# TAU RECO UPDATES – EFFICIENCY STUDIES

**ROSE POWERS** 

8/3/23



### **OVERVIEW**

- Generated a new sample, flat in pT and flat in theta
- Examined the same efficiencies as last time but against theta as well
- Saw huge improvement in pion tracking efficiency
- Varied several tracking cuts in Pandora and found one which improved efficiency greatly
- Revisited tau reconstruction efficiency

### PION TRACKING IMPROVES GREATLY WITH FLAT PT, THETA



#### LOST IN TRANSLATION...



reconstruction.

#### MISIDENTIFICATION STILL PLAGUES US





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### CHARGED PARTICLES STILL NOT BEING ASSIGNED TRACKS

PFO Track-Association Efficiency





## PANDORA TRACKING CUTS – MAX ENERGY FOR UNMATCHED TRK

- Tried adjusting several tracking cuts to find out why Pandora is throwing away tracks
- Found a parameter called "UnmatchedVertexTrackMaxEnergy", which limits the energy of tracks which originate at a vertex but are unmatched
- Was initially set to 5 GeV; since our energy ranges up to several hundred, I adjusted this cut to 500 GeV (to essentially remove it) and saw dramatic improvement in efficiency
- I am not sure if lifting this cut causes problems down the line, but it made a huge difference for Pandora reconstruction, as well as tau reconstruction downstream

#### PANDORA PFO EFFICIENCIES AFTER LIFTING MAX (CHARGED PIONS)



### REVISITING TAUFINDER, TAU EFFICIENCY WITH NEW SAMPLE

- Recall: previously, we had very poor tau reconstruction efficiency
- With a better sample and vastly improved pion efficiency, I figured I would take another look downstream at the TauFinder processor
- First a breakdown of the logic:



### ISOLATION ENERGY CUT... COUNTERINTUITIVE TO ME

- The TauFinder algorithm rejects a tau candidate if the isolation energy, i.e. the energy from tracks inside the isolation cone (see at right), is greater than 5 GeV
- Seems strange, because depending on level of collimation, nearly all the energy of a tau can be contained in the isolation cone (e.g. <u>at CMS it is</u> <u>90%</u>)
- A back-of-the-envelope calculation shows that for our pT range, even a conservative 50% of the tau energy could range up to >100 GeV
- Perhaps I am understanding the logic wrong, but this seems totally counterintuitive to me so I set the cut very high (which did improve efficiency)



#### TAU RECO EFFICIENCY – MOST RECENT PLOTS



### CONCLUSION/NEXT STEPS

- With a sample flat in theta and pT and lifting max energy cuts, we made huge leaps in PFO and tau reco efficiency
- Going forward, want to make a closer inspection of all the tau cuts and make sure they are optimized
  - Does lifting energy cuts have adverse affects elsewhere?
- I will be mostly offline for the rest of August, but I plan on continuing the tau study this coming fall
- Thanks so much everyone for welcoming me into the group this summer :)