



Progress Report

14th December, 2023

Harsimran Singh

Lokesh Kumar

Department of Physics, Panjab University
Chandigarh, INDIA

Outline

- Analysis general details
- Plots of total momentum (p), eta (η) and p vs eta for associated truth (MC) and associated reconstructed (RC) particles
- Plots of total momentum resolution ($p_{\text{rec}} - p_{\text{mc}}$) vs truth total momentum (p_{mc}) for all the vertex positions
- Plots of resolution of radius ($r_{\text{rec}} - r_{\text{mc}}$) & z component ($z_{\text{rec}} - z_{\text{mc}}$) for all the vertex positions

Simulation/Analysis General Details

- Particle Thrown: Muon
- Number of Events: 1000
- Gun Multiplicity i.e. Muons thrown per event: 10
- Distribution used: uniform, so it will be flat in theta
- Min. Muon Momentum: 0 GeV
- Max. Muon Momentum: 10 GeV
- Gun Direction: (0.000 0.000 1.000) //default
- Compact File: \$DETECTOR_PATH/\$DETECTOR_CONFIG.xml

Simulation was run for 4 different Gun Positions i.e. vertices (1000 events each):

1. Gun Position: (0.0 0.0 0.0) // $r = 0$ mm, $z = 0$ mm (default)
2. Gun Position: (0.0 0.0 5.0) // $r = 0$ mm, $z = 5$ mm
3. Gun Position: (5.0 0.0 0.0) // $r = 5$ mm, $z = 0$ mm
4. Gun Position: (3.0 4.0 5.0) // $r = 5$ mm, $z = 5$ mm

Variables Details:

The analysis is done using associated particles from *MCTrackerParticleAssociationCollection*

And,

p_{rec} : Reconstructed total momentum

p_{mc} : Truth(MC) total momentum

r_{rec} : Reconstructed vertex position r (accessed as *CentralCKFTrackParameters.getLoc().a*)

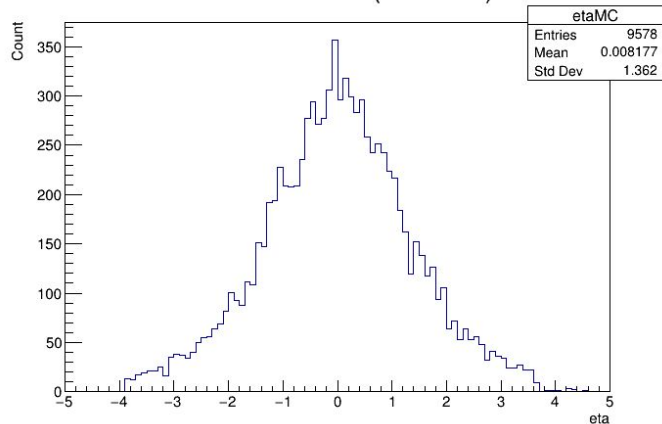
r_{mc} : Truth(MC) vertex position r

z_{rec} : Reconstructed vertex position z (accessed as *CentralCKFTrackParameters.getLoc().b*)

z_{mc} : Truth(MC) vertex position z

Plots: Eta and Momentum of MC and RC particles

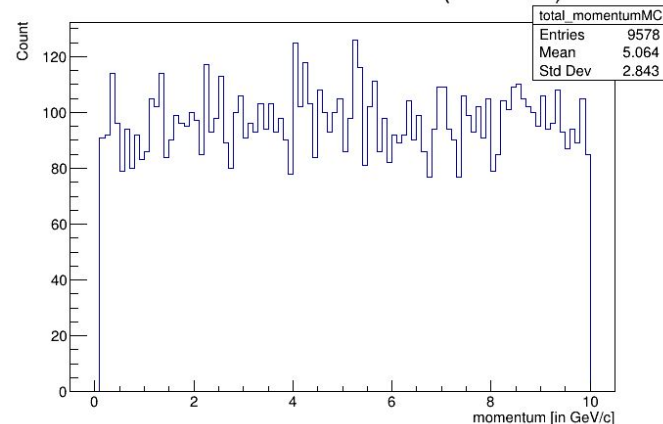
Eta of MC Particles (Associated)



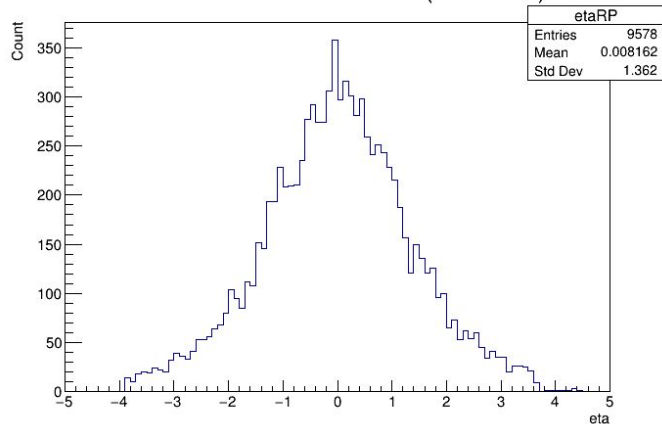
Vertex: (0,0,0)

MC Particles

Total momentum of MC Particles (Associated)

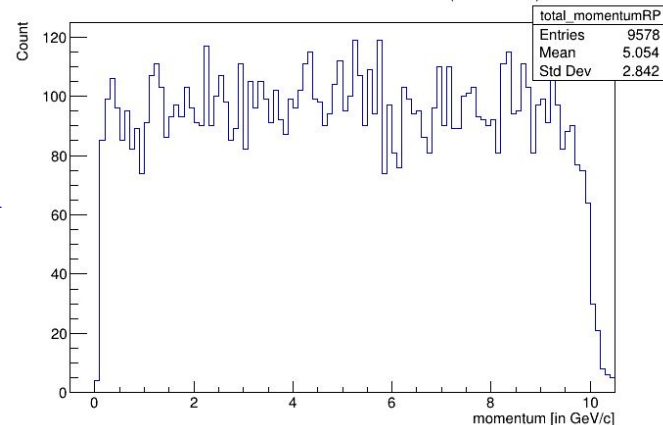


Eta of Reconstructed Particles (Associated)



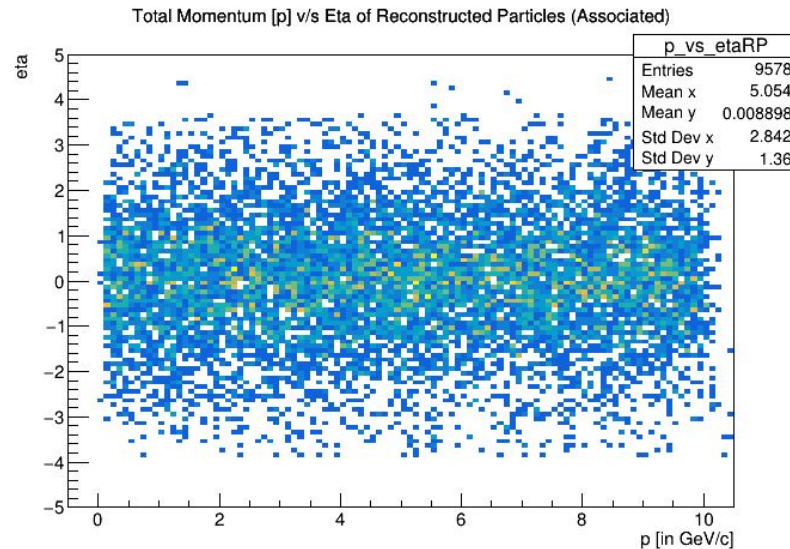
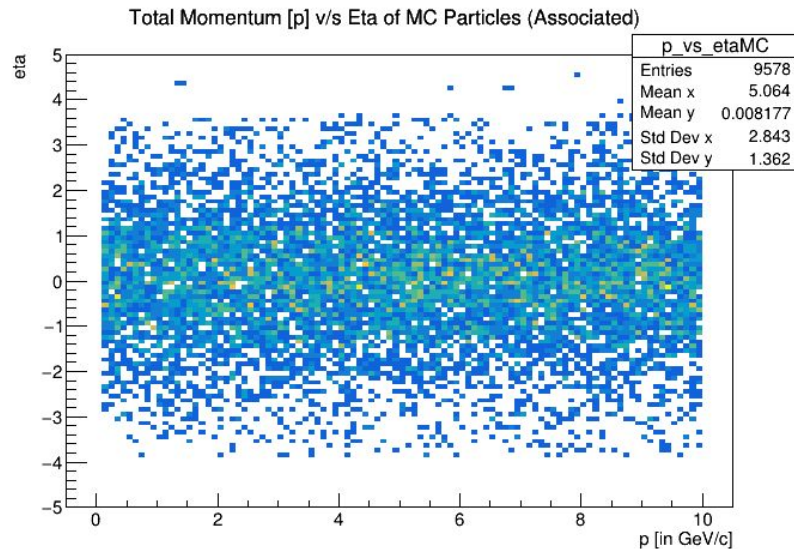
RC Particles

Total momentum of Reconstructed Particles (Associated)

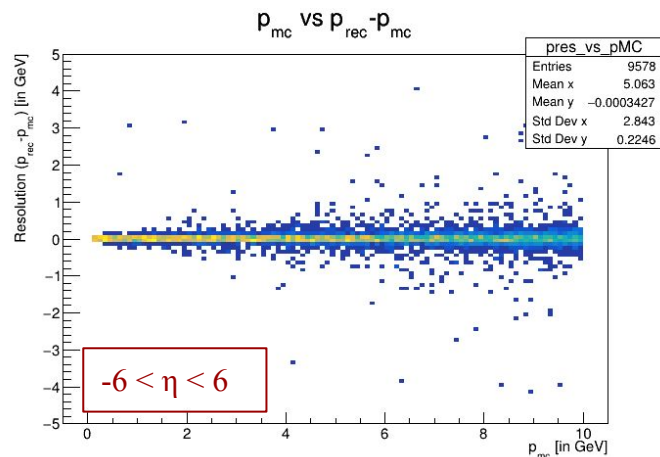


Plots: eta (η) vs total momentum (p) of MC and RC particles

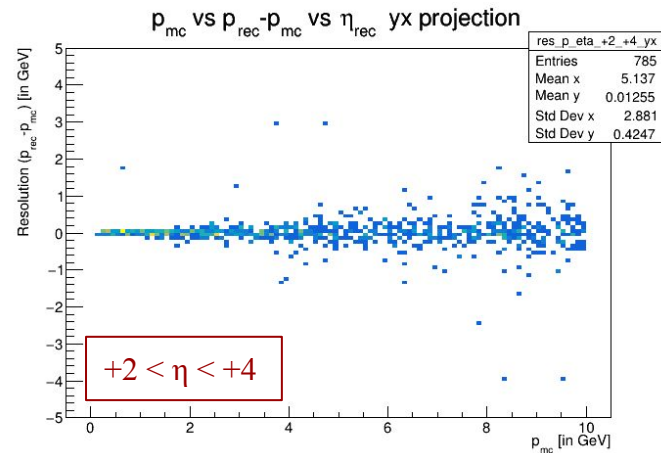
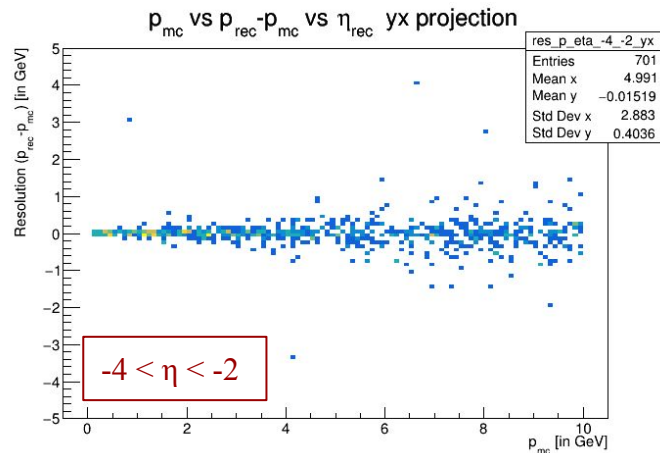
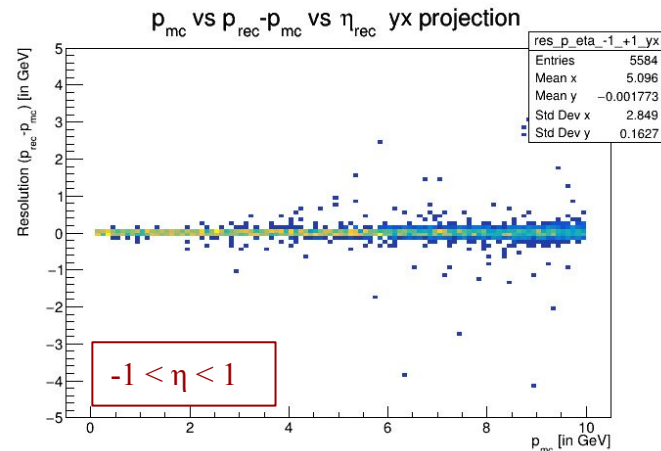
Vertex: (0,0,0)



Plots: $p_{\text{rec}} - p_{\text{mc}}$ vs p_{mc}



Vertex: (0,0,0)



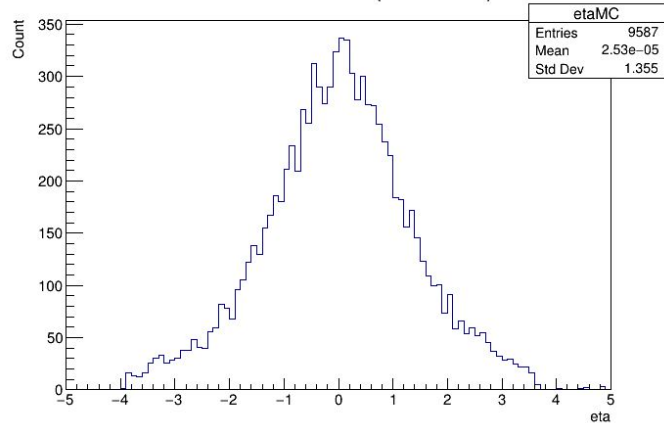
Plots: Eta and Momentum of MC and RC particles

Vertex: (0,0,5)

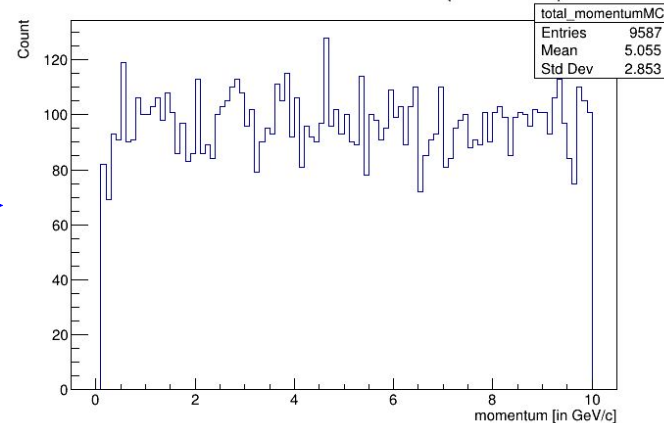
MC Particles

RC Particles

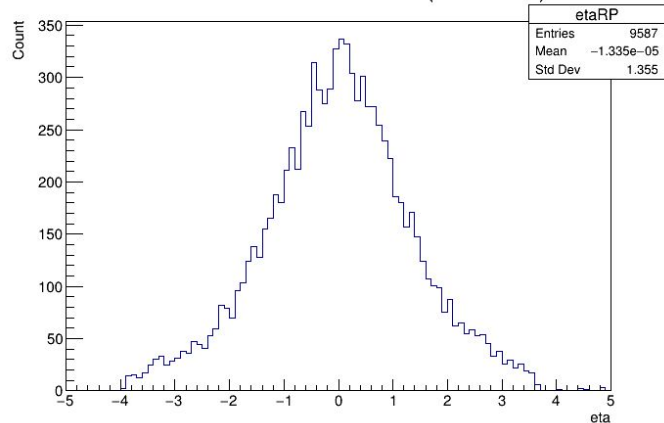
Eta of MC Particles (Associated)



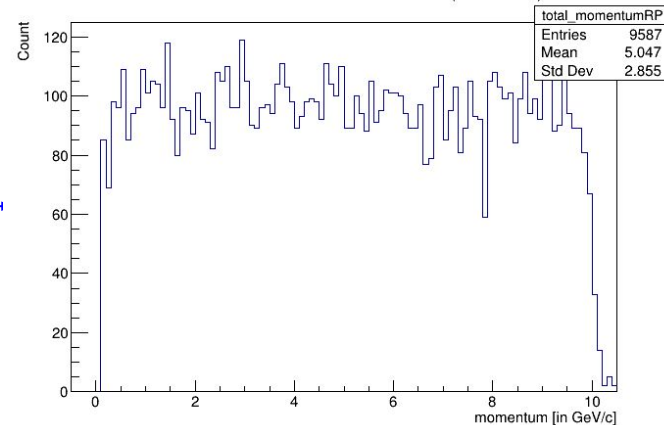
Total momentum of MC Particles (Associated)



Eta of Reconstructed Particles (Associated)

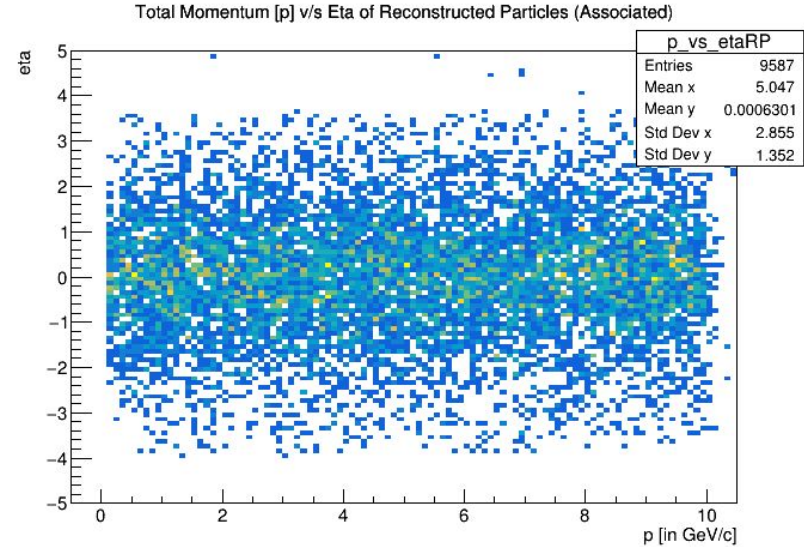
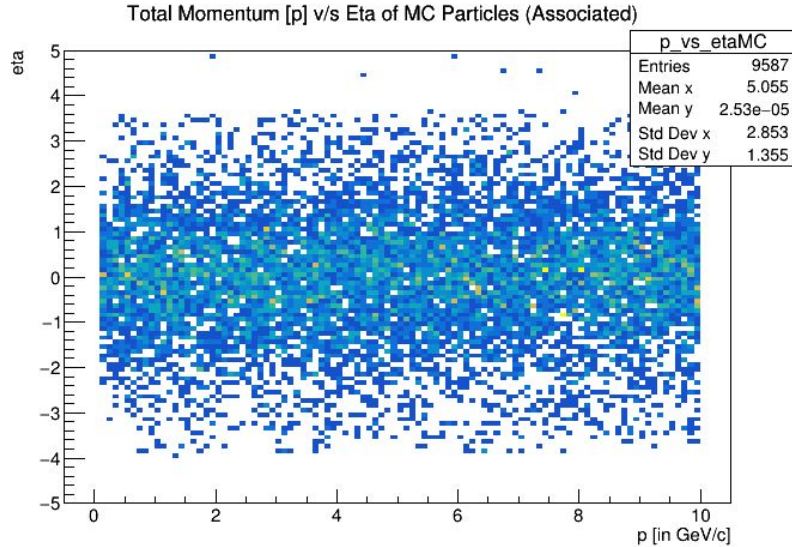


Total momentum of Reconstructed Particles (Associated)

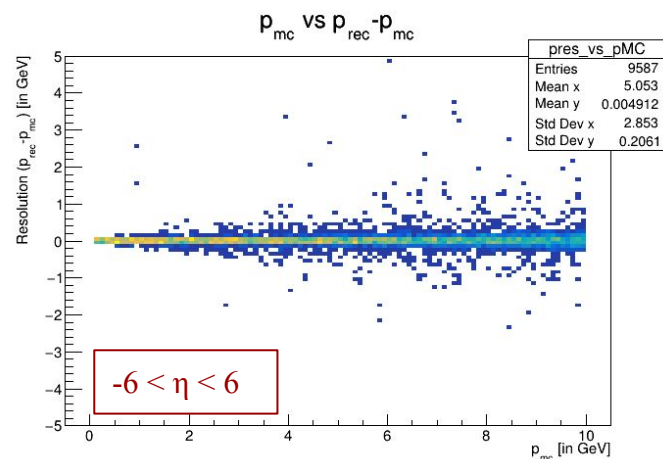


Plots: eta (η) vs total momentum (p) of MC and RC particles

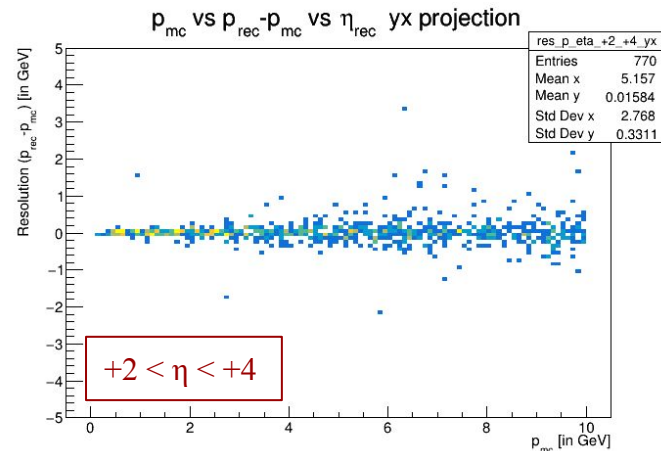
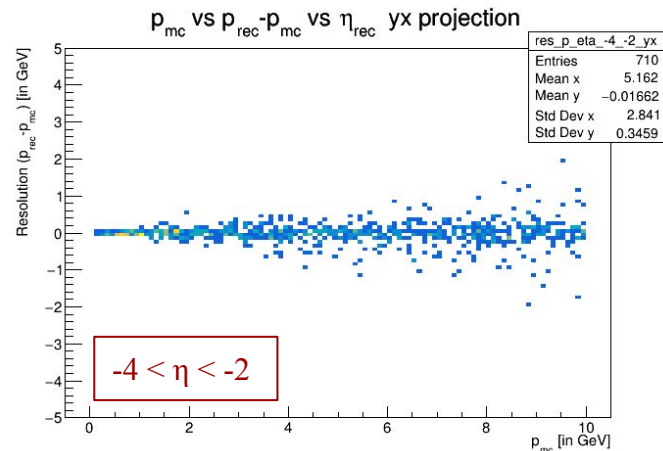
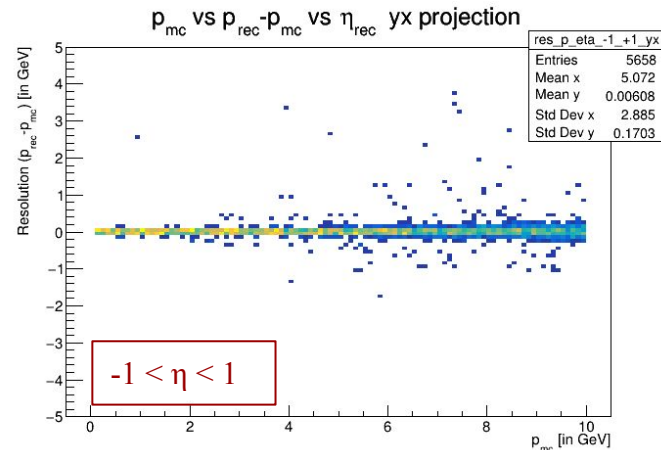
Vertex: (0,0,5)



Plots: $p_{\text{rec}} - p_{\text{mc}}$ vs p_{mc}

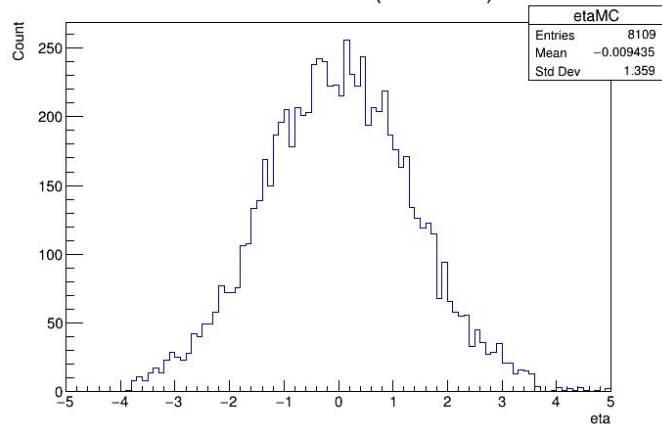


Vertex: (0,0,5)



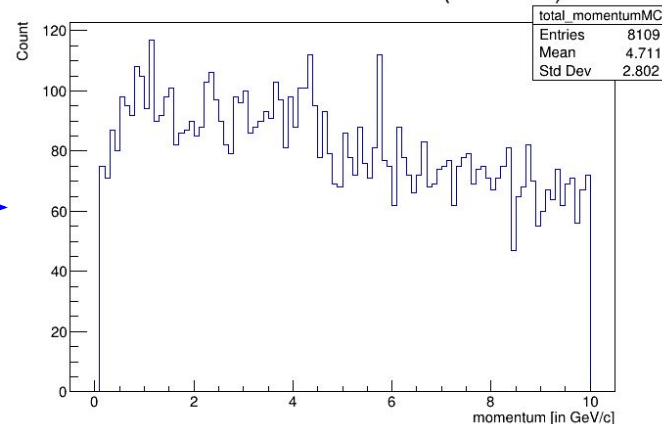
Plots: Eta and Momentum of MC and RC particles

Eta of MC Particles (Associated)



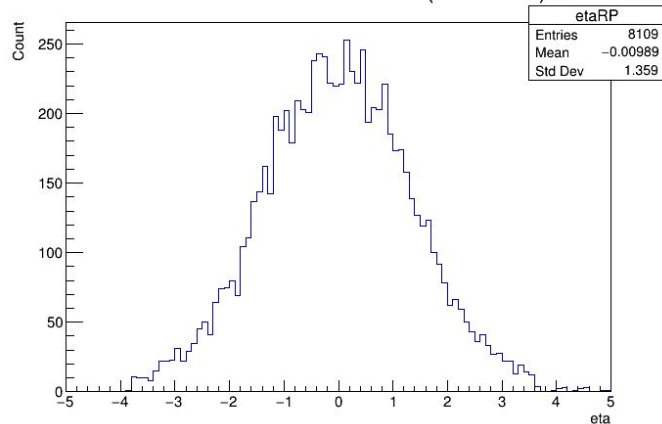
Vertex: (5,0,0)

Total momentum of MC Particles (Associated)

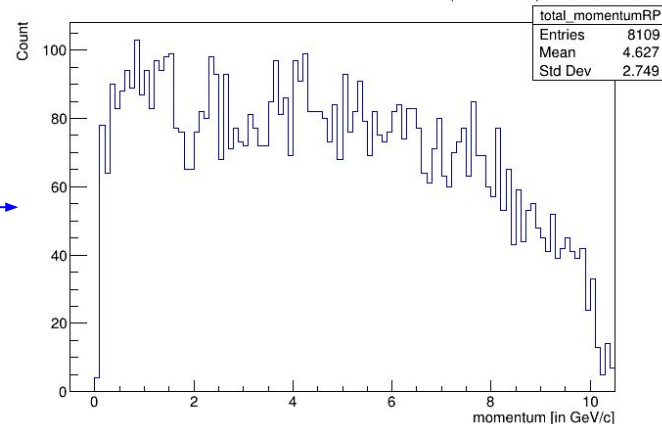


MC Particles

Eta of Reconstructed Particles (Associated)



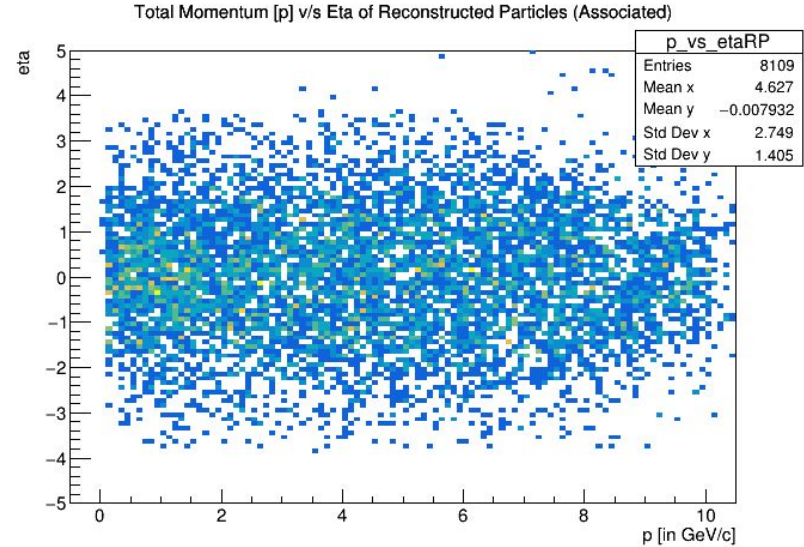
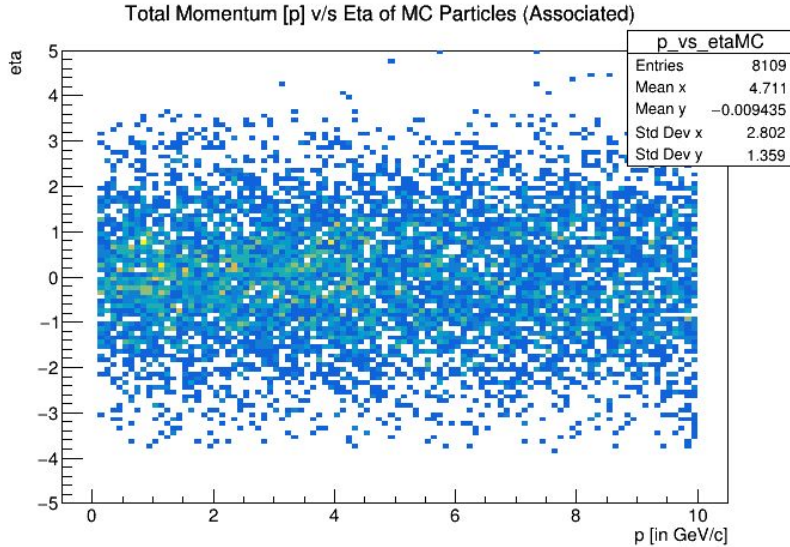
Total momentum of Reconstructed Particles (Associated)



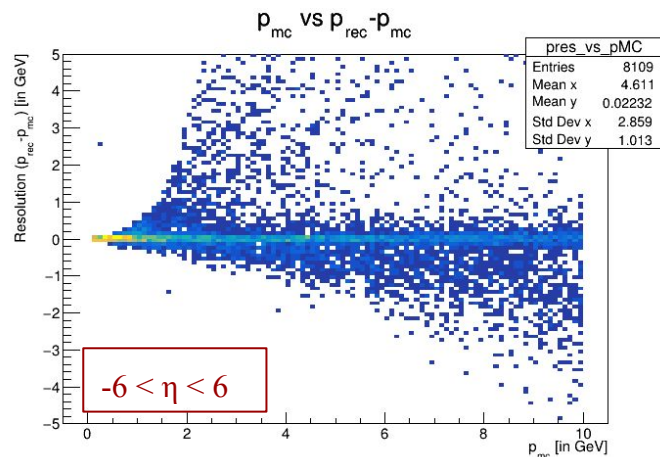
RC Particles

Plots: eta (η) vs total momentum (p) of MC and RC particles

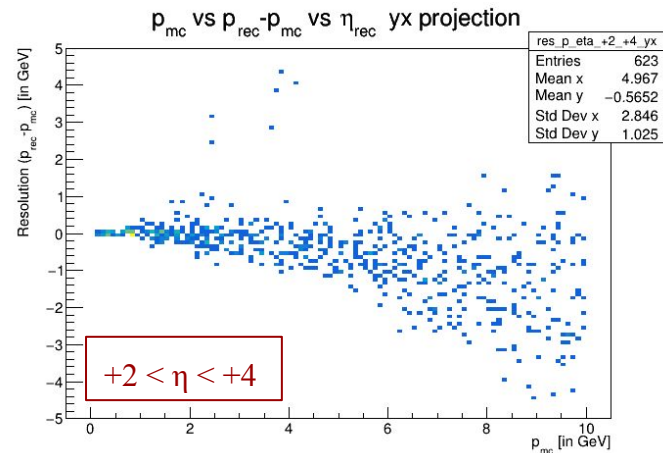
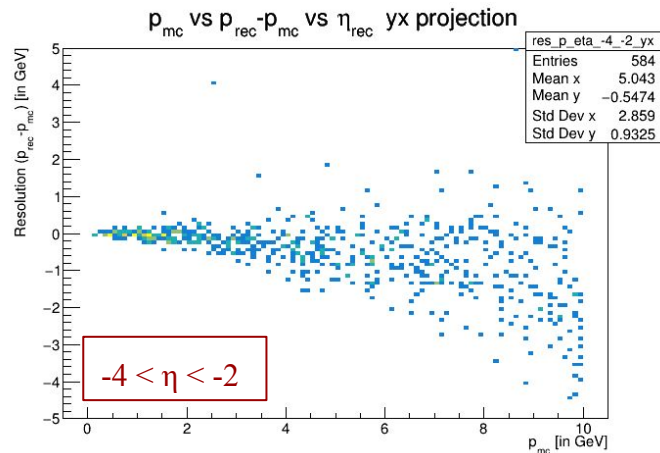
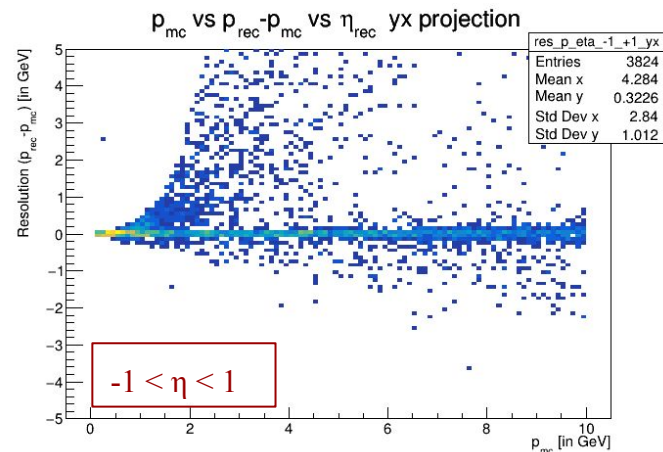
Vertex: (5,0,0)



Plots: $p_{\text{rec}} - p_{\text{mc}}$ vs p_{mc}

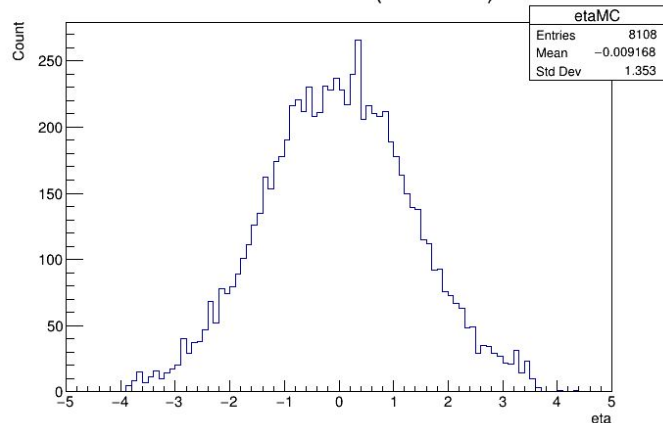


Vertex: (5,0,0)



Plots: Eta and Momentum of MC and RC particles

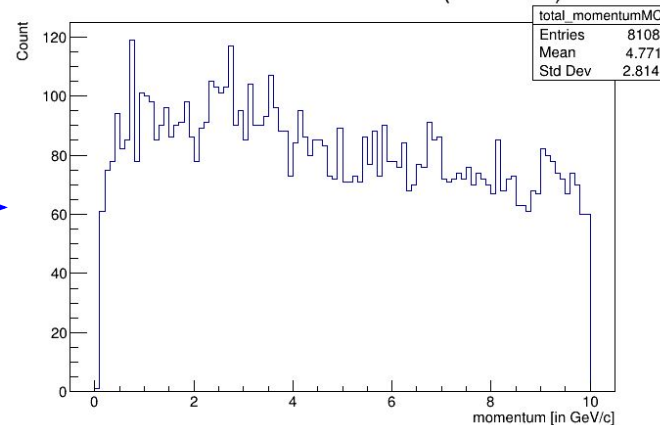
Eta of MC Particles (Associated)



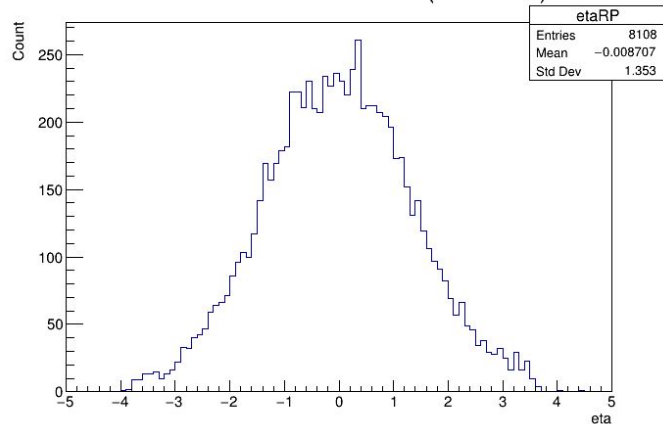
Vertex: (3,4,5)

MC Particles

Total momentum of MC Particles (Associated)

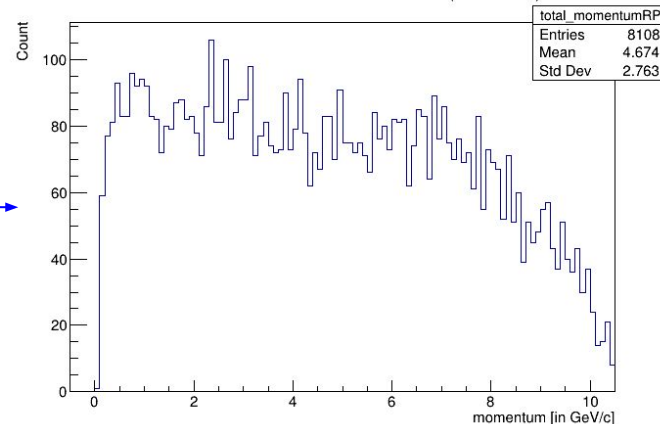


Eta of Reconstructed Particles (Associated)



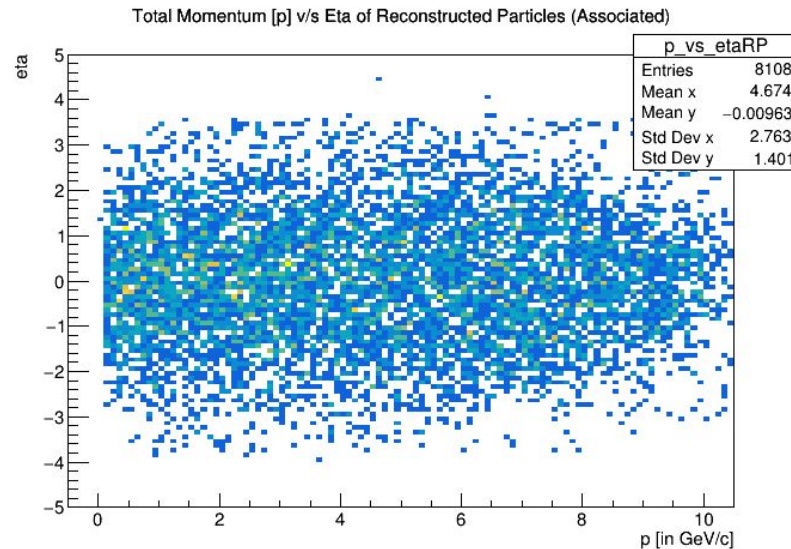
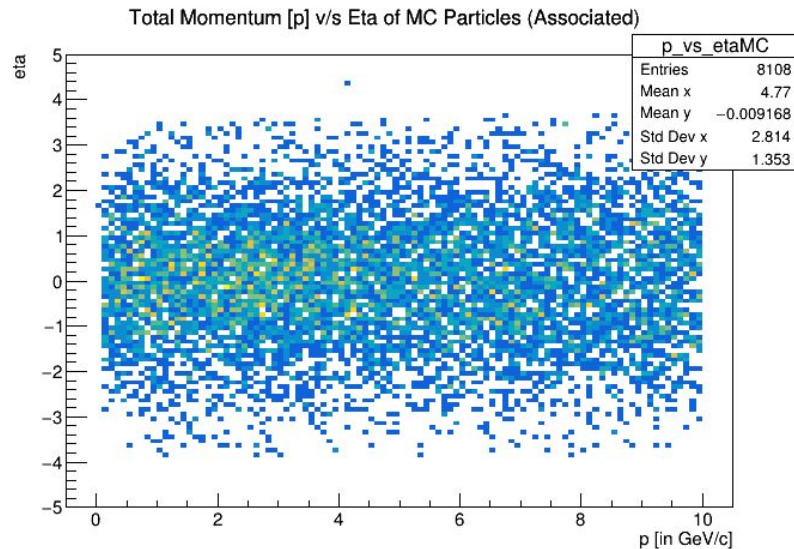
RC Particles

Total momentum of Reconstructed Particles (Associated)



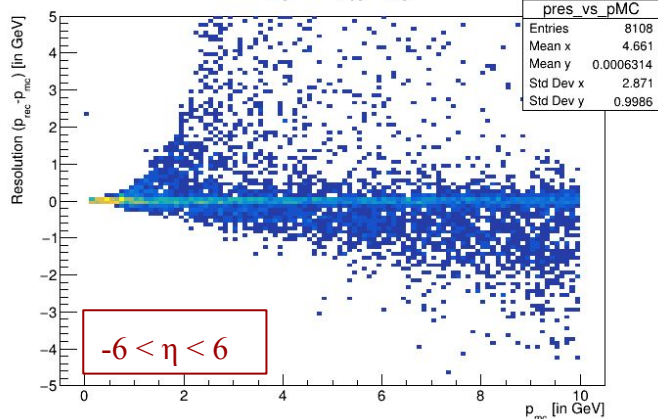
Plots: eta (η) vs total momentum (p) of MC and RC particles

Vertex: (3,4,5)



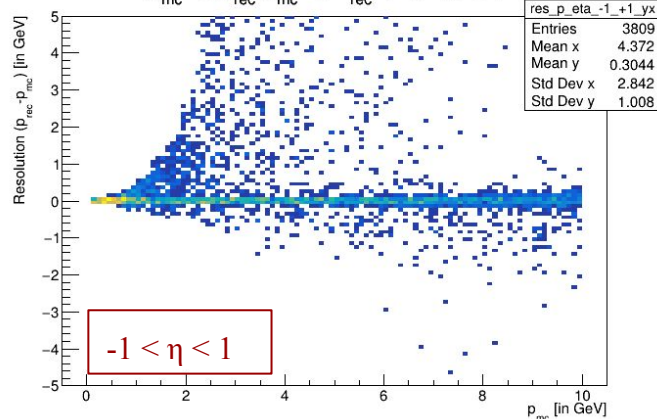
$p_{\text{rec}} - p_{\text{mc}}$ vs p_{mc}

p_{mc} vs $p_{\text{rec}} - p_{\text{mc}}$

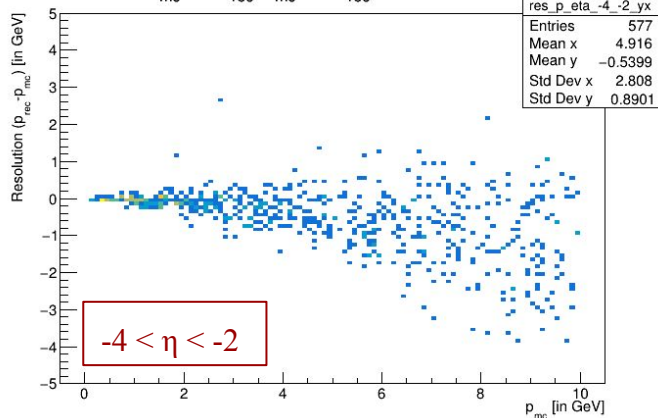


Vertex: (3,4,5)

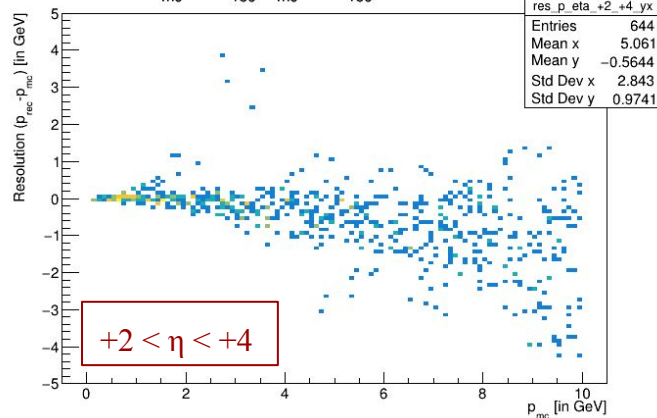
p_{mc} vs $p_{\text{rec}} - p_{\text{mc}}$ vs η_{rec} yx projection



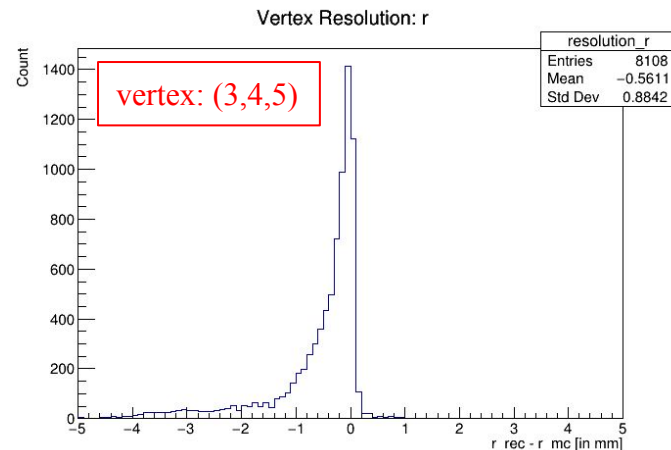
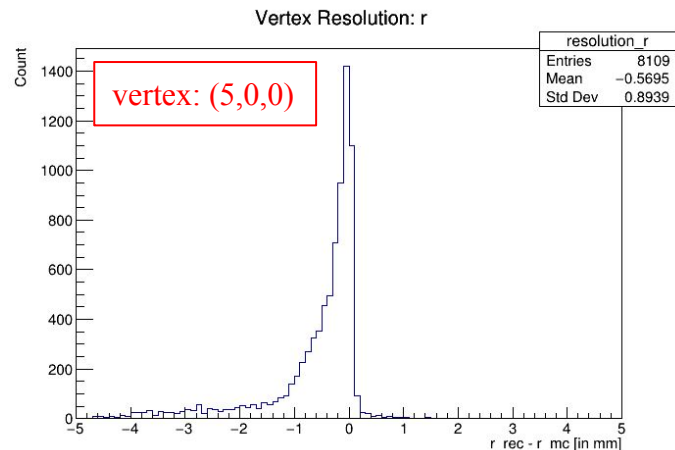
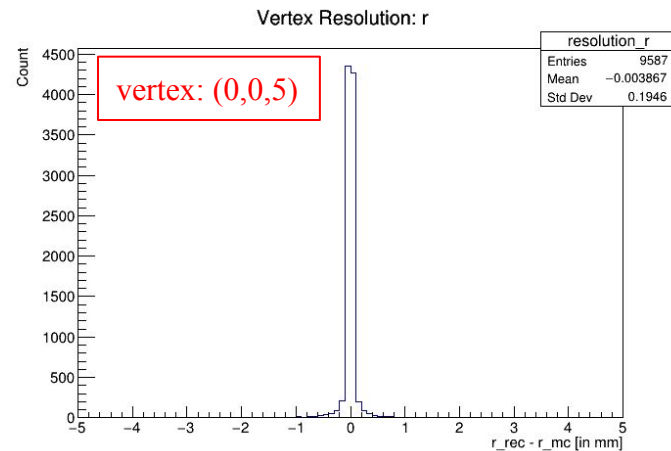
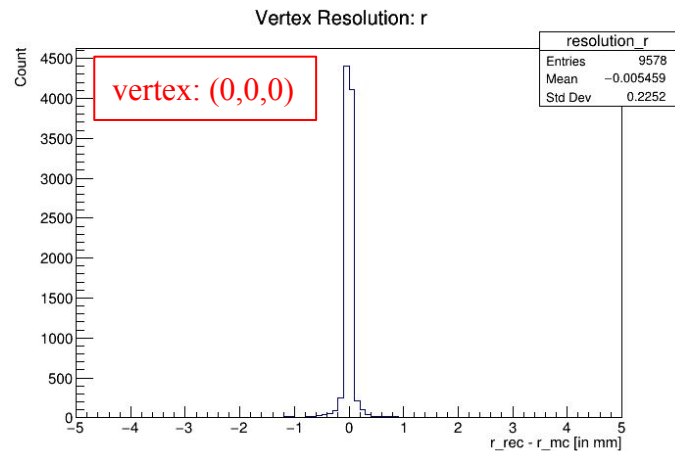
p_{mc} vs $p_{\text{rec}} - p_{\text{mc}}$ vs η_{rec} yx projection



p_{mc} vs $p_{\text{rec}} - p_{\text{mc}}$ vs η_{rec} yx projection

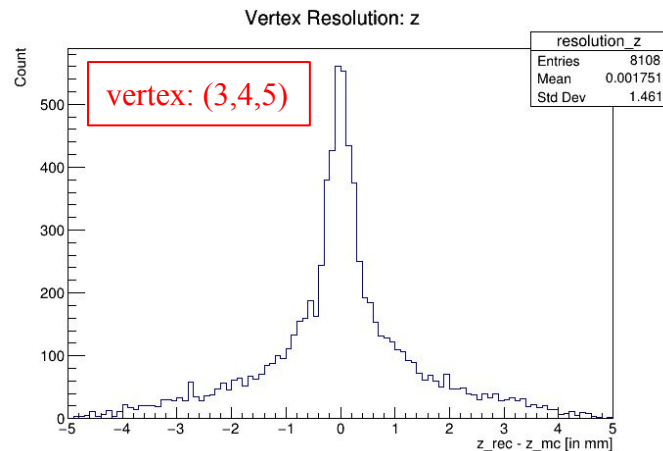
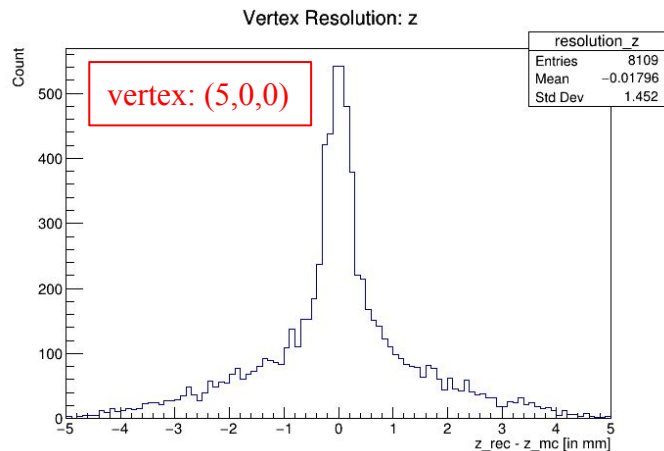
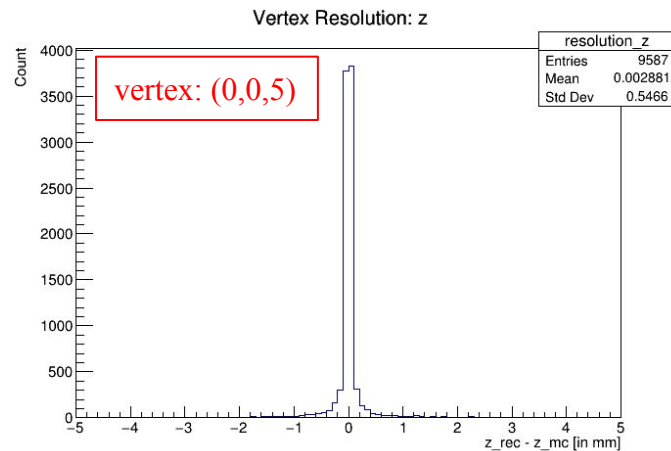
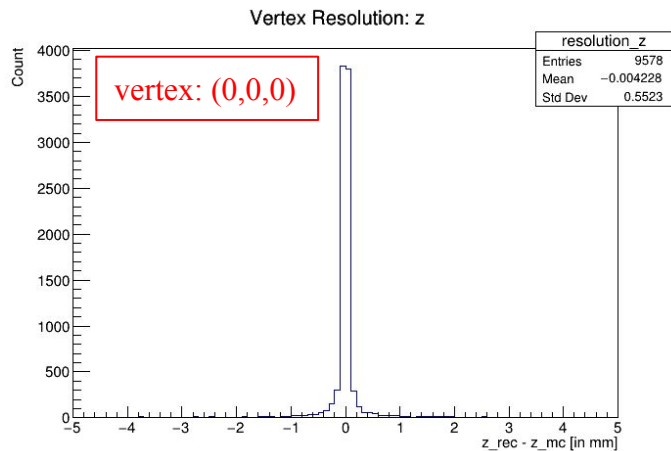


Plots: Comparison of $r_{\text{rec}} - r_{\text{mc}}$ for all the vertices



Possible explanation of the weird behaviour of resolution by Barak: <https://indico.bnl.gov/event/21496/#1-comparison-study-between-act>

Plots: Comparison of $z_{\text{rec}} - z_{\text{mc}}$ for all the vertices



Comments & further suggestions

Please provide your views about the work presented and suggestions about what should we do next.

Thank You!