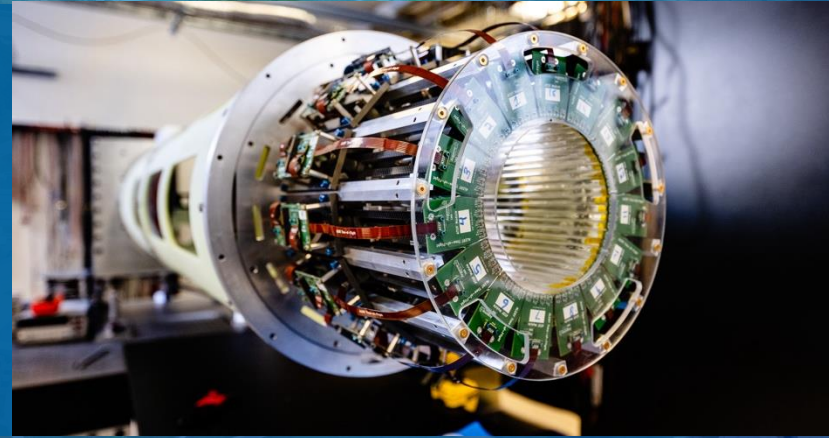


NOVEMBER 19TH 2025

ALERT AND RUN GROUP L STATUS

NOÉMIE PILLEUX



U.S. DEPARTMENT OF
ENERGY

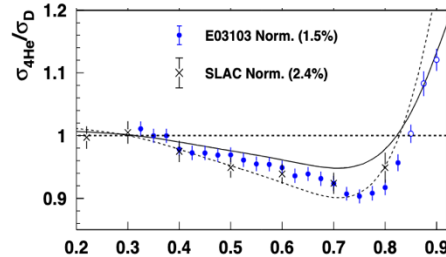
Argonne National Laboratory is a
U.S. Department of Energy laboratory
managed by UChicago Argonne, LLC.

Argonne
NATIONAL LABORATORY



ALERT PHYSICS

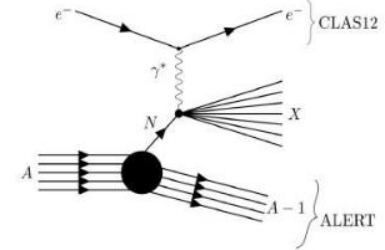
Partonic structure of nuclei and bound nucleons?



J. Seely et al., PRL 103, 202301 (2009) **x**

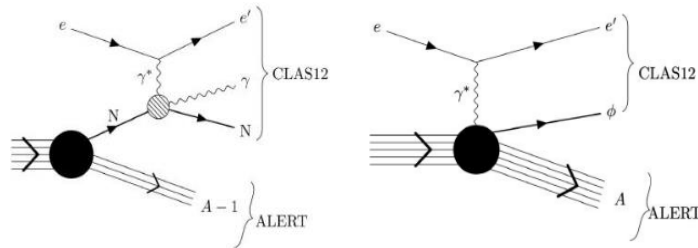
Tagged DIS

- Recoil momentum $\leftrightarrow$ initial nucleon off-shellness, control of final-state interactions
- Distinguishing between models involving hadronic or partonic degrees of freedom



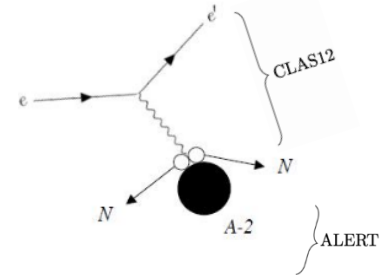
Tagged DVCS and DVMP

- Comprehensive, 3D, imaging
- Nuclei GPDs in coherent channels, confinement radius
- Modification of the bound nucleon GPDs in incoherent channels



Short Range Correlations

- Factorization test
- Mean-field to SRC transition



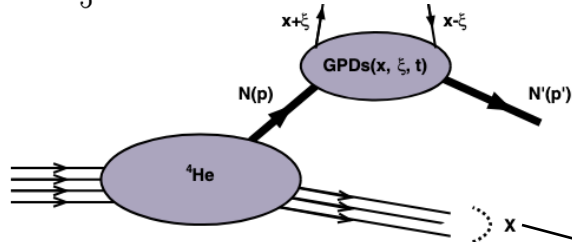
LIGHT ION TARGETS

Deuterium

Reference with quasi-free nucleons
Flavor separation
Proton tagging for neutron studies

$$F_u = \frac{3}{5} (4F^p - F^n)$$

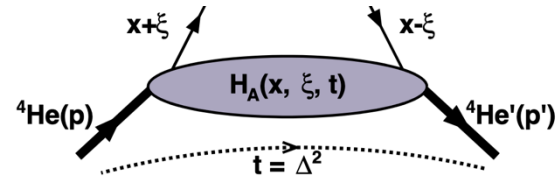
$$F_d = \frac{3}{5} (4F^n - F^p)$$



^4He

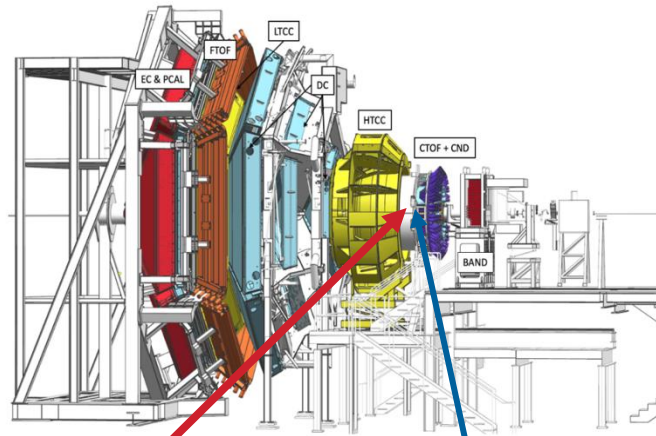
Light but tightly bound
Spin 0, unique set of GPDs!

$$A_{LU}(\phi) = \frac{\alpha_0(\phi) \Im m(\mathcal{H}_A)}{\alpha_1(\phi) + \alpha_2(\phi) \Re e(\mathcal{H}_A) + \alpha_3(\phi) (\Re e(\mathcal{H}_A)^2 + \Im m(\mathcal{H}_A)^2)}$$

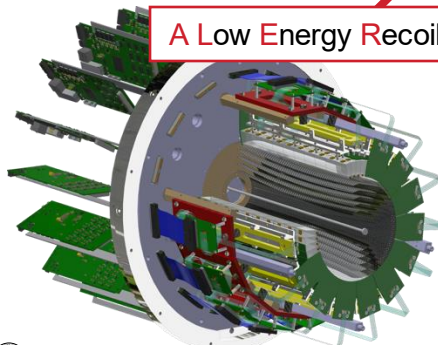


Need to tag protons,
D, ^3H , ^3He , ^4He at low
momenta!

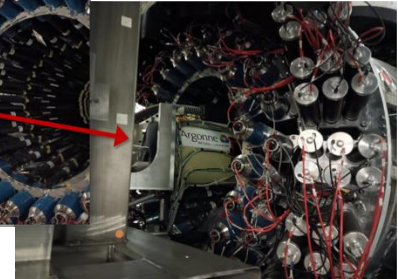
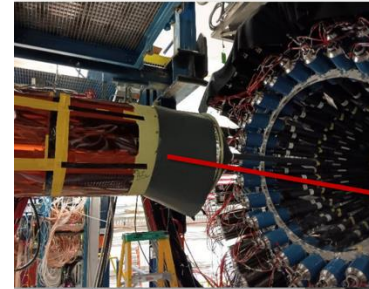
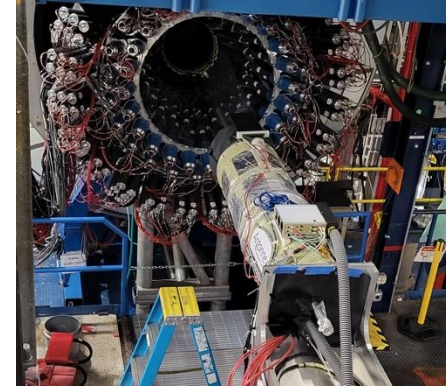
ALERT SETUP



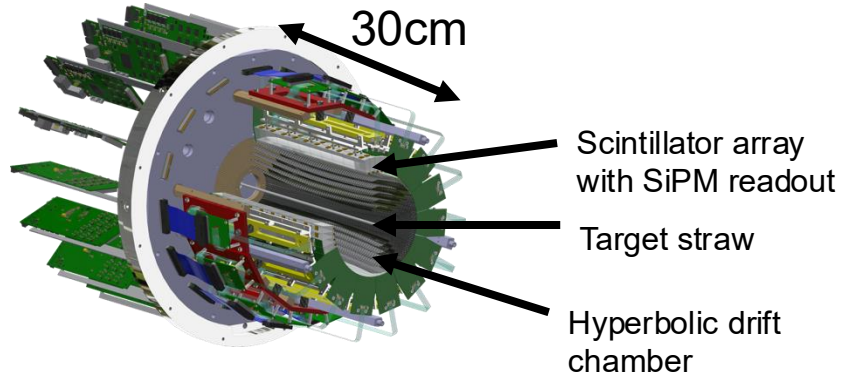
A Low Energy Recoil Tracker



Light-ion targets: high pressure straw target gases D_2 , 4He



ALERT SUBSYSTEMS



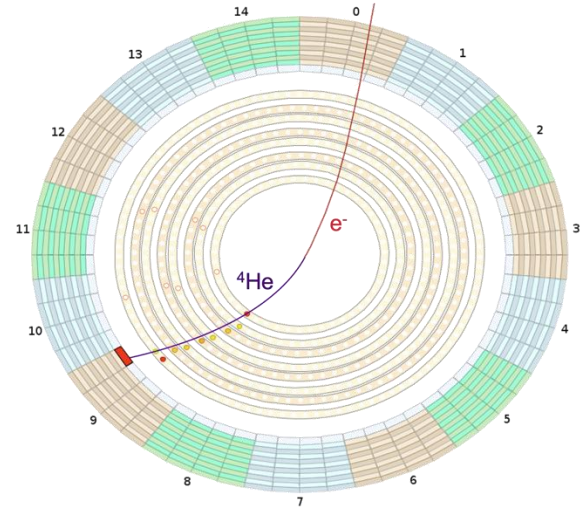
ALERT Hyperbolic Drift Chamber (AHDC)

- IJCLab (Orsay)
- 3026 aluminum wires,
- 576 sensor wires
- Stereo angle for position
- HeCO_2
- 250 ns drift time



ALERT Time Of Flight (ATOF)

- Argonne
- 660 plastic scintillators
- PETIROC readout, 150ps resolution, charge measurement



DATA TAKING

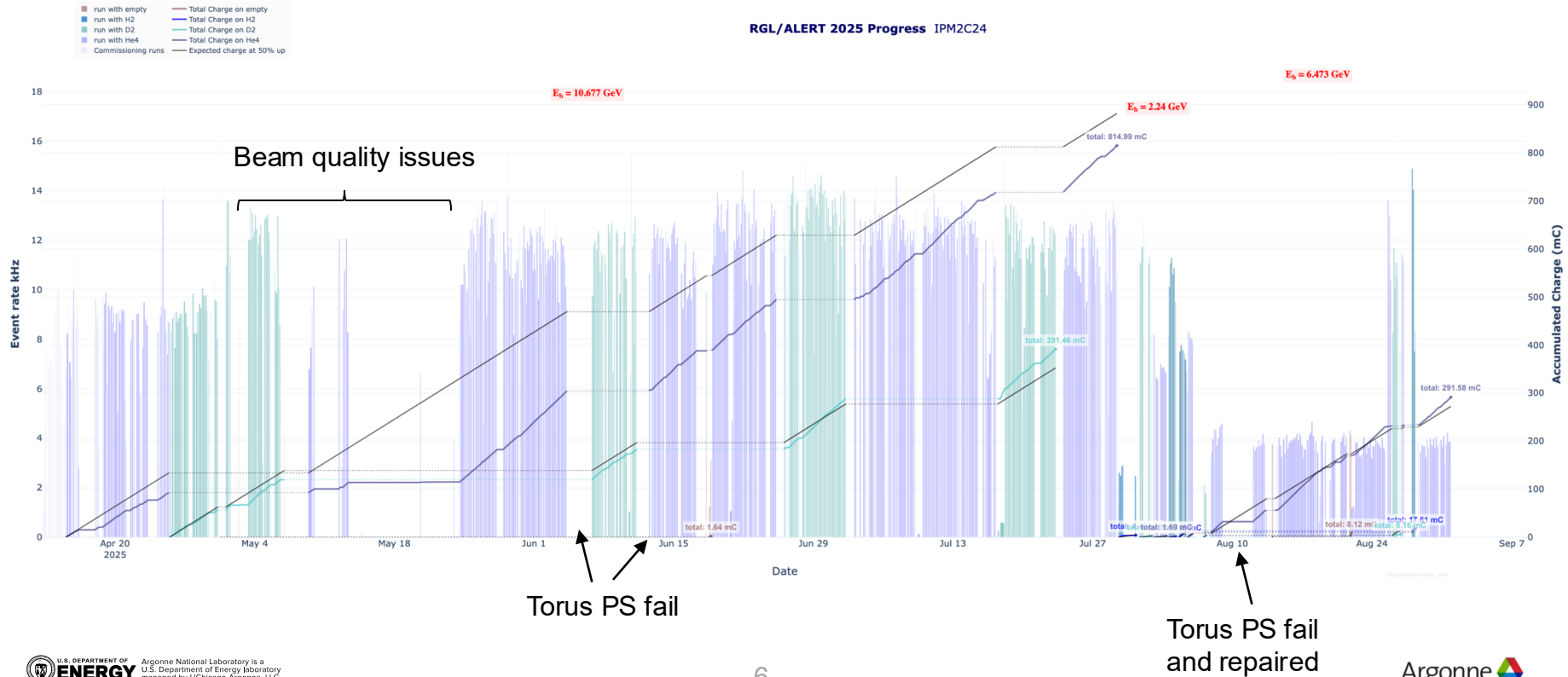
Scheduled Experiments	Setup / Status	Target	Beam Energy	Start Date	End Date	Scheduled Calendar Days	Remaining PAC Days Before Run	Scheduled PAC Days = Cal.Days/2	Actual PAC Days from ABUs
RG-L	ALERT	gas	2.1	2025-04-05	2025-04-12	7	55.0	3.5	1.0
	pass change			2025-04-12					
RG-L	ALERT	gas	11	2025-04-12	2025-08-01	111	54.0	55.5	52.0
	pass change			2025-08-01					
RG-L	ALERT	gas	2.1	2025-08-01	2025-08-04	3	2.0	1.5	2.0
	pass change			2025-08-04					
RG-L	ALERT	gas	6.6	2025-08-04	2025-09-03	30	17.0	15.0	15.0
SAM 2025	reconfigure	change		2025-09-03	2026-02-01	151	sums:	75.5	70.0

2 GeV data for calibrations with elastic events

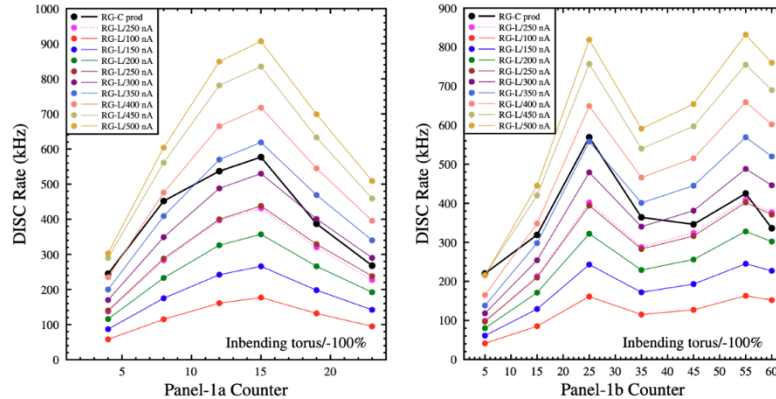
6 GeV SRC experiment

- Overall smooth running with the ALERT detector
- 1/3 data on D, 2/3 data on ^4He
- 325 nA on 66 psig target pressure
- >90% of the approved PAC days

ACCUMULATED CHARGE



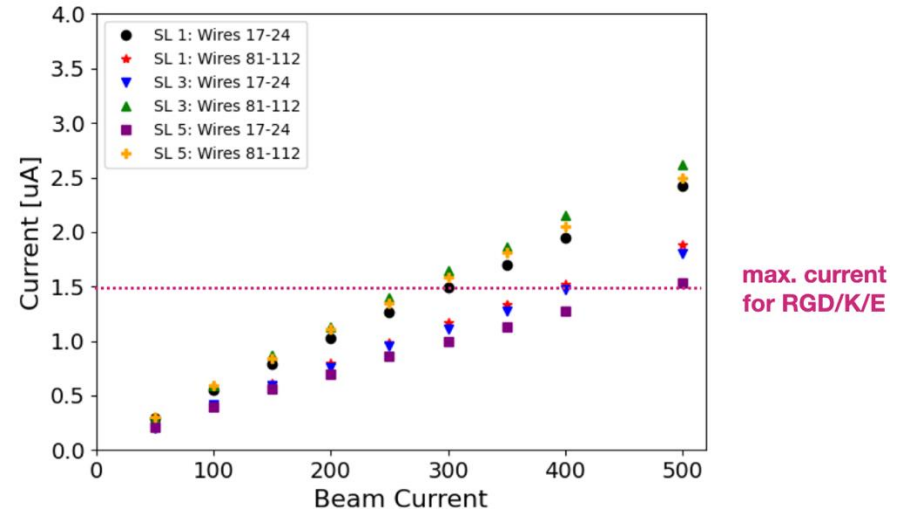
HIGHLIGHTS FROM THE RUN – 325 nA RUNNING



Chosen settings: 325 nA and 66 psig
target pressure to balance detector
performance and statistics

FTOF rates

DC currents

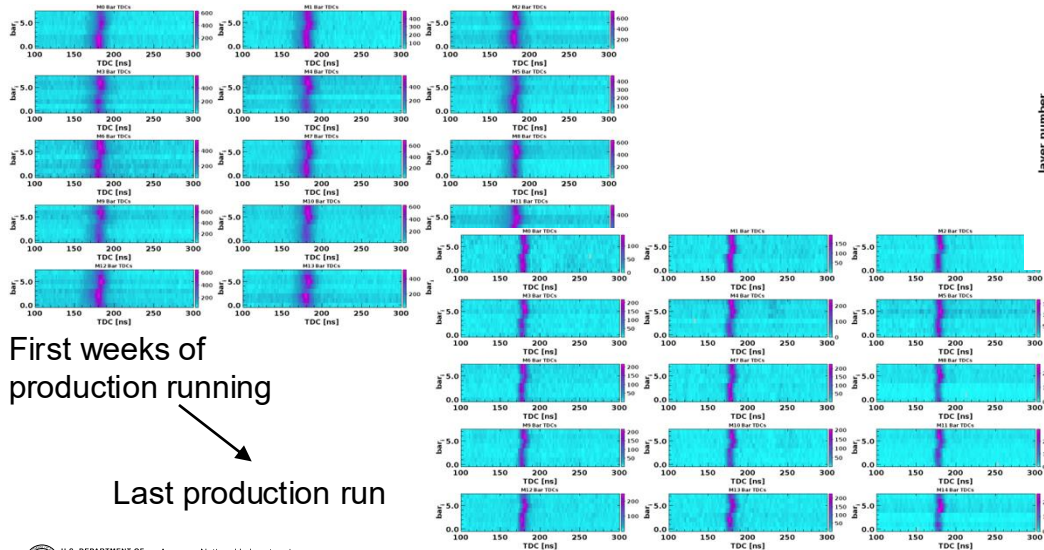


HIGHLIGHTS FROM THE RUN – ALERT

1-2 target purges a day went smoothly

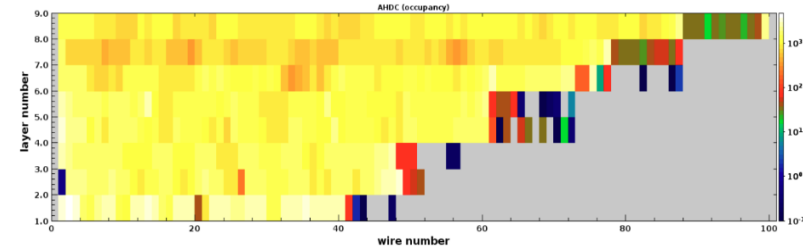
Solvable issues only:

- One AHDC wire broke and could be pulled out
- Readout board replacements

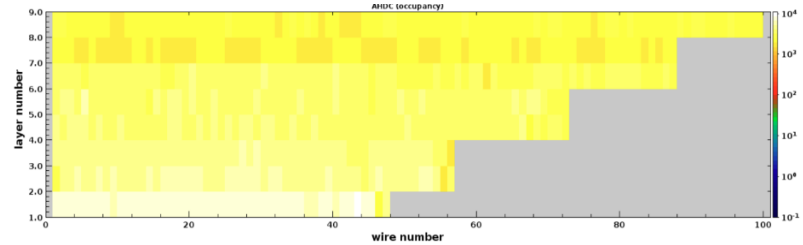


First weeks of
production running

Last production run



Before/after broken wire removal



DATA STATUS

- 1123 good runs identified
- Ongoing work focusing on calibrations
- Software is actively developed as we analyze ALERT data, adjusting calibrations, simulations, reconstruction

M. Hattawy

Calibration sequence:

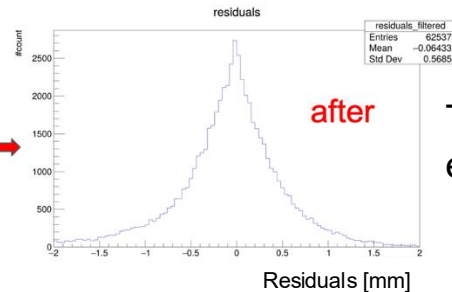
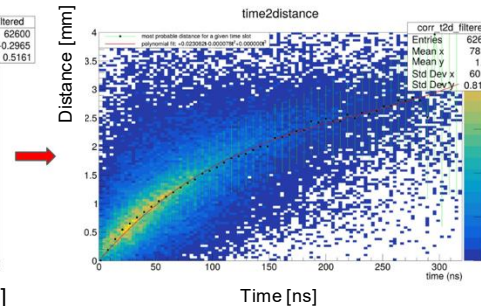
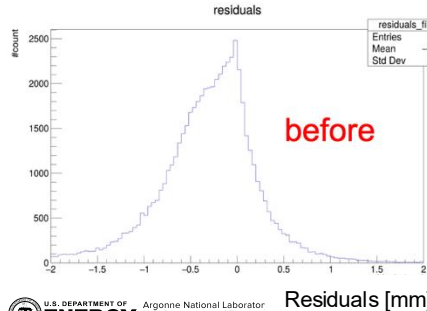
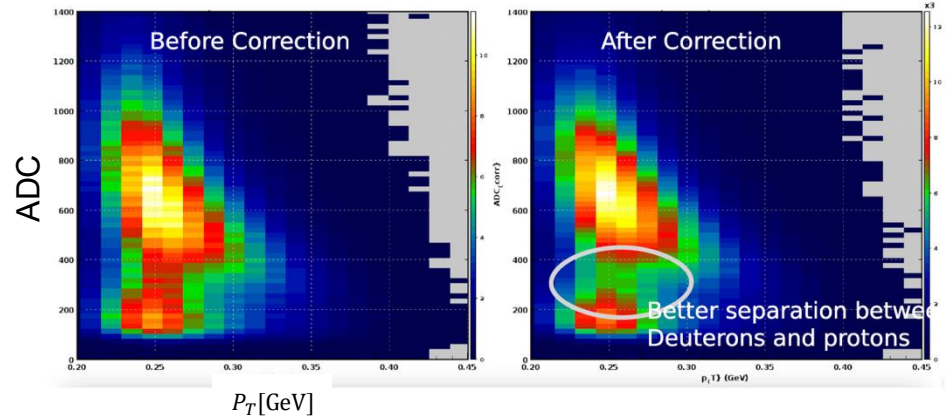
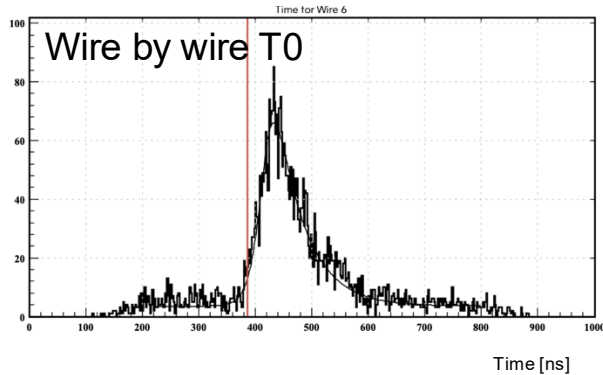
- Beam offset - **Completed**
- FTOF calibration - **Completed**
- RF calibrations - **Ongoing**
- DC calibration - **Ongoing**
- Other CLAS12 Subsystem Calibration
- Detector Alignment: **DC, ALERT**
- HW status tables: **HTCC (done)**
- AI network training/validation
- Luminosity scan studies data/MC

	Task	Implementation	Fine tuning / AI	Maintenance	Validation	Comments and future possible addition	Color code
R E C O N S T R U C T I O N	AHDC Decoding (incl. implementation of calibration constants)	Félix		Félix			No plan
	ATOF Decoding (incl. implementation of calibration constants)	Noémie		Noémie			Not ready
	AHDC Adv. Decod. (Time walk, non linearities etc.)						Need someone
	ATOF Adv. Decod. (Time walk, non linearities etc.)	Noémie ?					Attributed
	AHDC Noise Treatment	Félix	Noémie	Félix			Ongoing
	ATOF Noise Treatment	Noémie ?					Done
	AHDC Clustering	Mathieu	Mathieu	Mathieu			
	AHDC + ATOF Clustering		Mathieu	Mathieu			
	Track + ATOF Clustering	Noémie					
	Helix Fit (do proper helix fit or AI based reconstruction, and use e- vertex)	Mathieu				Needs a new version with actual helix fit to the wires, then time based, then include e-	
C A L I B R A T I O N	Check clustering (verify if some hits need to be reconsidered based on the helix fit)					Needs better helix fit to start	
	PID pass 1		Uditha			Base PID using dEdx and times is missing	
	Kalman Filter base	Mathieu / Eric		Eric			
	Kalman Filter with e- and ATOF information	Eric		Eric		ATOF hit integration option would be great	
	Kalman Filter accounting for PID pass 1					Allow the Kalman filter to treat different PIDs	
	Check clustering (verify if some hits need to be reconsidered based on the helix fit)					Allow dropping some hits during the tracking	
	PID pass 2						
	Kalman filter refined fit (and alternate PIDs)						
	Output production (with covariance matrix)					We need to fill a new bank with full recon (PID and covariant M)	
	AHDC Gain calibration	Churamani / Esteban	With run selection			We might want to have constants for ADCmax, ToT, and noise level	
S I M U L A T I O N	ATOF Gain calibration	Noémie / Zhiwan	With run selection				
	AHDC Time calibration	Michael	With run selection				
	ATOF Time calibration bars	Noémie / Zhiwan	With run selection				
	ATOF Time calibration wedges	Noémie / Zhiwan	With run selection				
	AHDC Pile-up treatment		With run selection			This needs some specific analysis	
	ATOF Noise Treatment		With run selection			This needs some specific analysis	
	Beam position	Mohammed	With run selection				
	AHDC Alignment (k _y / z / phi / tilts)		With run selection			Would be useful for CLAS calibration	
	ATOF Alignment		With run selection			Can be done with elastics to calibrate z and phi position with CLAS12	
	ALERT CLAS Alignment (mostly in z but maybe in other directions)						
G E N E R A L	AHDC Digitization	Félix	Félix	Félix			
	ATOF Digitization						
	AHDC Noise Merging						
	ATOF Noise Merging						
	AHDC Dead channels						
	ATOF Dead channels						
	Geometry adjustment to calibration						
	Reconstruction validation						
	Documentation					We need to renew the software installation documentation (probably redirect to CLAS doc now)	
	Timelines	SangBaek					
P O L A R I Z A T I O N	Cooking (making the standard and specialized yami files)	Mohammad				Need to be made available somewhere	
	Run list (define golden runs, run periods, etc.)						
	Polarization summary						

AHDC CALIBRATIONS

R. Dupre, A. Mehta, M. Paolone, C. Paudel, F. Touchte Codjo

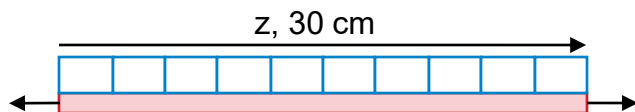
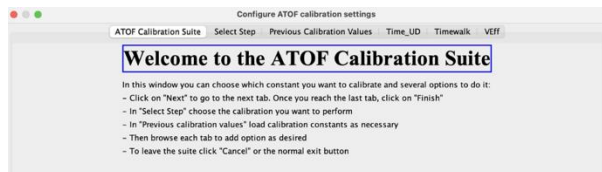
Gain calibration from D elastic events



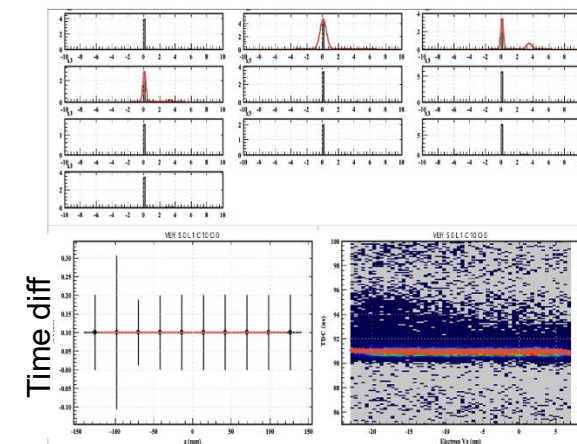
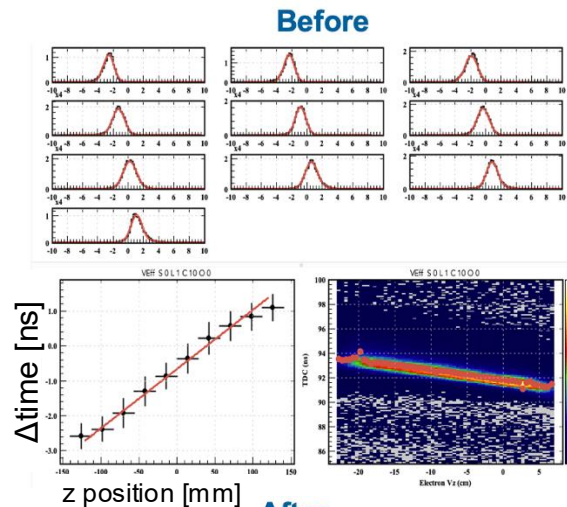
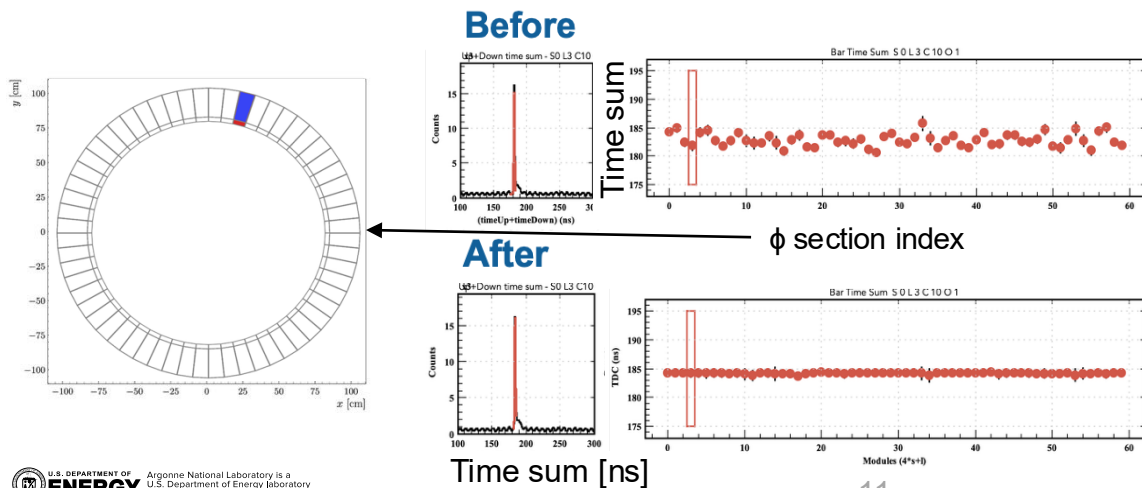
Time to distance from elastic events

ATOF CALIBRATIONS

See Zhiwan's talk



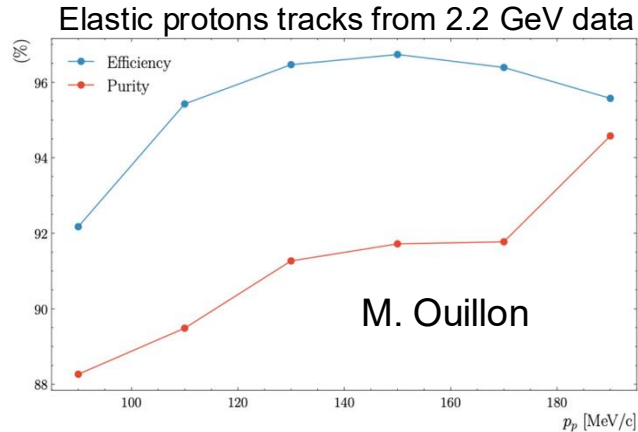
Double-sided readout:
Time sum $\leftrightarrow$ length
Time diff $\propto$ z position



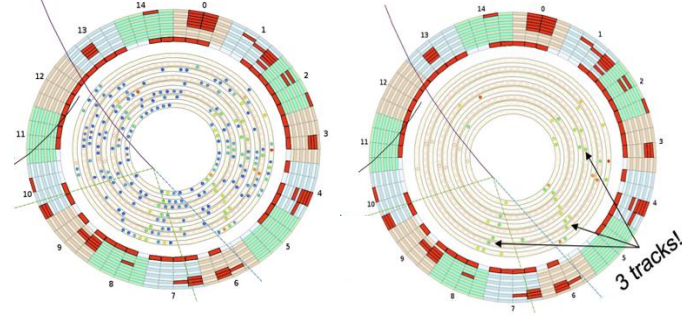
AHDC TRACKING

Track finding

MultiLayer Perceptron trained on simulations
Input: 2D (x/y) position of five AHDC clusters
Hit-based

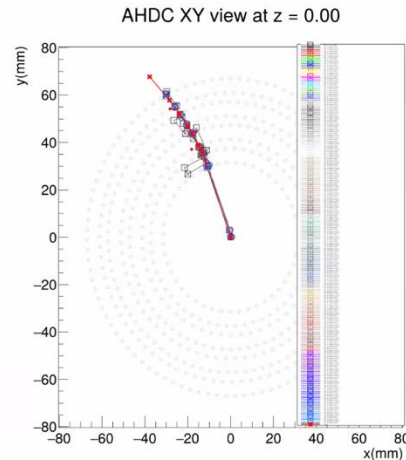


In CED

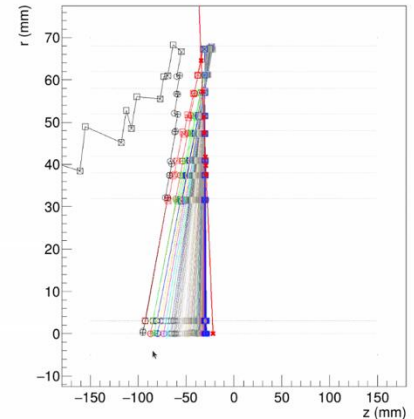


Tracking

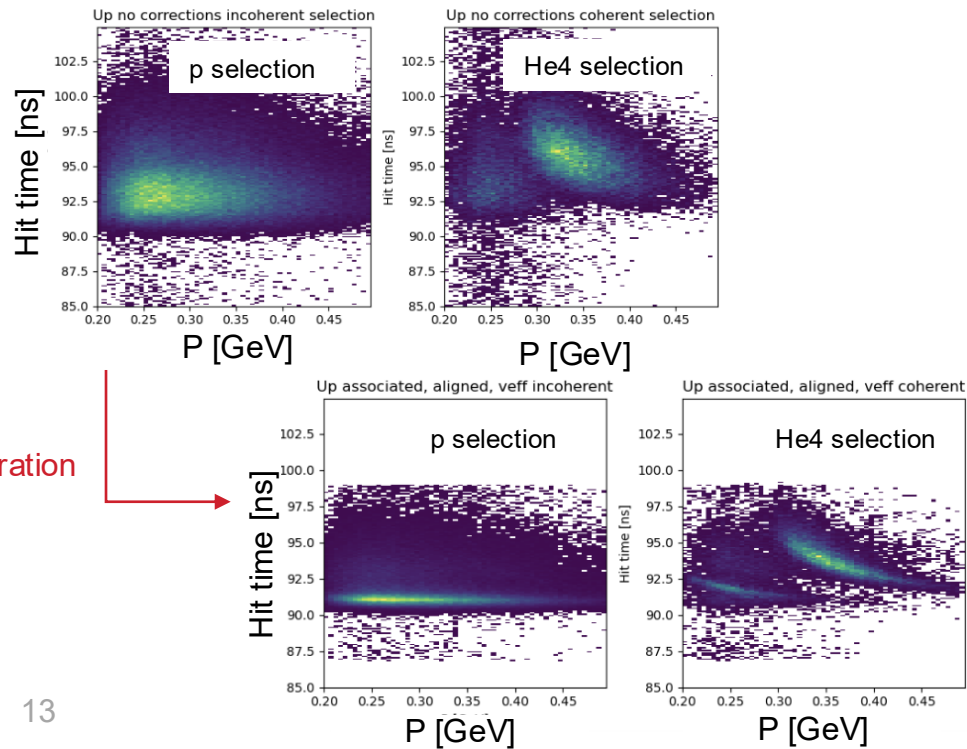
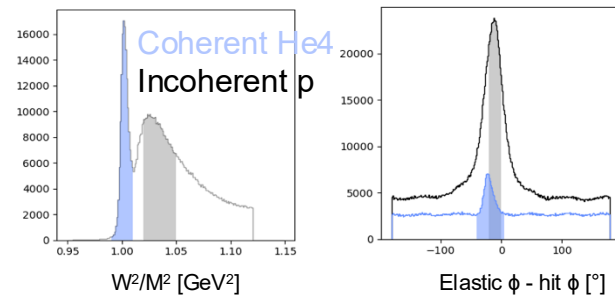
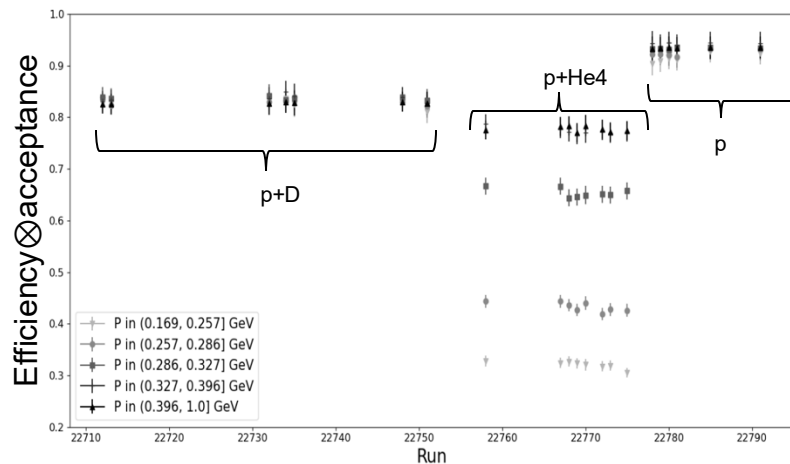
Kalman Filter
See Felix's talk



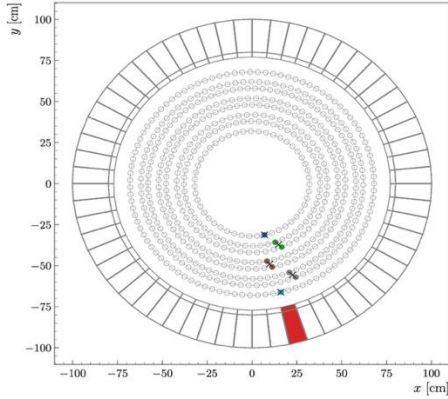
F. Touchte Codjo
ZR view



ATOF HITS AND PID



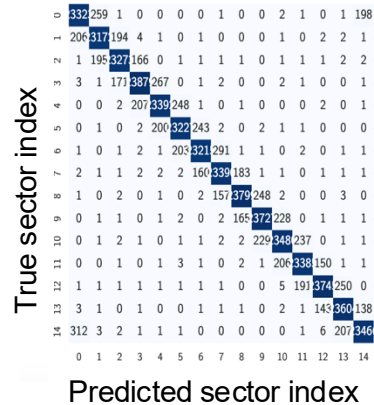
TRACK AND HIT MATCHING



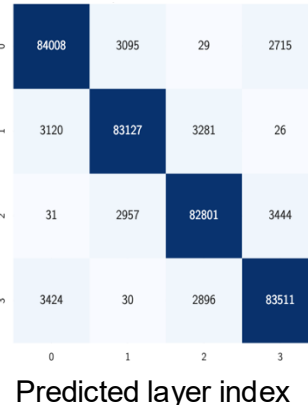
Hit-based, timing
will improve the z
accuracy

M. Ouillon

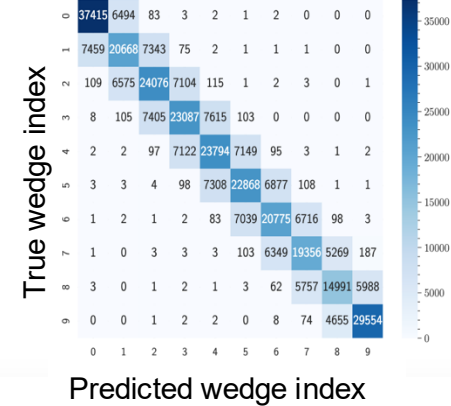
ϕ match



True layer index

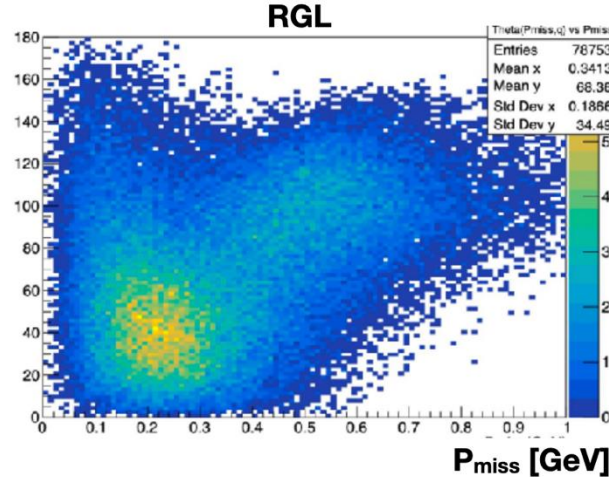


Wedge z index match



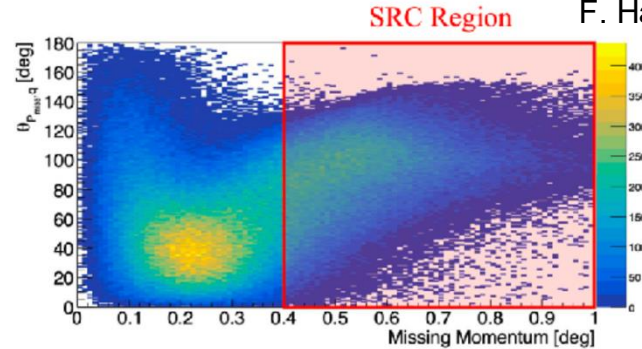
STATISTICS FROM THE SRC EXPERIMENT

$\theta(q, P_{\text{miss}})$ [deg]



Proposal (based on RGM)

Z. Zhang
F. Hauenstein



- With additional RGM P_{miss} cut: $0.3 \text{ GeV} < P_{\text{miss}} < 1 \text{ GeV}$:

RGL

**22448 events for $\sim 110 \text{ fb}^{-1}$
#ev/L $\sim 249 \text{ fb}$**

**Similar
Numbers!**

RGM (from Andrew)

**14257 events for 57.24 fb^{-1}
#ev/L $\sim 202 \text{ fb}$**

THANK YOU FOR A SUCCESSFUL RUN!

To all the shift takers, run coordinators, PDL, Hall B staff, technicians and engineers, experts on-call, software group, calibration team, cooking chef, ALERT team

