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Search for the SM (and BSM) production of four top quarks in the ATLAS detector at the LHC

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The top quark is the heaviest elementary particle we know. Therefore, it may play a special role in the Standard Model of particle physics. Its Yukawa coupling to the Higgs boson is close to one, which makes this particle a key element of many theories beyond the Standard Model.

The Large Hadron Collider (LHC), located at CERN (Geneva, Switzerland) is a proton-proton collider with a center-of-mass energy of 13 TeV. The LHC runs at the highest energy and luminosity ever reached by an accelerator. It is then able to study very rare collision scenarios, such as four top production : $t\bar{t}t\bar{t}$.

The $pp \rightarrow t\bar{t}t\bar{t}$ process has a theoretical cross-section of 9.2 fb, so we expect to produce only about 1000 such events in the LHC by 2018, compared to the 40 million events occurring each second !

The production of four top quarks is however very sensitive to several scenarios beyond the Standard Model, which predict an enhancement of its cross-section that could be detected experimentally.

Therefore, an analysis is performed to identify such events and detect potential deviations from the Standard Model. Events with two leptons of the same charge are selected, for their small background contamination.

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