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High resolution 4D monitoring of analogue experiments through CT scanning; preliminary results using novel high X-Ray absorbent materials

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Analogue models, help understanding geological processes, in particular deformational ones. However, standard procedures such as surface scanning (at any time) and sectioning at the end of the experiments represent 2D approaches for the analysis of deformation structures. The application of CT scanning techniques helps understanding deformation patterns inside the models during the development of the process. However, standard 3D reconstructions do not always enable to accurately monitor the strain patterns within the interior of the models. Digital Volume Correlation (DVC) techniques (Adam et al., 2013 J. Struc. Geol.) are a major step forward in the quantification of strain in space and time, but face limitations when trying to correlate DICOM images acquired at different times in cases when deformation is highly non-cylindrical, non-coaxial or rotational. Recently, a novel method using highly absorbent X-Ray markers (Ramón et al., 2013 Tectonophys.) was proposed to fully control deformational patterns in 3D in static simulations of complex folds.

In this work we focus on developing novel methodologies to obtain more accurate 4D monitoring in analogue models merging the aforementioned concepts; using highly absorbent X-Ray markers to significantly increase accuracy during DVC. We aim for: 1) Optimizing the type and proportion of linear and dispersed markers with respect to sand. Red lead (LT) or iron powders (IP), have demonstrated to produce enough brightness in the radiograms and, tto allow the markers to be tracked in DICOM images with the potential of applying Digital Image Correlation (DIC) techniques. 2) Enhancing the stratigraphic horizons by adding micro layers of low density materials (v.g. plastic sand). 3) Testing the applicability of the method in case studies; we re-designed the model setup on thrust wedges from along-strike tapered, silicone-floored multilayers (Storti et al., 2007, J. Geol. Soc. London) because strong oblique patterns are found in those models. 4) Characterizing the friction of the materials (quartz and plastic sands sand-iron powder mix) used in the experiments.