Performing non-intrusive measurements is key to acquiring accurate information representative of what is being observed. The act of measuring often changes the environment being observed altering the information that is being obtained. Due to this, the community of fluid scientists have gravitated towards using laser-based measurements to observe the phenomena occurring in their experiments. The study of fluids has advanced since this point utilizing techniques such as planar laser induced florescence (PLIF), particle image velocimetry (PIV), laser doppler velocimetry (LDV), particle doppler anemometry (PDA), etc. to acquire chemical species information and velocity information. These techniques, though, are inherently two-dimensional. To complicate further, in the field of reacting fluids (combustion) acquiring the local fuel to air ratio information is increasingly important. Without it, scientists must rely on global one-dimensional metering techniques to correlate the fuel to air ratio to their measurements. If the three-dimensional local fuel to air ratio is known along with three dimensional velocimetric and species information, it is possible to extract the necessary quantities to fully describe a flow field. Discussed in this work will be the development of a non-intrusive local fuel-air measurement technique along with an expansion of the PIV technique into the third dimension, tomographic PIV, utilizing minimum equipment to do so. The local fuel-air measurement is performed by recording to species (C2* and CH*) simultaneously on a single image sensor and calibrating their ratio to a known fully premixed metered fuel-air field. The calibration allows for the back calculation local fuel air information in non-premixed systems. Tomographic PIV is performed by utilizing fiber coupling to acquire multiple viewpoints utilizing a single image sensor. This reduces overall image resolution but simplifies the technique greatly. Coupling the two techniques allows for a simple non-intrusive method for acquiring three-dimensional informational information to accurately reacting flow fields.

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The public is welcome to attend.