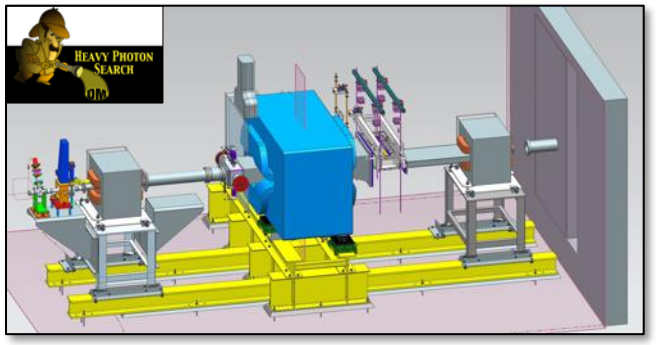
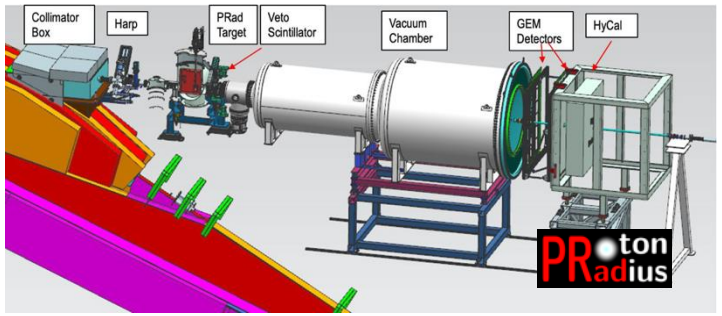
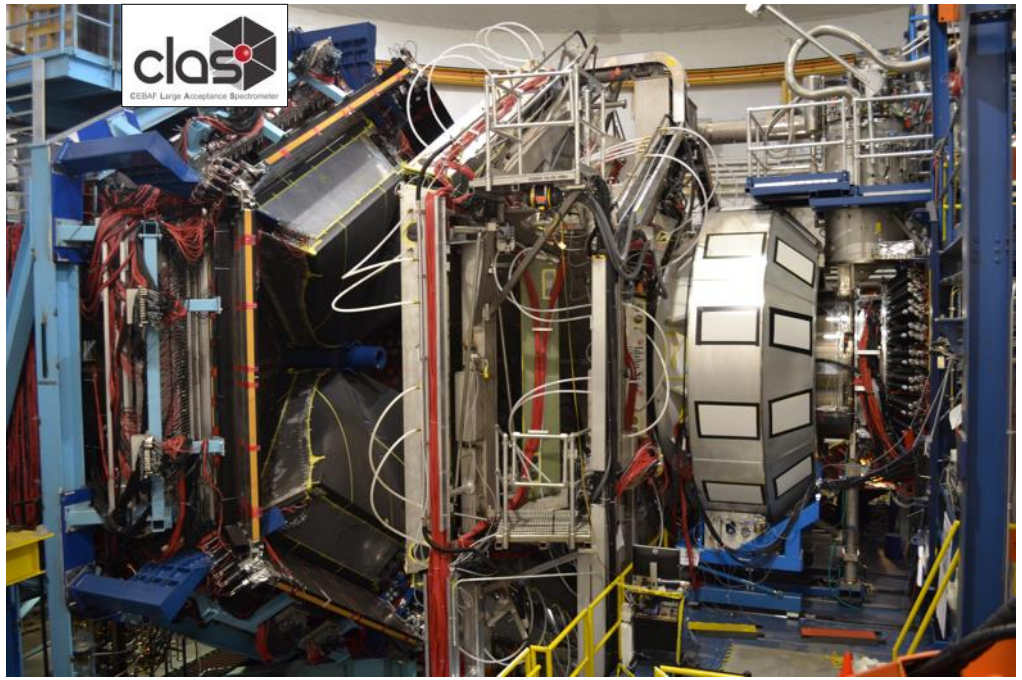
Status of Hall-B







S. Stepanyan (JLAB)

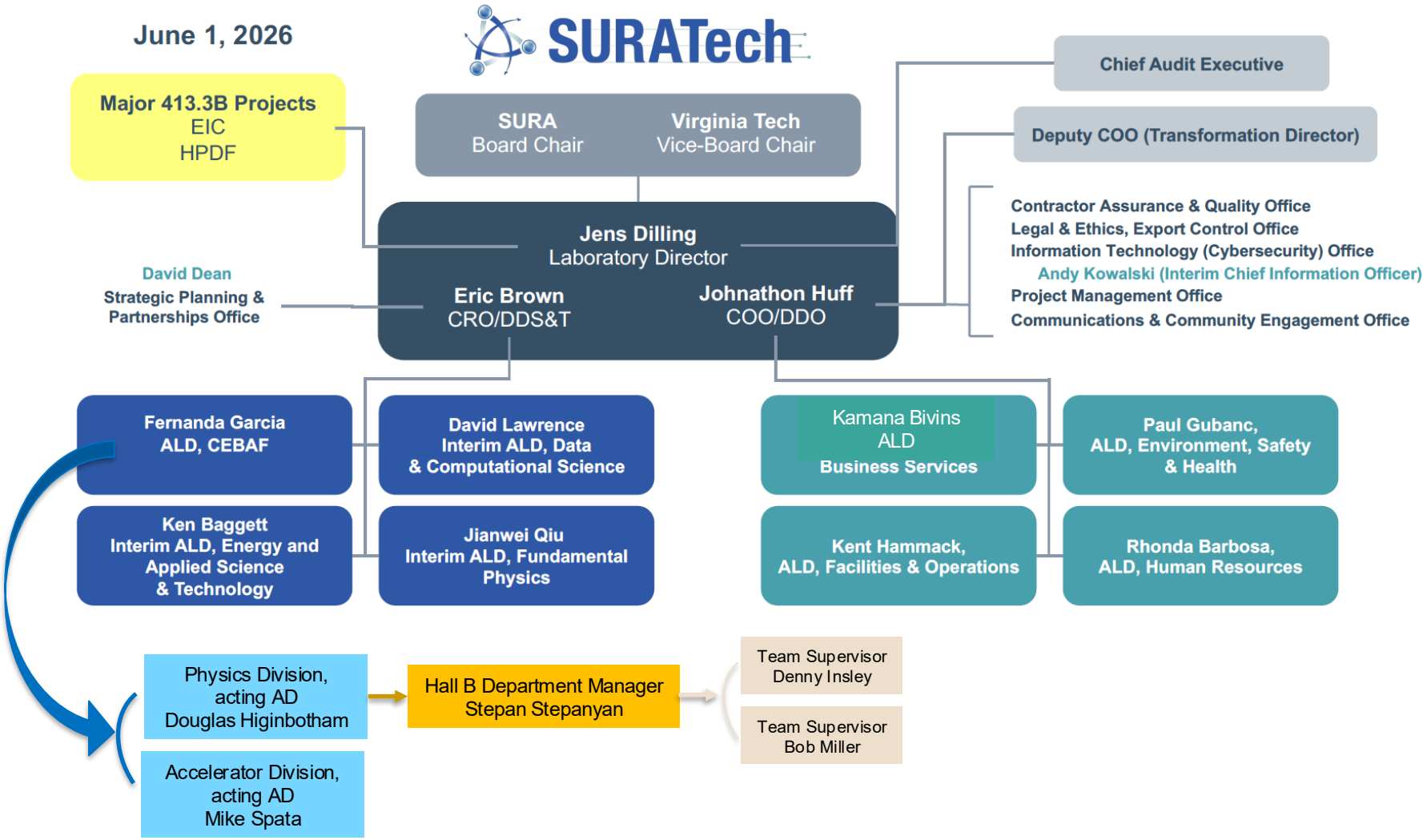
CLAS Collaboration meeting

November 17-20, 2026

Outline of the talk:

- News from the Lab and Hall B
- Activities in CY26
- CLAS/CLAS12 publications/presentations
- Next year's run schedule
- CalCom activities
- Software group update
- R1 μRWELL upgrade
- High luminosity upgrades
- Summary

New Lab Structure



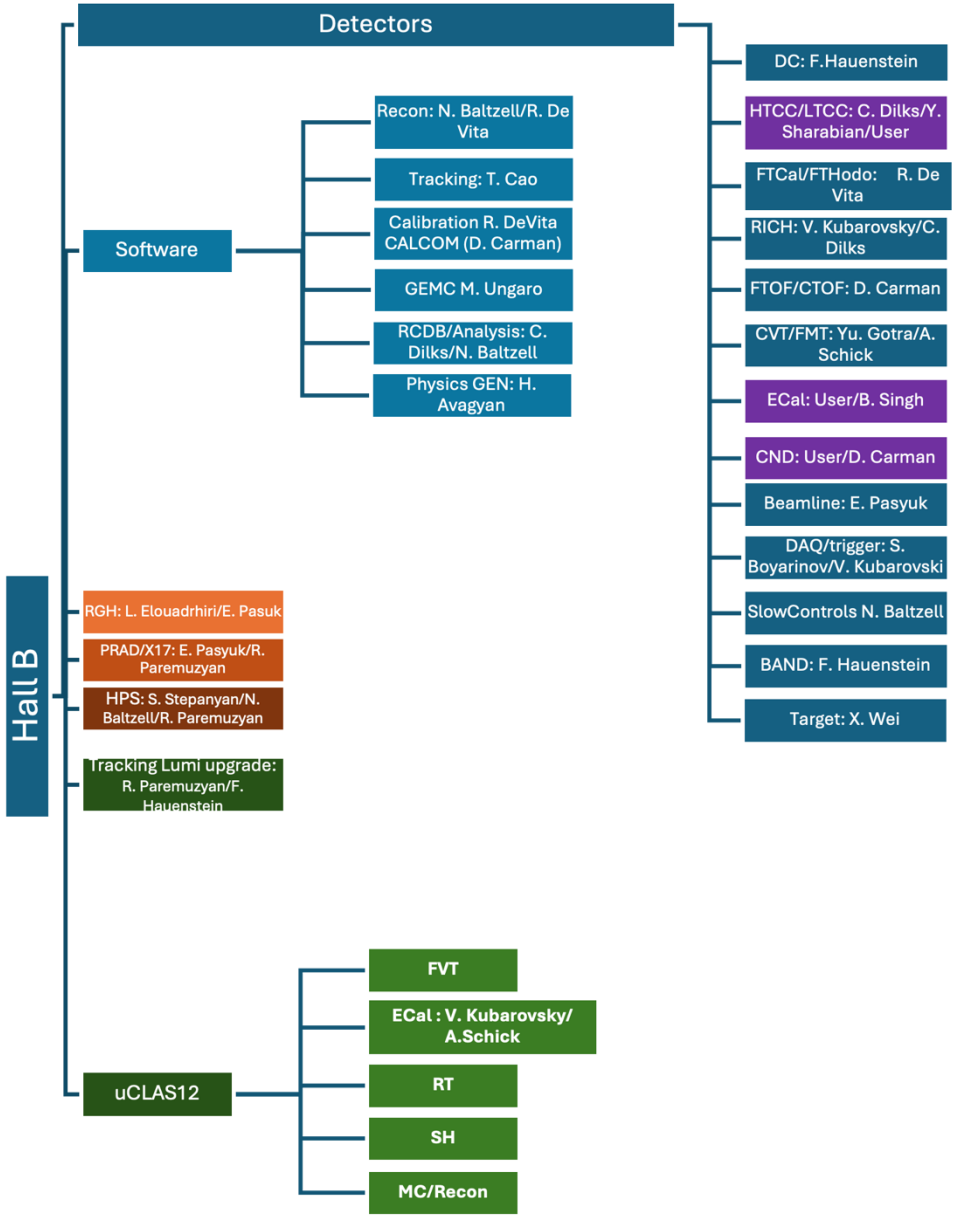
Hall B

- Our Department:
  - 18 staff scientists and two postdocs.
  - One engineer, one designer, and six technicians.

A warm welcome to

- Tashawn Smith joined Denny's group as a Hall technician.
- Randall Wilson started on September 15 as the Hall B designer.
- Andrew Schick started as the Hall B postdoc on November 16.

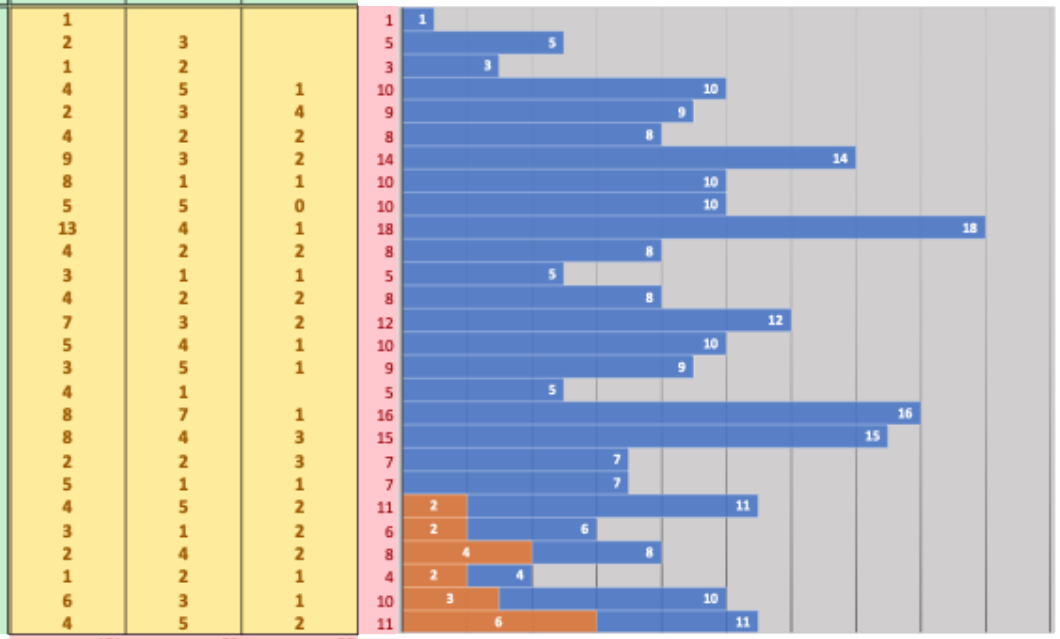
We expect to fill the staff scientist position, but it's not clear when.

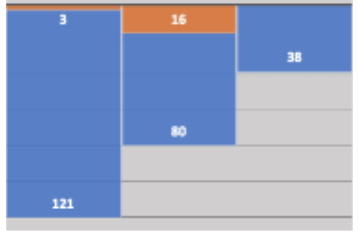


Physics publications and Conference presentations

Maintain a strong publication record in 2026: a total of 11 publications, 7 are published, and 4 are waiting for journal reviews, 1 in PRL, and CLAS12 papers dominate

Year	HSWG	DPWG	NPWG
2000	1		
2001	2	3	
2002	1	2	
2003	4	5	1
2004	2	3	4
2005	4	2	2
2006	9	3	2
2007	8	1	1
2008	5	5	0
2009	13	4	1
2010	4	2	2
2011	3	1	1
2012	4	2	2
2013	7	3	2
2014	5	4	1
2015	3	5	1
2016	4	1	
2017	8	7	1
2018	8	4	3
2019	2	2	3
2020	5	1	1
2021	4	5	2
2022	3	1	2
2023	2	4	2
2024	1	2	1
2025	6	3	1
2026	4	5	2
	121	80	38

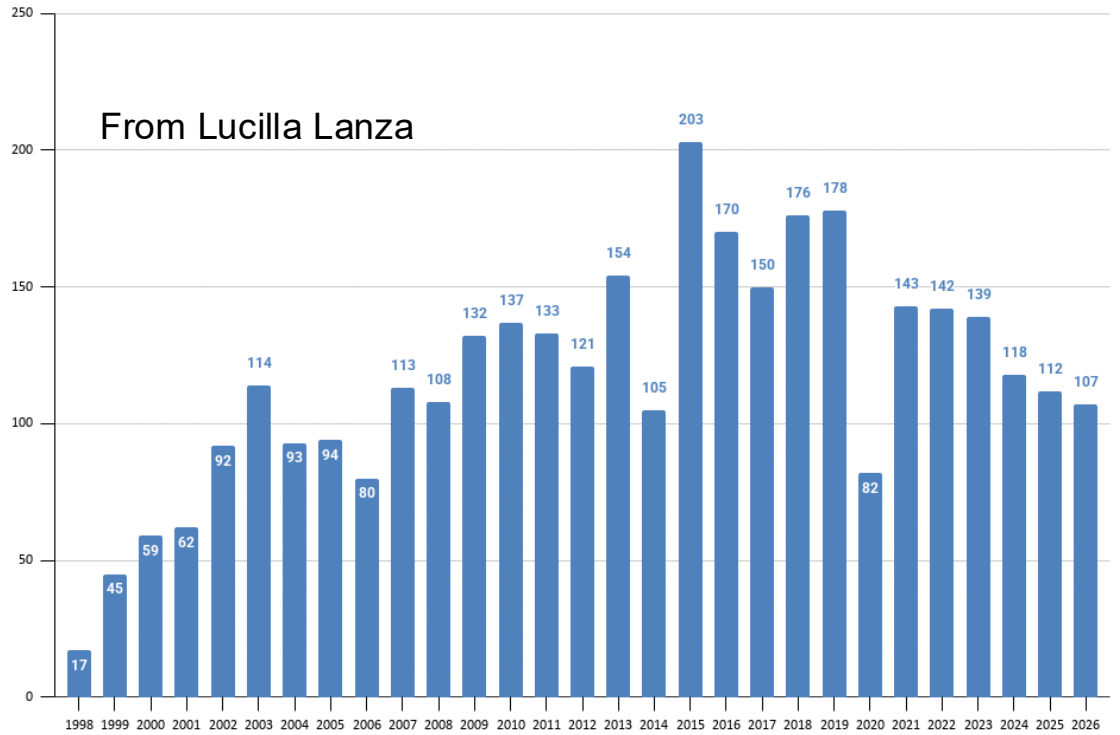




CLAS Collaboration Total 239

CLAS12 Publications 19

Averaging 9 papers per year



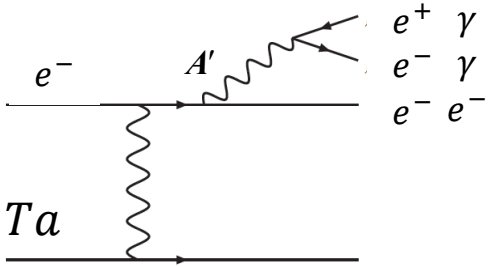
Conference and workshop participation appears to be slightly lower this year, possibly due to underreporting to the PPC and/or travel funding constraints.

Activities in CY26

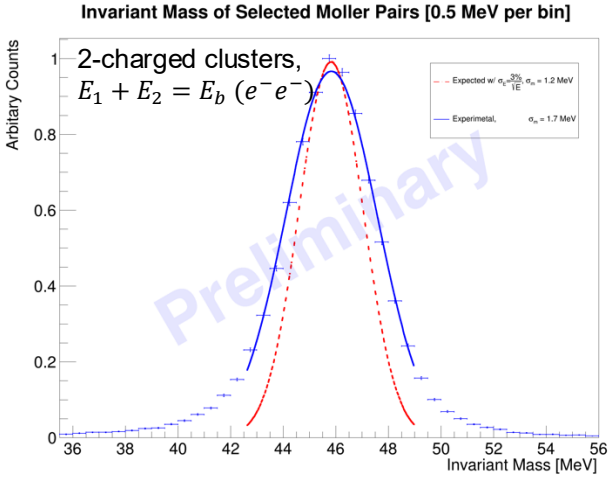
- Completed the Prad II experiment and 41% of the X17.
- Preparing for FY27 run: details below but we cannot run two run groups (RG-K and RG-E) as we intended. During the low-energy (~1 GeV/pass) portion of the run we will continue with X17.
- Preparations for the next CLAS12 running include partially completing the BMT upgrade and module replacement.
- The high-luminosity R1 upgrade – the second prototype cosmic tests are progressing, results are very encouraging. Design of the full-size detector near completion.
- Preparations for the RG-H run (in FY30) is picking up.
- Continue advancing with improving our software, reconstruction and GEANT4 MC.
- Preparing Pass-3 of previously processed data (RGA/B/K/…), including improvements in calibration, alignment, accelerated calibration workflow, and enhancements in forward and [possibly] CVT tracking.
- PAC 54 – No new approved proposals.

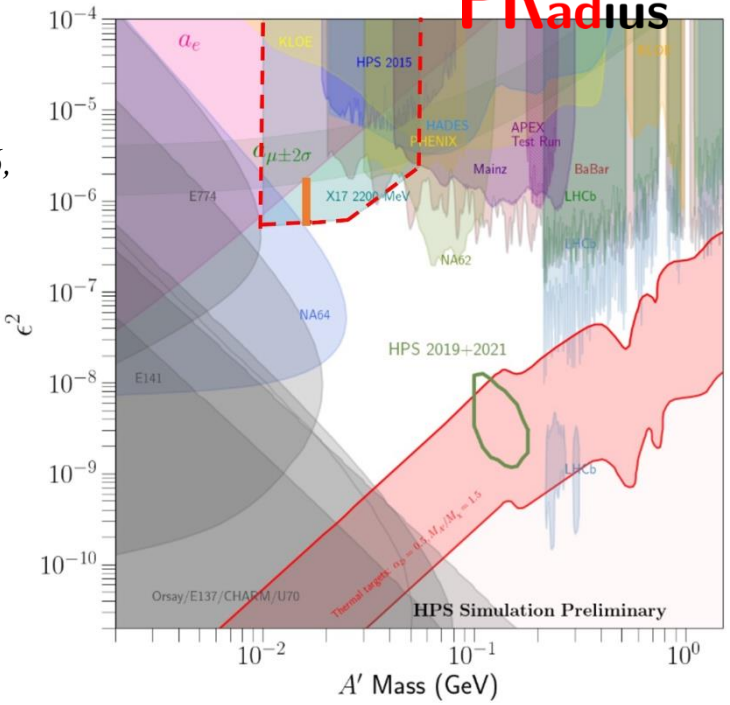
Currently running – X17

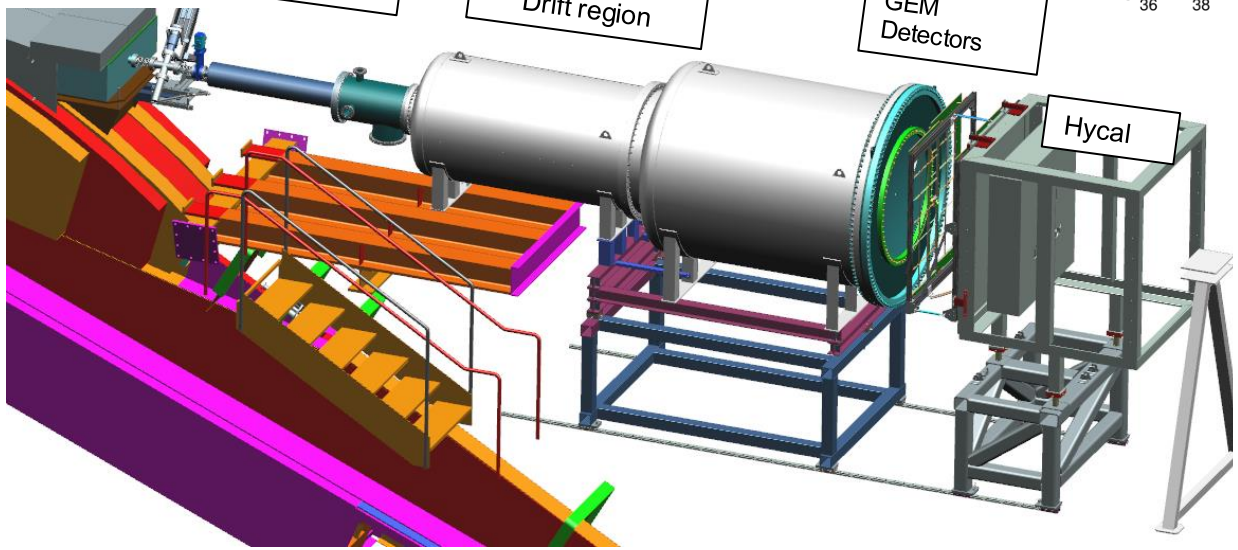
The experiment searches for a hypothetical 17 MeV neutral boson reported by the Atomki group in nuclear transitions of ^{8}Be, ^{4}He, and ^{12}C [*PRL 116, 042501 (2016), PRC* ***104****, 044003 (2021), PRC* ***106****, L061601 (2022)*].

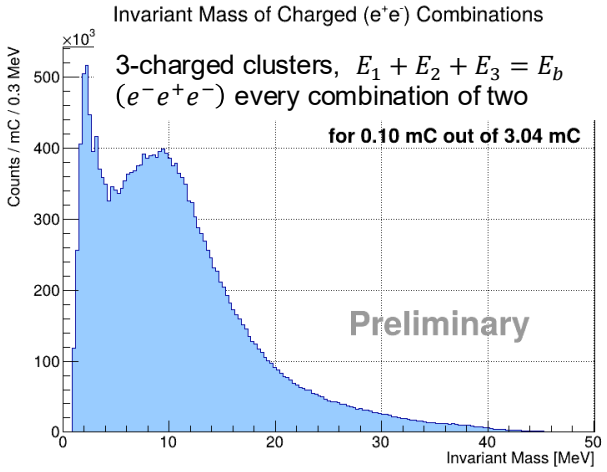


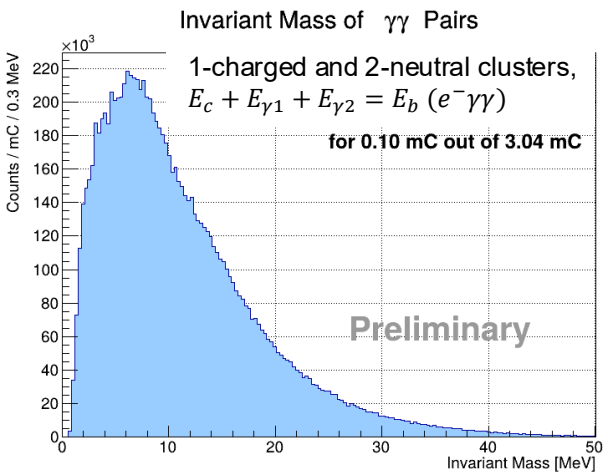
Collected 41% of the expected data. Will continue data collection in FY27 to reach 50% (need 6 ABU days).











The run plan for the next two years

FY27

Continue X17 – need 130 ABU-hours to cross the 50% mark of expected statistics.

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**		

Can accommodate only one run group:

- RGK (3- and 4-passes) requires approximately 15 weeks on the floor for completion.
- RGE (5-pass) only ~10 weeks on the floor to complete.
- We need approximately one week to bring CLAS12 back into operation. CLAS12 has not run for more than a year, and the CVT has not operated for two years and is coming with several new BMT tiles.
- Choosing RGE will leave room at the end of the run for about a week or so for high-luminosity tests.

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	**Must pass ERR**		110	55	55		0
							sum:	**95**		

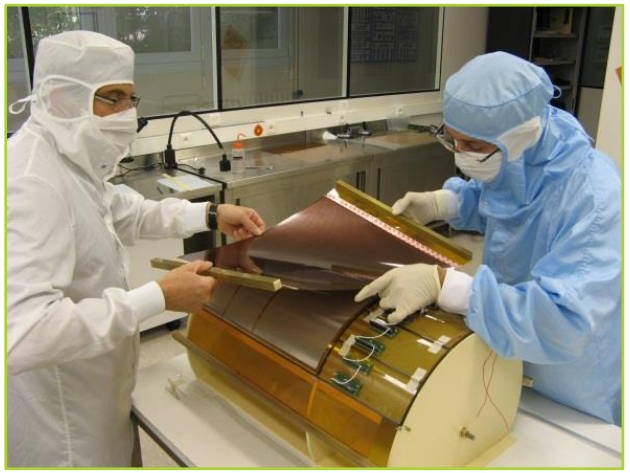
Micromegas tracker repairs

Preparing to replace aging Micromegas tracker modules.

- CEA Saclay is refurbishing failed tiles and fabricating new ones.
- Two layer-5 BMT-Z tiles from 2015/2016 batches that failed during an experiment on strip voltage are being repaired.
- Two new layer-1 and -6 BMT-C tiles are fabricated with new modifications.
- The new layer-6 and layer-1 tiles, and one repaired layer-5 tile, are now at the testing stage.
- The first four replacement modules are expected to arrive later this year. Replacement of bad tiles will happen before the next run (RGE or RGK). Currently, preparing to test modules as they arrive.





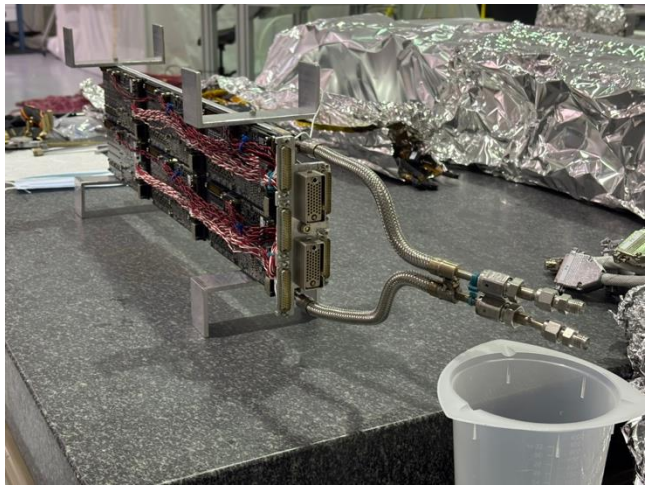


HPS SVT FEB and Data Flange work

- HPS SVT was removed from the freezer in EEL clean room for front end board (FEB) replacement.
- New FEBs (13) came from SLAC with J1 connectors, our fast electronics group helped to remove them (2 or 3 boards were damaged in the process).
- The old FEBs were removed and the new ones installed on the cooling plate completely (one of the FEBs will need to be replaced).
- The full plate was tested first with the old Data Flange, then with the new one.
- Powered and communicated with all of the chips in the first four layers, and then got CODA working and took a run with those modules.

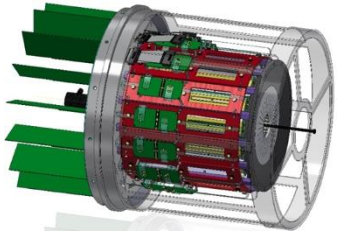






CALCOM Status and Plans – October 2026

RG-L calibration status:



- FD calibrations: DC, ECAL, FT, FTOF, HTCC, LTCC, RICH
- ALERT ATOF:
  - Initial timing calibration for bars and wedges complete – now studying z-dependent systematics
  - Information on energy deposition from time-over-threshold signals not fully understood – setting up test stand for modules at ANL to investigate
  - Tracking not advanced sufficiently to improve ATOF event selection using AHDC
- ALERT AHDC:
  - Progress on advancing calibration algorithms (time-walk implementation, wire-dependent time-to-distance
  - Levels of noise hits, pile-up events, and background hits making calibrations a challenge to meet specs
  - Groups at Orsay and NMSU working to understand path forward

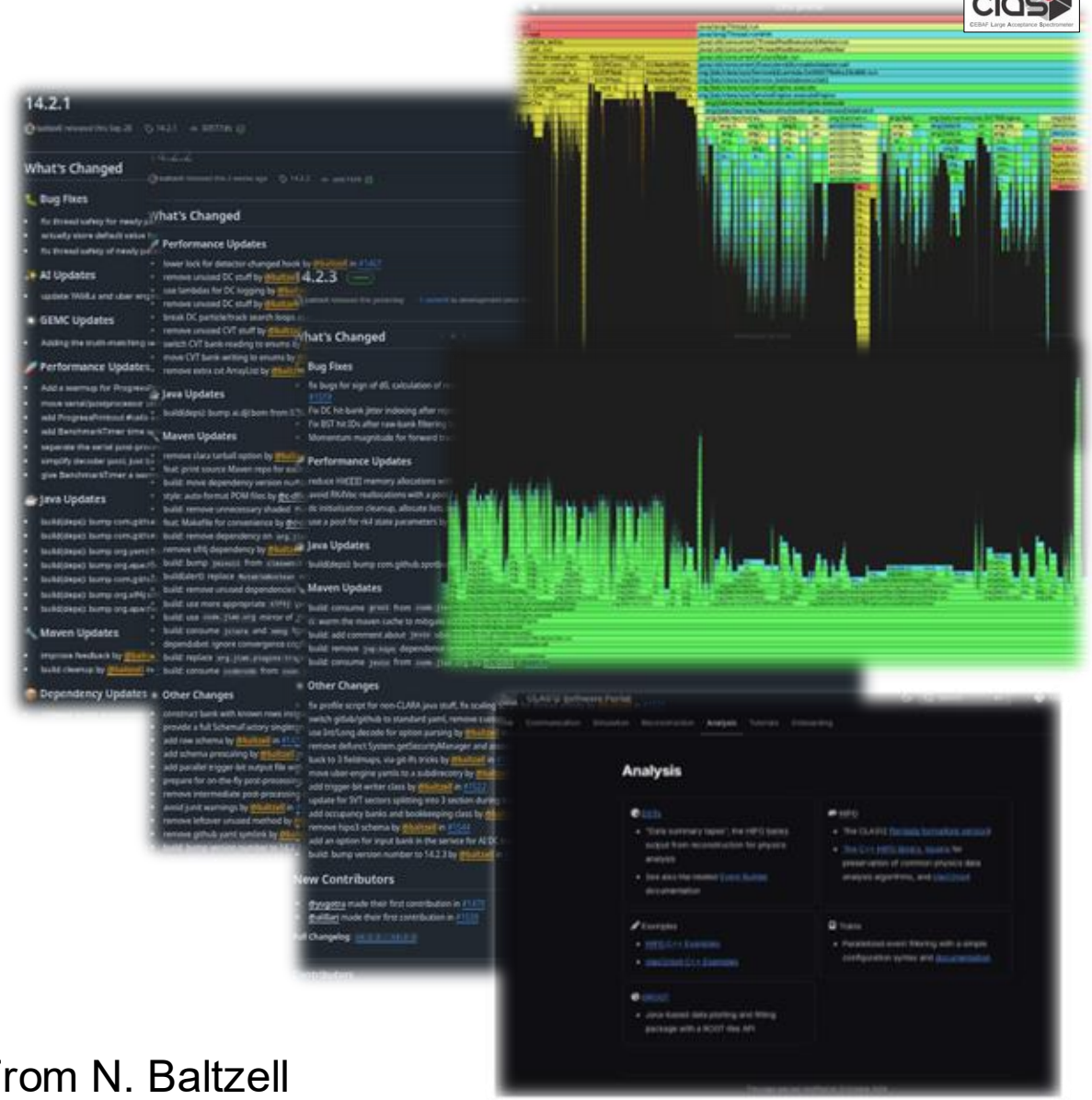
Pass-3 preparations:

- Suite development: improved fitting convergence, batch farm compatibility, DC suite benchmarking
- Workflow improvements: decoding speedup, configuration file streamlining, single chef model
- Reconstruction development: new DC denoising algorithm, optimized FD tracking efficiency
- Miscellaneous checks: studies of systematics of FD tracking to resolve charge-dependent z-vertex
  - DC endplate bowing, wire sag, investigation of R2 time-to-distance in torus field (currently assume straight segments)
- CVT: developing networks for AI-based denoising and cluster finding – effect on tracking TBD

From D. Carman

Hall B S&C – Recent

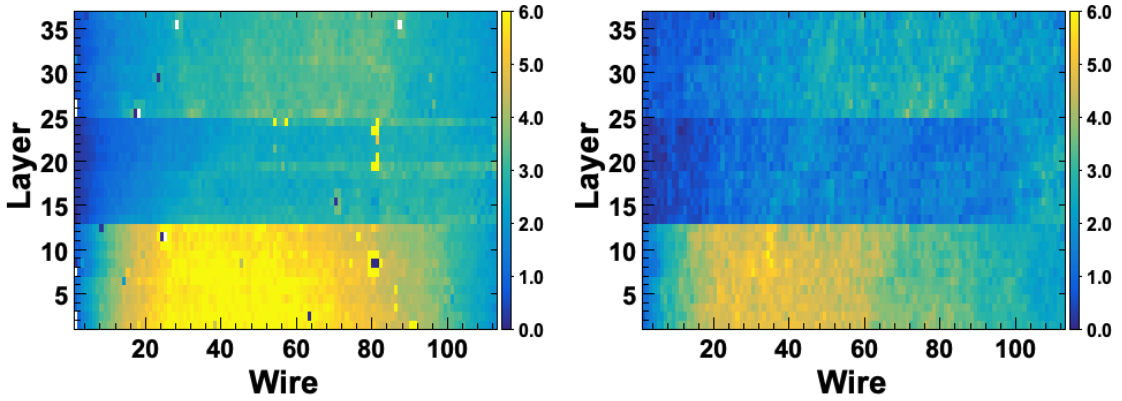
- Coatjava software optimizations targeting speed and efficiency, e.g., reducing memory allocation(s) and garbage collection CPU, 10x decoding speedup
- Component integration for workflow streamlining and portability, e.g., Clara-fication, parallel decoding, occupancy banks, calibration automation
- Java software independence from clasweb.jlab.org, undoing a decade of Maven repository layers and leveraging GitLab code.jlab.org, including et, evio, xmsg, groot, java-hipo ...
- AI expediting bug-finding and fixing and code improvements; collaboration formalizing AI best practices and analysis review guidelines
- Documentation upgrade, onboarding, migration from JLab's MediaWiki to static HTML and GitLab, pages.jlab.org
- Exploratory NERSC allocation for CLAS12 simulations granted; prepared for CLAS12 event streaming to OLCF and back w/ EPSCI
- Work with others: InvenioRDM and RUCIO adoption, ASC and FAIR

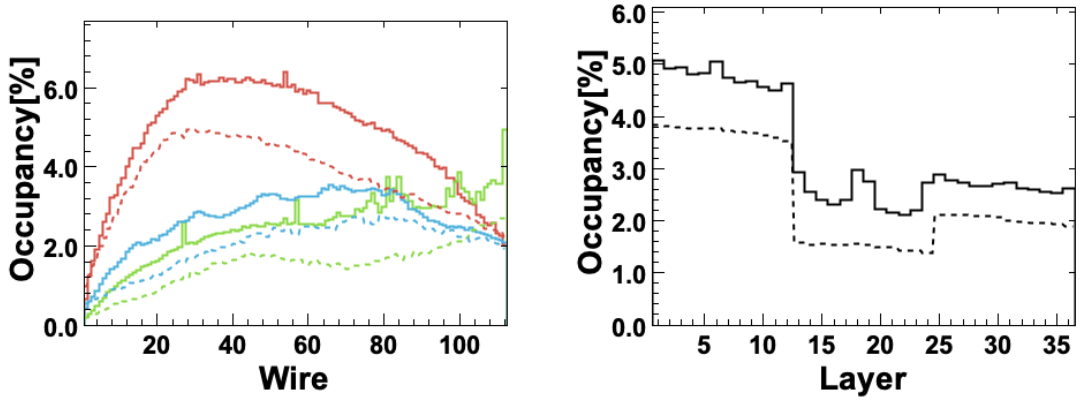


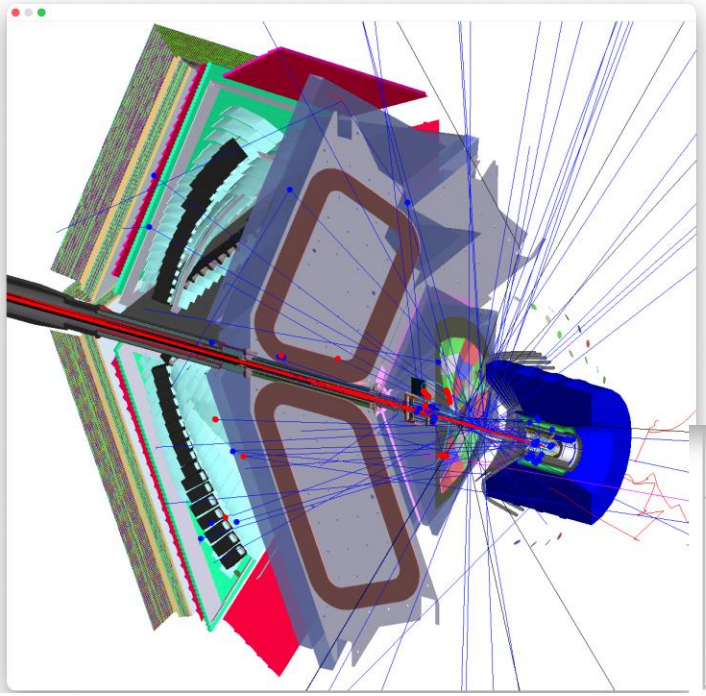
From N. Baltzell

GEANT4 model improvement

- Significant efforts went into improving the CLAS12 GEANT4 model (GEMC).
- Modeling beam background is crucial for high-luminosity detector design.
- The current GEMC reproduces background occupancies in detectors within 25%.

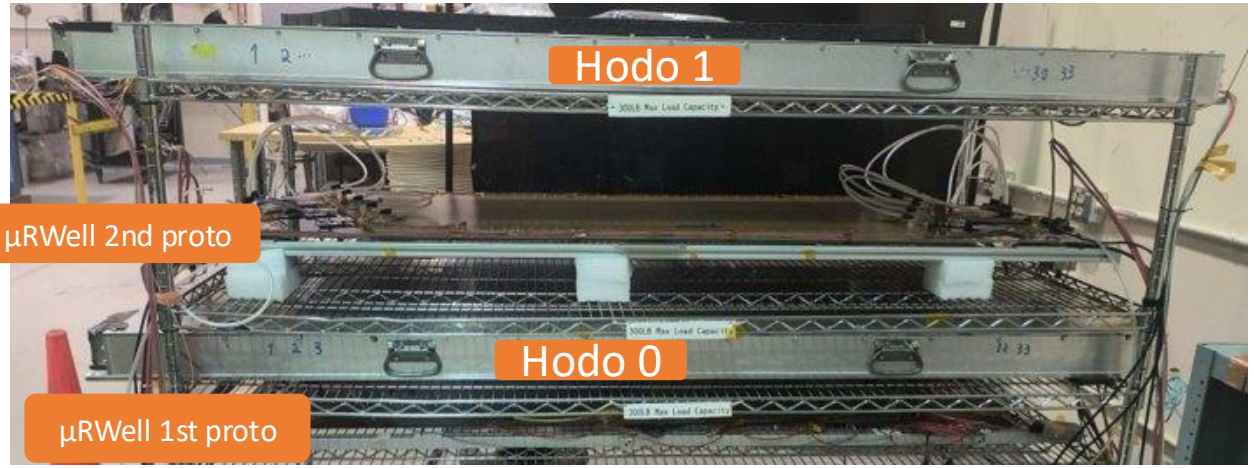




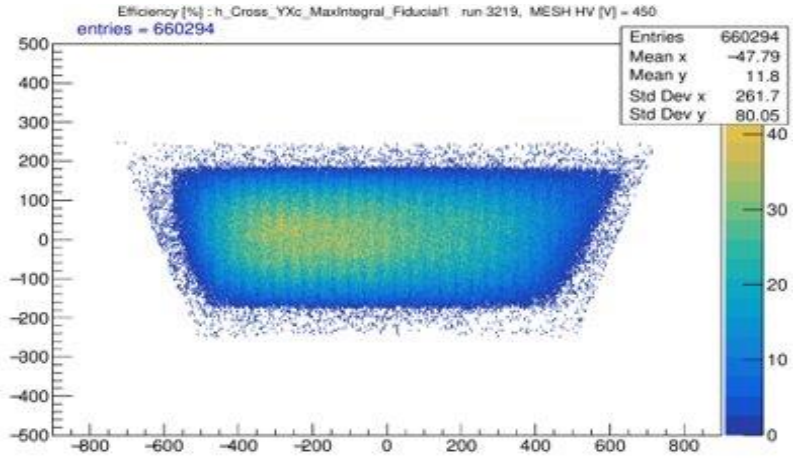


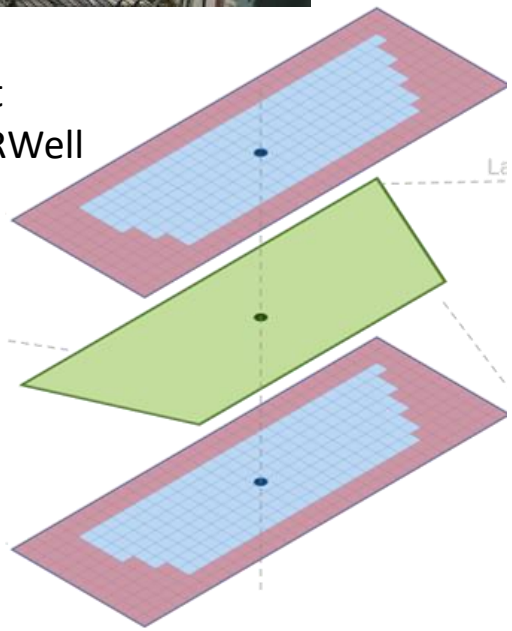
Configuration		FTon	FToff	Elmo	muCLAS12	Elmo7
Average Occupancy at 50 nA (%)	R1	3.71	1.59	0.91	0.49	0.67
	R2	1.51	0.83	0.74	0.58	0.63
	R3	2.02	1.22	1.09	0.76	0.89

Forward tracking upgrade: μRWELL project

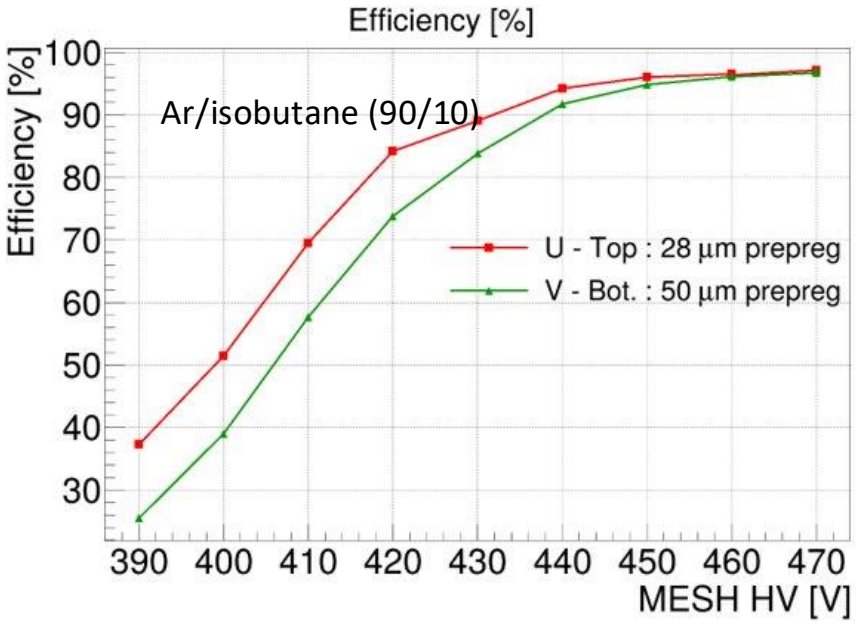


- Two identical hodoscopes: 33 × 12 pixels
- A coincidence of both hodoscopes and a fiducial cut ensures that the cosmic track passes through the μRWell



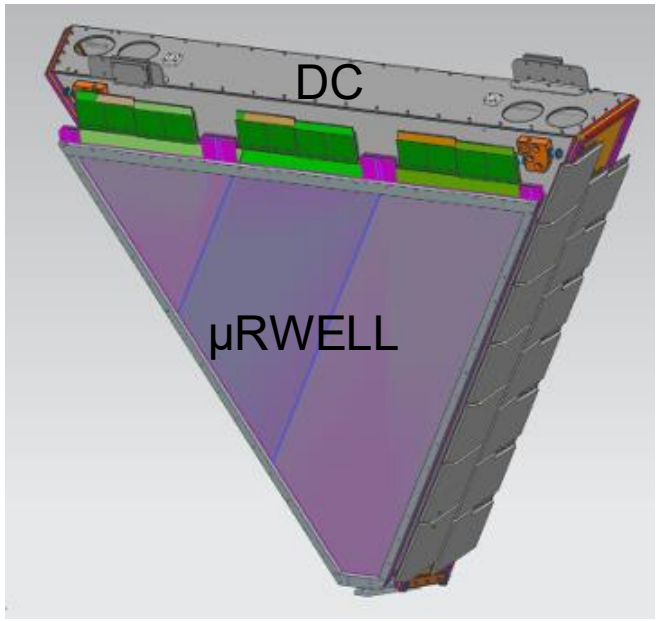


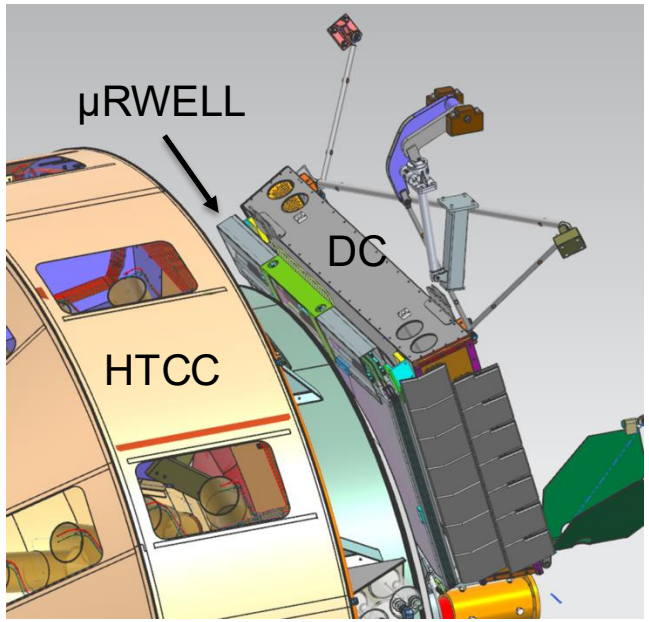
- The 2nd prototype reaches high efficiency at a lower HV, indicating a higher effective gain.
- ≥90% efficiency is reached at a much lower HV (440 V vs. 490 V).
- However, the 1st prototype can sustain a higher HV.
- Two gas mixtures were tested: Ar/isobutane (90/10) and Ar/CO_2/isobutane (90/7/3). In both mixtures, the 1st prototype holds higher HV.

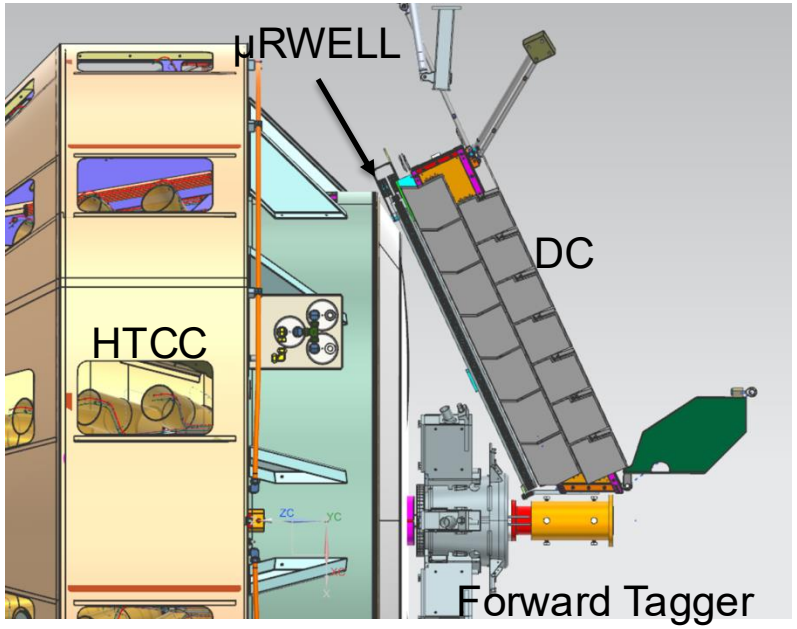


Full-size μRWELL in Hall B

- Mounted on CLAS12 drift chambers (Region 1)
- CLAS12 forward detectors move ~9 cm upstream to make space for μRWELL
- Installation procedures and tools in development



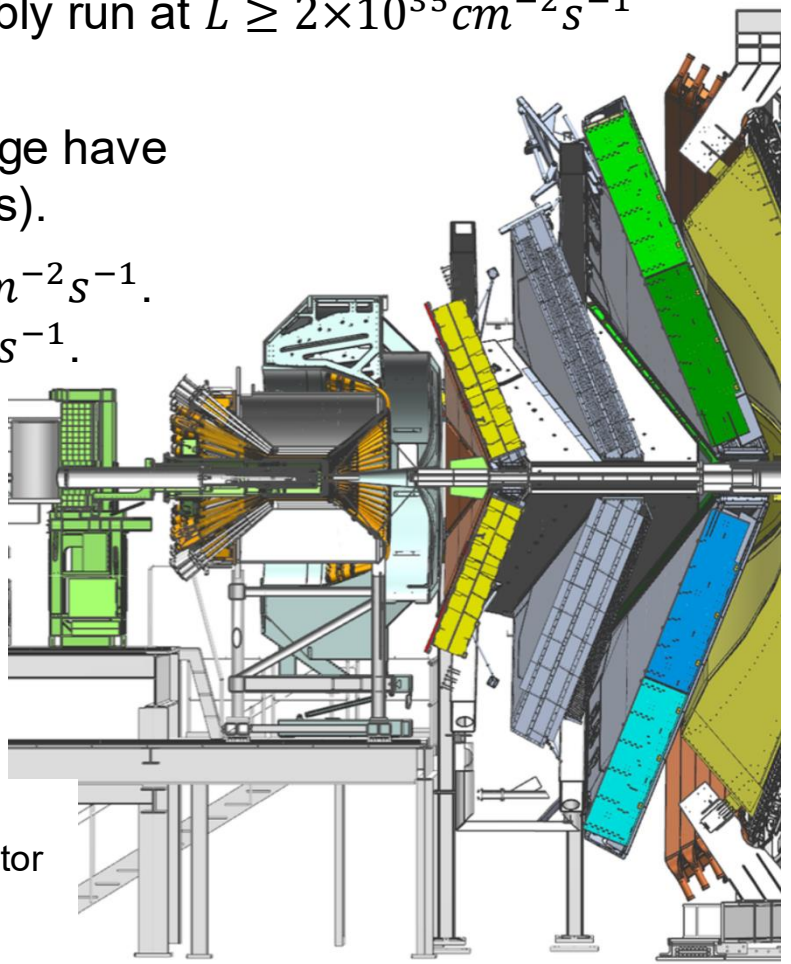




Current plan: finalize the design and order the μRWELL PCBs in the November-December timeframe.

Upgrades: Next few years

- With the current state of the software, we can run close to $L \approx 2\times10^{35} cm^{-2} s^{-1}$ in RG-A configuration.
- Forward tracking upgrade with μRWELL detectors will let us comfortably run at $L \geq 2\times10^{35} cm^{-2} s^{-1}$ with the FT-On configuration and FD tracking efficiency $> 90\%$.
- Variations of CLAS12 configurations with different Moller cone coverage have already been used to lower the background (FT-Off and No-FT configs).
- A large Moller cone, covering up 5° (*Elmo*) will get us to $L \approx 4\times10^{35} cm^{-2} s^{-1}$. Cone covering up to 7°, *Elmo7,* can allow running at $L \approx 5\times10^{35} cm^{-2} s^{-1}$.
- NO FT, no e'/γ tagging, and for Elmo7, no particle detection below 7°. May require enhanced capabilities for CVT and FVT.

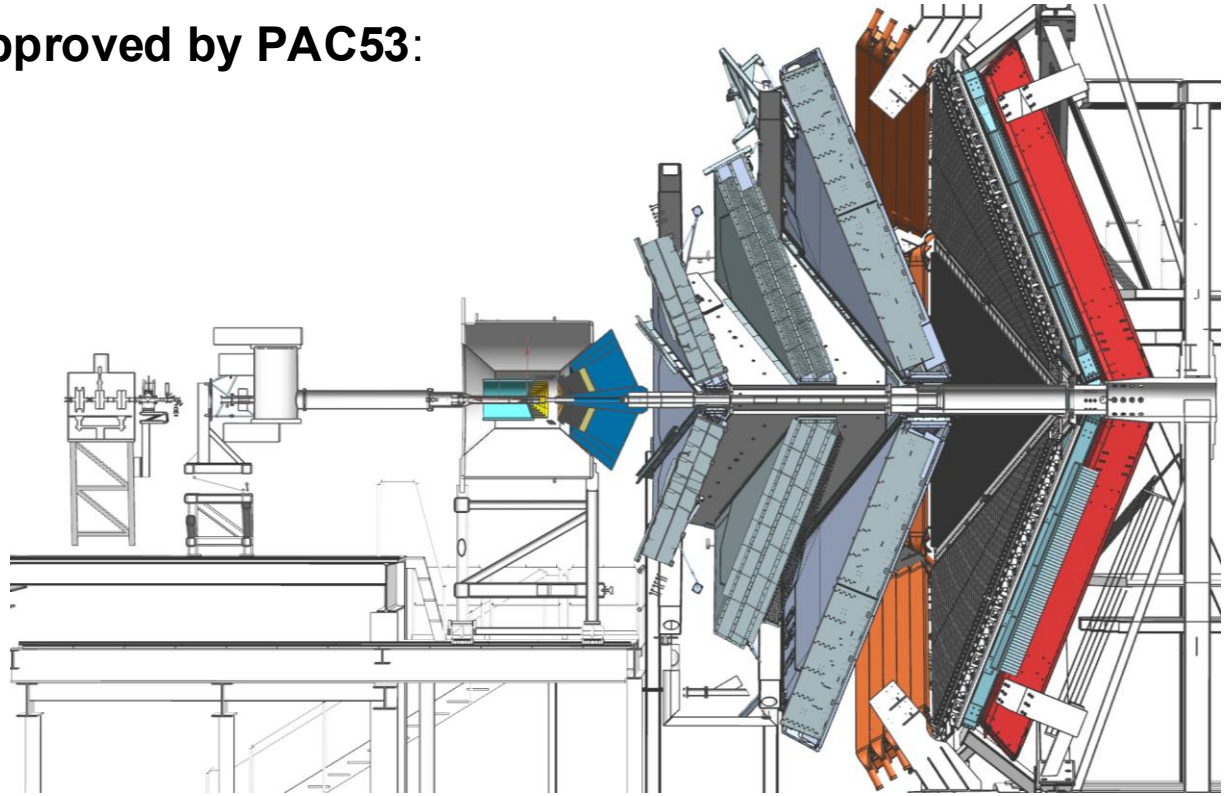


The loss of particle detection at very forward angles has a limited impact on the existing physics program (MesonX and DVCS are most impacted) while enabling ***high-statistics measurements in demanding kinematic domains such as high Q^2 and -t****.*

One of the physics topics discussed (N* program) requires electron detection in CD. Replacing the CTOF with an aerogel Cherenkov detector using SiPM-based light readout could provide the required capability. Further studies are needed to evaluate its feasibility and performance.

Upgrades: long-term – μCLAS12 to $L \geq 10^{37} cm^{-2} s^{-1}$

- **μCLAS12 (E12-25-001,** *EPJ A* 62, 157, 2026**) approved by PAC53**:
  - Configuration – **wECAL,** $PbWO_4$ calorimeter with APD readout, and **Pb shield** to replace FT and HTCC.
  - Central and forward vertex tracker and a scintillation hodoscope for recoil detection.
  - Transforms the CLAS12 forward detector into a high-rate muon detector optimized for rare exclusive processes.



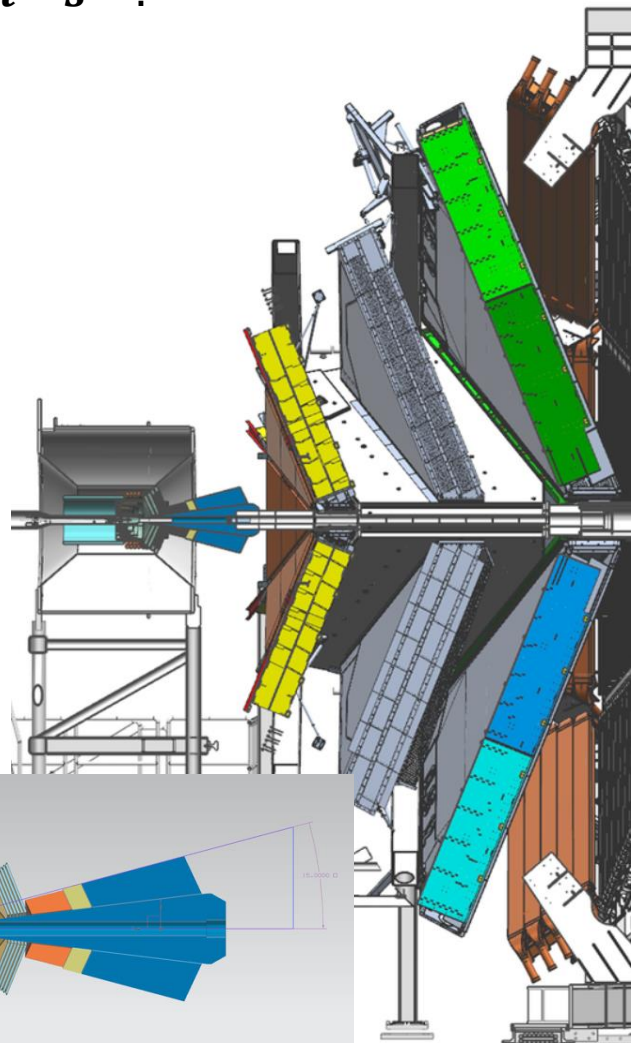
- **Physics goals of E12-25-001**:
  - **DDVCS and eJ/ψ** in the final state $e'\mu^+\mu^-$.
  - **pTCS** in the final state $p'\mu^+\mu^-$.
- **Other physics** (discussed at the high luminosity workshop):
  - Any reaction that, in the final state, has $\mu^{\pm}$ and/or e' and γ forward and charged hadrons at $40^{\circ} < \vartheta < 80^{\circ}$.

To manage the technical challenges of the upgrade while enabling an earlier start to the physics program, the collaboration adopted a phased implementation of **μCLAS12**.

Upgrades: in between Mini-μCLAS12

Halfway to μCLAS12. Occupancies in FD will allow running at $L \approx 10^{36} cm^{-2} s^{-1}$.

- wECal and the lead shield cover the angular range from 7° to 15°.
- Above 15°, the forward detector is the same.
- The wECal can detect electrons and photons.
- wECAL and the lead shielding will suppress the charged-pion flux by more than two orders of magnitude, enabling clean detection of muons below 15°.
- ***Will*** require enhanced capabilities for the Central (CVT) and Forward (FVT) Vertex Trackers, and better shielding downstream of the torus for R3 DC.



Physics case:

- Nucleon recoils from near-threshold J/ψ production produced in 15° and 30° the angular rage, well suited for **near-threshold J/ψ production studies on deuterium and heavier nuclei**, enabling studies of the gluonic structure of matter, sub-threshold production, and EMC-type effects.
- **pTCS** and a first stab at **DDVCS**.
- The setup is also very similar to what we had for the CLAS-DVCS program; it enables high-statistics DVCS measurements.

Summary

- Hall B continues productive work on all fronts and is on track to exceed the yearly average publication rate. This year, CLAS12 publications will surpass CLAS publications.
- The group completed PRad-II, ran X17 efficiently, and will continue with X17 for the early part of next year's low-energy run.
- The run schedule for next year is final. For 2028, we are aiming to run longitudinally polarized target experiments if the targets are ready.
- We have made several key improvements to the simulation and reconstruction software. Work on improvements to CD tracking is moving along.
- The CalCom group finished calibration of CLAS12 FD for RG-L (ALERT) and is preparing to recalibrate and reprocess large datasets (Pass-3).
- The high luminosity upgrade project is moving forward. Testing the second large-area prototype and finishing the full-module design.
- Working on future luminosity upgrades – $4{\times}10^{35}cm^{-2}s^{-1} \Rightarrow 10^{36}cm^{-2}s^{-1} \Rightarrow 10^{37}cm^{-2}s^{-1}$.

Experiment ID	Proposal title	Contact	PAC rating	Days approved	PAC	Days req. (PAC)	CLAS days	Detector	Beam energy	Hall-A Contact	Target	Days complete	% complete	Days remain	Total publications	Letter publication	Publications in peer-reviewed journals
E12-06-119(g)	Deeply virtual Compton scattering	M. DeLuca	A	60	50	48, 52									1	1	PRL 130, 211903 (2023), arXiv:2208.02581
E12-09-108	Hard exclusive electro-production of π^0, η	P. Stoler	B	90	30	48, 52									1	1	R. 8 048, 138403 (2024)
E12-12-007	Exclusive η meson electroproduction	P. Stoler, C. Munoz	B+	50	30	48, 52											
E12-06-112	Proton's quark dynamics in SIDIS pion production	H. Avakian	A	60	38	48, 52									5	5	PRL 126, 152501 (2021), PRL 126, 182001 (2021), PRL 130, 152501 (2023), PL B 830, 137130 (2022), JHEP 06 (2022) 004, PRD 104, 034004 (2021)
E12-06-104A	Semi-inclusive π production in target fragmentation region	M. Mirazita			42	48, 52											PRD 113, 052018 (2026)
E12-06-112B	Collinear nucleon structure at (anti-)3 in chiEFT on SIDIS	M. Mirazita				48, 52									1	1	PRL [arXiv:2602.14171]
E12-09-007(A)	Study of partonic distributions in kaon SIDIS	W. Armstrong	A-	110	55	48, 52									1		PRC 112, 055202 (2025)
E12-12-001	Timelike Compton scattering and Jpsi photoproduction	P. Nadel-Turonski	A-	120	30	48, 52									1	1	PRL 127, 262501 (2021)
E12-12-001A	Near threshold Jpsi photoproduction and LHCb pentaquarks	S. Stepanyan		45		48, 52									1		PRC 113, 065203 (2026)
E12-09-003	Nucleon Resonance Studies with CLAS12	R. Gothe	B+	40	24	48, 52									2		PRC 110, 035201 (2024), arXiv:2309.15169
E12-06-109A	Exclusive N^* to $K\Lambda$ studies with CLAS12	D. Carman		42		48, 52									1		PRC 112, 035208 (2025)
E12-06-108B	Transition form factor of the γ^* meson with CLAS12	G. Gokaldmand		60		48, 52											
E12-11-005	Hadron spectroscopy with forward tagger	M. Battaglieri	A-	110	37	48, 52											
E12-11-005A	Photoproduction of very strange baryon	L. Gan			40	48, 52											
E12-07-104	Neutron magnetic form factor	G. Gilfoyle	A-	28	32	48, 52											
E12-09-007(A)	Study of partonic distributions in kaon SIDIS	W. Armstrong	A-	110	55	48, 52											
E12-07-104A	Quasi real photoproduction on deuterium	F. Hauenstein		67		48, 52											
E12-09-008	Beam Multiple asymmetry in kaon SIDIS with H and D targets	M. Contalbrigo		56	30	48, 52											
E12-09-005B	Collinear nucleon structure at (anti-)3 in chiEFT on SIDIS	M. Mirazita		42		48, 52											
E12-11-003	DVCS on the neutron	S. Niccolai	A (HE)	90	30	48, 52									1	1	PRL 133, 211903 (2024).
E12-11-005A	In medium structure functions, SRC, and the EMC effect	O. Hen		40		48, 52											
E12-11-005B	Study of Jpsi photoproduction from the deuteron	Y. Gerus		68		48, 52											arXiv:2409.03879
E12-06-109	Longitudinal spin structure of the nucleon	S. Kuhn	A	50	30	48, 52											
E12-09-109A	DVCS on the neutron with polarized deuterium target	S. Niccolai			44	48, 52											
E12-06-119(b)	DVCS on longitudinally polarized proton target	M. DeLuca	A	120	30	48, 52											
E12-07-107	Spin-orbit correlations with longitudinally polarized target	H. Avakian	A-	100	55	48, 52											
E12-07-105A	Single hanger production in the target fragmentation region	T. Hayward			60	50											
E12-09-007(A)	Study of partonic distributions using SIDIS K production	W. Armstrong	A-	60	55	48, 52											
E12-09-007A	Dihadron electroproduction in DIS	C. Dilks			48	50											
E12-09-009	Spin-orbit correlations in K production with polarized targets	H. Avakian	B+	120	55	48, 52											
E12-06-105	Color transparency in exclusive vector meson production	L. El Fassi	B+	30	30	48	30	CLAS12	11	L. El Fassi	Nuclear targets	40	100%	0			
E12-06-105A	Nuclear TMDs	R. Dupre			48												
E12-06-117	Quark propagation and hadron formation	W. Brooks	A-	60	30	48	60	CLAS12	11	K. Hafidi/pen	Nuclear targets	27	45%	33			
E12-06-117A	Dihadron measurements in electron-nucleus scattering	M. Arratia			48												
E12-06-119	Free neutron structure at large x	S. Bueltmann	A	40	30		42	CLAS12, Radial TPC	11	F. Bossu	Deuteron D_2	42	100%	0			
E12-06-119A	Neutron DVCS measurements with SONIUS 12	W. Hattawy			47												
E12-14-001	EMC effect in spin structure functions	W. Brooks	B+ or A-	56	35	48, 52	56	CLAS12	11	G.M.Urciuoli	Longitudinally Polarized ^{3}He	6	9%	50			
E12-11-111	SIDIS on transverse polarized target	M. Contalbrigo	A+C2nA	110x120	30, 53	48, 52											
E12-12-009	Transversity with di-hadron on transverse target	H. Avakian	A+C2nA	110x120	30, 53	48, 52	125	CLAS12	11	M. Contalbrigo	Trans.Pol. NH3	6	5%	125			
E12-12-010	DVCS with transverse polarized target	L. Elouadrhiri	A+C2nA	110x120	30, 53	48, 52											
E12-11-111A	Measurements of target spin asymmetries in exclusive production of hadrons with H in transverse polarized target	H. Avakian			53												
E12-16-010	A search for hybrid baryons	A. D'Angelo	A-	120	48	48											
E12-16-010A	Nucleon Resonances in exclusive KY electroproduction	D. Carman			44	48	100	CLAS12, Forward Tagger	6.6, 8.8	A. D'Angelo	Liquid H_2	49	49%	51			PRC 105, 065201 (2022), PRC 112, 055208 (2025)
E12-16-010B	DVCS at 6.6 and 8.8 GeV	L. Elouadrhiri			48	48											
E12-16-010C	Separation of the σ_L and σ_T contributions to hadron production	H. Avakian			53												
E12-17-012	Partonic structure of light nuclei	Z. Meziani	A-	50	45		88	CLAS12, ALERT	11	L. R. Dupre	Gaseous H, D_2, ^{3}He	88	100%	0			
E12-17-012A	Tagged EMC measurements on light nuclei	R. Dupre			48												
E12-17-012B	Spectator-tagged DVCS on light nuclei	W. Armstrong			45												
E12-17-012C	Other physics opportunities with ALERT	R. Dupre			45												
E12-17-006	Electron for neutrinos addressing neutrino-nucleus issues	O. Hen	A	45	45		45	CLAS12	2.2, 4.4, 6.6, 8.8, 10.6	O. Hen	Nuclear	30	70%	15			
E12-16-005	Exclusive studies of short-range correlations in nuclei	O. Hen			48												
C12-20-002	Spin-dependent electron scattering with polarized 3He target	R. Milner	C1 (A-)	30	48		30	CLAS12	11	(RSH)	^{3}He, ^{3}He	0	0%	30			
E12-25-005	Precision measurements of A=3 nuclei	W. Schmitz-Matzen	A-	60	48		60	CLAS12	2.2, 6.6	(RG-F)	^{3}He/^{4}He	0	0%	60			
E12-25-015	Measuring Short-Range Correlations with ALERT	F. Hauenstein	A	17	53		17	CLAS12, ALERT	6.6	RGA	^{4}He	17	100%	0			
C12-25-001	Elastic- and photo-production of muon pairs with μCLAS12	S. Stepanyan	C1 (A)	240	53		240	μCLAS12	11	RG-E	Liquid H_2	0	0%	240			
							1215					458		764			
Non-e-CLAS12 RDs																	
E12-11-008	Heavy Photon Search (HPS)	T. Nelson	A	180	37, 56	48, 52	180	HPS setup	2.2, 4.4	RG-J	Nuclear	78	43%	102	3		PRD 99, 091101 (2019), PRD 104, 012016 (2021), PRD 113, 052010 (2026)
E12-11-106	High precision measurement of proton charge radius (PRad)	A. Gasparian	A	15	39		15	HyCal/ADM	1.1, 2.2	RG-J	H_2 gas jet	14	100%	0	1	1	Nature 575, 147–150 (2019)
E12-20-004	High precision measurement of proton charge radius (PRad-II)	A. Gasparian	A	45	45		100	HyCal/ADM	0.7, 1.9, 2.2, 4.4	RG-D	H_2 gas jet	60	100%	0			
E12-21-003	A direct detection search for hidden sector vector particles (DS)	A. Gasparian	A	60	60			HyCal/ADM	2.2		^{3}He foil	60	0.0	30			
E12-23-003	Precision measurement of neutral pion transition form factor	I. Larin	A-	67	59		67	HyCal/ADM	11	RS-G	^{3}He foil	0	0	67			
							342					142		199			

764 PAC days remain for the CLAS12 11 GeV e^- program. About 8.5 years of running, with 26 weeks per year of CEBAF availability for physics.

For non-CLAS12 experiments, the remaining beam time is 199 PAC days, or about 2+ years of running (26 weeks).

Another two to three years are needed to complete the 12 GeV e^+ program.

Approved physics program: ~11 years of experimental running time on the books. This does not include future experiments, additional setup and commissioning time, or scheduling-related losses.

Straw-man schedule

