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# Measurement of the differential cross section for t-channel single-top-quark production at 13 TeV

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The production of single top quarks is a cornerstone in understanding the nature of the heaviest known elementary particle and its involvement in electroweak interactions. An early differential cross section measurement of t-channel single-top-quark production is presented. Collision data at a center-of-mass energy of 13 TeV collected in 2015 were analyzed, corresponding to  $2.3 \text{ fb}^{-1}$ . The amount of signal events as a function of the top quark transverse momentum and rapidity is estimated by multiple fits using a multivariate discriminant. The results are unfolded to parton level and compared to predictions by various Monte-Carlo generators.

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# 1 Introduction

Cross section measurements of single top quark production allow to study electroweak interactions involving heavy quarks. For example, precise inclusive cross section measurements can yield model-independent limits on the CKM matrix element,  $V_{tb}$ , whereas differential measurements can probe theoretical calculation and generator modeling in great detail.

In this note, a first differential cross section of t-channel single-top-quark production is presented using the first pp collision data recorded by the CMS experiment in 2015 at  $\sqrt{s} = 13$  TeV corresponding to  $2.3 \text{ fb}^{-1}$ . It is based on Ref. [1].

## 2 Event selection

## 3 Signal extraction

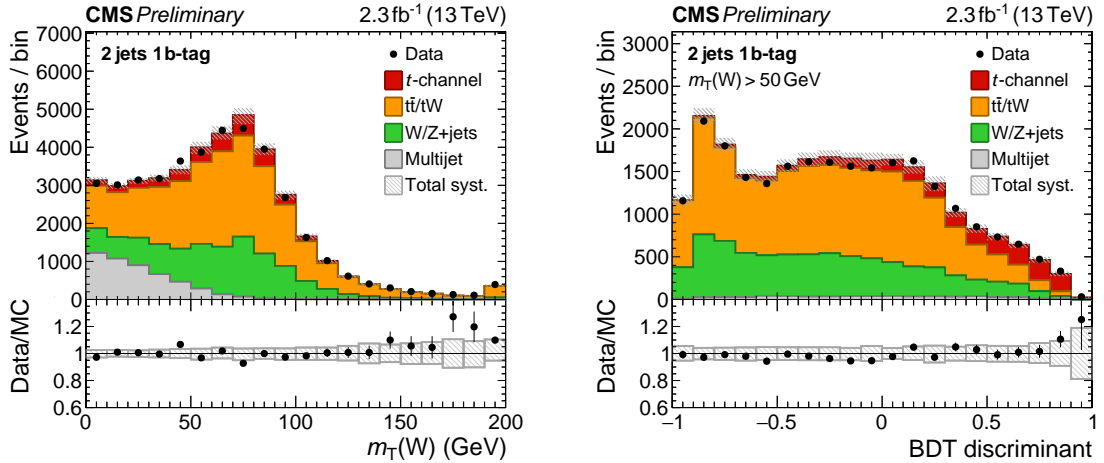


Figure 1: Distributions of (left) the transverse W boson mass and (right) the BDT discriminant after requiring  $m_T(W) > 50$  GeV.

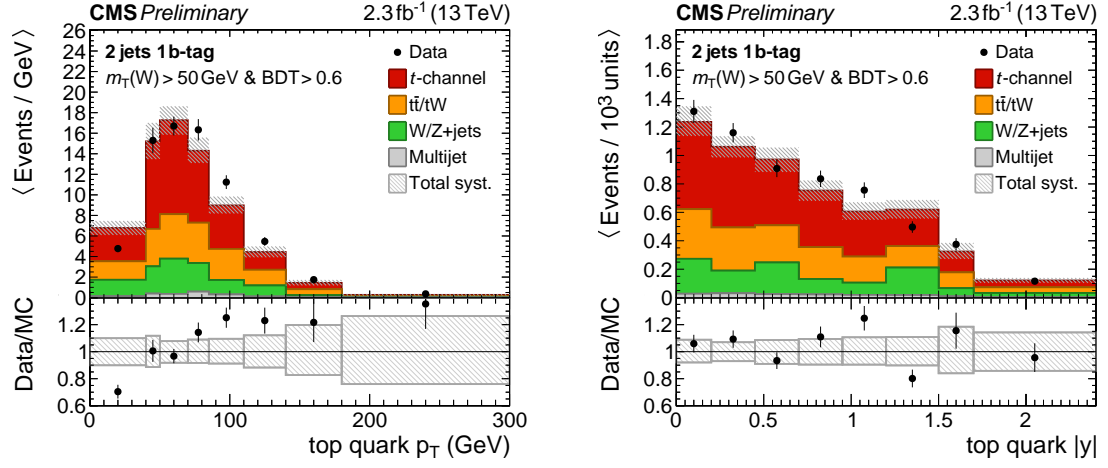


Figure 2: .

### 3.1 Boosted decision tree

### 3.2 Maximum likelihood fitting

### 3.3 Unfolding

## 4 Results

## 5 Conclusion

## References

- [1] CMS Collaboration, *CMS Physics Analysis Summary* CMS-TOP-16-004, 2016.

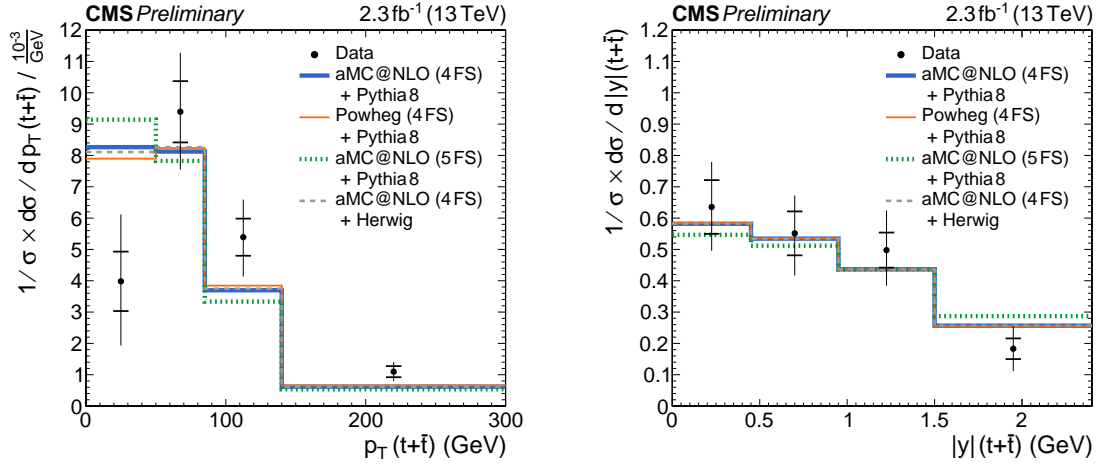


Figure 3: Normalized differential t-channel single-top-quark cross section as a function of the parton-level top quark (left) transverse momentum and (right) rapidity.