T 35: Top-Quarks 3

Zeit: Montag 16:45–19:00 Raum: HSZ-02

T 35.1 Mo 16:45 HSZ-02

Probing TTGamma at the CMS Experiment — Markus Backes, Günter Flügge, Heiko Geenen, Wael Haj Ahmad, Felix Höhle, Yvonne Küssel, Oliver Pooth, Achim Stahl, and •Heiner Tholen — III. Physikalisches Institut; RWTH Aachen

Photon radiation associated top quark pair production is investigated to quantify the electromagnetic coupling of quarks. The top-quark couplings are expected to be sensitive to effects of physics beyond the Standard Model. Generally, such effects can be spotted by probing top-correlated photon observables. We present a measurement of the inclusive cross section of the top-pair plus photon production, taking the course of a cumulative approach. Using a cut based event selection, we focus on top-pair events in the muon+jets channel with an additional high-energetic and well-isolated photon. The signal process ($pp \to q\bar{q}b\bar{b}\mu\nu_\mu\gamma$) is simulated with the LO event generator WHIZARD. A template-fit technique is applied to estimate the misidentification rate of photons in selected events. Preliminary results are presented with CMS-recorded data at sqrt(s)=8 TeV.

T 35.2 Mo 17:00 HSZ-02

Study of Anomalous Couplings in the ttgamma Vertex with the CMS Experiment — •Markus Backes, Günter Flügge, Heiko Geenen, Wael Haj Ahmad, Felix Höhle, Yvonne Küssel, Oliver Pooth, Achim Stahl, and Heiner Tholen — III. Physikalisches Institut B, RWTH Aachen

We investigate the top quark pair production with an associated photon in the final state to examine the electromagnetic top quark coupling. Among other observables, a deviation in the shape of the photon energy spectrum with respect to Standard Model predictions would indicate modifications in the ttgamma vertex and therefore reveal new physics. A Monte Carlo benchmark study is performed using the generator tool WHIZARD. A cut based event selection is implemented to focus on top pair events in the muon+jets channel. On top of this preselection, ttgamma candidates are identified by requiring a well isolated, high energetic photon. Preliminary results about the sensitivity of appropriate observables are obtained using Monte Carlo simulated events which are then compared to data collected with the CMS detector at LHC.

T 35.3 Mo 17:15 HSZ-02

Messung des inklusiven $t\bar{t}\gamma$-Wirkungsquerschnittes mit dem ATLAS-Detektor — •Oliver Rosenthal und Ivor Fleck — Universität Siegen

Die Analyse von Top-Quark-Paar-Ereignissen mit einem zusätzlichen abgestrahlten Photon ($t\bar{t}\gamma$) ermöglicht die direkte Untersuchung der elektromagnetischen Kopplung und der elektrischen Ladung des Top-Quarks. Der inklusive $t\bar{t}\gamma$-Wirkungsquerschnitt im Lepton+Jets-Zerfallskanal wurde nun bei einer Schwerpunktsenergie von $\sqrt{s} = 7\,\text{TeV}$ mit dem ATLAS-Detektor gemessen. Dazu wurde der gesamte aufgezeichnete Datensatz des Jahres 2011 mit einer integrierten Luminosität von $4,7\,\text{fb}^{-1}$ analysiert.
Bei der Messung nutzt man aus, dass Signal-Photonen wesentlich isolierter sind als Untergrund-Photonen, die hauptsächlich aus dem Prozess $\pi^0 \to \gamma\gamma$ stammen. So wurden Signal- und Untergrund-Templates der absoluten Photon-Spurisolation aus Daten bestimmt und anhand eines Likelihood-Fits der $t\bar{t}\gamma$-Ereigniskandidaten an diese Templates der $t\bar{t}\gamma$-Wirkungsquerschnitt berechnet.
Dieser Vortrag beschreibt die Methoden dieser Analyse, darunter die Herleitung der Templates und die Bestimmung der Prompt-Photon-Untergründe wie W+jets+γ und QCD+γ, und zeigt das Endergebnis der Messung.

T 35.4 Mo 17:30 HSZ-02

Reconstruction of the $t\bar{t}$ system in the dilepton channel using Neutrino Weighting — Kevin Kröninger, Arnulf Quadt, Elizaveta Shabalina, and •Tamara Vázquez Schröder — Georg-August-Universität, Göttingen, Germany

Top-quark pairs can decay in three different modes: 4/9th fully hadronic, 4/9th semileptonic and 1/9th dileptonic. The dilepton decay channel has two charged leptons and two neutrinos in the final state. It has a low branching fraction, but few background processes. Neutrinos escape direct detection but their presence can be inferred via an excess of missing transverse energy in the event. Due to the presence of two neutrinos in the final state, there is not enough information in the event to define kinematics and fully reconstruct the event. Kinematics are underconstrained by one degree of freedom. The neutrino weighting approach is used to reconstruct top events in the dilepton channel by assuming a neutrino rapidity distribution from Standard Model expectations and a top quark mass a priori. Event weights are then derived per event from comparing calculated and reconstructed missing transverse momentum for each top quark mass hypothesis, taking into account the detector resolution of the missing transverse energy. The neutrino weighting algorithm is now implemented in the KLFitter framework, having the option of choosing the best permutation of jets and so being able to reconstruct the top quark kinematics. This talk will focus on the neutrino weighting approach inside KLFitter and the possible implementation of this reconstruction code in a top mass measurement in the dilepton channel.

T 35.5 Mo 17:45 HSZ-02

Studies of Systematic Uncertainties with Profile Likelihood Fits at ATLAS — Andrea Knue, Kevin Kröninger, Arnulf Quadt, and •Philipp Stolte — II. Physikalisches Institut, Georg-August-Universität Göttingen

Profile likelihood fits constitute a comparatively new and promising fitting technique which can be applied to a variety of measurements. Those fits are based on the idea of constraining relevant systematic effects via additional fit parameters, so-called nuisance parameters, using data. Each source of systematic uncertainties is associated with a nuisance parameter added to the statistical model. In contrast to a standard likelihood, a profile likelihood is then maximised with respect to these nuisance parameters.

In this talk, studies of systematic uncertainties with profile likelihood fits are presented in the context of a W boson polarisation measurement in top quark pair decays using data recorded with the ATLAS detector at the LHC.

The profile likelihood fits described in this talk are based on template fits, which are covered as a starting point. Emphasis is then placed on investigating the general performance and possible strengths of profile likelihood fits by testing various interpolation methods, but also on validating the stability and the modelling of the fit in more detail. It is furthermore briefly discussed which systematic effects can be associated with nuisance parameters.

T 35.6 Mo 18:00 HSZ-02

Performance comparison of different top tagging techniques with the ATLAS detector — Geoffrey Herbert[1], •Christoph Eckardt[1], Heiko Lacker[1], and Elin Bergeaas Kuutmann[2] — [1]fourthgen@lists.hu-berlin.de — [2]elin.bergeaas.kuutmann@desy.de

Searches for New Physics at the Large Hadron Collider push the search limits of heavy particles to higher and higher mass values. In a variety of cases these heavy particles can decay into final states containing top quarks, which can be highly energetic and boosted, such that the decay products merge in the detector. Reconstruction techniques using fat-jets, also known as top taggers, are then useful. In this talk, a performance comparison between different top taggers is presented.

T 35.7 Mo 18:15 HSZ-02

Observables to identify leptonically decaying top quarks at high energies in ATLAS — •Madalina Stanescu-Bellu — DESY

Searching for new physics in ttbar events requires efficient reconstruction of the top quarks, over a large range in the invariant ttbar mass. For tops produced at low energies, the decay products are well separated. The tops produced at high energies are boosted and their decay products are collimated in a narrow cone. The main challenge is to distinguish the top quarks from SM background, such as W+jets. For leptonically decaying tops (l+b+neutrino), this is done by a lepton close to a b-jet. The topic of this study is the leptonically decaying boosted tops and the observables to distinguish the lepton from the close distanced b(c) jet. Such observables are the invariant mass of the jet, the fraction of the lepton momentum from the total jet momentum, and the relative isolation. These observables are compared for SM ttbar decays and ttbar pairs originating from a hypothetical heavy

particle Z'.

T 35.8 Mo 18:30 HSZ-02

Application of the Matrix Element Method to top quark physics at ATLAS — •Maike Hansen, Philip Bechtle, Ian C. Brock, Klaus Desch, Petra Haefner, and Thomas Loddenkötter — University of 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 measurement. The method is based on a likelihood maximization. A single likelihood function is taken as the probability that a measurement results from a certain process (i.e. a top quark decay) given a signal hypothesis and a set of parameters. The single event probabilities are then combined to one probability for the whole sample taking into account all possible permutations as well as all possible initial states and the detector resolution.

This method is 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. The application of this method in a top quark mass measurement as well as possible extensions to non standard model physics will be discussed. It is planned to apply this method in a search for $t\bar{t}$-resonances.

T 35.9 Mo 18:45 HSZ-02

Reconstruction of hadronic top quark decays in boosted event topologies at ATLAS — •Christoph Wasicki — DESY, Zeuthen, Germany

Several models beyond the Standard Model postulate heavy particles decaying predominantly into top pairs. For particle masses above 1 TeV top pairs become highly boosted and its jets in purely hadronic top decays merge and cannot be resolved experimentally.

New methods to identify and reconstruct boosted top pair events with the ATLAS detector are presented which make use of substructure observables such as jet shapes and masses to identify the individual hadronic decay products.