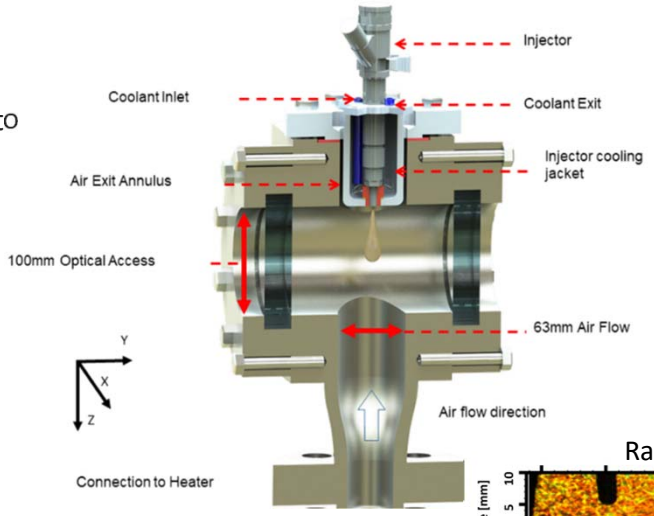
Characterization of Biomass-Based Fuels and Fuel Blends for Low-Emissions, Advanced Compression Ignition Engines

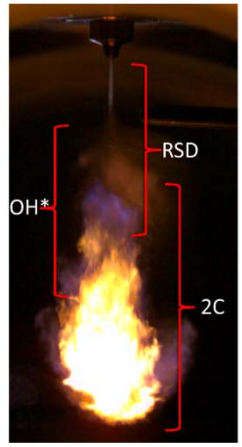
Goals

The project end goal is to provide a fuel-blend combustion property prediction toolset to enable the co-optimization of properties related to ACI engine development. A neural network will be developed and trained and validated using extensive sets acquired as part of the project. Thee resulting data sets will be valuable to the combustion community for future model development and validation.

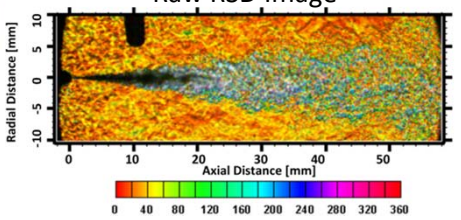
Approach

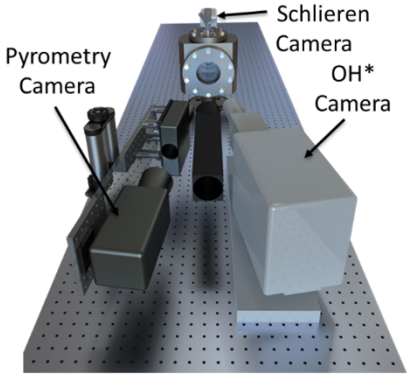
We aim to predict fuel properties relevant to Advanced Compression Ignition (ACI) engines by characterizing fuel-air mixing, ignition, and combustion properties. The models will be developed with data from combustion measurements in a constant pressure flow rig (CPFR) with optical access and simultaneous high-speed capture of reacting fuel sprays using three diagnostics – Rainbow Schlieren Deflectometry (RSD), OH* Chemiluminescence, and Two-Color Soot Pyrometry (2C). Experiments will be run at engine relevant conditions and with a range of Co-Optima fuel candidates to explore impact of injection, ambient, and fuel properties on the spray combustion process. Particular focus will be on properties that may enhance/enable lean lifted flame combustion.



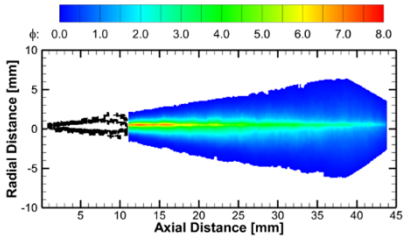


Raw RSD Image





Equivalence Ratio [-]



Potential Impact on Co-Optima Goals

The successful operation of lean lifted flame combustion at high loads will result in a substantially improved ACI engine platform. The proposed work will create a model to predict combustion properties and thus, help to co-optimize fuels and engines. Experimental data set will also provide critical input needed to develop and validate advanced computational fluid dynamics models.

Team Members

PI: Prof. Ajay Agrawal
Co-PI: Prof. Joshua Bittle

College of Engineering