Inter laboratory comparison on Industrial Computed Tomography

CIA-CT comparison

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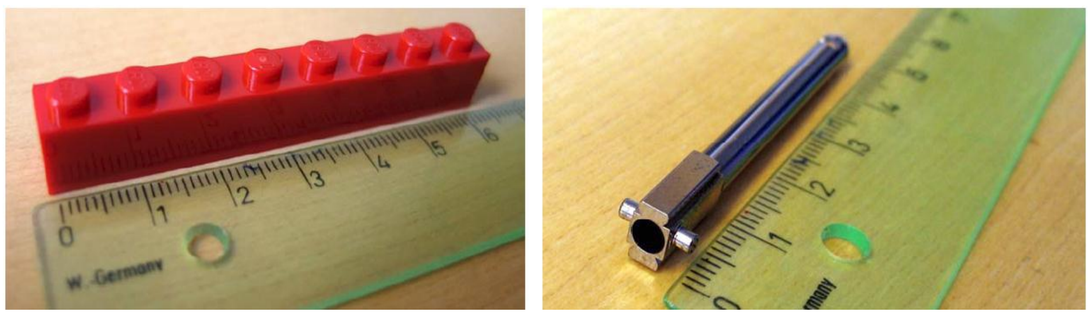
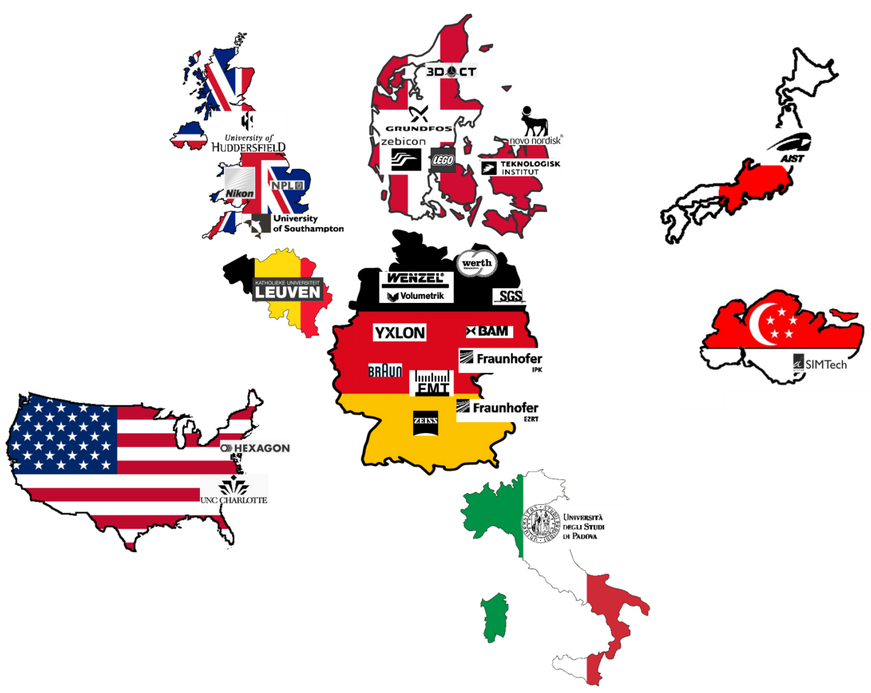
Comparison participants

An interlaboratory comparison on industrial X-ray Computed Tomography (CT) was organized by the Centre for Geometrical Metrology (CGM), Department of Mechanical Engineering, Technical University of Denmark (DTU) and carried out in 2013 within the project "Centre for Industrial Application of CT scanning - CIA-CT". 27 laboratories from 8 countries were involved.



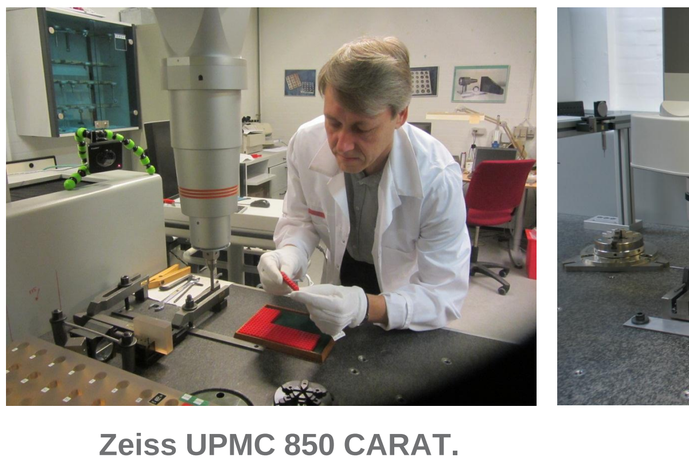
Item 1 (Polymer part). Item 2 (Metal part).



The 27 participants in the CIA-CT circulation.

Items and reference measurements

Two items were selected among common industrial parts: a polymer part and a metal part. Different measurands were considered, encompassing diameters, roundness, and lengths. All single items were measured at CGM using coordinate measuring machines (CMMs) before and after circulation. Both the metal item and the plastic item have shown a good stability over the 6 months of the comparison. Average reference expanded (k=2) measurement uncertainties in the range 1.5-5.5 µm were estimated.

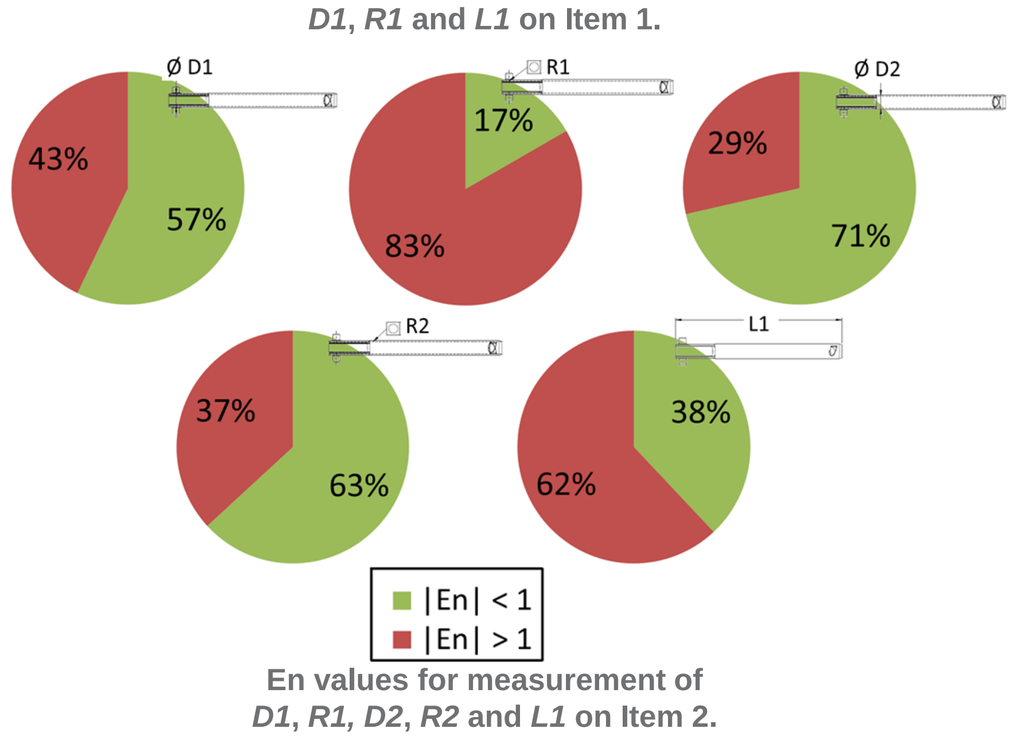


Zeiss UPMC 850 CARAT.

Zeiss OMC 850.

Analysis of participants' data

The participants stated average expanded uncertainties in the range 6-15 µm with maximum values up to 51 µm. Results by the single participants were compared with the reference values through the En value, where |En| < 1 indicates agreement between measurement results while |En| ≥ 1 shows disagreement. Out of a total of 167 single results, 54% of the measurements yield |En| values less than 1, and 46% values larger than 1. Systematic errors were detected for some participants on the diameters and lengths. Plausible measurement uncertainties were recalculated for the measurements connected to |En| values above 1. The comparison has shown that CT measurements on the small industrial parts that have been used can be divided in two groups. A group with average measurement uncertainties in the range 6-15 µm, and a group with average uncertainties in the range 14-53 µm, and maximum values up to 158 µm, compared to average uncertainties below 5.5 µm using CMMs. The comparison has shown that the two industrial items are suitable artefacts for CT measurements of this kind.



En values for measurement of *D1*, *R1* and *L1* on Item 1.

En values for measurement of *D1*, *R1, D2*, *R2* and *L1* on Item 2.

References

1. J. Angel, L. De Chiffre, E. Larsen, J. Rasmussen, R. Sobiecki, CIA-CT comparison, Reference Measurements, Department of Mechanical Engineering, Technical University of Denmark, 2013.
2. J. Angel, L. De Chiffre, CIA-CT comparison, Final Report, Department of Mechanical Engineering, Technical University of Denmark, 2013.

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