CLAS Deep Processes Working Group Summary

17 June 2016
CLAS Collaboration Meeting
Jefferson Lab
Keith Griffioen

Deep Processes Working Group Summary

Jun 2016

- 7 Analysis Notes currently under review
- 2 *ad hoc* reviews in progress or to start soon
- 4 submitted or published papers in 2015/16
- Several ongoing thesis analyses
- Several ongoing data-mining projects

Feb 2016

- 4 Analysis Notes currently under review
- 2 *ad hoc* reviews in progress or to start soon
- 4 submitted or published papers in 2015/16
- Several ongoing thesis analyses
- Several ongoing data-mining projects

Oct 2015

- 3 Analysis Notes currently under review
- 8 *ad hoc* reviews in progress or to start soon
- 4 submitted or published papers in 2015
- Several ongoing thesis analyses
- Several ongoing data-mining projects

Author	Run Group	Title	WGC	ad hoc	Pub
N Harrison, K Joo *et al.*	e1f	Exploring the Structure of the Proton via Semi-inclusive Pion Electroproduction	Begin: 160511 H Avakian M Osipenko A Movsisyan End:		
N Saylor *et al.*	e1-dvcs2	e1-dvcs analysis note	Begin: 150216 K Joo A Kim C Smith		
I Albyrak *et al.*	g12	Time-Like Compton Scattering	Begin: 150325 S Niccolai R Paremuzyan M Paolone link		
A Fradi *et al.*	e1-dvcs	Deeply Virtual Production of the ρ^+ Meson on the Proton	Begin: 150316 S Pisano K Giovanetti V Kubarovsky link		
S Koirala S Kuhn *et al.*	eg1-dvcs	Measurement of Single and Double Spin Asymmetries in Semi-Inclusive Deep Inelastic Scattering on Proton and Deuteron	Begin:140929 M Mirazita P Bosted M Contalbrigo link End:151001		

A. Kim *et al.*	e1f	Beam Spin asymmetries of ep -> epη in the deep-inelastic regime	Analysis note unknown	Begin: 140905: Angela Biselli Kijun Park A Celentano	
A. Kim *et al.*	eg1-dvcs	Single and Double Spin Asymmetries for Deeply Virtual Exclusive π^0 Production on Longitudinally Polarized Proton Target with CLAS	Begin: 130912 M. Guidal S. Pisano A. Biselli link End: 140905	Begin: 150615 E Votier A Biselli M Holtrop End: 151016	Submitted: 151110:
P Bosted *et al.*	eg1-dvcs	Spin Asymmetries in exclusive π^+, π^0, and π^- electro-production from the eg1-dvcs experiment	Begin:140120 FX Girod S A Pereira P Stoler link End: 150902	Begin: 150903 FX Girod S Bueltmann Jixie Zhang	

P Bosted *et al.*	eg1b	Spin Asymmetries in Exclusive pi+ and pi- electro-production from the Eg1b experiment	Begin:140909 G Dodge X Zheng FX Girod link End: 150815	Begin:151007 Andrew Puckett Jacques Ball Vitali Baturin End: 150108	Submitted: 160415
I Bedlinskiy V Kubarovsky *et al.*	e1-dvcs	Measurement of cross sections of η electroproduction in e1dvcs experiment with CLAS	Begin:140710 R Dupre H Avagyan A Kim link End:151022		
S Pisano *et al.*	e1f	Di-hadron Beam-Spin Asymmetry in SIDIS electro-production	Begin:140424 A Biselli B Raue S Kuhn link		
R. Fersch *et al.*	eg1b	Inclusive Double Spin Asymmetries	S. Niccolai H.Avagyan R. DeVita link link2 End: 120822	160618: waiting for ad hoc committee	

09:10 **Run Group C Update and Discussion** *20'*

Speaker: Sebastian Kuhn (ODU)

Material: **Slides** 

What is run group C? Double Polarized SIDIS and DVCS

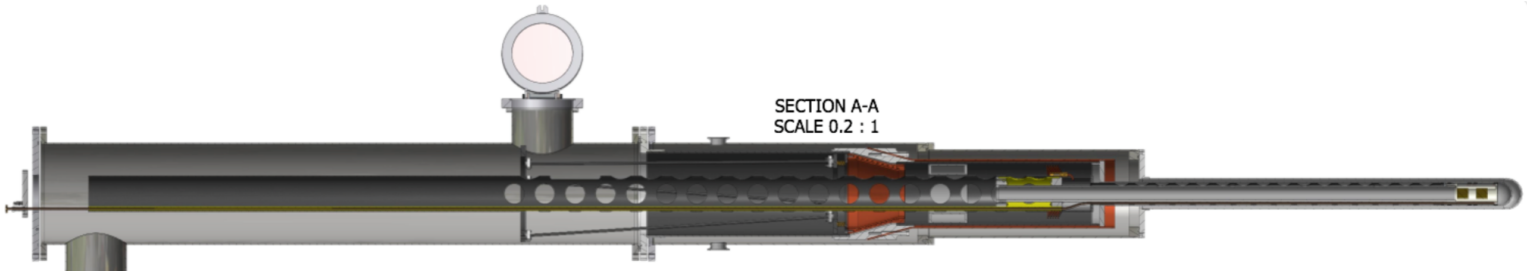
➢ Longitudinally polarized proton (NH_3) and deuteron (ND_3)

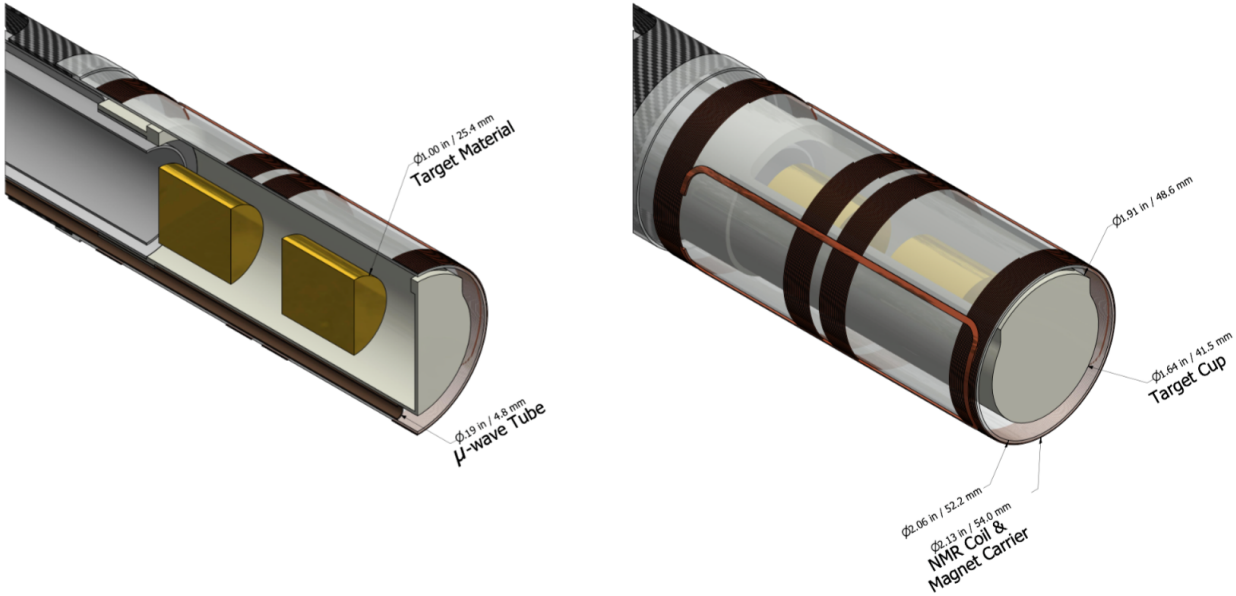
➢ Runtime so far: 120 days NH_3 (RG Ca) + 65 days on ND_3 (RG Cb)

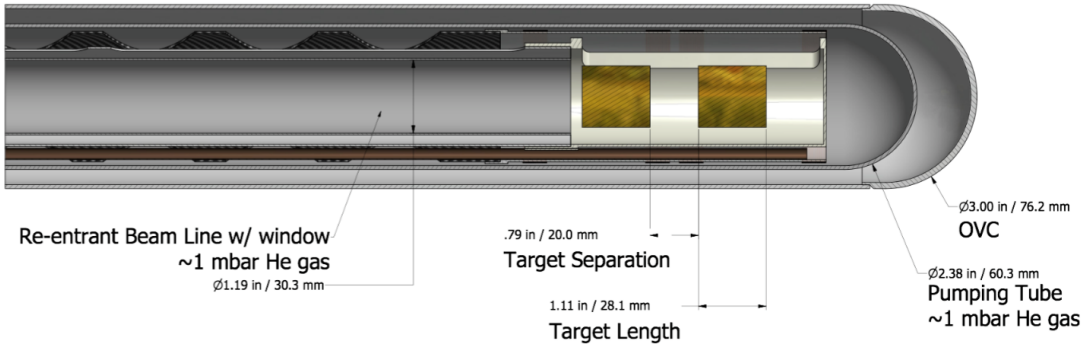
➢ PAC44 considering additional 68 days on ND_3

09:10 **Run Group C Update and Discussion** *20'*

Speaker: Sebastian Kuhn (ODU)







1 or 2 cells?

p, D, C targets?

rotating targets?

TO DO LIST

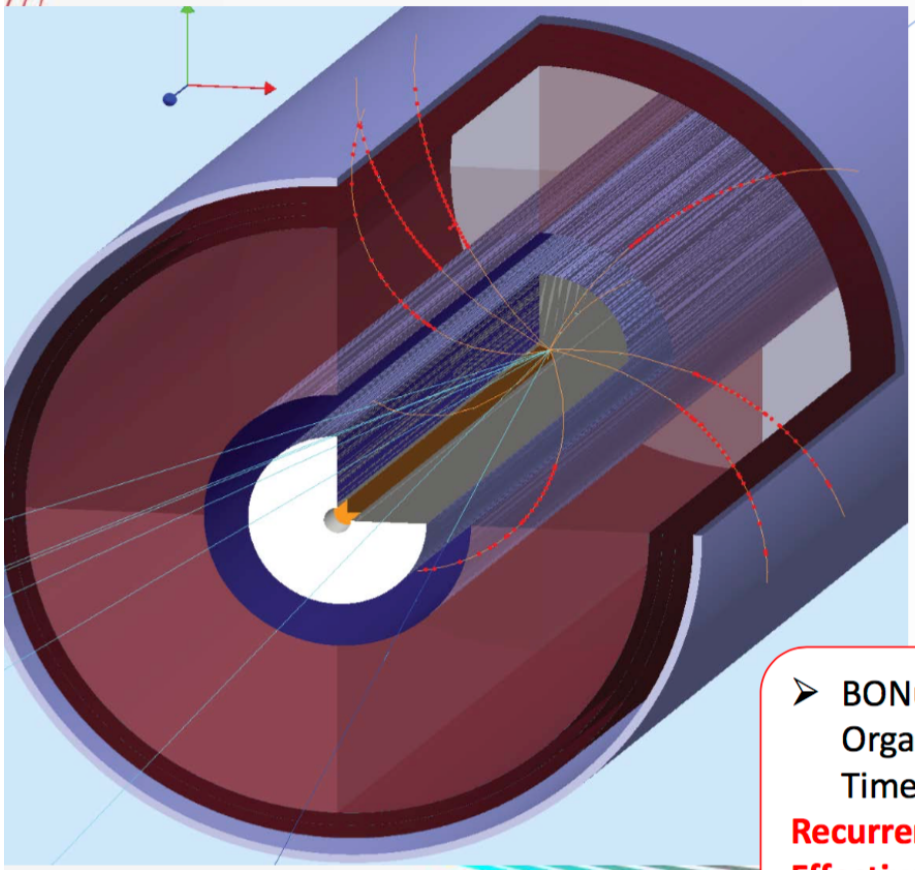
- **Raster system:** speed, shape, amplitude, range, position of magnets, driver, readout, calibration
- **Møller polarimeter:** readiness, optimization, accuracy
- **Beamline:** BPMs, harps, lumi, steering
- **Møller shield:** with and without FT, with rastering
- **Downstream:** Farady cup acceptance
- **Solenoid field map**
- **Full implementation of polarized target in GEMC**
- **Full background simulation**
- **Full simulation:** rates, acceptances, resolution, vertexing, dilution, backgrounds, systematics, helicity, tracking efficiency, Møller
- **Run plan:** 2.2 GeV? 6.6/8.8 GeV? In/outbending? ancillary runs?, polarization reversal, annealing, ammonia exchange
- **Geometry:** integration, design drawings, readiness review, CALCOM

09:30 **BONuS Detector Development** *20'*

Speaker: Carlos Ayerbe Gayoso (William & Mary)

Material: **Slides**

BONuS 12 RTPC I



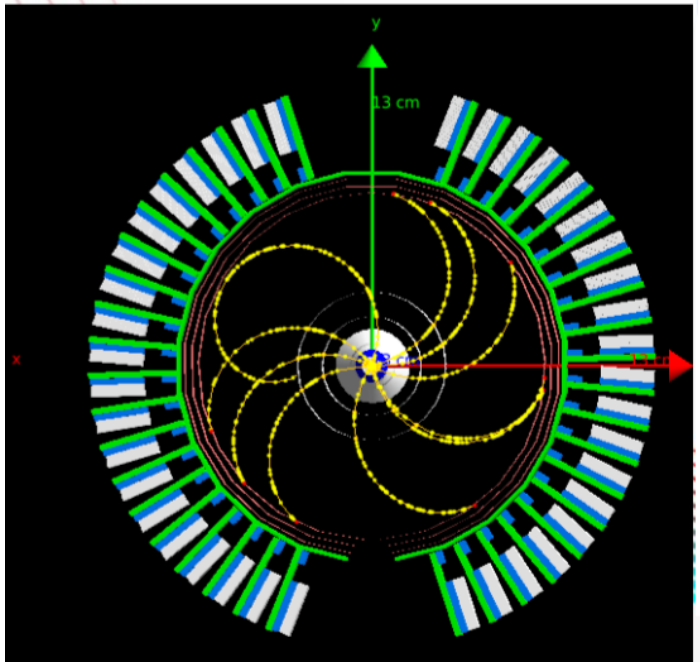
- Target D2, 293K, 7atm, 3mm radius and 40 cm long.
- Target wall 28 μm kapton.
- Drift region: 3<R<7cm
- Drift gas: 293K, 1atm, He/DME (90/10)
- Phi coverage: 360°
- 3 GEM layers separated 3 mm.
- Readout through 100x200 pads. Each pad 4 mm long (Z-direction) and 2.5 mm (Phi-direction).
- Pad signal read by "DREAM" chips from Saclay.

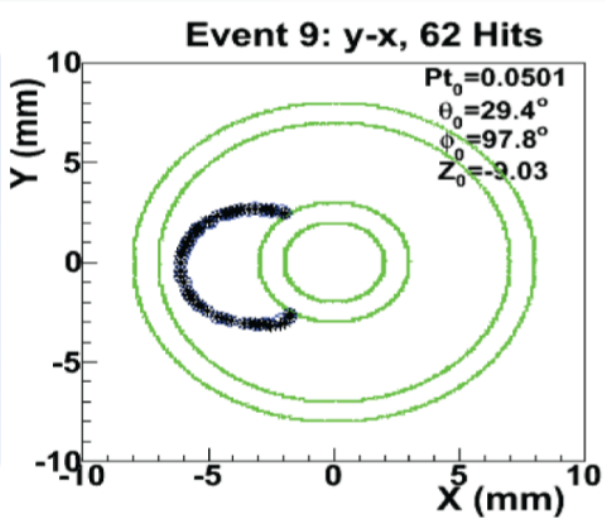
➢ BONuS Design Meeting
Organizer: Sebastian Kuhn
Time: 1:00:00 PM - 2:00:00 PM GMT -05:00
Recurrence : Every Tuesday No end date
Effective Jun 14, 2016

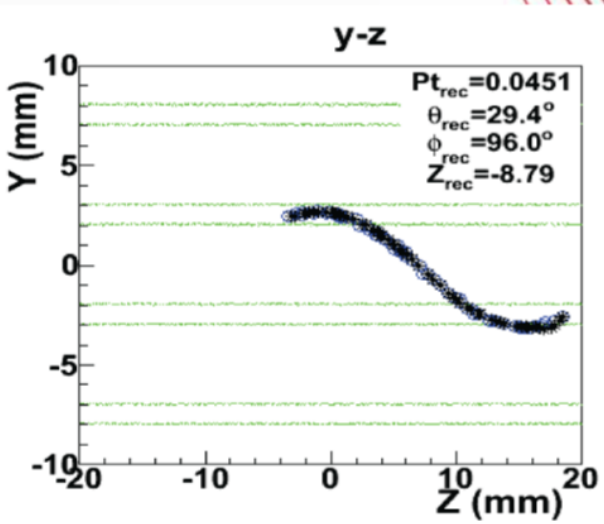
Simulation

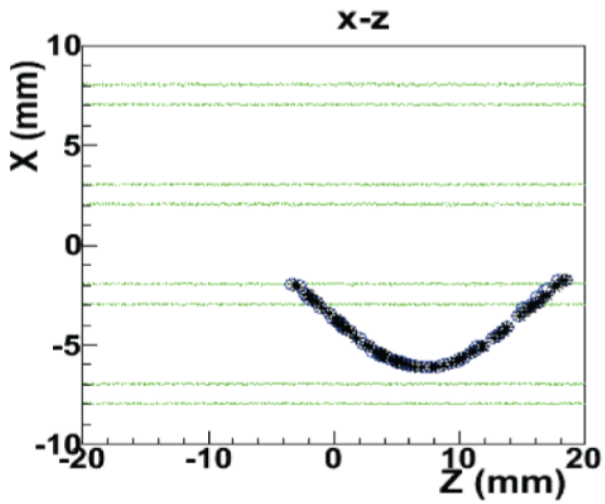
- Simulation and Analysis group:
  G. Dodge, S. Kuhn,
  N. Dzbenski, D. Payette,
  J. Zhang, K. Park;

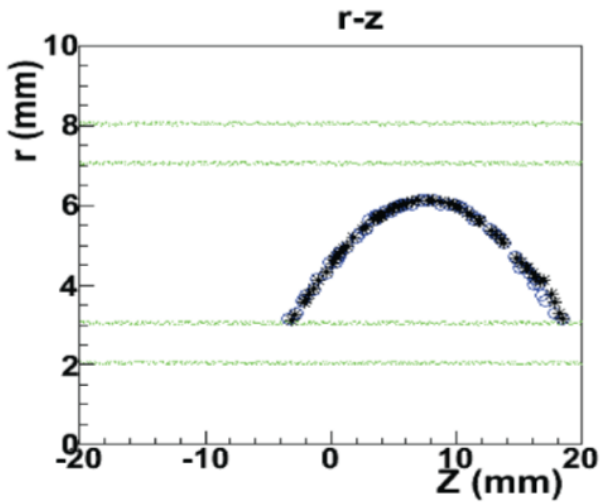
meetings Wednesdays at 3:00.









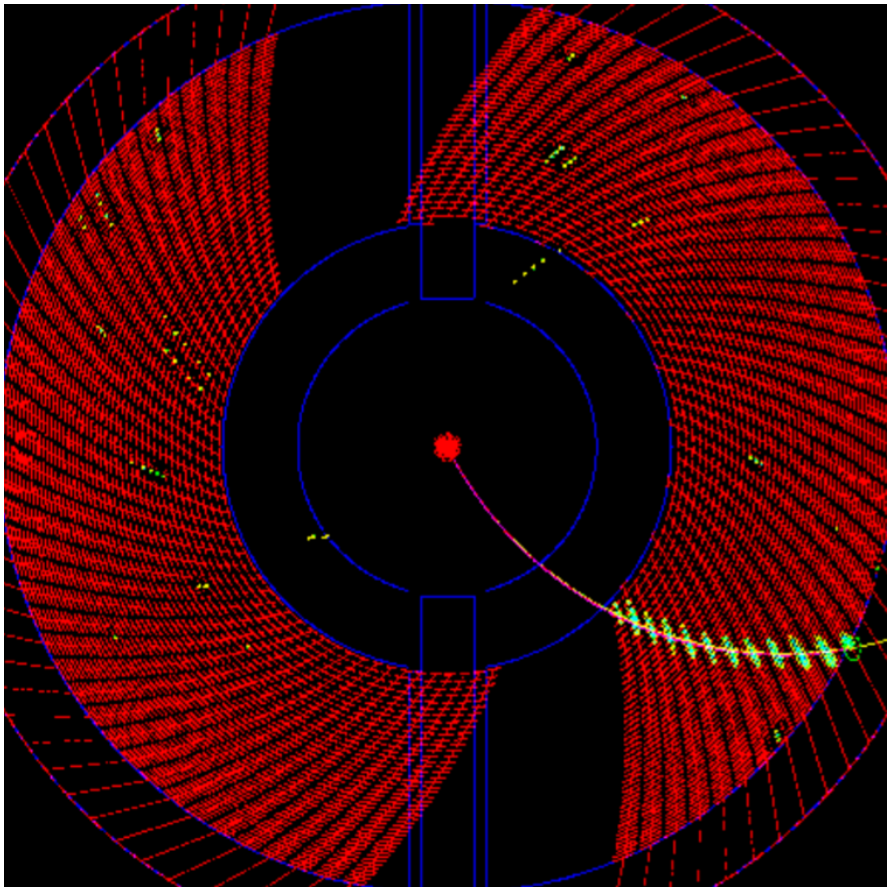


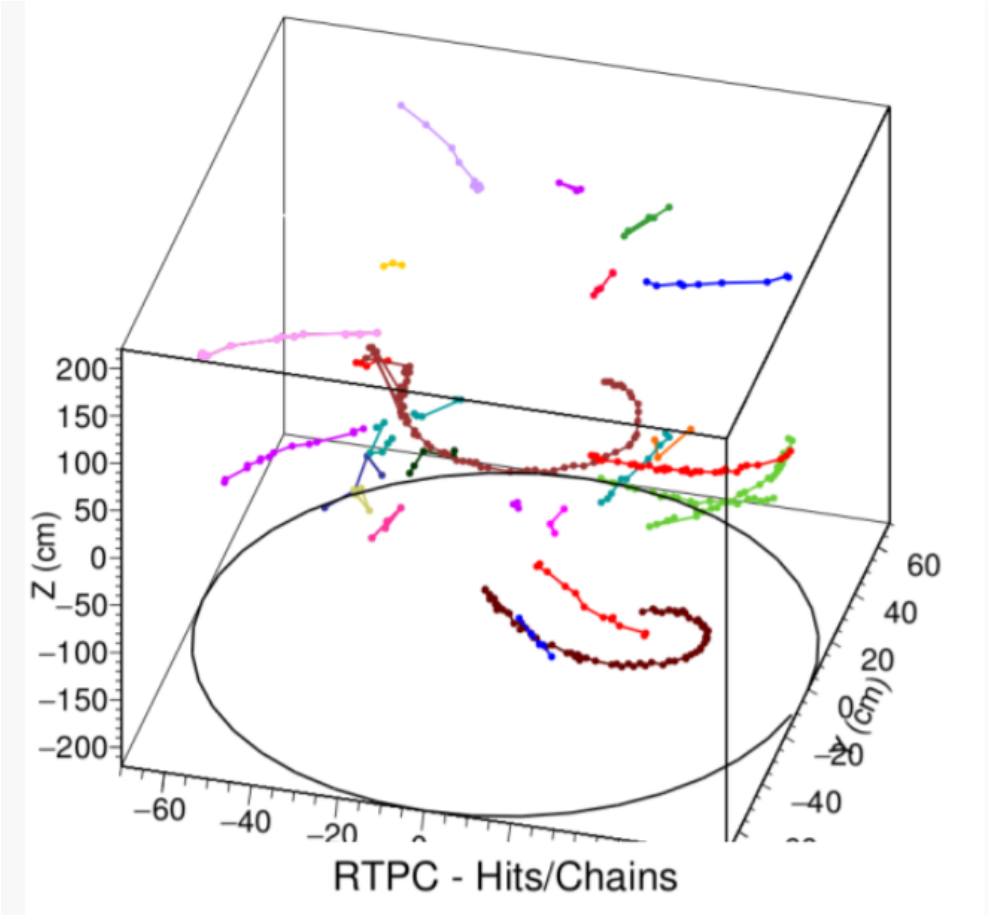
Tracking

- Tracking Group: L. El Fassi, K. Adhikari, C. Ayerbe, K. Park, **J. Zhang**. **Meetings on Fridays at 1:00 p.m**

- Two issues to solve:
  - Track finder
  - Fitting tracks
- Tracks to test code from Geant4 simulation.

Tracking Algorithms are being tested, starting from the 6 GeV tracker





09:50 **Measuring Cross Sections with Polarized Targets** *20'*

Speaker: Peter Bosted

Material: **Slides** 

Asymmetry advantages

Don’t need to know acceptance

Asymmetry drawbacks

Need to know the dilution factor

δσ Advantages

Don't need to know nuclear cross sections

δσ Drawbacks

Need to know:
integrated charge
proton target density
detector acceptance

Stricter cuts means poorer statistics

We need to do both

10:25 **Measuring P_bP_T Using BH"** *15'*

Speaker: Dr. Harut Avagyan (Jefferson Lab)

Material: **Slides**

Measuring PbPT using exclusive photon production

Target Polarization Measurement from BH Double Spin Asymmetry

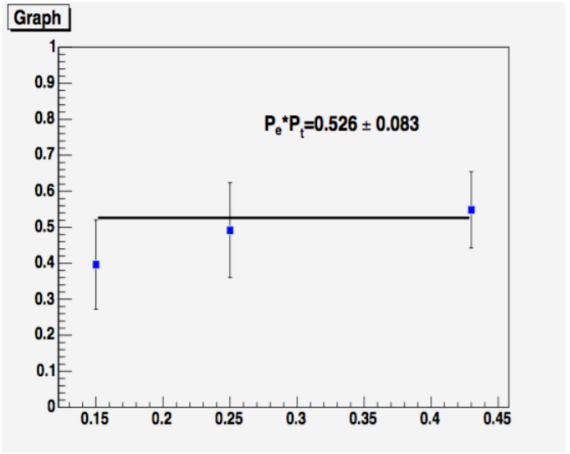
H. Avakian, V. Burkert, S. Chen, L. Elouadrhiri
Jefferson Lab, Newport News, VA 23606

Abstract

We present studies of the double spin asymmetry in the hard exclusive photon production. The double spin asymmetry which is dominated by the BH, is discussed as an alternative source of information on the product of beam and target polarizations for CLAS12 polarized target runs.

$$A_{LL} = \frac{(\frac{N^{\downarrow\uparrow}}{Q^{\downarrow\uparrow}} - \frac{N^{\uparrow\uparrow}}{Q^{\uparrow\uparrow}}) + (\frac{N^{\uparrow\downarrow}}{Q^{\uparrow\downarrow}} - \frac{N^{\downarrow\downarrow}}{Q^{\downarrow\downarrow}})}{f(\frac{N^{\uparrow\uparrow}}{Q^{\uparrow\uparrow}} + \frac{N^{\downarrow\uparrow}}{Q^{\downarrow\uparrow}} + \frac{N^{\uparrow\downarrow}}{Q^{\uparrow\downarrow}} + \frac{N^{\downarrow\downarrow}}{Q^{\downarrow\downarrow}})}$$

$$A_{LL} \sim \frac{c_{0,\mathrm{LP}}^{\mathrm{BH}}}{c_{0,\mathrm{unp}}^{\mathrm{BH}}}$$



10:10 **Radiative Corrections and Data Input for 3D pdf Analysis** *15'*

Speaker: Dr. Harut Avagyan (Jefferson Lab)

Material: **Slides**

LDRD-2016: Universal Analysis Framework for Nucleon Tomography: Nucleon 3D PDF extraction (L. Elouadrhiri *et al.*)

Due to radiative corrections, ϕ-dependence of x-section will get more contributions

- Some moments will modify
- New moments may appear, which were suppressed before in the x-section

- Asymmetries complicated for complex analysis (may be combined with x-sections to provide spin dependent x- sections)
- Need to define the data input (x-sections, normalized counts)
- Electromagnetic corrections are crucial for interpretation of electroproduction data (SIDIS and DVEP).
- Need a self consistent procedure integrating radiative corrections in the extraction of 3D PDFs, GPDs and form factors in nucleons and nuclei.

Example of a table

5D tables (counts in bins of x, Q^2, z, PT^2, \phi_h): N. Harrison (e1f)

column 1: x bin number (0-4)
column 2: Q^2 bin number (0-1)
column 3: z bin number (0-17)
column 4: PT^2 bin number (0-19)
column 5: phi bin number (0-35)
column 6: <x>
column 7: <Q^2> (GeV^2)
column 8: <z>
column 9: <PT^2> (GeV^2)
column 10: <phi> (degrees)

column 11: <y>
column 12: number of counts, corrected for acceptance and radiative effects
column 13: statistical error on the the number of counts
column 14: the radiative correction factor

0 0 2 3 19 0.147459 1.16316 0.126884 0.171938 15 0.770322 20528 472.849 1.06035
0 0 2 3 20 0.147459 1.16316 0.126884 0.171938 25 0.770322 19958.1 619.905 1.06123
0 0 2 3 21 0.147459 1.16316 0.126884 0.171938 35 0.770322 20775.6 541.396 1.06257
0 0 2 3 22 0.147459 1.16316 0.126884 0.171938 45 0.770322 19948.5 434.023 1.06435
0 0 2 3 23 0.147459 1.16316 0.126884 0.171938 55 0.770322 21764.5 465.939 1.06671

- DPWG analyses are working their way through the system
- Analysis/extraction frameworks are needed for SIDIS and DVCS