Estimation of burst-mode LDA power spectra

The estimation of power spectra from LDA data provides signal processing challenges for fluid dynamicists for several reasons: acquisition is dictated by randomly arriving particles, the registered particle velocities tend to be biased toward higher values, and the signal is highly intermittent. The signal can be interpreted correctly by applying residence time weighting to all statistics and using the residence time-weighted discrete Fourier transform to compute the Fourier transform. A new spectral algorithm using the latter is applied to two experiments: a cylinder wake and an axisymmetric turbulent jet. These are compared with corresponding hot-wire spectra as well as to alternative algorithms for LDA signals such as the time-slot correlation method, sample-and-hold and common weighting schemes.

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Contributors: Velte, C. M., George, W. K., Buchhave, P.
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