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Design optimization of bendable x-ray mirrors

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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

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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.

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