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Irradiations on DEPFET-like test structures

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For the upgrade of the Belle II detector DEPFET (Depleted p-channel field effect transistor) pixels are foreseen for the two innermost layers of the vertex detector. As a MOS device, the DEPFET is susceptible to ionizing radiation, which will be created near the interaction point.

One effect of ionizing radiation is the build-up of positive charge in the oxide insulation layer near the silicon interface. This positive charge leads to a change in the threshold voltage of the transistors. The readout of the individual ladders of the pixel detector is organized in a rolling shutter mode, switching one row on at a time. As the switching chips provide only one voltage, careful adaption to this shift is necessary.

To increase the radiation hardness of the detector, thinner oxides in addition with various layers of nitride are under investigation. Therefore special test structures (FETs) have been developed and irradiated with a 60keV x-ray tube. These structures correspond to several critical regions of the DEPFET, like the gate or the cleargate. Change in the transistor parameters, like threshold voltage or subthreshold swing have been measured and will be presented.

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