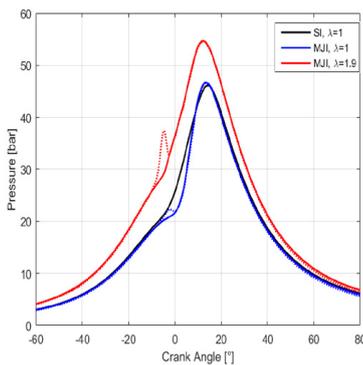


>  
**Jet Ignition® (MJI) - Active**



Injector & spark plug configuration in active system



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

**High Efficiency**

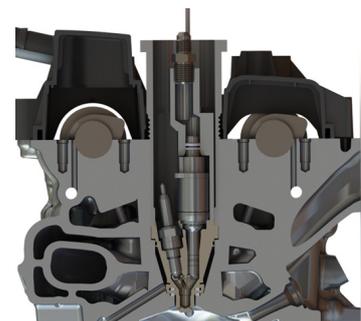
Combustion development is a key enabler to achieving future vehicle fuel economy and emissions targets. For many years, MAHLE Powertrain has been conducting advanced combustion research, culminating in the development of the MAHLE Jet Ignition® system.

**Achievements:**

- Fast, stable combustion enabling extension of the stable lean limit of the engine ( $\lambda > 2$  for gasoline, natural gas;  $\lambda > 3$  for H)
- 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

**Drive Systems**

- >42.5% BTE / < 200 g/kWh BSFC from a 1.5L 3-cylinder engine
- MFE provides 4 key functions simultaneously:
  - › 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

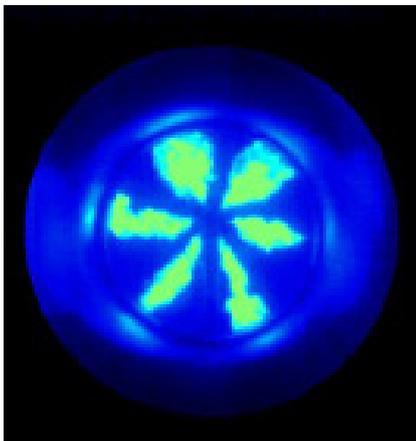


Cross section of an active system

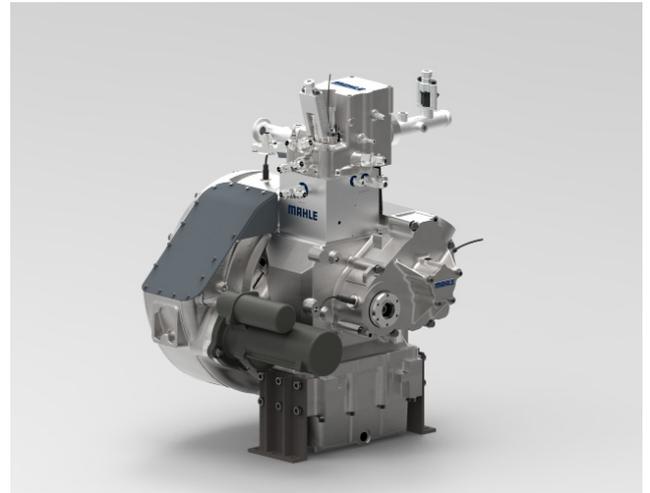
> **Emissions improvements**  
**Knock reduction**

### 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



MJl optical image



### Advantages

- 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 and cold emission capabilities
  - › Calibration & controls

