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We are interested in reconstructing the time evolution of 2D plane deformation of analogue models of tectonic processes. Under relevant forcings, these models develop internal deformation, such as faults, and broader zones of deformation. We use Particle Image Velocimetry (PIV) to derive incremental displacements from top-view images that we use in subsequent steps to calculate the shape changes that come with large deformation. Because PIV describes displacement in a spatial reference, and material moves through the area in view, displacements at any given time refer to fixed locations in space, and not to specific material points. By reconstructing the path of material, we can follow small regions of material while they translate, rotate and change shape.

To aid the qualitative interpretation of this deformation, we have developed a novel method that can qualitatively describe shape changes coming from extensional, shortening and horizontal shearing (strike-slip) deformation or combinations of these. This method is based on a logarithmic measure of stretch and results agree well with the visual interpretation of structures that we observe in our models. Thus, we provide tools with which the evolution of 2D tectonic deformation can be interpreted in a physically meaningful manner, but our method may be useful outside the realm of tectonics. Our software to compute deformation is freely available and can be used to post-process incremental displacements from PIV or similar autocorrelation methods.