

## T 93: Search for new particles V

Time: Friday 11:00–13:00

Location: H-HS IV

T 93.1 Fri 11:00 H-HS IV

**Model Unspecific Search in CMS (MUSiC) - Overview** — ●SARANYA SAMIK GHOSH, THOMAS HEBBEKER, ARND MEYER, TOBIAS POOK, and LORENZO VIGILANTE — III. Physikalisches Institut A, RWTH Aachen, 52074 Aachen, Germany

The Model Unspecific Search in CMS (MUSiC) is a long-term project aiming to search for new physics beyond the standard model (BSM) by searching for significant deviations from the standard model (SM) expectation in LHC data. Kinematic distributions of the data are compared with the SM expectation in hundreds of different final states using 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 93.2 Fri 11:15 H-HS IV

**Model Unspecific Search in CMS (MUSiC) - Results with 2016 Data** — SARANYA SAMIK GHOSH, ARND MEYER, TOBIAS POOK, THOMAS HEBBEKER, and ●LORENZO VIGILANTE — III. Physikalisches Institut A, RWTH Aachen, 52074 Aachen, Germany

The CMS experiment has been collecting data during proton-proton collisions at a center of mass energy of 13 TeV during Run 2 of the LHC. This presents a unique opportunity to search for new physics 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 the analysis based on the dataset collected during 2016 by the CMS detector corresponding to about  $36fb^{-1}$  using an automated search for significant deviations from the Standard Model expectation. The observed distribution of deviations is compared to a Standard Model only expectation estimated from pseudo experiments. The overall agreement between the CMS data and simulations is evaluated and most significant deviations are studied.

T 93.3 Fri 11:30 H-HS IV

**Search for Dark Matter in the Mono-H(bb) Channel** — ●ANDREA MATIC and JEANETTE LORENZ — Ludwig-Maximilians-Universität München

Astrophysical and cosmological measurements indicate that about 27% of the energy density in the universe consist of Dark Matter (DM). However, the particle nature of DM is unknown. Promising candidates for DM are weakly interacting massive particles (WIMPs). Apart from the gravitational force, these hypothetical particles only interact weakly. WIMPs could be produced in proton-proton collisions at the Large Hadron Collider (LHC). As they would not interact with the detector material, such collision events can be characterized by high missing transverse momentum.

A search for DM with the ATLAS detector at a center-of-mass energy of 13 TeV will be presented. This search is sensitive to the pair production of DM particles in association with a Higgs boson, which decays further into two  $b$ -quarks. This decay can have two different signatures in the detector: For low momenta of the Higgs boson the  $b$ -quarks hadronize into two well separated jets, while for high momenta they are merged into a single jet.

In this talk the search strategy will be presented as well as the improvements which have been introduced in light of the analysis with the full Run II dataset.

T 93.4 Fri 11:45 H-HS IV

**Searching for Dark Matter with the CMS experiment** — ●DOMINIC STAFFORD, CHRISTIAN SCHWANENBERGER, ALEXANDER GROHSJEAN, AFIQ ANUAR, NICOLE STEFANOV, SAMUEL BAXTER, and JONAS RÜBENACH — DESY, Hamburg, Germany

Astronomical observations provide strong evidence that a large proportion of the matter in the universe is "Dark Matter" not described

in the Standard Model of particle physics. Furthermore, cosmological considerations suggest Dark Matter should couple to the SM on the TeV scale, and hence may be discoverable at the LHC. We present a search for Dark Matter coupling to top quarks via a (pseudo)-scalar mediator in top quark pair production in pp-scattering at 13 TeV. Dark Matter particles would show up as an excess of missing transverse energy. We review the results of a previous search in dilepton final states using 2016 CMS data, and present our current status of the full-Run-2 analysis involving new techniques, such as adding the single top production channel, improvements in Monte Carlo simulations and data-driven modeling of backgrounds, and improvements of machine learning techniques, which may improve sensitivity to these models.

T 93.5 Fri 12:00 H-HS IV

**Suche nach Dunkler Materie in Assoziation mit einem hochenergetischen Top-Quark.** — ULRICH HUSEMANN, MATTHIAS SCHRÖDER, ●MICHAEL WASSMER und SEBASTIAN WIELAND — Institut für Experimentelle Teilchenphysik (ETP), Karlsruher Institut für Technologie (KIT)

In diesem Vortrag wird eine Suche nach Dunkler Materie in Assoziation mit einem hochenergetischen Top-Quark in Daten des CMS-Experiments vorgestellt. Diese sogenannte Mono-Top-Signatur zeichnet sich durch hohe fehlende transversale Energie und den Top-Quark-Zerfall aus, welcher eine klare Signatur besitzt. Im hadronischen Kanal werden Fat-Jets, Jet-Substruktur-Techniken und multivariate Methoden zur Identifizierung von Top-Jets verwendet. Im leptonischen Kanal wird zur Unterscheidung zwischen Untergrund und Signal die transversale W-Boson-Masse genutzt. Die Messergebnisse werden in vereinfachten theoretischen Modellen interpretiert, welche einen zusätzlichen Mediator und ein zusätzliches Teilchen als Kandidat für Dunkle Materie enthalten.

T 93.6 Fri 12:15 H-HS IV

**Search for a light CP-odd Higgs boson decaying into a pair of taus** — ●TOM KRESSE, WOLFGANG MADER, MAX MÄRKER, and ARNO STRAESSNER — IKTP, Dresden, Germany

Even though the predictions of the SM have often agreed with experimental observations to an incredible degree, there are still some phenomena it can not explain, for example the anomalous magnetic moment of the muon, which shows significant deviations between prediction and experiment. This deviation could be explained in the context of a 2 Higgs Doublet Model (2HDM), which predicts a second Higgs doublet with one CP-odd Higgs boson. Interesting parameters of the model are the mass of the CP-odd Higgs boson and the couplings to charged leptons and up type quarks.

In this talk, a search for a light CP-odd Higgs boson is presented through a cut based analysis. In the analysis the Higgs boson is produced via gluon fusion and then decays into a pair of two tau leptons, where both tau leptons decay leptonically, one into an electron, one into a muon. The analysed mass range of the CP-odd Higgs boson lies between 40 GeV and 90 GeV, which is a favored part of the parameter space to explain the deviation between SM prediction and experimental results of the magnetic moment of the muon. This promising new search is discussed based on Monte Carlo simulations, assuming  $139fb^{-1}$  of data collected by the ATLAS experiment at 13 TeV. A refined analysis will be presented and projections of the discovery significance will be given.

T 93.7 Fri 12:30 H-HS IV

**Search for new physics in the  $\tau$ +MET final state with CMS** — ●CHRISTOPH SCHULER, KERSTIN HOEPPNER, THOMAS HEBBEKER, and SWAGATA MUKHERJEE — III. Physikalisches Institut A, RWTH Aachen University

A search for new physics in the  $\tau$  +missing transverse energy (MET) channel is presented based on proton-proton collisions measured with the CMS detector at the LHC, using the full Run-II 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  $W'$ .

T 93.8 Fri 12:45 H-HS IV

**Search for low mass dark photon in dimuon channel using scouting trigger in CMS** — ●SWAGATA MUKHERJEE and THOMAS HEBBEKER — III. Physikalisches Institut A, RWTH Aachen University

After several years of running of the LHC, new physics has not been found yet. Data scouting is an attempt to search in a rather difficult corner of phase space, which is the low mass region. This special data flow, based on event-size reduction rather than event filtering, will be discussed in this talk. Scouting data is useful to perform searches in

regions where nominal triggers have reduced or zero sensitivity. A new search for dark-photons in the dimuon channel has been performed in CMS, which utilises dimuon scouting data for low mass. An intriguing possibility that the dark matter might interact via a new dark force, felt only feebly by standard model particles, has recently motivated a worldwide effort to search for dark forces. A particularly compelling dark-force scenario is that of a dark photon, which has very small couplings to standard model particles via kinetic mixing with the ordinary photon. This new search will be presented in this talk.