

Irradiation of DEPFET-like transistors with CO-60 gamma source up to 10 MRad

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The Pixel Detector (PXD) of the Belle II experiment at superKEKB accelerator in Japan is based in the DEPFET technology. Two layers of 8+12 modules at a radius of 13 and 22 mm will give a spatial resolution below 10 μm . The radiation level expected in the first layer in ten years of operation is about 10 MRad of total ionizing dose. In order to study the tolerance of the DEPFET technology sixty devices were irradiated using a standard procedure like ^{60}Co gamma source. Different doping types, channel sizes and biasing conditions were studied.

Summary 500 words

After being irradiated with a gamma source up to 10 MRad, thick oxide DEPFET-like transistors have shown a negative voltage shift of 18 - 23 V, reduced to 14 - 20 V after 28 days of annealing at room temperature. This voltage shift is foreseen to be compensated by changing the operation voltage in the switcher, the steering chip used for DEPFET matrix operation. In order to reduce the voltage shift therefore the complexity of this chip a new thin oxide technology is currently being developed in the DEPFET collaboration showing promising results in the first tests.

In the present work, in order to study the effect of radiation damage on DEPFET-like transistors, several parameters as threshold voltage, gain and sub-threshold zone were monitored during the irradiation. The influence of manufacturing and operational parameter such as doping, channel dimension and biasing voltage were also studied. The irradiation took place in 11 steps during the summer 2010 in the Radiation Physics Laboratory of the Santiago de Compostela University using a radioactive source of 2080 Ci of activity allowing a dose of 11 krad/h.

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