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Quantitative multi-scalar planar imaging in turbulent jets CODY BROWNELL, LESTER SU, Johns Hopkins University — We apply planar imaging techniques to investigate scalar mixing in a three-species turbulent axisymmetric jet. The jet consists of helium, acetone vapor, and air, issuing into a slow air co-flow. The diagnostic methods applied here are planar laser-induced fluorescence (PLIF) and planar laser Rayleigh scattering. The PLIF signal provides an absolute measure of the acetone vapor concentration. The jet composition is specified so that the Rayleigh scattering signal quantifies the concentration difference between the helium and acetone. Simultaneous application of these methods allows direct determination of all relevant mole fractions in the three-species system. The imaging results focus on the near-field of the flow. The jet Reynolds number varies from approximately 1000 to 3000. These multi-scalar measurements are particularly interesting to simulations of turbulent combustion that go beyond the conserved scalar approach to the mixing problem. Quantitative results presented include scalar differences and correlations, and joint statistics of the different scalars. We also discuss the roles played by the large-scale organization, and the intermittency, of the flow, and the effect of varying the Reynolds number.

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