Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

**Random error due to Brownian motion in particle image velocimetry** CHRISTOPTHER BOURDON, Sandia National Labs, MICHAEL OLSEN, Iowa State University — In particle image velocimetry (PIV) experiments, the Brownian motion of seed particles results in the addition of a random error component to the measured velocity. As the number of seed particles within each control volume increases, this random error component will decrease. Previous researchers have assumed that this random error decreases proportionally with the square root of the number of seed particles in the measurement volume as the central limit theorem predicts. However, this conclusion is based on the assumption that each seed particle contributes equally to the measured velocity, which is not the case in PIV. This assumption is even further weakened in micro-PIV experiments, where the contribution of individual particles is dependent on their separation from the image plane, due to volume rather than sheet illumination. In the present work, a computer simulation of volume-illuminated and sheet-illuminated particle-image interrogation for flowfields with a Brownian motion component was performed for various experimental conditions to determine the proper relationship between seed particle density and random error due to Brownian motion. It was found that the actual random error is greater than that predicted by application of the central limit theorem. To assist in the design and analysis of PIV experiments, an empirical formula for estimating error in micro and standard PIV experiments with Brownian motion is presented.

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Date submitted: 02 Aug 2005 Electronic form version 1.4