

Phenomenological Predictions for $t\bar{t}t\bar{t}$ Production at the LHC

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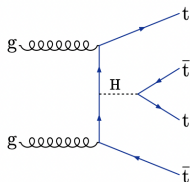
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This talk is based on the research work done at University of Hamburg, Germany for my Master's Thesis under the supervision of Prof. Dr. Sven-Olaf Moch, with the guidance of Dr. Maria Vittoria Garzelli and valuable inputs from Bakar Chargeishvili.

21. November 2023

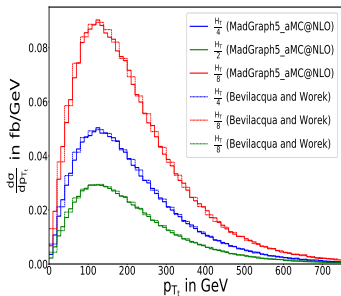
Production of $t\bar{t}\bar{t}\bar{t}$

- Cross section of $t\bar{t}\bar{t}\bar{t}$ production is sensitive to the magnitude of Yukawa coupling of the top quark to the Higgs boson [**Cao et al. 2016**].

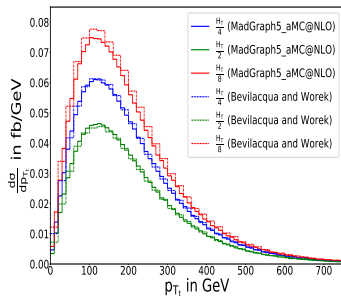


- $\sigma_{t\bar{t}\bar{t}\bar{t}} = 12.0 \pm 2.4$ fb with $\pm 20\%$ relative scale uncertainties at NLO (QCD + EW corrections) at $\sqrt{s} = 13$ TeV [**Frederix et al. 2018**].
- The measured cross-section by CMS is $\sigma_{t\bar{t}\bar{t}\bar{t}} = 17.7^{+3.7}_{-3.5}$ fb at an integrated luminosity of 138 fb^{-1} at $\sqrt{s} = 13$ TeV [**The CMS Collaboration 2023**].

Comparison with [Bevilacqua and Worek 2012]



LO

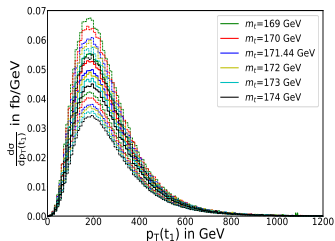
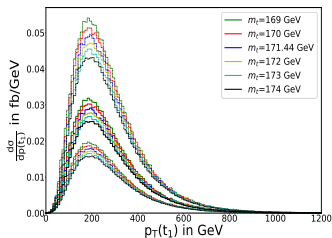


NLO

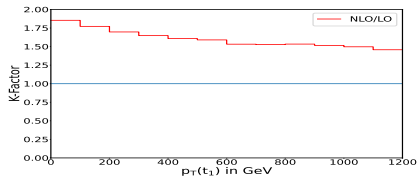
Averaged differential cross section distribution as a function of p_{T_t} : A weight of $\frac{1}{4}$ is assigned to each possibility and each bin is filled up four times.

$\mu_R = \mu_F = \frac{H_T}{4}$, $m_t = 173.2$ GeV, PDF set: MSTW200868cl, $\sqrt{s} = 14$ TeV

Varied values of the top mass

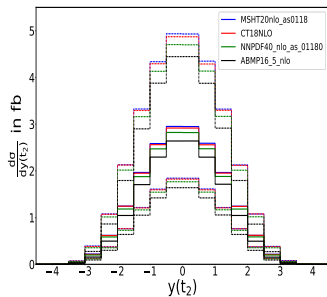


Differential cross section distribution as a function of $p_T(t_1)$
PDF set: ABMP16NLO, $\sqrt{s} = 14$ TeV

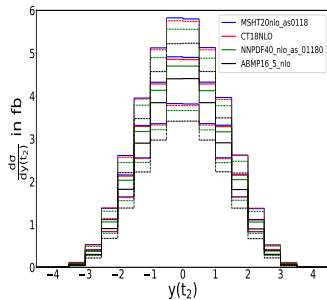


\mathcal{K} -Factor at $m_t = 171.44$ GeV

Varied PDF sets



LO

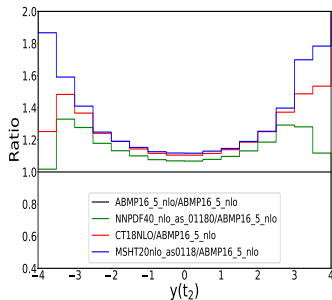


NLO

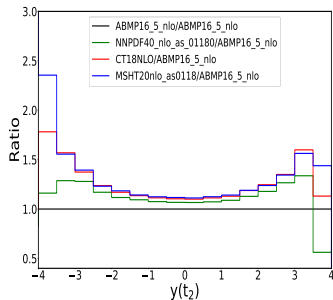
Differential cross section distributions as a function of $y(t_2)$

$$\mu_R = \mu_F = \frac{H_T}{4}, \quad m_t = 171.44 \text{ GeV}, \quad \sqrt{s} = 14 \text{ TeV}$$

Varied PDF sets



LO



NLO

Ratio of differential cross section as a function of $y(t_2)$ obtained with NNPDF40, CT18 and MSHT20 to that obtained with ABMP16

- Varied values of the top mass: Compare with experimental results to achieve precision in top mass measurement.
- Varied PDF sets: Provides input regarding constraining PDF sets.