Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Diffusion-Induced Bias in Near-Wall Velocimetry[1] REZA SADR, Georgia Tech Savannah, CHRISTEL HOHENEGGER, University of North Carolina, HAIFENG LI, Georgia Institute of Technology, PETER J. MUCHA, University of North Carolina, MINAMI YODA, Georgia Institute of Technology — Brownian fluctuations of the colloidal tracers used in many microscale velocimetry techniques yield effects that are typically isotropic in the bulk. In contrast, near-wall Brownian diffusion is strongly influenced by the wall because of the no-flux condition and hindered diffusion. These effects bias any measurement sampled by the colloidal tracers, potentially leading to significant overestimation of near-wall velocities. A Fokker-Planck description of the Brownian motion is used to generate probability density functions of the distances normal to the wall sampled by matched particles present in the same window at both the start and end of a time interval. The importance of the resulting bias for experimental parameters is then quantified in terms of the size of the tracer particles, imaged region, and measurement interval. A method for rescaling near-wall velocity data is presented, and the implications for image velocimetry and slip length measurements are briefly discussed.

[1]Supported by AFOSR and DOE

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Date submitted: 03 Aug 2006 Electronic form version 1.4