Workshop on single top physics and fourth generation quarks

Report of Contributions

https://indico.desy.de/e/2161

Contribution ID: **0** Type: **not specified**

Welcome

Contribution ID: **1** Type: **not specified**

Welcome

Contribution ID: **2** Type: **not specified**

Welcome

Monday 14 September 2009 13:00 (15 minutes)

Presenter: Dr SCHOERNER-SADENIUS, Thomas (DESY)

Session Classification: Single Top-Quark Production at the LHC

Contribution ID: **3** Type: **not specified**

Progress in single top predictions and simulations

Monday 14 September 2009 13:15 (1 hour)

I review the state-of-the-art of the theoretical predictions and the MC tools for single-top production (s-channel, t-channel and Wt) at the Tevatron and the LHC. Special attention will be devoted to the recent progress in the description of t-channel production of top and fourth generation quarks.

Presenter: Prof. MALTONI, Fabio (University of Louvain)

Session Classification: Single Top-Quark Production at the LHC

Contribution ID: **4** Type: **not specified**

Prosepcts of the measurement of single top quark production with ATLAS

Monday 14 September 2009 14:25 (30 minutes)

At the LHC single top-quarks will be produced at a high rate corresponding to a third of the top-quark pair-production. In addition to the direct access to the CKM matrix element Vtb, single top-quark production is also sensitive to the existence of new heavy gauge bosons, forth generation quarks and various other new physics phenomena. Methods developed to optimize the selection of single top-quark events in the three production channels are presented and the potential for the cross-section measurements for different integrated luminosities is established. The measurements are dominated by systematic uncertainties and show the need for early strategies devoted to control of experimental biases, modeling effects and reliable background determinations.

Presenter: Dr HIRSCHBUEHL, Dominic (Bergische Universität Wuppertal)

Session Classification: Single Top-Quark Production at the LHC

Contribution ID: **5** Type: **not specified**

Single Top Strategies and Potentials at CMS

Monday 14 September 2009 15:05 (30 minutes)

An overview of the activities of the CMS single top group is given with emphasis on the t-channel modeling and an early single top analysis. The selection and analysis strategies of such an analysis are summarized and the prospects are presented assuming an integrated luminosity of 200/pb at a centre-of-mass energy of 10TeV.

Presenter: Dr WAGNER-KUHR, Jeannine (Karlsruher Institut für Technologie (KIT))

Session Classification: Single Top-Quark Production at the LHC

Contribution ID: **6** Type: **not specified**

The b-Quark Distributions in the Nucleon

Monday 14 September 2009 16:15 (50 minutes)

A brief introduction into the concept of heavy-quark parton distribution functions (PDFs) is given with a particular discussion of the theoretical limitations on use of the b-quarks PDFs. The nucleon b-quark PDFs derived by different groups are compared and different sources of theoretical and experimental uncertainties are assessed. Impact of the uncertainties in the b-quark partonic luminosities on the single-top production cross sections is estimated.

Presenter: Dr ALEKHIN, Sergey

Session Classification: Parton Distribution Functions and Experimental Techniques

Contribution ID: **7** Type: **not specified**

Prospects for b-tagging techniques at the LHC experiments

Tuesday 15 September 2009 11:45 (25 minutes)

The identification of jets originating from a b quark is called b-tagging. It takes advantage of several of the b quark's properties such as the relatively long lifetime of the b-hadron and the therefore existing secondary vertex in the jet. The use of b-tagging is an essential ingredient for the selection of single top events. These contain a b quark from the top quark decay, which makes it possible to distinguish them from events containing only jets from light quarks. There are several b-tagging techniques, most of them requiring a well understood detector. However, there are also some algorithms with decreased performance that are suitable for first data. In this talk an overview over the most important b-tagging algorithms is given. It is motivated why b-tagging is powerful for top quark measurements. The expected performance of selected taggers suitable for either first data or later at ATLAS and CMS is shown.

Presenter: LANGE, Clemens (DESY Zeuthen)

Session Classification: Strategies

Contribution ID: **8** Type: **not specified**

Trigger Strategies for top and 4th Generation Quarks

Tuesday 15 September 2009 11:20 (25 minutes)

The ATLAS and CMS trigger systems have been designed to cope with unprecedented luminosities and accelerator bunch-crossing conditions. Trigger selections have been designed to have high efficiency for SM processes. Top-quark production is one of those for which the trigger efficiency is expected to be very high. This should ensure high efficiency for single top and fourth-generation quarks. We will review the present trigger strategies and their commissioning with early collision data as well as possible improvements in view of exploring the most challenging fourth-generation quark signatures.

Presenter: FELCINI, Marta (University College Dublin)

Session Classification: Strategies

Contribution ID: **9** Type: **not specified**

Search for 4th generation fermions: Motivation, status and prospects

Tuesday 15 September 2009 09:00 (55 minutes)

Current data do not exclude the existence of an additional sequential 4th generation of leptons and quarks. Such a natural extension of the standard model content has some interesting features: the possibility of gauge coupling unification without supersymmetry, a possible particular role of such particles in electroweak symmetry breaking and a sufficiently large amount of CP violation for baryogenesis.
Constraints on mass differences between these hypothetical new particles are provided by the electroweak precision fit. Direct mass limits have been obtained at LEPI/II and the Tevatron. Constraints on mixing matrix elements have been discussed in the literature. A complete and consistent picture, however, is still missing.
The LHC offers a unique opportunity to look for 4th generation fermions. In case of a discovery there will be important consequences for the Higgs phenomenology and we expect also indirect signals in flavour physics.

Presenter: Prof. LACKER, Heiko (Humboldt Universität zu Berlin)

Session Classification: A Fourth Generation of Fermions

Contribution ID: **10** Type: **not specified**

4th Generations and Higgs Physics

Tuesday 15 September 2009 10:05 (25 minutes)

Presenter: Prof. PLEHN, Tilman (University of Edinburgh & MPI Muenchen)

Session Classification: A Fourth Generation of Fermions

Contribution ID: **11** Type: **not specified**

Bounds on a Fourth Generation of Quarks Using Unitarity Constraints

Tuesday 15 September 2009 10:35 (20 minutes)

We perform an exploratory study of the allowed parameter range for the CKM-like mixing of hypothetical quarks of a fourth generation. As experimental constraints we use the tree-level determinations of the 3X3 CKM elements and FCNC processes (K-, D-, B_d-, B_s-mixing and the decay b->s gamma) under the assumption that the 4X4 CKM-matrix is unitary. For the FCNCs we use some simplifying assumptions concerning the QCD corrections. Typically small mixing with the fourth family is favoured, but contrary to expectation we find that also a quite large mixing with the 4th family is not yet excluded. This might change if electro-weak precision observables are also included to the bounds.

Presenter: Dr LENZ, Alexander (Universität Regensburg)

Session Classification: A Fourth Generation of Fermions

Contribution ID: **13** Type: **not specified**

Single-top t-channel cross section studies at 200 pb^-1 for ATLAS

Monday 14 September 2009 17:45 (25 minutes)

We study electro-weak single-top quark production t-channel process at 10 TeV center-of-mass energy of the LHC. The analysis has been performed for anticipated 200 pb^-1 integrated luminosity using ATLAS Monte Carlo pseudo-data. We investigate cut based analysis optimization for t-channel into an electron final state. The main systematic uncertainty sources (jet energy scale, background normalization and etc.) to the cross section measurement have been considered in the optimization procedure. All main SM background processes (tT, W(bb)+jets, Z+jets, di-Boson, Wt) were included in the study.

Presenter: KHORIAULI, Gia (Universität Bonn)

Session Classification: Parton Distribution Functions and Experimental Techniques

Contribution ID: **14** Type: **not specified**

Angular correlations in t-channel single top production at the LHC

Monday 14 September 2009 17:15 (20 minutes)

When a top quark decays there is a large amount of angular correlation, in its rest frame, between its spin orientation and the direction of flight of the charged lepton from its decay. In this letter we investigate the prospects of measuring this angular correlation using the MC@NLO framework. The strength of the correlation is investigated for different spin bases. The robustness against variations of PDF sets and uncertainties, factorization scale dependence, center-of-mass energy, and the jet R-parameter, is also examined.

Presenter: Dr MOTYLINSKI, Patrick (Universität Freiburg)

Session Classification: Parton Distribution Functions and Experimental Techniques

Contribution ID: **15** Type: **not specified**

Analysis Methods

Contribution ID: **16** Type: **not specified**

Strategies for First Data

Tuesday 15 September 2009 12:10 (40 minutes)

The search for Single Top process at LHC using first data will involve several steps, from the identification and reconstruction of objects that characterize Single Top signature (lepton, missing transverse energy, b-jet) to the reduction and modeling of the main backgrounds (multijet, W+jets, ttbar) and the selection of a purified signal sample using advanced statistical techniques. The measurement of the signal itself will require a carefull estimate of all systematic effects that affect the precision. This talk will review the strategies and methods to reach these goals and will present the expected sensitivity for Single Top cross section measurement using early data.

Presenter: DONINI, Julien (Universite Joseph Fourier Grenoble)

Session Classification: Strategies

Contribution ID: **17** Type: **not specified**

Workshop Summary

Tuesday 15 September 2009 12:50 (20 minutes)

Presenter: ZUR NEDDEN, Martin (Humboldt-Universitaet zu Berlin)

Session Classification: Strategies

Contribution ID: **18** Type: **not specified**

Estimating the W+jets background in single-top selections by a fraction fitting method

Monday 14 September 2009 18:10 (20 minutes)

At LHC single top quarks will be produced with more than 1 million events every year, a precise measurement of the cross section and comparing it with theoretical predictions will provide a crucial test of SM. For this reason the samples have to be purified from the background as much as possible and the remnant backgrounds such as W+jets and ttbar after cuts have to be measured. One of the robust methods is the fraction fitting where uncertainties coming from the data and MC are taken into account. In this study a fraction fitting method was applied in order to measure the W+jets and Z+jets background fractions and it was tested on a pseudo-dataset of muon final state events.

Presenter: ALHROOB, Muhammad (Uni-Bonn)

Session Classification: Parton Distribution Functions and Experimental Techniques