

COMBUSTION MEASUREMENT TECHNOLOGIES

GASOLINE ENGINES MPFI AND DI

COMBUSTION STABILITY UNDER FLOW AND EGR INFLUENCE

Reduce Combustion Fluctuations: Flow and EGR Influence on Flame Kernel Formation

Task / Challenge

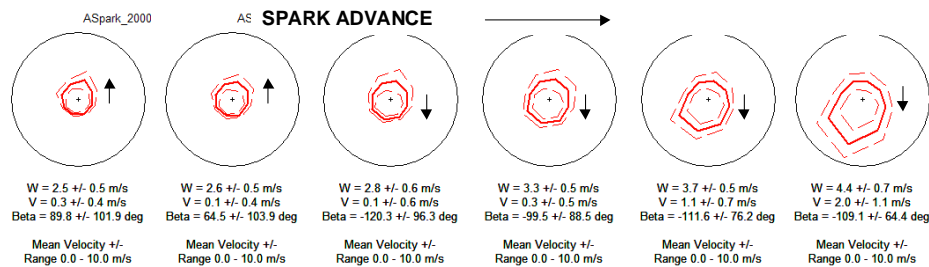
Higher than usual IMEP fluctuations in low and part load, insufficient transient response, cylinder to cylinder variations

Possible Root Cause

Flame kernel formation requires a well defined flow field (turbulence and net convective flow) to result in reproducible flame propagation and combustion. Flow field fluctuations, especially in medium and low load can result in poor flame kernel formation and in increased IMEP variations.

Test Procedure

Measurement and evaluation of flame kernel growth (how fast and in which direction) under influence of spark timing, air and EGR variation.



The example shows the response of flame kernel growth (mean +/- standard deviation) to a spark timing sweep.

Action: Measurement of flame kernel formation by means of VisioFlame sensor. Test variations to generate speed – load – spark timing maps

Data: Flame kernel data for tested variants

Result: Identification of operating areas with good and poor flame kernel stability.

Benefit: Understanding of necessary actions on in-cylinder flow

EGR Influence

Residual gas near the spark plug can have similar influence on flame kernel growth as the flow field. Whenever appropriate, flame kernel measurements under variation of EGR levels should be included in VisioFlame measurements.

Attention: direct means to separate flow field from EGR influence on flame kernel growth are not available. The separation of influence must be derived from the analysis of test variants.

Action: Measurement of flame kernel formation by means of VisioFlame sensors. EGR variation tests

Data: Flame kernel data for tested variants

Result: Identification of operating areas with good and poor flame kernel stability

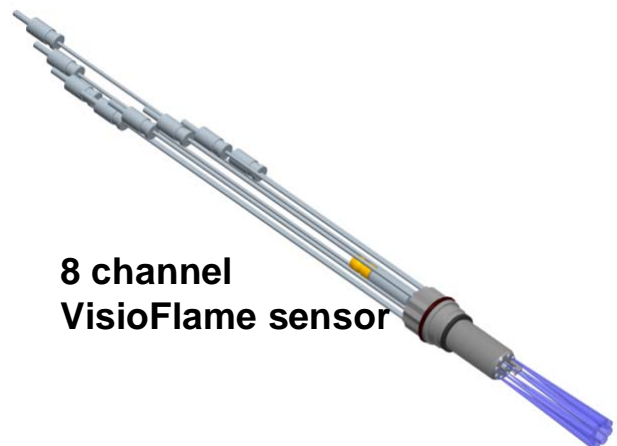
Benefit: Understanding of necessary actions on EGR calibration

Benefit in Engine Development Process

- have direct data on the influence of flow field / EGR on flame kernel growth
- understand action of (tumble) airflow on flame propagation
- understand effect of valve timing on flame kernel
- see influence of spark electrode position on flame propagation
- evaluate necessity and chances for modifications

Technical Data

- VisioFlame spark plug sensor together with 8 channel optical signal recorder
- VisioFlame signal evaluation software licence
- spark plug sensor applicable in any type of engine, NA or TC
- synch operation with indicating system



Project Packages

- spark plug sensor procurement: 2 week on stock, 8 weeks standard types, 10 weeks non standard types
- measurement packages: per day
- documentation and recommendations per measurement variant
- on site AVL measurement service supporting customer engine development projects
- application package and expert support for Visiolution system users