DeepTau scale factors and corrections

Huiling Hua [1] **Fabio Iemmi** [1] Duncan Leggat [2]
Hongbo Liao [1] Hideki Okawa [2] Yu Zhang [2]

[1]Institute of High Energy Physics (IHEP), Beijing

[2]Fudan University, Shanghai

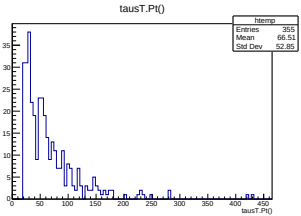
January 19, 2022

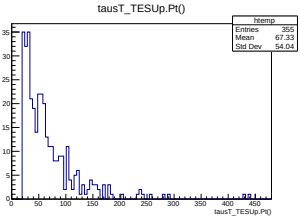
Introduction

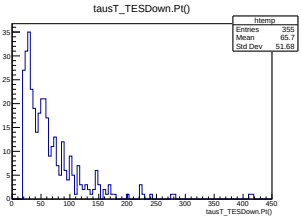
- DeepTau provides **three discriminators**:
  - VSjet
  - VsEle
  - VsMu
- **Corrections must be applied** depending on the discriminator working point, the gen matching of the reco tau, and more
- Spent last week **implementing these corrections**
- TAU POG (**in principle**) provides analyzers with tools for this
  - **C++ version of the tools is missing many ingredients** (see my post on HN)
- I "translated" many methods and classes from python to C++

Corrections to VSjet

- Corrections depend on tau p_T and tau gen matching (only applied to real taus)
- **If using very loose VSlepton WPs, additional uncertainties have to be added**. The tool takes care of it (after I wrote it...)
- Also, tau energy scale (**TES**) corrections **must be applied** to genuine taus
- I implemented this in the **NanoAOD** $\rightarrow$ **small_trees step**
  - There was no C++ class for this, I wrote it...
- Now small trees have "nominal" tau collections with nominal TES factor applied, and Up/Down collections too







Corrections to VSele

- Corrections depend on tau η and tau gen matching (only applied to taus matched to prompt/nonprompt e)
- We use **VVVLoose VSele WP, no SFs** are provided. **Use VVLoose SFs; additional uncertainties have to be added** (ZhangYu asked the conveners).
  - The tool takes care of it (after I wrote it...)
- Also, tau fake energy scale (**FES**) **corrections must be applied** to fake taus
- This is my **open item**; will do it asap

Corrections to VSmu

- Corrections depend on tau η and tau gen matching (only applied to taus matched to prompt/nonprompt μ)
- **We use VLoose VSele WP, SF are provided**
- **No FES corrections are needed** for fake taus from muons

Summary

- Work on implementing DeepTau SFs and related uncertainties is almost done
- **I only miss FES corrections for fake taus coming from electrons**
- The whole procedure is pretty convoluted; I **need to revise everything** carefully
- **Code** is constantly **uploaded on GitHub** so everyone can check