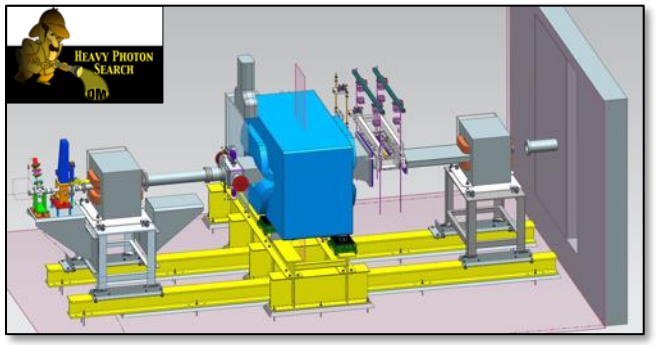
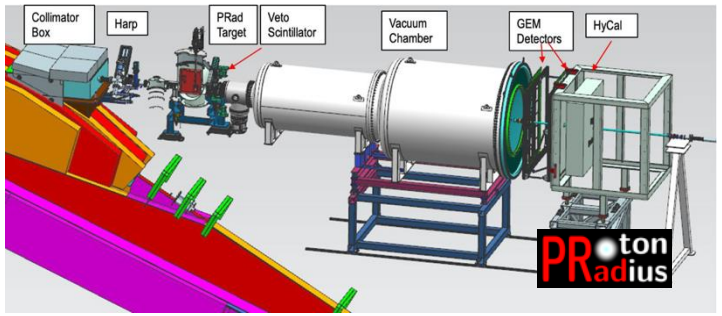
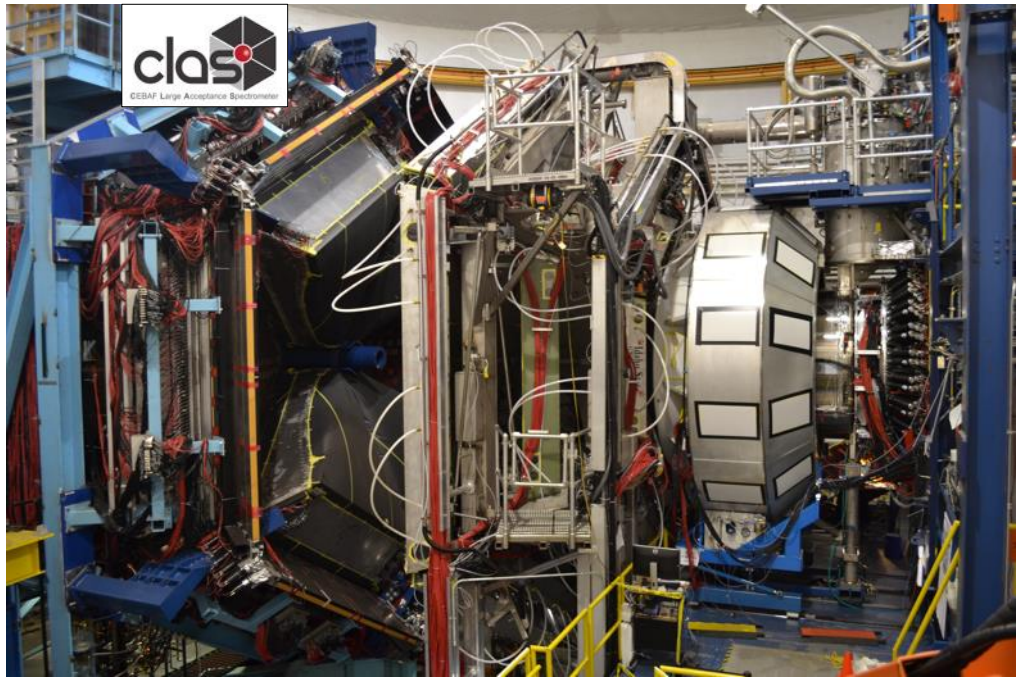
Status of Hall-B







S. Stepanyan, Hall B group leader

PAC54 meeting, JLAB

July 6 – 10, 2026

Outline of the talk:

- News from the Hall B group
- Publications and theses
- Progress on previous experiments
- The current run: Prad II/X17
- Other Hall B Developments
- Summary

Hall B staffing update

- Stepan Stepanyan assumed the position of Hall B group leader on September 1st, 2025, following Patrick Achenbach's departure from JLAB.
- Two staff scientists, G. Gavalian and V. Mokeev, separated from the lab in January 2026. Dr. Mokeev has since returned to JLAB as a user from USC.
- Veronique Ziegler left the Hall B group as of July 1st, 2026, and is expected to return to JLAB as a user shortly.
- Recruitment is underway for a postdoctoral research associate to replace Richard Tyson, who left last fall.
- We also expect to fill a staff scientist position later this year.
- Hiring is in progress to replace the retired technician (Calvin Mealer) and designer (Chris Guthrie).

Publications

A total of 13 collaboration papers have been submitted, and 11 have been published since the last PAC meeting (*CLAS12*, *CLAS6*, HPS).

2026 Publications

1. 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)
2. 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)
3. 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)
4. S.A. Dytman *et al. (CLAS Collaboration)*, "Proton Transparency and Neutrino Physics: New Methods and Modeling", Phys. Rev. D, 113, 092007 (2026). (paper)
5. 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)
6. 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)

2025 Publications

1. H. Jiang *et al. (CLAS Collaboration)*, "Polarization Observables T and F in the $\gamma p \rightarrow \pi^{0}p$ Reaction at CLAS", arXiv:2508.17589, submitted to Phys. Rev. C (2025). (arXiv)
2. S. Adhikari *et al. (CLAS Collaboration)*, "Measurement of Beam-Recoil Observables C_x and C_z for $K^{+}\Lambda$ Photoproduction", Phys. Rev. C 112, 065211 (2025). (paper), (summary)
3. A. Kripko *et al. (CLAS Collaboration)*, "Multidimensional Measurements of Beam Single Spin Asymmetries in Semi-Inclusive Deep-Inelastic Charged Kaon Electroproduction off Protons in the Valence Region", Phys. Rev. C 112, 055202 (2025). (paper)
4. D.S. Carman *et al. (CLAS Collaboration)*, "Recoil Polarization in $K^{+}Y$ Electroproduction in the Nucleon Resonance Region with CLAS12", Phys. Rev. C 112, 035206 (2025). (paper), (summary)
5. T. Mineeva *et al. (CLAS Collaboration)*, "Suppression of Neutral Pion Production in Deep-Inelastic Scattering of Nuclei with the CLAS Detector", Phys. Rev. C 112, 035203 (2025). (paper)
6. P. Roy *et al. (CLAS Collaboration)*, "Measurement of Single- and Double-Polarization Observables in the Photoproduction of $\pi^{+}\pi^{-}$ Pairs off the Proton Using CLAS at Jefferson Laboratory", Phys. Rev. C 112, 035201 (2025). (paper)
7. V. Klimenko *et al. (CLAS Collaboration)*, "Inclusive Electron Scattering in the Resonance Region from a Hydrogen Target with CLAS12", Phys. Rev. C 112, 025201 (2025). (paper), (slide), (summary)

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)

2025 Publications

1. I.I. Strakovsky, E.L. Isupov, V. Mokeev, and A. Schmidt, "ρ-Meson Nucleon Scattering Length from CLAS Threshold Photoproduction Measurements", Phys. Rev. D 112, 114045 (2025) (paper)
2. V.D. Burkert *et al.*, "Open Database for GPD Analyses", EPJC 85 8, 838 (2025). (paper)
3. P. Achenbach, D.S. Carman, R.W. Gothe, K. Joo, V.I. Mokeev, and C.D. Roberts, "Experiments on Electroexcitation of Nucleon Resonances and the Emergence of Hadron Mass", Symmetry 17, 1106 (2025). (paper)
4. V. Kubarovsky, J. Rittenhouse West, and S.J. Brodsky, "Quantum Chromodynamics Resolution of the ATOMKI Anomaly in ^{4}He Nuclear Transitions", Phys. Rev. C 111, 024320 (2025). (paper)
5. A.V. Sarantsev *et al.*, "Decays of N* and Δ* Resonances into Nρ, Δπ, and Nf_0(1500)", Phys. Rev. C 112, 015202 (2025). (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

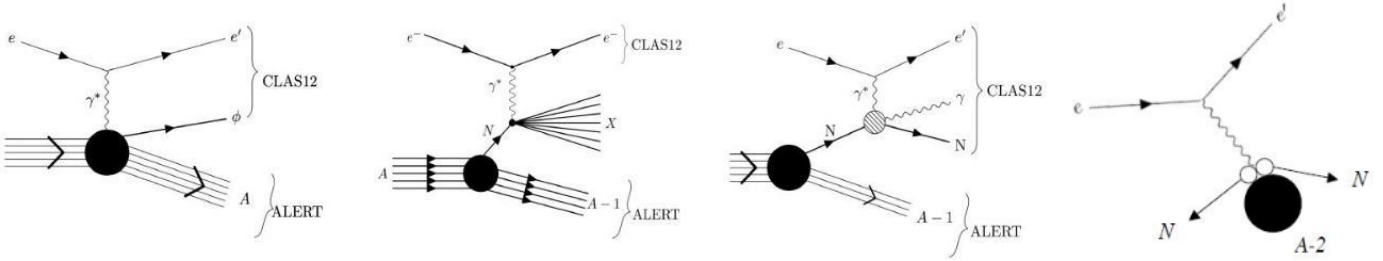
Theses completed since the last PAC meeting

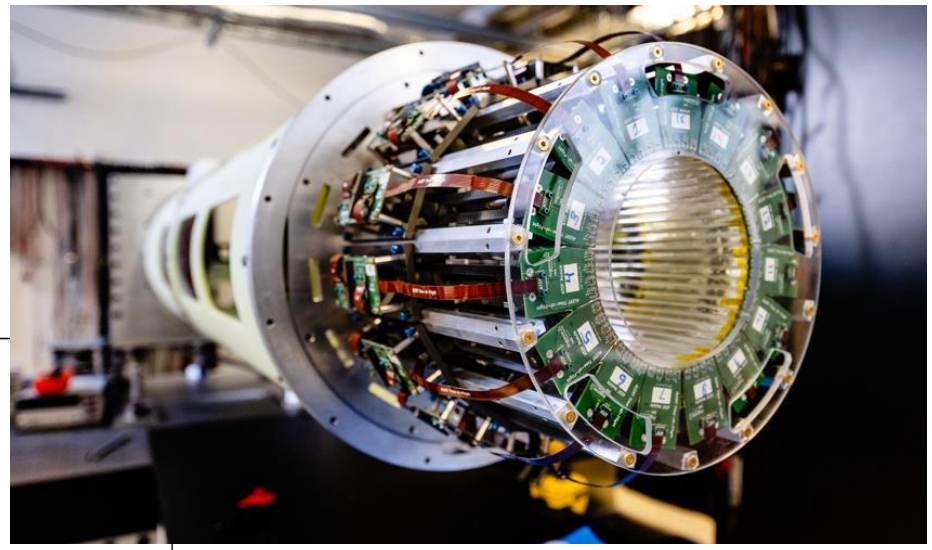
1. Samy Polcher Rafael (Saclay, France) “Nucleon Structure Studies: DVCS on Polarized Protons with CLAS12 Experiment”, September 2025. [CLAS]
2. Juan Sebastian Alvarado (Orsay, France) “Exploring the Nucleon Structure via Deep Electroproduction Processes via Deep Electroproduction Processes”, September 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]

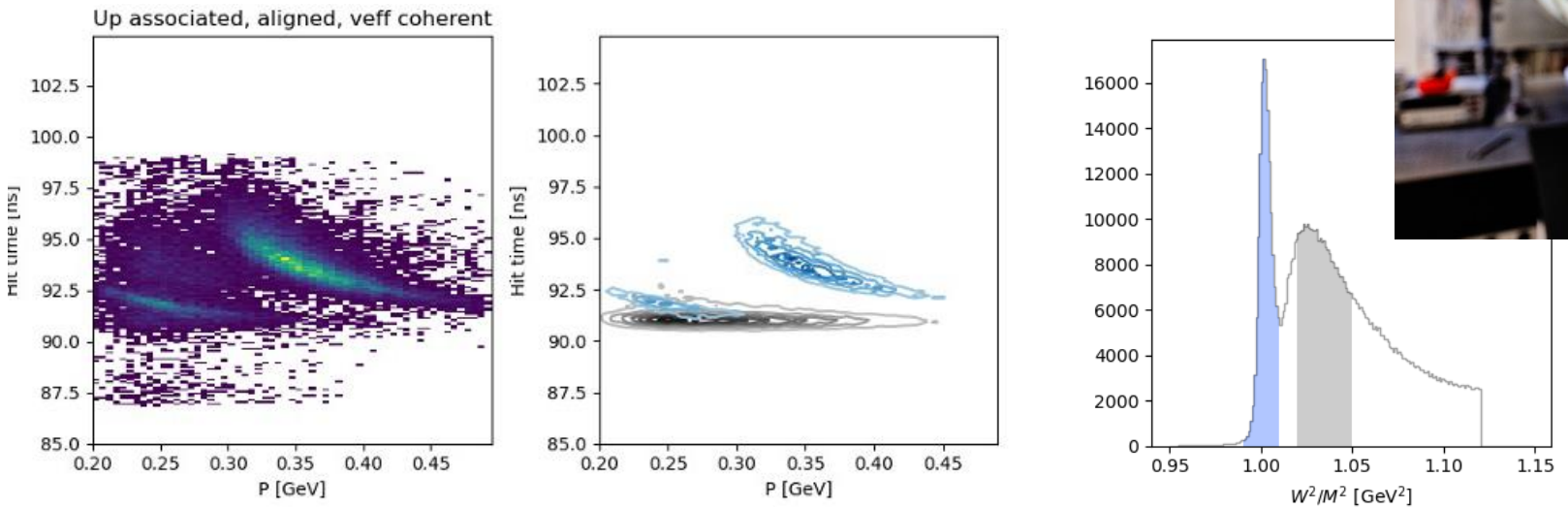
Experiments completed since the last PAC

Completed ALERT (E12-17-012) and ALERT-SRC (E12-23-013) experiments (RG-L run group) in August 2025, collecting >95% of the expected data. Calibration of the data is in full swing and is expected to be completed by the end of the year.

Nuclei GPDs (DVCS and DVMP), tagged DIS,(E12-17-012, A/B/C) and SRC (E12-23-013)



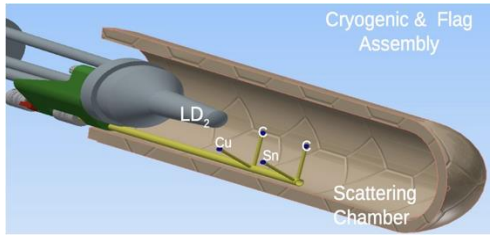


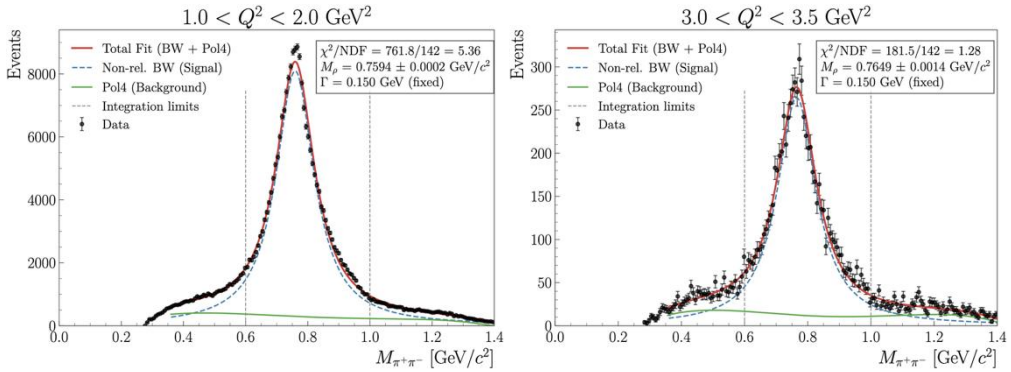


Data calibration and processing completed

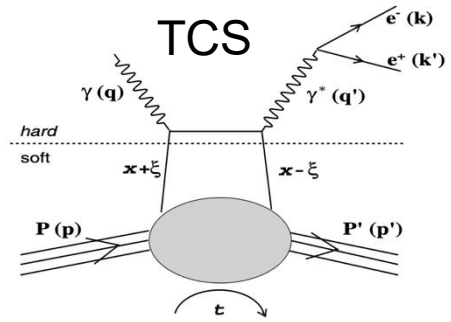
Calibration and processing of CALS12 data from FY23 and FY24 are complete; physics analysis is underway.

RG-D (CT)

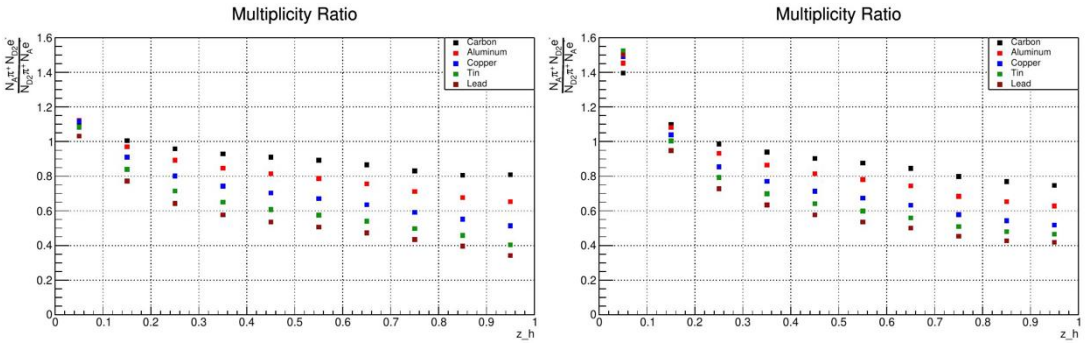


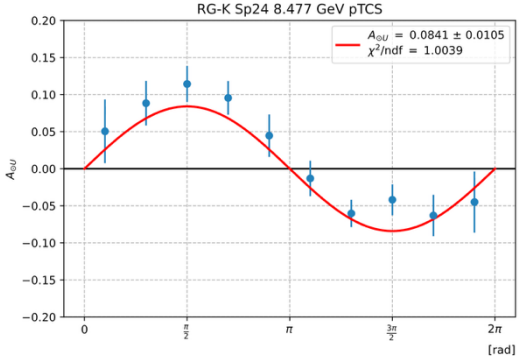


RG-K (GPDs, strangeness production, hybrid baryons.)



RG-E (quark prop.)



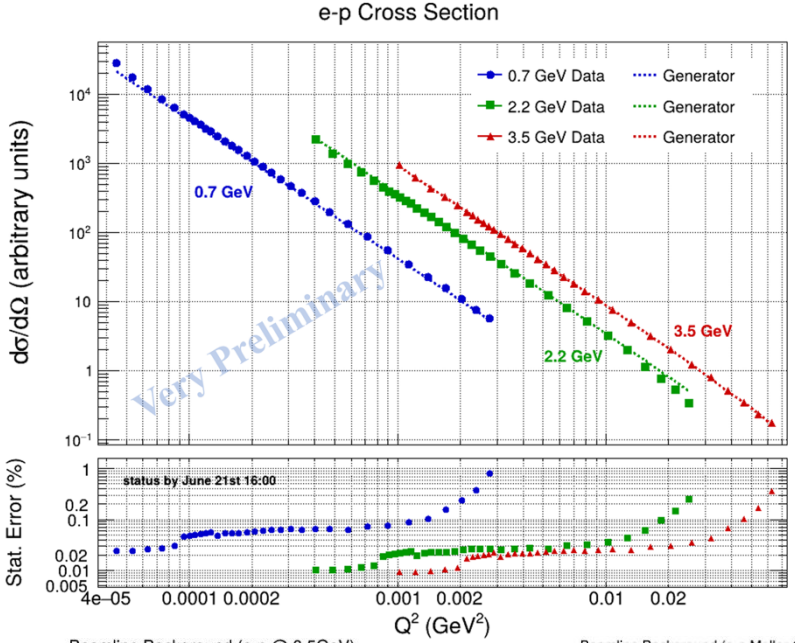


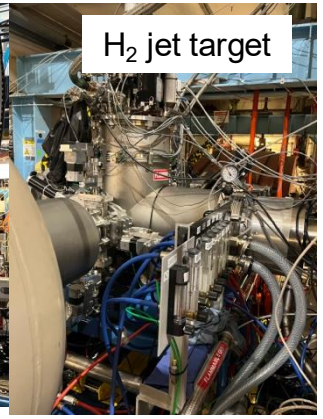
PRad II: completed on June 24

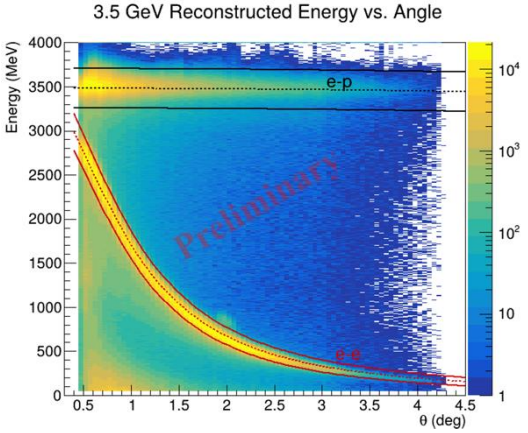
The experiment achieved, and in many cases exceeded, its original goals and performance expectations.

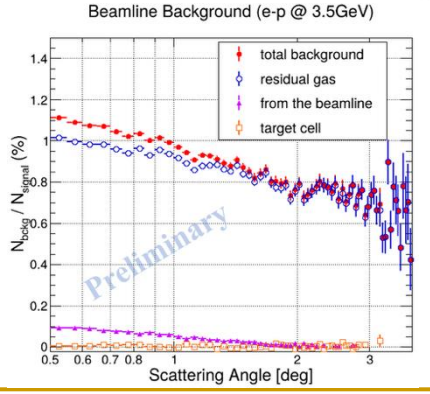
	PRad-I	PRad-II
H2 cell pressure	470/2.7 mTorr	**1030/4.3 mTorr**
H2 gas flow	600 cc/min	**1300 cc/min**
H2 gas density	$2x10^{18}$ H/cm^2	**$5.5x10^{18}$ h/cm^2**
Scatt. Cham. Press.	0.5 mTorr	**0.012 mTorr**
GEM	1-plane, No Tracking	**2-planes, with Tracking**
HyCal	Full HyCal, $PbWO_4$ +Pb-glass	Only $PbWO_4$
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)

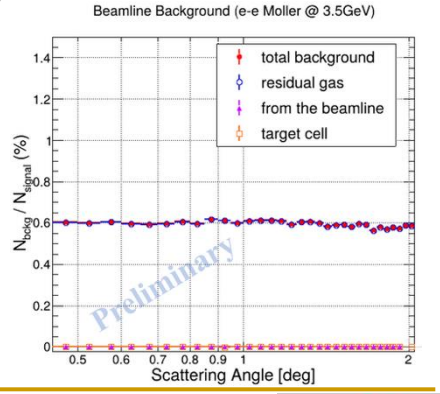
All planned data at beam energies 0.7, 2.1, and 3.5 GeV were successfully collected.





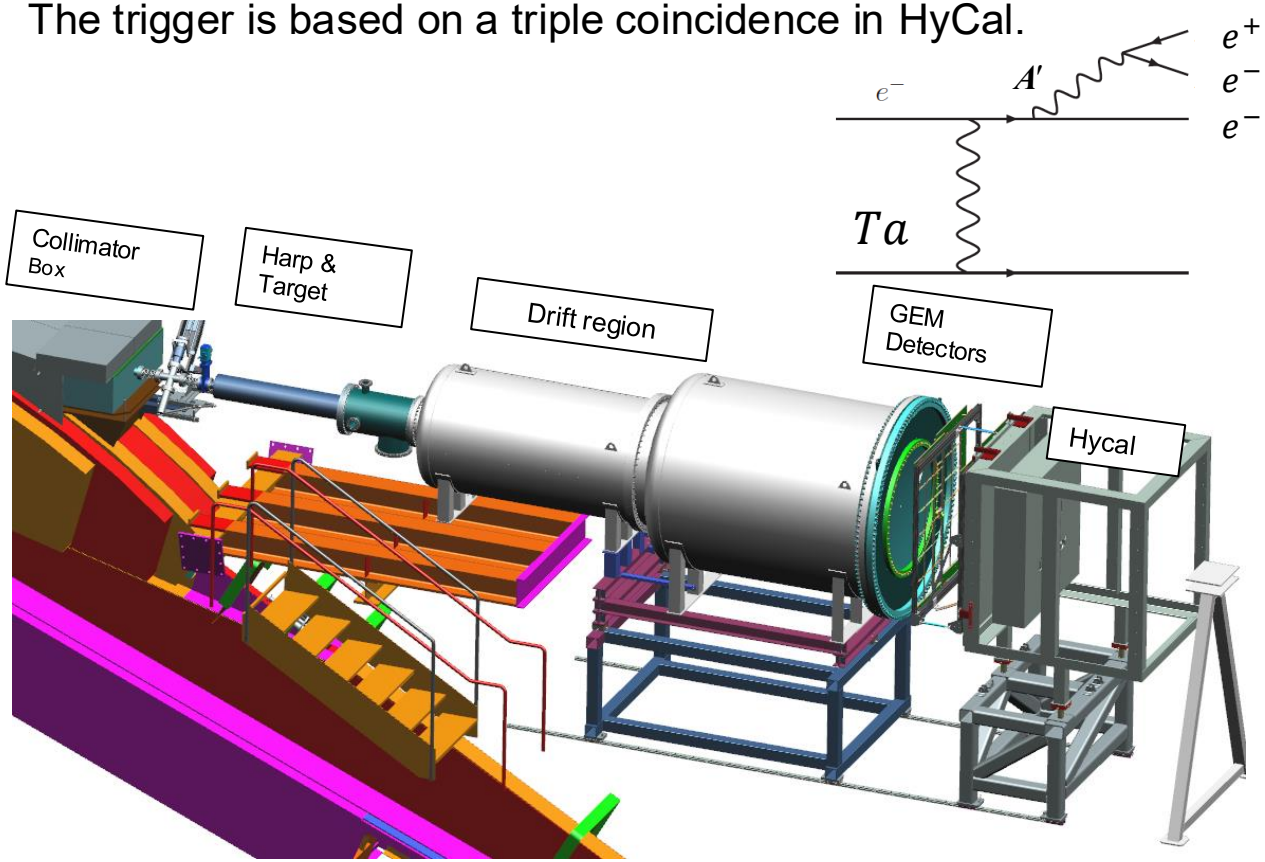


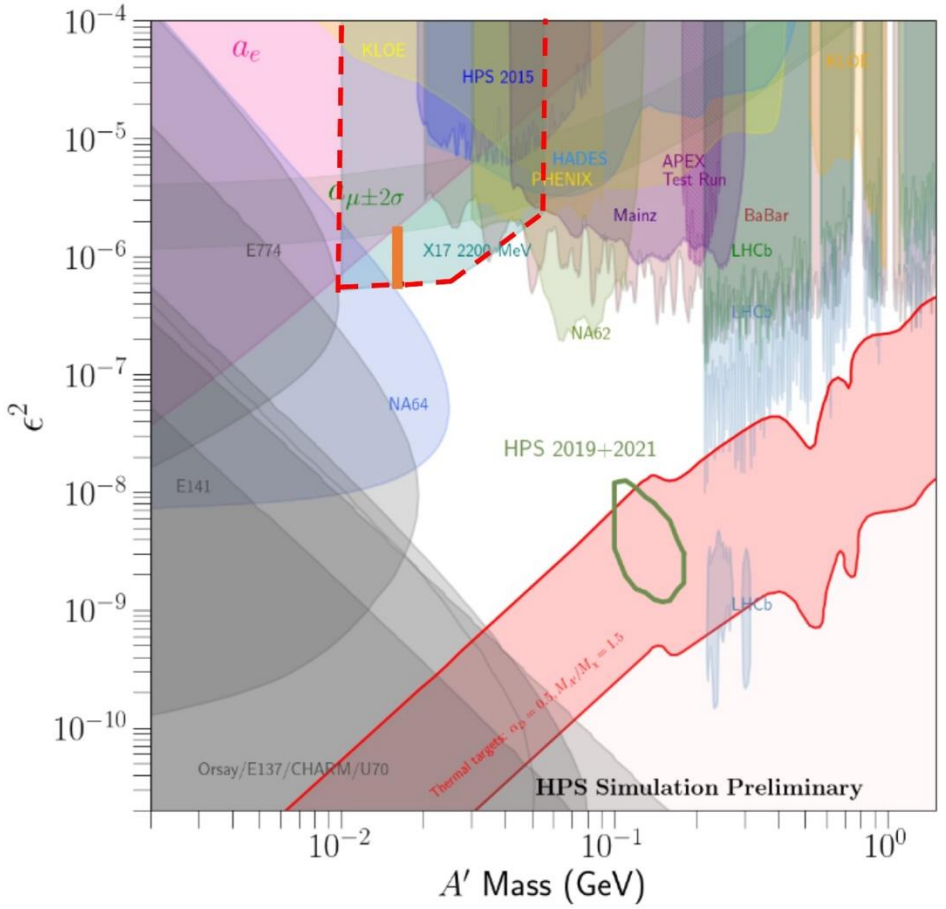




Currently running – X17

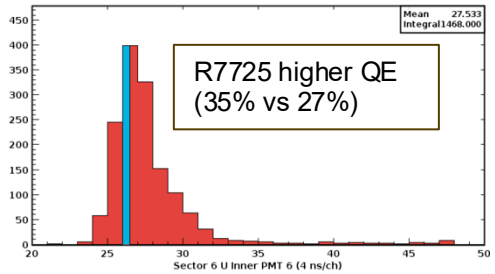
- The experiment searches for a hypothetical 17 MeV neutral boson reported by the Atomki group in nuclear transitions of ^{8}Be, ^{4}He, and ^{12}C [*PRL 116, 042501 (2016), PRC* ***104****, 044003 (2021), PRC* ***106****, L061601 (2022)*].
- The experiment uses the same detector configuration as PRad-II, along with a 4-mm tantalum target and a 2.1-GeV electron beam.
- The trigger is based on a triple coincidence in HyCal.

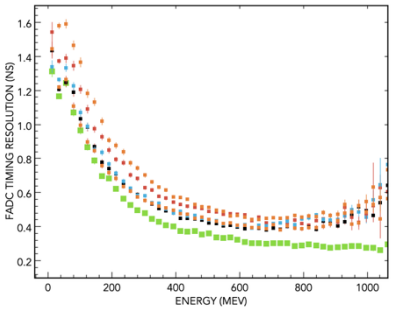




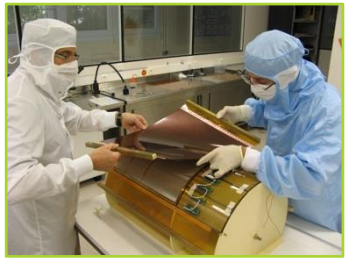
Other Hall B Developments

- **Completed the replacement of the 30-year-old PMTs in the CLAS calorimeters**. Most of the original PMTs had reached the limit of their HV operating range and could no longer provide the required gain. The new PMT/divider design delivers significantly improved time resolution.

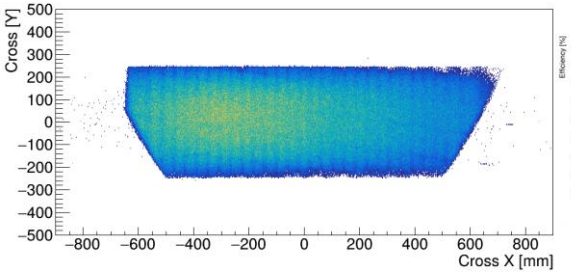


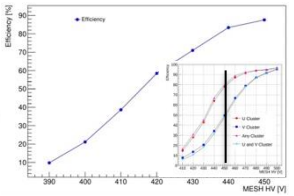


- **Preparing to replace aging Micromegas tracker modules.** Work at CEA Saclay has begun, and the first replacement modules are expected to arrive later this year.



- **The High-Luminosity Upgrade continues to make steady progress.** The second large-area μRWELL prototype, featuring a near-final layer layout, has been received from CERN and is currently undergoing cosmic-ray testing.





- **Significant software advancements** include new AI/ML methods for Forward Detector tracking and the implementation of the RG-L/ALERT upgrades, the RG-H recoil detector, mRWELL tracking, and the mCLAS12 detector in the standard reconstruction (coatjava) and simulation (GEMC) frameworks.

	+/- Track Inefficiency (%) per nA	
	Pass 2	***Now***
RG-A	0.143 / 0.140	0.077 / 0.074
RG-B	0.225 / 0.199	0.106 / 0.100
RG-D	0.167 / 0.159	0.079 / 0.087

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, and Hall B is now running the X17 experiment.
- Several major improvements have been implemented in the simulation and reconstruction software, including code speedups and improved Forward Detector tracking using AI/ML techniques. Development of enhanced Central Detector tracking is also progressing well.
- The High-Luminosity Upgrade project continues to advance. The second large-area Micromegas prototype, featuring a near-final layer layout, has been delivered by CERN and is currently undergoing testing at JLab. Development of μCLAS12 is picking up.
- The run schedule for the next two years is nearly finalized. 30 weeks of beam time for physics allow completion of the experiments in the RG-K and RG-E (2027), and RG-C and RG-G (2028) run groups.