山东大学 SHANDONG UNIVERSITY

Department of Physics, Shandong University

Compressed EWK study(ISRC1N2)

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Tasklist

- Bkg estimation for C1N2ISR
- BSc thesis: https://www.overleaf.com/project/674e7119837a2580151a0868

SR definition

Pre-Selection

- lep-had channel:nTaus$\geq$1;nLeps$\geq$1
- had-had channel:nTaus$\geq$2;nLeps=0
- MET$\geq$ 200; pass MET trigger
- $1 \leq nBaseJet$ → Nbjets > 0 For Top estimation
- b-veto
- OS

SR for HH channel

hyper parameter: NTrees=500, learning rate=0.05, max depth=12, MinNodeSize=1%(default)

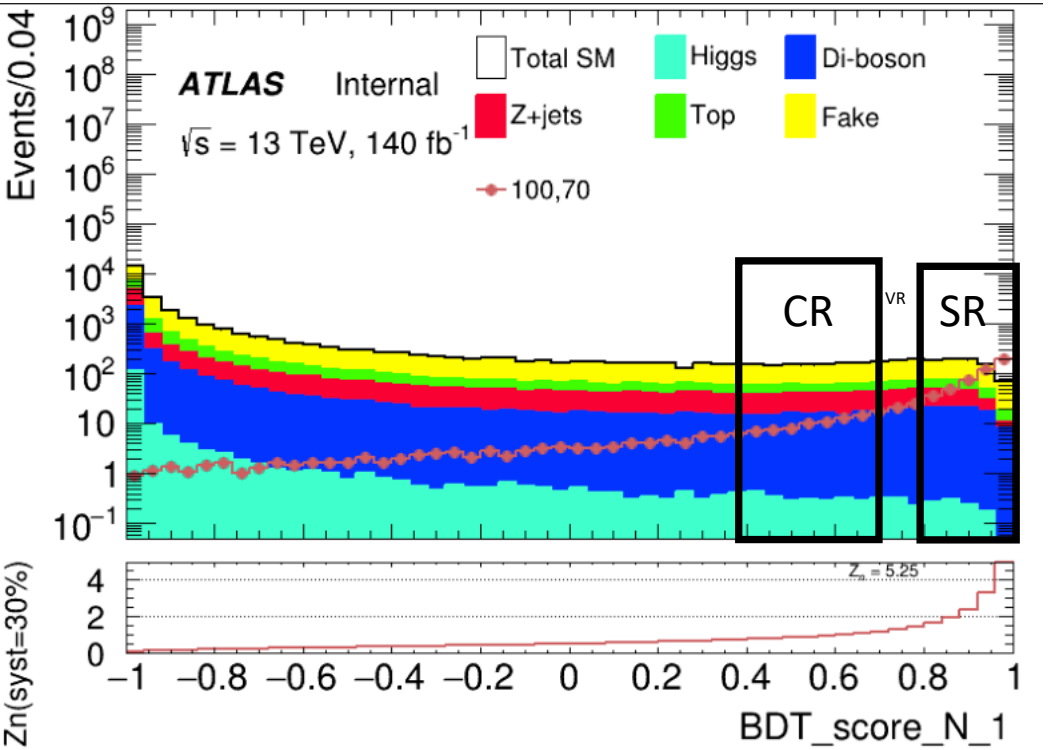
Pre-Selection + BDT score $\geq$ 0.91

SR for LH channel

hyper parameter: NTrees=400, learning rate=0.01, max depth=10, MinNodeSize=1%(default)

Pre-Selection + BDT score $\geq$ 0.87

Bkg Est ML(LH)

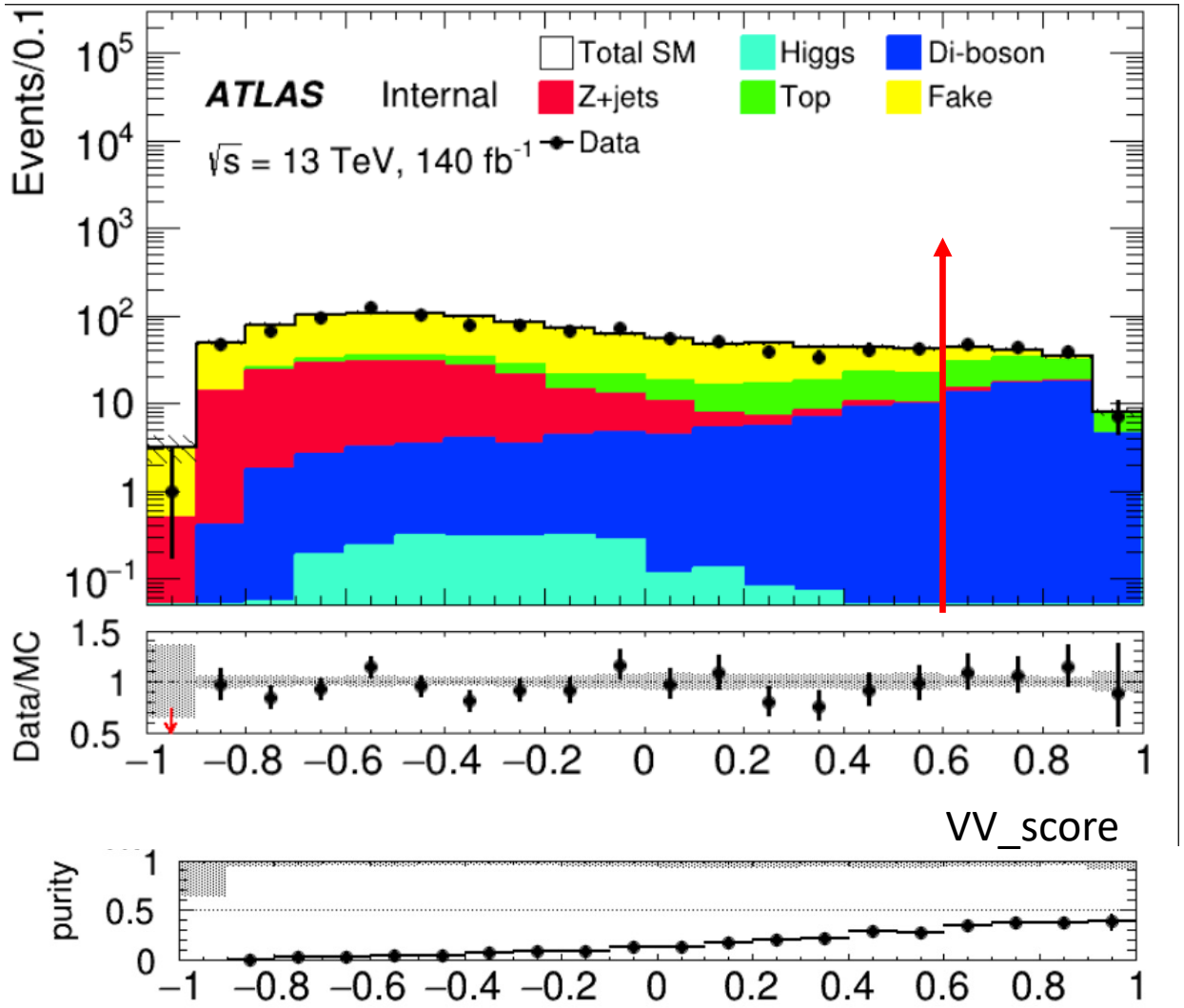



```
sigSR: 474.103
bkgSR: 806.432
sig/bkgSR: 0.587901
sigVR: 101.265
bkgVR: 748.158
sig/bkgVR: 0.135352
sigCR: 89.34
bkgVR: 1268
sig/bkgVR: 0.0704575
VVCR: 126.601
```

CR: [0.4, 0.7]
VR: [0.7, 0.8]
SR: [0.8, 1.0]

Already expanded the CR to [-0.5,0.5]
but I cover the result by mistake

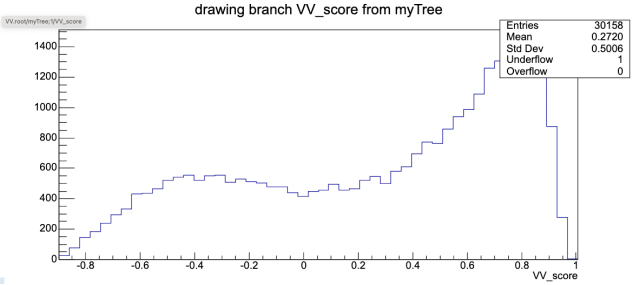
VV



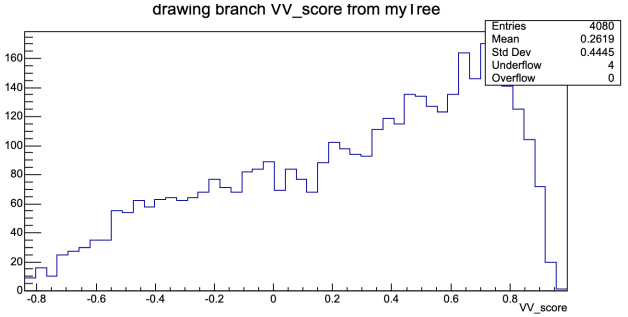
VV_score cut at 0.6

purity: 0.40509
VV: 51.4569
TotalBkg: 127.025

VV



Top



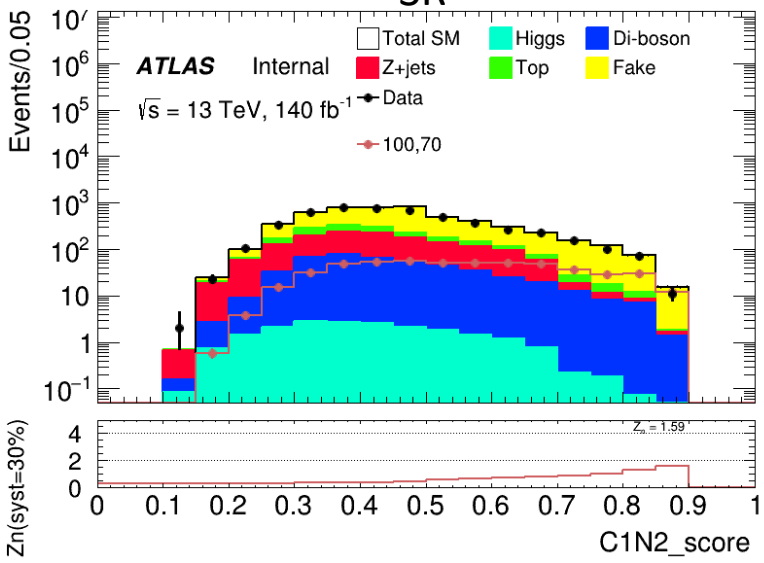
VV and Top have similar distribution

similar reuslt in [-0.5, 0.5] for CR

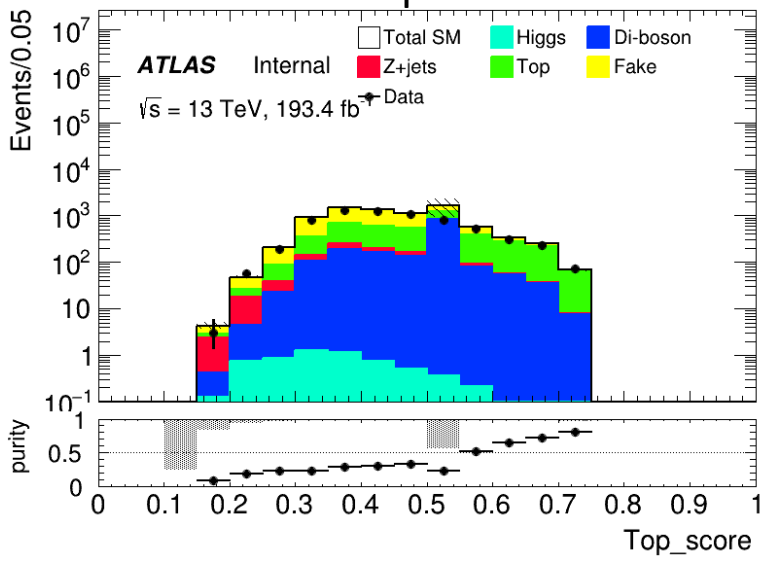
MultiClass

Try to define SR and CRs by using MultiClass, after disscuss with Professor, no time to redefine SR
result of MultiClass, still low purity of VV CR

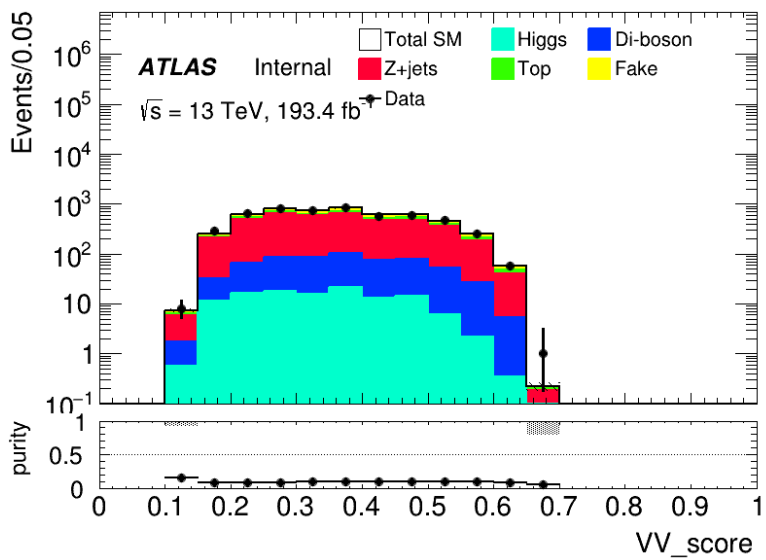
SR



Top



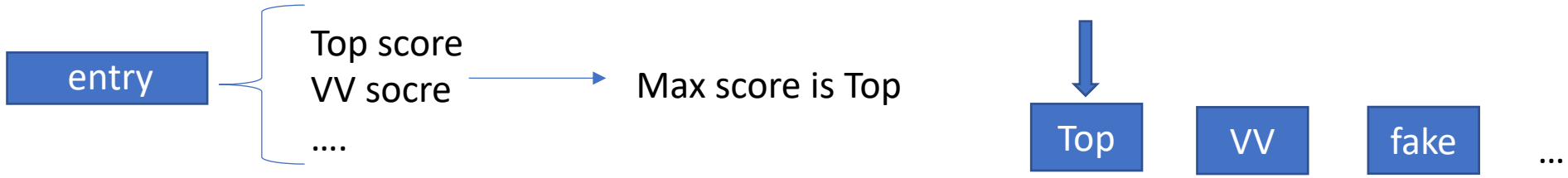
VV



Zn drop a lot by using MultiClass, no idea

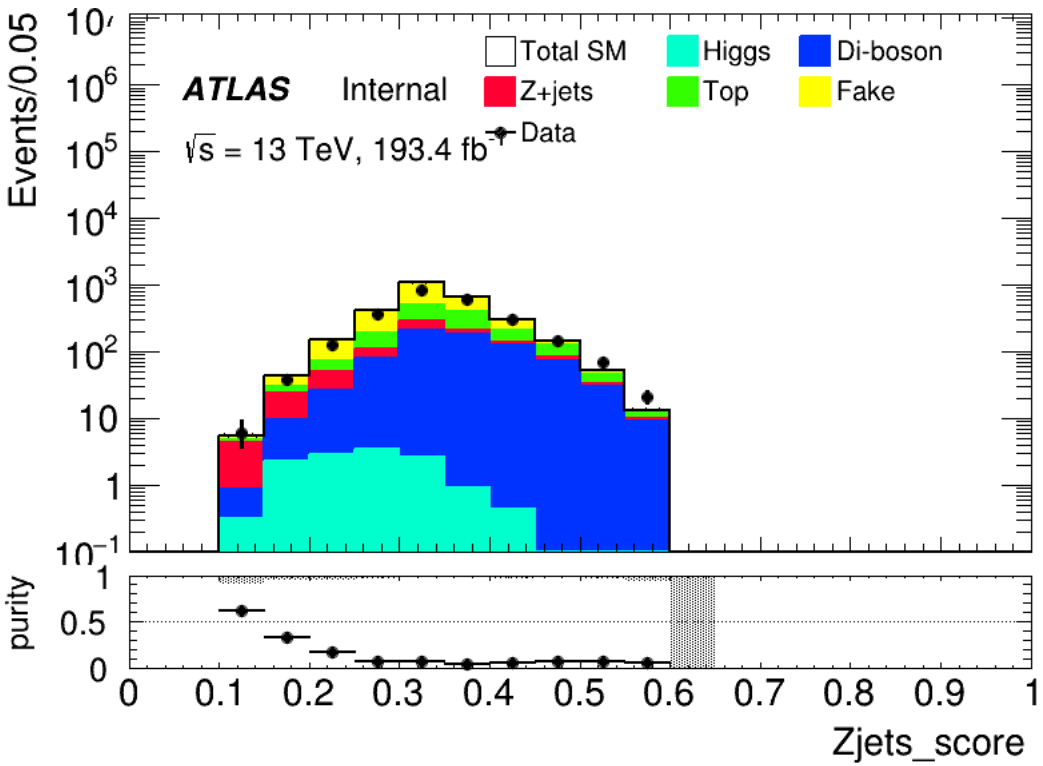
Selection: scoring entry for each class, then select max score and put this entry to the class that max score corespond

Example:

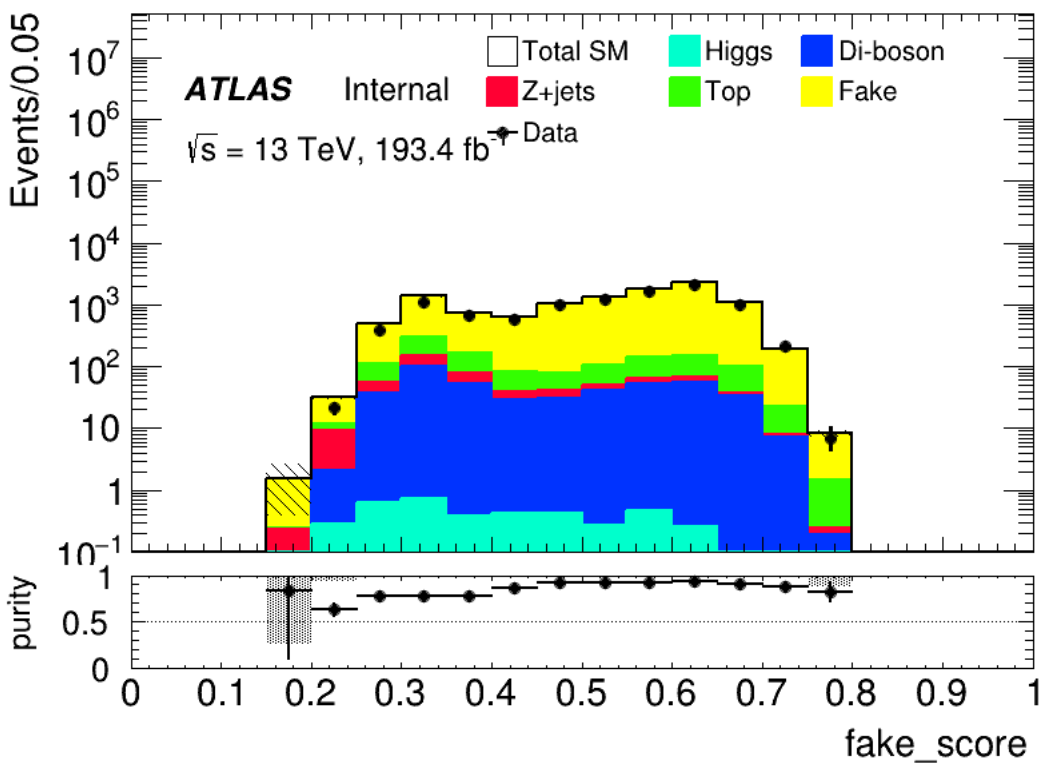


MultiClass

Zjets



fake



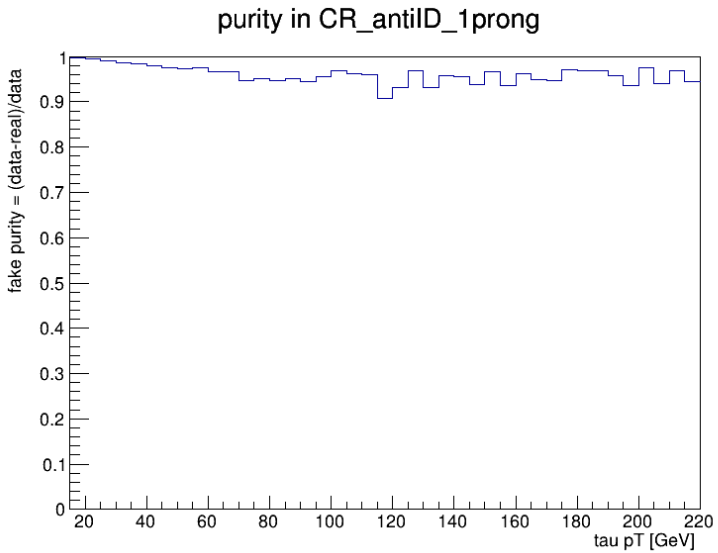
FF method

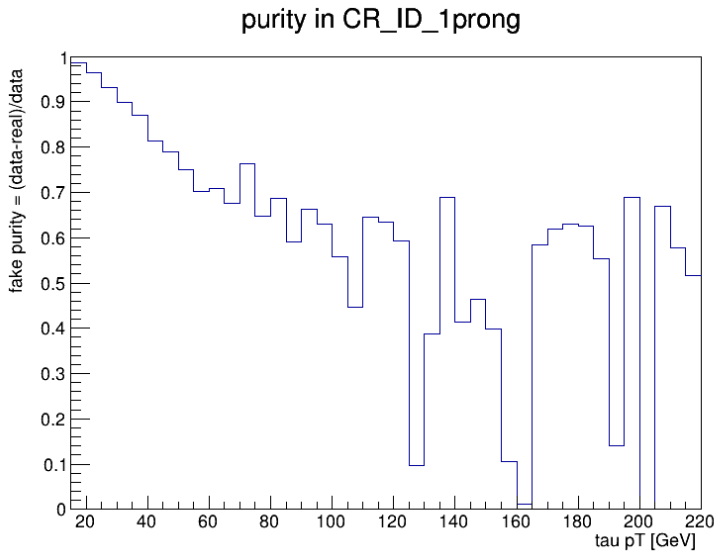
CR:
pre-selection(No OS)
>= 1 lepton, == 1 veryloose tau, == 0/1 medium tau(antiID, ID)

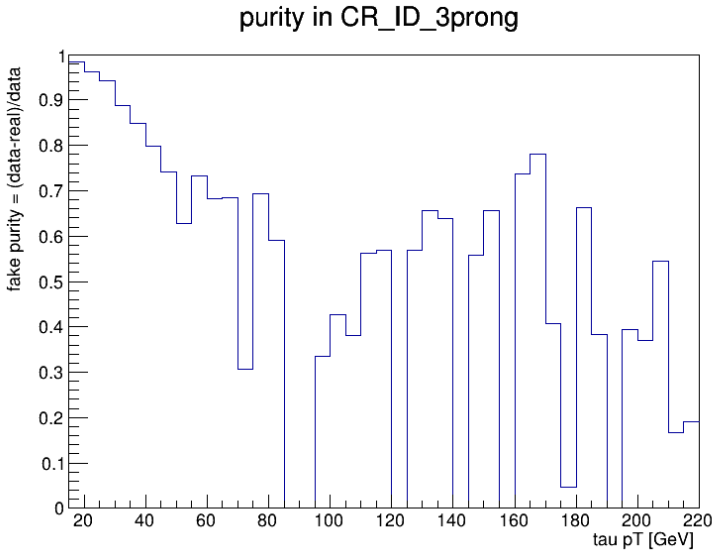
SR:
pre-selection
== 0 lepton, == 2 verylosse tau, == 0/1/2 medium tau(2anti, 1anti 1ID, 2ID)

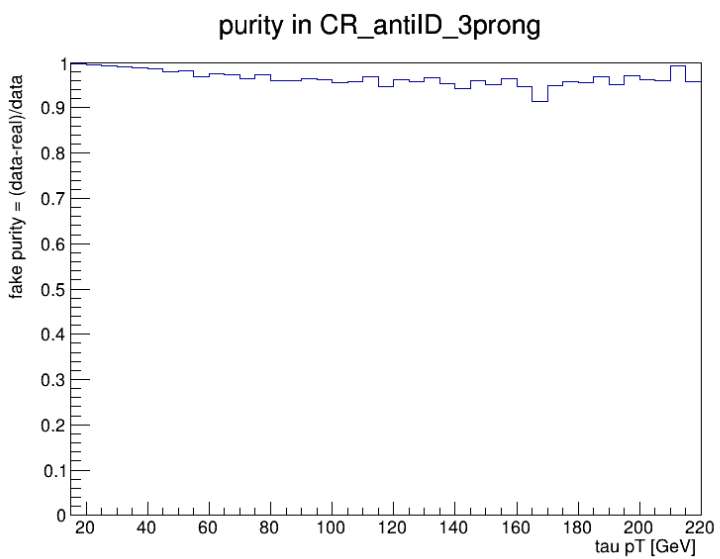
FF method

Fake purity









FF method

Binned by prongess, eta, pt_tau

2 ways to bin:

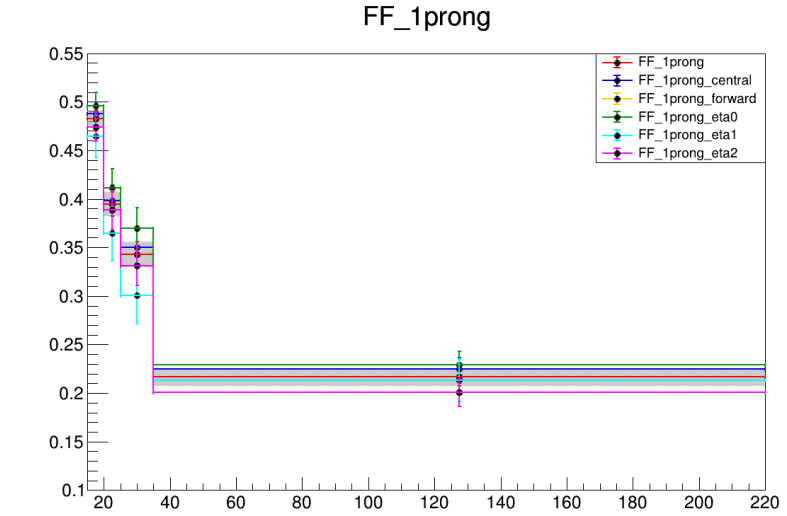
3bins eta: [0, 1), [1, 1.37), [1.52, 2.5]

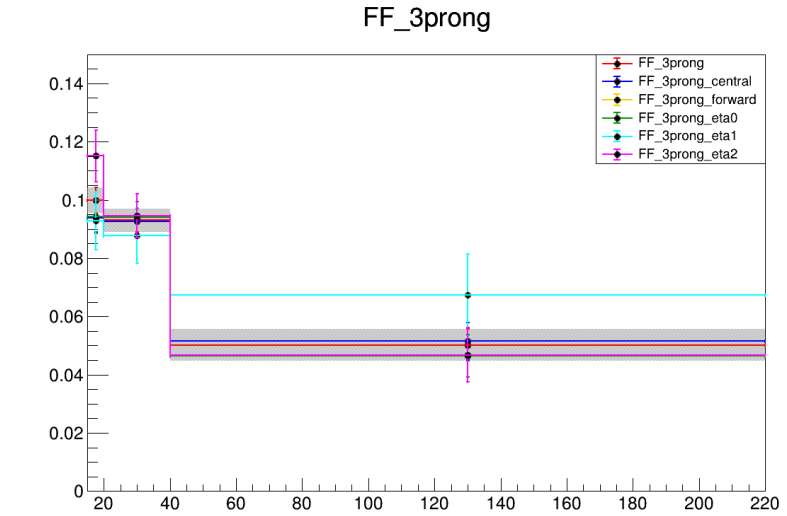
2bins eta: central [0, 1.37], forward [1.52, 2.5]

1-prong: 3 eta bins

3-prong: 2 eta bins

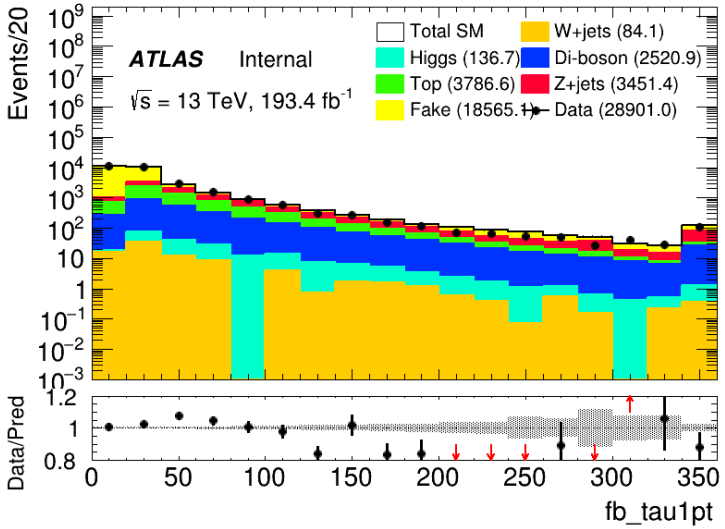
Auto binning

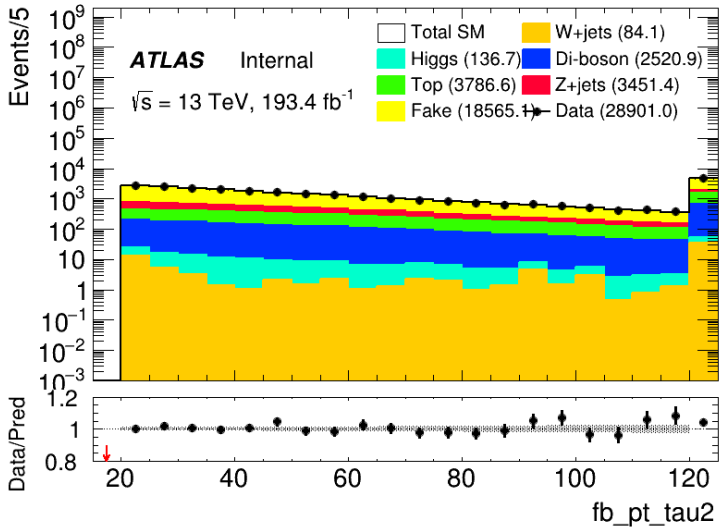


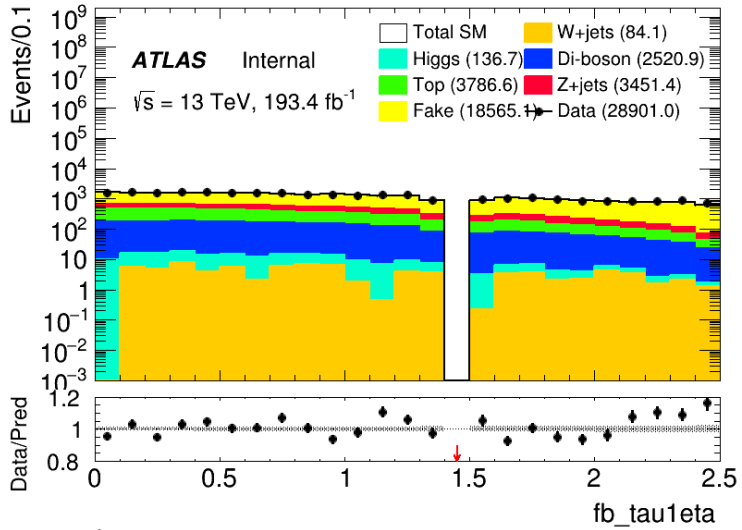


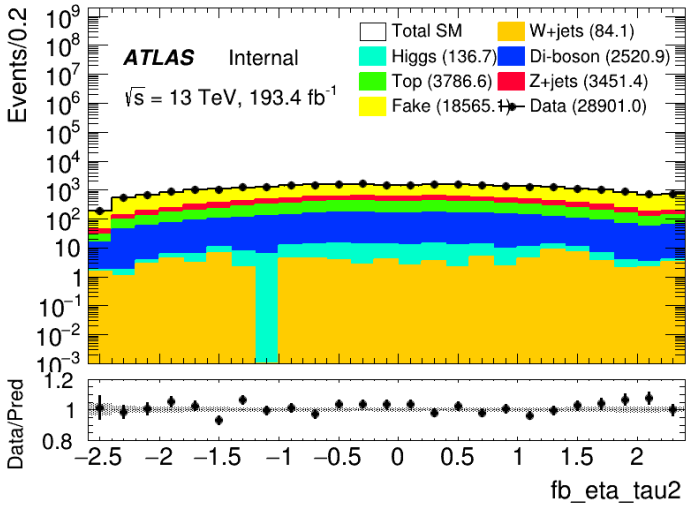
FF method

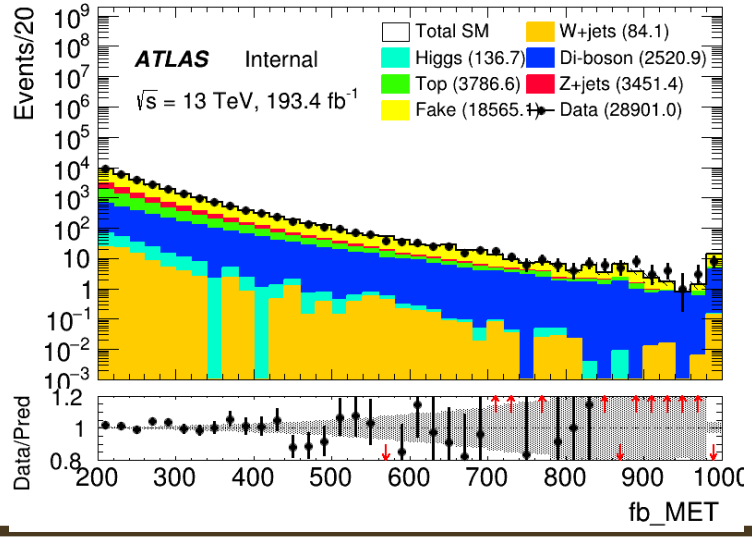
LH(CR)

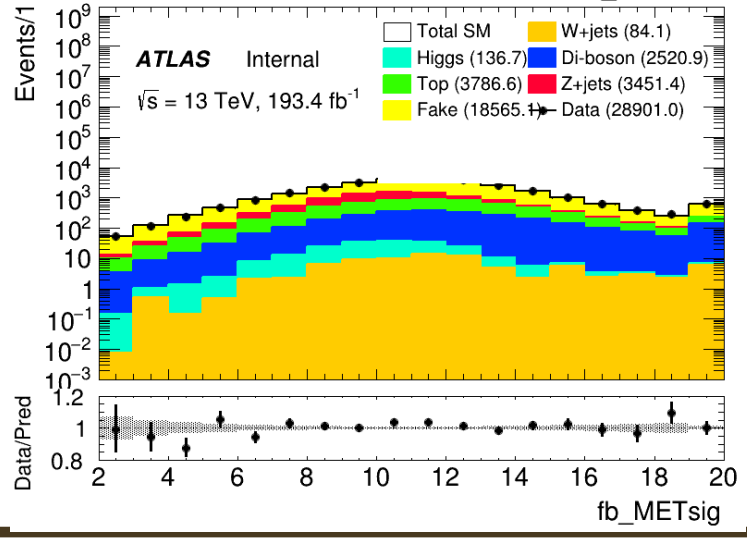






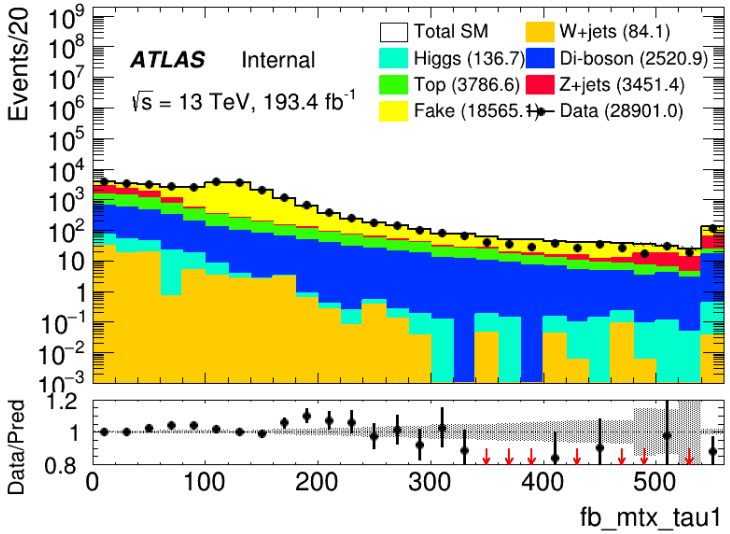


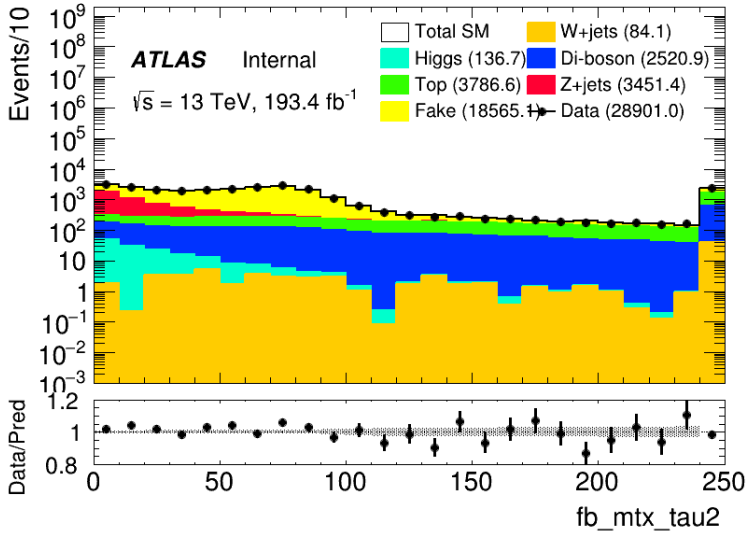


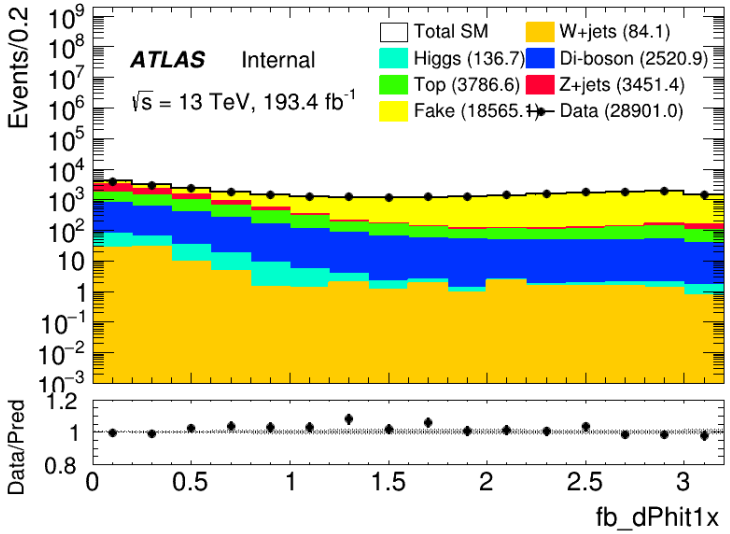


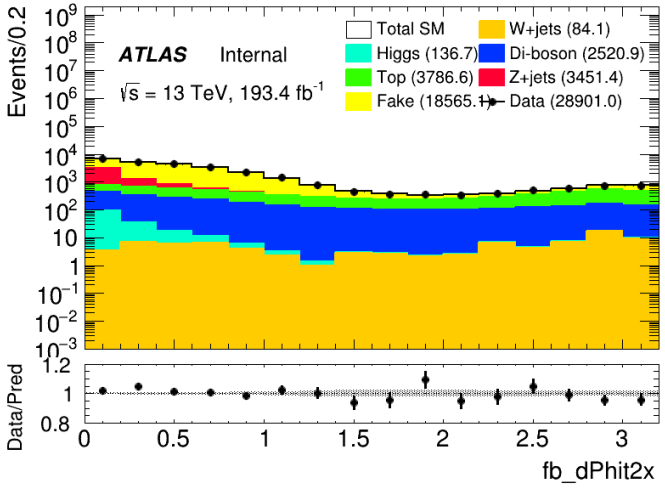
FF method

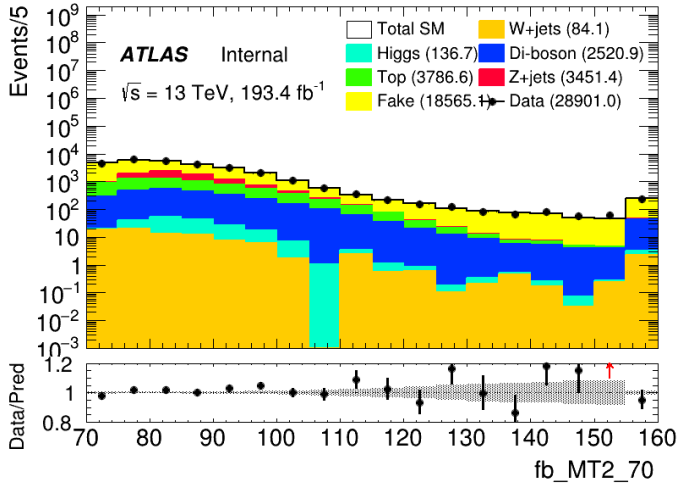
LH(CR)

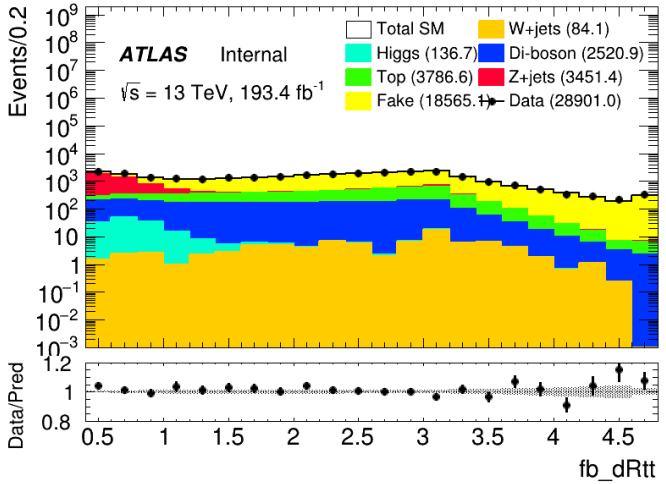






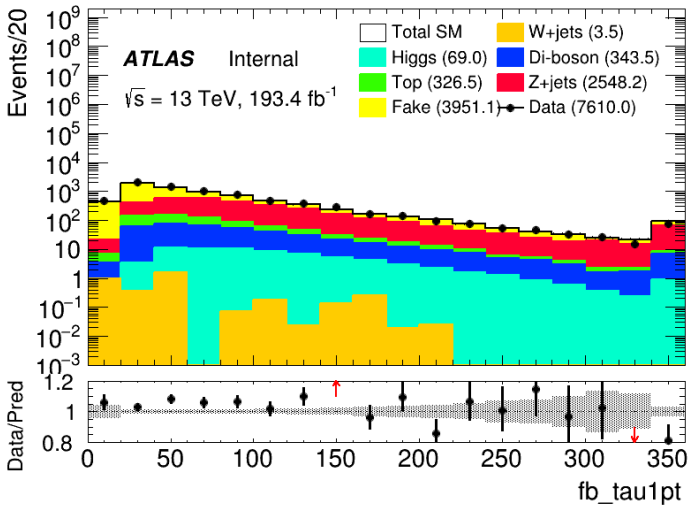


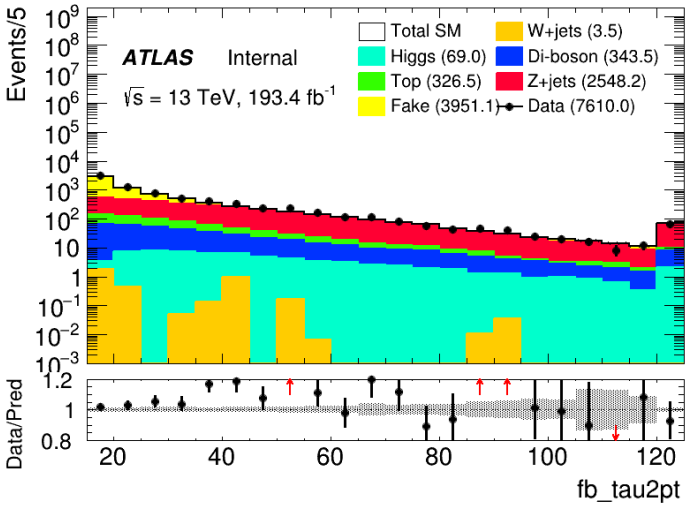


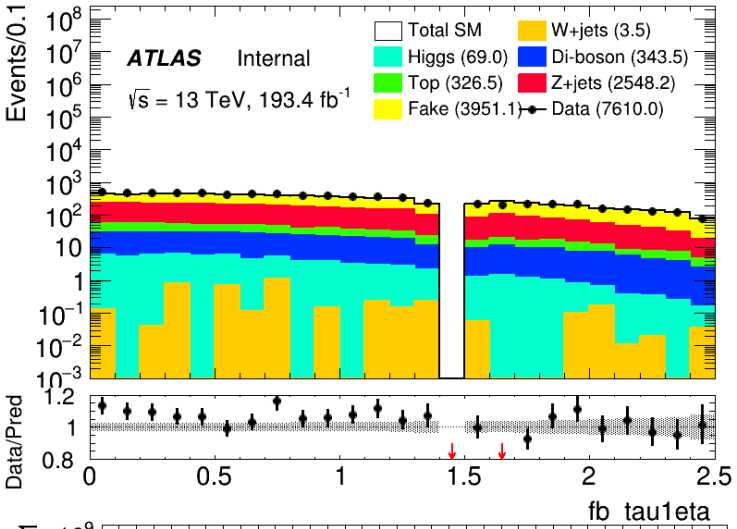


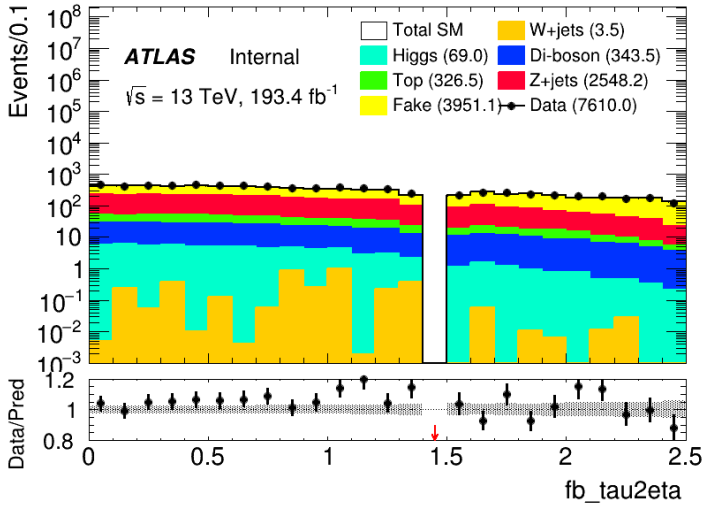
FF method

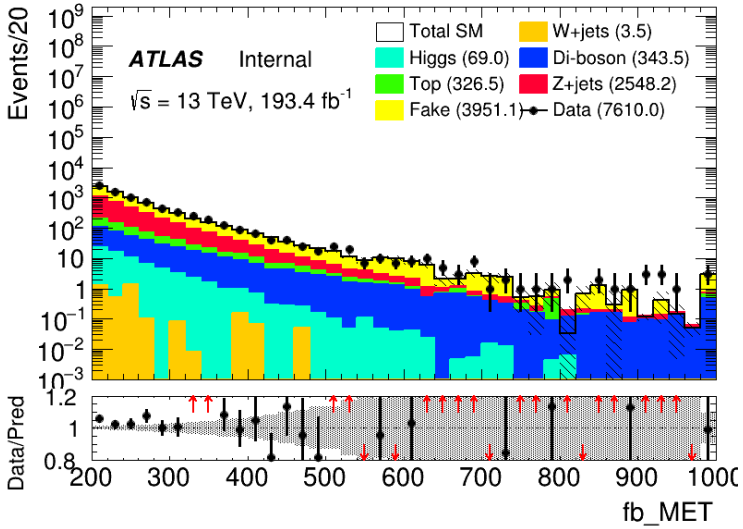
HH(SR)

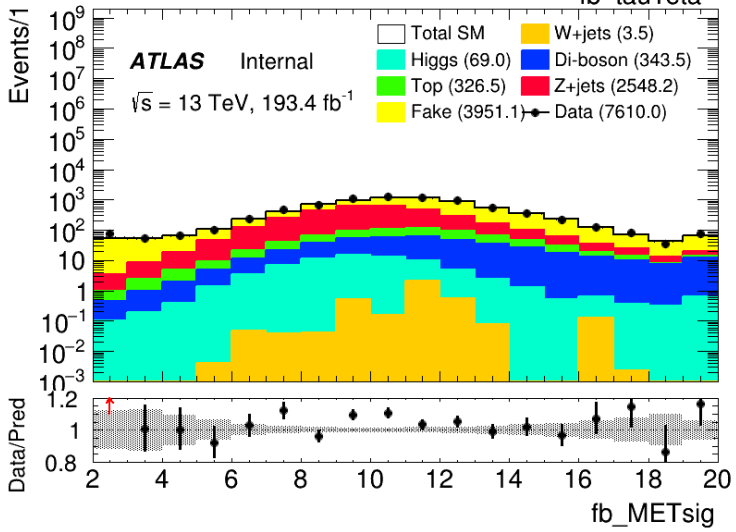






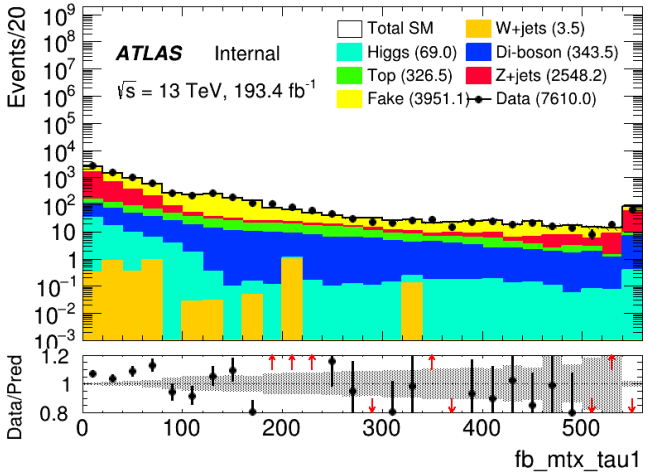


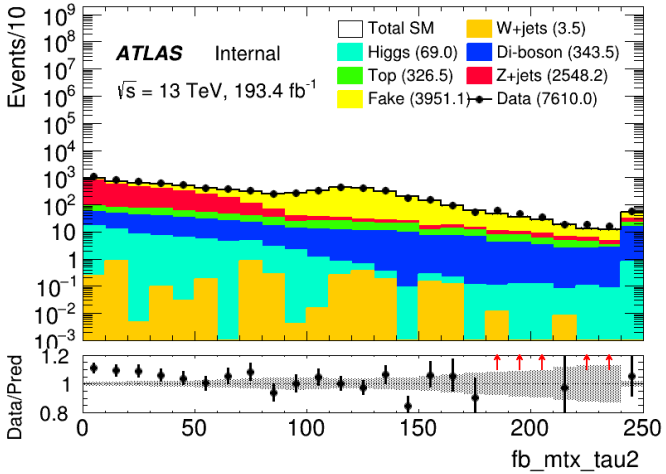


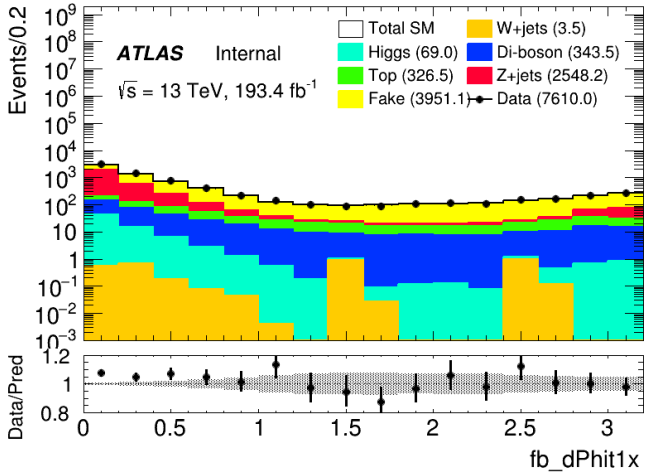


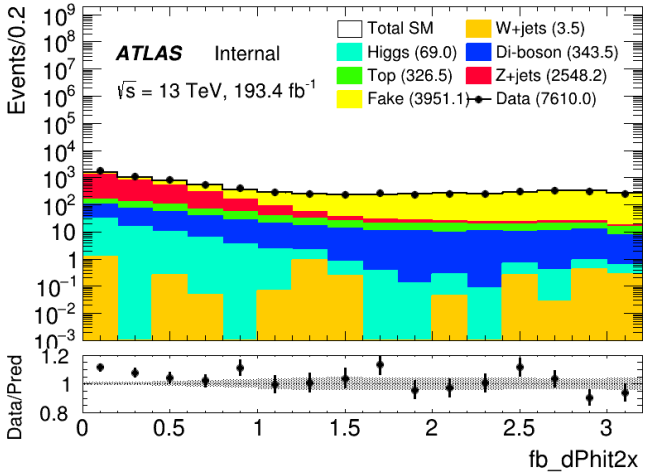
FF method

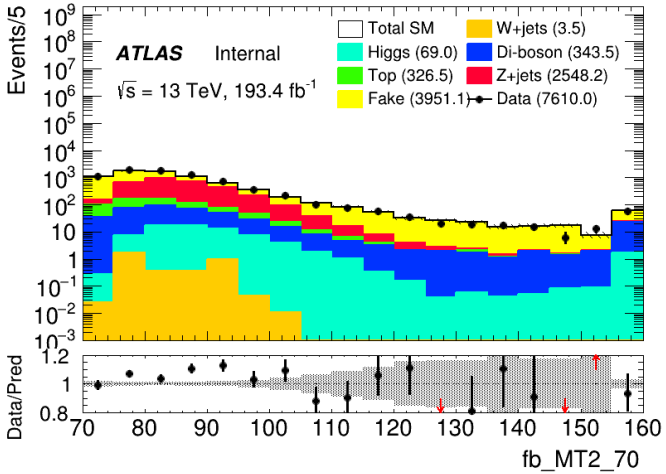
HH(SR)

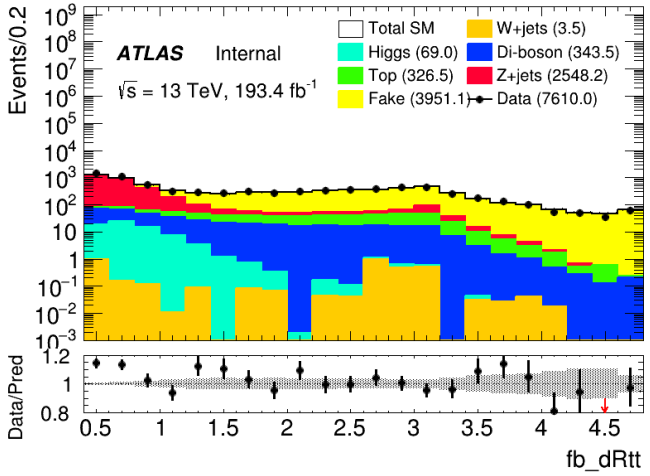












TODO

- Apply a cut at SR to make SR and CR orthogonal then use multiclass to train CRs

Backup

Bkg decay mode

Wjets: W->e/muon + nu
W->tau+nu(can contribute true tau_had)
jet misidentified to a fake tau

Zjets: Z->ll/tautau
jet misindentified to fake tau

Top: top->W+b, W can contribute a true tau_had
b-quark is a source of fake

VV: W/Z

LH channel: $\geq 1tau,\ \geq 1lep$
Wjets: W contribute lep, jets misidentified to fake
Zjets:
SingleTop: W contribute lep, b-quark misidentified to fake
VV:

HH channel: $\geq 2tau,\ == 0lep$
Wjets: W contribute tau_had, plus a fake tau
Zjets: Z->tautau(had) or 2 fake tau
SingleTop: W contribute a tau_had, plus a fake tau
VV: