LC 2 Scalar Dissipation in Axisymmetric Jets WILLIAM PITTS, National Institute of Standards and Technology CECILIA RICHARDS, Washington State University MARK LEVENSON, National Institute of Standards and Technology Scalar dissipation, defined as twice the product of the molecular diffusion coefficient and the local gradient of the mixture fraction taken as a dot product with itself, characterizes molecular mixing rates in turbulent flows and has a central role in turbulent combustion modeling. Laser-Induced Rayleigh light scattering combined with a unique line camera has allowed real-time concentration measurements along a line positioned in the radial direction of an axisymmetric turbulent jet of propane flowing into air with sufficient resolution to capture the small-scale fluctuations. Improving the effective signal-to-noise ratio using wavelet analysis and invoking Taylor’s Hypothesis to determine the scalar dissipation in the axial direction allows the determination of the probability distribution functions (pdfs) for scalar dissipation measurements in the axial-radial plane. By assuming the fluctuations are isotropic and have a log normal distribution, it is possible to obtain full pdfs for scalar dissipation fluctuations in three dimensions from the planar results. The resulting pdfs allow the calculation of the average value of the local scalar dissipation. The current results along with existing measurements in the literature are used to derive optimized parameters for a similarity expression describing the variation of the average scalar dissipation with downstream distance from the jet exit, initial flow velocity, and density ratio.

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