



Determination of the top quark mass from the top-pair cross section measured by CMS at $\sqrt{s} = 7 \text{ TeV}$

CMS
PAS-TOP-11-008

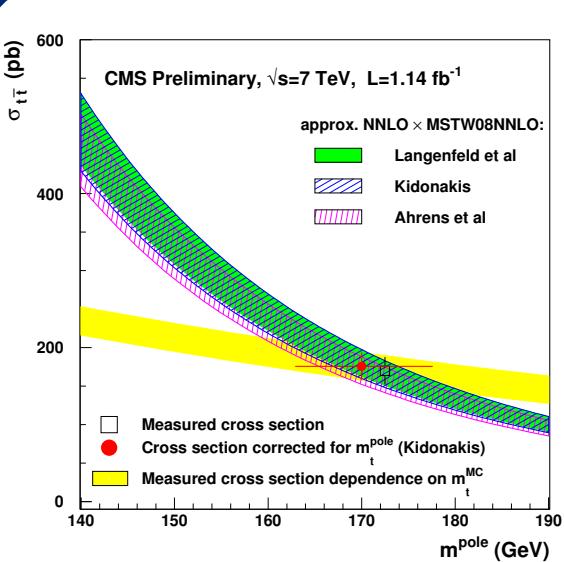
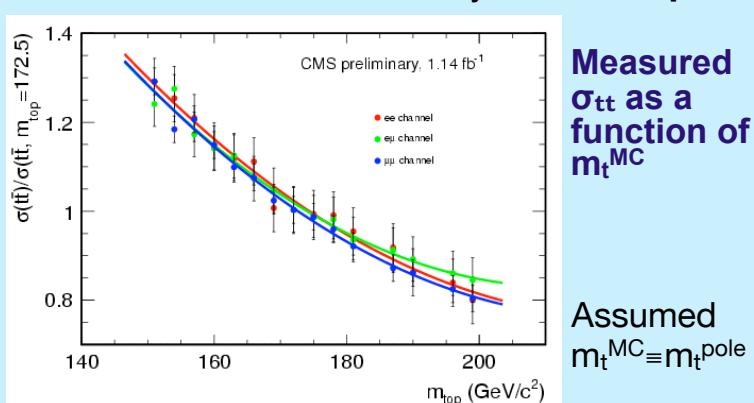
M. Aldaya, K. Lipka, S. Naumann-Emme, for the CMS collaboration

Higher-order QCD predictions are used to extract the top quark mass, both in the pole and in the MS scheme, from the top quark pair production cross section measured in the dilepton final state. The analyzed dataset corresponds to an integrated luminosity of 1.14 fb^{-1} collected by the CMS experiment in 2011 in pp collisions at $\sqrt{s} = 7 \text{ TeV}$

Top-quark pair production cross section depends on the value of the top quark mass

CMS-PAS-TOP-11-005 (2011)

$\mathcal{L} = 1.14 \text{ fb}^{-1}$, dilepton channels ($\mu\mu$, ee , μe):
 $\sigma_{tt} = 169.9 \pm 3.9_{\text{stat}} \pm 16.3_{\text{syst.}} \pm 7.6_{\text{lum. pb}}$



Approximate NNLO calculations:

Langenfeld, Moch, Uwer et al.:
(Phys. Rev. D80 (2009) 054009)

Kidonakis: (Phys. Rev. D82 (2010) 114030)

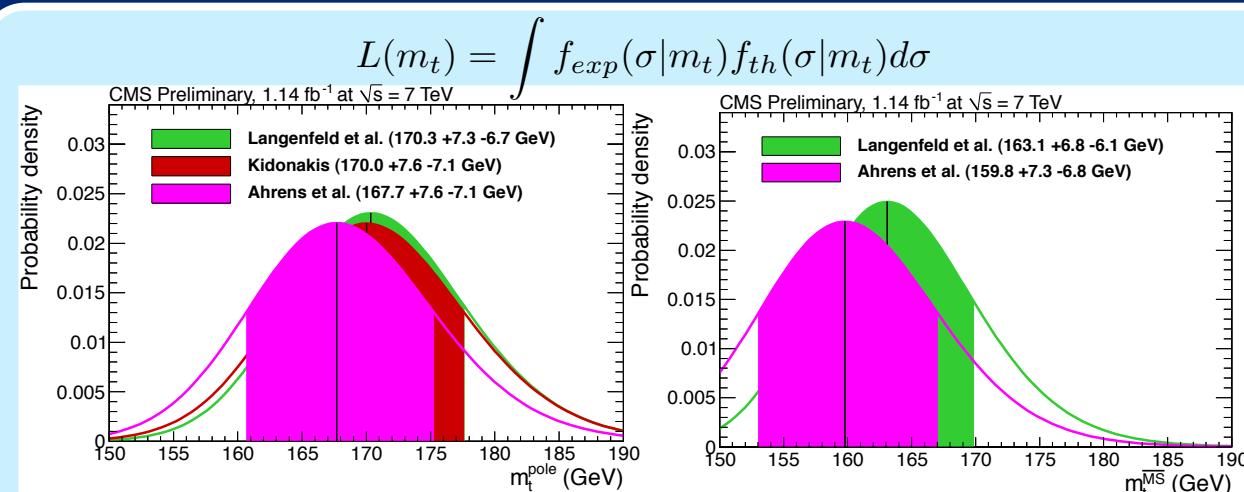
Ahrens et al.: (JHEP 09 (2010) 097)

QCD scales: $\mu_r = \mu_f = \mu_t$

Uncertainties:

PDF + $\alpha_s(M_Z)$ in PDFScale variation: $0.5\mu < \mu_r, \mu_f < 2\mu$

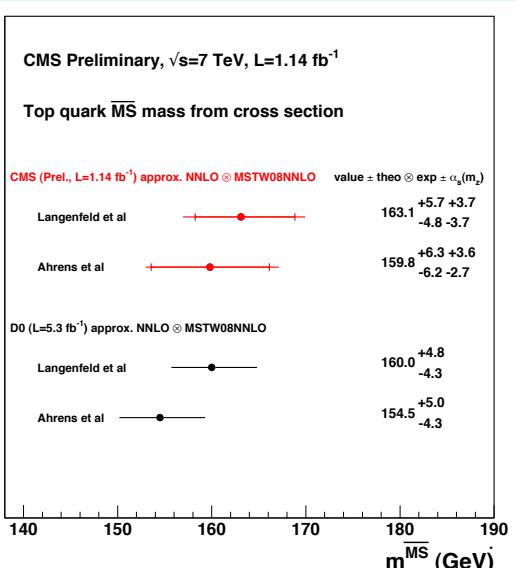
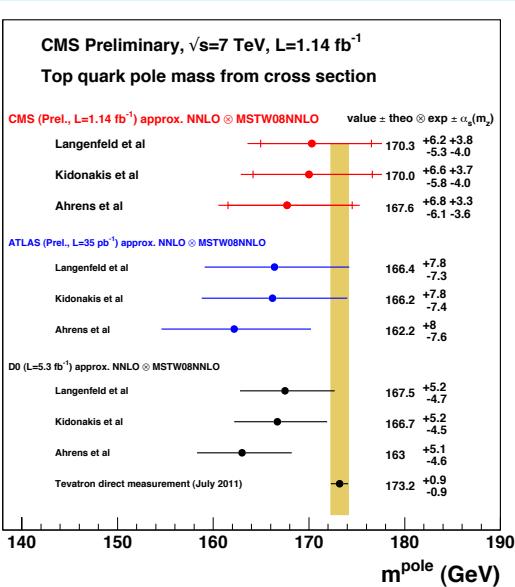
Top mass extracted using the folded likelihood from f_{exp} and f_{th} - Gaussian functions, widths: symmetrized errors



Langenfeld et al. and Ahrens et al.:
calculation available in running top mass

For the measurement, pole mass
translated to the running mass (MS
scheme), using α_s running in 3 loops

Different calculations agree well, results consistent with other experiments



Top quark mass determined in
an unambiguous definition

Pole mass value smaller than direct
measurement (LO+PS Monte Carlo)

Uncertainty constrained by

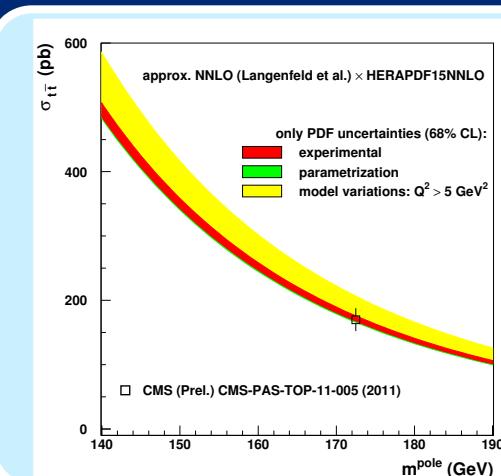
Theory: PDF+ α_s in PDF

Measurement: systematics+luminosity

MSTW08NNLO vs HERAPDF15NNLO

Approx. NNLO \times MSTW08NNLO	$m_t^{\text{pole}} / \text{GeV}$	$m_t^{\overline{\text{MS}}} / \text{GeV}$
Langenfeld et al. [6]	$170.3^{+7.3}_{-6.7}$	$163.1^{+6.8}_{-6.1}$
Kidonakis [7]	$170.0^{+7.6}_{-7.1}$	-
Ahrens et al. [8]	$167.6^{+7.6}_{-7.1}$	$159.8^{+7.3}_{-6.8}$

Approx. NNLO \times HERAPDF15NNLO	$m_t^{\text{pole}} / \text{GeV}$	$m_t^{\overline{\text{MS}}} / \text{GeV}$
Langenfeld et al. [6]	$171.7^{+6.8}_{-6.0}$	$164.3^{+6.5}_{-5.7}$
Ahrens et al. [8]	$169.1^{+6.7}_{-5.9}$	$161.0^{+6.8}_{-6.1}$



HERAPDF approach:
possible to study the influence
of assumptions in the PDF fit
on top production cross sections

Top production at the LHC
may help constraining
high-x gluon PDF