T 106: Top quarks: Single top production

Time: Friday 11:00–13:00 Location: L-4.001

T 106.1 Fri 11:00 L-4.001

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, Dominic Hirschbühl, •Joshua Reidelstürz, Mohsen Rezaei Estabragh, and Wolfgang Wagner for the ATLAS-Collaboration — Bergische Universität Wuppertal, Wuppertal, Germany

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 at the ATLAS detector from 2016 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 Monte Carlo simulated data. Cuts are applied to the data selecting events with the signature expected for the signal process. Next, to separate signal and background events a neural network is trained using the Monte Carlo simulated data combining several kinematic variables measured with the detector. 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 106.2 Fri 11:15 L-4.001

Suche nach der Einzel-Top-Quark-Produktion im s-Kanal bei einer Schwerpunktsenergie von 13 TeV mit dem CMS-Experiment — Thorsten Chwalek, Nils Faltermann, •Denise Müller und Thomas Müller — Institut für Experimentelle Teilchenphysik (ETP), Karlsruher Institut für Technologie (KIT)

Die Produktion einzelner Top-Quarks erfolgt, im Gegensatz zur Top-Quark-Paarproduktion, über die elektroschwache Wechselwirkung. Daher ist dieser Prozess sensitiv auf mögliche Abweichungen im elektroschwachen Sektor des Standardmodells. Eine besondere Herausforderung stellt hierbei die Produktion über den s-Kanal dar. Dieser Produktionsmodus ist von allen Einzel-Top-Quark-Produktionsmechanismen theoretisch am präzisesten beschrieben, weist jedoch nur einen geringen Anteil an der gesamten Produktion einzelner Top-Quarks auf. Dies erfordert eine gute Trennung zwischen Signal- und Untergrundereignissen mittels multivariater Analysemethoden.

Dieser Vortrag beschreibt die Suche nach der Einzel-Top-Quark-Produktion im s-Kanal unter Verwendung der 2016 bis 2018 bei einer Schwerpunktsenergie von 13 TeV gemessenen Daten des CMS-Experiments.

T 106.3 Fri 11:30 L-4.001

Measurement of the Single-Top production cross section in the s-channel at $\sqrt{s}$=13 TeV with the ATLAS detector — •Ken Kreul for the ATLAS-Collaboration — Humboldt-Universität zu Berlin

The production of single top-quarks in electroweak processes (Single-Top) is an important part for the study of the Standard Model and possible extensions. Single-Top production is possible in three channels: t-channel, s-channel and via associated production of a W-boson. In proton-proton collisions at the Large Hadron Collider (LHC), the s-channel has the lowest production cross section and is dominated by many background processes. During the LHC run at 8 TeV, the s-channel was already observed with a significance of 3.2σ using the Matrix Element Method. In this method, the matrix elements for the most important signal and background processes are integrated over the available phase space to compute process likelihoods, which can then be combined to a discriminant. The method is now applied to current ATLAS data at $\sqrt{s}$=13 TeV to improve the previous result using the higher luminosity of up to 140 fb^{-1}.

T 106.4 Fri 11:45 L-4.001

Mesurement of top quark polarization in t-channel single top quark events and constraining anomalous Wtb couplings with the CMS-Experiment — •David Seith, Thorsten Chwalek, Thomas Müller, and Nils Faltermann — Institut für Experimentelle Teilchenphysik(ETP), Karlsruher Institut für Technologie (KIT)

Single top quarks are produced via electroweak production and are therefore polarized at the LHC. Their polarization is highly sensitive to anomalous contributions to the Wtb vertex. Deviations in the top quark polarization from the predictions of the Standard Model could therefore hint at new physics. In this talk a measurement of the top quark polarization using the data taken from 2016 to 2018 at a center-of-mass energy of 13 TeV at the CMS-Experiment is presented.

T 106.5 Fri 12:00 L-4.001

Search for FCNC in strong interactions with the ATLAS detector — •Gunnar Jäkel, Wolfgang Wagner, and Dominic Hirschbühl — Bergische Universität Wuppertal

Flavor changing neutral currents (FCNC) are forbidden at tree level and highly suppressed at higher orders in the standard model. In some new physics models leading order contributions could enhance cross sections for FCNC processes by many orders of magnitude. A search for direct top quark production is presented. In this process a u(c)-quark interacts with a gluon and produces a top quark. Different cuts and neural networks are studied to increase the sensitivity of the search.

T 106.6 Fri 12:15 L-4.001

Search for flavour-changing neutral currents in single-top quark processes in association with a photon at $\sqrt{s} = 13$ TeV with the ATLAS experiment — Johannes Erdmann, Gregor Gessner, •Benedikt Gocke, and Olaf Nackenhorst — TU Dortmund, Lehrstuhl für Experimentelle Physik IV

In the Standard Model, flavor-changing neutral currents (FCNC) at tree level are forbidden and are highly suppressed by the GIM mechanism at higher orders. However, extensions to the Standard Model predict higher cross sections for processes including FCNCs.
One possible process with an FCNC includes a top quark that interacts with an up-type quark and a photon ($tq\gamma$ coupling with $q = u, c$). A distinction is made between the production mode, in which a single top quark is produced, and the decay mode, in which one of the top quarks of a $t\bar{t}$ system decays through an FCNC interaction.
A search with focus on the production process, which used 81 fb^{-1} of proton-proton collision data, was recently published (Phys. Lett. B 800 (2019) 135082). Now, first studies of the search for both processes, decay and production mode, using the full LHC Run-2 data are presented.

T 106.7 Fri 12:30 L-4.001

Search for single production of top quarks in association with a photon with the ATLAS detector at $\sqrt{s} = 13$ TeV — •Björn Wendland, Johannes Erdmann, and Kevin Kröninger — TU Dortmund, Experimentelle Physik IV

Analyses of top quark production in association with a photon are important tests of the Standard Model as top quark properties with respect to the electroweak interaction such as the structure of the top quark and photon vertex can be probed. Top quark pair production with a photon ($t\bar{t}\gamma$) in leptonic final states was observed and investigated by the ATLAS and CMS collaborations. No significant deviations from the Standard Model expectations were found by now.

With the rich datasets collected by the ATLAS and CMS experiments during Run 2 of the LHC programme, it is feasible to observe the Standard Model single production of top quarks in association with a photon. The CMS collaboration reported evidence corresponding to $4.4\,\sigma$ for this process using a partial Run 2 dataset. Investigations of this process are complementary to the measurement of the $t\bar{t}\gamma$ process.

In this talk, studies of t-channel single production of top quarks with a photon using the full Run 2 dataset collected by the ATLAS detector are presented. The leptonic decay channel of the top quark is targeted in this analysis where the final state consists of either an electron or a muon, a jet containing B hadrons, missing transverse energy, a photon and an additional jet produced in forward direction.

T 106.8 Fri 12:45 L-4.001

Measurement of highly boosted W-associated single top quark production with CMS — •Christopher Matthies, Paolo Gunnellini, Johannes Haller, and Roman Kogler — Institut für

Experimentalphysik, Universität Hamburg

A measurement of W-associated single top quark production in the highly boosted regime in proton–proton collisions at $\sqrt{s} = 13$ TeV with the CMS experiment is presented. The measurement focusses on the ℓ+jets final state in which the top quark decays hadronically and the associated W boson leptonically, leading to a distinct event signature with a hadronic and a leptonic hemisphere. The HOTVR jet clustering and tagging algorithm is used to identify the fully merged top quark decay. Deep learning techniques are used to discriminate the tW signal from top quark pair production and other background processes. It is shown that a measurement up to a transverse momentum of about 1 TeV of the top quark is feasible, extending the range of previous measurements considerably.