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# The Effects of Charge Homogeneity and Repeatability on Particulates Using the PLIF Technique in an Optical DISI Engine

Quan Liu, Alasdair Cairns, Hua Zhao, and Mohammadreza Anbari Attar  
Brunel Univ.

Luke Cruff and Hugh Blaxill  
MAHLE Powertrain LLC

## ABSTRACT

The work was concerned with visualisation of the charge homogeneity and cyclic variations within the planar fuel field near the spark plug in an optical spark ignition engine fitted with an outwardly opening central direct fuel injector. Specifically, the project examined the effects of fuel type and injection settings, with the overall view to understanding some of the key mechanisms previously identified as leading to particulate formation in such engines. The three fuels studied included a baseline iso-octane, which was directly compared to two gasoline fuels containing 10% and 85% volume of ethanol respectively. The engine was a bespoke single cylinder with Bowditch style optical access through a flat piston crown. Charge stratification was studied over a wide spectrum of injection timings using the Planar Laser Induced Fluorescence (PLIF) technique, with additional variation in charge temperature due to injection also estimated when viable using a two-line PLIF approach. Overall, both gasoline-ethanol fuels generally exhibited a higher degree of stratification, albeit at least partly alleviated with elevated rail pressures. Under both warm and cold liner conditions the E10 fuel showed clear evidence of fuel droplets persisting up until ignition. Interestingly, with late injection timing the repeatability of the injection was superior (statistically) with higher ethanol content in the fuel, which may have been associated with the higher charge temperatures aiding control of the evaporation of the main mass of alcohol.