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# Differential cross section measurements of the tW process at CMS

*13th International Workshop on Top Quark Physics (**TOP2020**) – Virtual conference – September 2020*

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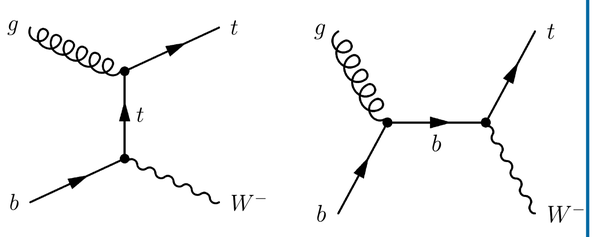
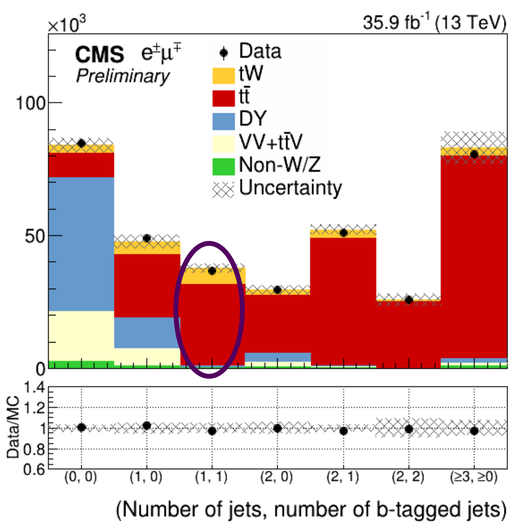
## Introduction

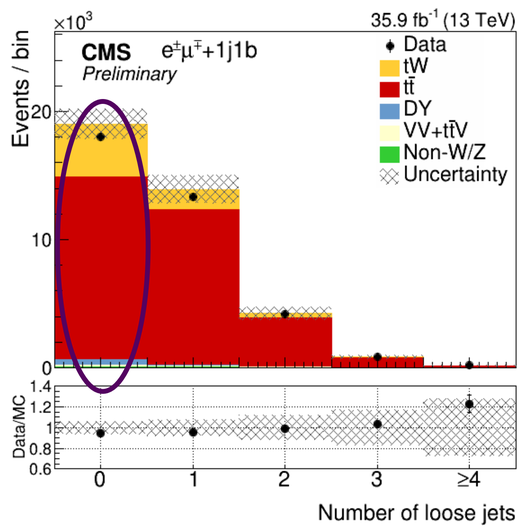
The tW process is one of the main channels for single top quark production.




- At NLO shows **interference** with the pair production diagrams of top quarks.
- Allows to **probe the $V_{tb}$ element** of the CKM matrix.
- Is sensitive to **beyond Standard Model** physics.

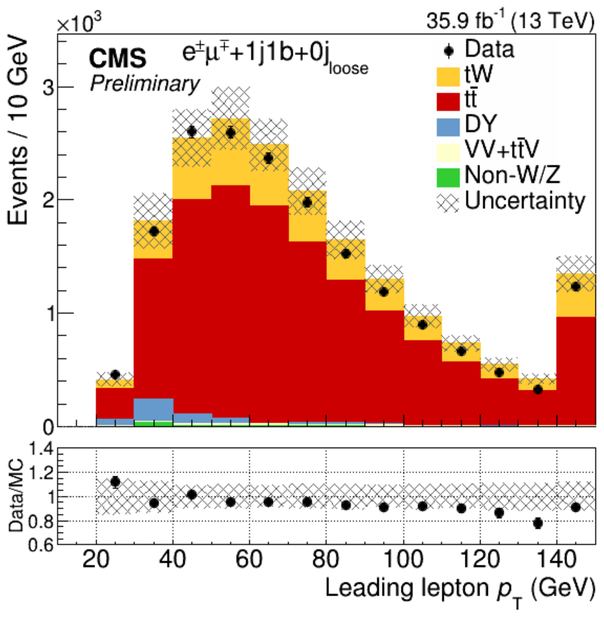
The differential cross sections are measured as a function of the leading lepton $p_T$, jet $p_T$, $\Delta\varphi(e^{\pm},\mu^{\mp})$, $p_Z(e^{\pm},\mu^{\mp}, j)$, $m(e^{\pm},\mu^{\mp}, j)$ and $m_T(e^{\pm},\mu^{\mp}, j, p_T^{miss})$.



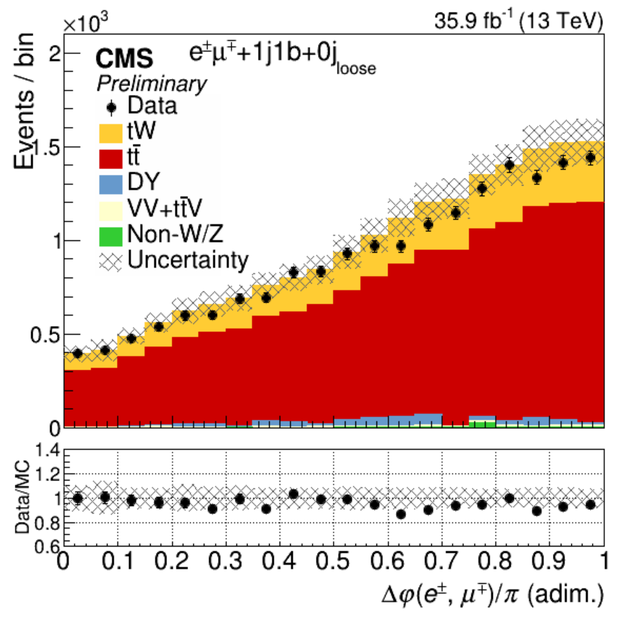

## Methodology

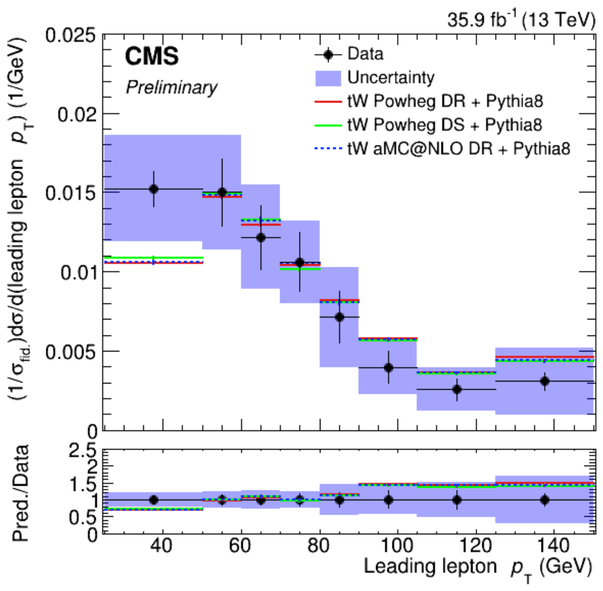
- Event **selection**:
  - Dileptonic channel ($e^{\pm}\mu^{\mp}$, with $p_T$ > 25, 20 GeV).
  - $m(e^{\pm}\mu^{\mp})$ > 20 GeV.
  - Exactly one jet ($p_T$ > 30 GeV) that is b-tagged. This exploits the ($n_{jet}$,$n_{b\text{-tagged jets}}$) distribution, as seen in the figure, to enhance signal-to-background ratio.
  - Veto events with loose jets (jets with 20 GeV < $p_T$ < 30 GeV), as seen in the plot.
- **Dominated by the overwhelming top quark pair production**.
- **Signal is extracted** by subtracting the background from the data.
- **Unfolding** [1] is performed to take into account detector effects in the reconstruction.
  - Systematic uncertainties are considered by repeating the entire process for each variation, and then taking the difference with the result.
  - No regularisation was deemed necessary, as all response matrices are mostly diagonal.

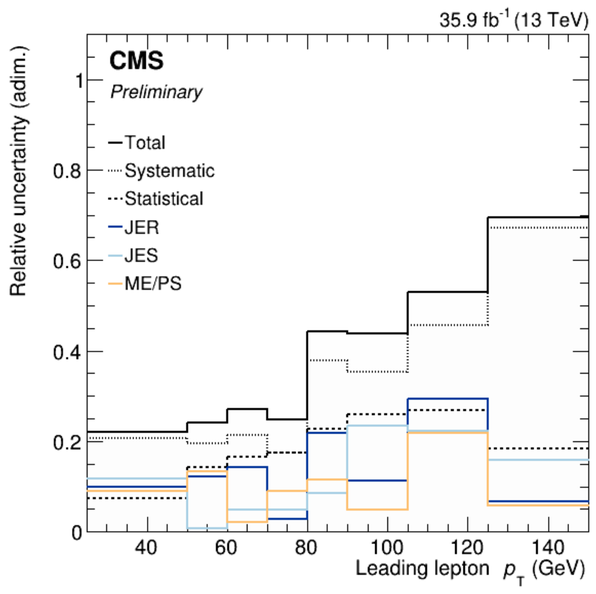


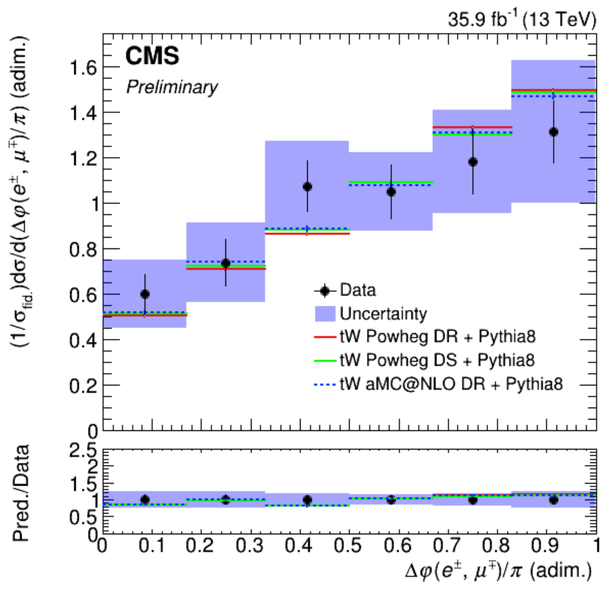

## Results

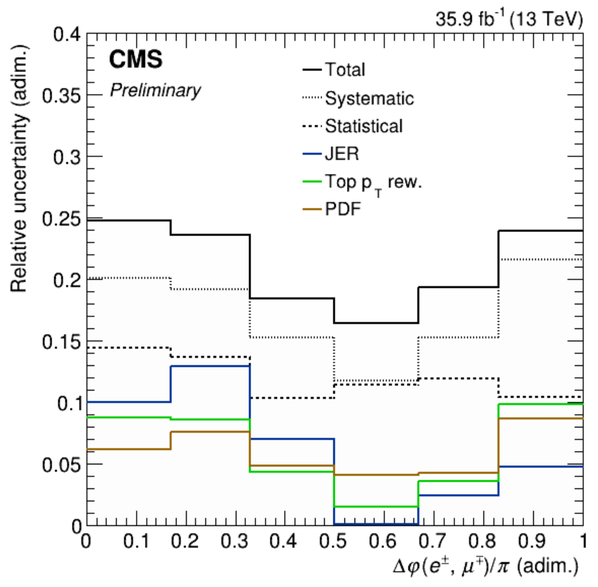
- Distributions are unfolded to **particle level** and **normalised** to the fiducial cross section.
- The **main sources of uncertainty**, both in the jet reconstruction and the theoretical modeling, are driven by the large top quark pair production background.
- The results obtained are, in general, **consistent with the expectations** from the two generators used for the modeling of the signal, POWHEG and MADGRAPH5_aMC@NLO.

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**[1]** ***S. Schmitt,*** "TUnfold: an algorithm for correcting migration effects in high energy physics", *JINST* ***7*** *(2012) T10003,* ***doi:10,1088/1748-0221/7/10/T10003****,* ***arXiv:1205.6201****.*