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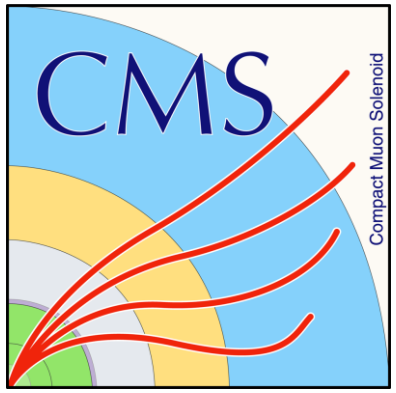

Inclusive $t\bar{t}$ production cross section at $\sqrt{s} = 5.02$ TeV in CMS

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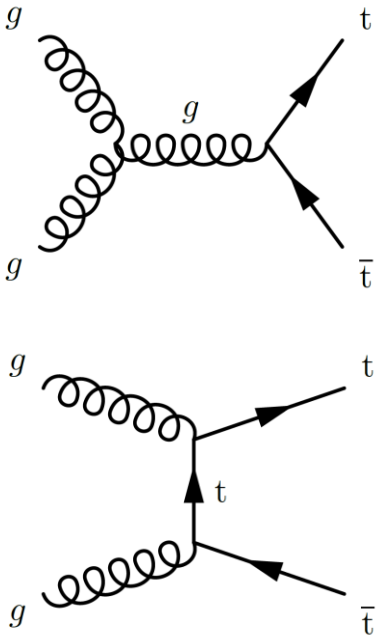
Introduction

- A measurement of the production cross section of $t\bar{t}$ at $\sqrt{s} = 5.02$ TeV in pp collisions is presented CMS-PAS-TOP-20-004.
- The study of the production and properties of the top quark is one of the core elements of the LHC physics programme.
- Its main production mode at the LHC is by pairs ($t\bar{t}$).
- The precise determination of the production cross section is sensitive to the gluon PDF in the proton.
- The analysis is performed using data from 2017 corresponding to a luminosity of 304 pb^{-1} → limited data sample size.
  - Only around 2 pileup interactions per bunch crossing.
- This result is combined with the measured cross section from the ℓ + jets channel based on 27.4 pb^{-1} of data collected in 2015 at $\sqrt{s} = 5.02$ TeV 10.1007/JHEP03(2018)115.



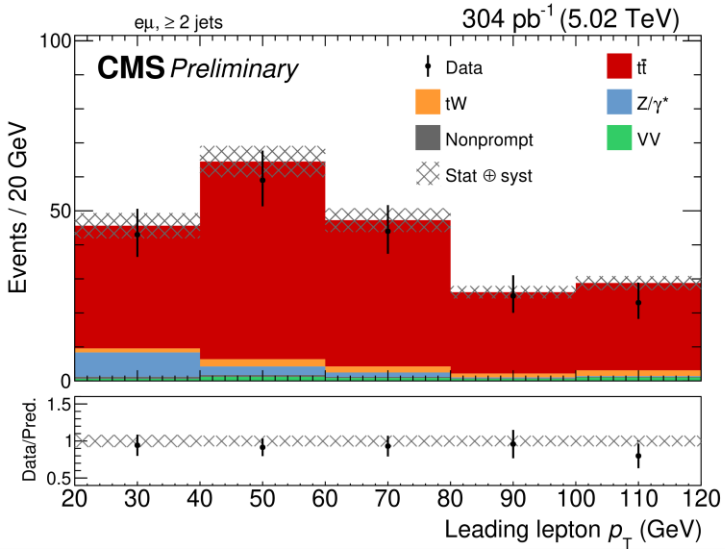
Methodology

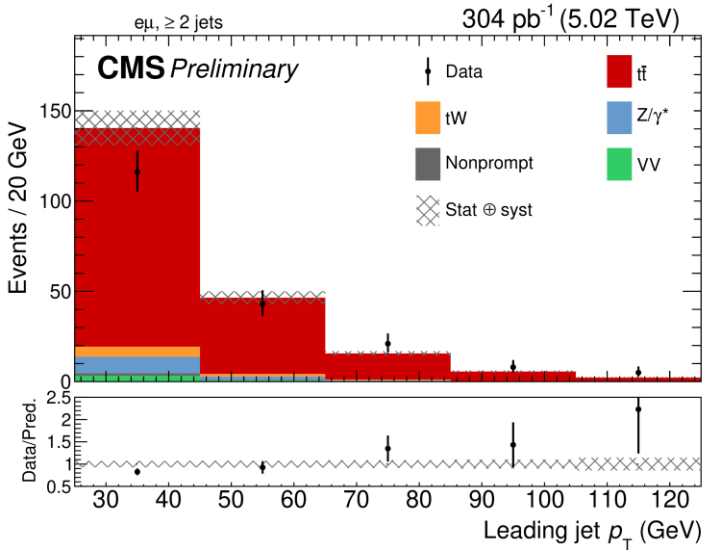
- Trigger strategy: events passing at least one of the single lepton triggers with p_T thresholds of 12 (17) GeV in the case of muons (electrons).

- Object selection:
  - Electrons: $|\eta| < 2.5$, $p_T > 10$ GeV.
  - Muons: $|\eta| < 2.4$, $p_T > 10$ GeV.
  - Jets: $p_T > 25$ GeV and $|\eta| < 2.4$.

- Event selection:
  - $e^{\pm}\mu^{\mp}$ + ≥2 jets final states.
  - Leading lepton p_T >20 GeV.
  - Dilepton invariant mass above 20 GeV.

- Signal is extracted by a counting experiment subtracting background from data.
- Main backgrounds:
  - **tW, VV**: estimated from simulation.
  - **DY**: estimated from data using $R_{out/in}$ method.
  - **Nonprompt** (W+jets, semileptonic $t\bar{t}$): estimated from simulation.





Results and discussion

2017 data: dilepton channel

Statistically limited

$\sigma_{t\bar{t}} = 60.3 \pm 5.0\ (\text{stat}) \pm 2.8\ (\text{syst}) \pm 0.9(\text{lumi})$ pb.

2017 + 2015 data: dilepton $\oplus$ ℓ + jets channel

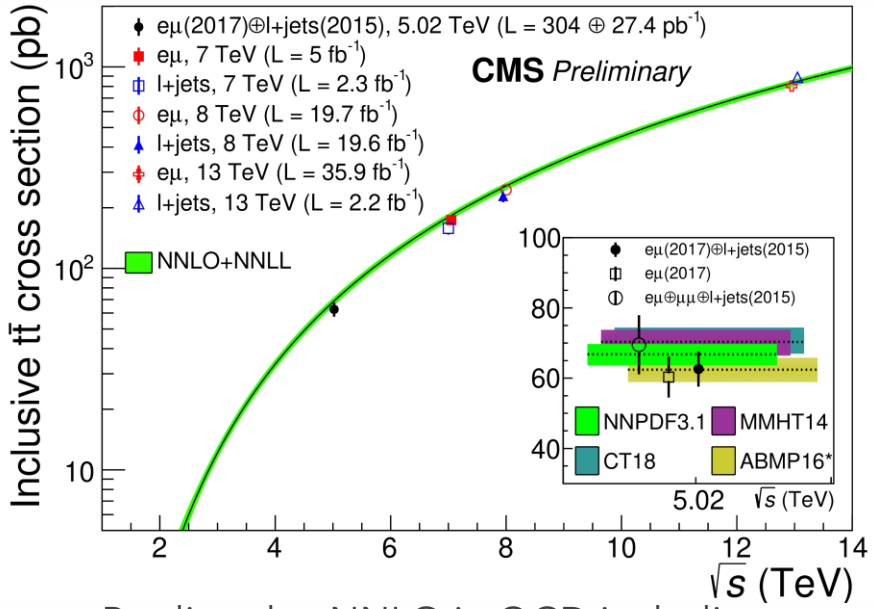
$\sigma_{t\bar{t}} = 62.6 \pm 4.1\ (\text{stat}) \pm 3.0\ (\text{syst+lumi})$ pb.

$$\sigma_{t\bar{t}} = \frac{N - N_{\text{bkg}}}{\varepsilon \mathcal{A} \mathcal{B} \mathcal{L}}$$

Source	$\Delta\sigma_{t\bar{t}}/\sigma_{t\bar{t}}$ (%)
tW	1.0
Nonprompt leptons	0.4
Drell–Yan	1.8
VV	0.8
Trigger efficiency	1.3
L1 prefiring	1.4
Electron efficiency	1.6
Muon efficiency	0.6
JES	2.2
JER	1.2
μ_R, μ_F scales	0.2
PDF$\oplus\alpha_S(m_Z)$	0.3
Final state radiation	1.1
Initial state radiation	< 0.1
h_{damp}	1.0
Underlying event tune	0.7
Total systematic	4.3
Integrated luminosity	1.5
Statistical uncertainty	8.2

- Combination done using the best linear unbiased estimator (BLUE).
- Improvement from a total uncertainty of 13% from 10.1007/JHEP03(2018)115 to 7.9%.
- Agreement with the SM:

$\sigma_{t\bar{t}}^{SM} = 66.8\ {}^{+1.9}_{-2.3}\ (\text{scale}) \pm 1.7(\text{PDF})\ {}^{+1.4}_{-1.3}\ (\alpha_S(m_Z))$ pb.



- Predicted at NNLO in QCD including soft-gluon resummation at NNLL.