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Characterization of RD53A compatible n-in-p planar pixel sensors

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The ATLAS experiment will undergo around the year 2025 a replacement of the tracker system in view of the high luminosity phase of the LHC (HL-LHC) with a new 5-layer pixel system.
Thin planar pixel modules are the baseline technology to instrument all layers of the new pixel system, with the exception of the innermost one, thanks to their high charge collection efficiency after irradiation and reduced power dissipation. Pixel sensors, 100-150 μm thick, produced at MPG-HLL, interconnected to RD53A read-out chips, have been characterized with radioactive source scans and beam tests.
New designs of the pixel cells have been implemented in recent n-in-p planar pixel productions, to address the challenges presented in terms of charge collection by the small pixel pitches of 50x50 μm² and 25x100 μm², under consideration for the ATLAS pixel upgrade.
A comparison of the performance of different sensor designs will be presented, based on the electrical characterization of these devices with IV curves, radioactive sources and beam tests. The main design features that have been investigated regard the implementation of the biasing grid and the inactive edge dimensions, for the two thickness and pitch parameter values under study.
These results give important information to decide on the last open design parameters for the ATLAS ITk planar pixel production

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