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Temperature Measurement using Brownian Motion in the Presence of a Velocity Gradient. PRAMOD CHAMARTHY, STEVE WERELEY, SURESH V. GARIMELLA, Purdue University — Brownian motion of sub-micron sized tracer particles is a common source of measurement uncertainty in micro fluidics experiments. This random movement of particles is known to broaden the cross correlation peak in Particle Image Velocimetry (PIV). If information on Brownian motion can be extracted from the increase in peak width, equations in the literature can be used to relate it to temperature. A PIV algorithm that detects both the location and broadening of the correlation peak can measure velocity as well as temperature simultaneously using the same set of images. The feasibility of this technique was demonstrated (Hohreiter et al. 2002) through experiments and simulations in a stationary fluid for the temperature range 20°C - 50°C. Preliminary experimental results will be presented in which temperatures ranging from 20°C - 80°C were measured in a quiescent pool of water using a standard epi-fluorescence μPIV system. Three different methods - standard PIV, Single Particle Tracking and Low Image Density PIV - were used to extract temperature from the same set of images and the results compared. The effects of velocity gradients on temperature measurement accuracy and temperature (and its gradients) on velocity measurement accuracy will be explored.

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