Abstract Submitted
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Direct Numerical Simulation of Multi-Injection Mixing and Ignition in Diesel Engine Environments[1] MARTIN RIETH, Sandia National Laboratories, MARC DAY, EMMANUEL MOTHEAU, Lawrence Berkeley National Laboratory, TIANFENG LU, University of Connecticut, JACQUELINE CHEN, Sandia National Laboratories — Multi-injection strategies are known to help reduce pollutant emissions and improve ignition reliability, among other benefits. Different parameters such as dwell time, injection duration and environment temperature govern the overall mixing and ignition sequence. While experiments provide valuable insight, a fundamental understanding on how multiple injections interact and mix, and how this influences low-temperature ignition and combustion of large alkanes is still lacking, especially at low-temperature conditions. The effect of ambient temperature will be highlighted for two Engine Combustion Network Spray A cases at 750 K and 900 K conditions, both at 60 atm and with 15% O2 in the oxidizer, using Direct Numerical Simulations (DNS) of a simplified and downscaled configuration. At 900 K, the first injection ignites before the second injection starts. At 750 K, the first injection only provides low-temperature intermediate species that accelerate the ignition of the second injection. The cases are compared and differences highlighted in the overall ignition sequence, combustion modes (ignition versus flame propagation), displacement speed statistics, flame topology and modeling challenges.

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Martin Rieth
Sandia National Laboratories

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