Progress Report

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Suggestions from Joe:

- Start with single particle simulations: say muons thrown flat in momentum and flat in phi and theta
- Make histograms of things like the track position as a function of momentum, phi, and theta. Even better would be if histograms of the reconstructed track position - the thrown truth track position as a function of momentum, phi, and theta
- Explore PODIO output file and see if we can access reconstructed track positions

Suggestions from Xin:

- Use MC particles' (MCP) and reconstructed particles' (RP) associations
- Make graphs of transverse momentum (p_T) vs eta for MCP & RP
- Graph of ratio of p_T of RP & MCP i.e. efficiency plot

Simulation/Analysis General Details & commands

- Particle Thrown: Muon
- Number of Events: 1000
- 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 Position: (0.000 0.000 0.000) //default
- Gun Direction: (0.000 0.000 1.000) //default
- ddsim --steeringFile=steering1.py
  --compactFile=$DETECTOR_PATH/$DETECTOR_CONFIG.xml
  --outputFile=output1.edm4hep.root -G -N=1000
- eicrecon -Ppodio:output_file=result1.root output1.edm4hep.root

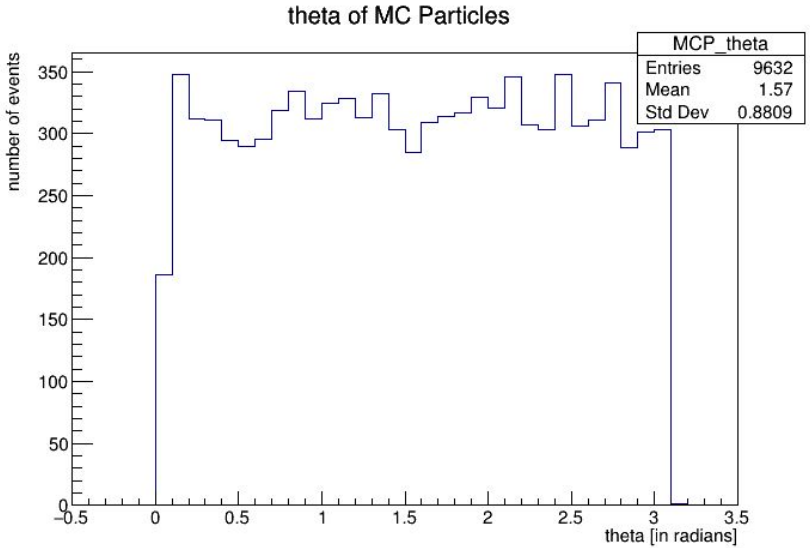
What is done?

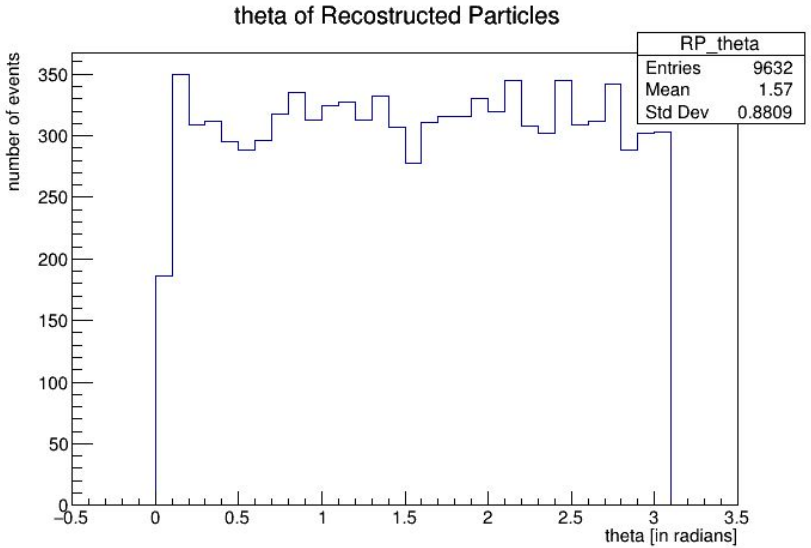
- Plots of theta, phi and eta of MCP and RP
- Plots of of p_T vs eta of MCP and RP
- Plots of energy, total momentum, p_T, p_x, p_y, p_z of MCP and RP and their difference
- Efficiency Plot

Please Note:

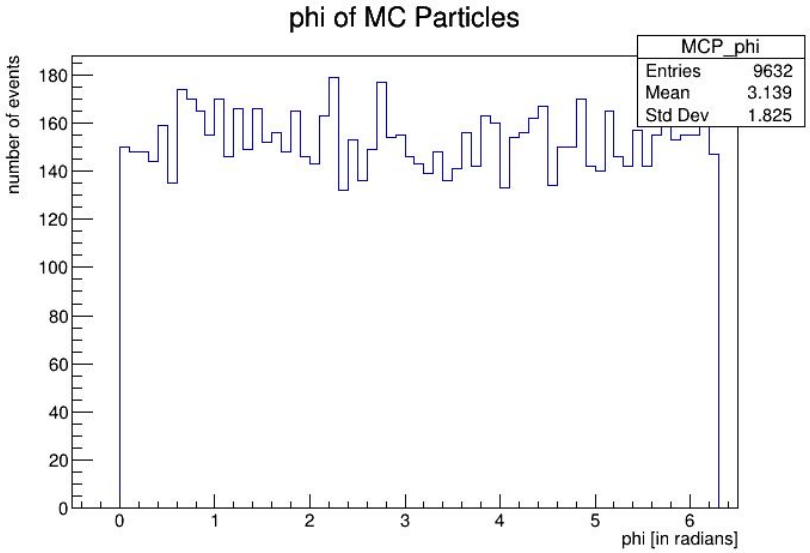
- Particles having PDG: 13 i.e. muon (both MCP and RP) and Generator Status: 1 are selected.
- Both MCP and RP are taken from “ReconstructedParticleAssociations” tag under “edm4eic::MCRecoParticleAssociationCollection”.
- MCP and RP having either p_x, p_y, p_z equal to zero are not selected in analysis.

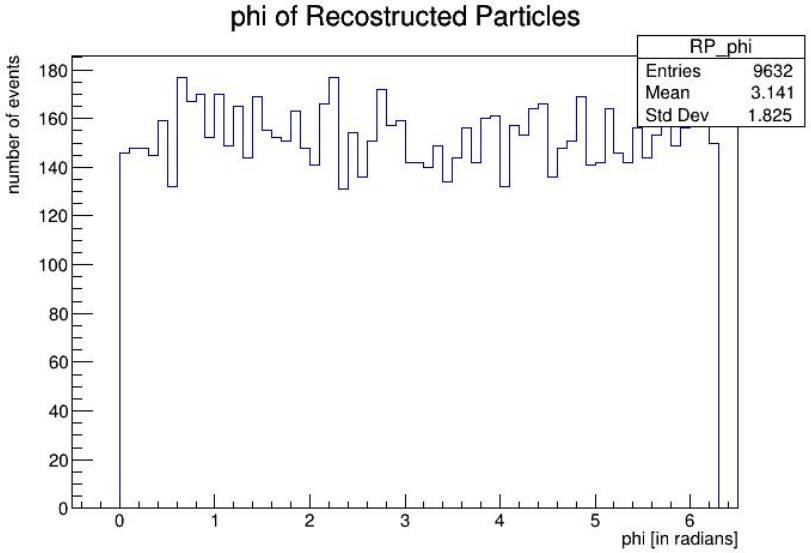
Results: Theta



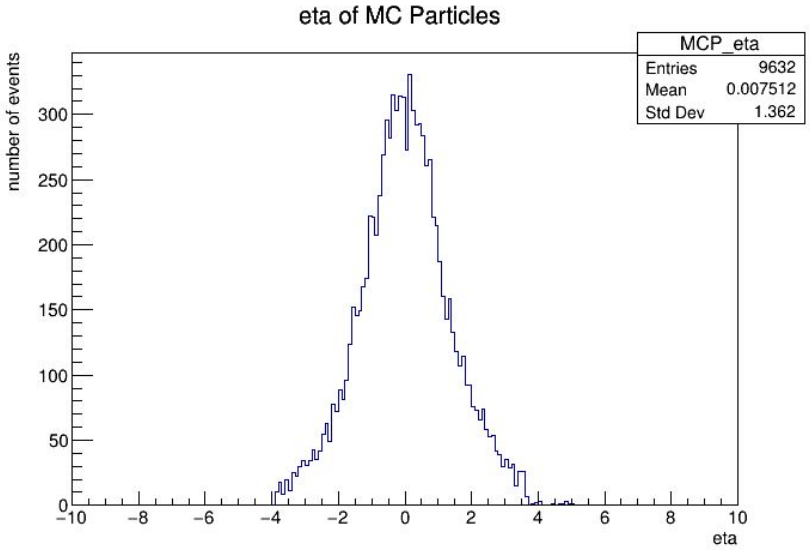


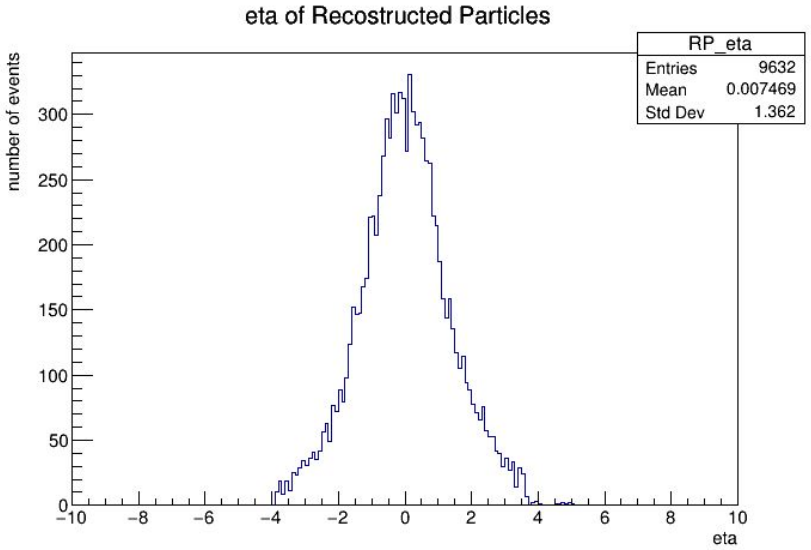
Results: Phi


phi of MC Particles
MCP_phi
Entries 9632
Mean 3.139
Std Dev 1.825
number of events
phi [in radians]

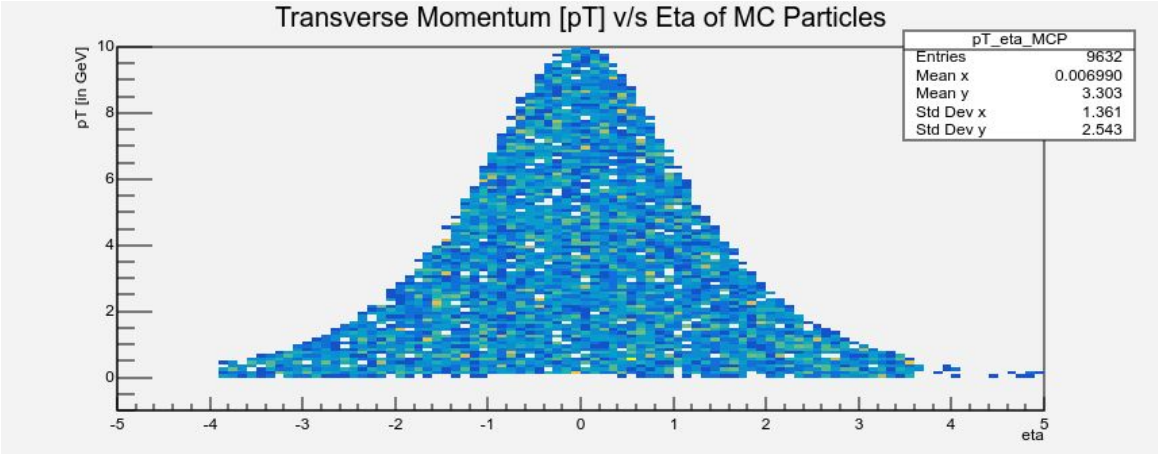

phi of Recostructed Particles
RP_phi
Entries 9632
Mean 3.141
Std Dev 1.825
number of events
phi [in radians]

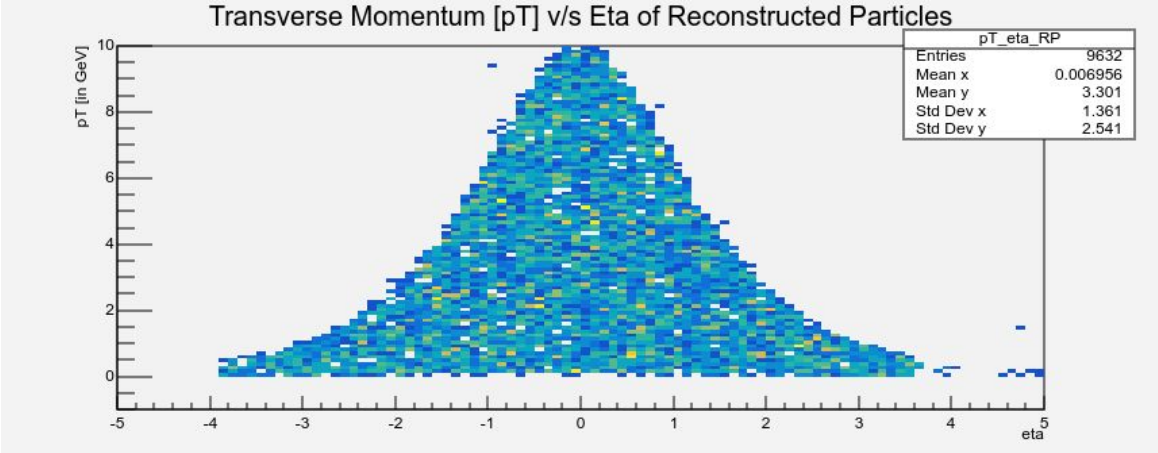
Results: Eta


eta of MC Particles
MCP_eta
Entries 9632
Mean 0.007512
Std Dev 1.362
number of events
eta

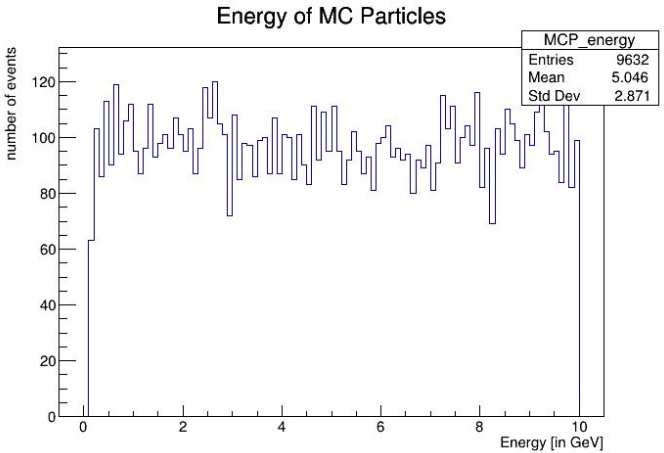

eta of Recostructed Particles
RP_eta
Entries 9632
Mean 0.007469
Std Dev 1.362
number of events
eta

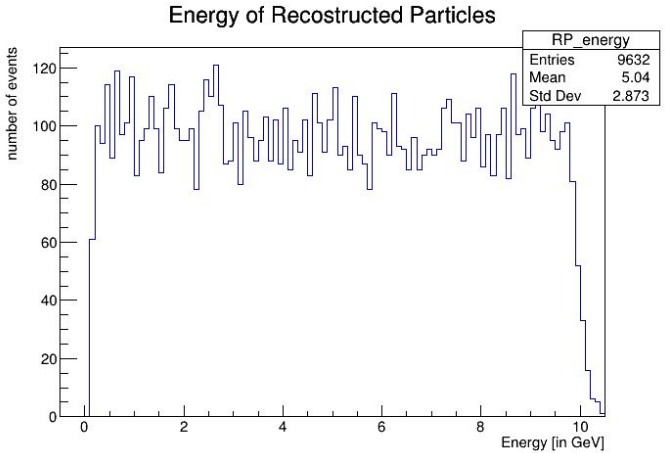
Results: p_T vs Eta

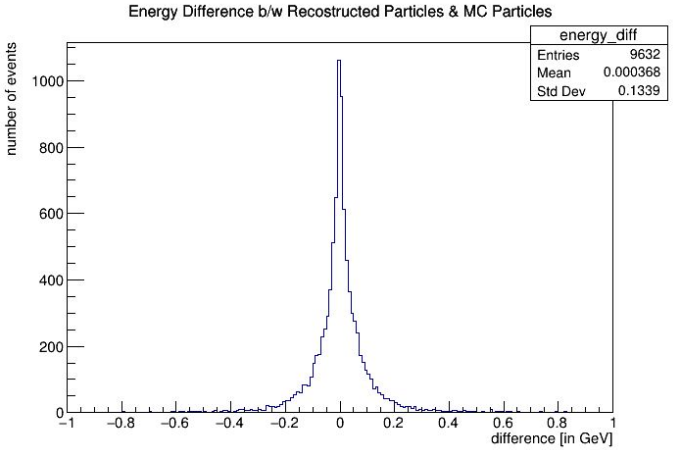




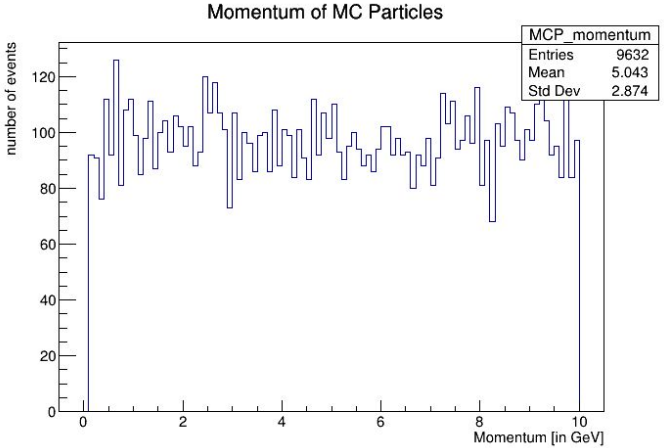
Results: Energy

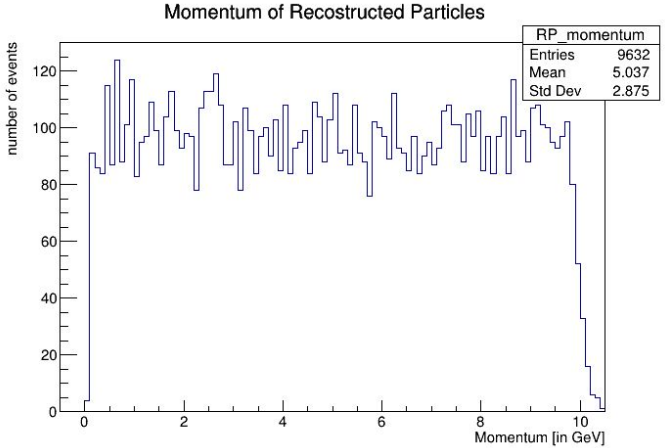


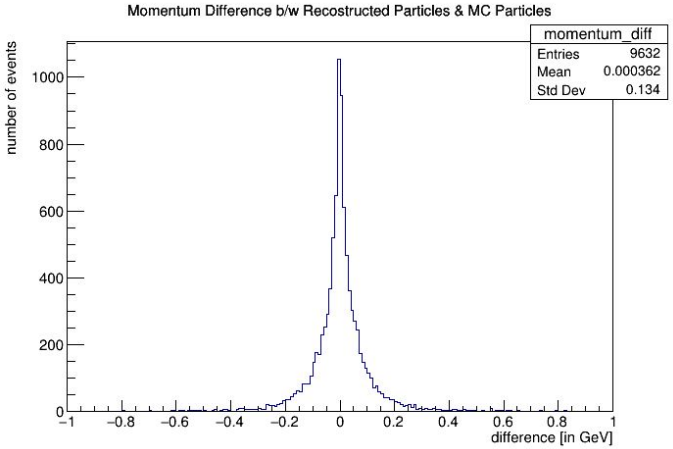




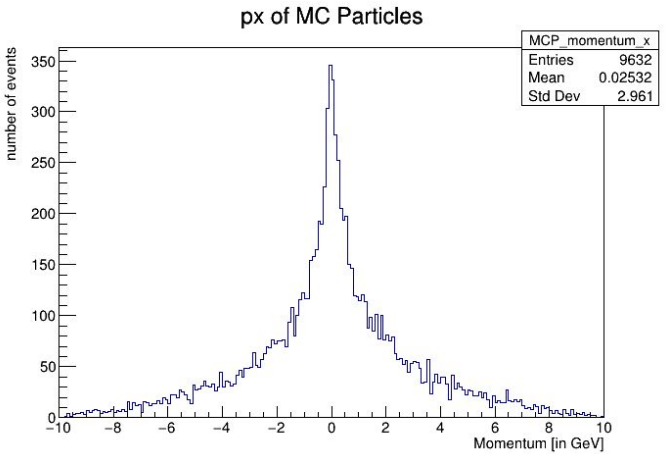
Results: Total Momentum

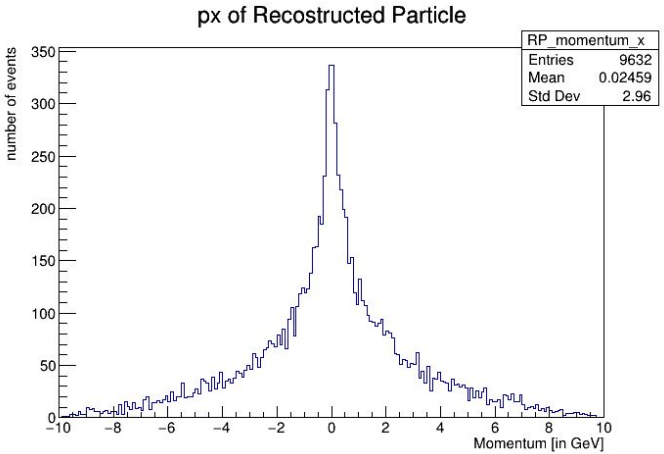


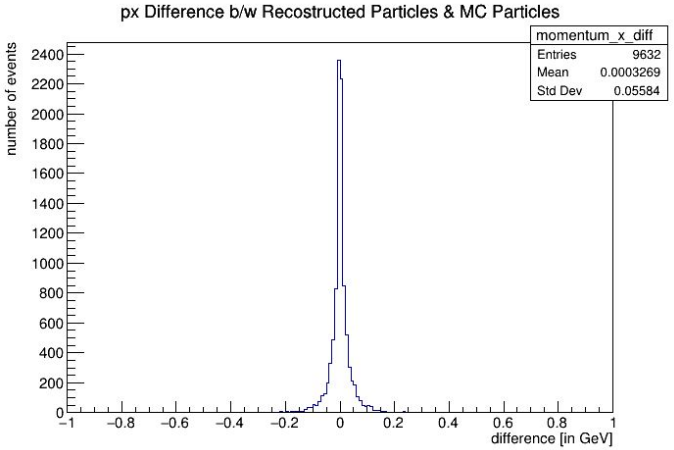




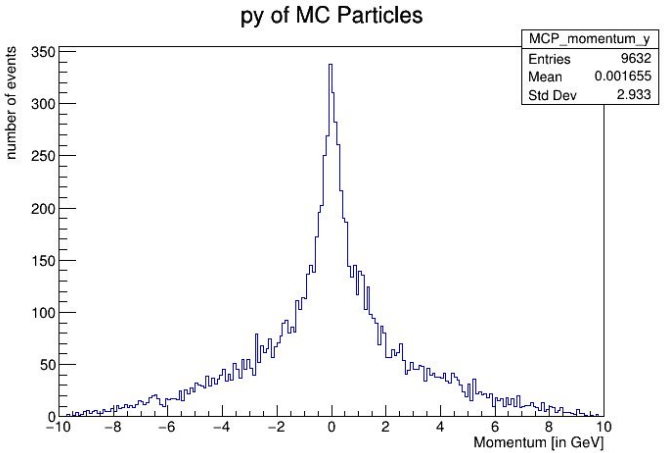
Results: p_x

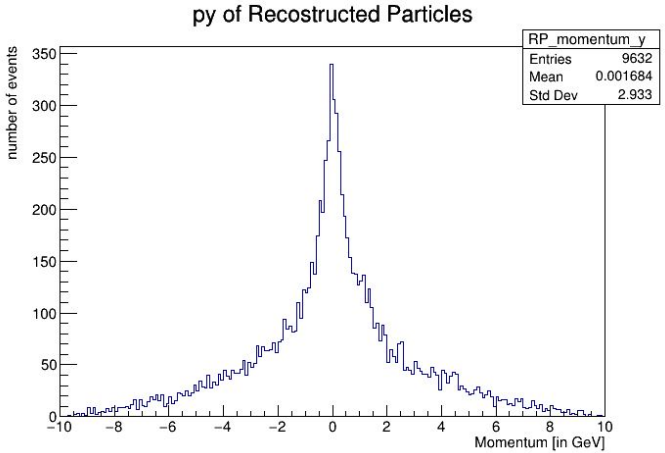

px of MC Particles
MCP_momentum_x
Entries 9632
Mean 0.02532
Std Dev 2.961
number of events
Momentum [in GeV]

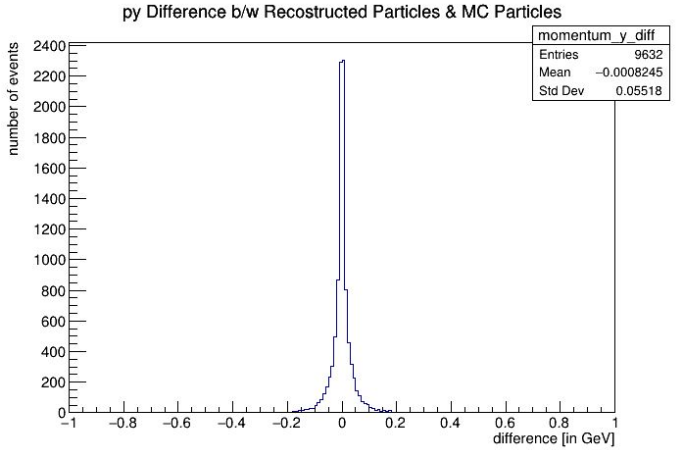

px of Recostructed Particle
RP_momentum_x
Entries 9632
Mean 0.02459
Std Dev 2.96
number of events
Momentum [in GeV]


px Difference b/w Recostructed Particles & MC Particles
momentum_x_diff
Entries 9632
Mean 0.0003269
Std Dev 0.05584
number of events
difference [in GeV]

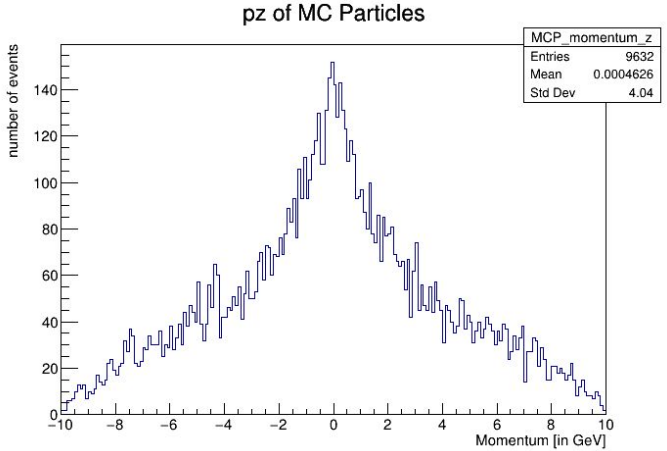
Results: p_y

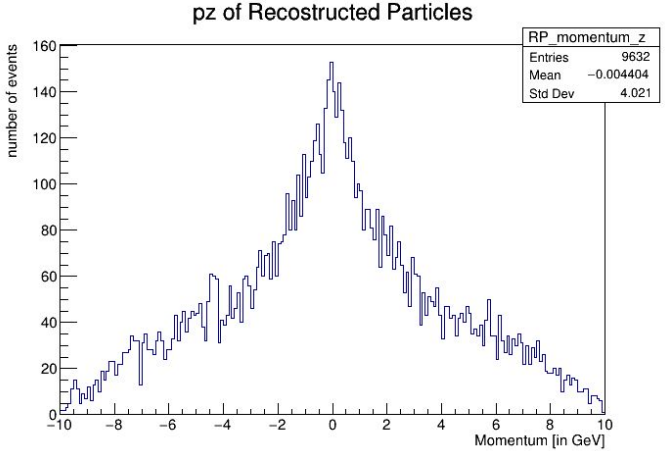

py of MC Particles
MCP_momentum_y
Entries 9632
Mean 0.001655
Std Dev 2.933
number of events
Momentum [in GeV]

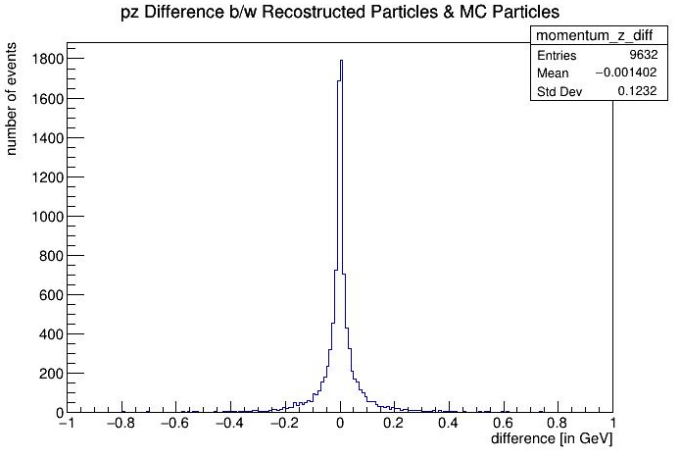

py of Recostructed Particles
RP_momentum_y
Entries 9632
Mean 0.001684
Std Dev 2.933
number of events
Momentum [in GeV]


py Difference b/w Recostructed Particles & MC Particles
momentum_y_diff
Entries 9632
Mean −0.0008245
Std Dev 0.05518
number of events
difference [in GeV]

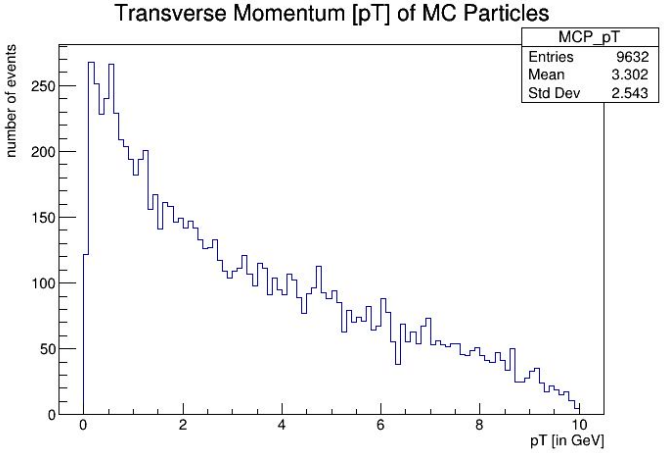
Results: p_z

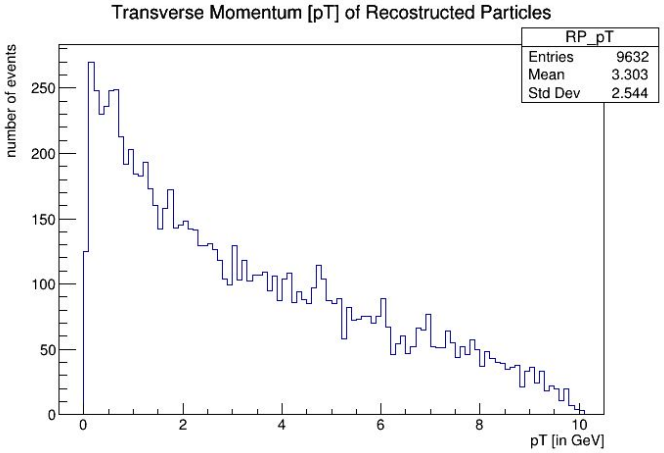

pz of MC Particles
MCP_momentum_z
Entries 9632
Mean 0.0004626
Std Dev 4.04
number of events
Momentum [in GeV]

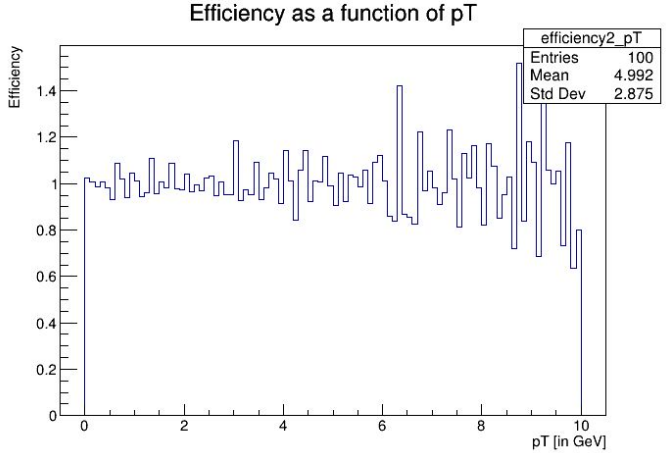

pz of Recostructed Particles
RP_momentum_z
Entries 9632
Mean −0.004404
Std Dev 4.021
number of events
Momentum [in GeV]


pz Difference b/w Recostructed Particles & MC Particles
momentum_z_diff
Entries 9632
Mean −0.001402
Std Dev 0.1232
number of events
difference [in GeV]

Results: p_T


Transverse Momentum [pT] of MC Particles
MCP_pT
Entries 9632
Mean 3.302
Std Dev 2.543
number of events
pT [in GeV]


Transverse Momentum [pT] of Recostructed Particles
RP_pT
Entries 9632
Mean 3.303
Std Dev 2.544
number of events
pT [in GeV]


Efficiency as a function of pT
efficiency2_pT
Entries 100
Mean 4.992
Std Dev 2.875
Efficiency
pT [in GeV]

Suggestions & further plan…

- Please provide your views about the work shown here and suggestions about what should we try to do next.
- I am currently exploring the PODIO output tree file. I got some information on reconstructed track positions in different detectors. I'll try to plot them as a function of momentum that we may get from accessing that detector's tag.

Thank you!