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Physics Program

Original Physics Program

Deuterium and helium targets at 11 GeV

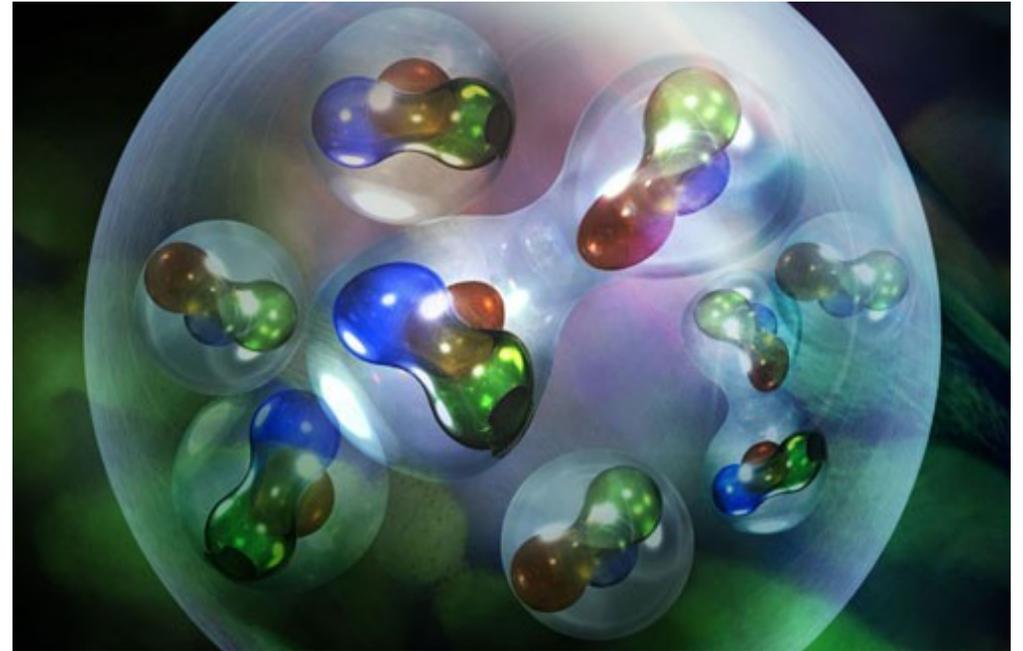
- Tagged DIS / EMC
- 4He GPDs (DVCS & DVMP)
- Tagged DVCS

Extension

Helium at 6 GeV

- SRC with ALERT

Ran during 2025



The Nucleus as quarks and gluons



The ALERT Detector

Hyperbolic Drift Chamber (AHDC)

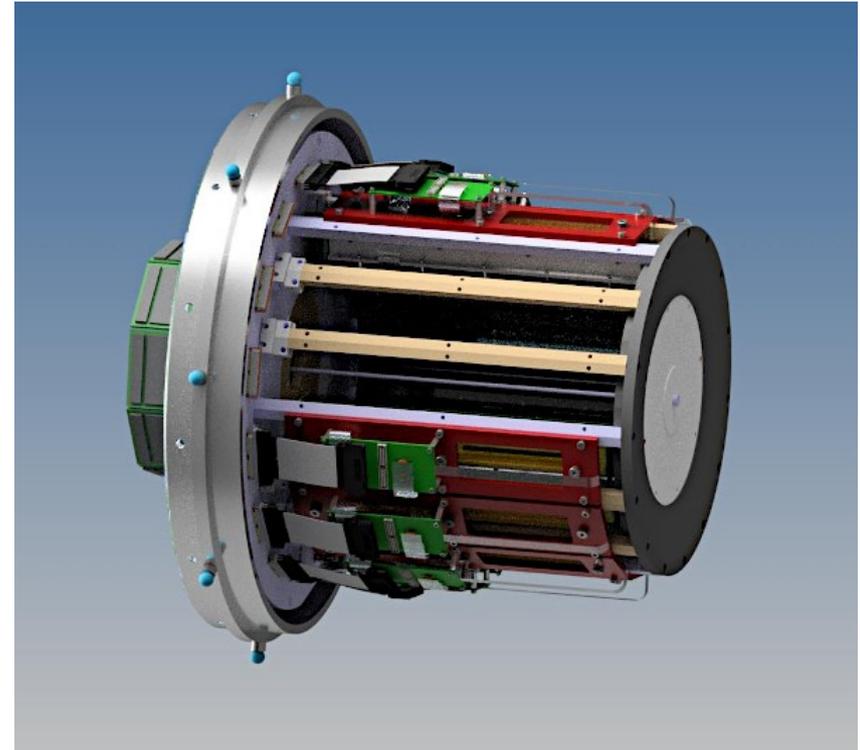
- He CO₂ drift chamber
- Aluminum wires spaced by 2mm
- Stereo-angle for z-resolution

Time-of-Flight (ATOF)

- Two layers for improved PID
 - First 2mm layer, read-out from both sides
 - Thick tiles, read-out from the back
- Using SiPM for read-out

Straw target filled with gas (~5 atm)

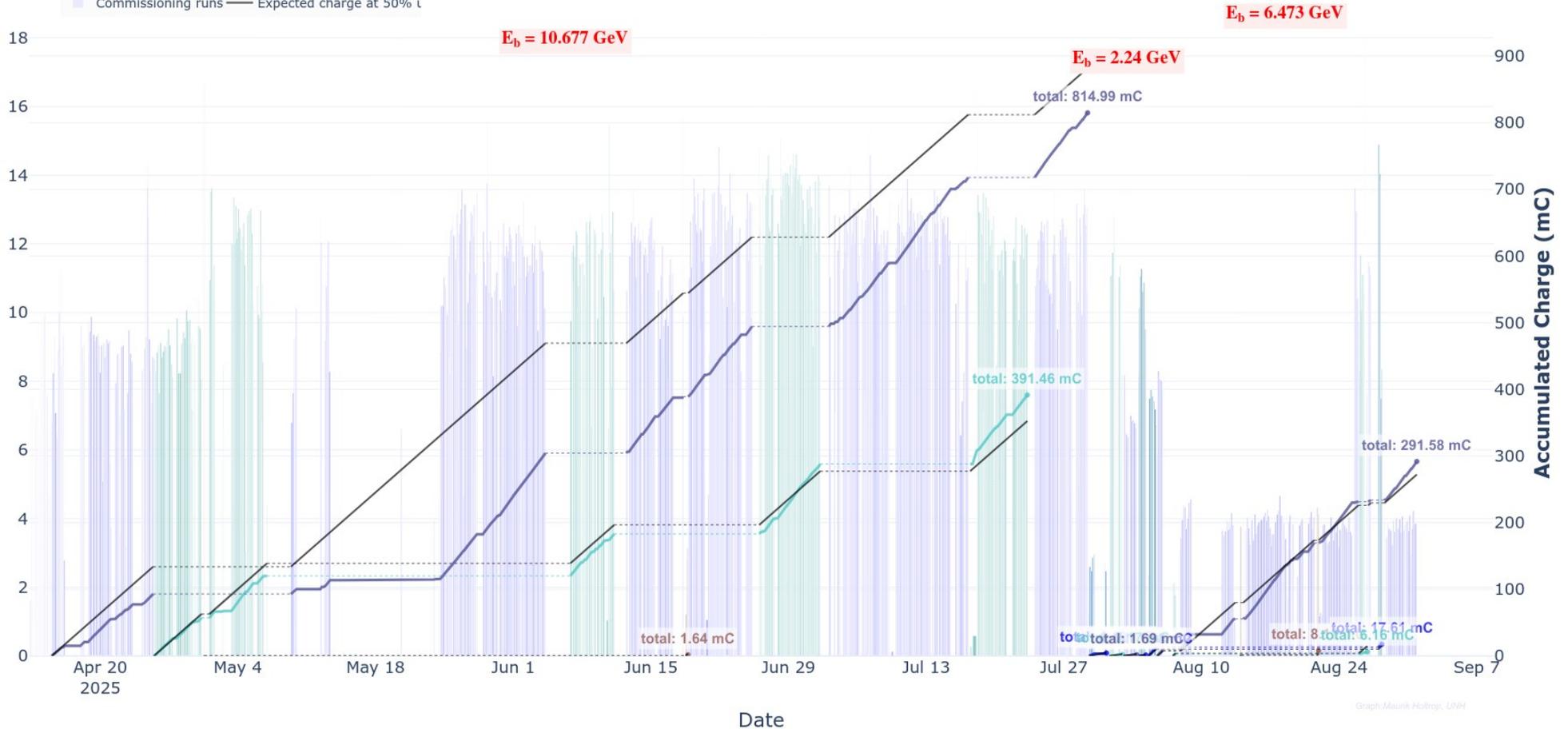
- Similar to bonus, eg6, and bonus12



Run Summary

RGL/ALERT 2025 Progress IPM2C24

- run with empty
- run with H2
- run with D2
- run with He4
- Commissioning runs
- Total Charge on empty
- Total Charge on H2
- Total Charge on D2
- Total Charge on He4
- Expected charge at 50% t



On going work with Reconstruction

Lot of the work is done :

- AI Tools extensively used for track finding, matching, and early PID

See talks of Mathieu and Uditha yesterday

- Helix fit used as input for the Kalman filter improved
- Reorganization of the AHDC/ATOF/ALERT engines
- Kalman filter progress (cleaning, optimization, new features...)

See talks from Zeyu, Felix

What is left to be done

- Particle identification and integration with KF energy loss
- Fine tuning and model retraining to be done once calibration is completed
- Create a proper output with covariance matrix

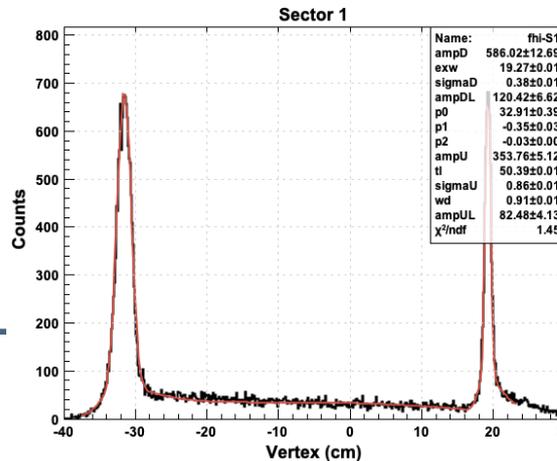
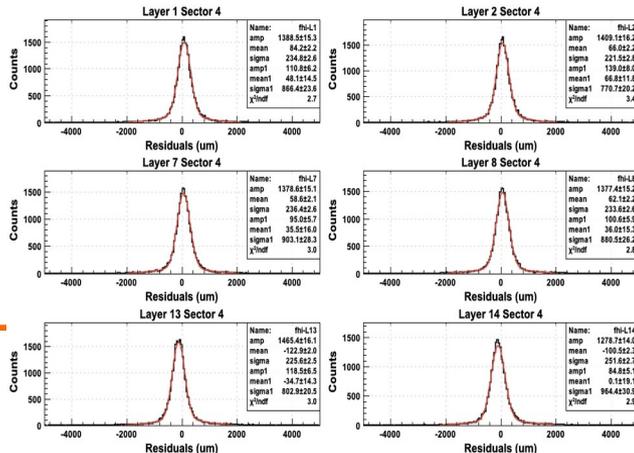
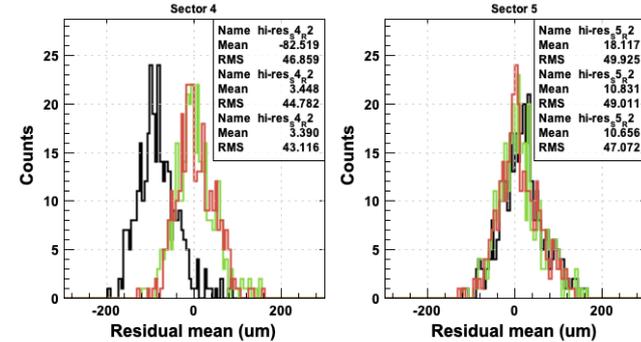
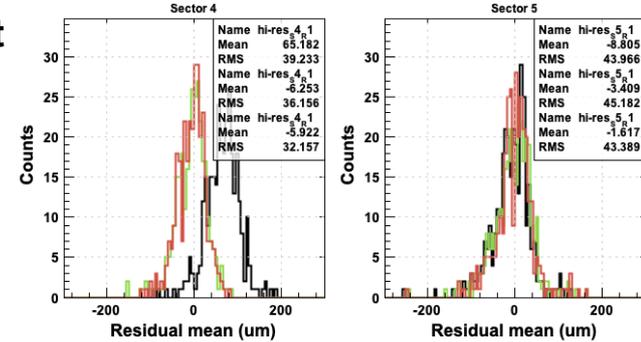
Timeline is to be done by end of March (except for fine tuning)



CLAS Alignment (Raffaella)

- Unexpected shift in tracking residuals in sector 4
- Other sectors consistent with RG-K alignment
- New alignment based (for the first time) on torus-off/solenoid-on data
 - Required EB update to assign electron momentum from ECAL energy for correct particle swimming in the solenoid field
 - Track residuals, target position, and length used as constraints
- Procedure converged successfully, correcting sector 4 anomaly with xz shifts (mostly x shift of R2)

RG-K alignment
xz shifts only
All distortions



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ALERT Calibration

AHDC calibrations ongoing

- t_0 , t_{2d} , gains and time over threshold have first results using elastic data
- They all need to be extended to 11 GeV data to provide timelines and adapt over time

ATOF Calibration

- Bars are calibrated, wedges are well advanced
- Gain calibration will be following

Alignment

- AHDC geometry improved, made closer to actual build
- More alignment work is needed for AHDC and between elements of ALERT



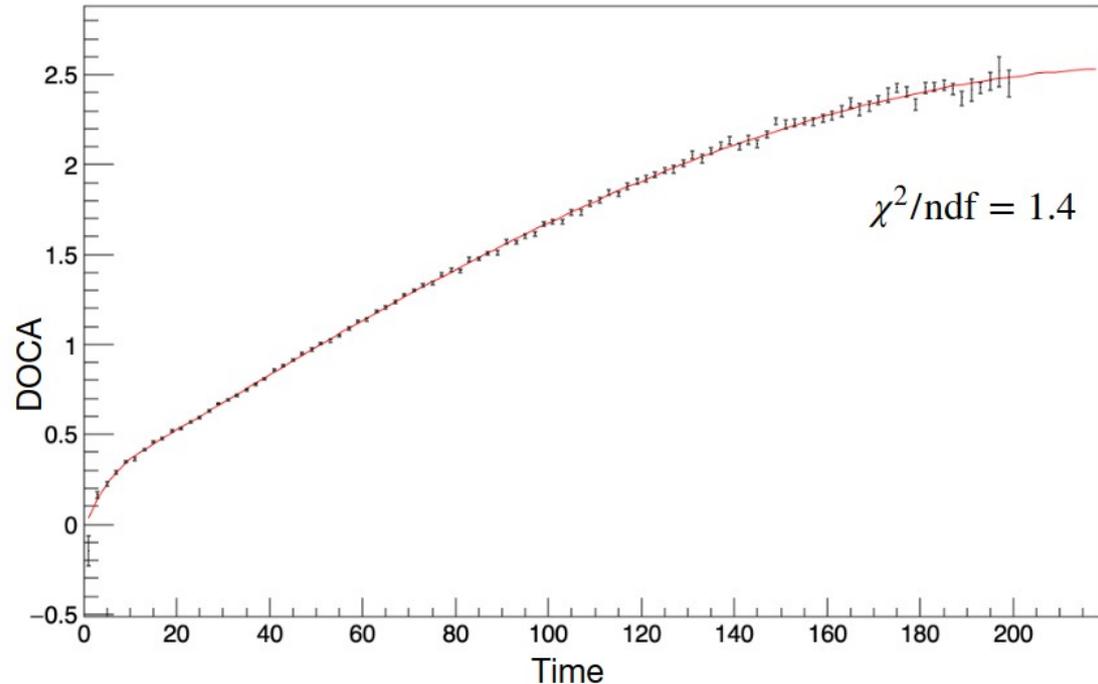
Time to distance calibration

Extraction with elastics

- 2.2 GeV data
 - Working on extension to 11 GeV data
- Extracted wire by wire
 - Implementation in code still in progress for this

More developments in progress

- Script to run iteratively on a sample rapidly



Simulation

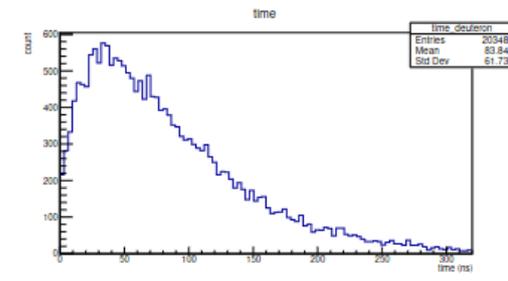
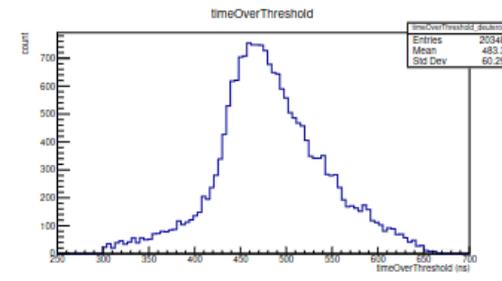
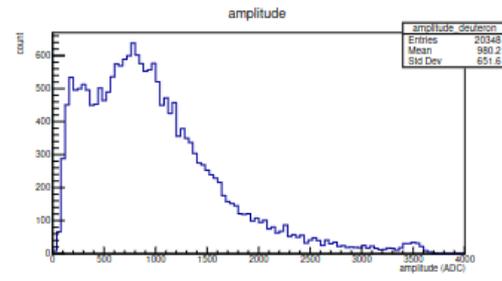
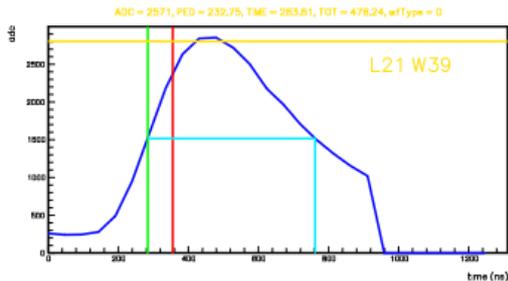
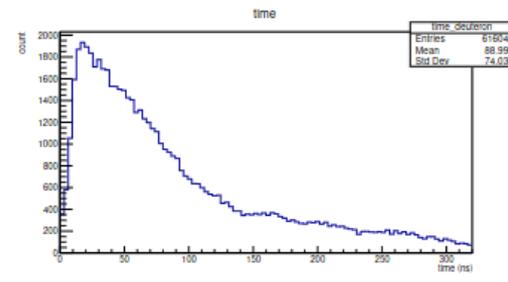
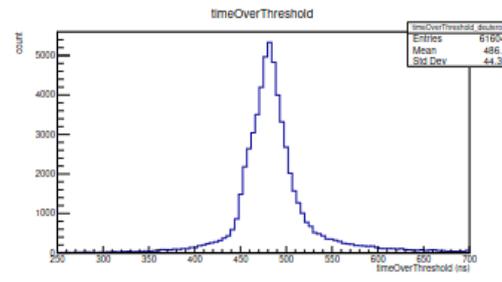
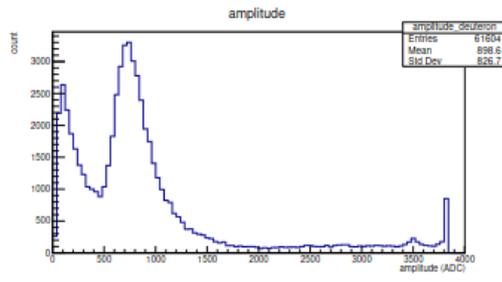
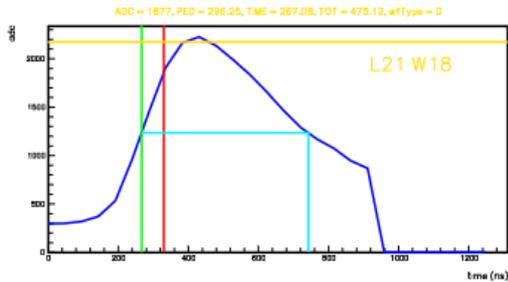
Some progress has been made

- AHDC and ATOF are synced with calibration constants

Much more work incoming

- Noise merging will be integrated
- Eventually real run number compatible

- For both CLAS12 and ALERT



Summary

Run Group L (ALERT) had a great run

- Accumulated expected data
- Detectors behaved pretty well

Reconstruction software is almost finalized

- Much work performed in the last four months
- Some fine tuning will be needed after calibration

Calibration is progressing well

- ATOF is very advanced already
- AHDC work is following
- Some alignment work will start soon

We are hoping to be done during the Summer

