

Differential cross sections for top-pair and single-top production

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- Higher-order two-loop corrections
- NNLL resummation and NNLO expansions
- Top p_T distributions in pair production
- Top rapidity distributions in pair production
- Top p_T in single-top production

Higher-order corrections

QCD corrections significant for top pair and single top production

Soft-gluon corrections are important

Soft terms: $\left[\frac{\ln^k(s_4/m_t^2)}{s_4} \right]_+$ with $k \leq 2n - 1$, s_4 distance from threshold

Resum these soft corrections - factorization and RGE

Complete results at NNLL–two-loop soft anomalous dimensions

Approximate NNLO cross section from expansion of resummed cross section

Calculation is for **partonic threshold at the double differential cross section level using the standard moment-space resummation in pQCD**

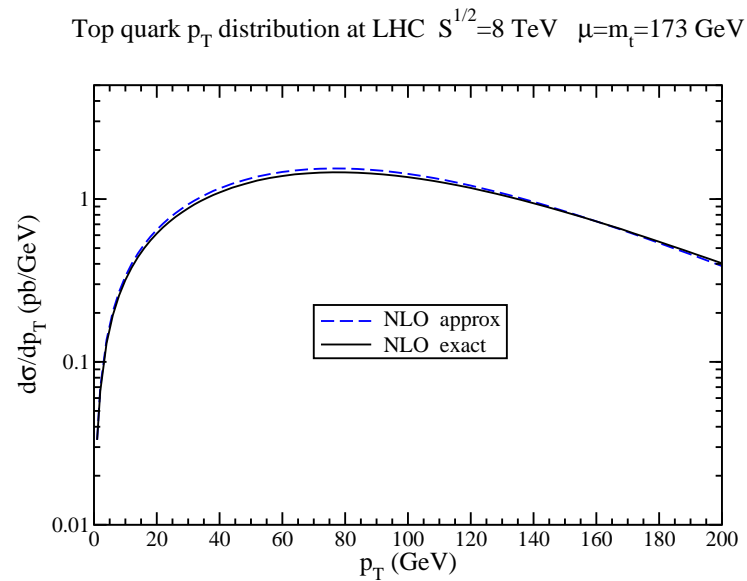
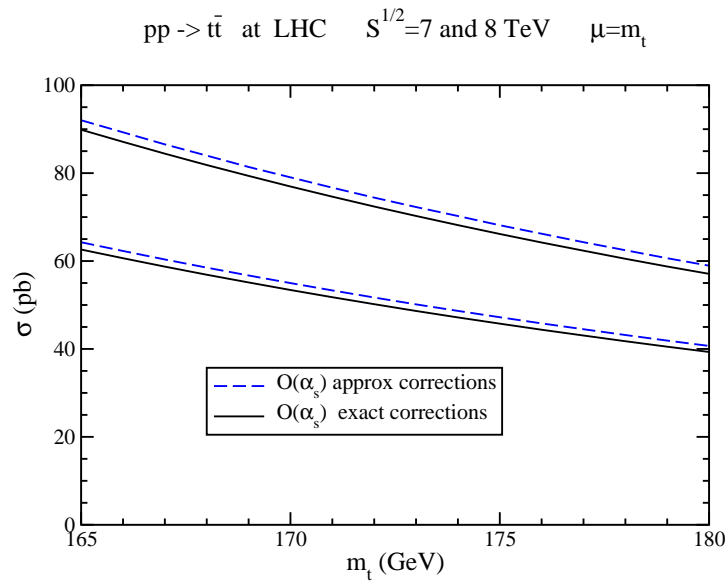
Latest results for differential distributions:

top-pair production, 1304.7775 [hep-ph]

single-top production, 1306.3592 [hep-ph]

Threshold approximation

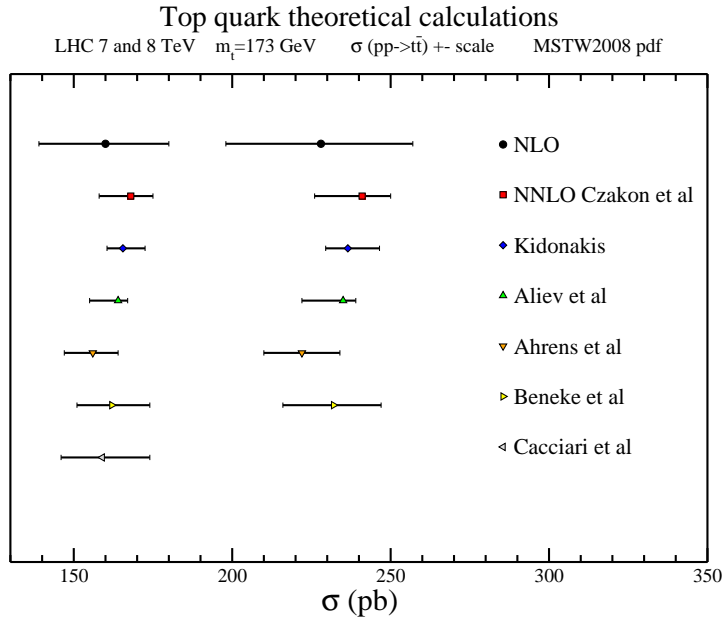
Approximation works very well for LHC and Tevatron energies



excellent approximation:

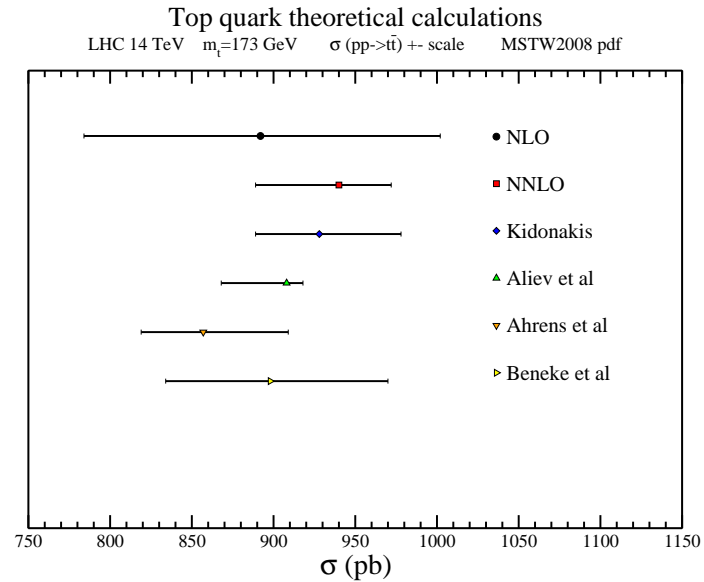
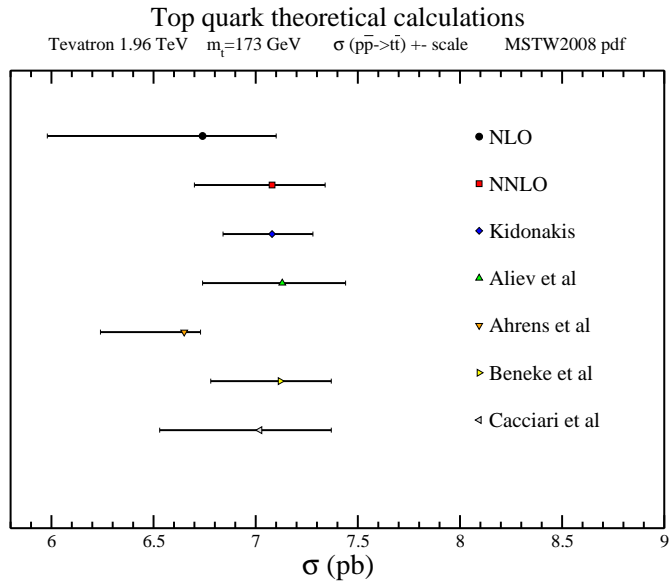
$\sim 1\%$ difference between NLO approximate and exact cross sections;
and also for differential distributions;
also true at NNLO for total cross sections

For best prediction for differential distributions add NNLO
approximate corrections to exact NLO result



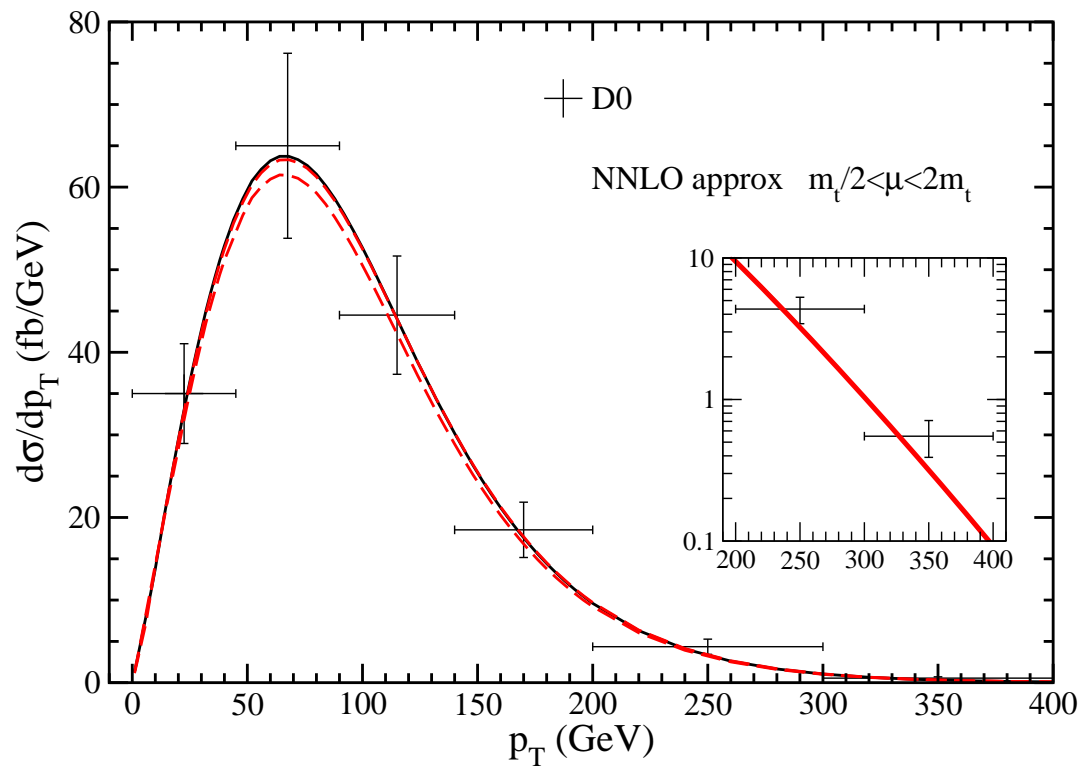
Comparison of various NNLO approx approaches all with the same choice of parameters

Kidonakis, PRD 82, 114030 (2010) differential-pQCD
Aliev et al, CPC 182, 1034 (2011) total-pQCD
Ahrens et al, PLB 703, 135 (2011) differential -SCET
Beneke et al, NPB 855, 695 (2012) total-SCET
Cacciari et al, PLB 710, 612 (2012) total-pQCD



Top quark p_T distribution at Tevatron

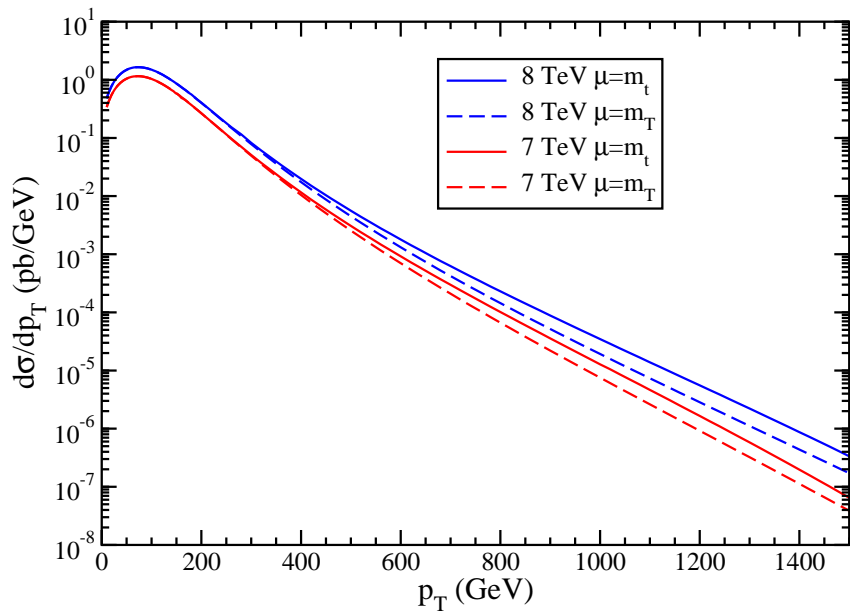
Top quark p_T at Tevatron $S^{1/2}=1.96$ TeV $m=170$ GeV



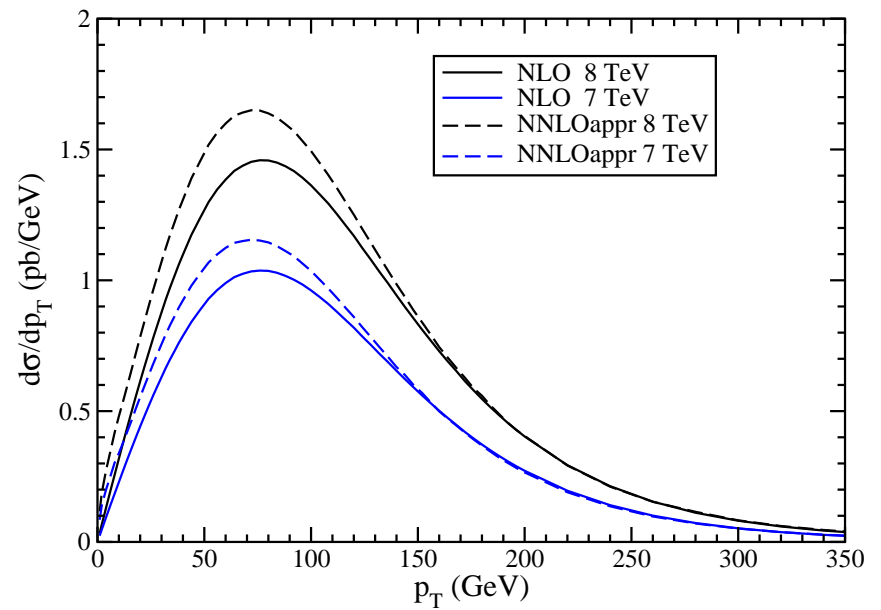
Excellent agreement of NNLO approx results with D0 data

Top quark p_T distribution at the LHC

Top quark p_T distribution at LHC NNLO approx $m_t=173$ GeV

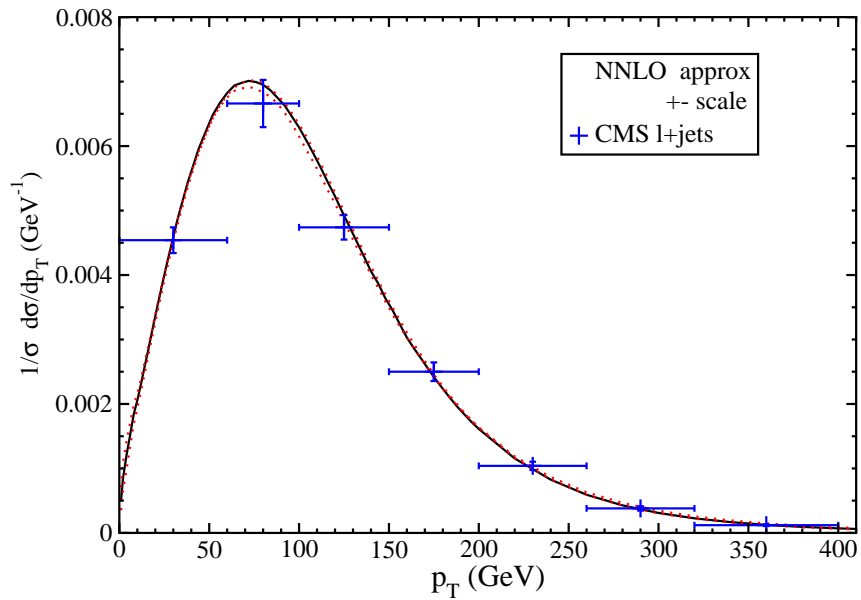


Top quark p_T distribution at LHC $\mu=m_t=173$ GeV

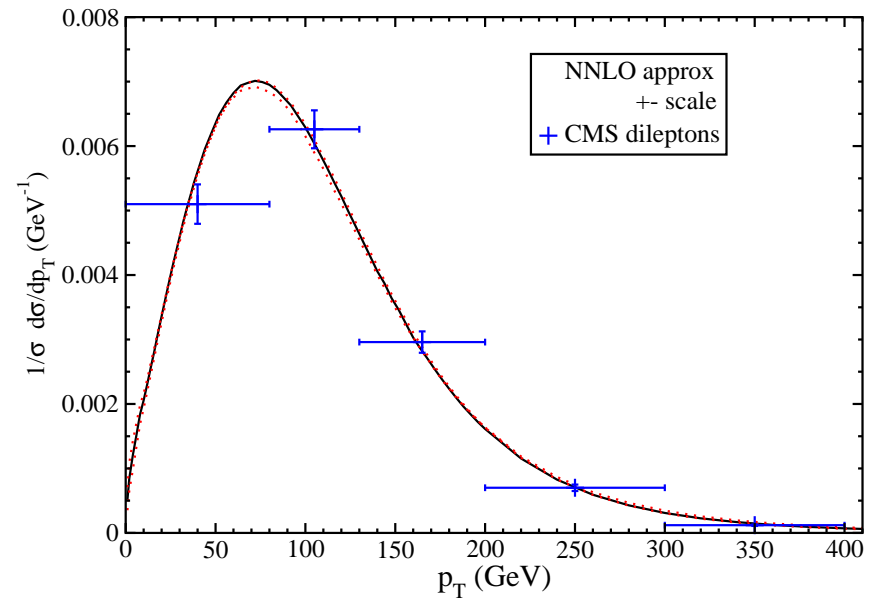


Normalized top quark p_T distribution at the LHC

Normalized top p_T distribution at LHC $S^{1/2}=7$ TeV $m_t=173$ GeV



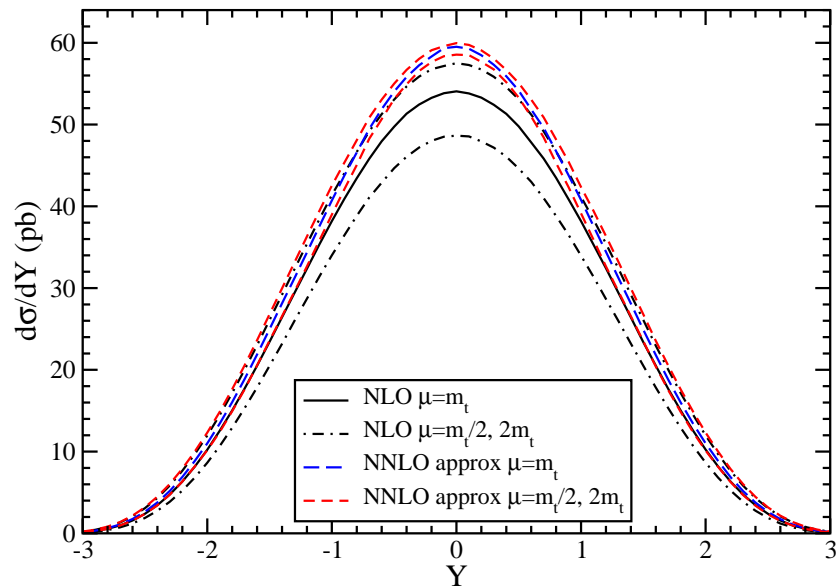
Normalized top p_T distribution at LHC $S^{1/2}=7$ TeV $m_t=173$ GeV



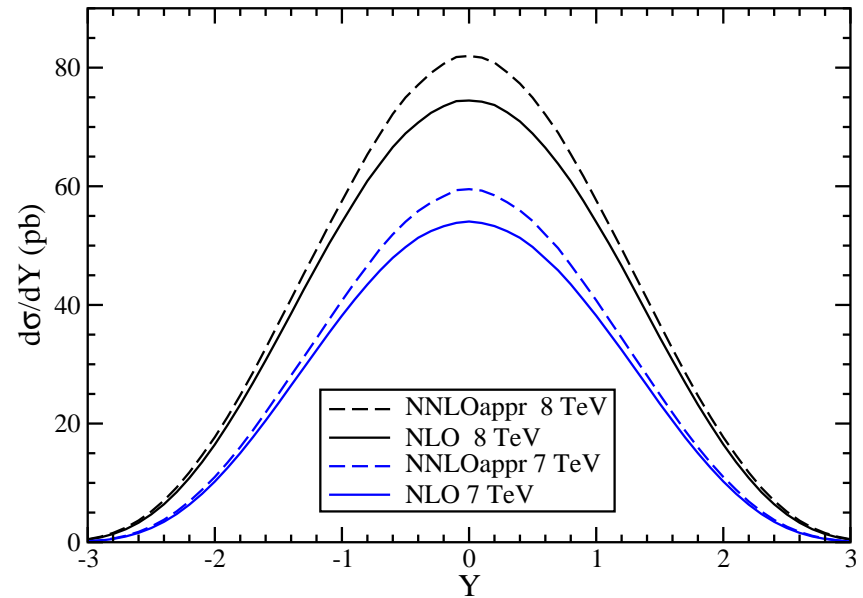
Excellent agreement with CMS data at 7 TeV; also at 8 TeV

Top quark rapidity distribution at LHC

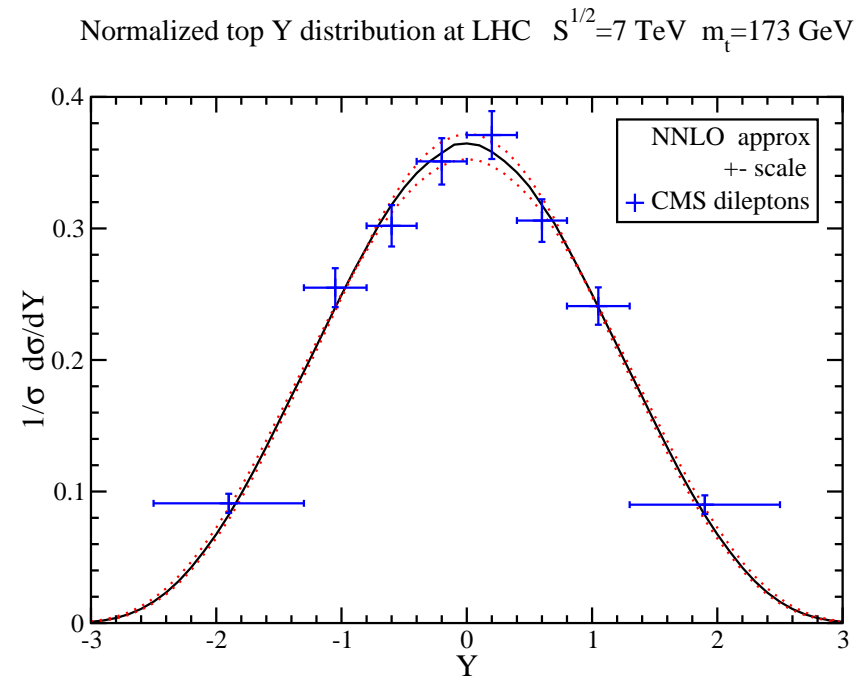
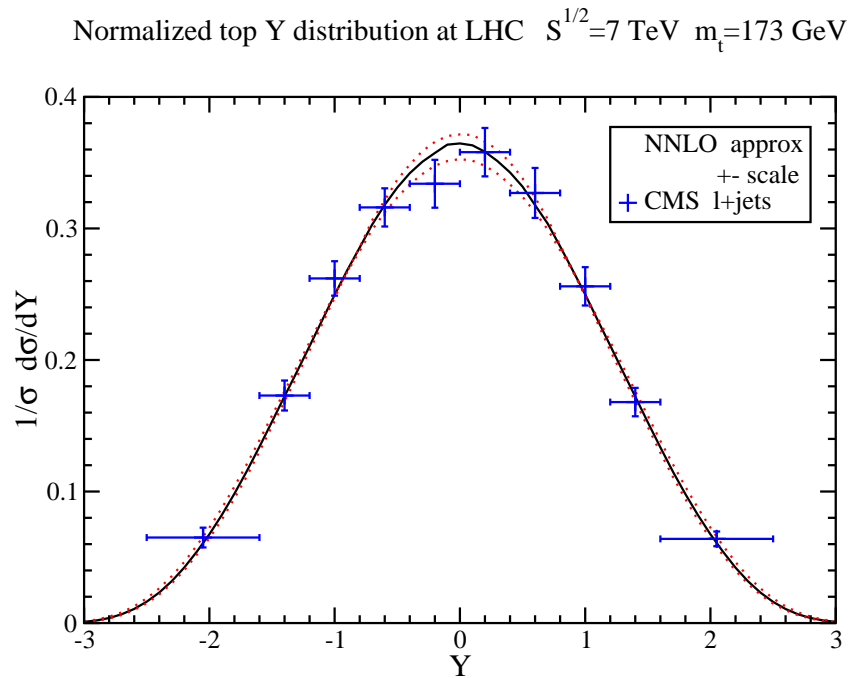
Top quark rapidity at LHC $S^{1/2}=7$ TeV $m_t=173$ GeV



Top quark rapidity distribution at LHC $\mu=m_t=173$ GeV



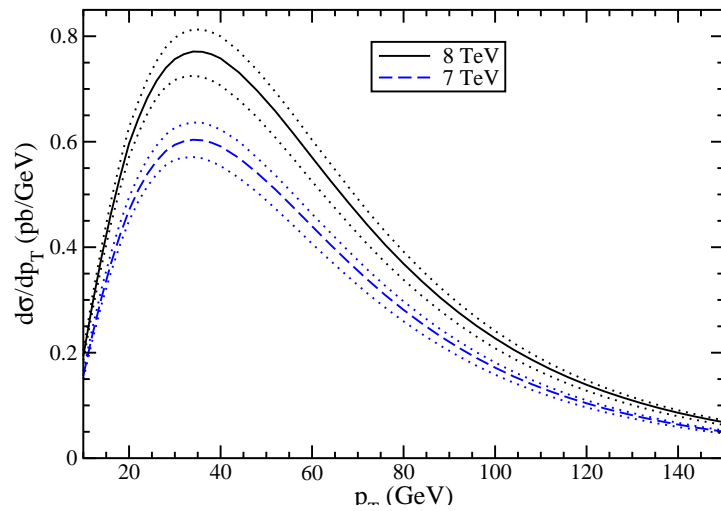
Normalized top quark rapidity distribution at LHC



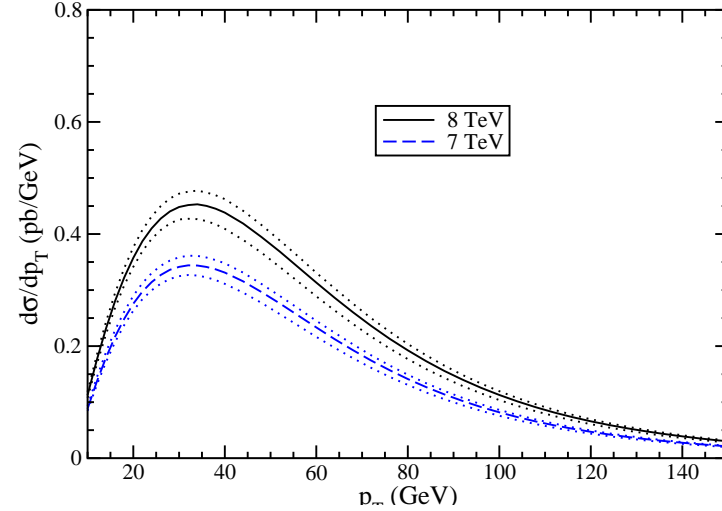
Excellent agreement with CMS data at 7 TeV; also at 8 TeV

t -channel top and antitop p_T distributions at LHC

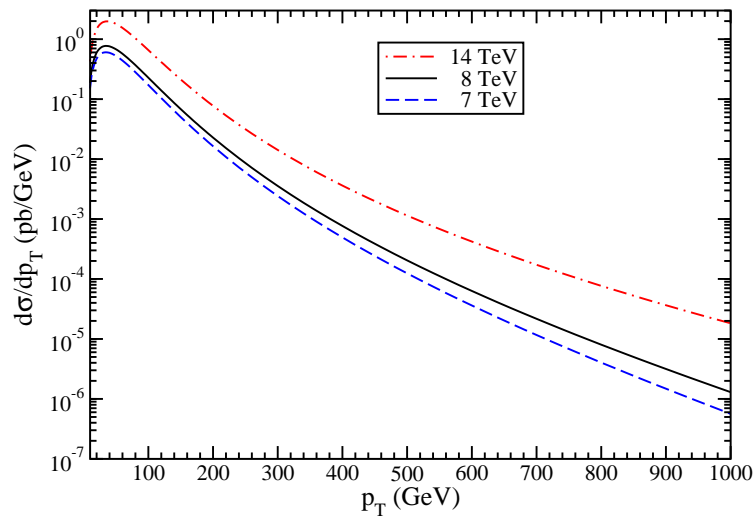
t-channel top quark p_T distribution at LHC $m_t=173$ GeV
NNLO approx (NNLL)



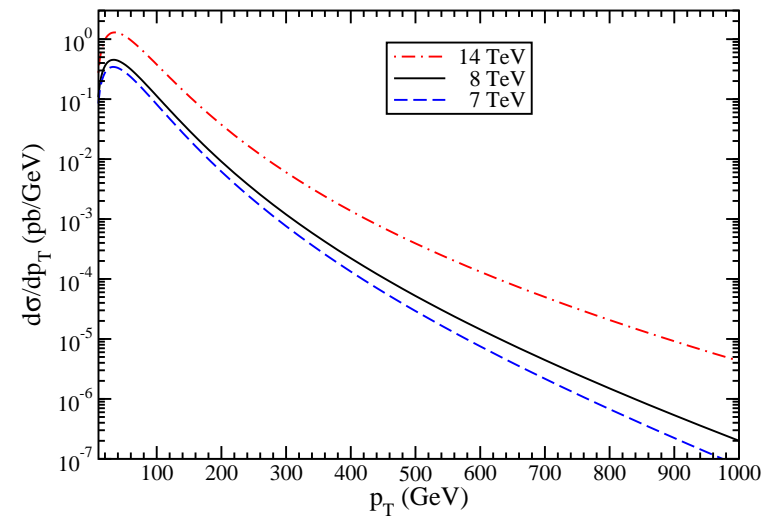
t-channel antitop quark p_T distribution at LHC $m_t=173$ GeV
NNLO approx (NNLL)



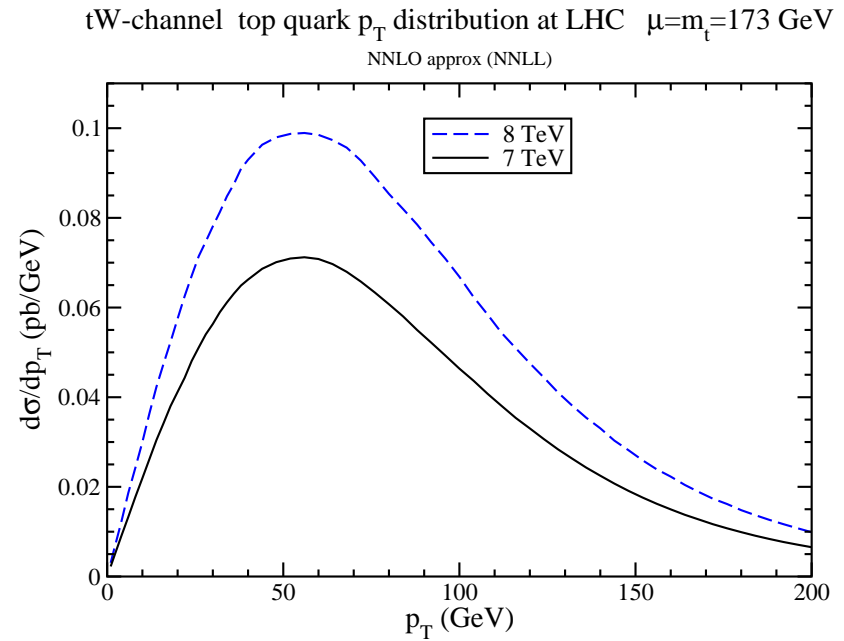
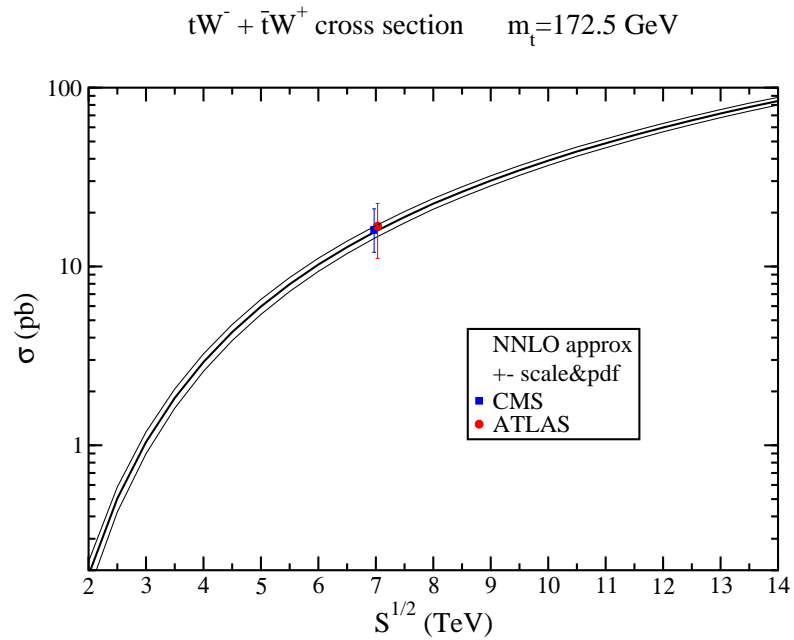
t-channel top quark p_T distribution at LHC $\mu=m_t=173$ GeV
NNLO approx (NNLL)



t-channel antitop quark p_T distribution at LHC $\mu=m_t=173$ GeV
NNLO approx (NNLL)



Associated tW^- production at the LHC



Cross section for $\bar{t}W^+$ production is identical to tW^-

Summary

- NNLL resummation for top-pair and single-top production
- top quark p_T and rapidity distributions
- NNLO approx corrections are significant at the LHC and the Tevatron
- excellent agreement with LHC and Tevatron data
- future work on more differential distributions