T 133: Top, EW II

Time: Thursday 17:30–19:00 Location: HSZ/0103

T 133.1 Thu 17:30 HSZ/0103

Measuring mass and width of the W-boson with the ATLAS detector — Philip Bechtle[1], Klaus Desch[1], Oleh Kyvernyik[1], Jakub Kremer[2], •Philipp König[1], and Matthias Schott[2] — [1]Rheinische-Friedrich-Wilhelms-Universität Bonn — [2]2Johannes Gutenberg-Universität Mainz

In 2017, the ATLAS collaboration measured the W-boson mass using *pp*-collision data taken at $\sqrt{s} = 7$ TeV in 2011, resulting in a precision of 19 MeV. We present a revised analysis of the same dataset, improving the fit methods and including a measurement of the width of the W-boson. A precise measurement of these quantities in the decay of the W-boson represent an excellent precision test of the Standard Model (SM). The recently released measurement of the W-boson mass using the full dataset recorded by the CDF collaboration is in significant tension with all previous measurements.

We will present the revised analysis of the ATLAS data including extensive cross-checks of the new profile likelihood fit approach. Detailed stability and consistency checks of the measurements will be discussed. Finally, a novel approach to validate fit models will be presented.

T 133.2 Thu 17:45 HSZ/0103

A direct measurement of the invisible width of the Z-boson with the ATLAS detector — •Martin Klassen — Kirchhoff-Institut für Physik, Heidelberg

The invisible width of the Z-boson, $\Gamma_Z(inv)$, is a fundamental parameter of the Standard Model. It is related to the number of light neutrinos that couple to the Z-boson, and its precise measurement allows for tests of the Standard Model. $\Gamma_Z(inv)$ has been indirectly measured at LEP with a precision of 0.3% and was in addition also directly determined using events with a photon and missing transverse energy to a precision of 3.2%.

At the ATLAS experiment, $\Gamma_Z(inv)$ can be obtained by measuring the ratio of $Z \to \nu\nu + jets$ to $Z \to ll + jets$ events (R^{miss}) as function of the Z boson's transverse momentum p_T. This approach is sufficient because the production cross section and the branching ratios can be decoupled leading to the relation $R^{miss} = \Gamma_Z(inv)/\Gamma_Z(ll)$ and the leptonic widths of the Z are already precisely measured. The ratio measurement benefits form a large degree of cancelation of many of the experimental and theoretical uncertainties. For this to work the phase spaces of selected $Z \to \nu\nu$ and $Z \to ll$ events need to be as similar as possible, and residual differences are corrected for using simulations.

In this talk the analysis strategy will be presented and it will be shown that the experiments at the Large Hadron Collider can obtain competitive results 30 years after the first direct measurement of $\Gamma_Z(inv)$ at LEP.

T 133.3 Thu 18:00 HSZ/0103

Measuring the Weinberg Angle at the Belle II Experiment * — •Lukas Grussbach, Daniel Greenwald, and Stephan Paul for the Belle II-Collaboration — Technical University Munich

The Weinberg angle is known precisely only at high energies around the Z^0 mass. At Belle II, we have the opportunity to measure it at a lower energy via $e^+e^- \to \mu^+\mu^-$, near to the energy where the NuTeV experiment has measured a discrepant value. We present preliminary studies of event selection criteria, muon identification performance and potential precision of such a measurement at Belle II.

*Funded by the DFG under Germany's Excellence Strategy - EXC2094 - 390783311 and BMBF Verbundforschung (05H21WOKBA BELLE2).

T 133.4 Thu 18:15 HSZ/0103

$t\bar{t}$+heavy flavor classification at the CMS experiment — •Emanuel Pfeffer, Ulrich Husemann, Rufa Rafeek, Jan van der Linden, and Michael Wassmer — Institute of Experimental Particle Physics (ETP), Karlsruhe Institute of Technology (KIT)

Processes in which a bottom quark-antiquark pair is produced in addition to the decay products of a top quark-antiquark pair are difficult to separate from each other. These processes include $t\bar{t}$+$b\bar{b}$, where the additional bottom quark-antiquark pair stems from a gluon splitting, as well as $t\bar{t}$+H with H $\to b\bar{b}$ and $t\bar{t}$+Z with Z $\to b\bar{b}$. New analysis techniques based on Graph neural networks are promising to improve the classification of these events. This talk sheds light on the current status of a simultaneous measurement of the production cross section of a top quark-antiquark pair in association with heavy flavor jets in the dileptonic channel at the CMS experiment. In this analysis, classification methods based on Graph neural networks are applied to separate processes in the $t\bar{t}$+heavy flavor phase space.

T 133.5 Thu 18:30 HSZ/0103

Differential cross-section measurements of an hadronically decaying top-quark-antitop-quark pair produced in association with two b-jets with the ATLAS detector at $\sqrt{s} = 13$ TeV — •Nina Wenke and Teresa Barillari — Max-Planck-Institut für Physik, München

The production of a top-quark-antitop-quark ($t\bar{t}$) pair in association with two b-jets ($t\bar{t}b\bar{b}$) is an important and insightful Standard-Model (SM) process to study at the LHC. It is the perfect playground to study the dynamics of multiple heavy quark production which is difficult to model precisely. It is also a major background in important SM measurements. In addition, precise $t\bar{t}b\bar{b}$ measurements could allow to catch glimpses of New Physics.

In this talk, preliminary results of the first ATLAS analysis targeting the hadronic decay channel of $t\bar{t}b\bar{b}$ production will be presented. It uses proton-proton collision-data recorded with the ATLAS detector at the LHC at a center-of-mass energy of 13 TeV, corresponding to an integrated luminosity of 139 fb^{-1}. The analysis uses a cut-based event selection with at least four b-jets. A likelihood-based algorithm is then used to reconstruct the hadronic decay of the $t\bar{t}$ pair in the event. The challenging large multijet background is modelled using a data-driven method. The final aim of the analysis is to perform fiducial differential cross-section measurements as a function of several variables and compare them to next-to-leading-order matrix-element calculations matched to a parton shower.

T 133.6 Thu 18:45 HSZ/0103

Simultaneous measurement of $t\bar{t}$+X($b\bar{b}$) processes in the semileptonic channel at the CMS experiment — •Rufa Kunnilan Muhammed Rafeek, Ulrich Husemann, Jan van der Linden, Emanuel Pfeffer, and Michael Wassmer — Institute of Experimental Particle Physics (ETP), Karlsruhe Institute of Technology (KIT)

Top quark anti-quark pairs ($t\bar{t}$) are produced in association with other particles (X) where X can be the Higgs boson, Z/W boson or QCD-initiated heavy flavour jets ($b\bar{b}/c\bar{c}$). The measurement of $t\bar{t} + X$ is a direct probe of the coupling of standard model particles like the Higgs and Z boson to the top quark and may reveal new physics effects in modifications of these couplings.

The analysis is challenging as these processes, particularly when the bosons decay into heavy flavour quarks, like for example, $t\bar{t} + H(H \to b\bar{b})$ and $t\bar{t} + b\bar{b}$ or $t\bar{t} + Z(Z \to b\bar{b})$, share the same signature and kinematic features. These high jet multiplicity final states create ambiguities in the reconstruction and identification of these processes and thus, it is hard to differentiate them from each other. Due to this challenge, an attempt to simultaneously measure these $t\bar{t} + X$ processes is made by exploring multivariate analysis strategies.

In this talk, an overview of the ongoing analysis, designed with the full Run-2 data of the LHC using the single lepton channel, is given.