T 10: Top quarks: pair production and tagging

Time: Monday 16:30–18:00 Location: H-HS XI

T 10.1 Mon 16:30 H-HS XI

Measurement of the $t\bar{t}$ production cross-section in the lepton+jets channel at $\sqrt{s}$ = 13 TeV with the ATLAS experiment — Baida Achkar[1], Tomas Dado[1,2], Kevin Moor[1], •Marcel Niemeyer[1], Arnulf Quadt[1], and Elizaveta Shabalina[1] — [1]II. Physikalisches Institut, Georg-August-Universität Göttingen — [2]Institute of Physics, Comenius University Bratislava

The top quark, as it is the heaviest of all quarks, plays a special role in the Standard Model (SM). Measuring its production cross-section provides an important test of QCD calculations and for SM predictions. A previous measurement of the $t\bar{t}$ production cross-section in the lepton+jets channel with ATLAS was based on a small dataset of 28 pb^{-1}. This talk will present the latest measurement of the $t\bar{t}$ production cross-section at $\sqrt{s}$ = 13 TeV in the lepton+jets channel with the ATLAS experiment based on the full Run II dataset corresponding to 139 fb^{-1}. A profile likelihood fit is used to determine the cross-section in three signal regions simultaneously and constrain the uncertainties significantly.

T 10.2 Mon 16:45 H-HS XI

Studies of $t\bar{t}$ production with additional heavy flavour jets in p-p collision with the ATLAS detector — •Lucas Klein, Mahsana Haleem, and Raimund Ströhmer — Universität Würzburg

The production of $t\bar{t}$-pairs with additional jets provides a strong test of quantum chromodynamics (QCD) predictions at high orders. Furthermore, this represents as a significant background to rare SM processes (e.g. $t\bar{t}H$, $t\bar{t}t\bar{t}$), as well as to processes beyond the standard model. The additional jets consisting of b-quarks originating from gluon splitting are particularly interesting in constraining uncertainties in the prediction of the process.

In this talk, we will show studies of $t\bar{t}$-pair production with additional b-jets in the dileptonic top decay channel using full Run 2 ATLAS data from proton-proton collision at $\sqrt{s} = 13$ TeV. Events are chosen by requiring an oppositely-charged $e\mu$-pair and at least two b-jets in the final state. In order to differentiate the b-jets coming directly from *top*-quark decays to those emerging from the gluon splitting, an algorithm is developed. This algorithm assigns the b-jets to *top*-quarks based on the kinematics of the final state objects, such as distributions of angular distances between objects and invariant masses. The performance of this algorithm as well as the distributions of additional jet-multiplicity and kinematics of various objects will be presented.

T 10.3 Mon 17:00 H-HS XI

Jet activity measurement in top pair production in dilepton channel with the ATLAS experiment — •Matthieu Robin for the ATLAS-Collaboration — DESY, Zeuthen

Following previous studies on $t\bar{t} + jets$ published in 2017 and on $t\bar{t}b\bar{b}$ published in early 2019, this study aims to use the full LHC run II dataset of 139 fb^{-1} to improve the results in statistically limited regions as well as methods to better estimate our signal background such as fake background and pile-up jets.

This study plays a major role for other analyses regarding the understanding of their QCD background (e.g.: $t\bar{t}Hb\bar{b}$), and is also important by itself to improve our understanding of additional jet radiation properties and provide tests of the QCD and SM predictions. This should further help to improve the modelling of $t\bar{t}+jets$ in the MC generators.

In this talk will be shown updated data/MC comparisons with some unfolded results and systematics studies that I performed with the help of the $t\bar{t} + jets$ analysis team of ATLAS.

T 10.4 Mon 17:15 H-HS XI

Measurement and EFT interpretation of the $t\bar{t}$ cross section in the boosted lepton+jets channel with the ATLAS detector at $\sqrt{s}$ = 13 TeV — •Kevin Sedlaczek, Johannes Erdmann, and Kevin Kröninger — TU Dortmund, Experimentelle Physik IV

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 particles can be quantified by higher dimension expansions of the SM Lagrangian at a higher energy scale.

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 couplings or new interactions coupling to the top quark. These aspects combined 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, studies on a differential $t\bar{t}$ cross-section measurement in variables including properties of additional jets are shown. The analysis is performed in the boosted lepton + jets channel on the full 139 fb^{-1} Run 2 dataset taken with the ATLAS detector at a centre-of-mass energy of $\sqrt{s}$ = 13 TeV. In order to derive bounds on the contributions of new physics within the EFT framework, the choice of variables for the unfolded differential distributions is investigated for sensitivity to the EFT operators.

T 10.5 Mon 17:30 H-HS XI

Measurement of top tagging efficiencies in CMS — Johannes Haller, Roman Kogler, and •Dennis Schwarz — Institut für Experimentalphysik, Universität Hamburg

Top quarks with high transverse momenta are abundantly produced at the LHC. In this kinematic regime the products of hadronic top quark decays ($t \to bW \to bq\bar{q}'$) are highly collimated and cannot be reconstructed in three separate jets but merge into a single large radius jet. In order to identify these decays, top tagging algorithms make use of the jet substructure. These are crucial for both, searches for heavy new particles as well as precision measurements of top quark production at high transverse momenta.

This talk presents a measurement of top tagging efficiencies in simulation and data recorded with the CMS detector at $\sqrt{s}$ = 13 TeV corresponding to an integrated luminosity of 137 fb^{-1}. Correction factors are derived for the application of these algorithms in physics analyses.

T 10.6 Mon 17:45 H-HS XI

Performance studies of the Heavy Object Tagger with Variable R (HOTVR) — •Anna Albrecht, Ksenia de Leo, Johannes Haller, Roman Kogler, and Christopher Matthies — Institut für Experimentalphysik, Universität Hamburg

The Heavy Object Tagger with Variable R (HOTVR) is an algorithm for the clustering and identification of boosted, hadronically decaying, heavy particles at the LHC. The central feature of the HOTVR algorithm is a variable distance parameter R that decreases with increasing transverse momentum p_{T} of the jet. It combines jet clustering, subjet finding and rejection of soft radiation. In its original version, soft and wide-angle radiation is rejected by a mass jump criterion. This study presents first results using the soft drop algorithm instead, comparing the performance between both grooming options.