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Statistical and Visual Analysis of Conserved Scalar Mixing Dynamics in Turbulent Jets Using kHz-Rate Imaging MICHAEL PAPAGEORGE, FREDERIK FUEST, JEFFRET SUTTON, Ohio State University — The objective of this work is to examine the space-time dynamics of conserved scalar transport and mixing in gas-phase, turbulent jets utilizing kHz-rate, planar laser diagnostics. This research is facilitated by the High-Energy Pulse-Burst Laser System (HEPBLS) at Ohio State, which is capable of delivering high-energy ($\sim$ 1 J) pulses at 532 nm at repetition rates of 10 kHz and higher. With this system, time-resolved 2-D scalar mixing fields are acquired with high signal-to-noise ratios. In this study Rayleigh scattering from a propane jet issuing into a low-speed air co-flow was used to measure mixture fraction at Re = 10,000 to 30,000 at axial locations of x/D = 10 to 40. Single- and multi-point time statistics are employed to gain a better understanding of the dynamics of large-scale features. Single point auto-correlations are used to calculate the integral time scale as a function of axial and radial location and Reynolds number with unprecedented spatial resolution. Multi-point time correlations are then used to examine the nature of scalar advection and spreading rate across the width of the jet. In addition to the statistical representation, both time scale and spreading rate are examined visually to gain an improved qualitative understanding of scalar mixing.

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