

Introduction

Evidence for tW was found at 7 TeV with 2.05 fb^{-1} at ATLAS experiment (Phys. Lett. B, 716:142, 2012) & observation at 8 TeV with 12.2 fb^{-1} at CMS experiment (PRL 112, 231802 (2014)).

tW production is second most dominant single top quark production at LHC.

- Sensitive to the V_{tb} element of the CKM matrix
- Background to many searches.
- Challenging to disentangle interference at NLO top-quark pair production.

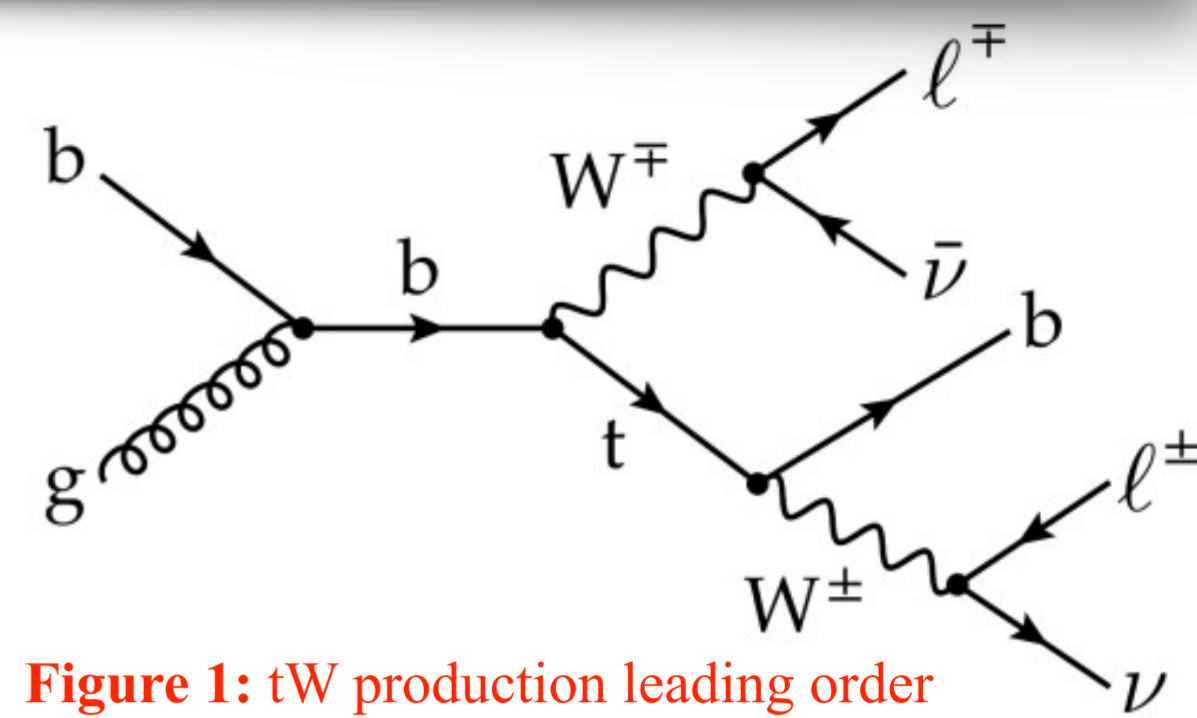


Figure 1: tW production leading order Feynman diagram with decay channel.

Analysis strategy

- Signature: 2 opposite sign leptons ($e\mu$), at least 1 jet which is b-tagged
- + Backgrounds: tt (dominant), Z +jets, W +jets, ZZ , WZ , WW
- Three signal and control regions defined (Fig. 2):
- + 1j1b and 2j1b: signal regions, still dominated by tt
- + 2j2b: control region, to keep systematic uncertainties under control
- Signal strength determined from a maximum likelihood fit to BDT distribution in 1j1b and 2j1b regions where it can be understood the BDTs trained against tt (Fig. 3), and sub-leading jet p_T in 2j2b.

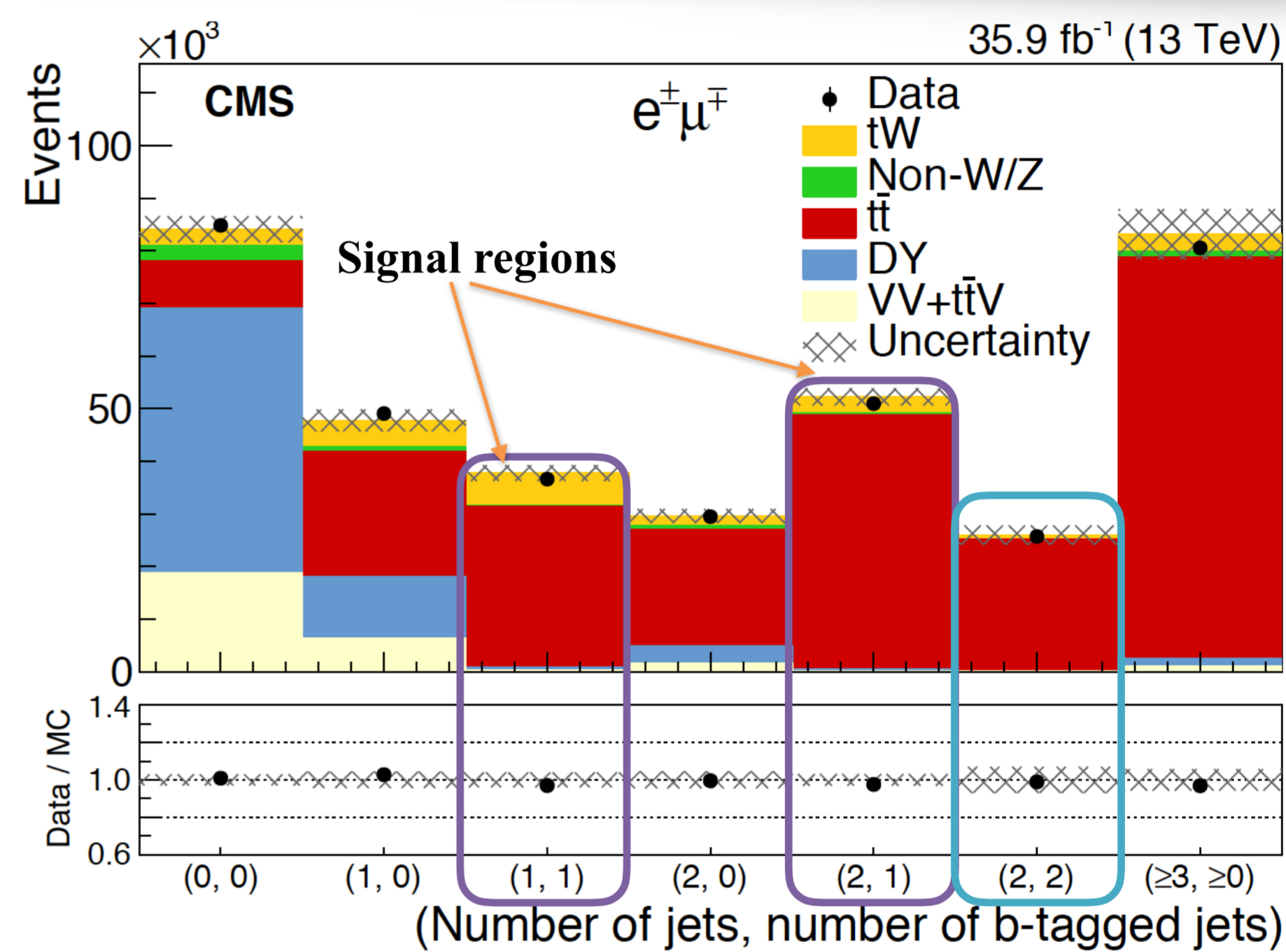


Figure 2: Distribution of number of jets and b-jets in events with $1e$ & 1μ .

- Systematic uncertainties are parametrized as nuisance parameters of the fit.

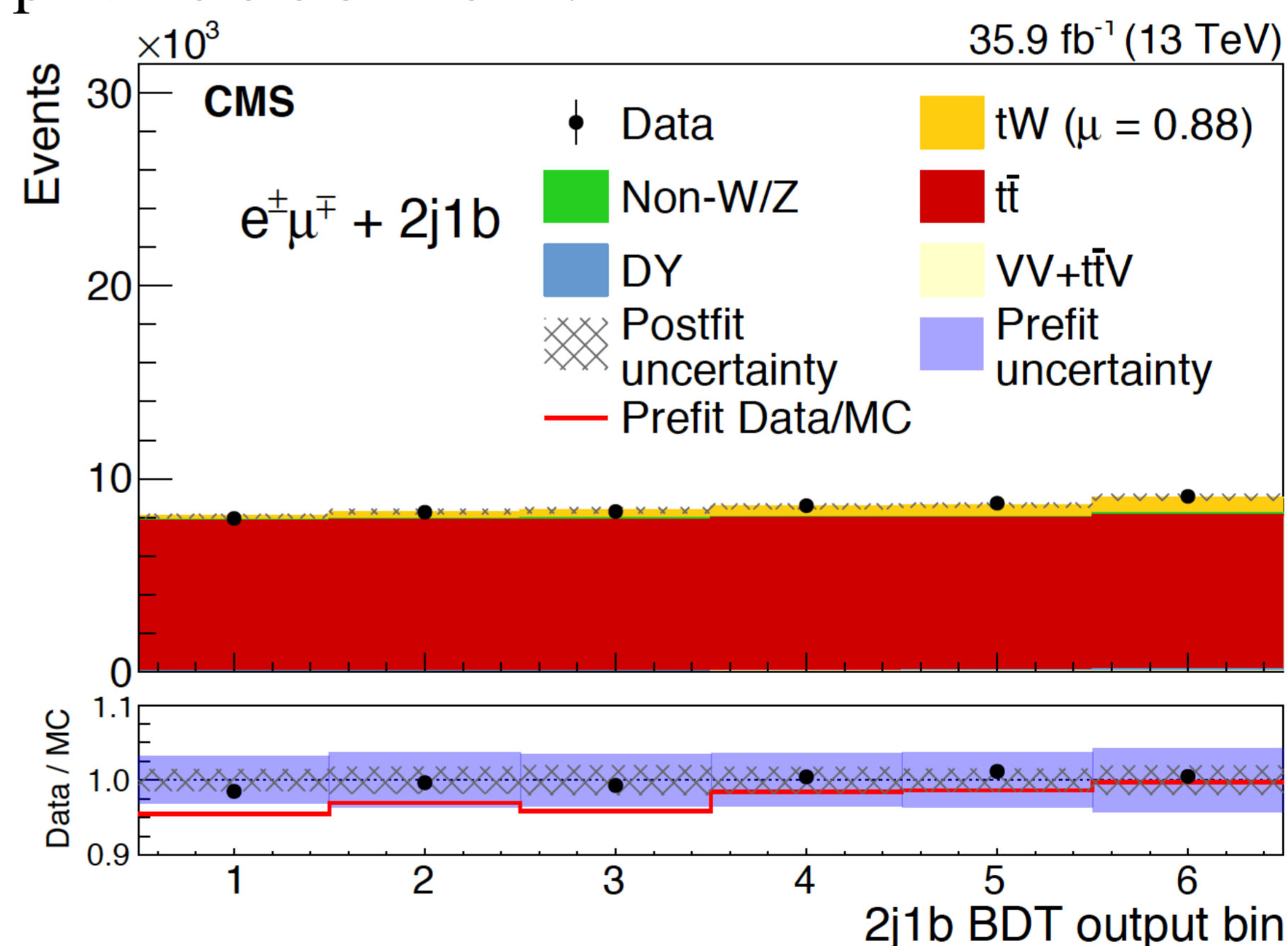
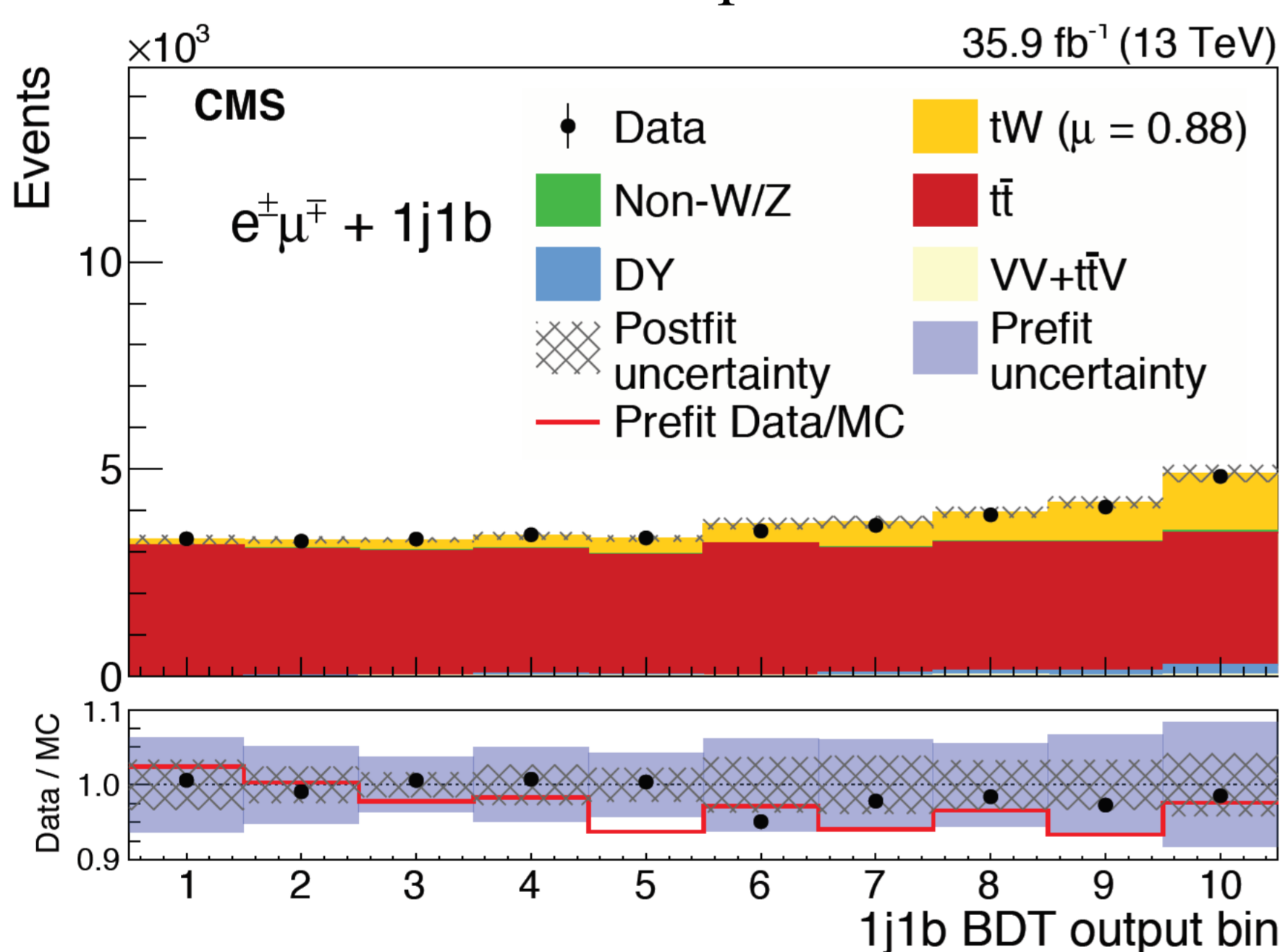


Figure 3: BDT output in the 1j1b (left) and 2j1b region (right).

Results

- First measurement of tW production cross-section by CMS at 13 TeV, using full 2016 Run-II dataset of SingleMuon, SingleElectron, MuonEG, DoubleEG, DoubleMuon corresponds to an integrated luminosity of 35.9 fb^{-1} .

- Signal strength and cross-section are measured to be:

$$\begin{aligned} \mu &= 0.88 \pm 0.02(\text{stat.}) \pm 0.09(\text{syst.}) \pm 0.03(\text{lumi.})pb \\ \sigma_{tW} &= 63.1 \pm 1.8(\text{stat.}) \pm 6.4(\text{syst.}) \pm 2.1(\text{lumi.})pb \\ \sigma_{tW}(NNLO) &= 71.7 \pm 1.8(\text{scale}) \pm 3.4(\text{PDF})pb \end{aligned}$$

corresponding to 11 % precision.

- Dominant uncertainties are JES, lepton identification, tt modeling.

Summary

- First measurement of production cross-section for single top quarks in association with W bosons by CMS at 13 TeV pp collisions (arXiv: 1805.07399) submitted to JHEP.
- Measured cross-section is in agreement with standard model prediction and with a similar measurement by ATLAS Collaboration (JHEP 01 (2018) 63).