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ALIGNMENT OF SUPERCONDUCTING UNDULATORS AT THE APS

The Advanced Photon Source (APS) at Argonne National Laboratory is a 7GeV third generation light source providing X-ray beams for research to scientific community since 1995. In order to remain the leading synchrotron radiation source in the western hemisphere, and to provide users with higher photon fluxes at higher photon energies, the APS decided to develop and build series of superconducting undulators (SCU). After several years of R&D and prototype testing the APS Magnetic Device group, in collaboration with the Budker Institute of Nuclear Physics, designed and assembled the first full-scale superconducting undulator, SCU0. In December 2012 SCU0 was installed in sector 6 of the APS storage ring, and after successful commissioning was released for user operation on January 29, 2013. Since then it has proven to be a dependable radiation source for high-energy X-ray studies, delivering enhanced photon flux at energies above 50 keV. The second in the series, SCU1, is being assembled as of this writing. This paper investigates the alignment aspects of the SCU devices. The extreme temperature changes in combination with limited access to the magnetic structure and beam chamber due to extensive thermal isolation pose unique alignment challenges. The alignment procedures and technology used for assembly, testing, and installation in the APS storage ring as well as a novel beam-based alignment and stability monitoring method are presented.

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