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Investigation of the laser-induced ignition in a prototype rocket combustor[1] KAZUKI MAEDA, Center for Turbulence Research, Stanford University, MARIO DI RENZO, Sapienza University of Rome — Accurate prediction of the reliability of laser-induced ignition of liquid propellants is crucial for aerospace propulsion, and has been challenging due to the short time scale and complex nature of ignition events in turbulence. In this exploratory study, we numerically analyze the ignition of high-speed, co-flowing jets of gaseous CH_4 and O_2 in a prototype rocket combustor. We model the deposition of pulsed-laser through point-source heating at downstream locations under conditions of a companion experiment. For specific sets of flow parameters and heating locations, mixing and reaction of the jets are simulated using the HTR solver, an open-source compressible reacting flow solver. The solver employs the Legion runtime system and is optimized for GPU-based, heterogeneous supercomputers. We address various combinations of the duration and the energy of heating, on the orders of $O(0.1)$ us and O(10-100) mJ, respectively. Obtained data sets are used to draw a probability map of ignition on parameter space, whose success is defined in terms of reaction-rate. Through this map, we assess the posterior probability of ignition with respect to input variables. Finally, we discuss the sensitivity of this inference to upstream conditions of the jets.

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