

The Neutral Particle Spectrometer (NPS) and its Science Program in Hall C

Tanja Horn

For the NPS Collaboration



NPS Collaboration (since 2012)

Collaboration and meetings open to All!

The NPS collaboration consists of members active in the construction and commissioning of the instrument (listed below) and additional collaborators on the individual NPS experiments.



1. Ibrahim Albayrak (Akdeniz Univ/Turkey)
2. Salina Ali (UVA)
3. Tristan Anderson (VTech)
4. Moskov Amaryan (ODU)
5. Vladimir Berdnikov (JLab)
6. Peter Bosted (W&M)
7. William J. Briscoe (GWU)
8. John R.M. Annand (U Glasgow)
9. Arshak Asatryan (JLab)
10. Vincenzo Bellini (INFN-Catania)
11. Kai Brinkmann (Giessen U.)
12. Marie Boert (VTech)
13. Alex Camsonne (JLab)
14. Marco Carmignotto
15. Josh Crafts (CUA)
16. Donal Day (UVA)
17. Maxime Defurne (CEA)
18. Bhesha Devkota (MSU)
19. Rolf Ent (JLab)
20. Yeran Ghandilyan (CUA)
21. Michel Guidal (IJCLab-Orsay)
22. Wassim Hamdi (U. of Monastir)
23. David J. Hamilton (U Glasgow)
24. Tanja Horn (CUA)
25. Zheng Huang (UIC)
26. Charles Hyde (Old Dominion University)
27. Oliver Jevons (U Glasgow)
28. Greg Kalicy (CUA)
29. Dustin Keller (UVA)
30. Cynthia Keppel (UVA)
31. Mitchell Kerver (ODU)
32. Paul King (Ohio University)
33. Edward Kinney (U. of Colorado)
34. Mark Mattison (Ohio University)

35. Malek Mazouz (U. of Monastir)
36. Arthur Mkrtchyan (AANL, YerPhI)
37. Hamlet Mkrtchyan (AANL, YerPhI)
38. Rachel Montgomery (U. Glasgow)
39. Carlos Munoz-Camacho (IJCLab-Orsay)
40. Jacob Murphy (Ohio University)
41. Pawel Nadel-Turonski (Stonybrook)
42. Gabriel Niculescu (James Madison U.)
43. Rainer Novotny (Giessen U.)
44. Rafayel Paremuzyan (JLab)
45. Ian Pegg (CUA)
46. Pierre Pichard (U. Nantes/Ohio University)
47. Christine Ploen (Old Dominion University)
48. Hashir Rashad (Old Dominion University)
49. Riley Reedy (Ohio University)
50. Julie Roche (Ohio University)
51. Oscar Rondon (UVA)
52. Simon Sirca (U Ljubljana)
53. Alex Somov (JLab)
54. Igor Strakovsky (GWU)
55. Vardan Tadevosyan (AANL, YerPhI)
56. Richard Trotta (CUA)
57. Hakob Voskanyan (AANL, YerPhI)
58. Erik Wrightson (MSU)
59. Bogdan Wojtsekhowski (JLab)
60. Steve Wood (JLab)
61. Zhenyu Ye (UIC)
62. Zhihong Ye (Tsinghua University, Beijing, China)
63. Carlos Yero (JLab)
64. Simon Zhamkochyan (AANL, YerPhI)
65. Yao Peng Zhang (Tsinghua University, Beijing, China)
66. Carl Zorn (JLab)
67. Jixie Zhang (UVA)

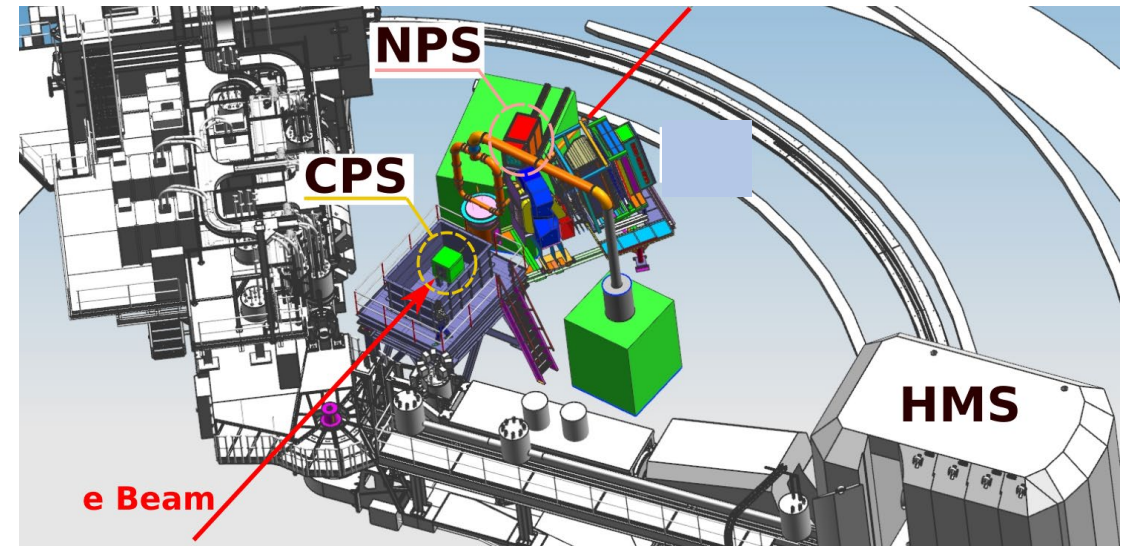
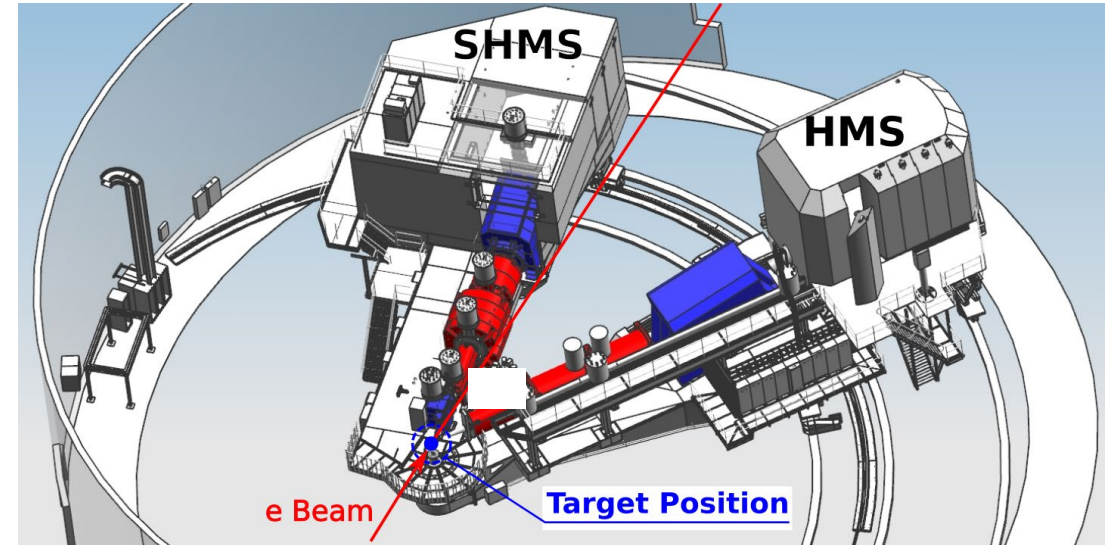


More info in the NPS Wiki: https://wiki.jlab.org/cuawiki/index.php/Main_Page

NPS in Hall C - Overview

- ❑ Neutral Particle Spectrometer replaces one of the Hall C focusing spectrometers in the experiments
 - Angle reach between 5.5 and 60 degrees
 - allows for precision (coincidence) cross section measurements of neutral particles (γ and π^0).
- ❑ HMS (existing 6 GeV era)
 - Has been recommissioned for 12 GeV
- ❑ Beam line and beam line instrumentation
- ❑ Cryogenic liquid hydrogen and solid targets
- ❑ Data acquisition, counting house, computing

Got ideas for experiments – join our meetings!



NPS Science Program

- ❑ The NPS Science program currently includes 8 approved experiments divided into two run groups. The first phase (run group 1) is scheduled for running in 2023/24.

Experiment Number	Title	Beam	Target	Run Group	PAC Days	Rating
E12-13-010	DVCS and exclusive π^0	\vec{e}^-	LH ₂	1	53	A
E12-13-007	SIDIS π^0	\vec{e}^-	LH ₂	1	(26)	A-
<i>E12-06-114 (days moved to Hall C)</i>	<i>Measurements of the electron-helicity dependent cross-sections DVCS</i>	\vec{e}^-	LH ₂	1	35	A
E12-14-003	Wide-Angle Compton scattering (WACS)	e^-, γ	LH ₂	2		A-
E12-14-005	Wide-Angle Exclusive π^0 photoproduction	e^-, γ	LH ₂	2		B
E12-22-006	DVCS off the neutron with the NPS	\vec{e}^-	LD ₂		44	A
E12-17-008	Polarization observables in WACS at high s, t, u	CPS: γ	$N\vec{H}_3$			A-
C12-20-012 (C2)	DVCS using positron beam in Hall C	e^+	LH ₂		77	TBD

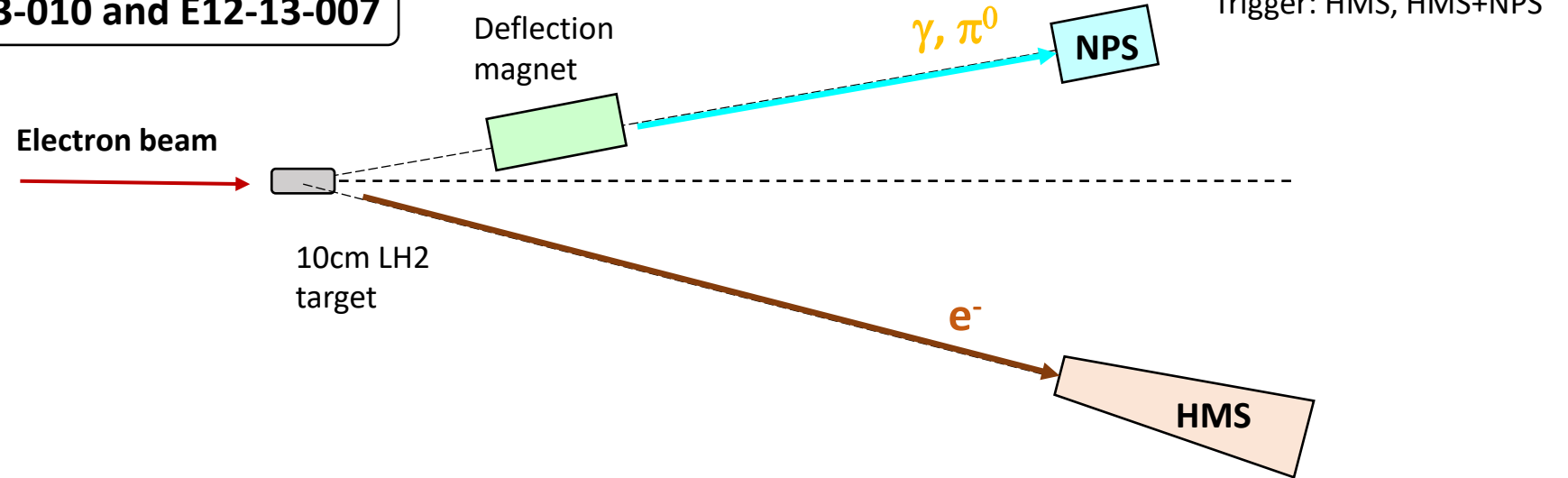
ERR
2019

- ❑ Two new proposals and two LOIs submitted to PAC51
- ❑ A proposal on Time-like Compton Scattering off transversely polarized proton is in preparation – previously submitted as C12-18-005

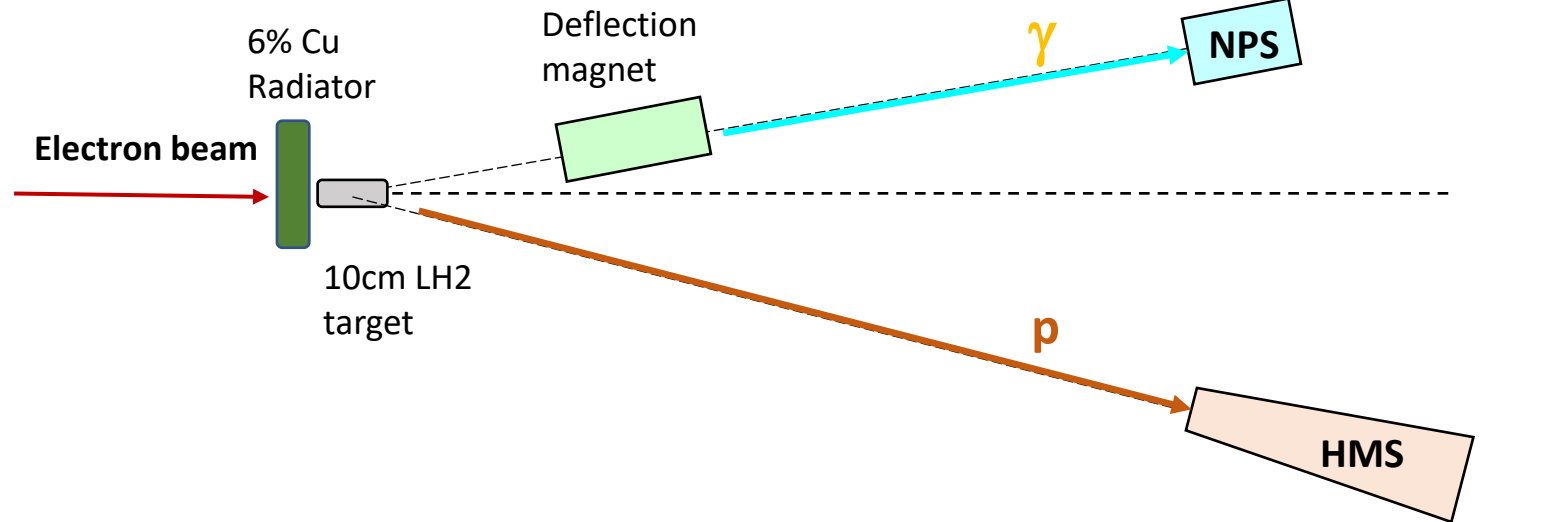
Experimental Techniques

The Neutral Particle Spectrometer (NPS) is a facility in Hall C, utilizing the well-understood HMS and the SHMS infrastructure, to allow for **precision (coincidence) cross section measurements of neutral particles (γ and π^0)**.

E12-13-010 and E12-13-007



E12-14-003 and E12-14-005

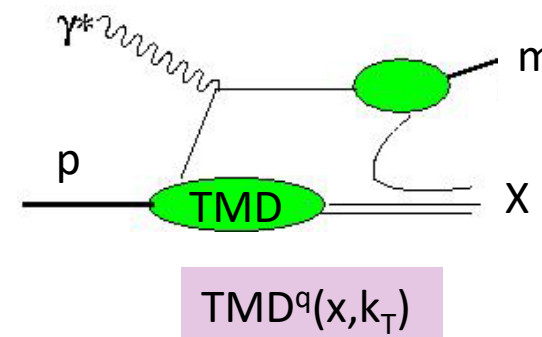


E12-13-007 – SIDIS basic $(e,e'\pi^0)$ cross sections

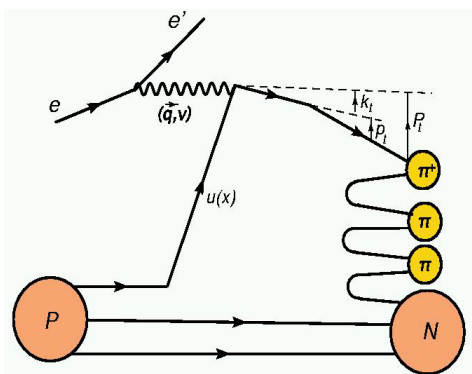


Linked to framework of *Transverse Momentum Dependent Parton Distributions*

- Validation of factorization theorem needed for most future SIDIS experiments and their interpretation
- Need to constrain TMD evolution w. precision data
- Questions on target-mass corrections and $\ln(1-z)$ re-summations require precision large- z data



Transverse momentum widths of quarks with **different flavor (and polarization)** can be different



$$P_T = p_t + z k_t + O(k_t^2/Q^2)$$

E12-13-007 goal: Measure the **basic SIDIS cross sections of π^0** production off the proton, including a map of the P_T dependence ($P_T \sim \Lambda < 0.5$ GeV), to validate(*) flavor decomposition and the k_T dependence of (unpolarized) up and down quarks

(*) Can only be done using spectrometer setup capable of % type measurements (an essential ingredient of the global SIDIS program!)

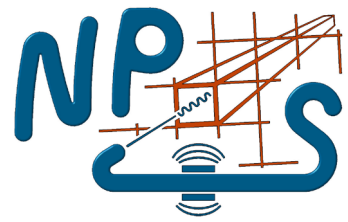
Requires new ~25 msr Neutral-Particle Spectrometer

Advantages of $(e,e'\pi^0)$ beyond $(e,e'\pi^{+/-})$

- ❑ Many experimental and theoretical advantages to validate understanding of SIDIS with neutral pions
- ❑ Can verify: $\sigma^{\pi^0}(x,z) = \frac{1}{2} (\sigma^{\pi^+}(x,z) + \sigma^{\pi^-}(x,z))$
- ❑ Confirms understanding of flavor decomposition/ k_T dependence

PAC: “the **cross sections** are **such basic tests of the understanding of SIDIS** at 11 GeV kinematics that they will play a **critical role** in establishing the entire SIDIS program of studying the partonic structure of the nucleon.”

E12-13-010: precision DVCS/ π^0 cross sections



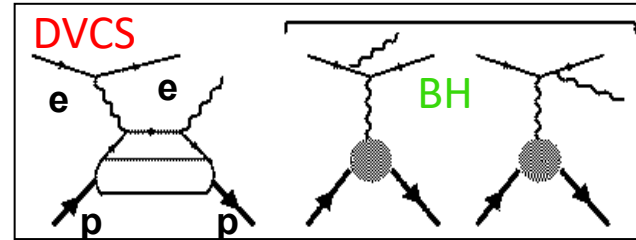
Simplest process: $e + p \rightarrow e' + p + \gamma$ (DVCS)

E12-13-010 DVCS measurements follow up on measurements in Hall A:

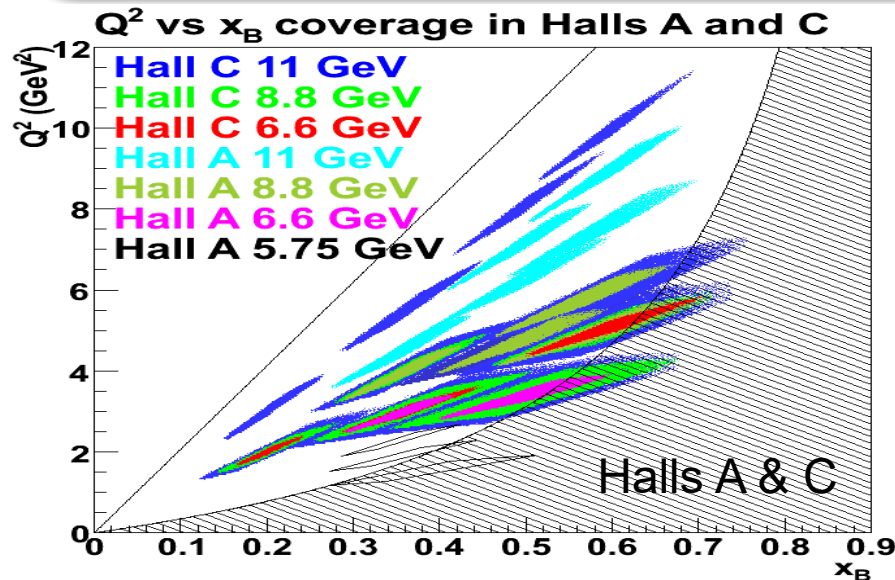
- Scaling of the Compton Form Factor
- Rosenbluth-like separation of DVCS:

$$\sigma = |BH|^2 + \text{Re}[DVCS^\perp BH] + |DVCS|^2$$

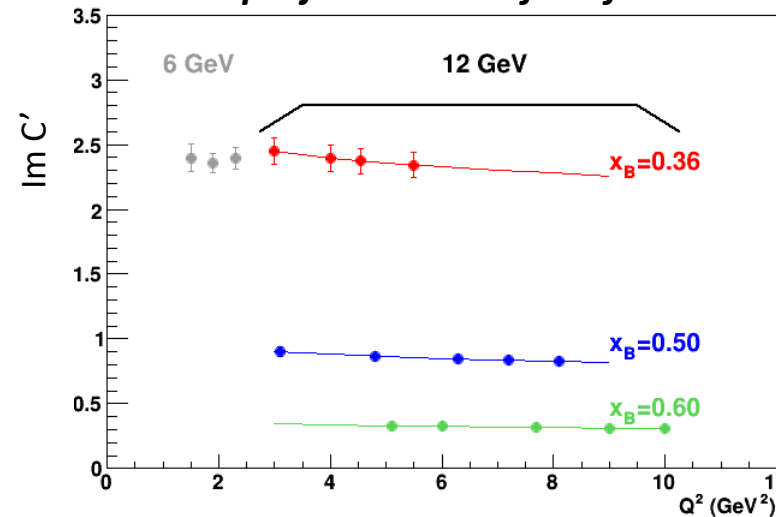
$\sim E_{beam}^2$ $\sim E_{beam}^3$
- L/T separation of π^0 production



Hall A data for Compton form factor (over *limited* Q^2 range) agree with hard-scattering



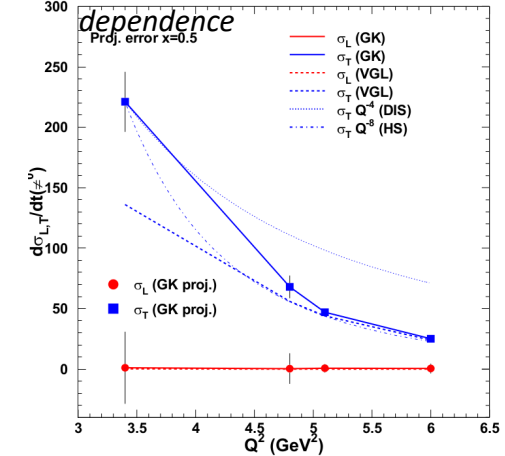
12 GeV projections: confirm formalism



π^0 Exclusive Cross Sections

- Relative L/T contribution to π^0 cross section important in probing transversity
- Results from Hall A at 6 GeV Jlab suggest that the longitudinal cross section in π^0 production is non-zero up to $Q^2=2 \text{ GeV}^2$

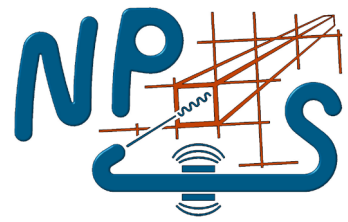
12 GeV projections: confirm Q^2/t



Extracting the real part of CFFs from DVCS requires measuring the cross section at multiple beam energies (DVCS²-Interference separation)

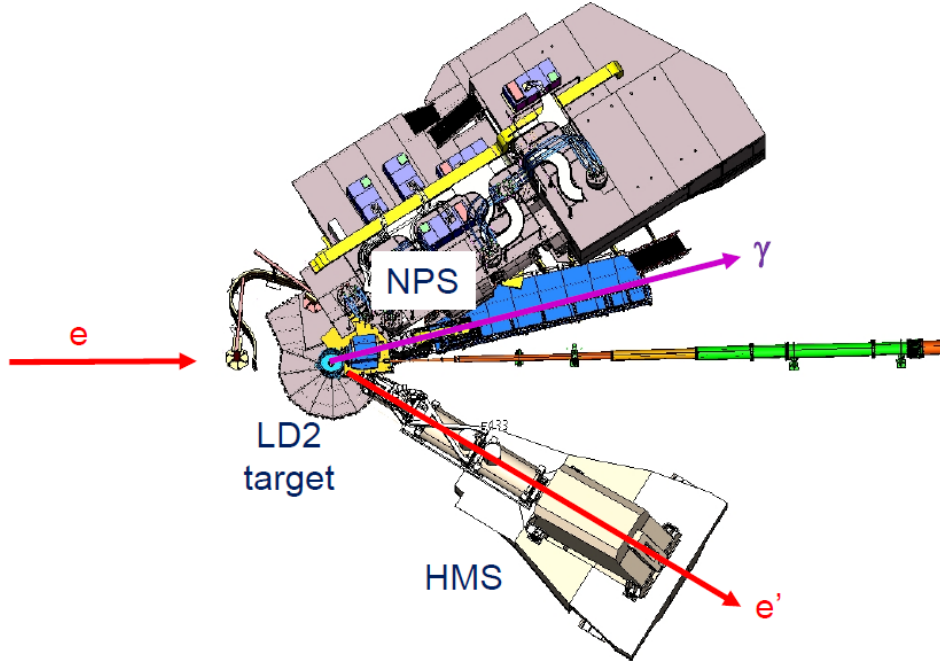
E12-13-010 provides also data on σ_T and σ_L at higher Q^2 for reliable interpretation of 12 GeV GPD data

E12-22-006: DVCS off the Neutron



Probe **flavor dependence of GPDs** with precision nDVCS cross sections

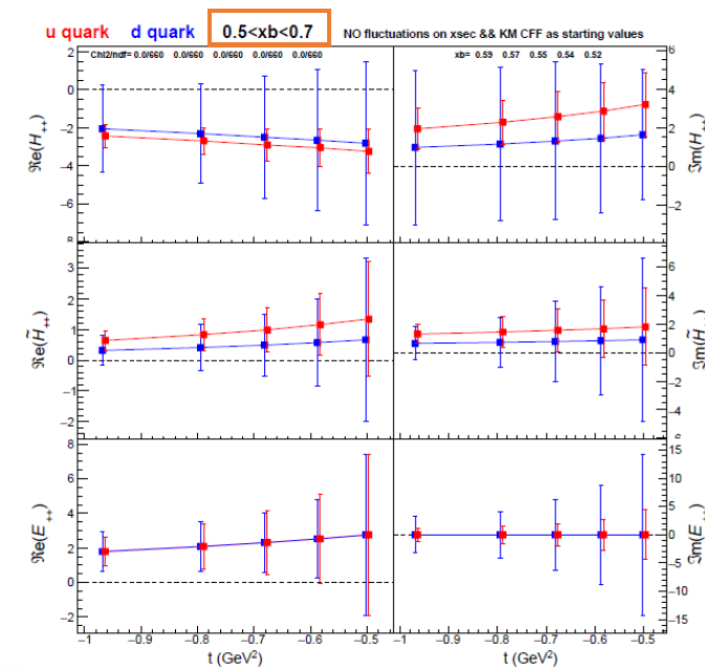
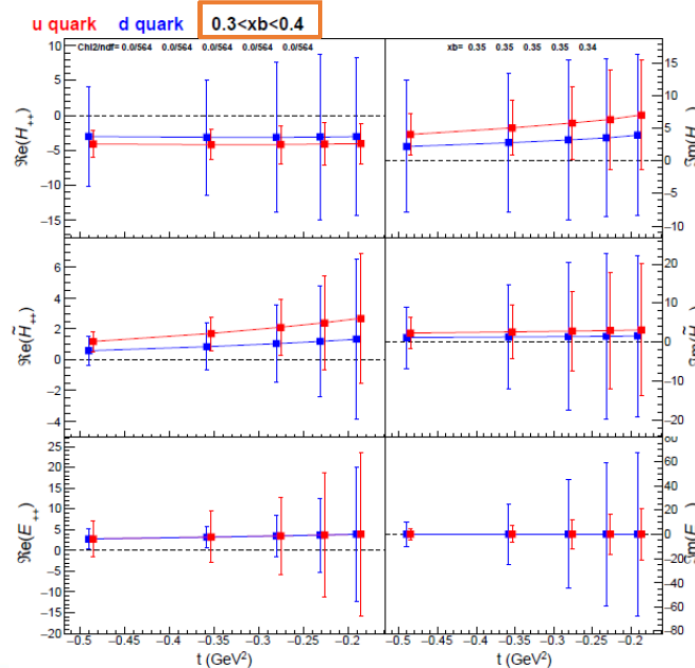
Measurement of the $N \rightarrow e' \gamma X$ reaction ($N=p, n, d$) using an LD₂ target in Hall C



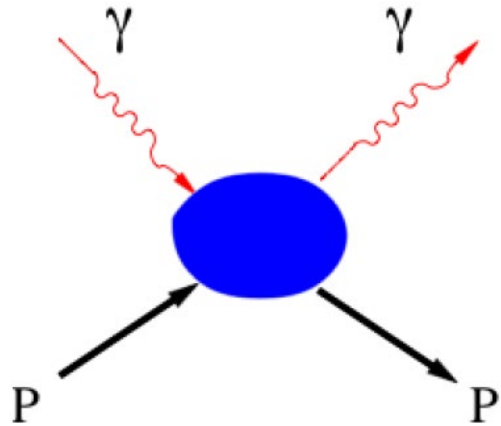
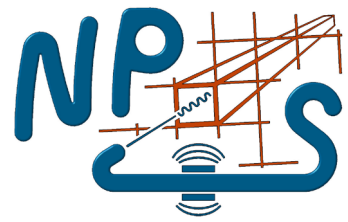
Projected Impact on flavor dependence of CFFs

- Simultaneous fit of E12-13-010 (p) and E12-22-006 (n)
- Real and imaginary parts of CFFs H and \tilde{H} and E (u & d) as free parameters (nDVCS not sensitive to \tilde{E})

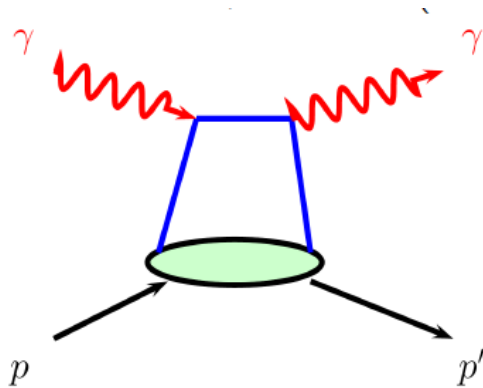
With NPS and HMS in Hall C reach ~x2-12 better nDVCS & dDVCS separation than previous 6 GeV experiment



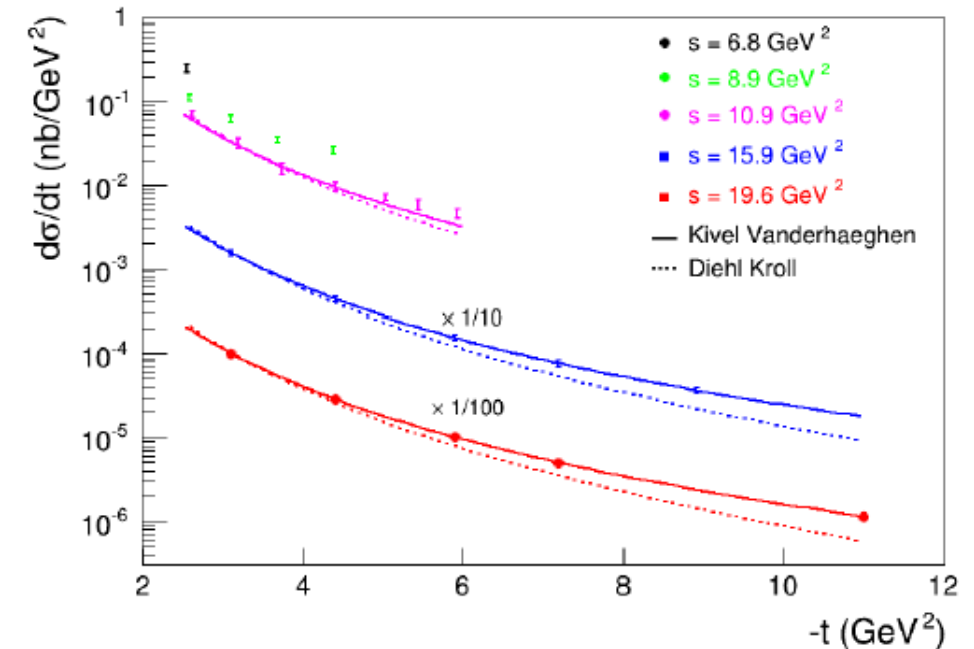
E12-14-003: Wide Angle Compton Scattering



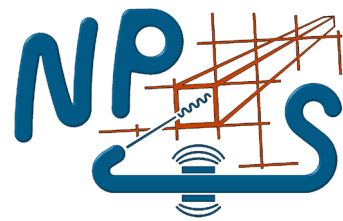
- ❑ Arguably the least understood of the fundamental reactions in the several-GeV regime
- ❑ Wide-Angle Compton Scattering cross section behavior was a foundation leading to the GPD formalism
- ❑ Reaction mechanism intrinsically intertwined with basics of hard scattering process (handbag diagram), yet also sensitivity to transverse structure like high- Q^2 form factors



- Perhaps (6-GeV data) factorization valid for $s, -t, -u > 2.5 \text{ GeV}^2$
- 12-GeV data for $-u > 2.5$ and $-t$ up to ~ 10 , s up to $\sim 20 \text{ GeV}^2$

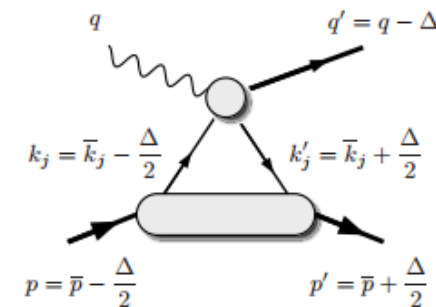


E12-14-005: Wide angle exclusive photo-production of π^0 mesons



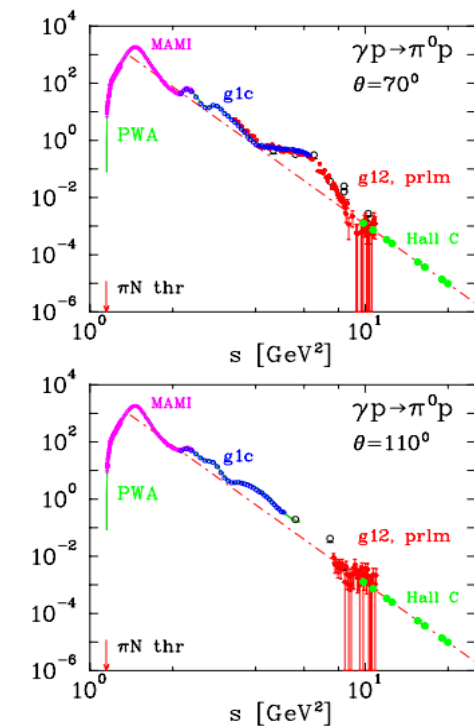
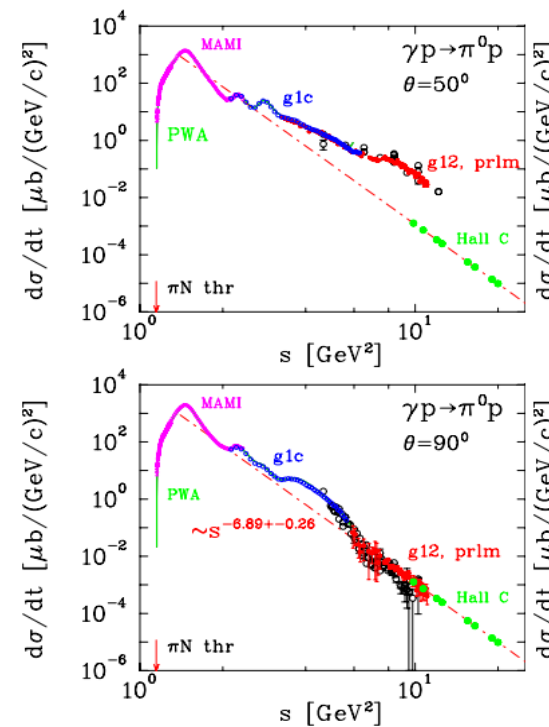
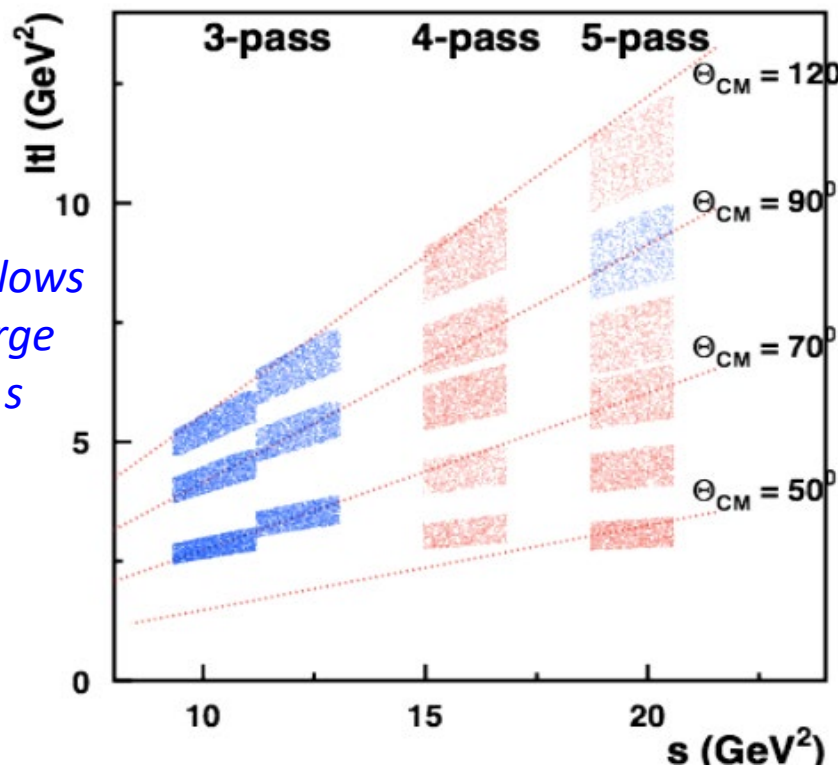
The next simplest reaction after Compton scattering.

But model prediction disagree with data by orders of magnitude!



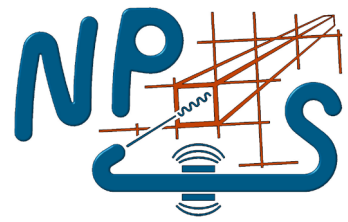
E12-14-005 projections

Using the NPS allows for covering a large range in $|t|$ and s

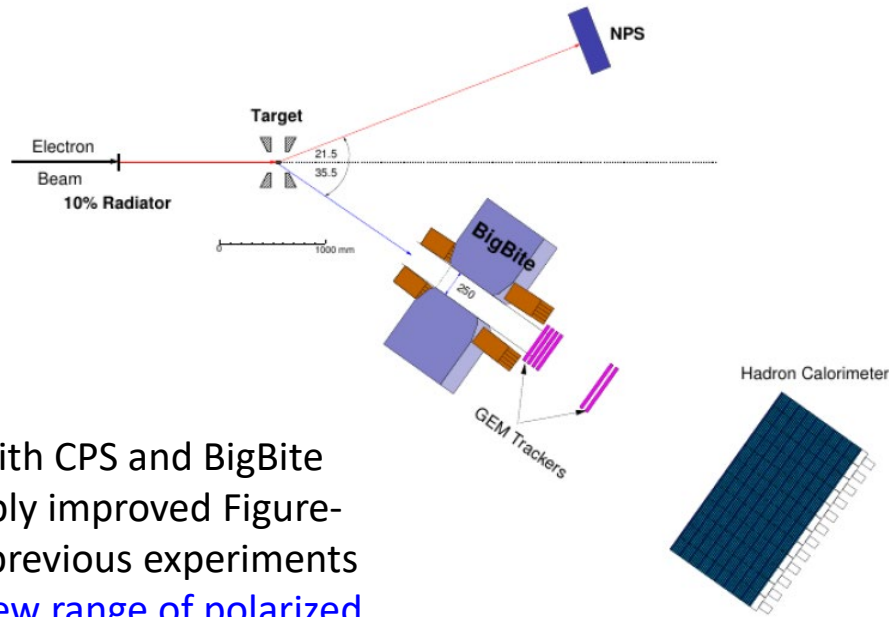


NPS data will help confirm scaling and provide wide angular coverage for testing models based on the dominance of handbag mechanism. Also help extract Regge trajectories.

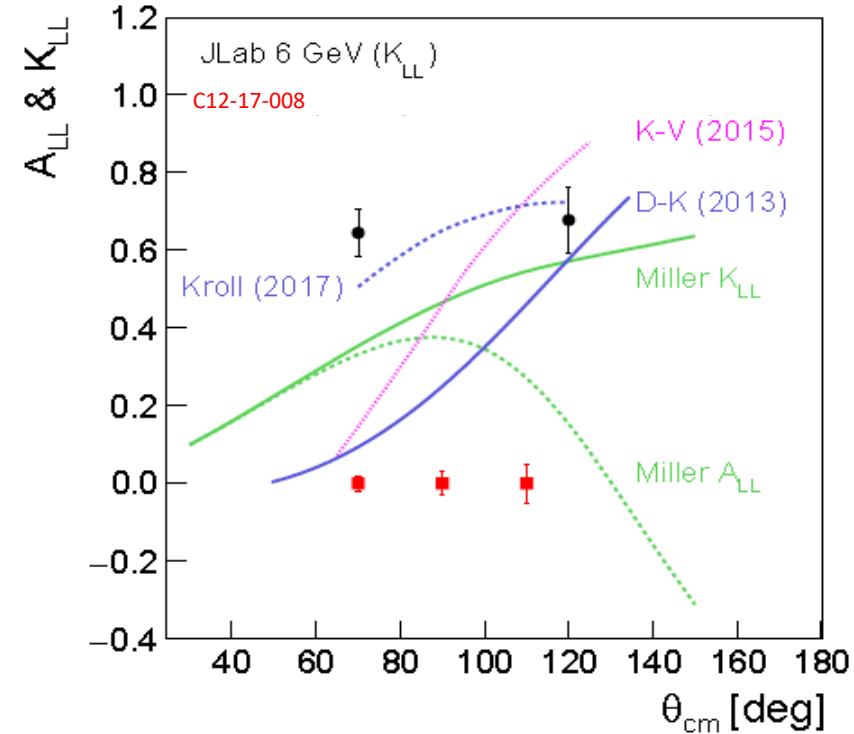
E12-17-008: Polarization Observables in WACS



Versatility – combine NPS with other equipment in Hall C

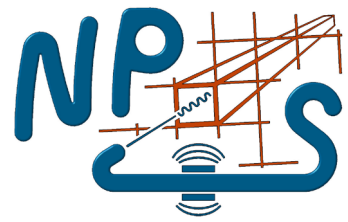


Combining NPS with CPS and BigBite gives a considerably improved Figure-of-Merit over all previous experiments and [opens up a new range of polarized physics opportunities at Lab](#)



- ❑ Make an explicit, model-independent test of factorization by measuring the s -dependence of the polarization observables at fixed centre of mass angle, t , and verify that target mass corrections and higher twist effects are small
- ❑ Measurement of A_{LL} at large angles allowed for tests of relevant degrees of freedom in hard exclusive reactions
- ❑ Also extract the Axial and Pauli form factors - constrain GPDs \tilde{H} and E at high $-t$

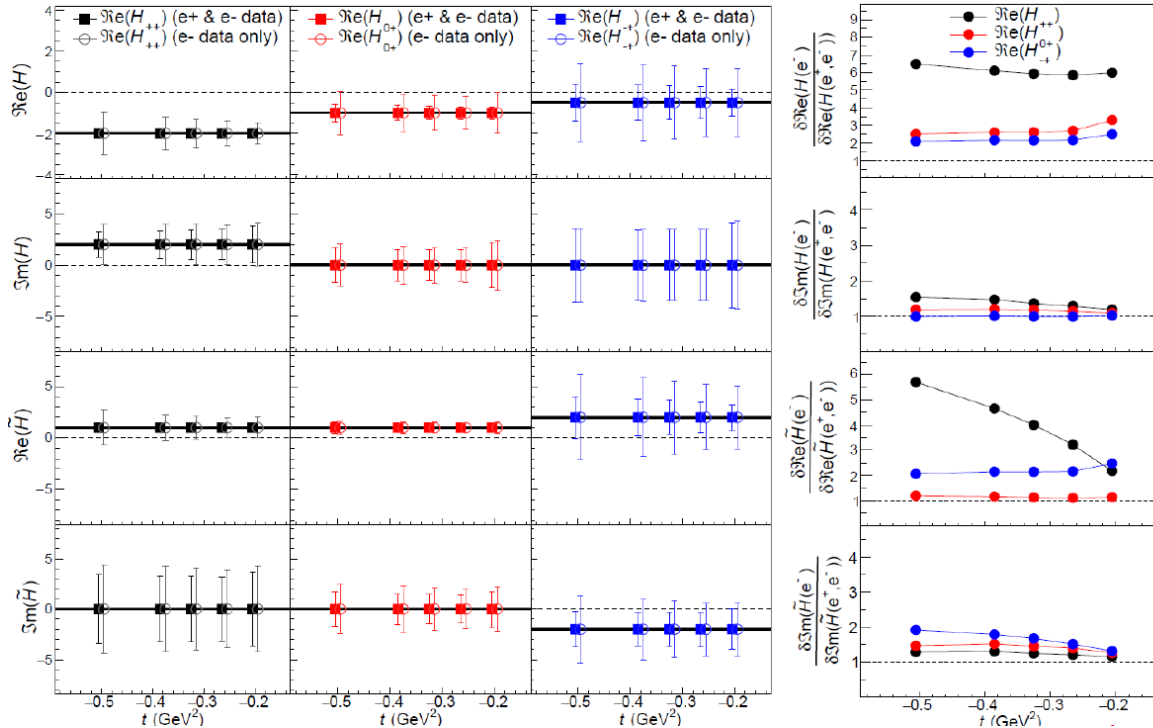
E12-20-012: DVCS using a positron beam in HC



Versatility – combine NPS and a positron beam in Hall C

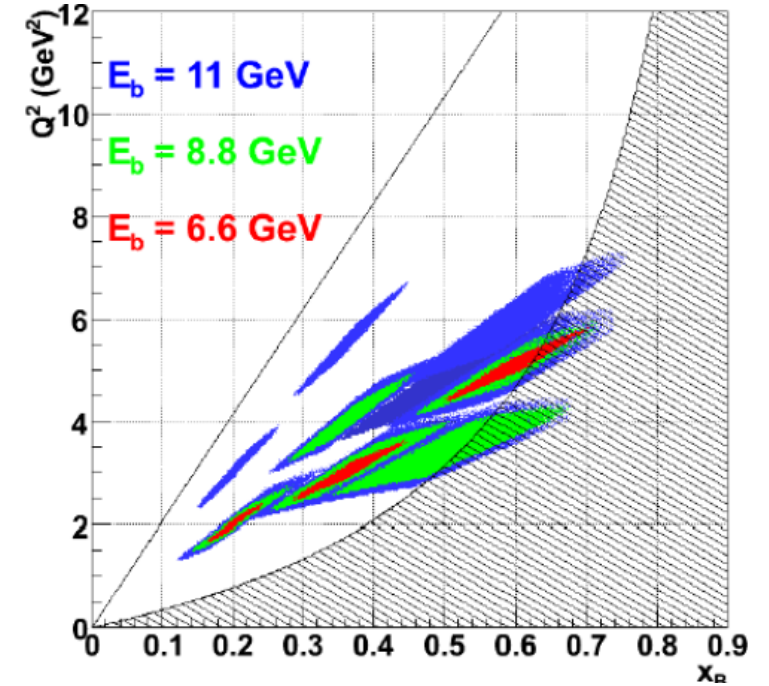
$$|\mathcal{T}(\pm ep \rightarrow \pm ep \gamma)|^2 = |\mathcal{T}^{BH}|^2 + |\mathcal{T}^{DVCS}|^2 \mp \mathcal{I}$$

Impact on Compton Form Factors (CFFs) extraction



A factor of 4-6 improvement in the extraction of LO/LT CFFs $\text{Re}(H)$ and $\text{Re}(\tilde{H})$, factor of ~ 2 for HT/NLO

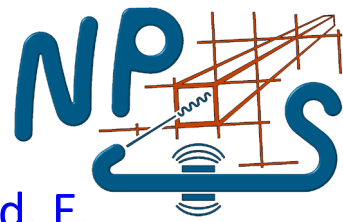
Opposite sign for e- & e+



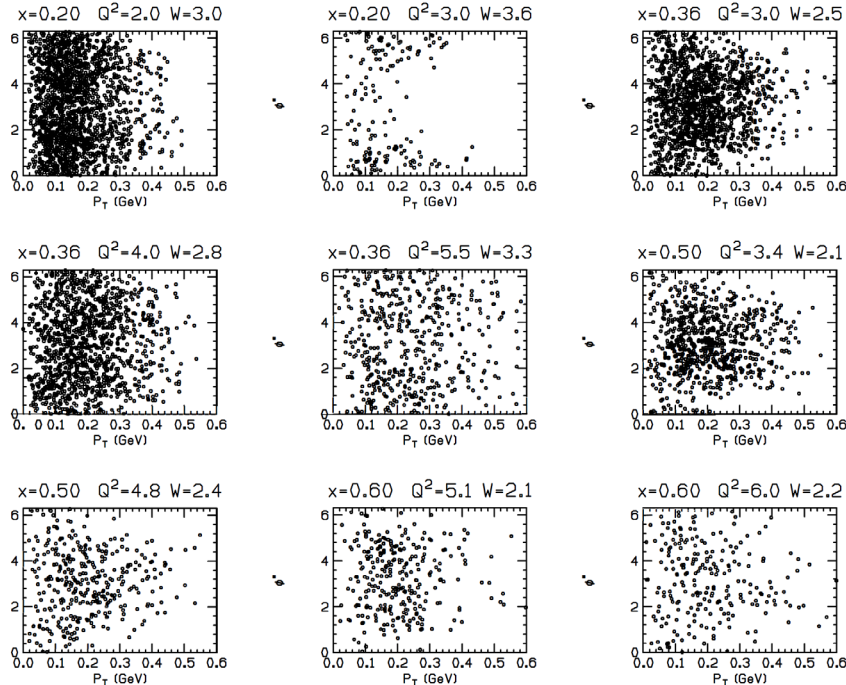
Physics Goals and motivation:

- Precise determination of the absolute photon electroproduction cross section
- Clean model-independent separation of DVCS² and DVCS-BH interference
- More stringent constraints on CFFs by combining e⁺/e⁻ data

PR12-23-014: SIDIS basic $(e,e'\pi^0)$ cross sections



Angles for which NPS has good acceptance in (z, p_T)

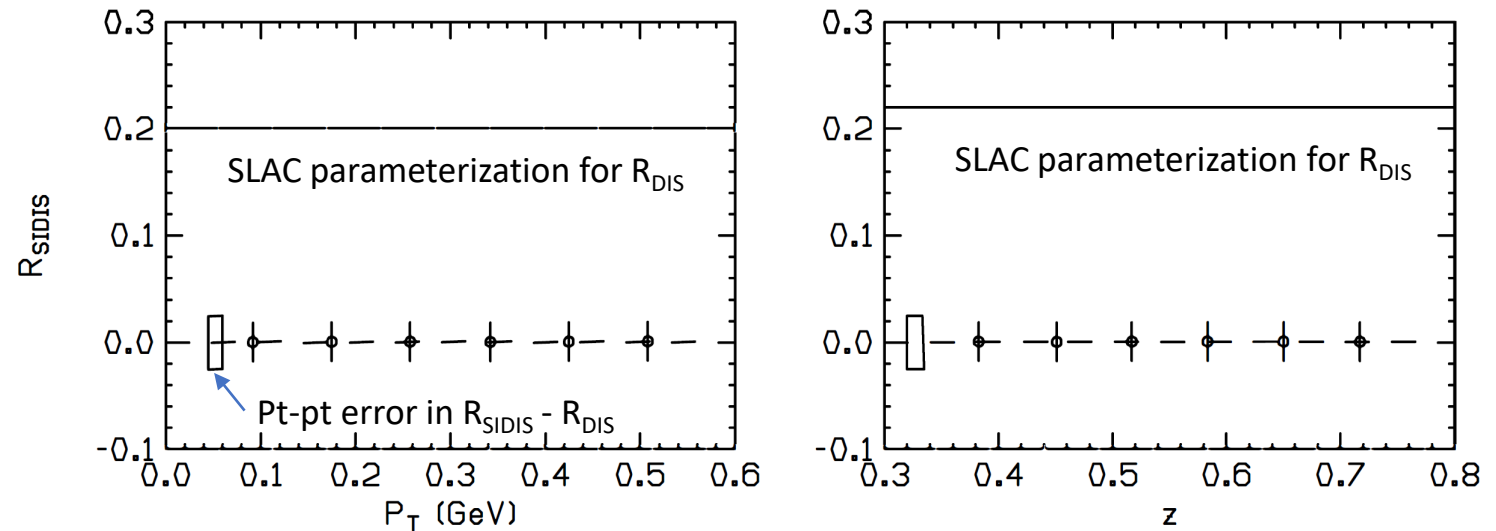


Set	x	Q^2	W	E	ϵ	E'	θ_e	θ_π	d	I	D_p	D_d
		GeV ²	GeV	GeV		GeV	deg	deg	m	μA	day	day
Ib	0.20	2.0	3.0	8.5	0.64	3.17	15.7	8.9	4	50	0.1	0.1
IIIa	0.36	3.0	2.5	6.4	0.51	1.96	28.3	11.2	3	28	0.1	0.1
IVb	0.36	4.0	2.8	8.5	0.52	2.58	24.7	9.9	4	40	0.1	0.1
V	0.36	5.5	3.3	10.6	0.41	2.46	26.6	7.5	4	40	0.3	0.3
VIIIa	0.60	5.1	2.1	6.4	0.46	1.87	38.1	13.2	3	28	0.3	0.3
VIa	0.50	3.4	2.1	6.4	0.67	2.78	25.3	16.9	6	28	0.1	0.1

New Run Group addition proposal to PAC51 (P. Bosted, E. Kinney, H. Mkrtchyan, V. Tadevosyan, R. Ent, T. Horn, et al.)

Measure $R_{LT} = \sigma_L / \sigma_T$, the ratios of d/u cross sections, the transverse momentum dependence of the cross section, and the spin-independent and beam-spin-dependant modulations of the cross section

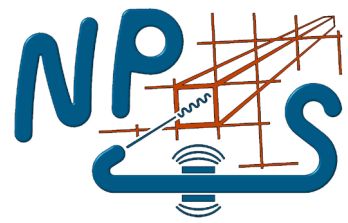
Projections for R_{LT} SIDIS as function of p_T and z



Physics goals are driven by the need to more fully understand the production processes that enter SIDIS for better understanding of the 3D nucleon structure

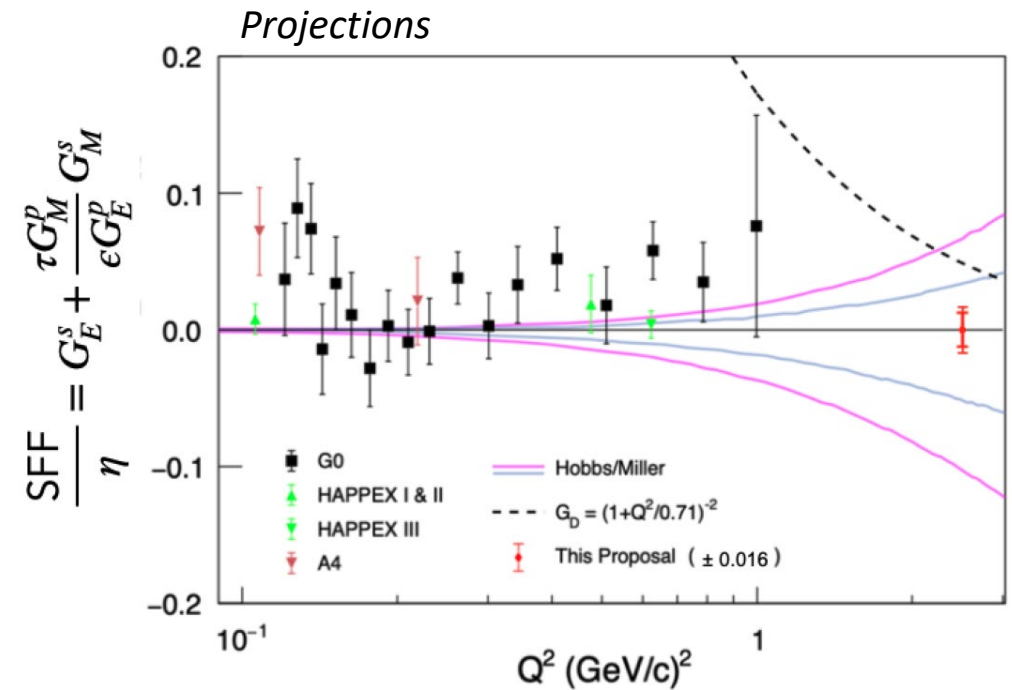
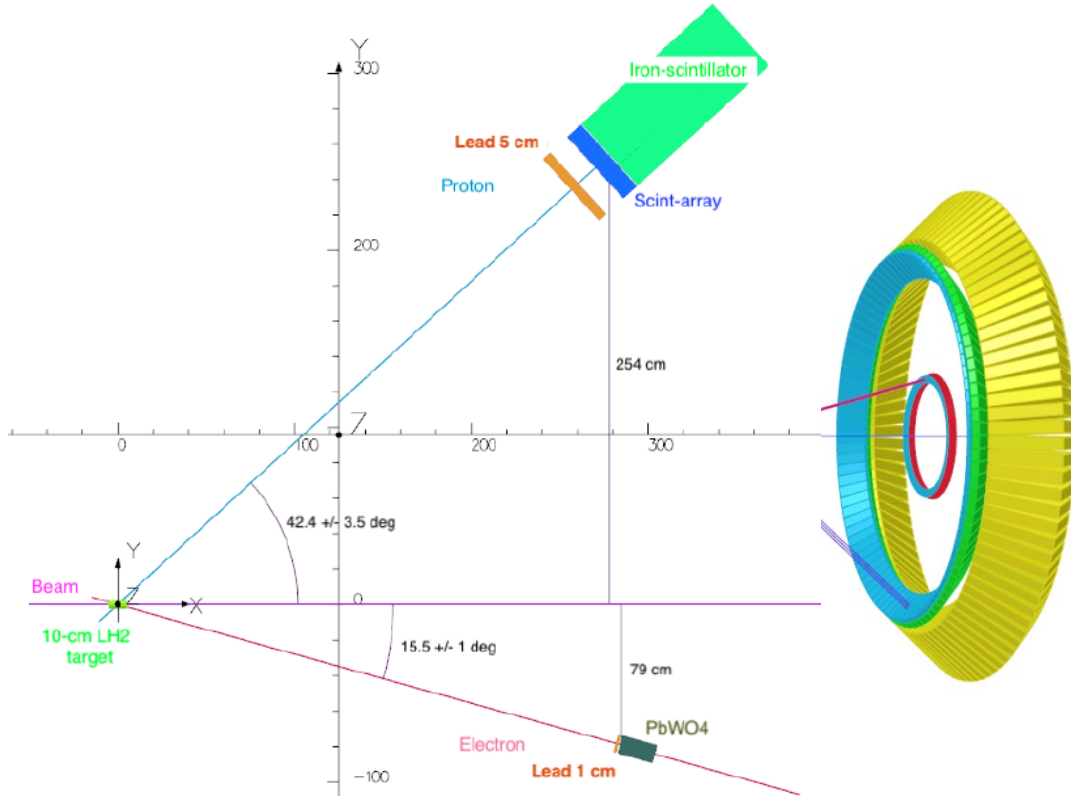
- Dynamic and target higher twist, deep-exclusive processes, VM, CSV 13

New Physics with NPS: Search for a Nonzero G_S at 2.5 GeV^2



Versatility – NPS as precision EMCal – reconfigure and use with other equipment in Hall C

Measure the PVA for elastic e-p using a highly segmented NPS-type EMCal as electron arm and an iron-scintillator-based HCal as proton arm in coincidence mode

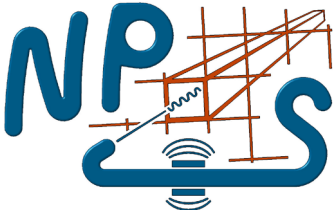


New proposal to PAC51
(B. Wojtsekhowski, C.
Palatchi, K. Paschke, et al.)

Science questions:

- How large is the contribution of $s\bar{s}$ quark pairs to the hadron current at $x_B=1$
- Is the lattice prediction of the almost zero values of G_S consistent with experiment 14

New Physics with NPS: New DVCS Observables

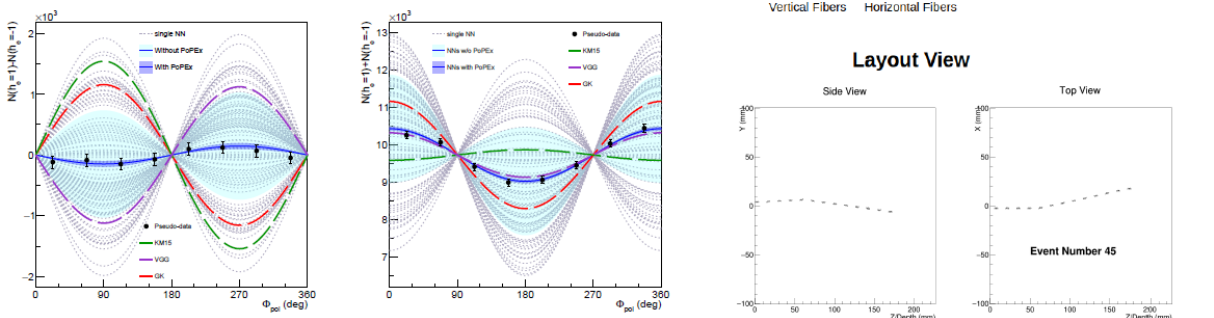


Versatility – NPS as precision EMCal – reconfigure and use with other equipment in Hall C

New DVCS observable: the recoil proton polarization

- Can only be done at JLab with NPS,
- Simultaneous access to E and \tilde{H} through the two transverse polarization of the recoil proton,
- Large polarimeter on the ground made of Scintillating Fibers.
- π^0 -electroproduction done simultaneously.
- More details in LOI 12-23-014.

Bessidskaia Bylund *et al.*, Phys. Rev. D 107, 014020

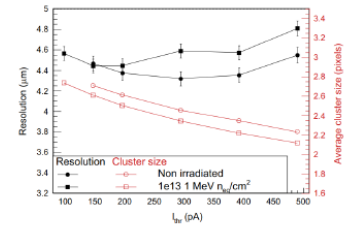
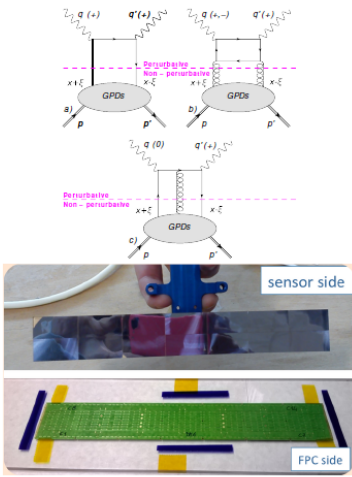
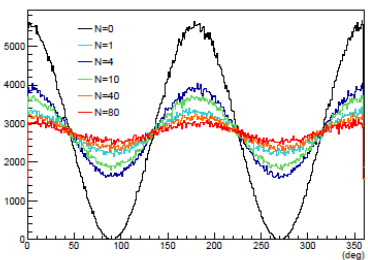


New LOIs to PAC51 (M. Defurne)

New DVCS observable: Linear polarization of DVCS photon

- Can only be done at JLab with NPS,
- Direct access to gluon transversity GPDs,
- Pair polarimeter composed of light MAPS planes.
- Figure-of-merit being optimized (analyzing power vs efficiency).
- May need SBS as electron arm to increase acceptance.
- More details in LOI 12-23-003.

Below, reconstruction of azimuthal angle as lepton pair goes through layers of 0.05% of radiation length spaced by 0.5 mm.

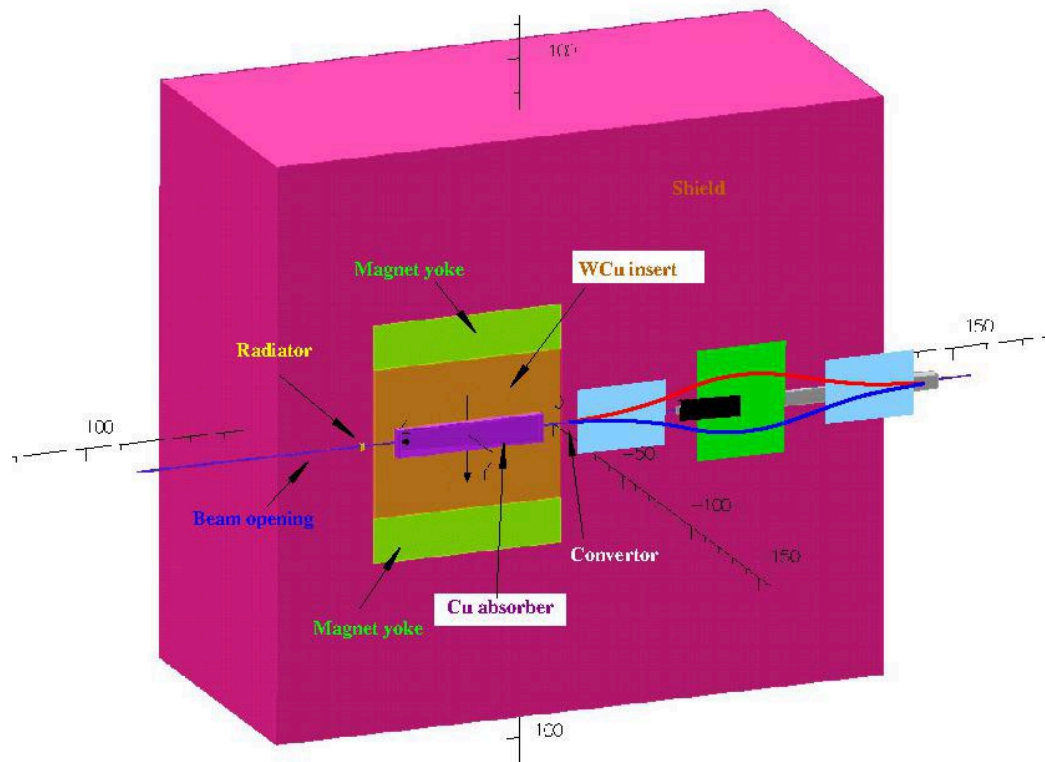


Other new physics ideas with NPS



CPS as a positron source

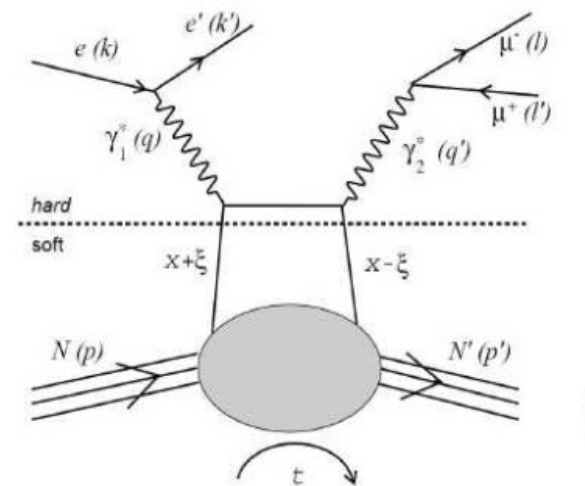
- TPE effects
- Dark photon search



More in Jefferson Lab Hall C: Precision Physics at the Luminosity Frontier (Hall C White Paper); [D. Mack et al. arXiv 2209.11838](#)

Beyond DVCS and TCS

- DDVCS (access to ERBL region)
- J/Psi on transversely polarized target



DDVCS

Access GPDs

$Q'^2 \neq Q^2$ & greater than 1 GeV^2

Depends on x, ξ, t + evolution

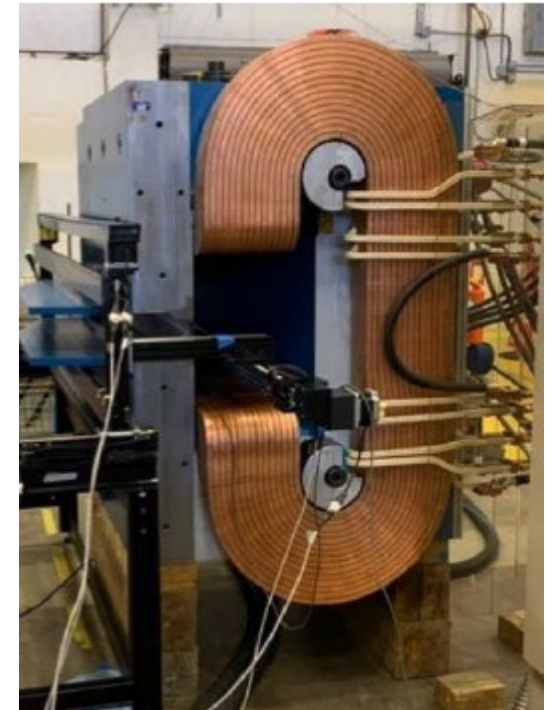
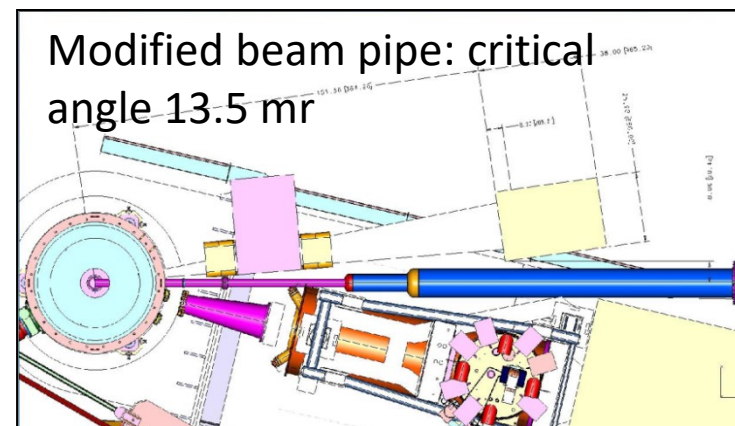
Marie Boer et al. – 2022 NPS Collaboration Meeting

NPS General Design Concept

NSF MRI PHY-1530874



- ❑ a ~25 msr neutral particle detector consisting of up to 1116 **PbWO₄ crystals** in a **temperature-controlled frame including gain monitoring and curing systems**
- ❑ **HV distribution bases with built-in amplifiers** for operation in a high-rate environment
- ❑ Essentially deadtime-less digitizing electronics to independently sample the entire pulse form for each crystal – JLab-developed Flash ADCs
- ❑ A new 0.3Tm **sweeping magnet** allowing for small-angle and large angle operation at 0.6 TM. The magnet is compatible with existing JLab power supplies.
- ❑ **Cantelevered platforms off the SHMS carriage** to allow for remote rotation (in the small angle range), and platforms to be on the SHMS carriage (in the large angle range)
- ❑ A beam pipe with as large critical angle as possible to reduce beamline-associated backgrounds



More on PWO crystal studies: Scintillating Crystals for the NPS in Hall C at JLab; [T. Horn et al., Nucl. Instrum. Meth. A 956 \(2020\) 163375](#)

NPS Examples of Preparation Tasks - Complete

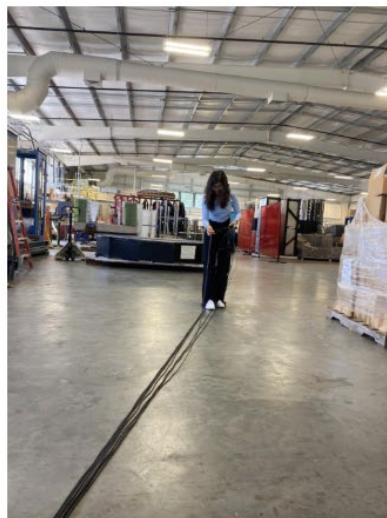


Reflector shaping/crystal wrapping



Cable bundling

Bundling Timeline → ~ 3 months,
ESB - building



The very beginning



12 pack in each box

Before and after



NPS collaboration meeting (02.02.2023)
Cable assembly

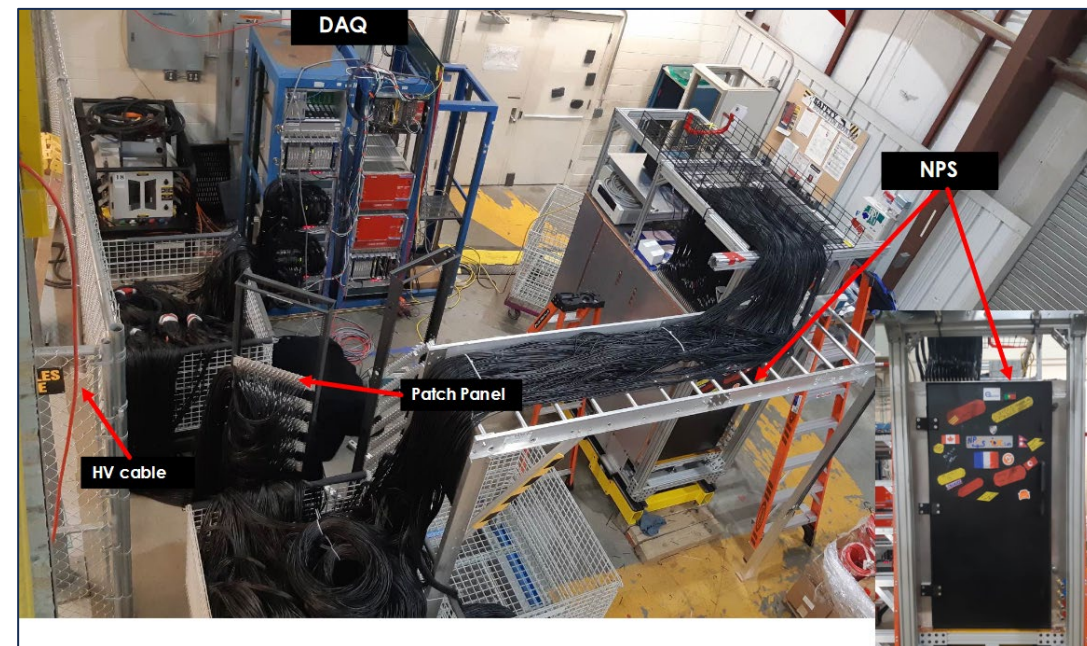
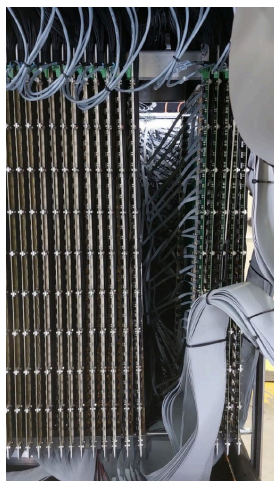
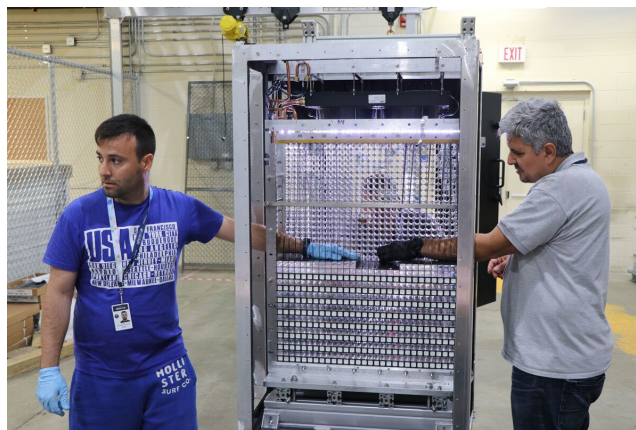
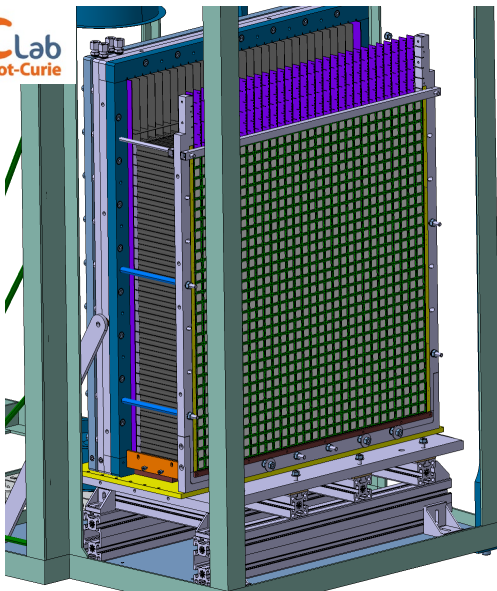


NPS Assembly in EEL108 - complete

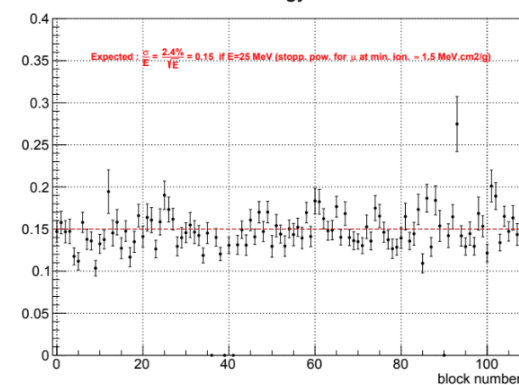


Complex procedure (77+ steps): assemble frame, insert crystals, and PMT+boards, cooling, cable+tests, etc.

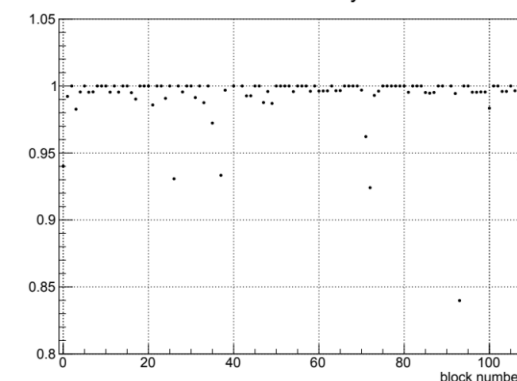
DAQ test setup and cabling for cosmics testing
Tests coordinated by Simona Malace (Hall C)



relative energy resolution



block efficiency

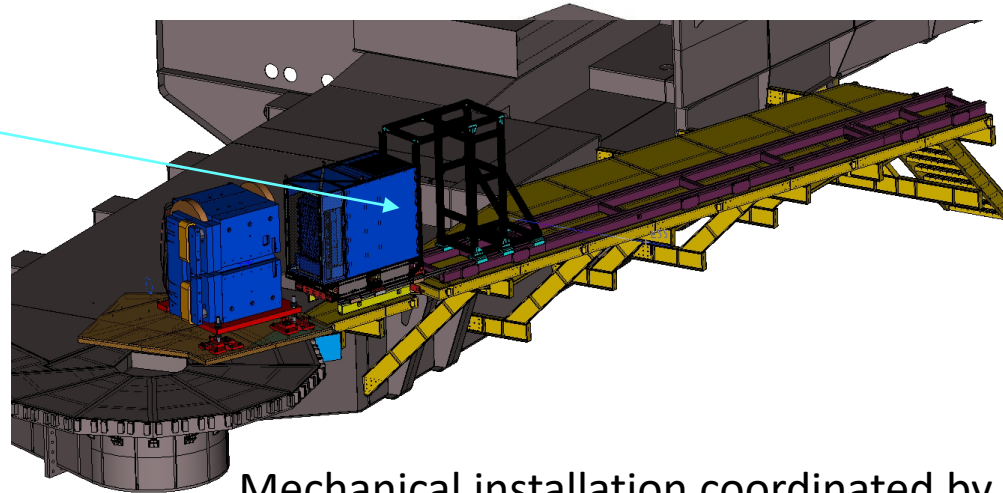
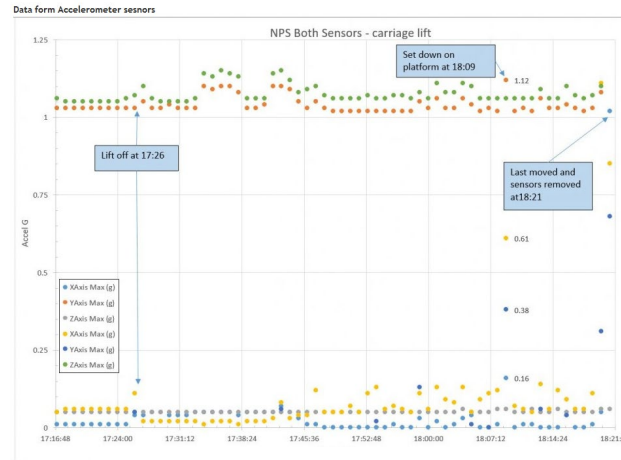
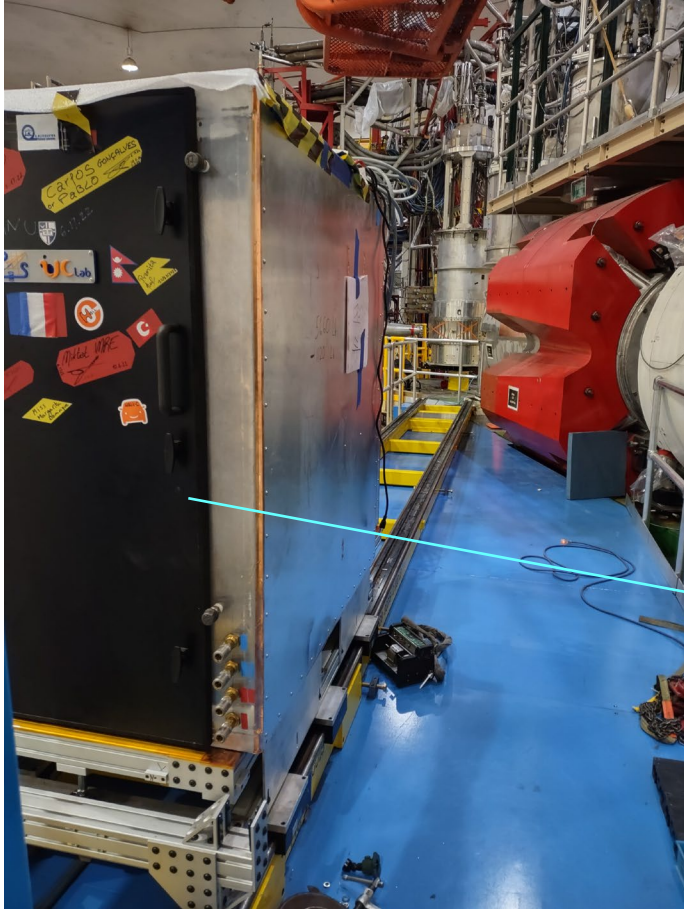


More day-to-day updates: [NPS Logbook](#)

NPS Status – installation on the SHMS platform



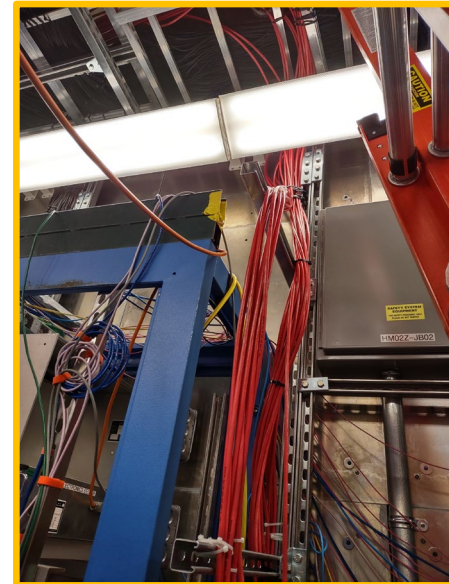
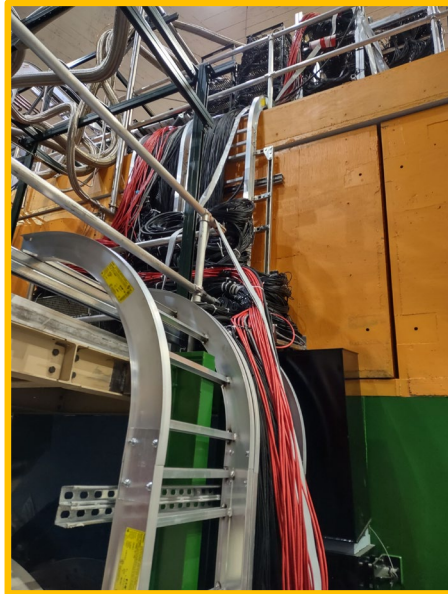
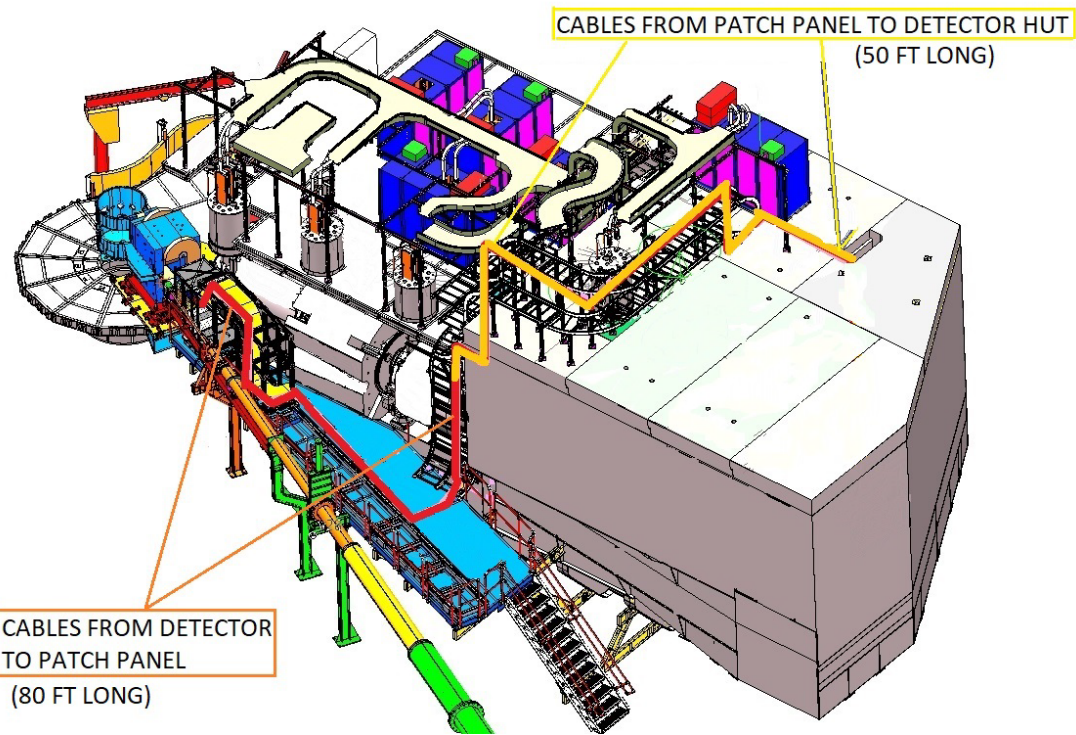
Move the NPS in one piece from EEL108 to Hall C and from floor onto the platform
Many preparation steps completed prior to this – see detailed schedule in NPS Logbook



Mechanical installation coordinated by S. Lassiter, W. Kellner, and the Hall C tech team



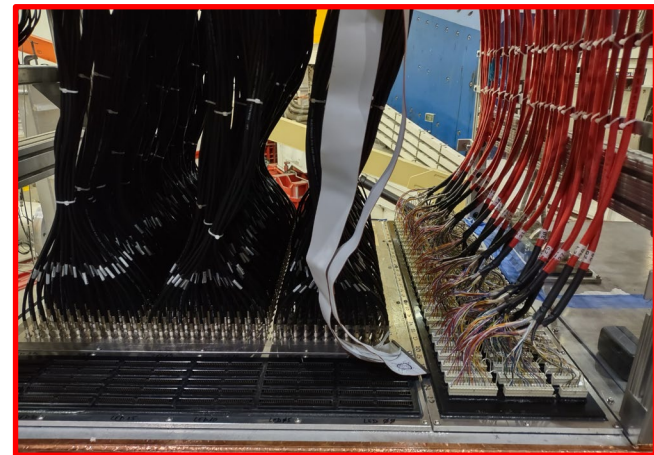
NPS Status – Cabling in Hall C



Cables (signal, HV, LV, LED) from patch panel to detector hut

Cables from detector top to patch panel

Cabling and testing coordinated by Simona Malace (Hall C)



More day-to-day updates: [NPS Logbook](#)

NPS Status – Controls (HV, LV, LED, temperature)



LabVIEW Control and Monitoring System

Phoebus High Voltage Control and Monitoring

Phoebus Low Voltage Control and Monitoring

- Developed and tested IOC
 - EP

LED Control Screen

- Control screen in development
 - LED control screen similar to high voltage control and monitoring screen

- Each cell is clickable and opens a pop-up screen to control individual LEDs
- Bleach mode is for recovering crystals from radiation damage
- Pulse mode is for calibration

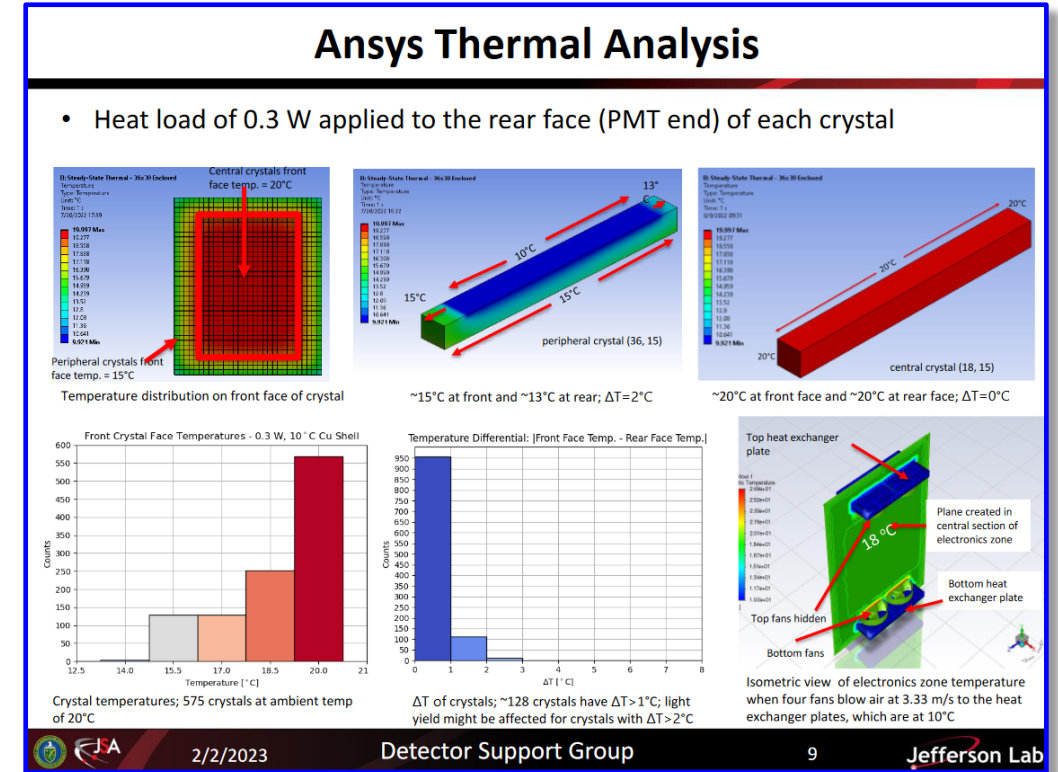
Jefferson Lab

2/2/2023

Detector Support Group

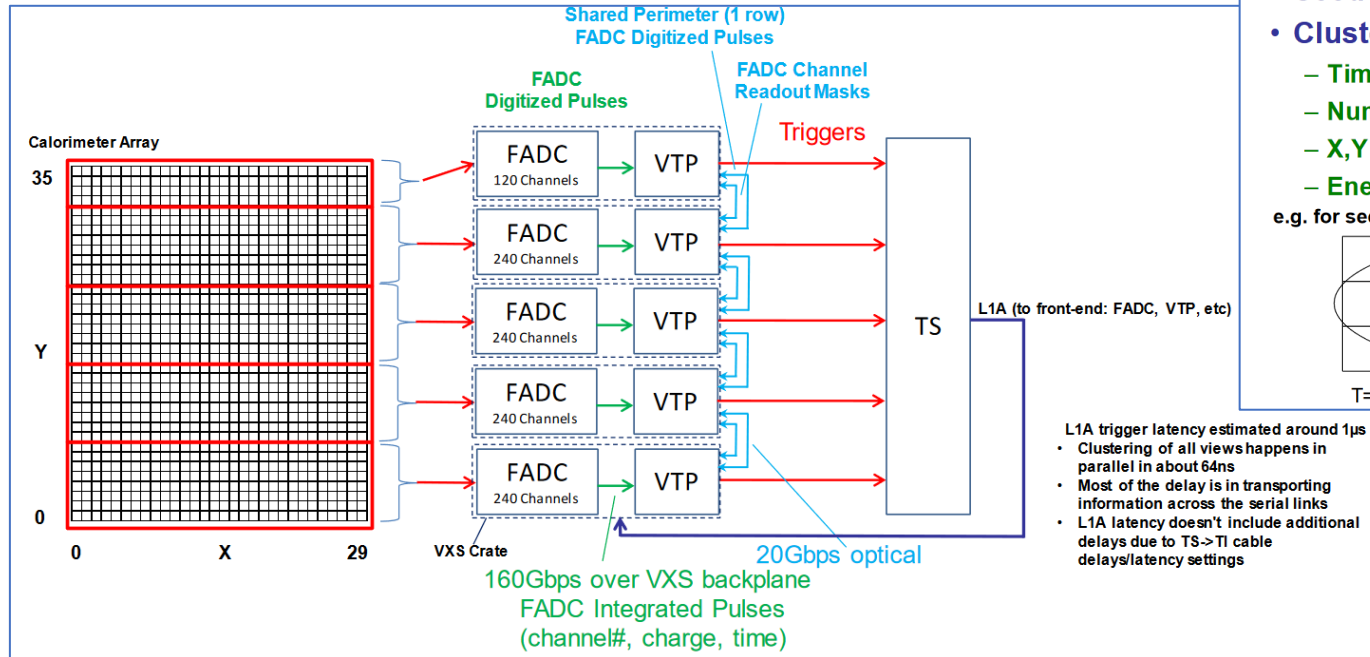
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Jefferson Lab



- ❑ Detailed study on thermal properties of crystals under different cooling strategies
- ❑ Conclusion: crystal temperature dependent on temperature of the environment

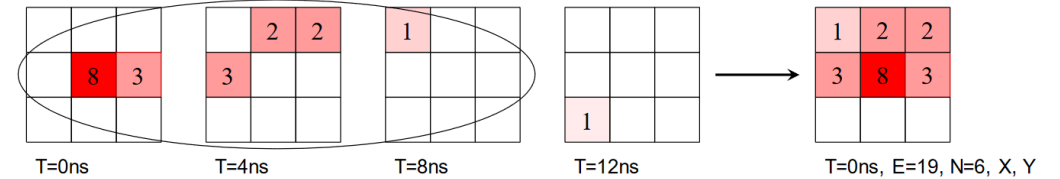
NPS Status – VTP Trigger



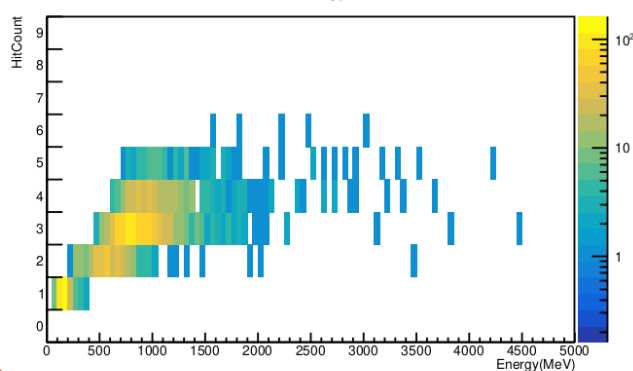
Cluster finding is done by (using 3x3 tower views, all views evaluated in parallel):

- Seed hit (center) must be \geq seed threshold
- Seed hit must also be a local maximum in both space and time
- Cluster is reported with:
 - Timestamp of seed hit (large amplitude hit \Rightarrow lowest jitter)
 - Number of hits in cluster
 - X,Y position of seed hit
 - Energy in MeV units

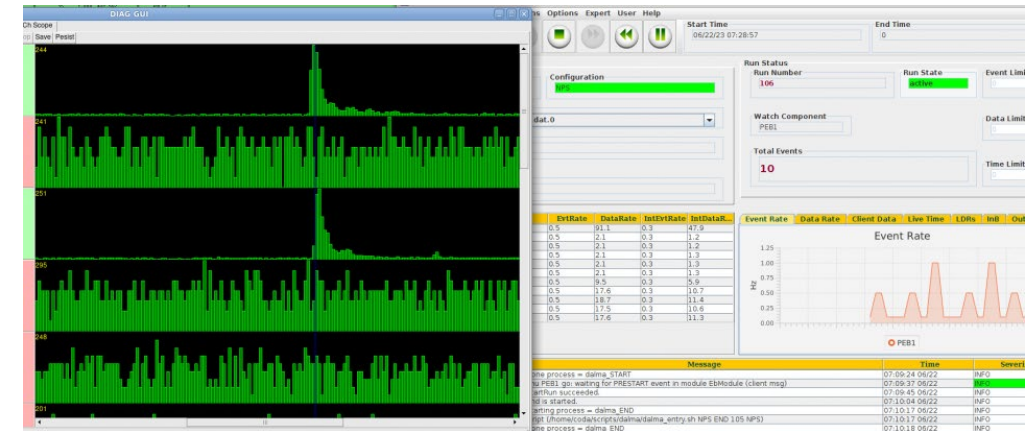
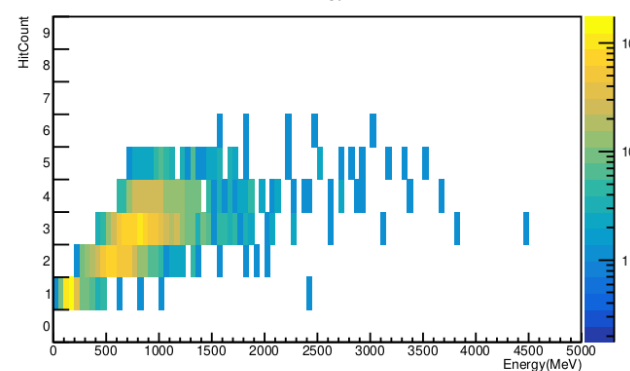
e.g. for seed threshold of 2 and hit $\Delta t = \pm 8$ ns, the following hit pattern evolving in time will report 1 cluster:



FADC Cluster Energy vs Hit Count



VTP Cluster Energy vs Hit Count



Initial data looks good – more tests ongoing

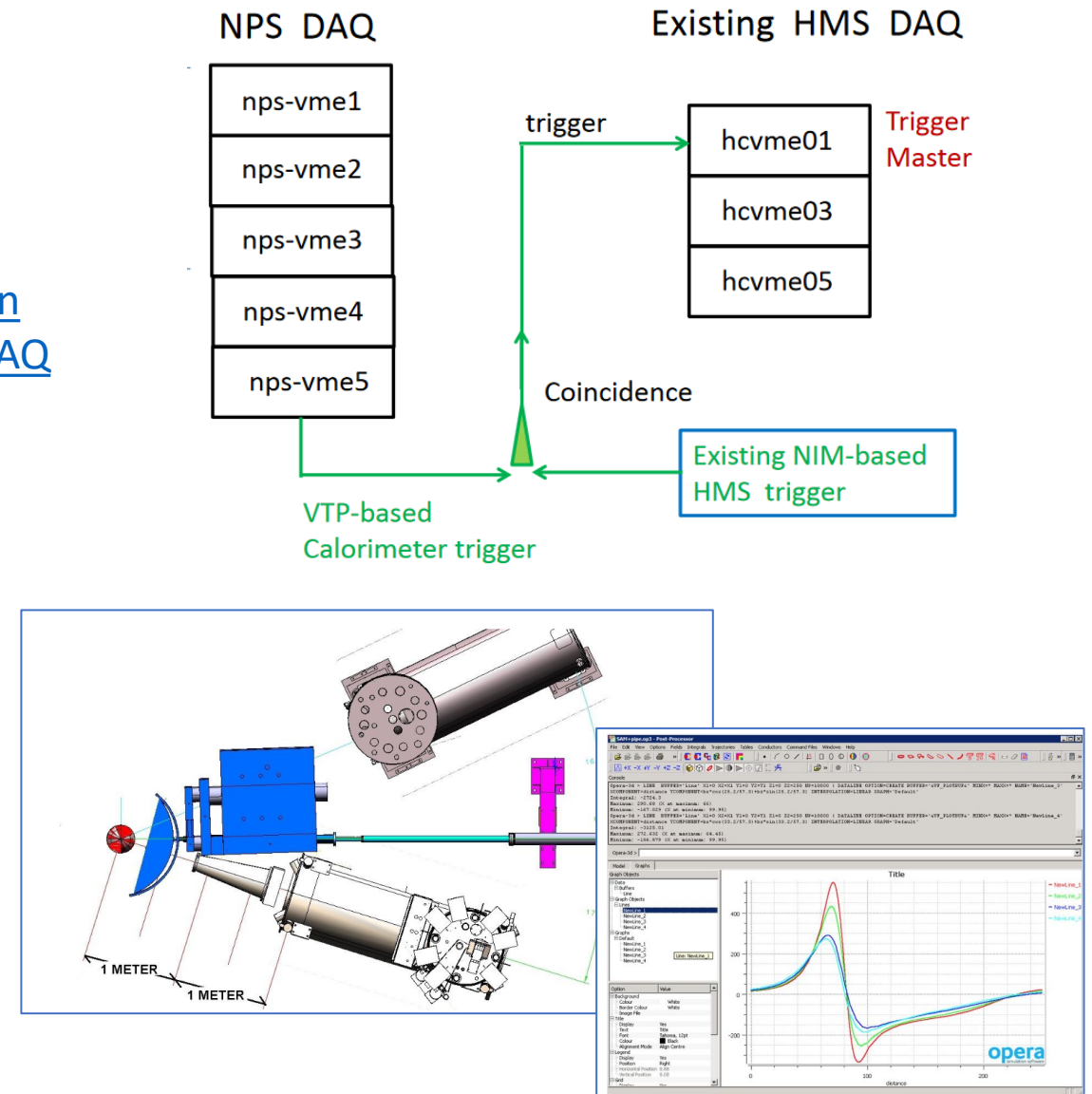
NPS Status – Further Ongoing Activities

- ❑ Upgrade HMS DAQ and checkout
- ❑ DAQ System and Software Preparations and Testing
 - Coincidence trigger setup
 - Synchronization system
 - DAQ tests
 - Analysis scripts
 - EPICS alarms and archiving
- ❑ Preparations for HMS optics tests with spectrometers at small angles – minimum separation 23.5 degrees
 - Possible effects of NPS fringe fields at HMS
- ❑ Background radiation studies for additional shielding
- ❑ Run plan development
- ❑

More detail in:
[NPS Wiki DAQ section](#)
[NPS Logbook HMS DAQ](#)

Many opportunities for groups (and students) to get involved even if not on one of the Run Group 1 experiments

More day-to-day updates: [NPS Logbook](#)



NPS Status – Run Group 1 Preparations

· [Main shift schedule page](#)

Hall C DVCS NPS (E12-13-010) 2023 Shift Schedule

x_B	0.25				0.36						0.5			0.6			
Q^2 (GeV) ²	2.1	2.4		3.0	3.0			4.0		5.5	3.4		4.8	5.1			6.0
E_b (GeV)	6.4	8.5	10.6		6.4	8.5	10.6	8.5	10.6		8.5	10.6		6.4	8.5	10.6	
k' (GeV)	1.73	3.15	5.44	4.16	1.96	4.05	6.15	2.57	4.67	2.45	4.87	6.96	5.47	1.87	3.96	6.06	5.26
θ_e (deg)	25.1	17.2	11.7	15.0	28.3	17.0	12.3	24.7	16.4	26.6	16.5	12.3	16.5	38.1	22.4	16.2	18.9
θ_{Calo} (deg)	8.68	9.69	11.95	9.37	11.24	14.38	16.0	9.91	12.1	7.40	19.9	21.4	16.3	13.2	17.4	19.5	16.9
D_{Calo} (m)	6	4		6	3			4	3	4	3						
I_b (μ A)	30				28			50	28	50	28						
$\frac{-t_{\min}}{(\text{GeV}^2)}$	0.06		0.07		0.16			0.17		0.37			0.39	0.65			0.67
$\frac{-t_{\min}}{2\sigma_{M_X^2}}$	0.15				0.6			0.55		0.4	2		1.7	3.6			3.7
H ₂ Days	1	1	1	1	1	0.5	0.5	1	1	2	3	2	5	5	1	5	10
D ₂ Days					1	0.5	0.5	1	1	2	3	2	5	5	1	5	10

Notes:

SL: Shift Leader TO: Target Operator

Read-only shift schedule: [DVCS-NPS-2023](#)

Shift Instructions:

Shift schedule for NPS run group

- E12-13-010: Exclusive Deeply Virtual Compton and Neutral Pion Cross-Section Measurements in Hall C

- E12-13-007: Measurement of Semi-inclusive p_0 production as Validation of Factorization

- E12-22-006: Deeply Virtual Compton Scattering off the neutron with the Neutral Particle Spectrometer in Hall C

Shift requirements: 10 shifts required for one paper 15 shifts required for all related papers (at least 3). Owl shifts have a 1.5 weight factor.

Please subscribe to the hallc_running mailing list to receive updates about the running of the experiment(s) and possible updates to the shift schedule.

https://mailman.jlab.org/mailman/listinfo/Hallc_running

Target training: The online target training can be found here: [https://www.jlab.org/div_dept/train/Hall_A-C_Tgt/Hall_A-C_Tgt_2018%20\(Published\)/index.html](https://www.jlab.org/div_dept/train/Hall_A-C_Tgt/Hall_A-C_Tgt_2018%20(Published)/index.html)

After completion of the online training, you must also schedule a practical training session with a target expert: (ipchen@jlab.org), (covrig@jlab.org)

Remember to check that your training is updated.

You need to have a Hall C walk through. Contact Joe Beaufait (beaufait@jlab.org) or Dave Gaskell (gaskell@jlab.org).

Contact camsonne@jlab.org for any shift related issues.

Friday, August 18 RC: Nathaly Santesteban Show run plans	Shift canceled / onhold	SL: Robert Michaels TO: Zhenyu Ye (<i>Trade requested</i>)	SL: Sanghwa Park TO: Bhesha Devkota
Saturday, August 19 RC: Nathaly Santesteban Show run plans	SL: Hisham Albataineh	SL: Bogdan Wojtsekhowski TO:	SL: Bhesha Devkota TO:
Sunday, August 20 RC: Nathaly Santesteban Show run plans	SL: Hisham Albataineh	SL: TO:	SL: TO:
Monday, August 21 RC: Nathaly Santesteban Show run plans	SL: TO: Hisham Albataineh	SL: Tanja Horn TO:	SL: Jan-Ping Chen TO: Sanghwa Park
Tuesday, August 22 RC: Nathaly Santesteban Show run plans	SL: TO: Hisham Albataineh (<i>Trade requested</i>)	SL: Ed Brash TO: Tanja Horn	SL: Nathan Heinrich TO: Bhesha Devkota
Wednesday, August 23 RC: Robert Michaels Show run plans	SL: TO:	SL: Nathan Heinrich TO: Alicia Postuma	SL: Ligang Tang TO: Bhesha Devkota
Thursday, August 24 RC: Robert Michaels Show run plans	SL: TO:	SL: Tanja Horn TO: Nathan Heinrich	SL: TO: Alicia Postuma
Friday, August 25 RC: Robert Michaels Show run plans	SL: TO:	SL: Tanja Horn TO: Nathan Heinrich	SL: TO: Bhesha Devkota
Saturday, August 26 RC: Robert Michaels Show run plans	SL: TO:	SL: Bogdan Wojtsekhowski TO: Nathan Heinrich	SL: TO: Bhesha Devkota
Sunday, August 27 RC: Robert Michaels Show run plans	SL: TO:	SL: Nathan Heinrich TO: Alicia Postuma	SL: TO:
Monday, August 28 RC: Robert Michaels Show run plans	SL: TO:	SL: Nathan Heinrich TO: Hunter Presley	SL: Jan-Ping Chen TO:
Tuesday, August 29 RC: Robert Michaels	SL: Peter Bosted TO: Alicia Postuma	SL: Nathan Heinrich TO: Hunter Presley	SL: TO: Bhesha Devkota

NPS Run Group 1 Shift Schedule is open – please consider signing up. Great training opportunity for students!

More day-to-day updates: [NPS Logbook](#)

Summary

- ❑ NPS is a new facility in Hall C allowing for high-precision studies of cross sections and polarization observable involving neutral final states
- ❑ The currently approved NPS science program consists of eight approved experiments aiming at
 - Systematically study the reaction mechanism and factorization
 - Map out nucleon structure in new kinematic regimes
- ❑ Some exciting new physics ideas are under development combining NPS with positron beam and/or other equipment in Hall C (possibly 22 GeV JLab)
- ❑ NPS run group 1 is scheduled to start as soon as 18 August 2023 – NPS installation and preparations for the run are ongoing
- ❑ Shift schedule is open - many opportunities for students and/or interested groups. Please consider signing up!

NPS - activities

