

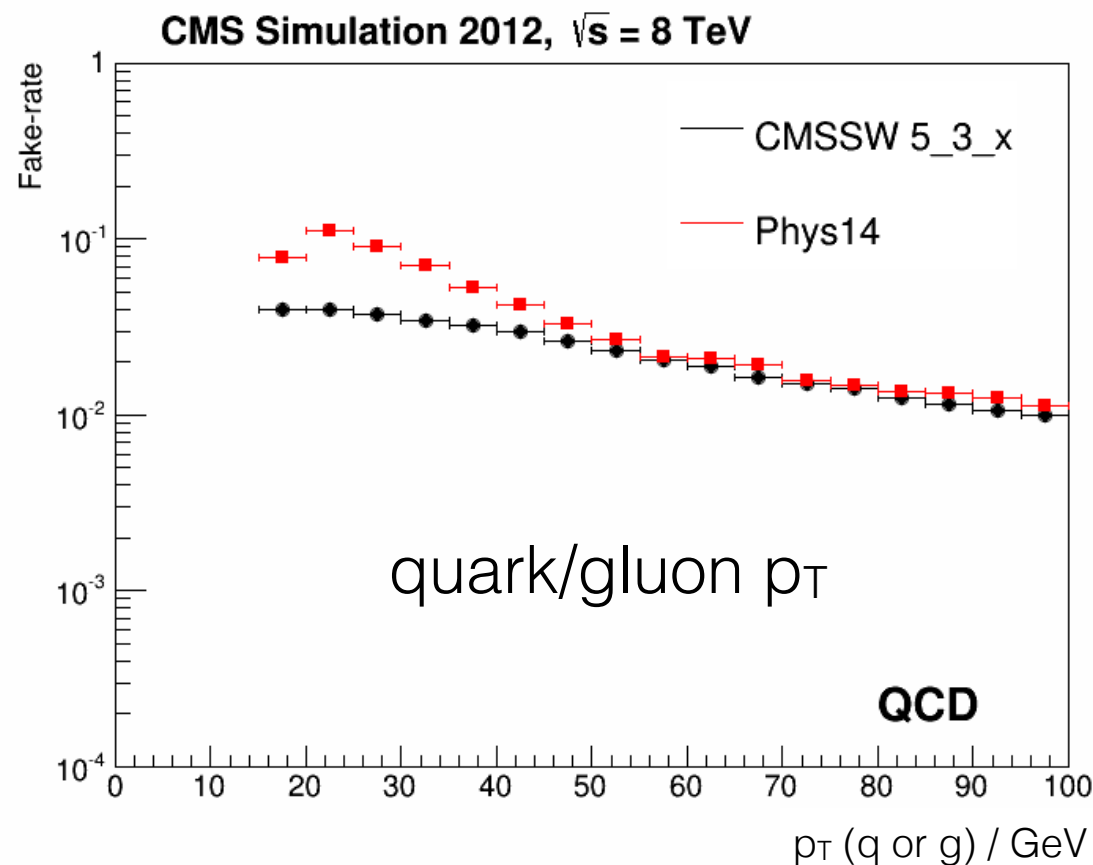
# Tau Fake Rate in Phys14 sample

Arun Nayak

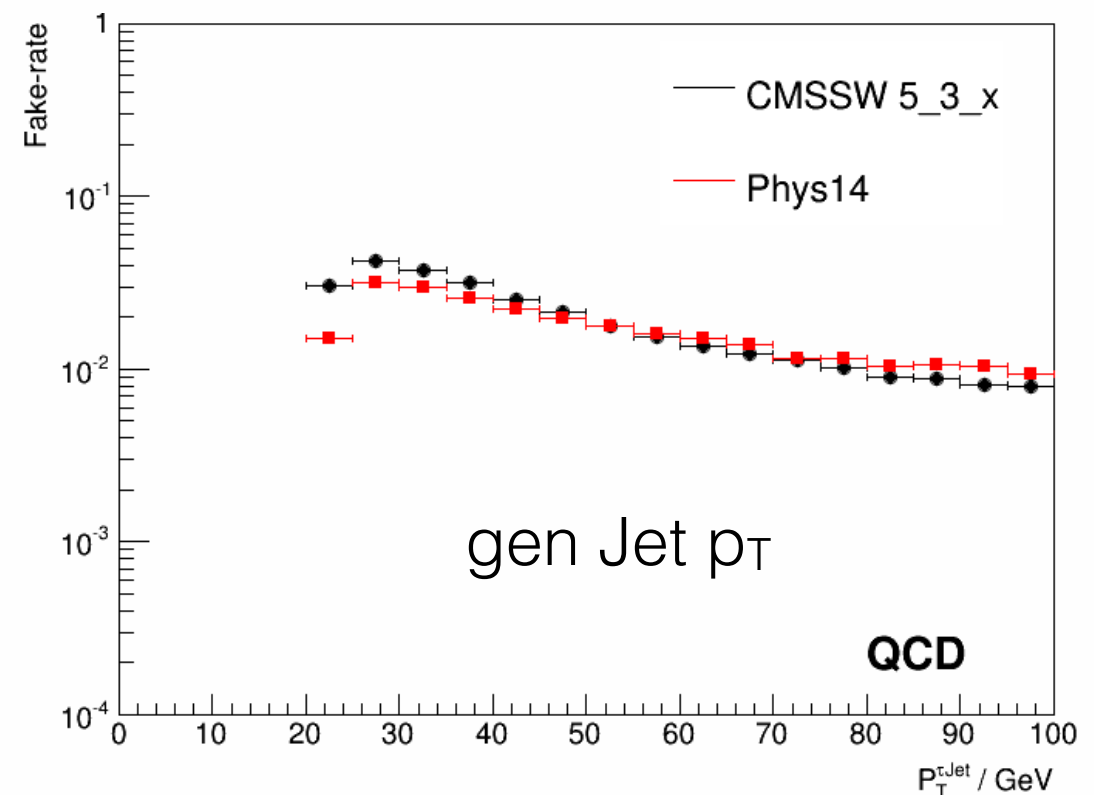
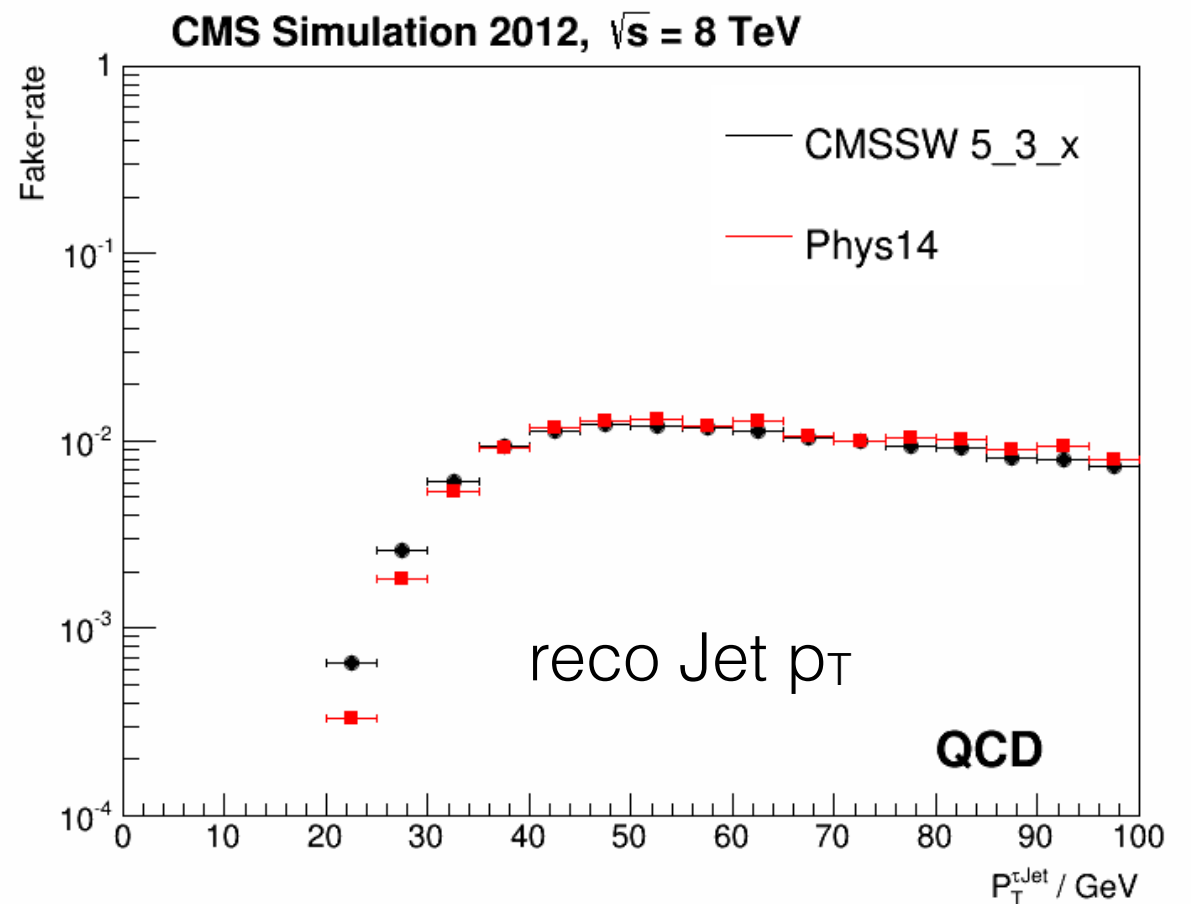
DESY-UHH Meeting  
24/02/2015

# Jet to Tau Fake Rate

## Charged Isolation

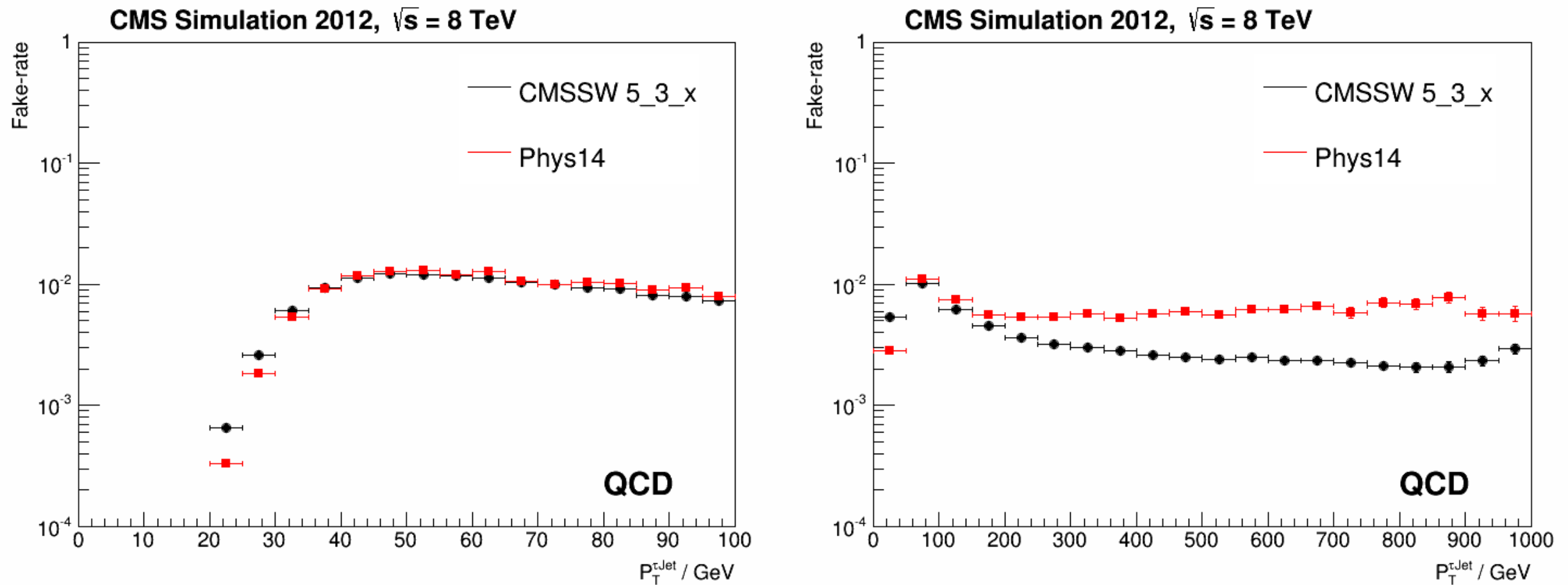


- In case of genJet OR gen quark/gluon, I require matching to a reconstructed tau in the denominator in 0.3 cone
- May be there is a difference between pythia-6 and pythia-8 in matching of quark/gluon to gen/reco jets



# Fake Rate at High $P_T$

## Charged Isolation

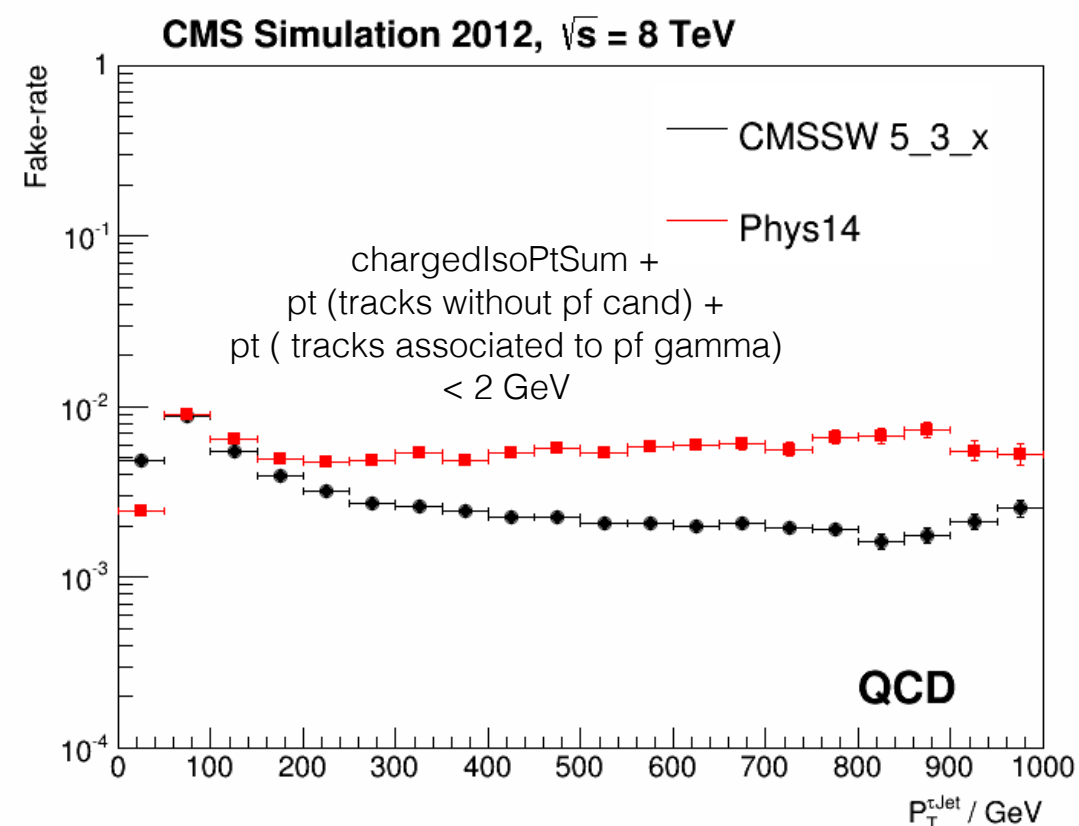
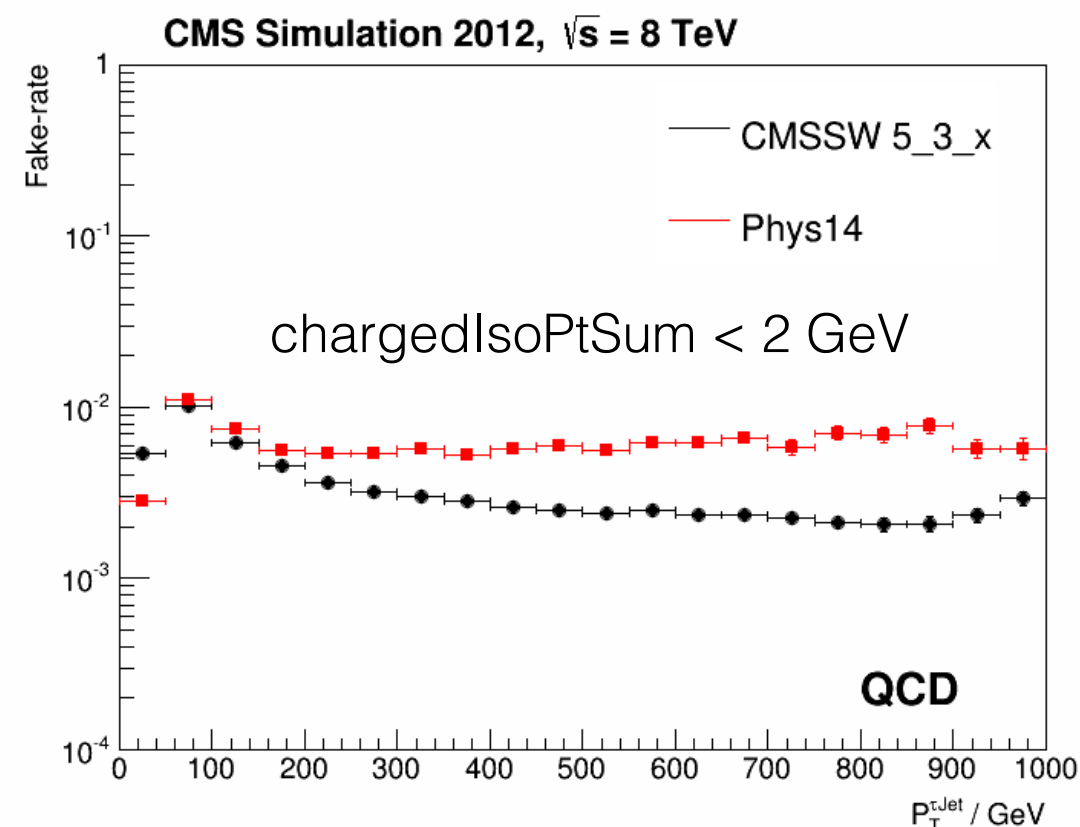


- Fake rate as function of jet (corrected)  $p_T$  looks ok at low  $p_T$
- It is still higher at high  $p_T$
- Check if low  $p_T$  tracks in isolation cone are not reconstructed as pfCandidate OR reconstructed as pfGamma.

# charged isolation

- Take all tracks in the isolation cone ( $DR < 0.5$  around tau direction) passing the quality cuts
- Find tracks not associated to any pf candidate or associated to pf photons in signal OR isolation cone.
- Add the extra sum pt of those tracks to chargedIsoPtSum and compute fake rate
- However, no significant changes to the fake rate

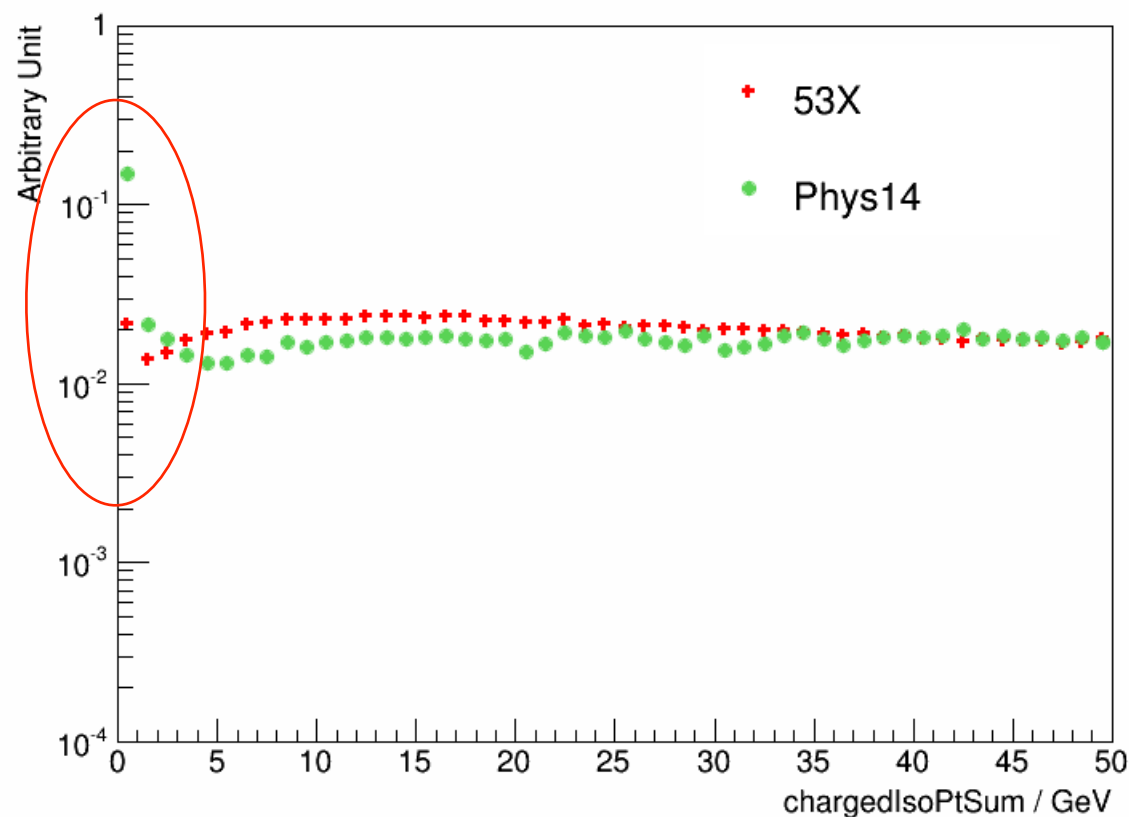
Look at the track distributions in next slides



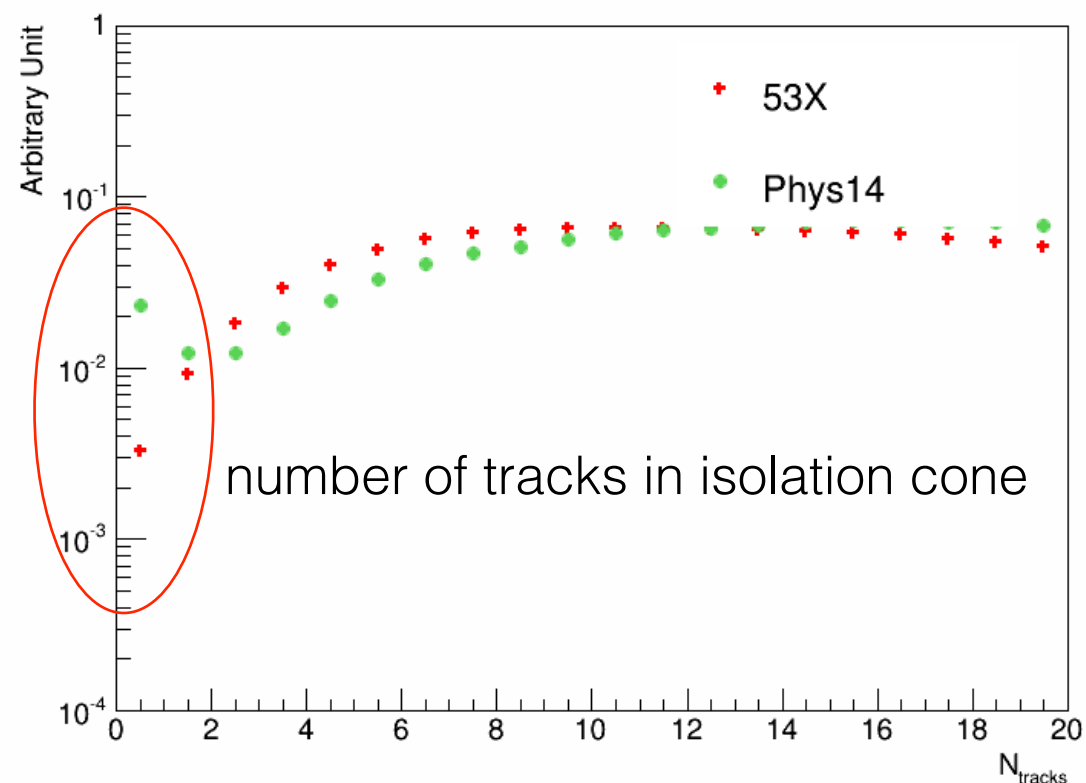
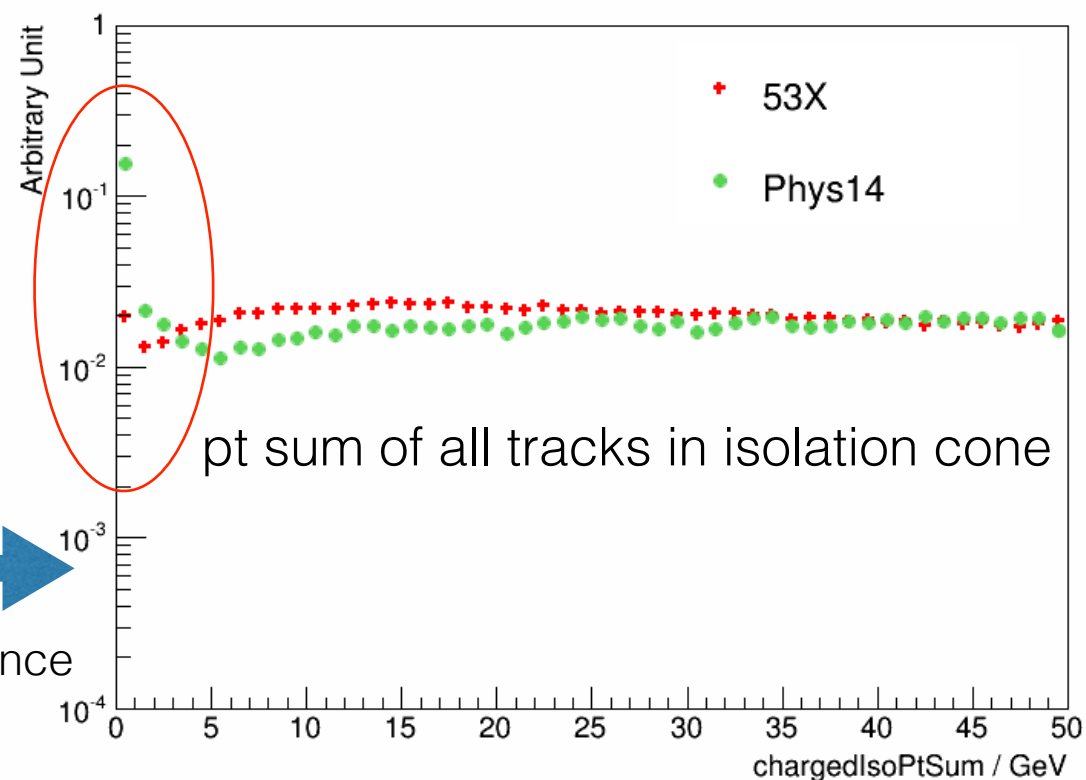
# Tracks in Isolation cone

$pT(\text{Jet}) > 400 \text{ GeV}$ ,  $|\eta(j)| < 2.3$ ,  $pT(\text{tau}) > 20 \text{ GeV}$ ,  $|\eta(\text{tau})| < 2.3$ , pass decay mode finding

chargedIsoPtSum

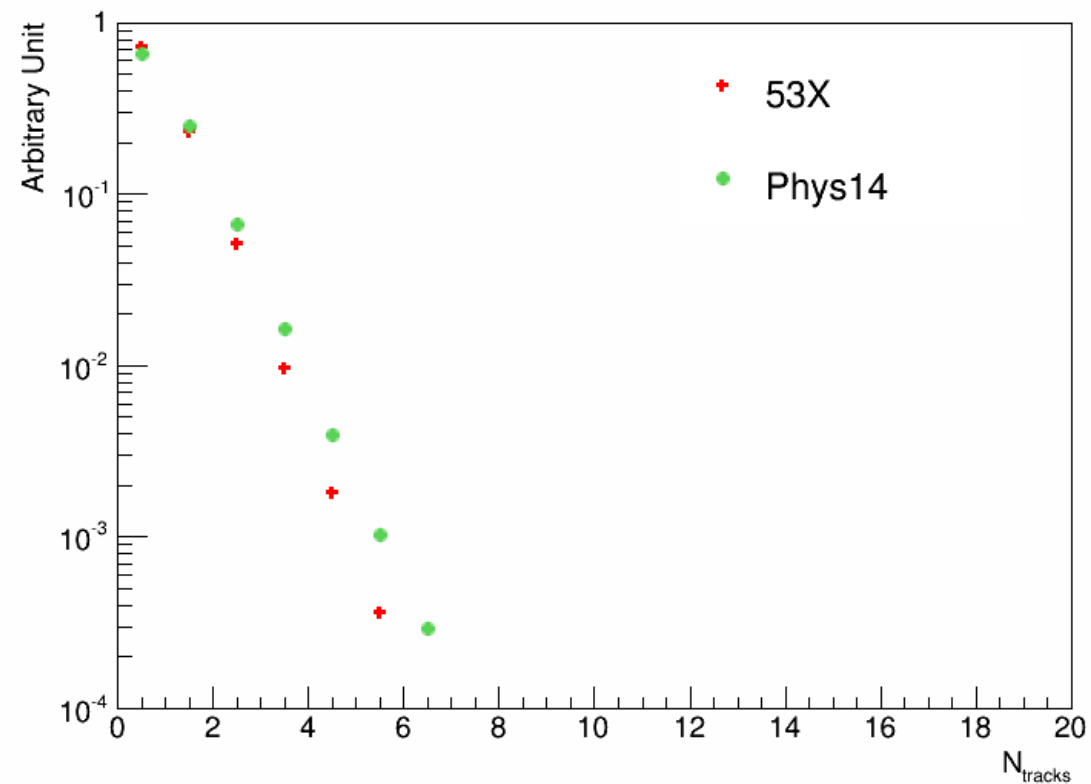


No difference

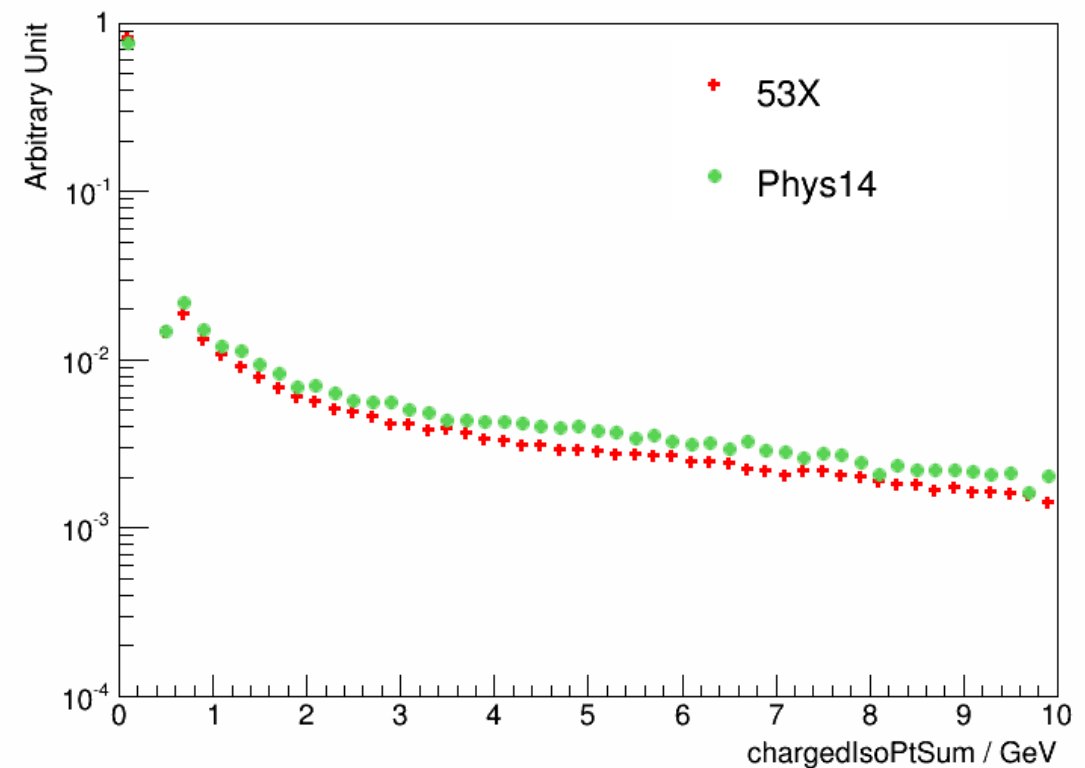


# Tracks in Isolation cone not associated to PF candidate

number of tracks in isolation cone not associated to any pf candidate



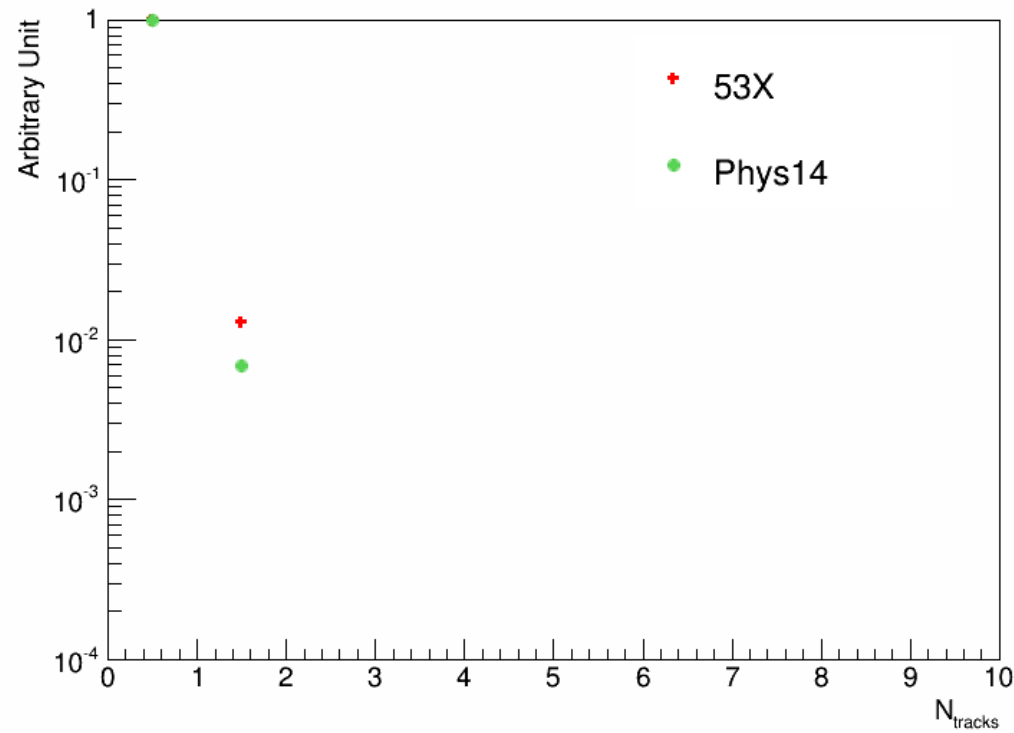
pt sum of tracks in isolation cone not associated to any pf candidate



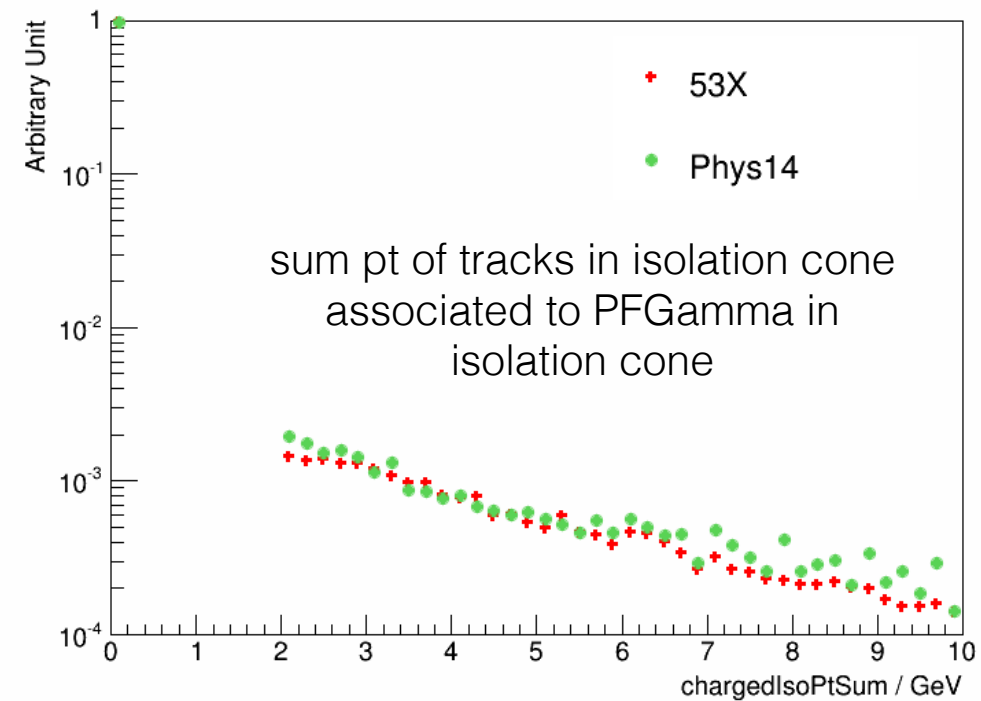
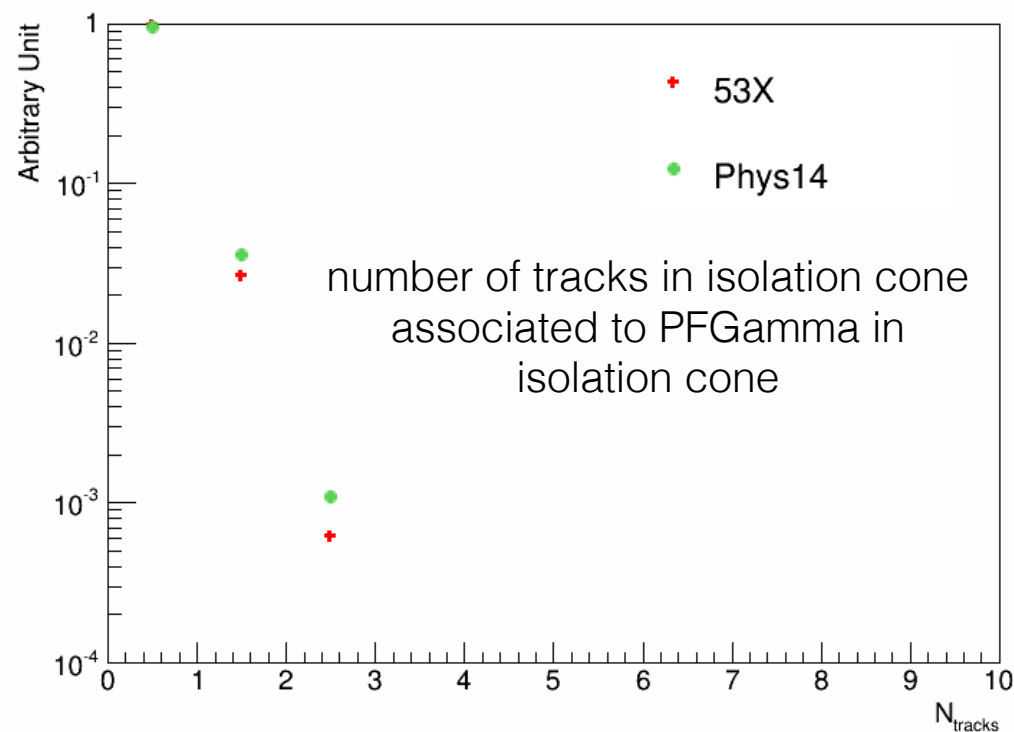
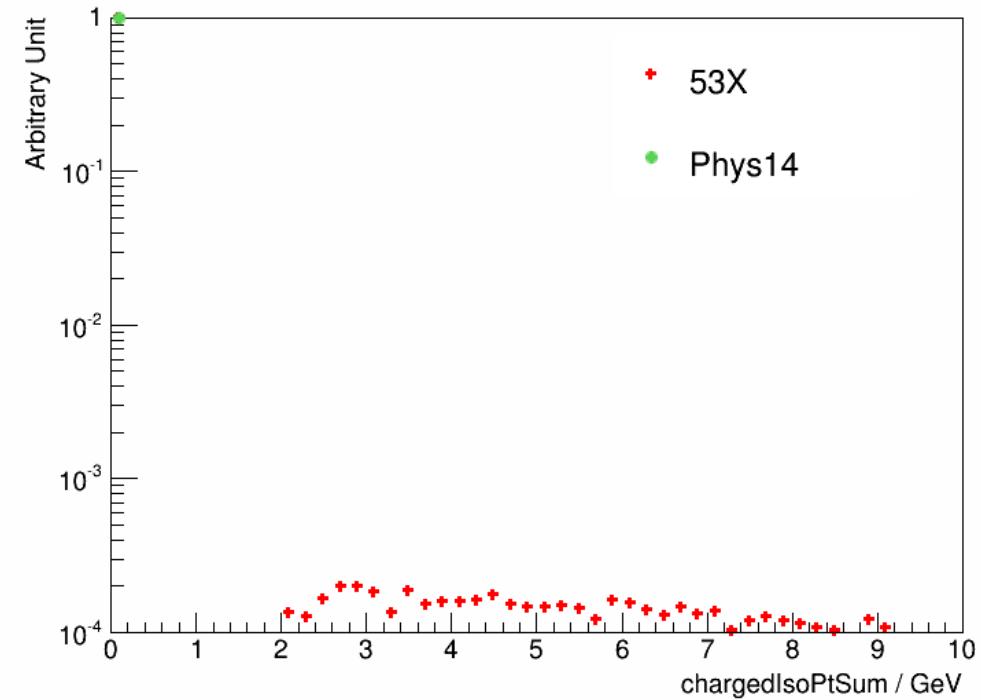
Only marginal differences between 53X and Phys14

# Tracks in Isolation cone associated to PFGamma candidate

number of tracks in isolation cone associated to PFGamma in signal cone



sum pt of tracks in isolation cone associated to PFGamma in signal cone

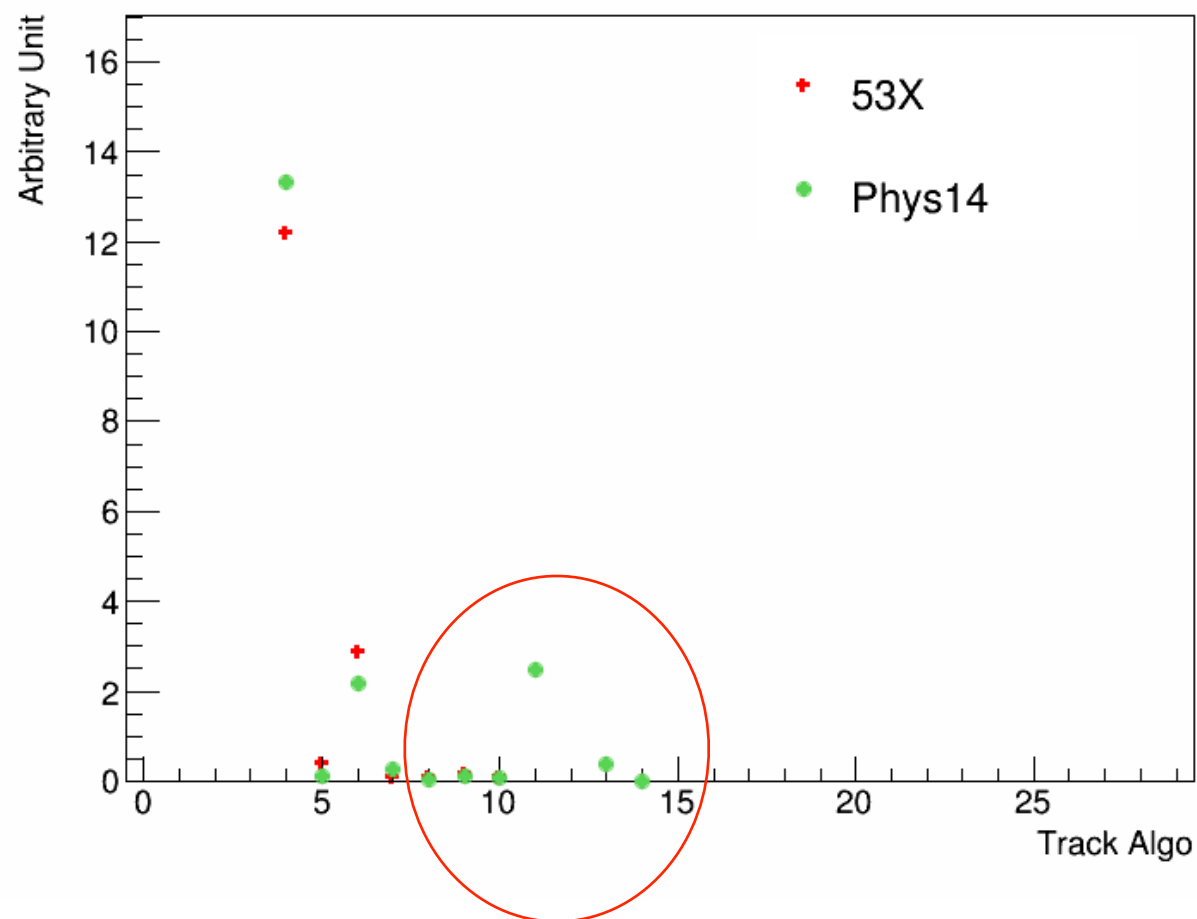


Only marginal differences between 53X and Phys14

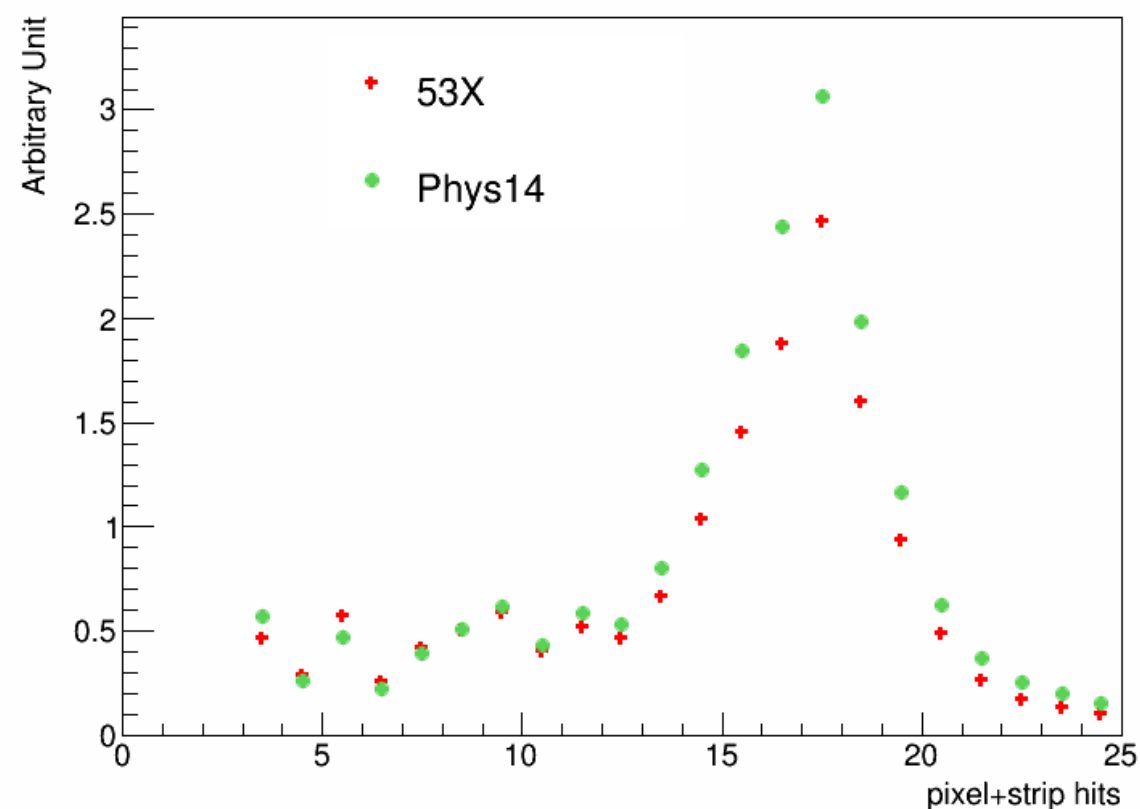
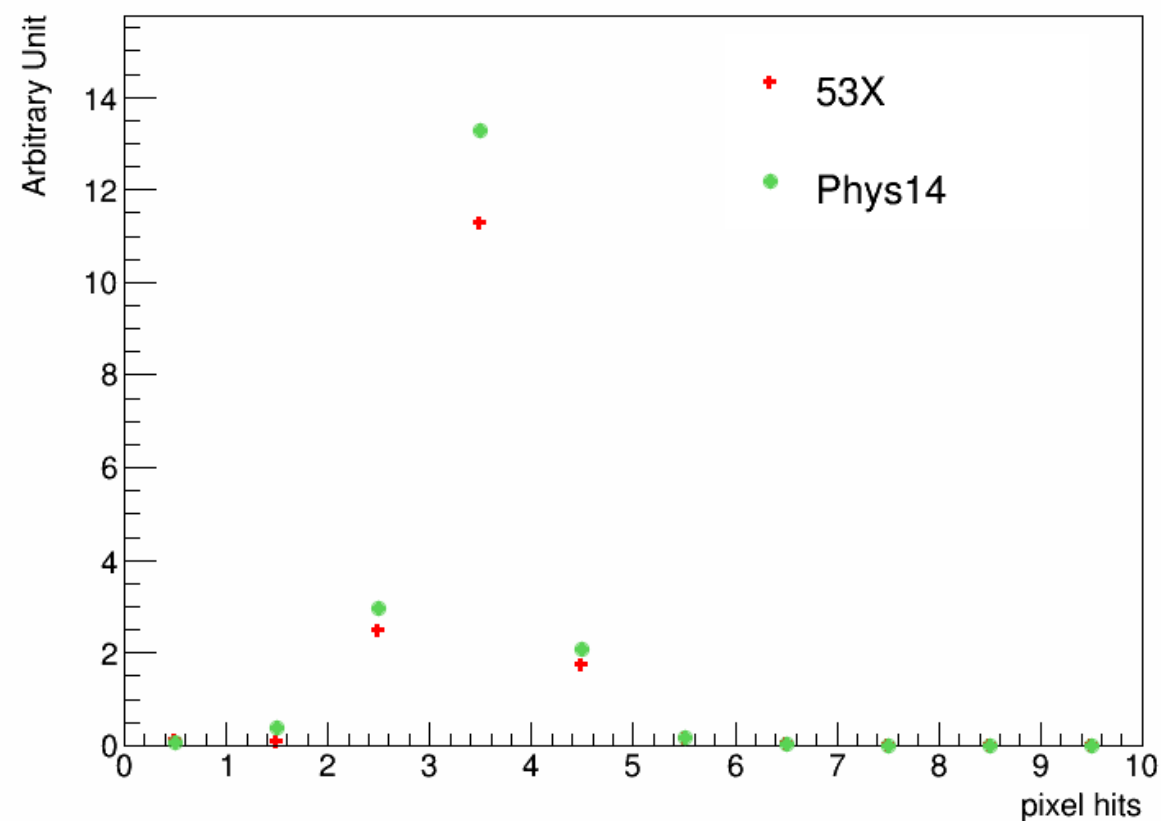


# Tracks in Isolation cone

$pT(\text{Jet}) > 400 \text{ GeV}$ ,  $|\eta(j)| < 2.3$ ,  $pT(\text{tau}) > 20 \text{ GeV}$ ,  $|\eta(\text{tau})| < 2.3$ , pass decay mode finding



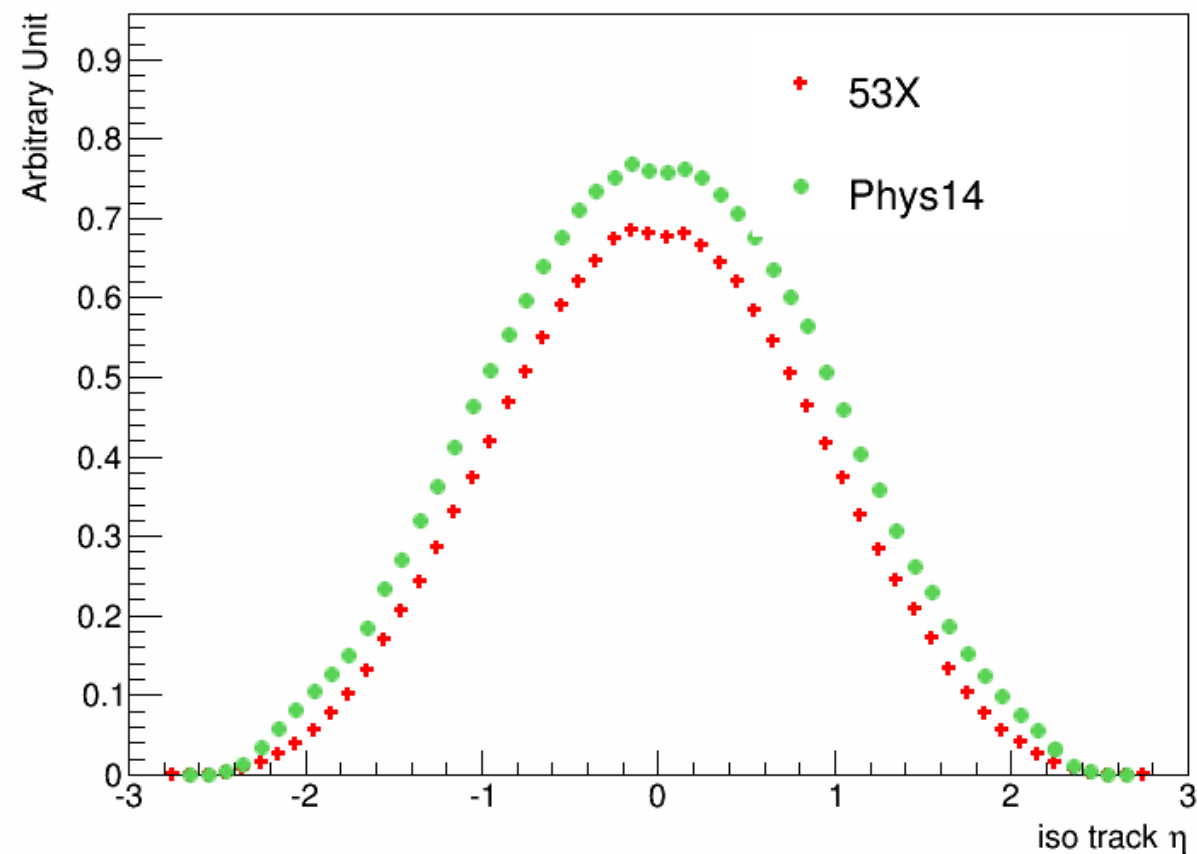
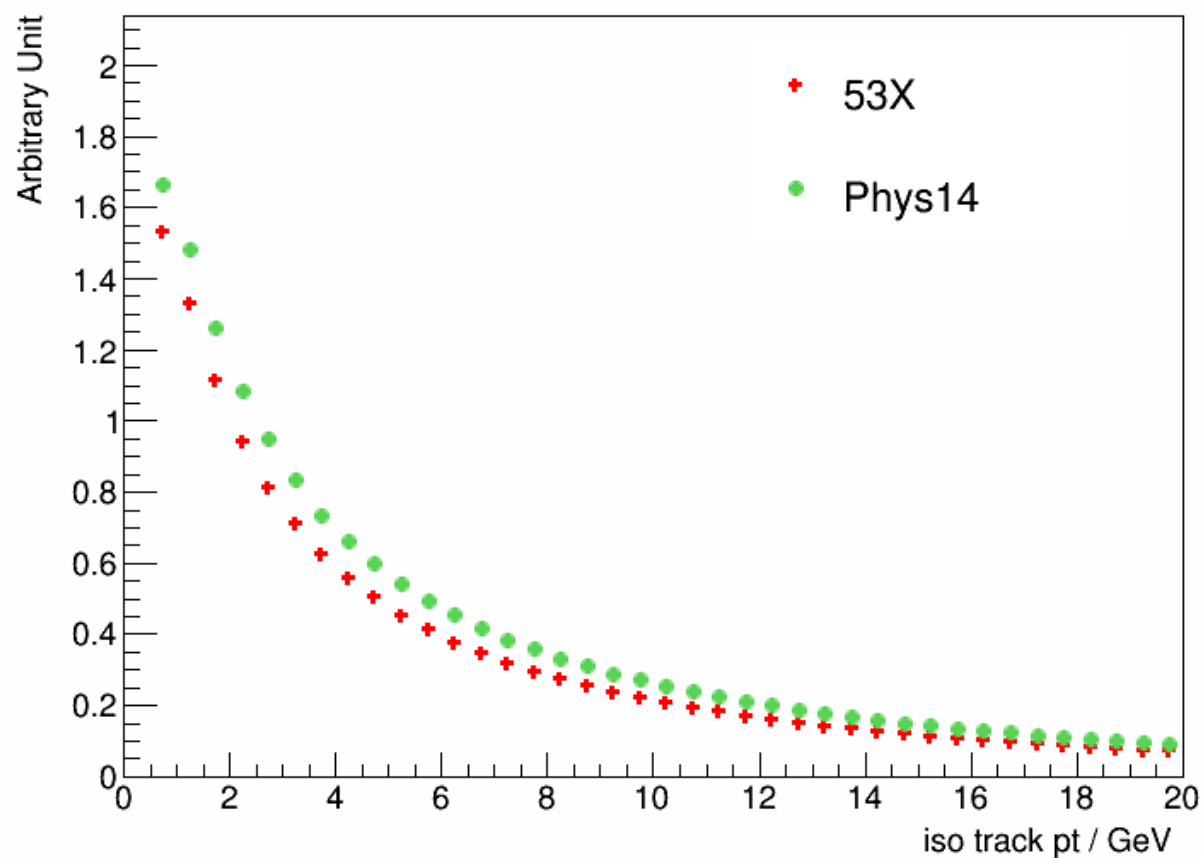
In Phys14, there some excess of tracks with track algo = 11 (jetCoreRegionalStep)





# Tracks in Isolation cone

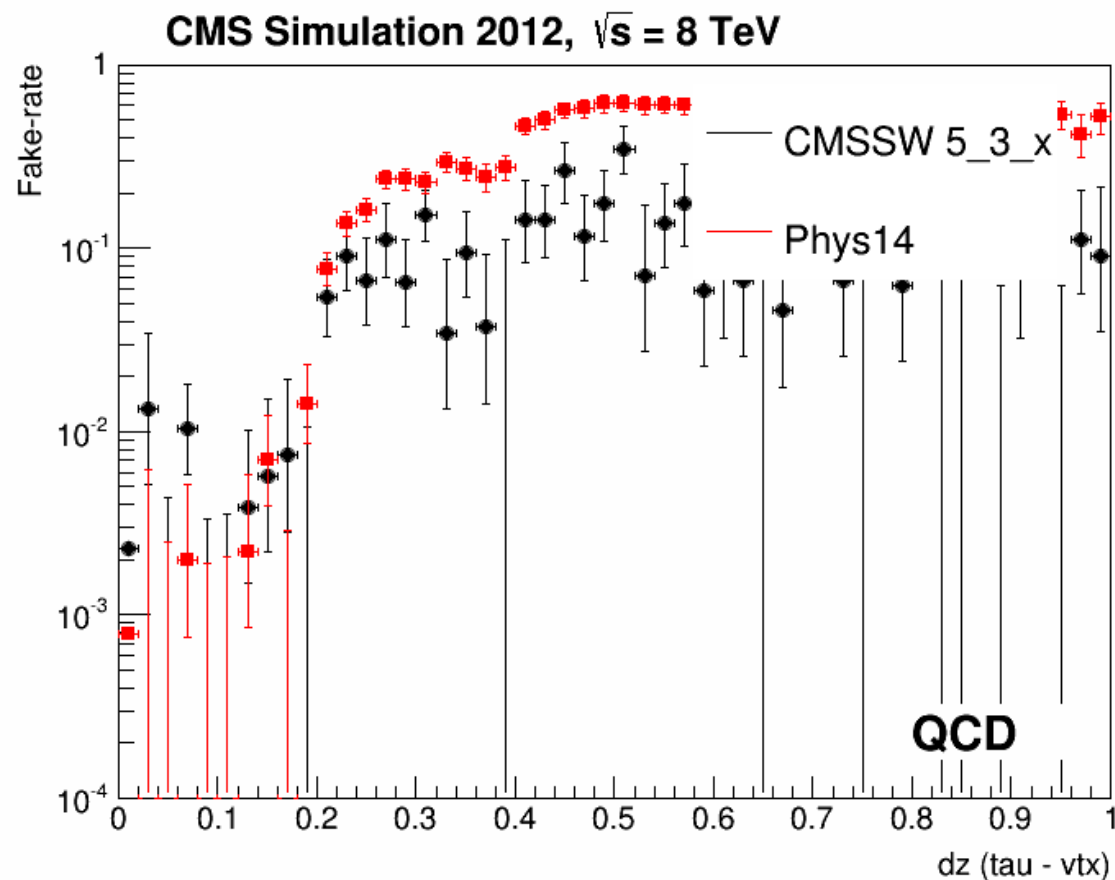
$pT(\text{Jet}) > 400 \text{ GeV}$ ,  $|\eta(j)| < 2.3$ ,  $pT(\text{tau}) > 20 \text{ GeV}$ ,  $|\eta(\text{tau})| < 2.3$ , pass decay mode finding



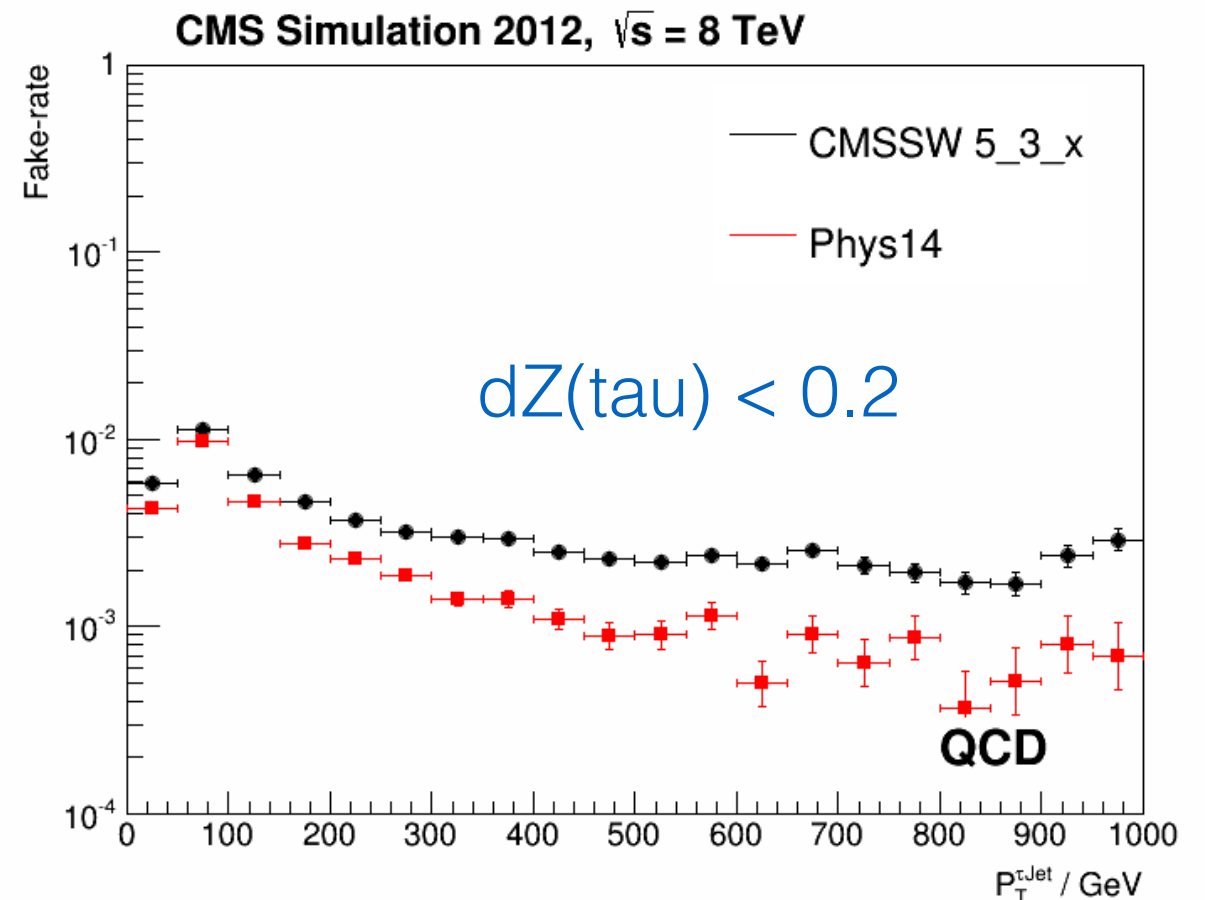
The number of tracks are slightly more at low pt

# Fake Rate vs dZ

$p_T(\text{Jet}) > 400 \text{ GeV}$ ,  $|\eta(j)| < 2.3$



- Jets with  $dZ > 0.3$  have very high fake rate
- Phys14 sample seems to have more jets with  $dZ > 0.3$  at high  $p_T$ , may be effect of higher pileup
- Not understood why the fake rate is higher at high  $dZ$ 
  - Under investigation



- Jet  $\rightarrow$  tau fake rate with a cut on  $dZ < 0.2$  (normal analysis level cut) reduces the fake rate substantially in Phys14 sample
- The physics performance is thus not affected

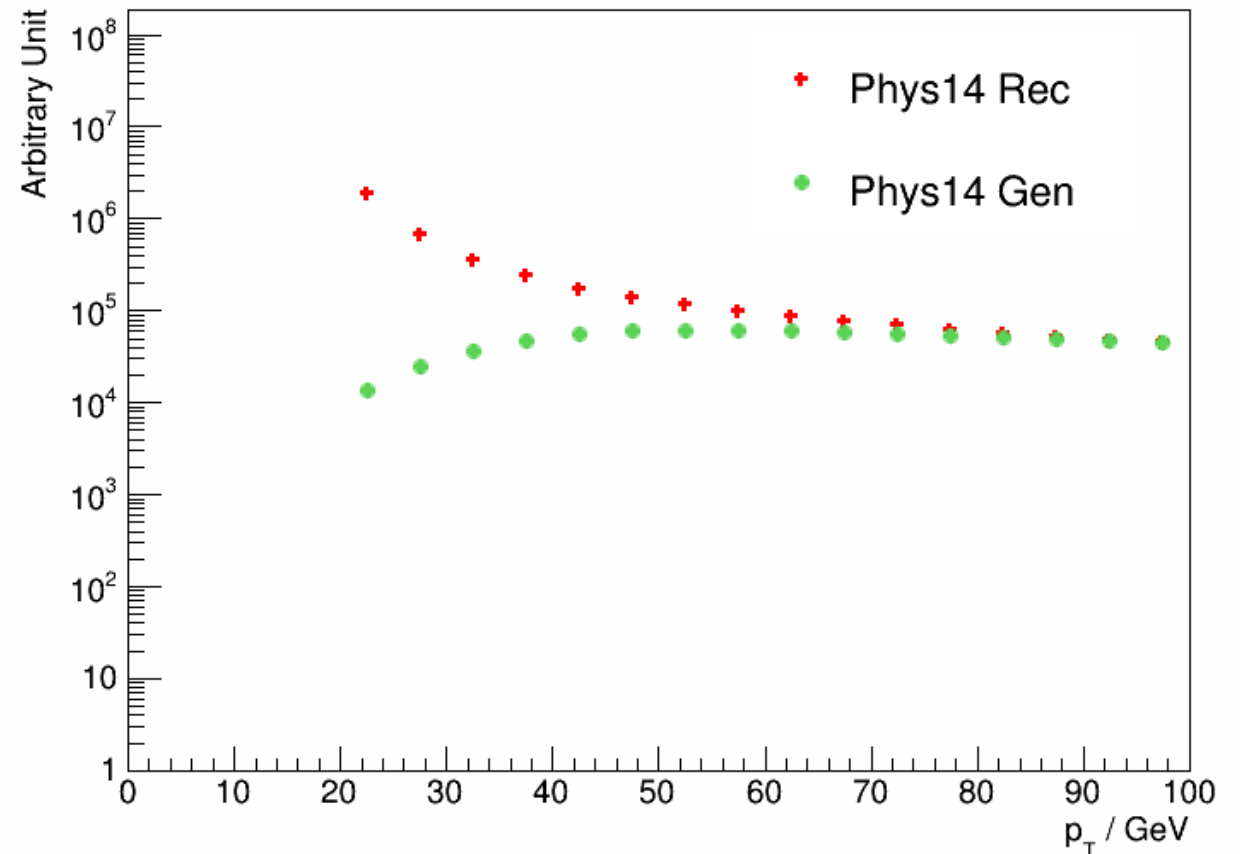
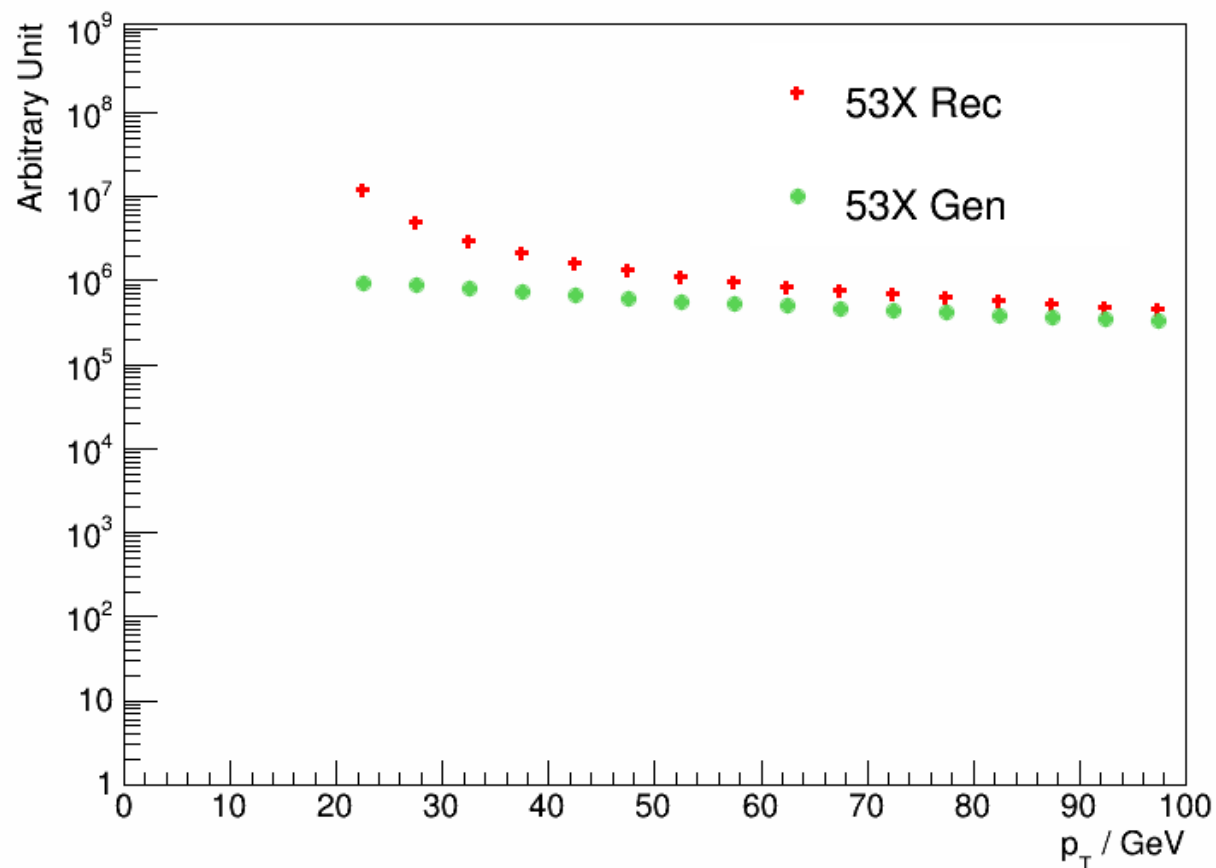
# Summary

- We saw an increase in jet  $\rightarrow$  tau fake rate at high  $P_t$
- It mostly comes from jets that falls away from primary vertex (high  $dZ$ ), and the fraction of such jets increased in Phys14 sample
- With a cut on  $dZ(\text{tau} - \text{vtx}) < 0.2$  reduces the fake rate significantly, thus not affecting the physics performance.
- We are still trying to understand what causes the jets to have high  $dZ$  and why jets with high  $dZ$  have less isolation energy.

backup

# charged isolation (denominator)

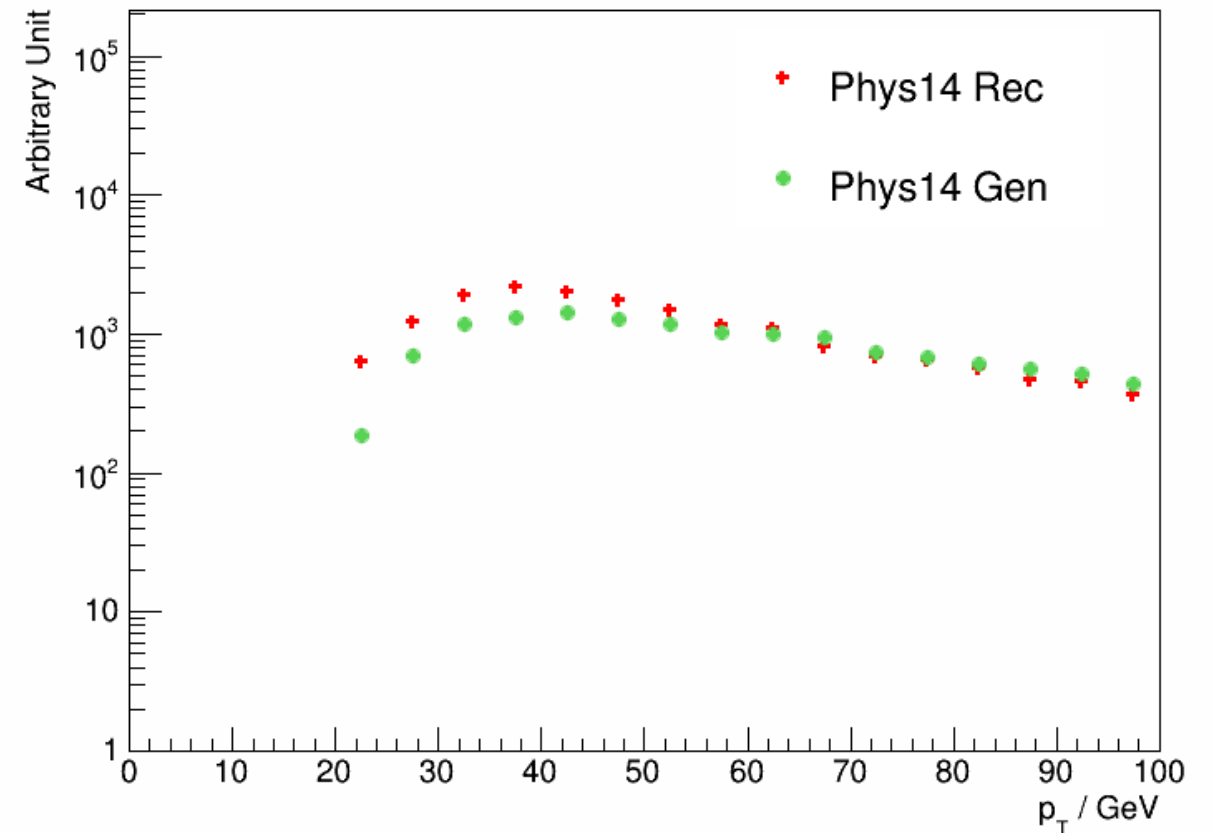
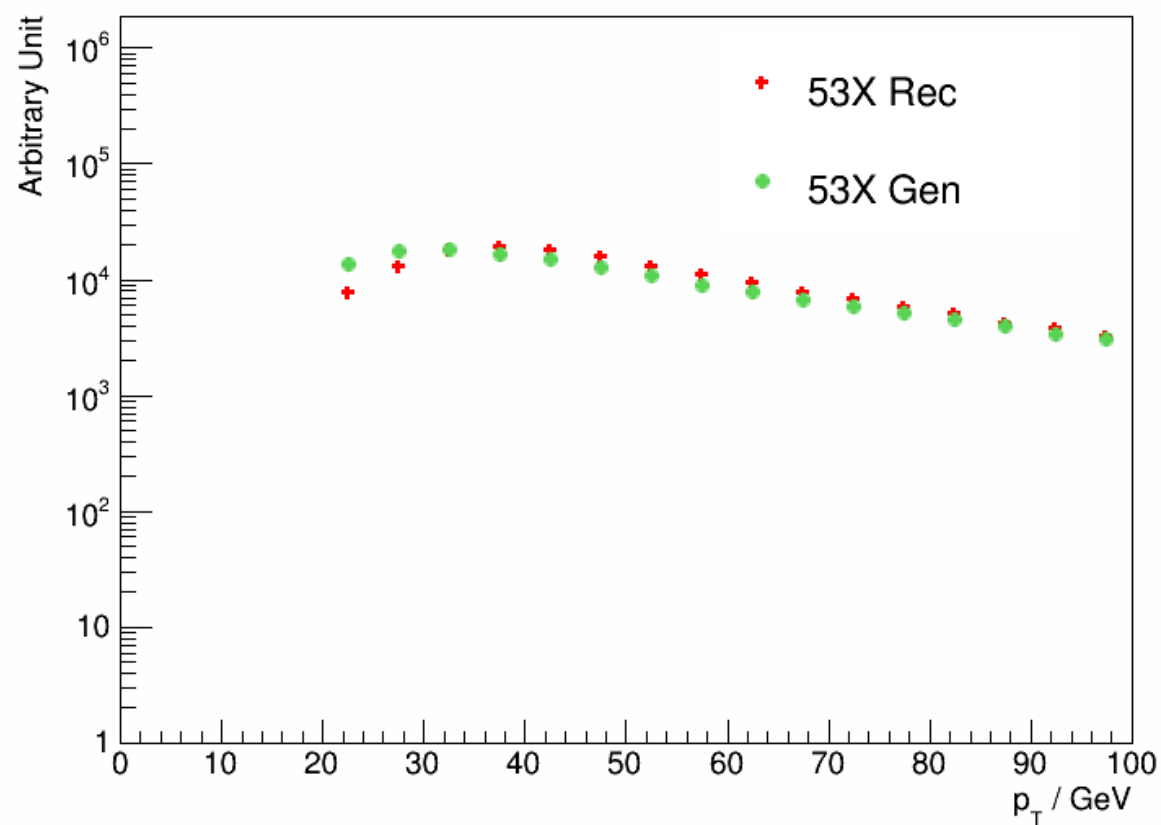
## gen quark/gluon



- The denominator distribution is very different for Gen and Rec
- In case of Gen, I require the quark/gluon match to a reconstructed tau
- May be in pythia-8, there is a problem in matching of quark/gluon to jets

# charged isolation (numerator)

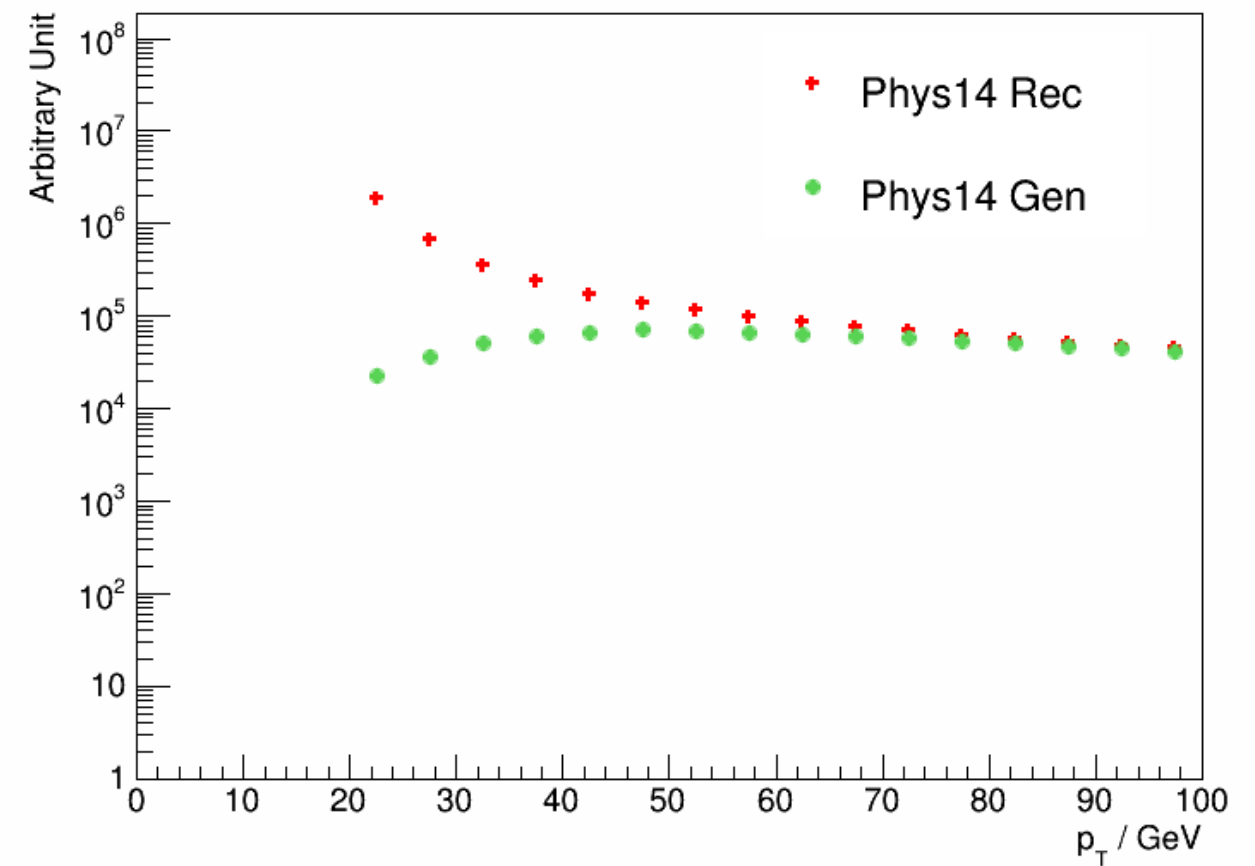
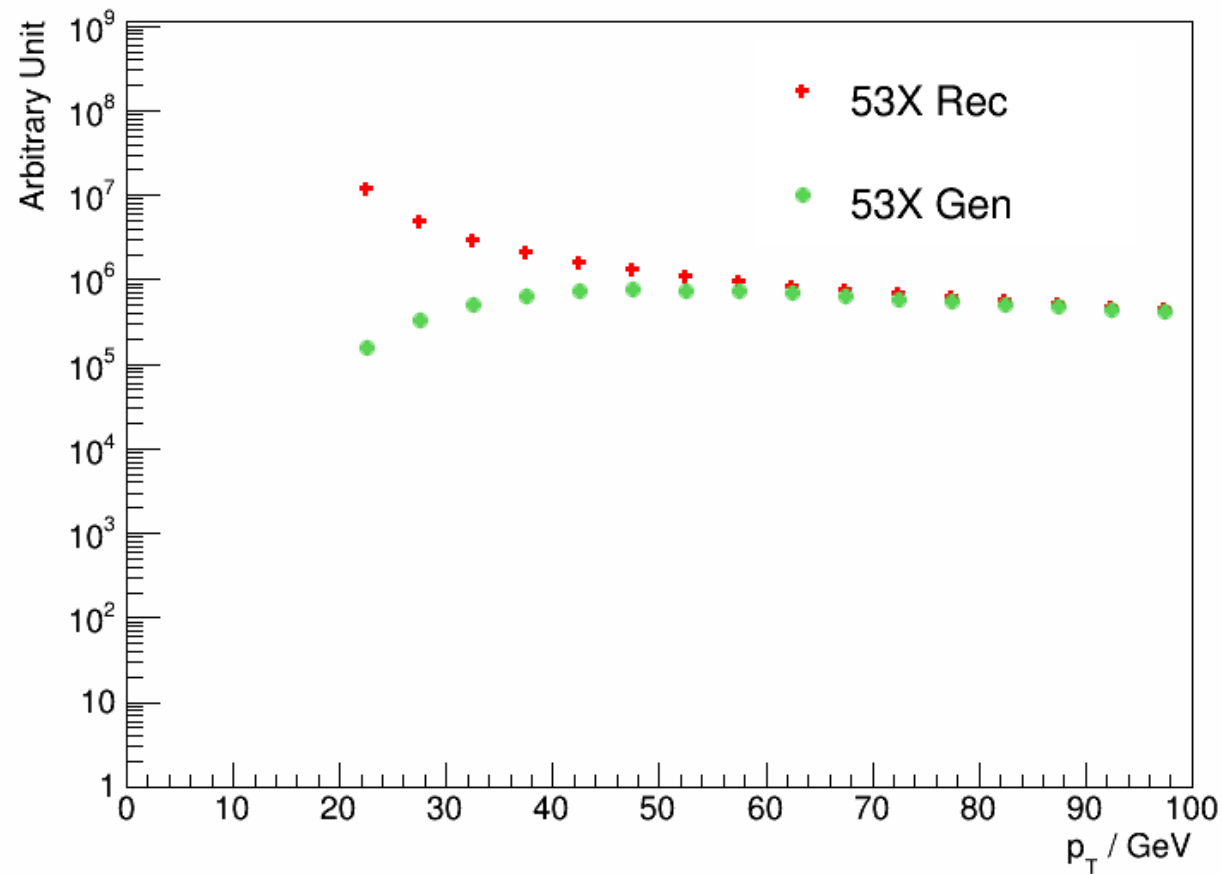
## gen quark/gluon



- The numerator distribution looks similar for Gen and Rec

# charged isolation (denominator)

gen Jet

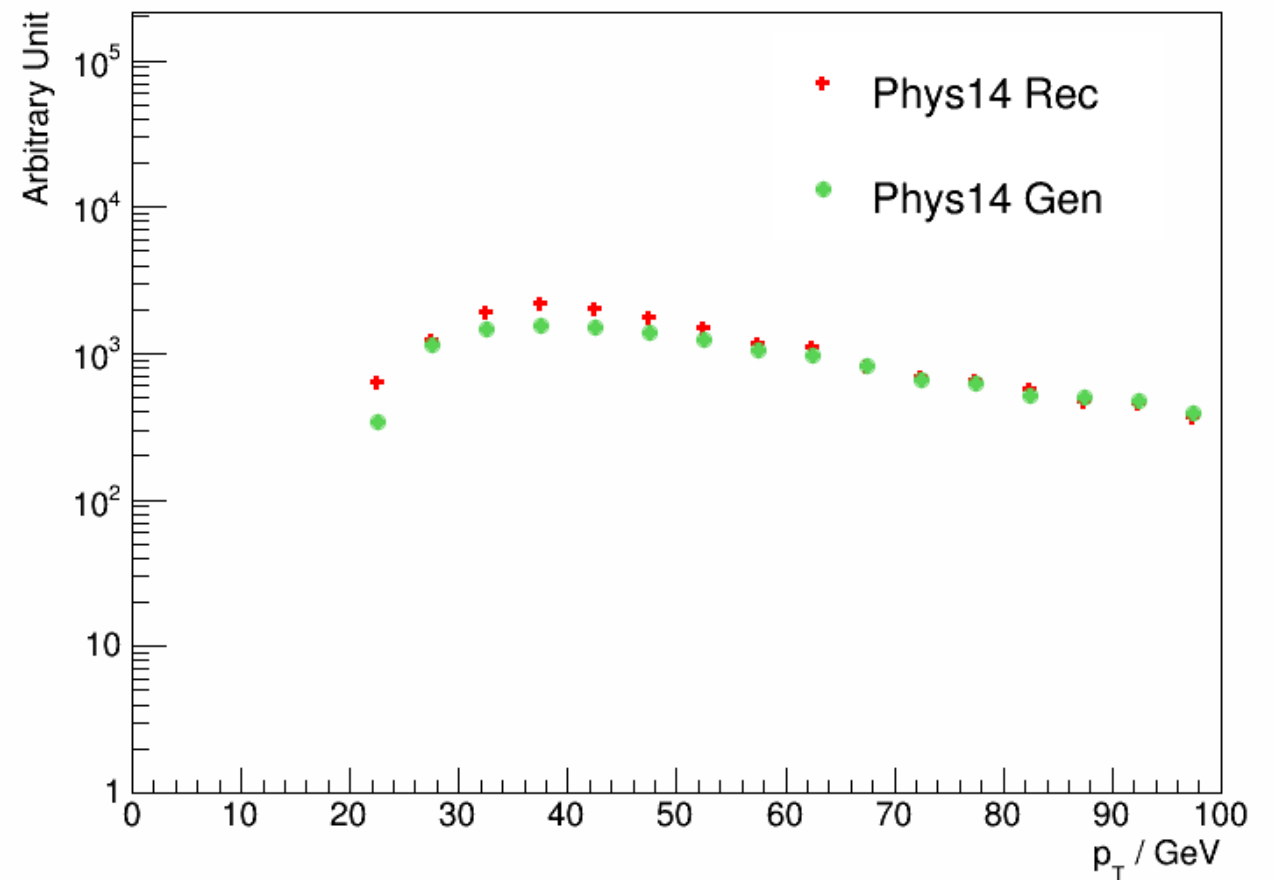
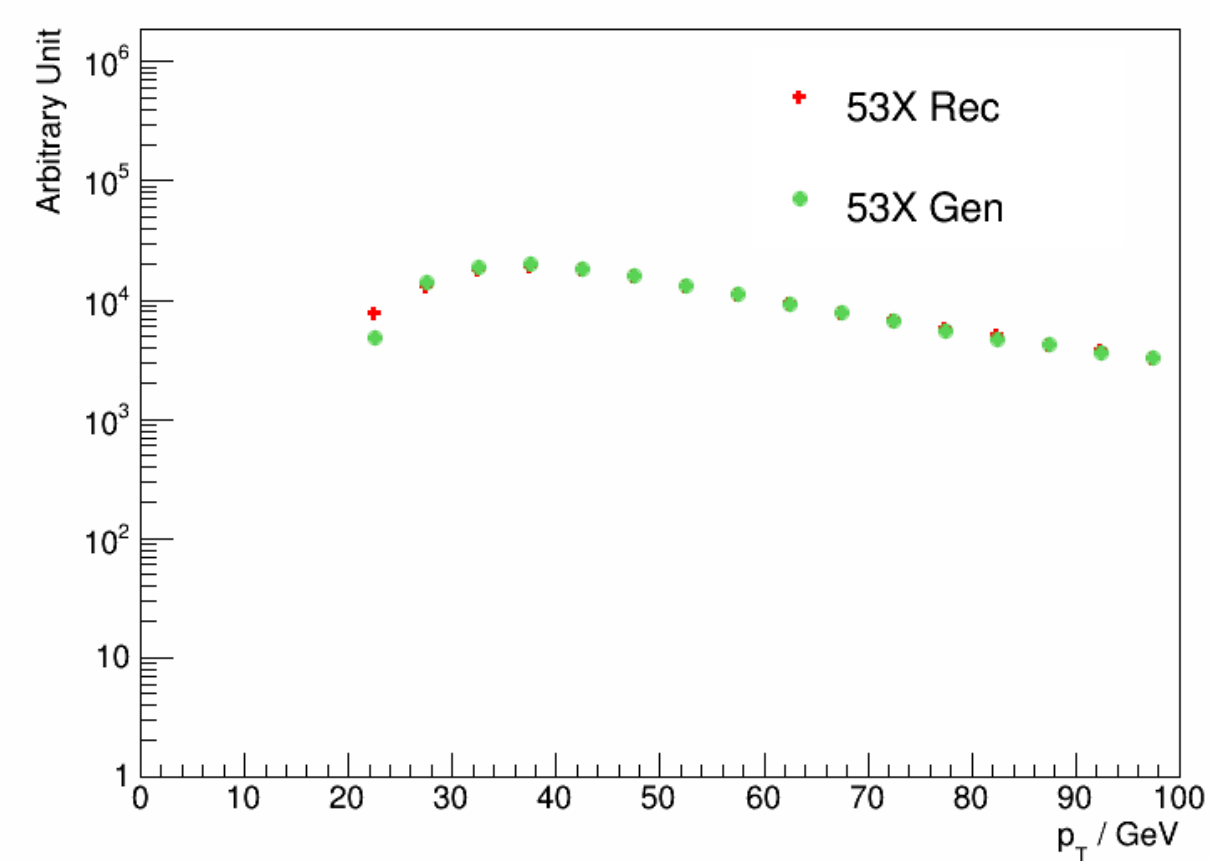


- The denominator distribution looks similar for Gen and Rec when genJet is used.
- In case of Gen, I require the genJet match to a reconstructed tau



# charged isolation (numerator)

gen Jet



- The numerator distribution looks similar for Gen and Rec