Simulation Results for the Baseline 2 Tracker

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Simulation

- 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

Baseline 2 Tracker (Thanks Nick)

BeamPipe+SIVTX+SIBARR+SIDISKS+ALSUPP+RICH+MRICH+DIRC+MPGD+INNERGEMS+OUTERGEMS

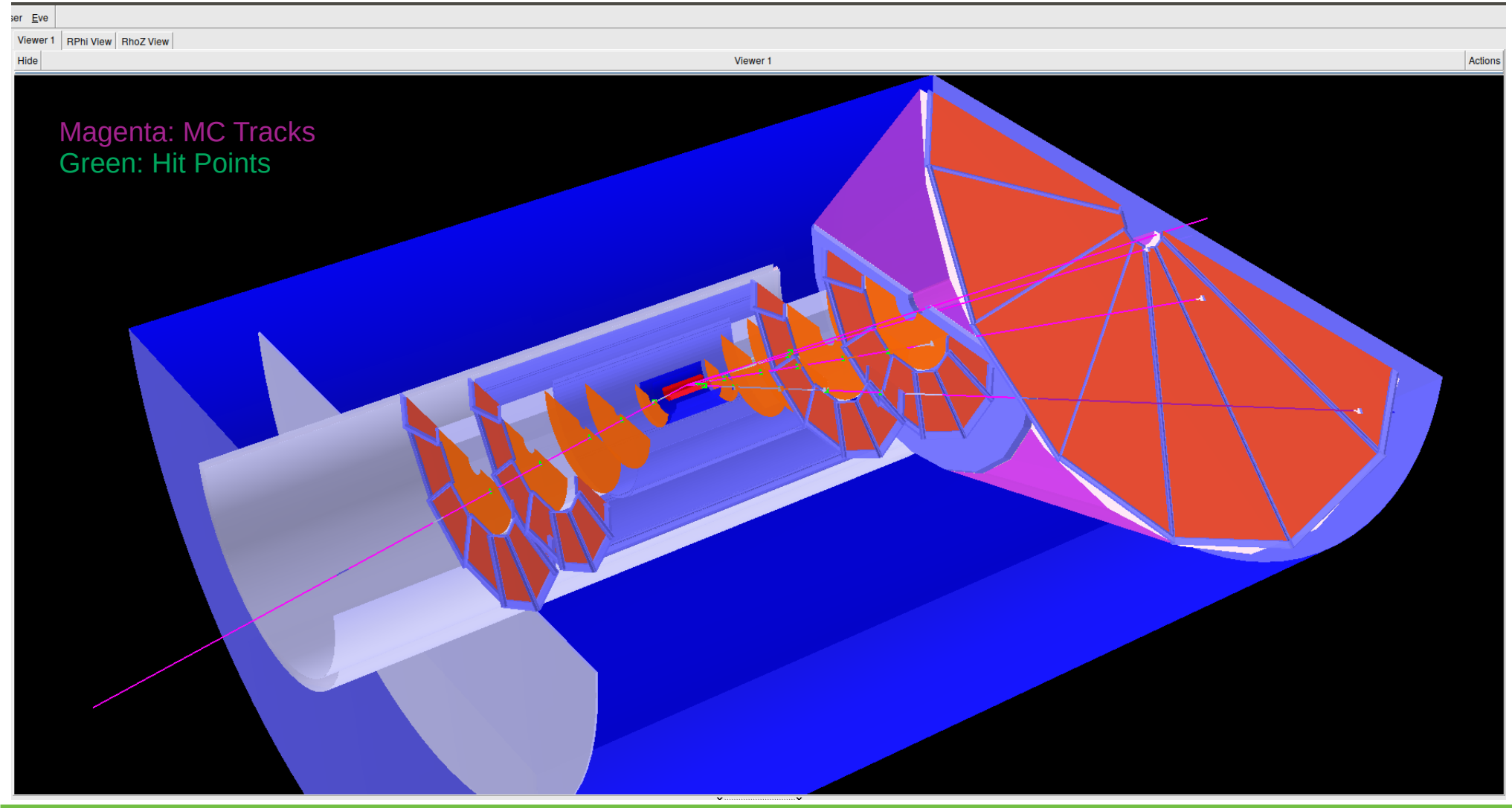
Vertexing layers radius: {3.3,4.41,5.51};

Barrel layers radius: {13.38, 18.0};

Silicon Disks z-positions: {-145, -109, -73, -49, -25, 25, 49, 73, 103.67, 134.33, 165};

Micromegas Barrel radius: {47.72, 49.57, 75.61, 77.47};

Event Display

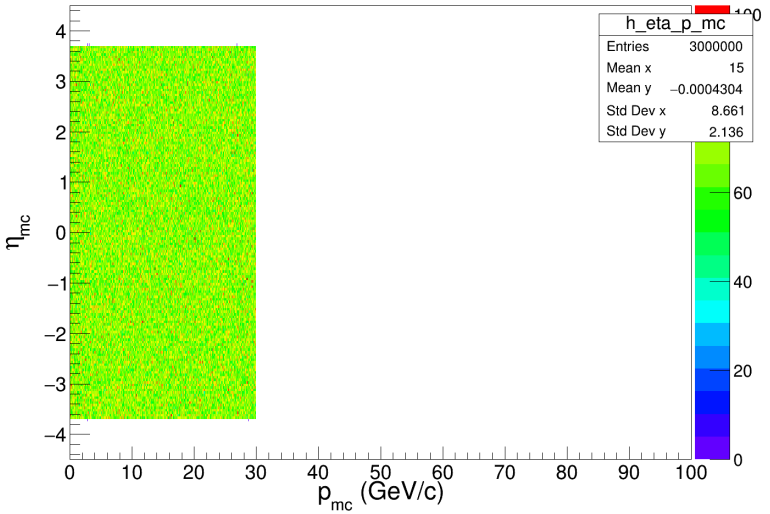


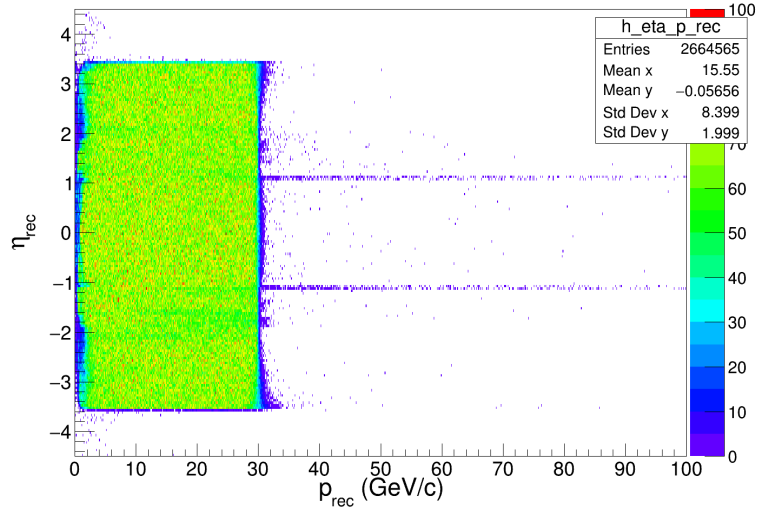
Simulation Results

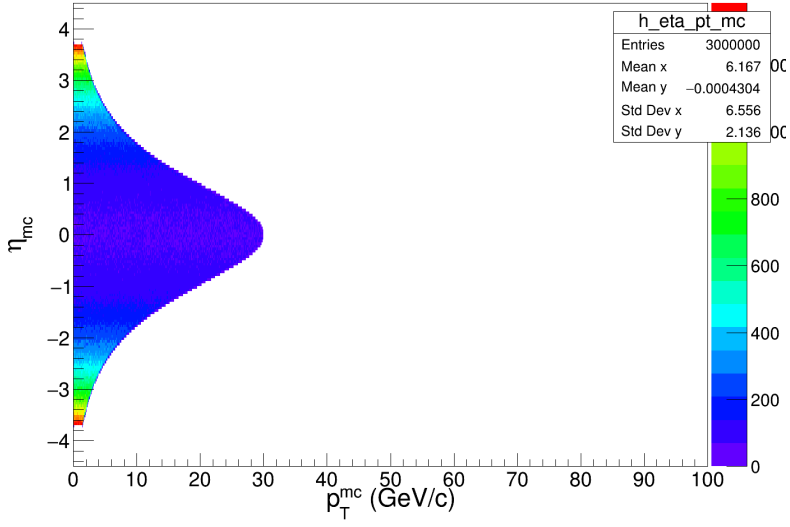
Generated: π^- uniform in η and p

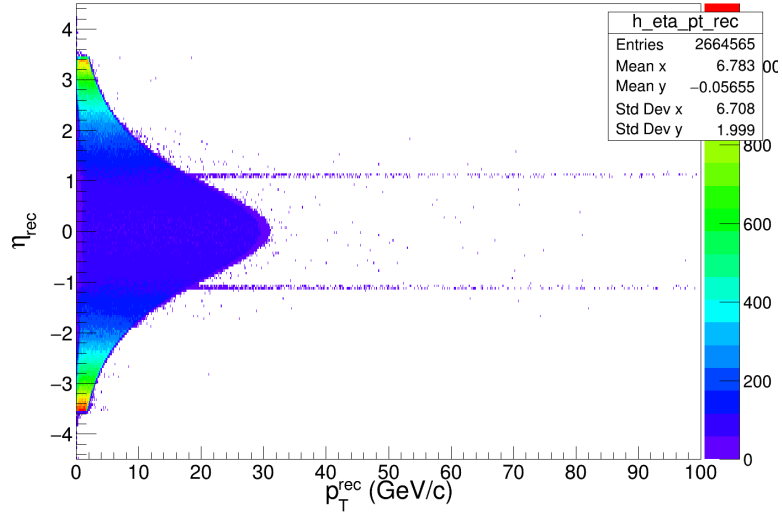
Acceptance not symmetric in η

Reconstructed: π^-









Eta Coverage

Detectors used in the Tracking with Resolutions

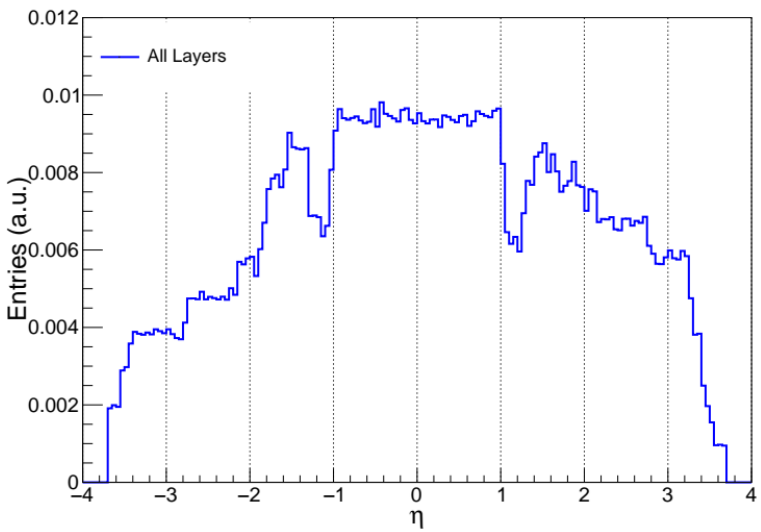
SIVTX: σ_r = 999. , σ_φ = 10.e-4/$\sqrt{12}$, σ_z = 10.e-4/$\sqrt{12}$

SIBARR: σ_r = 999. , σ_φ = 10.e-4/$\sqrt{12}$, σ_z = 10.e-4/$\sqrt{12}$

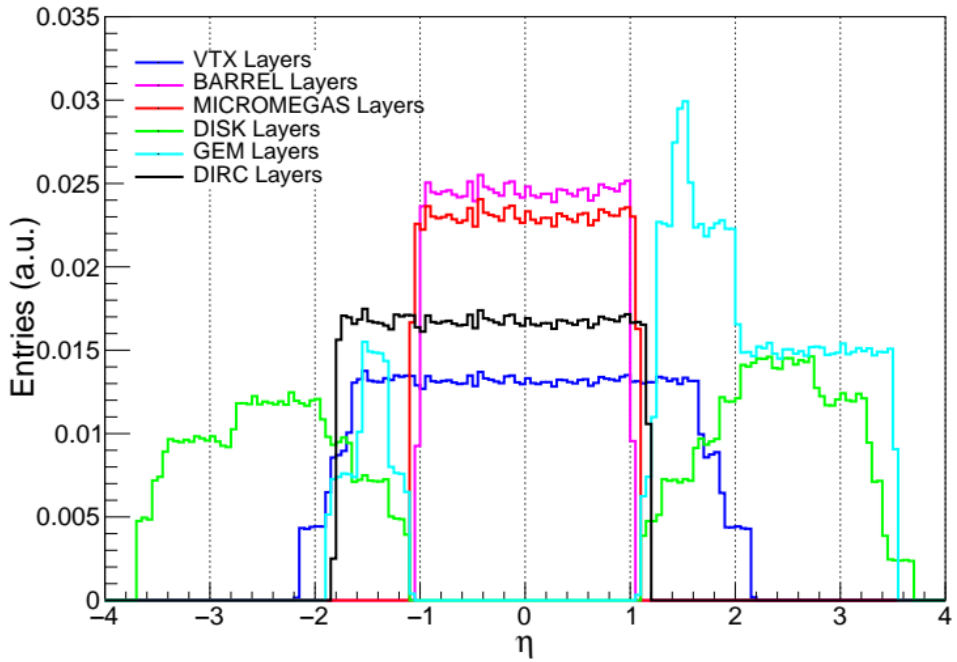
SIDISKS: σ_r = 10.e-4/$\sqrt{12}$, σ_φ = 10.e-4/$\sqrt{12}$, σ_z = 999.

MPGD: σ_r = 2.5/2/$\sqrt{12}$, σ_φ = 150e-4, σ_z = 150e-4

GEM: σ_r = 250.e-4, σ_φ = 50.e-4, σ_z = 999.

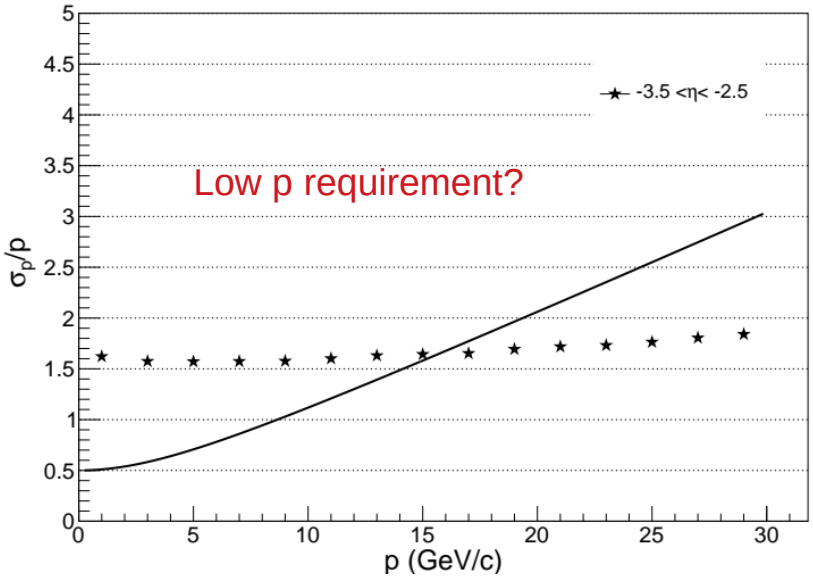


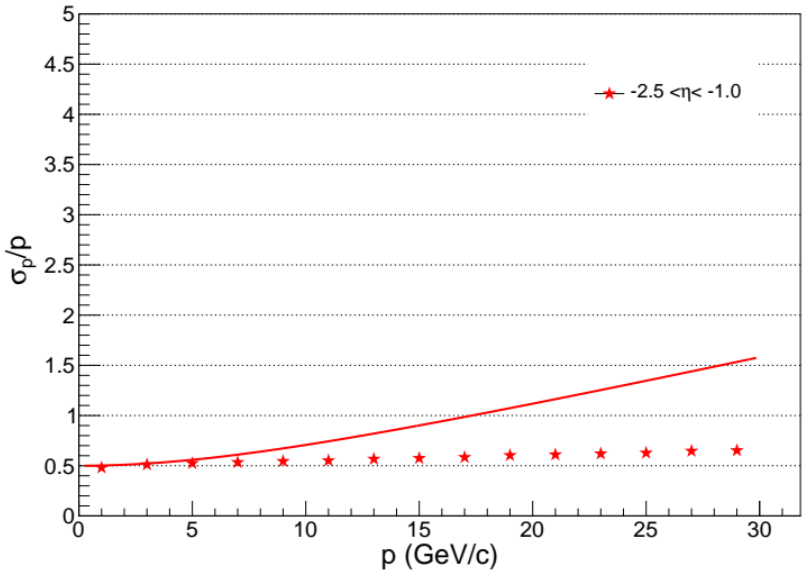
-Tmath::Log(TMath::Tan((TMath::Atan2(sqrt(X0*X0+Y0*Y0),Z0))/2)) for Y0>0

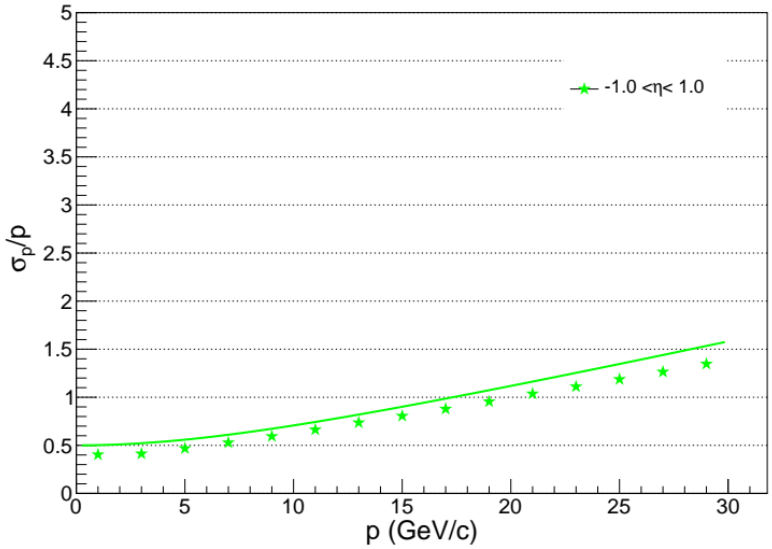


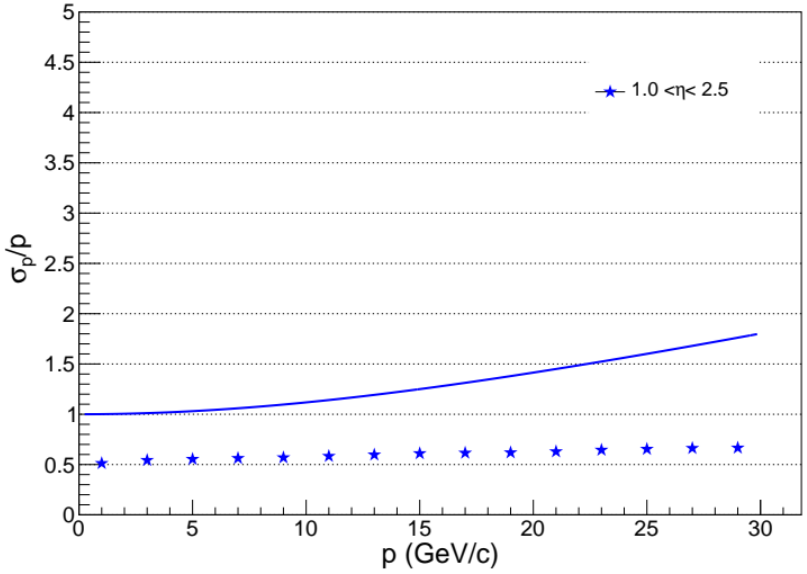
Hit Maps of detectors

Results with Requirements

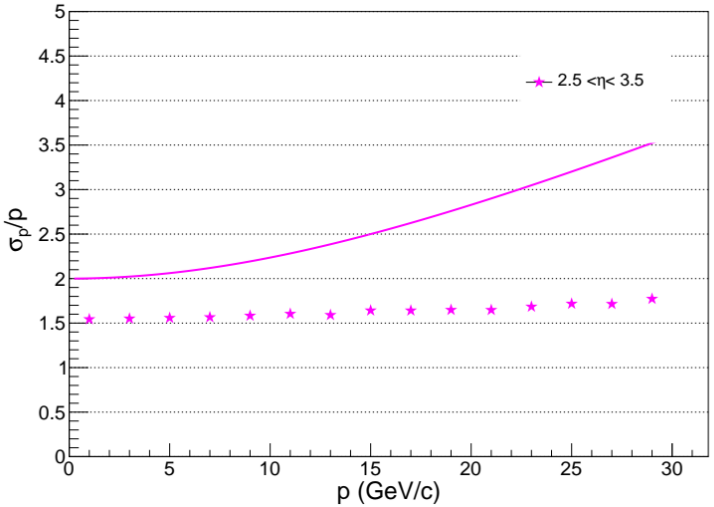


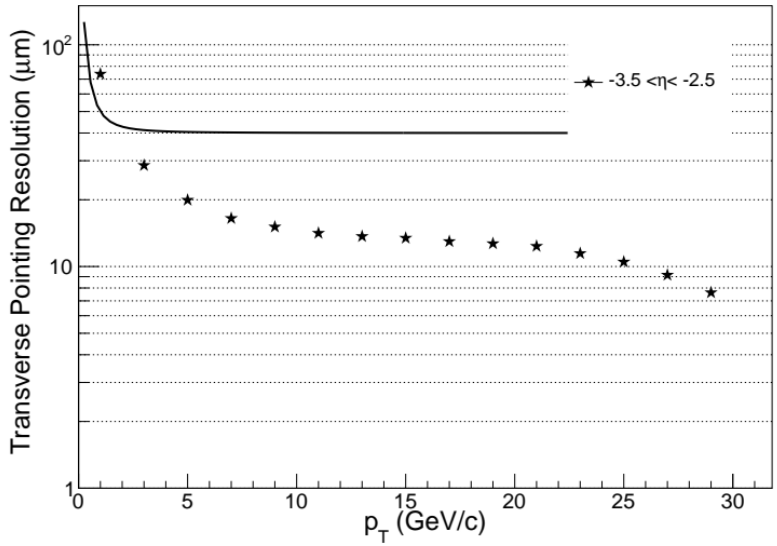


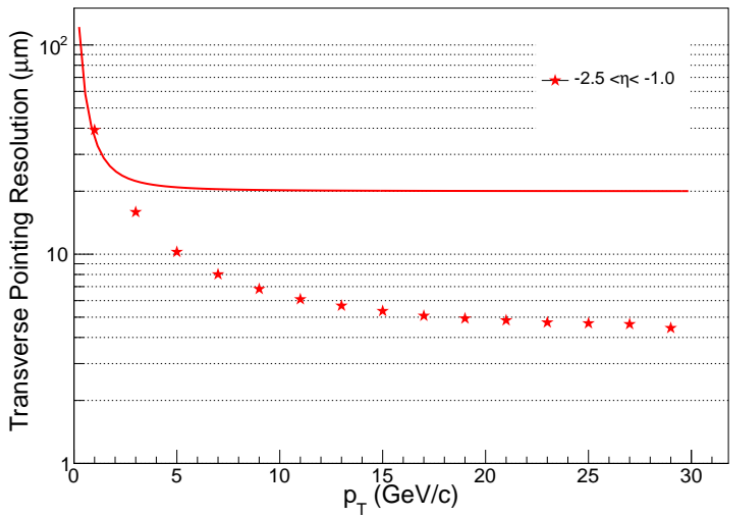


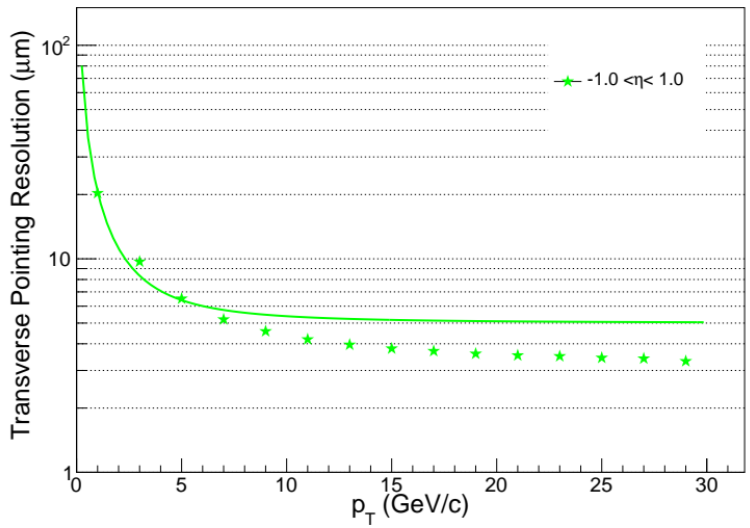


Results with Requirements

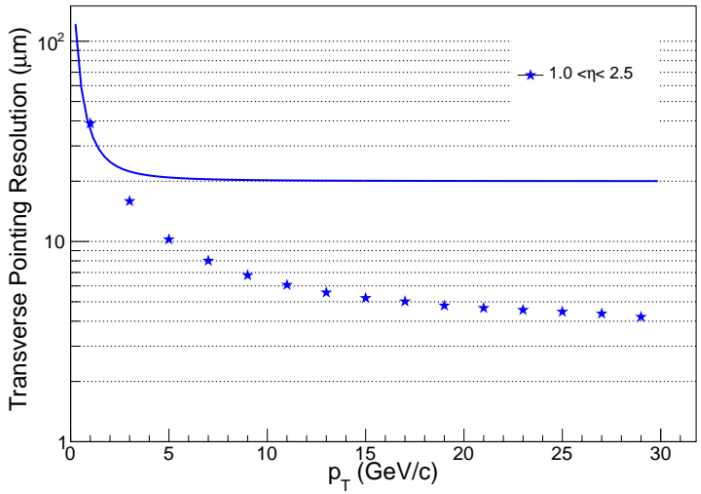


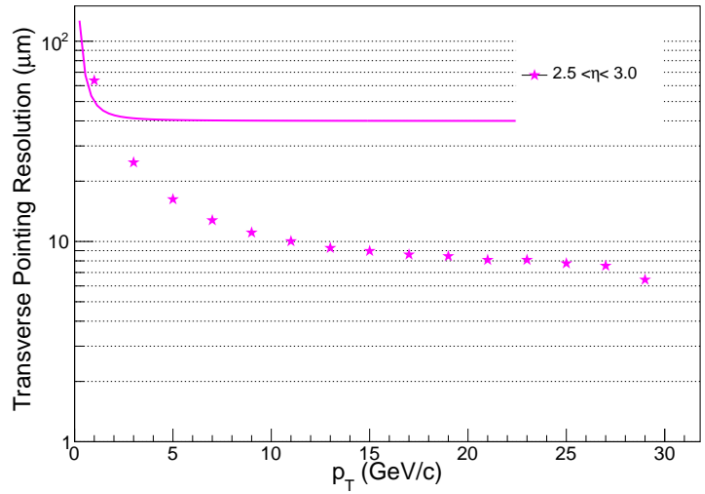


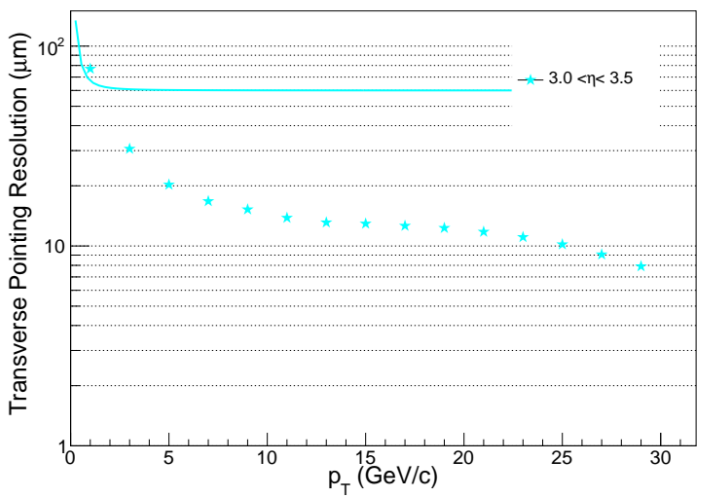




Results with Requirements







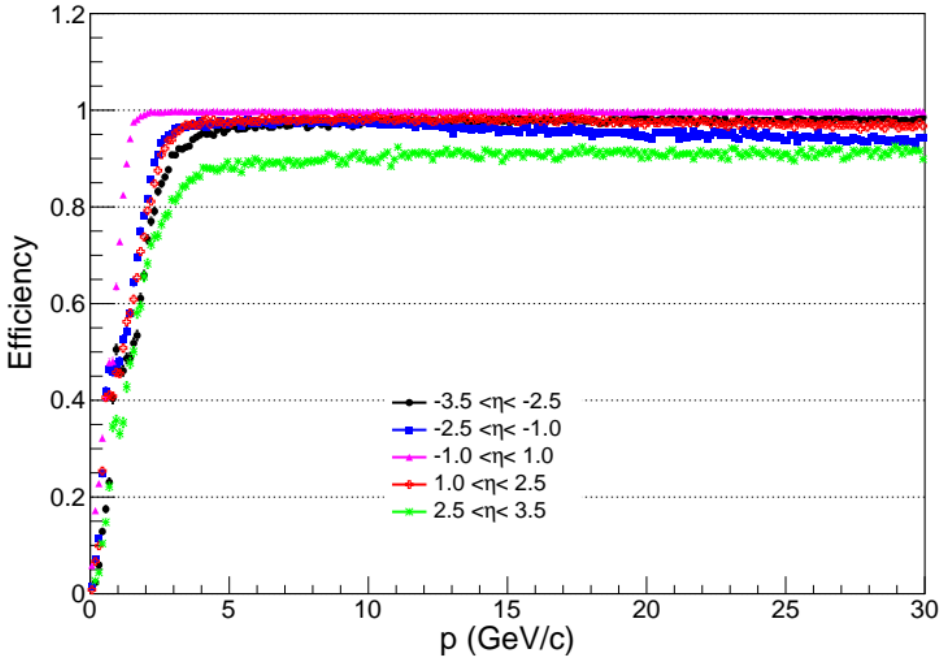
- Performance appears to fulfill the PWG requirements (lines) in all eta-regions but in the far backward below 15 GeV/c
  - Results to be cross-checked with those from Nick and others
  - Once fully aligned to Nick and others, will move to further studies (eg D^0 reconstruction etc)

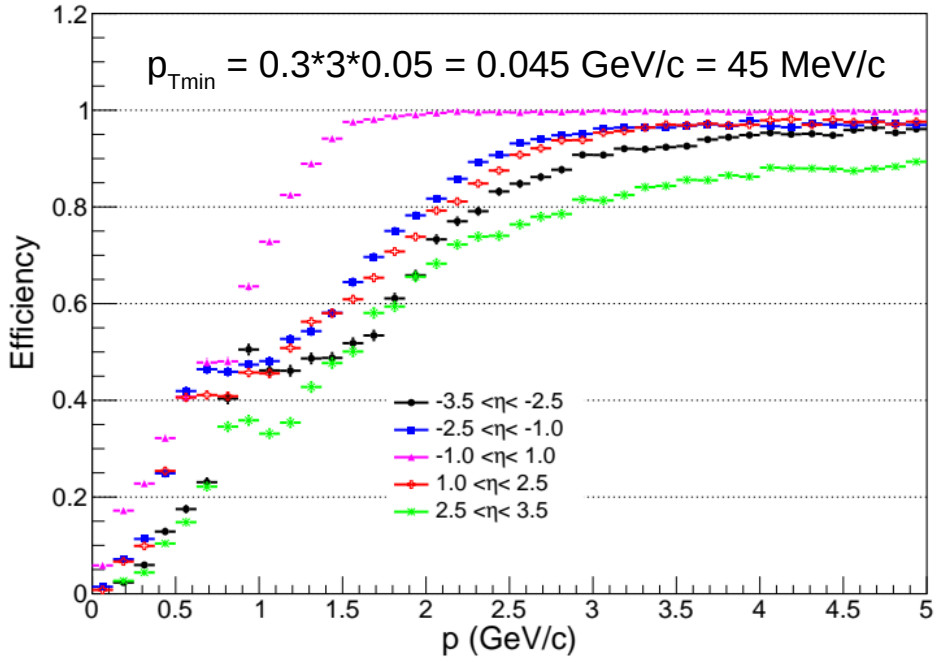
Pion- Efficiency

$p_T = 0.3\,B[T]\,R[m]$

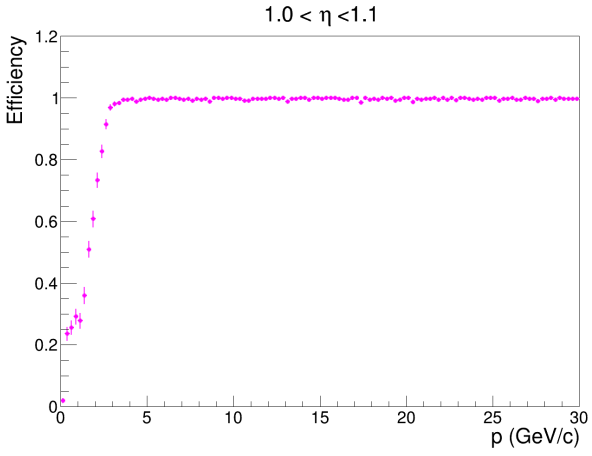
This doesn't include hit reconstruction (ε=1) efficiency

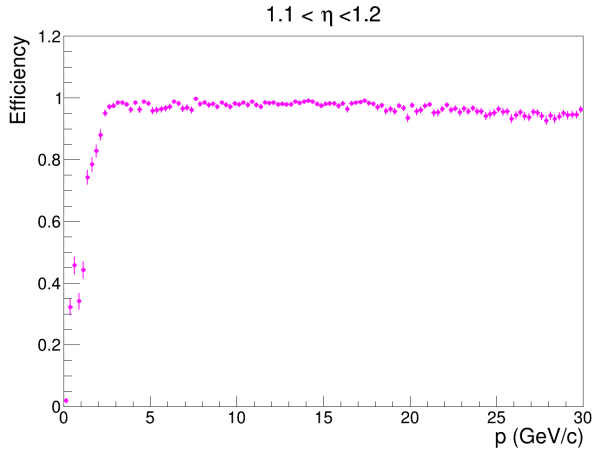
No Combinatorial Background (Single Particle in an Event)

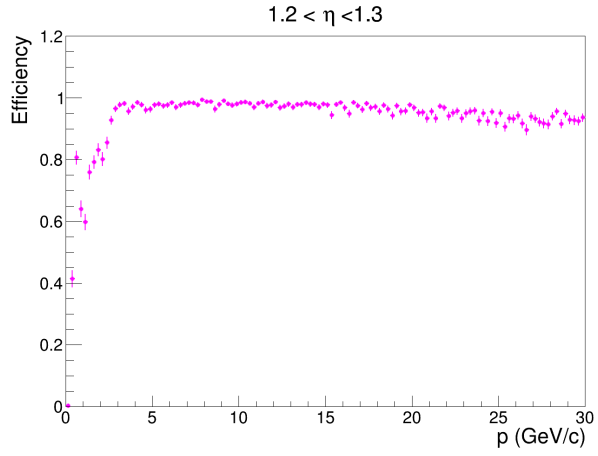


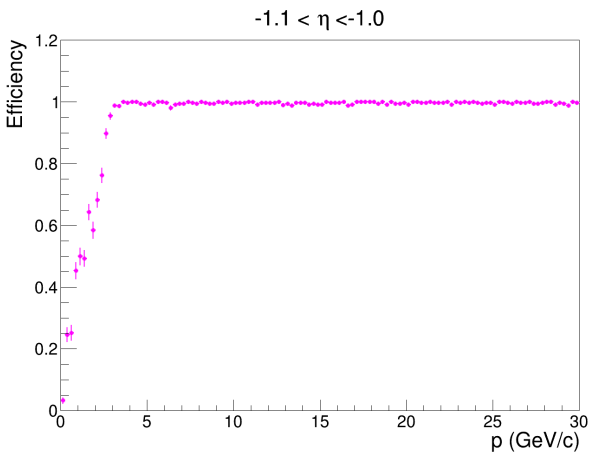


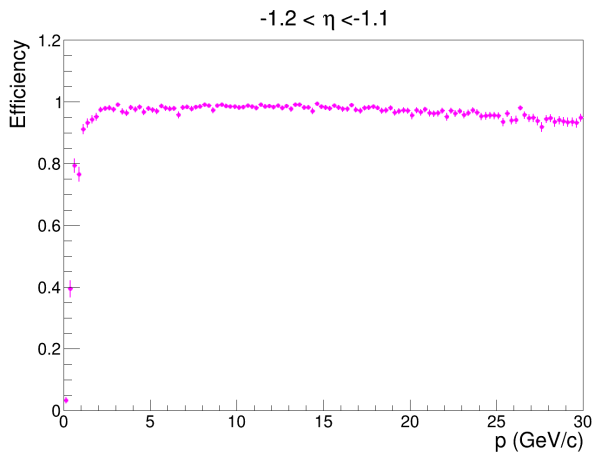
Acceptance Debugging

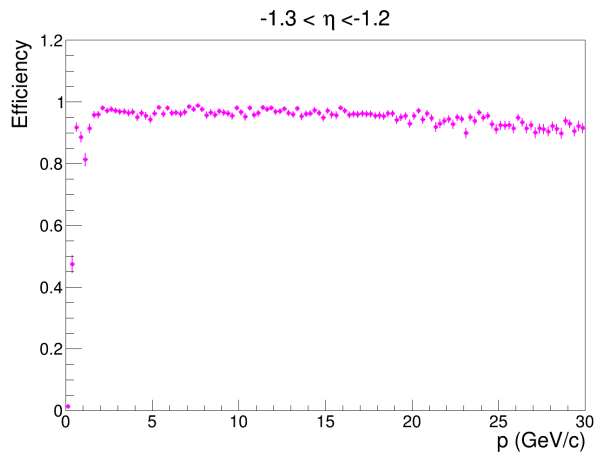




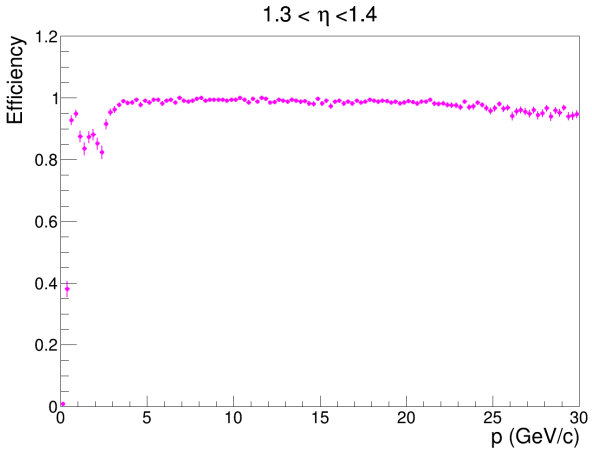


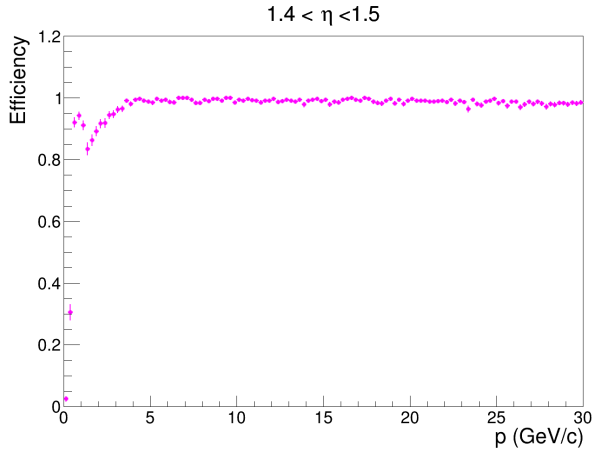


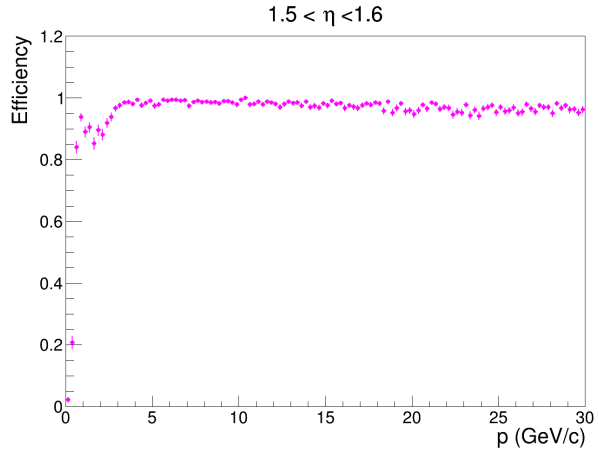


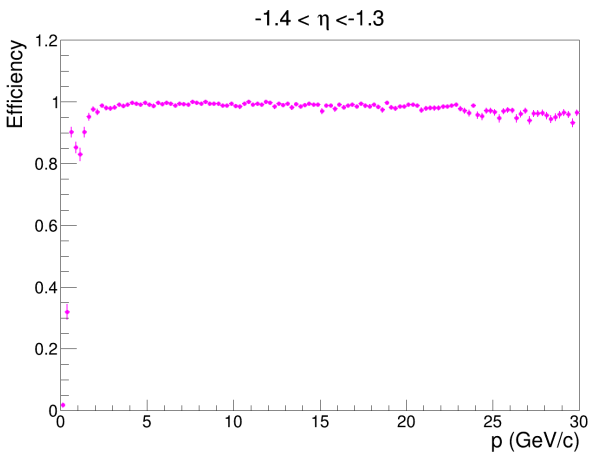


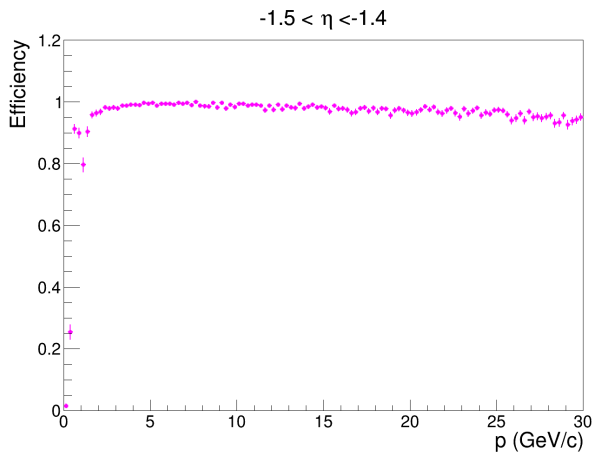
Acceptance Debugging

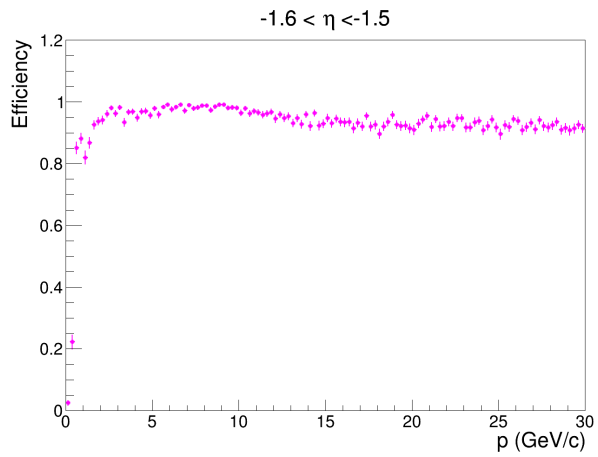




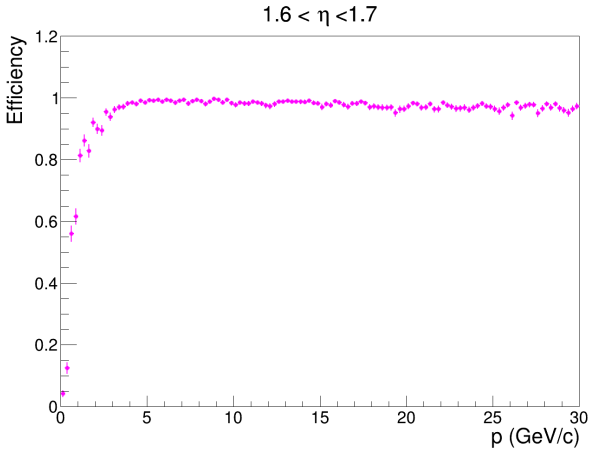


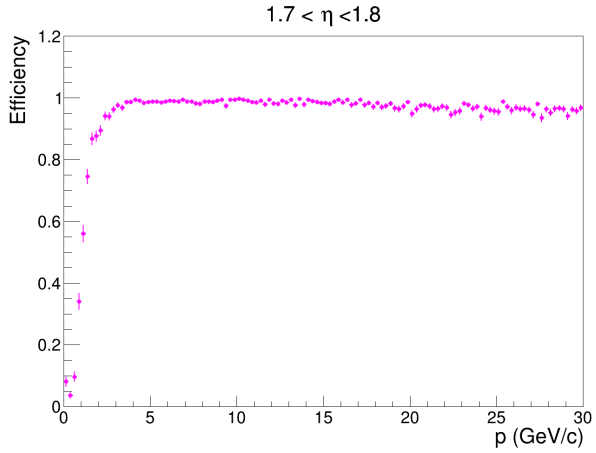


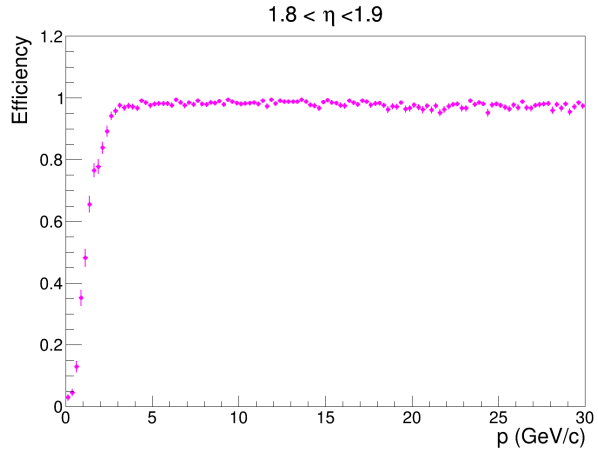


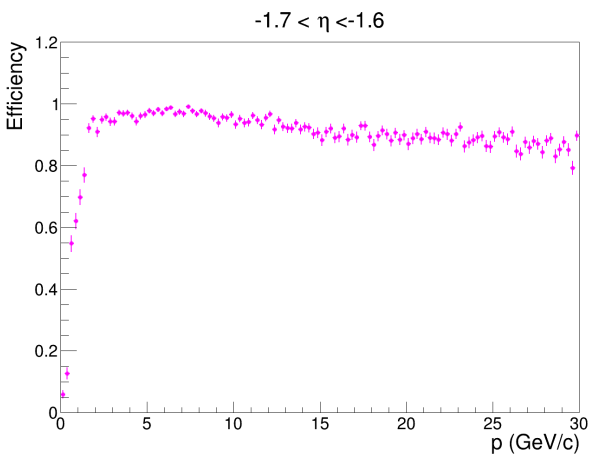


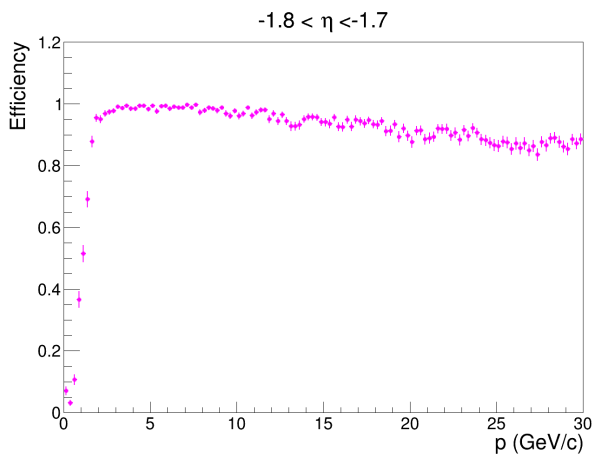
Acceptance Debugging

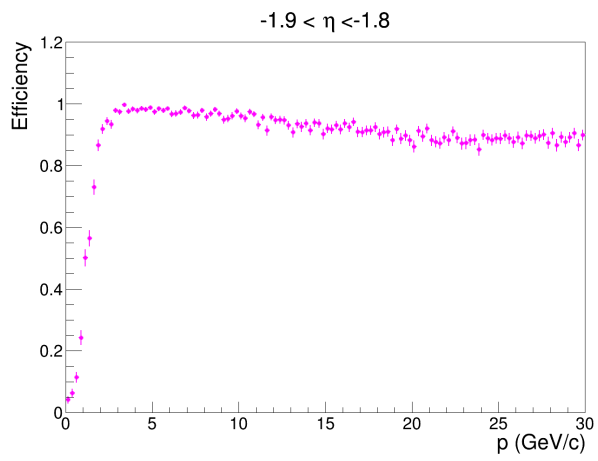




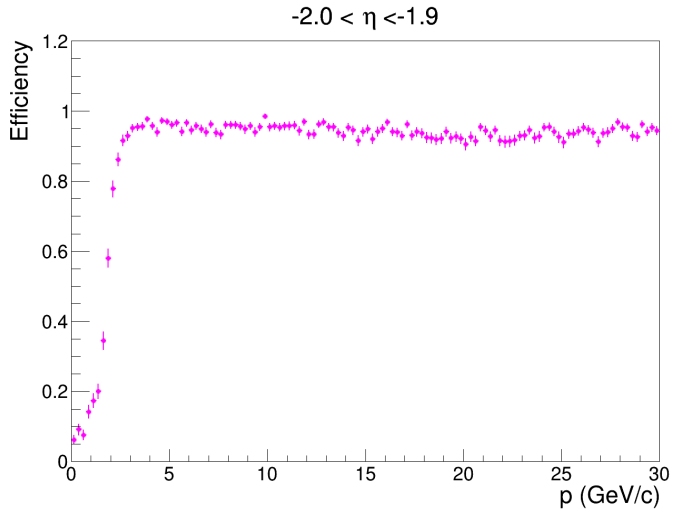


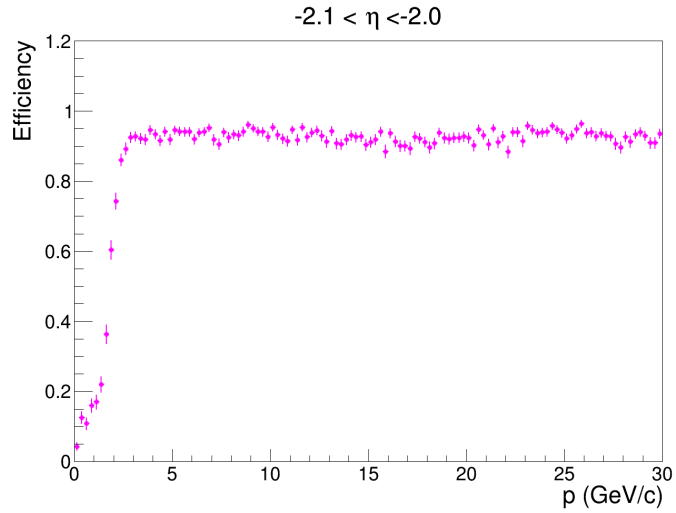


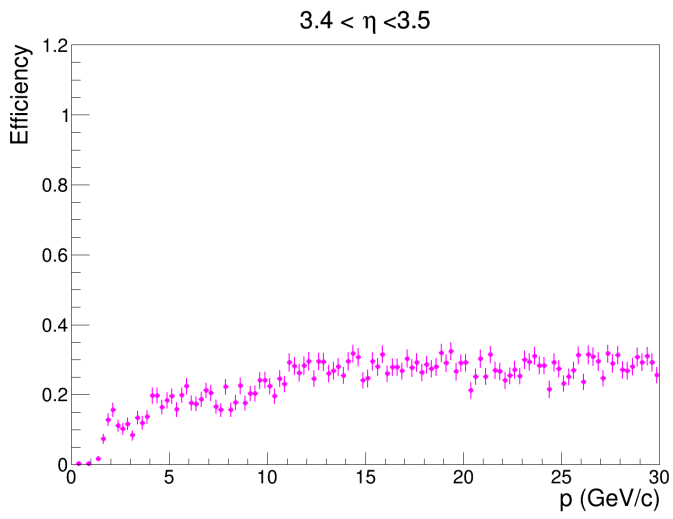


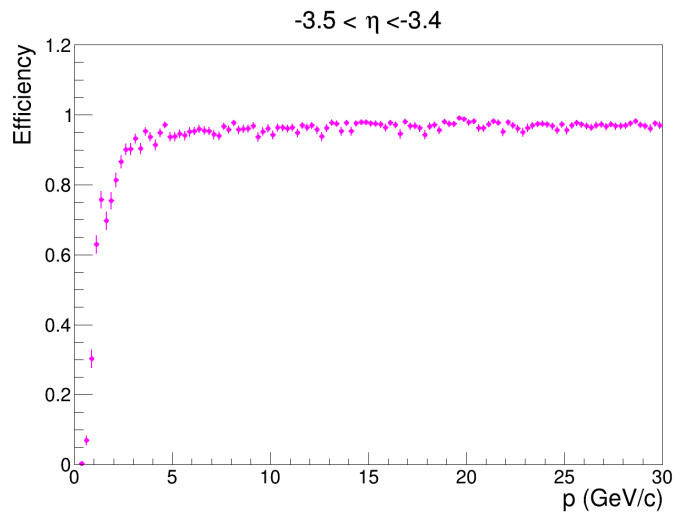


Acceptance Debugging



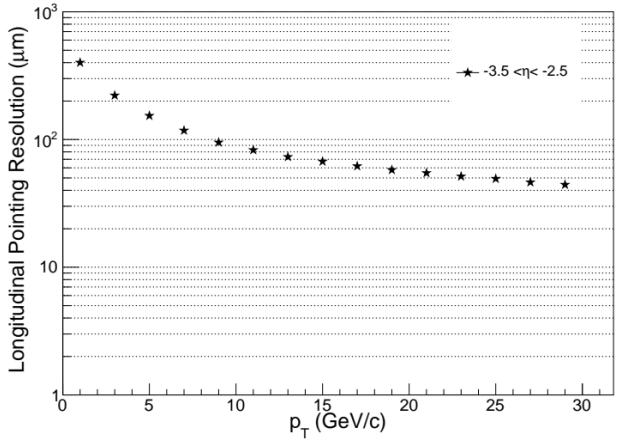


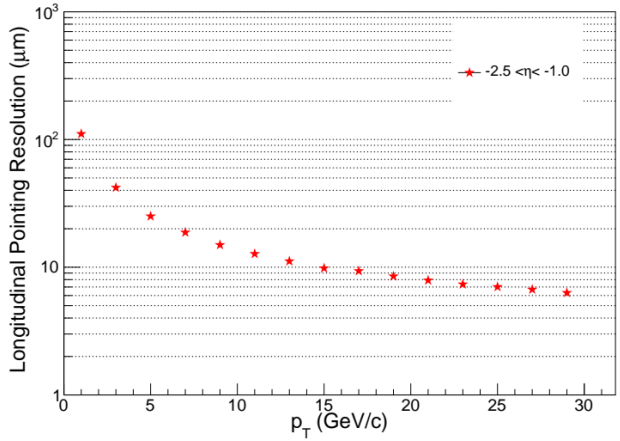


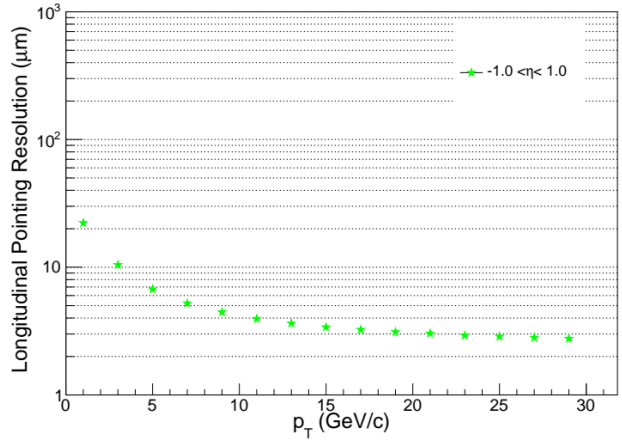


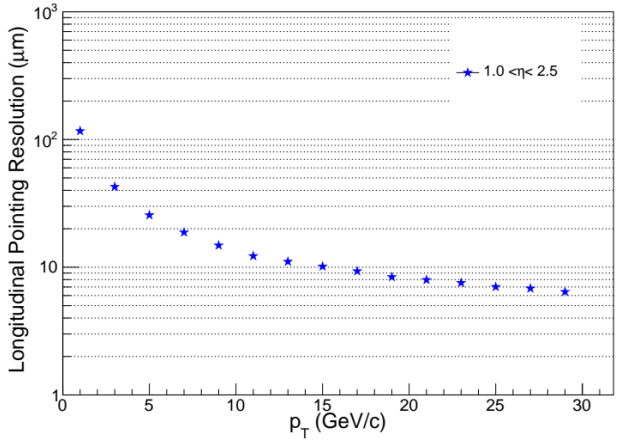
DCA Resolutions

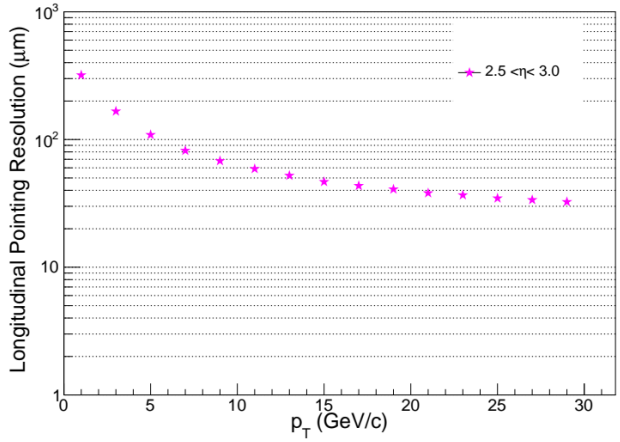
Longitudinal Pointing Resolution as a function of p_T

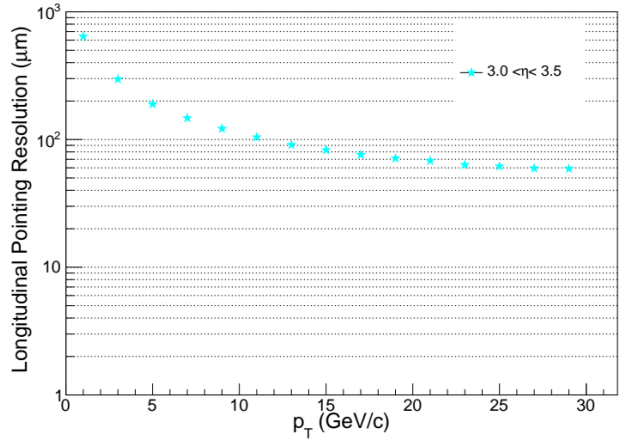






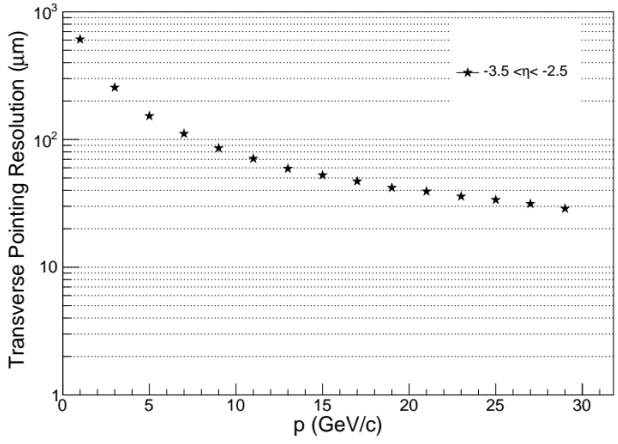


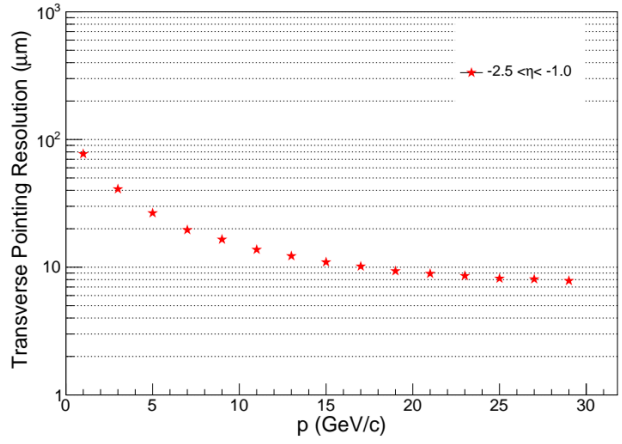


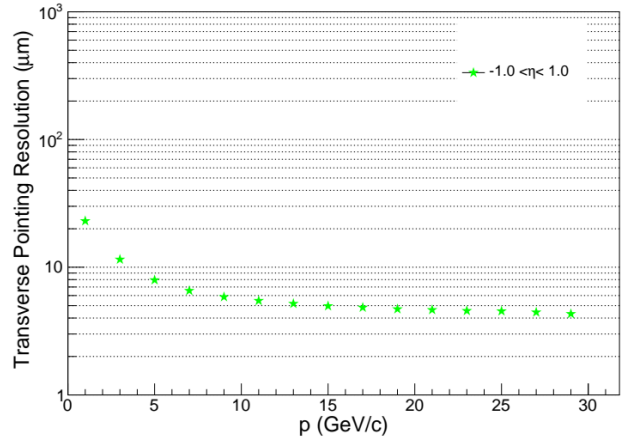


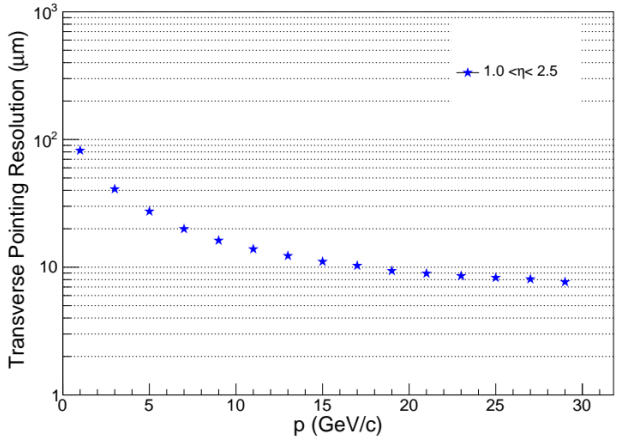
DCA Resolutions

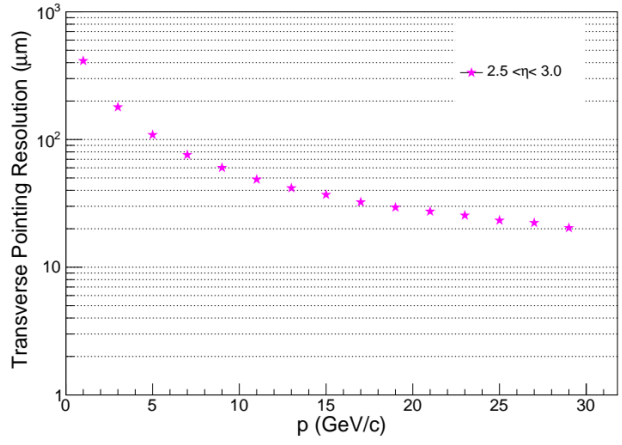
Transverse Pointing Resolution as a function of p

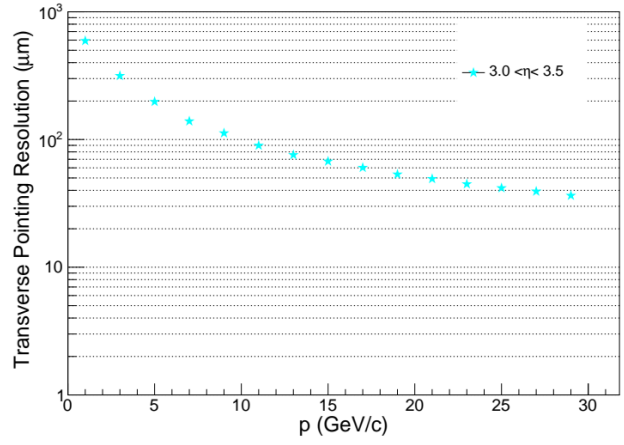






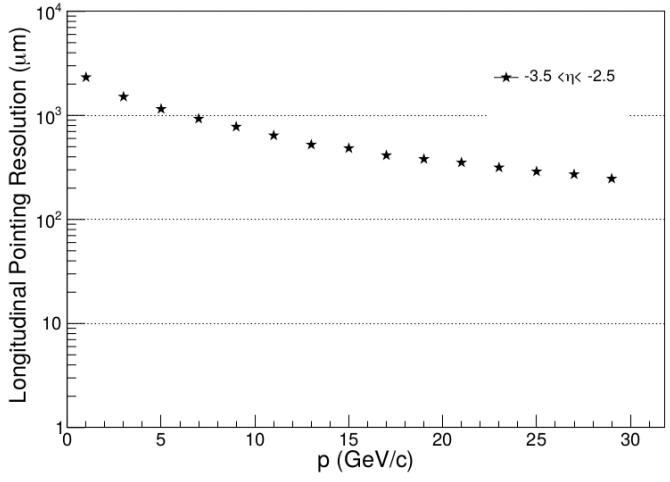


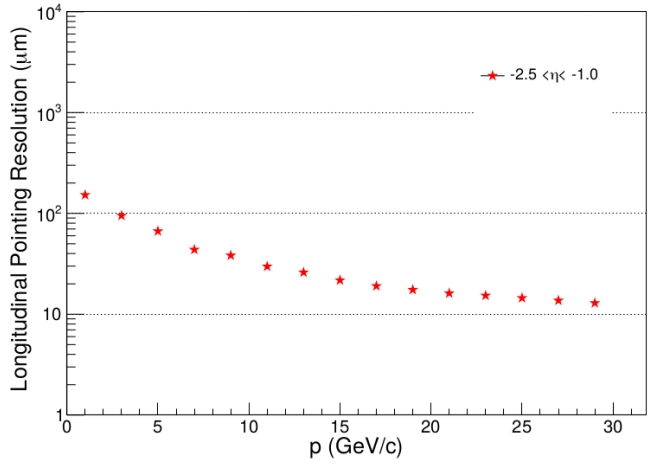


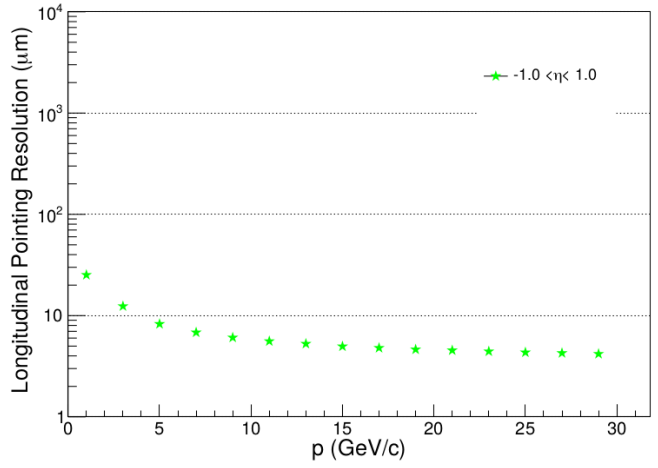


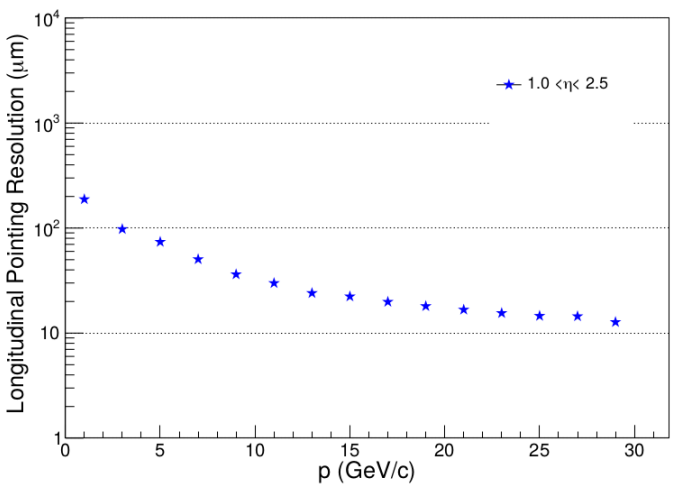
DCA Resolutions

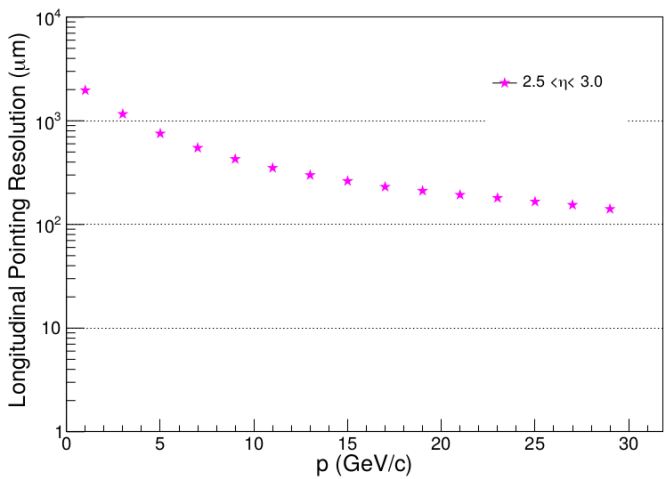
Longitudinal Pointing Resolution as a function of p

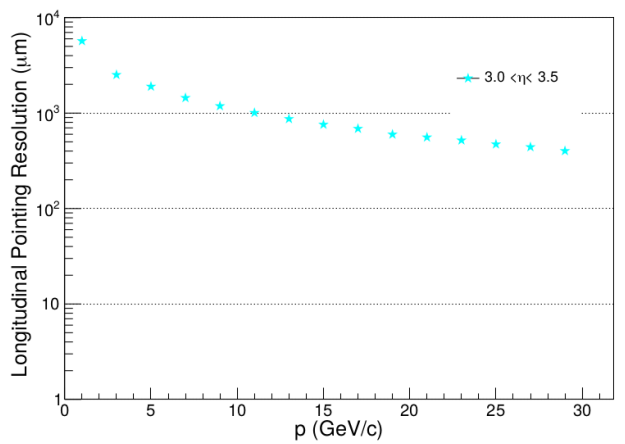












Warning

-------- WWWW ------- G4Exception-START -------- WWWW -------
*** G4Exception : GeomNav1002
issued by : G4Navigator::ComputeStep()
Stuck Track: potential geometry or navigation problem.
Track stuck, not moving for 10 steps.
Current phys volume: 'HadronForwardEnvelope_0'
- at position : (-28.23575275454786,-8.980237774479519,3131.26576428348)
in direction: (-0.6207603974044806,0.5037252475967199,0.6007640168550832)
(local position: (-28.23575275454786,-8.980237774479519,3131.26576428348))
(local direction: (-0.6207603974044806,0.5037252475967199,0.6007640168550832)).
Previous phys volume: 'P-PI-FLG-0062-2'

Likely geometry overlap - else navigation problem !
*** Trying to get *unstuck* using a push - expanding step to 1e-07 (mm) ... Potential overlap in geometry !

*** This is just a warning message. ***
-------- WWWW -------- G4Exception-END --------- WWWW -------

genfit::Exception thrown with excString:
RKTrackRep::RKutta ==> Total extrapolation length is longer than length limit : 3003 cm !
in line: 1886 in file: /phenix/u/phnxbld/workarea/sPHENIX_SL7.3/gcc-8.3/need_root_version/root-6.22.02/genfit/trackReps/src/RKTrackRep.cc
with fatal flag 0
PHG4TrackFastSim (ERROR): /home/phnxbld/EIC/gcc-8.3/new/source/fun4all_coresoftware/simulation/g4simulation/g4trackfastsim/PHG4TrackFastSim.cc: 903: Extraction faild!
Error in <TDecompChol::Decompose()>: matrix not positive definite
genfit::Exception thrown with excString:

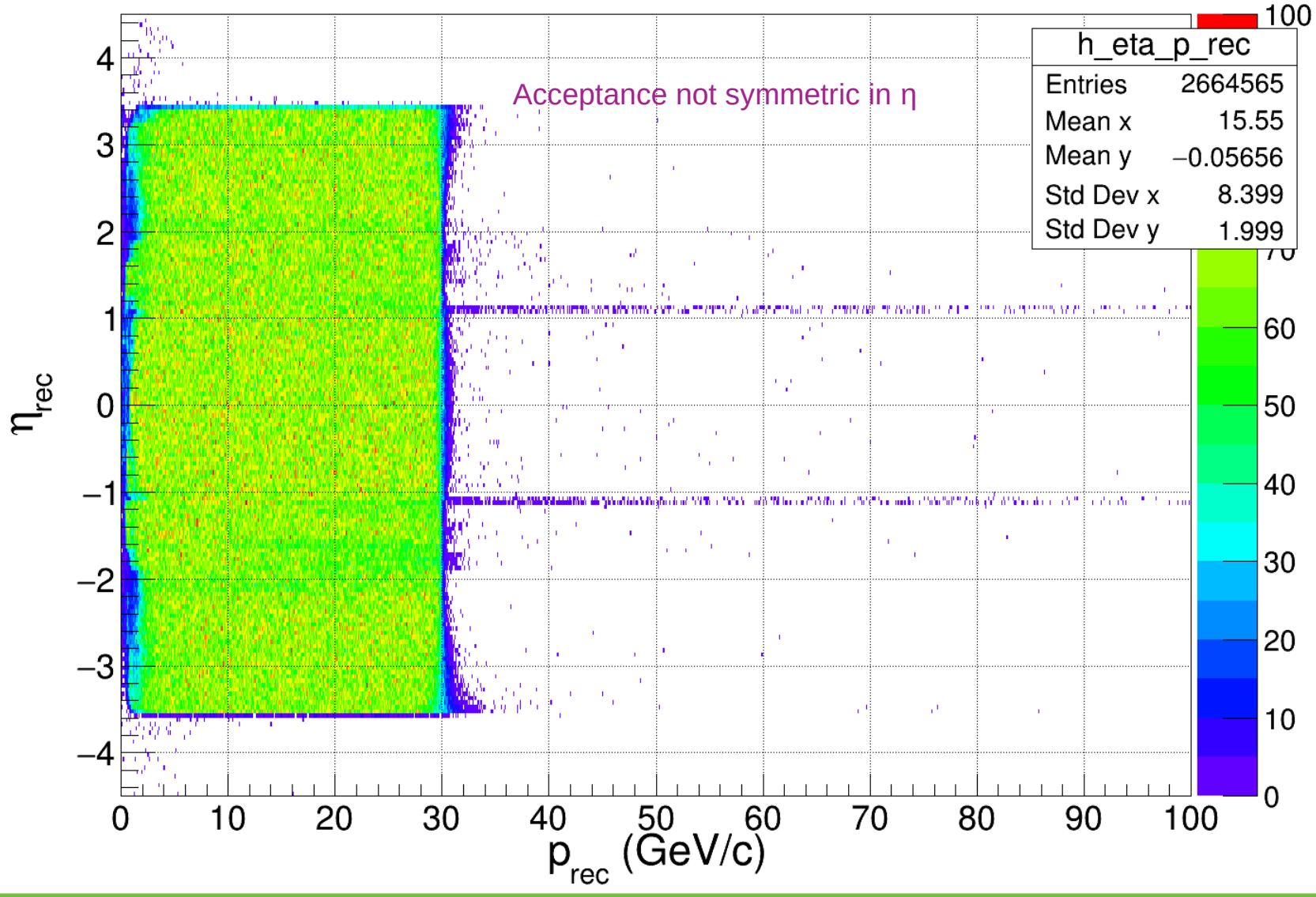
Beam Pipe

```
root [0] TGDMLParse parser;
root [1]  parser.GDMLReadFile("genfitGeom_AllSi_v2.gdml");
Info in <TGeoManager::TGeoManager>: Geometry Geometry, default geometry created
root [2] .q
shyam@shyam:~/Singularity/Tracker_Performance/detector$ root -l
root [0] TGDMLParse parser;
root [1]  parser.GDMLReadFile("Detector_chamber_3-20-20.G4Import.gdml");
Info in <TGeoManager::TGeoManager>: Geometry Geometry, default geometry created
Error: Unsupported GDML Tag Used :tessellated. Please Check Geometry/Schema.
Error: Unsupported GDML Tag Used :triangular. Please Check Geometry/Schema.
Error: Unsupported GDML Tag Used :triangular. Please Check Geometry/Schema.
Error: Unsupported GDML Tag Used :triangular. Please Check Geometry/Schema.

   Solid: T-Detector chamber - inner hadron forward:1, Not Yet Defined!
   Solid: T-PI-FLG-0061, Not Yet Defined!
   Solid: T-Detector chamber - hadron forward, Not Yet Defined!
   Solid: T-PI-FLG-0062-1, Not Yet Defined!
   Solid: T-PI-FLG-0062-2, Not Yet Defined!
   Solid: T-SOLID_2, Not Yet Defined!
   Solid: T-Electron beam screen - inner chamber:1, Not Yet Defined!
   Solid: T-SOLID_1, Not Yet Defined!
   Solid: T-Detector chamber - hadron rear, Not Yet Defined!

    *** Break *** segmentation violation
```

Beam Pipe (G4_Pipe_EIC.C)

```
	// electron-going section of the beampipe
	if (do_pipe_electron_forward_extension)
	{
		PHG4GDMLSubsystem* gdml = new PHG4GDMLSubsystem("ElectronForwardEnvelope");
		//gdml->set_string_param("GDMPath", string(getenv("CALIBRATIONROOT")) + "/Beam/Detector chamber 3-20-20.G4Import.gdml");
		gdml->set_string_param("GDMPath","./detector/Detector_chamber_3-20-20.G4Import.gdml");
		gdml->set_string_param("TopVolName", "ElectronForwardEnvelope");
		gdml->set_int_param("skip_DST_geometry_export", 1);  // do not export extended beam pipe as it is not supported by TGeo and outside Kalman filter acceptance
		gdml->OverlapCheck(OverlapCheck);
		g4Reco->registerSubsystem(gdml);
	}

	// Hadron-going section of the beampipe
	if (do_pipe_hadron_forward_extension)
	{
		PHG4GDMLSubsystem* gdml = new PHG4GDMLSubsystem("HadronForwardEnvelope");
		//gdml->set_string_param("GDMPath", string(getenv("CALIBRATIONROOT")) + "/Beam/Detector chamber 3-20-20.G4Import.gdml");
		gdml->set_string_param("GDMPath","./detector/Detector_chamber_3-20-20.G4Import.gdml");
		gdml->set_string_param("TopVolName", "HadronForwardEnvelope");
		gdml->set_int_param("skip_DST_geometry_export", 1);  // do not export extended beam pipe as it is not supported by TGeo and outside Kalman filter acceptance
		gdml->OverlapCheck(OverlapCheck);
		g4Reco->registerSubsystem(gdml);
	}
```

η vs p reco


Acceptance not symmetric in η
h_eta_p_rec
Entries 2664565
Mean x 15.55
Mean y −0.05656
Std Dev x 8.399
Std Dev y 1.999
η_{rec}
p_{rec} (GeV/c)