

T 34: Top Quarks: Properties -2

Time: Tuesday 16:15–18:00

Location: T-H19

T 34.1 Tue 16:15 T-H19

Measurement and EFT interpretation of differential $t\bar{t}$ cross-sections in the boosted lepton+jets channel with the ATLAS detector at $\sqrt{s} = 13$ TeV — KEVIN KRÖNINGER, JOHANNES ERDMANN, and KEVIN SEDLACZEK — TU Dortmund University, Department of Physics

Physics beyond the Standard Model (SM) can, in absence of resonances, be investigated in a model-independent way by using effective field theory (EFT) approaches. Without assumption of the underlying theory, effects of potential new high-mass particles at a low energy scale can be quantified by higher dimension expansions of the SM Lagrangian.

At the LHC, physics in the top sector is entering a phase of precision measurements combined with very accurate predictions. Meanwhile, many theories beyond the SM predict deviations in the top-quark couplings or new interactions of the top quark. These aspects make model-independent measurements in the top sector a very attractive way to test the SM for deviations arising from new physics at higher energy scales.

In this talk, a differential $t\bar{t}$ cross-section measurement is shown. The measurement is performed in the boosted lepton + jets channel on the full Run 2 dataset taken with the ATLAS detector at $\sqrt{s} = 13$ TeV. The differential measurements in different kinematic variables are unfolded to the particle level. One of the unfolded distributions is then used to derive bounds on the contributions of new physics within the EFT framework via two dimension-6 operators.

T 34.2 Tue 16:30 T-H19

Top-antitop energy asymmetry in jet-associated top-quark pair production at ATLAS — ALEXANDER BASAN¹, ASMA HADEF¹, JESSICA HÖFNER¹, LUCIA MASETTI¹, EFTYCHIA TZOVARA¹, and SUSANNE WESTHOFF² — ¹Universität Mainz — ²Universität Heidelberg

The top quark is particularly well suited to probe the standard model (SM) and many extensions thereof at the electroweak symmetry-breaking scale and beyond.

At hadron colliders, the $t\bar{t}$ production is symmetric at leading order perturbation theory under the exchange of the top- and anti-top-quark, while interferences at higher orders create an asymmetry. This charge asymmetry can provide sensitive probes for many models beyond the standard model. Within the framework of standard model effective field theories (SMEFT), the charge asymmetry is especially sensitive to four-quark operators and one operator that modifies the top-gluon interaction.

In inclusive jet-associated top-quark pair production the asymmetry arises already at leading order in quark-gluon interactions. Furthermore, the $t\bar{t}j$ final states allow the definition of a new observable, the energy asymmetry, expressed in terms of the distribution of the energy difference $E_t - E_{\bar{t}}$.

This talk presents the measurement in lepton+jets events with a high p_T hadronically decaying top quark at ATLAS with a centre of mass energy of $\sqrt{s} = 13$ TeV as well as limits on the Wilson coefficients of four-quark operators within the SMEFT framework.

T 34.3 Tue 16:45 T-H19

Untersuchung neuer Physik über die Energieasymmetrie in der Top-Antitop-Jet Produktion am ATLAS — JESSICA HÖFNER¹, ALEXANDER BASAN¹, ASMA HADEF¹, LUCIA MASETTI¹, EFTYCHIA TZOVARA¹ und SUSANNE WESTHOFF² — ¹Universität Mainz — ²Universität Heidelberg

Das Top-Quark ist das schwerste Teilchen im Standardmodell der Elementarteilchen und das einzige Quark das nicht direkt hadronisiert sondern zerfällt. Es eignet sich sehr gut dafür Physik außerhalb des Standardmodells zu suchen, denn es könnten noch unentdeckte schwerere Teilchen oder auch neue Wechselwirkungen mit dem Top-Quark interagieren.

Bei der Produktion eines Top-Antitop-Paares mit zusätzlichem Jet kann die Energieasymmetrie, eine neue Observable der Ladungsasymmetrie, bestimmt werden, die besonders sensitiv auf Physik jenseits des Standardmodells sein kann. Nach einer ersten veröffentlichten Messung der Energieasymmetrie mit dem ATLAS Experiment, werden Möglichkeiten untersucht sowohl den Phasenraum der Messung zu erweitern

als auch die Ergebnisse mit denen aus Wirkungsquerschnittmessungen zu kombinieren. In diesem Vortrag wird die erwartete Sensitivität dieser Erweiterungen vorgestellt.

T 34.4 Tue 17:00 T-H19

Measurements of observables sensitive to colour reconnection in $t\bar{t}$ events — DOMINIC HIRSCHBÜHL, WOLFGANG WAGNER, and SHAYMA WAHDAN — Bergische Universität Wuppertal, Wuppertal, Germany

Colour reconnection (CR) is a mechanism that describes the interactions that can occur between colour fields during the hadronisation transition. In the context of precise top-quark mass measurements, it plays a crucial role. The modelling of CR has become one of the dominant sources of systematic uncertainty in these measurements. Ongoing top-quark mass analyses use PYTHIA 8 MC event generator for parton showering and hadronisation. PYTHIA 8 comes with several alternative CR models which should be explored to estimate the CR modelling uncertainty. At the same time, the models should be confronted with LHC data to test their validity. Only models which are in agreement with data, in general, are suitable to define the corresponding modelling uncertainty. This analysis presents a measurement of charged-particle distributions sensitive to the different CR models in PYTHIA 8 in top-quark pair production. The measurement is based on data collected using the ATLAS detector at the LHC in proton-proton collisions at a centre-of-mass energy of 13 TeV with an integrated luminosity of 139 fb⁻¹.

T 34.5 Tue 17:15 T-H19

Search for flavour-changing photon interactions in top-quark production and decay at the ATLAS experiment — TOMAS DADO, JOHANNES ERDMANN, BENEDIKT GOCKE, FLORIAN MAUSOLF, OLAF NACKENHORST, and BJÖRN WENDLAND — TU Dortmund University, Department of Physics

In the Standard Model (SM) of particle physics, flavour-changing neutral currents (FCNC) are strongly suppressed, but several theories beyond the SM predict FCNC with much higher rates. In this talk, a search for flavour-changing photon interactions in top-quark production and decay is presented. Proton-proton-collision data corresponding to an integrated luminosity of 139 fb⁻¹ are analysed which were taken with the ATLAS detector at a centre-of-mass energy of 13 TeV. It is separately searched for interactions involving the top quark, the up quark and the photon as well as for interactions of the top quark, the charm quark and the photon. Events with one photon, one b -tagged jet, one electron or one muon, and a minimum amount of missing transverse momentum are selected. Contributions from events with objects mis-reconstructed as photons are estimated using data-driven methods. Multiclass deep neural networks are used to separate the signal from the background. The analysis strategy is presented and upper limits on the strength of the FCNC couplings are set.

T 34.6 Tue 17:30 T-H19

Studies for the measurement of the production of top-quark pairs in association with a Z boson decaying to a pair of tau leptons with the ATLAS detector — SIMON NEUHAUS and THOMAS DADO — TU Dortmund University, Department of Physics

A Study of the associated production of a top-quark pair and a Z boson decaying into a tau-lepton pair is presented. This process allows to test the lepton-universality prediction of the Standard Model of particle physics in the top-quark-sector. Additionally, this process is sensitive to various BSM couplings between the top quarks and tau-leptons. Because only the visible mass of the di-tau system is reconstructable, a significant contribution from the off-shell events is expected in the signal region.

The measurement targets decays with one or two light leptons, at least three jets and two hadronically decaying tau leptons. Some of the important background processes include the diboson (ZZ , WZ , WW) processes and processes with misreconstructed tau leptons. Initial studies on the optimization of the event selection using the Monte Carlo simulations for the ATLAS data of the complete LHC Run 2 will be shown. Observables that are interesting for the optimisation of the selection include: the transverse momentum of all three or four leptons, the number of jets and the number of b -tagged jets.

T 34.7 Tue 17:45 T-H19

Simulation of selected top-quark processes at the FCC-ee and their interpretation in terms of effective field theories — CORNELIUS GRUNWALD¹, KEVIN KRÖNINGER¹, ROMAIN MADAR², STÉPHANE MONTEIL², and LARS RÖHRIG¹ — ¹Department of Physics, Dortmund, Germany — ²Laboratoire de Physique de Clermont, Clermont-Ferrand, France

While in the flavor-physics sector future upgrades of the LHCb detector at CERN and Belle II at KEK are aimed at precision measurements, experiments at future colliders such as the FCC-ee are expected to

improve electroweak and top-quark physics in an unrivaled way. Since it is interesting to set the measurements by the FCC-ee into a global context, the estimation of the precision of selected top-quark processes is important for estimating the impact on the constraints of dimension-six operators.

In this talk, relevant observables and the impact of dimension-six operators on these observables are presented. The parameterizations as function of the dimension-six operator strength are given. This will allow to set constraints on the strength of dimension-six operators assuming uncertainties for the measurements at the FCC-ee.