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Multi-Scale Investigation of Spray Droplets Issued in a Turbulent Background DOUGLAS CARTER, ROUMAISSA HASSAINI, FILIPPO COLETTI, University of Minnesota — We present time-resolved planar measurements of an upward-facing hollow cone spray with simultaneous large and small scale fields of view. The measured mean droplet diameter of 50um for the spray issued into both quiescent and turbulent backgrounds is found to correspond to Stokes numbers approaching order one, indicating that the droplets act as non-ideal flow tracers. The dynamics of the drops are investigated by particle tracking velocimetry (PTV) to educe the instantaneous droplet motion and particle image velocimetry (PIV) to extract the correlated droplet motion in the far field of the spray. It is found that the droplets issued into quiescent air exhibit greater random uncorrelated motion (RUM) compared to the droplets in a turbulent background, implying that the turbulent eddies prevent the droplets from moving ballistically. This is also reflected by the lesser drop in the Eulerian autocorrelations at small separations for droplets issued into a turbulent background as well as the general increase in the magnitude of the Lagrangian autocorrelations. These results provide novel insight into the motion of inertial droplets in a turbulent gas, and have implications for the numerical modeling and control of liquid sprays.

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