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Design and performance of a novel data acquisition and processing system for the APS upgrade front end XBPM

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The APS-Upgrade (APS-U) ID beamline front ends are equipped with next-generation X-ray beam position monitors (XBPMs). Each XBPM utilizes 16-element array detectors to simultaneously capture beam distribution information from undulator and bend magnet (BM) sources. A novel IOC has been designed to handle the following tasks in real time: estimating and subtracting BM signals, applying undulator-gap-dependent calibration to calculate undulator beam center positions, collecting beam position statistics, and estimating X-ray RMS motion and XBPM resolution. Initial data from early APS-U user runs demonstrate significant performance improvements. The BM signal contribution is reduced by more than a factor of 10, observed RMS beam motion is within the micrometer range, and XBPM resolution is consistently below 1 micrometer, typically less than 10% of the RMS beam motion.

Footnotes

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