Status report

Apr 1, 2021

Jieun Choi

HYU / IP2I

Synchronization: remaining questions

1. JetID

For AK4CHS jets				
PF Jet ID	abs(η) <= 2.6	2.6 < abs(η) <= 2.7	2.7 < abs(η) <= 3.0	3.0 < abs(η) <= 5.0
Neutral Hadron Fraction	< 0.90	< 0.90	-	>0.2
Neutral EM Fraction	< 0.90	< 0.99	>0.01 and < 0.99	< 0.9
Number of Constituents	> 1	-	-	-
Muon Fraction	< 0.80 (for LepVeto)	< 0.80 (for LepVeto)	-	-
Charged Hadron Fraction	> 0	-	-	-
Charged Multiplicity	> 0	> 0	-	-
Charged EM Fraction	< 0.80 (for LepVeto)	< 0.80 (for LepVeto)	-	-
Number of Neutral Particles	-	-	> 1	> 10

   - TightID → TightLepVetoID

2. b-tag disc. Value ✅
   - Jet_btagDeepB > 0.7665 (Tight)

   nanoAOD:
   ?(bDiscriminator('pfDeepCSVJetTags:probb')+bDiscriminator('pfDeepCSVJetTags:probbb'))>=0?bDiscriminator('pfDeepCSVJetTags:probb')+bDiscriminator('pfDeepCSVJetTags:probbb'):-1
   MiniAOD:
   m_jetMet.at(ii).bDiscriminator("pfDeepCSVJetTags:probb")+m_jetMet.at(ii).bDiscriminator("pfDeepCSVJetTags:probbb")

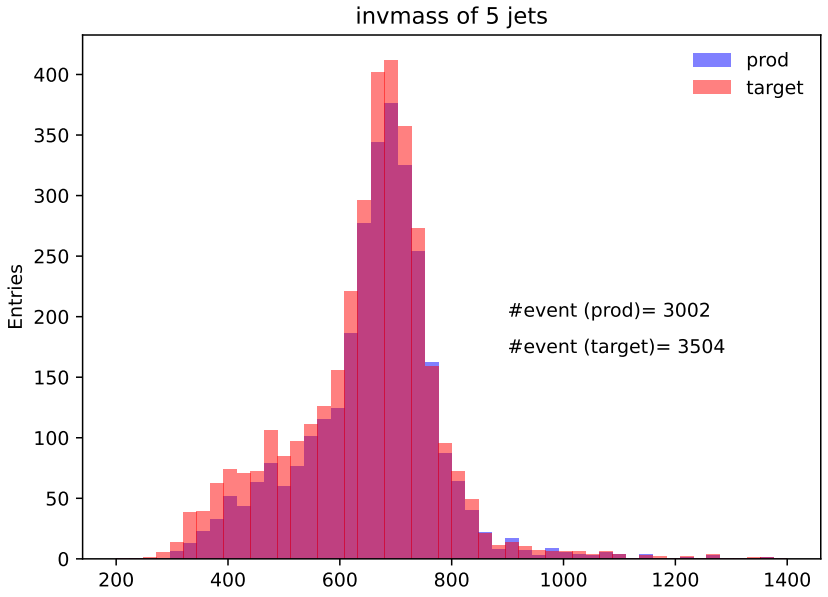
Synchronization: Recap

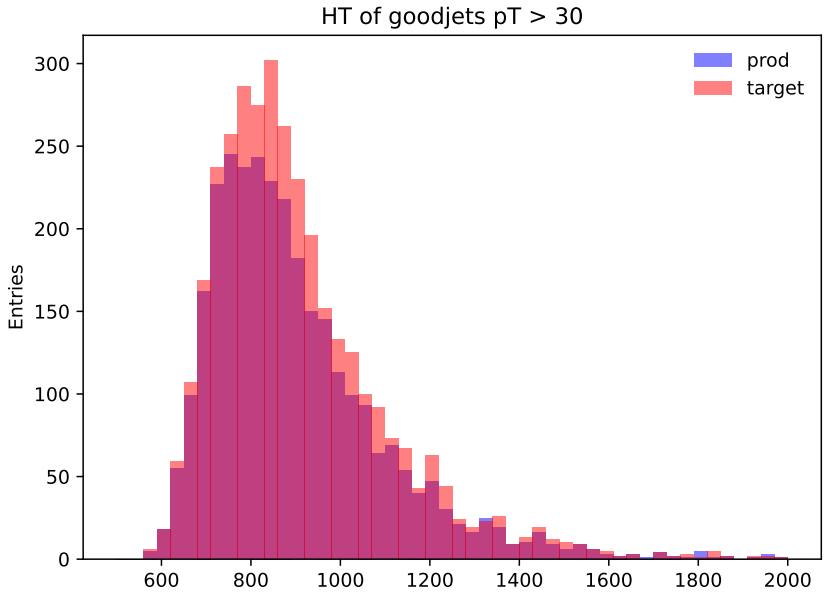
Adding more detail…

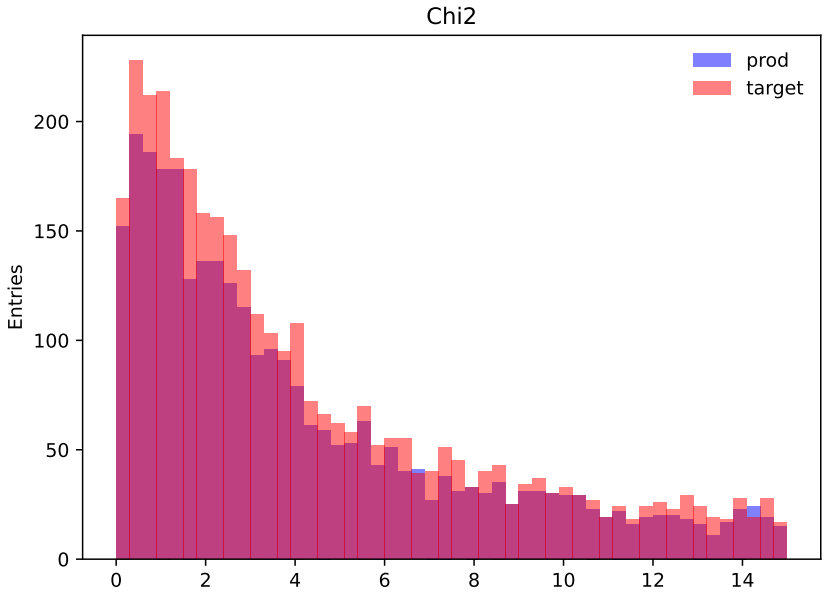
- Prod: nanoAOD + RDframework
- Target: miniAOD + previous result
- Number of events in common: 2721 → 2734

After Cut0:

1) HLT && nJets >= 6 && nb(DeepCSVT)Jets >= 3
2) jet1pt > 170 && jet2pt > 130 && jet3pt > 80 && HT (jets pT > 30) > 500
3) minimum Chi2 < 15
4) 2nd Top mass > 250
5) Higgs mass > 100







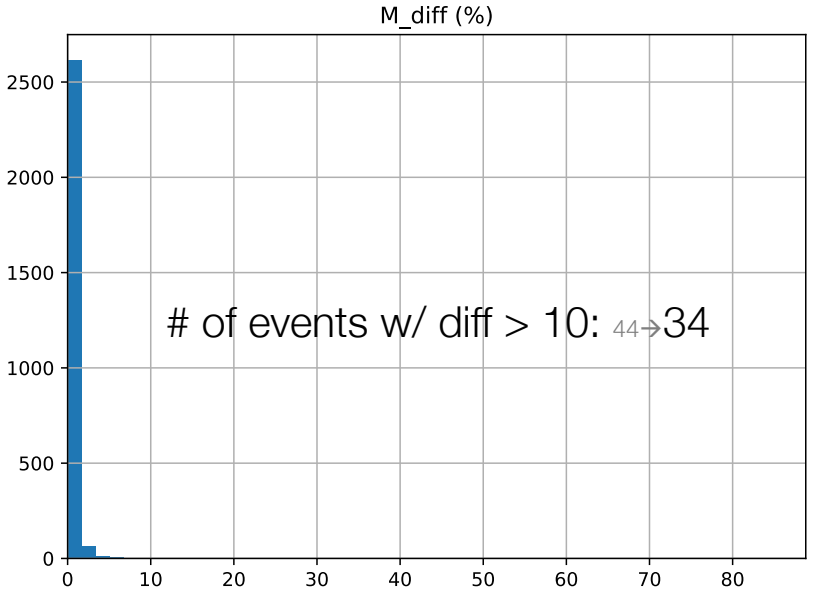
Synchronization: Recap

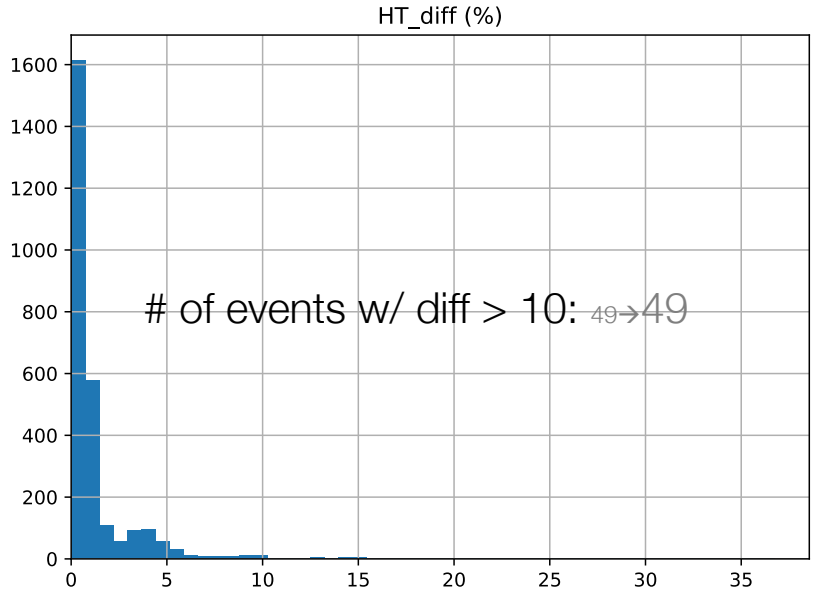
Adding more detail…

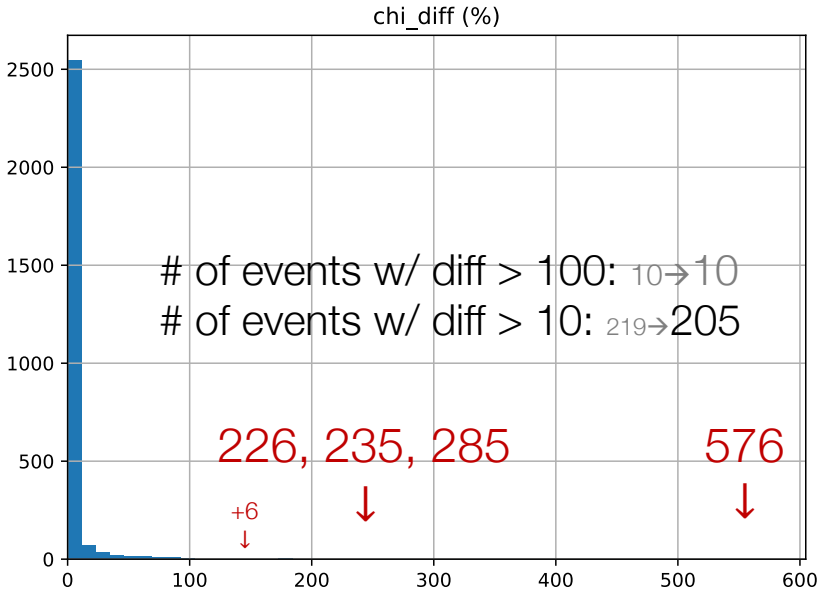
- Prod: nanoAOD + RDframework
- Target: miniAOD + previous result
- Diff: | (Prod – Target) / Target | * 100

After Cut0:

1) HLT && nJets >= 6 && nb(DeepCSVT)Jets >= 3
2) jet1pt > 170 && jet2pt > 130 && jet3pt > 80 && HT (jets pT > 30) > 500
3) minimum Chi2 < 15
4) 2nd Top mass > 250
5) Higgs mass > 100







Synchronization: Diff 576%

How Chi2 assign jets (Hb1 / Hb2 / Tbj / Wj1 / Wj2)

- Target: Jet 1 / 4 / 3 / 7 / 8

```
*****************************************************************************************************************
JET1.Pt() * JET4.Pt() * JET3.Pt() * JET7.Pt() * JET8.Pt() * First_Hig * Second_Hi * Top_Jet.P * First_W_J * Second_W_ *
*****************************************************************************************************************
249.57854 * 97.253764 * 113.99680 * 38.409073 * 30.223437 * 249.57854 * 97.253764 * 113.99680 * 38.409073 * 30.223437 *
*****************************************************************************************************************
```

- Prod: Jet 1 / 4 / 3 / 7 / 8

```
*****************************************************************************************************************
selJet_pt * selJet_pt * selJet_pt * selJet_pt * selJet_pt * selJet_pt *    Hb1_pt *    Hb2_pt *    Tbj_pt *    Wj1_pt *    Wj2_pt *
*****************************************************************************************************************
249.55607 * 97.247901 * 112.77773 * 48.943805 * 41.426467 * 51.953102 * 249.55607 * 97.247901 * 112.77773 * 48.943805 * 41.426467 *
*****************************************************************************************************************
```

Event 241745: Selecting the same jets → Differences arise from jet pT discrepancies

Target / Prod

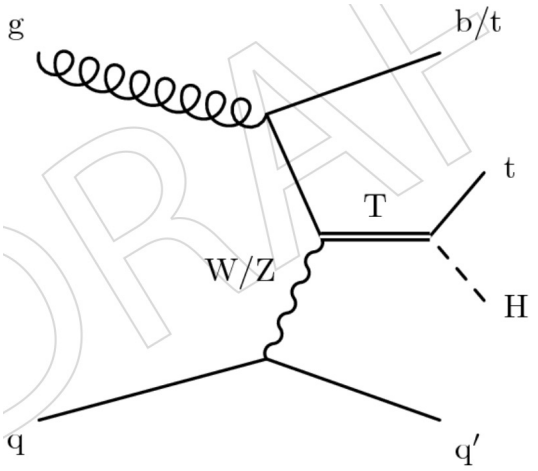
```
*****************************************************************************************************************
JET1.Pt() * JET2.Pt() * JET3.Pt() * JET4.Pt() * JET5.Pt() * JET6.Pt() * JET7.Pt() * JET8.Pt() *
*****************************************************************************************************************
249.57854 * 153.86052 * 113.99680 * 97.253764 * 54.352136 * 50.881399 * 38.409073 * 30.223437 *
*****************************************************************************************************************
```

```
*****************************************************************************************************************
* selJet_pt * selJet_pt * selJet_pt * selJet_pt * selJet_pt * selJet_pt * selJet_pt * selJet_pt *
*****************************************************************************************************************
* 249.55607 * 153.80375 * 112.77773 * 97.247901 * 51.953102 * 50.883064 * 48.943805 * 41.426467 *
*****************************************************************************************************************
```

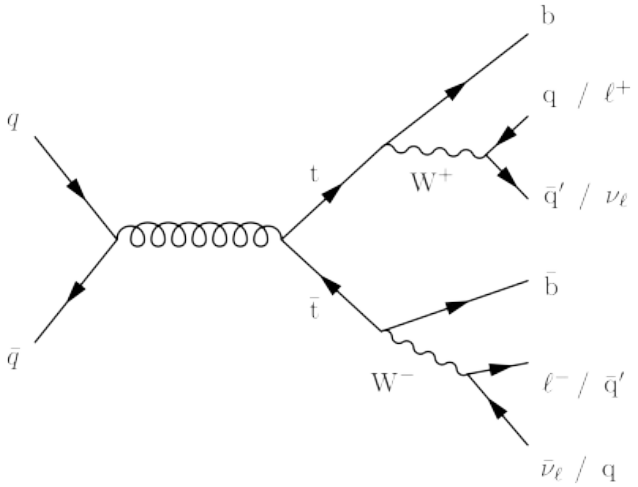
NN input features

Samples

TprimeBToTH_M-{700,1400}



TTToHadronic



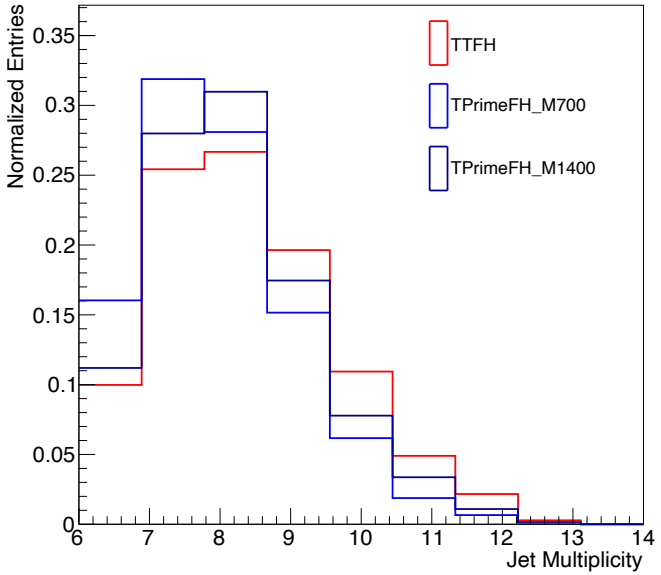
Selections

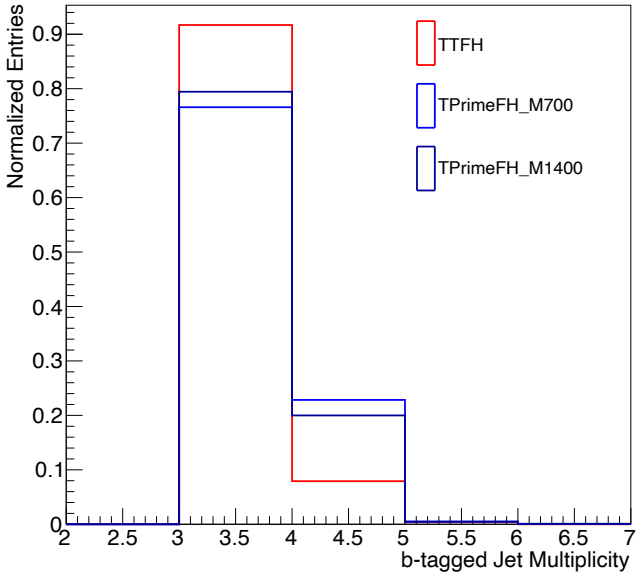
- After Cut0 : HLT + n(b)Jets with pT + HT>500 + Chi2 < 15 + H_mass > 100 + 2ndTop_mass > 250

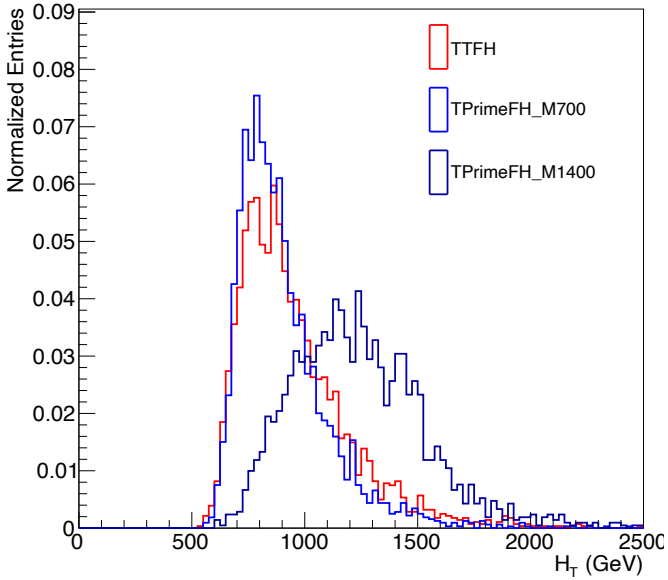
Compared variables

1. Low-level features
   - 4 vectors (pT,Eta,Phi,M) / b-discriminant value of {1st,2nd,3rd,4th ,5th} good (b)Jets
   - # of (b-tagged) jets, (good)Jet HT
2. High-level features
   - Invariant Mass / DeltaR of (b-tagged) jets : all combinations of two jets
   - Invariant Mass / DeltaR of b-tagged jets which have minimum Delta R
   - Invariant Mass / DeltaR of (b-tagged) jets selected from Chi2

Distributions of observables: Low-level





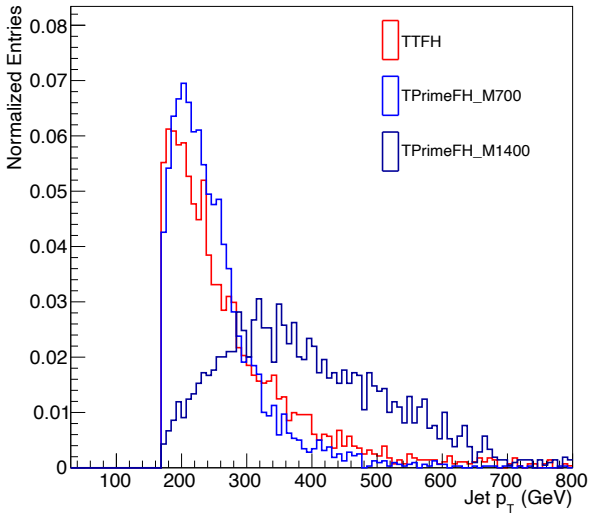


Normalized entries into 1
to compare shapes

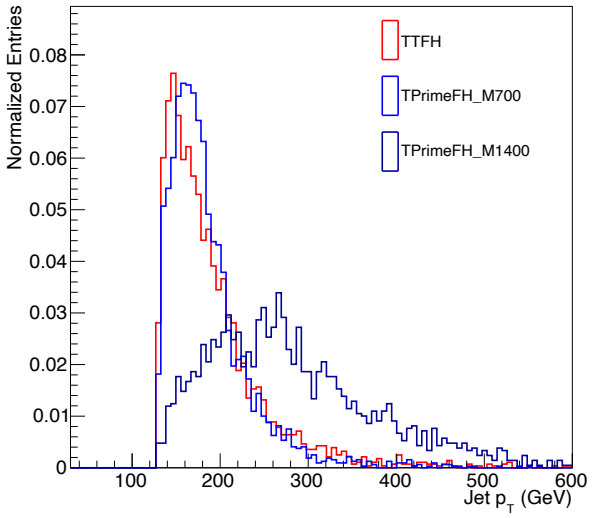
< GoodHT = HT of jets pT > 30 GeV

Distributions of observables: Jet pT

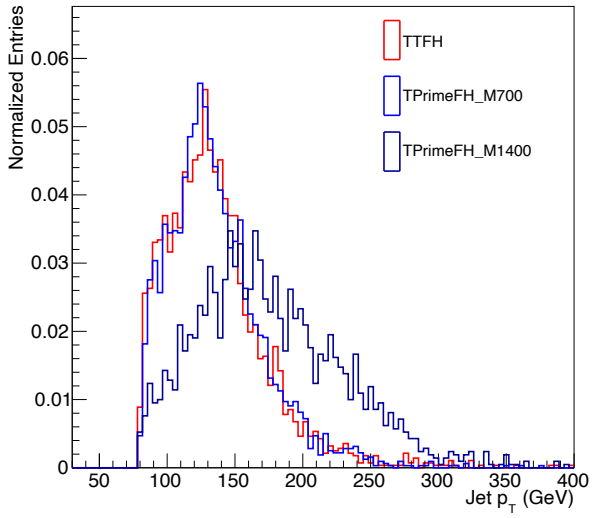
1st Jet



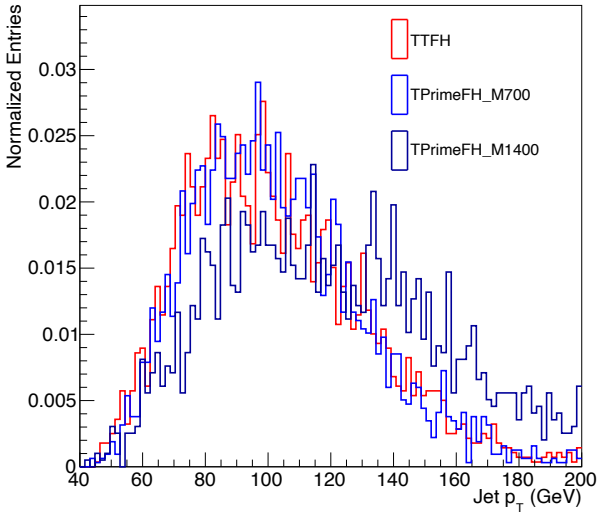
2nd Jet



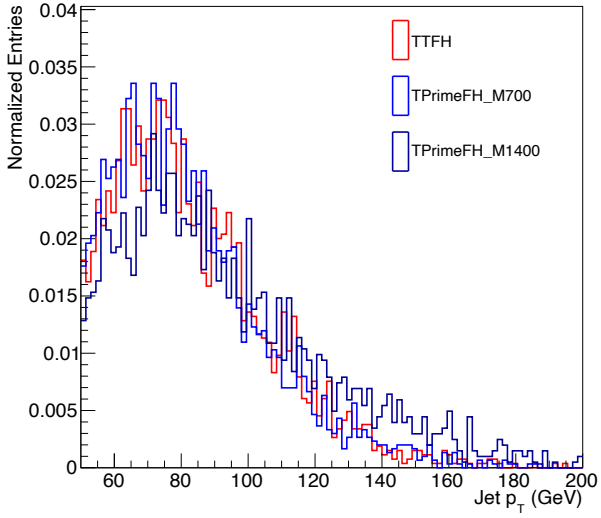
3rd Jet



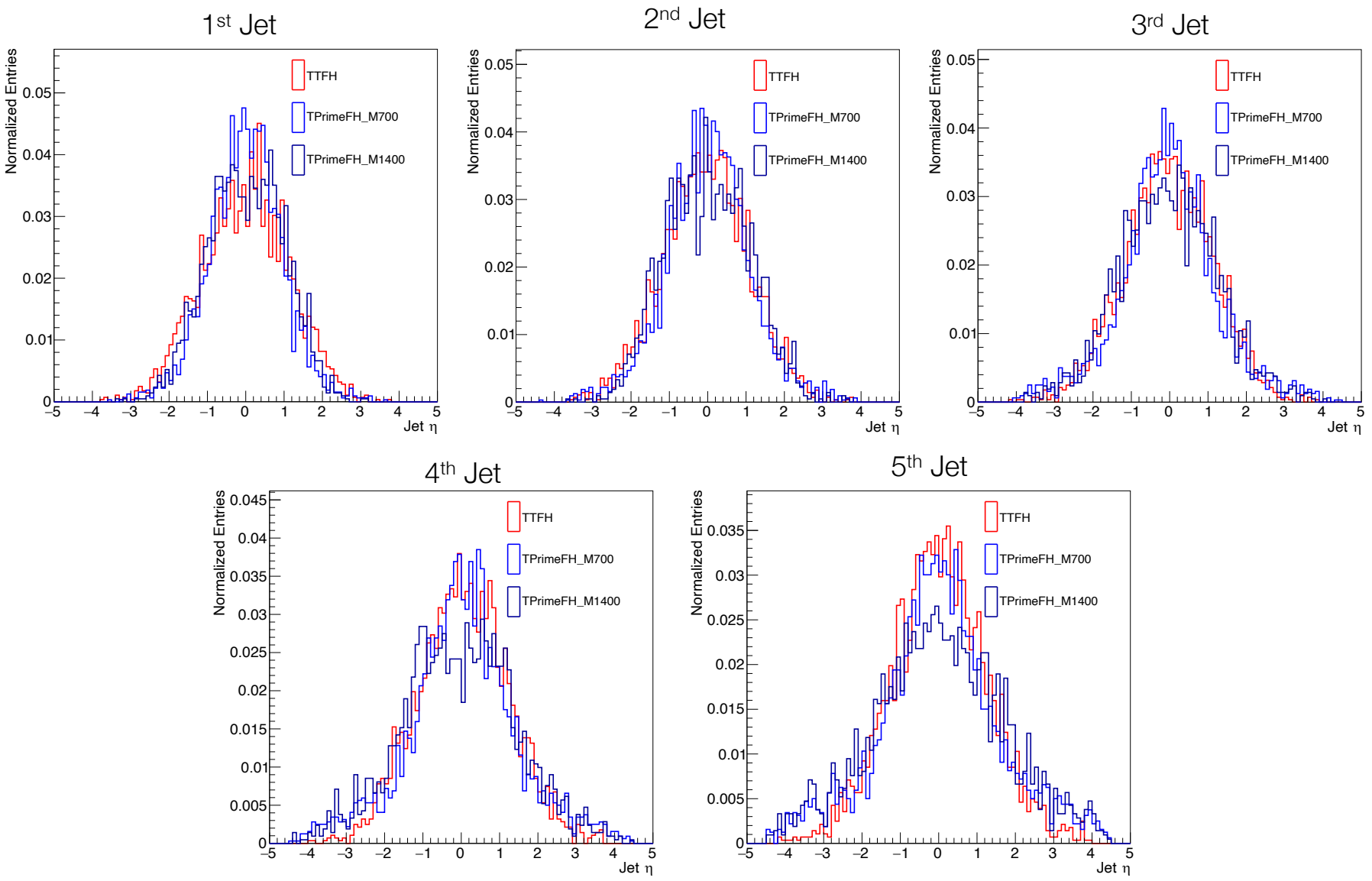
4th Jet



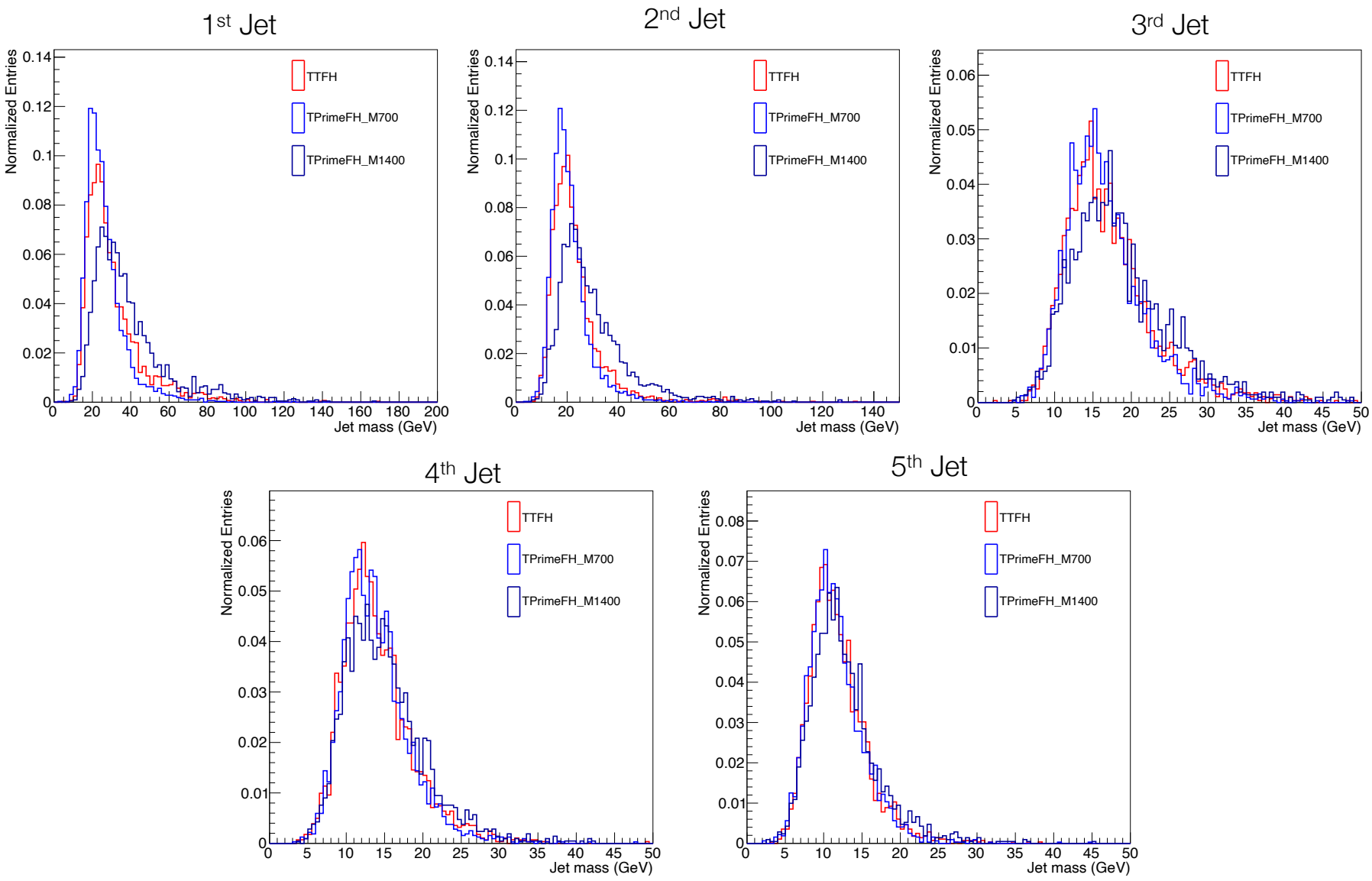
5th Jet



Distributions of observables: Jet eta

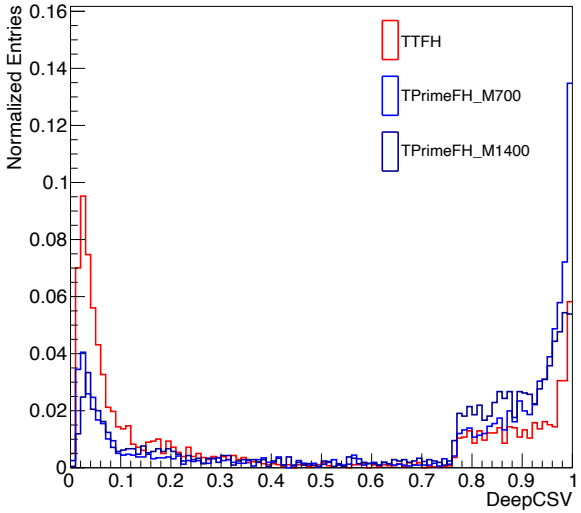


Distributions of observables: Jet mass

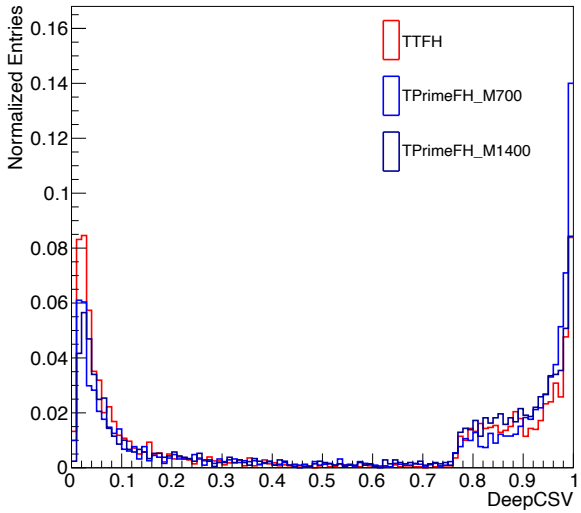


Distributions of observables: Jet btag disc.

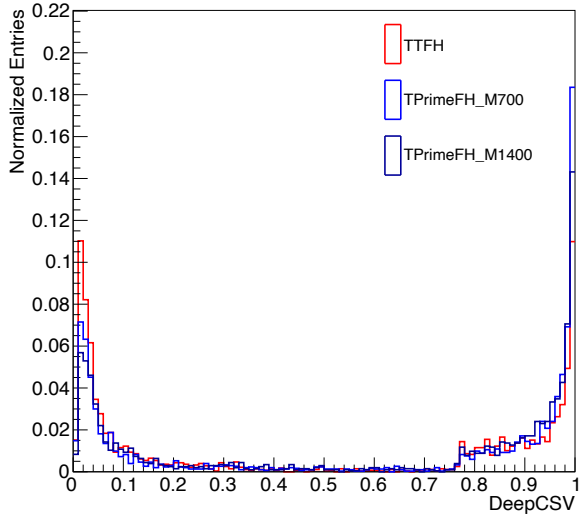
1st Jet



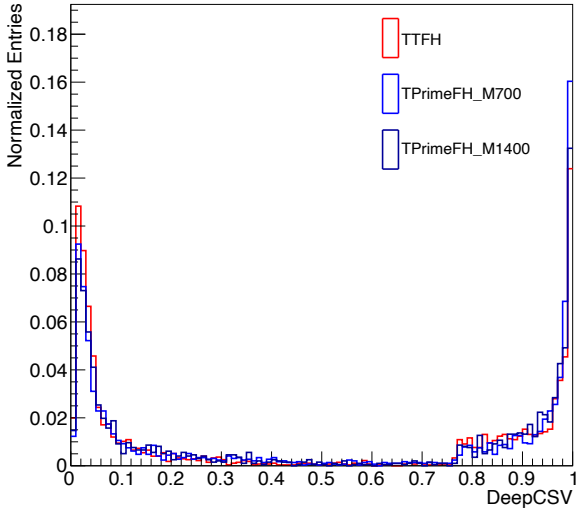
2nd Jet



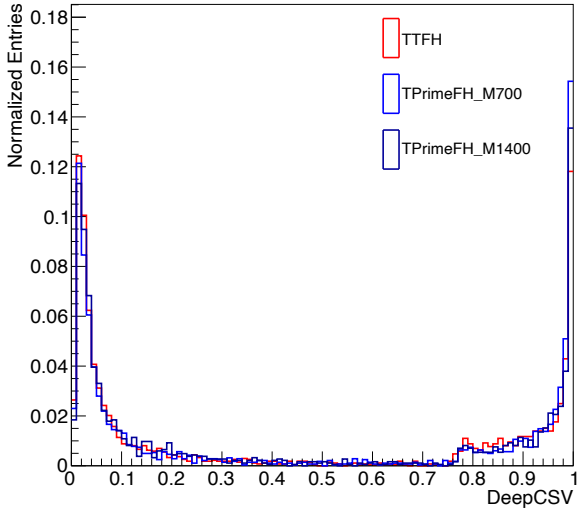
3rd Jet



4th Jet



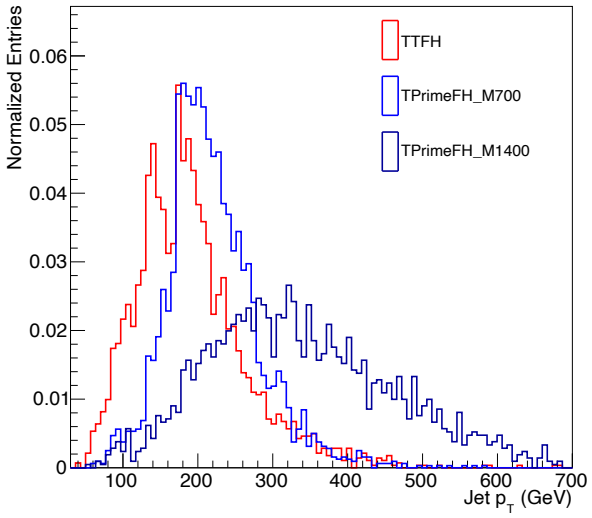
5th Jet



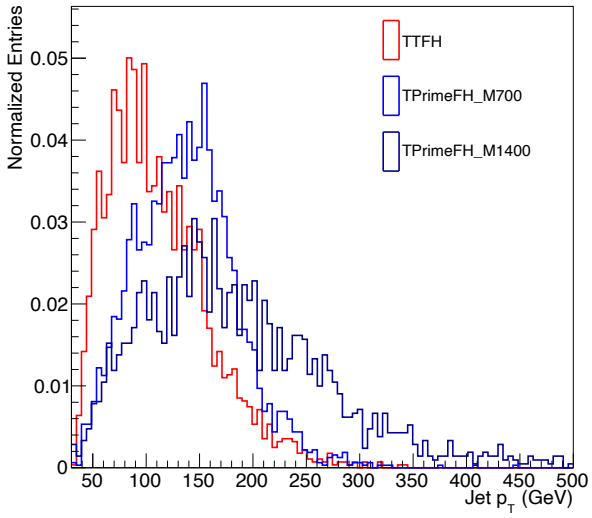
Distributions of observables: b-Jet pT, eta

pT order

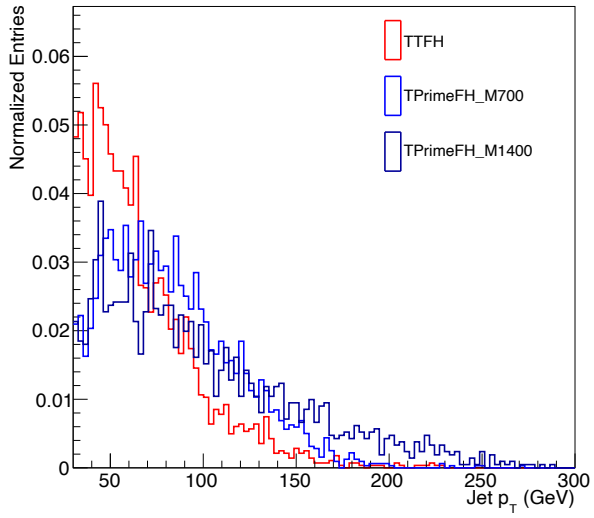
1st b-tagged Jet

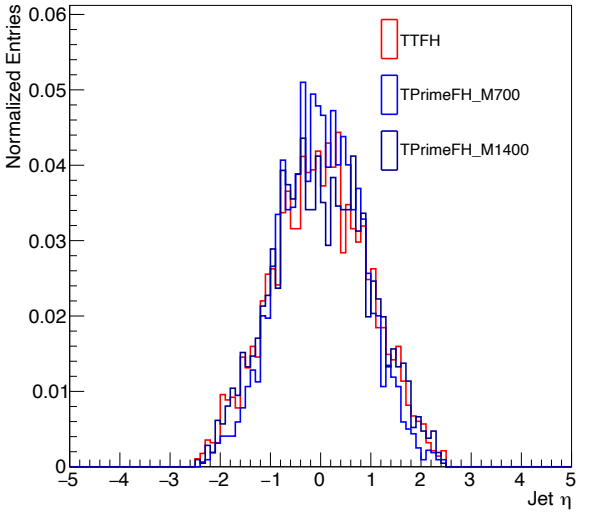


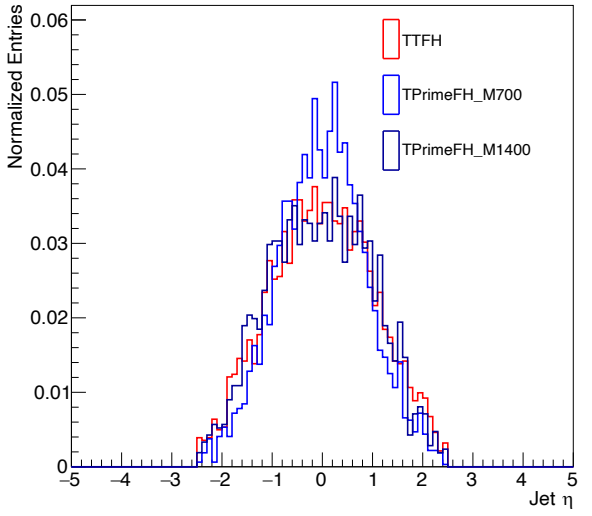
2nd b-tagged Jet

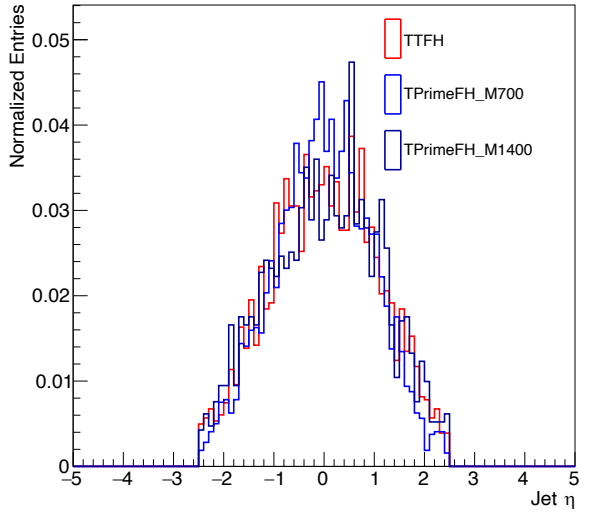


3rd b-tagged Jet





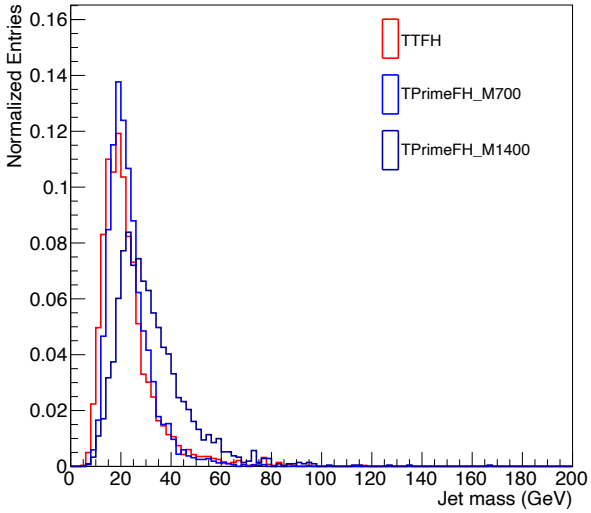




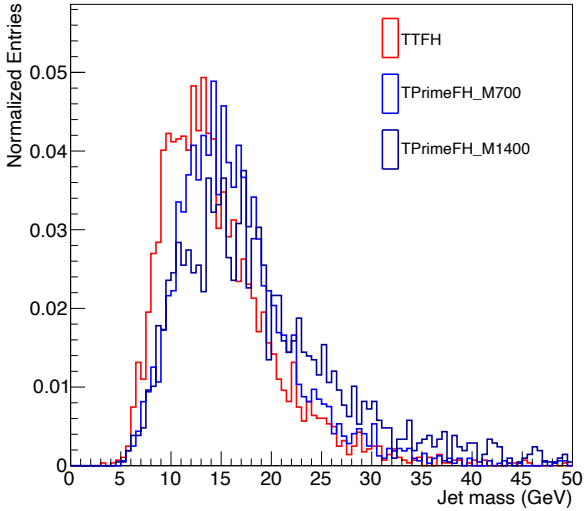
Distributions of observables: b-Jet M, b-disc.

pT order

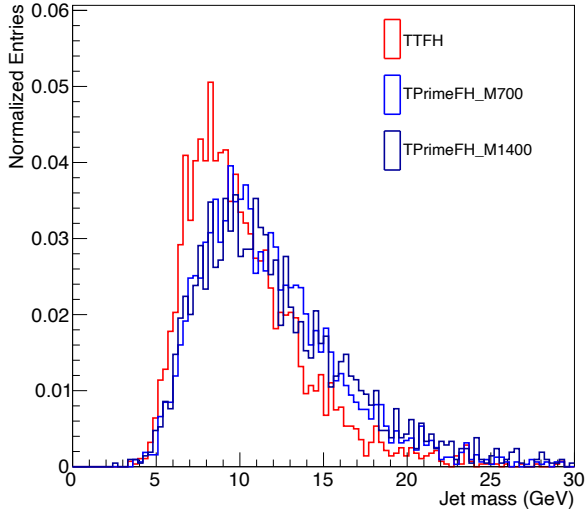
1st b-tagged Jet

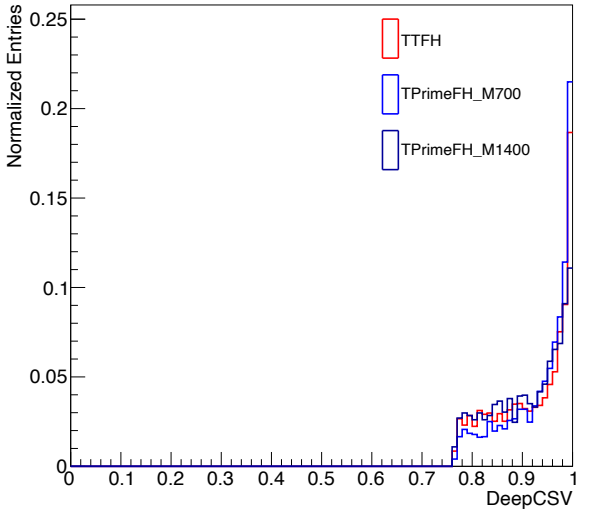


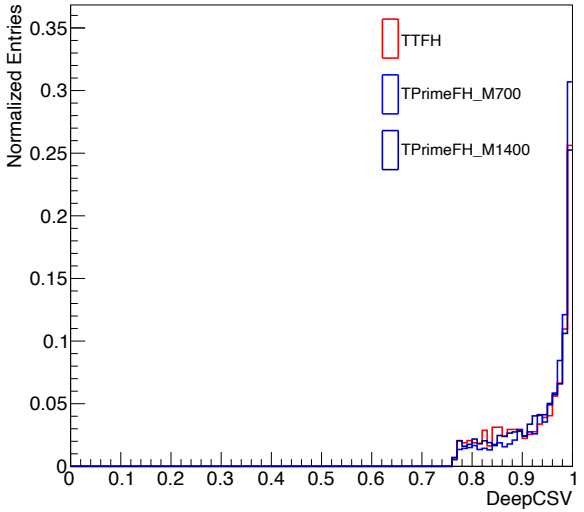
2nd b-tagged Jet

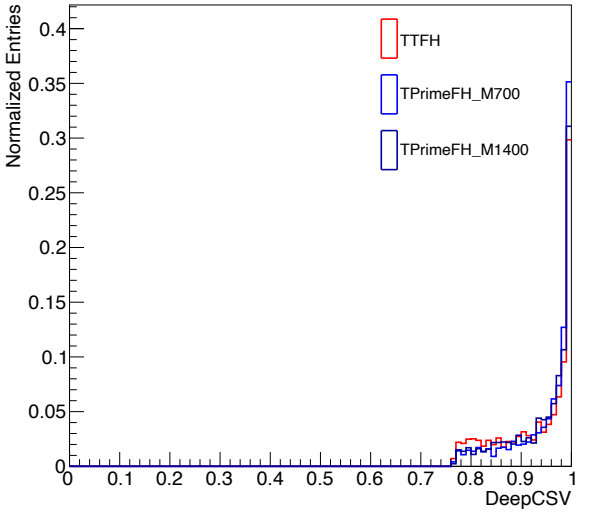


3rd b-tagged Jet

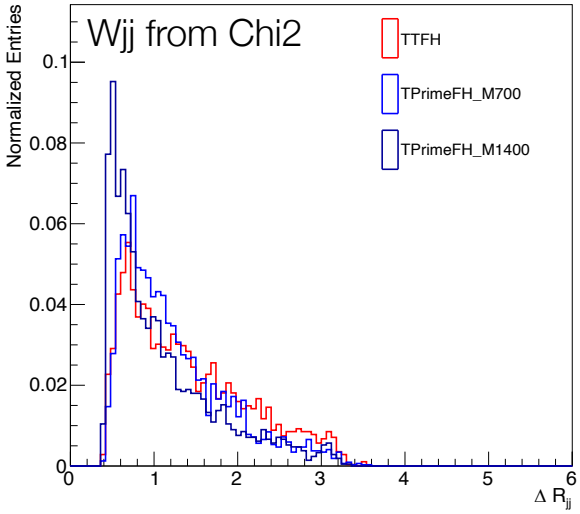


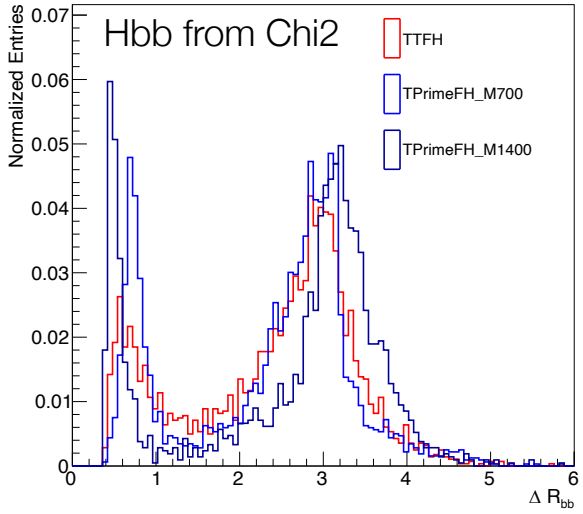


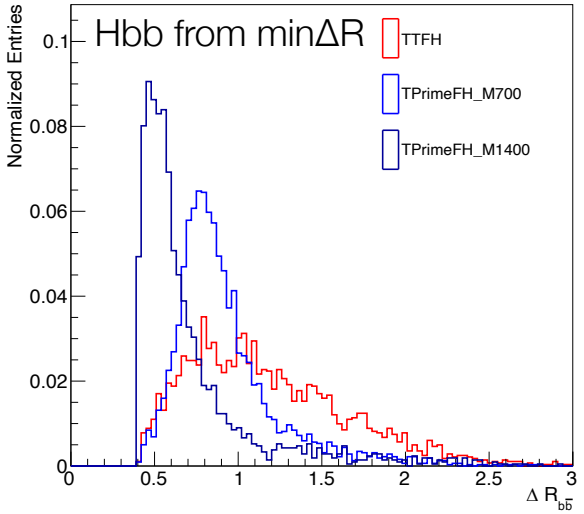


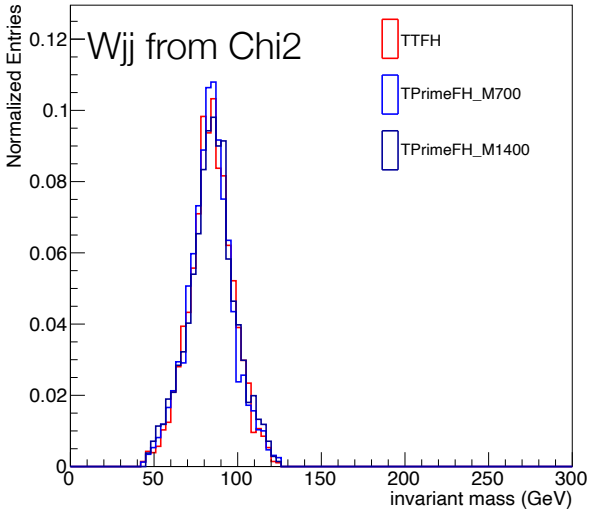


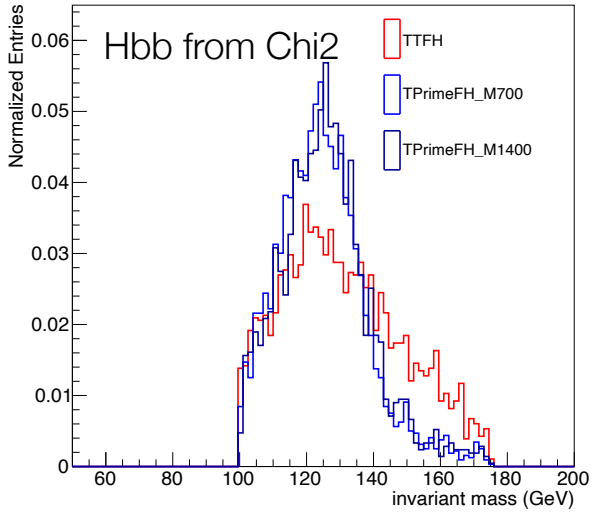
Distributions of observables: High-level

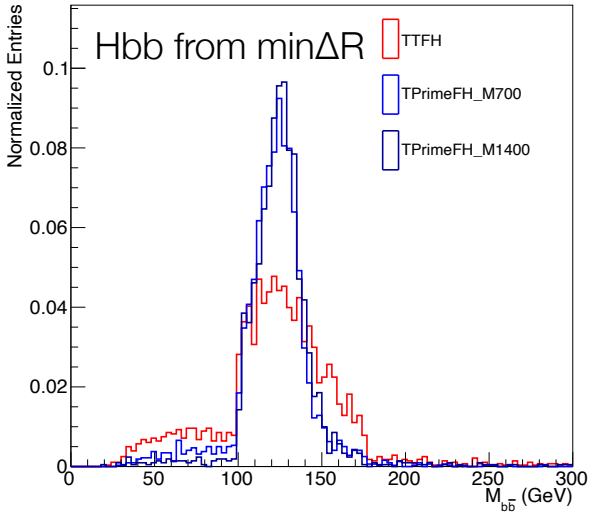




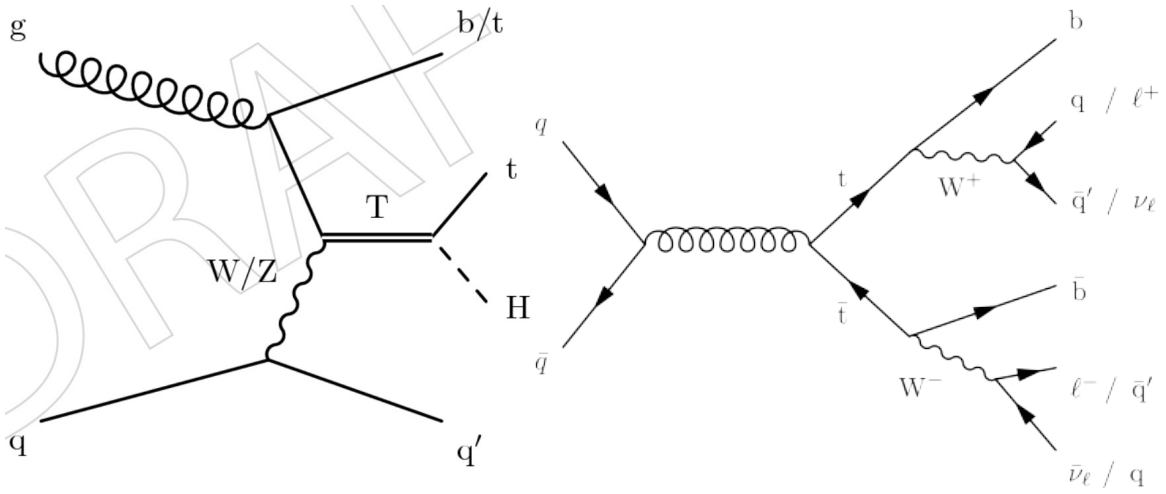


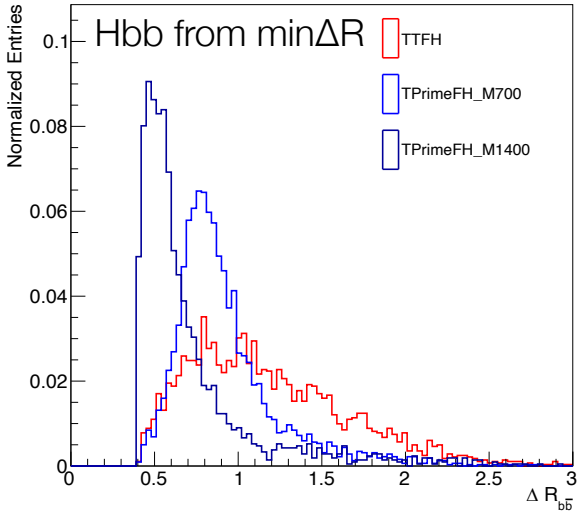






Distributions of observables: High-level

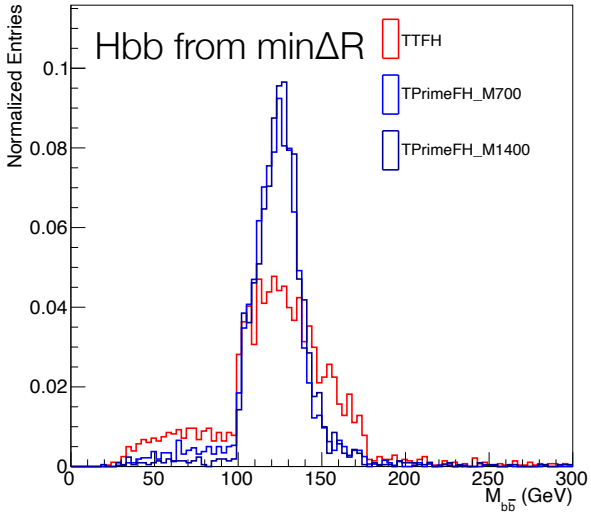




minΔR works for finding Higgs!

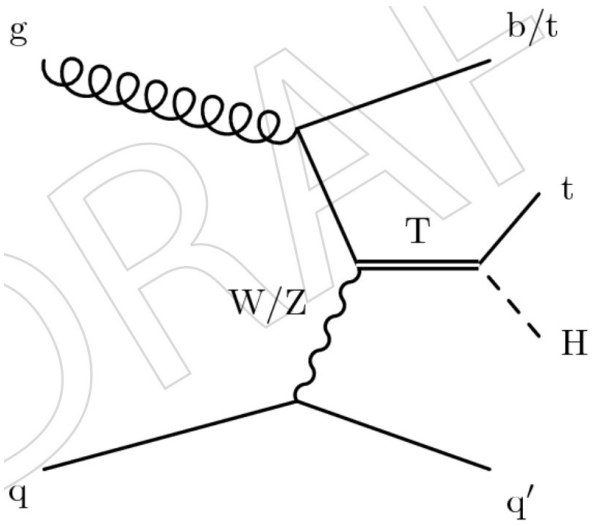
- ΔR between Hbb(minΔR) and jets (Wjj or others)
- …

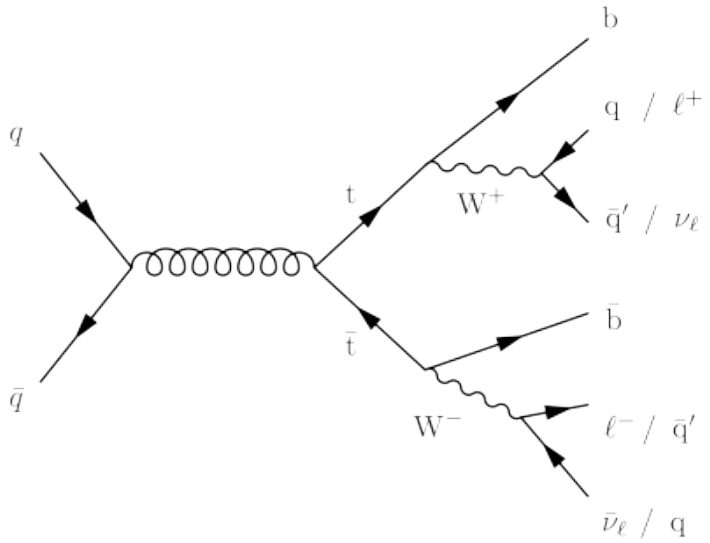
How about tHq cases..?



NN brainstorming

Tprime FH vs ttbar FH





- Resonances: Depends on Tprime mass

Typical attempts of NN for searching new masses

1. Train a single NN with an intermediate mass value (ex)
2. Train a single NN with an unlabeled mixture of signal sample
3. Train a set of NNs with a set of mass values
4. True mass as input features : parameterized NN?