T 38: Top-Quarks: Single-Top 1

Zeit: Dienstag 16:45–18:15 Raum: HSZ-04

T 38.1 Di 16:45 HSZ-04

Single Top Quark Production through Flavour Changing Neutral Currents — •Ozan Arslan[1], Ian C. Brock[1], and Dominic Hirshbuehl[2] — [1]Physikalisches Institute, Bonn, Germany — [2]University of Wuppertal, Wuppertal, Germany

Flavour Changing Neutral Current (FCNC) processes are highly suppressed in the Standard Model due to Glashow-Iliopoulos-Maiani (GIM) mechanism. However, in some extensions of the Standard Model such as supersymmetry (SUSY) and the 2-Higgs doublet model, the FCNC contributes at tree level, enhancing the branching ratio significantly. The FCNC are searched for single top-quark production where a u(c)-quark interacts with a gluon, producing a single top-quark with no associated quark production. The data collected by the ATLAS detector during year 2012 is used with a center-of-mass energy of $\sqrt{s} = 8$ TeV, corresponding to an integrated luminosity of $\sim$20 fb^{-1}. The candidate signal events are selected by requiring one lepton, muon or electron, missing transverse momentum and exactly one jet originating from a b-quark in the final state. The separation between the signal and background events is enhanced by using neural network algorithms. The cross section upper limit at 95% C.L. is calculated following Bayesian statistical approach using a binned likelihood method calculated from the full neural network output.

T 38.2 Di 17:00 HSZ-04

Search for Single Top Quark Production via Flavour Changing Neutral Currents in 8 TeV ATLAS data — •Conrad Friedrich — Deutsches Elektronen-Synchrotron (DESY), Zeuthen, Germany

In the Standard Model (SM) single top quarks are produced via charged current interactions with the W boson. Transitions between top quarks and other quark flavours mediated by neutral gauge bosons, so-called Flavour Changing Neutral Currents (FCNC), are forbidden at tree level and highly suppressed at higher orders due to the Glashow-Iliopoulos-Maiani (GIM) mechanism. However, there exist several new physics models, which significantly enhance their rate compared to the Standard Model predictions by allowing for FCNC interactions already at tree level and / or introducing new particles in higher order loop diagrams. Therefore any observation of such processes would be a strong indirect indicator for new physics.

In this analysis data collected with the ATLAS detector at a center-of-mass energy of $\sqrt{s} = 8$ TeV are searched for FCNC events in which a light quark (u,c) interacts with a gluon to produce a single top quark with or without the associated production of another quark or gluon. Candidate events of top quarks decaying leptonically are selected and classified into signal- and background-like events using a neural network. If no signal is observed, new upper limits on the production cross-sections multiplied by the t→Wb branching fraction and the coupling strengths of the involved FCNC interactions can be placed.

T 38.3 Di 17:15 HSZ-04

Single top quark production in the *Wt* channel at ATLAS with 2011 data — •Jan A. Stillings, Ian C. Brock, Irina Cioară, Thomas Loddenkötter, Sebastian Mergelmeyer, and Pienpen Seema — Physikalisches Institut, Universität Bonn

Single top quark production is the second largest source of top quarks from proton-proton collisions at the LHC. It has a lower cross-section than the $t\bar{t}$ production process and is also harder to separate from the background. There are several channels which produce single top quarks in the final state. Of these, the Wt channel is expected to have a measurable contribution. Its decay topology consists of a hard b-quark jet originating from the top quark decay as well as two W bosons. The analysis presented focuses on the lepton+jets channel where one W boson decays hadronically and the other one decays leptonically. In this talk, the isolation of the signal using an artificial neural network and the extraction of the signal from the resulting combined variable is presented using ATLAS pp collision data from the year 2011.

T 38.4 Di 17:30 HSZ-04

Application of kinematic fitting in Wt associated production analysis at ATLAS — •Irina Cioară, Ian C. Brock, Thomas Loddenkötter, Pienpen Seema, Sebastian Mergelmeyer, and Jan A. Stillings — Physikalisches Institut, Universität Bonn

One of the largest contributions to single top quark production at the LHC comes from the associated production of a top quark and a real W boson (Wt channel). The lepton + jets decay topology of this channel produces one b-jet, one charged lepton, two light-quark jets and one neutrino.
The main sources of background for the Wt signal are top quark pair production and events with a W boson and extra jets. A kinematic fit to the signal topology is performed in order to construct variables that are directly sensitive to how much an event looks like Wt signal. Additionally, a kinematic fit on the $t\bar{t}$ topology is implemented and its effect on the signal extraction in the 4-jet bin is studied. An artificial neural network is used to separate signal from background using the event kinematics and the information from the kinematic fit.

T 38.5 Di 17:45 HSZ-04

Monte Carlo generator comparison for the Wt-channel of single top-quark production — •Pienpen Seema, Ian C. Brock, Irina Cioară, Thomas Loddenkötter, Sebastian Mergelmeyer, and Jan A. Stillings — Physikalisches Institut, University of Bonn

Single top-quark production in the Wt-channel is the second most important production channel at the LHC. At next-to-leading-order (NLO) the problem arises that $t\bar{t}$ diagrams (with one subsequently decaying top quark) contribute to the Wt channel, such that the NLO corrections are much larger than the LO cross section itself. In order to recover a meaningful definition of the Wt channel at NLO, these contributions therefore have to be removed somehow. This is only possible if there is no interference between the "Wt-like" and the "$t\bar{t}$-like" diagrams. In NLO MC generators two different schemes to get rid of the $t\bar{t}$-like diagrams are implemented. These are called diagram removal and diagram subtraction. These are designed such that if they yield the same results, one can conclude that the interference is small and therefore the Wt channel is well-defined. Therefore it is important to investigate the differences between different generators.

This contribution will discuss results for Monte Carlo generator comparison for the Wt-channel single top-quark production in the lepton+jets mode in proton-proton collisions at a center-of-mass energy of $\sqrt{s} = 8$ TeV with the ATLAS detector.

T 38.6 Di 18:00 HSZ-04

W-associated production of single top-quarks decaying into leptons and jets (ATLAS) — •Sebastian Mergelmeyer, Ian C. Brock, Irina Cioară, Thomas Loddenkötter, Pienpen Seema, and Jan A. Stillings — Universität Bonn

Single top-quark production has a sizable contribution to the overall top-quark production cross-section at the LHC, opening an opportunity to probe electroweak couplings and discover new physics. One important production mode is the creation of a top quark in association with a W boson (Wt mode), which has so far eluded discovery. The close similarity of its final state to that of top-quark pair production, with its $\sim$10 times larger cross section, makes the measurement a challenging endeavour.

This analysis focuses on events with one lepton, three jets, one of which is a b-quark jet, and missing transverse energy. Multivariate techniques with carefully chosen variables are used to discriminate the Wt signal from its major background, at the same time keeping ever-present systematic uncertainties under control. Results based on $\sim 25\,\text{fb}^{-1}$ of pp-collision data recorded with the ATLAS detector at $\sqrt{s} = 8$ TeV are presented.