APBF-DEC Light-Duty NOx Adsorber/DPF Project

Dean Tomazic
Marek Tatur
FEV Technology, Inc.

Overview:

1. Program Objective
2. Engine
3. Vehicle
4. Emission Control System
5. Test Results
6. Future Outlook

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Program Objective

Light-Duty Program Objective:

This project aims to determine the influence of diesel fuel composition on the ability of *NOx adsorber technology in combination with diesel particulate filters* and advanced engine controls to achieve stringent emission levels while maintaining high fuel economy.

To meet Tier 2 light-duty emission standards, the goal of this project is Tier 2 – BIN 5 limits of 0.07 g/mi NOx and 0.01 g/mi PM.

Additionally, HC and CO emissions standards must be met. Minimizing fuel economy impacts while meeting emissions requirements is also an important aspect of the project.

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Engine

APBF-DEC Engine Specification:

Arrangement:	In-Line 4-Cylinder
Displacement:	1.9 L
Rated Power:	100 kW @ 4000 rpm
Max. Torque:	330 Nm @ 2000 rpm
Bore/Stroke:	79.5/95.5 mm
Turbocharger:	Garrett GT 17 V
Injection System:	Bosch Common Rail, 2nd Generation
Valves:	2 x Intake / 2 x Exhaust
Compression Ratio:	18.2 : 1

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Vehicle

Vehicle Specifications

Vehicle Mass:	1590 kg
Transmission:	5-Speed Manual
Total Length:	4544 mm
Total Height:	1429 mm
Total Width:	1766 mm
Air Drag Coefficient:	$c_w = 0.3$
Gear-Ratios:	1: 3.50
	2: 1.84
	3: 1.16
	4: 0.84
	5: 0.68
	Axle: 3.89

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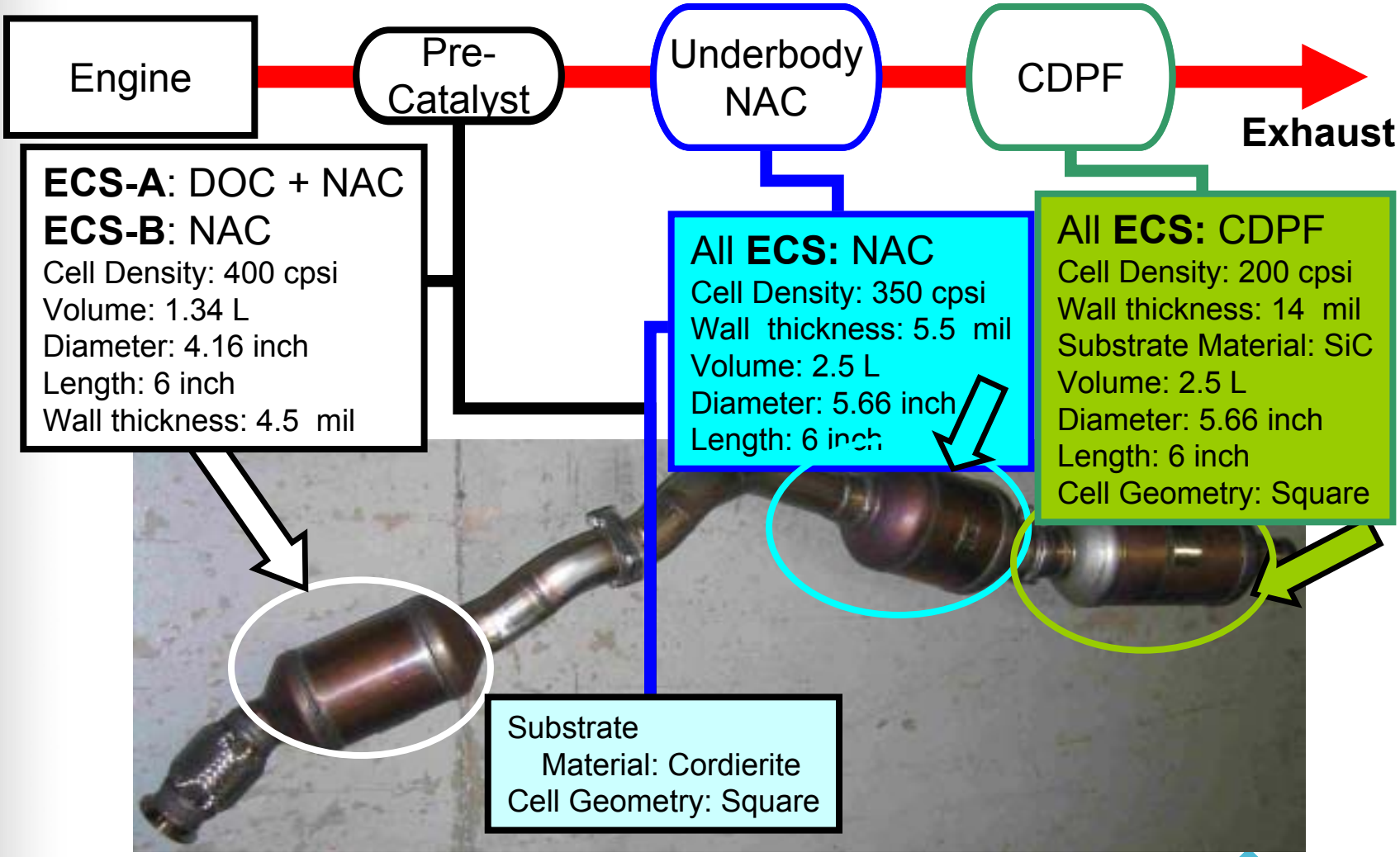
Emission Control System

Development Catalyst Configuration and Specifications



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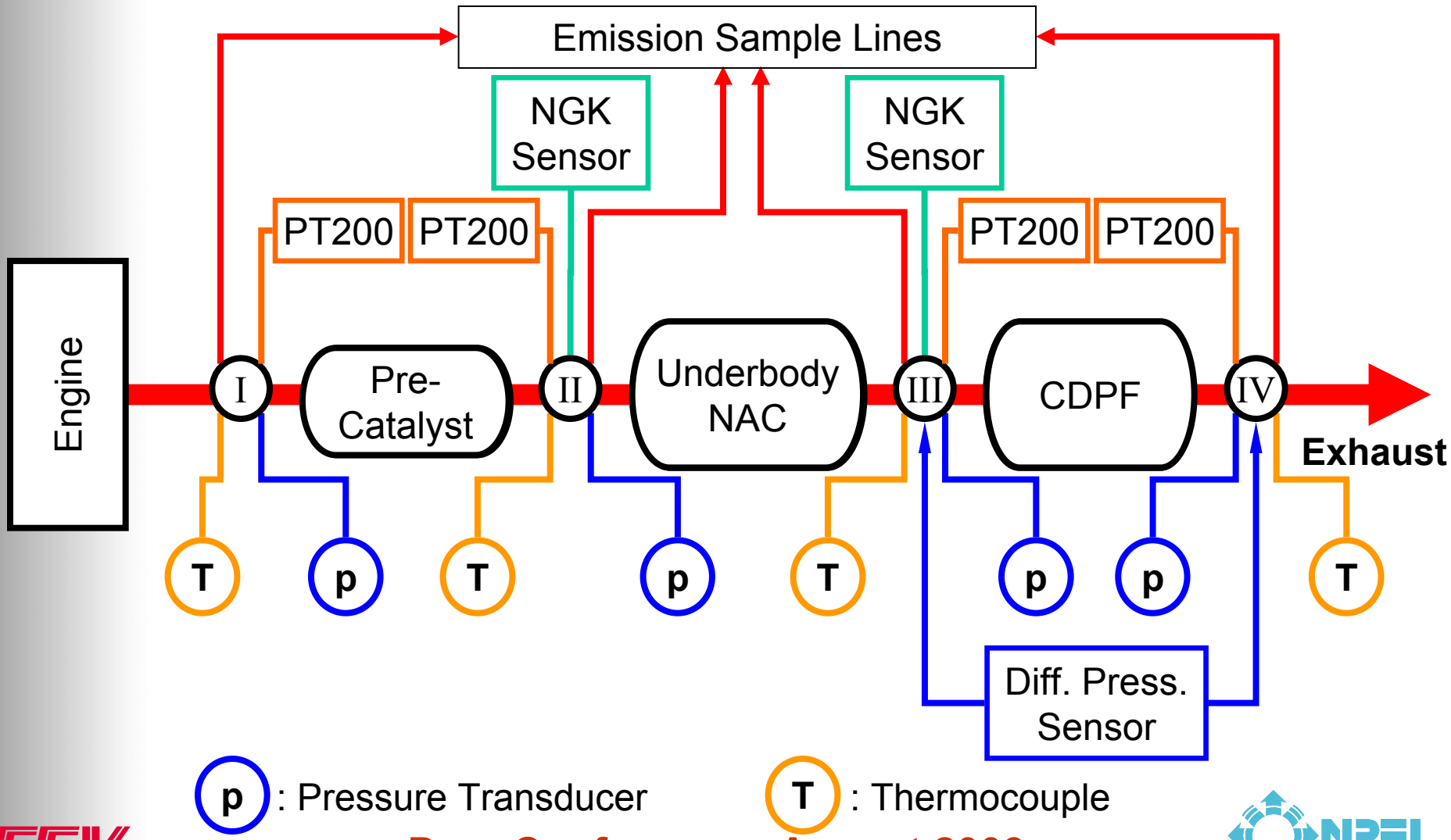
Emission Control System

Development Catalyst Configuration within Test Cells



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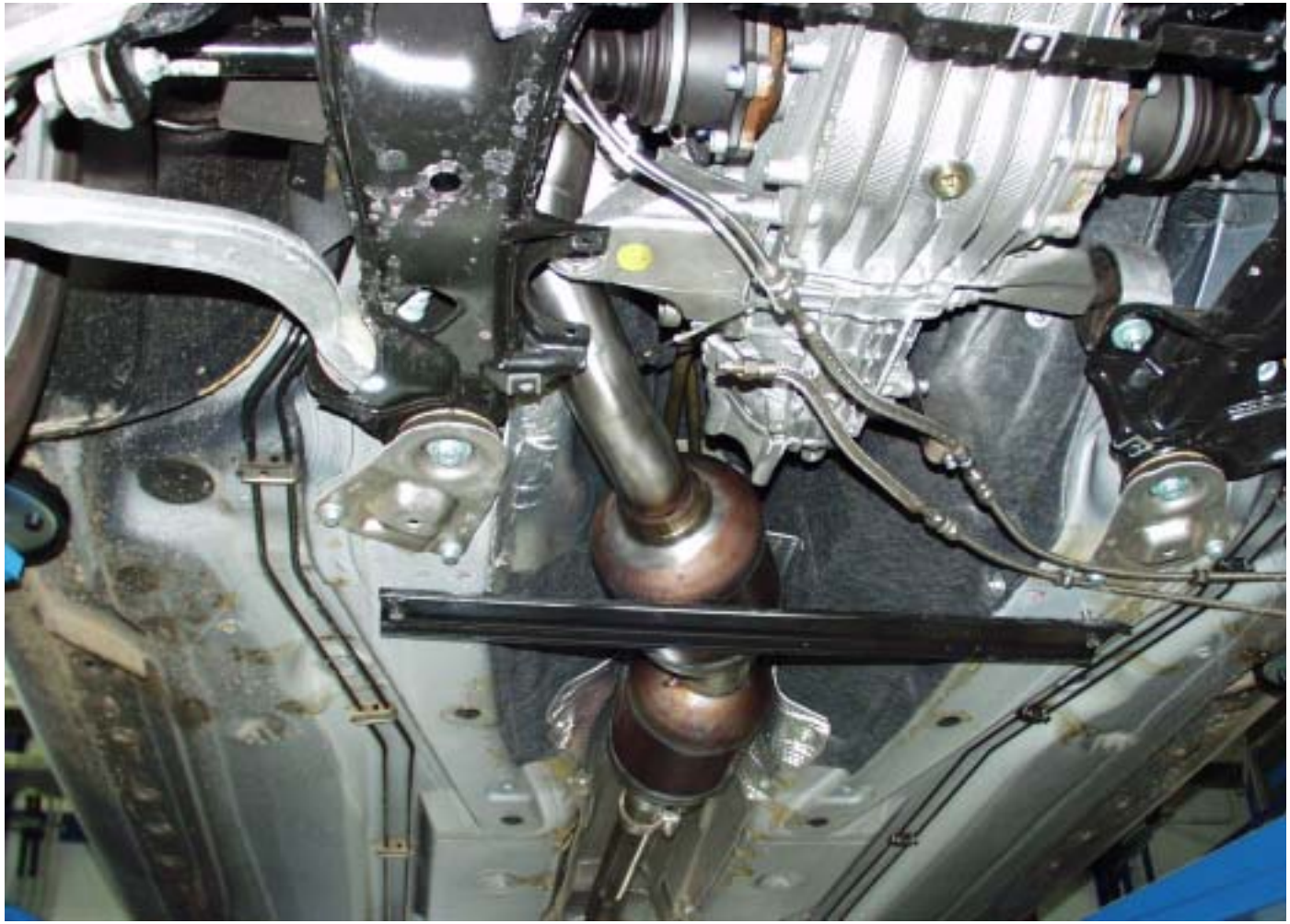
Emission Control System

Development Emission Control System Vehicle Installation



Test Results

1. Rapid Warm-Up
2. Lean/Rich Modulation (NAC)
3. Catalyst Mapping (NAC)
4. Desulfurization (NAC)
5. DPF Regeneration
6. Vehicle Tests

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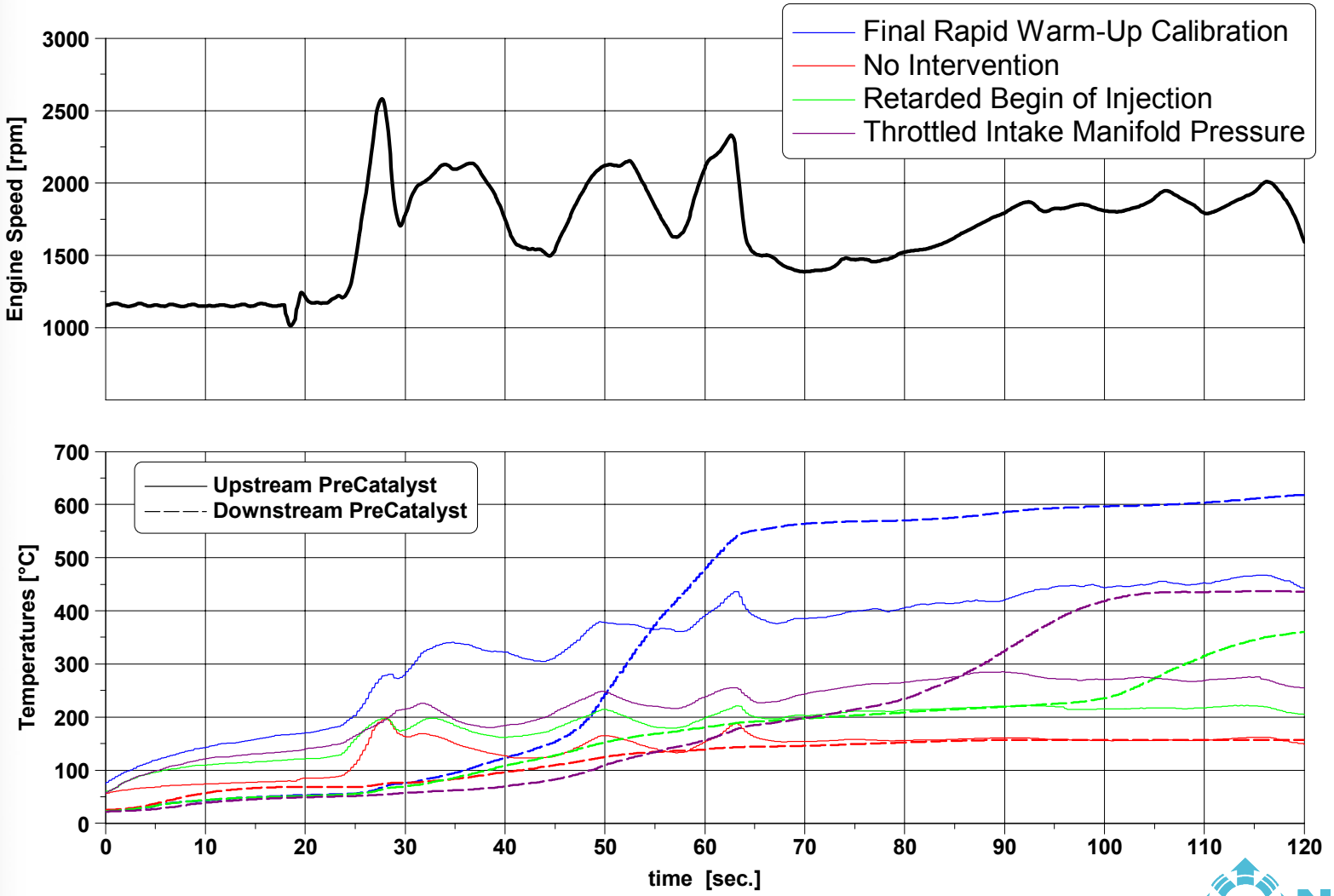
Rapid Warm-Up

Exhaust Gas Temperature Increase



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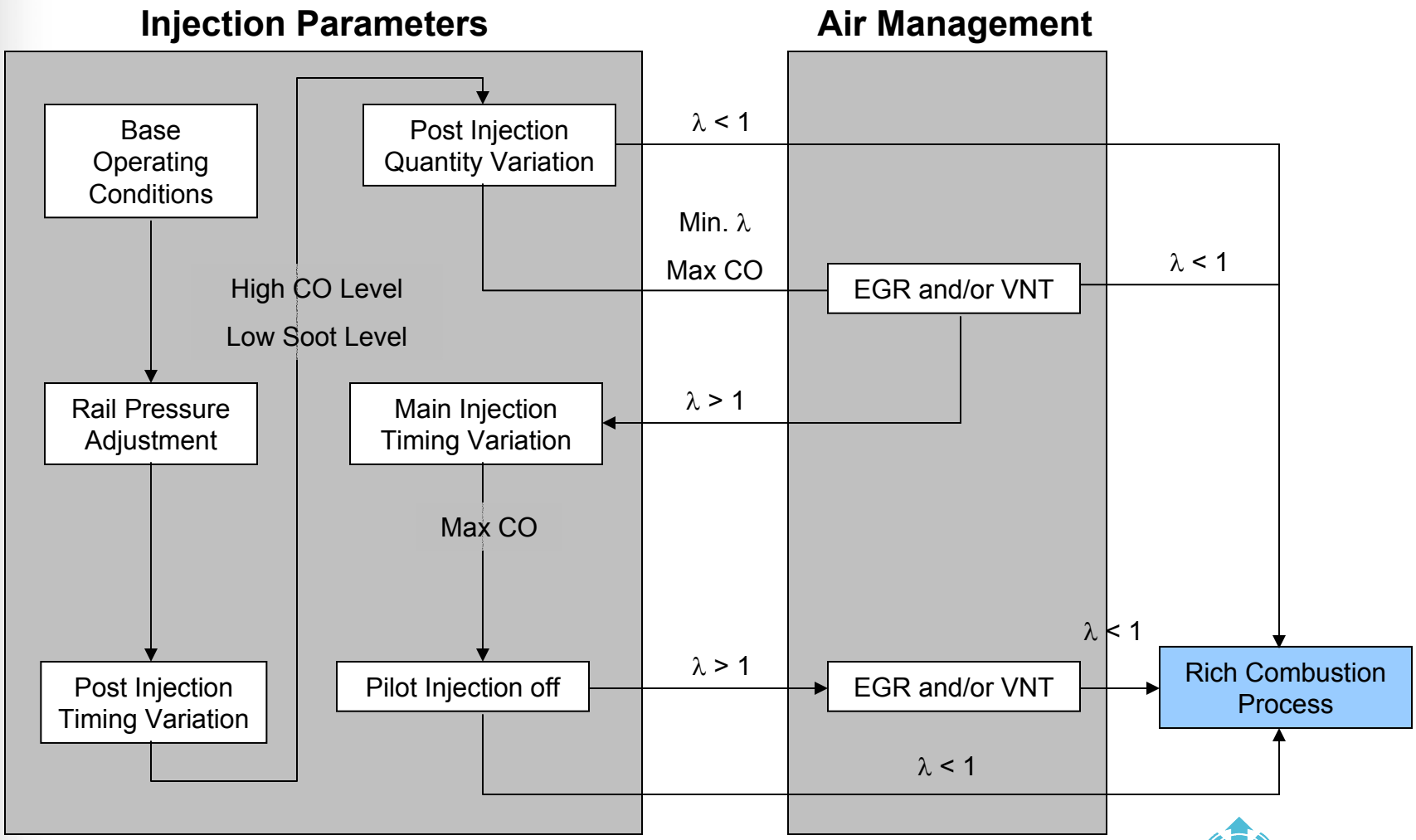
Lean/Rich Modulation

Strategy Approach



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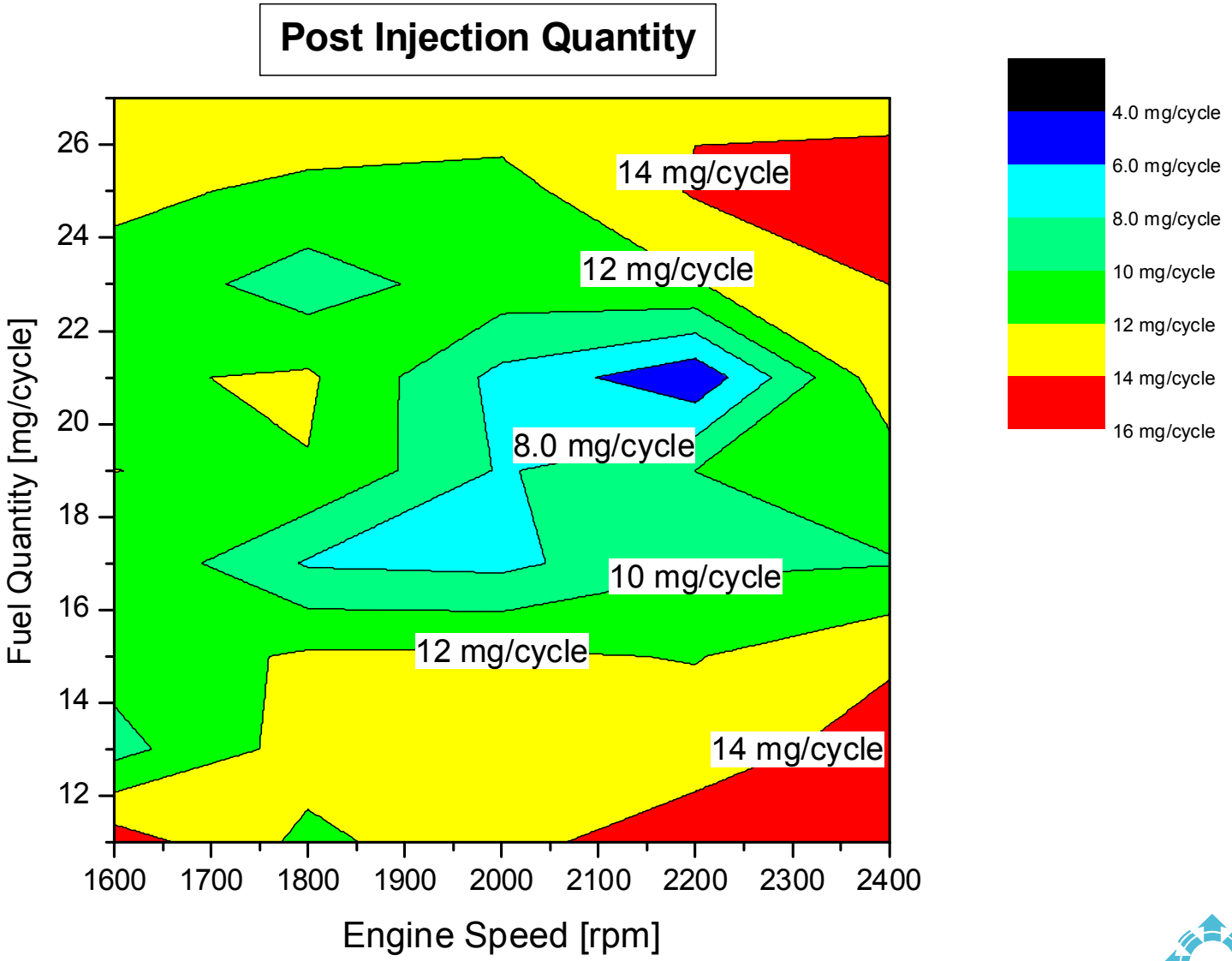
Lean/Rich Modulation



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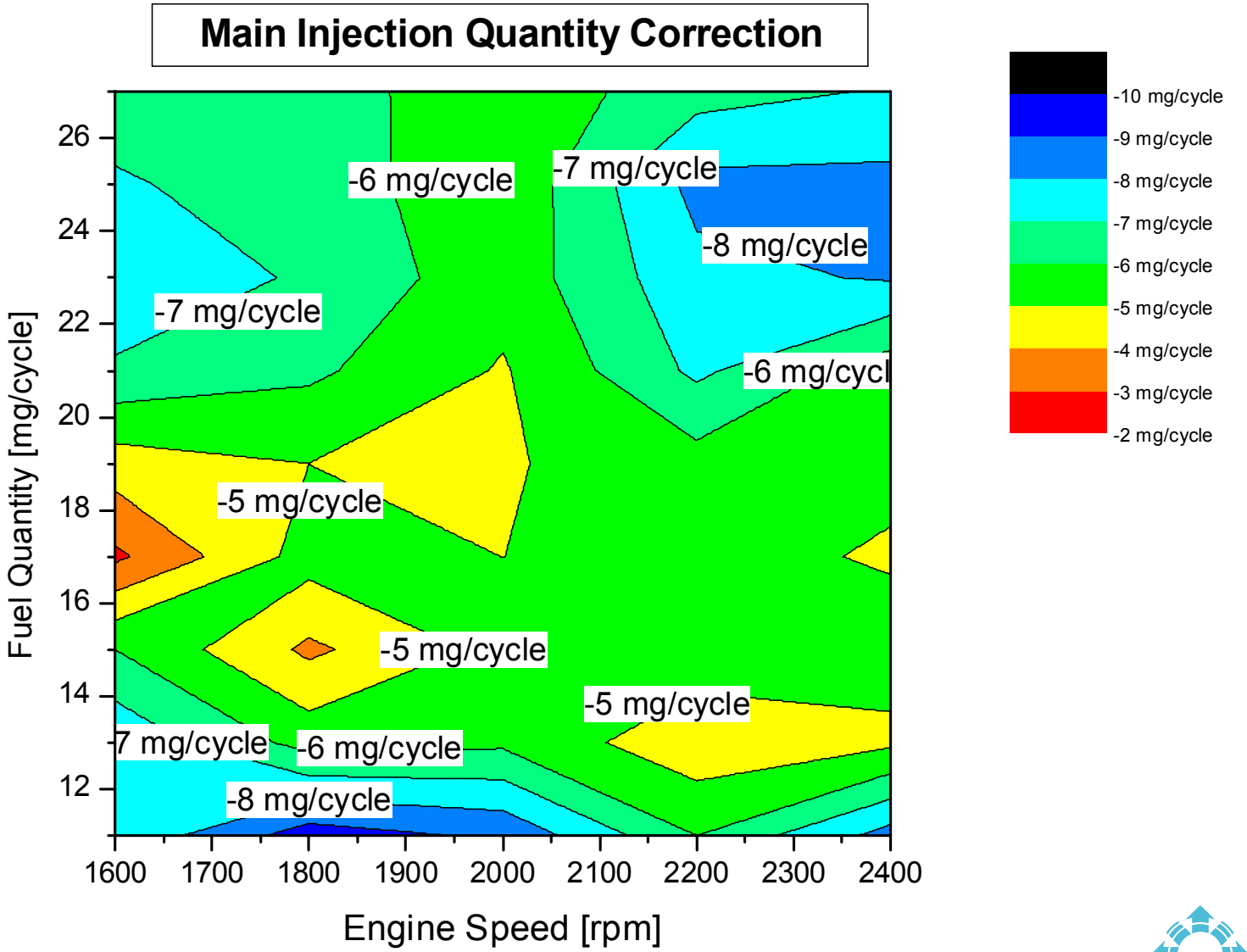
Lean/Rich Modulation



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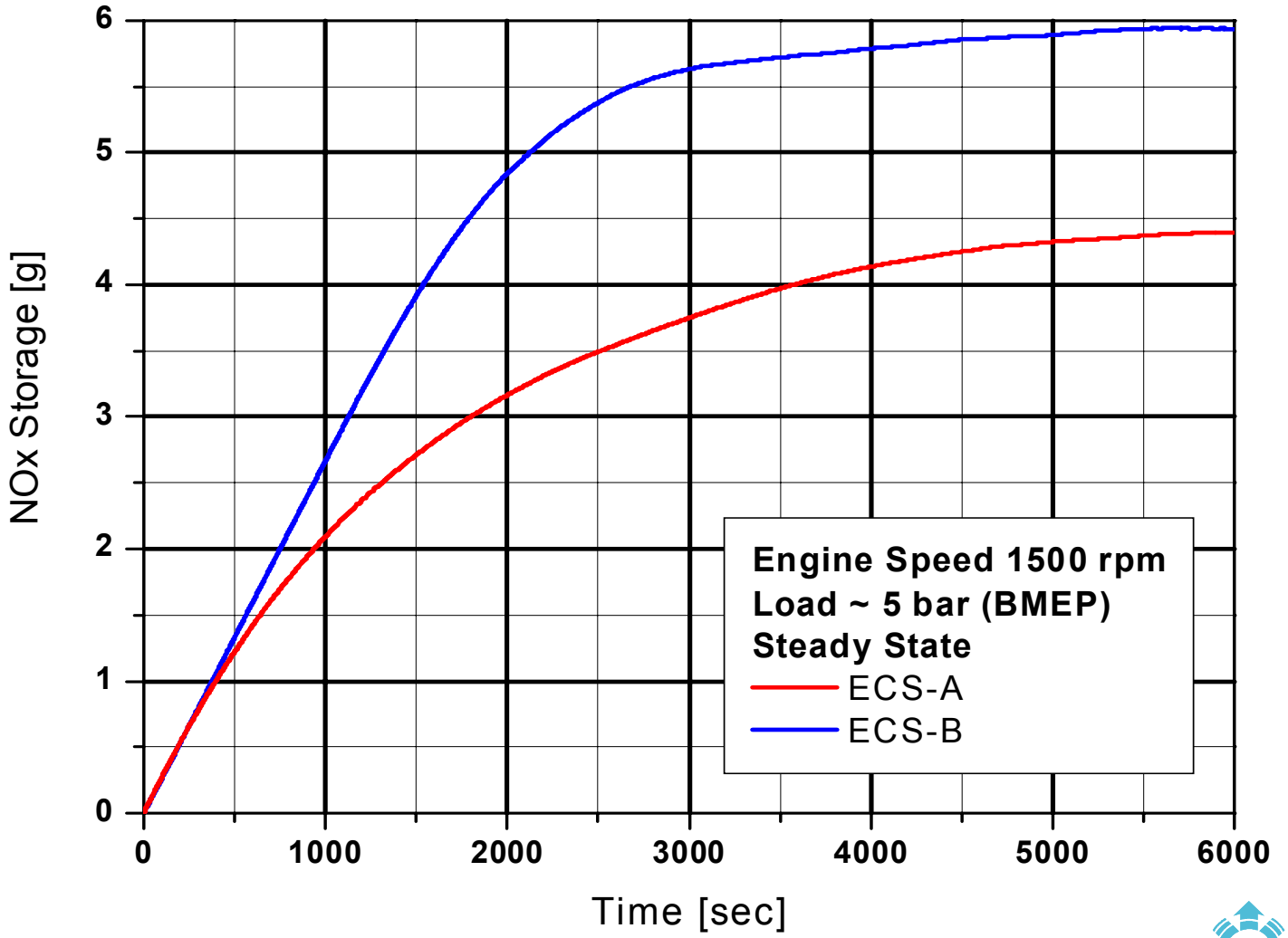
Catalyst Mapping

Catalyst Storage Capacity for NOx



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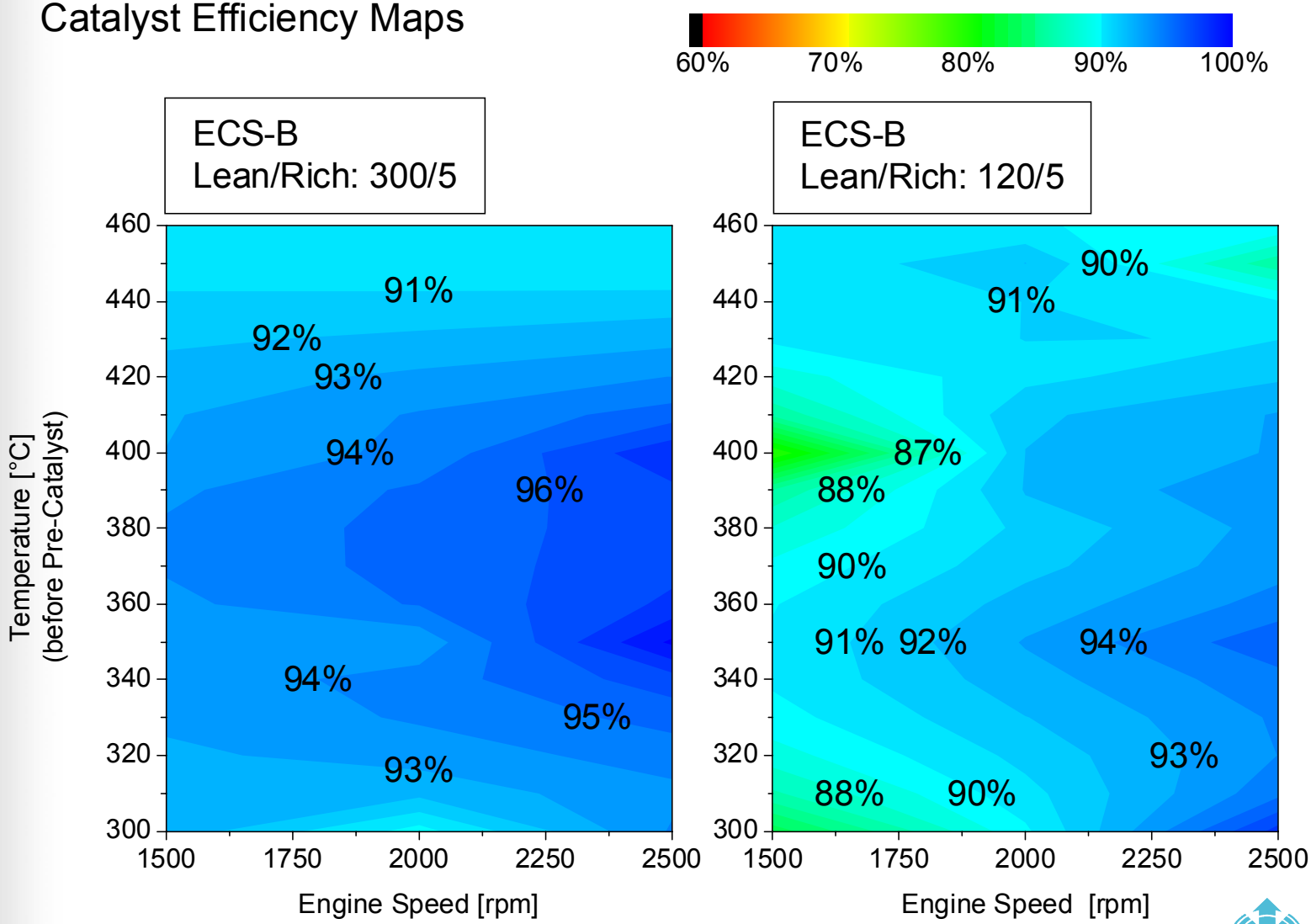
Catalyst Mapping

Catalyst Efficiency Maps



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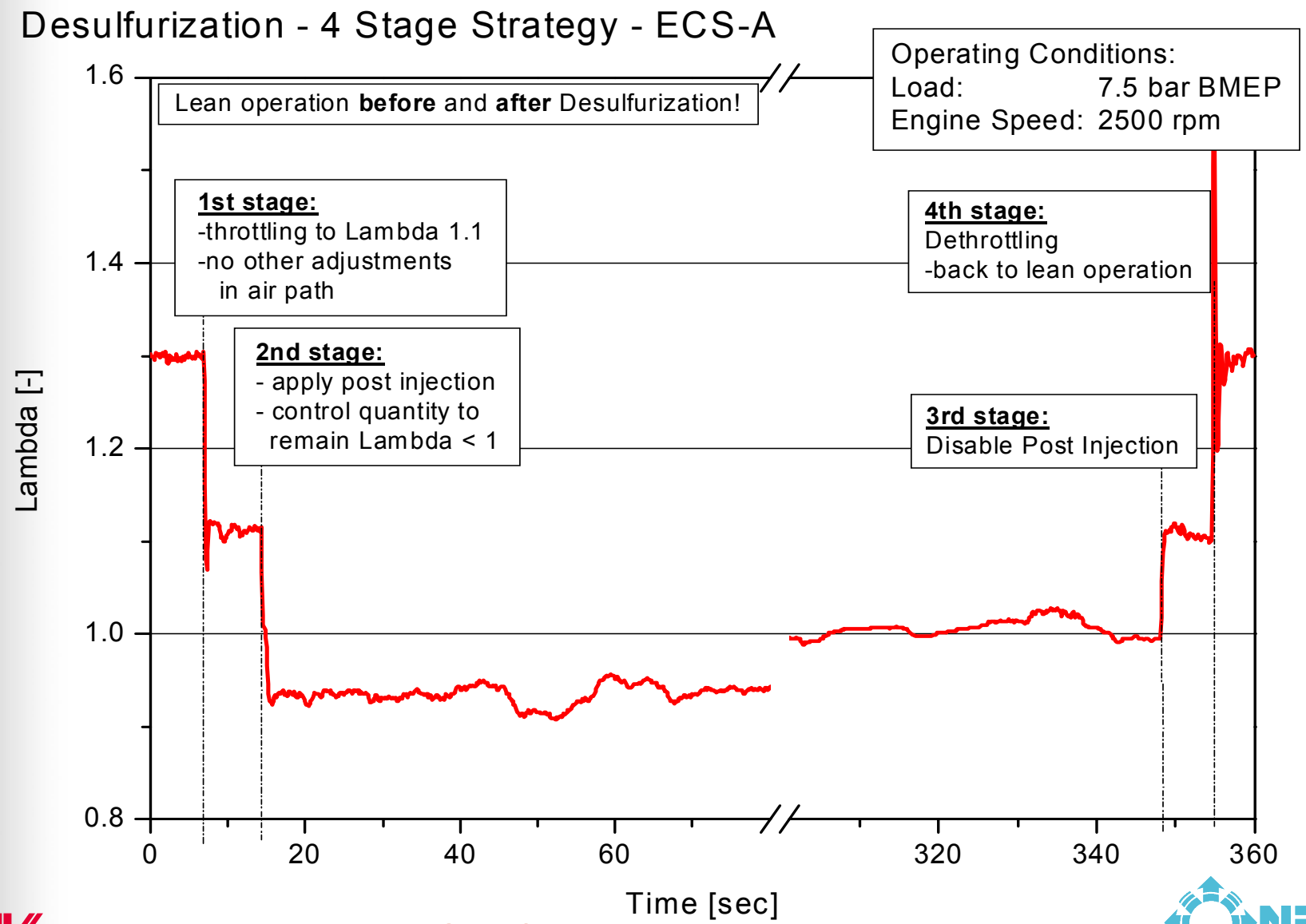
Desulfurization



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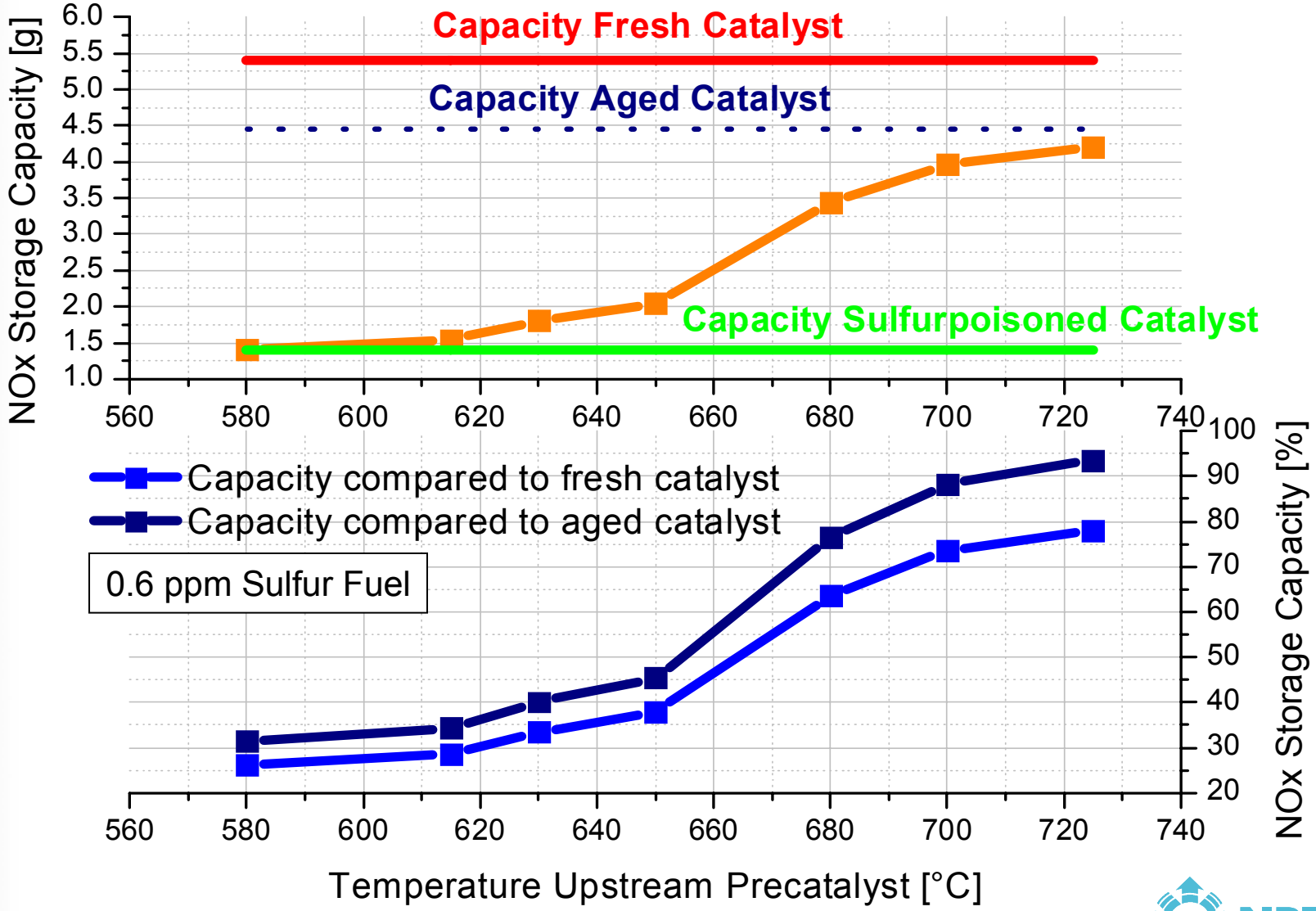

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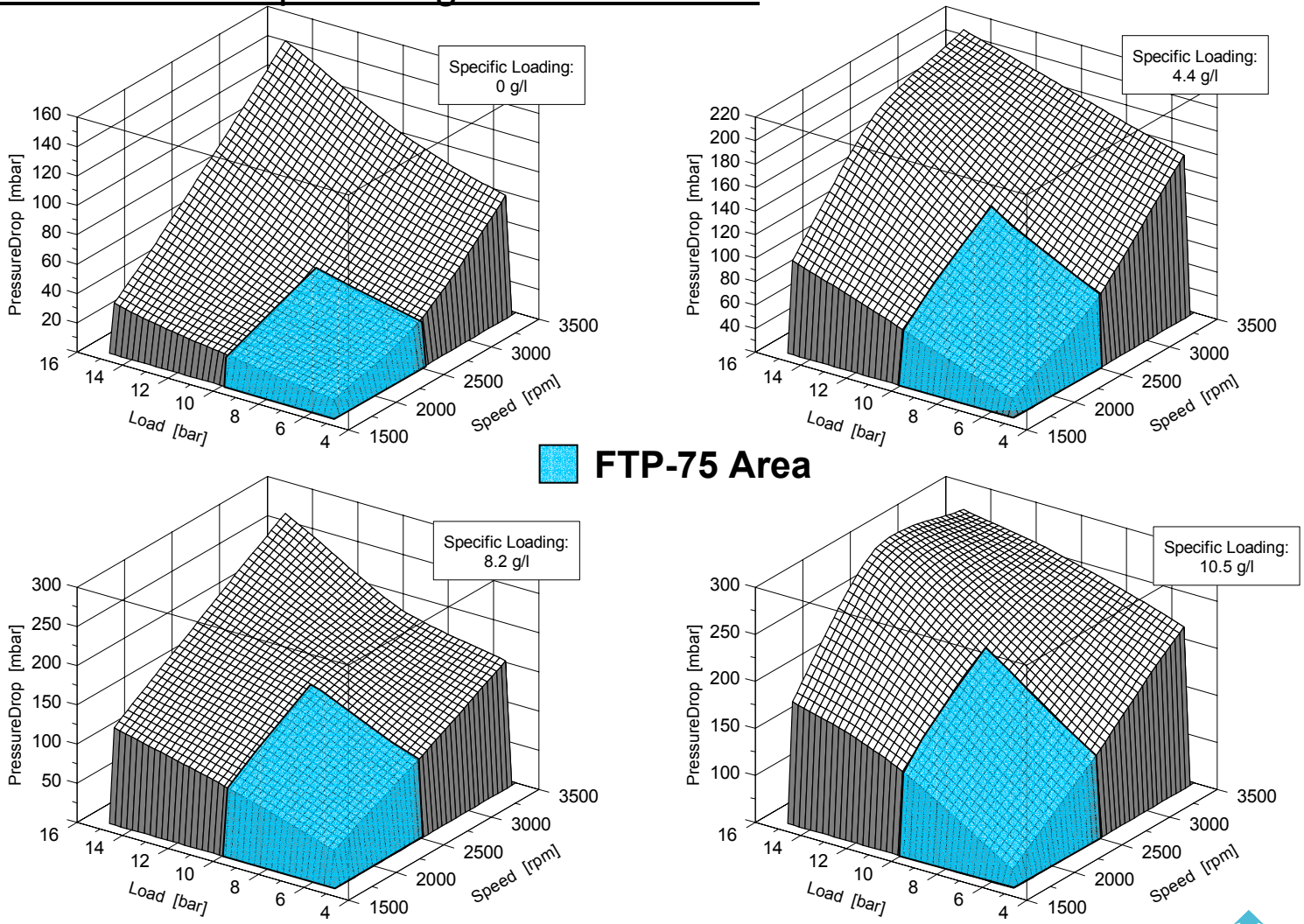
DPF Regeneration

DPF Pressure Drop Investigation – SiC DPF



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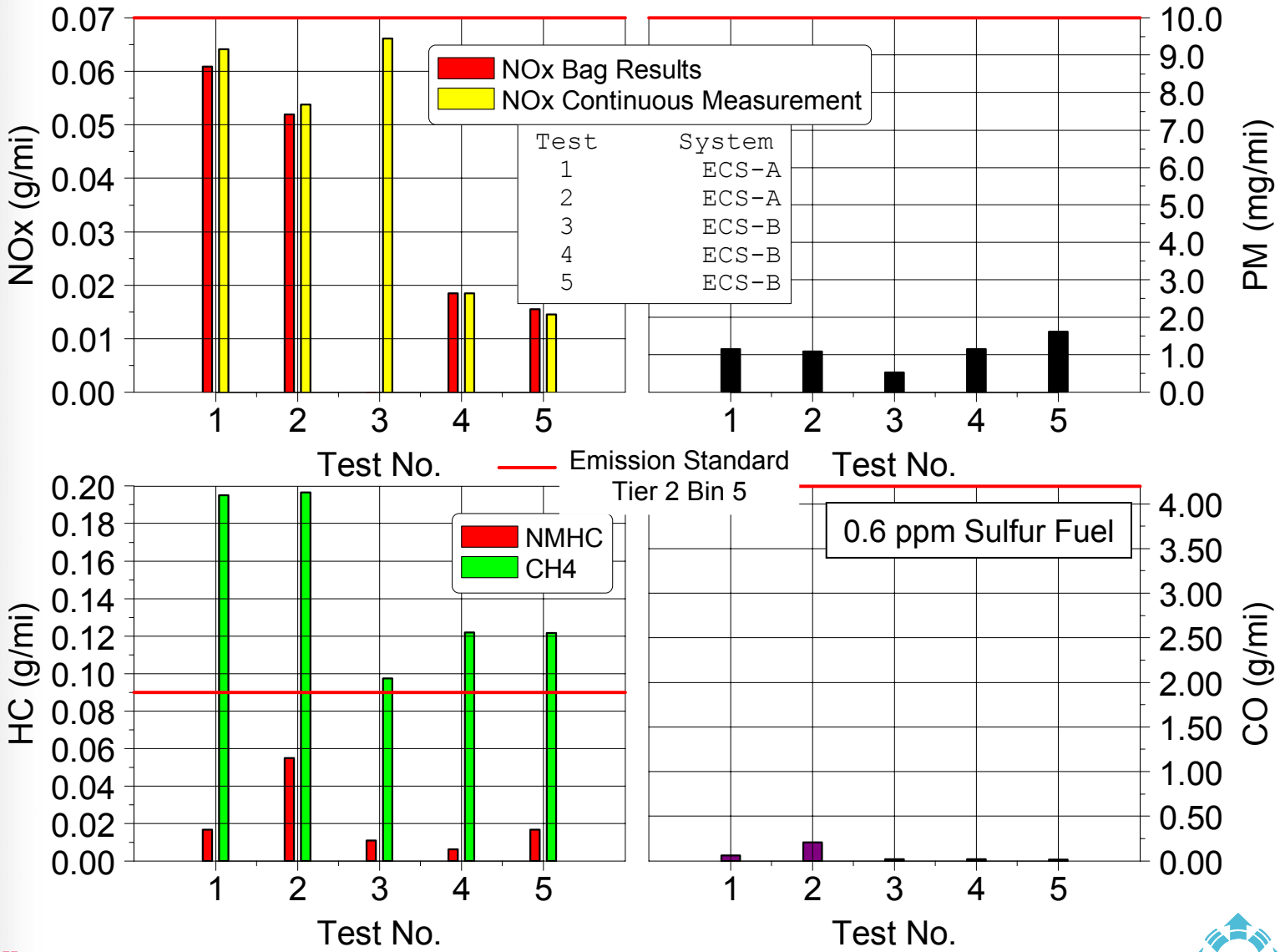
Vehicle Tests – FTP 75 (Conducted at EPA NVFEL in Ann Arbor)



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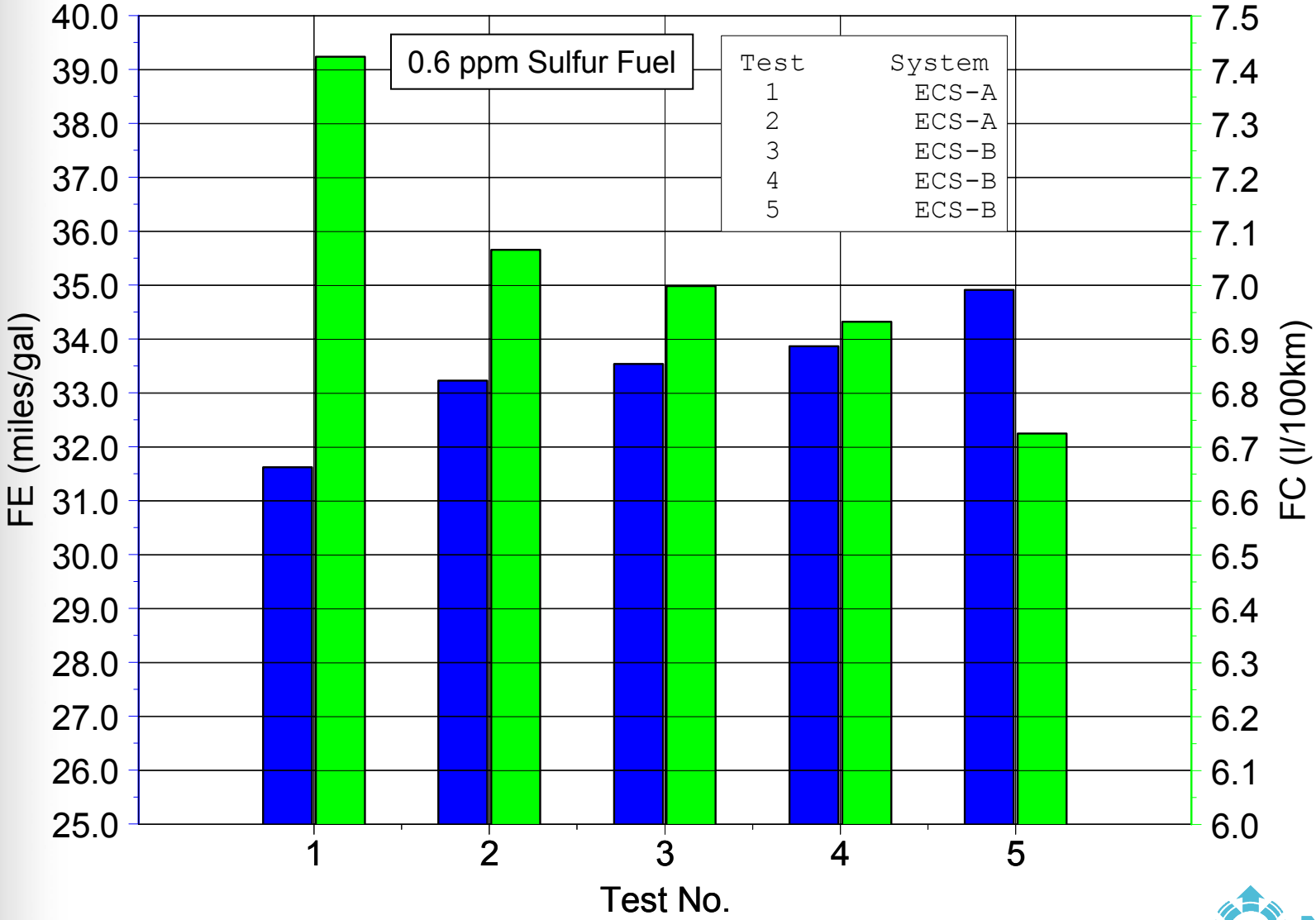

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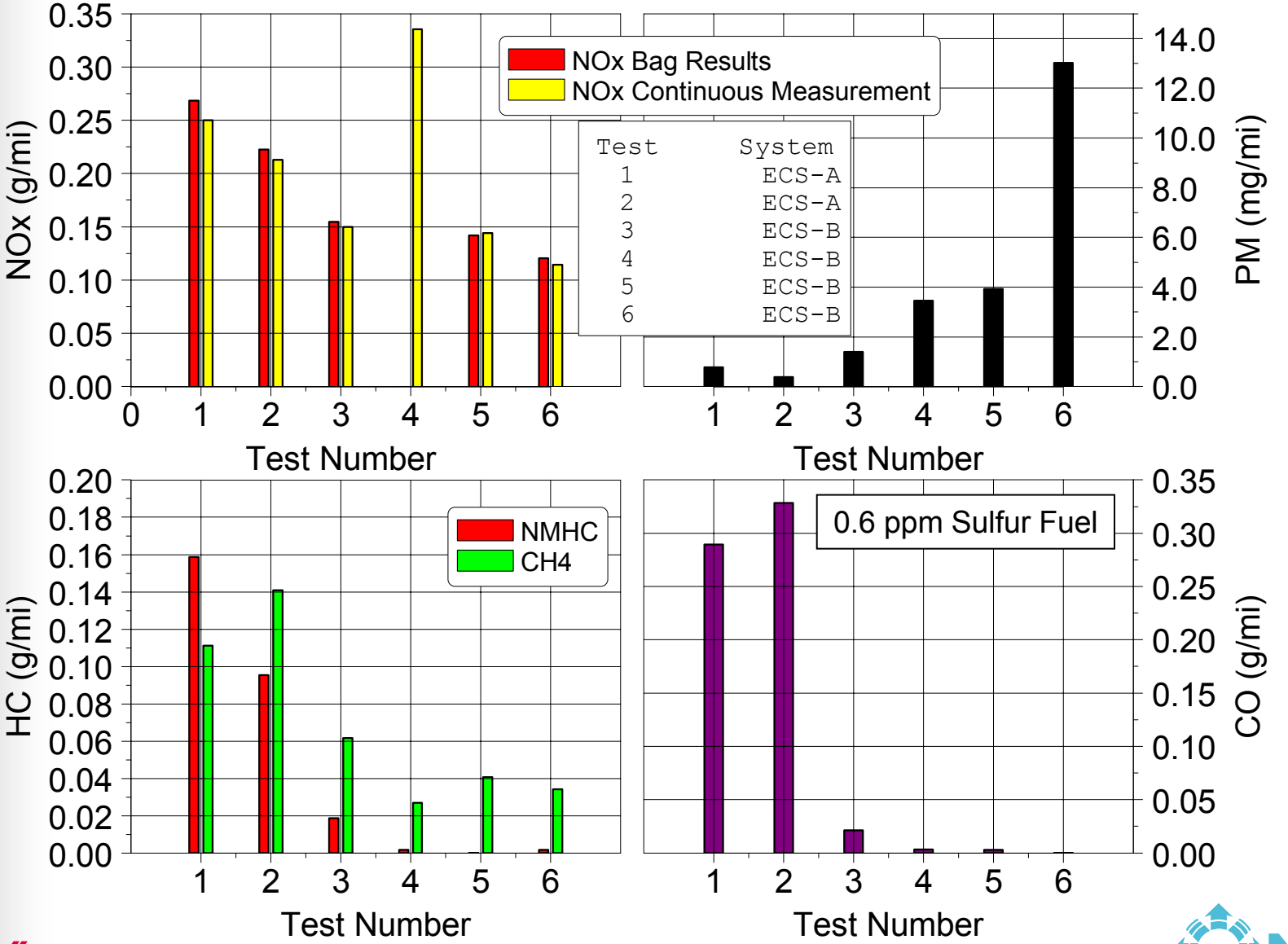
Vehicle Tests – US06 (Conducted at EPA NVFEL in Ann Arbor)



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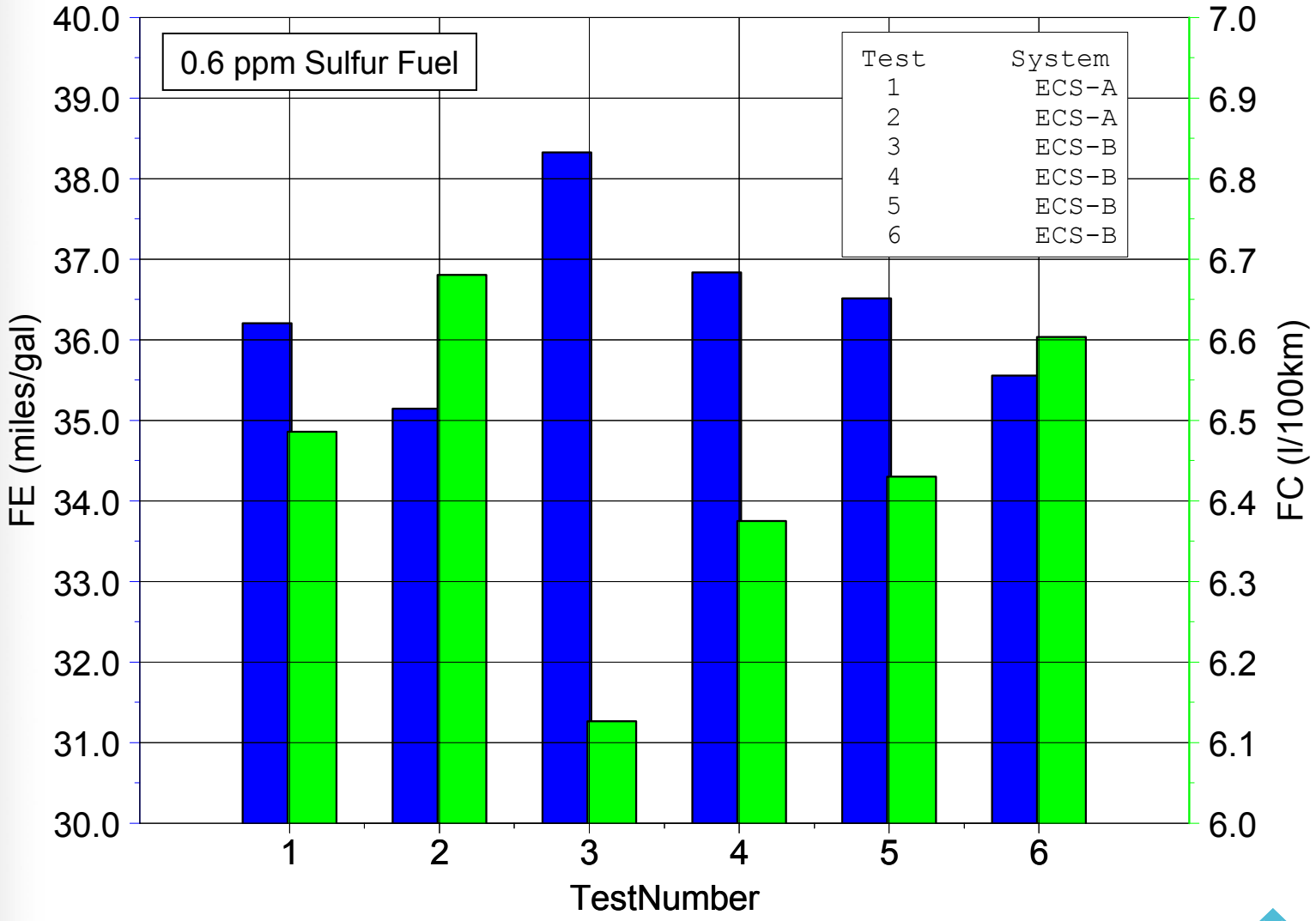
Vehicle Tests – US06 (Conducted at EPA NVFEL in Ann Arbor)



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Future Outlook

Next Step: ECS Aging

ECS A: 300h with 8 and 15 ppm fuel sulfur content
ECS B: 300h with 8 and 15 ppm fuel sulfur content

Final Test: 1750h with most promising configuration (ECS A or ECS B) using 15 ppm sulfur fuel (Total of 2,050h for one system)

- Testing includes test cell and vehicle testing
- Regulated and unregulated emissions will be sampled
- Final 50h misfueling (30 ppm sulfur) test is included