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Improved 3D reconstruction of velocity and density fields from SPIV and PLIF images by relaxation of Taylor's hypothesis DOMINIQUE FRATANTONIO, Los Alamos National Laboratory, CHRIS CHUNG KEI LAI, Georgia Institute of Technology, JOHN JAMES CHARONKO, KATHY PHILOMENA PRESTRIDGE, Los Alamos National Laboratory — Given the high cost and complexity of setting up simultaneous tomographic PIV and LIF for the analysis of variable-density turbulent flows, we developed a novel algorithm that reconstructs from stereoscopic-PIV and planar LIF accurate 3D velocity and density fields with spatial resolution and size comparable to those achievable with direct volumetric measurements. This new algorithm is based on the use of the local instantaneous velocity for the data convection and the relaxation of the Taylor's hypothesis by the iterative enforcement of the incompressibility constraint on the velocity field. With application to numerical and experimental data, we demonstrate that this new method provides reconstructed 3D fields of variable-density flows with strong shear layers that are more accurate and that better satisfy the conservation of mass and the vorticity transport equations than those provided by the traditional method based on the convective mean field.

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