My Progress

MonoHiggs to $b\bar{b}$

Prayag Yadav

Last updated: 2024-02-08 23:25:29+05:30

University of Hyderabad

Table of contents

1. Thu, 5^{th} October 2023
Basic kinematic plots (Without any scale factors or corrections)

2. Thu, 26^{th} October 2023
MET Filters / MET Flags

3. Tue, 2^{nd} January 2024
Contribution of various backgrounds:Resolved;2018

Basic kinematic plots

BTag Scores : MC

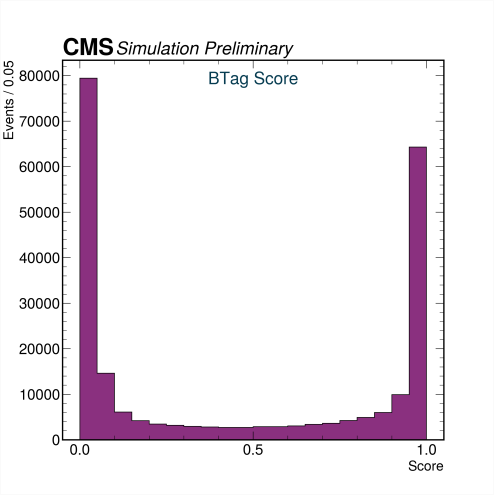


Figure 1: BTag score for signal MC sample

- Btagger used : `btagDeepFlavB`
- Sample used: `MonoHTobb_ZpBaryonic`
- Lots of bjets in Signal MC

BTag Scores : Data

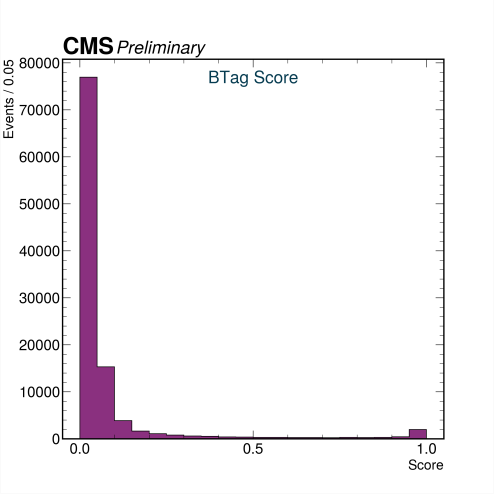


Figure 2: BTag score for Data samples

- Btagger used : `btagDeepFlavB`
- Sample used: `Run2018A/MET`
- Less number of bjets in Data

Jet p_t : MC

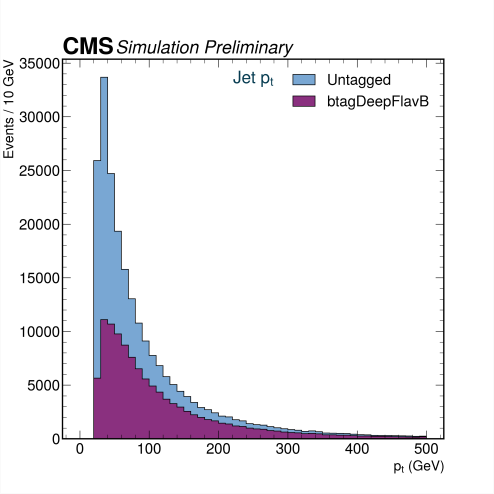


Figure 3: Jet p_t of signal MC samples

- Basic selections : $p_t > 25GeV$ and $|\eta| < 2.5$
- Btagger used : `btagDeepFlavB`
- Sample used: `MonoHTobb_ZpBaryonic`
- Medium Weight Parameter used for ak4bjets : 0.3040

Jet p_t : Data

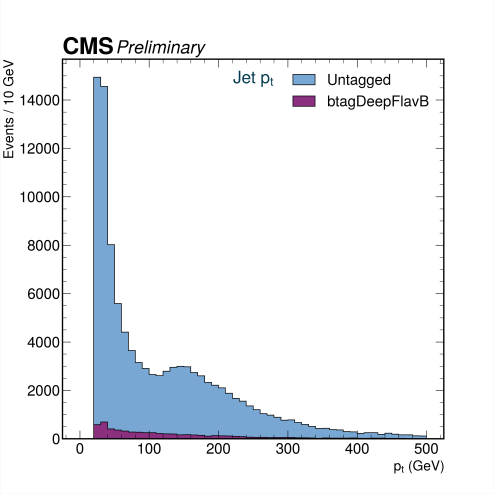


Figure 4: Jet p_t of Data samples

- Basic selections : $p_t > 25GeV$ and $|\eta| < 2.5$
- Btagger used : `btagDeepFlavB`
- Sample used: `Run2018A/MET`
- Medium Weight Parameter used for ak4bjets : 0.3040
- Not as predictable as signal MC

DiJet mass : MC

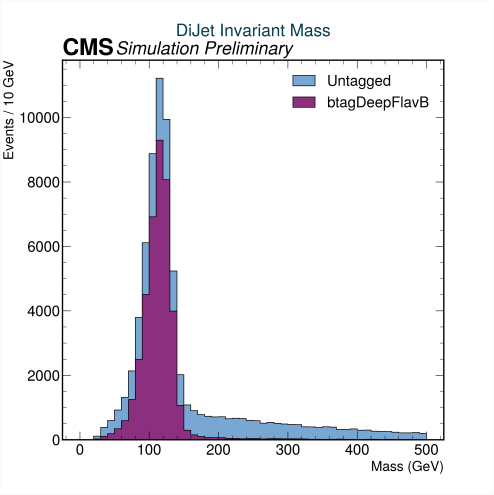


Figure 5: DiJet mass of signal MC samples

- Basic selections : $p_t > 25GeV$ and $|\eta| < 2.5$ for each jet
- Btagger used : `btagDeepFlavB`
- Sample used: `MonoHTobb_ZpBaryonic`
- Medium Weight Parameter used for ak4bjets selection : 0.3040
- Peaks around SM Higgs mass

DiJet mass : Data

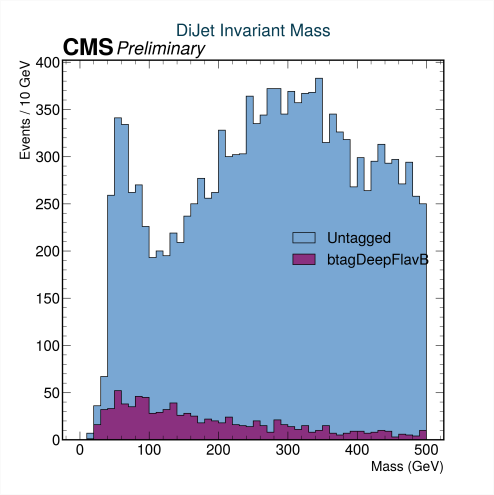


Figure 6: DiJet mass of Data samples

- Basic selections : $p_t > 25GeV$ and $|\eta| < 2.5$ for each jet
- Btagger used : `btagDeepFlavB`
- Sample used: `Run2018A/MET`
- Medium Weight Parameter used for ak4bjets selection : 0.3040
- Lot of noise, no clear structure

MET p_t : MC

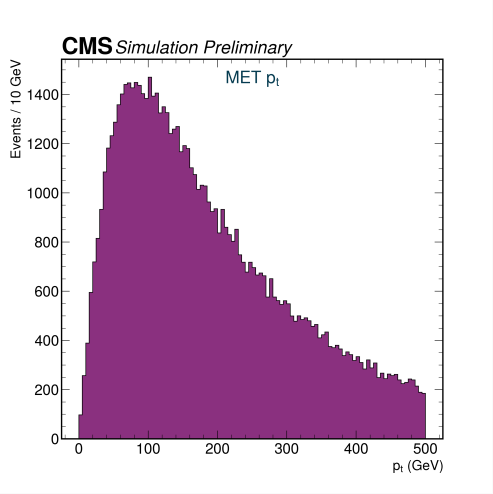
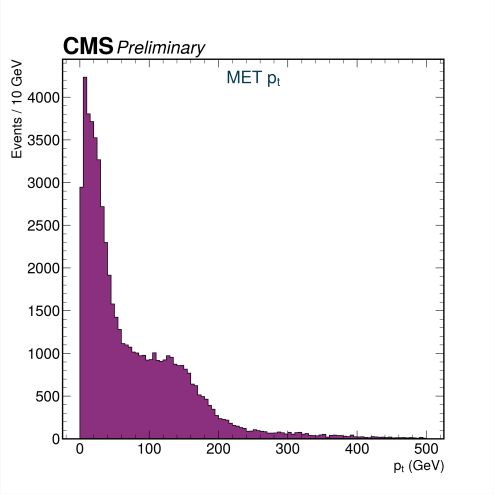


Figure 7: MET p_t for signal MC samples

- No filters or Trigger applied

MET p_t : Data



- No filters or Trigger applied
- Looks similar to the Jet data

Figure 8: MET p_t for Data samples

MET Filters

MET p_t : MET2018A

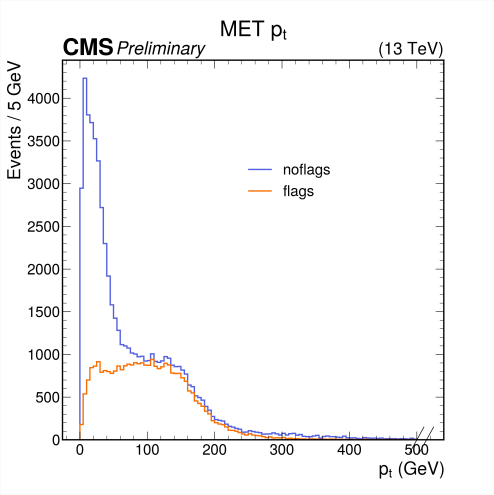


Figure 9: MET p_t for MET2018A

- Compared how the MET pt looks with and without MET triggers on Data
- .

MET ϕ : MET2018A

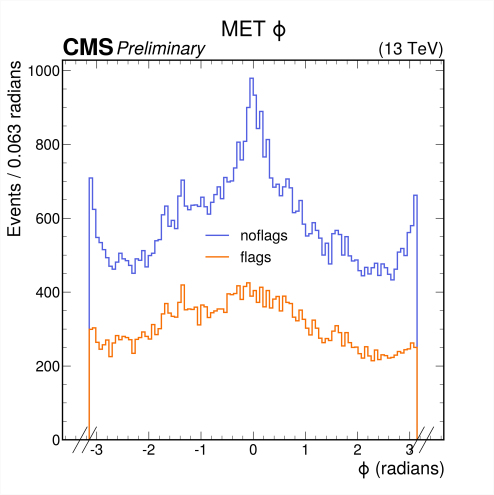


Figure 10: MET ϕ for MET2018A

- Compared how the MET ϕ looks with and without MET triggers
- .jf

MET p_t : MonoHtobb_ZpBaryonic

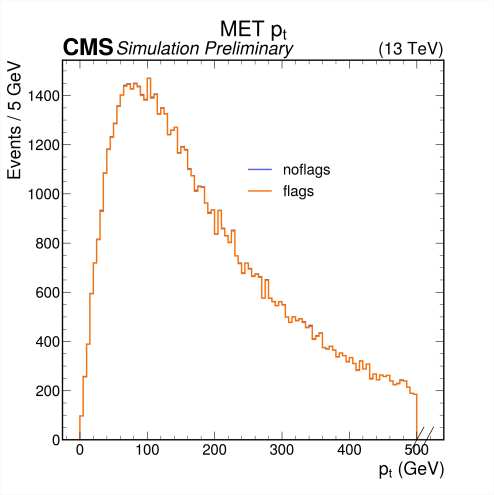


Figure 11: MET p_t for MonoHtobb_ZpBaryonic

- Compared how the MET p_t looks with and without MET triggers on Signal MC
- .jf

MET ϕ : MonoHTobb_ZpBaryonic

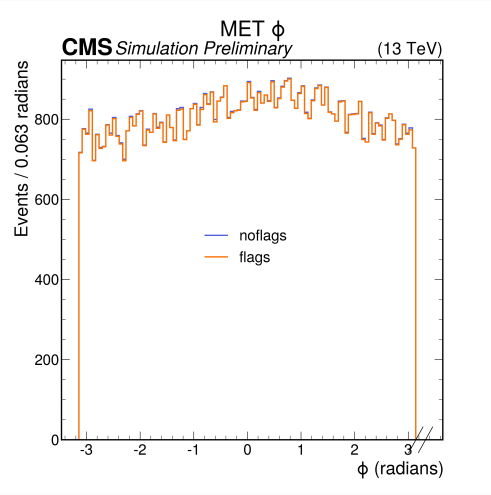


Figure 12: MET ϕ for MC

- Compared how the MET ϕ looks with and without MET triggers on Signal MC
- .

Contribution of various backgrounds:Resolved;2018

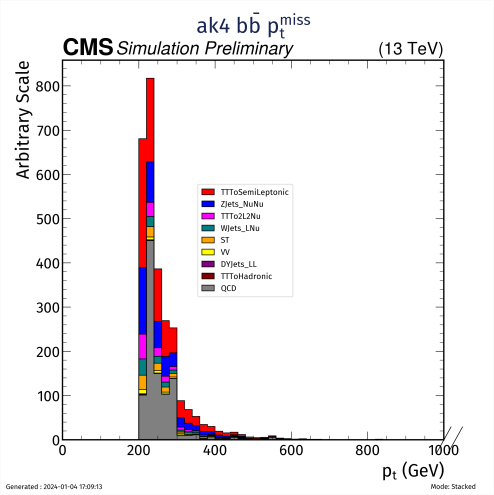


Figure 13: Simulated contribution of various backgrounds to the signal in the resolved b$\bar{b}$ bar case for 2018

Selections Applied:

Event Selections:

- MET > 200 GeV
- no leptons
- no photons

Object Selections:

- jet $p_t > 30$ GeV
- jet $|\eta| < 2.5$
- $\Delta\phi(Jet, MET)$
- at least 2 tight bjets (algorithm:DeepFlavB)
- leading bjet $p_t > 50$ GeV
- subleading bjet $p_t > 30$ GeV
- atmost 2 additional jets

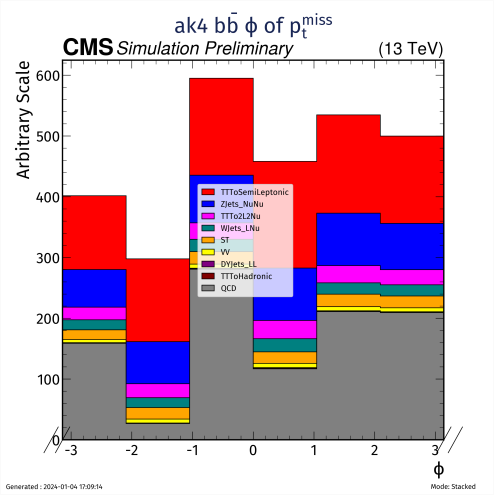


Figure 14: Simulated contribution of various backgrounds to the signal in the resolved b$\bar{b}$ bar case for 2018

Selections Applied:

Event Selections:

- MET > 200 GeV
- no leptons
- no photons

Object Selections:

- jet $p_t > 30$ GeV
- jet $|\eta| < 2.5$
- $\Delta\phi(Jet,\ MET)$
- at least 2 tight bjets (algorithm:DeepFlavB)
- leading bjet $p_t > 50$ GeV
- subleading bjet $p_t > 30$ GeV
- atmost 2 additional jets

ak4 dibjet Mass

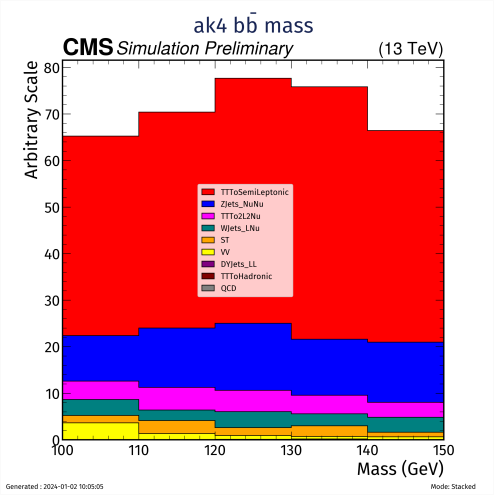


Figure 15: Simulated contribution of various backgrounds to the signal in the resolved b$\bar{b}$ bar case for 2018

Selections Applied:

Event Selections:

- MET > 200 GeV
- no leptons
- no photons

Object Selections:

- jet $p_t > 30$ GeV
- jet $|\eta| < 2.5$
- $\Delta\phi(Jet,\ MET)$
- at least 2 tight bjets (algorithm:DeepFlavB)
- leading bjet $p_t > 50$ GeV
- subleading bjet $p_t > 30$ GeV
- atmost 2 additional jets
- dijet = leading bjet + subleading bjet
- dijet mass between (100 GeV,150 GeV)
- dijet $p_t > 100$ GeV

ak4 dibjet p_t

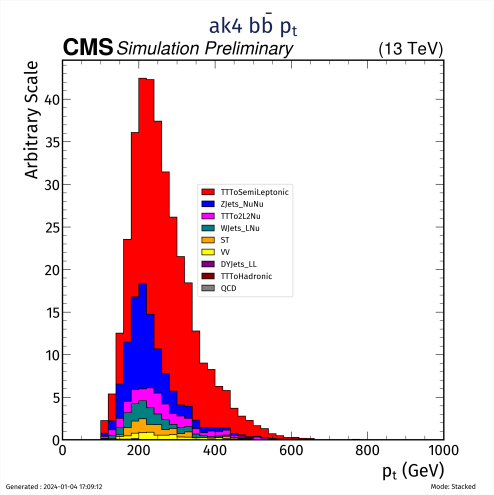


Figure 16: Simulated contribution of various backgrounds to the signal in the resolved b$\bar{b}$ bar case for 2018

Selections Applied:

Event Selections:

- MET > 200 GeV
- no leptons
- no photons

Object Selections:

- jet $p_t > 30$ GeV
- jet $|\eta| < 2.5$
- $\Delta\phi(Jet,\ MET)$
- at least 2 tight bjets (algorithm:DeepFlavB)
- leading bjet $p_t > 50$ GeV
- subleading bjet $p_t > 30$ GeV
- atmost 2 additional jets
- dijet = leading bjet + subleading bjet
- dijet mass between (100 GeV,150 GeV)
- dijet $p_t > 100$ GeV

ak4 dibjet η

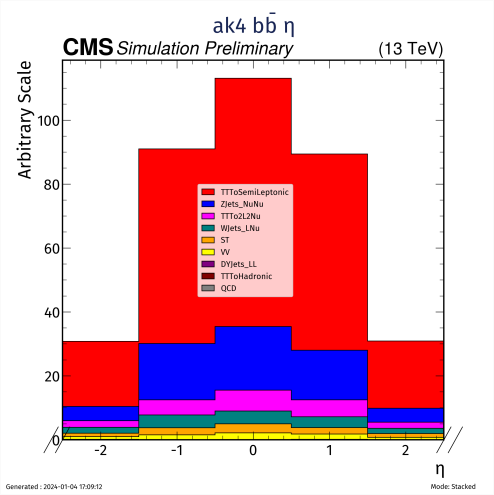


Figure 17: Simulated contribution of various backgrounds to the signal in the resolved b$\bar{b}$ bar case for 2018

Selections Applied:

Event Selections:

- MET > 200 GeV
- no leptons
- no photons

Object Selections:

- jet $p_t > 30$ GeV
- jet $|\eta| < 2.5$
- $\Delta\phi(Jet,\ MET)$
- at least 2 tight bjets (algorithm:DeepFlavB)
- leading bjet $p_t > 50$ GeV
- subleading bjet $p_t > 30$ GeV
- atmost 2 additional jets
- dijet = leading bjet + subleading bjet
- dijet mass between (100 GeV,150 GeV)
- dijet $p_t > 100$ GeV

ak4 dibjet ϕ

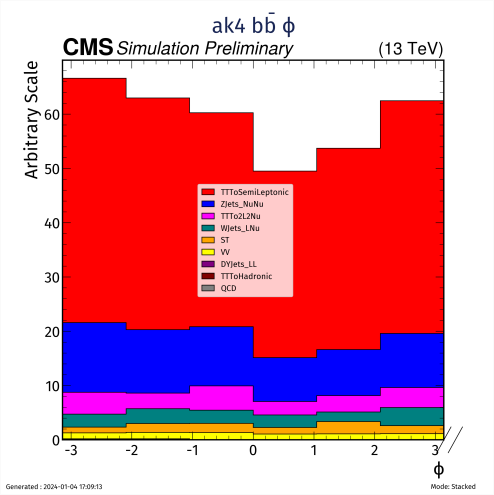


Figure 18: Simulated contribution of various backgrounds to the signal in the resolved b$\bar{b}$ bar case for 2018

Selections Applied:

Event Selections:

- MET > 200 GeV
- no leptons
- no photons

Object Selections:

- jet $p_t > 30$ GeV
- jet $|\eta| < 2.5$
- $\Delta\phi(Jet,\ MET)$
- at least 2 tight bjets (algorithm:DeepFlavB)
- leading bjet $p_t > 50$ GeV
- subleading bjet $p_t > 30$ GeV
- atmost 2 additional jets
- dijet = leading bjet + subleading bjet
- dijet mass between (100 GeV,150 GeV)
- dijet $p_t > 100$ GeV

References i

Mono-Higgs to bb

8th February 2024

Top Muon Control Region

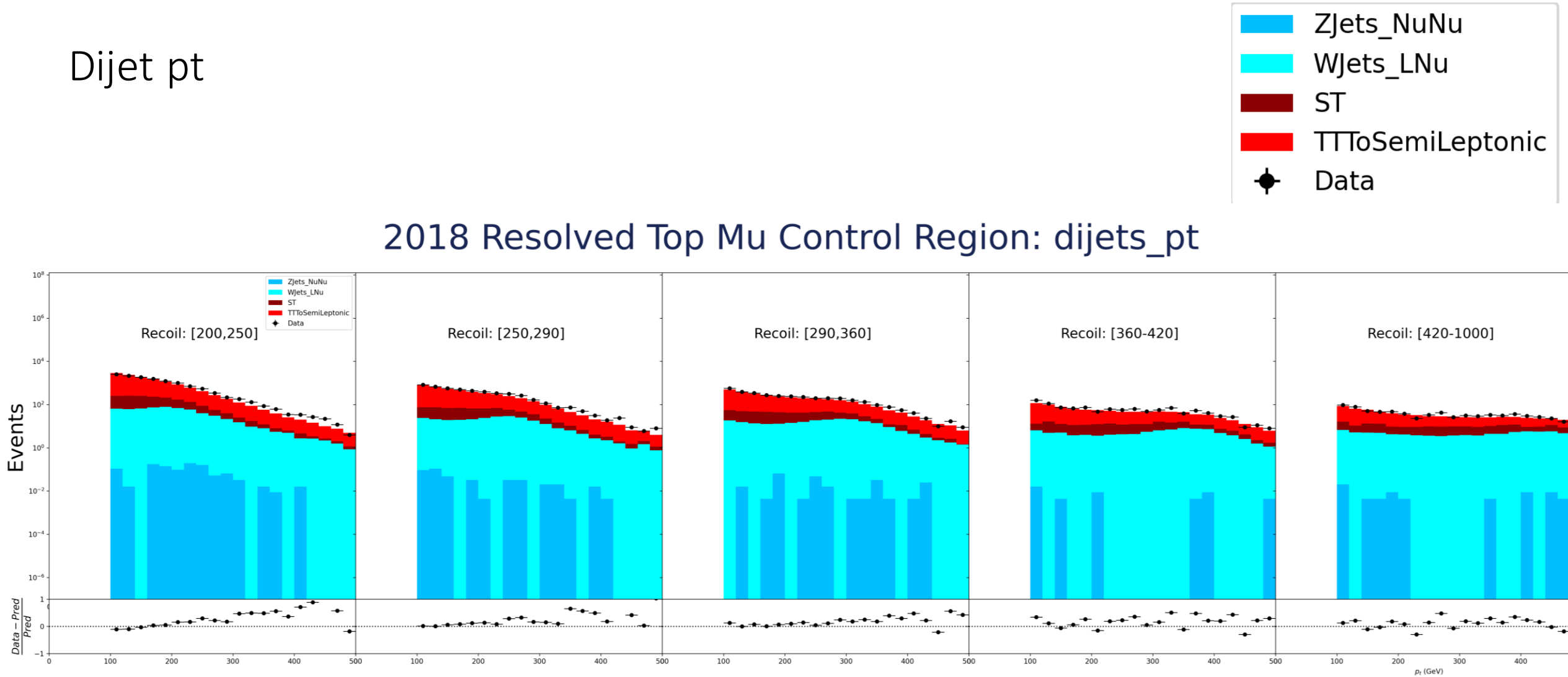
Resolved Category

2018 data

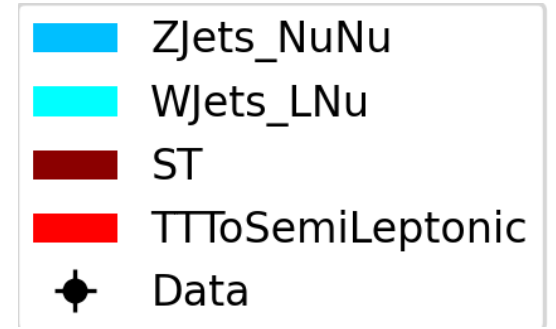
For different recoil ranges

- Working on estimation of Top Muon Control Region(Single muon CR)
- Goal was to estimate one of the CRs already done by Shivani
- No corrections except HEM veto applied at this stage
- Many bugs fixed in the codes:
  - HEM veto implementation was wrong(fixed with the help of Shivani)
  - Wrong implementation of Recoil (used a minus instead of plus and did not add as a vector)
  - Incorrect variables used for veto objects(e, gamma, tau) were there
  - Other minor bugs which did not affect the final results much

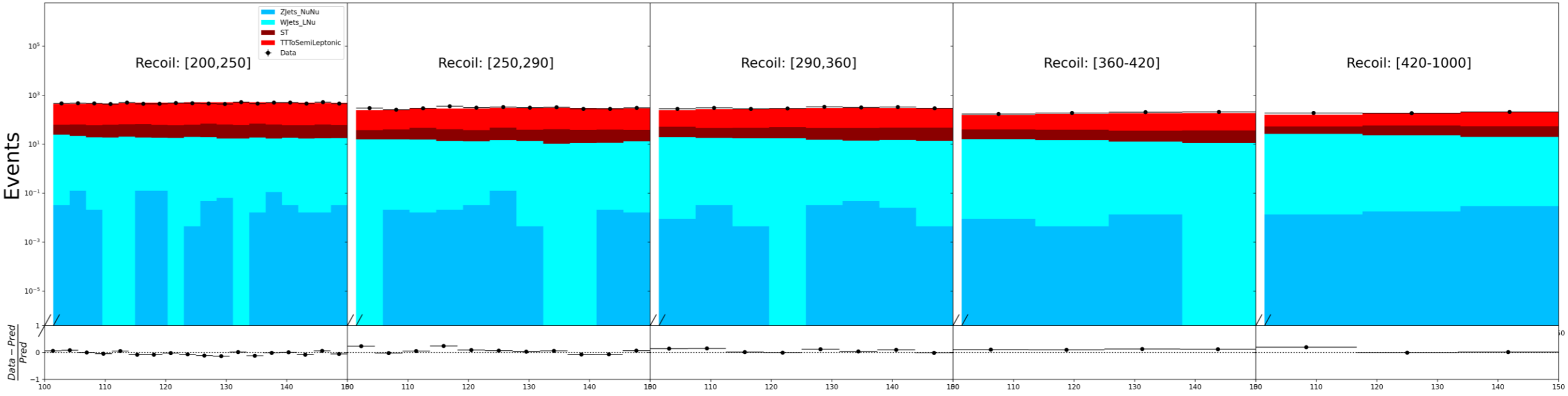
Dijet pt


ZJets_NuNu
WJets_LNu
ST
TTToSemiLeptonic
Data
2018 Resolved Top Mu Control Region: dijets_pt
Recoil: [200,250]
Recoil: [250,290]
Recoil: [290,360]
Recoil: [360-420]
Recoil: [420-1000]
Events
Data − Pred / Pred
p_t (GeV)

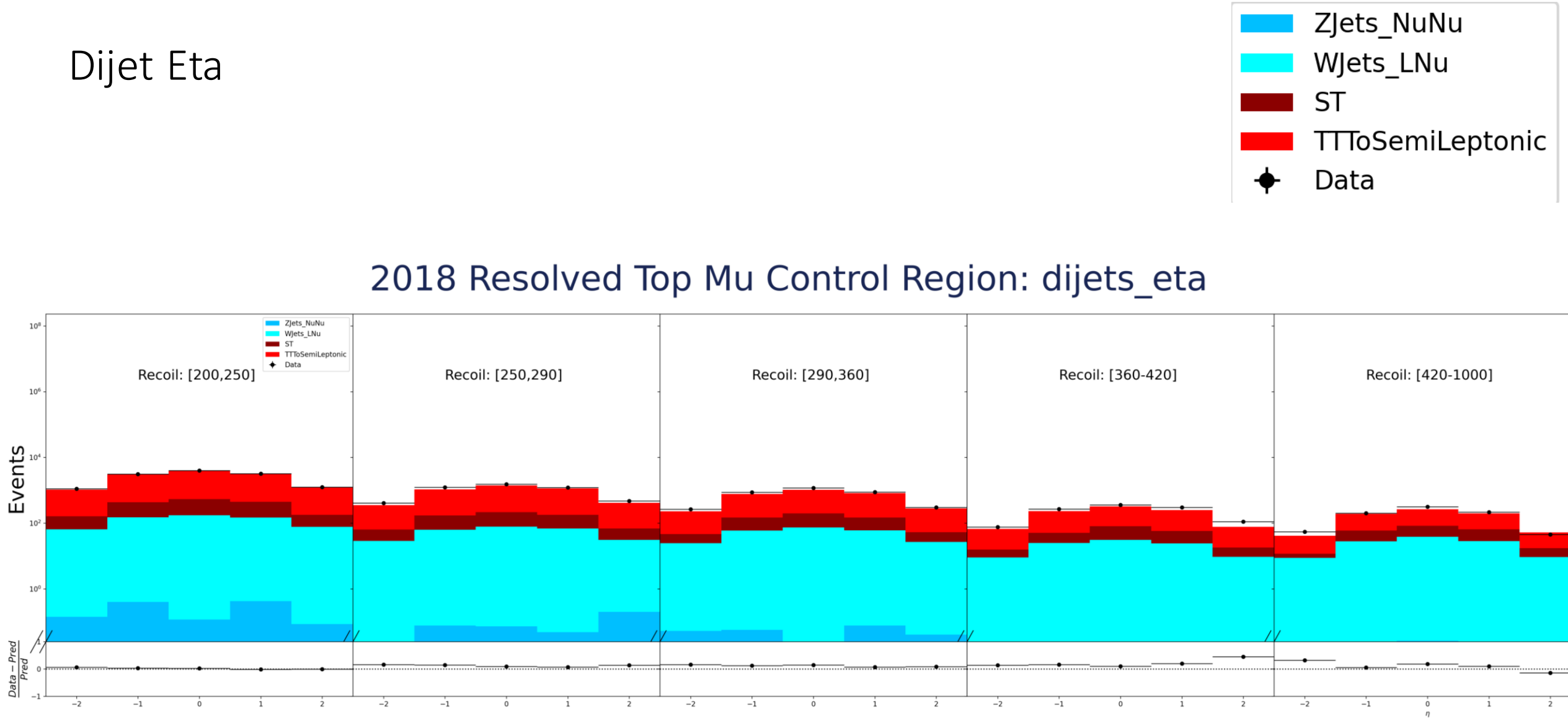
Dijet Mass



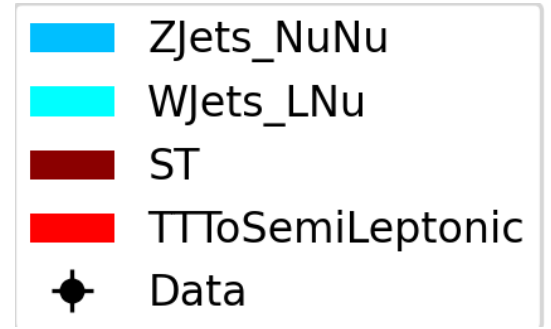
2018 Resolved Top Mu Control Region: dijets_mass

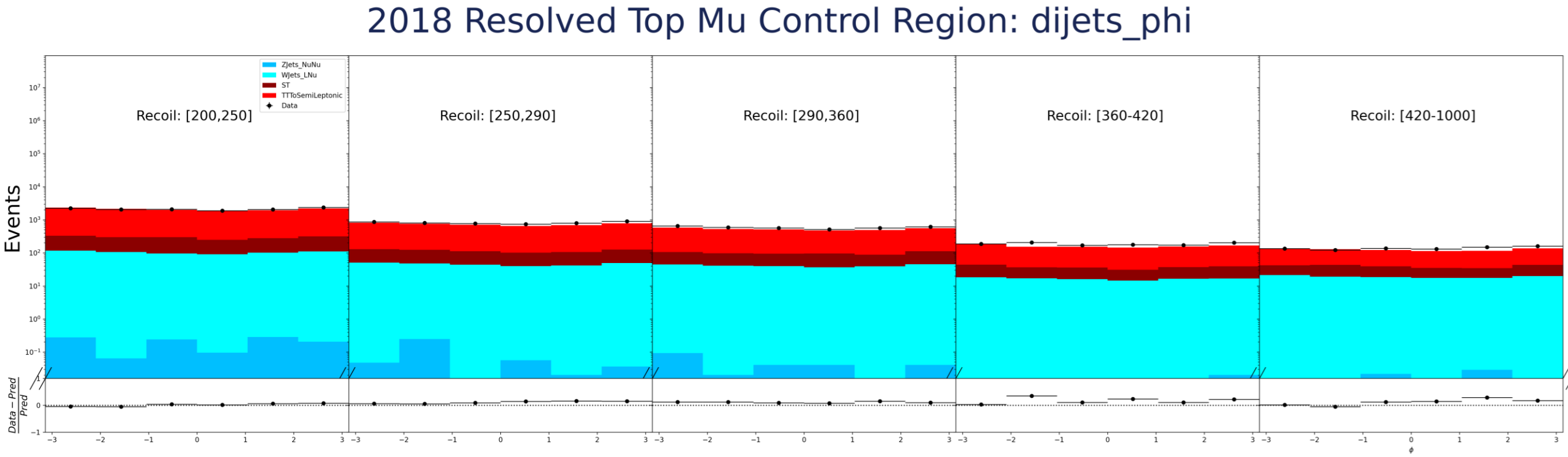


Dijet Eta


ZJets_NuNu
WJets_LNu
ST
TTToSemiLeptonic
Data
2018 Resolved Top Mu Control Region: dijets_eta
Recoil: [200,250]
Recoil: [250,290]
Recoil: [290,360]
Recoil: [360-420]
Recoil: [420-1000]
Events
Data − Pred / Pred
η

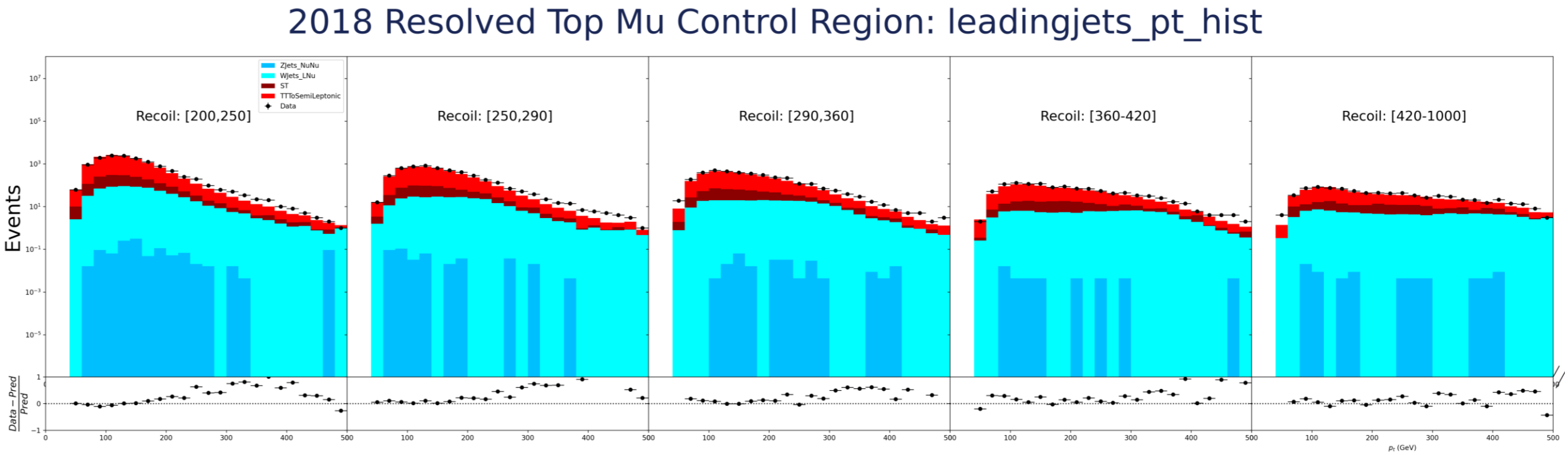
Dijet phi


ZJets_NuNu
WJets_LNu
ST
TTToSemiLeptonic
Data

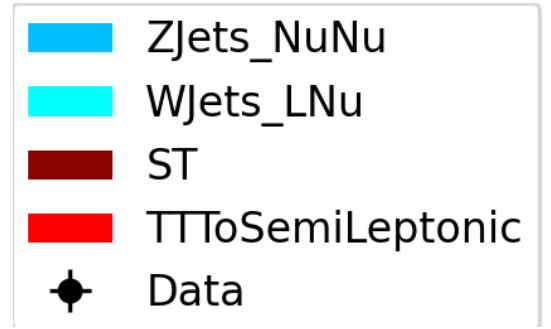

2018 Resolved Top Mu Control Region: dijets_phi
Recoil: [200,250]
Recoil: [250,290]
Recoil: [290,360]
Recoil: [360-420]
Recoil: [420-1000]
Events
Data − Pred / Pred
ϕ

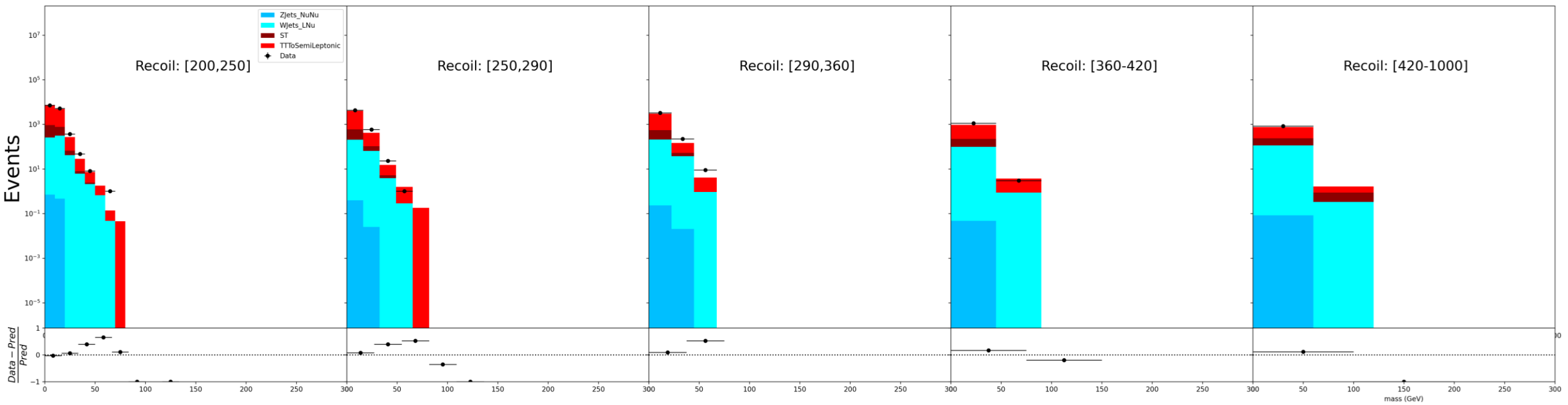
Leading Jet pt

ZJets_NuNu
WJets_LNu
ST
TTToSemiLeptonic
Data

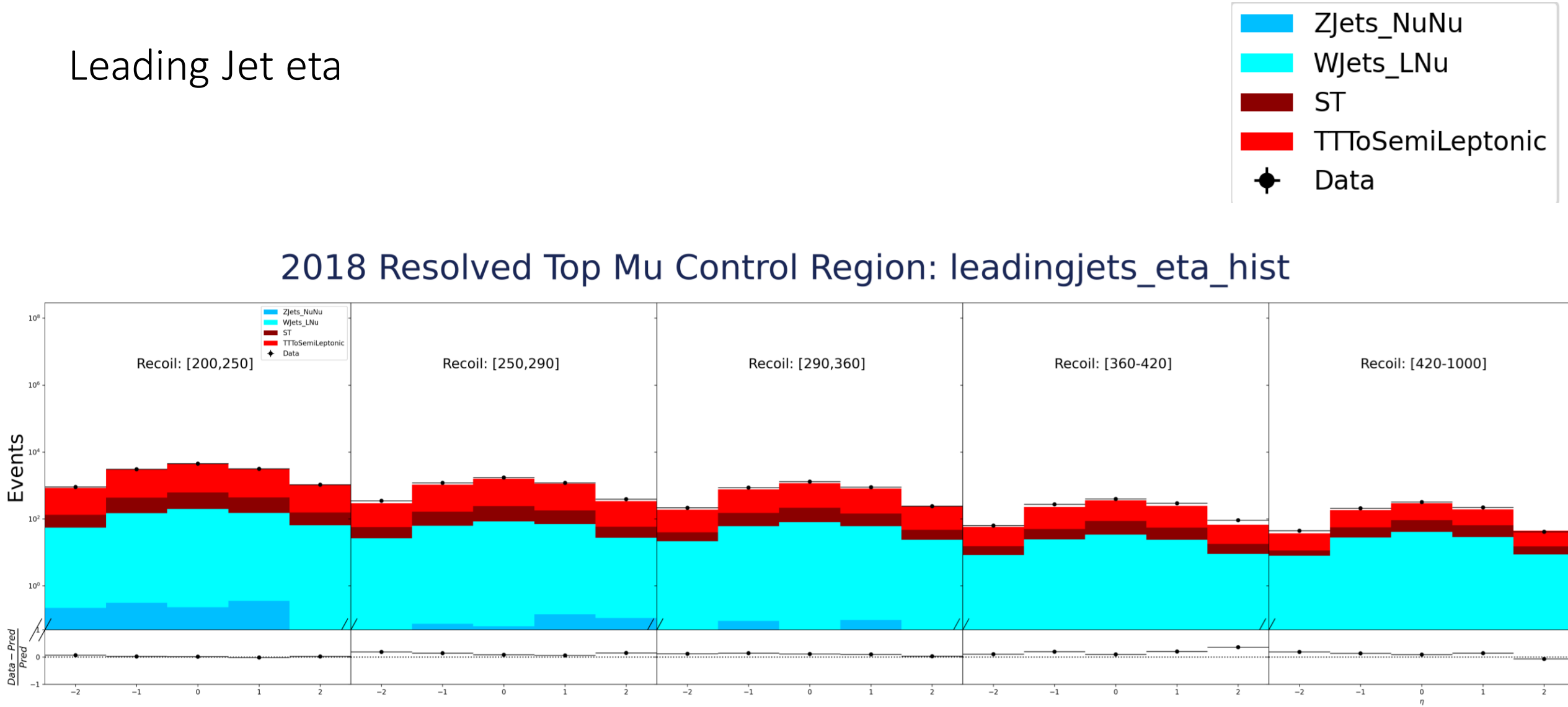


Leading Jet mass

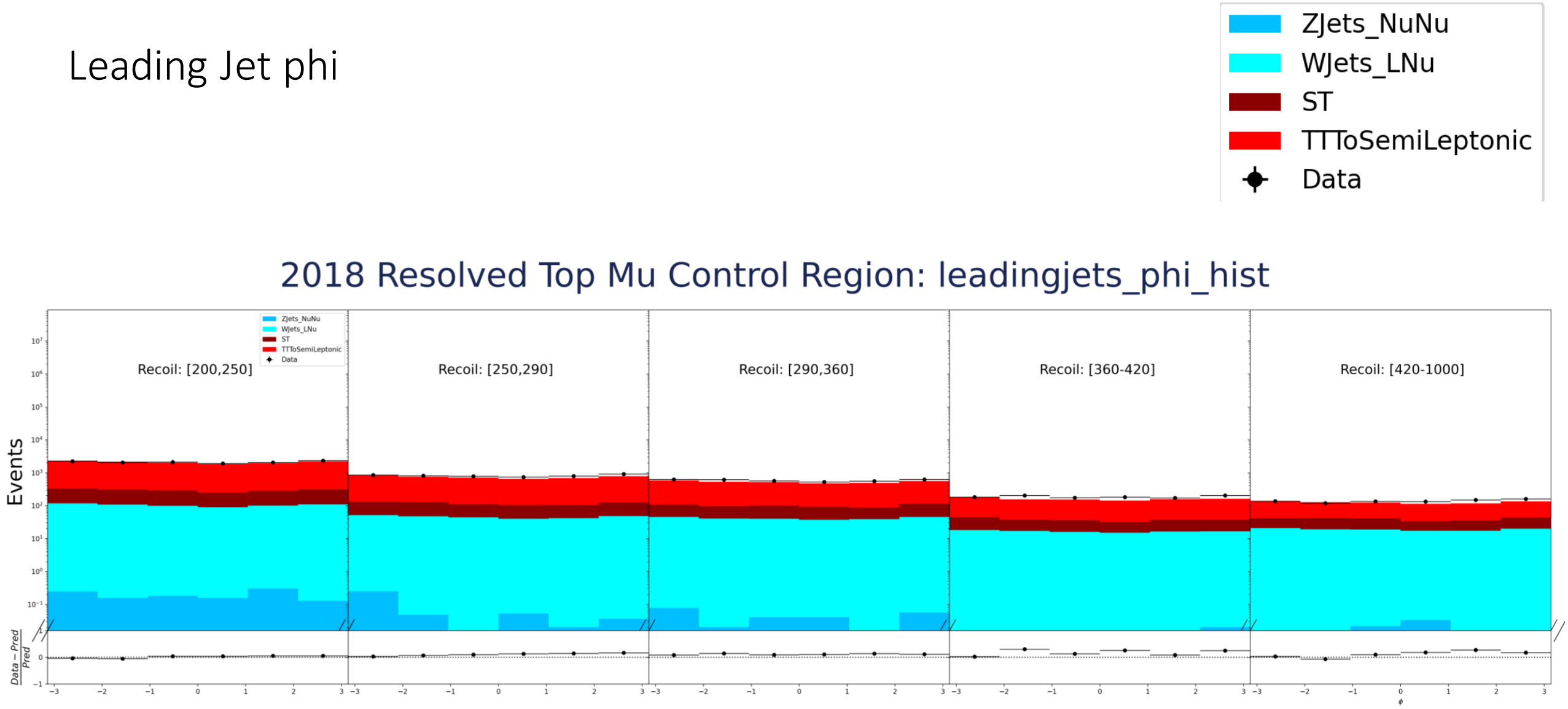




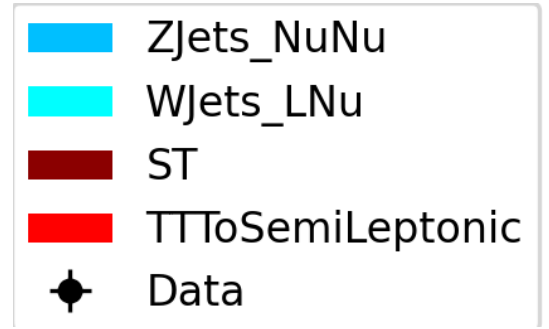
Leading Jet eta

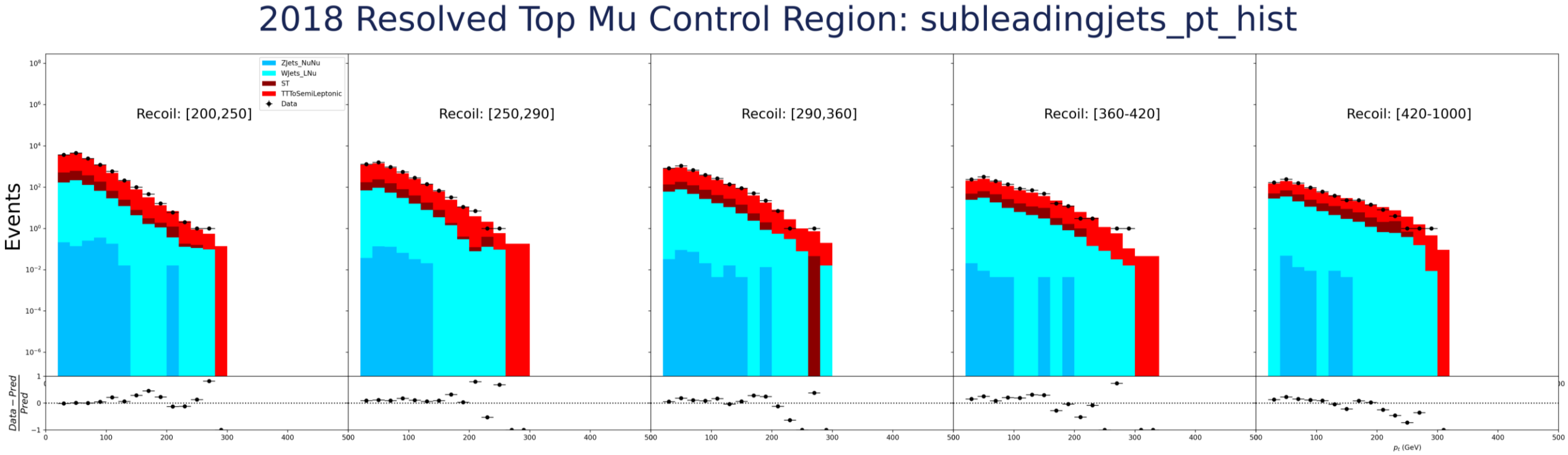


Leading Jet phi

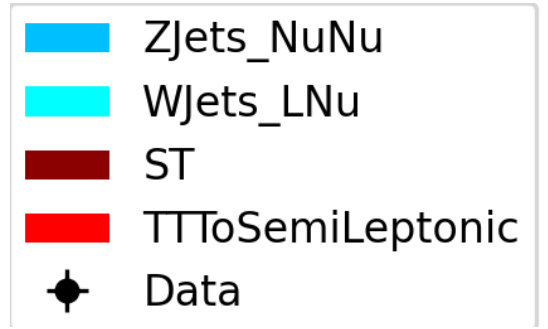


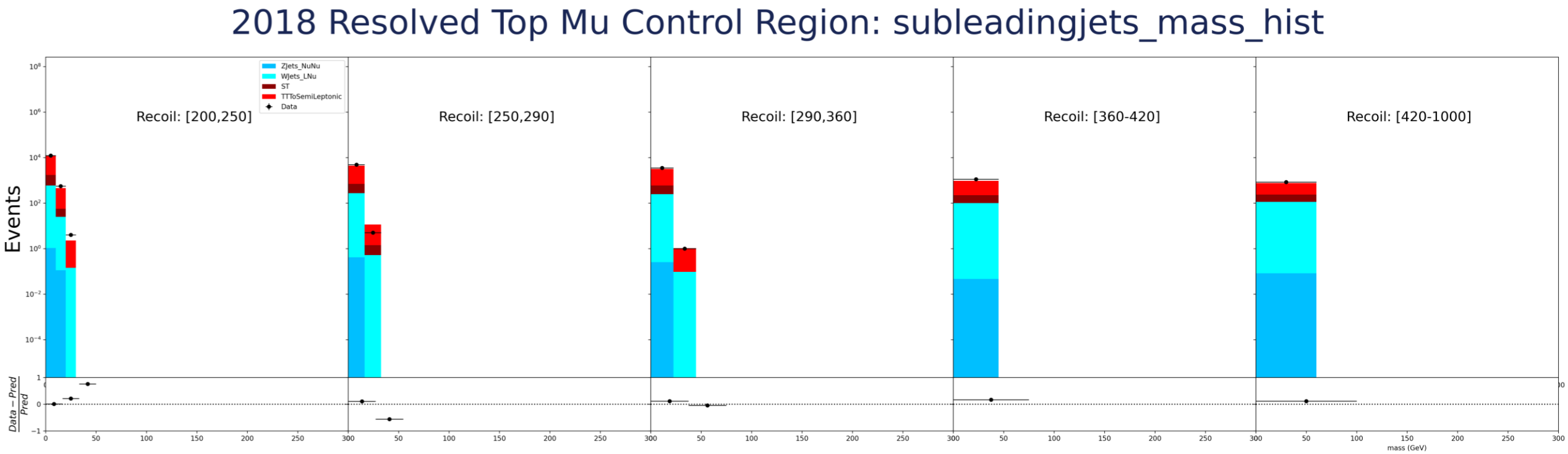
Subleading Jet pt



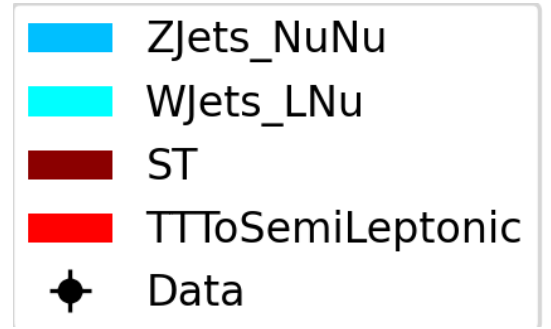


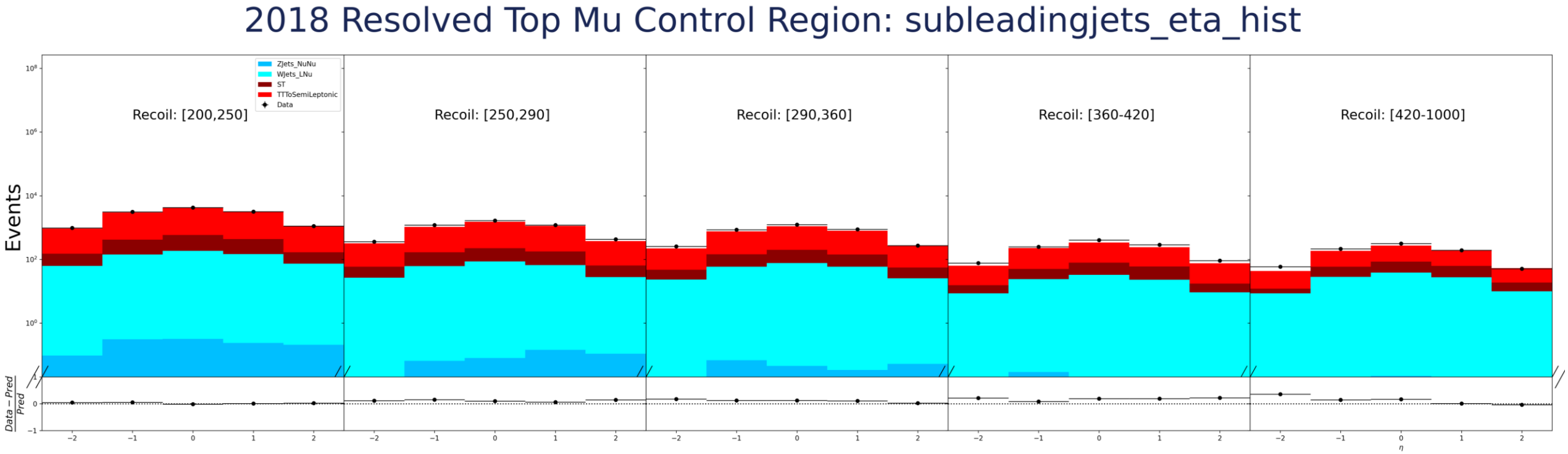
Subleading Jet mass



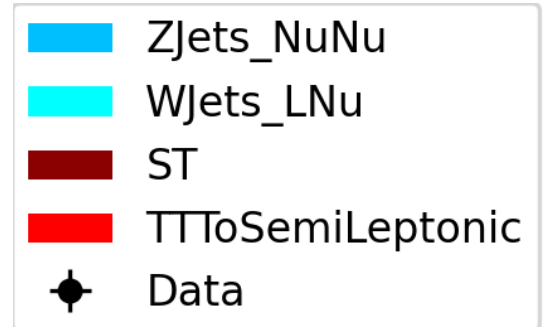


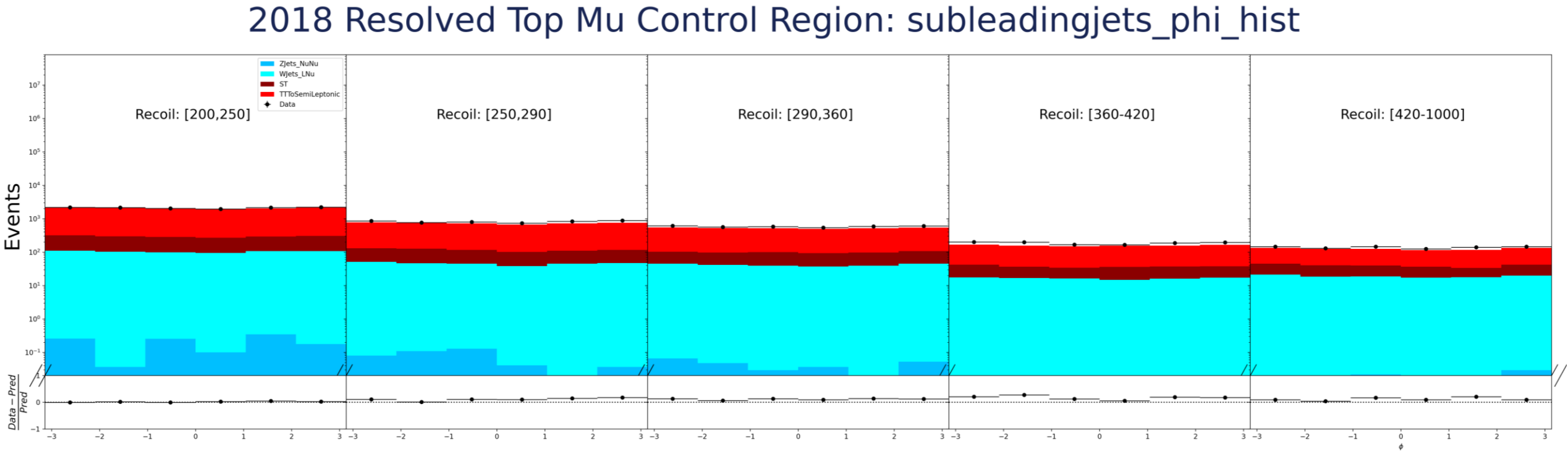
Subleading Jet eta



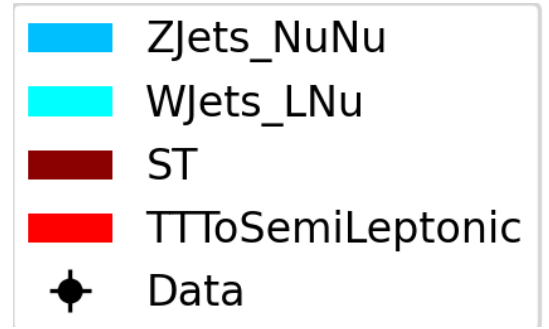


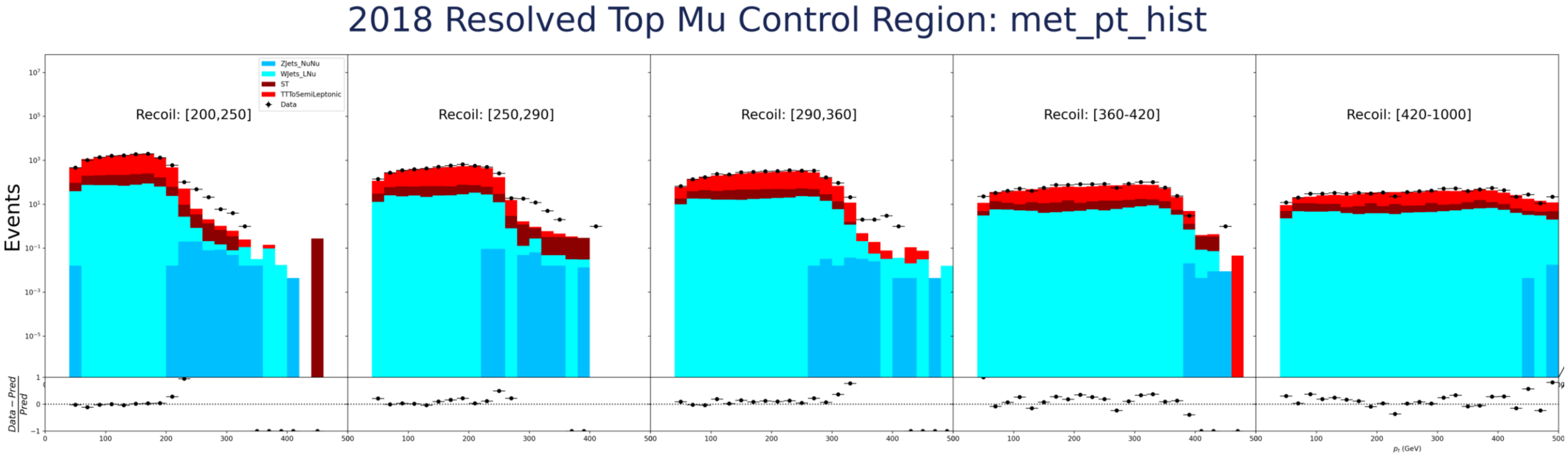
Subleading Jet phi





Missing transverse momentum (MET-pt)





Missing transverse momentum phi (MET-phi)