

Investigation of modified ATLAS pixel implantations after irradiation with neutrons and protons

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The innermost tracking detector of the ATLAS experiment consists of planar n-in-n silicon pixel sensors. Closest to the beam pipe lays the insertable b-layer (IBL). Its pixels are arranged in a pitch of 250um x 50um, with a rectangular shaped n-implant.

Based on this design six modified pixel designs have been developed in Dortmund.

The new pixel designs are arranged in structures of ten columns and have been placed besides structures with the standard design on one sensor. Because of a special guard ring design, each structure can be powered and investigated separately. Several of these sensors have been bump bonded to FE-I4 read-out chips. One of these modules has been irradiated with reactor neutrons up to a fluence of $5 \times 10^{15} \text{ n}_{\text{eq}} \text{ cm}^{-2}$, another has been irradiated with protons at CERN-PS IRRAD to a mean fluence of $6 \times 10^{15} \text{ n}_{\text{eq}} \text{ cm}^{-2}$.

This contribution presents the results of these irradiated devices, including important sensor characteristics, charge collection determined with radioactive sources and hit efficiency measurements, performed in laboratory and test beam. They are also compared with the results of non-irradiated devices.

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