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Active pixel sensors in 180 nm HV CMOS technology for HL-LHC detector upgrades

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Recently, certain CMOS processes featuring the option to apply significant bias voltages have shown the potential for producing drift-based radiation-hard tracking detectors.

We explore the concept of using a deep-submicron HV CMOS process to produce a drop-in replacement for traditional radiation-hard silicon sensors. Such active sensors contain simple circuits, e.g. amplifiers and discriminators, but still require a traditional (pixel or strip) readout chip. This approach yields most advantages of MAPS (improved resolution, reduced cost and material budget, etc.), without the complication of full integration on a single chip.

After outlining the basic design of the HV2FEI4 test ASIC, results after irradiation with protons, x-rays and neutrons up to 1e16 neq/cm2 or 100MRad will be presented. Design changes towards the optimised HV2FEI4_v2 are discussed and results after irradiation up to 862 MRad are shown before elaborating on future plans and general prospects of active sensors. Finally, an overview is given on similar approaches aiming for fully monolithic rad-hard pixel and strip detectors.

Author: MUENSTERMANN, Daniel (Universite de Geneve (CH))

Presenter: MUENSTERMANN, Daniel (Universite de Geneve (CH))

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