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Cinematographic 3-D PIV of a Turbulent Jet NOEL T. CLEMENS, BHARATHRAM GANAPATHISUBRAMANI, KRISHNA LAKSHMINARASIMHAN, Center for Aeromechanics Research, The University of Texas at Austin, TX 78712 — The structure of a fully developed turbulent jet at a Reynolds number of 5000 is investigated with cinematographic (1 kHz) stereoscopic PIV in a plane normal to the jet axis (i.e., "end view"). The temporal resolution is sufficiently high that Taylors hypothesis can be used to enable the computation of velocity gradients in the axial direction. Furthermore, the resolution (in space and time) is approximately three Kolmogorov scales, and is therefore sufficient to resolve the structure of the dissipation field. The technique enables computation of all terms of the velocity gradient tensor in a plane, at kilohertz rates, and therefore at each point in the plane we can compute the complete vorticity vector, strain rate tensor and kinetic energy dissipation. We use the data to investigate the time-evolution of the dissipation field and its relationship to the vorticity and strain rate fields. The data can alternatively be used to form y-z-t volumes (with x the axial direction). These pseudo-volumes show that the vorticity field is dominated by tube-like structures and the dissipation structures are often sheet-like or more nondescript blobs. The spatial relationship among the dissipation, strain rate and vorticity will be discussed, as well as a statistical analysis of these quantities.

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