High-precision high-load manipulator for EUV reflectometry

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We present a high-precision in-vacuum manipulator for EUV reflectometry at large samples with up to 800 kg weight. Samples can be positioned and oriented in six degrees of freedom in ranges >500 mm and >360° with a relative accuracy of ~1 µm /0.001°, a reproducibility of a few microns and an absolute accuracy of better than 50 µm / 0.01°.

The manipulator was realized using a combination of a stacked design and a parallel kinematics with six degrees of freedom. The absolute accuracy was achieved by calibration of the encoders at the respective axes using a laser tracker as independent diagnostics. An external optical system based on photogrammetry can be used in-situ for optimizing the absolute accuracy beyond the values achieved by ex-situ calibration or for re-calibration under vacuum.