ttHbb Semi-Leptonic Fake-Leptons estimation

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Status

- ttH: fake-leptonsのstudyをしている
  - triggeを追加
  - METの分布がおかしい
    →mumuのeventを持ってきてMETを確認してみた
  - pileup reweightingはこれから（muの分布確認中）

- ttH: 6j2bのstudyを今週中に進める

- QT: localでROSモニタリングコードを動かすためのデバッグ中
  - エラーの原因がISサーバーにアクセスするクラスにある。
    （local：ISサーバーを使わない⇔ヒストグラムやデータの管理が一緒のクラスで行われている）
  - Nickにメールして確認中

Technical Information

AnalysisTop-2-3-20 + TTHbbLeptonic-02-03-20-01

- GRL / GOODCALO
- TRIGDEC
- LEP_N ==1
- TRIGMATCH
- JET CLEAN LOOSEBAD

Trigger for 50ns

- HLT_e24_lhmedium_iloose_L1EM20VH
- HLT_e60_lhmedium
- HLT_mu20_iloose_L1MU15
- HLT_mu50

Jet Object Selection

- pT>25GeV
- |η|<2.5
- JVT>0.64 if [pT<50GeV && |η|<2.4]
- AntiKt4TopoEM
- btagging MV2C20 77%OP.

Lepton Object Selection

- pT>25GeV
- |η|<2.4 && veto LAr-crack region
- ID_{el} = TightLH with isol.
- $ID_{el,loose}$ = LooseLH w/o isol.
- ID_{mu} = Tight with isol.
- $ID_{mu,loose}$ = Loose w/o isol.

Dataset

- mc15_13TeV & DAOD_TOPQ1 derivation -

- **ttbar** *410000.PowhegPythiaEvtGen*

  nonallhad

- **sg-top** *410011-14.PowhegPythiaEvtGen*

  Wt-ch + t-ch

- **Wjets** *361100-05.PowhegPythia8EvtGen*

  enu + munu + taunu

  > ***also prepare 361300-29,361333-71.Sherpa for MC-modeling***

- **Zjets** *361106-08.PowhegPythia8EvtGen*

  ee + mumu + tautau

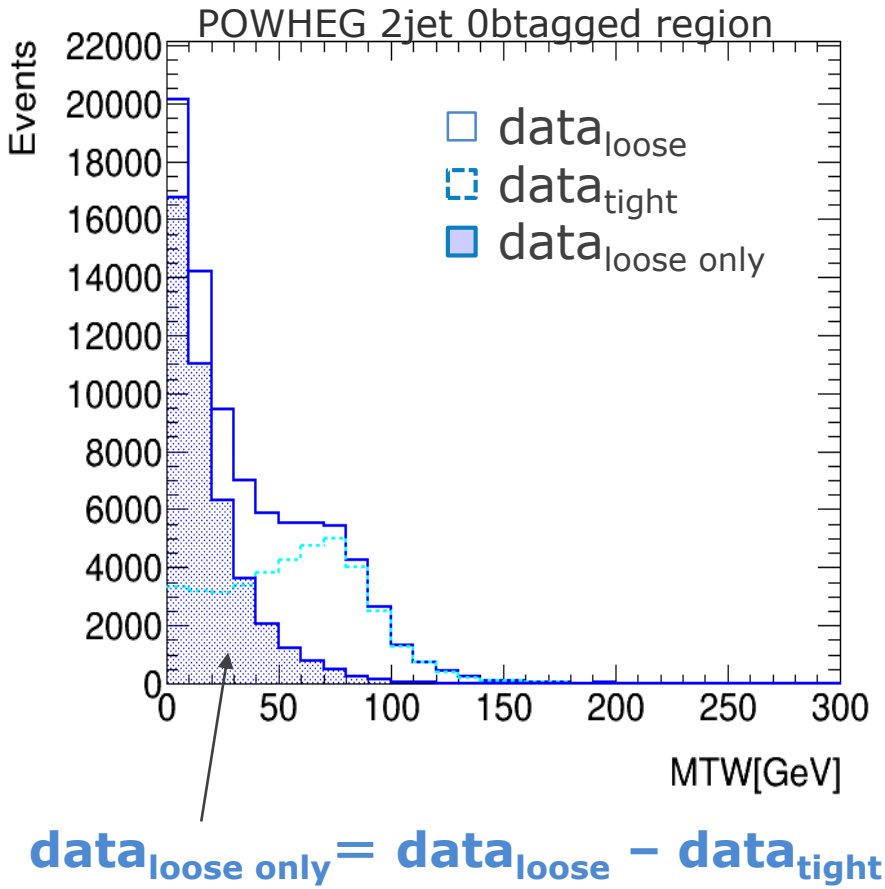
- data15_13TeV & DAOD_TOPQ1 derivation -

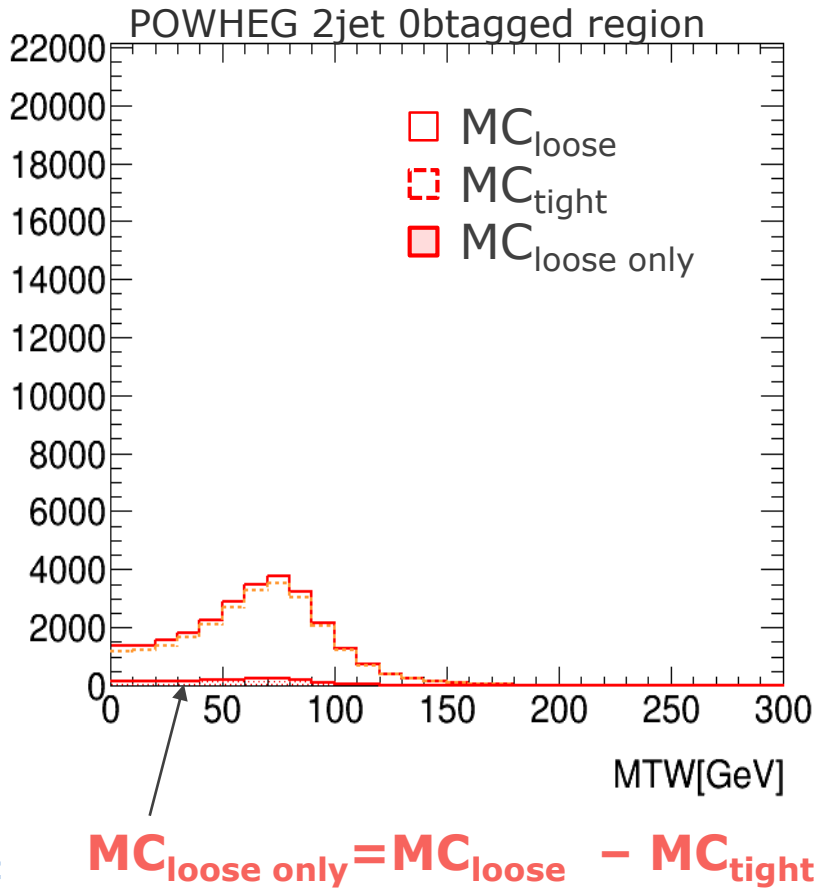
- **periodA-C (~85 pb^{-1})** *00266904-00272531*

Fake-Lepton Template

Using MTW distribution for each jetbin and bjetbin

$$\text{fake-lepton}_{\text{template}} = \text{data}_{\text{loose only}} - \text{MC}_{\text{loose only}}$$





$\text{data}_{\text{loose only}} = \text{data}_{\text{loose}} - \text{data}_{\text{tight}}$

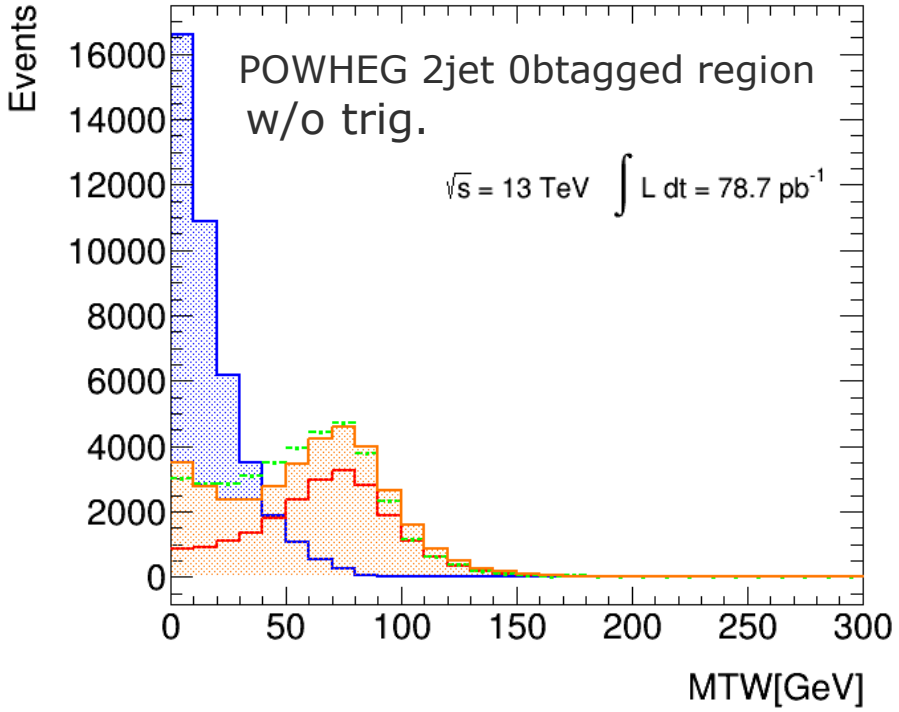
$\text{MC}_{\text{loose only}} = \text{MC}_{\text{loose}} - \text{MC}_{\text{tight}}$

Fake-Lepton and Wjets SF

Chi-squire bin-by-bin fitting

SF_{Wjets} x $Wjets_{tight}$ + SF_{fake} x $fake_{template}$ to

data-MC(but not Wjets)$_{tight}$: data(fake+Wjets) using TMinuit

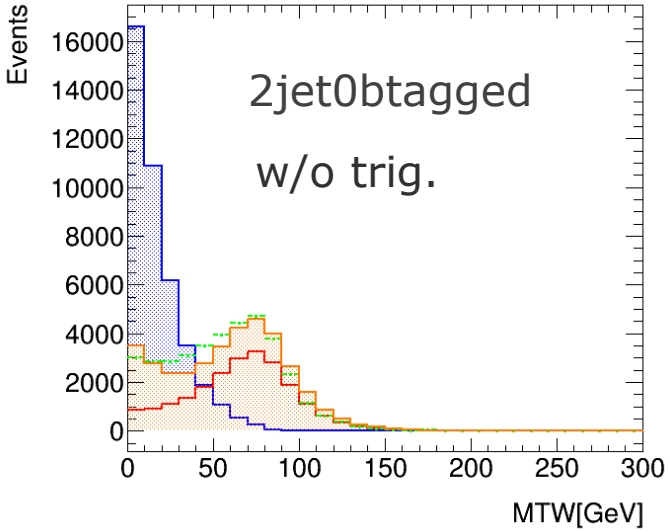


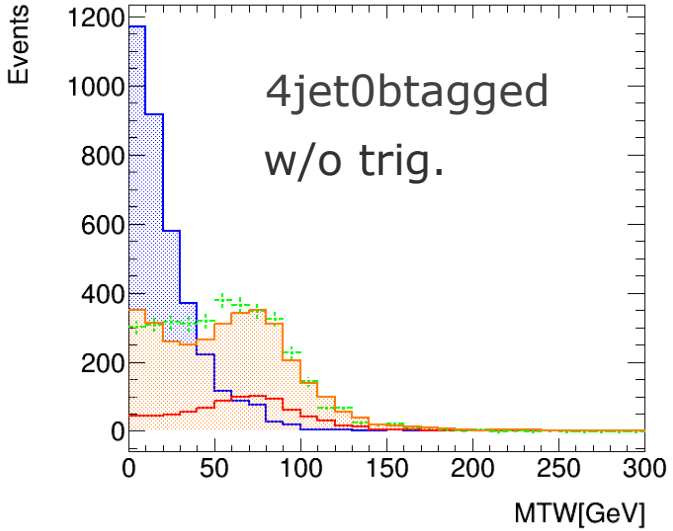
- $fake_{template}$
- $Wjets_{tight}$
- data-MC(but not Wjets)$_{tight}$
- 1.404 x $Wjets_{tight}$ + 0.137 x $fake_{template}$

MTW Distributions for SFs

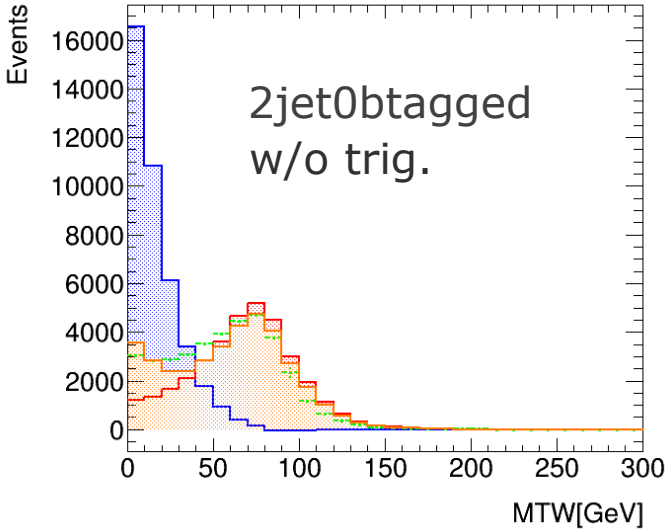
mu-ch

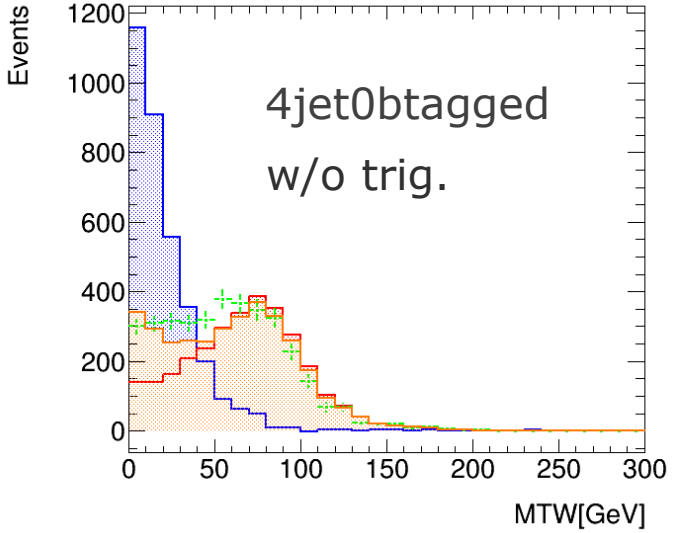
Powheg Pythia





Sherpa



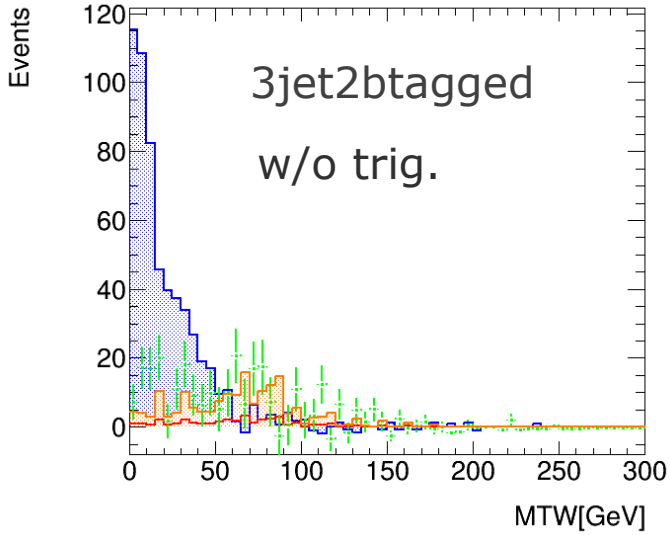


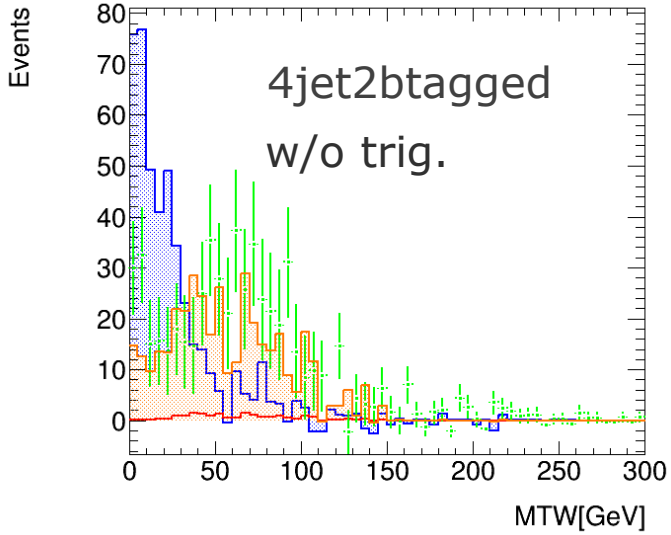
- $fake_{template}$
- $data\text{-}MC(but\ not\ Wjets)_{tight}$
- $Wjets_{tight}$
- $SFwjets \times Wjets_{tight} + SFfake \times fake_{template}$

MTW Distributions for SFs

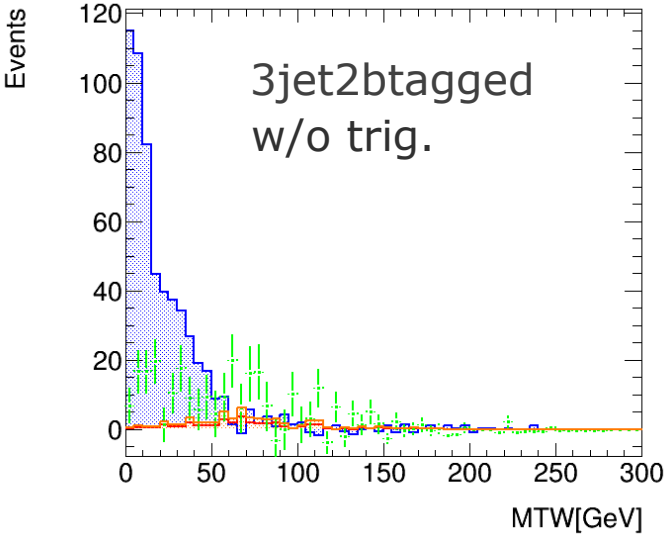
mu-ch

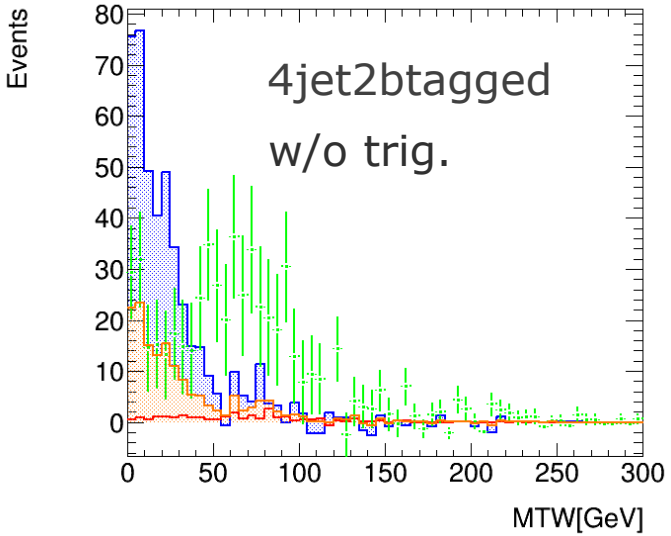
Powheg Pythia





Sherpa





Due to the low statistics with 2btagged region,
W peak are not and SFs are not reliable… :

Determined SFs

muon ch only w/o trriger
(electron ch is now in going)

PowhegPythia

Jetbin	bjetbin	SF in fake	SF in Wj
0	0	0.173	0.919
1	0	0.165	0.950
1	1	0.103	1.159
2	0	0.137	1.523
2	1	0.100	1.968
2	2	0.008	3.331
3	0	0.149	2.331
3	1	0.074	3.200
3	2 incl.	1.23×10^{-9}	4.931
4 incl.	0	0.175	3.631
4 incl.	1	0.119	5.150
4 incl.	2 incl.	0.142	18.380

Sherpa

Jetbin	bjetbin	SF in fake	SF in Wj
0	0	0.152	1.011
1	0	0.159	1.017
1	1	0.100	1.567
2	0	0.145	1.069
2	1	0.100	1.618
2	2	0.058	1,226
3	0	0.165	1.054
3	1	0.073	1.590
3	2 incl.	0.015	2.271
4 incl.	0	0.177	1.103
4 incl.	1	0.139	1.355
4 incl.	2 incl.	0.336	3.735

SF of the Wjets increases at higher jet multiplicity events in POWHEG.
This must be because of POWHEG mis-modeling.

Determined SFs with Trigger

Sherpa w/o trigger

Jetbin	bjetbin	SF in fake	SF in Wj
0	0	0.152	1.011
1	0	0.159	1.017
1	1	0.100	1.567
2	0	0.145	1.069
2	1	0.100	1.618
2	2	0.058	1,226
3	0	0.165	1.054
3	1	0.073	1.590
3	2 incl.	0.015	2.271
4 incl.	0	0.177	1.103
4 incl.	1	0.139	1.355
4 incl.	2 incl.	0.336	3.735

Sherpa with trigger

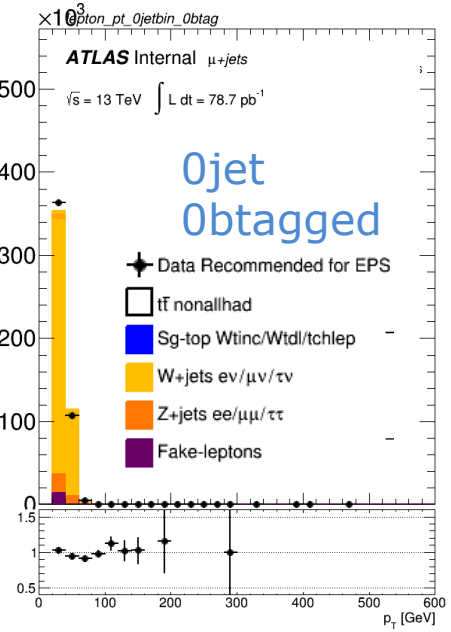
			fake	wjets
#jets	#btags	lepton	SFs	SFs
inclusive		mujets	0.151661	0.961206
0	0btag	mujets	0.152575	0.96018
1	0btag	mujets	0.168198	0.932575
1	1btag	mujets	0.105965	1.3507
2	0btag	mujets	0.145721	0.969178
2	1btag	mujets	0.110329	1.3155
2	2btag	mujets	0.098742	2.33265e-07
3	0btag	mujets	0.175302	0.911054
3	1btag	mujets	0.0976796	1.1444
3	2btag	mujets	1.22714e-08	1.69949e-09
4	0btag	mujets	0.202462	0.895054
4	1btag	mujets	0.147982	0.48877
4	2btag	mujets	1.84637e-08	7.12659e-10

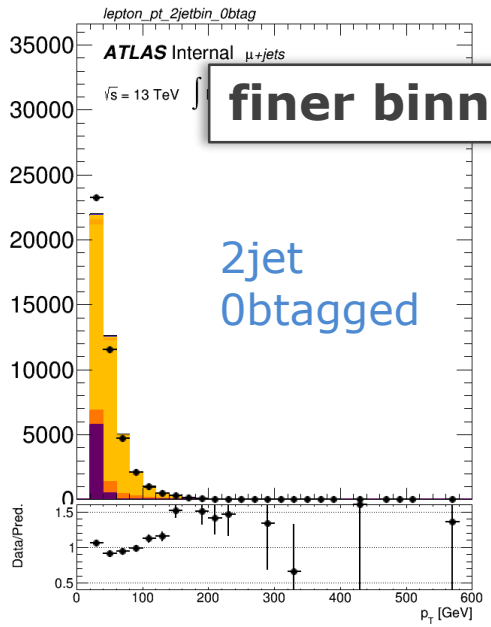
WjetsのSFが１に近づいた。
2btagged領域では全くうまくfitできなくなった。
：統計が増えるのを待つ・MMでの見積もりをやってみる

MC-Data Comparison with SF_{fake} only

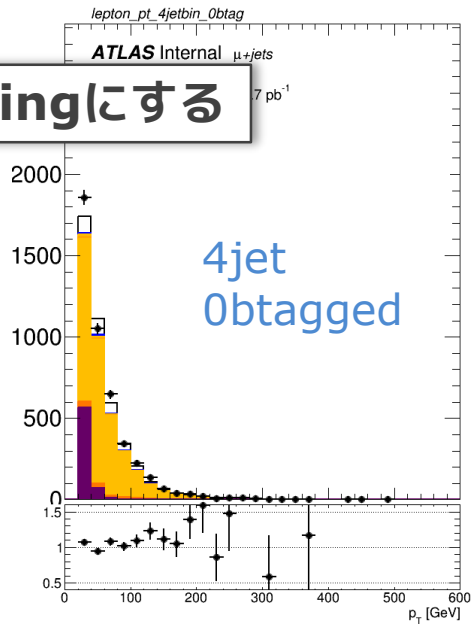
lepton w/o trig.

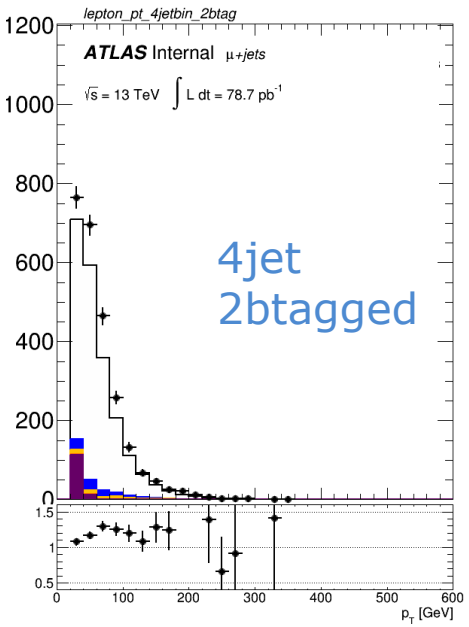
mu-ch, Wmunu:Sherpa
weight = lep*btag*mc

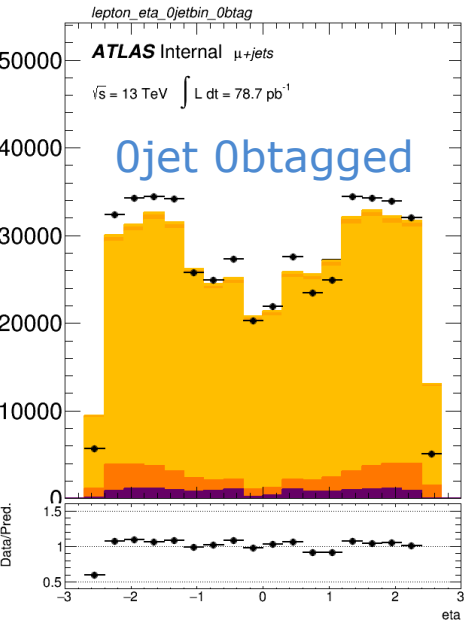


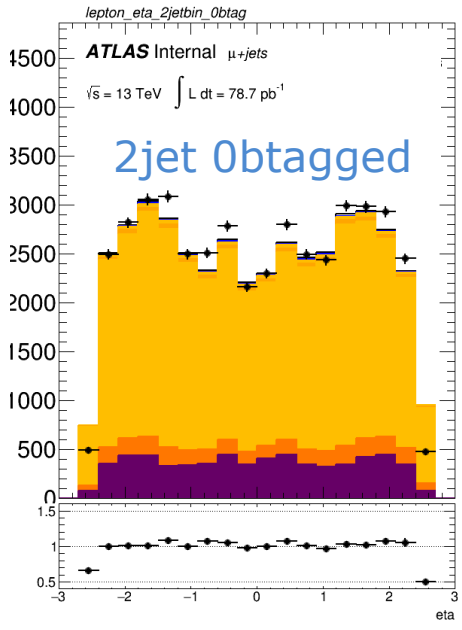


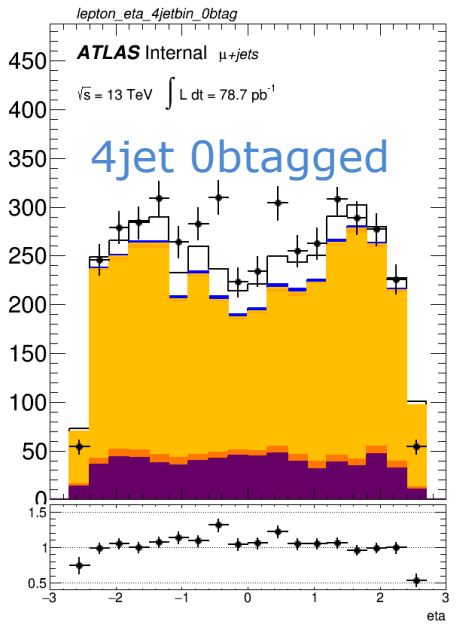
finer binningにする

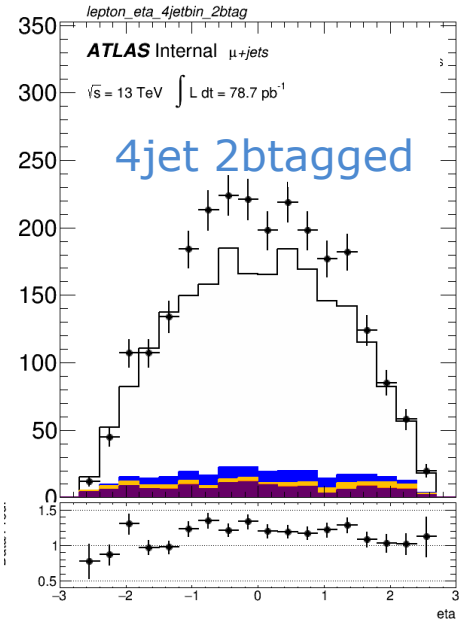








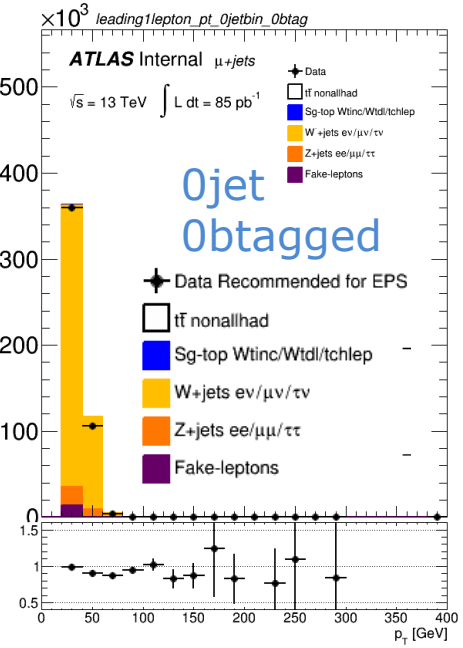


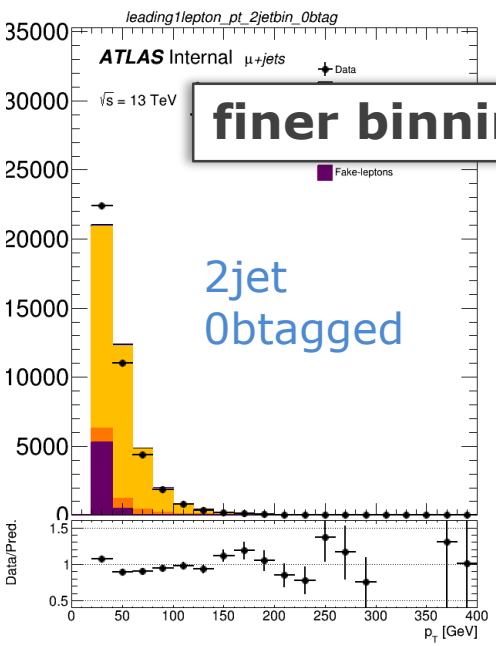


MC-Data Comparison with SF_{fake} only

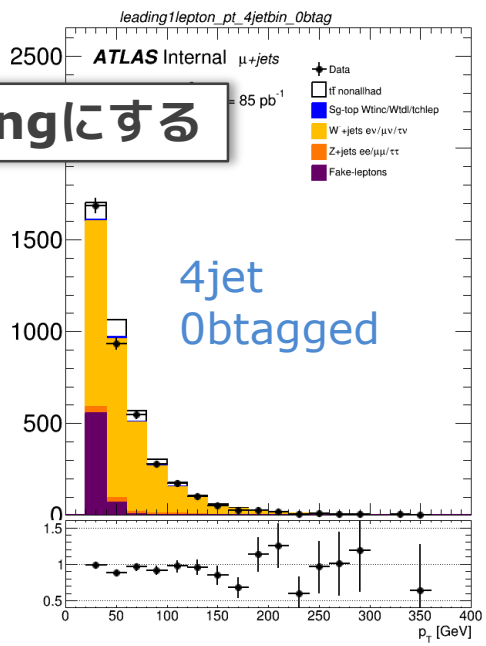
lepton w/ trig.

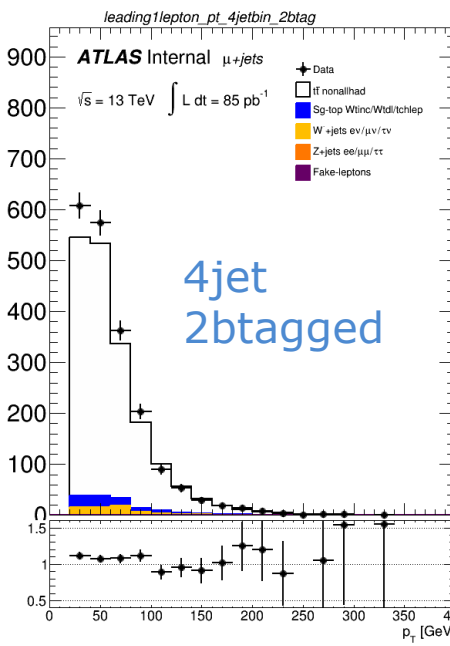
mu-ch, Wmunu:Sherpa
weight = lep*btag*mc

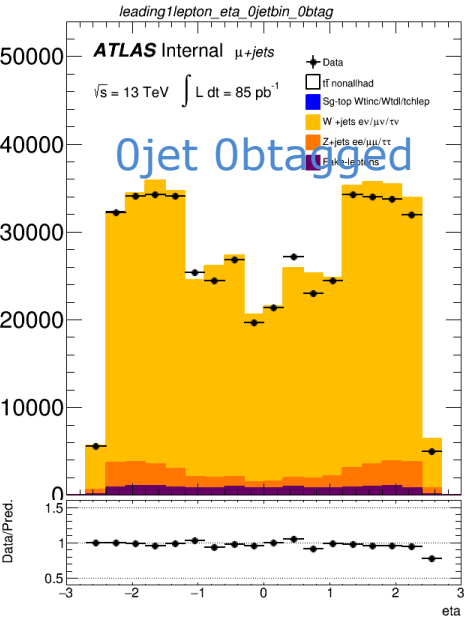


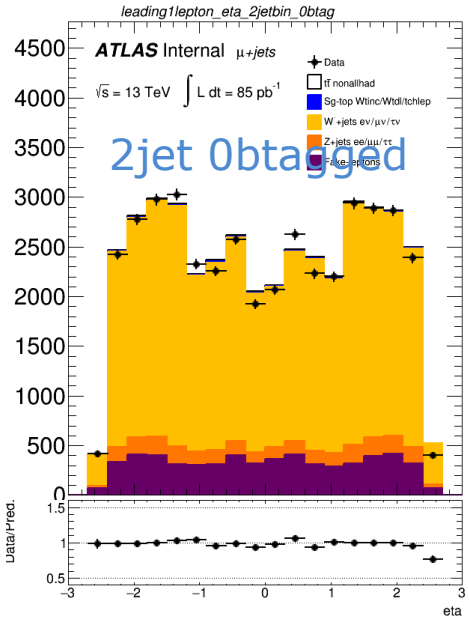


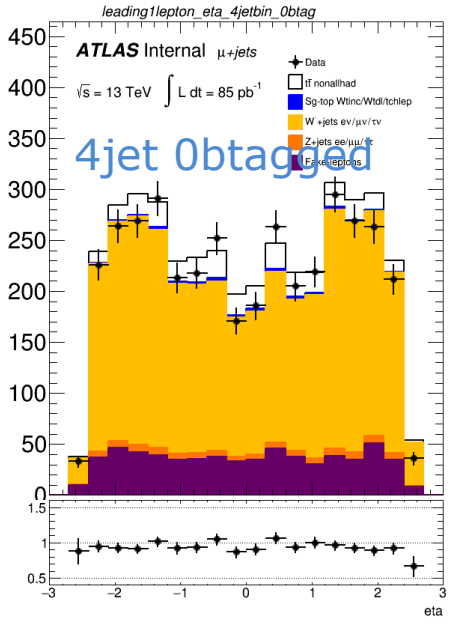
finer binningにする

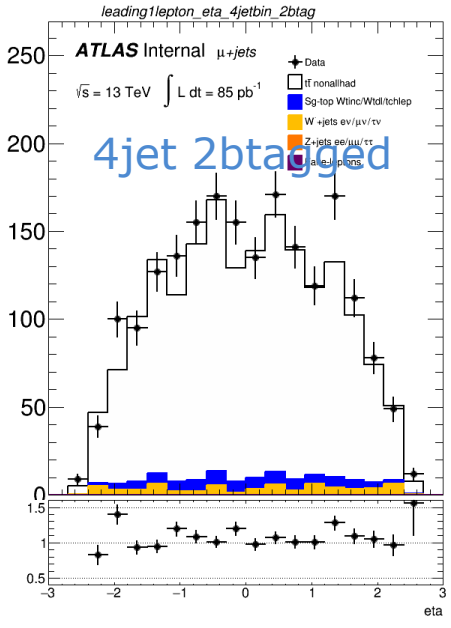










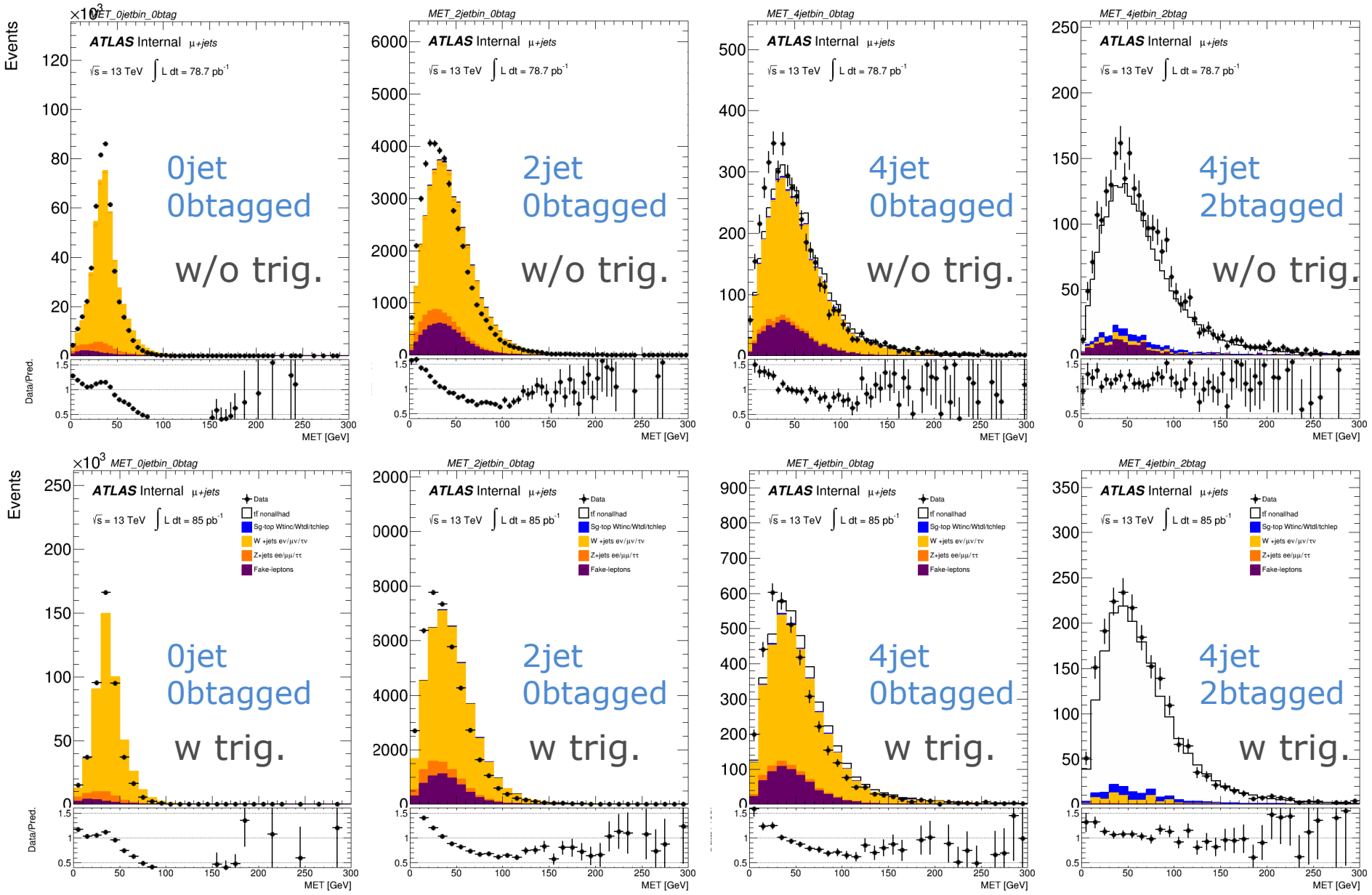


MC-Data Comparison with SF_{fake} only

MET

data/pred.にスロープがある
→low METの一致が特に悪い

mu-ch, Wmunu:Sherpa
weight = lep*btag*mc



MC-Data Comparison with SF_{fake} only

MTW

mu-ch, Wmunu:Sherpa
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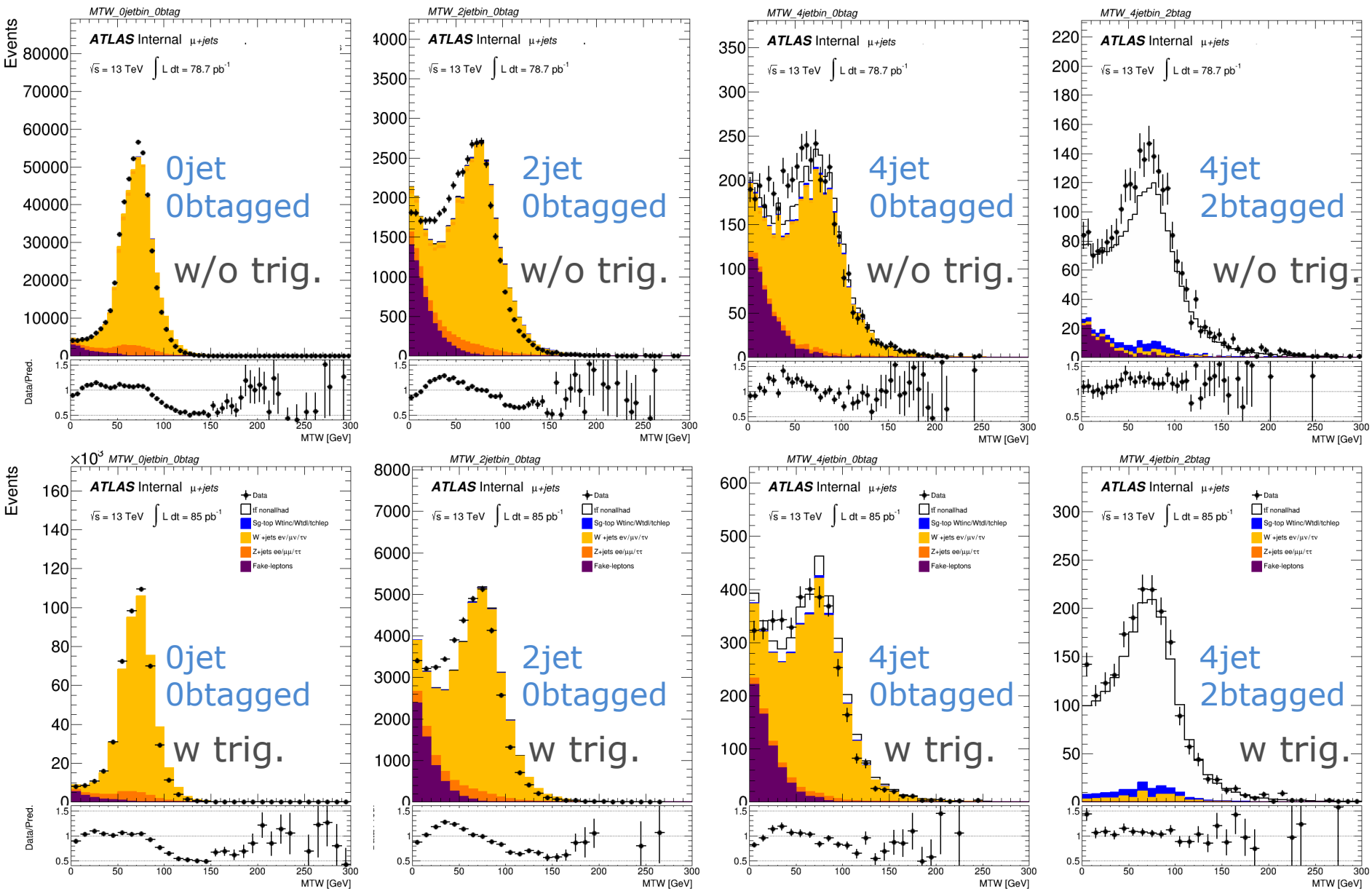


Di-leptonic Selection

Using Top-Physics Recommendation (default in AnalysisTop)

- GRL / GOODCALO
- TRIGDEC
- LEP_N >=2
- TRIGMATCH
- JET CLEAN LOOSEBAD

Trigger for 50ns: same as semilep

- HLT_e24_lhmedium_iloose_L1EM20VH
- HLT_e60_lhmedium
- HLT_mu20_iloose_L1MU15
- HLT_mu50

Jet Object Selection

- pT>25GeV
- |η|<2.5
- JVT>0.64 if [pT<50GeV && |η|<2.4]
- AntiKt4TopoEM
- btagging MV2C20 77%OP.

Lepton Object Selection

- leading pT>25GeV
- sub-leading pT>15GeV
- |η|<2.4 && veto LAr-crack region
- ID_{el} = TightLH with isol.
- $ID_{el,loose}$ = LooseLH w/o isol.
- ID_{mu} = Tight with isol.
- $ID_{mu,loose}$ = Loose w/o isol.

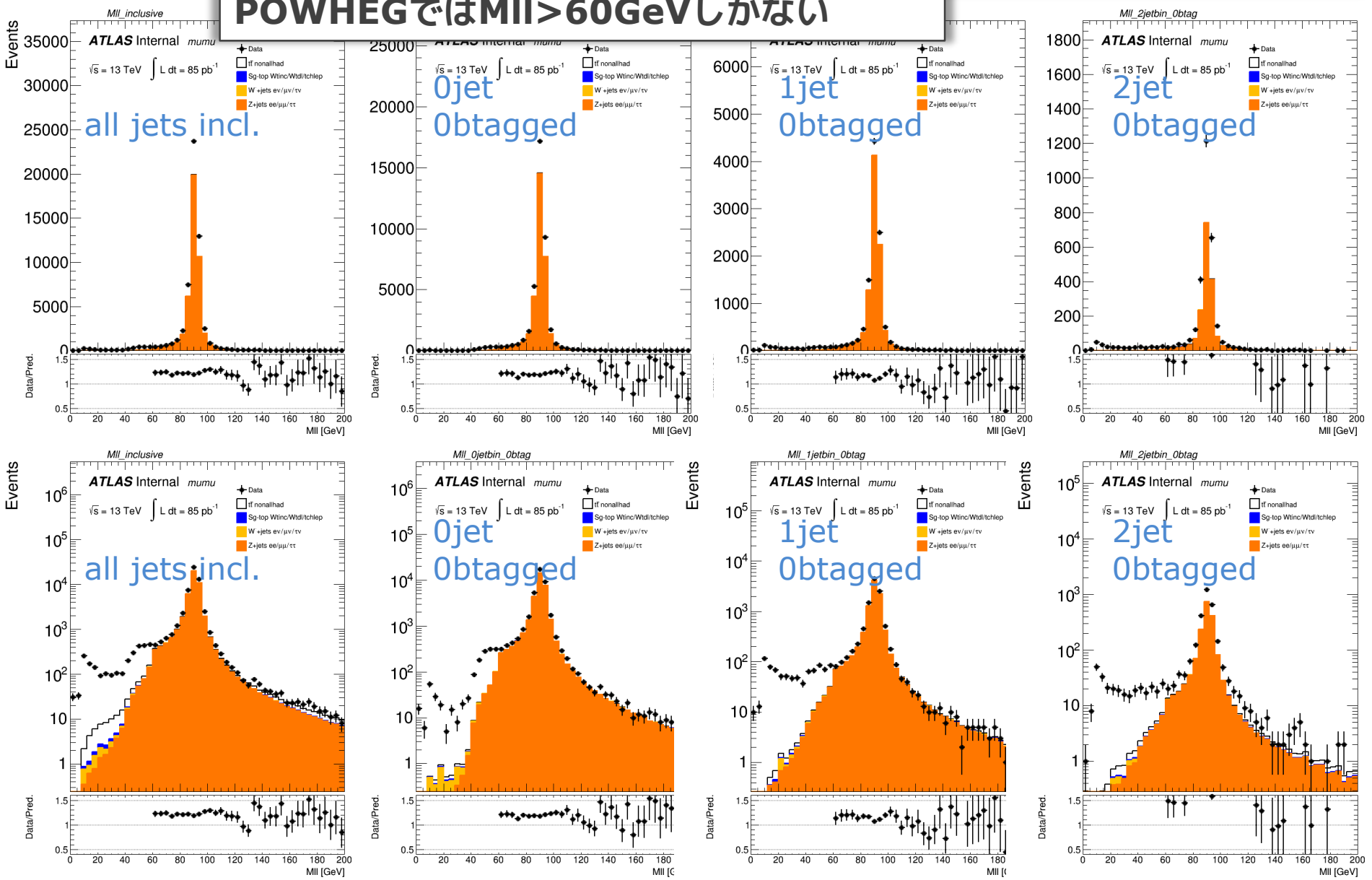
- processed with / without Mll=80~100GeV only in mumu.

MII low MIIはfake-leptons?

mu-ch, Wmunu:Sherpa

ight = lep*btag*mc

→truth MII でcutされていないか確認する
POWHEGではMII>60GeVしかない



MET w/ tirg.

mu-ch, Wmunu:Sherpa
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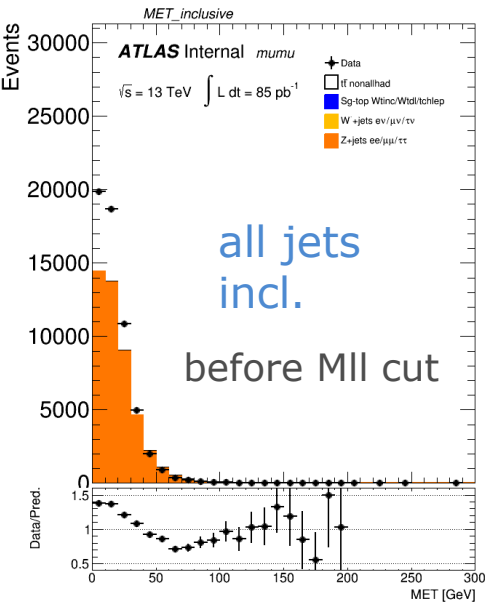
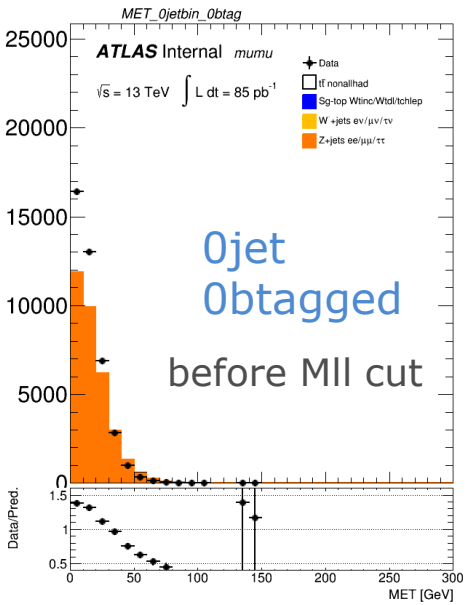
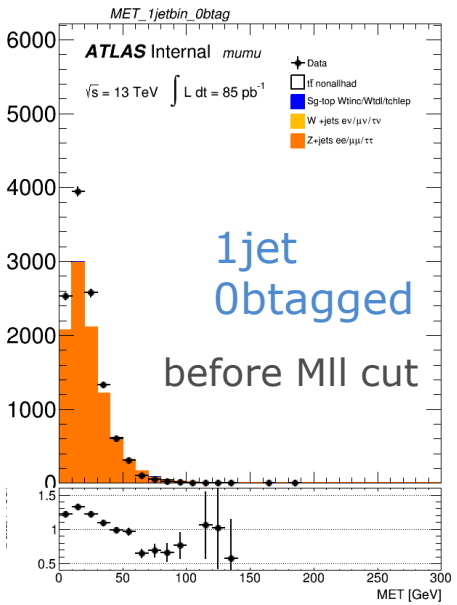
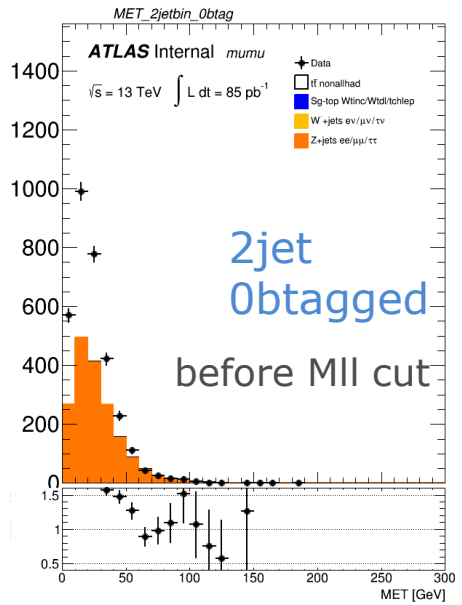
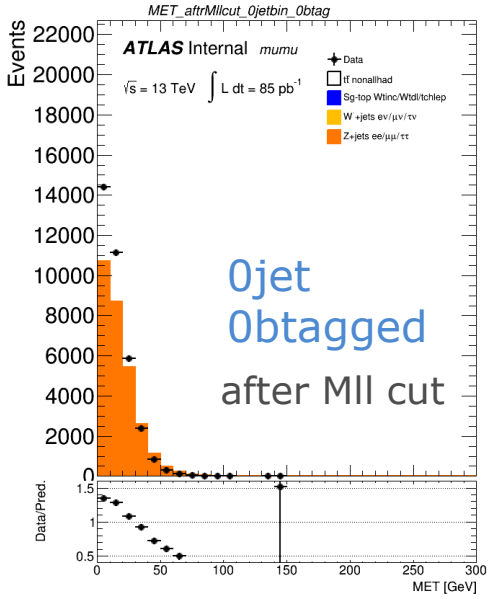


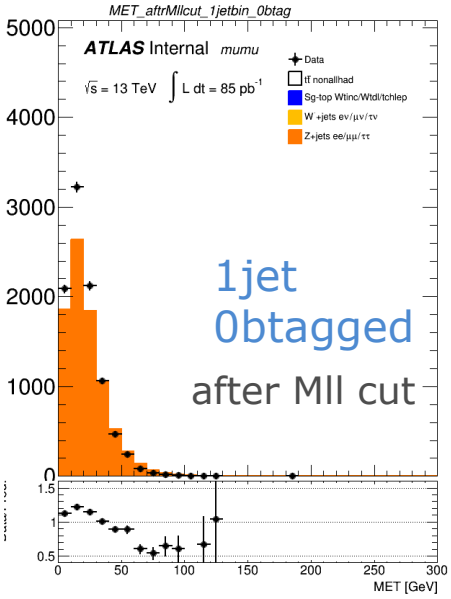


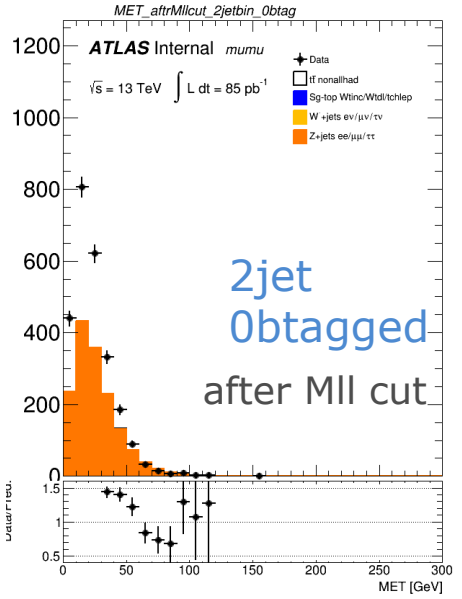




METスロープある







MET w/ tirg.

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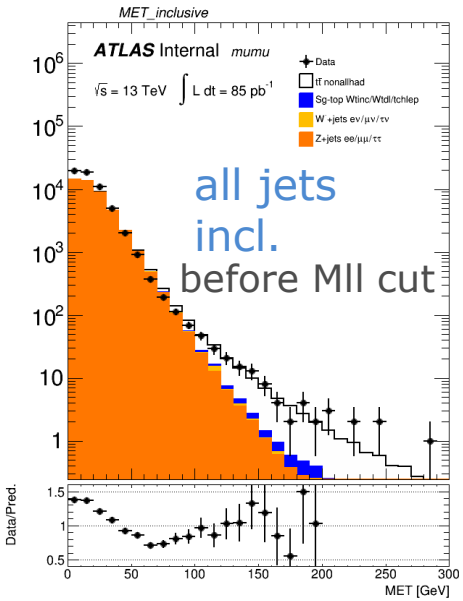
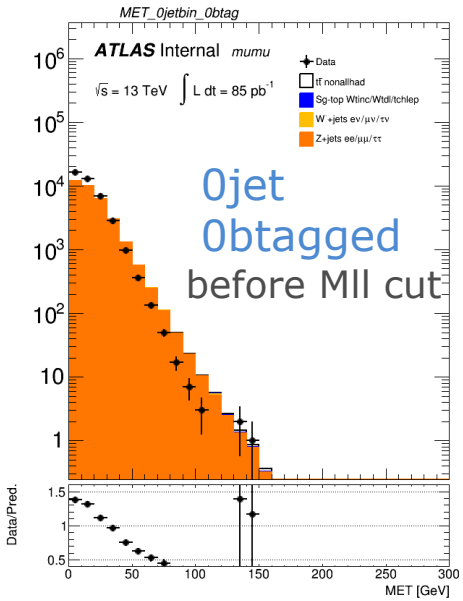
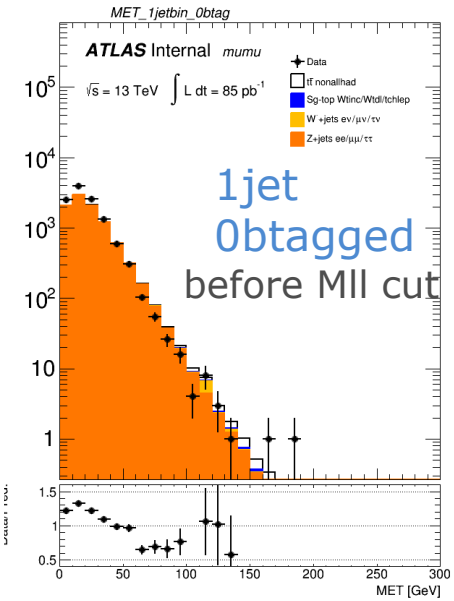
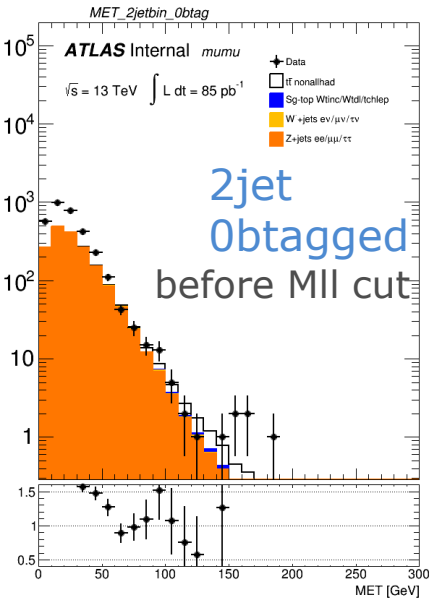
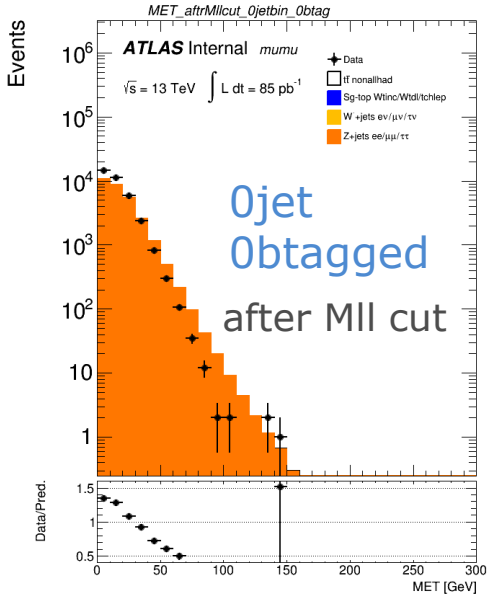
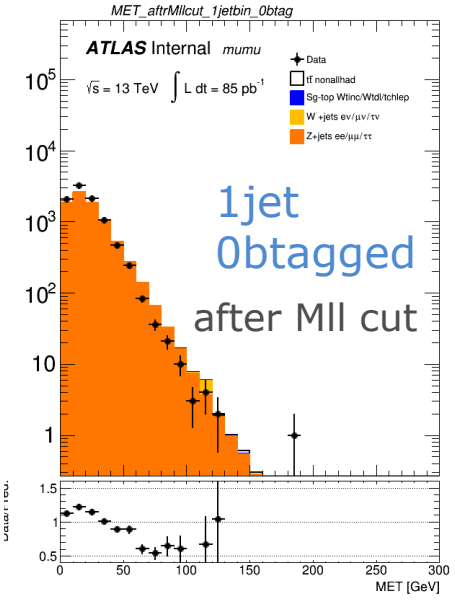


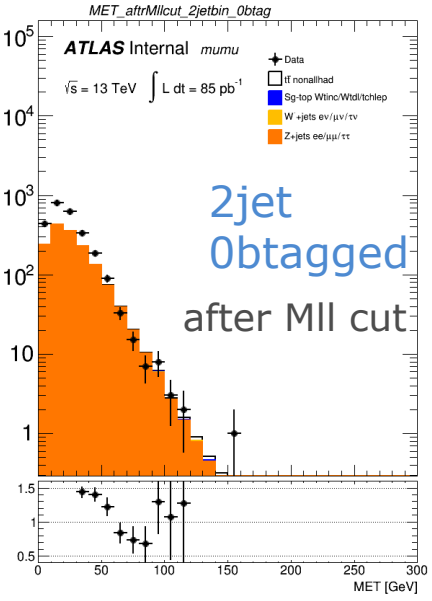












Summary

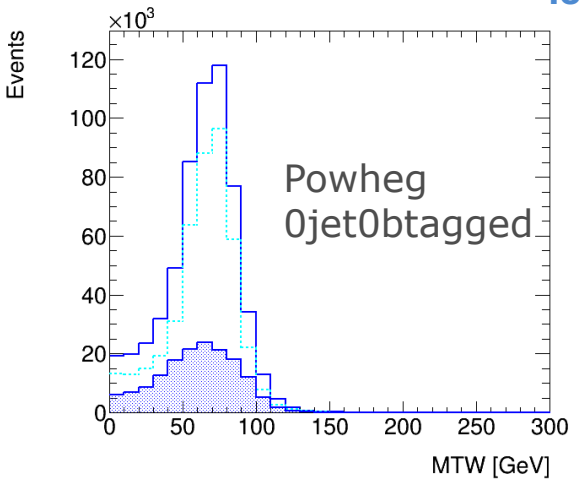
- **tthbb needs looser signal-region**
  ⇒looser fake estimation are needed.

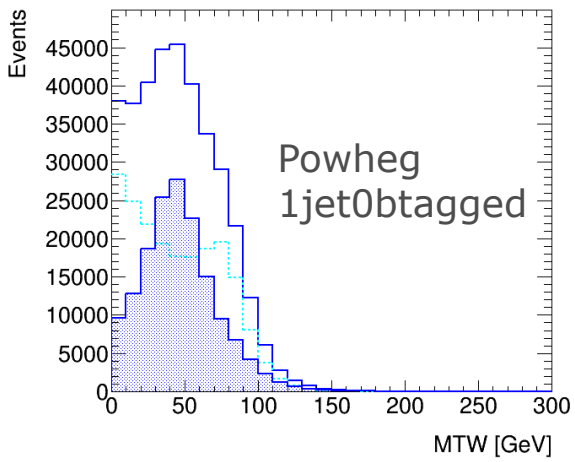
- **Good agreement of MC/data as first comparison with fake(QCD) estimate.**
  - Fakes were estimated using the MTW simply.
  - Electron channel analysis is now in going.
  - It is better to use Sherpa or multi-leg generators for Wjets-MC.
  - MET has a slope in the Data/MC ratio.
    - MET recalculation = “FinalTrk” (using PVSoftTrkCore)

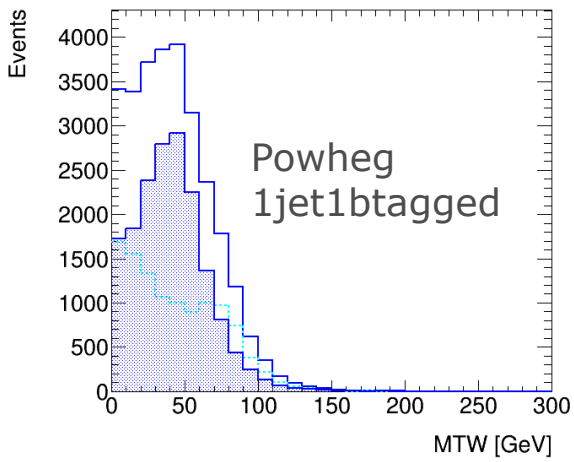
BACK UP >>

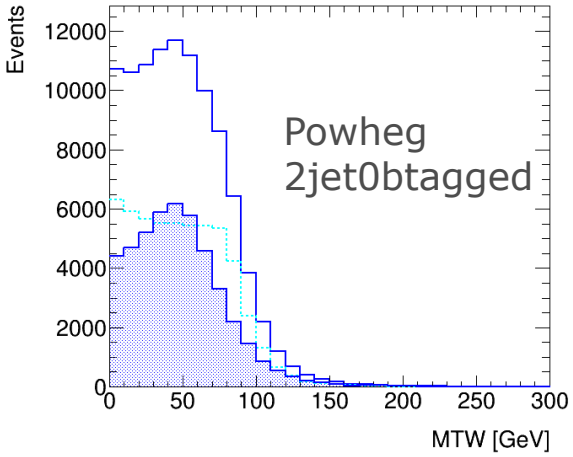
Electron Channel: loose only data

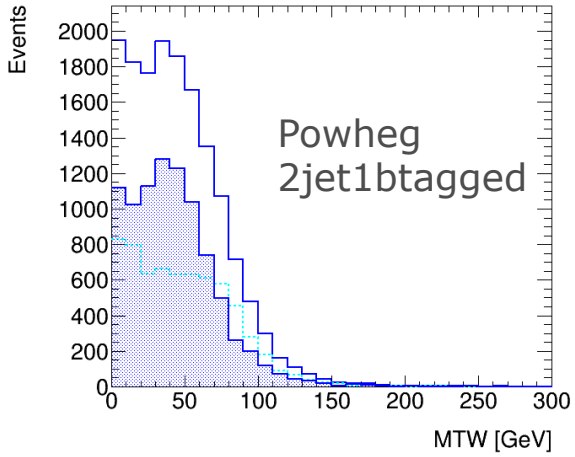
$data_{loose\ only} = data_{loose} - data_{tight}$ with trig.

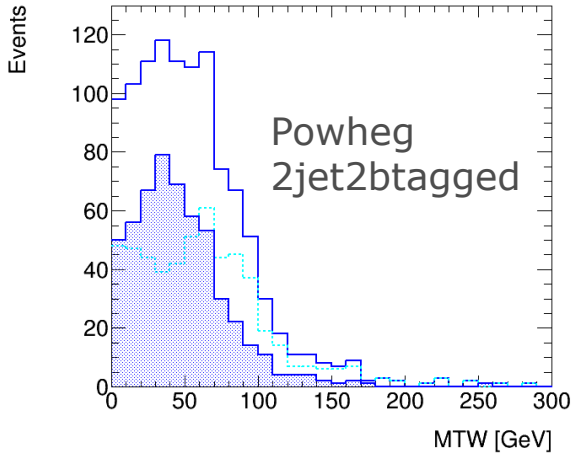








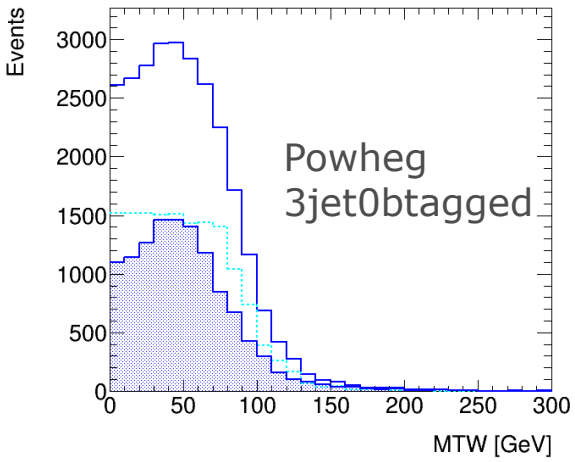


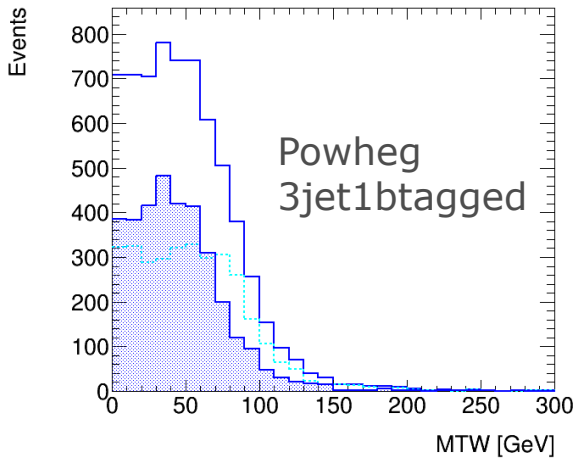


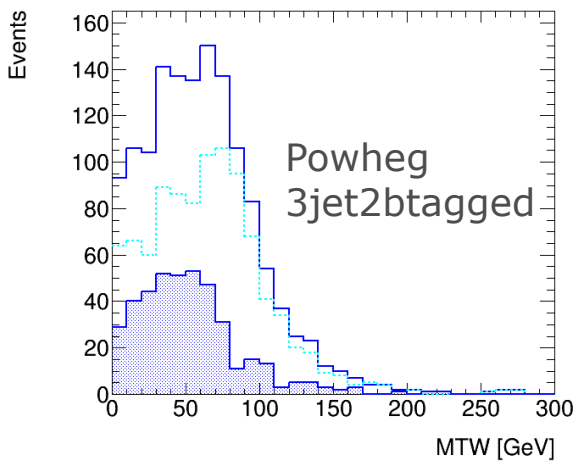
- $data_{loose}$
- $data_{tight}$
- $data_{loose\ only}$

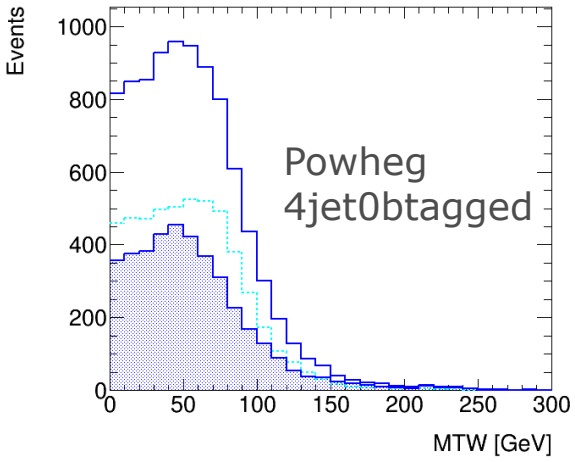
Electron Channel: loose only data

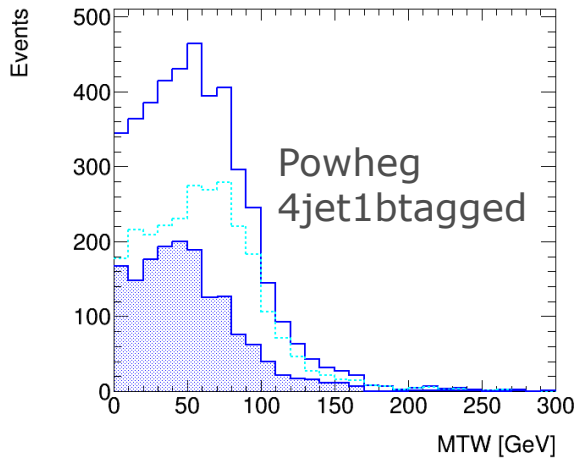
$data_{loose\ only} = data_{loose} - data_{tight}$ with trig.

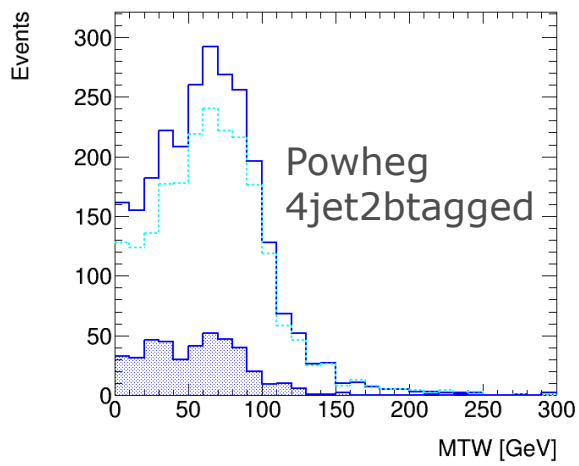








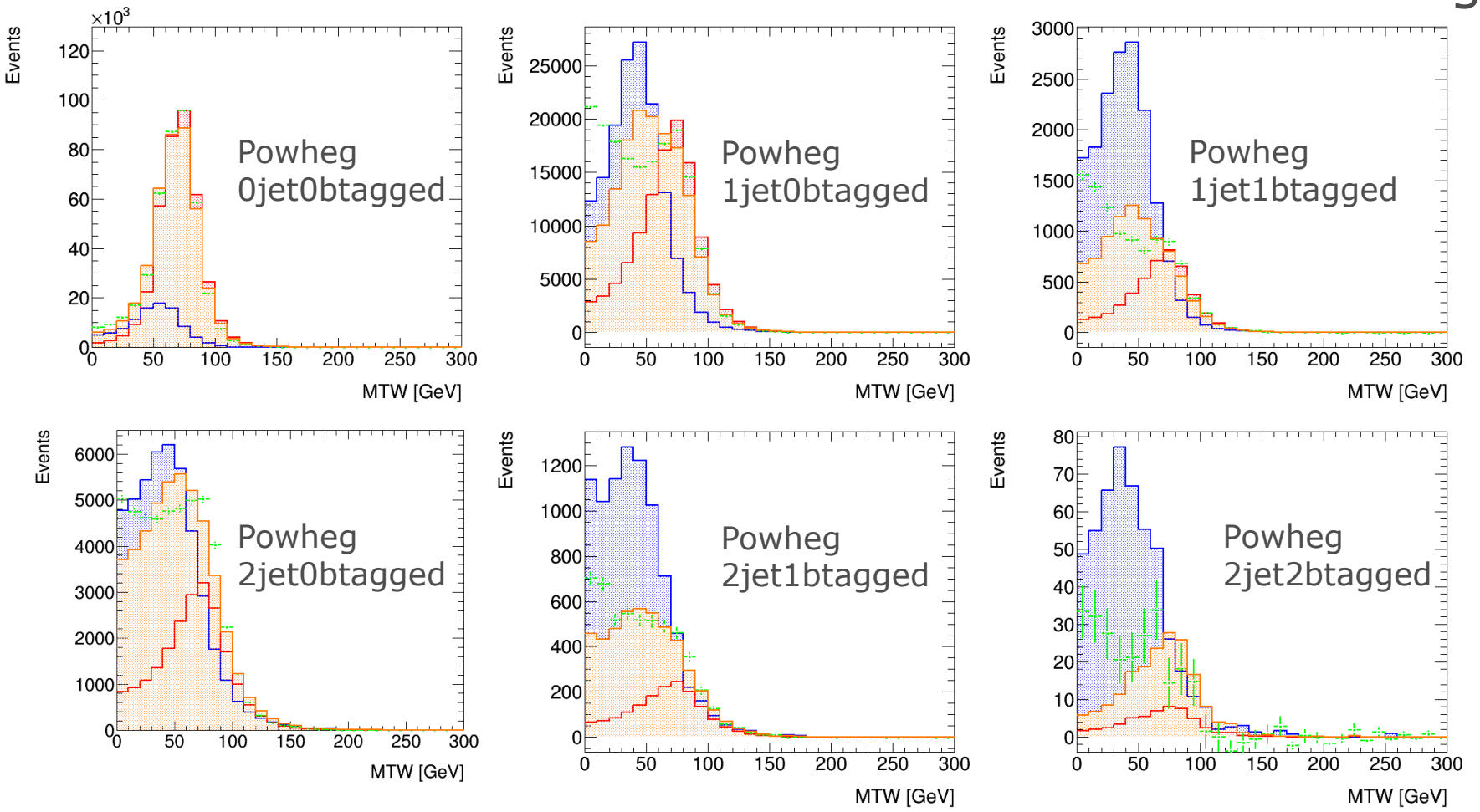




- $data_{loose}$
- $data_{tight}$
- $data_{loose\ only}$

Electron Channel: fitting

with trig.



Electron Channel: fitting

with trig.