An update on ttbar dilepton distributions vs LHC data since Top2019

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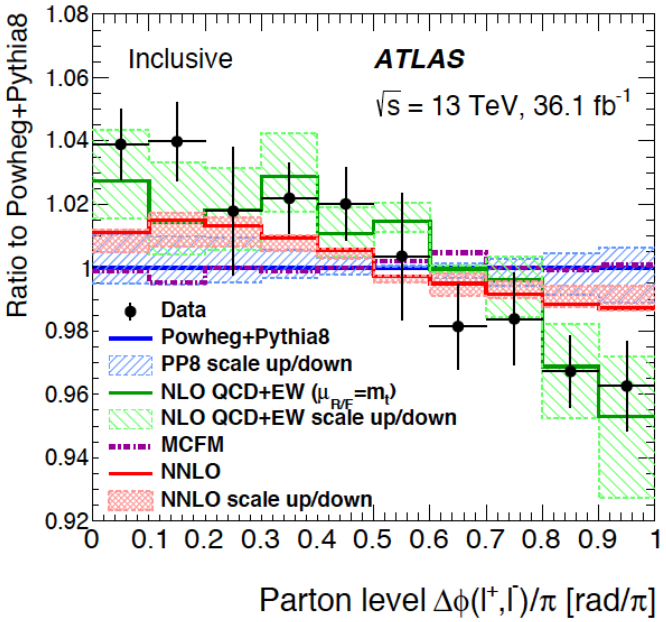
Outline

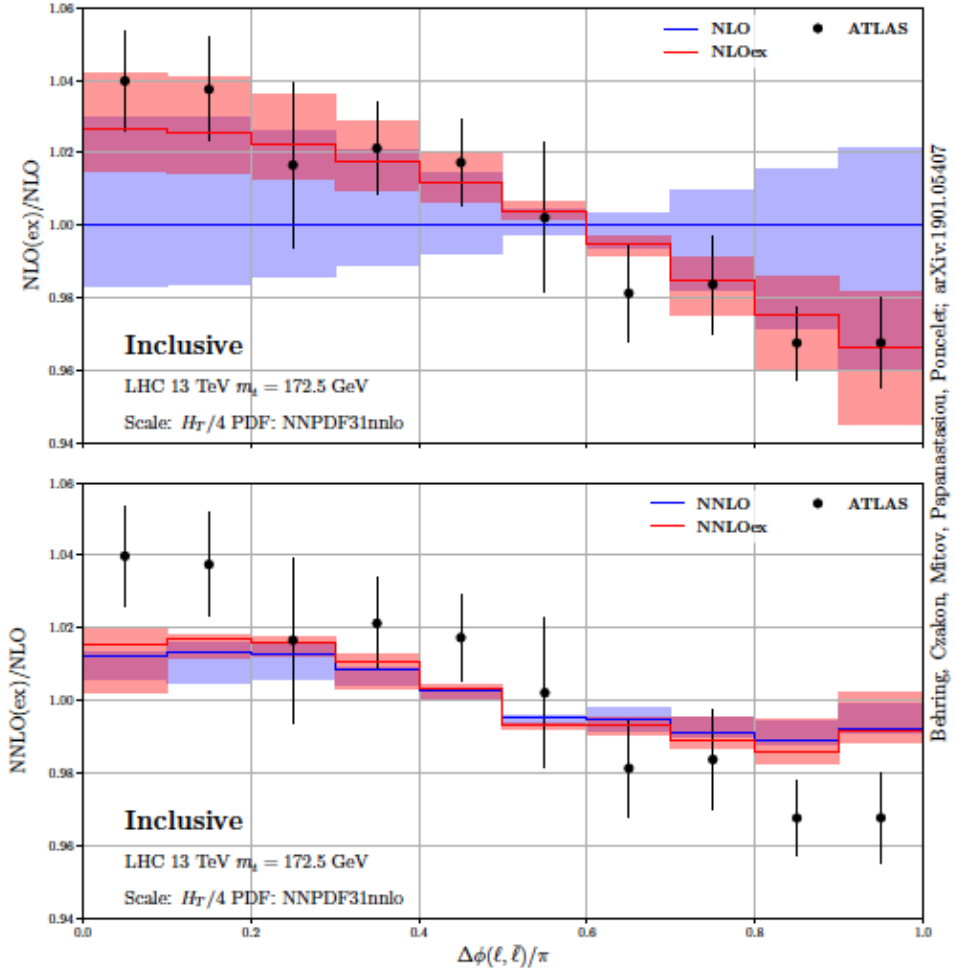
- ✓ Some reminders since top
- ✓ Plots for ATLAS comparison improved (just more statistics) as promised at Top2019
- ✓ Status of the comparison with CMS

Please update

✓ Based on the green band it is

ATLAS: arXiv:1903.07570





These predictions are public

$$R = \frac{1}{\sigma^0 + \alpha_S \sigma^1 + \alpha_S^2 \sigma^2} \left(\frac{\mathrm{d}\sigma^0}{\mathrm{d}X} + \alpha_S \frac{\mathrm{d}\sigma^1}{\mathrm{d}X} + \alpha_S^2 \frac{\mathrm{d}\sigma^2}{\mathrm{d}X} \right) + \mathcal{O}\left(\alpha_S^3\right)$$

$$R^{\mathrm{NNLO,exp}} = R^0 + \alpha_S R^1 + \alpha_S^2 R^2 \,,$$

$$R^0 = \frac{1}{\sigma^0} \frac{\mathrm{d}\sigma^0}{\mathrm{d}X} \,,$$

$$R^1 = \frac{1}{\sigma^0} \frac{\mathrm{d}\sigma^1}{\mathrm{d}X} - \frac{\sigma^1}{\sigma^0} \frac{1}{\sigma^0} \frac{\mathrm{d}\sigma^0}{\mathrm{d}X} \,,$$

$$R^2 = \frac{1}{\sigma^0} \frac{\mathrm{d}\sigma^2}{\mathrm{d}X} - \frac{\sigma^1}{\sigma^0} \frac{1}{\sigma^0} \frac{\mathrm{d}\sigma^1}{\mathrm{d}X} + \left(\left(\frac{\sigma^1}{\sigma^0} \right)^2 - \frac{\sigma^2}{\sigma^0} \right) \frac{1}{\sigma^0} \frac{\mathrm{d}\sigma^0}{\mathrm{d}X}$$

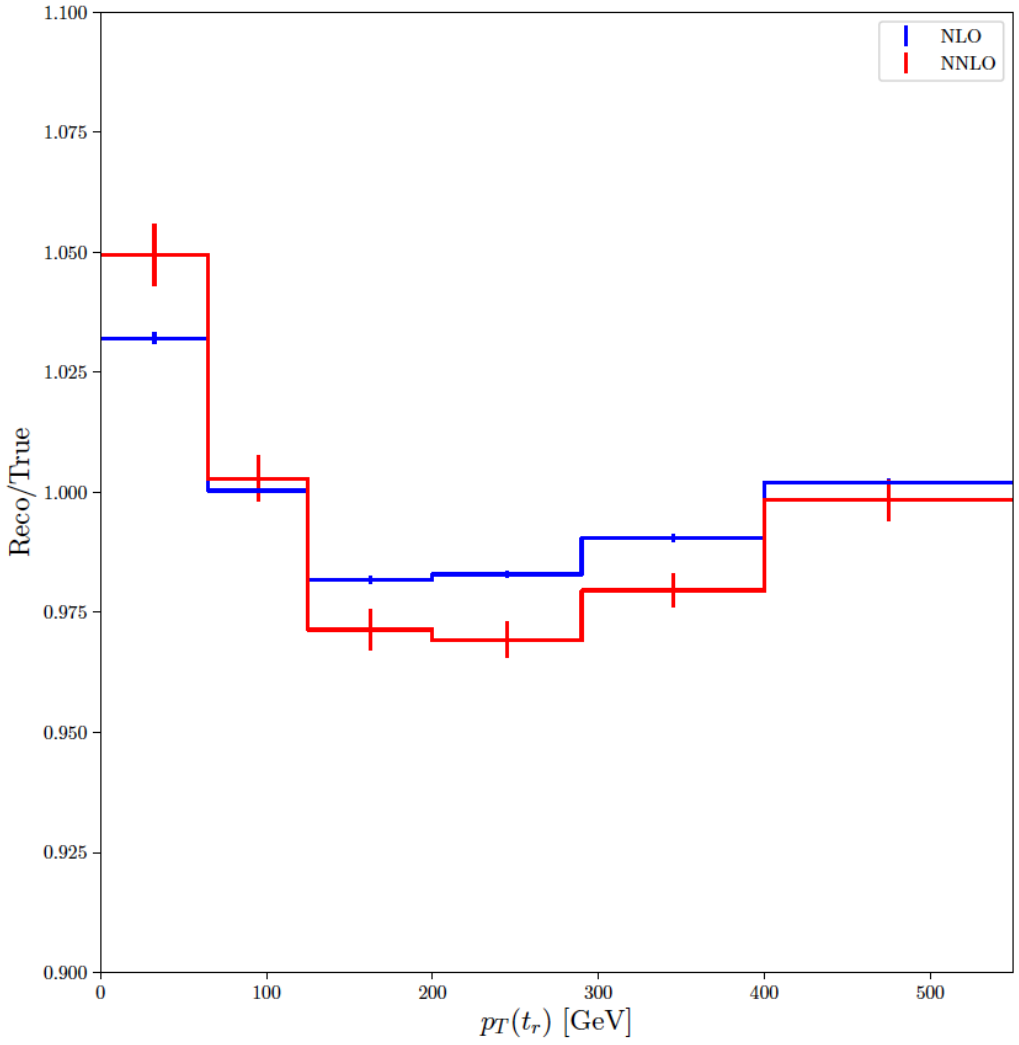
NNLO QCD vs CMS data

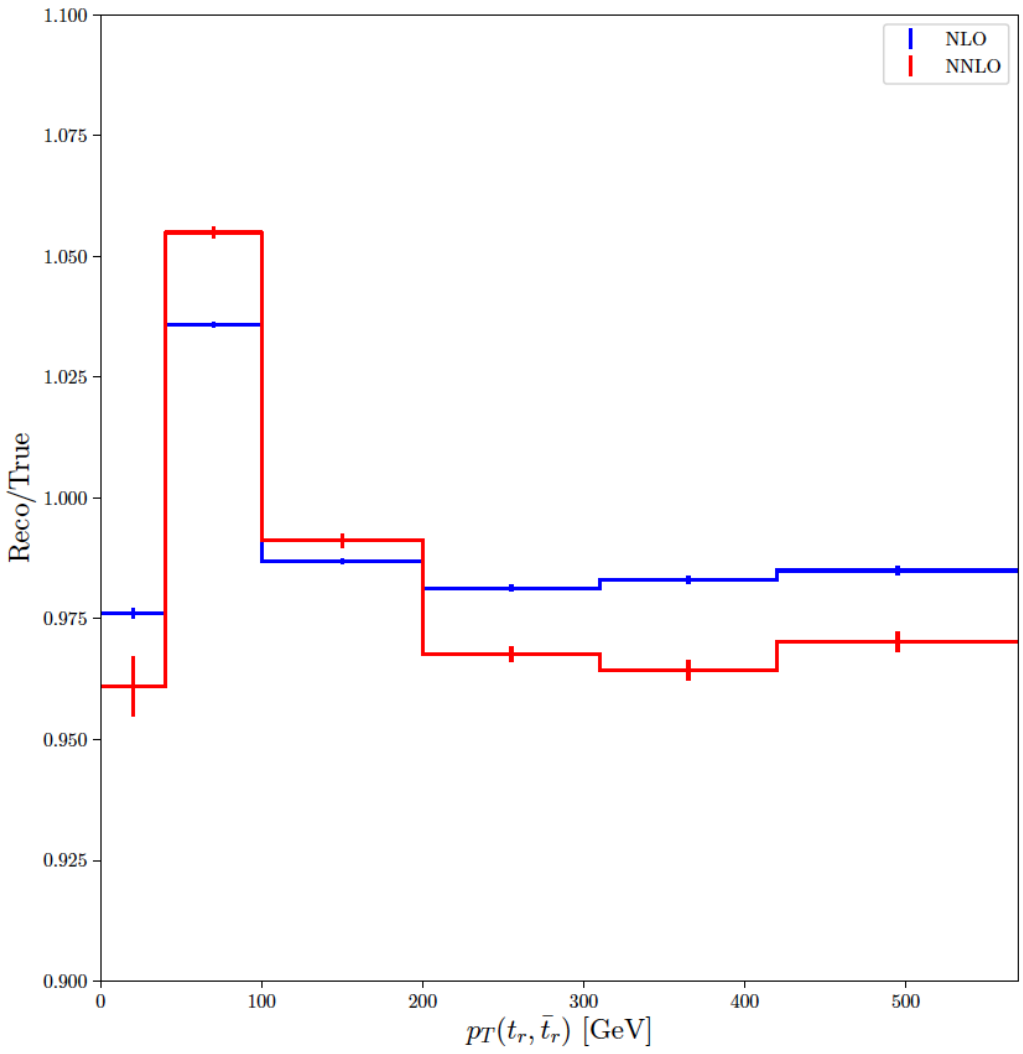
arXiv:1811.06625

- ✓ Do not yet find agreement at the fiducial level
- ✓ Active comparison with CMS is in progress
- ✓ One possible culprit that was identified during our discussions was potential difference due to different definitions of "top"
  - ✓ We use the true top (which is known before the decay)
  - ✓ Experimentally the top is reconstructed from the decay products:
    - ➢ Assume neutrino momenta are known
    - ➢ Leptons + neutrinos give the two W's (minimizing the differences from the true W mass). For us this step is unambiguous.
    - ➢ Then combine the two W's with two b-jets that minimize the difference between the reconstructed top masses and "true" mass. In our calculation we can have up to 4 b-quarks so this introduces a potential difference.

NNLO QCD vs CMS data

- ✓ Here is the ratio between the true top and the constructed top at NLO and NNLO (in the context of the CMS selection)





NNLO QCD vs CMS data

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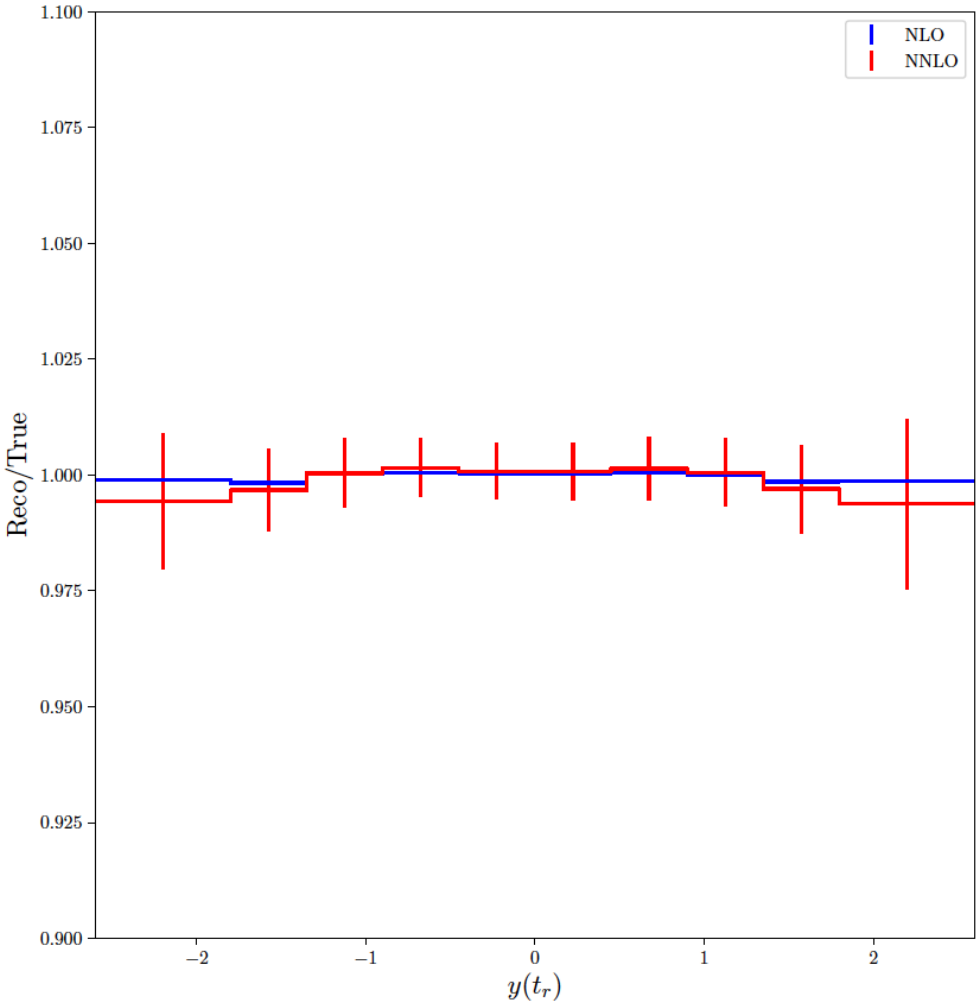
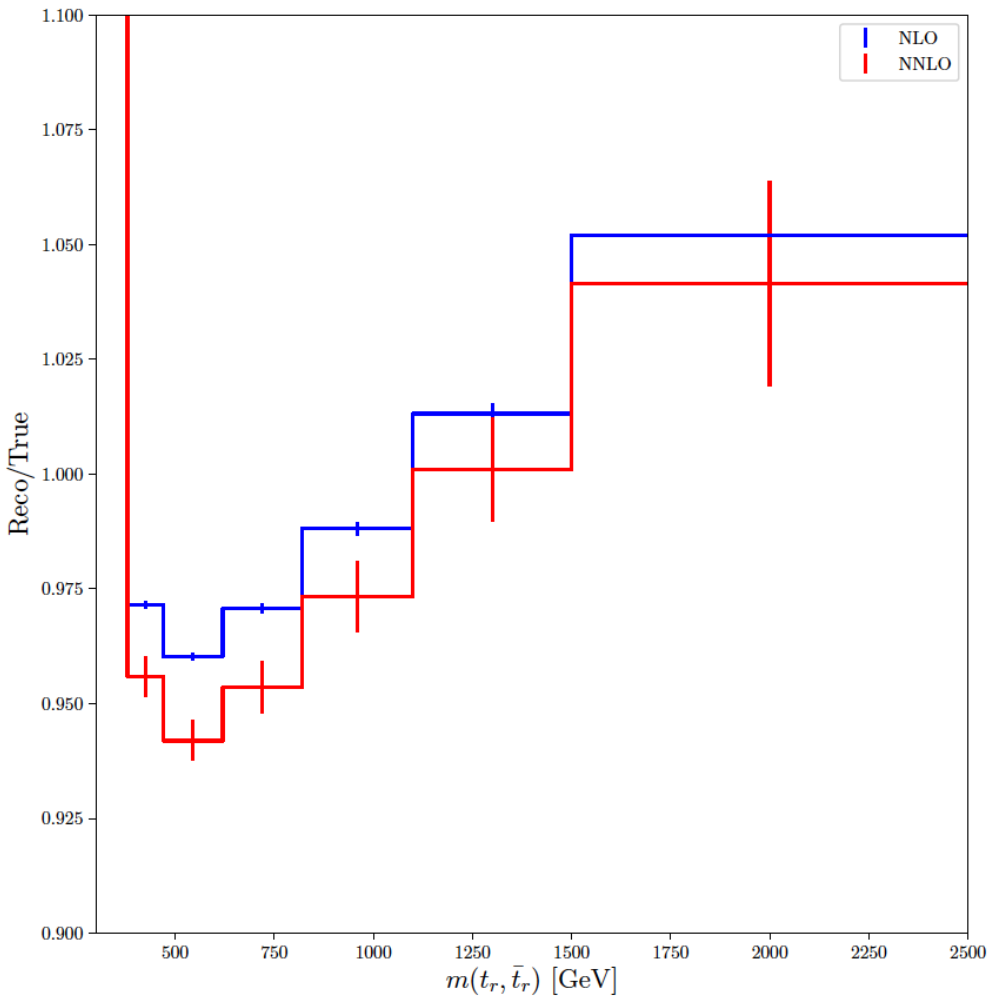


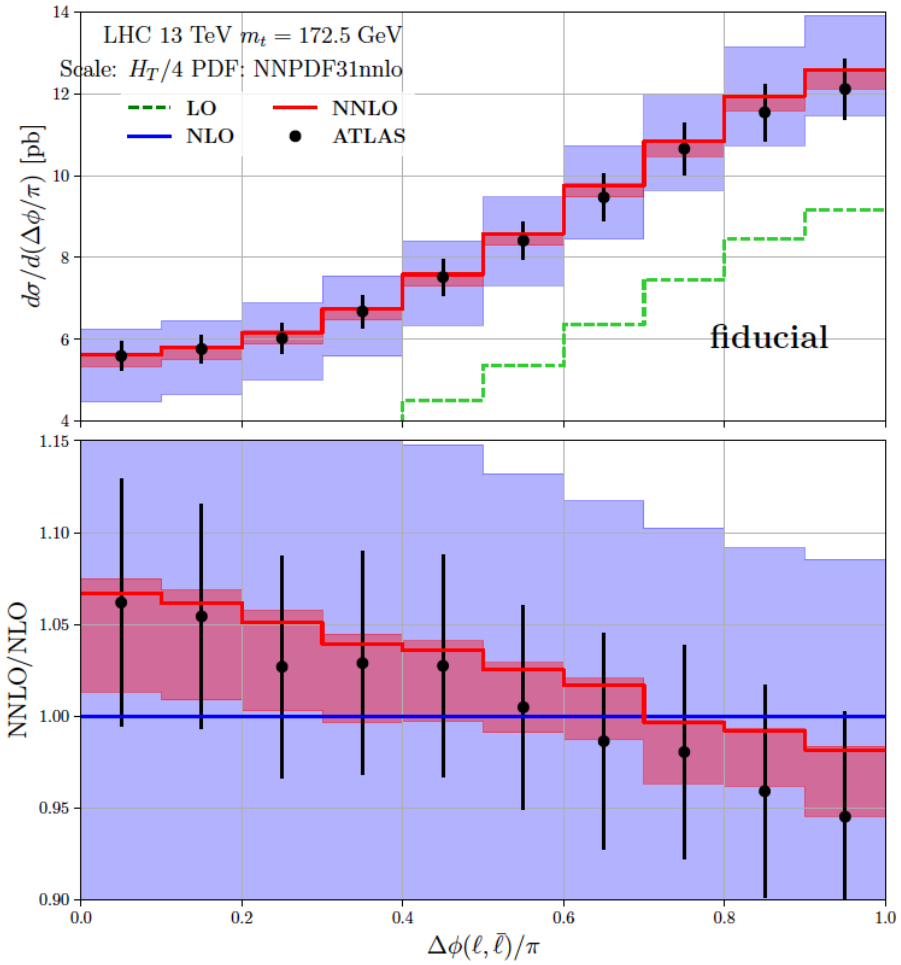


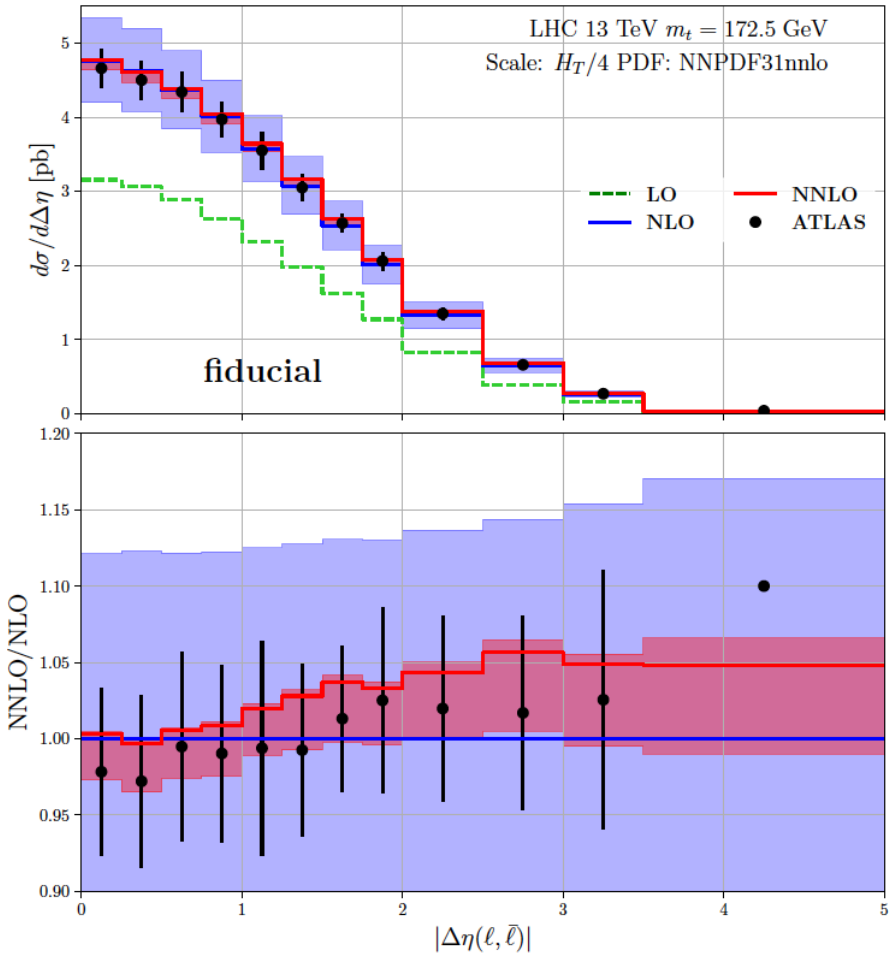
NNLO QCD vs CMS data

- ✓ Although there are clear differences that change with the order (expected) this is not nearly enough to explain our differences.
- ✓ Work is ongoing.
- ✓ Given that fiducial comparisons have never been done before at such a level of predictions, it is not unexpected there are differences. Understanding them is mandatory.
- ✓ We can independently test our ability to produce fiducial calculations.
  - ✓ Show in the following:
    - ➢ Comparison with ATLAS for the fiducial Delta-phi distribution
    - ➢ Comparison with an older 8 TeV CMS fiducial measurement (it has a different setup from the current 13 TeV one)

NNLO QCD vs ATLAS delta-phi & delta-eta

✓ Setup is different; agreement is good





NNLO QCD vs 8 TeV CMS

✓ Setup is different; agreement is reasonable (**plots are way too preliminary**)