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Investigation of modified ATLAS pixel implantations

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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 lies since the phase-0 upgrade the insertable b-layer (IBL). Its pixels are arranged in a pitch of $250\ \mu\text{m} \times 50\ \mu\text{m}$, with a rectangular shaped n-implant. Based on this design 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 $5 \times 10^{15}\ \text{n}_{\text{eq}}\text{cm}^{-2}$.

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

In addition, an outlook is given to first measurements of a device irradiated with protons as well as of a new sensor with five follow-up designs, which had been placed on a recently finished R&D production.

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