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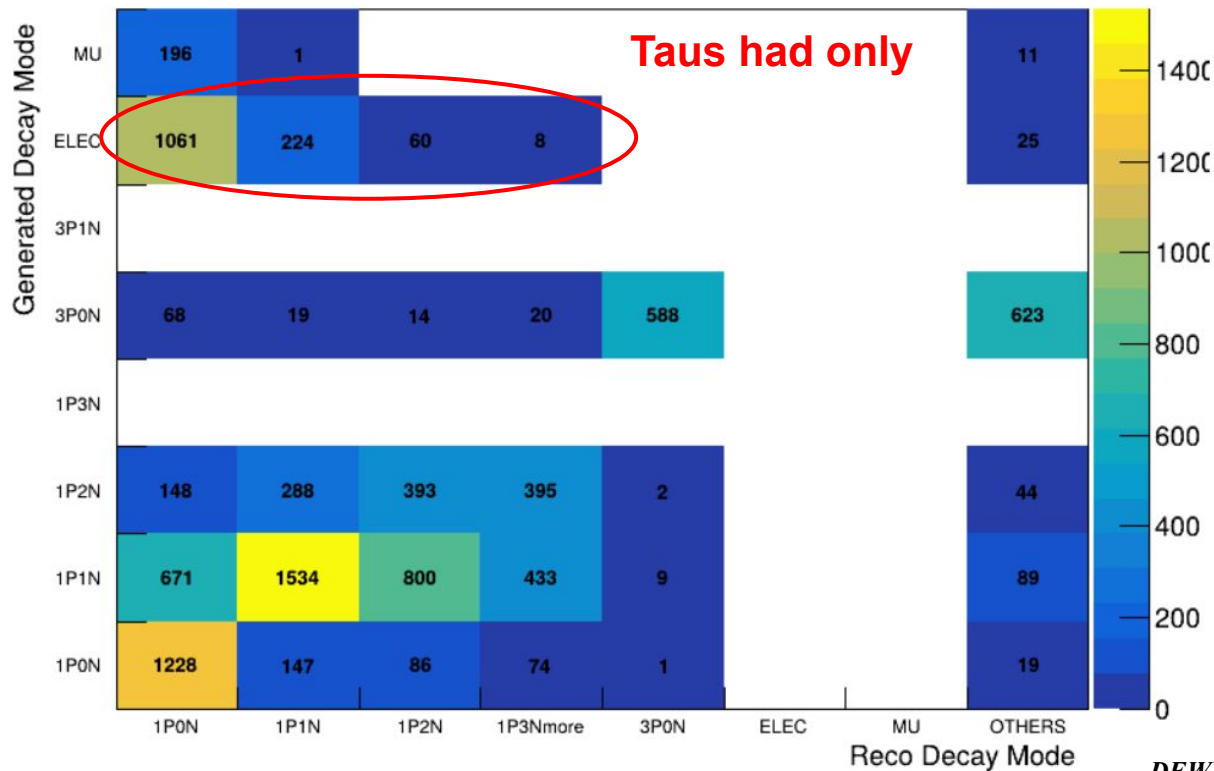/cvmfs/unpacked.cern.ch/ghcr.io/muoncollidersoft/mucoll-sim-alma9:latest

Latest improvement:

- Implement of new a **requirement** on the Electromagnetic Fraction (**EMF**) on Tauguns

- Comparison between **H→bb** samples and **Tauguns**

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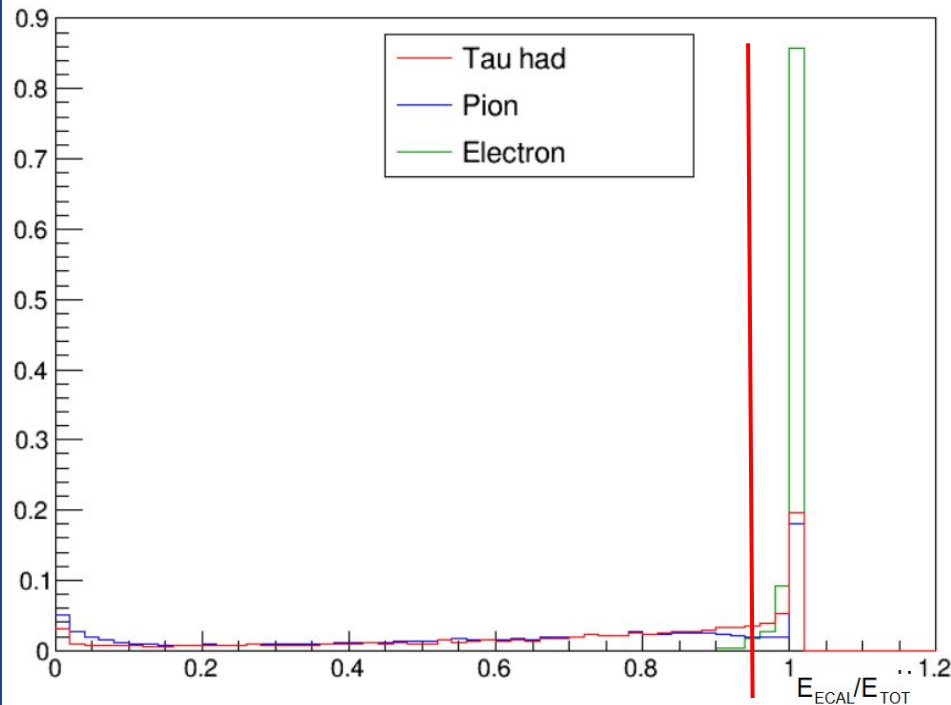
Decay mode Matrix for Hadronic Taus

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

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Comparison Electromagnetic Fraction (EMF)

Cut at EMF < 0.95

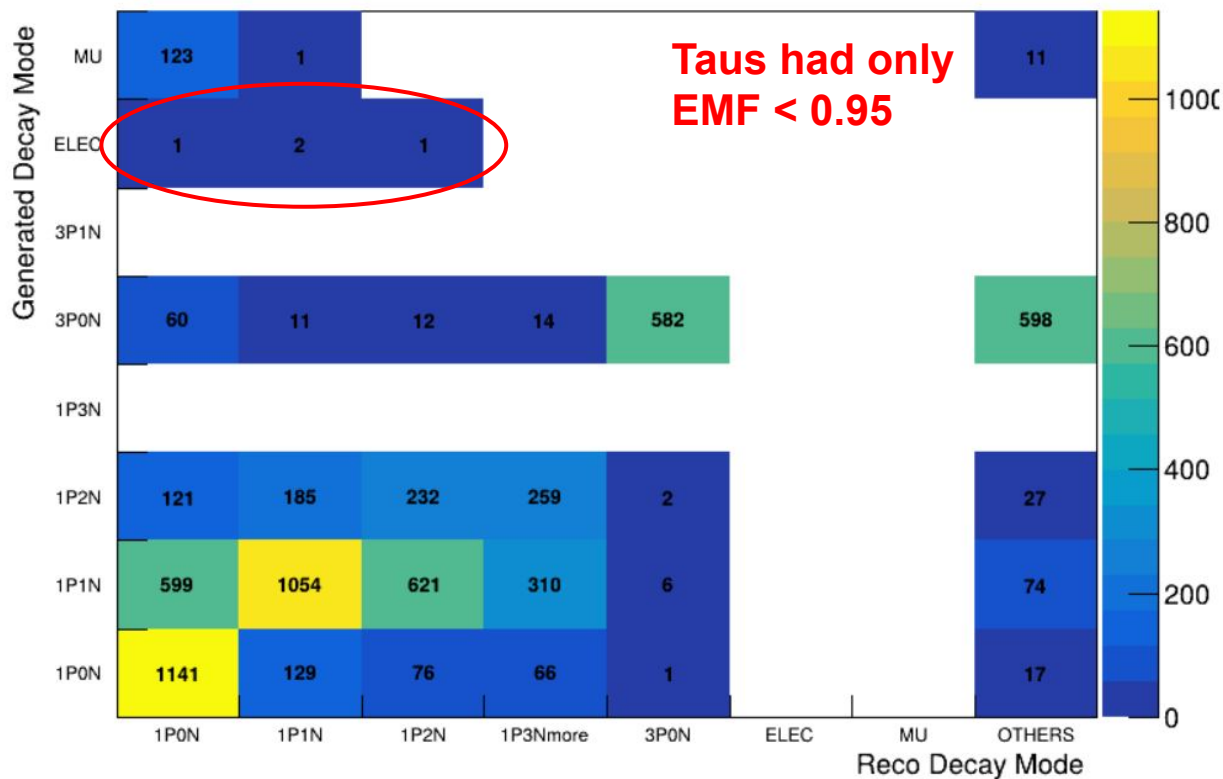Normalised EMF for Tau had, Pions, and Electrons

In order to remove Generated electrons seen as pions:

- We implement a requirement on the **EMF < 0.95**

- This will remove the majority of the mismatched electrons

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Decay mode Matrix for Hadronic Taus

After applying a **requirement** of **EMF < 0.95**

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Comparison between H→bb and Tauguns

Tauguns samples: **15000 τ** events generated: 0 ≤ φ ≤ 2π rad; 10° ≤ θ ≤ 170°; 20 ≤ pT ≤ 320 GeV/c

H→bb samples: **15000** events generated

**We use TauFinder to see how much bjets will be seen as taus**

Comparison of the efficiencies: $\text{eff} = \dfrac{\#\ \text{reconstructed taus}}{\#\ \text{generated taus}}$

- Select only events without generated taus:
  Tauguns = 94% and H→bb = 55%

- By removing events with 2 or 4 reconstructed number of charged tracks: Tauguns = 90% and H→bb = 31%

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Comparison between H→bb and Tauguns

Normalised Number of reconstructed Pfos of H→bb and Tauguns

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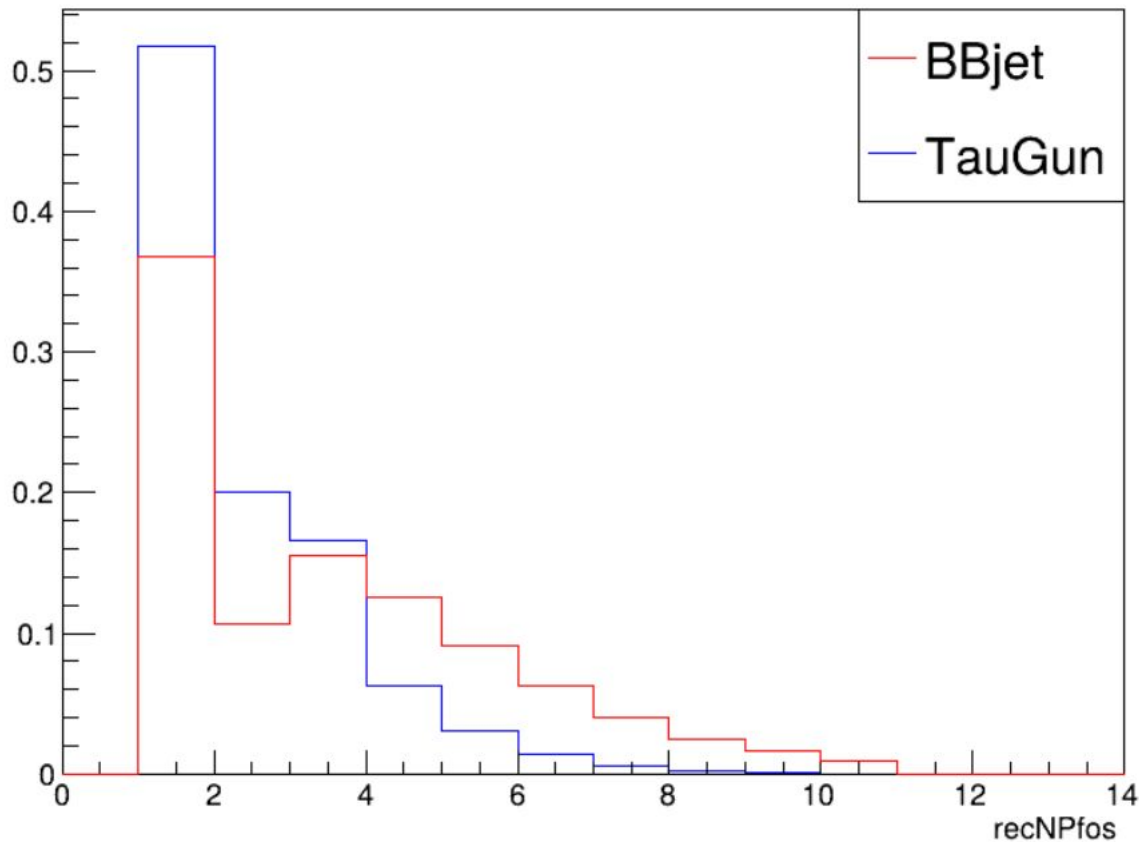
Comparison between H→bb and Tauguns

Normalised D0 of H→bb and Tauguns

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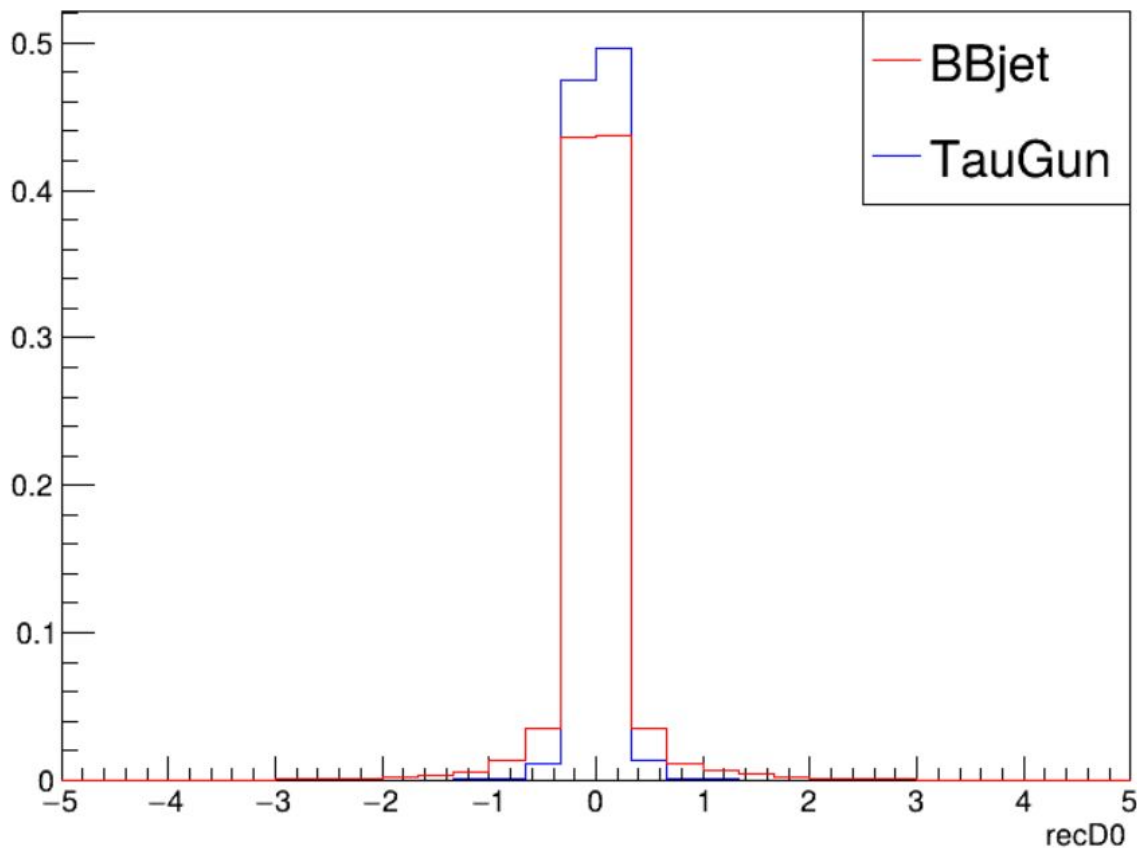
Comparison between H→bb and Tauguns

Normalised Reconstructed Invariant mass of H→bb and Tauguns

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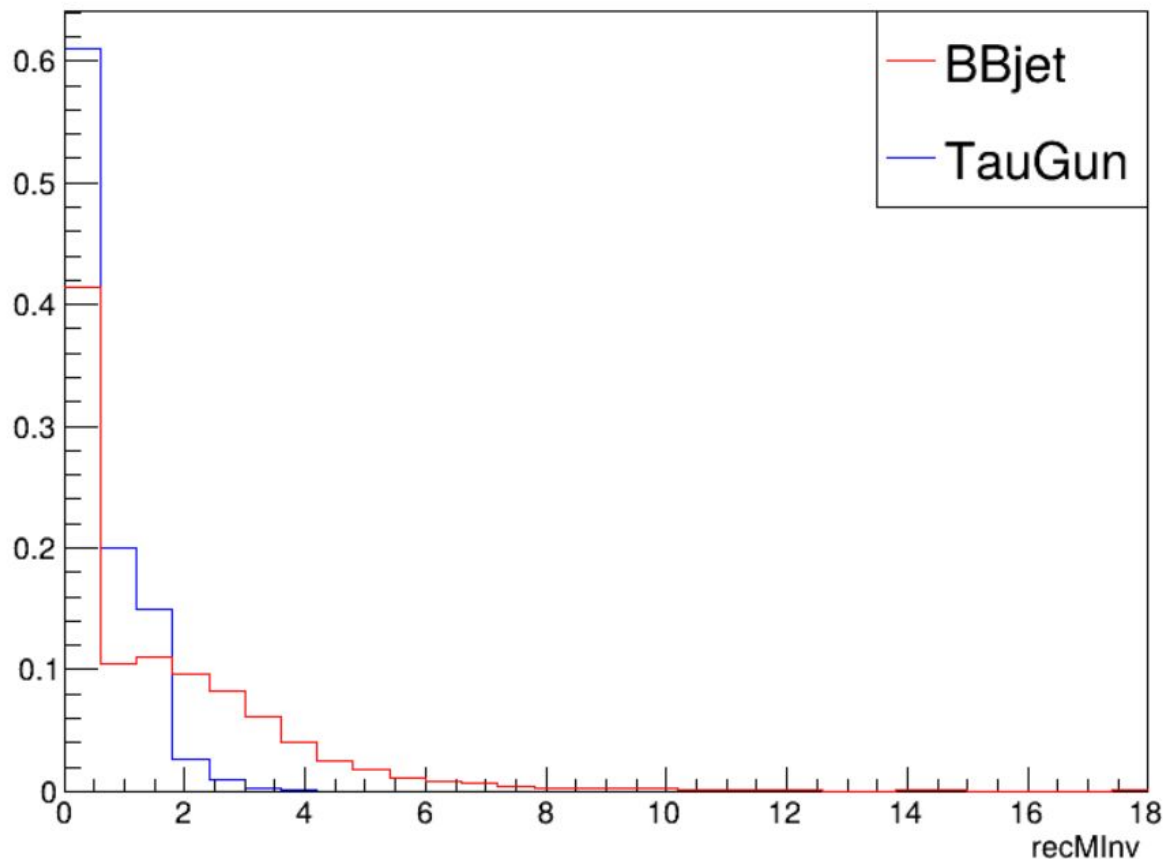
Comparison between H→bb and Tauguns

Normalised reconstructed Pt of H→bb and Tauguns
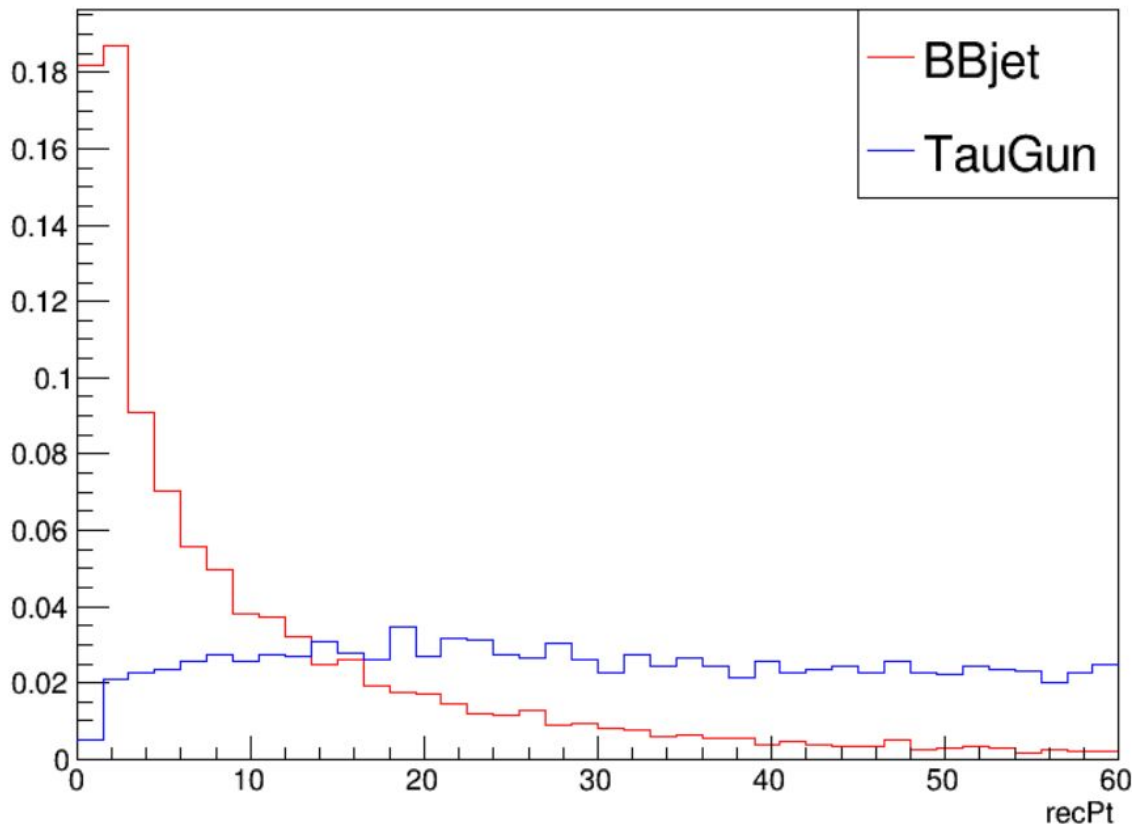
We observe that:

- a cut at **20 GeV** on the reconstructed **Pt** would remove the majority of **bjets seen as taus**

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Plan for the next steps

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

- Extract expected cross sections from MadGraph
- 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$\rightarrow$jj
- See how many jets are seen as τ

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Thank you for your attention