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Holographic Measurements of Fuel Droplet Diffusion in Isotropic Turbulence[1] BALAJI GOPALAN, EDWIN MALKIEL, JOSEPH KATZ, Johns Hopkins University — High-speed digital holographic cinematography was used to investigate the diffusion of slightly buoyant fuel droplets in locally isotropic turbulence. High turbulence levels with a weak mean velocity was generated at the center of a tank by four rotating grids. 0.3-1.5mm droplets were injected here and tracked using in-line holography. To obtain all three components of velocity, we simultaneously recorded holograms of the central 37x37x37 mm^3 volume from two perpendicular directions. These were numerically reconstructed to provide focused images of the droplets. An automated code was developed to identify the 3-D droplet trajectories from the two views, and then calculate time series of their velocity. After subtracting the local mean fluid velocity, the time series were used to obtain the 3-D Lagrangian autocorrelation function of droplet velocity. Averaging over many trajectories provided the autocorrelation functions as a function of direction and droplet sizes. As expected, the correlation was higher in the vertical direction due to the effect of gravity. Data analysis is still in progress.

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