RCM Characterization Initiative:
Towards a better description of low temperature ignition

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Rapid compression machines (RCMs) are widely-used experimental platforms employed to acquire fundamental insight into fuel ignition and pollutant formation chemistry, as well as fluid dynamics – chemistry interactions, especially at conditions relevant to current and future combustion engines, such as low temperature combustion (LTC) regimes. Their operational range is complementary to other laboratory platforms such as shock tubes and flow reactors, and datasets acquired with RCMs are often utilized as validation targets for chemical kinetics. Currently, more than twenty laboratories worldwide utilize RCMs for chemical kinetics related studies, and additional facilities are being commissioned.

Even after many years of development however, opportunities still exist to improve methods for reporting and representing RCM data, such as quantifying facility-dependent effects like heat transfer, and formulating alternative approaches for comparing RCM data with datasets from other devices such as shock tube and flow reactors. These opportunities represent the principal motivation for the RCM characterization initiative. Twelve international research groups have acquired ignition data for iso-octane/'air' at similar state and mixture conditions in the form of pressure time histories at reactive and non-reactive conditions. These data are compared and analysed to provide insight on modeling strategies for detailed chemical kinetics mechanism validation, and also to better understand the causes for differences in measurements from various RCMs, including compression trajectories, heat loss and non-uniformities. This Initiative will help reduce uncertainties in datasets critical to the combustion community.