H->hh->WWWW search

H->hh->WWWW Channel

$\frac{\sigma \cdot Br(wwww \to l^{\pm}\nu l^{\pm}\nu qqqq)}{\sigma \cdot Br(ww\gamma\gamma \to l\nu qq\gamma\gamma)}$ = 6.5 $\frac{\sigma \cdot Br(wwww \to lvlvlvqq)}{\sigma \cdot Br(ww\gamma\gamma \to lvqq\gamma\gamma)}$ = 2.2 $\frac{\sigma \cdot Br(wwww \to lvlvlvqq)}{\sigma \cdot Br(ww\gamma\gamma \to lvqq\gamma\gamma)}$ = 0.7

- ✓ **The events have signature with Multi-leptons, missing ET and/or jets**
- ✓ **Will first try same sign lepton channel including different flavors.**

MC generation

- Signal:
- Using MadGraph5 HeavyScaler to generate gg -> H - >hh
- Using MadGraph5 SM to generate

  p p > l+ l+ j j j j vl vl
- Using Pythia within ATHENA FRAMEWORK to do the SM h decay, and parton shower
- Only mH=300 GeV samples now

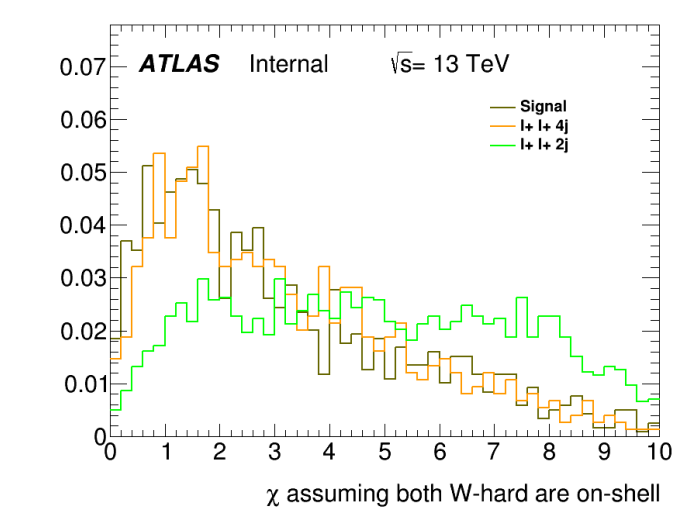
Basic selections

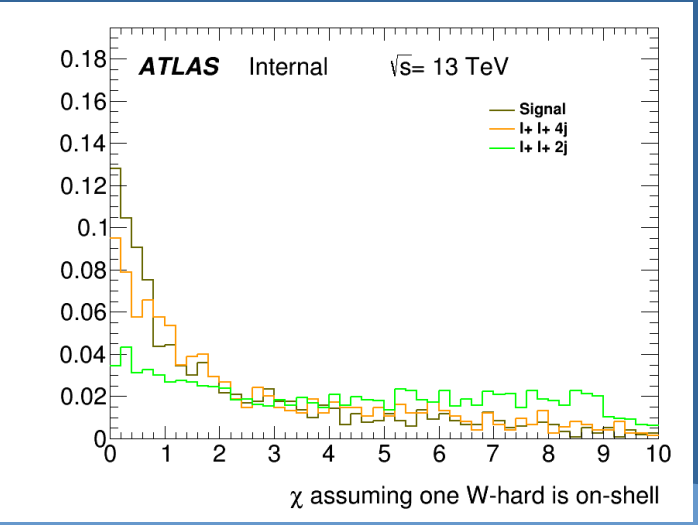
- At least 2 same sigh leptons(electron or muon) Pt>10GeV, isolated
- At least 4 jets, Pt > 25GeV, isolated

Categorization

- We plan to divide events into 3 categories based on the on-shell W decay hardronically : HH HL LL
- A cut on X may be useful, and the truth matching check is on-going

$$X = \sqrt{\left(\frac{M1-Mw}{\sigma(M1)}\right)^2+\left(\frac{M2-Mw}{\sigma(M2)}\right)^2}, \quad \text{where } \sigma(M) = 0.1 * M$$





Background components

- Real SS background
  - e.g. WZ+jets, $W^{\pm}W^{\pm}$+jets,
  - Currently we only have p p –> $l^{\pm}vl^{\pm}vqqqq$,Generated with MadGraph5, inclusively, but later we need to generate in separately
  - Also need to consider process with less jets and pileup
- Background due to charge miss ID
  - tt~, WW+jets, Z/gamma + jets
  - Need to be generated separately,
- Background due to fake
  - Jet fake as lepton, photon reconstructed as lepton…
  - e.g. Wγ , Zγ , W+ jets…

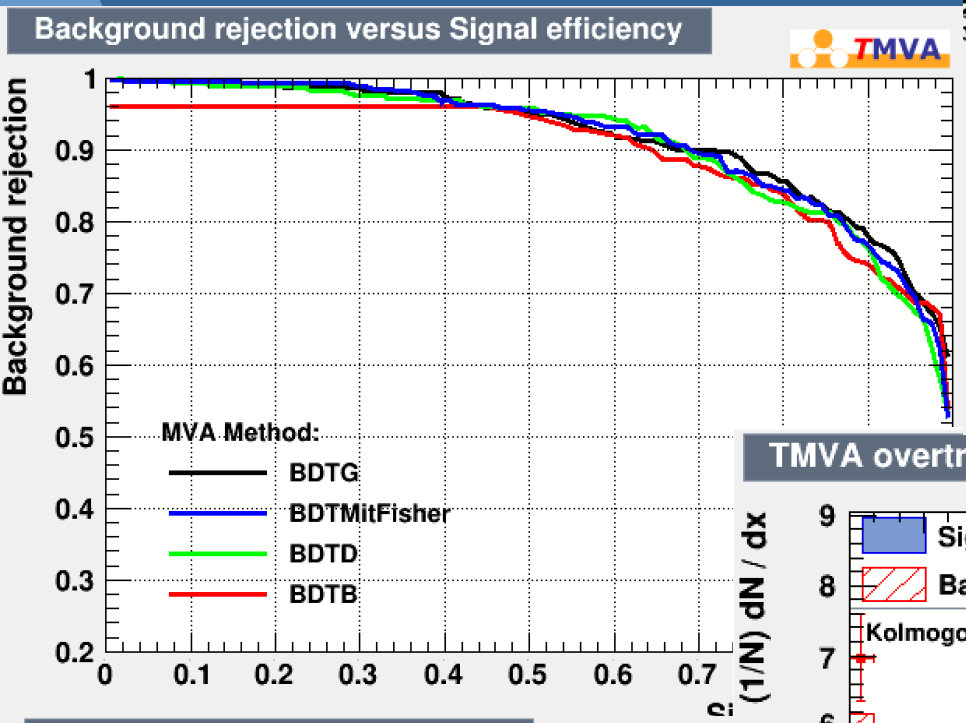
Parton shower *VS* matrix element

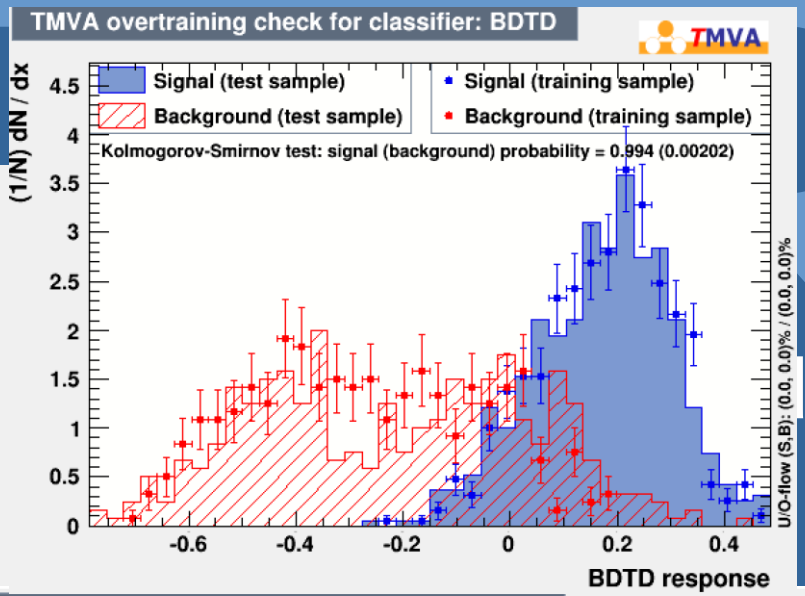
- Comparing l+ l+ v v j j with 2 jets from parton shower with l+ l+ v v j j j j

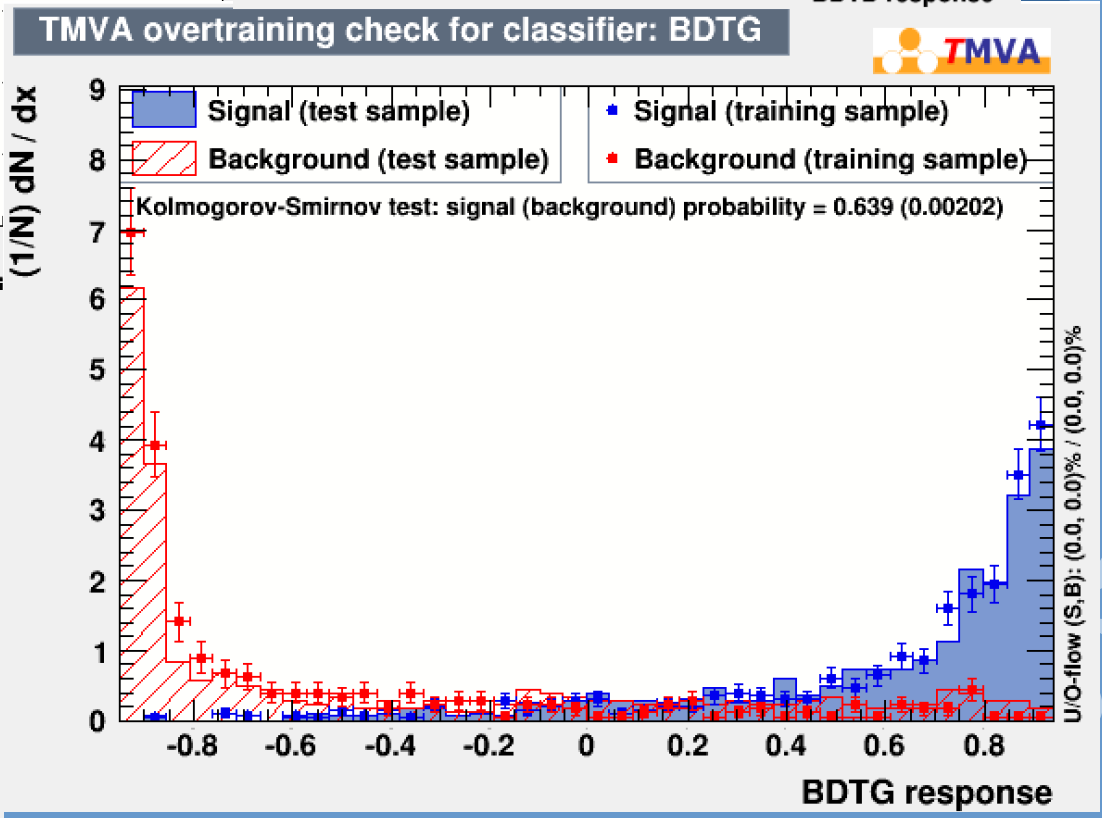
PROCESS	Xsection(fb)	Efficiency	Final (fb)
l+l+vvjj	5.3	40%	2.1
l+l+vvjjjj	2.4	80%	1.9

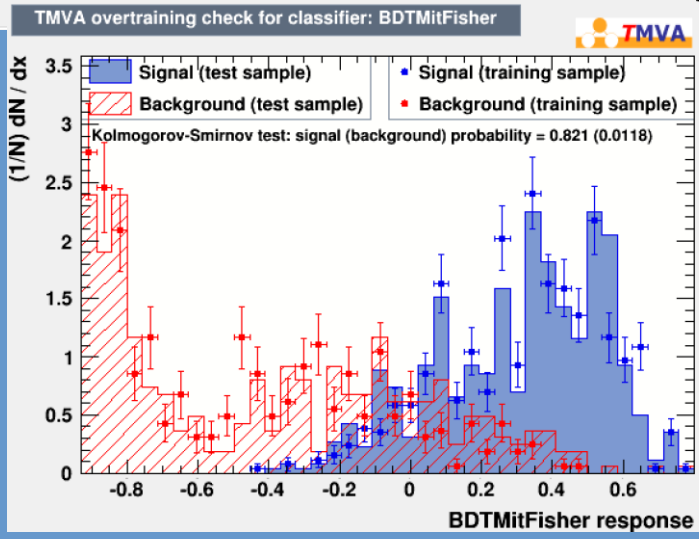
- May due to the configuration of parton shower

Some MVA result



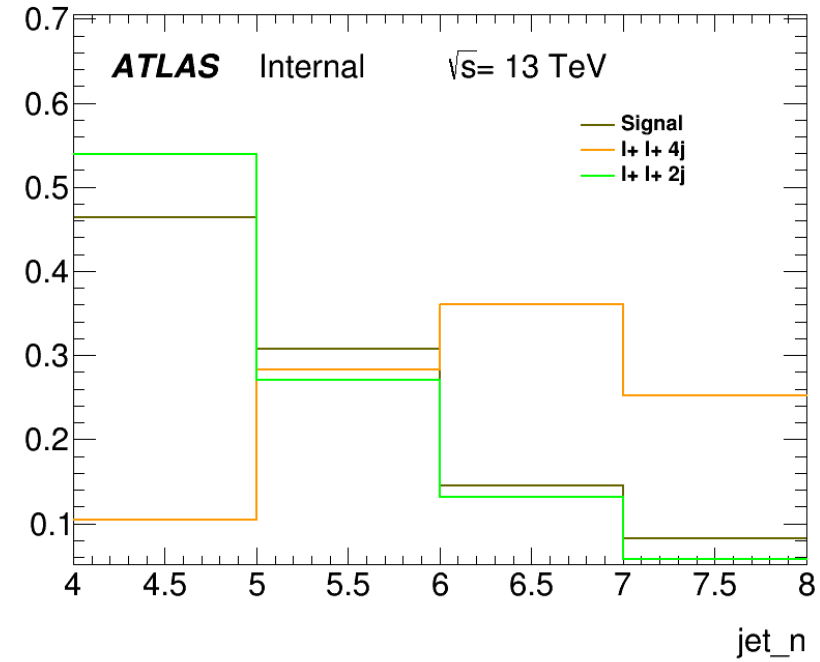


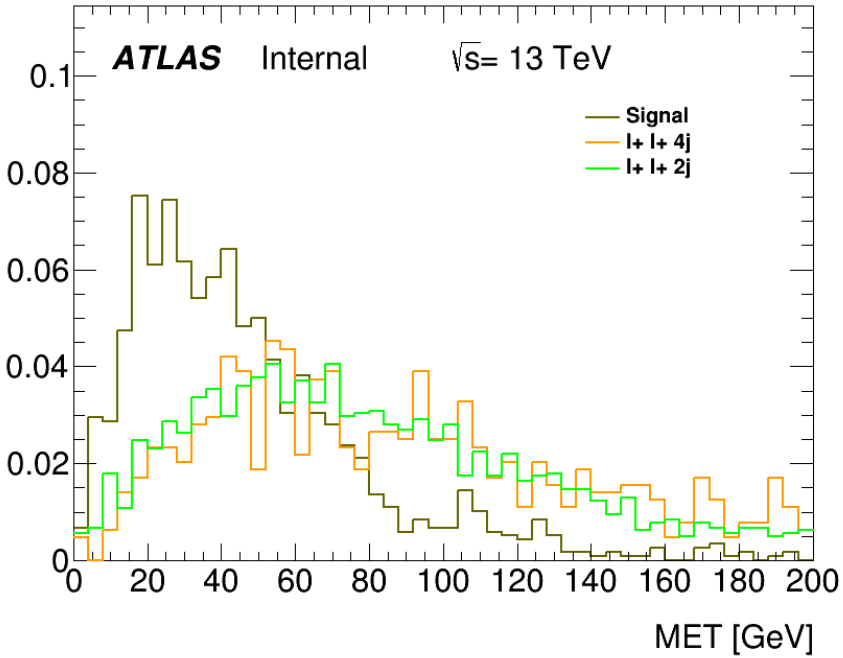


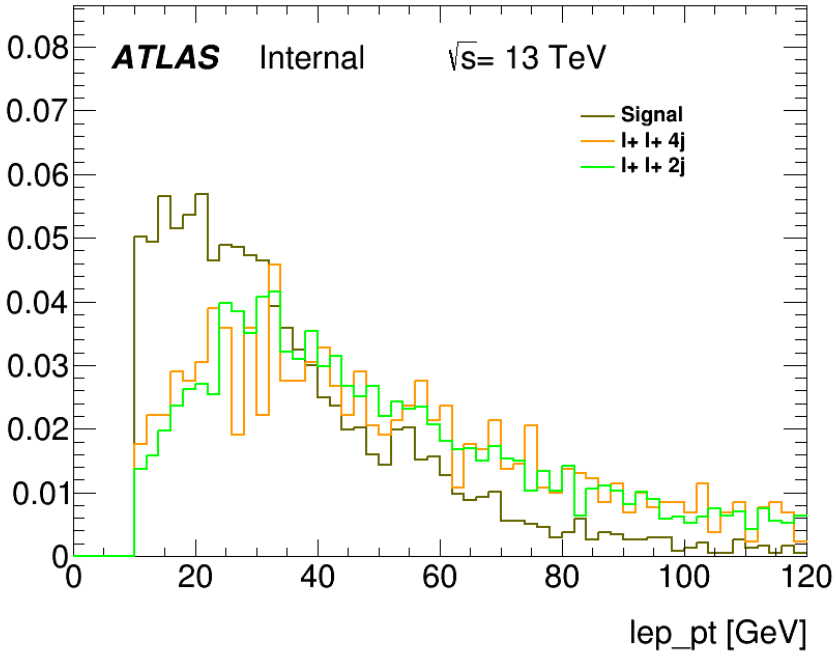


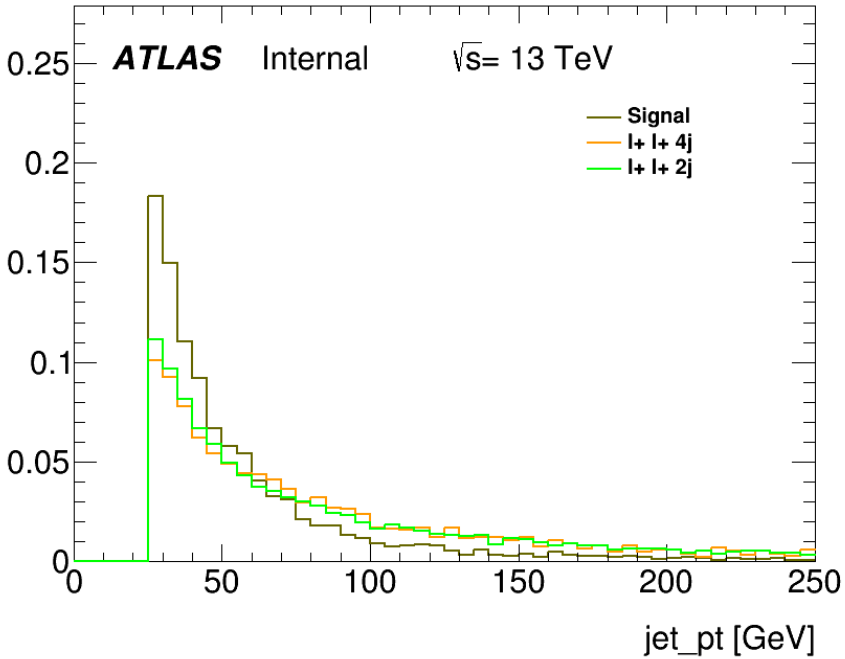
To do

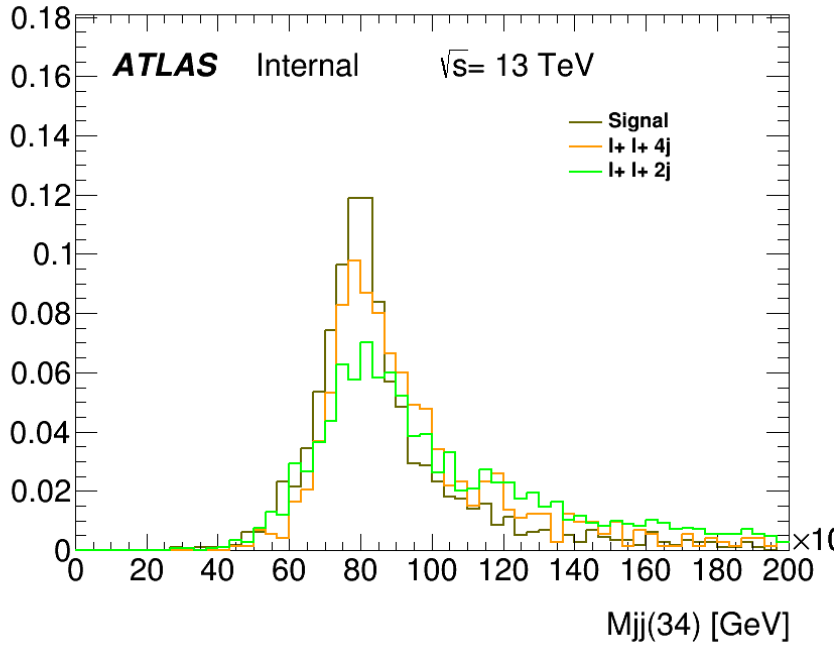
- To develop cuts for specific category
  - same sign leptons + missing et + 4jet (on-shell)
  - same sign leptons + missing et + 4jet (off-shell, one on-shell and one off-shell)
  - three lepton +missing et + jets or 4leptons(another story)
  - And check with truth matching…
- Request official signal samples:
- Check whether there are some bkg samples already available.
  - Present the analyses in WW, exotic groups and get feedback (this or next week)

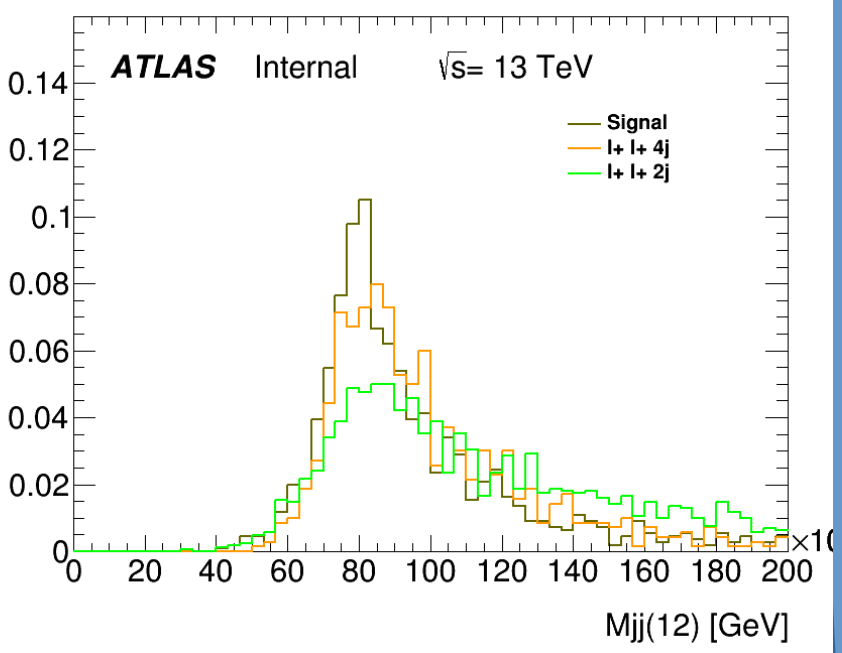

ATLAS Internal √s= 13 TeV
Signal
l+ l+ 4j
l+ l+ 2j
jet_n

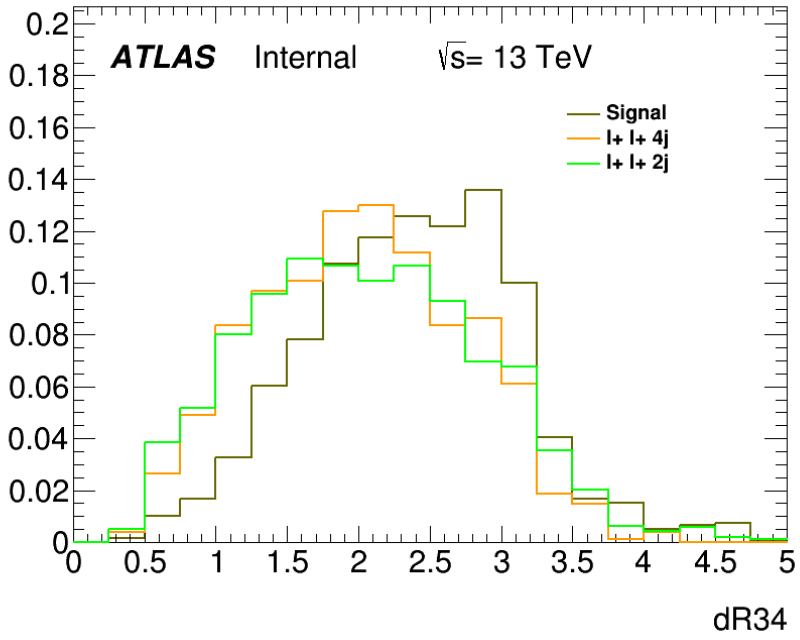

ATLAS Internal √s= 13 TeV
Signal
l+ l+ 4j
l+ l+ 2j
MET [GeV]

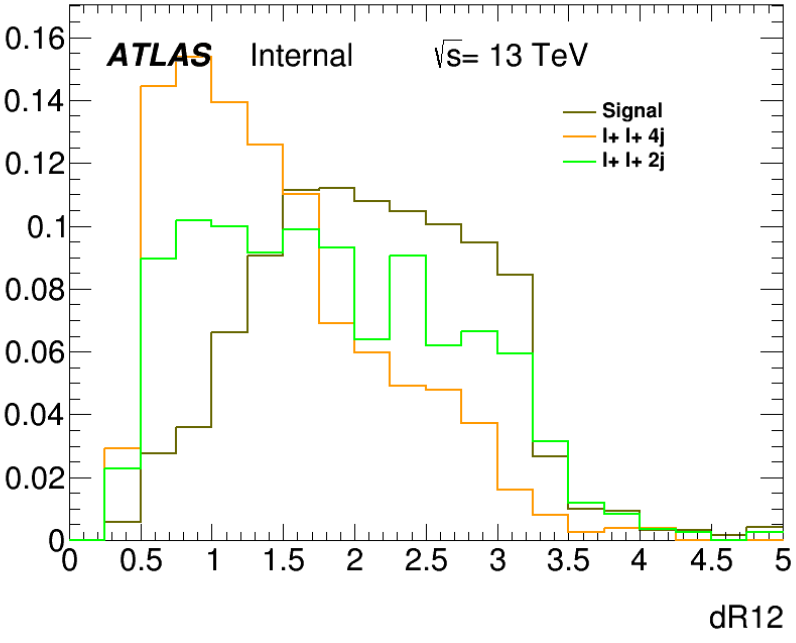

ATLAS Internal √s= 13 TeV
Signal
l+ l+ 4j
l+ l+ 2j
lep_pt [GeV]

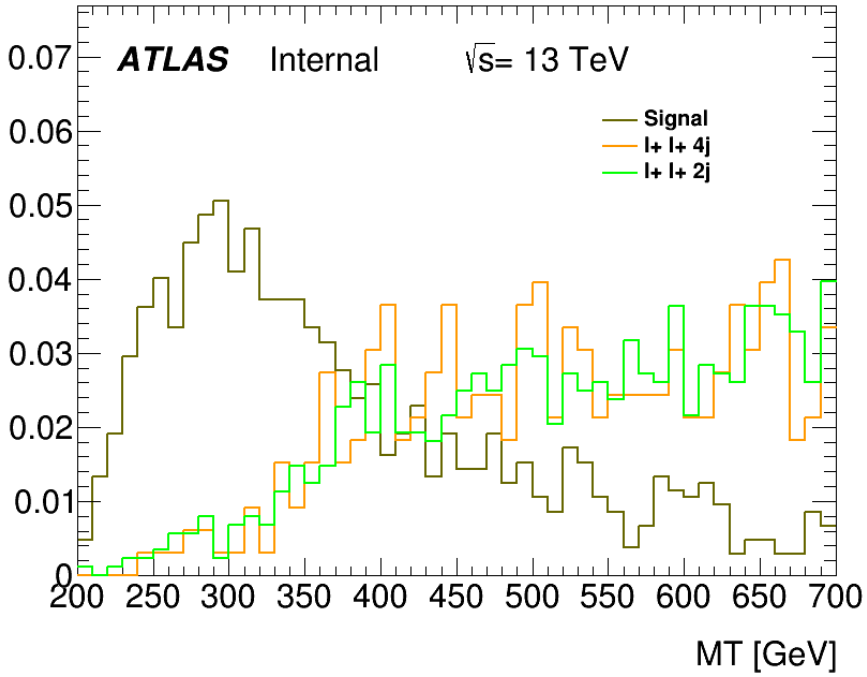

ATLAS Internal √s= 13 TeV
Signal
l+ l+ 4j
l+ l+ 2j
jet_pt [GeV]

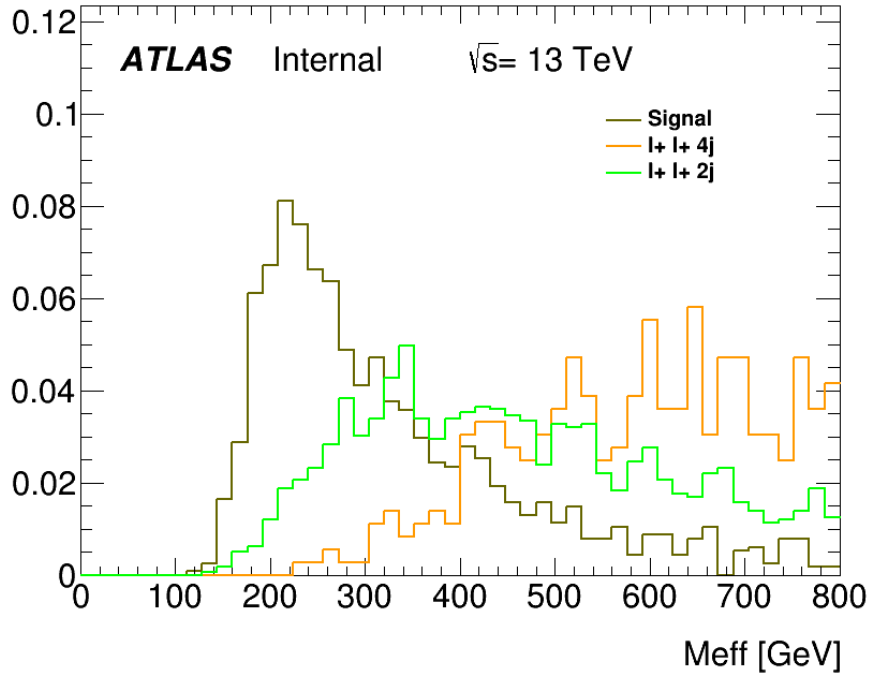

ATLAS Internal √s= 13 TeV
Signal
l+ l+ 4j
l+ l+ 2j
Mjj(34) [GeV]

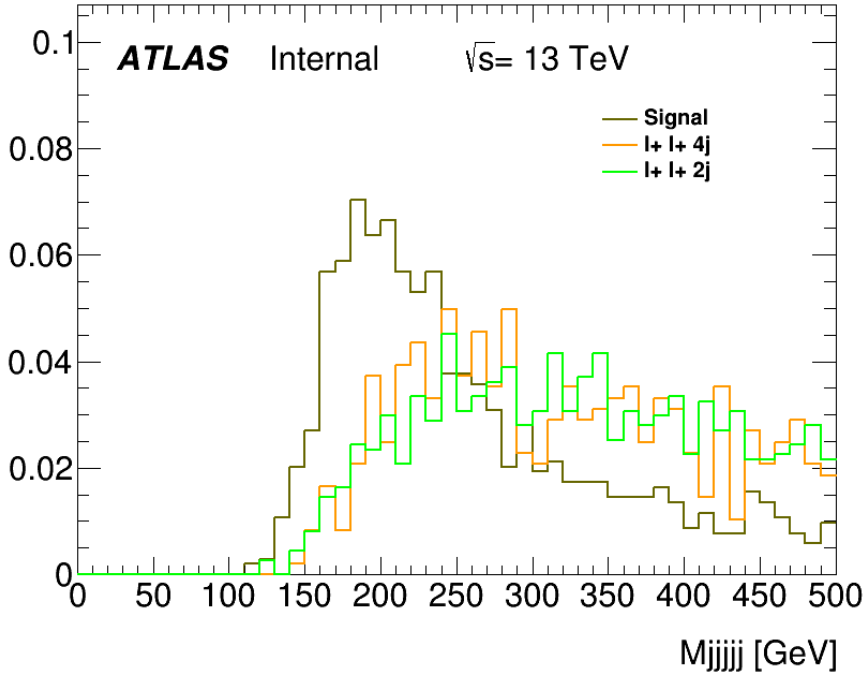

ATLAS Internal √s= 13 TeV
Signal
l+ l+ 4j
l+ l+ 2j
Mjj(12) [GeV]

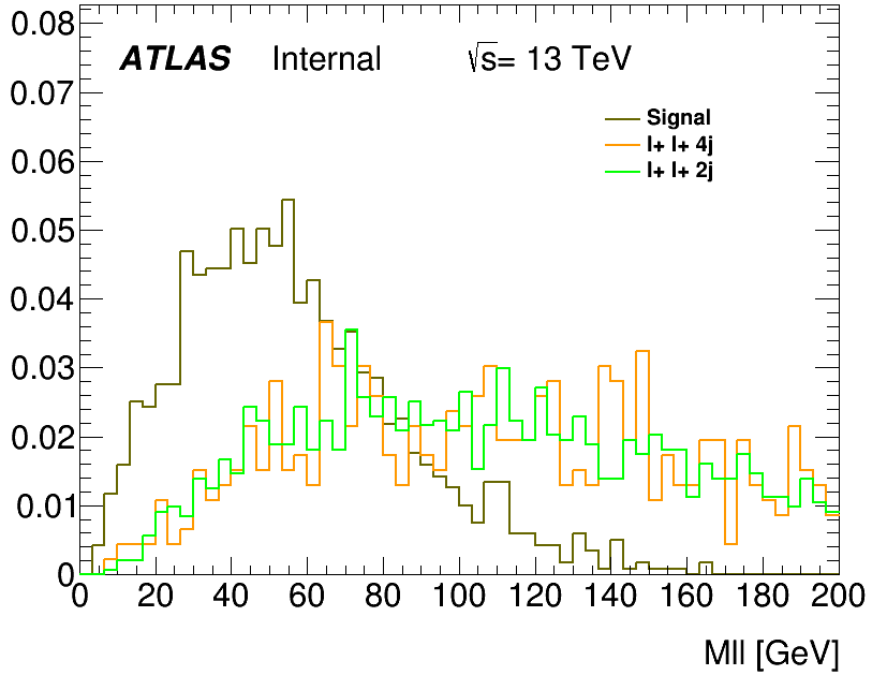

ATLAS Internal √s= 13 TeV
Signal
l+ l+ 4j
l+ l+ 2j
dR34


ATLAS Internal √s= 13 TeV
Signal
l+ l+ 4j
l+ l+ 2j
dR12


ATLAS Internal √s= 13 TeV
Signal
l+ l+ 4j
l+ l+ 2j
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
200 250 300 350 400 450 500 550 600 650 700
MT [GeV]


ATLAS Internal √s= 13 TeV
Signal
l+ l+ 4j
l+ l+ 2j
0.12
0.1
0.08
0.06
0.04
0.02
0
0 100 200 300 400 500 600 700 800
Meff [GeV]


ATLAS Internal √s= 13 TeV
Signal
l+ l+ 4j
l+ l+ 2j
0.1
0.08
0.06
0.04
0.02
0
0 50 100 150 200 250 300 350 400 450 500
Mjjjjj [GeV]


ATLAS Internal √s= 13 TeV
Signal
l+ l+ 4j
l+ l+ 2j
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0 20 40 60 80 100 120 140 160 180 200
Mll [GeV]

backup