T 57: Single Top – Higgs Top

Time: Wednesday 15:50–17:20   Location: HSZ/0101

T 57.1   Wed 15:50   HSZ/0101

EFT interpretation of a t-channel single top-quark production cross-section measurement in proton-proton collisions at a centre-of-mass energy of 13 TeV with the ATLAS detector — Benedikt Gocke[2], Dominic Hirschbühl[1], Joshua Reidelstürz[1], •Maren Stratmann[1], and Wolfgang Wagner[1] — [1]Bergische Universität Wuppertal, Wuppertal, Deutschland — [2]Technische Universität Dortmund, Dortmund, Deutschland

Effective field theories (EFTs) provide a model-independent approach for searches for physics beyond the Standard Model (SM). The impact of new physics at high energy scales is parameterized by higher-dimension operators extending the SM Lagrangian.

In this talk, an EFT interpretation of a t-channel single top-quark production cross-section measurement is presented. Constraints on the four-fermion operator $O_{qQ}^{(1,3)}$ are set. The impact of a non-zero contribution of $O_{qQ}^{(1,3)}$ is studied from dedicated samples with simulated events. Constraints on the operator strength are set from a fit to data collected by the ATLAS detector from 2015 to 2018 at a centre-of-mass energy of 13 TeV.

T 57.2   Wed 16:05   HSZ/0101

Constraining effective field theory coefficients with machine learning in top quark pair production at CMS — •Andre Zimermmane-Santos, Gilson Correia, Afiq Anuar, Alexander Grohsjean, and Christian Schwanenberger — Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, D-22607 Hamburg

Effective Field Theories (EFT) provide a systematic way to look for physics beyond the Standard Model (SM) via indirect searches. Nevertheless even the most restrictive scenarios contain dozens of operators predicting subtle deviations from the SM. Such small effects could only be significantly measured over a high-dimensional space of observables. While this complex problem does not scale well with traditional analysis approaches, *likelihood-free inference* methods based on machine learning (ML) techniques can be combined with the knowledge of the EFT structure to perform test statistics efficiently using several EFT parameters as well as a high number of observables. In this study, we aim at applying recent developments in ML-based inference on the measurement of all QCD-like dimension-six EFT operators in the top quark pair production process at the LHC.

T 57.3   Wed 16:20   HSZ/0101

Search for the tWZ process in the boosted region with the CMS experiment — •Michele Mormile[1], Abideh Jafari[2,3], and Alessia Saggio[2] — [1]Institute of Experimental Particle Physics (ETP), Karlsruhe Institute of Technology (KIT) — [2]Deutsches Elektronen-Synchrotron (DESY) — [3]Isfahan University of Technology

Searching for rare processes is a fundamental instrument in testing our understanding of the universe. The high luminosity of proton-proton collisions delivered by the LHC in the 2016-2018 period (Run 2) allows us to search for processes with cross sections in the order of magnitude of 100 fb, such as the associated production of a single top quark with a W and a Z boson (tWZ). The tWZ process has never been observed and has been shown to be promisingly sensitive to new physics in the context of SM Effective Field Theory (SMEFT), especially in the high-p_T spectrum of the final state products. An ongoing search for tWZ in the boosted top quark regime is presented. The data has been collected by the CMS experiment during LHC Run 2 and amounts to 138 fb^{-1}. Final states with three leptons are explored, where the Z boson decays to two oppositely charged leptons, either the W boson or the

top quark decays leptonically, the remaining one decays hadronically. A boosted leptonic top tagger was developed using a deep neural network to identify leptons and b-jets arising from the decay of a top quark. The tagger was validated in a phase space pure in events of top quark-antiquark pair production, with both tops decaying into leptons. The results are included in an inclusive tWZ search.

T 57.4   Wed 16:35   HSZ/0101

Search for tWZ production at CMS and its interpretation in the SMEFT — •Alberto Belvedere, Roman Kogler, and Katerina Lipka — DESY, Hamburg, Germany

The production of a single top quark t in association with a W and a Z boson in proton-proton collisions has not been observed so far. Its small predicted cross section of 115 fb^{-1} at $\sqrt{s} = 13$ TeV and a large background from ttZ production make this process very challenging to study. However, tWZ production receives large contributions from beyond-the-standard-model (BSM) theories through the electroweak interaction of the top quark, making this process an important probe of BSM physics. In the context of the Standard Model Effective Field Theory (SMEFT), tWZ is sensitive to unitarity violating effects, leading to an anomalous growth of the cross section as a function of the energy.

A search using Run 2 and 3 data collected by the CMS experiment at $\sqrt{s} = 13$ and 13.6 TeV offers the possibility to study tWZ with high significance. A status of the ongoing efforts is presented, including studies of the discriminating power of selected variables between tWZ and ttZ. Additionally, the sensitivity to different SMEFT dimension-6 operators is shown.

T 57.5   Wed 16:50   HSZ/0101

tbH$^+$ analysis with multileptons with Run-2 ATLAS data — •Martin Rames and Andre Sopczak — CTU in Prague

The latest results with Run-2 ATLAS data are presented for the search tbH$^+$ in the multilepton channel.

T 57.6   Wed 17:05   HSZ/0101

CP-violation, Asymmetries and Interferences in ttphi — •Duarte Azevedo[1,2], Rodrigo Capucha[3], António Onofre[4], and Rui Santos[3,5] — [1]Institute for Theoretical Physics, Karlsruhe Institute of Technology, 76128 Karlsruhe, Germany — [2]Institute for Astroparticle Physics, Karlsruhe Institute of Technology, 76344 Karlsruhe, Germany — [3]Centro de Fisica Teórica e Computacional, Faculdade de Ciências, Universidade de Lisboa, Campo Grande, Edifício C8 1749-016 Lisboa, Portugal — [4]Departamento de Fisica , Universidade do Minho, 4710-057 Braga, Portugal — [5]ISEL - Instituto Superior de Engenharia de Lisboa, Instituto Politécnico de Lisboa 1959-007 Lisboa, Portugal

We present the results of our paper, where we use the associated production of top-quark pairs (t\bar{t}\phi) with a generic scalar boson (\phi) at the LHC (pp \to t\bar{t}\phi) to explore the sensitivity of a large set of observables to the sign of the CP mixing angle (\alpha), present in the coupling between the scalar boson and the top quarks.

The mass of the scalar boson is set to m_\phi = 125 GeV (the Standard Model Higgs boson mass) and its coupling to top-quarks is varied such that \alpha = 0, 22.5, 45.0, 67.5, 90.0, 135.0 and 180.0. Dileptonic final states of the t\bar{t}\phi system are used, where the scalar boson is set to decay as \phi \to b\bar{b}.

The most sensitive CP-observables are selected to compute Confidence Level (CL) limits as a function of the sign of the top quark Yukawa couplings to the \phi boson.