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Towards Pulse-by-pulse XFEL Beam Measurement

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Characterization of XFEL beams can be challenging, requiring the use of several different types of detectors to measure beam properties. Sensors fabricated using electronic grade single crystal diamond have been shown to have rapid response and enable measurement of signals over a wide dynamic range for synchrotron beams. To study the utility for measurement of XFEL beams, flux linearity and temporal response measurements were performed at the SwissFEL Bernina station with two such devices through a collaboration formed during PhotonDiag2018. Comparisons were made with synchrotron beam measurements (flux linearity, spatial uniformity and temporal response) performed at NSLS-II using the same detectors prior to and subsequent to FEL beam testing. The results indicate a relationship between flux linearity and temporal response, which may provide guidance for improved detector design. Development of these monitors holds promise for enabling measurement of the intensity (and potentially also position) of single XFEL pulses over a significant dynamic range.

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