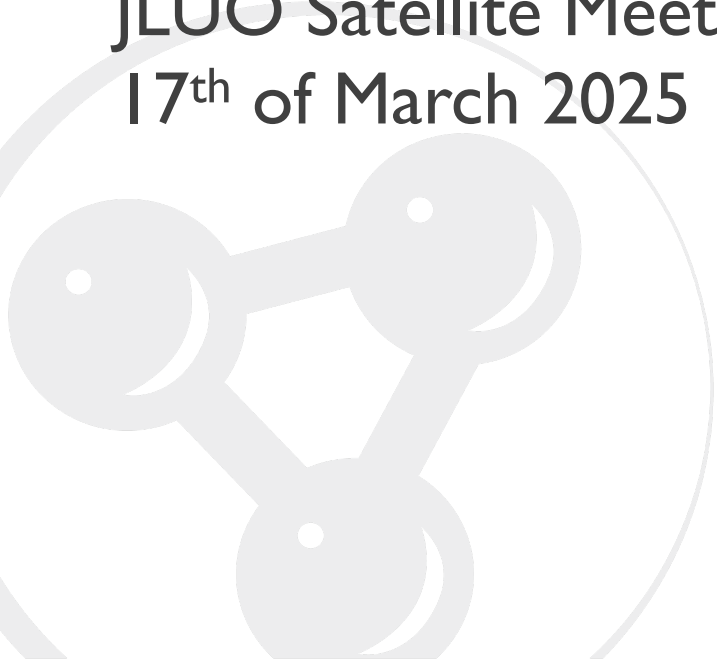


Status of Hall B

Noémie Pilleux, with a lot of help from Richard Tyson

JLUO Satellite Meeting

17th of March 2025



Outline

I

Data Taking in 2024: RG-K & RG-E

II

Data Taking in 2025:ALERT

III

Future Data Taking: XI7 & PRad

IV

CLAS & CLAS12 Recent Publications

V

Completed Ph.D.Thesis

VI

PAC 52

Data Taking in 2024

SAD or scheduled 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-D		liq. D2 & nuclear	11	2023-10-01	2023-12-15	75	30	38	40	0
RG-K		liq. H2	6,4	2023-12-15	2023-12-18	3	88	2	2	86
	winter break	change		2023-12-18	2024-01-10	23				
RG-K		liq. H2	6,4	2024-01-11	2024-02-12	32	86	16	19	67
RG-K		liq. H2	8,4	2024-02-12	2024-03-11	28	67	14	16	51
		change		2024-03-11	2024-03-15	4		2		
RG-E		liq. D2 & nuclear	11	2024-03-15	2024-05-20	66	60	33	27	33
SAD 2024				2024-05-20			sum:	104	104	

RG-K

N* resonances and search for hybrid baryons.

March 11, RG-K finished data-taking after two months with ℓ H2 at lower-pass beam.

Reached highest momentum resolutions in CLAS12 for baryon spectroscopy.

RG-E

Quark propagation, hadron formation, and dihadron measurements in electron-nucleus scattering.

May 19, RG-E ended data-taking using 5 different solid target materials simultaneously with ℓ D2.

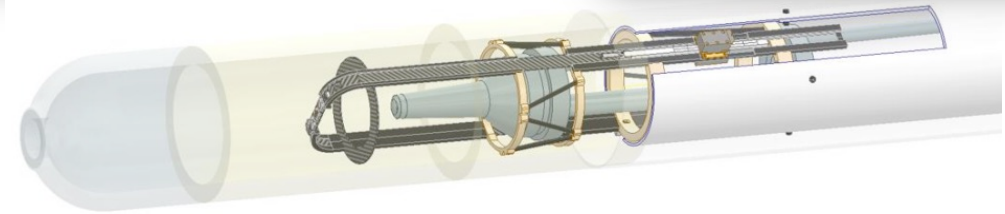
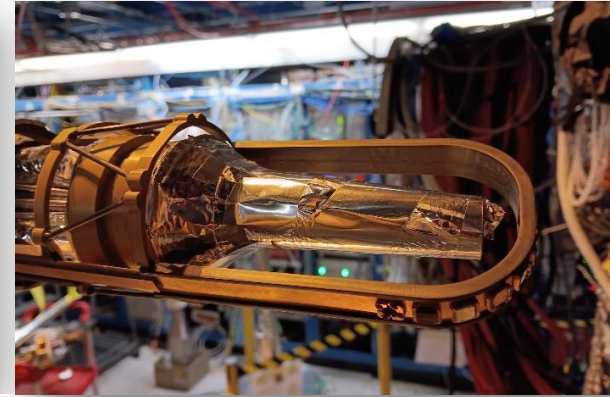
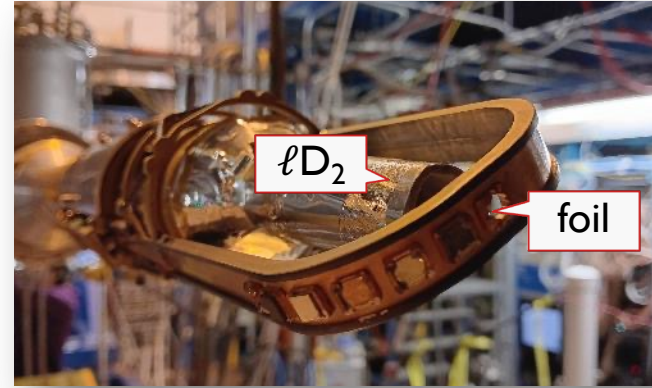
Run Group E

Target

Double-target system combining liquid deuterium cell with solid nuclear target foils affixed on a band for fast solid-target changes.

Achieved Comparable luminosities on all targets:

- C x ℓD_2 : 23 1/fb
- Al x ℓD_2 : 24 1/fb
- Cu x ℓD_2 : 22 1/fb
- Sn x ℓD_2 : 22 1/fb
- Pb x ℓD_2 : 26 1/fb



Online analysis

Quick analysis turnaround during data taking verified production from dual targets.

Preliminary hadron multiplicity ratios as expected.

Data quality and statistics seem good enough for high-level physics output!

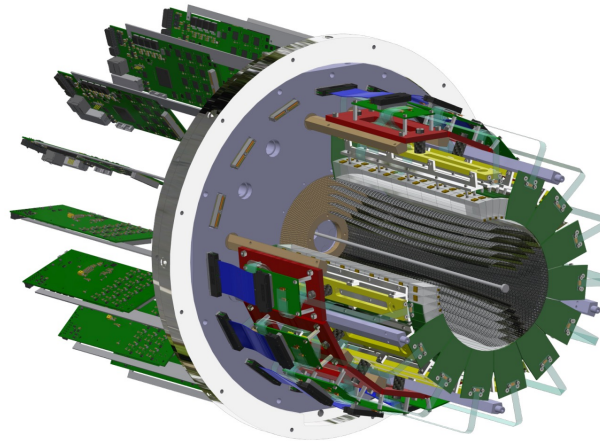
Current Schedule for 2025

SAD or scheduled Run Group	Setup / Status	Target	Beam Energy	Start Date	End Date	Scheduled Calendar Days	Remaining PAC Days Before Run	Scheduled PAC Days = Cal.Days/2	Actual PAC Days from ABUs	Remaining PAC Days After Run
SAD 2024				2024-05-19	2025-03-07	292				
RG-L	ALERT	high pressure gas	2.1	2025-03-24	2025-03-31	7	55	4		52
	pass change			2025-03-31	2025-04-01	1				
RG-L	ALERT	high pressure gas	11	2025-04-01	2025-07-18	108	52	54		-3
	pass change			2025-07-18	2025-07-19	1				
RG-L	ALERT	high pressure gas	2.1	2025-07-19	2025-07-21	2	-3	1		-4
	pass change			2025-07-28	2025-07-29	1				
RG-L	ALERT	high pressure gas	6.6	2025-07-29	2025-09-04	37	17	18.5		-1.5
SAM 2025	reconfigure	change				157				
							sum:	77		

ALERT

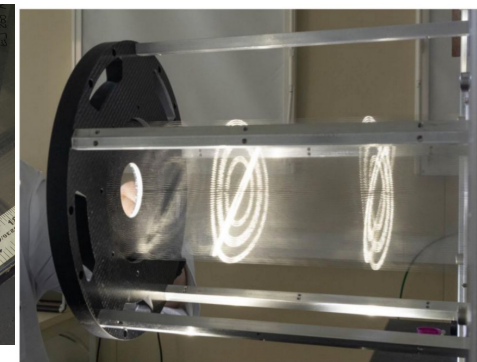
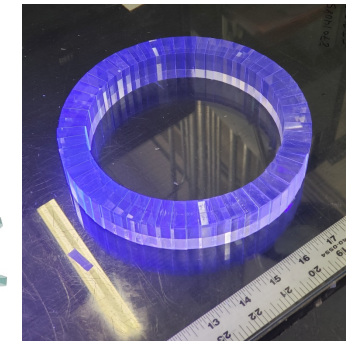
A Low Energy Recoil Tracker:

- Stereo drift chamber for track reconstruction at momenta down to 70 MeV for protons.
- Time of flight array of scintillators for particle identification of p, d, ^3H , ^3He , ^4He .
- High pressure gas H, d and ^4He targets.

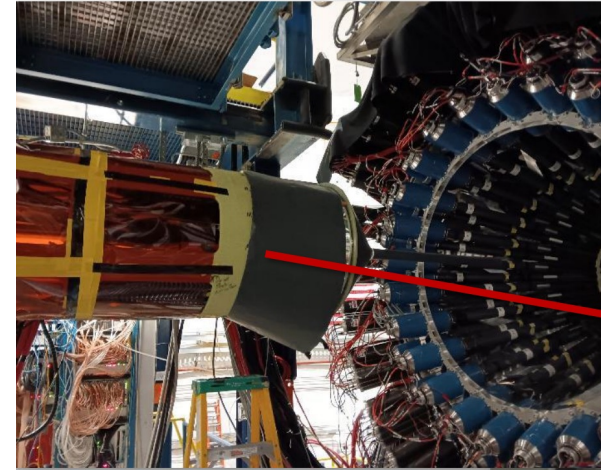
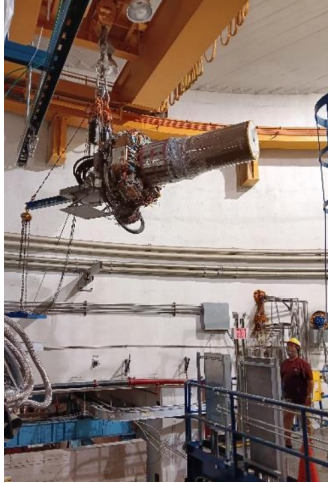


Physics Goals

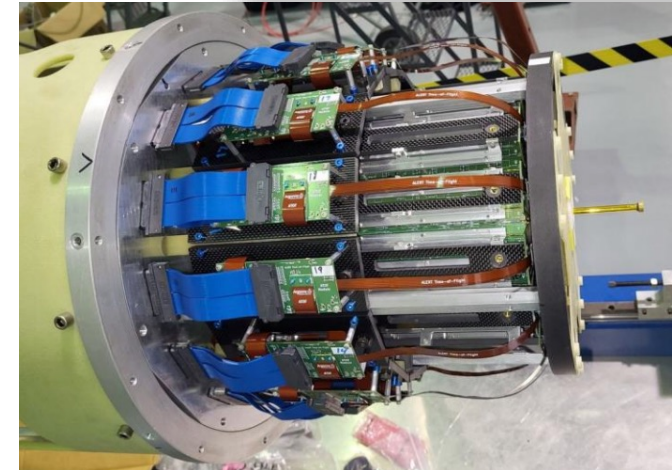
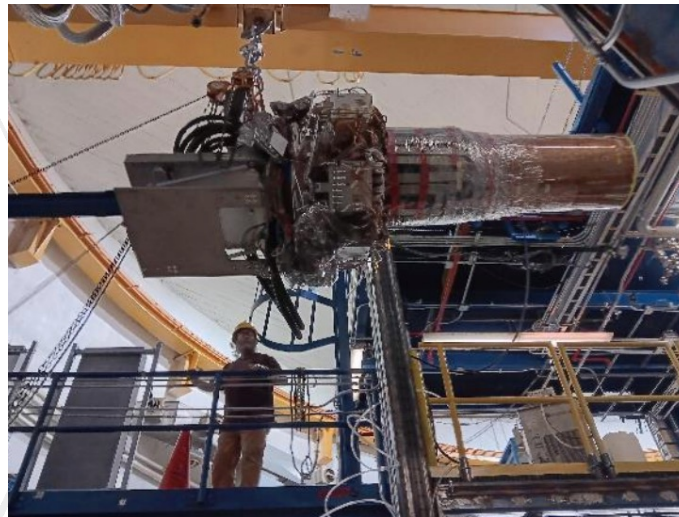
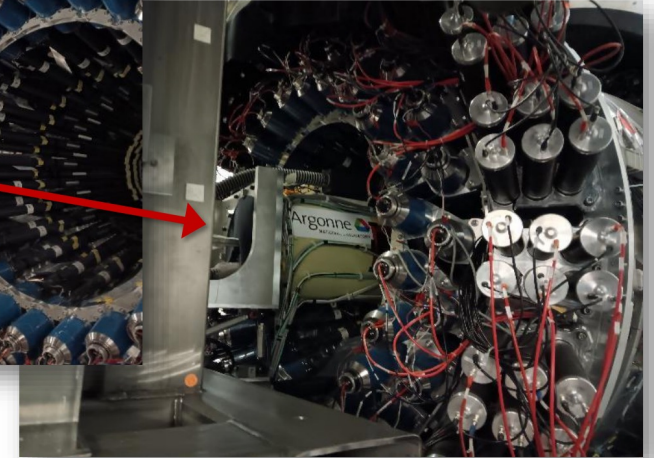
- Fundamental structure of light nuclei
- Structure of ^4He : quark and gluon radii with coherent DVCS and ϕ DVMP.
- Partonic structure of bound nucleons with tagged measurements: EMC ratio, incoherent DVCS for bound neutrons and protons in deuterium and ^4He .



ALERT Installation

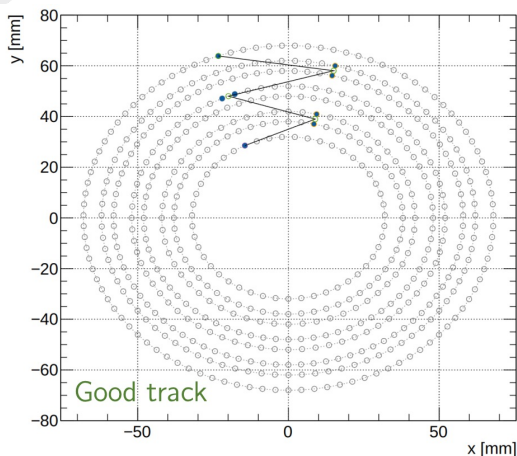


Operation position



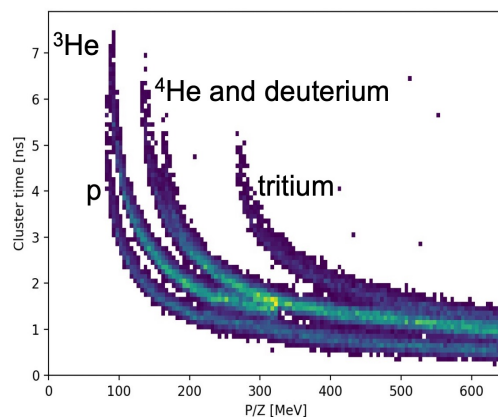
ALERT Preparation

- Gas systems for the AHDC and the targets are in place.
- DAQ extensively tested in cosmic runs.
- CLAS12 magnets ramped up.
- Cosmic data are being analyzed.
- Monitoring tools are being completed.
- Software effort ongoing.
- And much more in the busy times pre-beam times!

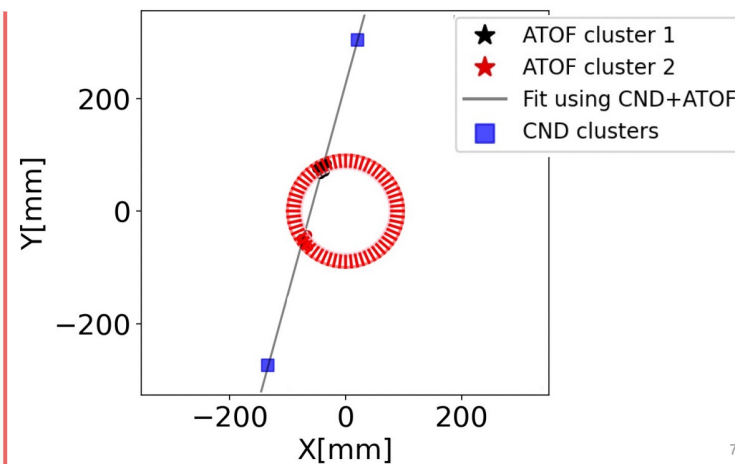


Track finding algorithm from simulations, M. Ouillon.

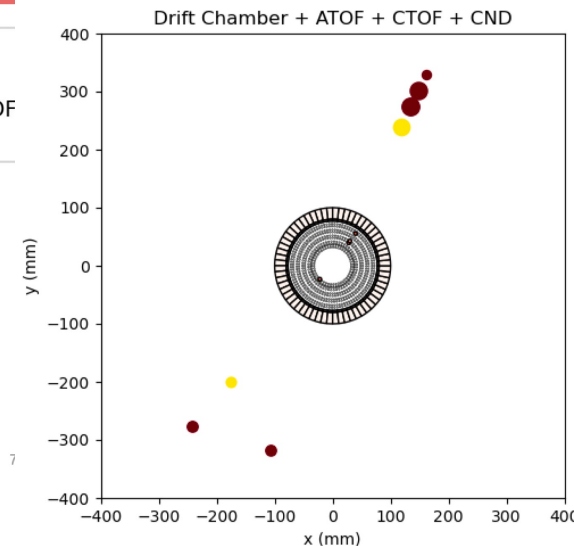
PID FROM SIMULATIONS



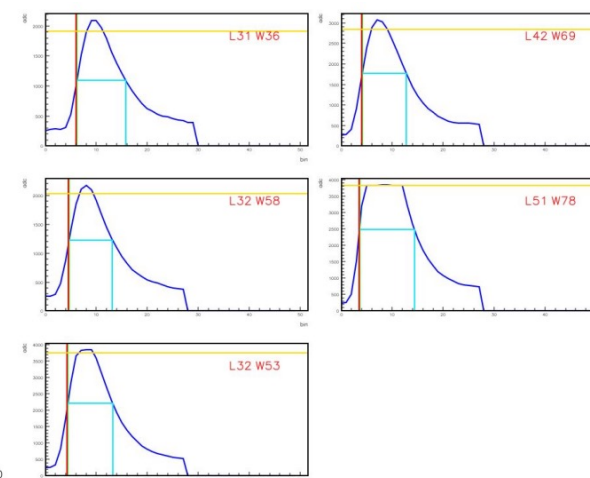
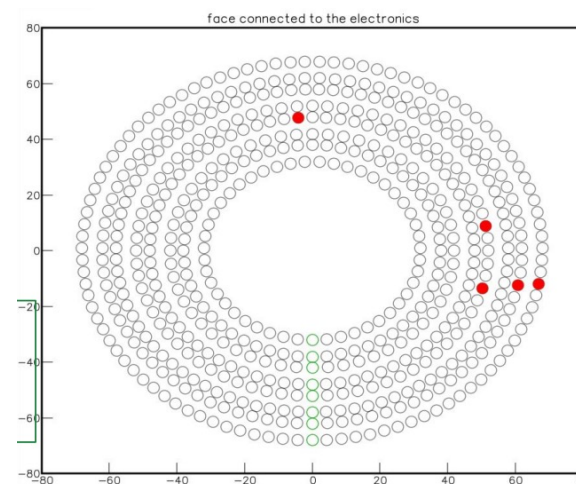
ATOF clustering,
ALERT PID, NP.



Cosmics in the ATOF, NP



Cosmics in the AHDC, H. Klest and F. Touchette



The Future (end of 2025 - 2026)

SAD or scheduled Run Group	Setup / Status	Target	Beam Energy	Start Date	End Date	Scheduled Calendar Days	Remaining PAC Days Before Run	Scheduled PAC Days = Cal.Days/2	Actual PAC Days from ABUs	Remaining PAC Days After Run
X17 search	HyCal/GEMs	Ta foil	2,2	2025-11-05	2025-12-20	45	60	22,5		37,5
	winter break	change		2025-12-20	2026-01-12					
X17 search	HyCal/GEMs	Ta foil	4,4	2026-01-12	2026-03-30	77	37,5	39		-1
	reconfigure	change		2026-03-30	2026-04-06	7				
PRad-II	HyCal/GEMs	gas jet	2,2	2026-04-06	2026-04-27	21	40	11		30
	pass change			2026-04-27	2026-05-04	7				
PRad-II	HyCal/GEMs	gas jet	3,6	2026-05-04	2026-06-15	42	30	21		9
	pass change			2026-06-15	2026-06-16	1		1		
PRad-II	HyCal/GEMs	gas jet	0,7	2026-06-16	2026-07-06	20	9	10		-2
SAD 2026							sum:	103		

Schedule

Very conditional schedule based on assumed start dates and successful Experiment Readiness Review

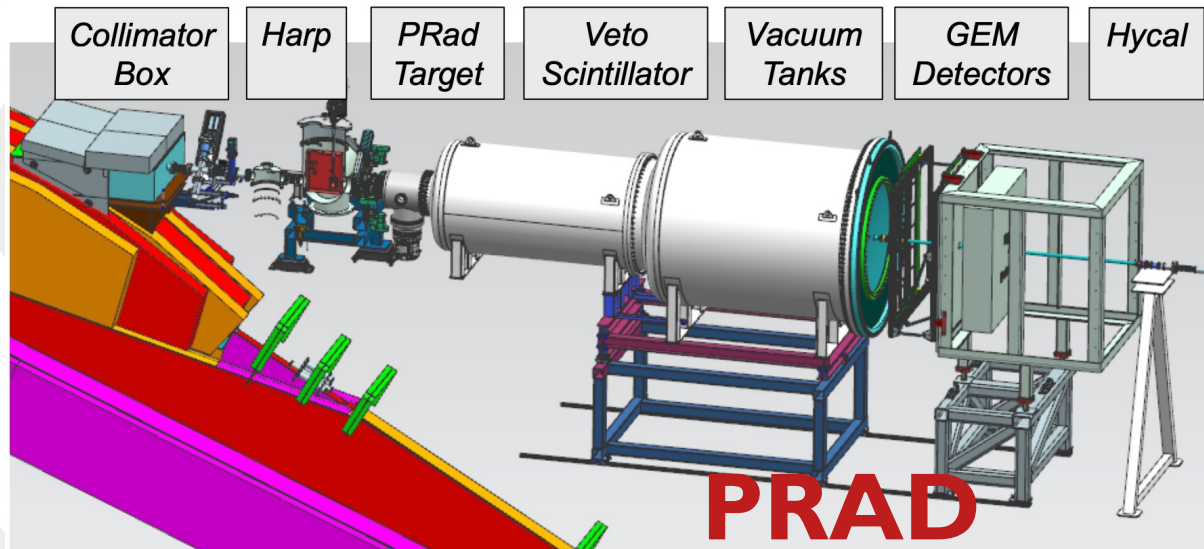
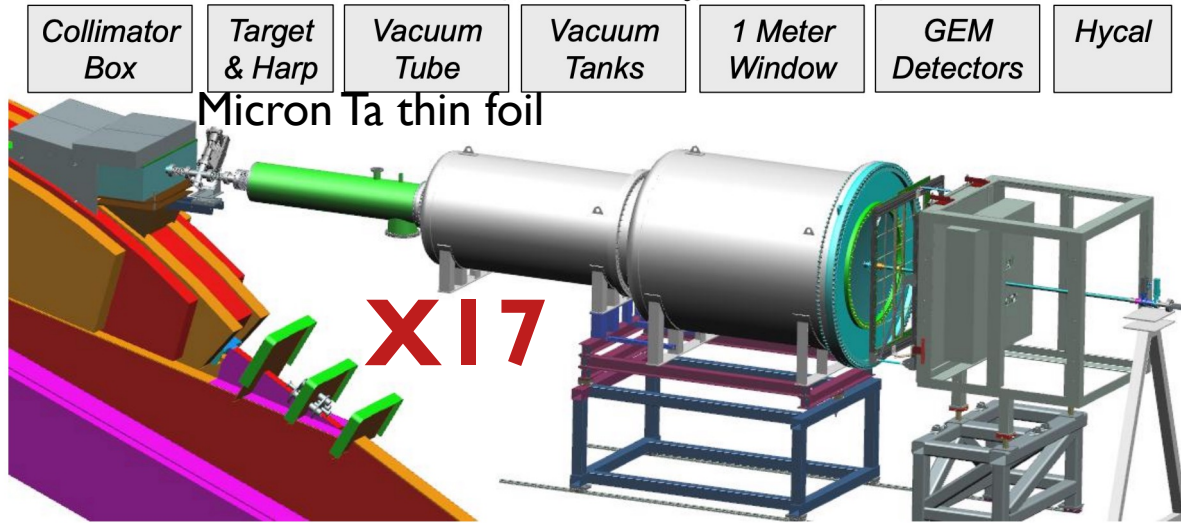
Optimistically assuming 30 weeks of physics running while the lab currently plans with 25 weeks.

Experiments

X17: Search for the X17, hypothetical explanation for anomaly in the ^8Be nuclear transition, possibly connected to dark matter.

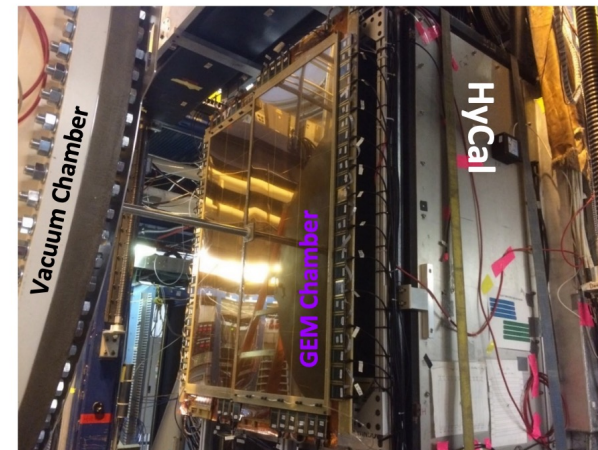
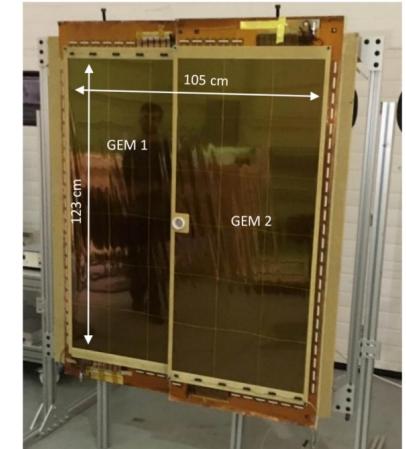
Prad-II: Measurement of the proton charge radius.

PRAD/X17



Hycal for electrons and gamma
1156 PbWO₄ modules with new
fADC readout

GEMs for precision tracking
Assembly in progress



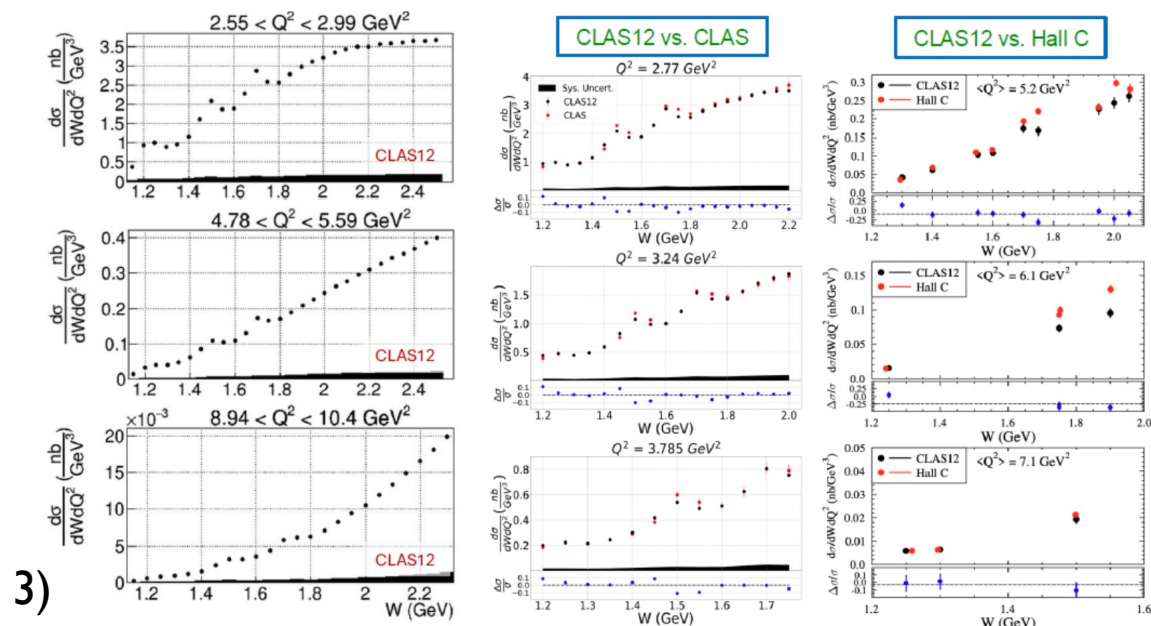
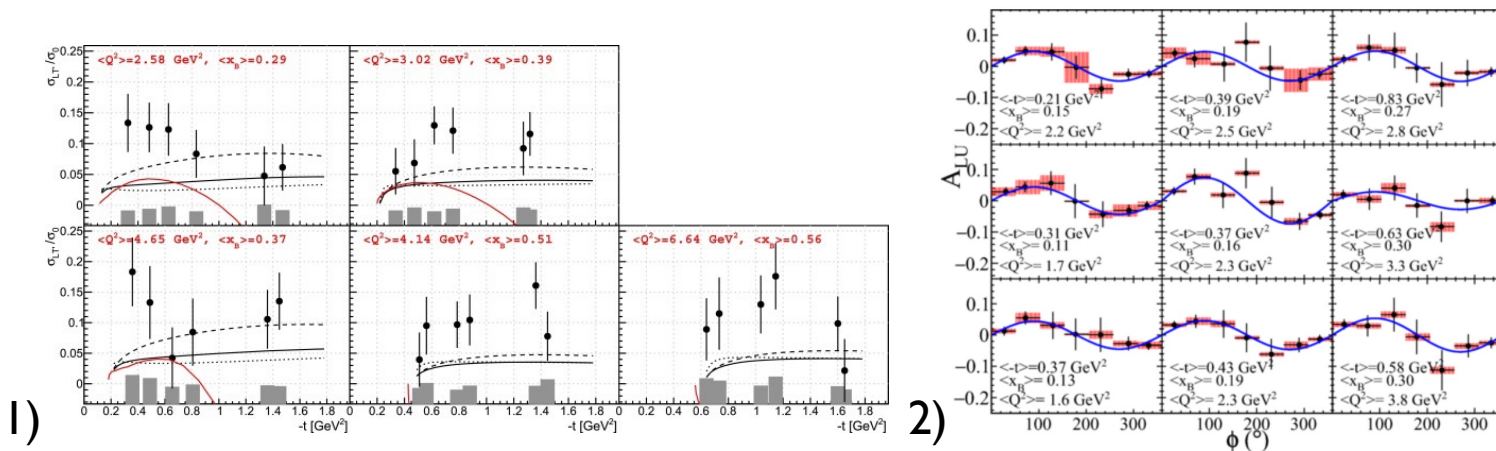
CLAS12 Publications

List

1) A. Kim et al. (CLAS Collaboration), Beam Spin Asymmetry Measurements of Deeply Virtual π^0 Production with CLAS12, *Phys. Lett. B* **849**, 138459 (2024).

2) A. Hobart et al. (CLAS Collaboration), First Exclusive Measurement of Deeply Virtual Compton Scattering on the Neutron, *Phys. Rev. Lett.* **133**, 211903 (2024).

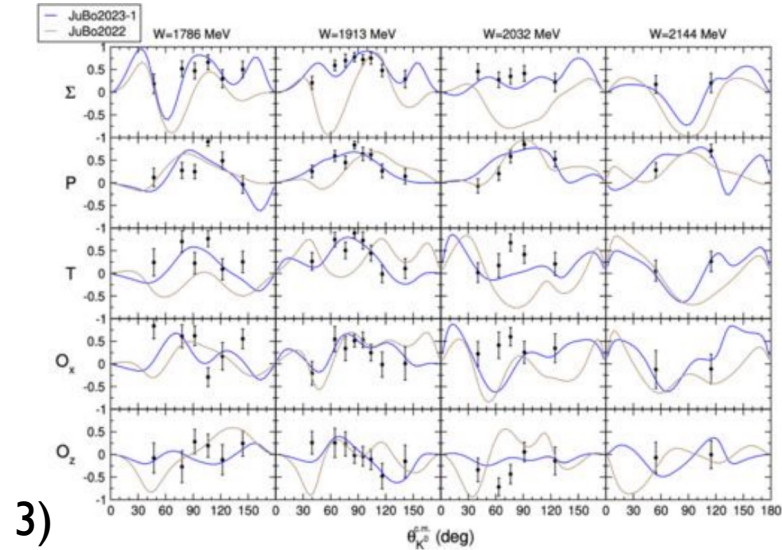
3) V. Klimenko et al. (CLAS Collaboration), Inclusive Electron Scattering in the Resonance Region off a Hydrogen Target with CLAS12, accepted in *Phys. Rev. C* (2025).



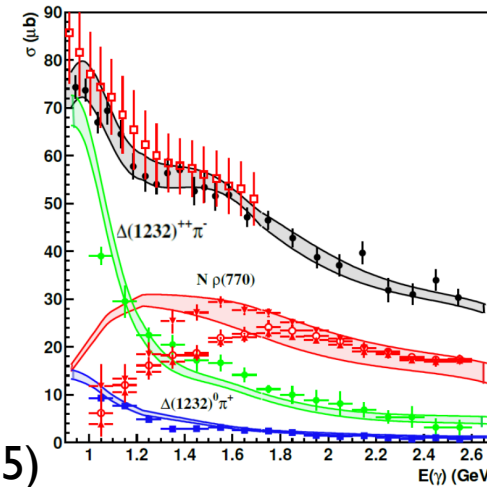
CLAS Publications

List

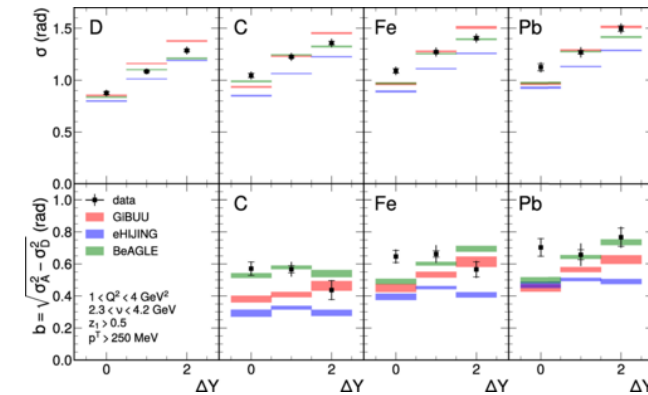
- 1) Iu. A. Skorodumina et al. (CLAS Collaboration), Double-Pion Electroproduction off Protons in Deuterium: Quasi-Free Cross Sections and Final State Interactions, *Phys. Rev. C* **109**, 065205 (2024).
- 2) T. Mineeva et al. (CLAS Collaboration), Suppression of Neutral Pion Production in Deep-Inelastic Scattering of Nuclei with the CLAS Detector, submitted to *Phys. Rev. Lett.* (2024)
- 3) L. Clark et al. (CLAS Collaboration), Photoproduction of the Σ^+ hyperon using linearly polarized photons with CLAS, *Phys. Rev. C* **111**, 025204 (2025).
- 4) A. Deur et al. (CLAS Collaboration), Measurement of the nucleon spin structure functions for $0.01 < Q^2 < 1 \text{ GeV}^2$ using CLAS", submitted to *Phys. Rev. C*.
- 5) A.V. Sarantsev, E. Klempt et al. (CLAS Collaboration), Photoproduction of two charged pions off protons in the resonance region, accepted in *Phys. Rev. C* (2025).
- 6) S.J. Paul et al. (CLAS Collaboration), Dihadron Azimuthal Correlations in Deep-Inelastic Scattering Off Nuclear Targets, *Phys. Rev. C* **111**, 035201 (2025).



3)



5)



6)

8 Completed Ph.D. from CLAS, 1 from HPS

université
PARIS-SACLAY

Diffusion Compton profondément
virtuel sur le neutron avec
l'expérience CLAS12 et le détecteur
BONuS12 au laboratoire Jefferson
(USA)

Tagged DVCS on neutron with the CLAS12 Experiment
and the detector BONuS12 at Jefferson Lab (USA)

Thèse de doctorat de l'université Paris-Saclay

École doctorale n°576 : particules hadrons énergie et noyau : instrumentation,
imagerie, cosmos et simulation (PHENICS)
Spécialité de doctorat : Physique hadronique
Graduate School : Physique. Référent : Faculté des sciences d'Orsay

Thèse préparée dans l'unité de recherche IJCLab (Université Paris-Saclay, CNRS, 91405,
Orsay, France), sous la direction de **Raphaël DUPRÉ**, Chargé de recherche

Thèse soutenue à Paris-Saclay, le 5 avril 2024, par

Mathieu Ouillon

Differential Cross Sections from CLAS12 RG-A
Inclusive Electron Scattering

Valerii Klimenko

B.S. Physics, Moscow State University, 2017
M.S. Physics, Moscow State University, 2019

Exclusive η Electro-Production Beam Spin Asymmetry Measurements using CLAS12 at
Jefferson Lab

by Isabella Illari

B.A. in Physics, May 2017, Barnard College of Columbia University
M.S. in Physics, January 2020, The George Washington University
M.Phil. in Physics, August 2022, The George Washington University

Timelike Compton Scattering from a Longitudinally Polarised
Target with CLAS12 at Jefferson Lab

Kayleigh Gates

Probing the Isospin Composition of Short-Range Correlated Pairs at Jefferson Lab Hall B

by Erin Marshall Seroka

B.S. in Physics, May 2013, Le Moyne College
M.S. in Physics, December 2016, University of Maryland, College Park
M.Phil. in Physics, January 2024, The George Washington University

université
PARIS-SACLAY

Nucleon Structure Studies at
Jefferson Lab and the Electron Ion
Collider

Études de la structure des nucléons au laboratoire
Jefferson et au collisionneur électrons-ions

Thèse de doctorat de l'université Paris-Saclay

École doctorale n° 576 Particules Hadrons Énergie et Noyau :
Instrumentation, Imagerie, Cosmos et Simulation (PHENICS)
Spécialité de doctorat : Physique nucléaire
Graduate School : Physique. Référent : Faculté des sciences d'Orsay

Thèse préparée dans l'unité de recherche IJCLab (Université Paris-Saclay, CNRS),
sous la direction de **Silvia NICCOLAI**, Directrice de recherche,
le co-encadrement de **Carlos MUNOZ CAMACHO**, Directeur de recherche.

Thèse soutenue à Paris-Saclay, le 14 octobre 2024, par

Noémie PILLEUX

UNIVERSITY OF CALIFORNIA
SANTA CRUZ

SEARCHING FOR STRONGLY-INTERACTING DARK MATTER
WITH THE HEAVY PHOTON SEARCH EXPERIMENT

A dissertation submitted in partial satisfaction of the
requirements for the degree of

DOCTOR OF PHILOSOPHY

in

PHYSICS

by

Alic Spellman

December 2024

Measuring Neutron Polarisation in
Deuteron Photo-disintegration with the
CLAS Start Counter



William Andrew Booth

MEASURING CLAS12 $D(E, E^* \pi^+)$ CROSS SECTIONS FOR E_{ANU}

by

Caleb Fogler
B.S. December 2016, Old Dominion University
M.S. May 2019, Old Dominion University

A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

PHYSICS

OLD DOMINION UNIVERSITY
December 2024

PAC 52 (July 2024)

Jeopardy

Several experiments went through jeopardy and successfully defended their beam time:

- RG-A: 11 GeV Polarized Electrons on Liquid Hydrogen Target
- RG-B: Electroproduction on deuterium with CLAS12
- RG-C: Electroproduction from longitudinally polarized protons or deuterons
- E12-11-006: Heavy Photon Search Experiment
- E12-14-001: The EMC Effect in Spin Structure Functions (RGG)

One experiment will resubmit their proposal this year due to significant changes in the experimental setup:

- Run-Group H: electroproduction on transversely polarized proton with CLAS12

Proposals

One proposal has been conditionally approved on the basis that positron beams will be available at CEBAF:

- A Dark Photon Search with a JLab Positron Beam

Conclusion

Hall B is continuing to produce high quality electroproduction data:

- RG-K: N^* resonances and search for hybrid baryons (2024)
- RG-E: Measurements in electron-nucleus scattering (2024)
- RG-L: Study light nuclei structure with ALERT (2025)
- X17 Search and Proton Radius with Prad (est. 2025-2026)

Several CLAS and CLAS12 high level publications in the last year.

8 CLAS and 1 Heavy Photon Search Completed Ph.D.s.

Successful jeopardies and new proposals in 2024 with more to come in 2025.



Some Pictures from the
2024 JLab Open House