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Recent Stitching Measurements Performed on Supersmooth Elliptical X-ray Nanofocusing Kirckpatrick-Baez Mirrors*

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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 a few100 μm up to the mirror length. Metrology of such mirrors using conventional methods with Fizeau interferometers is challenging because it requires an expansive wavefront adaptive optics (a diverger lens), and both the measurement and data analysis procedures are very time consuming. Because the steep mirror surface slope, only part of the mirror surface can be probed with the conventional interfeometer's without the auxiliary wavefront adaptive optic.

An alternative consists of using the interferometer to measure the mirror surface at a number of consecutive overlapped locations. Then a computer algorithm is used to stitch together the obtained subaperture measurements to construct the mirror surface profile. This method has become a mainstream method for measuring aspheric optics with surfaces larger than the interferometer's aperture. However, generally, x-ray mirrors lead to one-dimensional stitching problems. Therefore, the accuracy of the measured mirror profile is greatly influenced by the number of stitched subapertures.

To improve the stitching accuracy we stitched together data from two different instruments: a Fizeau interferometer and the long trace profiler (LTP). The data obtained from the LTP was used as "a guide" 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.

This poster present and discuss the results obtained on two pairs of APS KB mirrors.

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