

### MAHLE Powertrain Jet Ignition® (MJI) - Active



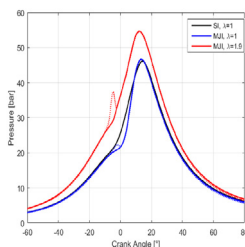
High Efficiency

Emissions Improvements

Knock Reduction



>> Injector & spark plug configuration in active system



>> Comparison of in-cylinder pressure at fixed engine load - MJI & SI engines

#### MAHLE Jet Ignition® (MJI) - Active

Combustion development is a key enabler to achieving future vehicle fuel economy and emissions targets. For many years, MAHLE Powertrain has been conducting advanced combustion research, culminating in the development of the MAHLE Jet Ignition® system.

#### Achievements

- Fast, stable combustion enabling extension of the stable lean limit of the engine ( $\lambda > 2$  for gasoline, natural gas;  $\lambda > 3$  for  $H^2$ )
- Knock mitigation due to rapid combustion & lean limit extension, enabling high compression ratio
- Whole map operation without the requirement for a 2<sup>nd</sup> ignition system in the main chamber
- Compatible with PFI or DI fueling
- MJI-enabled dilute combustion produces significant efficiency / fuel consumption benefit - translates across wide range of base engine technology levels

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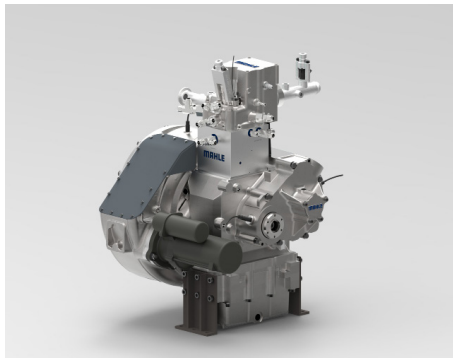
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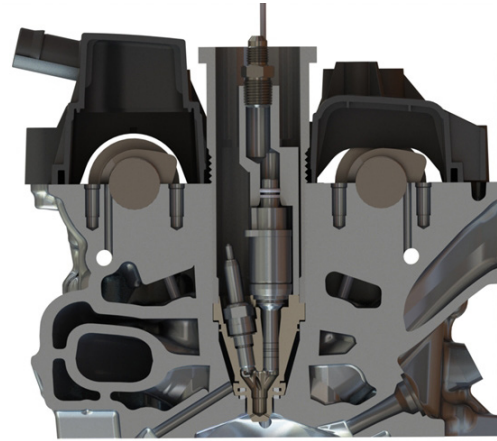
[www.mahle-powertrain.com](http://www.mahle-powertrain.com)

## Demonstrator Engine

- >42.5% BTE / < 200 g/kWh BSFC from a 1.5L 3-cylinder engine
  - › CR > 14:1
  - › Engine-out NOx < 100ppm
  - › Production boost system
- 20% increase in peak BTE over baseline
- Idle and catalyst heating capability & feed gas emissions equal to conventional central spark plug



>> Single cylinder genset engine using active MJl



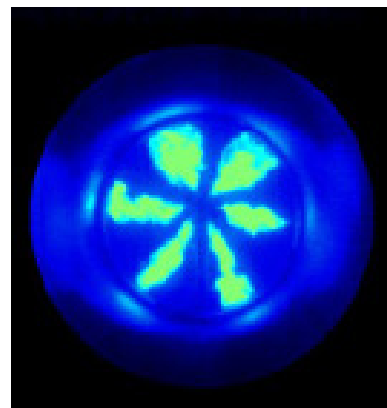
>> Cross section of active system

## Applications

- Robustness demonstrated across multiple engine applications: passenger car, HD on-road & off-road, race-winning motorsport, small engine, CHP, alt fuel
- Enabling technology for safe, stable large-bore H<sup>2</sup> combustion
- Numerous multi-cylinder engine demonstrators produced for commercial partners & internal research
- Flexible operating strategies: fully dilute map, "dual-mode" lean + stoich, combustion mode-switching

## Engineering Services

- Maximising Active MJl benefits requires both pre-chamber & combustion system optimisation
- Full range of inter-related engineering services to develop solutions:
  - › Design
  - › Combustion, performance & structural analysis
  - › Engine development & testing
  - › Transient & cold emission capabilities
  - › Calibration & controls



>> MJl optical image

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