Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

A conditional sampling-based method for noise and resolution corrections for scalar dissipation rate measurements[1] CHENNING TONG, JIAN CAI, Clemson University — A conditional sampling-based method for correcting noise and resolution effects for scalar dissipation rate measurements is developed. Noise and resolution effects on the measured dissipation rate have opposite trends, making their separation and accurate corrections difficult. A major task in dissipation rate correction, therefore, is to isolate each effect. The method presented in this work uses instantaneous local scalar mean and variance as conditioning variables, and is based in part on Kolmogorov's refined similarity hypotheses. It ensures selection of instantaneous fully resolved local scalar fields, which are analyzed to determine the measurement noise. Noise correction is applied to potentially under-resolved local scalar fields, also selected using the conditional-sampling procedure, effectively separating the effects of noise from those of resolution. The error function is used as a model for the potentially under-resolved local scalar fields to evaluate their dissipation length scales and to make corrections for the dissipation rate. The present method uses local instead of spectral analyses; therefore, can be applied to the mean scalar dissipation rate conditional on the scalar values. An application of the method to temperature dissipation rate in a slightly heated turbulent jet shows excellent results, validating the method. The method has also been applied to turbulent flames.

[1]Supported by NSF and AFOSR.

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Date submitted: 10 Aug 2011 Electronic form version 1.4