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Optical metrology for bender and adaptive optics optimization and characterization

We present some of the methods, procedures and analysis tools used at ALBA to characterize mirror benders, and other adaptive optics mirror systems. The tests we describe combine measurements of different instruments, including our NOM and our stitching interferometry platform, with a number of optimization routines based on the deformation model of the mirror within the bender.
The characterization of an adaptive optics system has three distinct purposes: Checking that the system meets the optical requirements, Optimizing some mechanical adjustments, and providing information for the operation of the bender at the beamline. Besides this, metrology often reveal features of the opto-mechanical system which are useful information for continuous improvements.
The characterization of an adaptive optics system is very time consuming, since one must explore the configuration space of the system under test with sufficient surface measurements. At the same time, the continuously-improving quality of optical surfaces requires that the measurements are taken with sufficient averaging, redundancy and stabilization. To be effective in this aspect, we have optimized our metrology instruments to be fast and still accurate.
A feature of the presented procedures is the analysis of the obtained surface measurements using the deformation model of the system. This analysis allows minimizing the number of required measurements for a complete characterization, and allow identifying the nature of some of the observed deviations.
We describe the procedures and provide results based on measurements on more than 50 systems, with a wide range of optical lengths, figures and surface qualities.

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

yes

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