

Abstract Submitted  
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**Simultaneous time-resolved measurement of flow field and surface deformation combining tomographic PIV and Mach-Zehnder interferometry**<sup>1</sup> CAO ZHANG, RINALDO MIORINI, JOSEPH KATZ, Johns Hopkins University — Flow induced vibrations are ubiquitous in numerous applications, for which knowledge of the relationship between surface deformation and the corresponding flow field is vital to the understanding of the processes involved. A novel technique, combining tomographic PIV (TPIV) and Mach-Zehnder interferometry (MZI), has been developed to perform simultaneous, time-resolved measurements of both the 3D flow field above a compliant transparent PDMS wall, and the spatial distribution of surface deformation. Five high speed cameras are involved, four for TPIV, and the fifth for MZI. The same high-speed laser is used for both measurements by allowing a small fraction (0.1%) of the TPIV light, which is transmitted through PDMS coating, to propagate through a 99.9% mirror to the MZI camera. This object beam interferes with a similarly weak reference beam that does not pass through the sample volume. Methods for extracting the deformation from the resulting fringes will be discussed, such as fringe enhancement techniques to improve the S/N ratio. Sample velocity and deformation results recorded at 3kHz will be presented, demonstrating the ability of combined TPIV and MZI to study the dynamical interactions between 3D flow structure and surface deformation.

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