Outer Tracker calibration and open charm production cross section measurement at LHCb

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Abstract

The LHC is a hadron collider located in a circular tunnel 27 km in circumference, designed to collide two beams of protons with 7 TeV nominal energy in each beam. The LHCb experiment is one of the four experiments located at interaction points. The LHCb detector is a single-arm forward spectrometer dedicated to flavor physics studies. Its main goals are precision measurements of CP-violation and meson mixing, as well as studies of rare decays of heavy flavor particles, to search for physics beyond the Standard Model ('New Physics') using the decays of b- and c-hadrons.

The first part of the dissertation describes the timing calibration of the Outer Tracker, one of the LHCb sub-detectors, and includes t_0 and TR-relation, as well as signal propagation and resolution calibration. The developed calibration procedures are currently used for the OT timing calibration in the LHCb experiment. The calibration allows to achieve an average time resolution of approximately 3 ns, which is equal to the result obtained in the 2005 beam test.

The second part presents the measurement of the open charm production cross section of D^0 and D^{*+}. The measurement is performed using $15\,\mathrm{nb}^{-1}$ of proton-proton collision data collected under low pile-up conditions with the LHCb detector at 7 TeV center-of-mass energy in May 2010. The cross sections are measured in bins of transverse momentum p_{T} and rapidity y. The measured cross sections are compared with theoretical predictions and found to be compatible within the theoretical uncertainties.