T 30: Suche nach Neuen Teilchen II

Zeit: Dienstag 16:00–18:30 Raum: H07

T 30.1 Di 16:00 H07

Model Unspecific Search in CMS (MUSiC) - Introduction — •Arnd Meyer, Saranya Ghosh, Thomas Hebbeker, and Tobias Pook — III. Physikalisches Institut A, RWTH Aachen

The "Model unspecific search in CMS" (MUSiC) is a long-term project aiming to discover significant deviations from the standard model (SM) expectation in LHC data. Hundreds of final states are evaluated in an automated procedure with a minimum of additional assumptions, and in particular without optimization for specific models beyond the SM. In this presentation, the general method and its current implementation will be discussed, pointing out limitations and applications beyond the original scope, as well as methods used for validation and benchmarking.

T 30.2 Di 16:15 H07

Model Unspecific Search in CMS (MUSiC) - Results with 2016 Data — Arnd Meyer, Saranya Ghosh, Thomas Hebbeker, and •Tobias Pook — III. Physikalisches Institut A, RWTH Aachen

The CMS Detector recorded a dataset of about $36 fb^{-1}$ during 2016 at a center of mass energy of 13 TeV. This dataset presents a unique opportunity to find new phenomena beyond the Standard Model.

The majority of searches for new physics are optimized for an established signal hypothesis in one or few decay channels. These searches cover only a fraction of all observed final states with model dependent analysis strategies. The Model Unspecific Search in CMS (MUSiC) provides a unique procedure to search for new physics at CMS in several hundred final states that are not all covered by dedicated analyses. This talk extends the previous introductory talk and presents results from an automated search for deviations in significant parts of the complete 2016 dataset.

The observed distribution of deviations is compared to a standard model only expectation estimated from pseudo experiments. The overall agreement between current CMS data and simulations is evaluated and most significant deviations are discussed.

T 30.3 Di 16:30 H07

Search for high-mass resonances decaying to $\tau\nu$ in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector. — •Christos Vergis and Jochen Christian Dingfelder — Physikalisches Institut, Bonn, Germany

Many models beyond the Standard Model predict the existence of new heavy charged gauge bosons (W'). In case of leptonic W' decays, the signature in the detector is a high-p_{T} lepton and large missing energy from the undetected neutrino of the $W' \to \tau\nu$ decays. Although searches for W' decays to electrons or muons and their neutrinos are more sensitive than $W' \to \tau\nu$ for models with universal couplings to leptons, decays to tau lepton are well suited for models in which the W' couples preferentially to the third-gerneration of fermions.

This talk will cover the search for heavy resonances decaying to a tau and a neutrino, in events where the tau lepton decays hadronically, using data collected during the 2015-2017 pp collisions at $\sqrt{s} = 13$ TeV by the ATLAS detector at the LHC. Recent updates to the signal modelling, background estimation and analysis strategy will be discussed. Preliminary expected exclussion limits to the W' masses in the Sequential Standard Model (as benchmark model) will be shown. Due to the increase in luminosity, as well as the upgrades in the tau reconstruction algorithms and analysis strategy, the reach of the search is significantly improved compared to the first ATLAS results.

T 30.4 Di 16:45 H07

Search for new physics in the τ+MET final state with CMS. — •Christoph Schuler, Kerstin Hoepfner, Swagata Mukherjee, and Thomas Hebbeker — III. Physikalisches Institut A, RWTH Aachen University

A search for new physics in the τ+missing transverse energy (MET) channel is presented based on proton-proton collisions measured with the CMS detector at the LHC, using the full 2016 CMS data set recorded at a center of mass energy of 13 TeV. The analysis strategy is discussed and the results are interpreted in the context of the Sequential Standard Model (SSM) which predicts a new heavy charged vector boson W'. In addition, results of a high-luminosity LHC upgrade study in this channel are presented.

T 30.5 Di 17:00 H07

Recent results on the search for heavy neutral resonances decaying into di-tau final states at the ATLAS detector — •Max Maerker, Dirk Duschinger, Wolfgang Mader, and Arno Straessner — IKTP, TU-Dresden

Searches for new heavy resonances decaying to tau-lepton pairs are both theoretically and experimentally well motivated. Extensions of the Standard Model often include additional particles, such as the Minimal Supersymmetric Standard Model (MSSM) introducing new heavy neutral Higgs bosons A and H. Since the couplings of the heavy neutral Higgs bosons to up-type fermions are strongly enhanced at large values of $\tan(\beta)$, their decay into tau lepton pairs is particularly interesting to search for these particles.

In this talk a analysis of the full Run 2 dataset taken with the ATLAS detector in the search for heavy, neutral Higgs bosons in the fully hadronic di-tau final state is presented. Further improvements are investigated by optimizing the event selection and by splitting the signal region into multiple subregions based on the identification quality and the charge multiplicity of the decay products of the subleading tau candidate. Preliminary results of these studies will be shown.

T 30.6 Di 17:15 H07

Search for high mass lepton flavour violating processes with CMS — •Sebastian Wiedenbeck, Thomas Hebbeker, Arnd Meyer, and Swagata Mukherjee — III. Physikalisches Institut A, RWTH Aachen University

Lepton flavour is a conserved quantity in the standard model of particle physics but it does not follow from an underlying symmetry. Neutrino oscillations imply that lepton flavour is not conserved in the neutral sector. Lepton flavour violating processes are common in several models of physics beyond the standard model (e.g. supersymmetry with R-parity violation, black hole production, and leptoquarks). Some models predict objects at the TeV mass scale that can decay into two standard model leptons of different flavours: electron + muon, muon + tau, or electron + tau. The challenges in a search for such phenomena are to achieve a high mass resolution, good rejection of standard model backgrounds, and efficient lepton identification at the same time. The status of the analysis is presented, based on the latest CMS data taken in Run 2.

T 30.7 Di 17:30 H07

Search for singly produced excited bottom quarks decaying to tW with the CMS experiment — •Alexander Fröhlich, Johannes Haller, and Roman Kogler — Institut für Experimentalphysik, Universität Hamburg

We present a search for singly produced excited bottom quarks (b*) in pp-collisions at $\sqrt{s} = 13$ TeV recorded with the CMS experiment. The search is performed in the tW decay channel with a lepton and hadronic jets in the final state, where the top quark is assumed to decay hadronically, while the W boson decays into a lepton and a neutrino.

The reconstruction and identification of the top quark is performed using the Heavy Object Tagger with Variable R (HOTVR). The stable performance of this algorithm allows for a high signal sensitivity over a wide range of b* masses. Data driven methods are used to estimate standard model background contributions from misidentified objects.

T 30.8 Di 17:45 H07

Eine Suche nach exotischen Resonanzen im Zwei-Boson-Zerfallskanal mit vollhadronischem Endzustand mit dem CMS-Experiment — Matthias Mozer, Thomas Müller und •Daniela Schäfer — Institut für Experimentelle Teilchenphysik (ETP), Karlsruher Intstitut für Technologie (KIT)

Viele Erweiterungen des Standardmodells sagen die Existenz neuer Teilchen mit Massen im TeV-Bereich voraus, die zum Beispiel über ihren resonanten Zerfall in zwei Vektor-Bosonen nachgewiesen werden könnten. Die hier präsentierte Suche benutzt bei einer Schwerpunktsenergie von 13 TeV mit dem CMS-Detektor aufgenommene Daten, um im vollhadronischen Endzustand nach exotischen Zwei-Boson-Resonanzen zu suchen. Aufgrund der großen Masse der gesuchten Resonanzen sind ihre Zerfallsprodukte stark geboostet. Ein solches geboostetes Vektor-Boson kann nicht mehr über zwei einzelne Jets rekonstruiert werden, sondern seine Zerfallsprodukte werden stattdessen

in einen einzigen "fetten" Jet geclustert. Um zwischen solchen Jets, die von stark geboosteten Vektor-Bosonen stammen, und Untergrund-Jets zu unterscheiden, werden Methoden basierend auf der Substruktur der Jets verwendet (*V-tagging*). Eine weitere Herausforderung ist die Modellierung des von QCD-Multijet Ereignissen dominierten Untergrundes. Hierfür wird eine neue Strategie verwendet, die auf einem multidimensionalen Fit im Zwei-Jet-Massenspektrum m_{jj} und den zwei Jet-Massen m_{jet1} und m_{jet2} beruht.

T 30.9 Di 18:00 H07

Search for heavy resonances decaying into $t\bar{t}$ in the fully hadronic final state with the ATLAS full Run-2 dataset — Katharina Behr, •Yu-Heng Chen, and Klaus Mönig — Deutsches Elektronen-Synchrotron, Hamburg and Zeuthen, Germany

Heavy resonances decaying into a top-antitop quark pair ($t\bar{t}$), such as a heavy gauge boson Z', are predicted by many extensions of the Standard Model.

We analyse the full dataset recorded by the ATLAS experiment during the second run of the LHC to search for resonances at the high-mass frontier that decay to $t\bar{t}$. In this kinematic region, the decay products of each top quark are highly collinear and form a single hadronic jet with a characteristic substructure.

Top-tagging using machine learning techniques as well as b-tagging in a very busy environment are studied and further optimised to better suppress the challenging multijets background while retaining reasonably good signal efficiency. In addition, for the first time in this final state, the background spectrum is estimated using data-driven techniques by a functional form fit to data in order to reduce the impact of limited Monte Carlo (MC) statistics in the high $t\bar{t}$ mass region. Several ways for signal interpolation are also introduced to obtain a finer signal grid to reduce the need for computing-time intensive Monte Carlo simulations.

T 30.10 Di 18:15 H07

Search for heavy resonances decaying to top quark pairs with the CMS experiment — Johannes Haller, Anastasia Karavdina, Roman Kogler, and •Arne Christoph Reimers — Institut für Experimentalphysik, Universität Hamburg

We present a search for new heavy resonances decaying to pairs of top quarks ($\mathrm{t\bar{t}}$) in data of pp-collisions at $\sqrt{s} = 13\,\text{TeV}$ recorded by the CMS experiment in 2017.

The search is carried out in the final state with exactly one muon and jets. Highly boosted top quarks decaying to the all-jets final state are identified using a top-tagging technique, maximizing the expected sensitivity to large resonance masses.

The invariant mass of the $\mathrm{t\bar{t}}$ system is reconstructed from the muon, missing transverse momentum, and jets, where the hadronically decaying top quark is identified either by a top-tagged large-radius jet or a combination of jets with smaller radius. Its distribution is used to set expected exclusion limits on the production cross section of new heavy resonances decaying to top quarks in different benchmark models. The expected limits are compared to the public result obtained with the 2016 dataset. Different approaches to improve the overall sensitivity of the analysis are discussed.