T 61: Higgs I

Time: Wednesday 15:50–17:20 Location: HSZ/0204

T 61.1 Wed 15:50 HSZ/0204

ttH analysis with two light leptons and one hadronically decaying tau lepton with Run-2 ATLAS data — •Vladyslav Yazykov and Andre Sopczak — CTU in Prague

The latest results on the analysis with Run-2 ATLAS data are reported on the ttH 2lSS1tau channel.

T 61.2 Wed 16:05 HSZ/0204

Measurement of the inclusive $t\bar{t}H$ Cross-Section in the 4ℓ Final State — •Stephen Eggebrecht, Steffen Korn, Arnulf Quadt, Baptiste Ravina, and Elizaveta Shabalina for the ATLAS-Collaboration — II Physikalisches Institut, Göttingen

The Higgs boson production in association with a top quark pair plays a key role for studying the Yukawa coupling between the Higgs boson and the top quark. The coupling can be determined by measuring the cross-section of the $t\bar{t}H$ production to various finial states. Multilepton final states are quite but pure since most backgrounds are significantly suppressed. The non-resonant $t\bar{t}H \to 4\ell$ process has low rate and is sensitive to various Higgs decay modes like $H \to WW$, $H \to \tau\tau$, and $H \to ZZ$. The dominant background arises from $t\bar{t}Z$ and ZZ events. A multiclass dense neural network (DNN) is trained to separate signal events from these backgrounds and to define analysis regions. Input features such as kinematic information of all final state particles, missing transverse energy, and other high level variables like invariant masses of lepton pairs and their distances are used. An Asimov fit is then performed to evaluate the signal sensitivity.

T 61.3 Wed 16:20 HSZ/0204

Multivariate techniques for measurements of Higgs boson production cross-sections in $H \to WW^* \to e\nu\mu\nu$ decays with the ATLAS experiment — •Ahmed Markhoos, Karl Jakobs, Karsten Köneke, and Benedict Winter — University of Freiburg, Germany

The $H \to WW^* \to e\nu\mu\nu$ channel provides a sizeable signal and moderate background yields, allowing for accurate measurements of the total and differential cross-sections. The measurements for gluon-fusion production are generally dominated by systematic uncertainties, except in the sparsely populated regions of the phase space, such as at large transverse momenta.

In this talk, Deep Neural Network models (DNN) are showcased as powerful tools in tackling this complex but highly sensitive channel. Enhancing the signal purity with respect to the current cut-based selection method, reduces systematic uncertainties from backgrounds and statistical uncertainties, as well as enables measurements of simplified template cross-sections with finer granularity. Additionally, DNNs facilitate the difficult measurement of vector boson fusion in the single jet channel.

T 61.4 Wed 16:35 HSZ/0204

Search for the Higgs plus charm quark production mode in the H→WW→2ℓ2ν channel — •Ming-Yan Lee[1], Spandan Mondal[1], Alena Dodonova[1], Alexander Schmidt[1], Annika Stein[1], Luca Mastrolorenzo[1], Andrzej Novak[1], Xavier Coubez[1,2], Andrey Pozdnyakov[1], Manuella Guirgues[1], and Valentyn Vaulin[1] — [1]RWTH III. Physikalisches Institut A, Aachen, Germany — [2]Brown University, Providence, USA

The Higgs plus charm production mode is another topology to probe Higgs-charm Yukawa coupling complementary to H→cc channels. This topology provides the possibility to access the Higgs-charm coupling via cleaner final states. In this analysis, we aim to consider the Higgs decay into W boson to dileptonic final states with additional charm-tagged jets. The expected upper limit to extract H-c coupling is demonstrated using the data-taking period 2017 of the CMS experiment at the LHC at $\sqrt{s}$ =13 TeV.

T 61.5 Wed 16:50 HSZ/0204

Higgs Boson Cross Section Measurement in the $H \to ZZ \to 4\ell$ Channel with Early Run 3 ATLAS Data — •Alice Reed and Sandra Kortner — Max Planck Institut für Physik, München

Run 3 of the LHC began in July 2022, starting a new period of data taking at a higher centre of mass energy of 13.6 TeV, compared to 13.0 TeV during Run 2. At this higher center of mass energy, the Higgs boson cross section is expected to increase by $\sim 7\%$ compared to Run 2.

An important process for the measurement of the Higgs boson properties is the Higgs boson decay into two Z bosons, which subsequently decay into a $\mu^+\mu_-$ or e^+e^- pair, $H \to ZZ \to 4\ell$. Due to its clear signature, this decay channel can already be studied with early Run 3 data. The precision of the fiducial and differential $H \to 4\ell$ cross section measurements was studied and optimized in preparation for the measurements with early Run 3 data from the ATLAS experiment.

T 61.6 Wed 17:05 HSZ/0204

Measurement of $pp \to WH \to WWW$ with the ATLAS Experiment — •Moritz Hesping, Volker Büscher, Ralf Gugel, and Christian Schmitt — Johannes Gutenberg Universität Mainz

The measurement of the couplings of the Higgs boson is of great scientific interest, since it has the potential of testing possible extensions to the Standard Model. The decay of a Higgs boson into a pair of W bosons after production in association with a W boson is especially useful, since in this process the Higgs boson exclusively couples to W bosons.

In this talk, the analysis of the $pp \to WH \to WWW$ using the full run 2 dataset of the ATLAS experiment will be presented, focusing on the three lepton Z-depleted channel. First preliminary results for this analysis will be shown. Finally, the extension of the analysis to the Simplified Template Cross Sections (STXS) scheme will be discussed. In the STXS scheme, the measurement is performed as a function of the momentum of the associated W boson, which gives improved sensitivity to possible contributions from physics beyond the standard model.