



Energy Calibration of the PANDA Electromagnetic Calorimeter Investigation for the Backward and Forward End-cap

Hang Qi

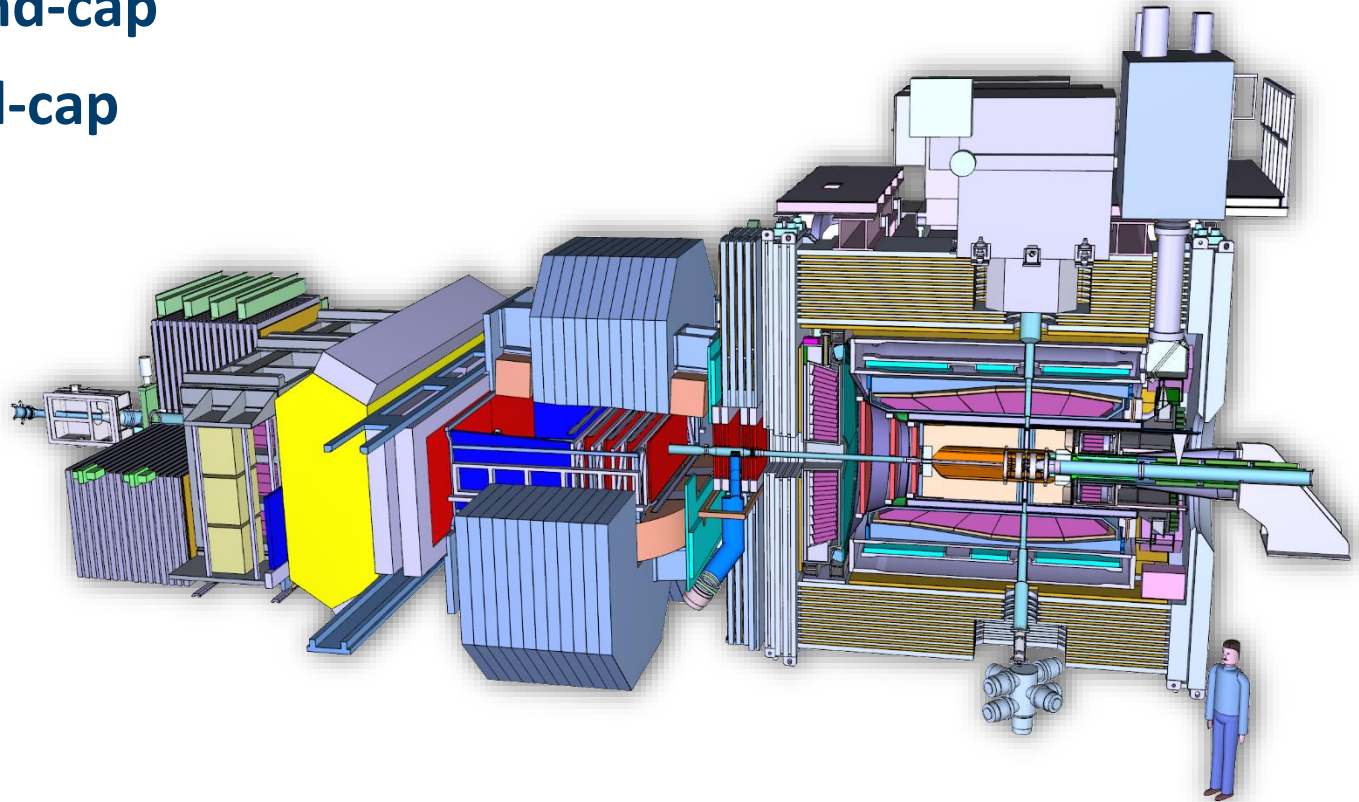
On behalf of IHEP/USTC group

EMC Meeting

March, 2022

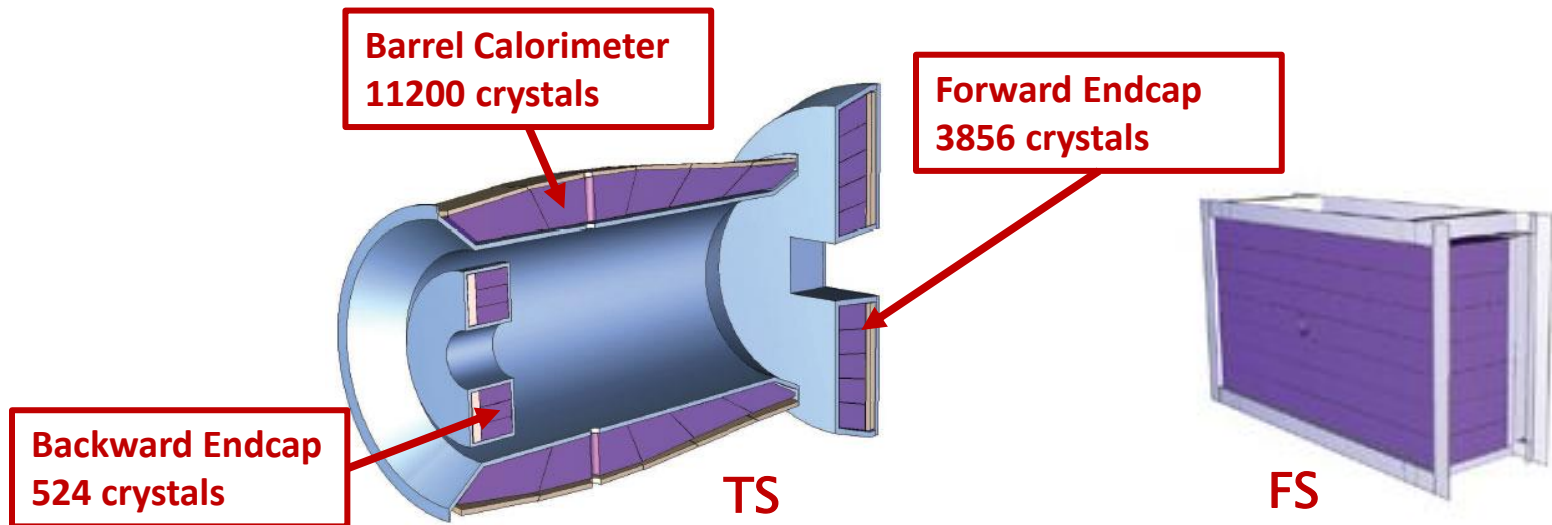
Outline

- PANDA EMC
- Energy Calibration
- Backward End-cap
- Forward End-cap
- Summary



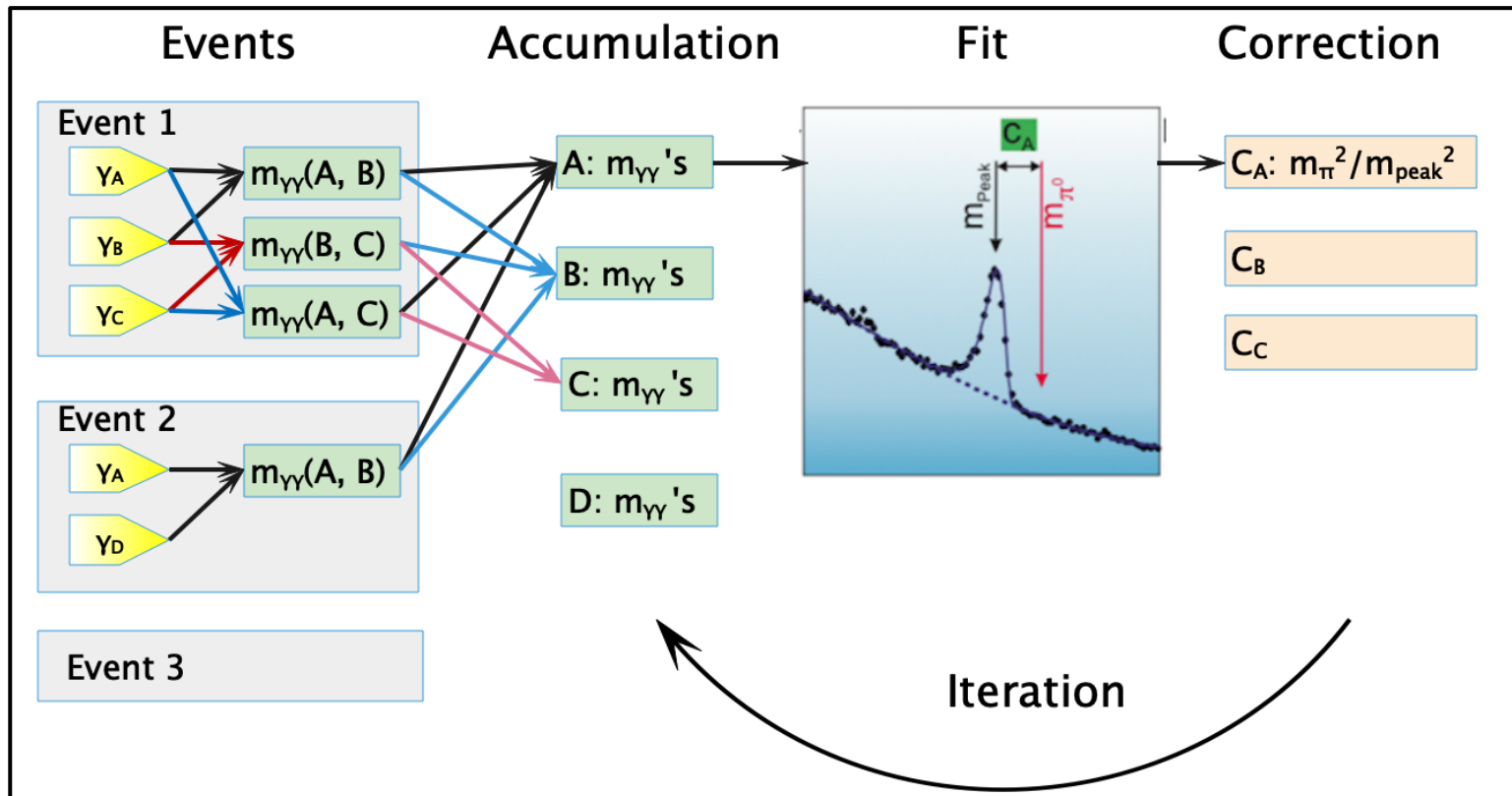
PANDA EMC

- Energy measurement
- Position measurement
- Separation of γ/e and hadrons



Energy Calibration

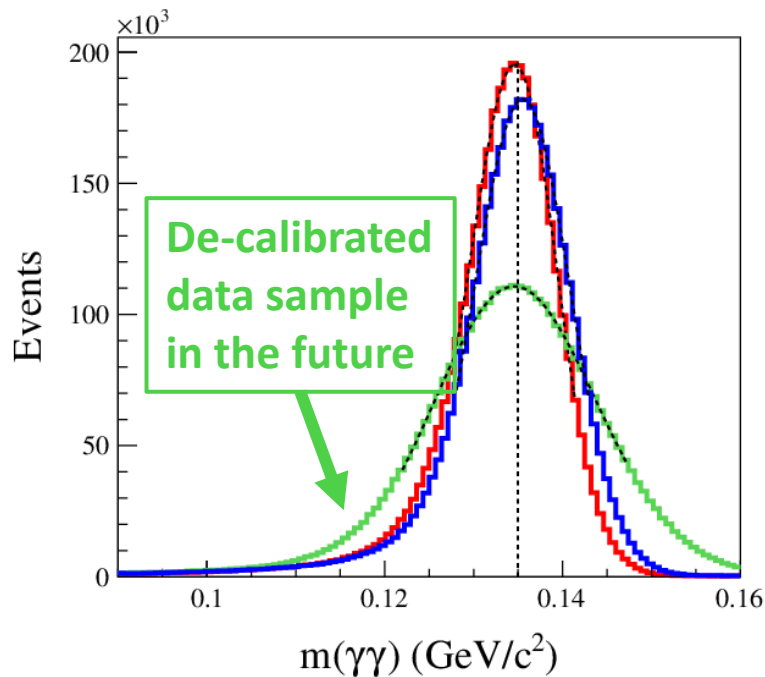
- Monte Carlo simulated sample of $\pi^0 \rightarrow \gamma\gamma$



Energy Calibration

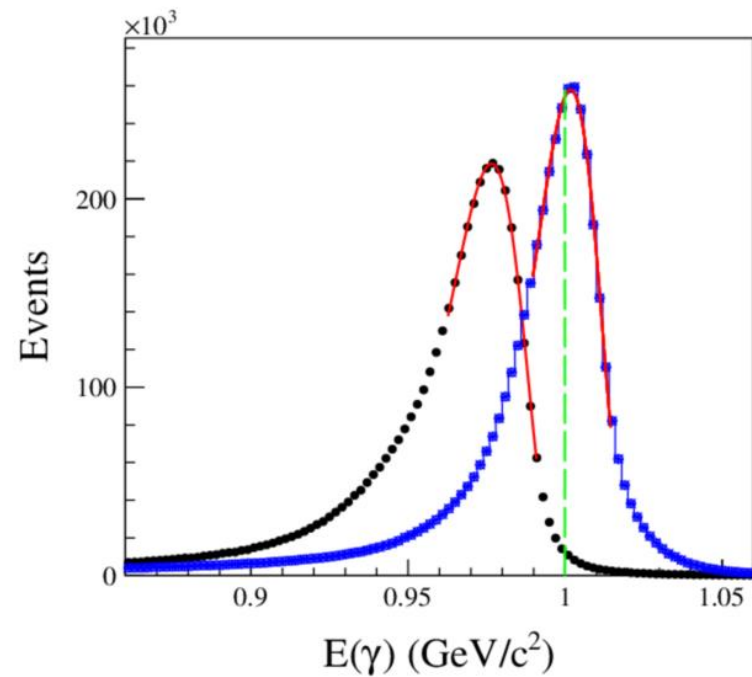
$$\pi^0 \rightarrow \gamma\gamma$$

- Smearred raw data: $m = 0.13457, \sigma = 0.009$
- Calibrated data: $m = 0.13459, \sigma = 0.005$
- Raw data: $m = 0.13551, \sigma = 0.005$



Single γ

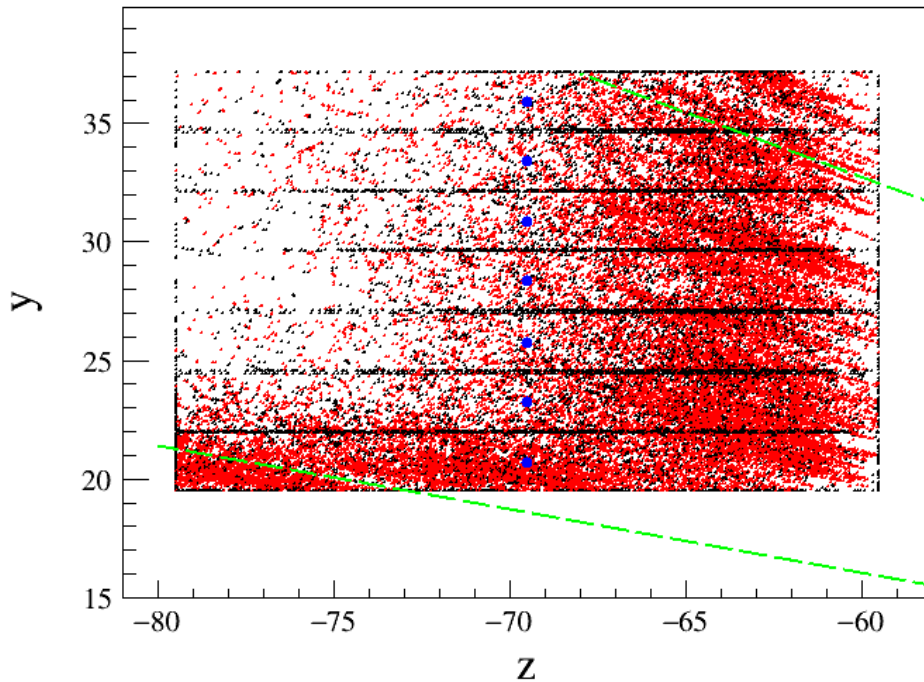
- (out) raw (MPV = 0.977, $\sigma = 0.013$)
- (out) raw $\times C$ (MPV = 1.002, $\sigma = 0.011$)
- (in) raw $\times C$ (MPV = 1.002, $\sigma = 0.011$)
- (in) raw $\times \Sigma C_i$ (MPV = 1.002, $\sigma = 0.011$)



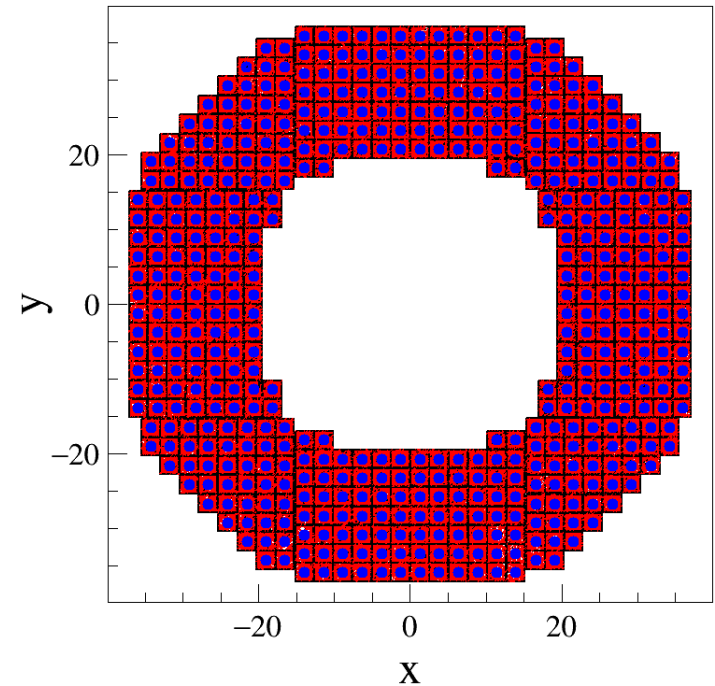
Backward End-cap

Backward End-cap

z-y frame



x-y frame

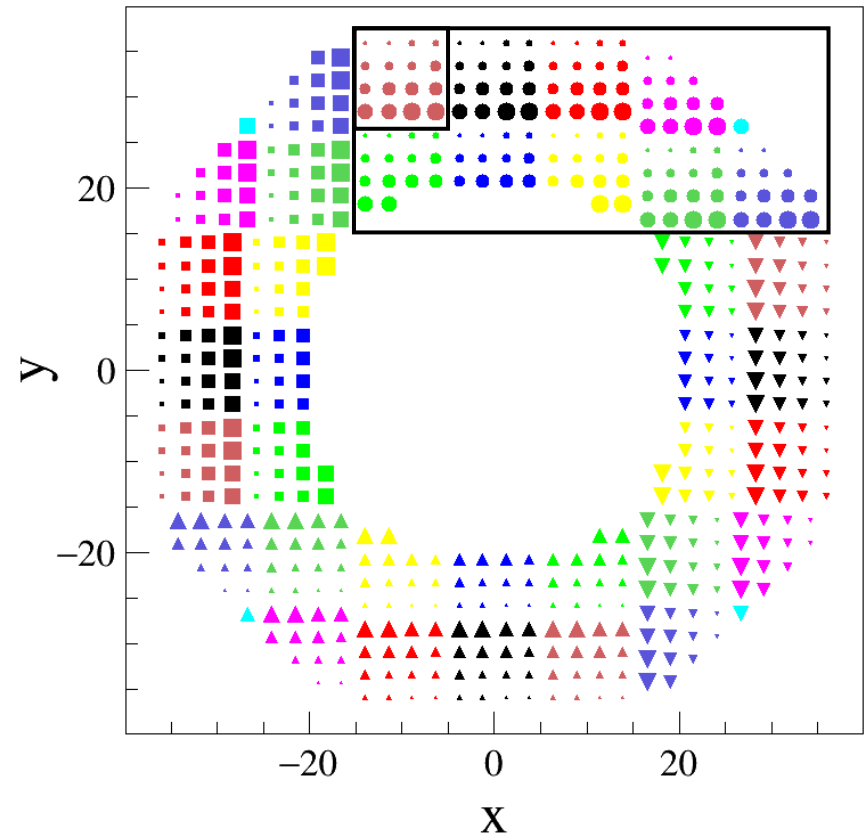


- $\theta: 150^\circ - 165^\circ$
- Crystals are horizontal instead of pointing to the IP

Backward End-cap

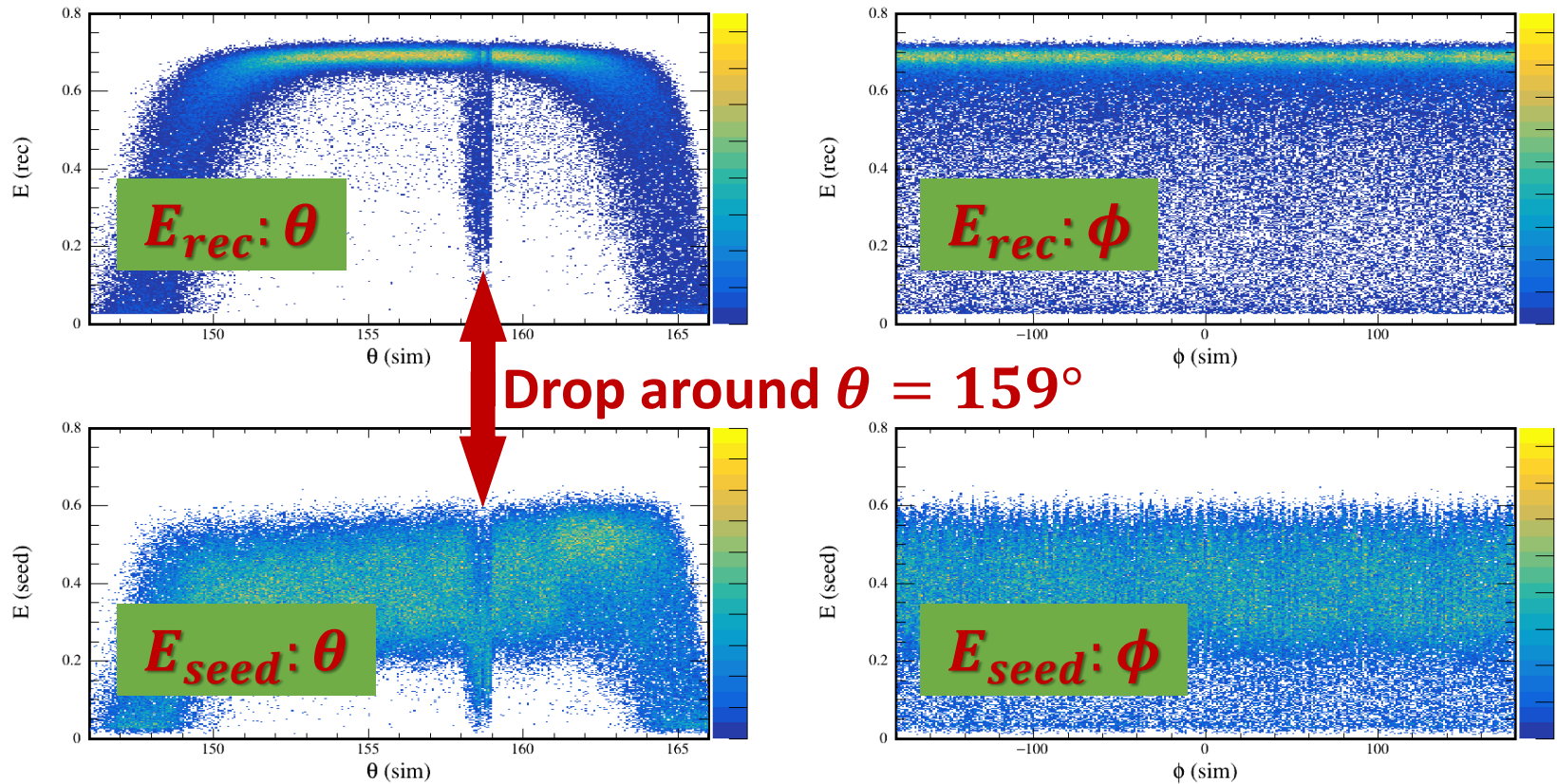
How to number the crystals:

- 4 super modules (marker style)
- 10 modules (marker color)
- 16 crystals (marker size)
- Total: $4 \times 131 = 524$



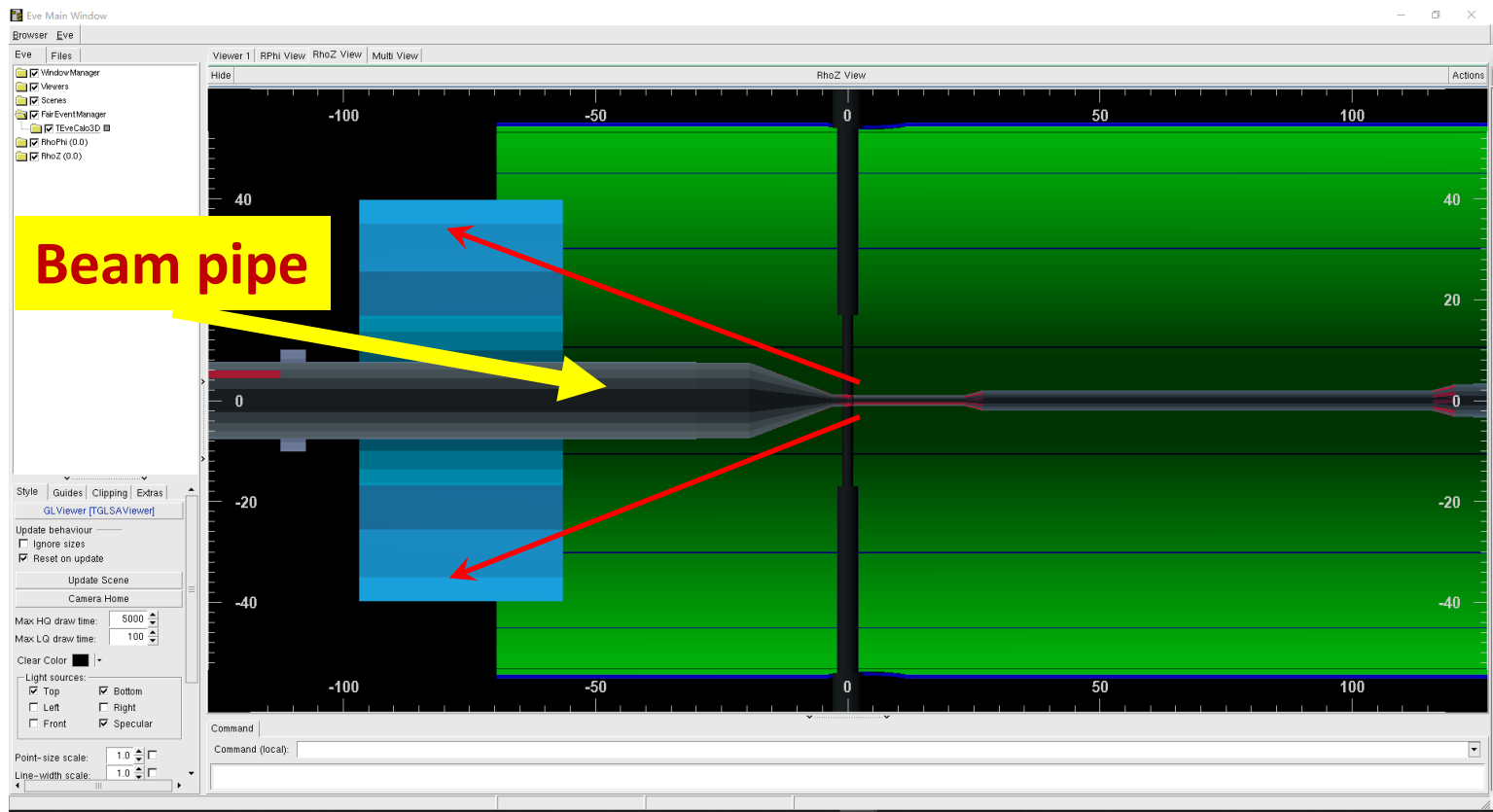
Backward End-cap

γ simulation with only the EMC



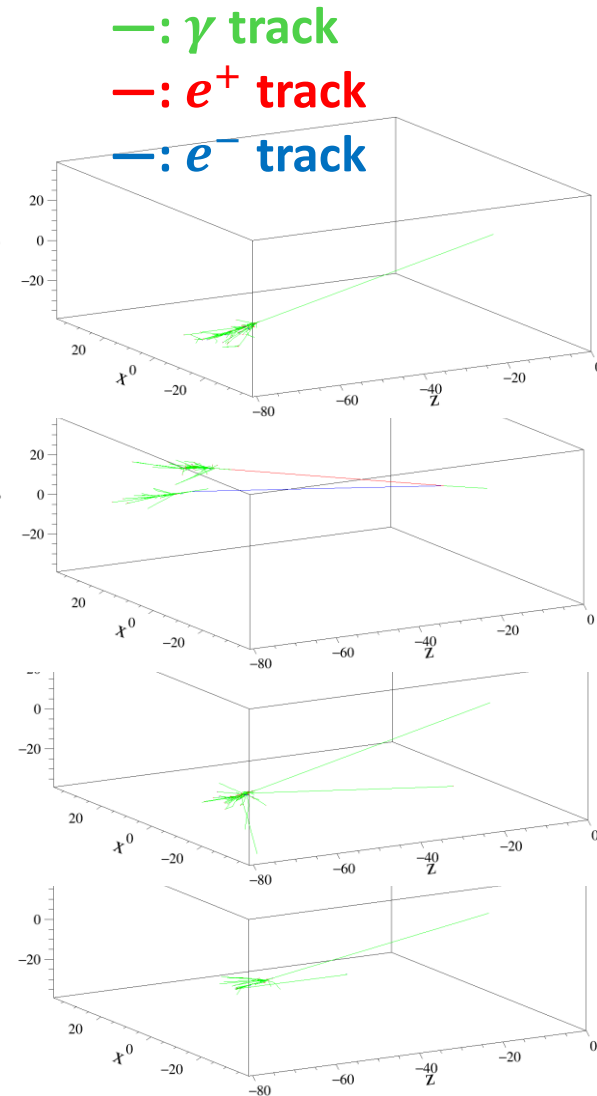
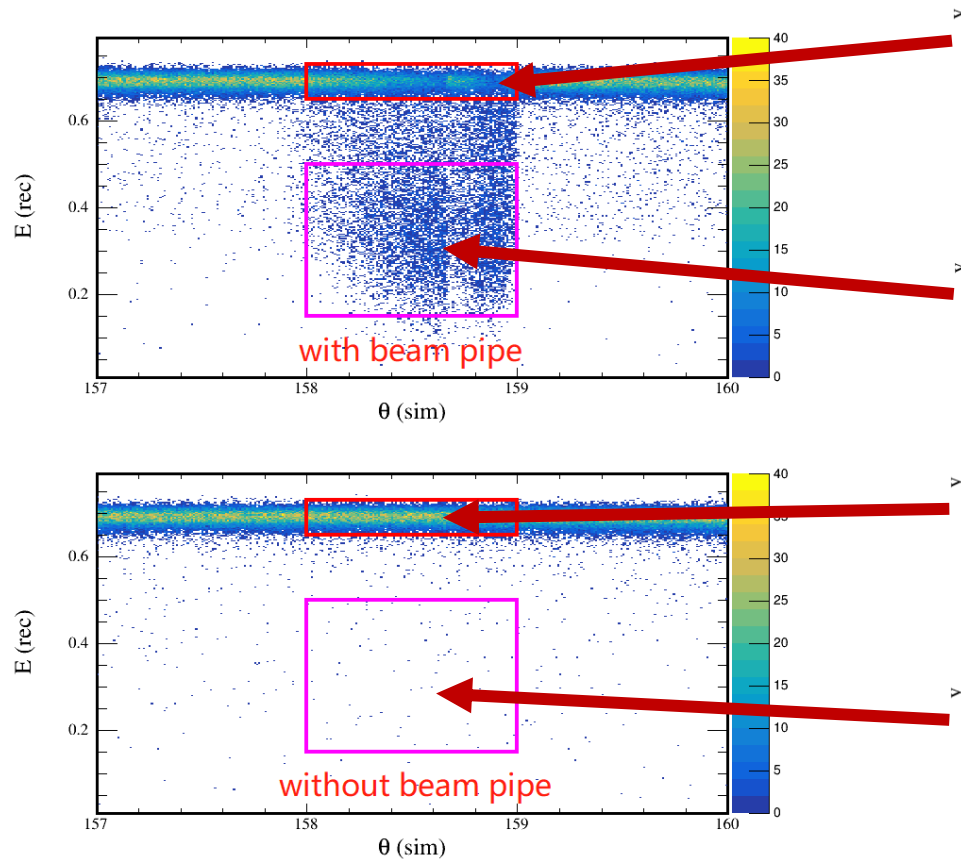
Backward End-cap

Simulation geometry

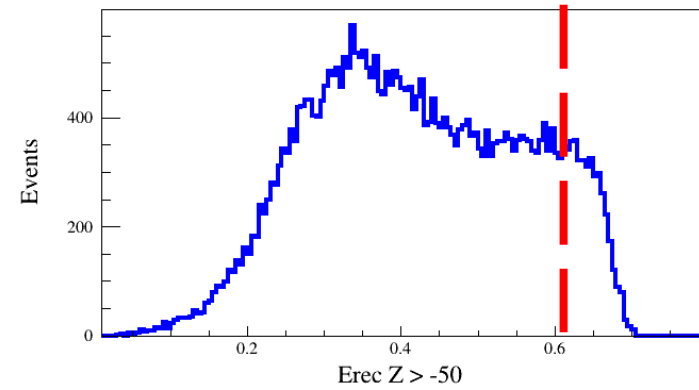
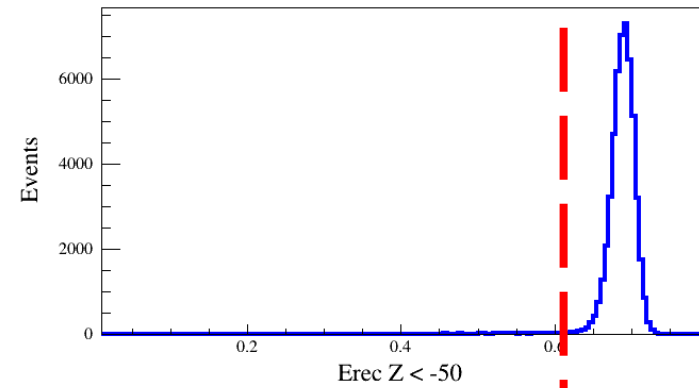
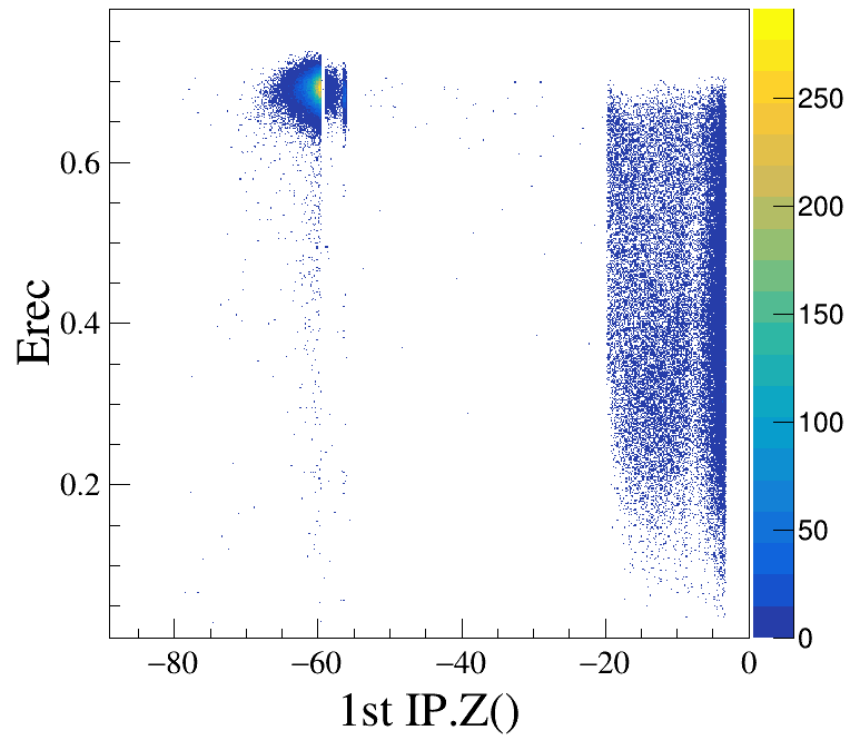


Backward End-cap

Simulation with/without beam pipe

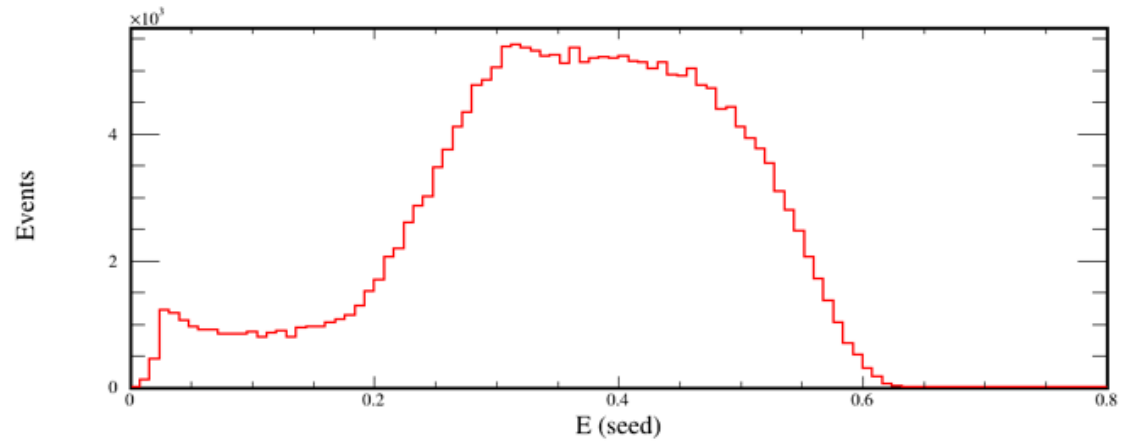


Backward End-cap

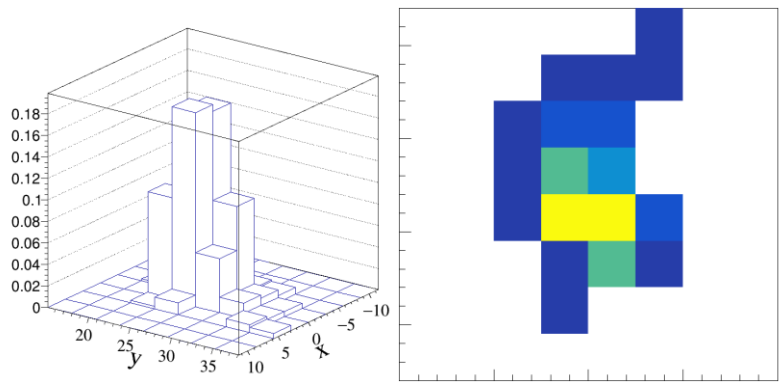


Backward End-cap

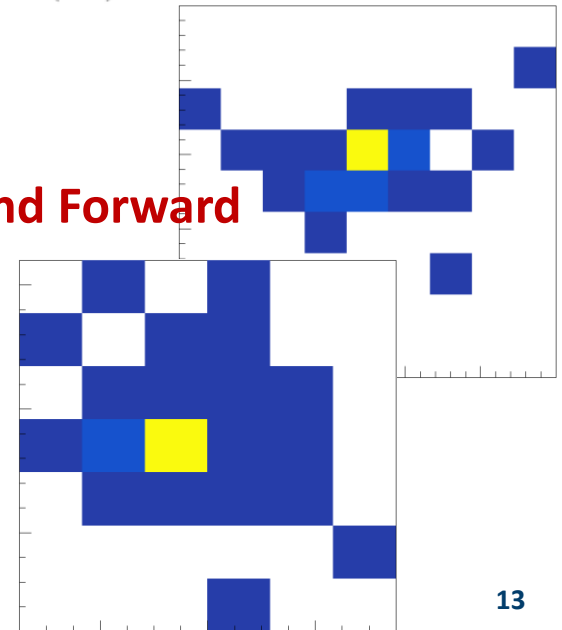
The energy of seed crystal



A shower in backward end-cap

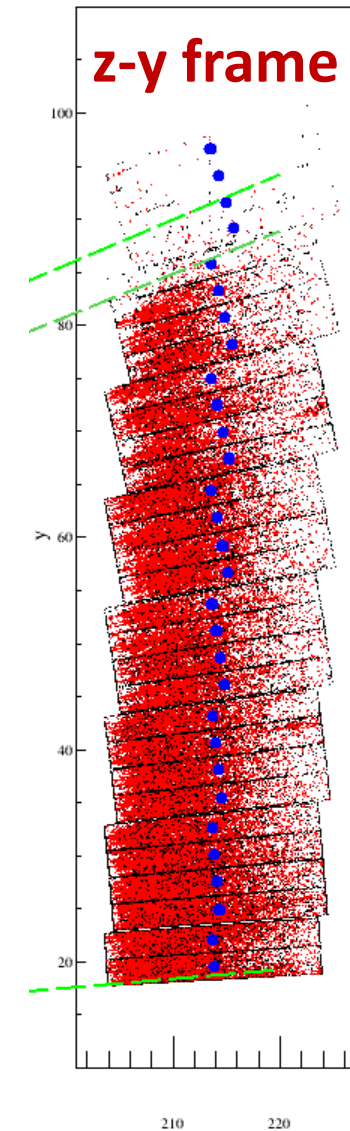
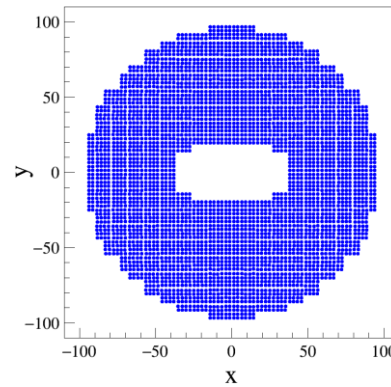
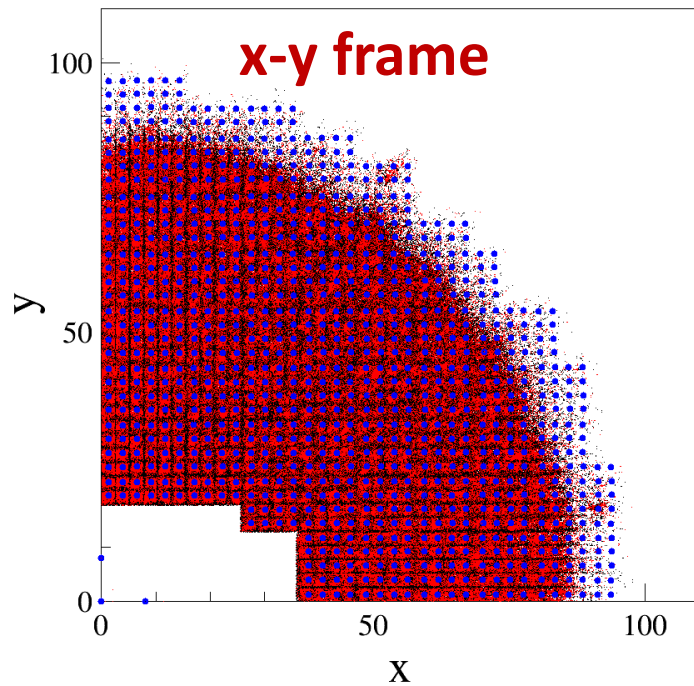


Barrel and Forward



Forward End-cap

Forward End-cap

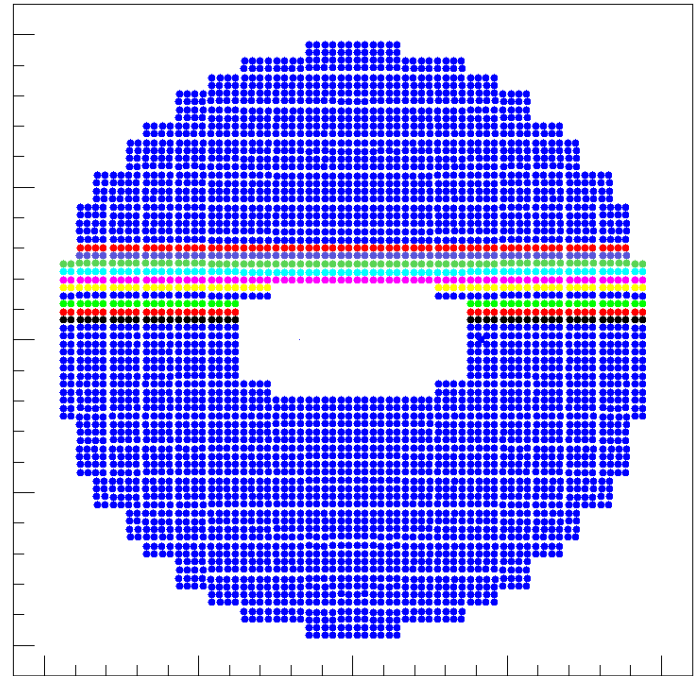


- $\theta: 5^\circ - 23^\circ$
- Crystals are pointing to the IP
- Overlap with Barrel part

Forward End-cap

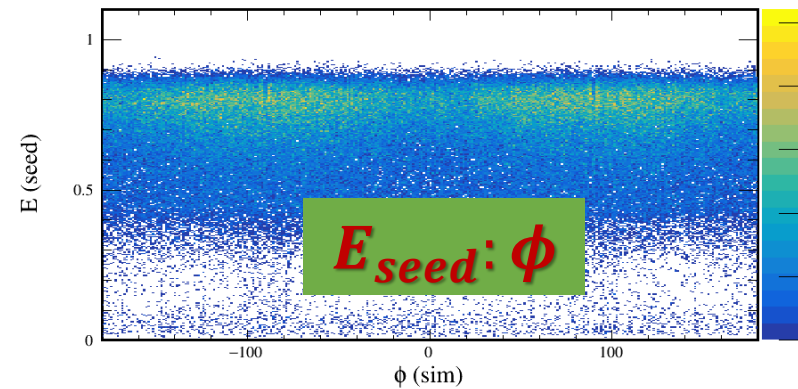
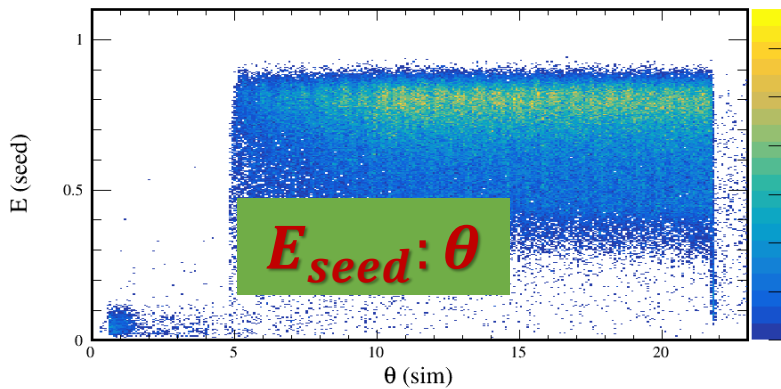
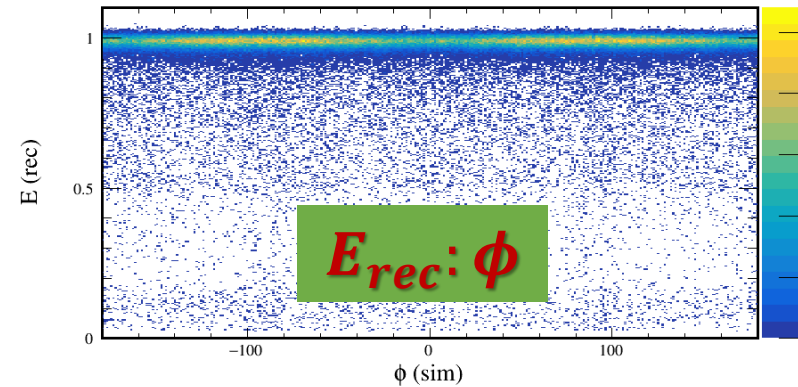
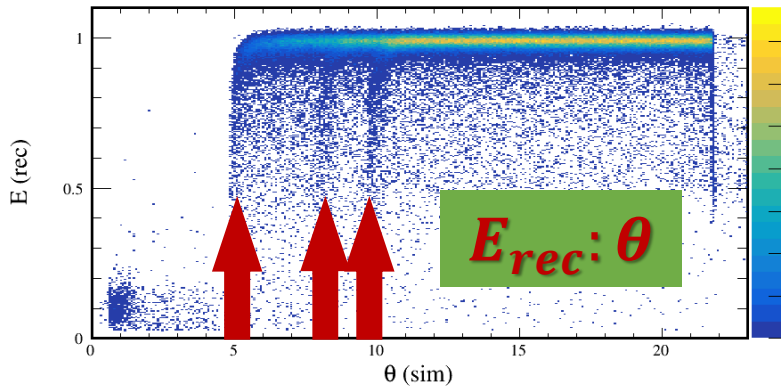
How to number the crystals:

- 74 rows (marker color)
- Different number of crystal for each row
- Total: 3856



Forward End-cap

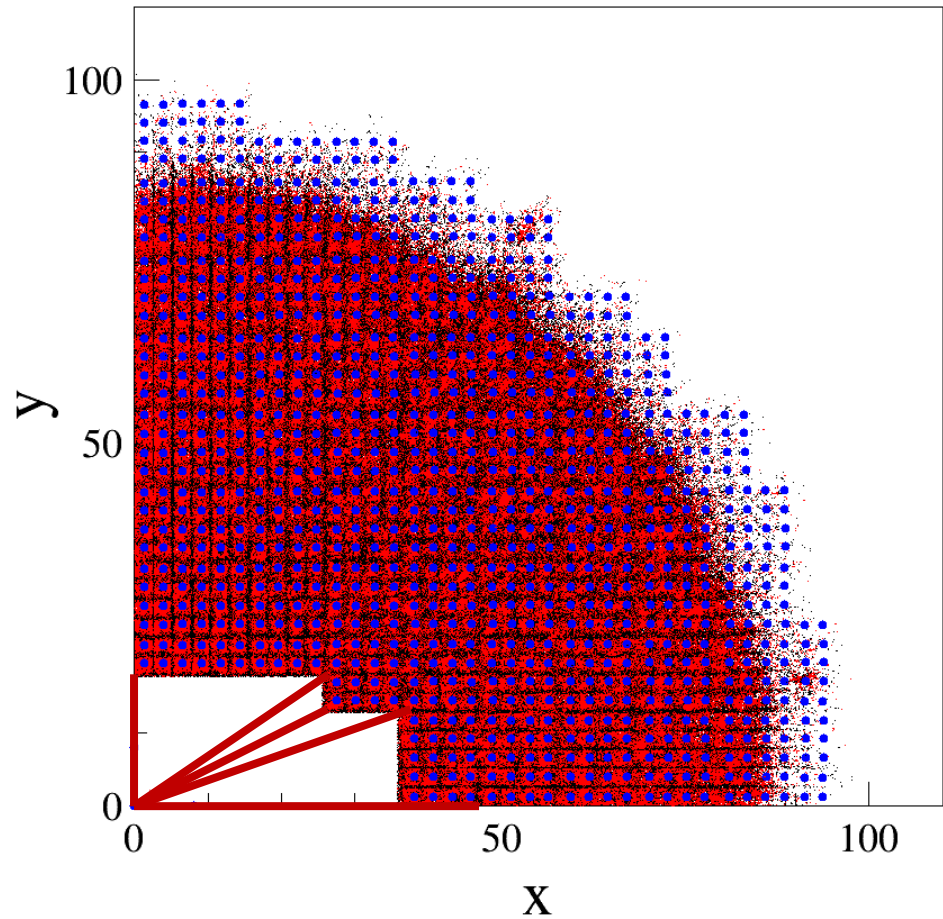
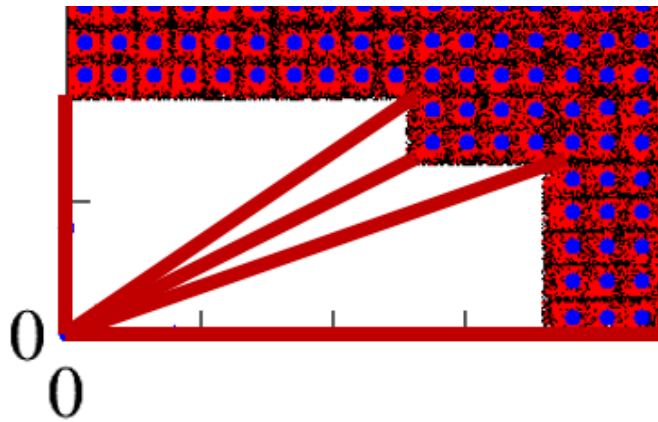
γ simulation with only the EMC



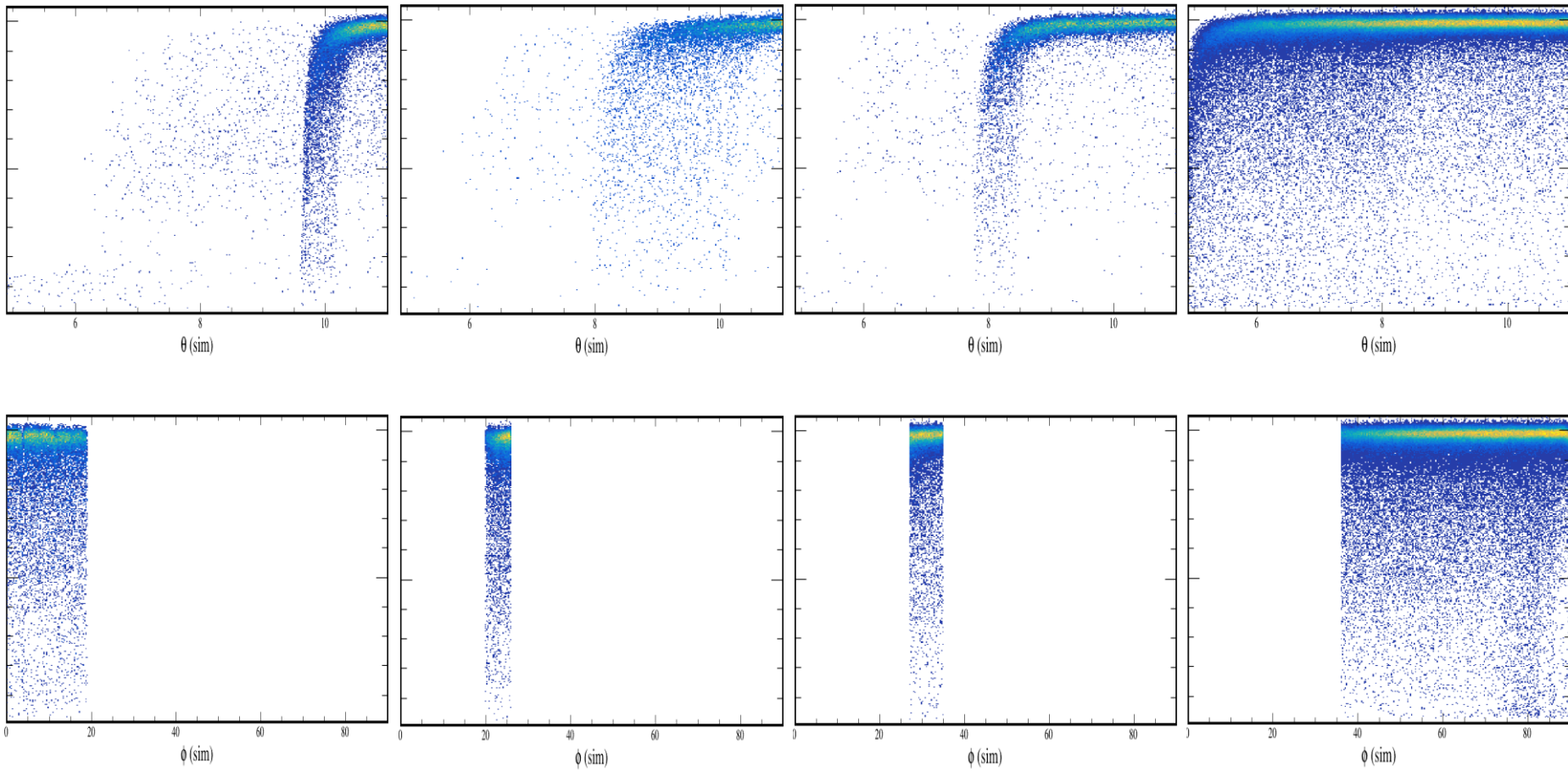
Forward End-cap

Inner side geometry

- Divided into 4 part along ϕ



Forward End-cap



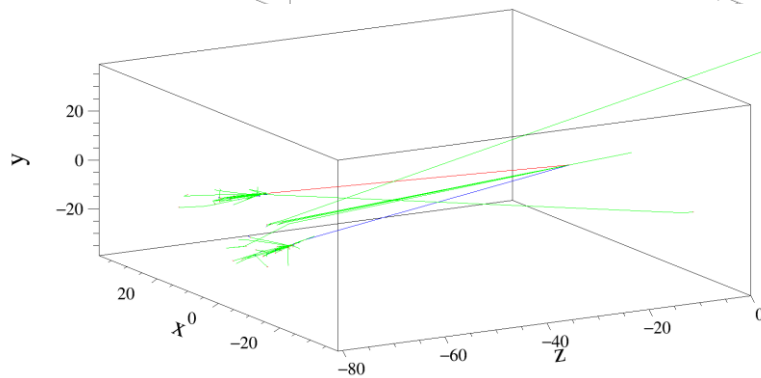
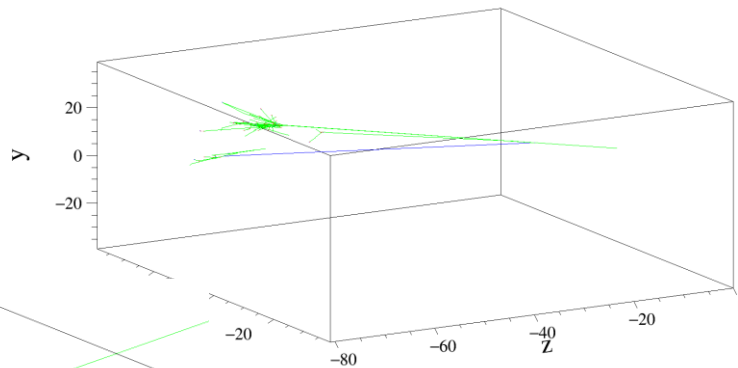
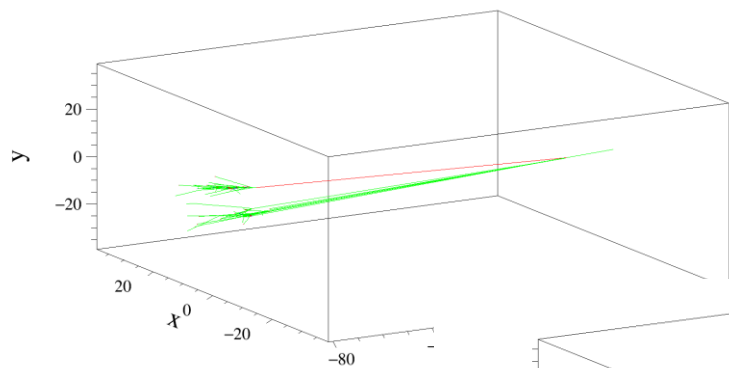
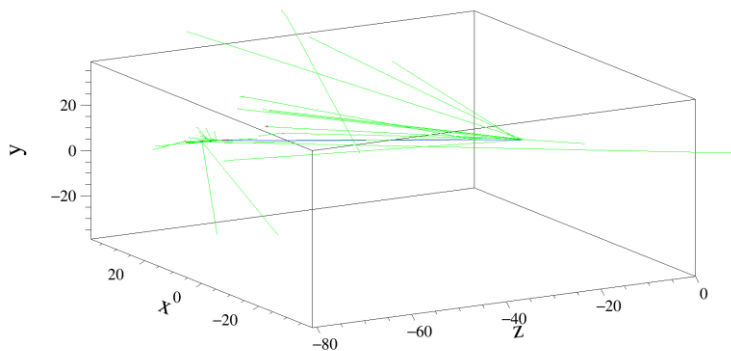
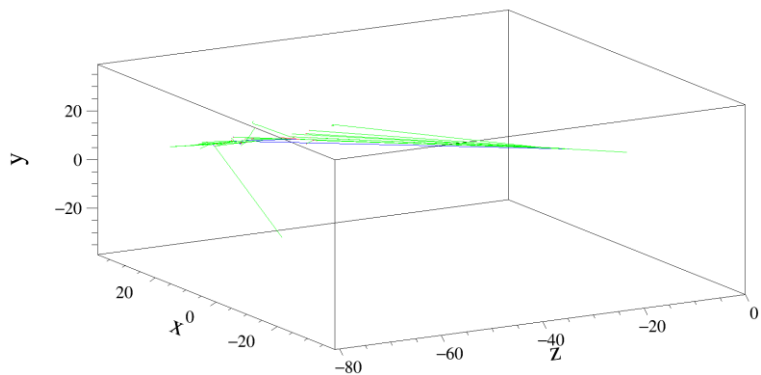
Summary and Outlook

- **Backward end-cap:**
 - Two seed can be found due to the horizontal arrangement of crystals;
 - Pre-shower caused by the material before EMC will influence the energy reconstruction;
- **Forward end-cap**
 - Overlap with barrel EMC in the outermost region;
 - The energy leakage problem in the inner side can be solved.
- **Further test with physics events, which include the kinematic information for different part of EMC.**

Thank you!

Backup

Backup



Backup

