Application of Dimensional X-ray Tomography principles to the study of Cultural Heritage

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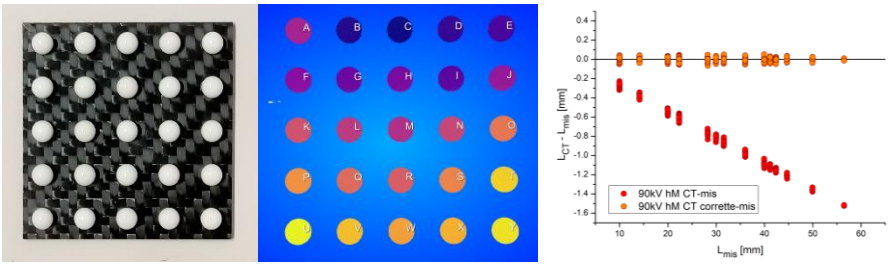
Computed Tomography (CT) is a non-destructive technique based on X-rays that allows to obtain information on the internal structure of the analysed object without the need to take samples. CT is nowadays used in the Cultural Heritage field, because of the necessity of non-invasive techniques for the investigation of archaeological and historical artefacts, maintaining so their integrity [1]. CT allows the visualization and study of the inner features and characteristics of different kind of objects based on the field of application. Since CT data contain complete volumetric information about the measured part, it is possible, after the reconstruction of the two-dimensional projection images, to perform dimensional measurements of external and internal structures and provide accurate dimensional and geometrical information. This is why in industrial applications, CT is often used for quality control, in order to reveal defects in the manufacturing and also measurements of components containing hard-to-access internal micro structures. To achieve this objective, it is necessary to evaluate and analyse different aspects concerning a tomographic measurement, also through the use of standard reference objects.

This type of analysis approach is increasingly used in industry [2], but it is rarely applied to Cultural Heritage because in most of the cases, the need is the qualitative investigation of artefacts structure. However in some applications a quantitative evaluation of some features through dimensional CT measurements is a very important issue. This is the case with wind musical instruments in order to get playable 3D printing replicas with acceptable tolerance respect to the original artefacts. In particular, in our work, woodwind musical instruments dated towards the end of the 18th century are studied [3]. For these reasons, the principles of industrial dimensional CT analysis were adopted, i.e., the characterization of CT parameters during the acquisition and the reconstruction phases is performed thanks to the use of calibration objects [3], like ball bars (often used for metrological aims), to assess the reproducibility of measurements in terms of dimensions.



CT calibration object (ball plate) and correction factor calculation

References

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