Simulation Results for the All-Silicon Tracker

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Simulation Details

- Simulation of 3M Pion- using PHG4ParticleGenerator in three magentic field configuration
- Momentum Range [0.,30.] GeV/c
- Eta Range [-3.7,3.7]
- Phi Range: [0., 2π]
- Pixel Size = 10 μm

Simplified geometry using Material (Fun4All) Information by Reynier Cruz Torres

```
double vtx_matBud  = 0.05; // % X/X0 (material budget of vertexing layers)
double barr_matBud = 0.55; // % X/X0 (material budget of middle layers)
double disk_matBud = 0.24; // % X/X0 (material budget of disk layers)
```

+

All Silicon Tracker+Two GEM Layers

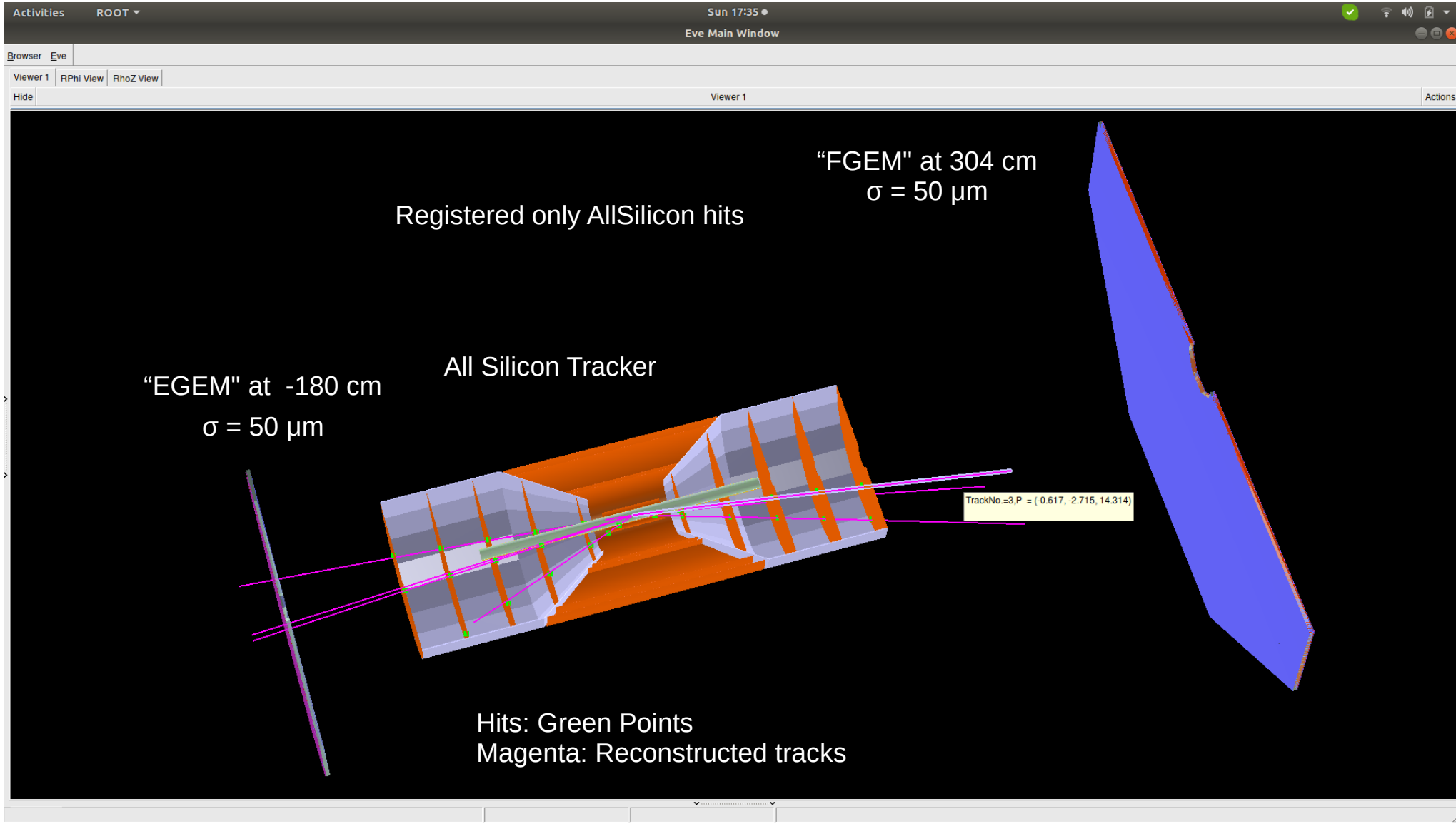
Two GEM Stations:
"EGEM" at -180.0 cm
"FGEM" at 304.0 cm

Mag field: EIC_Magnetic_Field_Map_2021_05_07

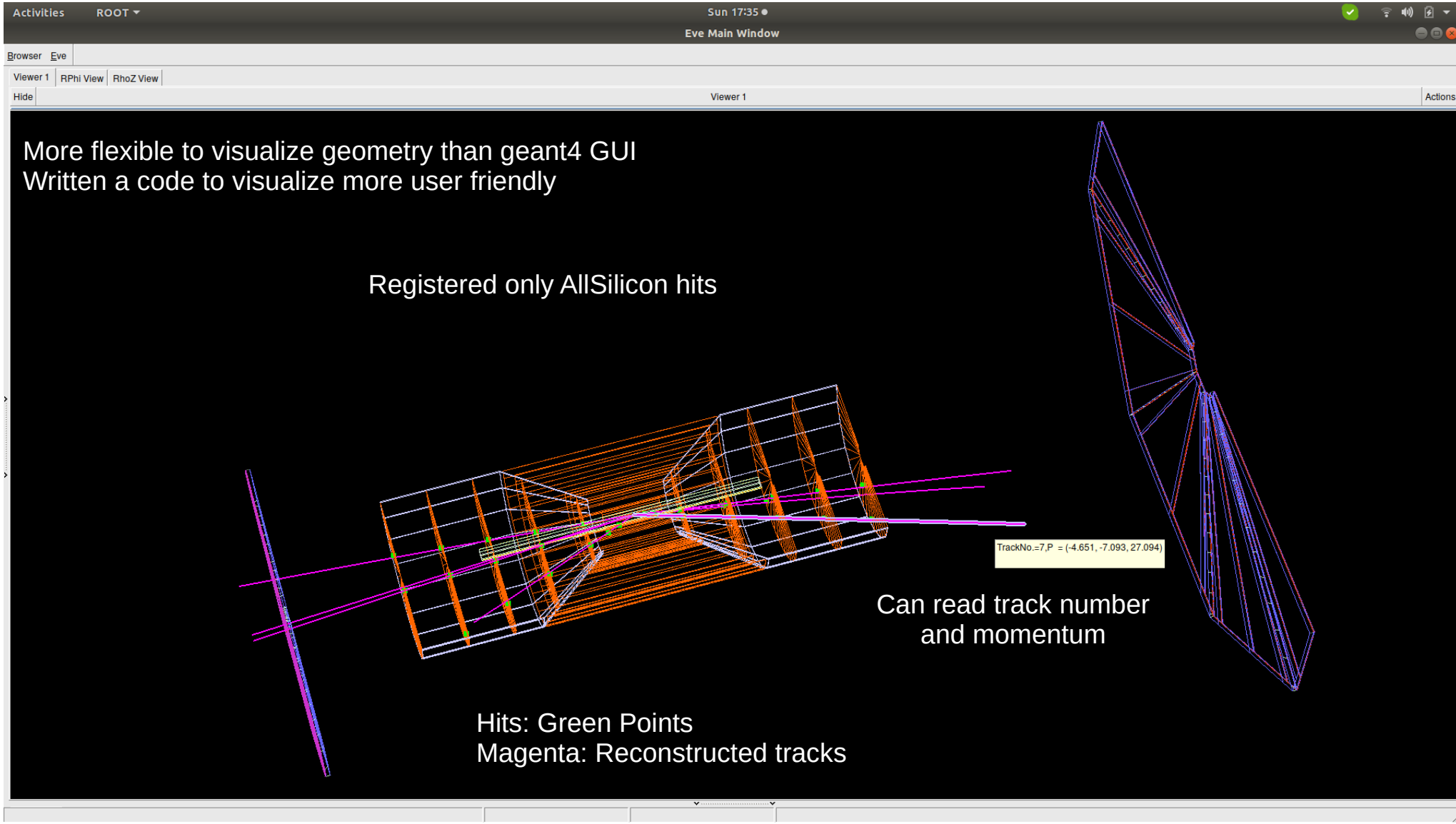
The code used Fun4All_G4_simplified_v2_new.C (Thanks to Reynier Cruz Torres)

As a beginner in this framework, I should first produce existing plots then go for the further improvements

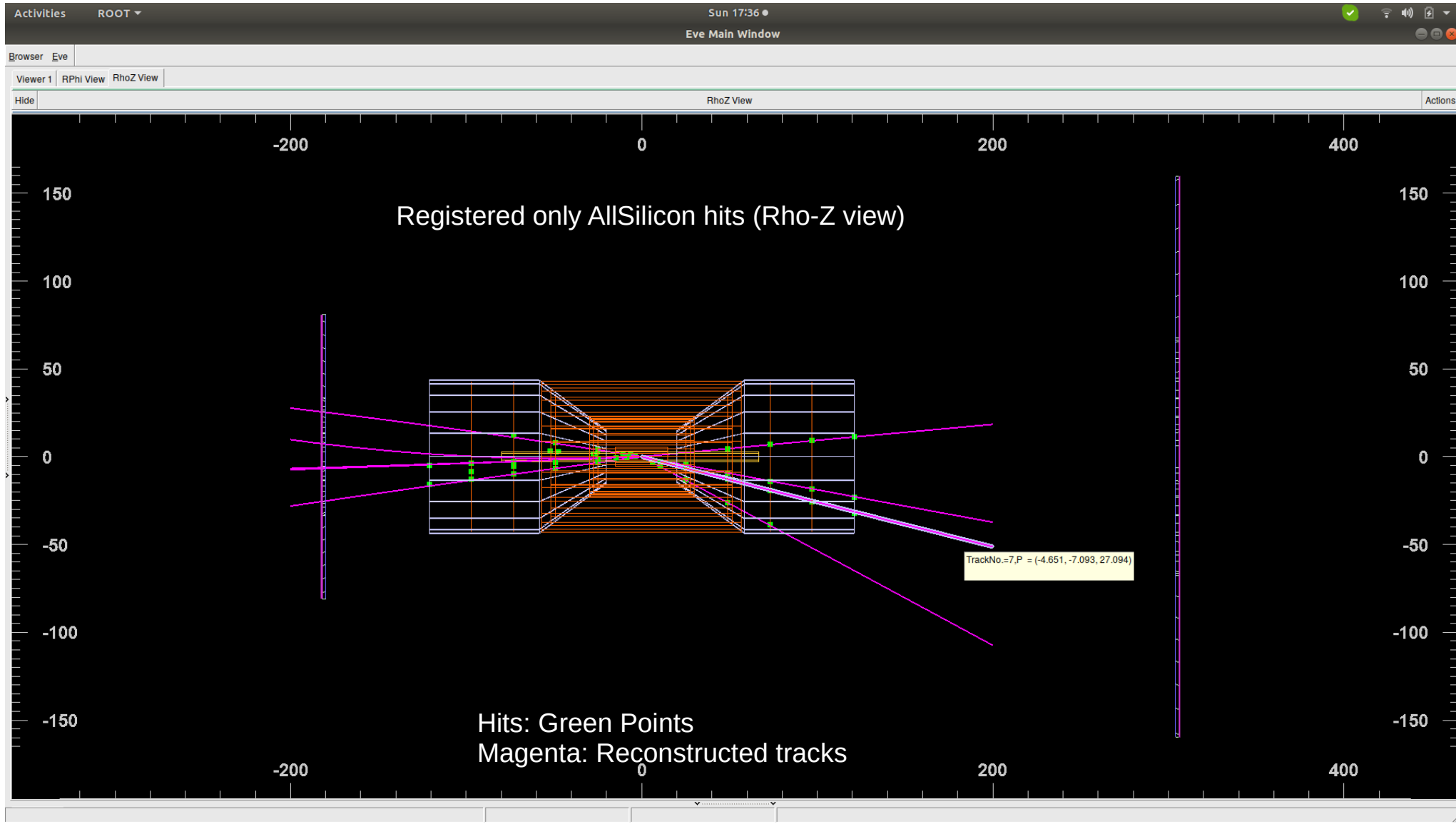
Geometry Visualization (TGeoManager and TEveManager)



Geometry Visualization (TGeoManager and TEveManager)

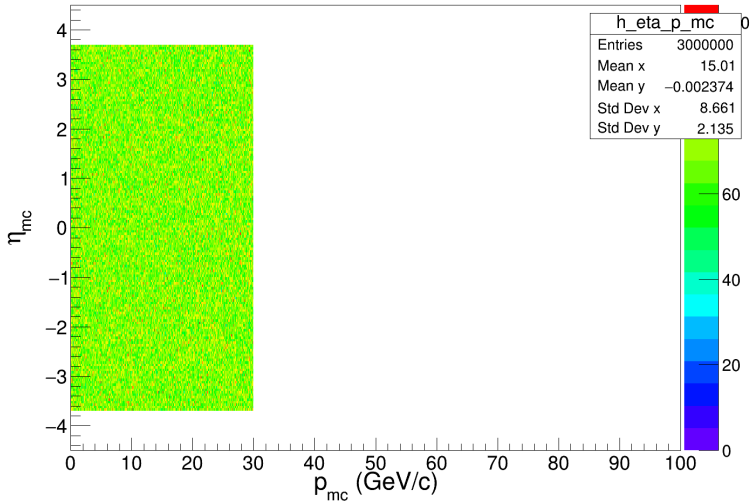


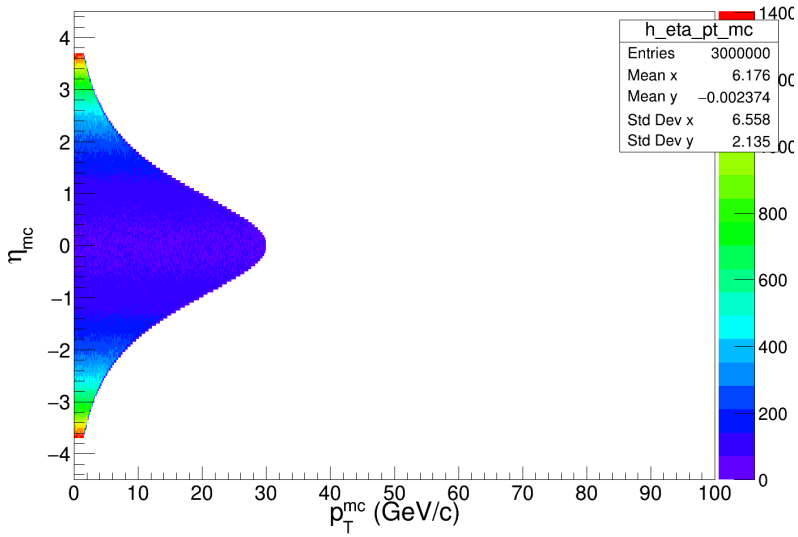
Geometry Visualization (TGeoManager and TEveManager)



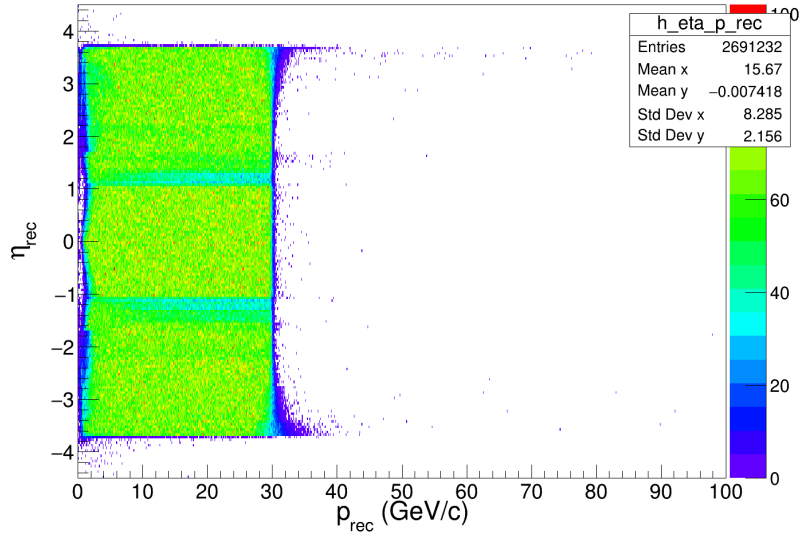
Simulation Results

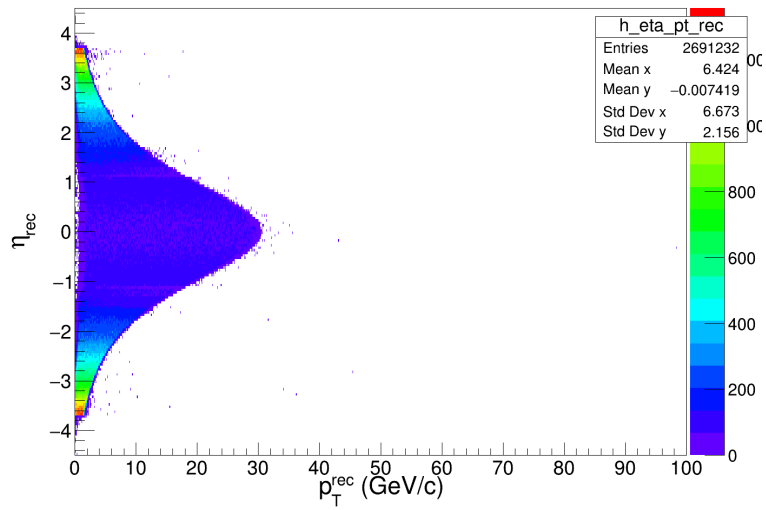
Generated: π^- uniform in η and p



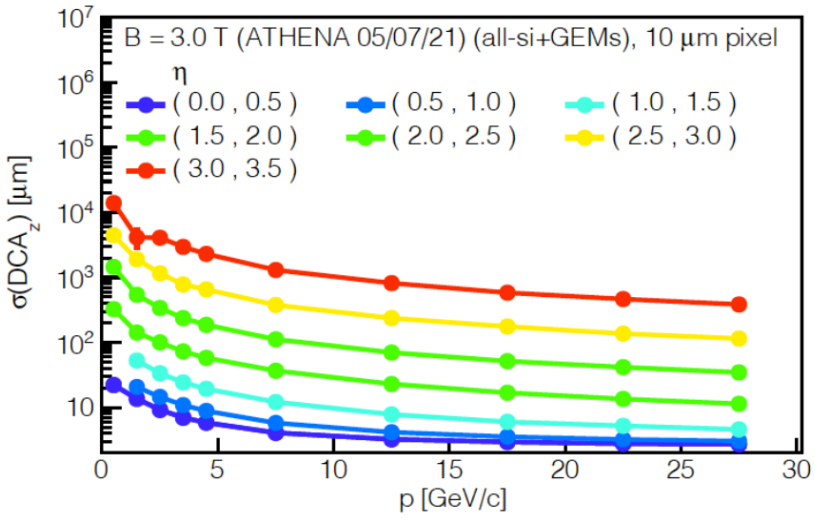


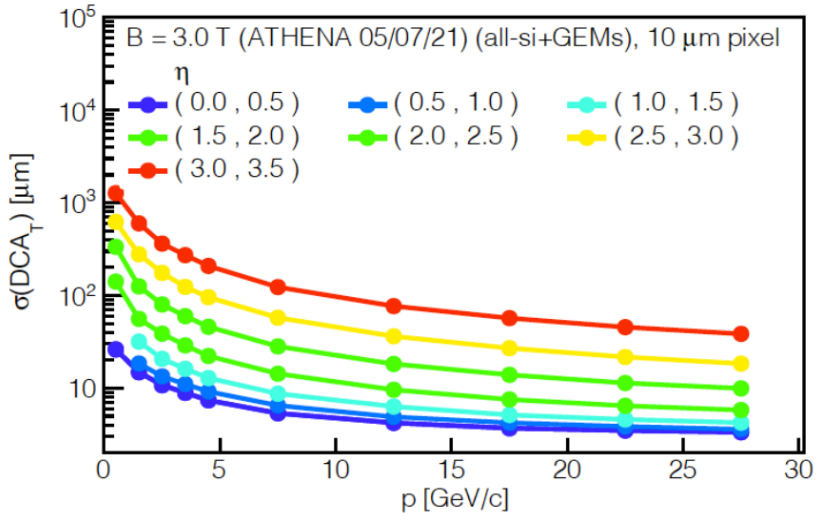
Reconstructed: π^-



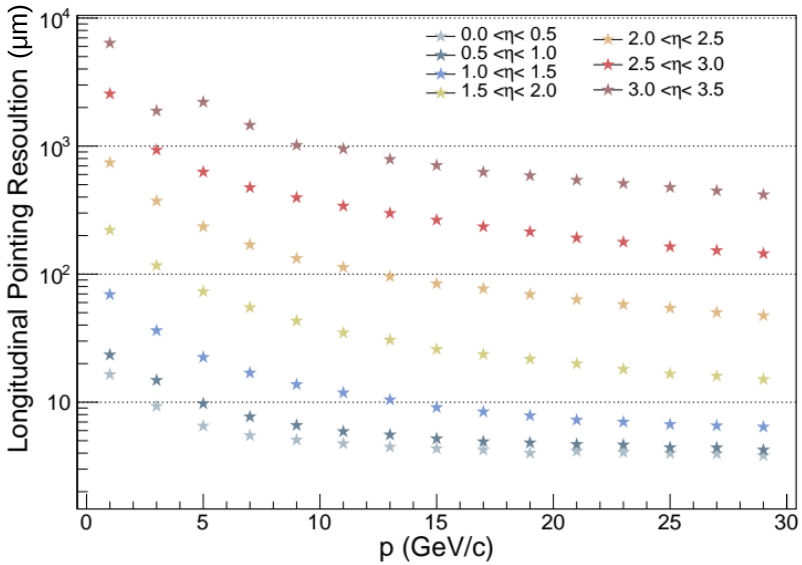


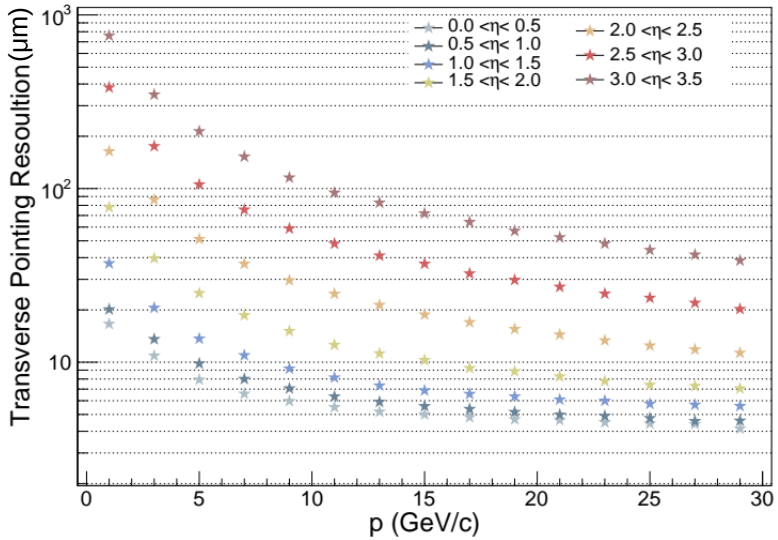
DCA Resolution





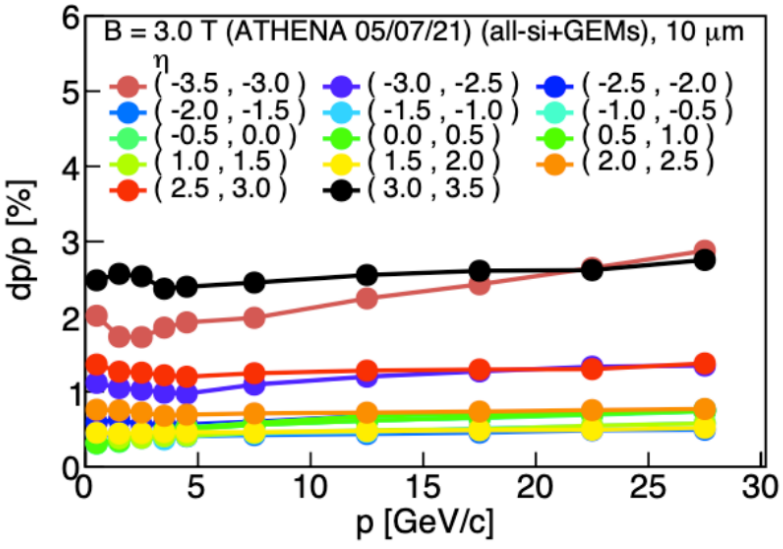
Reynier

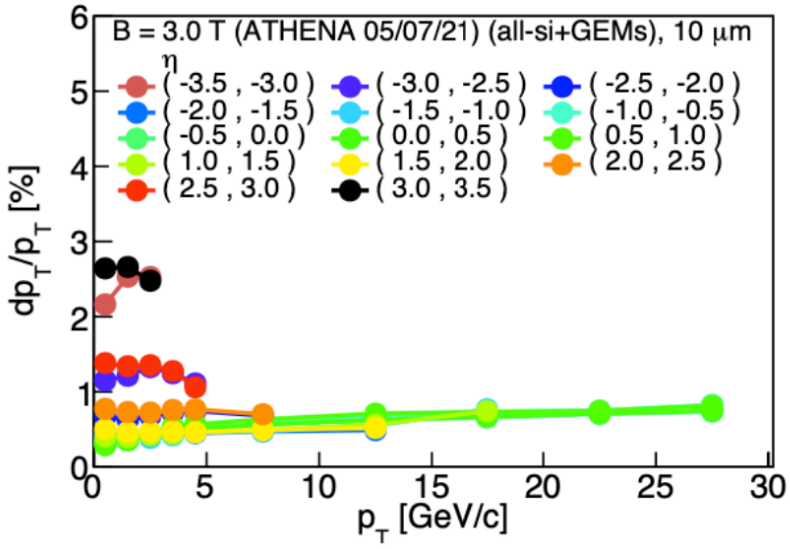




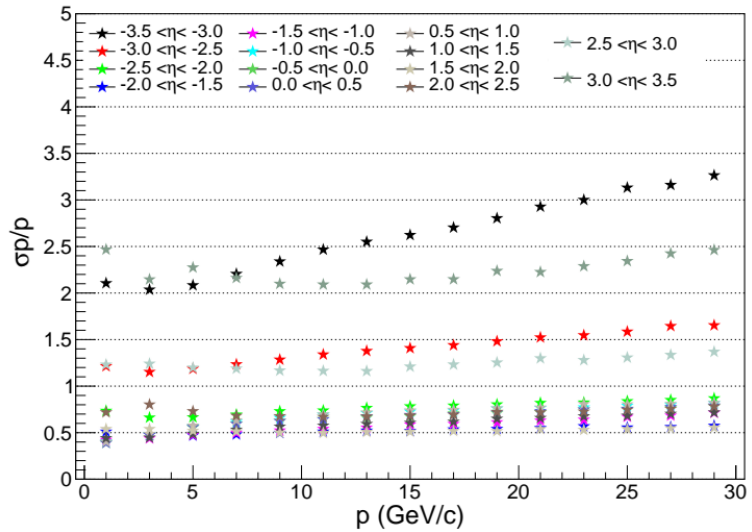
Shyam

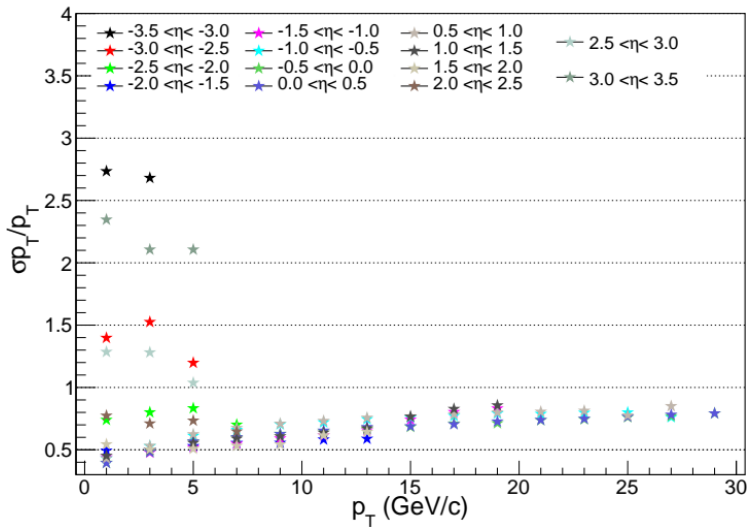
Momentum Resolution





Reynier



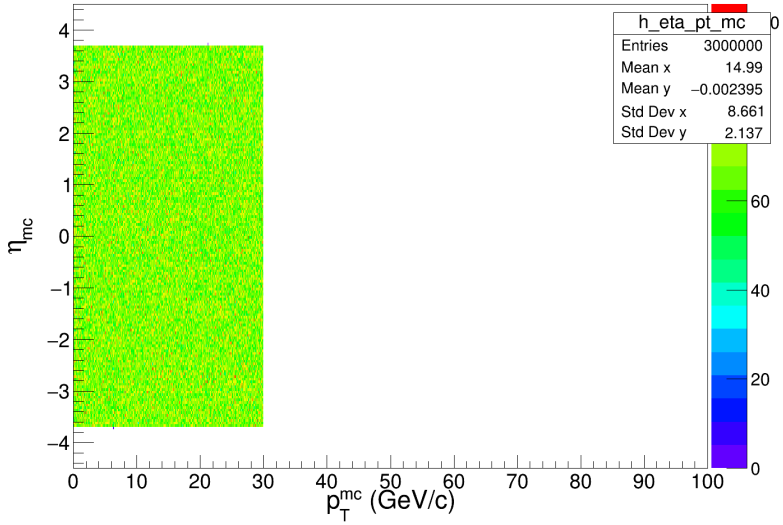


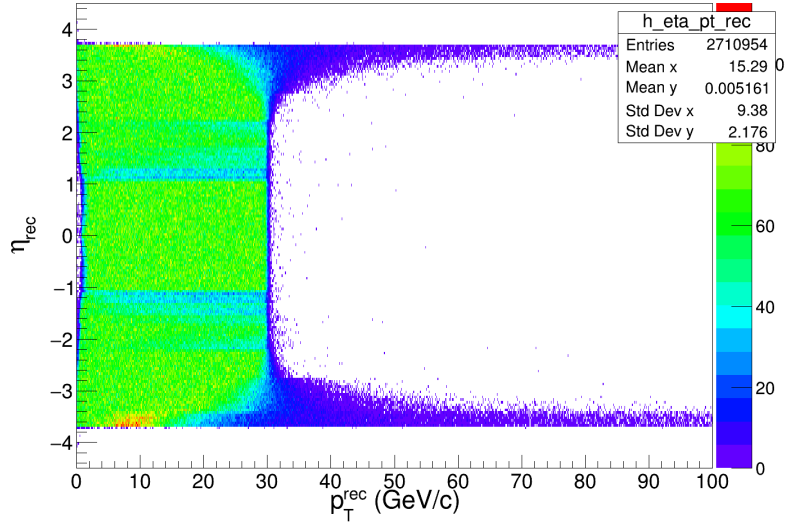
Shyam

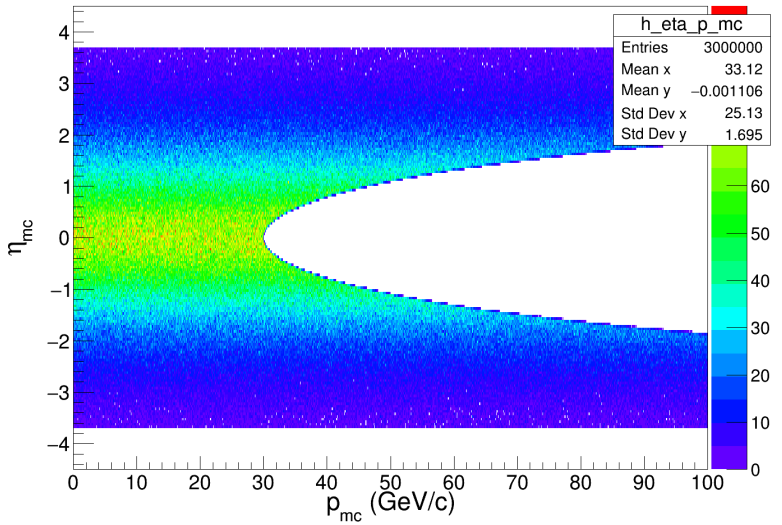
https://indico.bnl.gov/event/12598/contributions/53972/attachments/37046/61010/210907_performance_update.pdf

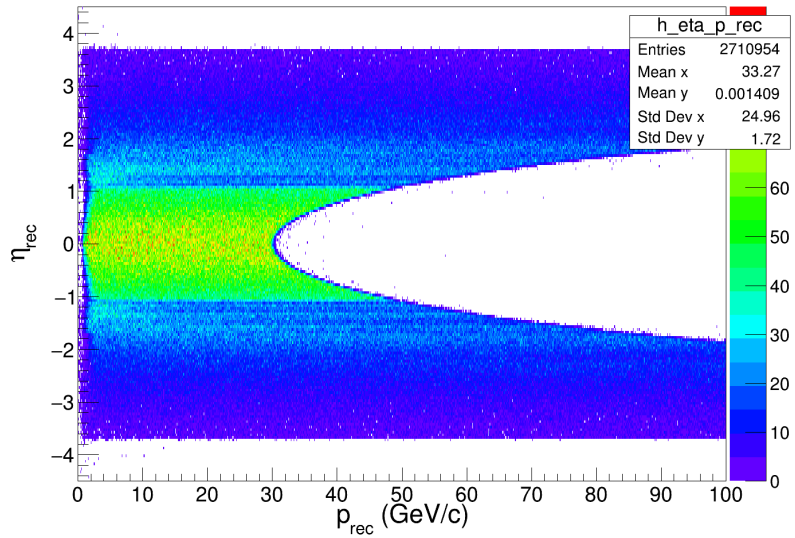
Simulation Results

Simulation of 3M Pion- using PHG4ParticleGenerator_flat_pT

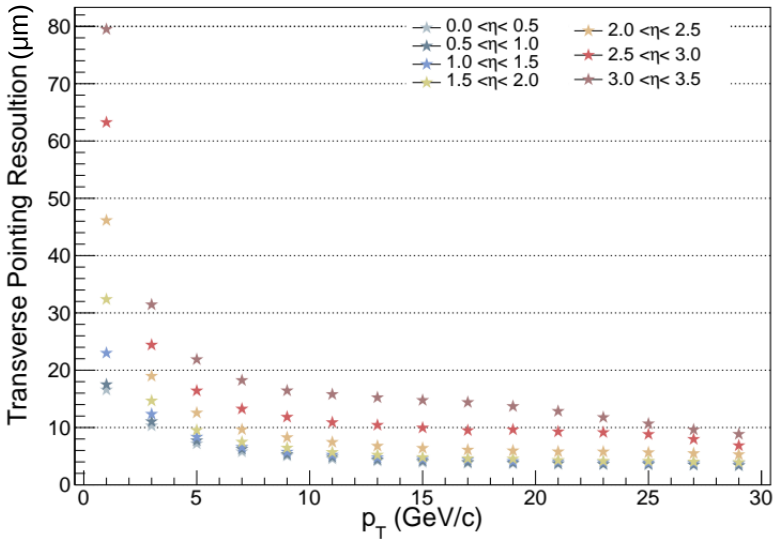


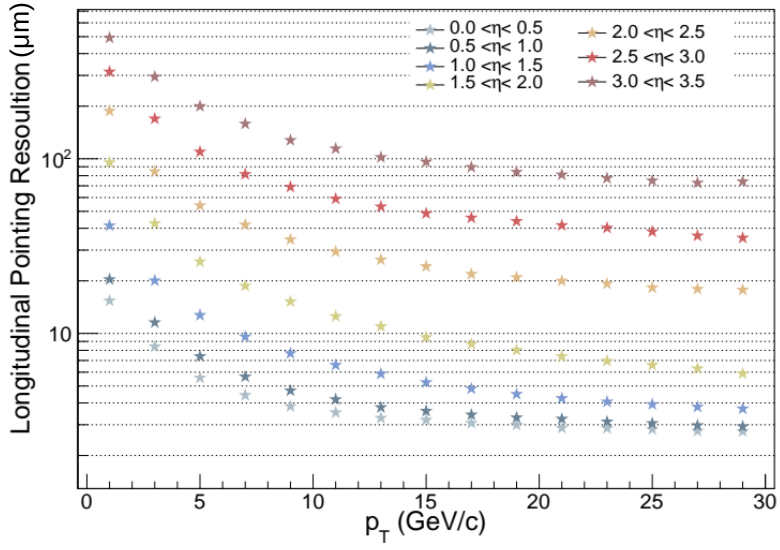


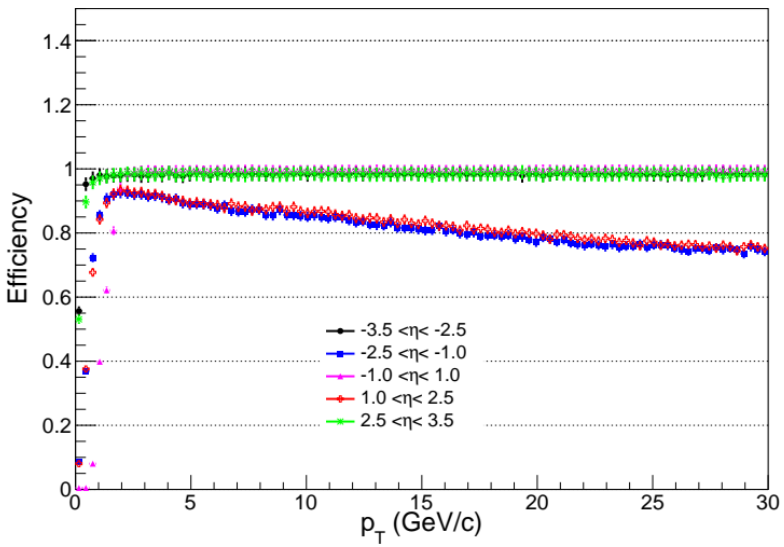




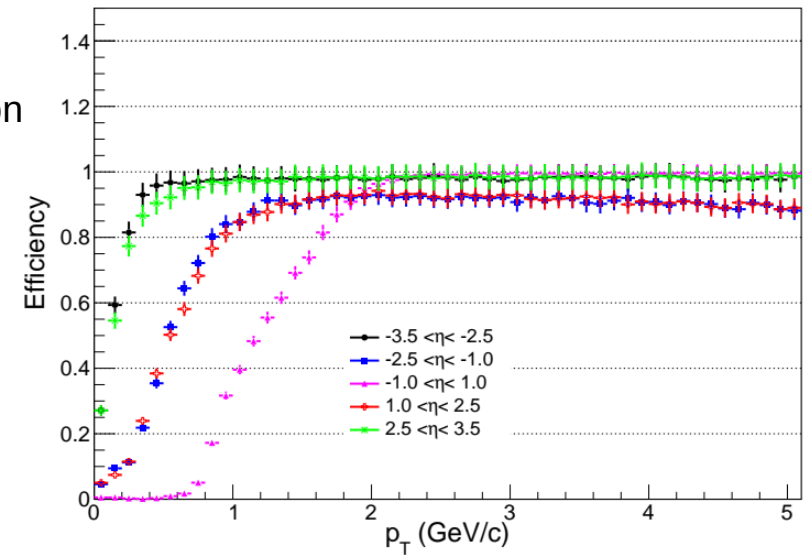
Simulation Results



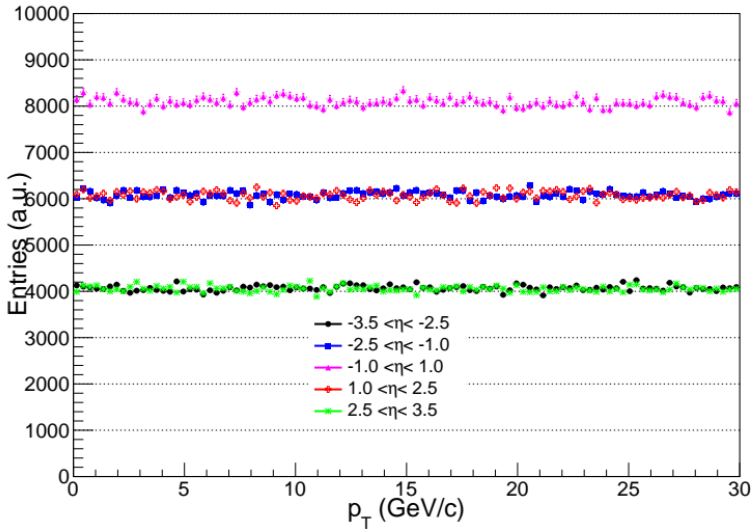


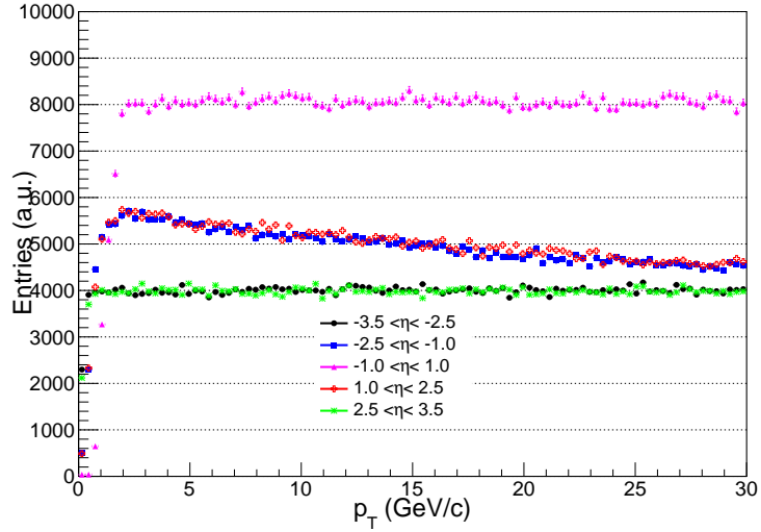


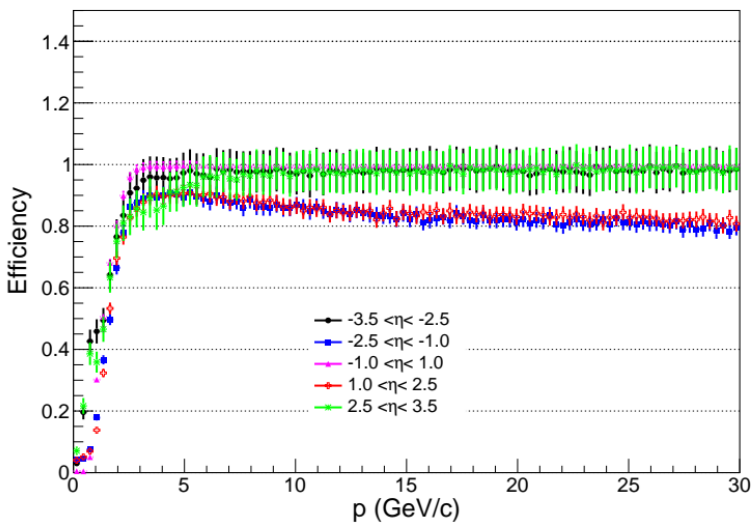
π^- reconstruction efficiency

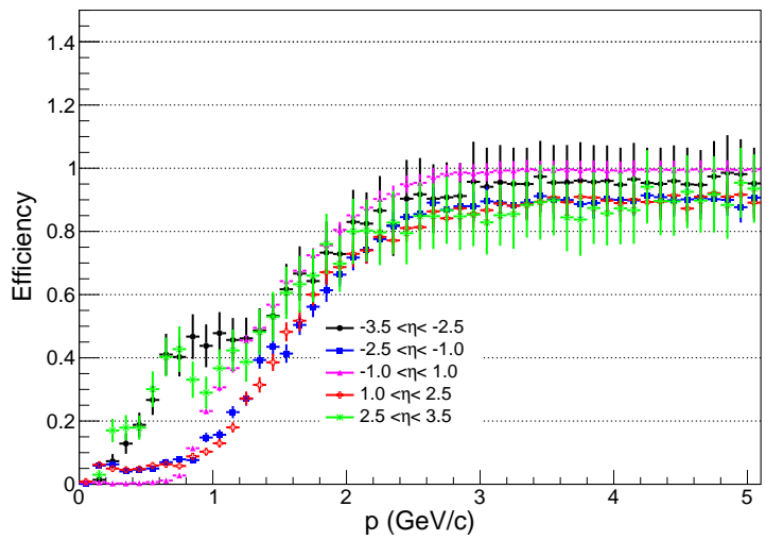


Simulation Results

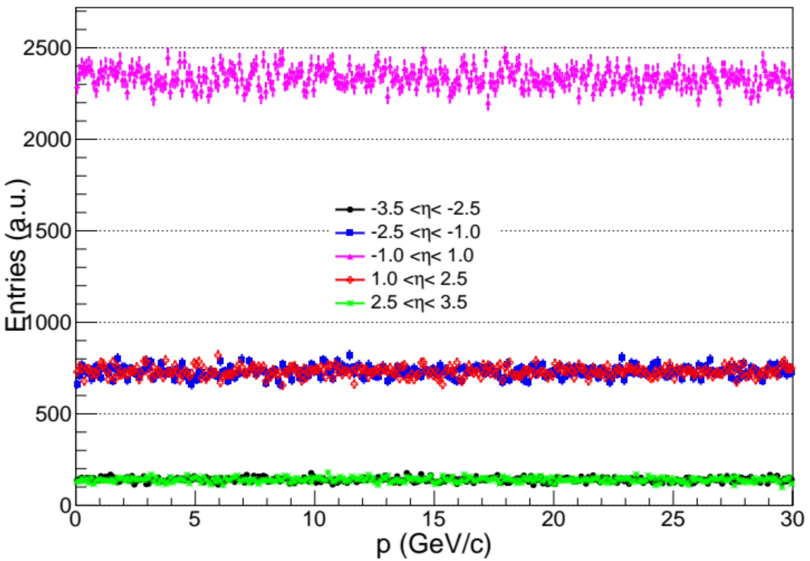


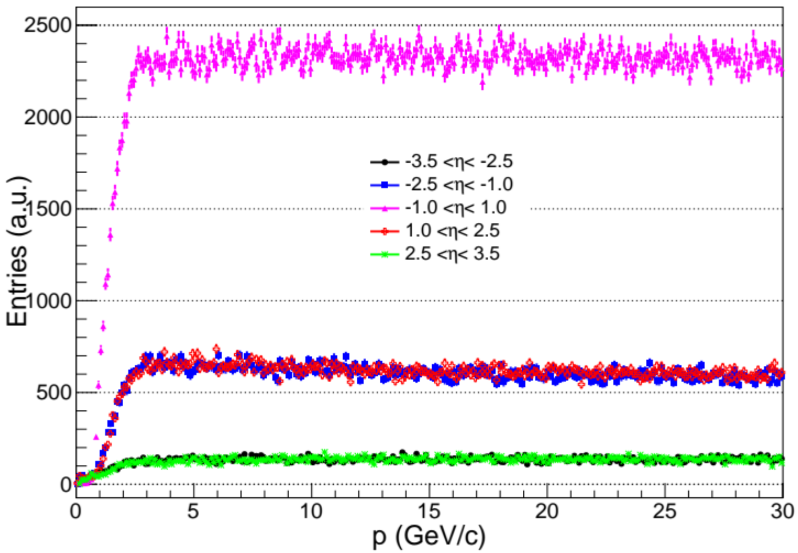


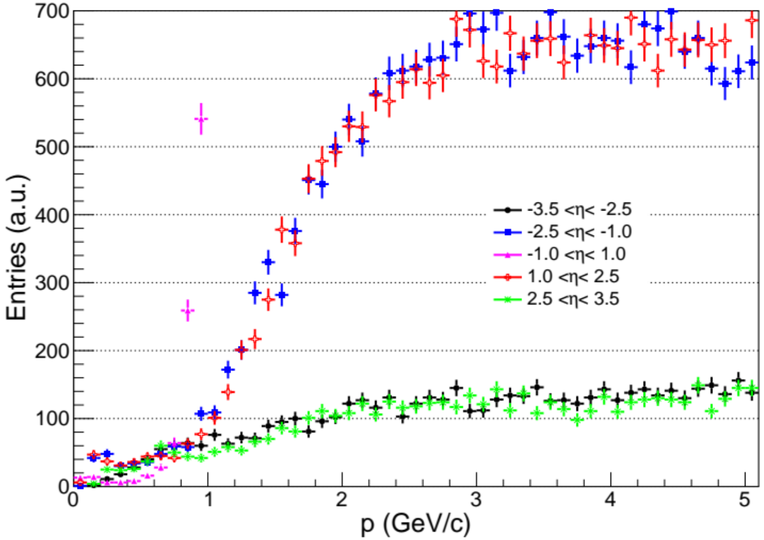




Simulation Results



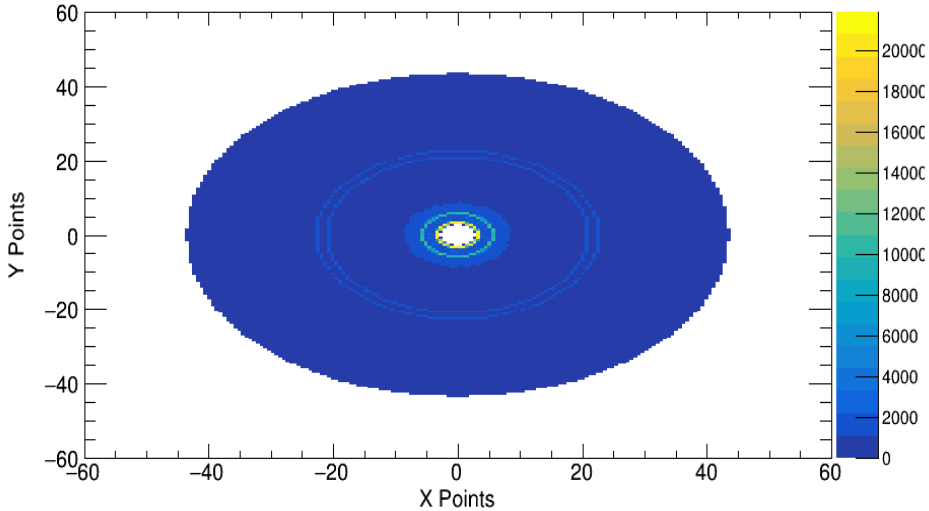




- Reconstruction at low p and high η showing the structure need to look more details of tracking
- Need to access Chi2, ndf, number of clusters used in the fit

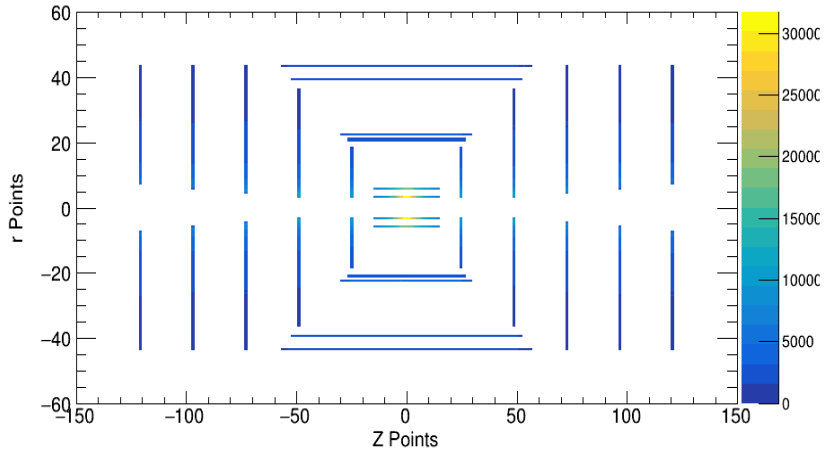
Material Budget Study (All Silicon Part)

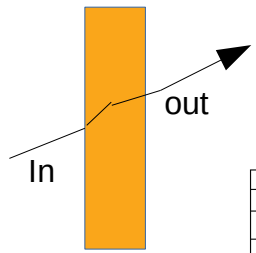
1M geantino particles of p_T: 0-30 GeV/c of η Range [-3.5,3.5] and φ Range: [0., 2π]

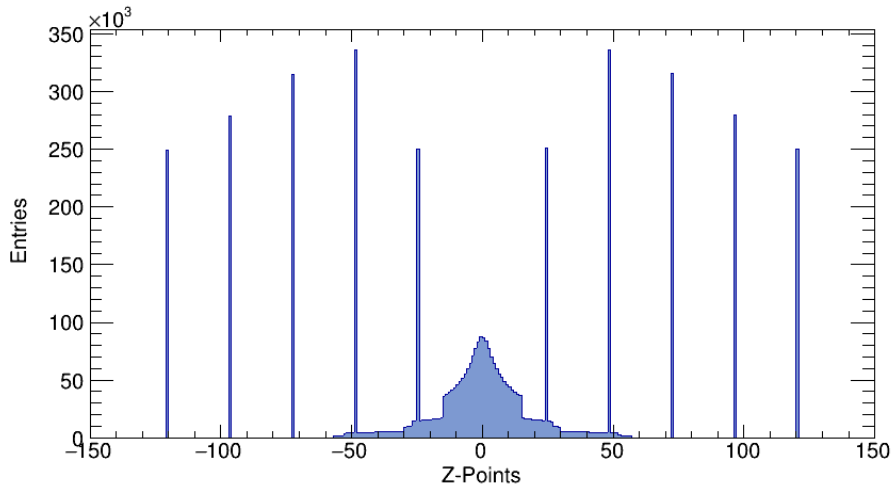


Code Input:

In Position
Out Position
Track Id
X_0 automatic from geometry

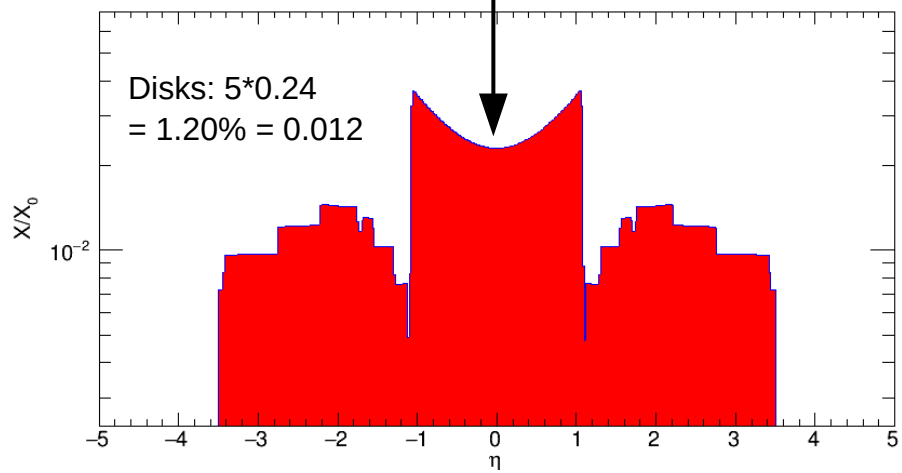




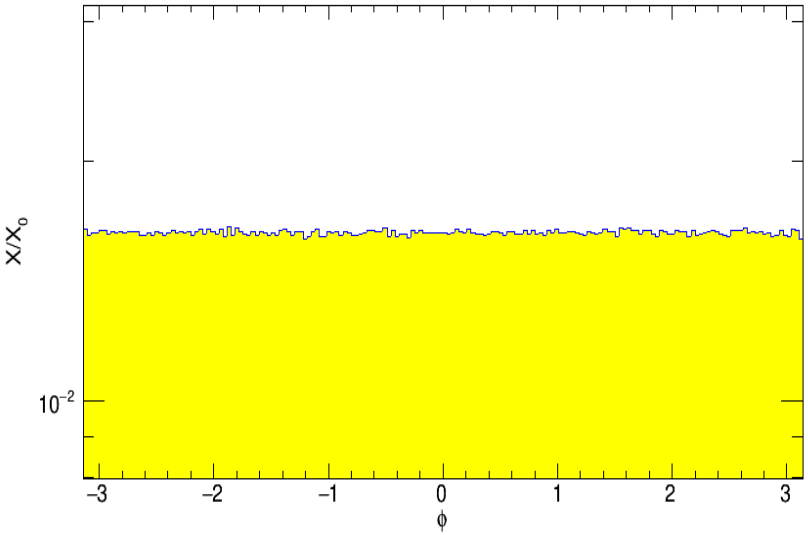


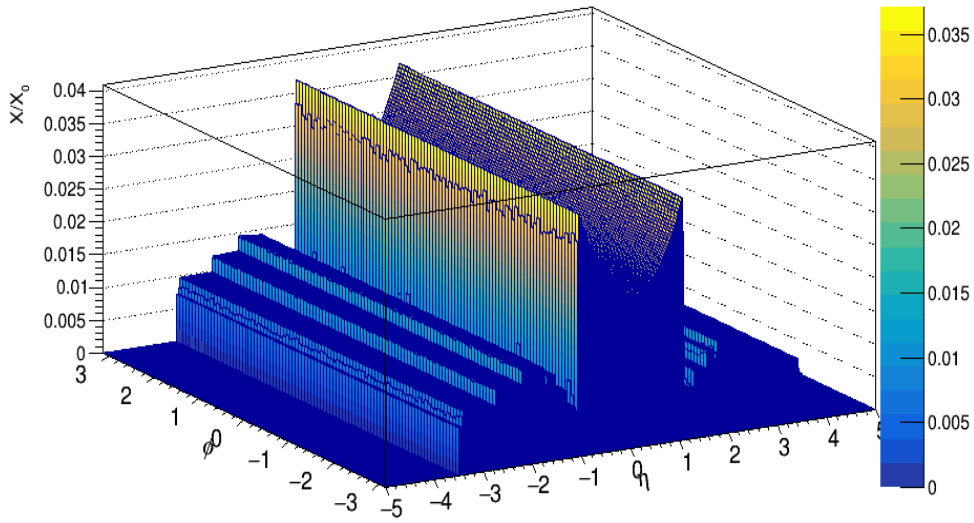
Vtx+Barrel: 0.05*2+0.55*4 = 2.3% = 0.023

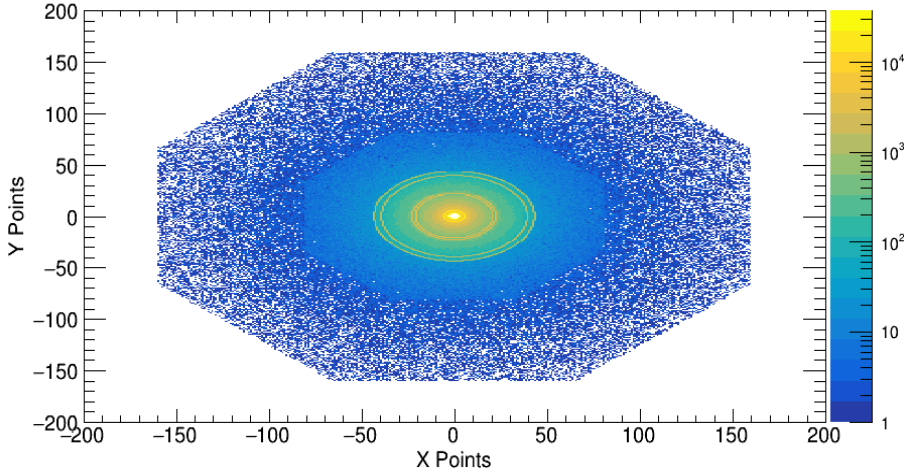
Disks: 5*0.24
= 1.20% = 0.012

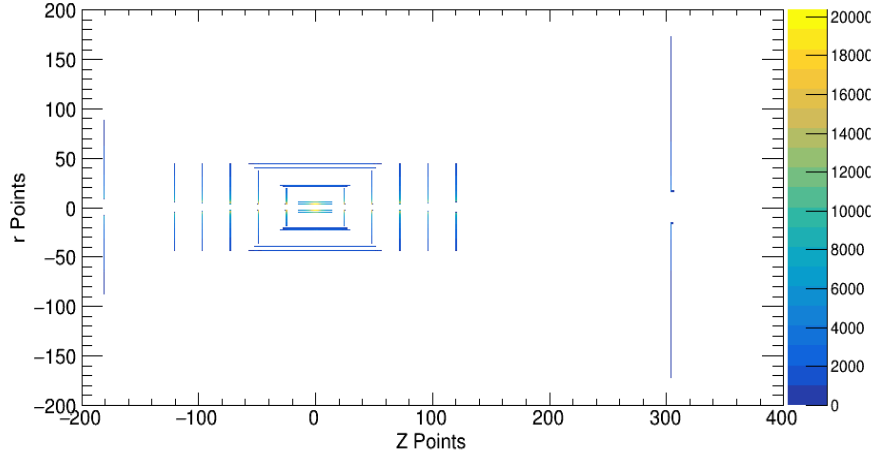


Material Budget Study (All Silicon Part)



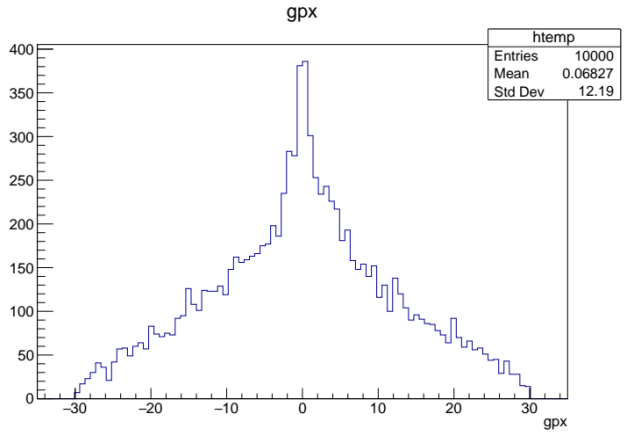


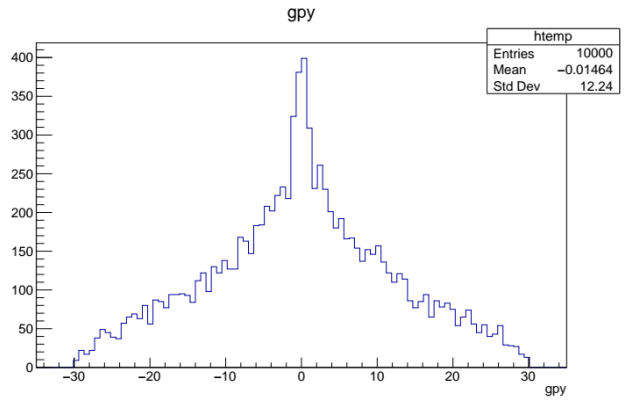


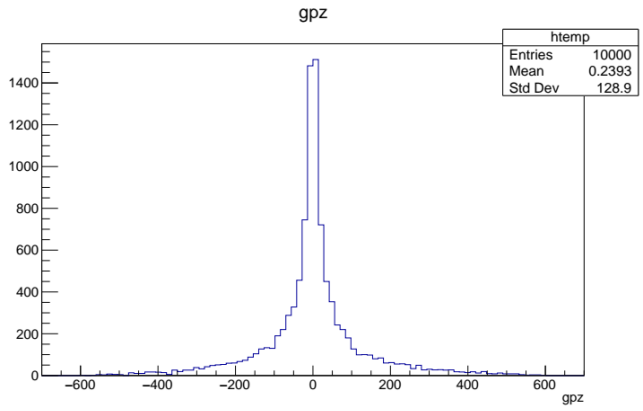


Lambda Reconstruction

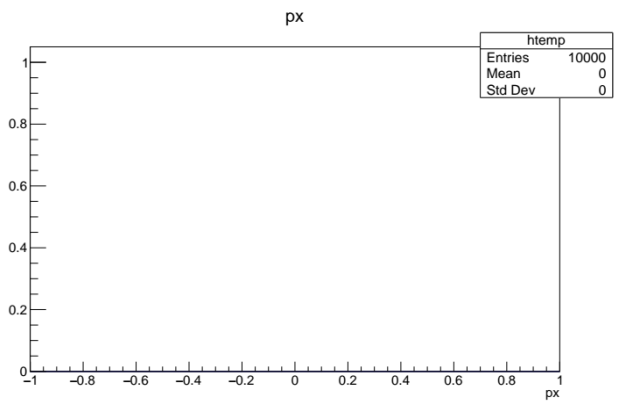
Simulation of 10000 Lambda's using PHG4ParticleGenerator_flat_pT

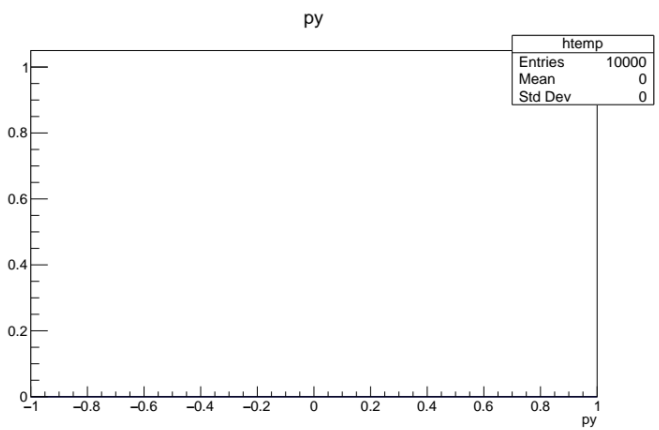


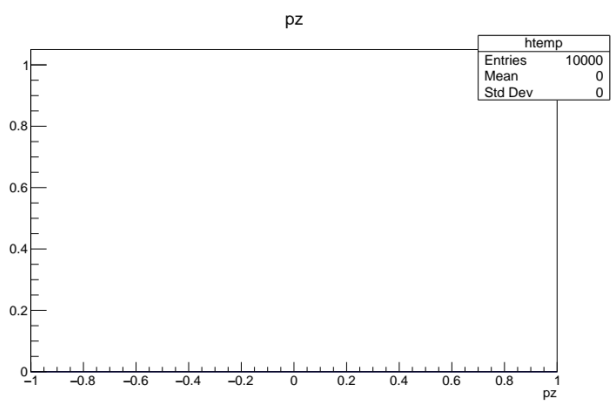




Reconstruction of Lambda's not clear, All entries show overflow







Summary and Future Plan

- Produced the Result of Reynier to check everything looking fine.
- Visualized geometry using EveManager and GeoManager more flxible than default Geant4 GUI
- Efficiency as a function of momentum for Pion- is presented.
- Material budget estimated using the current geometry and geantino particle.
- Lambda reconstruction need to be understood

Future Plans:

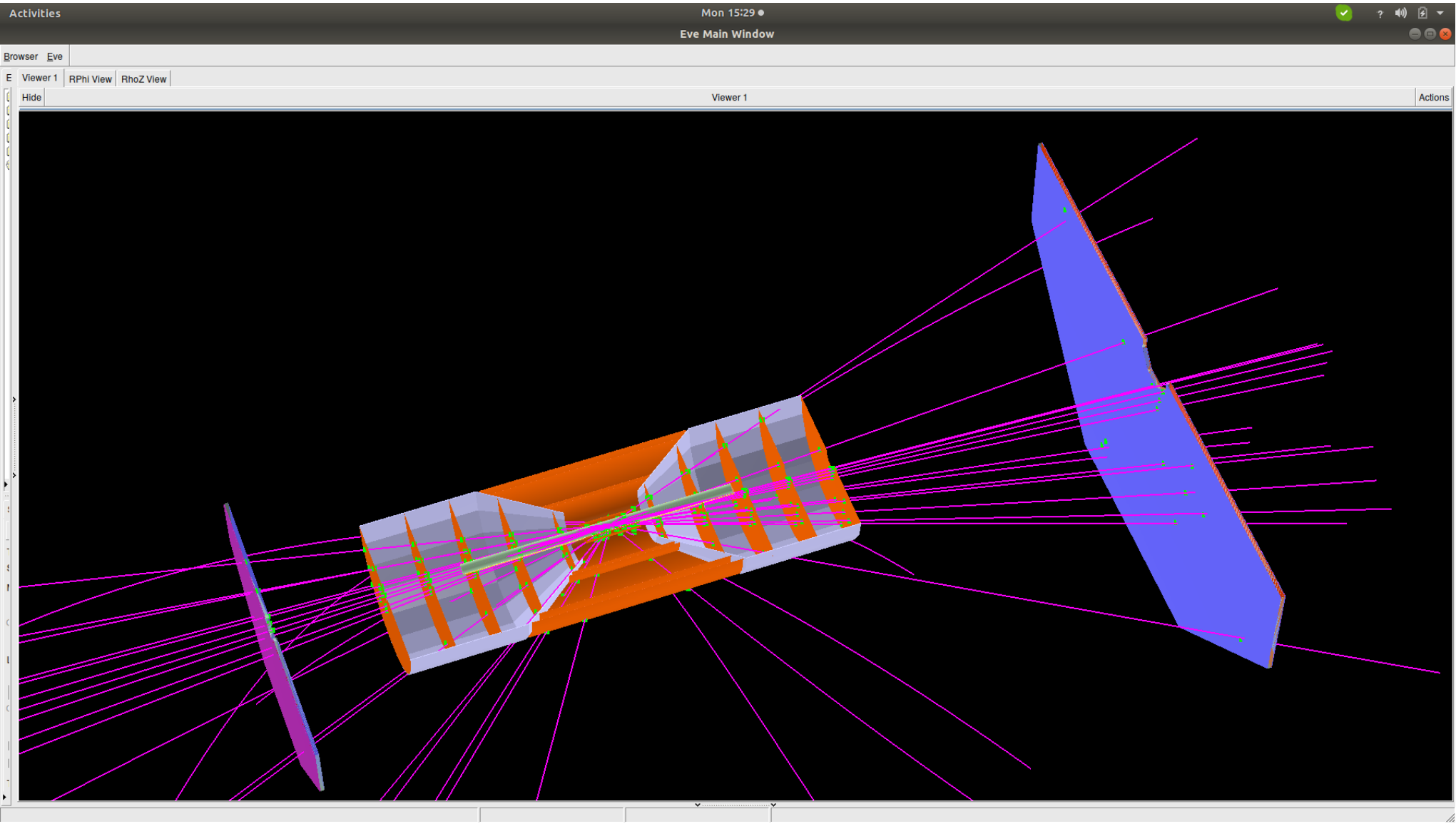
- Charged hadron reconstruction performances (DCA, Resolution, Efficiencies)
- Will also evaluate reconstruction performance of other particles (Lambda's, D^0)

in line: 149 in file: /phenix/u/phnxbld/workarea/sPHENIX_SL7.3/gcc-8.3/need_root_version/root-6.22.02/genfit/core/src/MeasuredStateOnPlane.cc
with fatal flag 0
Error in <TDecompChol::Decompose()>: matrix not positive definite
Error in <TDecompChol::Decompose()>: matrix not positive definite
genfit::Exception thrown with excString:
KalmanFitterInfo::calcAverageState: ill-conditioned covariance matrix.

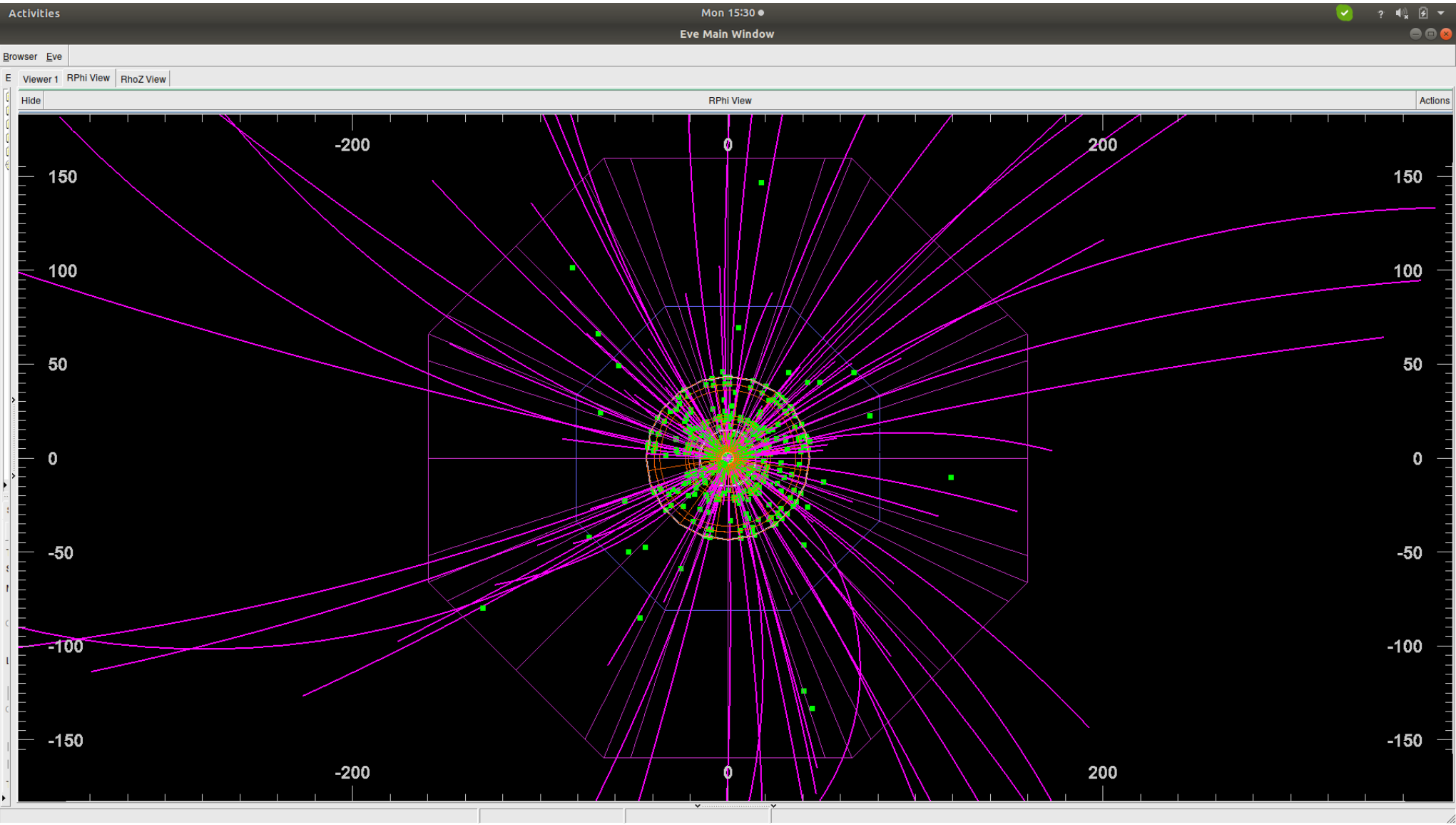
Warning most of the time??? Need to understand

Thank You

EveManager with GEM hits



EveManager with GEM hits (R-Phi View)



EveManager with GEM hits (R-Z View)