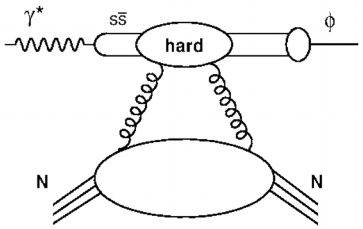
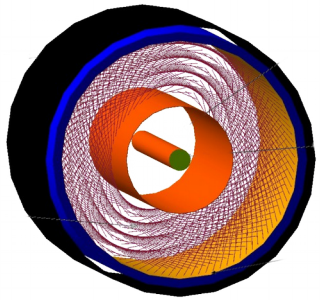
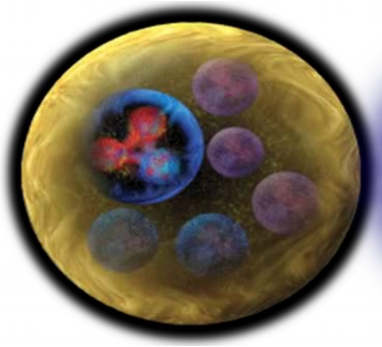
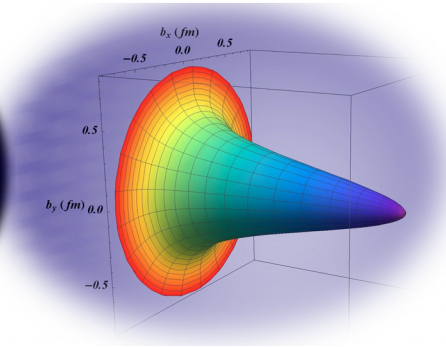
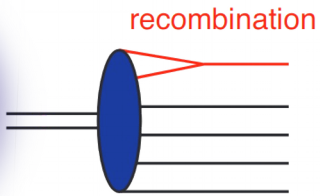
Status of ALERT











Run Group L

Raphaël Dupré

IPN INSTITUT DE PHYSIQUE NUCLÉAIRE ORSAY

université PARIS-SACLAY

erc European Research Council Established by the European Commission

Run Group L (ALERT)

Helium and deuterium targets

Nuclear GPDs

- Coherent Nuclear DVCS
- Coherent Nuclear DVMP

Tagged EMC

- Measurement of the tagged PDF

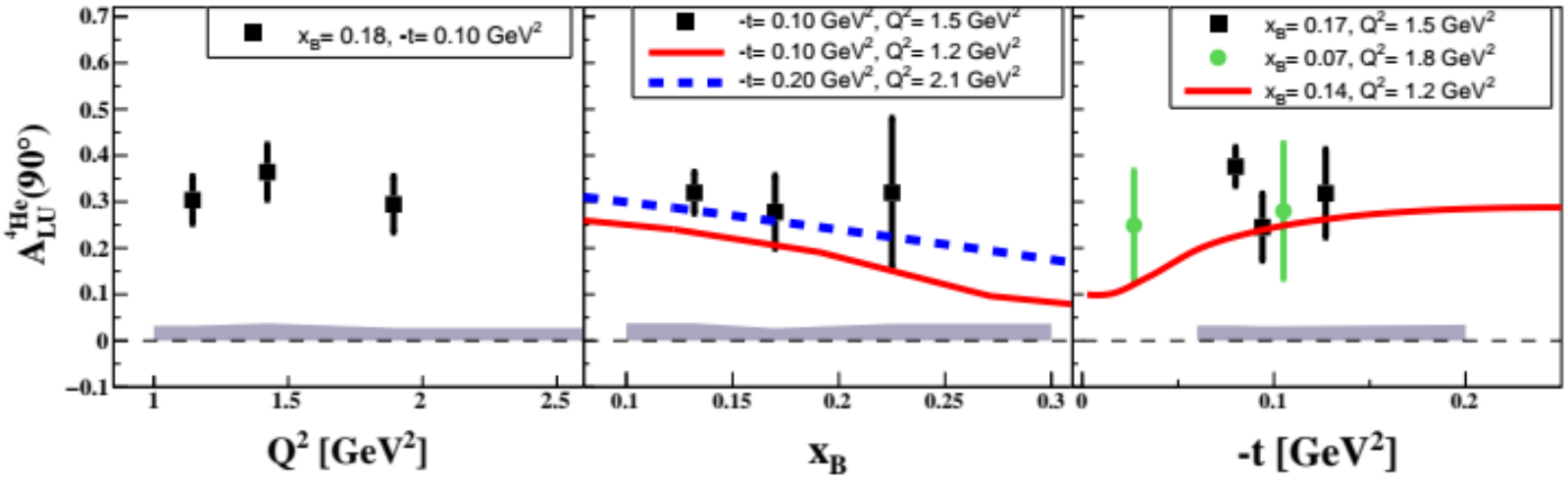
Tagged DVCS

- Measurement of the tagged incoherent DVCS

Other topics

- Tagged quasi-elastic, deuterium DVCS etc.

CLAS Coherent DVCS



Beam-spin asymmetries of the coherent DVCS off helium

- **Fully exclusive measurement (all particles directly measured)**
- **We observe very strong beam-spin asymmetry**
  - *Almost double of that on proton target*

Physics interpretation

- **Expected from the different DVCS and BH behavior with Z**
- **Very strong signal proves that we observe DVCS/BH interferences with little to no contamination from incoherent processes**

Promise of an easy and direct GPD extraction

- **Helium has a single GPD so the fitting should be much simpler**

M. Hattawy et al. (CLAS Collaboration), Phys.Rev.Lett. 119 (2017) no.20, 202004

Extraction of the CFF

Helium allows for a simple extraction

- Spin-0 → 1 GPD/CFF

The contributions from *Im* and *Re* are very different

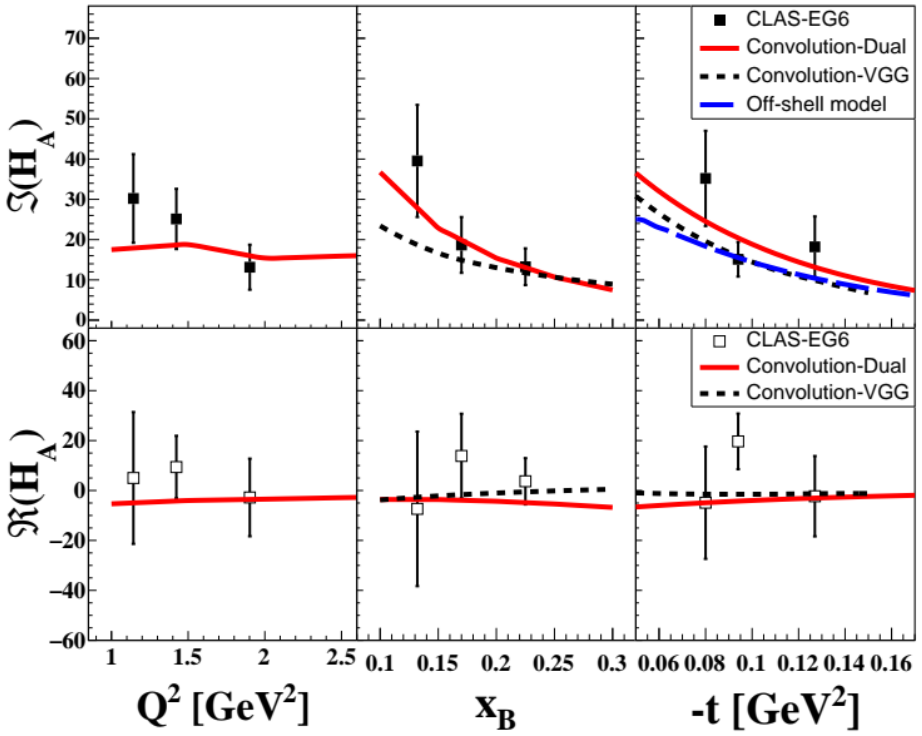
- The terms are calculable within perturbative QCD
- Allows to separate their contributions

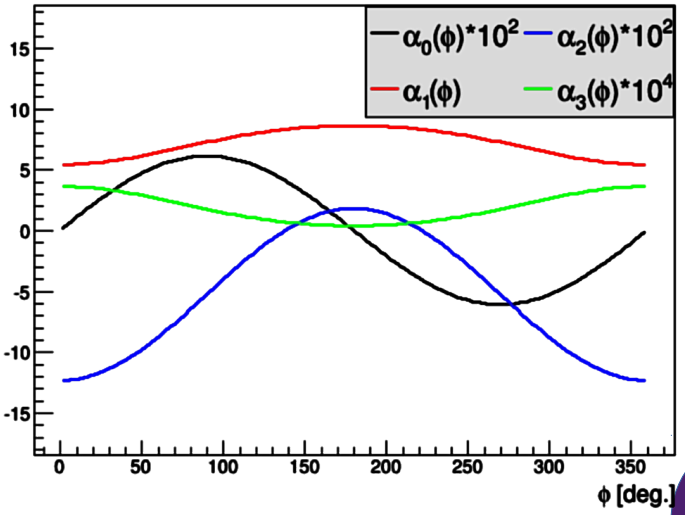
$$A_{LU}(\phi) = \frac{\alpha_0(\phi)\,\Im m(\mathcal{H}_A)}{\alpha_1(\phi) + \alpha_2(\phi)\,\Re e(\mathcal{H}_A) + \alpha_3(\phi)\left(\Re e(\mathcal{H}_A)^2 + \Im m(\mathcal{H}_A)^2\right)}$$

It happens to works very well

- No model input, the fit converges immediately
- We are mostly sensitive at the imaginary part
- More statistics will be needed for a tomography

M. Hattawy et al. (CLAS Collaboration), Phys.Rev.Lett. 119 (2017) no.20, 202004





The EMC effect through tagging

Projections for JLab

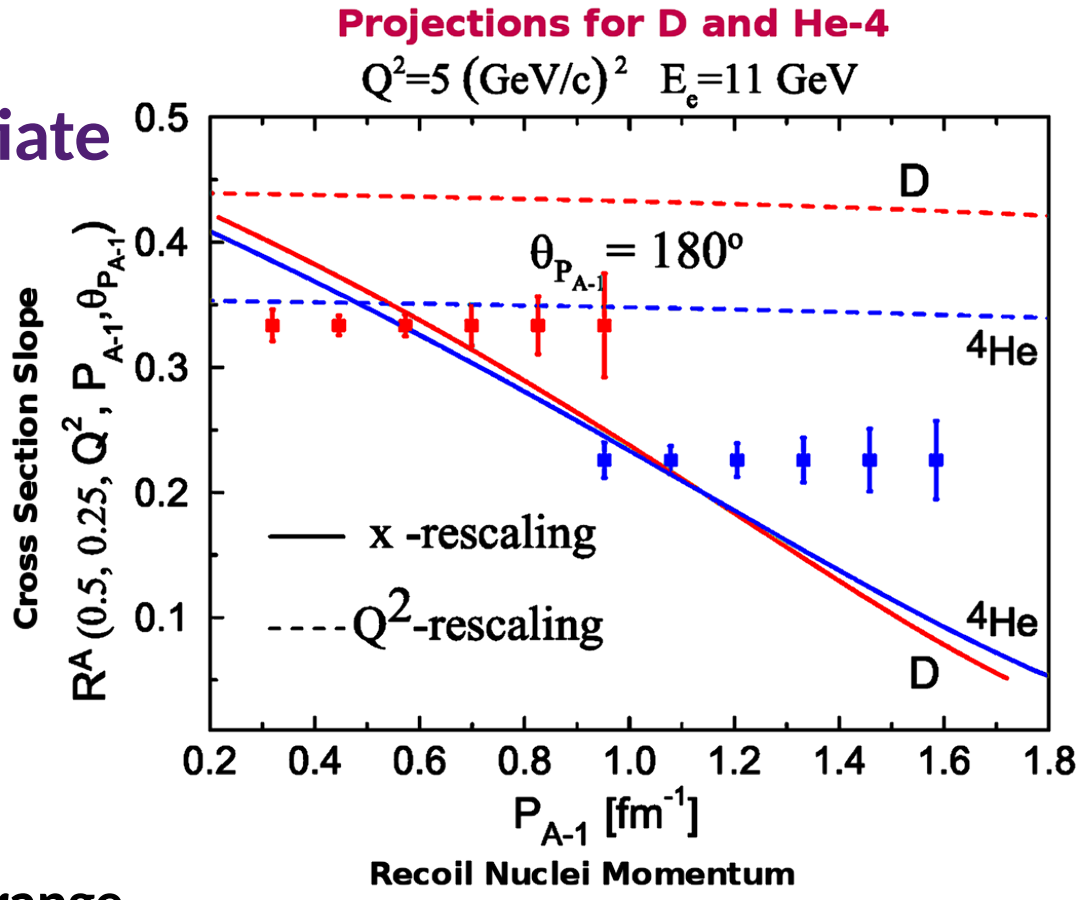
- No data yet

Tagging can help differentiate models

- Q^2 and x rescaling give drastically different predictions

Some models have more trouble

- It is difficult to make a mean field prediction here
- If one wants to probe short range correlated nucleon pairs → Detect A-2 fragments



CLAS Incoherent DVCS

Measurement of CLAS

- From the same data set
- Proton bound in helium target

Gives a generalized EMC

- This time smaller asymetries than on free protons
- Strange behavior compared to the models

A New kind of EMC effect?

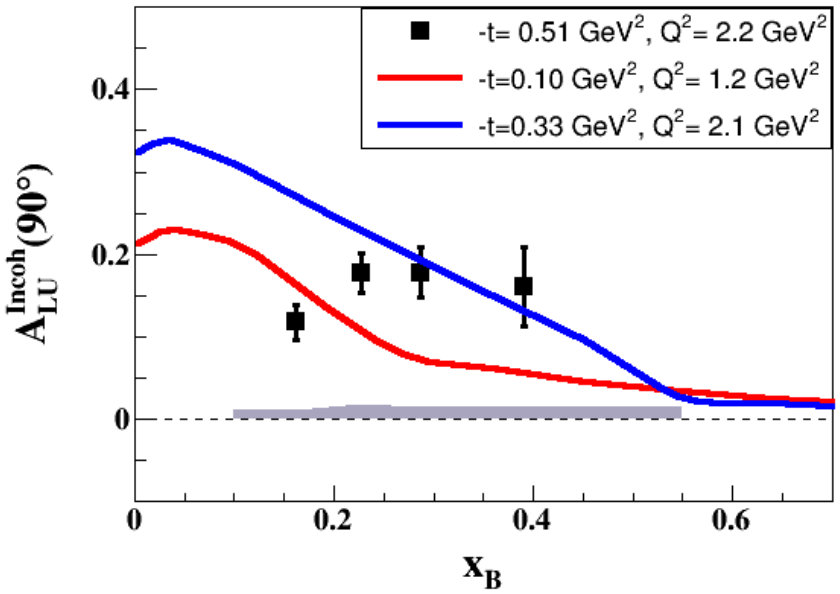
- It could be a nuclear effect
- Or it could be due to final state interactions
  - *Can be very complicated in DVCS*

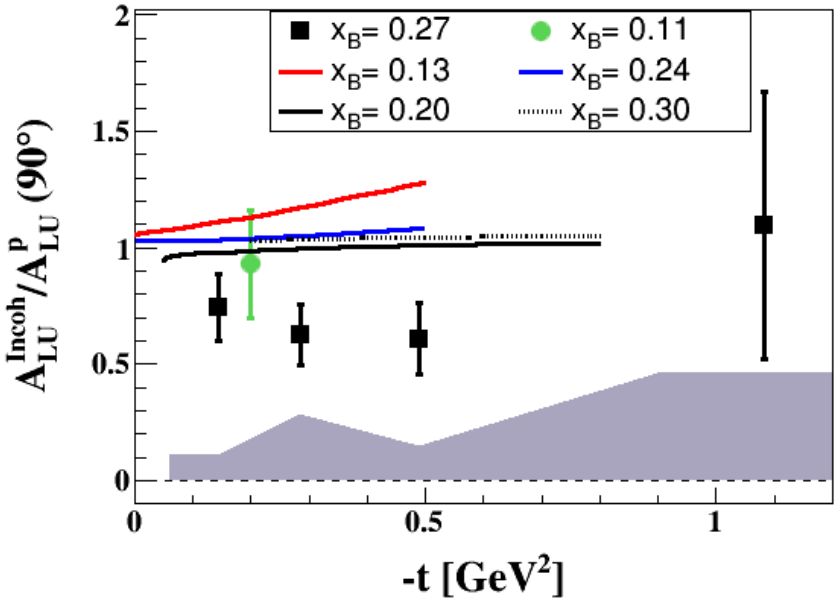
Recent theoretical work can reproduce the data

- Using the same model for coherent and incoherent measurements

M. Hattawy et al. (CLAS Collaboration) Phys.Rev.Lett. 123 (2019) no.3, 032502

S. Fucini, S. Scopetta and M. Viviani Phys.Rev. C98 (2018) no.1, 015203

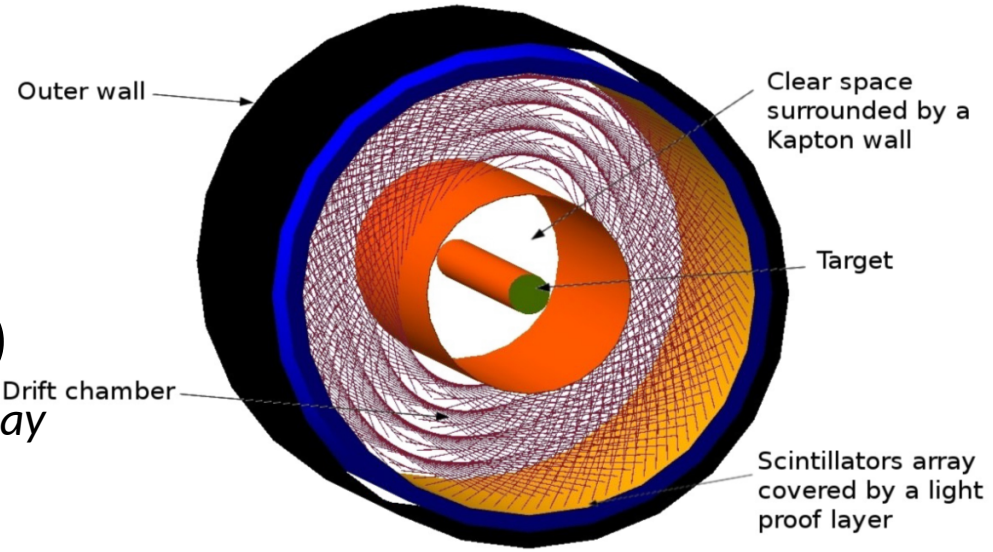




ALERT Status

A Low Energy Recoil Tracker

- **Target**
  - *Similar to Bonus one made in ODU*
- **Hyperbolic Drift Chamber (HDC)**
  - *Design and construction in IPN Orsay*
- **ALERT Time of Flight (ATOF)**
  - *Design and construction in ANL*
- **Software**



Much progress in the last year

- **Three general meetings of the collaborators (Jlab and Orsay)**
- **ERR scheduled in a week (Nov. 20)**
  - *https://clasweb.jlab.org/wiki/index.php/ERR*

The Team

Physics case

- W. Armstrong, N. Baltzell, R. Dupré, K. Hafidi, M. Hattawy, Z.E. Meziani, M. Paolone

Instrumentation

- W. Armstrong (ATOF), L. Causse, G. Charles, R. Dupré (HDC)

Design

- T. O'Connor (ATOF), J. Bettane (HDC)

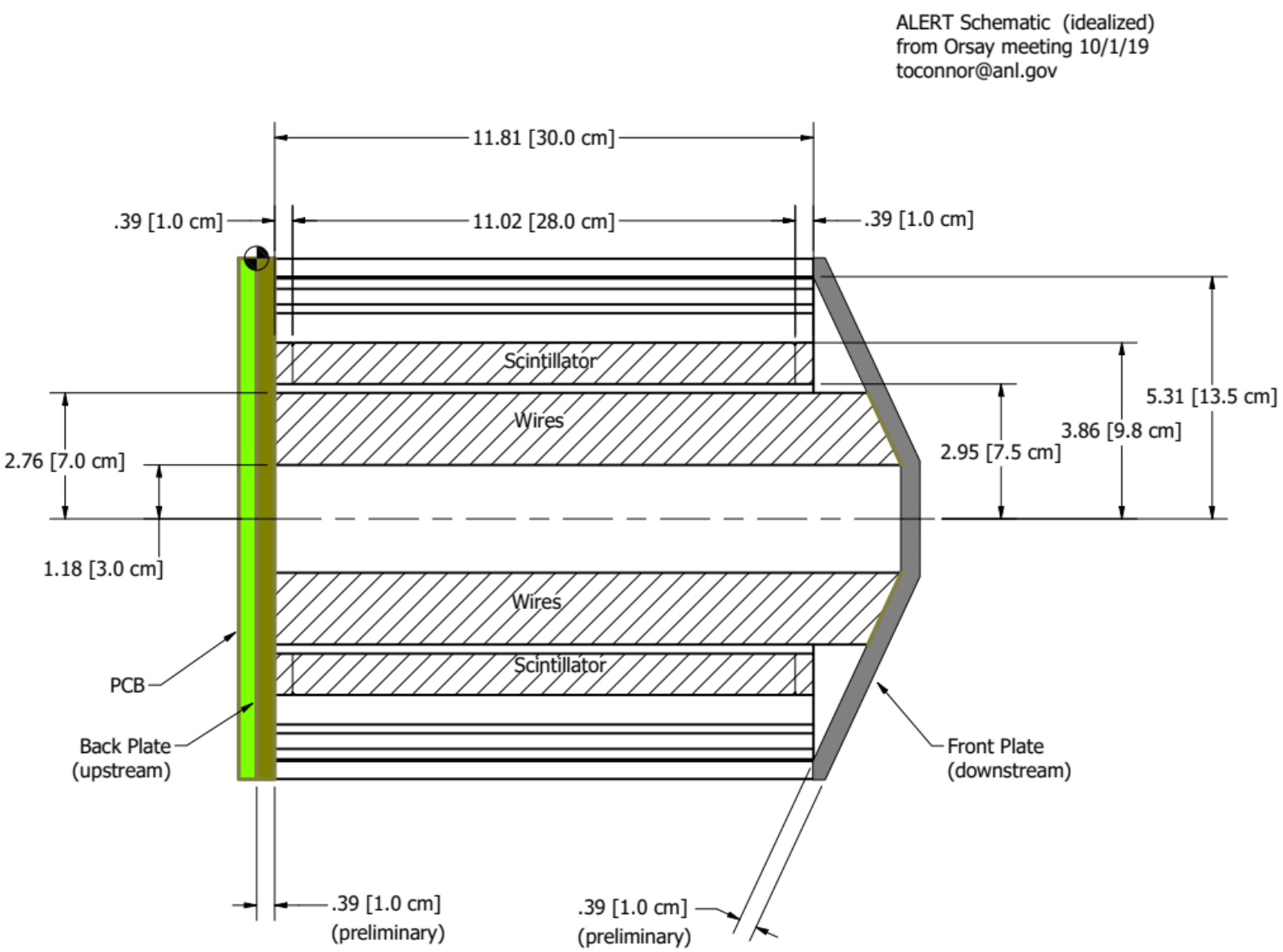
Target and gas system

- M. Hattawy

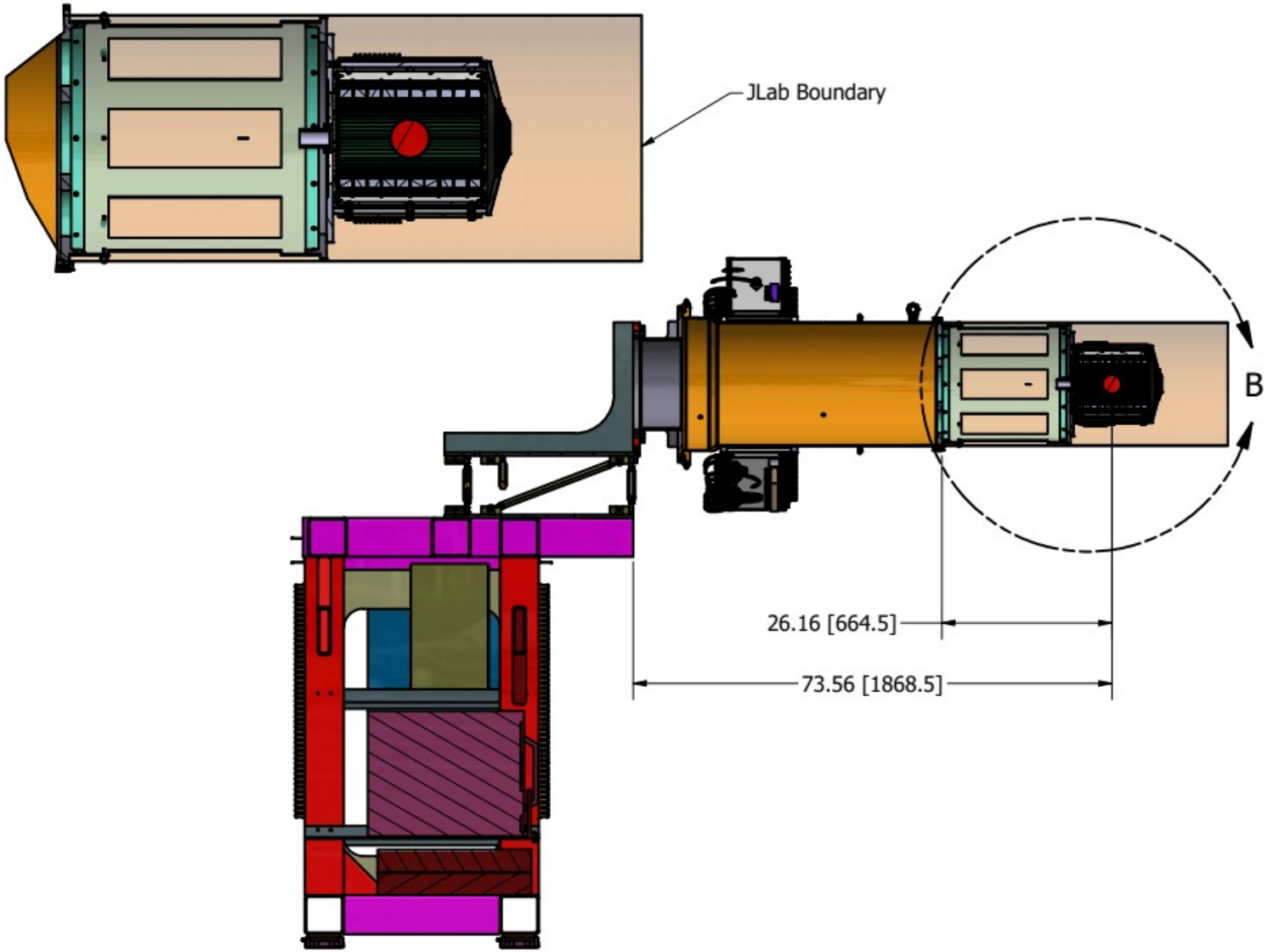
Software

- M. Paolone, V. Sergeyeva

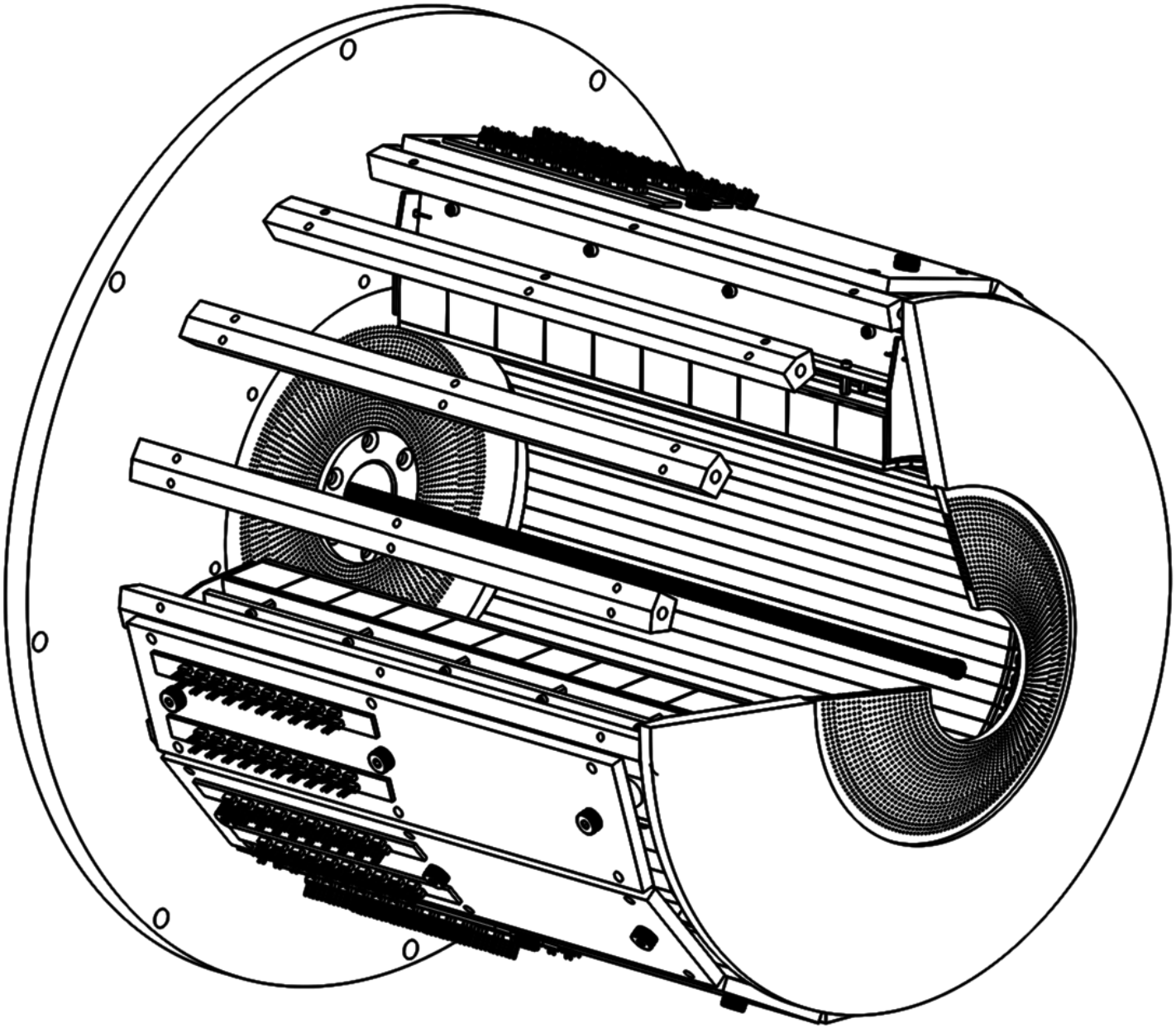
General Layout



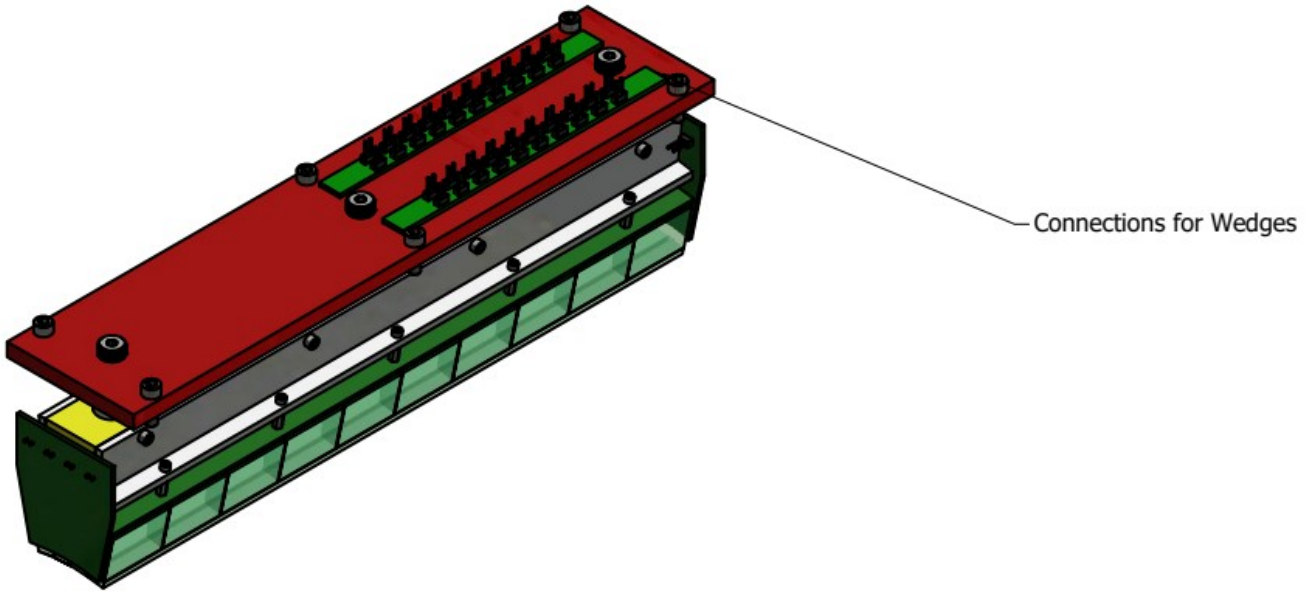
Integration in CLAS12

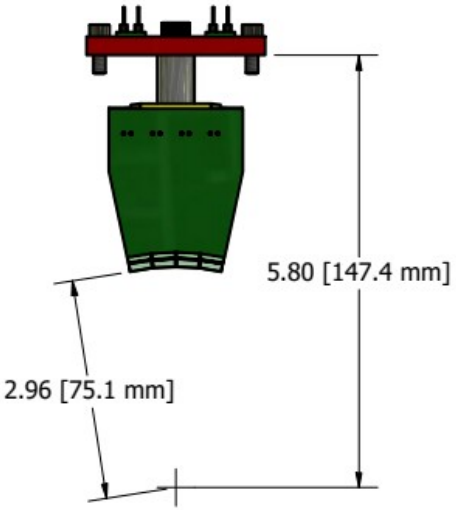


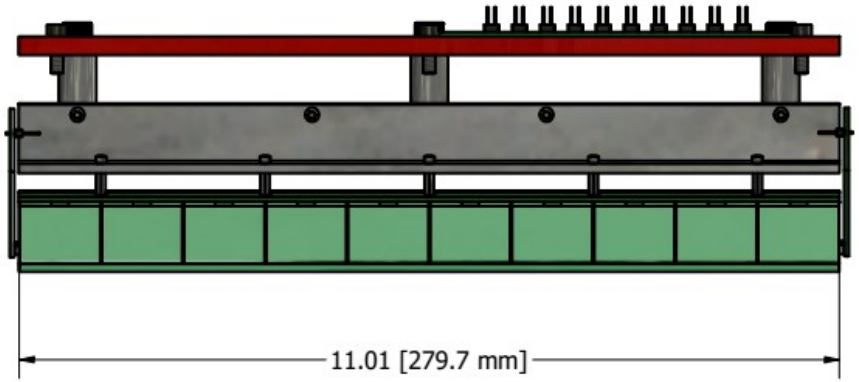
Design of ALERT



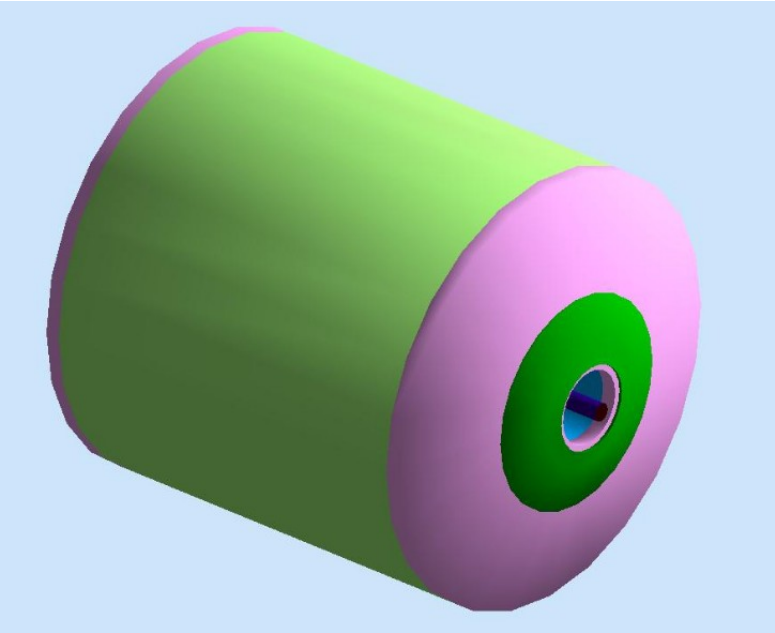
ATOF Module







Simulation



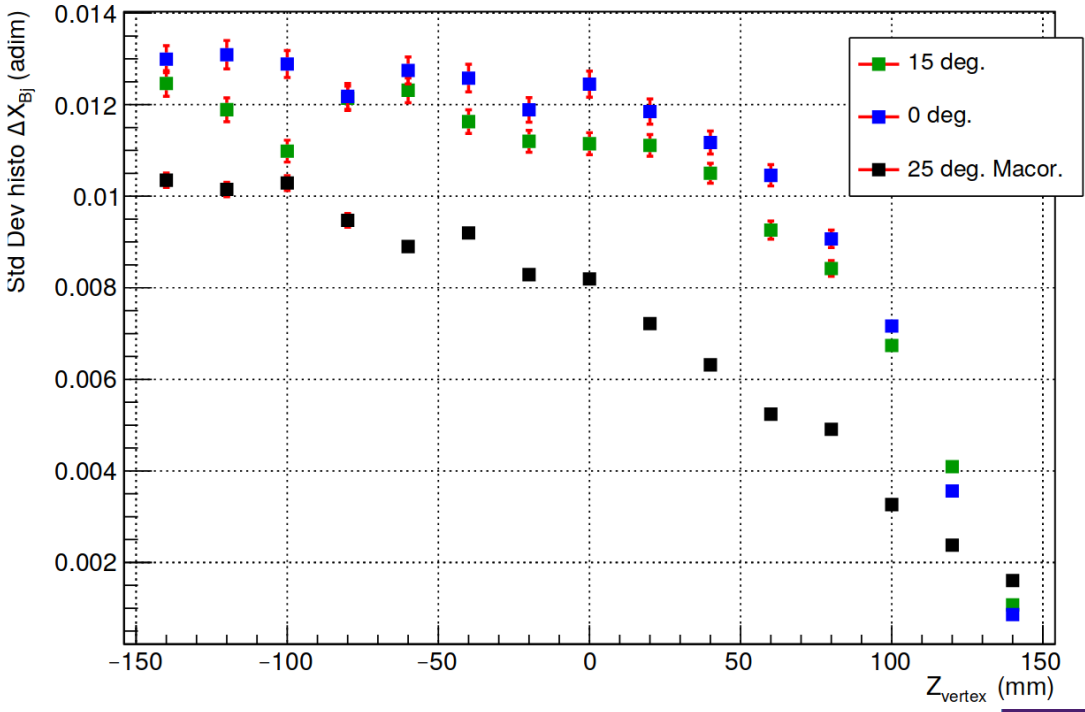
Starting to develop the ALERT software

- Framework in place for reconstruction and calibration

Precise definition of the geometry in progress

Simulation for Design

- Helped to keep a reasonable amount of material and optimize design
- Used GEMC with the data format for Bonus
  - *That was not optimal…*



Summary

Physics case of ALERT is strong

- **Recent publication of 6 GeV results**
  - *Show feasibility and interest of many aspects of our proposals*

ALERT is getting ready

- **Last year has seen much progress**
- **End of design is planned for early 2020**
- **Construction to be finished by end of 2020**

Next steps

- **ERR in a week**
- **Finalize the design, develop the software…**
- **Build the detector!**

Extension of the physics case are being studied

- **Phi-N proposal by Duke group for instance**