Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Experimental variable-density mixing statistics

SERGIY GERASHCHENKO, KATHERINE PRESTRIDGE, Los Alamos National Laboratory — Velocity and density statistics are studied experimentally for variable density mixing of a heavy fluid jet into air coflow at two Atwood numbers. The effect of buoyancy is found to be important for most turbulent quantities measured. The high At jet with larger Reynolds number shows reduced lateral spreading compared to the low At jet of smaller Reynolds number. Some universal features of variable density mixing are elucidated from PDFs of density and density gradients. The low Atwood number PDFs show fast and uniform mixing. High Atwood number PDFs of density have skewness toward the larger densities, indicating reduced rate of mixing of pure heavy fluid due to its inertia. This skewness is related to strong local compression events that can lead to enhanced molecular mixing. Turbulent kinetic energy decreases with distance from the jet for low Atwood number but increases for high Atwood number due to flow acceleration and generation of extra shear and turbulence. This is clearly a buoyancy-mediated effect. Statistical characteristics of mixing such as Favre-averaged Reynolds stress and its anisotropy, turbulent mass flux velocity, density-specific volume correlation, density power spectra are also examined in the near and far field from the jet.

Katherine Prestridge
Los Alamos National Laboratory

Date submitted: 29 Jul 2013 Electronic form version 1.4