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Studies of 2 b-jet + 2 jet production in proton-proton collisions at 7 TeV

Abstract

Measurements are presented of inclusive differential two b- and two-jet production cross sections as a function of the transverse momentum p_T , pseudorapidity η , as well as of correlations in azimuthal angle ϕ , pseudorapidity η and p_T balance among the jets. The data sample was collected from proton-proton collisions at a centre-of-mass energy of 7 CMS.TeV with the CMS detector at the LHC, corresponding to an integrated luminosity of 3.03 pb^{-1} . The jets are reconstructed with the anti-k R jet algorithm with $p_T > 20 \text{ CMS.GeV}$. At least four jets are required: two jets need to be originated by a bottom quark within the range of pseudorapidity $|\eta| < 2.4$, while the other two jets are required to be in $|\eta| < 4.7$ without any flavour requirement on the initial quark. Only the two leading jets of each selection are considered. The cross section is measured to be $\sigma(\text{pp} \rightarrow 2 \text{ b} + 2 \text{ j} + \text{X}) = 64.6 \pm 2.4 \text{ (stat.)} \pm 21.6 \text{ (syst.) nb}$. Various model predictions are compared to the measured differential cross sections. The data agree within uncertainties with the predictions of parton shower Monte Carlo event generators and with NLO calculations matched to parton showers only in some regions of the phase space.

Figures

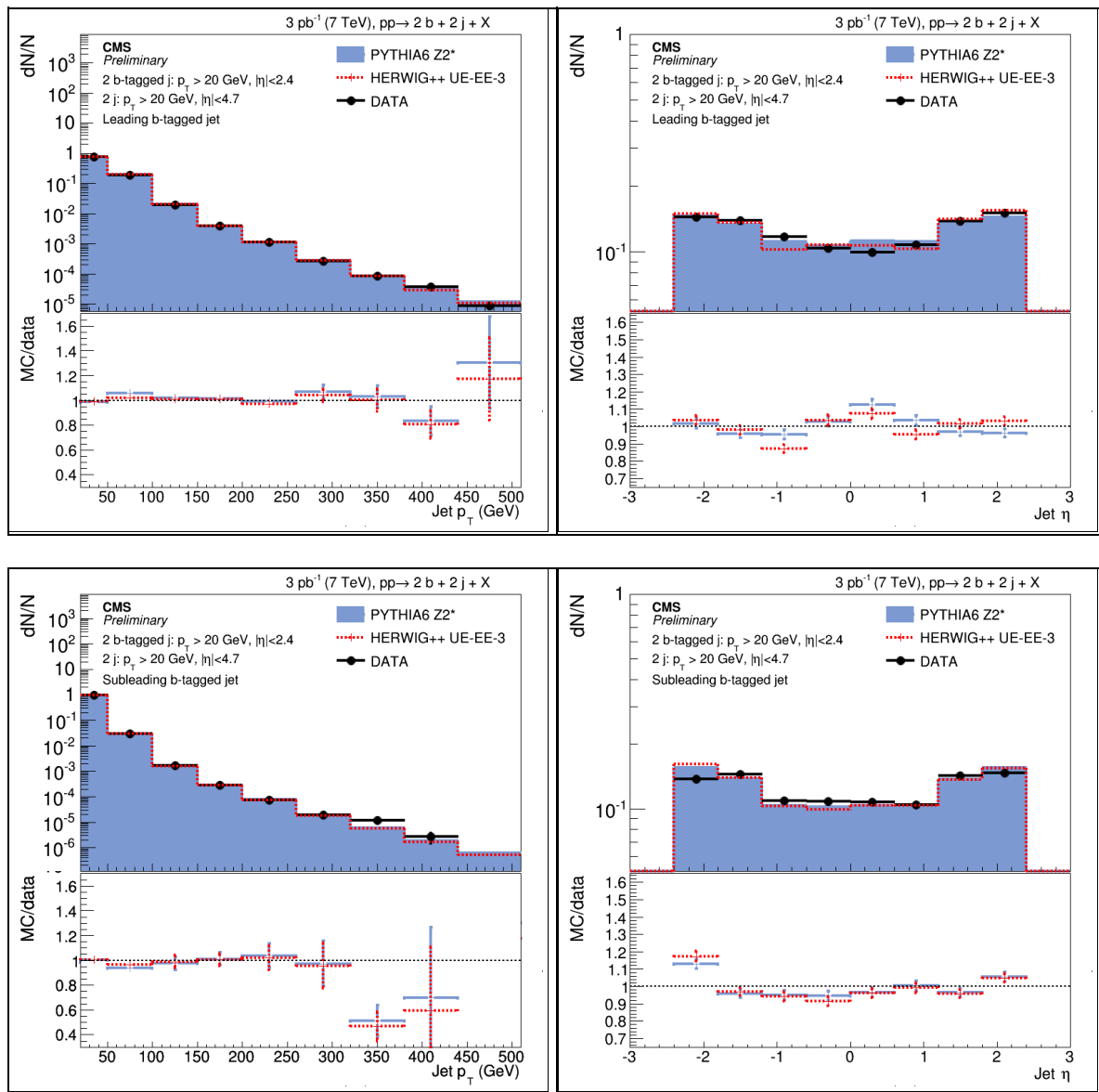
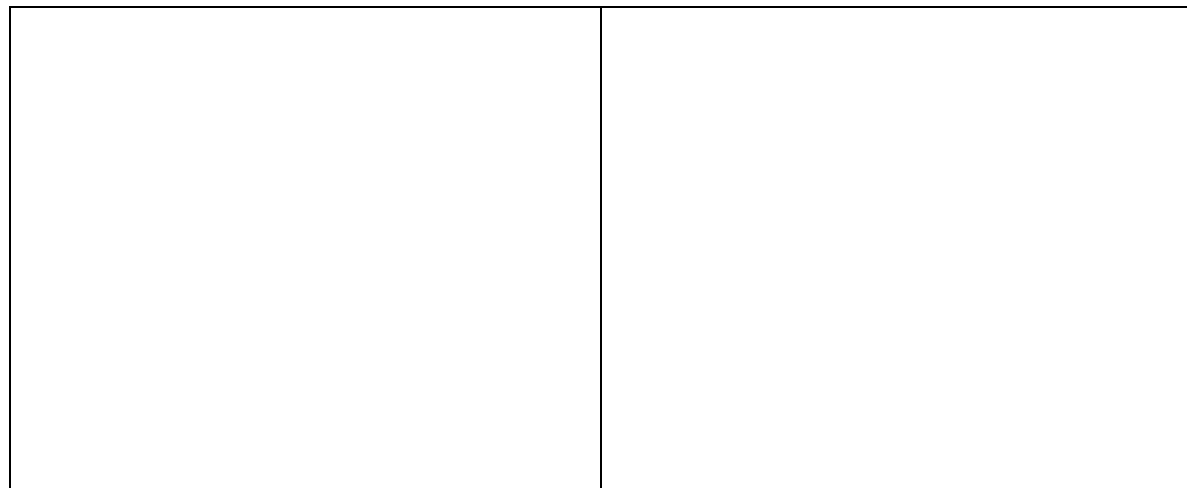
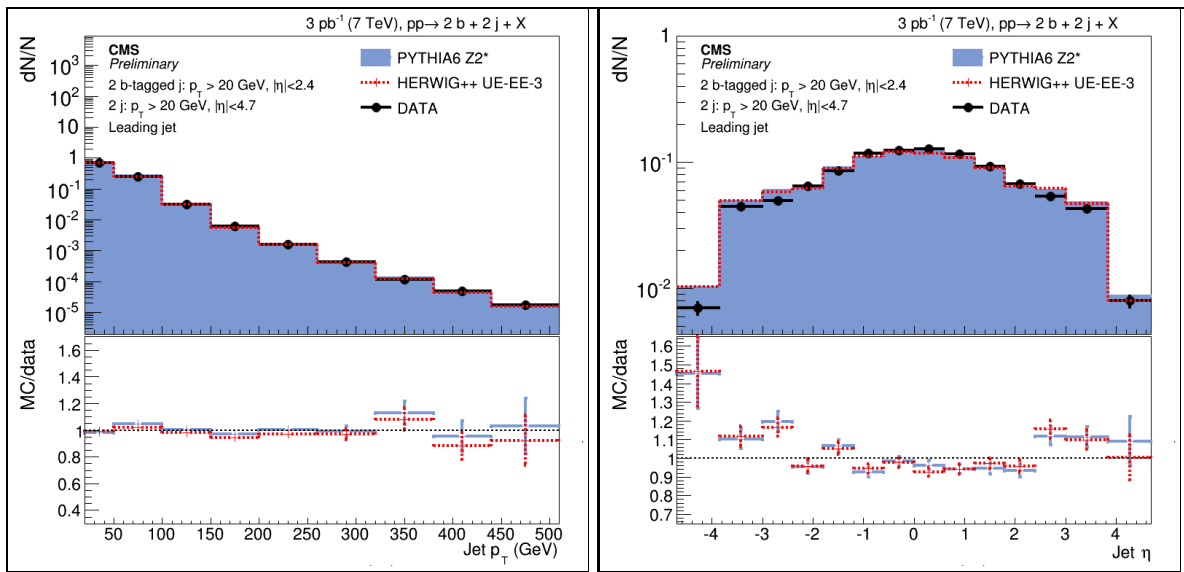


Figure 1.
Comparison of

data with simulations from MC event generators (PYTHIA 6 and HERWIG++) for the transverse momentum and pseudorapidity for the leading (a,b) and subleading (c,d) b-tagged jets. Only statistical uncertainties are shown for the data. Distributions are not normalized to the bin width.



Figures

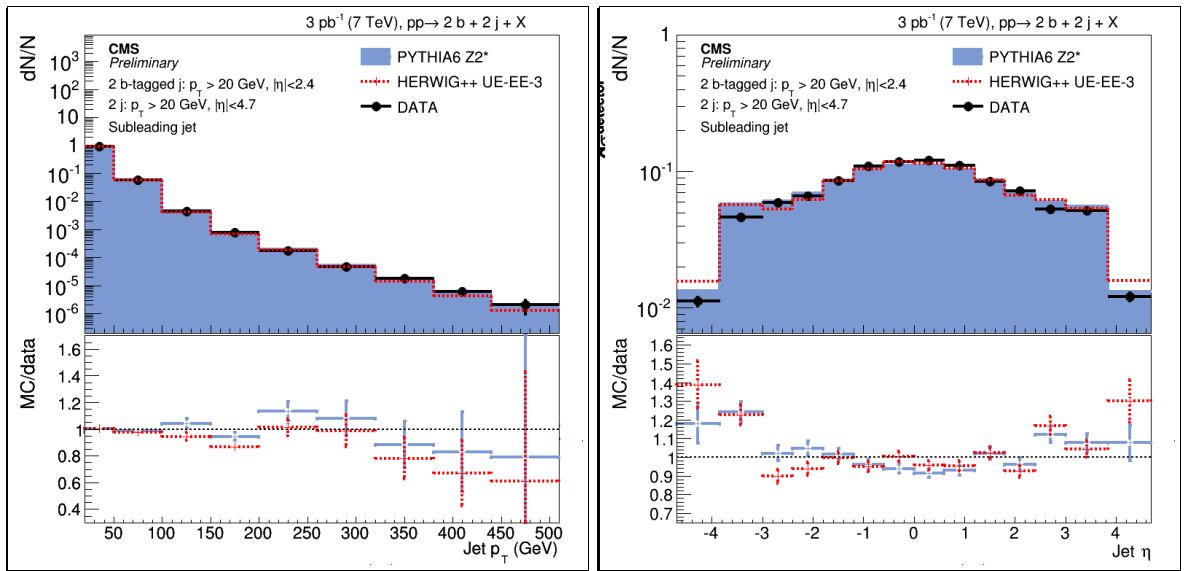


Figure 2. Comparison of data with simulations from MC event generators (PYTHIA 6 and HERWIG++) for the transverse momentum and pseudorapidity for the 3rd (a,b) and 4th jet (c,d). Only statistical uncertainties are shown for the data. Distributions are not normalized to the bin width.

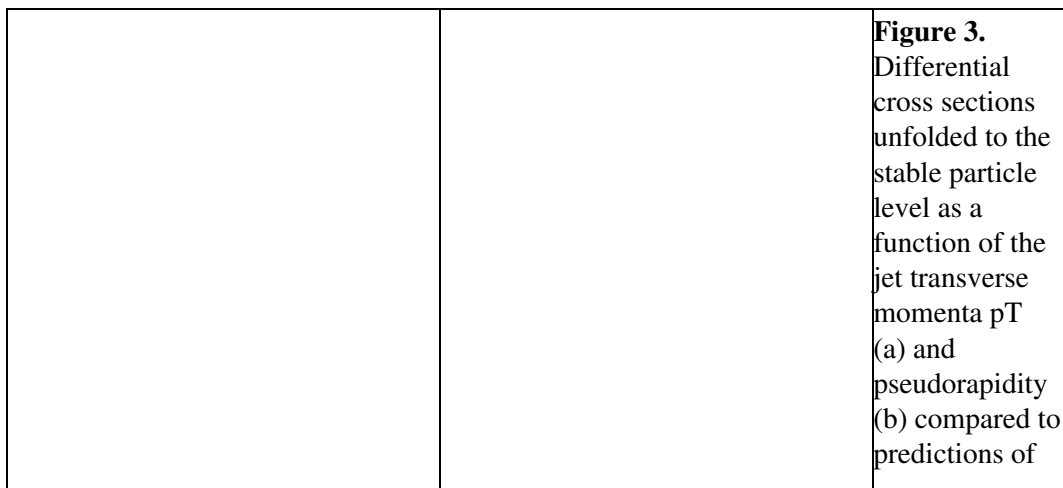
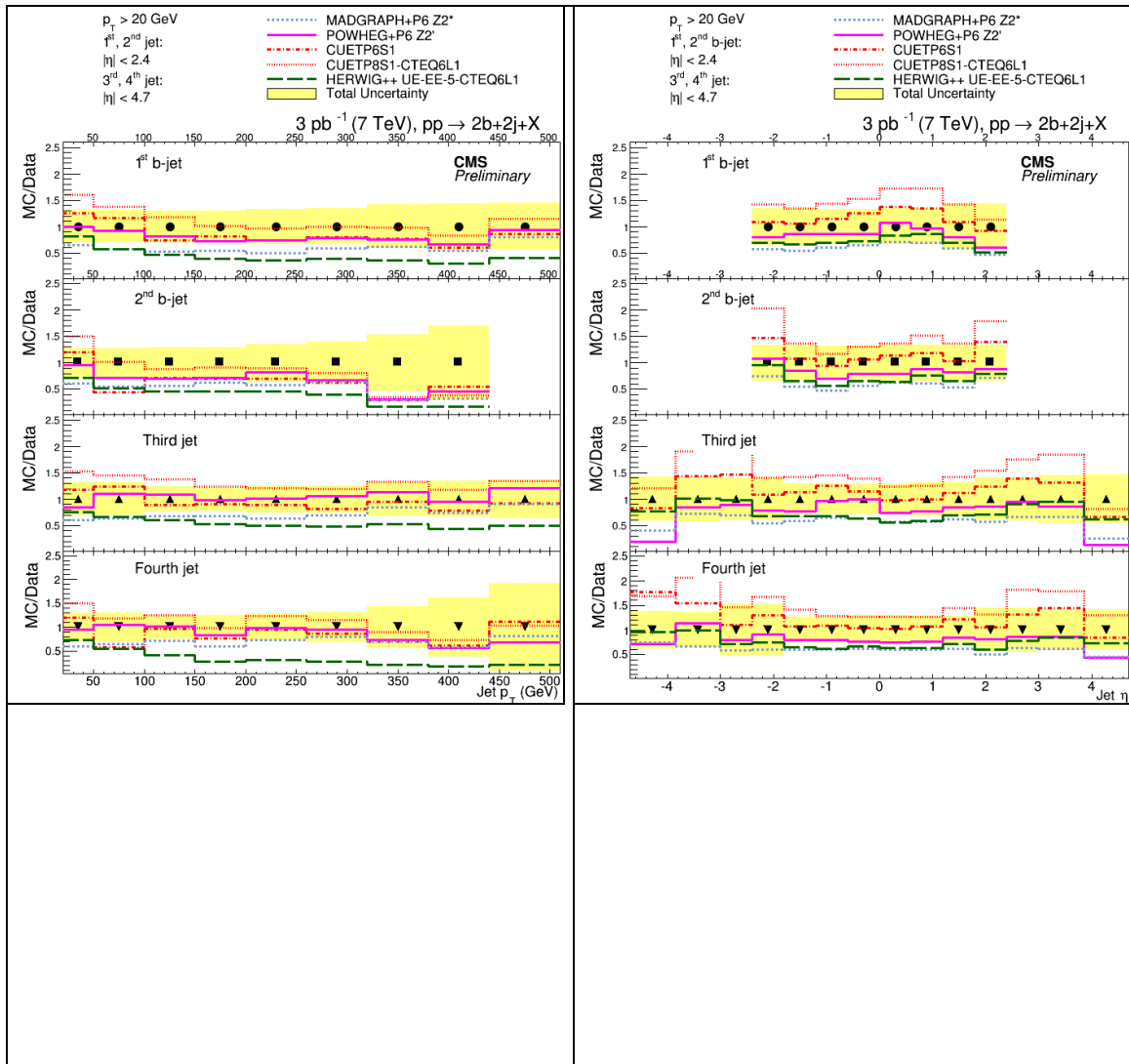
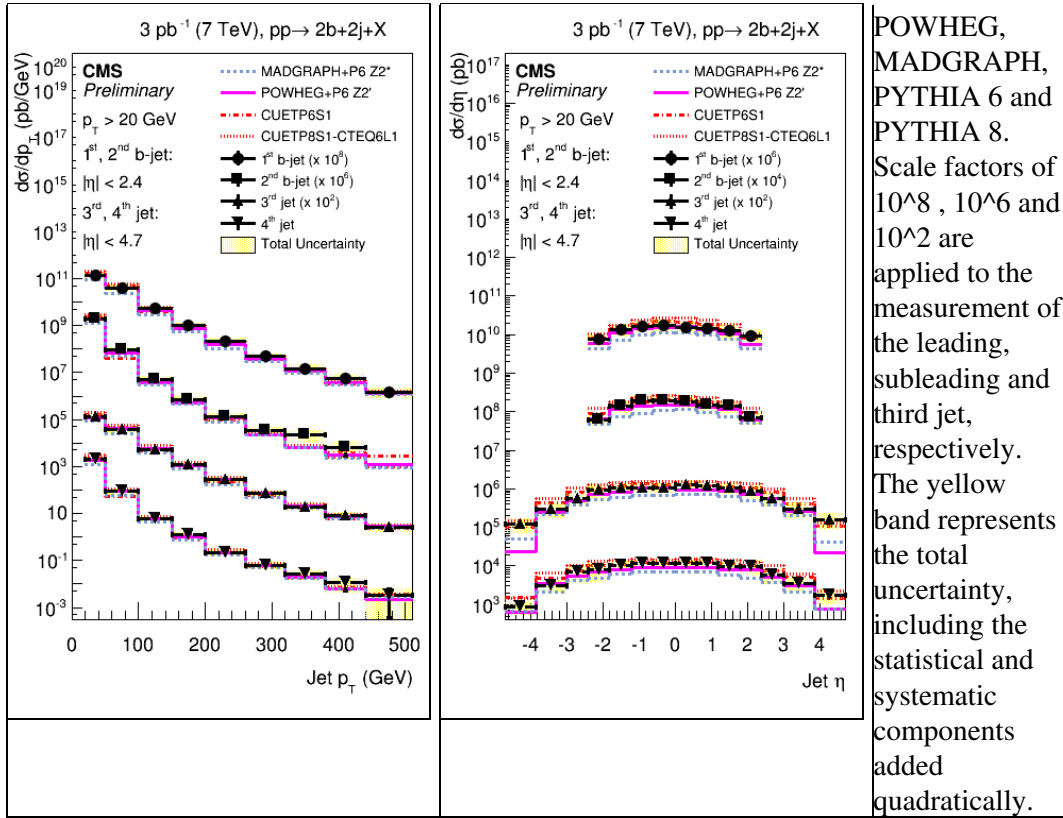


Figure 3. Differential cross sections unfolded to the stable particle level as a function of the jet transverse momenta p_T (a) and pseudorapidity (b) compared to predictions of



jet. The yellow band represents the total uncertainty, including the statistical and systematic components added quadratically.

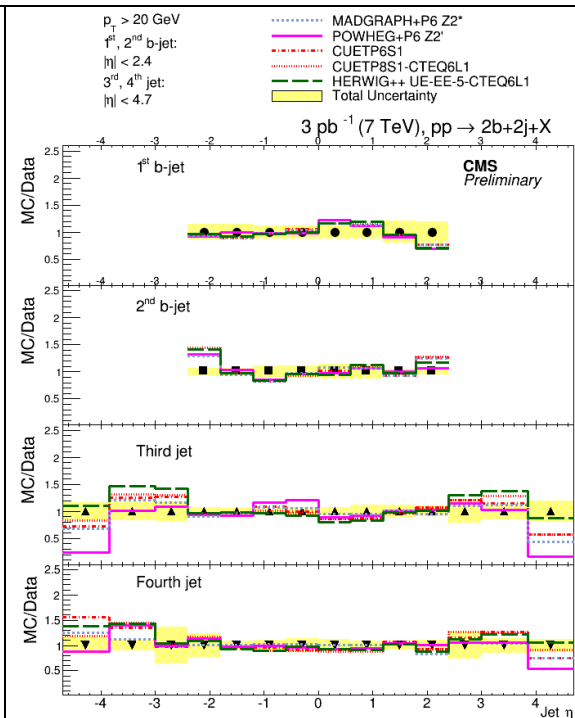
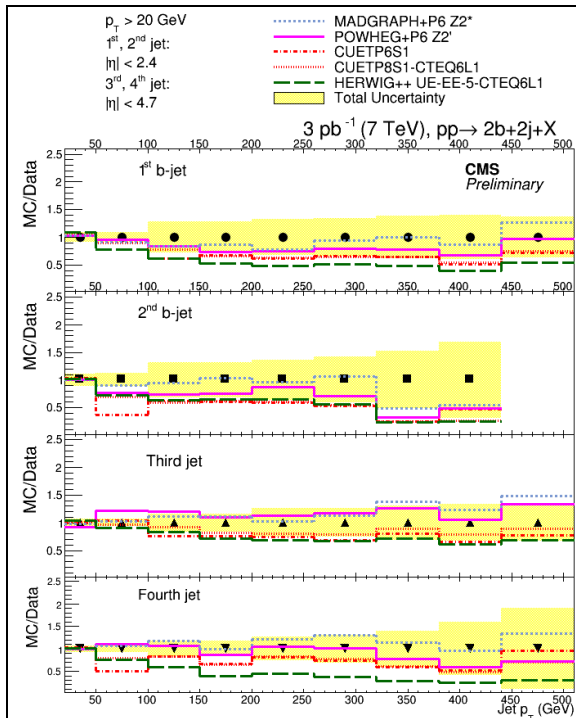


Figure 5. Ratios of the normalized cross section predictions of POWHEG, MADGRAPH, PYTHIA 6, PYTHIA 8 and HERWIG++ to data unfolded to the stable particle level as a function of the jet transverse momenta p_T (a) and pseudorapidity $|\eta|$ (b) for each specific jet. The yellow band represents the total uncertainty, including the statistical

and
systematic
components
added
quadratically.

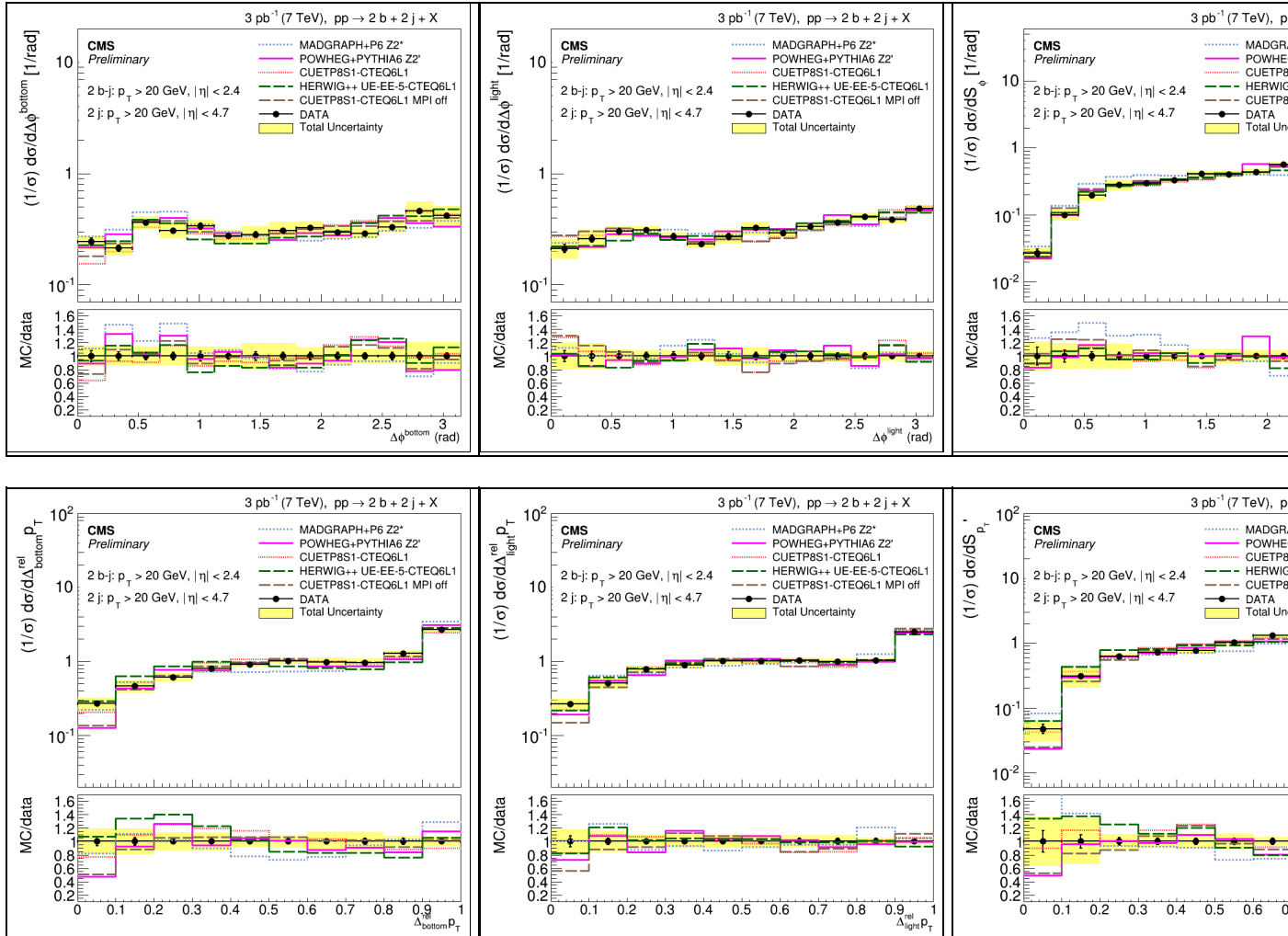


Figure 6. Normalized cross sections unfolded to the stable particle level as a function of Δ_{bottom} (a), Δ_{light} (b), S (c), $\Delta_{\text{rel bottom pT}}$ (d), $\Delta_{\text{rel light pT}}$ (e) and $S' \text{ pT}$ (f), compared to predictions of POWHEG, MADGRAPH, PYTHIA 6, PYTHIA 8 and HERWIG ++. A comparison with the PYTHIA 8 CUETP8S1-CTEQ6L1 predictions without the simulation of the MPI

is also shown. The lower panel shows the ratios of the predictions to the data. The yellow band represents the total uncertainty, including the statistical and systematic components added quadratically.

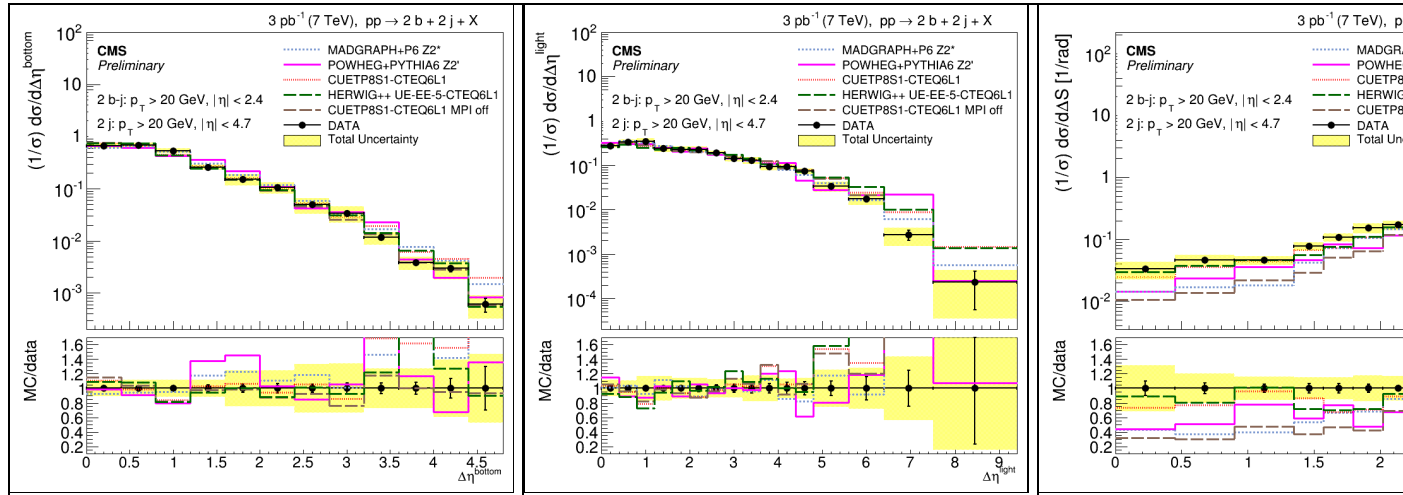


Figure 7. Normalized cross sections unfolded to the stable particle level as a function of Δ_{bottom} (a), Δ_{light} (b) and Δ_S (c), compared to predictions of POWHEG, MADGRAPH, PYTHIA 6, PYTHIA 8 and HERWIG ++. A comparison with the PYTHIA 8 CUETP8S1-CTEQ6L1 predictions without the simulation of the MPI is also shown. The lower panel shows the ratios of the predictions to the data. The yellow band represents the total uncertainty, including the statistical and systematic components added quadratically.

-- PaoloGunnellini - 2015-04-17

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