

Benchmark Comparison

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- Steps towards benchmark comparison
- Part1 The difference of all the predictions with different rivet plugins
- Part2 The difference between different MPI settings
- Part3 The difference between different tunes
- Conclusion

Steps towards Benchmark Comparison

- Prepare LHE files
 - W+j-7TeV-aMCatNLO-Pythia8-NNPDF30NNLO-*.lhe
- Run PYTHIA8 and Rivet on LHE files
 - set up environment variables
 - link lhe files to the one in pythia cards
 - set pythia cards (tune, MPI)
 - run 1000 jobs
 - merge all files using yoda-merge
 - create html pages

Part 1 The Difference of All the Predictions with Different Rivet Plugins

Settings :

- Rivet Plugins:

- ATLAS_2012_I1083318

- ATLAS_2014_I1319490

- CMS_2014_I1303894

- Tunes :

- pp = 17 ("ATLAS Tune AZ", is tuned to the pT spectrum of the Z^0/γ^0 boson in a set of rapidity bins)

- pp = 18 ("CMS Tune MonashStar", alias CUETP8M1-NNPDF2.3LO, an underlying-event tune based on the Monash 2013 tune)

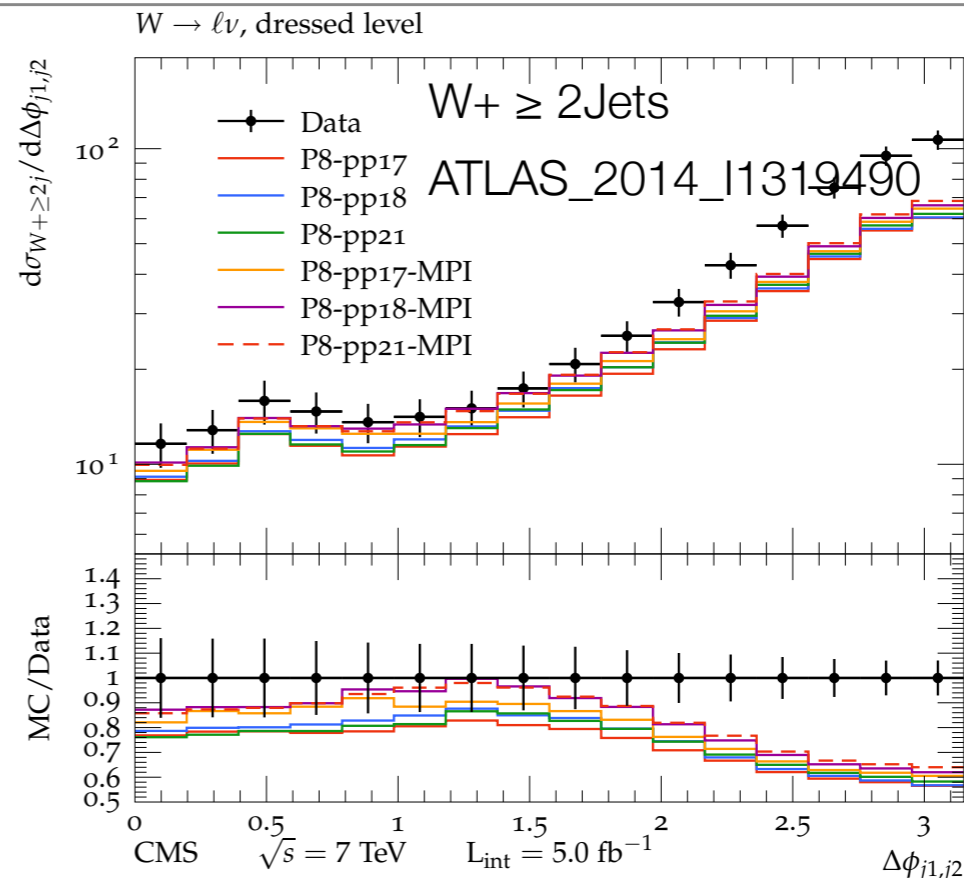
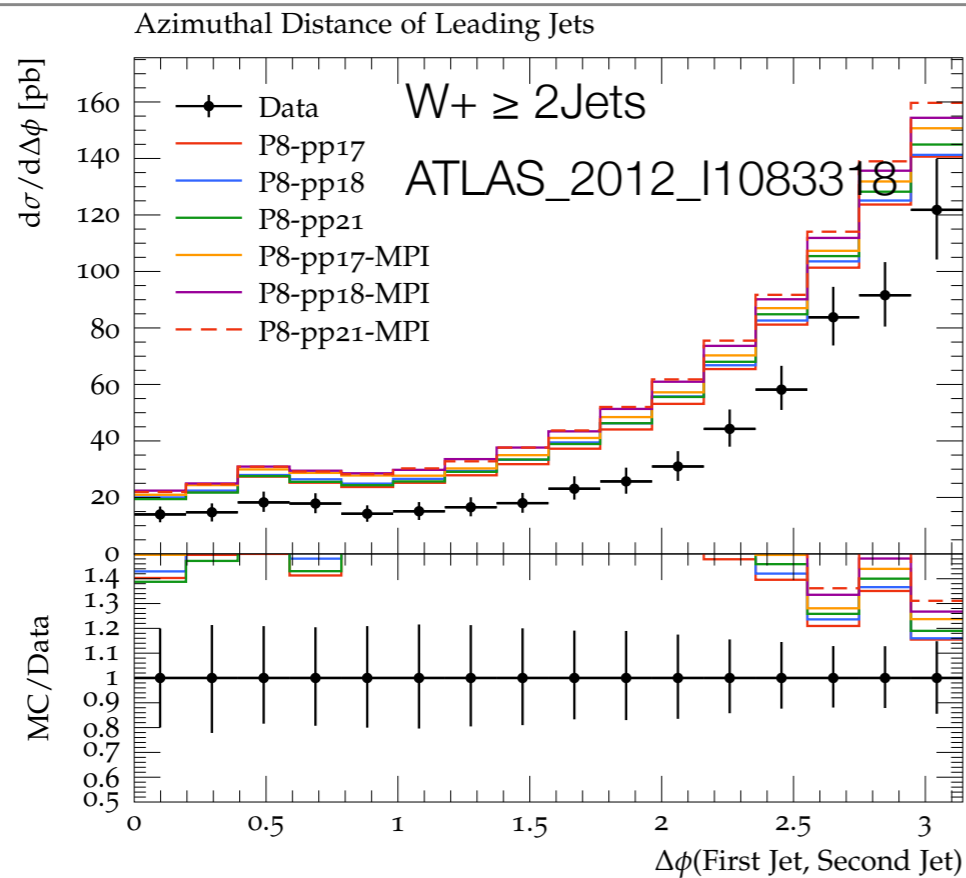
- pp = 21 ("ATLAS A14 central tune with NNPDF2.3LO", a full-scale tune to most ATLAS jet and underlying-event observables)

- Multiparton Interactions :

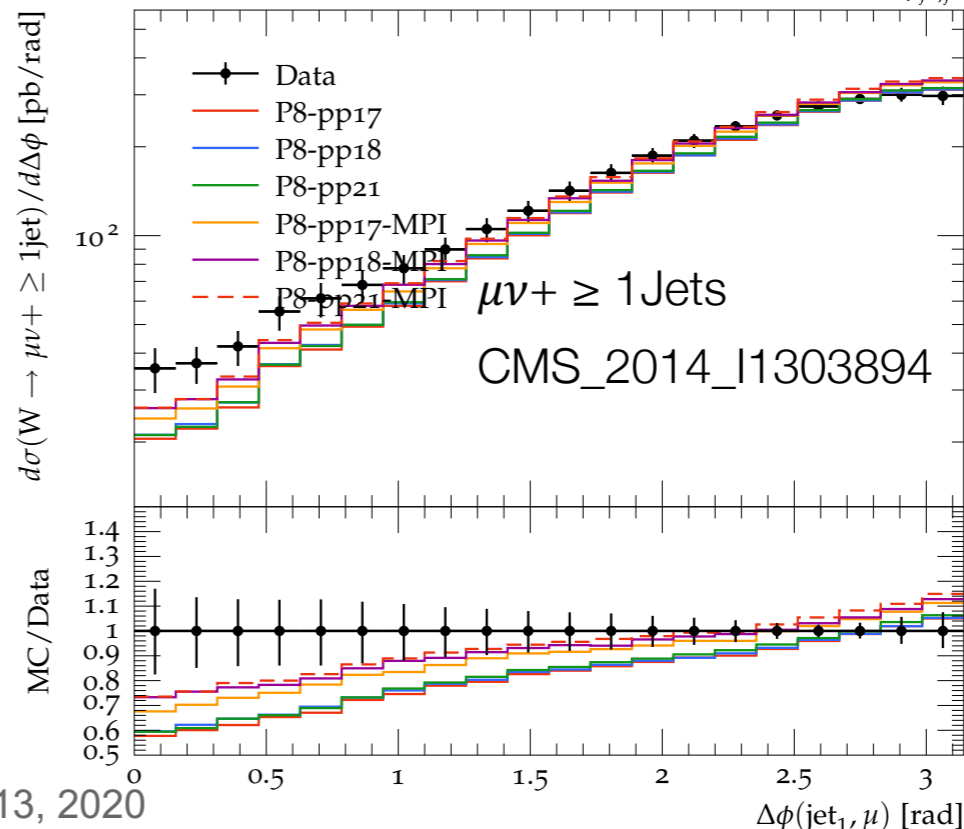
- MPI = on

- MPI = off

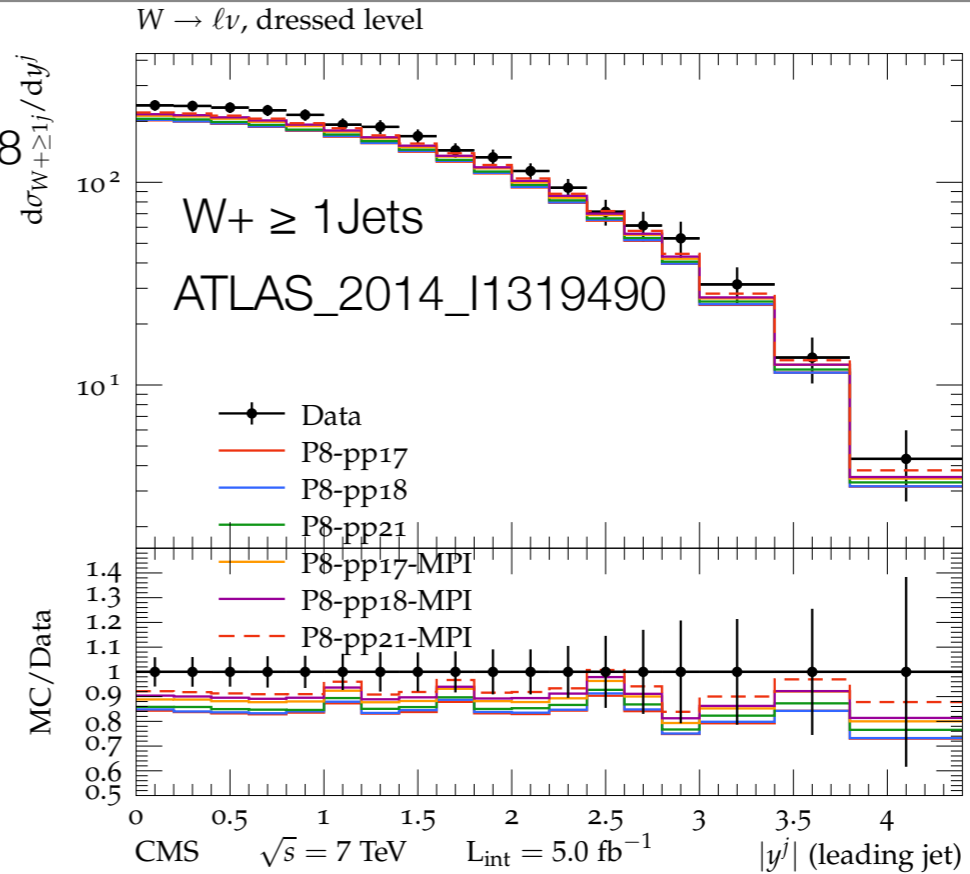
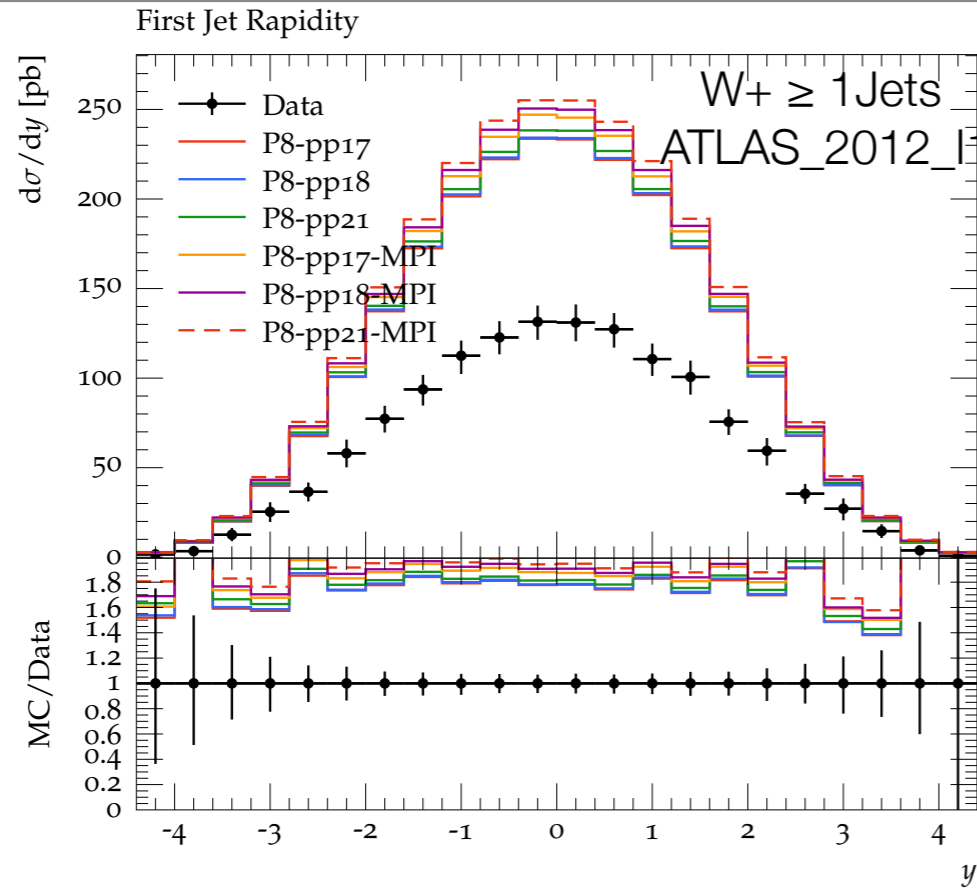
$\Delta\phi(\text{Jet1, Jet2})$ or $\Delta\phi(\text{Jet1, } \mu)$



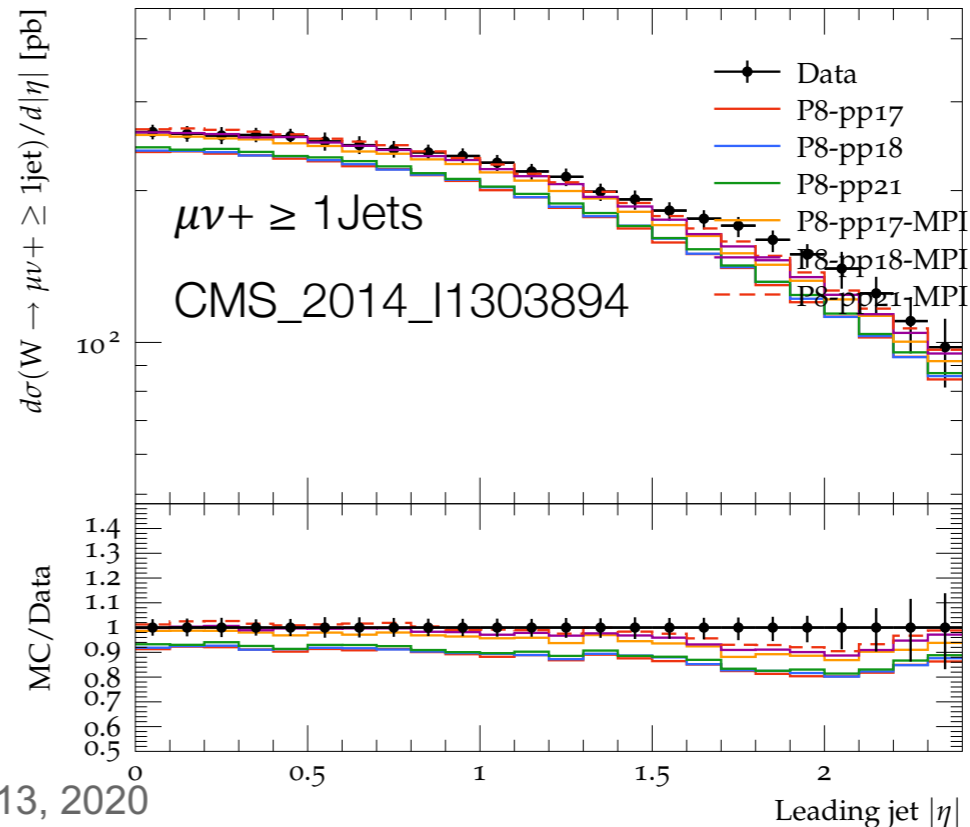
- ATLAS_2012_I1083318 (upper left) : Prediction is too large
- ATLAS_2014_I1319490 (upper right) : Prediction is too small at high $\Delta\phi$ region ($\Delta\phi > 2$)
- CMS_2014_I1303894 (lower right) : Prediction is too small at small $\Delta\phi$ region ($\Delta\phi < 1$)



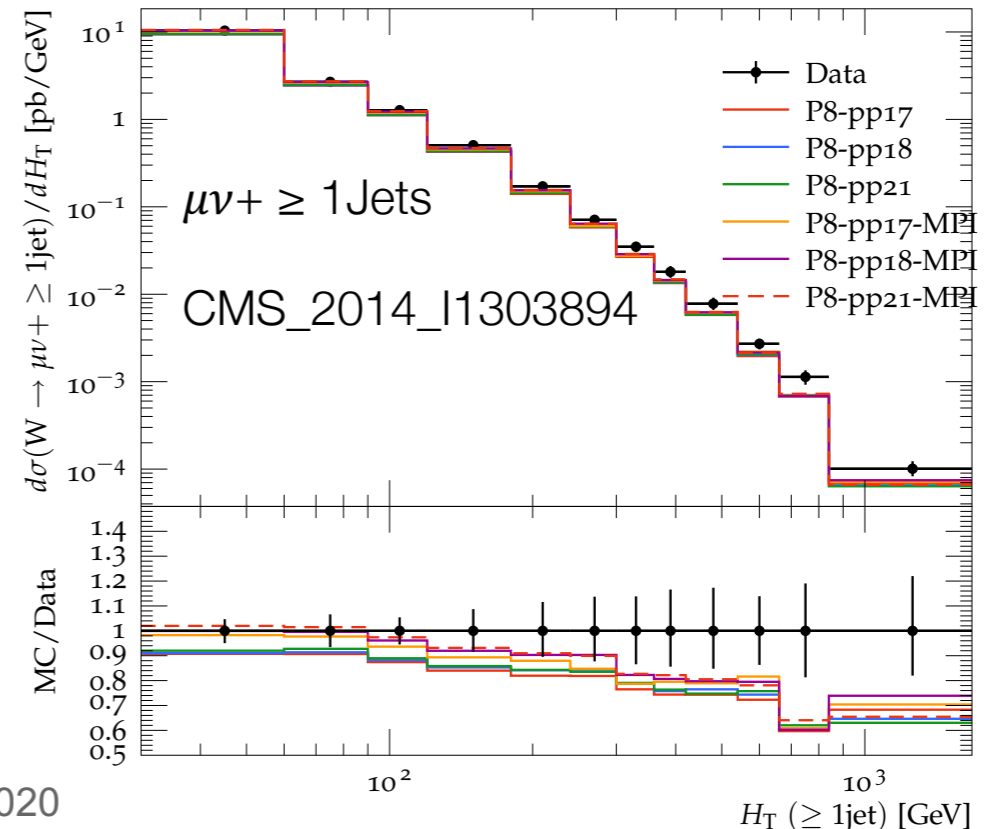
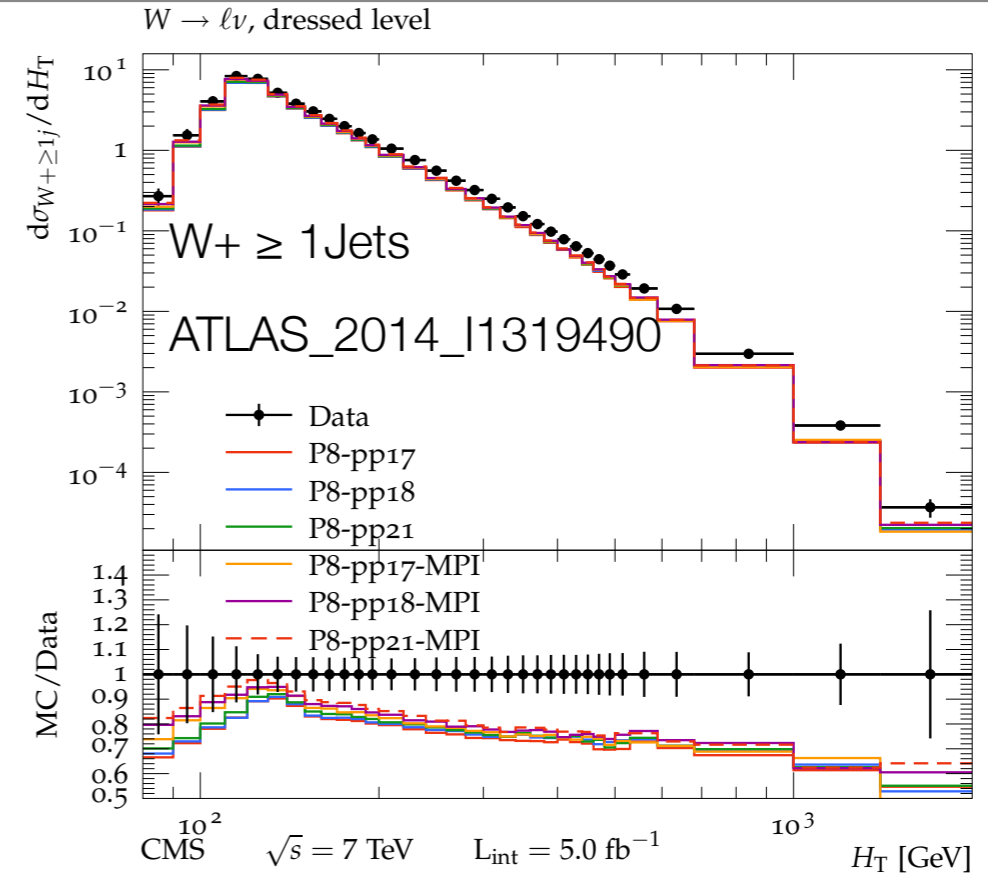
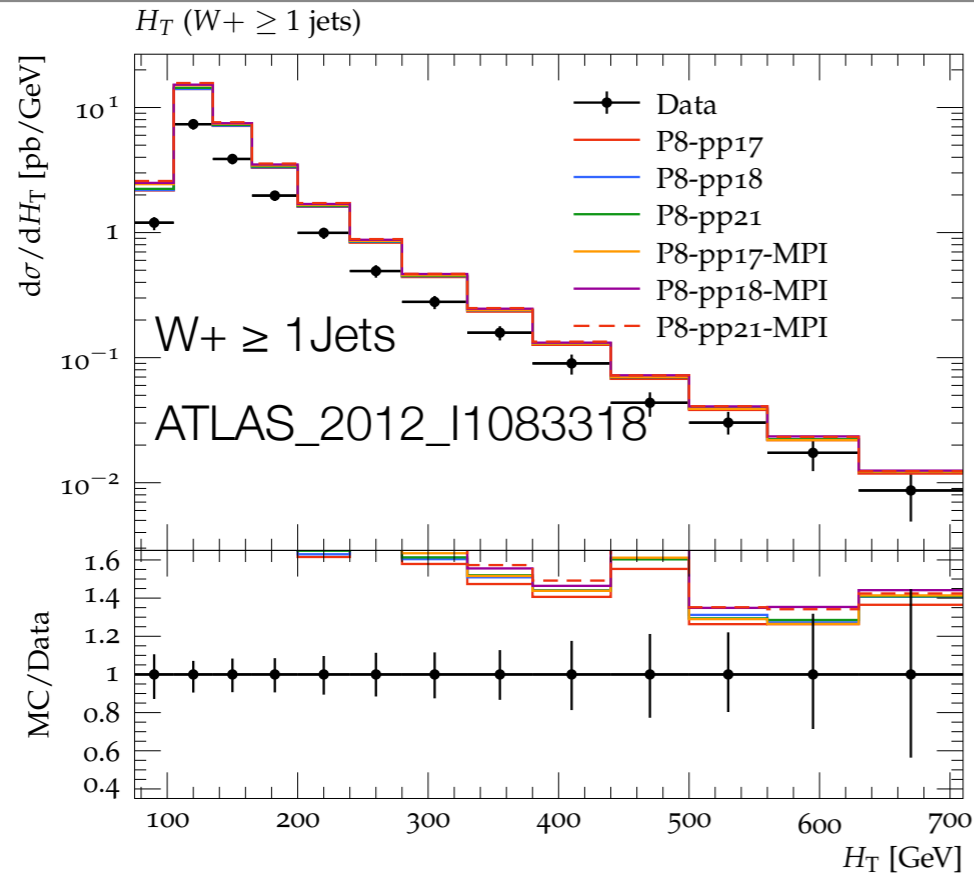
Leading Jet Rapidity or Pseudorapidity



- ATLAS_2012_I1083318 (upper left) : Prediction is too large compared with ATLAS 2014 plugin (upper right) and CMS plugin (lower right)

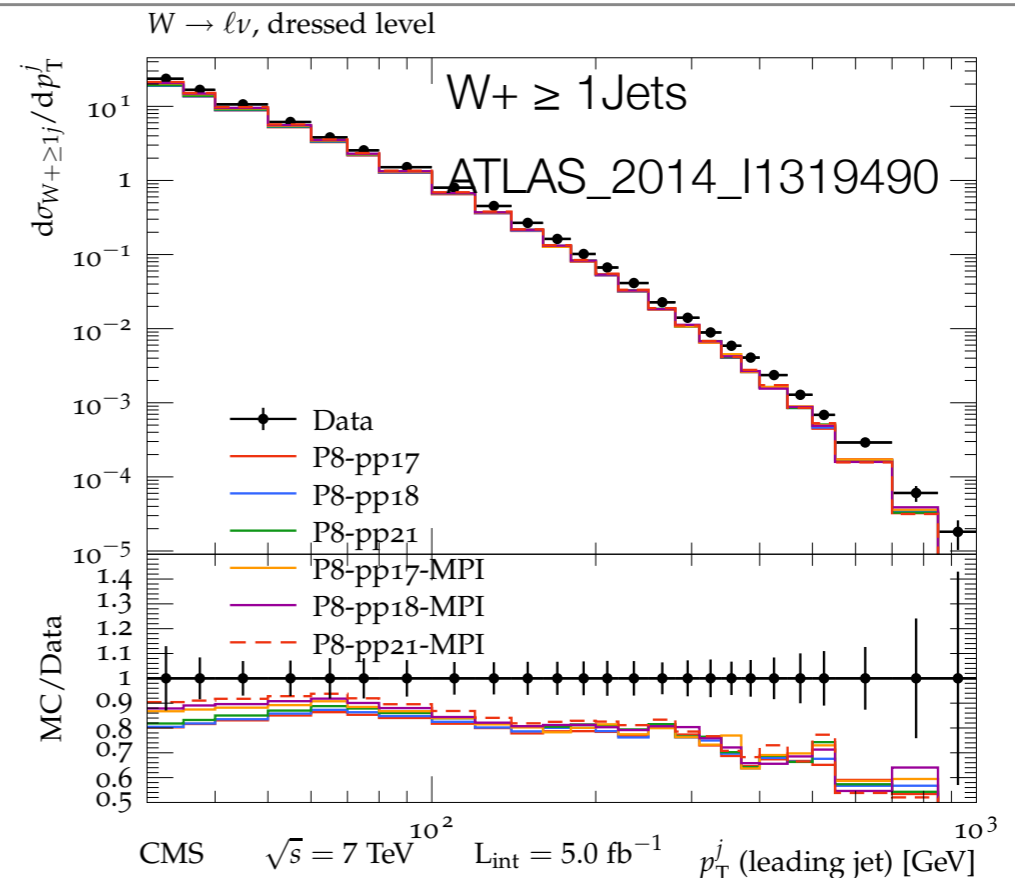
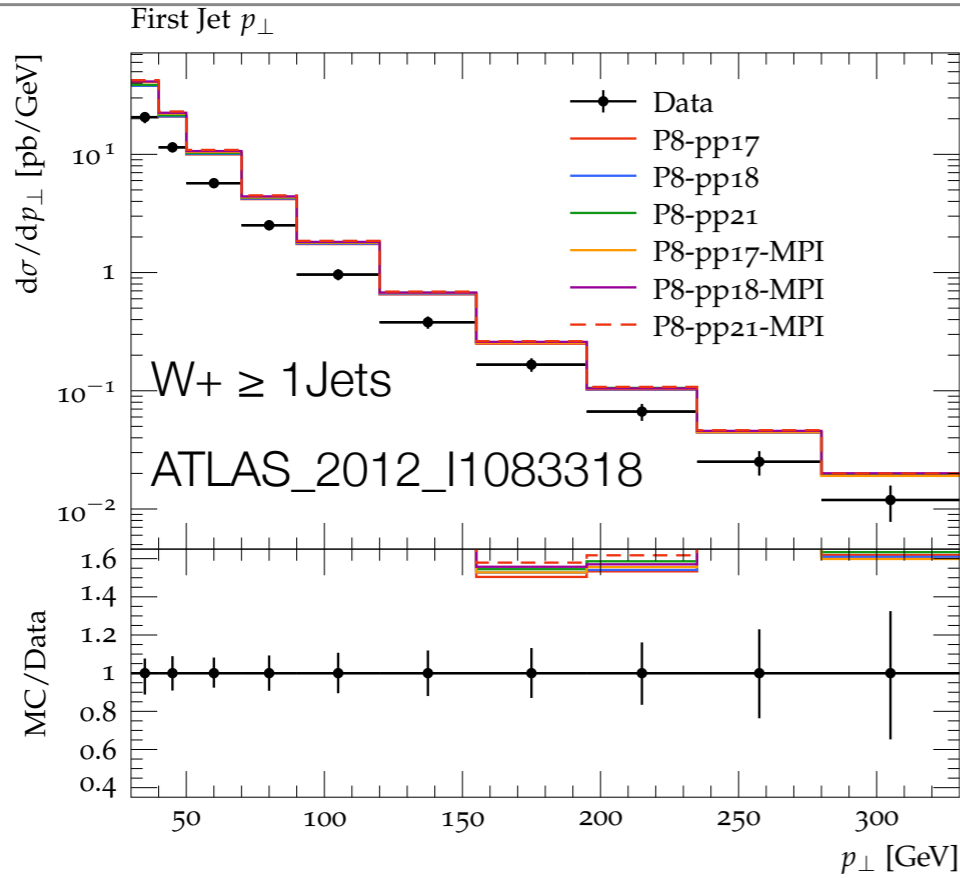


H_T

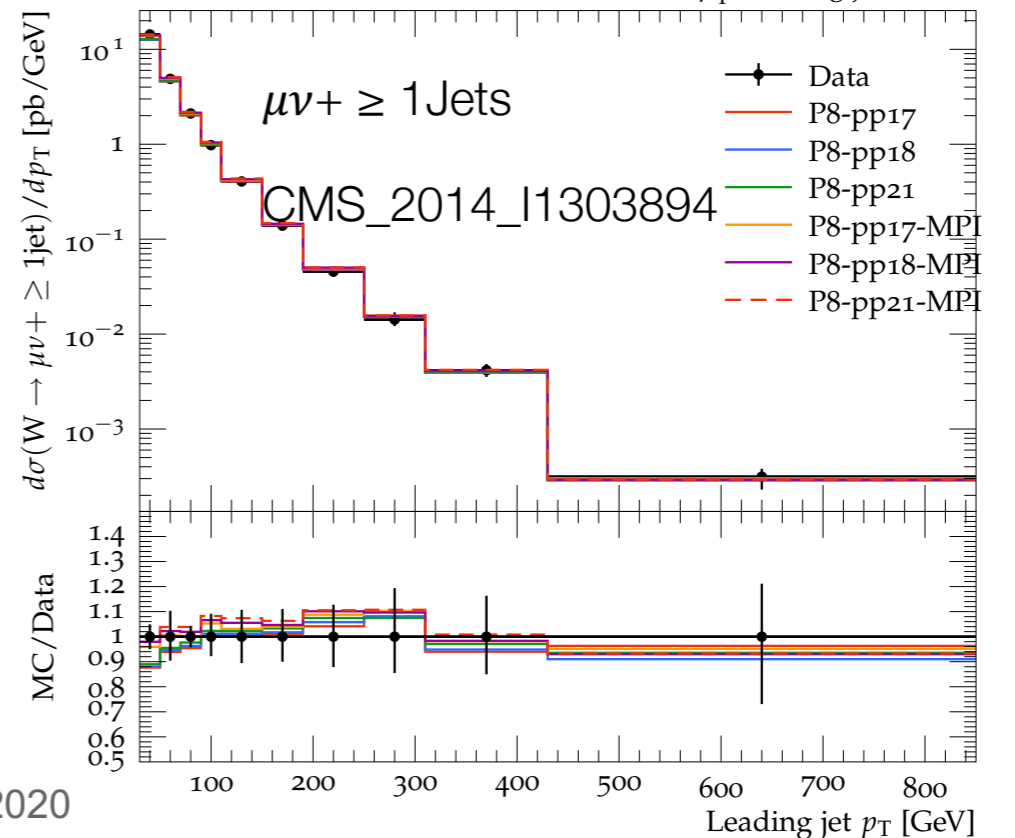


- ATLAS_2012_I1083318 (upper left) : Prediction is too large
- ATLAS_2014_I1319490 (upper right) : Prediction is too small
- CMS_2014_I1303894 (lower right) : Prediction is too small at large H_T region ($H_T > 100$ GeV)

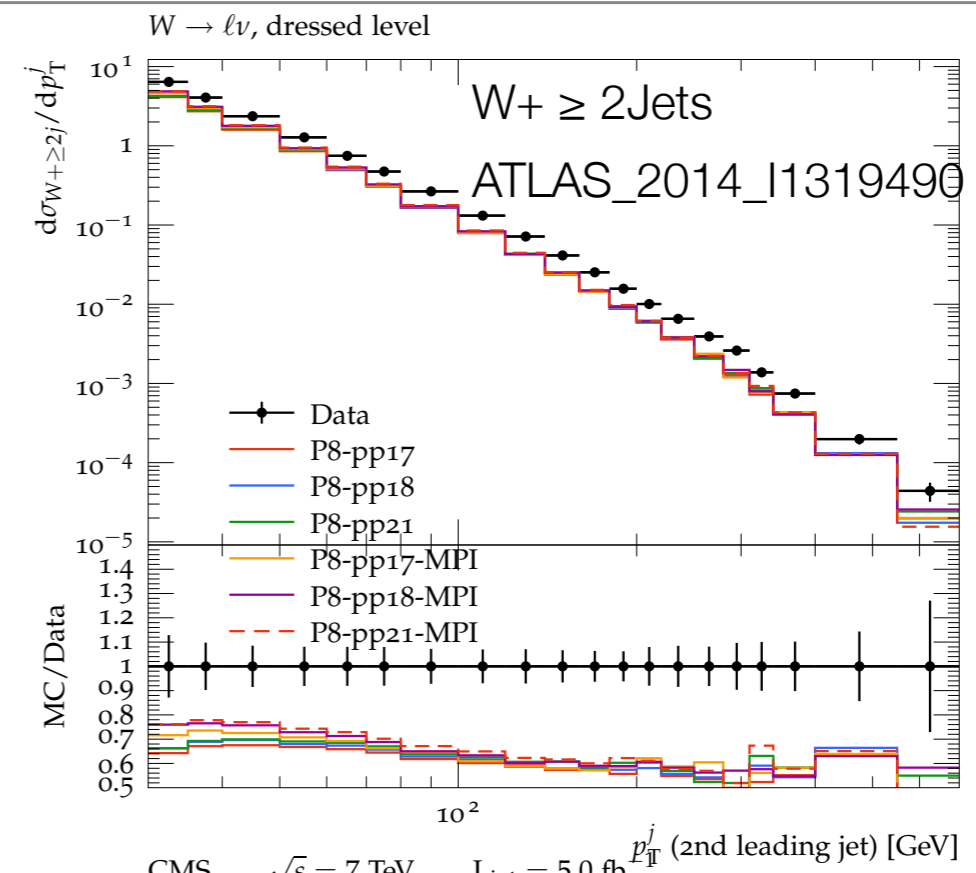
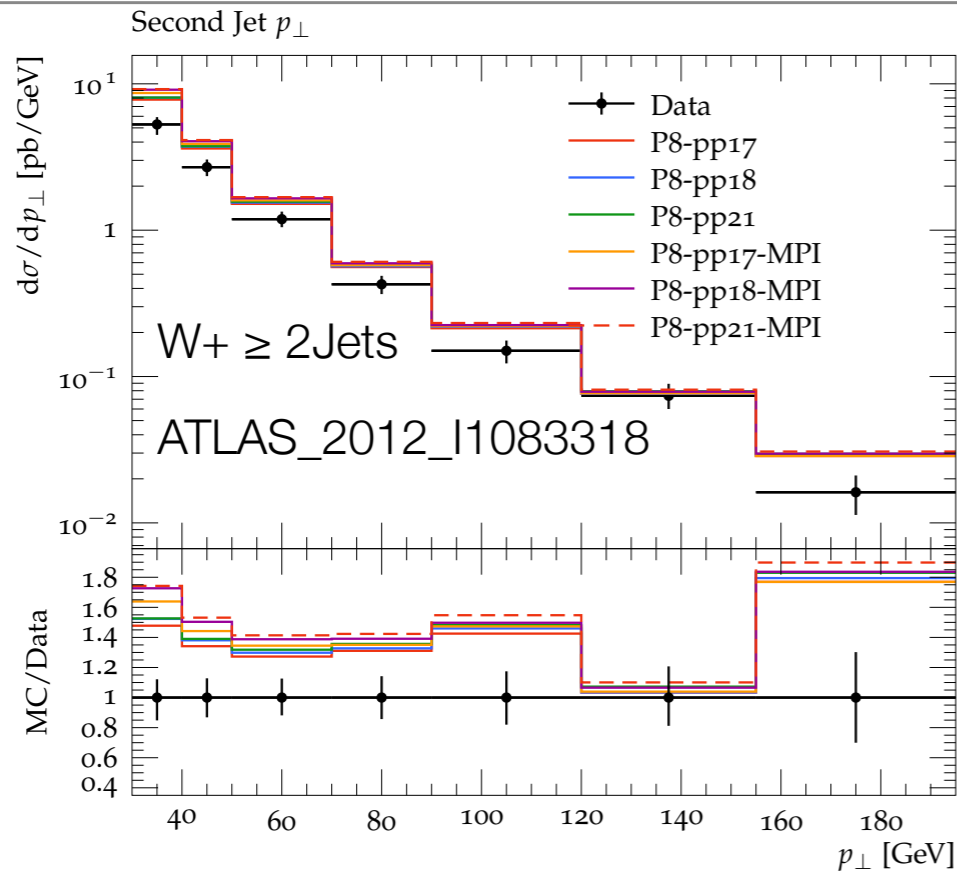
Leading Jet P_T



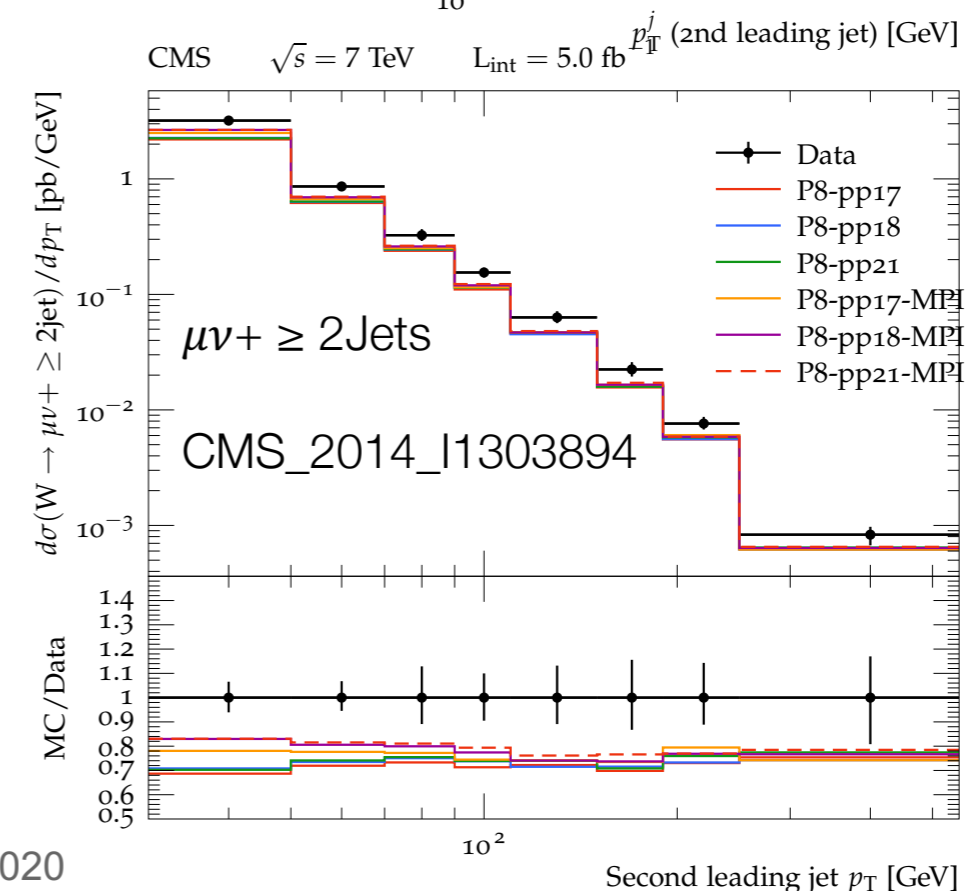
- ATLAS_2012_I1083318 (upper left) : Prediction is too large compared with ATLAS 2014 plugin
- ATLAS_2014_I1319490 (upper right) : Prediction is too small at large P_T region ($P_T > 100$ GeV) compared with CMS plugin (lower right)



Subleading Jet P_T



- ATLAS_2012_I1083318 (upper left) : Prediction is too large
- ATLAS_2014_I1319490 (upper right) : Prediction is too small
- CMS_2014_I1303894 (lower right) : Prediction is too small

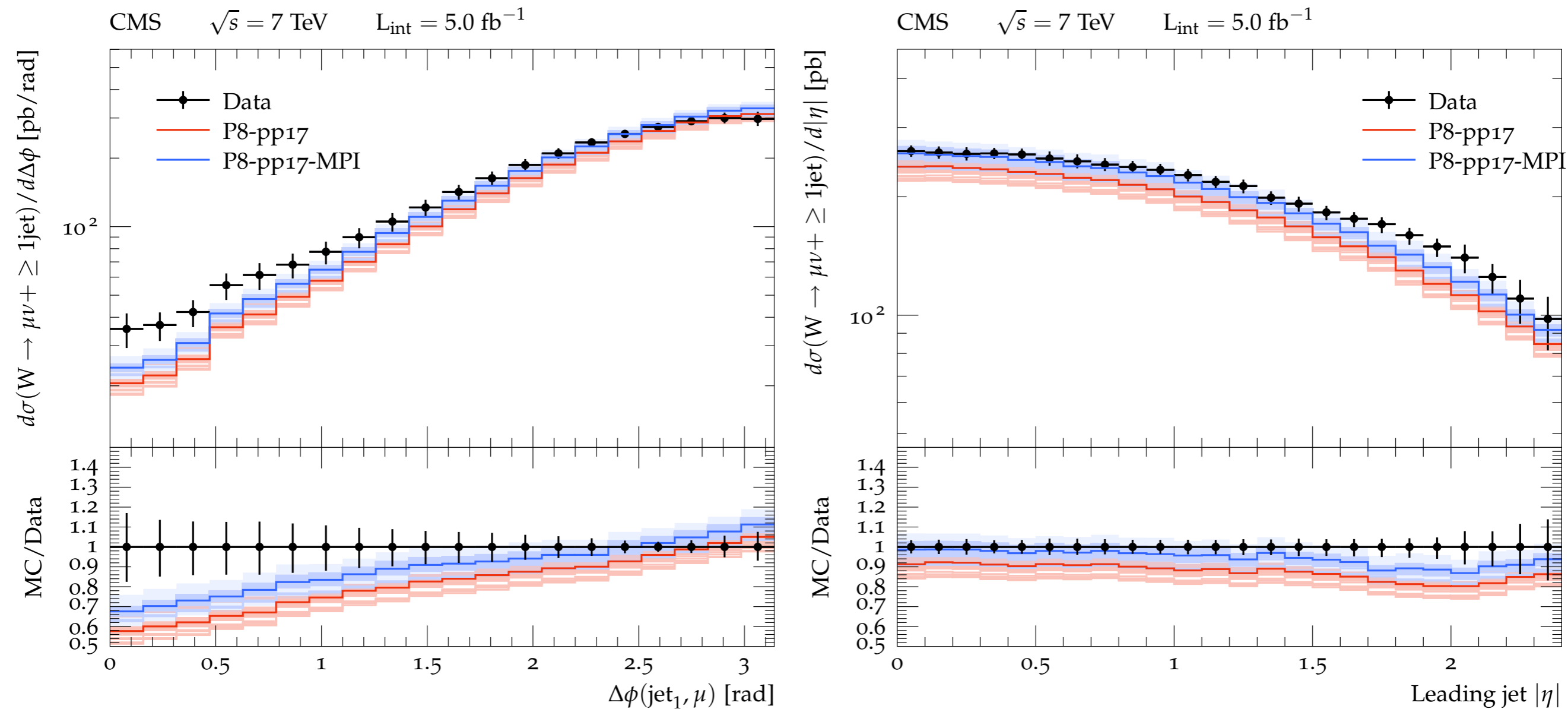


Part 2 The Difference between Different MPI Settings

Settings :

- Rivet Plugin :
 - CMS_2014_I1303894
- Tune :
 - pp = 17
- Multiparton Interactions :
 - MPI = on
 - MPI = off

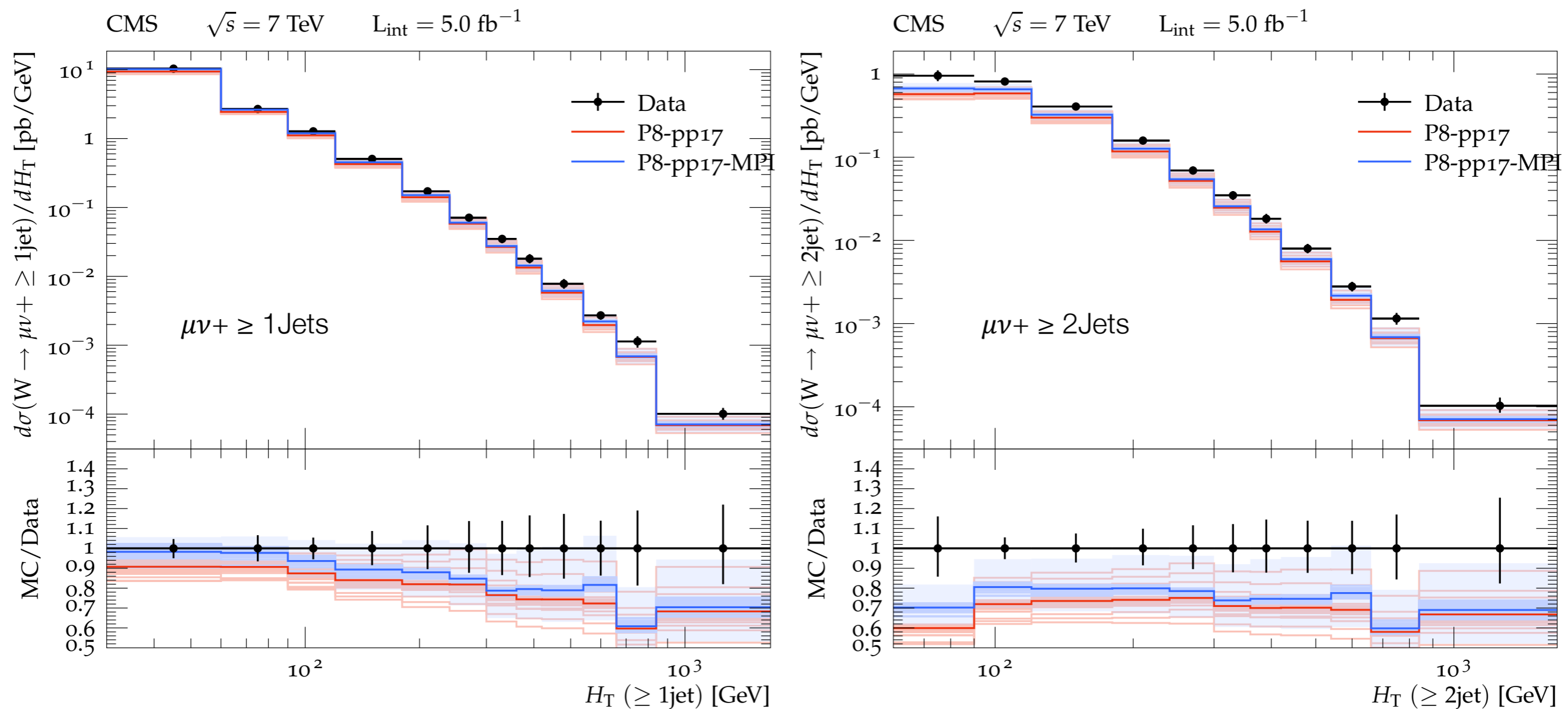
CMS_2014_I1303894



The MPI effect is not significant compared to the scale uncertainty band

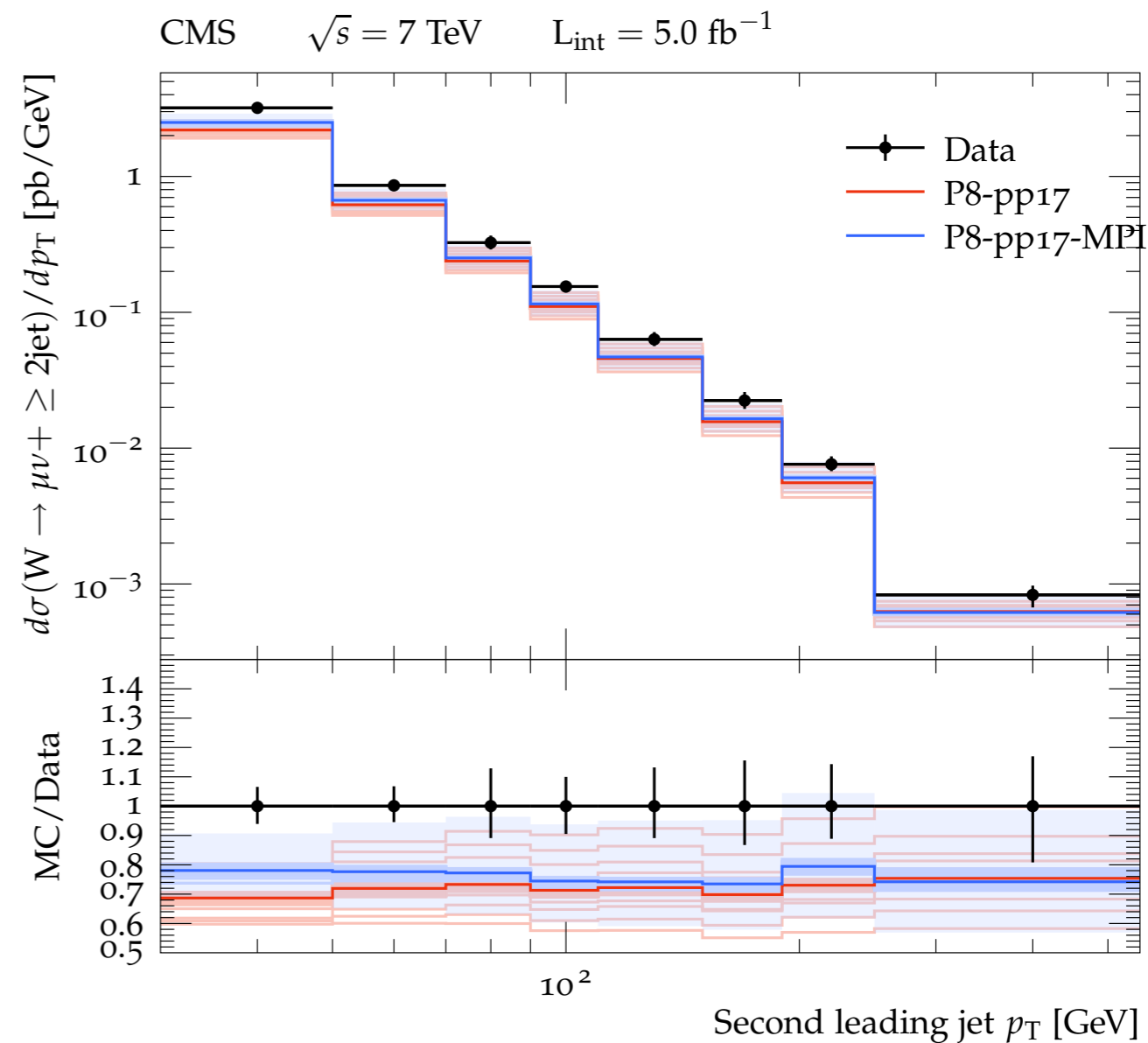
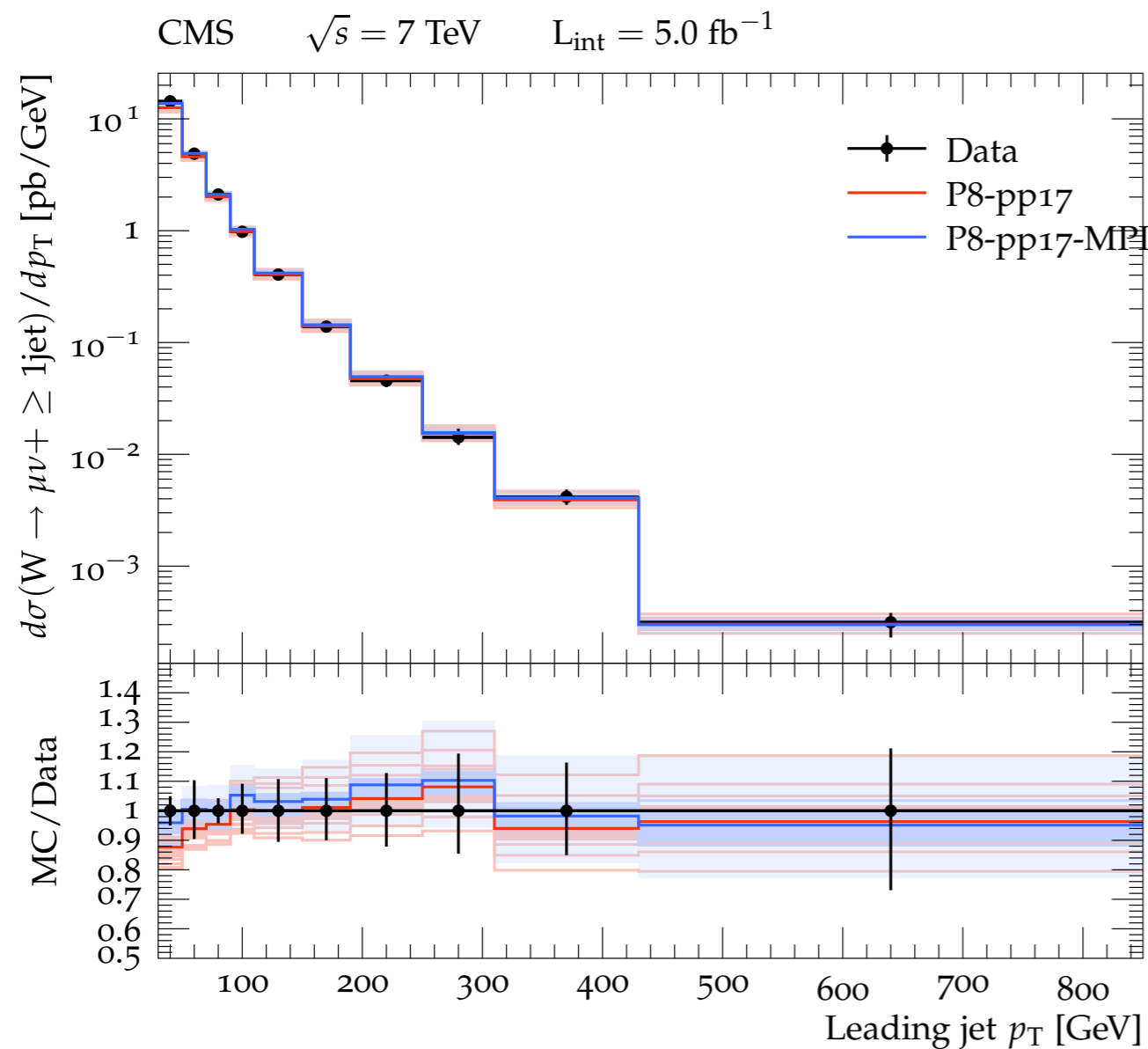
- $\Delta\phi$ between μ and Jet1 (left) : At $\Delta\phi < 1.5$, MPI effects around 10%
- Leading Jet $|\eta|$ (right) : MPI effects around 10%

CMS_2014_I1303894



- $\mu\nu + \geq 1\text{Jets}$ and $\mu\nu + \geq 2\text{Jets}$ H_T : At small H_T region ($H_T < 100 \text{ GeV}$), MPI effects around 10%, which is not significant compared to the scale uncertainty band

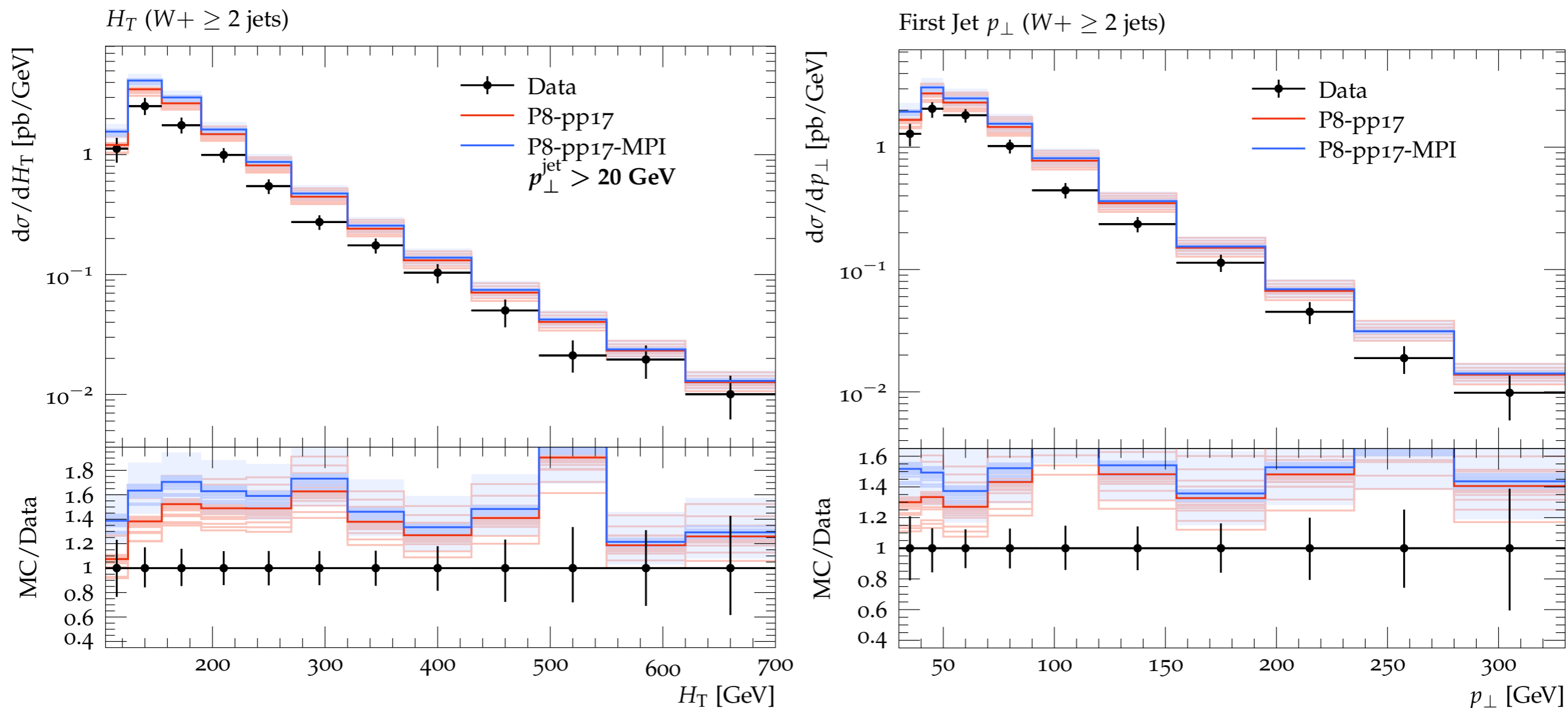
CMS_2014_I1303894



The MPI effect is not significant compared to the scale uncertainty band

- Leading Jet P_T (left) : At $P_T < 100$ GeV, MPI effects around 10%
- Subleading Jet P_T (right) : At $P_T < 50$ GeV, MPI effects around 10%

ATLAS_2012_I1083318



However, for some variables with rivet plugin ATLAS_2012_I1083318, the MPI effect is significant compared to the scale uncertainty band

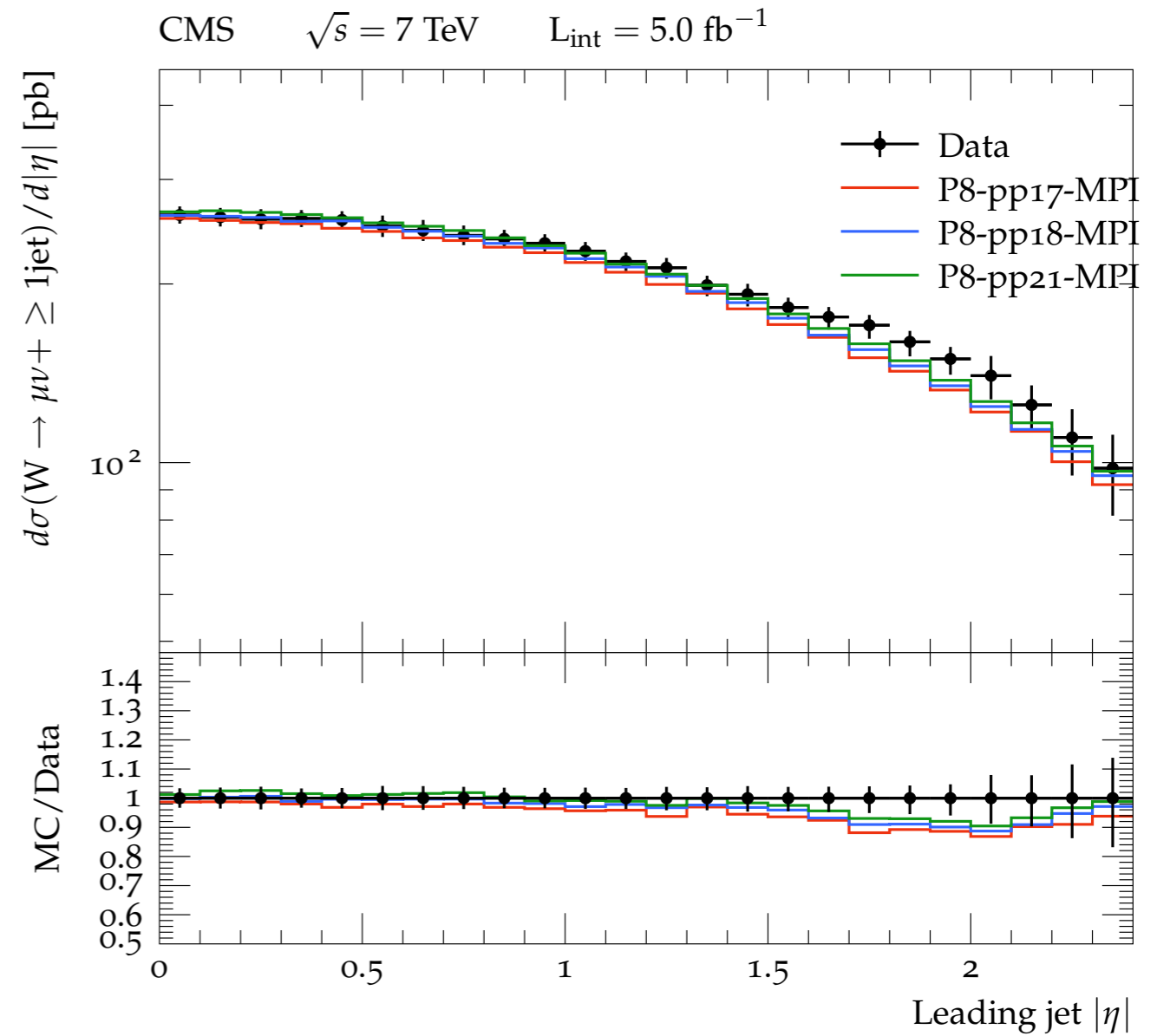
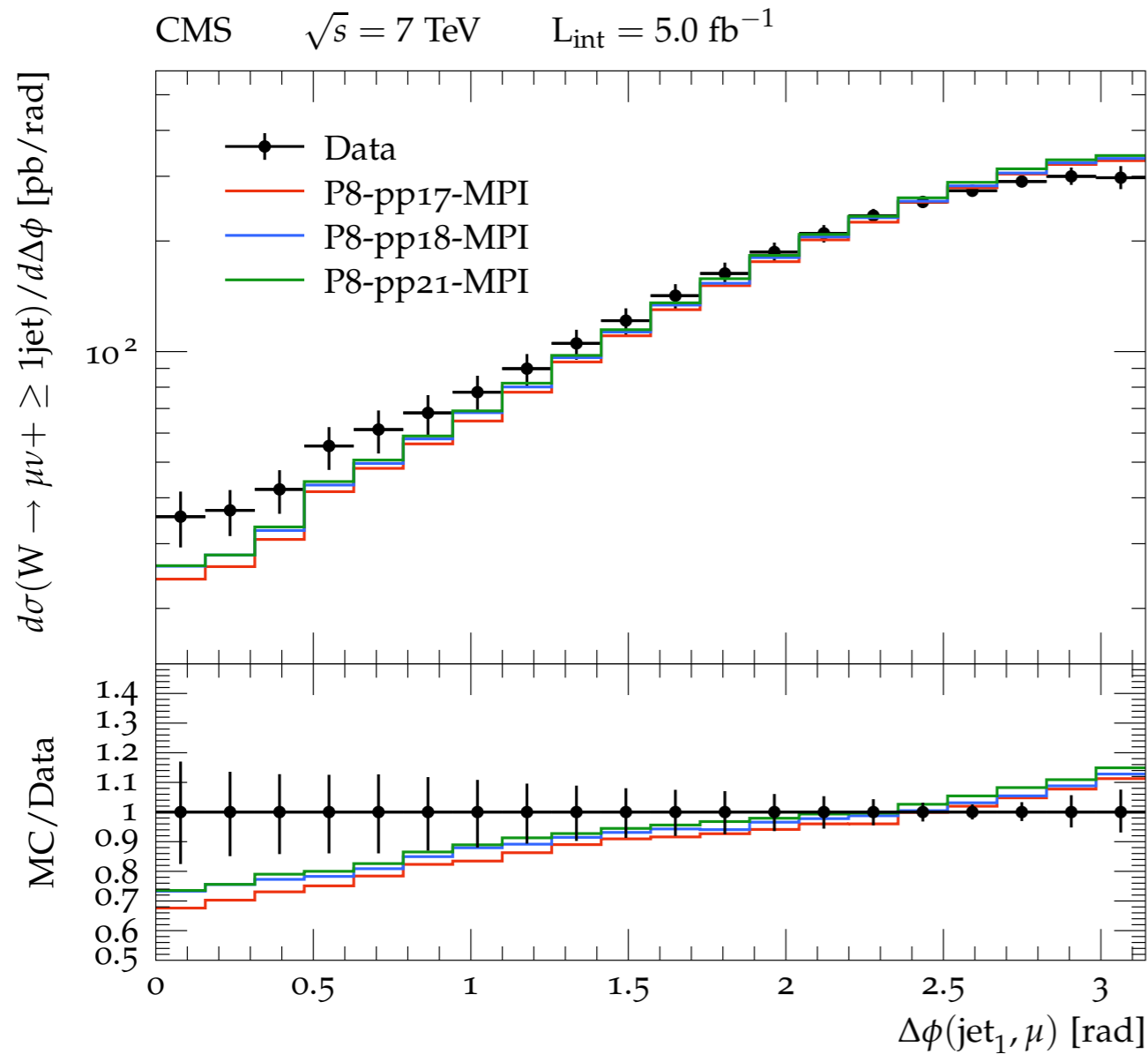
- $W+ \geq 2 \text{ Jets } H_T$ (left) : at small H_T region ($H_T < 200 \text{ GeV}$), MPI effects more than 20%
- Leading Jet P_T (right) : at $P_T < 50 \text{ GeV}$, MPI effects around 20%,

Part 3 The Difference between Different Tunes

Settings :

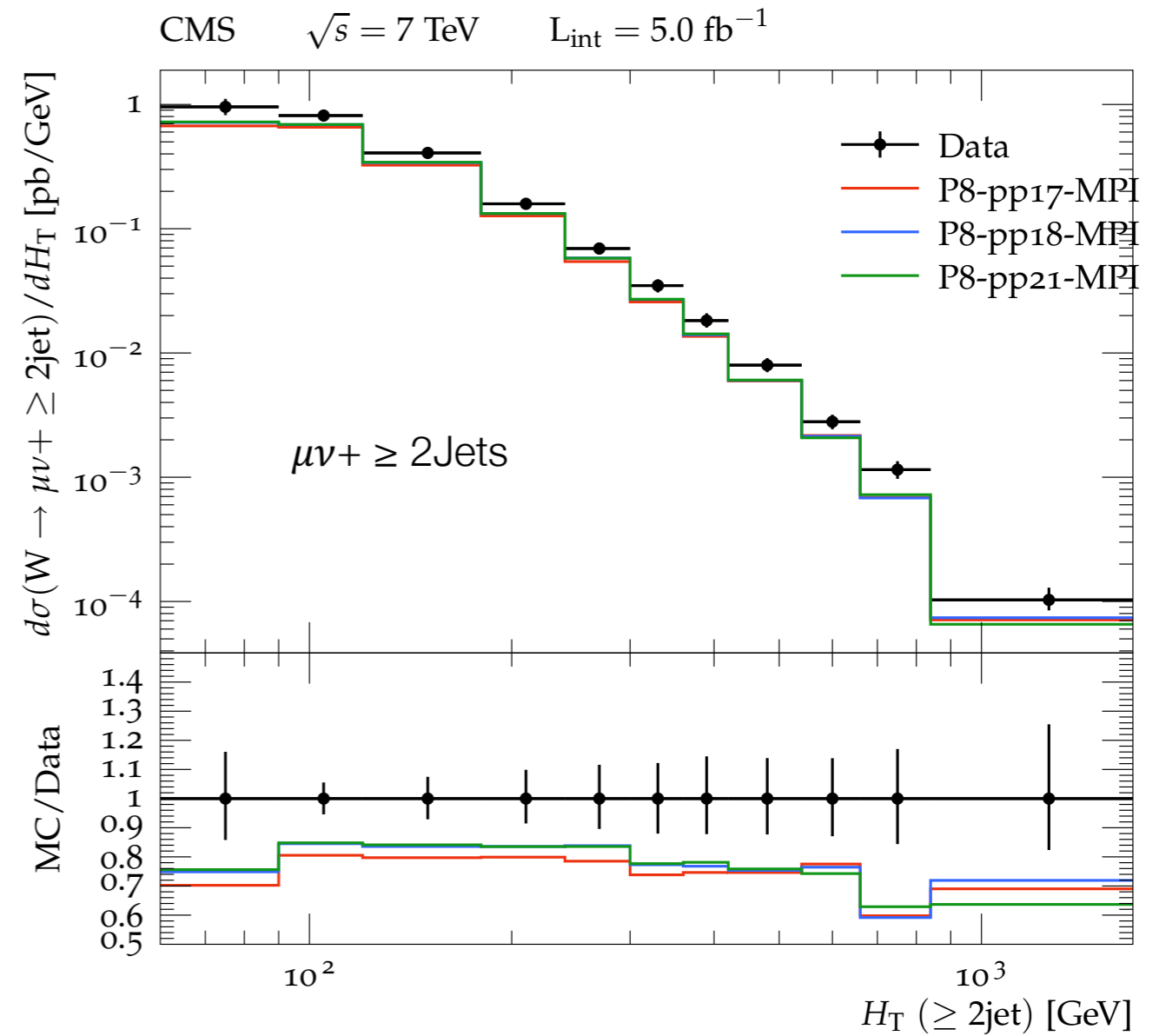
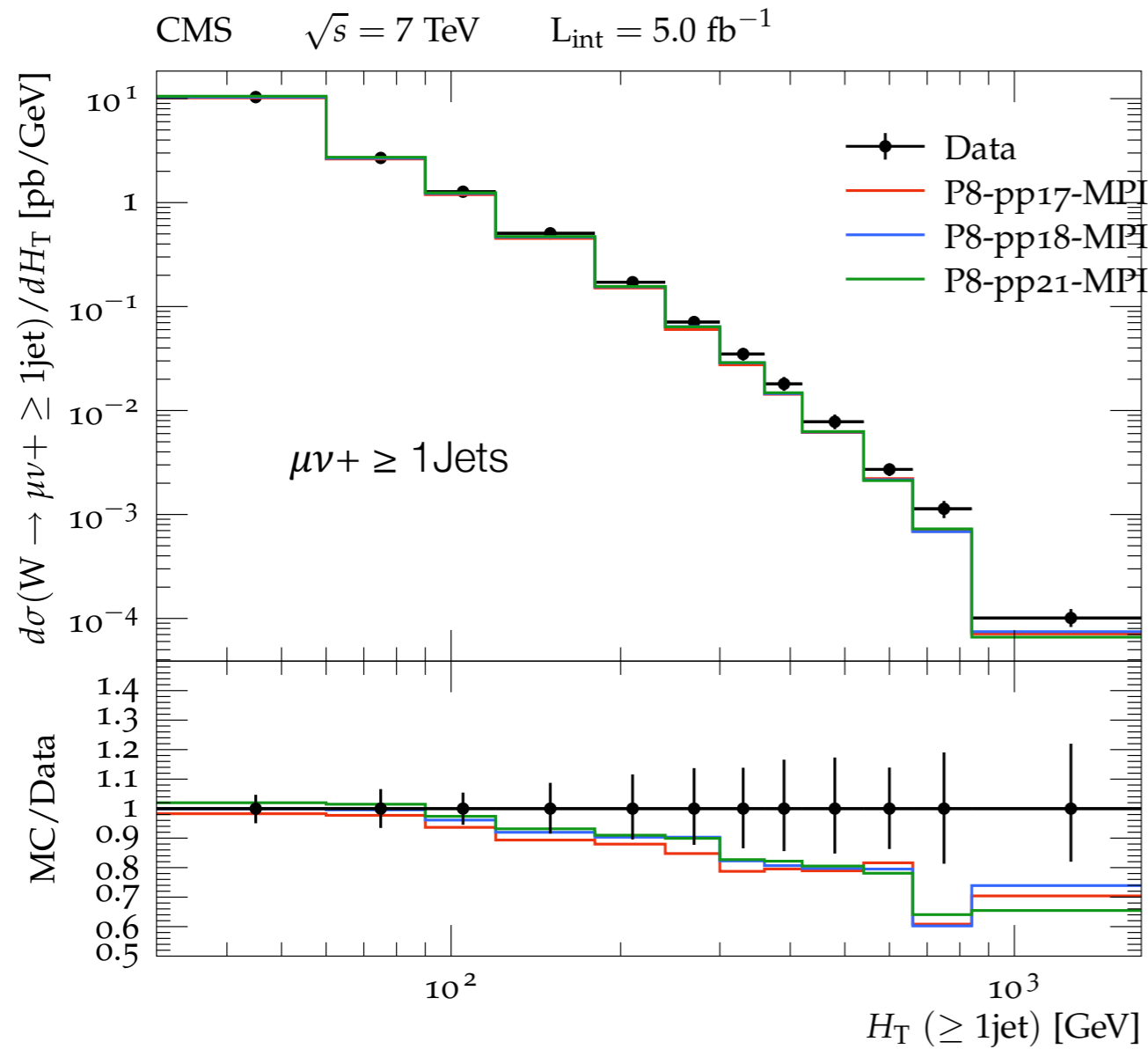
- Rivet Plugin :
 - CMS_2014_I1303894
- Tune :
 - pp = 17
 - pp = 18
 - pp = 21
- Multiparton Interactions :
 - MPI = on

CMS_2014_I1303894



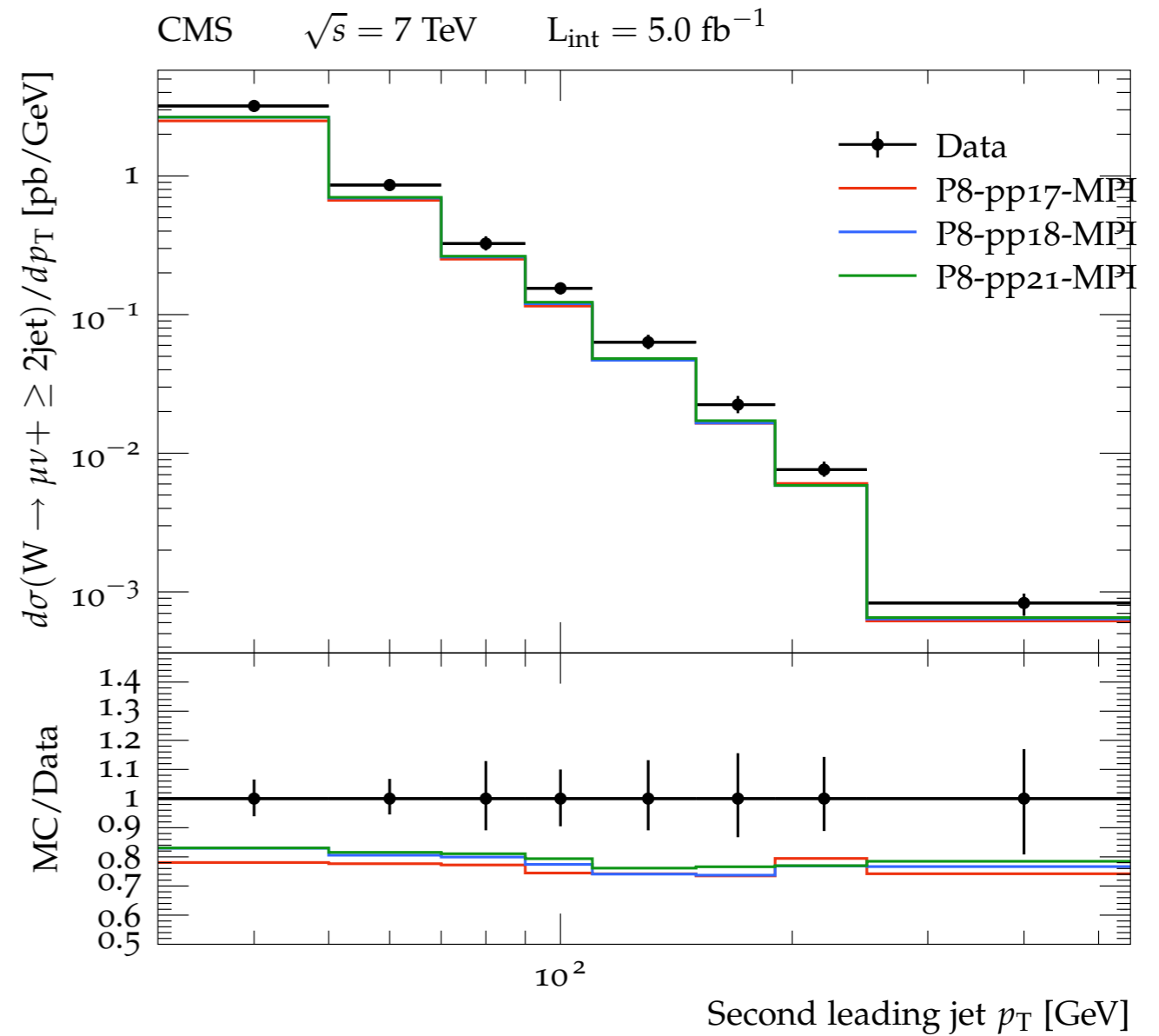
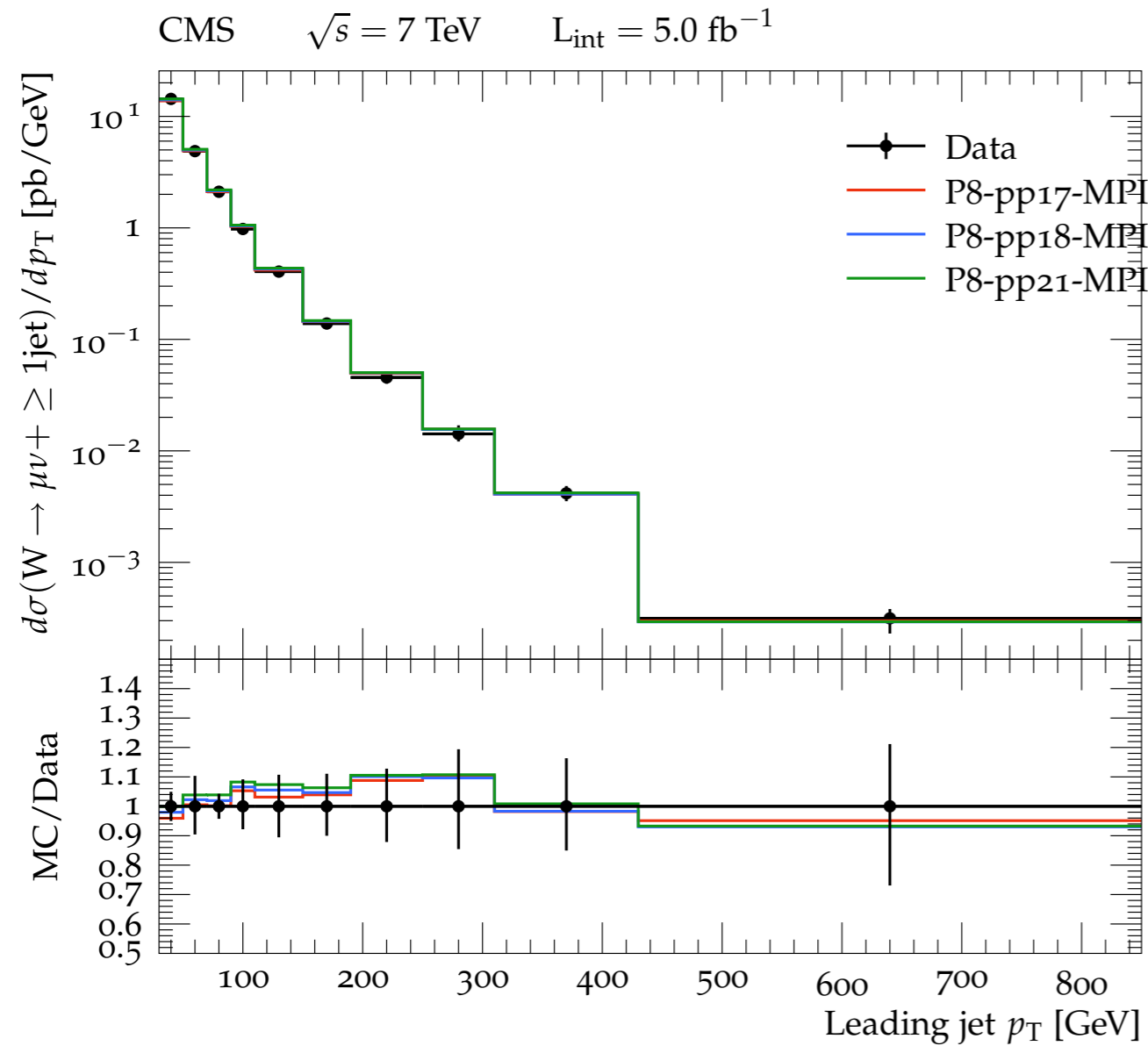
- $\Delta\phi$ between μ and Jet1 (left) : At small $\Delta\phi$ region ($\Delta\phi < 0.5$), pp = 18 and 21 are similar, and the difference between pp=21 and 17 is around 5%
- Leading Jet $|\eta|$ (right) : At small $|\eta|$ region ($|\eta| < 0.5$), three curves are similar

CMS_2014_I1303894



- $\mu\nu + \geq 1\text{Jets } H_T$ (left) : At $H_T < 100$ GeV, three curves are similar
- $\mu\nu + \geq 2\text{Jets } H_T$ (right) : At $H_T < 100$ GeV, pp=18 and 21 are similar, and the difference between 17 and 21 is around 5%

CMS_2014_I1303894



- Leading Jet P_T (left) : At small P_T region ($P_T < 100$ GeV), three curves are similar
- Subleading Jet P_T (right) : At $P_T < 100$ GeV, pp=18 and 21 are similar, and the difference between 17 and 21 is around 5%

Conclusion

- Compared the difference of all the predictions with rivet plugins.
 - predictions of ATLAS_2012_I1083318 are too large compared with 2014 plugins
 - predictions of ATLAS_2014_I1319490 are too small compared with ATLAS 2012 and CMS 2014 plugins
- Compared the difference between different MPI settings in tune $pp = 17$ of rivet plugin CMS_2014_I1303894.
 - MPI effects at small region of variables
 - the effect is not significant compared to the scale uncertainty band
 - however, with rivet plugin ATLAS_2012_I1083318, MPI effects significantly for some variables, such as H_T and leading jet P_T
- Compared the difference between $pp = 17, 18$ and 21 with MPI of rivet plugin CMS_2014_I1303894.
 - at small region of variables, curves of $pp = 18$ and 21 are very similar to each other
 - at small region of variables, the difference of $pp = 17$ and 21 is around 5% for some variables ($\Delta\phi$ between μ and Jet1, H_T of $\mu\nu+\geq 2$ Jets and subleading jet P_T)

Back Up

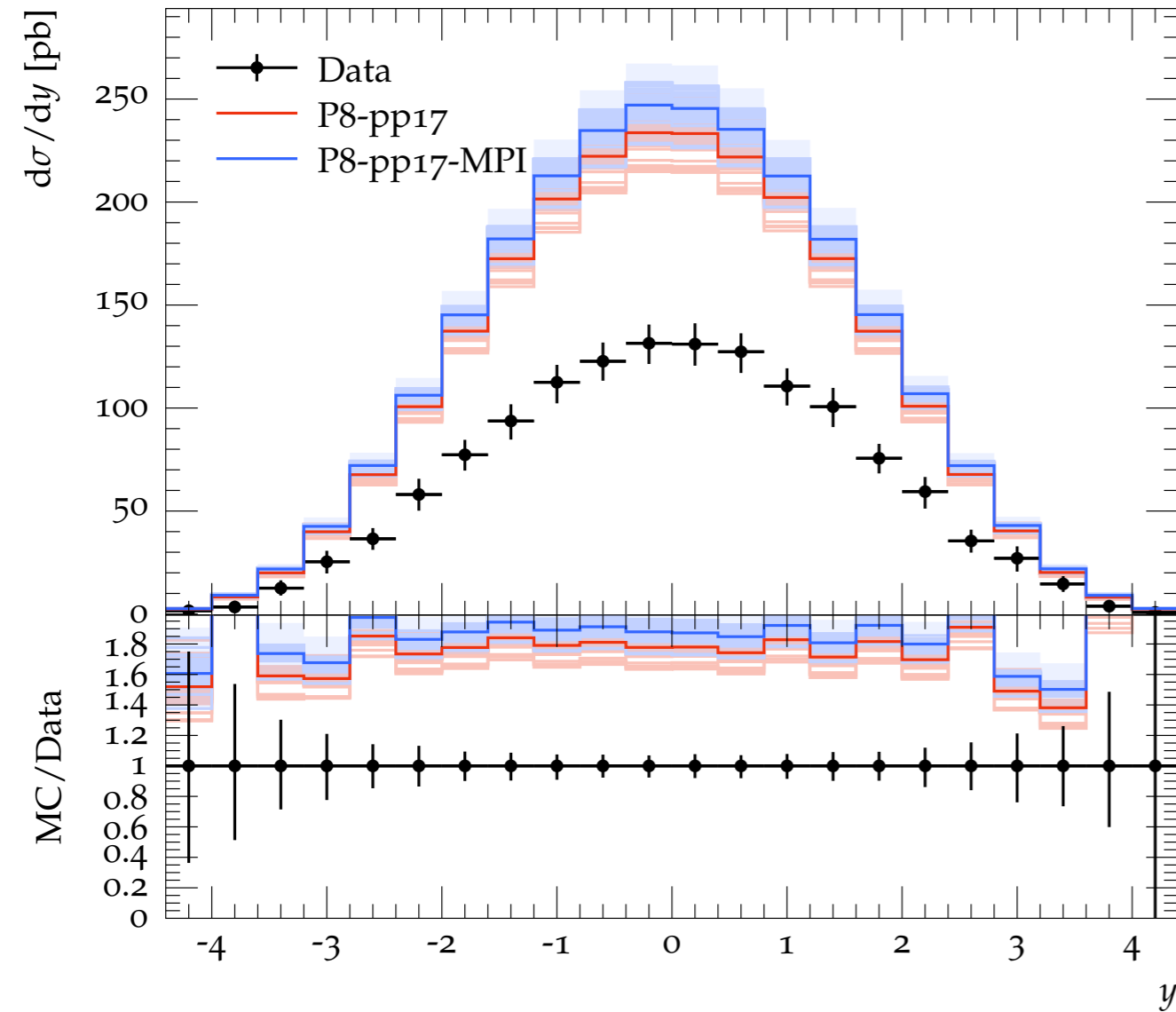
Back Up-Part 2

Settings :

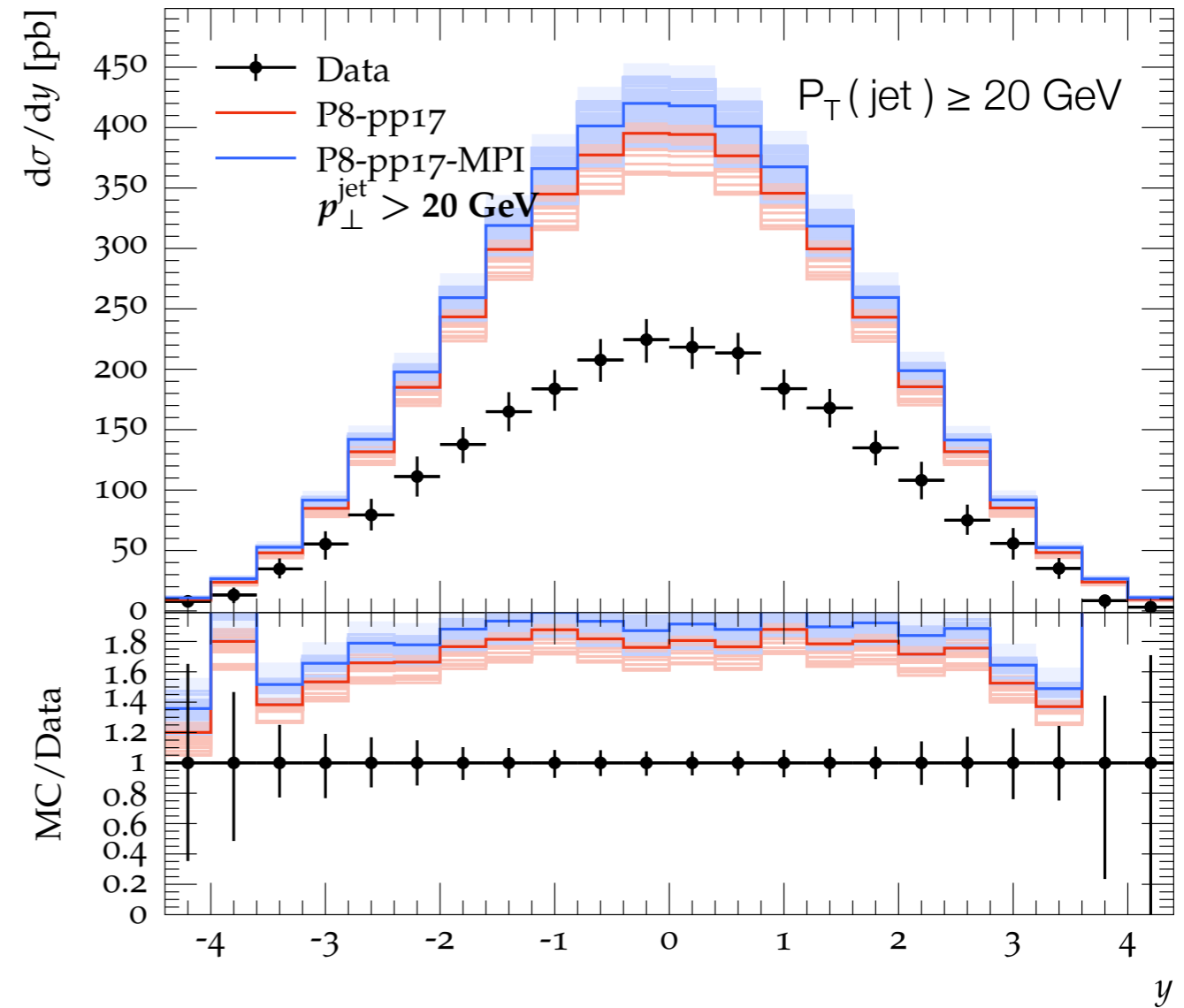
- Rivet Plugin :
 - ATLAS_2012_I1083318
 - ATLAS_2014_I1319490
- Tune :
 - pp = 17
- Multiparton Interactions :
 - MPI = on
 - MPI = off

ATLAS_2012_I1083318

First Jet Rapidity

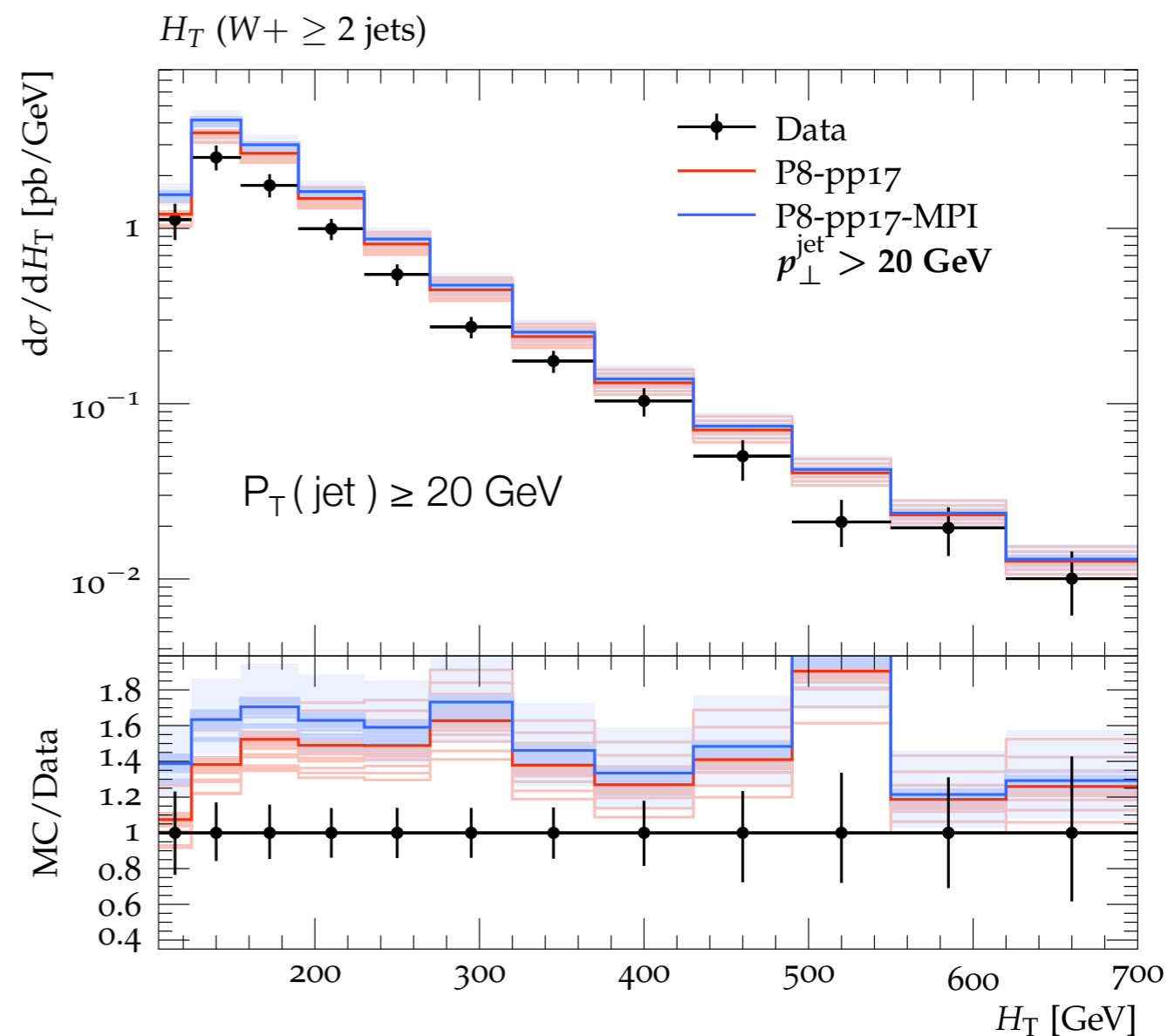
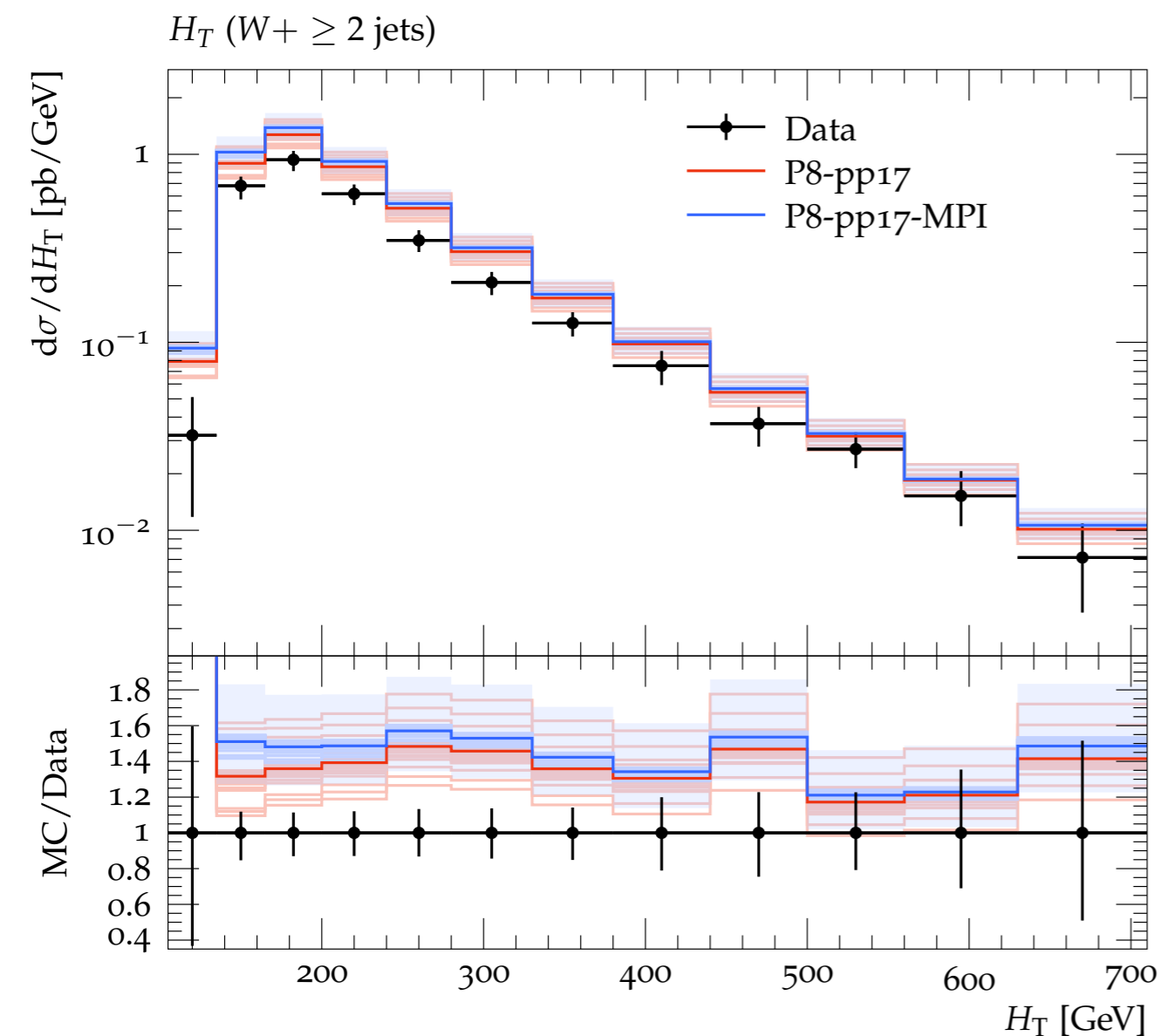


First Jet Rapidity



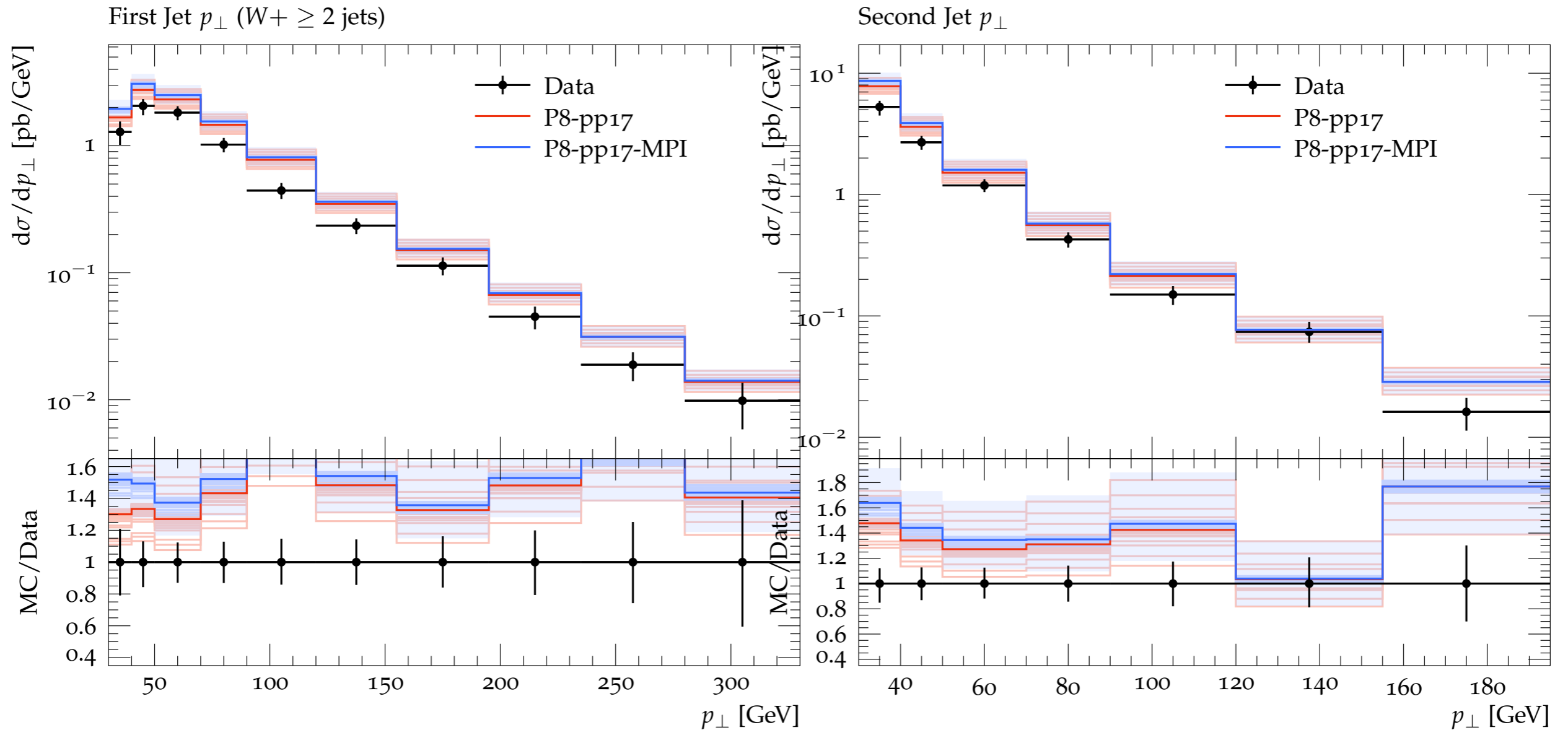
- Leading Jet Rapidity : at small $|y|$ ($|y| < 2$), MPI effects around 10%, which is small compared to the scale uncertainty

ATLAS_2012_I1083318



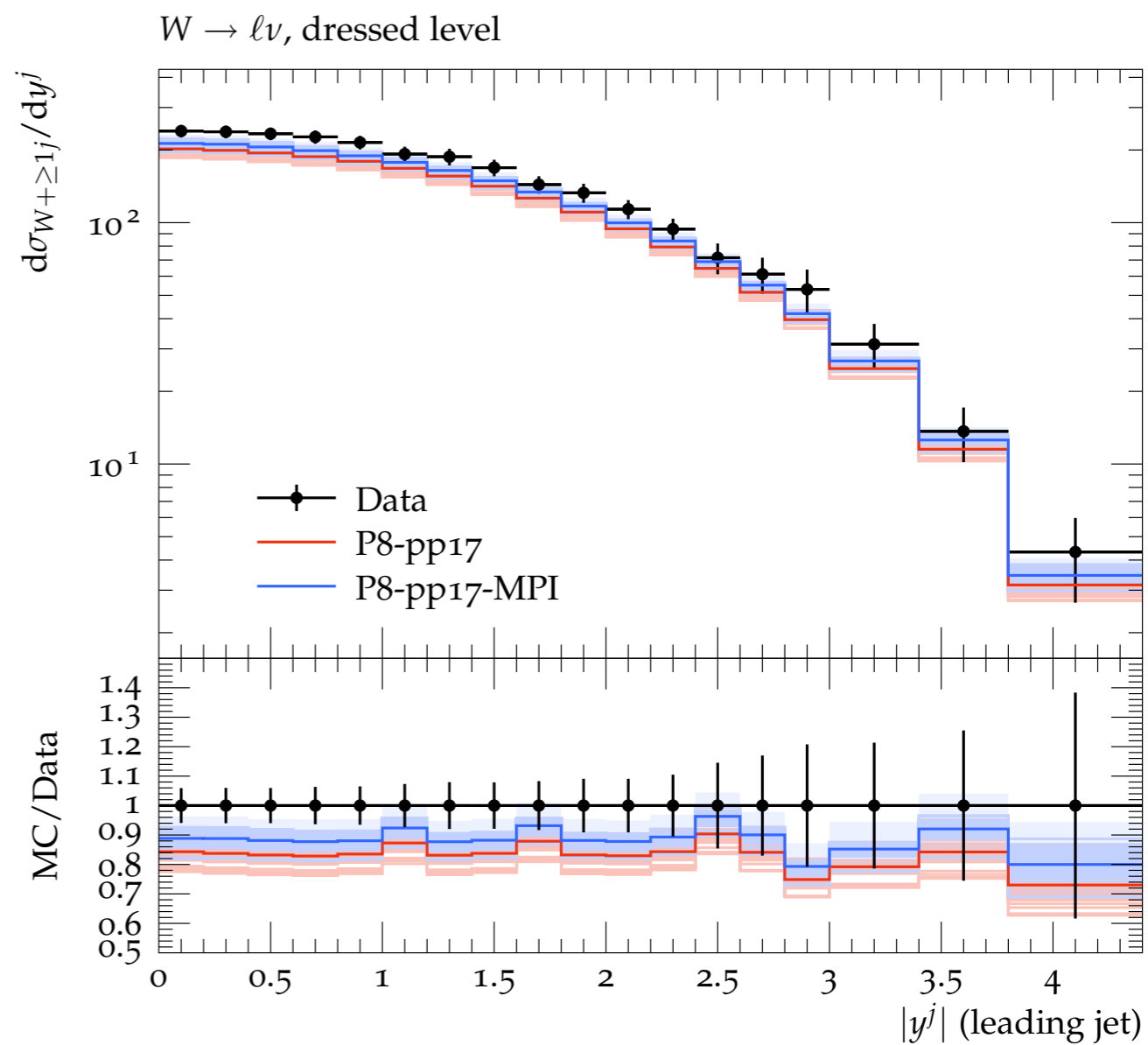
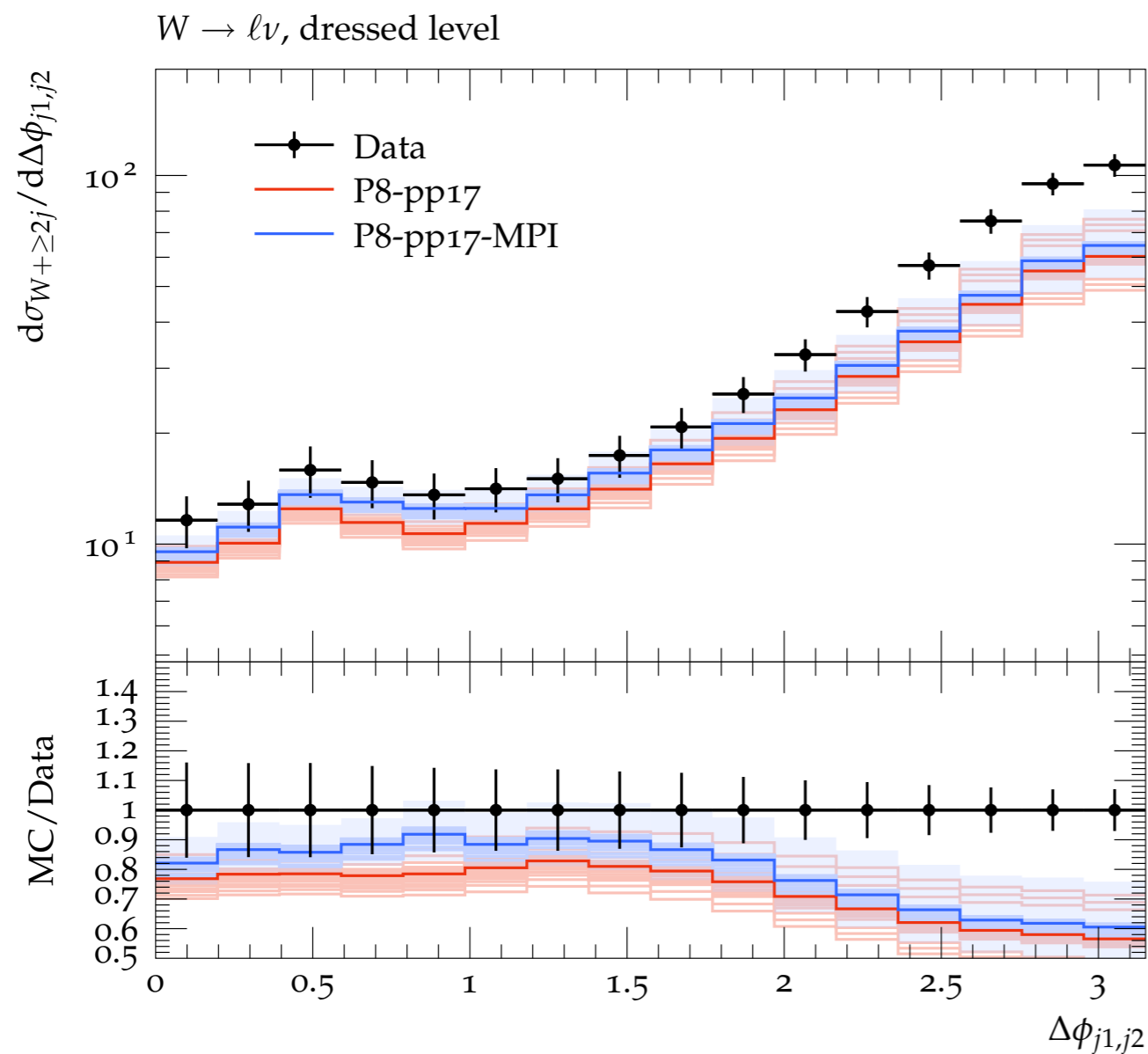
- $W+ \geq 2$ Jets H_T : at small H_T region ($H_T < 200$ GeV), MPI effects around more than 20%, which is significant compared to the scale uncertainty

ATLAS_2012_I1083318



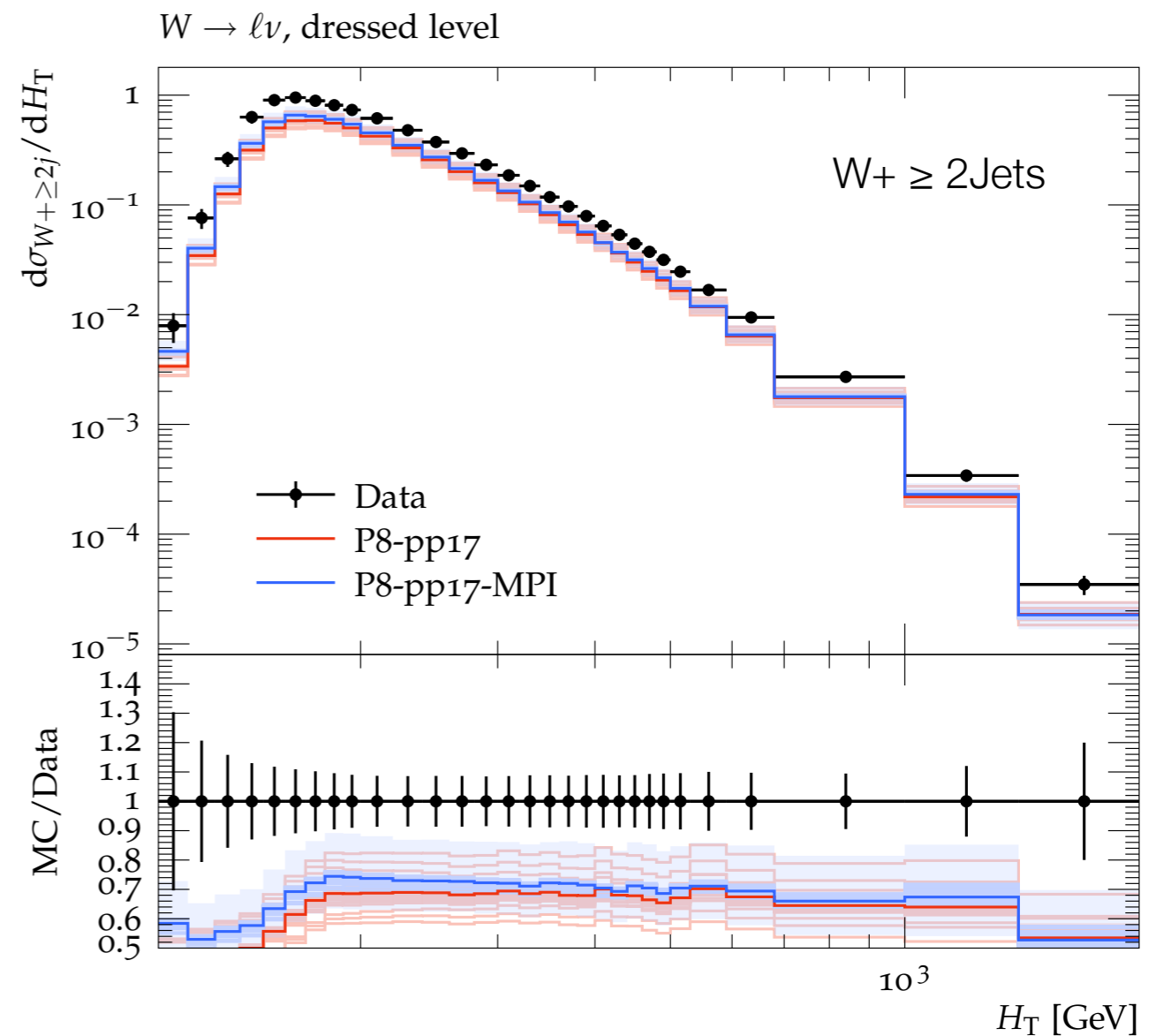
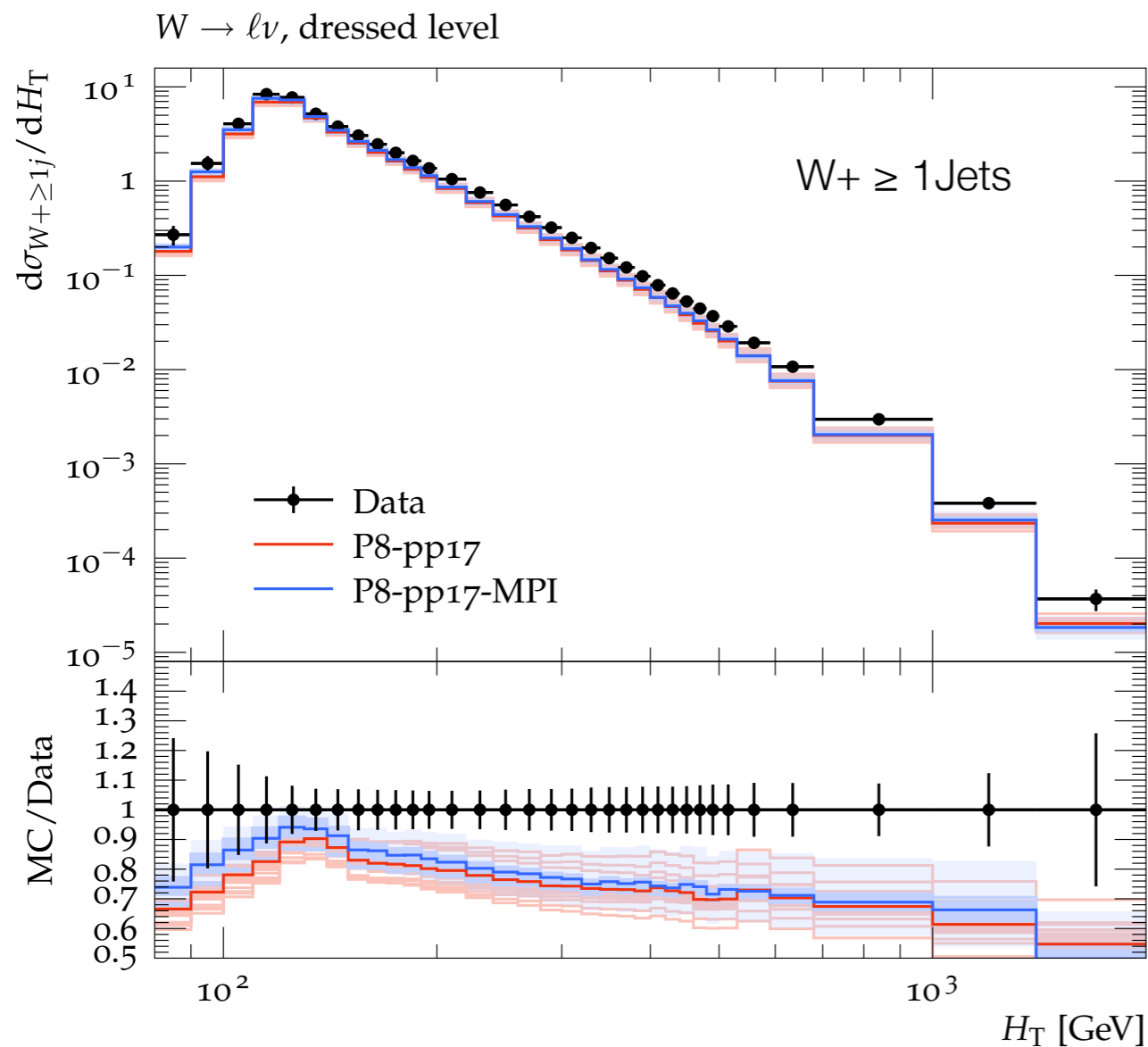
- Leading Jet P_T : at $P_T < 50$ GeV, MPI effects around 20%, which is large compared to the scale uncertainty
- Subleading Jet P_T : at $P_T < 40$ GeV, MPI is small compared to the scale uncertainty (around 20%)

ATLAS_2014_I1319490



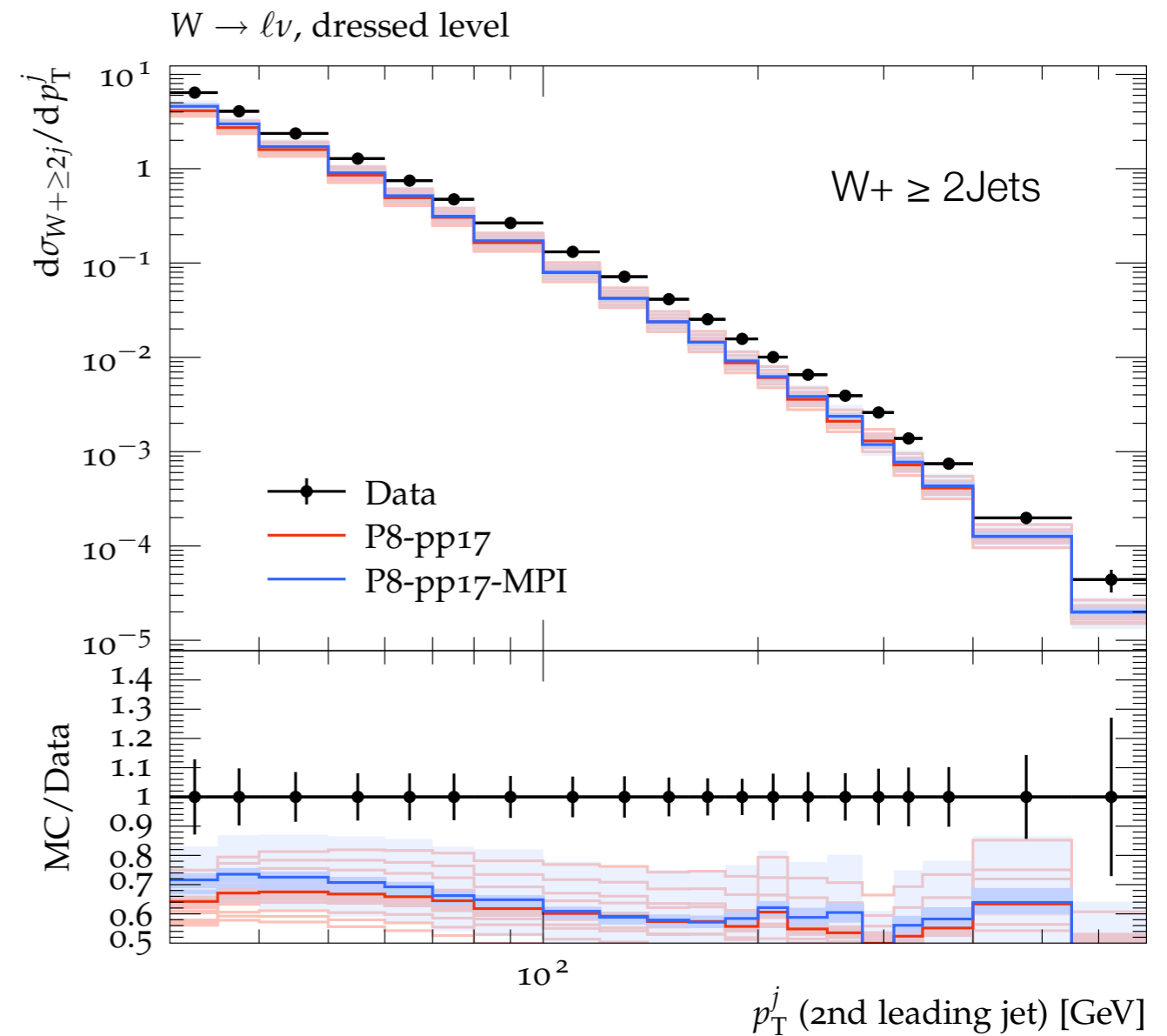
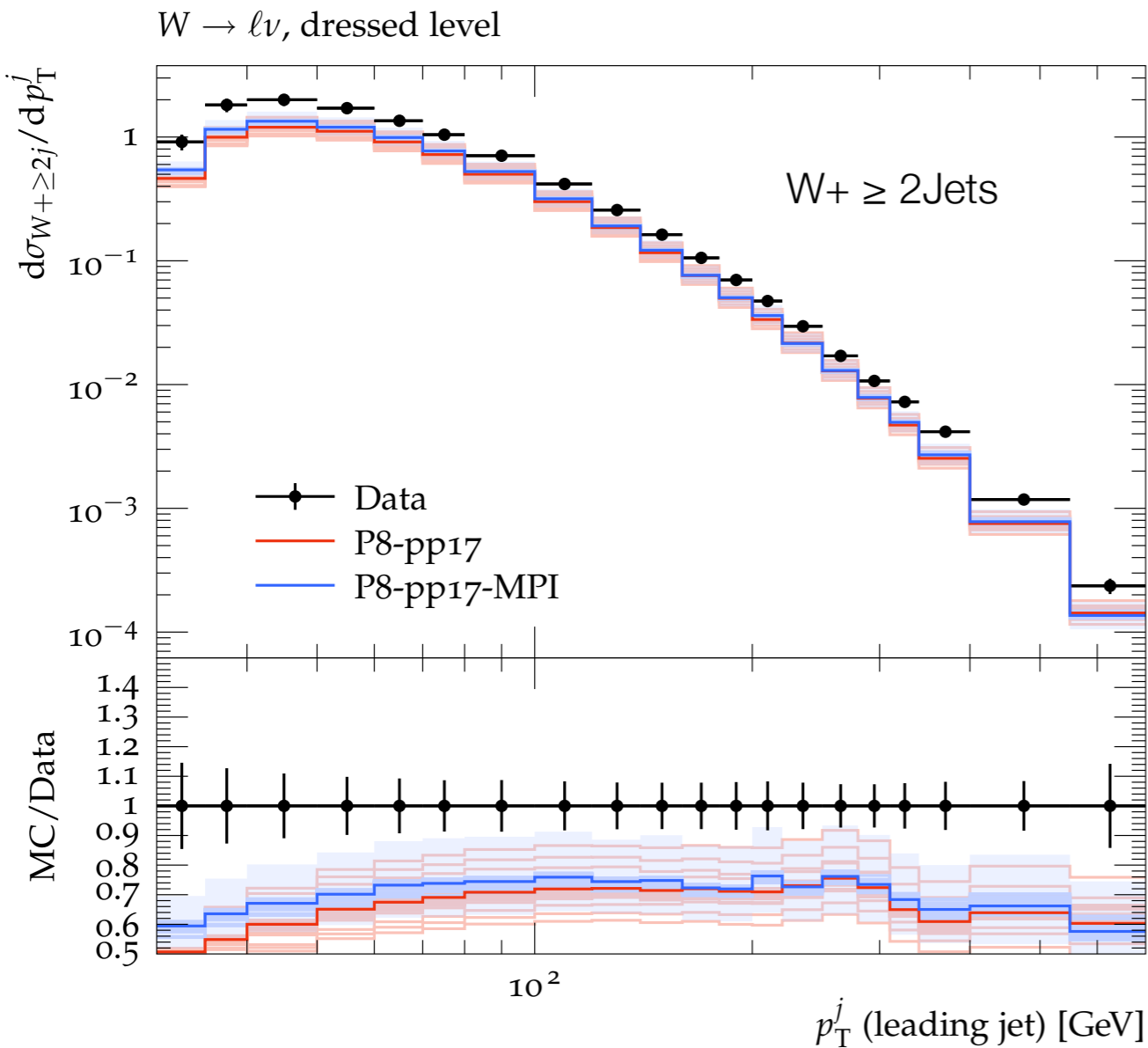
- $\Delta\phi$ between Jet1 and Jet2 : MPI effects around 10% at small $\Delta\phi$ ($\Delta\phi < 1$), which is small compared to the scale uncertainty
- Leading Jet Rapidity : MPI effects around 5%, which is small compared to the scale uncertainty

ATLAS_2014_I1319490



- $W^+ \geq 1\text{Jets}$ and $W^+ \geq 2\text{Jets}$ H_T : MPI effects around 10% at region $H_T < 100$ GeV, which is not significant compared to the scale uncertainty

ATLAS_2014_I1319490



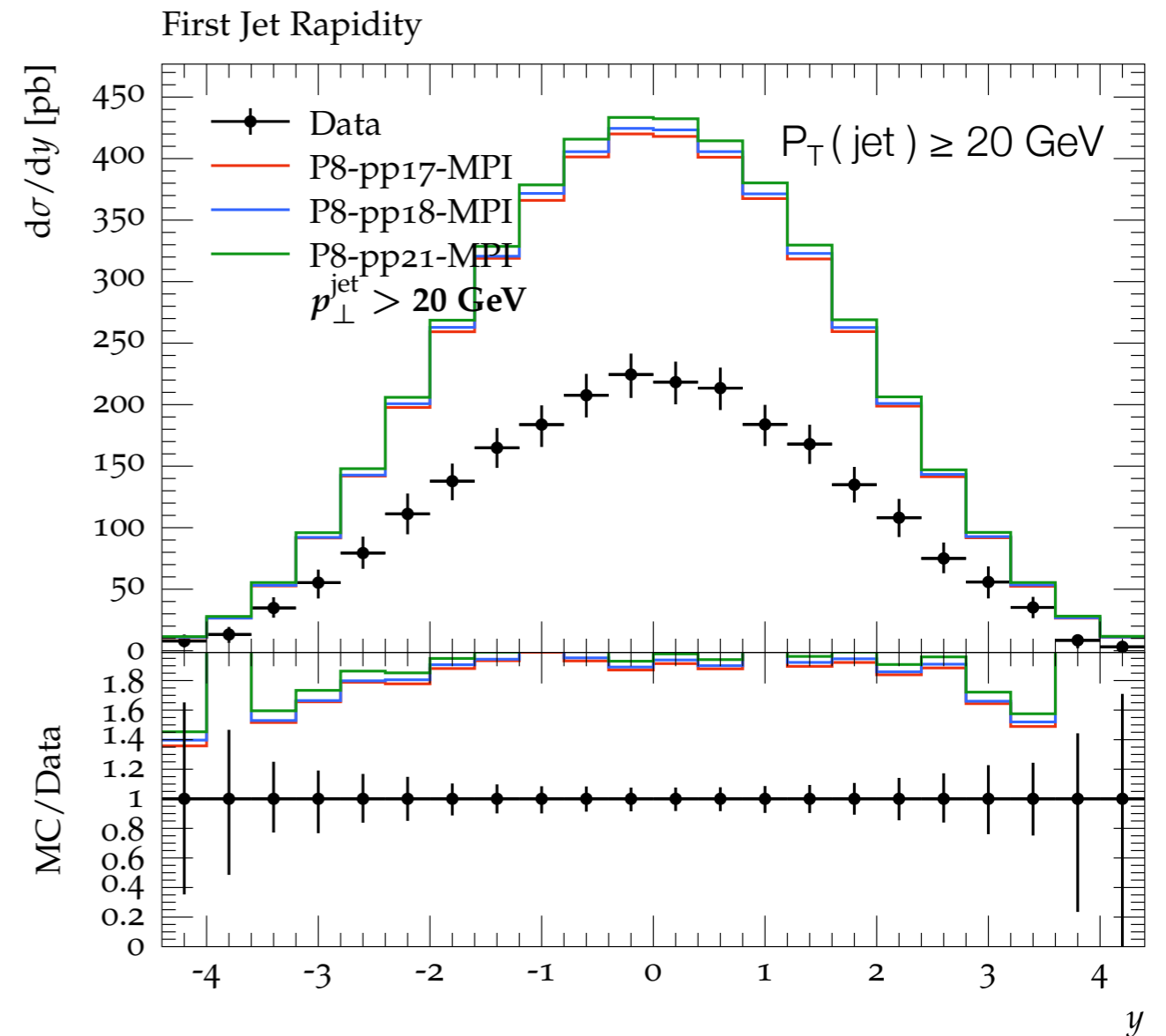
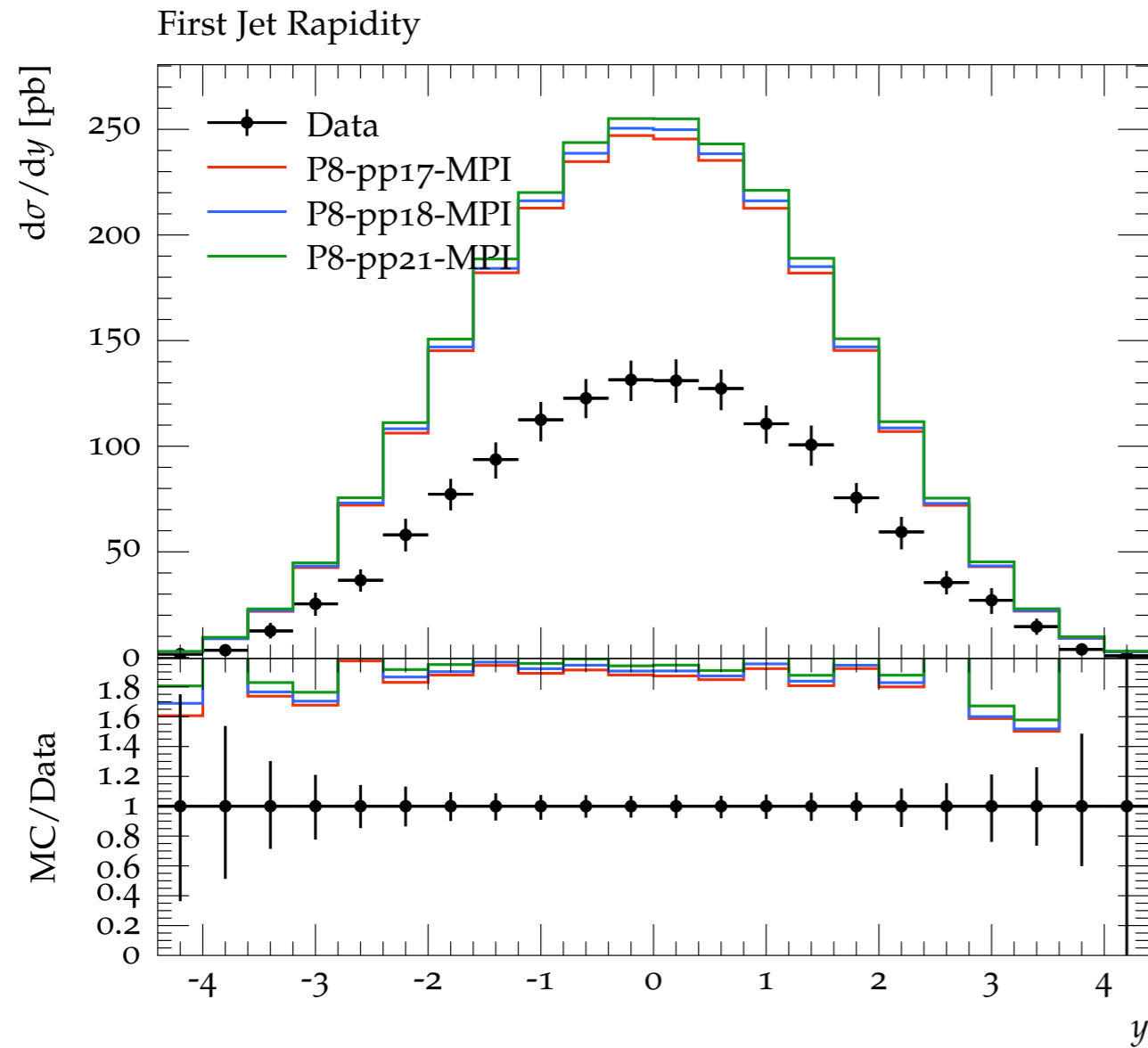
- Leading Jet P_T : at small P_T region ($P_T < 50$ GeV), MPI effects around 10%, which is small compared to the scale uncertainty
- Subleading Jet P_T : at small P_T region ($P_T < 50$ GeV), MPI effects small compared to the scale uncertainty (around 10%)

Back Up-Part 3

Settings :

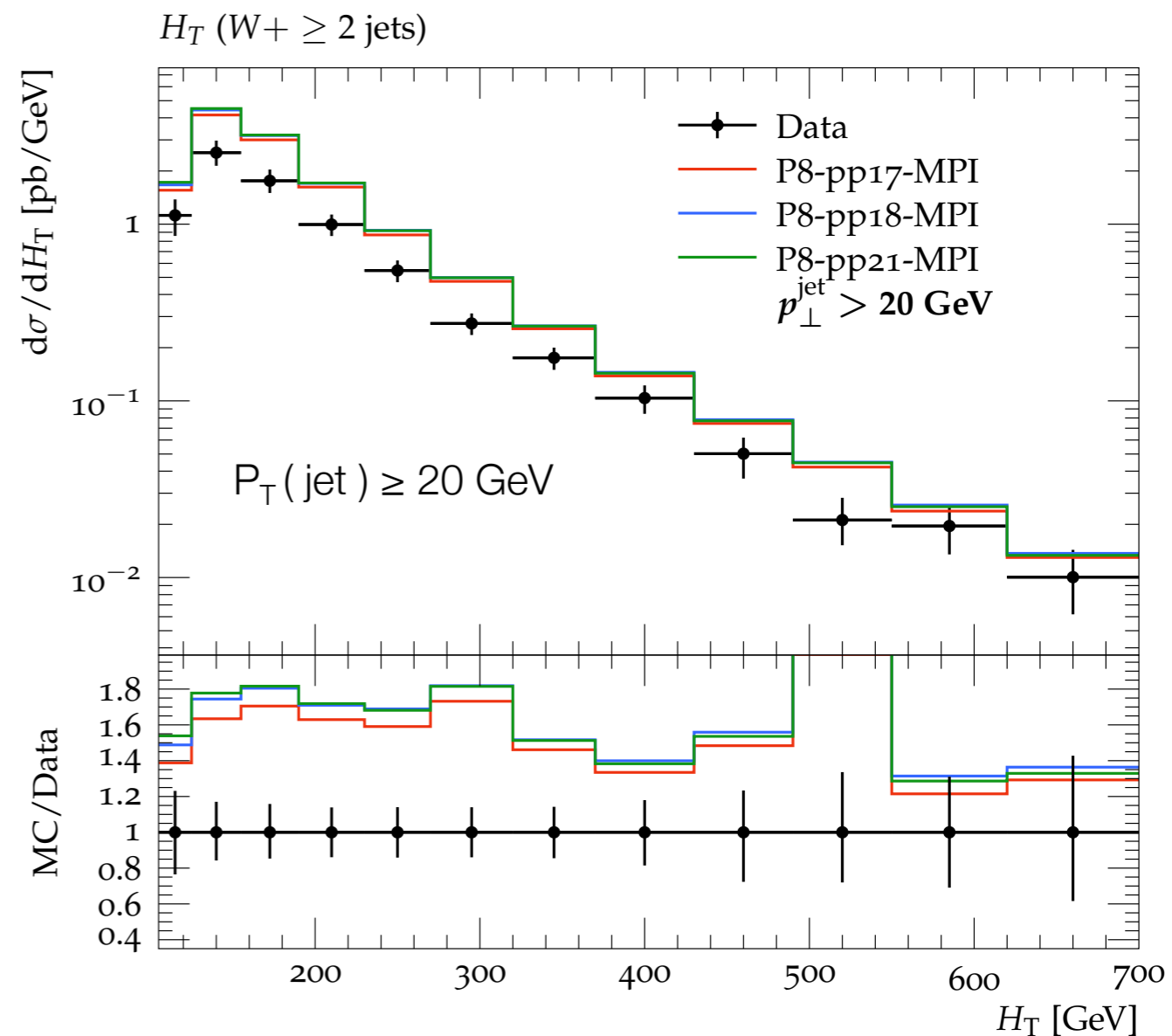
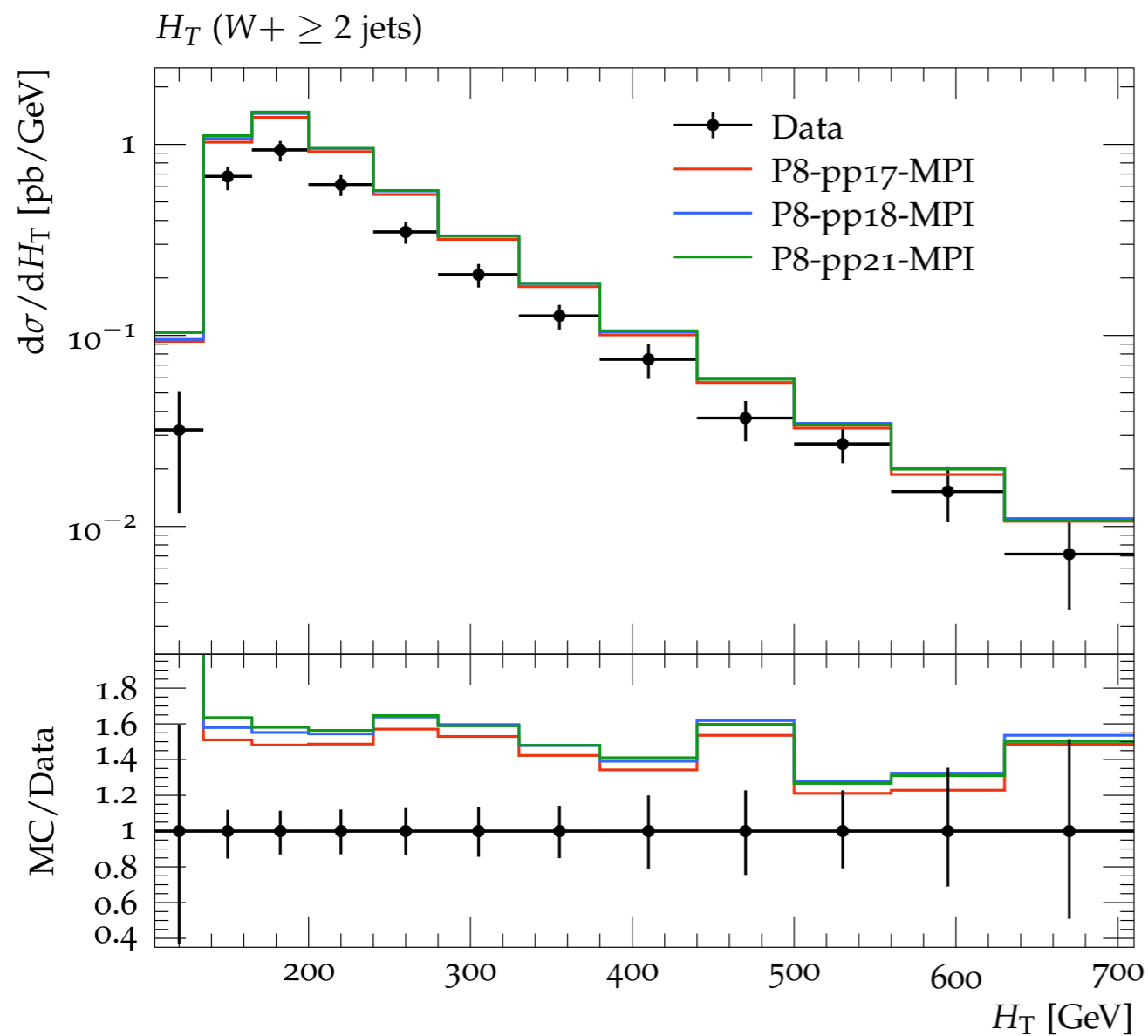
- Rivet Plugin :
 - ATLAS_2012_I1083318
 - ATLAS_2014_I1319490
- Tune :
 - pp = 17
 - pp = 18
 - pp = 21
- Multiparton Interactions :
 - MPI = on

ATLAS_2012_I1083318



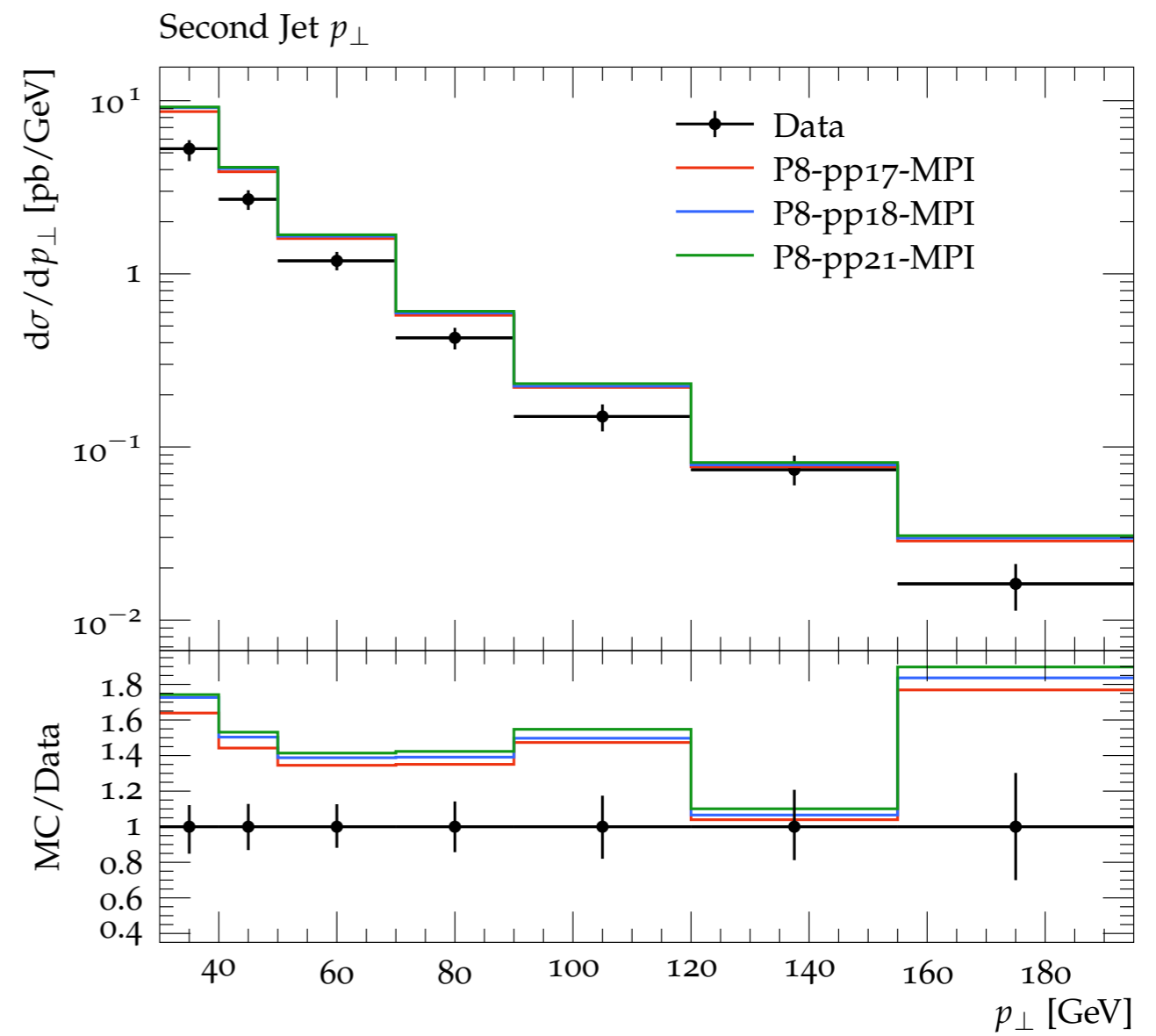
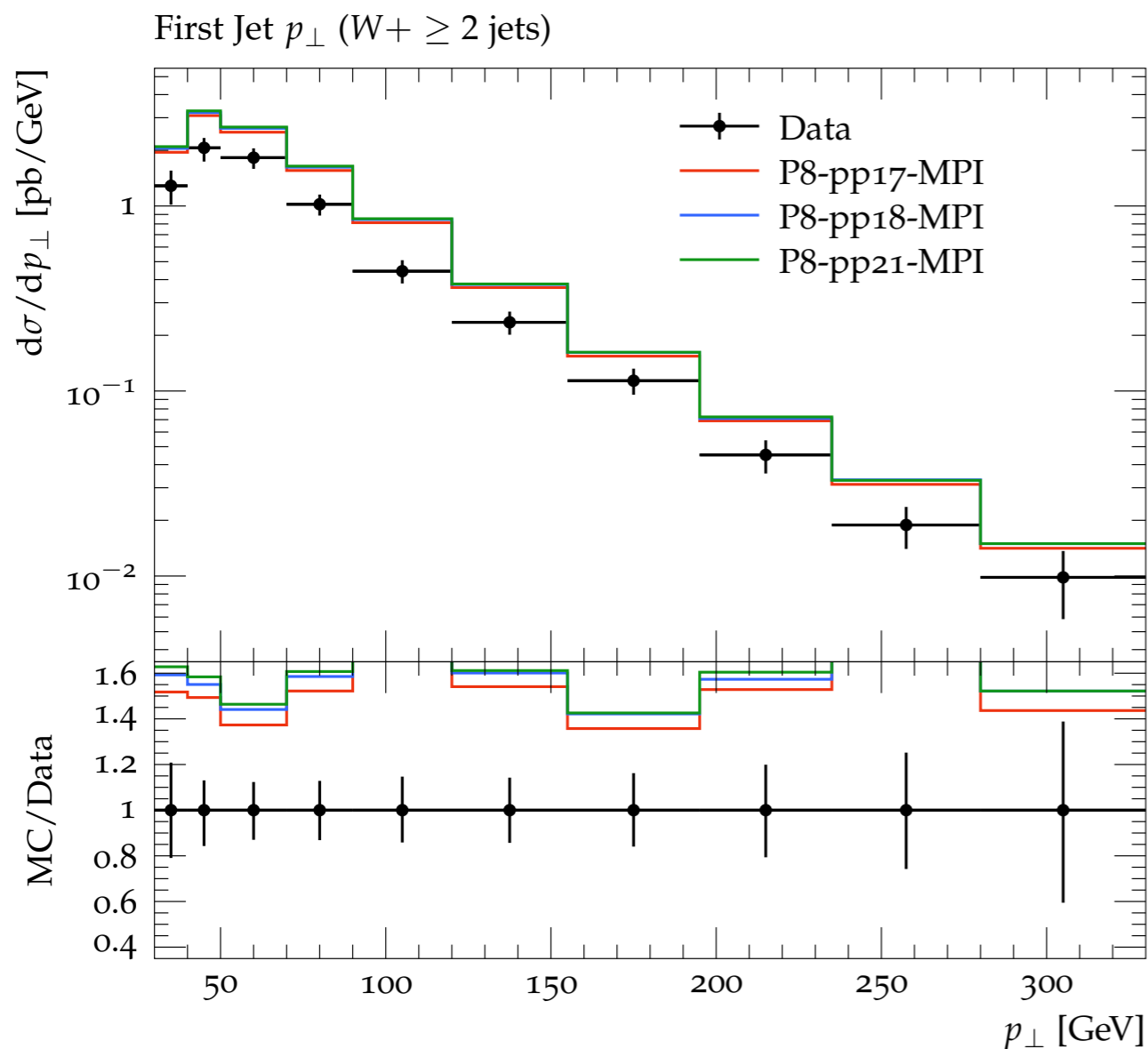
- Leading Jet Rapidity : at small $|y|$ ($|y| < 2$), pp = 17, 18 and 21 are similar ($\leq 2\%$)

ATLAS_2012_I1083318



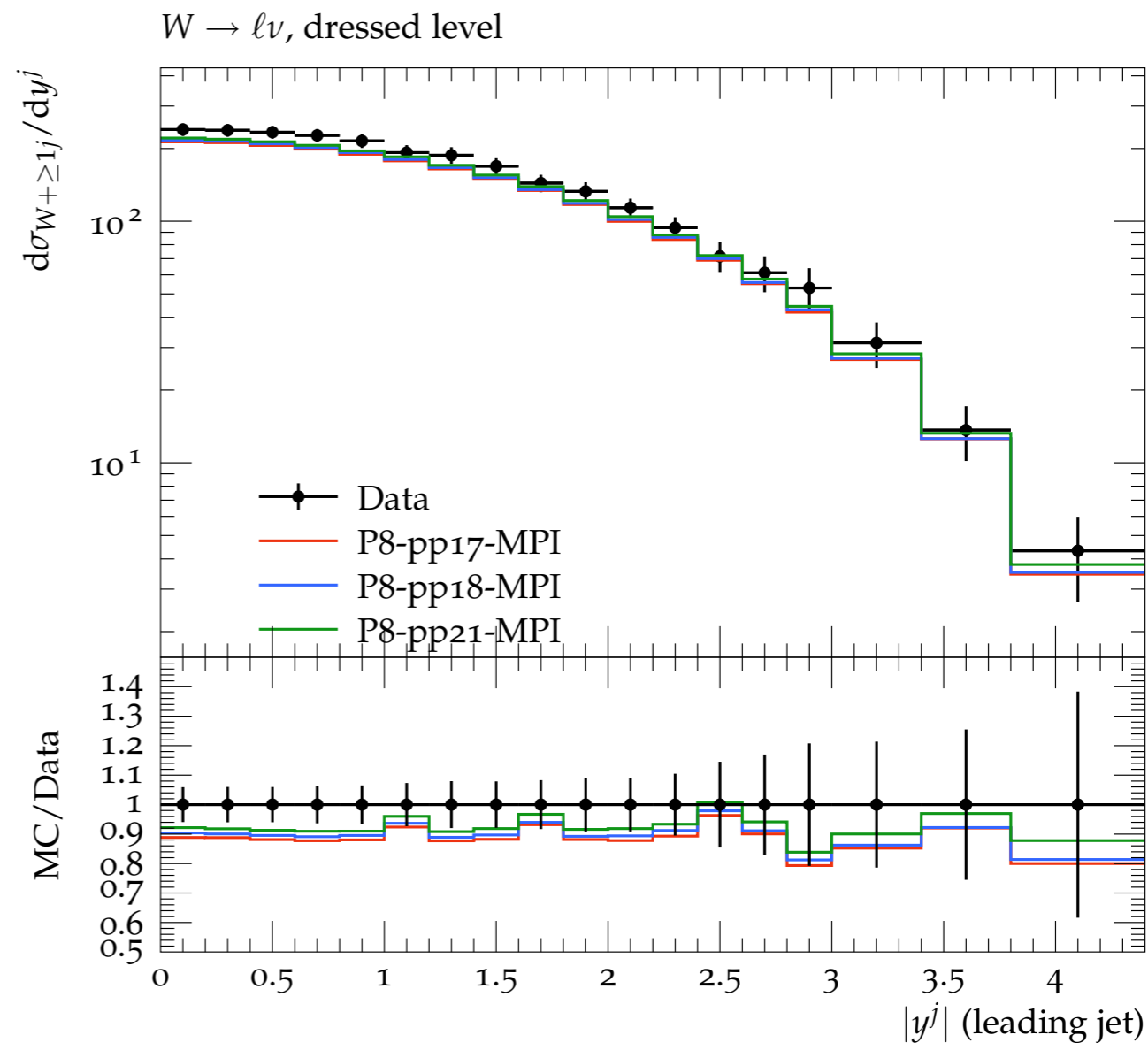
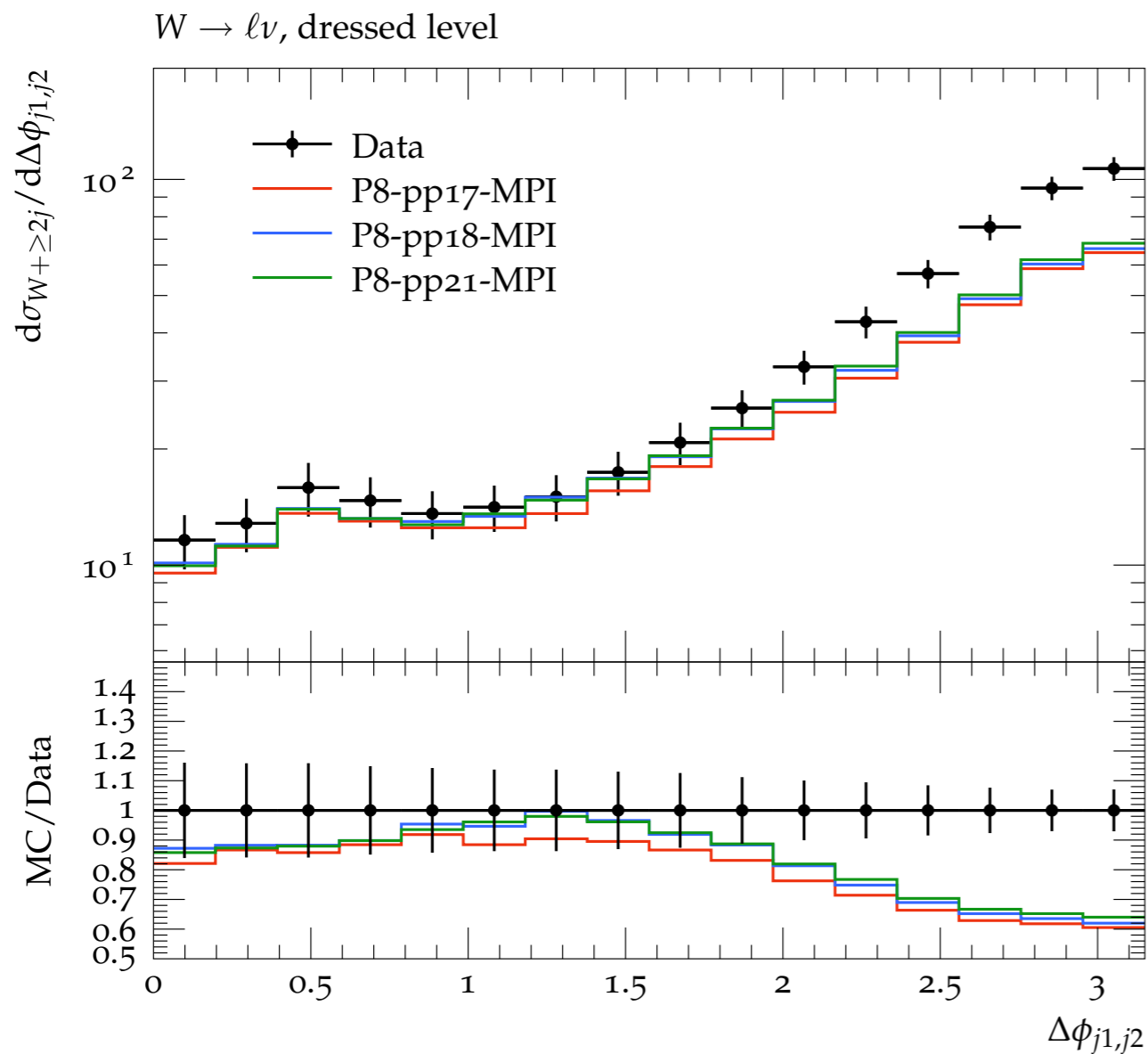
- $W_{+ \geq 2 \text{ Jets}} H_T$: at small H_T region ($H_T < 200 \text{ GeV}$), pp=18 and 21 are similar, and the difference between 17 and 21 is around 20%

ATLAS_2012_I1083318



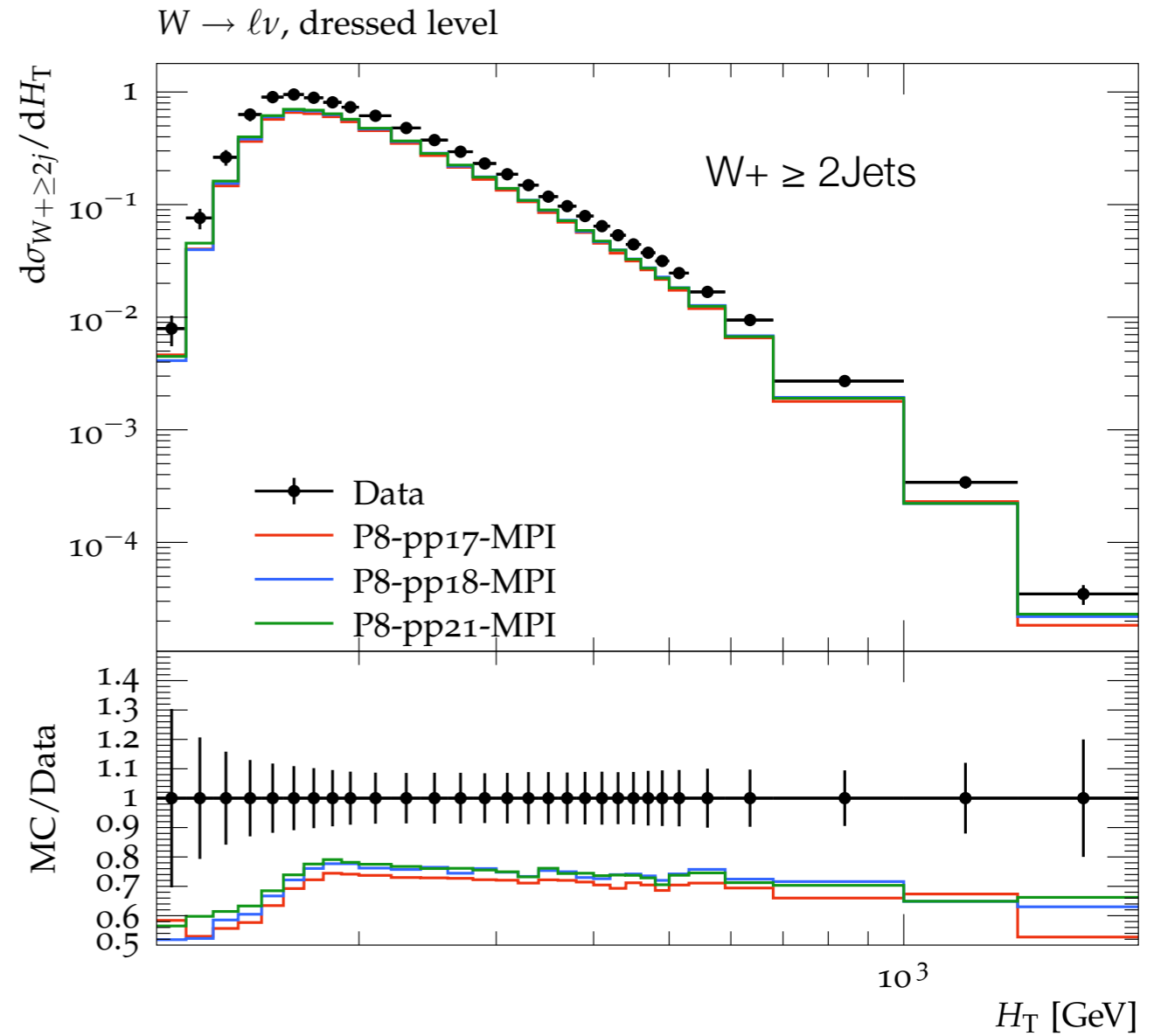
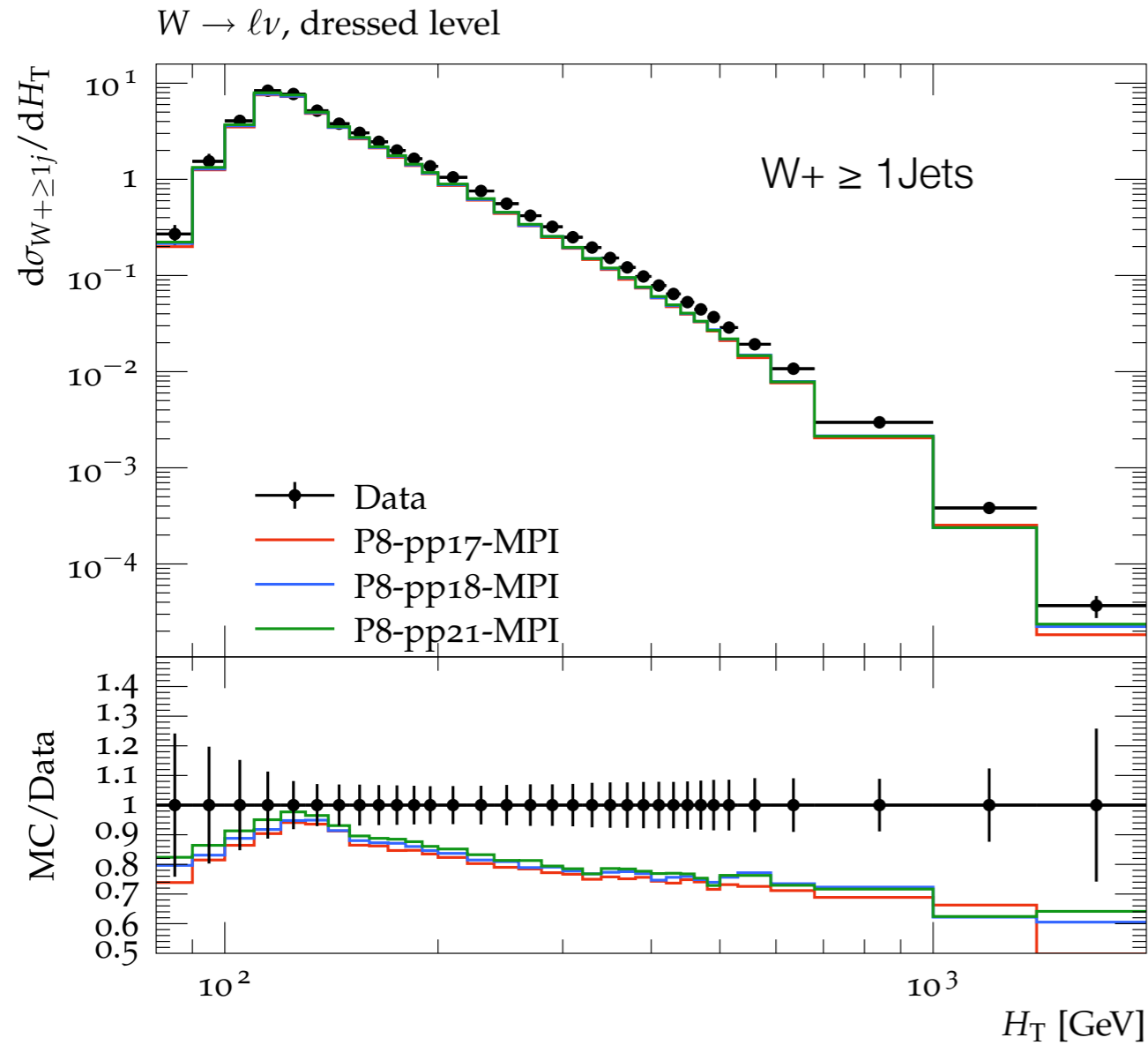
- Leading Jet P_T : at $P_T < 50$ GeV, pp = 18 and 21 are similar, and the difference between pp=21 and 17 is around 10%
- Subleading Jet P_T : at $P_T < 40$ GeV, pp = 18 and 21 are similar and the difference between pp=21 and 17 is around 10%

ATLAS_2014_I1319490



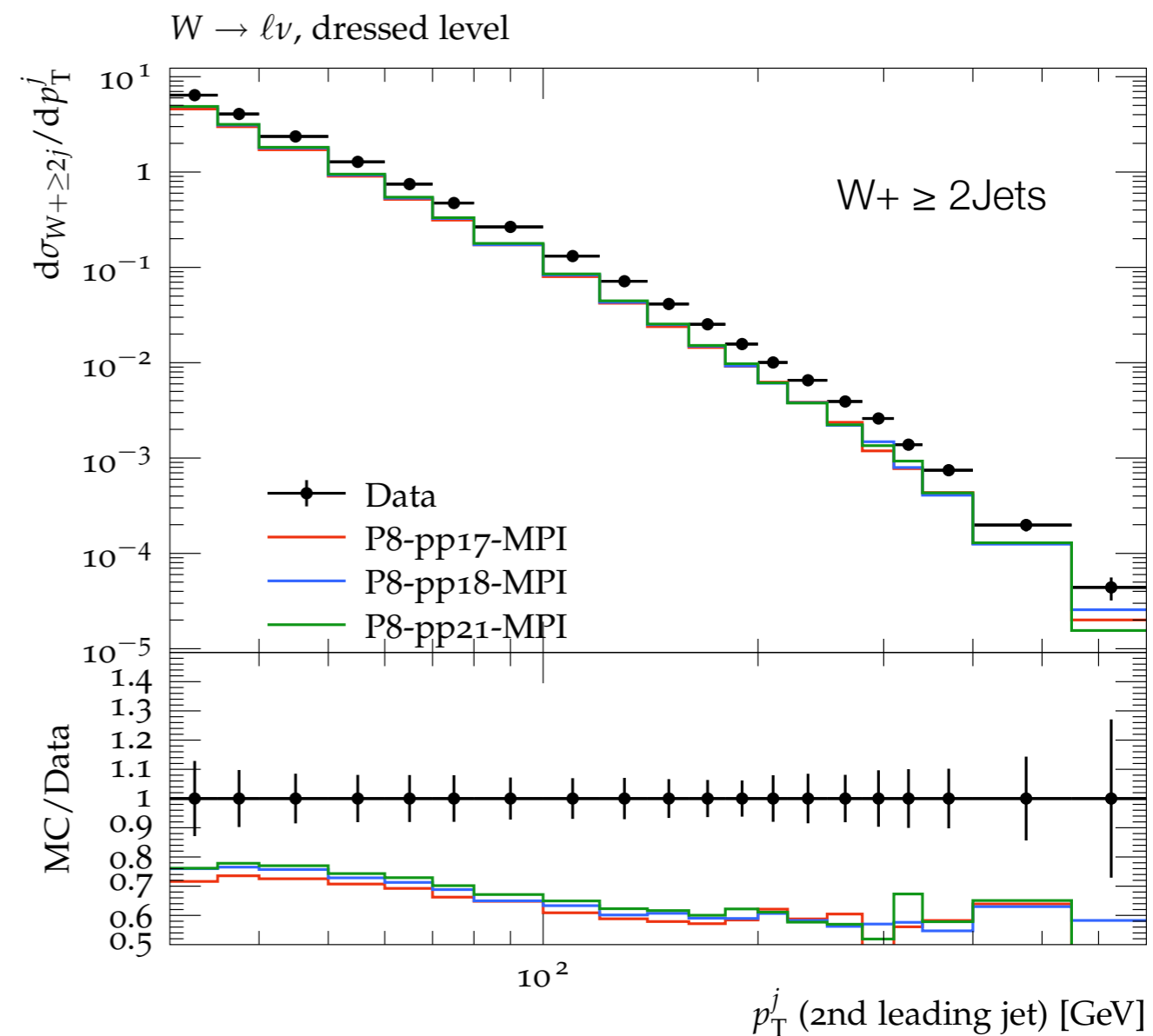
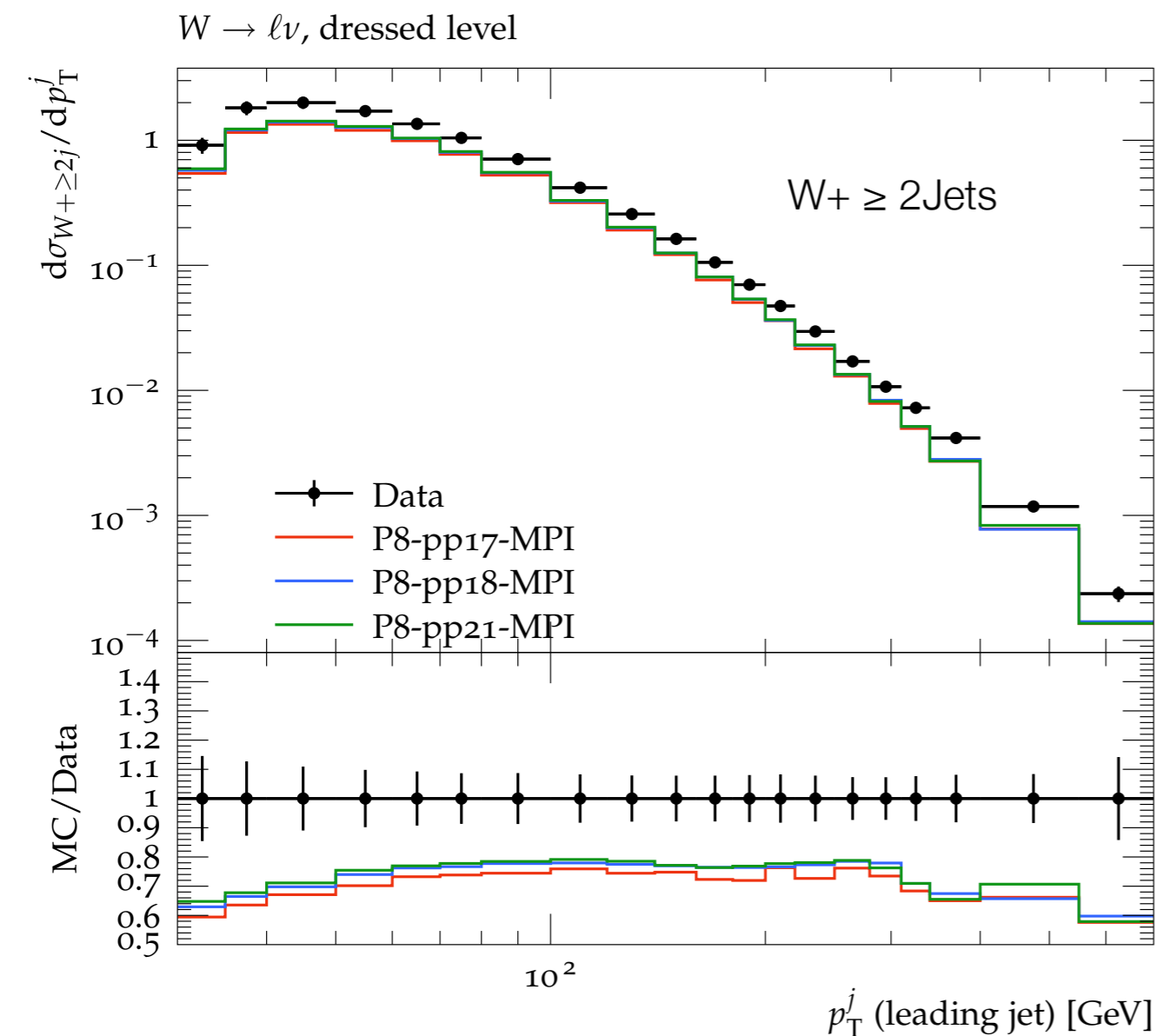
- $\Delta\phi$ between Jet1 and Jet2 : at small $\Delta\phi$ region ($\Delta\phi < 0.5$), pp=18 and 21 are similar, and the difference between pp = 21 and 17 is around 5%
- Leading Jet Rapidity : at small $|y|$ ($|y| < 0.5$), pp = 17, 18 and 21 are similar ($\leq 2\%$)

ATLAS_2014_I1319490



- $W_+ \geq 1\text{Jets}$ and $W_+ \geq 2\text{Jets}$ H_T : the difference between pp = 17 and 21 is around 10% at small H_T region ($H_T < 100$ GeV)

ATLAS_2014_I1319490



- Leading and Subleading Jet P_T : at $P_T < 100$ GeV, pp=18 and 21 are similar, and the difference between 17 and 21 is less than 5%