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Development of Ion beam figuring (IBF) system at Diamond Light Source

Modern synchrotron and free-electron laser sources demand ultra-high-quality x-ray mirrors for many challenging x-ray applications, including nano focusing, preserving coherence, and extreme energy resolution. As a deterministic polishing technique, Ion Beam Figuring (IBF) is often used to produce these mirrors with the required precision. Recently, an in-house IBF system has been developed and commissioned at Diamond Light Source [1]. It has a large diameter DC gridded ion source, 4-axis motion stages, and an imaging system for alignment. In addition, a laser Speckle Angular Metrology (SAM) instrument [2] has been incorporated to monitor progress during each IBF iteration, thereby reducing the overall time required. We describe developmental details of our position–velocity–time (PVT) algorithm, including the fiducialization procedure for precise alignment with ex-situ metrology data [3]. Preliminary figuring results will be presented for 1D and 2D corrections, with accuracy on the sub-nanometres level.

Reference:
1. M. Hand, S. G. Alcock, M. Hillman, R. Littlewood, S. Moriconi, H. Wang, K. Sawhney, Advances in Metrology for X-Ray and EUV Optics VIII. Vol. 11109. SPIE, 2019.
2. H. Wang, S. Moriconi, and K. Sawhney, Light: Science & Applications, 10, 195 (2021).
3. M. B. Da Silva, S. G. Alcock, I. T. Nistea, and K. Sawhney, Optics and Lasers in Engineering 161, 107192 (2023).

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yes

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