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Application of Medical Magnetic Resonance Imaging for Particle Concentration Measurement DANIEL BORUP, CHRISTOPHER ELKINS, JOHN EATON, Stanford Univ — Particle transport and deposition in internal flows is important in a range of applications such as dust aggregation in turbine engines and aerosolized medicine deposition in human airways. Unlike optical techniques, Magnetic Resonance Imaging (MRI) is well suited for complex applications in which optical access is not possible. Here we present efforts to measure 3D particle concentration distribution using MRI. Glass particles dispersed in water flow reduce MRI signal from a spin-echo or gradient-echo scanning sequence by decreasing spin density and dephasing the spins present in the fluid. A preliminary experiment was conducted with a particle streak injected at the centerline of a turbulent round pipe flow with a U bend. Measurements confirmed that signal strength was related to particle concentration and showed the effects of gravitational settling and turbulent dispersion. Next, measurements of samples in a mixing chamber were taken. Particle volume fraction was varied and sensitivity to particle/fluid velocity was investigated. These results give a relationship between MRI signal, particle volume fraction, MRI sequence echo time, and spin relaxation parameters that can be used to measure local particle volume fraction in other turbulent flows of interest.

Daniel Borup
Stanford Univ

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