



Analysis of inclusive DIS Events

2 Million Statistics

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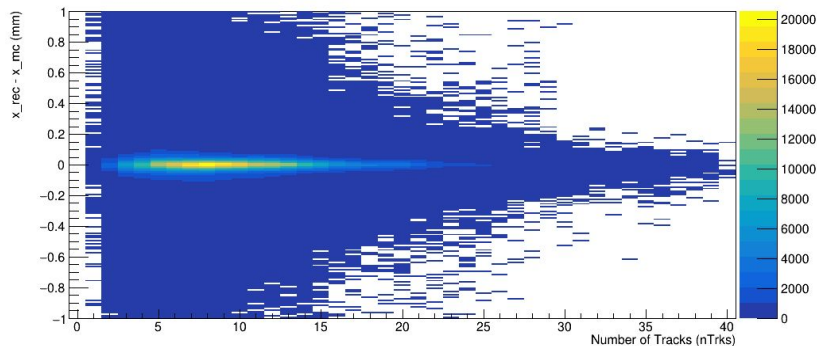
General Details of the Analysis

- Simulated and ran reconstruction on 2 Million DIS events (electron-proton collisions) generated using Pythia8 at a fixed vertex (0,0,0).
- The events have following specifications:
 - Electron Beam Energy: 18 GeV
 - Proton Beam Energy: 275 GeV
 - Min. Q square: 10 GeV²
 - With Neutral Current (Z⁰ Boson)
- The events were simulated on 30th May, 2024 with the detector geometry, epic-24.05.2

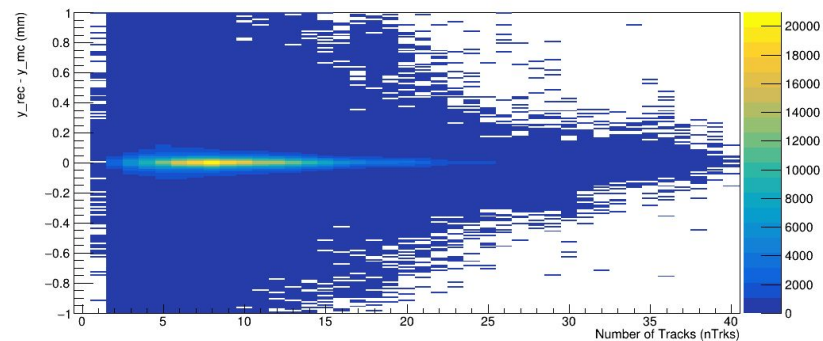
Vertex Resolution ($vtx_rec - vtx_mc$)

Inclusive DIS events

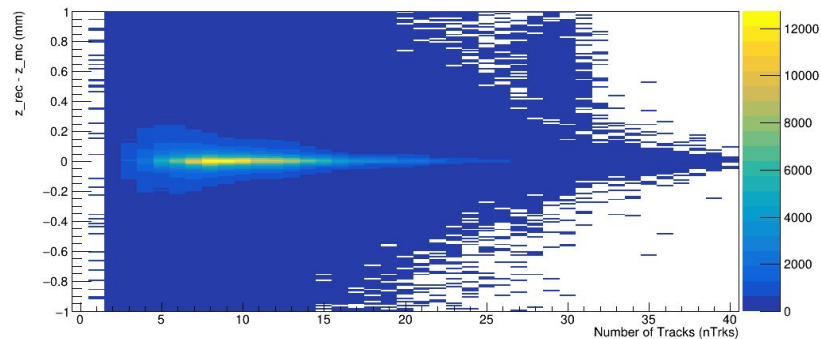
X resolution



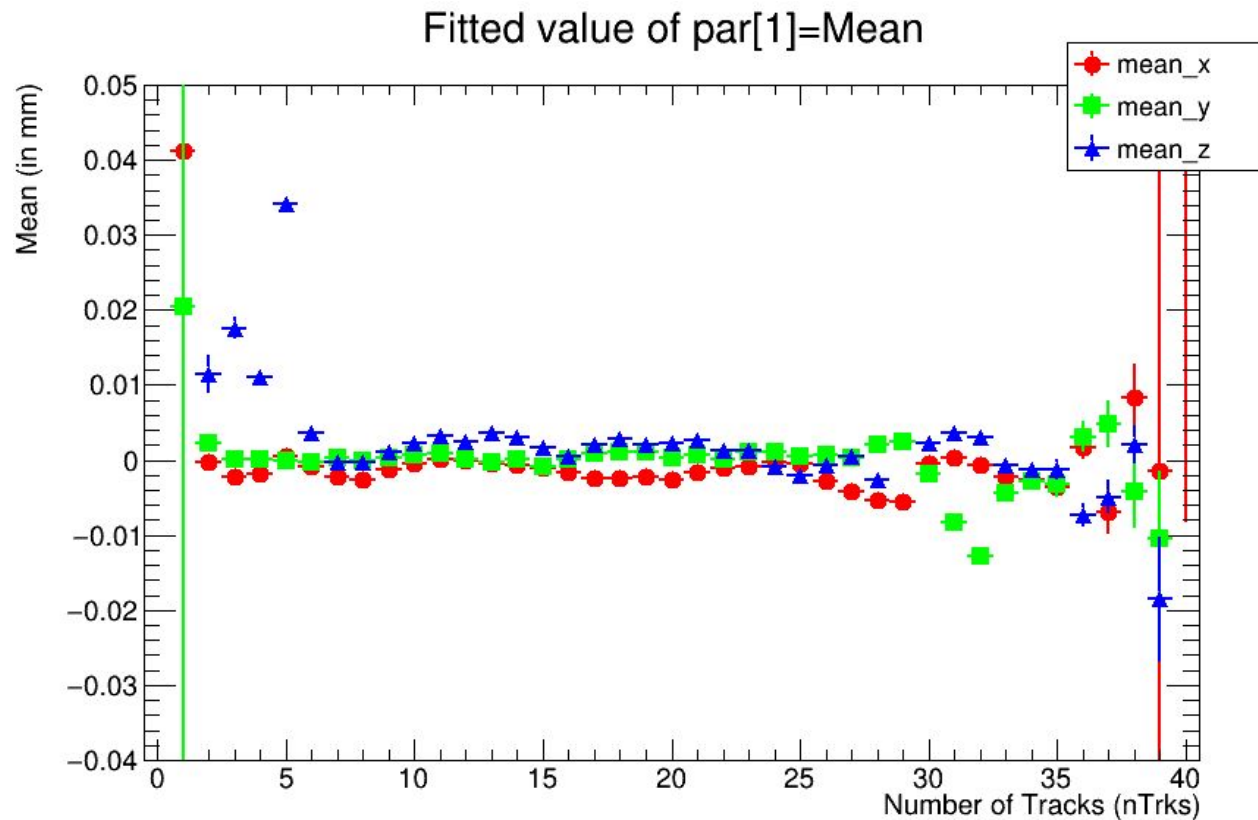
Y resolution



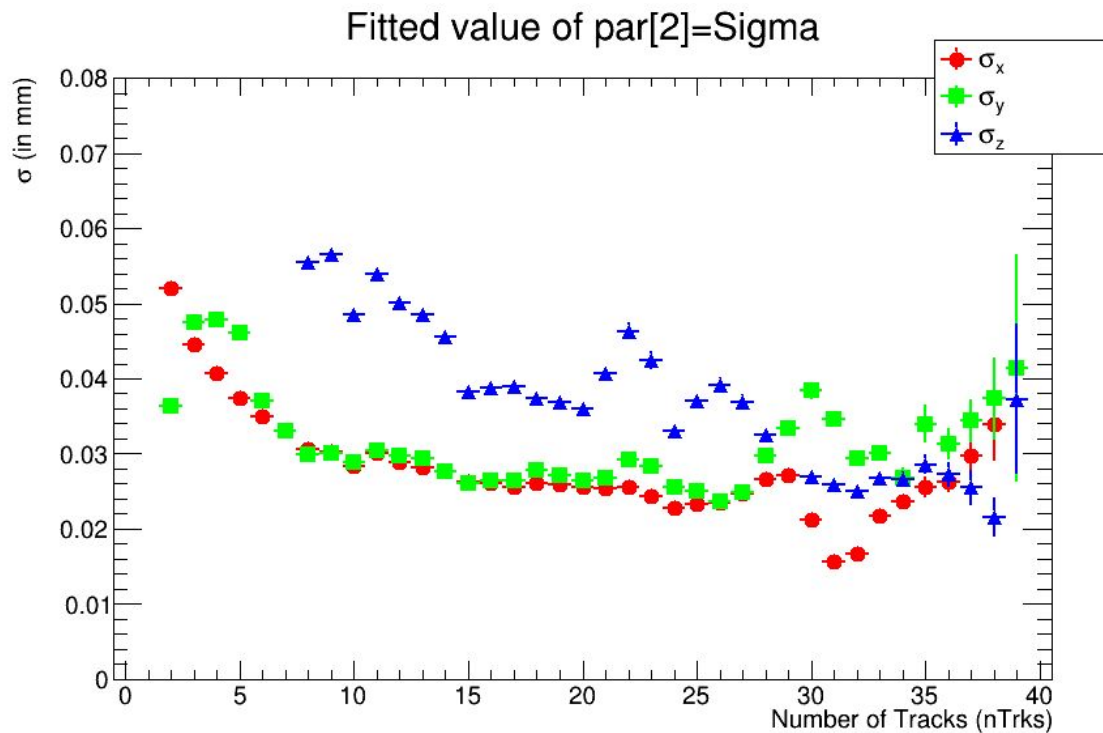
Z resolution



Vertex Resolution Plots: Mean (using FitSlicesY())

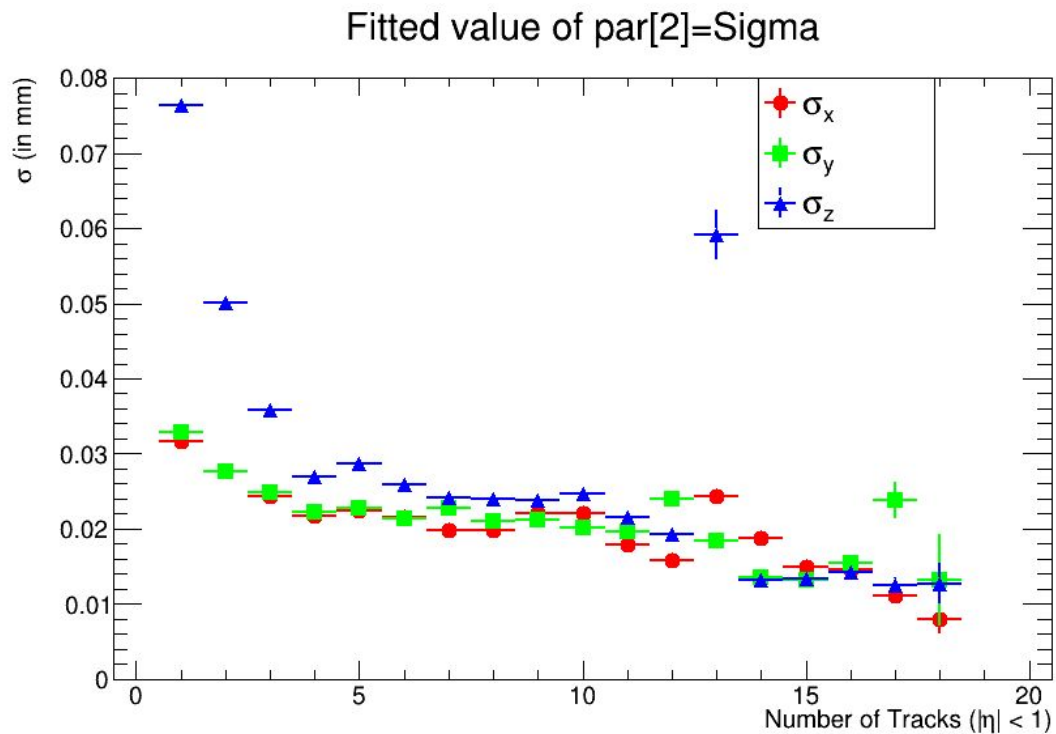


Vertex Resolution Plots: Sigma (using FitSlicesY())



Much larger resolution for z-component as compared to x and y-components.

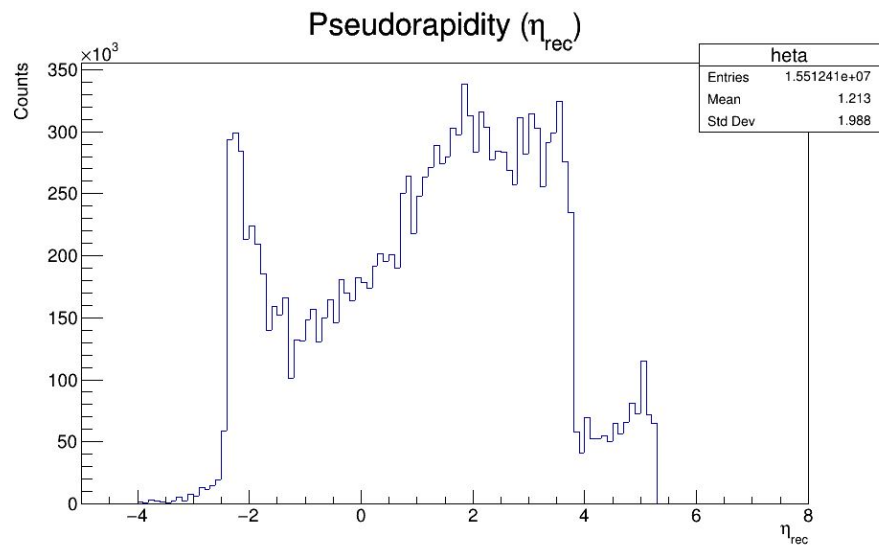
Vertex Resolution Plots: Sigma (with $|\eta| < 1$)



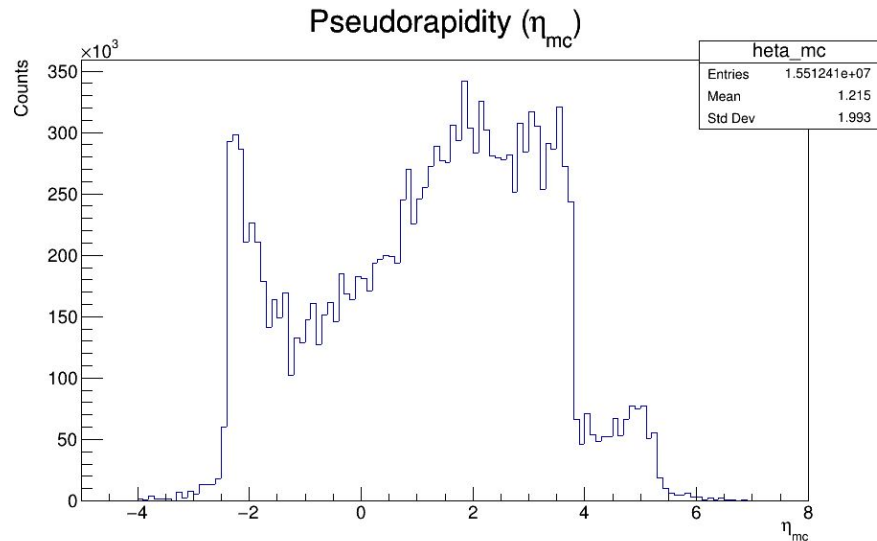
z vertex resolution becomes comparable to x and y-components.

Tracking Parameters: Pseudorapidity (η)

Reconstructed Particles

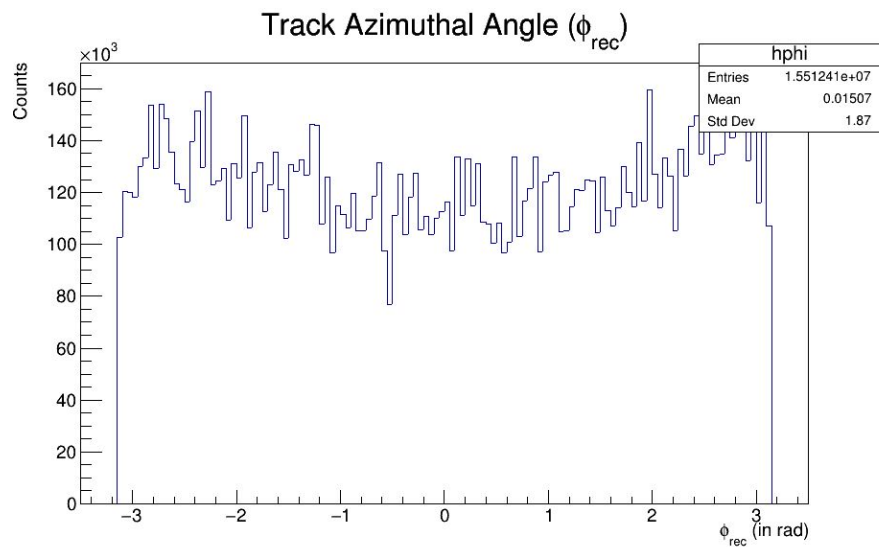


MC Particles

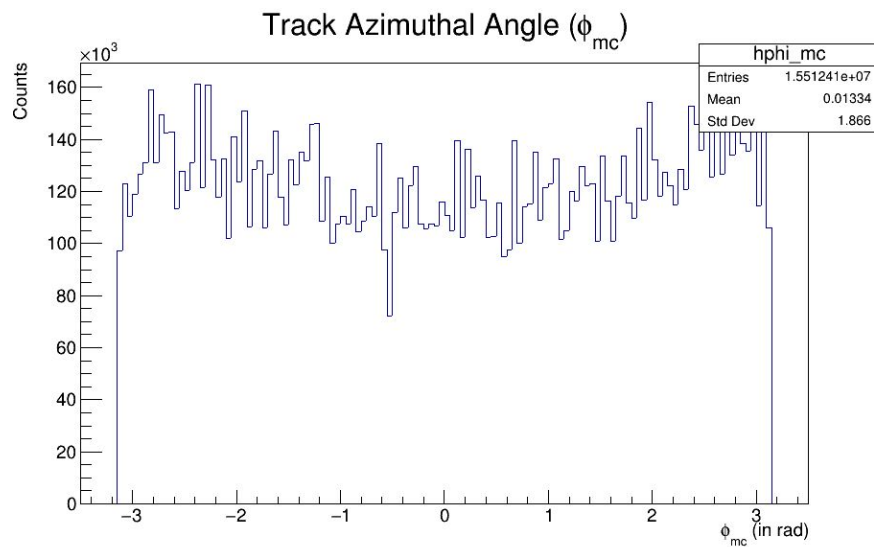


Tracking Parameters: Azimuthal Angle (ϕ)

Reconstructed Particles

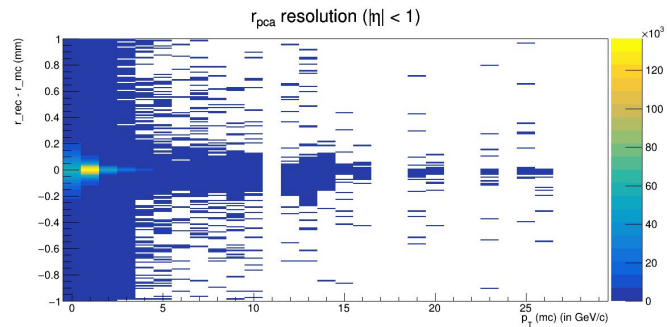


MC Particles



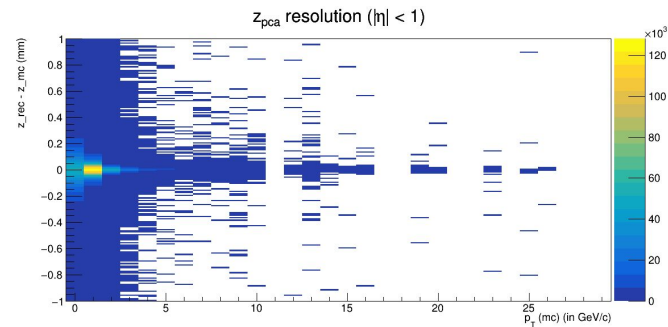
Pointing Resolutions: r_{pca} and z_{pca} v/s Transverse Momentum

r_{pca}

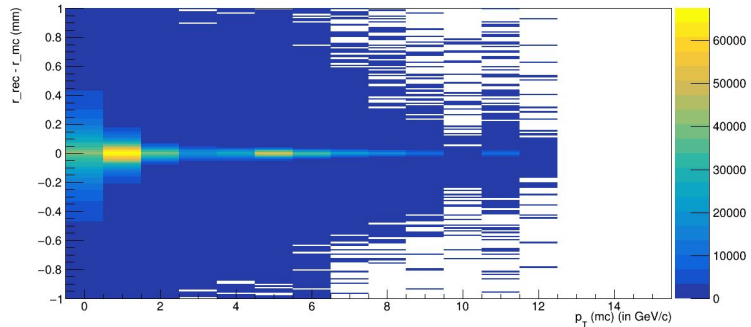


$|\eta| < 1$

z_{pca}

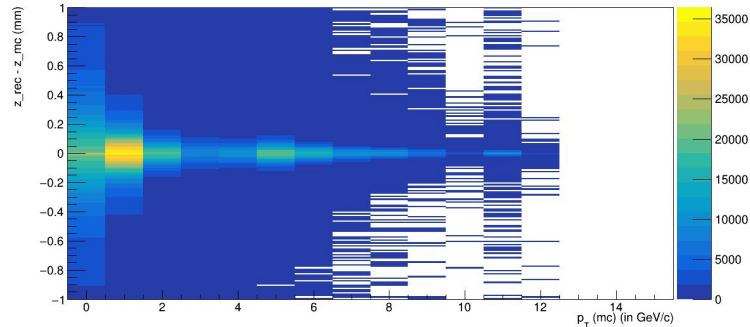


r_{pca} resolution ($1 < |\eta| < 2$)

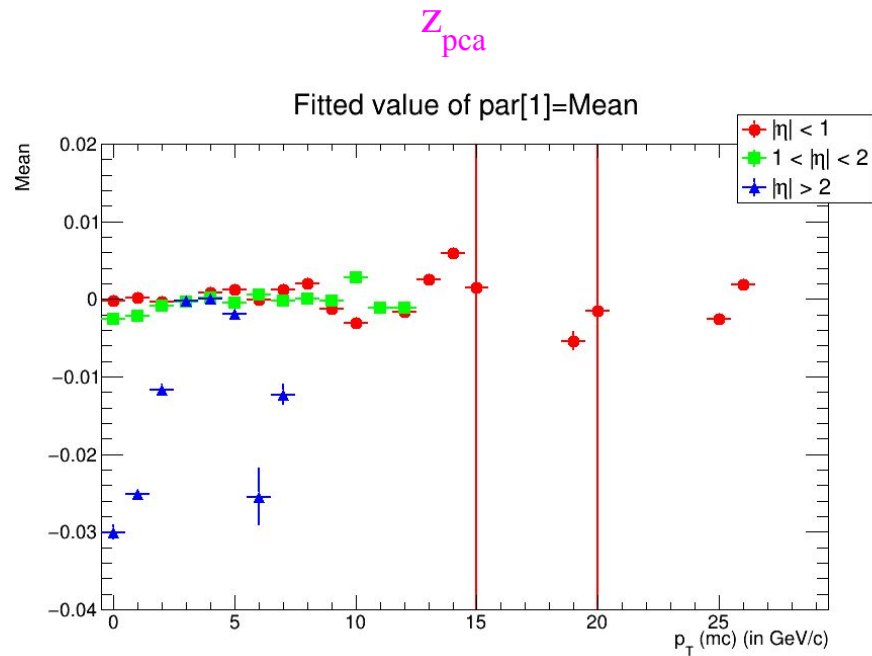
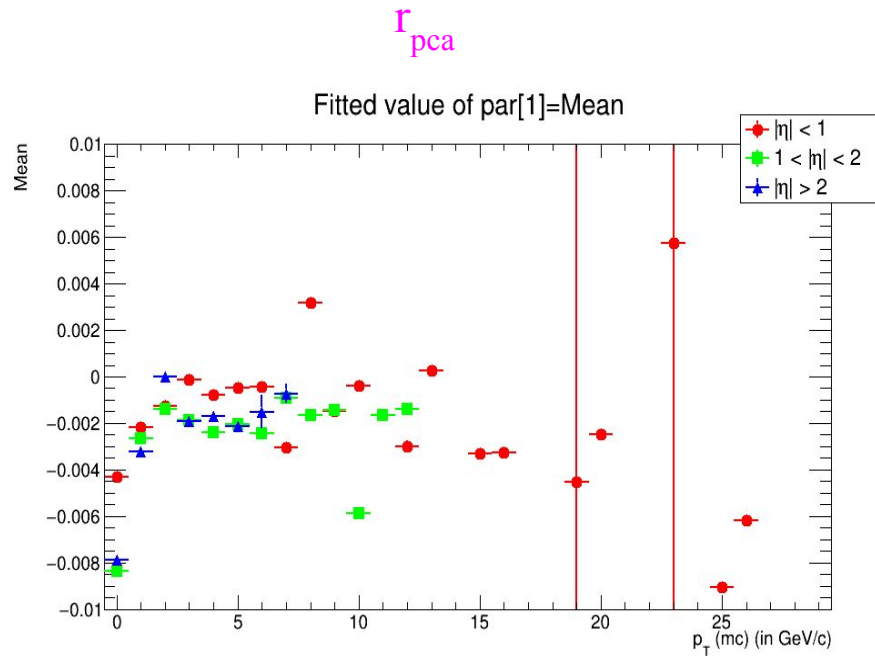


$1 < |\eta| < 2$

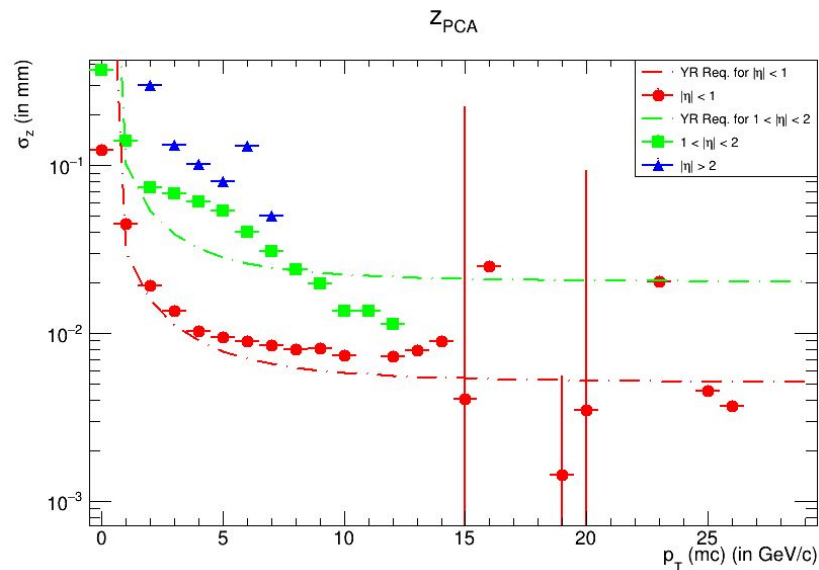
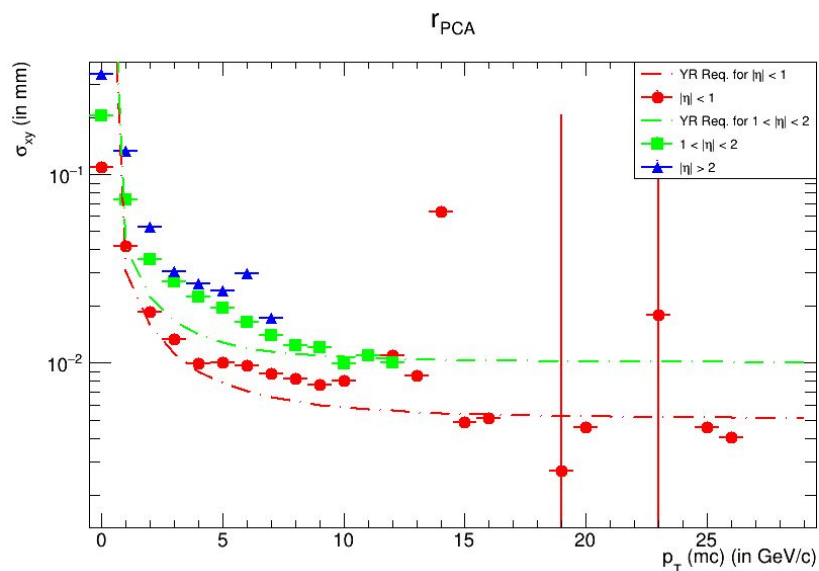
z_{pca} resolution ($1 < |\eta| < 2$)



Pointing Resolution: r_{pca} and z_{pca} (Mean)



Pointing Resolution: r_{pca} and z_{pca} (Sigma)

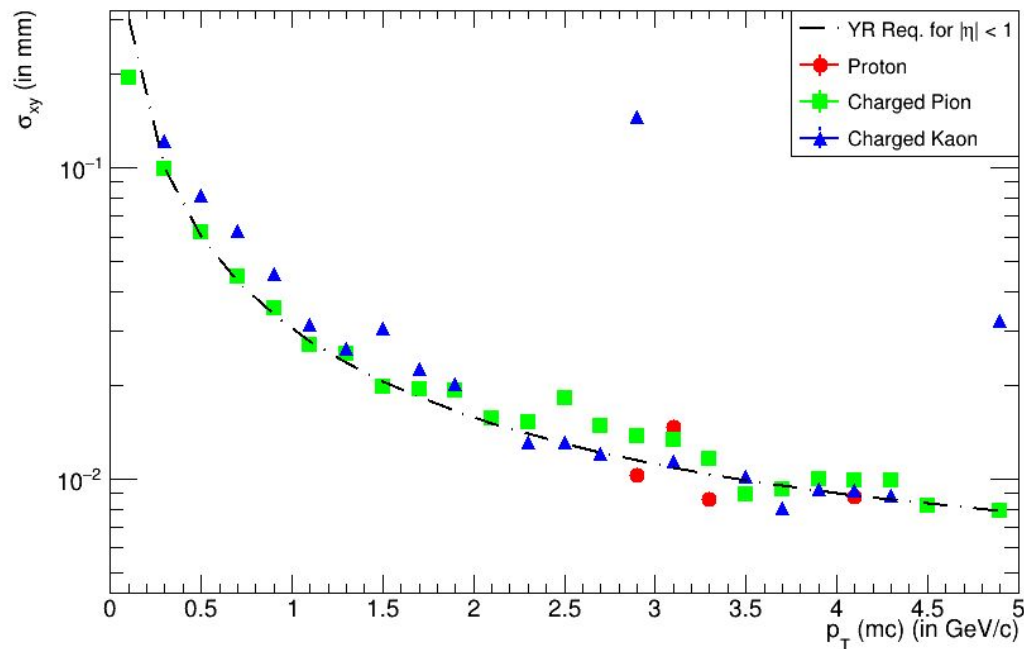


Yellow Report Requirement for Pointing Resolutions have been taken from (Page 29, Table 3.1) <https://arxiv.org/pdf/2103.05419.pdf> and plotted using Equation 11.3, Page 465.

Pointing Resolution: r_{pca} (Particle Species Dependence)

$$|\eta| < 1$$

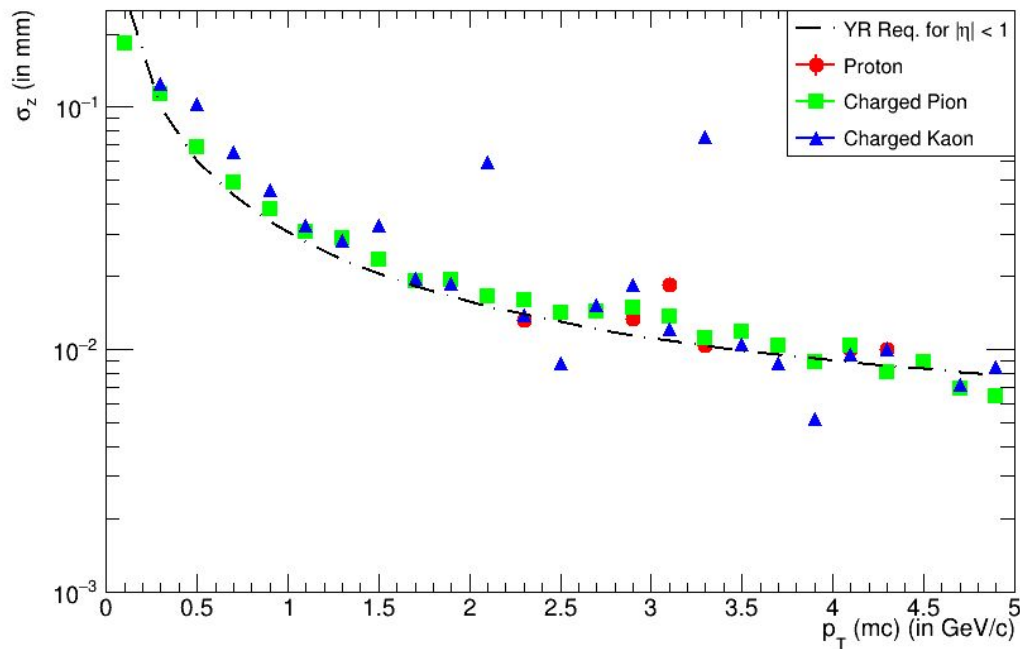
Fitted value of par[2]=Sigma



Pointing Resolution: z_{pca} (Particle Species Dependence)

$$|\eta| < 1$$

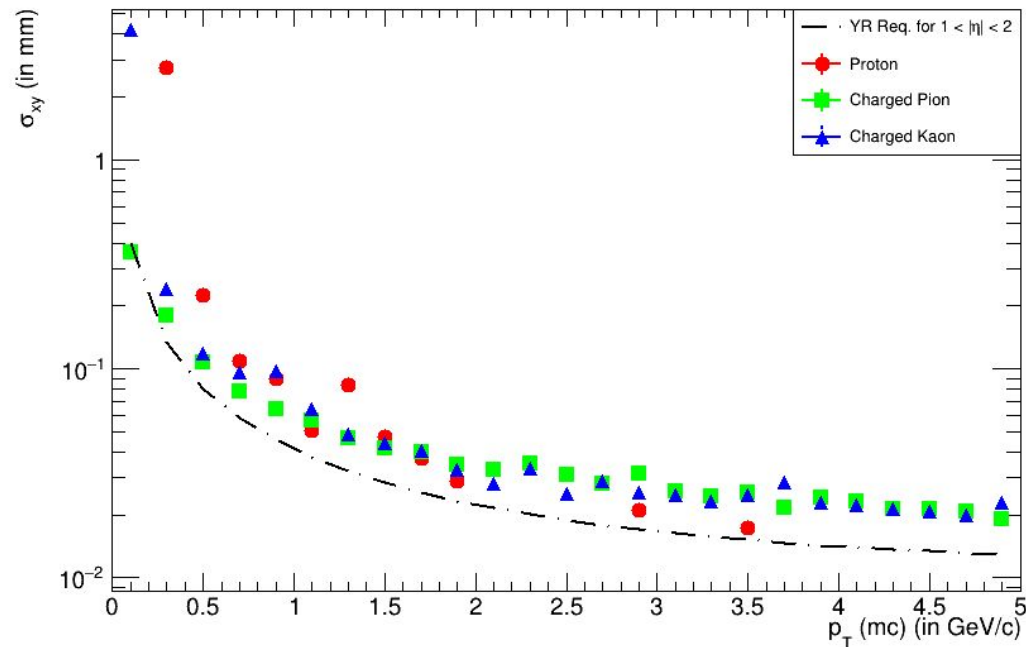
Fitted value of par[2]=Sigma



Pointing Resolution: r_{pca} (Particle Species Dependence)

$$1 < |\eta| < 2$$

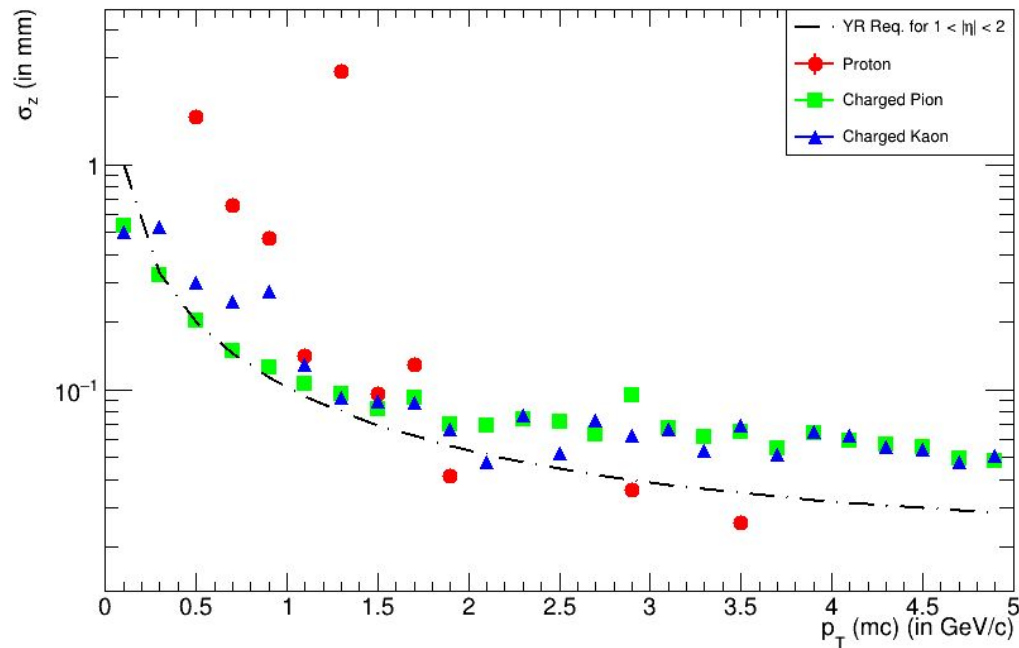
Fitted value of par[2]=Sigma



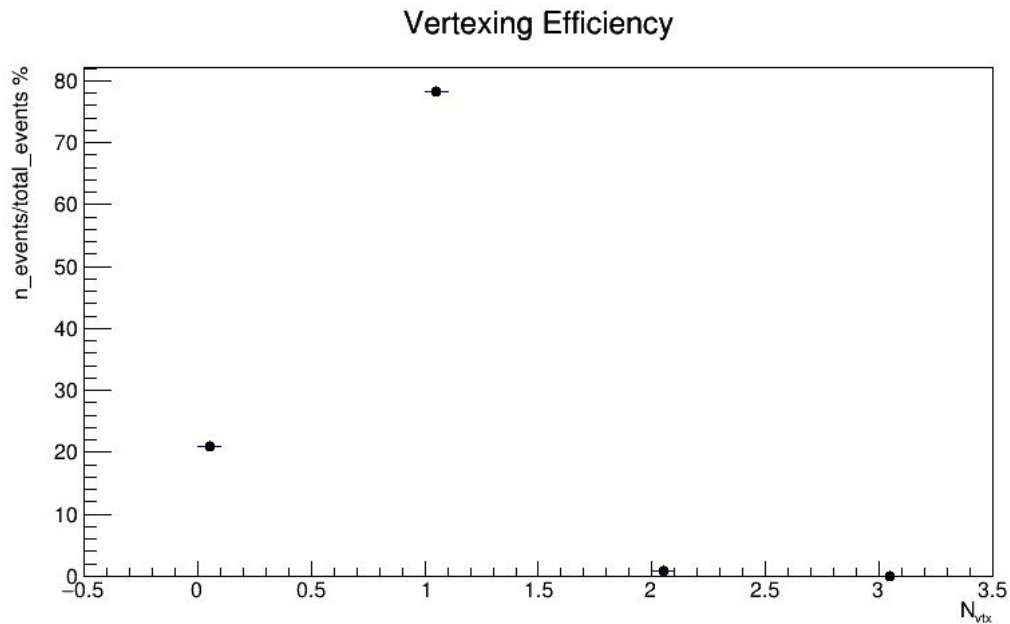
Pointing Resolution: z_{pca} (Particle Species Dependence)

$$1 < |\eta| < 2$$

Fitted value of par[2]=Sigma

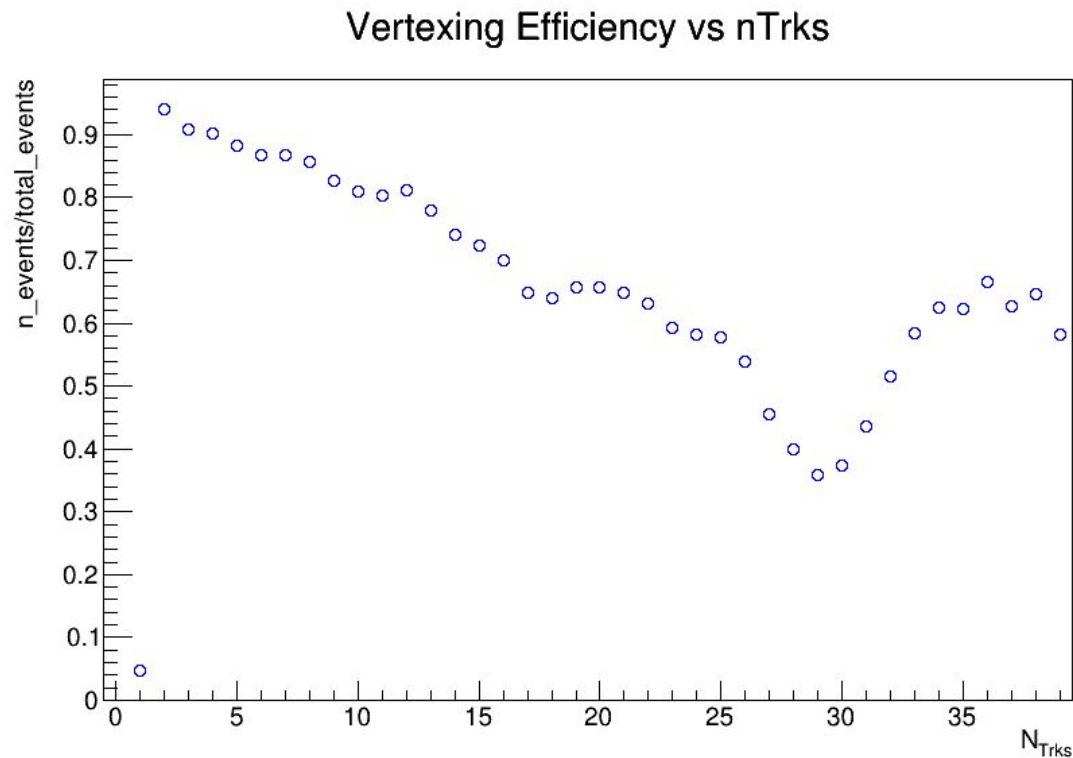


Vertexing Efficiency



80% of total events have a
reconstructed vertex

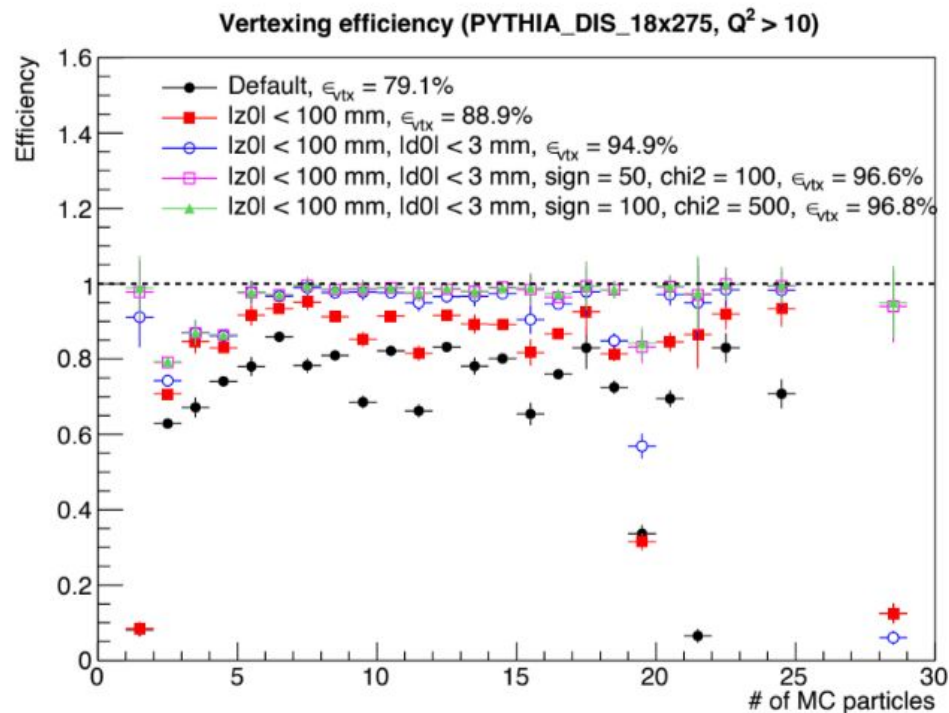
Vertexing Efficiency versus No. of Reconstructed Tracks



Study of Vertexing Efficiency

- Filtering tracks too far away from (0, 0, 0)

Rongrong Ma

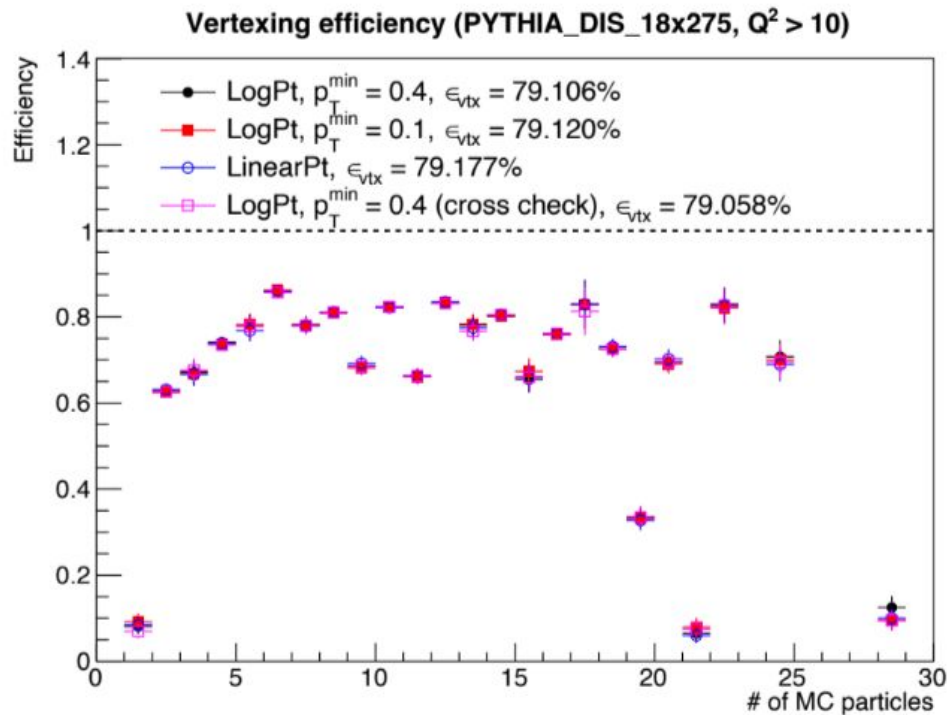


z₀ and d₀ cuts have the biggest impact.

Study of Vertexing Efficiency

- Applying cuts to pT weighting

Rongrong Ma



No visible difference.

To-Do List

- Study of vertex resolution for DIS events after applying the cuts to the Vertex Finder.
- Vertex resolution evaluation for events coming away from $(0, 0, 0)$