Universidad de Oviedo
Universidá d'Uviéu
University of Oviedo

ICTEA
Instituto Universitario de Ciencias y Tecnologías Espaciales de Asturias

CMS

30-07-2020

ICHEP 2020

Latest single top differential cross section measurements at CMS

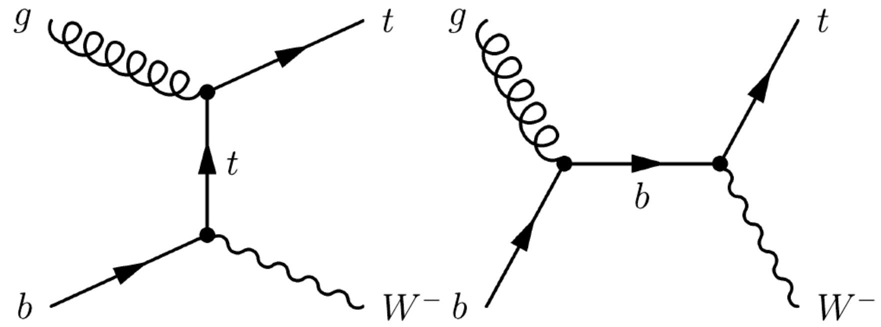
Víctor Rodríguez Bouza (on behalf of the CMS Collaboration)

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

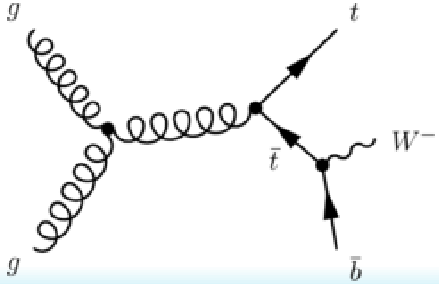
Partially publicly funded by Ministerio de Ciencia e Innovación (Gobierno de España), *through the* "Ayudas para contratos predoctorales para la formación de doctores 2019" *program.*

Introduction

- The CMS' latest measurement of single top differential cross sections has been done on the tW process with 2016 data using dilepton final states (CMS-PAS-TOP-19-003).



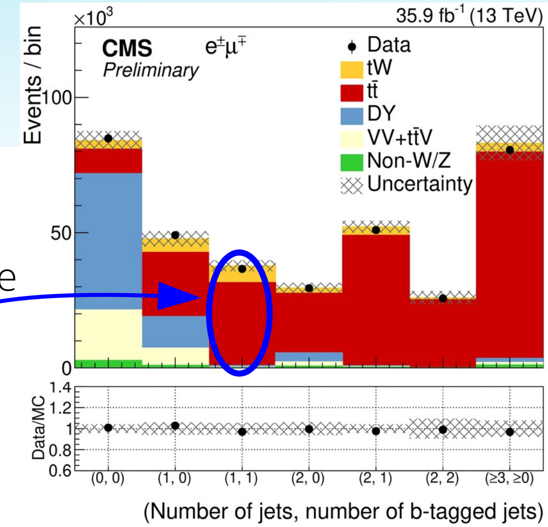
- Main challenge: **background** *largely* **dominates signal**, being the most important $t\bar{t}$.
- This is a consequence of its similarity with the most important way of producing top quarks at p-p collisions: pair production. Actually, at NLO, **they interfere**. In order to resolve both processes' definitions, and avoid double counting issues, two approaches (JHEP 07 (2008) 029) are used to obtain the tW simulation samples.
  - Diagram Removal (**DR**): we remove Feynman diagrams that might present two on-shell tops (also called *double resonant*).
  - Diagram Subtraction (**DS**): we remove locally the pair-production contribution by adding an artificial term in the calculation.



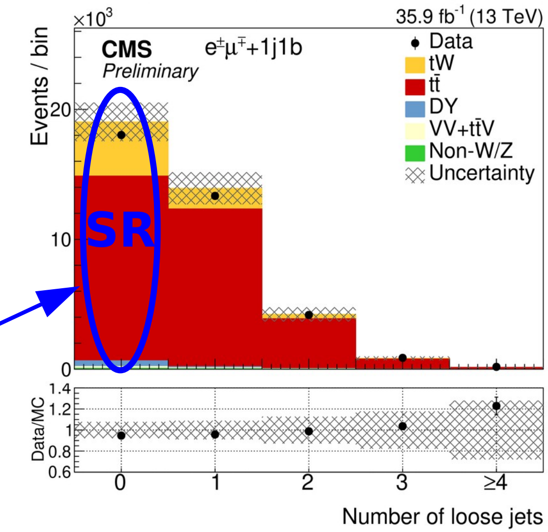
- The differential cross sections are measured as a function of the leading lepton p_T, jet p_T, $\Delta\varphi(e^{\pm},\mu^{\mp})$, $p_Z(e^{\pm},\mu^{\mp}, j)$, $m(e^{\pm},\mu^{\mp}, j)$ and $m_T(e^{\pm},\mu^{\mp}, j, p_T^{miss})$.

Methodology

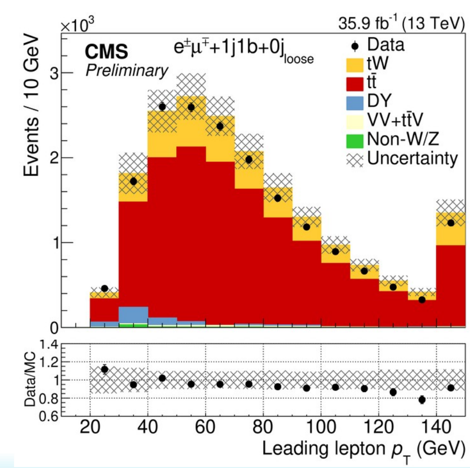
- The analysis is performed using the **complete 2016 dataset** (35.9 fb^{-1}).
- The **trigger strategy** uses a combination of single and double triggers to maximise efficiency.

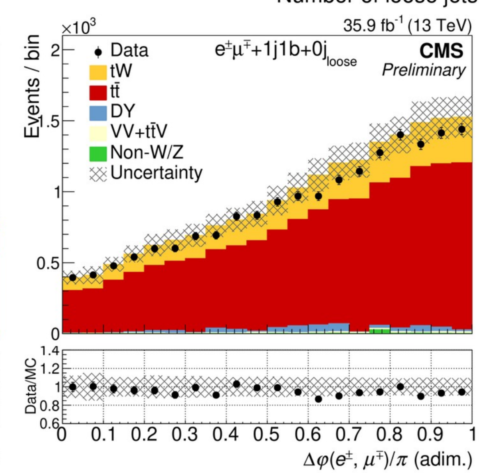


- **Event selection**
  - At least two identified leptons.
  - One of them must fulfil $p_T > 25$ GeV.
  - The two first (in terms of p_T) must have opposite charge…
  - … and be an electron and a muon (eμ channel)…
  - …whose invariant mass satisfy m(e, μ) > 20 GeV.
  - Exactly 1 jet ($p_T > 30$ GeV) that must be b-tagged.
  - Exactly zero loose jets (jets with 20 GeV < p_T < 30 GeV).



- Signal is extracted by subtracting background to data.
- Afterwards, unfolding (implemented using `TUnfold`: JINST 7 (2012) T10003) is done to an equivalent fiducial region at particle level. The result is normalised to the fiducial cross section.





Result & discussion

- **Agreement** between data and expectations (with the two generators, `POWHEG` and `MADGRAPH5_aMC@NLO`) is **fairly good**.

- Analysis **largely dominated by systematic sources of uncertainties**, whose main origin is the overwhelming **background**.
  - Main sources: jet–related uncs. (e.g. JES, JER) and modeling (e.g. ME/PS matching).
  - Depending on the bin and distribution, varying from ~15-40% (bulk of distributions) up to ~25-100% in the tails.

- In addition, the result shows **compatible agreement** for the DR and DS schemes of the signal process.