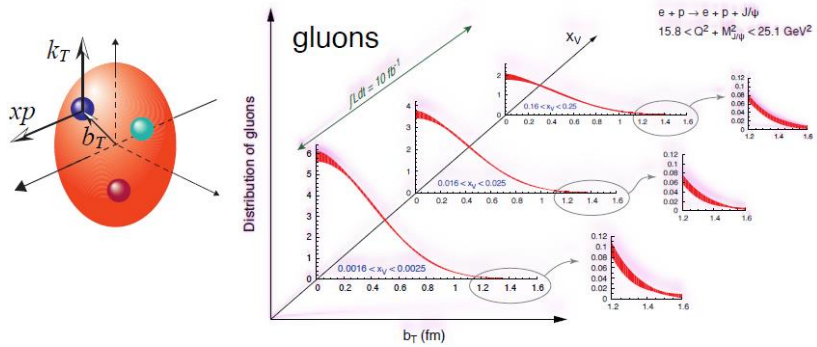
IJCLab, Orsay, CNRS/IN2P3 (France)

Raphaël Dupré, Mostafa Hoballah, Dominique Marchand,
Carlos Muñoz, Silvia Niccolai, Eric Voutier

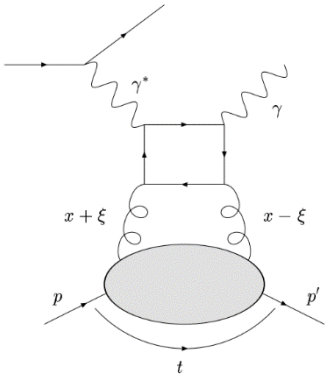
Feb 8 2021

IJCLab EIC group

- Currently: 6 staff members, 5 PhD students, 2 postdocs
- Long experience in the Generalized Parton Distributions (GPD) experimental program at Jefferson Lab



Transverse distribution of gluons through J/Ψ exclusive production



DVCS: e p→ e p γ

- Physics interests: 3D imaging of the nucleon and nuclei through exclusive reactions (eg. DVCS, DVMP)
- Detector interests: Electron-Endcap Electromagnetic Calorimeter and Roman Pots

EMCal recent work and interests

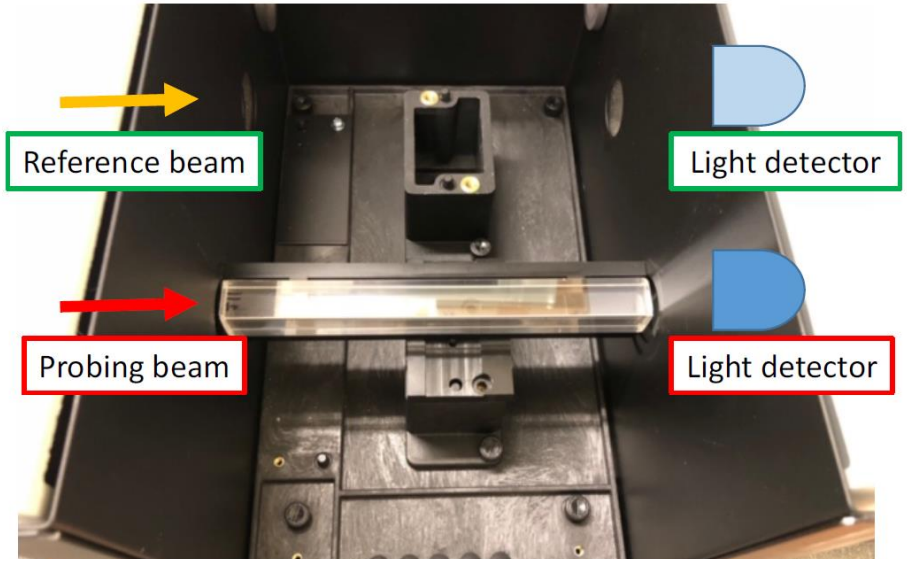
- Joined eRD1 in 2014 and worked on crystal calorimetry developments
- In synergy with ongoing EMCal projects at JLab (NPS in particular)

Main activities:

- PWO crystal characterization from different vendors (SICCAS, CRYTUR)
- Radiation damage recovery (optical bleaching)
- Simulations: energy resolution, electromagnetic backgrounds

Optical transmittance measurements

LAMBDA 850+ UV/Vis Spectrophotometer
with integrating sphere



Transmittance (T) measurement

$$T = \frac{\Phi(z)}{\Phi(0)}$$

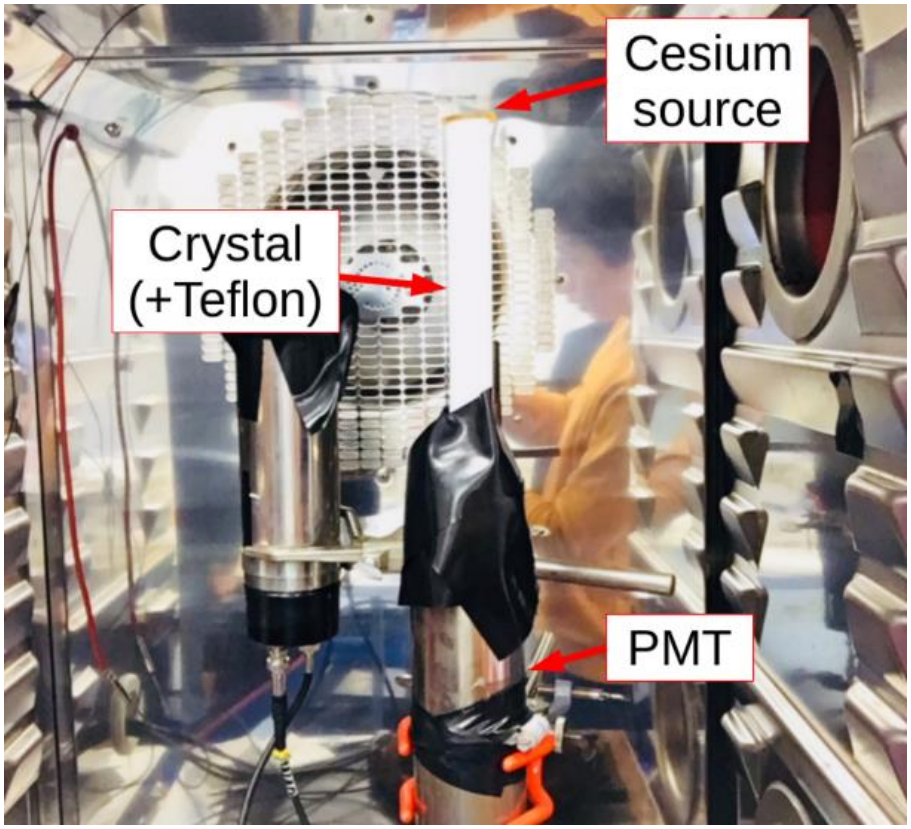
From probing beam

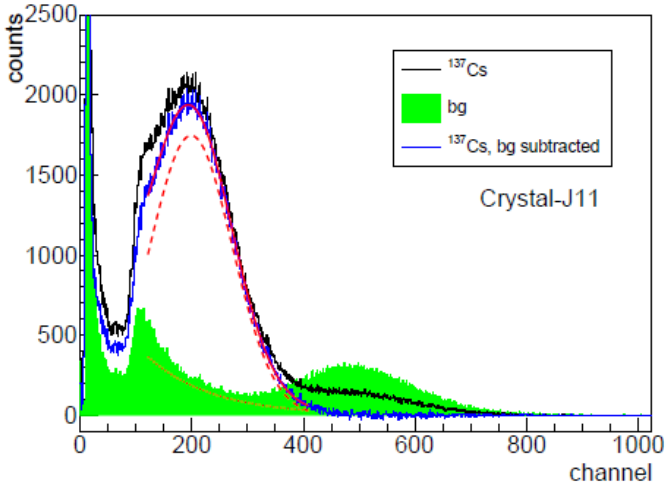
From reference beam

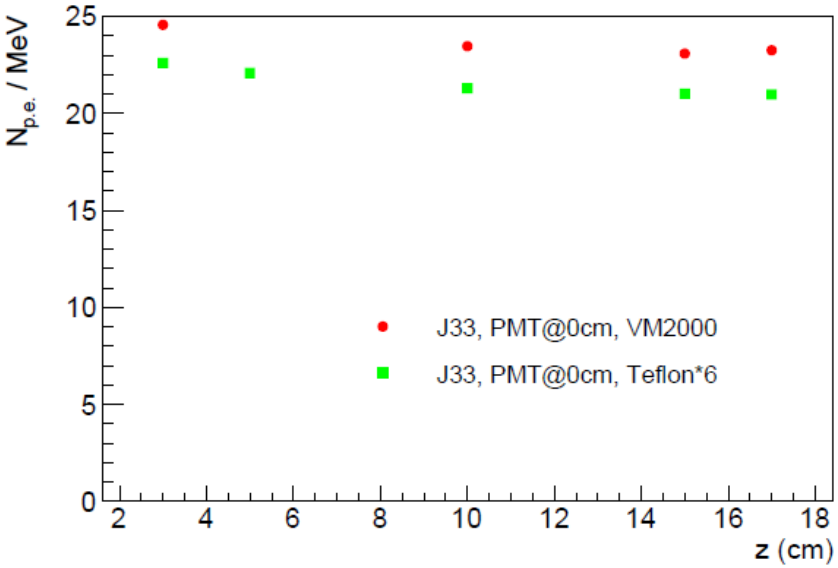
$\Phi(z)$: Radiation flux transmitted by the material during the travel along the probing direction (z)

Light yield measurements

Light yield measurements with a ^{137}Cs source
(in temperature-controlled chamber)

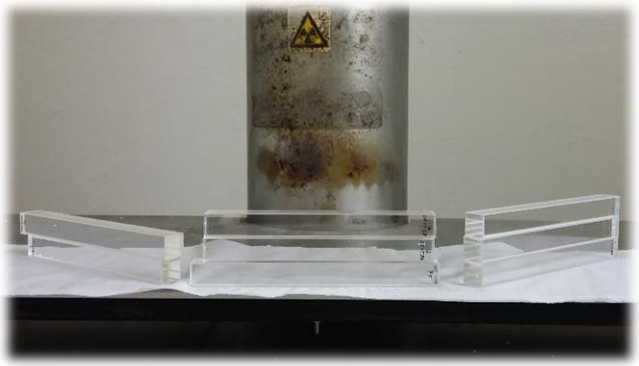




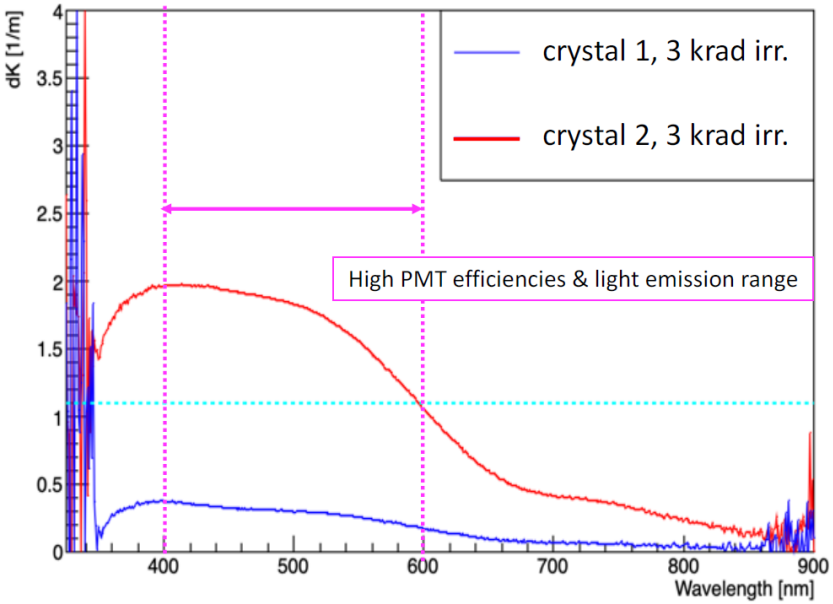


Radiation hardness measurements

Panoramic irradiation facility on Campus

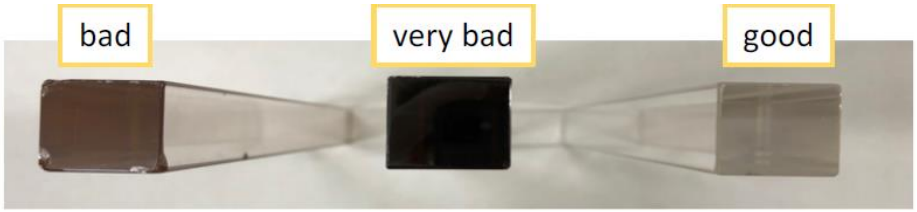


Dose rates:
0.01 to 100 Gy/min



$$dk = ln(T_b/T_a)/l$$

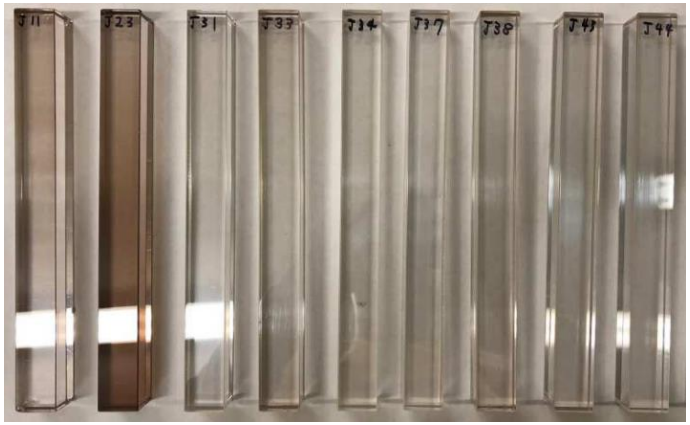
T_b : transmittance measured before the irradiation
T_a : transmittance measured after the irradiation
l : length of the crystal

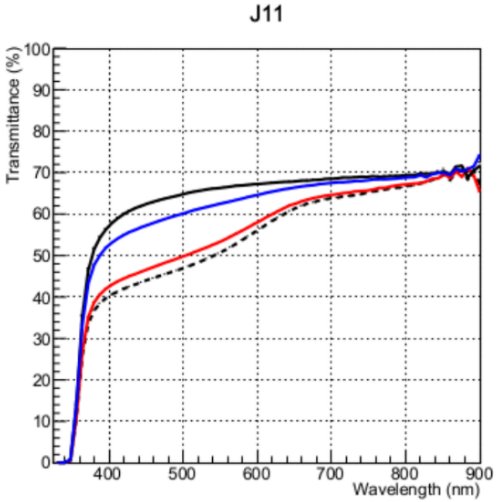


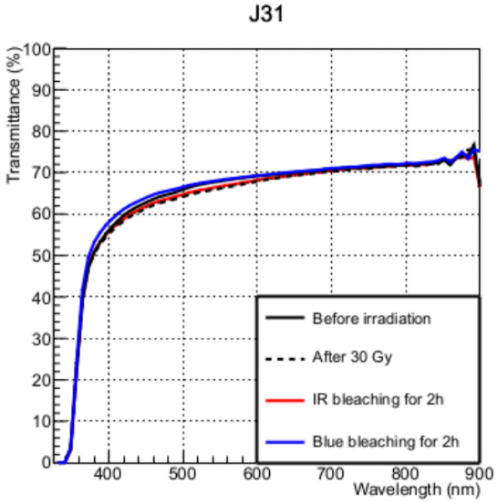
After 500 krad dose

Optical bleaching

- Optical bleaching with blue light validated
- Tests with infrared light also: less efficient







Nucl. Instrum. Meth. A956 (2020) 163375. ArXiv: 1911.11577

Outlook

Characterization of newly produced glass ceramic produced by VSL (CUA)/Scintilex LLC

Initial sample measured at IJCLab

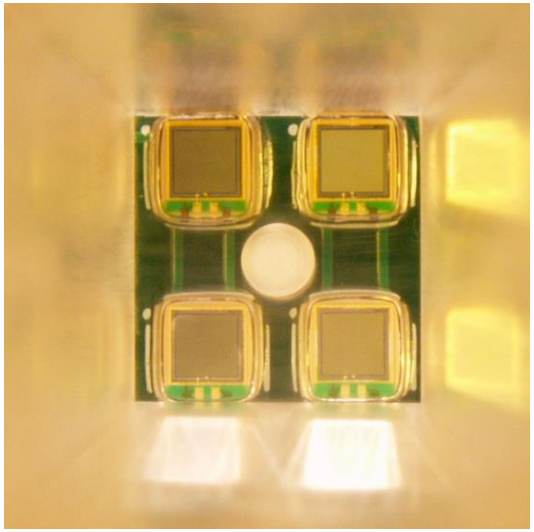
Recent sample
(not yet measured at IJCLab)

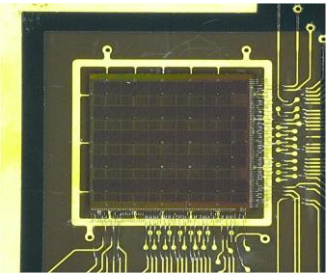
2cm x 2cm x 20cm

Readout

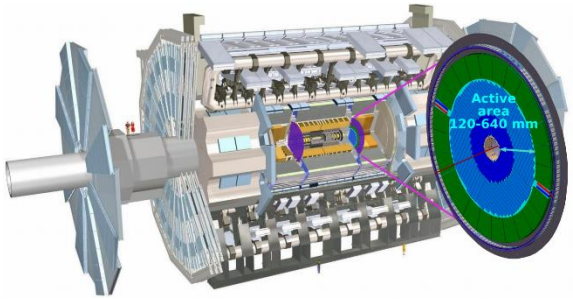
Interest in investigating the combination of PWO and SiPM as a readout

- Electronics department
  can assist in developing the backend and frontend electronics





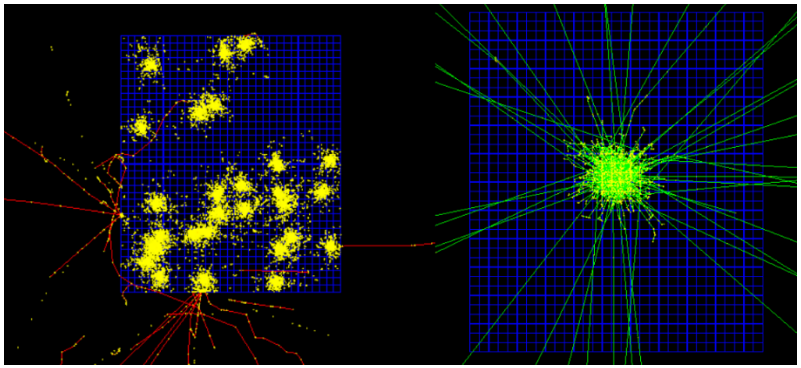
Microscope view of ALTIROC1 chip for the ATLAS HGTD

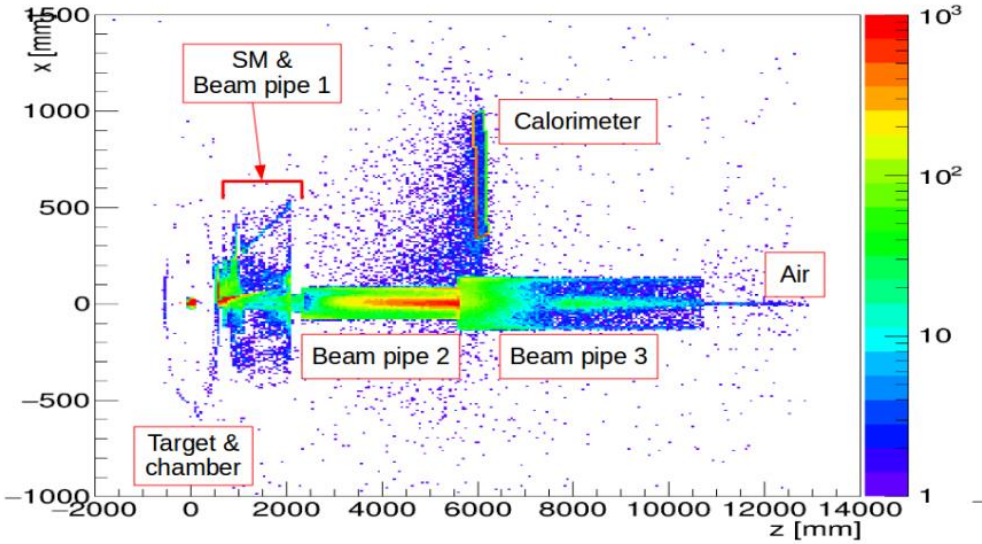


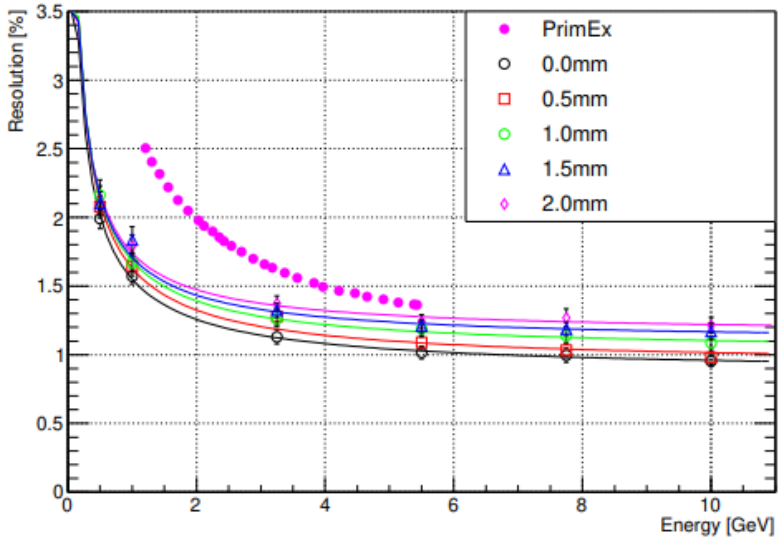
The HGTD will provide time measurements for objects in the forward regions of the ATLAS detector

- Microelectronics department
  (+ collaboration with OMEGA)
  can assist in ASIC development (if needed)

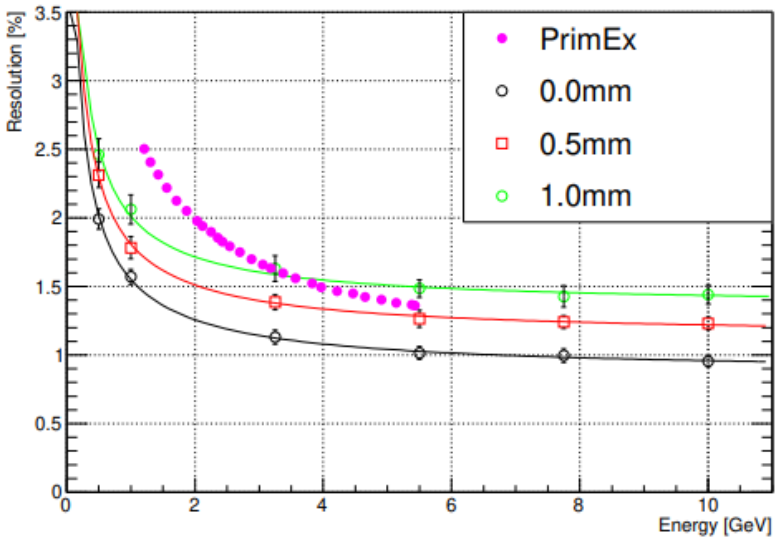
Simulations







Air gap between crystals



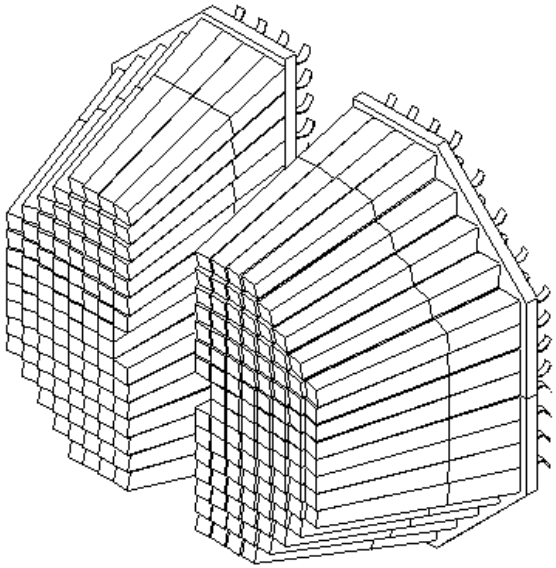
C-fiber between crystals

Design and engineering

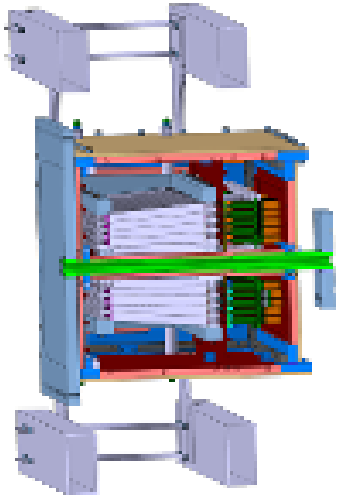
Large experience in ECAL development and construction:

- JLab Hall A calorimeter (PbF_2)
- JLab CLAS inner calorimeter ($PbWO_4$)
- JLab HPS EM calorimeter ($PbWO_4$)
- PANDA EM calorimeter prototypes ($PbWO_4$)
- JLab Hall C NPS calorimeter ($PbWO_4$)

PANDA ECAL prototype



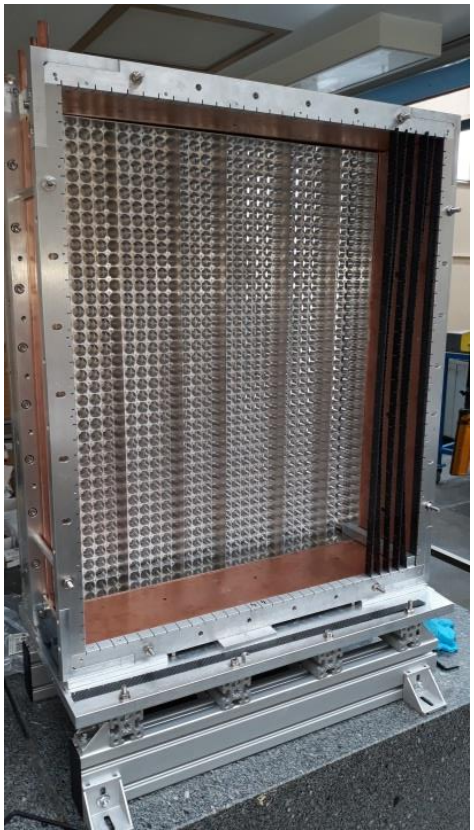
CLAS Inner ECAL



HPS ECAL

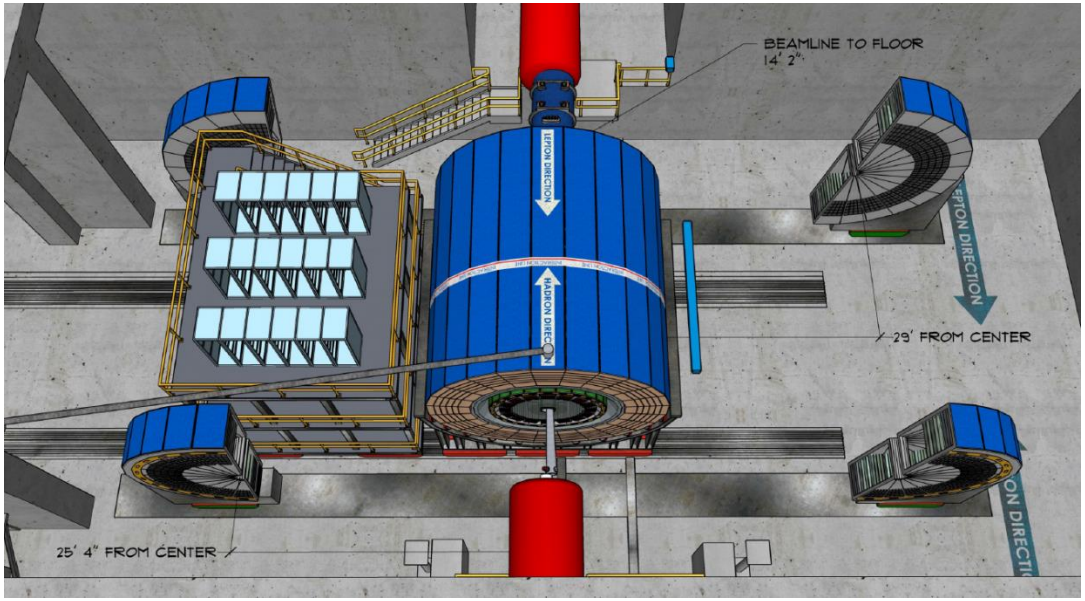
Machine shop

- Team of ~10 technicians
- Prototyping, development and fabrication



Possible contributions

- Mechanical engineering
- Prototype construction
- (Micro-) Electronics development



Outlook

EEEmCal specifications:

- Physics: energy resolution, granularity, radiation hardness…
- Mechanical: volume constraints, interfaces…
- Electronics & readout: dynamic range, noise, dissipation…
- Services: cooling, calibration…
- Other: maintenance requirements…

Back up