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Methodology for Optimal In Situ Alignment and Setting of Bendable Optics for Diffraction-Limited Focusing of Soft X-Rays

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An effective procedure developed at the Advanced Light Source (ALS) for in situ optimal adjustment of a single bendable x-ray mirror has been recently reported [Proc. SPIE 8139, 813907 (2011)]. The procedure has allowed achieving diffraction-limited one dimensional (1D) focusing of soft (1.24 keV) x-rays to a full-width-at-half-maximum (FWHM) of about 150 nm. Here we describe a systematic methodology developed at the ALS for optimal in situ alignment and bender's setting of a 2D system with two bendable mirrors in the Kirkpatrick-Baez configuration. Adding a second mirror to the system introduces more stringent alignment requirements that are derived based on simulations using ray-tracing software Shadow™. Additionally, 2D focusing optics must be carefully aligned with respect to the mutual angular orientation (roll and yaw angles), as well as the mutual position of the focal plane. This places additional constraints on the optimization of the mirrors. We adapt our previous methods to accommodate these requirements. New methods for optimal angular and position alignment of the mirrors have been developed and are discussed in the present work. Supported by the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.

Keywords: bendable mirrors, x-rays, x-ray optics, synchrotron radiation, synchrotron beamline, Kirkpatrick-Baez, metrology of x-ray optics

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