

Abstract Submitted
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Focused tracer detection algorithm for particle shadow velocimetry.¹ ADRIAN HERRERA-AMAYA, MARGARET L. BYRON, Pennsylvania State University — Particle Shadow Velocimetry (PSV) is an optical measurement technique which shares much with Particle Image Velocimetry (PIV), with some key differences. The light source shares a common optical axis with the camera and illuminates a volume, rather than the perpendicular light sheet used in PIV. To isolate tracers to a plane, PSV relies on the optical depth of correlation (DoC) rather than the thickness of the light sheet. PSV tracers thus appear as dark spots in a bright background rather than the converse, with out-of-focus particles much more visible than in comparable PIV images. Common practice is to invert the images, then use PIV algorithms. However, typical PIV image prefilters retain significant noise from the out-of-focus tracers. We present a new approach which detects focused tracers in PSV images with nontrivial DoC and lighting intensity variation, with an estimated error of 0.5%. We then construct new images based on the detected positions of in-focus tracers, completely eradicating the out-of-focus noise. Tracer positions are detected via three primary operations: contrast stretching, edge detection, and thresholding on the image diameter, circularity, and darkness. We also show the application of our algorithm to the flow generated by the appendages of a gelatinous marine zooplankton. By presenting details of our focused tracer detection algorithm, we intend to help other PSV users improve their own data quality, and provide techniques that may also be useful to PIV users with noisy images.

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