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# Searches for flavour violation and flavour changing neutral currents in top quark final states

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The remarkably large integrated luminosity collected by the ATLAS detector at the highest proton-proton collision energy provided by LHC allows to probe the presence on new physics that might break well established symmetries or enhance extremely rare processes in the SM. Two such significant examples are lepton universality and Flavour Changing Neutral Currents (FCNC). Recent measurements involving B-meson decays sparked renewed interest in testing lepton universality between tau and light leptons because of observed deviations at the four-standard-deviation level. On the other hand, SM FCNC involving the top-quark decay to another up-type quark and a neutral boson are so small that any measurable branching ratio for such a decay is an indication of new physics.

By selecting events with two opposite sign leptons (muon pairs and electron-muon pairs) and at least two b-tagged jets, a highly pure sample of top-quark pair decays is assembled and used to extract a large unbiased sample of W bosons decaying to leptons down to low transverse momenta. A fit to the two dimensional distribution for the transverse momentum and the transverse impact parameter of the lepton is then used to differentiate between leptons originating directly from the W boson and those resulting from the W-boson-to-tau-lepton decay chain. This results into a precise measurement of the ratio between the probability for the W boson decay to tau to the probability for its decay to muon.

In addition, three searches for FCNC couplings are presented. First, the search for the FCNC coupling between the top quark and the Higgs boson uses events with one electron or muon, missing energy and three or four jets to search for both the production of a single top in association with a Higgs boson or the production of a top-quark pair with one top quark decaying to a Higgs boson and an up or a charm quark. A neural network is used to improve background rejection. The results are interpreted also in terms of effective field theory couplings describing the tqH vertex. Second, the FCNC interactions between the top quark, a gluon and a charm or an up-quark is searched for in events producing a single top-quark decaying leptonically by selecting final states with one lepton, one b-jet and missing transverse momentum. A neural network is used to discriminate signal from background. The results are also interpreted in terms of anomalous and Effective filed theory couplings. Finally, 81/fb of integrated luminosity are used to search for FCNC via the coupling of a top quark, a photon and an up or charm quark in events with one photon, one lepton (electron or muon), one b-tagged jet and missing transverse momentum.

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**Primary author:** KOEHLER, Nicolas Maximilian

**Presenter:** KOEHLER, Nicolas Maximilian

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