SHARPeR

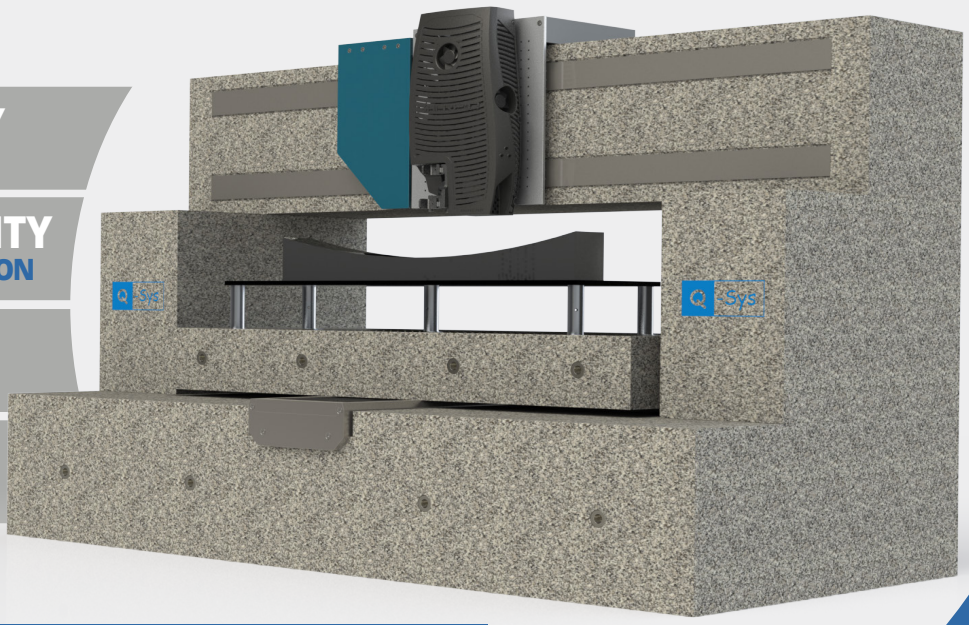
eurostars project 8304

HIGH ACCURACY
2D SLOPE MEASUREMENT

FOR HIGH QUALITY
MIRROR CHARACTERISATION

COMPLETE
METROLOGY PLATFORM

50 NRAD RMS
SLOPE ACCURACY



"First version : fast, reliable, accurate, 1.2 mm spatial resolution, able to measure sub 100 nrad rms (even below 50 nrad rms), I look forward to the second generation."

Dr. Mourad Idir
Optical Metrology, Energy Sciences Directorate/Photon Science Division
Brookhaven National Laboratory - NSLS II

SHARPeR is a Eurostars project that aims at developing a new high accuracy automated metrology platform for extremely high quality optical components needed for example in synchrotron beamlines, EUV lithography systems and telescopes. Meter-scale X-ray mirrors will be characterized with a slope error accuracy better than 50nrad rms.

The system includes three main elements:

- **A highly stable and repeatable motion platform with rotation and tip-tilt stage**
- **A high precision wavefront sensor with an absolute accuracy of λ/1000 rms**
- **An advanced stitching algorithm for high accuracy results**

Contact Imagine Optic for more details : contact@imagine-optic.com

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EUREKA eurostars™ Q-Sys

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The new ultra-high precision Shack-Hartmann wavefront sensor is integrated in an optical head coupled with a dedicated motion platform to provide 2D slope/height maps. The surface under test can be oriented horizontally or vertically to match the actual used configuration. Customers can specify both longitudinal (scanning direction) and transversal travelling ranges to expand the range of characterization area. Motorized rotation and tip-tilt axes (RTT) are added to the motion system. This enables the user to automatically flip the optical component under test without disturbing the measurement environment by manual interference. This complete metrology platform is designed to help the off-line manufacturer of extreme precision optical surfaces used, for example, to transport or to focus x-rays in synchrotron applications. The SHARPeR platform should sit in a special enclosure to ensure the best possible environment for ultimate measurement results.

HASO UHP

With more than 15 year experience in the Shack-Hartmann technology, Imagine Optic develops the ultra-high precision Shack-Hartmann wavefront sensor (HASO UHP) with exceptional wavefront measurement accuracy up to λ/1000 rms in absolute mode (λ/2000 rms in relative mode) and with high repeatability.

StitchWave

StitchWave is a unique software tool which enables precise characterization of large surfaces using HASO wavefront sensors. Thanks to its advanced stitching algorithms that minimize translation stage effects, the user can aquire and reconstruct a complete wavefront from multiple sequential measurements. Surface diagnostic tools such as fitting and power spectral density are included.

STAMP

The motion system includes innovative techniques for maximizing the stability and repeatability of measurements while reducing angular errors to a minimum. Special features that can be referred to in this context are cut-off air supply to the air bearings to minimize turbulences that can disturb the measurements and a special design to couple the driving force to the optics carriage. The motion platform including the RTT makes it possible to have an appropriate combination of different positions of the optical component, orientations and scanning directions. This will result in significant suppression of the contribution of the systematic error to the measurements. In order to minimize thermal effects the power of the RTT can be switched off during measurements without compromising the overall accuracy.

Mirror tangential and sagittal slope accuracy	< 50 nrad RMS*
Mirror radius	From flat down to 1.7 m
Spatial resolution	1.2 mm
Maximum mirror slope	± 4 mrad
Measurement configuration	Horizontal and vertical
Mirror surface	With and without coating
Maximum mirror length	1.5 m
Transverse axis length	300 mm
Rotation	305°
Tip-tilt range	± 5°
Gantry dimension / weight	2.5 m x 1.1 m x 1.7 m / 5700 kg
Power consumption	<3 W**
Acquisition time	20 min / 250 mm***

* under a stabilized temperature better than 0.1°C/hour, ** including grantry, ***for 5 images/sec

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