T 63: Top-Quarks: Paarproduktion

Zeit: Dienstag 16:45–18:45 Raum: P104

T 63.1 Di 16:45 P104

Search for $t\bar{t}$ resonances with the CMS-detector — Daniel Gonzalez, Johannes Haller, Roman Kogler, •Vilius Kripas, and Thomas Peiffer — Institut für Experimentalphysik, Universität Hamburg

A search for resonances in $t\bar{t}$ production at the LHC is presented. The top quark is the heaviest known quark and there are many theoretical extensions of the SM which predict $t\bar{t}$ production via the exchange of a heavy new particle. For high resonance masses the decay products of the top quarks do not occur as isolated leptons or individual jets due to the high Lorentz boost. Therefore, special analysis methods including jet substructure algorithms and specific isolation criteria are used. In this talk the methods for the selection of top quark pairs in the lepton+jets decay channel are presented. The use of advanced top-tagging and b-tagging algorithms within jet substructure is discussed. The invariant mass distribution of the $t\bar{t}$ system is used to determine exclusion limits for $t\bar{t}$ resonances in various models of new physics.

T 63.2 Di 17:00 P104

Messung des $t\bar{t}$-Wirkungsquerschnitts bei hohen invarianten Massen am LHC — Johannes Haller, Roman Kogler, Thomas Peiffer und •Marc Stöver — Institut für Experimentalphysik, Universität Hamburg

Aufgrund seiner großen Masse spielt das Top-Quark eine entscheidene Rolle bei der Suche nach neuer Physik am LHC. So werden beispielsweise von mehreren theoretischen Modellen Resonanzen bei hohen Massen in der Produktion von $t\bar{t}$-Paaren vorhergesagt.

Bei einer Schwerpunktsenergie von 8 TeV und einer integrierten Luminosität von $19,7\,\mathrm{fb}^{-1}$ wird eine Messung des $t\bar{t}$-Wirkungsquerschnitts bis hin zu sehr hohen invarianten Massen am CMS-Experiment durchgeführt. Dazu werden Ereignisse im Myon+Jets-Zerfallskanal von Top-Quark-Paaren selektiert. Die Wirkungsquerschnitts-Messung wird mit Hilfe einer regularisierten Entfaltungsmethode durchgeführt.

T 63.3 Di 17:15 P104

Suche nach $t\bar{t}$ Resonanzen im Lepton+Jets-Kanal — Julien Caudron, Sabrina Groh, •Tobias Heck und Lucia Masetti — Johannes Gutenberg Universität Mainz

In vielen Erweiterungen des Standardmodells zerfallen neue schwere Teilchen (wie Z' oder Kaluza-Klein Gluonen) bevorzugt in Top-Antitop Paare. Das ATLAS Experiment am LHC hat im Jahr 2012 21.3 fb^{-1} an Daten aufgezeichnet, womit eine gesteigerte Sensitivität auf Resonanzen mit einer invarianten Masse von einigen TeV einhergeht. Es wird die Suche nach solchen schweren Resonanzen durch Rekonstruktion von Top-Antitop Zerfällen im Lepton+Jets Kanal in voll aufgelösten (klar separierte Zerfallsprodukte) sowie geboosteten (kollimierte Zerfallsprodukte) Topologien vorgestellt. Für die geboosteten Topologien werden verschiedene Techniken zur Rekonstruktion des hadronisch zerfallenden top Quarks ($t \to Wb \to qqb$) mit so genannten TopTaggern präsentiert. Neben dem ATLAS TopTagger wird insbesondere der *HepTopTagger* Algorithmus und dessen Optimierung auf größere Signal-Effizienzen für den Lepton+Jets Kanal vorgestellt.

T 63.4 Di 17:30 P104

Suche nach schweren Resonanzen mit dem HEPTopTagger in pp-Kollisionen bei $\sqrt{s} = 8$ TeV mit dem ATLAS-Experiment — •Christoph Anders, Maddalena Giulini, Sebastian Schätzel und André Schöning — Physikalisches Institut, Universität Heidelberg

Schwere Resonanzen, die in zwei Topquarks zerfallen, werden im vollhadronischen Endzustand in Proton-Proton-Kollisionsdaten gesucht, die im Jahr 2012 bei einer Schwerpunktsenergie von 8 TeV mit dem ATLAS-Detektor aufgezeichnet wurden.

Der auf der Analyse der Zerfallsstruktur basierende HEPTopTagger wird verwendet, um Multijetproduktion zu unterdrücken. Zusätzlich wird verlangt, dass sich den Topquarkkandidaten jeweils ein Bottomquarkzerfall zuordnen lässt. Die dominanten Untergründe, $t\bar{t}$- und Multijetproduktion, lassen sich mit Hilfe von Daten in Kontrollregionen abschätzen.

Die Daten werden mit den erwarteten Standardmodelluntergründen verglichen und für verschiedene Modelle Neuer Physik mit statistischen Methoden interpretiert.

T 63.5 Di 17:45 P104

Variable-R Jets for $t\bar{t}$ Resonance Searches with the ATLAS detector — •Katharina Behr and Çiğdem Işsever — Subdepartment of Particle Physics, University of Oxford, Denys-Wilkinson Building, Keble Road, Oxford OX1 3RH, United Kingdom

Heavy exotic resonances that decay to $t\bar{t}$ pairs are predicted by a range of extensions to the Standard Model such as Randall-Sundrum warped extra-dimension or top-colour assisted technicolour models. Current searches based on Run-I LHC data set lower exclusion limits on the resonance masses for benchmark models in the TeV range. The top quarks from these resonance decays typically have large transverse momenta $p_{T,top}$ ("boosted" top quarks) and the separation between their decay products decreases inversely with $p_{T,top}$ which makes the decay products likely to overlap and thereby difficult to resolve. Instead of reconstructing the individual decay products current (hadronic) top taggers therefore treat boosted top quarks as a single large-R jet with fixed R-parameter.

We show that these fixed-R jets over-estimate the real top jet size which decreases like $p_{T,top}^{-1}$ and that jets for which R scales like $p_{T,top}^{-1}$ (Variable-R jets) provide a more natural description of boosted hadronic top quarks while - due to their smaller areas - suffering significantly less from soft contaminations introduced by pile-up and the Underlying Event than large fixed-R jets. In this talk, I will discuss both the choice of jet parameters and the performance of Variable-R jets in searches for new physics in final states with boosted top quarks.

T 63.6 Di 18:00 P104

Search for $t\bar{t}$ resonances in the full hadronic final state with the CMS Detector — Rebekka Höing, Ivan Marchesini, Alexander Schmidt, and •Emanuele Usai — Universität Hamburg

A search for new physics in the form of high-mass particles decaying to highly-energetic top quark-antiquark pairs is performed using 19.7 fb^{-1} of proton-proton collisions at a center-of-mass energy of 8 TeV collected with the CMS detector.

In this search the decay products of the top quarks are boosted and cannot be reconstructed as separate jets. Top tagging algorithm are then used to reconstruct the top decay.

For moderately boosted regimes the HEPTopTagger algorithm is used, while for higly boosted regimes the CMSTopTagger is used.

Jet substructure tools, in addition to newly developed techniques of b-tagging in boosted topologies, are employed to reduce the QCD multijet background and improve the sensitivity of the analysis.

Exclusion limits are set for several physics models, including both wide and narrow Z' resonance production.

T 63.7 Di 18:15 P104

Observables to distinguish BSM Z'->ttbar signal vs QCD/W+jets in leptonic top decay at ATLAS — •Madalina Stanescu-Bellu — DESY, Zeuthen, Deutschland

Searching for new physics in ttbar events requires efficient reconstruction of the top quarks, on a large ttbar mass spectrum. For tops produced at low energies, the decay products are well separated (resolved). The tops produced through a heavy resonance are boosted in pT and their decay products are collimated in a narrow cone, forming a monojet topology with substructure. The main challenge is to distinguish the top mono-jets from SM background, such as QCD di-jets and W+jets: hadronically decaying tops (q+q'+b) by the jet substructure; leptonically decaying tops (l+b+nu) by the lepton embedded in a leptonic top mono-jet. Some observables distinguish as well events with prompt (good) muons vs decay muons within the same Z'->ttbar signal samples. Also the energy corrections are investigated, that are needed to ballance the leptonic top mono-jet with the hadronic top mono-jet.

T 63.8 Di 18:30 P104

Application of the matrix element method to top quark physics and searches at ATLAS — •Maike Hansen, Philip Bechtle, Ian C. Brock, Klaus Desch, Petra Haefner, and Thomas Velz — Universität Bonn

The matrix element method has proven to yield a very precise measurement of the top quark mass at Tevatron. It is designed to extract the

maximum amount of information from each single event. The method is based on a likelihood maximisation. The likelihood function is defined by the probability that a set of measurements results from a certain process (i.e. a top quark decay) given a set of parameters. In the calculation, all possible permutations as well as all possible initial states and the detector resolution are taken into account. This method is also highly promising in searches for new physics where we expect low statistics and therefore need a very precise measurement. Here we benefit from the fact that the full kinematic information is used.

Two applications of the matrix element method were studied: First, a top-quark mass determination on fully-reconstructed ATLAS pseudo data has been performed. Second, the matrix element method has been extended to search for $t\bar{t}$ resonances in the minimal universal extra dimension (MUED) model. For the $t\bar{t}$-resonance search, a likelihood ratio test and a signal fraction measurement based directly on the matrix element likelihood have been performed and tested on simulated events at generator level. As a $t\bar{t}$-resonance candidate, a second Kaluza-Klein excitation of the gluon was assumed.