We are important as we come from the dominant channel for single top-quark production. Our total cross-sections are measured @ 8 TeV with a precision better than 10%.

Therefore, it is reasonable to extract our cross-sections as a function of various kinematic variables in order to improve modelling and search for new physics. Below, you can find the useful information how to measure them differentially ...

Let us introduce ourselves, I am a top quark produced in the t-channel.

I am a top antiquark produced in the t-channel.

Event Selection

- 20.2 fb\(^{-1}\) of data collected by ATLAS in pp collisions at 8 TeV in 2012
  - 1 charged isolated lepton: \(p_T > 25\text{ GeV}, |\eta| < 2.5\)
  - 2 jets: \(p_T > 30\text{ GeV}, |\eta| < 4.5\)
  - 1 b-tagged jet using MV1c with 50% WP
  - \(E^\text{miss}_{T} > 30\text{ GeV}\)
  - \(m_T(t, E^\text{miss}_{T}) > 50\text{GeV}\)
  - \(p_T(t) > \max(25\text{GeV}, 40\text{GeV} \cdot \frac{\pi - |\Delta\phi(j_1, t)|}{\pi - 1})\)
- \(t\bar{q}\) production separated from \(tq\) production by sign of lepton charge

Measurement Region

- Neural network (NeuroBayes) with several input variables to separate signal from backgrounds
- Cut at \(O_{NN} > 0.8\) to enhance signal fraction (\(S/B \sim 2\))

Results

- 8 TeV absolute and normalised differential cross-sections for \(t\bar{q}\) and \(tq\) production measured as a function of:
  - \(p_T\) and \(|y|\) of \(t\) and \(\bar{t}\) at parton level and particle level
  - \(p_T\) and \(|y|\) of scattered jet at particle level
  - Typically 5-20% precision per bin
  - Normalised cross-sections for \(t\bar{q}\) production at particle level are the most precise measurements
  - Good agreement with NLO+NNLL prediction
  - MC predictions somewhat harder than data as a function of \(p_T\)

Systematic Uncertainties

- Major sources: background normalisation, top-quark (background and signal) modelling and jet energy scale
- Small contribution from unfolding procedure

Signal and Background Sources

- All processes except multijet normalised to their theoretical cross-sections
- Multijet normalisation obtained from a binned maximum-likelihood fit to the \(E^\text{miss}_{T}\) distribution
- To correct a distorted distribution due to experimental limitations back to its true distribution
- Parton-level measurements
  - Top quark defined before its decay but after gluon radiation
  - Done inclusively
- Particle-level measurements
  - Stable particles (lifetime > 30 ps)
  - Done in a fiducial volume (close to experimental phase space)
  - Exploiting iterative Bayesian unfolding in RooUnfold

Unfolding

- Major sources: background normalisation, top-quark (background and signal) modelling and jet energy scale
- Small contribution from unfolding procedure