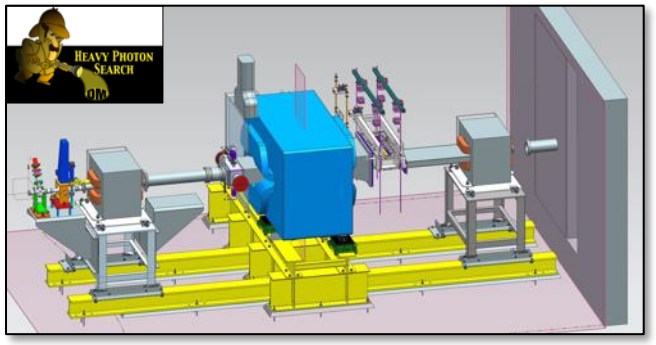
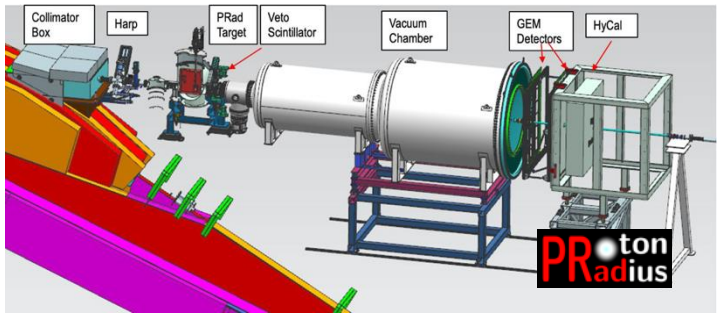
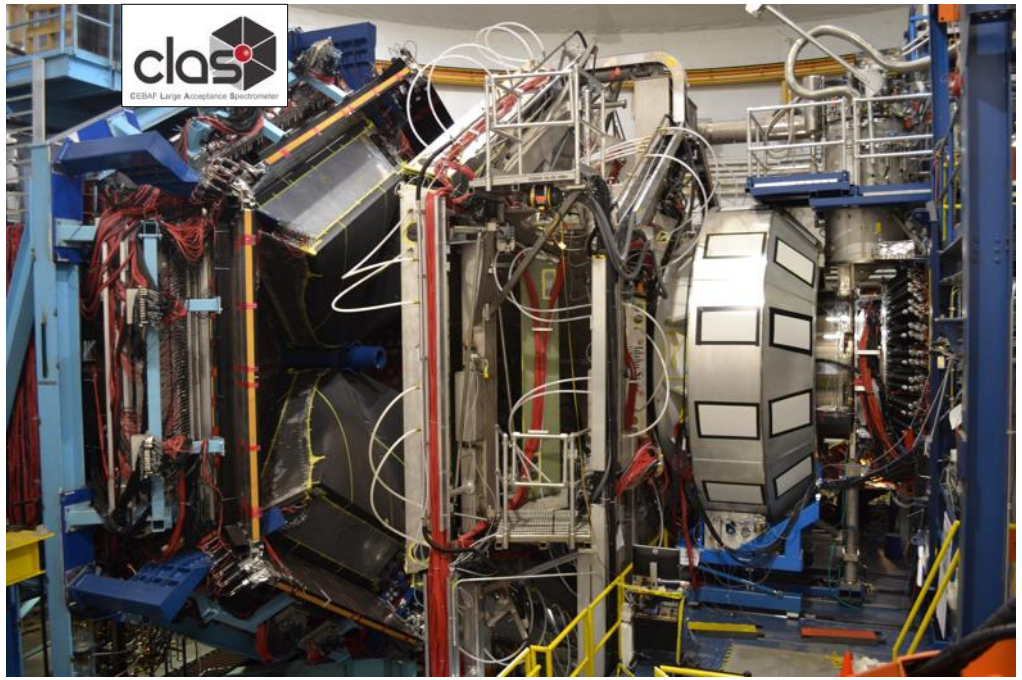
Hall B Status Update







S. Stepanyan, Hall B Department Manager

HPS Collaboration Meeting, JLAB

October 19 to 21, 2026

Hall B staffing update

- Current status:
  - 18 staff scientists and two postdocs.
  - One engineer, a designer, and six technicians.
- Two staff scientists separated from the lab in January 2026.
- Veronique Ziegler left the Hall B group as of July 1st, 2026, and has since returned to JLAB as a user.
- We also expect to fill a staff scientist position later this year.

Theses completed over the past year

1. Samy Polcher Rafael (Saclay, France) “Nucleon Structure Studies: DVCS on Polarized Protons with CLAS12 Experiment”, September 2025. [CLAS]
2. Juan Sebastian Alvarado (Orsay, France) “Exploring the Nucleon Structure via Deep Electroproduction Processes via Deep Electroproduction Processes”, September 2025. [CLAS]
3. Rory O’Dwyer (Stanford University) “Displaced Vertex Search: SIMPS”, June 2026. [HPS]
4. Mariana Tenorio Pita (Old Dominion University) “Tagged J/ψ Photoproduction Near Threshold”, June 2026. [CLAS]

Publications

- Hall B submitted 12 collaboration papers over the last year, and 8 were published (*CLAS12*, *CLAS6*, HPS).

2026 Publications

1. K. Neupane, D.S. Carman et al. (CLAS Collaboration),"Measurements of γvp → p'π+π- Cross Sections with the CLAS12 Detector for Q2 from 2.4-8.0 GeV2 and W from 1.4-2.1 GeV", arXiv:2609.19395, submitted to Phys. Rev. C (2026). (arXiv)
2. R. Tyson et al. (CLAS Collaboration), "First Measurement of Near-Threshold J/ψ Photoproduction on the Neutron", arXiv:2609.03579, submitted to Phys. Rev. Lett. (2026). (arXiv)
3. S. Lee et al. (CLAS Collaboration), "Multi-Differential DVCS Cross-Section Measurement on the Proton in the Valence Region with CLAS12", arXiv:2608.20585, submitted to Phys. Rev. C (2026). (arXiv)
4. A. Trivedi, D.S. Carman et al. (CLAS Collaboration),"Measurements of γvp → π+π-p' Cross Sections with the CLAS Detector for Q2 from 2.0-5.0 GeV2 and W from 1.400-2.125 GeV", arXiv:2607:06793, submitted to Phys. Rev. C (2026). (arXiv)
5. A.G. Acar *et al. (CLAS Collaboration), "Measurements* of Beam Spin Asymmetry of $\pi^{\pm}\pi^{0}$ DiHadrons at CLAS12", arXiv:2602.1471, submitted to Phys. Rev. Lett. (2026). (arXiv)
6. T. Hu *et al. (CLAS Collaboration)*, "First Measurement of Polarized Spin-Density Matrix Elements and Differential Cross Sections dσ/dt in ω Photoproduction off the Proton for $2.7 < E_{\gamma} < 5.2$ GeV using CLAS at Jefferson Lab", Phys. Lett. B 880, 140845 (2026). (paper)
7. H. Jiang *et al. (CLAS Collaboration)*, "Polarization Observables T and F in the γp → π^{0}p Reaction at CLAS", Phys. Rev. C 114, 015203 (2026). (paper)
8. P. Chatagnon *et al. (CLAS Collaboration), "Measurement* of the Near-Threshold J/ψ Photoproduction Cross Section with the CLAS12 Experiment", Phys. Rev. C. 113, 065203 (2026). (paper)
9. M. McEneaney *et al. (CLAS Collaboration)*, "Longitudinal Spin Transfer to Λ Hyperons in Semi-Inclusive Deep Inelastic Scattering with the CLAS12 Spectrometer", Phys. Rev. C 113, 092019 (2026). (paper)
10. S.A. Dytman *et al. (CLAS Collaboration)*, "Proton Transparency and Neutrino Physics: New Methods and Modeling", Phys. Rev. D, 113, 092007 (2026). (paper)
11. S. Paul *et al. (CLAS Collaboration)*, "First Study of the Nuclear Response to Fast Hadrons via Angular Correlations between Pions and Slow Protons in Electron-Nucleus Scattering", Phys. Lett. B 874, 140250 (2026). (paper)
12. P.H. Adrian *et al.* (HPS Collaboration), "First displaced vertex search for electroproduced dark-sector strongly interacting massive particles by the HPS experiment", Phys. Rev. D **113**, 032019 (2026). (paper)

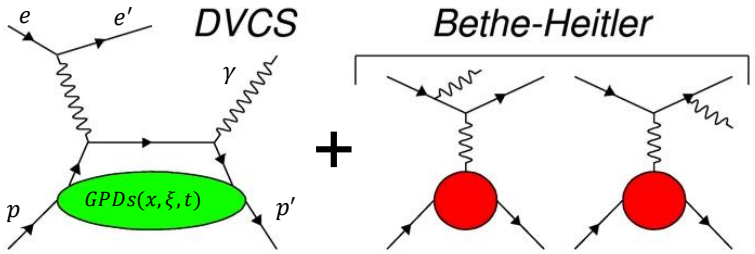
Other, non-collaboration, publications

2026 Publications

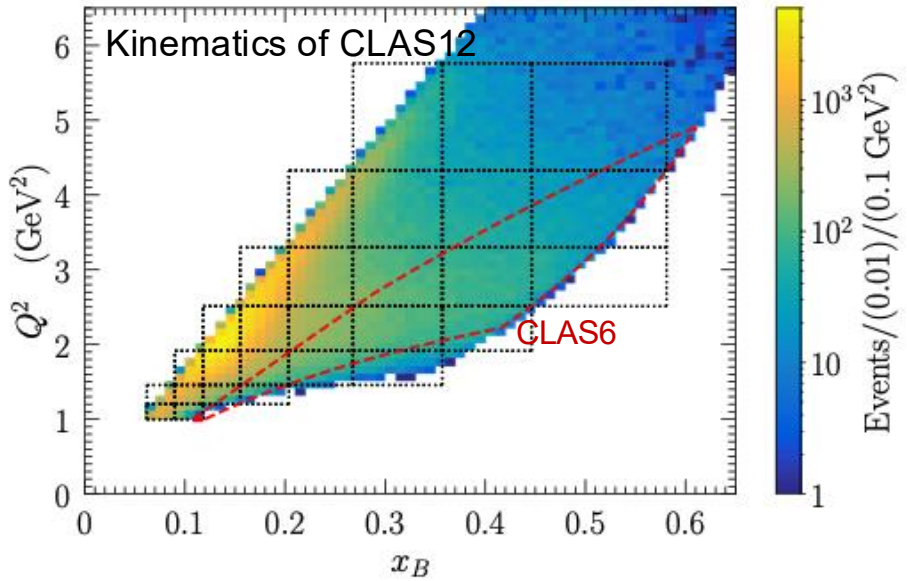
1. T. Mart, J.A. Djaja, and D.S. Carman, "Electromagnetic Production of Kaons on the Nucleon", Prog. Part. Nucl. Phys. 150, 104252 (2026). (paper).
2. J. S. Alvarado, N. Baltzell, M. Bondi, P. Chatagnon, et al., "*Electro- and photoproduction of muon pairs with μCLAS12: Double Deeply Virtual Compton Scattering, Timelike Compton Scattering, and J/ψ production*" has been accepted for publication in EPJ (2605.11690).
3. H. Avakian, "Solving Challenges in QCD 3D Partonic Distributions", Eur. Phys. J. A 62, 84 (2026). (paper)
4. V.I. Mokeev and D.S. Carman, "The Roper Resonance Structure and Emergence of Hadron Mass from Exclusive Meson Electroproduction Data", Acta Phys. Pol. B 57, 2-A5 (2026). (paper)
5. V. Burkert and E. Klempt, "The Roper Resonance and Kin", Acta Phys. Pol. B 57, 2-A4 (2026). (paper)
6. V. Burkert, G. Eichmann, and E. Klempt, "The Impact of γN and γ*N Interactions on our Understanding of Nucleon Excitations", Prog. Part. Nucl. Phys. 146, 104214 (2026). (paper)

The full list, including technical papers on detector developments, AI/ML, and SRO can be found at https://www.jlab.org/Hall-B/pubs-web/non-collab.html

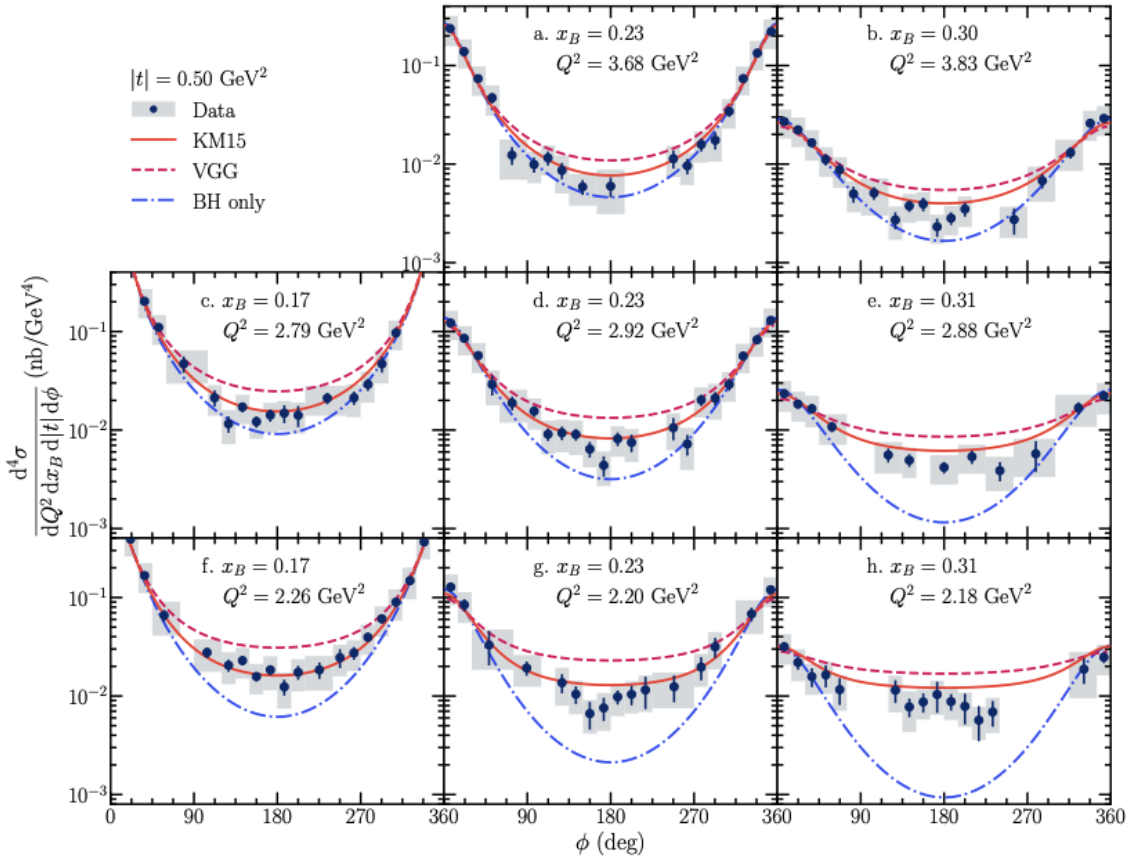
Proton DVCS Cross sections



$$\frac{d^4\sigma_{ep\to e'p'\gamma}}{dx_B\, dQ^2\, d|t|\, d\phi} = 2\pi\Gamma\left(|\mathcal{T}_{\rm DVCS}|^2 + |\mathcal{T}_{\rm BH}|^2 + \mathcal{I}\right)$$



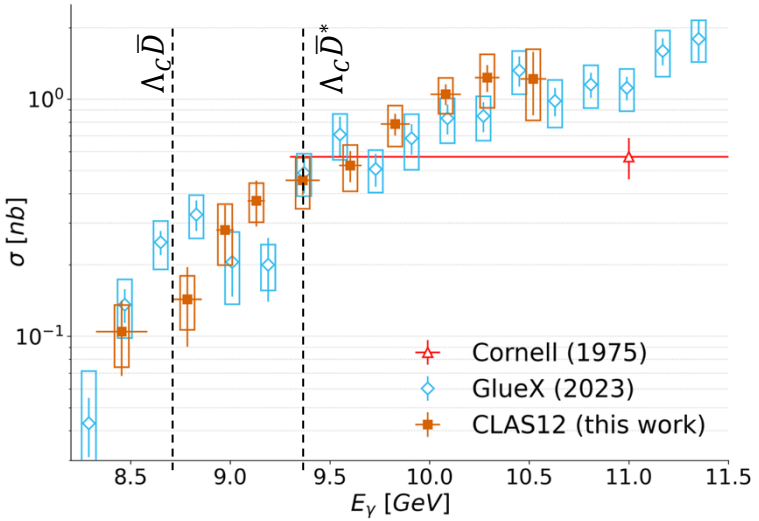
S. Lee, et al., CLAS Collaboration, arXiv:2608.20585 submitted to *PRC.*

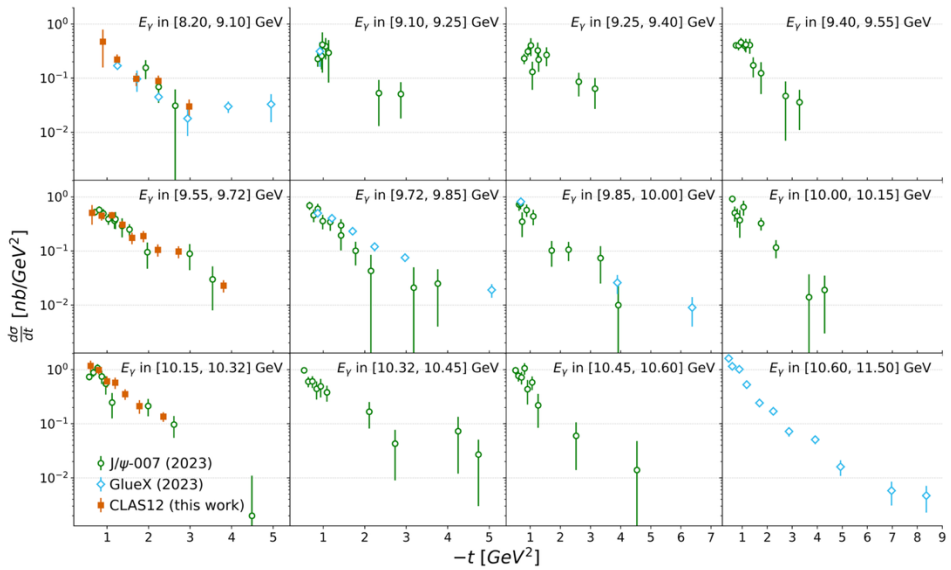


J/ψ on the proton

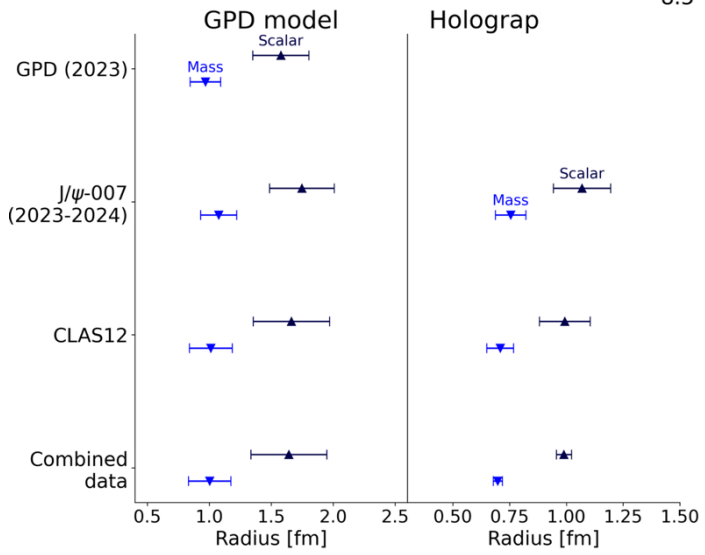
P. Chatagnon *et al.*, [the CLAS Collaboration], *"Measurement of the near-threshold J/ψ photoproduction cross section with the CLAS12 experiment"*, Phys. Rev. C. 113, 065203 (2026).

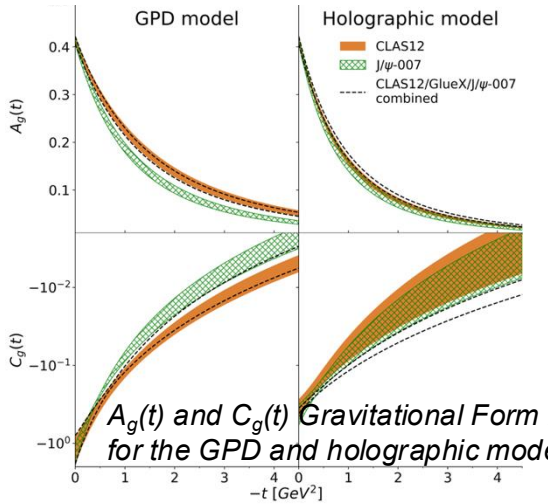
- The E_γ and t-dependances of the near-threshold photoproduction cross section.
- Extract the proton mass and scalar radii from the t-dependence of phenomenological models.
- Study the gluon Gravitational Form Factors $A_g(t)$ and $C_g(t)$ of the proton using both GPD and holographic-QCD approaches.
- No evidence for the $\Lambda_C \overline{D}$ and $\Lambda_C \overline{D}^*$ threshold effects reported by GluEx.





Extracted mass and scalar ra

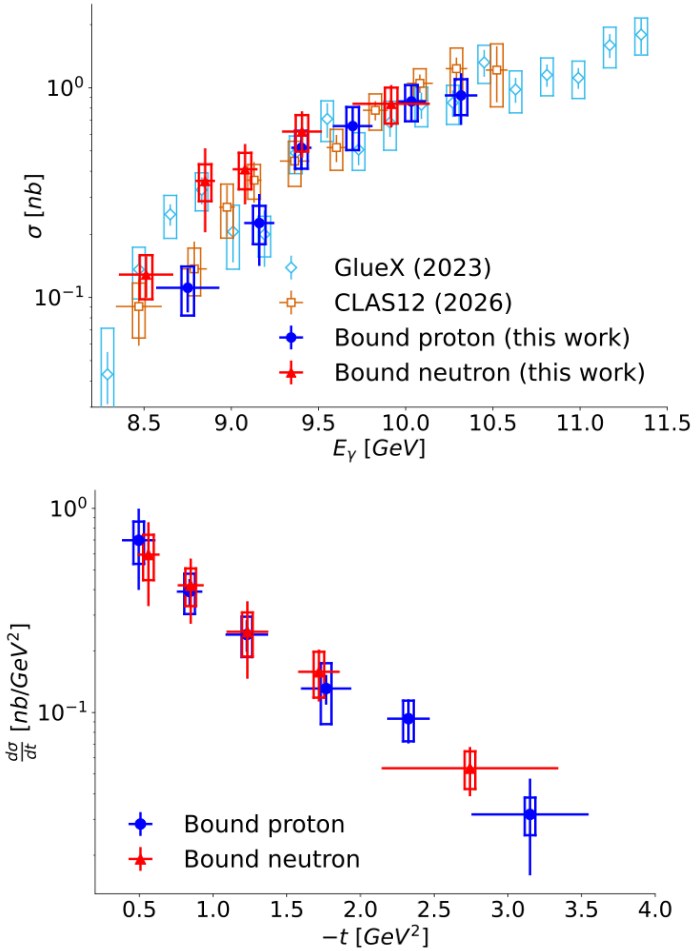




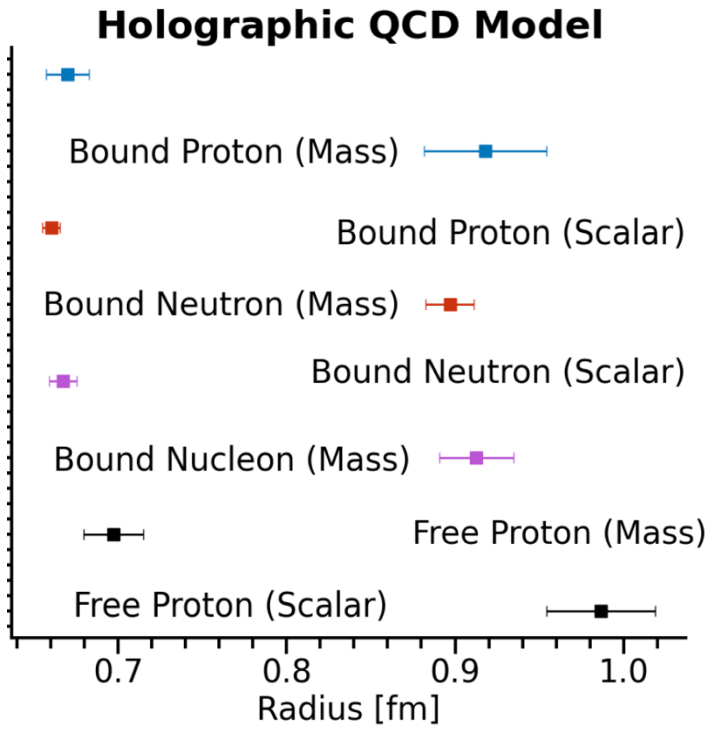
$A_g(t)$ and $C_g(t)$ Gravitational Form Factors for the GPD and holographic models

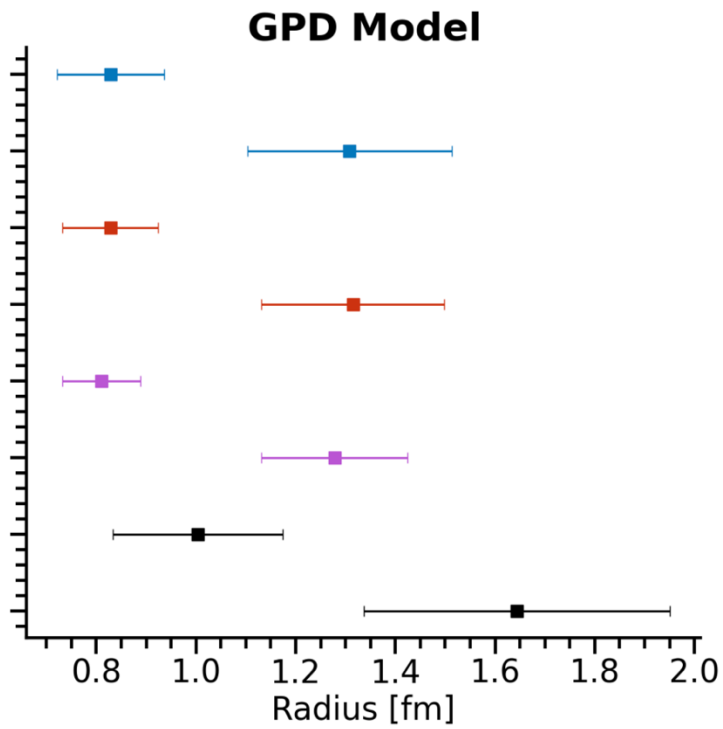
J/ψ on deuteron

Paper R. Tyson *et al.*, "Measurement of Near-Threshold J/ψ Quasi-real Photoproduction on the Proton and Neutron at CLAS12," is currently completing the ad hoc review process and is expected to be released for publication by the end of September.



First exclusive near-threshold photoproduction measurement of $\gamma n \to n' J/\psi$, enabling a comparison of gluonic properties in the neutron and proton, as well as in free and bound nucleons, including the gluonic mass and scalar radii.



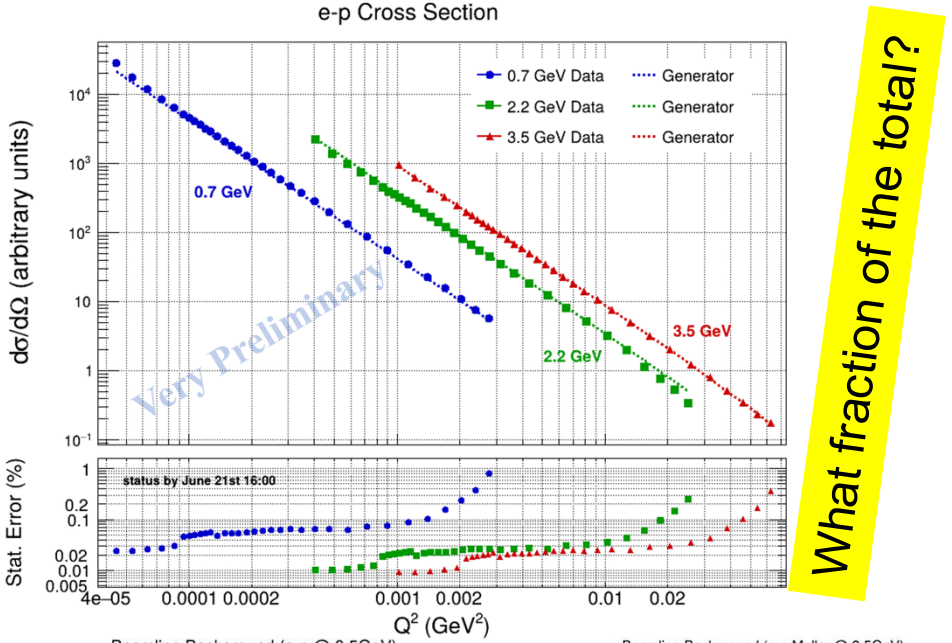


PRad II (E12-20-004): completed on June 24

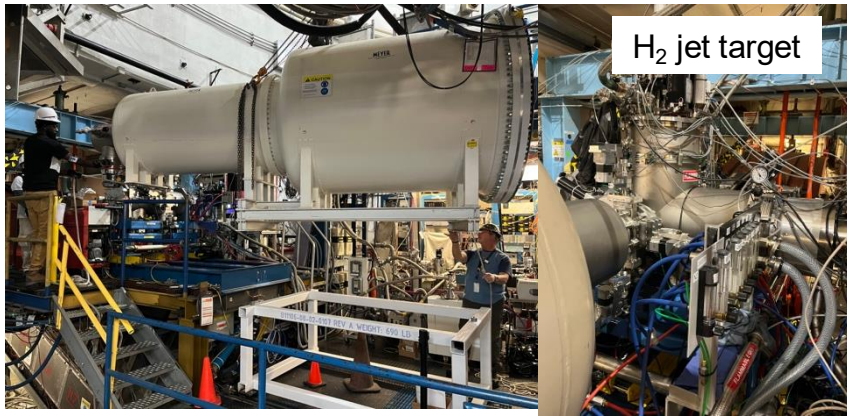
The experiment achieved, and in many cases exceeded, its original goals and performance expectations.

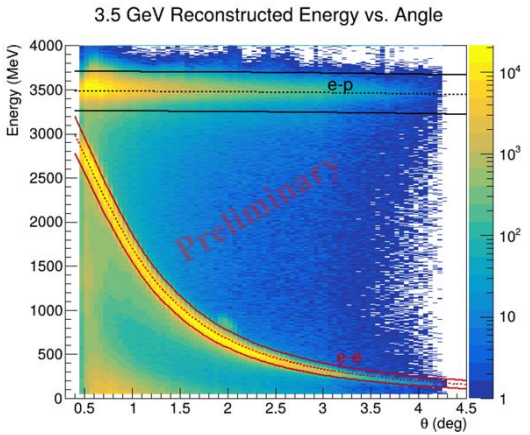
	PRad-I	PRad-II
H2 cell pressure	470/2.7 mTorr	**1030/4.3 mTorr**
H2 gas flow	600 cc/min	**1300 cc/min**
H2 gas density	$2x10^{18}$ H/cm^2	**$5.5x10^{18}$ h/cm^2**
Scatt. Cham. Press.	0.5 mTorr	**0.012 mTorr**
GEM	1-plane, No Tracking	**2-planes, with Tracking**
HyCal	Full HyCal, $PbWO_4$ +Pb-glass	Only $PbWO_4$
Beam Background	~ 10-30% for ep-events	**~ 2% for ep-events**
DAQ rate	4-5 kHz	**20-25 kHz**
Beam current	~ 50 nA	**~ 600 nA**
Luminosity	~ $6x10^{29}$ /cm^{2}s	**~ $2.6x10^{31}$ /cm^{2}s**
Q^2 Range	~ 10^{-4} GeV^2, No Veto counters	**~ 10^{-5} GeV^2**, with Veto counters (Moller background suppression)

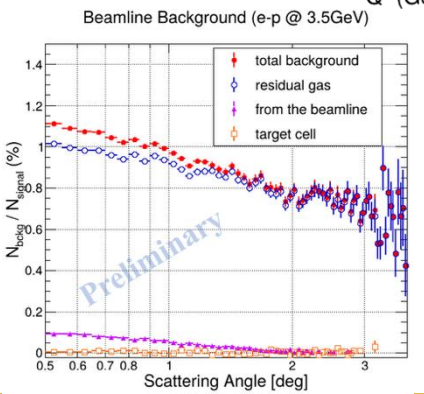
All planned data at beam energies 0.7, 2.1, and 3.5 GeV were successfully collected.

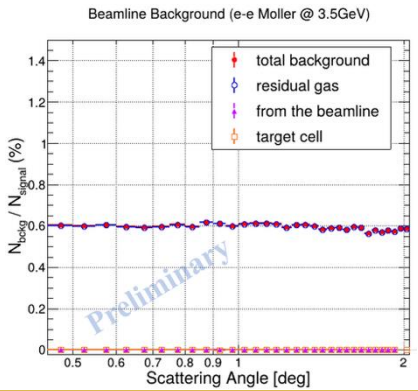


What fraction of the total?



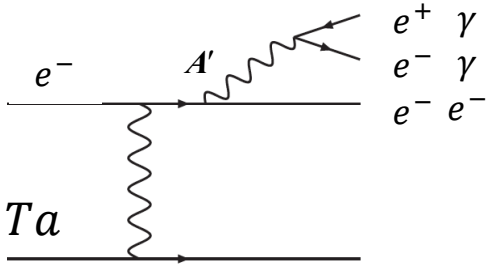




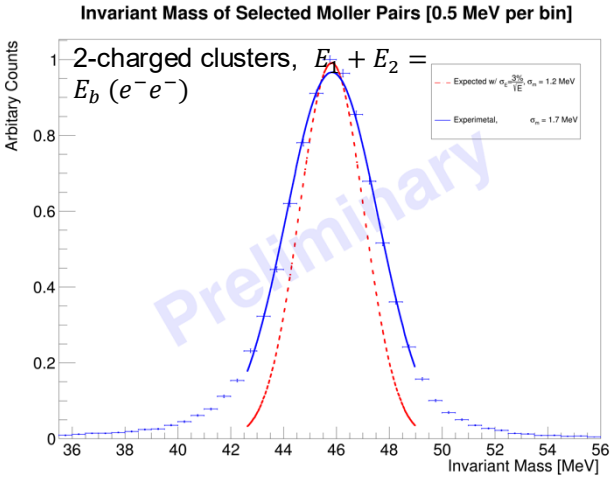


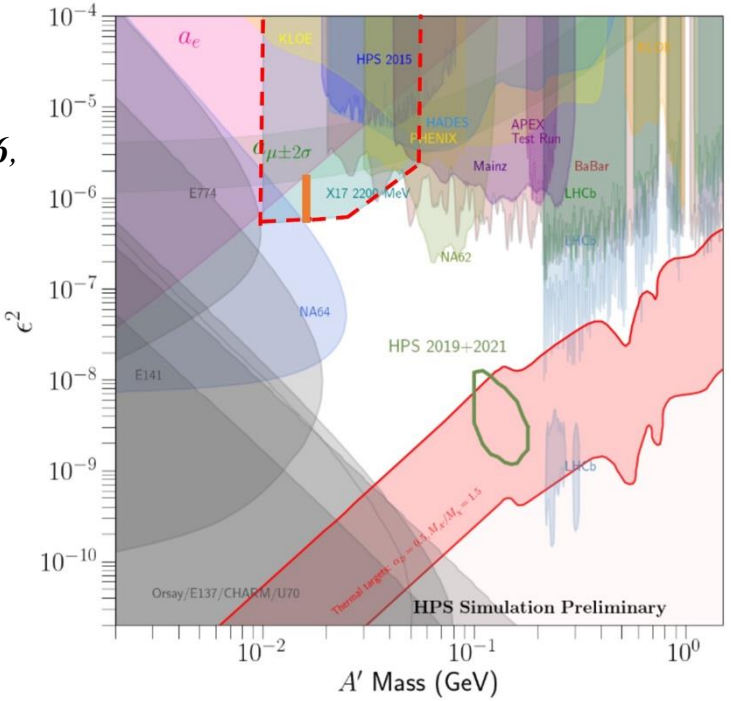
X17 (E12-21-003): 1st part ended on August 14

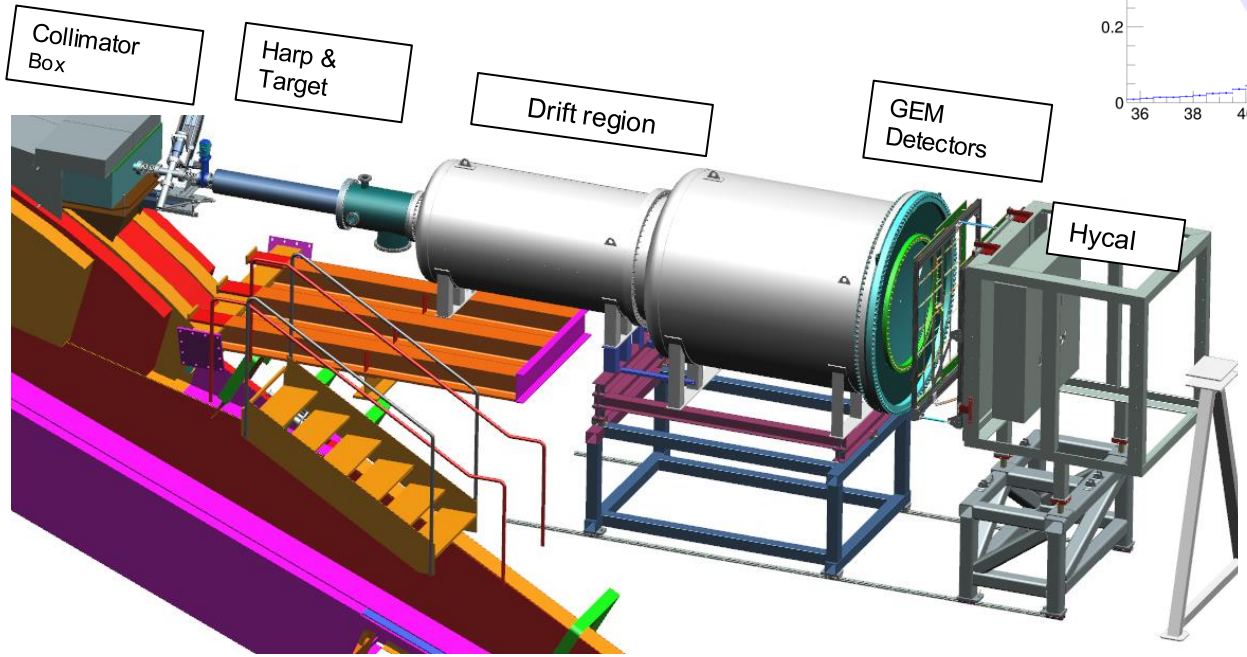
The experiment searches for a hypothetical 17 MeV neutral boson reported by the Atomki group in nuclear transitions of ^{8}Be, ^{4}He, and ^{12}C [*PRL 116, 042501 (2016), PRC* ***104****, 044003 (2021), PRC* ***106****, L061601 (2022)*].

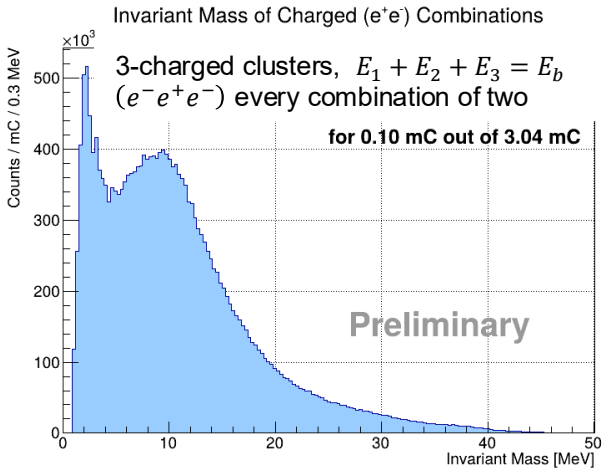


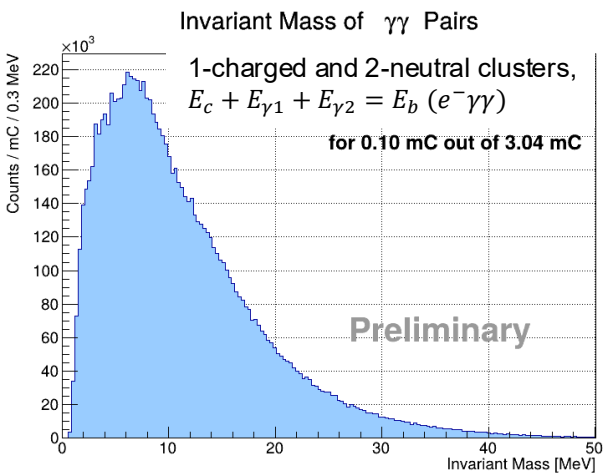
Collected 41% of the expected data. Will continue data collection in FY27









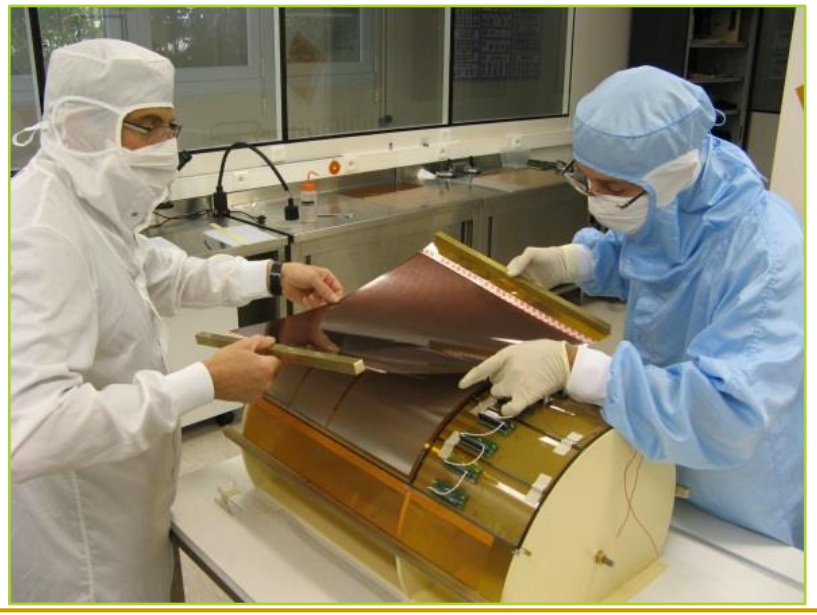


CVT refurbishment

- **Preparing to replace aging Micromegas tracker modules.**
  - Work at CEA Saclay has begun, and the first replacement modules are expected to arrive later this year.
  - Replacement should happen before the next run (RGK), currently expected to start in mid-April.





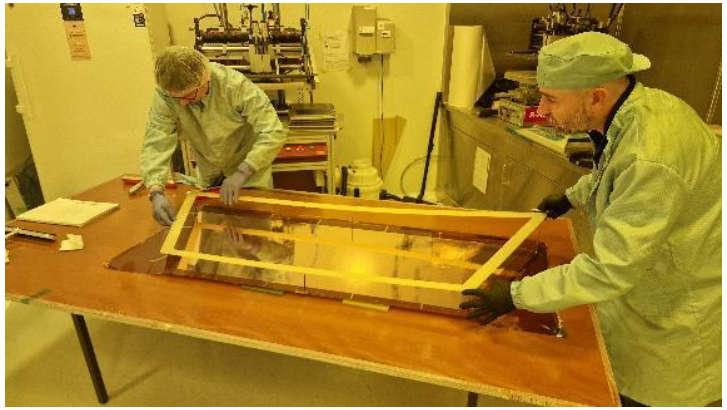


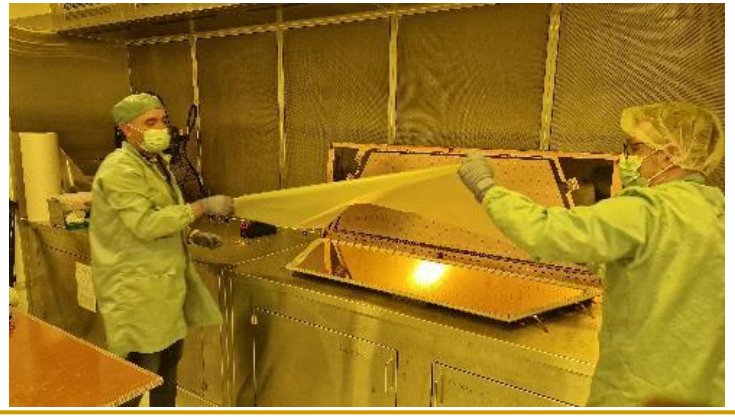
CLAS12 luminosity upgrade – R1 μRWell project

- The 2nd **μ**RWELL prototype (V7), with near-final arrangements for the readout layers, was fully assembled at the CERN MPGD group and arrived in April as expected.
- 2X1-D detectors are almost identical; they differ only in the pre-preg thickness of the μRWells.

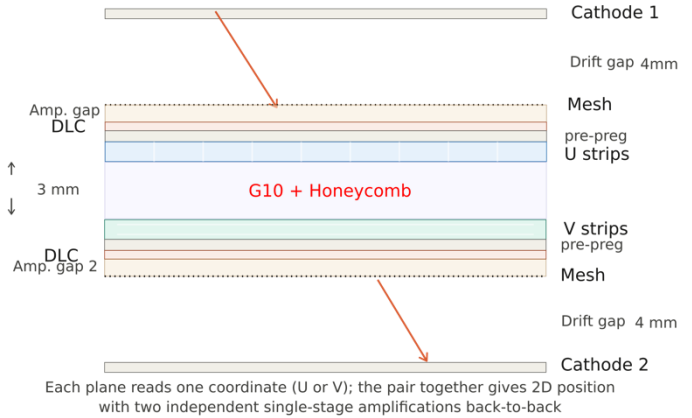




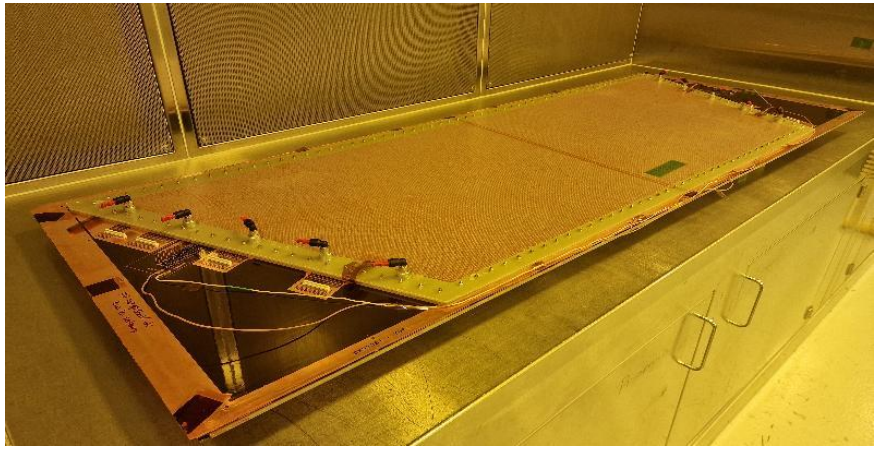




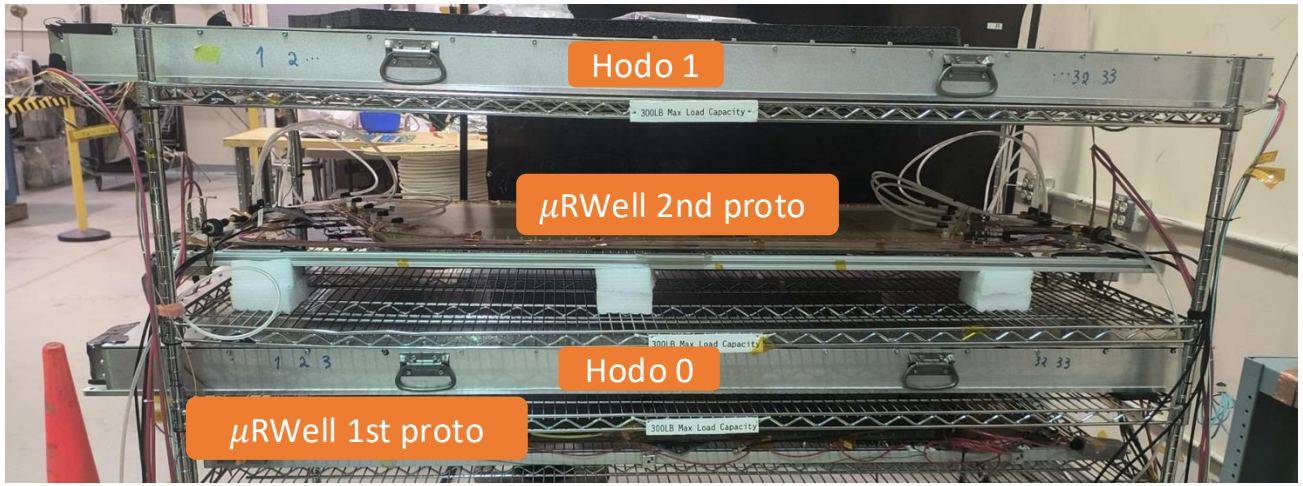
2nd prototype: Dual 1D detector

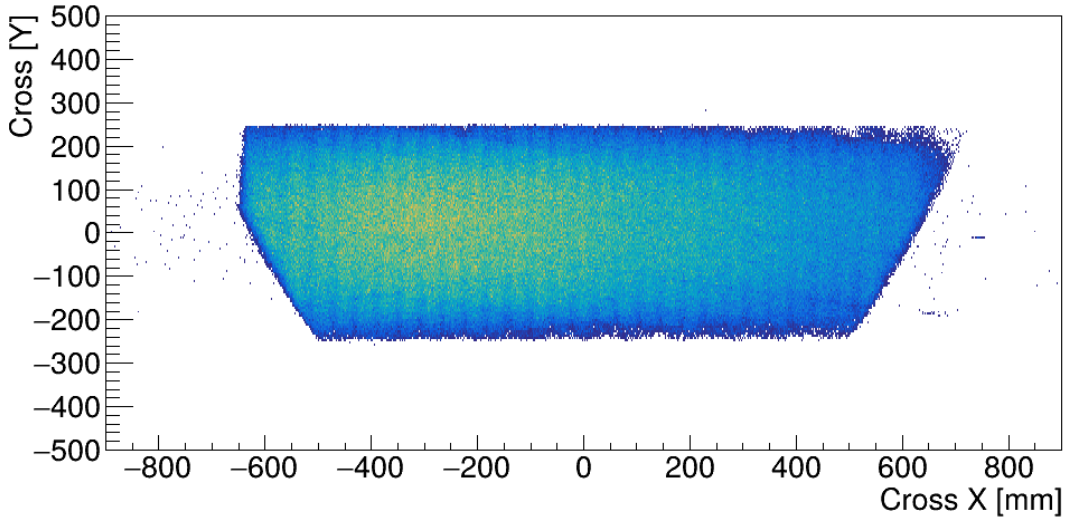


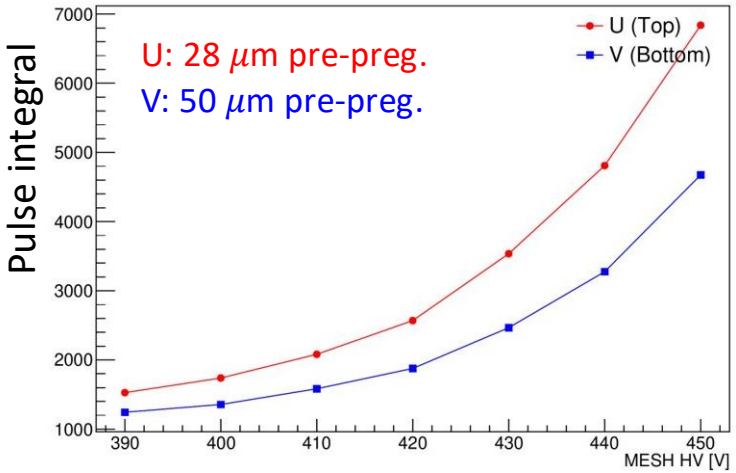
Each plane reads one coordinate (U or V); the pair together gives 2D position with two independent single-stage amplifications back-to-back

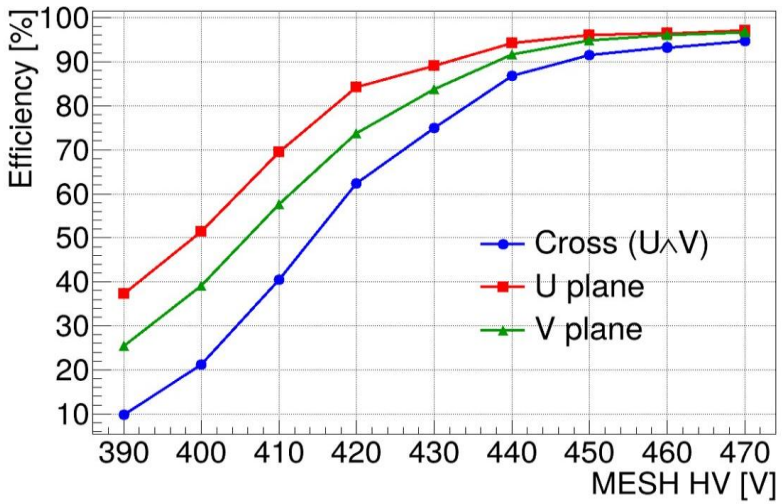


Ongoing tests of new μRWell prototype (v7 design)









- After a month of preparations, cosmic tests are in full swing.
- Got the expected efficiency results, higher than the 1st prototype with capacitive sharing.
- Signal amplitudes are higher for thinner pre-preg.
- Challenge: time resolution is ~ 35 ns for UV coincidence.
- Parallel efforts by Fast Electronics Group:
  - Finishing design of the VMM3 RO board w/ Hirose connectors,
  - Panasonic-to-Hrose adapter design is nearly complete,
  - By the end of summer, boards should be ready to read out μRWell with VMM3.

The results of this prototype test and what we learn from operating it will define the final design of the full module.

Future plans □ μCLAS12 @ $10^{37} cm^{-2} s^{-1}$

$$ep \rightarrow e' \gamma^* p' \rightarrow e' \mu^+ \mu^- p'$$

The setup is based on the existing CLAS12 forward detector.

- *A lead shield to reduce pion background in the FD.*
- *A PbWO4* calorimeter *for scattered electron identification.*
- *A GEM Forward Vertex* tracker *will be used for vertexing.*
- *A recoil proton detector – μRWELL recoil tracker surrounds the target, and a Central Scintillator Hodoscope.*

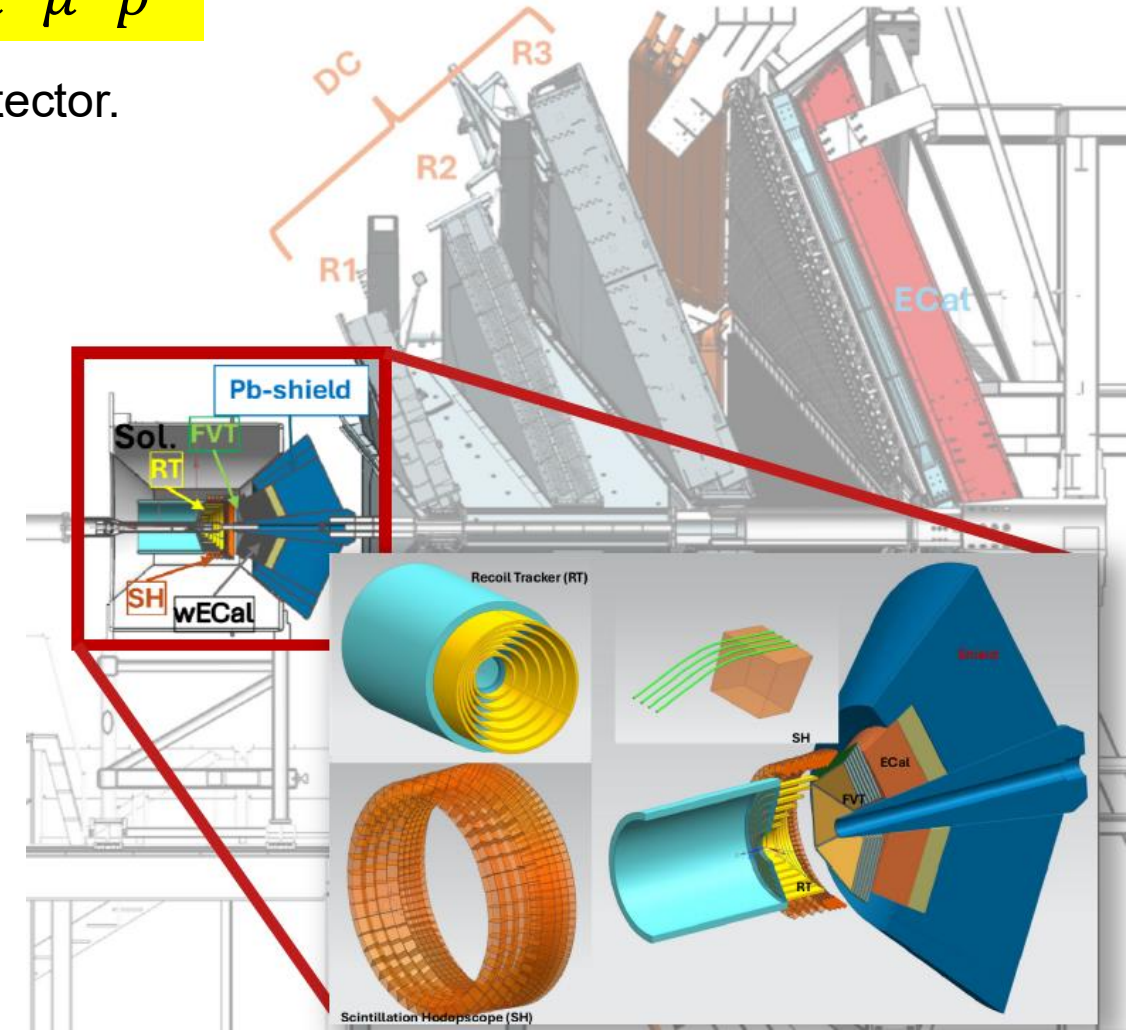
Single MIP (μ) Trigger rate: 21kHz.

DDVCS and J/ψ electroproduction:

$$e' \mu^+ \mu^-$$

Time-like Compton scattering

$$p' \mu^+ \mu^-$$



On a way to μCLAS!2

Standard CLAS12 with μRWell (2×10^{35} $cm^{-2}s^{-1}$)

Staged approach to μCLAS12 (under study)

- Stage II (up to 10^{36} $cm^{-2}s^{-1}$): new physics, e.g., J/ψ photoproduction on the bound neutron in deuterium, ~26× the RG-B sample, and on nuclear targets in general.

New interest in using μCLAS12/CLAS12 for BSM physics

- Dark photon searches (M. Graham)
- CLFV: search for eN → μX (e.g., via leptoquarks); high luminosity is key (Y. Furletova)
- LNV: lepton double charge exchange A(e^-, μ^+/e^+)X, complementary to $0\nu\beta\beta$ decay; (F. Cappuzzello)

Upgrade path: Stage II

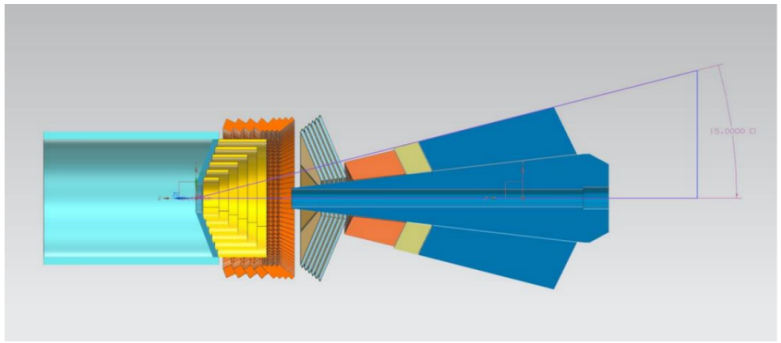
Stage I
7° Møller cone, no Forward Tagger
up to 5 x10^{35} $cm^{-2}s^{-1}$

→

Stage II
wECal + Pb shield, 7°–15°,no HTCC
up to 10^{36} $cm^{-2}s^{-1}$

→

Stage III = μCLAS12
full FD shield and wCal
10^{37} $cm^{-2}s^{-1}$



Stage II layout: wECal and Pb shield from 7° to 15°

Simulation studies

- Luminosity up to 10^{36} $cm^{-2}s^{-1}$, based on estimated background levels
- First estimates for J/ψ production on neutron

Configuration

- wECal + Pb shield from the 7° Møller cone to 15°
- HTCC removed

Physics

- CLAS12 program, limited to high-rate kinematics
- J/ψ quasi-real photoproduction tagging the recoil nucleon
- Deuteron target: separate bound neutron and proton
- Possible first DDVCS measurements

Operations

- Experience running with μA beam currents

The run plan for the next two years

FY27 – expect 26 weeks of running, but it may end up having only 22 weeks.

- Starts with a low-energy machine with two settings, 500 MeV/linac and 550 MeV/linac, for about 21 PAC days.
- Hall B will continue X17 at 500 MeV/linac for the first part (~10 PAC days). This will bring X17 to 50% of approved beam time.

Run Group	Setup / Status	Target	Beam Energy	Start Date	End Date	Scheduled Calendar Days	Remaining PAC Days Before Run	Scheduled PAC Days	Actual PAC Days from ABUs	Remaining PAC Days After Run
~~**RG-E**~~	-	~~liq. D2 & nucl. doublet~~	~~11~~			~~66~~	~~33~~	~~33~~	-	~~0~~
	reconfigure	change				7		4		
RG-K		liq. H2	8.8			120	52	60		0
							sum:	**97**		

FY28

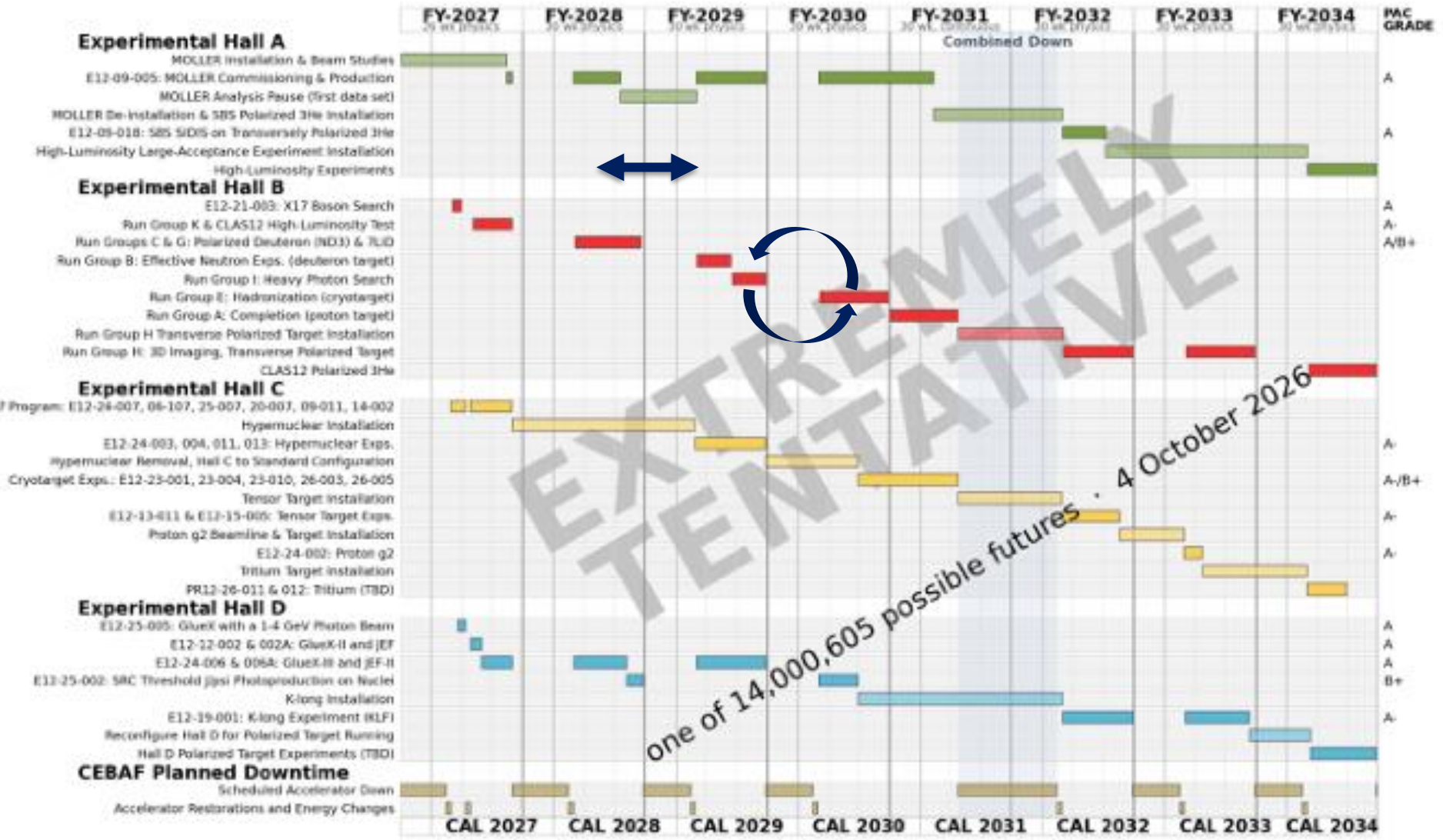
Run Group	Setup / Status	Target	Beam Energy	Start Date	End Date	Scheduled Calendar Days	Remaining PAC Days Before Run	Scheduled PAC Days	Actual PAC Days from ABUs	Remaining PAC Days After Run
RG-C		long. pol. NH3/ND3	11			80	40	40		0
RG-G		long. pol. 7LiD	11			110	55	55		0
							sum:	**95**		

The annual runtime is shorter than we projected a couple of years ago. So, we can't keep the previously shown experimental schedules.

The tentative plan for FY-2028 depends on the readiness of polarized targets.

Why move HPS to FY-2030?

- Transitioning from CLAS12 to HPS, or vice versa, will significantly cut the running time
- Running HPS with any CLAS12 run group in the same run cycle is impractical.
- In 2030, HPS can run whatever is available, 22 or 26 weeks, and possibly complete the experiment.



Summary

- Hall B continues to make strong progress across all fronts, including publications, thesis production, data calibration and processing, detector installation, and experimental operations.
- PRad-II was completed successfully, along with the first part of the X17 experiment.
- Several major improvements have been implemented in the CLAS12 simulation and reconstruction software, including code speedups and improved Forward Detector tracking using AI/ML techniques. Development of enhanced Central Detector tracking is progressing.
- The High-Luminosity Upgrade project continues to advance. CERN delivered the second large-area Micromegas prototype, featuring a near-final layer layout, and it is currently undergoing testing at JLab.
- Development of μCLAS12 is picking up. The staged approach will help with construction with limited resources while opening new physics opportunities.
- The run schedule for the next two years is nearly finalized. 30 weeks/year of beam for physics allows us to continue X17 and complete RG-K experiments in 2027, and RG-C and RG-G run groups in 2028.