Two-Particle Position Resolution Study from Backward HCal

Leszek Kosarzewski, Alexandr Prozorov, Subhadip Pal



ePIC calorimetry meeting – July 10, 2024

Setup

Objective : Use clusters to distinguish between neutron/pion shower reconstruction.



- $\begin{array}{l} \square & (1 n + 1 \pi^{-}) / \text{ event.} & ---- & \underline{Standalone \ ddsim} \\ \square & \varphi = 45^{\circ} \\ \bullet & \theta_n = 155^{\circ} (\eta = -1.51) ---- & \underline{fixed} \\ \bullet & \theta_\pi = 155^{\circ} (\eta = -1.51), 158^{\circ} (\eta = -1.64), \\ & 161^{\circ} (\eta = -1.79), 164^{\circ} (\eta = -1.96), \end{array}$
 - 167° (η = -2.17), 170° (η = -2.44)

- Only Backward HCal was taken into account [not the whole ePIC geometry – scattering effects neglected]
- -4.14 < η < -1.18
- Alternating Steel and Scintilator slices
- 10 cm. x 10 cm. Polystyrene tiles

Cluster Positions (local xy)



Cluster (x,y) are shown along with simulated angular coordinates

p = 1 GeV/c

[neutron showers in outer region; pion showers in inner region]

Distributions are becoming more smeared as $(\theta_{\pi} - \theta_{n})$ increases...

Cluster Radial Coordinates



R_{n(MC)} = 191.54 cm R_{n(MC)} = 191.54 cm R_{n(MC)} = 191.54 cm $-\pi^{-} + n$ $-\pi^{-} + n$ $-\pi^{-} + n$ R_{_{π(MC)} = 191.54 cm} R_{π(MC)} = 141.43 cm R_{π(MC)} = 165.95 cm $-\pi^{-}$ [84.75%] $-\pi^{-}$ [79.96%] $-\pi^{-}$ [78.50%] 8000 — n [12.50%] — n [18.72%] — n [17.28%] 6000 6000 6000 4000 4000 4000 2000 2000 2000 _____ 100 150 200 250 300 350 400 450 500 50 0 50 100 150 200 250 300 350 400 450 500 0 50 100 150 200 250 300 350 400 450 500 Local Radial Coordinate(R) [cm] Local Radial Coordinate(R) [cm] Local Radial Coordinate(R) [cm] R_{p(MC)} = 191.54 cm R_{n(MC)} = 191.54 cm R_{n(MC)} = 191.54 cm — π⁻ + n — π⁻ + n $-\pi^{-} + n$ R_{π(MC)} = 94.83 cm R_{π(MC)} = 117.78 cm R_{π(MC)} = 72.43 cm $-\pi^{-}$ [78.15%] $-\pi^{-}$ [79.75%] 8000 $-\pi^{-}$ [80.57%] — n [19.09%] — n [17.42%] -n [16.70%] 6000 6000 6000 4000 4000 4000 2000 2000 2000 150 200 250 300 350 400 450 500 50 100 150 200 250 300 350 400 450 500 0 50 100 150 200 300 350 400 450 500 0 0 50 100 250 Local Radial Coordinate(R) [cm] Local Radial Coordinate(R) [cm] Local Radial Coordinate(R) [cm]

Percentages are based on ClusterMCParticle associations

Neutron Clusters start to shift inwards as $(R_n - R_\pi)$ increases

~ 80% of the clusters associated with pions

~ 20% of the clusters associated with neutrons

p = 1 GeV/c

Cluster Reconstruction





Expectation: 2 clusters per event

Observation: > 90% events have 1 reconstructed cluster

Clusters are being merged...?

Cluster Reconstruction





Thank You



