Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Lagrangian Statistics of Slightly Buoyant Droplets in Isotropic Turbulence[1] BALAJI GOPALAN, EDWIN MALKIEL, JOSEPH KATZ[2], Johns Hopkins University — This project examines the dynamics of slightly buoyant diesel droplets in isotropic turbulence using high speed in-line digital Holographic PIV. A cloud of droplets with specific gravity of 0.85 is injected into the central portion of an isotropic turbulence facility. The droplet trajectories are measured in a 50x50x50 mmˆ3 sample volume using high speed in-line digital holography. An automated program has been developed to obtain accurate time history of droplet velocities. Data analysis determines the PDF of velocity and acceleration in three dimensions. The time histories enable us to calculate the three dimensional Lagrangian velocity autocorrelation function, and from them the diffusion coefficients. Due to buoyancy the vertical diffusion time scale exceeds the horizontal one by about 65% .The diffusion coefficients vary between 2.8 cmˆ2/sec in the horizontal direction to 5.5 cmˆ2/sec in the vertical direction. For droplets with size varying from 2 to 11 Kolmogorov scales there are no clear trends with size. The variations of diffusion rates for different turbulent intensities and the effect of finite window size are presently examined. For shorter time scales, when the diffusion need not be Fickian the three dimensional trajectories can be used to calculate the generalized dispersion tensor and measure the time elapsed for diffusion to become Fickian.

[1]Sponsored by Department of Energy
[2]Contact author

Balaji Gopalan
Johns Hopkins University

Date submitted: 05 Aug 2006 Electronic form version 1.4