

Abstract Submitted
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Simultaneous Cinematographic PIV and PLIF measurements at kilohertz frame rate for turbulent cavity flows S. BIAN, S.L. CECCIO, Dept. of Mech. Engr., Univ. of Michigan, J.F. DRISCOLL, Dept. of Aerospace Engr., Univ. of Michigan — A temporally-resolved flow visualization method has been developed for simultaneous measurement of velocity and concentration quantities in time-varying flows through the combination of cinematographic Particle Imaging Velocimetry (PIV) and Planar Laser Induced Fluorescence (PLIF). PIV images are acquired using two high-speed CMOS cameras that were optically combined and registered by using a non-polarizing beam splitter and a calibration target with known dimensions. The alignment uncertainty contributes up to 5% to the overall velocity measurement uncertainty. A third camera was added to simultaneously record PLIF images. The illumination of both particles and fluorescent dye is provided by two high repetition rate frequency-doubled Nd:YAG lasers. A long-pass color filter in front of PLIF camera eliminates the laser light reflected by PIV particles. A sequence length of 1083 image pairs with 1600 x 800 pixels was obtained at 1500 frames per second while simultaneous PLIF images with a full resolution of 800 x 600 pixels are taken through synchronizing signal generator. Both mean and instantaneous velocity and concentration fields are presented along with dynamic pressure data to illustrate the effect of the large-scale structures on the self-sustained oscillation inside the cavity. Correlations between the fluctuating velocities and concentration in the impinging shear layer reveal the dynamics of the transient mixing process.

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