Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Multiphase turbulence in vertical wall-bounded collisional gas-particle flows RODNEY O. FOX[1], Department of Chemical and Biological Engineering, Iowa State University, JESSE CAPECELATRO, OLIVIER DESJARDINS, Sibley School of Mechanical and Aerospace Engineering, Cornell University — Wall-bounded particle-laden flows are common in many environmental and industrial applications, and are often turbulent. In vertical flows, strong coupling between the phases leads to the spontaneous generation of dense clusters that fall due to gravity at the walls, while dilute suspensions of particles rise in the central region. Sustained volume fraction and velocity fluctuations caused by the clusters result in the production of fluid-phase turbulent kinetic energy, referred to as cluster-induced turbulence (CIT). To better understand the nature of CIT in wall-bounded flows, Eulerian-Lagrangian simulations of statistically stationary three-dimensional gas-solid flows in vertical pipes are performed. To extract useful information consistent with Eulerian turbulence models, a separation of length scales is introduced to decompose correlated and uncorrelated granular motion. To accomplish this, an adaptive spatial filter is employed on the particle data with an averaging volume that varies with the local particle-phase volume fraction. Radial profiles of turbulence statistics are generated from the Eulerian-Lagrangian results. Details on the nature of the turbulence are described, as well as the challenges they present to turbulence modeling.

[1]Marie-Curie Senior Fellow, Ecole Centrale Paris

Rodney Fox
Chemical and Biological Engineering, Iowa State University

Date submitted: 30 Jul 2014 Electronic form version 1.4