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Signal and Charge Collection Efficiency of a p-type 3D-Detector irradiated to sLHC-Fluences, read out with 40 MHz

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In view of the projected luminosity upgrade of the LHC, we are studying novel Silicon detectors in terms of their radiation-hardness to be employed as tracking detectors at the sLHC. We have tested 3D-detectors of singletype-column (STC) design, with only n-type columns etched into a p-type substrate. Rows of the columns are connected together to form strips. Using ATLAS SCT electronics, we have built prototype detector modules which were then irradiated to a dose of up to 10 15N eq/cm². After irradiation, the modules were tested with two methods: a β -source set-up and an IR-laser. The former allows measurements of the absolute CCE and Signal, whereas the laser yields only relative results, though with high position resolution. Position-sensitive measurements are required, as from simulation the STC 3D-detector geometry is expected to have low-field regions with lower CCE. We will report on the performance of the irradiated 3D-modules read out at 40 MHz, compare it to the un-irradiated behaviour, and draw conclusions about the feasibility of using such detectors for tracking at the sLHC.

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