

Evidence of charge multiplication in silicon detectors operated at a temperature of 1.9 K

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The work is dedicated to studying the kinetics of the process of charge collection in silicon detectors at a temperature of 1.9 K in situ irradiated by protons. The main research method is TCT, which allows one to receive current responses of high time resolution. As a result of in situ tests, non-standard current pulse shapes were obtained, which can be described only within the framework of a two-stage charge transfer process model. The model is complicated by the effects of polarization of the electric field in the detector volume, which creates a region of the electric field of such a magnitude that is sufficient for the avalanche multiplication of charge carriers. The experimental results are analyzed in detail. Based on the analysis, a physical model of charge collection is proposed. Moreover, qualitative and quantitative estimates of the transport parameters of charge carriers in the detector are given.

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