

DOCTORAL DEFENSE

Complete Measurement of the Top-Quark Polarization in T-Channel Single Top-Quark Production Using pp Collisions at 13 TeV with the ATLAS Detector

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Abstract: The top quarks are undoubtedly one of the most promising and experimentally relevant probe into finding new physics. They can be produced in charged-current electroweak processes via a Wtb vertex. Its unique mass scale led to a late discovery in experiment — until 1995 at Tevatron proton-antiproton collider at Fermilab on the events from top pair production. The observation of the EW single top process was established even later — in 2009 also at Fermilab based on 2.3 fb^{-1} and 3.2 fb^{-1} of data. Nowadays, the high energy proton-proton collider — Large Hardon Collider (LHC), with a data set of 139 fb^{-1} from the ATLAS detector, made it possible to perform more sophisticated measurements on top quarks using both $t\bar{t}b$ and single top channels.

At the LHC, electroweak production of single top quarks in the t-channel leads, in the standard model, to a high degree of top quark polarization. Two subprocesses, $ub \rightarrow dt$ and $db \rightarrow ut$ contribute to t-channel production of single top, while the charge-conjugate processes contribute to production of top anti-quark. The top quark is expected to be polarized along the direction of the scattered light-quark (or "spectator" quark), and opposite to that direction for top anti-quark production. This talk presents a measurement of the top quark polarization produced within a fiducial region of acceptance, using an integrated luminosity 139 fb^{-1} of proton-proton collisions at 13 TeV, collected by the ATLAS detector. From the angular distribution of top quark decay products, we obtain all three components of the polarization of both top quarks and top anti-quarks. .

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