PaREGEn

Particle Reduced, Efficient Gasoline Engines

Simon Edwards, Ricardo

29th November, 2018

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 723954

Administrative Information

Partner Number	Partner Name	Partner Code	Partner Country	Organisation Type
1	Ricardo UK Ltd	RIC	UK	IND-SUPP
2	Daimler AG	DAI	DE	IND-OEM
3	Jaguar Land Rover Ltd	JLR	UK	IND-OEM
4	Robert Bosch GmbH	BOSCH	DE	IND-SUPP
5	FEV GmbH	FEV	DE	IND-SUPP
6	Johnson Matthey plc	JM	UK	IND-SUPP
7	Honeywell, Spoll. S.R.O. (Garrett Air Motion)	HON	CZ	IND-SUPP
8	JRC - Joint Research Centre	JRC	IT	RESEARCH
9	Uniresearch BV	UNR	NL	IND-SME
10	IDIADA Automotive Technology SA	IDIADA	ES	IND-SUPP
11	Siemens Industry Software SAS	SIEMENS	FR	IND-SUPP
12	Lund Combustion Engineering LOGE AB	LOGE	SE	IND-SUPP
13	Eidgenoessische Technische Hochschule Zuerich	ETH	CH	HE
14	Universitaet Duisburg - Essen	UDE	DE	HE
15	Rheinisch-Westfaelische Technische Hochschule Aachen	RWTH	DE	HE
16	UFI Filters	UFI	IT	IND-SUPP
17	University of Brighton	UOB	UK	HE

PaREGEn

BUDGET: €12.1 million

FUNDING: €9.95 million

START: October 2016

DURATION: 36 months

Call: H2020-GV-02-2016-INEA

CONTRACT NUMBER: 723954

COORDINATOR: Simon Edwards, Ricardo

CONTACT: secretary@uniresearch.com

WEBSITE: www.paregen.eu

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Objectives

- Demonstrate a new generation of gasoline direct injection engines achieving a ≥ 15% reduction in CO_2 emissions through the optimal combination of advanced engine and robust aftertreatment technologies

- These vehicles will comply with upcoming Euro 6 RDE limits with particle number emissions measured to a 10nm size threshold

- Modelling and simulation software will be verified that can improve the design and the control capability of subsequent vehicles

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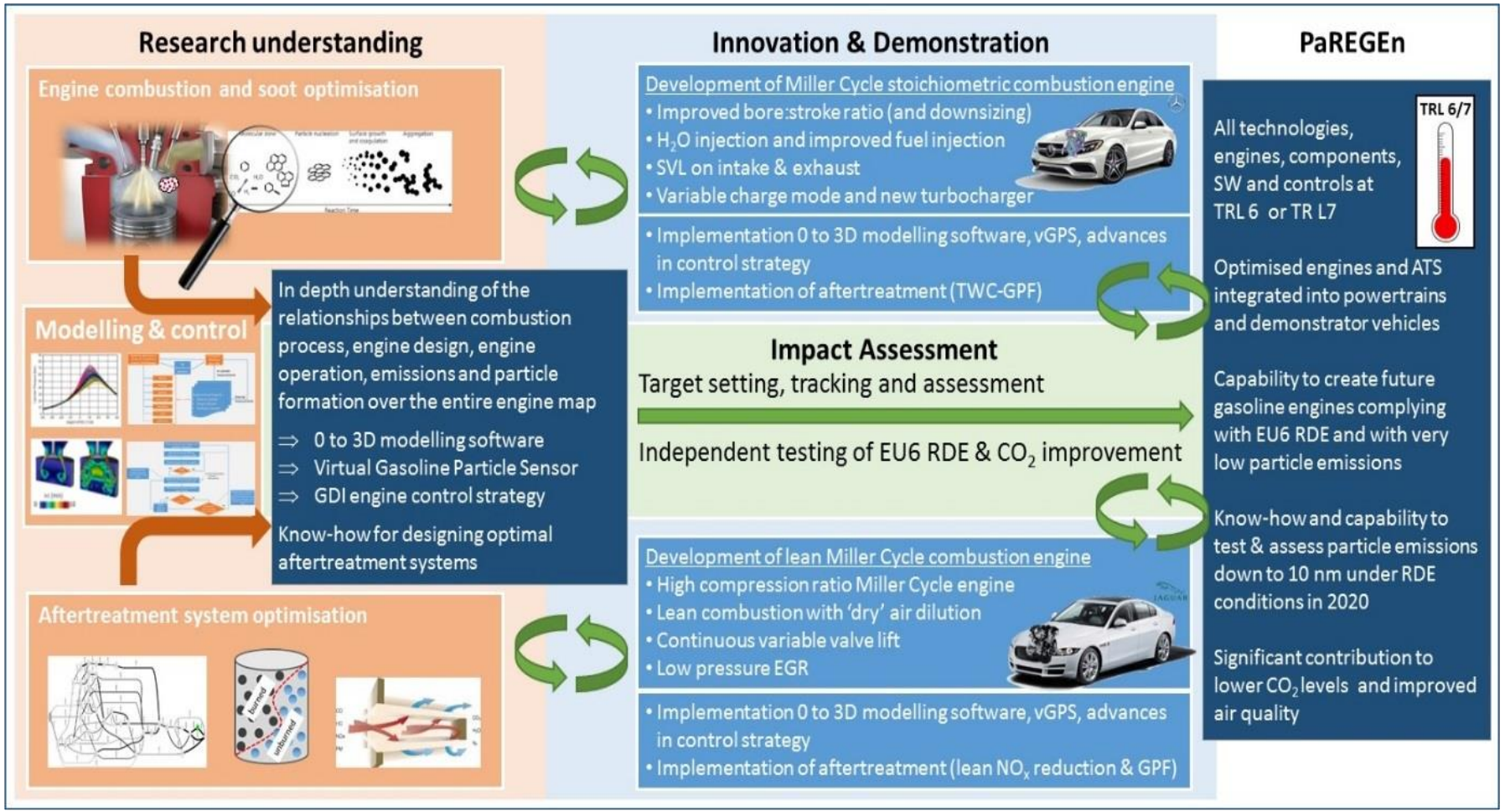
Project Approach



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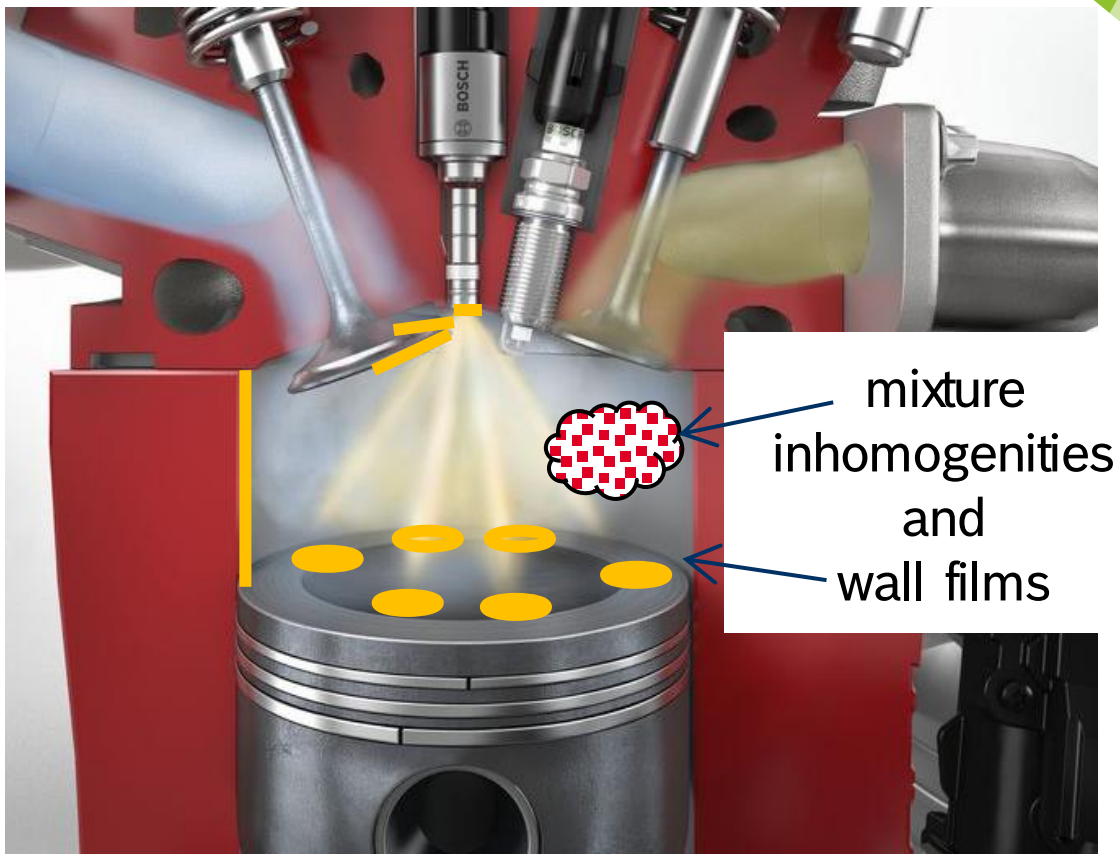
Modelling and simulation software, that can improve the design and the control capability of subsequent vehicles, will be verified

- Fuel wall films as one major source for particle formation

- Optical diagnostic methods, using on calibrated laser based techniques, may enable thickness quantification of in-cylinder fuel films



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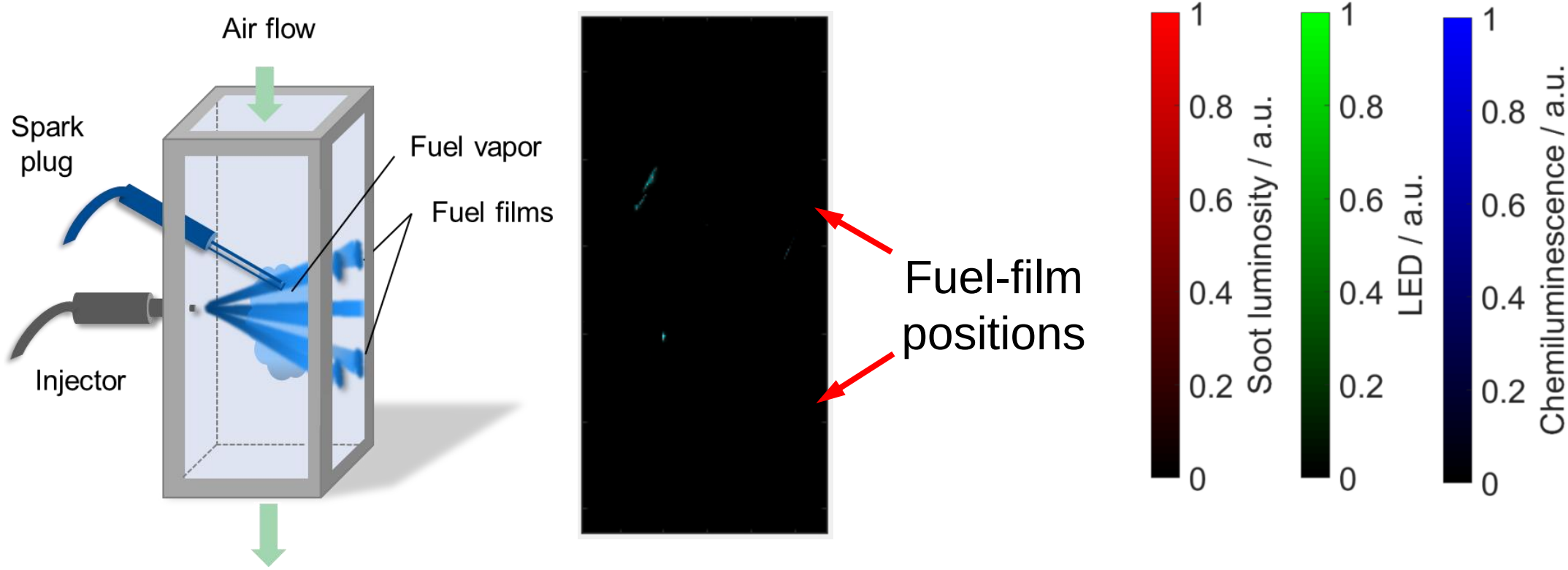

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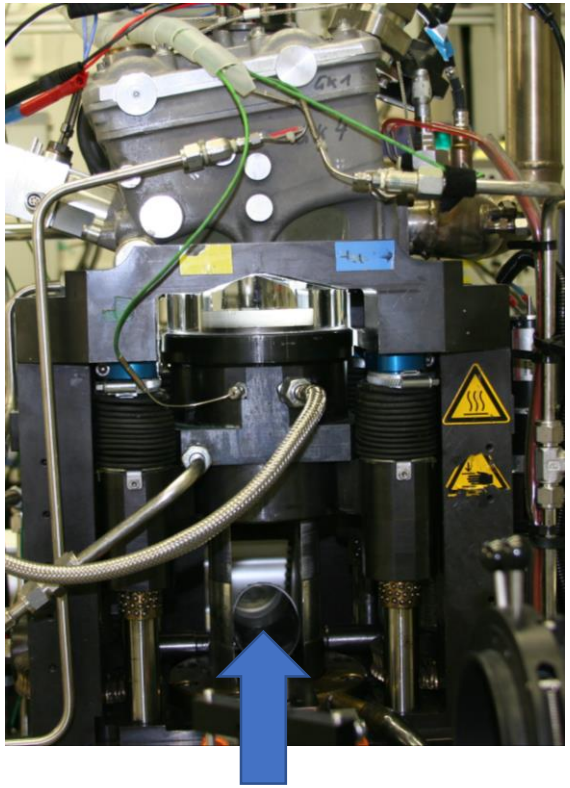
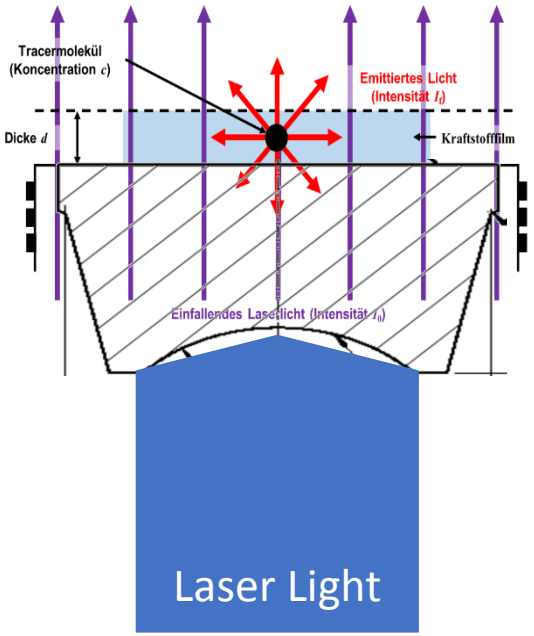


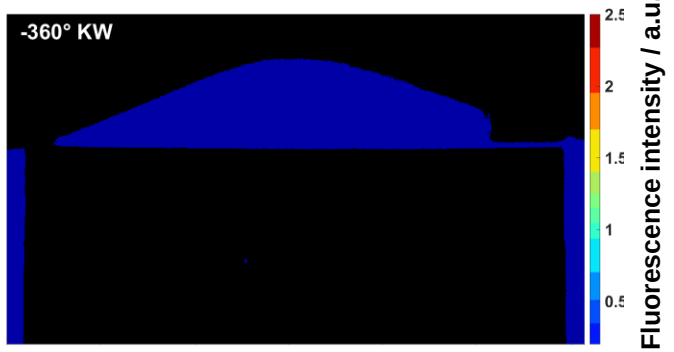
Viewed from below

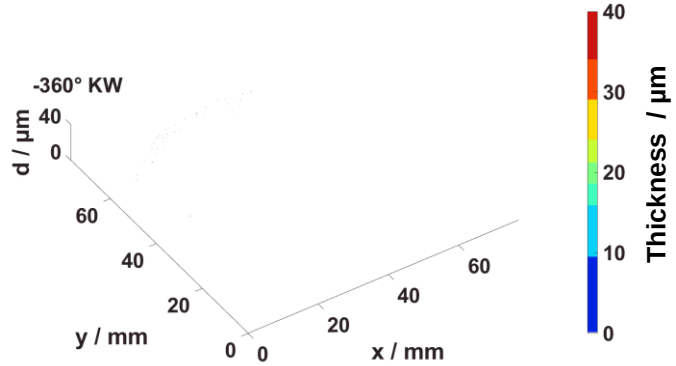
Optical access piston window:

Fluorescence signal ≈ absorbed light



p_{rail}=200 bar, t_i=2079 µs





PhD Thesis: J.N. Geiler, Bosch

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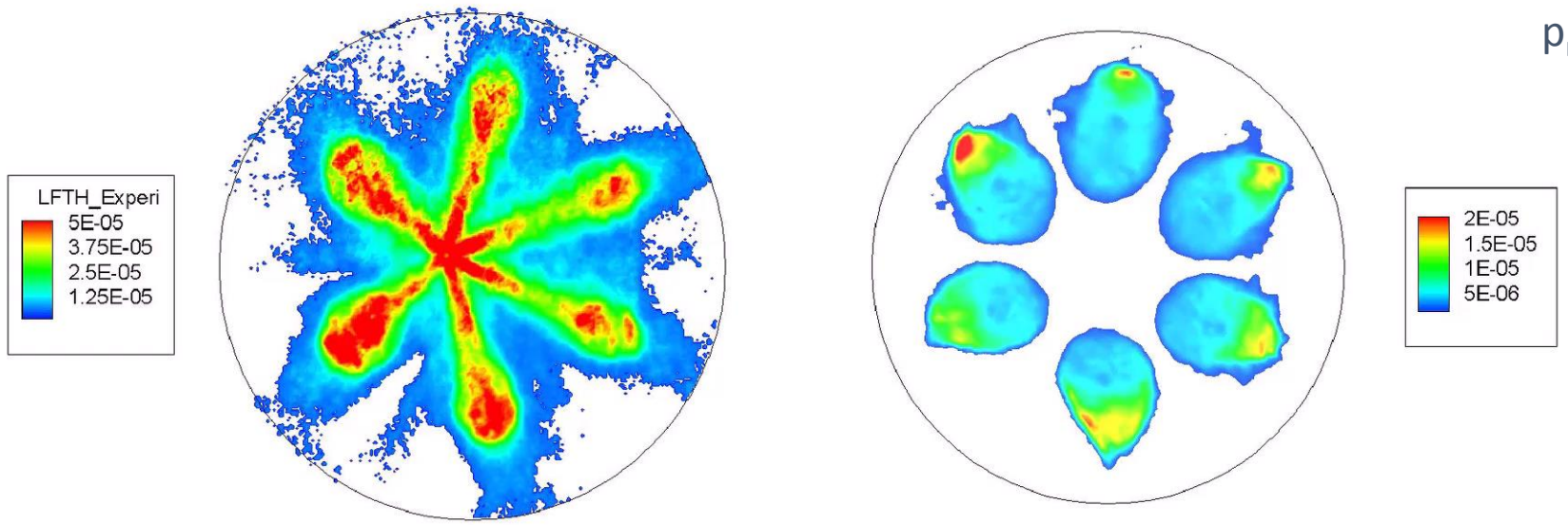
Modelling and simulation software, that can improve the design and the control capability of subsequent vehicles, will be verified

- Evolution of liquid film distribution in motored conditions

p_{rail}=200 bar



Measurement

Simulation

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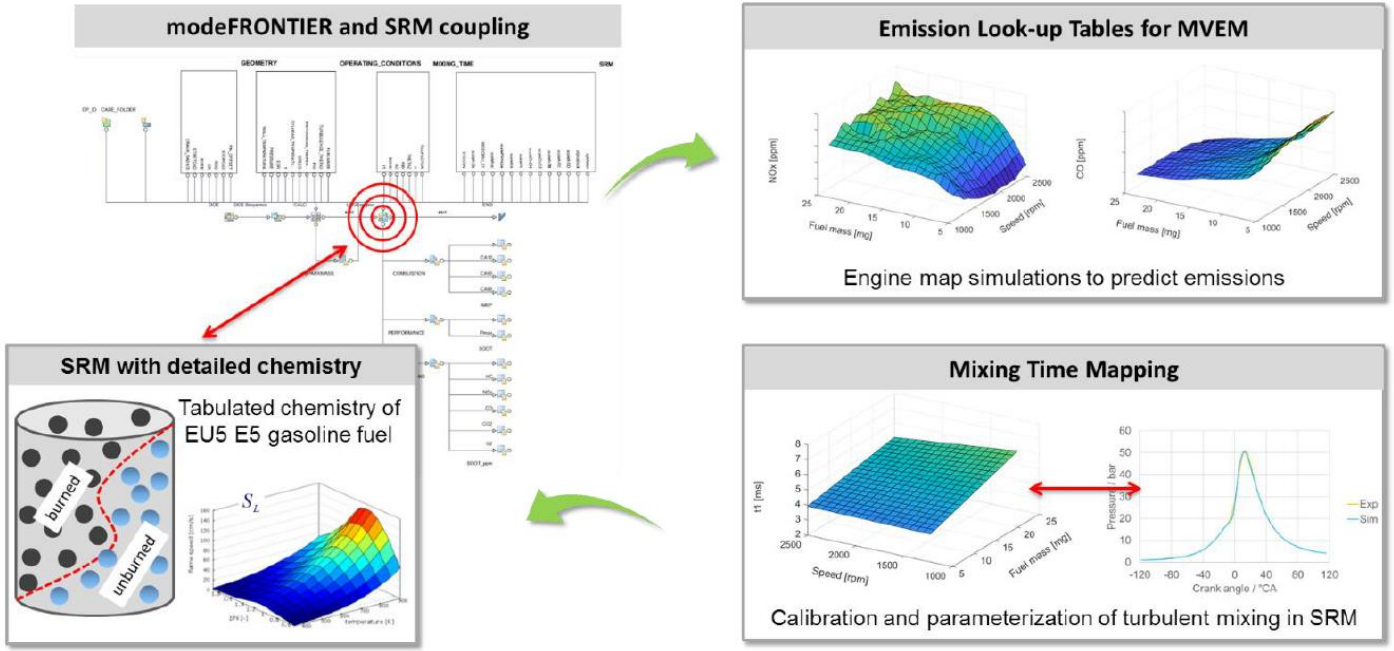
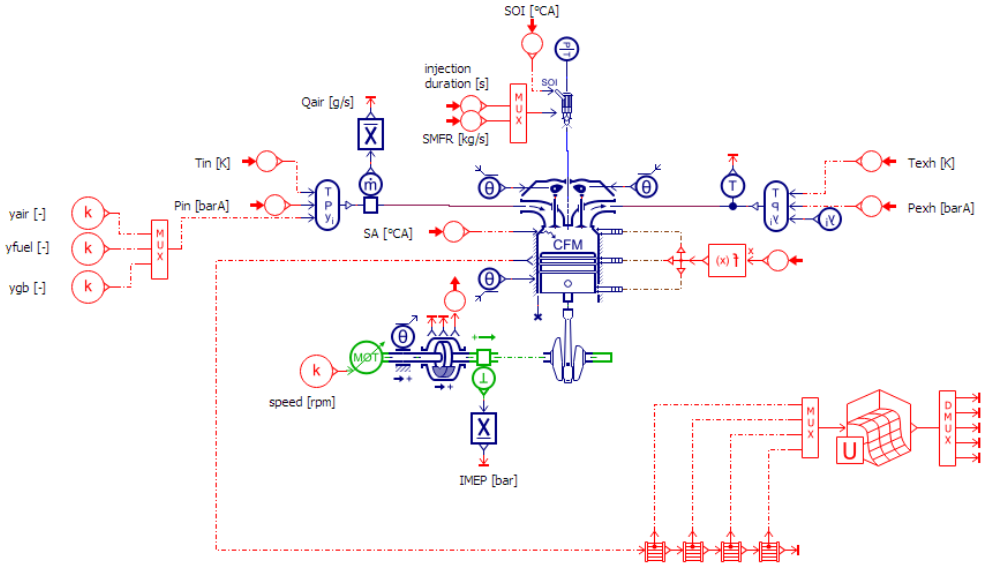
Modelling and simulation software, that can improve the design and the control capability of subsequent vehicles, will be verified

- Development of the real time models for the vGPS on-going



Emissions predictions



Real time engine models

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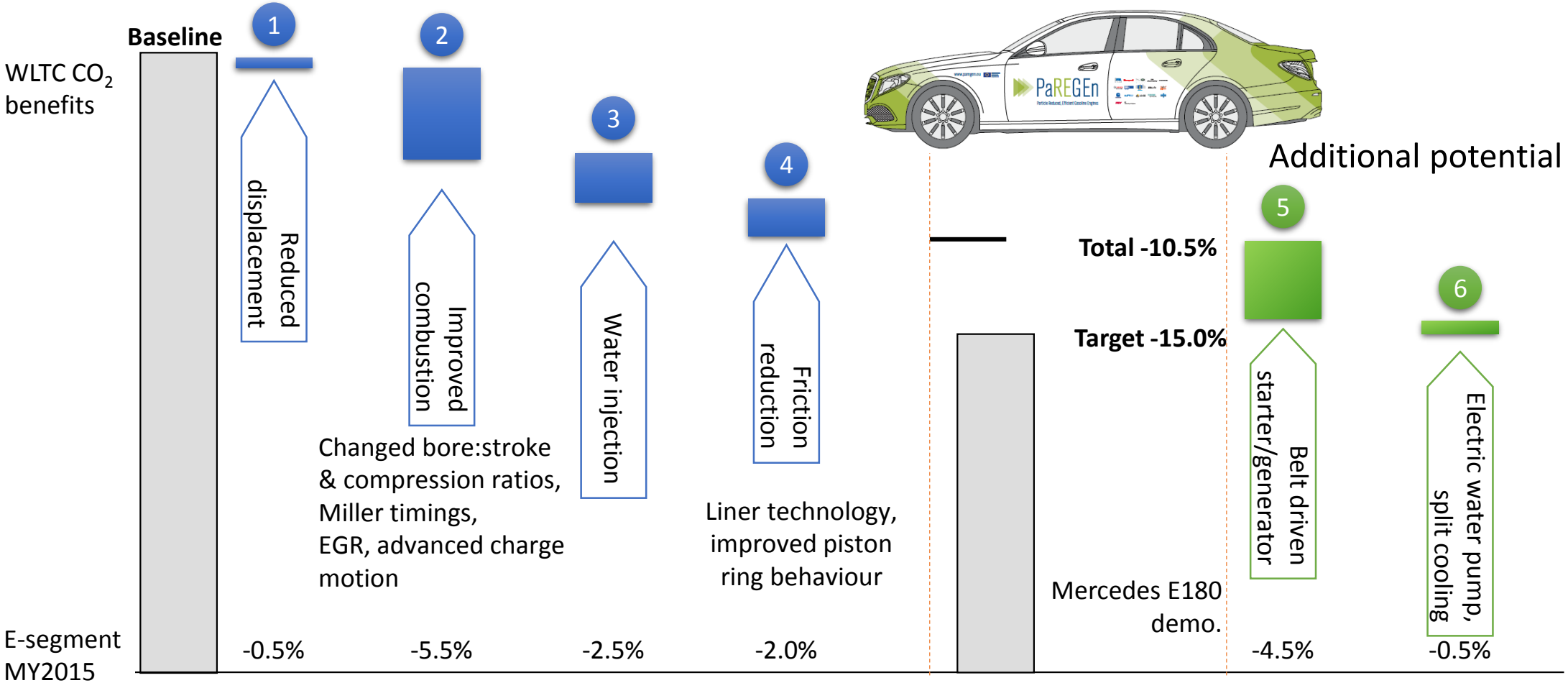
Demonstrate a new generation of gasoline DI engines achieving a ≥ 15% reduction in CO_2 … Stoichiometric small TC-VVA-DI water injection engine (WP3)



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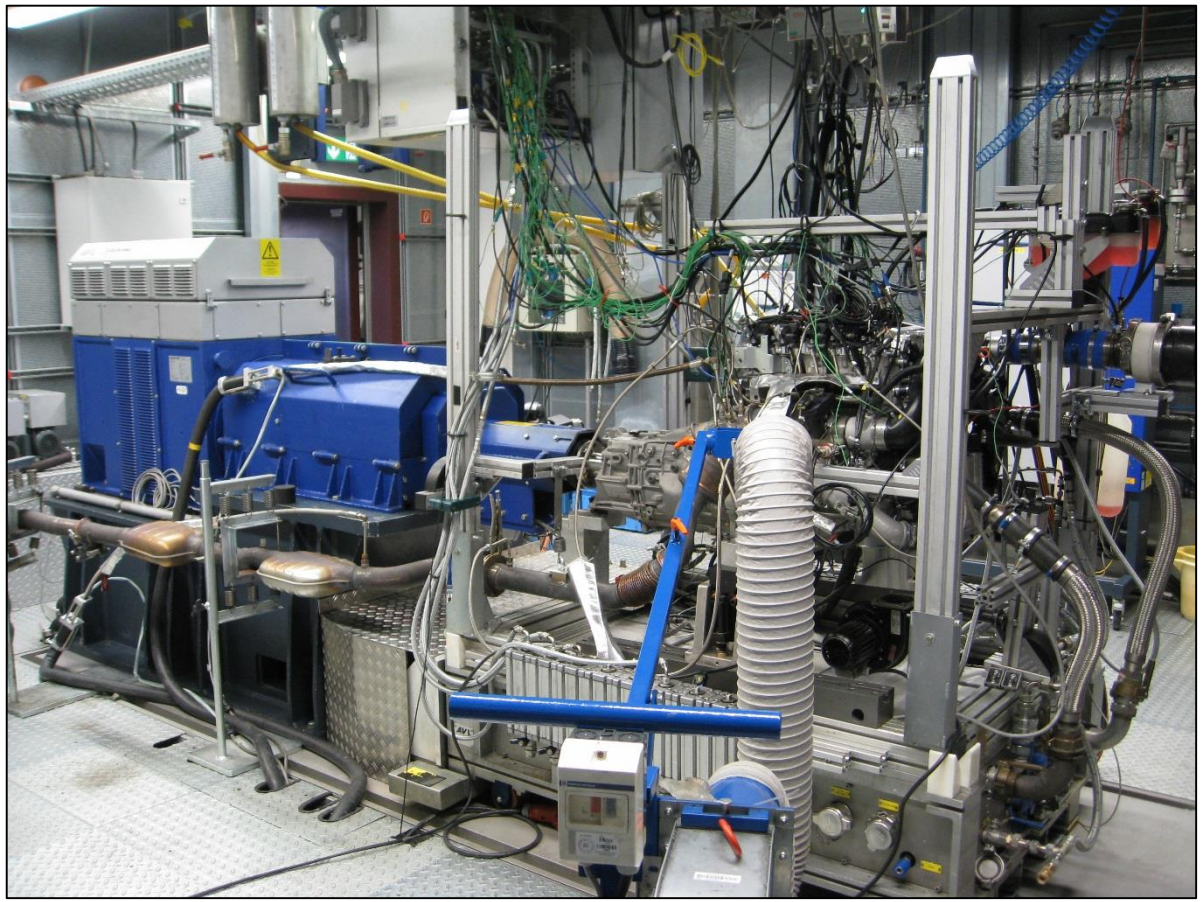
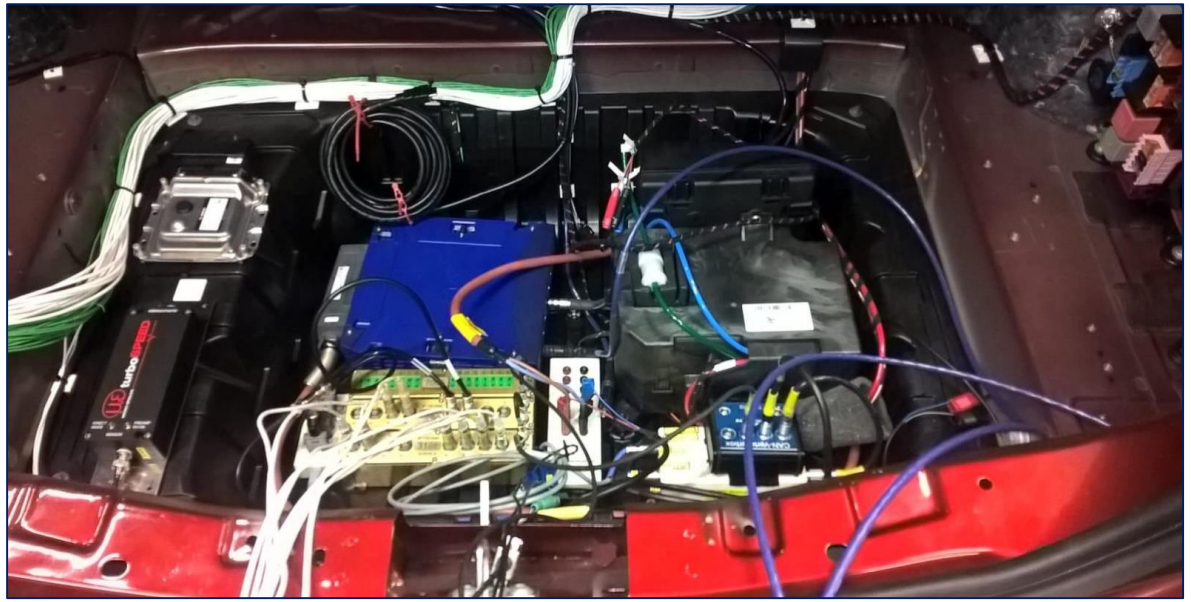


- Engine on test and demonstrator vehicle being built



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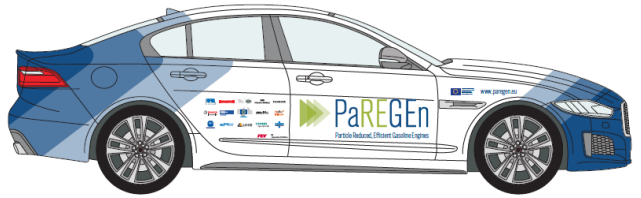
Demonstrate a new generation of gasoline DI engines achieving a ≥ 15% reduction in CO_2 …
Dry Dilute Combustion Demonstrator (WP4)



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Demonstrate a new generation of gasoline DI engines achieving a ≥ 15% reduction in CO_2 …
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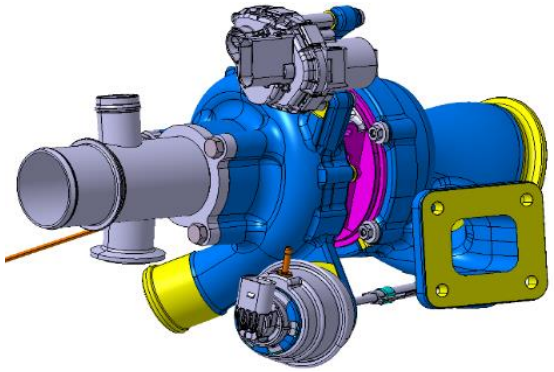
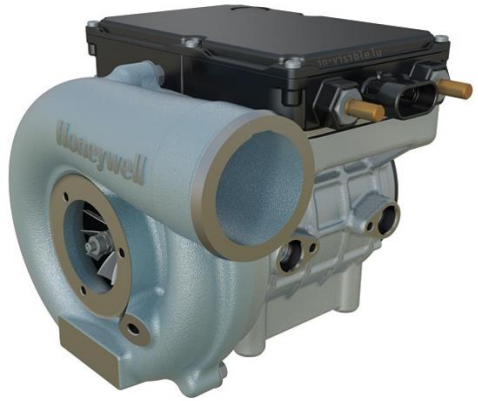
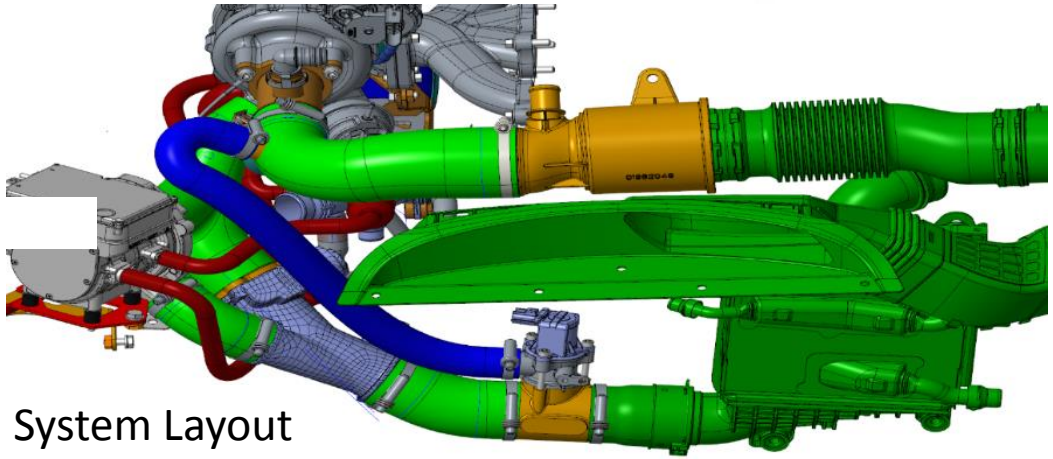
VNT



eCompressor





System Layout

- Engine with new componentry on test (air handling system shown) and demonstrator vehicle being readied for evaluation

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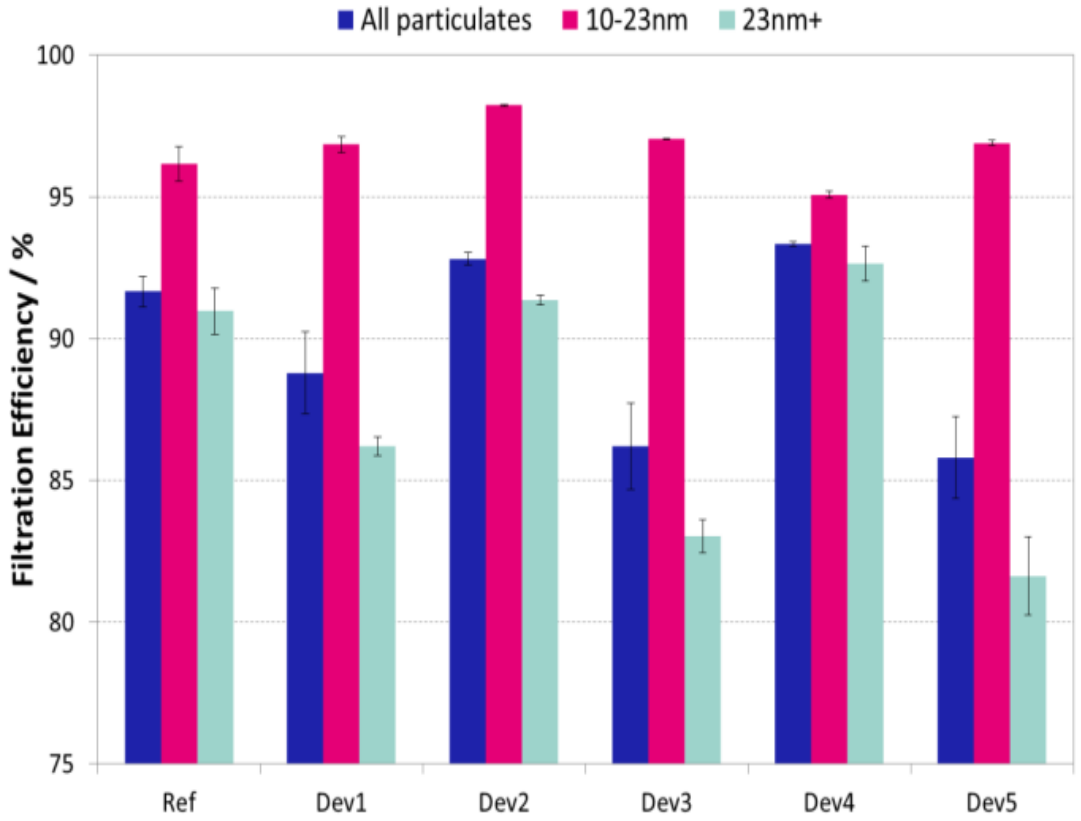
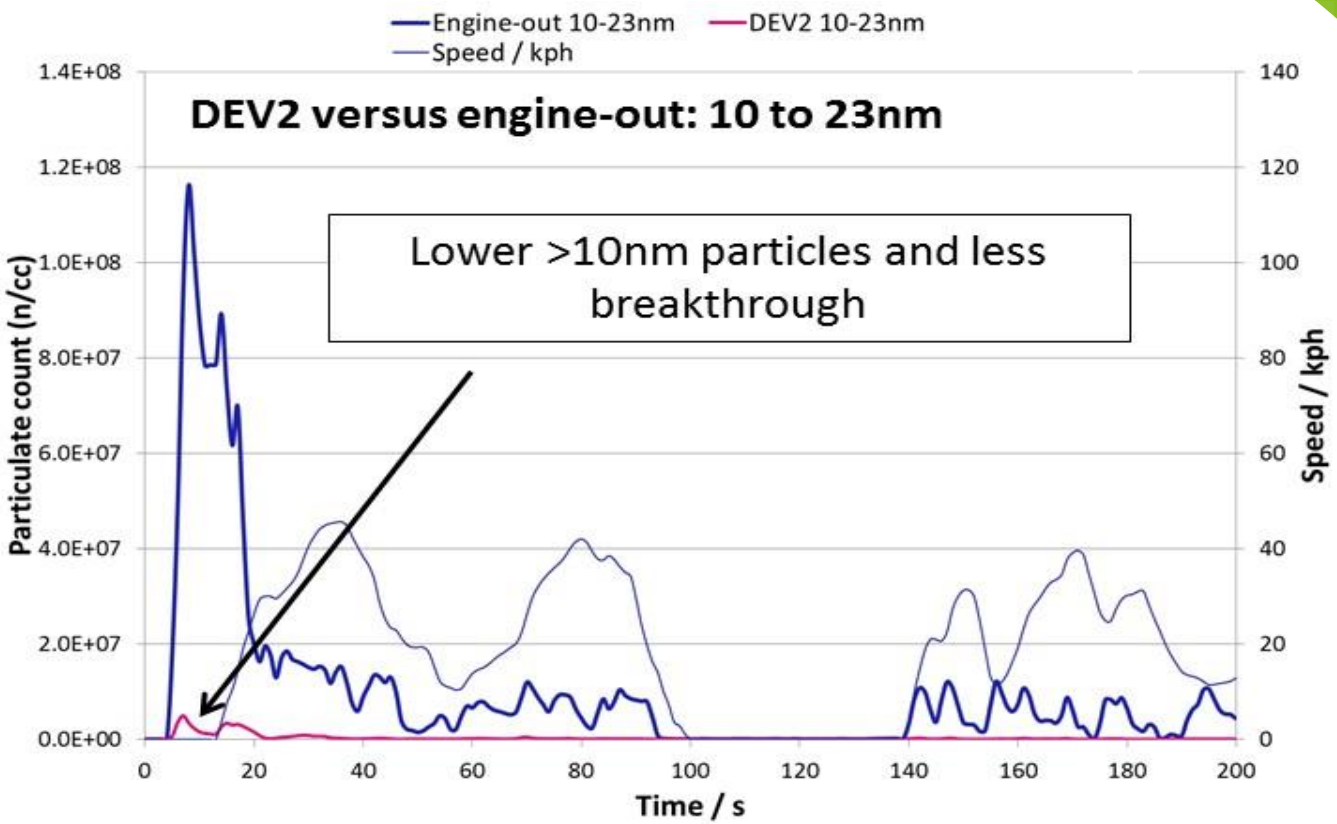
… Vehicles will comply with upcoming Euro 6 RDE limits with particle number emissions measured to a 10nm size threshold

- New aftertreatment systems including GPFs under test & development





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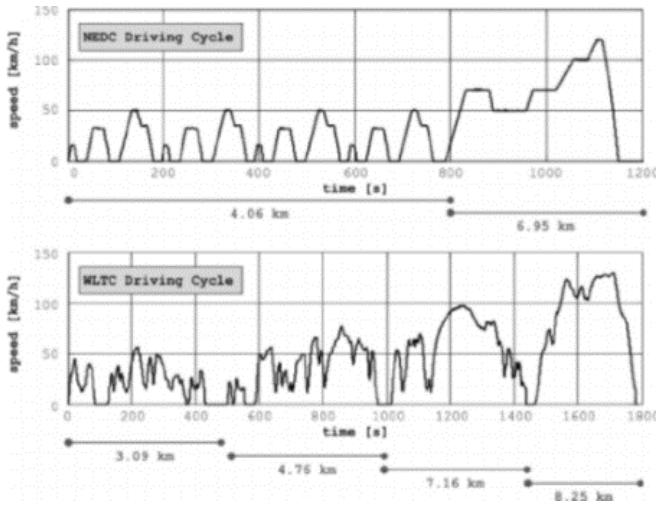
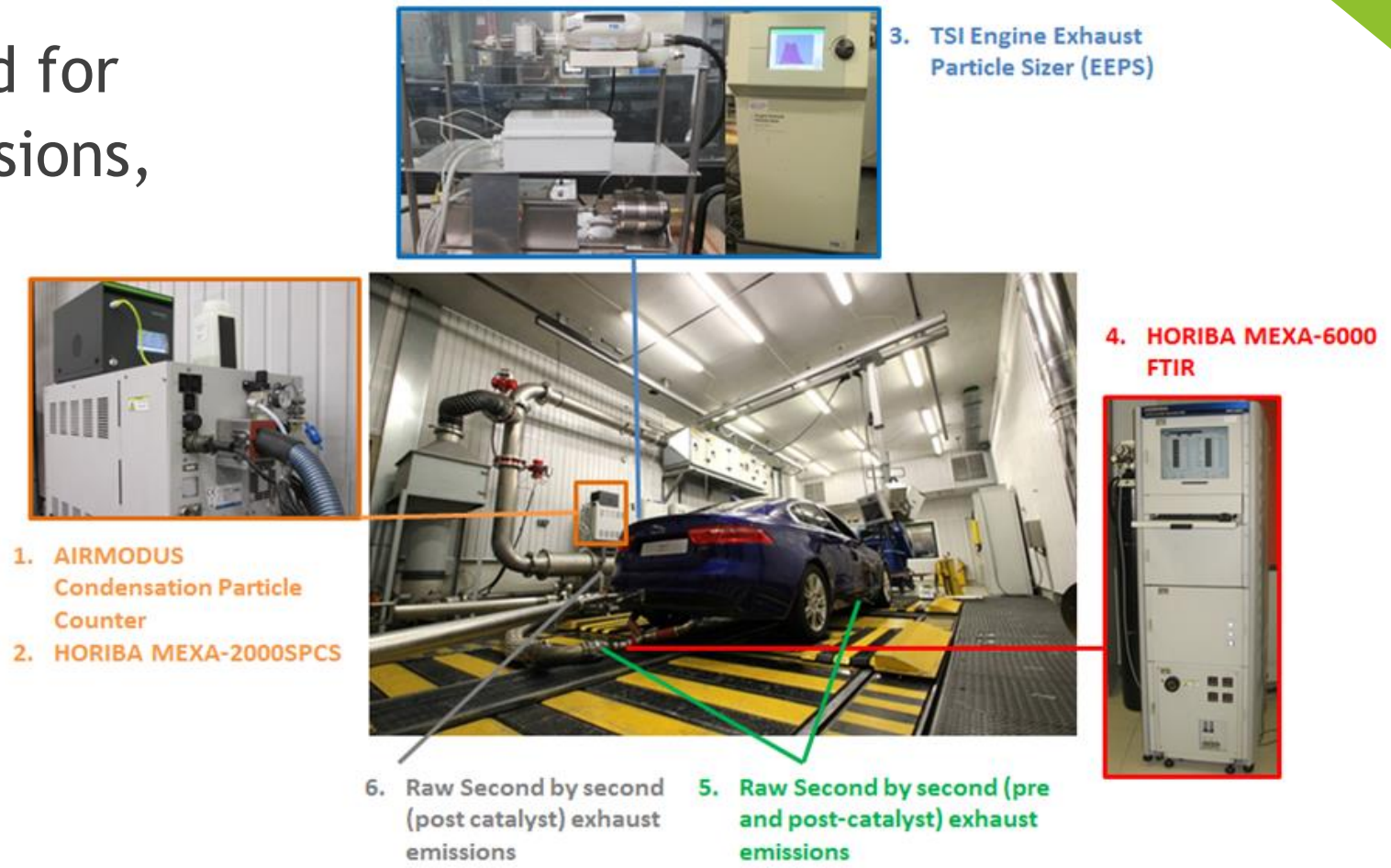
- Baseline vehicles tested for fuel economy and emissions, including PN





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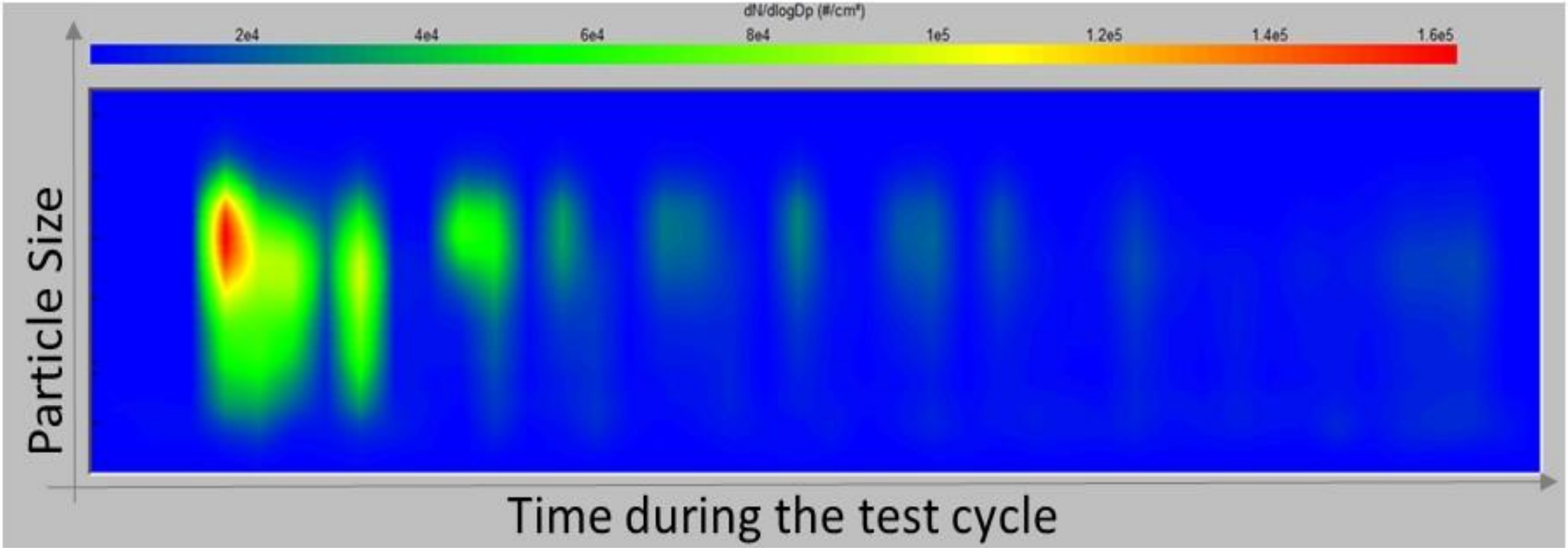
- Example measurements of particle size & number (on the colour scale) over a transient test



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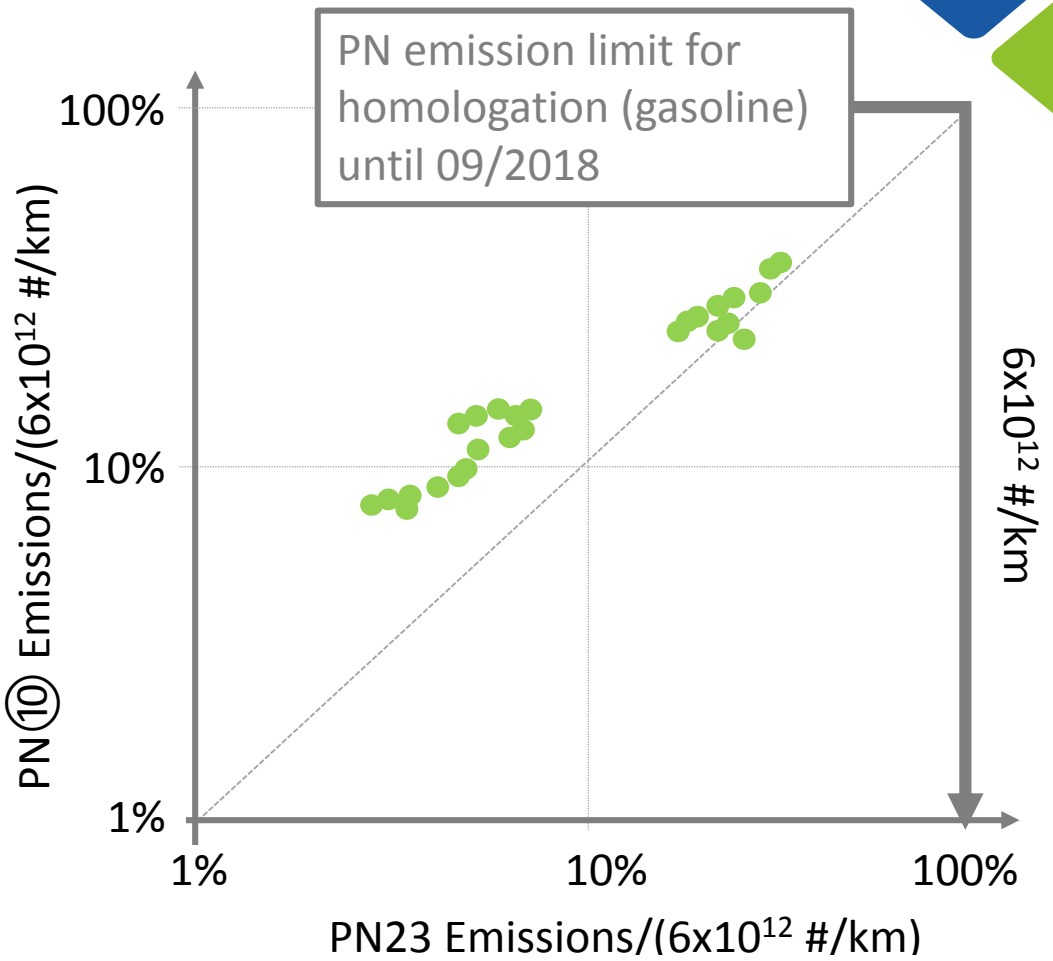
- PaREGEn baseline vehicle measurements made over the NEDC, WLTP (high and low), and RDE (on-road and on-dyno) with AIRMODUS and EEPS instruments
- Over the wide range of tests the baseline vehicles were well below the relevant legislative PN levels
- The relationship between the PN23 and PN⑩ measurements is consistent with the other measurements made within the DownToTen project



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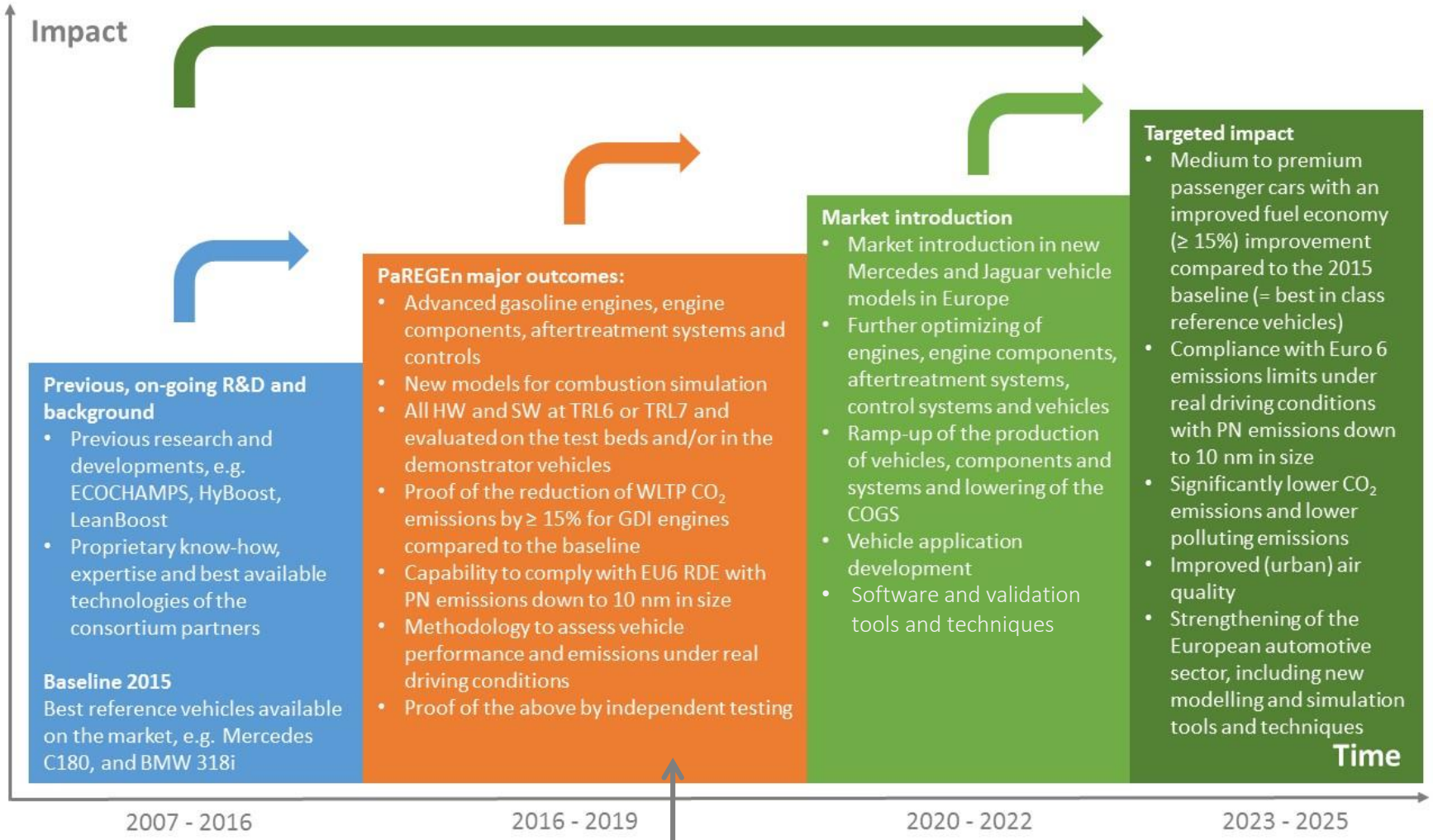
Expected or potential impact (long-term)



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Expected or potential impact (long-term)

- The project PaREGEn will give developers the opportunity to complement current work with new combinations of advanced technologies through cooperative effort committed to achieve a 15% CO_2 reduction along with real driving emissions targets
- Other socially important impacts of the PaREGEn project are
  - Through the improvement in engine fuel efficiency, achieving the PaREGEn project goals will contribute to a lowering of the dependence on oil imports
  - It will lead to technology leadership and economic growth at the European vehicle OEMs, suppliers of engines and powertrain components, aftertreatment systems, automotive engineering and software supply companies and automotive research institutes
  - It will lead to benefits for the European economy, jobs, economic growth and society as a whole, e.g. improvement of the local environment and air quality

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Conclusions and Future Work

- In PaREGEn, further development of gasoline engines used in mid to premium sized passenger cars is being made
- The project is currently two years into its three-year plan and the technology developments are showing progress towards achieving the overall project objectives and expected impact
  - The development engines are running on the test beds
  - And the demonstrator vehicles are being readied for calibration
- Over the next 12 months the component, engine & aftertreatment technologies will be tested in the two demonstrator vehicles, ready for independent evaluation
- The simulation tools are being validated through experiment & the learning will be applied to the demonstrator vehicles
- The step thereafter is market introduction: a roadmap to implementation of the technologies has been devised & is supported by more detailed plans

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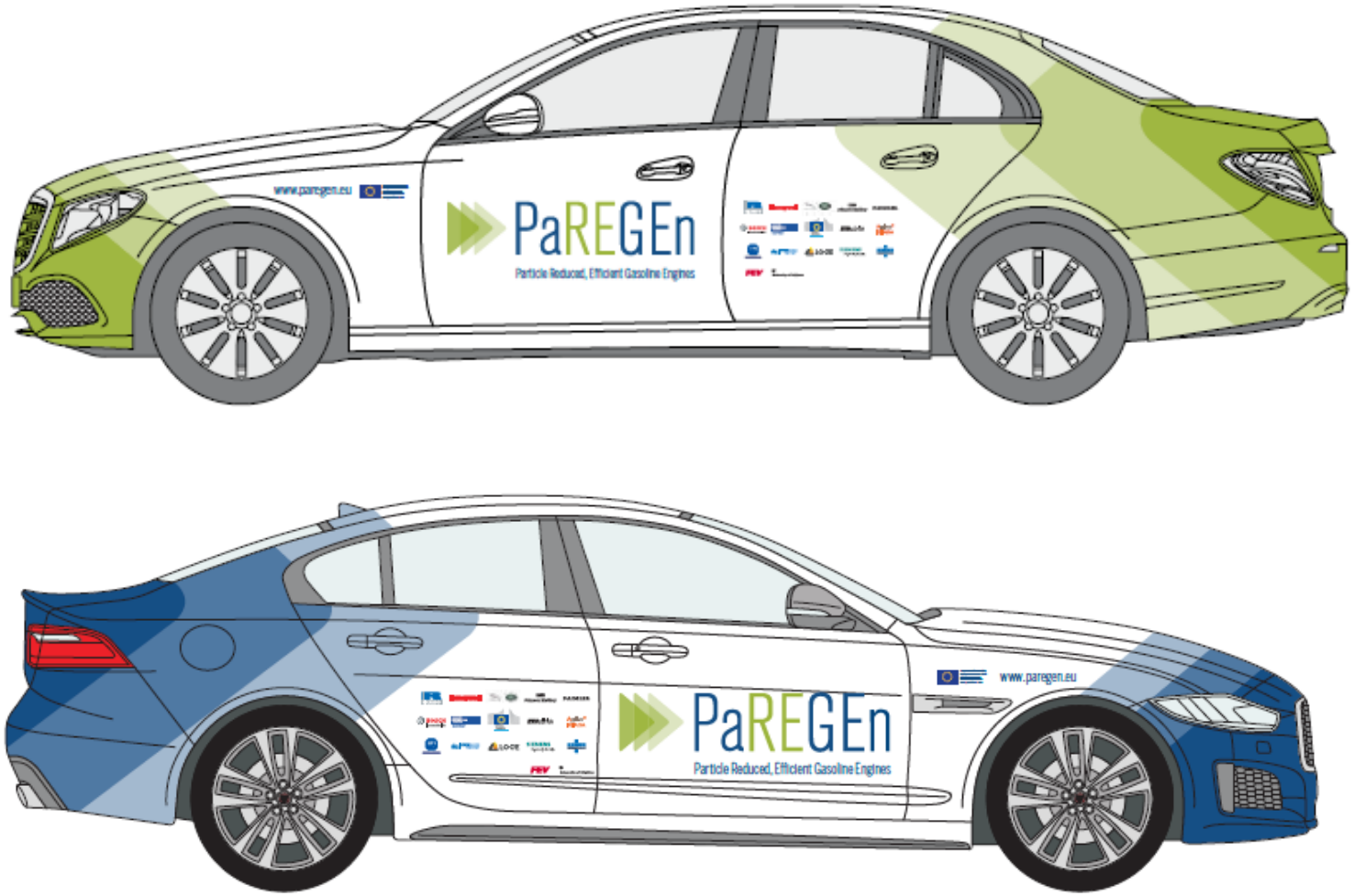
Thank you for your attention



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