SAND2008-5288P

Primary Standards Laboratory Metrology

Primary Dimensional Standards

Fact sheet

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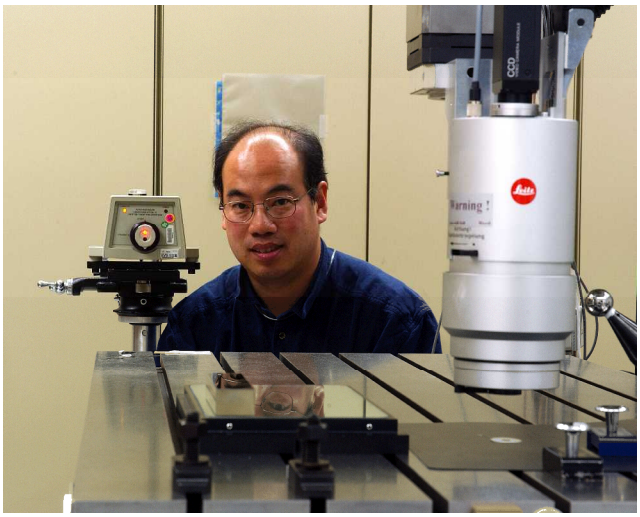
The Primary Standards Laboratory (PSL) maintains a wide variety of primary dimensional standards to assure accurate and traceable measurements for its customers.

Sub-micrometer capabilities include gage blocks, roundness, thread wires, gaging balls, surface roughness, step gages, line standards, and three-dimensional measurements (see below). All primary dimensional standards are directly traceable to the National Institute of Standards and Technology (NIST), other National Metrology Institutes, or to the wavelength of light. Most of the measurements listed here are accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) administered by NIST.

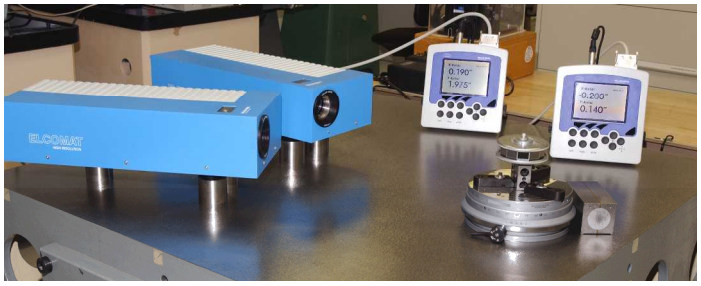
3D artifact measurements are performed using a Leitz PMM-C-Infinity Coordinate Measuring Machine (CMM) with QUINDOS software. The CMM can measure in a 1.2m x 1.0m x 0.6m volume with a resolution of 0.004 µm.

Customer short gage blocks (up to 4" or 100 mm) are measured by comparison to reference blocks using a redundant drift-eliminating design. We measure our reference blocks against the wavelength of light on a Brown & Sharpe automated 2-color laser-based gage block interferometer. Customer long gage blocks are measured by comparison to reference blocks calibrated by NIST.

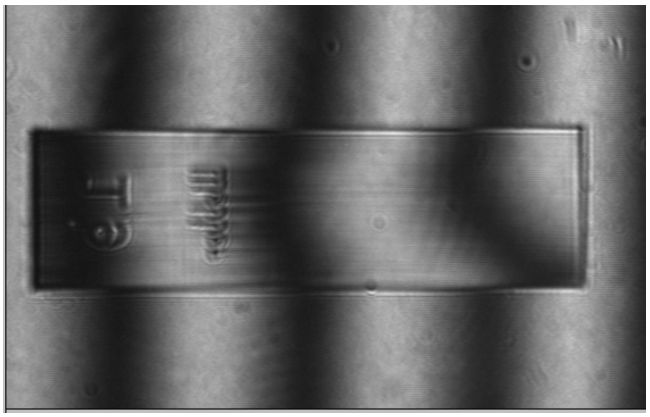


Checking CMM Alignment with a Laser Interferometer

Gage blocks, angle blocks, thread wires, gaging balls, index tables, optical polygons and squares, true squares, step gages, plain ring gages, optical flats, roundness, and surface roughness can be certified.



Calibration of an Optical Polygon



Fringes Observed by Gage Block Interferometry

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Dimensional Capabilities (95% confidence)

Below is a representative sample of our uncertainties. We are accredited by NVLAP under Lab Code 105002-0 by the National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program (NIST/NVLAP). For full details see http://ts.nist.gov/standards/scopes/1050020.pdf

Length	
CMM-(3D)	±(0.3 μm + 1 ppm)
Short gage blocks	±(37 nm + 0.6 ppm)
Long gage blocks	±(127 nm + 0.3 ppm)
Flatness	
Optical flats	±30 nm
Surface Texture	
Step standards 0.0125-12.5 μm	±0.0025-0.2 μm
Roughness standards 0.0125-3.1 μm RA	±0.0025-.07 μm
Angle	
Angle gage blocks	±0.47" arc
Optical squares	±0.46" arc
True squares	±0.28" arc
Index tables and Optical polygons (stack method)	±0.08" arc
Roundness	
Roundness stds.	±(10.6 nm + 6.8%)
Diameter	
Thread wires	±0.16 μm
Gaging balls	±0.15 μm
Plain plug gages and ring gages	±(0.23 μm + 1.7 ppm)

Major Resources

- State-of-the-art laboratory environmental controls
- Leitz PMM-C-Infinity 12-10-6 Coordinate Measuring Machine with low-force probing
- Talyrond 73HPR high-precision roundness measuring system
- Brown & Sharpe automated 2-color laser gage-block interferometer
- Elcomat HR autocollimators
- Federal 4" and 24" gage block comparators
- Laser-augmented SIP MI-6B micro-indicator
- Talysurf 6 automated surface roughness measuring system
- Talystep film thickness measuring system
- Hewlett Packard Metrology Lasers
- Zeiss interference microscope

Selected Accomplishments

- NIST/NVLAP (National Voluntary Laboratory Accreditation Program) accreditation for most measurement parameters
- Successful participation in national and international round robins

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