T 132: Searches VI

Time: Thursday 17:30–19:00 Location: HSZ/0101

T 132.1 Thu 17:30 HSZ/0101

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, based on the CMS data taken in Run 2, and plans for Run 3 are presented.

T 132.2 Thu 17:45 HSZ/0101

Search for Leptoquarks in the multilepton channel with ATLAS Run-2 data — •Janik Böhm and Andre Sopczak — CTU in Prague

The latest results in the search for leptoquarks in the multilepton channel are presented using ATLAS Run-2 data.

T 132.3 Thu 18:00 HSZ/0101

Search for new particles decaying to top quark-antiquark pairs at CMS — •Henrik Jabusch[1], Ksenia de Leo[1], Johannes Haller[1], and Roman Kogler[2] — [1]Institut für Experimentalphysik, Universität Hamburg — [2]DESY, Hamburg

We present a model-independent search for new particles decaying to top quark-antiquark pairs ($t\bar{t}$) using 138 fb^{-1} of pp collision data at $\sqrt{s} = 13$ TeV recorded with the CMS detector during LHC Run 2. The search targets both resonant and non-resonant signatures in the spectrum of the invariant mass $m_{t\bar{t}}$.

Focusing on lepton+jets final states, we use novel top-tagging techniques to identify the hadronic decay of highly Lorentz-boosted top quarks. We further employ a deep neural network for event classification. Reconstructed $m_{t\bar{t}}$-distributions are used to derive constraints on various physics models predicting new particles decaying to $t\bar{t}$, such as heavy resonances, Kaluza-Klein gluons, heavy Higgs bosons (including interference with the SM process), as well as non-resonant axion-like particles, extending the reach of earlier searches significantly.

T 132.4 Thu 18:15 HSZ/0101

Search for supersymmetry in single lepton events using angular correlations and heavy-object identification — Kerstin Borras[4,5], •Frederic Engelke[4,5], Kimmo Kallonen[3], Henning Kirschenmann[3], Pantelis Kontaxakis[1], Dirk Krücker[4], Isabell Melzer-Pellmann[4], Ashraf Mohammed[4,5], Paris Sphicas[1,2], Costas Vellidis[1], and Lucas Wiens[4] — [1]University of Athens — [2]CERN — [3]Helsinki Institute of Physics — [4]DESY — [5]RWTH Aachen IIIA

Results are presented from a search for supersymmetry in events with a single electron or muon, and multiple hadronic jets. The data corresponds to a sample of proton-proton collisions at $\sqrt{s} = 13$ TeV with an integrated luminosity of 138 fb^{-1}, recorded by the CMS experiment at the LHC.

The search targets gluino pair production, where the gluinos decay into the lightest supersymmetric particle (LSP) and either a top quark-antiquark pair or a pair of light quarks in the final state.

We use the angular correlation between the lepton and the W boson's transverse momenta for a strong separation between the signal and the background region. The investigation of the two different signal models benefits from improved top and W tagging methods.

Furthermore, we also present current endeavors to prepare this analysis for the Run3 period using modern analysis tools.

T 132.5 Thu 18:30 HSZ/0101

Investigation of background processes for proton decay search in the JUNO experiment — •Carsten Dittrich[1], Ulrike Fahrendholz[1], Meishu Lu[1], Sarah Braun[1], Lothar Oberauer[1], Hans Steiger[2], and Matthias Raphael Stock[1] — [1]E15, Physik-Dep., Technische Universität München, James-Franck-Str. 1, 85748 Garching — [2]Cluster of Excellence PRISMA$^+$, Staudingerweg 9, 55128 Mainz

The Jiangmen Underground Neutrino Observatory (JUNO) is a large liquid scintillator detector, capable to search for the hypothetical proton decay $p \to K^+ + \bar{\nu}$, which is predicted by supersymmetric Grand Unified Theories (GUTs). As the momentum of the daughter kaon is below the Cherenkov threshold in water, JUNO will quickly be able to provide competitive results in comparison to the current lifetime limit of $\tau > 5.9 \cdot 10^{33}$ years by the Super-Kamiokande collaboration. The three-fold coincidence signature generated by the kaon and its daughter particles will be crucial to discriminate proton decay events from possible backgrounds produced by atmospheric neutrinos. This talk will present a brief overview on the proton decay search in JUNO, the different background processes and possible identification criteria to discriminate between the two.

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T 132.6 Thu 18:45 HSZ/0101

Search for Higgsinos in final states with a low-momentum, displaced track at the CMS experiment — Samuel Bein, Yuval Nissan, Peter Schleper, Alexandra Tews, and •Moritz Wolf — Universität Hamburg

Many supersymmetric extensions to the Standard Model predict the three lightest electroweakinos, χ_2^0, $\chi_1^\pm$, and χ_1^0, to be Higgsino-like with nearly degenerate masses around the electroweak scale. The lightest chargino can be produced alongside another electroweakino and then decay to the lightest neutralino. To search for these particles, the best strategy depends on the differences between the various masses. For $\Delta m(\chi_2^0, \chi_1^0) > \mathcal{O}(1\,\text{GeV})$ lepton pairs from the decay of the second-lightest neutralino leave an experimentally distinct signature, whereas $\Delta m(\chi_1^\pm, \chi_1^0) \lesssim 0.3\,\text{GeV}$ can lead to the chargino giving rise to a disappearing track. For mass splittings in the range of $\Delta m(\chi_1^\pm, \chi_1^0) = 0.3 - 1.0\,\text{GeV}$, searches carried out so far at the LHC are lacking in sensitivity.

In this analysis, a slightly displaced track with small transverse momentum, corresponding to a pion originating from the chargino decay, is used to gain sensitivity to this challenging range of mass splittings.