

## T 104: Suche nach neuen Teilchen 5

Zeit: Donnerstag 16:45–19:00

Raum: JUR 2

T 104.1 Do 16:45 JUR 2

**Search for a heavy resonance  $Z'$  decaying into  $T't$  at  $\sqrt{s} = 13$  TeV with the CMS experiment** — ●ANNA BENECKE, JOHANNES HALLER, ANDREAS HINZMANN, and ROMAN KOGLER — Institut für Experimentalphysik, Universität Hamburg

Many models of physics beyond the Standard Model predict vector-like quarks ( $T'$ ) and a new heavy gauge boson ( $Z'$ ). While decays of the  $Z'$  and  $T'$  into Standard Model particles have been already studied, no experimental results for the decay  $Z' \rightarrow tT'$  with  $T' \rightarrow Ht, Zt$  are available so far. In this talk a search for a heavy spin-1 resonance  $Z'$  decaying into  $T't$  at  $\sqrt{s} = 13$  TeV with the CMS experiment is presented. Two decays of the  $T'$  quark to third generation Standard Model quarks are considered:  $T' \rightarrow Ht$  and  $T' \rightarrow Zt$ .

Due to the large mass of the  $T'$  the  $H$  and  $Z$  bosons receive a large Lorentz boost and the decay products of the bosons appear as a single merged jet. Jet substructure techniques are used to identify these jets. The performance of the taggers is evaluated by measurements of the efficiency and the mistag rate. Sidebands are used to test the simulation of the Standard Model backgrounds in this search. The reconstruction of the  $Z'$  mass is done with a  $\chi^2$  method, and the distribution obtained is used to test for deviations from Standard Model predictions.

T 104.2 Do 17:00 JUR 2

**Kinematic fits in  $t\bar{t}$  resonance searches** — ●MELANIE EICH, JOHANNES HALLER, ROMAN KOGLER, and ANASTASIA KARAVDINA — Institut für Experimentalphysik, Universität Hamburg

Many extensions of the Standard Model predict new massive gauge bosons ( $Z'$ ) with an enhanced coupling to top quarks. The experimental signature of such a new boson decaying into a top-quark pair is a resonant structure in the invariant mass of the  $t\bar{t}$  system. While previous searches focussed on high mass resonances with boosted signatures, an extension to low mass resonances with resolved topologies is performed in this work.

In this talk the status of the  $Z' \rightarrow t\bar{t}$  search in the lepton+jets channel is presented, using data recorded with the CMS experiment in 2016. A kinematic fit tool is employed, which improves the reconstruction of  $W$  bosons and top quarks using measured final state objects, such as jets and leptons. The effect on the resolution of the invariant mass of the  $t\bar{t}$  system is studied and compared to previous reconstruction techniques.

T 104.3 Do 17:15 JUR 2

**Search for heavy resonances decaying to a neutrino and a tau lepton using hadronic tau decays at ATLAS** — ●CHRISTOS VERGIS, WILLIAM DAVEY, and JOCHEN DINGFELDER — Physikalisches Institut, Nussallee 12, Bonn

Many models beyond the Standard Model predict the existence of new heavy, charged ( $W'$ ) and neutral ( $Z'$ ) gauge bosons. In case of leptonic  $W'$  decays, the signature in the detector is a high- $p_T$  lepton and large missing transverse energy from the emitted neutrino. Although searches for  $W' \rightarrow (e/\mu)\nu$  are more sensitive than  $W' \rightarrow \tau\nu$  for a universal coupling to leptons, decays with a tau lepton are well suited to investigate models in which the  $W'$  bosons couple predominantly to third generation fermions.

This talk presents preparations of a search for  $W' \rightarrow \tau\nu$  decays with a hadronically decaying tau lepton, using 2015 and 2016 pp-collision data at a center-of-mass energy of  $\sqrt{s} = 13$  TeV collected with the ATLAS detector at the Large Hadron Collider. The expected limits to the cross-sections are derived from simulation considering a Sequential Standard Model scenario, where the  $W'$  bosons have the same couplings as the Standard Model  $W$  bosons.

T 104.4 Do 17:30 JUR 2

**Search for a new heavy resonance in the decay channel  $V' \rightarrow VH \rightarrow \ell\nu/\ell\ell/\nu\nu + b\bar{b}$  with the ATLAS experiment** — ●RUTH JACOBS, ALESSANDRA BETTI, GÖTZ GAYCKEN, VADIM KOSTYUKHIN, TATJANA LENZ, ALEXANDER MELZER, ELISABETH SCHOPF, ECKHARD VON TÖRNE, and NORBERT WERMES — Physikalisches Institut, Universität Bonn

One of the aims of the LHC Run-2 is the search for BSM physics. Many BSM models predict heavy resonances with masses in the TeV range. Some of these resonances are predicted to decay into a SM Higgs boson

and a massive electroweak boson  $V = W, Z$ . A search for new heavy resonances in the decay mode  $V' \rightarrow VH \rightarrow \ell\nu/\ell\ell/\nu\nu + b\bar{b}$  using data collected with the ATLAS detector in 13 TeV  $pp$ -collisions is presented. The resonance search is performed by studying the invariant mass distribution of the reconstructed  $VH$  system and testing for a localized excess. The talk will focus on the decay channel  $Z' \rightarrow ZH \rightarrow \nu\nu + b\bar{b}$  ("0-lepton channel"), presenting studies on the SM background suppression and the optimization of the statistical model used to obtain upper limits on the resonance cross section. In addition, the statistical combination of the search results in the individual lepton channels into a combined  $V'$  cross section limit is discussed.

T 104.5 Do 17:45 JUR 2

**Search for  $W'$  decays taking into account interference effects with pp-collisions at  $\sqrt{s} = 13$  TeV in the ATLAS experiment** — ●PAUL GESSINGER and STEFAN TAPPROGGE — Johannes Gutenberg-Universität Mainz

As part of the search for new physics, the electronic decay of new heavy charged gauge bosons,  $W' \rightarrow e\nu$ , can be looked for in pp-collisions at  $\sqrt{s} = 13$  TeV in the ATLAS experiment at the LHC. Events with a lepton of high transverse momentum and high missing transverse energy are selected. If no significant excess is observed, statistical methods can be employed to calculate a lower limit on the mass of a hypothetical  $W'$  particle. Narrow resonance signal templates are used, either taking into account interference with the background processes, or neglecting it. Interference effects modify the overall signal shape and can thus impact the limit obtained. The results of both approaches will be presented and discussed.

T 104.6 Do 18:00 JUR 2

**Search for new physics in the dilepton channel with ATLAS using proton-proton collisions at  $\sqrt{s} = 13$  TeV** — ●SIMON SCHMITZ, STEFAN TAPPROGGE, and MARKUS ZINSER — Johannes Gutenberg-Universität Mainz, Institut für Physik

Decays with two leptons in the final state are considered to be one of the most promising processes to find new physics. Well understood backgrounds as well as high signal efficiencies lead to an excellent sensitivity to models beyond the Standard Model predicting a narrow resonance (for example a  $Z'$  boson) decaying into two leptons. The search is performed with final states consisting either of two electrons or two muons. The results are based on an integrated luminosity of  $36.5 \text{ fb}^{-1}$  of proton-proton collision data at  $\sqrt{s} = 13$  TeV recorded with the ATLAS detector in 2015 and 2016.

This talk presents the analysis details with a focus on the determination of the background arising from QCD processes. This background is essential to know in the dielectron channel and can not be estimated by Monte Carlo simulation. Finally the status of the analysis in both channels will be shown. Furthermore an approach to express the results of the analysis in a model-independent way allowing a comparison to a wide variety of models is presented.

T 104.7 Do 18:15 JUR 2

**A data-driven QCD background estimate in ATLAS searches for heavy  $Wh$  resonances in the final state  $\ell\nu b\bar{b}$**  — ●ANDREAS HÖNLE, SANDRA KORTNER, HUBERT KROHA, and FELIX MÜLLER — Max-Planck-Institut für Physik

Many extensions of the Standard Model (SM) predict the existence of heavy resonances that decay into boson pairs. A promising channel is the decay of a heavy  $W'$  resonance into a charged SM vector boson  $W$  and the SM Higgs boson  $h$ , followed by a semi-leptonic decay into the final state  $\ell\nu b\bar{b}$ . Multijet background, originating from QCD processes, is difficult to describe with Monte Carlo simulations and is thus particularly challenging to model. In this talk, two data-driven methods to estimate this background are presented: the Template Method and the ABCD method.

T 104.8 Do 18:30 JUR 2

**Model-Independent Limits on the Production Cross Section of Diboson Resonances with the CMS-Detector at  $\sqrt{s} = 13$  TeV** — MATTHIAS MOZER, THOMAS MÜLLER, and ●DANIELA SCHÄFER — Institut für Experimentelle Kernphysik/KIT

Due to the multitude of theoretical models describing physics beyond

the standard model, only a fraction of the existing models can be considered by a dedicated analysis by one of the experimental groups at the LHC. In this talk we present a framework which provides a model-independent interpretation of two CMS resonance searches in the diboson channel.

As a first step towards this goal, model-independent limits on the production cross section of diboson resonances with semileptonic or hadronic final states are extracted. For this, data collected by the CMS detector at a center of mass energy of  $\sqrt{s} = 13$  TeV corresponding to an integrated luminosity of  $2.3(2.7) \text{ fb}^{-1}$  are analyzed. Based on these limits we provide a ready-to-use framework, which enables theorists to calculate the approximate signal yield predictions of their theories. As a proof-of-concept the provided framework is applied to a Randall-Sundrum model.

T 104.9 Do 18:45 JUR 2

**Suche nach  $X \rightarrow t\bar{t}$  Resonanzen mittels der Methode *Buckets of tops* im ATLAS Experiment** — ●MATHIS KOLB, CHRISTOPH ANDERS, DANILO FERREIRA DE LIMA und ANDRÉ SCHÖNING — Physikalisches Institut, Universität Heidelberg, Deutschland

In Modellen für neue Physik koppeln neue schwere Teilchen häufig an

Top Quarks. Daher stellt die Suche nach Resonanzen im invarianten Massenspektrum von Top Quark Paaren ein vielversprechendes Mittel dar, um Erweiterungen des Standardmodells zu testen. Dieser Vortrag behandelt die Suche nach solchen schweren Resonanzen mit den in 2016 aufgezeichneten Proton-Proton ATLAS Daten, wobei beide Top Quarks hadronisch zerfallen. Die Analyse konzentriert sich auf eine Verbesserung der Sensitivität bei niedrigen Ditop Massen unterhalb von 1 TeV.

Zur Rekonstruktion des Top Quark Paar Systems wird die Methode *Buckets of tops*, wie in JHEP 08 (2013) 086 vorgeschlagen, verwendet. Die Methode eignet sich insbesondere für moderate transversale Impulse der Top Quarks im Bereich  $p_T = 100 - 400$  GeV. So bietet sie die Möglichkeit Methoden, die auf Substruktur großer R-Jets basieren, zu ergänzen. Es werden anti- $k_T$  ( $R = 0.4$ ) Jets in drei *Buckets* aufgeteilt. Diese entsprechen den beiden Top Quarks und der weiteren hadronischen Aktivität.

Die größten Untergründe, bestehend aus Standardmodell Top Quark Paaren und QCD Multijets, werden mittels Kontrollregionen in Daten abgeschätzt und validiert. Die Daten werden analysiert und entsprechende Ergebnisse werden präsentiert.