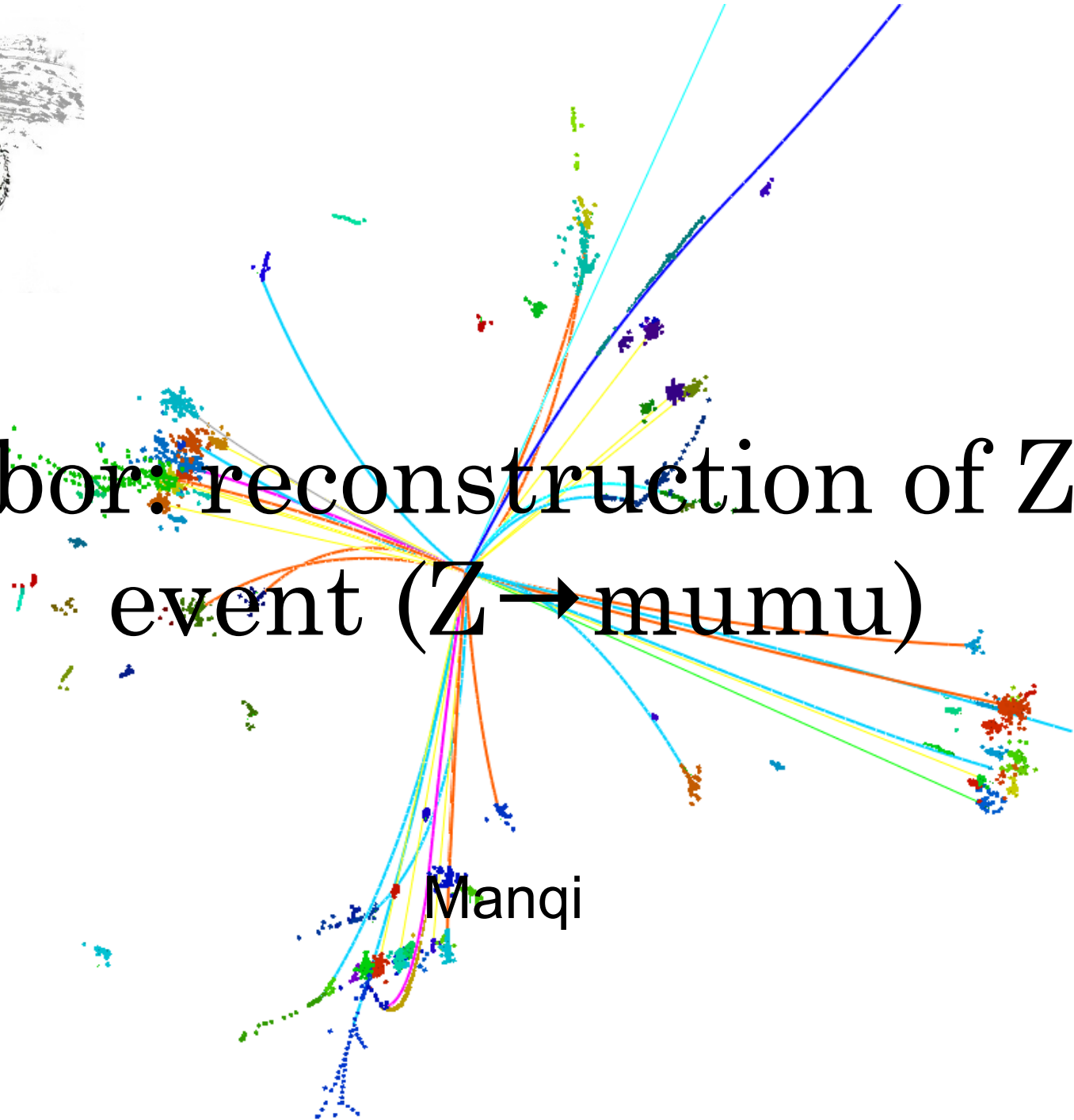




# Arbor: reconstruction of ZH event ( $Z \rightarrow \mu\mu$ )



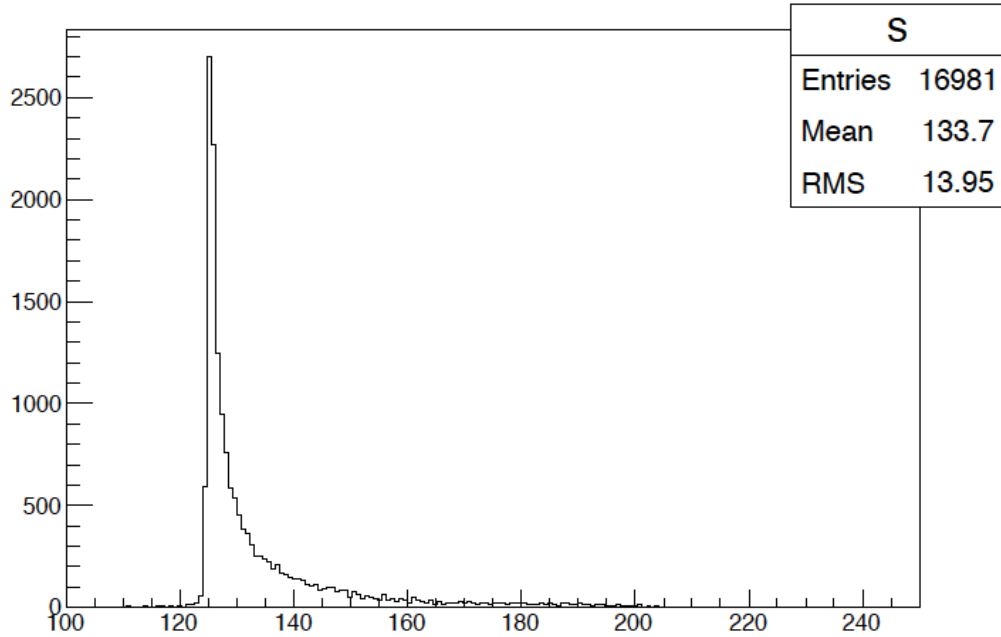
Manqi

# ZH, Z->mumu

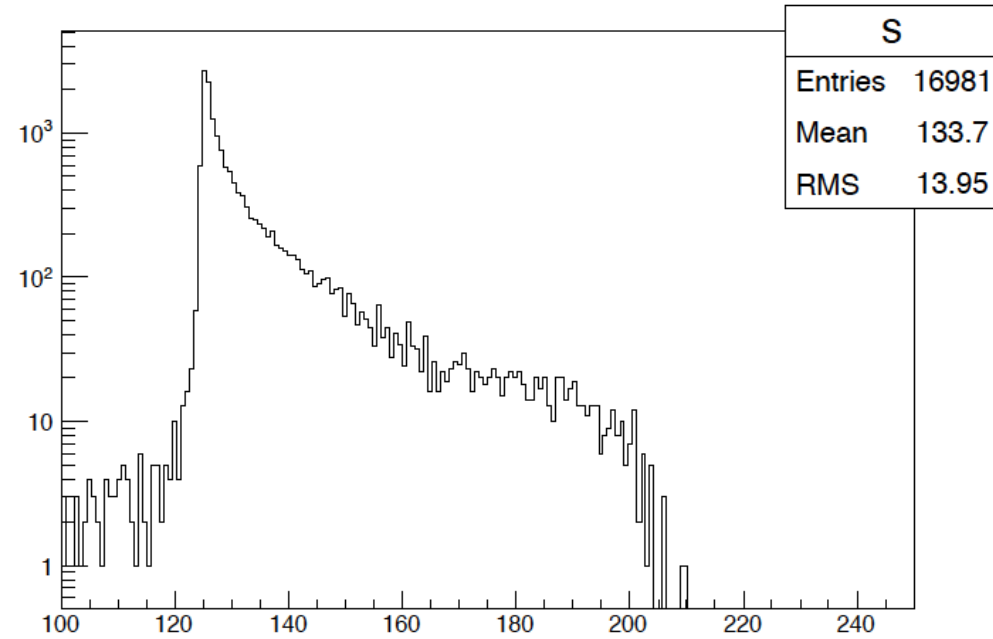
- Straight forward reconstruction/analysis
- Key performances
  - Tracking
  - Muon Identification
  - PFA: In the sense of Separation
- Sample: ~17k events

# Recoil Mass Spectrum

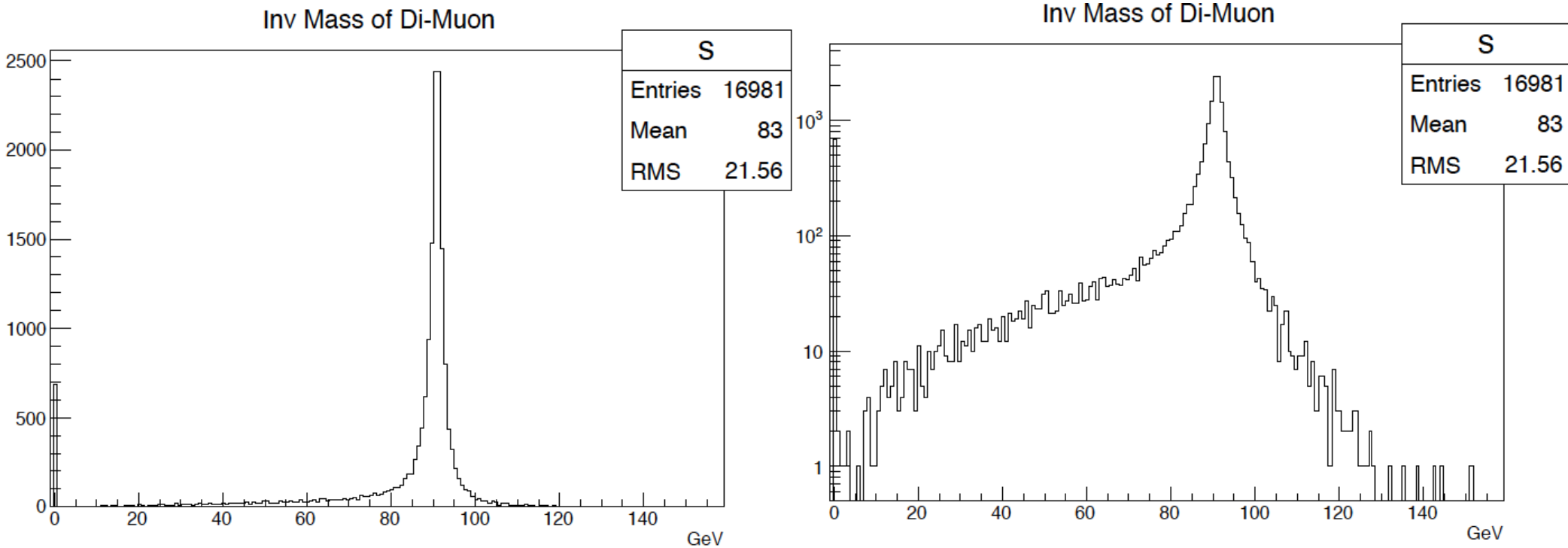
RecoilMass



RecoilMass



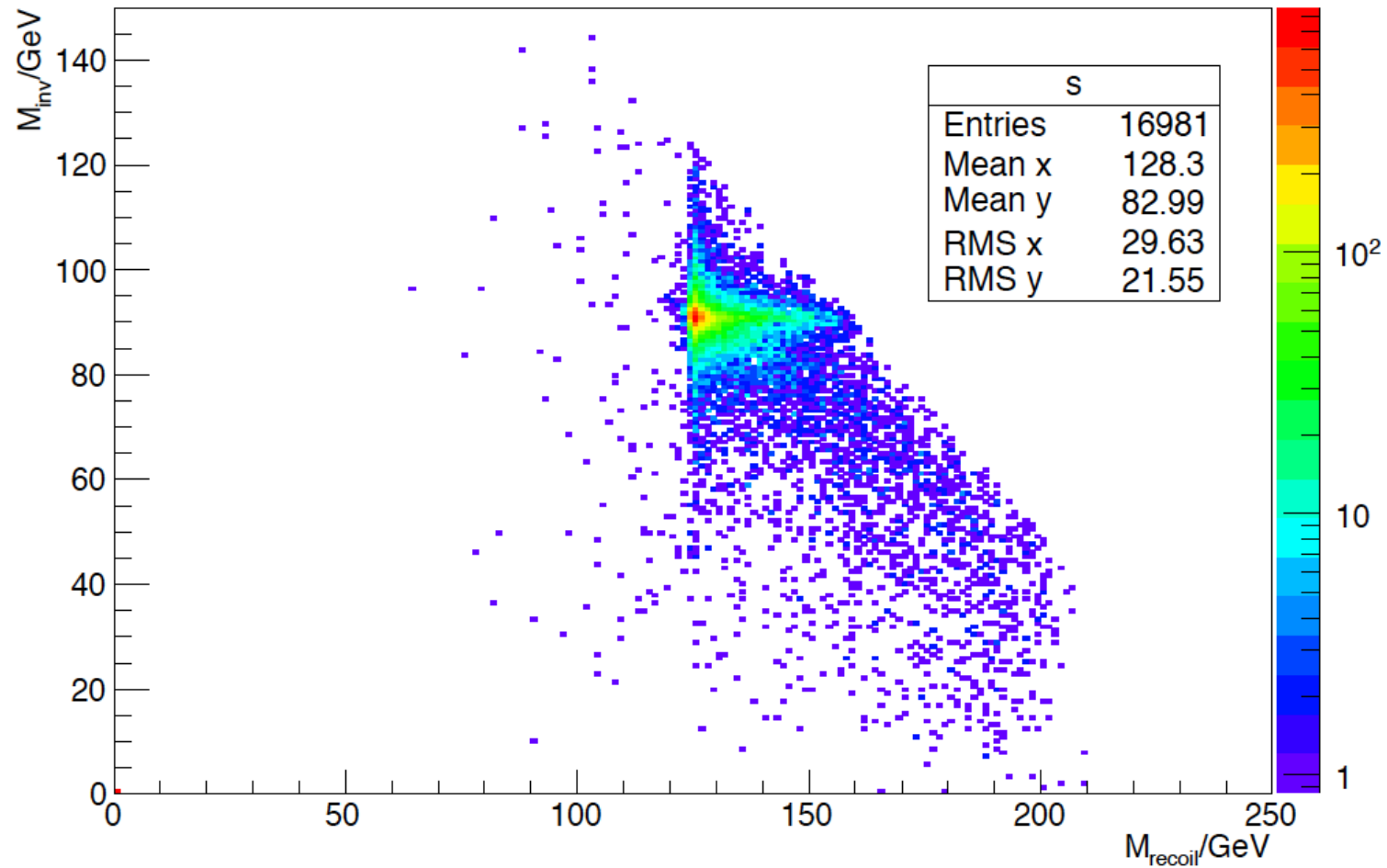
# Inv Mass spectrum



Radiations: Seems MUCH stronger than I expected.

# Di-lepton system: Inv Vs Recoil:

Di Muon System



# PID efficiency & Event Type

Type = -1: **3.7%**, No lepton pair tagged (one Muon Non-accepted, or identified as neutral)

Type = 0: **90.6%**, Muon pair tagged

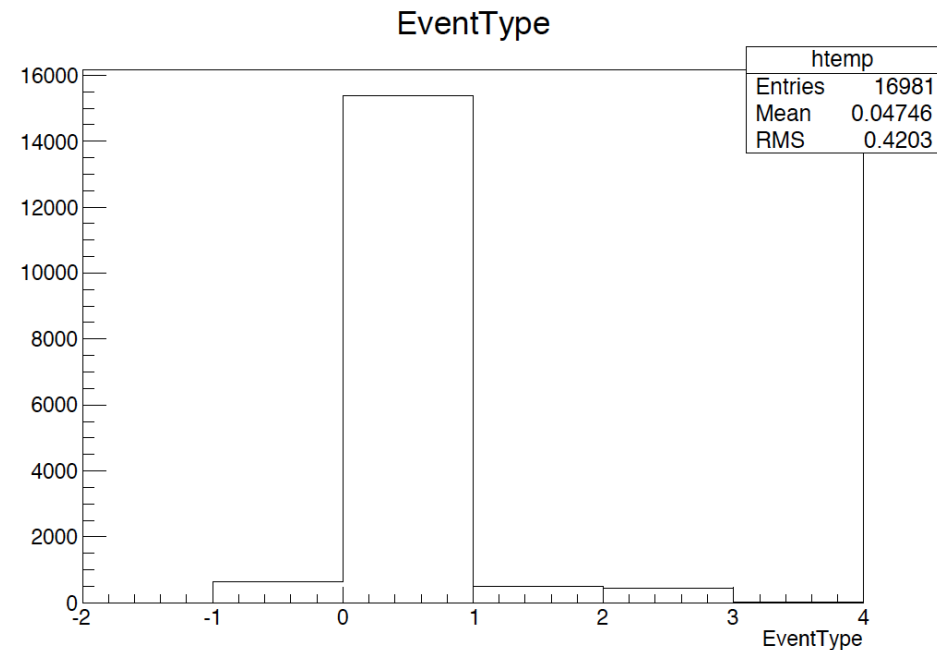
Type 1, 2: **5.6%**, Muon + Pion pair (one Muon Mis ID)

Type 3: **0.07%** Pion pair (~ 2 Muon Mis ID)

Single Muon ID efficiency ~ 95%:

Inefficiency: Besides acceptance  
~ Mainly due to FSR & Showering (Bremmstrahlung)

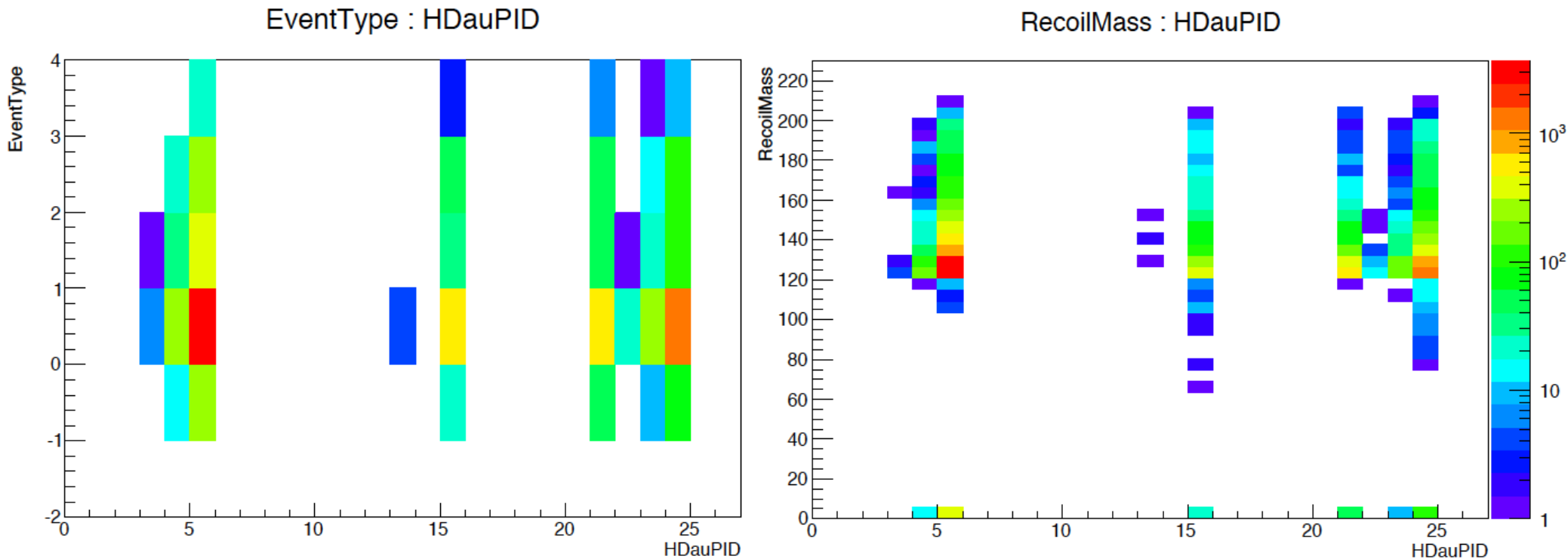
Can certainly be improved.



```
ClusterSize > 40 && NLECAL > 10 && Hcalhits.size() > 25 ) // Muon candidate
{
    chargeparticle->setType( int(-13*charge) );
}
else if(ECALTotalEn/currChargePEn > 0.85 && ClusterFD_ECAL > 0.6)
{
    chargeparticle->setType( int(-11*charge) );
}
else
{
    chargeparticle->setType( int(211*charge) );
}
```

Naively Muon-ID based on E/P  
(Cluster size) & FD

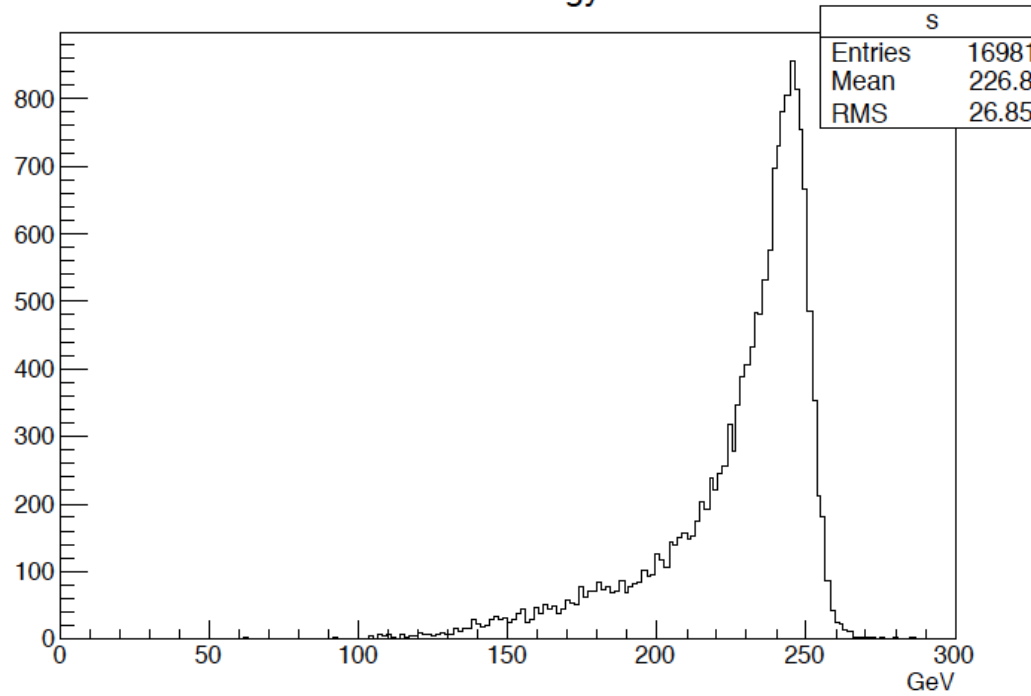
# Recoil Mass Vs Type:



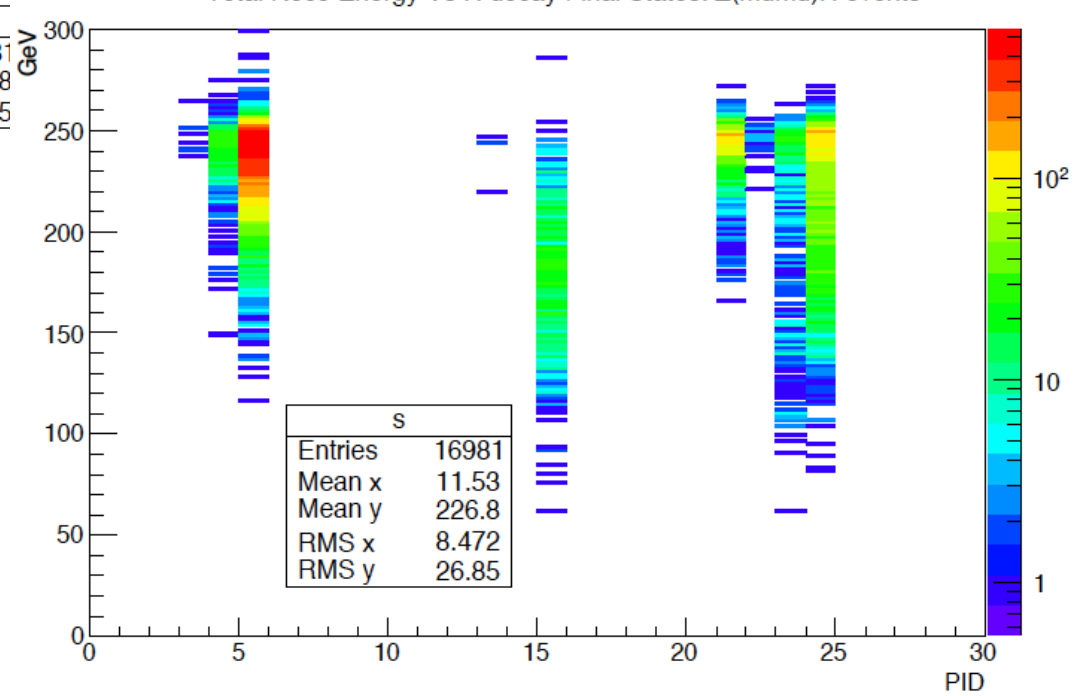
No Significant dependence: No Bias... (of coz need more statistic to Check)

# Total Energy

Total Reco Energy: ZH events



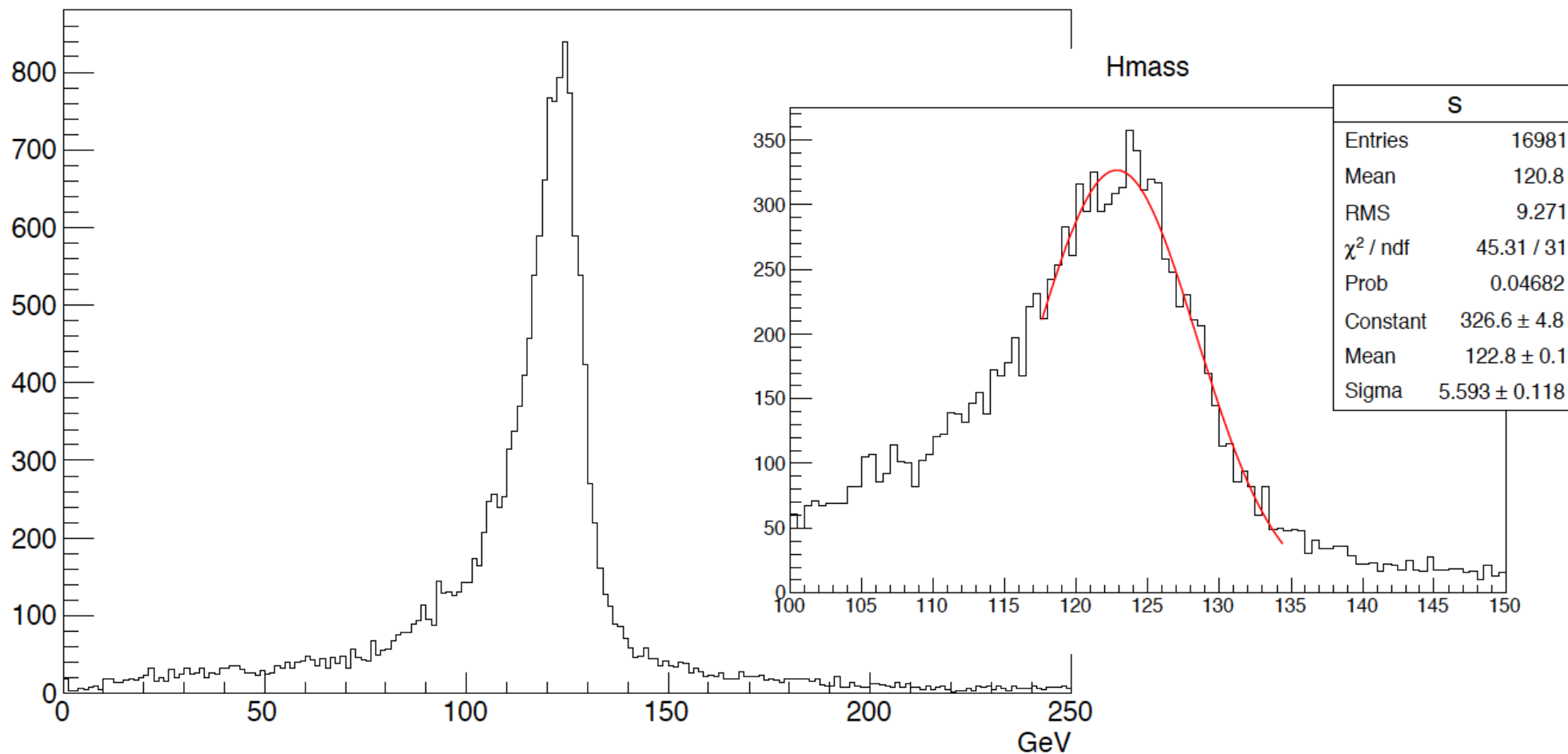
Total Reco Energy Vs H decay Final States: Z(mumu)H events





# Everything besides the lepton pair

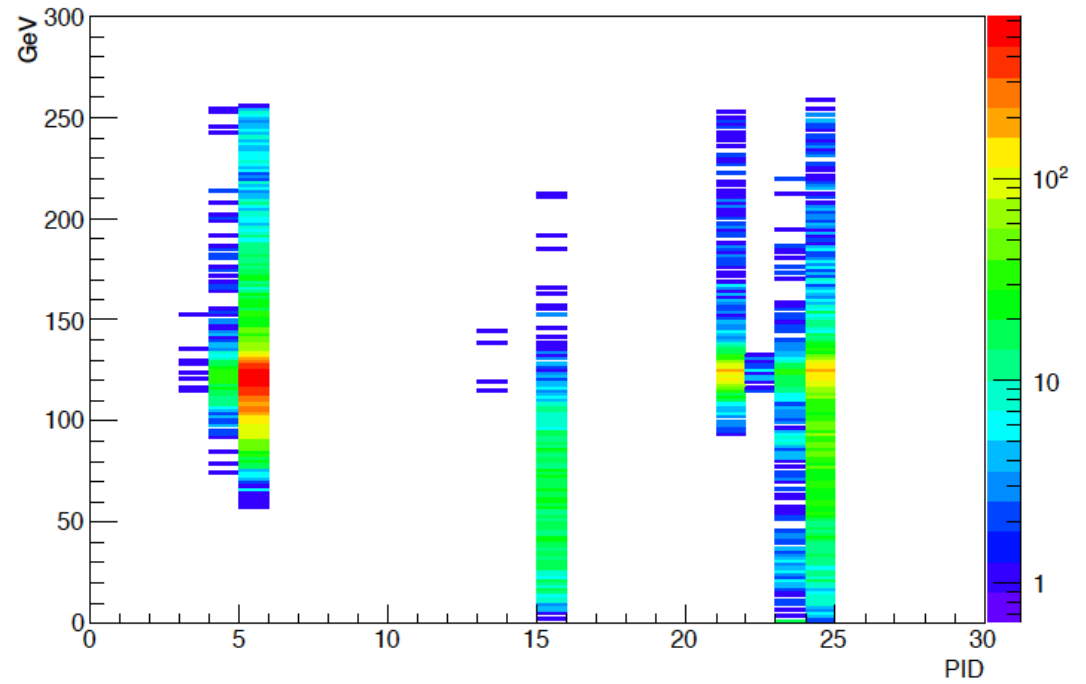
Invariance mass of Tagged Higgs



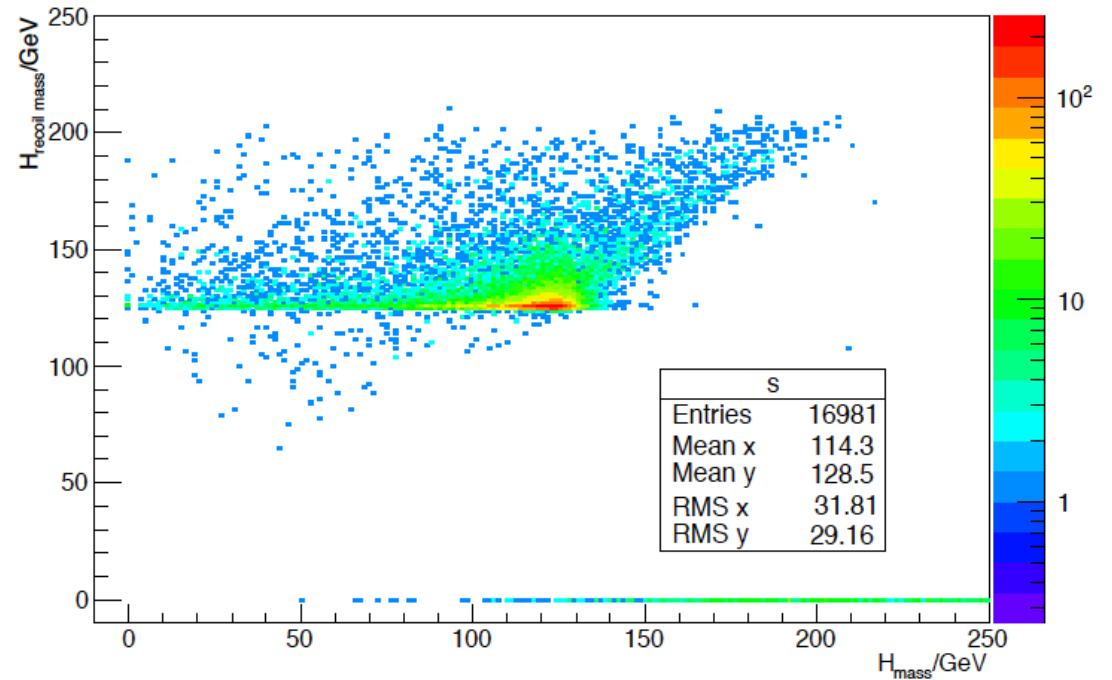
# H inv:

Radiations, Neutrinos, etc

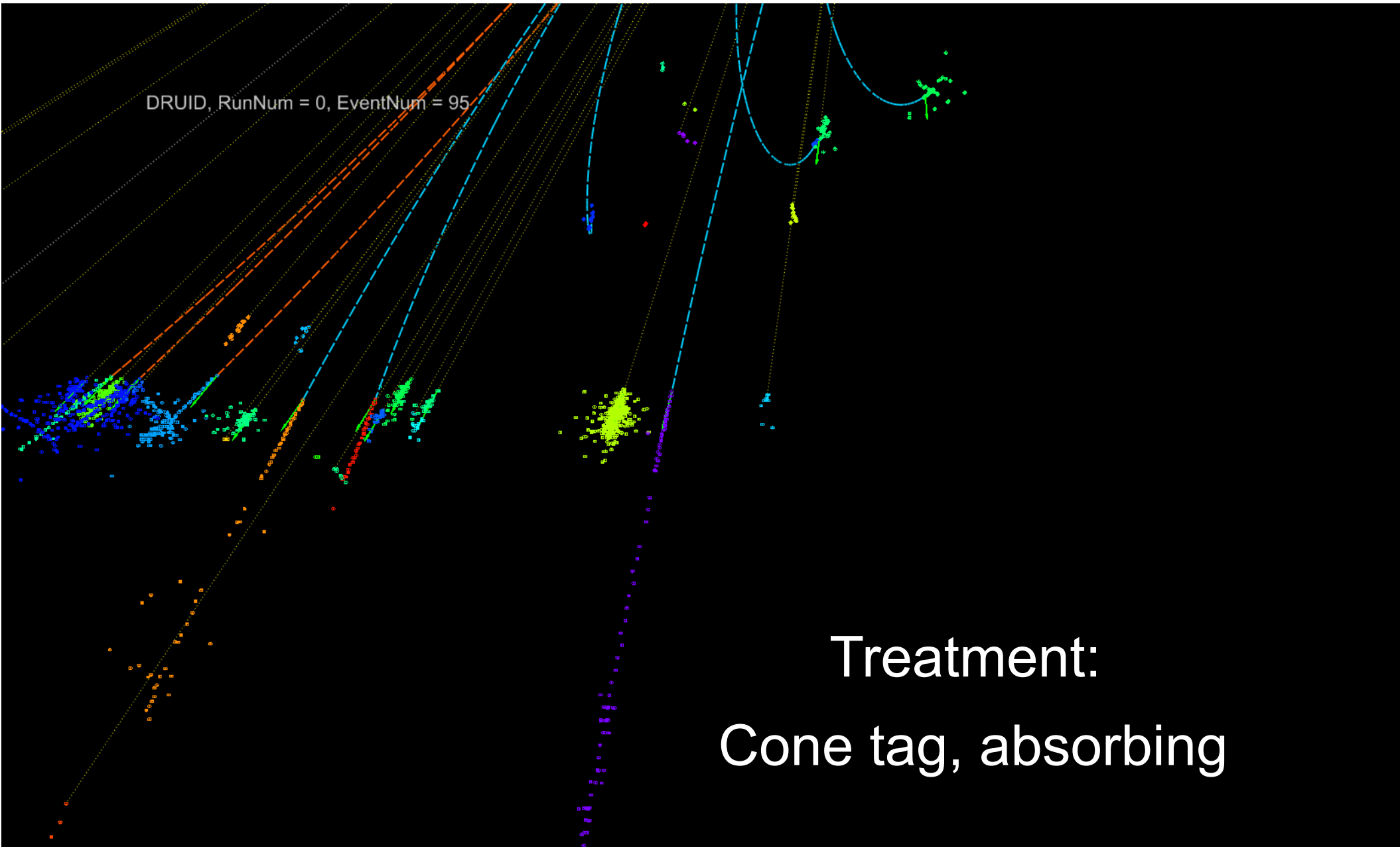
### Invariance mass of Tagged Higgs



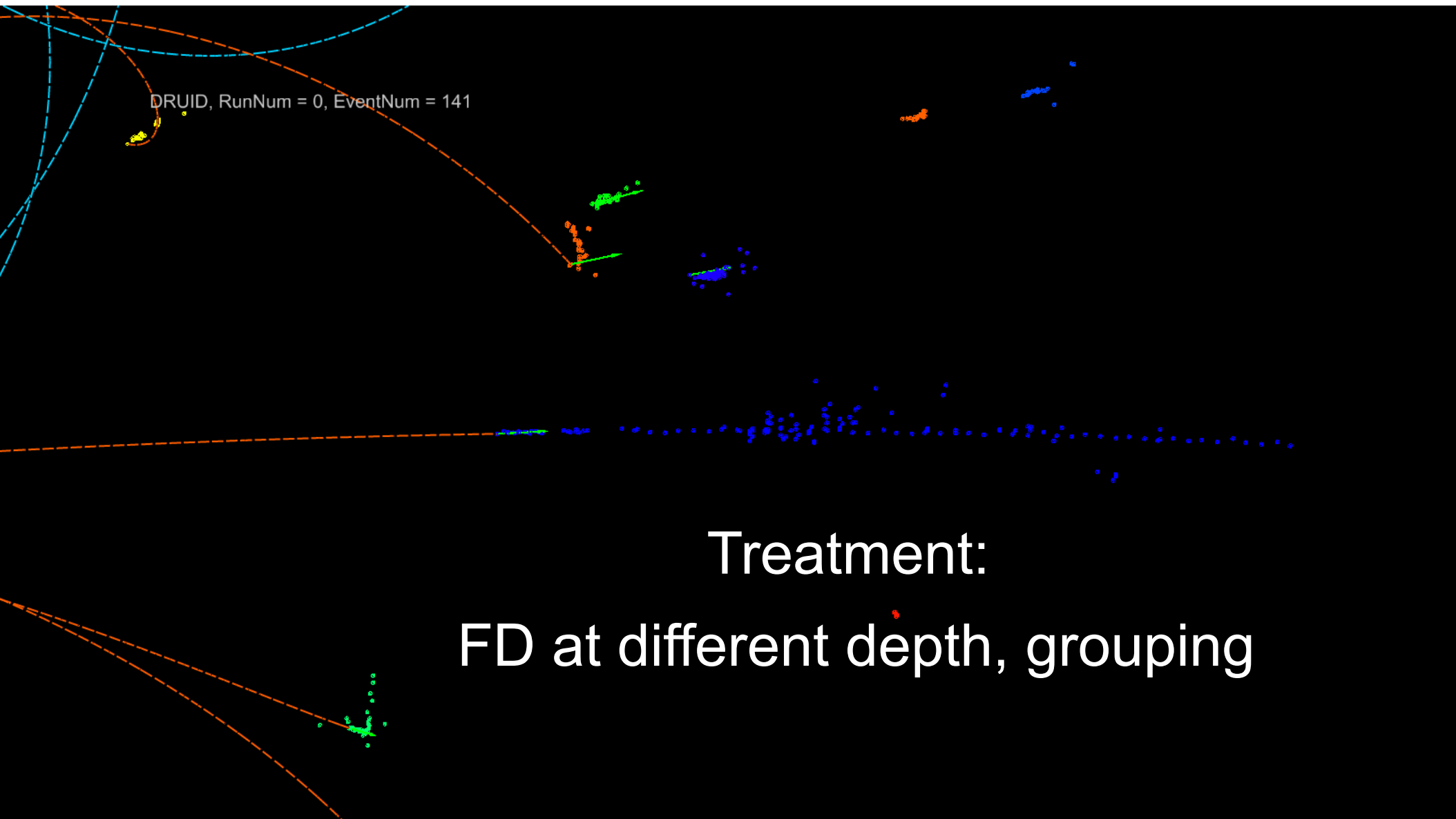
### Z(mumu)H evt



# Example: FSR



# Example: Bremsstrahlung



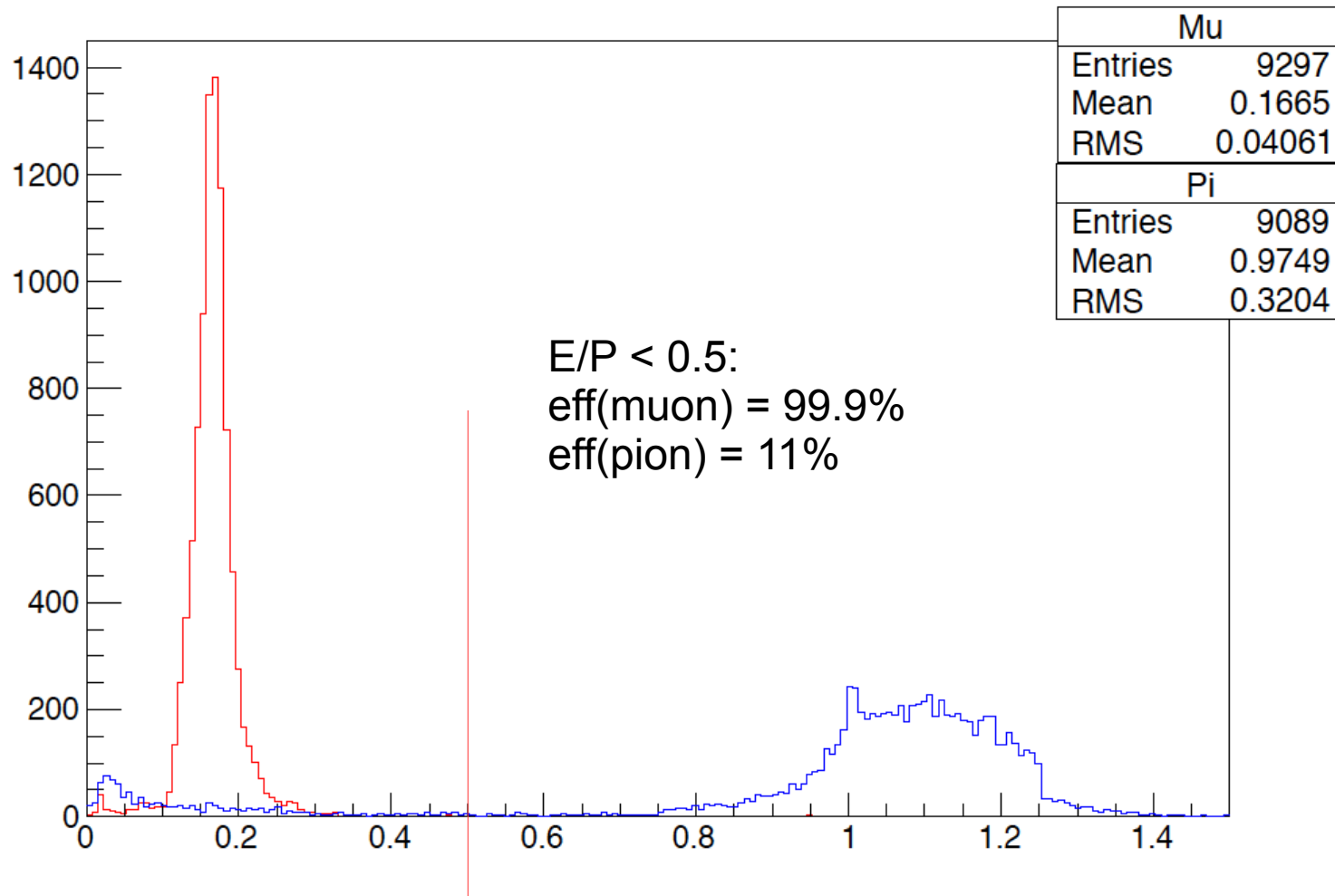
# Summary

- Arbor: works as expected
  - Separation Validated
  - Naive Muon ID leads to reasonable performance
- Will shot down the Muon ID issue
  - Treatment towards FSR & bremsstrahlung
  - *Radiation Chance seems too large...*
  - *40 GeV Particle Gun ~97%; ZH event ~ 95%*
- Next target: EM shower tagging
- Play at different geometry: let's try some crazy idea...

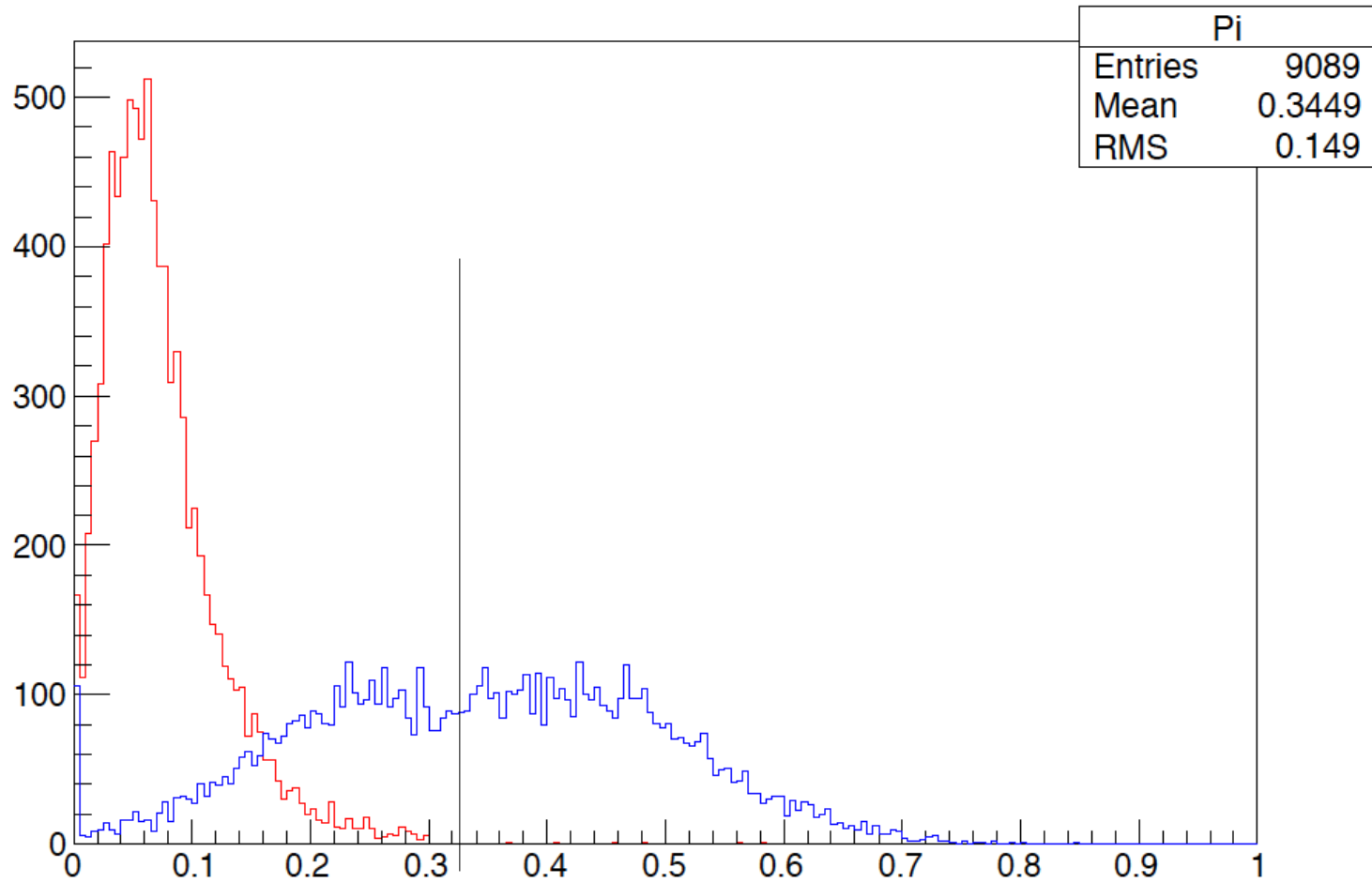
# Potential Of PID

# Some comparison

E over P, Muon & Pion

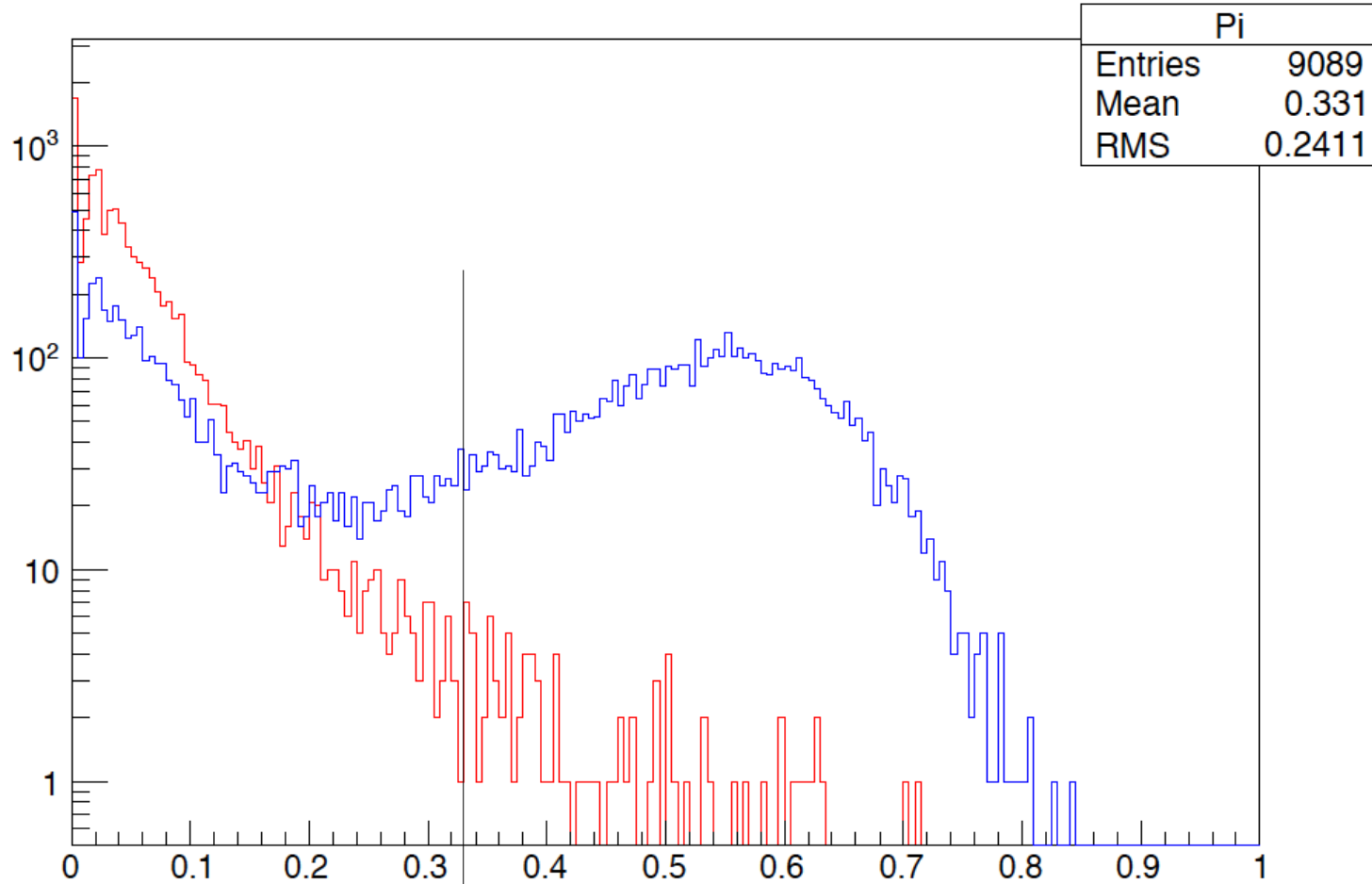


# FD HCAL, Muon & Pion





# FD ECAL, Muon & Pion

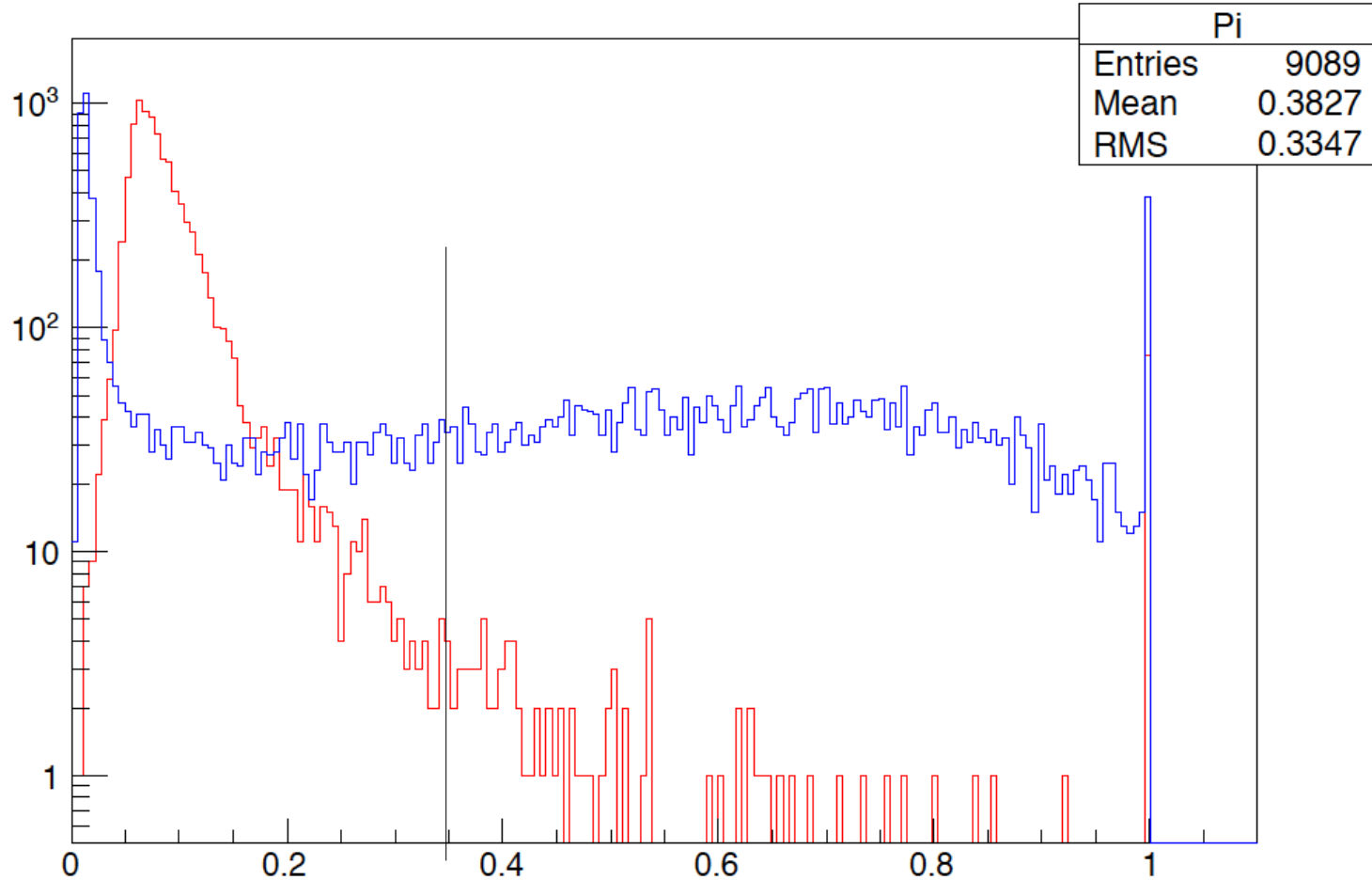


$E/P < 0.5$ : eff(muon) = 99.9%, eff(pion) = 11%

+

HCALFD < 0.33 && ECALFD < 0.33:  
eff(muon) = 99%, eff(pion) = 5.2%

# ECAL Energy Fraction, Muon & Pion



$E/P < 0.5$ ,  
HCALFD  $< 0.33$  && ECALFD  $< 0.33$ :  
ECAL En Fraction  $< 0.35$   
eff(muon) = 98.7%, eff(pion) = 2.8%