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A Diamond Sensor for Position Resolving Measurements at the European XFEL

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The European X-ray Free Electron Laser (XFEL) facility produces extremely intense and short X-ray pulses, where the diagnostics of the X-ray beam properties is of critical importance. Besides existing diagnostic components, utilization of a diamond sensor was proposed to achieve radiation hard, non-invasive beam position and pulse energy measurements for hard X-rays. In particular, at very hard X-rays diamond-based sensors become a useful complement to gas-based devices which lose sensitivity due to significantly reduced gas cross-sections. The measurements performed with a diamond sensor consisting of a 40 μm thick electronic grade single crystal chemical-vapour-deposition diamond with position-sensitive resistive electrodes in a duo-lateral configuration are presented in this work. The results show, for the first time to the best of our knowledge, that the diamond sensor delivers pulse-resolved beam position within less than 1% uncertainty at 2.25 MHz, and can be a valuable tool for X-ray Free Electron Lasers, especially for the coming high repetition rate machines, enabling applications such as beam based alignment and intra-pulse-train position feedback.

Journal of Synchrotron Radiation Special Issue: will you submit your contribution?

yes

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