



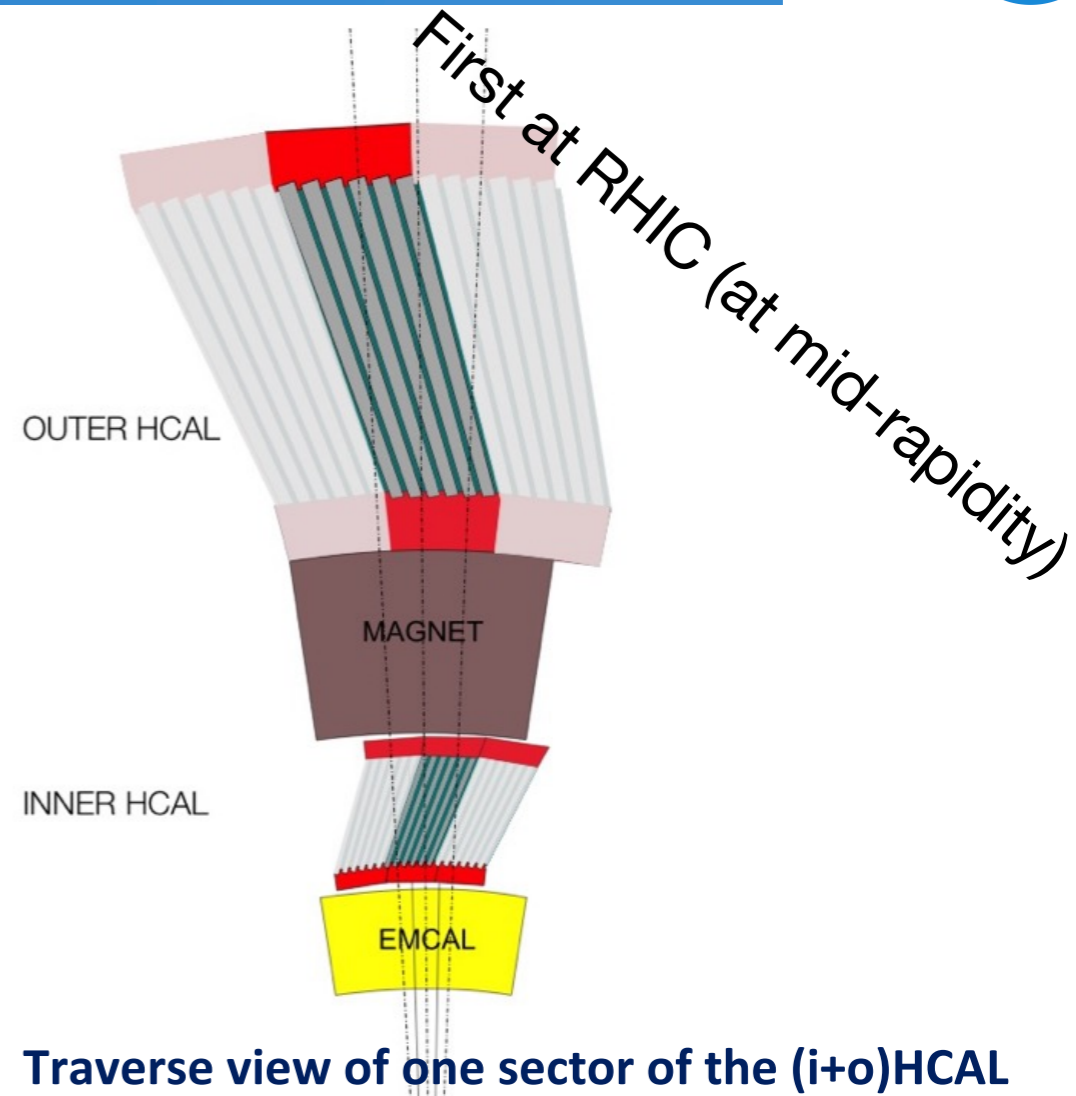
# Calibration of the sPHENIX hadronic calorimeter system

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on behalf of the **sPHENIX** collaboration

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- Plastic scintillating tiles + tilted steel plates with embedded WLS fibers (oHCAL) ; scintillating tiles + Al plates for the iHCAL
- Hadrons traversing the HCALs shower due to the plates and deposit energy in the tiles
  - ❑ Signal from the tiles is directed to SiPMs
  - ❑ Signal from the SiPMs is aggregated into towers
- **HCAL sectors geometry**
  - ❑ 32 Sectors
  - ❑ 48 towers/sector
  - ❑ 5 tiles/tower (oHCAL); 4 tiles/tower (iHCAL)
  - ❑ 24 towers in  $\eta$
  - ❑ 2 towers in  $\phi$



**A section of iHCAL sector with tiles and SiPMs**

- **Cosmic muon event selection**

- A sector is divided into thirds (shown in teal, yellow & magenta in the plot below)
- Each third have the same trigger for cosmics. The sum of the signal of a third of the towers must pass surpass a given threshold.

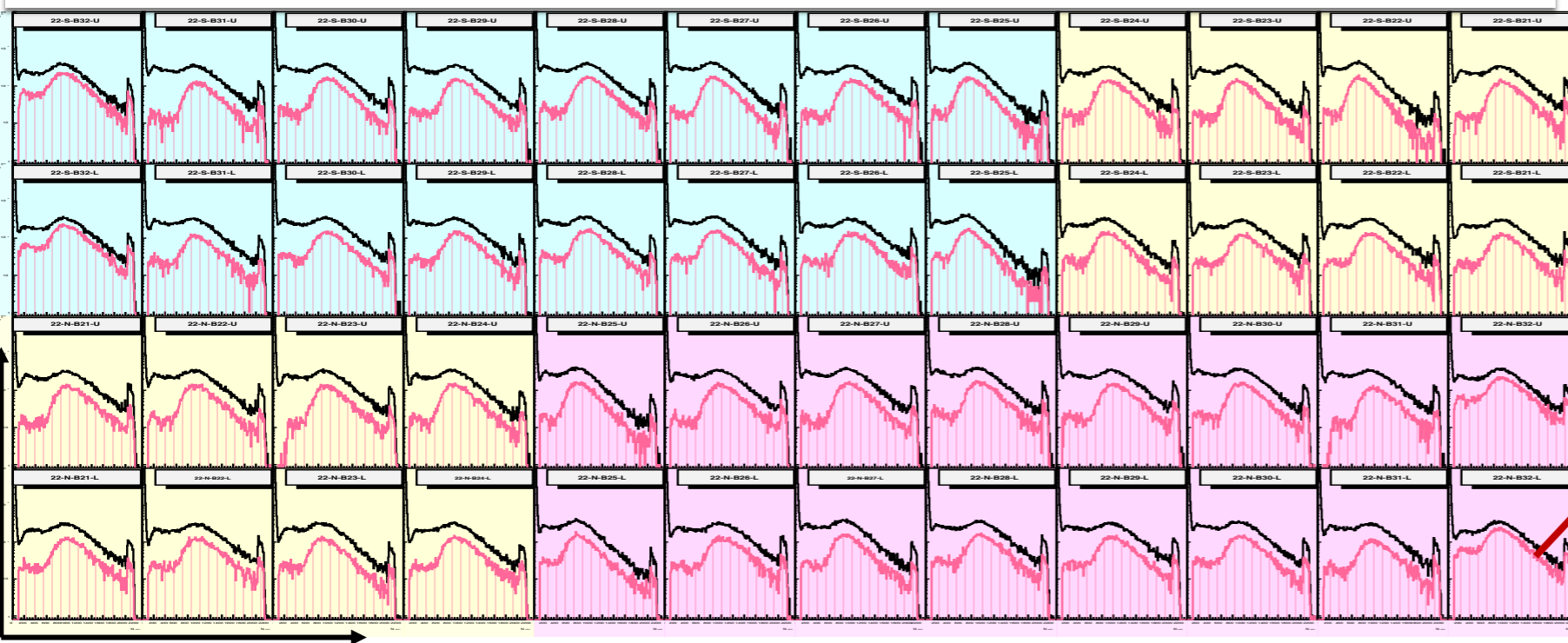
- **Offline cuts**

- Vertical towers, i.e., 2 towers in  $\phi$  are hit
- No horizontally neighbor towers are hit (i.e., immediate towers in  $\eta$ )

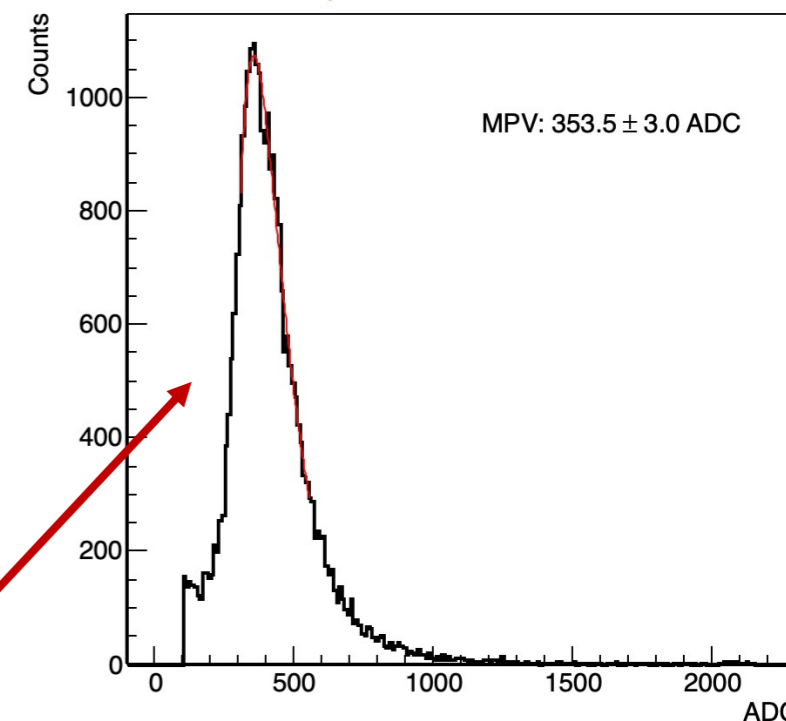
oHCAL sectors at BNL's AGS Fixed-Target Exp. Hall



Cosmic muon data for all towers in 1 HCAL sector over the course of 1 hour (black = no offline cuts; red = with offline cuts)



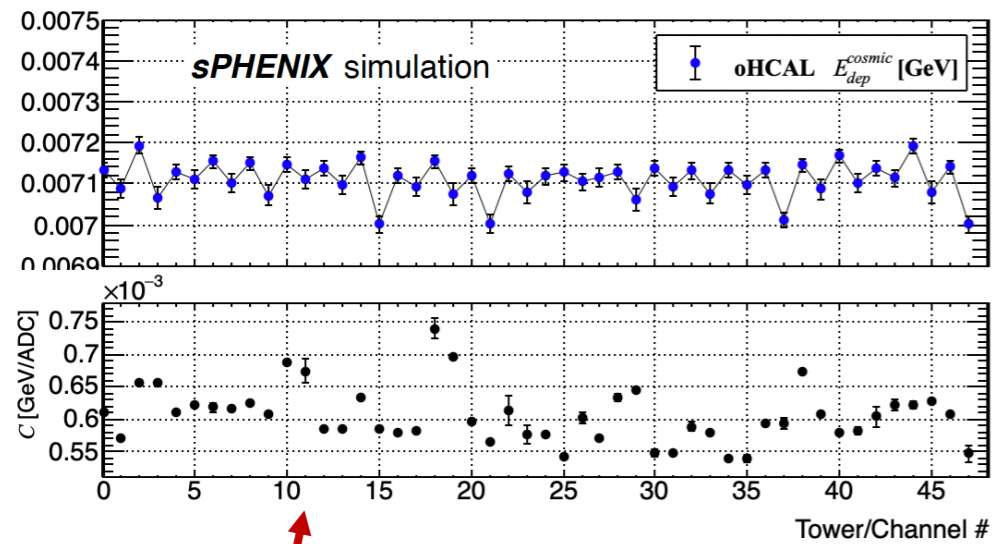
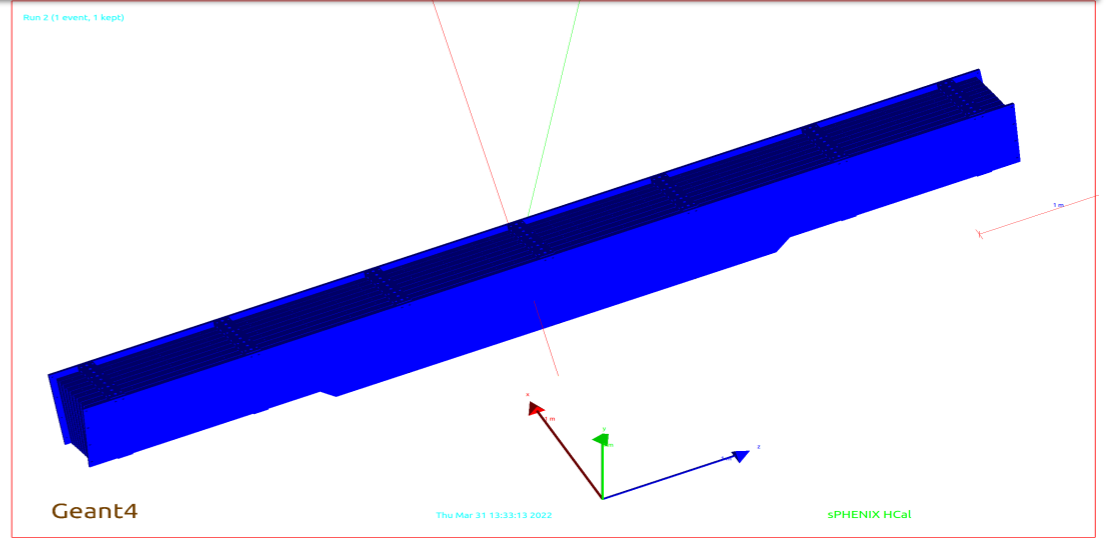
Single oHCAL Tower ADC Distribution  
Fit around peak: Gamma + linear function



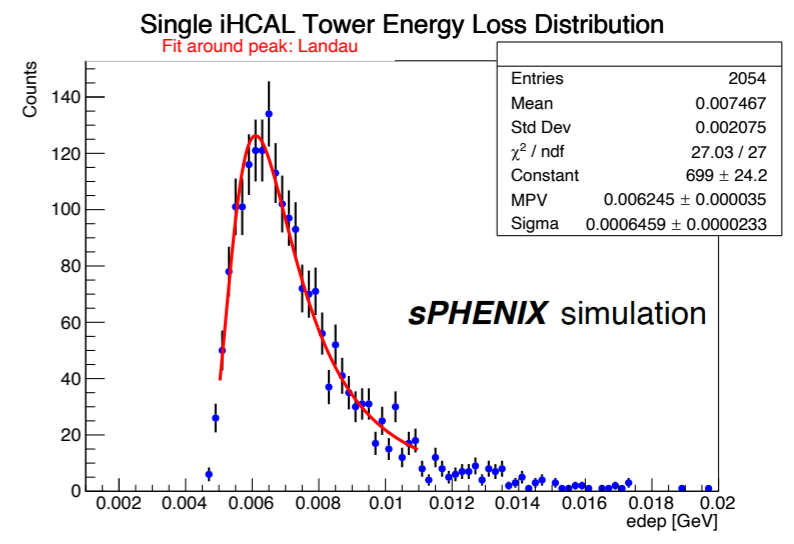
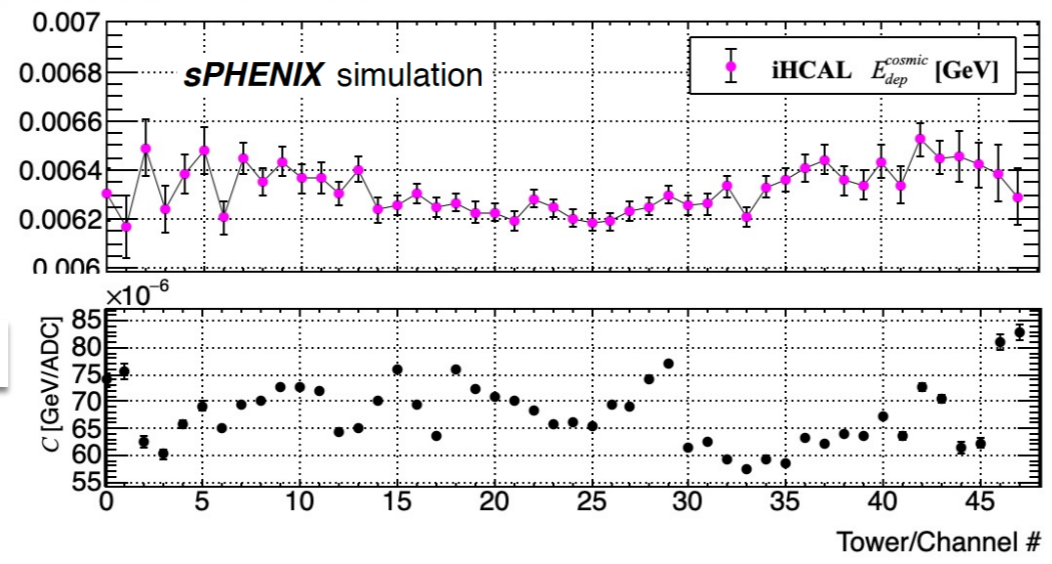
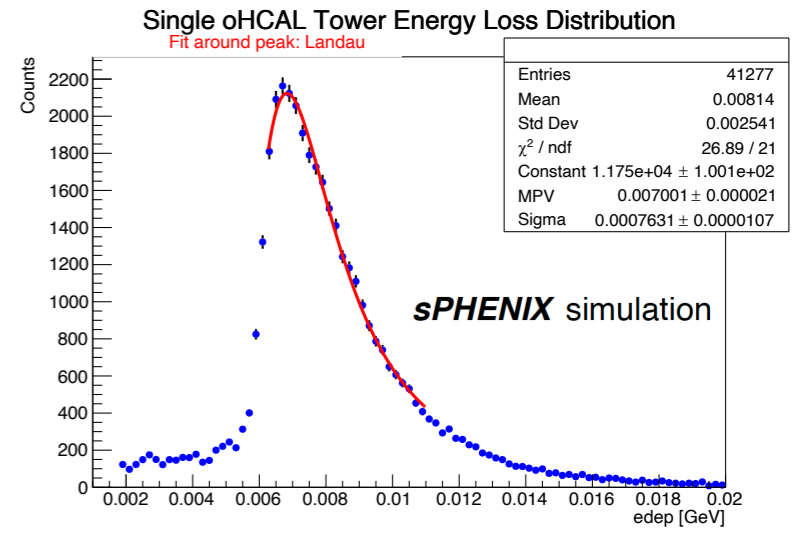
ADC

- A muon is simulated going through one sector with energy and angular dependence described in [1]
  - This simulation result is used to calibrate the ADC signal peak in each tower with:
    - $$C = \frac{E_{dep}^{cosmic}}{E_{dep}^{ADC} \times SF(muon)}$$
    - Where,  $E_{dep}^{cosmic}$  is the peak of the eloss distribution extracted from GEANT4 cosmic simulation,  $E_{dep}^{ADC}$  is the ADC peak measured from the cosmic data, and  $SF(muon)$  is the muon sampling fraction [2]

## Simulated single muon event on 1 oHCAL sector



e loss distributions for 1 tower in HCAL sector



Initial tower-by-tower calibration constants, C, for the HCAL sectors

- **sPHENIX** will be the first new collider detector at RHIC in over 20 years!
  - First hadronic calorimetry at RHIC (at mid-rapidity).
- The outer and inner HCAL sectors are now fully assembled at BNL!
  - Future calibrations will include the sectors in their fully assembled configuration.

## OHCAL Installation Complete!



## IHCAL Barrel Complete!



sPHENIX is supported by



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