Hall-B Status Report

- News from Hall-B Group
- Status of Run Preparations
- Schedule and Remarks

Patrick Achenbach

Mar 3, 2025

News from Hall-B Group and Collaborations

User Visits

- **Single point-of-contact** for Hall B visitors is admin support Chris Ross (cross@jlab.org)
- **User Visit Initiation Form** for Hall B visitors
- Ladder (SAF307) and Basic Electrical (ESC001) Safety **Trainings** required for work in Hall-B
- New regulations require **ePAS permits** before work commences (*Electronic Permit Admin-instration System* for work permits, risk assessments, job hazard analyses, etc.)
- New regulations require **pre-job briefings** for every work task that is performed
- All documentation needs to be submitted **7 days in advance** of the visit, also for meetings
- Every visitor must **check in and check out** with their hosts upon arrival and ending the visit

Dates

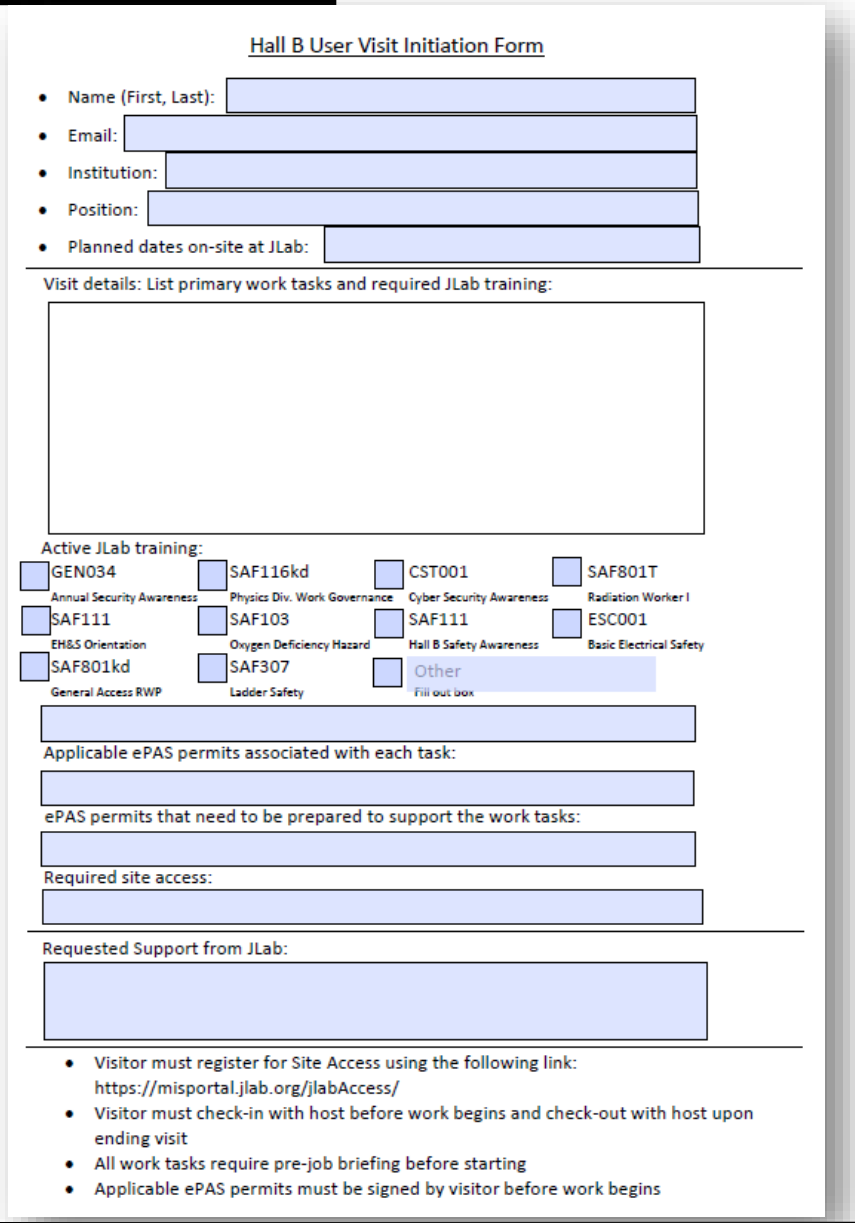
Work tasks

Trainings

ePAS

Support

Responsi-bilities



Hall B User Visit Initiation Form

- Name (First, Last):
- Email:
- Institution:
- Position:
- Planned dates on-site at JLab:

Visit details: List primary work tasks and required JLab training:

Active JLab training:

GEN034 Annual Security Awareness	SAF116kd Physics Div. Work Governance	CST001 Cyber Security Awareness	SAF801T Radiation Worker I
SAF111 EH&S Orientation	SAF103 Oxygen Deficiency Hazard	SAF111 Hall B Safety Awareness	ESC001 Basic Electrical Safety
SAF801kd General Access RWP	SAF307 Ladder Safety	Other Fill out box	

Applicable ePAS permits associated with each task:

ePAS permits that need to be prepared to support the work tasks:

Required site access:

Requested Support from JLab:

- Visitor must register for Site Access using the following link: https://misportal.jlab.org/jlabAccess/
- Visitor must check-in with host before work begins and check-out with host upon ending visit
- All work tasks require pre-job briefing before starting
- Applicable ePAS permits must be signed by visitor before work begins

Hall-B Group

- **Hall-B Postdoc Bhawani Singh** (TUM, Germany, ALICE Collab.) started last week
- **New LDRD Postdoc position** on AI/ML developments
- Currently **35** positions in Hall B Group including small Spin-Polarized Fusion team **+ 2** Joint Appointments with CNU

Group Leader

Achenbach, Patrick

Scientific Staff

Avagyan, Harut
Baltzell, Nathan
Boyarinov, Sergey
Burkert, Volker
Cao, Tongtong
Carman, Daniel
De Vita, Raffaella
Dilks, Christopher
Elouadrhiri, Latifa
Gavalian, Gagik
Gotra, Yuri
Hauenstein, Florian
Kubarovsky, Valery
Mokeev, Viktor
Paremuzyan, Rafayel
Pasyuk, Eugene
Sharabian, Youri
Stepanyan, Stepan
Ungaro, Maurizio
Wei, Xiangdong
Ziegler, Veronique

Post Docs

Liyanaarachchi, Sara
Tyson, Richard
Singh, Bhawani

Joint Appointments

Heddle, David (CNU)
Phelps, William (CNU)

Admin. Support

Ross, Christopher

Engineering Staff

Dobrenz, Phillip
Miller, Robert

Designer Staff

Guthrie, Chris

Technical Staff

Bruhwel, Krister
Cook, Morgan
Docherty, Steve
Insley, Denny
Mealer, Calvin
Tucker, Dontre
Williams, Donald

Status of Run Preparations

General Hall-B Status

- **Superconducting magnets** prepared for energization
- **Hot Check-Out** for all CLAS12 subsystems has started
- Expecting beam for physics from **24 Mar to 7 Sep, 2025**
- **PRad-II/X17 Experiments** are tentatively and conditionally scheduled for Spring 2026
- Hall B has recovered from a **safety incident** on 14 Feb, 2025 (the first incidence since years)

Safety Flash Alert:

Hall B Electrical Shock

On Friday, Feb. 14, an employee working in Hall B was shocked while replacing a band heater on the torus service tower. The access space was very tight, with limited visibility and mobility to work. The employee was unaware that the area where the heater was located was fed by multiple power sources. The employee immediately reported the event to their co-worker, and they were driven to Occupational Medicine for evaluation and released back to work without restrictions.

What We Require You To Do:

- During the work-planning process, ensure that you have considered what to do in case of an incident, so mitigations are established.
- Ensure non-Nationally Recognized Testing Laboratory (NRTL) equipment is inspected prior to use and equipment with multiple energy sources are appropriately labeled. Contact John Riesbeck, Electrical Authority Having Jurisdiction, for more information.
- Always perform a voltage verification on the workspace before starting your work.
- Ensure that you are both mentally and physically fit for duty, regardless of the time pressures.

What We Have Done:

- Work was paused in Hall B.
- Timely fact-finding was conducted.
- Comprehensive review of work planning and controls took place.
- Prepared new work-planning documents to address controls for multiple hazardous energy sources.

Current ALERT Schedule

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**		

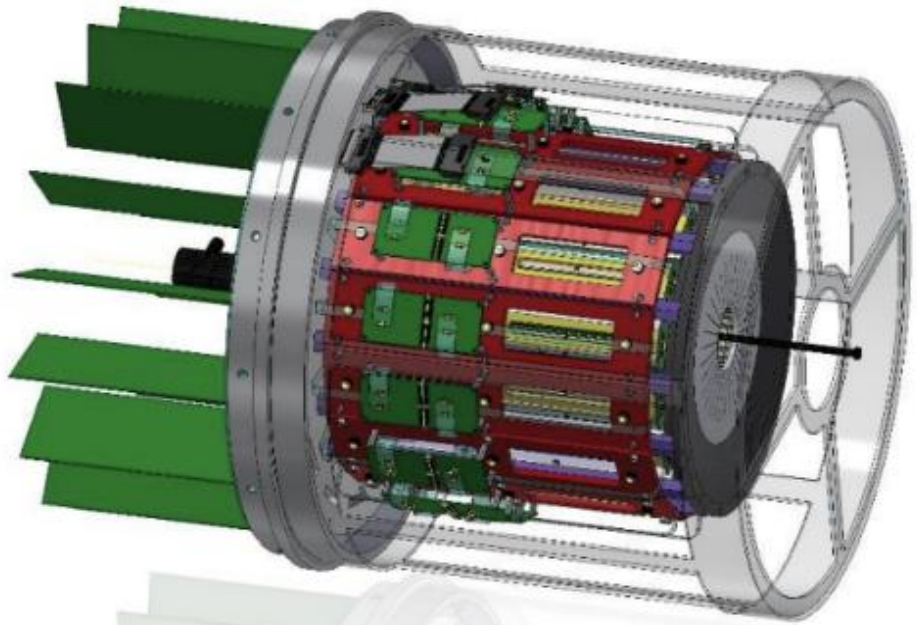
ALERT Detector

A Low Energy Recoil Tracker (ALERT)

- Hyperbolic **drift chamber**
- **Time-of-Flight** array
- **Target straw** for H_2, D_2, and ^4He

  30 cm active length, 6 mm Ø

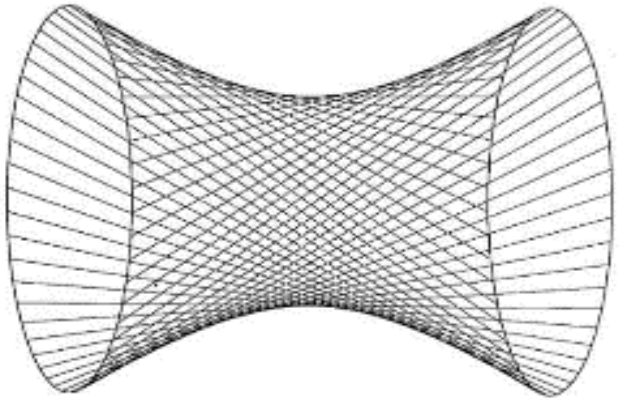
Measurement	Particles detected	p range	θ range
Nuclear GPDs	^{4}He	$230 < p < 400 MeV/c$	$\pi/4 < \theta < \pi/2$ rad
Tagged EMC	p, ^{3}H, ^{3}He	$70 < p < 250\, MeV/c$	As close to π as possible
Tagged DVCS	p, ^{3}H, ^{3}He	$70 < p < 250 MeV/c$	As close to π as possible

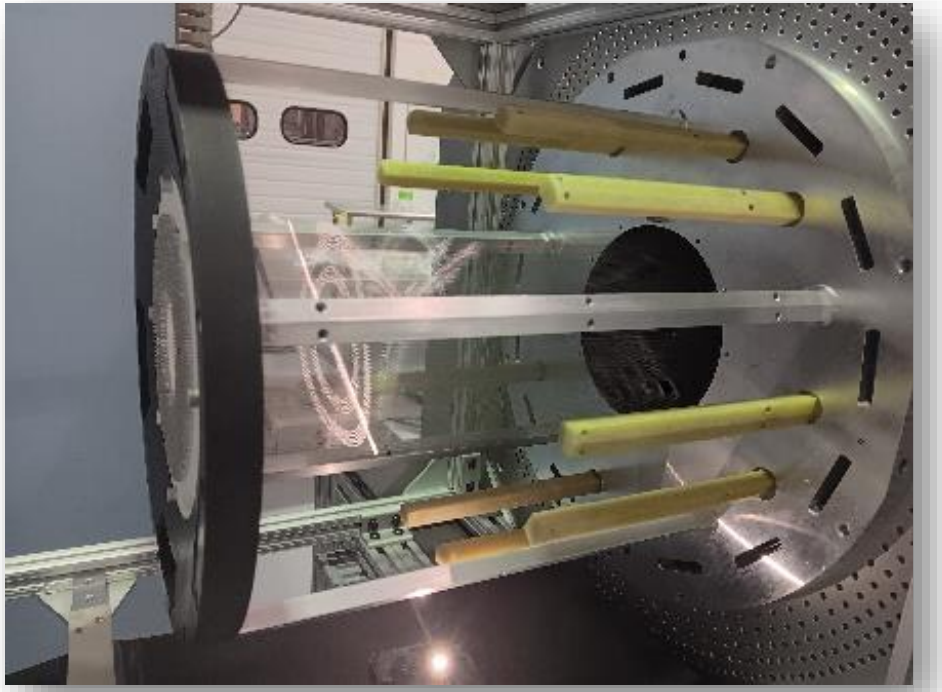


ALERT is effectively replacing the CVT similarly to BONuS

ALERT Drift Chamber (AHDC)

- **AHDC**:
  - 30 cm active length, hyperboloid shape
  - 576 signal + 2450 guard wires = 3026 wires
  - Al 30 µm diameter, 20° stereo angle
  - He - CO_2 gas mixture





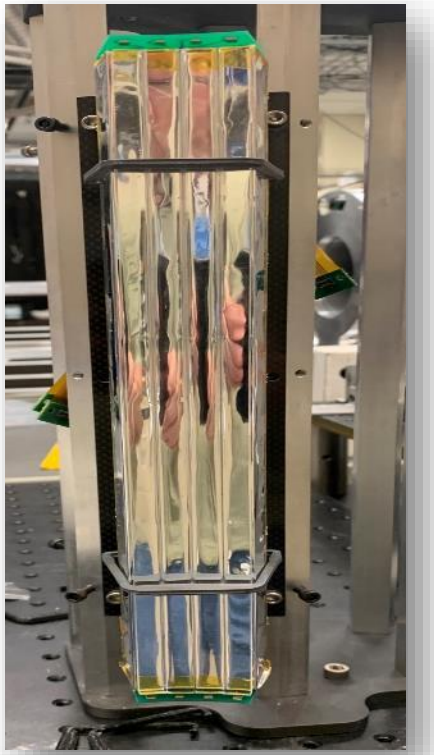
ALERT Time-Of-Flight (ATOF)

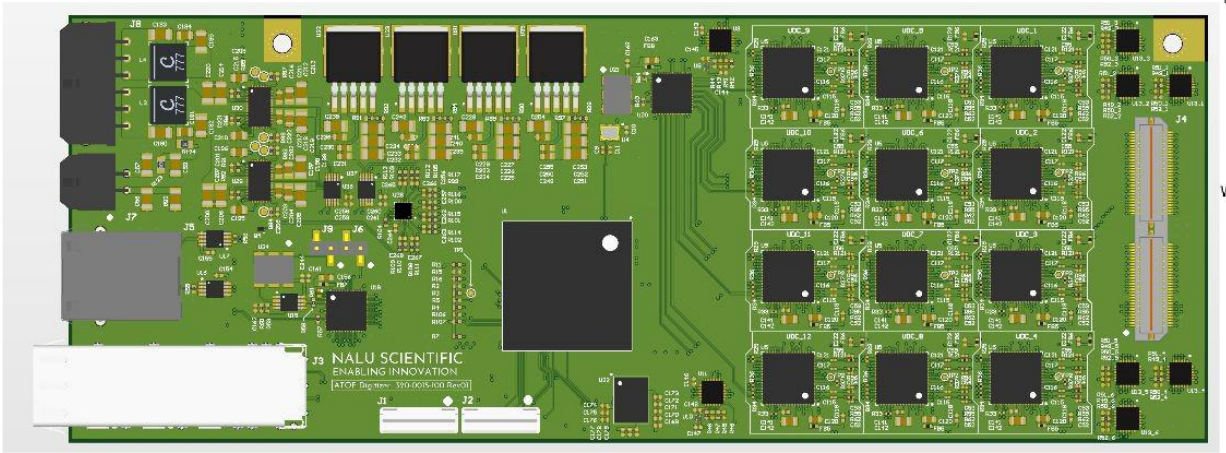
- **TOF**: Two layers of scintillators with SiPM readout, 28 cm length, 15 sub-assemblies: 600 wedges, 60 bars

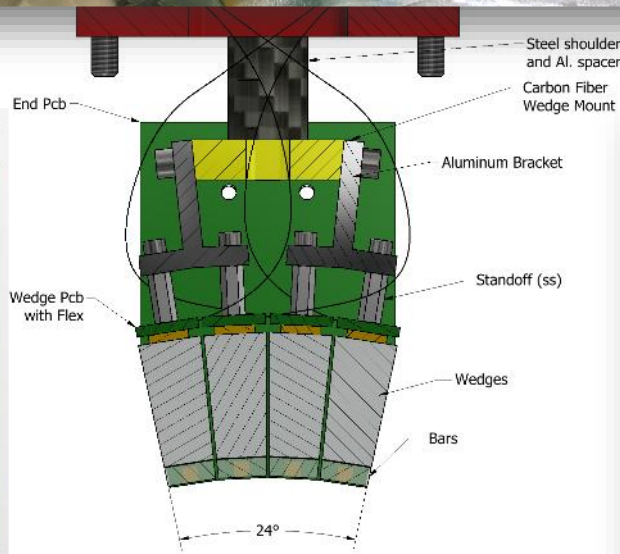
- **Electronics**

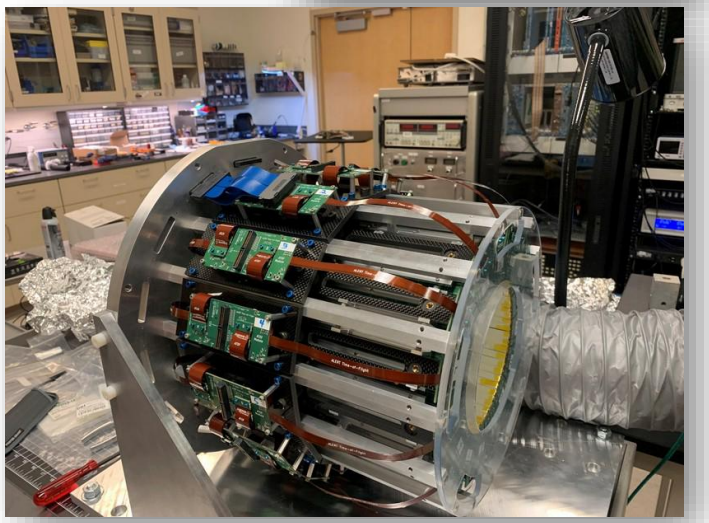
– 19 PETIROC boards from JLab

– One NALU board from ANL



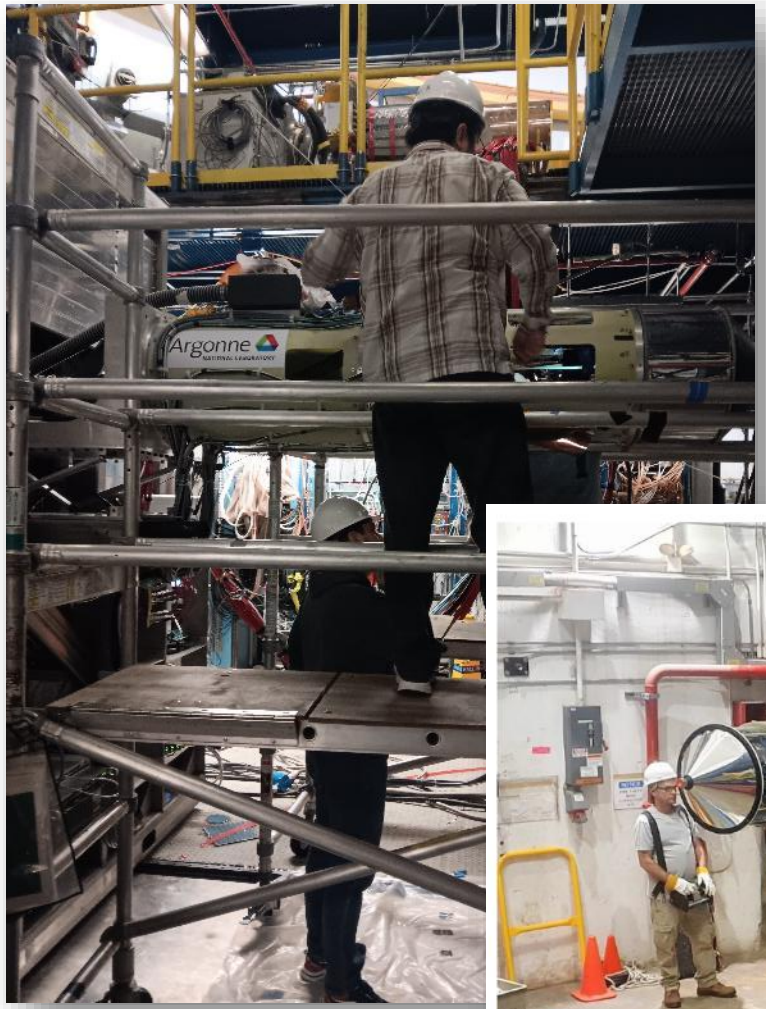


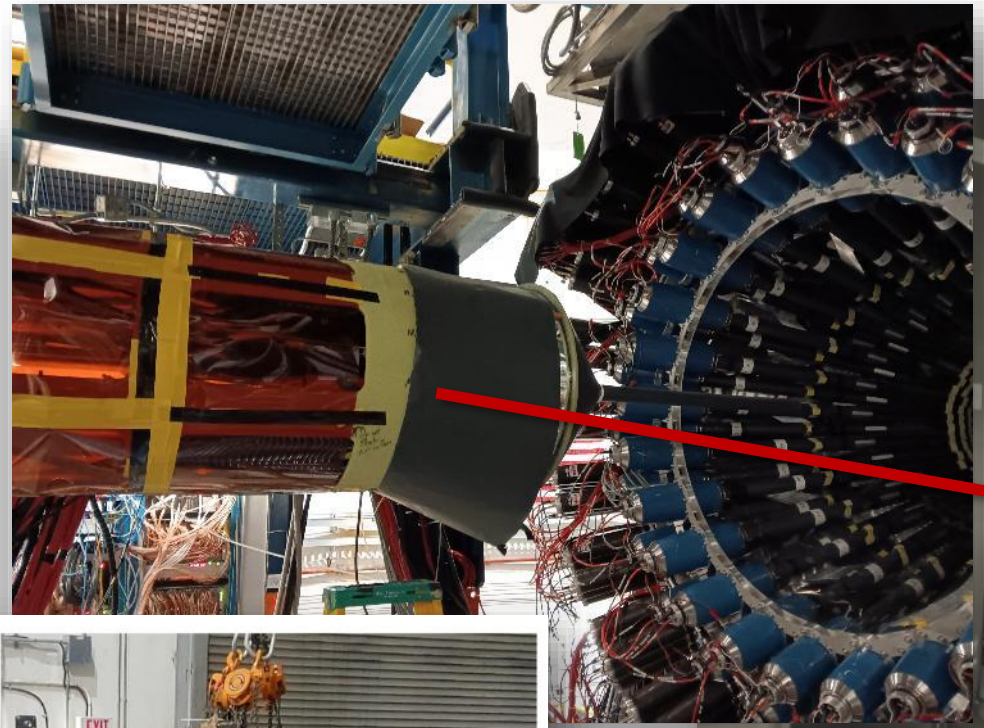




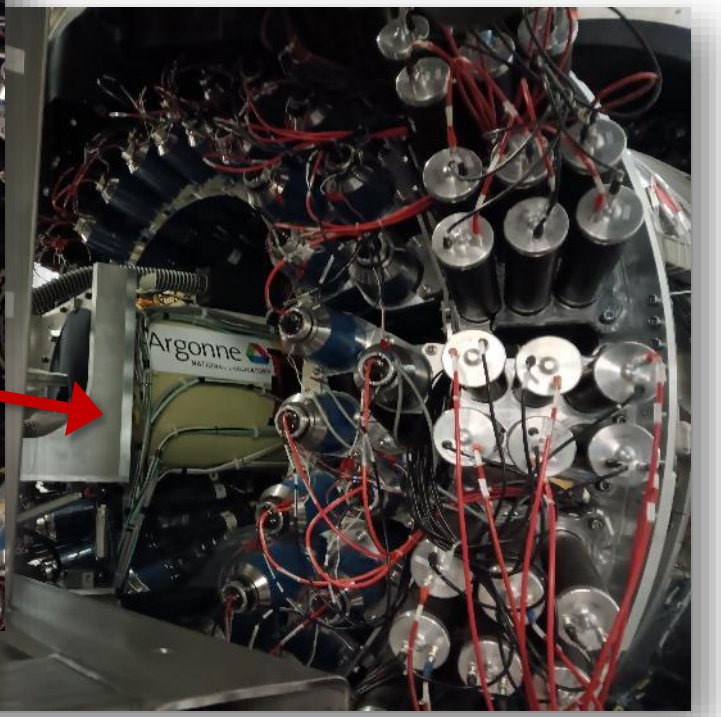
ALERT Detector Installation

Maintenance position





Operation position



The ALERT detector is transported to its new home in Hall B.

ALERT DETECTOR INSTALLED IN HALL B FOR JANUARY 2025 RUN

After eight months of assembly, cabling, gas system configuration and electronics testing in the Experimental Equipment Lab, the ALERT detector has now been successfully moved to Hall B, marking a significant milestone in preparation for the upcoming CLAS12 run period beginning in January 2025. ALERT, which stands for “A Low Energy Recoil Tracker,” is a state-of-the-art detector that will replace the Central Vertex Tracker of the CLAS12 system for one year. ALERT was specifically designed to track and identify low-momentum recoil nuclei from interactions of the electron beam with the target gas (typically helium). For more information on ALERT and its upcoming role in CLAS12, contact Patrick Achenbach.

Publication on ATOMKI Anomaly aka X17

PHYSICAL REVIEW C **111**, 024320 (2025)

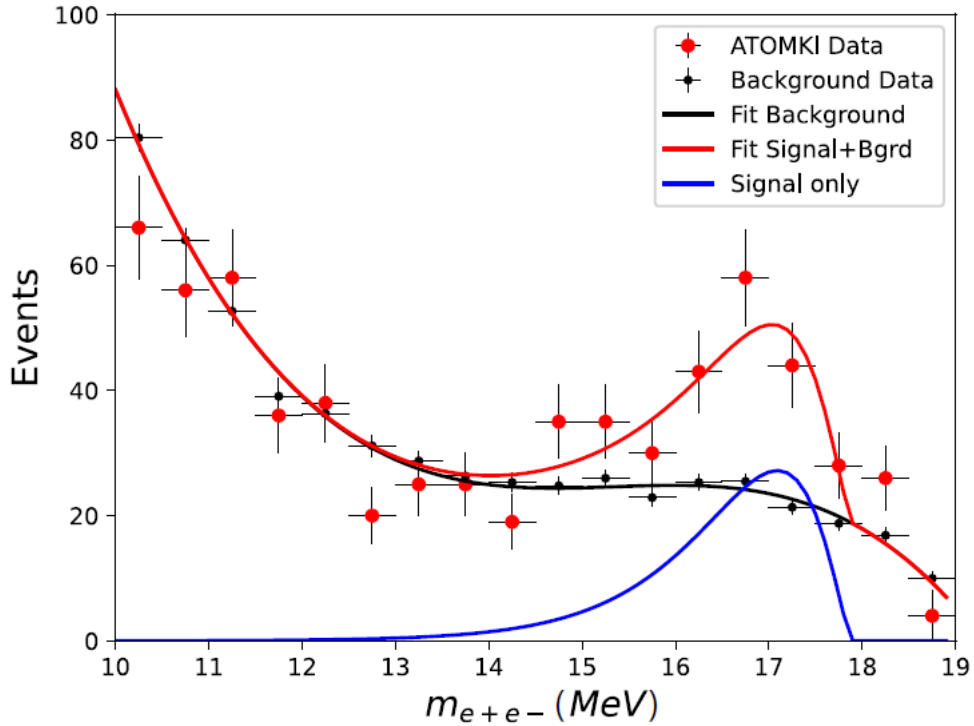
Quantum chromodynamics resolution of the ATOMKI anomaly in ^{4}He nuclear transitions

Valery Kubarovsky [*]
Thomas Jefferson National Accelerator Laboratory, Newport News, Virginia 23606, USA

Jennifer Rittenhouse West [†]
Lawrence Berkeley National Laboratory, Berkeley, California 94720, USA
and EIC Center at Thomas Jefferson National Accelerator Laboratory, Newport News, Virginia 23606, USA

Stanley J. Brodsky [‡]
SLAC National Accelerator Laboratory, Stanford University, Stanford, California 94309, USA

(Received 3 June 2024; accepted 3 February 2025; published 27 February 2025)



"In light of this work, we emphasize the need for independent experimental confirmation or refutation of the ATOMKI results …"

Description of ATOMKI invariant mass distribution with **electromagnetic transition** hexadiquark*(17.9) → ^{4}He + (e^+e^-)

Update on HPS

- Review of SIMS analysis from 2016 data started: There is a reach in uncharted regions of parameter space for some parameters of dark mesons
- SVT alignment for 2021 is in good shape: Getting ready to process 1% of the data to do final check reconstruction and skims before processing 10% of data for analysis
- Progress has been made in MC by using a beam background from random trigger events instead of a CPU-intensive MC beam background: beam BG merging has been validated
- **Preparations for next run:**
  - New FEB fabrication is in progress after the validation of two boards
  - There are issues with cutting edges of slim sensors: If not resolved, the strategy will be to order more than previously planned and select
  - Studied the possibility of running the beam on target without chicane magnets on for alignment with straight tracks: possible by moving the magnet ~3” to the beam right

Completed PhD Thesis with HPS Data

- Last December, Alic Spellman graduated from UCSC with a search for SIMS using 10% of 2016 data

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

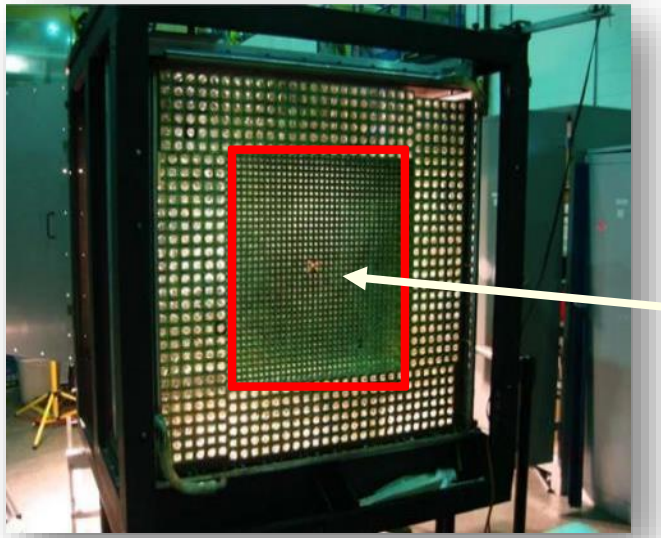
by

Alic Spellman

December 2024

PRad-II/X17 Run Preparations

- **New scintillator system** designed and constructed at JLab
- **Beam-lines** for PRad2/X17 designed; **Vacuum box** inspected
- **HyCal** is being refurbished and tested channel-by-channel
- **HyCal electronics** is procured (based on new fADC-250 modules)
- **PRad windowless gas flow target** has been set up and is tested in a lab on site



Experimental Readiness Review is scheduled for 9 May, 2025

Preliminary & Conditional Schedule

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
PRad-II/X17	HyCal/GEMs	Radiator	2.2	2026-01-23	2026-02-02	10	60	5		55
X17 search	HyCal/GEMs	Ta foil	2.2	2026-02-02	2026-04-24	81	55	41		**15**
	reconfigure	change		2026-04-24	2026-05-01	7				
PRad-II	HyCal/GEMs	H2 gas	2.1	2026-05-01	2026-05-30	29	40	15		26
	pass change			2026-05-30	2026-05-31	1				
PRad-II	HyCal/GEMs	H2 gas	0.7	2026-05-31	2026-06-13	13	26	7		19
	pass change			2026-06-13	2026-07-14	31				
PRad-II	HyCal/GEMs	H2 gas	3.5 (1.4)	2026-04-22	2026-05-25	33	19	17		**3**
SAM 2026					**sum:**	**205**		**sum:**	**83**	

Concluding Remarks

- **X17 was proposed to run with two beam energies which seemed “critical to the success”**
  - Can a single beam energy deliver the proposed physics goals?
- **X17 is 15 PAC days short of the 60 PAC-approved days (70% of total statistics)**
  - Can the reduced run time deliver the proposed physics goals?
  - Contrary to other runs, a partial data set will likely not be enough to reach the primary goal
- **X17 was proposed with a X17 signal calculation based on unpublishable estimates**
  - The collaboration has to improve on these estimates

- **PRad-II was proposed to run with 25 kHz DAQ rate for the GEM detector**
  - The planned readout is not ready, what are the implications of the alternative?
- **PRad-II was proposed to run with an upgraded all $PbWO_4$ calorimeter**
  - This has not materialized; can the smaller inner HyCal acceptance be compensated?
  - A different set of beam energies will cover the proposed Q^2 range, but each setting is having a smaller acceptance than proposed
  - I would like to see a projection of the uncertainties vs. Q^2 for the planned settings

Its still time to optimize the settings and the share of the time