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Digital closed orbit feedback system for the Advanced Photon Source storage ring

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Closed orbit feedback for the Advanced Photon Source (APS) storage ring employs unified global and local feedback systems for stabilization of particle and photon beams based on digital signal processing (DSP). Hardware and software aspects of the system will be described. In particular, we will discuss global and local orbit feedback algorithms, PID (proportional, integral, and derivative) control algorithm, application of digital signal processing to compensate for vacuum chamber eddy current effects, resolution of the interaction between global and local systems through decoupling, self-correction of the local bump closure error, user interface through the APS control system, and system performance in the frequency and time domains. The system hardware including the DSPs is distributed in 20 VME crates around the ring, and the entire feedback system runs synchronously at 4 kHz sampling frequency in order to achieve a correction bandwidth exceeding 100 Hz. The required data sharing between the global and local feedback systems is facilitated via the use of fiber-optically networked reflective memories.

Work supported by the U.S. Department of Energy, Office of Basic Energy Sciences, under Contract No. W-31-109-ENG-38.