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100 Nano-radian Surface Slope Metrology with the Upgraded ALS LTP-II

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Abstract:

Requirements for synchrotron radiation and free electron laser beamlines demonstrate the need for surface slope tolerances of x-ray optics on the order of 200 nano-radians in order to preserve brightness. Hence, the accuracy of dedicated surface slope metrology must be 100 nano-radians, or even less. Achieving this level of measurement accuracy with the instrument typically used at synchrotron radiation metrology laboratories, the Long Trace Profiler (LTP)¹⁻⁴, requires all systematic, random, and instrumental drift errors to be reduced or eliminated. In this respect, components of the existing Advanced Light Source LTP-II design are analyzed, considering the principal justification for inclusion of each component, possible systematic error due to the quality of its optical material, and drift effects due to generated heat, etc. Specifically, we also consider the effects of replacement of the existing diode laser with a fiber-coupled laser light source, and analyze whether significantly reducing the number of components by using a single beam on the surface under test (SUT), rather than a double beam maintains, or even improves the accuracy of measurement with our LTP.

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