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**Ignition Kernel Dynamics in a $M = 3$ Flame holder** ESTEBAN CISNEROS-GARIBAY, University of Illinois at Urbana-Champaign, DAVID BUCHTA, The Center for Exascale Simulation of Plasma-Coupled Combustion, University of Illinois at Urbana-Champaign, JONATHAN FREUND, University of Illinois at Urbana-Champaign — The coupled mixing and reaction time scales of ignition in a supersonic flame-holding cavity flow are studied with detailed numerical simulations. A round jet ejects ethylene into the cavity under a $M = 3$, $T = 440$ K free-stream. The ignition (and subsequent sustained flame) are studied in detail, including direct comparisons with corresponding measurement. Two injection configurations are simulated: (i) vertical, from the cavity floor; and (ii) horizontal, from the cavitys 45° back wall. Ignition is seeded by a laser-induced breakdown (LIB), which creates radical species and locally heats the gas. Comparisons are made against measured excited hydroxyl radical (OH*) to assess prediction accuracy. The injection geometry significantly affects the direction in which ignition kernels (as quantified by OH mass fraction) advect and grow. Over the first 75 $\mu$s, the turbulence mechanics that produce this and the observed large variance of ignition kernel statistics are studied and compared. These variances are greater than dependencies on the chemical kinetic parameters.

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