Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Self-similarity in high Atwood number Rayleigh-Taylor experiments[1] MARK MIKHAEIL, PRASOON SUCHANDRA, GOKUL PATHIKONDA, DEVESH RANJAN, Georgia Institute of Technology — Self-similarity is a critical concept in turbulent and mixing flows. In the Rayleigh-Taylor instability, theory and simulations have shown that the flow exhibits properties of self-similarity as the mixing Reynolds number exceeds 20000 and the flow enters the turbulent regime. Here, we present results from the first large Atwood number (0.7) Rayleigh-Taylor experimental campaign for mixing Reynolds number beyond 20000 in an effort to characterize the self-similar nature of the instability. Experiments are performed in a statistically steady gas tunnel facility, allowing for the evaluation of turbulence statistics. A visualization diagnostic is used to study the evolution of the mixing width as the instability grows. This allows for computation of the instability growth rate. For the first time in such a facility, stereoscopic particle image velocimetry is used to resolve three-component velocity information in a plane. Velocity means, fluctuations, and correlations are considered as well as their appropriate scaling. Probability density functions of velocity fields, energy spectra, and higher-order statistics are also presented. The energy budget of the flow is described, including the ratio of the kinetic energy to the released potential energy.

[1]This work was supported by the DOE-NNSA SSAA Grant DE-NA0002922.

Devesh Ranjan
Georgia Institute of Technology

Date submitted: 31 Jul 2017 Electronic form version 1.4