

tZ single-lepton / di-lepton analysis @ 13 TeV

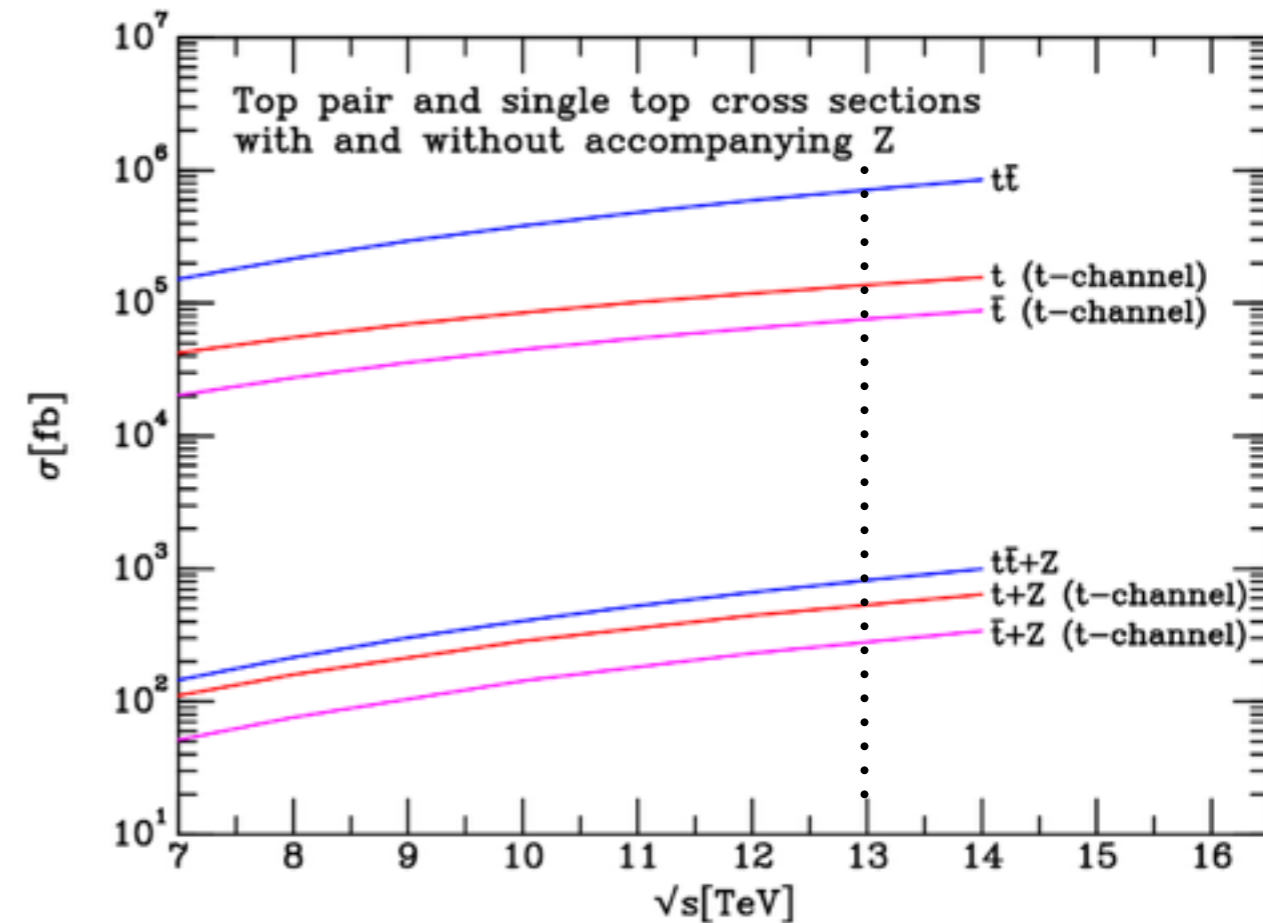
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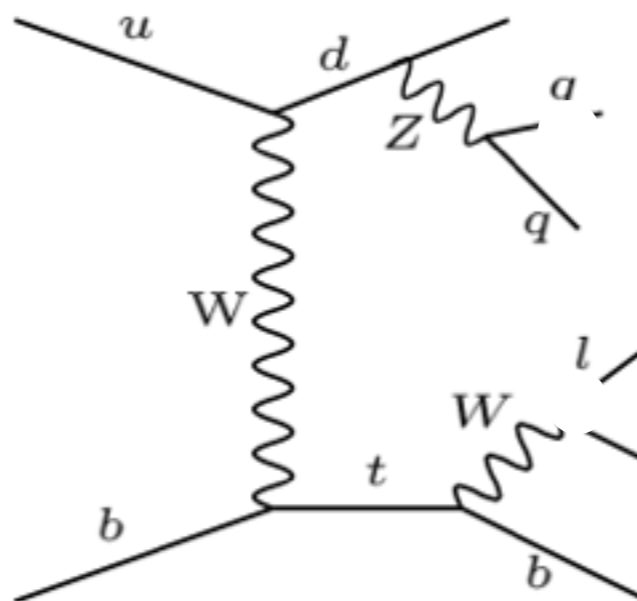
Introduction to tZ@13TeV

- electroweak process uninvestigated so far in ATLAS
- for $Z \rightarrow bb$, analysis strategy identical to tH
- background in searches for FCNC decays of the top quark in $t\bar{t}$ production



All hadronic : $t \rightarrow bqq + Z \rightarrow qq$
BR: ~47%

2l+jets : $t \rightarrow bqq + Z \rightarrow ll$
BR: ~4.5%



3l : $t \rightarrow bl\nu + Z \rightarrow ll$
BR: ~1.5%

1l+jets : $t \rightarrow bl\nu + Z \rightarrow qq$
BR: ~16%

Analysis Strategy

- using Analysis Top + extra package (similar to SingleTopAnalysis) implementing tZ specific selection
- separate common framework for applying additional cuts, performing reconstruction and creating the input files for the neural network
- use MVA techniques to separate signal and background:
 - team already experienced with NeuroBayes
 - plan to check BDT performance as well
- fit the NN output distribution
- evaluate systematic uncertainties

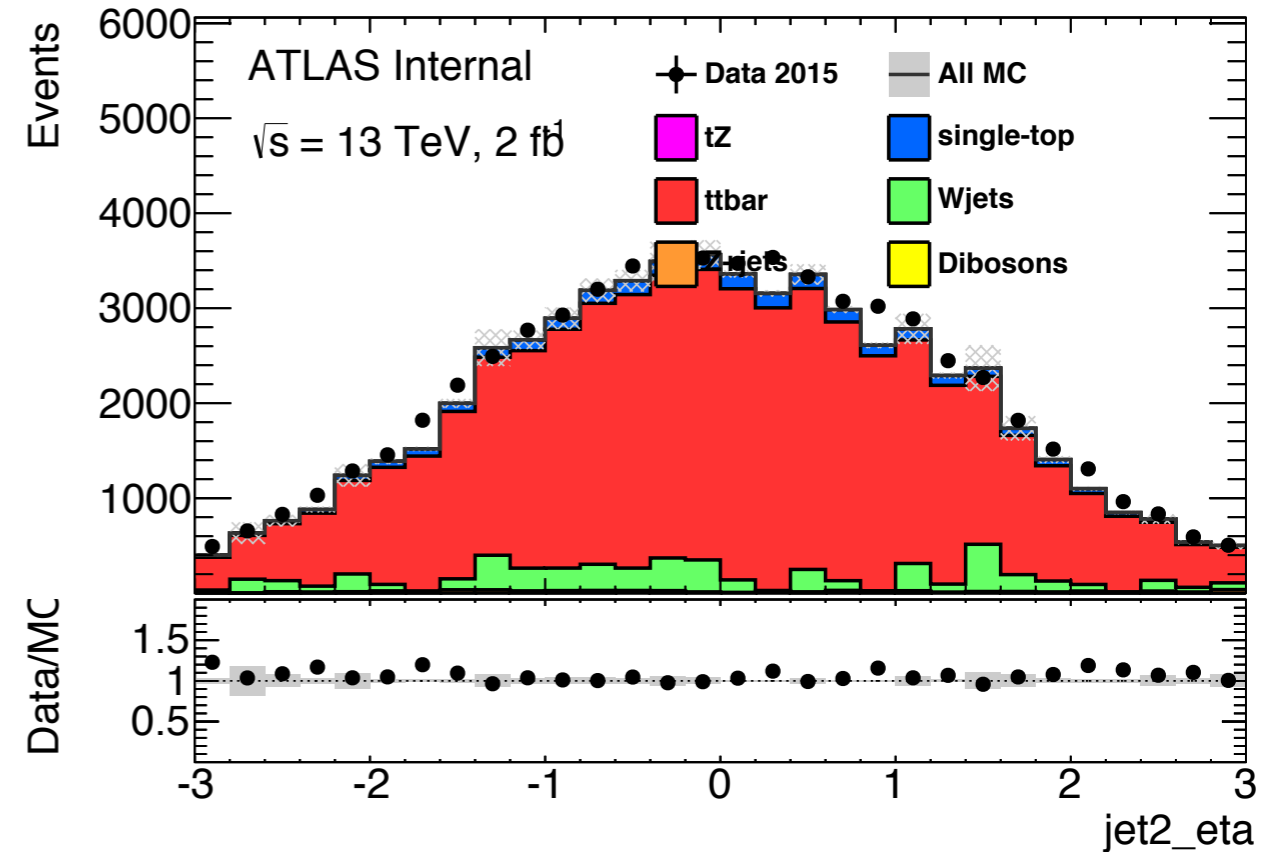
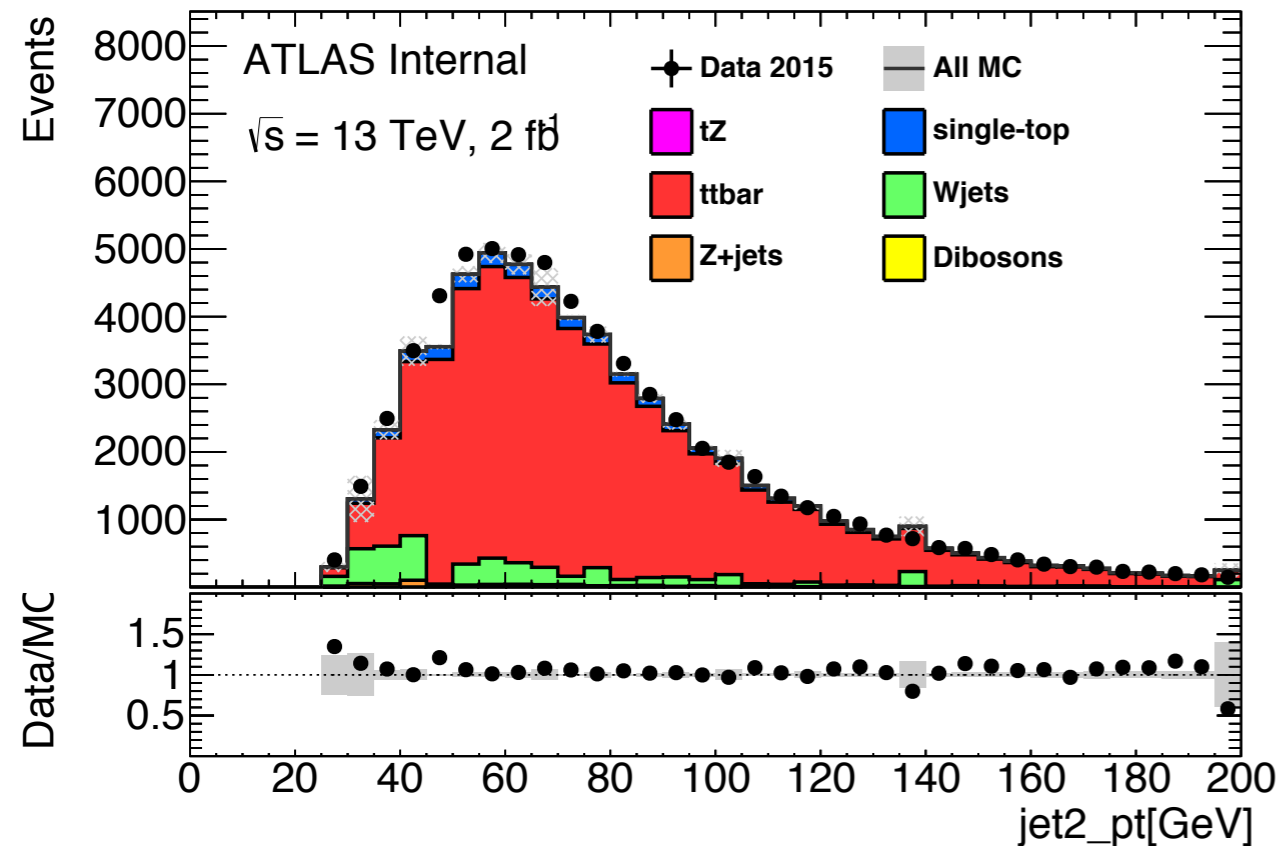
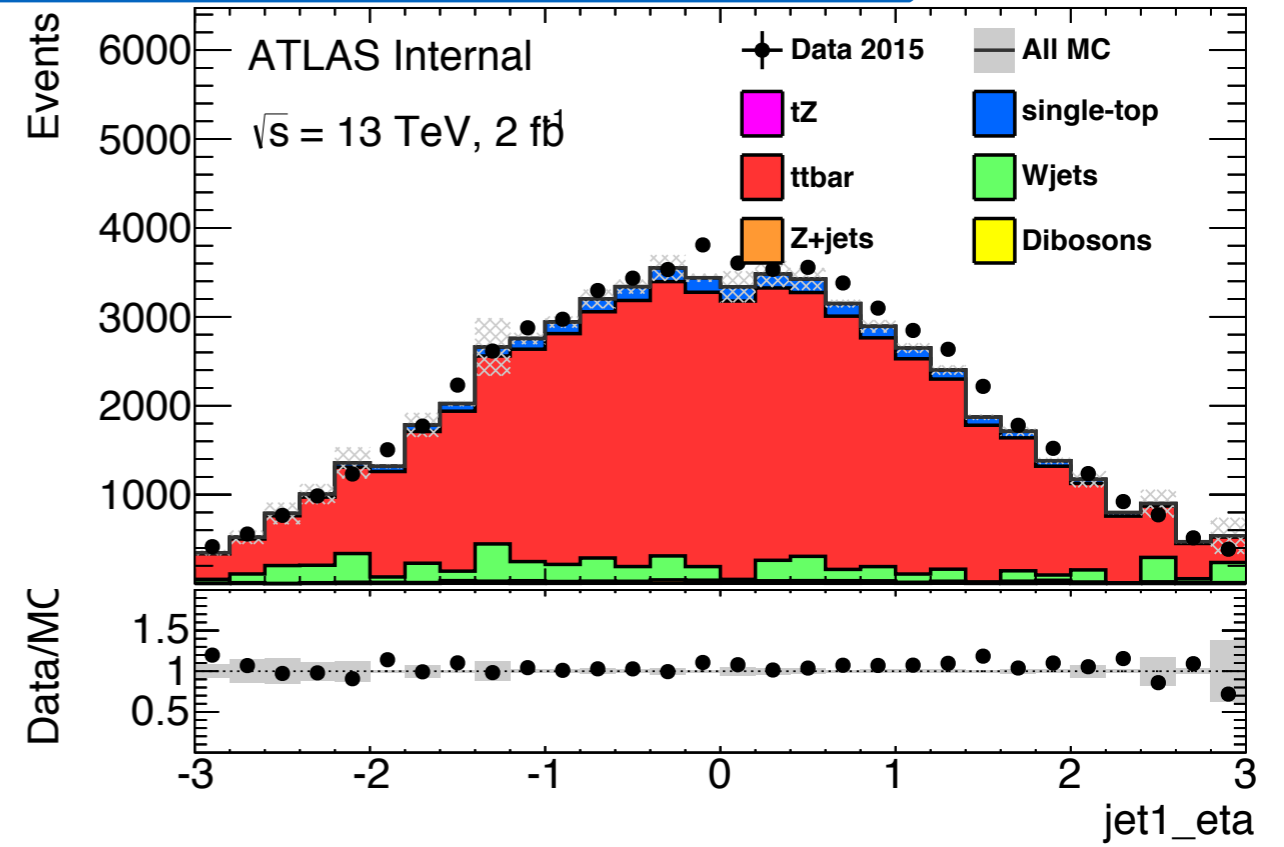
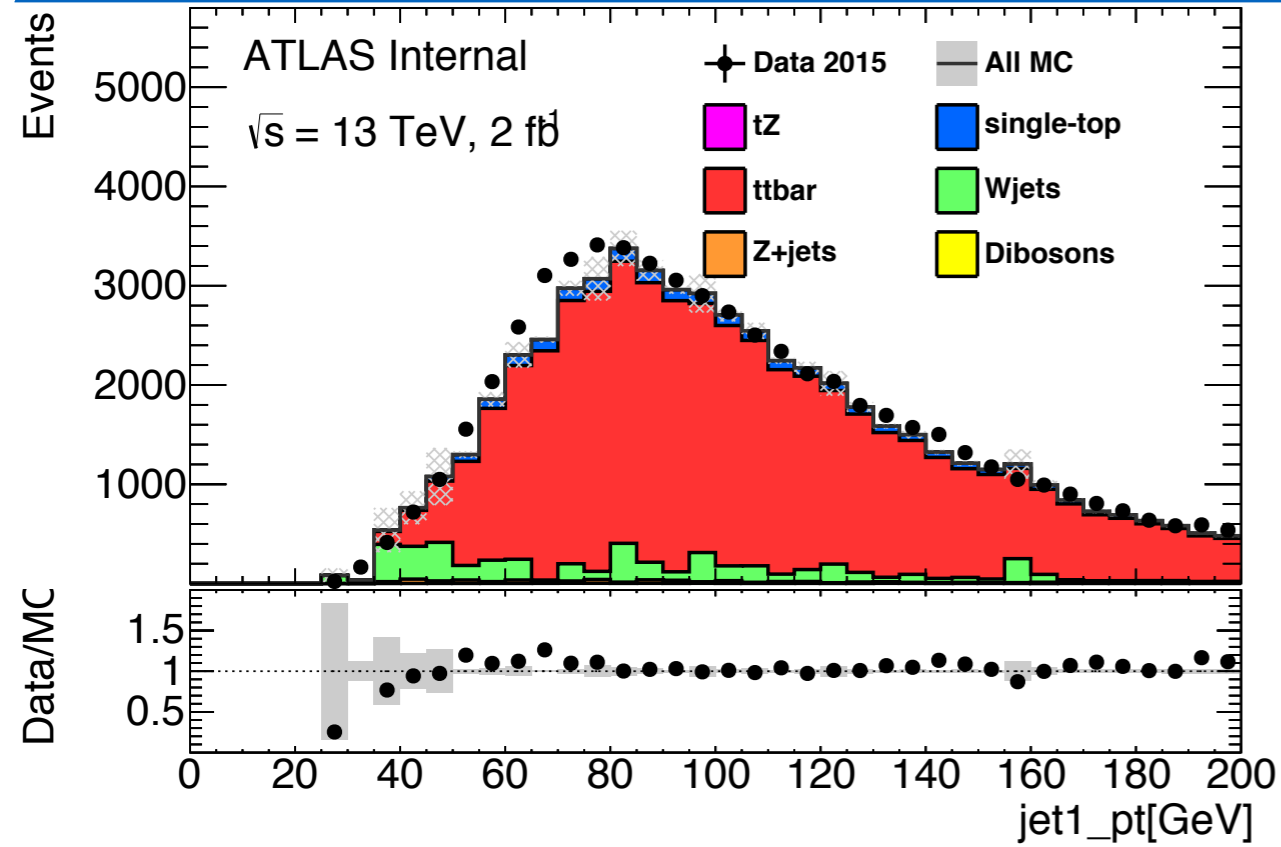
Event selection and object definitions

- Standard top object definitions:
 - tight LH for electrons
 - isolated leptons
 - Jets $p_T > 25$ GeV
 - MV2C2 77% b-tagging WP
- Single lepton channel
 - 1 lepton
 - $p_{T,l} > 20$ GeV
 - ≥ 4 jets (one b-tagged)
 - $E_T^{\text{miss}} > 20$ GeV
- Dilepton channel
 - two opposite sign leptons
 - $p_{T,l} > 20$ GeV
 - ≥ 4 jets (one b-tagged)

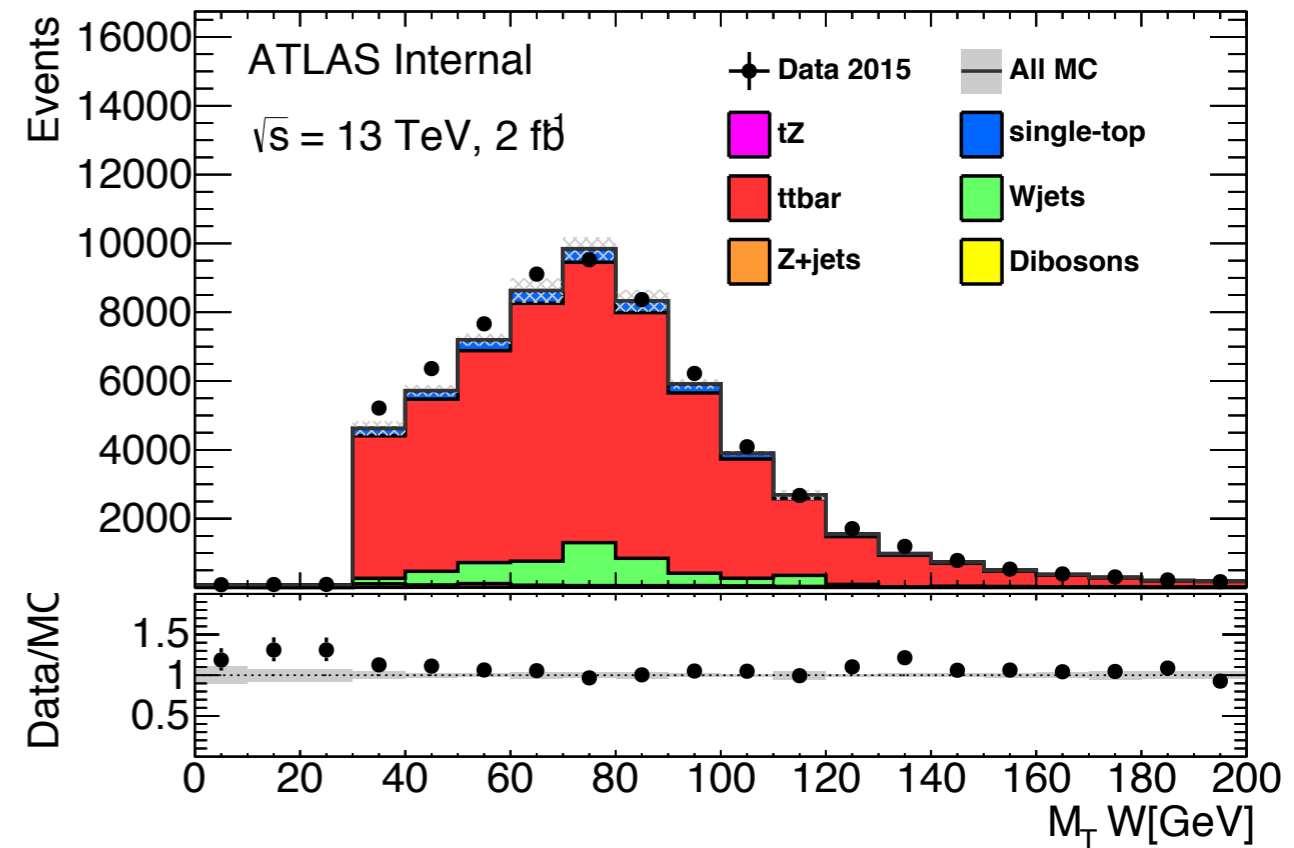
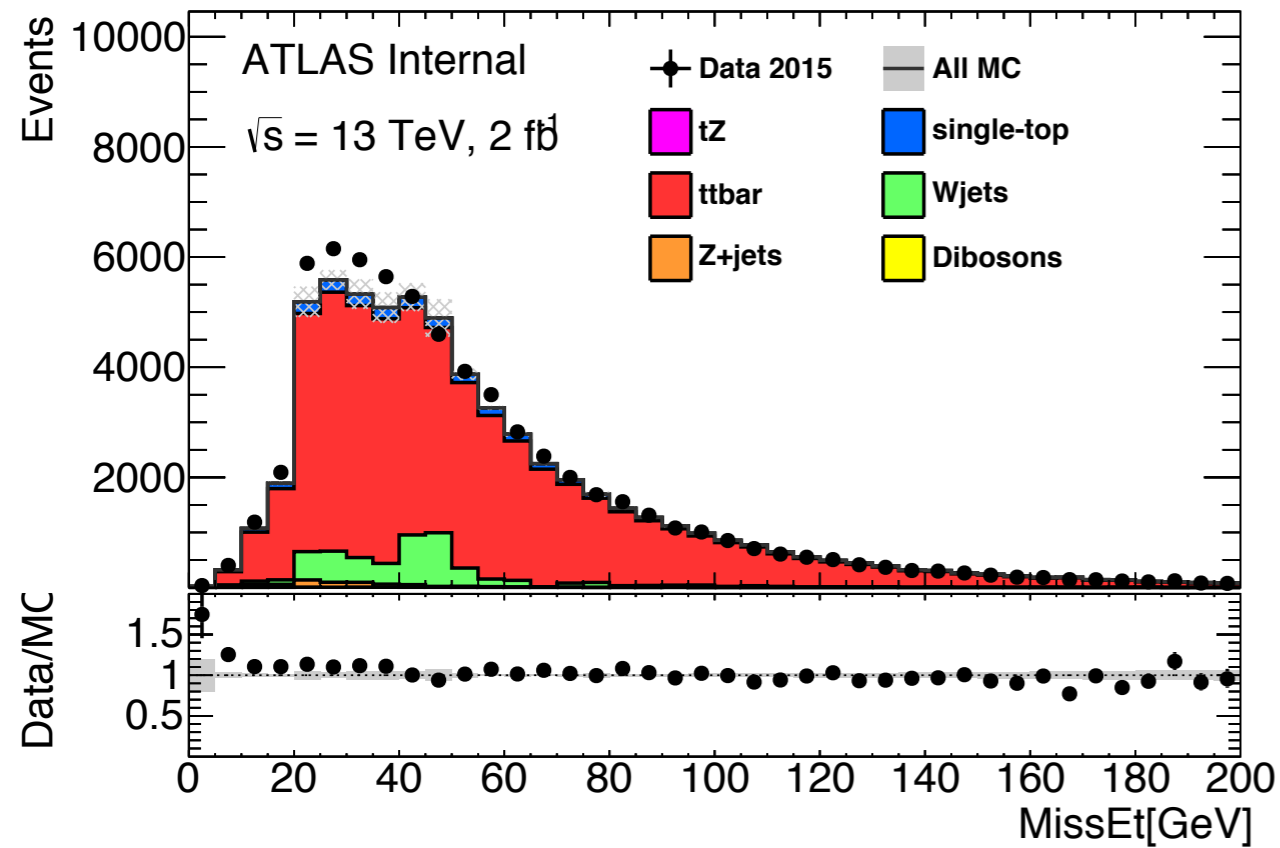
Data and MC samples

- samples produced from TOPQ1 derivations (Analysis Top 2.3.26)
- Data Samples
 - 13TeV 25ns dataset $\sim 2\text{fb}^{-1}$ (updating to the full 2015 dataset in the near future)
 - standard single lepton triggers
- MC Samples
 - tZ : MadGraphPythia
 - W+jets, Z+jets, diboson : Sherpa
 - Single top t-, Wt- and s-channel, ttbar : Powheg+Pythia
 - ttWZH : aMC@NLO+Herwig++ & MadGraphPythia8
- Generator systematics samples (see Muhammad's presentation)
 - 1) scales and factorization up (radHi and radLo)
 - 2) scales and factorization down (radHi and radLo)

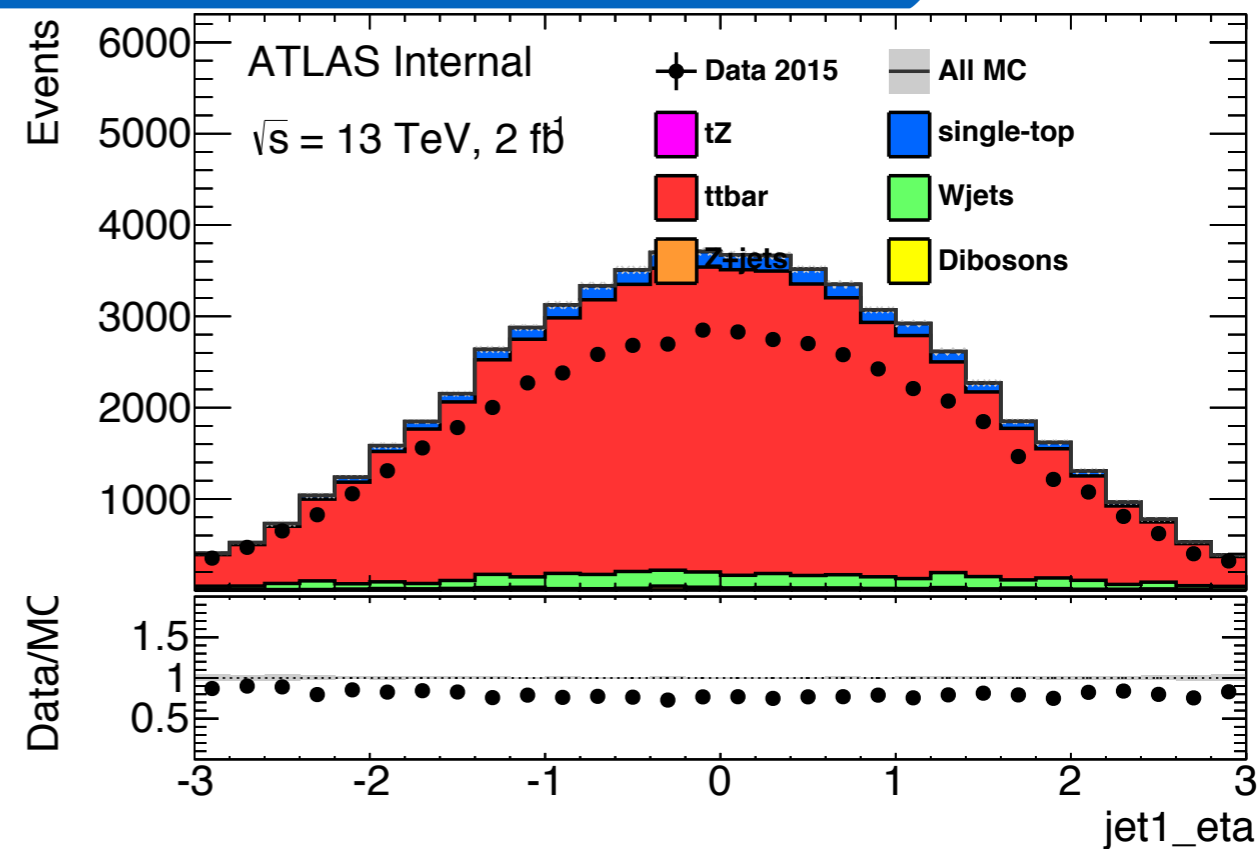
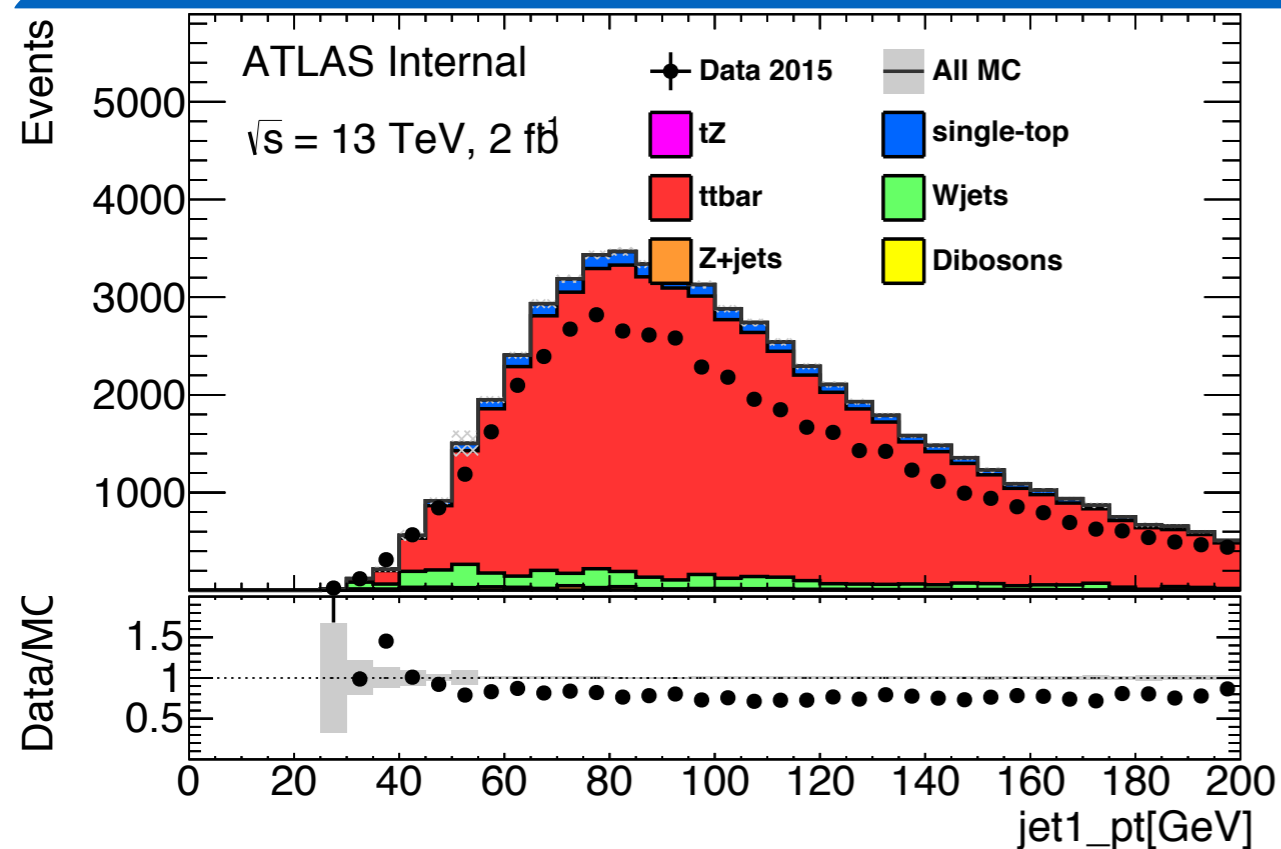
Control Plots - e+jets channel



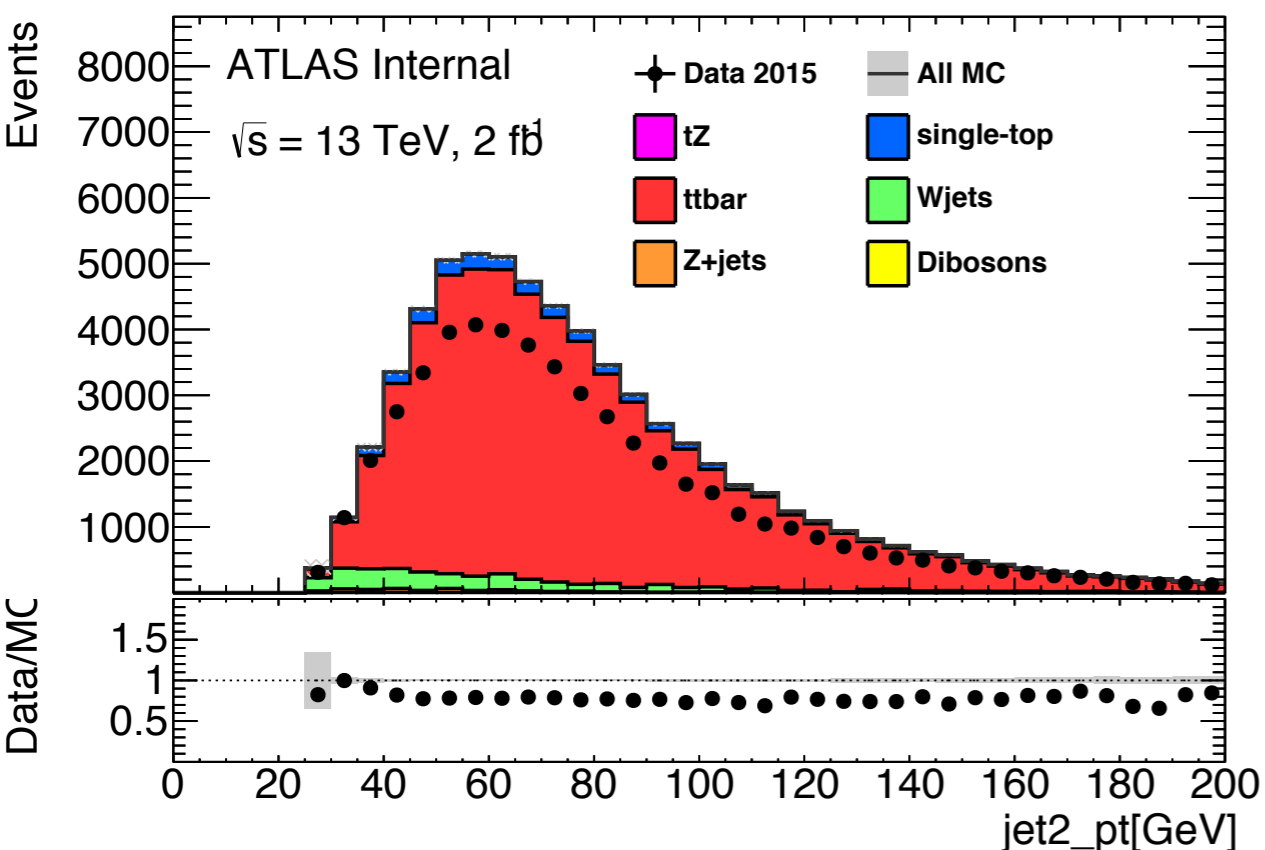
Control Plots - e+jets channel



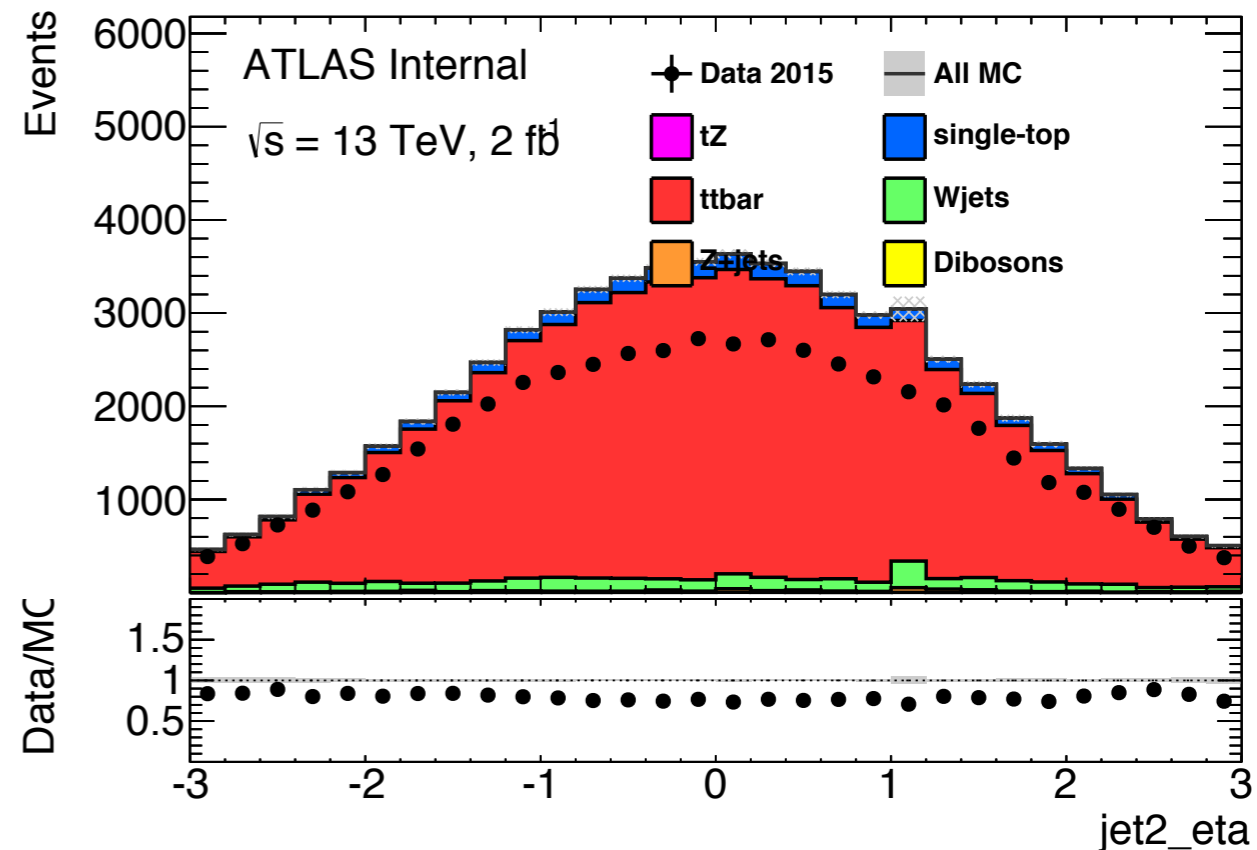
Control Plots - μ +jets channel



• **problem with normalisation!**



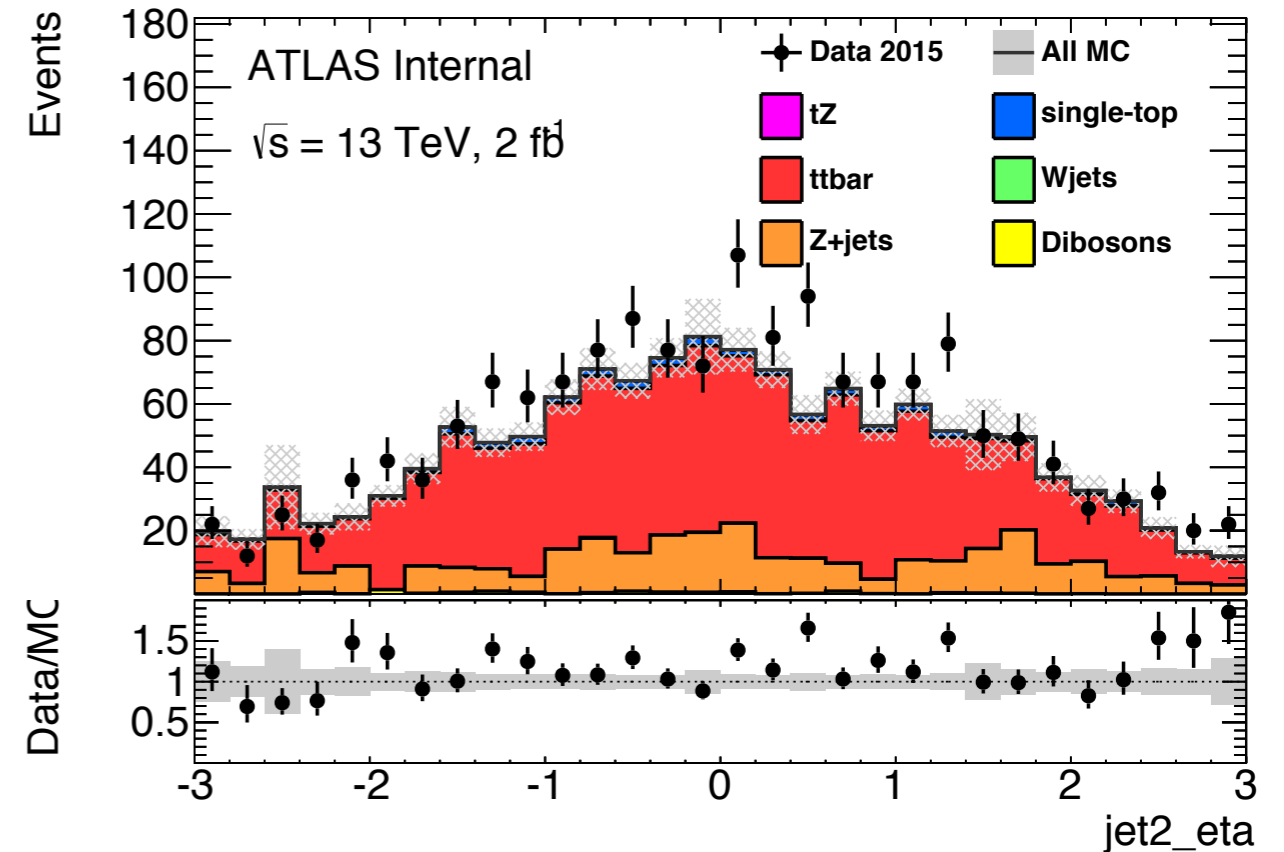
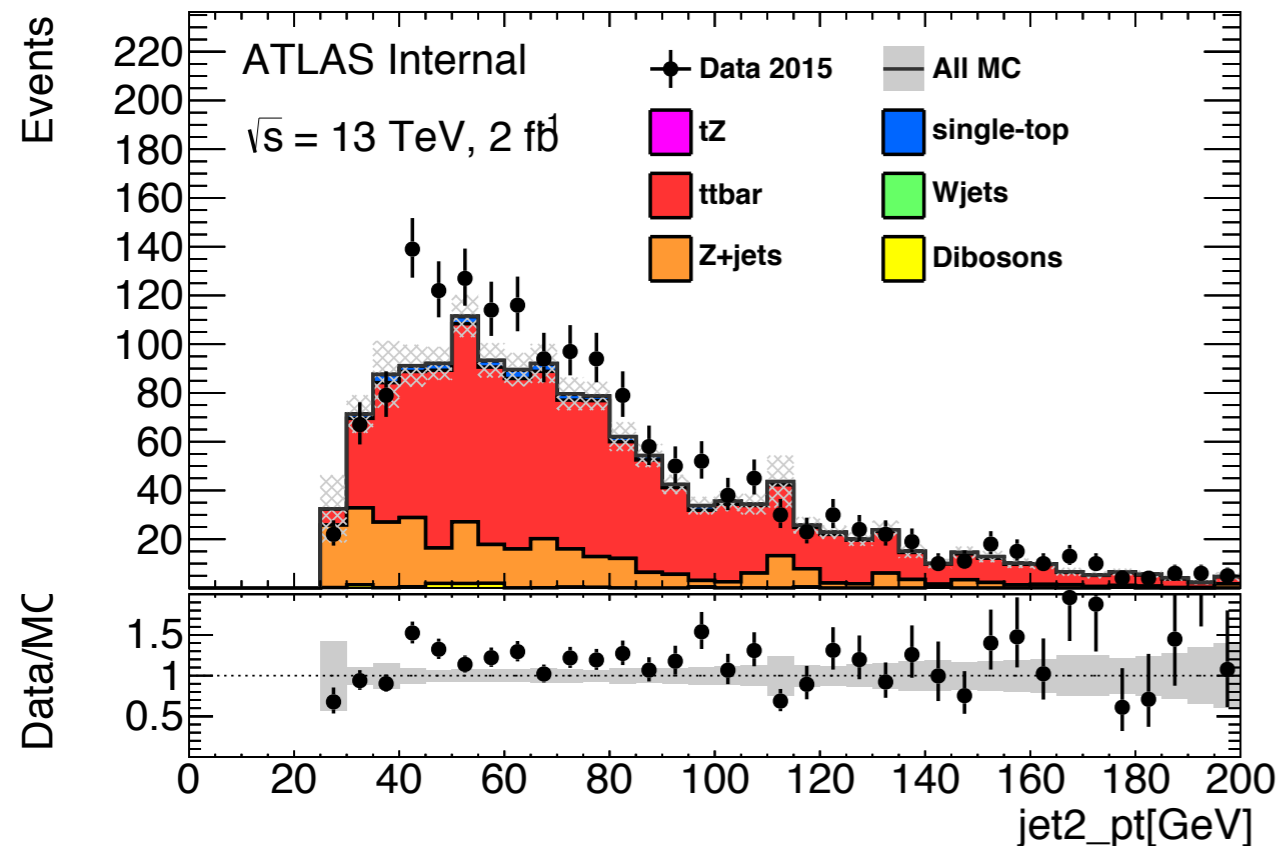
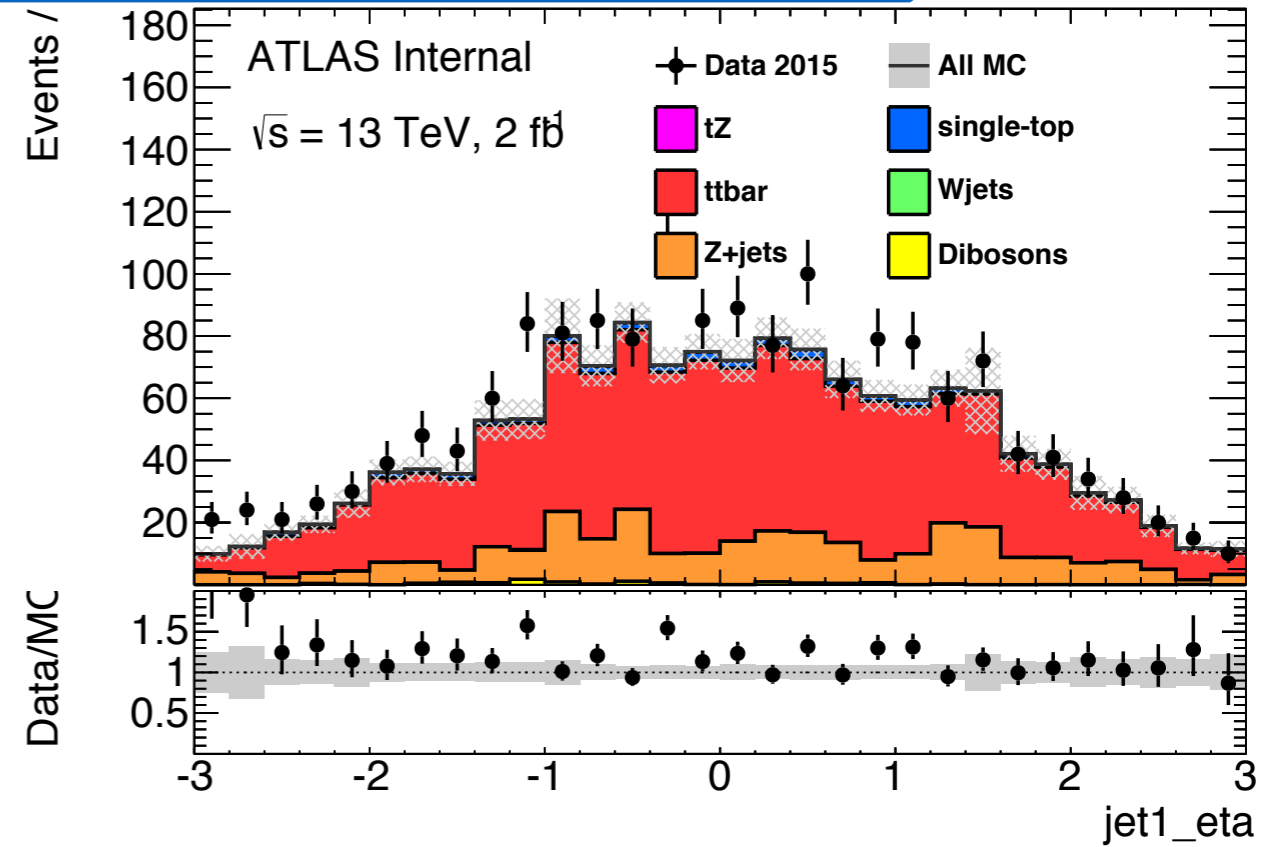
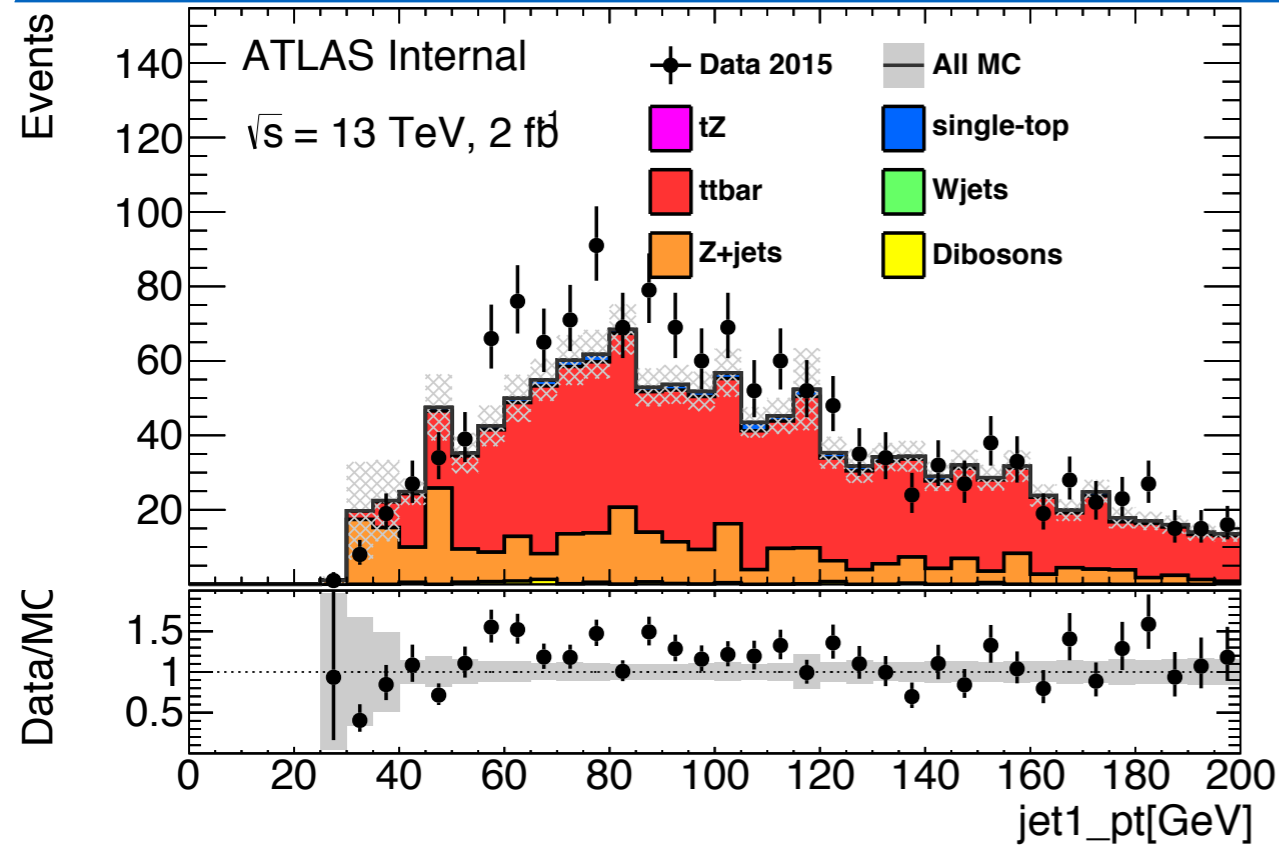
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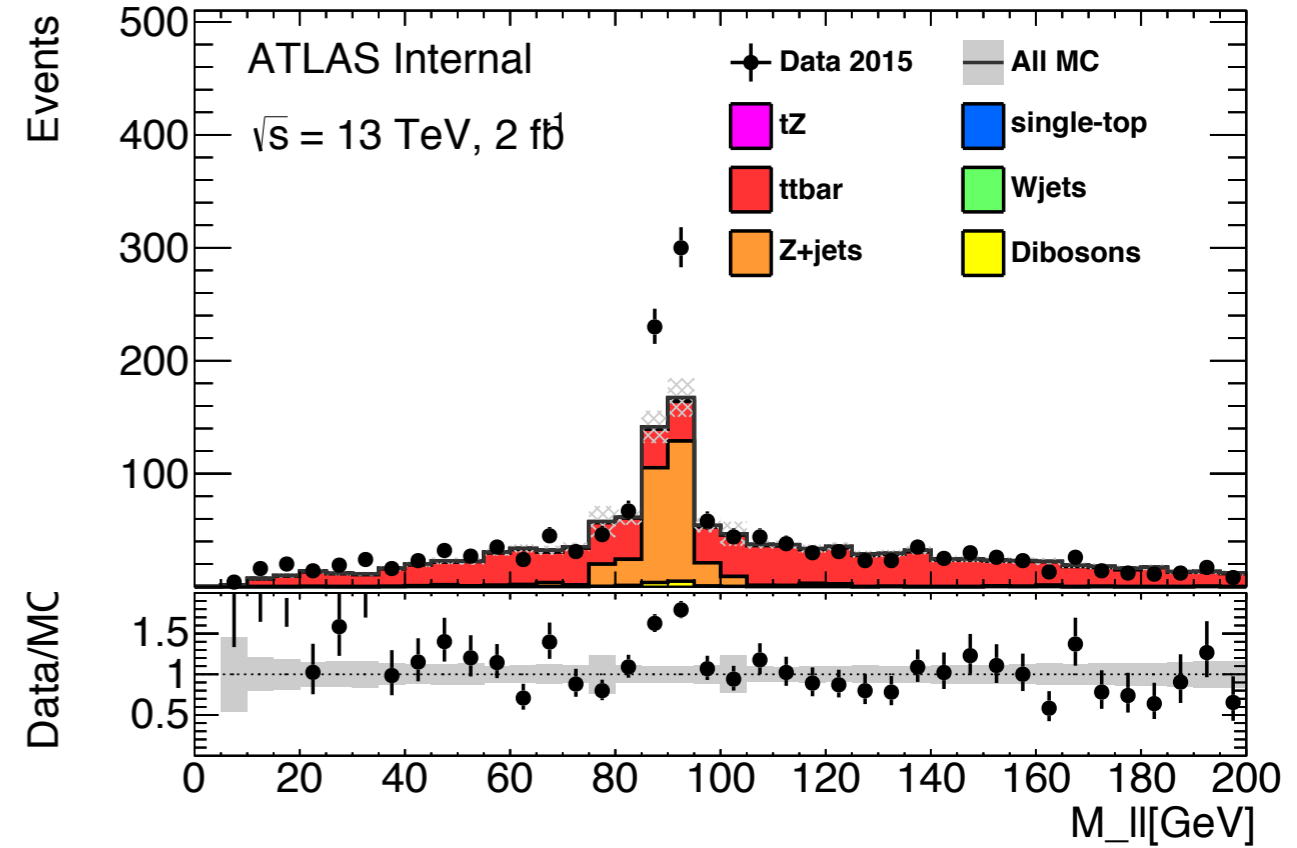
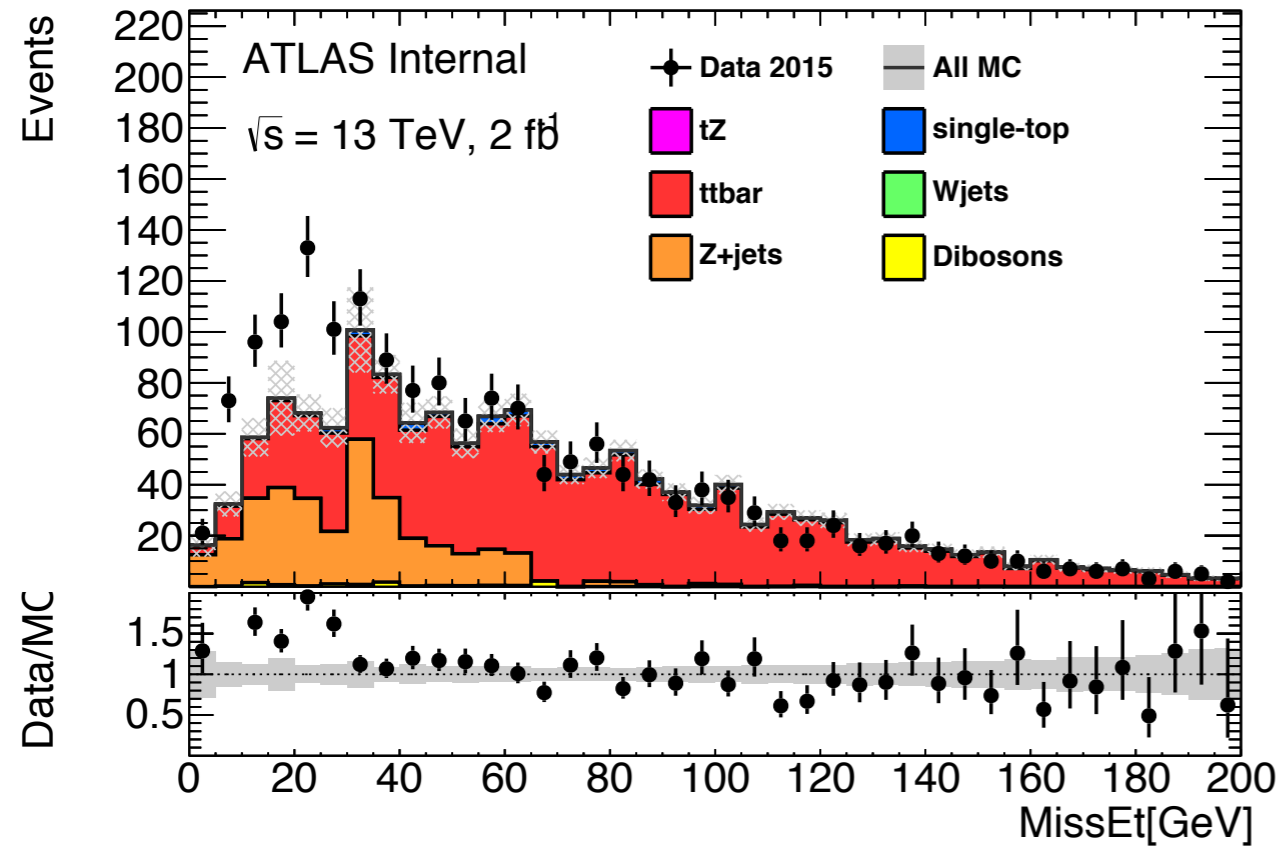
Event yields

# of events	ee	$\mu\mu$
tZ	3	4
single-top	44	64
ttbar	1080	1498
Diboson	11	10
Zjets	323	?
Wjets	1	-
MC total	1463	1577
Observed Events	1700	2427

Control Plots - ee channel



Control Plots - ee channel



Work in progress and plans

- currently working on:
 - checking data/MC agreement
 - cut optimisation (n_jets, missing ET cut, lepton pt ...)
 - comparing different reconstruction algorithms in both channels
 - many plots showed by Muhammad in our last working meeting
 - finding variables with good discrimination power
- next step:
 - run MVA (code already in place)

Further details and time scale

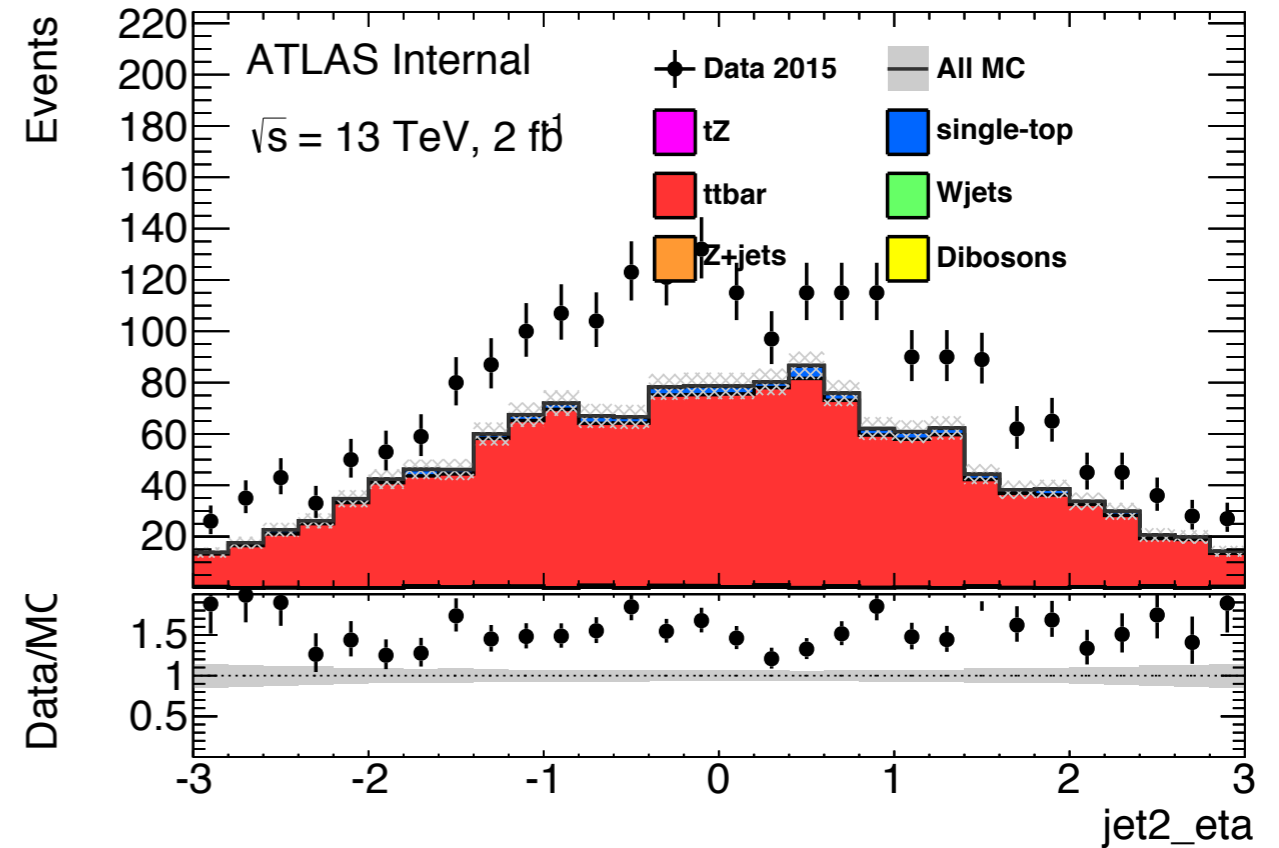
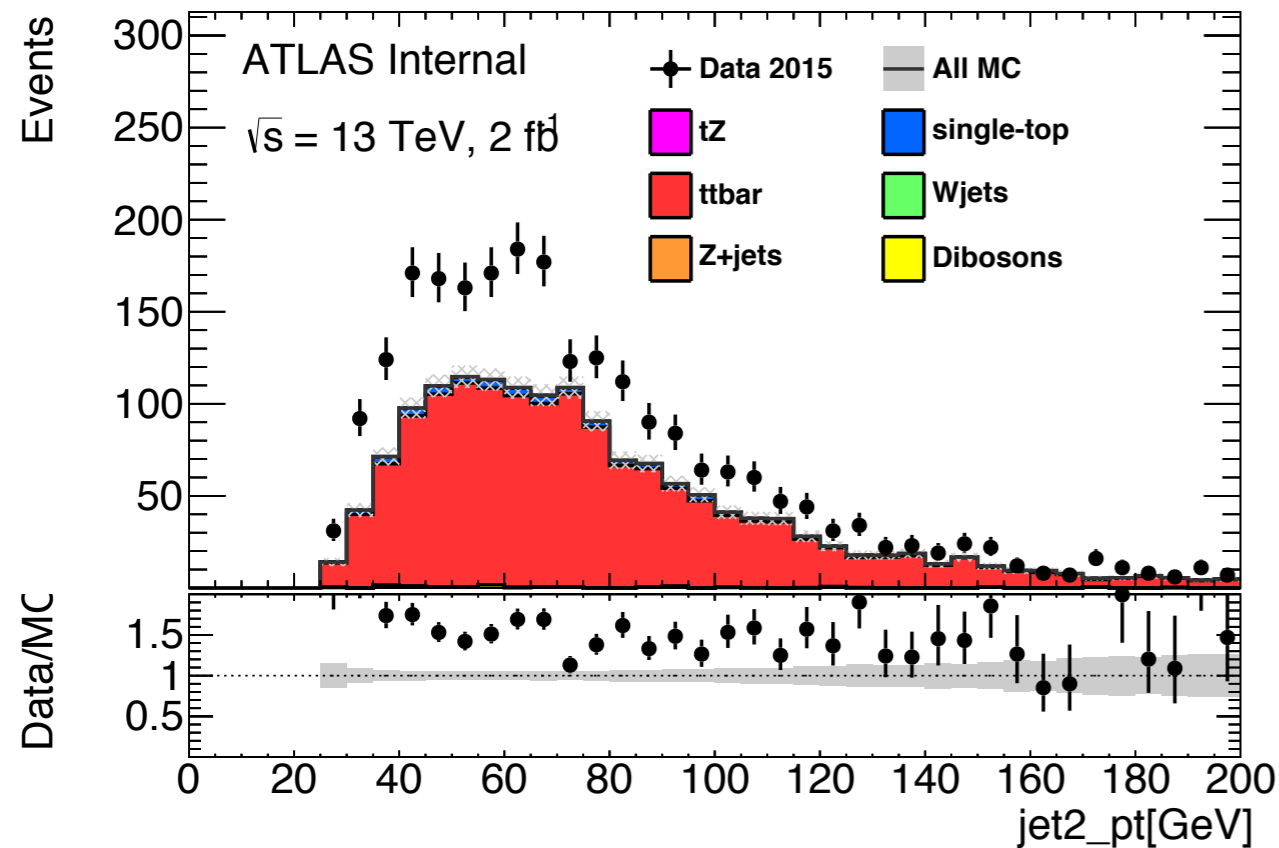
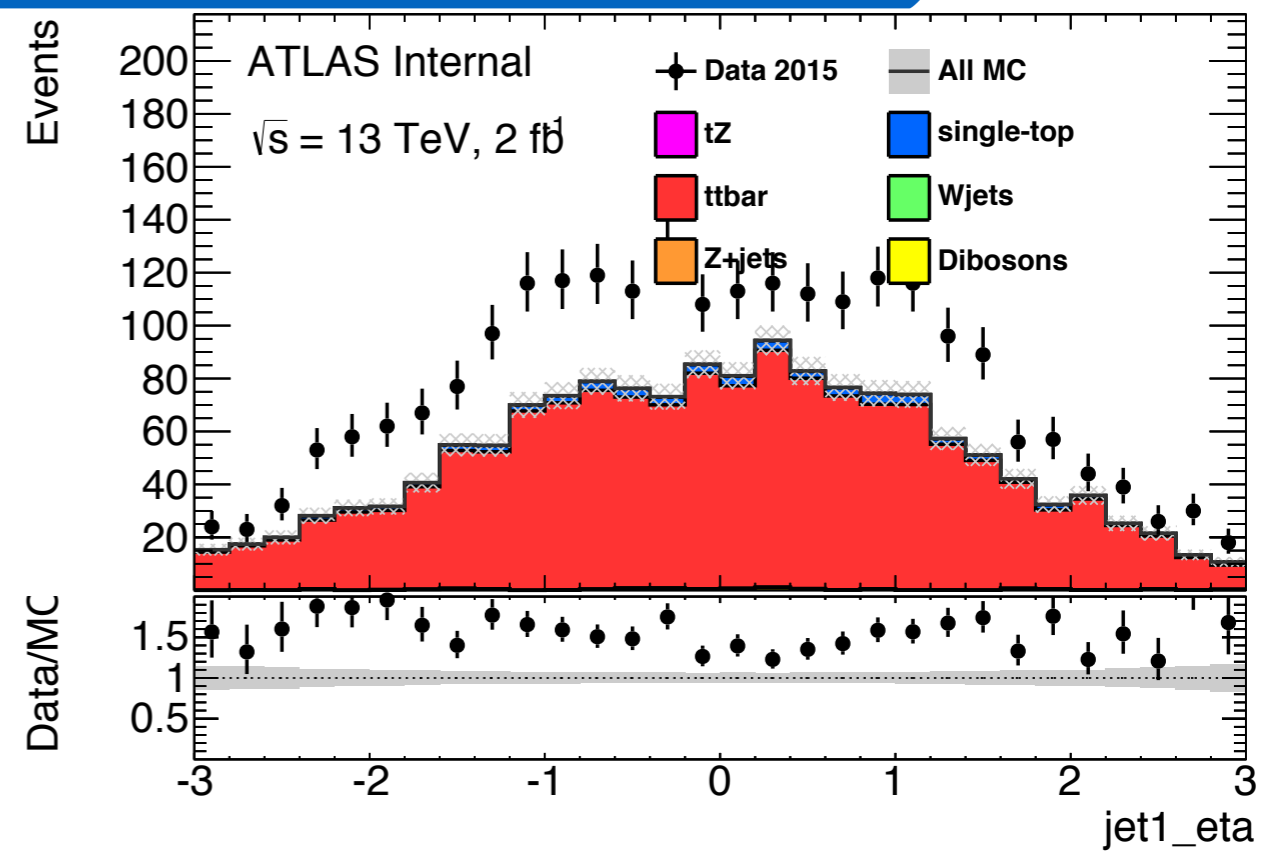
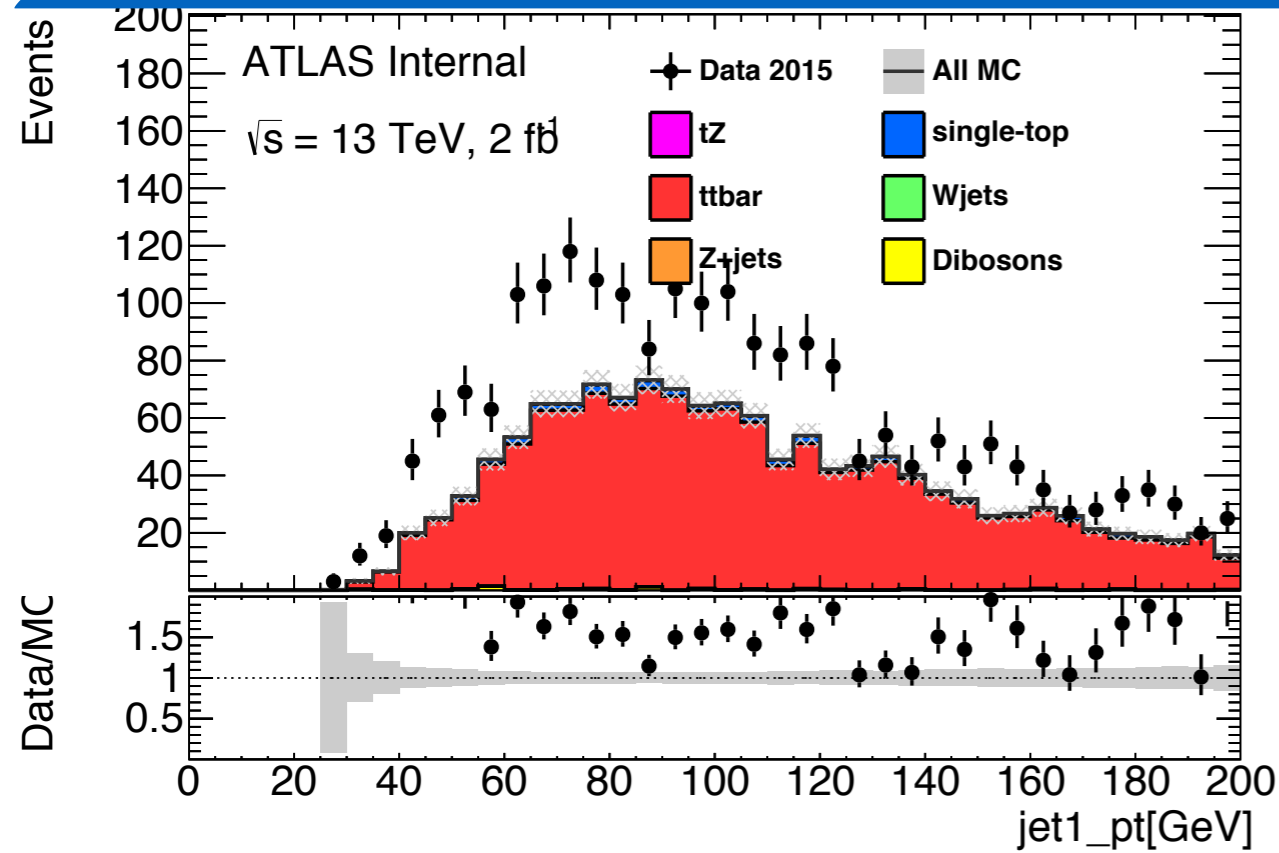
- analysis working meeting Mondays (every two weeks)
- egroup: atlas-phys-top-tZ-run2@cern.ch
- JIRA project: ATLAS tZ Run2 ljets&dilepton (ATLTZLJETS)

Timescale

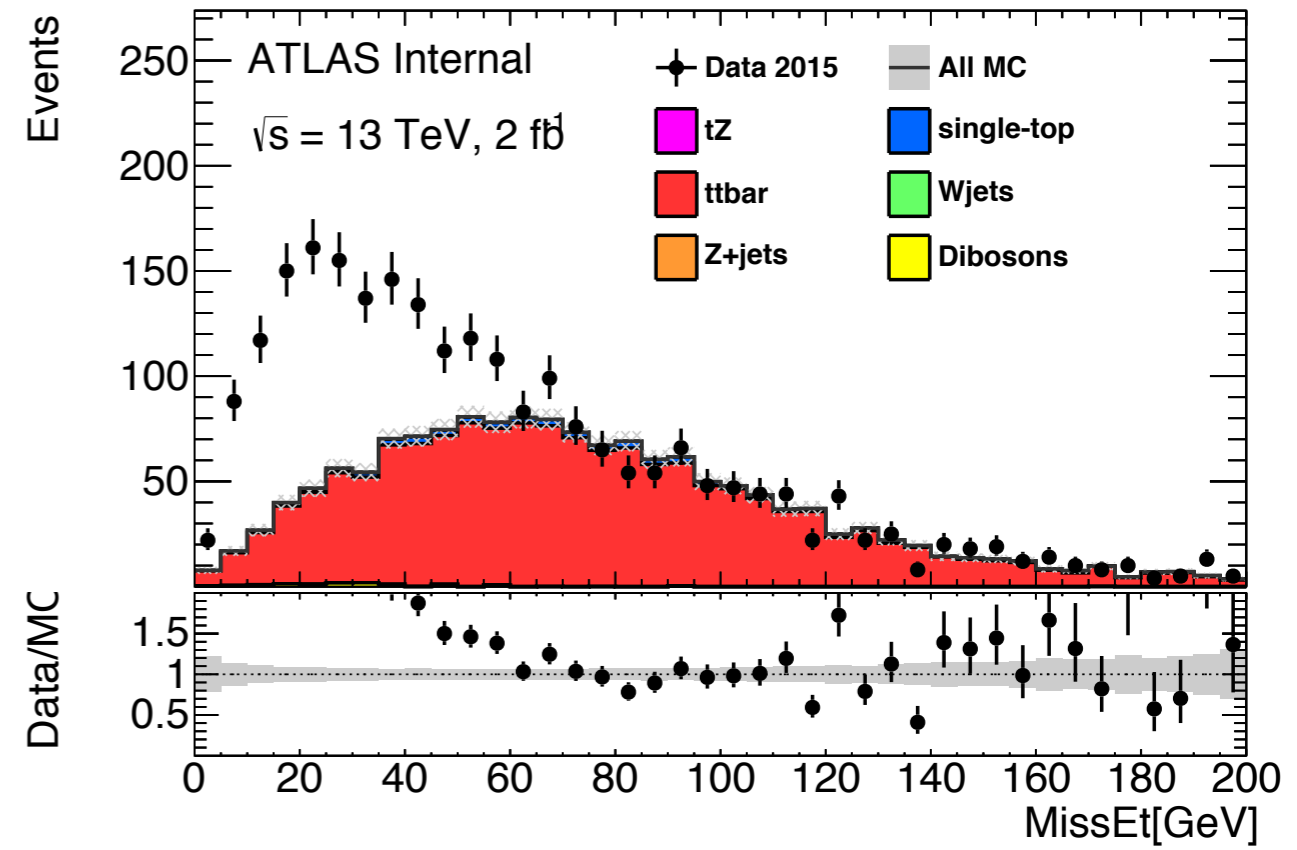
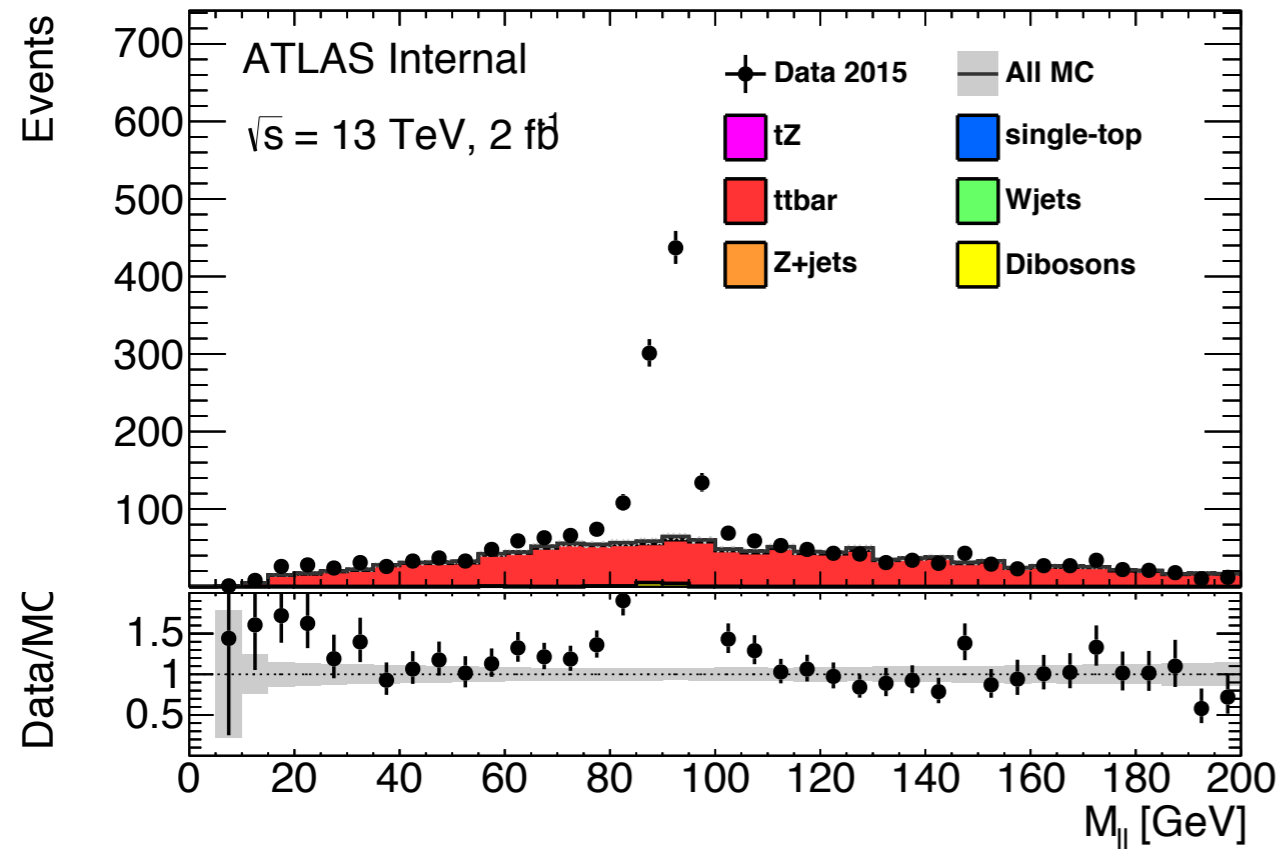
- evaluate limits that can be achieved, as a function of luminosity
- decide based on that when it makes sense to go for publication

Backup

Control Plots - $\mu\mu$ channel



Control Plots - $\mu\mu$ channel



Control Plots - μ +jets channel

