Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Prediction of strong and weak ignition regimes in turbulent reacting flows with temperature fluctuations: A direct numerical simulation study[1] PINAKI PAL, Univ of Michigan - Ann Arbor, MAURO VALORANI, Sapienza University, Rome, Italy, HONG IM, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia, MARGARET WOOLDRIDGE, Univ of Michigan - Ann Arbor — The present work investigates the auto-ignition characteristics of compositionally homogeneous reactant mixtures in the presence of thermal non-uniformities and turbulent velocity fluctuations. An auto-ignition regime diagram is briefly discussed, that provides the framework for predicting the expected ignition behavior based on the thermo-chemical properties of the reactant mixture and flow/scalar field conditions. The regime diagram classifies the ignition regimes mainly into three categories: *weak* (deflagration dominant), *reaction-controlled strong* and *mixing-controlled strong* (volumetric ignition/spontaneous propagation dominant) regimes. Two-dimensional direct numerical simulations (DNS) of auto-ignition in a lean thermally-stratified syngas/air turbulent mixture at high-pressure, low-temperature conditions are performed to assess the validity of the regime diagram. Various parametric cases are considered corresponding to different locations on the regime diagram, by varying the characteristic turbulent Damköhler and Reynolds numbers. Detailed analysis of the reaction front propagation and heat release indicates that the observed ignition behaviors agree very well with the corresponding predictions by the regime diagram.

[1]U.S. DOE NETL award number DE-FE0007465; King Abdullah University of Science and Technology (KAUST)

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Date submitted: 01 Aug 2015 Electronic form version 1.4