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Application of a High-Speed Plenoptic Camera for 3D Measurements in Small-Scale Biological Flows ZU PUAYEN TAN, RICHARD ALARCON, JOHANNES ALLEN, BRIAN S. THUROW, ANTHONY MOSS, Auburn University, ADVANCED FLOW DIAGNOSTICS LAB TEAM, MOSS BIOLOGICAL SCIENCES LAB TEAM — The application of conventional multi-camera tomographic-PIV and related 3D techniques to study biological flows remains limited due to their expense, complexity and bulk. This is particularly true for small experiments (e.g., heart-valve and micro-swimmer) or portable setups (e.g., carried by divers in open-water measurements) where equipment footprint is a critical constraint. In this presentation, we propose single-camera plenoptic-PIV as an attractive alternative to the standard multi-camera techniques. Specifically, a modular kHz-rate plenoptic camera newly developed at Auburn University will be introduced. The system, composed of a single main-lens, a microlens adaptor and an off-the-shelf high-speed camera, was used to characterize unsteady 3D flows around a 2cm ctenophore Mnemiopsis in a 71x40x34mm volume. Various 3D flow features such as the creature's downwash and intermittent vortex-ejections were successfully captured. These will be presented to showcase the plenoptic system's capabilities for measuring small-scale biological flows.

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