

General Updates on Testbeam and Crystal ECAL

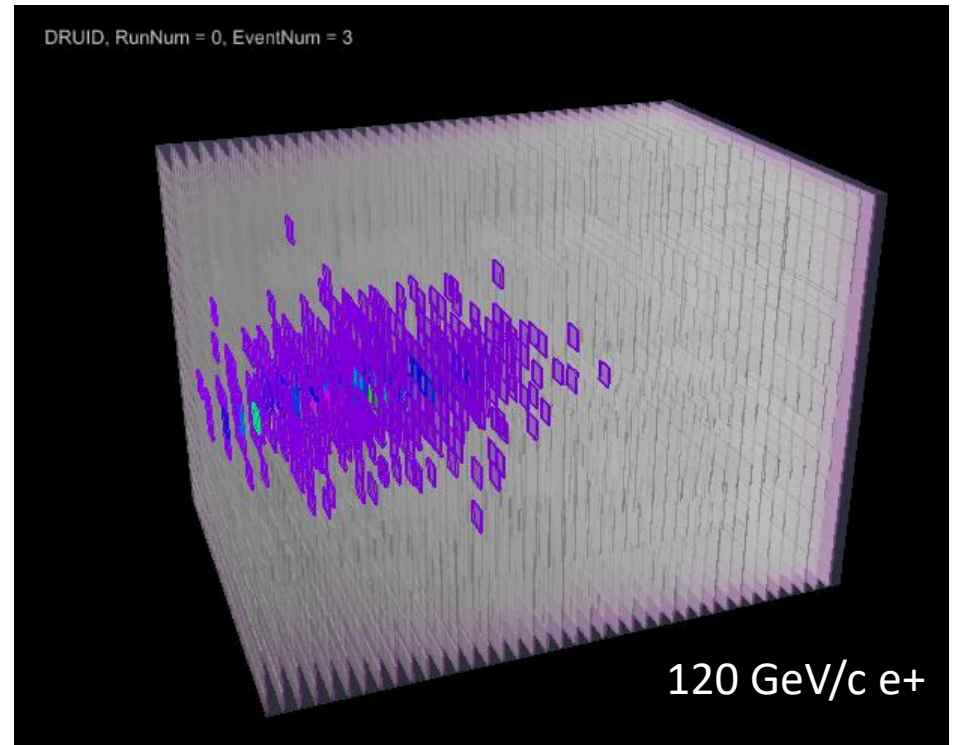
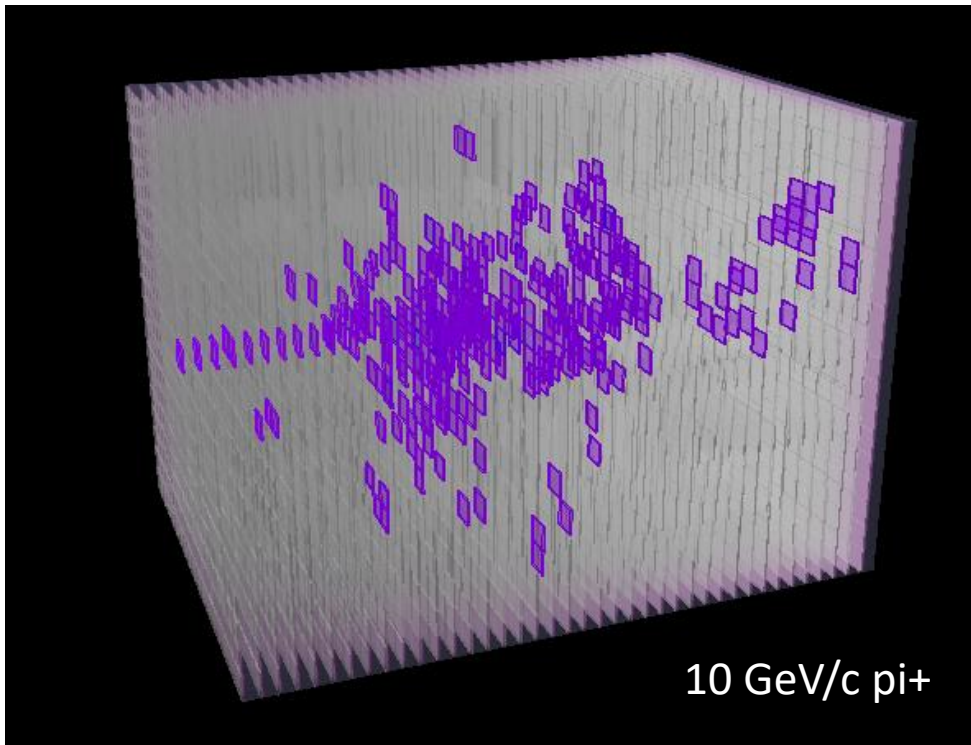
Baohua Qi

February 22, 2023

CEPC Scintillator Calorimeter Meeting

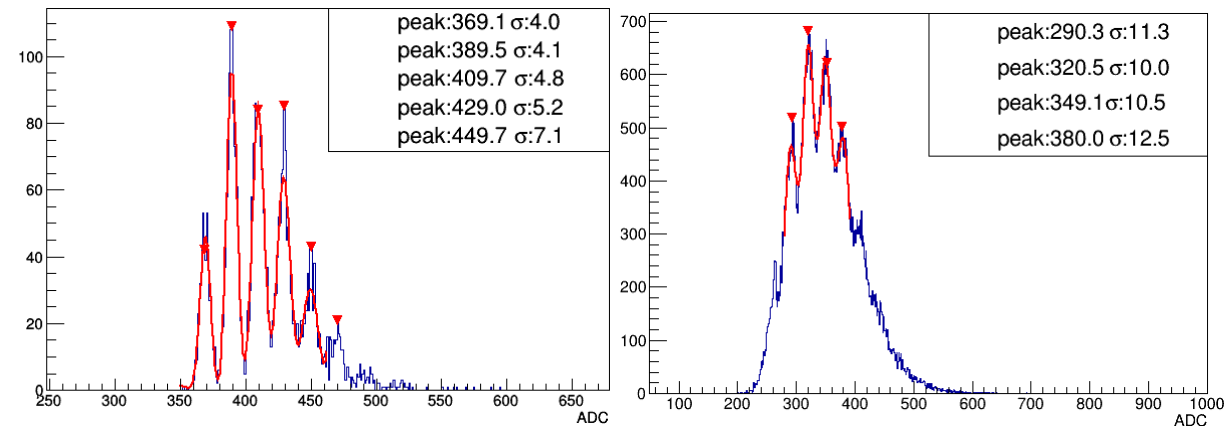
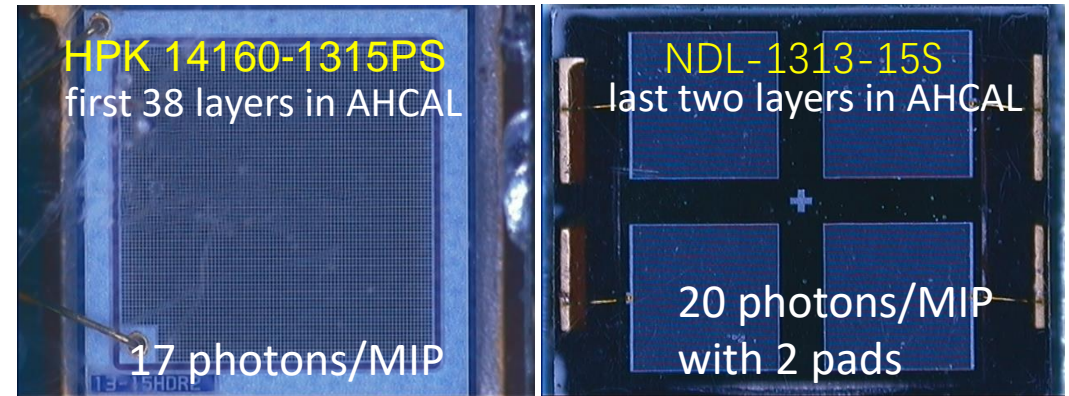
Geant4 simulation for beam test

- Simulation setup: AHCAL alone, Birks effect considered in simulations
- Beam: μ^+ , e^+ , π^+



Testbeam: data simulation and digitization method

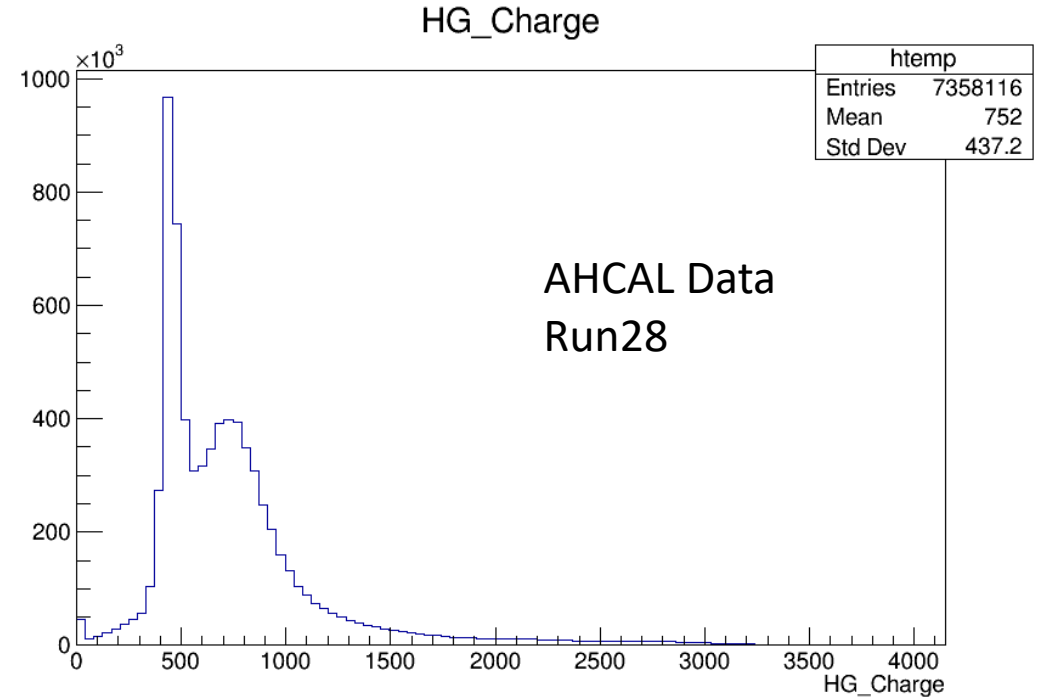
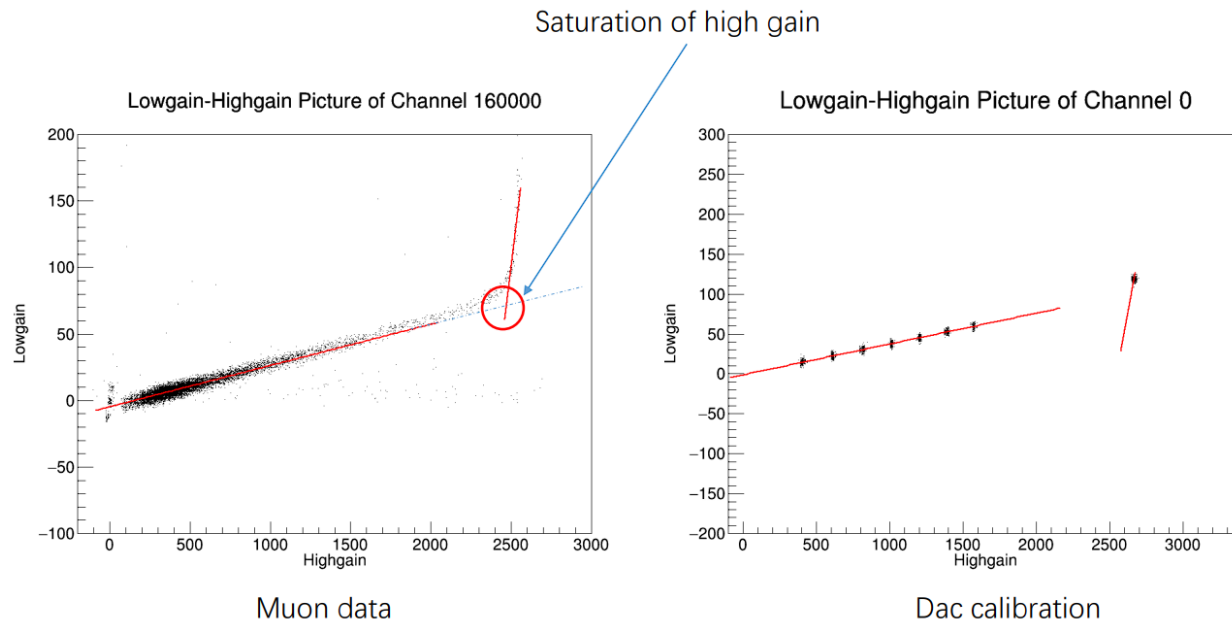
- Simulation: AHCAL alone
 - Birks effect considered in simulations
- Digitization:
 - Photon statistics: Poisson distribution concerning #detected photons (light output)
 - SiPM saturation: $response = \#pixel \times e^{-\frac{photon}{\#pixel}}$
 - SiPM gain uncertainty
 - ADC error: assume 0.02%
 - ADC saturation: based on MIP data
 - Energy cut: 0.3 MIP



<https://indico.cern.ch/event/847884/contributions/4831207/>

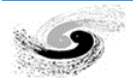
ADC saturation

- Simulation of ADC response
 - Baseline: ~ 400 tics
 - High gain: ~ 250 tics/MIP
 - Low gain: ~ 5 tics/MIP
 - ADC limit: saturated at ~ 2700 tics



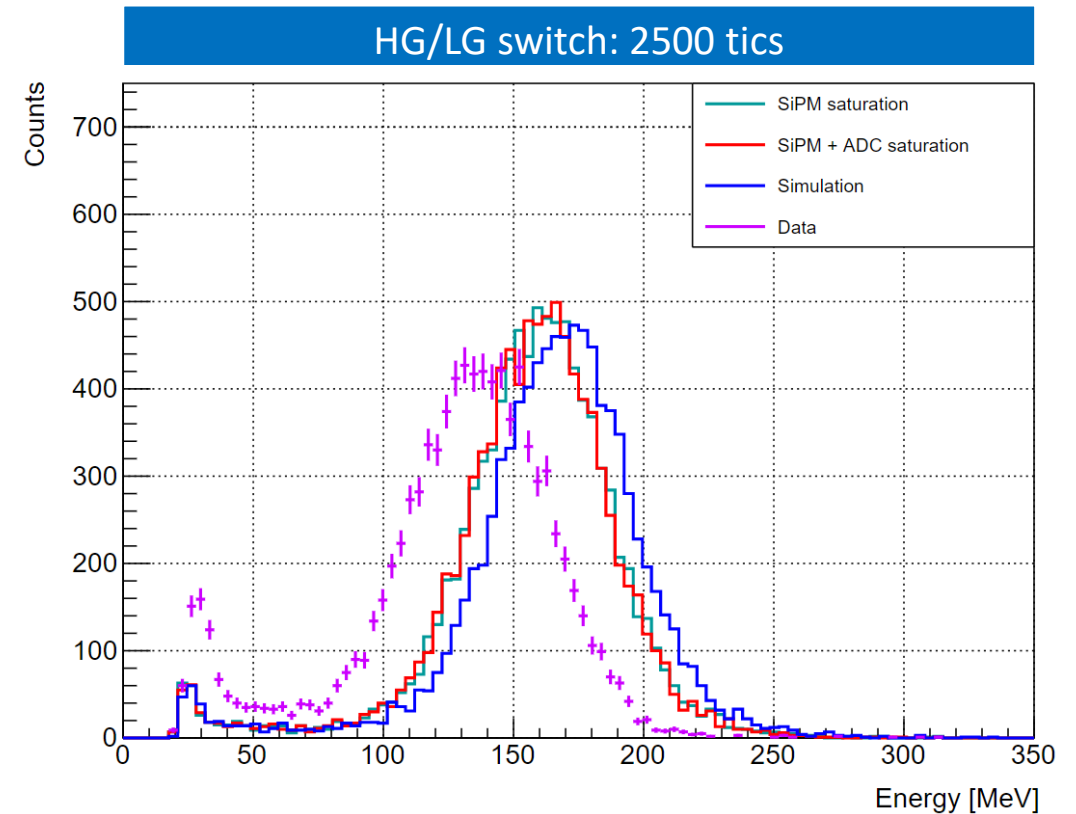
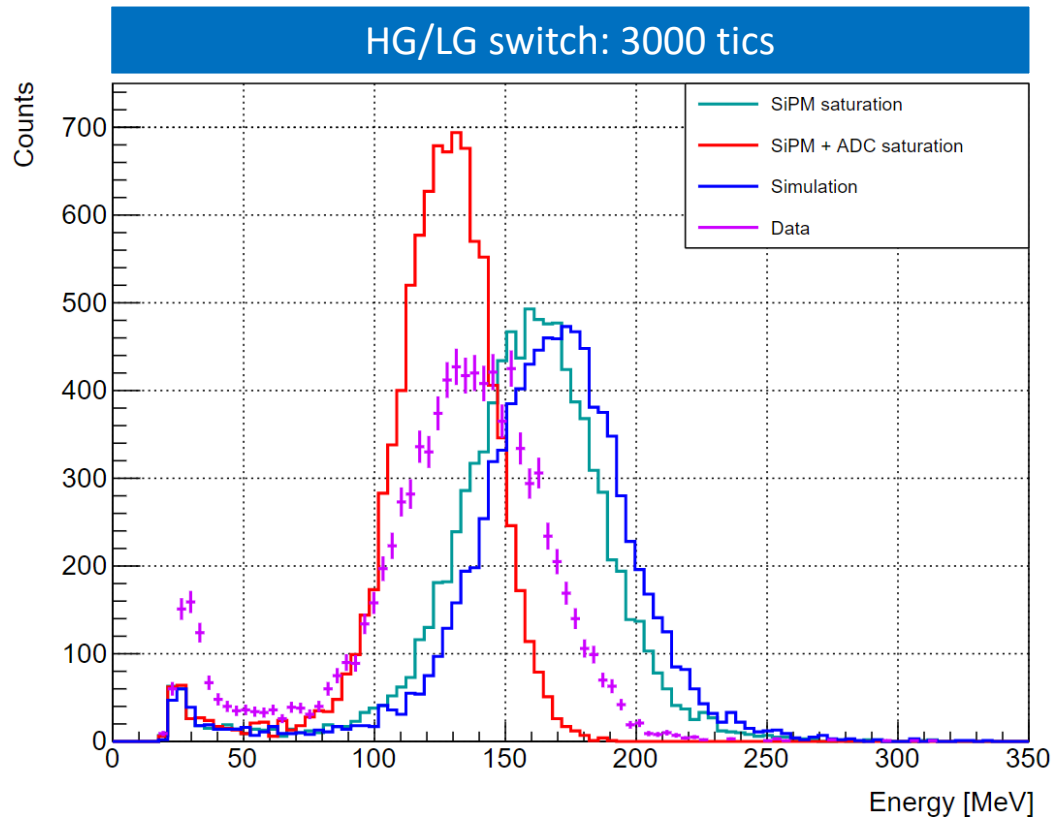
https://indico.ihep.ac.cn/event/18956/contributions/128809/attachments/66894/79174/AHCAL_Data_Calibration.pdf

https://indico.ihep.ac.cn/event/18956/contributions/128813/attachments/66892/79181/Update_MIP_Uniformity.pdf



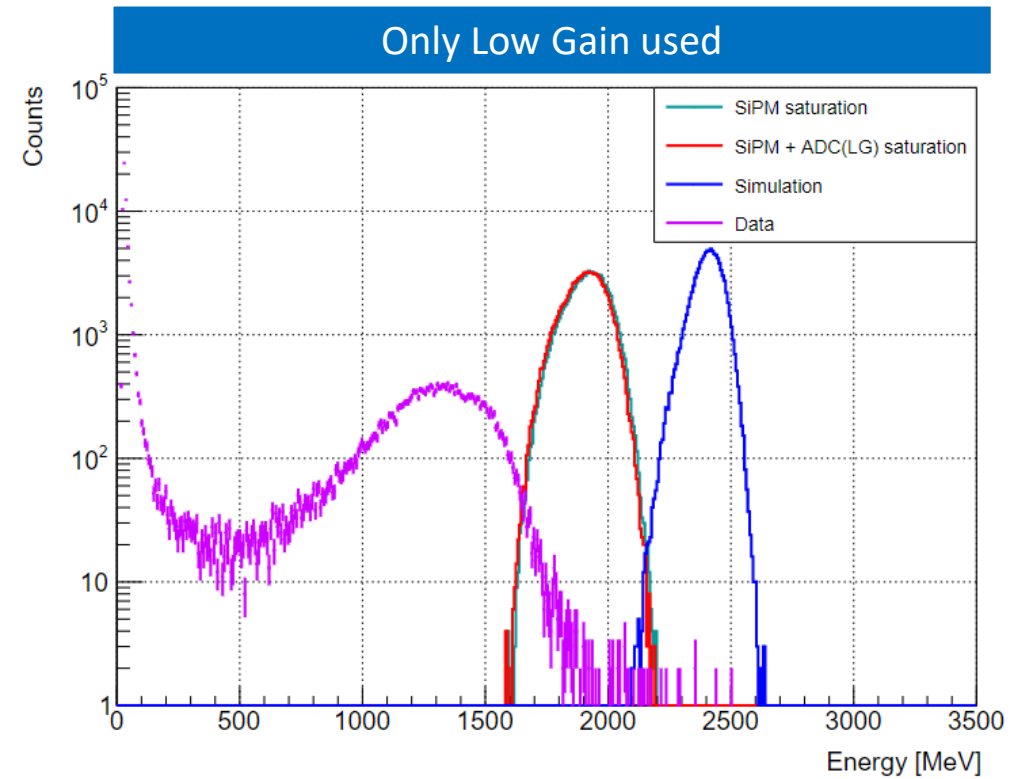
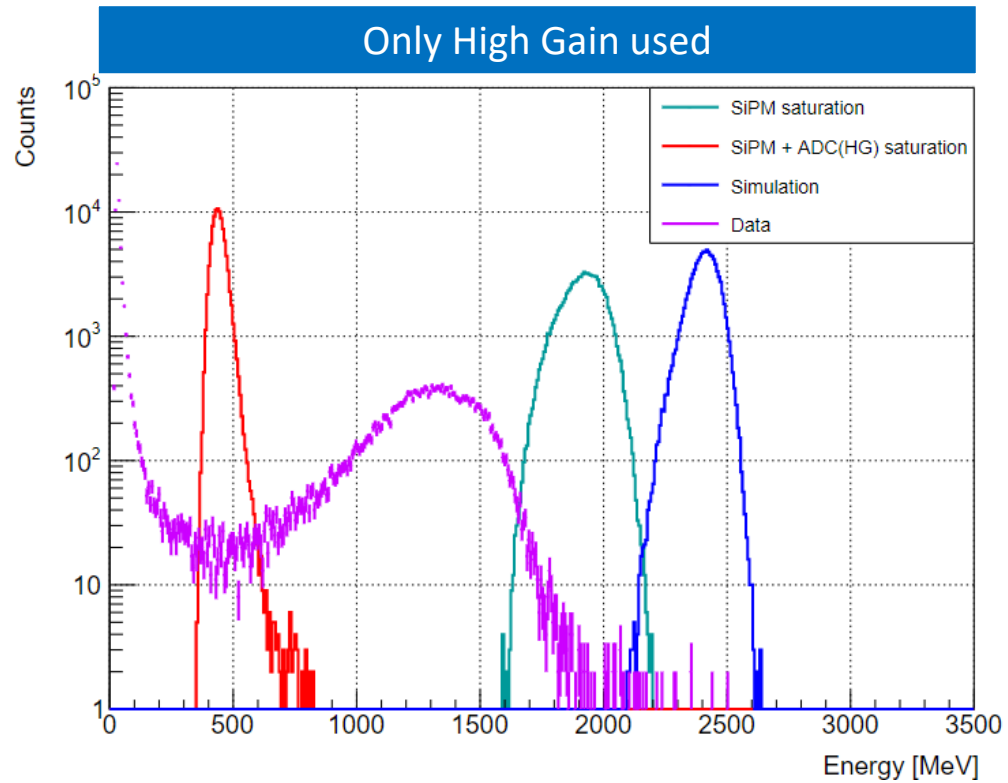
10 GeV pi+ events

- Preliminary analysis: AHCAL alone, **redline: digitization**, **violet line: data**
- High gain/Low gain switch in data: 3000 tics (from Yukun)
- Since high gain ADC will be saturated at ~ 2700 tics, the low gain information seems unused



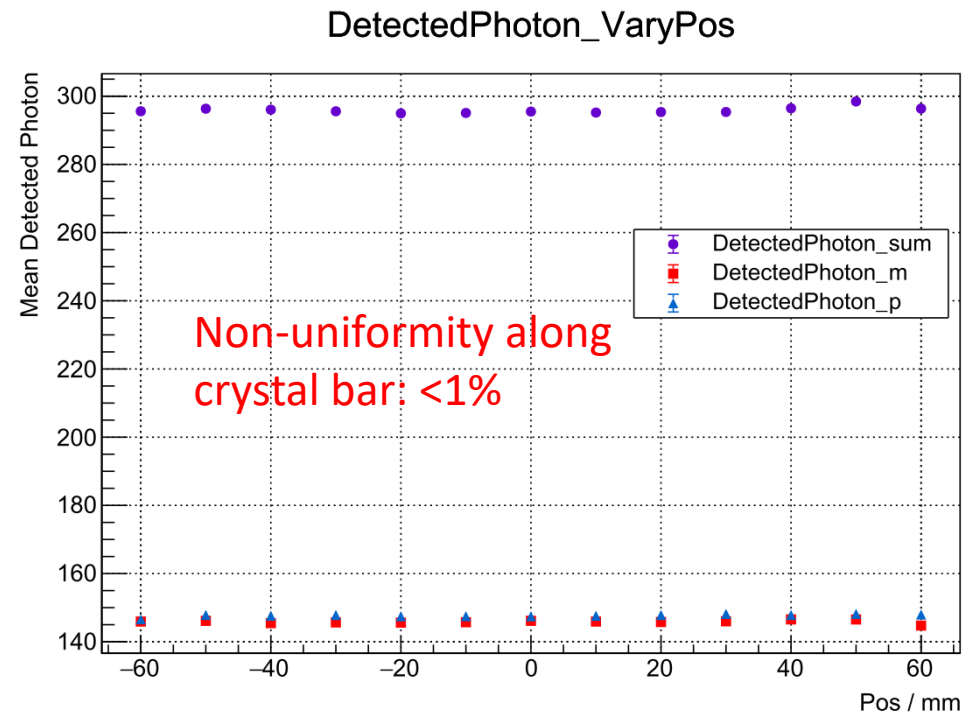
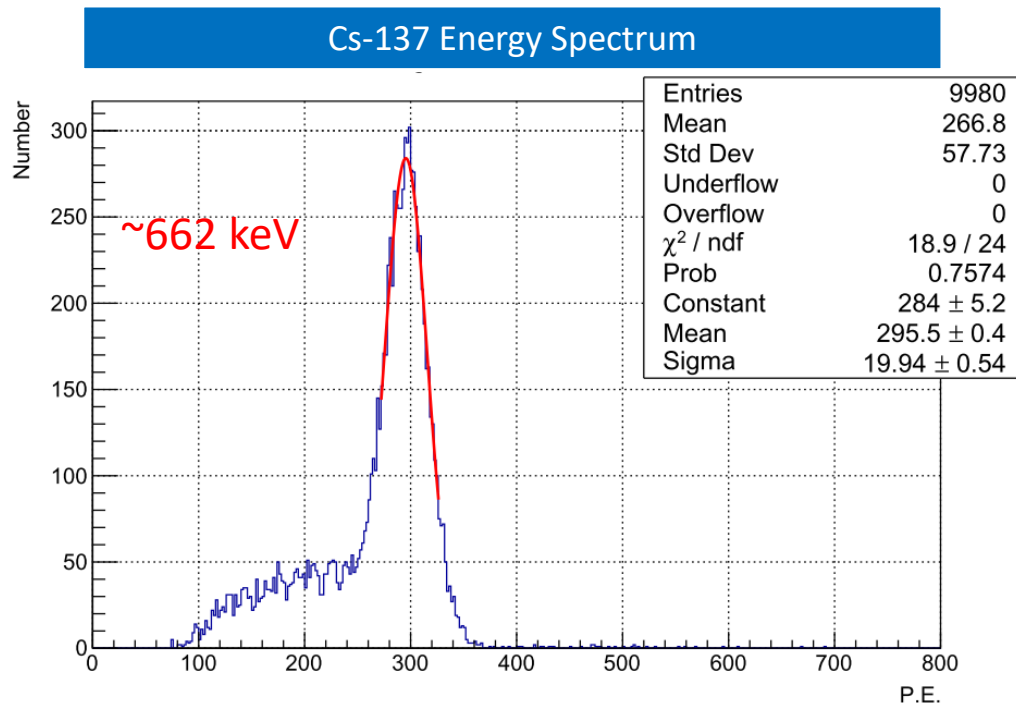
120 GeV e+ events

- Preliminary analysis: AHCAL alone, **redline: digitization**, **violet line: data**
- Almost no 120 GeV e+



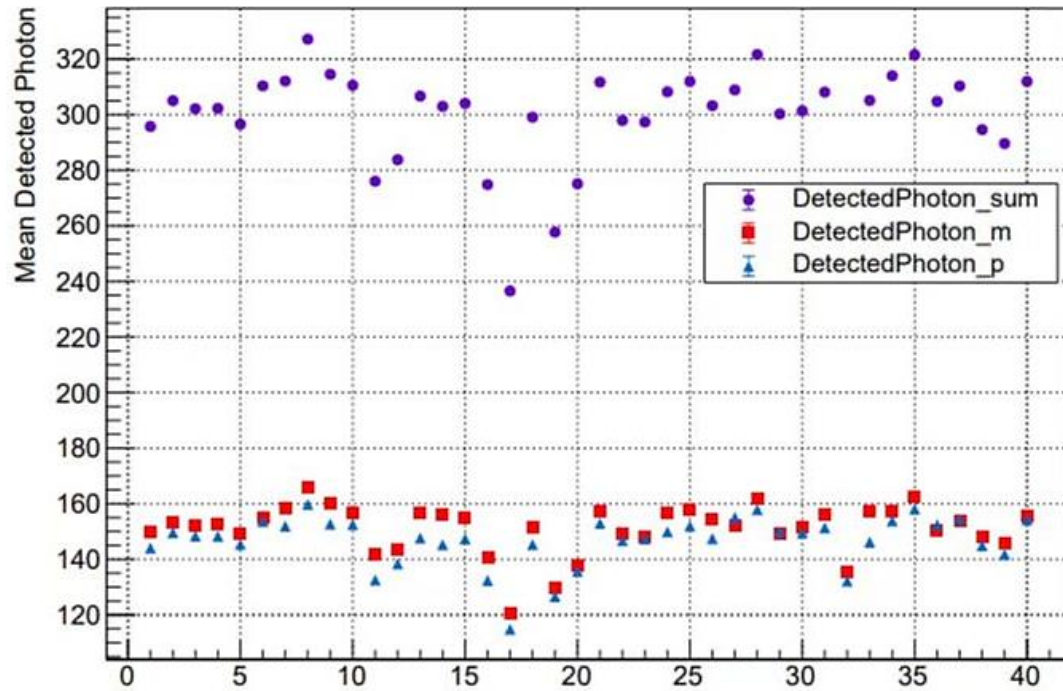
Tests on SIC crystals

- SIC BGO crystal: $12 \times 2 \times 2 \text{ cm}^3$
 - Cs-137 scan: uniformity
 - Energy spectrum



Tests on SIC crystals

- Batch test of 40 crystal bars
 - Response uniformity among crystals



- Retest of #11 #16 #17 #19 #20: similar results

