

T 68: Suche nach Supersymmetrie III (Hadronische, Tau, Photon Endzustände)

Zeit: Mittwoch 16:45–19:00

Raum: VMP5 HS B2

T 68.1 Mi 16:45 VMP5 HS B2

Search for supersymmetry in dileptonic final states with jets and missing transverse energy with the JZB method at CMS

— LUTZ FELD, JAN-FREDERIK SCHULTE, and ●MARIUS TEROERDE — I. Physikalisches Institut B, RWTH Aachen University

Supersymmetry (SUSY) is a popular extension of the Standard Model of particle physics, as it would solve a variety of problems in modern physics. In the model considered in the presented analysis, a possible final state contains jets as well as the stable lightest supersymmetric particle (LSP), which is produced together with a leptonically decaying Z boson. Thus, the signal is characterized by two same-flavour opposite-sign leptons, missing transverse energy (MET) and the presence of two or more jets.

An important background for this search is the Drell-Yan process with additional jets, as it has a similar event topology. In contrast to SUSY events, Drell-Yan events only contain instrumental MET. Therefore, the variable "jet-Z balance" (JZB), which takes the transverse momentum of the Z boson and the hadronic recoil into account, is distributed differently for Drell-Yan and SUSY events. This allows the definition of a signal depleted control region which is used to predict the Drell-Yan background.

The JZB method was successfully used in several analyses at $\sqrt{s} = 7-8$ TeV. This talk shows the current progress towards its application on the dataset collected at $\sqrt{s} = 13$ TeV.

T 68.2 Mi 17:00 VMP5 HS B2

Search for electroweak production of supersymmetric particles with photonic final states at CMS

— LUTZ FELD, ●JOHANNES LANGE, and JOHANNES SCHULZ — I. Physikalisches Institut B, RWTH Aachen University

Supersymmetry (SUSY) is a prominent extension of the standard model of particle physics, providing possible solutions to the hierarchy problem, unification of the coupling constants and the existence of dark matter. In the context of gauge mediated SUSY breaking the next-to-lightest SUSY particle (NLSP) is the lightest neutralino, while the gravitino is the lightest SUSY particle. For a bino-like mixture, the NLSP predominantly decays to a photon and a gravitino, the latter leaving the detector undetected.

This analysis focuses on final states containing at least one photon, missing transverse energy and low hadronic activity, thus increasing the sensitivity to electroweak gaugino production and complementing searches requiring the presence of jets. The main background contributions are estimated using a template fit of the background simulations to the data in a control region.

The search has already been carried out using a special *parked data set* recorded by the CMS detector at $\sqrt{s} = 8$ TeV and an integrated luminosity of 7.4fb^{-1} . We present the current status of the analysis for the LHC RunII at $\sqrt{s} = 13$ TeV.

T 68.3 Mi 17:15 VMP5 HS B2

Search for physics beyond the Standard Model with photons, missing transverse energy and hadronic activity

— CHRISTIAN AUTERMANN, LUTZ FELD, and ●MAXIMILIAN KNUT KIESEL — I. Physikalisches Institut B, RWTH Aachen University

A search for physics beyond the Standard Model in proton-proton collisions with photons in the final state will be presented. Such final states are motivated by gauge mediated supersymmetry breaking models, in which a neutralino decays to an undetectable gravitino and a photon. If the neutralinos are produced via the strong interaction, the jets in the decay cascade lead to a large amount of hadronic activity.

This search uses data recorded with the CMS detector at a center-of-mass energy of 13TeV . At least one high energetic photon, hadronic activity and missing transverse energy are required. In this presentation, signal scenarios for physics beyond the Standard Model and data-driven background estimation methods are discussed.

T 68.4 Mi 17:30 VMP5 HS B2

Reconstruction and Identification of Boosted Tau Pair Topologies in ATLAS

— ●DAVID KIRCHMEIER — IKTP, TU Dresden, Germany

Decays that involve a pair of tau leptons in the final state are important channels for the search for heavy resonances, which are predicted by

theories that go beyond the Standard Model of particle physics. With the restart of LHC in 2015 higher energies and particle masses will be accessible for these processes. Thus, in particular the understanding of highly boosted tau pairs in the high energy region is essential for the search for new physics. With the current approach of tau reconstruction it is not possible to reconstruct di-tau topologies with low spatial separation, corresponding to a di-tau $p_T \gtrsim 500$ GeV. A dedicated di-tau reconstruction algorithm has been developed, extending the accessible di-tau p_T up to 1200 GeV. Additionally, a multi-variate di-tau identification algorithm is under development which is able to suppress the background of QCD jets with high efficiency.

T 68.5 Mi 17:45 VMP5 HS B2

Performance of Different Searches for Supersymmetry with Tau Leptons at the ATLAS Experiment

— PHILIP BECHTLE, KLAUS DESCH, ●PHILIPP KÖNIG, OLIVER RICKEN, STEFFEN SCHAEPE, and MARTIN SCHULTENS — University of Bonn

The Standard Model (SM) of particle physics is a successful approach to explain the building blocks of matter and the universe but still incomplete. Run-II of the Large Hadron Collider (LHC) is a bargain to discover physics beyond the SM. Supersymmetry (SUSY) is one of the most promising models of physics beyond the SM amongst many others.

The search for tau leptons in the final state is very interesting, since their heavy mass makes their SUSY partners preferred particles in the decay chain. In addition, only a few SM processes can produce multiple tau leptons and large missing transverse energy in the final state. While in Run-I the search for SUSY was mainly focussed on mechanisms for soft supersymmetry breaking such as GMSB, the search in Run-II is aiming for Simplified Model Spectra (SMS).

In this talk the motivation and performance of different analyses with two or more tau leptons in the final state with the ATLAS detector will be presented. Aspects like acceptance and efficiency, particularly for the SMS, will be addressed. The presented analyses will be compared and strengths of each analysis will be stressed as well as any differences. The parametrization of the SMS will be tested for the dependence of the efficiency on intrinsic mass relations, to suggest possible extensions of the SMS.

T 68.6 Mi 18:00 VMP5 HS B2

Messungen der Trigger-Effizienzen mit dem ATLAS-Detektor für Suche nach Supersymmetrie in Ereignissen mit Tau-Leptonen im Endzustand

— FEDERICA LEGGER und ●MARINA STEIMLE — Ludwig-Maximilians-Universität München

Die elektroschwache Produktion von supersymmetrischen Teilchen ist ein vielversprechender Kandidat für die Entdeckung von Supersymmetrie am LHC.

In der hier vorgestellten Analyse wird ein sogenanntes Simplified Model angenommen, bei dem die leichtesten Charginos und die zweit-leichtesten Neutralinos elektroschwach produziert werden. Diese zerfallen über ein Stau oder Tau-Sneutrino in das leichteste Neutralino, welches zugleich auch das leichteste supersymmetrische Teilchen ist und somit stabil. Zusätzlich dazu entstehen mindestens zwei Tau-Leptonen, die unterschiedlich geladen sind. Um derartige Ereignisse zu selektieren, wird ein Trigger, der zwei hadronisch zerfallende Taus pro Ereignis fordert, verwendet.

In diesem Vortrag geht es im besonderen darum, die Effizienz dieses Triggers für die in 2015 mit dem ATLAS-Detektor aufgenommenen Daten von Proton-Proton-Kollisionen zu messen. Dazu wird die Trigger-Effizienz in Daten mit einer Tag-and-Probe-Methode bestimmt und das Ergebnis mit Monte-Carlo-Simulationen verglichen.

T 68.7 Mi 18:15 VMP5 HS B2

Latest Developments in the Search for Supersymmetry with Tau Leptons at the ATLAS Experiment

— PHILIP BECHTLE, KLAUS DESCH, PHILIPP KÖNIG, ●OLIVER RICKEN, STEFFEN SCHAEPE, and MARTIN SCHULTENS — University of Bonn

The upgraded Large Hadron Collider (LHC) and ATLAS experiment provide a new and unique discovery potential for physics beyond the Standardmodel (SM). One of the most promising extensions to the successful yet incomplete SM is Supersymmetry (SUSY).

While in proton-proton collisions production through the strong in-

teraction is favoured, it is due to the nature of SUSY itself that tau leptons and their distinct detector signatures are expected to be rather abundant. These two aspects make up the foundation and motivation of this new physics search.

This talk addresses the ongoing searches for hadronic di-tau final states in different models of SUSY as pursued by the ATLAS collaboration. In contrast to the Run-I analyses this study focuses on Simplified Models (SMS) of SUSY. After introducing the SMS searched for, the analysis strategy and design are presented. Finally, the expected sensitivity in this first 13 TeV analysis is shown and discussed.

T 68.8 Mi 18:30 VMP5 HS B2

Suche nach skalaren Quarks im Endzustand mit Jets und fehlender Transversalenergie mit dem ATLAS-Experiment
— KATHARINA BIERWAGEN, VOLKER BÜSCHER, ●KATHARINA JAKOBI, MANUEL LORNATUS, JAN SCHÄFFER, ANDREAS REISS und PEDRO URREJOLA — Universität Mainz

Der Nachweis neuer Physik jenseits des Standardmodells ist eines der wichtigsten Ziele des ATLAS-Experiments am Large Hadron Collider am CERN. Die in diesem Vortrag präsentierte Analyse wurde für die Suche nach supersymmetrischen Quarks \tilde{q} , die in ein Quark q und ein Neutralino $\tilde{\chi}_1^0$ zerfallen, $\tilde{q} \rightarrow q + \tilde{\chi}_1^0$, für verschiedene Quarkflavour entwickelt, beispielsweise für $\tilde{t} \rightarrow c + \tilde{\chi}_1^0$ oder $\tilde{b} \rightarrow b + \tilde{\chi}_1^0$. Bei einem Endzustand mit zwei Quark-Jets und fehlender Transversalenergie stellt der hohe hadronische Untergrund eine Herausforderung dar. Zur Extraktion des Signals werden die Unterschiede in den Formen der Verteilungen von Signal und Untergrund in verschiedenen diskriminierenden Varia-

blen ausgenutzt. Da die Analyse eine möglichst lockere Selektion verwendet, ist sie vergleichsweise modellunabhängig und komplementär zu bereits existierenden Analysen. Durch die Betrachtung von Systemen mit hoch-energetischen Abstrahlungen im Anfangszustand liegt der Schwerpunkt auf Modellen mit kleinem Δm zwischen \tilde{q} und $\tilde{\chi}_1^0$. Der aktuelle Stand dieser Analyse mit dem Datensatz von 2015 und einer Schwerpunktsenergie von 13 TeV wird in diesem Vortrag vorgestellt.

T 68.9 Mi 18:45 VMP5 HS B2

ATLAS SUSY Search in 0-Lepton Channel — ●MANFREDI RONZANI — Albert-Ludwigs-Universität Freiburg, Germany

Many extensions of the Standard Model (SM) include heavy coloured particles, such as the squarks and gluinos of supersymmetric (SUSY) theories, which could be accessible at the Large Hadron Collider (LHC) and detected by ATLAS. Large number of R-parity-conserving models predict squarks and gluinos produced in pairs and decaying through $\tilde{q} \rightarrow q\tilde{\chi}_1^0$ and $\tilde{g} \rightarrow q\tilde{q}\tilde{\chi}_1^0$, or via intermediate production of charginos as $\tilde{q} \rightarrow q\tilde{\chi}^\pm$ and $\tilde{g} \rightarrow q\tilde{q}\tilde{\chi}^\pm$, with subsequent chargino decay to $W^\pm\tilde{\chi}_1^0$. The neutralino $\tilde{\chi}_1^0$ is assumed to be the Lightest Supersymmetric Particle (LSP) and escape undetected, resulting in large missing transverse momentum which, in addition to the jets resulting from the quark decays, form the final states investigated in the 0-Lepton SUSY analysis.

This talk presents the latest results of the ATLAS 0-Lepton SUSY analysis using data recorded in 2015 by the ATLAS experiment in $\sqrt{s}=13$ TeV proton-proton collision during the LHC Run2.