Abstract Submitted
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Direct calculation of the weighting function and depth of correlation in Micro-Particle Image Velocimetry (Micro-PIV) from particle images MICHAEL HEIN, Saarland University, MPI for Dynamics and Self-Organization, BERNHARD WIENEKE, LaVision GmbH, RALF SEEMANN, Saarland University, MPI for Dynamics and Self-Organization — Micro-PIV has become the most popular tool to measure flow profiles in microfluidics. When measuring in-plane velocities in a three dimensional flow the measured velocity depends on all particles in the images, even on defocused particles, and is given by a weighted average of the true velocity dx(z) with a weighting function W(z). W(z) depends on the optical setup as well as on the particle diameter and gradients of the flow-profile. The width of W(z) determines the height-extension of the plane in which particles can influence the measurement (Depth of Correlation, DOC). Thus the knowledge of the system dependent W(z) is crucial and can be used to reduce the errors introduced by depth-averaging the velocity field. We determine W(z) and thus the DOC using artificial double images for any given flow profile generated from particle images taken with the same optical setup as used for the PIV measurements. Experimental results for objectives with different numerical apertures (NA), different particle sizes and various out-of-plane gradients will be discussed. The resulting weighting function turns out to be quite asymmetric for air-objectives with high NAs, differing significantly in shape and width (DOC) from existing theoretical predictions.

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