

Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Sensitivity of inertial particle response on turbulent duct flows to mass loading ratio and Reynolds number.¹ LAURA VILLAFANE, ANDREW BANKO, CHRIS ELKINS, JOHN EATON, Stanford University — The momentum coupled dynamics of particles and turbulence are experimentally investigated in a vertical fully developed turbulent square duct flow of air laden with Nickel particles. Significant preferential concentration is present for the Stokes numbers investigated, which vary from 3 to 30 based on the Kolmogorov time scale. Higher order measures of preferential concentration, such as the sizes and shapes of clusters and voids, are analyzed for increasing mass loading ratios. The mass loadings chosen span the one-way and two-way coupled regimes, while the volume loading is kept low. The effect of Stokes number and mass loading is also evaluated for particle velocity statistics and compared to the unladen gas statistics. Planar laser scattering is used to record instantaneous particle images in the center of the duct. Preferential concentration statistics are computed from box counting and Voronoi tessellation algorithms. PIV and PTV techniques are used to calculate particle velocity statistics. The analysis is extended to the near wall region in the logarithmic layer for the case of low mass loading. These results are compared to those from the duct center to assess the effects of strong carrier phase inhomogeneity on the particle distributions.

¹This Material is based upon work supported by the Department of Energy National Nuclear Security Administration under Award Number DE-NA0002373-1

Laura Villafane
Stanford University

Date submitted: 28 Jul 2016

Electronic form version 1.4