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3D Diamond Detectors

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I shall present on the fabrication and characterization of the first prototype 3D diamond detector for particle physics applications. A femto-second laser was used to create arrays of graphitic columns in single crystal and polycrystalline diamond samples, these conductive columns are a few microns in diameter and create a 3D readout similar to that produced in silicon. Creating a 3D structure within diamond has two main objectives; firstly, to increase the radiation hardness compared to that of planar diamond detectors and secondly, to increase the signal response from polycrystalline diamond. Polycrystalline diamond has crystal boundaries within its bulk which act as charge traps reducing the un-irradiated drift path to ˜ 250µm compared to >1000µm in single-crystal, however, as a material it is much cheaper than single-crystal diamond. Both prototype single-crystal and polycrystalline detectors were tested in particle beams at CERN (proton/pion) using a charge integrating readout. Other laboratory tests are currently being conducted to fully understand the detector characteristics.

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