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Pixel cell local efficiency of FBK 3D pre-production pixel sensors after irradiation up to 1.9·10^{16} n$_{eq}$/cm^2

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The High Luminosity program of the Large Hadron Collider (HL-LHC) will improve the performance of the accelerator by increasing the instantaneous luminosity $\mathcal{L}$ up to 7.5· 10^{34} cm^{-2} s^{-1}, with an average of 200 proton-proton collisions per beam-crossing. An upgrade of the ATLAS detector is needed to cope with the harsher radiation levels and with a much higher number of tracks. The Inner Tracker (ITk) will be the new all-silicon tracker. The ITk innermost layer will be exposed to a fluence of 1.3·10^{16} n$_{eq}$/cm^2 at the half at the HL-LHC program when it is scheduled to be replaced. Considering a 1.5 safety factor the sensors placed in this layer need to be qualified up to a fluence of 2·10^{16} n$_{eq}$/cm^2. Due to their radiation hardness, 3D pixel sensors have been chosen to instrument the innermost layer of the detector. 3D sensors with a pixel cell 25x100 μm^2 have been chosen for the central region of the detector (Barrel) while the 50x50 μm^2 ones will instrument the two side regions (End-Caps). The latter have been characterized in laboratory and in beam tests after irradiation up to a fluence of 1.9·10^{16} n$_{eq}$/cm^2 during 2022. A summary of their performance before and after irradiation will be presented, with a particular focus on the pixel cell local efficiency.

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