

Lawrence Berkeley National Laboratory

Lawrence Berkeley National Laboratory

Title

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

Permalink

<https://escholarship.org/uc/item/6zf6f8md>

Author

Merthe, Daniel

Publication Date

2012-10-01

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

Daniel J. Merthe, Valeriy V. Yashchuk, Kenneth A. Goldberg, Martin Kunz, Nobumichi Tamura, Wayne R. McKinney, Richard S. Celestre, Gregory Y. Morrison, Erik Anderson, Brian V. Smith, Edward E. Domning, Howard A. Padmore

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 ShadowTM. 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

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.