



# Progress Report

---

30<sup>th</sup> November, 2023

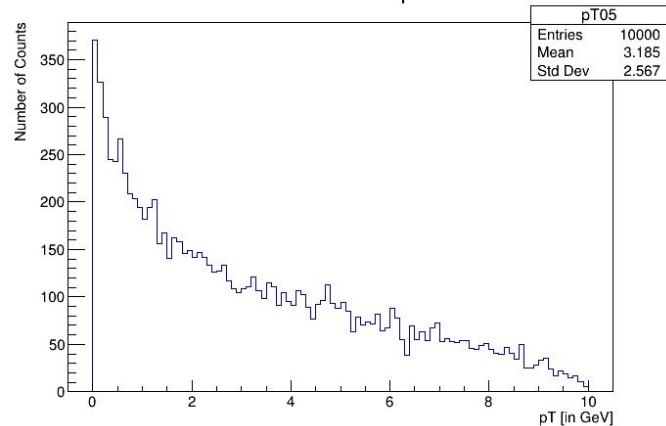
Harsimran Singh

Lokesh Kumar

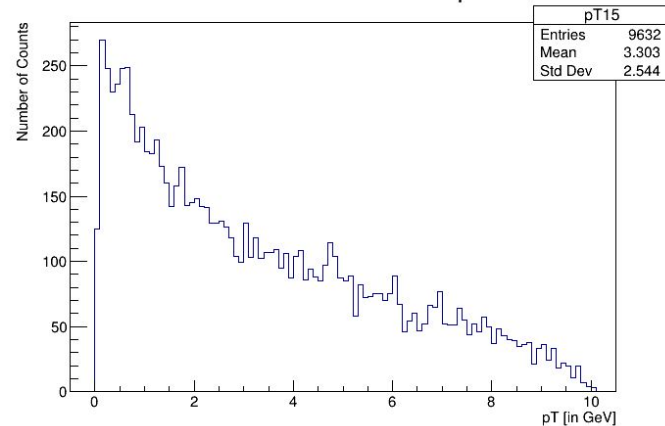
Department of Physics, Panjab University  
Chandigarh, INDIA

# Efficiency Plot: pT

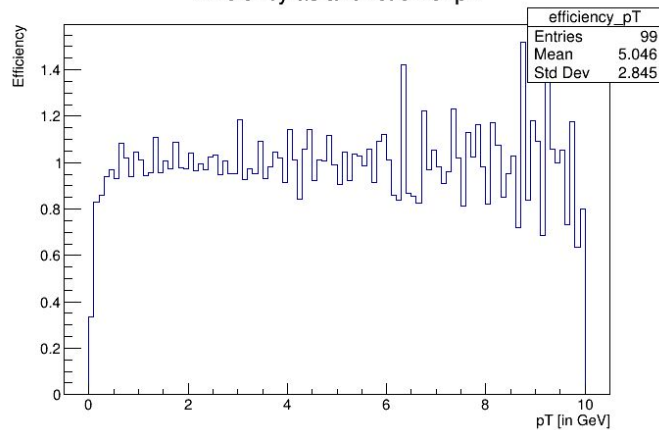
MC Particles : pT



Reconstructed Particles : pT

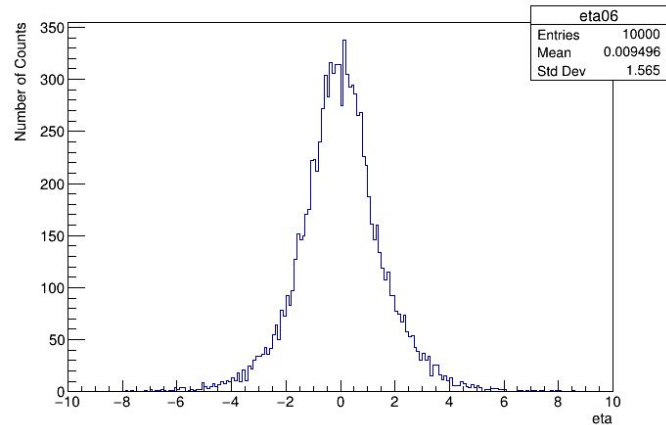


Efficiency as a function of pT

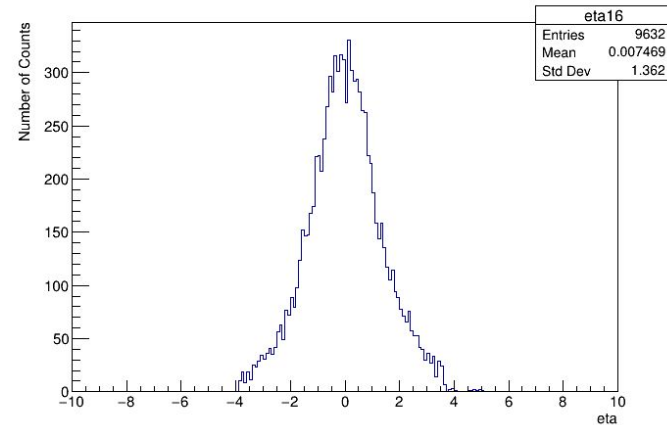


# Efficiency Plot: Eta

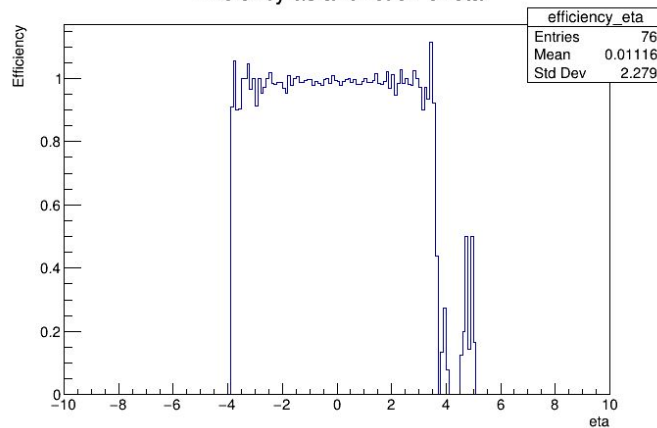
MC Particles : eta



Reconstructed Particles : eta

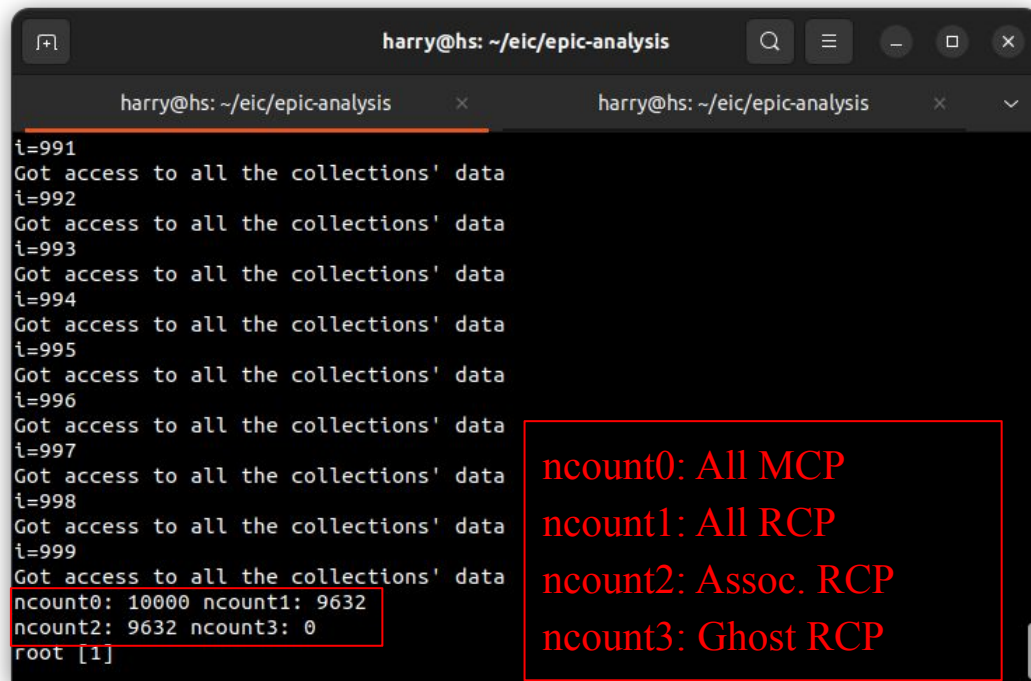


Efficiency as a function of eta



# Ghost Rate

I am not getting any ghost particles i.e. Muons that ARE reconstructed but NOT having an association to any MC particle.

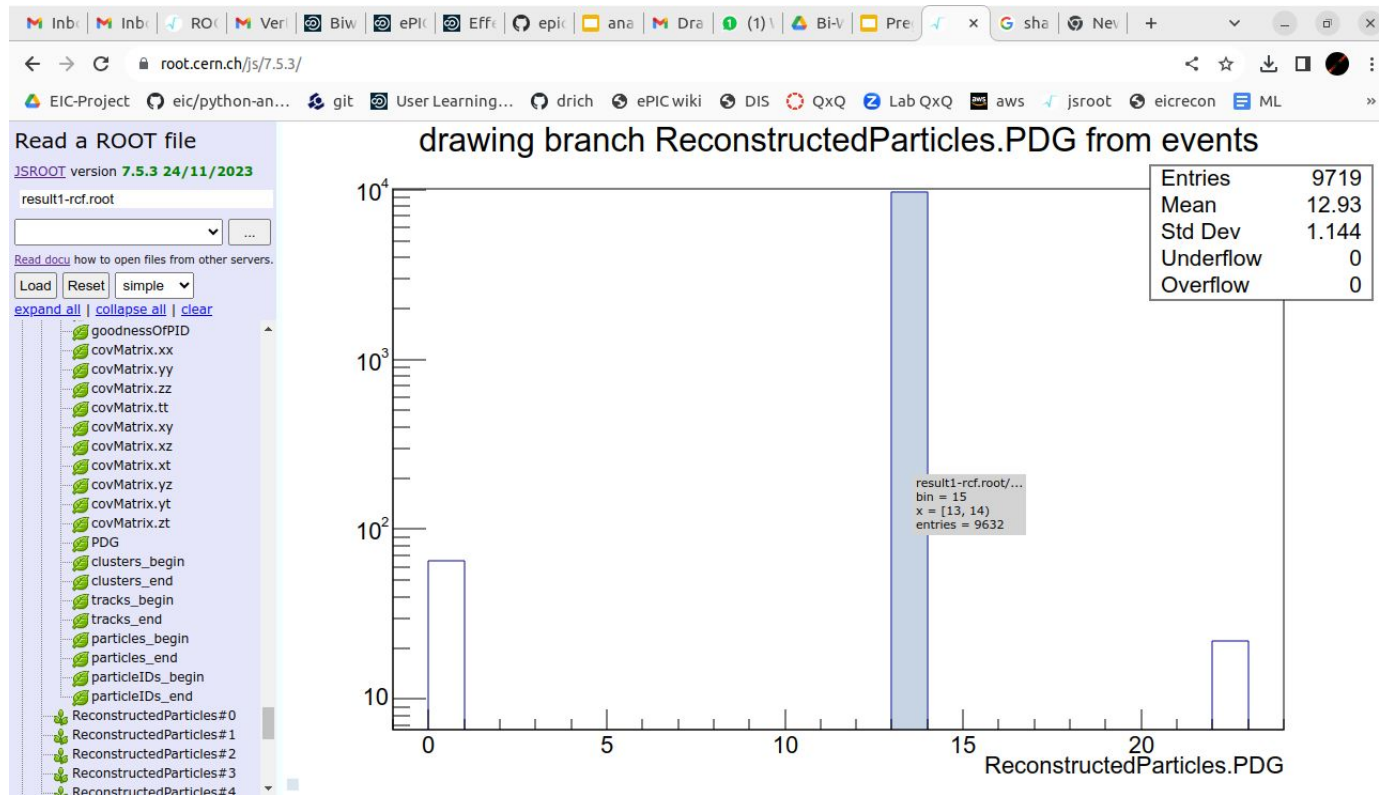


```
harry@hs: ~/eic/epic-analysis
i=991
Got access to all the collections' data
i=992
Got access to all the collections' data
i=993
Got access to all the collections' data
i=994
Got access to all the collections' data
i=995
Got access to all the collections' data
i=996
Got access to all the collections' data
i=997
Got access to all the collections' data
i=998
Got access to all the collections' data
i=999
Got access to all the collections' data
ncount0: 10000 ncount1: 9632
ncount2: 9632 ncount3: 0
root [1]
```

ncount0: All MCP  
ncount1: All RCP  
ncount2: Assoc. RCP  
ncount3: Ghost RCP

# Ghost Rate

Total 9632 muons are reconstructed and all the associated to a MC particle.



# Ghost Rate

Conditions/Cut used to select particles from associations:

```
// loop over association to find reconstructed particles having a corresponding MC particles using "bool found"
for (const auto &assoc : mcRecAssocs)
{
    auto recPart = assoc.getRec(); // reconstructed particle
    auto simPart = assoc.getSim(); // simulated (truth) particle

    if (simPart.getGeneratorStatus() != 1 || recPart.getPDG() != 13 || simPart.id() != mp.id() )
    {
        continue;
    }

    found_RC_corres_MC = true;

    //vector_mc_asso.SetPxPyPzE(simPart.getMomentum().x, simPart.getMomentum().y, simPart.getMomentum().z, simPart.getEnergy());
    vector_rp_asso.SetPxPyPzE(recPart.getMomentum().x, recPart.getMomentum().y, recPart.getMomentum().z, recPart.getEnergy());
    break;
}

if(found_RC_corres_MC) //these are only those reconstructed particles which have a corresponding associated MC particle
{
    ncount2+=1;
    hist[2][0]->Fill(vector_rp_asso.E());
    hist[2][1]->Fill(vector_rp_asso.P());
    hist[2][2]->Fill(vector_rp_asso.Px());
    hist[2][3]->Fill(vector_rp_asso.Py());
    hist[2][4]->Fill(vector_rp_asso.Pz());
    .....
```

# About reconstructed track positions

I am able to access the position coordinates as:

```
for (const auto parameters : truth_seeded_tracking)
{
    auto r_rec = parameters.getLoc().a;
    auto x_rec = r_rec*cos(parameters.getPhi());
    auto y_rec = r_rec*sin(parameters.getPhi());
    auto z_rec = parameters.getLoc().b;

    //std::cout<< "parameters.id(): " << parameters.id() << std::endl;
    //std::cout<< "x_rec: " << x_rec << " y_rec: " << y_rec << std::endl;
    //TVector3 reconstructed_position(x_rec, y_rec, z_rec);
    //float pos_mag = reconstructed_position.Mag();
}
```

# About reconstructed track positions

But not able to match them using the `.id()` function as done with associations because:

```
harry@hs: ~/eic/epic-analysis
trajectory : ffffffff-1
x_rec: -0.0158882 y_rec: 0.037186
RECONSTRUCTED PARTICLE id: c04
type : 0
energy : 9.69847
momentum : 6.81104 1.67583 6.69705
referencePoint : 0 0 0
charge : -1
mass : 0.105658
goodnessOfPID : 0
covMatrix : 0 0 0 0 0 0 0 0 0
PDG : 13
startVertex : ffffffff-1
particleIDUsed : ffffffff-1
clusters :
tracks :
particles :
particleIDs :
```

**Reconstructed Particle Data**

**ID not in similar format**

```
parameters.id(): id: 530
type : 0
loc : -0.443071 -0.0188692
locError : 0.0408164 0.00312522 0.00136255
theta : 2.33663
phi : -0.49322
qOverP : -0.885156
momentumError : 8.27122e-07 3.48657e-05 0.00947378 -3.79964e-08 9.05975e-07 -0.000561289
time : 0.00462502
timeError : 2.99792e+12
charge : -1
trajectory : ffffffff-1

x_rec: -0.390263 y_rec: 0.209779
parameters.id(): id: 531
type : 0
```

**CKF Track Parameters**



## Some Questions:

- What is truth seeded and real seeded track reconstruction?
- Any idea on how to associate track parameters with the reconstructed particles?

## Further Plans:

- To locate truth(MC) track positions in order to plot track position resolutions
- To use something other than muons in simulations like pions so that I may observe some ghost particles as well and check that there is no issue with the code atleast.

Please provide suggestions on what to do next?

Thank you!