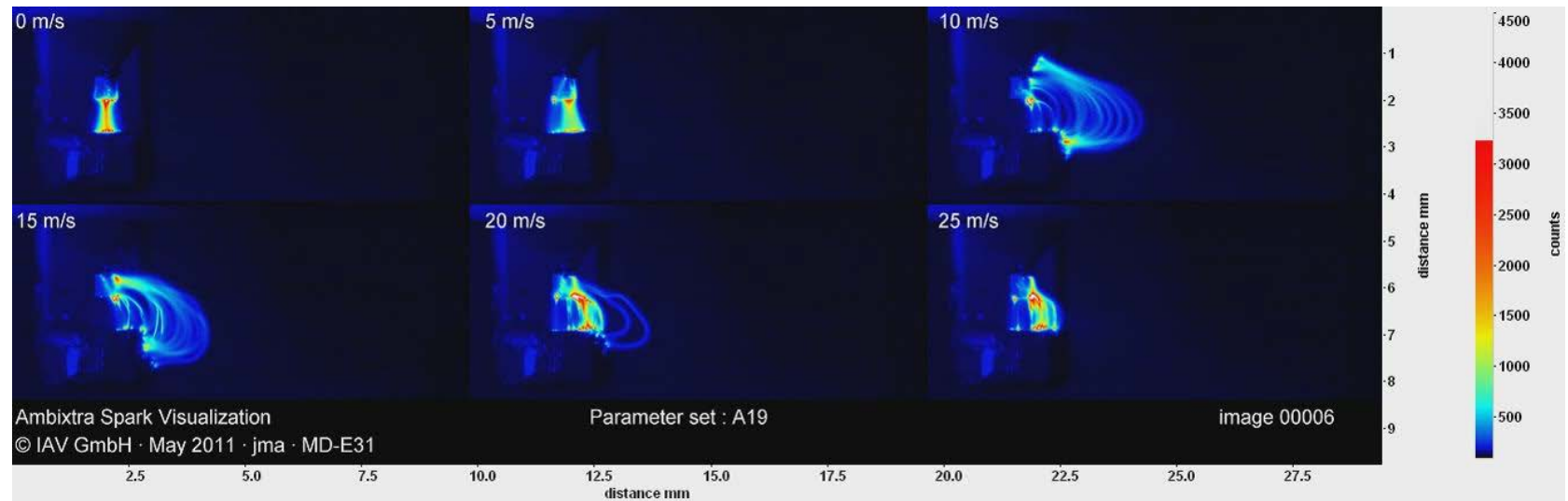


Ambixtra VSI Testing

Final Report

Berlin, 11st June 2013

Paul-Benjamin Reinicke, Michael Rieß



Phase 2.1: Variation of Ignition System

2000rpm/2.8bar stratified

Goal of Variation:

- Evaluation of best ignition system for robust misfire free operation in stratified mode at optimised injector position (GDI InjPos +2)
- Comparison of Ambixtra VSI system to WRC standard ignition system and a prototype high power ignition system

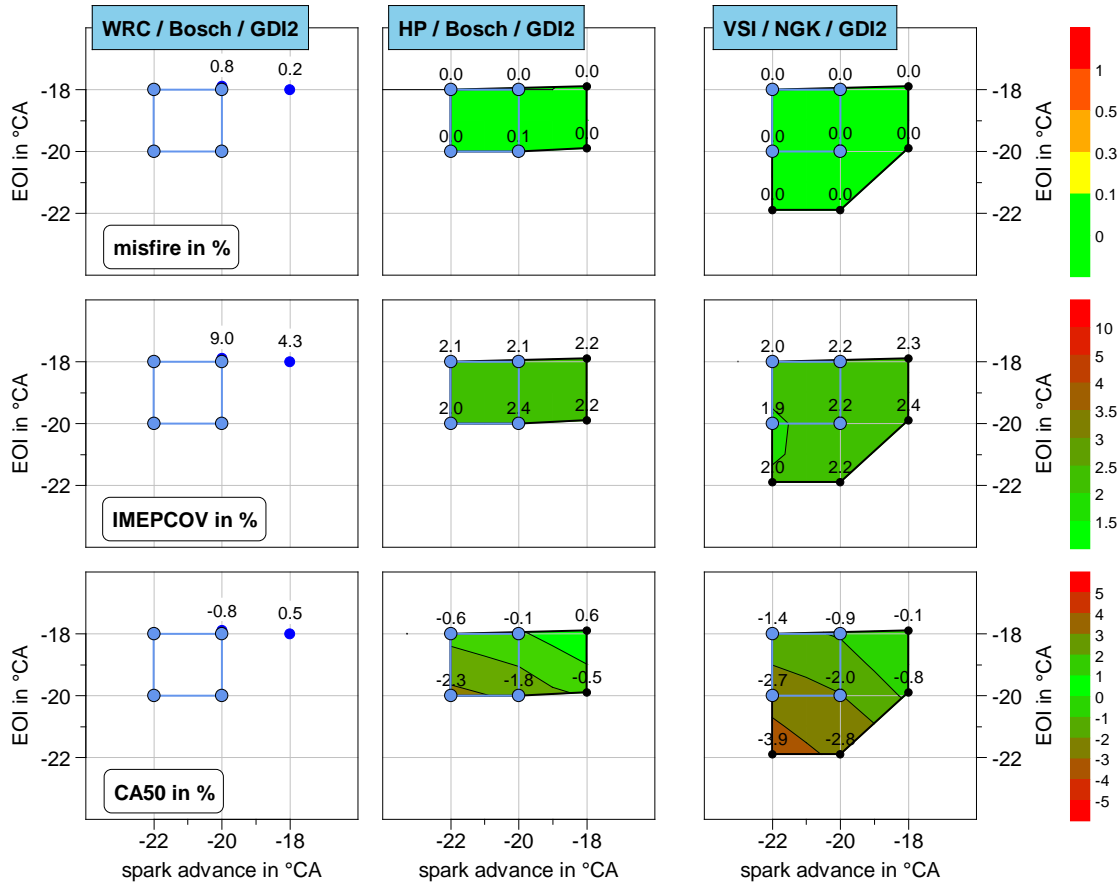
Conduction of Variation:

- Variation of EOI/SA with 2°CA step width
- Limits for variation: - Misfire
- IMEPCOV = 5%

Boundary Conditions:

speed:	2000rpm	injector type:	GDI-MH
IMEP:	2.8bar	injector nozzle:	GDI InjPos +2
MAP:	1000mbar	ignition system:	VSI / WRC / HP
EGR:	0%	spark plug:	NGK / Bosch
prail:	200bar		
EOI1:	var.		
SA:	var.		

Phase 2.1: Variation of Ignition System 2000rpm/2.8bar stratified



- Comparison of VSI system with reference ignition system (WRC) shows marked improvement regarding inflammation probability and combustion robustness → WRC enables no misfire free operation at all
- Compared to high power (HP) ignition system slight improvement of stratified combustion robustness and ignition delay (advanced CA50)

Phase 2.1: Variation of Ignition System

1500rpm/7bar stratified

Goal of Variation:

- Evaluation of best ignition system for robust misfire free operation in stratified mode at optimised injector position (GDI InjPos +2)
- Comparison of Ambixtra VSI system to WRC standard ignition system and a prototype high power ignition system

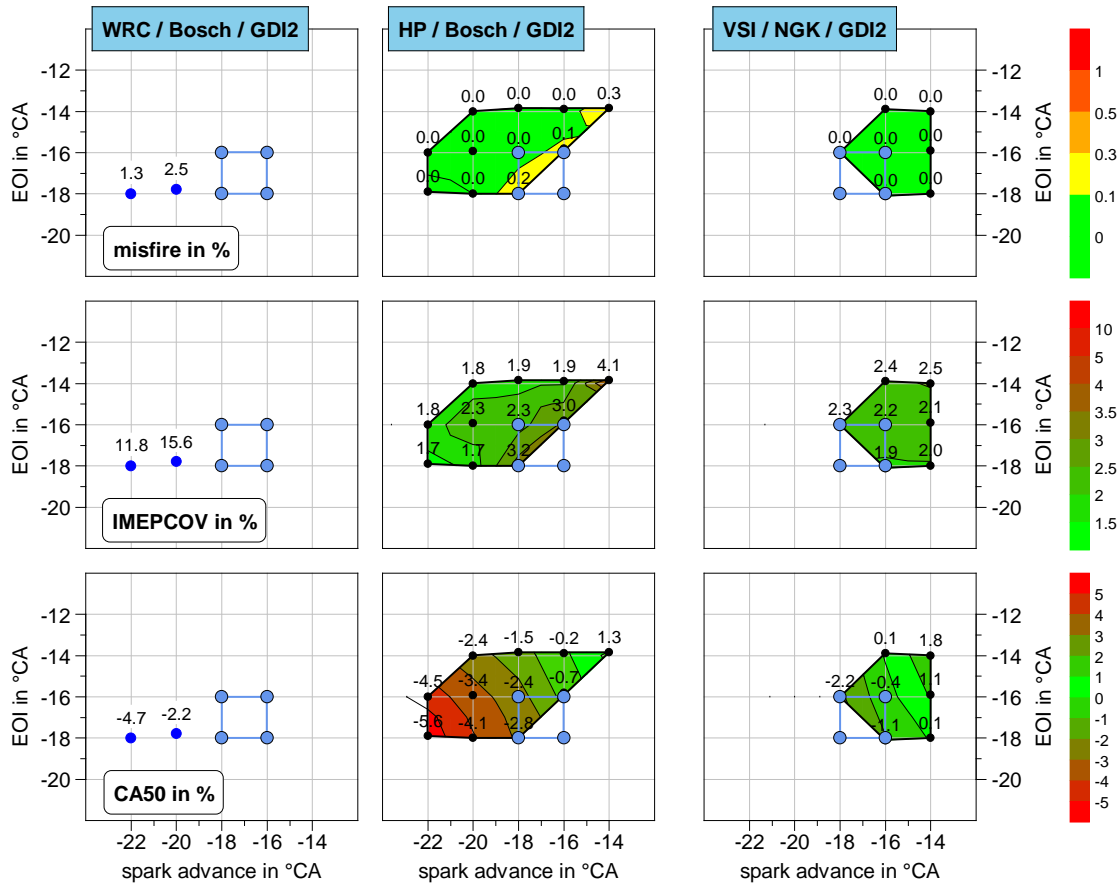
Conduction of Variation:

- Variation of EOI/SA with 2°CA step width
- Limits for variation: - Misfire
- IMEPCOV = 5%

Boundary Conditions:

speed:	1500rpm	injector type:	GDI-MH
IMEP:	7.0bar	injector nozzle:	GDI InjPos +2
MAP:	1600mbar	ignition system:	VSI / WRC / HP
EGR:	0%	spark plug:	NGK / Bosch
prail:	200bar		
EOI1:	var.		
SA:	var.		

Phase 2.1: Variation of Ignition System 1500rpm/7bar stratified



- Comparison of VSI system with reference ignition system (WRC) shows marked improvement regarding inflammation probability and combustion robustness → WRC enables no misfire free operation at all
- Compared to high power (HP) ignition system improvement of stratified combustion robustness and ignition delay (advanced CA50)
- VSI system especially enables misfire free operation of retarded SA (to EOI) and thus application of ISFC and soot beneficial settings

Phase 2.2: Variation of Lambda

1500rpm/7bar homogenous

Goal of Variation:

- Investigation of lean burn capability in homogeneous mode
- Comparison of Ambixtra VSI system to WRC standard ignition system

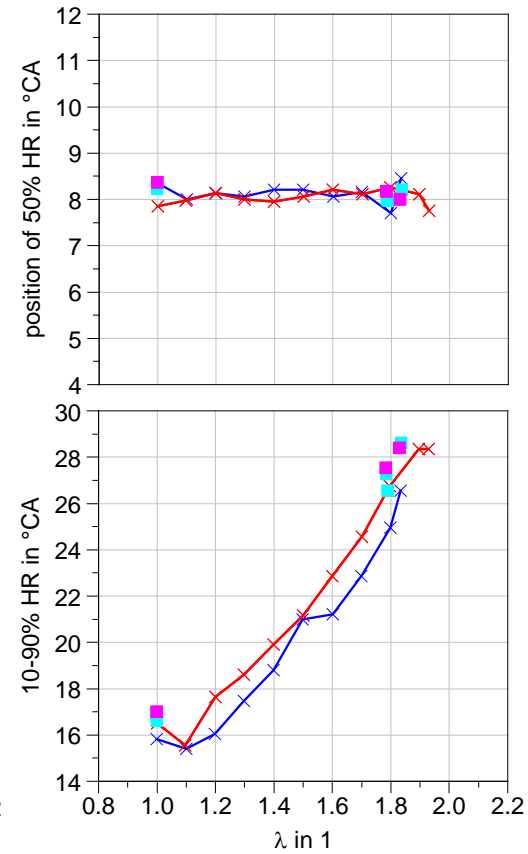
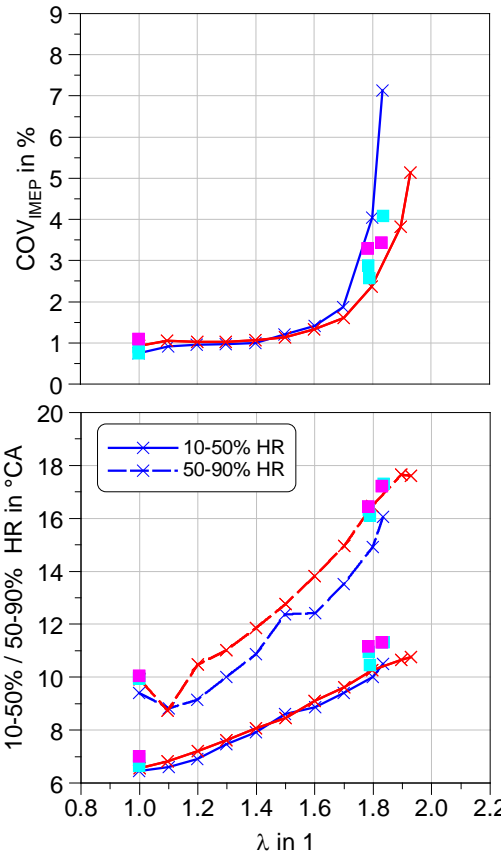
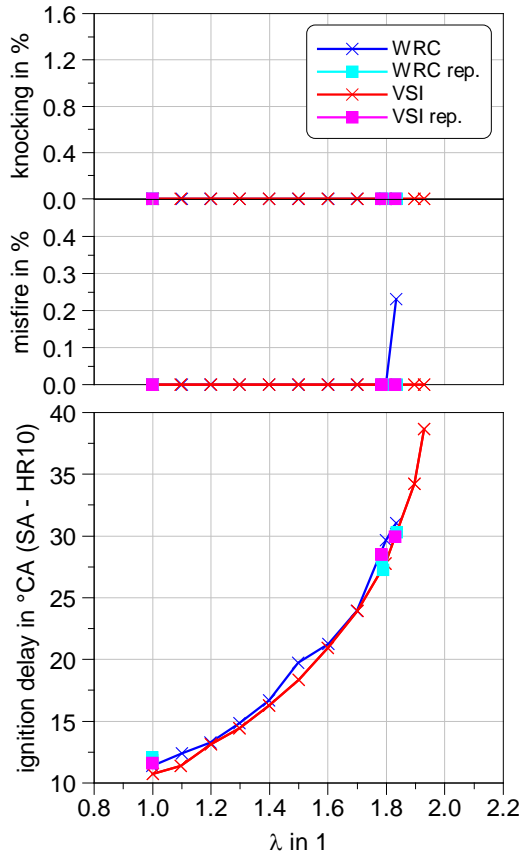
Conduction of Variation:

- Variation of Lambda with fixed step width until stability limit
- Limits for variation: - Misfire
- IMEPCOV = 5%

Boundary Conditions:

speed:	1500rpm	injector type:	GDI-MH
IMEP:	7.0bar	injector nozzle:	GDI InjPos 0
Lambda:	var.	ignition system:	WRC / VSI
EGR:	0%	spark plug:	Bosch / Beru
prail:	200bar		
SOI1:	-300°CA		
CA50:	8°CA		

Phase 2.2: Variation of Lambda 1500rpm/7bar homogenous



- At 1500rpm/7bar in general also similar results with VSI and WRC
→ VSI tends to provide very little advantages in enlenament capability → 0.05 to 0.1 units
- No differences in combustion performance (inigiton delay, combustion duration)

Phase 2.2: Variation of EGR

1500rpm/7bar homogenous lean

Goal of Variation:

- Investigation of EGR tolerance in homogeneous mode under lean conditions
- Comparison of Ambixtra VSI system to WRC standard ignition system

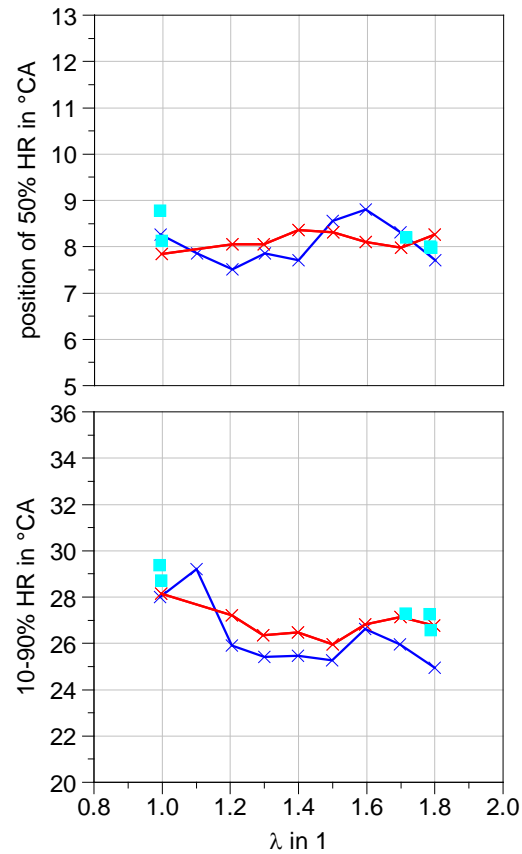
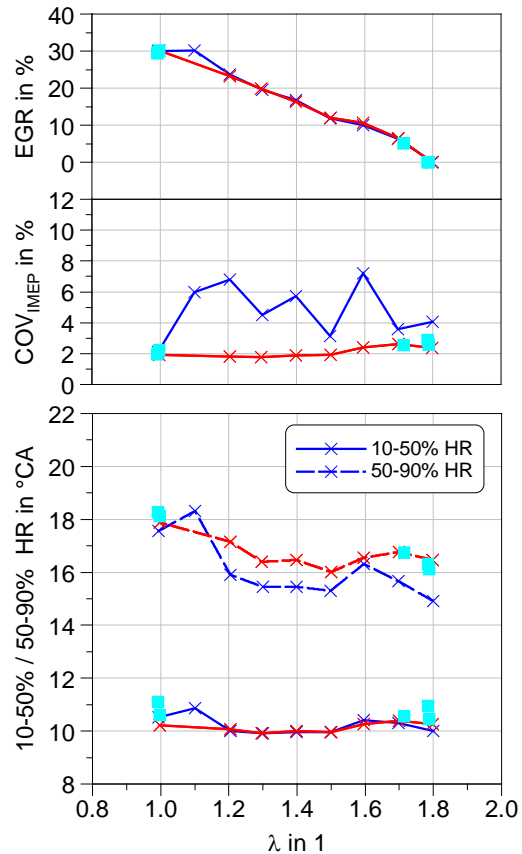
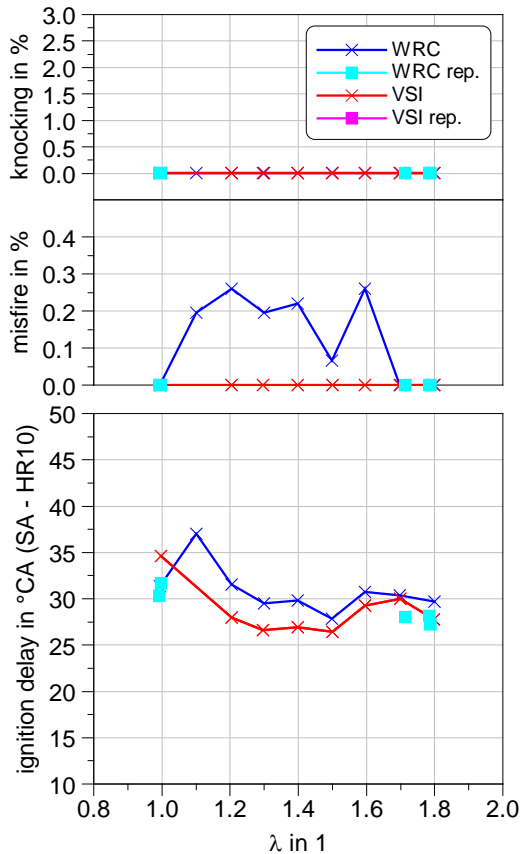
Conduction of Variation:

- Variation of EGR and Lambda with fixed step width until stability limit
- Limits for variation: - Misfire
- IMEPCOV = 5%

Boundary Conditions:

speed:	1500rpm	injector type:	GDI-MH
IMEP:	7.0bar	injector nozzle:	GDI InjPos 0
Lambda:	var.	ignition system:	WRC / VSI
EGR:	var.	spark plug:	Bosch / Beru
prail:	200bar		
SOI1:	-300°CA		
CA50:	8°CA		

Phase 2.2: Variation of EGR 1500rpm/7bar homogenous lean



- Comparable results for both systems during operation on dilution limit with air + EGR
- High IMEPCOV with WRC configuration caused by single misfiring
→ however as described before, stability/misfire limit is very sensitive to engine history/condition
→ repetition with WRC system shows similar IMEPCOV as VSI

Vielen Dank

Paul-Benjamin Reinicke

IAV GmbH

Telefon +49 30 39978-9884

paul-benjamin.reinicke@iav.de

www.iav.com