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Simultaneous PIV and PLIF measurement of passive scalar mixing in a confined planar jet HUA FENG, MICHAEL OLSEN, JAMES HILL, RODNEY FOX, Iowa State University — Simultaneous velocity and concentration fields in a confined liquid-phase planar jet with a Reynolds number based on hydraulic diameter of 50,000 were obtained using combined particle image velocimetry (PIV) and planar laser-induced fluorescence (PLIF). Data at six downstream locations were analyzed for flow statistics such as mean velocity, Reynolds stresses, turbulent kinetic energy, concentration mean and variance, turbulent fluxes, turbulent viscosity and diffusivity, and turbulent Schmidt number. Spatial correlation fields of turbulent fluxes and concentration were then determined. The $R_{u'\phi'}$ correlation was elliptical in shape with a major axis tilted downward with respect to the streamwise axis, whereas the $R_{v'\phi'}$ correlation was a horizontally oriented ellipse. The $R_{\phi'\phi'}$ correlation field was found to be an ellipse with the major axis inclined at about 45-degrees with respect to the streamwise direction. Linear stochastic estimation was used to determine conditional flow structures. Large-scale structures were observed in the conditional velocity fields that are elliptical in shape with a streamwise major axis. The size of the structure initially increased linearly with respect to downstream distance, but then grew more slowly as the flow evolved towards channel flow.

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