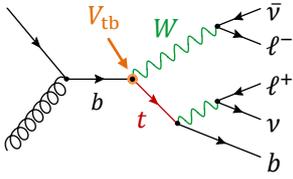


MEASUREMENT OF THE Wt PRODUCTION CROSS SECTION IN DILEPTON EVENTS WITH THE ATLAS DETECTOR

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example Feynman diagram for Wt production at LO QCD with decay

INTRODUCTION

Single top quark production, accounting for $\sim 1/3$ of the overall top quark production at the LHC, constitutes an excellent probe of the W-t-b coupling, which could be modified by certain types of new physics. The associated production of a single top quark and W boson, the Wt mode, was discovered at the LHC in summer 2013. The most recent measurement of Wt production by ATLAS is presented.

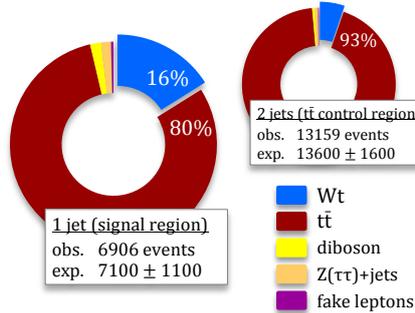
Standard Model cross-section: $\sigma_{Wt} = 22.4 \pm 1.5$ pb (NLO + NNLL QCD)



ATLAS detector

EVENT SELECTION

- 20.3 fb⁻¹ of 2012 pp-collision data @ 8 TeV
- exactly 2 isolated leptons (1 e[±] and 1 μ[±]) with p_T > 25 GeV
- 1 or 2 central jets with p_T > 30 GeV, and ≥ 1 b-tag (80% efficiency)

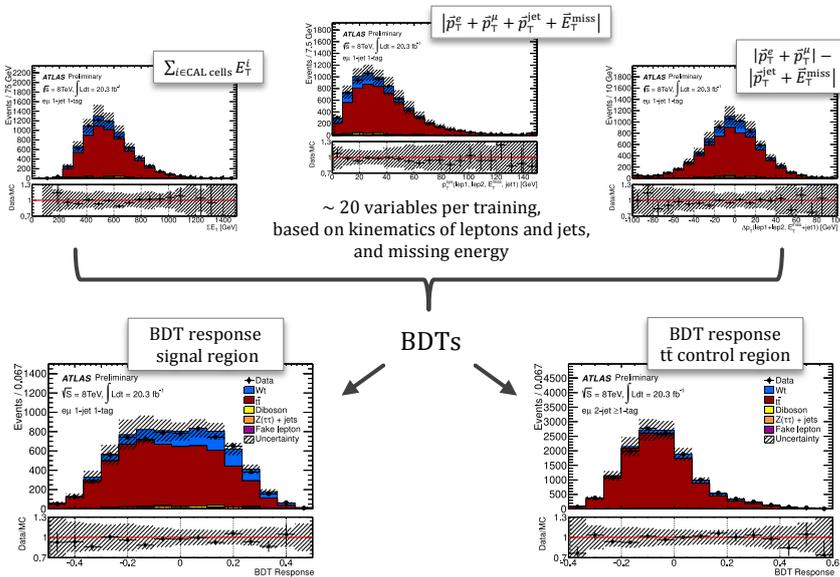


BACKGROUNDS

- top pair production (tt̄)
NLO MC, normalised to NNLO (253⁺¹³₋₁₅ pb)
- diboson (WW, ZZ, WZ)
multi-leg MC, normalised to NLO
- Z(→ττ) + jets
multi-leg MC, normalised to NNLO
- fake leptons
data-driven

SIGNAL EXTRACTION

- Wt signal extremely difficult to distinguish from tt̄ background
- use multivariate analysis method based on Boosted Decision Trees to construct discriminant with good separation power
- train Wt against tt̄, separately in signal and tt̄ control regions

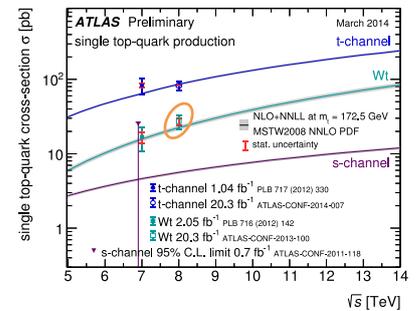


RESULTS

Measured cross-section:

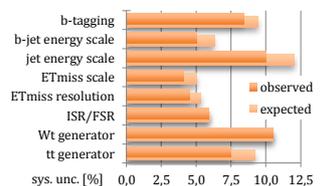
$$\sigma_{Wt} = 27.2 \pm 2.8 \text{ (stat.)} \pm 5.4 \text{ (syst.) pb}$$

- at $\sqrt{s} = 8$ TeV, $m_t = 172.5$ GeV.



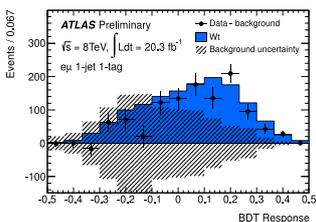
Significance:

4.2 observed
4.0 expected



STATISTICAL ANALYSIS

- binned profile likelihood fit of MC templates to observed BDT output distributions
- use pseudo-experiments to derive systematic uncertainties and significance
- test statistic: ratio of likelihoods maximised for signal-and-background over background-only hypotheses



CKM matrix element:

$$|V_{tb}| = 1.10 \pm 0.12 \text{ (exp.)} \pm 0.03 \text{ (theo.)}$$

- assuming $\mathcal{B}(t \rightarrow Wb) \approx 1$, $|V_{td}|, |V_{ts}| \ll |V_{tb}|$, and unmodified tt̄ production
 - no assumptions on unitarity or number of families
- ⇒ results compatible with other measurements and Standard Model predictions

REFERENCE

Measurement of the cross-section for associated production of a top quark and a W boson at $\sqrt{s} = 8$ TeV with the ATLAS detector, ATLAS-CONF-2013-100