Update on Tracking Studies using DD4HEP

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Thanks to Shujie for the discussion

EPIC Barrel configuration from Fun4All

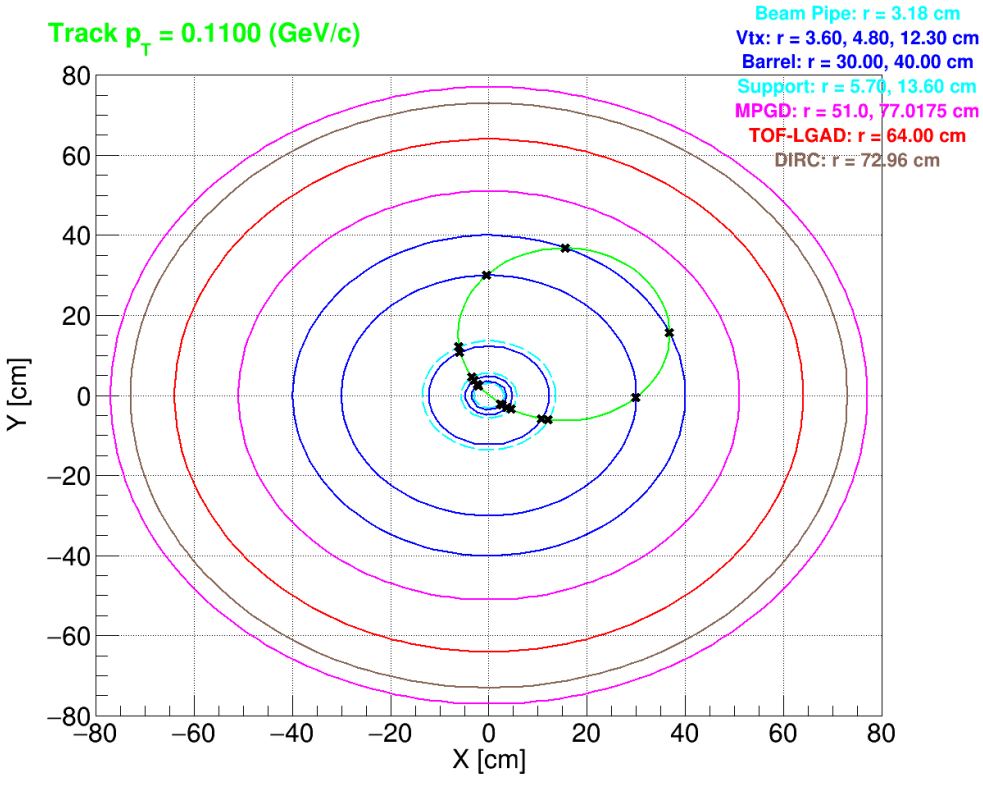
EPIC Configuration Barrel:

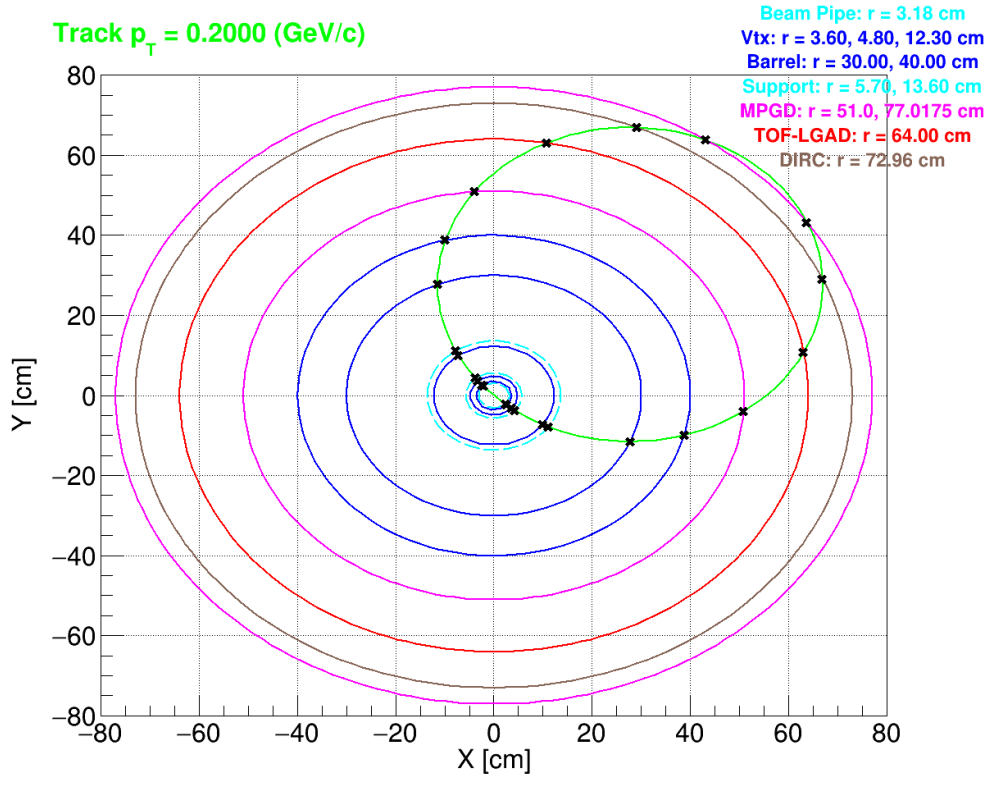
Name	Radius (cm)	X/X0	R-Phi resol (cm)	R-Z resol (cm)
BeamPipe	3.18	0.0022	----------	
Vtx1	3.6	0.0005	10.0e-4/sqrt(12)	10.0e-4/sqrt(12)
Vtx2	4.8	0.0005	10.0e-4/sqrt(12)	10.0e-4/sqrt(12)
VtxSupport	5.7	0.001	----------	
Vtx3	12.3	0.0005	10.0e-4/sqrt(12)	10.0e-4/sqrt(12)
BarrSupport	13.6	0.001	----------	
Barr1	30.0	0.0025	10.0e-4/sqrt(12)	10.0e-4/sqrt(12)
Barr2	40.0	0.0055	10.0e-4/sqrt(12)	10.0e-4/sqrt(12)
MM1	51.0	0.0026	55.0e-4	55.0e-4
ACLGAD	64.0	0.0558	30.0e-4	30.0e-4
DIRC	72.96	0.1274	----------	
MM2	77.0175	0.0026	55.0e-4	55.0e-4

EPIC Geometry

p_T = 0.3 B [T] R[m] = 0.3*1.7*0.20 = 0.102 GeV/c

p_T = (0.3*1.7*0.77)/2 = 0.196 GeV/c





Magnetic Field Scaling

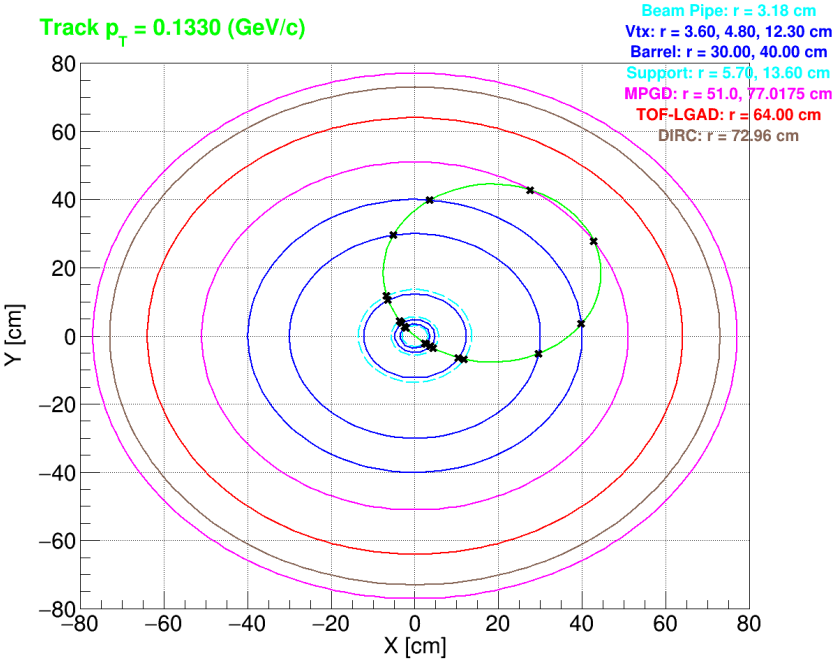
Simulation of 3M pi+

If the magnetic field is 1.5 Tesla.

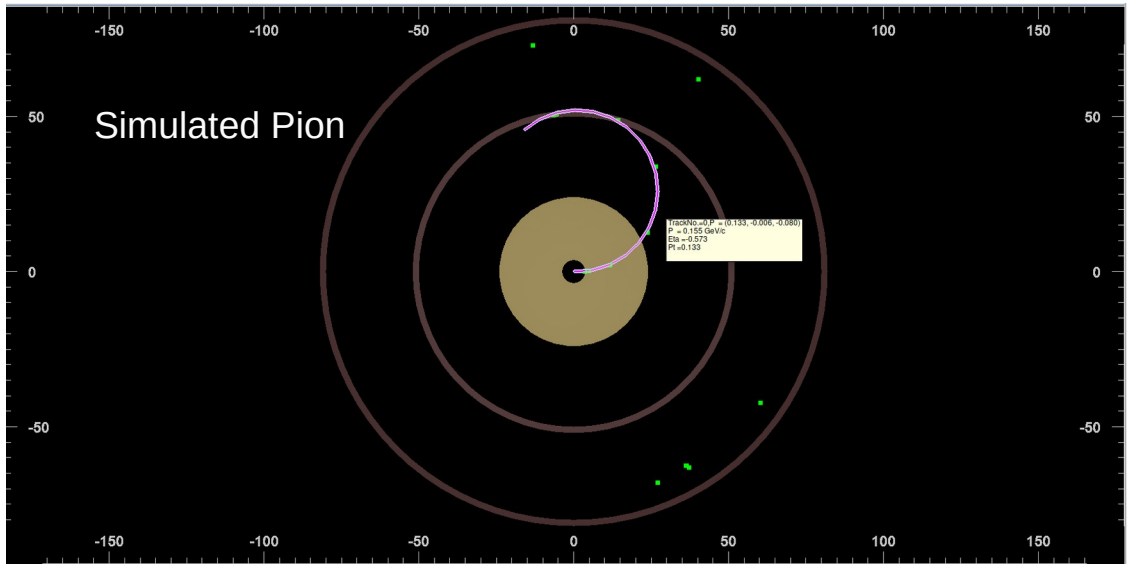
Layer hit R = 2*0.133/(0.3*1.5)= 0.59111111 m

If the magnetic field is 1.7 Tesla.

Layer hit R = 2*0.133/(0.3*1.7) = 0.521568 m

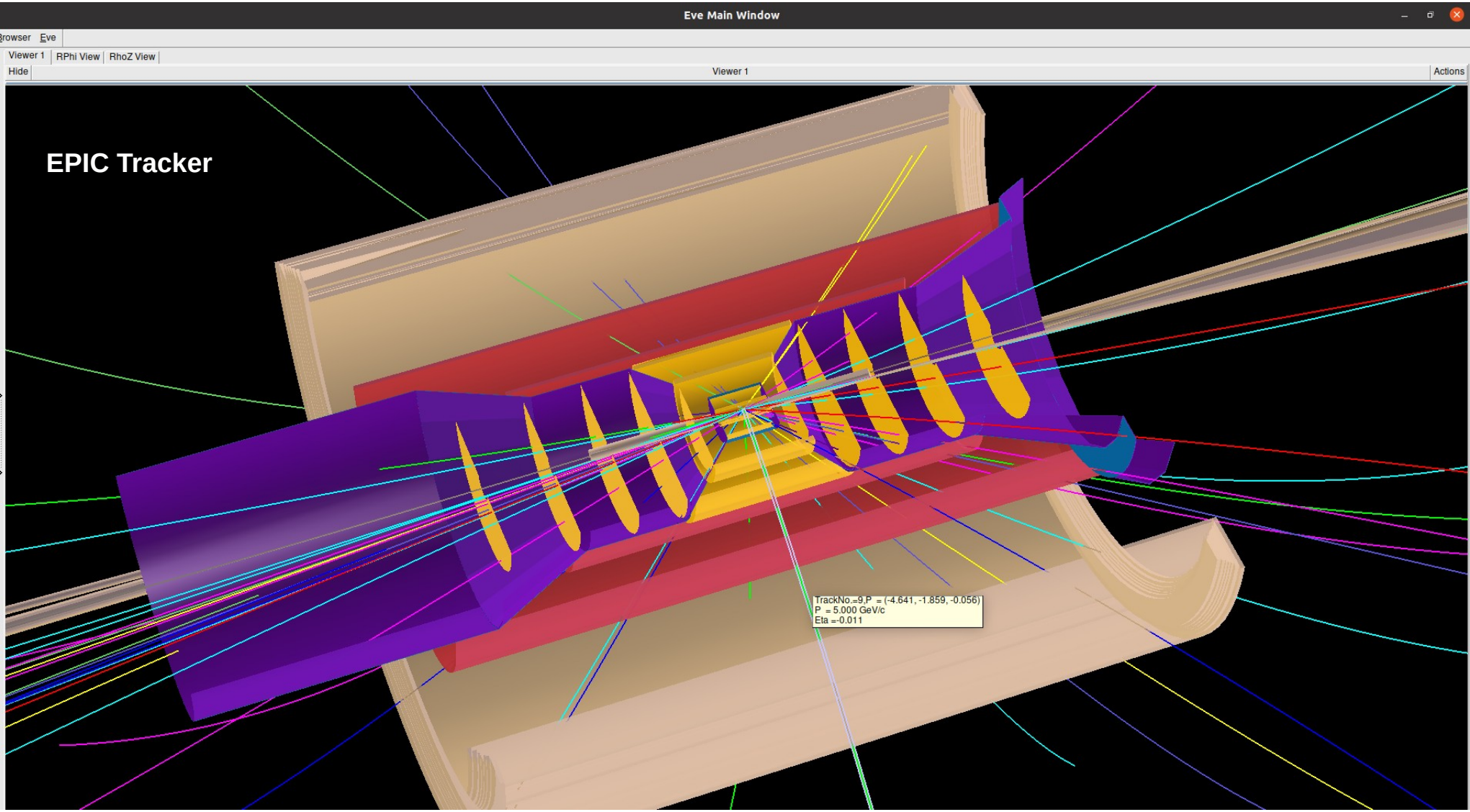


Event display



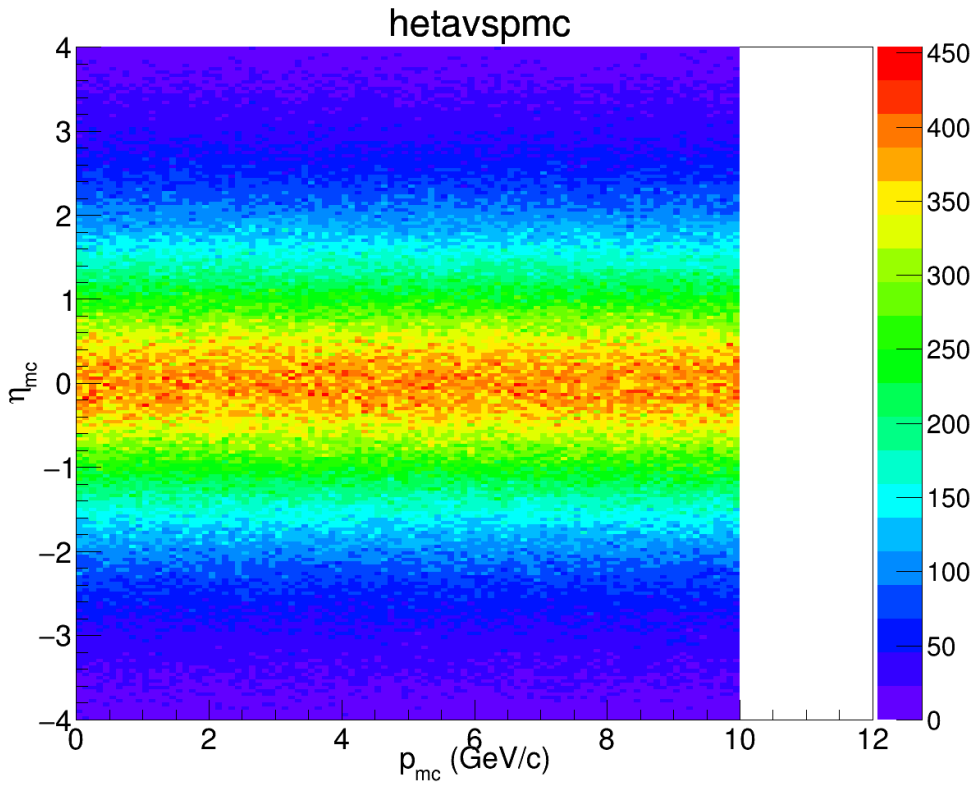
Magnetic field scaling is working properly

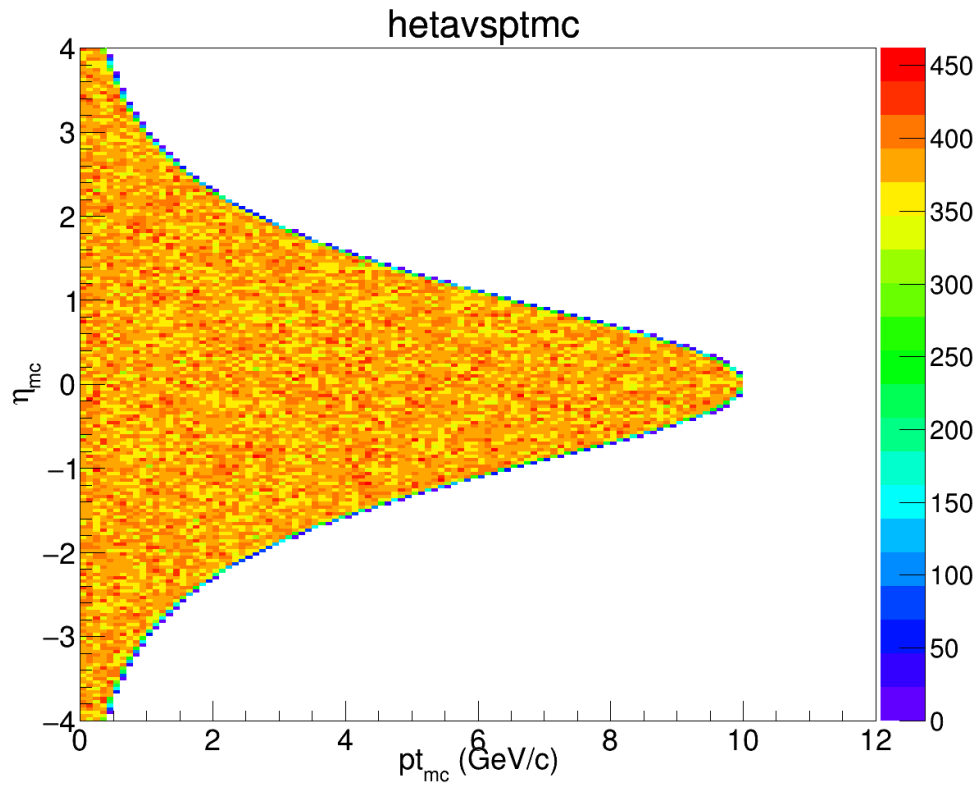
EPIC Tracking Geometry



Particle Simulation

Simulation of 3M pi+ using particle gun in geant4 (single particle), Mom [0.,10.] GeV/c

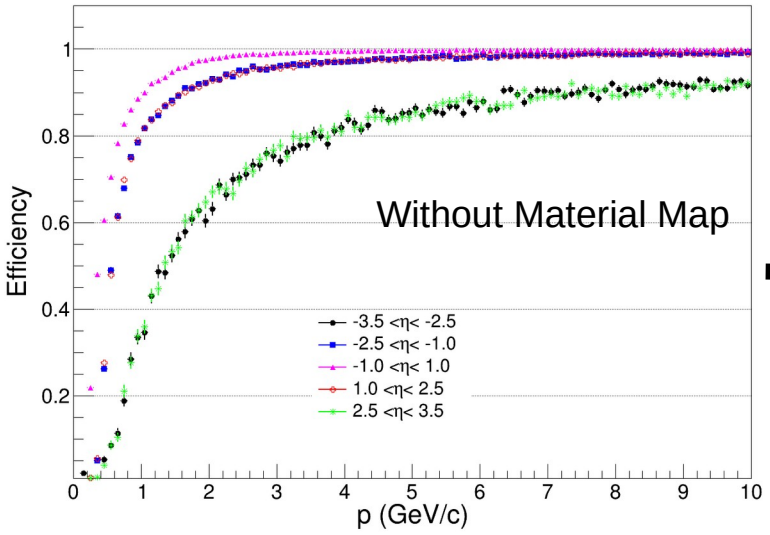




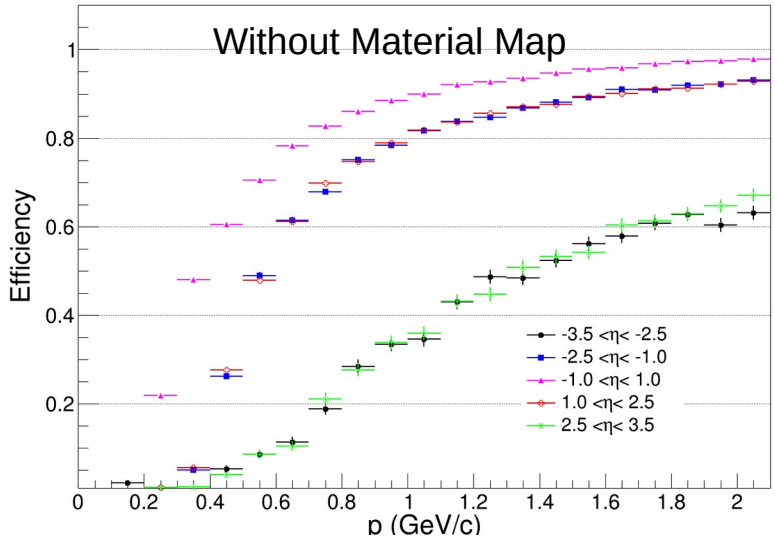
Efficiency Calculation: hp_mc->Fill(pmc); if (reconstructed) hp_rec->Fill(pmc)

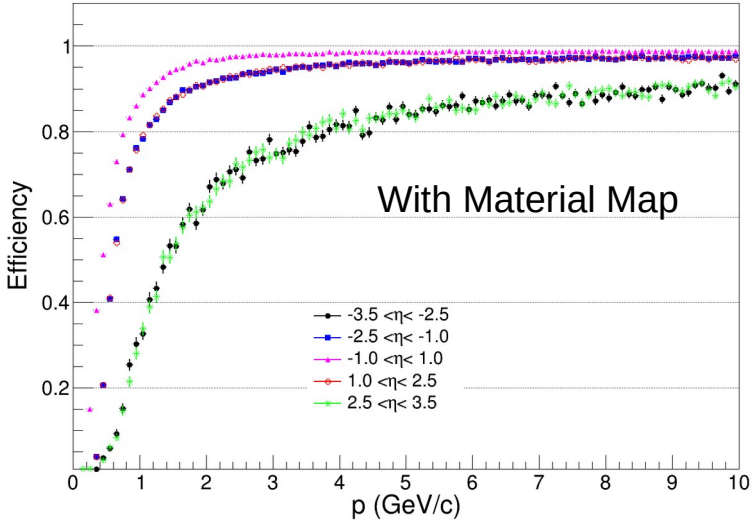
Efficiency: hp_rec->Divide(hp_rec,hp_mc,1,1,"B"); // Binomial errors propagation

Efficiency (EPIC Tracking Geometry)

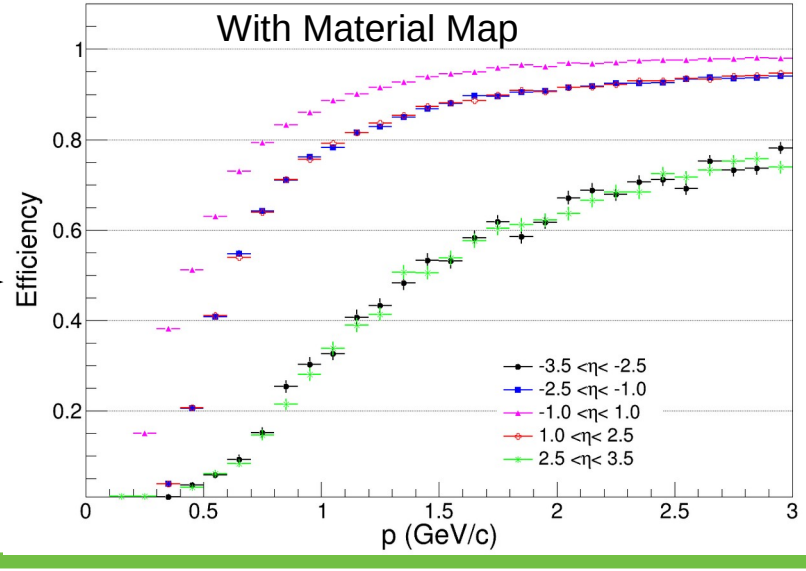


Zoom

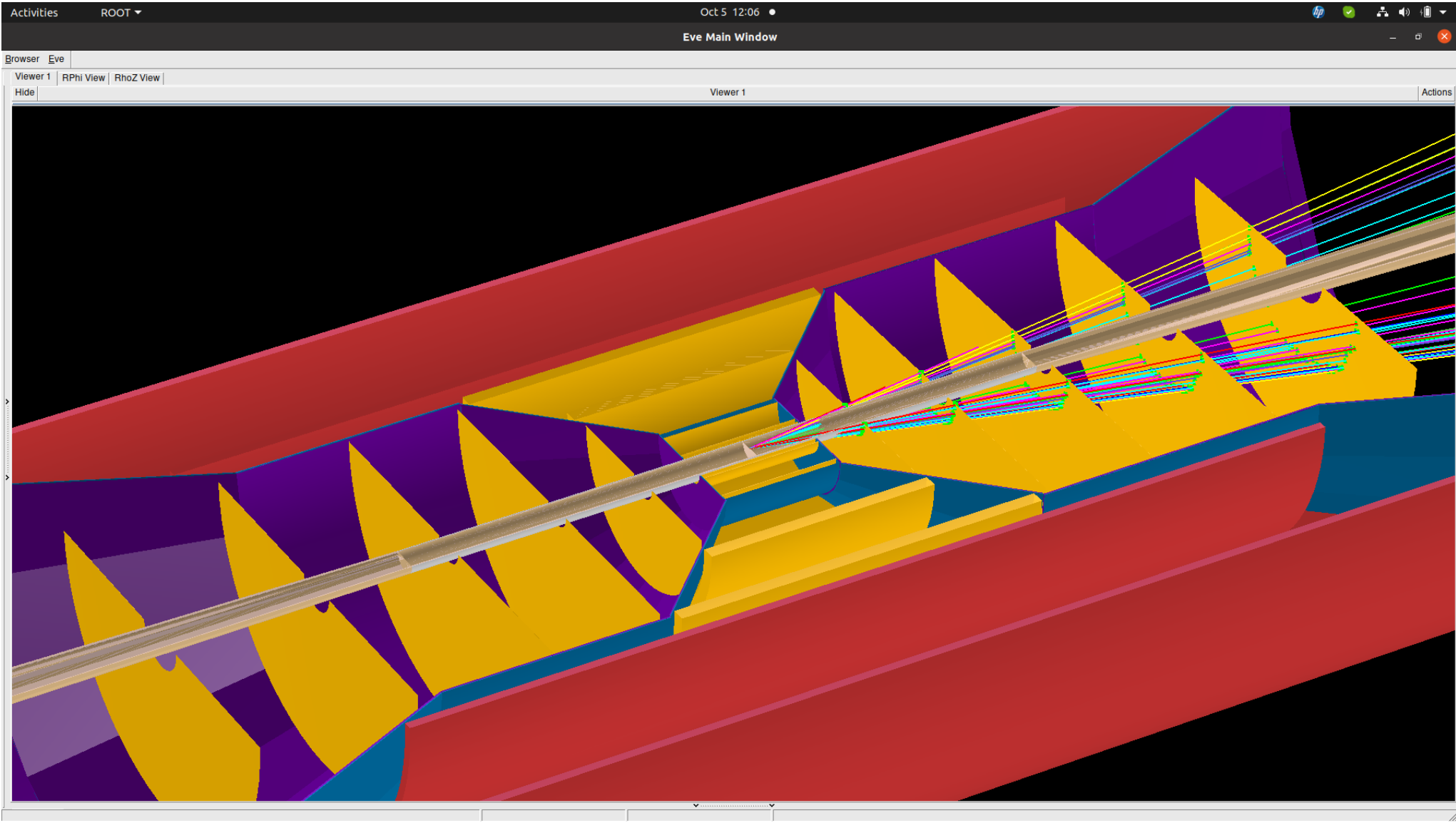




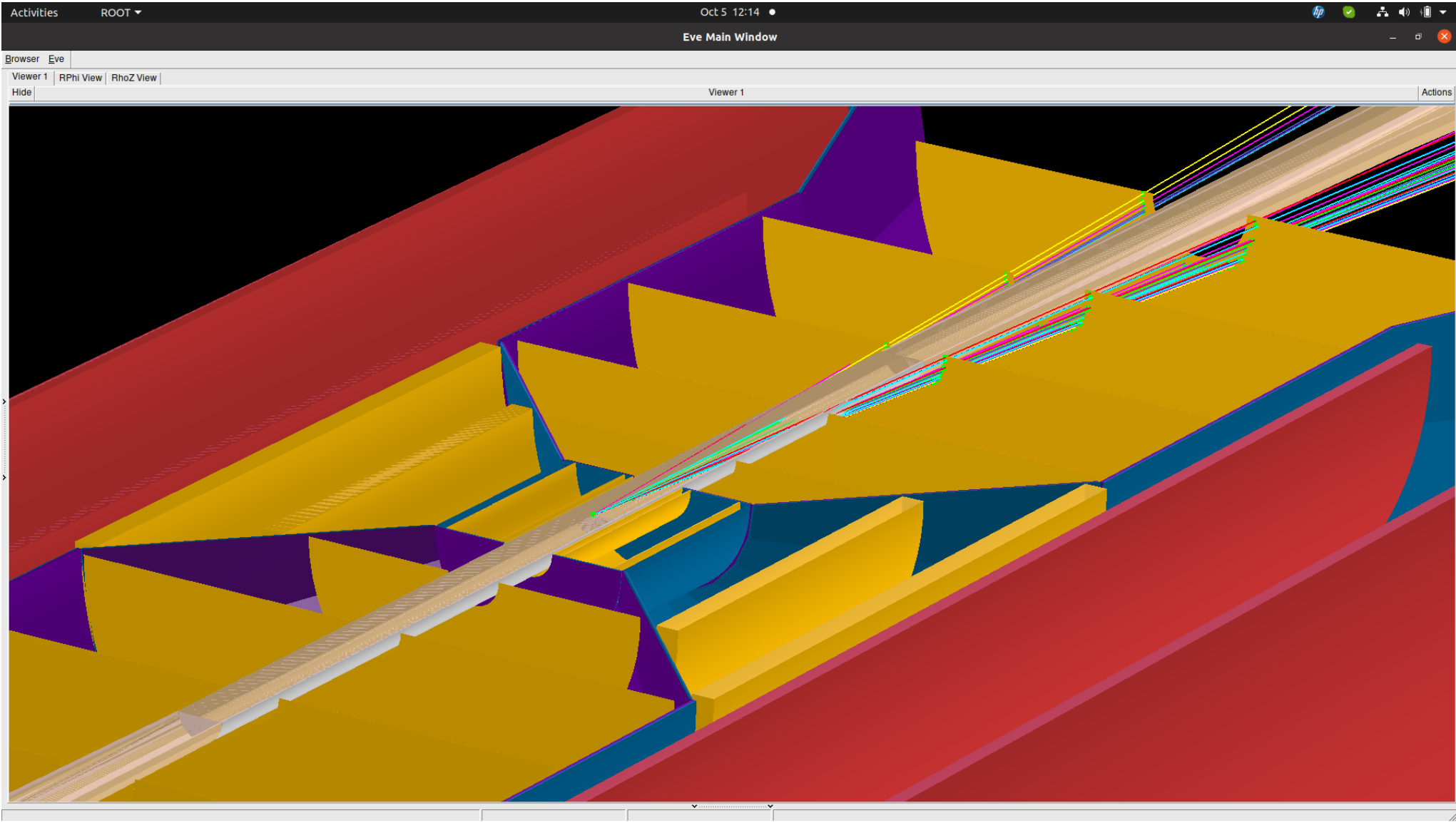
Zoom



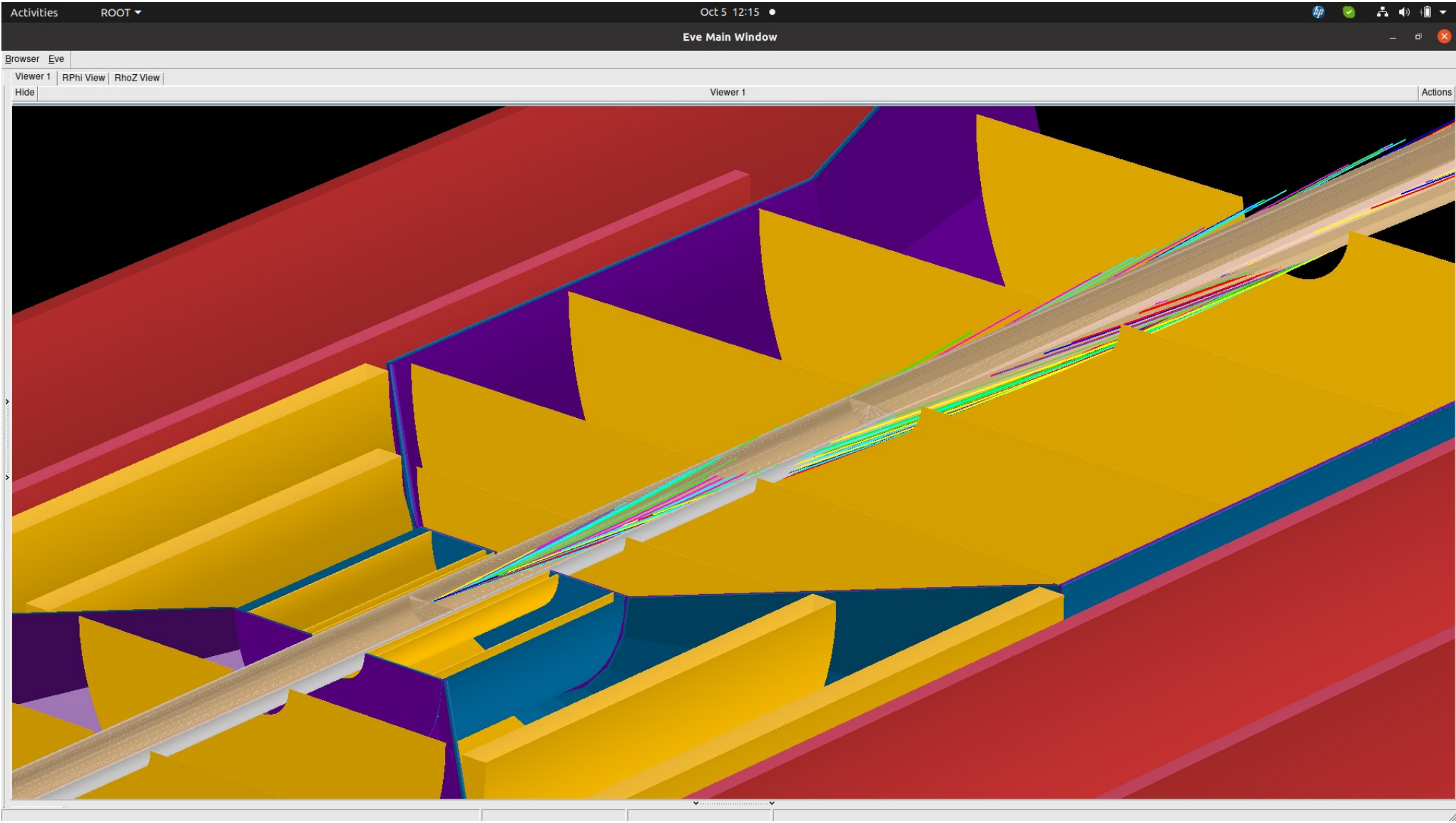
Tracks η [2.5-2.6] & p = 5.0 GeV/c



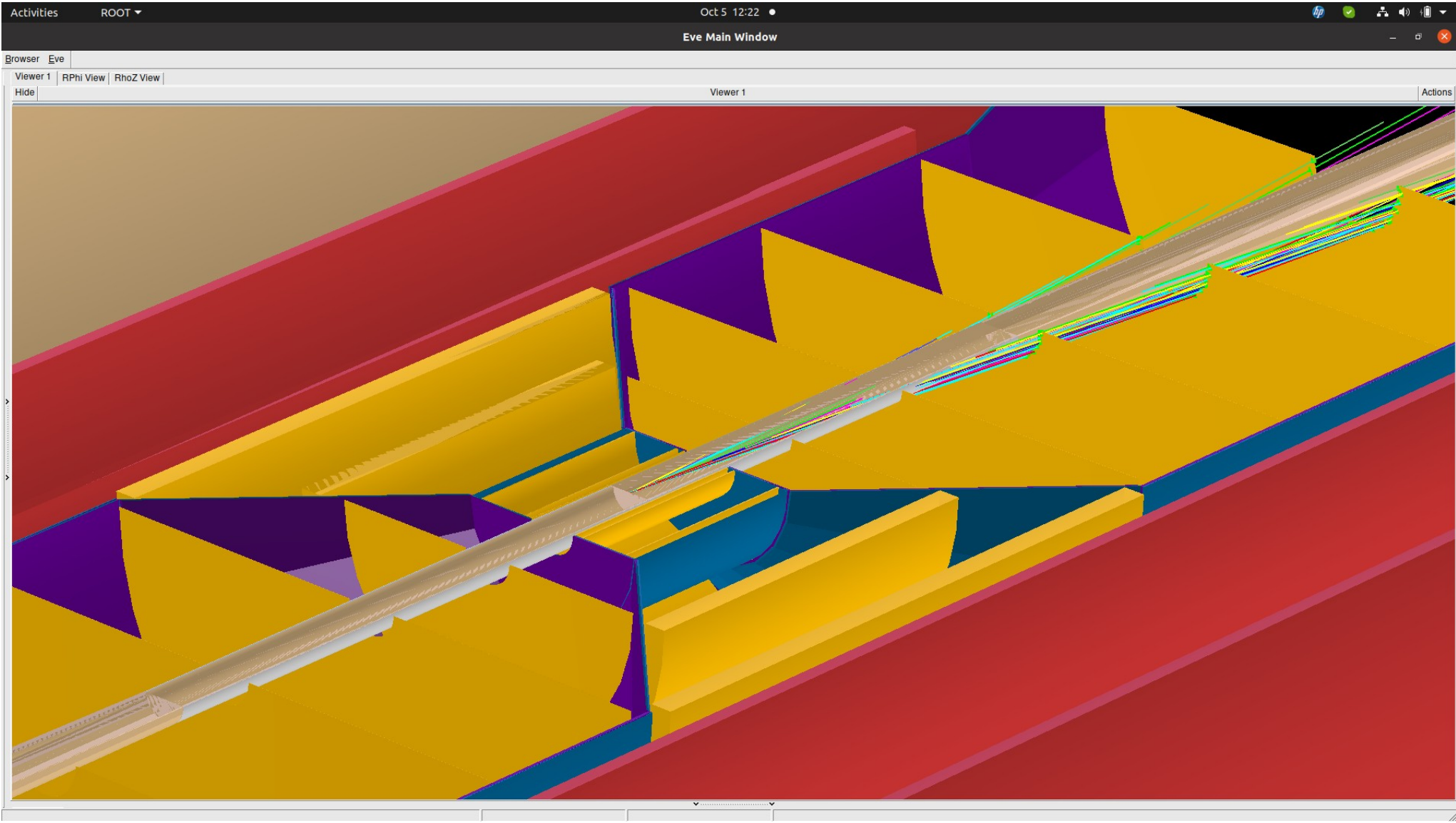
Tracks η [3.4-3.5] & p = 5.0 GeV/c



Tracks η [3.4-3.5] & p = 0.2 GeV/c

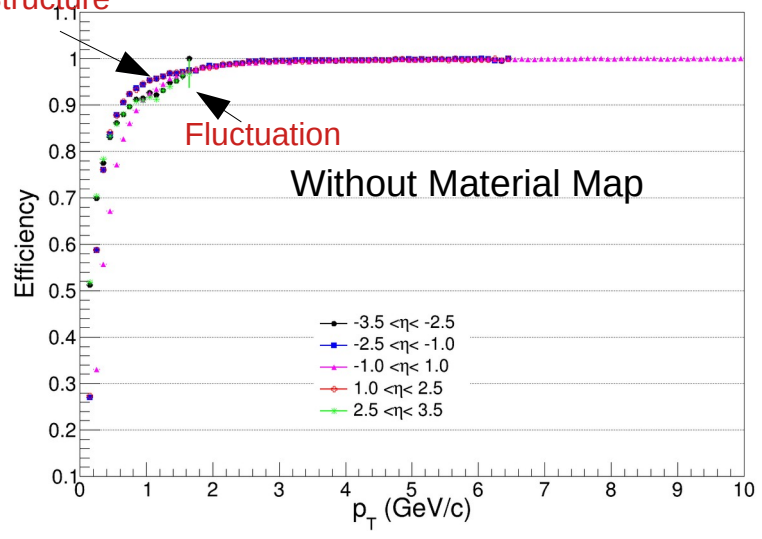


Tracks η [3.4-3.5] & p = 0.4 GeV/c

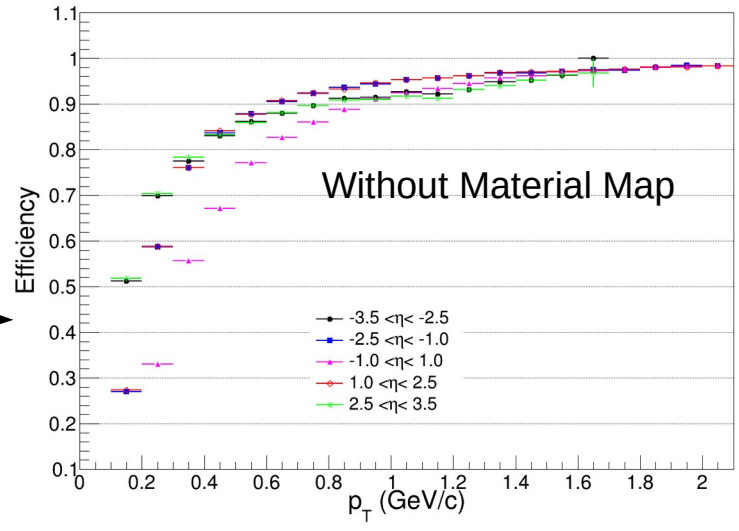


Efficiency (EPIC Tracking Geometry)

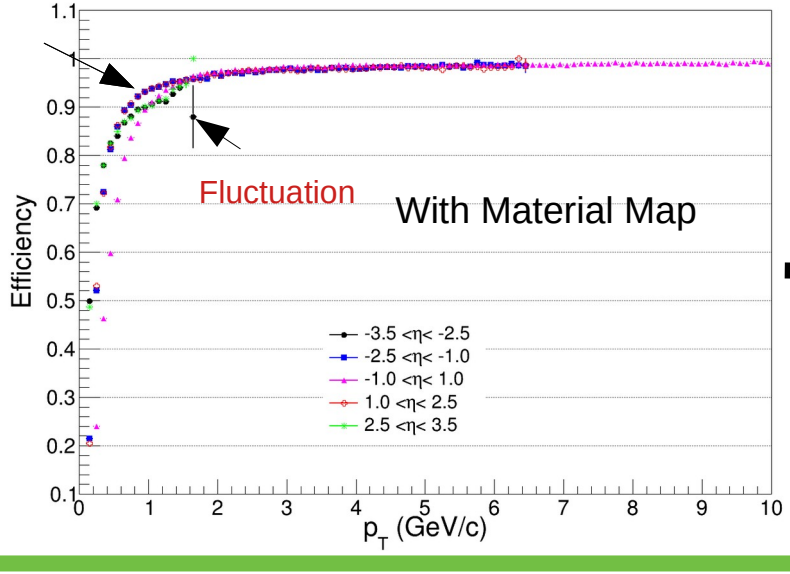
Structure



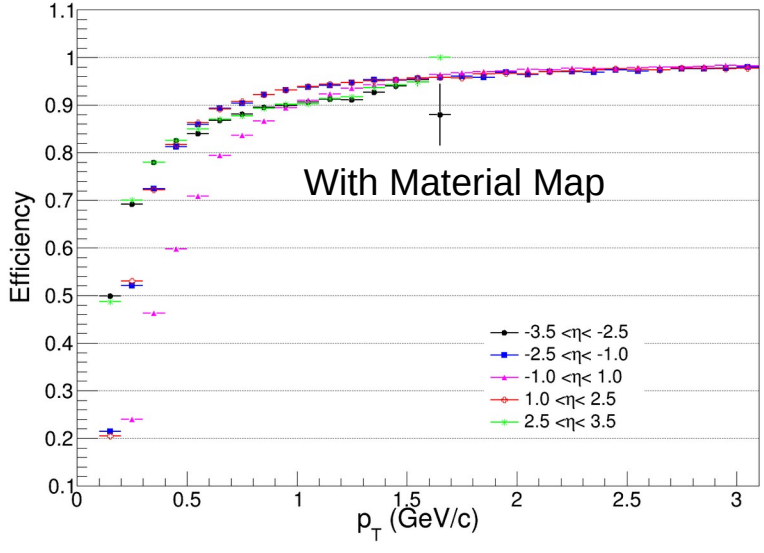
Zoom



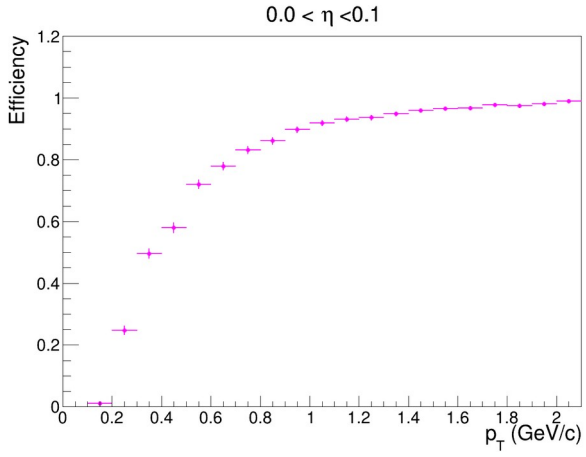
Structure

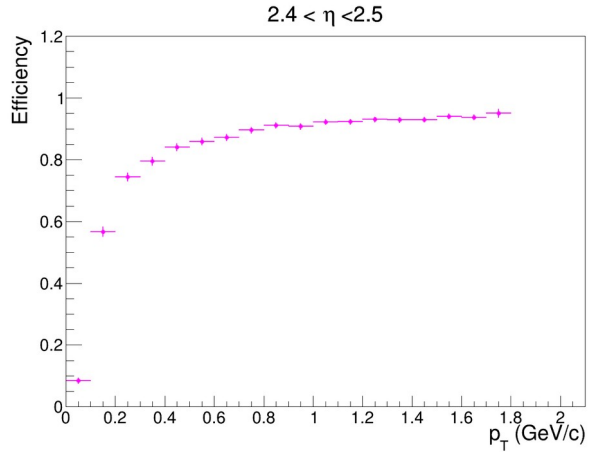


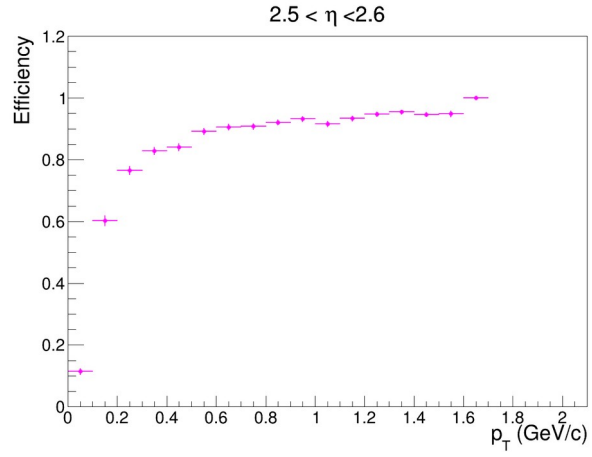
Zoom

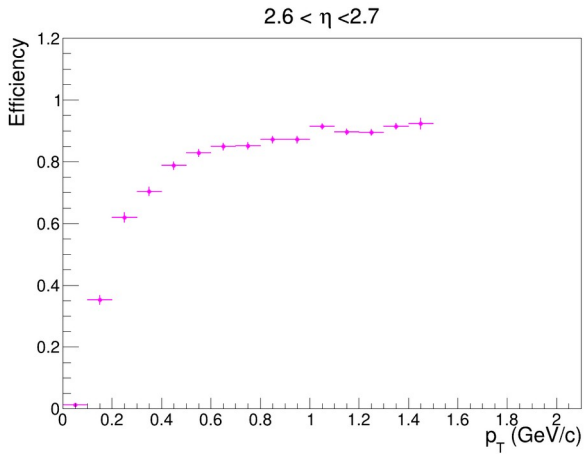


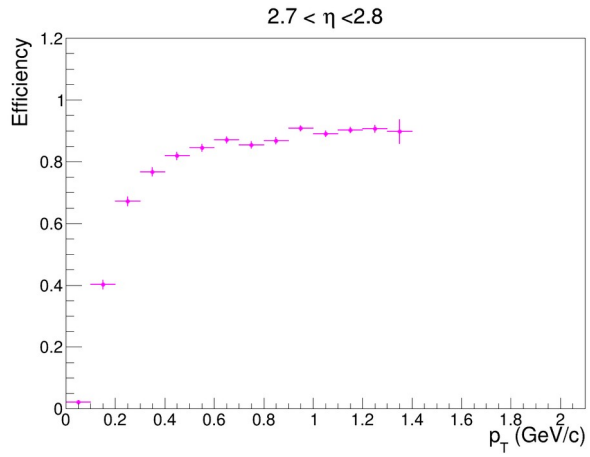
Efficiency full tracker in fine bins (With Material Map)

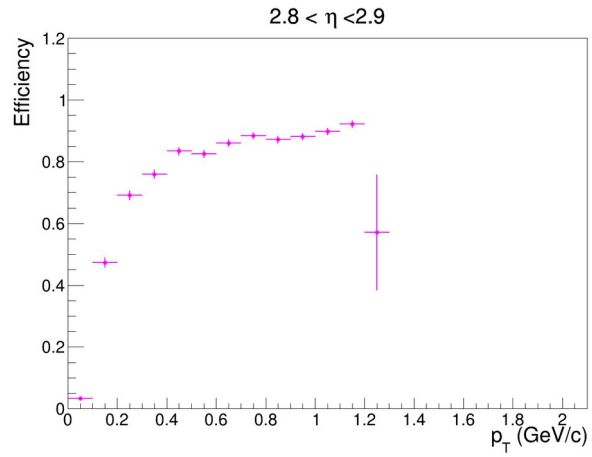




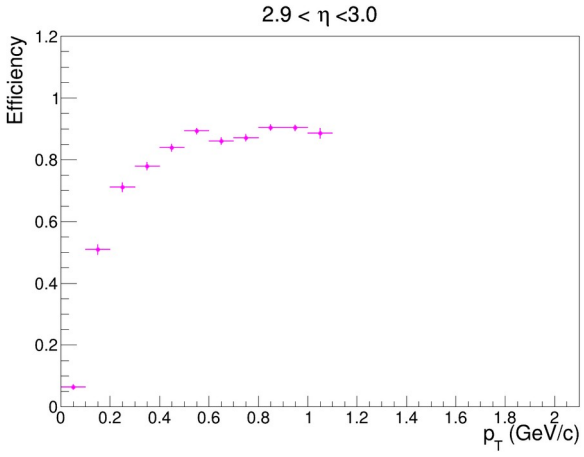


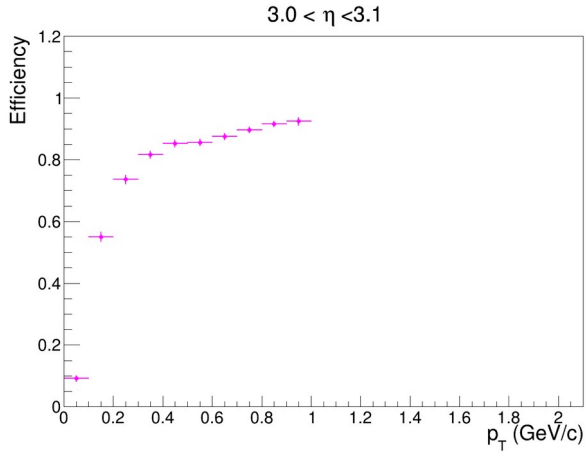


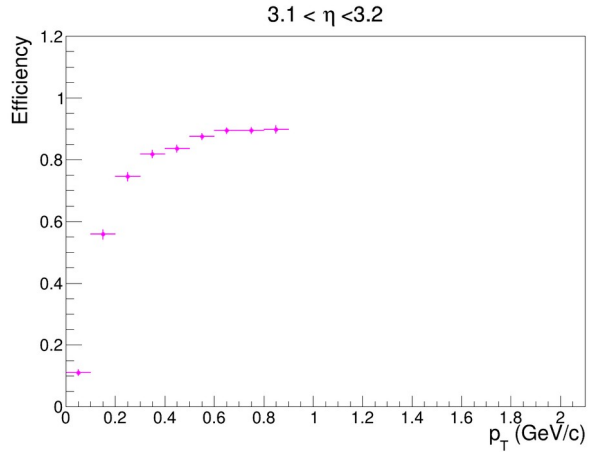


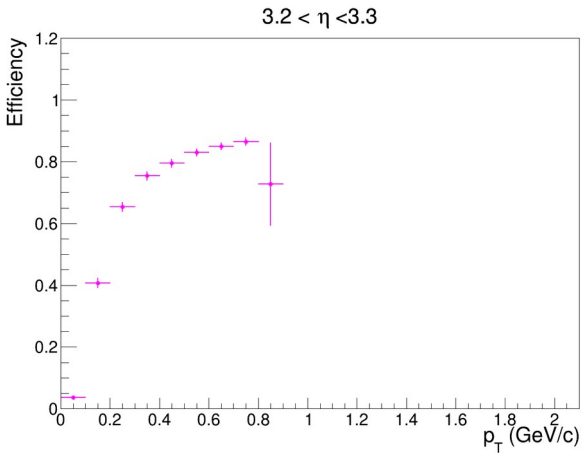


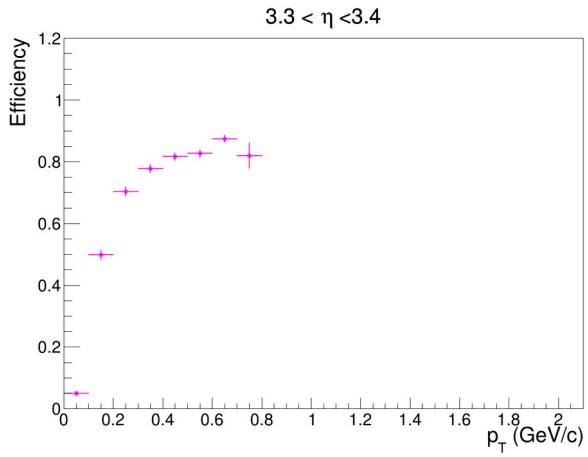
Efficiency full tracker in fine bins (With Material Map)

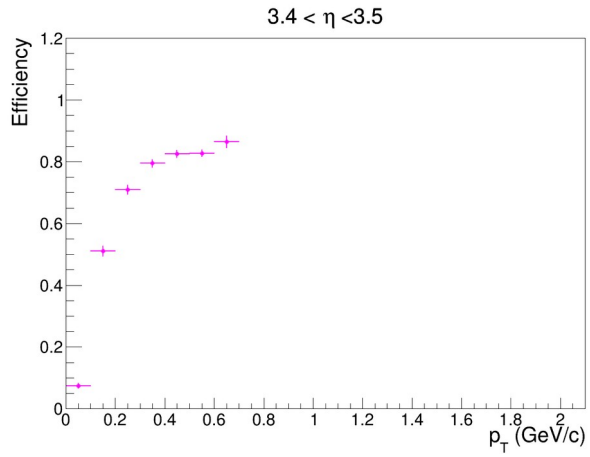




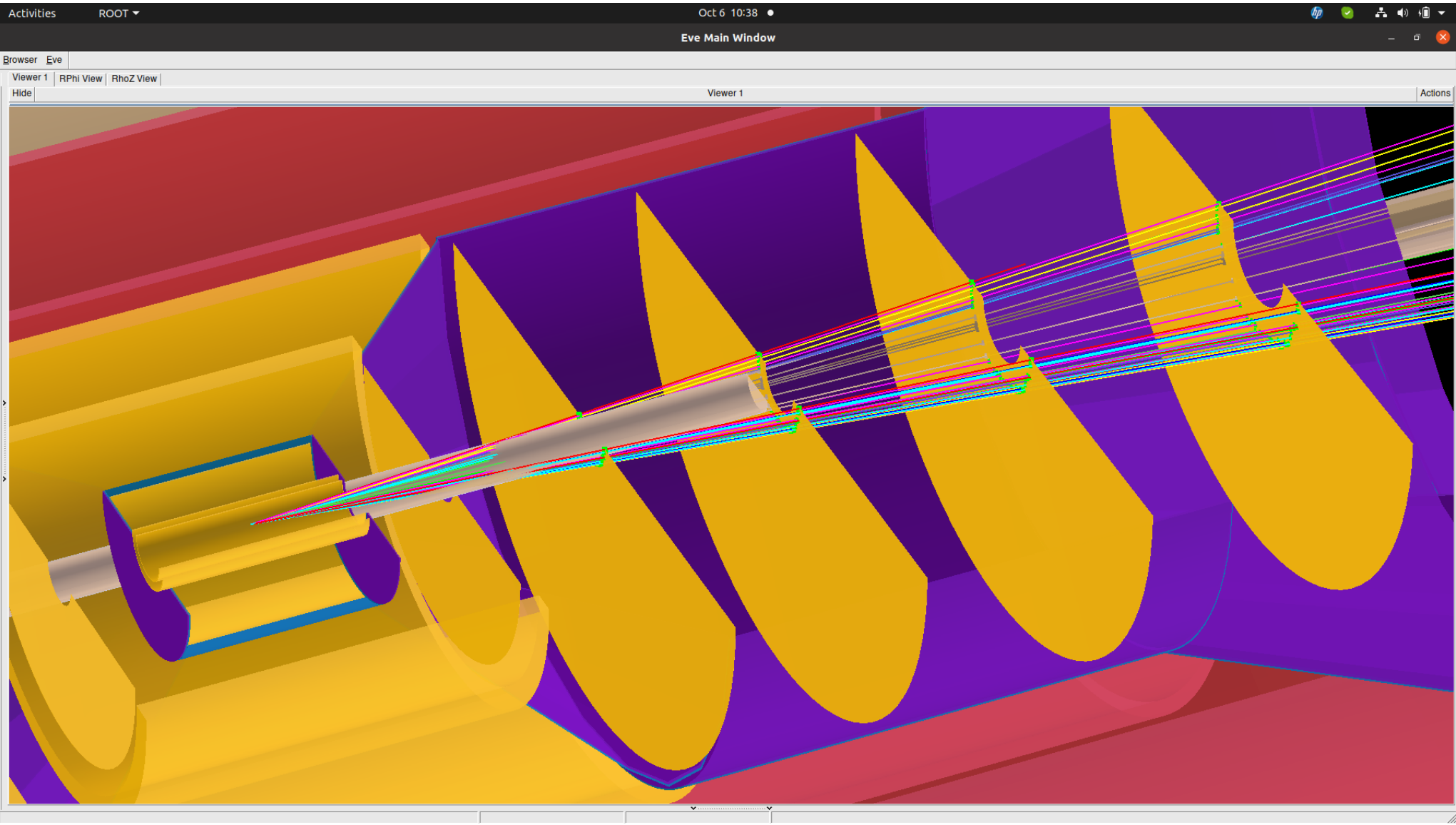




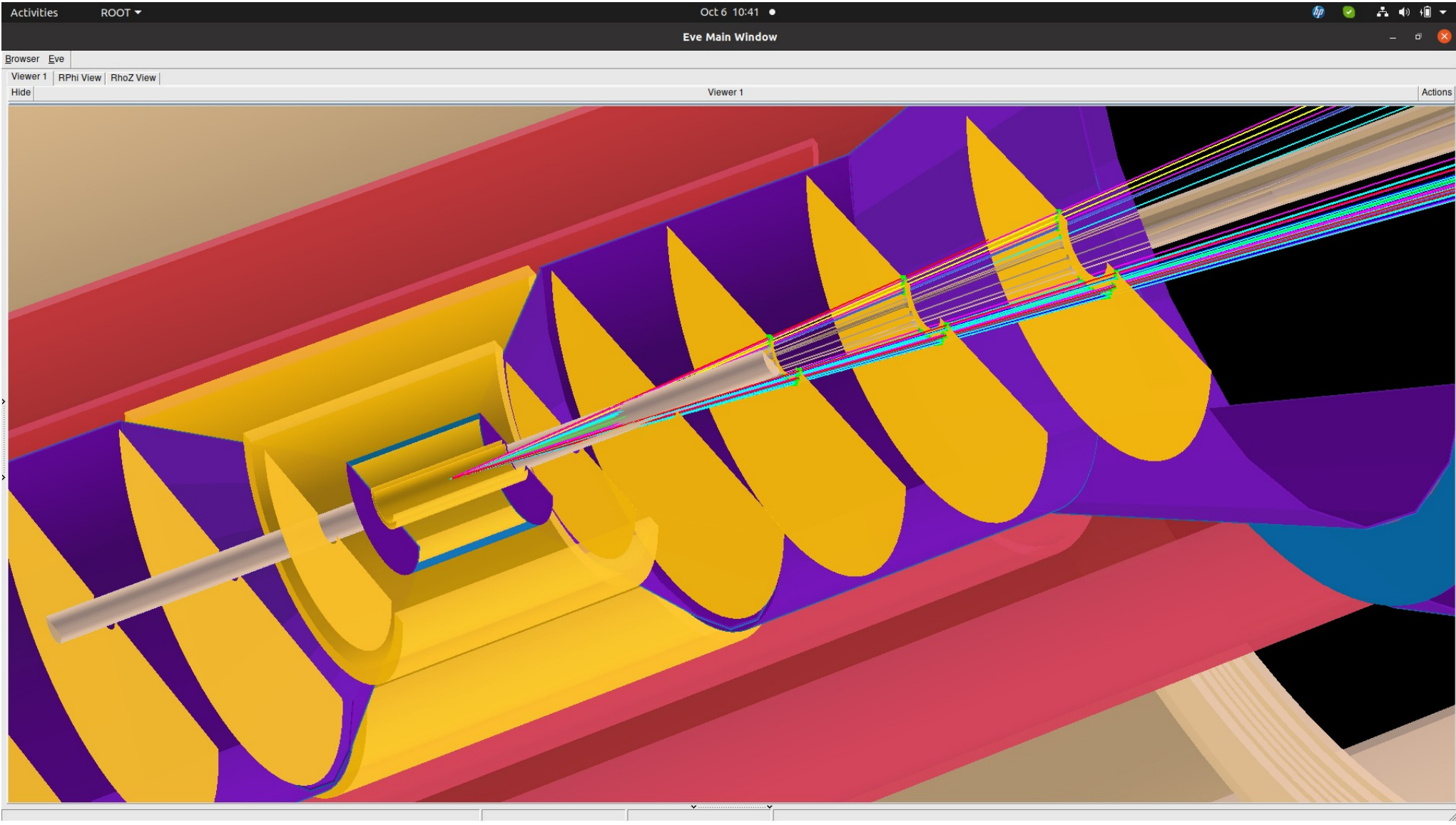




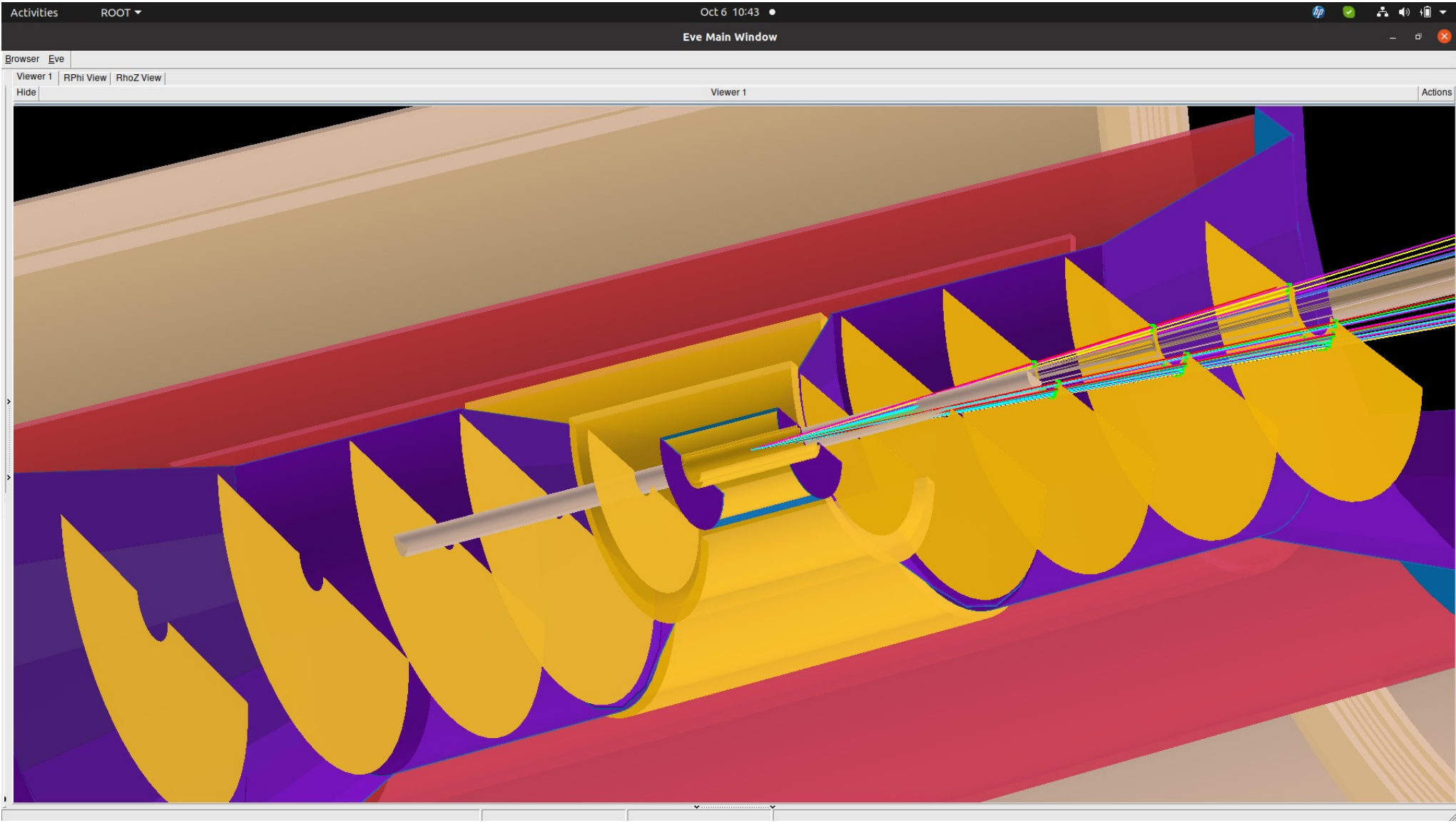
Tracks η [3.1-3.2] & pT = 1.2 GeV/c



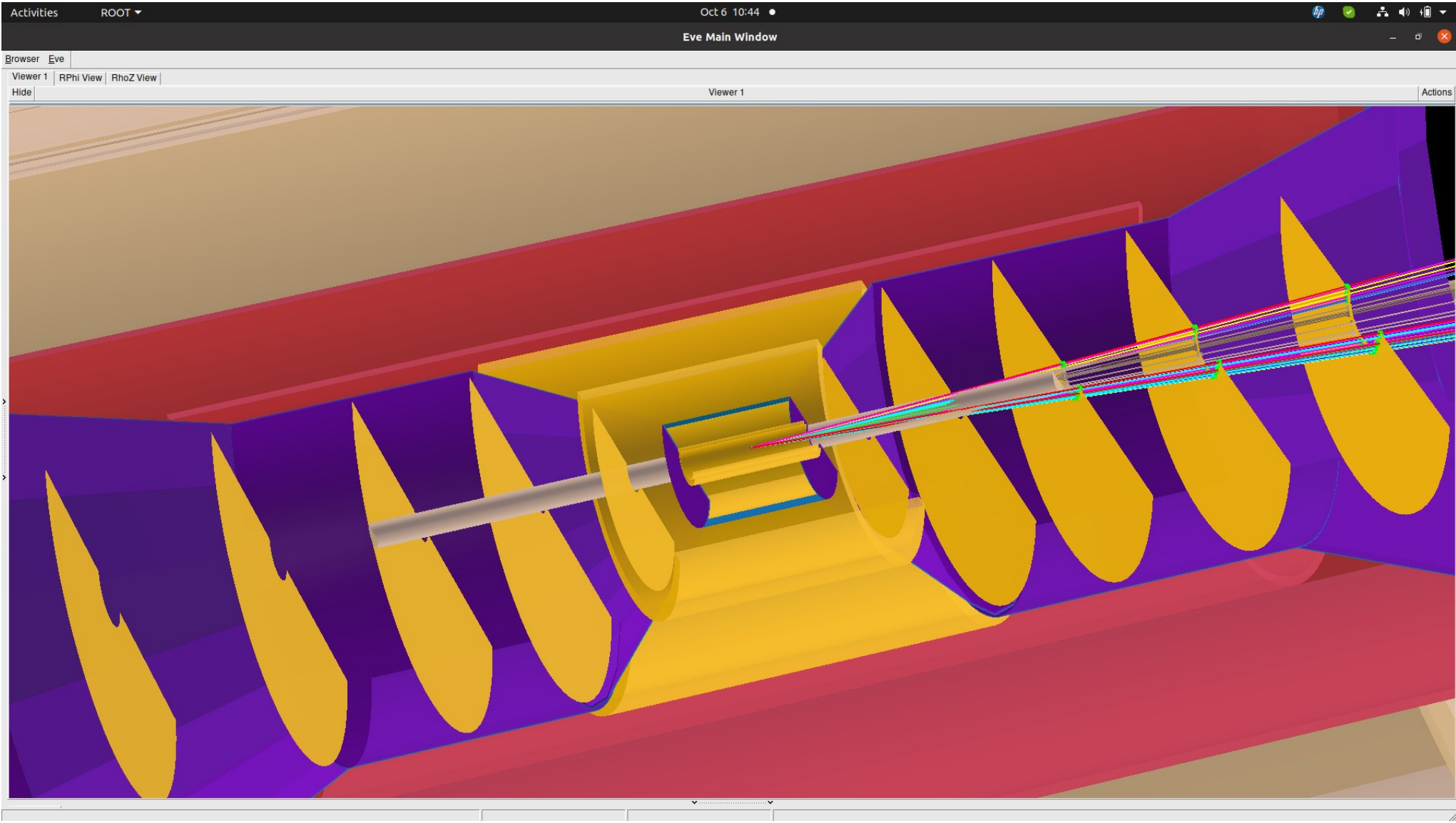
Tracks η [3.2-3.3] & pT = 1.2 GeV/c



Tracks η [3.3-3.4] & pT = 1.2 GeV/c



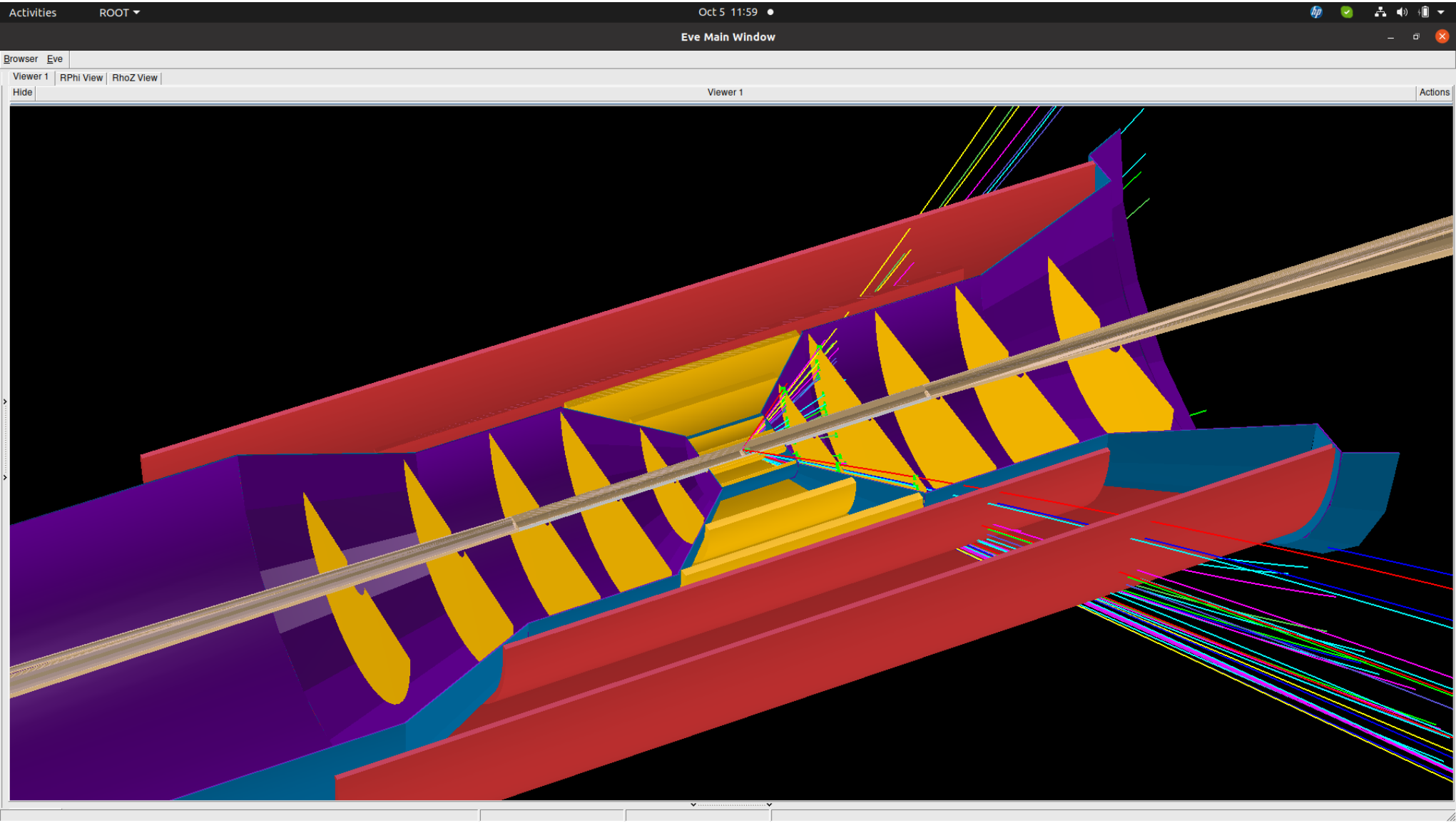
Tracks η [3.4-3.5] & pT = 1.2 GeV/c



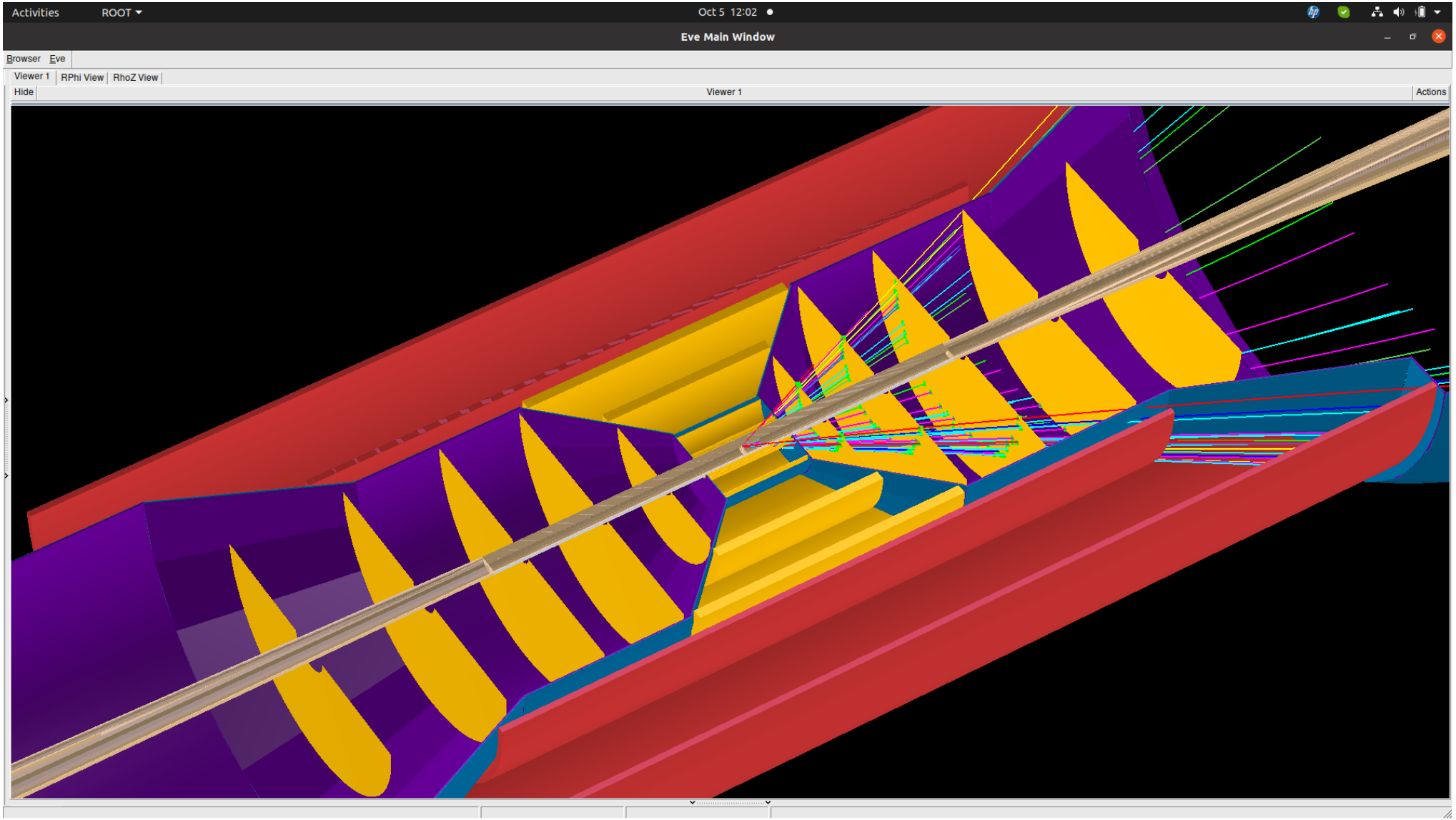
Summary and Future Plan

- Presented the first look of efficiency.
- Magnetic field is scaled from 1.5 T to 1.7 T confirmed.
- Next
  - Understand the efficiency pattern in more detail.
  - Once we have MC matching then will able to check the effect of pattern recognition also.
  - Evaluation of Tracking Performances and validation with Fast Simulation.

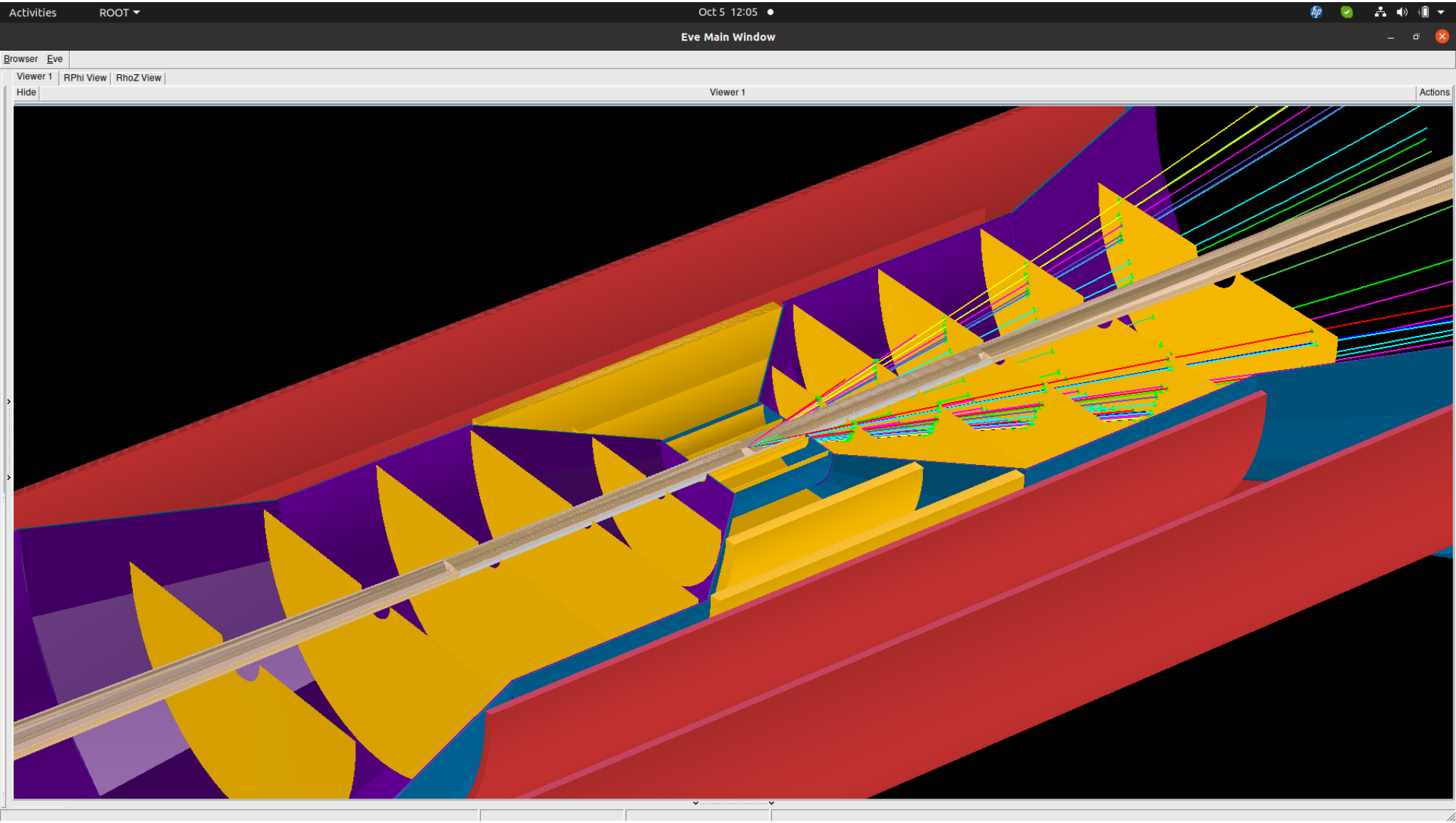
Tracks η [1.0-1.1] & p = 5.0 GeV/c



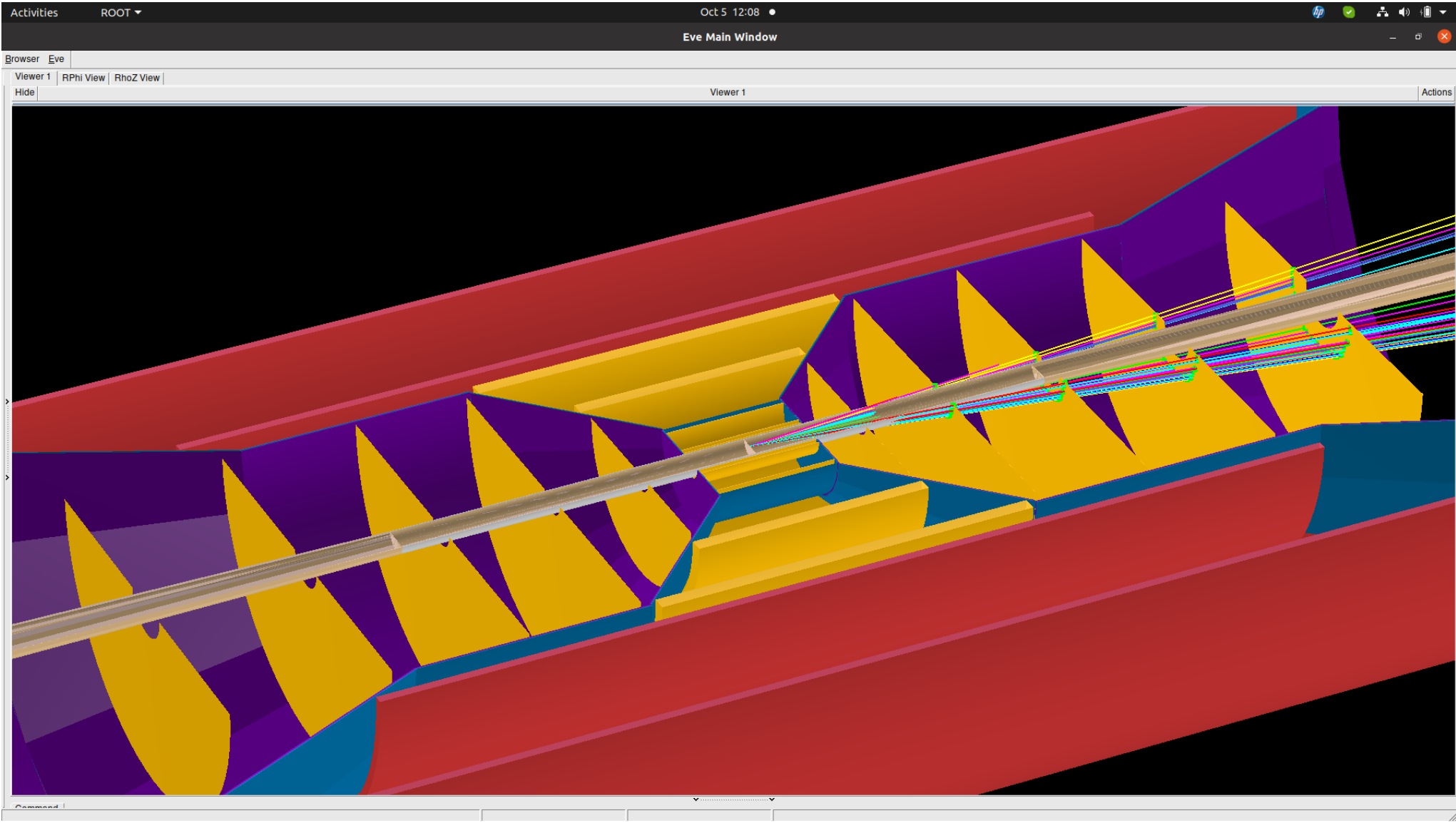
Tracks η [1.5-1.6] & p = 5.0 GeV/c



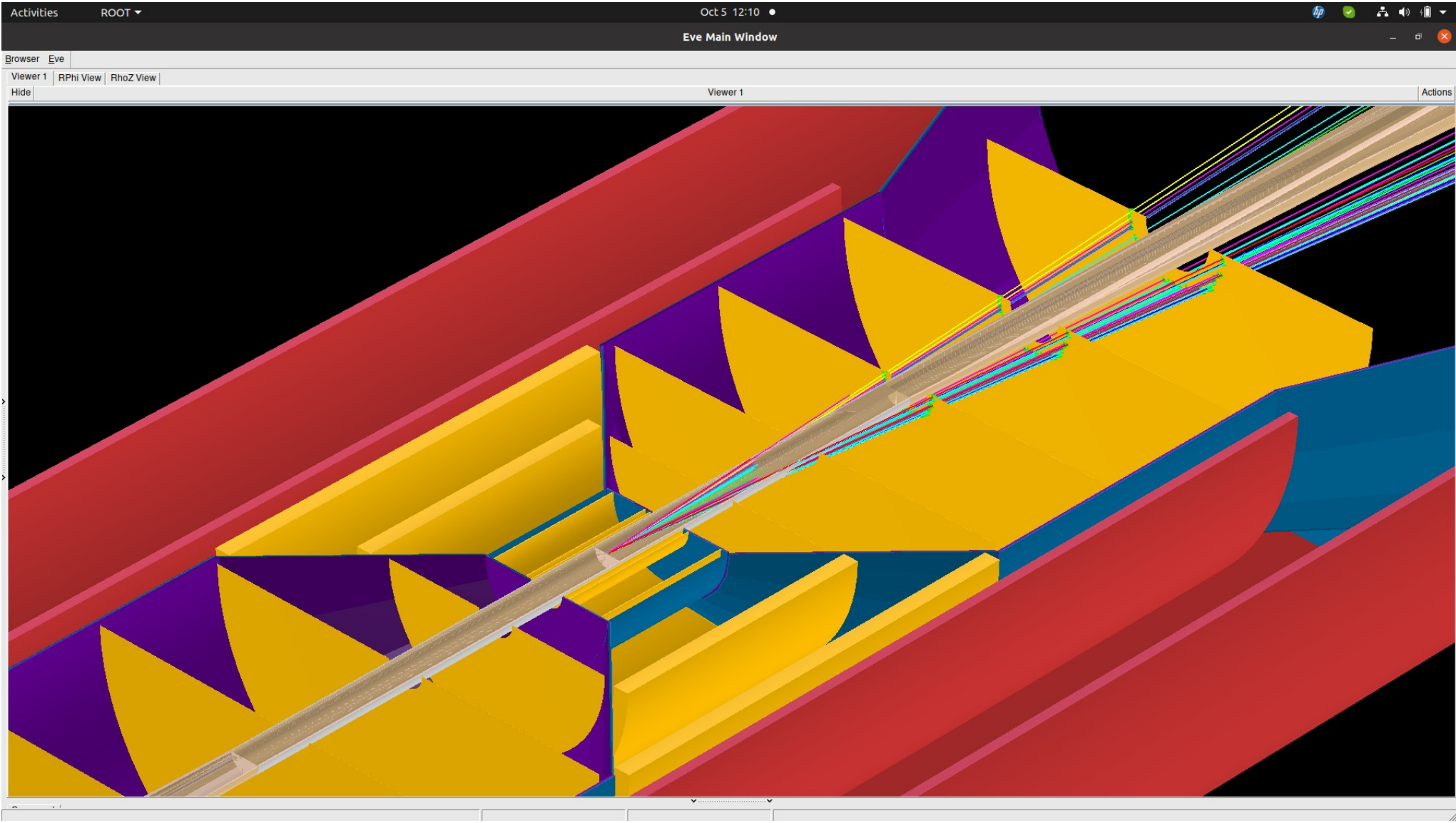
Tracks η [2.0-2.1] & p = 5.0 GeV/c



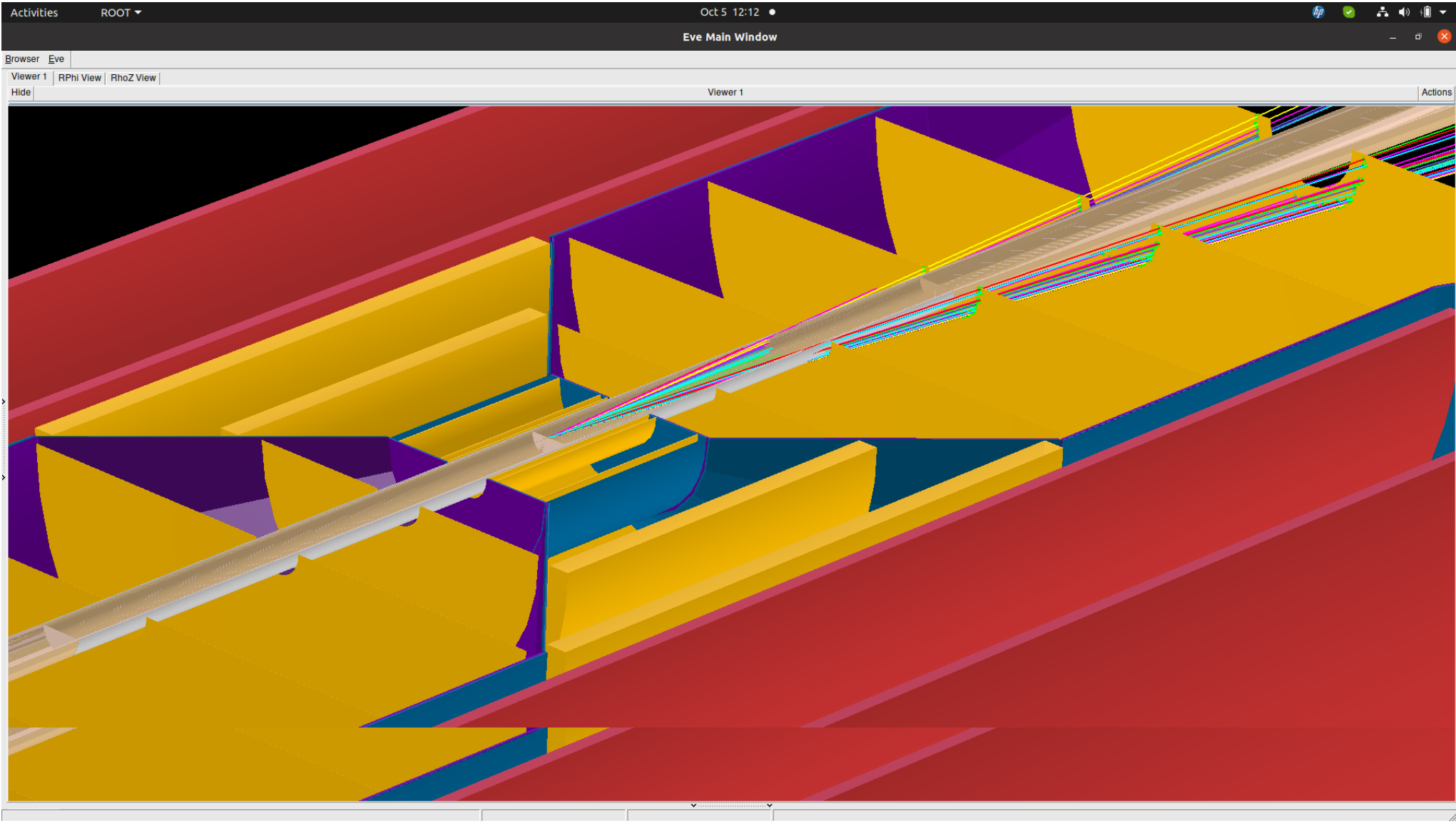
Tracks η [3.0-3.1] & p = 5.0 GeV/c



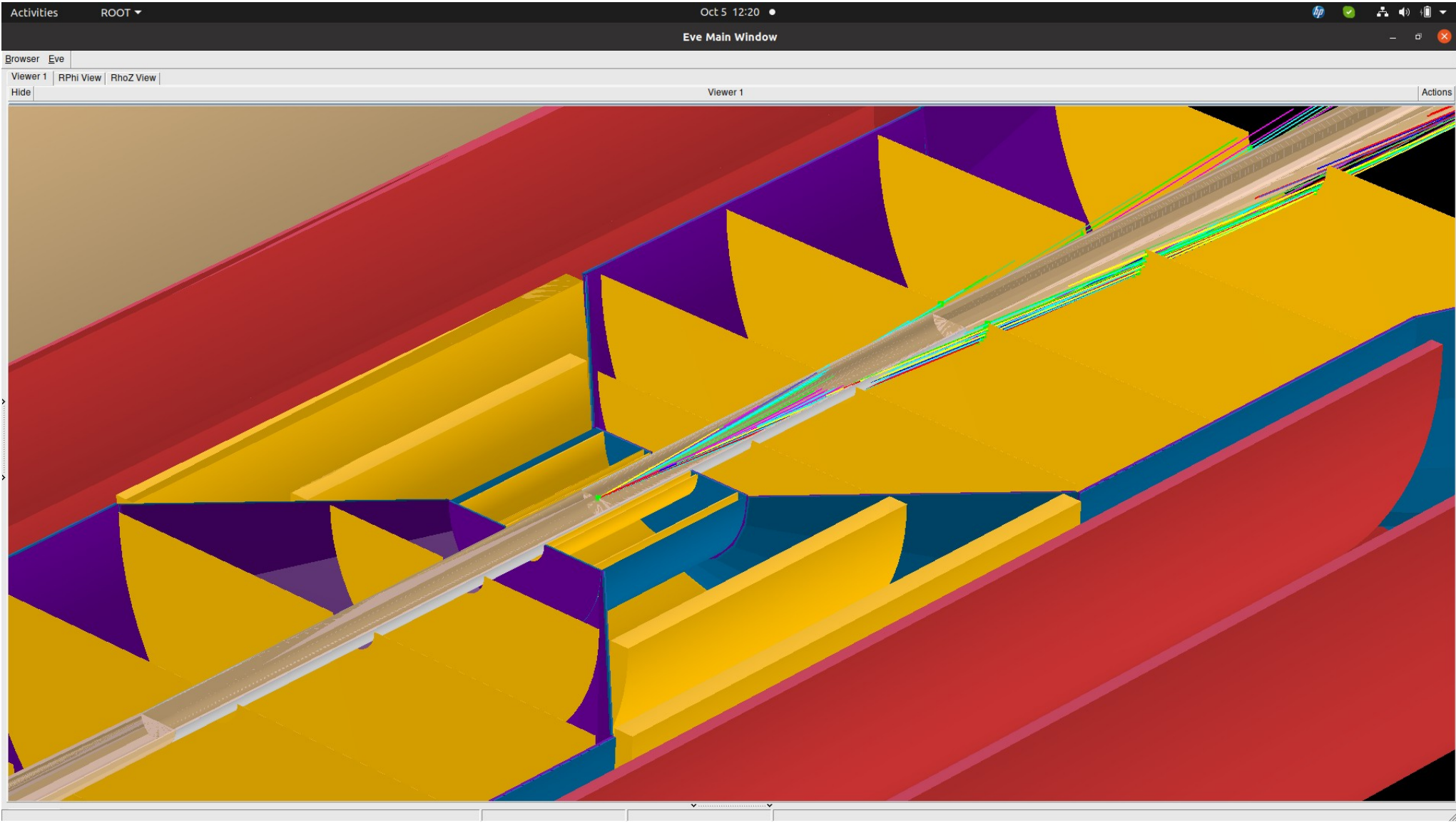
Tracks η [3.2-3.3] & p = 5.0 GeV/c



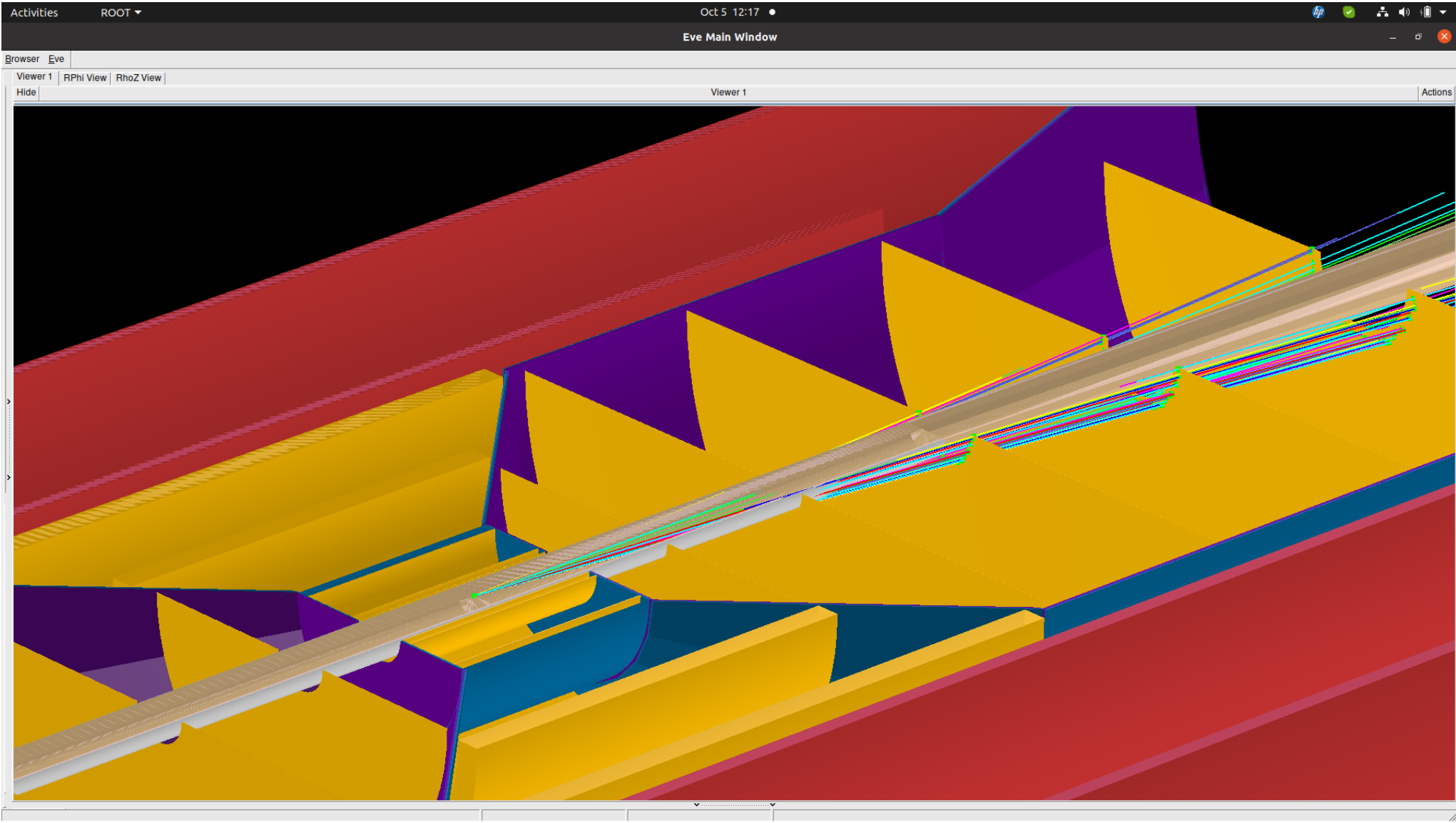
Tracks η [3.3-3.4] & p = 5.0 GeV/c



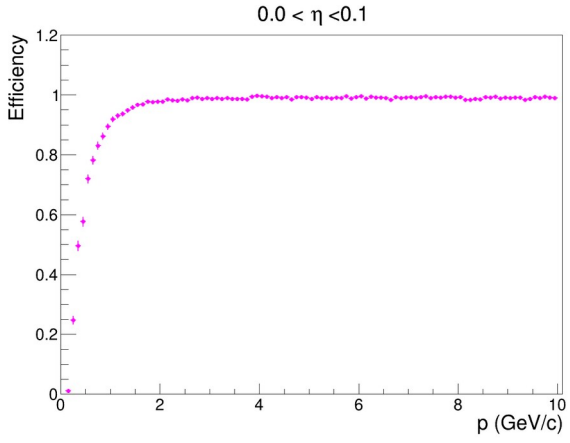
Tracks η [3.4-3.5] & p = 0.3 GeV/c

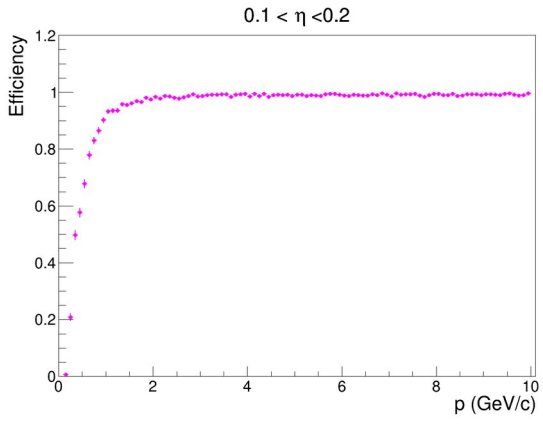


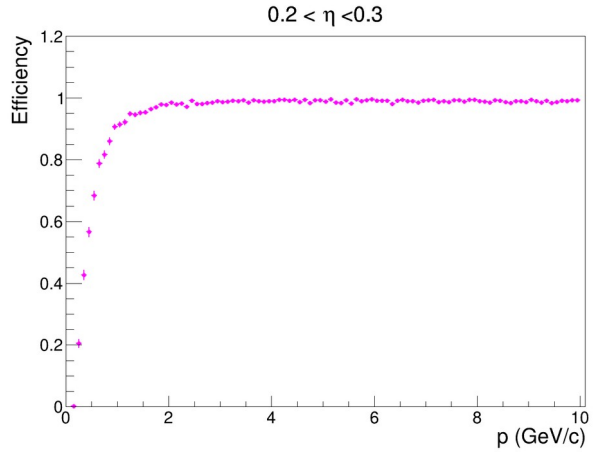
Tracks η [3.4-3.5] & p = 1.0 GeV/c

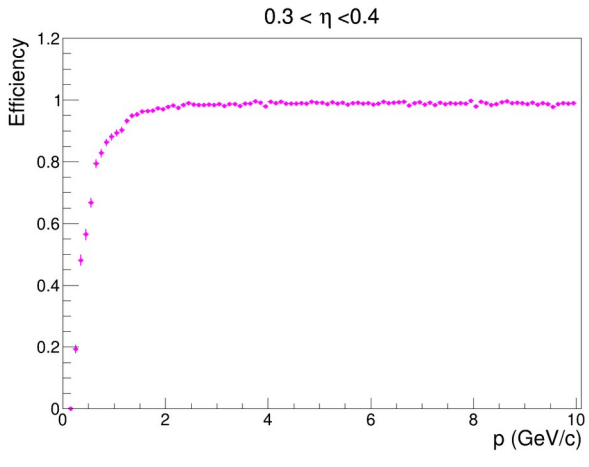


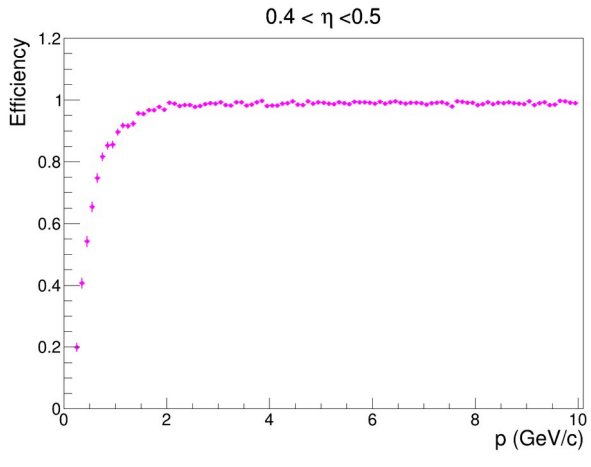
Efficiency full tracker in fine bins (With Material Map)

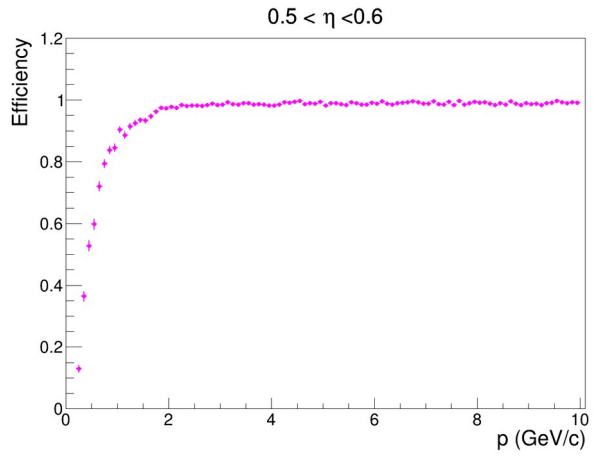




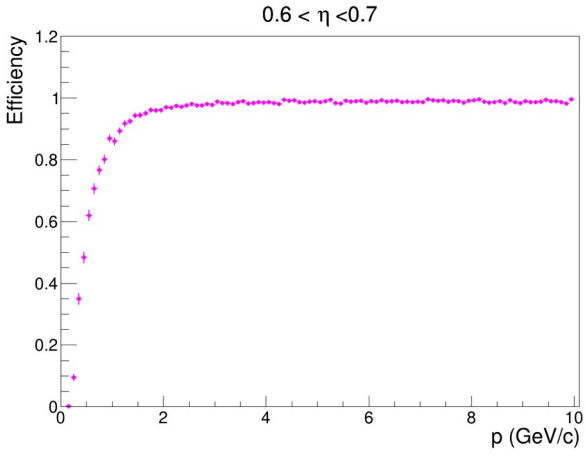


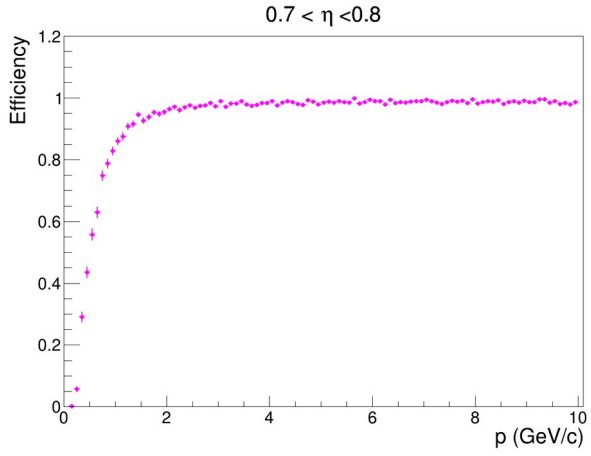


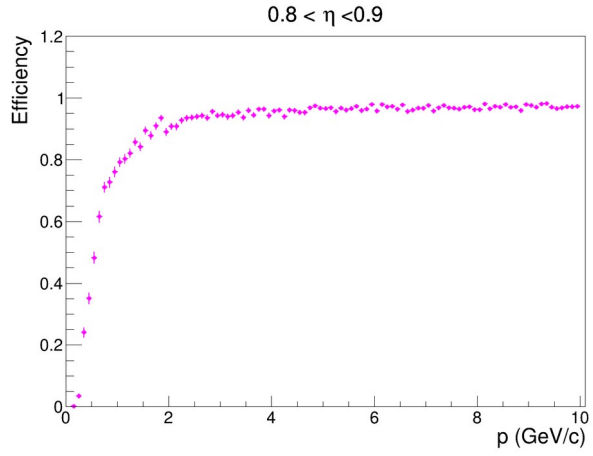


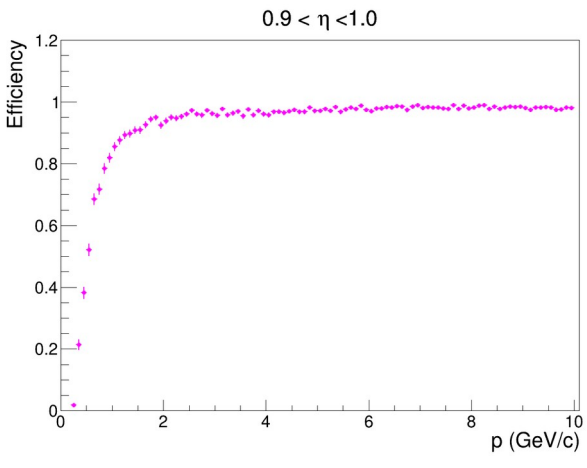


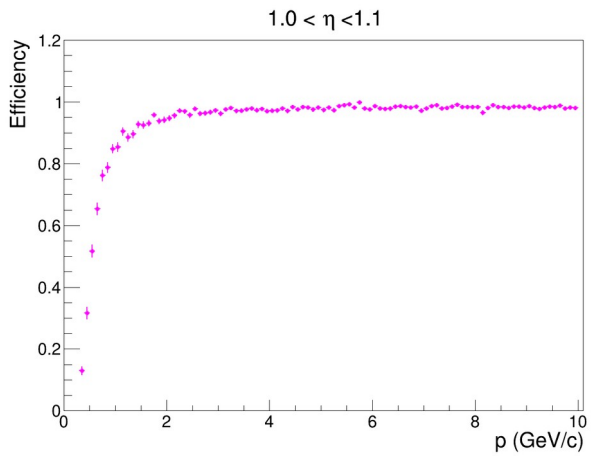
Efficiency full tracker in fine bins (With Material Map)

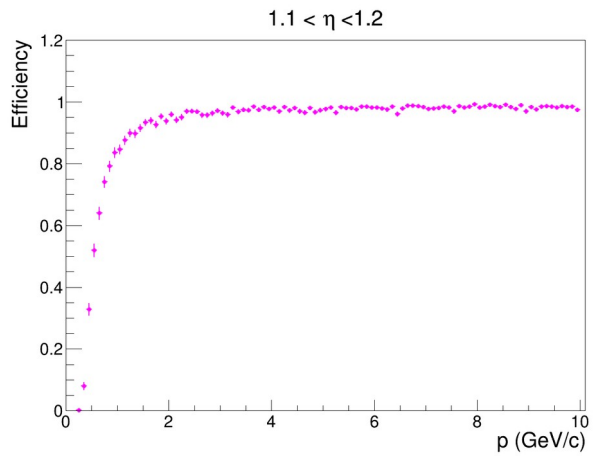




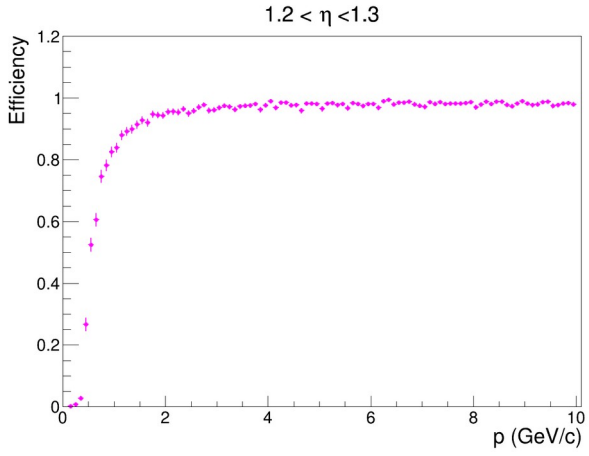


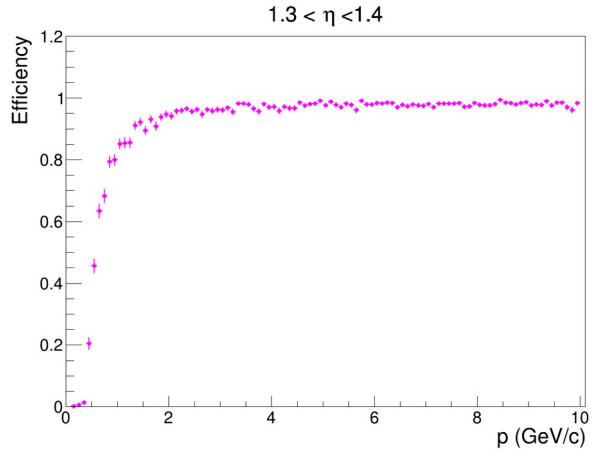


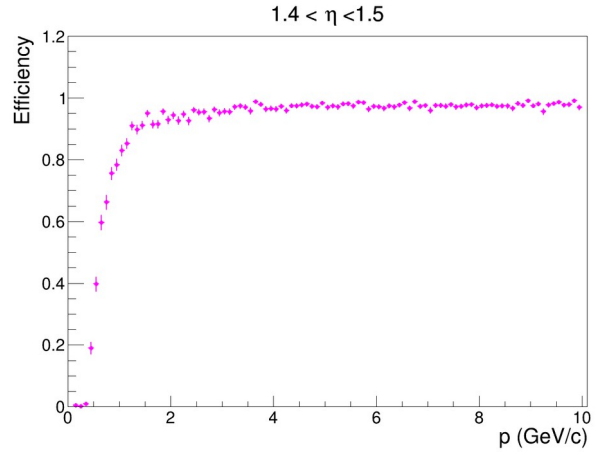


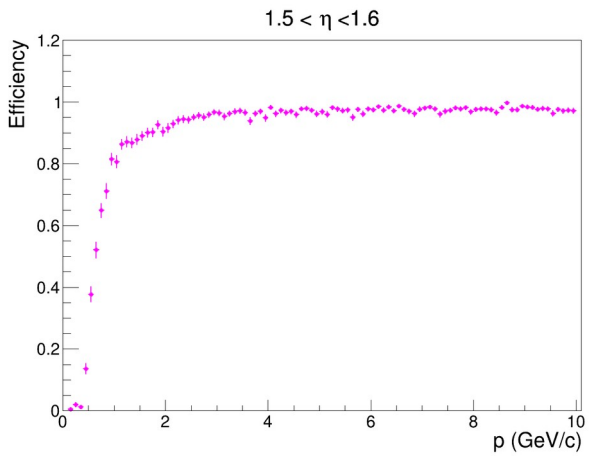


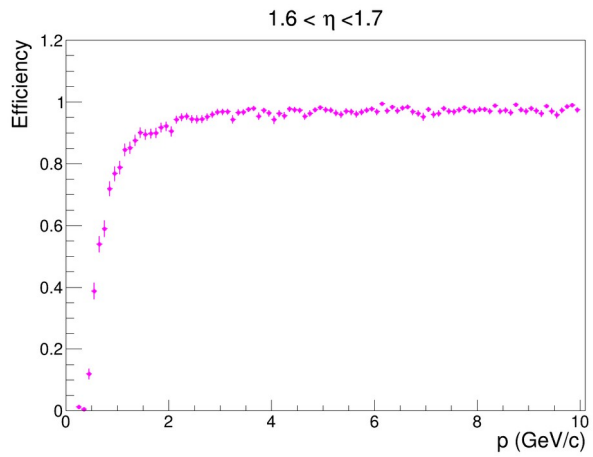
Efficiency full tracker in fine bins (With Material Map)

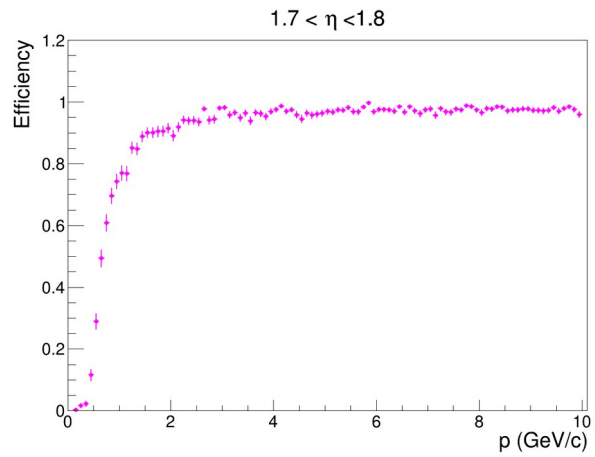




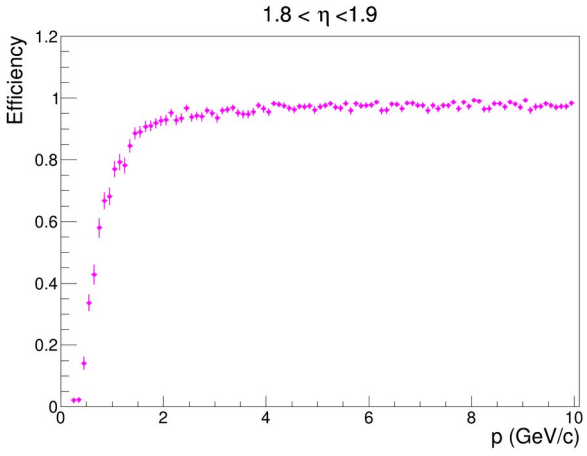


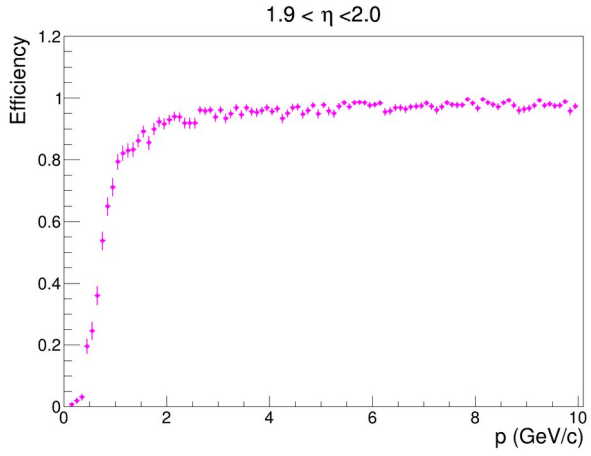


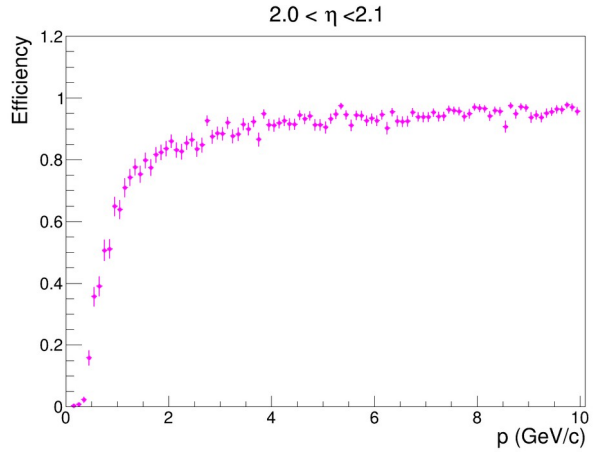


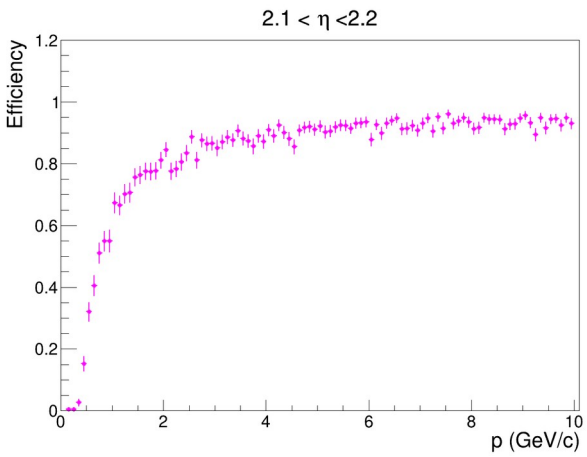


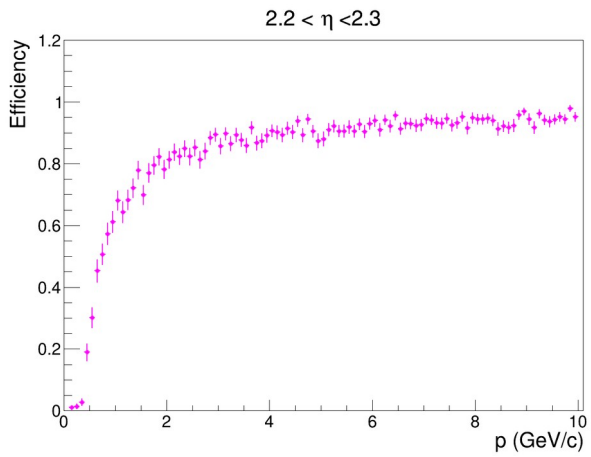
Efficiency full tracker in fine bins (With Material Map)

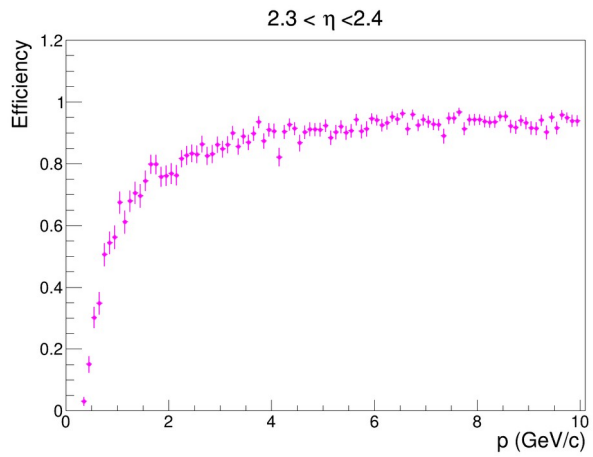




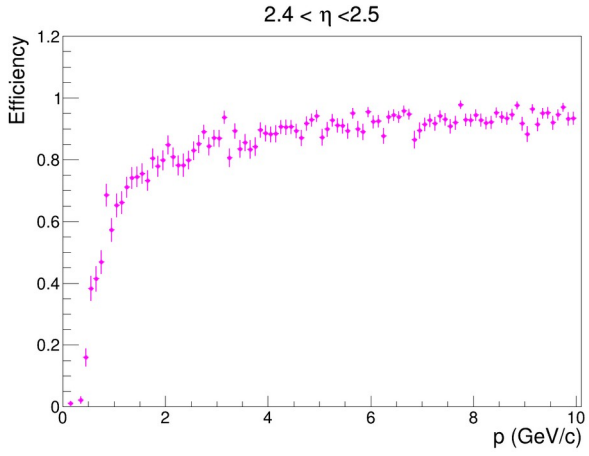


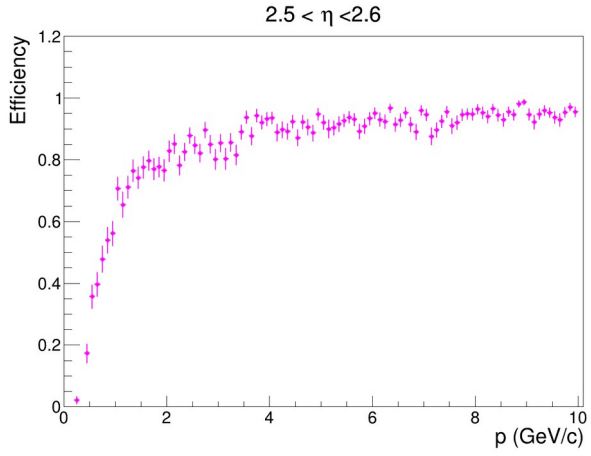


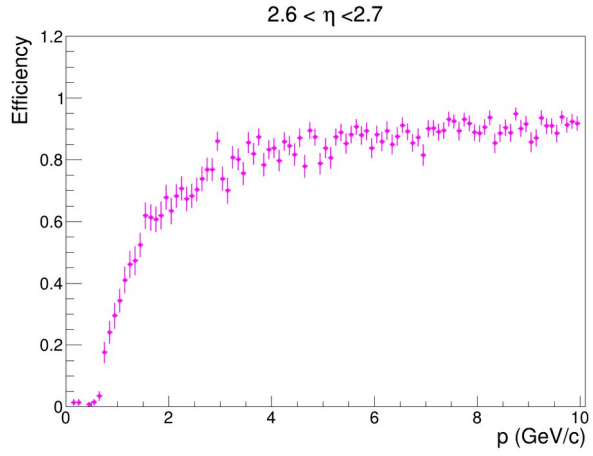


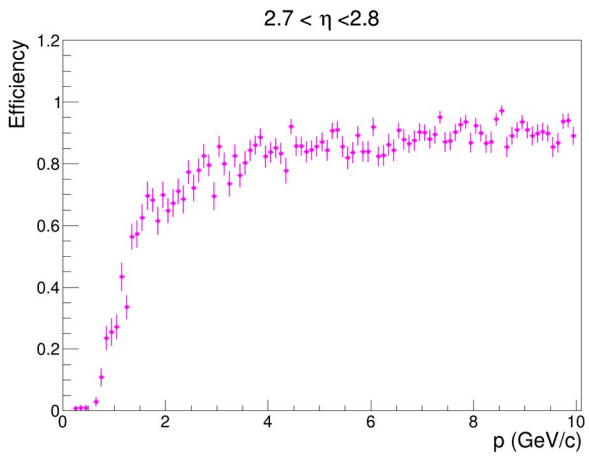


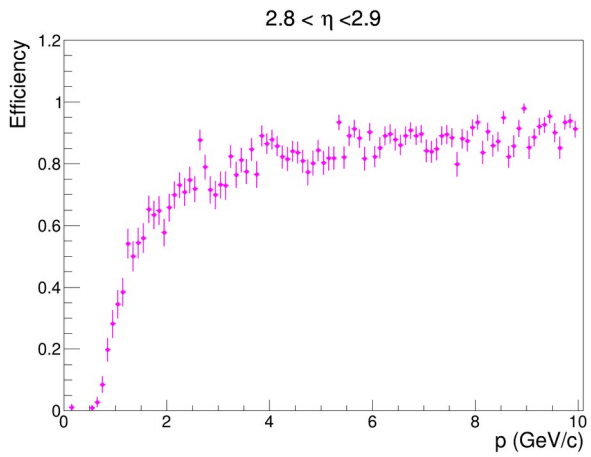
Efficiency full tracker in fine bins (With Material Map)

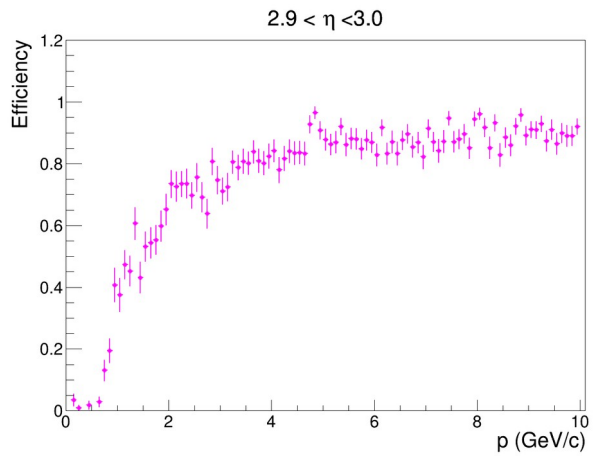




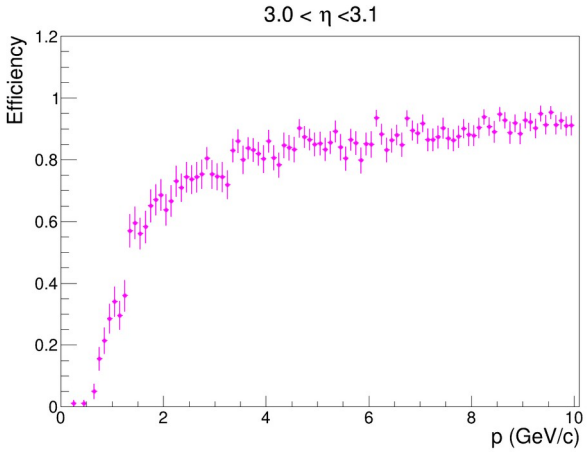


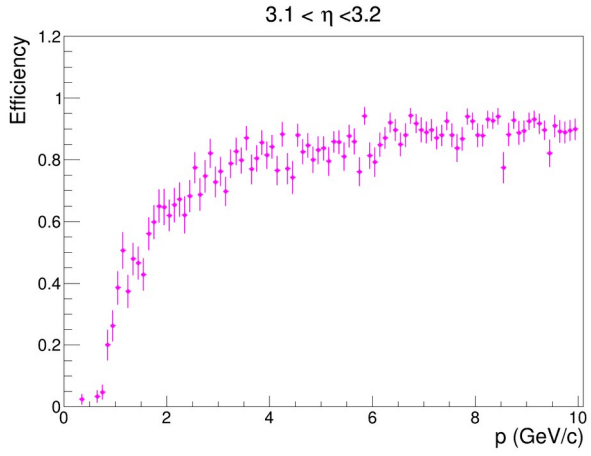


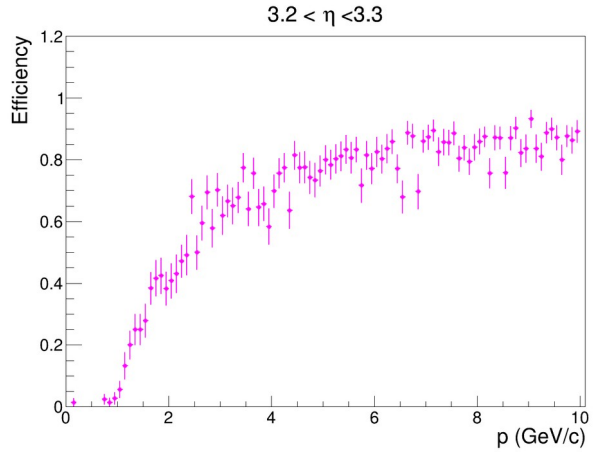


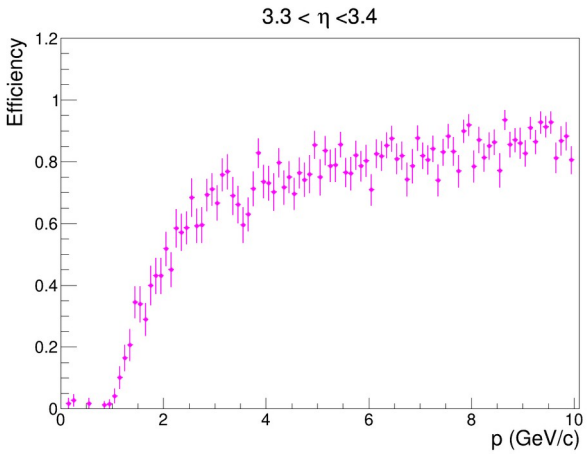


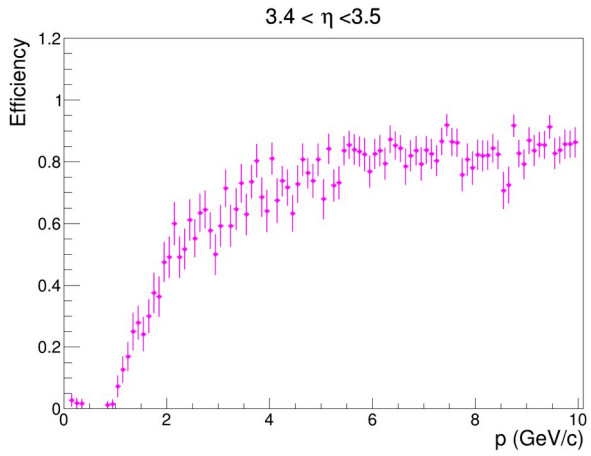
Efficiency full tracker in fine bins (With Material Map)



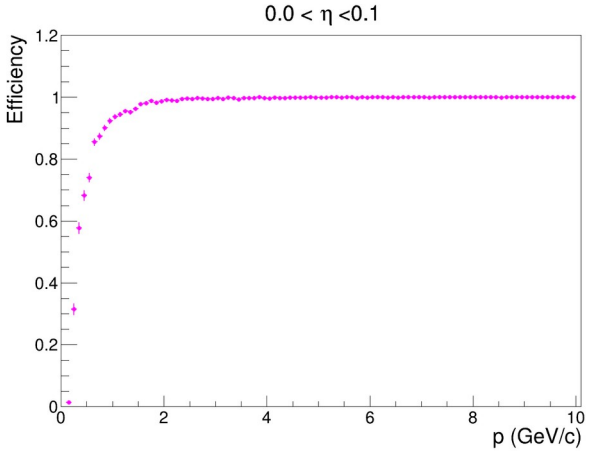


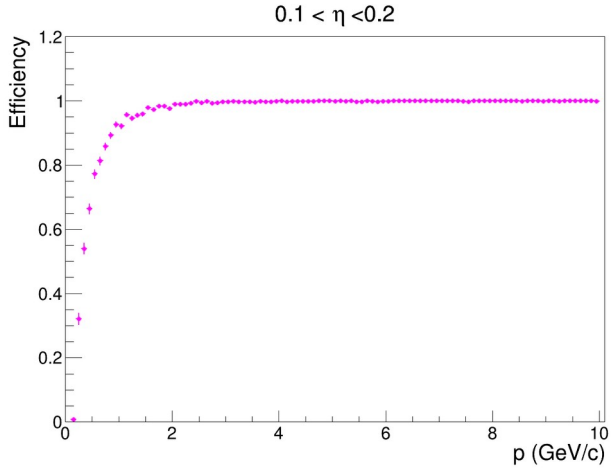


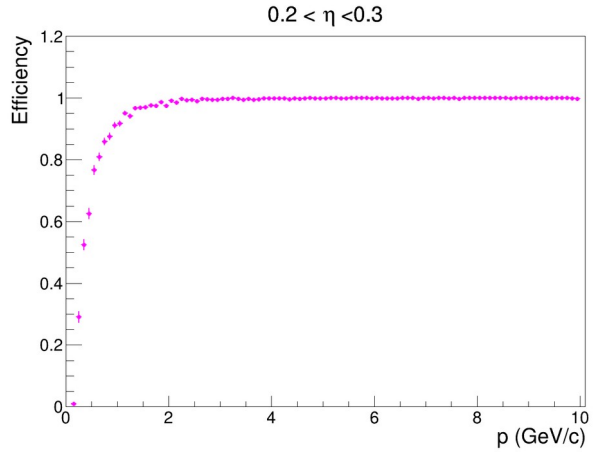


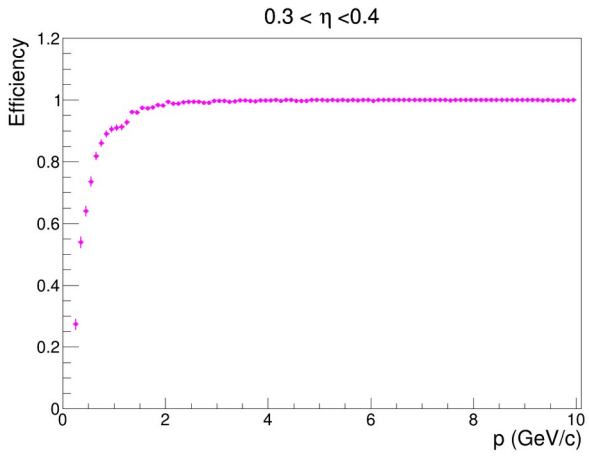


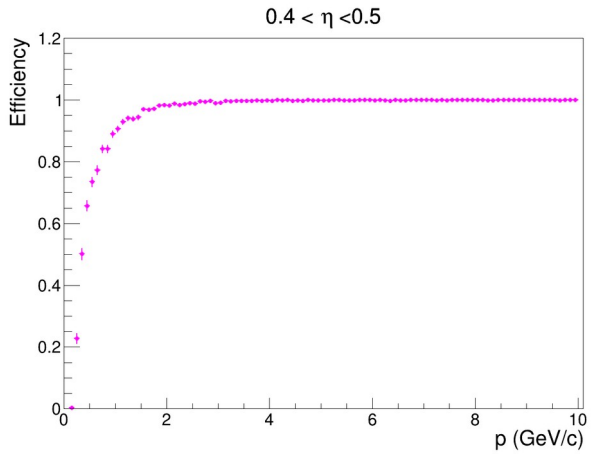
Efficiency full tracker in fine bins (Without Material Map)

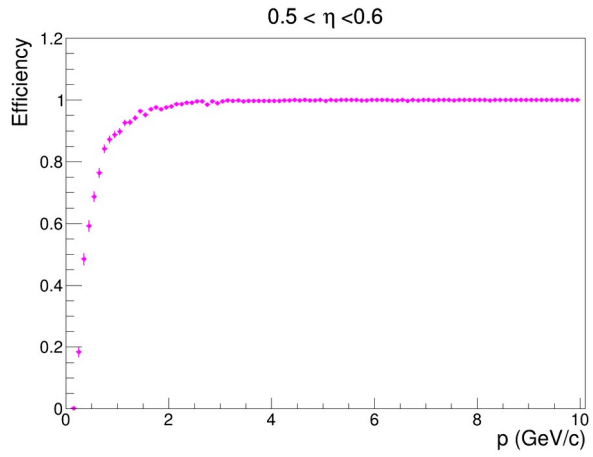




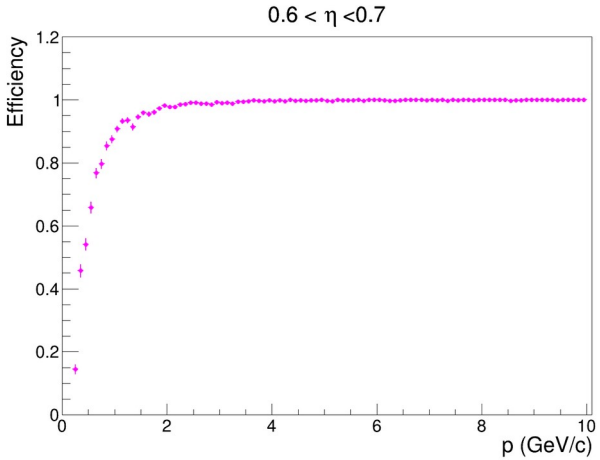


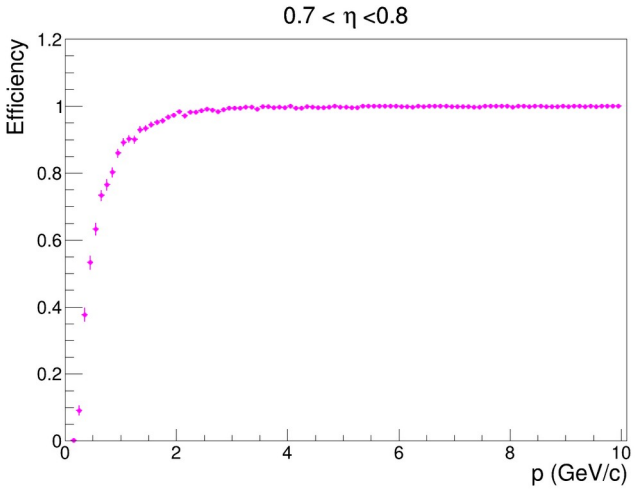


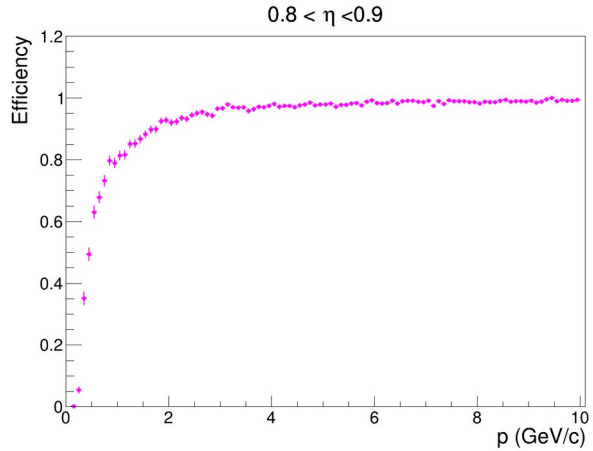


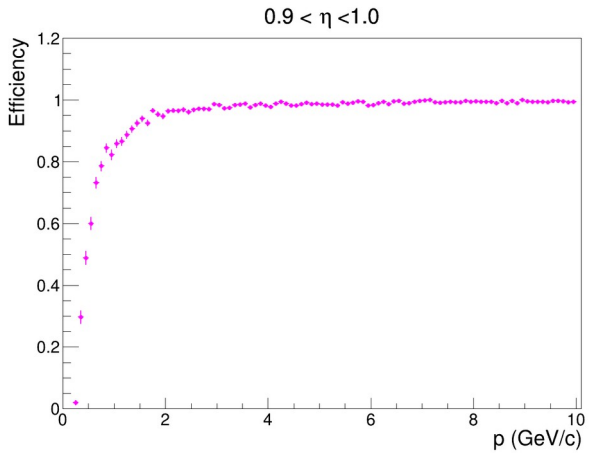


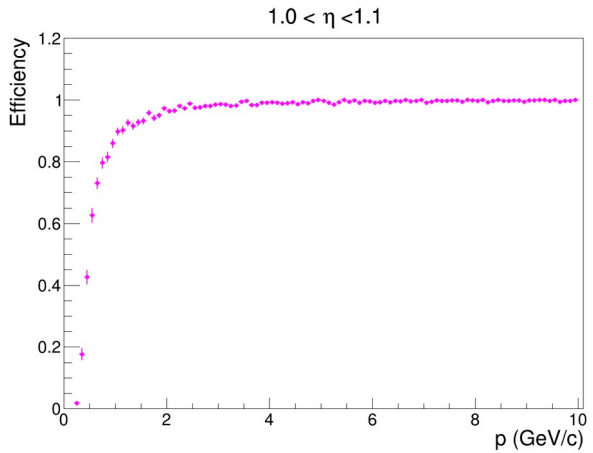
Efficiency full tracker in fine bins (Without Material Map)

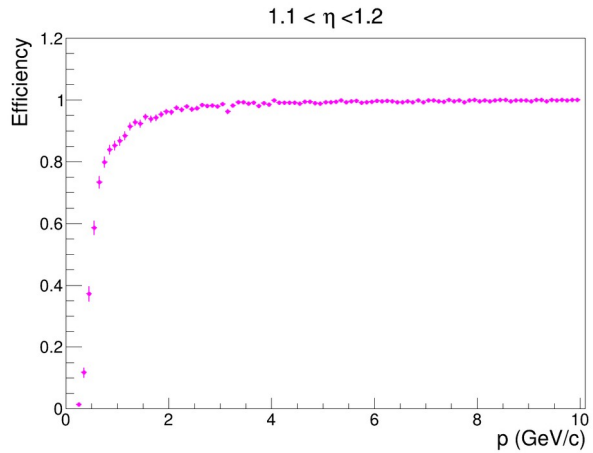




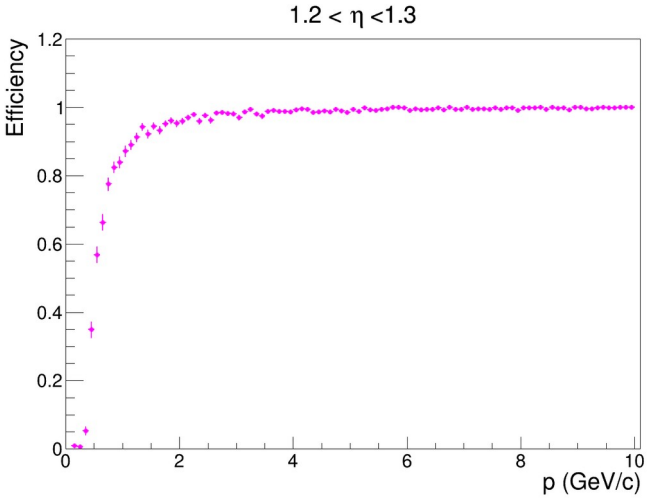


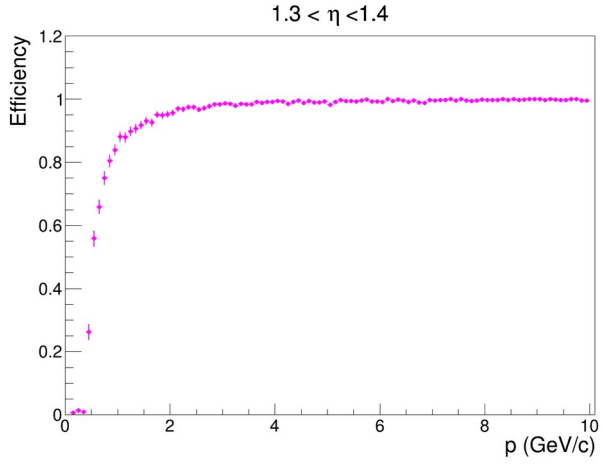


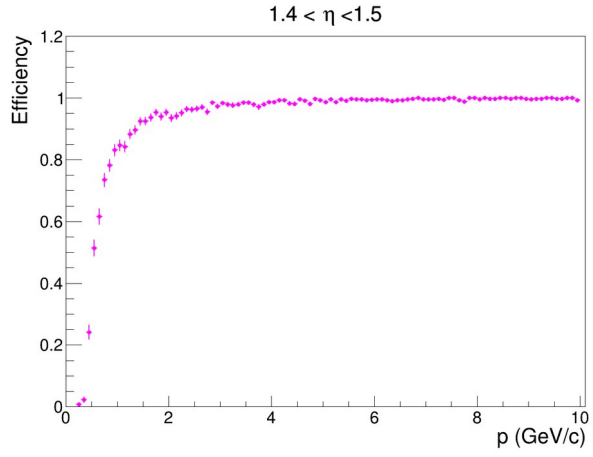


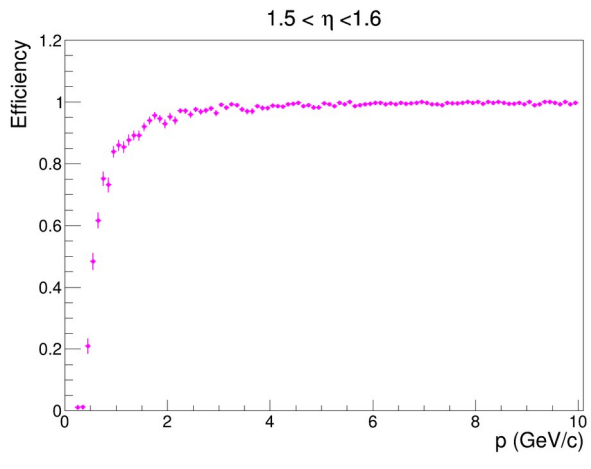


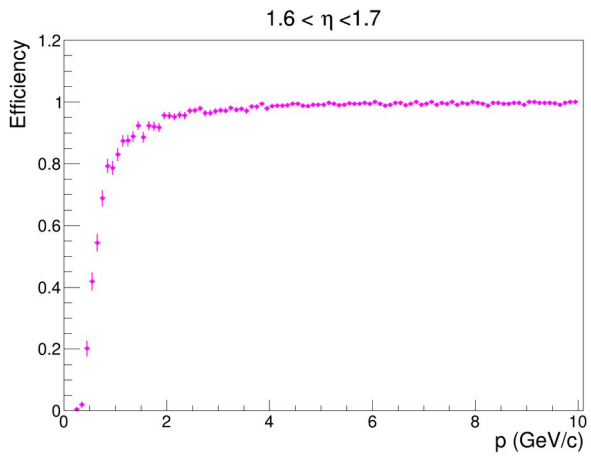
Efficiency full tracker in fine bins (Without Material Map)

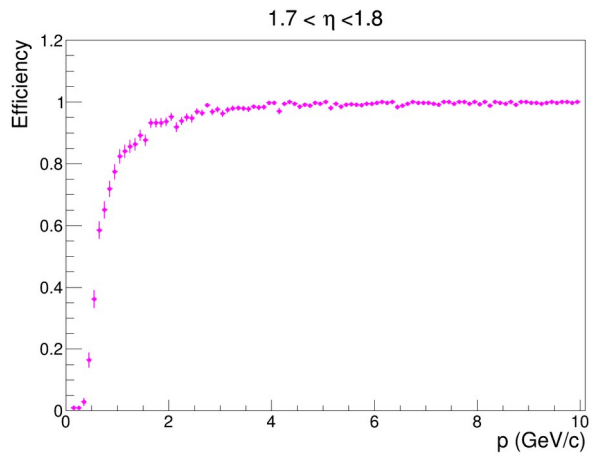




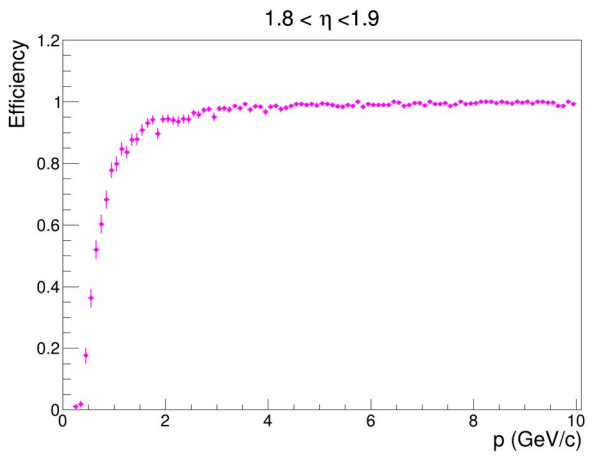


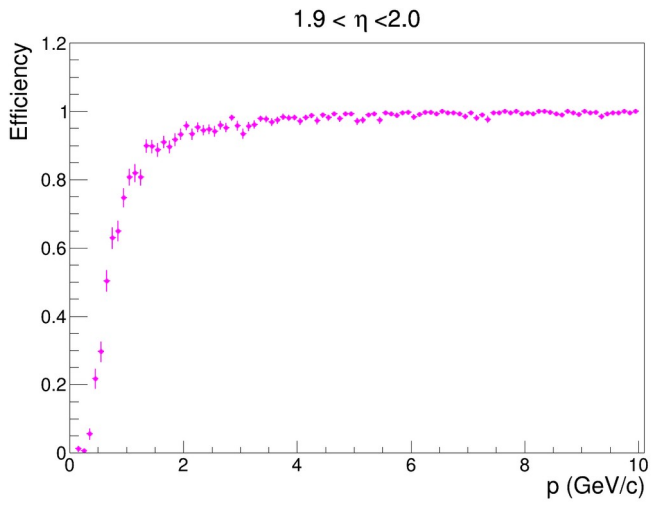


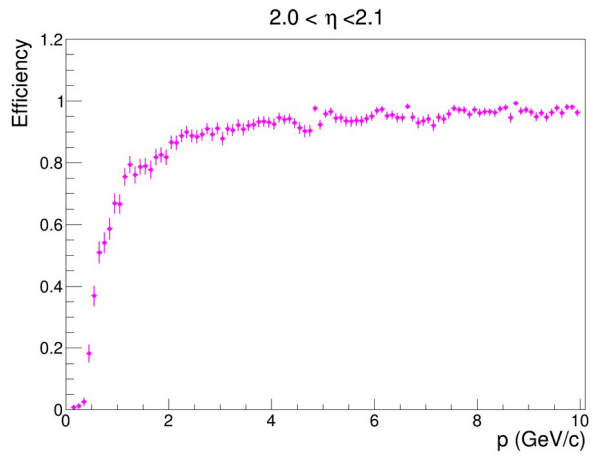


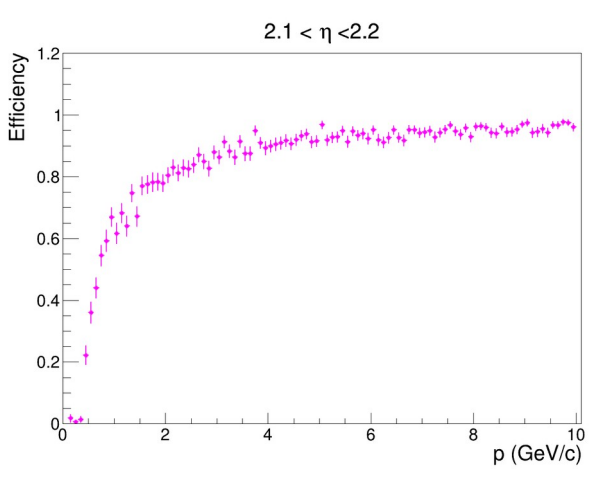


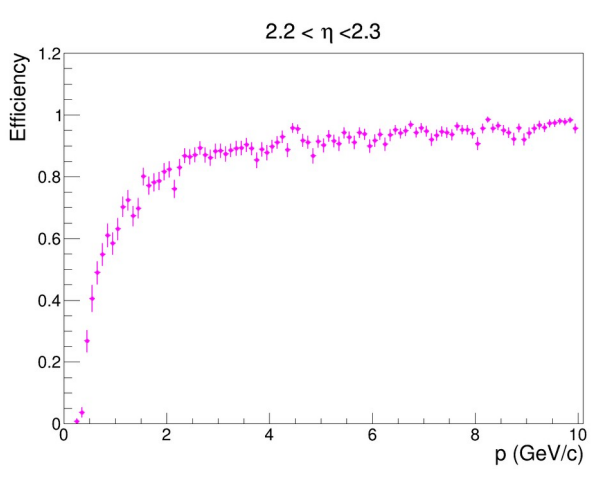
Efficiency full tracker in fine bins (Without Material Map)

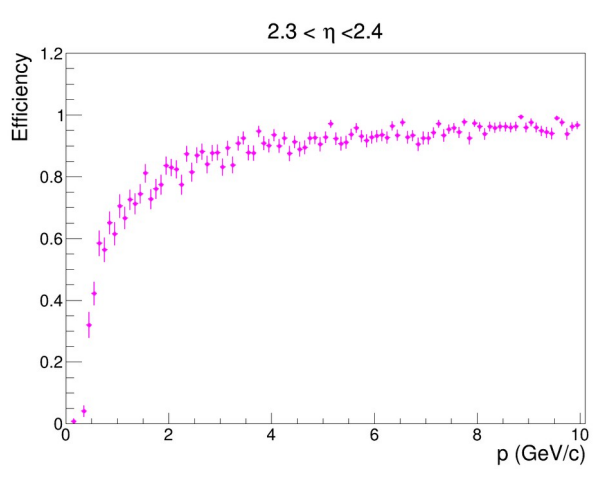












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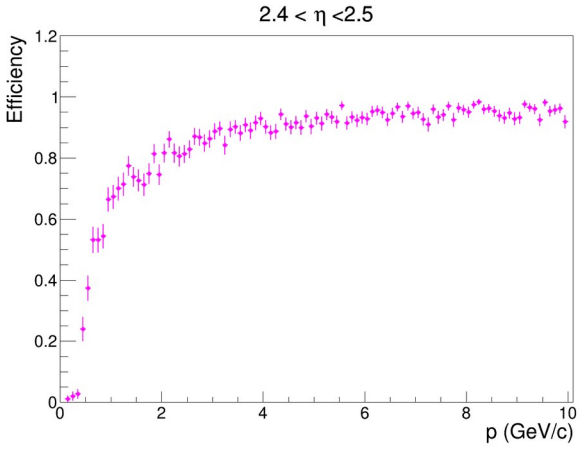
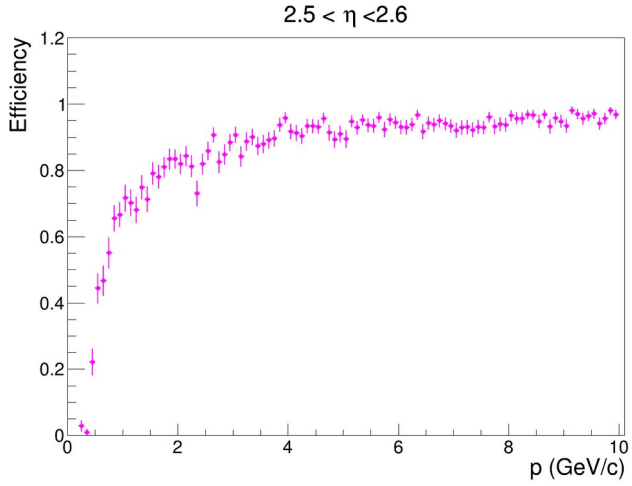
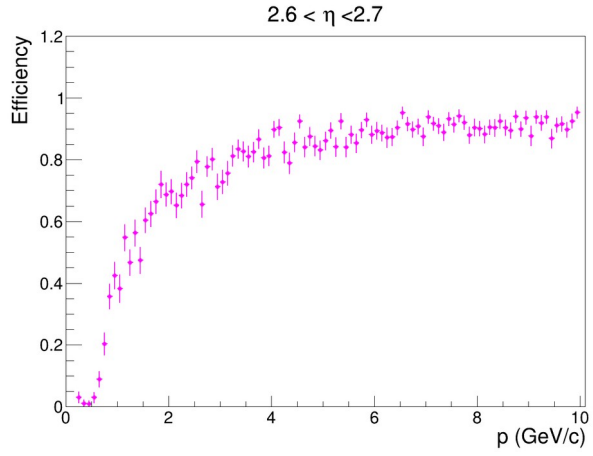
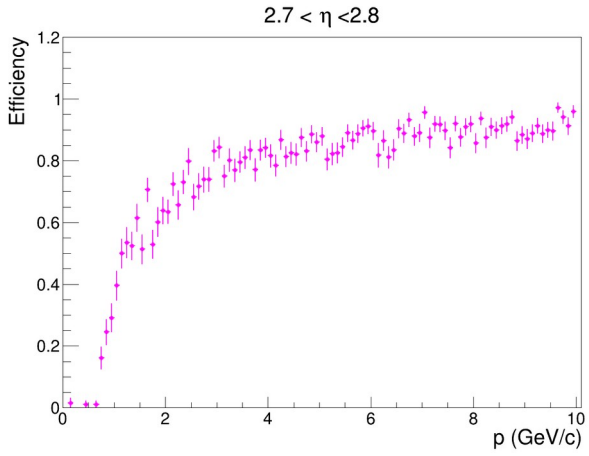
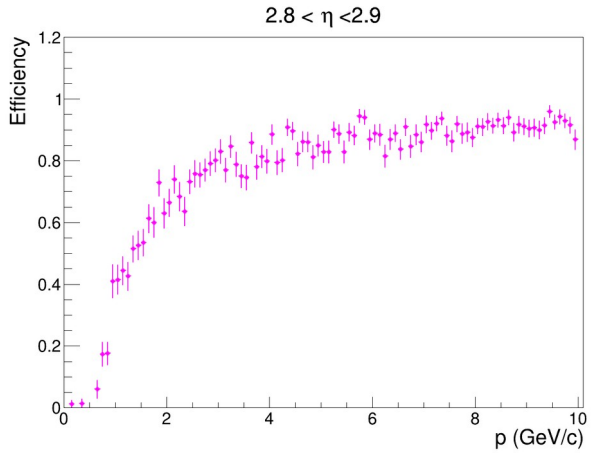
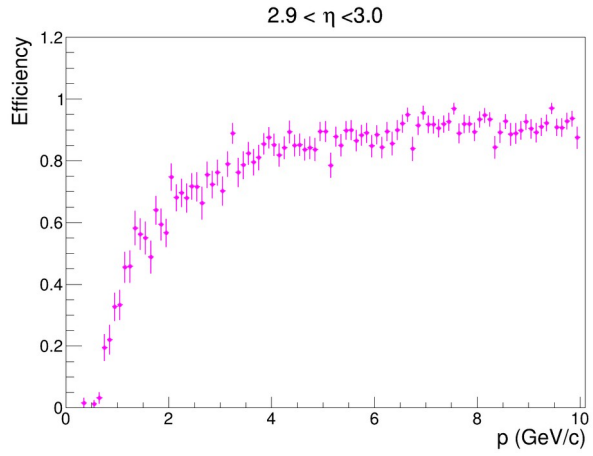




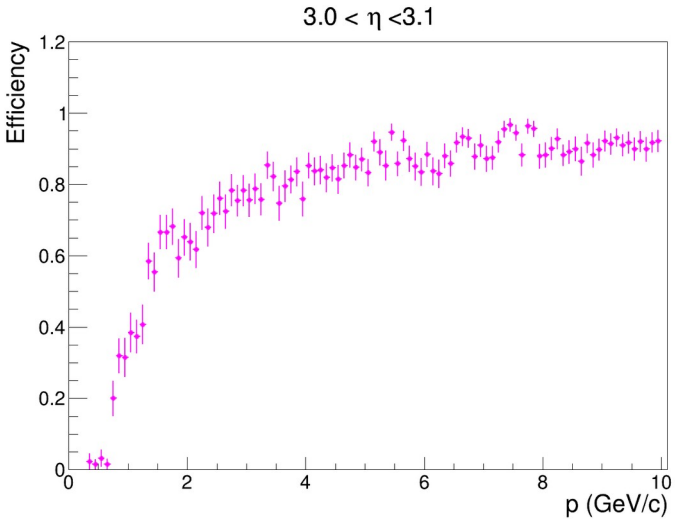


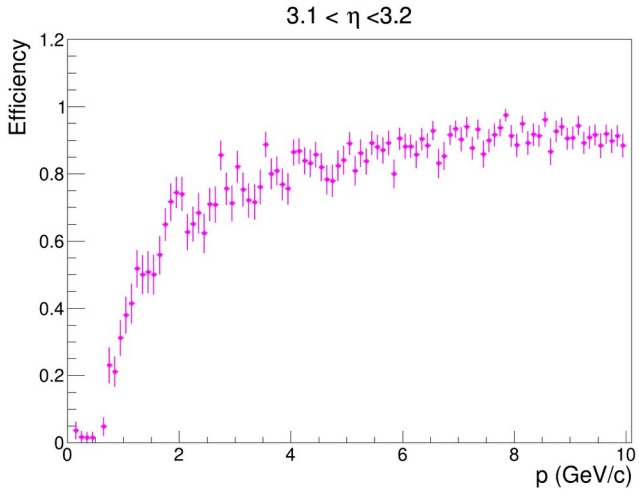


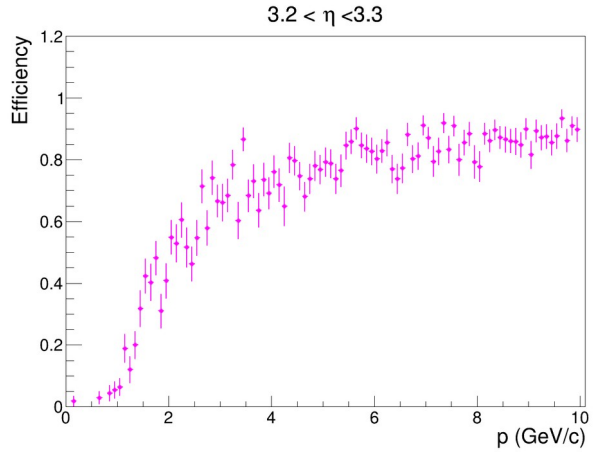


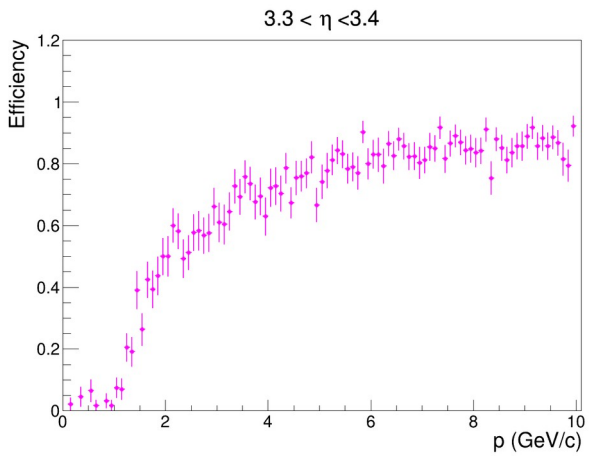


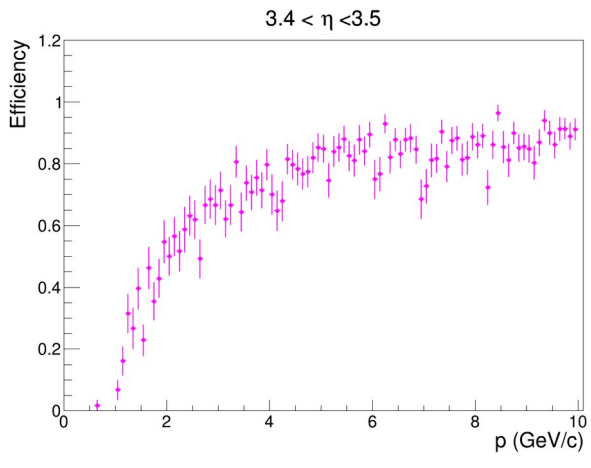
Efficiency full tracker in fine bins (Without Material Map)



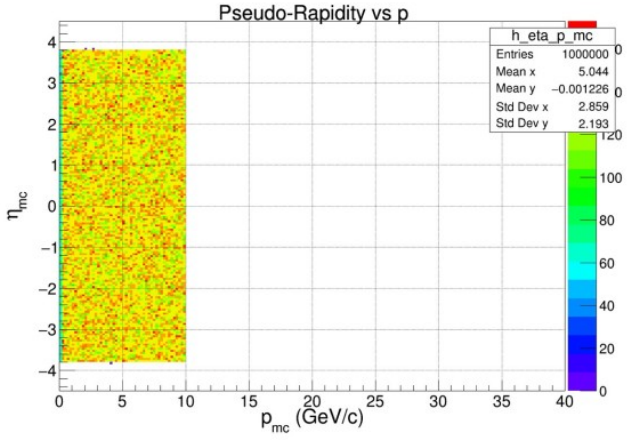
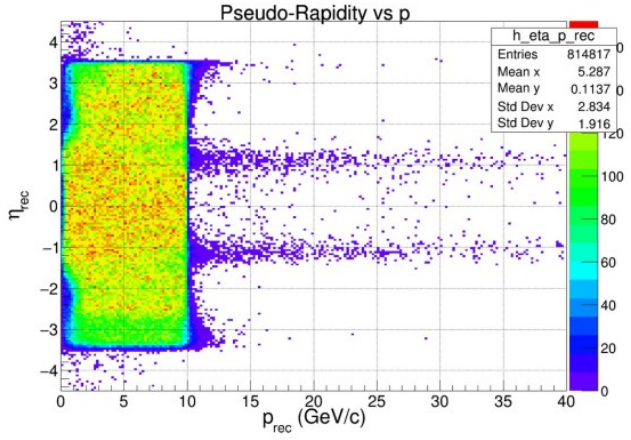
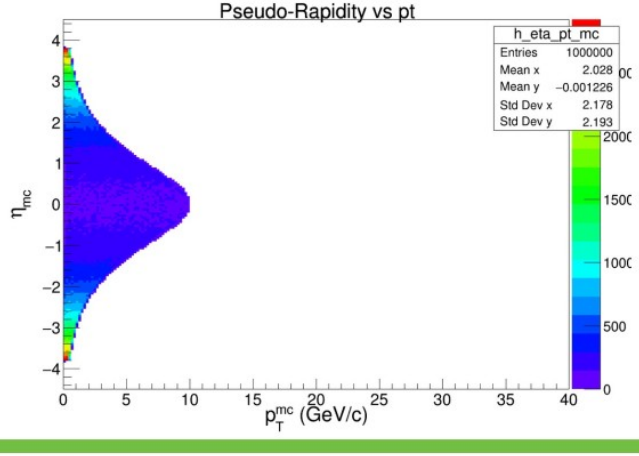
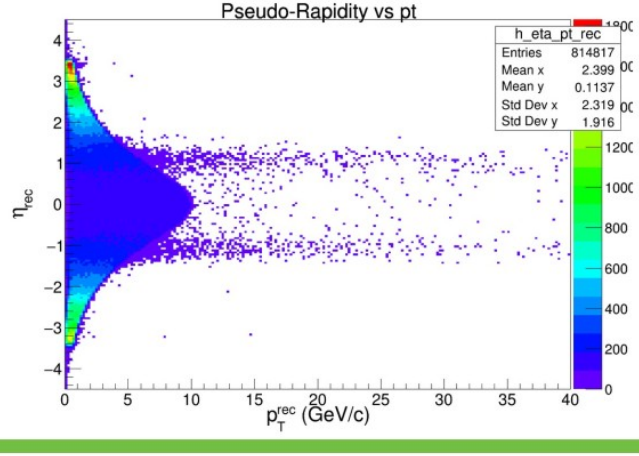








Fun4All Simulation

Particle Simulation

1M Negative Pions uniform in η [-3.5,3.5] and momentum [0.1,10.]