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## Development of stitching interferometry and ion beam figuring methods for high precision X-ray mirrors

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Driven by the fast development of the new generation storage ring and free-electron laser facilities, X-ray mirrors with nanometer figure accuracy, complex shape and large size are widely demanded. These optics are being developed in Tongji University using stitching interferometry and ion beam figuring technique. Stitching interferometry is commonly used for the 2-D figure metrology of X-ray mirrors, while the accumulated angular error among neighboring subapertures and the systematic error within each subaperture are affecting the stitching accuracy. A method to correct the angular error using low-frequency profiles measured by other instruments is studied, called 'mixed stitching'. It directly obtains the stitching angles from the 1-D profile along one direction of the entire tested mirror which further correct the relative angles fitted from algorithm. The stitching accuracy can be both improved either by a commercial contact profiler or a high-precision slope measurement system and the minimum figure error of below 1 nm RMS can be achieved. The shape error of a single subaperture is studied and reduced by calibration of the reference mirror and lateral resolution of the Fizeau interferometer. Based on these improvements, the measured figure accuracy of elliptical mirror using simple global stitching algorithm was improved to 1.5 nm RMS. Based on the high-precision stitching interferometry, mirrors with maximum length of 500mm and figure height error of 1nm RMS were manufactured and some of them have been applied in the synchrotron radiation facility. These results will be presented and discussed.

### Journal of Synchrotron Radiation Special Issue: will you submit your contribution?

yes

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