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Design of a high precision mirror rotation system at the Advanced Photon Source

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A high precision rotation system has been designed for a horizontal deflecting mirror at the Advanced Photon Source Sector 2 undulator beamline. A prototype has been built and tested. The UHV high-heat-load mirror, which is the first optical element in the first optics enclosure, diverts undulator white beam to the downstream optics and experimental stations up to 47 meters away [1]. Submicro-radian positioning of this deflection arm is essential due to the position accuracy requirements at the experiment station and is accomplished using a differential-style actuator with a frictionless rotation platform mounted externally to the mirror chamber. The differential actuator combines a high gear-ratio mechanical drive with a series of bellows to achieve near-zero-backlash positioning. As a result, submicroradian resolutions are possible without the use of closed-loop controls. This paper will present the mechanical design and specifications of this system and will discuss the prototype test results.

[1] W. Yun, A. Khounsary, B. Lai, and E. Gluskin, "Use of a Mirror as the First Optical Component for an Undulator Beamline at the APS, Technical Bulletin ANL/APS/TB-2, September 1992.

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