Recent jet measurements by ATLAS

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DESY

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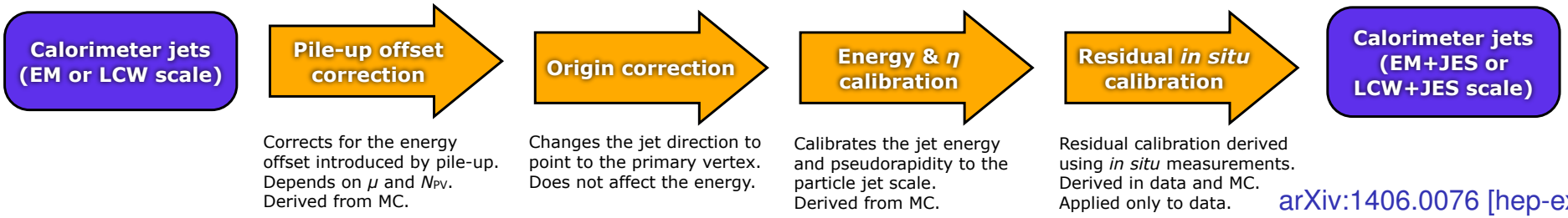
Jet measurements. JES uncertainty



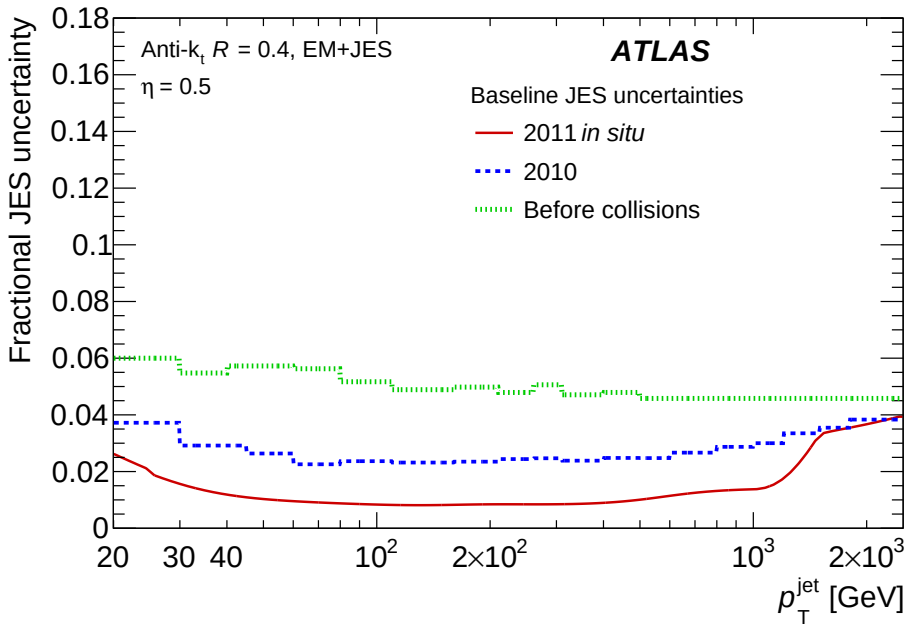
arXiv:1406.0076 [hep-ex]

Three jet cross-section measurements with the same JES systematics

- Dijet production JHEP05(2014)059
- Inclusive jet cross-section arXiv:1410.8857
- Three-jet mass spectrum arXiv:1411.1855

Jets are defined with anti-k_t alg. two jet sizes: R=0.4 and R=0.6

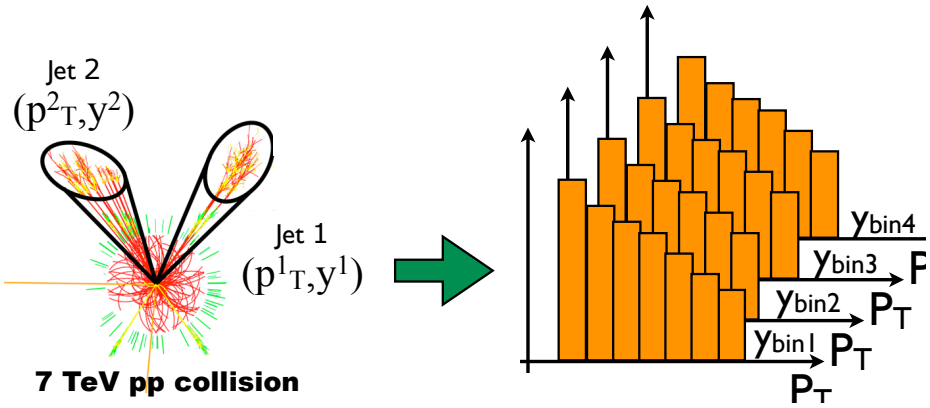
Combination of in situ measurements (Z/γ–jet, multi-jet)

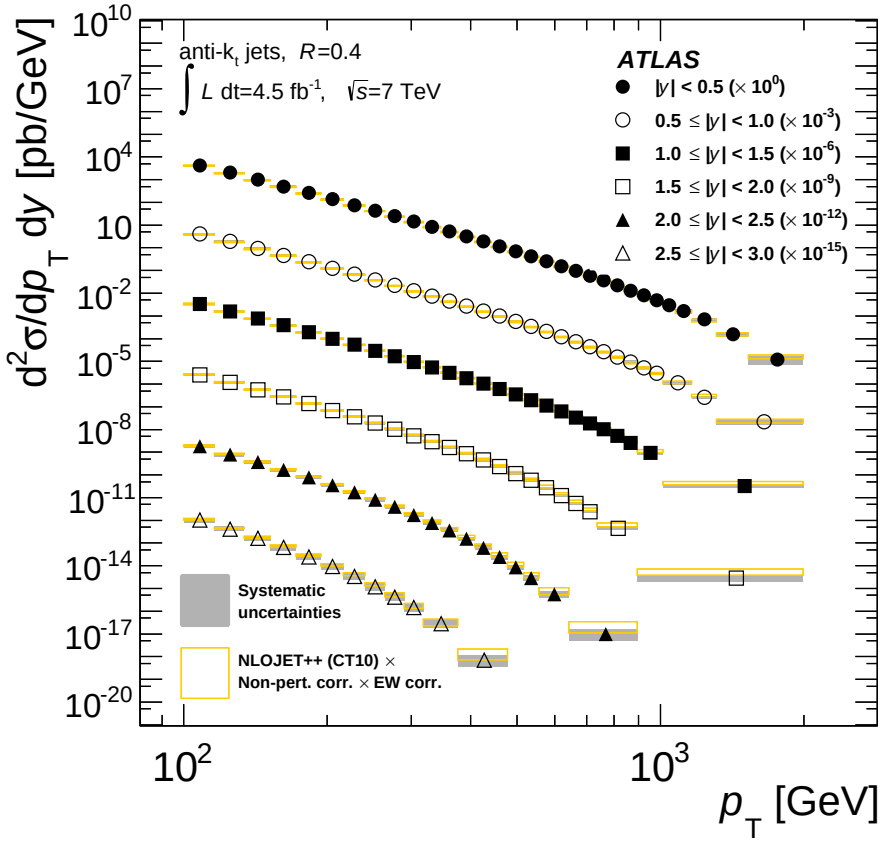


$\sim 5^{\times}$ reduction in the JES uncertainty

Jet measurements. Inclusive jet p_T

arXiv:1410.8857





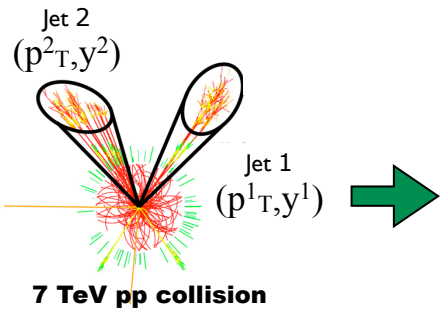
- $p_T > 100$ GeV, binned according to resolution
- $|y| < 3$, six rapidity bins, in steps of 0.5
- Theory: NLOJET++ $\times$ NPC $\times$ EW
- non-pert. correction : Pythia/Herwig with various tunes

- theory is corrected for EW effects

Good agreement between data and theory over 7 orders of magnitude

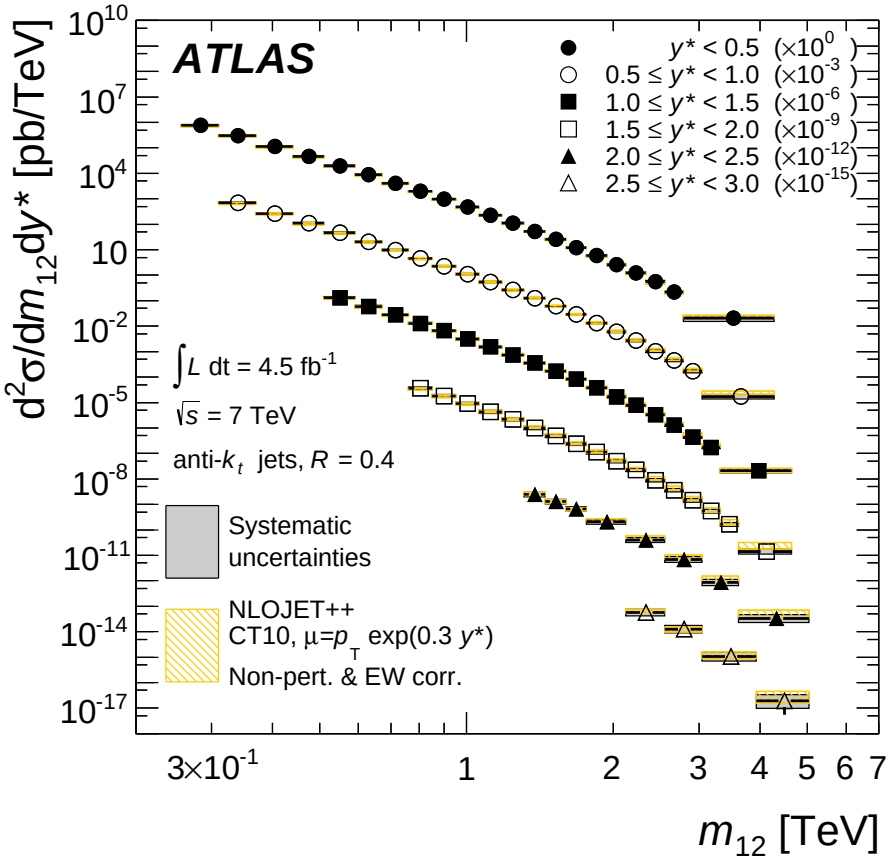
Jet measurements. Dijet mass

JHEP05(2014)059



$$m_{12} = \sqrt{p_1 + p_2}$$
$$y^* = |y_1 - y_2|/2$$

- $p_T^1 > 100$ GeV, $p_T^2 > 50$ GeV, $|y^{jet}| < 3$
- $|y^*| < 3$, six rapidity separation bins, in steps of 0.5
- Theory: NLOJET++ $\times$ NPC $\times$ EW
- non-pert. correction : Pythia/Herwig with various tunes

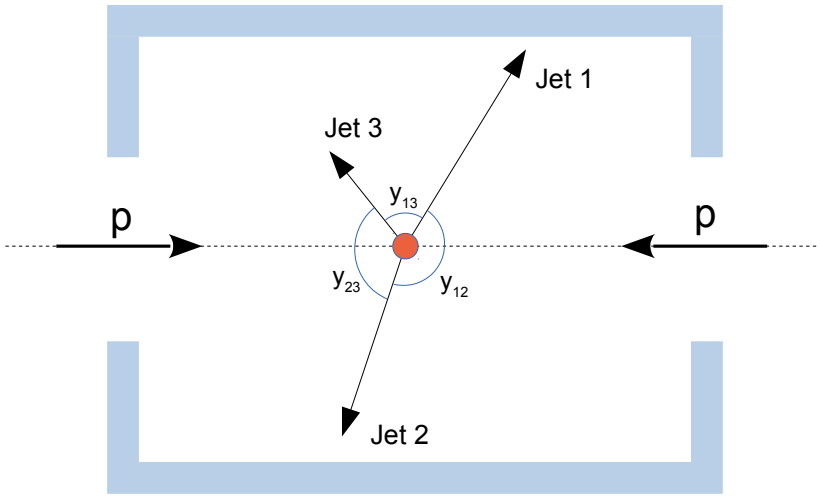


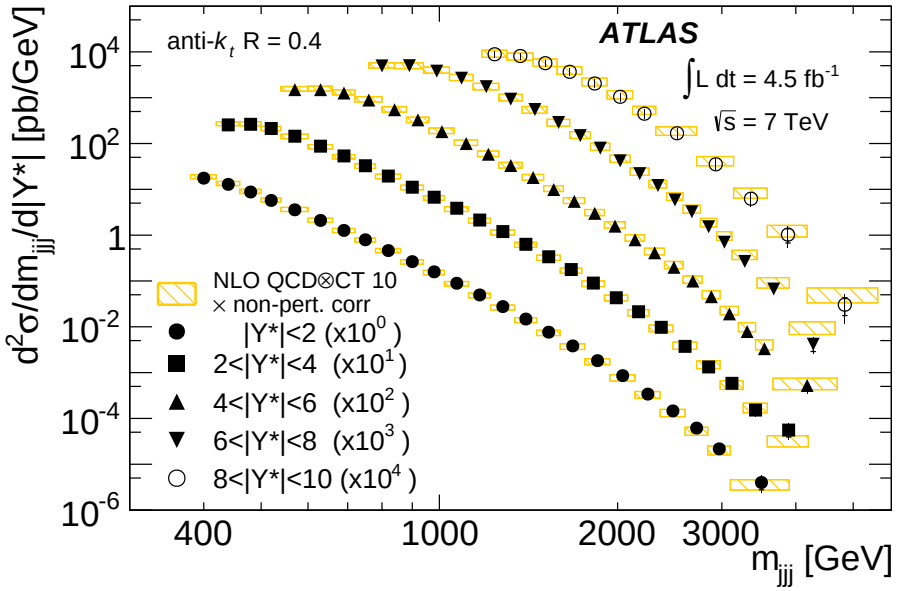
- theory is corrected for EW effects

Good agreement between data and theory over 7 orders of magnitude

Jet measurements. Three-jet mass

arXiv:1411.1855



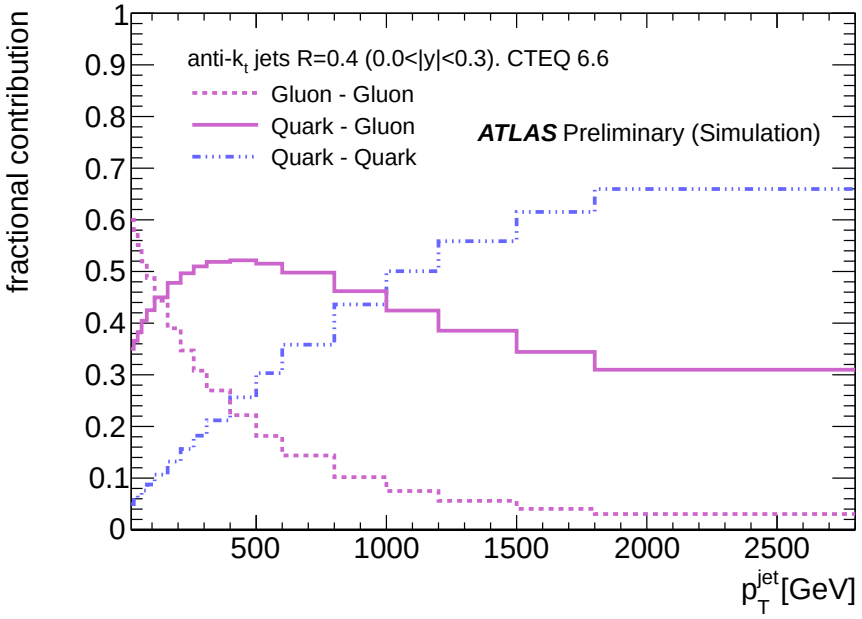


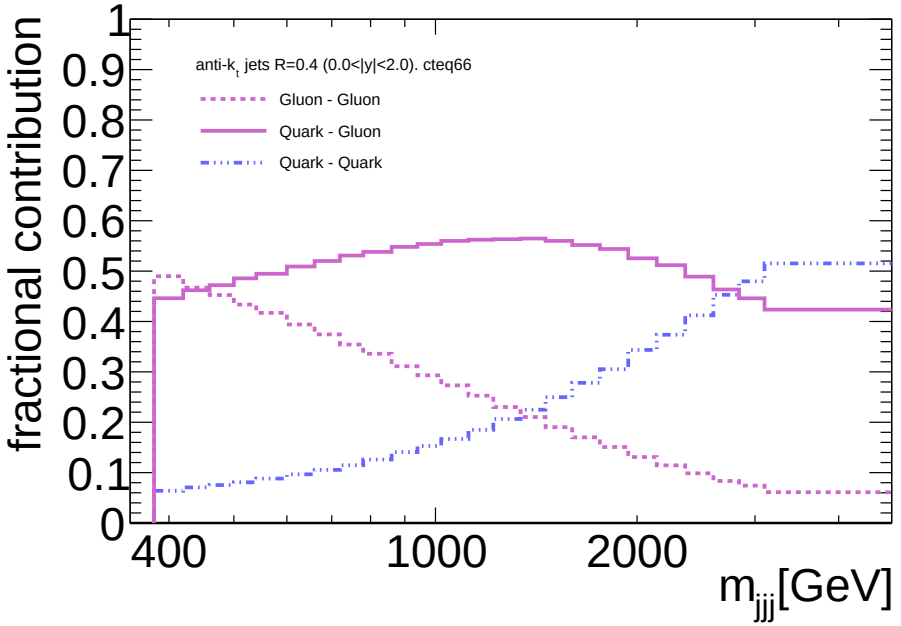
- $p_{\mathrm{T}}^1 > 150$ GeV, $p_{\mathrm{T}}^2 > 100$ GeV, $p_{\mathrm{T}}^3 > 50$ GeV, $|y^{jet}| < 3$
- $Y^* = |y_1 - y_2| + |y_1 - y_3| + |y_2 - y_3|$
- $|Y^*| < 10$, five rapidity separation bins, in steps of 2

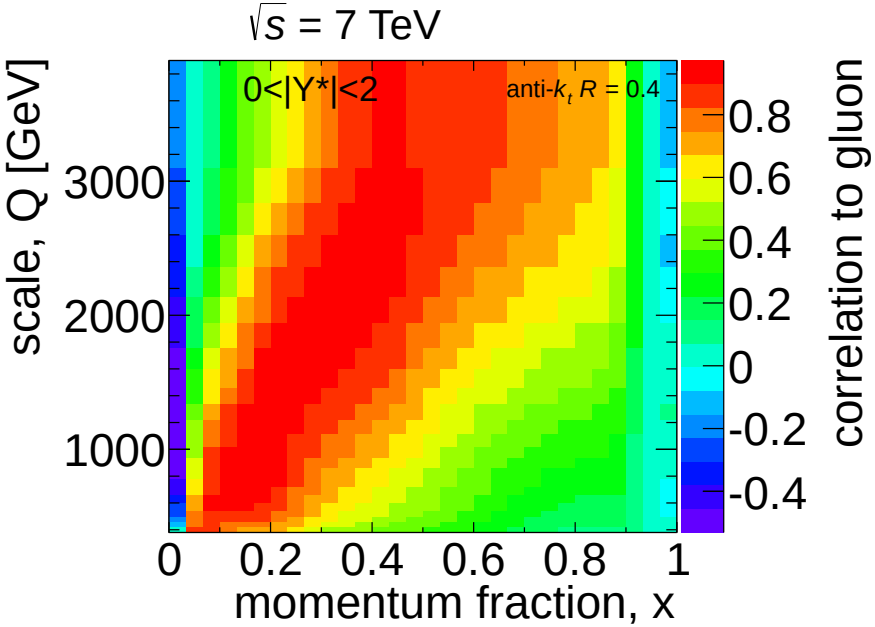
- Theory: NLOJET++ × NPC
- non-pert. correction : Pythia/Herwig with various tunes
- no EW correction is available

Good agreement between data and theory over 6 orders of magnitude

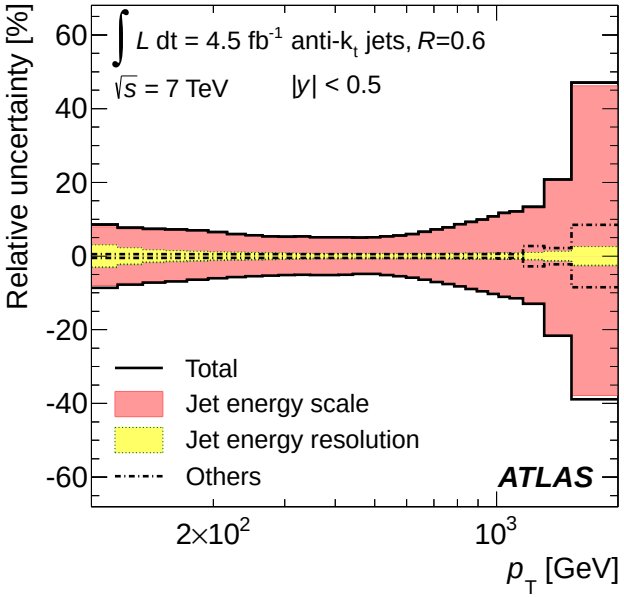
Probing quark and gluon PDFs at high-x



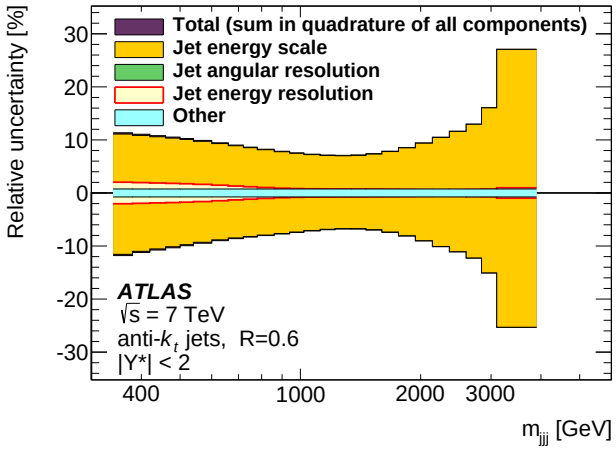




Experimental uncertainies



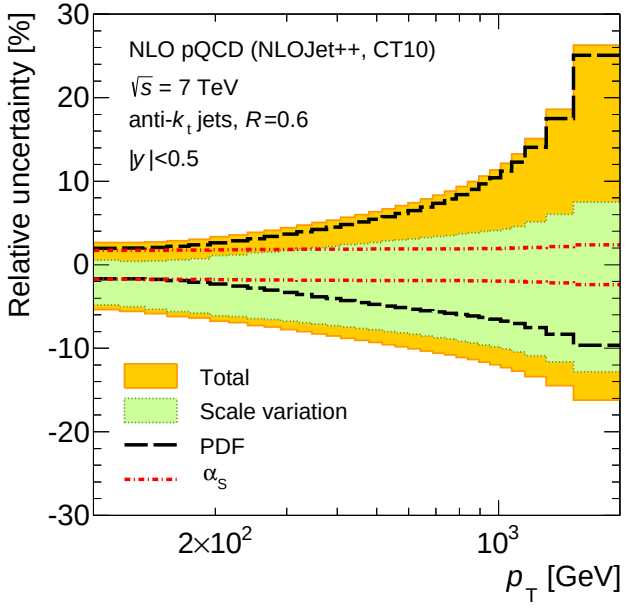
inclusive jets



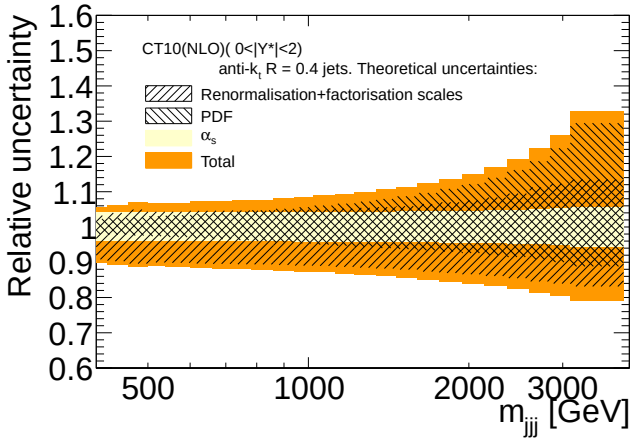
three-jet mass

- JES – largest source of uncertainty
- JER, JAR are also considered
- Jet quality selection, unfolding - are the subdominant
- 64 components of JES uncertainty are propagated through the measurement
- In the most precise regions the total uncertainty is $\sim 8 - 10\%$
- Uncertainty increases in the high-p_{T}, high-mass regions

Theory uncertainies



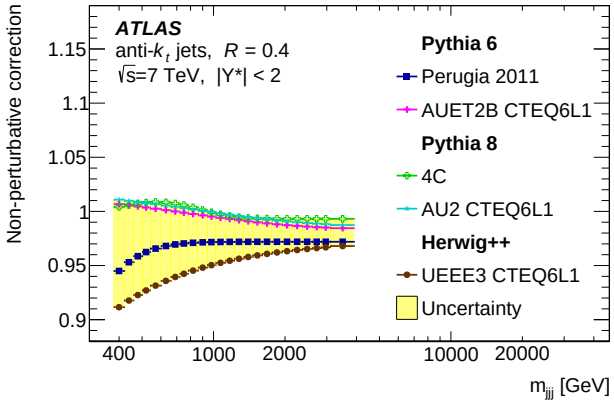
inclusive jets



three-jet mass

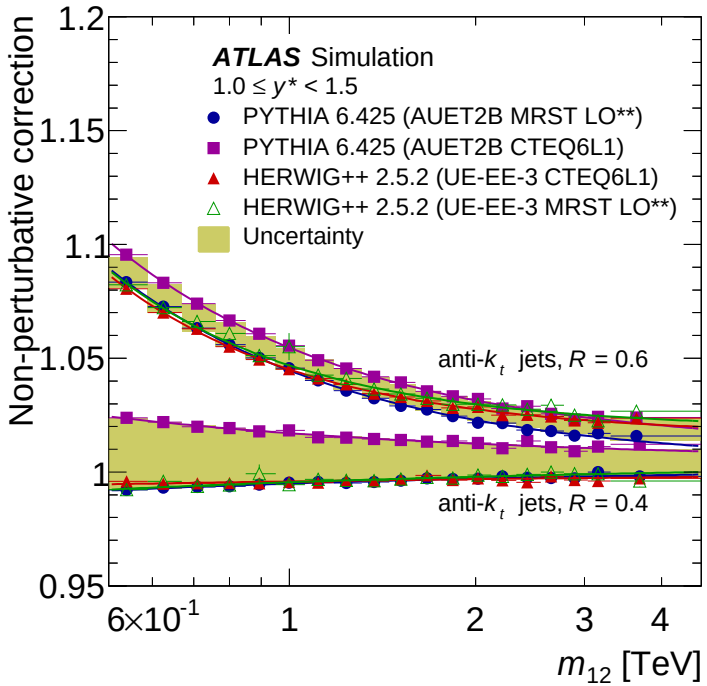
- Theory uncert. : PDF+scale+α_s+corr. Scale is the dominant
- Scale choice
  - inclusive jets : $p_{\mathrm{T}}^{jet}{}_{max}$ in the event
  - dijets : $p_{\mathrm{T}}^{jet}{}_{max} \times e^{0.3*y^*} \sim m_{12}$
  - three-jet mass : m_{jjj}

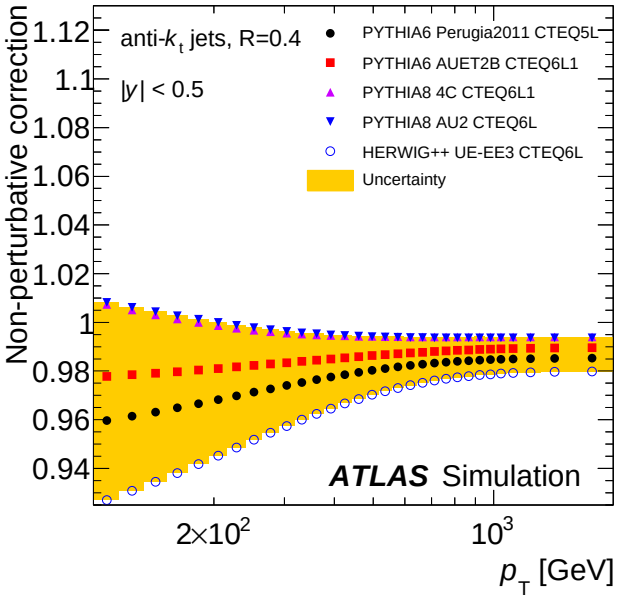
Non-perturbative corrections



three-jet mass

$$C_{\mathrm{NP}} = \frac{\left.\frac{d^2\sigma}{d\mathcal{O}}\right|_{\mathrm{NP\ on}}}{\left.\frac{d^2\sigma}{d\mathcal{O}}\right|_{\mathrm{NP\ off}}}.$$

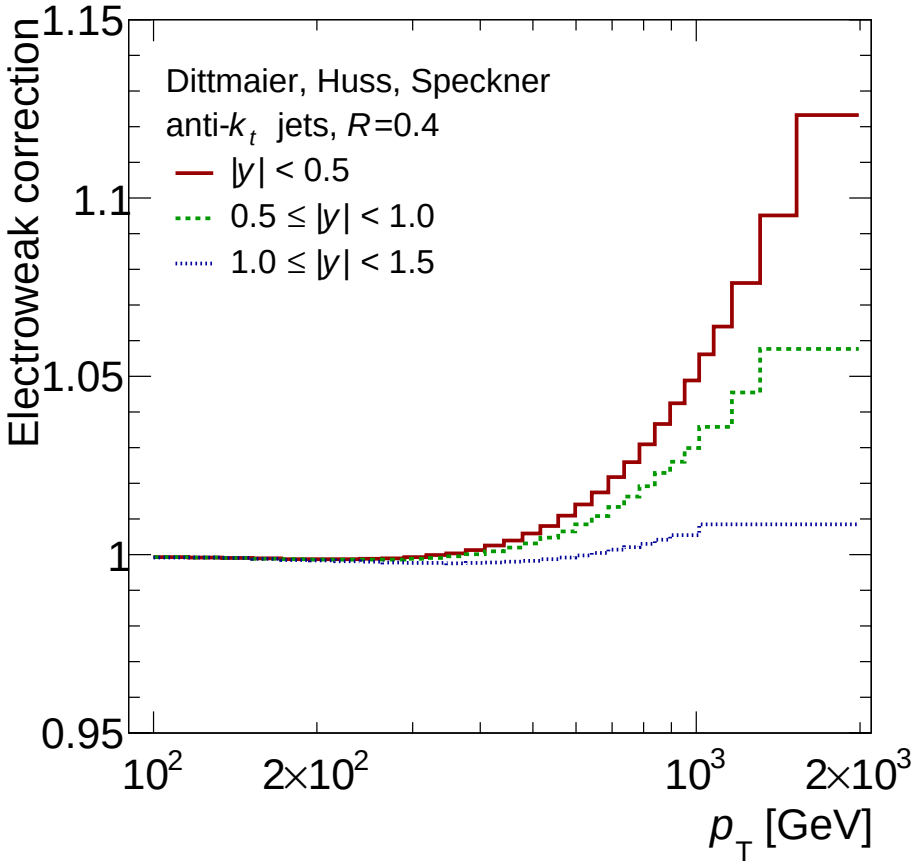




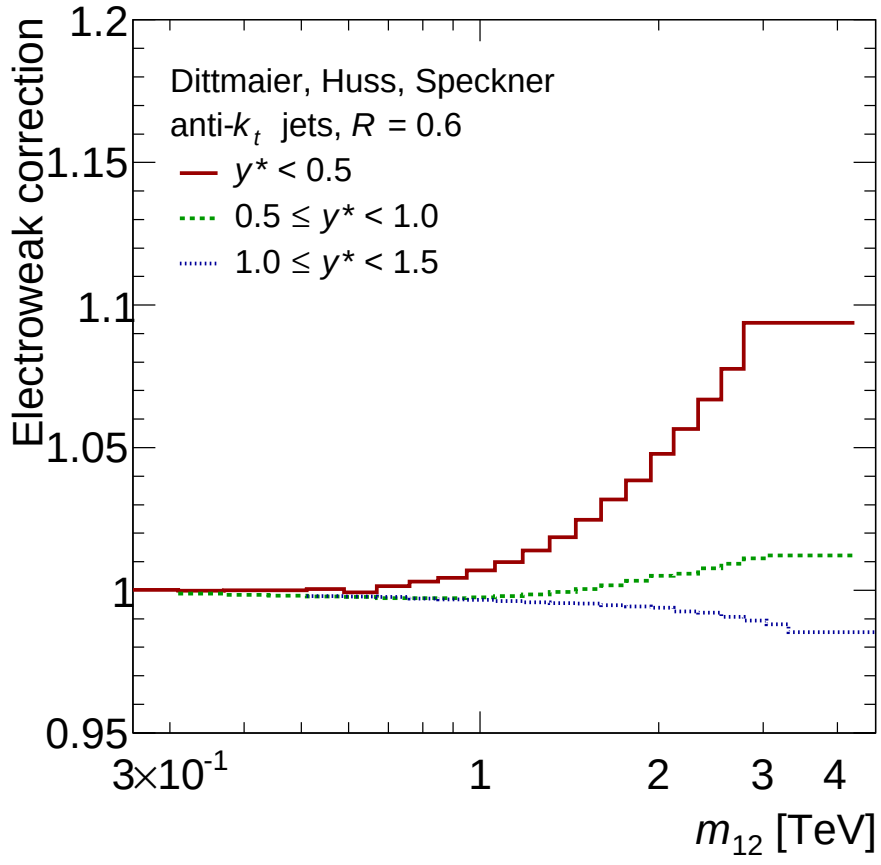
inclusive jets

- One tune is used for the nominal
- Uncertainty - envelope of the different tunes
- 5–10% in the low p_T(mass) region
- negligibly small in the high-p_T range

Electroweak corrections



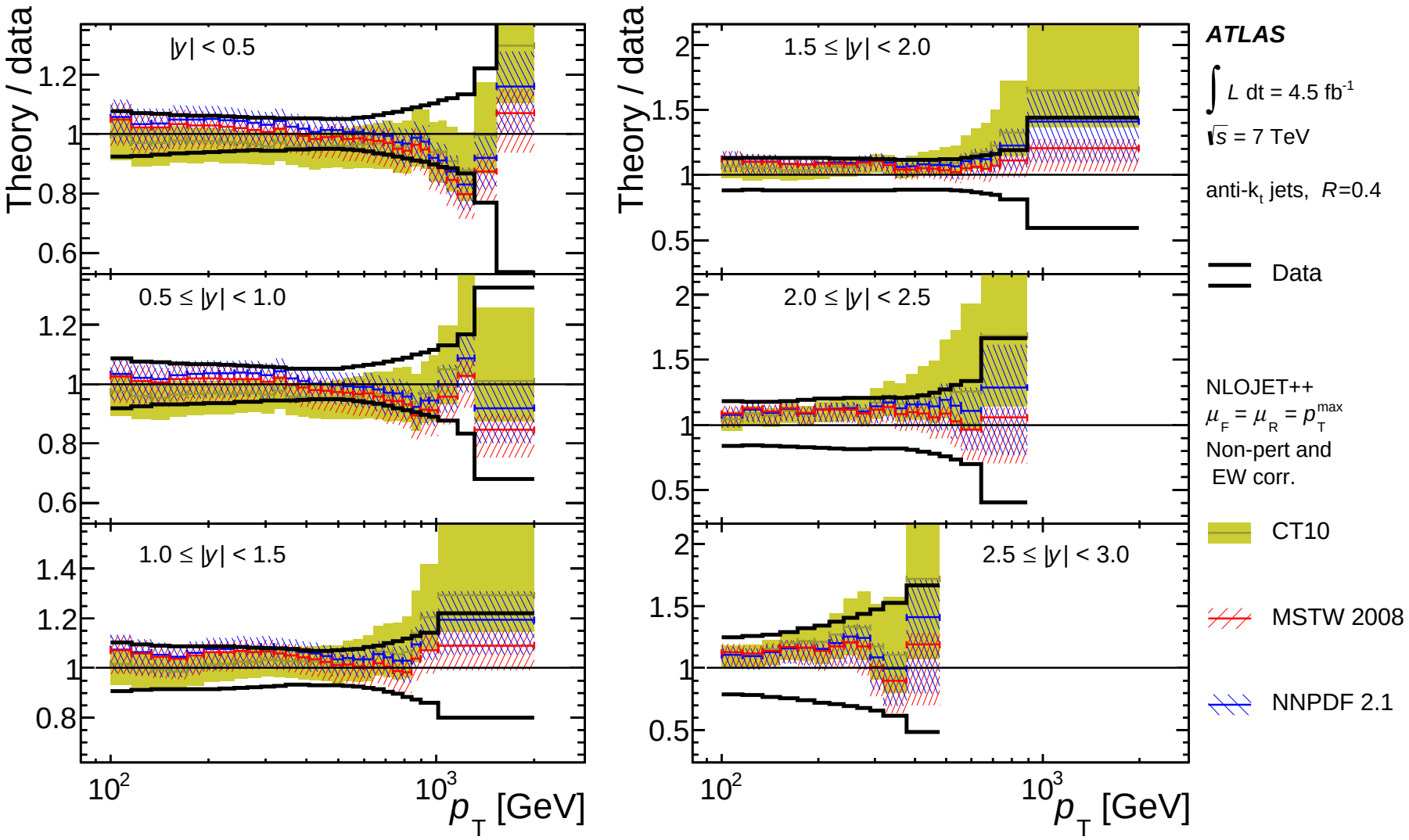
inclusive jets



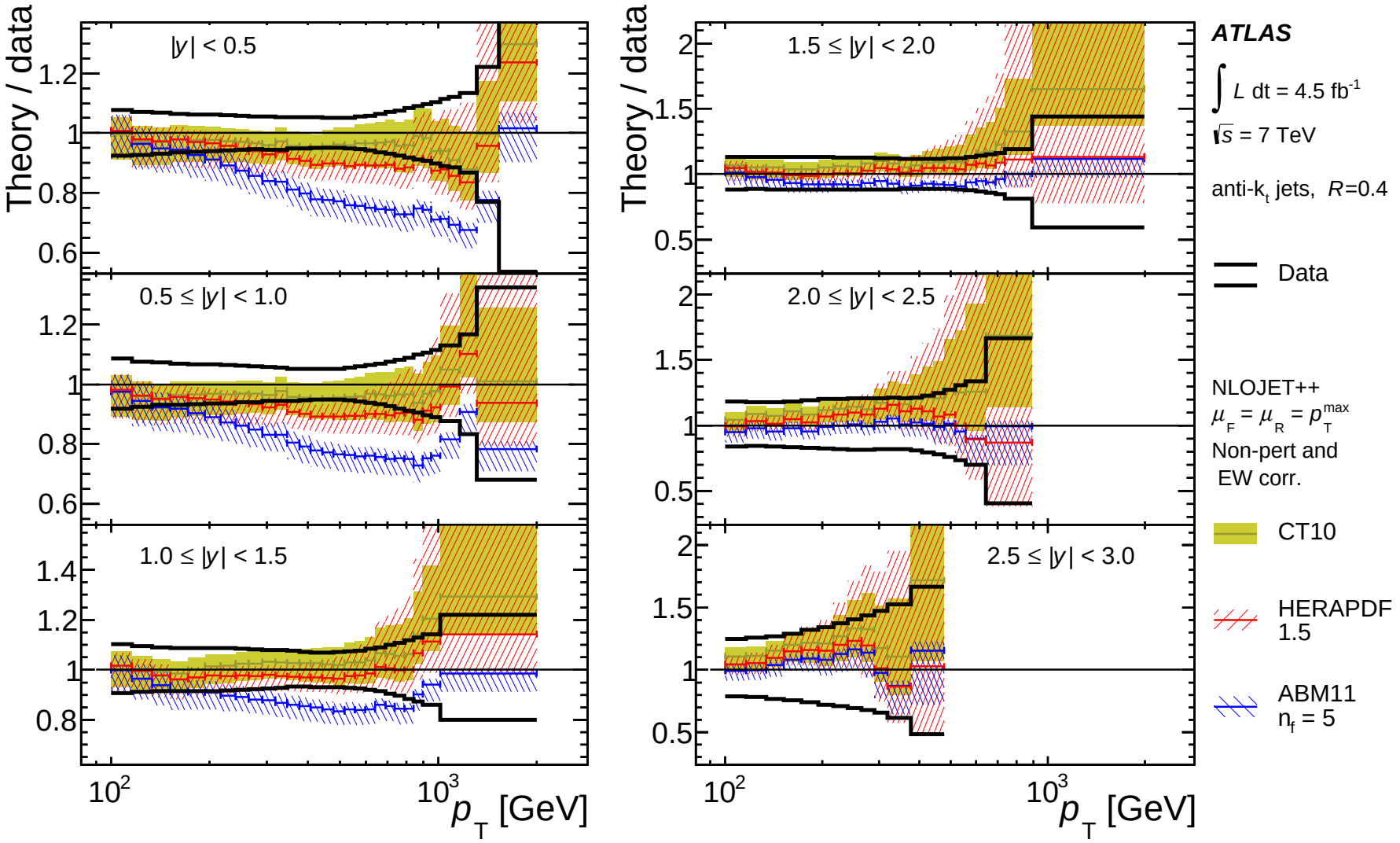
dijets

- Very small impact for p_T(mass) below 600(1000) GeV
- Up to 10% effect in the high-p_T(mass) range

Inclusive jets. Detailed comparison to theory (I)

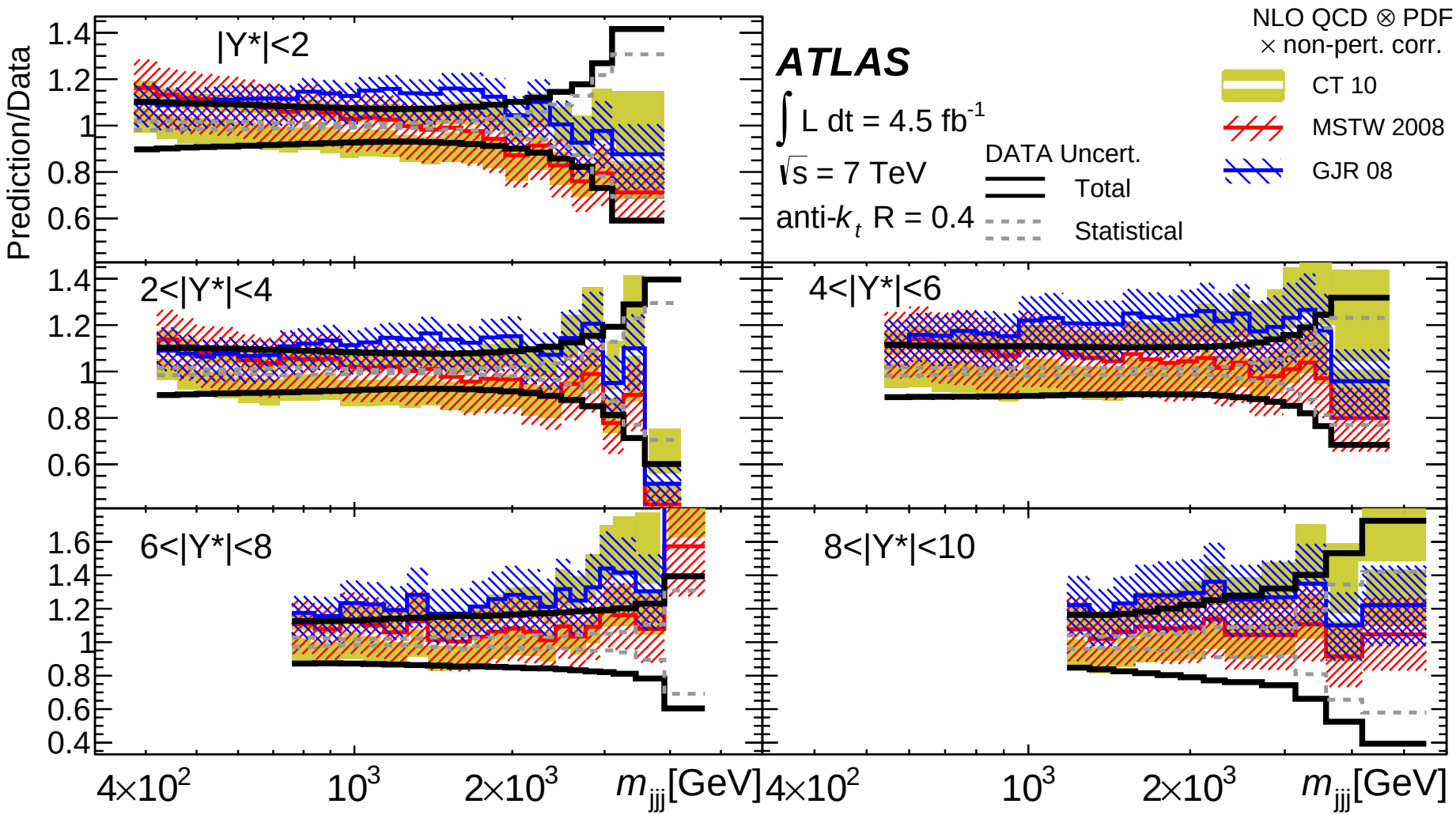


Inclusive jets. Detailed comparison to theory (II)



different set of PDFs

Three-jets. Detailed comparison to theory (I)



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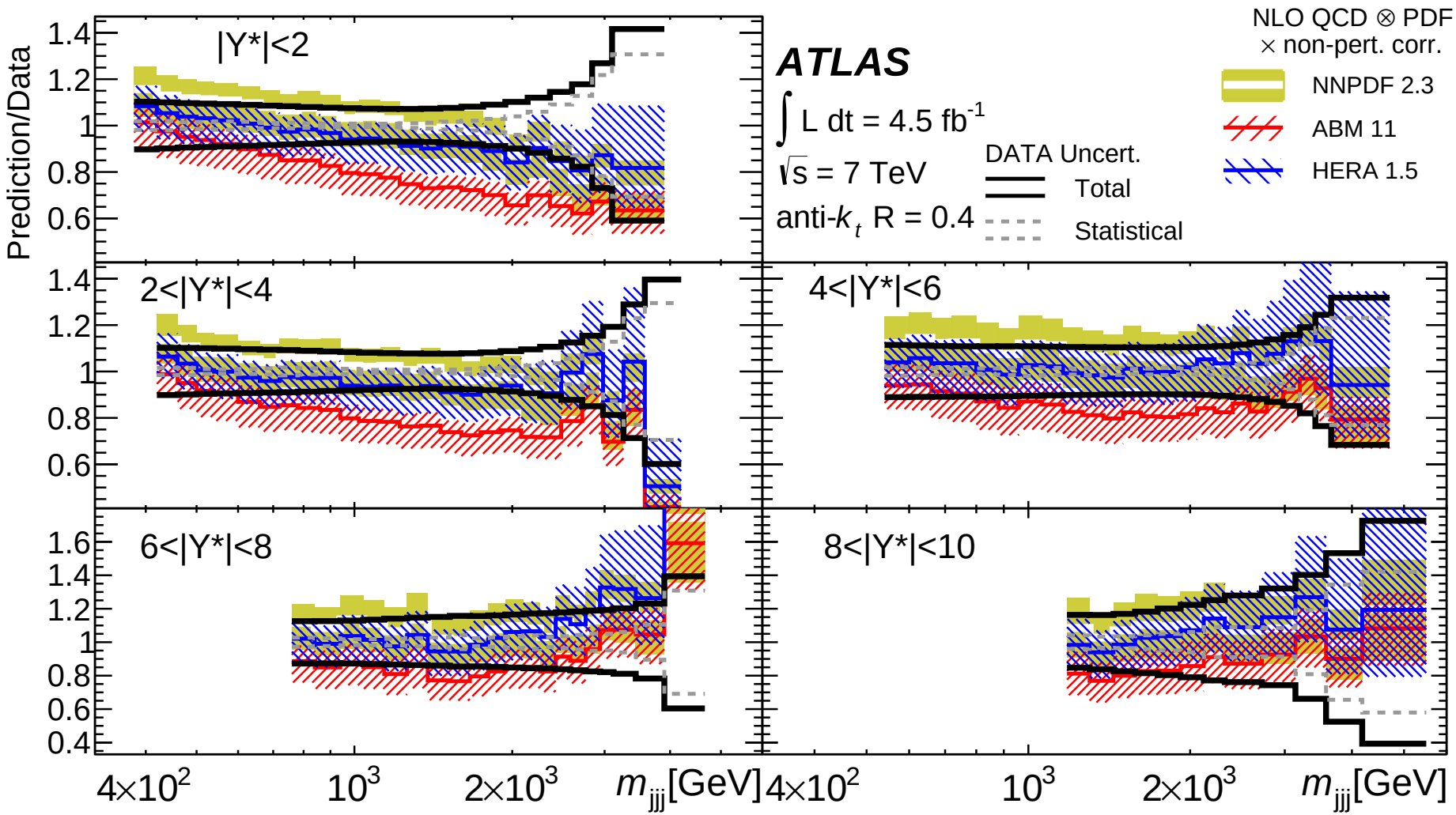
Three-jets. Detailed comparison to theory (II)



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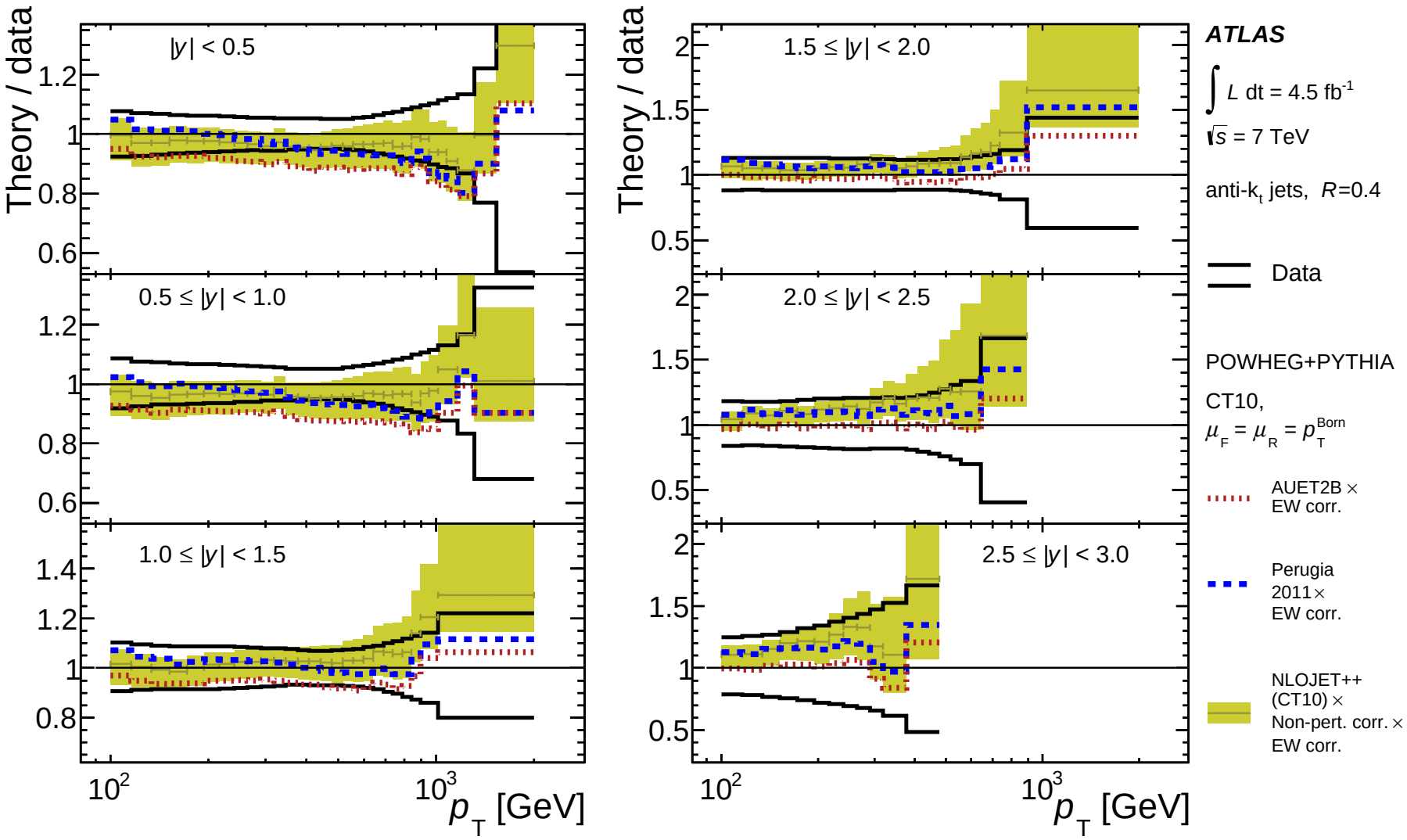
Inclusive jets. Powheg comparison

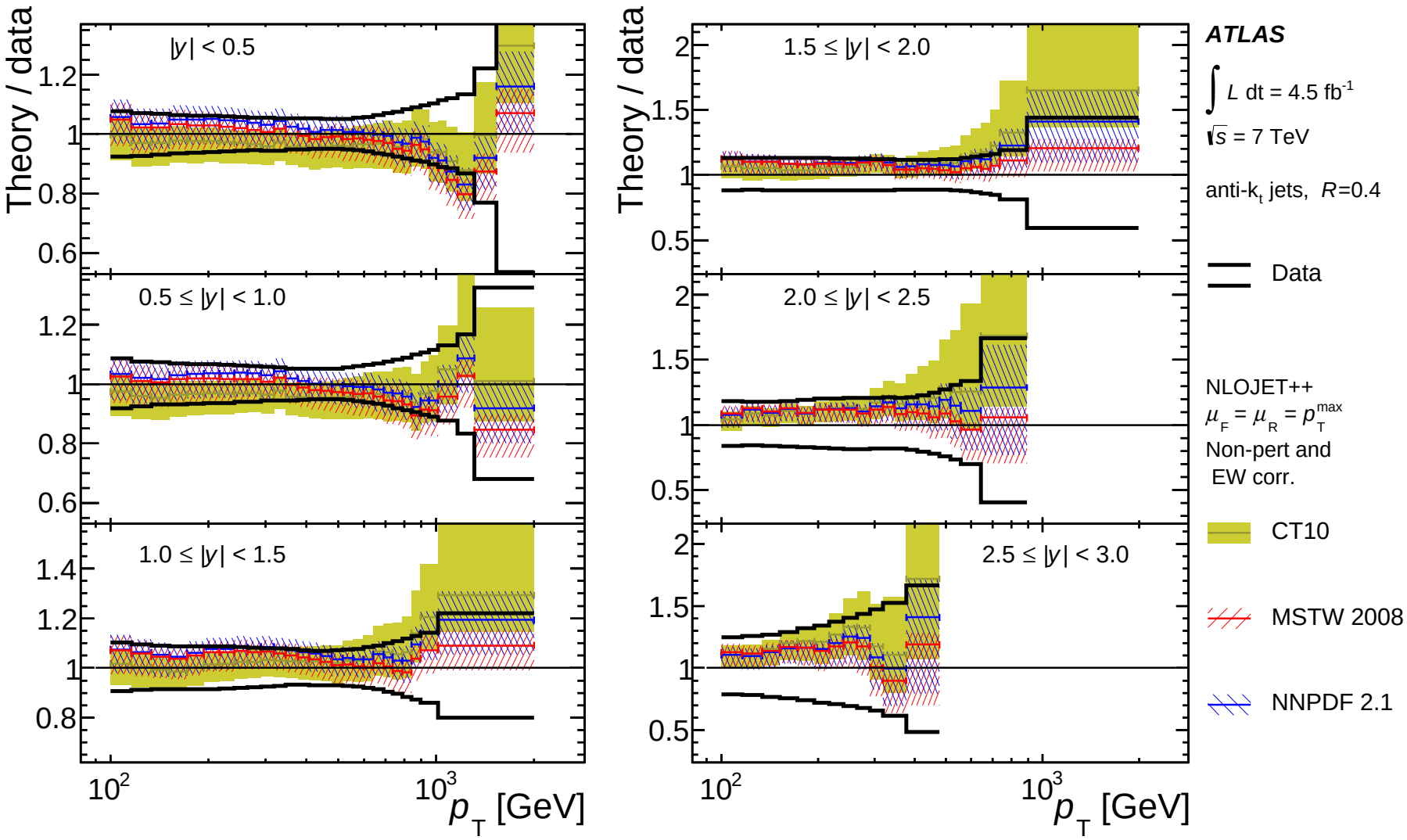


Summary

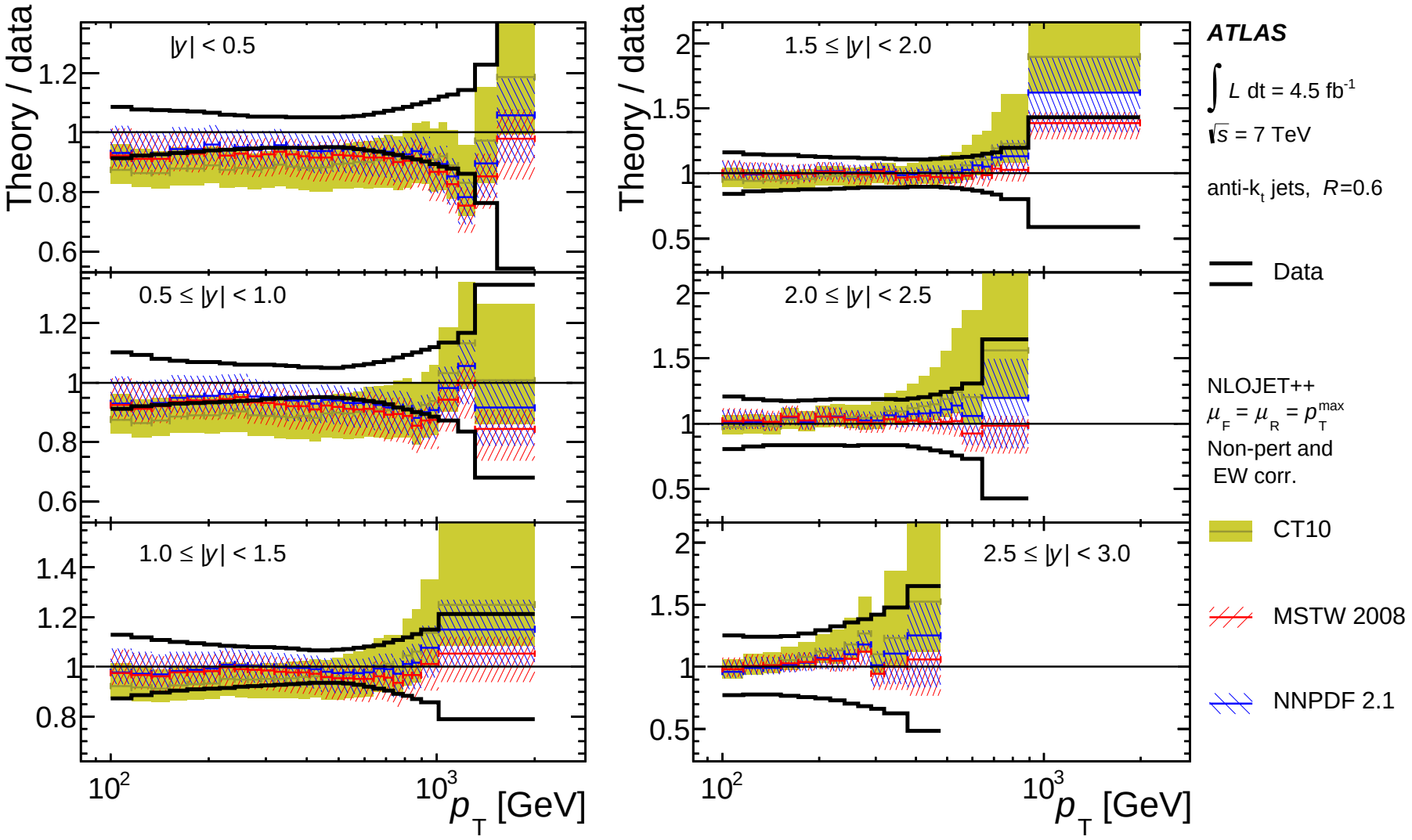
- Three new jet cross-section measurements at 7 TeV using 2011 dataset are presented :
- provide constraints on high-x gluon and α_s running
- common set of systematic uncertainies
- statistical correlations between cross-sections
- three scenarios of syst. uncert. correlations are provided : nominal+ weak+strong

Back-up

Inclusive jets. Detailed comparison to theory (I)



Inclusive jets. Detailed comparison to theory (II)



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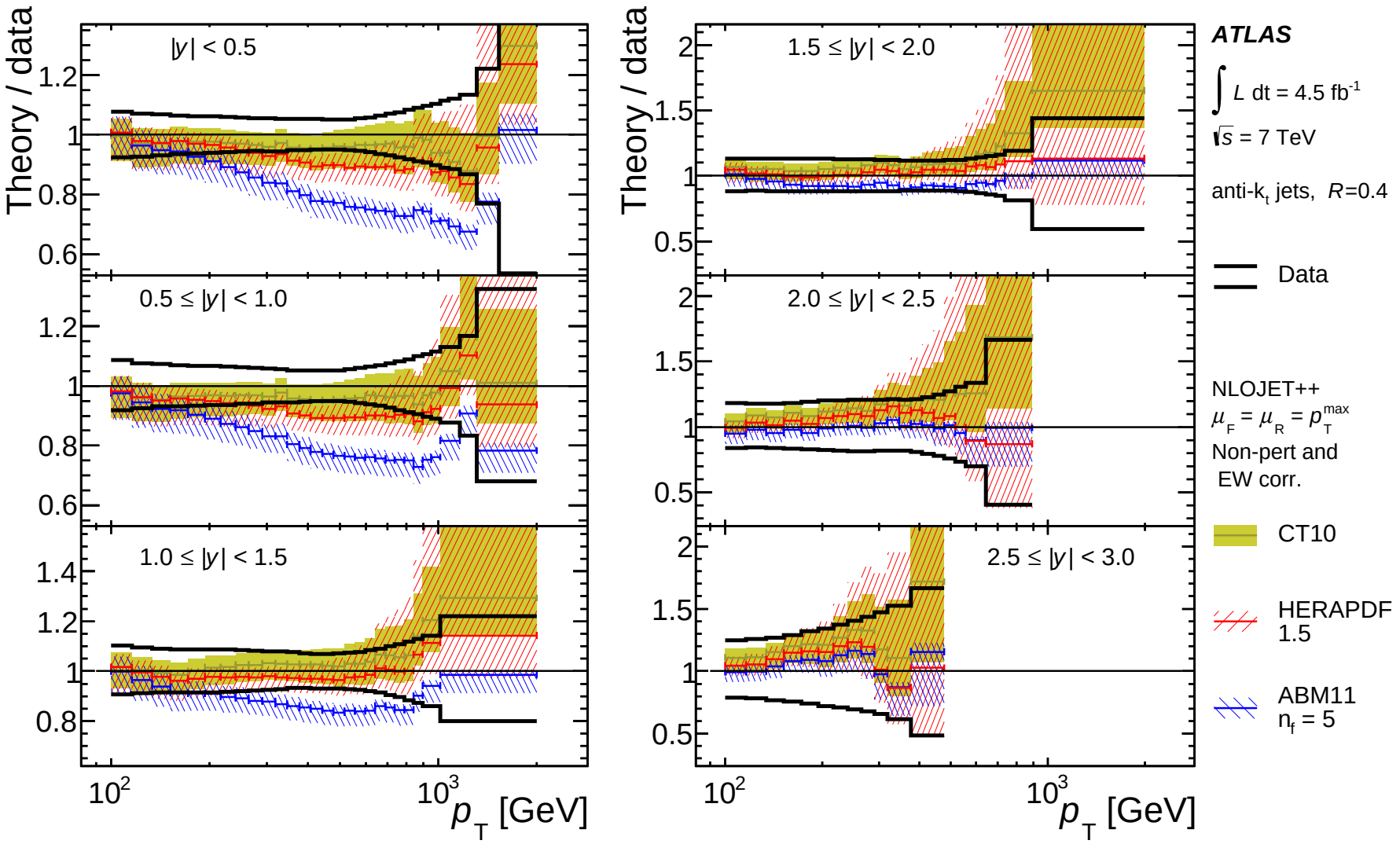
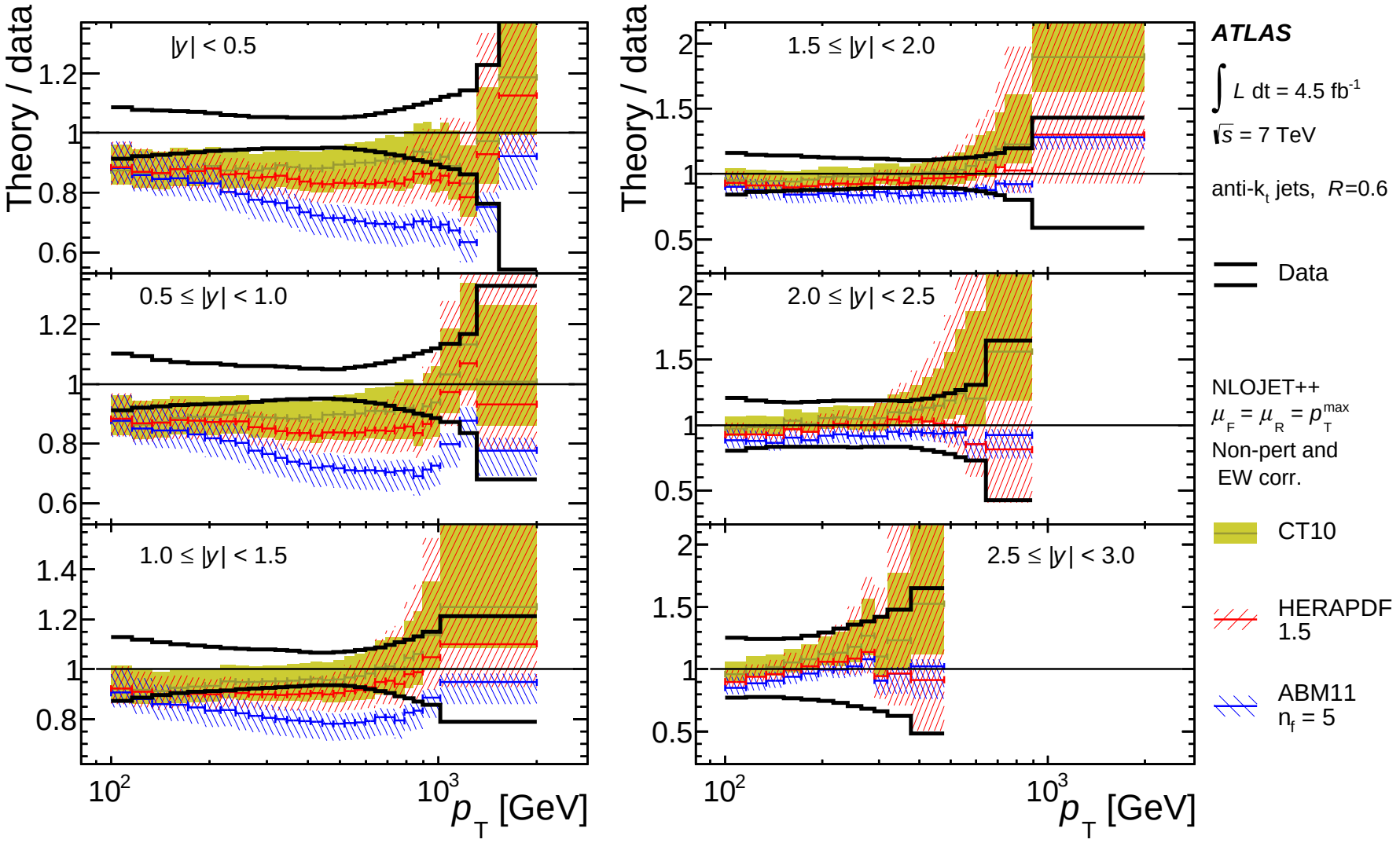
Inclusive jets. Detailed comparison to theory (I)



Inclusive jets. Detailed comparison to theory (II)



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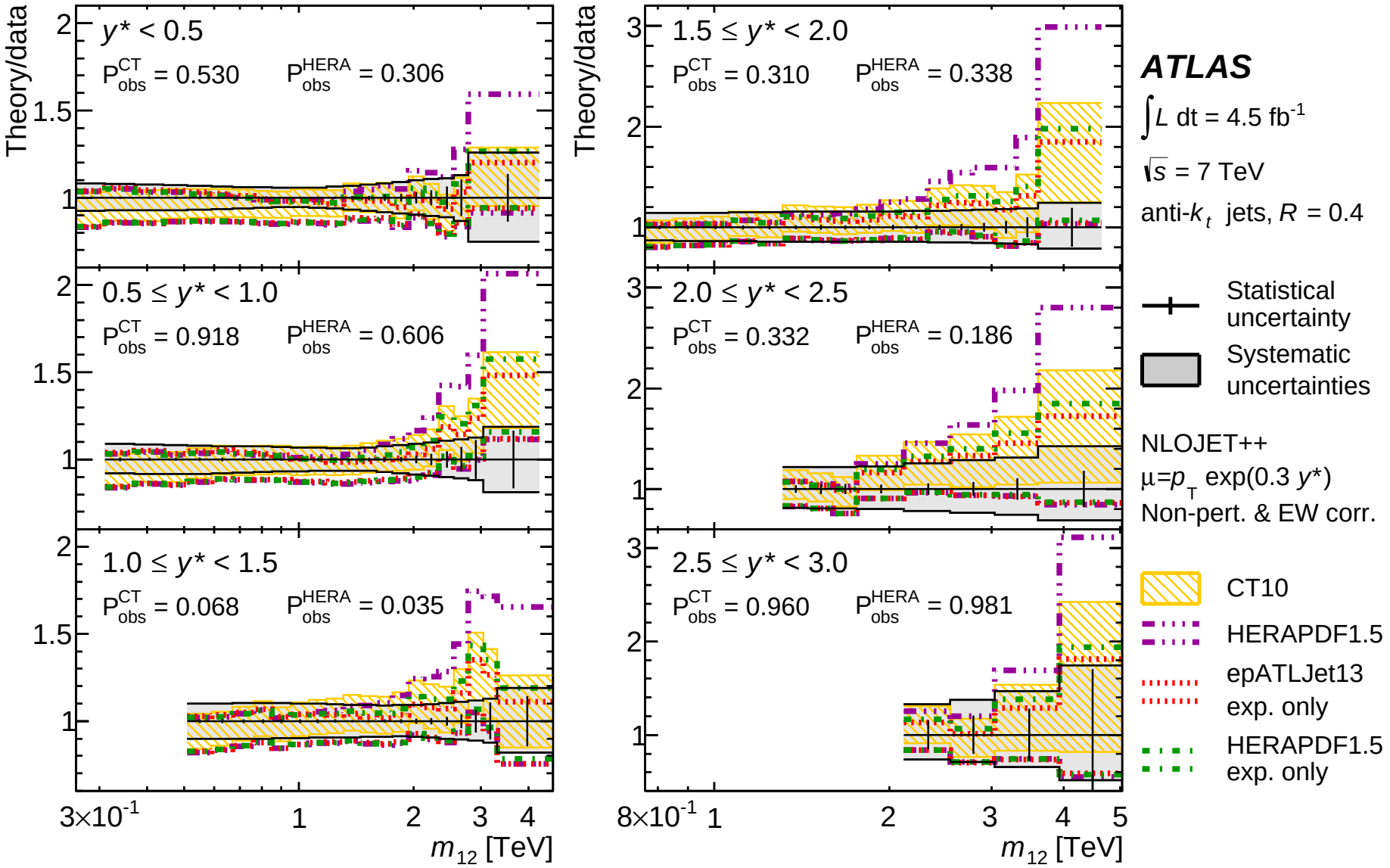
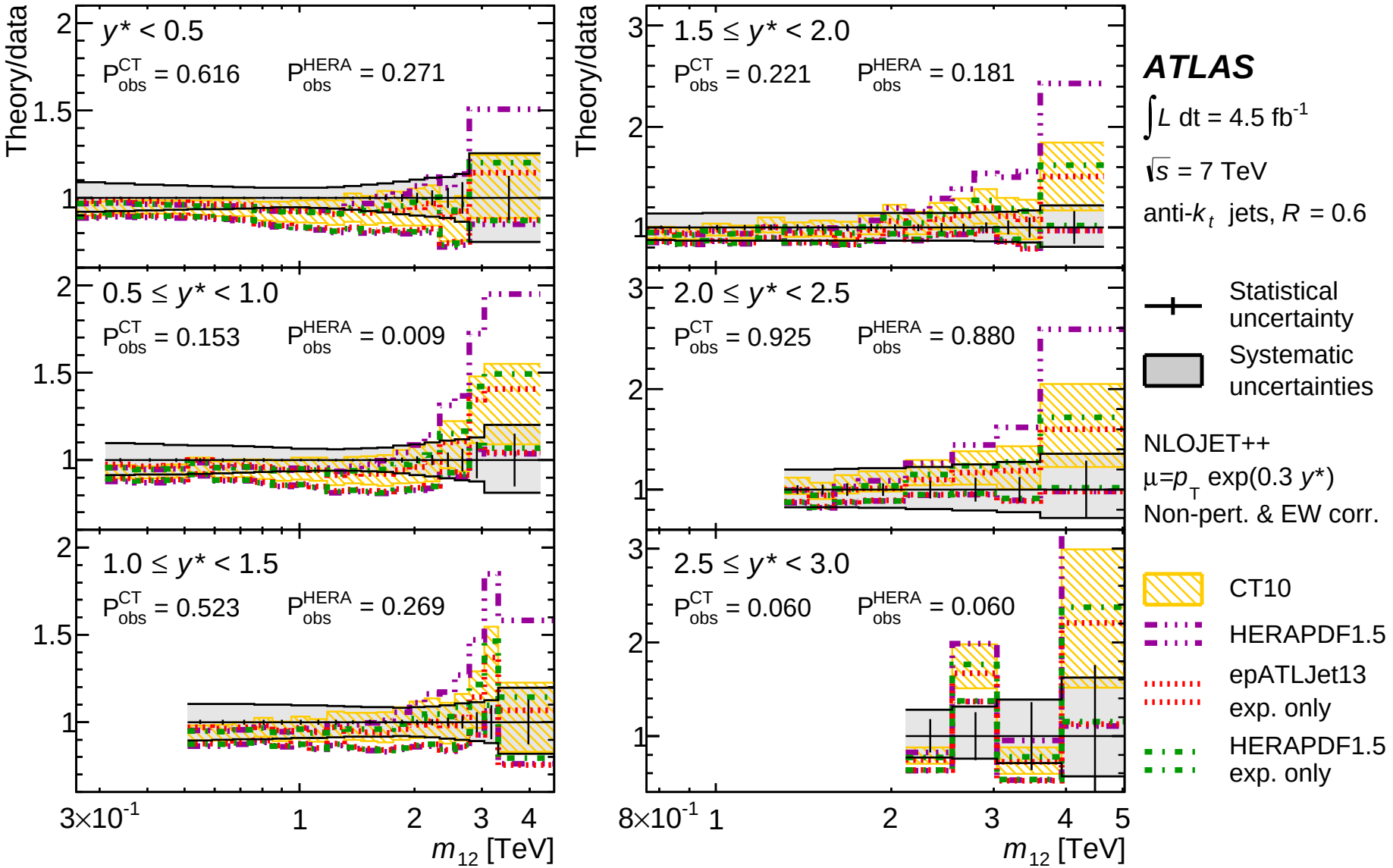
Dijets. Detailed comparison to theory (I)



Dijets. Detailed comparison to theory (II)



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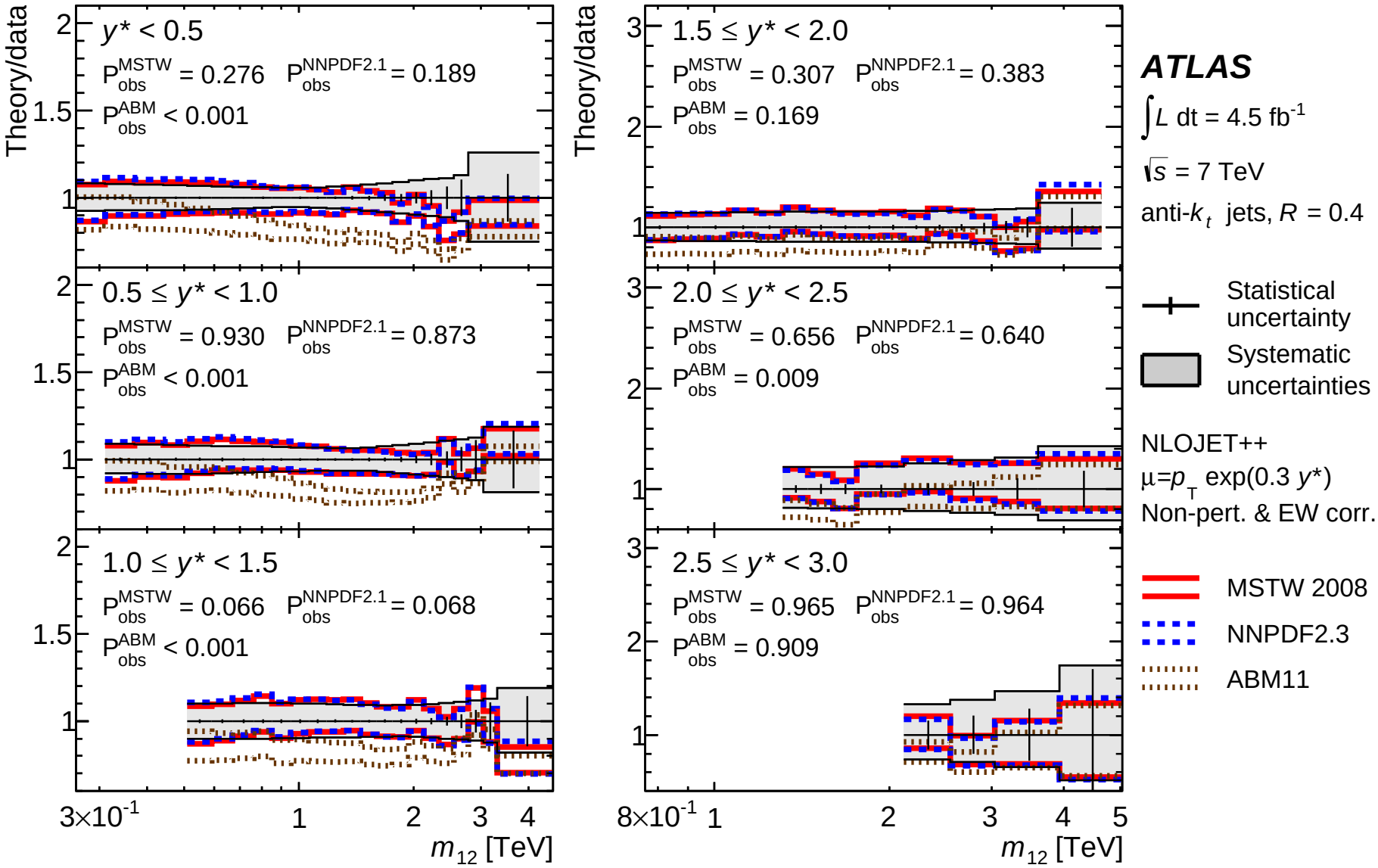
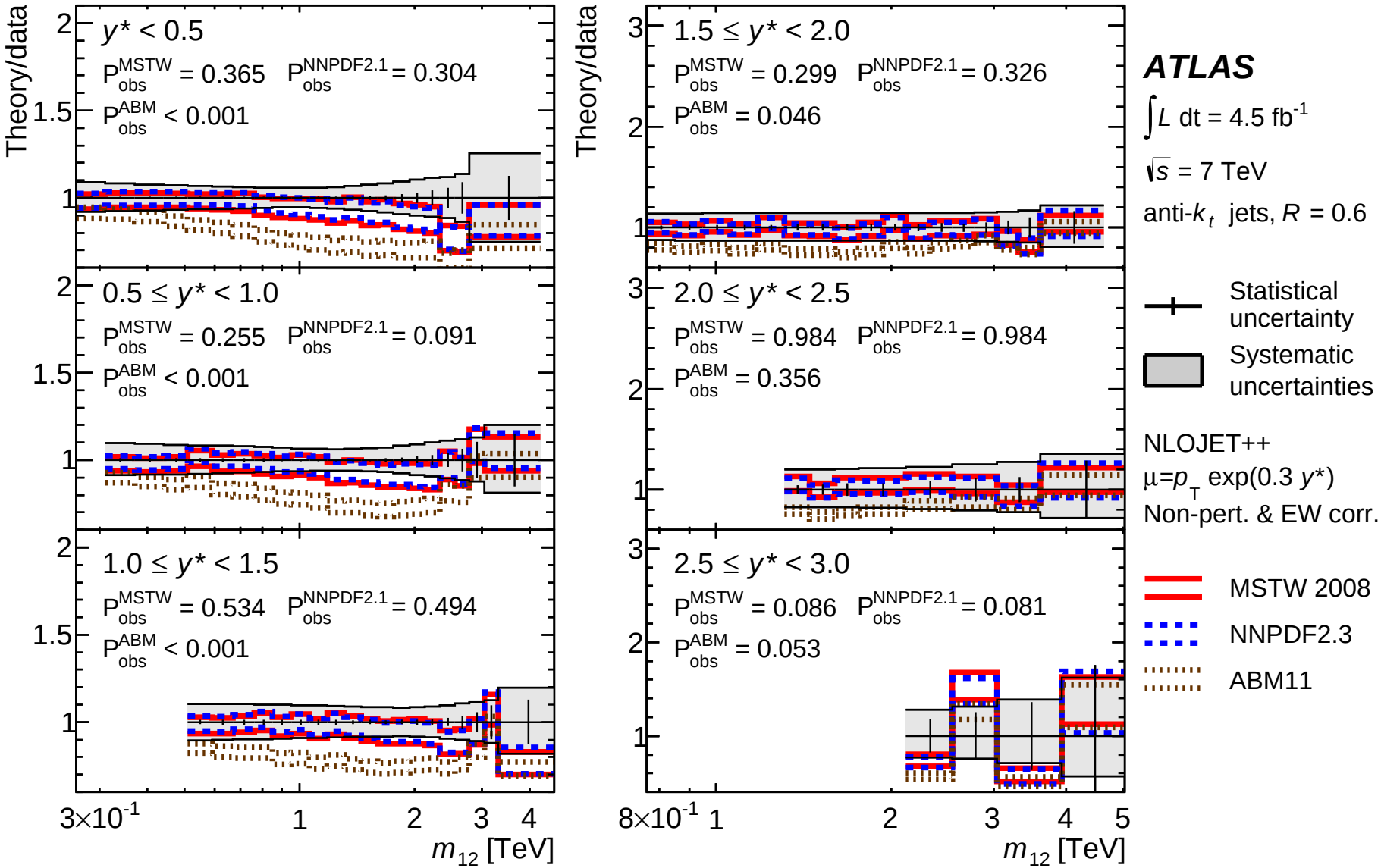


Dijets. Detailed comparison to theory (II)



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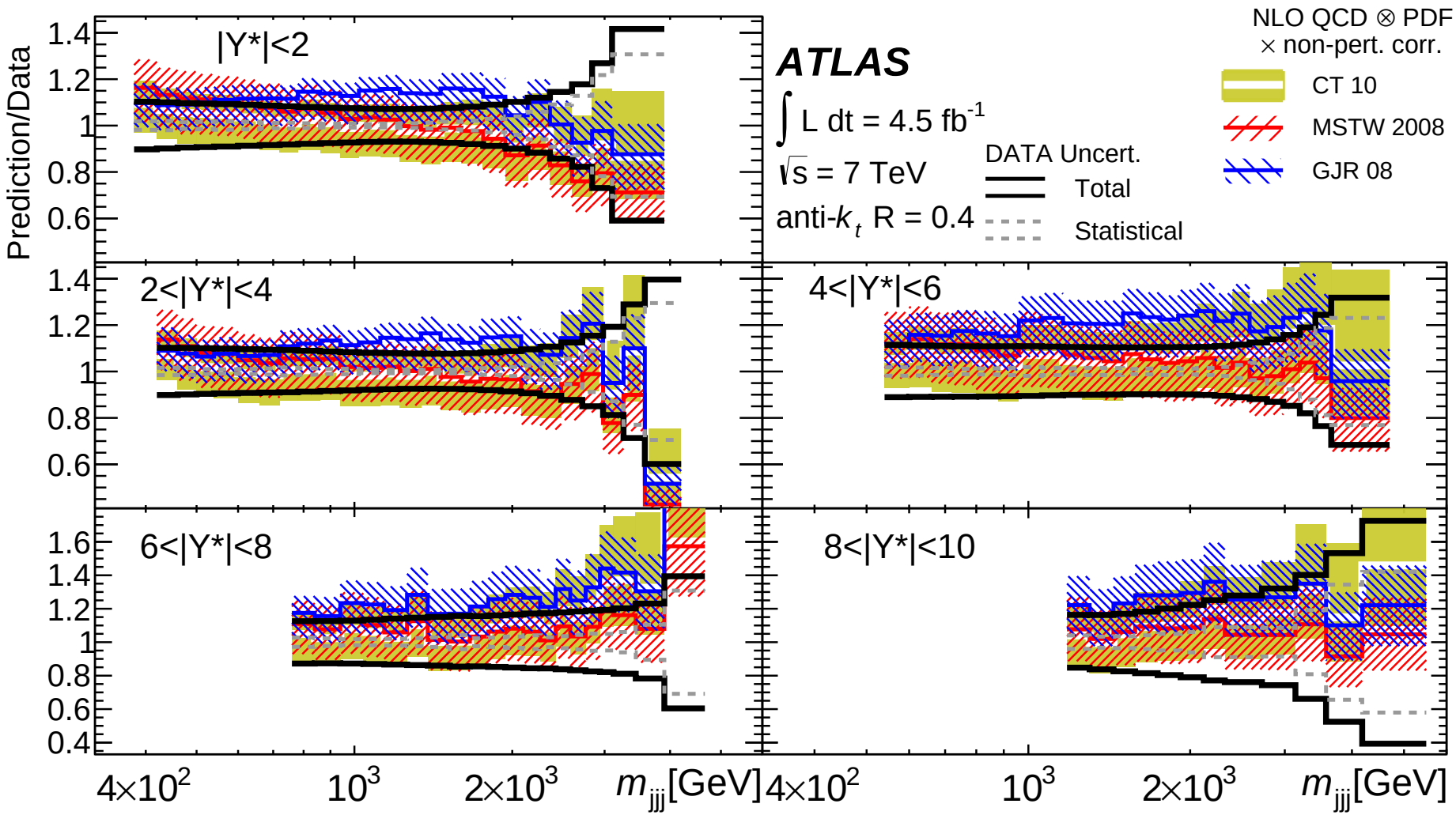
Three-jets. Detailed comparison to theory (I)



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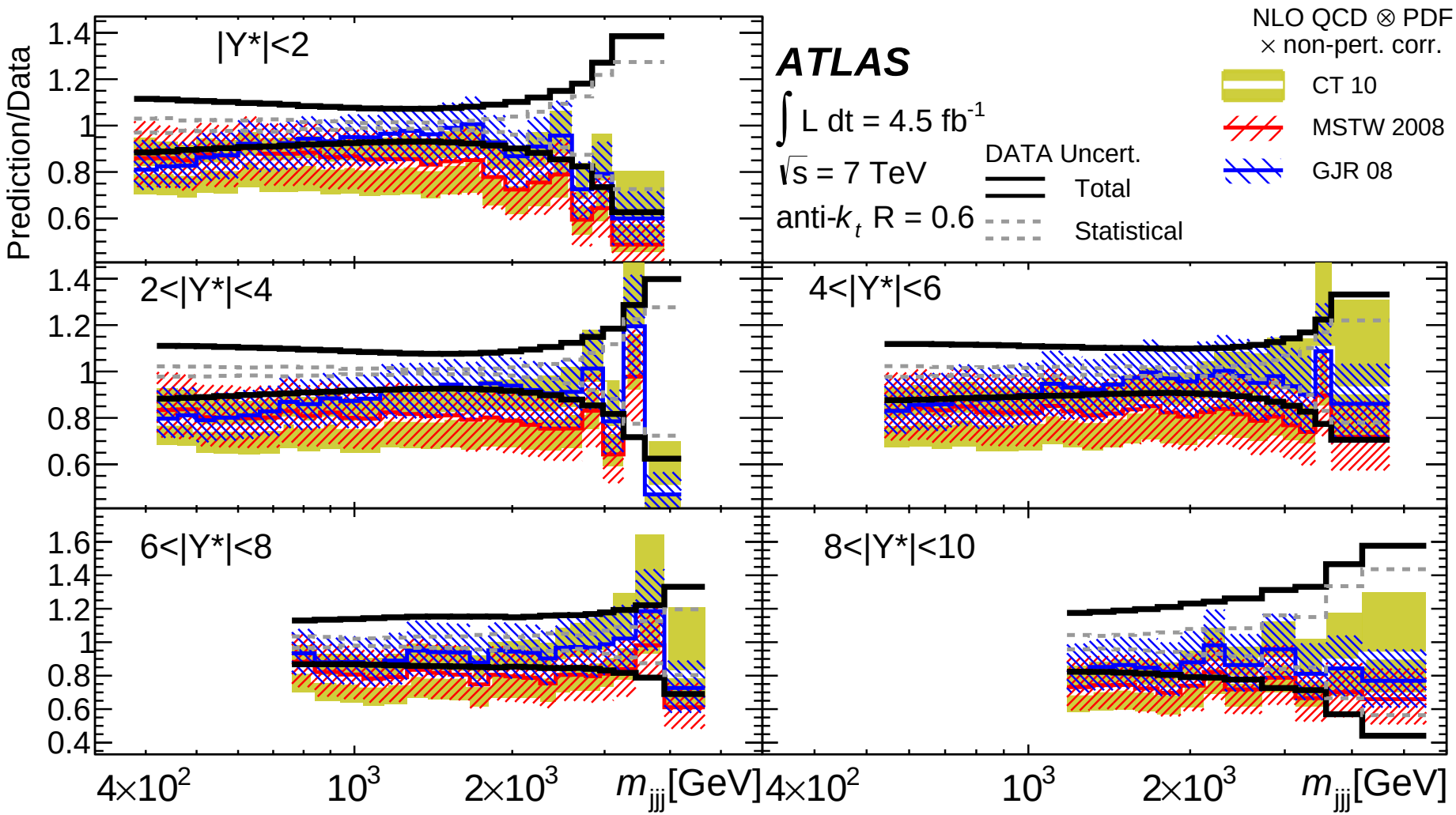
Three-jets. Detailed comparison to theory (II)



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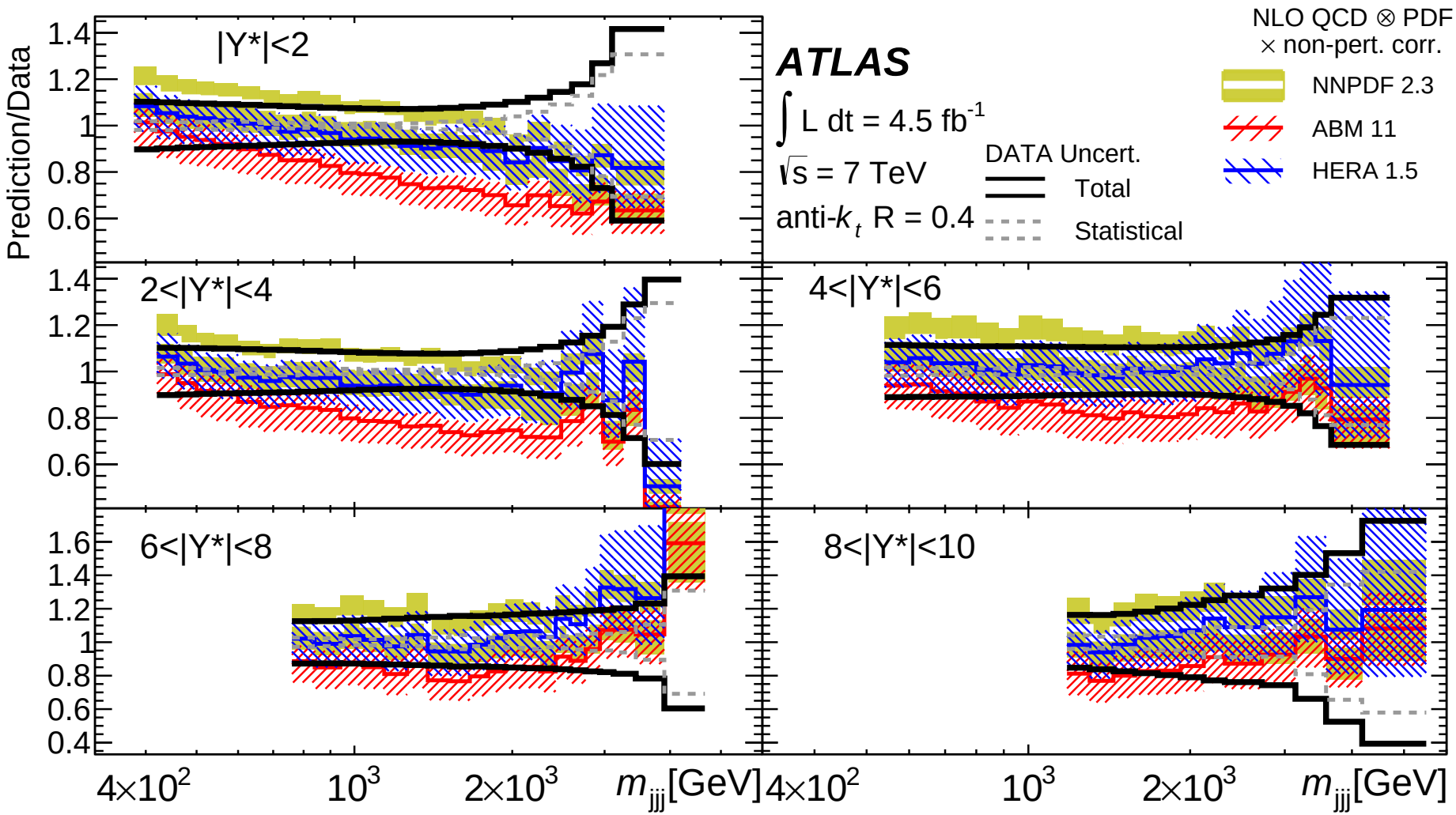

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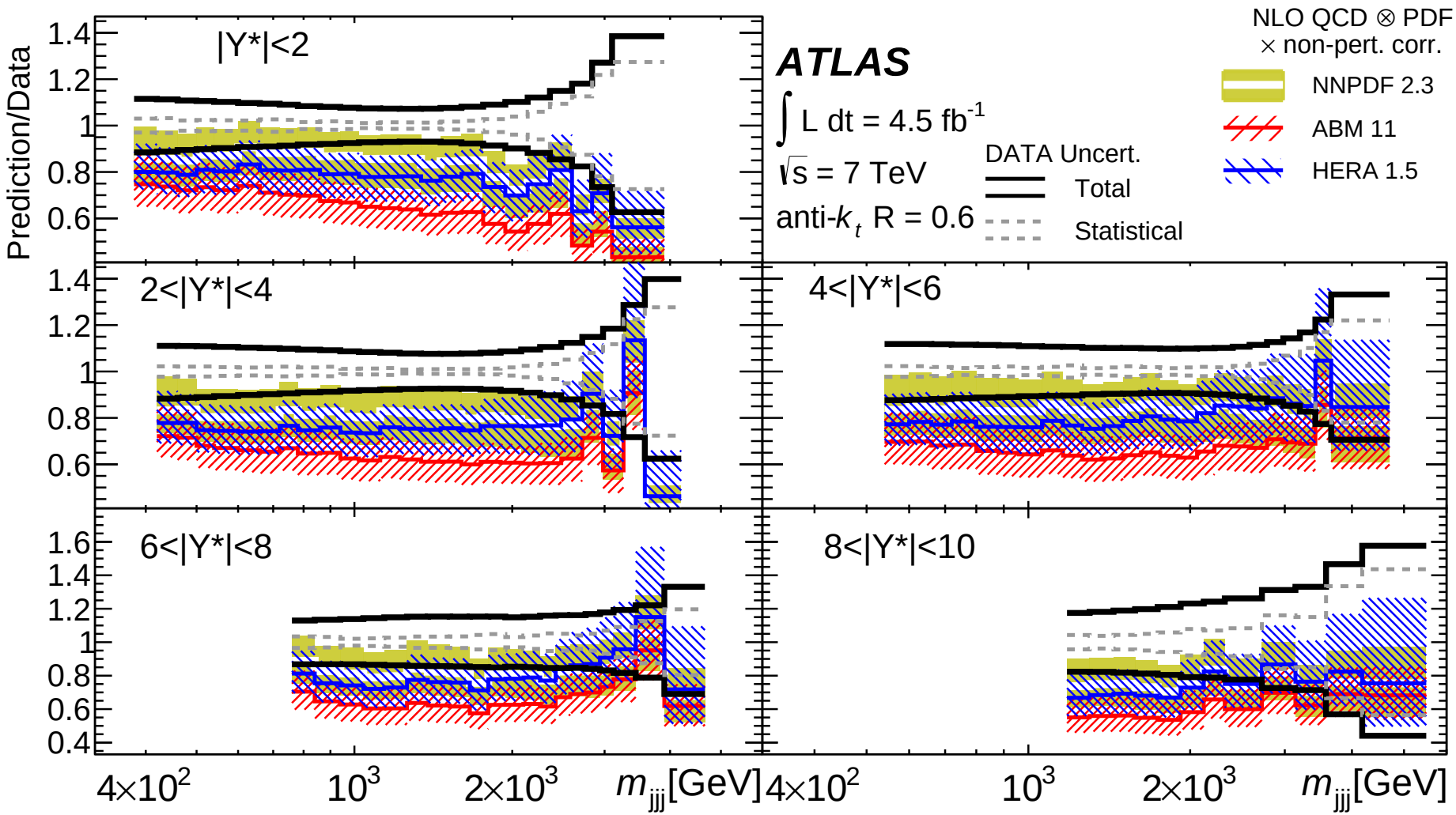
Three-jets. Detailed comparison to theory (II)



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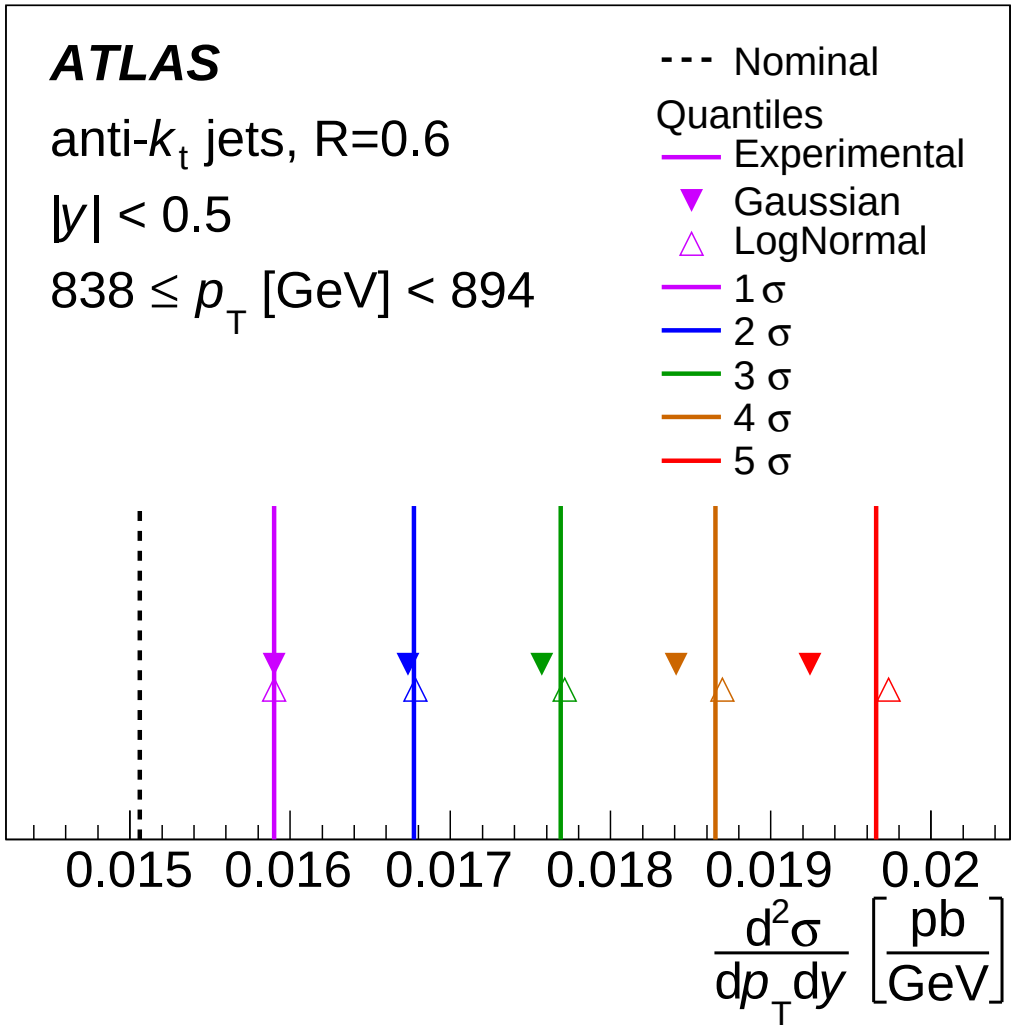
Inclusive jets. Test of gaussianity of uncertainies



Uncertainty in the energy deposited in the EM calorimeter