Extraction of $\alpha_\mathrm{S}(\mathrm{M_Z})$ and $m_\mathrm{t}(m_\mathrm{t})$ using $\mathrm{t\bar{t}}$ events in the $e\mu$ channel
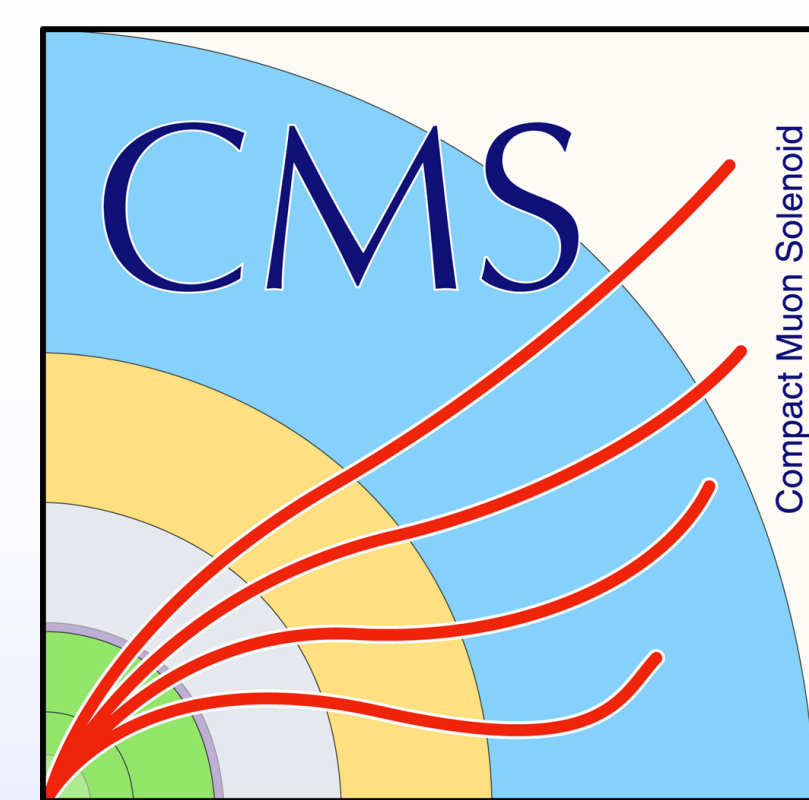
Matteo Defranchis (DESY) - on behalf of the CMS Collaboration

selection of results from **CMS-PAS-TOP-17-001** [1]

the method

simultaneous measurement of $\sigma_{\mathrm{t\bar{t}}}$ and m_t^MC using dilepton ($e\mu$) $\mathrm{t\bar{t}}$ events

- $\sigma_{\mathrm{t\bar{t}}}$ measured at optimal mass point
- uncertainty on $\sigma_{\mathrm{t\bar{t}}}$ includes contribution from m_t^MC
- no assumption between m_t^MC and m_t

$\rightarrow m_\mathrm{t}^\mathrm{MC}$ constrained from $m_\mathrm{lb}^\mathrm{min}$
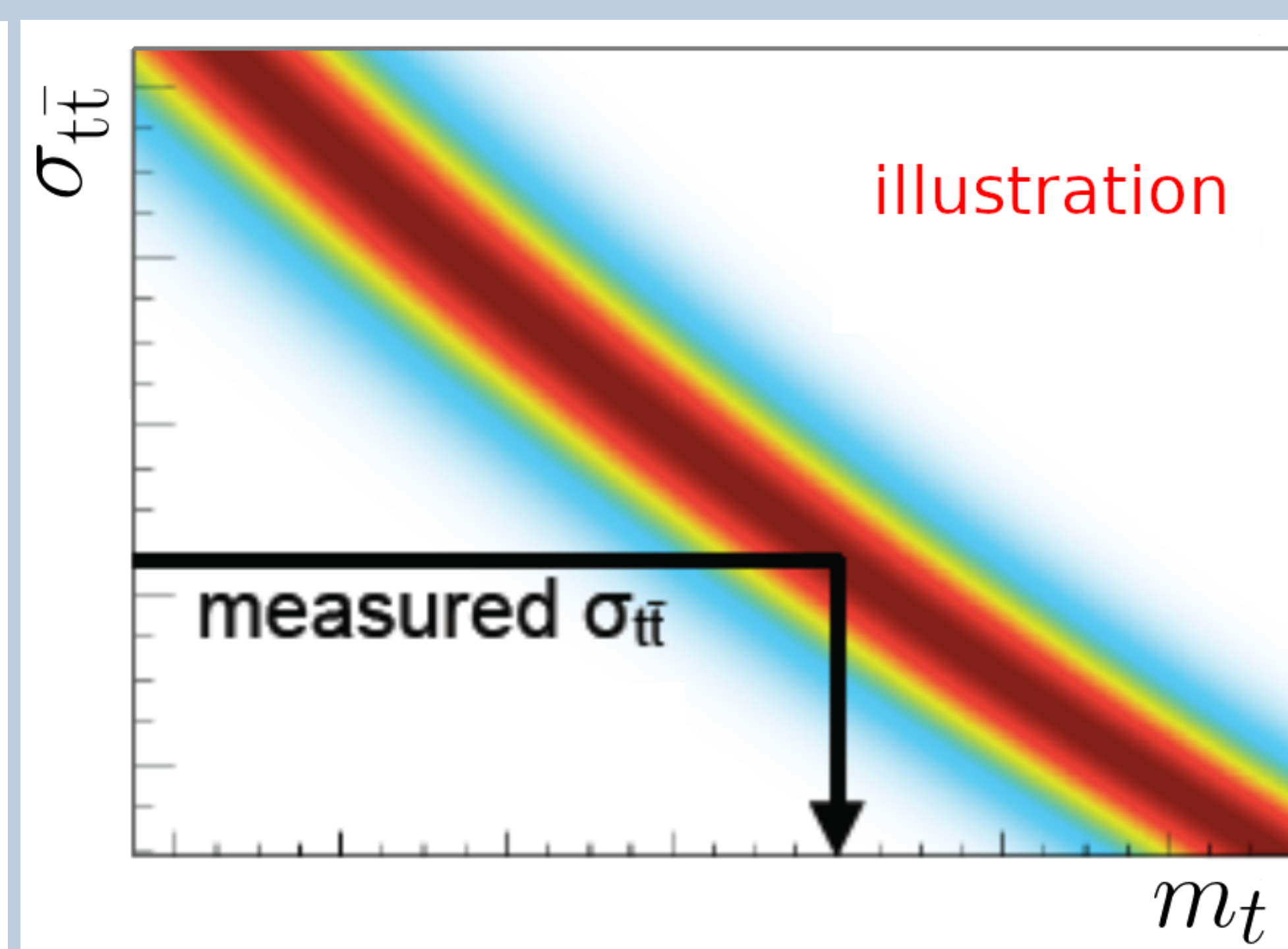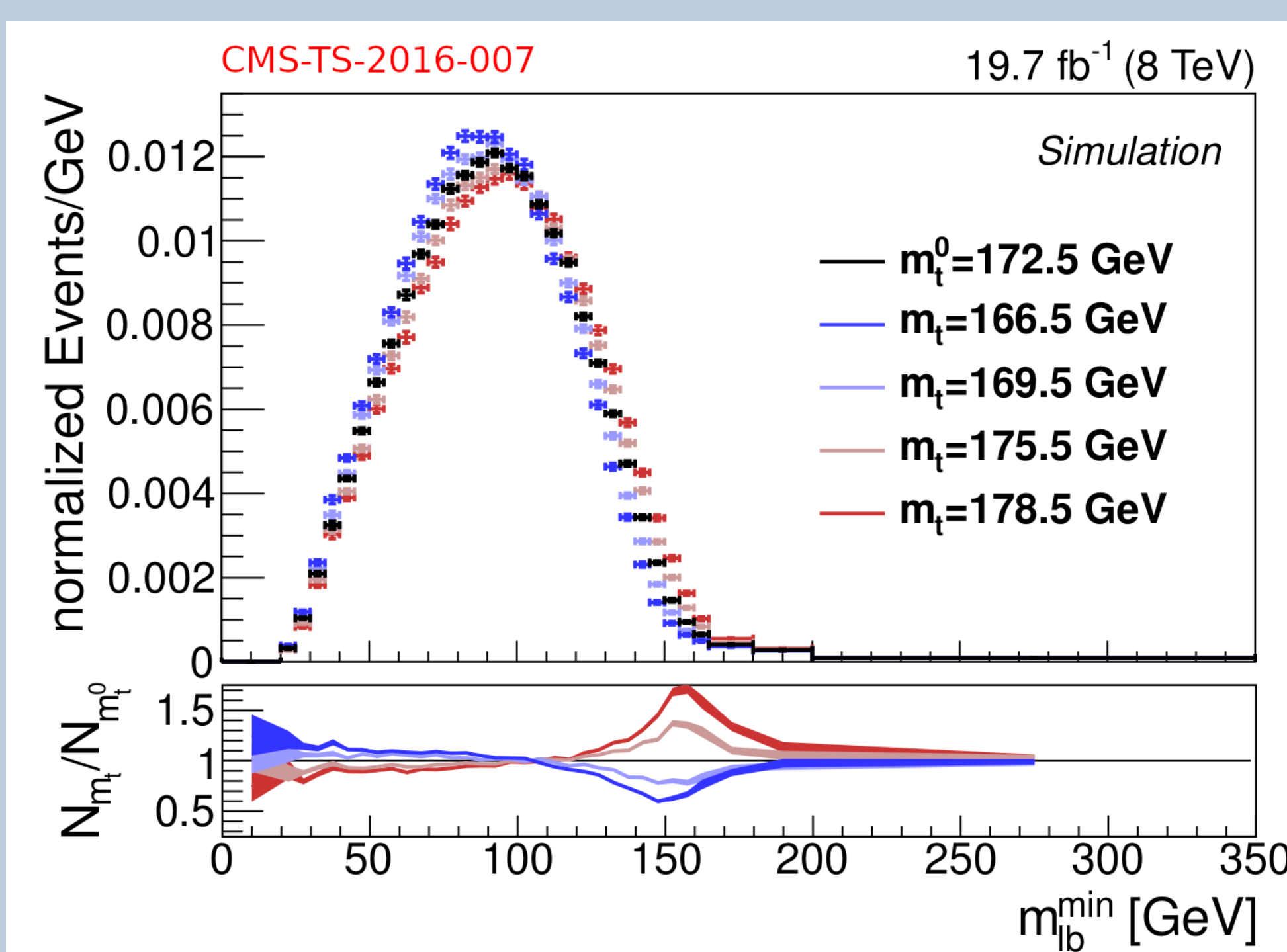
m_t and α_S extracted from data-theory χ^2
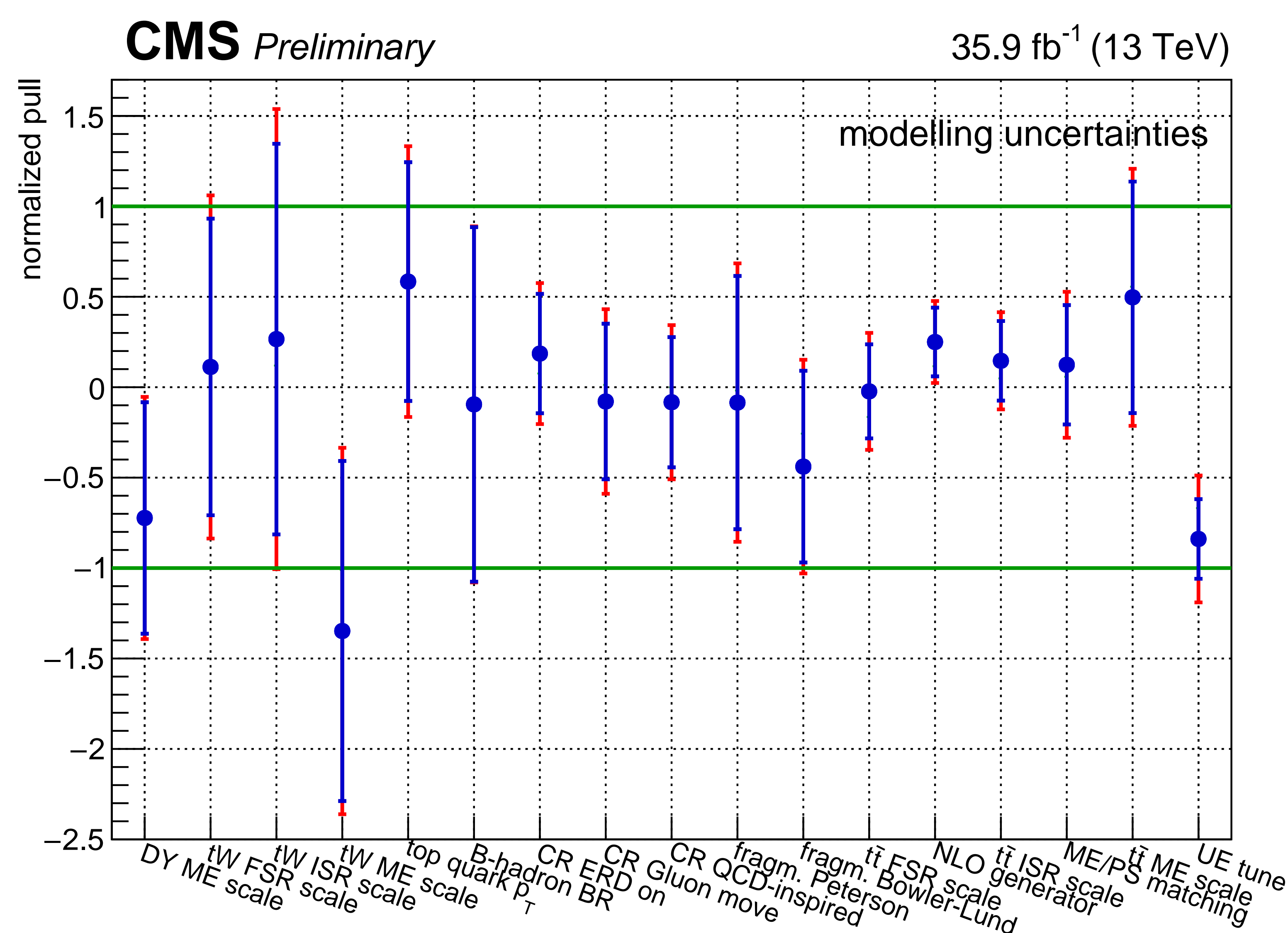
measurement strategy

- template fit of final state distributions in categories of jet and b-tagged jet multiplicities
- systematic uncertainties treated as nuisance parameters and constrained *in situ*
- jet $\mathrm{p_T}$ spectra used to constrain JES uncertainties
- impact of statistical fluctuations in the MC estimated *a posteriori* using pseudo-templates

theory predictions

- NNLO QCD prediction obtained with Hathor2.0
- top quark mass in $\overline{\mathrm{MS}}$ scheme

uncertainties

- PDF (and α_S) from eigenvectors
- $m_\mathrm{t}/2 < \mu_\mathrm{r}, \mu_\mathrm{f} < 2m_\mathrm{t}$ avoiding cases where $\mu_\mathrm{r}/\mu_\mathrm{f} = 1/4, 4$

in α_S determination, m_t is fixed to native value of PDF (and *vice versa*)

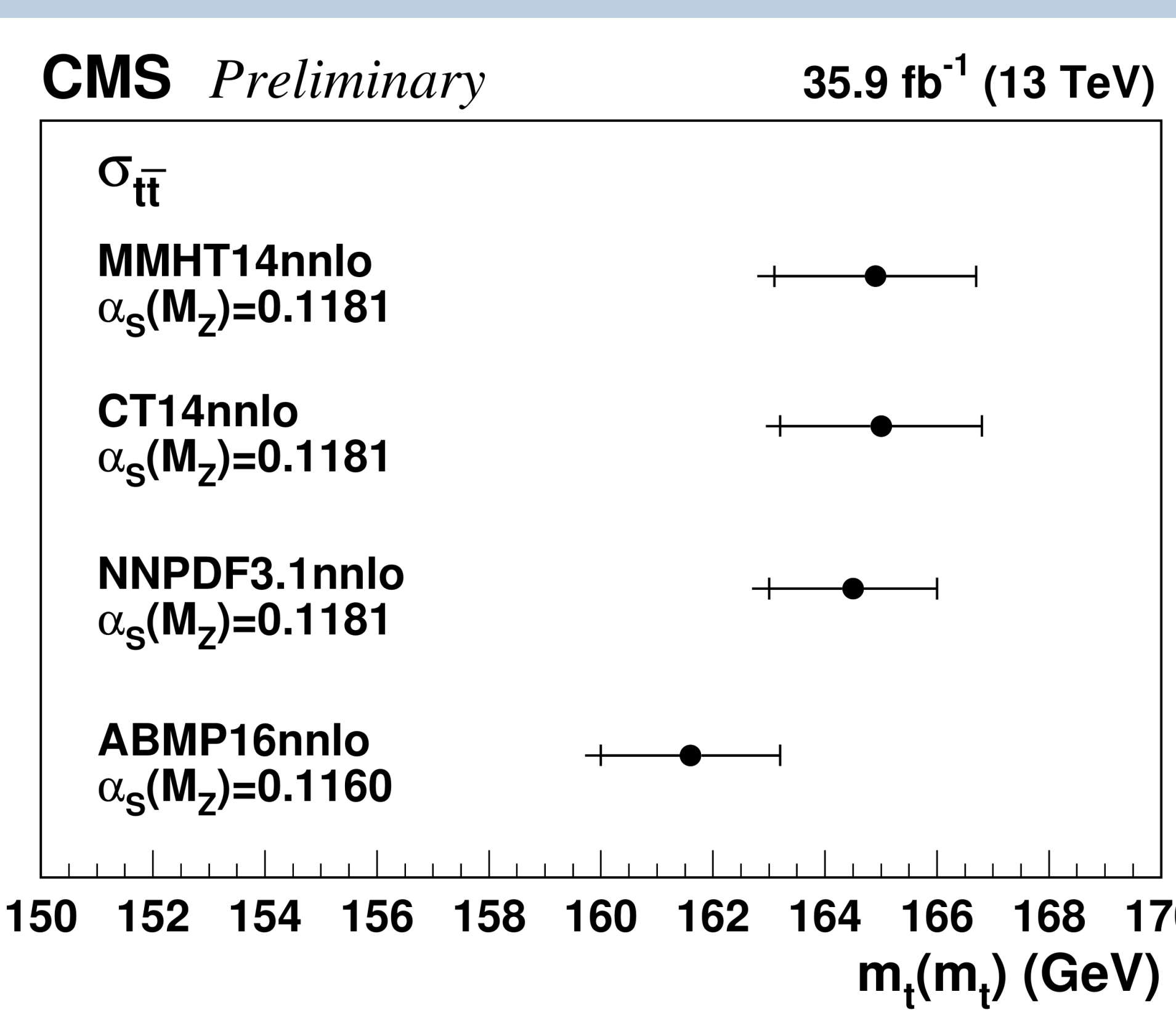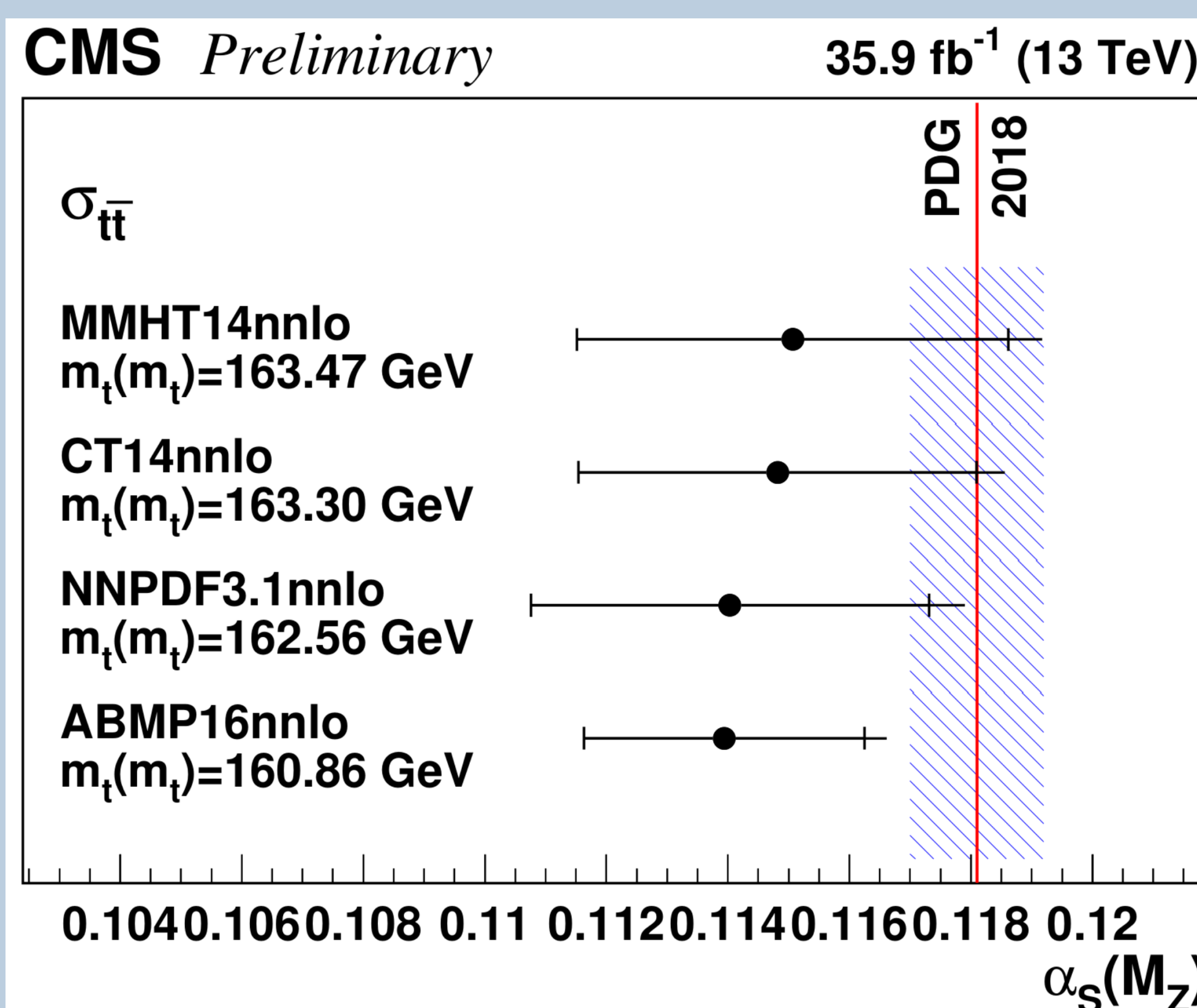## (*) CMS $\sigma_{\mathrm{t\bar{t}}}$ result in dilepton

the measuremnt of $\sigma_{\mathrm{t\bar{t}}}$ presented in this poster is in good agreement with the CMS result in dilepton [1] obtained at a fixed top mass

$\sigma_{\mathrm{t\bar{t}}} = 803 \pm 2\,(\text{stat}) \pm 25\,(\text{syst}) \pm 20\,(\text{lum})\,\text{pb}$

references

[1] CMS Collaboration. Measurement of the $\mathrm{t\bar{t}}$ production cross section, the top quark mass, and the strong coupling constant using events in the dilepton final state in pp collisions at $\sqrt{s} = 13$ TeV. Technical Report CMS-PAS-TOP-17-001, CERN, Geneva, 2018.

illustration

pulls, constraints and results

$$\sigma_{\mathrm{t\bar{t}}} = 815 \pm 2\,(\text{stat}) \pm 29\,(\text{syst}) \pm 20\,(\text{lum})\,\text{pb}\ (^*)$$

$$m_\mathrm{t}^\mathrm{MC} = 172.33 \pm 0.14\,(\text{stat}) \pm_{0.72}^{0.66}\,(\text{syst})\,\text{GeV}$$

determination of $m_\mathrm{t}(m_\mathrm{t})$ and $\alpha_\mathrm{S}(\mathrm{M_Z})$

strong coupling constant

- consistent results are obtained using different NNLO PDF sets
- better precision with ABMP16 due to $\overline{\mathrm{MS}}$ scheme for top quark mass and simultaneous determination of m_t and α_S in PDF

top running mass

- lower result with ABMP16 due to lower value of α_S in PDF