

High-precision calibration system for the sphericity of the reference spherical lenses' surface profile

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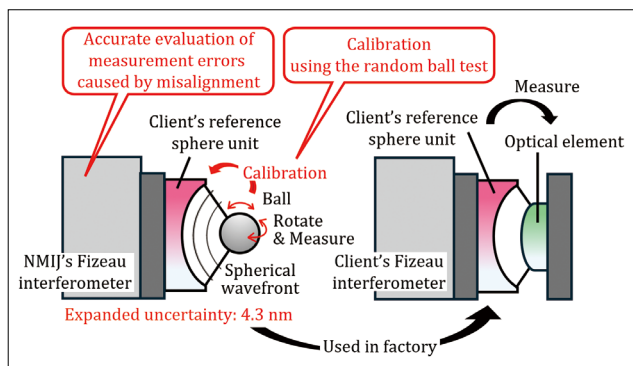
As high-precision optical elements are manufactured in industry and science, high-precision measurement of the deviation from the ideal spherical surface (sphericity) is required. Spherical Fizeau interferometers are widely used for evaluation of sphericity. The measurement result is the sum of the deviations of the test surface and the reference surface from each ideal sphere surface. Therefore, the absolute surface profile of the reference sphere should be calibrated. The sphericity calibration accuracy of the reference spherical lens is the bottleneck of the measurement accuracy of the spherical Fizeau interferometer. The sphericity of the reference spherical lens is about $\lambda/50$ (approx. 13 nm) to $\lambda/20$ (approx. 32 nm) at commercial lens production sites, and the calibration measurement capability required by the NMIJ is $\lambda/100$ (approx. 6 nm). The NMIJ has introduced the random ball method for reference spherical lens calibration, and furthermore, has established an uncertainty evaluation method by analyzing the measurement errors due to misalignment in detail. NMIJ has developed a system that can calibrate the sphericity of the reference spherical lens surface with an expanded uncertainty of 4.3 nm.

Reference:

N. Kawashima et al., *Opt. Lasers Eng.*, **184**, 1, 2025

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https://www.aist.go.jp/aist_e/list/latest_research/2024/20241227/en20241227-2.html



Schematic image of sphericity calibration system