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Three-dimensional in vivo blood flow imaging based on DDPIV defocusing concept JIAN LU, Option of Bioengineering, California Institute of Technology, Pasadena, CA 91125, USA, FRANCISCO PEREIRA, INSEAN– Italian Ship Model Basin, Rome 00128, Italy, MORTEZA GHARIB, Option of Bioengineering, California Institute of Technology, Pasadena, CA 91125, USA — Three-dimensional microscale quantitative flow visualization is of considerable interest in fluid mechanical and biomedical research. In this study we present a high-speed three-dimensional microscopic system capable of in vivo microscale biofluid imaging, based on the defocusing digital particle image velocimetry (DDPIV) defocusing concept. A 3-aperture mask is attached to the back of an objective lens on an inverted microscope in order to generate defocused triangular image patterns. The system is capable of resolving spatial coordinate (Z) of a flow tracer from the separation between its corresponding defocused images. Capability of microscale imaging was validated by a calibration procedure. We demonstrated 3D blood flow imaging in an embryonic zebrafish using the developed system. Trajectories of injected 1-μm fluorescent tracer particles in the zebrafish yolk sac were obtained, with a measurement volume of 80x40x25 μm^3.

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