

An angular analysis of the rare decay  $B^0 \rightarrow K^*(K^+\pi^-)\mu^+\mu^-$  is presented. The study is based on a data sample from  $pp$  collisions at centre-of-mass energy of 8 TeV recorded by the ATLAS detector at the Large Hadron Collider which corresponds to an integrated luminosity of  $20.3\text{fb}^{-1}$ . An extended unbinned maximum-likelihood fit of the decay angular distribution is used to measure the  $CP$ -averaged angular observables  $F_L$ ,  $S_3$ ,  $S_4$ ,  $S_5$ ,  $S_7$  and  $S_8$  and the corresponding form-factor independent observables  $P_1$ ,  $P_4'$ ,  $P_5'$ ,  $P_6'$  and  $P_8'$ . The measurements are performed in the region  $0.04\text{GeV}^2 < q^2 < 6\text{GeV}^2$ , where  $q$  is the dimuon invariant mass.

The results are in agreement with the Standard Model predictions and compatible with measurements published by other experiments. The most significant deviations are observed for parameters  $P_4'$ ,  $P_5'$  at the level of 2.7 standard deviations and for  $P_8'$  which is 1.9 standard deviations away from one of the predictions. The  $P_5'$  deviation in bin  $4\text{GeV}^2 < q^2 < 6\text{GeV}^2$  is consistent with the one reported by the LHCb collaboration.

The second part of this work shortly summarises the operation of the ATLAS Semiconductor Tracker, testing of the prototype module for the Inner Tracker strip upgrade, and the monitoring of non-collision background which was developed as a part of this thesis.