



TAU RECO UPDATES – CLUSTER MATCHING

9/14/25

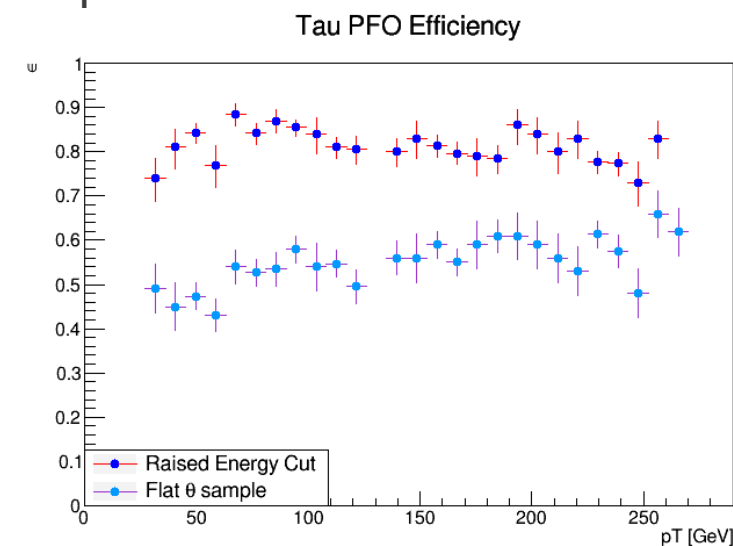
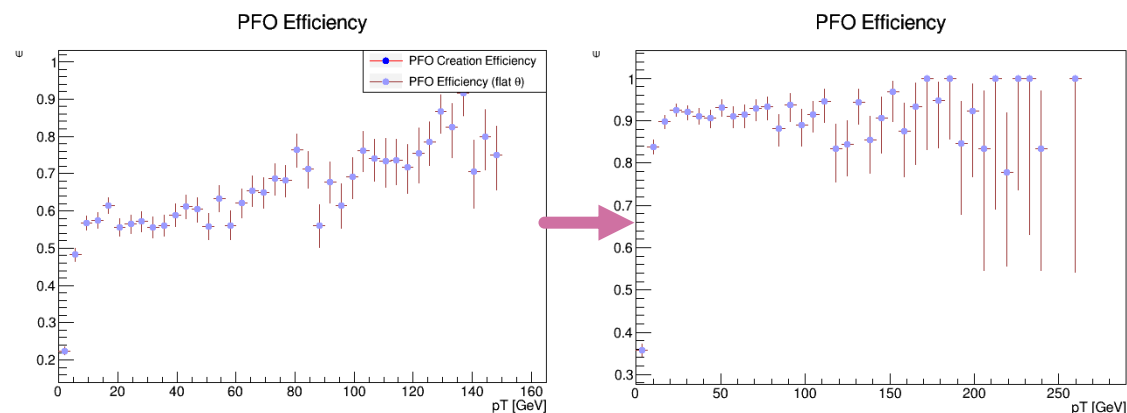


OVERVIEW

- Recall the issue: cluster matching for charged tracks
- Initial assessment of clusterless PFO
- 1-prong vs 3-prong decay

CLUSTER MATCHING PROBLEM

- Recall: back in August, identified unmatched tracks (i.e. tracks w/o a matching calo cluster) as the main source of PFO reco inefficiency for charged pions (and hence tau reco inefficiency)
- 5GeV max energy cut on unmatched tracks
- The cut is logical: anything with appreciable energy should reach the calo and therefore have a matched cluster
- However, only in turning off this cut did we raise efficiency for pion and tau reco

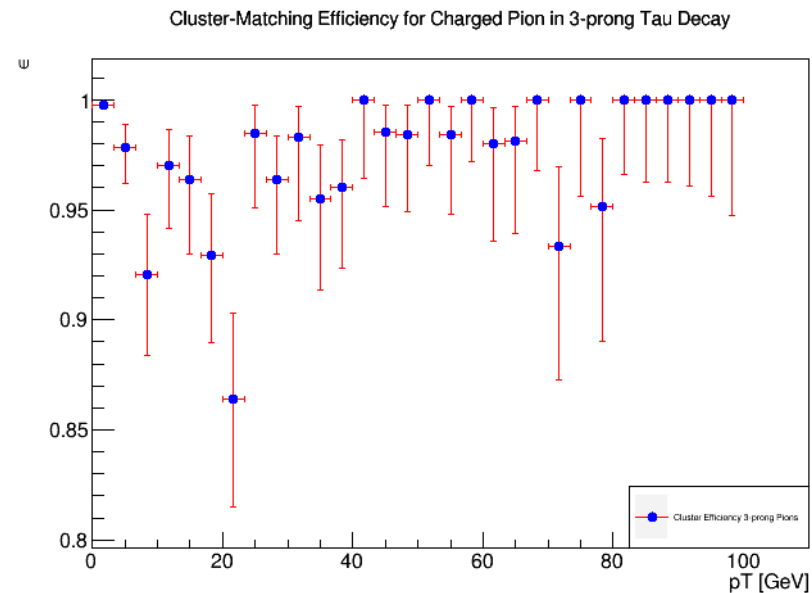
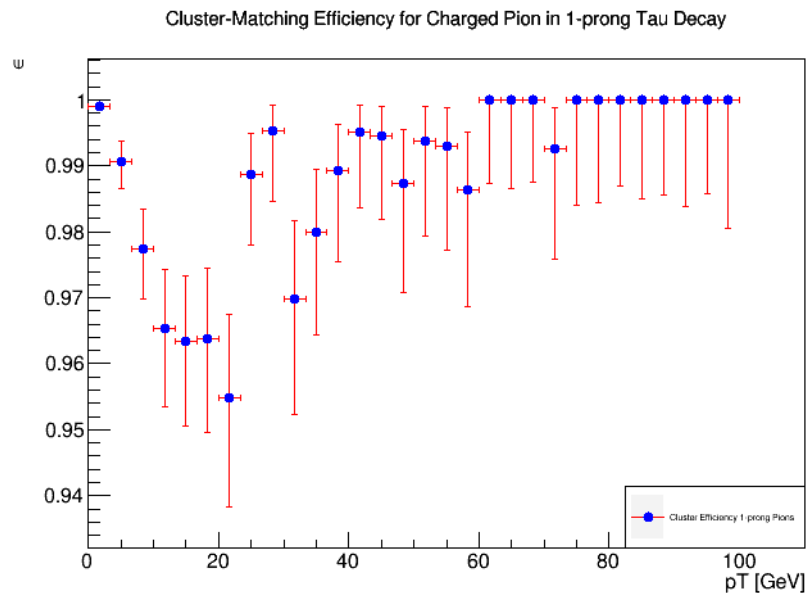


INITIAL ASSESSMENT OF CLUSTERLESS PFO

- With cut still turned off, looked at which PFO objects lacked a cluster
- **Exclusively** $\text{pdg}=211, -211$ (charged pions)
- At least among tau decay products, this is an issue affecting solely charged pions

I-PRONG VS 3-PRONG PION DECAYS

- 2 main decay modes of the tau involving charged pion: the 1-prong and the 3-prong
- Did some preliminary analysis of cluster matching efficiency for each case, results somewhat puzzling
- Dip at 20 GeV, better efficiency for 1-prong, overall surprisingly high matching ...?



NEW SAMPLES

- I am in the process of generating a large new sample, the plots from the previous page were processed from the first 10k taus
- Evidently, there is a fight for statistics going on here, ultimately going to have a full 100k sample which might be more illuminating
- Snowmass/CVMFS outages creating significant roadblocks ☹️

GOING FORWARD...

- Repeat the 1-prong/3-prong cluster efficiency study on the old sample for consistency
- Aggregate and validate the new sample, repeat August studies on the new taus
- Cut at higher p_T for analysis studies