

## Medium term stability investigation of polymer step gauges for CT scanner verification - DTU Orbit (08/11/2017)

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A miniature step gauge fabricated using a material for dental applications was previously used at DTU as a reference object for instrument verification in optical 3D scanning and Computed Tomography (CT). Initial material investigations had indicated a good metrological compatibility but a later stability investigation showed that the material was not hard and stable enough to be used for reference objects. In order to achieve better performance mechanical properties and stability, two other polymer materials, polyetheretherketone (PEEK) and polyphenylene sulphide (PPS), were selected. Five miniature step gauges of each material were manufactured using milling. A tactile CMM and grade I steel gauge blocks were used for calibration. A practical approach inspired by the PUMA method was used for uncertainty estimation, as a simplification of the GUM approach. The long term stability of the step gauges was monitored through reproduced measurements of 10 groove distances for each step gauge, both uni-directionally and bi-directionally, carried out eight times over approximately one year. The stability investigation showed for PPS deviations below 3  $\mu\text{m}$  and expanded uncertainties ( $k=2$ ) below 5  $\mu\text{m}$  while 4  $\mu\text{m}$  and 7  $\mu\text{m}$ , respectively, were obtained for PEEK. The  $E_n$  value normalised with respect to the estimated uncertainty was computed according to ISO 17043 guidelines. The estimated  $|E_n|$  values are generally in the acceptable range for both polymer materials, with a calculated average of  $|E_n| = 0.2$ .

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