T 81: Single Top, Top Properties

Time: Wednesday 17:30–19:00 Location: HSZ/0103

T 81.1 Wed 17:30 HSZ/0103

Measurement of the t-channel single top-quark production cross-section in proton-proton collisions at a centre-of-mass energy of 13 TeV with the ATLAS detector — Olga Bessidskaia Bylund[1], Dominic Hirschbühl[1], •Joshua Reidelstürz[1], Mohsen Rezaei Estabragh[1], Wolfgang Wagner[1], Johannes Erdmann[2], Benedikt Gocke[2], Lukas Kretschmann[1], Olaf Nackenhorst[2], and Maren Stratmann[1] — [1]Bergische Universität Wuppertal, Wuppertal, Deutschland — [2]Technische Universitaet Dortmund, Dortmund, Deutschland

The measurement of the single top-quark t-channel production cross sections σ_{tq} and $\sigma_{\bar{t}q}$ and their fraction R_t as well as the total cross section $\sigma_{tq,\bar{t}q}$ is presented. These measurements provide a precise test of the standard model and are sensitive to new-physics phenomena by probing the properties of the Wtb vertex and placing limits on the CKM matrix element $|V_{tb}|$. Data taken with the ATLAS detector from 2015 to 2018 corresponding to an integrated luminosity of $\mathcal{L} = 139\,\mathrm{fb}^{-1}$ at a center-of-mass energy of 13 TeV is analyzed using corresponding samples of simulated events. Requirements are applied to the data selecting events with the signature expected for the signal process. To further enhance the separation between signal and background events a neural network is trained using the Monte Carlo simulated data combining several kinematic variables. The neural network output distribution is then used in a binned profile maximum likelihood fit including all systematic uncertainties to determine the cross sections.

T 81.2 Wed 17:45 HSZ/0103

Differential cross-section measurement of the tZq process with the ATLAS detector — •Nilima Akolkar[1], Ian Brock[1], Lidia Dell'Asta[2], and Thomas Stevenson[3] for the ATLAS-Collaboration — [1]Physikalisches Institut, Universität Bonn — [2]University of Milano — [3]University of Sussex

The associated production of a single top-quark with a Z-boson (tZq) is a rare process that has been discovered by the CMS and ATLAS Collaborations. This process is of special interest, as it allows one to probe the couplings of the Z-boson to the quark sector and to the W-boson simultaneously.

This talk will focus on the differential cross-section measurement of the tZq process, analyzed in the trilepton decay channel. The data used was collected with the ATLAS detector during Run 2 of the LHC. The tZq differ- ential cross-section is measured using profile likelihood unfolding and the preliminary results will be presented in the talk.

T 81.3 Wed 18:00 HSZ/0103

first simultaneous differential measurement of tZq and ttZ with the CMS detector — •Federica Cecilia Colombina — Deutsches Elektronen-Synchrotron (DESY), Notkestraße 85, 22607 Hamburg

With the large dataset of proton-proton collisions recorded during LHC Run-2, several precise and differential measurements of both ttZ and tZq processes have been produced with the CMS experiment. These two processes are mutual backgrounds to one another. In previous measurements, background processes were assumed to follow the expectations of the standard model. In this measurement, for the first time, both processes ttZ and tZq are measured simultaneously and differentially. The measurement will therefore be more sensitive to new physics, and particularly suitable for effective field theory interpretations.

T 81.4 Wed 18:15 HSZ/0103

Measurements of observables sensitive to colour reconnection in $t\bar{t}$ events with the ATLAS detector at $\sqrt{s} = 13$ TeV — •Shayma Wahdan, Dominic Hirschbühl, and Wolfgang Wagner — Bergische Universität Wuppertal, Wuppertal, Germany

A measurement of observables sensitive to effects of colour reconnection in top-quark pair-production events is presented using 139 fb^{-1} of 13 TeV proton–proton collision data collected by the ATLAS detector at the LHC. Events are selected by requiring exactly one isolated electron and one isolated muon with opposite charge and two or three jets, where exactly two jets are required to be b-tagged. For the selected events, measurements are presented for the charged-particle multiplicity, the scalar sum of the transverse momenta of the charged particles, and the same scalar sum in bins of charged-particle multiplicity. These observables are unfolded to the stable-particle level, thereby correcting for migration effects due to finite detector resolution, acceptance and efficiency effects. The particle-level measurements are compared with different colour reconnection models in Monte Carlo generators. These measurements disfavour some of the colour reconnection models and provide inputs to future optimisation of the parameters in Monte Carlo generators.

T 81.5 Wed 18:30 HSZ/0103

Measurements of top-quark pair spin correlation in the ℓ + jets channel using the ATLAS experiment — •Oleksandr Burlayenko, A. Knue, and Z. Rurikova for the ATLAS-Collaboration — University of Freiburg

The top quark is the heaviest known fundamental particle and has a lifetime of $\mathcal{O}(10^{-25}s)$. This lifetime is shorter than the quantum chromodynamic (QCD) hadronization time scale $1/\Lambda_{QCD} \approx 10^{-24}$s, and much shorter than the spin decorrelation time scale $m_t/\Lambda^2_{QCD} \approx 10^{-21}$s. This gives an opportunity to study the spin properties of a bare quark, as top-quark spin information is preserved in the angular distribution of its decay products.

The Standard Model predicts the $t\bar{t}$ pairs to have correlated spins. The degree of this correlation is sensitive to the production mechanism. The most recent measurement performed by ATLAS uses 13 TeV data in the dilepton channel.

This work presents ongoing studies of the $t\bar{t}$ spin correlation in the ℓ + jet channel at $\sqrt{s} = 13$ TeV. While this channel provides a larger dataset to study, the analyzing power is reduced compared to the dilepton channel.

To improve the event reconstruction, machine learning techniques are employed and non-reconstructable events are removed. Studies of various observables on particle- and detector-level measured inclusively and as a function of mass of the $t\bar{t}$ system will be presented. In addition the impact of systematic uncertainties on these observables will be studied.

T 81.6 Wed 18:45 HSZ/0103

Measurement of top quark involved CKM matrix elements in single top-quark t-channel processes — •Benedikt Gocke[1], Dominc Hirschbuel[2], Kevin Kröninger[1], Olaf Nackenhorst[1], Joshua Reidelstürz[2], Maren Stratmann[2], and Wolfgang Wagner[2] — [1]TU Dortmund, AG Kröninger — [2]Bergische Universität Wuppertal

Measuring top quark properties is one of the main purposes of the ATLAS experiment at the LHC. Since the top quark is the heaviest quark and thus decays before it hadronises, it can be seen as a quasi free quark. Therefore, its properties and especially its couplings are crucial to test the Standard model.

In general, all flavour-changing quark couplings are described by the Cabbibo-Kobayashi-Maskawa (CKM) matrix. Furthermore, all CKM matrix elements are free parameters of the Standard model and thus need to be measured. For the three CKM matrix elements involved in top quark processes - V_{tb}, V_{ts} and V_{td} - this is especially challenging due to the very small magnitudes for the two latter ones.

The CKM interpretation of the single top-quark t-channel cross section measurement at $\sqrt{s} = 13$ TeV with the ATLAS experiment is presented, in which all possible top quark production and decay processes are considered. The aim is to set limits on each involved CKM element individually for the first time. For this purpose, a profile-likelihood scan is used for the interpretation.