PID and Track Efficiency

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Francisco Reyes

Supervisors:
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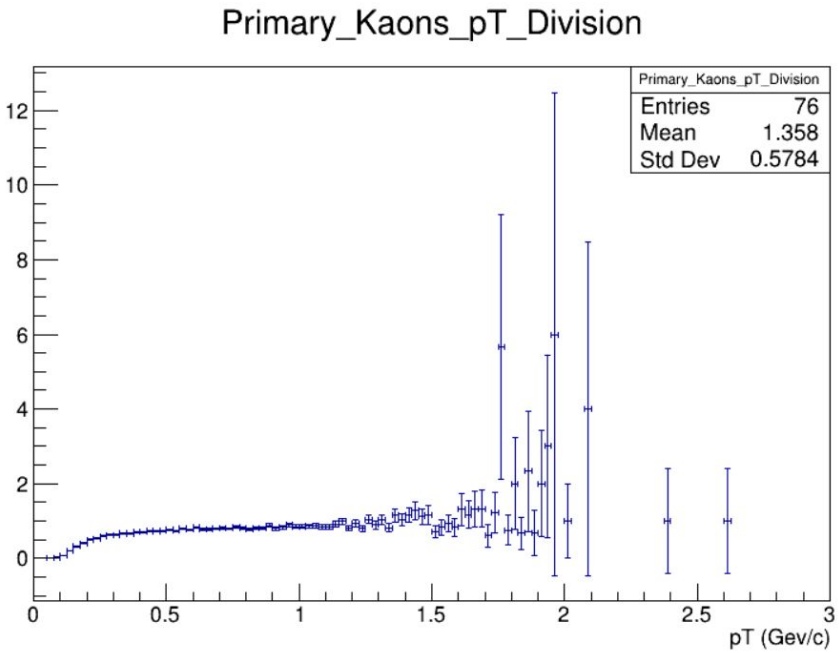
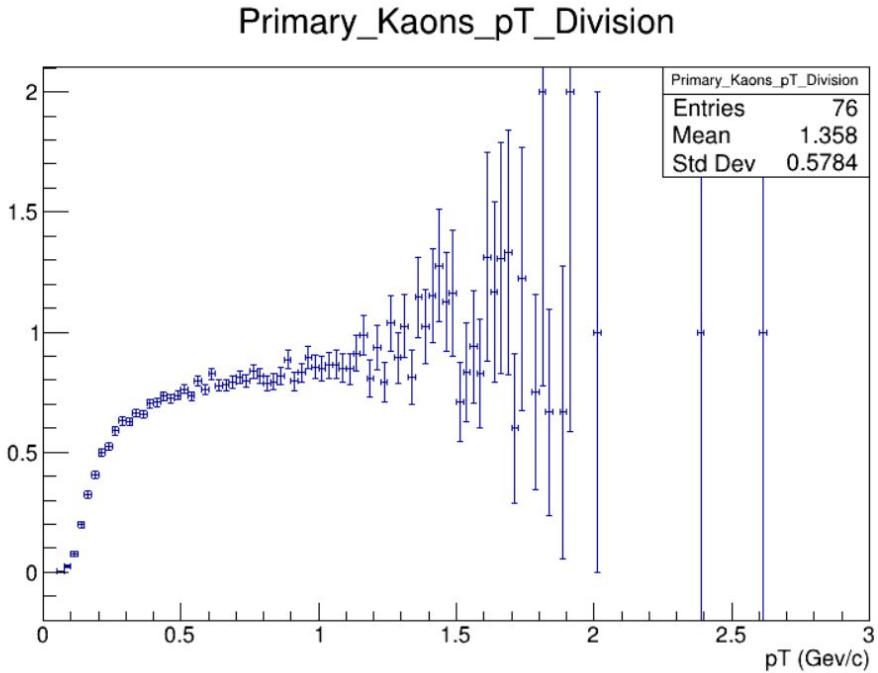
Track Efficiency pT

Cuts on MC Tracks:
Only Primary Particles
Only Charged particles
Eta (-1, 2)
Impact parameter b < 13

Cuts on Reco Tracks:
Eta (-1 , 2)
DCA <= 2
NHits => 20
Impact parameter b < 13

Primary Kaons pT (Reco/MC)





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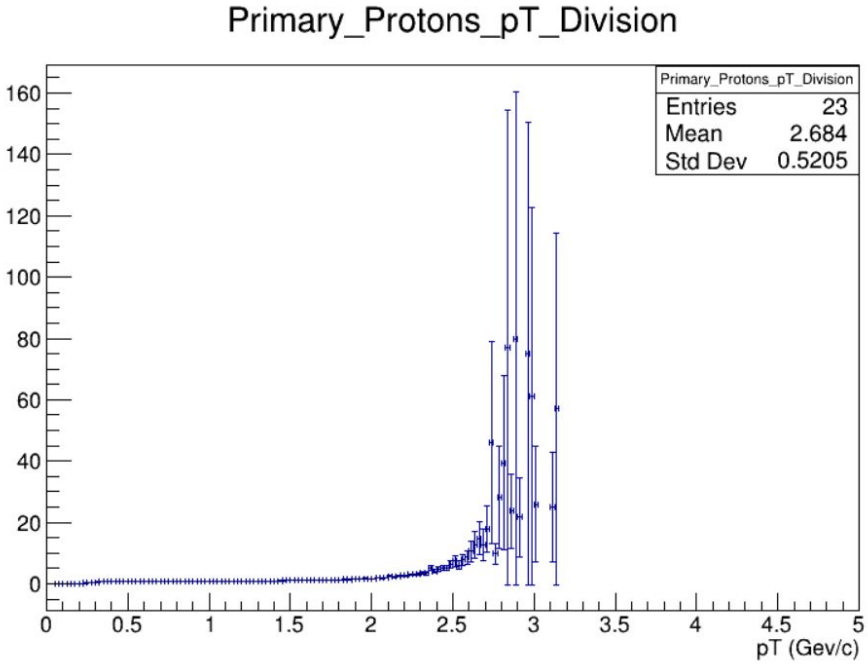
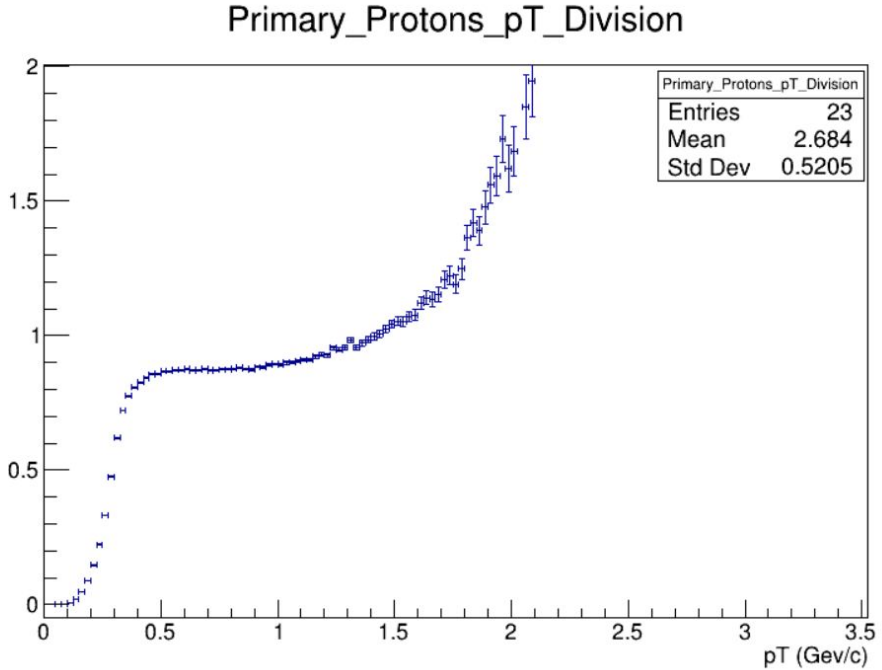
Primary Protons pT (Reco/MC)





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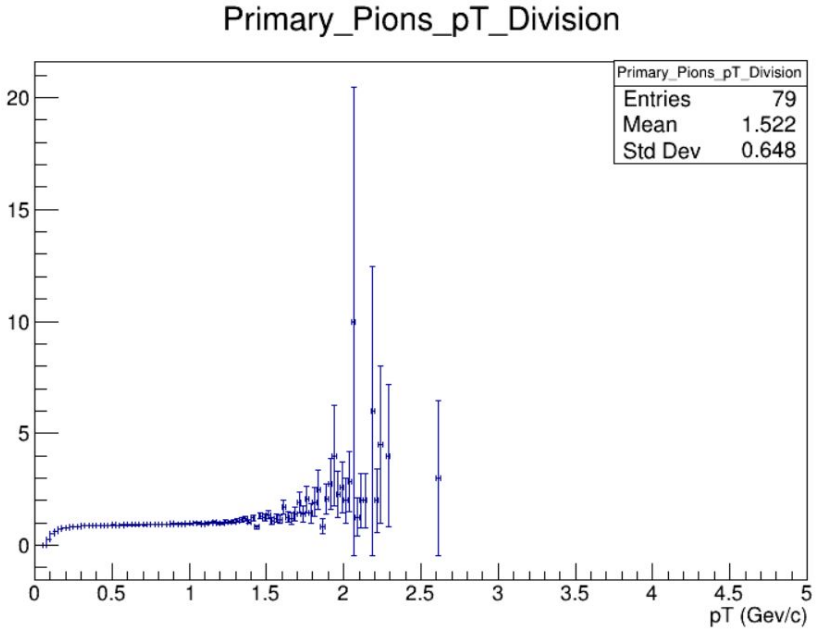
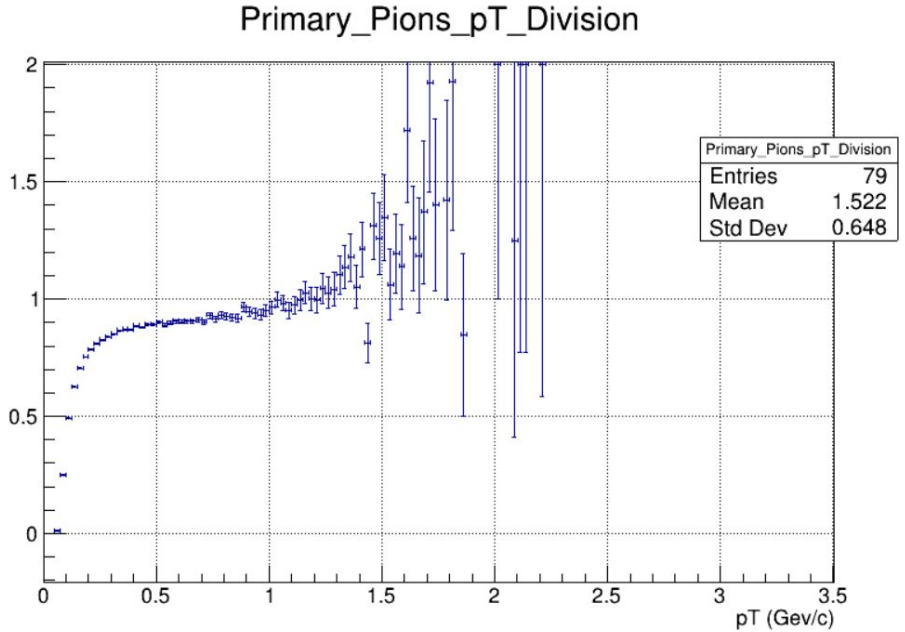
Primary Pions pT (Reco/MC)





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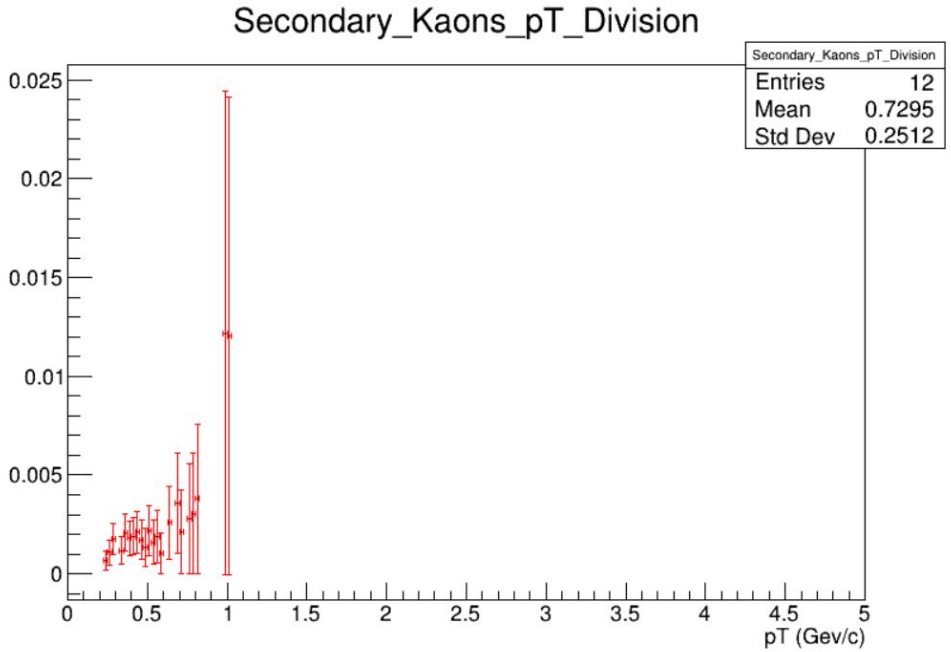
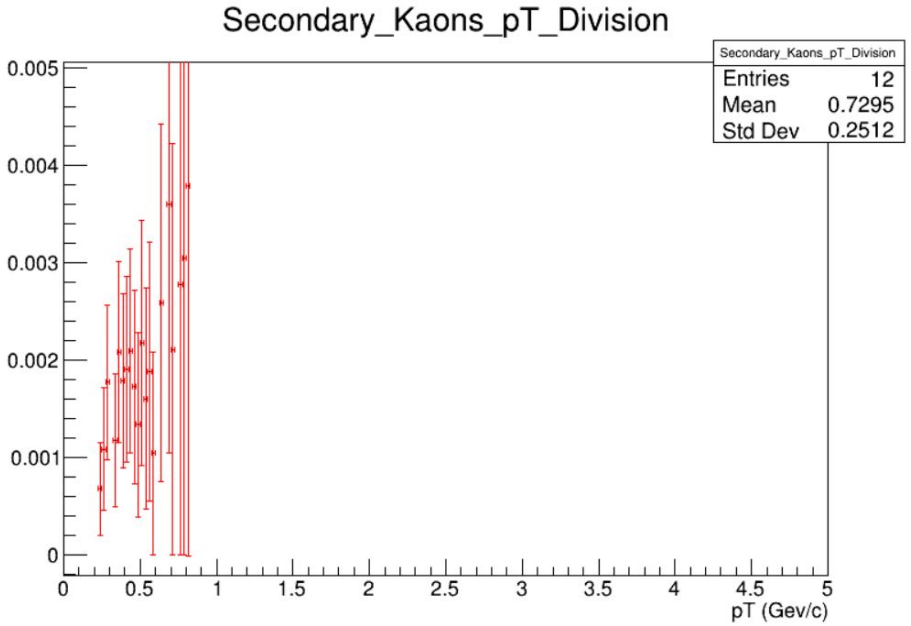
Secondary Kaons pT (Reco/MC)





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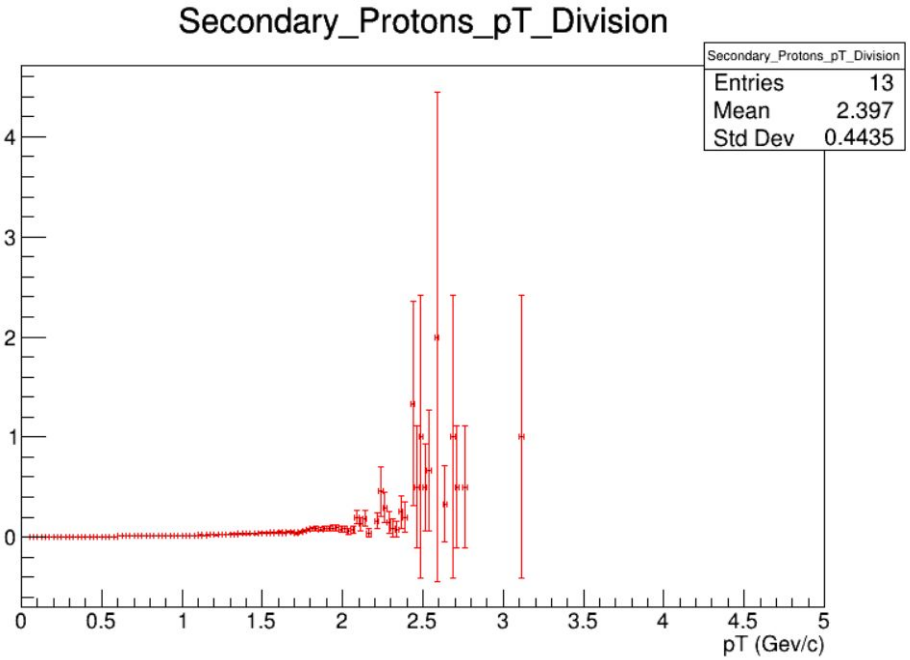
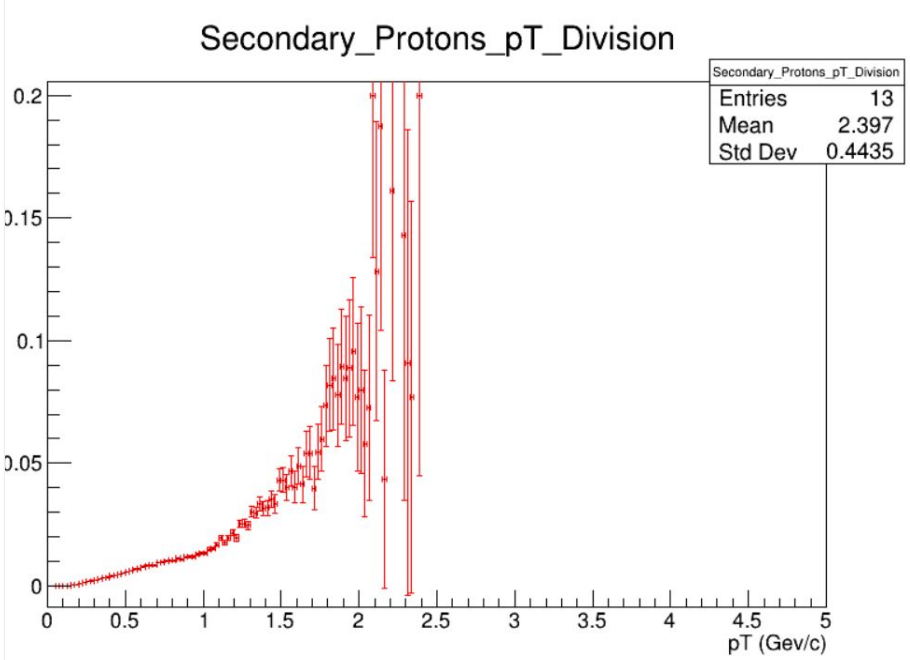
Secondary Protons pT (Reco/MC)





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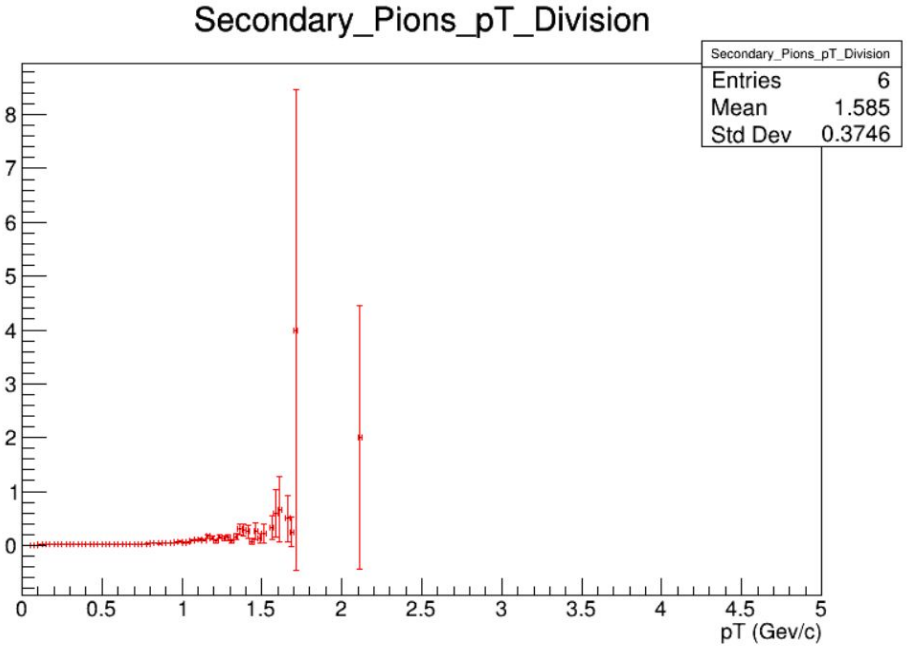

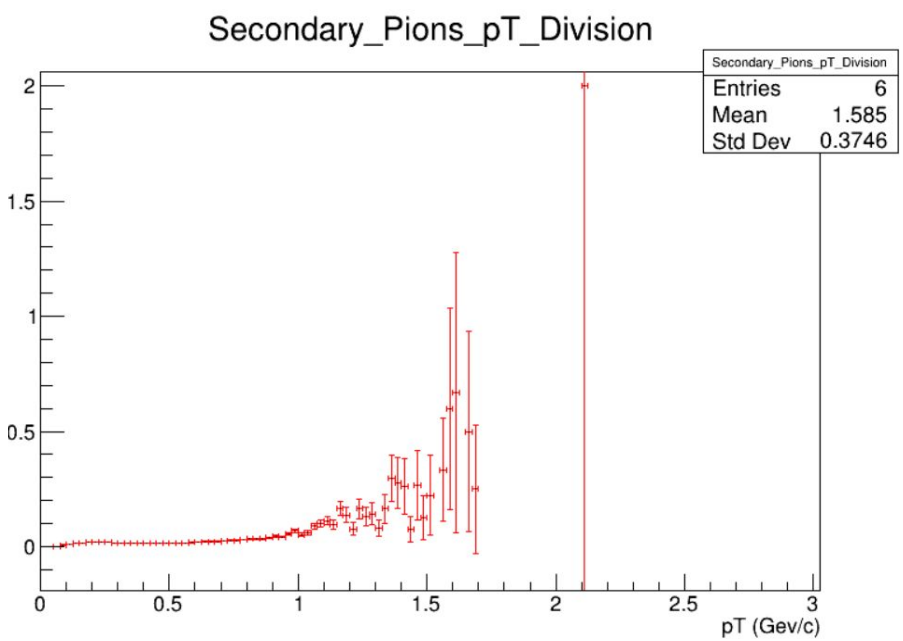

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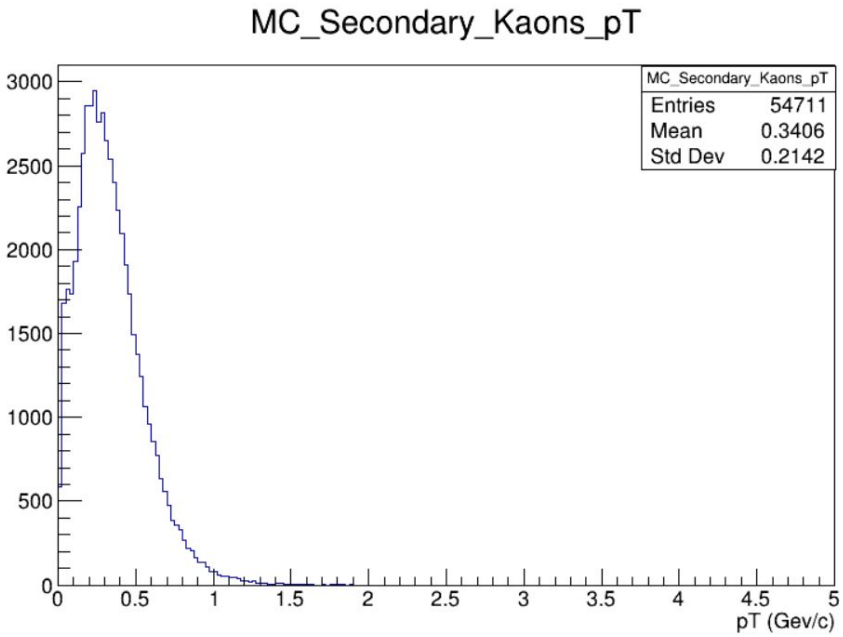
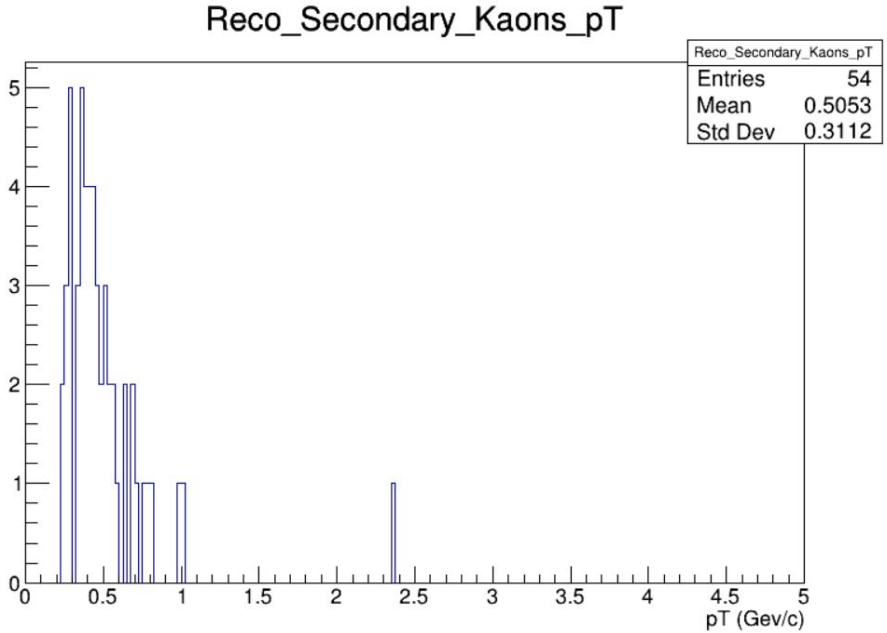
Reco and MC Kaons pT





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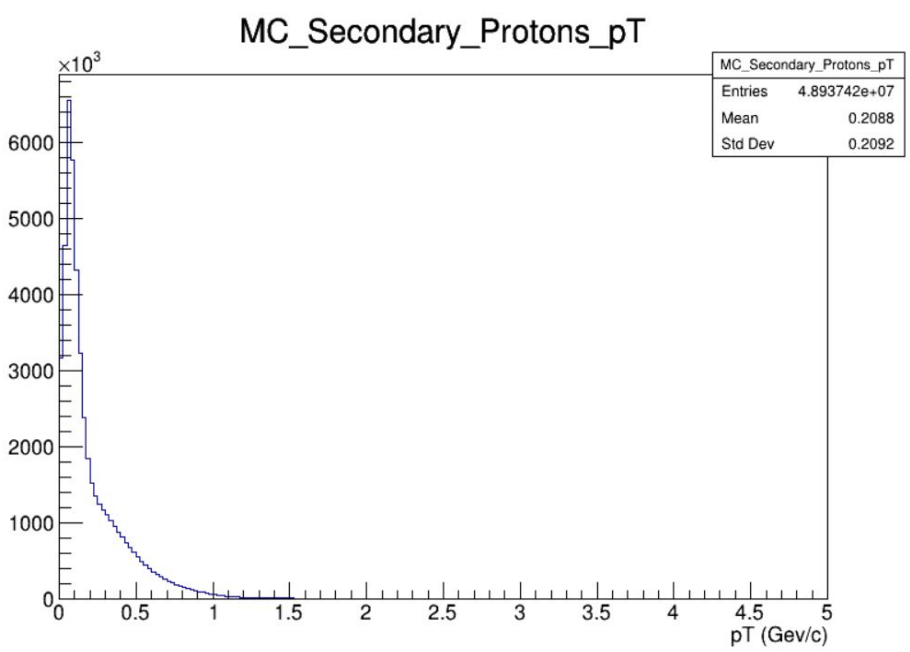
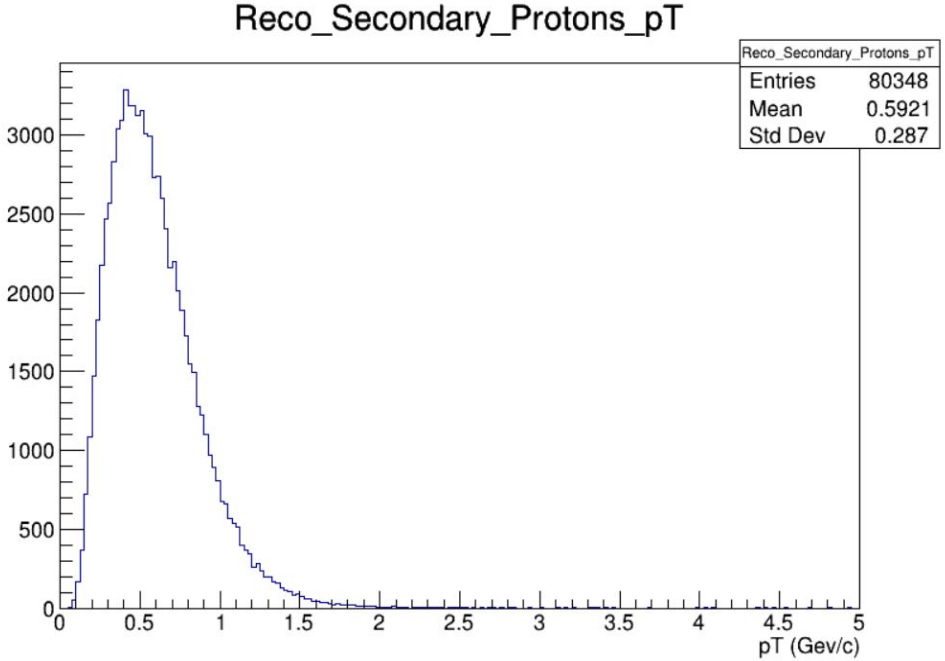
Reco and MC Protons pT





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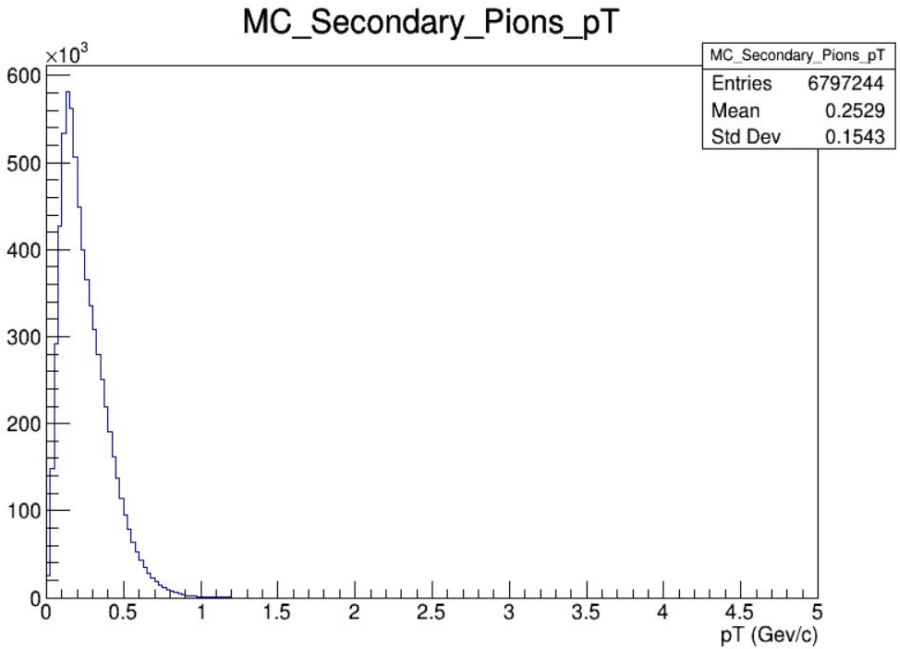
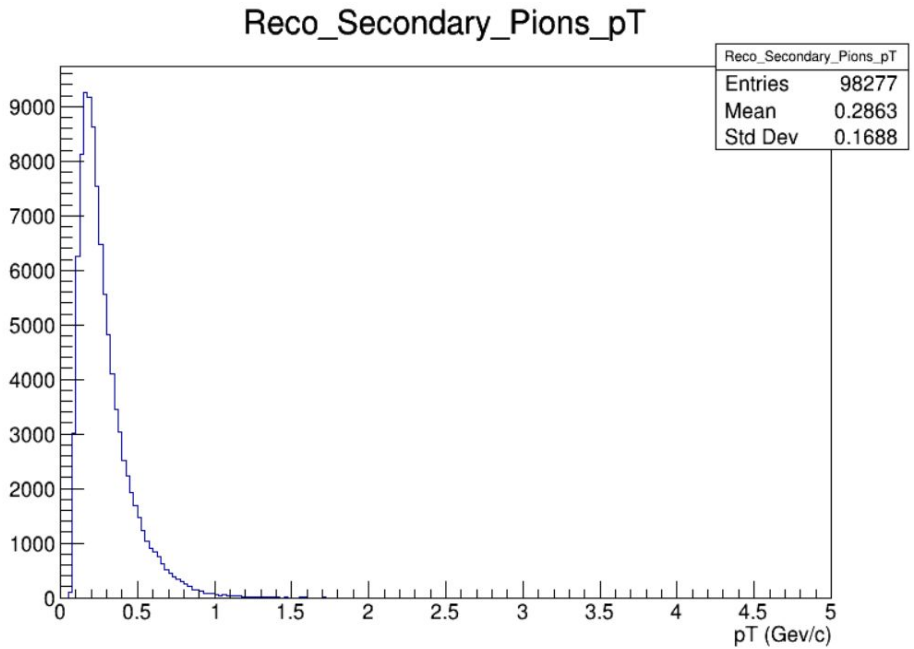
Reco and MC Pions pT





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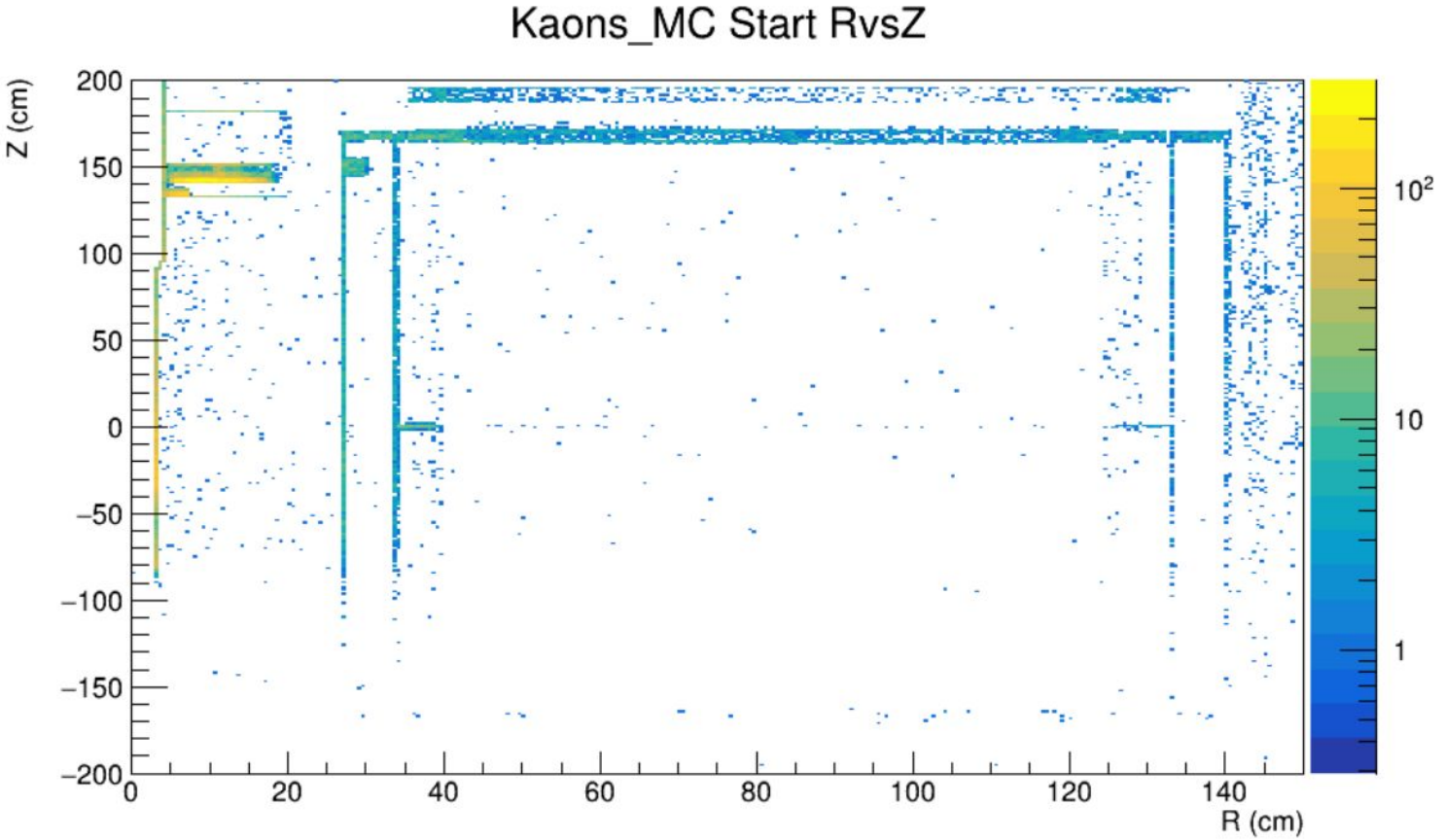
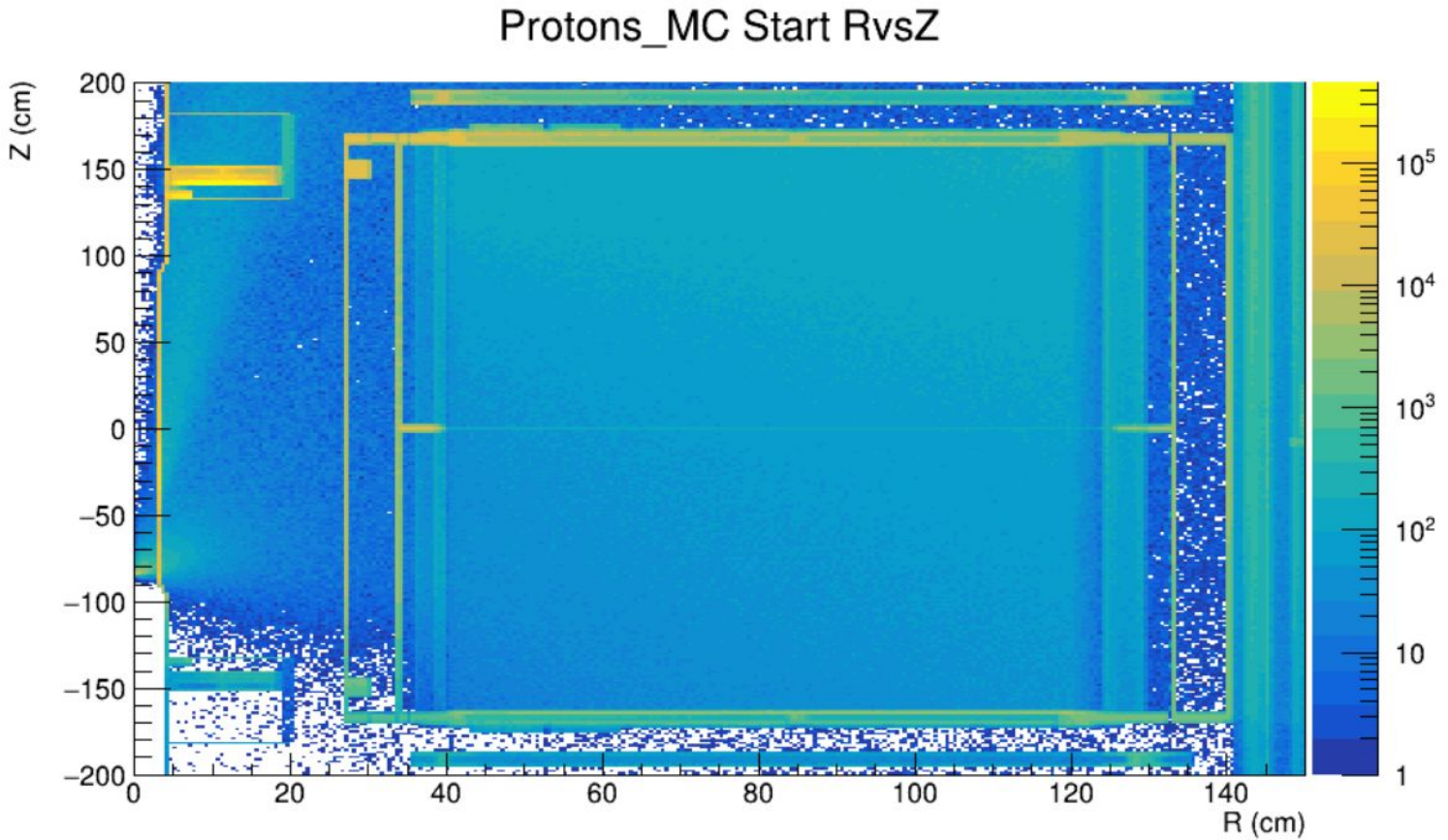
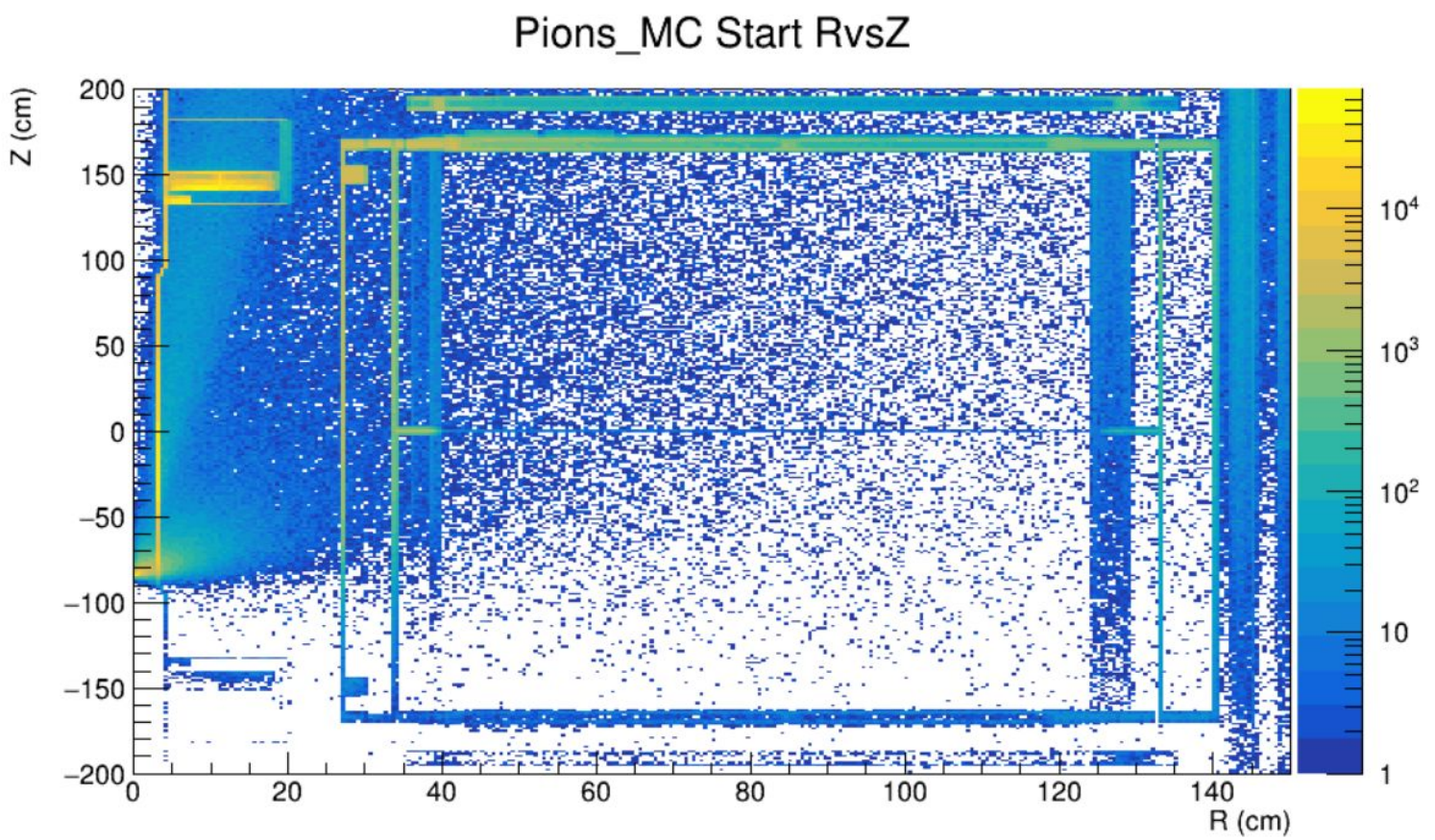
MC Start RvsZ Kaons



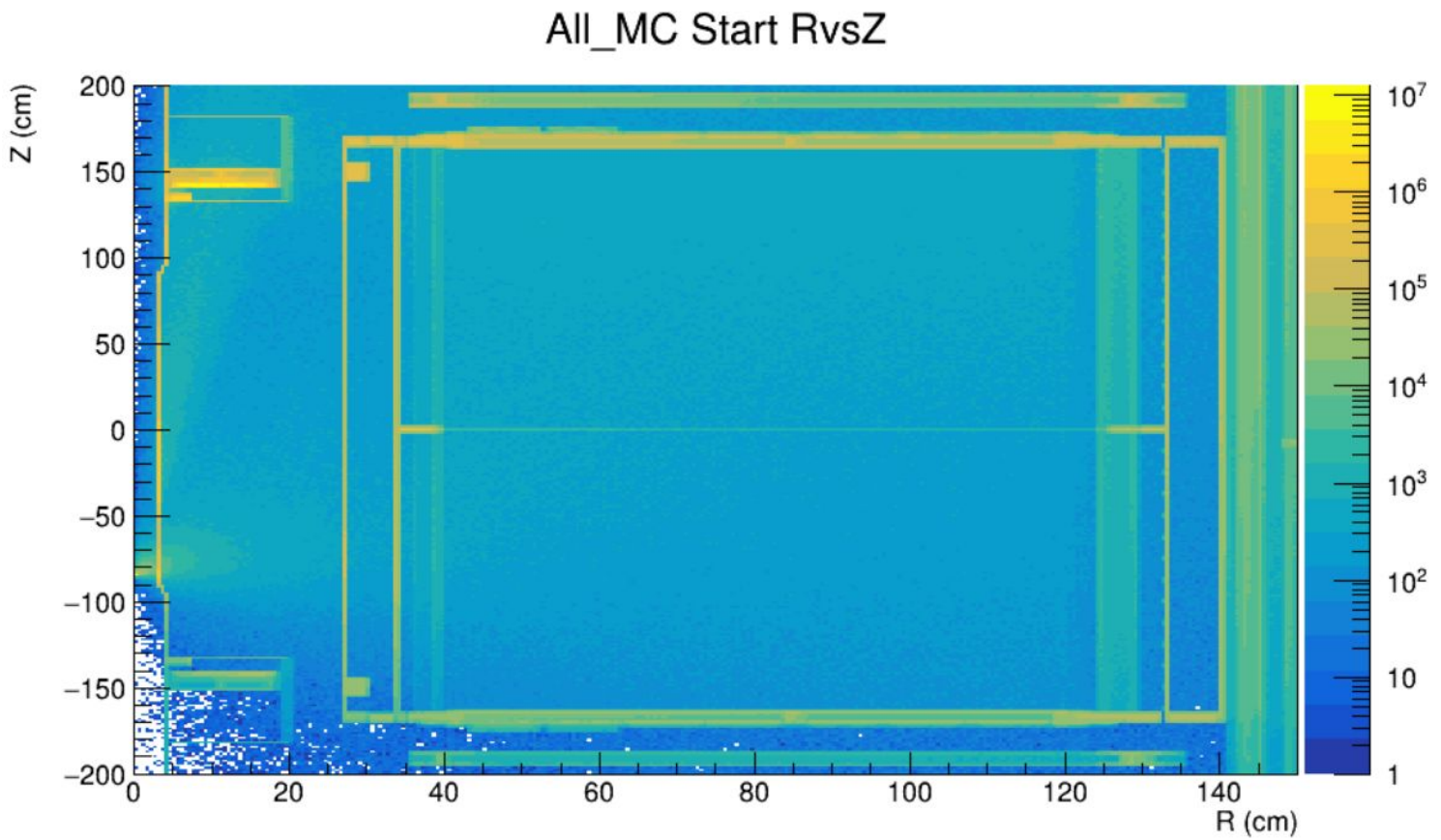
MC Start RvsZ Protons



MC Start RvsZ Pions



MC Start RvsZ All



Implementation in Code

```
//Primary p = 0 ; Secondary p = 1
Int_t p = (MCTrack->GetMotherId() == -1) ? 0 : 1;

//Kaons, Protons, Pions
abspdgcode = TMath::Abs(MCTrack->GetPdgCode());
Int_t l = 3;

switch (abspdgcode)
{
  case 321://Kaons
    l = 0;
    break;
  case 2212://Protons
    l = 1;
    break;
  case 211://Pions
    l = 2;
    break;
}
```

```
if (abspdgcode == 321 || abspdgcode == 2212 || abspdgcode == 211 || abspdgcode == 11)// kac
{
  if(Impactb < 13 && Eta > -1 && Eta < 2 && ZReco > -100 && ZReco < -70)
  {//Matching cuts of RecoTracks
    if(pTMC == 0) continue;
    HistMCPSKpPi1[0][p][l][0]->Fill(pTMC);//p primary or secondary, l - kaons, protons, pic
    HistMCPSKpPi1[0][p][3][0]->Fill(pTMC);//3-all particles
  }

}
```

MC Loop

Line 170

Path:
AdrianLara/Classes_created/Fixed_TrackEff
/Fixed_Track.cxx

Implementation in Code

```
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Int_t p = (MCTrack->GetMotherId() == -1) ? 0 : 1;

//Kaons, Protons, Pions
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    break;
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    l = 2;
    break;
}
```

```
if (ZReco > -100 && ZReco < -70)//Cut on Primary Vertex
{
  if (Impactb < 13 && Eta_Reco > -1 && Eta_Reco < 2 && DCA <= 2 && NumHits >= 20 )
  { //Impact Parameter Cut
    Multiplicity++;

    if(Pt_MC == 0) continue;
    HistMCPSKpPi1[1][p][l][0]->Fill(Pt_Reco);
    HistMCPSKpPi1[1][p][3][0]->Fill(Pt_Reco);

    Dpt_pt_Multi_Profile_cuts->Fill(Pt_Reco,Diff_Pt);
  }
}
```

Reco Loop

with MonteCarlo Identification

Line 270

Path:

AdrianLara/Classes_created/Fixed_TrackEff/Fixed_Track.cxx

Implementation in Code

Line 144

Path:
AdrianLara/Classes_created/Fixed_TrackEff/DivisionKpPi.C

```
Division[0][j][l][k]->Divide(HistMCPSKpPi1[1][j][l][k],HistMCPSKpPi1[0][j][l][k]);
Division[0][j][l][k]->SetOption("E1");
```

https://github.com/iamaldonado/START_Summer24

Previously

z-Vertex vs Eta - Track efficiency

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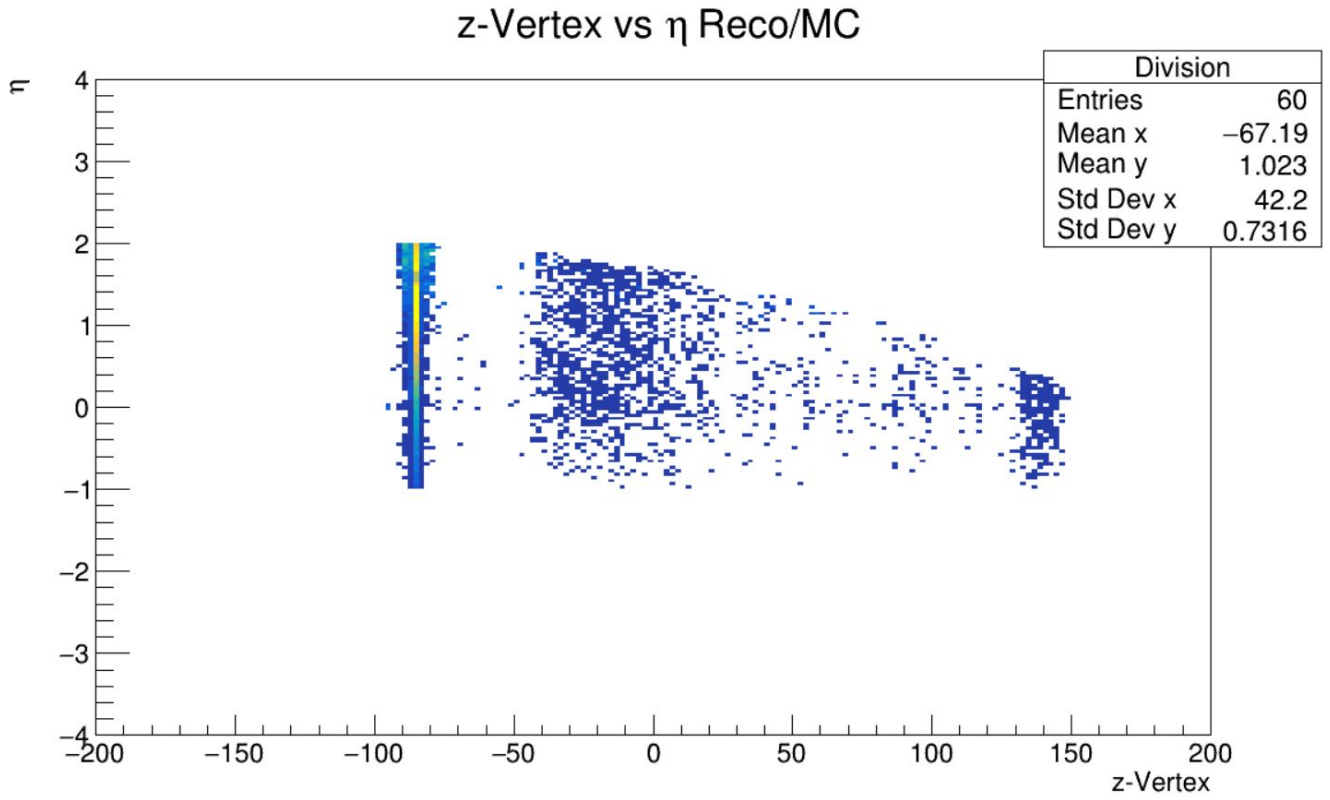
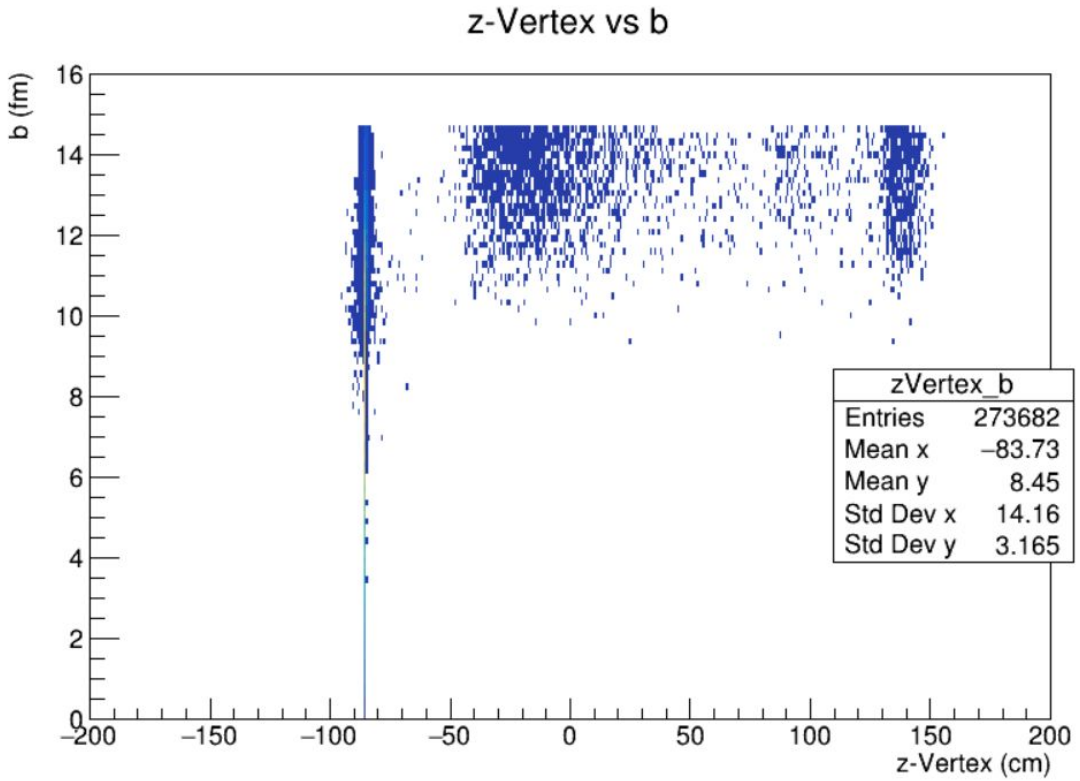
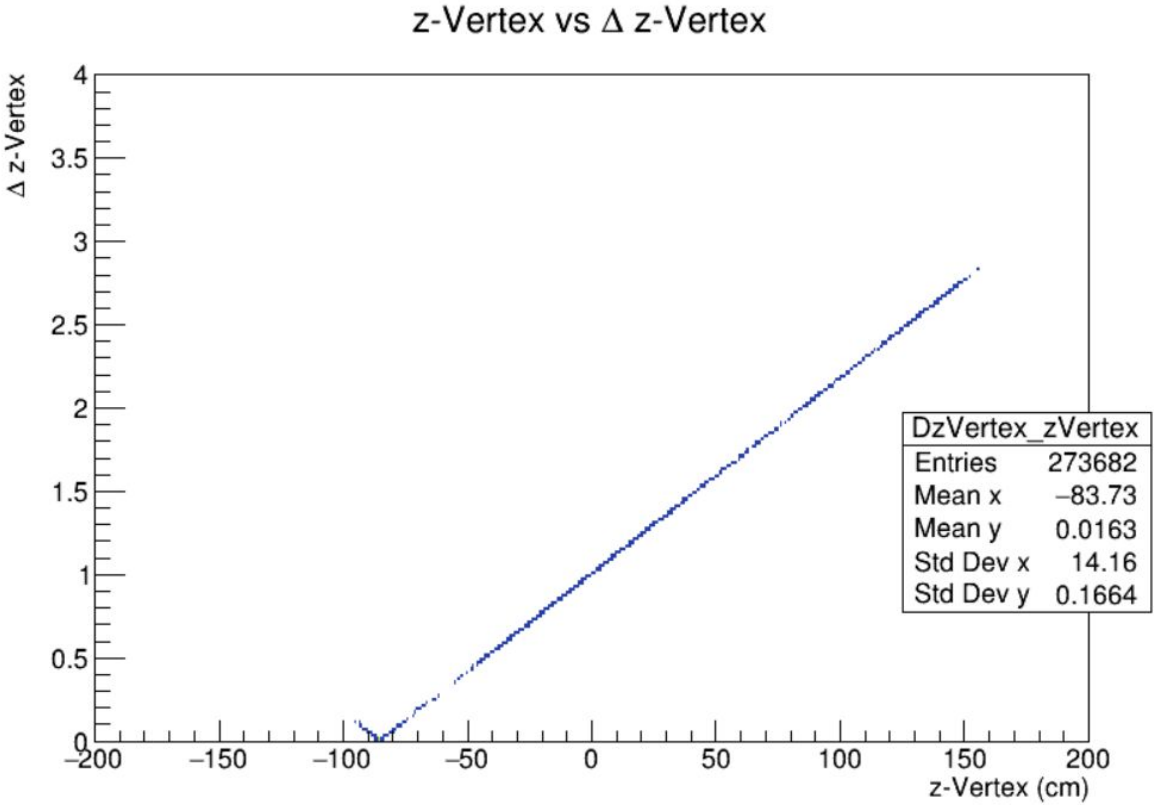
Its not applied the cut on Z-Vertex (-100,-70) on Reco Tracks



z-Vertex vs Impact Parameter



z-Vertex vs Resolution z-Vertex



z-Vertex vs Eta - Track efficiency

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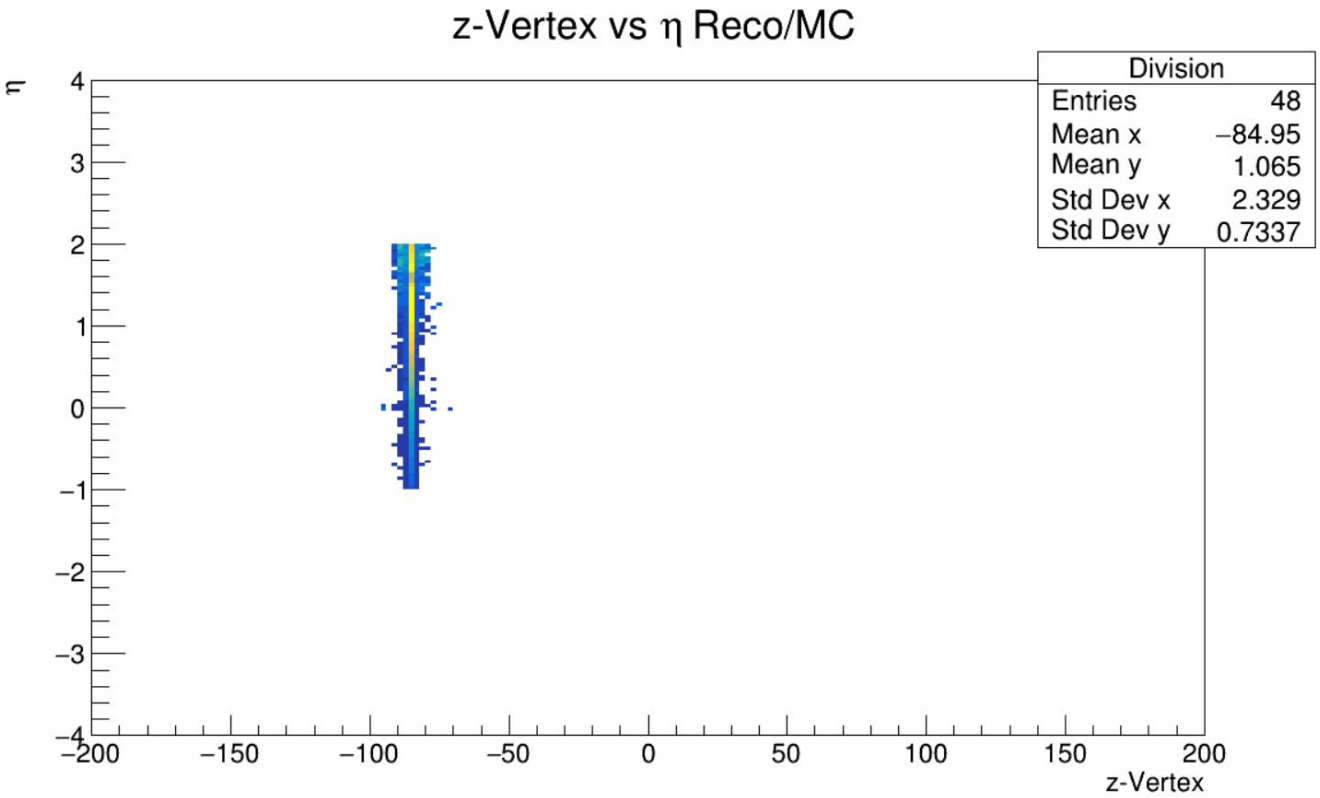
cut on Z-Vertex (-100,-70) on Reco Tracks



Resolution z-Vertex vs Multiplicity Reco

Cuts on Reco Tracks:
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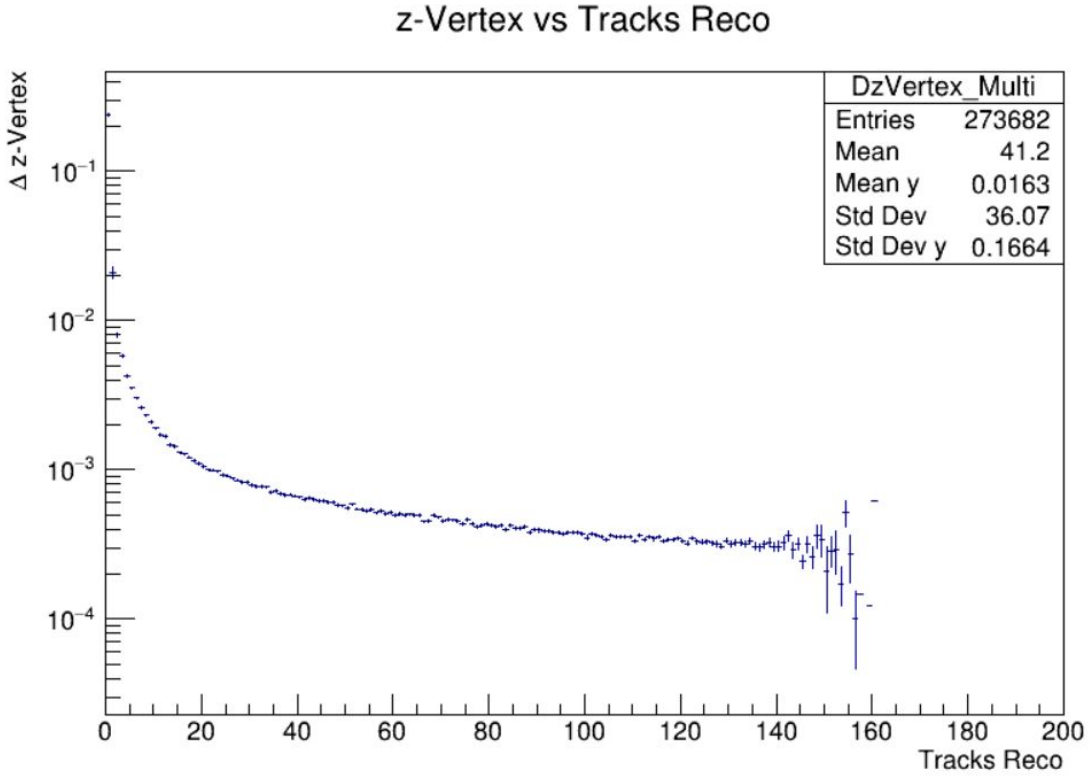
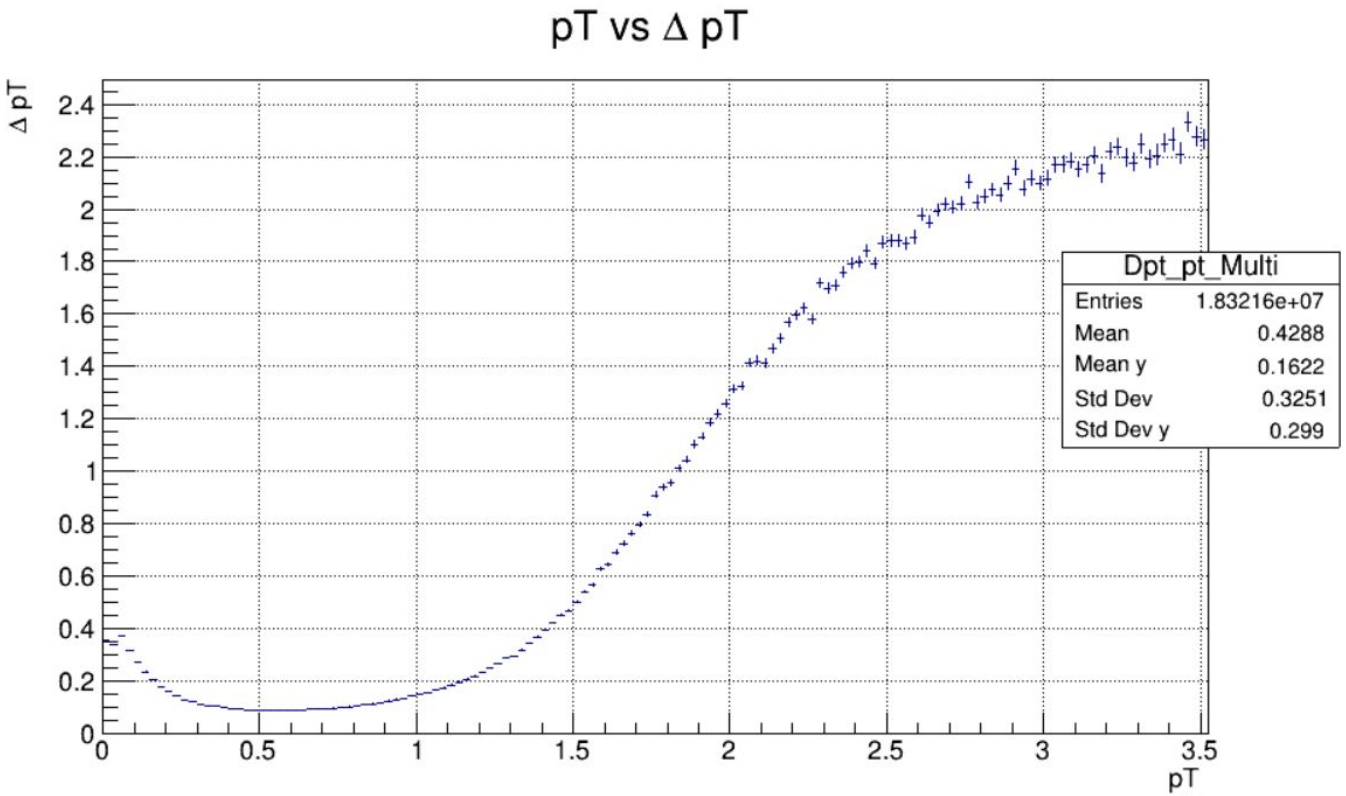
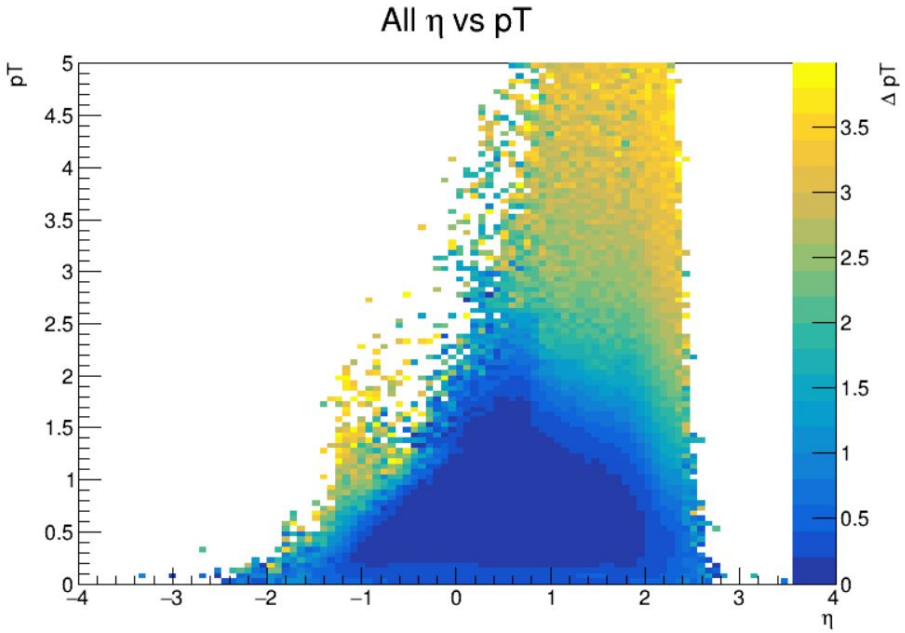


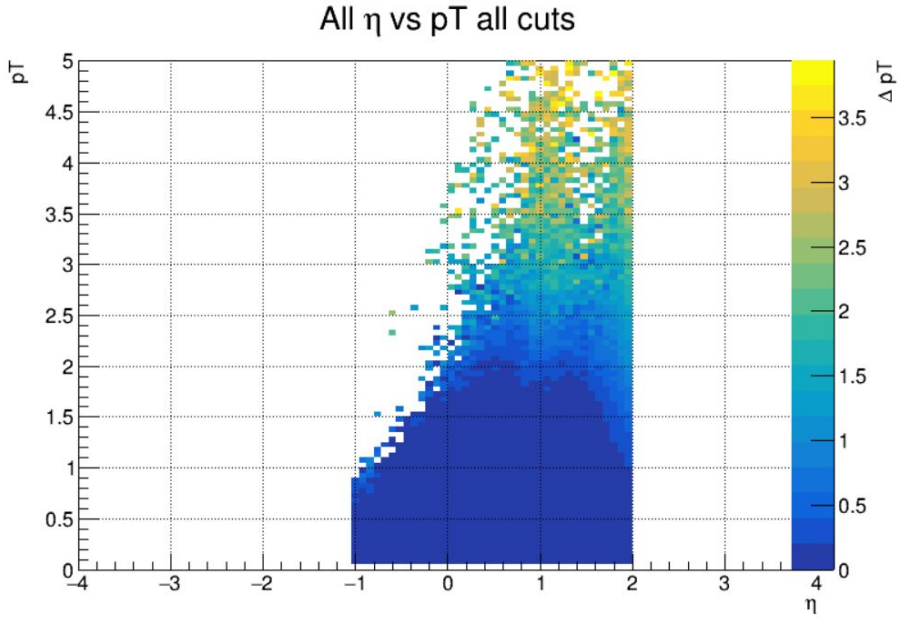
pT vs Resolution pT

No cuts on Reco Tracks were made



Eta vs pT





Cuts on Reco Tracks:
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Cuts all particles for the PID

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Cuts on Reco Tracks:
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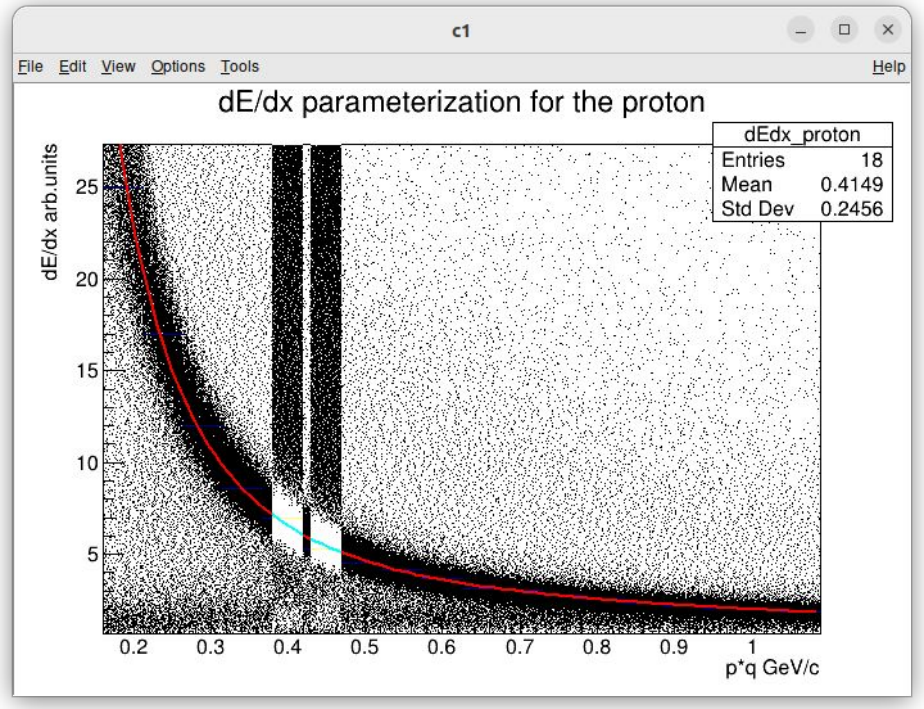
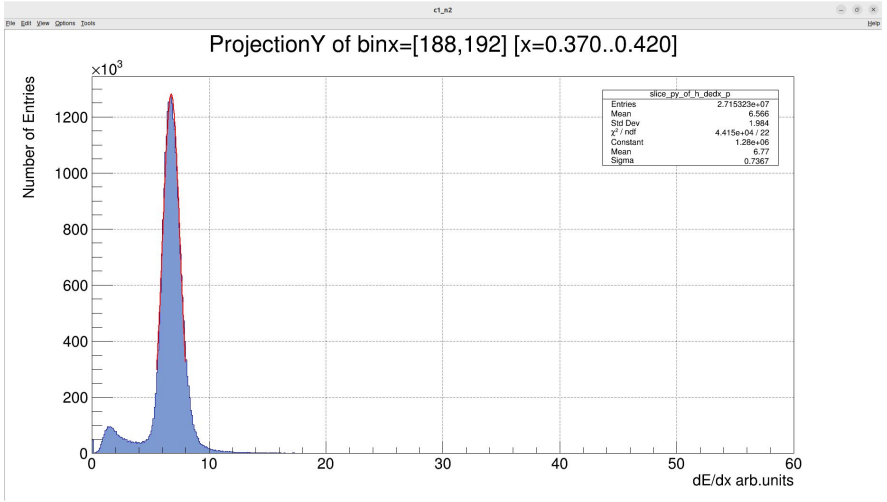
Previous work

fit is found by making cuts on the Y-axis and adjusting a guasiana per bin

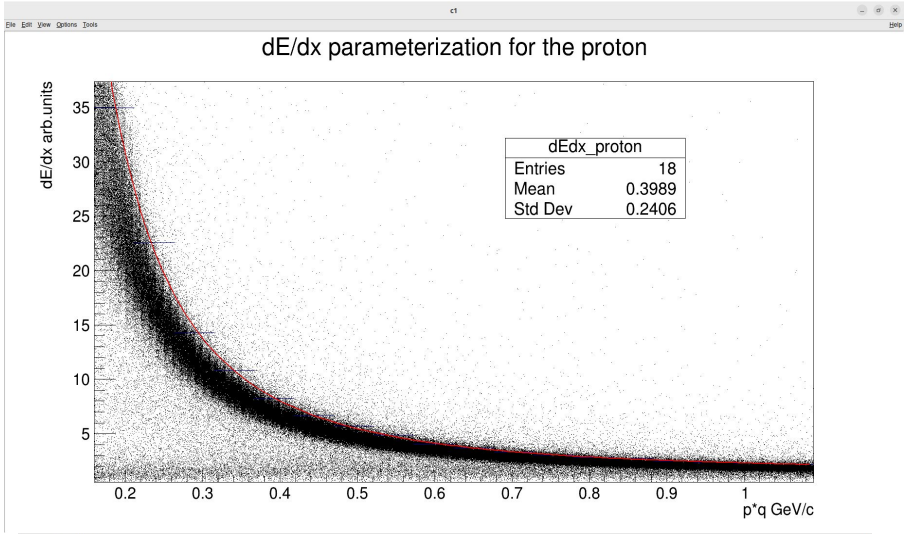


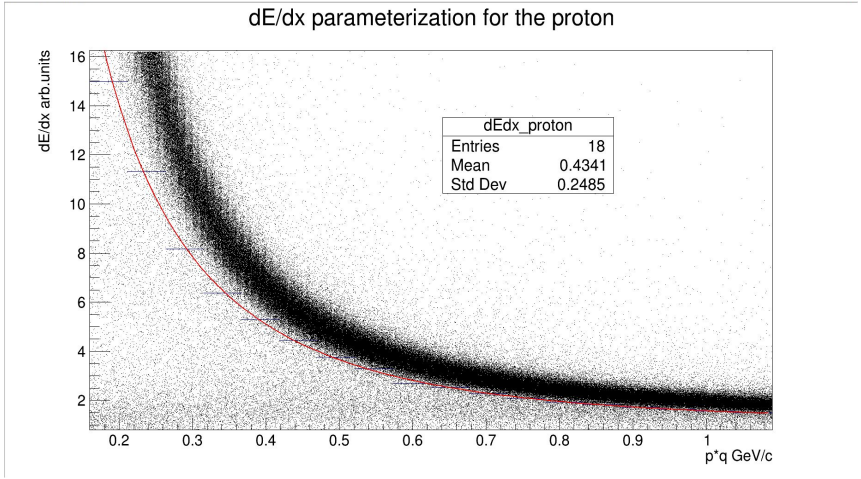


Extraction of parameters for the Bethe-Bloch equation

p0= -1.30554
p1= 0.381237
p2= 1.46136
p3= 1.52176
p4= 1.50261

Adjustments are made taking the maximum and minimum limits per histogram and parameters for the use of the equation are extracted



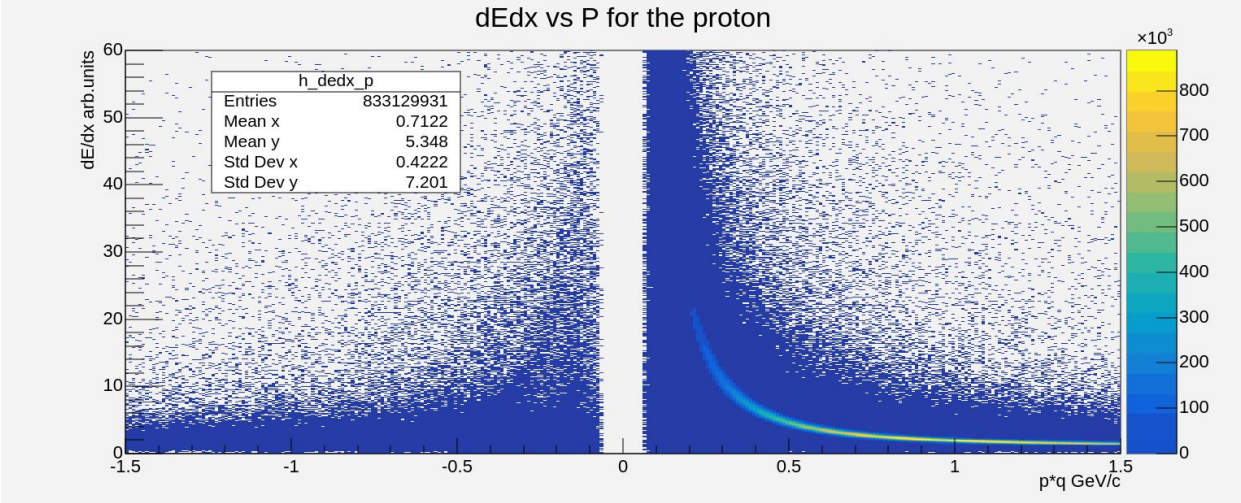


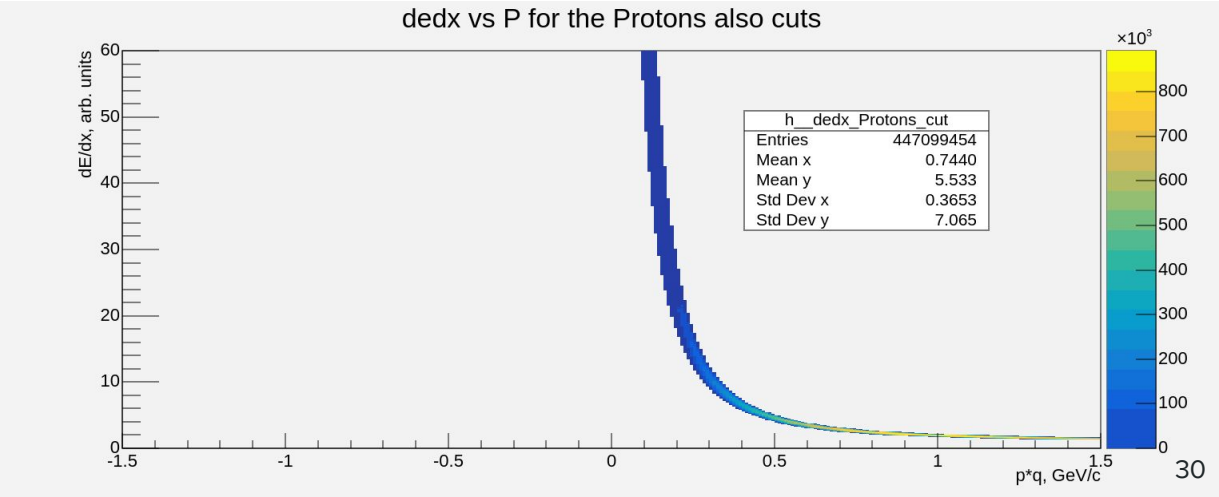
Code, min and max fit for the protons

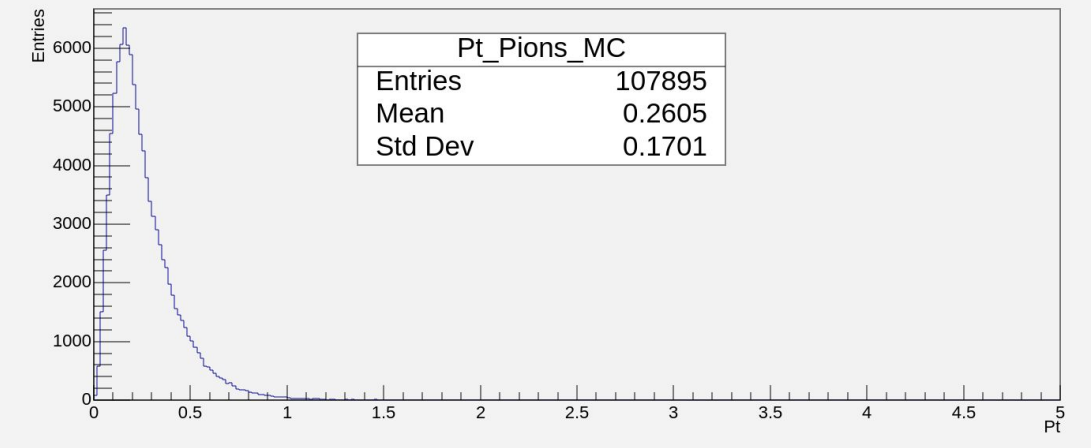
Using the parameters of the settings of maximums and minimums are put in the code as constraints

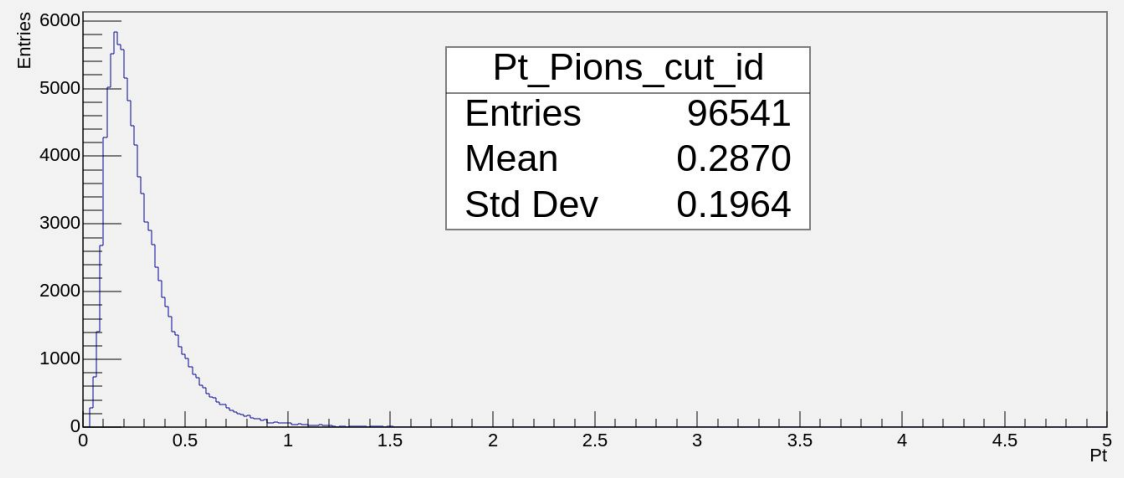
```
    Double_t proton_min =   ( (-0.570265) / TMath::Power(p / TMath::Sqrt(p * p + 0.88), (1.19768))) * ( ((-0.606429) - TMath::
:Power(p / TMath::Sqrt(p * p + 0.88), (1.19768))) - (TMath::Log((1.4379) + TMath::Power(1.0 / (p / 0.9383), (2.65445))))   );
    Double_t proton_max =  ((-0.833873) / TMath::Power(p / TMath::Sqrt(p * p + 0.88), (1.78132))) *(  (  (-0.48671) - TMath::
Power(p / TMath::Sqrt(p * p + 0.88), (1.78132))) - (  TMath::Log((0.547201) + TMath::Power(1.0 / ( p / 0.9383), (0.842978)))
)  );
```

Histograms of energy loss are obtained with the limits selected from the settings and with the same limits we obtain histograms of Pt





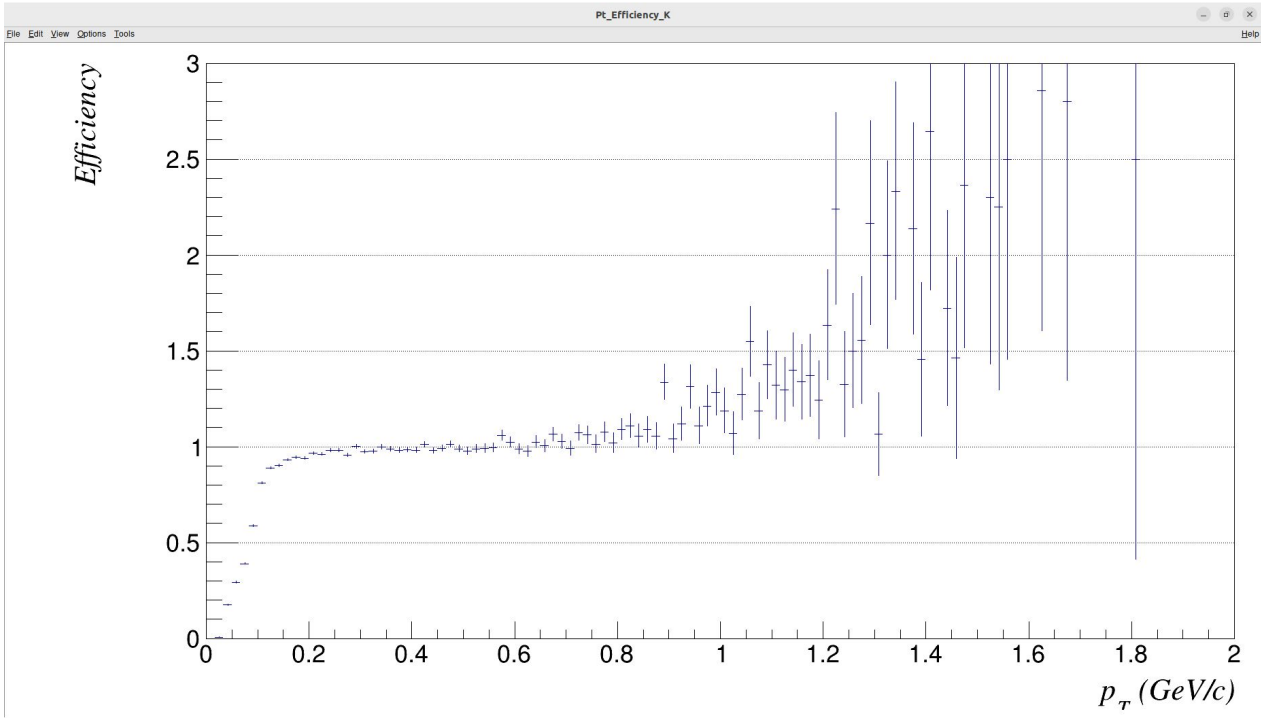




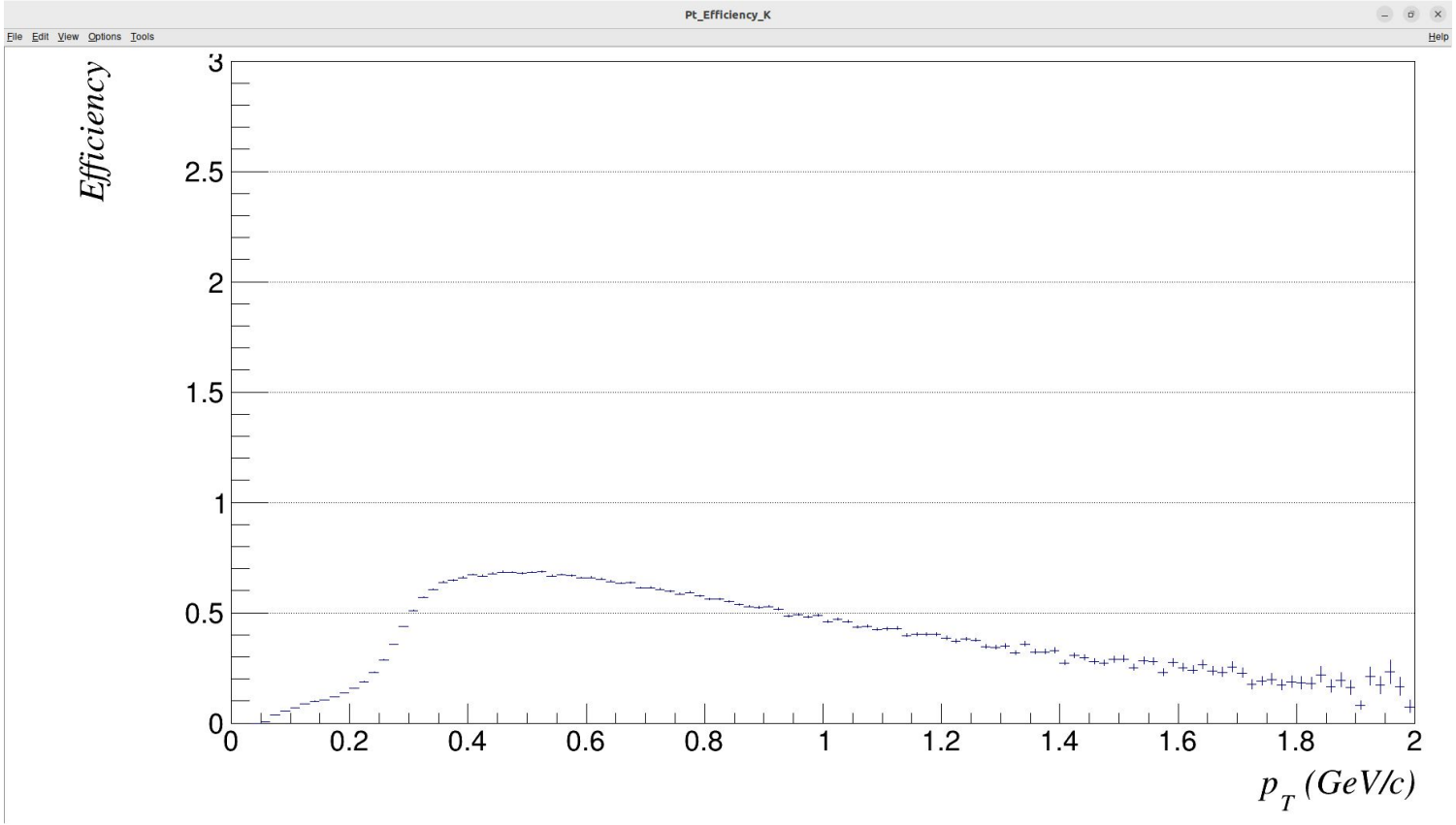
Pt reco and Pt MC histograms were found

Pions

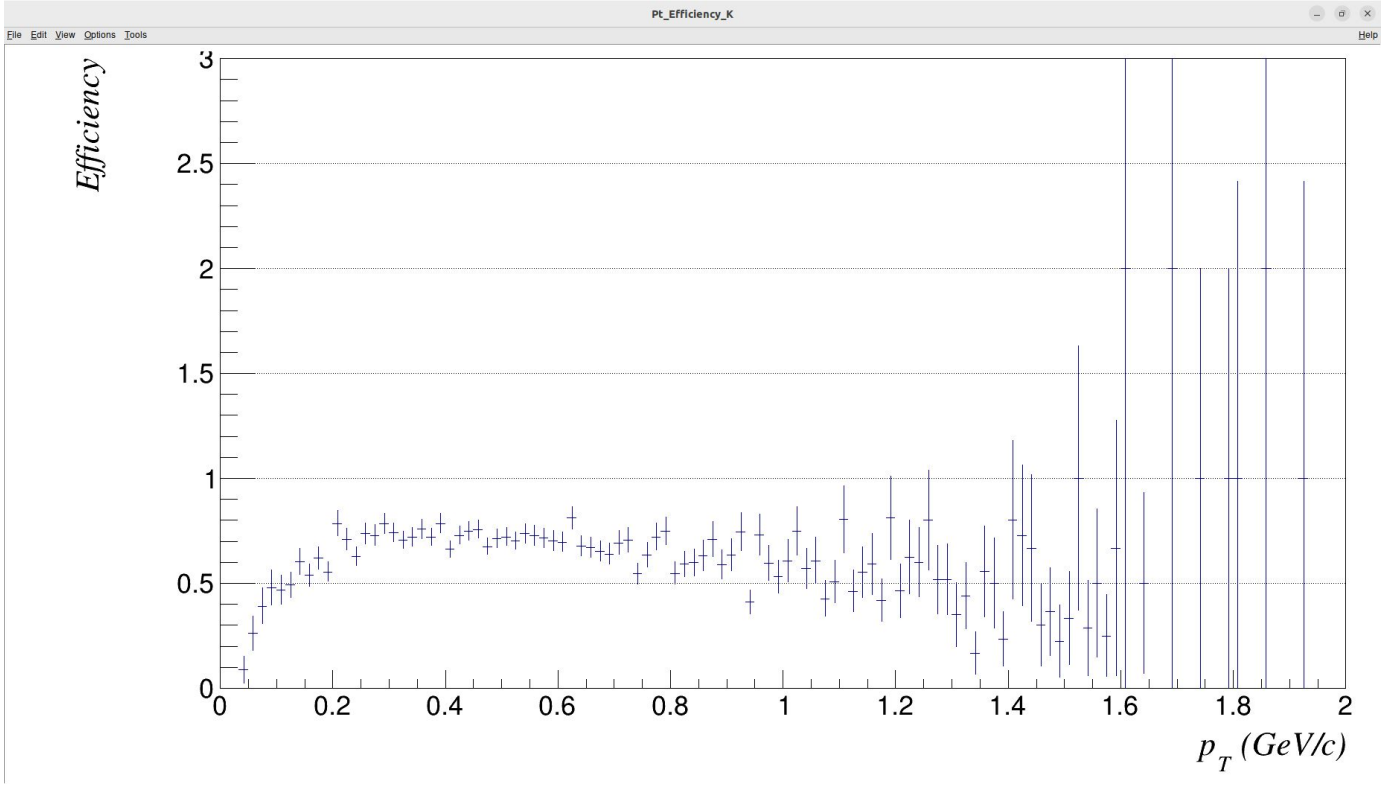
Pt efficiency histograms were performed comparing the Reco with the limits against the Pt monte carlo



Protons


Pt_Efficiency_K
File Edit View Options Tools
Help
Efficiency
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
p_T (GeV/c)

Kaons


Pt_Efficiency_K
File Edit View Options Tools
Help
Efficiency
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
p_T (GeV/c)

Future work

In the future, it is planned to continue working with the collaboration.
So the next steps are:

- Improve pT efficiency
- Analysis of distributions by centrality