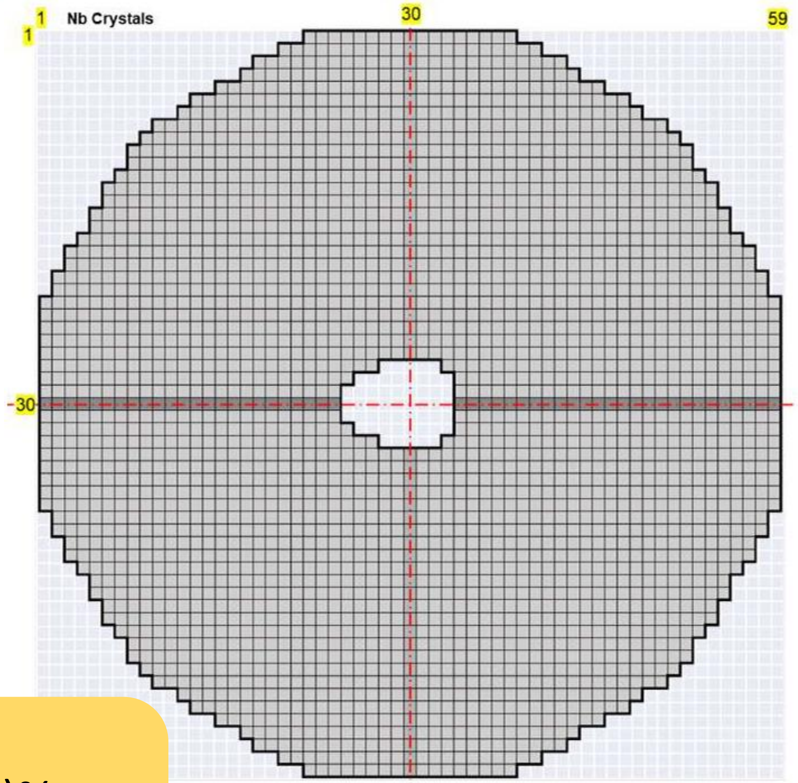
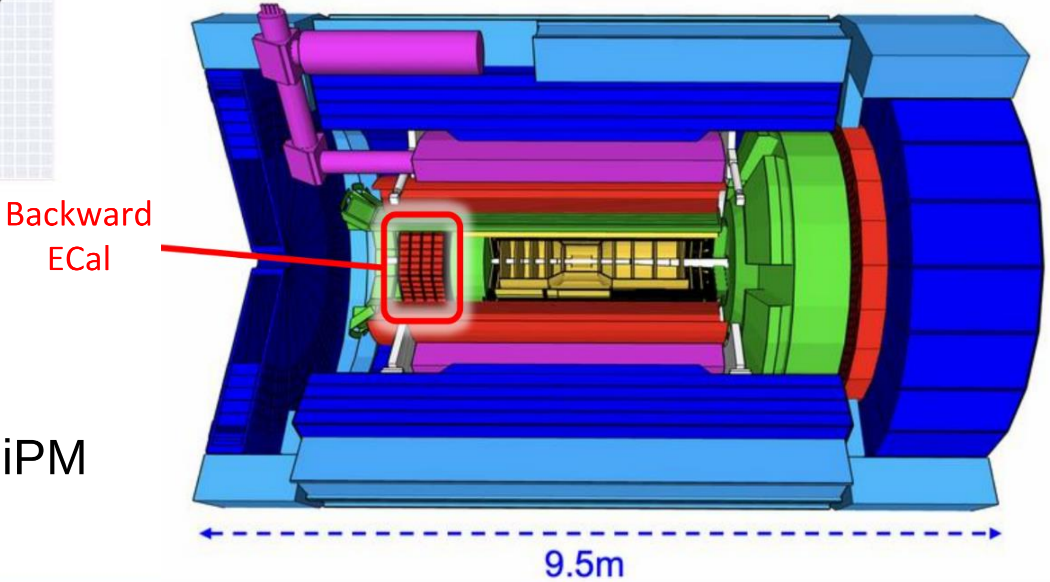
Backward ECal in ePIC

- ~3000 PWO crystals
- SiPM readout
- Cooling
- LED monitoring



High resolution in the forward region (endcap) can only be achieved with homogeneous materials, such as crystals



Requirements:
- Energy resolution: $2\%/\sqrt{E} + (1\text{-}3)\%$
- Pion suppression: $1:10^4$
- Minimum detection energy: > 50 MeV

Technology choice: PWO crystals (2x2 cm^2) with high density SiPM (16 3x3 mm^2 or 4 6x6 mm^2 per crystal)

Backward ECal calibration

Will use physics processes/particles to best determine

calibration coefficients their evolution with time

- Single electrons:
  - Relies on tracker (calibration, accuracy…)
  - May not be possible for all crystals

- Neutral pion decays: $\pi^0 \rightarrow \gamma\ \gamma$
  - **Very clear signal – no need of other detectors**
  - Invariant mass of π^0 used for calibration, but non-linear procedure (2 clusters per event)

- MIPs
  - Wide signal distribution
  - Relies on simulation (or independent measurement) for absolute calibration

Calibration with π^0s

- Methods successfully used with EMCals at JLab
- Based on NIM A566 (2006) 366

Basic principle:

optimize calibration coefficient to constrain the π^0 invariant mass position and minimize its width

$$F = \sum_{i=1}^{N_{events}} (m_i^2 - m_0^2)^2 + 2\lambda \sum_{i=1}^{N_{events}} (m_i^2 - m_0^2)$$

resolution term to optimize

constraint $\langle m_i^2 \rangle = m_0^2$

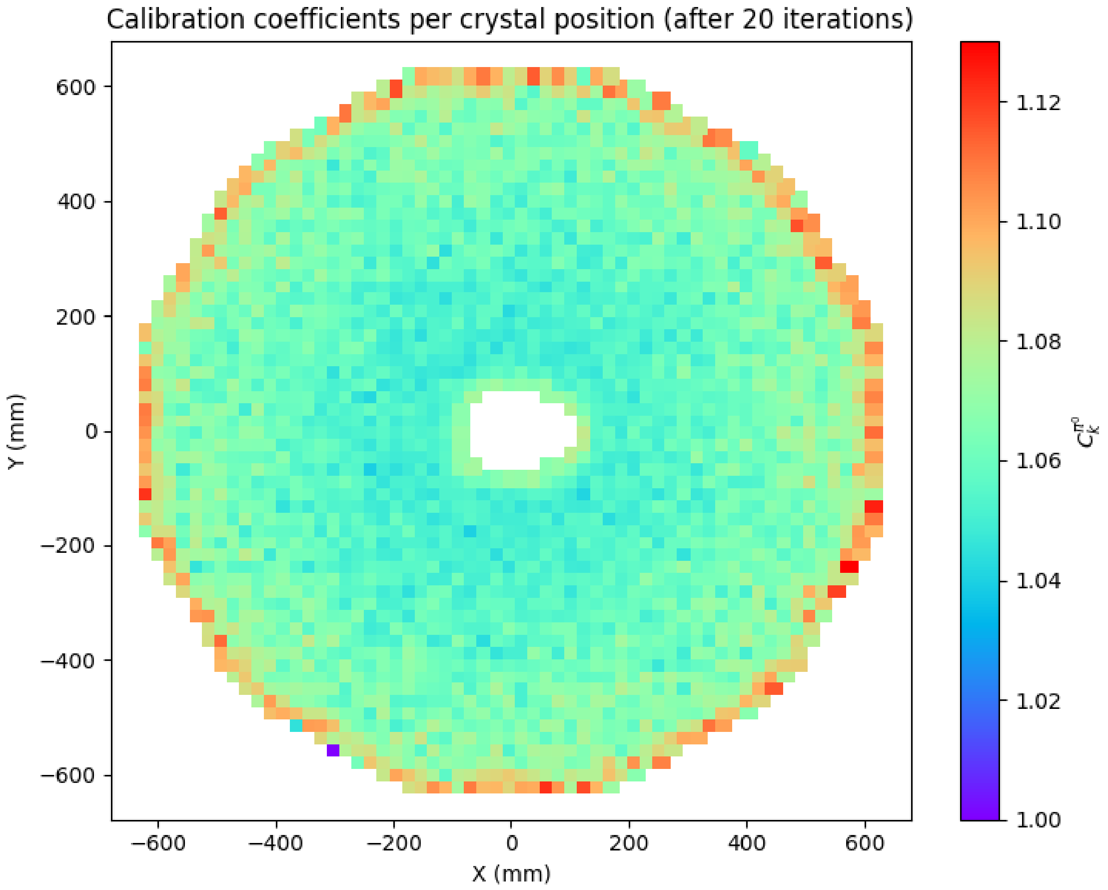
$m_0 = M_\pi = 0.1349766$ GeV

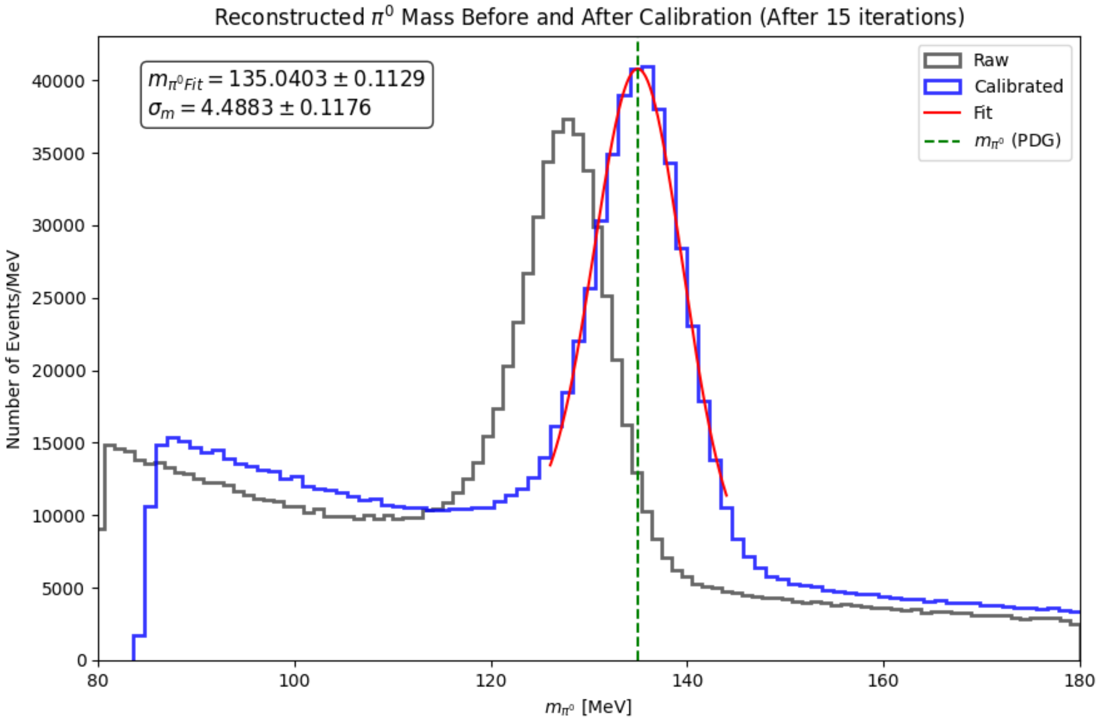
m_i: reconstructed $M_{\gamma\gamma}$

λ: Lagrange multiplier

Backward ECal calibration with π^0s

SIDIS simulation at 18x275 GeV

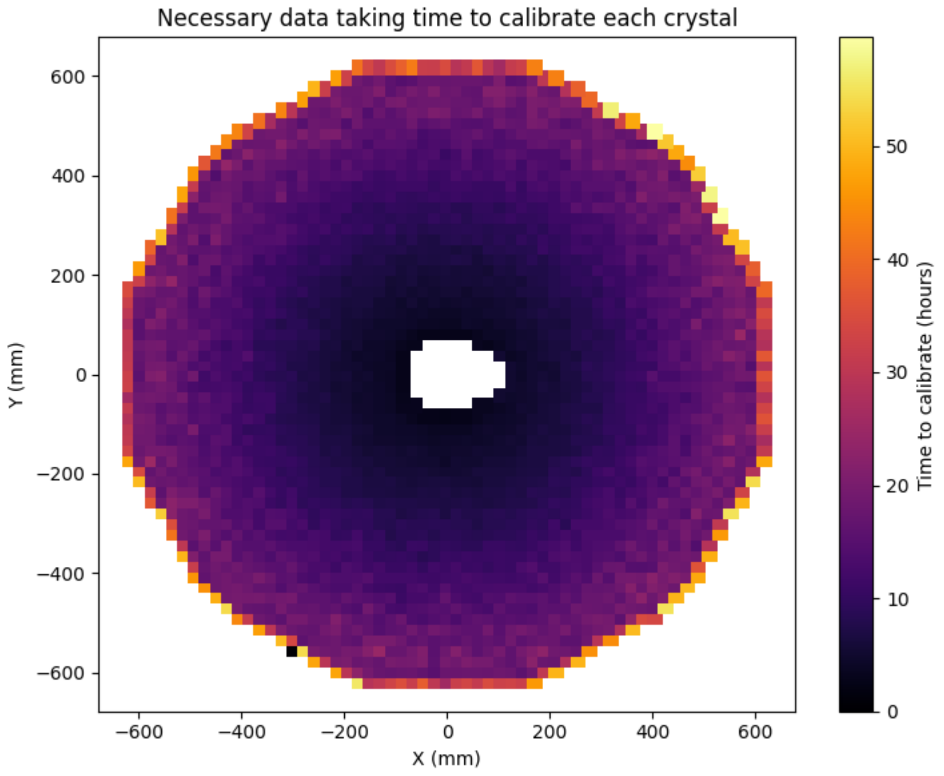




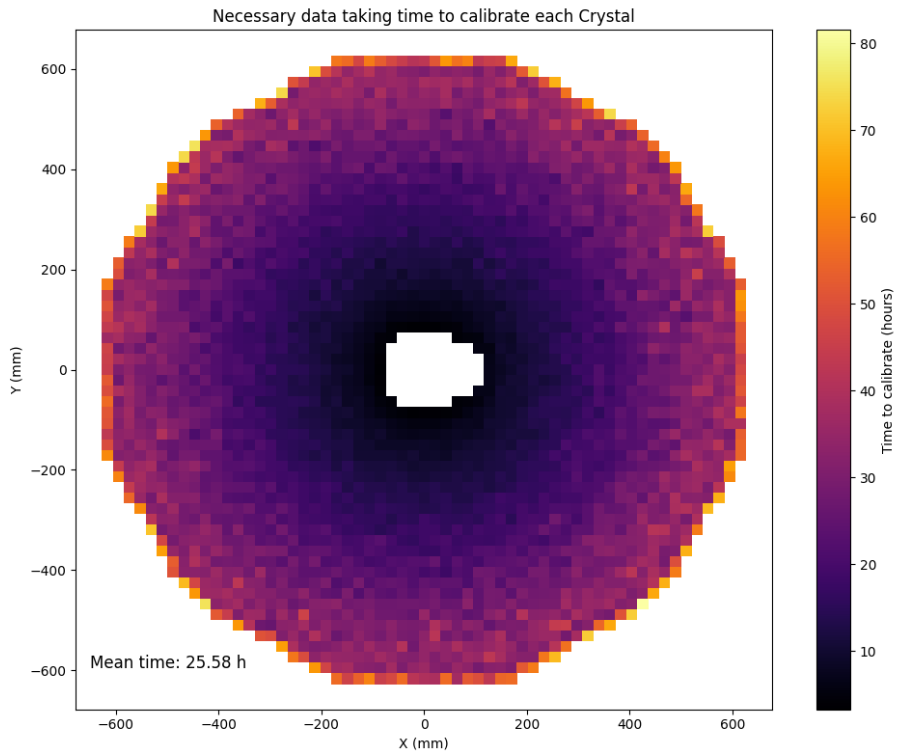
Analysis by Axel Perez Ruiz (IJCLab)

Calibration with π^0s: time required

- Number of hours needed for 1000 events/crystal
- SIDIS simulation



18x275 GeV



5x41 GeV

1-2 days of data should be sufficient

Analysis by Axel Perez Ruiz (IJCLab)