

## T 50: Suche nach Supersymmetrie II

Zeit: Mittwoch 16:30–19:00

Raum: Philo-HS3

T 50.1 Mi 16:30 Philo-HS3

**Sensitivity studies using multivariate techniques for the search for fully hadronic decays of top squarks with the ATLAS detector** — ●NICOLAS KÖHLER, OLIVER KORTNER, and JONAS GRAU — Max Planck Institut für Physik, München

The search for the supersymmetric partner of the top quark in final states with jets and missing transverse energy using  $36.1 \text{ fb}^{-1}$  of the LHC Run-2 dataset at  $\sqrt{s} = 13 \text{ TeV}$  excludes a large range of top squark and LSP (lightest supersymmetric particle) masses with conventional cut-based event selections. In order to further increase the signal sensitivity, different multivariate analysis techniques have been investigated and compared. The achievable gain in sensitivity in the top squark-LSP mass plane with the full Run-2 dataset will be discussed.

T 50.2 Mi 16:45 Philo-HS3

**Search for electroweak production of supersymmetric states in compressed mass spectra in Run 2 with the ATLAS detector** — ●MICHAEL HOLZBOCK and ALEXANDER MANN — Ludwig-Maximilians-Universität München

Supersymmetry (SUSY) is one of the best studied and tested extensions of the Standard Model. Although there is no sign of physics beyond the Standard Model yet, SUSY could still be hiding in more challenging signatures, one of them being compressed mass spectra. These scenarios involve small mass differences between heavier SUSY particles and the lightest supersymmetric particle (LSP) leading to the appearance of soft objects in the decay chain.

A search is presented in which the lightest electroweakino states are nearly mass degenerate, leading to final states with one or more soft leptons. Usually, these events are selected using a trigger on missing transverse energy that originates from the SUSY system recoiling against a jet from initial state radiation. This trigger requires a tight cut on missing transverse energy in the offline selection, reducing the signal acceptance significantly. New dedicated triggers with lower thresholds exploiting topological information already at the lowest trigger level have been included in the 2017 data taking to recover signal efficiency in compressed scenarios.

The talk comprises studies on these multi-object triggers and the potential gain in sensitivity for the analysis when a selection based on these triggers is introduced.

T 50.3 Mi 17:00 Philo-HS3

**QCD multi-jet background estimation for direct Stau searches** — CHRISTIAN SANDER and ●KRISHNA KULKARNI — Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany

For searches after direct stau production with final states of reconstructed taus and missing transverse energy (MET), QCD multi-jet events can be an important background. In this case jets are "faking" taus and additionally MET is generated by jet mis-measurement or detector resolution effects. Previously, ABCD methods have been used to estimate the QCD background, which can face a significant non-QCD background and signal contamination in the used control regions. In this talk, we would like to propose an alternative approach based on a "Rebalance-and-Smear" technique: Inclusive jet events are re-balanced in the transverse momentum plane, and are smeared with jet response templates to get a data driven multi-jet background sample. Tau fake probabilities are then applied on the individual jets to obtain a prediction for the taus+MET final state.

T 50.4 Mi 17:15 Philo-HS3

**Search for supersymmetry with tau leptons in the CMS experiment using MVA approach** — ●ILYA BOBOVNIKOV<sup>1</sup>, ALEXIS KALOGEROPOULOS<sup>1,2</sup>, ISABELL MELZER-PELLMANN<sup>1</sup>, and ALEXEI RASPEREZA<sup>1</sup> — <sup>1</sup>DESY — <sup>2</sup>Princeton

Supersymmetry (SUSY) is a popular theory beyond-the-standard-model. A search for SUSY in events with  $\tau$  leptons in the final state using an MVA technique with  $36/\text{fb}$  of 13 TeV data taken during 2016 is presented. Results are interpreted in terms of a direct stau-pair production model, where each stau is expected to decay to a  $\tau$  lepton and the lightest SUSY particle (LSP). To optimize the sensitivity to the direct stau-pair production topology, we apply and compare various MVA approaches with different kinematic variables, based on final

states with one hadronically decaying  $\tau$  lepton and an electron or muon from the decay of the second  $\tau$ . Finally, expected exclusion limits are calculated and compared with a cut based approach.

T 50.5 Mi 17:30 Philo-HS3

**Search for direct pair production of scalar tau leptons in final states with two hadronically decaying taus with the ATLAS detector** — ●FERDINAND KRIETER, CLARA LEITGEB, and ALEXANDER MANN — Ludwig-Maximilians-Universität München

As a proposed fundamental symmetry of nature, Supersymmetry provides elegant solutions to various open questions of the standard model by predicting superpartners of known particles, whose spins differ by one half unit. In  $R$ -parity-conserving models, these hypothetical particles are pair-produced and decay ultimately into the stable, lightest supersymmetric particle, providing a candidate for dark matter. A search for electroweak pair production of scalar tau leptons in final states with two hadronically decaying leptons, missing transverse momentum and low jet activity is presented. The simplified signal models consider scalar tau leptons decaying exclusively into a tau lepton and a stable neutralino. Such a production mode may dominate if the strongly interacting superpartners and gauginos are heavy and thus beyond the reach of currently probed energy scales. The analysis uses  $pp$  collision data at a center of mass energy of 13 TeV, recorded with the ATLAS detector from 2015 to 2017. Variables computed with the recursive jigsaw reconstruction technique are studied for the purpose of developing signal selections with optimal sensitivity. For the estimation of the multijet background a data-driven fake-factor method is presented. To allow for a measurement of the tau fake rates, a procedure to reweight data collected by a set of partially prescaled single jet triggers is used.

T 50.6 Mi 17:45 Philo-HS3

**Search for R-parity violating Supersymmetry in final states with four-leptons with the ATLAS experiment** — ●JOHANNES JUNGGEBURTH, ZINONAS ZINONOS, and HUBERT KROHA — Max-Planck-Institut für Physik

Supersymmetry is the favoured framework for providing solutions to open questions in the Standard Model. In most supersymmetric models, the discrete quantum number of R-parity is assumed to be conserved leading to a stable Lightest Supersymmetric Particle (LSP). However, it is possible that this quantum number is not conserved thus allowing for its decay into leptons. In proton collisions, multilepton final states provide a clear signature with excellent background suppression. This talk presents the latest results of a search for R-parity violating supersymmetry with the ATLAS experiment at the Large Hadron Collider using  $36 \text{ fb}^{-1}$  of data at  $\sqrt{s} = 13 \text{ TeV}$ . The results are interpreted in terms of simplified models. Possibilities for further improvements of the analysis are also discussed.

T 50.7 Mi 18:00 Philo-HS3

**Designing searches for unexplored SUSY models with the CMS detector** — PETER SCHLEPER<sup>1</sup>, ●MALTE MROWIETZ<sup>1</sup>, SAM BEIN<sup>1</sup>, JORY SONNEVELD<sup>1</sup>, and FEDERICO AMBROGI<sup>2</sup> — <sup>1</sup>Institut für Experimentalphysik, Universität Hamburg — <sup>2</sup>HEPHY Vienna

Searches for Supersymmetry (SUSY) are one of the main goals of the LHC. Many of the searches for SUSY are interpreted in terms of simplified models. In this way, a large portion of the low-TeV SUSY parameter space has already been excluded. The tool *Smodels* can be used to identify "missing" simplified models, for which no search has been performed yet. An analysis of the remaining parameter space of the low-TeV phenomenological minimal supersymmetric standard model (pMSSM) with *Smodels* shows that models with a neutralino lightest sparticle and a nearly mass-degenerate second neutralino or chargino are among the most common missing simplified models. In this talk, the spectrum of missing simplified models is discussed and a potential search for the type of model above is presented, using data collected by the CMS detector.

T 50.8 Mi 18:15 Philo-HS3

**Search for supersymmetry in multileptonic final states with collimated  $\tau$  pairs with the ATLAS detector** — ●MARIAN RENDEL, ZINONAS ZINONOS, HUBERT KROHA, and JO-

HANNES JUNGGEBURTH — 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 background, the search for four-lepton final states provides excellent sensitivity to R-parity violating (RPV) SUSY models where the lightest supersymmetric particle (LSP), produced in pairs, decay into final states with at least two charged leptons. For LSP decays into hadronically decaying  $\tau$  lepton pairs, however, the current analysis is not sensitive if the mass difference between LSP and the next heavier NLSP is large, because the  $\tau$  jet become highly collimated and the standard  $\tau$  reconstruction method is not able to resolve them. A new specialized high- $p_T$   $\tau$  jet pair reconstruction method has been developed for LHC run-2 at 13 TeV center-of-mass energy. In this talk, the application of the new reconstruction technique to the four-lepton RPV SUSY search is discussed as well as further improvements of the method to recover also low- $p_T$   $\tau$  pairs.

T 50.9 Mi 18:30 Philo-HS3

**Suche nach Top-Squark-Produktion mit Top Quarks und fehlendem Transversalimpuls im vollhadronischen Endzustand bei ATLAS** — ●PHILIPP MOGG, CHRISTIAN LÜDTKE und FREDERIK RÜHR — Albert-Ludwigs-Universität Freiburg

In vielen supersymmetrischen Modellen ist der Partner des Top Quarks relativ leicht und könnte am LHC produziert werden. Dieser Beitrag stellt den aktuellen Stand der Suche nach vollhadronischen Signaturen bei ATLAS mit  $36,1 \text{ fb}^{-1}$  bei  $\sqrt{s} = 13 \text{ TeV}$  vor, der beim Journal of High Energy Physics eingereicht wurde. Darüber hinaus werden neue

Methoden wie hadronisches Top-Tagging und die Signifikanz des fehlenden Transversalimpulses diskutiert, die benutzt werden können, um die Sensitivität der Suche zu verbessern.

T 50.10 Mi 18:45 Philo-HS3

**ATLAS analyses preservation project (RECAST) and reinterpretation of specific SUSY searches for variable RPV-coupling strength.** — ●SIMONE CURCIO, F. CARDILLO, V. MAGERL, Z. RURIKOVA, and P. TORNAMBÈ — Albert-Ludwigs-Universität Freiburg

Over the past several decades, many extensions and alterations to the Standard Model (SM) of particle physics have been proposed. These take the form of concrete modifications or extensions to the known particle spectrum and interactions. Searches for new physics are often sensitive to a larger class of models than they were originally designed to test. Reusing the estimates of the background and systematic uncertainties of the original search, one can “recast” the results of an existing analysis and set limits on new models. RECAST is a framework developed at CERN to facilitate the reinterpretation of new signal models. Among all the searches for BSM physics a lot of analyses were designed to search for SuperSYmmetric partners of the SM particles, assuming either R-Parity conservation (RPC), generating a stable Lightest Supersymmetric Particle (LSP) or R-parity violation (RPV). The transition between these two scenarios can be realised by varying the strength of the RPV couplings. In this talk the results of the search for strongly-produced superpartners in final states with 2 same-sign or three leptons and jets (SS3L) are presented for signals with variable RPV-coupling.