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Testing some limits of long trace profilers using Zemax simulations.

Acquiring direct images of distant exoplanets or focusing X-rays requires high performance optics. Laboratories and optics suppliers are therefore actively seeking to improve polishing methods and metrology. For slope-error evaluation, many accelerator-based light sources use Long Trace Profilers (LTP) whose measurement accuracy can reach 80 nrad in a relatively short period of 6 hours, and which typically have a better reproducibility in radius determination for highly curved mirrors than interferometers with stitching. The ESRF implementation of this measuring device, the result of over 35 years of development, has been modelled using Zemax from Optic Studio. This ray-tracing code offers the possibility to configure the simulations using Python code. This provides a convenient means to explore the potential influence of multiple parameters of the LTP (e.g. alignment, optical aberrations) upon the measurement accuracy. This can guide and complement experiments with the instrument itself. This study is the beginning of a theoretical approach, which aims to improve LTPs, and identify the key parameters in slope profiler accuracy and repeatability. For example, in the ESRF LTP design, errors in positioning the sensor from the Fourier Transform (FT) lens focal plane have been predicted to induce repeatable errors. However, slight misorientation of this sensor, or the (FT) lens, has no impact compared with the lowest measurement noise. Field curvature can also be neglected, but pixel size can have an importance depending on interpolation algorithms. The impact of calibration in different configurations is also discussed.

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no

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