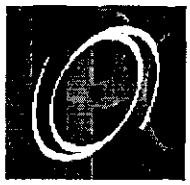

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Jiří KVITA Thesis
"Measurement of differential cross-sections in the $t\bar{t} \rightarrow l + jets$ channel at $\sqrt{s} = 1.96\ TeV$ with the D0 experiment at Fermilab"

Referee Report

The work described in the thesis document of Jiří KVITA is centred on a study of the Top quark pair production in proton-antiproton collisions at the Tevatron with the D0 detector.

The Standard Model, the present theory describing the forces and the matter, postulates the existence of six quarks. The heaviest, the Top quark, has been discovered in 1995 by the D0 and CDF experiments at Fermilab (USA). At present time some of its properties have been measured from a restricted sample of Top candidates. All these measurements consolidate the description of the matter and the interactions within the framework of the Standard Model of particle physics.
Its very large mass suggests that the Top quark can play a particular role in the theory. It thus constitutes one of the most important parameters of the Standard Model and an open a window towards the unknown from its particular sensitivity to effects of New Physics.
Any New Physics in connection with the Electro-Weak Symmetry Breaking (EWSB), a key piece of the theory which mechanism is not yet understood, would be preferentially coupled to the Top quark, leading to deviations in the $t\bar{t}$ production rate and inducing modifications in Top quark kinematics spectra with respect to the Standard Model Theory. For example, new resonances or gauges bosons, decaying in Top quark pairs could be revealed in the $t\bar{t}$ invariant mass distribution. Any deviation observed would be a signature of effects of New Physics. It is in this general competing context that Jiří KVITA developed his study.

Jiří KVITA extracted Top quark pair events among one fb^{-1} of data collected by the D0 detector in proton-antiproton collisions during the period 2001-2006 with an energy in the centre of mass of 1.96 TeV.
The document summarizes in a synthetic and rigorous way the analysis strategy followed to carry out the measurement of the differential cross sections with the data. Jiří KVITA

reviewed the theoretical aspects of the standard model, the Top properties and Top quark unique features among all other quarks. After a description of the collider and the D0 detector, he explains the method use to reconstruct various objects (vertex, electrons, muons, missing transverse energy light and b-jets) focusing in a dedicated chapter on the essential point of the Jet Energy Scale (JES) determination.

A particular care and emphasis has been put on the evaluation of the detector and Monte-Carlo modelling biases that could distort the observed raw distributions. The document describes in a very convincing way the stages necessary to compute the corrections to be applied to obtain the final differential cross sections distributions.

The observed corrected differential distribution shapes are in agreement with the Standard model, although some differences are observed in the prediction using two different generators ALPGEN and MC@NLO. A quantitative estimation of these differences is unfortunately missing as well as an interpretation of the results in the framework of New Physics where a limit on the production of new particles could have been computed. These differential distribution shapes could have been compared with previous or other measurements performed in D0 or CDF. Finally a better explanation of the importance of the measurement of the Top transverse momentum and a description of the New Physics that could modify the measured spectra would have increased the quality of the document.

The presented document is well structured, includes many information and leads to original measurements, compatible with the Standard Model expectations.
The study performed by Jiří KVITA is of high level. Thus, I have no doubts that this PHD Thesis should be accepted.

Clermont-Ferrand, February 10, 2009

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