T 10: Search for New Particles -1

Time: Monday 16:15–18:30 Location: T-H23

T 10.1 Mon 16:15 T-H23

Combination of diboson resonance searches with CMS Run2 data — •Enrico Wendrich[1], Anna Albrecht[1], Irene Zoi[2], Ankita Mehta[1], and Andreas Hinzmann[1] — [1]Universität Hamburg, Institut für Experimentalphysik, Luruper Chaussee 149, Hamburg, Germany — [2]Fermilab, Batavia IL, USA

In many extensions of the standard model, we have new physics resonances decaying to boson pairs. This talk focuses on new resonances decaying into a pair of W, Z and H bosons. Searches in two channels (fully hadronic VV and semi-leptonic VW) are statistically combined to receive a higher sensitivity for the upper cross section limits and the expected sensitivity is presented. The searches are based on CMS proton-proton collision data at 13 TeV, corresponding to an integrated luminosity of 138/fb.

T 10.2 Mon 16:30 T-H23

Search for high-mass dilepton resonances in association with b-jets with the ATLAS detector at $\sqrt{s}$=13TeV — Volker Austrup, Frank Ellinghaus, Jens Roggel, and •Maren Stratmann — Bergische Universität Wuppertal

Potential deviations from the Standard Model predictions observed in decay processes involving a $b \to s$ quark transition hint at Beyond Standard Model physics. One possible explanation for the deviations is the existence of a new heavy vector boson, the Z', which couples only to quarks of the second and third generation.
In this talk, the status of a search for a lefthanded Z' produced in association with jets originating from b or s quarks is presented. The search is carried out in the dileptonic Z' decay channel. An overview of the analysis strategy, including two different approaches for defining a signal region, is given and a preliminary limit on the Z' production cross section is set.

T 10.3 Mon 16:45 T-H23

Search for heavy resonances in ATLAS experiment in events with four top final state — •Elizaveta Sitnikova, Krisztian Peters, Alicia Wongel, and Philipp Gadow — DESY, Hamburg, Germany

A search for heavy resonances in the four-top-quark final state is presented. This search provides a unique way to probe new physics, such as top-philic resonances (Z') produced in association with top quarks ($t\bar{t}Z'$) resulting in events containing four top-quarks. The study was performed using data of proton-proton collisions with center-of-mass energy of 13 TeV collected by the ATLAS experiment at the LHC in 2015-2018 with total luminosity of 139 fb^{-1}. Selected events contain a single lepton in association with multiple jets and are categorized into signal regions according to the multiplicity of jets and how likely these contain b-hadrons. In this presentation we will outline the analysis strategy and discuss the results which are interpreted in a model independent way, as well as in terms of a simplified model for top-philic resonances.

T 10.4 Mon 17:00 T-H23

Search for heavy resonances decaying to top quark pairs at CMS — •Ksenia de Leo[1], Johannes Haller[1], Roman Kogler[2], Artur Lobanov[1], and Matthias Schröder[1] — [1]Institut für Experimentalphysik, Universität Hamburg — [2]DESY, Hamburg

A search for new heavy resonances decaying to top quark pairs is presented. The analysis uses pp-collision data with a center-of-mass energy of 13 TeV, collected with the CMS experiment during Run-2 of the LHC. The data correspond to an integrated luminosity of 137 fb^{-1}.

The search is performed in final states with one lepton, missing transverse energy and jets, and exploits top-tagging techniques to identify the hadronic decay of top quarks. A multi-class neural network has been developed to categorise the events into the main backgrounds from known standard model processes. Exclusion limits on the production cross section of new particles are set for different benchmark models. While the main target of the analysis is the highest possible mass region, improvements have been implemented to increase the sensitivity for masses below 1 TeV, important for models where a scalar or pseudo-scalar particle decays to top quark pairs.

T 10.5 Mon 17:15 T-H23

A search for pair production of excited top quarks t* at CMS — •Finn Labe[1], Johannes Haller[1], Roman Kogler[2], Artur Lobanov[1], and Matthias Schröder[1] — [1]Institut für Experimentalphysik, Universität Hamburg — [2]DESY

A search for pair production of excited top quarks t^* in the decay channel $t^*t^* \to tgtg$ is presented. The search uses proton-proton collision data at a center-of-mass energy of 13 TeV, collected with the CMS experiment during Run 2 of the LHC, corresponding to a total integrated luminosity of 137 fb^{-1}. The analysis is performed in the lepton+jets final state, where the fully hadronic decay of the highly boosted top quark is identified with top tagging techniques. For discrimination of signal from background, a deep neural network is used, which is decorrelated from the sum of all object momenta S_T using a "designing decorrelated taggers" (DDT) approach. Distributions of signal and background events of S_T are used to evaluate the expected sensitivity of the search, which yields promising results over the full mass range analyzed.

T 10.6 Mon 17:30 T-H23

Categorizing final states and deriving limits on ALPs coupling to the SM Higgs boson in multiphoton events with ATLAS — Peter Krämer, Kristof Scmieden, Matthias Schott, and •Olivera Vujinović — Johannes Gutenberg University, Mainz, Germany

Some puzzling questions in particle physics, such as the strong CP problem or the discrepancy of the muon magnetic moment could be solved by introducing light scalar or pseudo-scalar axion-like particles (ALPs). Theoretical models allow a wide range of ALP-masses and couplings to SM particles such as photons and the Higgs boson. Therefore, parts of the ALP parameter space could be investigated with collider experiments like the ATLAS experiment at the LHC.

In the ongoing analysis, we search for the SM Higgs boson decaying into a pair of ALPs further decaying into two photons each. Depending on ALP properties such as mass and their coupling to photons, the signal is expected to form different final states, ranging from 2 to 4 photons. Each final state requires a dedicated approach to deriving the desired limits. In this talk it will be discussed which final states are expected, how they can be accessed and categorized.

T 10.7 Mon 17:45 T-H23

Multivariate photon classification for an analysis aiming to derive limits on ALPs coupling to the SM Higgs boson in multiphoton events — •Peter Krämer, Kristof Schmieden, Matthias Schott, and Olivera Vujinovic — Johannes Gutenberg Universität Mainz

Some puzzling questions in particle physics, such as the strong CP problem or the discrepancy of the muons magnetic moment could be solved by introducing light scalar or pseudo-scalar axion like particles (ALPs). Theoretic models allow a wide range of ALP-masses and couplings to SM particles such as the photon and the Higgs boson. Therefore, parts of the ALPs parameter space could be investigated with collider experiments like the ATLAS experiment at the LHC.

In the present analysis we search for SM Higgs bosons decaying to a pair of ALPs further decaying to two photons each. Depending on the mass of the ALP, the kinematic of the decay photons differ a lot. Especially for low ALP masses, the photons experience a Lorentz-boost which results in highly collinear photons. These collinear photons are not recognized by standart ATLAS photon reconstruction algorithms.

In this talk I want to discuss how events with highly collimated photons can be distinguished from $H \to \gamma\gamma$ events using multivariate techniques.

T 10.8 Mon 18:00 T-H23

Search for Axion-Like Particles in Non-Resonant $t\bar{t}$ Production Using Lepton+Jets Final States with the CMS Detector — •Henrik Jabusch[1], Ksenia de Leo[1], Johannes Haller[1], Roman Kogler[2], Artur Lobanov[1], and Matthias Schröder[1] — [1]Institut für Experimentalphysik, Universität Hamburg — [2]DESY, Hamburg

We search for signs of axion-like particles (ALPs) in top quark pair production at the LHC. In high-energy proton-proton collisions, ALPs could arise as off-shell mediators. Employing a model-independent ef-

fective field theory approach with ALP couplings to gluons and top quarks, ALPs lead to non-resonant signatures modifying the shape of the invariant mass distribution of the $t\bar{t}$ system.

Our search targets these signatures using 137 fb^{-1} of pp collision data at $\sqrt{s} = 13$ TeV recorded with the CMS detector. Focusing on lepton+jets final states, we utilize a deep neural network for event classification and constrain the ALP-top quark coupling for the first time.

T 10.9 Mon 18:15 T-H23

Searching for ALPs in Light-by-light Scattering in pp Collisions Using AFP Proton Tagging with the ATLAS Detector — Peter Bussey[1], Tomas Chobola[2], Petr Dostal[2], •Hussain Kitagawa[3], Patrick Odagiu[4], Rafal Staszewski[5], André Sopczak[2], Gen Tateno[6], Junichi Tanaka[6], Marek Tasevsky[7], and Koji Terashi[6] — [1]University of Glasgow — [2]CTU in Prague — [3]Okayama University — [4]EPFL Lausanne — [5]IFJ PAN Krakow — [6]ICEPP Tokyo — [7]CAS Prague

The search for an Axion-Like-Particle (ALP) is being performed using about 20 fb^{-1} data recorded with the ATLAS experiment and the ATLAS Forward Proton (AFP) detector in 2017. The two components of the AFP detector are positioned symmetrically at approximately 220 m on either side of the interaction point near the beam pipe and are used to measure the kinematics of surviving protons. The high-mass diphoton spectrum is studied for the search for an ALP mediated by light-by-light scattering. The investigated mass range is between 0.1 TeV and 2 TeV ALP with a typical coupling $g = 1\,\mathrm{TeV}^{-1}$. A blinding strategy is established, and an optimization of the acoplanarity angle is performed. A Functional Decomposition study for the background modeling is applied.