Metrology for new industrial measurement technologies

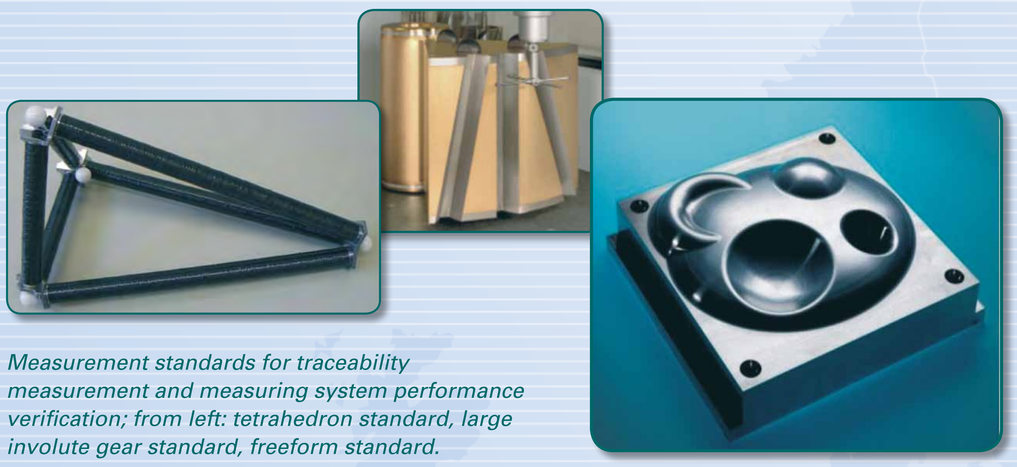
EURAMET
European Association of National Metrology Institutes

The need for the project

Three main challenges in large-scale dimensional measurements prevent manufacturers from testing exactly what rolls off their assembly lines – e.g. wind turbine blades, machine tool parts, automobile and aircraft parts:

- a lack of calibrated measurement standards
- inadequate measuring techniques to implement task-specific measurement uncertainty of large parts directly on the shop floor
- a lack of internet infrastructure for online validation of Coordinate-Measuring Machine (CMM) evaluation software and other geometrical evaluation algorithms

This project aimed to improve the understanding of large scale dimensional measurements by developing new and traceable measurement technologies – different advanced measurement standards, sophisticated measuring techniques, and good practice guides on the use of indoor GPS, lasertracers and other mobile measuring technologies.



Measurement standards for traceability measurement and measuring system performance verification; from left: tetrahedron standard, large involute gear standard, freeform standard.

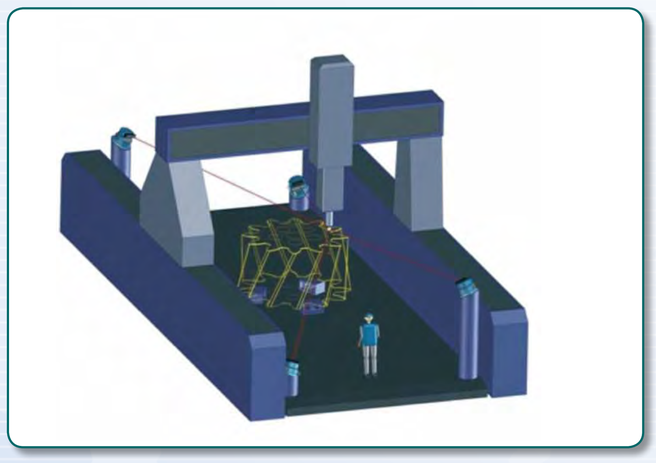
Technical achievements

Innovative and advanced standards designated for traceable measurements, calibration of parts, and performance assessments of measuring systems:

- a novel large involute gear standard with a diameter of 1 metre
- 3D freeform standards to validate optical-based CMMs and improve comparison measurements
- tetrahedron standards with ceramic optically cooperative targets for CMMs
- comparison measurements between optical and tactile based CMM measurements
- a waviness standard to assist the automobile industry

A new multi-lateration measuring system (M3D3) dedicated to the measurement of large objects has been developed and validated. This novel system can implement task specific uncertainty measurements and map CMM error, and can also be retrofitted into either a laboratory or industrial shop floor. The M3D3 is currently housed at PTB, Germany's National Metrology Institute, and will be used by manufacturers of large-scale parts, the automobile industry and other CMM users.

A new software validation technique has been developed; the Internet Aided Software Validation (IASV) infrastructure enables clients to communicate online for the purpose of CMM software and other algorithm validation.



Multi-lateration measuring system (M3D3) demonstrating measurement on an industrial shop floor.

Large gear and CMM calibration

Developed a large involute gear standard and M3D3 system to assist industries in assessing the performance of large-scale measurement machines, the implementation of task specific uncertainty measurement and the accurate measurements of complex parts.

Guidance for users

Produced comprehensive good practice guides and software for error detection and configuration of multi-sensor measurement systems that will be used by developers and users of multi-sensor networks, aircraft and automobile manufacturers, machine tool industries and calibration laboratories.

Interferometer and laser tracer calibration

Developed a new facility for the calibration of interferometers and laser tracers, used in the development of the new multi-lateration measuring system (M3D3). The facility will be used by calibration bodies and large object manufacturing industries, e.g. wind turbine, ship, aircraft and automobile industries.

Online validation of software

Launched the pilot Internet Aided Software Validation (IASV) infrastructure that is currently being tested by eight industrial partners: Carl Zeiss Industrielle Messtechnik GmbH, Klingelnberg GmbH, Mahr OKM GmbH, Messtechnik Wetzlar GmbH, Mitutoyo Messgeräte GmbH CTL, Mahr OKM GmbH, FRENCO GmbH, PTB Berlin.

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EMRP
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