T 86: Searches/BSM V (Misc.)

Time: Friday 9:00–10:30 Location: ZHG010

T 86.1 Fri 9:00 ZHG010

BSM Searches at a 12 GeV Gamma-Gamma collider based on the European XFEL — •Marten Berger[1], Gudrid Moorgat-Pick[1,2], and Monik Wüst[1] — [1]Universität Hamburg, Hamburg, Germany — [2]DESY, Hamburg, Germany

Photon-Photon colliders have been discussed before, offering so far unrealized complimentary possibilities to any current and future linear collider. Implementing one as extension to the Beam dump of the 17.5 GeV European XFEL as the first high energy collider of its sort. It would not just be to study the concept of photon colliders but would also be a collider without competition in the region of $5-12$ GeV for photon-photon collision. In this range, $b\bar{b}$ and $c\bar{c}$ resonances, tetraquarks as well as mesonic molecules can be observed. Furthermore, some BSM processes can also be reached in this range making use of the polarization effects from compton backscattering. In this talk we want to discuss the possibility of observing ALPs at such a collider. We will use a simplified description of the compton backscattering process to get a first look at cross sections and extend this to the full beam dynamics included prediction.

T 86.2 Fri 9:15 ZHG010

Hunting coloured scalars with machine learning — Thomas Flacke[1], Jeong Han Kim[2], •Manuel Kunkel[3], Jun Seung Pi[2], and Werner Porod[3] — [1]Center for AI and Natural Sciences, KIAS, Seoul, Republic of Korea — [2]Department of Physics, Chungbuk National University, Republic of Korea — [3]Institut für Theoretische Physik und Astrophysik, Julius-Maximilians-Universität Würzburg, Germany

Composite Higgs models with an underlying fermionic description predict an extended scalar sector featuring also QCD coloured states. We study an electrically neutral colour octet and a colour sextet with charge 4/3. Both states couple to top quarks such that pair production leads to a four top quark signature. We train neural networks to separate these signal processes from their SM backgrounds and derive the discovery reach and expected exclusion limits at the HL-LHC. Since both states may be present simultaneously, we also assess how well the respective events can be separated by our networks.

T 86.3 Fri 9:30 ZHG010

Trigger-level search for dijet resonances at ATLAS — •Falk Bartels — Kirchhoff-Institut für Physik, Heidelberg

The search for sub-TeV dijet resonances at the LHC is statistically limited due to the reduced readout rate of lower p_T jet triggers. The ATLAS trigger-level analysis covers this part of the spectrum by recording a strongly reduced set of event-level information processed by the High Level Trigger for all events passing the seeding Level-1 trigger. This allows for lowering the minimal detectable dijet resonance mass from above 1 TeV to around 400 GeV.

With more than 1 billion events in the recorded dijet mass spectrum, an exceptional statistical precision can be achieved. Matching this level of precision poses unique challenges especially for the custom trigger-level jet calibration and the background estimate. A general overview of the well-advanced analysis is presented.

T 86.4 Fri 9:45 ZHG010

Searching for anomalous dijets in CMS data with CATHODE — •Chitrakshee Yede, Gregor Kasieczka, Louis Moureaux, Tore von Schwartz, and Manuel Sommerhalder — Institute for Experimental Physics, Universität Hamburg, Hamburg, Germany

In high-energy physics, numerous analyses conduct searches for new phenomena beyond the Standard Model. A new paradigm of model-agnostic searches has emerged based on anomaly detection which is aimed at automatically identifying deviations from the background expectation in the data using machine learning. We present the recently published analysis by the CMS Collaboration that employs such machine learning techniques. We discuss CATHODE, a method combining density estimation and weak supervision and its first-ever application on 13 TeV proton-proton collision data recorded by the CMS experiment at the LHC. This study focuses on heavy resonances decaying into two large-radius jets with anomalous substructure. This approach establishes a foundation for data-driven, model-agnostic searches, enabling the simultaneous investigation of multiple potential new physics signals within a single analysis.

T 86.5 Fri 10:00 ZHG010

Statistical analysis with anomaly detection — •Kristian Warnholz, Louis Moureaux, Gregor Kasieczka, and Manuel Sommerhalder — Universität Hamburg

Although extensive searches for new physics at the Large Hadron Collider have been conducted, no new particles beyond the Standard Model have been discovered. A key limitation may stem from the reliance on specific models to guide these searches, potentially overlooking more exotic phenomena. In response, recent years have seen the development of numerous machine learning-based, model-independent anomaly detection methods designed to uncover unexpected signals in the data. The first results using these methods have recently been published by the ATLAS and CMS Collaborations. We present a statistical analysis of the behavior of the p-values and exclusion limits derived using the anomaly detection process.

T 86.6 Fri 10:15 ZHG010

Exploring new physics at LHC with Model Unspecific Search in CMS — Alexander Schmidt, Arnd Meyer, •Chinmay Seth, Felipe Torres Da Silva De Araujo, and Thomas Hebbeker — III. Physikalisches Institut A, RWTH Aachen

The Standard Model of Particle Physics, while highly successful, has limitations and fails to provide a comprehensive description of fundamental particles. Beyond Standard Model theories explore alternative explanations for these shortcomings.

The Large Hadron Collider provides access to unprecedented energy for proton-proton collision experiments, generating data to explore theories beyond the Standard Model. Model Unspecific Search in CMS (MUSiC) is one such effort where a model-independent approach is used to look for regions of possible discrepancies between observations from the CMS detector and standard model predictions.

MUSiC classifies events into 'event classes' based on the multiplicity of specific reconstructed final state particles, such as a class with 2 muons and 1 jet. Kinematic distributions for these classes are generated using three key event variables. The algorithm calculates a p-value, considering systematic and statistical effects, and identifies regions in distributions that deviate from the statistical model. Applying further statistical corrections yields a final $\tilde{p}$-value, highlighting the most deviating event classes. If the $\tilde{p}$-value surpasses a set threshold, it signifies a potential window to new physics in that corresponding region. We discuss the concept of MUSiC, its scope, and challenges in this talk.