Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Favre-Averaged Turbulence Statistics in Variable Density Mixing of Buoyant Jets JOHN CHARONKO, KATHY PRESTRIDGE, Los Alamos National Lab — Variable density mixing of a heavy fluid jet with lower density ambient fluid in a subsonic wind tunnel was experimentally studied using Particle Image Velocimetry and Planar Laser Induced Fluorescence to simultaneously measure velocity and density. Flows involving the mixing of fluids with large density ratios are important in a range of physical problems including atmospheric and oceanic flows, industrial processes, and inertial confinement fusion. Here we focus on buoyant jets with coflow. Results from two different Atwood numbers, 0.1 (Boussinesq limit) and 0.6 (non-Boussinesq case), reveal that buoyancy is important for most of the turbulent quantities measured. Statistical characteristics of the mixing important for modeling these flows such as the PDFs of density and density gradients, turbulent kinetic energy, Favre averaged Reynolds stress, turbulent mass flux velocity, density-specific volume correlation, and density power spectra were also examined and compared with previous direct numerical simulations. Additionally, a method for directly estimating Reynolds-averaged velocity statistics on a per-pixel basis is extended to Favre-averages, yielding improved accuracy and spatial resolution as compared to traditional post-processing of velocity and density fields.

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Date submitted: 31 Jul 2014 Electronic form version 1.4