High Accuracy Wavefront Sensing for X-ray Free Electron Laser Using Single-Grating Talbot Interferometry

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We present a versatile yet sensitive and accurate wavefront sensing scheme for X-ray Free Electron Laser (FEL) beam using single grating Talbot interferometry. Experiments done at the Linac Coherent Light Source (LCLS) demonstrated that it can retrieve 2D hard X-ray (wavelength 0.12nm) wavefronts from both unfocused and focused beams on single-shot basis, with sensitivity and accuracy both better than l/100. It allows systematic studies on X-ray FEL beam wavefronts from the undulator output and following changes caused by beamline transport optics and endstation focusing optics, all with the same setup.