TAU RECO UPDATES – PION TRACKING EFFICIENCY

ROSE POWERS

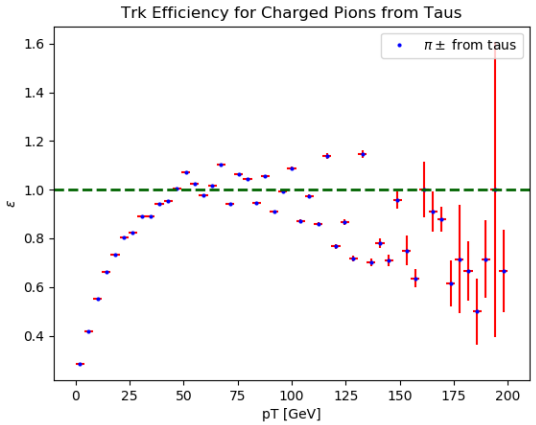
7/20/23

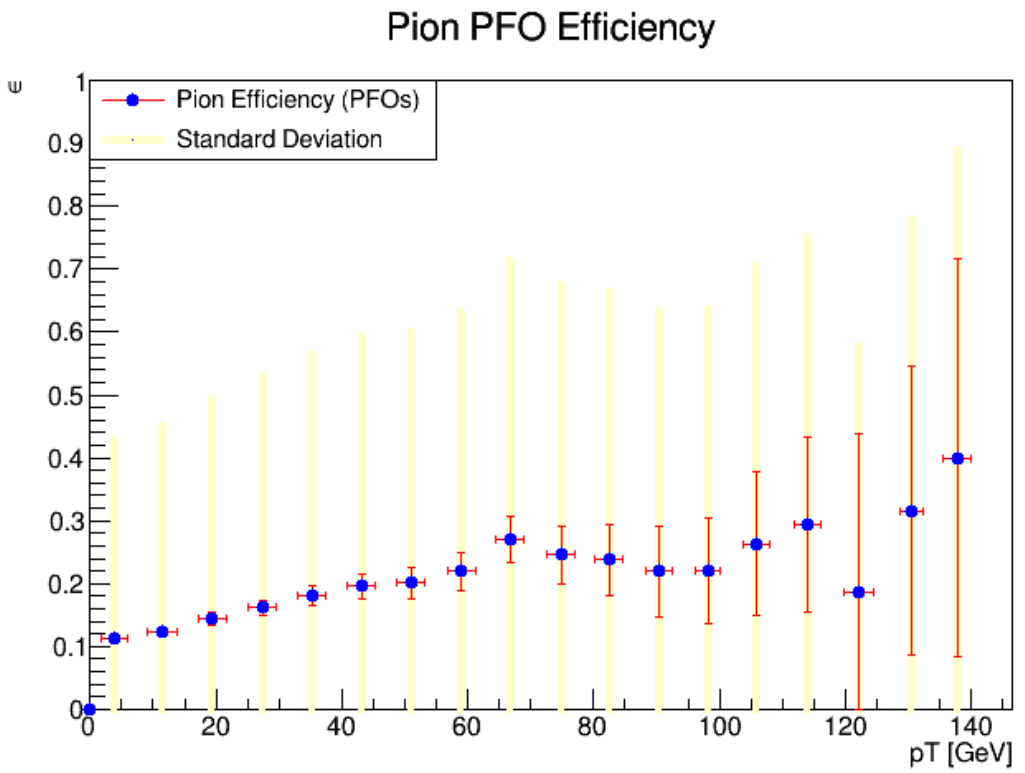
OVERVIEW

- Assessed pion tracking efficiency at the PFO level instead of trk level
- Poor efficiency → I believe this is the main contributing factor to poor tau reco
- Also looked at momentum resolution for reco'd pions
- Duplicate tracks:
  - Made a few changes to Track DeDuper Processor (ACTSDuplicateRemoval)
  - Looked at duplicates as a function of number of hits
  - Studied downstream impacts on reco efficiency and PFO finding – inconclusive as of yet

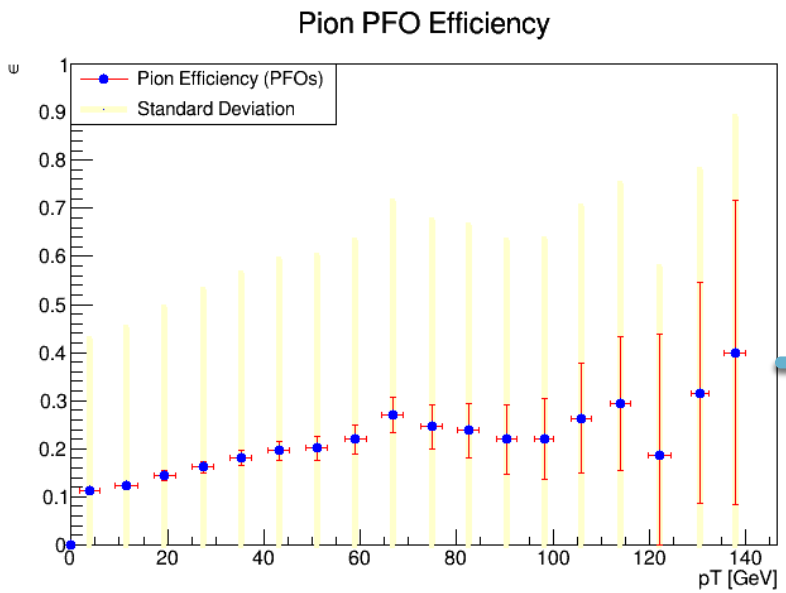
PION PFO EFFICIENCY

- Recall the assessment of track efficiency for charged pions from last week
- An imperfect estimate because it doesn't establish direct link between MCP and trk, just based on number of tracks of appropriate type per momentum bin (also sensitive to duplicate tracks)
- PFO efficiency – each PFO matched directly to an MCP

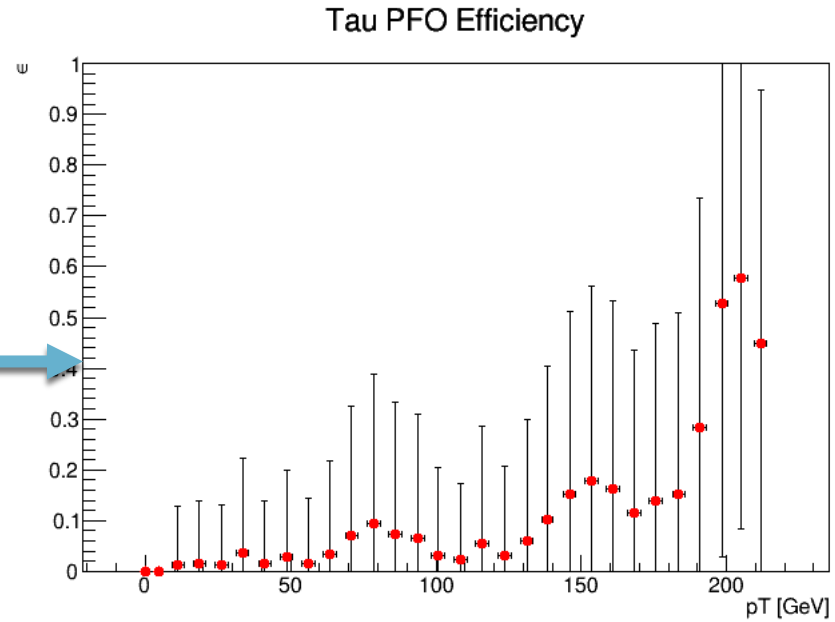




PION PFO INEFFICIENCY → TAU PFO INEFFICIENCY

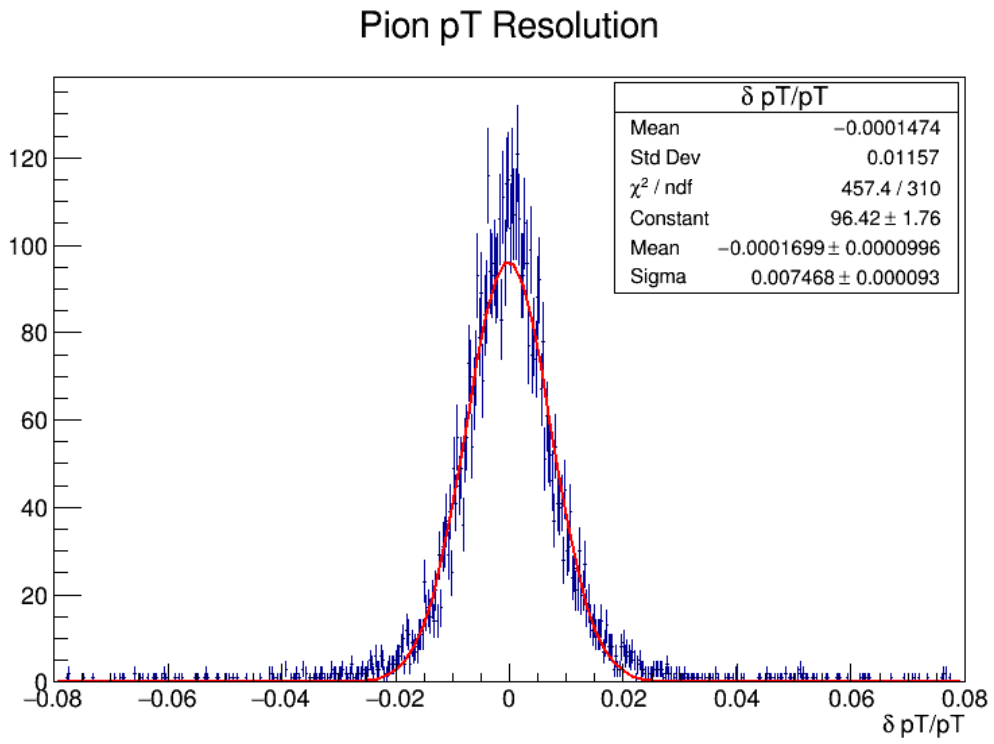


TauFinder



PION PFO MOMENTUM RESOLUTION

- Wanted to see if bad pT reco was contributing to rejecting tau candidates at the invariant mass check
- Very Gaussian; no strange features
- A little bit wider spread than we would ultimately like but not of much concern at this stage
- I do not think bad pT resolution is a major contributing factor to poor tau efficiency

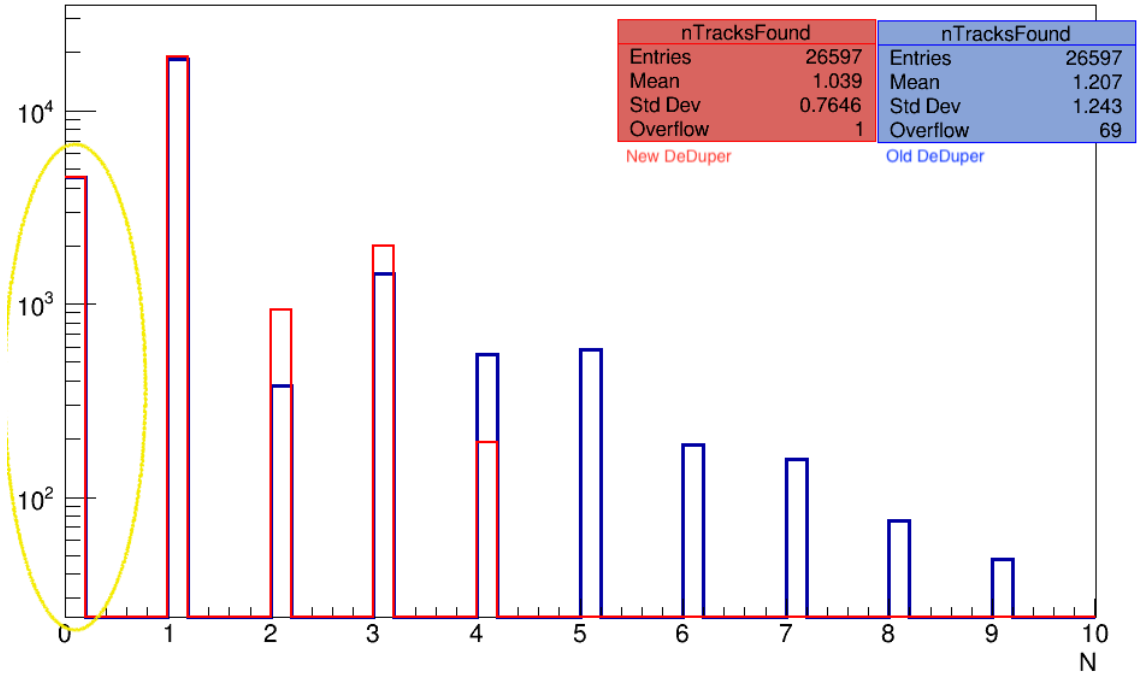


CHANGES TO ACTSDUPLICATEREMOVAL

- Made the percentage of shared hits to trigger a duplicate track an input parameter and reduced it to 25% for these studies (was originally hard coded at 50%)
- Added a check for tracks which share identical Z0 or identical phi, as this was often an indicator of duplication when I was manually debugging
- Have done some preliminary comparisons using my altered processor and the original one

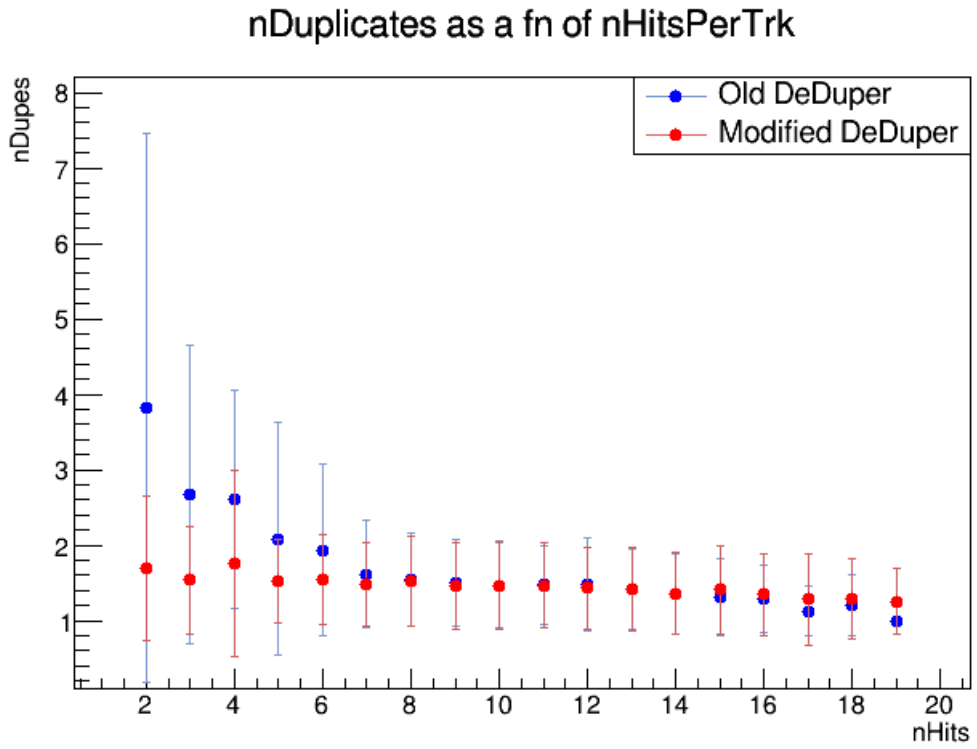
AFFECT OF CHANGES ON NTRKS FOUND

- Red is the modified processor, blue is original
- Promising: note that the number of empty events did NOT increase w the changes, suggesting we did not lower overall tracking efficiency



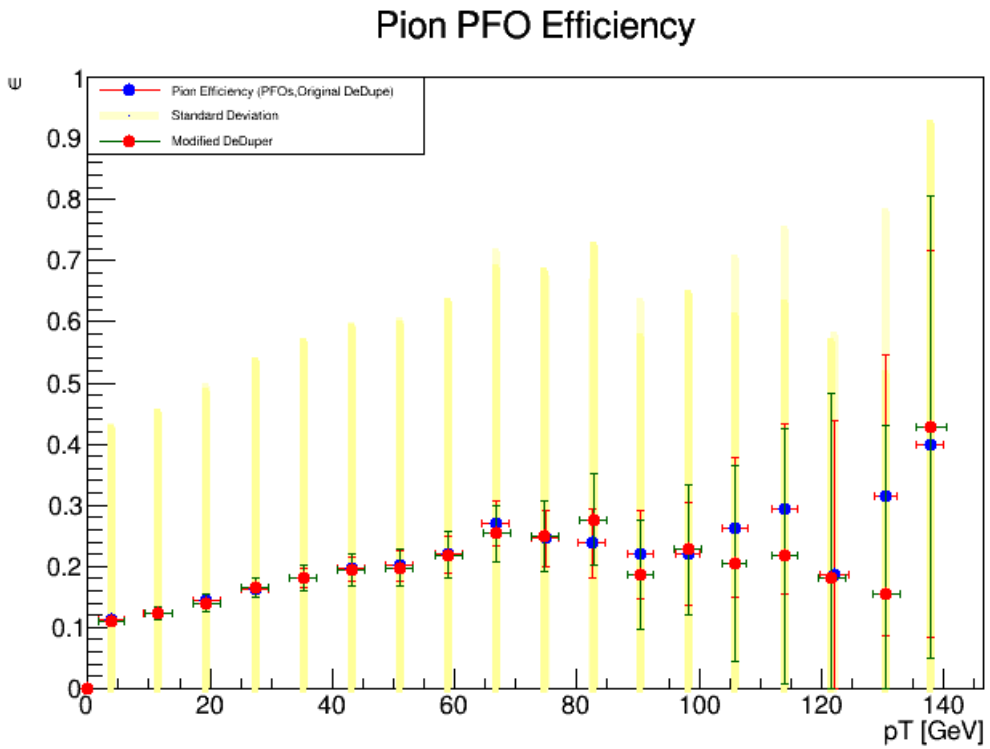
AFFECT ON NUMBER OF DUPLICATES AS A FN OF NHITS

- As Fede predicted last week, originally many of the duplicates had a very low number of hits
- Will try a more aggressive nHits tracking cut with the unmodified processor to see if that helps the issue as well
- The modified processor gives us significantly fewer numbers of duplicates (on average) with low numbers of track hits. We see a slightly greater amount of duplicates with >15 hits



AFFECT ON CHARGED PION TRACKING EFFICIENCY

- Inconclusive;
- Nearly identical for low-pT pions
- Some efficiency loss in the low-statistics, high-pT area
- Will try some more aggressive tracking cuts using original DeDuper and see if we can eliminate those efficiency losses



TAKEAWAYS/NEXT STEPS

- We are doing a poor job of reconstructing charged pions that have decayed from taus
- Any advice/ insights from Isobel + Junjia on pion studies? Are there parameters that need to be optimized for pion tracking?
- The major issue seems to be at the Pandora PFO creation step
- Inconclusive as to whether removing more duplicate tracks helps or hurts efficiency – my modifications may have gone overboard, so I want to try different/more moderate approaches (tracking cuts, remove the Z0 and phi checks)
- However I do support having the nSharedHits cut as an input parameter (unless there is a reason I'm unaware of that it was hardcoded)