T 3: Top I

Time: Monday 16:30–18:00 Location: HSZ/0401

T 3.1 Mon 16:30 HSZ/0401

Top-beauty couplings at FCC-ee and synergies in global SMEFT interpretations — Kevin Kröninger[1], Romain Madar[2], Stéphane Monteil[2], and •Lars Röhrig[1,2] — [1]TU Dortmund University, Department of Physics — [2]Université Clermont-Auvergne, Laboratoire de Physique de Clermont

Experiments for the post-LHC era as proposed nowadays are aimed at precision measurements in the electroweak, flavor, Higgs and top-quark sector. The FCC-ee among other proposals offers unrivaled precision in these fields and allows to combine measurements within the Standard Model Effective Field Theory at energy scales ranging from 91 GeV up to 365 GeV.

This talk motivates the combination of the top- and the $Z \to b\bar{b}$ energy scale and possible synergies through a common set of dimension-six operators. The estimation of several top-quark observable sensitivites is highlighted, as well as challenges and prospects of a full reconstruction in an FCC-ee environment. Systematically limited measurements of EWPO at the Z-pole at FCC-ee are discussed and novel hemisphere tagging techniques are presented to reduce these uncertainties.

T 3.2 Mon 16:45 HSZ/0401

Search for same-sign top pair production with the Standard Model Effective Field Theory at the ATLAS experiment — Noemi Cavalli[1,2], Merve Nazlim Agaras[4], Maximiliano Sioli[2], Matteo Negrini[2], Kevin Alexander Kroeninger[1], Shalini Epari[4], Aurelio Juste Rozas Rozas[4], Stergios Kazakos[4], Javier Montejo Berlingen[3], Nicola Orlando[4], Tamara Vazquez Schroeder[3], and •Aaron van der Graaf[1,2] — [1]TU Dortmund — [2]Bologna — [3]CERN — [4]IFAE

Model-independent searches for new physics at high energies by using the Standard Model (SM) Effective Field Theory (SMEFT) are an important part of todays physics program. Same-sign top-quark pair production is highly suppressed in the SM while several models beyond the SM enhance the production. SMEFT is used obtain model-independent predictions for the production of the same-sign top pairs beyond the SM. Three EFT operators are considered to simulate the searched signal. The full Run 2 dataset collected by the ATLAS detector from proton-proton collisions is used for this search for same-sign top-quark pairs, in the dilepton final state. A Neural Network (NN) is employed to build separate signal regions (SR) enriched in same-sign top events resulting from different EFT operators. Within the defined SRs, a second NN is applied to perform a signal-background discrimination. In order to attain an accurate estimation of background contributions in the SRs, several Control Regions (CRs) are defined. The background estimation and the signal search are performed by using a maximum likelihood fit over all analysis regions.

T 3.3 Mon 17:00 HSZ/0401

Measurement of SMEFT parameters in $t\bar{t} + \gamma$ using Run 2 data with the ATLAS experiment — •Jan Joachim Hahn[1], Binish Batool[1], Beatrice Cervato[1], Markus Cristinziani[1], Carmen Diez Pardos[1], Ivor Fleck[1], Arpan Ghosal[1], Gabriel Gomes[1], Vadim Kostyukhin[1], Buddhadeb Mondal[1], Amartya Rej[1], Katharina Voss[1], Wolfgang Walkowiak[1], and Tongbin Zhao[1,2] — [1]Center for Particle Physics Siegen, Experimentelle Teilchenphysik, Universität Siegen — [2]Shandong University, China

In the Standard Model Effective Field Theory (SMEFT), the effects of physics phenomena beyond the Standard Model (SM) are modelled via higher dimension operators. Measurements of sensitive processes can be used to constrain the coefficients of operators that contribute to a process. The top quark is the heaviest known particle and the only quark that decays before hadronisation. It is expected to play a relevant role in many models of physics beyond the SM given its large mass. Final states including photons are sensitive to modifications in the electroweak sector, changing the photon energy spectrum. This talk will focus on a interpretation of the ongoing $t\bar{t}\gamma$ cross section measurement in terms of SMEFT. To constrain several EFT operators, $t\bar{t}\gamma$ events decaying semileptonically are studied. The study is performed using the full Run 2 data set collected by the ATLAS experiment corrosponding to 139 fb^{-1} at $\sqrt{s} = 13\ TeV$.

T 3.4 Mon 17:15 HSZ/0401

Kinematic Fit for Top-Antitop Production at LHC — •Constant Peeters, Patrick Connor, Johannes Lange, Hartmut Stadie, and Peter Schleper — Institut für Experimentalphysik, Universität Hamburg

The decay products of top quark pairs in proton-proton collisions at the LHC can be reconstructed independently of one another using the particle flow algorithm. A fit utilising physical properties of the event topology may be used in addition to further constrain their kinematics. This may be beneficial to measure fundamental quantities of the top quark, such as its mass. In this work, we present the general technique and investigate the impact of the jet energy resolution on the fit results. The kinematic fitting package KinFitter, commonly used within the CMS software framework, is utilized with the aim of ensuring usability independent of the CMS software stack.

T 3.5 Mon 17:30 HSZ/0401

Messung der Energieasymmetrie bei der Top-Antitop-Jet Produktion in der resolved Topologie am ATLAS — •Jessica Höfner, Alexander Basan, Asma Hadef, Lucia Masetti, Eftychia Tzovara und Doga Elitez für die ATLAS-Kollaboration — Universität Mainz

Das Top-Quark ist das schwerste Teilchen im Standardmodell der Elementarteilchen und das einzige Quark das zerfällt bevor es hadronisieren kann. Es eignet sich sehr gut dafür Physik jenseits des Standardmodells zu suchen, denn es könnten noch unentdeckte schwerere Teilchen mit dem Top-Quark wechselwirken.

Bei der Produktion eines Top-Antitop-Paares mit zusätzlichem Jet kann die Energieasymmetrie, eine Observable, die auf der Ladungsasymmetrie beruht, bestimmt werden, die besonders sensitiv auf Physik jenseits des Standardmodells sein kann. Daher ist es vom großem Interesse diese Observable zu messen. Nach einer ersten veröffentlichten Messung der Energieasymmetrie mit dem ATLAS Experiment in der Topologie mit einem kollimierten hadronischen Top-Quark Zerfall und einem semileptonischen Zerfall, ist es ebenfalls das Ziel die Observable in einem erweiterten Phasenraum zu bestimmen. Dazu wird zunächst die Eventrekonstruktion in der "resolved" Topologie, in der der hardonische Zerfall durch mehrere small-R Jets rekonstruiert wird, optimiert. In diesem Vortrag werden die bisher erzielten Fortschritte dieser Optimierung vorgestellt.

T 3.6 Mon 17:45 HSZ/0401

Machine learning approaches for parameter reweighting in MC samples of top quark production — •Valentina Guglielmi, Katerina Lipka, and Simone Amoroso — Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, D-22607 Hamburg, Germany

In particle physics, complex Monte Carlo (MC) simulations are needed to compare theoretical predictions to observables. Further MC samples have to be generated to account for all the systematic uncertainties. Therefore, the MC statistic becomes a limiting factor for most measurements. Moreover, the significant computational cost of these programs is a bottleneck in most physics analyses. Therefore, finding a way to reduce the number of MC samples is important to decrease the MC statistical uncertainties and lower the computational cost. In this contribution, an approach called Deep neural network using Classification for Tuning and Reweighting (DCTR) is evaluated. DCTR is a method, based on a Deep Neural Network (DNN) technique, to reweight simulations to different models by using the full kinematic information in the event. This methodology avoids the need for simulating the detector response multiple times by incorporating the relevant variations in a single sample. This way, the MC statistical uncertainties and the computational cost are reduced. Unlike the standard reweighting, in which the ratio in bins of two histograms at truth level is performed, multidimensional and unbinned information can be used as inputs to the DNN. This method is tested on MC simulations of top quark pair production within the CMS experiment.