T 58: Top-Physik II

Zeit: Mittwoch 16:00–17:45 Raum: S10

T 58.1 Mi 16:00 S10

Studies for the measurement of $|V_{ts}|$ in top quark decays — Johannes Erdmann, Kevin Kröninger, and •Sonja Zeissner — TU Dortmund, Experimentelle Physik IV

The full Run-2 dataset collected by the ATLAS detector at the LHC allows for the search for processes that were so far unobservable. In this talk, we look at first steps towards measuring the CKM matrix element $|V_{ts}|$ in top quark decays. One focus will be the differentiation between jets from strange quarks and jets from other light quark flavors using neural network techniques.

T 58.2 Mi 16:15 S10

Suchen nach der Produktion von 4 Top-Quarks mit dem ATLAS Detektor — Clara Nellist, Thomas Peiffer, Arnulf Quadt, Paolo Sabatini, Elizaveta Shabalina und •Fabian Sohns — II. Physikalisches Institut, Georg-August-Universität Göttingen

Die vom ATLAS-Experiment gemessene Datenmenge von ca. 140 fb^{-1} im RUN-2 des Large Hadron Colliders (LHC) ermöglicht Präzisionsstudien und die Untersuchung von seltenen Prozessen, insbesondere im Bereich der Physik des Top-Quarks.
Die Produktion von $t\bar{t}t\bar{t}$ ist ein noch nicht beobachteter Prozess mit einem Wirkungsquerschnitt von $\sigma_{t\bar{t}t\bar{t}} \approx 10\,\mathrm{fb}$. Er wird vom Standardmodell vorhersagt und ist sensitiv auf viele Modelle jenseits des Standardmodells. In diesem Vortrag wird eine Übersicht des einfachleptonischen und des zweifach-leptonischen Kanals mit ungleicher Ladung gegeben. Die beiden Kanäle haben die gemeinsame Herausforderung, ein sehr kleines Signal in einem Bereich nachzuweisen, in welchem der $t\bar{t}$-Prozess den Untergrund dominiert. Somit ist es wichtig, sehr genau zwischen dem geringem Signal und dem großen Untergrund zu unterscheiden und systematische Unsicherheiten genauestens zu analysieren. Zu diesem Zweck werden verschiedene Methoden getestet, die von datengetriebenen Abschätzungen des $t\bar{t}t\bar{t}$-Untergrundes bis hin zu multivariaten Analysen zur Rekonstruktion der Ereignisse sowie zur Differenzierung von Signal und Untergrund reichen. Weiterhin ist es notwendig, Abweichungen zwischen der theoretischen Vorhersage und den gemessenen Daten mithilfe einer Umgewichtung zu korrigieren.

T 58.3 Mi 16:30 S10

Studies of background processes for the search of the simultaneous production of four top quarks at the ATLAS detector — •Lennart Rustige and Romain Madar — LPC, Clermont-Ferrand, Frankreich

The search for the simultaneous production of four top quarks has so far been dominated by searches for physics beyond the standard model. Using the full dataset of the LHC Run II recorded at the ATLAS detector, corresponding to an integrated luminosity of almost $\mathcal{L} = 150\,\mathrm{fb}^{-1}$, the observation of this process as predicted by the standard model (SM) may finally come within reach.

This process is fairly rare under the SM assumption, with a next-to-leading order prediction for the production cross-section of $\sigma_{tttt} = 11.97^{+18\%}_{-21\%}$ fb [arXiv:1711.02116] at a centre-of-mass energy of $\sqrt{s} = 13\,\mathrm{TeV}$. Therefore, detailed studies of the background processes play an important role for the search of this process. This contribution discusses some of these studies, where the final state signature contains either a lepton pair with the same electric charge, three leptons or four leptons.

T 58.4 Mi 16:45 S10

Ein Vergleich des $\mathrm{t\bar{t}}+\mathrm{b\bar{b}}$-Prozesses in verschiedenen Simulationen — •Maximilian Horzela, Ulrich Husemann, Philip Keicher und Matthias Schröder — Institut für Experimentelle Teilchenphysik (ETP), Karlsruher Institut für Technologie (KIT)

In der Analyse der mit einem Top-Quark-Antiquark-Paar ($\mathrm{t\bar{t}}$) assoziierten Higgs-Boson-Produktion mit einem Zerfall des Higgs-Bosons in ein Bottom-Quark-Antiquark-Paar ($\mathrm{b\bar{b}}$) ($\mathrm{t\bar{t}H(b\bar{b})}$) begrenzt die Unsicherheit auf den dominanten Untergrundprozess $\mathrm{t\bar{t}}+\mathrm{b\bar{b}}$ die Sensitivität der Analyse.

Die Komplexität des $\mathrm{t\bar{t}}+\mathrm{b\bar{b}}$-Prozesses in Monte-Carlo(MC)-Simulationen hat zur Folge, dass einige Beiträge mit zum Teil unterschiedlichen Ansätzen existieren. Ein Beispiel für diese ist die Wahl zwischen 4- und 5-Flavor-Schema (4FS und 5FS). Diese unterschiedlichen Methodiken führen zu teils deutlichen Diskrepanzen in den MC-Vorhersagen. In Kombination mit dem Mangel an Referenzdaten aus Messungen führt dies zu relativ hohen Unsicherheiten in der Beschreibung.

Dieser Vortrag soll die Schwierigkeiten in der Beschreibung und Interpretation von $\mathrm{t\bar{t}}+\mathrm{b\bar{b}}$-Ereignissen umreißen und zeigt diesbezüglich einen Vergleich unterschiedlicher MC-Vorhersagen des $\mathrm{t\bar{t}}+\mathrm{b\bar{b}}$-Prozesses mit möglichen Anwendungen im Rahmen der $\mathrm{t\bar{t}H(b\bar{b})}$-Analyse.

T 58.5 Mi 17:00 S10

Reconstruction-studies of $t\bar{t}Z$ events in the $t\bar{t}$-allhadronic channel with $Z \to ll$ at the ATLAS experiment — Otmar Biebel, Florian Fischer, Jeannine Wagner-Kuhr, and •Nina Wenke — Ludwig-Maximilians-Universiät München

The process of the associated production of $t\bar{t}$ pairs with Z-bosons has just been discovered in 2015 and is regarded as an important process in top-quark physics ever since. It is sensitive to the tZ-coupling, thus the measurement of the $t\bar{t}Z$ cross-section is a direct probe of the weak coupling of the top-quark. The latter might be modified in the presence of physics beyond the standard model, so a precise measurement of this coupling is essential. On top of that, the $t\bar{t}Z$ process is also an important background in the measurement of the $t\bar{t}$H process in the multi-lepton final state.

The studies presented in this talk are based on Monte Carlo simulated data and are conducted in the context of the full Run-2 ($140 fb^{-1}$) analysis. They consider $t\bar{t}Z$ systems in which the top and the antitop quark decay hadronically and the Z-boson decays either in an electron-positron or muon-antimuon pair. The presented studies focus on the reconstruction of those kind of events. First, the standard χ^2_{min} reconstruction technique is used and its weaknesses are studied. As an additional approach, a multivariate reconstruction method is developed and studied.

T 58.6 Mi 17:15 S10

Studies on the measurement of the $t\bar{t}Z$ production cross section in the multilepton channel — Otmar Biebel[1], •Florian Fischer[1], Thomas McCarthy[2], and Jeannine Wagner-Kuhr[1] — [1]Ludwig-Maximilians-Universität, München — [2]Max-Planck-Institut für Physik, München

The measurement of the production cross section of top-antitop quark pairs in association with a Z boson is sensitive to the coupling between top quarks and Z bosons. In the Standard Model, this coupling is precisely predicted via the weak interaction and therefore any deviation from the Standard Model value is an indicator for new physics. Although, with four leptons in the final state, the tetralepton decay channel is the most rare leptonic decay channel of $t\bar{t}Z$, it has the highest signal purity of all.

In this talk, studies for an analysis with the full Run-2 dataset taken by the ATLAS experiment in the years 2015 to 2018, corresponding to an integrated luminosity of 140 fb^{-1}, are performed. In order to increase the signal efficiency and to reconstruct not only the Z boson but also $t\bar{t}$ and thus the whole $t\bar{t}Z$ system with four leptons in the final state, a neutrino weighting method has been applied. For the differential cross section measurement kinematic variables of the $t\bar{t}Z$ system and its decay products are tested for differences between several Monte Carlo generators. In addition, the benefits of jets reconstructed with a particle-flow algorithm will be studied in the context of this analysis.

T 58.7 Mi 17:30 S10

Iterative Bayes Unfolding for $t\bar{t}\gamma$ production using full Run2 pp collisions with the ATLAS detector — •John Meshreki and Ivor Fleck — Universität Siegen

The top-quark has a unique position in the Standard Model of elementary particle physics. Due to its large mass, it has a very short lifetime, which allows it to decay to a W boson and b-quark almost 100% of the time and pass its spin information on to its decay products. This permits to test the validity of the SM as well as unraveling hints of theories beyond the Standard Model.

This talk presents the Iterative Bayes Unfolding (IBS) for the differential cross-section measurement of the top-quark pair production associated with a photon using full Run2 proton-proton collisions data

collected by the ATLAS detector. The IBS estimates the initial distribution needed by Bayes' theorem through an iterative approach. It gives stable results with respect to variations of the initial probabilities and of the smoothing procedures. The IBS method is performed in the electron-muon channel to remove experimental distortions, due to the detector's limitations, for observed detector-level observables allowing to estimate their "truth-level" spectra. Such truth-level distribution will be used in measuring the differential cross-section as a function of the observable.