Refine Cut Strategy

- **Focus on 1 signal process for now**
  - **T'->tH; t->Wb->qqb; H->WW->m+m-*vv* (1 lepton pair, 3 jets and at least 1 b jet)**

- **Basic cuts**
  - **Cuts for muons**
    - **Tight ID cut: Muon_tightId**
    - **Pt(mu) > 20GeV**
    - **|eta| < 2.4**
    - **Tight isolation cut: goodMuons_miniPFRelIso_all < 0.05**
    - **Muon_sip3d < 3**
  - **Cuts for jets**
    - **Tight jet ID cut: Jet_jetId: 6**
    - **Pt(jet) > 30GeV**
    - **|eta| < 2.5**
  - **Cuts for events**
    - **1 OS muon pair (2 muons)**
    - **At least 3 jets**
    - **At least 1 b jet**
      - **Loose b-tag jet: goodJets_btagDeepFlavB>0.049**

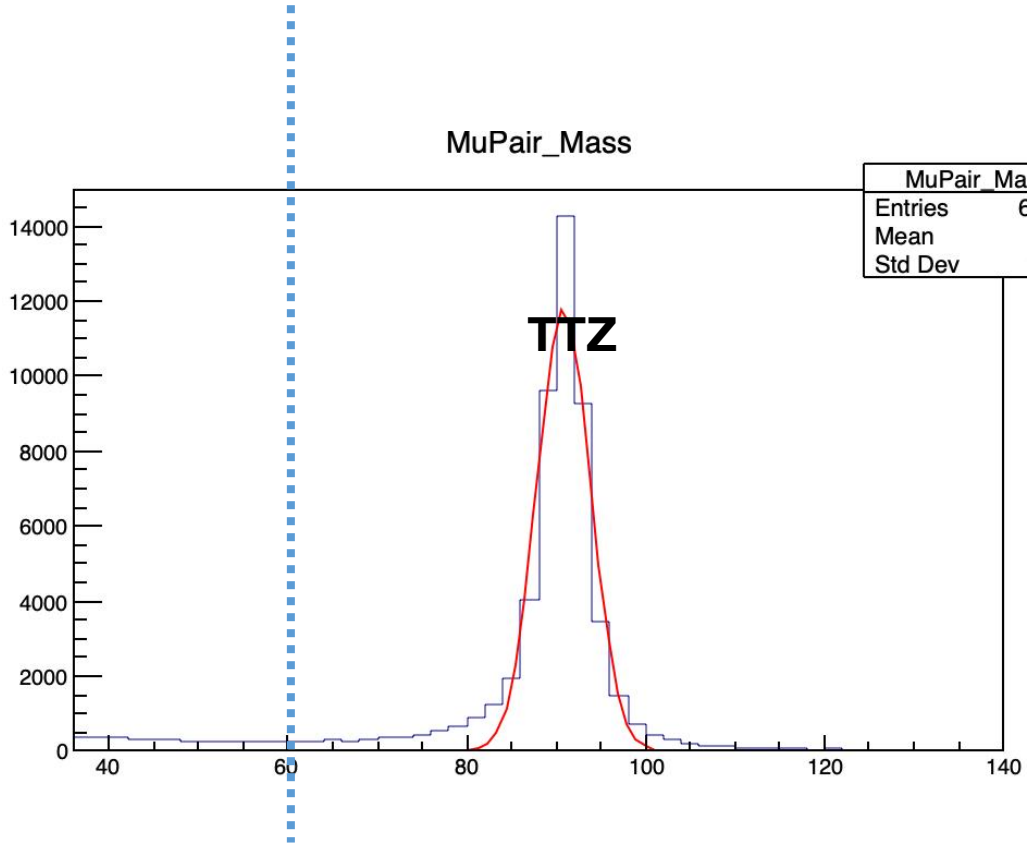
After Basic Selection

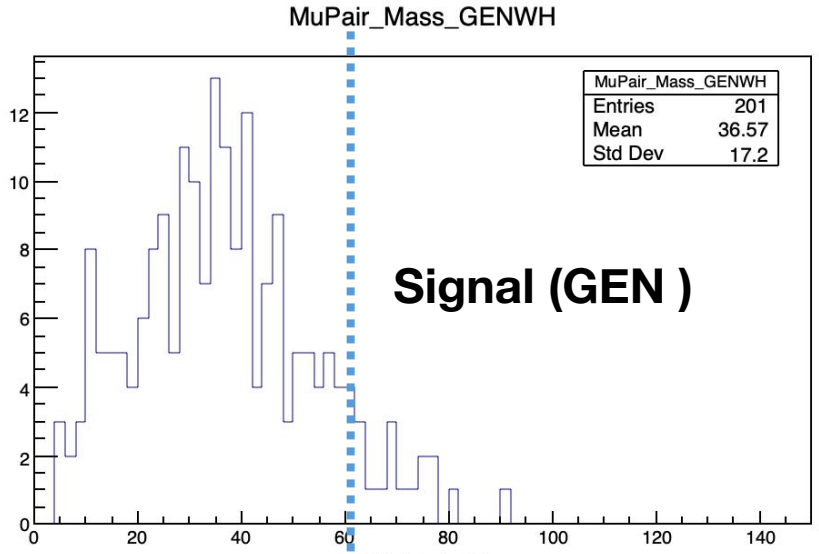
- **Signal: Basic cuts && GEN selection (H->W->mu)**
  - **2016, 2016apv, 2017& 2018 Official UL MC samples**
  - **Find 2.25 events (cross-section 89fb)**
- **Background: Basic cuts**
  - **TTbar, TTZ, TTH, TTW**

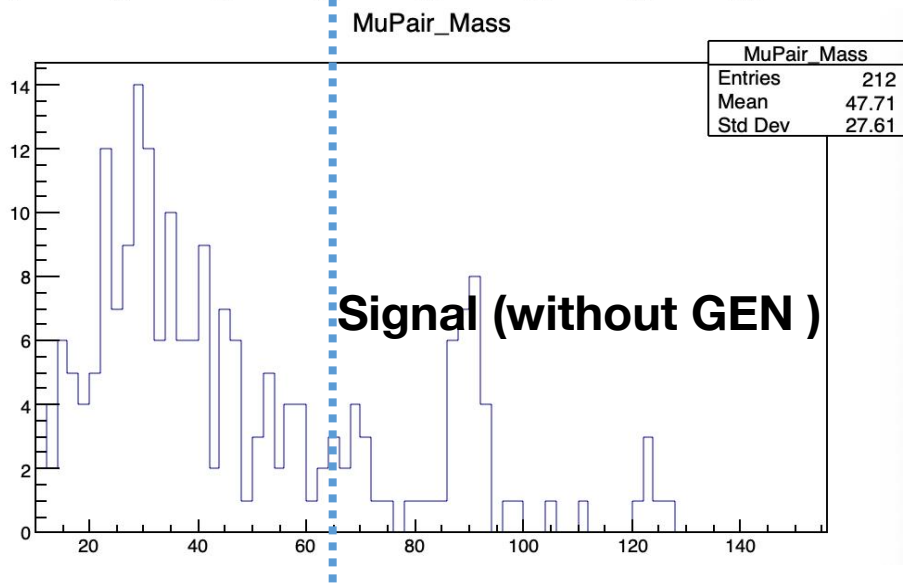
Cuts	N_signal (89fb)	N_signal GEN (89fb)	Signal ϵ	Signal Purity	N_TTbar (87315fb)	N_WW&WZ (12178 fb)	N_TTZ (770 fb)	N_TTW (610.5 fb)	S(GEN)/B
Basic cuts	9.53	2.25	100%	24%	36878	75	883	182	0.006%

Cut0 : Mu Pair Mass < 60

- **Remove Z peak and Higgs peak in Muon pair mass distribution**
  - **Add mass window cut: Mu Pair Mass <60**
  - **Remove many TTZ**
  - **Remove TTbar& TTW as well :-)**







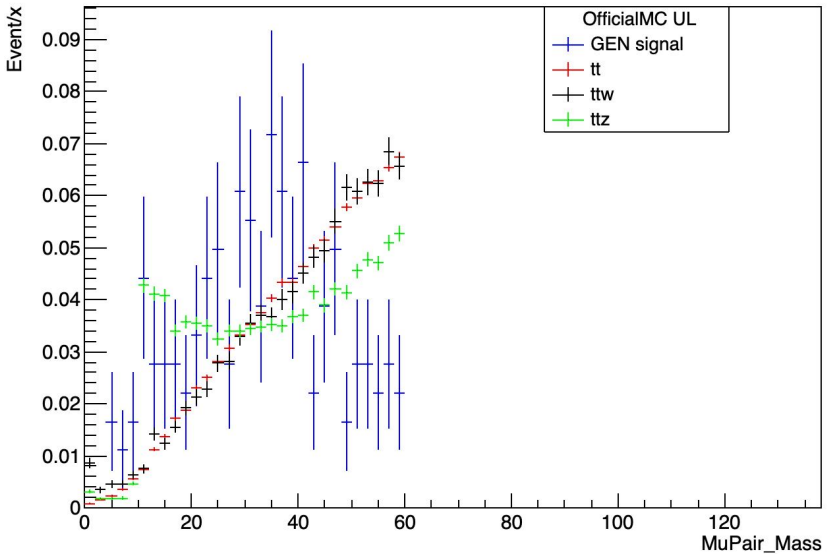
Cut0 : Mu Pair Mass < 60

- $\epsilon = N(\text{Gen} \&\& \text{Seclection})/N(\text{Gen})$
- Purity = $N(\text{Gen} \&\& \text{Seclection})/N(\text{Selection})$
  - Gen: H->W->mu

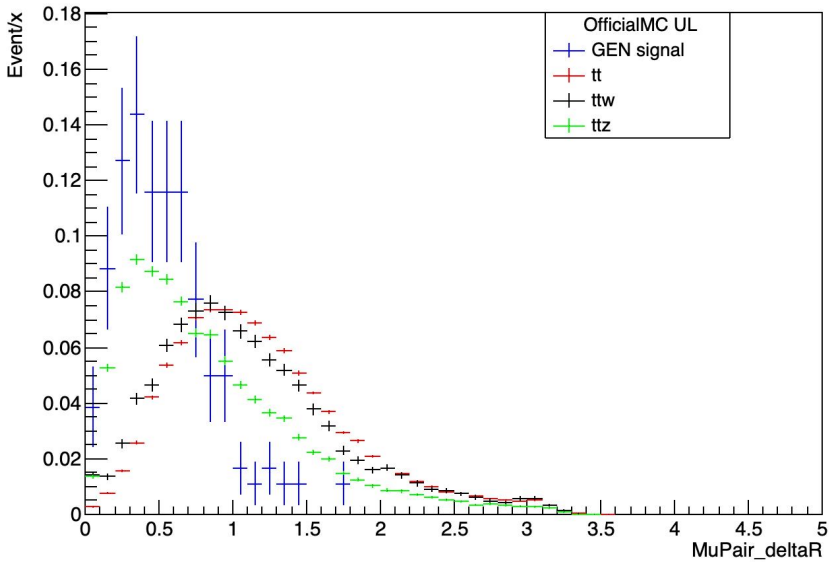
Cuts	N_signal (89fb)	N_signal GEN (89fb)	Signal ϵ	Signal Purity	N_TTbar (87315fb)	N_WW&WZ (12178 fb)	N_TTZ (770 fb)	N_TTW (610.5 fb)	S(GEN)/B
Basic cuts	9.53	2.25	100%	24%	36878	75	883	182	0.006%
Basic cut && cut0	5.60	2.03	90%	36%	8076	1 (ignore it)	63	28	0.025%

After Basic Cuts && Cut0

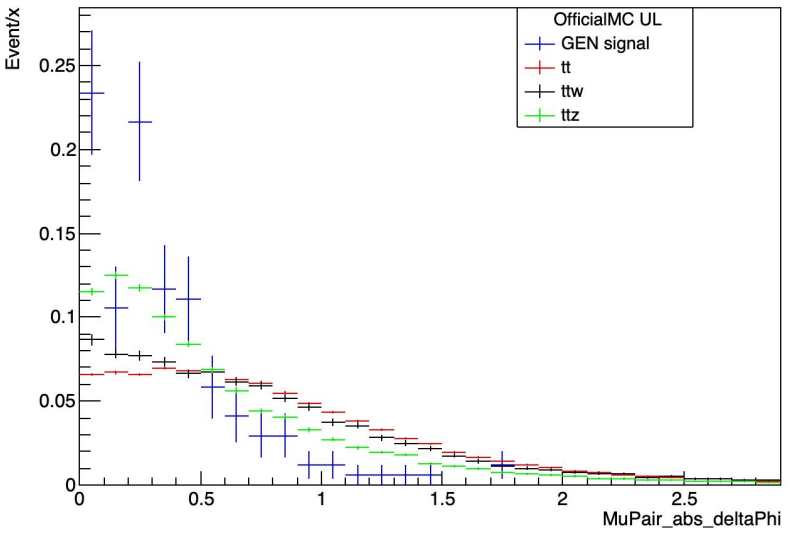
MuPair_Mass_GENWH



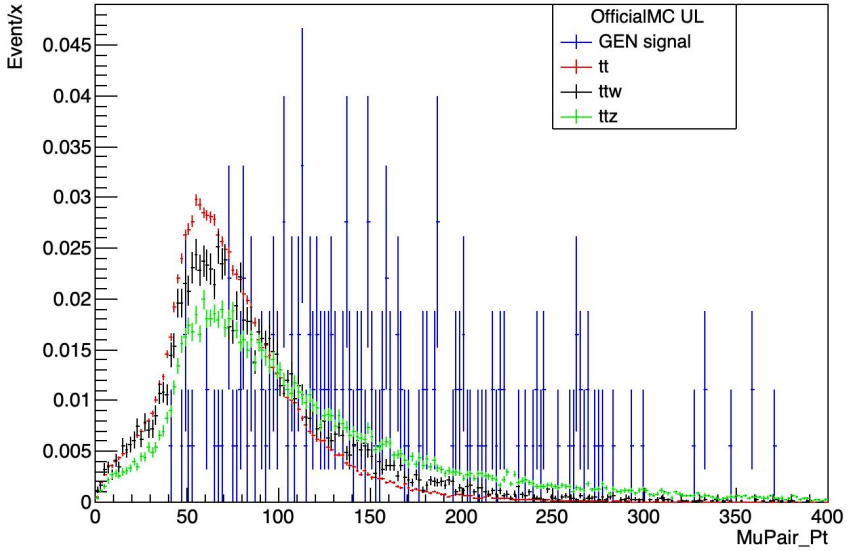
MuPair_deltaR_GEN_HW



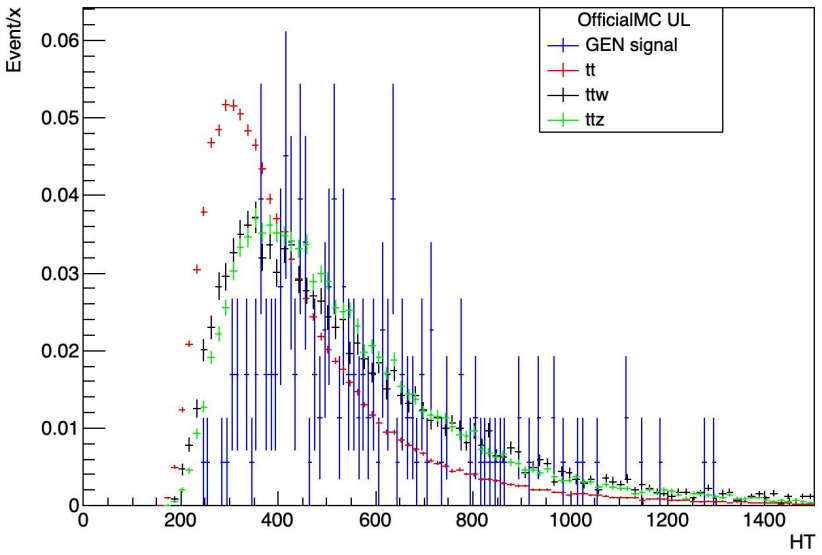
MuPair_abs_deltaPhi_GEN_HW



MuPair_Pt_GEN_HW



HT



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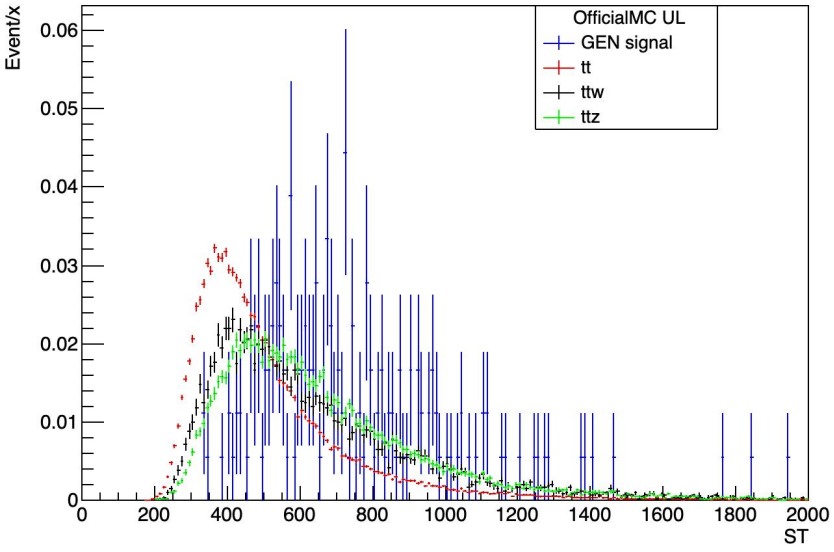
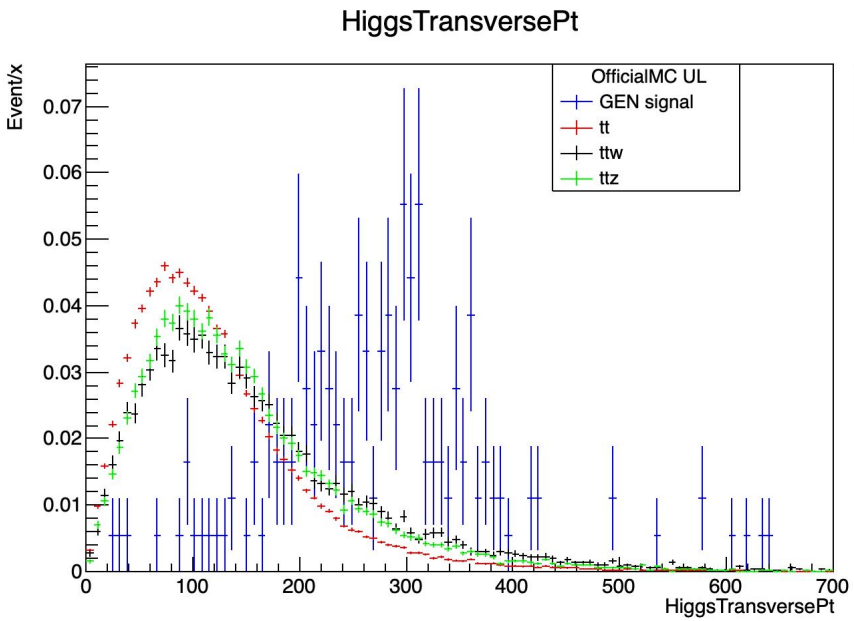
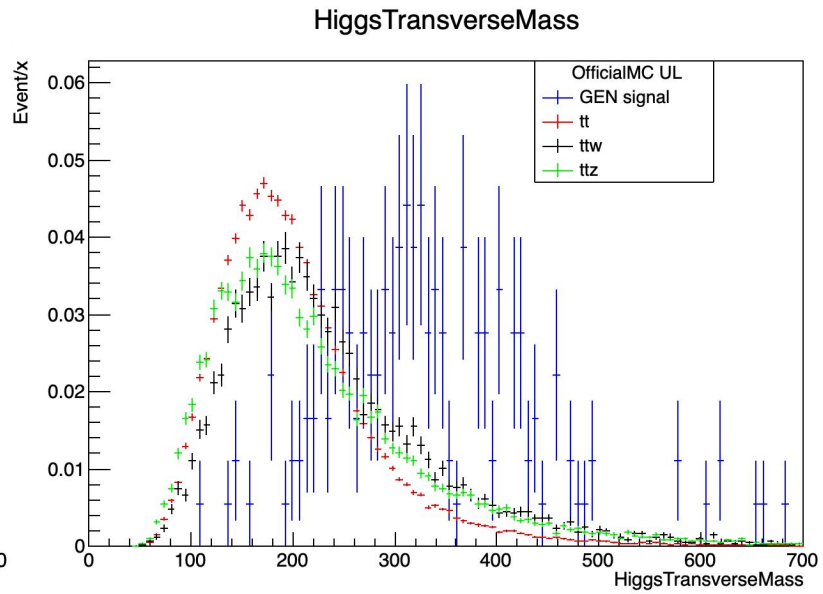
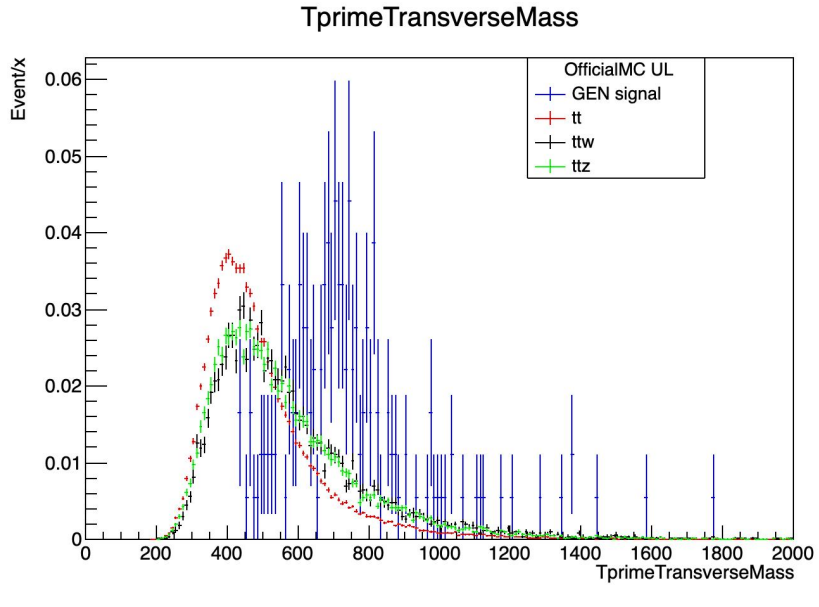


After Basic Cuts && Cut0





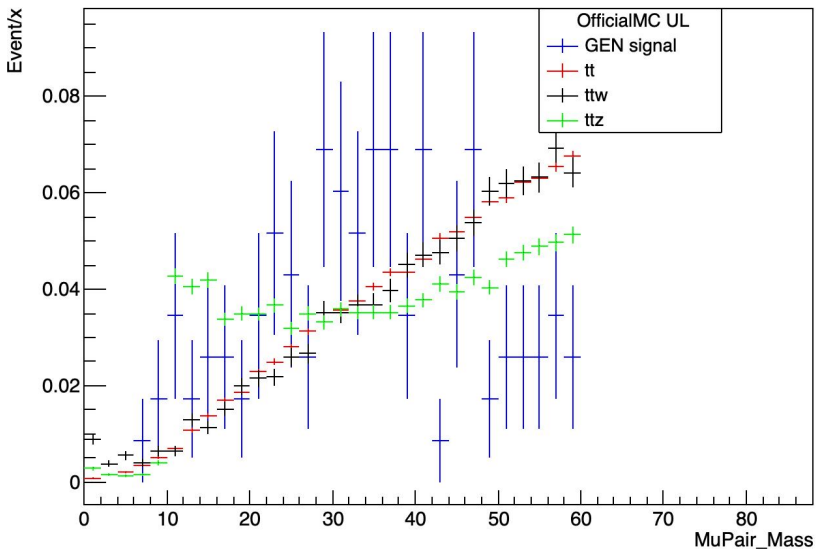


Cut1: Xmin < 18

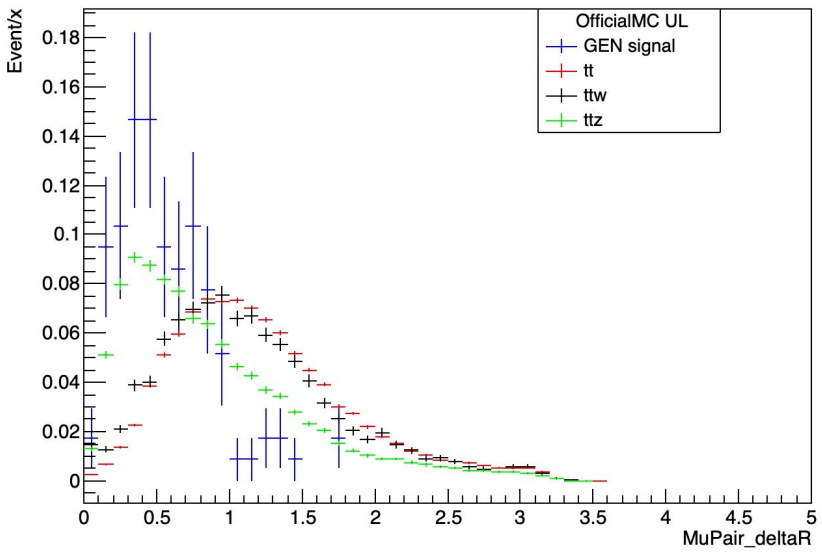
Cuts	N_signal (89fb)	N_signal GEN (89fb)	Signal ϵ	Signal Purity	N_TTbar (87315fb)	N_TTZ (770 fb)	N_TTW (610.5 fb)	S(GEN)/B
Basic cuts	9.53	2.25	100%	24%	36878	883	182	0.006%
Basic cut && cut0	5.60	2.03	90%	36%	8076	63	28	0.025%
Basic cut && cut0 && cut1	2.41	1.30	58%	54%	5735	46	20	0.022%

After Basic Cuts && Cut0 &&Cut1

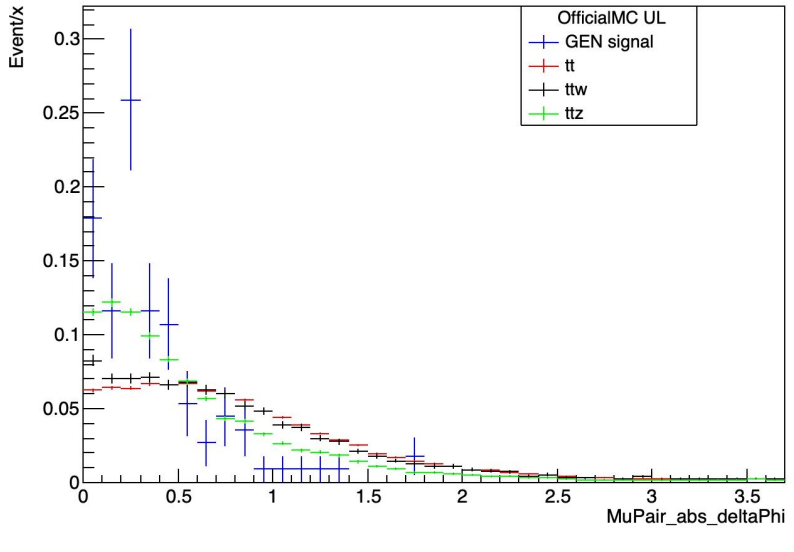
MuPair_Mass_GENWH



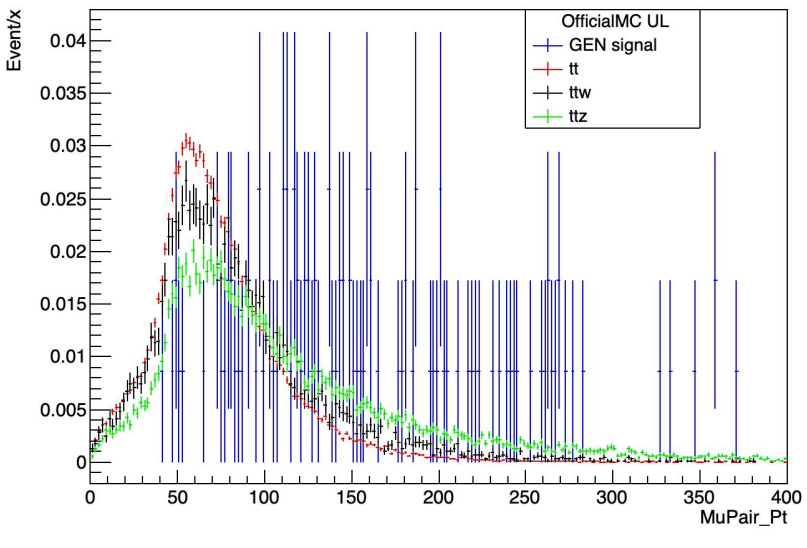
MuPair_deltaR_GEN_HW



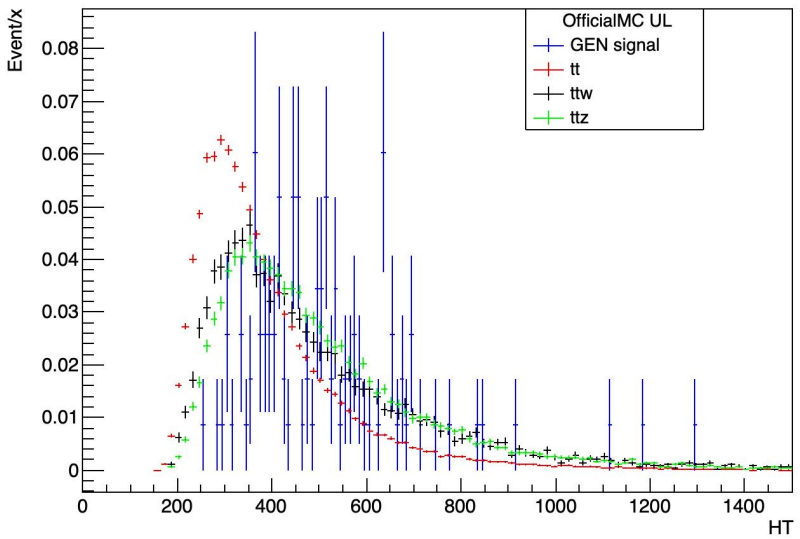
MuPair_abs_deltaPhi_GEN_HW



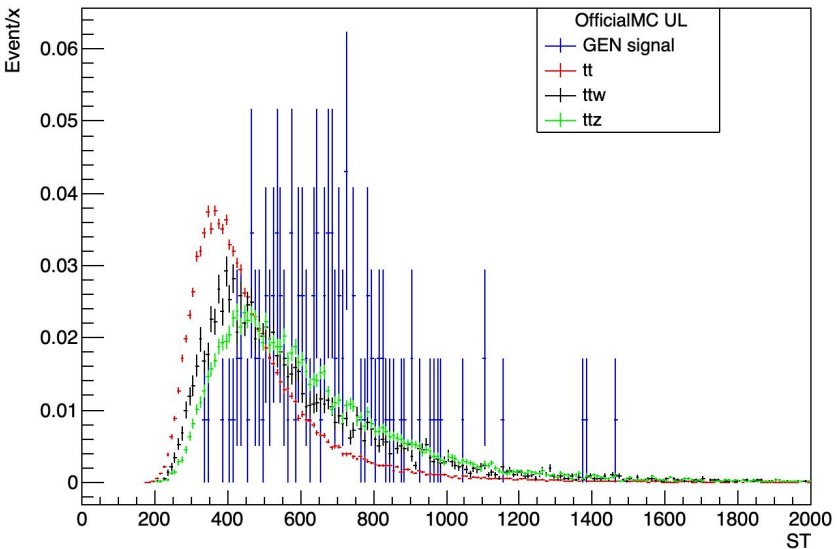
MuPair_Pt_GEN_HW



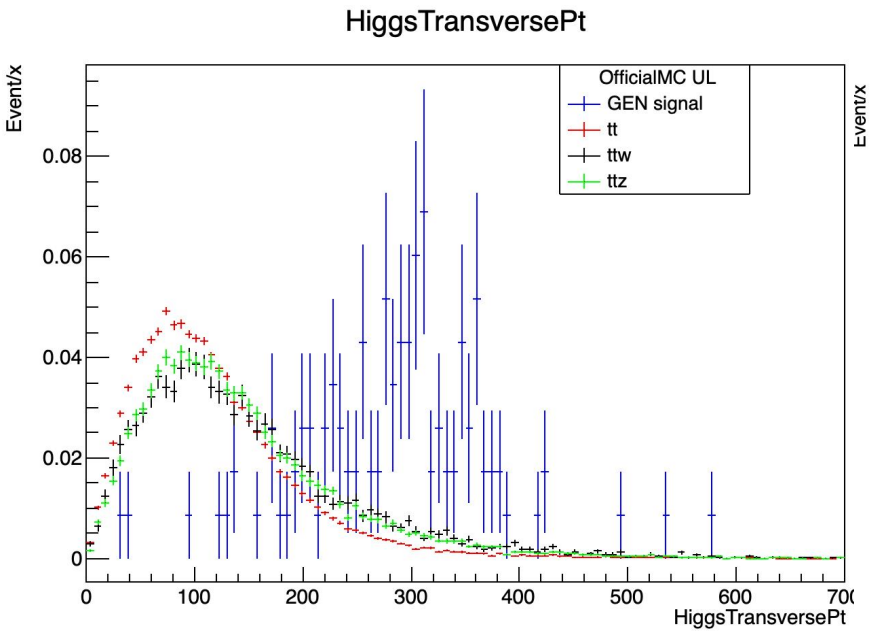
HT

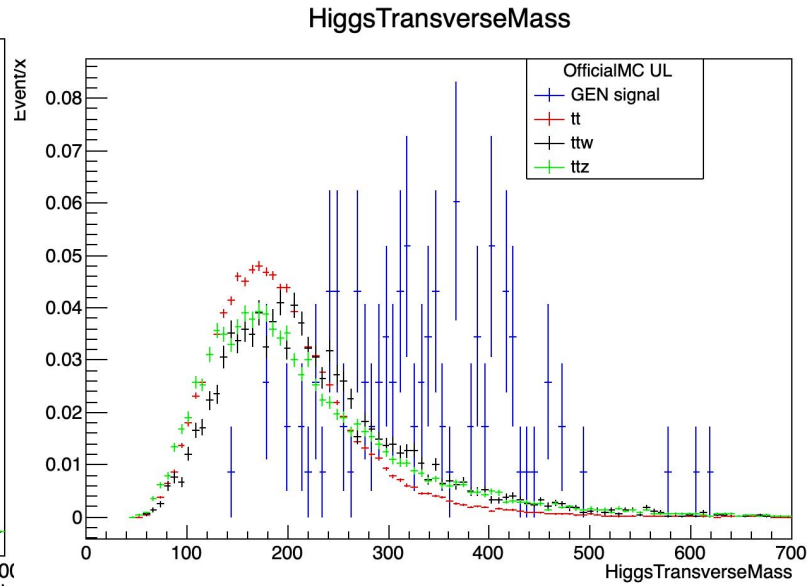


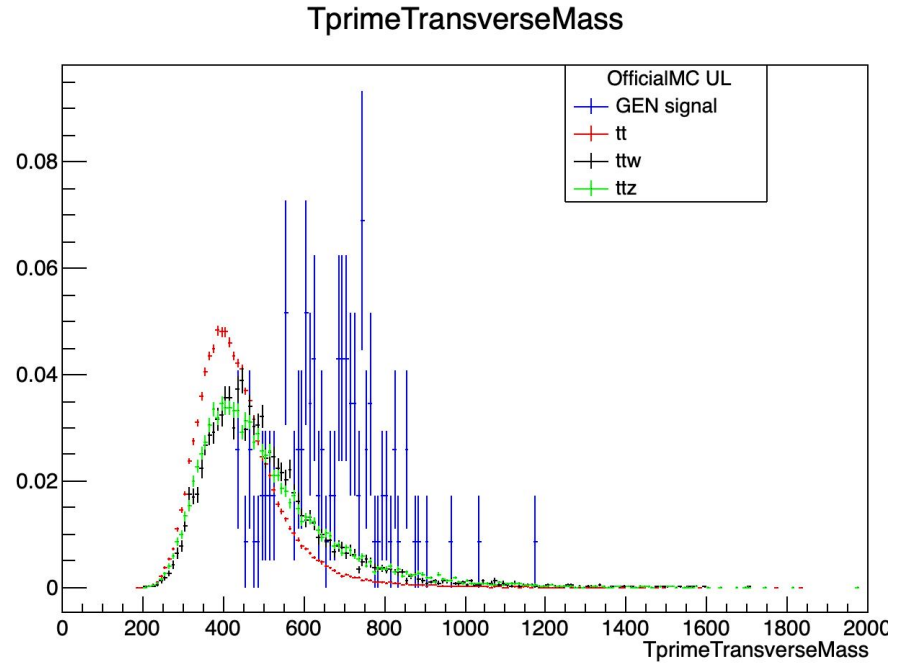
ST



After Basic Cuts && Cut0 &&Cut1

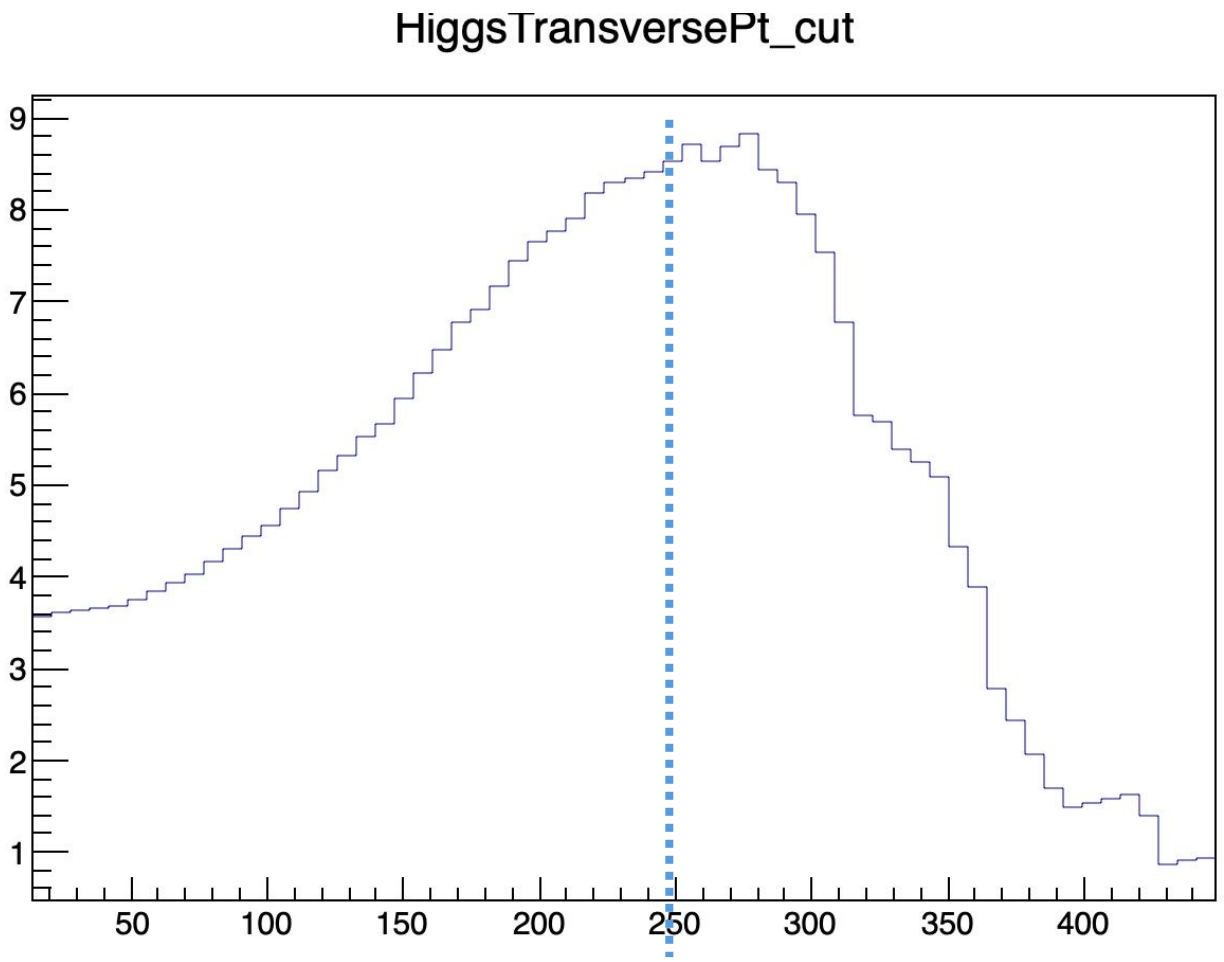






Cut2: Higgs Transverse pT > 250

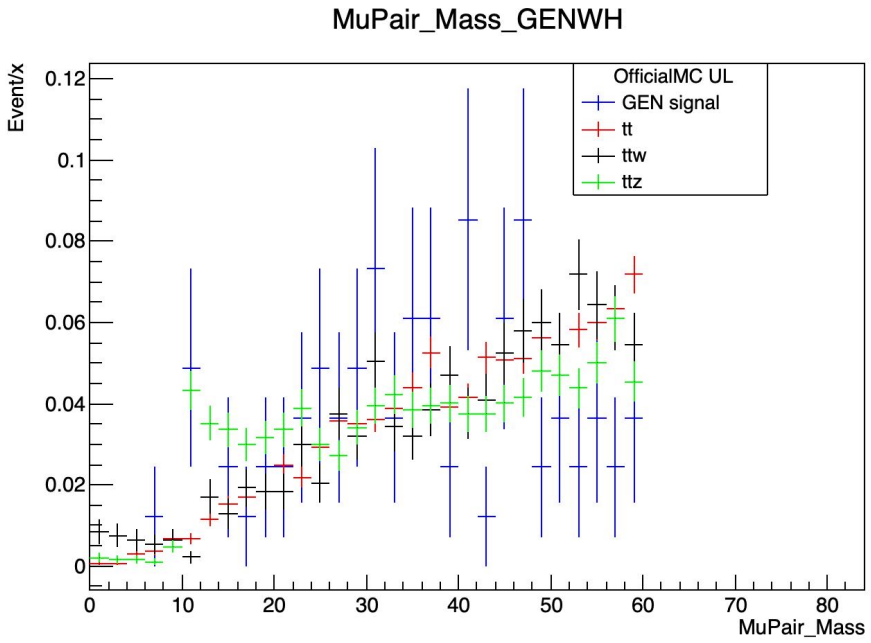
- **Include 2 muons and missing Et**

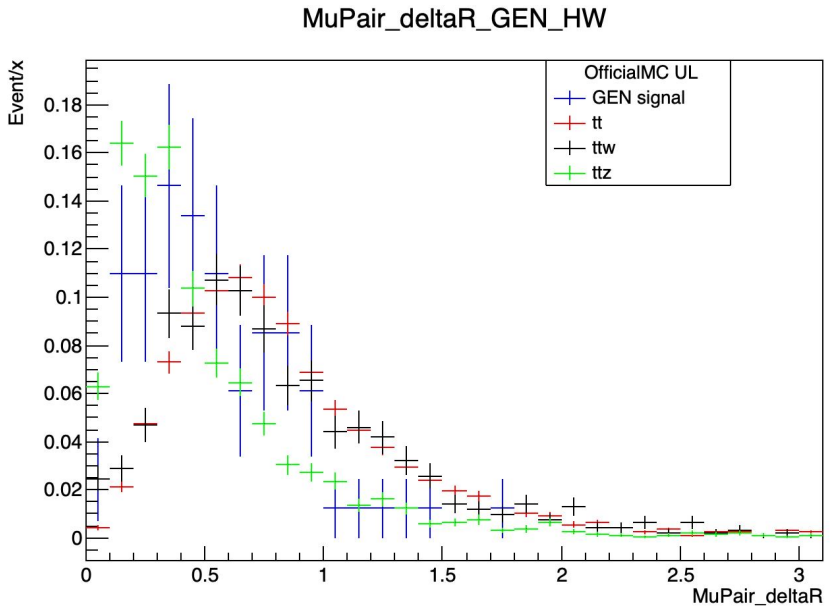


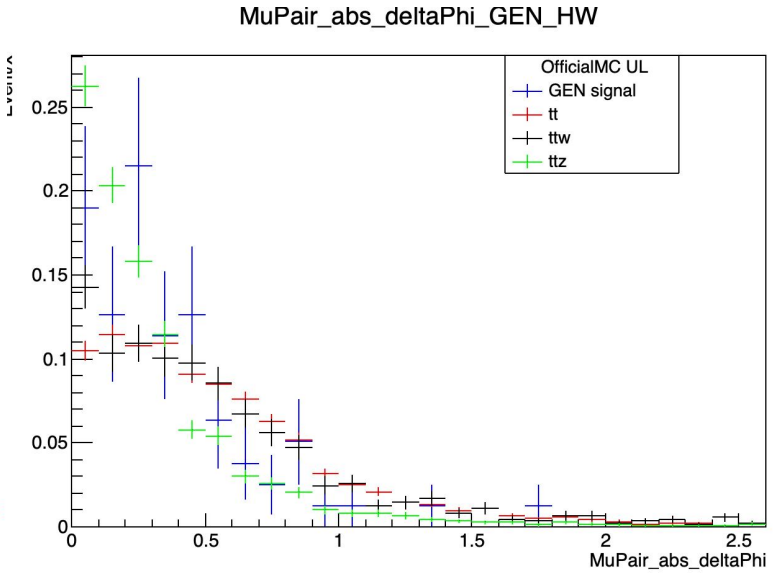
Cut2: Higgs Transverse pT > 250

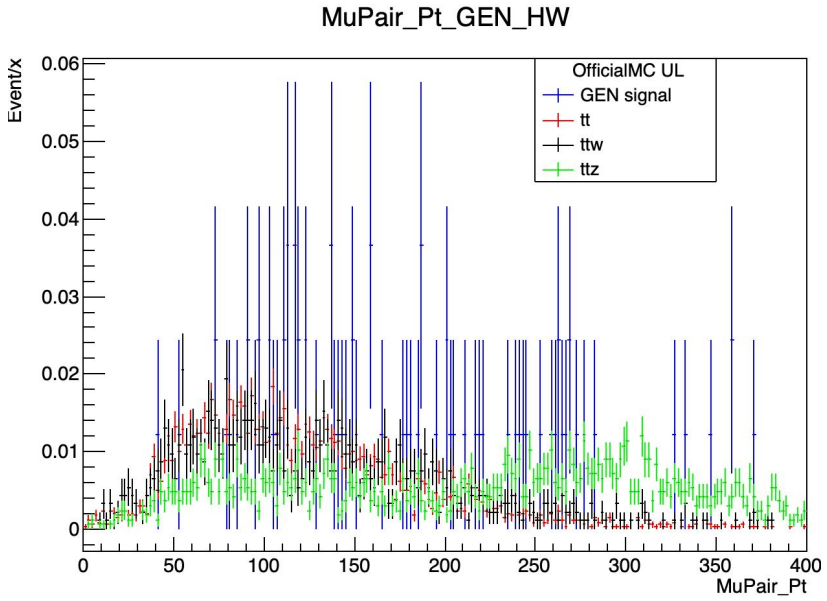
Cuts	N_signal (89fb)	N_signal GEN (89fb)	Signal ϵ	Signal Purity	N_TTbar (87315fb)	N_TTZ (770 fb)	N_TTW (610.5 fb)	S(GEN)/B
Basic cuts	9.53	2.25	100%	24%	36878	883	182	0.006%
Basic cut && cut0	5.60	2.03	90%	36%	8076	63	28	0.025%
Basic cut && cut0 && cut1	2.41	1.30	58%	54%	5735	46	20	0.022%
Basic cut && cut0 && cut1 && cut2	1.60	0.92	41%	58%	310	5	3	0.29%

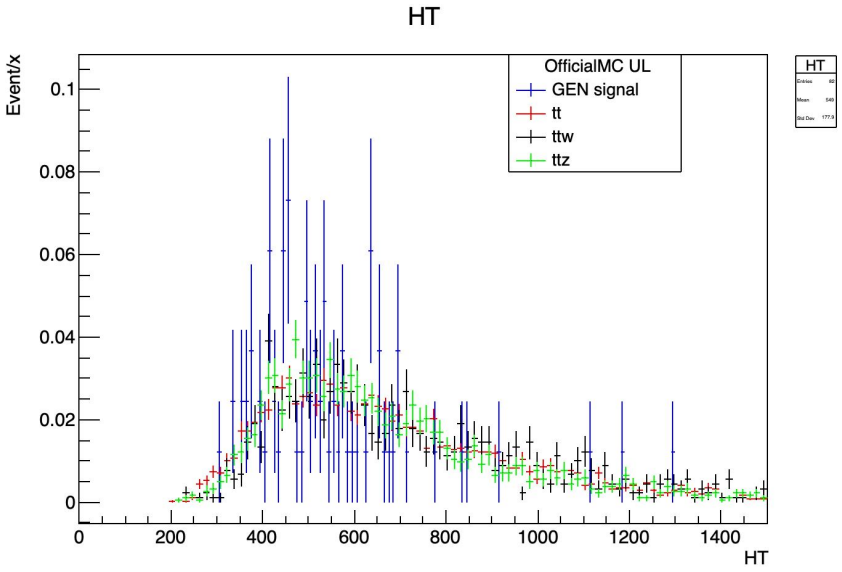
After Basic Cuts && Cut0 &&Cut1&& Cut2

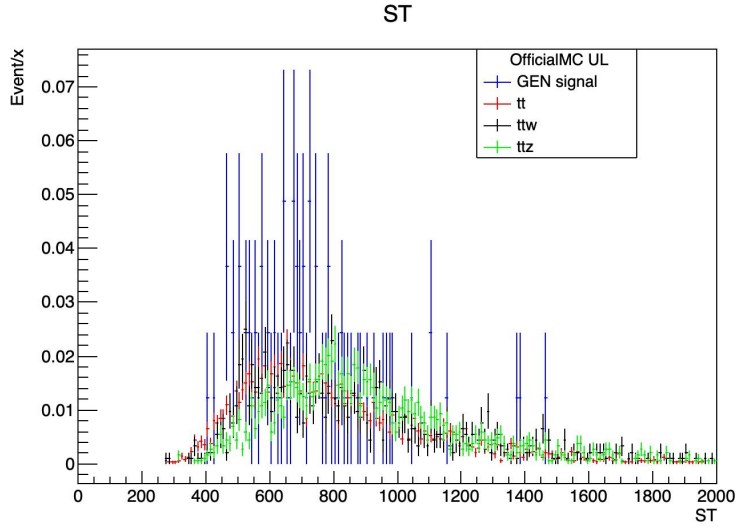












After Basic Cuts && Cut0 &&Cut1&& Cut2