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Resolution limit of Digital Particle Image and Particle Tracking Velocimetry CHRISTIAN J. KAEHLER, SVEN SCHARNOWSKI, CHRISTIAN CIERPKA, Universitaet der Bundeswehr Muenchen — This work analyzes the spatial resolution that can be achieved by DPIV in dependency on the tracer particles and the imaging and recording system. While the in-plane resolution of DPIV is given by the interrogation window size, ensemble-correlation seams to increase the achievable resolution up to a single pixel. However, it is shown that the resolution limit of single-pixel ensemble-correlation is determined by the particle image size which is dependent on the diameter of the particles, the magnification, the f–number of the imaging system, and optical aberrations. As the minimum detectable particle image size is given by the pixel dimension of the camera sensor in DPIV, this quantity is also important for a systematic analysis of the resolution limit. It is shown that the optimal magnification that results in the best possible spatial resolution can be estimated from the particle size, the lens properties, and the pixel size of the camera. Thus, the provided information in this paper allows to optimize the camera and objective lens choices as well as the working distance for a given setup. Furthermore, it is shown that the resolution limit of DPIV can be resolved by using PTV evaluation techniques.

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