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X-ray beam position monitor with pixelated GaAs detectors for high-power synchrotron radiation beams

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A novel soft X-ray BPM (sXBPM) for high-power beams of synchrotron undulator radiation has been developed through a joint effort by BNL/NSLS-II and Stony Brook University. In this approach, custom-made multi-pixel GaAs detector arrays are positioned in the outer portions of the X-ray beam, with beam position inferred from the pixel photocurrents. The first R&D device was installed in the 23-ID canted undulator beamline of NSLS-II, about 27 m downstream of the canted EPU source, and ahead of any beamline elements (i.e. in white beam). The device has demonstrated sub-micron positional resolution without interfering with user experiments, including the most sensitive ones exploiting the beam's coherent properties. Beyond positional measurements, the sXBPM effectively monitors the beam's cross-sectional shapes at the detector array locations. Due to movable detectors, the sXBPM can also capture complete 2D cross-sections of the X-ray beam when beam interception is permitted. This paper reviews the sXBPM design and highlights the latest experimental results, demonstrating why this approach is well-suited for XBPMs in future light sources with highly coherent X-ray beams.

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