# ALERT update

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On behalf of the ALERT collaboration
CLAS Collaboration Meeting, Jun 26th 2024

# The ALERT Detector



- **A Low Energy Recoil Tracker**

  - Straw pressurized target

  - Hyperbolic drift chamber

  - Time-of-Flight array

- **Collaborative effort within CLAS12**

  - ANL, IJCLab, JLab, NMSU, Mississippi SU, ODU, Temple...

- **Why such a detector ?**

  - Light nuclei quark and gluon structure

  - Measure of PDFs and GPDs of nuclei and bound nucleons
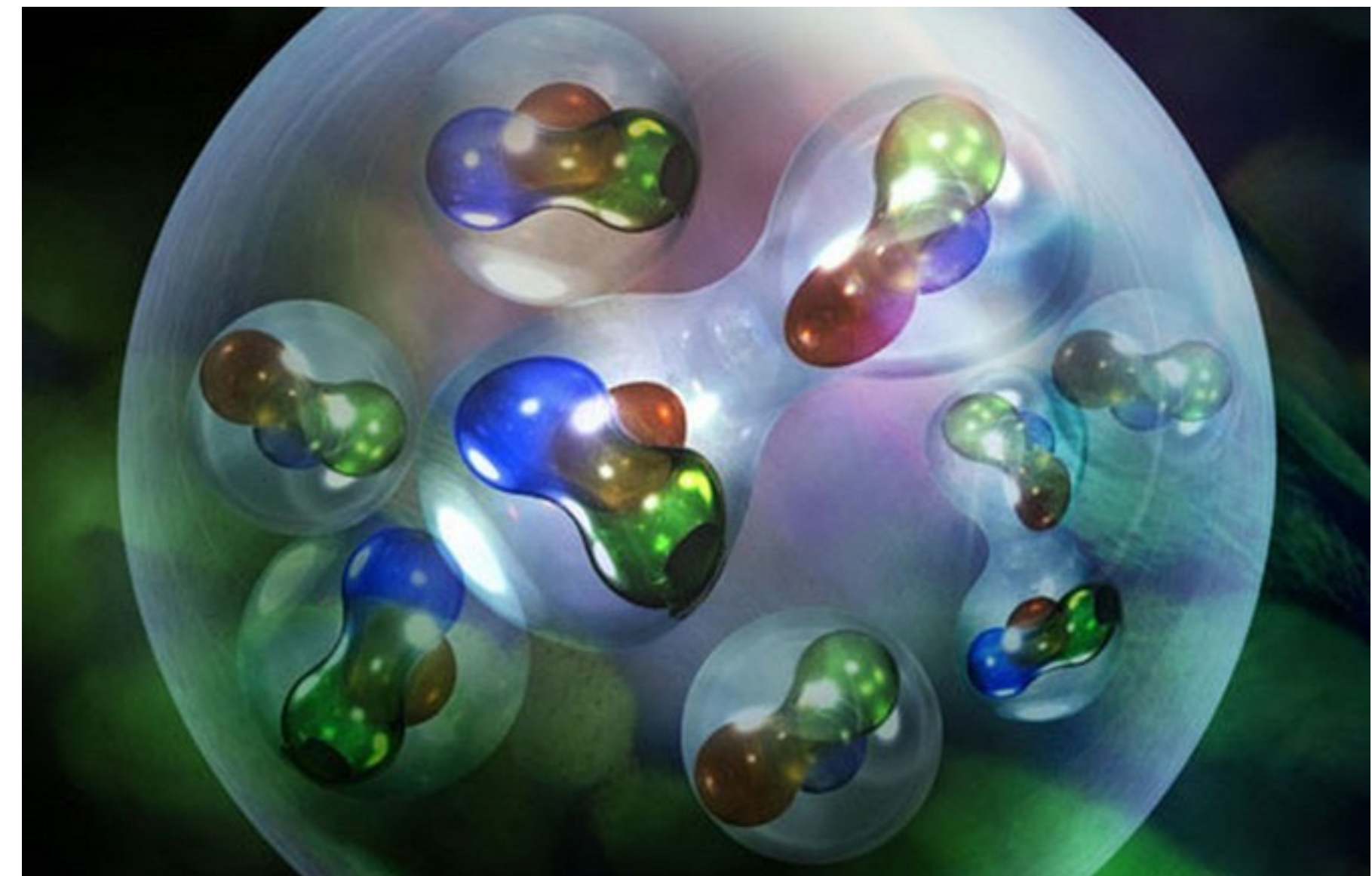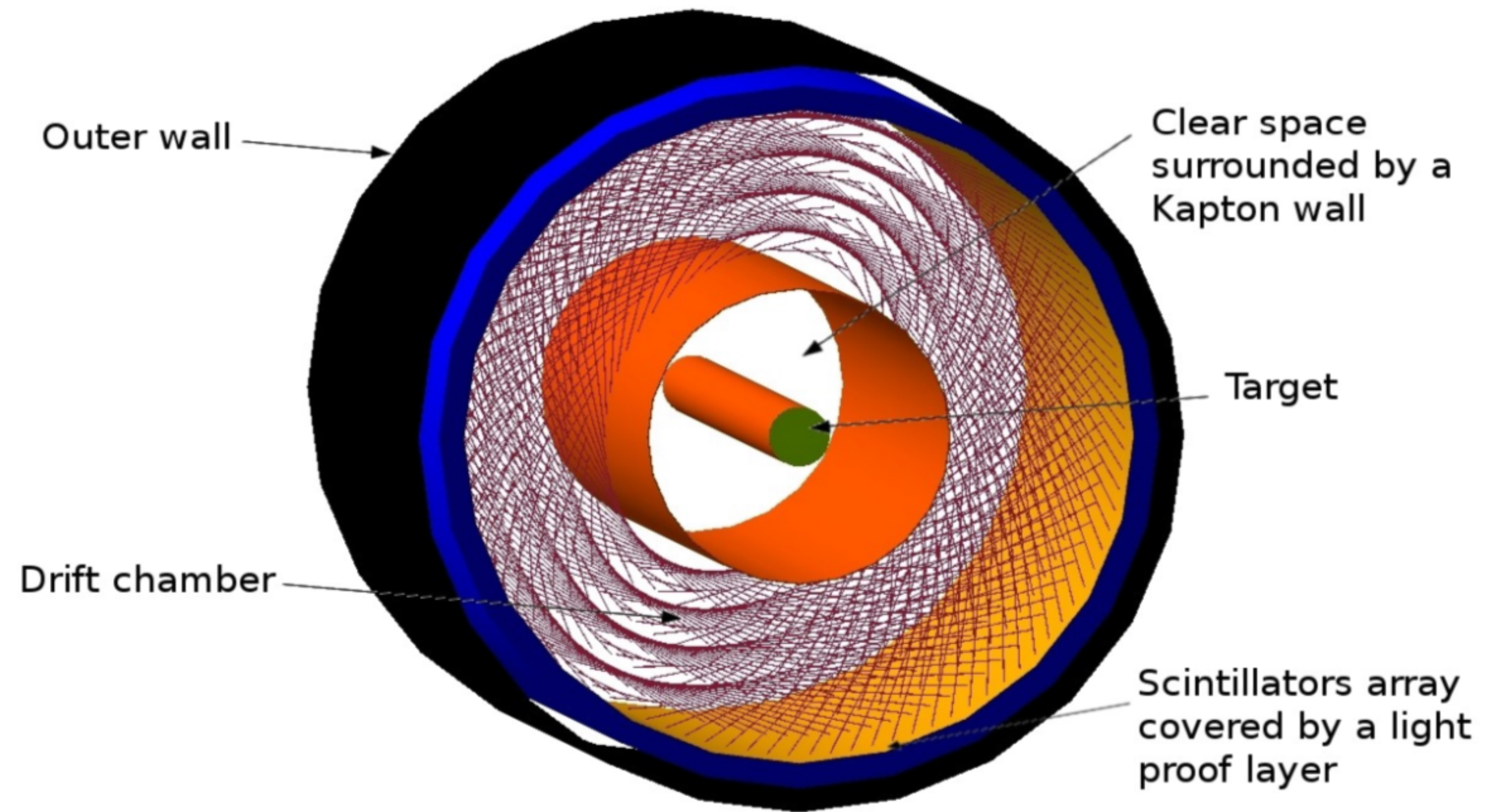
# The ALERT Detector: Physics

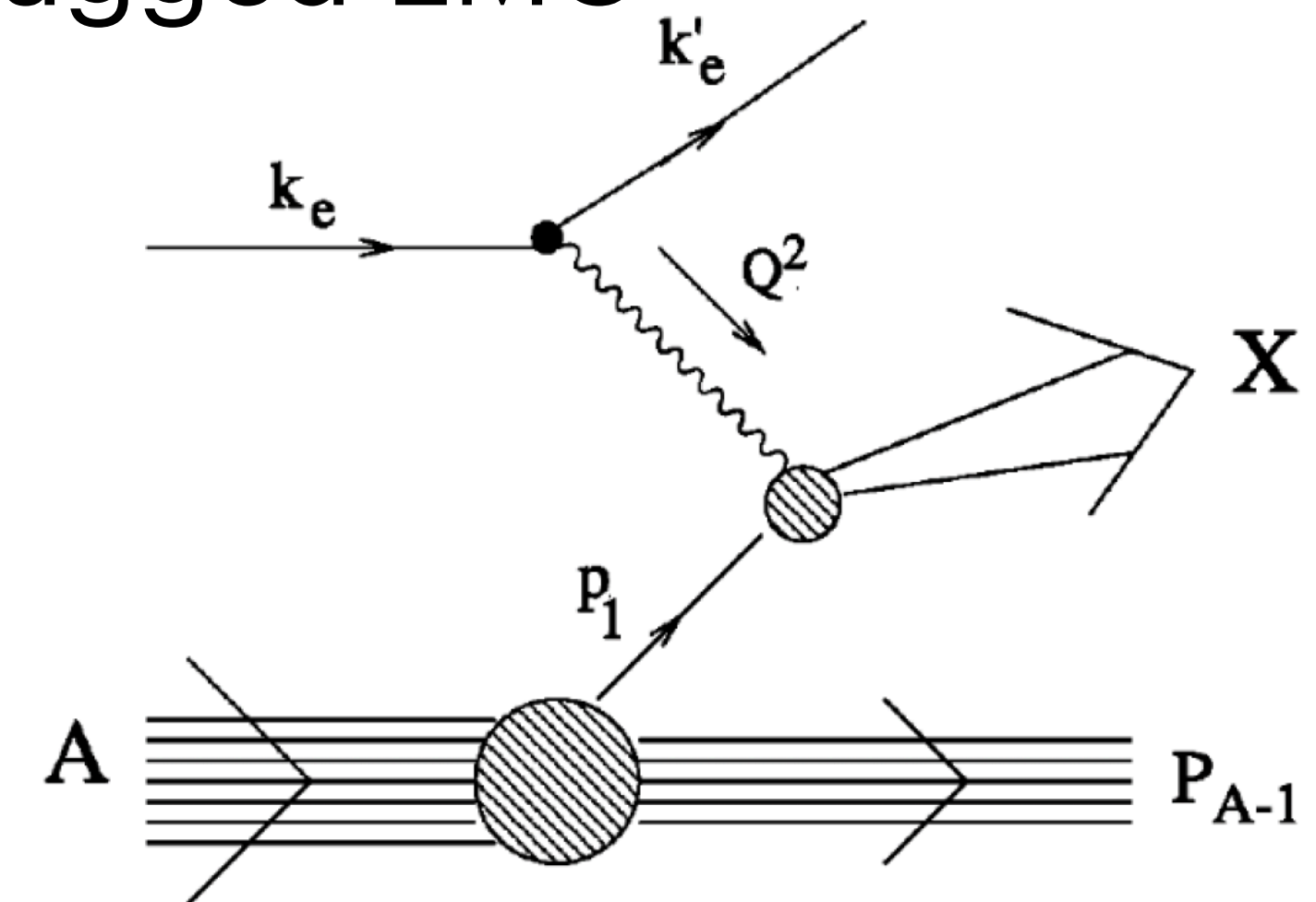- **Some Physics:**

  - DVCS

    - Gives access to quark GPDs in $^4$He.

  - DVMP

    - Gives access to gluon GPDs in $^4$He.

    - Information useful to proton mass studies

  - Tagged EMC

    - Test EMC models versus A -1 tagged kinematics.

  - **+ much more**



DVCS

DVMP

or $\phi$

Factorization

$H_A(x, \xi, t)$

$x+\xi$  $x-\xi$

$^4He(p)$  $^4He'(p')$

$t = \Delta^2$
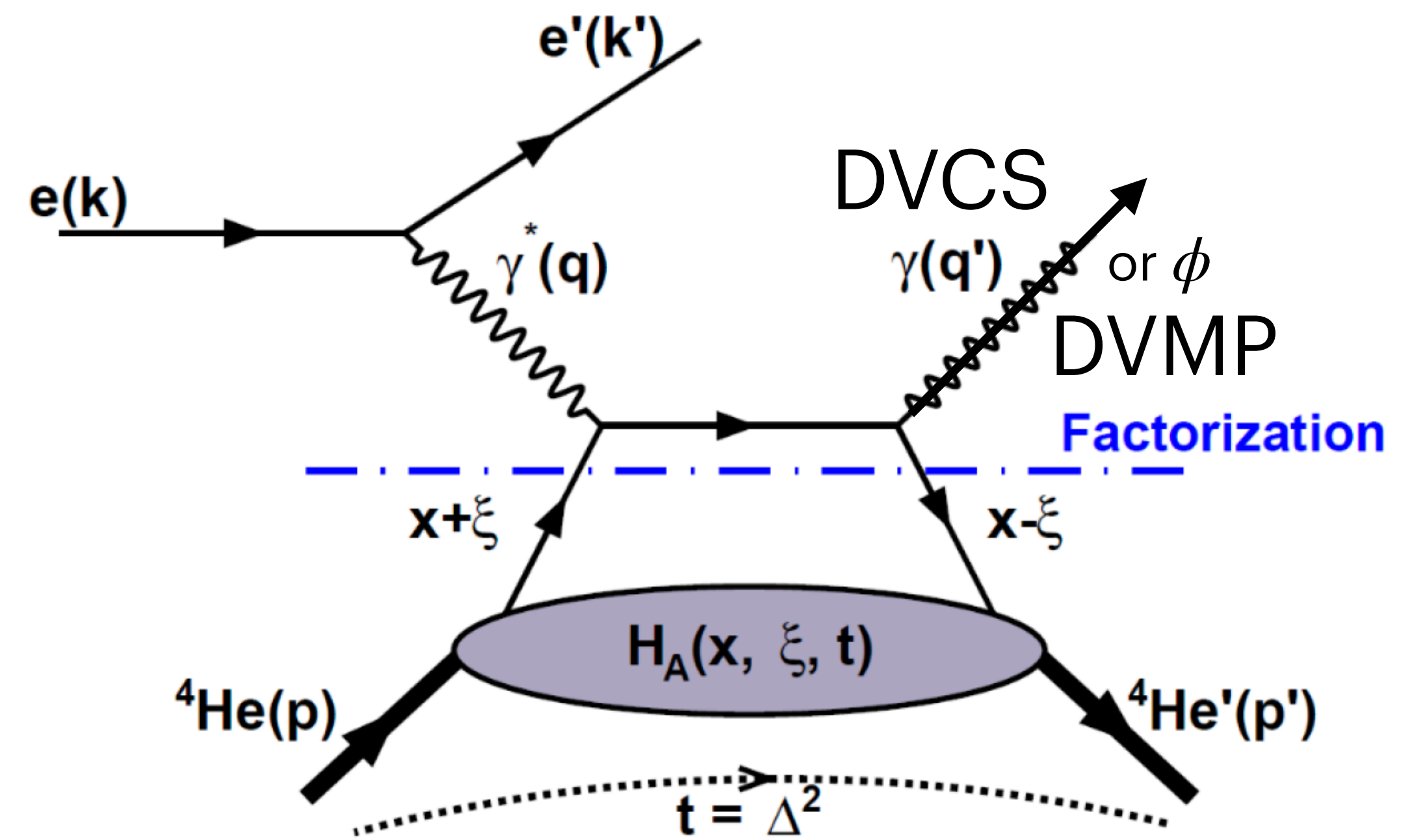
Tagged EMC

# The ALERT Detector: Hyperbolic Drift Chamber (AHDC)

- **Stringing started in September 2023 in Orsay**
  - Mostly problem/issue free!
    - A few issues with the PCB found, but resolved before installing wires.

- **Finished early March 2024**
  - All wires are in place
    - A single wire appear slightly below nominal tension and will need repair

- **Delivered to JLab in April**
  - First tests are positive
  - We had to reorder HeCO2 gas

# The ALERT Detector: Hyperbolic Drift Chamber (AHDC)

- **Installed in EEL**
  - Some first signal seen from cosmics
    - A DREAM chip was damaged, we are investigating the cause
- **DAQ is being setup**
  - All wires are in place
    - Saclay is helping to make DREAM work for us.
- **Gas systems**
  - Gas panel is installed next to the detector
  - Right now a temporary teflon gas chamber
  - Still some work on these is coming
- **Repair of a loose wire**
  - We tested a method to put tension in the loose wire

# The ALERT Detector: Time of Flight (ATOF)

- **All 15 modules are assembled**

  - Work made at Argonne

  - Three spares will be made soon

- **Mock-up assembly**

  - Fit tightly → broke some glue joints

  - Everything is now repaired, we will add shims to resolve the issue

    - The method was tested and validated

- **Issues with shipping....**
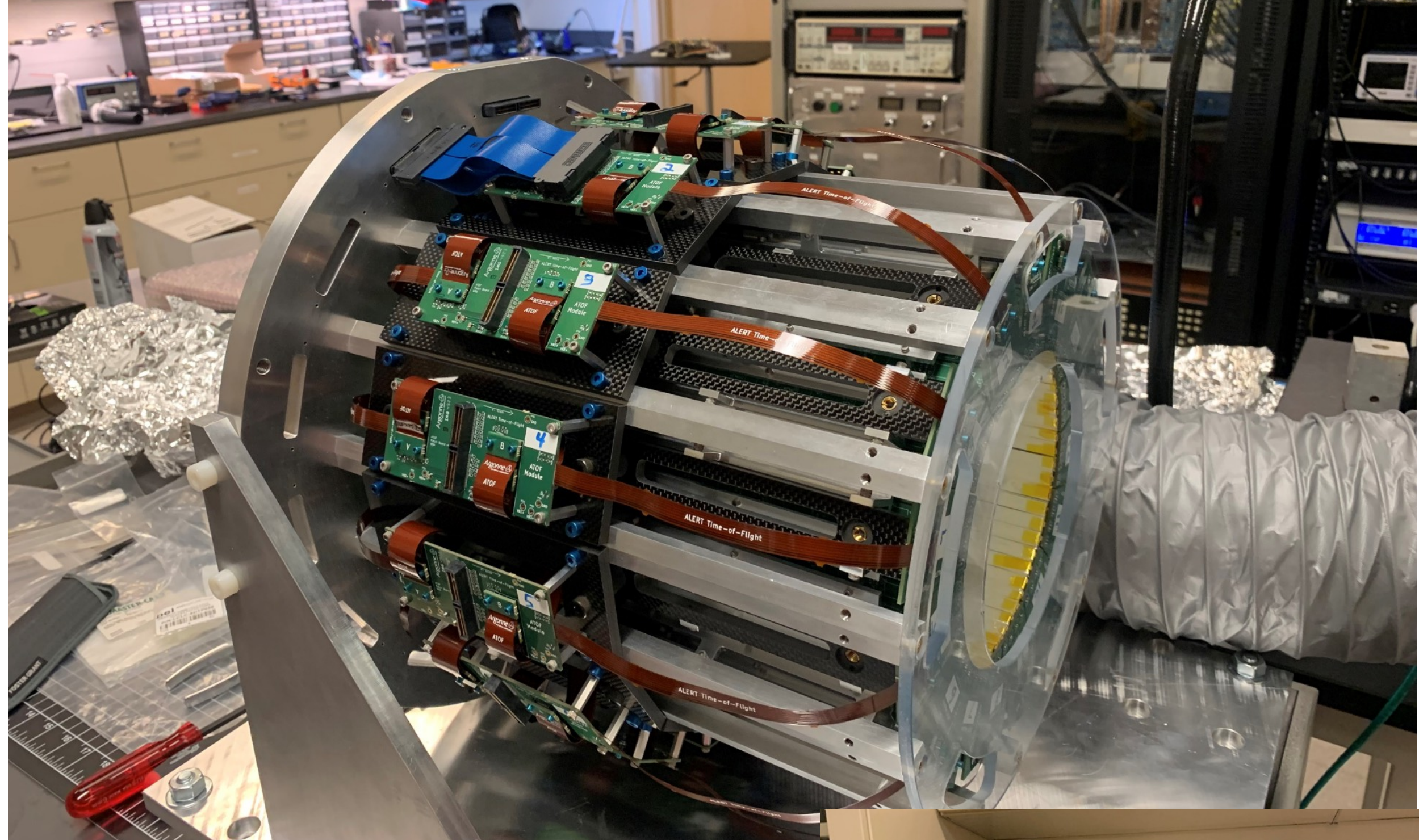
# The ALERT Detector: Time of Flight (ATOF)



- **ATOF modules were damaged during shipping**

  - Unsure of exact cause

    - There are multiple visible impacts on the transport box

    - It looks like it was dropped repeatedly

    - We did not have enough padding for such a treatment.

- **We inspected the 15 modules shipped**

  - 5 are apparently intact

  - 5 have broken glue joints that should be easier to repair

  - 5 have SiPMs torn off PCBs and will need new parts

- **Damaged modules have been sent to ANL for repair and testing**
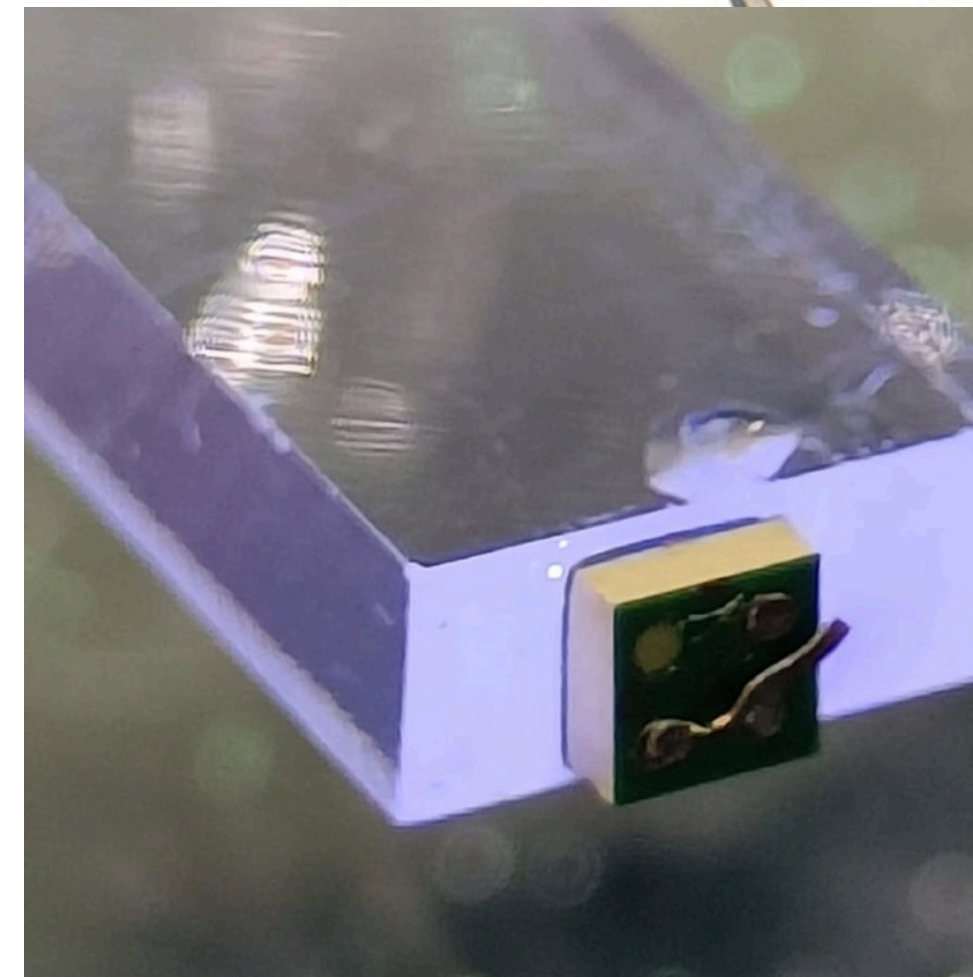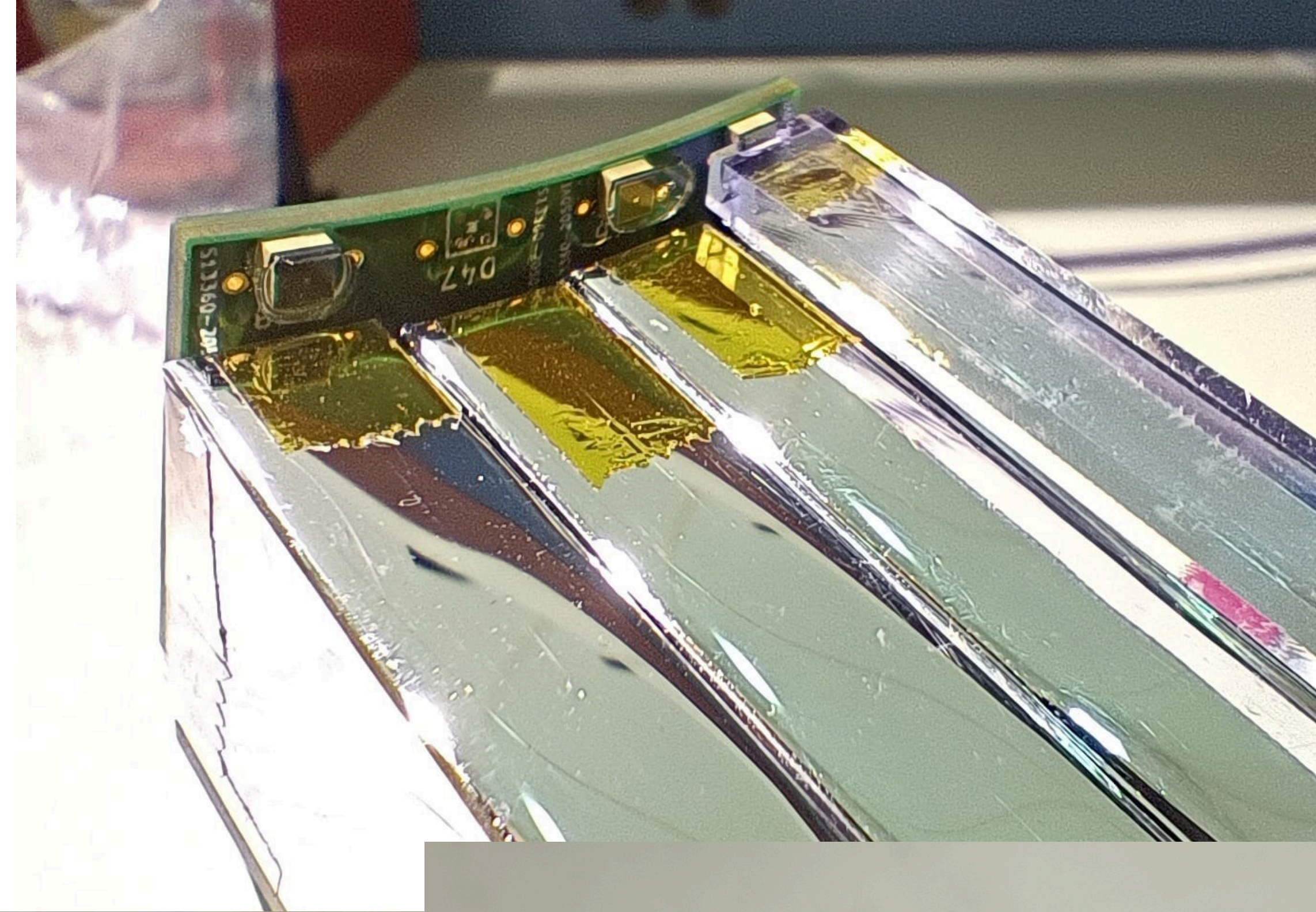
# The ALERT Detector: Hall-B integration

- **Tube to mount on Hall-B cart**

  - Designed, built and assembled by Argonne

  - At JLab now. Detector will be installed soon.

- **Power supplies and cabling**

  - We made a lot of progress on the details of cabling in the past few months

    - We still need to make sure there is no surprise

    - The precise specifications of the power supplies can be important

# The ALERT Detector: Beamline and Target

- **Beamline situation has seen some changes**

  - Some changes with the helium bag

    - It will contain drift gas

    - We removed a window, but have slightly heavier gas

  - FT ON for DVCS experiments

    - Bonus12 data showed the drawbacks of doing DVCS without the FT

    - We are working on simulations to assess the effect of these changes

    - We take this chance to update the whole ALERT material in GEMC

- **JLab ordered new target straws**

  - Target straws arrived

    - First tests of bursting limits from Moahmmad are promising

  - They appear slightly better than Bonus12 straws

    - First results indicate that we should be able to run up to 6 atm (ERR value was 5 atm)

  - More tests are coming to check the resistance to repeated usage and time
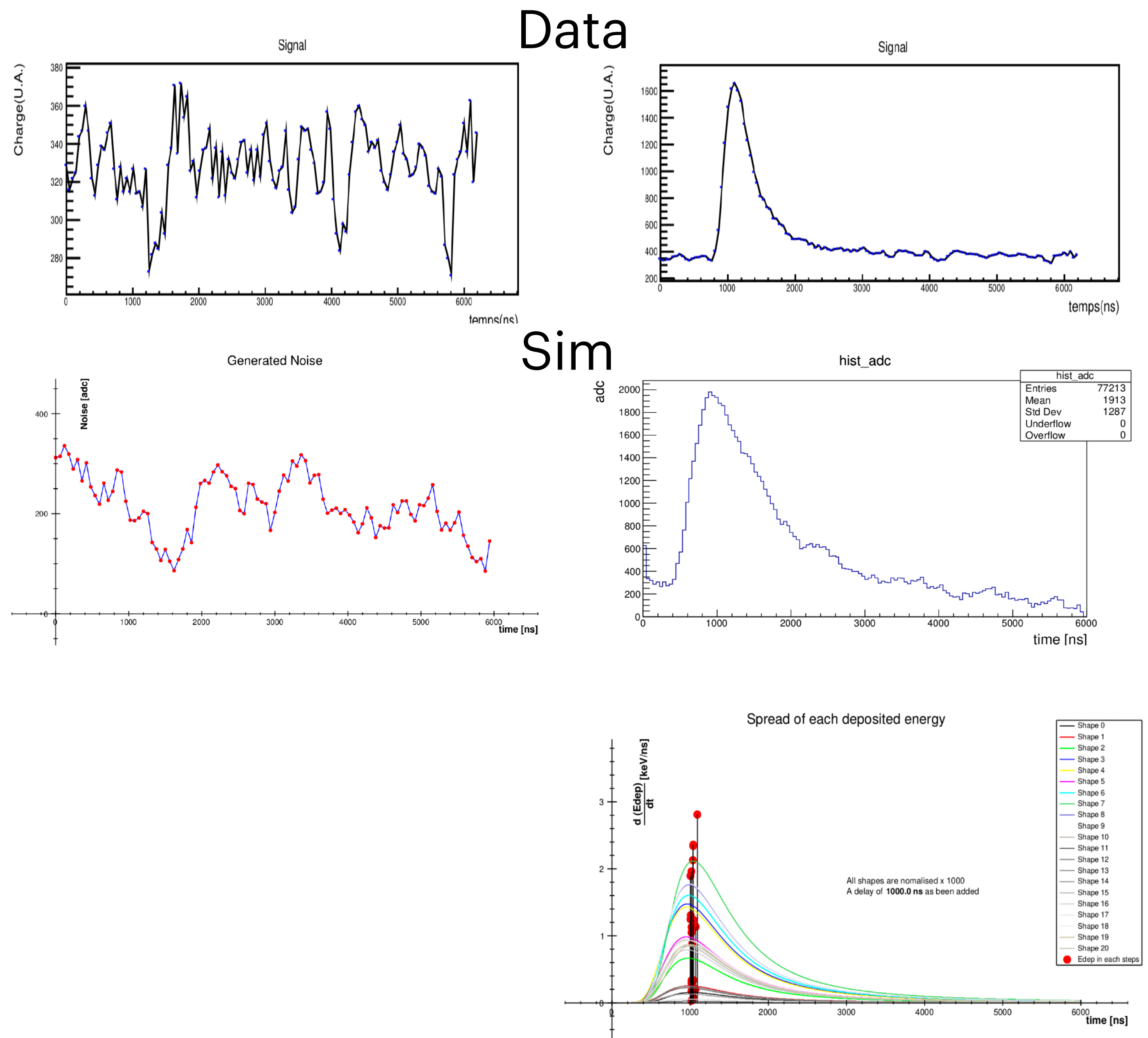
# The ALERT Detector: Software

- **Management / Deployment:**

  - Weekly Meetings dedicated to software development.

    - We have healthy participation.

      - Many recent additions, many are new to clas12 software and are "ramping up".

  - We have moved to ALERT specific development repositories for GEMC and coatjava.

    - builds found at `/work/clas12/rg-l/sw`

    - Simulation -> Reconstruction -> Analysis chain has been established and documented

# The ALERT Detector: Software

- **Simulation:**

  - More realistic digitization of charge pulse on wire: Felix Touchte Codjo

    - Sum of energy deposits, along with estimated backgrounds.

  - Currently working on updating all materials in sim to latest design specs.

  - Test occupancies on detectors with latest materials, including the FT.

Data



Sim

# The ALERT Detector: Software

- **Reconstruction Efforts:**

  - Internal indexing of detector components are now inline with clas12 convention (component counting begins at 1 instead of 0).

  - Testing and refinement of Kalman Filter is ongoing.

    - ML techniques are being investigated to assist in functionality.

  - Work on ATOF specific PID has just begun.

    - Plans are to expand to ATOF + AHDC refined PID

  - Integration into event builder.

- **Calibration:**

  - ATOF calibration routines have been in place for a while.

    - ...old enough that they should probably be revalidated.

  - AHDC routines for T2D calibration is in progress:

    - Recently moved to an adapted version of the clas12 DC calibration software.

  - Some cross-component calibration routines may be pursued.

# The ALERT Detector: Software

- **Lots of work left to do:**

  - **DAQ:** finish programing of AHDC (DREAM chip) and ATOF (NALU boards) data acquisition.

    - Would be nice to have proper data banks with bench data that could be input into reconstruction and simulation.

  - **Tools:** CED, mon12, slow controls.

    - Note: CED has proper visualization for ALERT, but data bank structure needs to be adapted for readout.

  - **Database:** We currently work with local sqlite or text databases, but we will need to integrate into the clas12 mysql soon.

  - **+** all the simulation/reconstruction/calibration tasks mentioned before.

# The ALERT Detector: What's Next?

- **Installation of ALERT is progressing nicely**

  - Assemble the drift chamber and the ATOF modules at JLab in progress.

  - Then mount the whole detector on the transport cart

  - Early July, we will fix the loose wire and assemble a new gas enclosure

    - Without helium bag for now

- **Probably moving the detector in the Hall early September**

  - The program will be clarified when we have a start date

- **With hardware tasks wrapping up we now transition our efforts more toward software**

  - Many software projects in progress.

  - We aim at a full calibration and reconstruction software before beam

- **THANKS!**