Abstract Submitted for the DFD07 Meeting of The American Physical Society

Design of a 3D Digital Liquid Crystal Particle Thermometry and Velocimetry (3DDLCPT/V) System¹ ROB GROTHE, GREG RIXON, DANA DABIRI, University of Washington — A novel 3D Digital Liquid Crystal Particle Thermometry and Velocimetry (3DDLCPT/V) system has been designed and fabricated. By combining 3D Defocusing Particle Image Velocimetry (3DDPIV) and Digital Particle Image Thermometry (DPIT) into one system, this technique provides simultaneous temperature and velocity data using temperature-sensitive liquid crystal particles (LCP) as flow sensors. A custom water-filled prism corrects for astigmatism caused by off-axis imaging. New optics equations are derived to account for multi-surface refractions. This redesign also maximizes the use of the CCD area to more efficiently image the volume of interest. Six CCD cameras comprise the imaging system, with three allocated for velocity measurements and three for temperature measurements. The cameras are optically aligned to sub-pixel accuracy using a precision grid and high-resolution translation stages. Two high-intensity custom-designed xenon flashlamps provide illumination. Temperature calibration of the LCP is then performed. These results and proof-of-concept experiments will be discussed in detail.

¹Supported by the NSF (Grant CTS-331140).

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Date submitted: 03 Aug 2007

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