RUN GROUP A - Experiments

Duration:	**139 days** 20 days commissioning 60 days high luminosity 39 days low luminosity 20 days reversed torus polarity
New equipment:	Forward Tagger, (RICH?)
Energy:	11 GeV
Target:	LH2

Experiment	Contact	Topic	Specifics
E12-06-108	Stoler	Deep pi0/eta	
E12-06-108A	Carman	N*->KY studies	
E12-06-112	Avakian	Pion SIDIS	
E12-06-112A	Mirazita	Lambda SIDIS	
E12-06-112B	Pisano	Di-Hadron SIDIS	
E12-06-119	Sabatie	DVCS	
E12-09-003	Gothe	Nucleon Resonance	
E12-11-005	Battaglieri	Meson Spectroscopy	Needs FT + special trigger + low-luminosity running time
E12-11-005A	Guo	Very strange baryons	
E12-12-001	Nadel-Turonski	TCS & J/Psi	Needs reversed torus polarity running
E12-12-007	Stoler, Weiss	Deep Phi	

RUN GROUP A - Commissioning

During the 20-day commissioning part of Run-Group A:

1. Establish 11 GeV beam at low or moderate current on an empty target
2. Confirm the correct functionality of ALL subsystems
3. Switch to full target, establish beam at moderate luminosity and verify detector subsystem correlations using the event display and the reconstruction software
4. Perform trigger studies to determine the optimal electron trigger configuration for the subsequent physics run
5. Perform luminosity scans to determine the allowed range for the subsequent running
6. Perform magnetic field scans to determine the detector acceptance and, comparing with simulations, identify the optimal settings
7. Perform alignment studies with zero field
8. Accumulate data to perform full detector subsystem calibrations

9. If enough data, use them for first publication ?

Pending question related to schedule: will there be time between commissioning and data taking to “digest” the data? If not, need a strong and prepared task force.

RUN GROUP A – Beam time request

1) In addition to the 20 days for the commissioning experiment, **high luminosity running of 60 days** is needed for 4 experiments (E12-06-108, E12-06-119, E12-11-005, E12-12-001). Experiment **E12-11-005 requires lower luminosity operation for 39 days**. Experiment E12-12-001 declared that the 80 days plus the 39 days addition low luminosity days are equivalent to the total of 100 days they had requested.

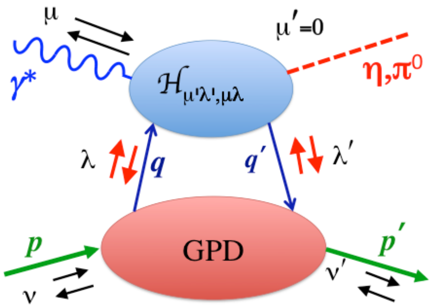
2) E12-12-001 received approval for **additional 20 days of running at reversed Torus polarity**. The listed RG-A time of 139 days will thus serve all PAC-approved experiments with a total of 559 days of individually approved beam times. (This number does not include the run group experiments, which account for an additional 300 days if run independently.)

3) **Note that E12-11-005 requires an additional trigger** that uses charged tracks from the CLAS12 tracking detectors. This trigger system is now under construction. Should the trigger not be available for the first run of RG-A, a re-arrangement of the Run Group would be necessary.

Note: **Experiment E12-11-005 part of RG-A requires the Forwards Tagger (FT)** that allows for electron scattering at very low Q^2 ($10^{-2} - 10^{-1}$ GeV^2), which provides a high photon flux and a high degree of linear polarization, complementary to the capabilities of Hall D. The FT detector systems will require an independent Experimental Readiness Review (ERR) prior to installation and operation as part of CLAS12.

E12-06-108 Hard exclusive π0 and η electroproduction with CLAS12

P. Stoler, K. Joo, V. Kubarovsky, M. Ungaro, C. Weiss



Quark helicity flip

Kroll, Goloskokov
Goldstein Liuti

Transversity GPDs

Generalized form factors “GFF”

Nucleon GFFs

$|\langle \bar{E}_T \rangle|^2 \propto \frac{1}{t}\sigma_{TT}$

$|\langle H_T \rangle|^2 \propto [\sigma_T + \sigma_{TT}]$

$\sigma_T \gg \sigma_L$

Quark flavor GFFs:

$\langle E_T^u \rangle \propto \langle E_T^\pi \rangle + \sqrt{3}\langle E_T^\eta \rangle$

$\langle E_T^d \rangle \propto \langle E_T^\pi \rangle - \sqrt{3}\langle E_T^\eta \rangle$

Similarly for H_T

Physics objectives

- Quantify approach to small-size regime in exclusive π0, η production at $Q^2 > 1$ GeV^2
- Extract GFFs containing **quark transversity GPDs** and perform flavor separation

Observables and analysis

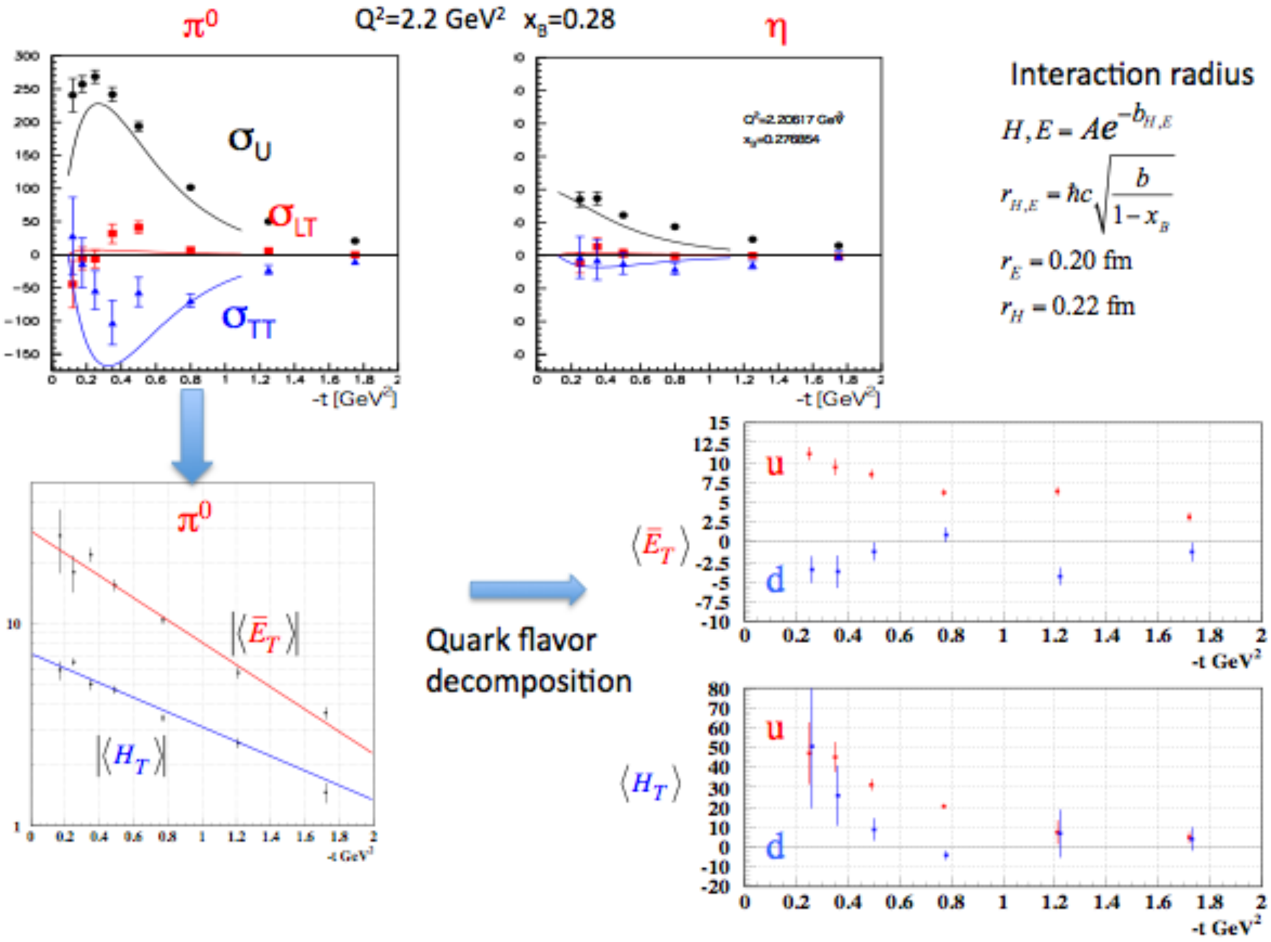
- Differential cross section dσ/dt: *Q^2, W,* t-dependence for reaction mechanism, size
- L/T information from **φ-dependent structure functions** sufficient because $\sigma_T \gg \sigma_L$, Rosenbluth separation not needed! (*F.S. : arguable depending on Q2*)
- Method successfully demonstrated with 6 GeV data

Impact and significance

- Unique access to quark transversity: chiral symmetry breaking, lattice QCD

E12-06-108 Hard exclusive π0 and η electroproduction with CLAS12

- GFFs extracted from CLAS 6 GeV data + minimal theoretical input
- First successful **flavor separation of transversity GPDs**



Interaction radius

$$H,E = Ae^{-b_{H,E}}$$

$$r_{H,E} = \hbar c\sqrt{\frac{b}{1-x_B}}$$

$$r_E = 0.20 \text{ fm}$$

$$r_H = 0.22 \text{ fm}$$

- Much more information will become accessible with CLAS12!

Exclusive N* → KY Studies CLAS12

- Experiment E12-06-108A was designed to measure exclusive $K^+\Lambda$ and $K^+\Sigma^0$ electroproduction cross sections (and to extract the separated structure functions) from an unpolarized proton target with a longitudinally polarized electron beam using the CLAS12 spectrometer.

Spokespersons:
D.S. Carman,
R. Gothe,
V. Mokeev

E_b = 11 GeV, Q^2 = 3 – 12 GeV^2, W = 1.6 – 3.0 GeV, cos θ_K^* = [-1:1]

- Key Motivations:
  - *Extract $\gamma_v NN^*$ electrocouplings for high-lying N* states that couple to KY vs. Q^2*
    - *Important source of information on still poorly determined N* → KY hadronic decays*
    - *Important independent check of electrocouplings derived from CLAS12 $N\pi\pi$ data*
  - *Provide information on KY electroproduction amplitudes at distance scales that correspond to the transition from meson-baryon to quark-gluon degrees of freedom*
  - *Enhance capabilities to search for new states of hadronic matter ("missing" N*'s, hybrid baryons)*

- A dedicated experiment to study N* structure in the electroproduction of exclusive non-strange ($N\pi$, $N\pi\pi$) final states with CLAS12 has already been approved (E12-09-003).

The KY experiment results in a more complete N program with CLAS12*

E12-06-112: H.Avakian, M.Contalbrigo, Z.Meziani, B. Seitz, K.Joo
Probing the proton's quark dynamics in semi-inclusive pion production at 11 GeV

$$\frac{d\sigma}{dx_B\,dy\,d\psi\,dz\,d\phi_h\,dP_{h\perp}^2} = \frac{\alpha^2}{x_B y Q^2}\frac{y^2}{2(1-\varepsilon)}\left(1+\frac{\gamma^2}{2x_B}\right)\Big\{F_{UU,T}+\varepsilon F_{UU,L}+\sqrt{2\varepsilon(1+\varepsilon)}\,\cos\phi_h\,F_{UU}^{\cos\phi_h} + \varepsilon\cos(2\phi_h)\,F_{UU}^{\cos 2\phi_h}+\lambda_e\sqrt{2\varepsilon(1-\varepsilon)}\,\sin\phi_h\,F_{LU}^{\sin\phi_h}\Big\},$$

$f_1 \otimes D_1$

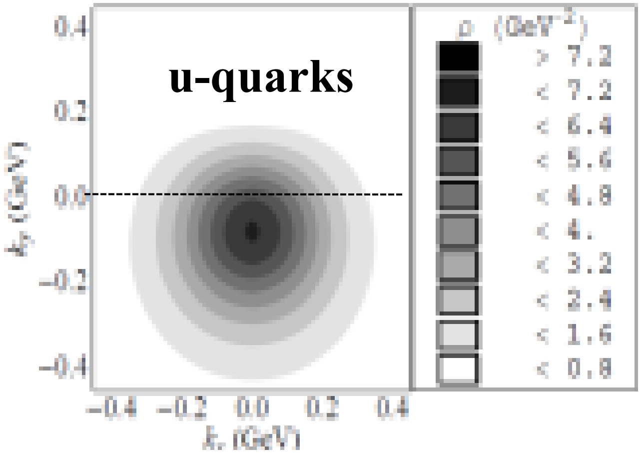
HT

HT

$h_1^\perp \otimes H_1^\perp$

HT

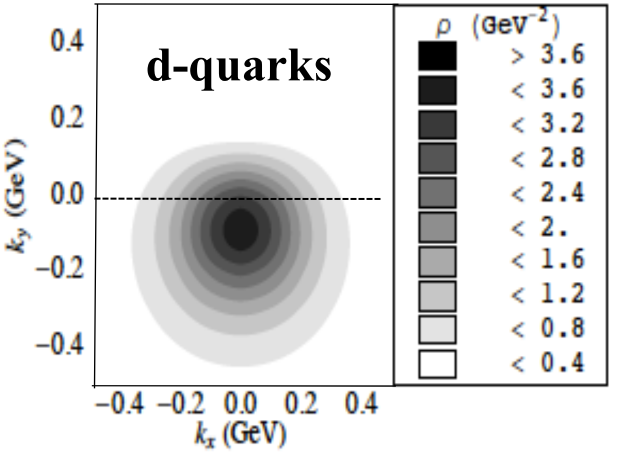
N/q	U	L	T
U	f_1		$h_1^\perp$
L		g_1	$h_{1L}^\perp$
T	$f_{1T}^\perp$	$g_{1T}^\perp$	h_1 $h_{1T}^\perp$



BM TMD (1998) describes correlation between the transverse momentum and transverse spin of quarks, requires FSI or ISI

$$f_{q/p}(x,k_\perp^2)=\frac{1}{2}[f_1^q(x,k_\perp^2)-h_1^{\perp q}(x,k_\perp^2)\frac{(\hat{P}\times k_\perp)\cdot S_q}{M}]$$

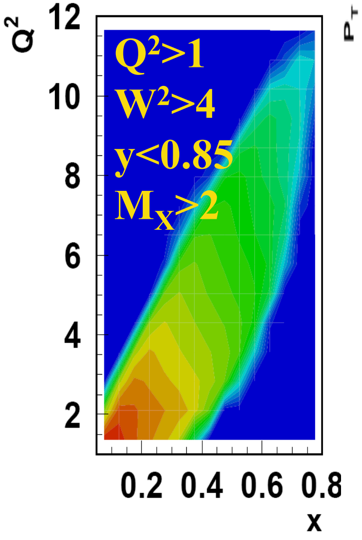
$$h_1^{\perp q}(SIDIS) = -h_1^{\perp q}(DY)$$

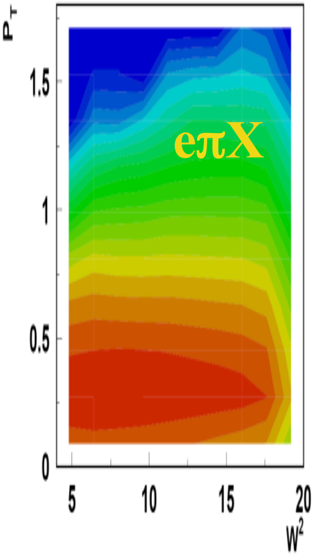


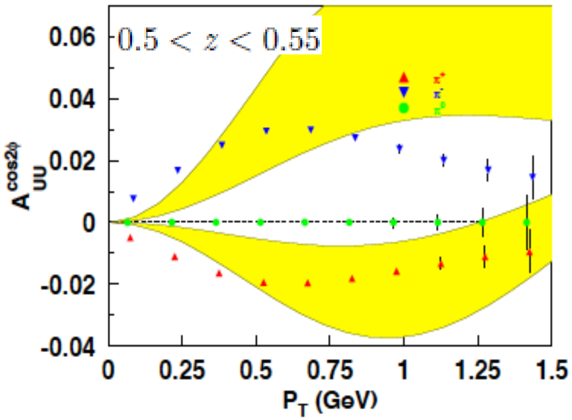
BM TMD under intensive studies worldwide, including SIDIS and DY experiments, model calculations, lattice simulations.

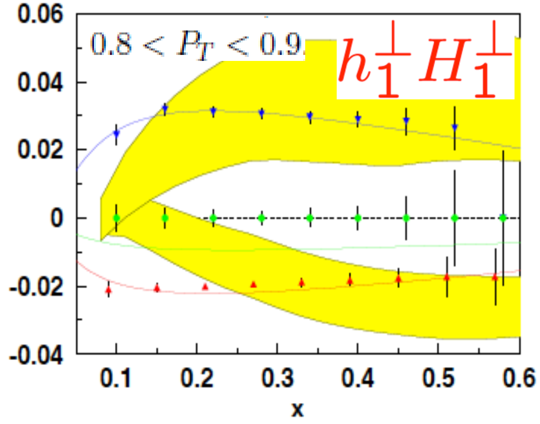
Projected measurements

2000h @ 11 GeV with L=10^{35}cm^{-2}sec^{-1}









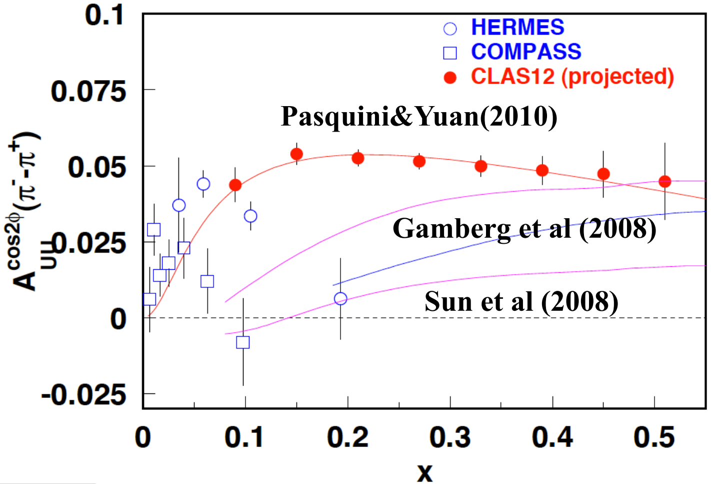
Background contributions :

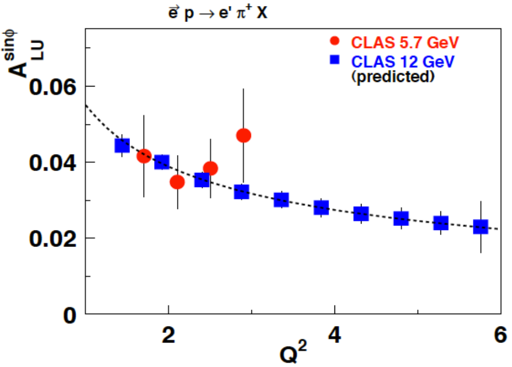
Higher twist azimuthal moments
  kinematical HT (Cahn)
  dynamical HT (Berger-Brodsky)

} "flavor blind" →

Radiative correction

Acceptance





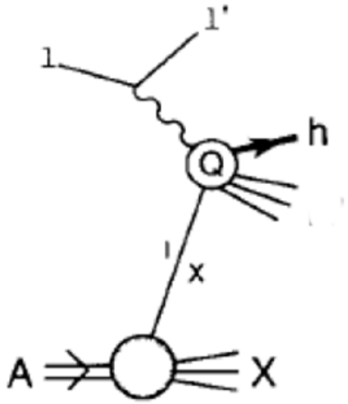
Systematic uncertainties :

Source	$\Delta A^{cos\phi}$	$\Delta A^{cos2\phi}$	$\Delta A^{sin\phi}$
Beam polarization			2%
ϕ acceptance	3%	1%	1%
other moments	1%	2%	1%
Radiative corrections	2%	1%	1%
Total	< 4%	< 3%	< 3%

Wide range in Q^2 and P_T accessible with CLAS12 are important for cos2ϕ studies (all background contributions are HT)

E12-06-112A: Lambda SIDIS

Semi-Inclusive production of hadrons e p → e h X

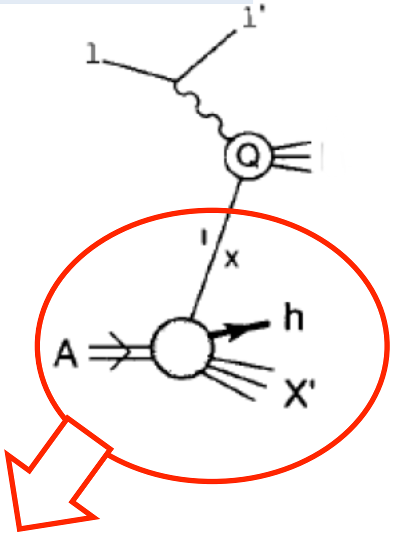


Current Fragmentation Region, CFR

- ➢ h is produced by the struck q

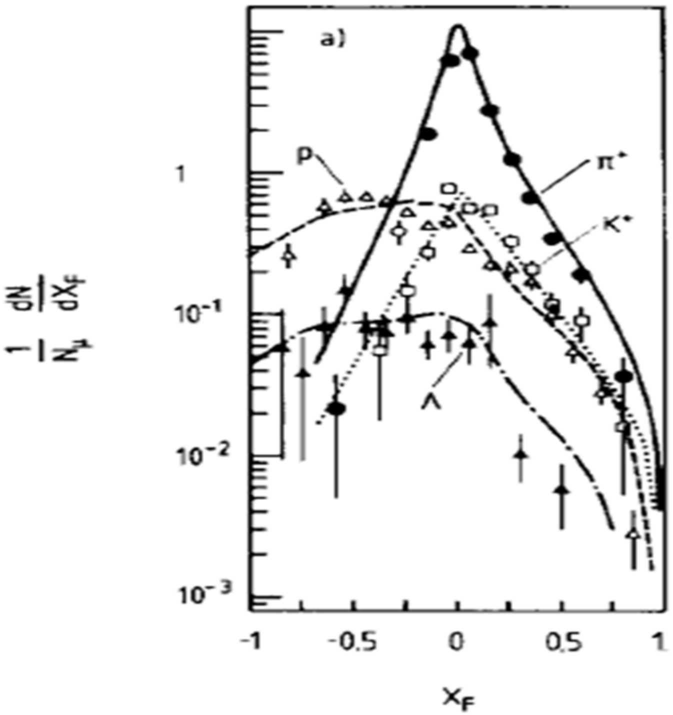
Target Fragmentation Region, TFR

- ➢ h is produced by the nucleon remnants



Fracture Function

- probability to produce a hadron h when the quark of type i is hit by the virtual photon



- ➢ TFR is the dominant baryon production mechanism at backward angles
- ➢ It may still contribute at forward angles
- ➢ TFR/CFR separation needs to be understood

SIDIS Λ in CLAS12

e p → e Λ X   polarized beam, unpolarized hydrogen target

$$\sigma \propto \left(1 - y + \frac{y^2}{2}\right)\boxed{M\left(x_B, z\right)} + hy\left(1 - \frac{y}{2}\right)S_\Lambda^{//}\boxed{\Delta M^L\left(x_B, z\right)}$$

The Fracture Function are the observables

Polarization transfer

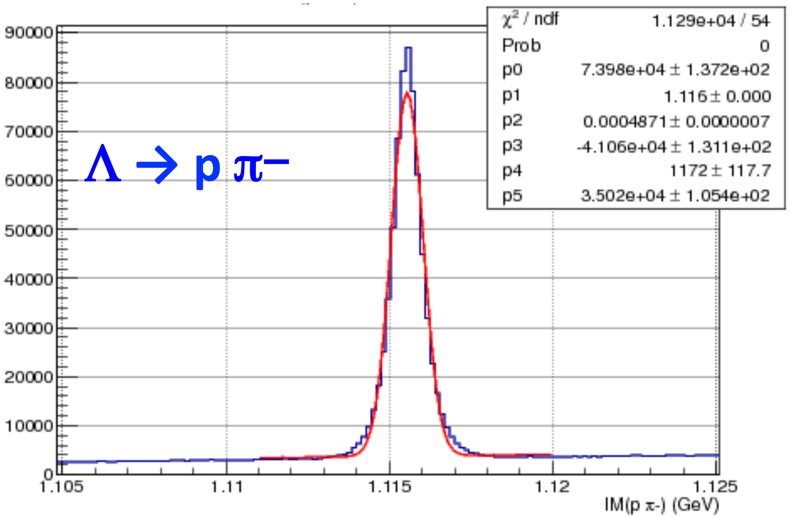
- **measured from BSA**

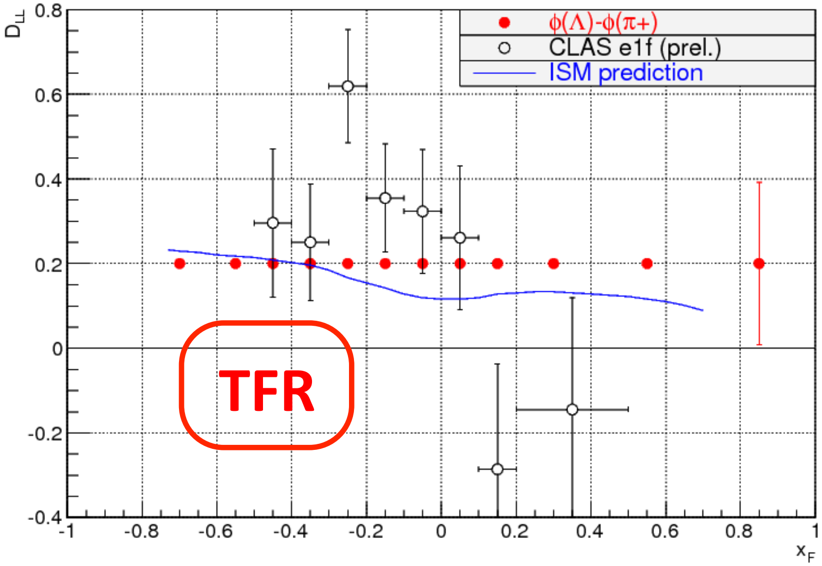
$$D^{LL} \propto \frac{\Delta M^L\left(x_B, z\right)}{M\left(x_B, z\right)}$$

D^{LL} Projected results

- **60 days at 10^{35}**

clasDIS + FastMC simulations



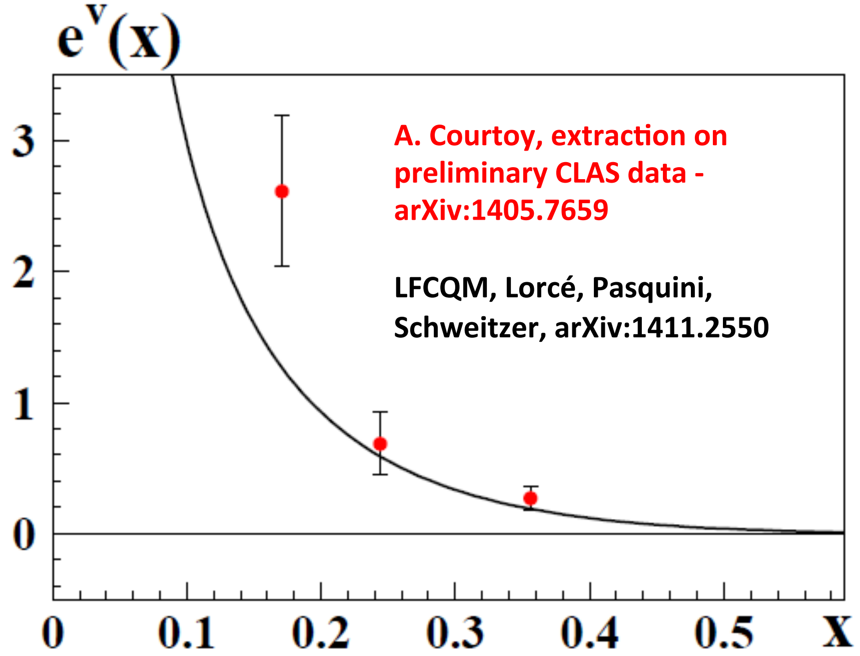


E12-06-112B/E12-09-008B

Higher-twist collinear structure of the nucleon through di-hadron SIDIS on unpolarized hydrogen and deuterium

Higher-twist 1D Parton Distribution Function $e(x)$ offers important insight into the quark-gluon correlations, and its integral is related to the *scalar charge* of the nucleon and to the nucleon-pion sigma term

- Di-hadron SIDIS Beam-Spin Asymmetry represents the cleanest observable to access $e(x)$
- 6-GeV results on *A↓LU* led to a first extraction of $e(x)$
- combined measurement on hydrogen and deuterium will allow to perform a *flavor separation* to access *e↑u (x)*, *e↑d (x)*

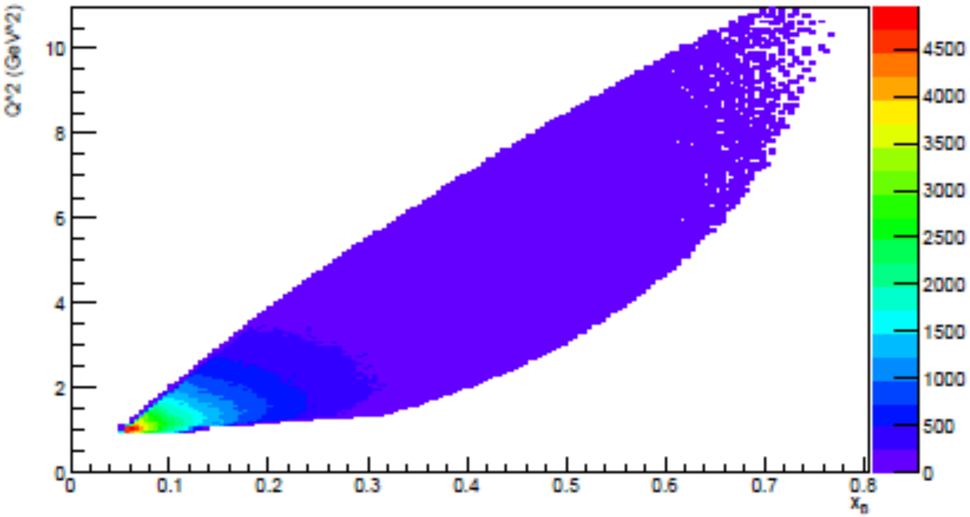


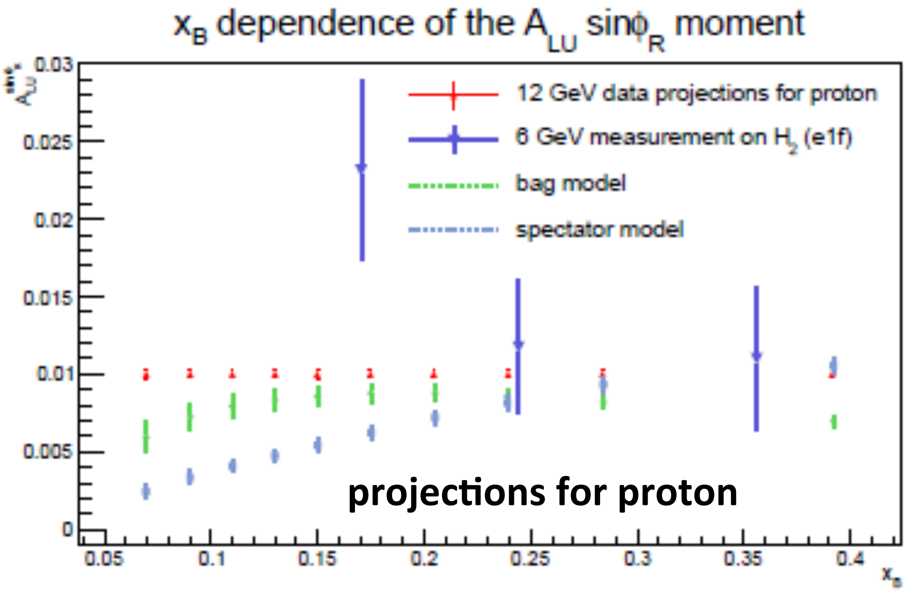
A. Courtoy, extraction on preliminary CLAS data - arXiv:1405.7659

LFCQM, Lorcé, Pasquini, Schweitzer, arXiv:1411.2550

No major issues expected in the extraction of the di-hadron Semi-Inclusive Beam-Spin Asymmetry.

- $A{\downarrow}LU$ has been already measured at 6-GeV (analysis review is ongoing, paper in preparation)
- analysis strategy has been developed in collaboration with theorists (A. Bacchetta, A. Courtoy, M. Radici)
- expertise in the asymmetry extraction, binning, kinematic cuts and systematics developed during the 6-GeV analysis
- asymmetry, in principle, can be extracted also if a full MC is not available (differently from cross-sections)
- measurement at 11 GeV will extend the kinematics of the 6-GeV analysis, and will improve dramatically its precision



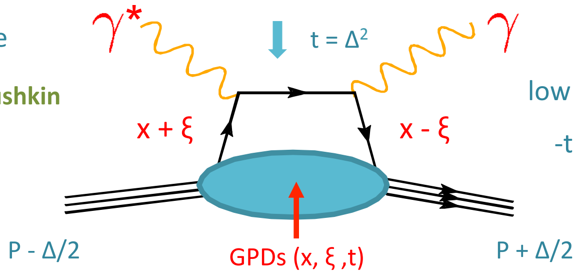


projections for proton

Deeply Virtual Compton Scattering with CLAS12 – E12-06-119

Q_{hard}^2 large

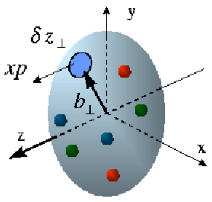
Mueller, Ji, Radyushkin (94-96)

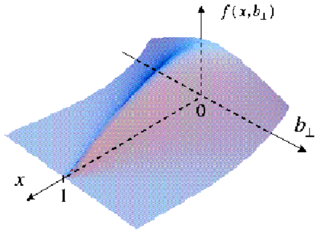


Mostly H for unpolarized proton target

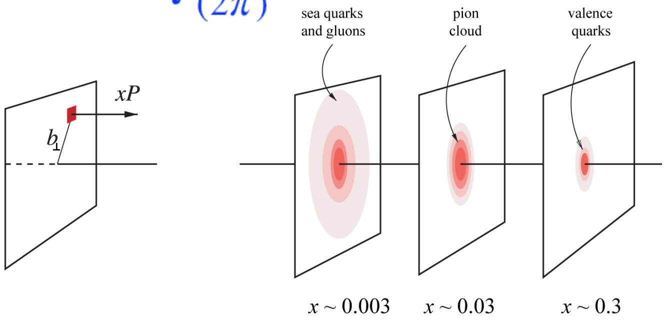
low -t process :

$-t << Q_{hard}^2$

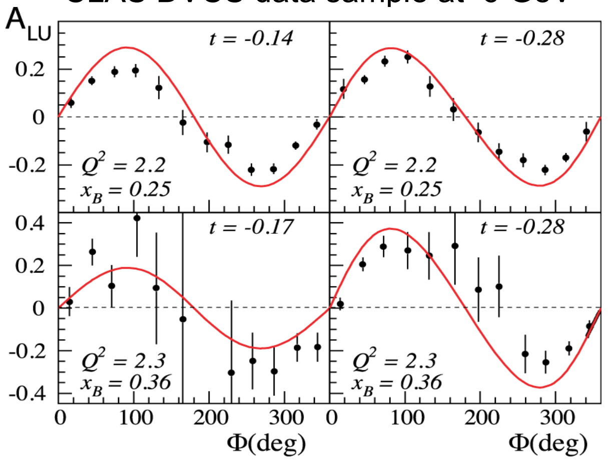




$$q(x,\vec{b}_\perp) = \int \frac{d^2\vec{\Delta}_\perp}{(2\pi)^2} e^{i\vec{b}_\perp\cdot\vec{\Delta}_\perp} H(x,\xi=0,-\Delta_\perp^2)$$



CLAS DVCS data sample at 6 GeV



The DVCS amplitude is expressed in terms of Compton Form Factors (CFF) at LO:

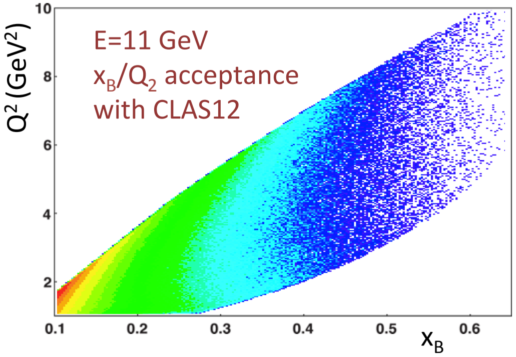
$$\mathcal{H}(\xi,t) = \sum_q e_q^2 \left\{ i\pi \left[H^q(\xi,\xi,t) - H^q(-\xi,\xi,t)\right] \right.$$
$$\left. + \mathcal{P}\int_{-1}^{+1} dx \left[\frac{1}{\xi - x} - \frac{1}{\xi + x}\right] H^q(x,\xi,t) \right\}$$

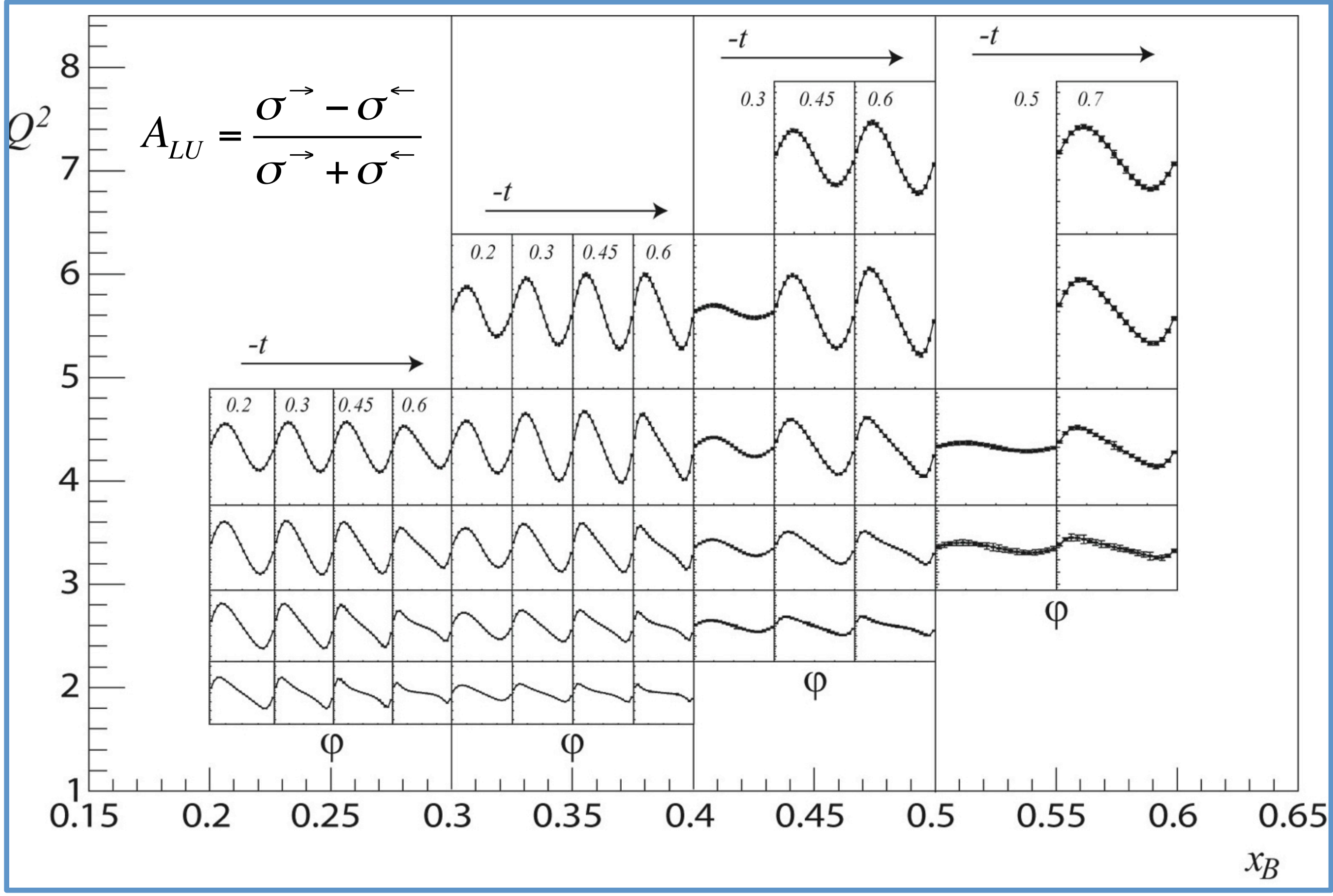
(similarly for other GPDs)

By measuring Beam and Target Spin Asymmetries, and through an harmonic analysis, one may extract Imaginary and Real parts of CFF :

$$A = \frac{d\sigma^{\leftarrow} - d\sigma^{\rightarrow}}{d\sigma^{\leftarrow} + d\sigma^{\rightarrow}} \simeq \Gamma_A(x_B,Q^2,t) \frac{\boxed{s_1^I}\sin\phi + s_2^I \sin(2\phi)}{\kappa c_0^{BH} + c_0^I + (\kappa c_1^{BH} + c_1^I)\cos\phi}$$

$$\boxed{s^I_{1,unp}} = y(2-y)\,\mathrm{Im}\left\{\boxed{F_1\mathcal{H}} + \frac{x_B}{2-x_B}(F_1+F_2)\widetilde{\mathcal{H}} - \frac{t}{4M^2}F_2\mathcal{E}\right\}$$

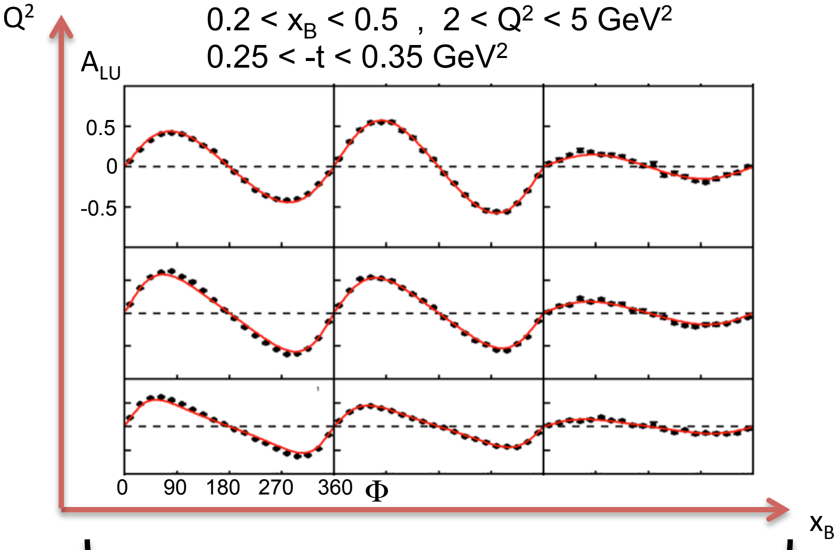




Source	A_{LU}(90°)	Δσ	σ
Beam Polar.	2%	2%	-
π^0 contam.	1-5%	1-5%	3-8%
Acceptance	3%	5-8%	5-8%
Radi. corr.	1%	3%	3%
Luminosity	-	2%	2%
Total	**4-7%**	**8-10%**	**8-12%**

80 days of beam time
85% beam pol.
10^{35} cm^{-2}s^{-1} luminosity
$1 < Q^2 < 10$ GeV^2
$0.1 < x_B < 0.65$
$-t_{min} < -t < 2.5$ GeV^2
Statistical error : 1 to 10%
of sinΦ moment

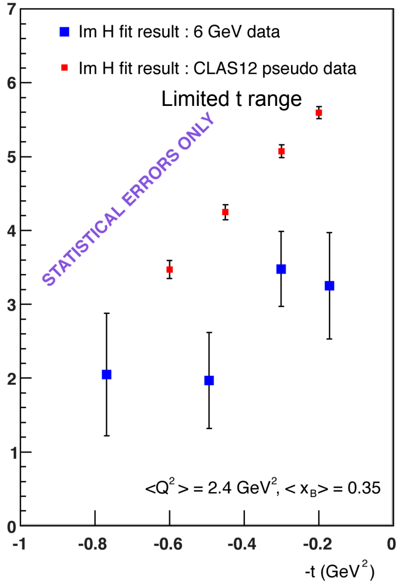
CLAS12 pseudo-data sample in :
$0.2 < x_B < 0.5$, $2 < Q^2 < 5$ GeV^2
$0.25 < -t < 0.35$ GeV^2

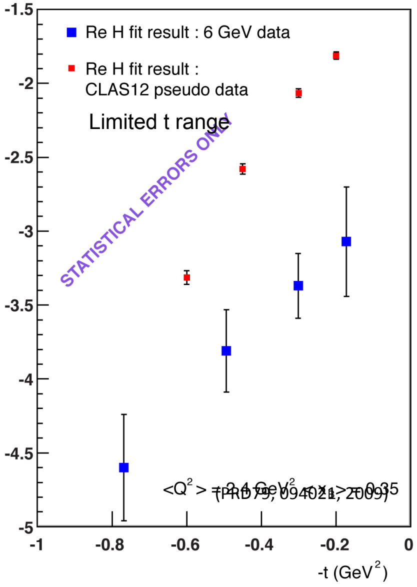


Fit to CLAS6 or **CLAS12** A_{LU}

x10 accuracy improvement from CLAS6 to CLAS12

H and $\tilde{H}$ separation needs unpolarized and polarized proton data (PLB693,17, 2010)

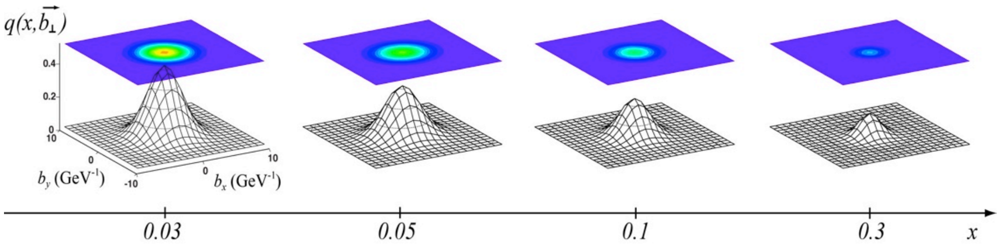




Parametrized GPDs

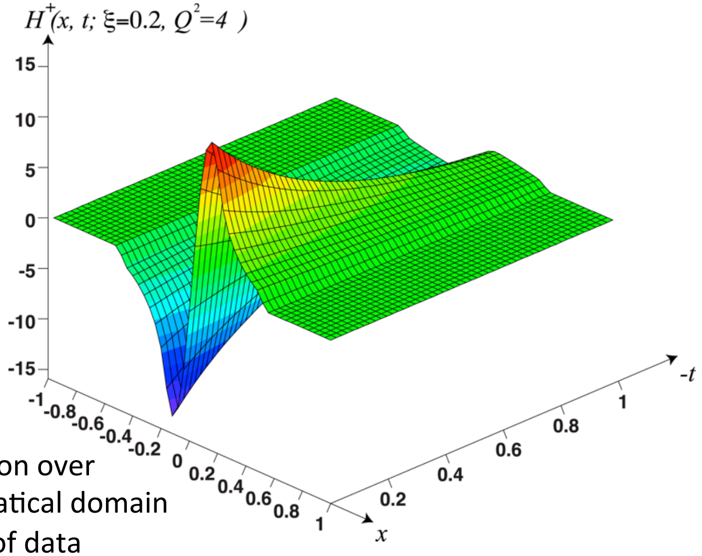
Lots of new developments in the next 5 years

$$q(x,\vec{b}_\perp) = \int \frac{d^2\vec{\Delta}_\perp}{(2\pi)^2} e^{i\vec{b}_\perp\cdot\vec{\Delta}_\perp} H(x,\xi=0,-\Delta_\perp^2)$$



$$\xi = 0$$

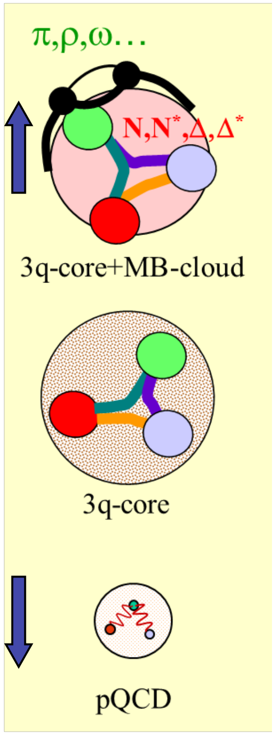
GPD parametrization needed for ξ=0 or t=0 extrapolations



Global fits:

- Parametrization over the full kinematical domain
- Use all kinds of data from several experiments
- Include Q^2 evolution

Excited Baryon Structure with the CLAS12 …

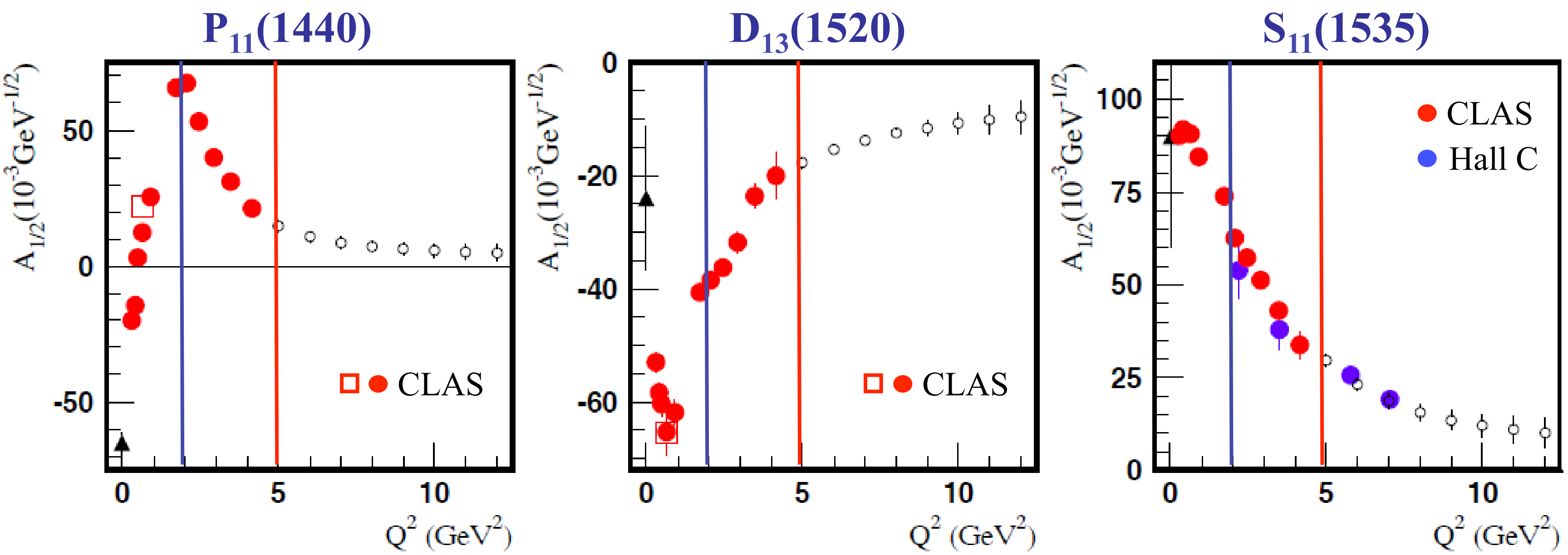


- CLAS12 will be only available facility worldwide capable of obtaining electro-excitation amplitudes for all prominent N* states from exclusive measurements of single meson, double pion, and KY electroproduction at still unexplored ranges from low photon virtualities down to 0.05 GeV^2 up to the highest photon virtialities ever achieved for exclusive reactions (5.0 GeV^2 $<Q^2<$ 12 GeV^2).
- The expected results will allow at low Q^2 to
  - search for new states of hadronic matter - hybrid baryon,
  - extend the previous high-statitics analyses of exclusive meson photoproduction continuously to the new CLAS12 electroproduction data,

  and at high Q^2 to
  - probe quark distributions in excited baryons,
  - explore the dressed quark mass evolution at the distances where the transition from quark-gluon confinement to pQCD regime is expected, and thus addressing the most challenging problems of quark-gluon confinement and on the nature of 98% of the hadronic mass in the universe.

- The "Studies of the Excited Baryon Structure with CLAS12" will continue a productive and synergetic collaboration between experiment, phenomenology, and theory. This program will be very beneficial for Jefferson Lab since it will substantially contribute to the broad international efforts on the exploration of the strong interaction in non-perturbative regime and thus solidifying the US leadership in this important area, Int. J. Mod. Phys. E, Vol. 22, 1330015 (2013) 1-99.

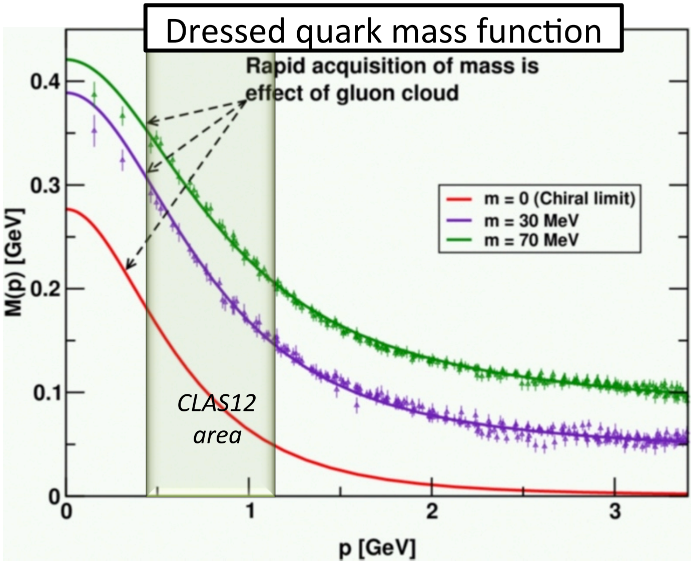
…Offers a Unique Opportunity to Explore Strong QCD



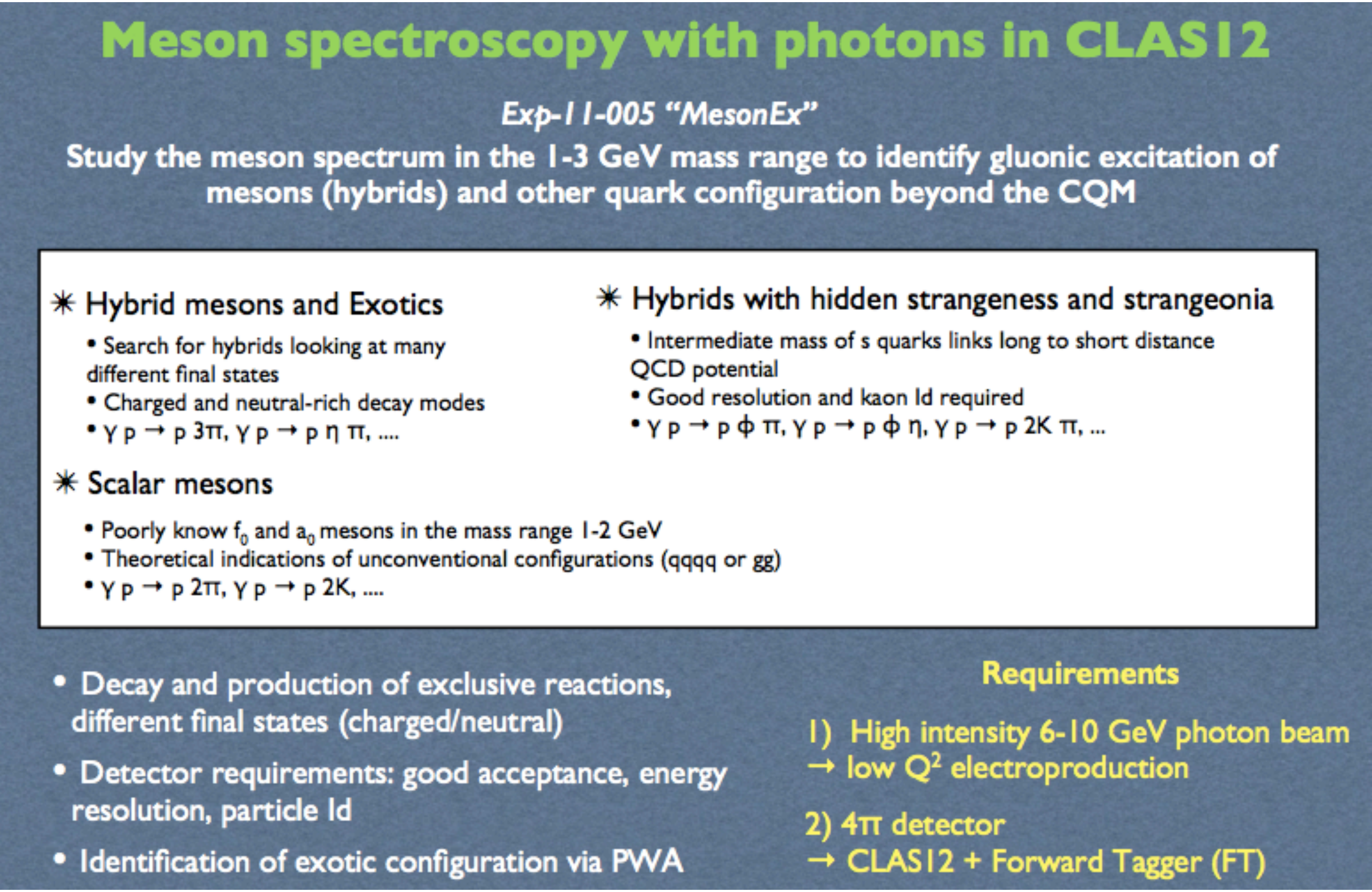
Open circles represent projections and all other markers previously available results with the 6-GeV electron beam.

➢ Examples of published and projected results obtained within 60d for three prominent excited proton states from analyses of $N\pi$ and $N\pi\pi$ electroproduction. Similar results are expected for many other resonances at higher masses, e.g. $S_{11}(1650)$, $F_{15}(1685)$, $D_{33}(1700)$, $P_{13}(1720)$, …

➢ Description of all $\gamma_v NN^*$ electrocouplings by the same quark mass function over the full Q^2 range will validate insights into the essence of strong QCD.


Dressed quark mass function

Important direction in the recommendations of the 2014 Town Meeting on QCD and Hadron physics for the next US Long Range Plan, S.J. Brodsky et al., arXiv:1520.05728 [hep-ph].



Meson spectroscopy with photons in CLAS12

Exp-11-005 "MesonEx"

Study the meson spectrum in the 1-3 GeV mass range to identify gluonic excitation of mesons (hybrids) and other quark configuration beyond the CQM

✳ Hybrid mesons and Exotics

- Search for hybrids looking at many different final states
- Charged and neutral-rich decay modes
- $\gamma\, p \rightarrow p\, 3\pi$, $\gamma\, p \rightarrow p\, \eta\, \pi$, ...

✳ Hybrids with hidden strangeness and strangeonia

- Intermediate mass of s quarks links long to short distance QCD potential
- Good resolution and kaon Id required
- $\gamma\, p \rightarrow p\, \phi\, \pi$, $\gamma\, p \rightarrow p\, \phi\, \eta$, $\gamma\, p \rightarrow p\, 2K\, \pi$, ...

✳ Scalar mesons

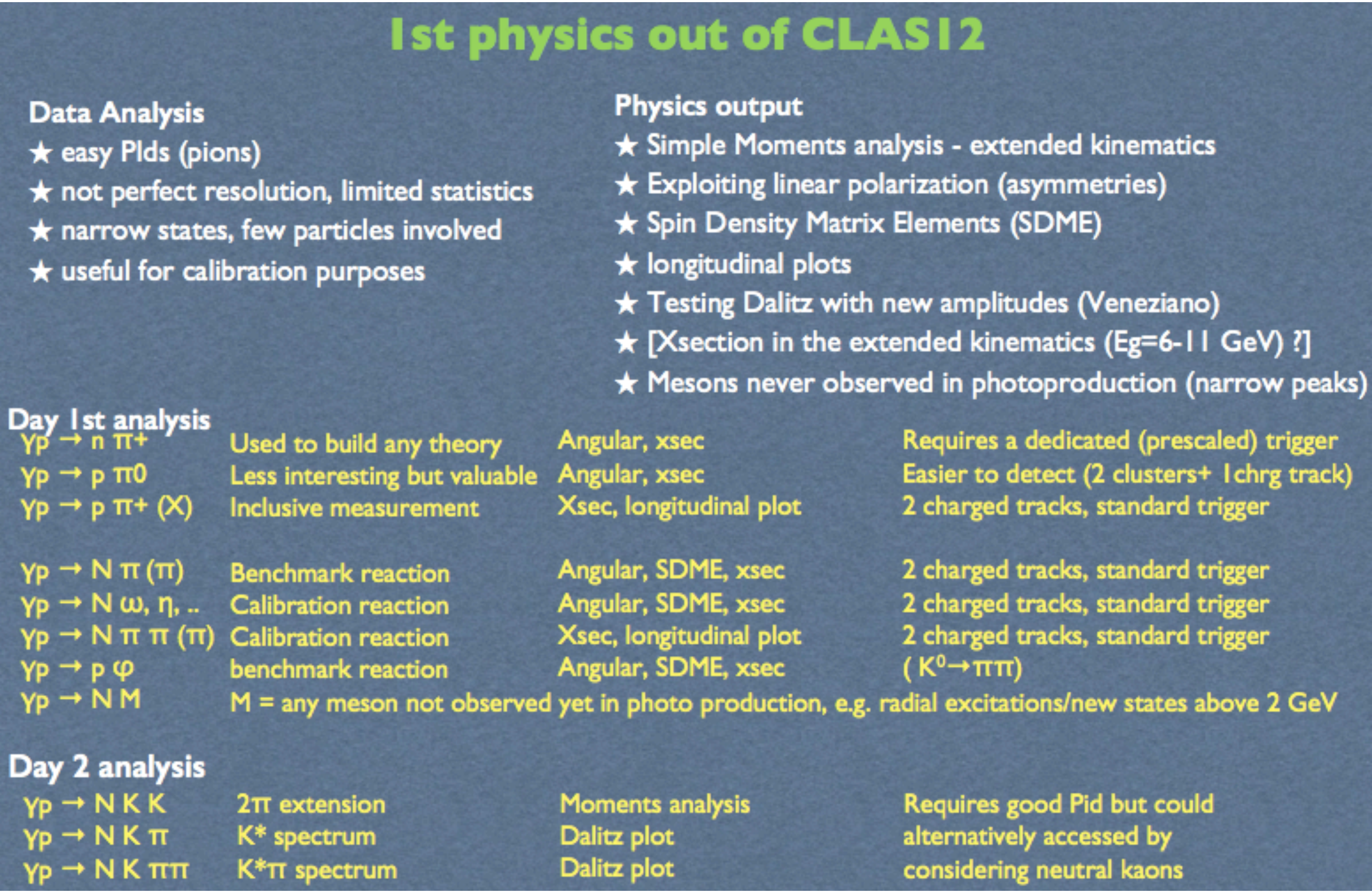
- Poorly know f_0 and a_0 mesons in the mass range 1-2 GeV
- Theoretical indications of unconventional configurations (qqqq or gg)
- $\gamma\, p \rightarrow p\, 2\pi$, $\gamma\, p \rightarrow p\, 2K$, ...

- Decay and production of exclusive reactions, different final states (charged/neutral)
- Detector requirements: good acceptance, energy resolution, particle Id
- Identification of exotic configuration via PWA

Requirements

1) High intensity 6-10 GeV photon beam
→ low Q^2 electroproduction

2) 4π detector
→ CLAS12 + Forward Tagger (FT)



1st physics out of CLAS12

Data Analysis

- ★ easy PIds (pions)
- ★ not perfect resolution, limited statistics
- ★ narrow states, few particles involved
- ★ useful for calibration purposes

Physics output

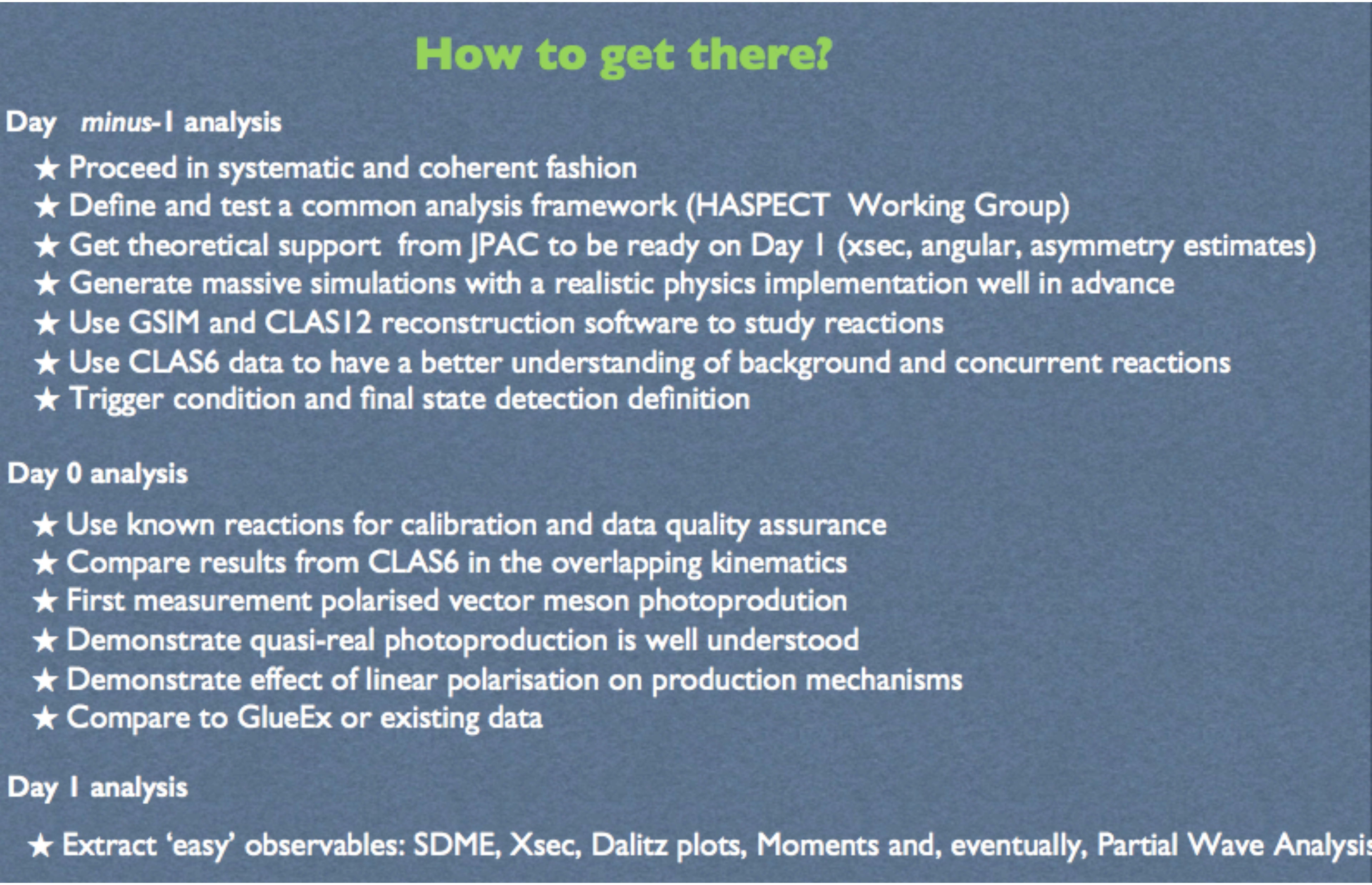
- ★ Simple Moments analysis - extended kinematics
- ★ Exploiting linear polarization (asymmetries)
- ★ Spin Density Matrix Elements (SDME)
- ★ longitudinal plots
- ★ Testing Dalitz with new amplitudes (Veneziano)
- ★ [Xsection in the extended kinematics (Eg=6-11 GeV) ?]
- ★ Mesons never observed in photoproduction (narrow peaks)

Day 1st analysis

$\gamma p \to n \pi+$	Used to build any theory	Angular, xsec	Requires a dedicated (prescaled) trigger
$\gamma p \to p \pi0$	Less interesting but valuable	Angular, xsec	Easier to detect (2 clusters+ 1chrg track)
$\gamma p \to p \pi+ (X)$	Inclusive measurement	Xsec, longitudinal plot	2 charged tracks, standard trigger
$\gamma p \to N \pi (\pi)$	Benchmark reaction	Angular, SDME, xsec	2 charged tracks, standard trigger
$\gamma p \to N \omega, \eta, ..$	Calibration reaction	Angular, SDME, xsec	2 charged tracks, standard trigger
$\gamma p \to N \pi \pi (\pi)$	Calibration reaction	Xsec, longitudinal plot	2 charged tracks, standard trigger
$\gamma p \to p \varphi$	benchmark reaction	Angular, SDME, xsec	$(K^0 \to \pi\pi)$
$\gamma p \to N M$	M = any meson not observed yet in photo production, e.g. radial excitations/new states above 2 GeV		

Day 2 analysis

$\gamma p \to N K K$	2π extension	Moments analysis	Requires good Pid but could
$\gamma p \to N K \pi$	K* spectrum	Dalitz plot	alternatively accessed by
$\gamma p \to N K \pi\pi$	K*π spectrum	Dalitz plot	considering neutral kaons



How to get there?

Day *minus*-**1 analysis**

- ★ Proceed in systematic and coherent fashion
- ★ Define and test a common analysis framework (HASPECT Working Group)
- ★ Get theoretical support from JPAC to be ready on Day 1 (xsec, angular, asymmetry estimates)
- ★ Generate massive simulations with a realistic physics implementation well in advance
- ★ Use GSIM and CLAS12 reconstruction software to study reactions
- ★ Use CLAS6 data to have a better understanding of background and concurrent reactions
- ★ Trigger condition and final state detection definition

Day 0 analysis

- ★ Use known reactions for calibration and data quality assurance
- ★ Compare results from CLAS6 in the overlapping kinematics
- ★ First measurement polarised vector meson photoprodution
- ★ Demonstrate quasi-real photoproduction is well understood
- ★ Demonstrate effect of linear polarisation on production mechanisms
- ★ Compare to GlueEx or existing data

Day 1 analysis

- ★ Extract 'easy' observables: SDME, Xsec, Dalitz plots, Moments and, eventually, Partial Wave Analysi

CLAS12 Very Strange Experiment (E12-11-005a)

Expected Particle Rate

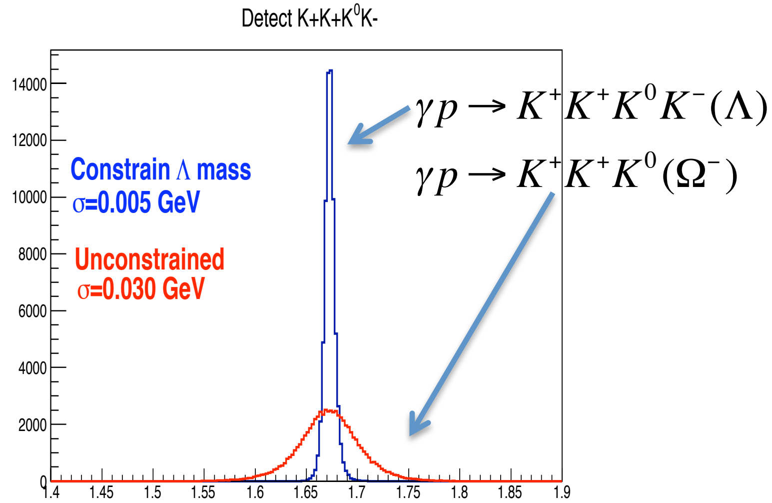
	Detected particles	**Measured Decays**	**Overall Efficiency**	**Rate/hr**	**Total Detected**
Ω^-	$K^+K^+K^0$		~3.9%	~3.6	~7k
Ω^-	$K^+K^+K^0K^-$	Ω^-	~0.5%	~0.5	~1k
Ξ^-	$K^+K^+\pi^-$	Ξ^-	~9.3%	~440	~0.9M
$\Xi^-(1530)$	$K^+K^+\pi^-$	$\Xi^-(1530)$	~7.4%	~140	~270K
$\Xi^-(1820)$	$K^+K^+K^-p$	$\Xi^-(1820)\Lambda$	~0.63%	~6	~12K

- Assuming half field and 80 beam days
- Vertex Efficiency/Branching Ratio included

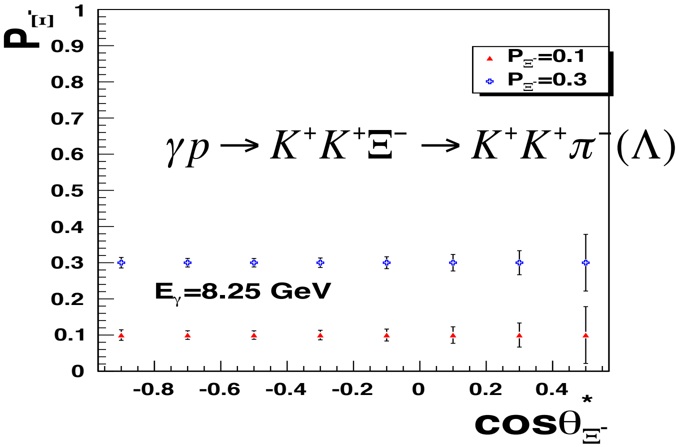
CLAS12 Very Strange Experiment (E12-11-005a)

Expected Key Physics Results:

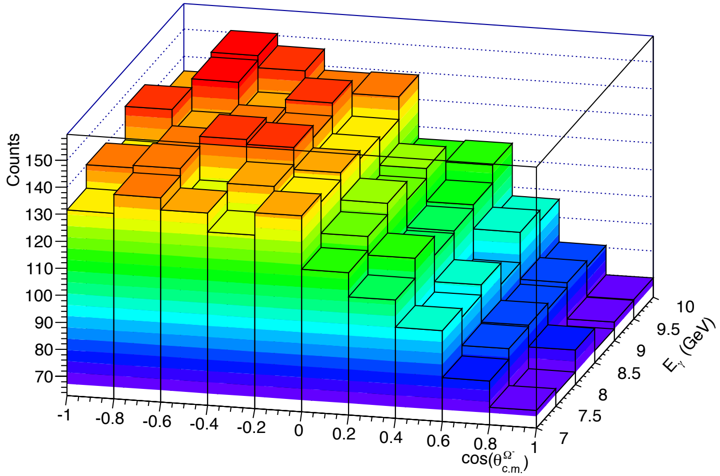
- Ω^- photoproduction: Mass resolution



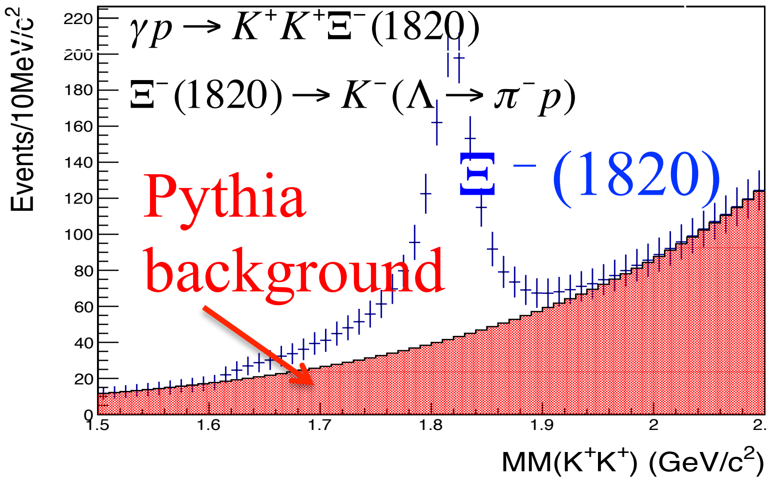
- Ξ^- polarization measurement:



Expected Ω^- Cross section Measurements



Excited Cascades: Cross section and J^P determination



E12-12-001: Timelike Compton Scattering and J/psi

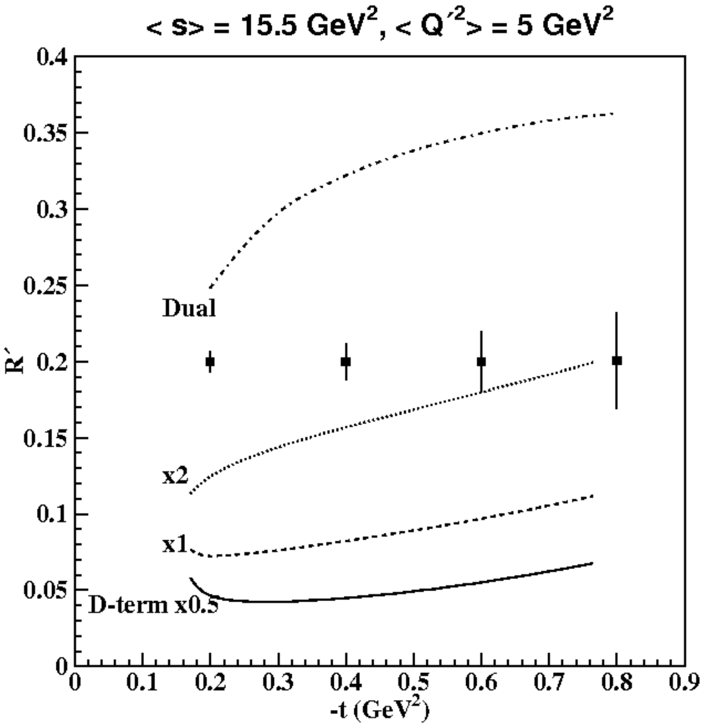
Approved for 100 days with the run group and 20 additional days with reversed torus polarity

Timelike-spacelike correspondence and the universality of GPDs

- Of fundamental importance for the GPD program
- Analogous to universality of PDFs in DIS and Drell-Yan

Compton Form Factor fits

- Combined fits of TCS and DVCS data significantly reduces uncertainty on CFFs compared with DVCS alone
- TCS moments are sensitive to the D-term
  - The figure shows statistical uncertainties in a rather wide bin of *s* and Q^2 for 100 days at a luminosity of 10^{35}. The lower curves show the double distribution with different values of the D-term (x1 is nominal).



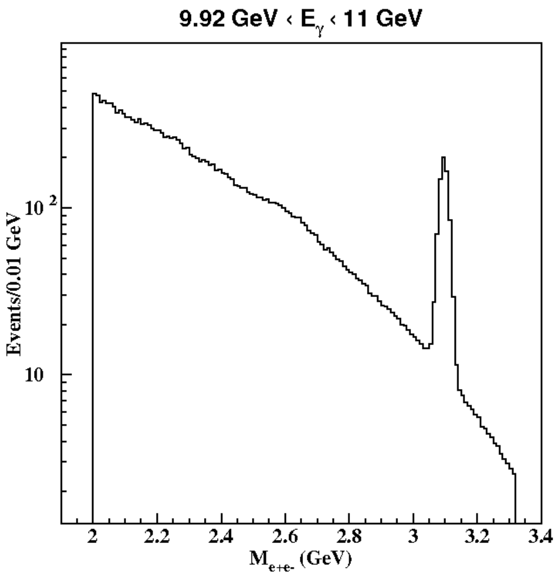
First measurement of J/ψ production near threshold

- Establish reaction mechanism
- Access to gluonic structure of the nucleon

E12-12-001 early results: J/psi near threshold

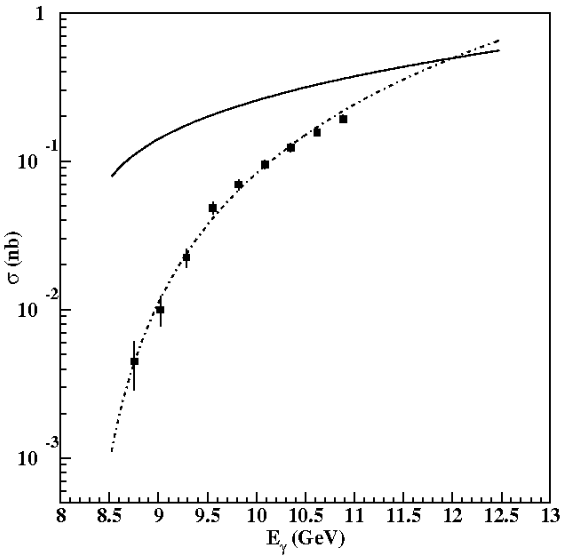
J/ψ peak will be very clean in CLAS12

- The good electron ID and momentum resolution of CLAS12 are essential
  - Fully exclusive measurement
  - Good coverage in -*t*
  - Good acceptance for high-mass dileptons



Large theoretical uncertainties

- Theoretical predictions differ by orders of magnitude near threshold
  - Even most pessimistic assumption on cross section (shown) will be sufficient essentially all the way down to threshold
  - Even a quick analysis of CLAS12 data will have a major impact!

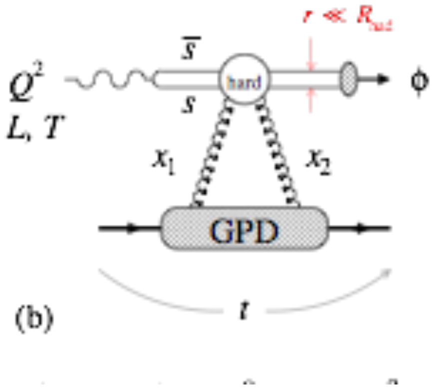


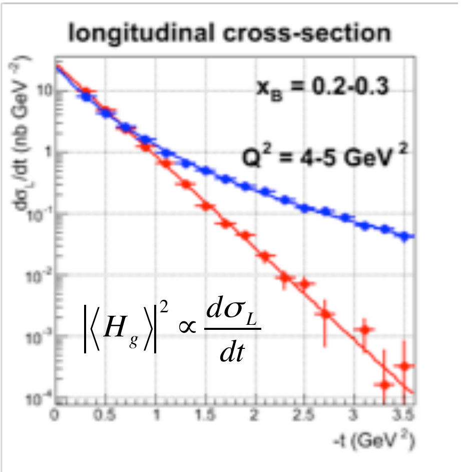
LHCb "charm-pentaquark"?

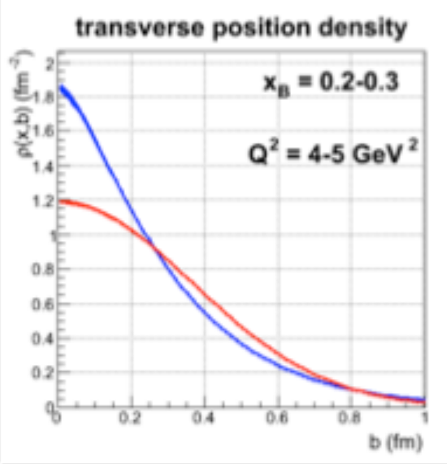
- Only currently approved JLab experiment that will search for the new LHCb "pentaquark"
  - Full data set will give uncertainties comparable to LHCb
  - Early running can provide important first look

E12-12-007 Exclusive Phi Meson Electroproduction with CLAS12

P. Stoler, F.X. Girod, M. Guidal, V. Kubarovsky, C. Weiss




longitudinal cross-section


transverse position density

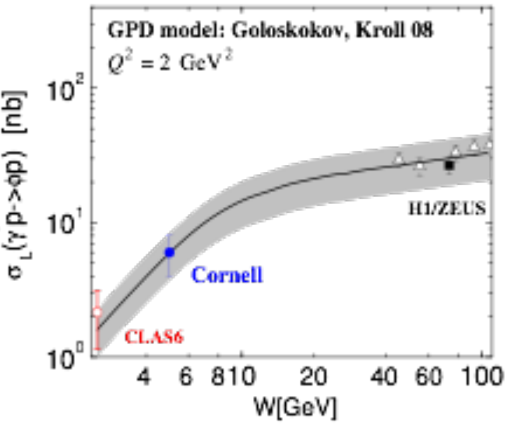
Physics objectives

- Quantify approach to small-size regime in exclusive phi production at $Q^2 > 1$ GeV^2
- Extract nucleon's **gluonic transverse size** in valence region
- Explore signatures of possible intrinsic s-sbar near threshold

Impact and significance

- Unique access to gluons in JLab12 kinematics
- Complements studies of quark transverse distributions with elastic FFs & GPDs
- Results can be directly interpreted & connected with high-energy data
- Growing interest in gluonic structure & imaging with future EIC

E12-12-007 Exclusive Phi Meson Electroproduction with CLAS12



Theoretical status

- Exclusive φ 6 GeV cross section & kin. dependences well described by GPD model with finite-size effects
- Gluonic size data from high-energy experiments, models of *W* and *x*-dependence

Observables and analysis

- Differential cross section dσ/dt: Q^2 and *W* dependence for reaction mechanism, t-dependence for gluonic size — insensitive to absolute normalization
- L/T ratio from φ -> KK decay — simple, well established technique
- Possible to check φ reconstruction using K_L K_S mode

Early physics potential

- Simple final state, analysis well understood, multiple cross-checks
- Immediate physics impact, no global analysis required

RUN GROUP A – Steps towards the 1st publication

Main steps:

1. Alignment : how do we go from perfect geometry to reality. Need persons in charge (probably for each detector) and procedures.
2. Calibration: define calibration groups + person in charge for each detector subsystem.
3. Reconstruction: Proof of principle with simulated data. Mostly ready I believe?
4. Analysis: from reconstructed data to the physics results. Proof of principle with simulated data. Again, need one (or more) person in charge.

Questions for the discussion session this afternoon:

1. Should everyone focus on one (more?) particular analysis to get it out ASAP? Should the usual proponents focus on their own analysis instead ?
2. 1st paper probably should not be: cross-section, complicated (PWA, …), many particle final state. Need to focus on ratios, asymmetries of simple processes.
3. Are DVCS asymmetries reasonable ? (3-particle final state with one photon, need to analyze 2-photon final state and have a “fair” idea of acceptance effects). Caveat: errors will be dominated by systematic effects, which need to be ALARA.
4. If we use only the 20 first days of beam time, what can we get out?