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Highly concentrated falling inertial particles in a vertical duct/riser[1] KEE ONN FONG, FILIPPO COLETTI, Univ of Minnesota - Twin Cities — Highly concentrated particle-laden turbulent flows, such as flows found in fluidized beds and falling-particle receivers, form complex and poorly understood interactions owing to the strong feedback of the dispersed phase on the fluid and possible inter-particle collisions. We present experimental observations on the velocity response and topological distribution of highly concentrated, falling inertial particles in a vertical rectangular duct. The working fluid is air laden with size-selected glass particles. The experiment is conducted in two different configurations of free-falling particles, and particles suspended by flowing air, enabling particle volume fractions as high as 3E-2. Two different resolutions are employed - a full-scale view to capture large-scale motions of the particles and cluster formation using particle image velocimetry; and a zoomed-in view to resolve the individual motions of particles using particle tracking velocimetry. The findings are discussed in the context of collective effect of particles, the influence of clusters on the mean statistics, and the partitioning of particle velocities into spatially correlated and random uncorrelated motions.

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