τ reconstruction at the Muon Collider

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LIP - Laboratório de Instrumentação e Física Experimental de Partículas

Introduction:

10 TeV MAIA detector geometry

Singularity latest version:
/cvmfs/unpacked.cern.ch/ghcr.io/muoncollidersoft/mucoll-sim-alma9:latest

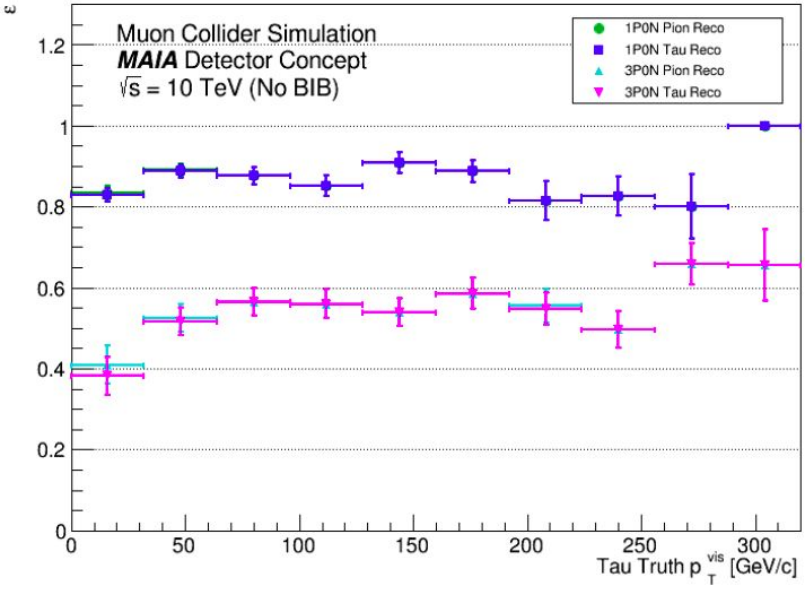
Last version of TauFinder:

- Implementation of the dynamic cone
- 1 GeV cut on all PFOs added to TauFinder
- Cut neutrons from being added to TauFinder
- dR-based truth matching (from Ethan's slides)
- Stick to requiring all 3 pions to be reconstructed (no inclusion of 2P taus)

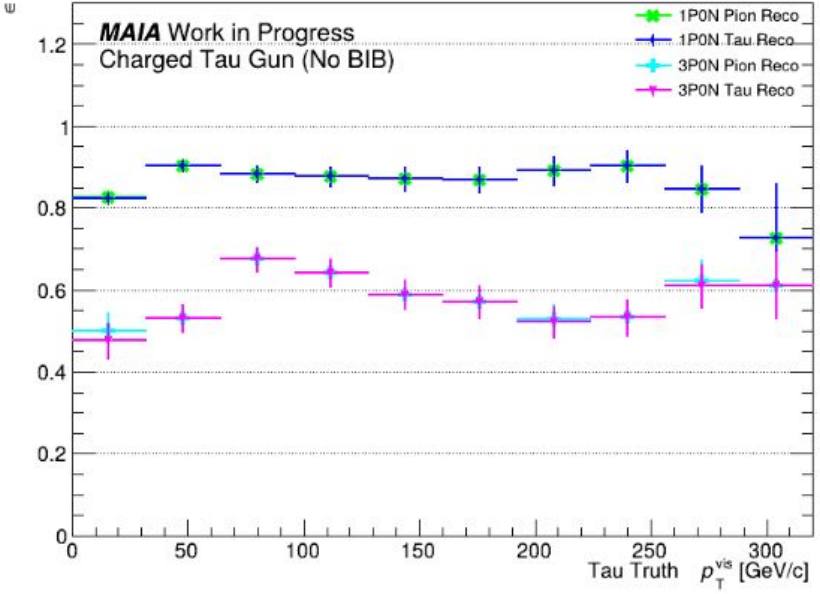
Bug Fix on Invariant mass for $Z \Rightarrow \tau\tau$

Tauguns Efficiency comparison

15000 τ events generated: $0 \leq \varphi \leq 2\pi$ rad; $10° \leq \theta \leq 170°$; $20 \leq pT \leq 320$ GeV/c



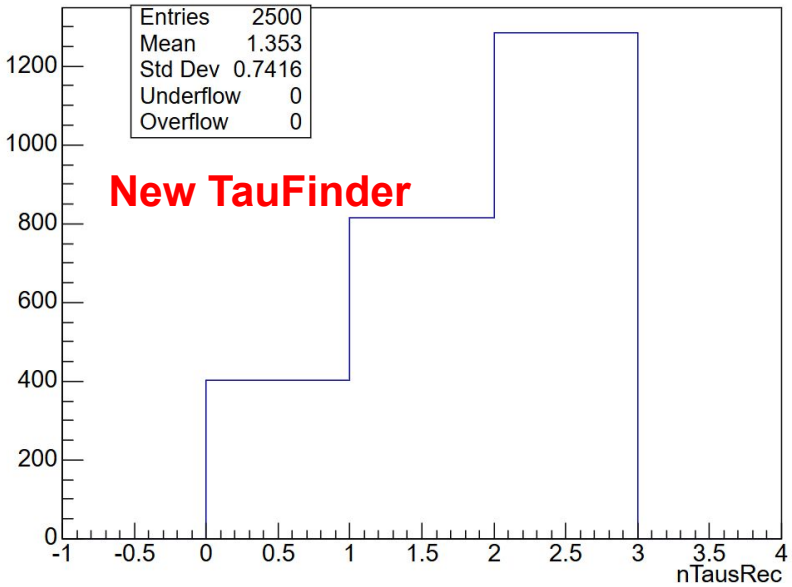
Ethan's Plot

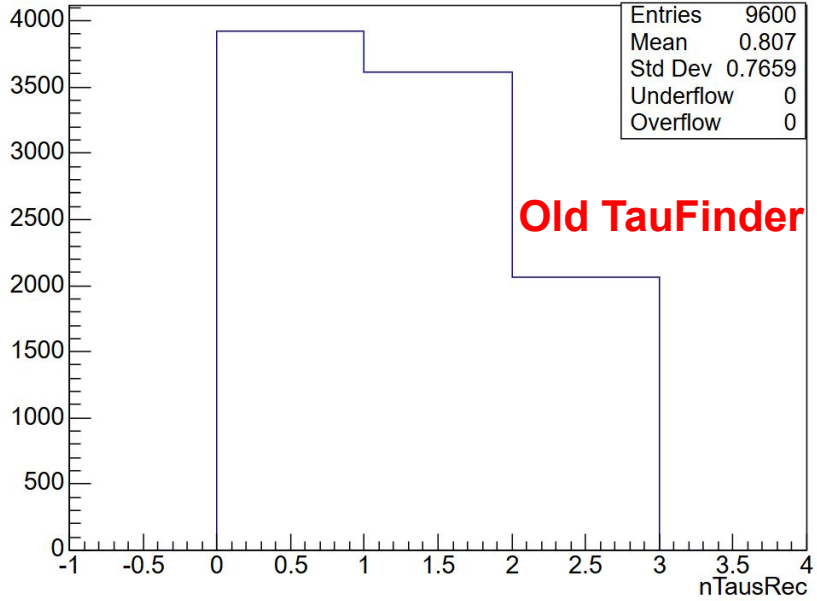


Similar results

Differences in the new TauFinder

Tau Multiplicity in H⇒$\tau\tau$ samples tau pairs reconstructed increased

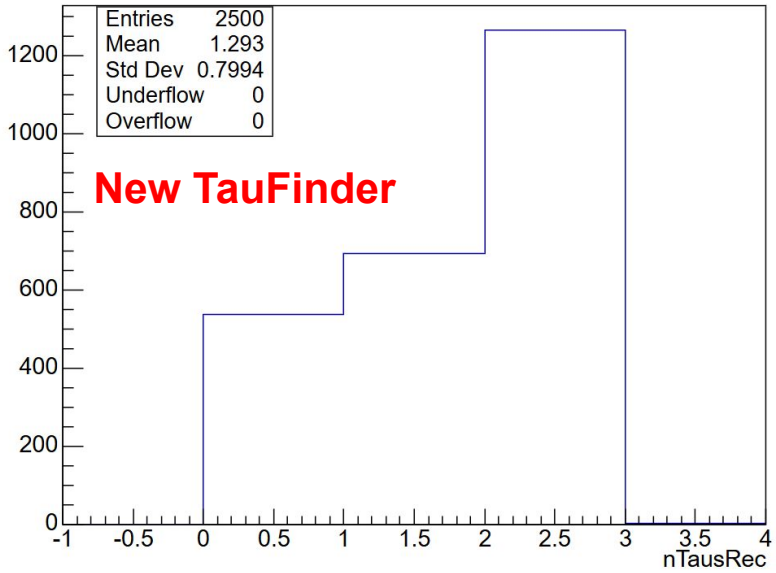


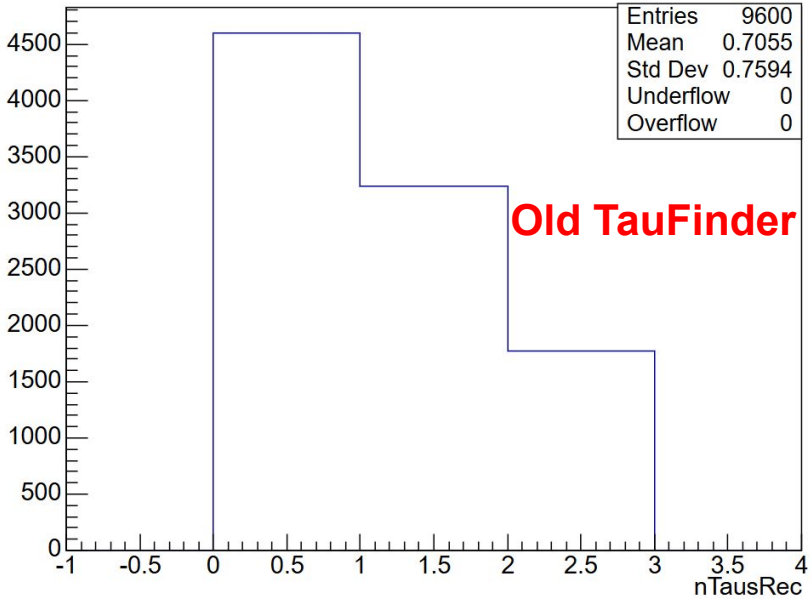


21,5 % reconstructed tau pair in Old TauFinder against 51,4 % for New version

Differences in the new TauFinder

Tau Multiplicity in Z⇒$\tau\tau$ samples tau pairs reconstructed increased

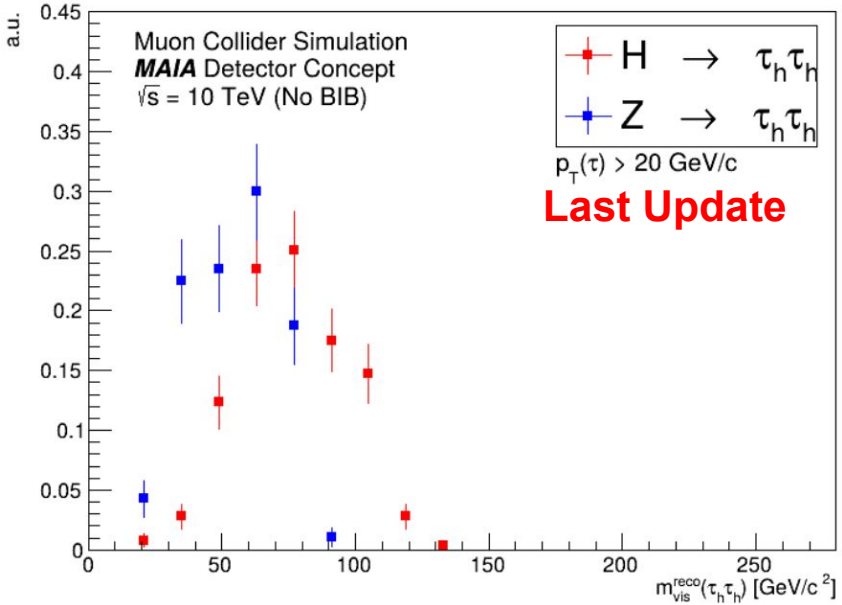


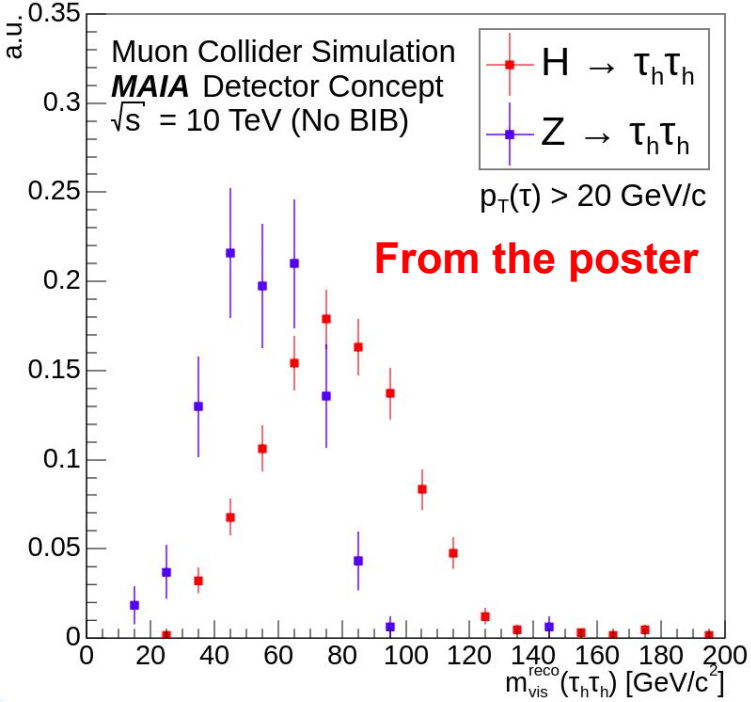


18,4 % reconstructed tau pair in Old TauFinder against 51 % for New version

Invariant mass bug fix

I was able to generate only 2500 H/Z events due to Condor issues





Bug fix from a factor 3 difference between the y uncertainties

Plan for the next steps

Measurement of the uncertainty on the H→$\tau\tau$ cross section:

- Check values of MadGraph cross sections
- Check for additional unreducible backgrounds
- Use Roofit tool to extract predicted uncertainty from invariant mass templates normalized to the expected luminosity

Jets study:

- For Z→jj and H→bb
- See how many jets are seen as τ

Thank you for your attention

Total Efficiency comparison

Kevin's values (below)

Decay Mode	$\pi^{\pm}$ Reco Efficiency	$\tau^{\pm}$ Reco Efficiency
1P0N	86,25%	86,03%
3P0N	54,70%	54,30%

Ethan's values (below)

Decay Mode	$\pi^{\pm}$ Reco Efficiency	$\tau^{\pm}$ Reco Efficiency
1P0N	86.81%	86.70%
3P0N	58.38%	58.03%