T 42: Top-Quarks: Produktion I

Zeit: Dienstag 16:30–19:00 Raum: Z6 - SR 2.011

T 42.1 Di 16:30 Z6 - SR 2.011

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, Thomas Müller, Genti Saliu und Fabian Schenkel — 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 zwar theoretisch exakt beschrieben, weist jedoch nur einen geringen Anteil an der gesamten Produktion einzelner Top-Quarks auf. Dies erfordert eine gute Trennung zwischen Signal- und Untergrundereignissen.

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

T 42.2 Di 16:45 Z6 - SR 2.011

Search for single top quark production in association with a W and a Z boson in the 3ℓ channel with the ATLAS experiment at 13 TeV — Julien Caudron[1], Markus Cristinziani[1], Mazuza Ghneimat[1], Carlo A. Gottardo[1], Sebastian Heer[1], Vadim Kostyukhin[1], •Ö. Oğul Öncel[1,2], Arshia Ruina[1], and Andrea Sciandra[1] — [1]Physikalisches Institut, Universität Bonn — [2]Institut für Kernphysik, Universität zu Köln

Production of tWZ in pp collisions is a rare process predicted by the Standard Model with an expected cross section of less than 0.01 pb. As it has not been measured yet, it is one of the current research frontiers in top-quark physics. The tWZ is also important in other top-quark related measurements: for example in $t\bar{t}Z$ production, as an important background. A better understanding of this process will contribute to the improvement of other measurements as well.

A search for this process in the 3ℓ-channel using ATLAS data collected at the LHC during 2015 & 2016 with 36.1 fb^{-1} integrated luminosity and at a center-of-mass energy of 13 TeV is presented. The main challenges are the small cross section and the irreducible background contaminations from the WZ and $t\bar{t}Z$ processes. This talk will present the current progress in addressing those challenges, particularly with the help of multivariate techniques.

T 42.3 Di 17:00 Z6 - SR 2.011

Messung des Wirkungsquerschnittes der Einzel-Top-Quark-Produktion im t-Kanal bei 13 TeV mit dem CMS-Experiment — Thorsten Chwalek, Nils Faltermann, Thomas Müller, •Philipp Ott und Tim Pambor — Institut für Experimentelle Teilchenphysik (ETP), Karlsruher Institut für Technologie (KIT)

Mit Hilfe des Datensatzes, der bislang in Run II am LHC aufgezeichnet wurde, können Präzisionsmessungen der Eigenschaften der Einzel-Top-Quark-Produktion durchgeführt werden. Anschließend können diese zur Validierung der Vorhersagen des Standardmodells der Teilchenphysik verwendet werden. Im Gegensatz zur Top-Quark-Paarerzeugung findet die Produktion einzelner Top-Quarks über den Austausch geladener Ströme in elektroschwachen Wechselwirkungen statt. Sie ist daher seltener, aber sensitiv auf die direkte Kopplung zwischen Top-Quark, W-Boson und Bottom-Quark. Der t-Kanal-Prozess stellt den dominanten Produktionsmechanismus für Einzel-Top-Quarks dar. In einem multivariaten Verfahren werden Signal- und Untergrundereignisse klassifiziert und anschließend der Wirkungsquerschnitt der Einzel-Top-Quark-Produktion im t-Kanal bestimmt.

In diesem Vortrag wird die oben beschriebene Messung des Wirkungsquerschnittes anhand der im Jahr 2016 bei 13 TeV mit dem CMS-Experiment gemessenen Daten vorgestellt.

T 42.4 Di 17:15 Z6 - SR 2.011

Anwendung der Matrixelement-Methode zur Messung des Wirkungsquerschnittes für die Produktion einzelner Top-Quarks im s-Kanal bei einer Schwerpunktsenergie von 13 TeV mit dem ATLAS-Detektor — •Stephan Kaphle — Humboldt-Universität zu Berlin

Für die Untersuchung des Standardmodells und möglicher Erweiterungen spielt die Produktion einzelner Top-Quarks in elektroschwachen Prozessen (Single-Top) eine wichtige Rolle. Die Single-Top-Produktion findet in drei Kanälen statt: t-Kanal, s-Kanal und assoziierter Produktion von W-Bosonen. In pp-Streuung am Large Hadron Collider (LHC) besitzt der s-Kanal den kleinsten Produktionsquerschnitt und wird von vielen Untergrundprozessen überlagert. Mit der Matrixelement-Methode konnte der s-Kanal in einer Untersuchung der Daten des ATLAS-Experiment am LHC während der Laufzeit mit einer Schwerpunktsenergie von 8 TeV bei einer integrierten Luminosität von 21 fb^{-1} mit einer Signifikanz von $3{,}2\sigma$ nachgewiesen werden. Die Matrixelement-Methode berechnet eine Diskrimante für ein Ereignis unter Verwendung des Matrixelementes für den Signal- und die dominanten Untergrundprozesse. Dadurch wird eine gute Trennung von Signal- und Untergrundereignissenund ermöglicht. Die aktuelle hier vorzustellende Analyse wendet die gleiche Methode auf aktuelle Daten mit einer Schwerpunktsenergie von 13 TeV an, um von der höheren Luminosität von derzeit bis zu 93 fb^{-1} zu profitieren. Es wird der aktuelle Stand der Analyse präsentiert.

T 42.5 Di 17:30 Z6 - SR 2.011

Studies for the search for flavor-changing neutral currents in single-top quark production processes in association with a photon at the ATLAS experiment — •Gregor Gessner, Johannes Erdmann, and Kevin Kröninger — TU Dortmund, Lehrstuhl für Experimentelle Physik IV

Flavor-changing neutral currents (FCNC) are highly suppressed by the GIM mechanism within the Standard Model (SM). It is speculated that the top quark may play a key role in the search for deviations from the SM prediction since its mass is close to the electroweak symmetry breaking scale. In several models for physics beyond the SM, the cross section of processes including top quarks and FCNC may be larger by several orders of magnitude than expected in the SM.
Studies will be presented for the search of processes in which top quarks are produced in association with a photon via a flavor-changing neutral interaction ($qg \to t\gamma$ with $q = u, c$). The studies are performed using data recorded at the ATLAS experiment at the LHC at $\sqrt{s}$=13 TeV.

T 42.6 Di 17:45 Z6 - SR 2.011

Single top production in association with a Z boson with ATLAS — •Marius Blaut and Jan C. Brock — Physikalisches Institut, University of Bonn

Evidence of the electroweak process in which a Z boson is radiated in t-channel single top-quark production (tZq channel) was first reported by the ATLAS collaboration after analyzing 13 TeV data collected in 2015 and 2016. The analysis, which was performed in the trilepton final state, is extended by adding data collected in 2017.

The trilepton decay topology of this process is characterised by one jet originating from a b quark, three charged leptons with high transverse momentum (including an opposite sign, same flavour pair from the Z boson) and one light-quark jet that tends to be in the forward direction and missing transverse momentum.

The main sources of background are diboson and $t\bar{t}Z$ production, as well Z+jets and $t\bar{t}$ events with a lepton which is fake or non-prompt. The data-driven technique used to estimate the non-prompt and fake lepton background will be presented along with the preliminary results of this analysis.

T 42.7 Di 18:00 Z6 - SR 2.011

Measurement of the Single Top tW Inclusive Cross Section in the Single Lepton Final State at 13 TeV with ATLAS — Ian C. Brock and •Federico G. Diaz Capriles — Physikalishes Institut, University of Bonn

Single top-quark production in association with a W boson (known as the tW channel) can be measured in the ATLAS detector at the Large Hadron Collider. In general, single top-quark cross-section measurements allow for a precise test of Standard Model physics and can aid in the discovery of new physics (i.e. FCNC, anomalous couplings, ...). The tW channel has the second largest cross-section of the three main single top production processes at the LHC and it is sensitive to different new physics from that of the s- and t-channels. In this work, tW

production is studied in the lepton plus jets channel by selecting events with three jets, one lepton and some amount of missing transverse momentum. Separation of signal and background events is performed by a neural network trained on Monte Carlo samples. This training helps identify the tW signal from its more prominent backgrounds, top-quark pair production and W plus jets events, which share similar signatures but have much greater cross-sections. Lastly, a likelihood fit is used to extract the signal cross-section.

T 42.8 Di 18:15 Z6 - SR 2.011

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 42.9 Di 18:30 Z6 - SR 2.011

Feasibility Studies on the Measurement of Boosted Single Top Quark Production with the CMS Experiment — •Christopher Matthies, Roman Kogler, and Johannes Haller — Institut für Experimentalphysik, Universität Hamburg

Due to its unique properties, the top quark plays a key role in the search for physics beyond the Standard Model. Besides just being the heaviest elementary particle, its mean life time is significantly smaller than the usual time scale of hadronization processes. Thus, it can be surveyed as an isolated quark, allowing unique experimental studies.

At the LHC, only measurements of inclusive single top production cross sections have been performed so far. In this work, feasibility studies of measurements with highly boosted top quarks, with high transverse momentum, from single top quark production are presented. These processes provide stringent tests of the Standard Model predictions in the top sector and play an important role in searches for new physics with boosted top quarks in the final state. Additionally, such a measurement could help to constrain new physics models which predict particles with large couplings to top quarks.

T 42.10 Di 18:45 Z6 - SR 2.011

Studies on the four-tops production process with the ATLAS detector — Clara Nellist, Thomas Peiffer, Arnulf Quadt, •Paolo Sabatini, and Elizaveta Shabalina — II. Physikalisches Institut, Georg-August-Universität Göttingen

The Large Hadron Collider (LHC) at CERN is a proton-proton collider that has provided, in the last three years, an exceptional integrated luminosity of about 80 fb^{-1} at $\sqrt{s} = 13$ TeV. This large dataset pushes the hosted experiment towards more and more challenging analyses, aimed at the measurement of ultra-rare processes. One of those is certainly the process of four top quarks production.

The four-top production process, having a Standard Model (SM) cross-section of $\sigma_{t\bar{t}t\bar{t}} \approx 9$ fb, has a particular role in many Beyond-the-Standard-Model theories that predict particles much heavier than the top quark, which are then able to decay into a single or a pair of tops. A precise measurement of this cross-section represents not only a strong test for the SM predictions, but also an opportunity for the detection of new physics signals. A feature of this process is a strong hadronic environment, resulting in a large number of jets in the final state, many of which are b-jets. Consequently, this makes a precision measurement very challenging.

In this talk an overview over the main features of the analysis as well as detailed discussions on the features of the process are given.