Abstract: Rare $B_d^0 \to K^* \mu^- \mu^+$ decay is one of physics channels testing Standard Model predictions at the ATLAS experiment. This work provides input to the future analysis of this rare decay in the data-taking period of Run 2. Specifically, in the work we were searching for the descriptions of the distributions of reconstructed invariant masses of the B and $K*$ mesons and of the distribution of the decay angles for the signal decay and expected background processes. For the procedure of finding optimal description, a maximal likelihood method of fit was used. Search for the probability density functions was performed on simulated data containing signal decay and main the background channels (decays, which are misinterpreted by the detector like our signal decay). The background decays included $B_s \to \phi(K^+K^-)\mu^+\mu^-$, $\Lambda_b \to \Lambda(1520)(pK^-)\mu^+\mu^-$ and $\Lambda_b \to pK^-\mu^+\mu^-$. The signal data were contamined with events, when detector misidentified the kaon and pion from the K^* meson decay, which lead to modifications of the fitted parameters. These cases were separated and treated as special background process. In addition to the simulations, we analyzed the combinatorial background from the real data of Run 1, though only the angular distribution. Invariant masses were not analyzed for their simplicity. We also show comparison with Run 1 analysis, which used simplified description of the decay angles distributions by the polynomial product, while we improved the description using spherical harmonics expansion instead.