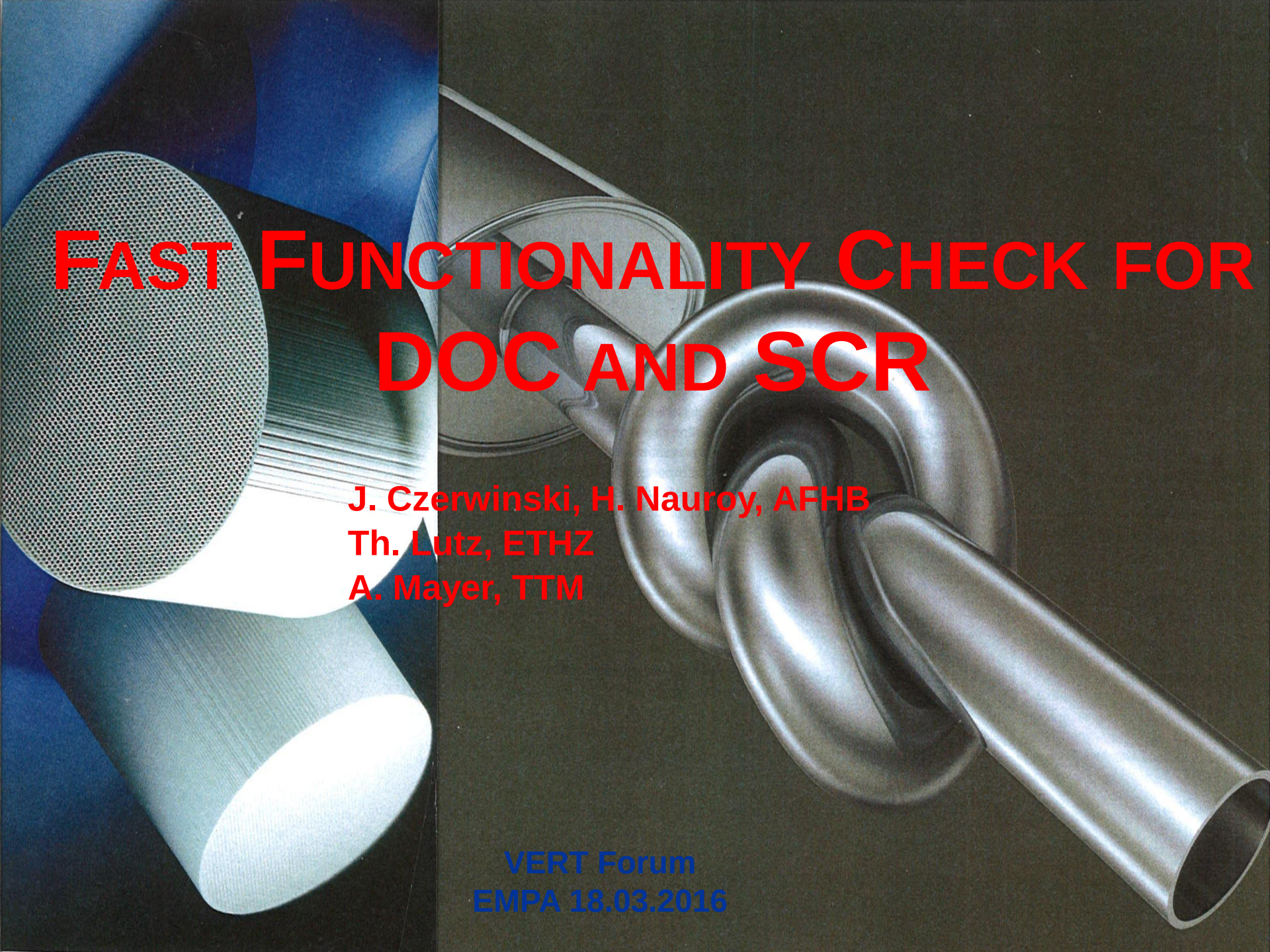


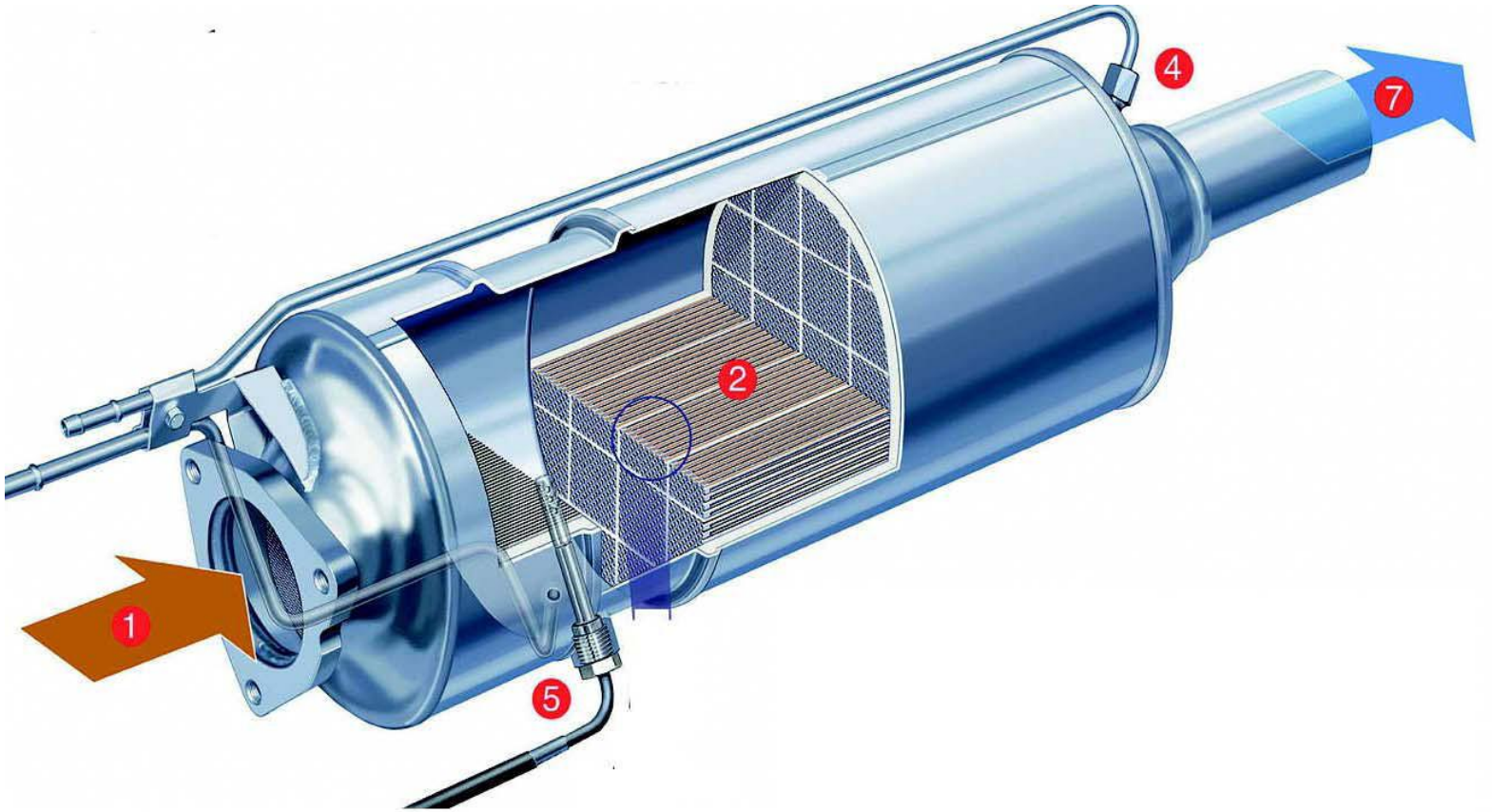
Fast Functionality Check for DOC and SCR

J. Czerwinski, H. Nauroy, AFHB
Th. Lutz, ETHZ
A. Mayer, TTM

VERT Forum
EMPA 18.03.2016

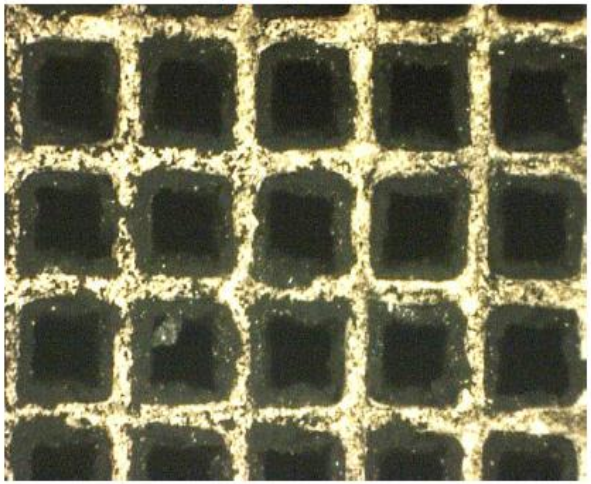
DOC

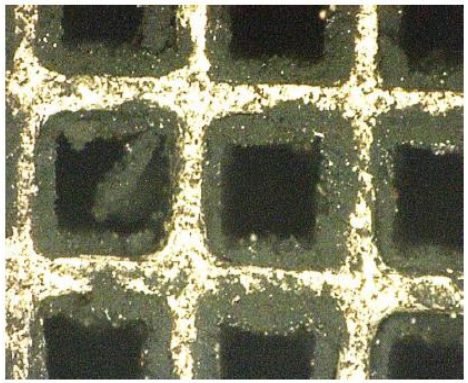
Why Check DOC Conversion



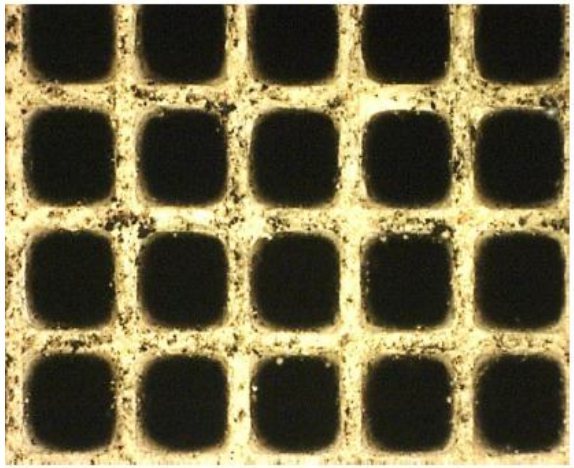
DOC might be covered by soot

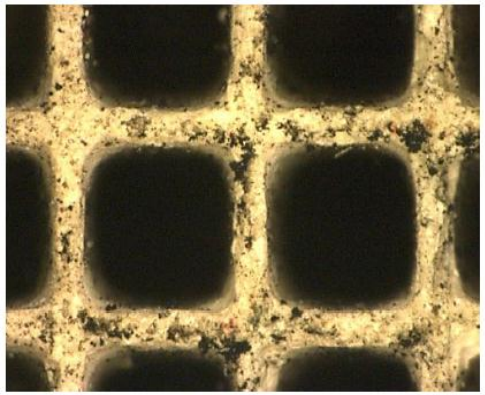
Inlet





Outlet



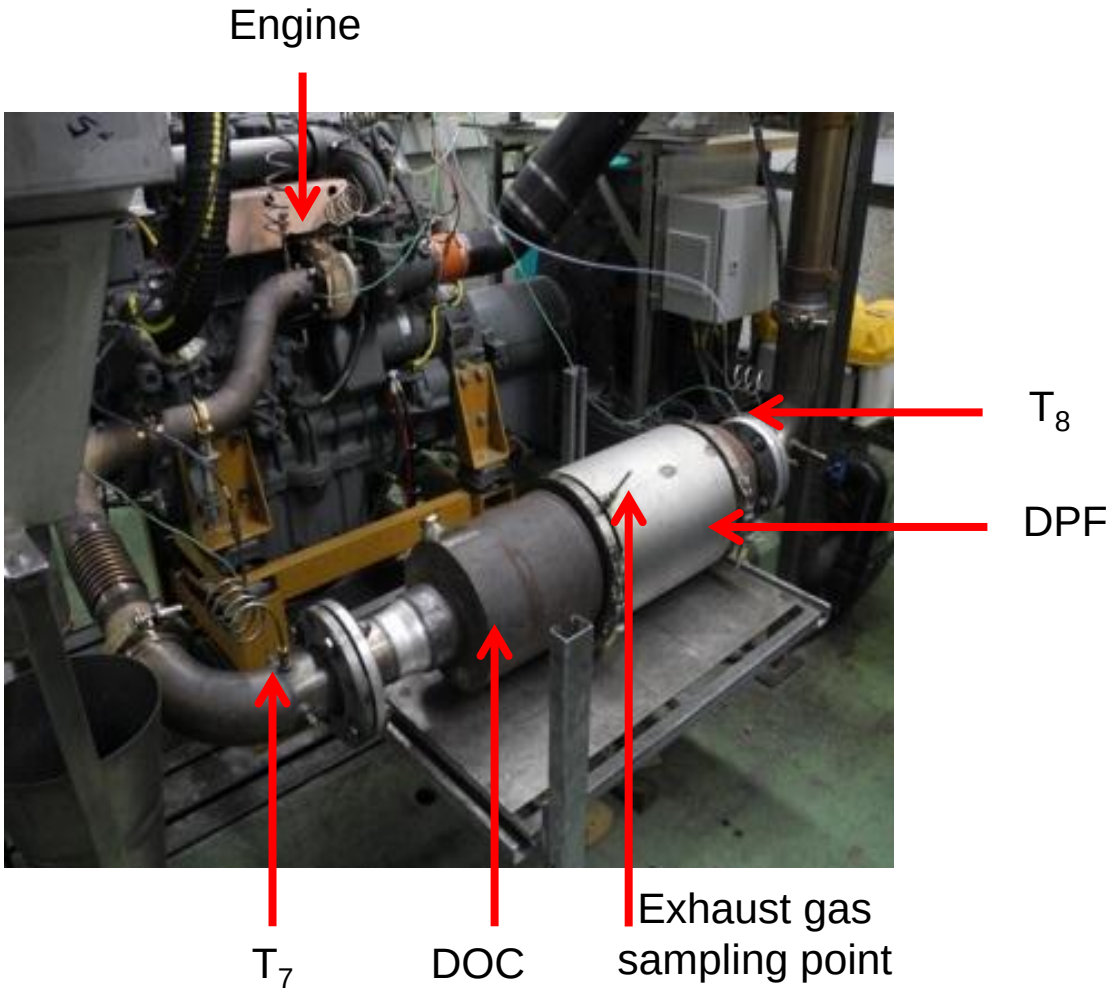


If a DPF is not properly regenerating, the reason might be DOC aging, pollution or poisoning

How to detect malfunction of the DOC during maintenance ?

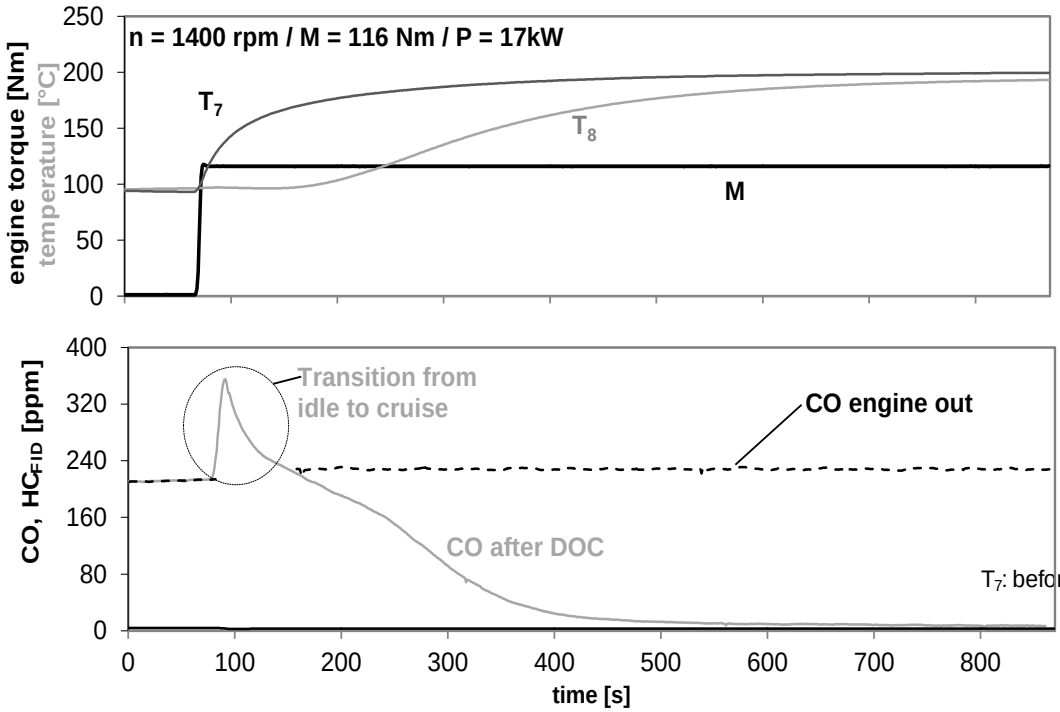
→ Check catalytic conversion efficiency
→ use CO-conversion
→ during engine temperature ramp

DOC Light Off test set-up



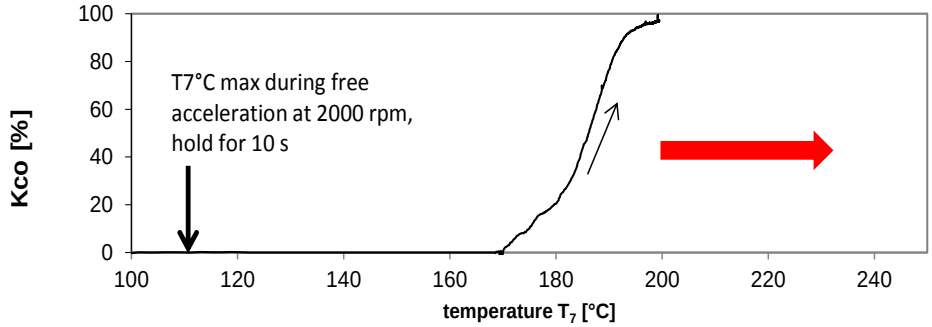
DOC Pt/Pd 18/1 g/ft^3

DOC Light Off test set-up

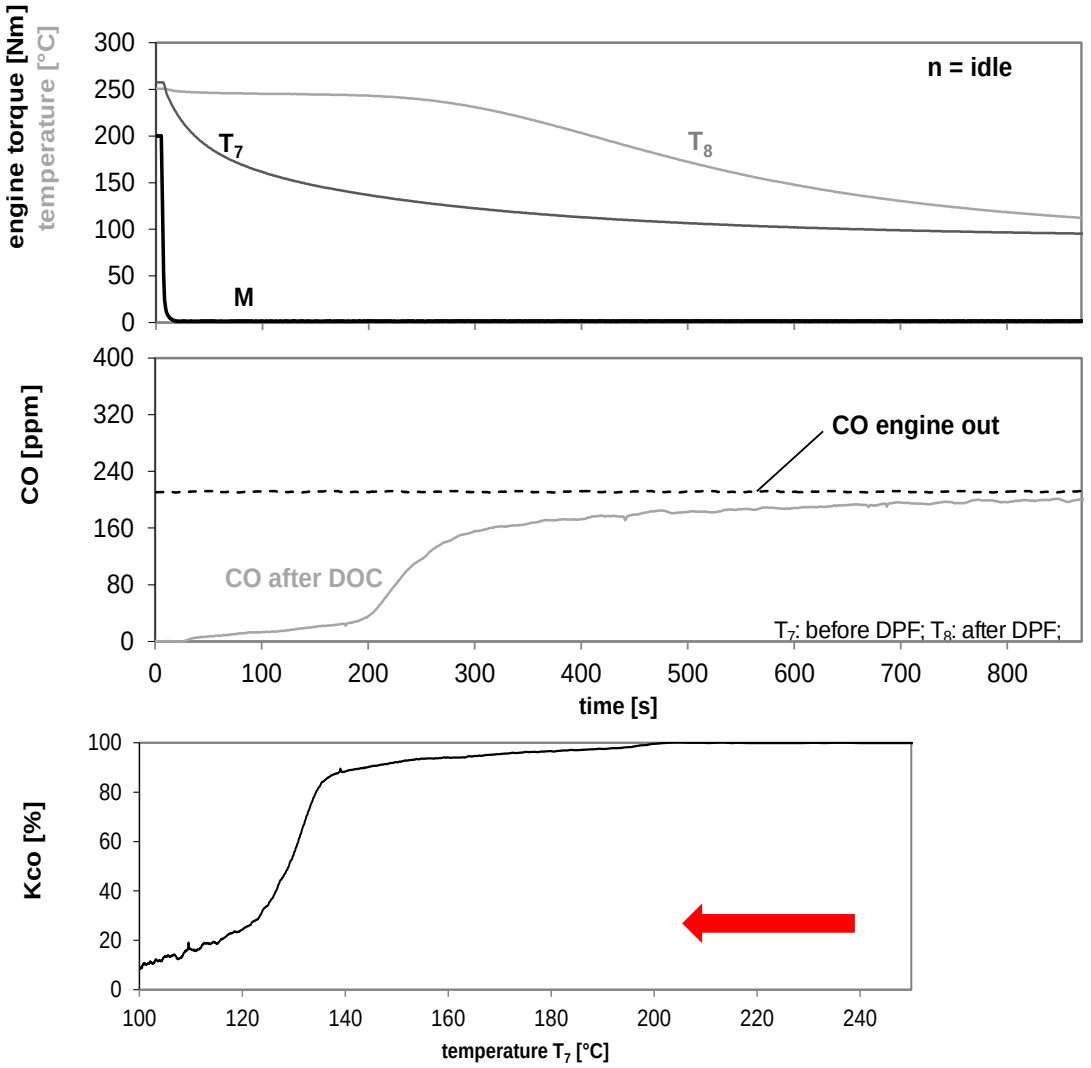


T_7: before DPF; T_8: after DPF;

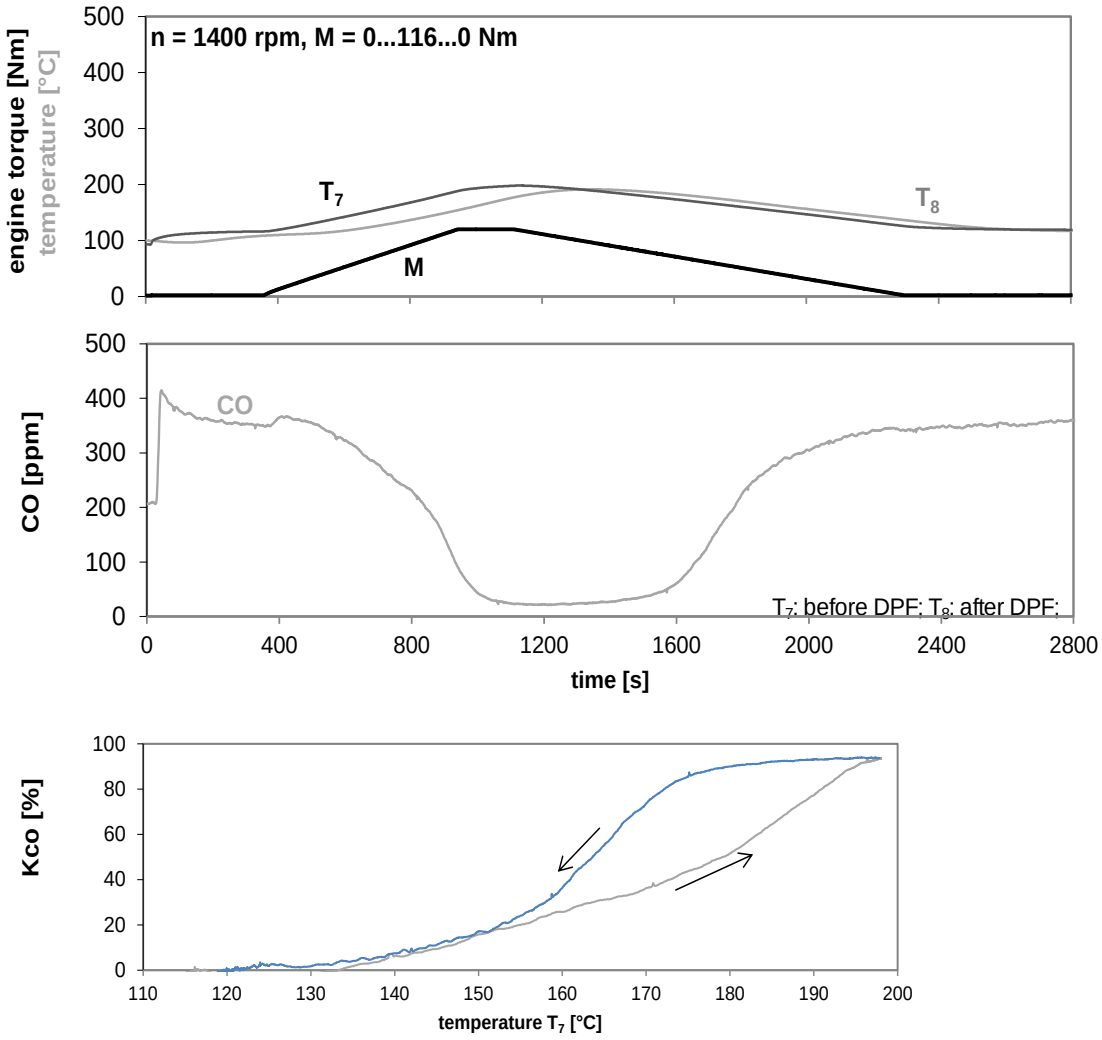
needs chassis dynamometer



DOC Light off test during cooling at idle



Ramp Test shows hysteresis due to thermal inertia



Conclusion

CO-conversion test during engine cooling at idle after road operation

→ is easy to perform and fast

→ confirms proper function of DOC

→ detects malfunctions

→ Supplies quantitative data to either clean or replace the CRT-DOC

→ if there is a coated DPF it needs measuring access after DOC

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SCR

SAE 2014-01-1569

VERTdePN
2007-2011

TeVeNO$_x$
2012-2013

BAFU, ASTRA, SUVA
AFHB, EMPA, UMTEC
TTM, DINEX, HUG,
HJS

ASTRA, BAFU,
AFHB, EMPA,
MAE, TTM

3 Types of Vehicle Tests

Test Type 1

- **HD Chassis Dynamometer**

Test Type 2

- **Parcours on the Road**
  (real world operation)

Test Type 3

- **Simple Function Test**
  (short operation on the road)

Investigated vehicles

Investigated vehicles

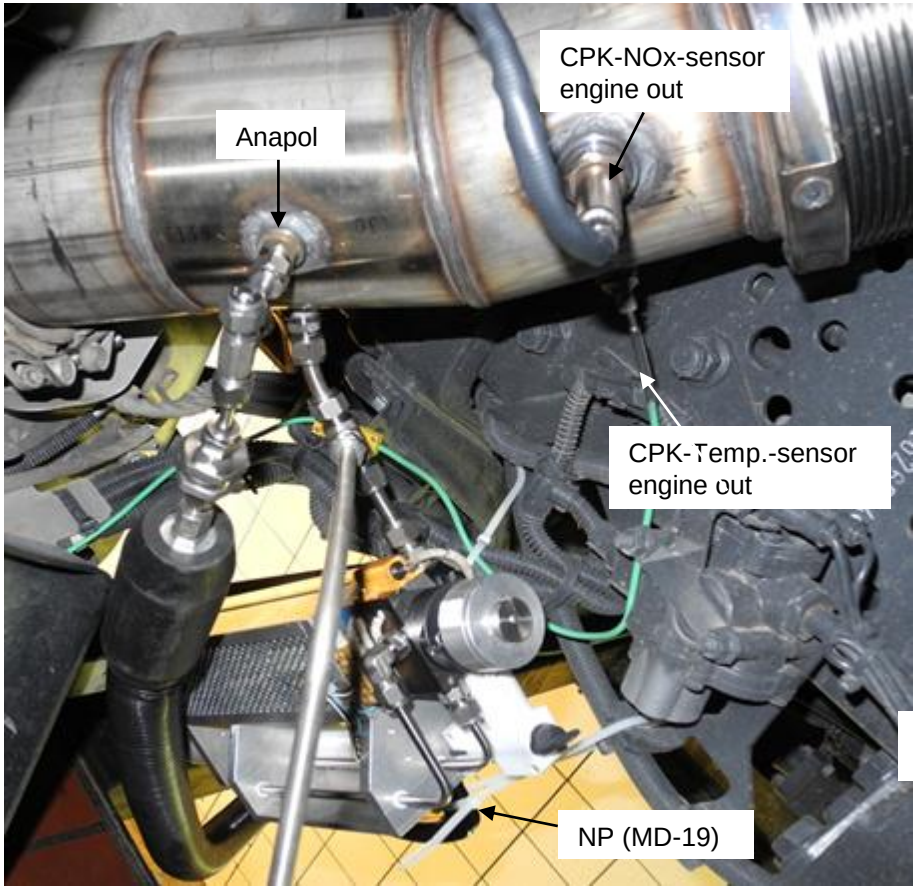
Vehicles		Exhaust system
A	Bus Volvo 180 kW	DINEX DPF+SCR retrofit
B	Bus volvo Hybrid 158 kW	OEM DPF+SCR
C	Mercedes Actros 300 kW 570 km	OEM SCR
D	Mercedes Actros 300 kW 500520 km	OEM SCR
E	MAN TGS 397 kW 220 km	OEM SCR + DPF retrofit

Vehicles		Exhaust system
F	Mercedes Actros Blutec 6 330 kW 12000km	OEM CRT+SCR
G	DAF Truck 340 kW	OEM SCR
H	MAN TGS 400 kW	OEM SCR 00KM
I		OEM SCR 84.9 T km
J	Mercedes Actros 260 kW	NOxOFF DPF+SCR retrofit

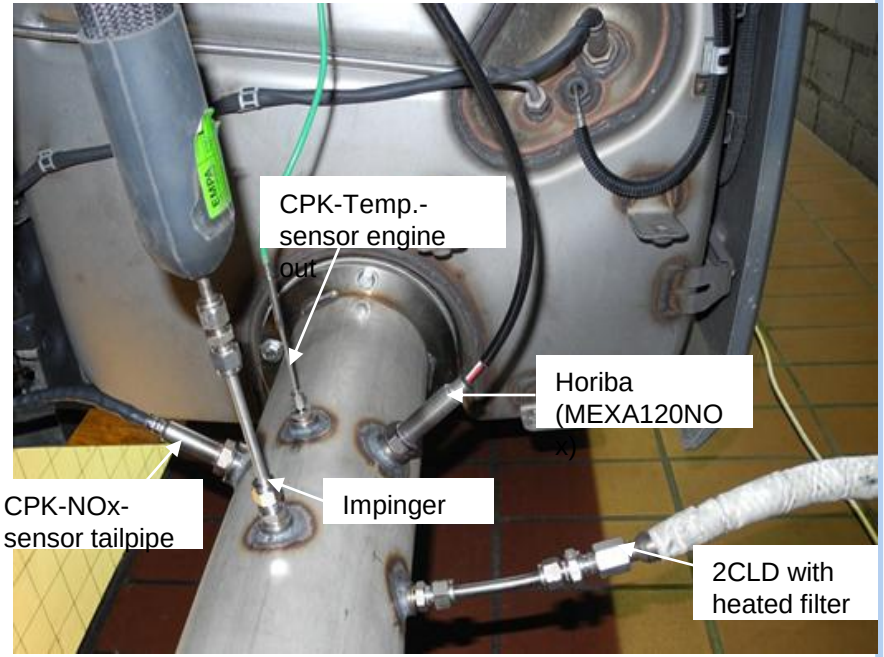
Vehicle E on the MAN HD chassis dynamometer with OEM SCR & retrofitted DPF

SAMPLING POSITIONS ON VEHICLE F

engine-out



tailpipe



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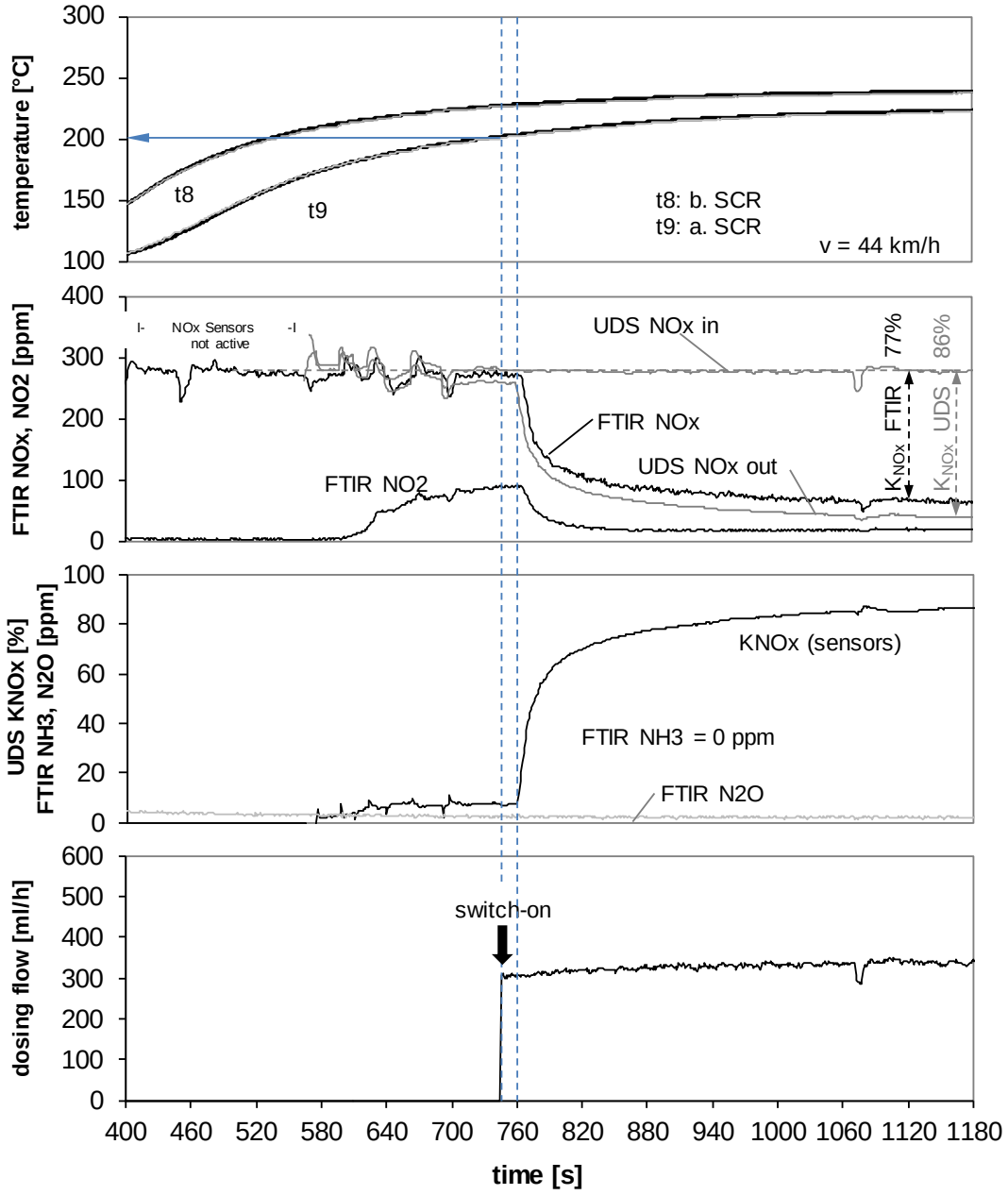
Steptest

Chassis dyno



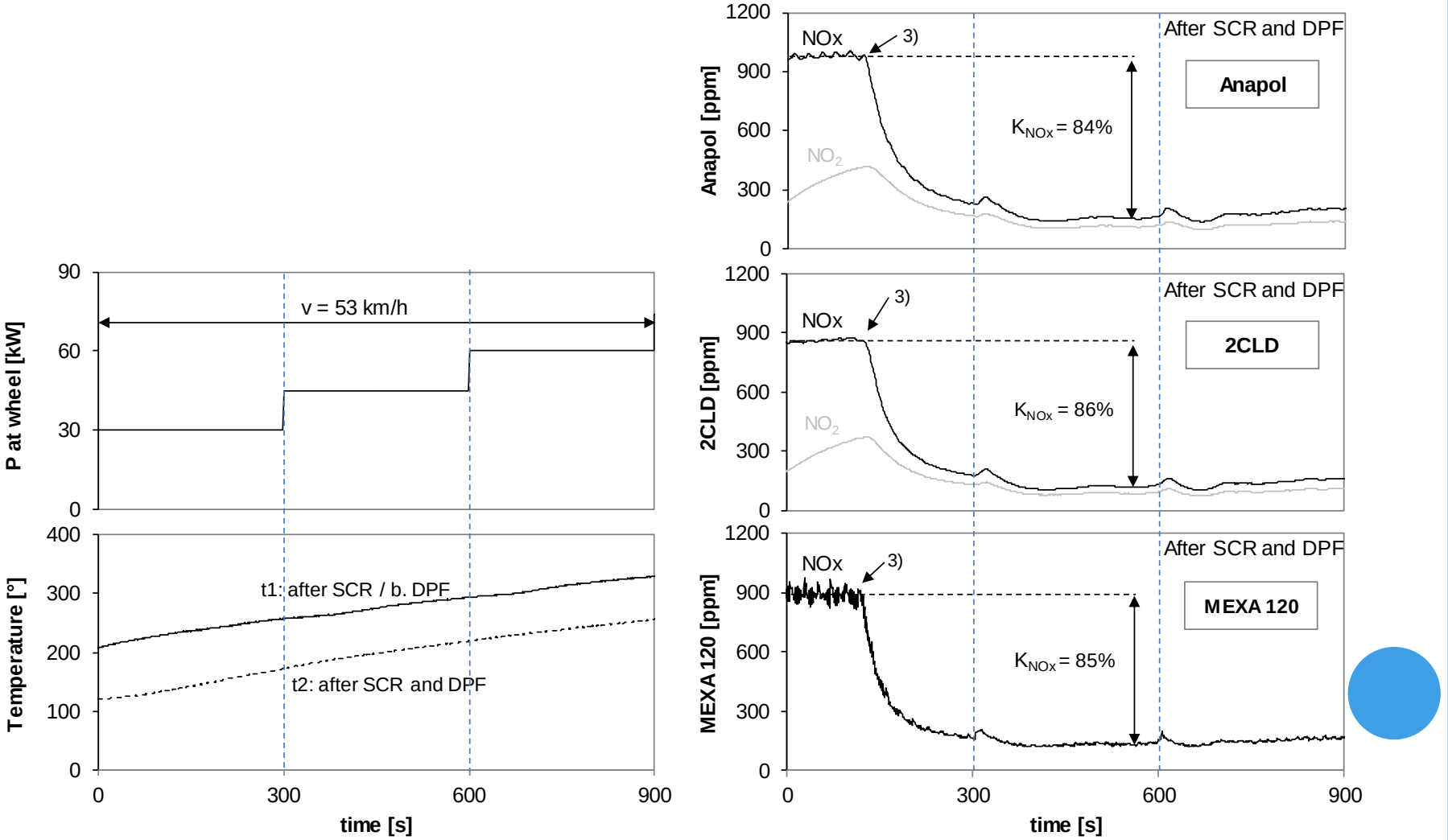
Switch-on Dosing

retrofit system cDPF & SCR; α = 0.75
vehicle A; ULSD; Chassis Dyno

K_{NOx} at SWON in steptest with different analyzers

OEM SCR; dosing activated

Vehicle E; ULSD; Chassis Dyno MAN



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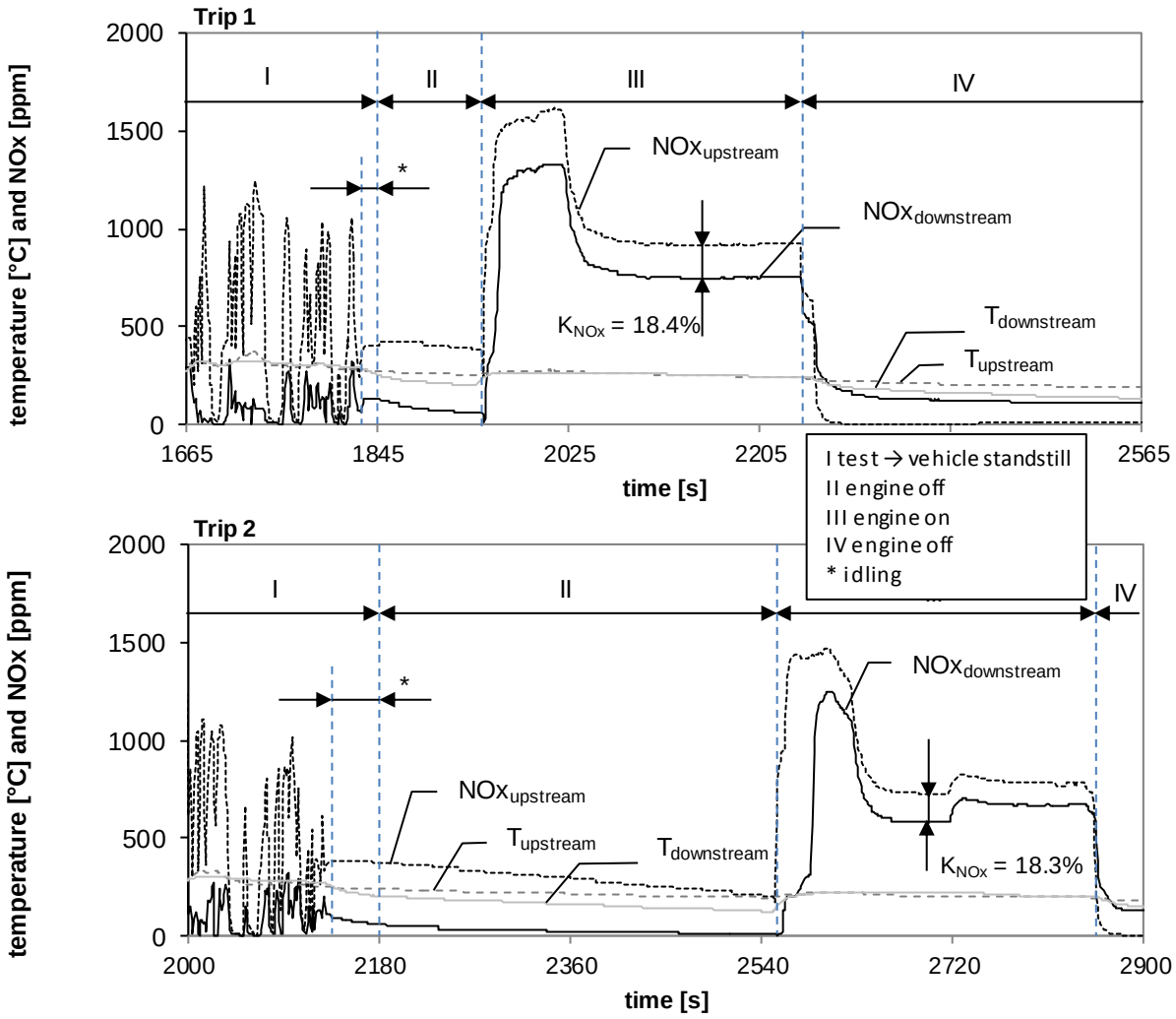
Simple function test

SWOFF on-road

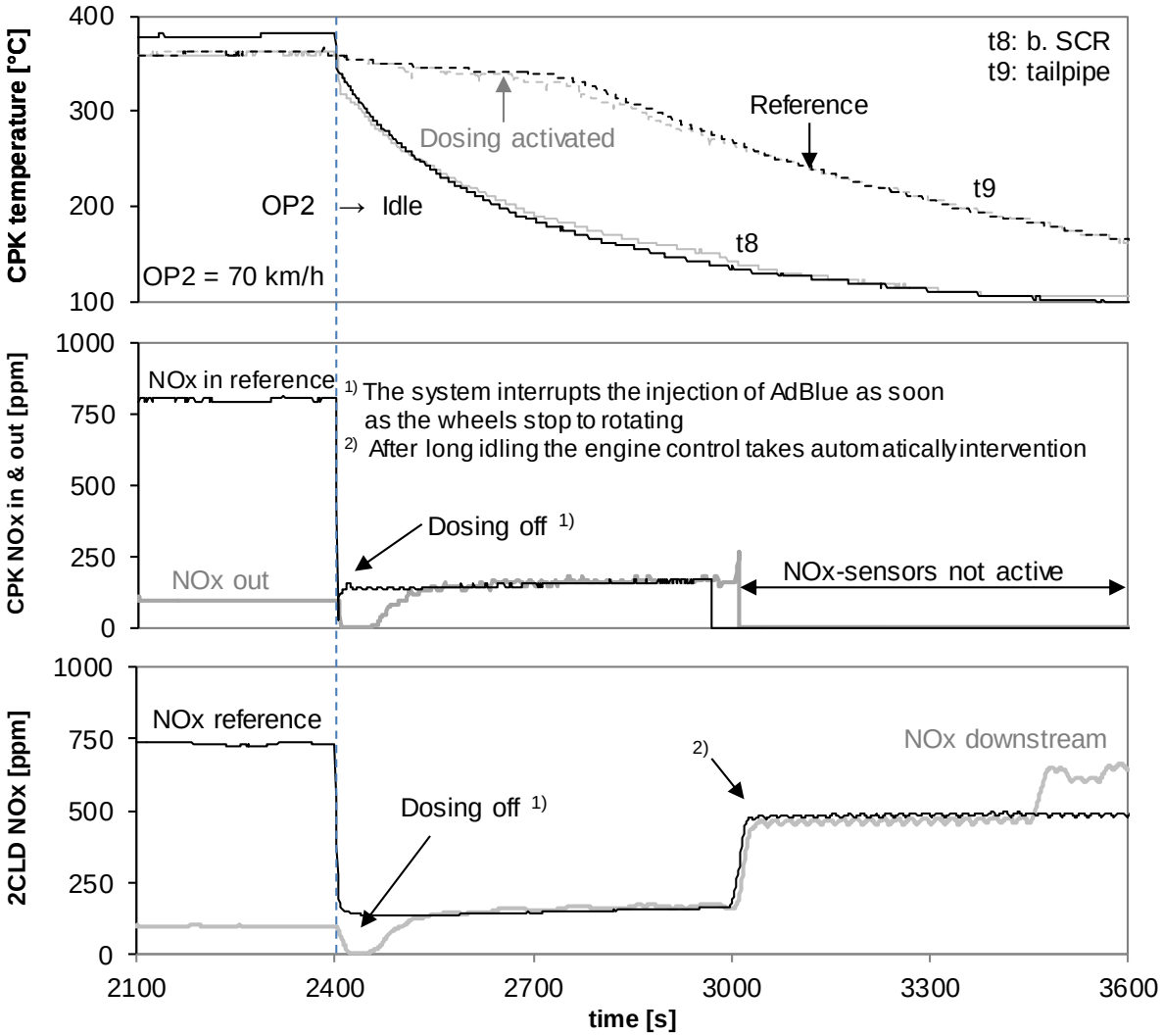
HEV: Engine switch off & on after vehicle stop, dependent on battery SOC

vehicle B, CRT & SCR; ULSD; AdBlue



SWOFF - intervention of ECU after long idling

OEM SCR; dosing activated
Vehicle D; ULSD; Chassis Dyno LARAG



Conclusions

- **The switch-on test & the OEM NO_x-sensors are appropriated tools for the in-use control**
- **For OEM: SWOFF at idling not possible but special test procedures possible**
- **The SCR-systems are not active at lower temperatures < 200°C**

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Support of BAFU, VERT and AFHB for DPF Retrofit Projects on the research level

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Nanoparticle Conference
TECHNION Haifa
June 21st, 2016


Thank you
for your
attention !