Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Large Eddy Simulation / Filtered Mass Density Function Modeling of High Pressure Turbulent Hydrogen Flames[1] RICHARD MILLER, ZHIYUAN MA, Clemson University — The hybrid Large Eddy Simulation / Filtered Mass Density Function (LES/FMDF) approach to turbulent combustion simulations is extended to include high pressure physics. A posteriori simulations of an existing database of Direct Numerical Simulations (DNS) of high pressure turbulent hydrogen-oxygen and hydrogen-air flames are presented. The DNS include a real fluid equation of state, realistic pressure dependent property models, generalized heat and mass diffusion derived from non-equilibrium thermodynamics and fluctuation theory, and a detailed pressure dependent chemical kinetics mechanism. The geometry considered is a temporally developing reacting shear layer flame. The DNS are conducted at initial shear layer Reynolds numbers up to 4,500 and for pressures as large as 125 atm on numerical meshes up to approximately 3/4 billion grid points. Proper implementation of the LES/FDF approach to simulating the DNS flames is discussed and the simulation results are compared to the filtered DNS results.

[1]NSF Grant CBET-0965624

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Date submitted: 02 Aug 2013 Electronic form version 1.4