Lawrence Berkeley National Laboratory

Recent Work

Title

Design optimization of bendable x-ray mirrors

Permalink

<https://escholarship.org/uc/item/4mc4s3hb>

Journal

SPIE Proceedings, OP322

Authors

McKinney, Wayne
Goldberg, Kenneth
Howells, Malcolm
et al.

Publication Date

2011-08-25

Design optimization of bendable x-ray mirrors

Wayne R. McKinney,¹ Kenneth A. Goldberg,¹ Malcolm Howells,¹ Daniel J. Merthe,¹ Sheng Yuan,² and Valeriy V. Yashchuk¹

¹Lawrence Berkeley National Laboratory, Berkeley, California, 94720

²OmniVision Technologies, 4275 Burton Drive, Santa Clara, CA, 95054 USA

Corresponding Author: Wayne R. McKinney

Affiliation: Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA

Mailing address: Lawrence Berkeley National Laboratory,
1 Cyclotron Road, M/S 15R0317
Berkeley, CA 94720-8238, USA

Telephone number: +1-510-486-4395

Fax number: +1-510-486-4385 Email address: WRMcKinney@lbl.gov

Presentation preference: Oral Presentation

Abstract text:

Convenience and cost often lead to synchrotron beamlines where the final Kirkpatrick-Baez (KB) focusing pair must relay the final image to different samples at different image distances [Proc. FEL2009, 246-249 (2009)], either for different experimental chambers, or diagnostics. We present an initial analytical approach, starting from, and extending the work of Howells et al. [OE 39(10), 2748-62 (2000)] to analyze the trade-offs between choice of mirror, bending couples and the given, shaped sagittal width of the optic. Both experimentally and in simulation, we have found that sagittally shaped optics can perform with high quality at significantly different incidence angles and conjugate distances. We present one successful demonstration from the ALS Optical Metrology Beamline 5.3.1.

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

Abstract submitted to SPIE Optics and Photonics 2011, Conference OP322: Advances in Computational Methods for X-Ray Optics II, San Diego, August 21-25, 2011

Principle author's biography:

Wayne R. McKinney received his BA, MA, and PhD in Physics from The Johns Hopkins University, finishing in 1974 with a thesis in ultraviolet astronomy. He then completed a post-doctoral appointment in molecular biology supported by a National Cancer Institute Fellowship at the Biology Department of Brookhaven National Laboratory in 1977. Remaining at Brookhaven from 1977 to 1979 in the Instrumentation Division he designed optical systems for the National Synchrotron Light Source. From 1979 to 1987 he joined the research staff of the Richardson Grating Lab in Rochester New York, becoming Manager of Diffraction Grating R&D in 1981. From 1987 to 1989 he was a staff scientist in the Center for X-Ray Optics at Lawrence Berkeley National Laboratory working on water cooled optical components and monochromator designs for the Advanced Light Source. This work won local and national Tech Transfer Awards, and led to Fellow status in the OSA. He now works directly for the Advanced Light Source where he designed and built the first infrared beamlines. Currently his responsibilities are in optical metrology, particularly the specification of x-ray optics by calculation of scattering, and optimization of the adjustment of adaptive x-ray mirrors.

Author: Kenneth A. Goldberg

Affiliation: Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA

Mailing address: Lawrence Berkeley National Laboratory,
1 Cyclotron Road, M/S 2R0400
Berkeley, CA 94720-8199, USA

Telephone number: +1-510-495-2261

Fax number: +1-510-486-4550 Email address: KAGoldberg@lbl.gov

Author: Malcolm R. Howells

Affiliation: Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA

Mailing address: Lawrence Berkeley National Laboratory,
1 Cyclotron Road, M/S 15R0217
Berkeley, CA 94720-8238, USA

Telephone number: +1-510-486-4949

Fax number: +1-510-486-7696 Email address: MRHowells@lbl.gov

Author: Daniel J. Merthe

Affiliation: Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA

Mailing address: Lawrence Berkeley National Laboratory,
1 Cyclotron Road, M/S 15R0317
Berkeley, CA 94720-8238, USA

Telephone number: +1-510-495-2644

Fax number: +1-510-486-7696 Email address: DJMerthe@lbl.gov

Author: Sheng Yuan

Affiliation: OmniVision Technology Inc. Santa Clara, CA, 95054, USA

Mailing address: Lawrence Berkeley National Laboratory,
4275 Burton Drive,
Santa Clara, California 95054, USA

Telephone number: +1-408-567-4895

Email address: shyuan1977@gmail.com

Author: Valeriy V. Yashchuk

Affiliation: Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA

Mailing address: Lawrence Berkeley National Laboratory,
1 Cyclotron Road, M/S 15R0317
Berkeley, CA 94720-8238, USA

Telephone number: +1-510-486-2592

Fax number: +1-510-486-7696 Email address: VVYashchuk@lbl.gov

This work was supported by the Director, Office of Science, Office of Basic Energy Sciences, of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.