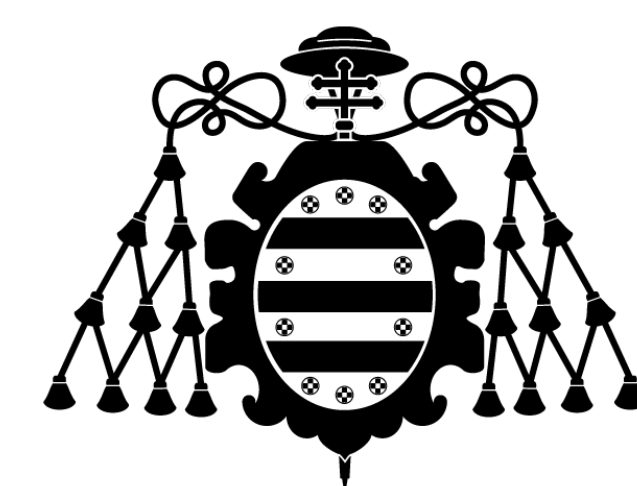
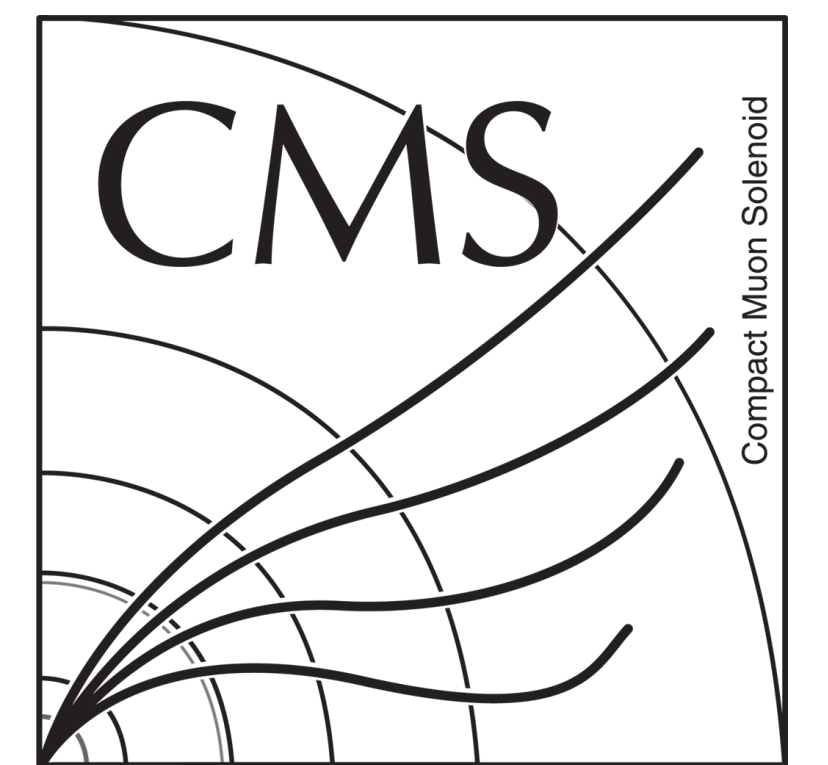


Measurement of tW production cross-section at 13 TeV with CMS



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Introduction

tW production process (Fig 1): is one of the sources of single top production.

- + Sensitive to **BSM physics**
- + Sensitive to the V_{tb} element of the CKM matrix
- + Background to **tt** production and **interference** at NLO

Measurement strategy

Measurement performed in the $e\mu$ channel

Exploit different n_{jet} and n_{b-tag} distributions in tW and the dominant **tt** background (Fig. 2)

Three **signal and control regions** are defined according to n_{jet} and n_{b-tag} :

- **1j1b** and **2j1t**: signal regions, still dominated by **tt**
- **2j2b**: control regions, in order to keep systematic uncertainties under control

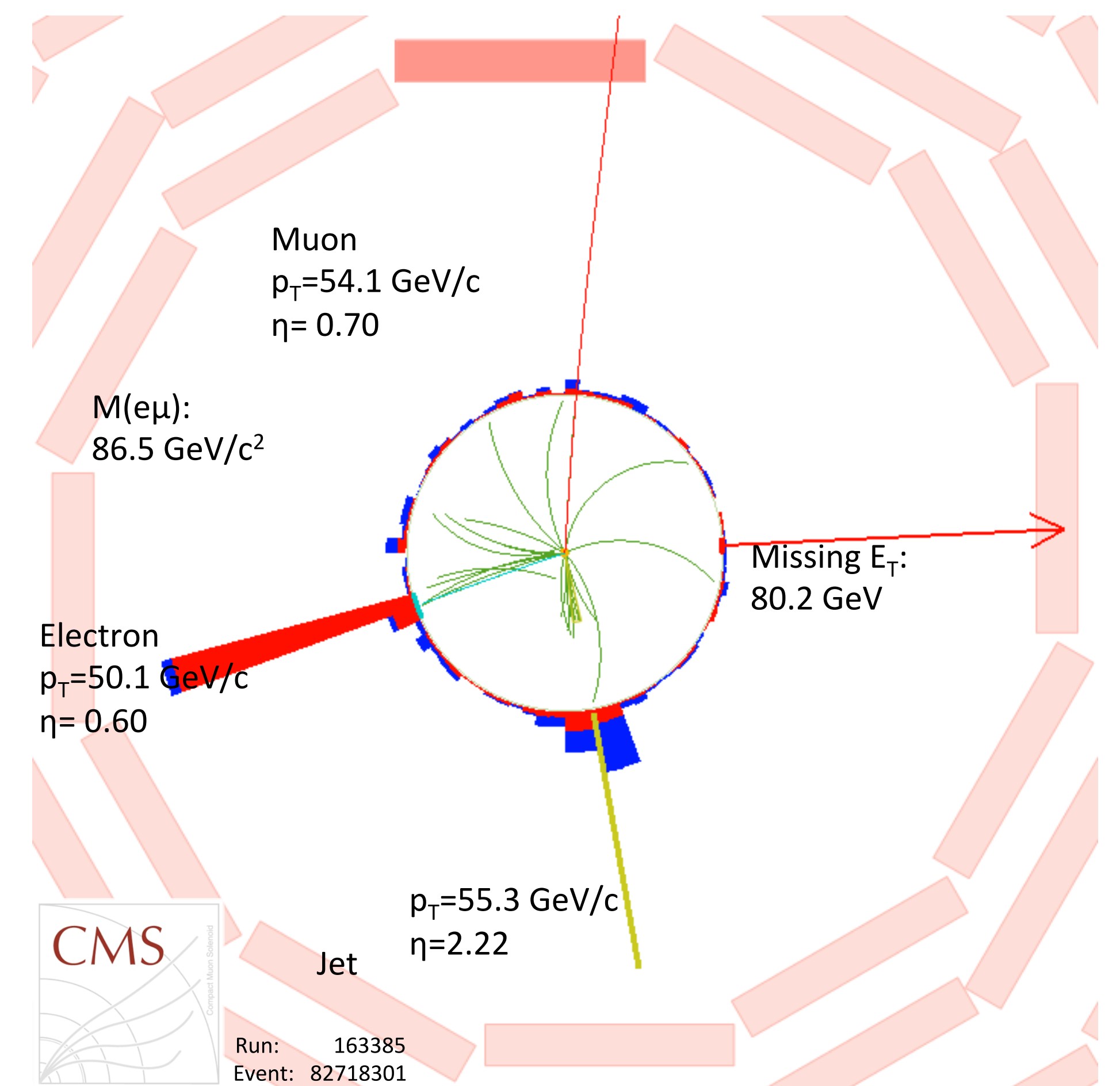
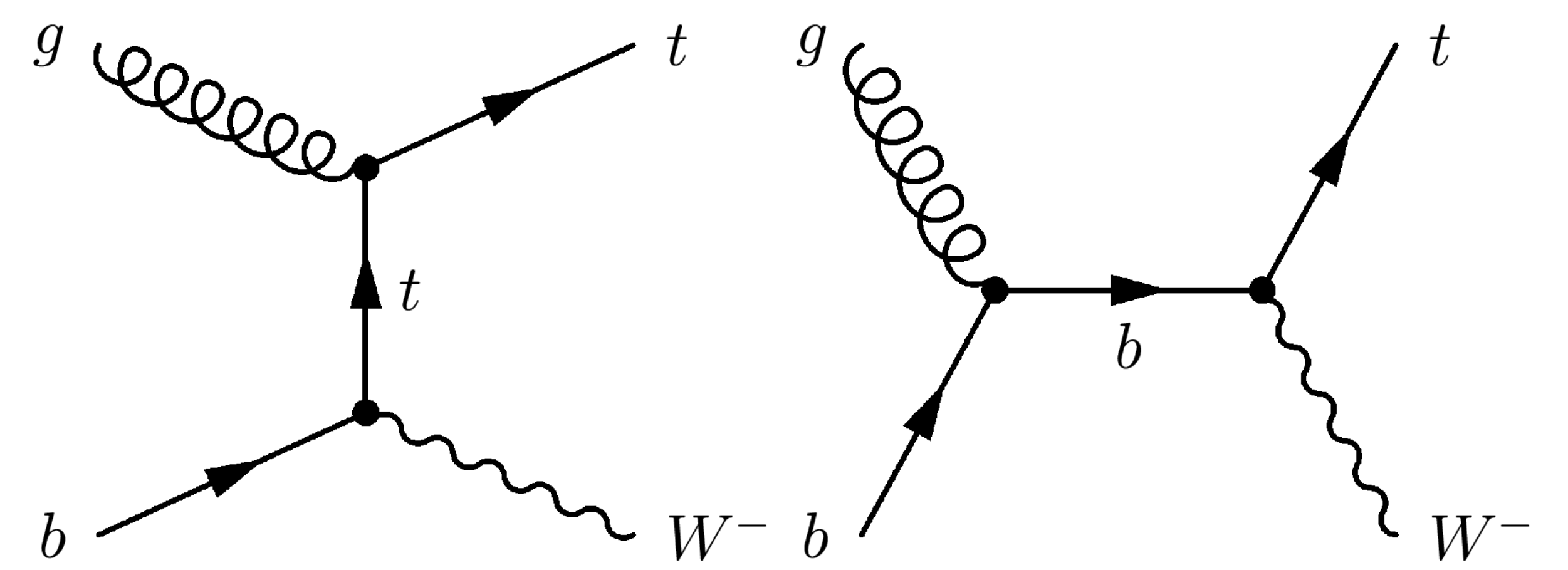


Figure 1: Leading order Feynman diagrams of tW production (top), and event display of a typical tW production event candidate as measured by the CMS detector (bottom).

Signal extraction

Signal is extracted by performing a **maximum likelihood fit** to several distributions in each of the regions

+ **BDTs trained against tt** in the 1j1b and 2j1b regions (Fig. 2)

- BDT 1j1t exploits the presence of a jet outside the acceptance in tt events

- BDT 2j1t exploits angular correlations and different sub-leading p_T spectrum in signal and background

+ **Subleading jet p_T** in the 2j2b region to constrain systematic uncertainties affecting tt background

Systematic uncertainties are parametrized as **nuisance parameters** of the fit

Results

Signal strength and cross-section are measured to be:

$$\mu = 0.88 \pm 0.02(\text{stat.}) \pm 0.09(\text{syst.}) \pm 0.03(\text{lumi.})$$

$$\sigma = 63.1 \pm 1.8(\text{stat.}) \pm 6.4(\text{syst.}) \pm 2.1(\text{lumi.}) \text{ pb}$$

which corresponds to a measurement of the tW cross-section with a **11 % uncertainty**. Dominating systematic uncertainties are experimental uncertainties that affect the measurement due to their effect in the estimation of the tt background



References

Measurement of the production cross section for single top quarks in association with W bosons in pp collisions at $\sqrt{s} = 13$ TeV
arXiv:1805.07399

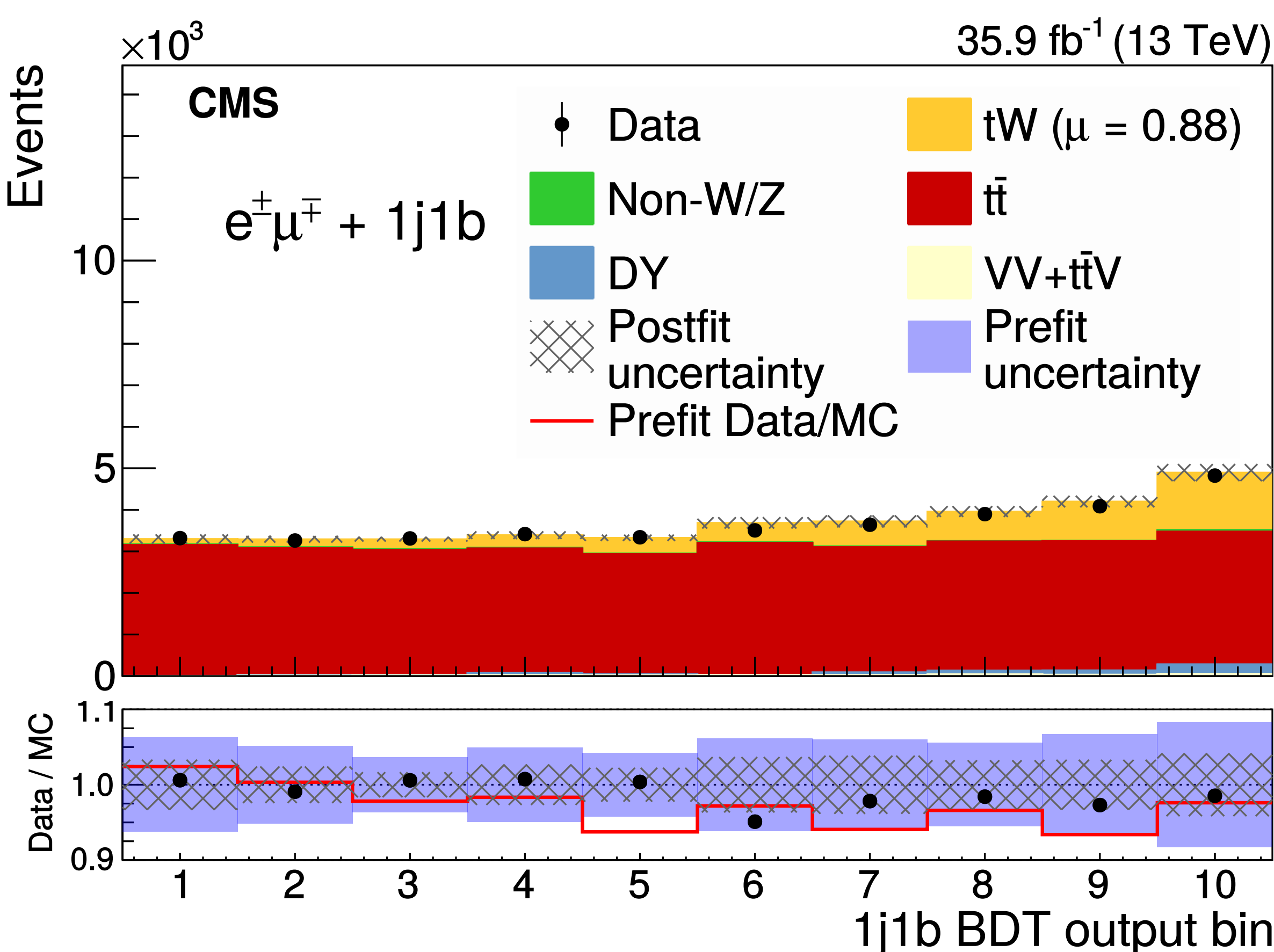
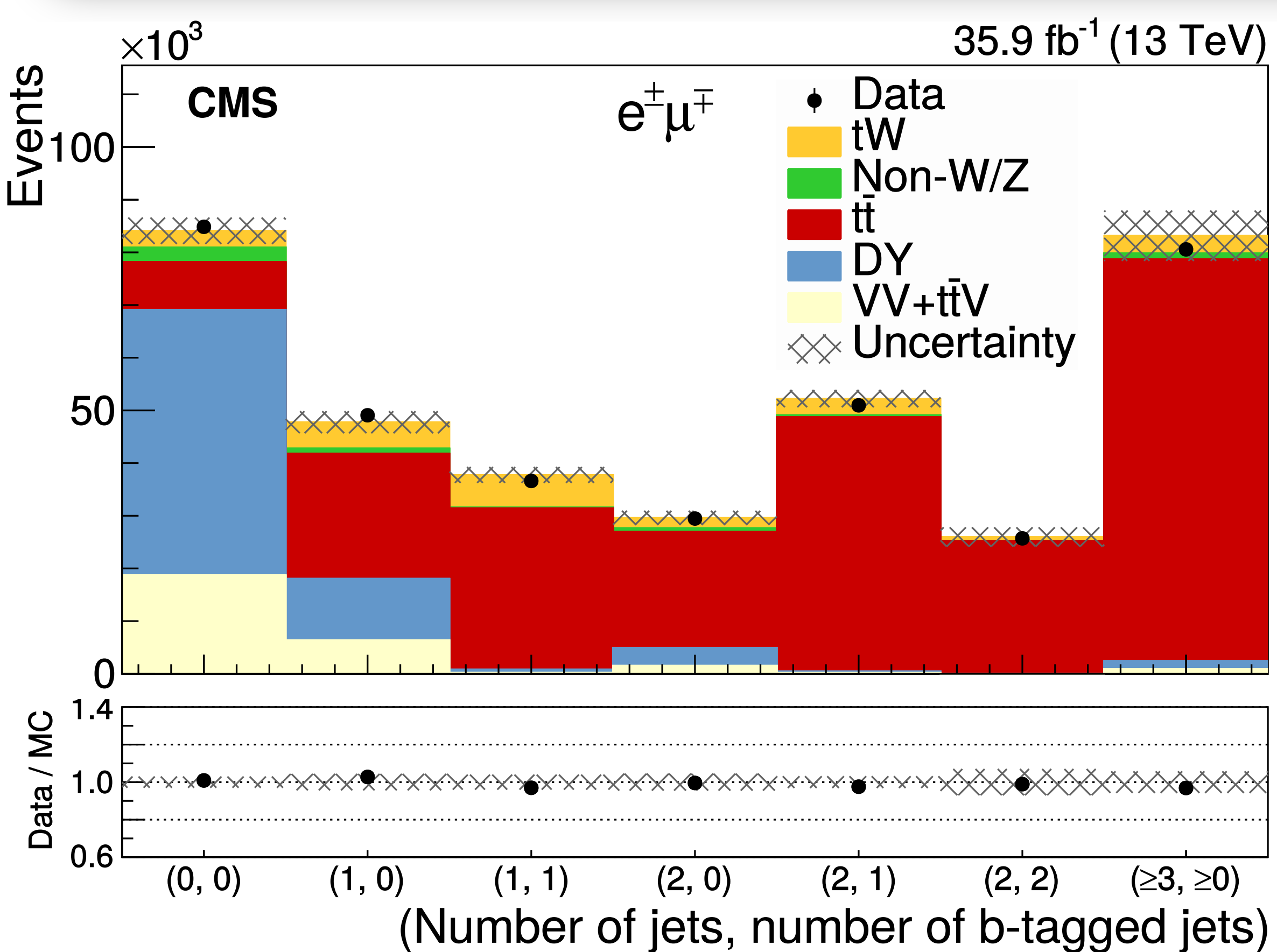


Figure 2: Distribution of number of jets and b-jets after the $e\mu$ selection (top) and BDT output in the 1j1b region (bottom).



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on behalf of the CMS Collaboration

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