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Characterization of FBK 3D pixel sensor modules based on RD53A readout chip for the ATLAS ITk

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3D pixel sensors are the technology of choice for the innermost layer (L0) of the ATLAS ITk detector at High Luminosity LHC. The considered sensors have pixel size of either 25 um x 100 um or 50 um x 50 um, with one read-out electrode at the center of a pixel and four bias electrodes at the corners. The former geometry has been chosen for the central part of L0 (barrel), the latter for the lateral rings (endcap). A new generation of 3D pixels featuring these small-pitch dimensions and reduced active thickness (˜150 um) has been developed to this purpose within a collaboration of INFN and FBK since 2014. The most recent R&D batches have been oriented to sensors compatible with the RD53A chip. Several sensors of different geometries were bump bonded to RD53A read-out chips at Leonardo (Rome, Italy) and tested in laboratory and at beam lines.
In this talk, we report on the module characterization results, including threshold tuning and noise measurements, and results from a beam test performed at DESY facility on a 25 um x 100 um sensor irradiated with 27 MeV protons up to a fluence of 5×1015 1 MeV neq cm-2.

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