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Test beam studies of monolithic HV-CMOS pixel detectors for HL-LHC

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Depleted Monolithic Active Pixel Sensors (DMAPS) built with High Voltage CMOS (HV-CMOS) technology are investigated as an option to cover large areas in the outermost layers of the future pixel detector of the ATLAS Inner Tracker (ITk) at HL-LHC.

The H35Demo is a large area HV-CMOS demonstrator prototype chip developed for the ITk which features a large fill factor layout with 25x250 umˆ2 pixel cells.
It was designed by KIT, IFAE and University of Liverpool, and produced in AMS 350 nm CMOS technology with different resistivities. The chip consists of four pixel matrices: two matrices including digital electronics in the periphery and thus designed to be operated as monolithic detectors, and two matrices meant to be capacitive coupled to ATLAS FE-I4 chips.

H35Demo chips have been irradiated with reactor neutrons at JSI up to 2e15 n_{eq}/cmˆ2 and with 23 MeV protons at KIT up to 1e15 n_{eq}/cmˆ2. The performance in terms of hit efficiency of the monolithic matrices have been investigated in two beam test campaigns, at Fermilab with a 120 GeV proton beam and at CERN SpS with 180 GeV pions. For particle tracking the FE-I4 telescope provided by University of Geneva was used. Results obtained for not irradiated and irradiated chips will be presented.

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