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Operation and testbeam results of HV/HR-CMOS active sensors with pixel readout

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In the Phase-II Upgrade of the Large Hadron Collider, the instantaneous luminosity will be increased up to about $5 \cdot 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$, which creates many challenges for future detectors. This necessitates a fundamental redesign of the ATLAS Inner Tracker (ITk) to cope with increased radiation damage and increased occupancy in the sub-detectors.

Several industrial CMOS foundries offer a High Voltage (HV) and High Resistivity (HR) design option, allowing the creation of a deep depletion zone, suitable for particle detection with active pixel detectors. These so-called HV/HR-CMOS detectors offer new in-pixel signal processing solutions, reduced clustersizes and are potentially more cost effective than current hybrid detectors.

An ATLAS R&D project has been started to qualify commercial HV/HR-CMOS technologies suitable for Pixel Detectors for the ATLAS ITk. To optimize the performance of the active sensors together with the readout chips, intricate tuning procedures are implemented in a easy-to-use test system for the collaboration to use. The latest results from characterization measurements in the lab, using the newly developed tuning procedures, and in beam tests of prototypes from several vendors will be presented.

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