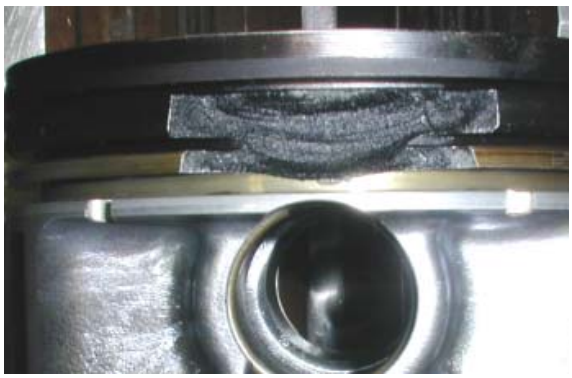


COMBUSTION MEASUREMENT TECHNOLOGIES

# GASOLINE ENGINES

## IRREGULAR COMBUSTION EVENTS
## EVALUATE RISK FOR GLOW IGNITION

**Irregular Combustion: Classify Combustion Events, understand Root Cause, define Methods for Improvement and avoid Engine Damage**

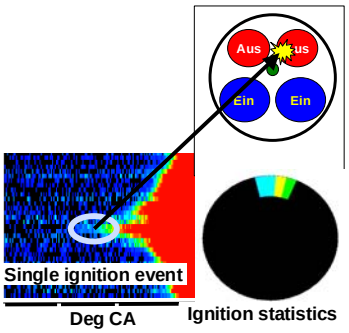
### Background

In high load operation, uncontrolled ignition can occur on hot thermal spots, on glowing deposits or as a result of EGR-gas exchange- fuel injection events. The uncontrolled ignition can result in irregular combustion with excessively high pressure peaks. Such events can result in engine damage.
High thermal load together with further parameter combinations is one of the root causes. This puts special emphasis into avoiding such uncontrolled ignition events especially in high efficiency high power density engines.

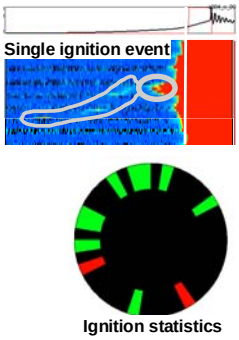
### Root Cause Analysis

Whenever irregular combustion occurs, the foremost task is to identify the location of the ignition event. Ignition location statistics are then used to understand the root causes, such as:

- local hot spot
- local deposit
- flaking deposit, not localized
- other parameter combinations including manifold and mixture effects




One specific area of self ignition events: signature of a thermal hot spot ignition




Ignition by flaking deposits at random locations

Action: Use Visiolution spark plug sensor to locate self ignition event. Measurement requires trigger on event with pre- and post trigger signal recording. Synch with indicating.
Data: Ignition event traces and event statistics, pre- and post event data
Result: Identification of ignition location supports root cause analysis of self ignition events

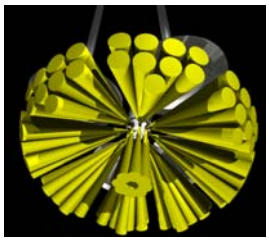
## Benefits

Find measures to avoid self ignition by:
- improved local cooling after hot spot identification
- reduction of oil and fuel deposits after distributed ignition events
- combination of gas exchange, mixture formation and EGR events

## Technical Data

- Visiolution spark plug sensors in standard and special design

„Hybrid“ sensor to distinguish ignition at spark plug from glow ignition in cylinder



Special spark plug sensor with up to 80 fiber optic channels

- Visiolution „Flame cycle pattern“ analysis software
- spark plug sensors applicable in any type of engine configuration on test bed and on chassis dyno
- NA or TC engines
- Master / Slave operation and synch with indicating system, trigger on event logic
- access to pre- and post trigger data via ring memory

## Project Packages

- spark plug sensor procurement: 2 weeks on stock, 8 weeks standard types, 10 weeks non standard types
- measurement packages: per week
- 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