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Method to Determine the Minimum Random Uncertainty in PIV Based on Real Images KYLE JONES, BARTON SMITH, Utah State University — The noise floor, or minimum random uncertainty, of PIV based on the actual acquired PIV images can be determined by generating image pairs with known displacement. Image pairs are acquired with sufficiently small dt such that there is zero displacement between the images. A second image is then shifted by a prescribed amount. By computing a vector field based on these image pairs and calculating the standard deviation of the errors, a random uncertainty can be computed that incorporates the effects of camera noise, particle density, particle images, and displacement. The resultant values are helpful in determining whether the image quality is sufficient to achieve the desired uncertainty. A common PIV experimental setup with seeded water in a glass tank was used. The aperture of the camera lens was varied to achieve a range of particle image diameters. It was found that it is critical to filter the images prior to shifting in order to prevent smearing of the particle images. A Matlab code was written to shift the images by a prescribed, sub-pixel displacement, which were then imported into DaVis and correlated, resulting in displacement vector images. The random and bias errors of the DaVis and PRANA SCC algorithms are also compared for multiple sub-pixel displacements.

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