

T 94: Supersymmetry: Searches

Time: Friday 11:00–13:00

Location: H-HS V

T 94.1 Fri 11:00 H-HS V

Search for the electroweak production of supersymmetric particles decaying to final states with a lepton with the ATLAS detector — ●LARS FERENCZ and JEANETTE LORENZ — LMU, Munich, Germany

Profiting from the large pp data statistics available, collected by the ATLAS detector at the LHC during Run 2, some searches for the electroweak production of supersymmetric particles get accessible for the first time. This talk presents a search for chargino and neutralino pair production, where the chargino $\tilde{\chi}_1^\pm$ decays to a W boson and the lightest neutralino $\tilde{\chi}_1^0$ (lightest supersymmetric particle, LSP), and the neutralino $\tilde{\chi}_2^0$ to a Z boson and the LSP. The search presented focuses on signatures with an isolated electron or muon, which provides complementary sensitivity to searches in multilepton signatures. Depending on the boost of the W and Z boson emitted, advanced tagging techniques to identify these bosons can be used, leading to different search regions.

T 94.2 Fri 11:15 H-HS V

Search for supersymmetry in final states with opposite-sign same-flavor lepton pairs at the CMS experiment with data taken from 2016 to 2018 — LUTZ FELD, DANILO MEUSER, JOHANNES SCHULZ, and ●MARIUS TEROERDE — 1. Physikalisches Institut B, RWTH Aachen

Supersymmetry (SUSY) is an extension of the standard model (SM) of particle physics with the potential to solve open questions in physics like the unification of forces or the nature of dark matter by introducing superpartners to all SM particles. In the presented analysis, the production of opposite-charge same-flavor lepton pairs along with jets and stable, undetected SUSY particles is considered.

Events from top-pair production have a similar event topology and thus are an important background to the analysis. A likelihood variable based on the characteristics of top-pair production suppresses this background. Using the flavor-symmetry of the process, a data-driven background estimation is then employed.

The presented search is performed on data taken by the CMS detector at the Large Hadron Collider at $\sqrt{s} = 13$ TeV in the years 2016 to 2018.

T 94.3 Fri 11:30 H-HS V

Search for Supersymmetry in Multileptonic Final States with the ATLAS Detector — ●MARIAN RENDEL, JOHANNES JUNGGE-BURTH, ZINONAS ZINONOS, and HUBERT KROHA — Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), München

The search for supersymmetry (SUSY) is a major part of the ATLAS physics program. Due to the low Standard Model (SM) background, multileptonic final states provides excellent sensitivity to various supersymmetric scenarios. In this talk a search for events with at least four charged leptons is presented which uses LHC proton-proton collision data collected by the ATLAS detector during 2015 to 2018. The results are interpreted in terms of various supersymmetric models with R-parity conservation and R-parity violation.

T 94.4 Fri 11:45 H-HS V

Search for Higgsino production in SUSY scenarios with a compressed mass spectrum. — ●YUVAL NISSAN¹, SAM BEIN¹, PETER SCHLEPER¹, and GUDRID MOORTGAT-PICK² — ¹Institut für Experimentalphysik, Universität Hamburg — ²Institute of Theoretical Physics, Universität Hamburg

A search for leptonic decays of Higgsino-like neutralinos in the case of a compressed mass spectrum using a track, a reconstructed lepton and missing transverse momentum is presented. We consider the case of a second-lightest neutralino decaying into a dark matter candidate - lightest neutralino - and two leptons via an off-shell Z boson. In the case of a very small mass differences between the neutralinos, the leptons produced are very soft, making it very difficult to reconstruct them at CMS. We consider a case where one of the leptons is reconstructed by a track, and the other as a reconstructed lepton of opposite charge. Signals of different mass splitting are probed and interpreted within a set of simplified models. Multivariate discriminants are employed in the event- and object-level selection, and their performance is studied.

T 94.5 Fri 12:00 H-HS V

Searches for sleptons with semi-compressed mass spectra using the ATLAS detector at $\sqrt{s} = 13$ TeV — ●JORGE SABATER IGLESIAS for the ATLAS-Collaboration — DESY, Hamburg

Supersymmetry (SUSY) is a symmetry that introduces a relation between every Standard Model (SM) particle with a superpartner state whose spin differs by half a unit. This provides an elegant solution to, among others, the hierarchy problem, and it has a possible candidate for dark matter. In the Minimal Supersymmetric extension of the SM (MSSM), the bosonic superpartners of the fermions (sfermions) can be classified into scalar leptons (sleptons) and scalar quarks (squarks). The talk will focus on specific scenarios for the mass spectra of the supersymmetric particles and cover an ongoing search for slepton pair production. These scenarios are of particular interest since they explain the dark matter abundance observed in the universe and the longstanding muon $g-2$ discrepancy between the measured value and theoretical prediction.

Sleptons are unstable and decay to a lepton and the lightest supersymmetric particle (LSP), resulting in a final state with two same flavour opposite sign (SFOS) leptons and missing transverse momenta coming from the undetected LSP. In this search we exploit the flavour asymmetry of the signal final state (100% same flavour leptons) in order to discriminate signal from background. Sensitivity to a yet unexplored region in the phase-space will be demonstrated.

T 94.6 Fri 12:15 H-HS V

Search for Compressed Higgsinos in events with two oppositely charged soft leptons at the CMS experiment — SAMUEL BEIN, VIKTOR KUTZNER, YUVAL NISSAN, PETER SCHLEPER, ●ALEXANDRA TEWS, and MORITZ WOLF — Universität Hamburg, Deutschland

A variety of supersymmetric extensions of the Standard Model lead to light Higgsinos with compressed mass spectra.

In case of pair production of Higgsino-like electroweakinos, e.g. $\tilde{\chi}_1^\pm, \tilde{\chi}_2^0$, the decay of the second neutralino through an off-shell Z boson can lead to a pair of same-flavor opposite-sign leptons. These leptons can have very low momentum and semi-stable lifetimes if the mass spectrum of the SUSY particles is sufficiently compressed (nearly degenerate).

Searches for SUSY in events with two low-momentum opposite-sign leptons are particularly sensitive to such SUSY models. Scenarios with compressed Higgsinos with a mass splitting below 2 GeV with the CMS experiment are studied. We exploit new reconstruction and vertexing techniques for oppositely charged displaced lepton tracks with very low momenta of order of a few hundred MeV.

T 94.7 Fri 12:30 H-HS V

Search for chargino and neutralino production in final states with one lepton, a Higgs boson and missing transverse momentum with the ATLAS detector. — ●ERIC SCHANET and JEANETTE LORENZ — Ludwig-Maximilians-Universität München

Supersymmetry is a popular extension of the Standard Model of Particle Physics (SM), providing a solution to several open questions of the SM. If squarks and gluinos are beyond the reach of the LHC, the production of charginos and neutralinos could be the dominant production mode of supersymmetric particles in $\sqrt{s} = 13$ TeV pp collisions at the LHC.

A search for electroweak production of supersymmetric particles, using 139 fb^{-1} of pp collisions recorded by the ATLAS detector, is presented. In the signal scenario considered, a chargino $\tilde{\chi}_1^\pm$ is pair-produced together with a next-to-lightest neutralino $\tilde{\chi}_2^0$. The chargino decays via $\tilde{\chi}_1^\pm \rightarrow W^\pm \tilde{\chi}_1^0$ while the neutralino decays through $\tilde{\chi}_2^0 \rightarrow h \tilde{\chi}_1^0$. The final state of this signal scenario is thus in many cases characterised by the presence of two b -jets from the Higgs decay, missing transverse momentum and exactly one lepton from $W^\pm \rightarrow \ell^\pm \nu$, providing high discrimination against SM background.

In this talk, the analysis strategy is introduced. It exploits the different shapes of signal and background distributions in a two-dimensional shape fit, resulting in sensitivity to a broad range of kinematic regimes. Finally, the results of the search are presented and discussed.

T 94.8 Fri 12:45 H-HS V

Search for top squarks with one-lepton final states in $\sqrt{s} = 13$ TeV pp collisions with the ATLAS detector — ●ZULIT
PAOLA ARRUBARRENA TAME and ALEXANDER MANN for the ATLAS-Collaboration — Ludwig-Maximilians-Universität München

Supersymmetry (SUSY) is an extension of the standard model of particle physics which predicts a supersymmetric partner for each particle in the standard model. If R-parity is conserved, then the lightest supersymmetric particle (LSP) is stable and a good dark matter candidate. In many models the LSP is favored to be the lightest neutralino ($\tilde{\chi}_1^0$), and the SUSY partner of the top quark, top squark (\tilde{t}_1), is usually assumed to be light and in the reach of the LHC. In

this talk a search for top squark pair production in final states with one isolated lepton, jets, and missing transverse momentum using pp collision data recorded by the ATLAS detector over the full Run 2 of the LHC is presented.

The latest results of an analysis targeting a compressed region of the top-squark phase space are shown where the mass difference between the \tilde{t}_1 and $\tilde{\chi}_1^0$ is smaller than the W -boson. In this scenario the \tilde{t}_1 decays via a 4-body process into a b -quark, two soft fermions and a $\tilde{\chi}_1^0$. A strategy to discriminate the SUSY signal from the dominant top-quark and W +jets background processes is described.