

**VOLKSWAGEN**

AKTIENGESELLSCHAFT

GROUP RESEARCH



## EU-PROJECT: GASON - LEAN CNG COMBUSTION PROCESS

30.06.2017



**Gas-Only Internal Combustion Engines**

Project number 652816

*H2020 GV-3-2014 Future natural gas powertrains and components for cars and vans*



## 1. EU-FUNDED PROJECT

### H2020 project:



1. Acronym: GasOn
2. Title: Gas-Only Internal Combustion Engines
3. Number 652816
4. Topic: H2020 GV-3-2014 Future natural gas powertrains and components for cars and vans
5. Start Date: 1st of May 2015 (42 months)
6. Website: [www.gason.eu](http://www.gason.eu)



**Objectives:** in order to exploit the main benefits of CNG-powered engines, the aim is to develop CNG-only (monofuel) engines able to comply with post Euro 6 noxious emissions and post 2020 CO<sub>2</sub> targets according to new homologation cycle and real driving conditions and simultaneously improving engine efficiency and performance.

#### **Expected Outcomes:**

- Three demo vehicles with integrated technologies (direct injection of CNG, innovative air management, high compression ratio, advanced boosting, CNG fuel quality sensor) and stoichiometric or lean combustion.
- Innovative combustion concepts and advanced exhaust gas after treatment system.

#### **Expected exploitation:**

New generation of extremely efficient CNG engines.

#### **Expected impact:**

Tank to Wheel Greenhouse gases (CO<sub>2</sub>) mitigation among 16% and 25% on NEDC cycle vs. current best in class.



## MOTIVATION

CNG OFFERS AN ECO-FRIENDLY, SUSTAINABLE AND COST EFFECTIVE MOBILITY



see: [www.discover-cng.de](http://www.discover-cng.de)

**Renewable Production of CH<sub>4</sub>**

**Low Emissions**



**Availability**

**Very good TCO and Driveability**



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## MOTIVATION

STRUCTURE OF EU-PROJECT IN HORIZON 2020

**Aim: development of monovalent and highly efficient CNG engines for future emission- and CO<sub>2</sub>-legislation**

### State of the art:

stoichiometric burn ( $\lambda=1$ ) with TWC

### GasOn WP5:

lean burn ( $\lambda \gg 1$ ) to reach CO<sub>2</sub> levels of 20% below best in class (2015)

WP5 (VW)

Combustion concept and on-board sensor concept

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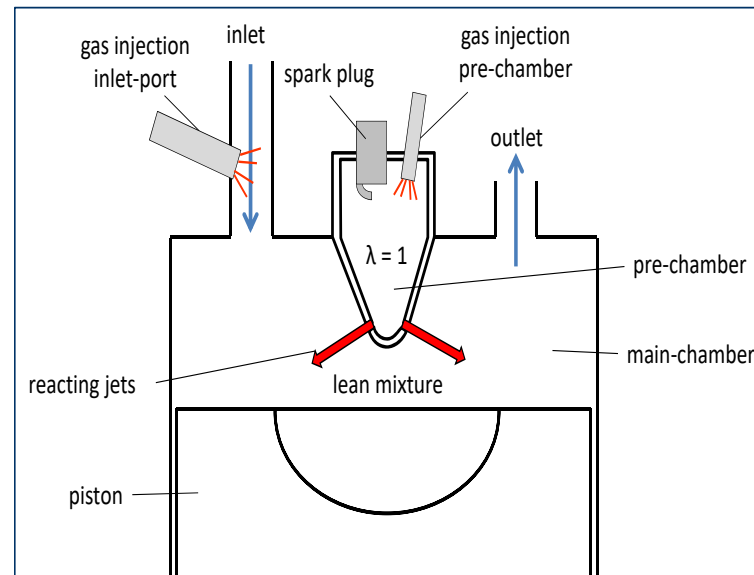
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## CONCEPT

### FURTHER RESEARCH FOR MAXIMUM EFFICIENT CNG-ENGINES

- Monovalent engine to exploit CNG advantages by 100% (high knock resistance)
- Lean burn and high compression ratio offer further increase of engine efficiency
- Lean CNG-mix especially under high pressure can not be ignited properly by a spark plug
- Ignition chamber concept overcomes the ignition limits and enables a lean burn with high compression ratio

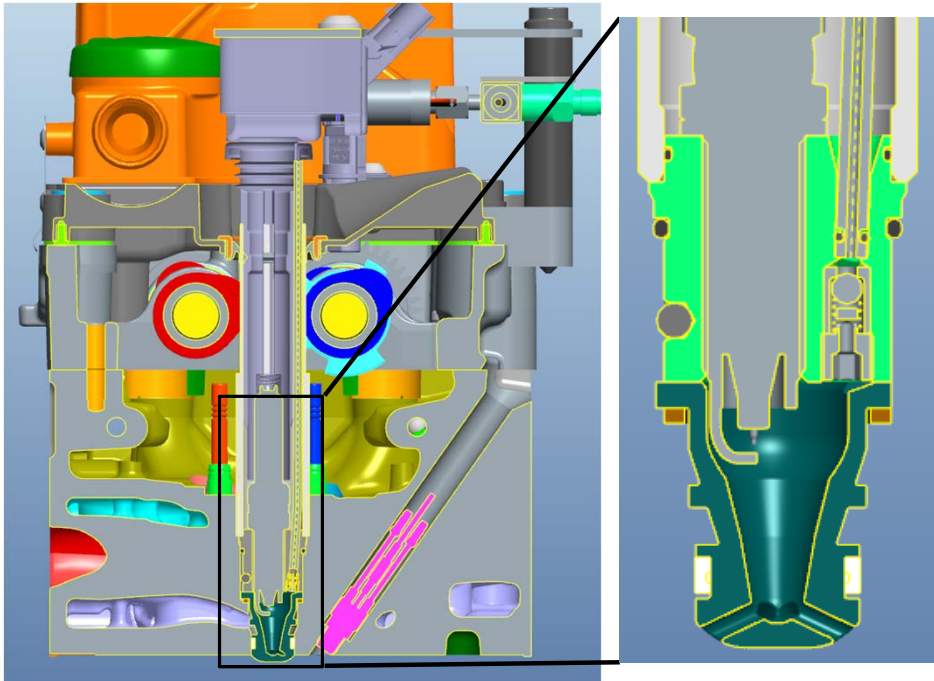


Scheme of Ignition-chamber concept

## OBJECTIVES

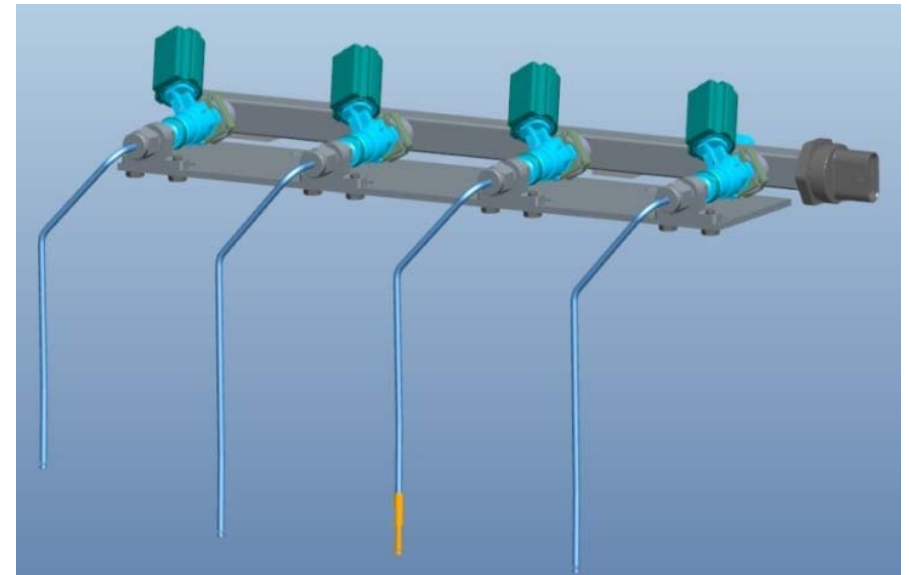
### INTEGRATION INTO A DIESEL BASE ENGINE

- Package of components in the limited space of the cylinderhead
- Development of an dosing system to feed very small amounts of CNG into the ignition chamber



Section view through cylinderhead

Detail view of ignition chamber



Dosing system to supply CNG into the ignition chamber

## APPROACH

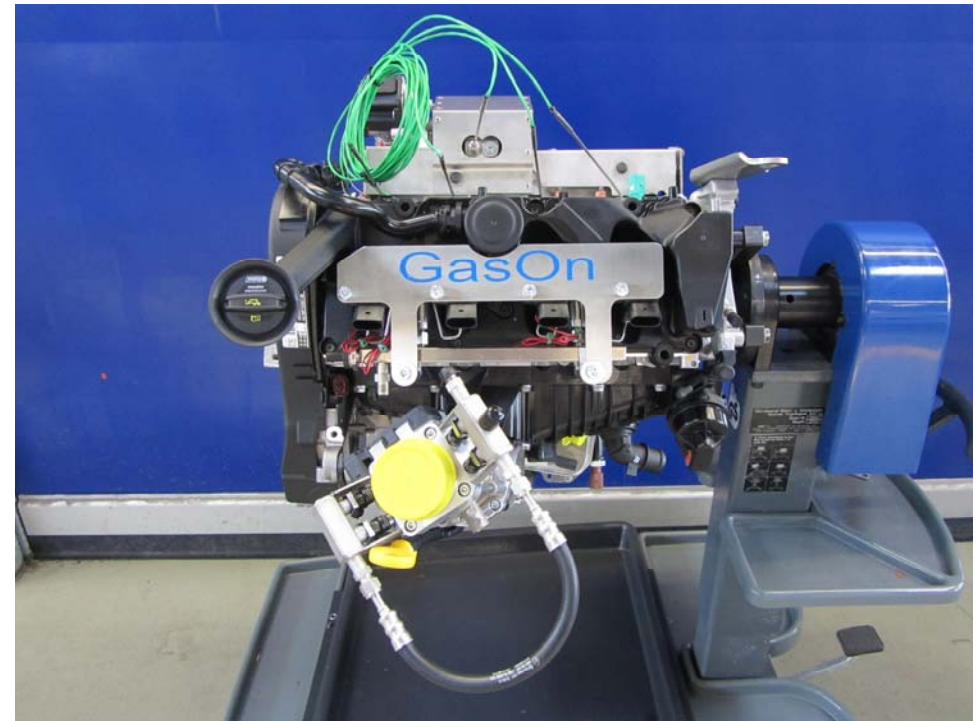
FIRST SET OF HARDWARE FOR BASIC TESTS

### Technical Setup

- Full engine tests with 4cylinder
- Fundamental tests (lean limits, dosing, etc.)
- Comparison to standard spark ignition
- Variation of compression ratio



Ignition Chamber with check valve and spark plug



GasOn Engine



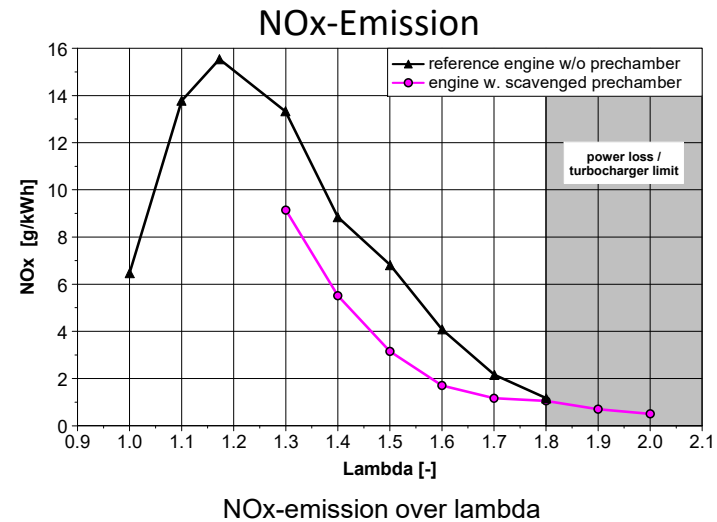
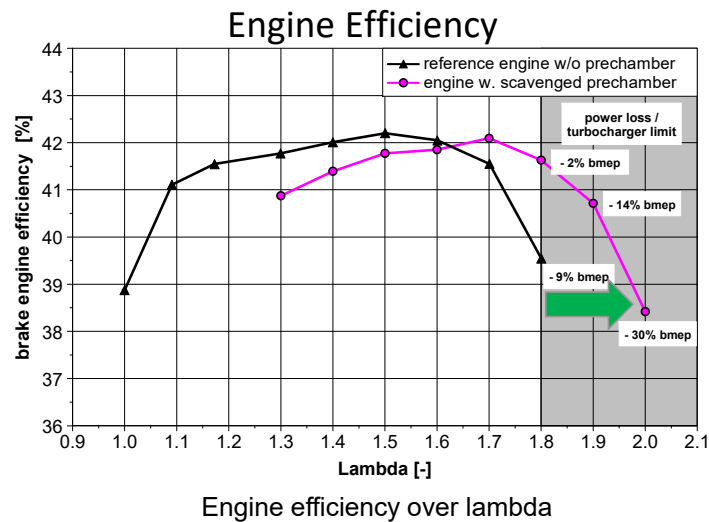
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## RESULTS

FULL ENGINE TESTS: COMPARISON STANDARD IGNITION VS. IGNITION CHAMBER (2000RPM/ 220NM)



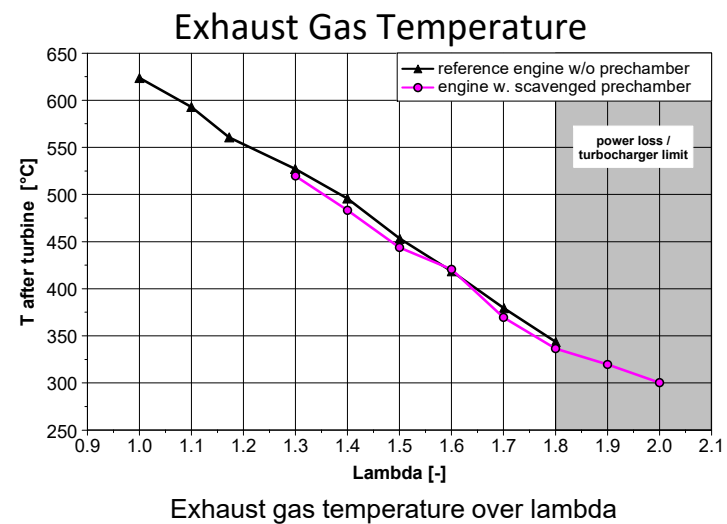
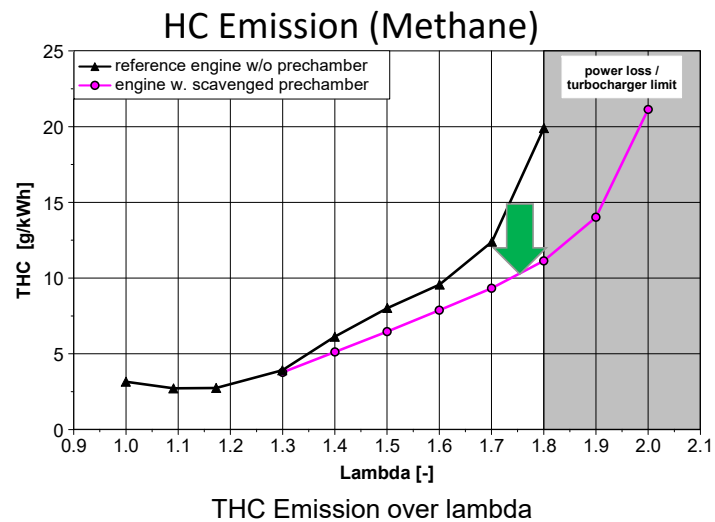
## Conclusion

- Lean limits successfully extended
- High efficiencies are demonstrated



## RESULTS

FULL ENGINE TESTS: COMPARISON STANDARD IGNITION VS. IGNITION CHAMBER (2000RPM/ 220NM)



## Conclusion

- Lean limits successfully extended
- High efficiencies are demonstrated
- Aftertreatment is challenging; GasOn-concept is a step in the right direction to reduce HC emission

# GASON DELIVERS ADDITIONAL KNOWLEDGE IN NEW TECHNOLOGICAL AREAS TO ROUND UP THE CNG ACTIVITIES IN THE GROUP

**Sustainable**

**Available**

**Cost effective**

**Future**



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# Thank You!



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