Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Experimental analysis of clustering in particle risers[1] KEE ONN FONG, University of Minnesota Twin-Cities, FILIPPO COLETTI, ETH Zurich —
In particle risers, where the dispersed phase fall against a rising fluid, clusters are observed to form near the walls. These have sizes of order of the riser diameter and alters the bulk mass and heat transfer properties of the device. Previous experimental studies focused on clusters in risers are either limited to quasi-two-dimensional configurations, report only the bulk properties, or observe only the near-wall dynamics. Here we present experimental observations on the velocities and spatial distribution of particles in a three-dimensional, gas-solid riser with particle volume fractions approaching 1%. The setup consists of a vertical square duct in which air flows upwards against falling 212 μm glass spheres. We use a backlighting technique and a high-speed camera to image and quantify the spatial and temporally resolved particle concentration and velocity fields. By controlling the particle feed rate and the flow rate of the fluidizing air, volume fractions and bulk flow Reynolds number are adjusted independently. Results show that, in the present range of parameters, clustering of particles appear beyond a critical volume fraction regardless of fluidization velocities. The findings are discussed in the context of collective particle behaviour, the influence of clusters on the mean statistics, and modelling strategies for dense particle-laden flows.

[1]National Science Foundation, Army Research Office, MN Environmental and Natural Resources Trust Fund

Kee Onn Fong
University of Minnesota Twin-Cities

Date submitted: 31 Jul 2020 Electronic form version 1.4