

An update on top pair differential distributions at NNLO

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Work in progress with:
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New developments since Top2015

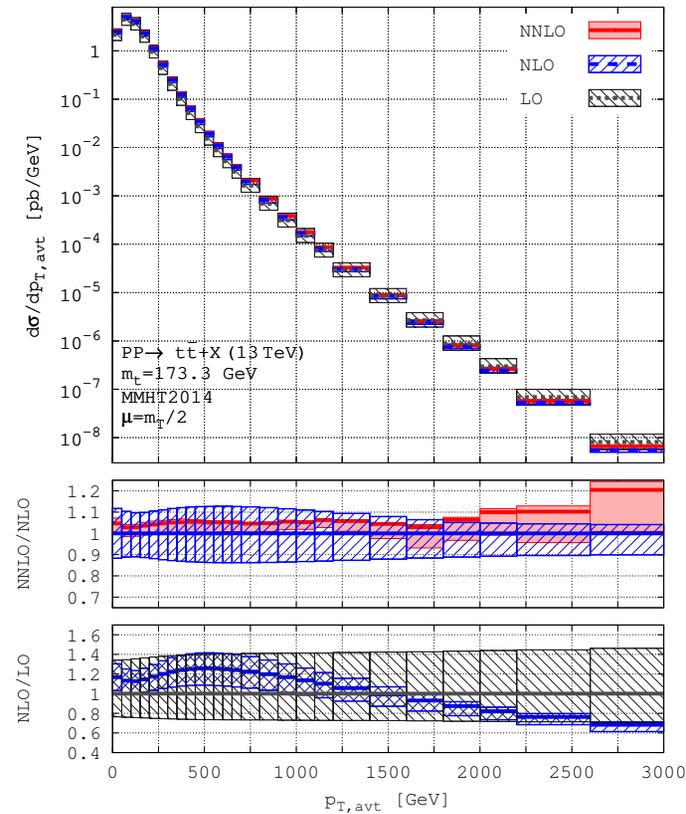
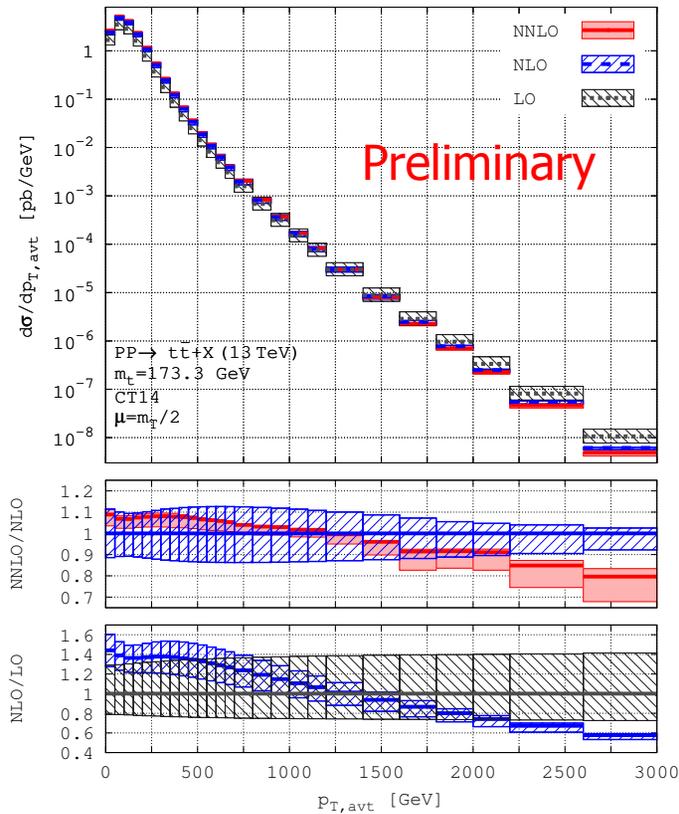
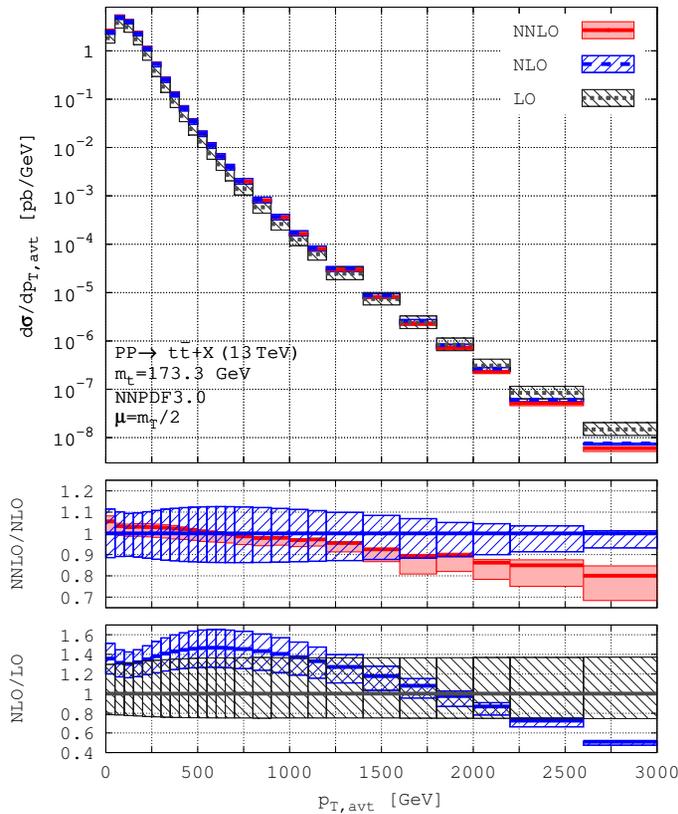
- ◆ Differential distributions with dynamic scales
- ◆ Problems to be overcome first:
 - ◆ Technical issues related to distributions on extended ranges (Completed)
 - ◆ Choice of “best” dynamic scale (Completed)
- ◆ By now both have been resolved and distributions produced
- ◆ Paper being finalized (with Czakon and Heymes)
- ◆ Results already passed on to ATLAS/CMS (and everybody else that may want them)

Main characteristic of the results

- ◆ Results available for:
 - ◆ LHC 8 and 13 TeV
 - ◆ 3 PDF sets (NNPDF3.0, CT14, MMHT2014)
 - ◆ Stable tops only:
 - ◆ Top/antitop P_T and y
 - ◆ $M_{t\bar{t}}$, $P_{t\bar{t}}$, $Y_{t\bar{t}}$
 - ◆ Extended ranges: Results cover all that will be needed at LHC 13 in the long run.
- ◆ ALL results will be made available in electronic format on ArXiv (to avoid the need for private versions floating around)
- ◆ Full 7 point scale variation will be made available. This allows to construct normalized distributions over any kinematic range within the full computed range!
- ◆ $m_t=173.3$ GeV only. Do we need more masses (m_t extraction)?
- ◆ Scale error is stable; MC error is rather minimized with reasonably wide bins.

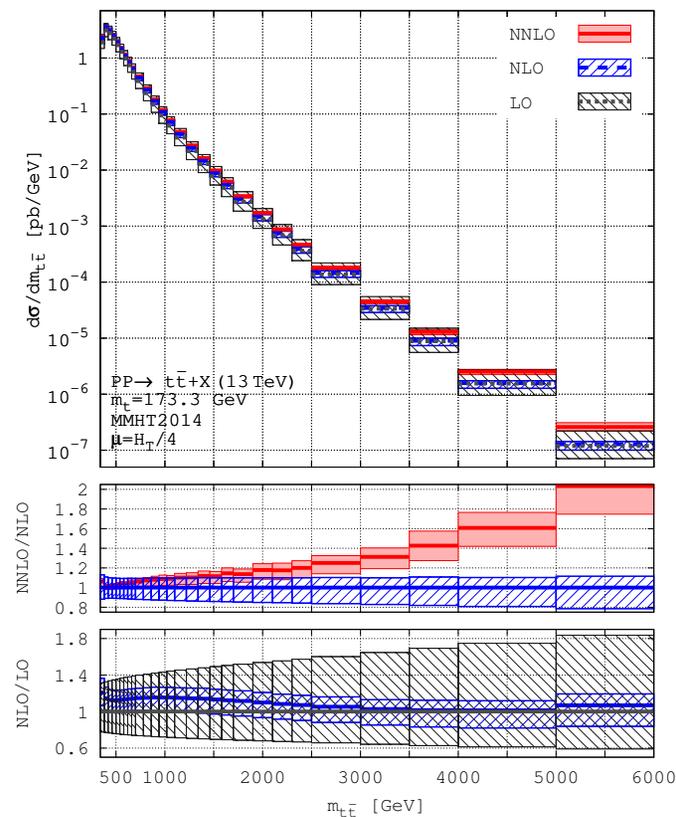
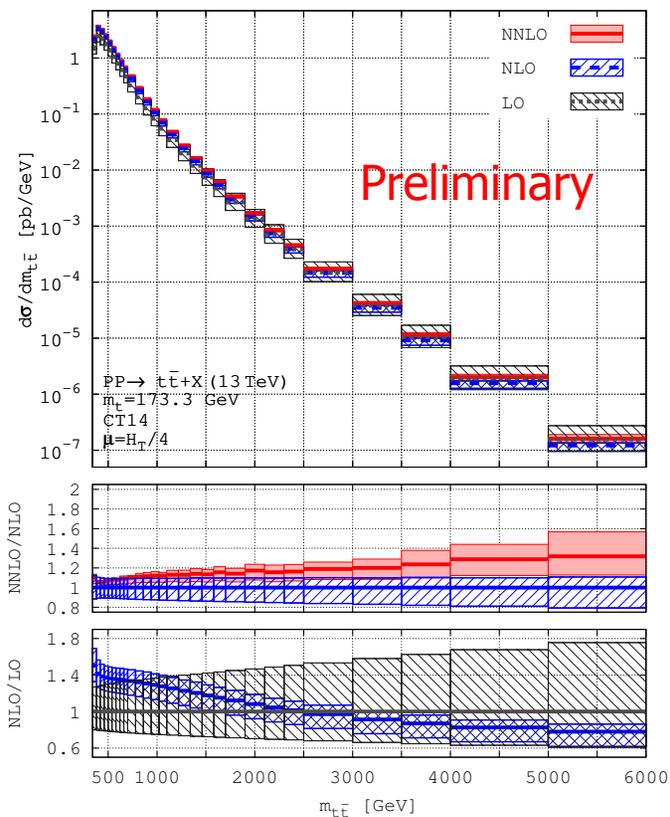
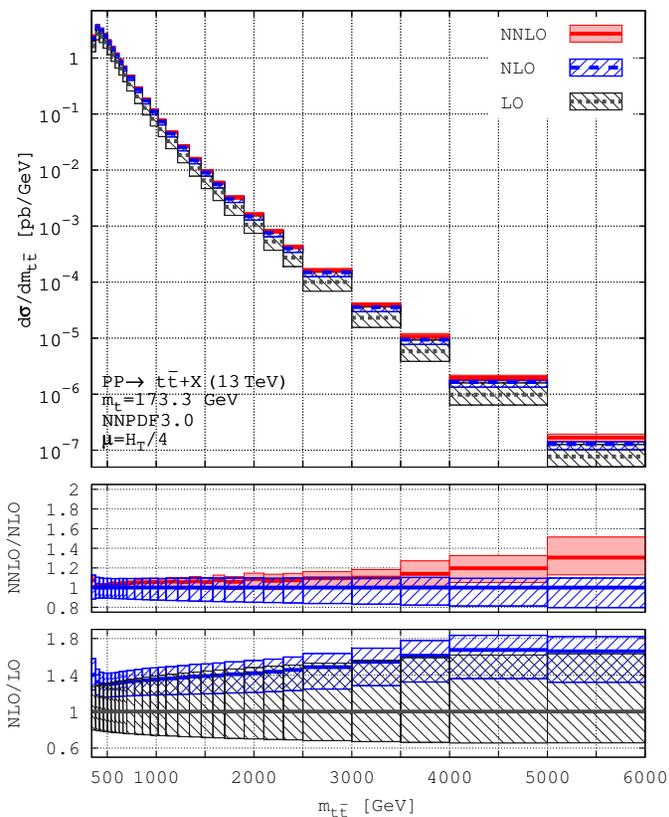
New predictions ($P_{T,avt}$ @ 13 TeV)

✓ Compare 3 pdf's (plots preliminary)

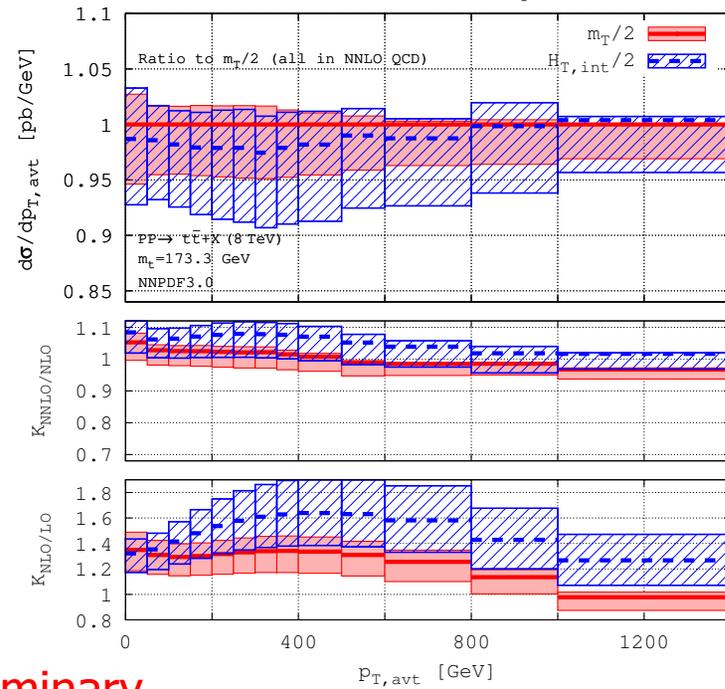
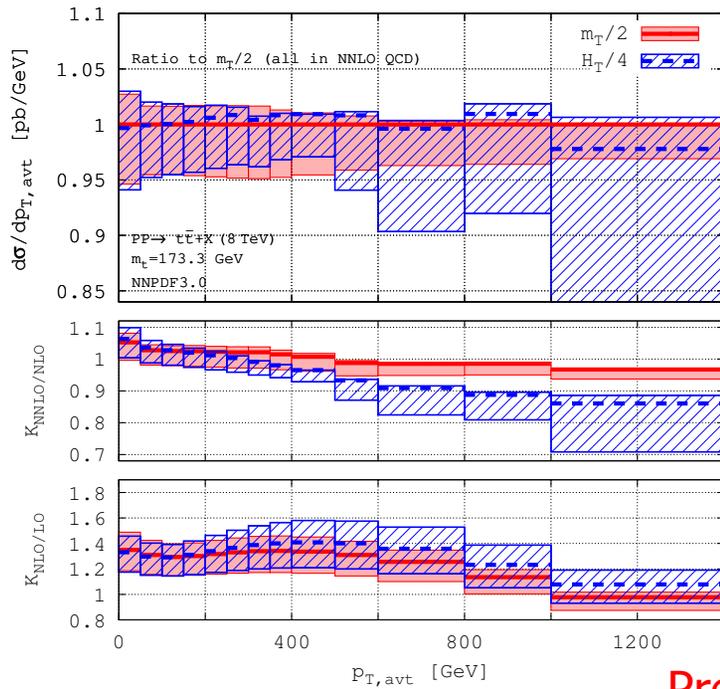


New predictions ($M_{t\bar{t}}$ @ 13 TeV)

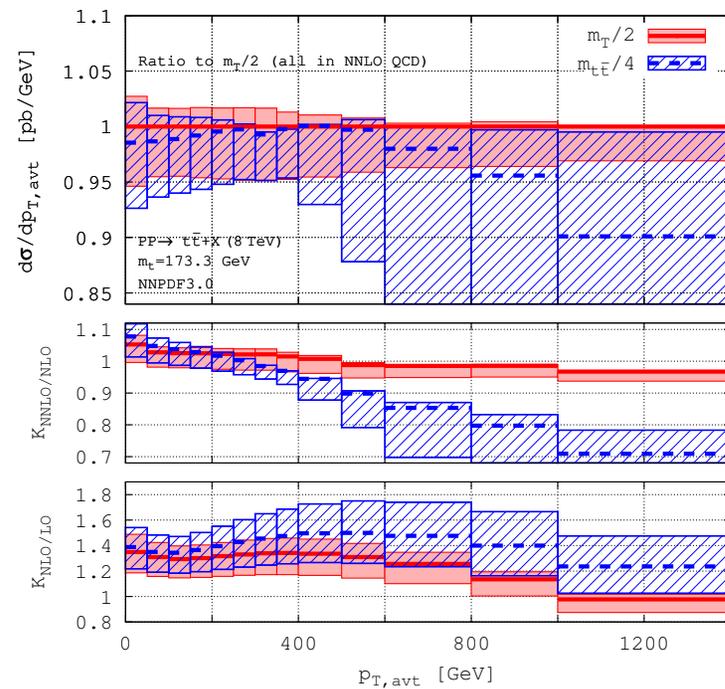
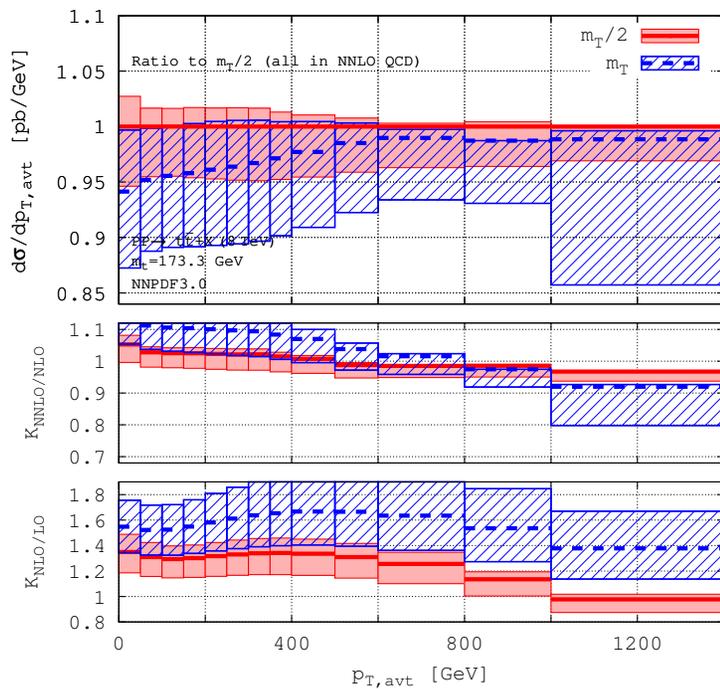
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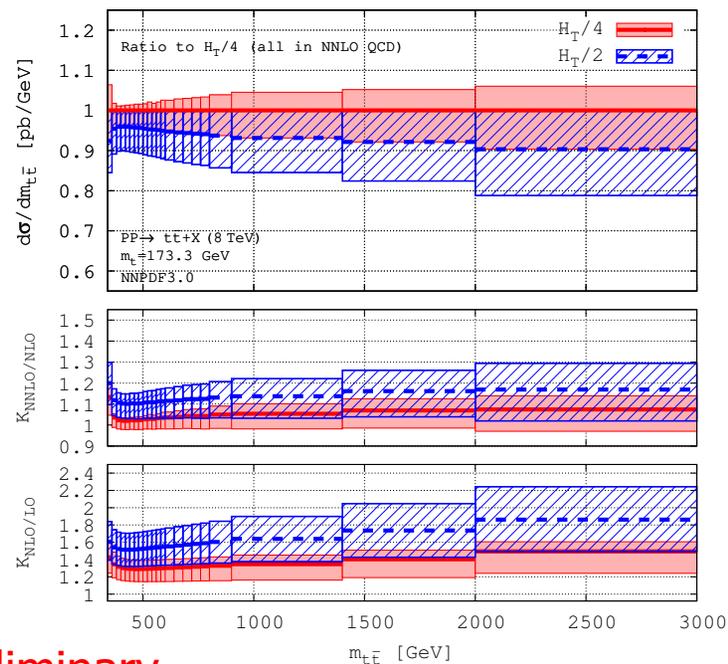
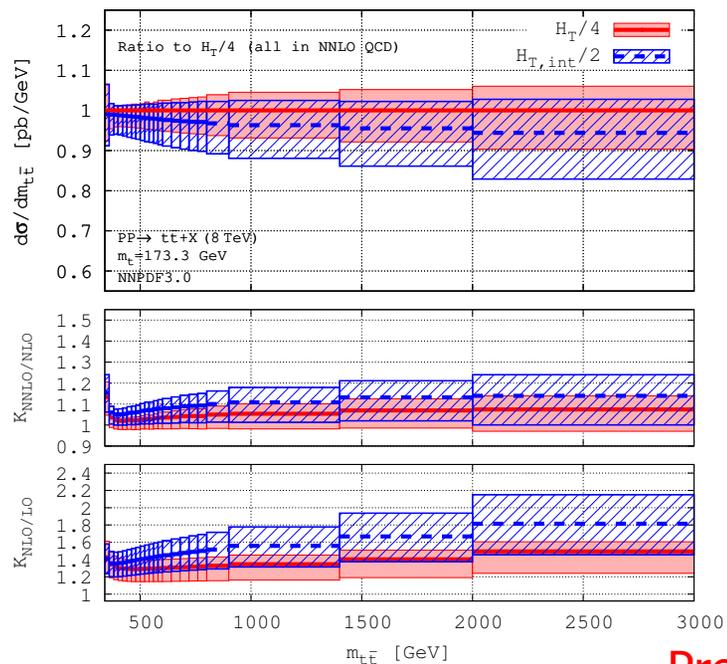
Compare predictions with various scales ($P_{T,avt}$ @ 8 TeV)



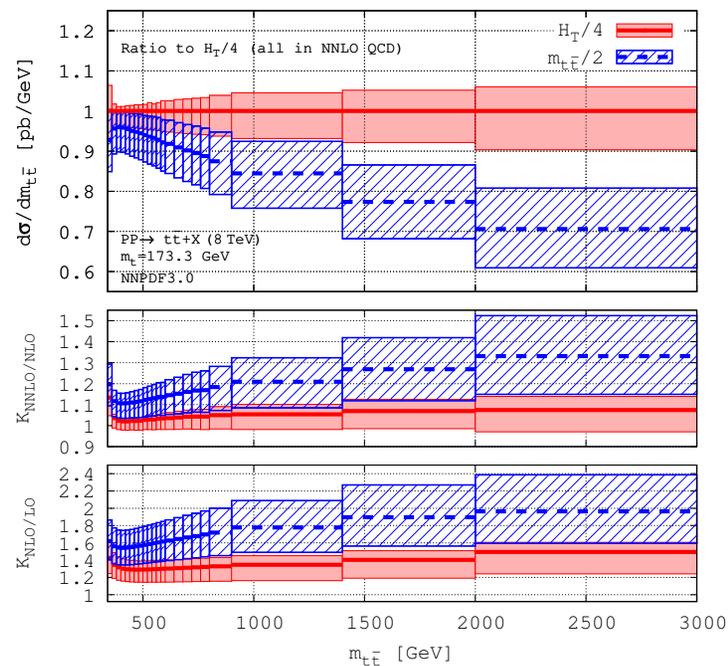
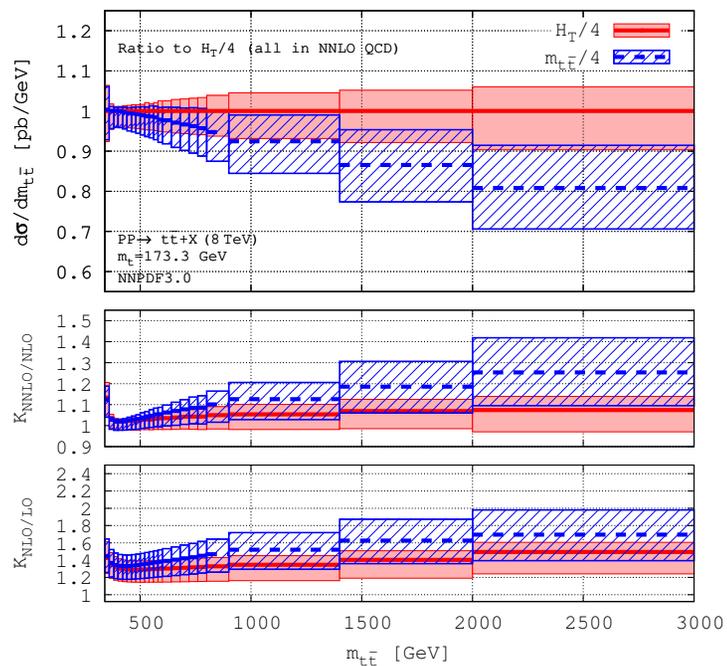
Preliminary



Compare predictions with various scales (M_{tt} @ 8 TeV)



Preliminary



Plans for the near future

- ◆ We have interfaced with fastNLO. Can produce tables on demand.
 - ◆ Any demand besides pdf fitters? Any suggestions about binning etc?
- ◆ Combine NNLO QCD with EW corrections
 - ◆ EW corrections computed with aMC@NLO. Will use pdf with QED corrections.
- ◆ Not much more is left to do with stable tops ... Any recommendations or needs?
- ◆ Work ongoing towards inclusion of top decay (new collaborator: Andrew Papanastasiou)
 - ◆ The required “bits and pieces” have been collected. Putting it together now. Should have results not too far into the future.
 - ◆ What is the best format for the output?
- ◆ Treating top as top jets; could be beneficial at large P_T (since may better resemble the measurement).
 - ◆ Is it needed for stable tops?
 - ◆ Would it make sense only with top decay included?

What else remains to be done?

- ◆ There are few more points related to stable tops one may have to worry about: (but do not require immediate attention)
 - ◆ Resummation at large PT : naively one can expect noticeable effect at around 2 TeV.
 - ◆ 5 versus 6 flavors (not unrelated to above): will it ever be a real issue for top at the LHC 13 TeV?
 - ◆ Calculations for higher energies (like LHC @ 100 TeV) would require some tuning of the code. Nothing conceptual; some low-level work is ongoing. Any need for it (given we missed the 100 TeV report)?
 - ◆ Do we need top-pair and single top combined?
- ◆ And a concluding comment:
 - ◆ I presented an exhaustive coverage of stable top production: both what's accomplished and what's missing. I wonder what one can hope to learn from comparisons with partial results like approximate NNLO's (even when they are called approx N^3LO 's they are still not even N^2LO accurate)?
 - ◆ This is unlike comparisons with showers – which are great
 - ◆ Also unlike comparisons with resummed results from which, if done right, one may also learn.