_2\,\mathcal{E} + \ldots\}d\phi$$

A typical DVCS/BH event in the CLAS detector

$ep \rightarrow e'p'\gamma$

The DVCS/BH photon is mostly emitted at forward angles





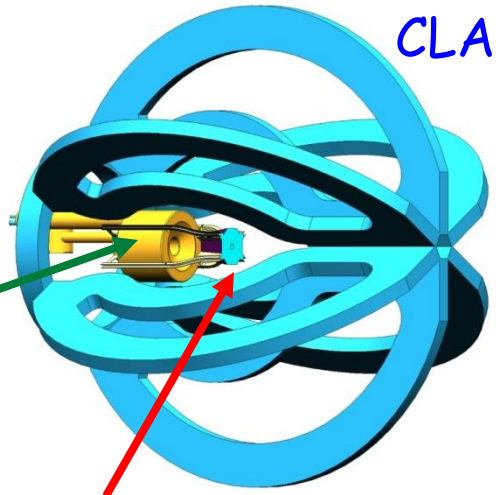
DVCS/BH photon not detected with CLAS alone

Need an electromagnetic calorimeter at forward angles for DVCS experiments

The e1-DVCS experiment (first experiment with CLAS dedicated to DVCS) with the CLAS detector + DVCS electromagnetic calorimeter + Solenoid

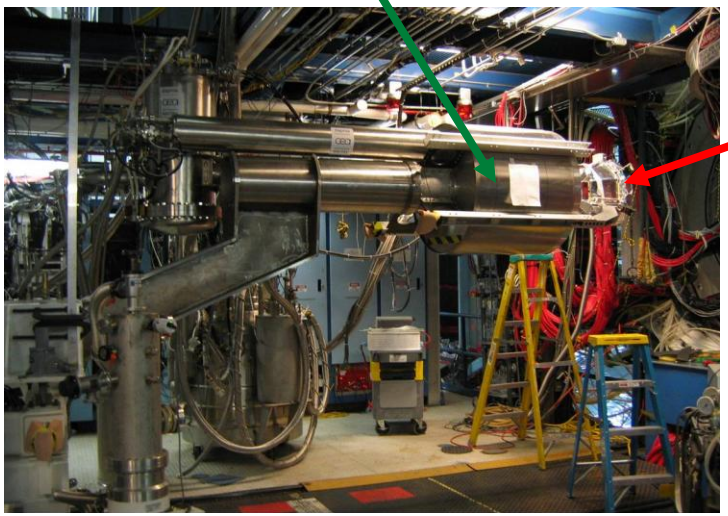
Part 1 of the e1-DVCS experiment:

- Data taken from March 11 until May 27, 2005
- Beam energy ~ 5.766 GeV
- Beam current = 20-25 nA
- Polarization ~ 76-82%
- Integrated luminosity ~ 3.33×10^7 nb^{-1}
- Target LH_2

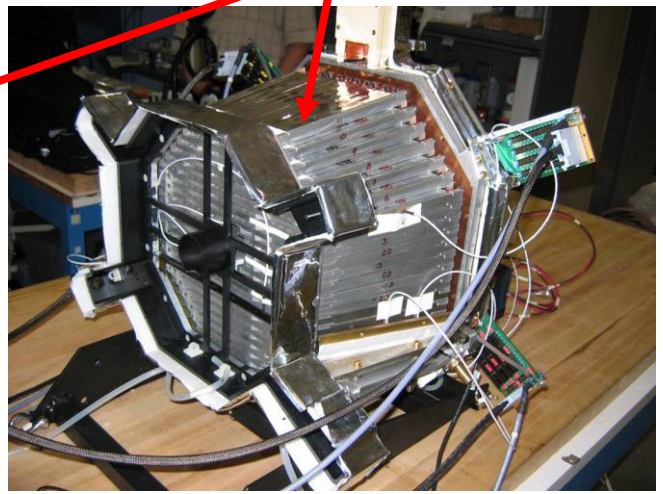


Solenoid

DVCS electromagnetic calorimeter

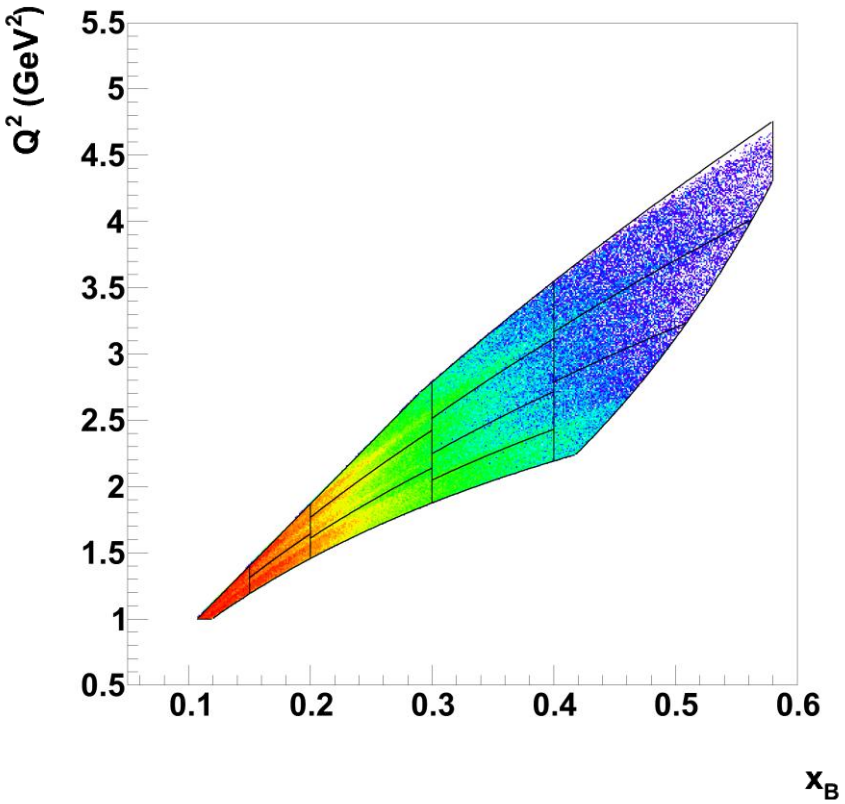


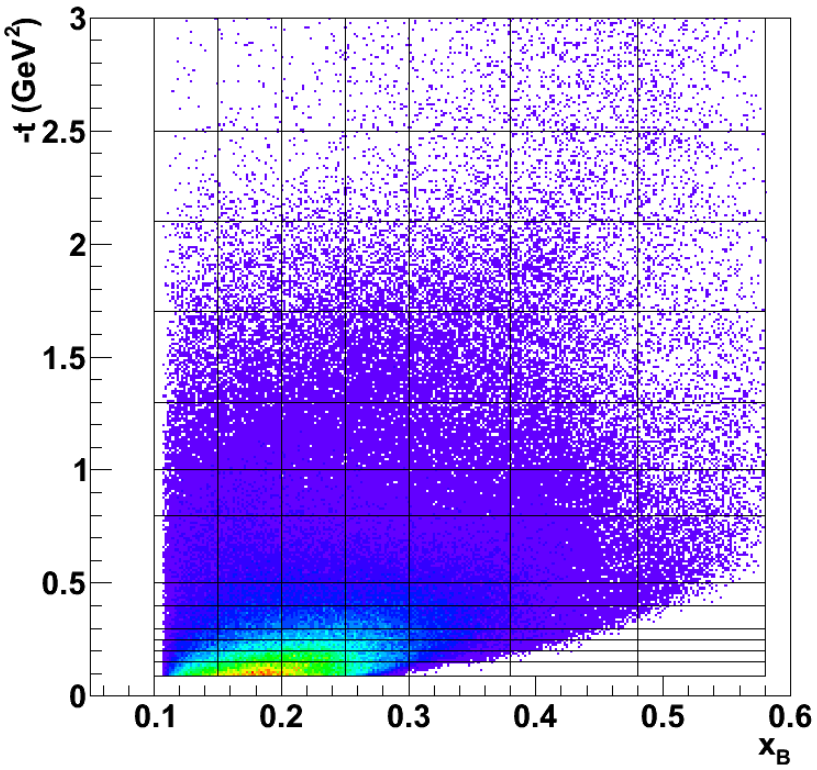
shielding the detectors from the Møller electrons



424 lead tungstate crystals + APD readout

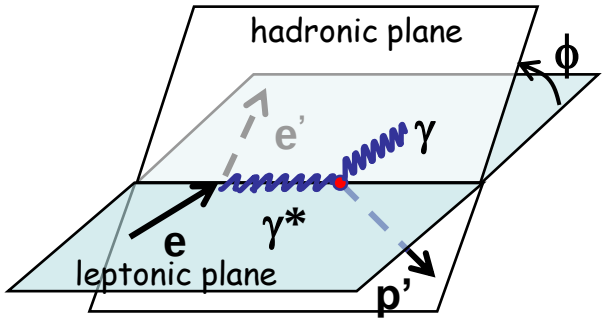
Kinematic coverage of the e1-DVCS data





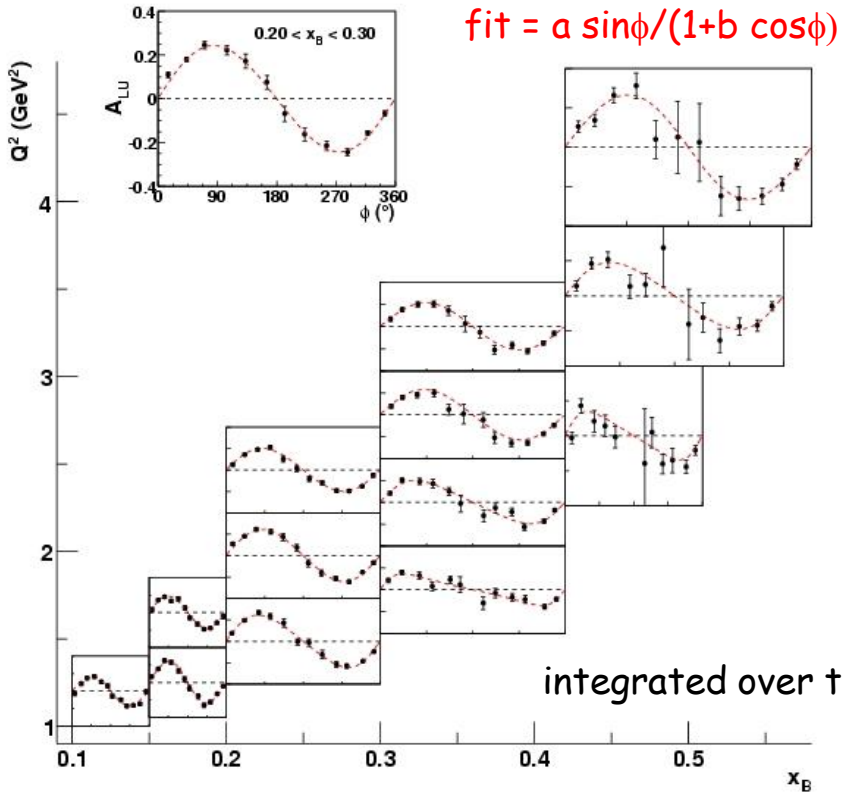
The kinematics of the DVCS reaction is defined by 4 independent variables : Q^2, x_B, t and ϕ

4-dimensional bins = (Q^2, x_B , -t, ϕ)

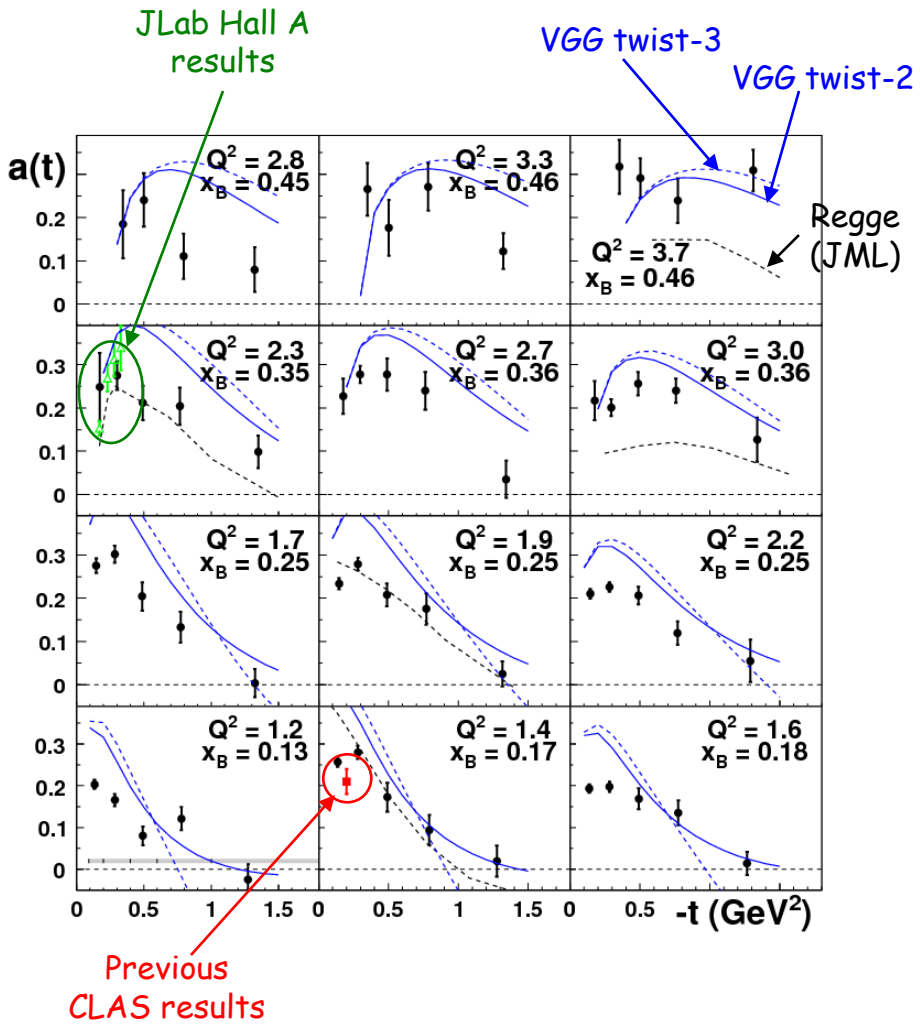


e1-DVCS: DVCS Beam Spin (A_{LU}) asymmetries

A_{LU} on the proton



F.X. Girod et al. (CLAS Collaboration), Phys. Rev. Lett. 100, 162002 (2008)



$$\Delta\sigma_{LU} \sim \sin\phi \; \mathrm{Im}\{F_1\mathcal{H} + \xi(F_1+F_2)\tilde{\mathcal{H}} - kF_2\mathcal{E}\}d\phi$$

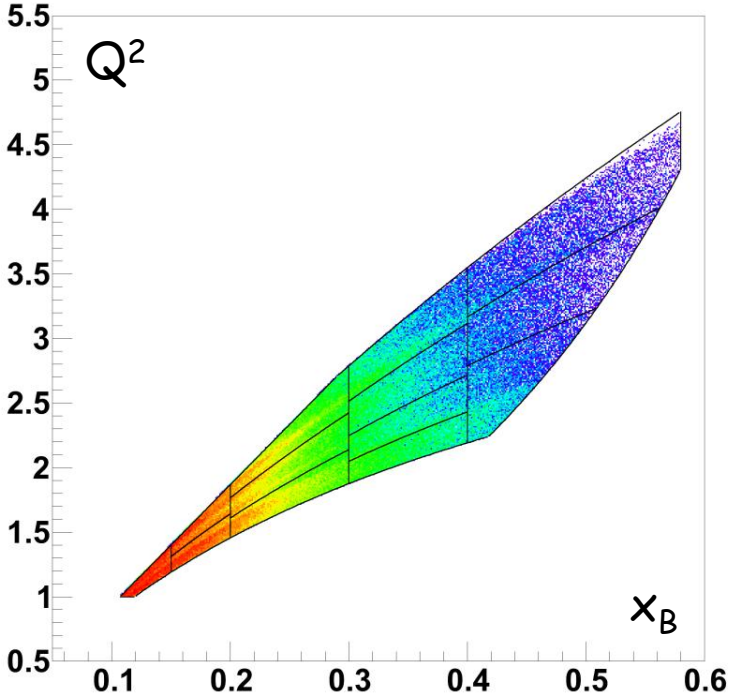
VGG model: Vanderhaeghen,Guichon,Guidal

e1-DVCS: DVCS cross sections

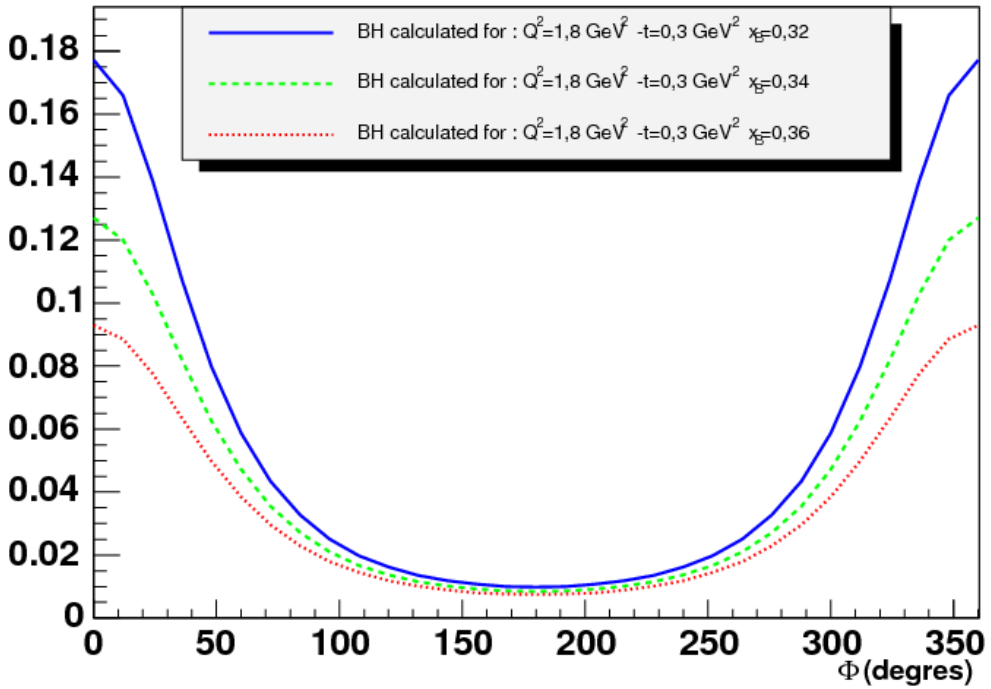
$Q^2 > 1$, $0.1 < x_B < 0.58$, $0.09 < -t < 3$

$21 < \theta_e < 45$, $p_e > 0.8$, $W > 2$

4-dimensional bins = (Q^2, x_B , -t, ϕ)



The fast variation of the BH cross section: Around Φ=0 (where lies the BH singularity), there can be a factor ~2 between neighbouring kinematics



The fast variations of the BH cross section make the DVCS cross section analysis particularly difficult

e1-DVCS: DVCS cross sections

$Q^2 > 1$, $0.1 < x_B < 0.58$, $0.09 < -t < 3$

$21 < \theta_e < 45$, $p_e > 0.8$, $W > 2$

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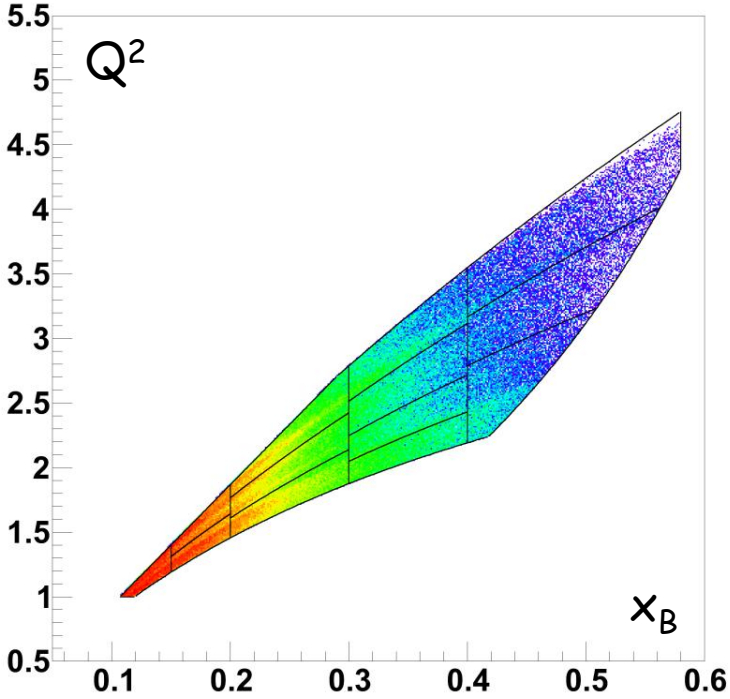
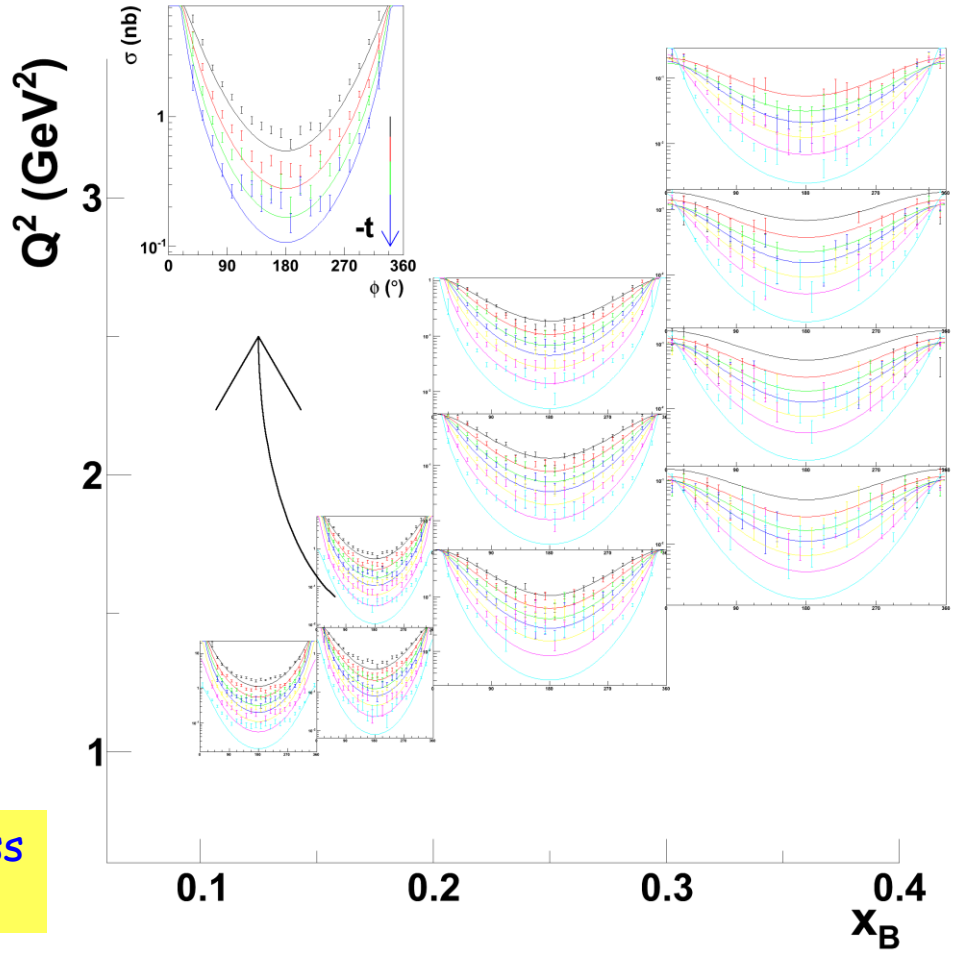


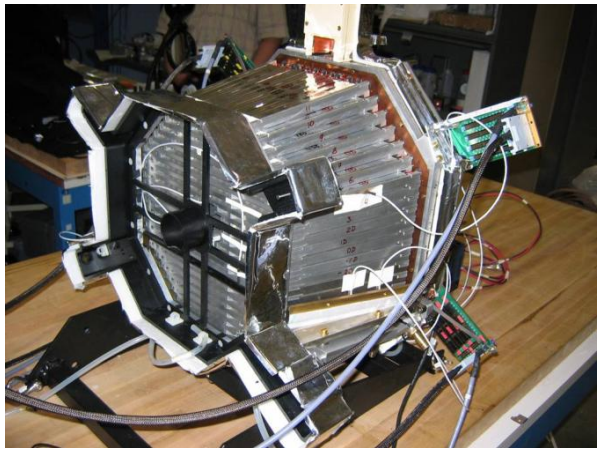
PRELIMINARY



2 independent analyses in progress
JLab / IPN Orsay

The eg1-DVCS experiment: longitudinally polarized target

- Data taken from February 4 until September 21, 2009
- Beam energy = 4.735, 5.764, 5.892, 5.967 GeV
- Target: longitudinally polarized NH_3 (~80%) and ND_3 (~30%)
- DVCS electromagnetic calorimeter to detect photons emitted at forward angles



Goals:
- DVCS Target-spin asymmetries A_{UL}
- DVCS Double-spin (beam-target) asymmetries A_{LL}

$$\Delta\sigma_{UL} \sim \sin\phi\ \mathrm{Im}\{F_1\tilde{\mathcal{H}}+\xi(F_1+F_2)(\mathcal{H}+x_B/2\mathcal{E})-\xi k F_2\,\mathcal{E}+\ldots\}d\phi$$

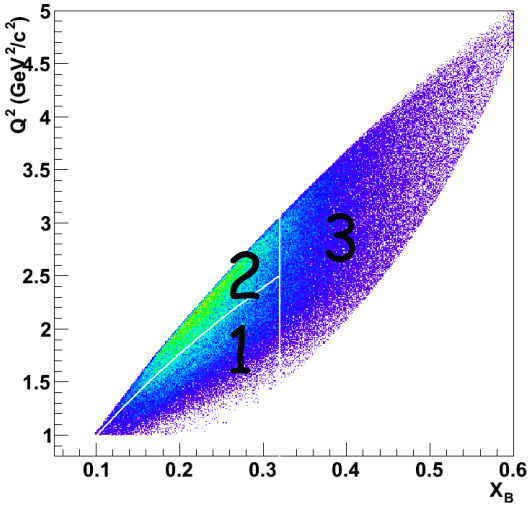
$$\Delta\sigma_{LL} \sim (A+B\cos\phi)\ \mathrm{Re}\{F_1\tilde{\mathcal{H}}+\xi(F_1+F_2)(\mathcal{H}+x_B/2\mathcal{E})\ldots\}d\phi$$

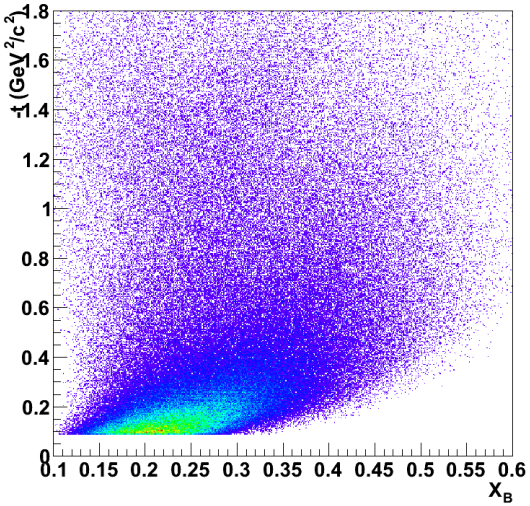
$Im\{\mathcal{H}_p, \tilde{\mathcal{H}}_p\}$
$Im\{\mathcal{H}_n, \mathcal{E}_n, \tilde{\mathcal{E}}_n\}$

$Re\{\mathcal{H}_p, \tilde{\mathcal{H}}_p\}$
$Re\{\mathcal{H}_n, \mathcal{E}_n, \tilde{\mathcal{E}}_n\}$

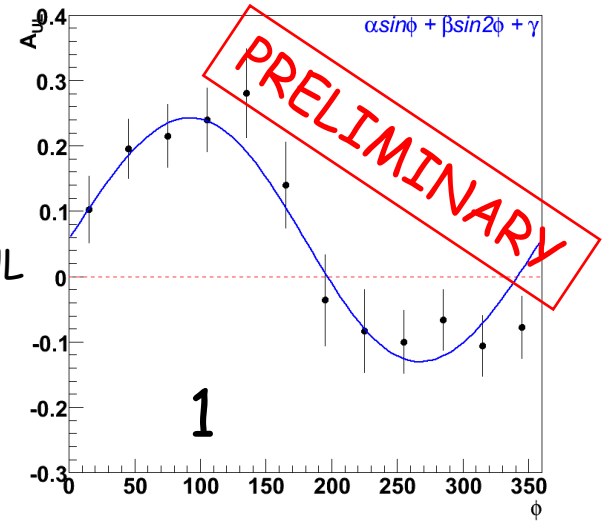
The eg1-DVCS experiment: longitudinally polarized target

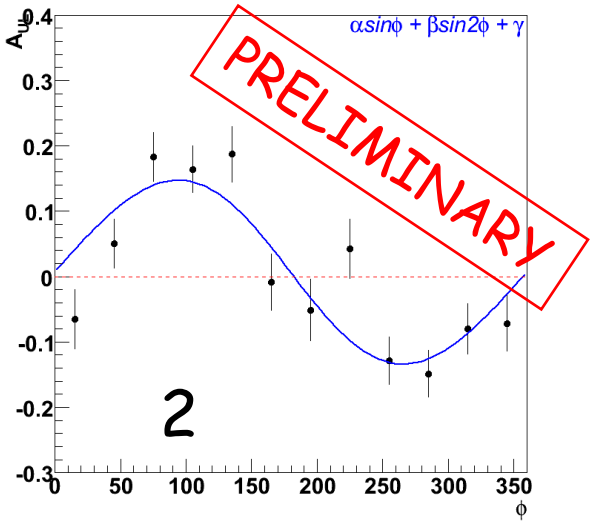
Preliminary results of DVCS target-spin asymmetries on the Proton

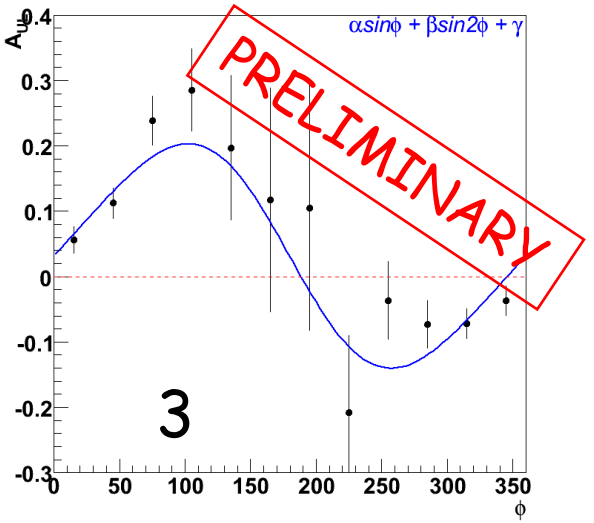




A_{UL}







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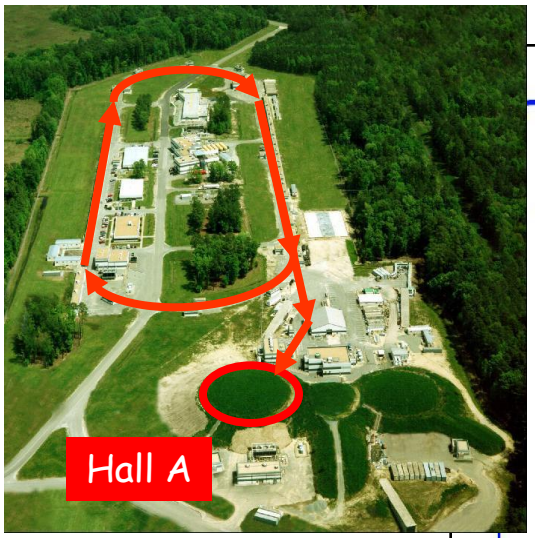
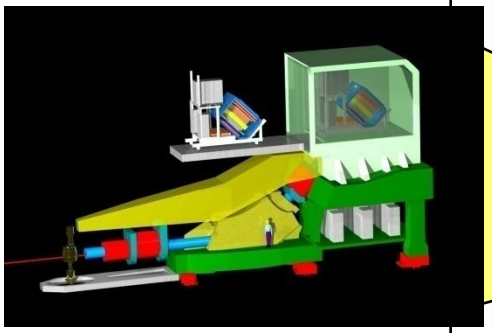
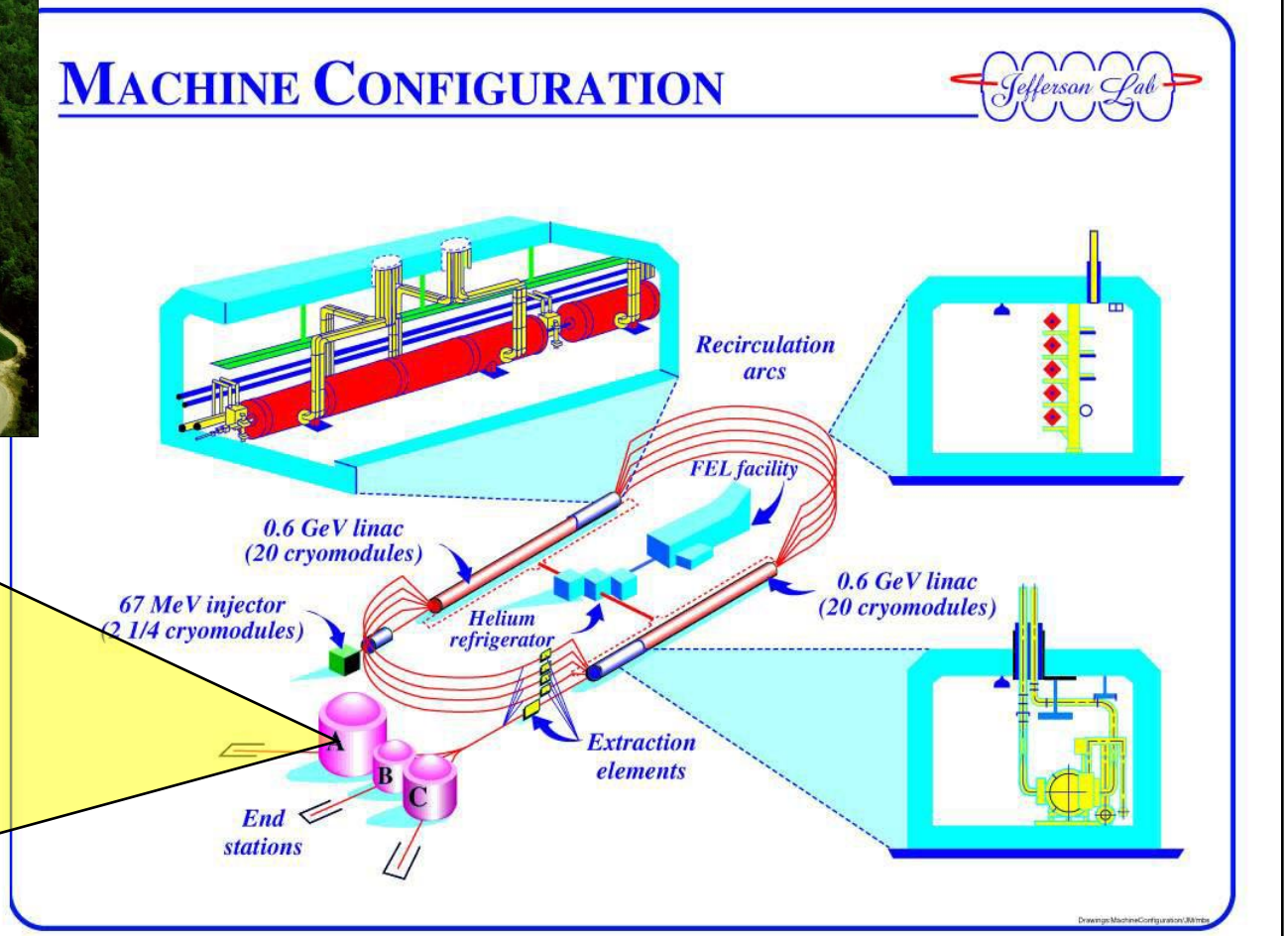
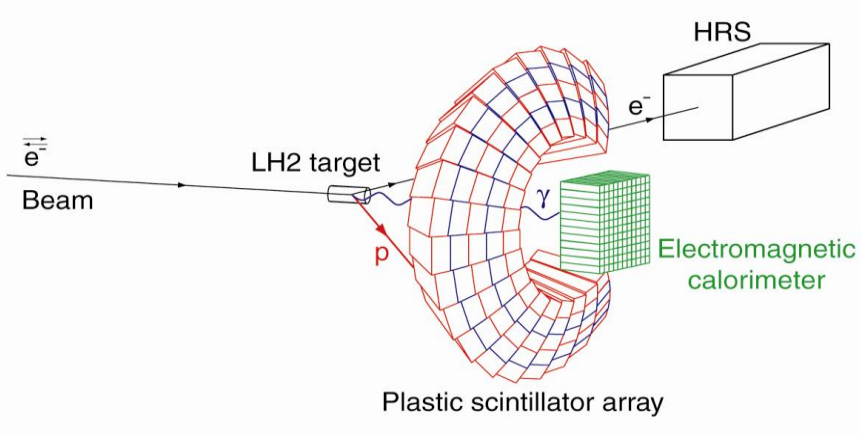




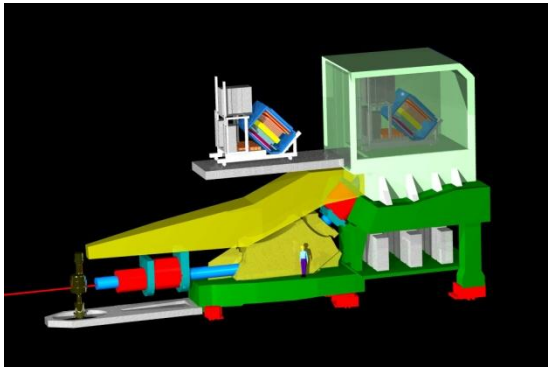
Hall A :
2 High Resolution Spectrometers



Hall A E00-110 experiment: DVCS on the Proton

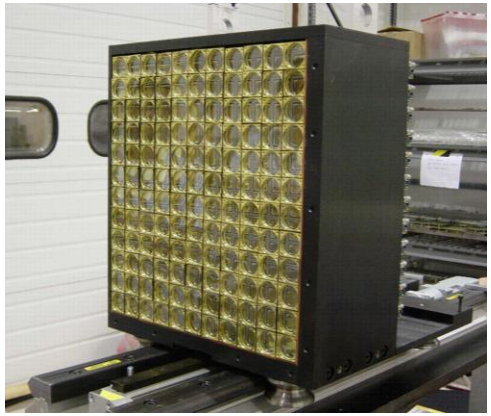


Left Hall A High Resolution Spectrometer



100-channel scintillator array

PbF_2 electromagnetic calorimeter

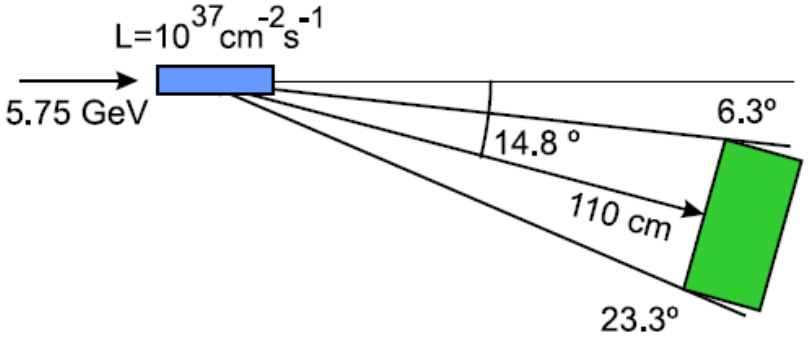


- 75% polarization
- 2.5μA electron beam
- LH_2 target

- High Resolution Hall A spectrometer for electron detection
- 100-channel scintillator array for proton detection
- 132-block PbF_2 electromagnetic calorimeter for photon detection

Kinematic settings of the Hall A E00-110 experiment

Kin	Q^2 (GeV^2)	x_B	θ_e (deg.)	θ_{γ^*} (deg.)	P_e (GeV)
1	**1.5**	0.36	15.6	**22.3**	3.6
2	**1.9**	0.36	19.3	**18.3**	2.9
3	**2.3**	0.36	23.9	**14.8**	2.3

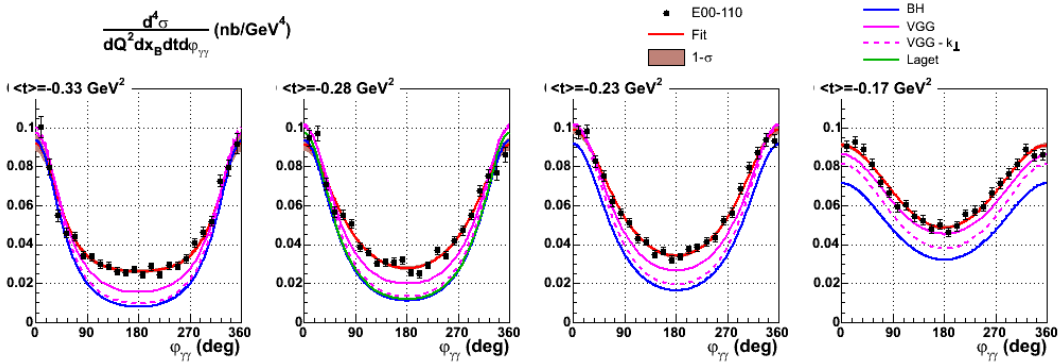


50 days of beam time in 2004, at I = 2.5 μA

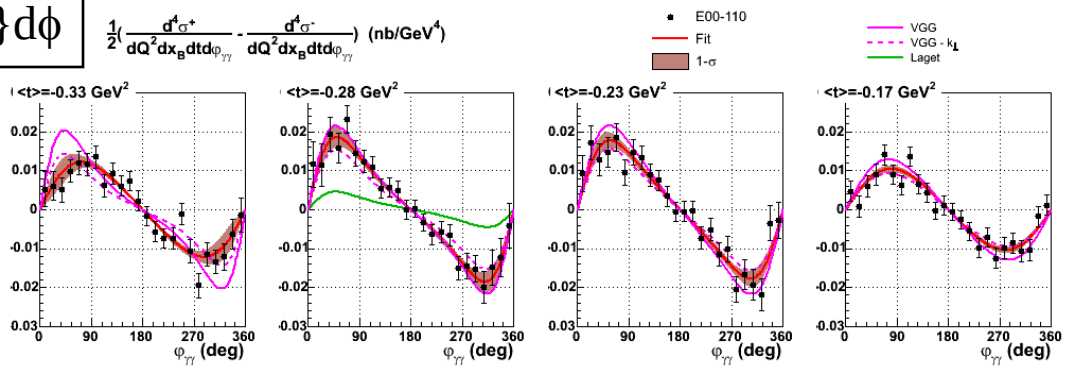
$$\int Lu \cdot dt = 13294 \text{ fb}^{-1}$$

Hall A E00-110: unpolarized and polarized DVCS cross sections

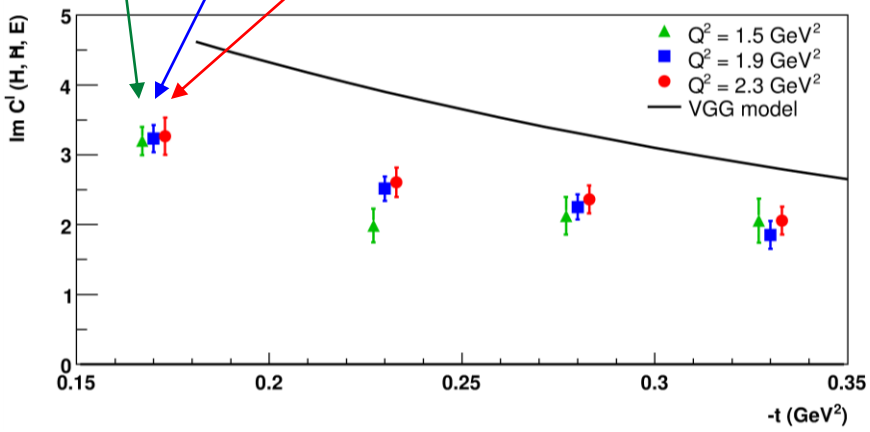
C. Munoz Camacho et al. (JLab Hall A Collaboration)
Phys. Rev. Lett. 97, 262002 (2006)



$$\Delta\sigma_{LU} \sim \sin\phi \; \mathrm{Im}\{F_1\mathcal{H} + \xi(F_1+F_2)\tilde{\mathcal{H}} - kF_2\mathcal{E}\}d\phi$$



DVCS polarized cross sections extracted for 3 different values of Q^2: 1.5 GeV^2, 1.9 GeV^2, 2.3 GeV^2

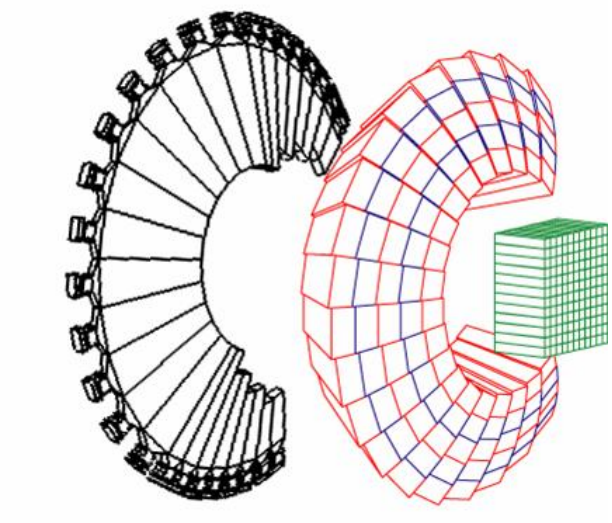


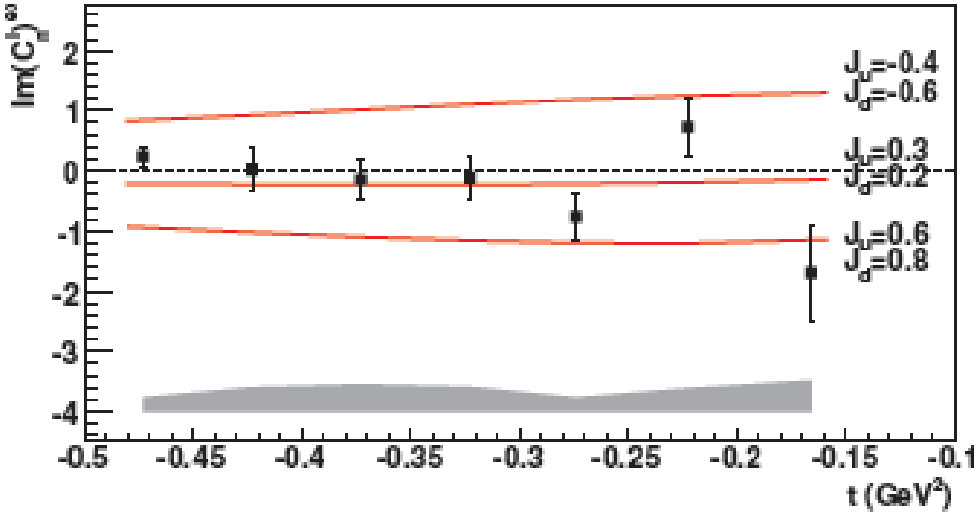
No Q^2 dependence: strong indication for scaling behavior and handbag dominance (but on a limited Q^2 range)

Hall A E03-106 experiment: DVCS on the Neutron

- LD_2 target
- Charged particle veto added to the scintillator array

M. Mazouz et al. (JLab Hall A Collaboration)
Phys. Rev. Lett. 99, 242501 (2007)





$$\Delta\sigma_{LU} \sim \sin\phi\ \mathrm{Im}\{F_1\mathcal{H} + \xi(F_1+F_2)\tilde{\mathcal{H}} - kF_2\mathcal{E}\}d\phi$$

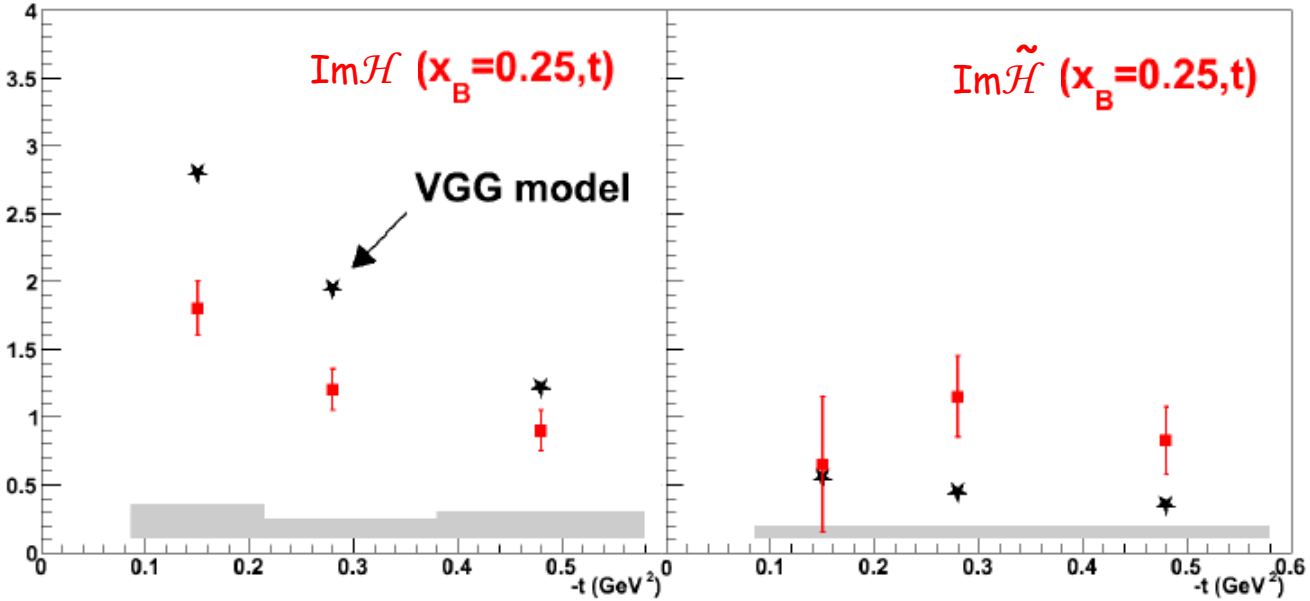
$$\Rightarrow \quad Im\{\mathcal{H}_n, \tilde{\mathcal{H}}_n, \mathcal{E}_n\}$$

Needed to access J^q (Ji's sum rule)

Hall A E07-007 (Proton) & E08-025 (Neutron) DVCS experiments were carried out in Fall 2010, using different beam energies to attempt a Rosenbluth-like separation of the DVCS-BH interference term and the pure DVCS term (analysis in progress)

Extraction of GPDs from fitting A_{LU} and A_{UL} CLAS data

Having both the beam-spin and longitudinal target-spin asymmetries, a nearly model-independent GPD analysis in leading twist was achieved fitting simultaneously A_{LU} and A_{UL} extracted with CLAS at 3 values of t and fixed x_B

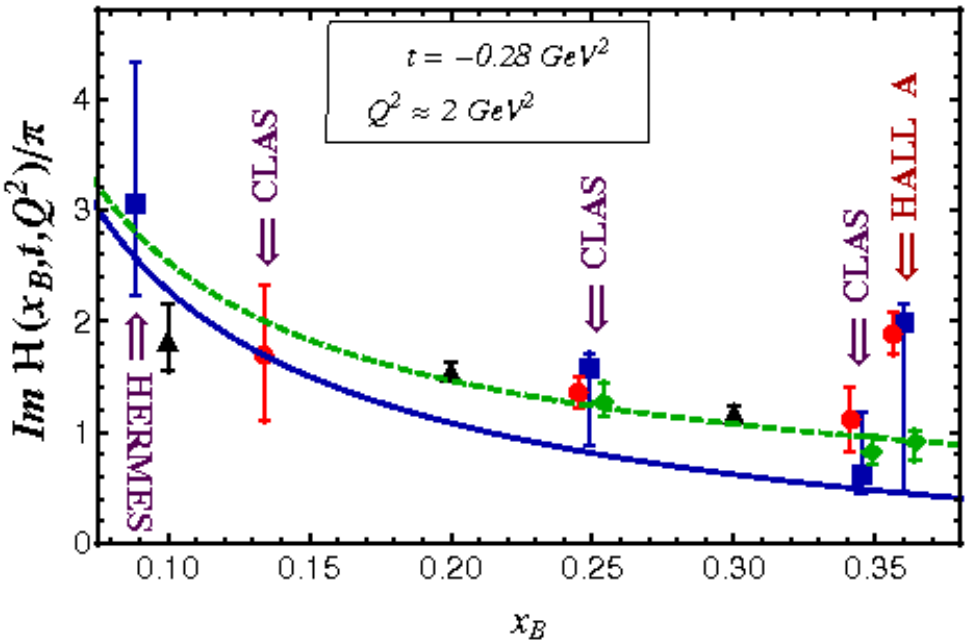


M. Guidal, Phys. Lett. B 689, 156-162 (2010)

- Im$\mathcal{H}$: VGG model predictions reproduce the shape of the data but overestimate it, especially at lower t
- Im$\tilde{\mathcal{H}}$: VGG model predictions tend to underestimate the data

Im$\mathcal{H}$ shows a steeper t-slope than Im$\tilde{\mathcal{H}}$ which would suggest that the axial charge is more concentrated than the electromagnetic charge

Extraction of GPDs from fitting world data



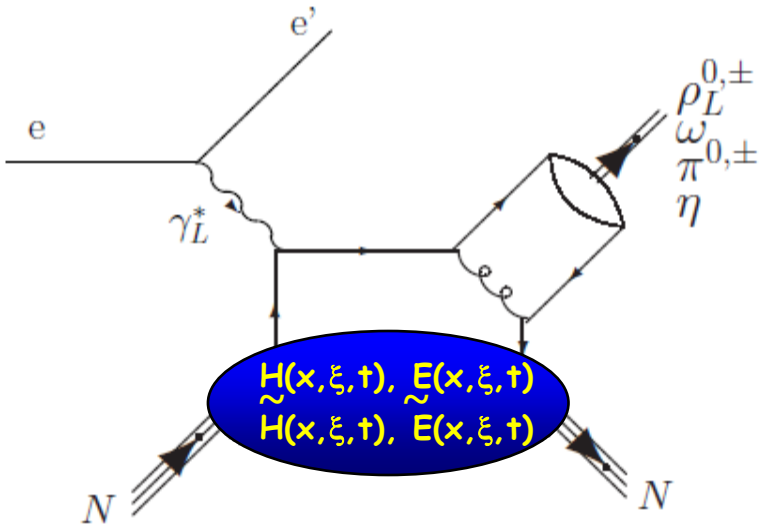
[Guidal '08, Guidal and Moutarde '09], seven CFF fit (blue squares), [Guidal '10] $\mathcal{H}$, $\tilde{\mathcal{H}}$ CFF fit (green diamonds), [Moutarde '09] H GPD fit (red circles) , [Kumericki and Mueller] (blue and green curves, black triangles)

K. Kumericki and D. Mueller, Proceedings of 4th Workshop on Exclusive Reactions at High Momentum Transfer, Newport News, Virginia, 18-21 May 2010

Deeply Virtual Meson Production (DVMP)

"handbag" diagram (high Q^2, small t, fixed x_B)

DVMP



Factorization proven only for **longitudinally polarized** virtual photons

$$\sigma_T \sim \frac{1}{Q^2}\sigma_L$$

conserve nucleon spin

$H(x,\xi,t)$ $\quad \tilde{H}(x,\xi,t)$

$E(x,\xi,t)$ $\quad \tilde{E}(x,\xi,t)$

flip nucleon spin

Vector mesons (ρ, ω, ϕ) sensitive to **H** and **E**

ρ^0	2u+d
ω	2u-d
ρ^+	u-d

Pseudoscalar mesons (π, η) sensitive to $\tilde{H}$ and $\tilde{E}$

π^0	$2\Delta u+\Delta d$
π^+	$\Delta u-\Delta d$
η	$2\Delta u-\Delta d$

DVMP allows quark flavor decomposition

Deeply Virtual Meson Production (DVMP) at CLAS

Vector mesons: exclusive ρ^0, ω, ϕ and ρ^+ electroproduction on the proton at CLAS 6 GeV:

K. Lukashin *et al.*, Phys. Rev. C 63, 065205, 2001 (ϕ@4.2 GeV)
C. Hadjidakis *et al.*, Phys. Lett. B 605, 256-264, 2005 (ρ^0@4.2 GeV)

} e1-b (1999)

L. Morand *et al.*, Eur. Phys. J. A 24, 445-458, 2005 (ω@5.75GeV)
J. Santoro *et al.*, Phys. Rev. C 78, 025210, 2008 (ϕ@5.75 GeV)
S. Morrow *et al.*, Eur. Phys. J. A 39, 5-31, 2009 (ρ^0@5.75GeV)

} e1-6 (2001-2002)

A. Fradi, Orsay Univ. PhD thesis (ρ^+@5.75 GeV)

} e1-DVCS (2005)

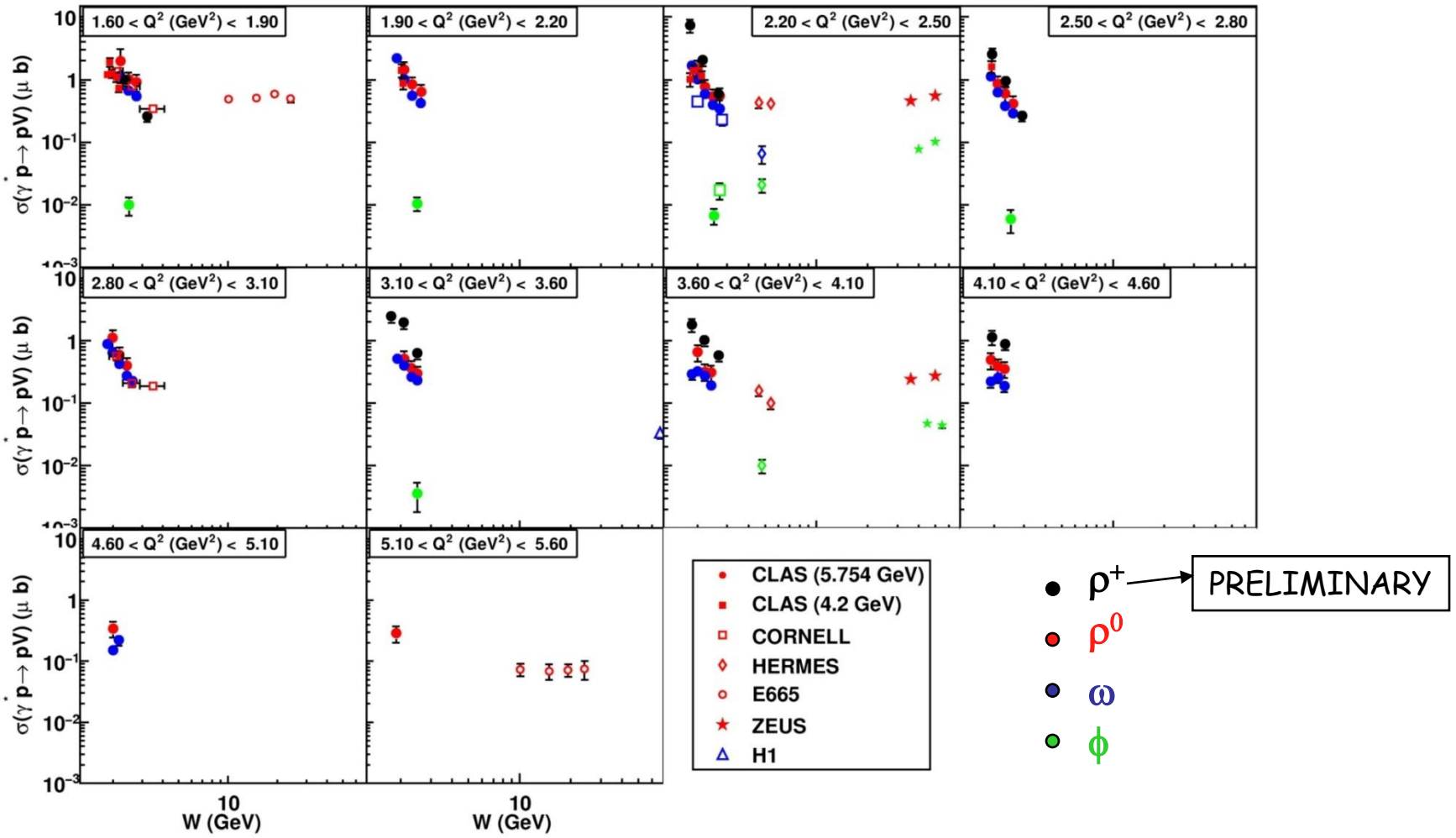
There are also results on exclusive pseudoscalar meson electroproduction on the proton at CLAS 6 GeV:

R. De Masi *et al.*, Phys. Rev. C 77, 042201(R), 2008 (π^0@5.75GeV)

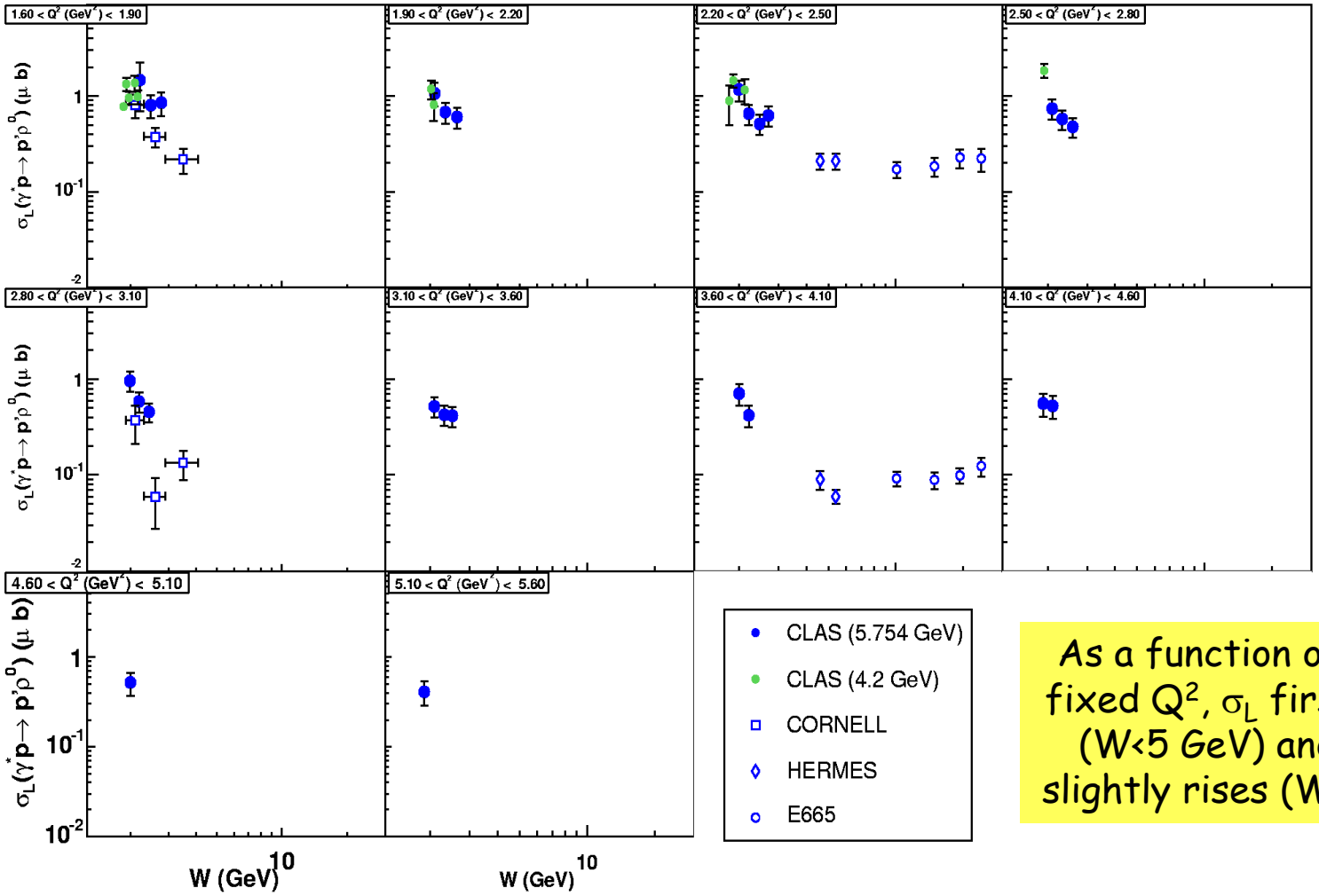
K. Park *et al.*, Phys. Rev. C 77, 015208, 2008 (π^+@5.75 GeV)

I. Bedlinskiy *et al.*, paper in preparation (π^0@5.75GeV)

Comparison between ρ^0, ρ^+, ω and ϕ: cross section σ



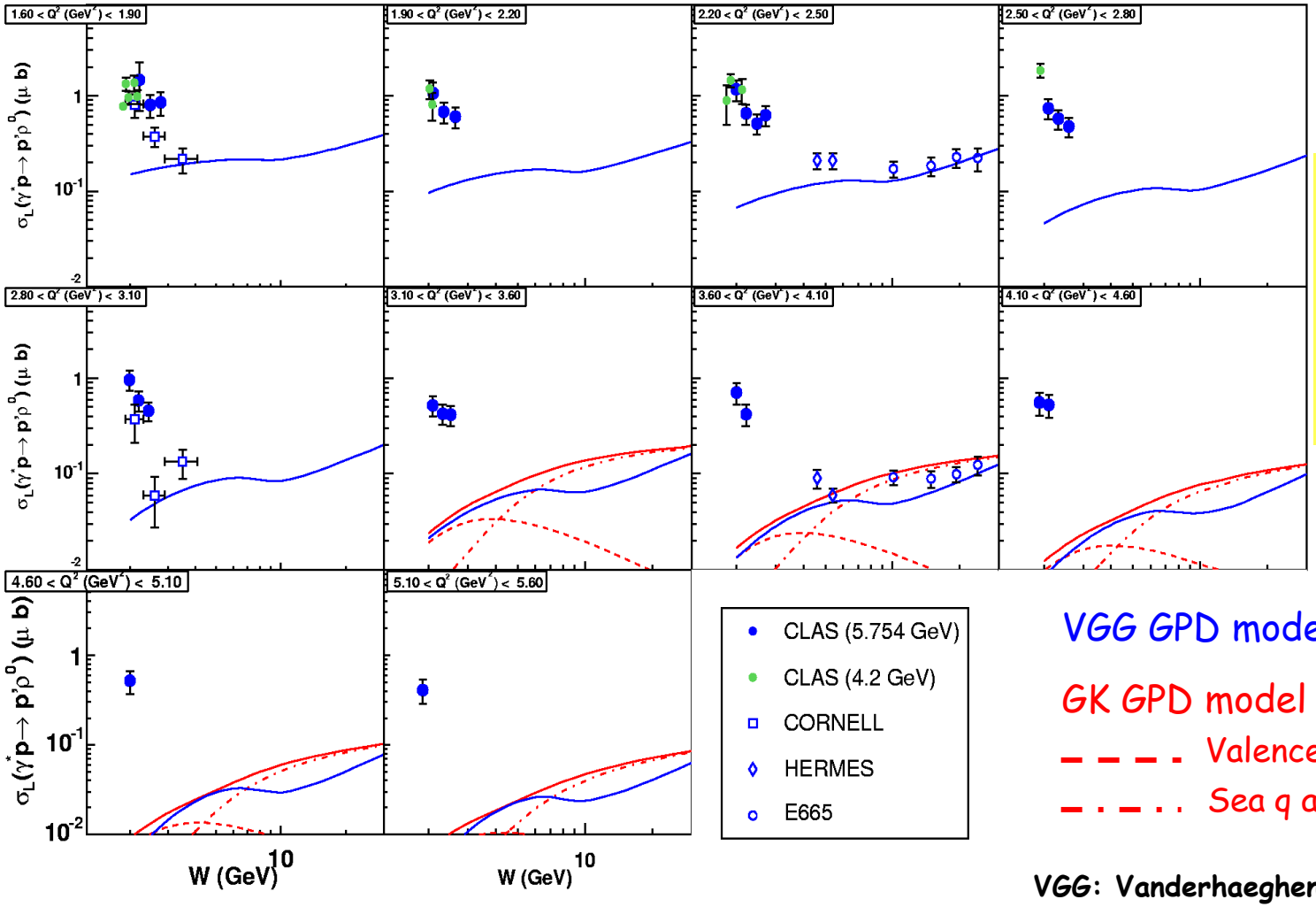
Longitudinal cross section $\sigma_L(\gamma^*_L p \rightarrow p\ \rho_L^0)$



As a function of W, at fixed Q^2, σ_L first drops (W<5 GeV) and then slightly rises (W>5 GeV)

S. Morrow *et al.*, Eur. Phys. J. A 39, 5-31, 2009

Longitudinal cross section $\sigma_L(\gamma^*_L p \to p \rho_L^0)$



The GPD models fail to reproduce the behavior at low W (W < 5 GeV)

VGG GPD model

GK GPD model

Valence q

Sea q and gluons

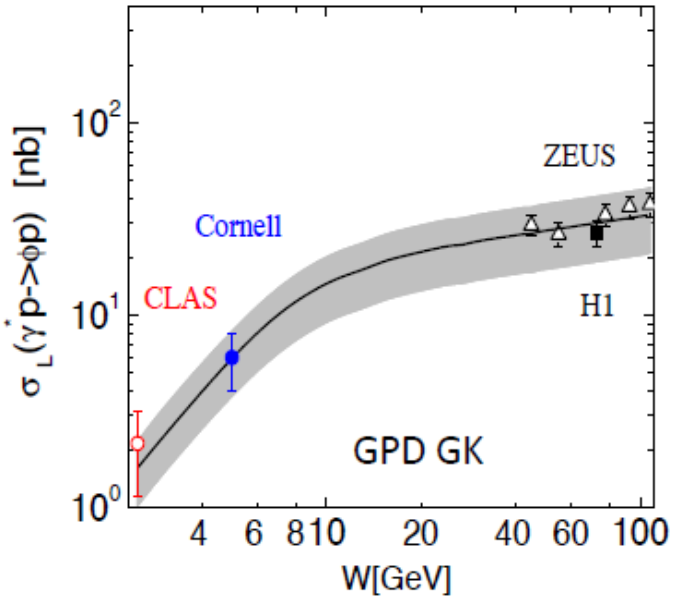
VGG: Vanderhaeghen,Guichon,Guidal

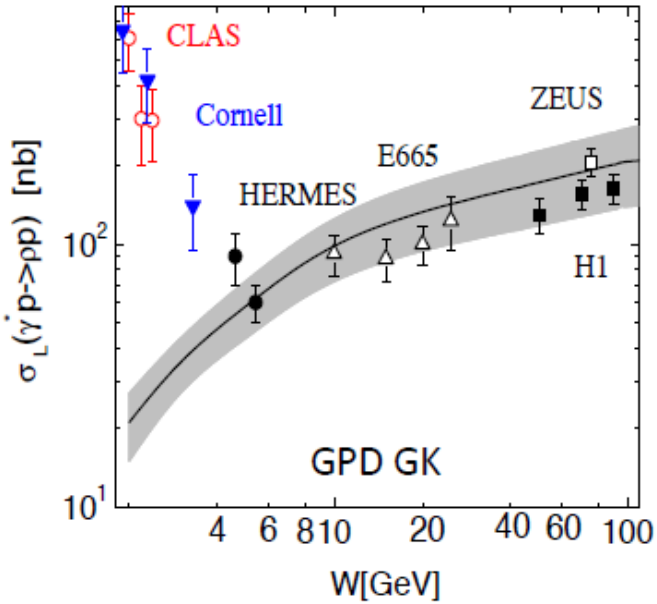
GK: Goloskokov,Kroll

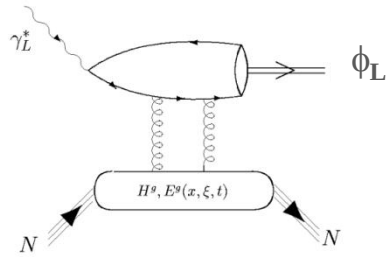
S. Morrow *et al.*, Eur. Phys. J. A 39, 5-31, 2009

Comparison between ϕ and ρ^0

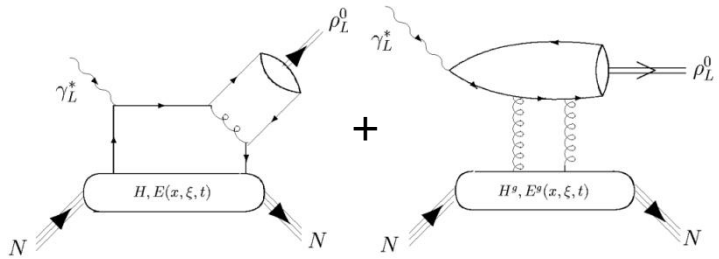
$\gamma^*_L p \to p\,\phi$ GK: Goloskokov,Kroll $\gamma^*_L p \to p\,\rho_L{}^0$







Gluon GPDs

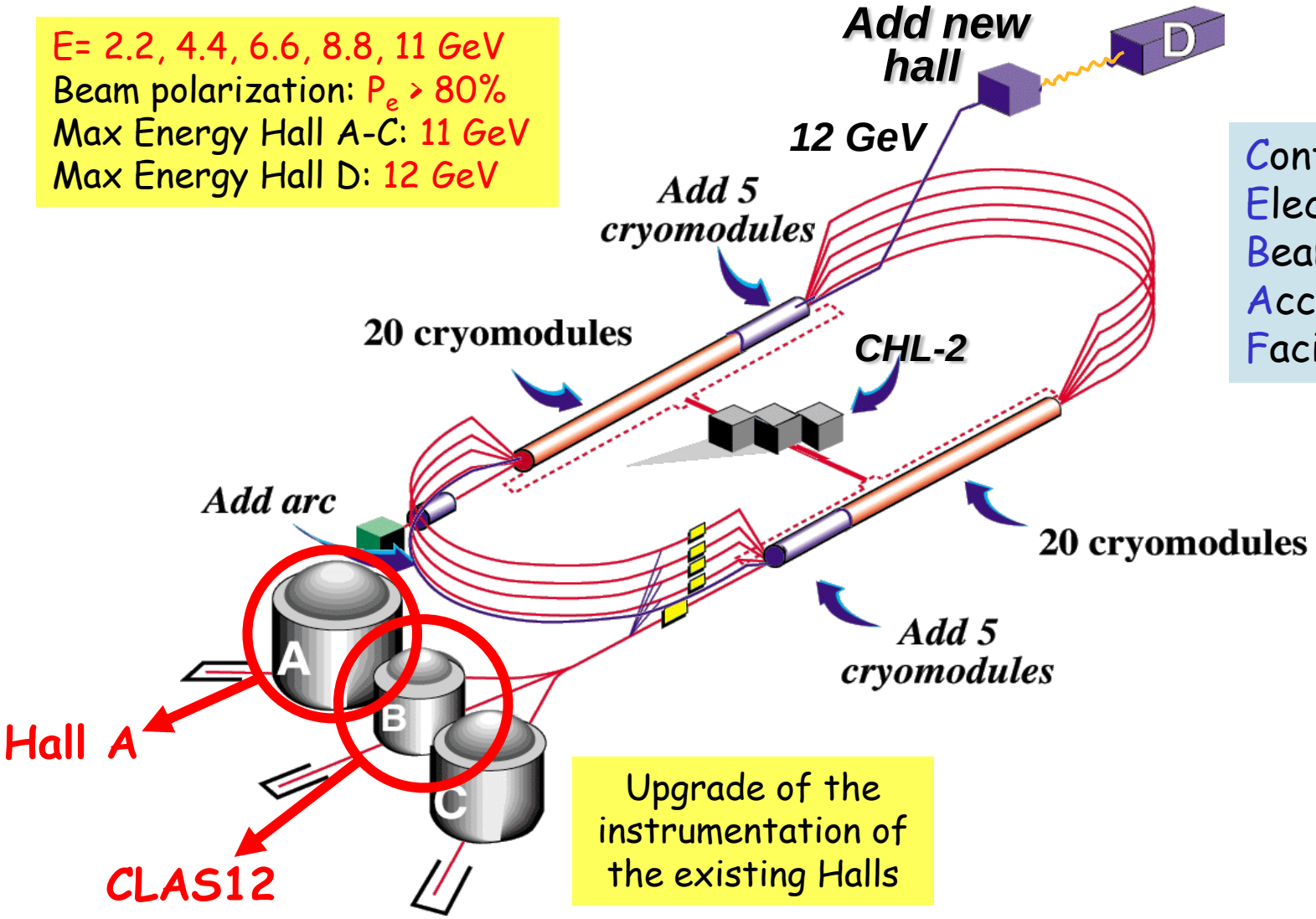


Quark GPDs + Gluon GPDs

GPD models fail to reproduce the behavior at low W (W < 5 GeV) for ρ^0, ρ^+, ω but succeed for ϕ which is only sensitive to gluon GPDs

JLab upgrade to 12 GeV

E= 2.2, 4.4, 6.6, 8.8, 11 GeV
Beam polarization: P_e > 80%
Max Energy Hall A-C: 11 GeV
Max Energy Hall D: 12 GeV



Continuous Electron Beam Accelerator Facility

Upgrade of the instrumentation of the existing Halls

Hall B at JLab 12GeV: CLAS12

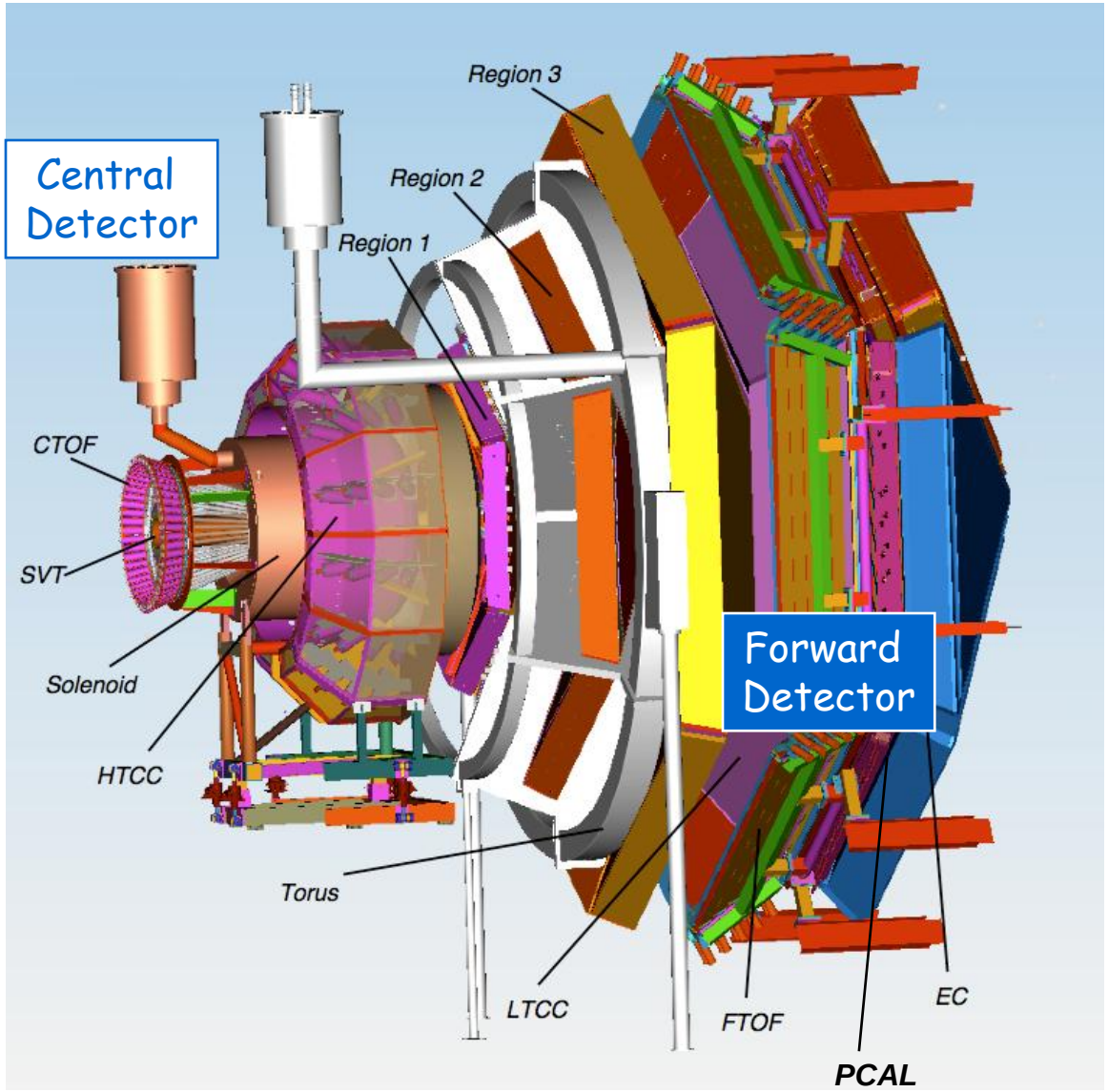
CLAS12

Design luminosity
$L \sim 10^{35}\ cm^{-2}s^{-1}$

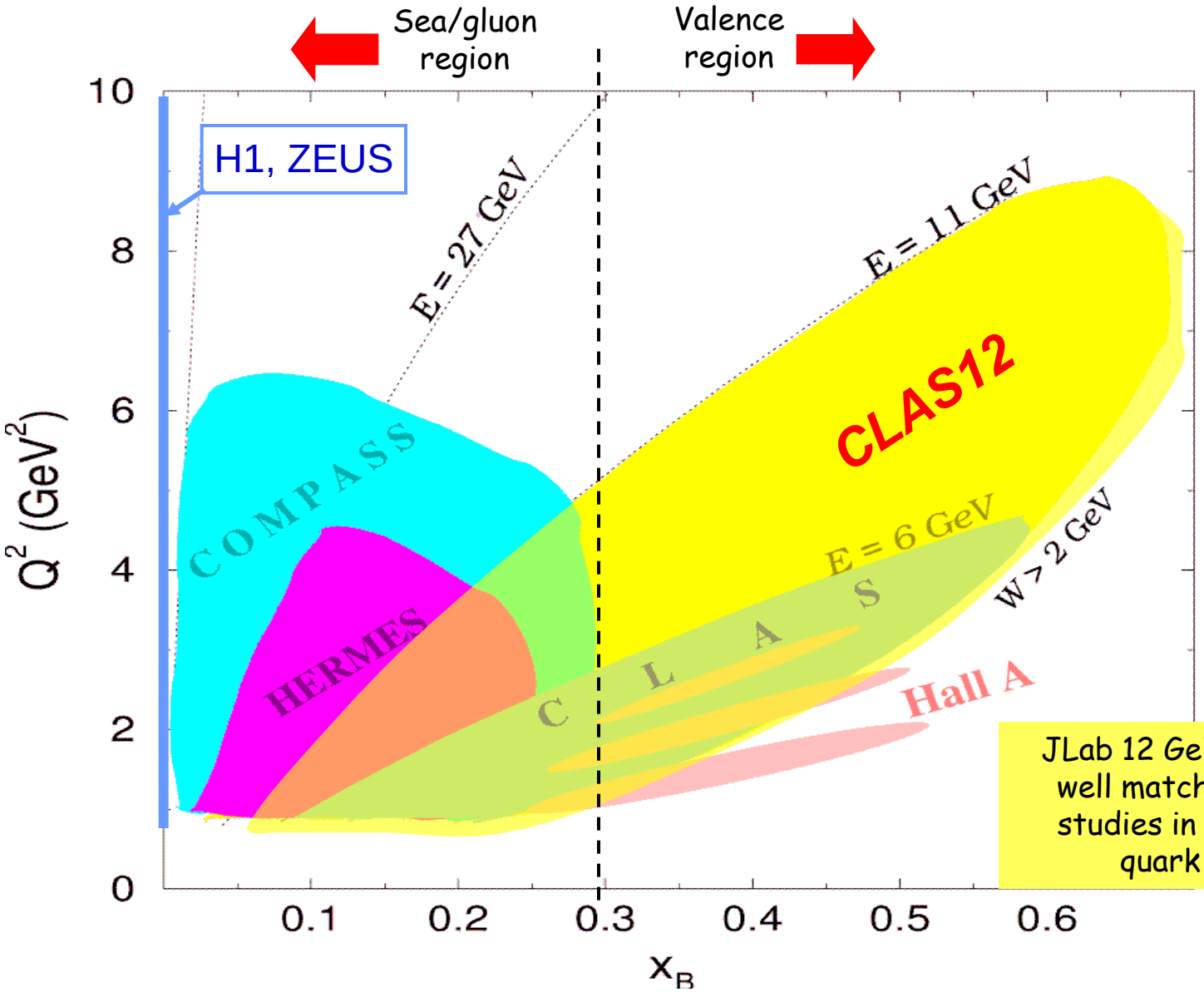
High luminosity

Large acceptance

Large kinematic coverage



Kinematic coverage of CLAS12



JLab 12 GeV Upgrade is well matched for GPD studies in the valence quark regime

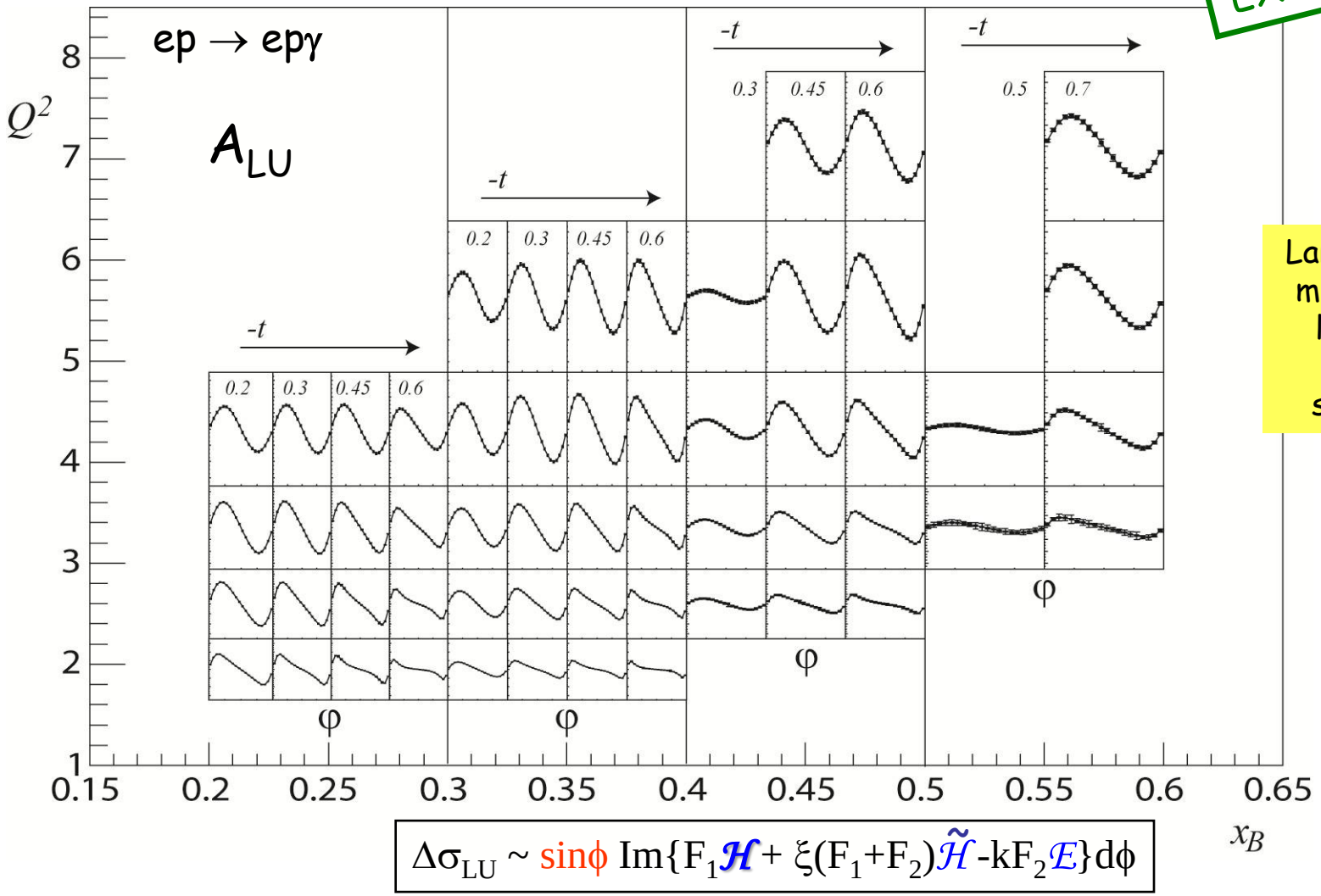
GPD program at CLAS12

- DVCS beam-spin asymmetry A_{LU} on the Proton
- DVCS longitudinal target-spin asymmetry A_{UL} on the Proton
- DVCS transverse target-spin asymmetry A_{UT} on the Proton
- DVCS on the Neutron
- DVCS unpolarized and polarized cross sections
- DVMP: pseudoscalar mesons
- DVMP: vector mesons

Projections of DVCS A_{LU} on the Proton with CLAS12

APPROVED EXPERIMENT

80 days – LH_2 target – 10^{35} Luminosity – VGG model



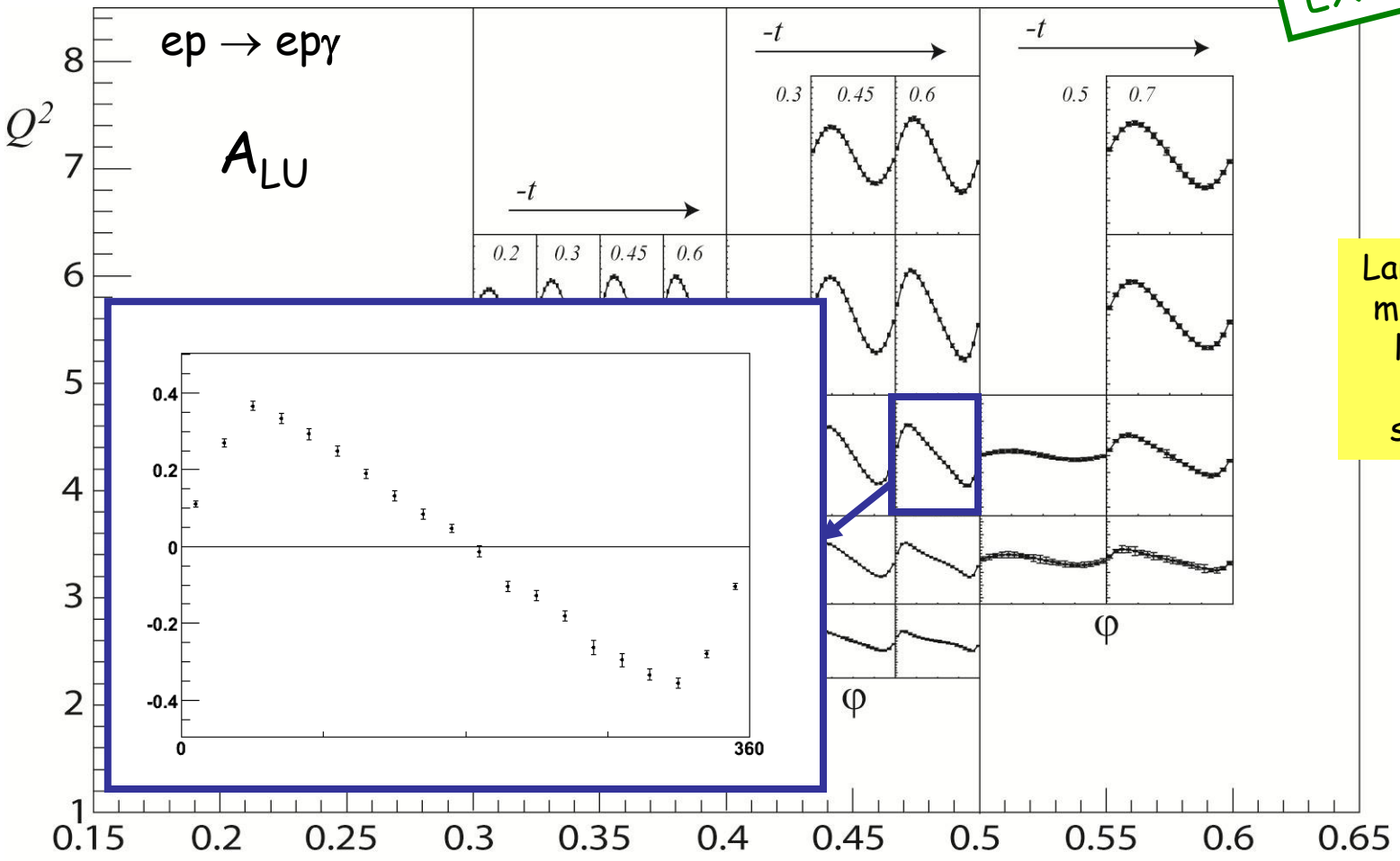
Large acceptance: measurements in large Q^2, x_B, t ranges simultaneously

$$\Delta\sigma_{LU} \sim \sin\phi \; \mathrm{Im}\{F_1\mathcal{H} + \xi(F_1+F_2)\tilde{\mathcal{H}} - kF_2\mathcal{E}\}d\phi$$

Projections of DVCS A_{LU} on the Proton with CLAS12

APPROVED EXPERIMENT

80 days – LH_2 target – 10^{35} Luminosity – VGG model



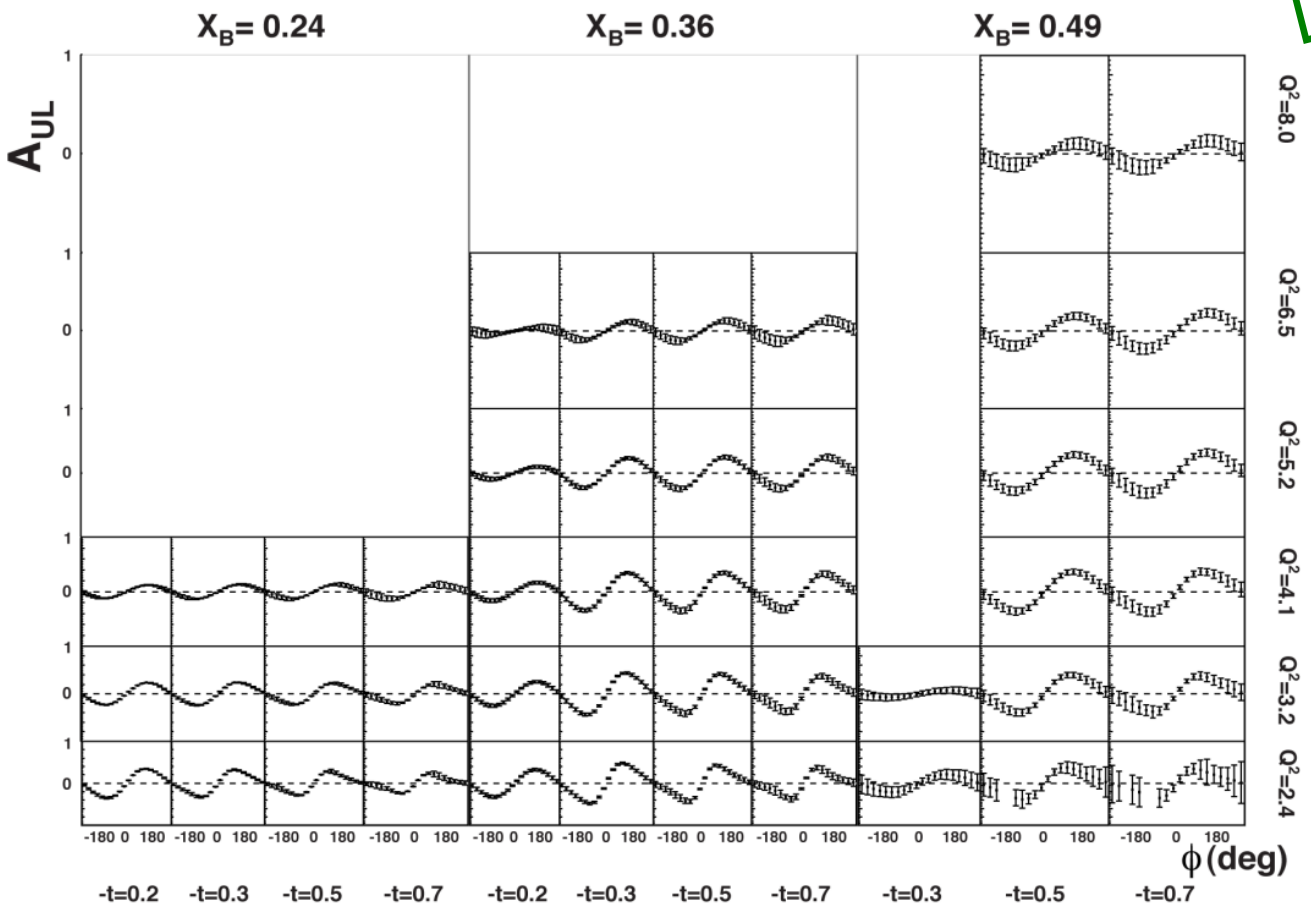
Large acceptance: measurements in large Q^2, x_B, t ranges simultaneously

$$\Delta\sigma_{LU} \sim \sin\phi \; \mathrm{Im}\{F_1\mathcal{H} + \xi(F_1+F_2)\tilde{\mathcal{H}} - kF_2\mathcal{E}\}d\phi$$

Projections of DVCS A_{UL} on the Proton with CLAS12

120 days – polarized NH_3 target – 2.10^{35} Luminosity – *VGG* model

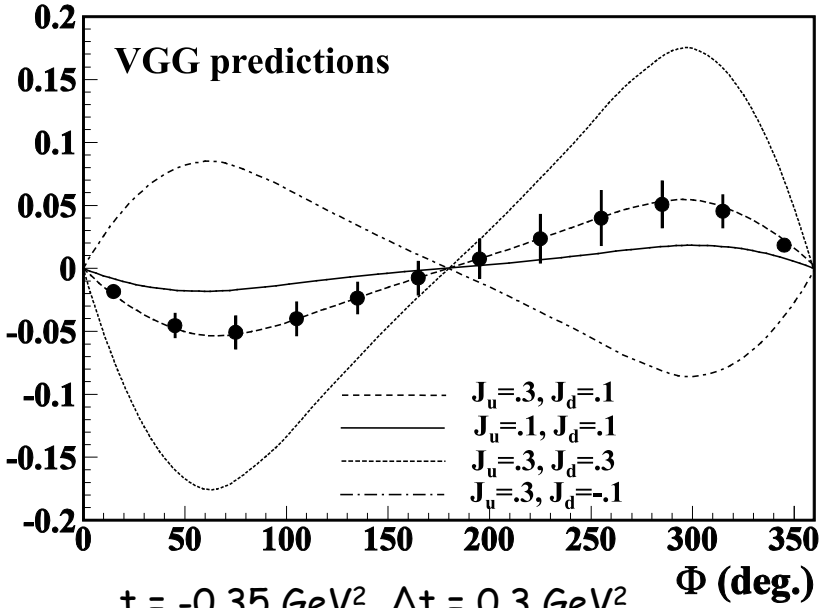
APPROVED EXPERIMENT



Large acceptance: measurements in large Q^2, x_B, t ranges simultaneously

$$\Delta\sigma_{UL} \sim \sin\phi\ \mathrm{Im}\{F_1\tilde{\mathcal{H}} + \xi(F_1+F_2)(\mathcal{H} + x_B/2\mathcal{E}) - \xi k F_2\ \mathcal{E} + \ldots\}d\phi$$

Projections of DVCS A_{LU} on the Neutron with CLAS12

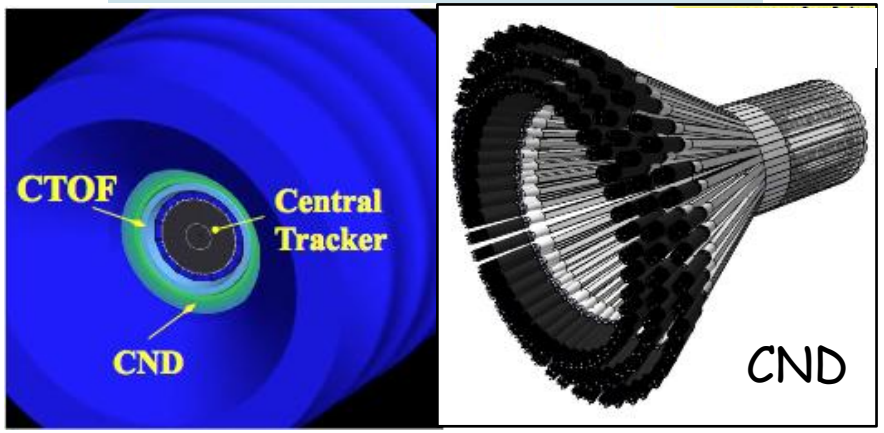


Total of 588 bins in t, Q^2, x_B, ϕ

APPROVED EXPERIMENT

Combined analysis of DVCS on Proton and Neutron allows flavor separation of GPDs

This program requires adding a Central Neutron Detector (CND) to the CLAS12 base equipment



t = -0.35 GeV^2, Δt = 0.3 GeV^2
Q^2 = 2.75 GeV^2, ΔQ^2 = 1.5 GeV^2
x_B = 0.225, Δx_B = 0.15

DVCS A_{LU} on Neutron is mostly sensitive to the GPD E_n

$$\Delta\sigma_{LU} \sim \sin\phi\ \mathrm{Im}\{F_1\mathcal{H} + \xi(F_1+F_2)\tilde{\mathcal{H}} - kF_2\mathcal{E}\}d\phi$$

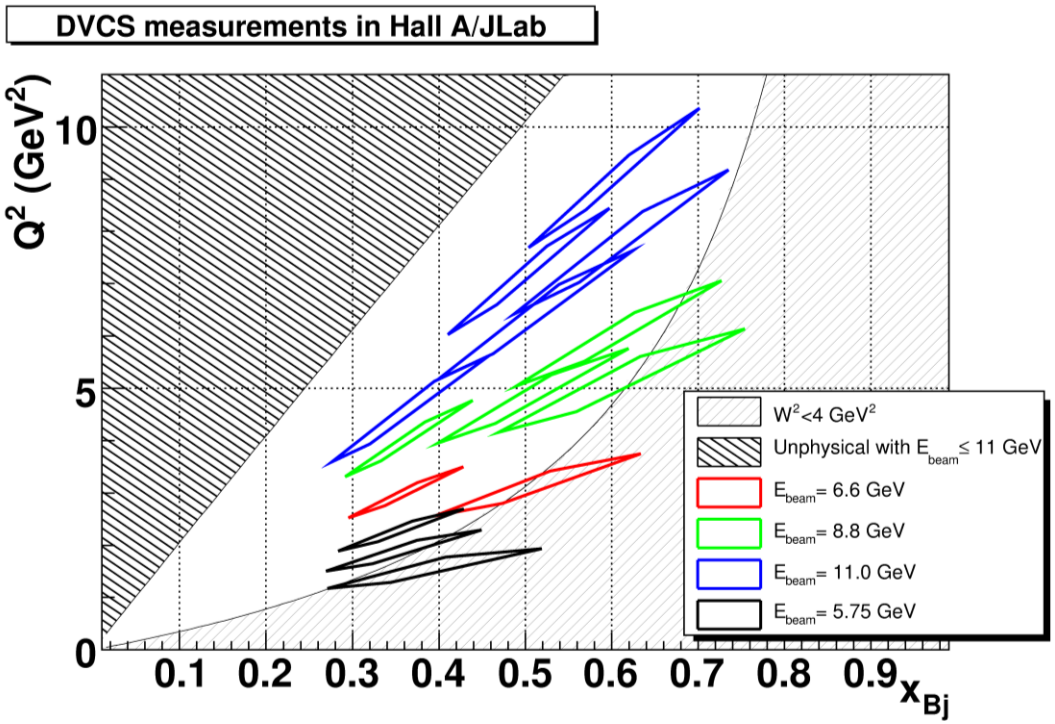
$$\Rightarrow\ Im\{\mathcal{H}_n, \mathcal{H}_n, \mathcal{E}_n\}$$

Needed to access J^q (Ji's sum rule)

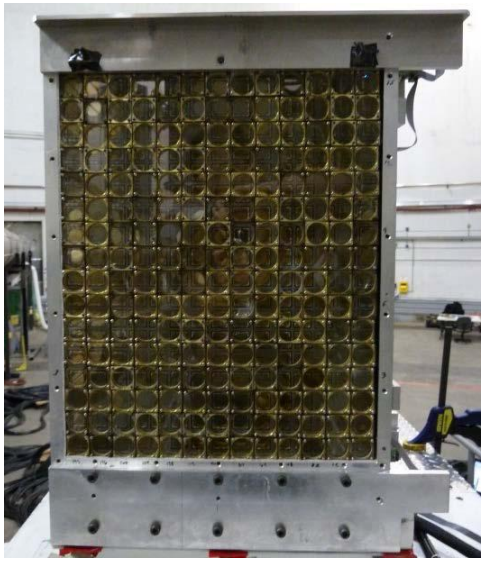
Hall A at JLab 12 GeV : DVCS on the Proton

APPROVED EXPERIMENT

Goals of the E12-06-114 experiment:
- Scaling tests of DVCS cross sections
- Separation of the real and imaginary parts of the DVCS amplitude
- Large kinematic coverage in Q^2, x_B and t
- Operation with different beam energies: 6.6 GeV, 8.8 GeV, 11 GeV



Expanded PbF_2 calorimeter
(76 blocks added to the existing 132)

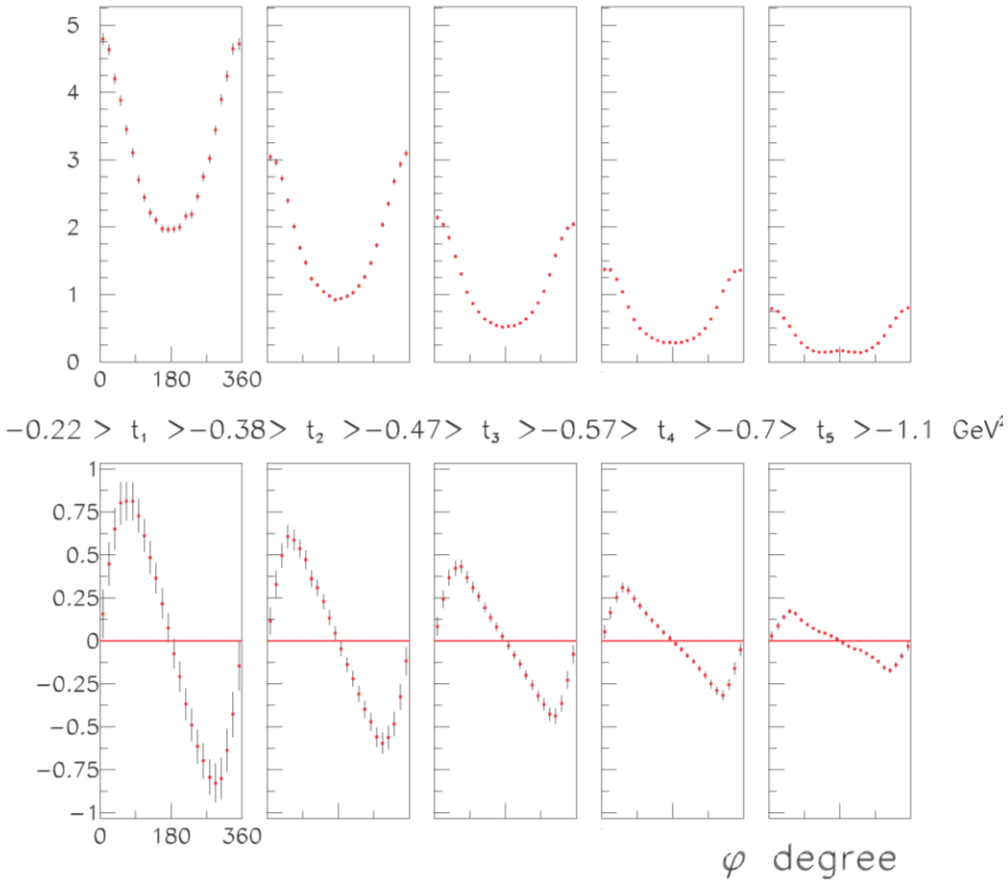


E07-007 & E08-025 DVCS experiments successfully ran in Fall 2010 with 12 GeV equipment

Hall A at JLab 12 GeV : DVCS on the Proton

APPROVED EXPERIMENT

Projections on DVCS unpolarized and polarized cross sections
Luminosity: from 4.10^{37} to 1.10^{38} cm^{-2} s^{-1}
E=8.8 GeV, Q^2=4.8 GeV^2, x_B=0.5



Beamtime request (days)

Q^2 (GeV)	x_B = 0.36	x_B = 0.5	x_B = 0.6
3.0	3		
4.0	2		
4.6	1		
3.1		5	
4.8		4	
6.3		4	
7.2		7	
5.1			13
6.0			16
7.7			13
9.0			20

88 days

Conclusions

- JLab Hall A and CLAS have produced promising DVCS results: strong indication of handbag dominance (Hall A) and a very large set of data providing constraints on GPD models on a very large kinematic domain (CLAS)
- CLAS has the largest set ever of data for DVCS and exclusive vector meson production in the valence region
- GPD models fairly agree with the DVCS asymmetry data at high Q^2 but fail to reproduce it at lower Q^2
- GPD models describe well the exclusive vector meson data for $W>5$ GeV (sea quarks and/or gluons) which seem to be interpretable in terms of leading order handbag diagram (quark/gluon GPDs) but fail by large for $W<5$ GeV (valence region) except for ϕ which is only sensitive to gluon GPDs
- JLab 12 GeV will provide high luminosity for high accuracy measurements to test models on a large x_B scale and thus will be a well matched facility to study GPDs in the valence region
    - Hall A will allow high accuracy DVCS measurements on a larger kinematic domain allowing to test the scaling on a wider Q^2 range
    - CLAS12 will be perfectly suited for a rich experimental GPD program (DVCS on the Proton/Neutron, DVCS with polarized targets, DVMP,…)