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Simultaneous 3D Volumetric PIV and 2D OH PLIF in the Far-Field of a Nonpremixed Turbulent Jet Flame MIRKO GAMBA, NOEL T. CLEMENS, OFODIKE A. EZEKOYE, The University of Texas at Austin — Cinematographic stereoscopic PIV, combined with Taylor's hypothesis, is used to generate quasi-instantaneous volumes of the 3D velocity field in the far field of a turbulent nonpremixed jet flame at a jet exit Reynolds number of 8,000. The 3D data enable computation of the nine components of the velocity gradient tensor and its derived kinematic quantities. The volumetric PIV is combined with simultaneously acquired OH PLIF to mark the instantaneous reaction zone. The combined data sets enable investigation of the relationship between the jet kinematics and the reaction zone. Three-dimensional rendering of regions of intense vorticity and dissipation reveals that sheet-like layers of vorticity and dissipation tend to coincide and are aligned with the OH layers. Due to the stabilizing effect of heat release on this relatively low Reynolds number jet flame, intense dissipation is mostly due to the laminar shear caused by the presence of the flame rather than the strain generated by vortical structures as typically observed in non-reacting jets. It is further observed that both positive and negative dilatation is present and is believed to be mainly due to convection of regions of varying density rather than to instantaneous heat release rate.

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