

Combined Stitching Profiler for Elliptical KB Mirrors Metrology*

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ABSTRACT

There is a growing interest in utilizing elliptically shaped KB mirrors to achieve diffraction-limited focused beam spots at hard x-ray synchrotron radiation facilities around the world. Obtaining such a performance requires mirrors with surface figure error on the order of a few nm over the spatial wavelengths ranging from 100 μm up to the mirror length. There are currently no commercially available tools that are accurate and easy to use to characterize such optics.

The stitching interferometry technique looks very promising, and significant progress has been made during the last few years such that made this technique has become a mainstream method for measuring optics with high aspheric departure in industry.

However, generally, x-ray mirrors lead to one-dimensional stitching problems. Therefore, the accuracy of the overall mirror shape is greatly influenced by the number of stitched subapertures.

To overcome this difficulty, we propose a compact integrated stitching system that combines the advantages of two different and complementary sensors: a long-trace profiler-like profilometer that can be optimized to accurately measure the mirror shape and a Fizeau interferometer for high-resolution subaperture measurement.

The data obtained from the long-trace profiler (LTP) is used to accurately stitch subaperture data from the Fizeau interferometer. Thus reliable data can be obtained over the wider range of spatial wavelengths than either of the two instruments can probe alone. Moreover, with the two sensors integrated in a single instrument one can measure the optic with the same setup and under the same environment conditions, which further improves measurement accuracy.

The concept was presented at the International X-ray Optics Metrology Workshop held at the European Synchrotron Radiation Facility, Grenoble, France, in April 2004, and the combined stitching technique has been discussed in a previous paper. This talk focuses on the design of the instrument and on the preliminary test results and possible improvements.

*This work is supported by the U.S. Department of Energy, Office of Basic Energy Sciences, under Contract No. W-31-109-ENG-38.