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Test beam results of planar pixel quad modules and spatial resolution of 3D pixels for the phase-2 CMS tracker

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The High Luminosity upgrade of the CERN Large Hadron Collider (HL-LHC) calls for an upgrade of the CMS tracker detector to cope with the increased radiation fluence, $2.3E16$ neq/cm² (1MeV equivalent neutrons) for the innermost layer while maintaining the excellent performance of the existing detector. An extensive R&D program aiming at 3D and thin planar pixel sensors, has been put in place by CMS. The new CMS pixel detector is built with sensor modules covering 2 or 4 (2x2) readout chips. In planar pixel modules, the inter-chip sensor region is made by special pixel cells having a non-standard, typically bigger, cell size in order to bridge the gap between the CMS Read Out Chip (CROC), avoiding dead regions. A non irradiated CMS quad CROC module, made in silicon planar technology by Hamamatsu, was tested with a particle beam and results on the performance of the inter-chip pixel cells are presented in this talk. Another topic presented in this talk is a first measurement of the spatial resolution as a function of the tilt angle for 3D pixel sensors, made by the FBK foundry in Trento, Italy, in collaboration with INFN, equipped with the CROC after irradiation up to an equivalent fluence of $1E16$ neq/cm².

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