

**Z  $\rightarrow$   $\mu\mu$**

**Higgs  $\rightarrow$  Invisible**

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# ● Samples

- **240GeV: /cefs/data/DstData/CEPC240/CEPC\_v4**
  - **Signal: ffh\_e2e2**
  - **Background: qq, sw\_l, sw\_sl, sze\_l, szeorsw\_l, sze\_sl, sznu\_l, sznu\_sl, ww\_h, ww\_l, ww\_sl, zz\_h, zz\_l, zzorww\_h, zzorww\_l and zz\_sl**

**Change beam energy from 240GeV to 250GeV**

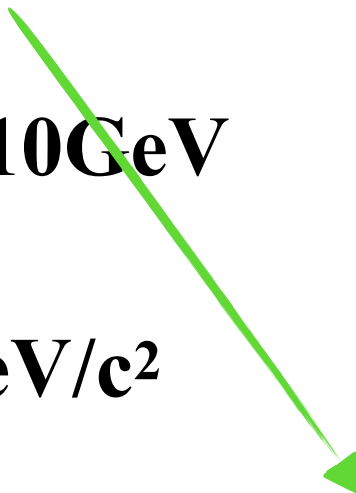


- **250GeV: /cefs/data/RecData/CEPC250/CEPC\_v1**
  - **Background: bhabha, e2e2, e3e3, n2n2, dd, cc and bb**
- **According to <http://cepcsoft.ihep.ac.cn/guides/Generation/docs/ExistingSamples/>, there are still some background samples missing**
  - **Missing background: wwbosons, zzbosons, nn, n1n1, n3n3, uu and ss**

# ● Selection Criteria

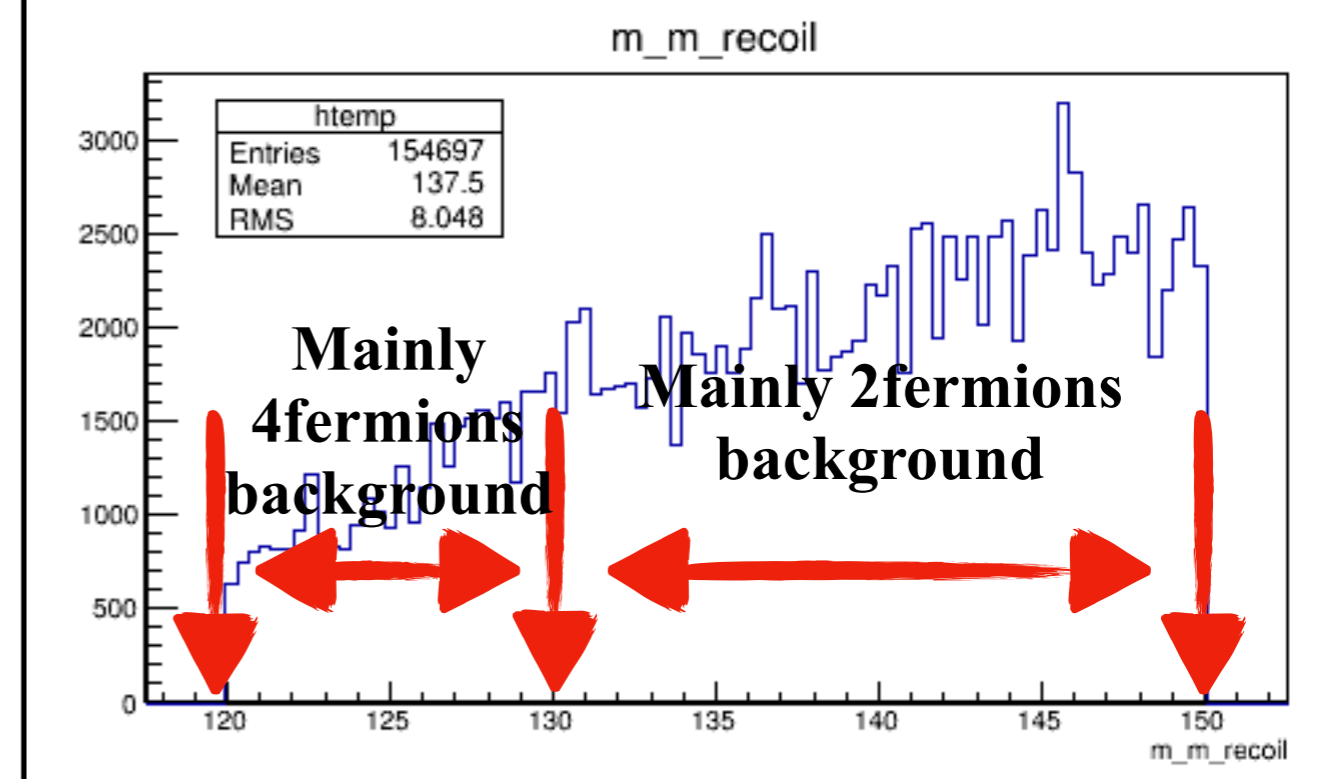
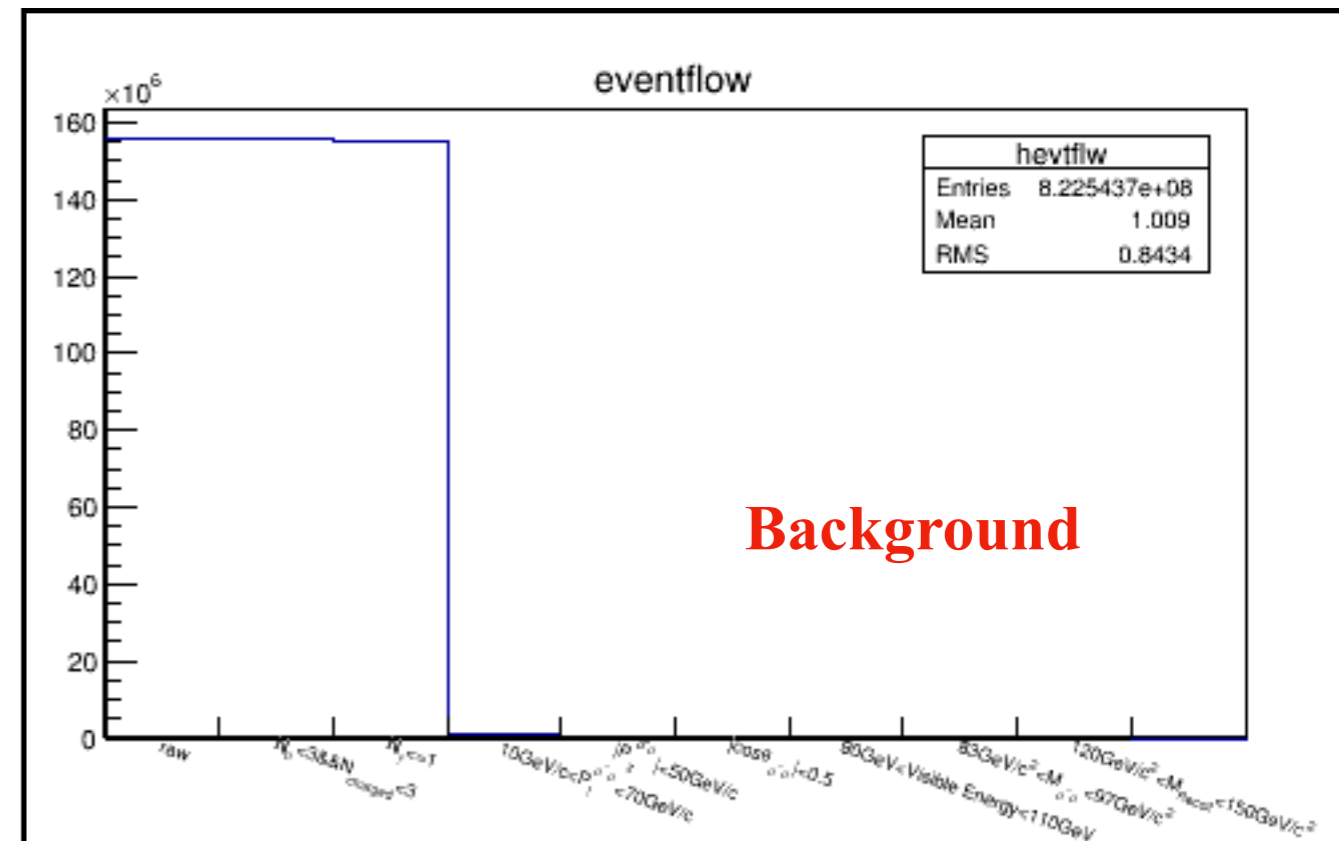
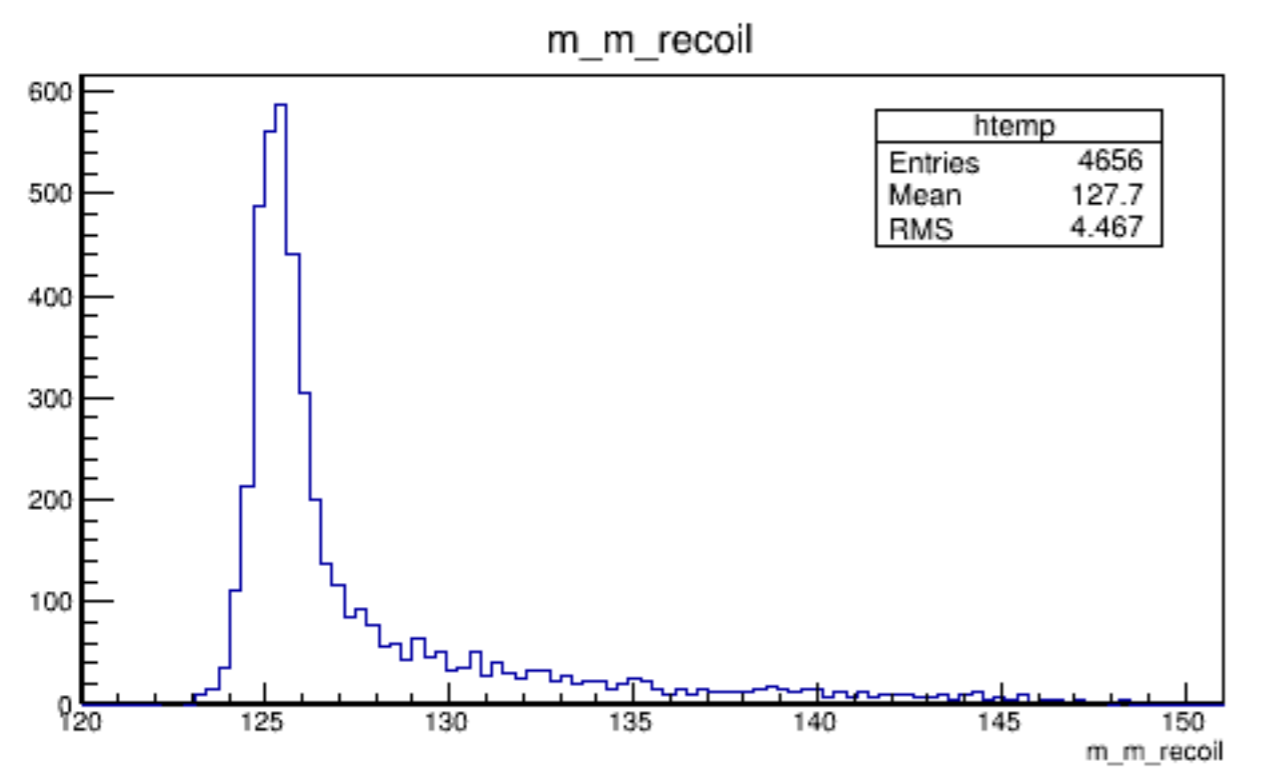
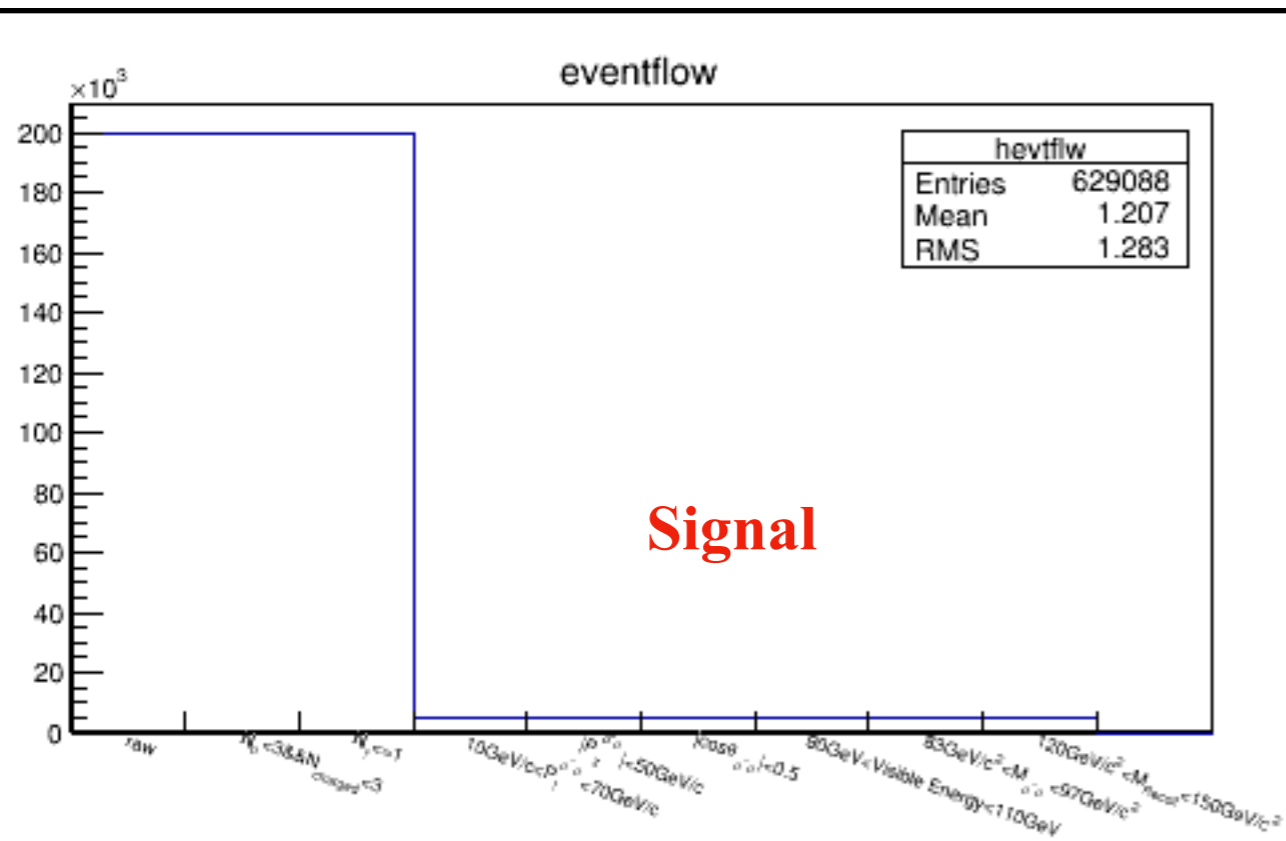
- $N_{\mu^+} + N_{\mu^-} < 3$  &  $N_{\text{charged}} < 3$
- $N_{\gamma} < 2$
- $10 \text{ GeV}/c < P_t^{\mu^+\mu^-} < 70 \text{ GeV}/c$
- $|P_z^{\mu^+\mu^-}| < 50 \text{ GeV}/c$
- $|\cos\theta_{\mu^+\mu^-}| < 0.5$
- $90 \text{ GeV} < \text{Energy}_{\text{visible}} < 110 \text{ GeV}$
- $83 \text{ GeV}/c^2 < M_{\mu^+\mu^-} < 97 \text{ GeV}/c^2$
- $120 \text{ GeV}/c^2 < M_{\text{recoil}} < 150 \text{ GeV}/c^2$

Scale factors  
need to be added



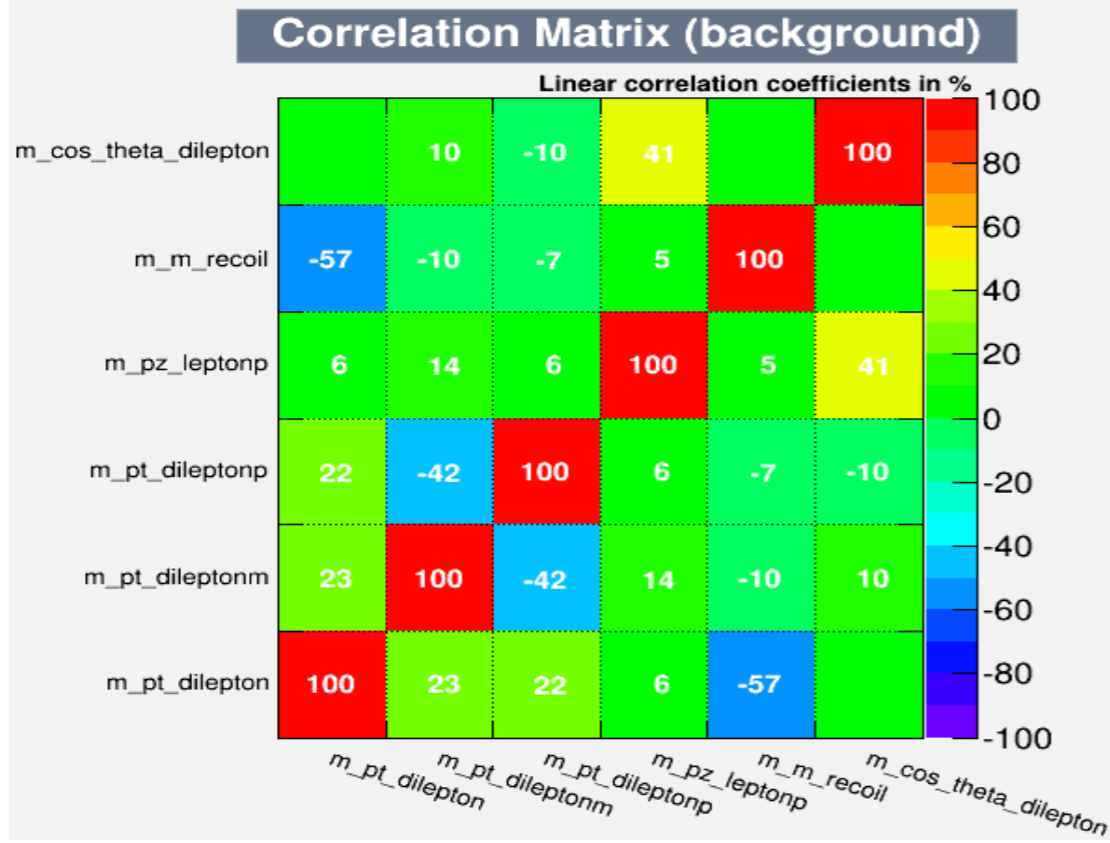
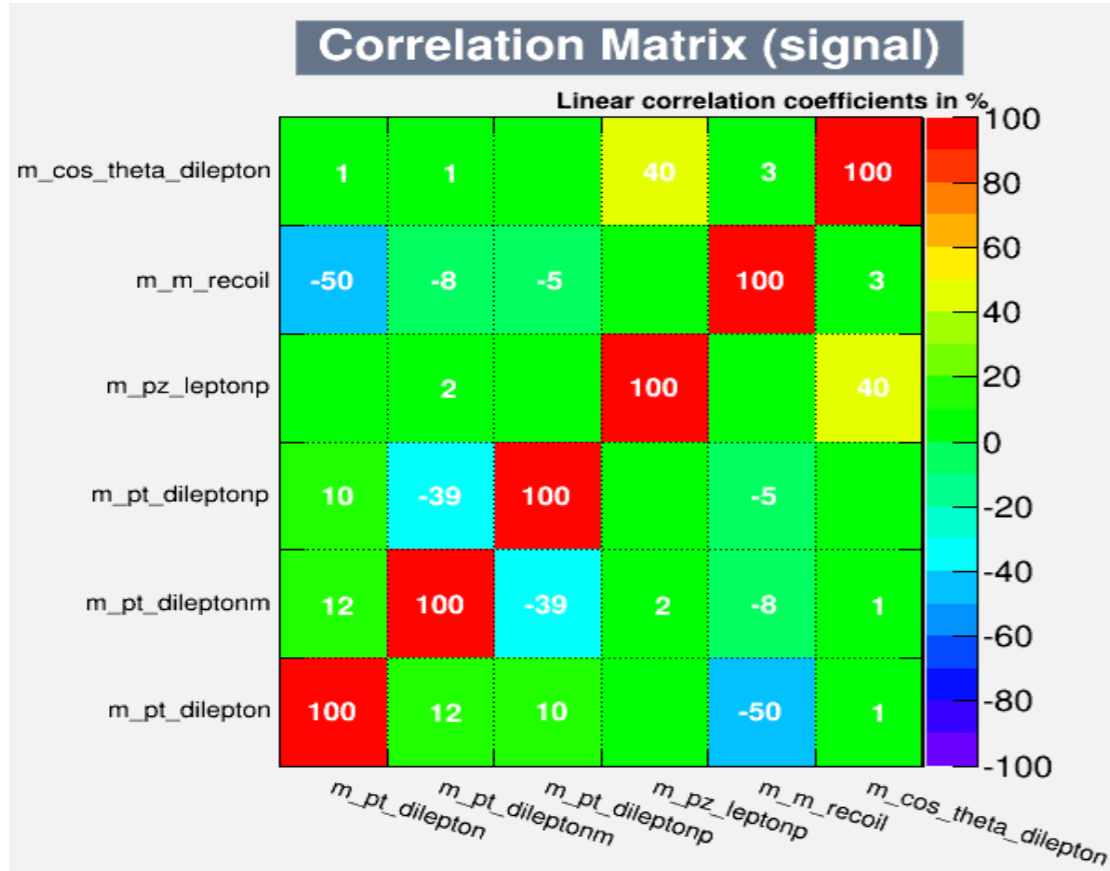
- After our base cuts, there are some events left in some background samples
  - **zzorww\_l:**  $(22.1+211.18)*5000=2161400(2183002); 20373$
  - **sznu\_l:**  $(43.42+14.57)*5000=289950(319278); 3851$
  - **sze\_l:**  $(78.49+845.81+28.94+147.28+125.83+190.21)*5000=7082800(5556664); 4517$
  - **ww\_l:**  $403.66*5000=2018300(2036465); 13387$
  - **ww\_sl:**  $(2423.43+2423.56)*5000=24234950(24476395); 2472$
  - **zz\_h:**  $(98.97+233.46+85.68+98.56)*5000=2583350(2608138); 5$
  - **zz\_l:**  $(15.56+4.61+19.38+18.65+9.61)*5000=339050(499503); 2651$
  - **zz\_sl0mu+zz\_sl0tau:**  $(136.14+87.39+67.31+37.77)*5000=1653050(1653050); 15544$
  - **e2e2:**  $4991.91*5000=24959550(328311); 601$
  - **e3e3:**  $4432.18*5000=22160900(1484572); 1226$
  - **bb:**  $9957.7*5000=49788500(885200); 138$
  - **cc:**  $50513750(1181208); 226$
  - **dd:**  $10010.07*5000=50050350(1152000); 296$

# • Cut flow and recoiling mass distribution

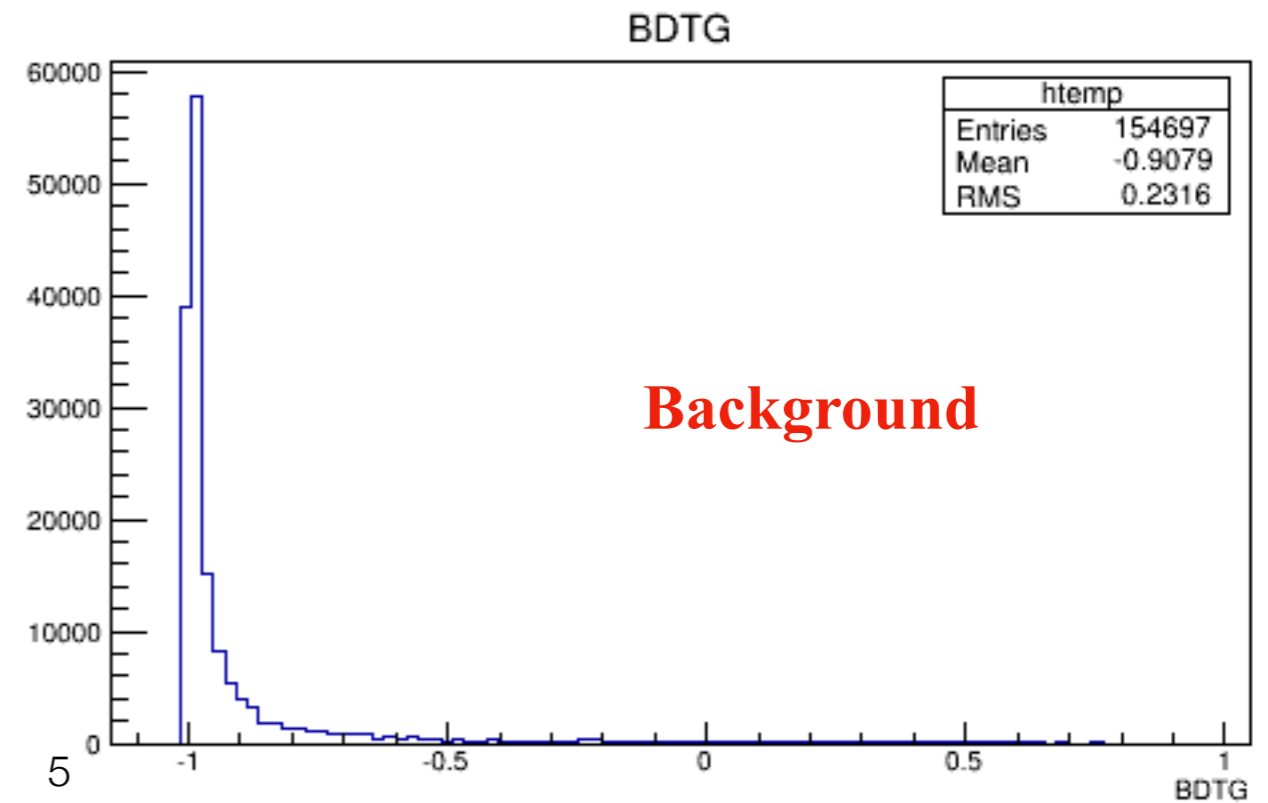
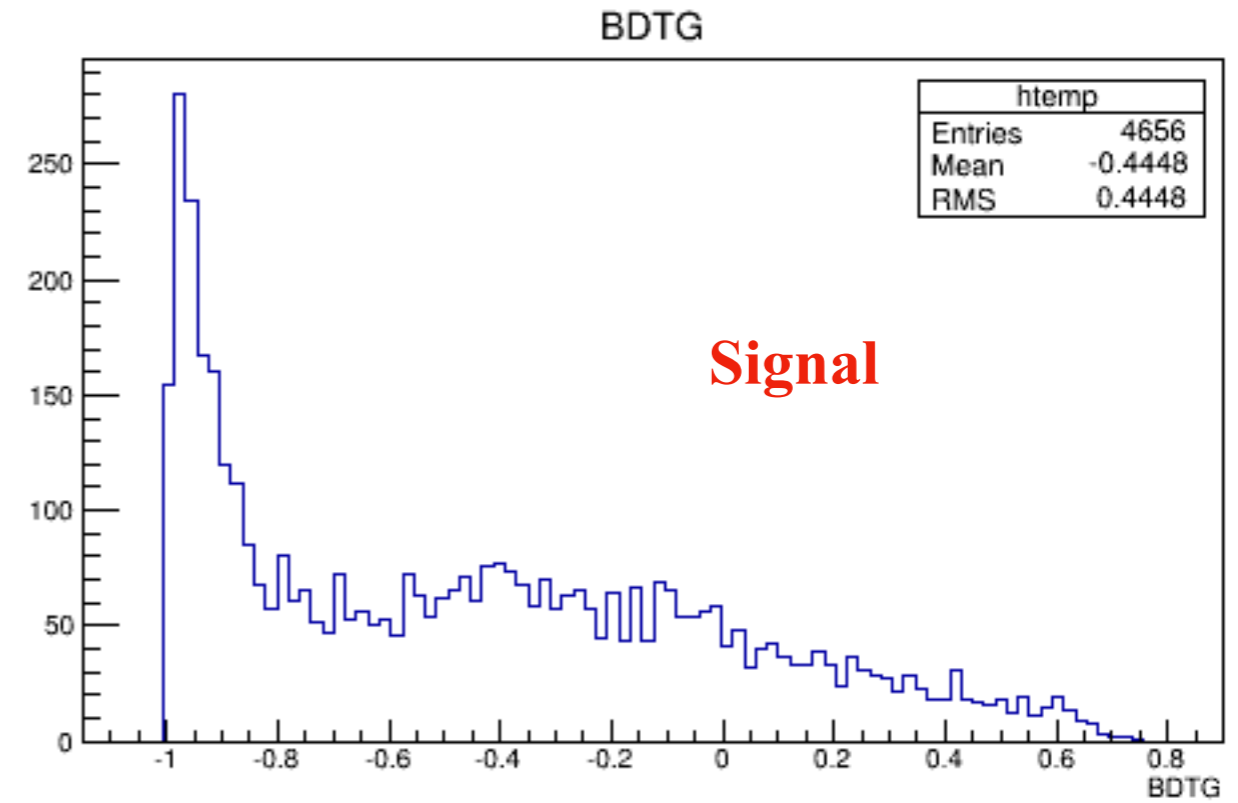


# •BDT Cut

## • Variables

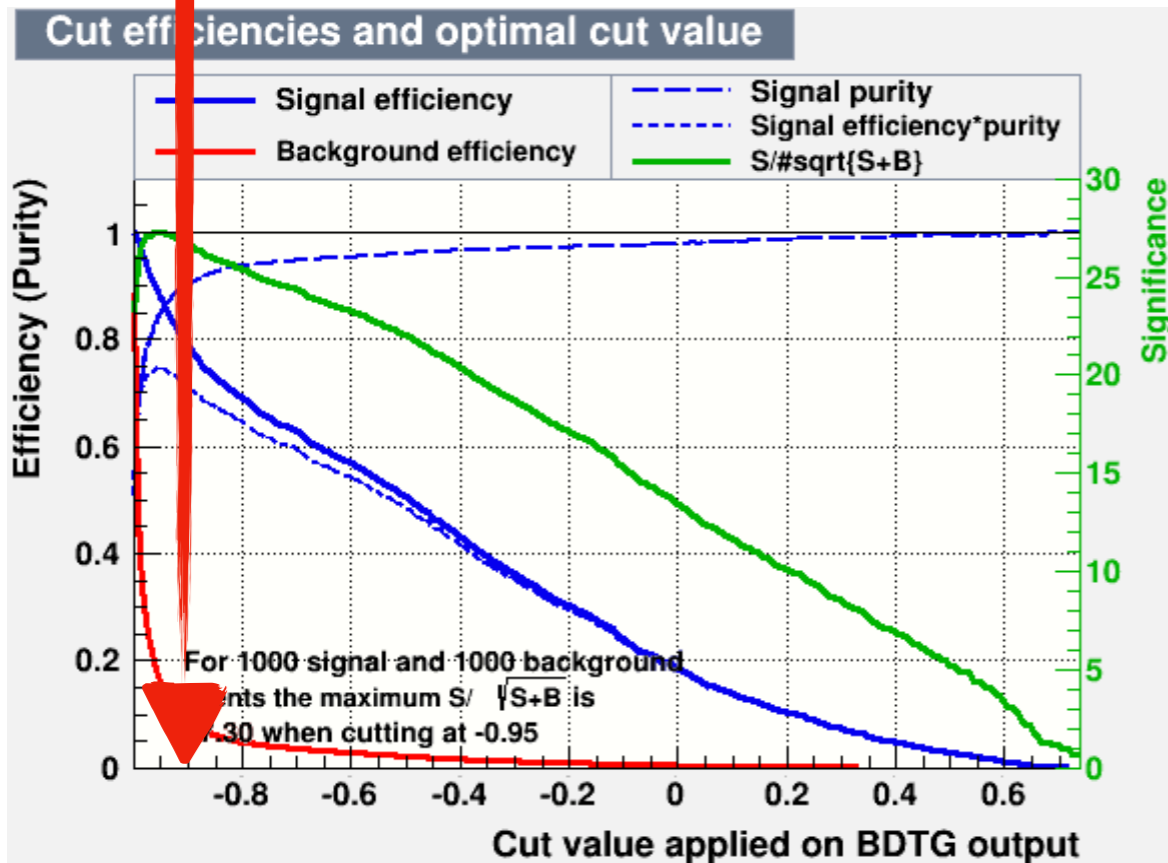
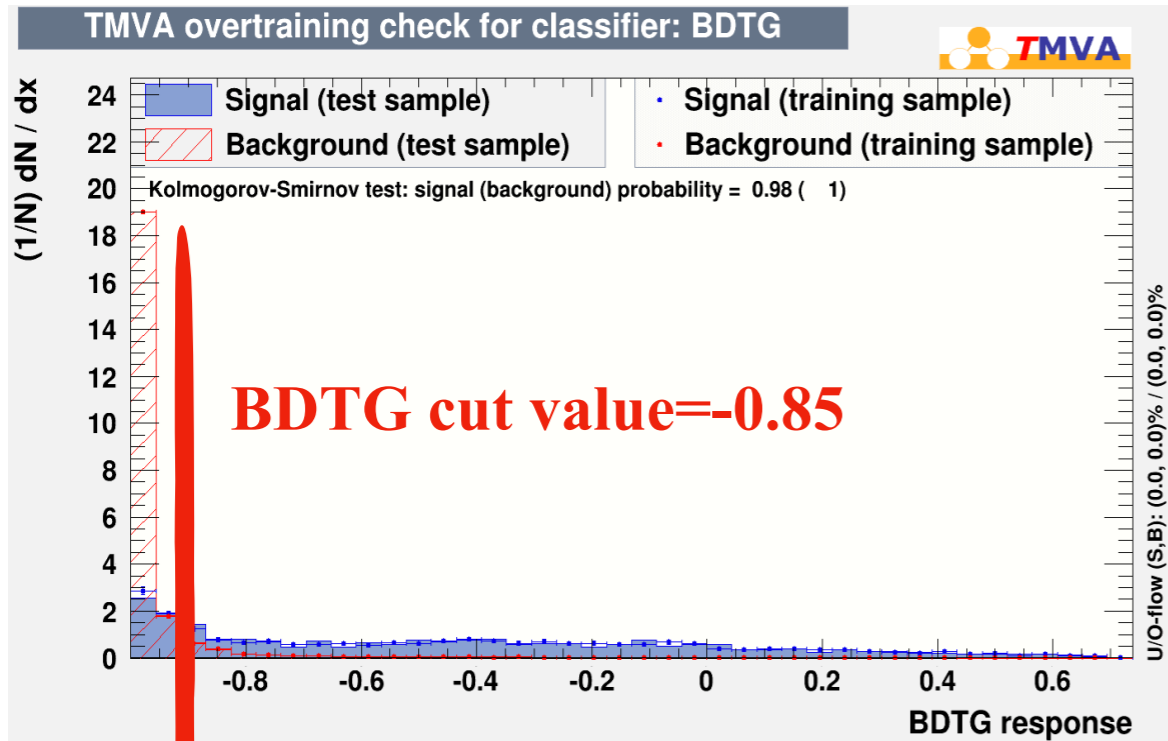


## • BDT training results

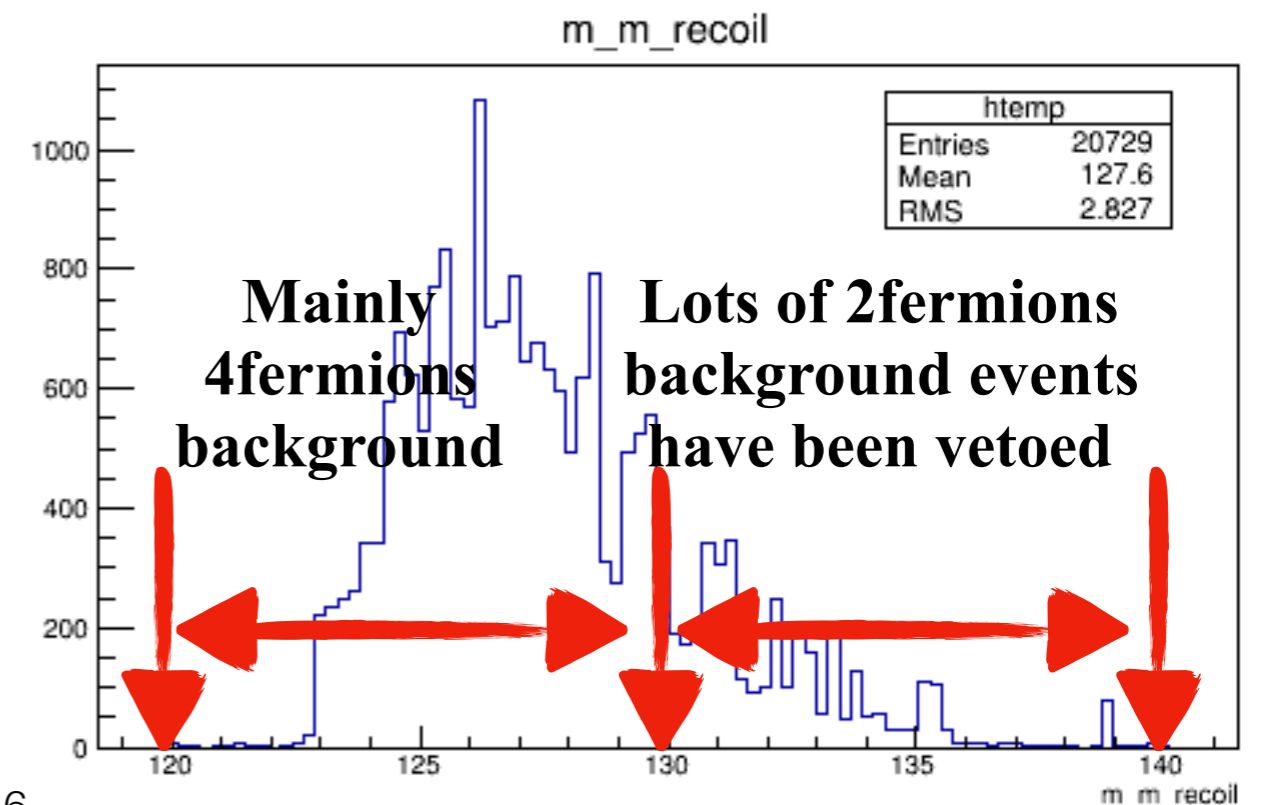
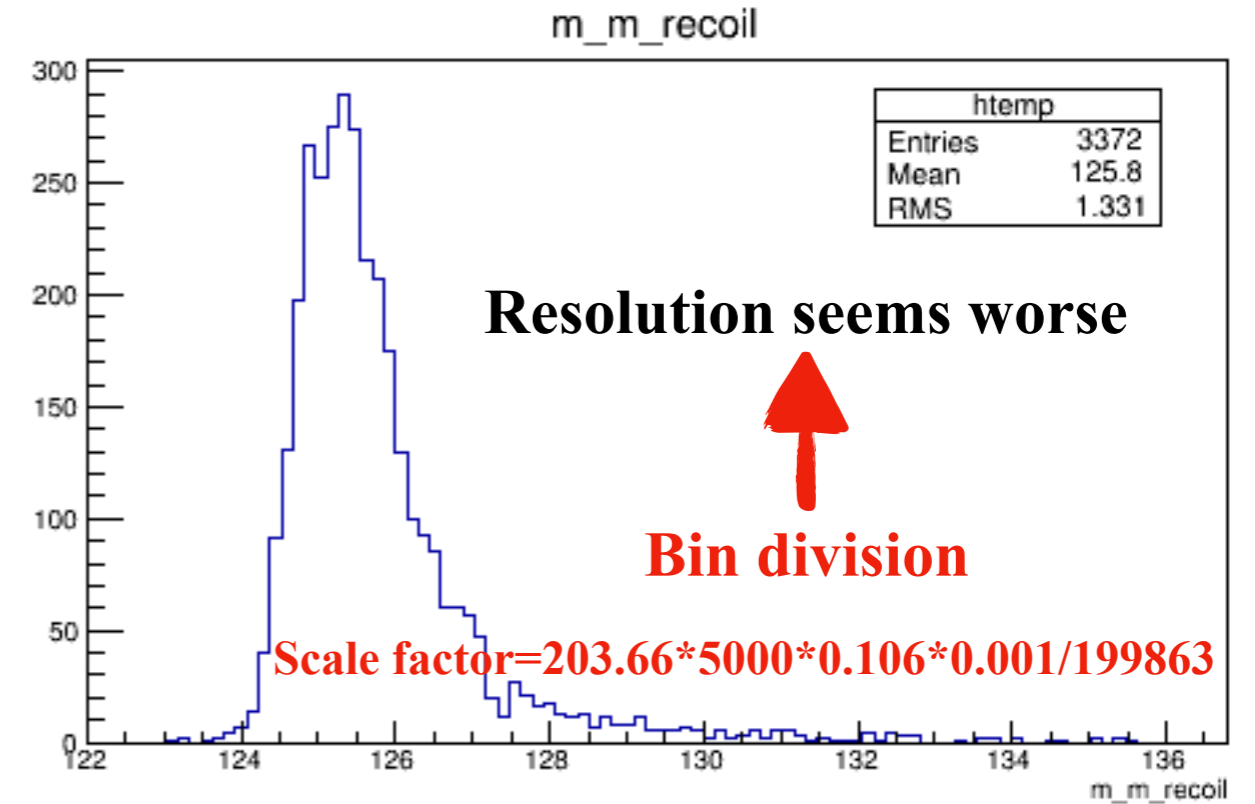


# • BDT Cut

## • BDT cut decision

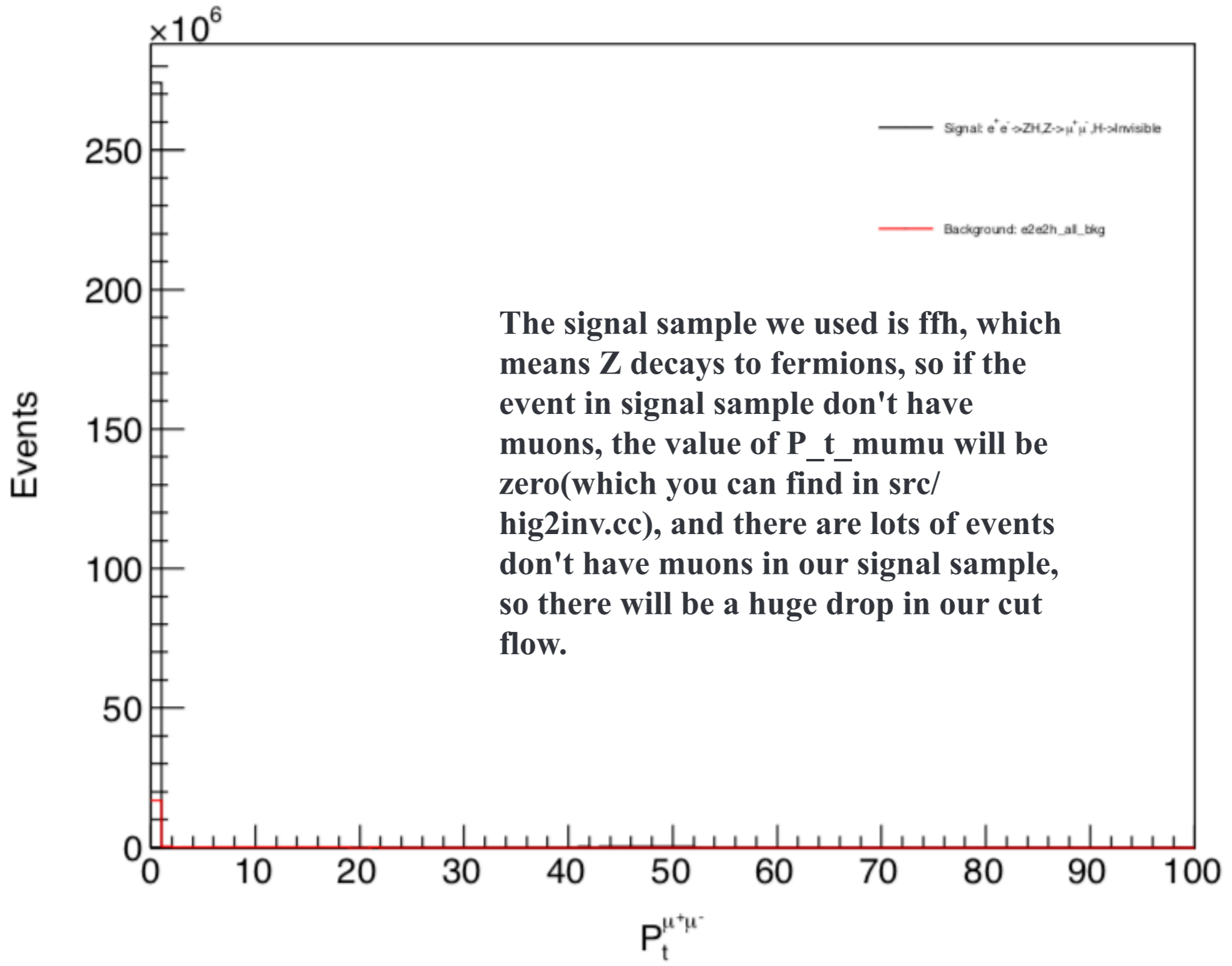


## • Distribution after BDT cut



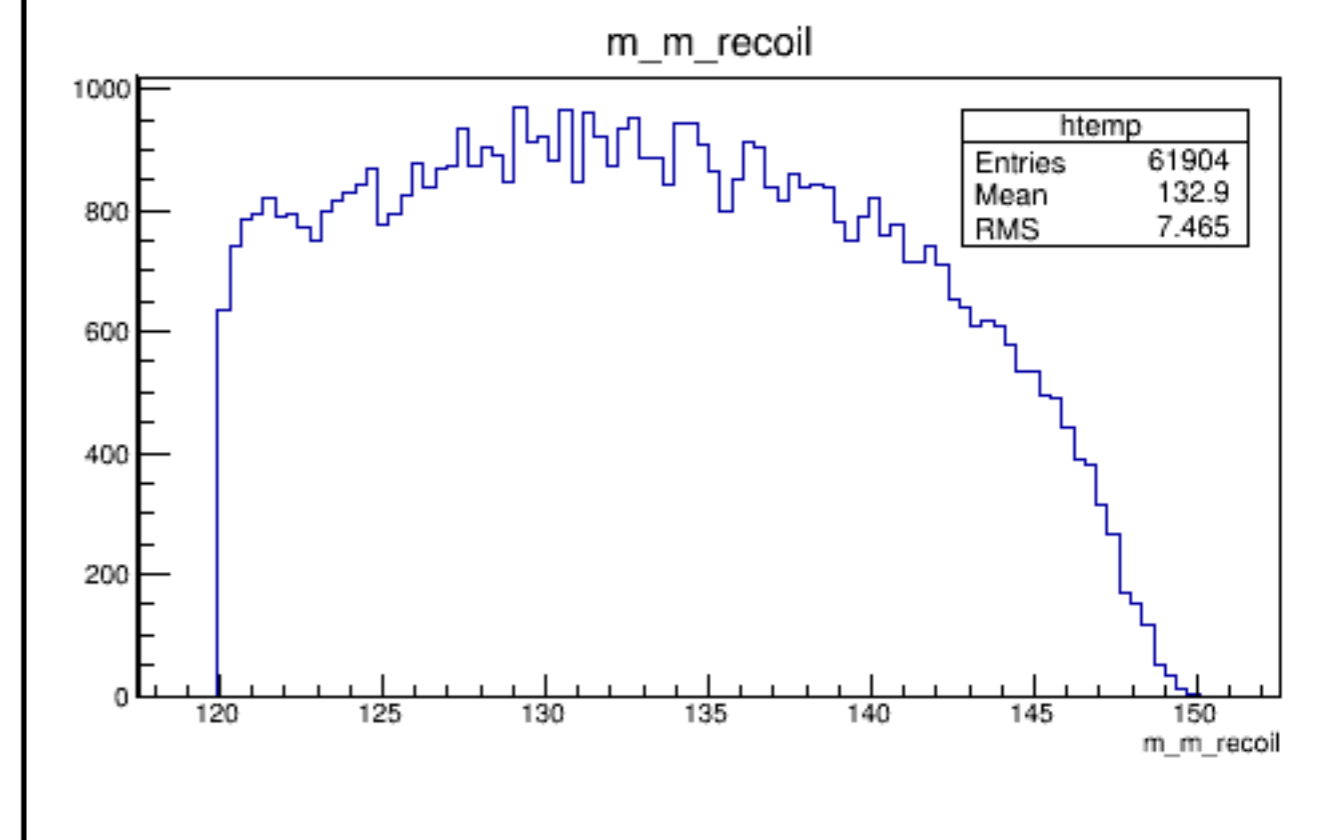
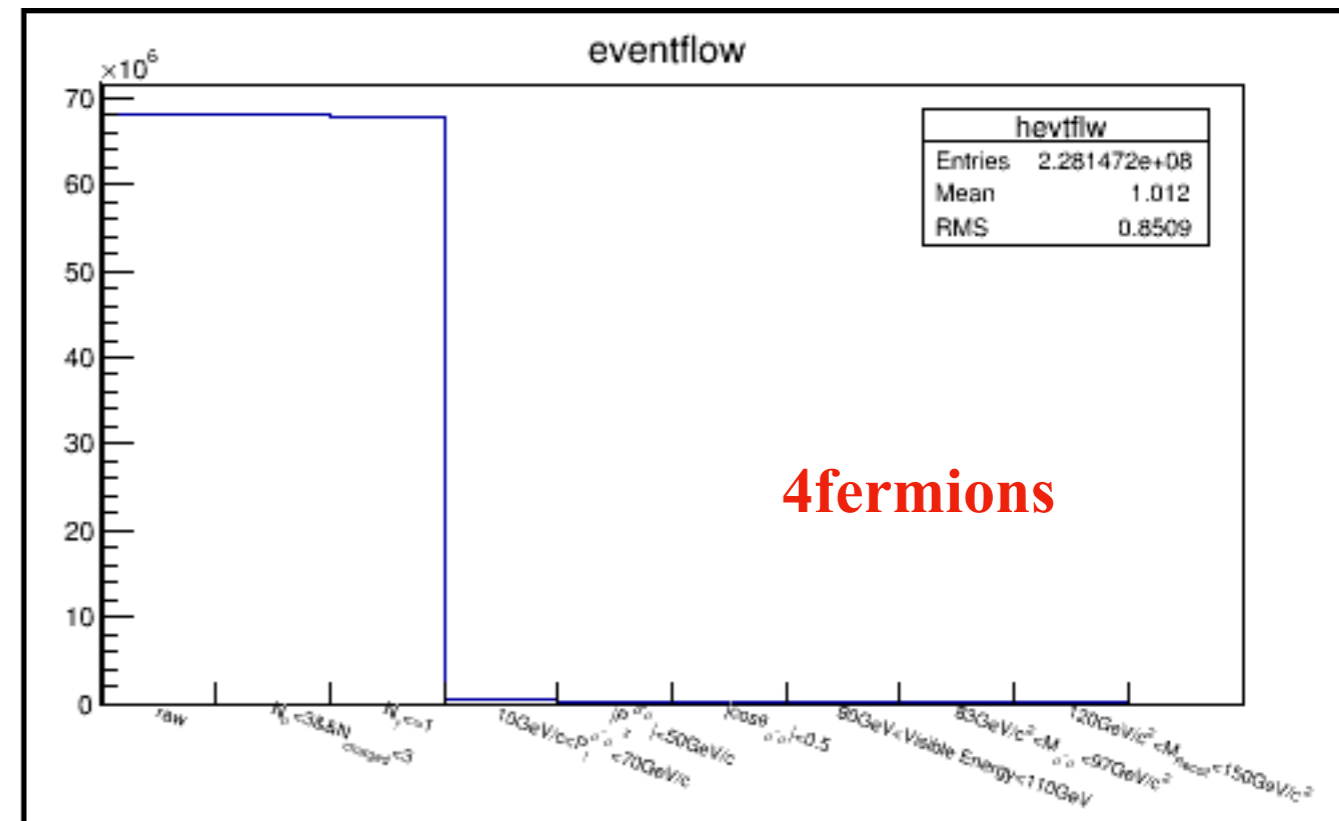
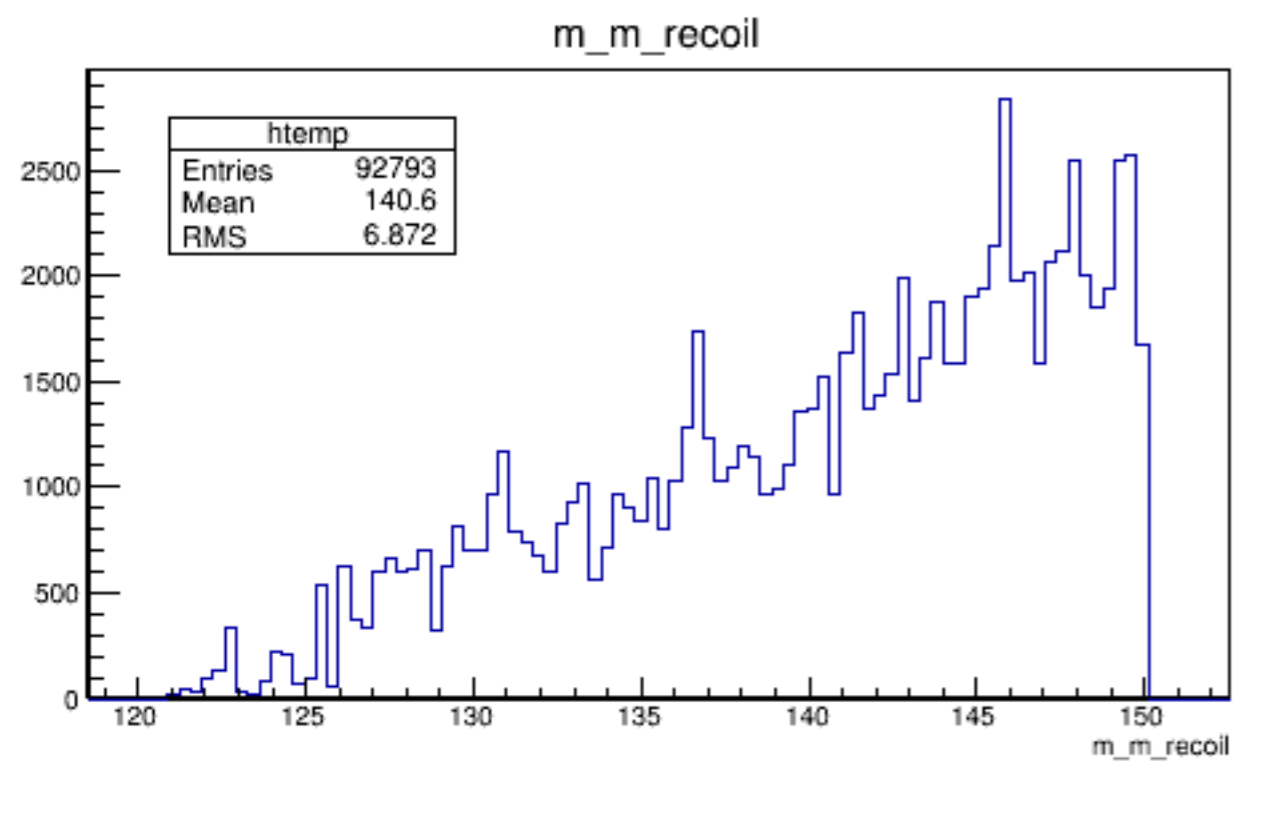
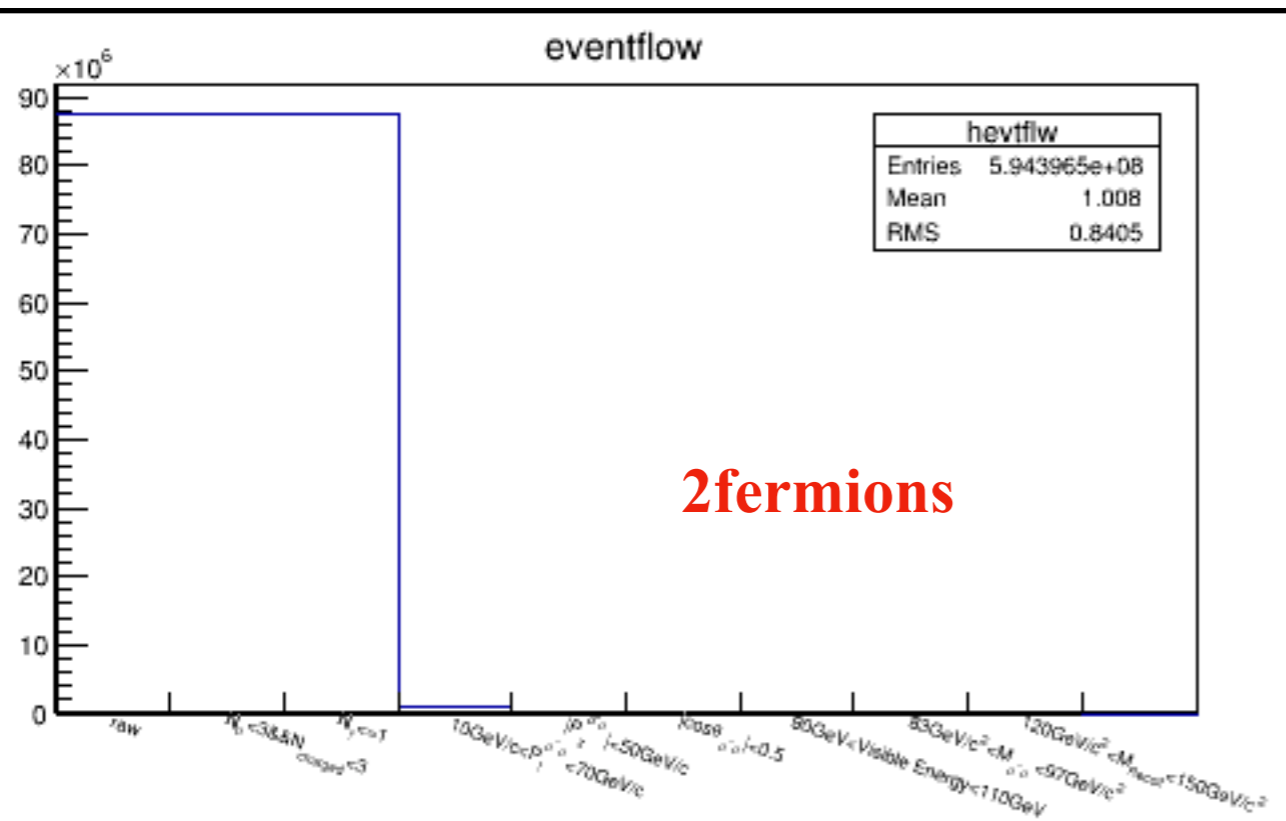
# Backup

# ● A huge drop in our cut flow

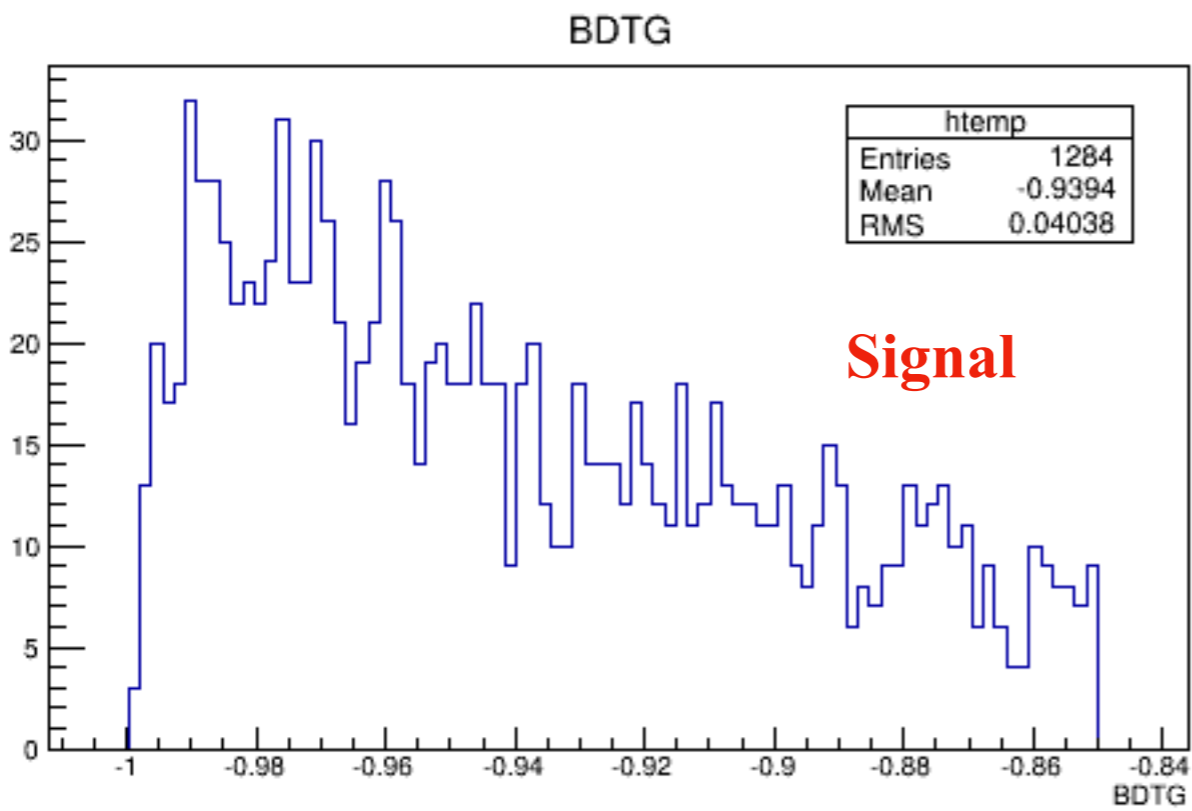




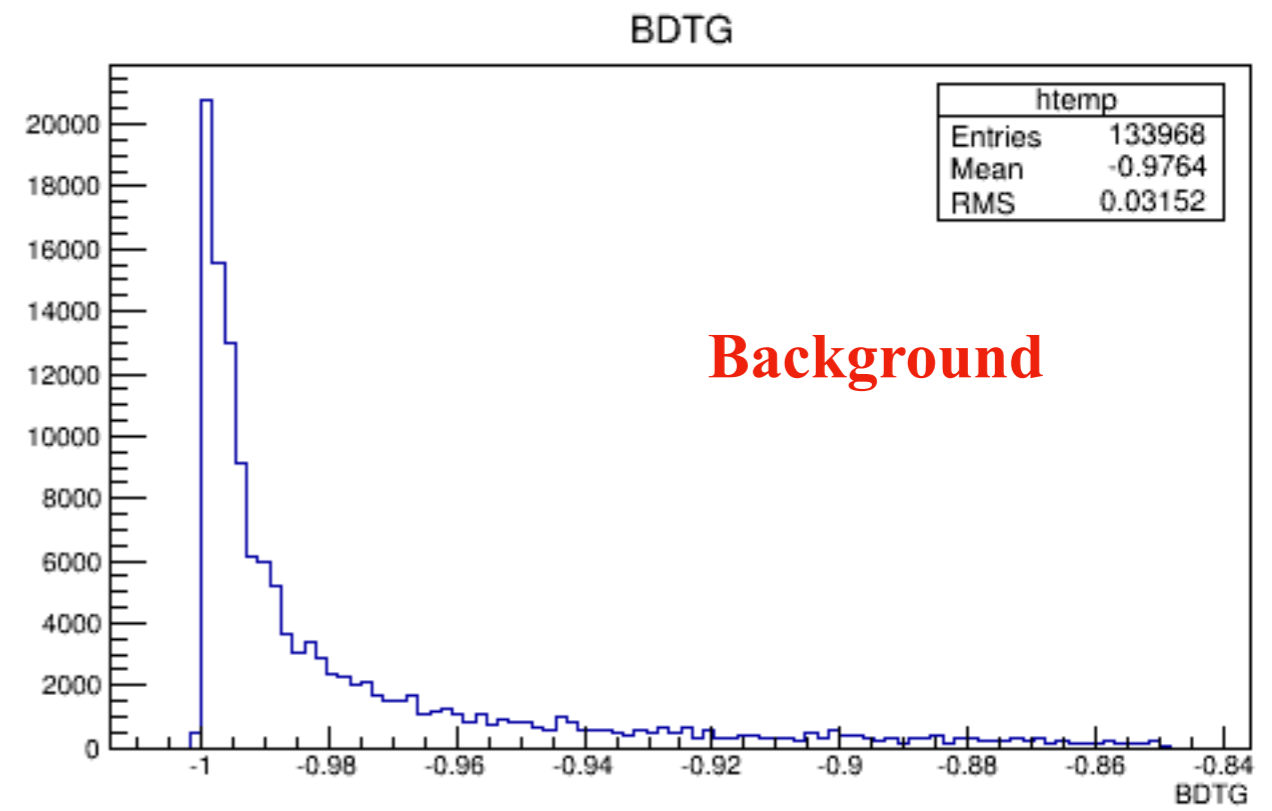
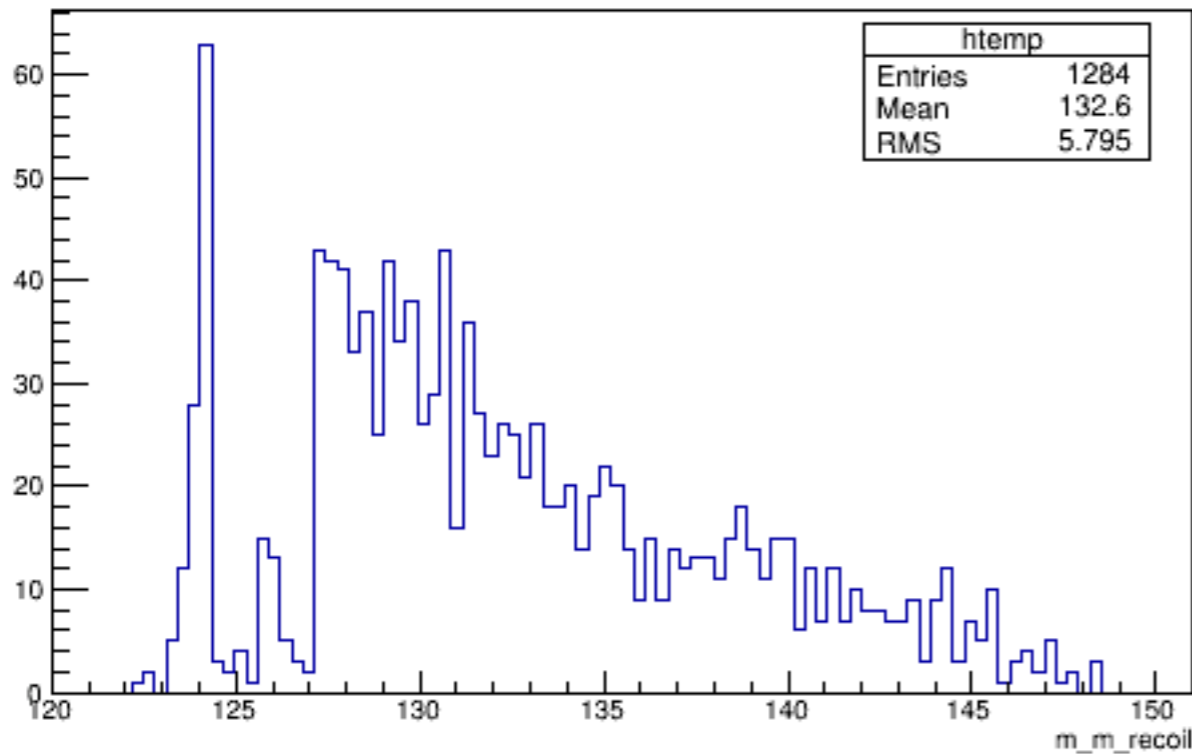
# ● Cut flow and recoiling mass distribution



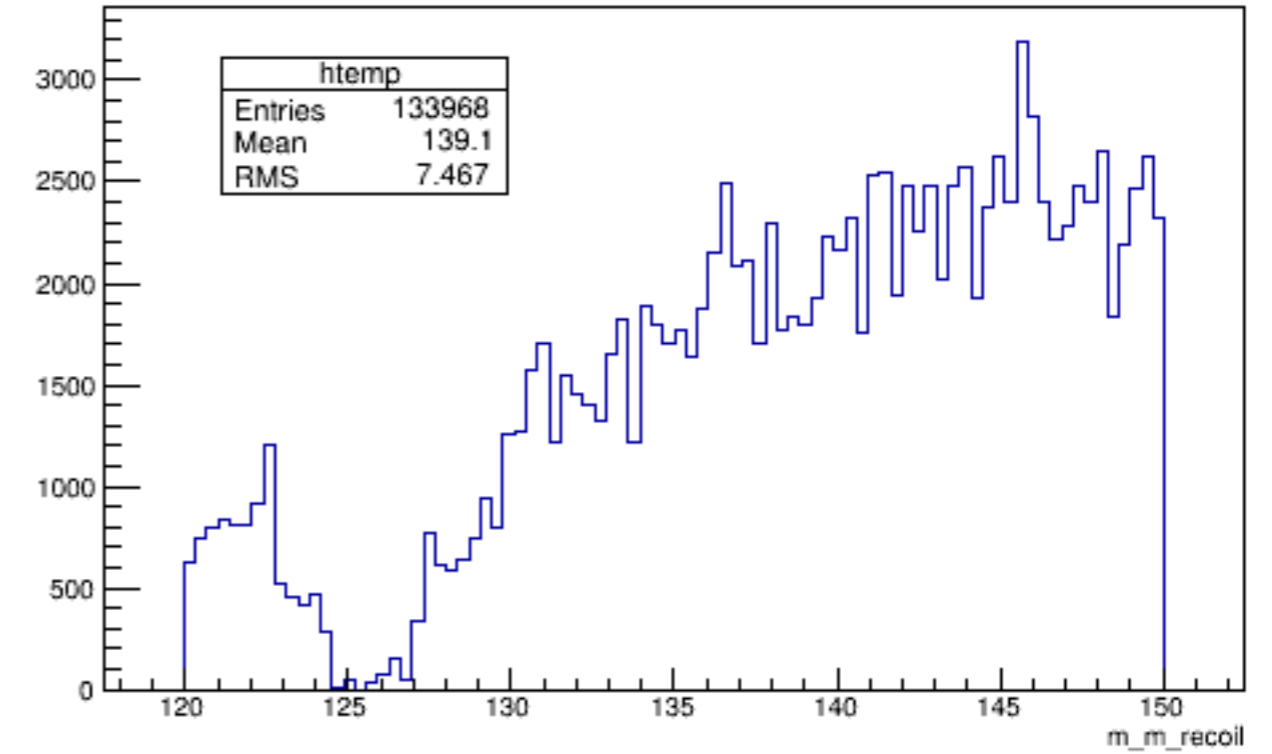
# ● Recoiling mass distribution (BDT value < BDT\_cut)



m\_m\_recoil

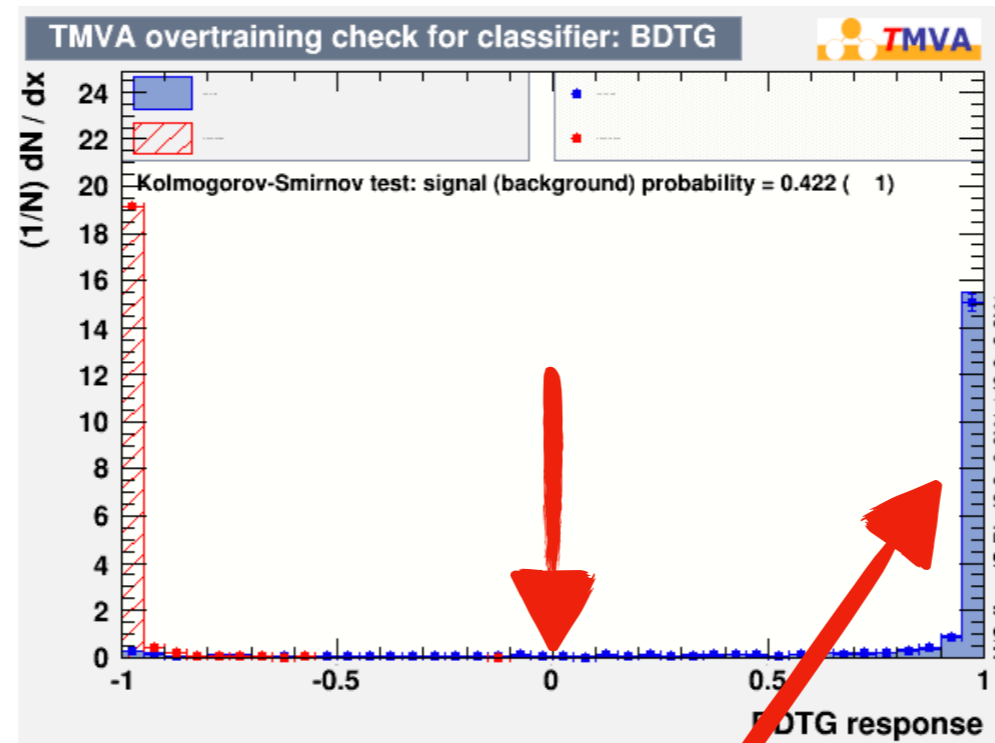


m\_m\_recoil

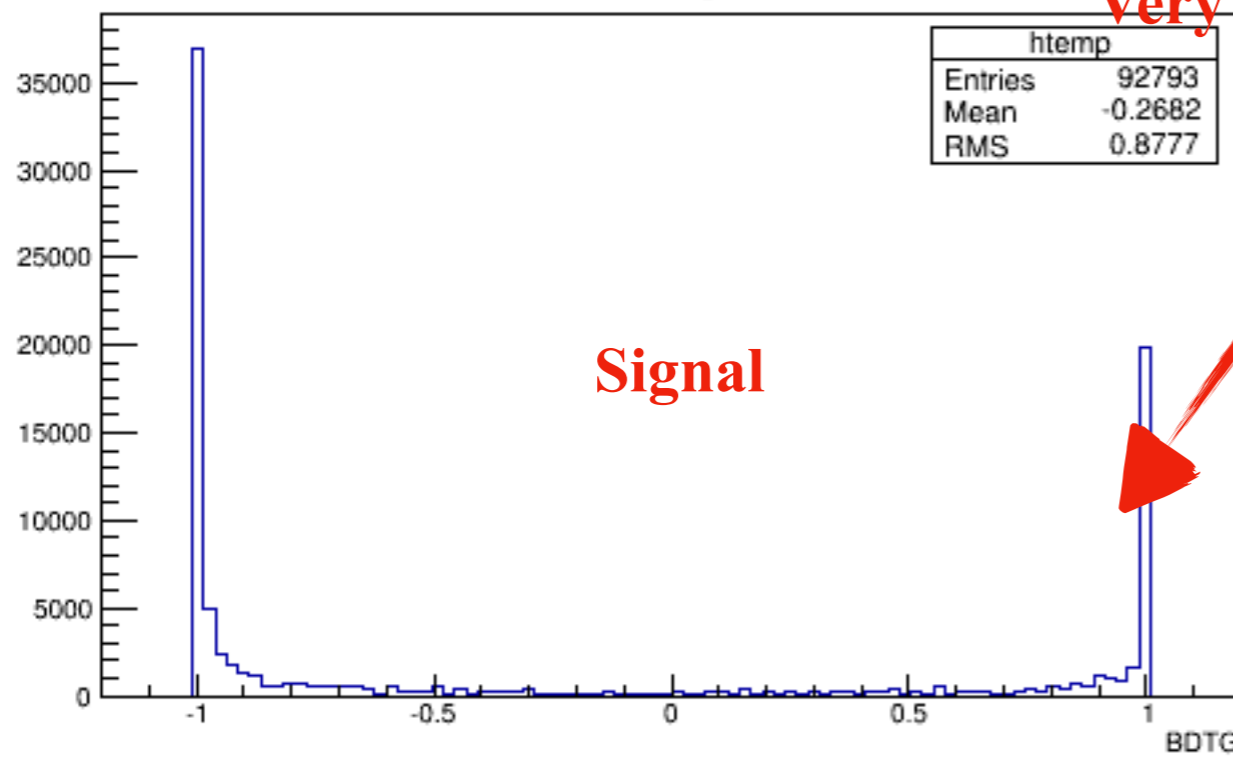


# •BDT suggestion from Kaili

- Step 1: Use 2fermions background samples and signal sample as BDT input

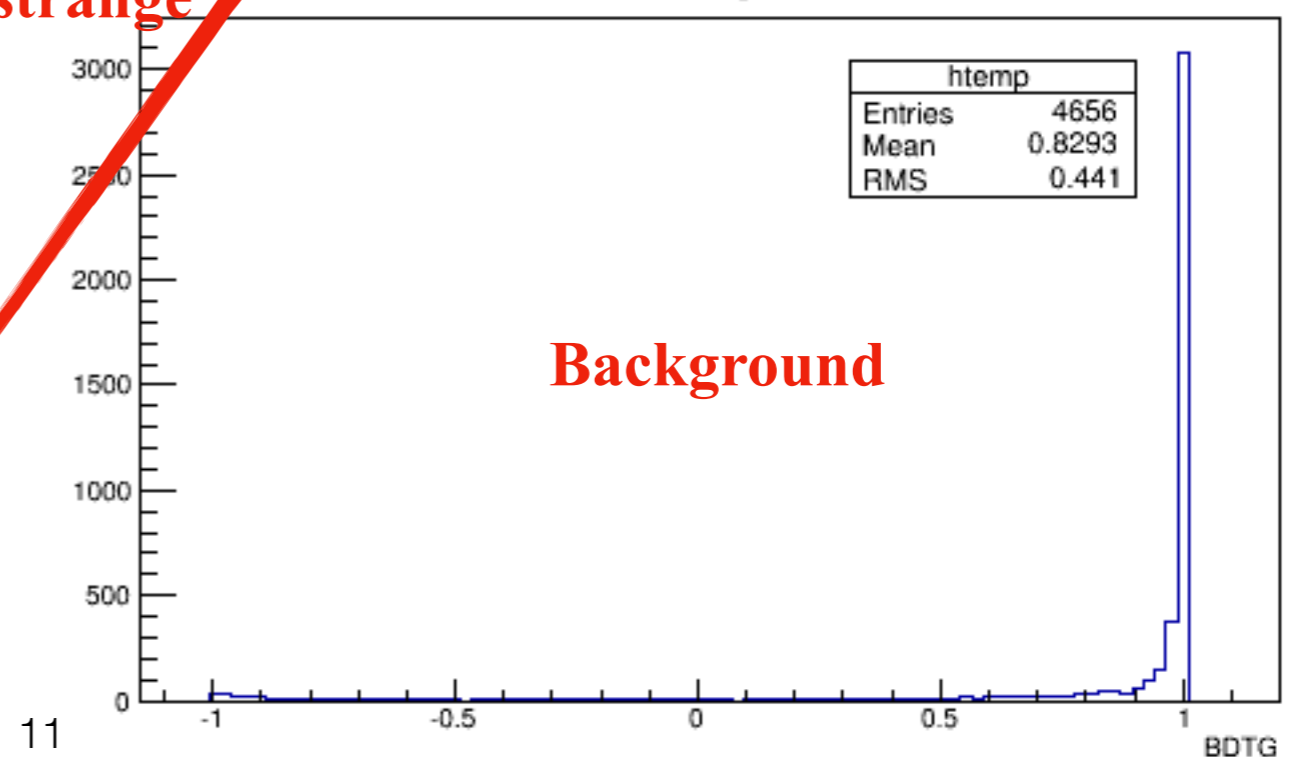


BDTG



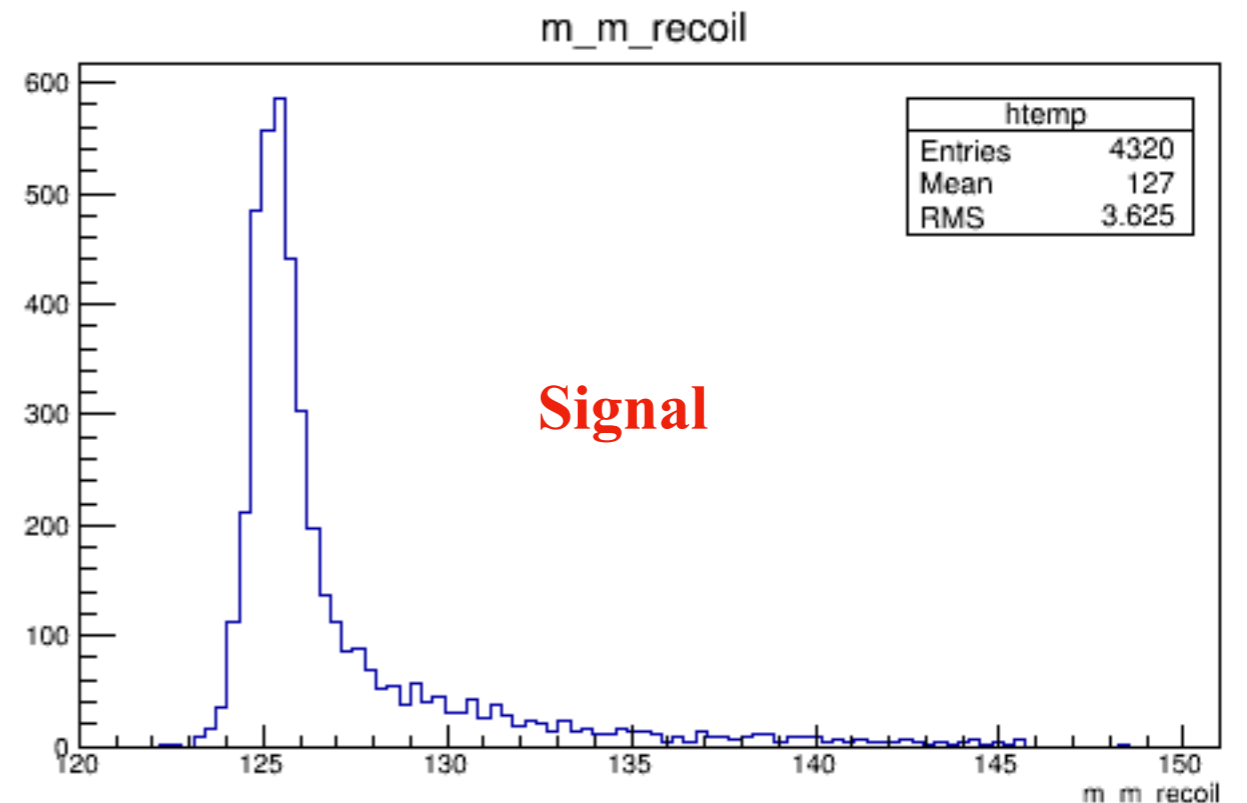
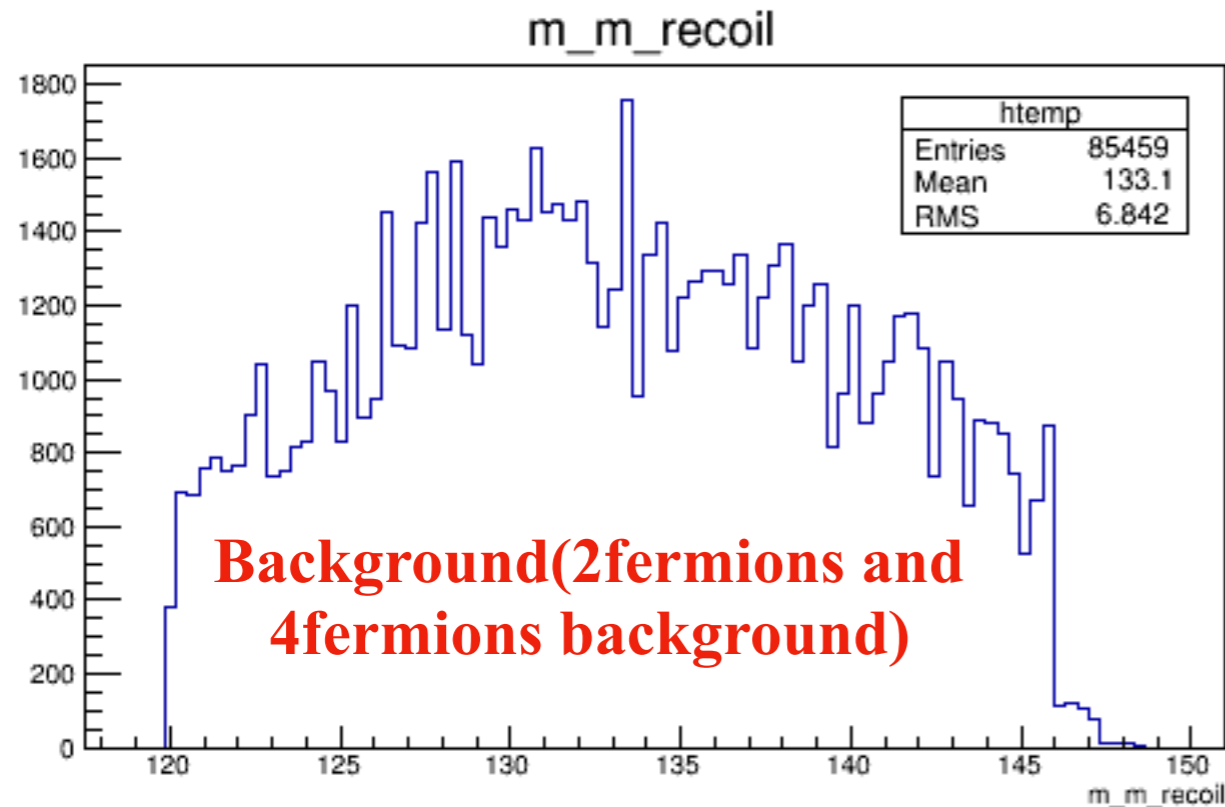
Very strange

BDTG



# •BDT suggestion from Kaili

- Step 2: Apply BDT\_cut in step1 to 2fermions and 4fermions background samples and signal sample



- Step 3: Use BDT training results in step2 as the input of BDT training in step3

# •BDT suggestion from Kaili

- Step 3: Use BDT training results in step2 as the input of BDT training in step3

