Abstract Submitted
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Performance of kHz-rate plenoptic-PIV versus tomo-PIV on a 10mm-scale pipe flow[1] BIBEK SAPKOTA, Auburn University, SAYANTAN BHATTACHARYA, Purdue University, ZU PUAYEN TAN, DUSTIN KELLY, Auburn University, JAVAD ESHRAGHI, PAVLOS VLACHOS, Purdue University, BRIAN THUROW, Auburn University — Plenoptic-Particle Image Velocimetry (PIV) is a 3D velocimetry technique performed via custom cameras imbued with microlens arrays (MLA). The MLA serves to encode both spatial and parallax information of a subject into a single recorded image, allowing depth inference using as few as one plenoptic camera. Thus, plenoptic-PIV represents a viable solution for 3D velocimetry in facilities with limited optical access, while also reducing alignment complexities and hardware costs relative to multi-camera tomographic-PIV. Here, we show the performance comparison of a single-camera high-speed plenoptic-PIV against the 4-camera tomographic-PIV, to characterize 3D flow in a 10mm scale pipe. The flow was varied from steady laminar (Re_d =621-1167) to turbulent (Re_d =3283) to pulsatile (ω_0 =9.5) to produce different velocity profiles. Results, after 3D reconstructions and cross-correlations, were benchmarked using metrics such as particle counts, mutual information between correlating frames, and reconstructed particle shape. The velocity-field probability density function and the average velocity profiles were compared relative to each other and to the expected profile from pipe-flow theory.

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