Feasibility Study of Measuring the Higgs Self-coupling Using the Muon Collider

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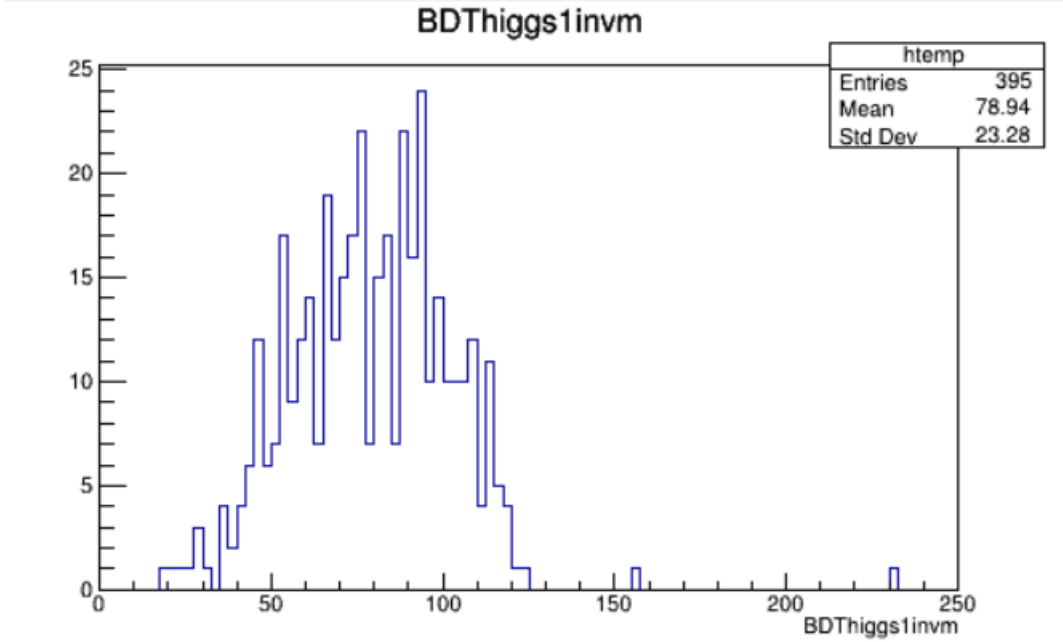
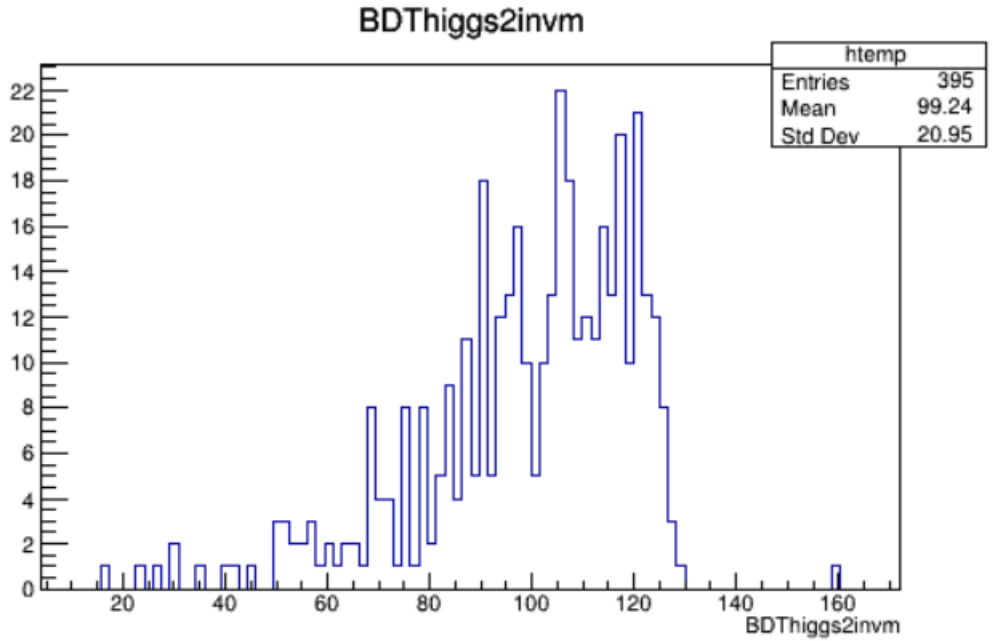
Reconstruction of hadronically decaying di-τ

- Since the Higgs are highly boosted with 10 TeV center of mass energy, the $\tau^+\tau^-$ pairs almost have a separation $\Delta R < 0.5$ all the time, hence they would fail the standard reconstruction procedure. After applying the following selections criteria:
  - charge product Q of the two leading di-τ jets = -1;
  - ΣBTag =2 for the $b\bar{b}$ jets pair;
  - ΣTauTag = 2 for the tau-tagged jets pair;

  only 395 events passed the selection (~10% of 100k*BR(HH->bb$\tau\tau$)*(BTag-eff^2)*(TauTag-eff^2)=3784), which is consistent with our previous argument.
- In both the CMS and the ATLAS paper, they have developed a method that selected untrimmed large-radius jets with $p_T > 300$ GeV, then reclustered its constituents into anti-k_t sub-jets with $R = 0.2$, then labeled remain tracks as “iso-tracks”.
- However, we don’t have any substructure information from Delphes simulation 😟, thus reclustering is not possible. The only idea I have now is to run both anti-k_t jet algorithm with cone size $R = 0.5$ and 0.2. Then performance “truth-matching”-like algorithm which matches the sub-jets inside jets.

Results from standard selection criteria





Next step:

- Write code for the “mix” decay mode.
- How to combine those three decay modes’ algorithm?