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3D diamond detectors for particle tracking and dosimetry

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Advances in the laser assisted transformation of diamond into amorphous-carbon has enabled the production of a new type of particle detector - 3D diamond. Compared to conventional planar technologies, previous work has proven a 3D geometry to improve the radiation tolerance of detectors fabricated in silicon. First tests of single-crystal and polycrystalline CVD diamond 3D detectors in various particle beams and performance comparison with simulations demonstrate the viability of this concept.

Recent improvement in the fabrication methods, including the use of a spatial light modulator to produce conductive wires with ˜1um diameter allowed the fabrication of devices in both single-crystal and polycrystalline CVD diamond with lower resistivity of the wires, promising an improved performance. Furthermore the use of spatial light modulators open
up the possibility of arbitrary wire shapes and therefor new detector concepts.

Outside the field of high energy particle physics, a potential application for this technology includes medical dosimetry; where the high resilience to radiation damage, operation at low bias voltage with well defined active volume, in addition to high compatibility to human tissue, makes their use desirable. First tests with at an clinical irradiation facility show promising results.

Summary

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