T 126: Top physics 5 (top mass)

Time: Friday 9:00–10:15 Location: Geb. 30.95: Audimax

T 126.1 Fri 9:00 Geb. 30.95: Audimax

Measurement of the top quark mass and width from $t\bar{t}$ events with Run2 data at CMS — •Valentina Guglielmi, Jiwon Park, Katerina Lipka, and Simone Amoroso — Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, D-22607 Hamburg

A measurement is presented of the top quark mass and width using $t\bar{t}$ events produced in proton-proton collisions at 13 TeV, recorded by the CMS experiment. In the context of the Standard Model (SM), the relationship between the top-quark mass and width has been precisely calculated. The strategy employed to determine the top quark mass and width consists in performing template fits to invariant mass spectra centered around the top-quark mass. Due to their cleaner event signatures, dilepton decays from $t\bar{t}$ production are considered. The minimax pairing of lepton-bjet invariant masses m_{lb} is used in the fit, since it is the most sensitive observable. While the position of the m_{lb} peak exhibits linear sensitivity to the top-quark mass, the tails of m_{lb} distribution are sensitive to the top quark width. A comparison between the newest NLO bb4l MC generator, accounting for $t\bar{t}$ and tW interference and top off-shell contributions, with the standard Powheg+Pythia MC generator will be undertaken. In this talk, an overview of the current status of the measurement will be given.

T 126.2 Fri 9:15 Geb. 30.95: Audimax

Measurement of the top quark mass with the template method in the $t\bar{t} \to$ lepton + jets channel using the full Run 2 dataset in ATLAS — •Dimbiniaina Rafanoharana[1] and Andrea Knue[2] — [1]Albert-Ludwigs-Universität Freiburg — [2]TU Dortmund

The top-quark mass is a free parameter of the Standard Model (SM) and is playing a key role in the test of the consistency of the SM. Its precise determination is therefore of paramount importance. Several measurements of the top-quark mass in different final states using various methods were performed at the Tevatron and the Large Hadron Collider.

The combined measurement of the top-quark mass using fifteen measurements performed by ATLAS and CMS at Run 1 achieved a precision of 2 per mill. The combination is limited by the systematic effect as the relative statistical and systematic uncertainties are 0.8 per mill and 1.7 per mill, respectively.

The measurement of the top-quark mass with the template method in the $t\bar{t} \to$ lepton + jets channel using the full Run 2 dataset in ATLAS will be shown. Given the large amount of data collected during Run 2, the measurement is limited by systematic effects. The investigation of various methods aimed at reducing the dominant systematic uncertainty on the top-quark mass will be presented, where the latest ATLAS uncertainty prescriptions are used.

T 126.3 Fri 9:30 Geb. 30.95: Audimax

Towards the simultaneous extraction of the top-quark mass and decay width using $bb4\ell$ predictions — Diptaparna Biswas[1], Beatrice Cervato[1], Markus Cristinziani[1], Carmen Diez Pardos[1], Ivor Fleck[1], Arpan Ghosal[1], Gabriel Gomes[1], Jan Joachim Hahn[1], Vadim Kostyukhin[1], Nils Krengel[1], Buddhadeb Mondal[1], Stefanie Müller[1], •Katharina Voss[1], Wolfgang Walkowiak[1], Adam Warnerbring[1], and Tongbin Zhao[1,2] — [1]Experimentelle Teilchenphysik, Center for Particle Physics Siegen, Universität Siegen — [2]Shandong University, China

We present the first dedicated measurement aimed at the simultaneous extraction of the top-quark mass and decay width, which are two closely related input parameters in high-precision theoretical predictions. Previous top-quark decay width measurements were performed for a fixed top-quark mass value and a dependence of the decay width on the assumed mass value in the extraction was observed.

The sensitive observable used in the measurement is the $m_{\ell b}$ distribution obtained from top-quark pair production events in the dileptonic $e\mu$ decay channel of the full Run-2 $\sqrt{s} = 13$ TeV ATLAS dataset. Since especially in the $t\bar{t}/tW$ interference region a high sensitivity to the top-quark decay width was observed, an accurate description of this phase space region is essential for the parameter extraction. This can be achieved with the $bb4\ell$ POWHEG generator. Studies of the systematic uncertainties related to the use of the $bb4\ell$ generator will be presented, which is of central importance to have a reliable estimate of the modelling uncertainties influencing the measurement.

T 126.4 Fri 9:45 Geb. 30.95: Audimax

Mass-Decorrelated Classification of Unlabeled Data for $t\bar{t}$ Identification — •Sofia Brozzo, Patrick Connor, Johannes Lange, Peter Schleper, and Hartmut Stadie — Institut für Experimentalphysik, Universität Hamburg

Precision measurements of the top quark mass are an important tool to test the Standard Model. Although the fully hadronic decay channel provides the largest branching fraction, the large QCD multijet background leads to a challenging event selection. To improve on the mass resolution and reduce combinatorical $t\bar{t}$ and QCD background, a kinematic fit is applied before the top quark mass is extracted.

Here, a neural network trained on unlabeled CMS data is employed to further improve the selection of $t\bar{t}$ events and to reject QCD background.

To further ensure that the neural network is not biased on the top mass, the aim of this analysis is to decorrelate the neural network output from the input mass via distance correlation.

T 126.5 Fri 10:00 Geb. 30.95: Audimax

Improvements of the matching uncertainty definition in top-quark processes simulated with Powheg+Pythia8 — •Dominic Hirschbühl, Wolfgang Wagner, and Joshua Reidelstürz — Bergische Universität Wuppertal

Top-quark processes are modelled by the ATLAS Collaboration by matching the hard-scatter matrix element calculations of next-to-leading order Monte-Carlo generators with a parton shower generator. This talk presents a comprehensive study of the uncertainty related to the matching procedure and a new strategy to evaluate this uncertainty. The new approach is based on the Pythia 8 parton-shower matching parameter $p_{\mathrm{T}}^{\mathrm{hard}}$. It is designed to surpass the previous method, which involved comparing two generator setups to cover the uncertainty. The old method entangled all differences between the two setups in a single uncertainty while the new prescription implements a focused uncertainty that avoids double-counting with other uncertainties on the modelling of the top processes. Additionally first matching studies of a NNLO matrix element generator matched to parton shower are presented.