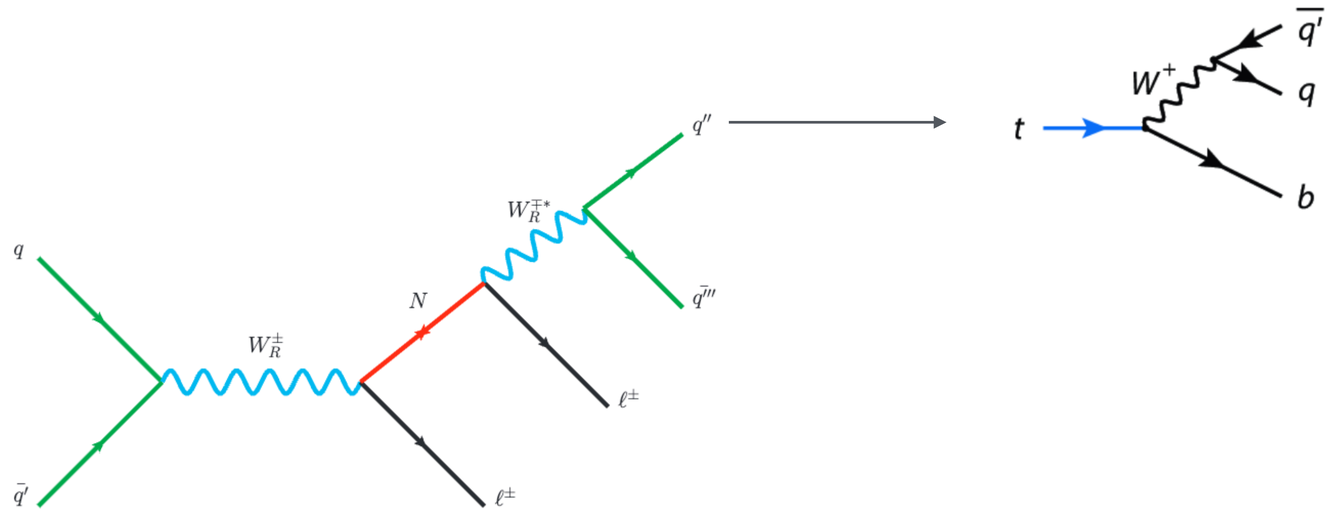
Search For W_R Using t/b Jets
top & bottom jet searching

Chihwan.An. 2025.06.30

Review of last presentation..

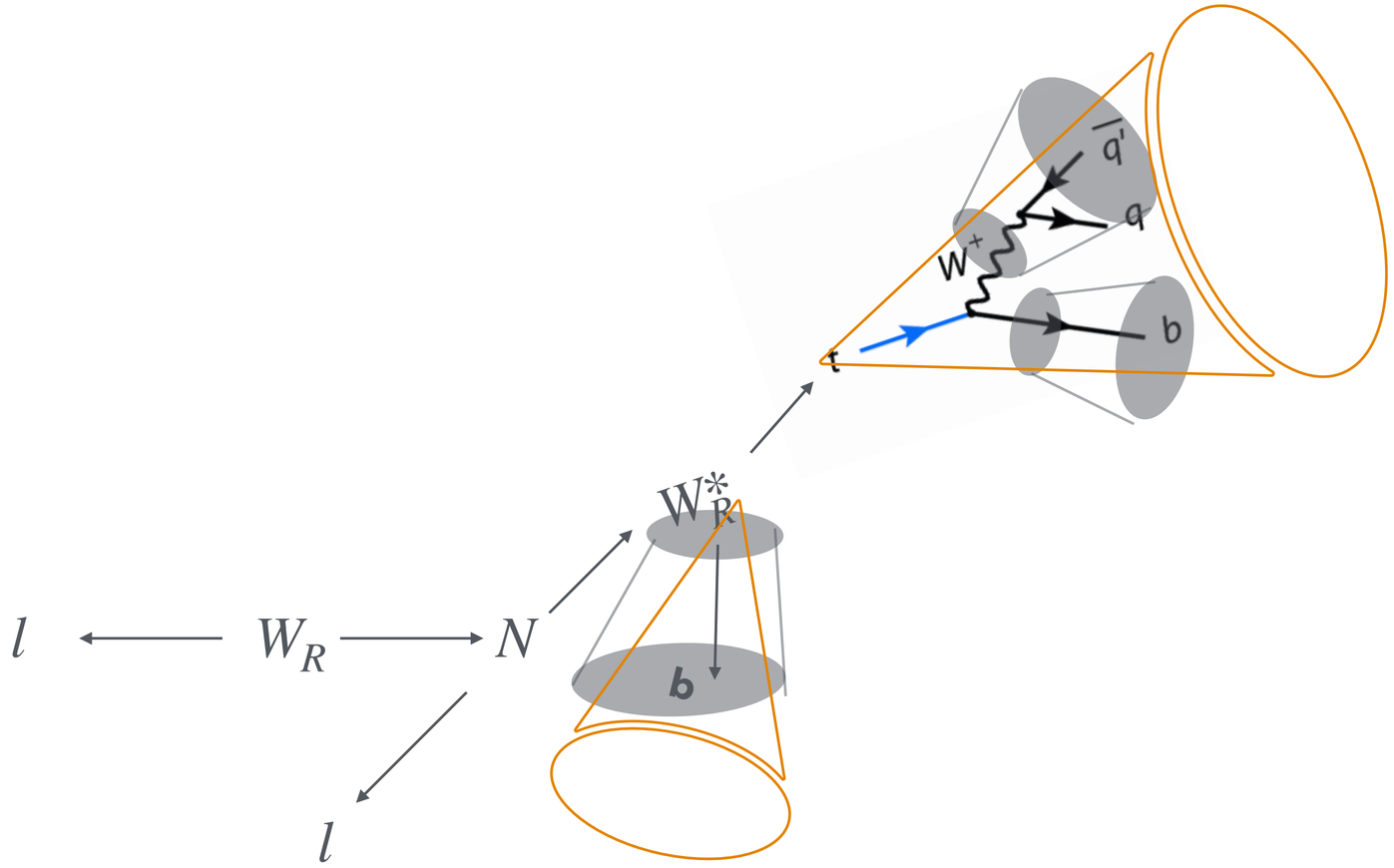


- Topology
  If all structure is boosted , more than 5 substructure (top - 3 jets , b quark , leptons) mixed :resolved topology required

- Setting mass of W_R N similar -> makes N slow : W_R* , lepton separated
  -> makes W_R* slow : t jets & b jet separated

Topology Of Main Target

- Main target : W_R ~ N
  - 1 top jet
  - 1 b jet
  - 2 same sign lepton



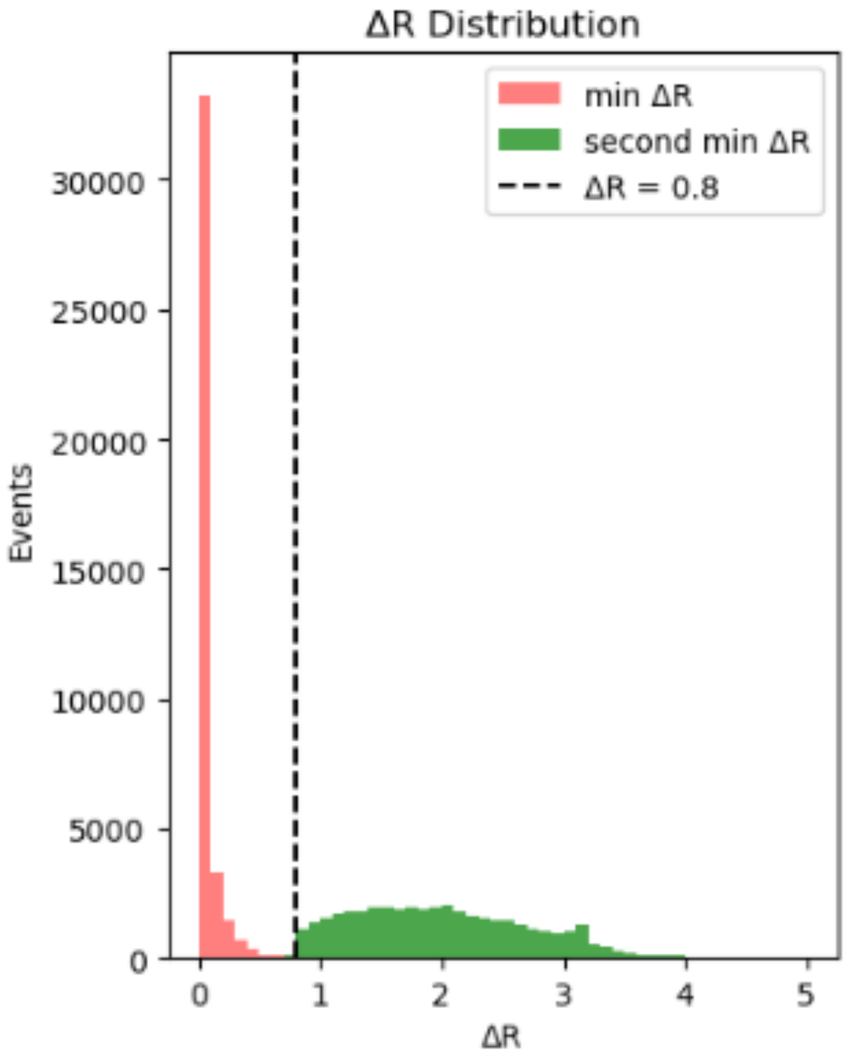
Top jet analysis

Jet matching with genlevel top

1. Is AK8 well matched with genlevel top ?

2. Does other AK8 get inside top jet?

-> Well matched , can trust AK8 which is closest to top

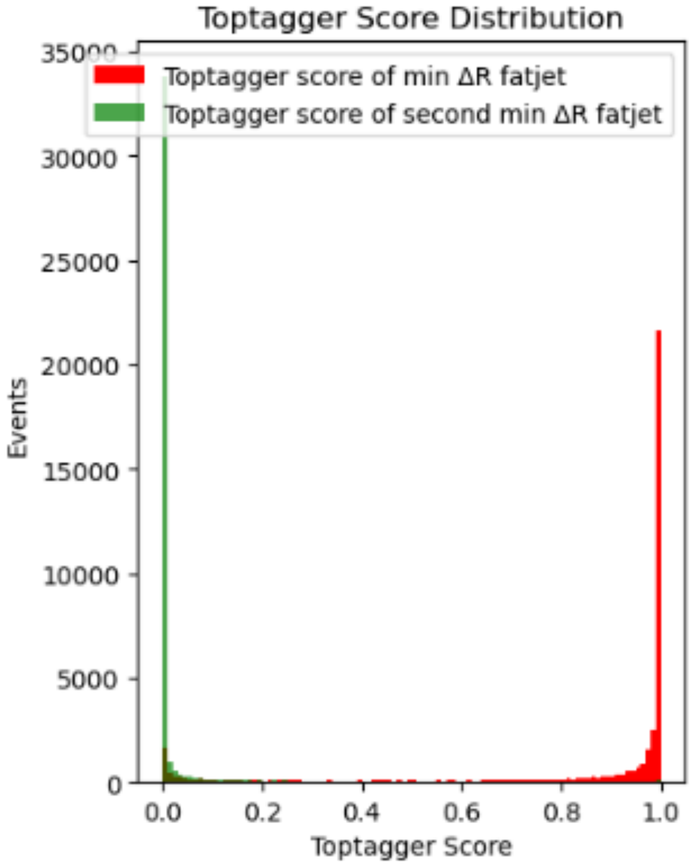


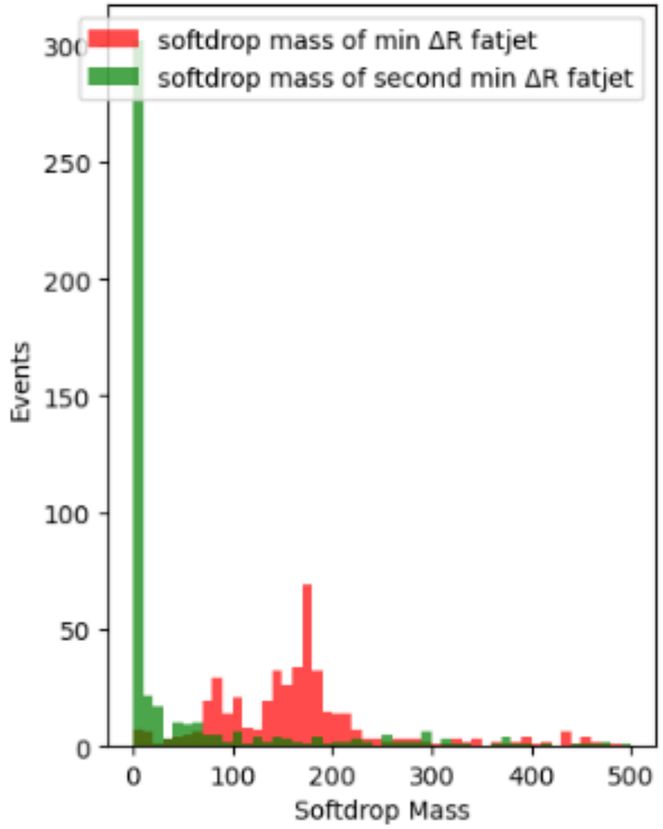
Mass WR 5Tev , N 4.9 Tev

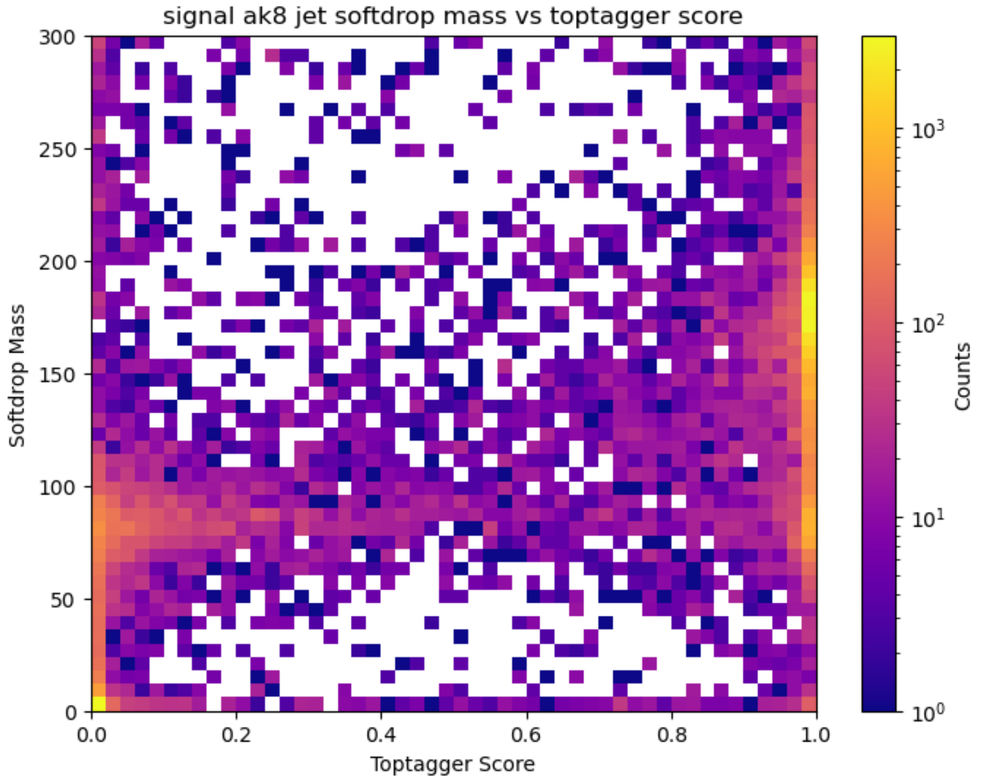
Top jet analysis

How to discriminate top AK8 in signal

1. Checked signal AK8 with toptagger [FatJet_particleNetWithMass_TvsQCD] , softdropmass
2. Does other AK8 has similar score ?





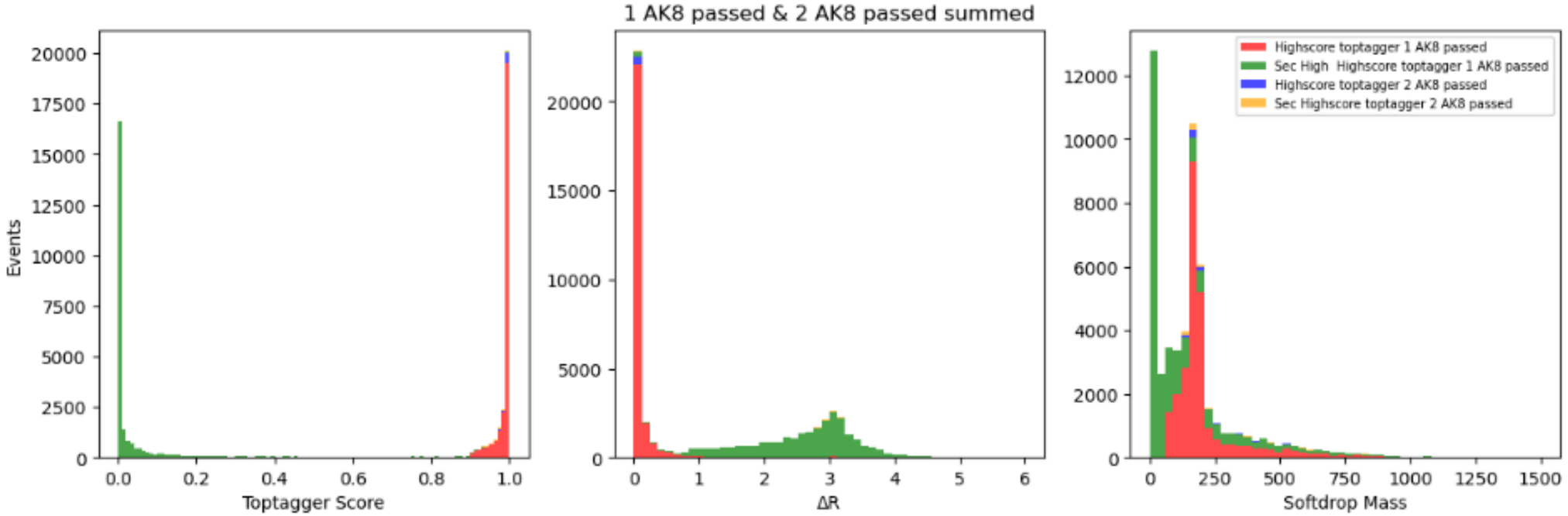


Top jet analysis

How to discriminate top AK8 in signal

1. Checked signal AK8 with toptagger [FatJet_particleNetWithMass_TvsQCD] , softdropmass
2. Does other AK8 has similar score ?

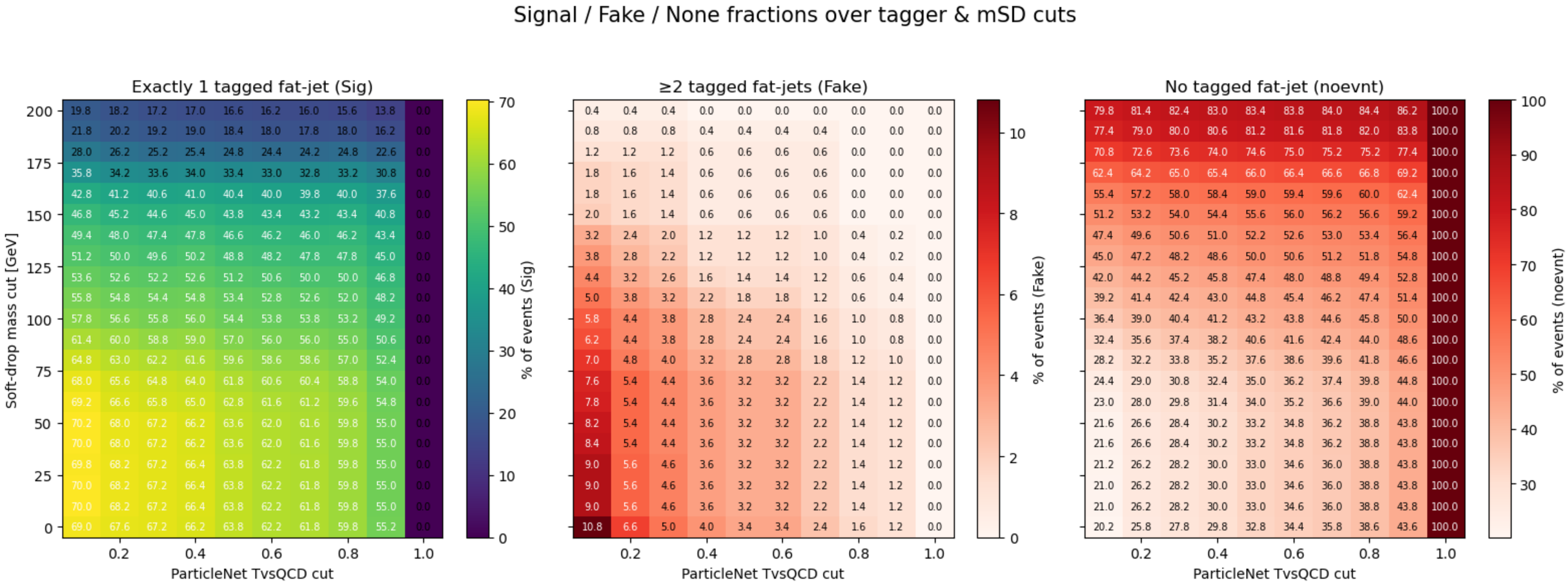
- By diagram it must have only one top jet .
  -> Using cut (toptagger score > 0.9 , softdropmass > 120) , max number of AK8 was 2 .



-> Concluded to use signal with only 1 top jet with cut adjusted.

Top jet analysis

Efficiency for cut(toptagger , softdropmass)

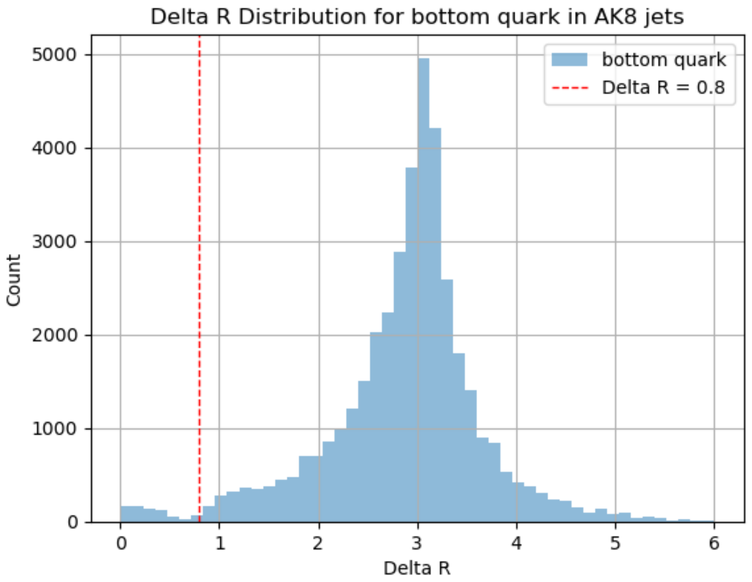


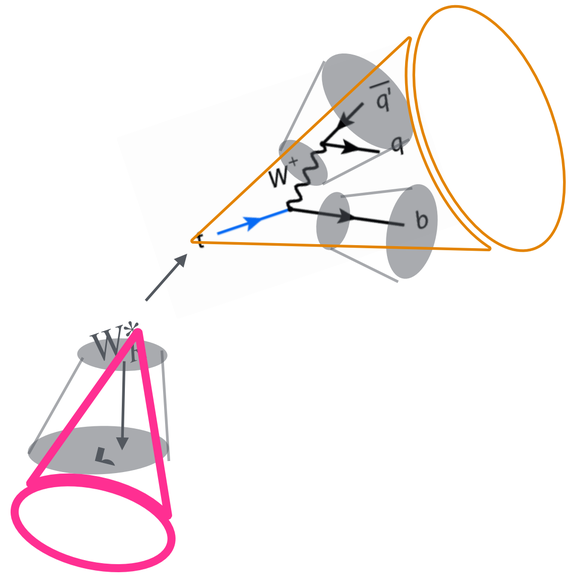
- It is just for signal
- At least 20 % lost happens due to low scores of AK8s. (~ 8.3 % of b escape top [WR 5 Tev , N 4.9Tev])

Signal B jet analysis

- B jet is boosted due to high WR* mass.
- WR* is resolved , top jet and b jet has back - to -back topology.

- By LHE level , must have to check does b jet get inside AK8.





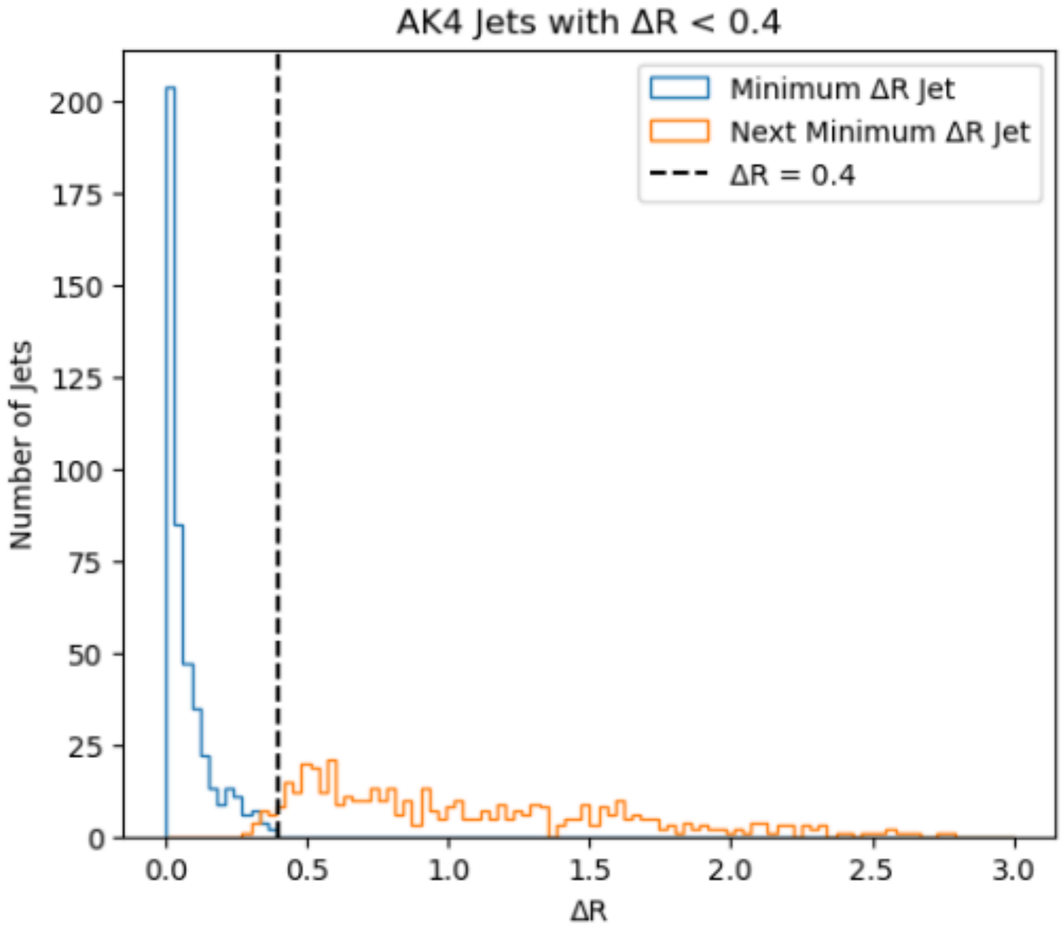
WR 5 Tev , N 4.9 Tev : 1.2%

gets inside AK8

WR 5 Tev, N 2.5 Tev : 8.3%

Signal B jet analysis

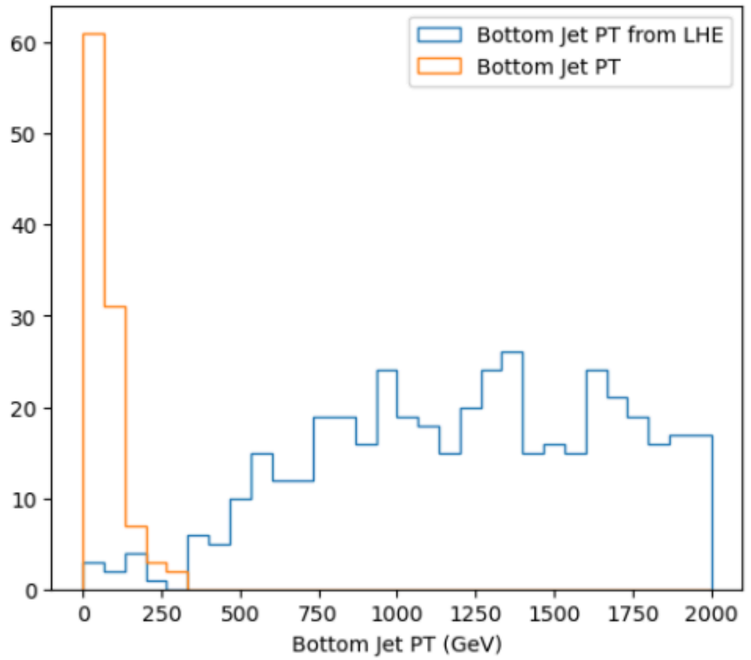
- Same way as top jet , checked closest AK4 jet with LHE b quark , in $\Delta R < 0.4$

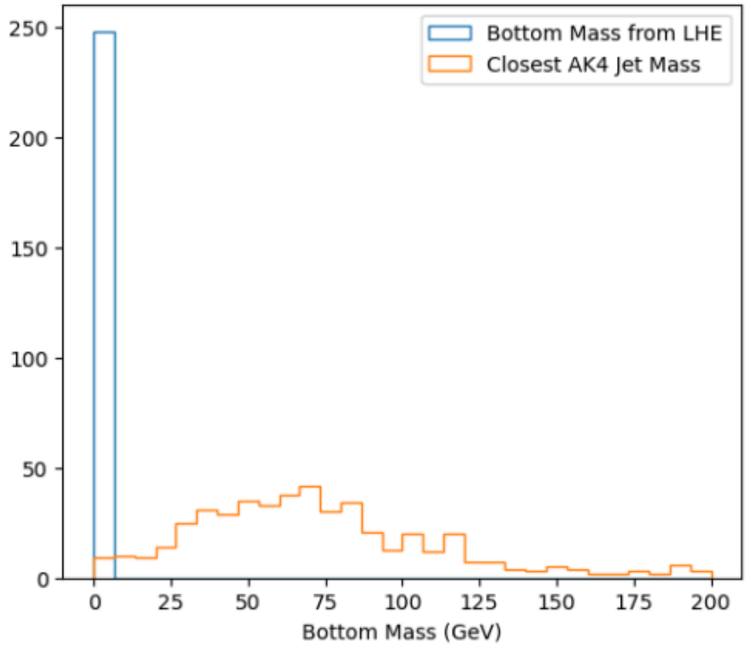


Closest ak4 with LHE would be high probability of signal

Signal B jet analysis

- Same way as top jet , checked closest AK4 jet with LHE b quark , in $\Delta R < 0.4$
  + checked AK4 mass and p_t distribution





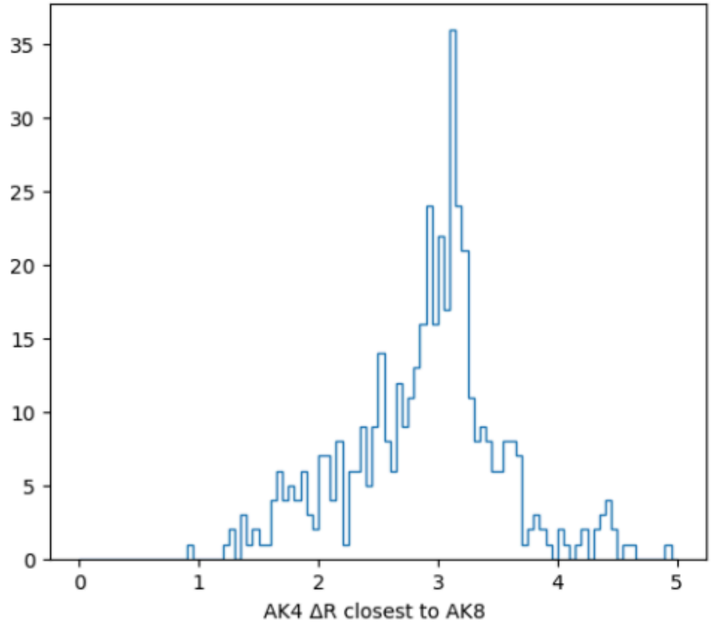
Mass and p_t is not appropriate way to check signal due to hadronization of b quark ..

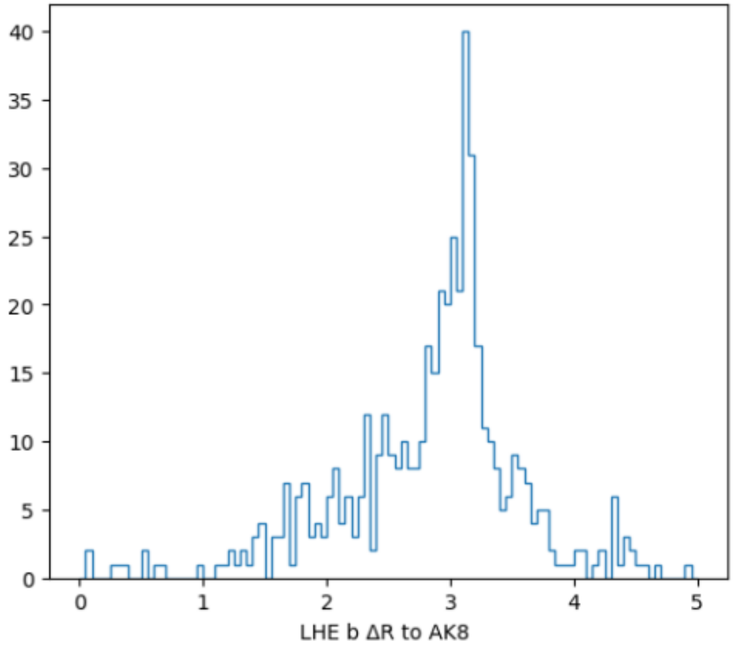
Signal B jet analysis

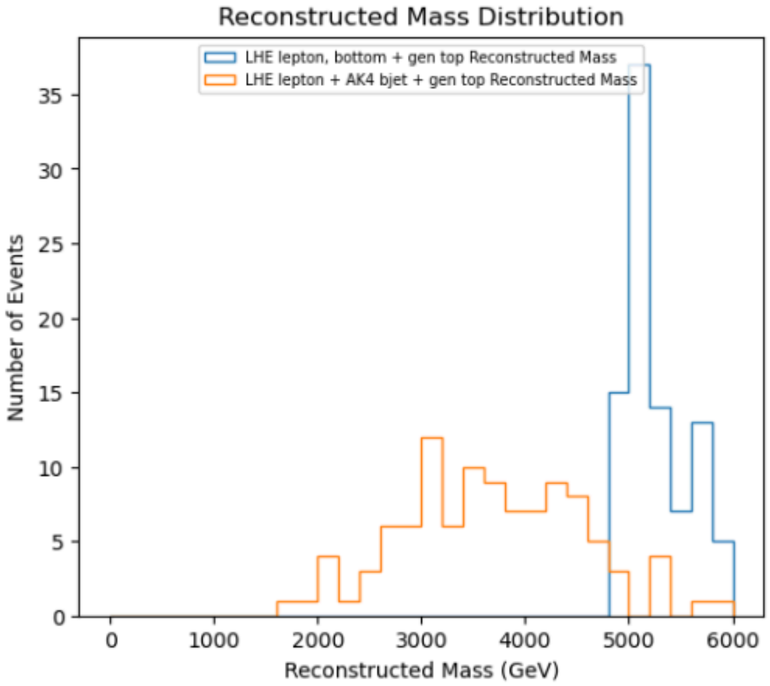
- Same way as top jet , checked closest AK4 jet with LHE b quark , in $\Delta R < 0.4$

  ~~+ checked AK4 mass and p_t distribution~~

  + checked minimum ΔR AK4 and signal AK8 , reco mass

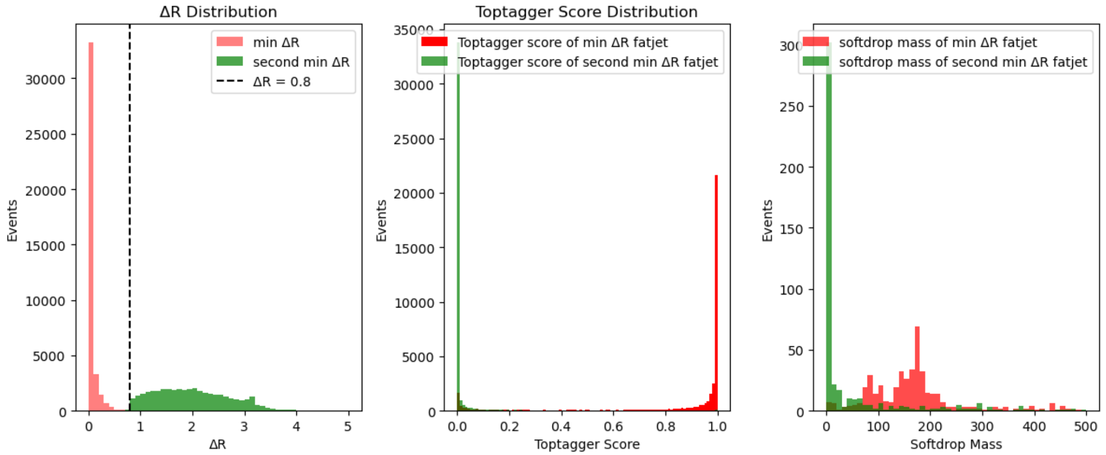


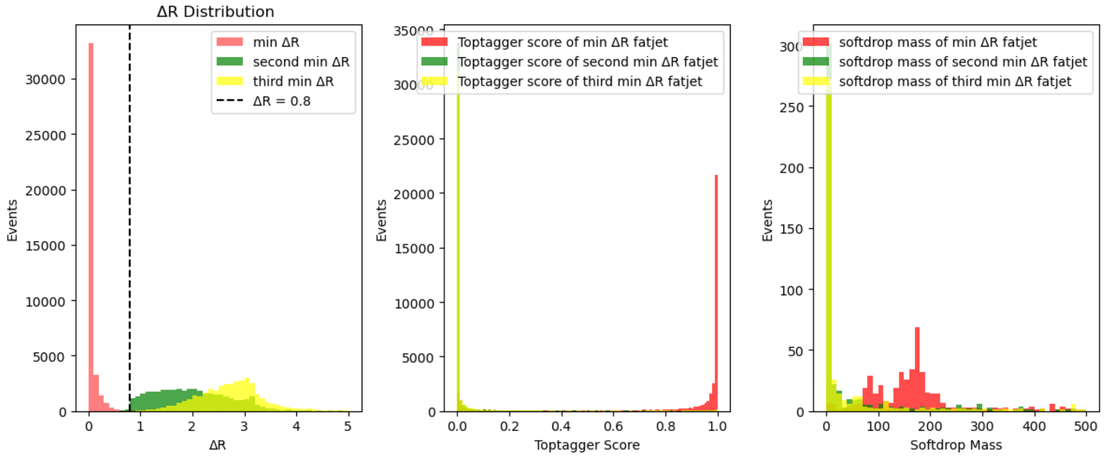




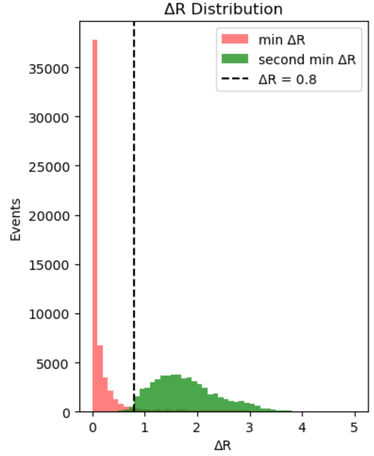
Backups

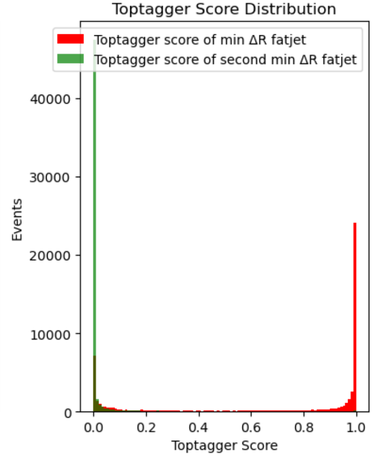
5000 4900

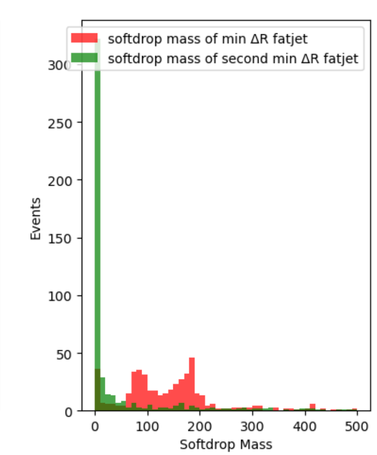


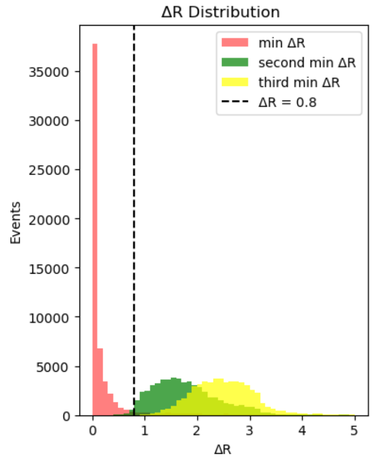


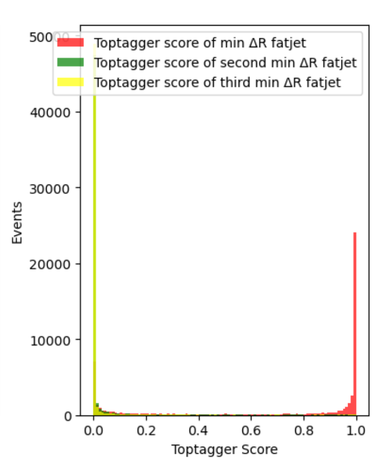
2500

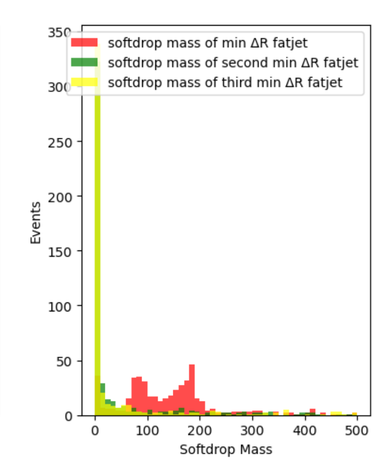






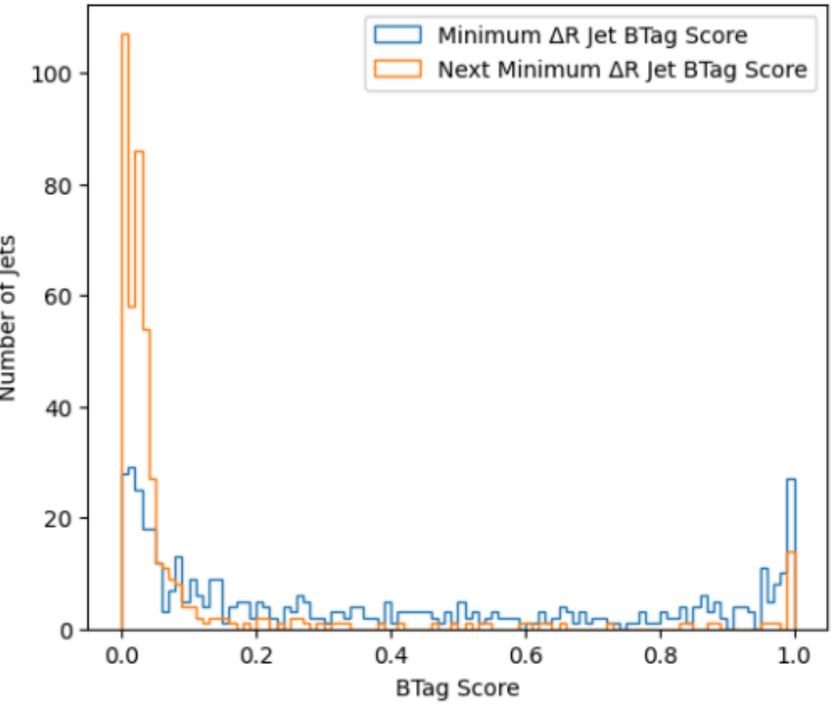


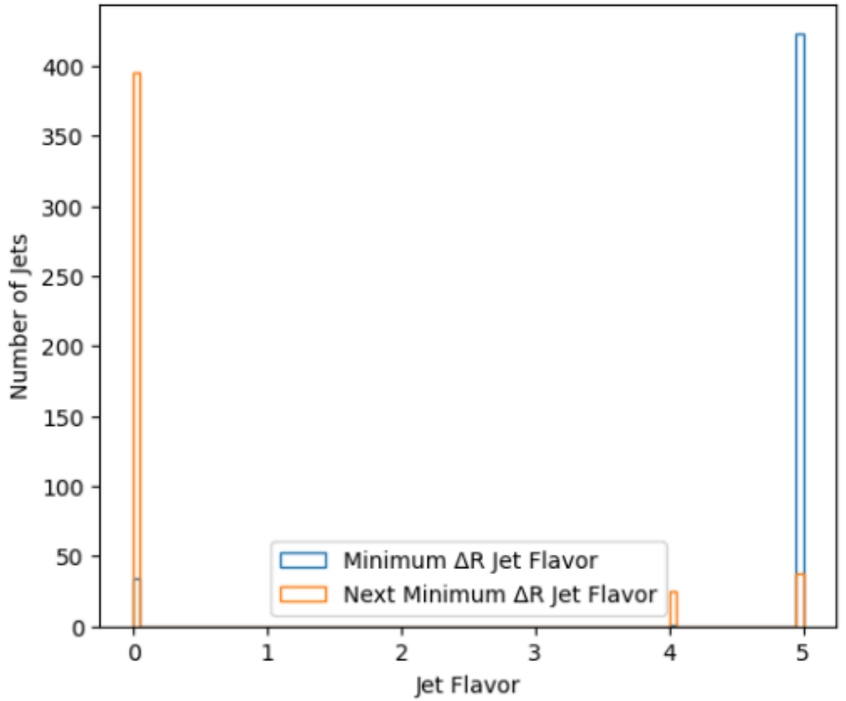


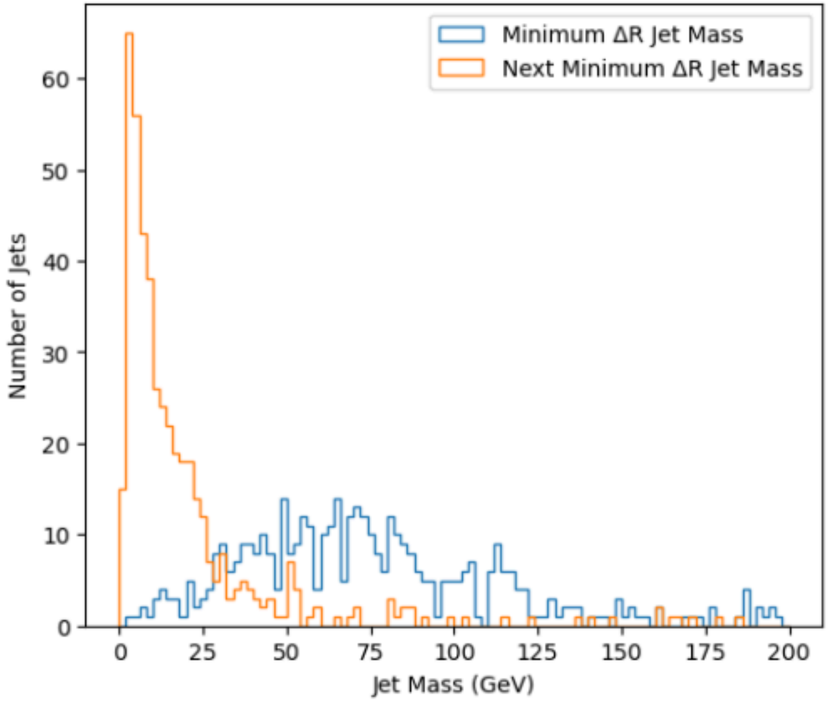


Signal B jet analysis

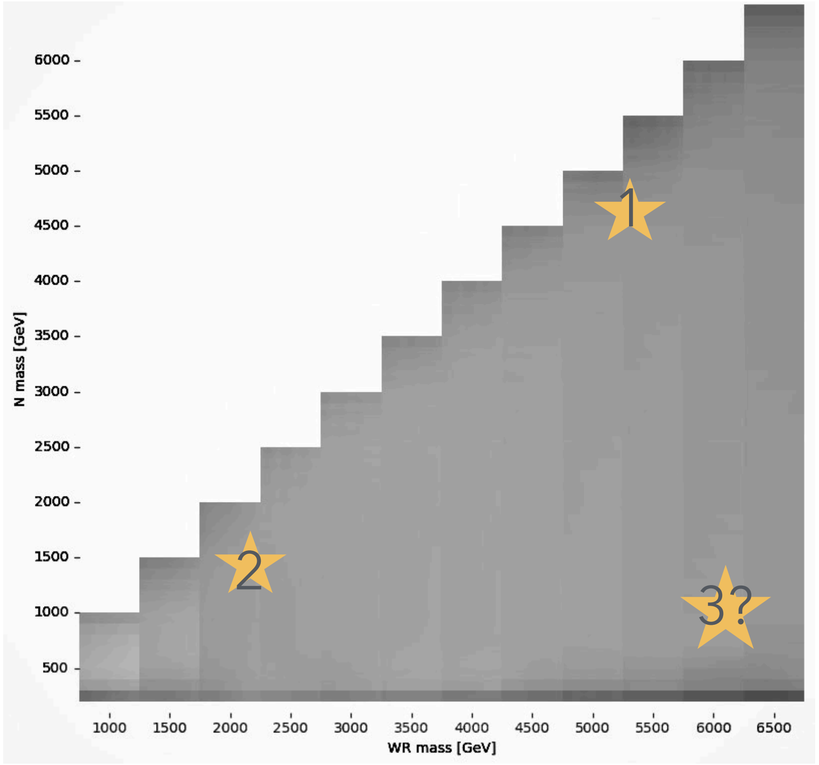
- How to get signal AK4 (closest to LHE b quark) from all of the AK4?
  - B tag score can not discriminate well ,
  though jet Flavor [“Jet_hadronFlavour”] & jet mass >50 could define well.







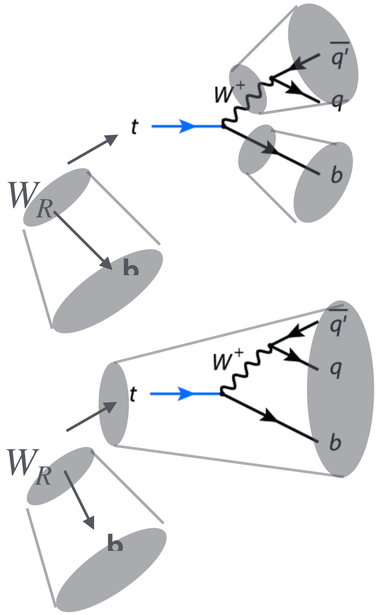
Subtarget Topology in Mass W_R~ N



- Main target : W_R ~ N

1. High mass W_R
Jets are boosted which can be inside one jet

2. Low mass W_R
Jets are separated by two jets,



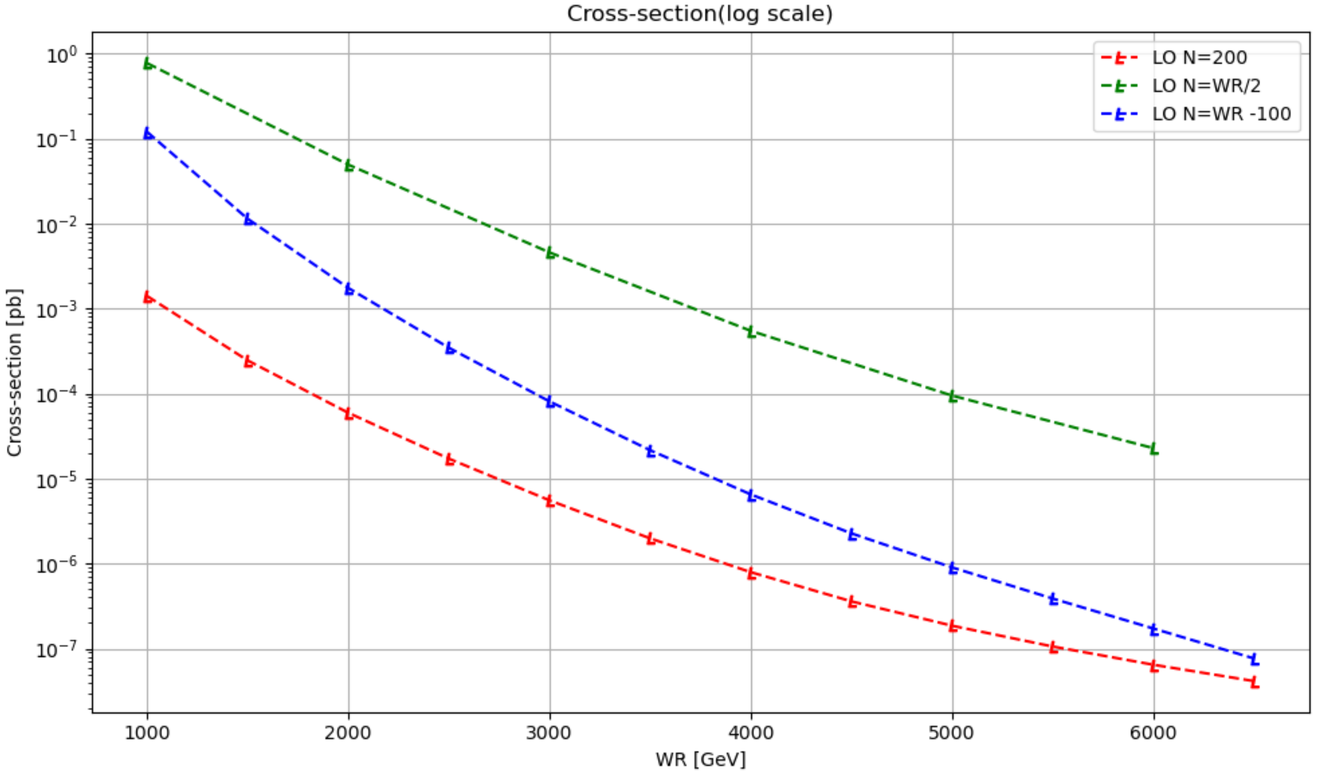
Sub-target : High W_R low N

- Onshell W_R is not useful : boosted

- Offshell W_R can be useful..? : Low mass W_R produced , similar to ★2 topology.
& low pdf variation

Cross sections checking

Structure draft



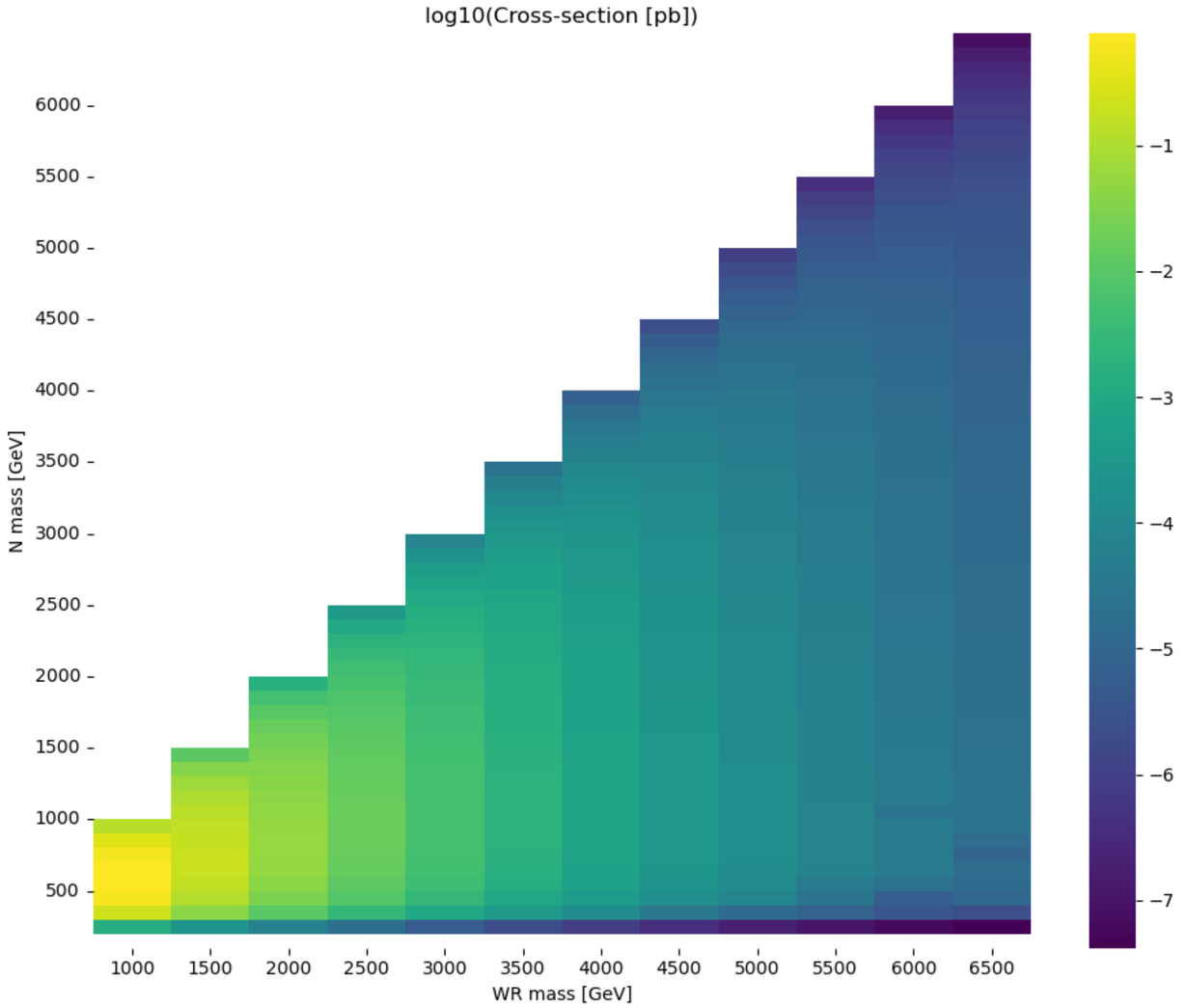
- Checked cross section with mad graph
  (v.2.9.18 20,000 run)

  - Due to phase space (top ~ 173GeV) cross section is constrained

  - N phase space makes N=WR/2 > N = WR-100

Cross Sections Checking

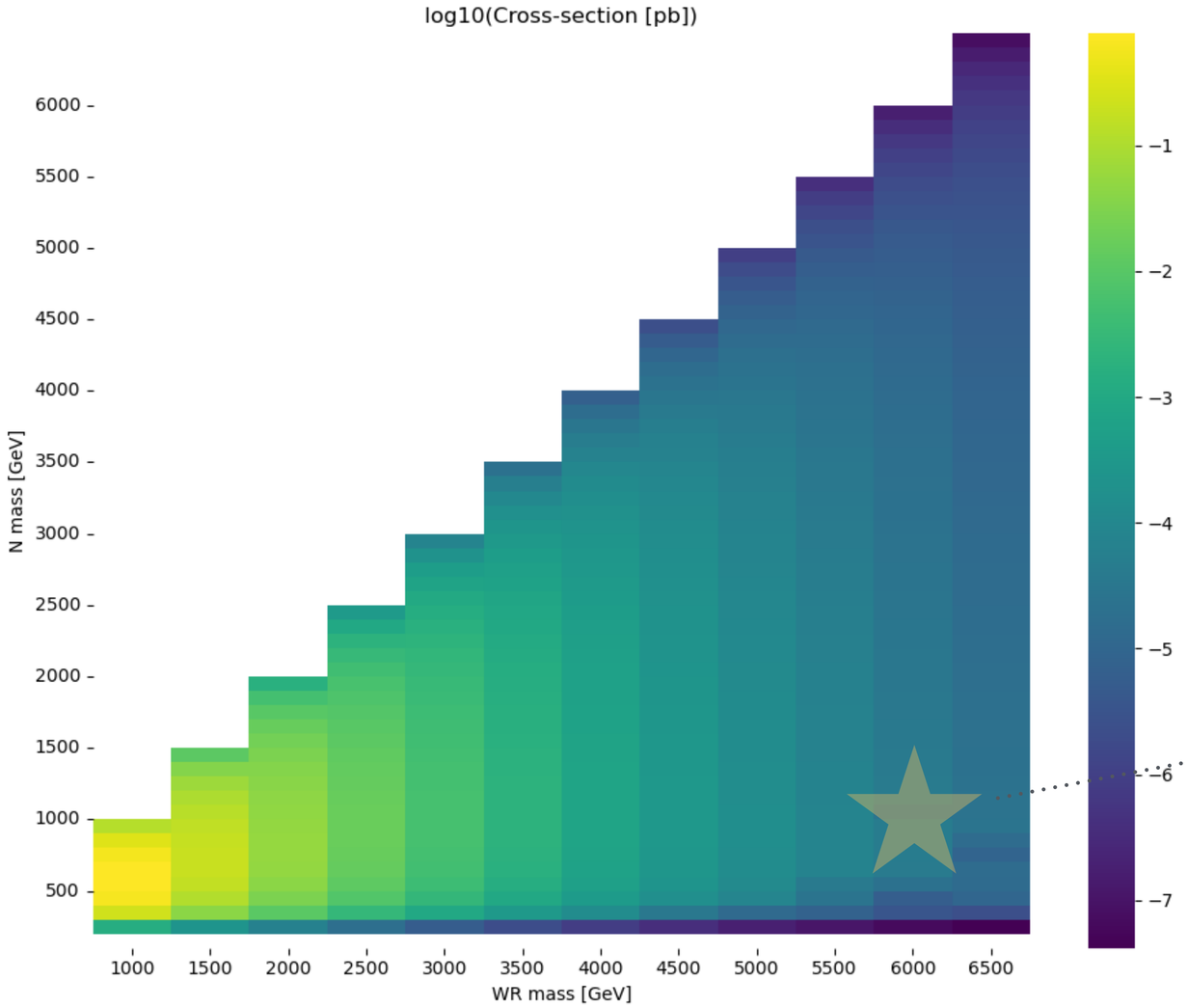
Full cross section



- W_R fixed & N increase
  Cross section increases -> decrease
  : top quark phase space constraint ->
  N phase space constraint -> ..

Cross Sections Checking

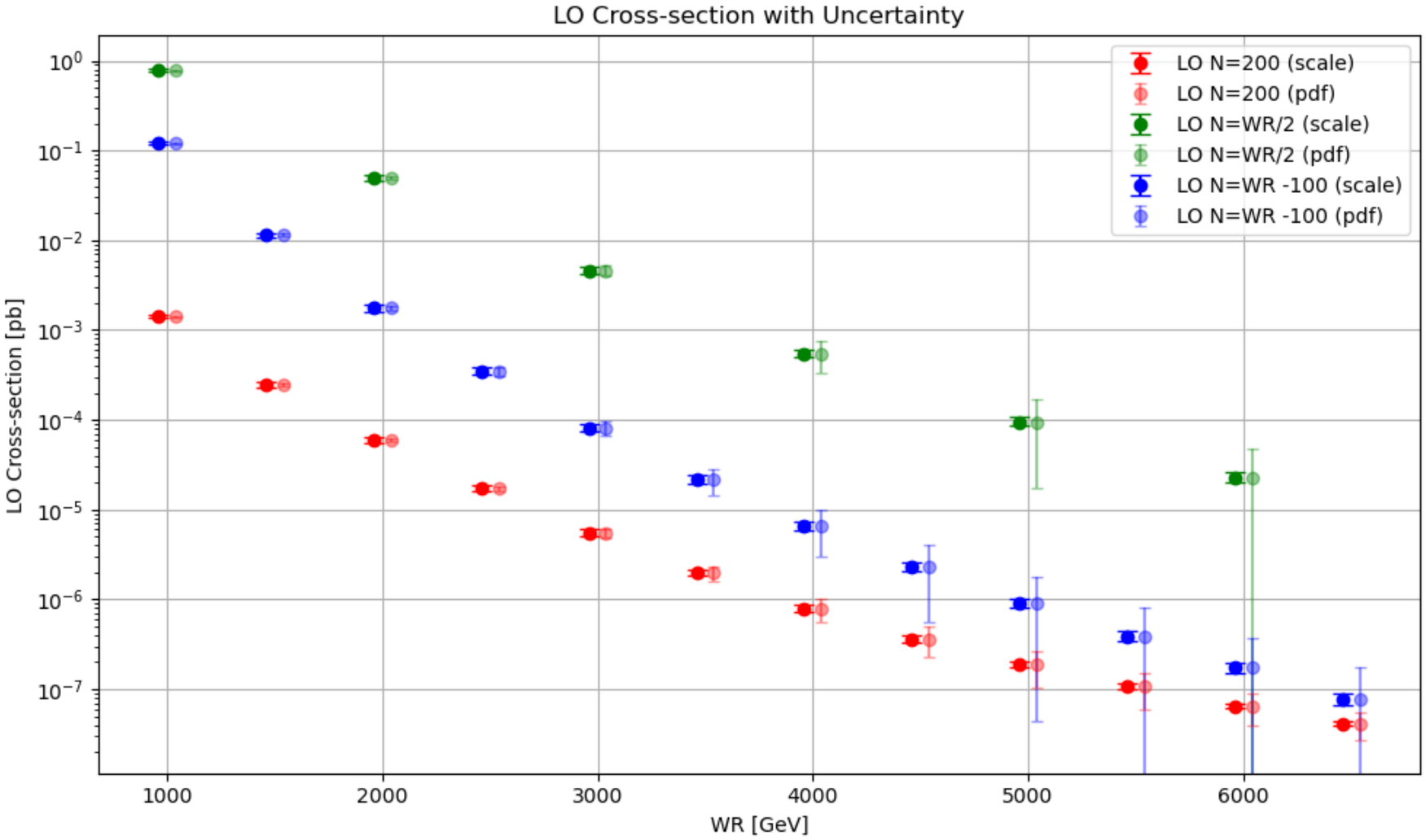
Full cross section



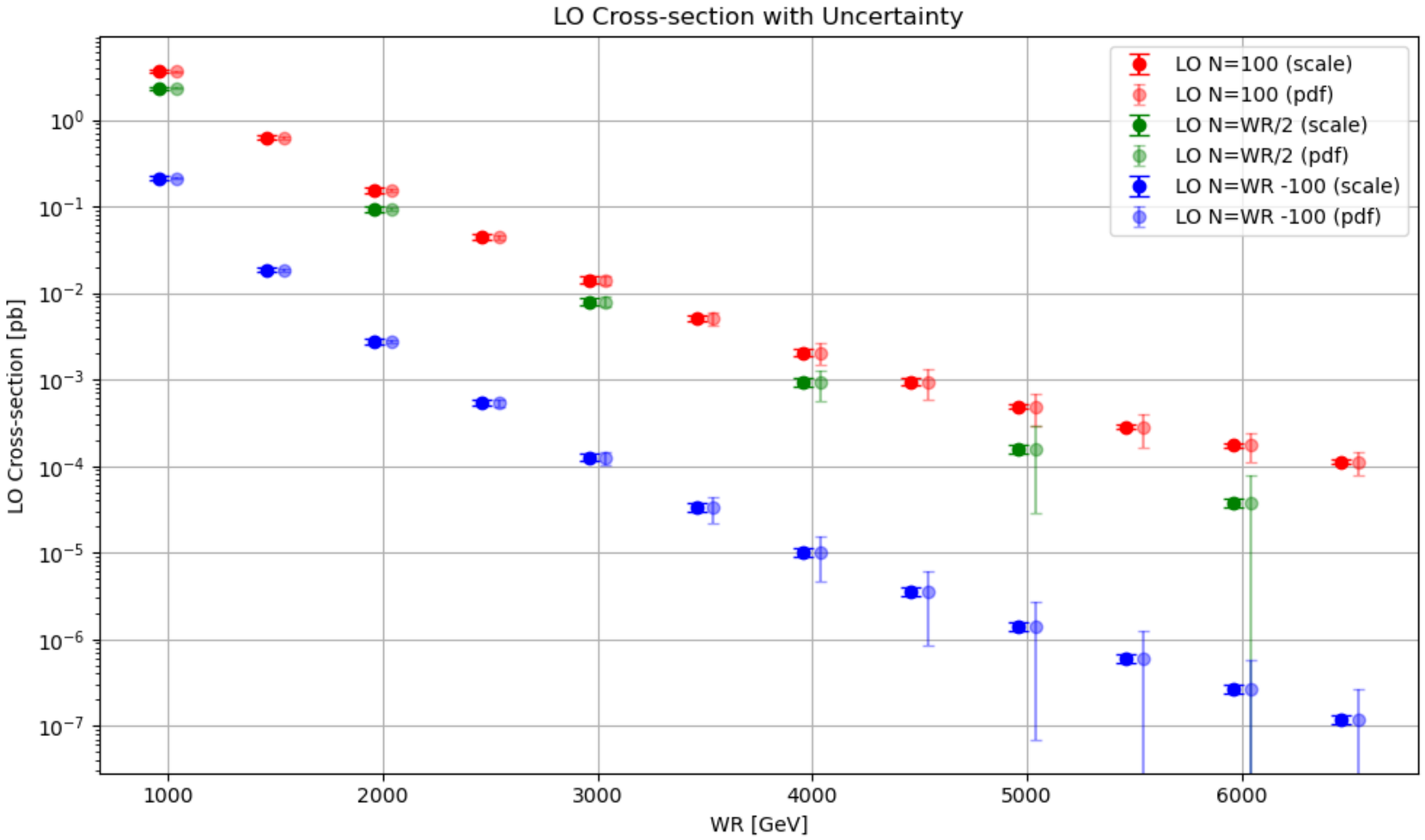
- W_R fixed & N increase
  Cross section increases -> decrease
  : top quark phase space constraint ->
  N phase space constraint -> ..

- Now checking on # of offhsell W_R in this region

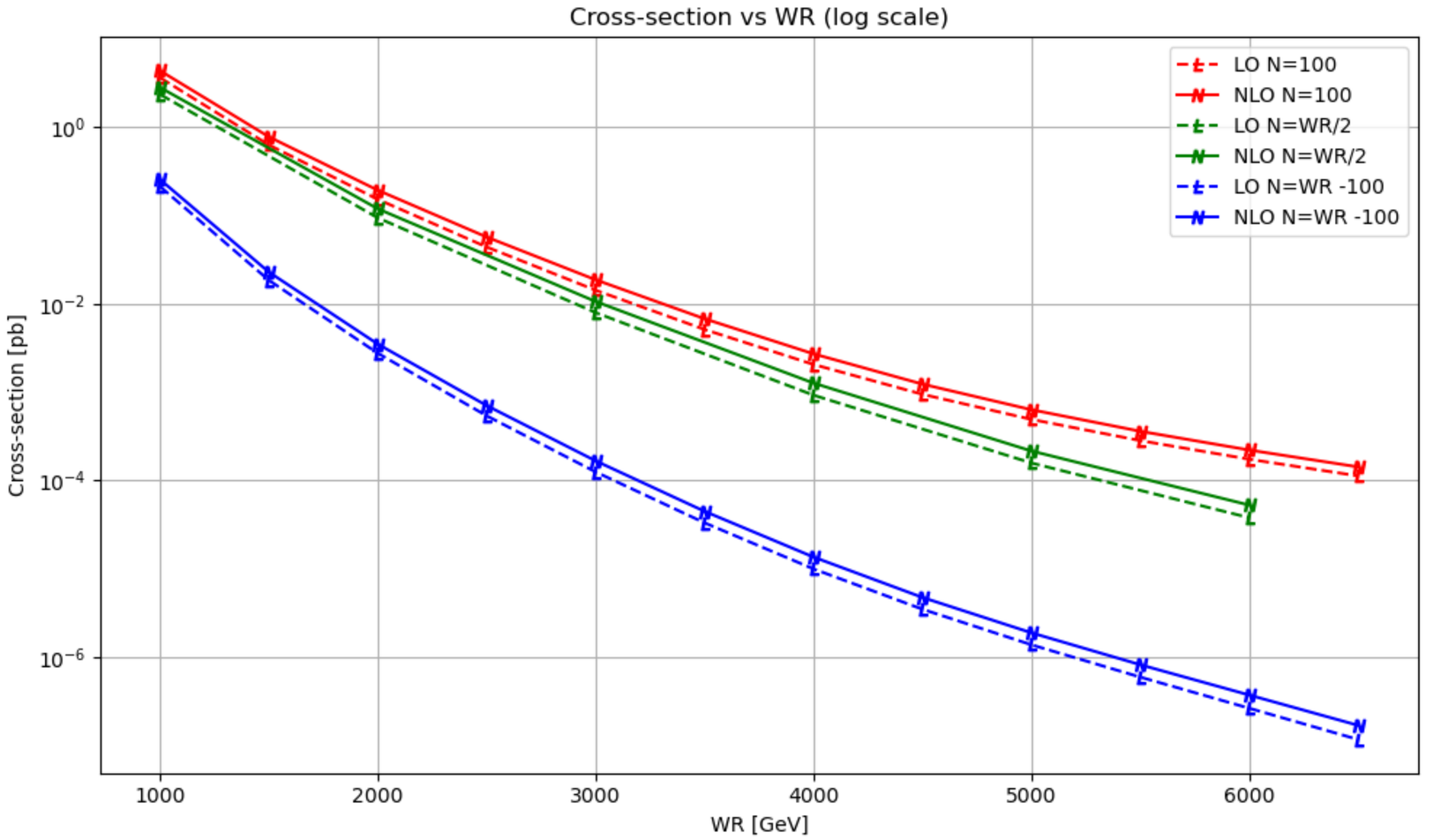
Pdf & scale variation



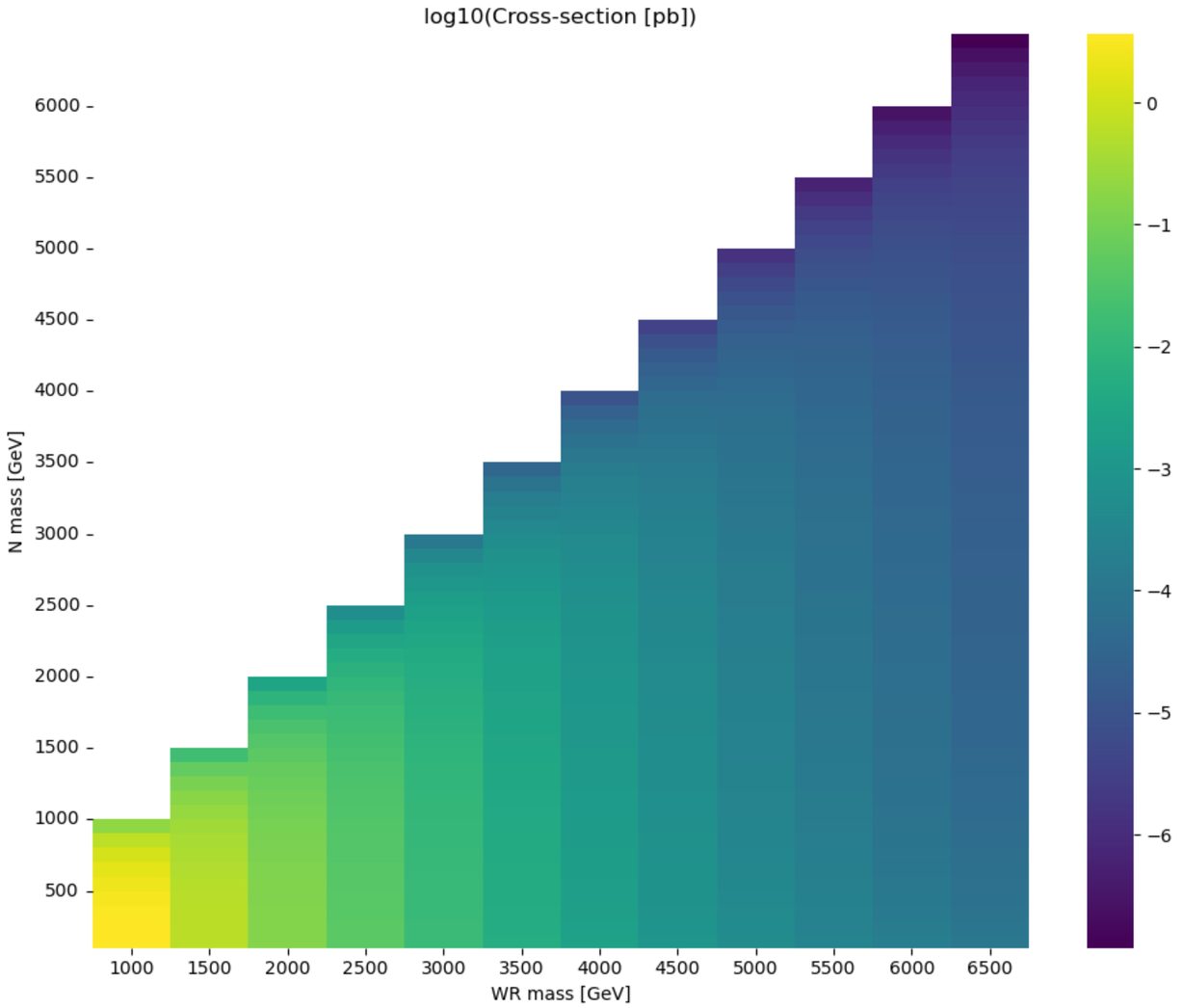
pdf & scale variation for tau



Cross section for tau



Full cross section for tau



Thanks!