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Charge collection efficiencies of 3D detectors irradiated at SLHC fluences and testbeam operation results

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Three-dimensional (3D) photodiode detectors offer advantages over standard planar detectors in a range of applications. These include radiation hardness properties for charged particle tracking in SLHC operation, and their advantages for X-ray detection for synchrotrons and medical imaging due to their low charge sharing between adjacent pixels which improves spatial and spectral resolution. 3D detectors with the novel double-sided geometry have been designed by the University of Glasgow and CNM, and fabricated at CNM clean room facilities. Results from short-strip devices and from 55x55μm pixel devices are presented.
The strip detectors have been irradiated to a fluence of 2 x 1016 cm−2 1 MeV equivalent neutrons. Measurements have used analogue electronics running at LHC speeds. The 3D detector is shown to have superior charge collection even at the highest fluences, with the 3D detector operating at relatively modest voltages and the planar devices operating at 1000V. The experimental results are compared to the simulation of charge transport in the devices.
Unirradiated pixel devices have been tested in a monochromatic X-ray beam at the Diamond synchrotron and the CERN SPS. Substantially lower charge sharing than standard planar Medipix2 and TimePix sensors is demonstrated. Maps of the charge collection uniformity and loss in the holes in a single pixel of the device have been produced, and the single hit resolution for charge particles obtained.

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

http://parkes.web.cern.ch/parkes/3D.pdf

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