Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Statistics and Modeling of the Scalar Dissipation and its Relation to the Filtered Mixture Fraction ROBERT KNAUS, CARLOS PANTANO, University of Illinois at Urbana-Champaign, JOSEPH OEFELEIN, Sandia National Laboratories — Scalar dissipation is an important quantity for characterizing turbulent mixing and chemical reactions in combustion. It exhibits highly intermittent statistical properties, which have been shown to produce one-point probability density functions that agree well with a log-normal distribution. In large eddy simulation, only the filtered mixture fraction is available to calculate the scalar dissipation. The filtered scalar dissipation, however, is not of primary relevance when modeling phenomena that is sensitive to the smallest scale of the turbulence. Ideally, a statistical approximation of the true scalar dissipation is required. This study examines how filtering mixture fraction affects estimates of the scalar dissipation. Statistics are investigated using DNS databases of turbulent shear layers with different levels of heat release. Using these databases, the effects of filter size to Kolmogorov scale and heat release are determined. A stochastic model of the filtered scalar dissipation that mimics the effects of filtering mixture fraction is then proposed and used as an inverse model to estimate the statistics of the true scalar dissipation.

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Date submitted: 24 Jul 2008 Electronic form version 1.4