

Status on TTJ analysis

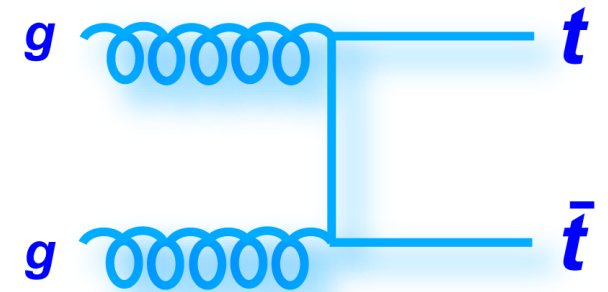
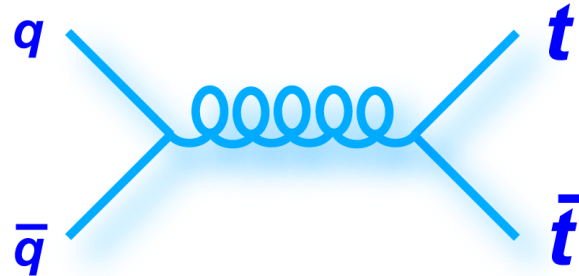
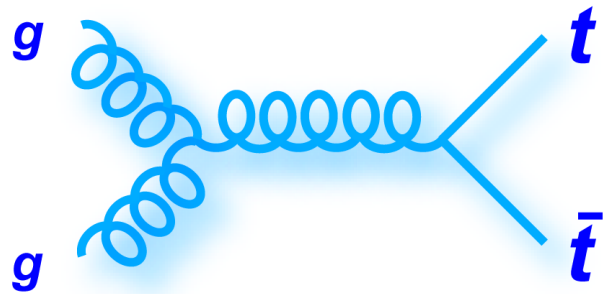
DESY – Zeuthen group meeting

ROBIN Matthieu, Li Yichen, Timothée Theveneaux-Pelzer, Thorsten Kuhl
DESY – Zeuthen, July 12, 2019



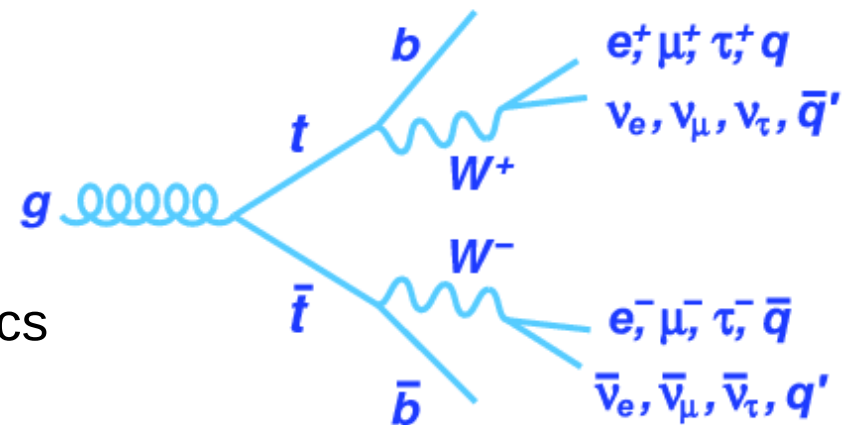
Introduction

LHC known as a top factory



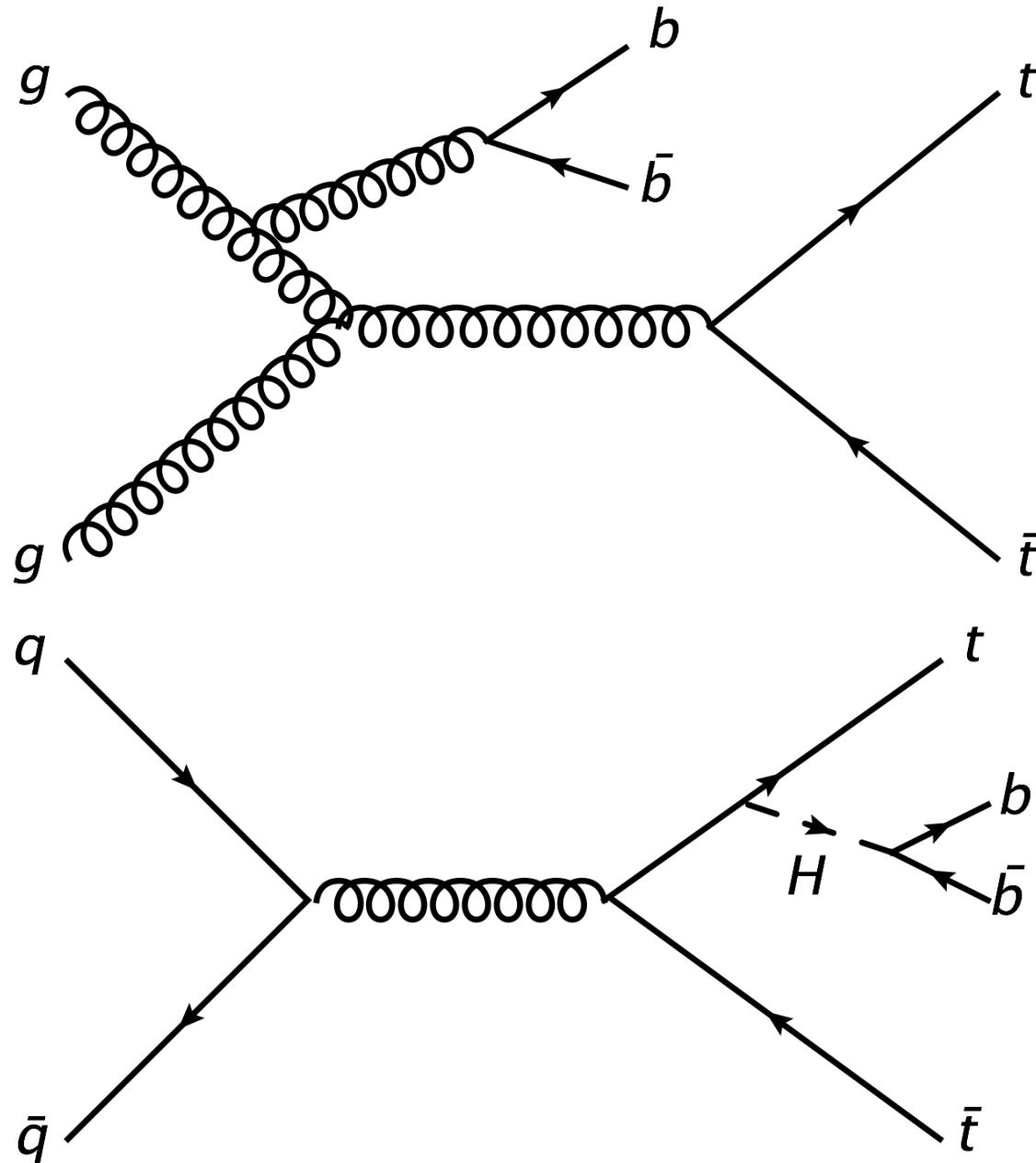
Major role of *top* quark in (B)SM:

- Heaviest elementary particle in SM
- Highest Yukawa coupling to the Higgs
- Any deviation w.r.t. SM = hint for new physics



Introduction

Important background for measurements of other process cross-sections

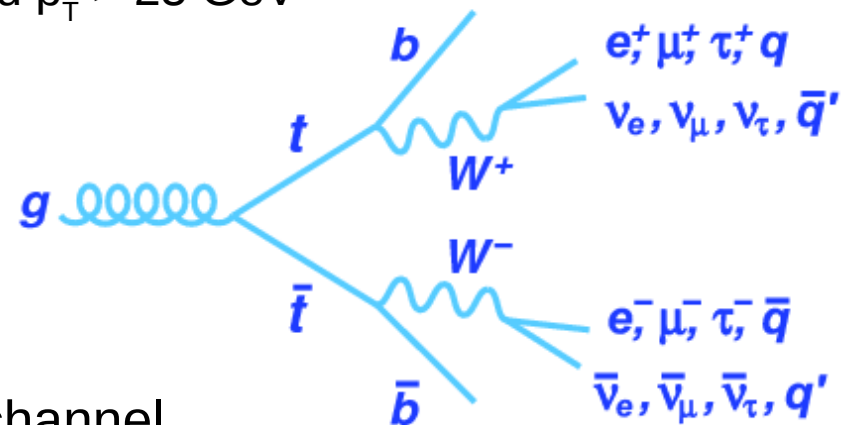


Selection

Selection:

- 1 electron & 1 muon: $p_T > 25$ GeV
- at least 1 lepton at trigger level with $p_T > 27$ GeV
- opposite sign leptons
- at least 2 b -tagged jets @77% WP MV2c10 and $p_T > 25$ GeV
- $H_{T,\text{had}} > 120$ GeV
- $M_{ll} > 15$ GeV

Nominal Powheg+Pythia8 ttbar sample
Alternative Sherpa 2.2.1/4 ttbar samples
tt+0,1j@NLO+2,3,4j@LO in the dileptonic channel



% alphas scale factor 1 for better high jet multi
CSS_IS_AS_FAC=1.0

% improve b-fragmentation (AGENE-1426)
SPLIT_LEADEXPONENT=1.0

AT 21.2.73 with a manual implementation of the JES/R calibration (same as in AT 21.2.74) with medium JVT cut

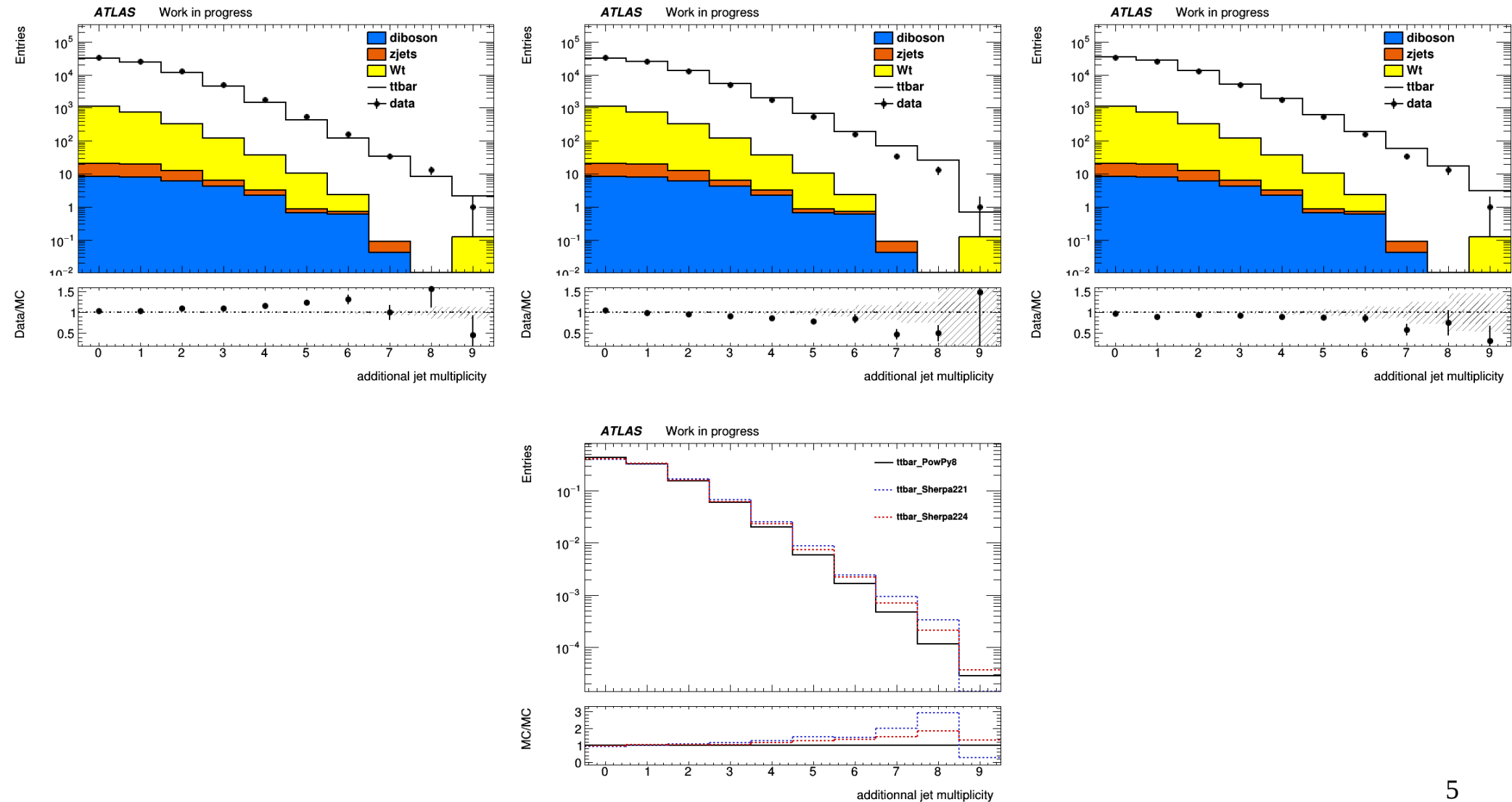
PowPy8 vs Sherpa alternative samples

Jet multiplicity

PowPy8

Sherpa 2.2.1

Sherpa 2.2.4



Bottom plot is normalized for shape comparison only

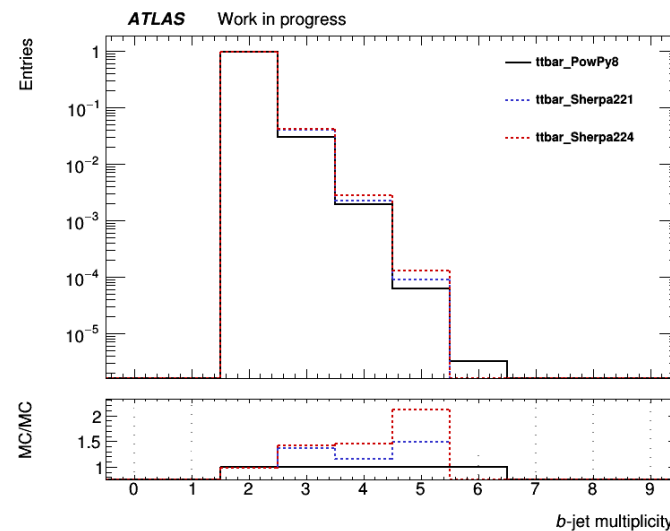
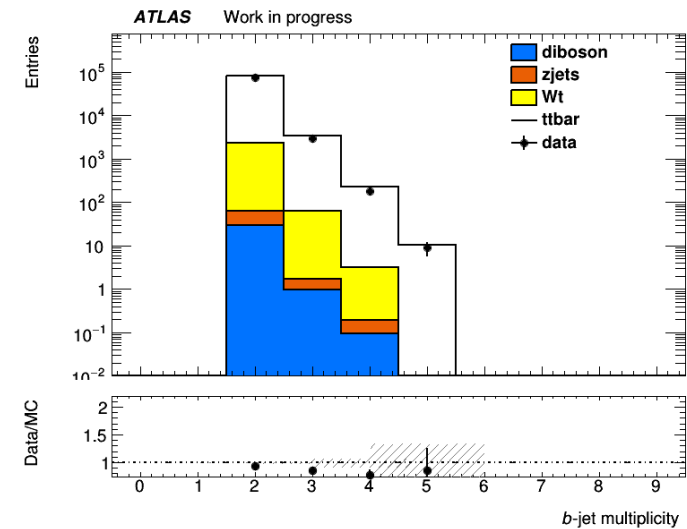
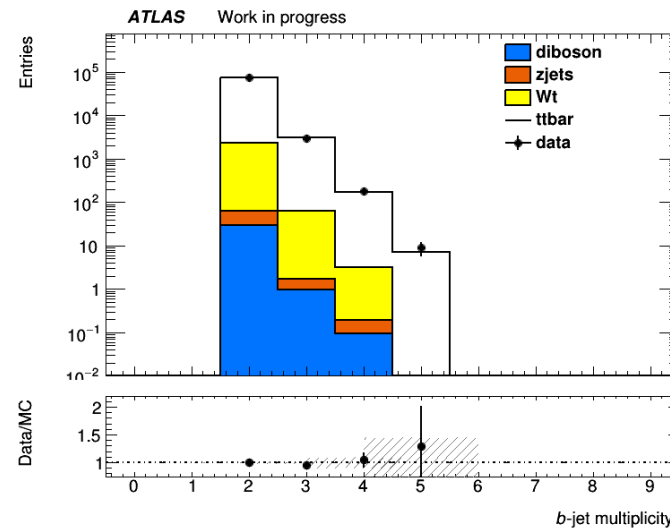
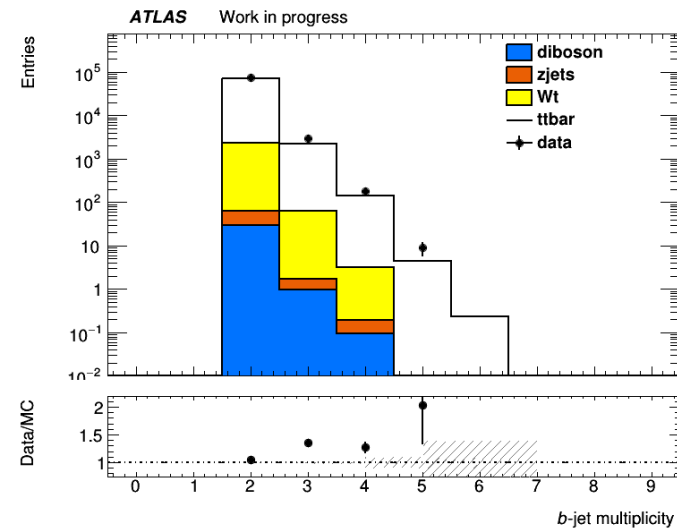
PowPy8 vs Sherpa alternative samples

b-jet multiplicity

PowPy8

Sherpa 2.2.1

Sherpa 2.2.4



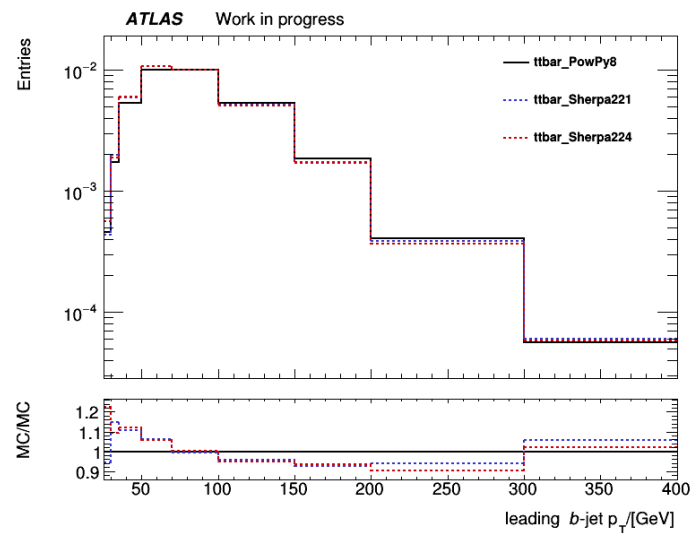
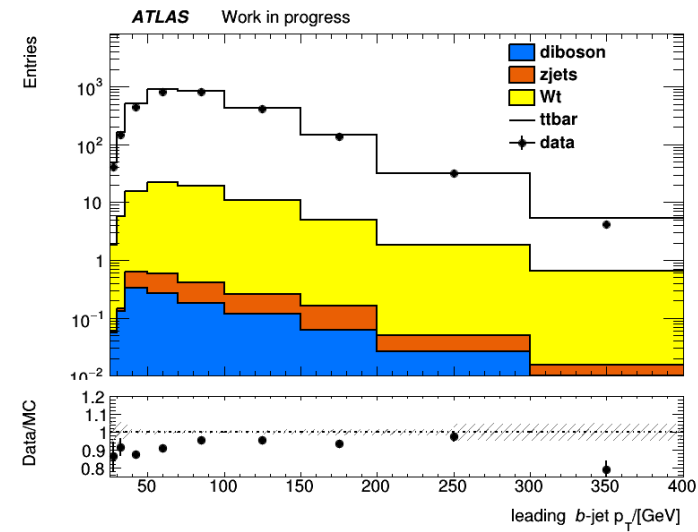
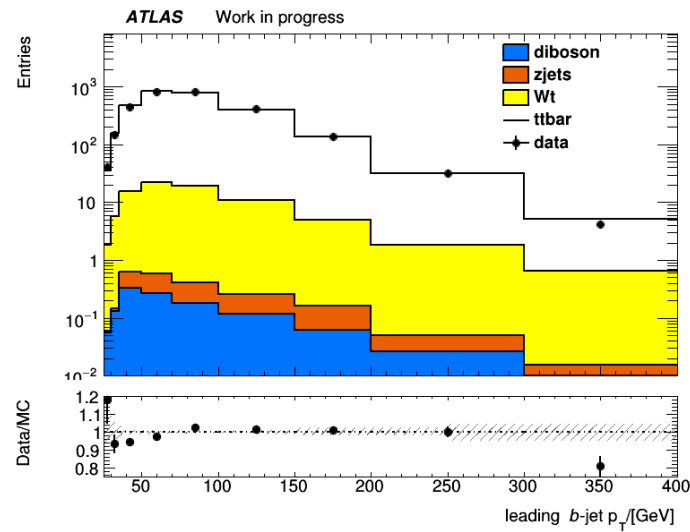
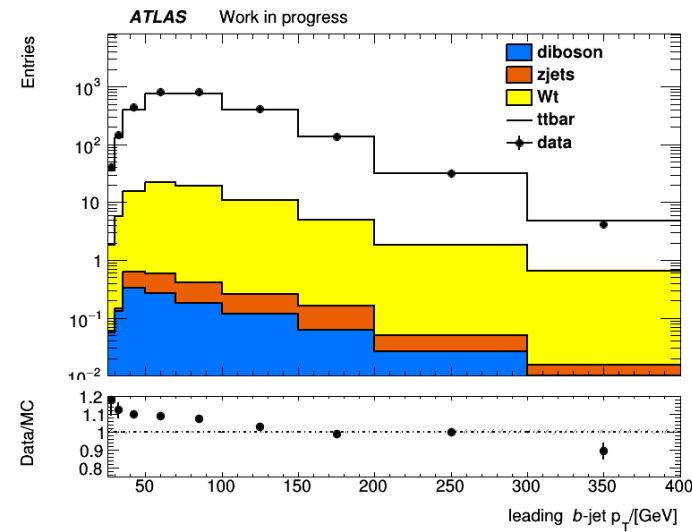
PowPy8 vs Sherpa alternative samples

Leading b -jet p_T

PowPy8

Sherpa 2.2.1

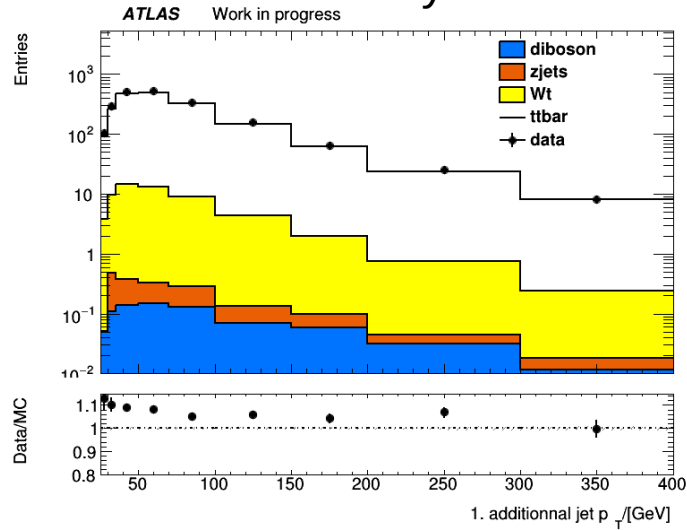
Sherpa 2.2.4



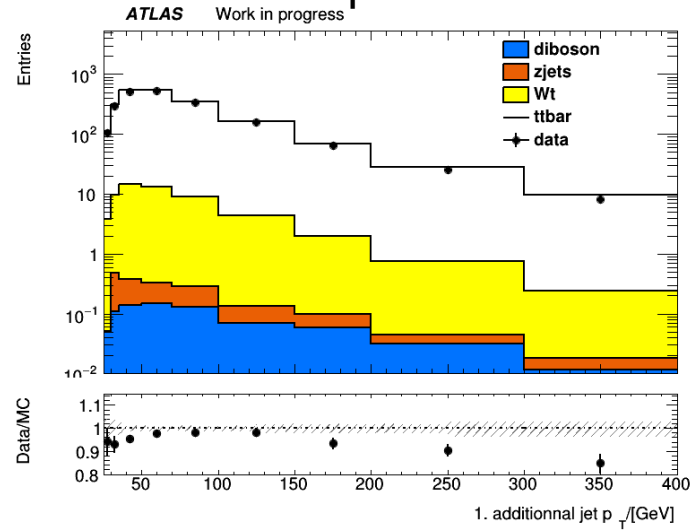
PowPy8 vs Sherpa alternative samples

1st additional b -jet p_T

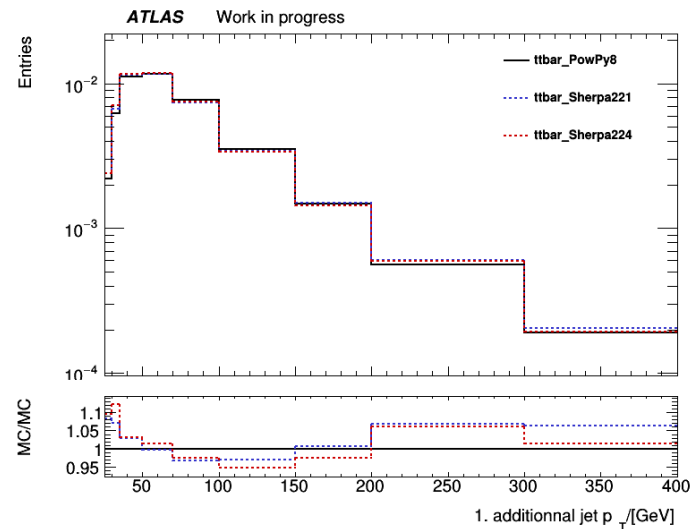
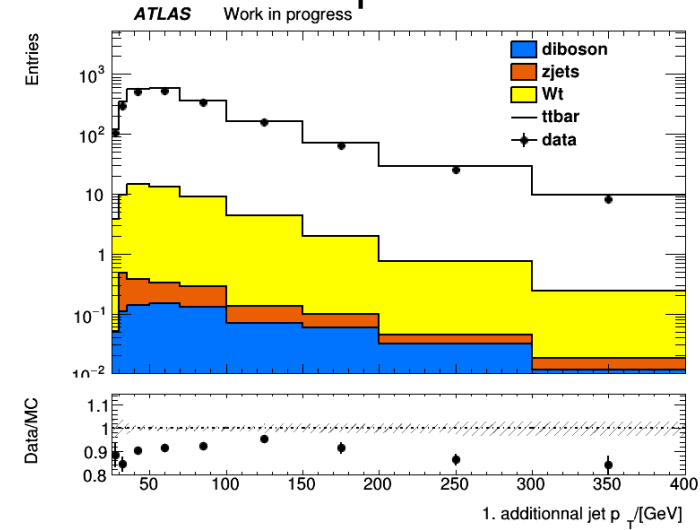
PowPy8



Sherpa 2.2.1



Sherpa 2.2.4



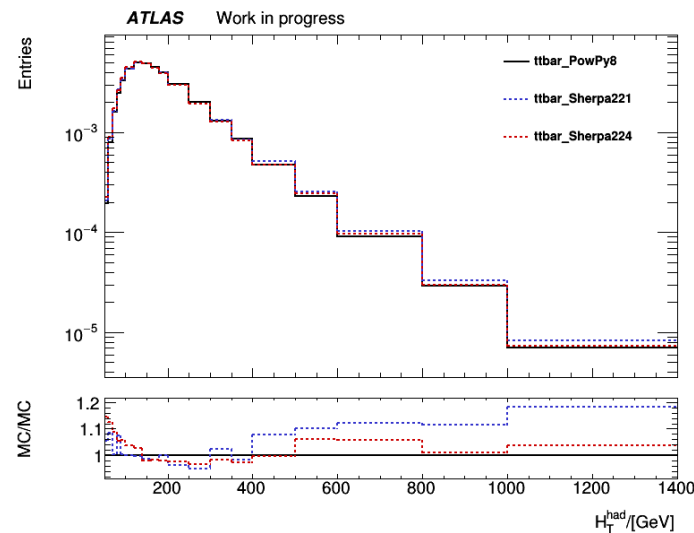
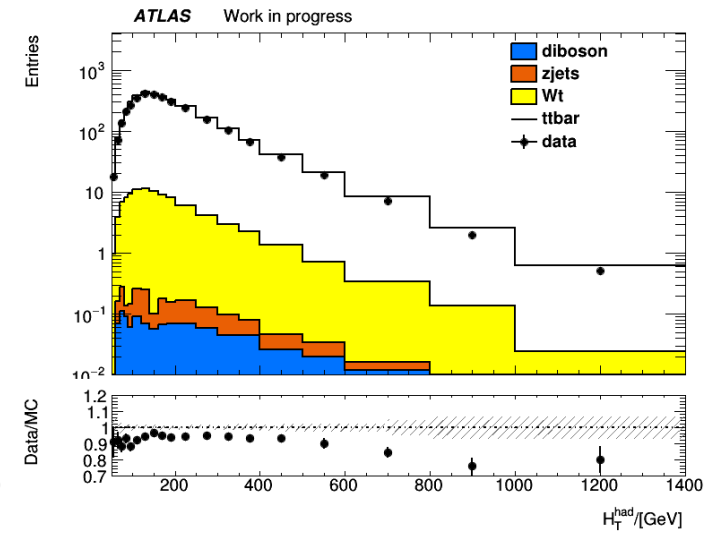
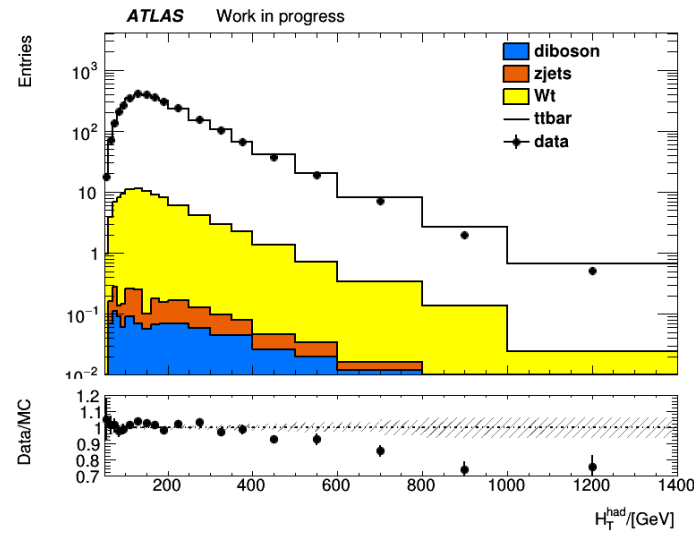
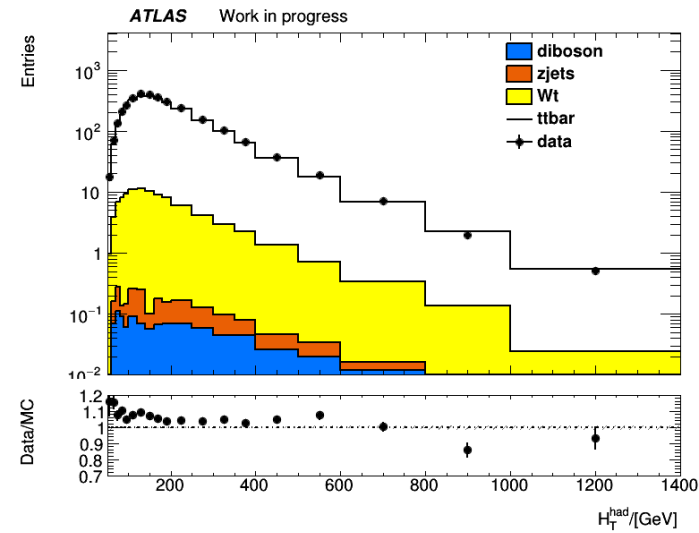
PowPy8 vs Sherpa alternative samples

$H_{T, had}$

PowPy8

Sherpa 2.2.1

Sherpa 2.2.4



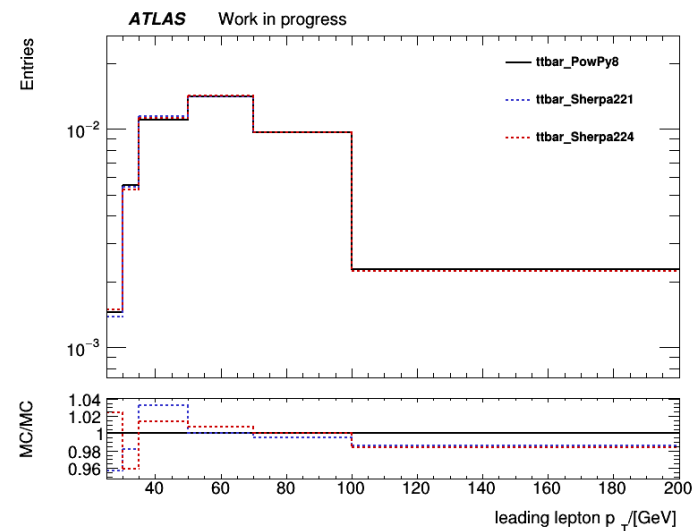
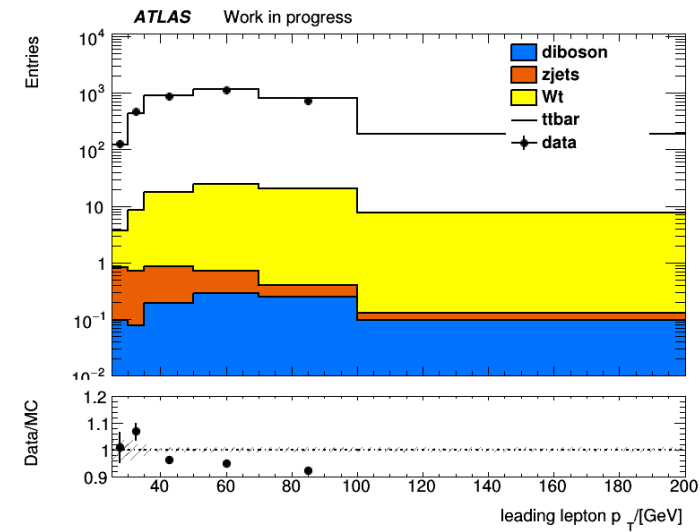
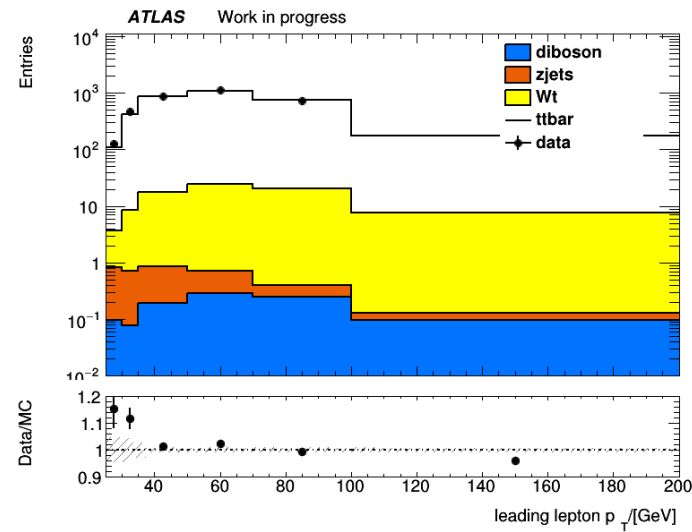
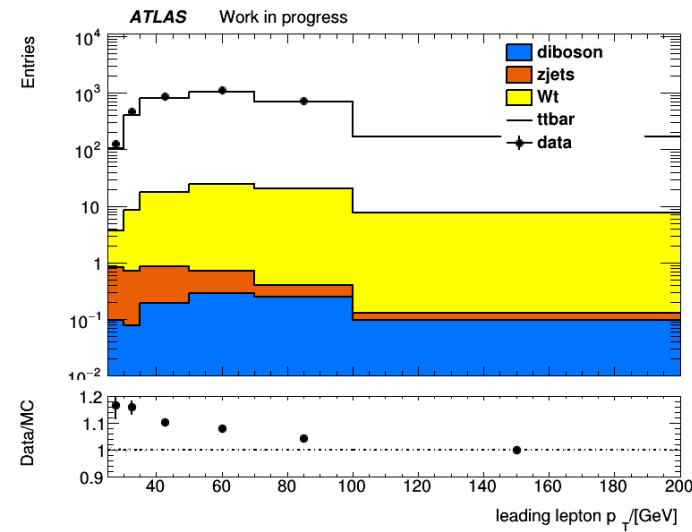
PowPy8 vs Sherpa alternative samples

Leading lepton p_T

PowPy8

Sherpa 2.2.1

Sherpa 2.2.4



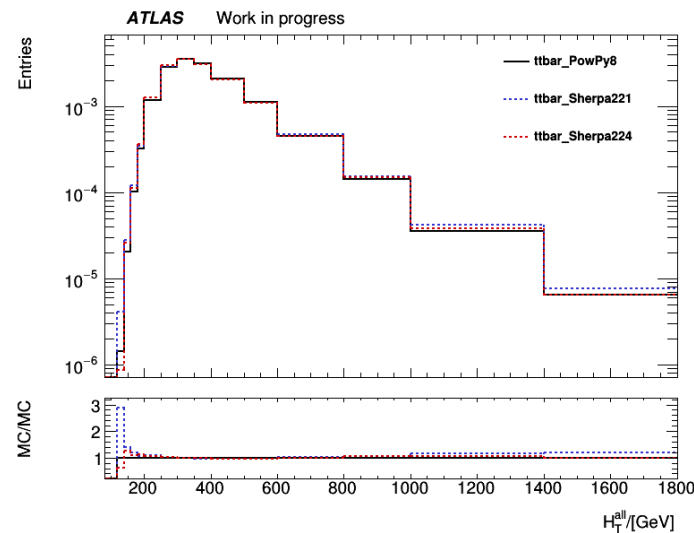
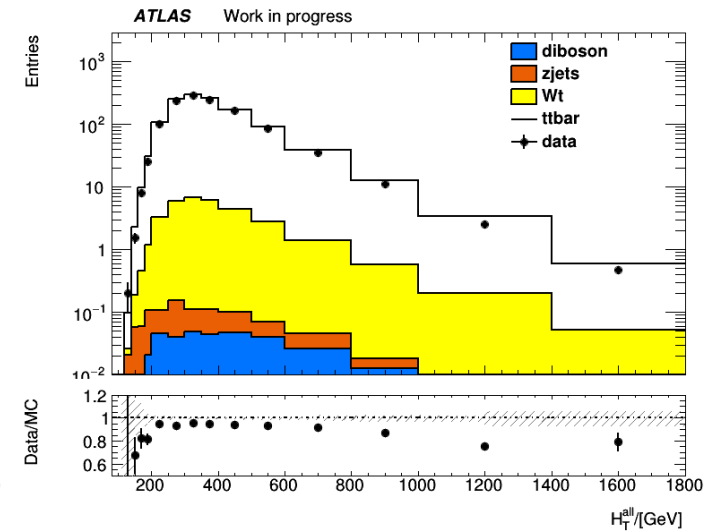
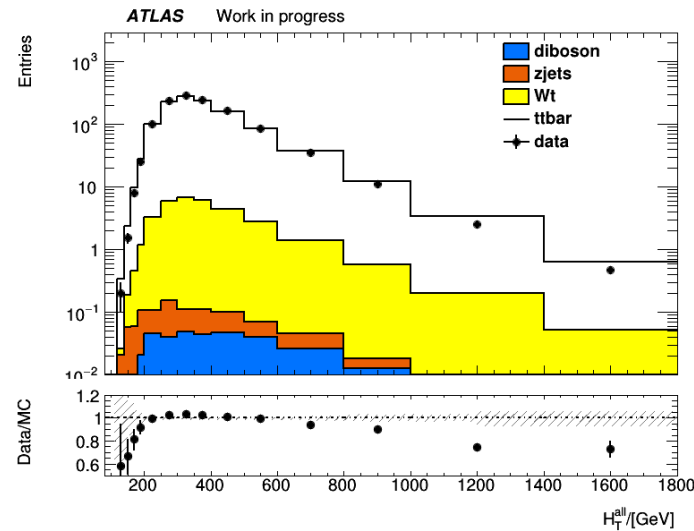
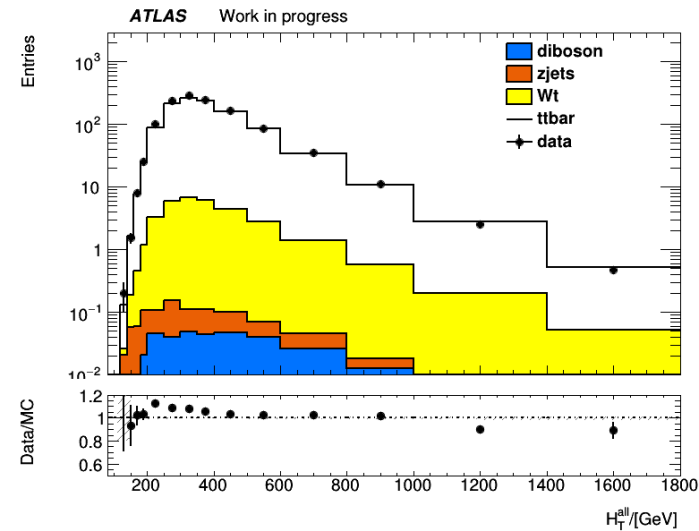
PowPy8 vs Sherpa alternative samples

$H_{T, \text{all}}$

PowPy8

Sherpa 2.2.1

Sherpa 2.2.4



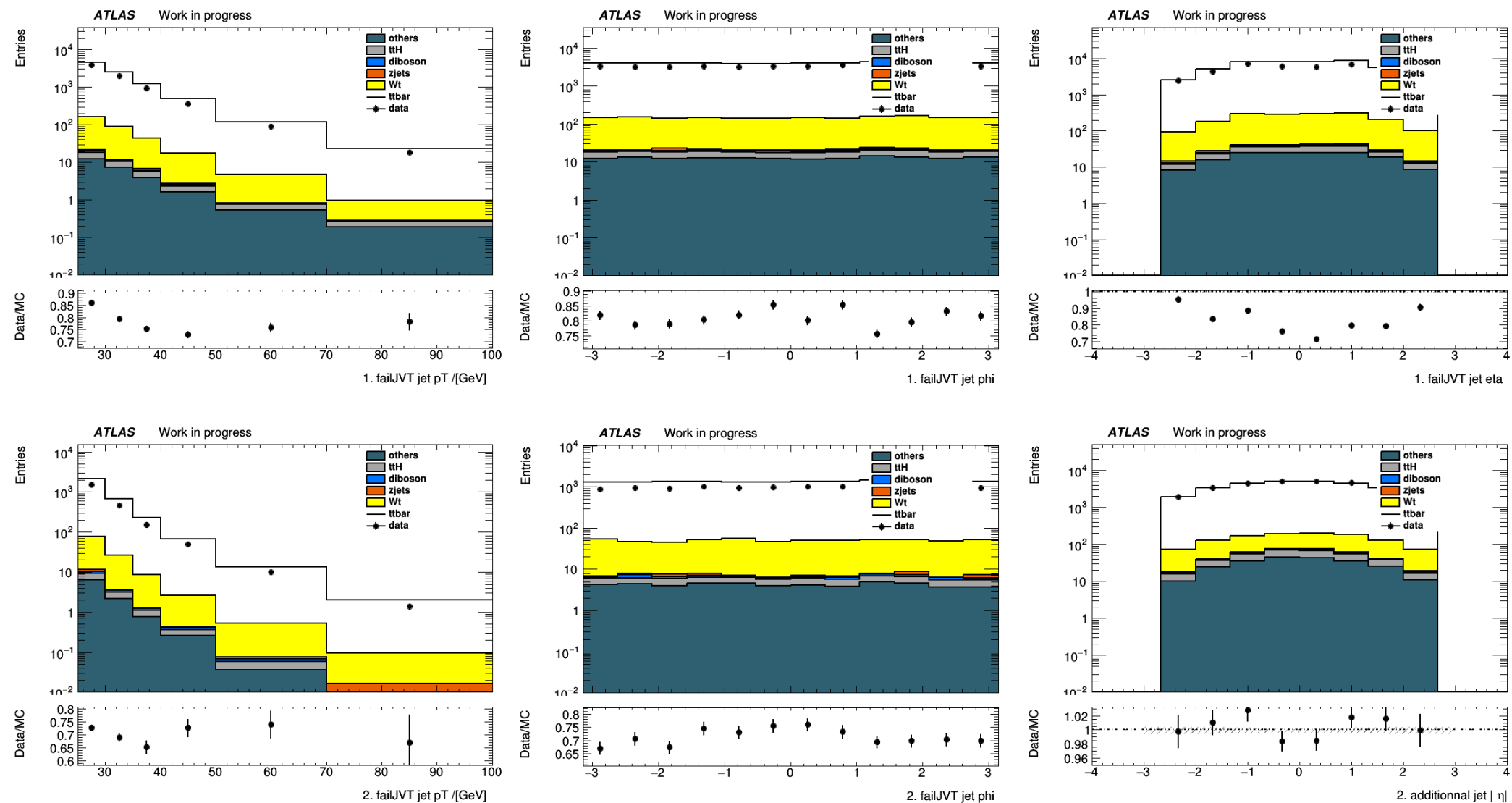
MC/MC Outcome

- Sherpa predicts less events
- Sherpa 2.2.4 shows more discrepancies with data than Sherpa 2.2.1
- normalized MC/MC comparisons
- Powheg+Pythia8 Data/MC comparisons
- Sherpa 2.2.1 Data/MC comparisons
- Sherpa 2.2.4 Data/MC comparisons

FailJVT

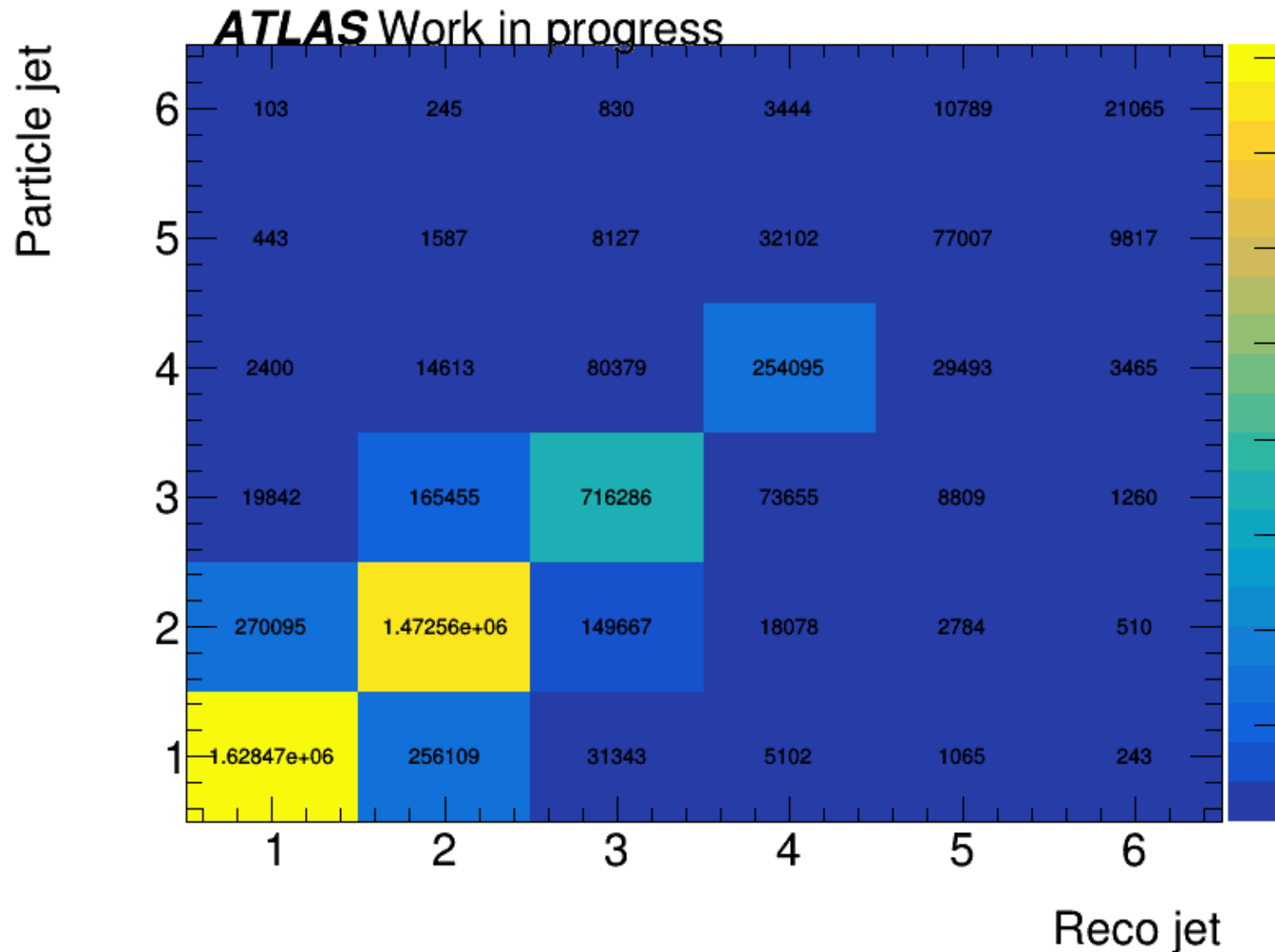
p_T spectrum

subdivide the selection in 2 parts : hard scattering and soft scattering



2D matching variables

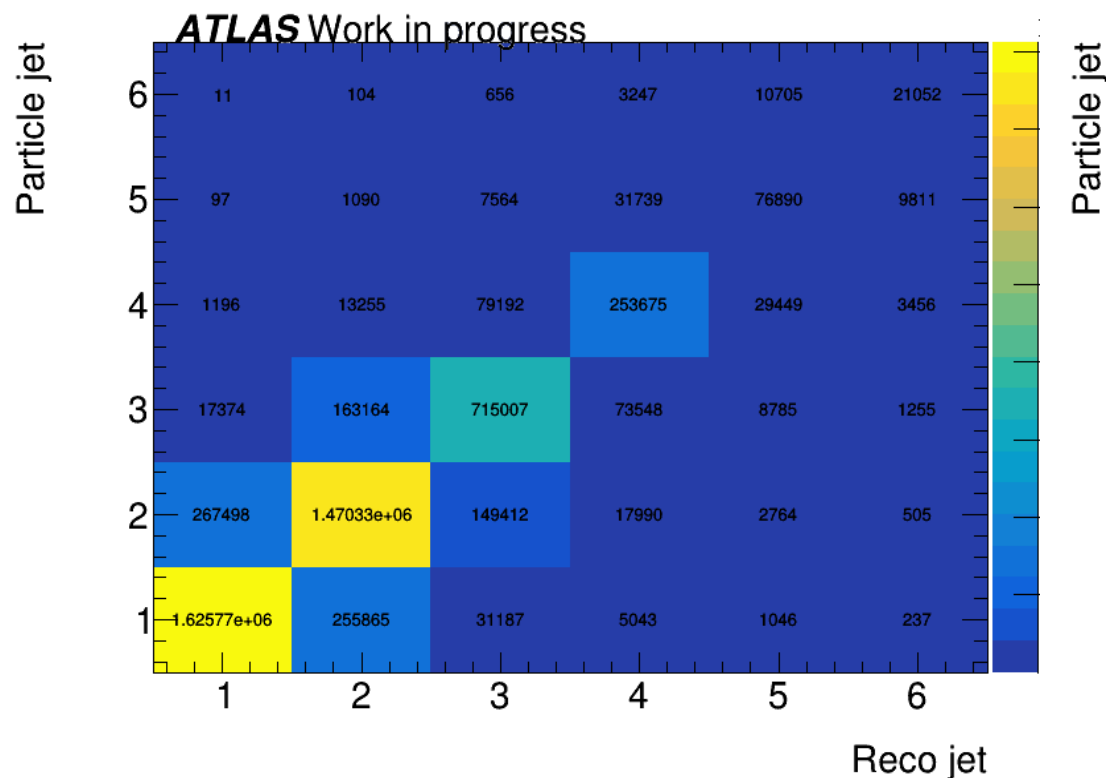
Matching matrix criteria: $\Delta R_{\text{reco,particle}} < 0.4$ (default)



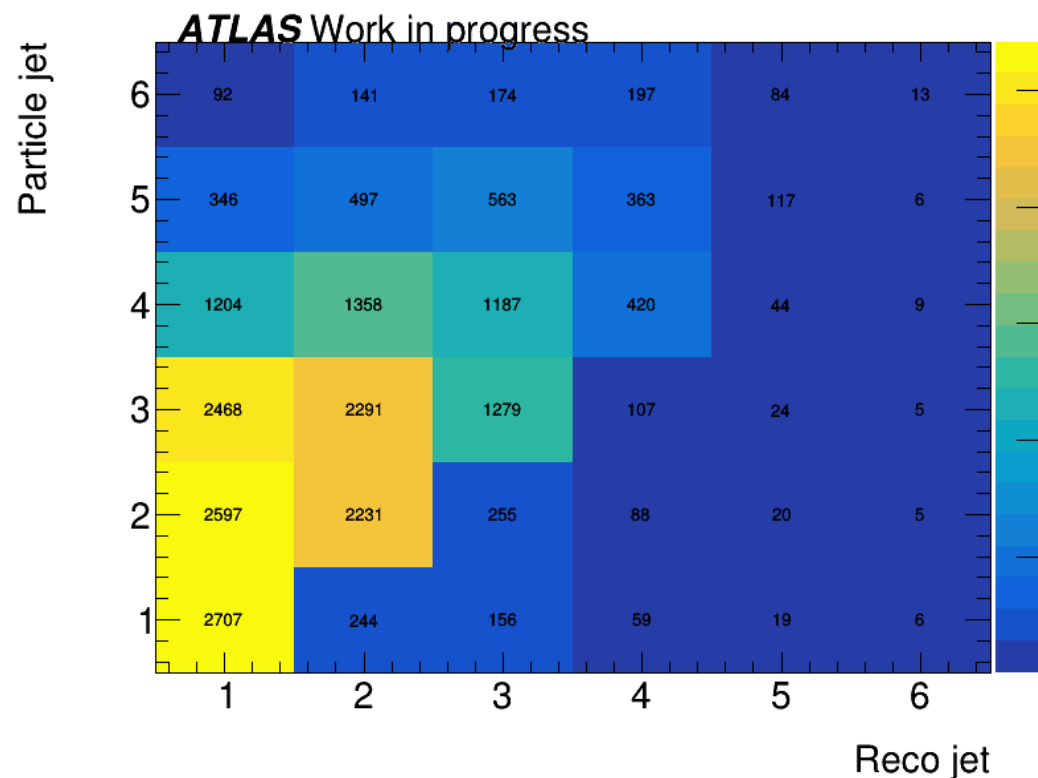
2D matching variables

Matching matrix criteria: $\Delta R_{\text{reco,particle}} < 0.4$ (default)

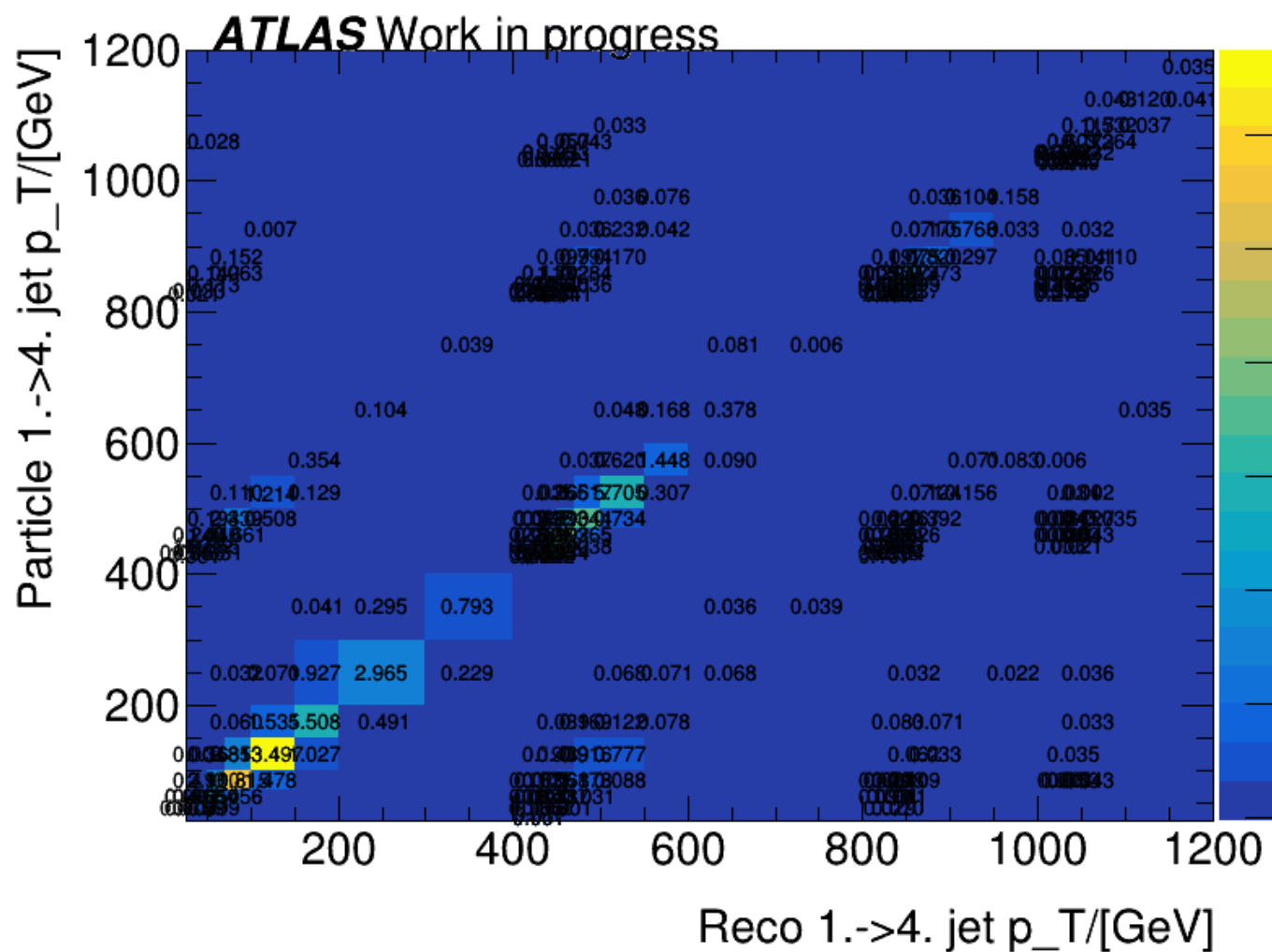
Exactly 1 matching possibility/reco-jet



More than 1 matching possibility/reco-jet

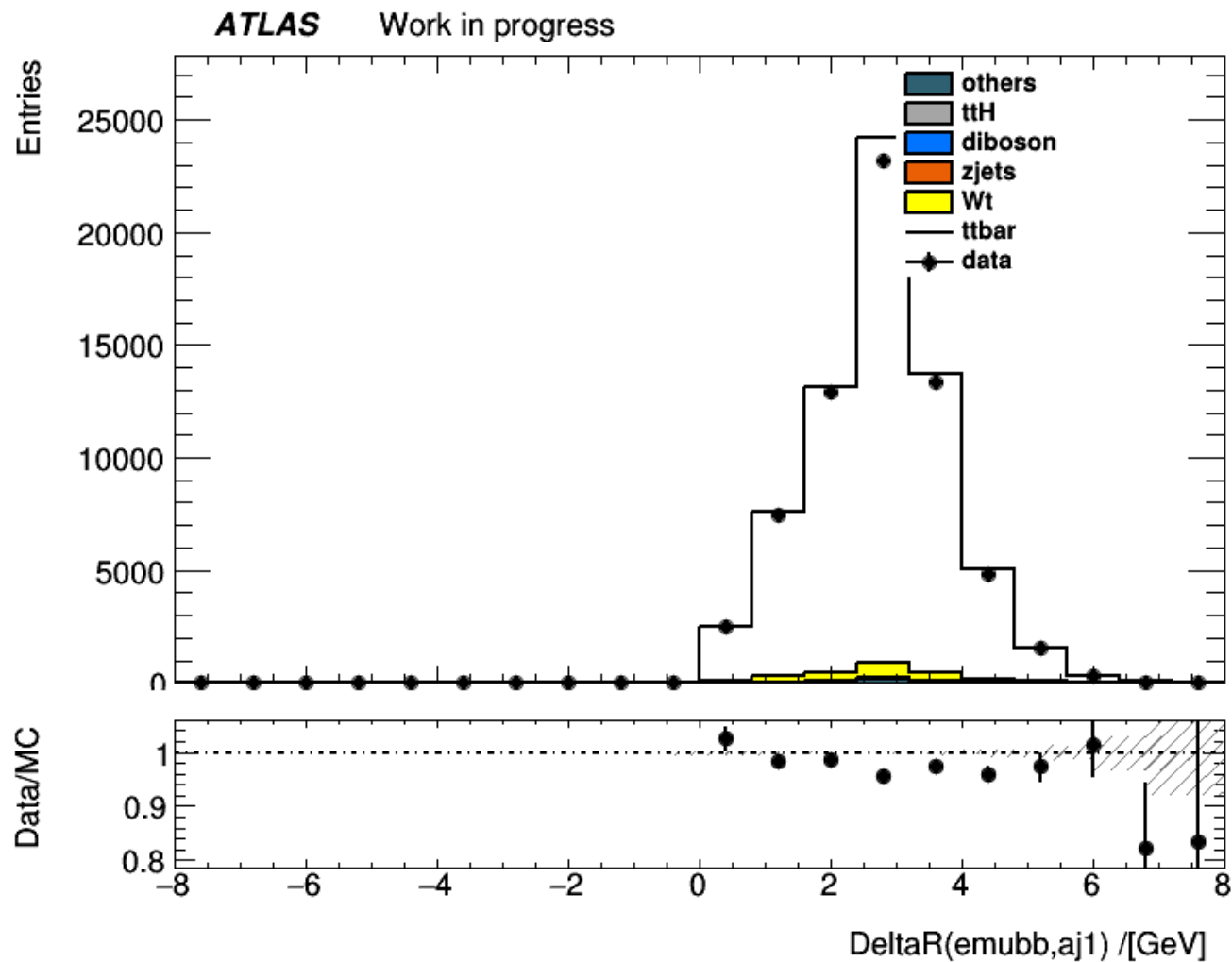


2D matching variables



Additional variables of interest

$$\Delta R_{t\bar{t},j1} \rightarrow (\Delta R_{e\mu b\bar{b},j1}, \Delta\Phi_{t\bar{t},j1})$$



Outcome

Ideas for new variables – to-do list

- (in)efficiency of the matching
- $\min\Delta R$ for each particle or reco-jet as a 1D histogram
- $\Delta\Phi(\text{ttbar}, j_1)$