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Radiation-hard Active Pixel Sensors for HL-LHC Detector Upgrades based on HV/HR-CMOS Technology

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We explore the concept of using deep-submicron HV-CMOS and imaging processes to produce a replacement for traditional radiation-hard silicon sensors. Unlike fully integrated monolithic active pixel sensors (MAPS), such active sensors contain simple circuits, e.g. amplifiers and discriminators, but still require a readout chip - which can be a traditional strip or pixel readout chip or a tailor-made one without any analogue circuits. This approach yields most of the advantages of MAPS (improved resolution, reduced cost and material budget, etc.), without the complication of full integration on a single chip; in particular, high-speed clocked circuits necessary for trigger handling and efficient communication can be kept separated from the crosstalk-susceptible pre-amplifiers.

The design of test ASICs produced in different processes, characterization results before and after irradiation and experience obtained with pixel and strip readout will be shown. In addition, plans for further submissions with higher-resistivity substrates will be outlined and an outlook will be given on application options for HL-LHC detector upgrades.

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