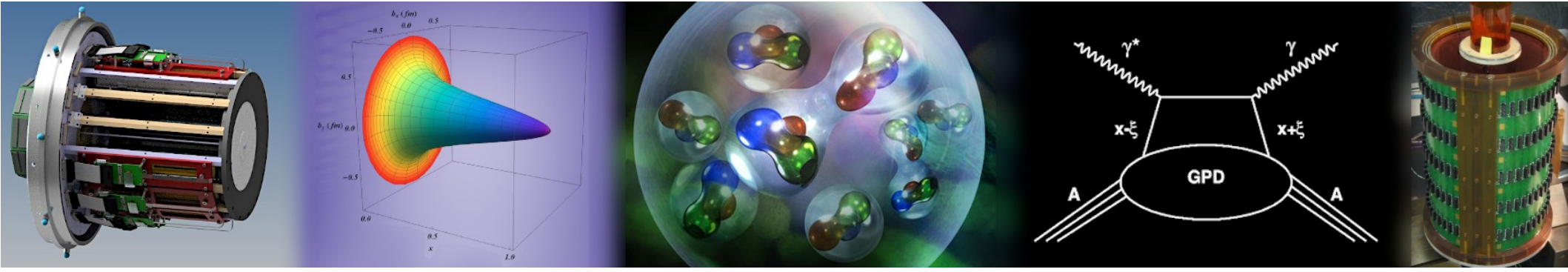
# RG L : ALERT Status Update




**Raphaël Dupré**

Univ. Paris-Saclay

European Research Council
Established by the European Commission

# Physics Program

## Original Physics Program

*Deuterium and helium targets at 11 GeV*

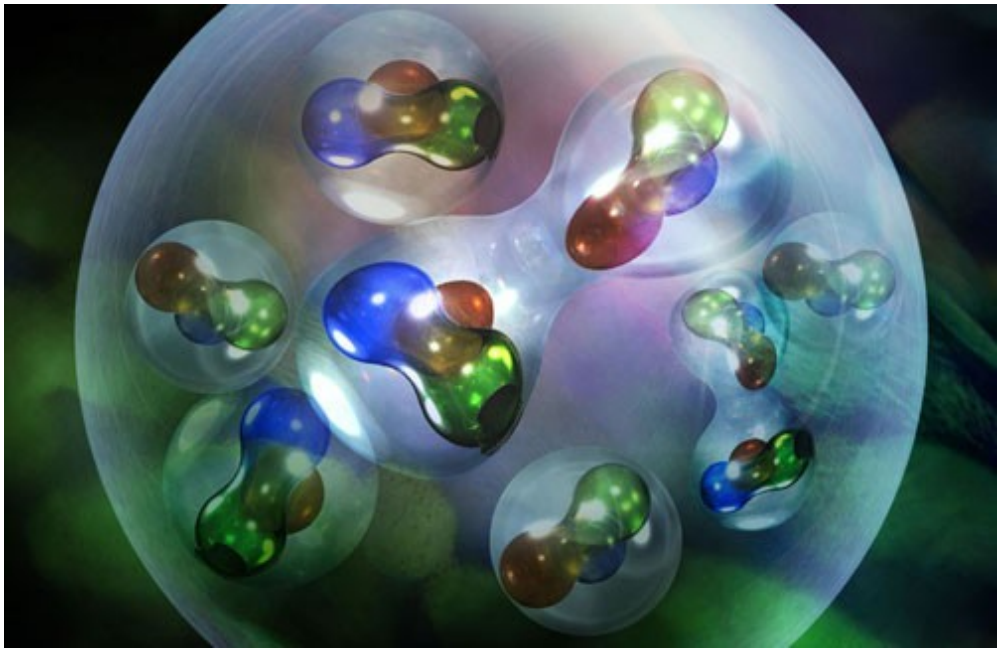
- Tagged DIS / EMC
- 4He GPDs (DVCS & DVMP)
- Tagged DVCS

## Extension

*Helium at 6 GeV*

- SRC with ALERT

## Run Apr-Sept 2025



*The Nucleus as quarks and gluons*

# The ALERT Detector

## Hyperbolic Drift Chamber (AHDC)

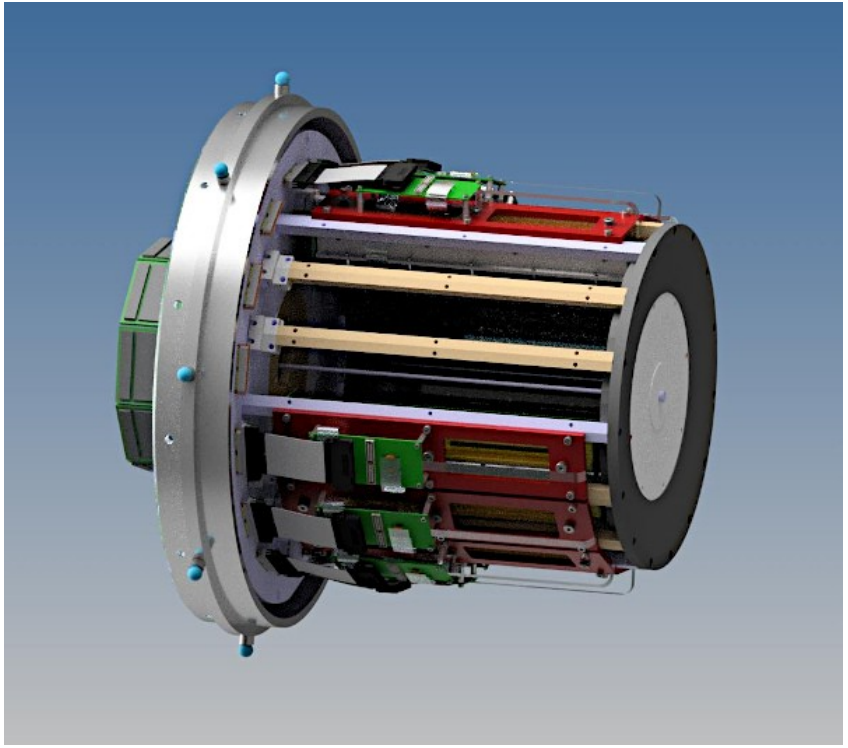
- He CO2 drift chamber
- Aluminum wires spaced by 2mm
- Stereo-angle for z-resolution

## 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



# Reconstruction with AI

## GNN implementation for track finding

- Much more effcient on simulations
  - **Reduce number of fakes**
  - **Improve the elastic track efficiency by 3 %**

*See talk of Mathieu Monday*

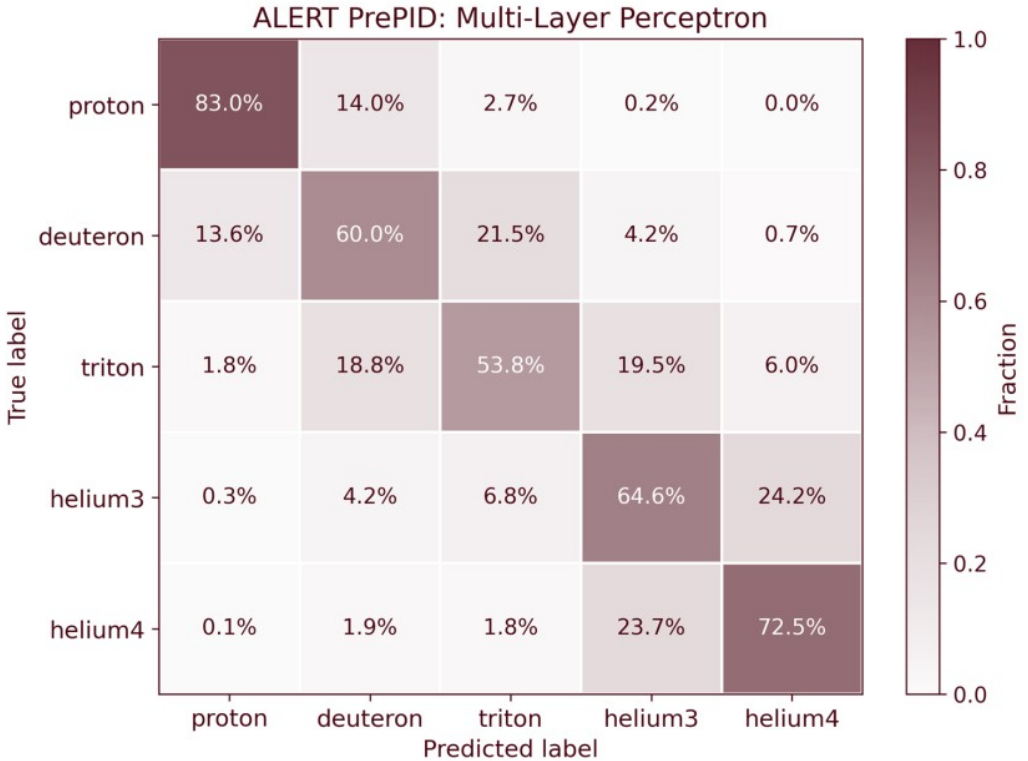
| Metric | GNN | MLP | Improvement |
|---|---|---|---|
| Efficiency | 99.95% | 60.50% | +39.4 pp |
| Avg. completeness | 99.96% | 73.39% | +26.6 pp |
| Avg. contamination | 8.56% | 21.36% | −12.8 pp |
| Fake rate | 5.90% | 9.85% | −3.9 pp |

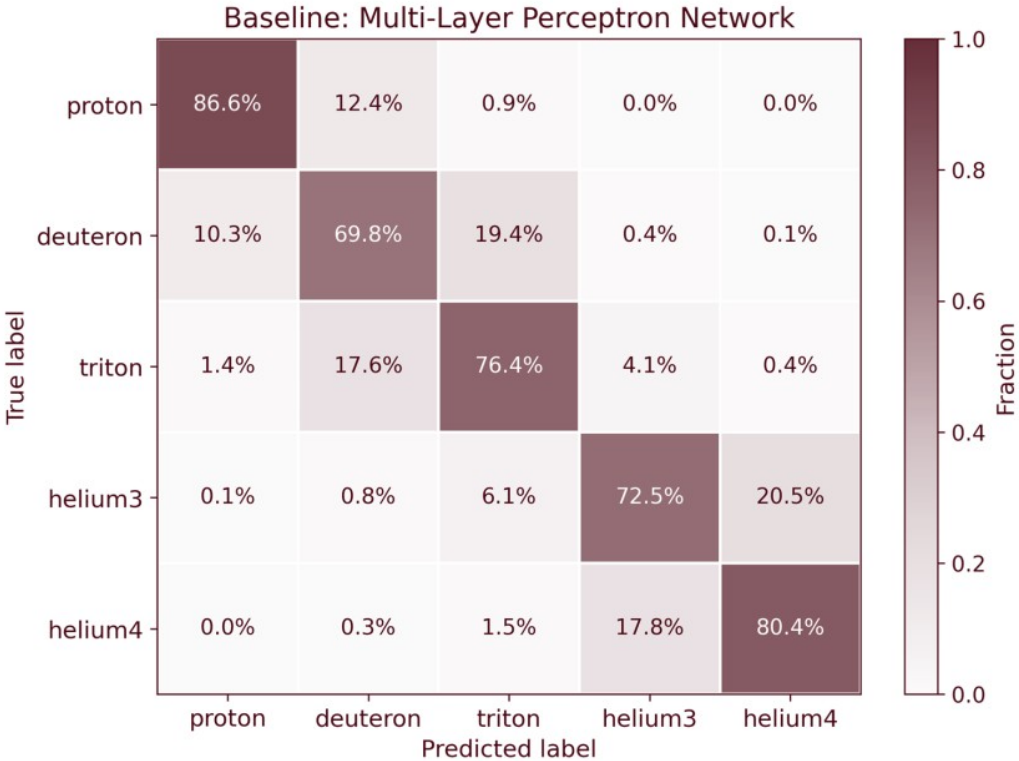
# Particle identification with AI

## Done before and after the Kalman filter

- The results are improving, we hope to improve further as things progress

*See talk of Uditha Monday*



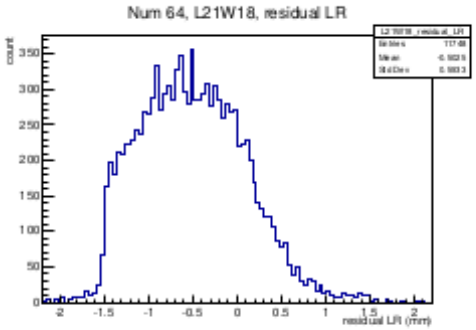



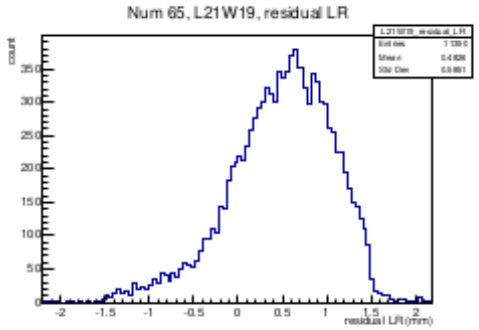
# AHDC wire swaps

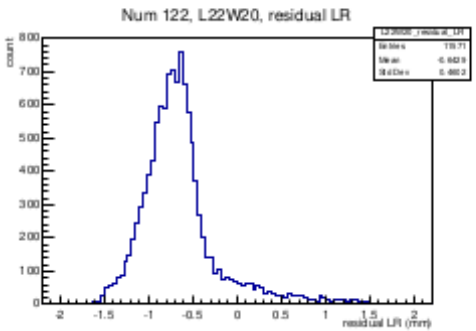
## We identified a few wire swaps in the reconstruction

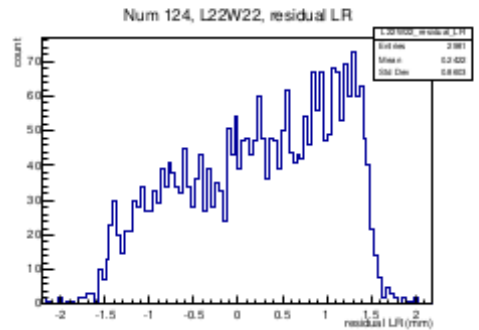
- See residuals before (left) after (right) resolving the issue

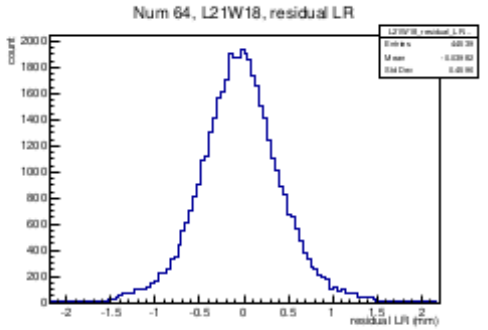
*See talk from Felix yesterday for more details*

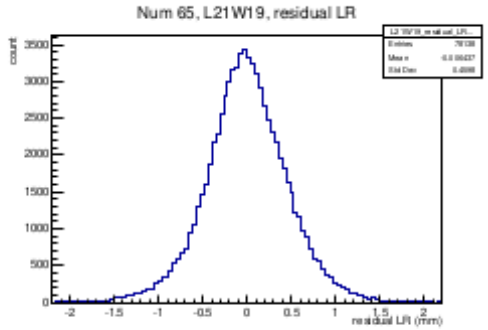


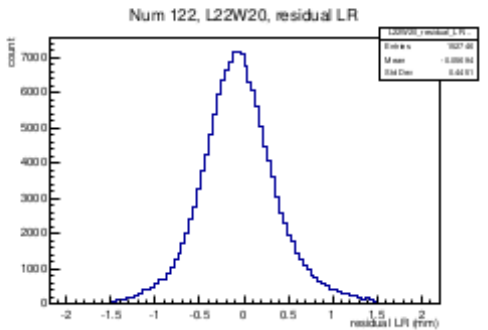



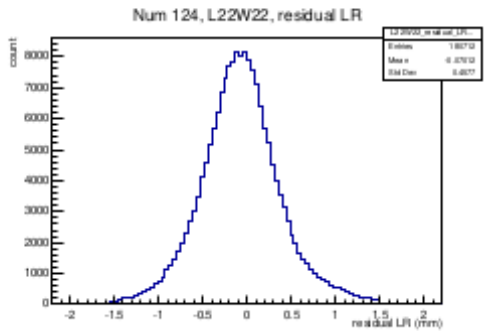



# Upcoming Work on Reconstruction

**Pile up hit treatment**

- Work just started with Kathleen from Glasgow

**Annealing filter for the Kalman filter**

- Looking for contributors

**Beam position alignment**

- In progress (M. Ouillon from Mississippi)

**Final PID and output creation**

- TBD

**Fine tuning of all parameters**

- To be performed when calibration is finalized (or close to)

# AHDC alignment

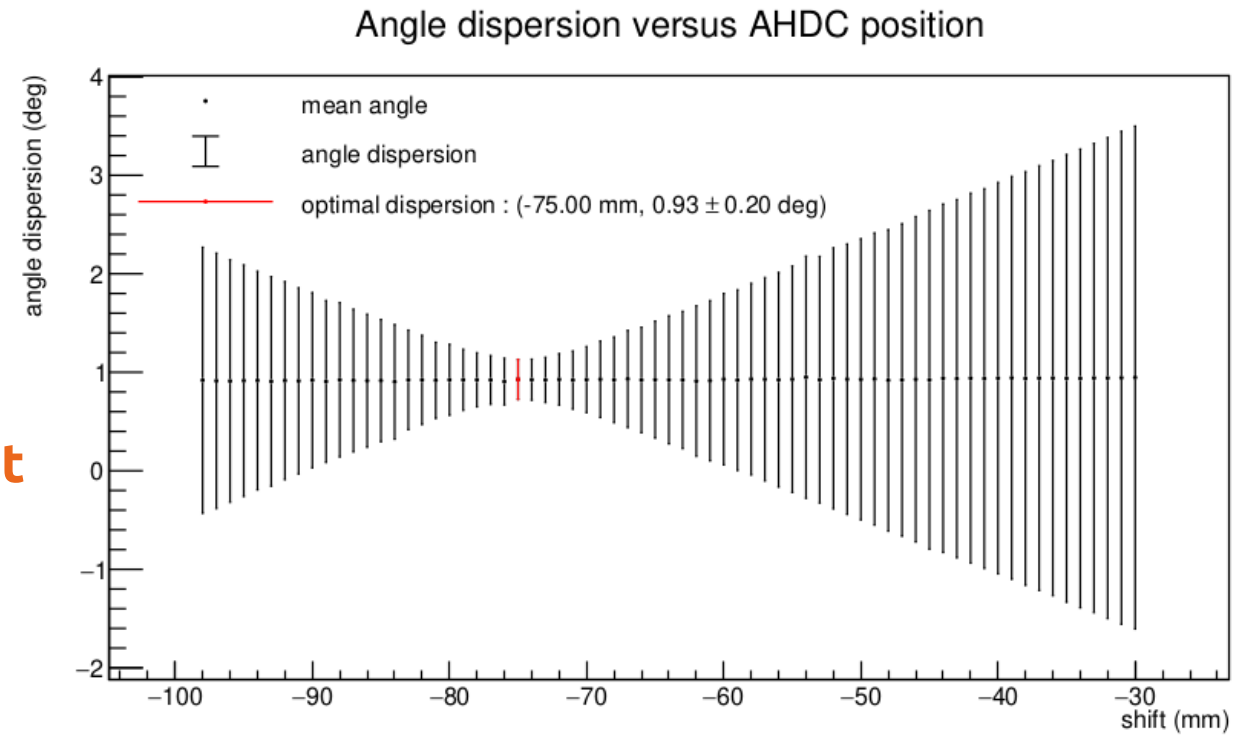
## We align the chamber layer by layer by minimizing the residual distributions

- We found that we had to move the detector
  - **Due to a shift in vz recon in CLAS12 for outbending**
- Overall shift of a degree
  - **Spread of a fraction between layers**

## More work on doing alignment wire by wire

- Statistics challenge

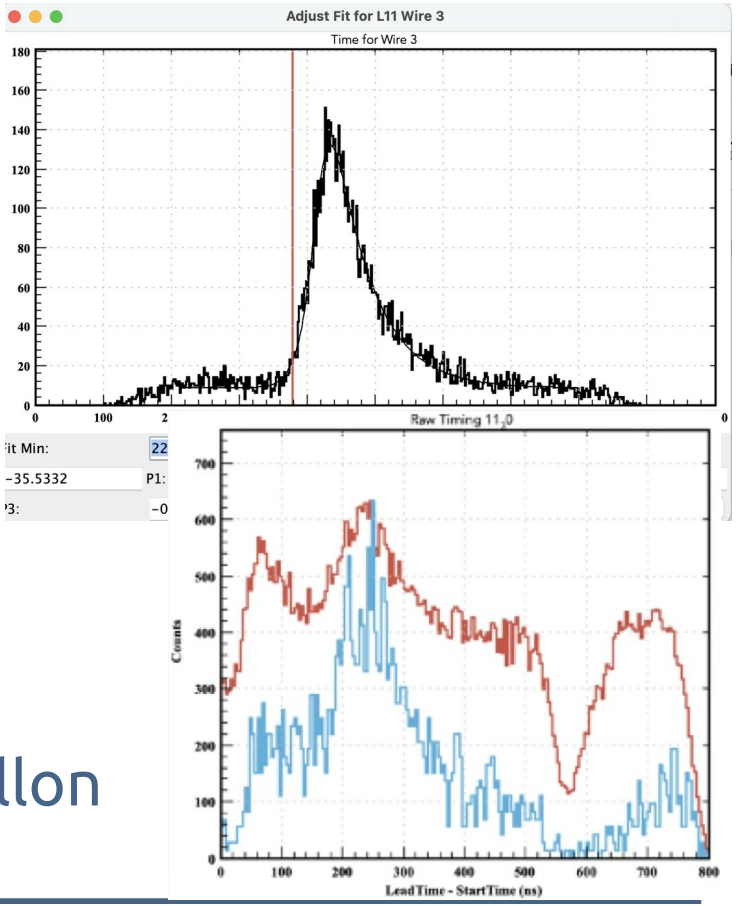
*See Felix talk yesterday for details*

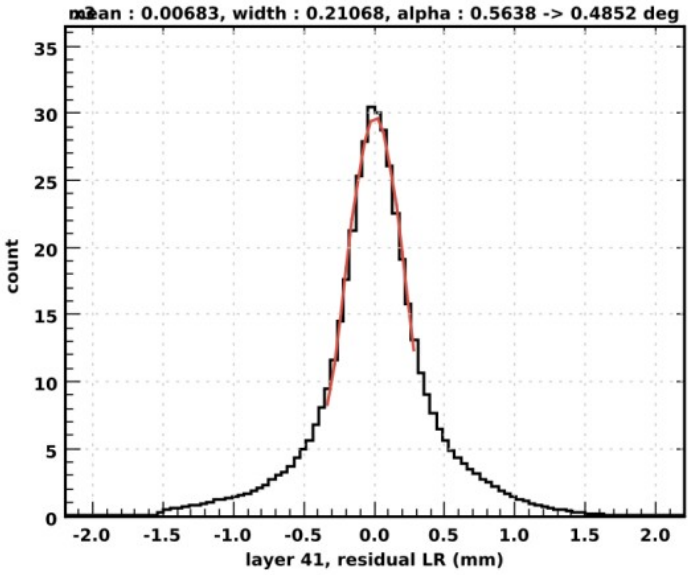


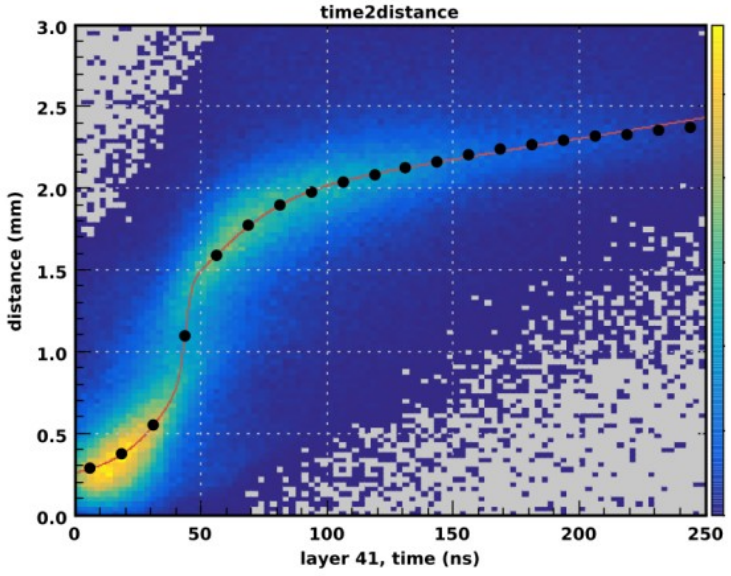
# AHDC t0 Calibration

## Difficult to progress on this front

- Difficulties to find the timing peak
- Depends a lot on data
  - **2 GeV elastics very clean, 11 GeV not so much**
- Depends on wires
  - **Back to back with CLAS sectors are easy**
  - **In between sectors much less**
- Work on going by M. Paolone and M. Ouillon






# AHDC t2d

## Depends a lot on t0 but we can progress

- Established new fitting functions
- We can extract the functions
  - **M. Paolone and F. Touchte-Codjo are working on this**

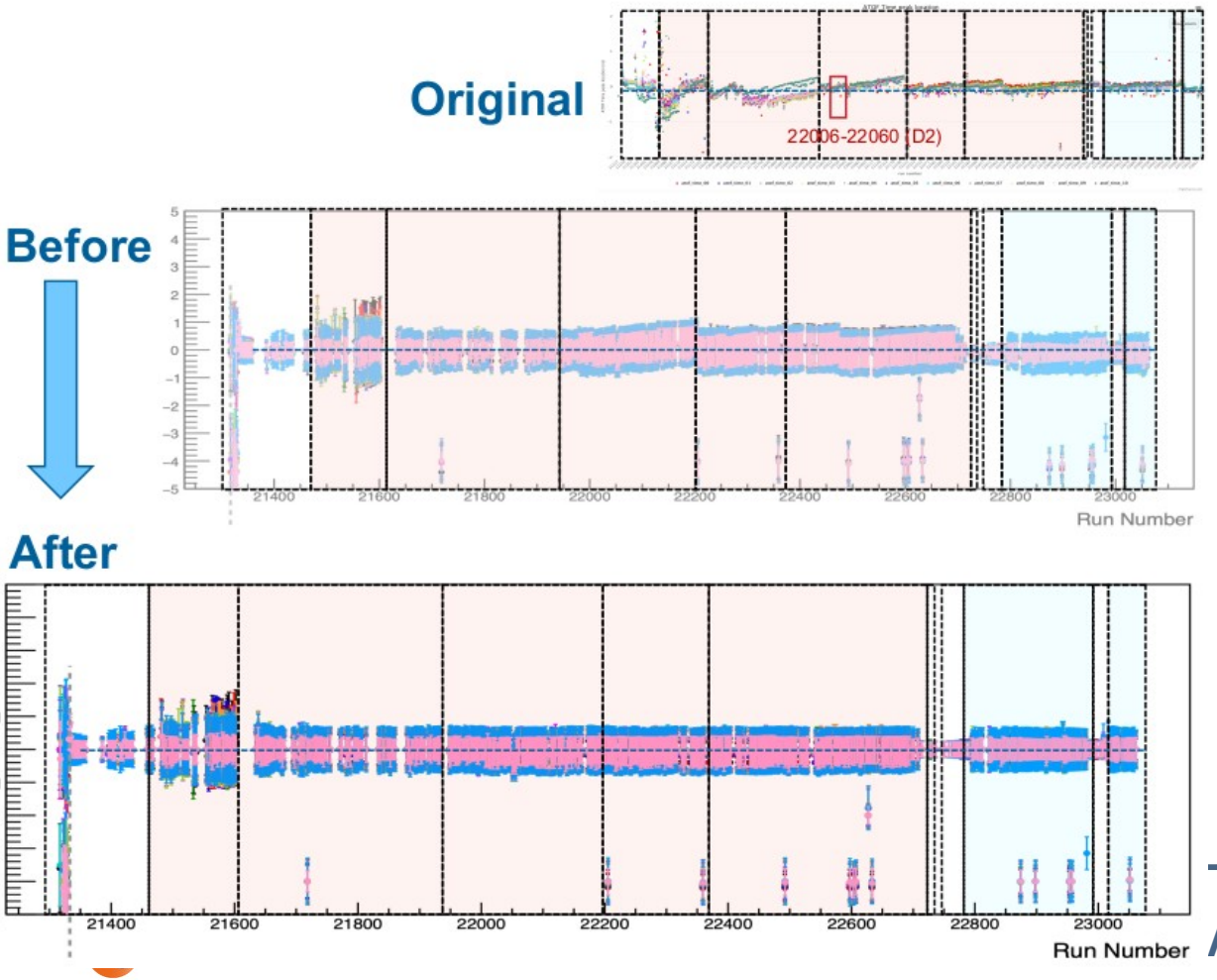
## ← Felix recent extractions

- The best layer down to 210 µm residuals
  - **Very close to our 200 µm goal**

    **→ We are getting there**

*See Felix talk yesterday for details*

# ATOF Calibration (1)



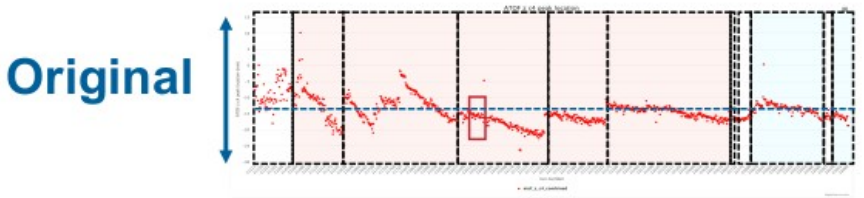

## Calibration of time in wedges

- This is done now
  - **For the full span of the experiments**
- Time line looks clean
- Implementation to be checked with the next pass0

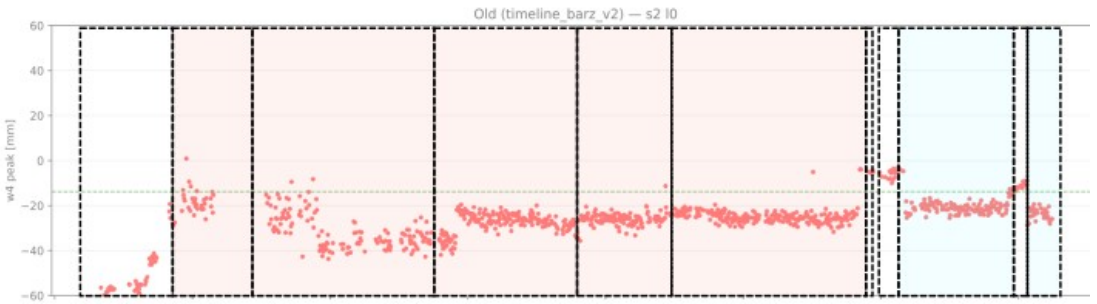
## Great milestone !

*See talk from Zhiwan yesterday*

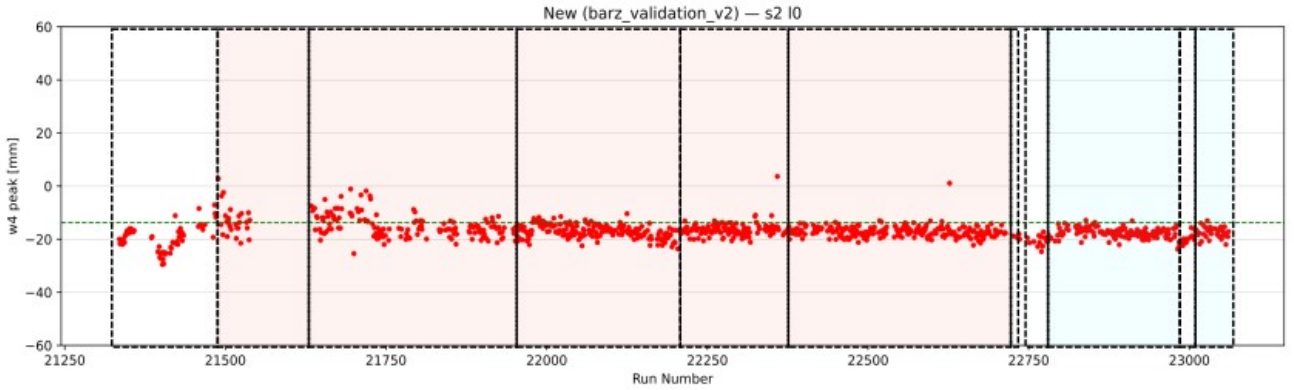
# ATOF Calibration (2)




Before




After




## ATOF bars provide z position

- Using time difference between the two ends
- These times are now calibrated
  - **For the full span of the experiments**
- Looking for the results in the next pass0

## Another Milestone !

*See talk from Zhiwan yesterday for details*

# Summary

## Reconstruction software is almost finalized

- Work is continuing on our software
  - **tasks left are refinements of the current status**
- Some fine tuning will be needed after calibration
- Contribution on-going with BNL team to implement background merging in the simulation

## Calibration is progressing well

- ATOF timing is now done
  - **ATOF gains are next**
- AHDC work is following
  - **It is a bit more difficult, more people are joining**
- Alignment work has progressed a lot

**We are still hoping to conclude the ALERT calibration toward the end of the Summer**