Biodiesel Effects on the Operation of U.S. Light-Duty Tier 2 Engine and Aftertreatment Systems

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Overview

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- ❑ Test Results
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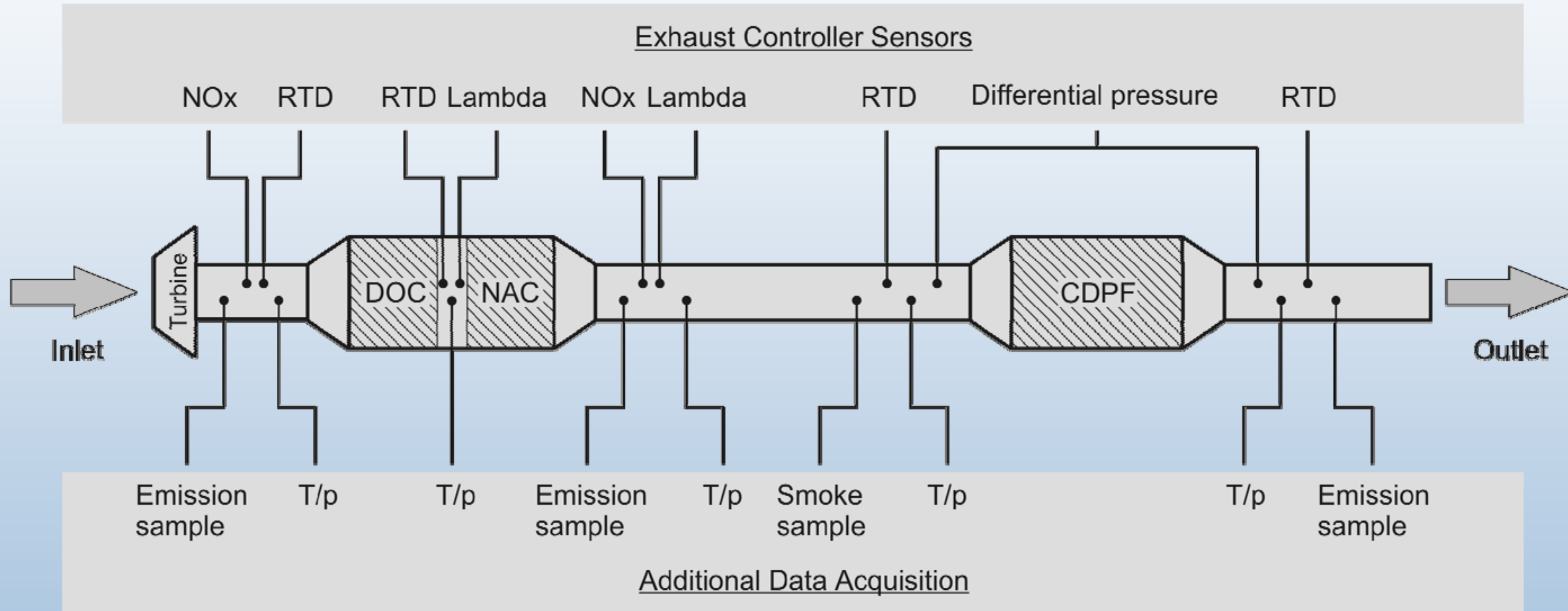
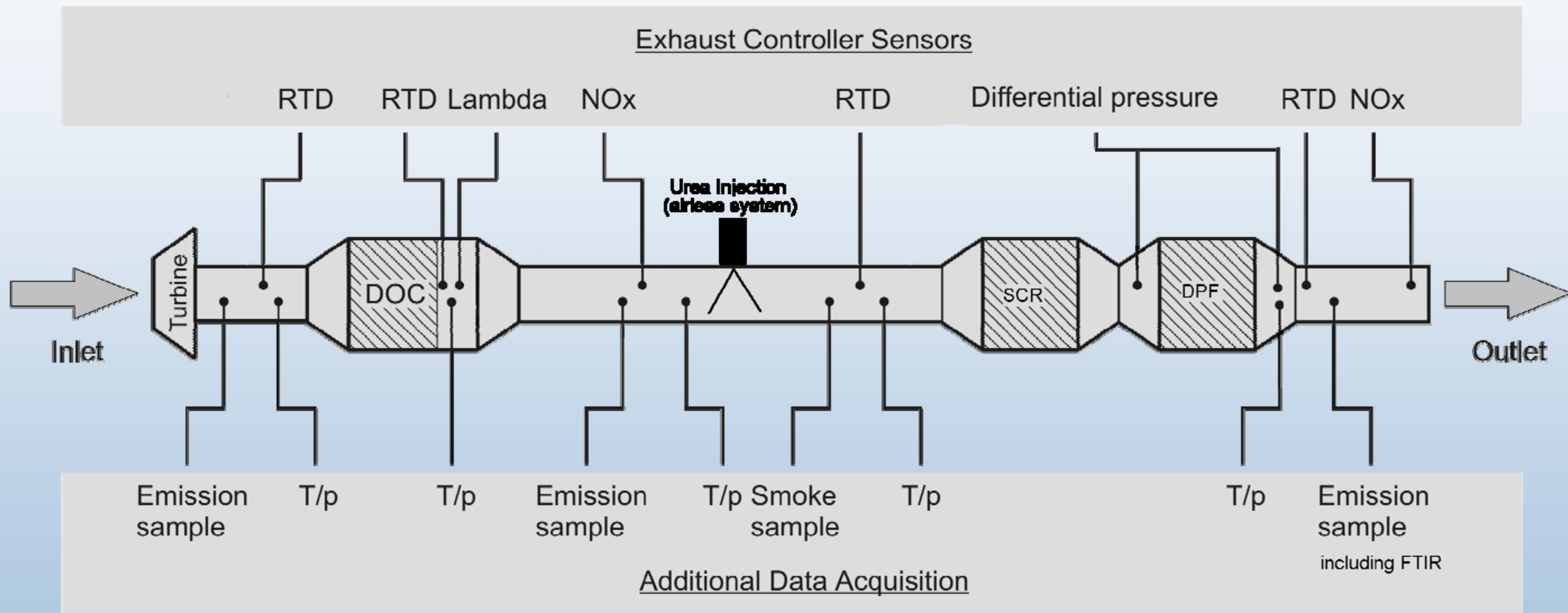
Project Goals

- ❑ Evaluate the impact of Biodiesel fuel blends on the performance of advanced emission control systems for light-duty diesels e.g. conversion efficiencies, regeneration effects (NAC/DPF and SCR/DPF)
- ❑ Understand effects over time (system aging)
- ❑ Assess engine and fuel system operation impacts at end of project (i.e. combustion chamber, fuel injection system, fuel pump)

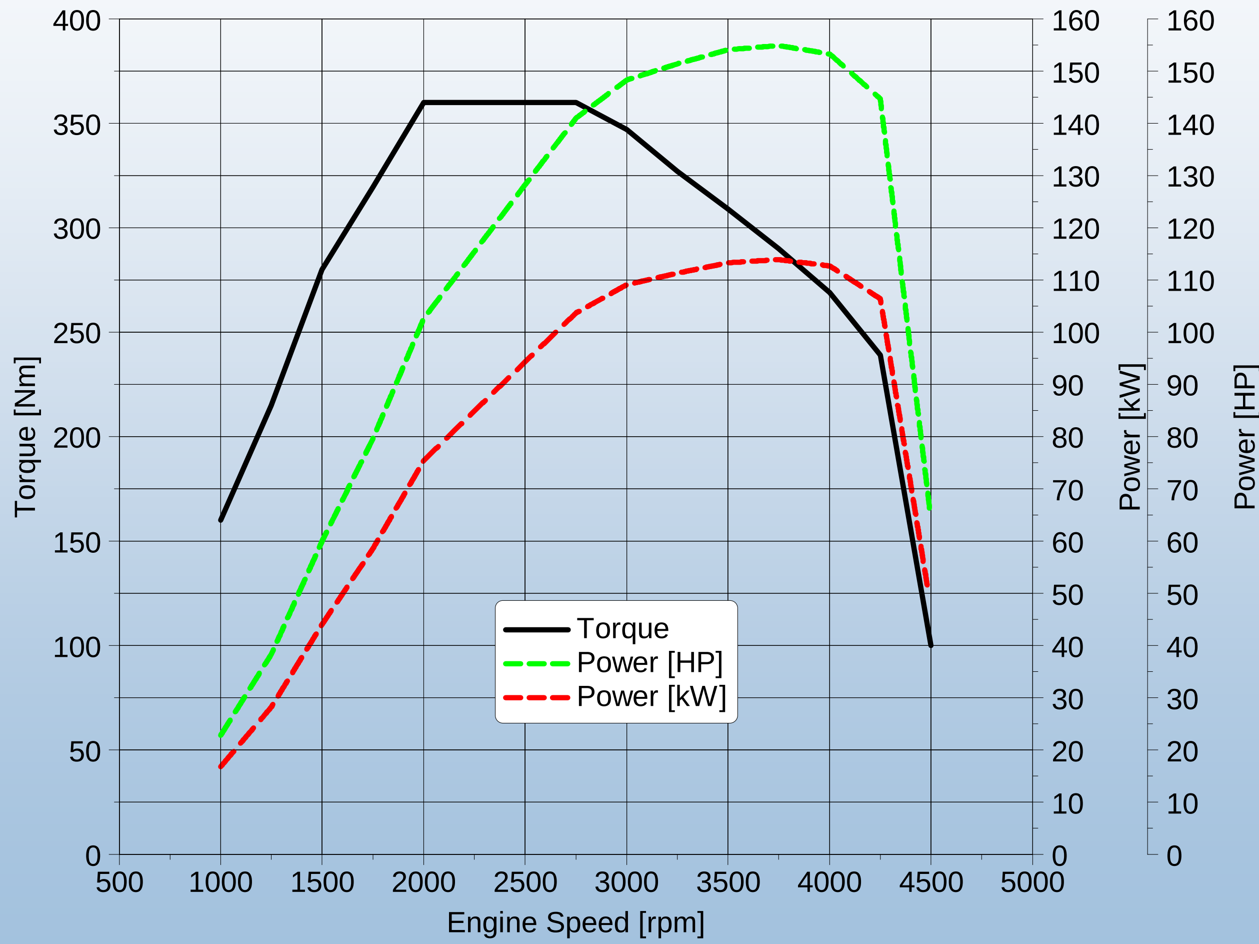
Hardware Overview – NOx Adsorber System



Hardware Overview – SCR System

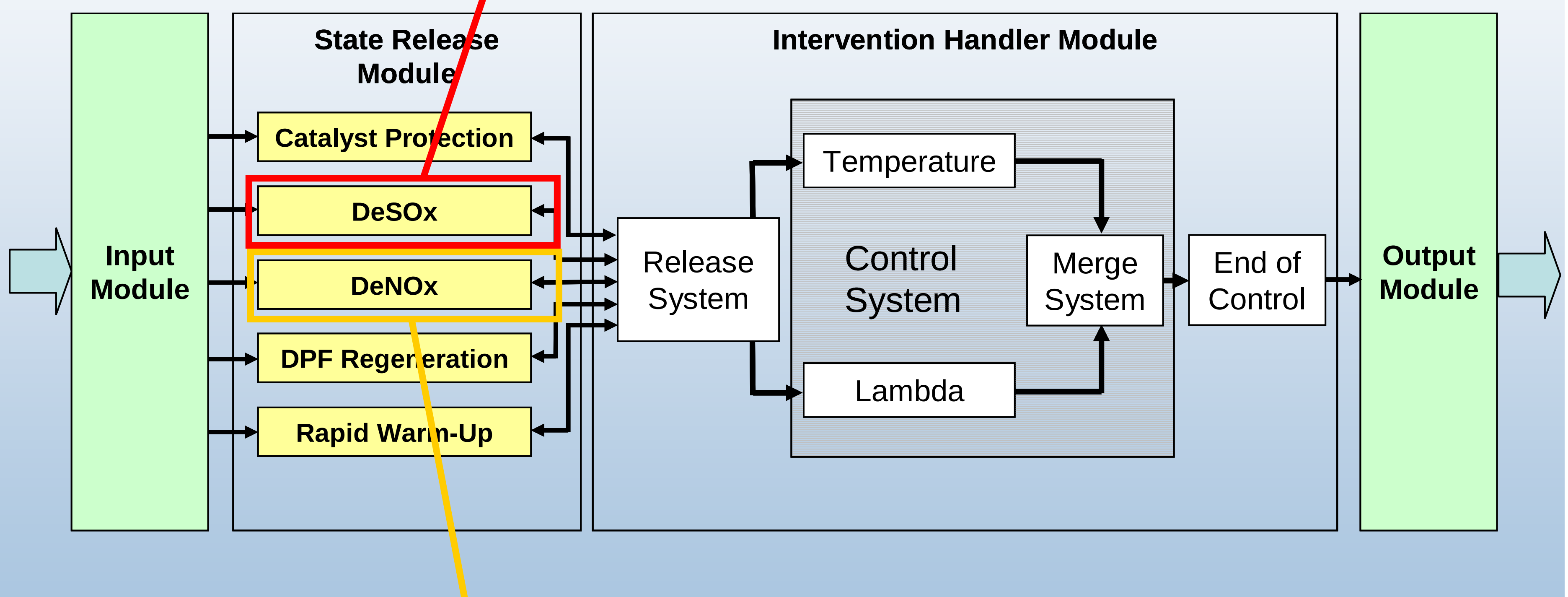


Hardware Overview – Test Engine Hardware



Control System Overview

Only used with the NOx adsorber system



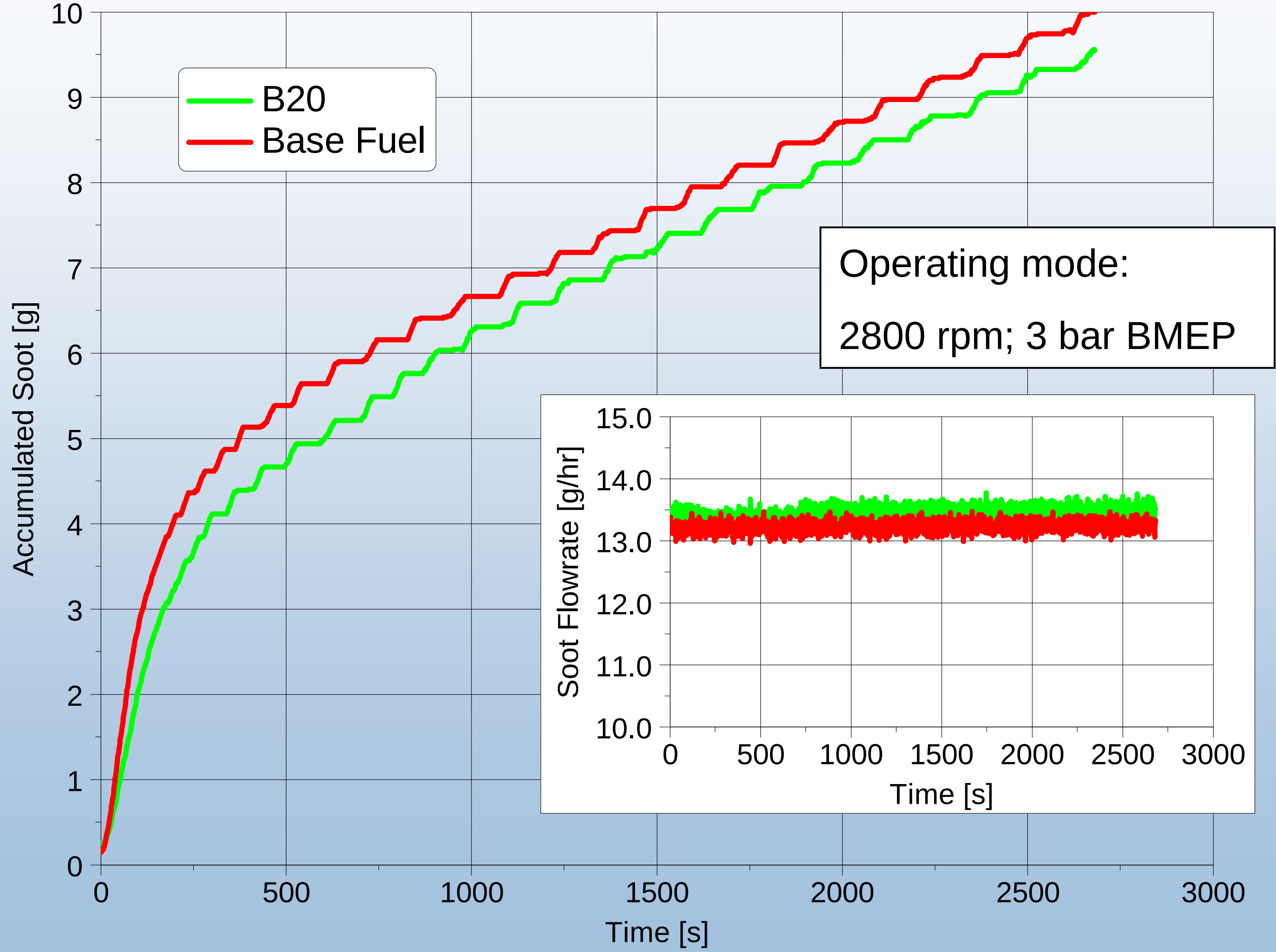
NOx adsorber: Lean-rich modulation release

SCR: Urea dosing

Fuel Comparison

	ULSD Base Fuel	B20
Density (kg/dm^3)	*0.846*	*0.853*
Cetane Number	*42.0*	*43.2*
Carbon (wt%)	*87.08*	*85.04*
Oxygen (wt%)	*0.00*	*2.37*
Hydrogen (wt%)	*12.92*	*12.59*
Kinematic Viscosity at 40°C [mm^2/sec]	*2.28*	*2.74*

Test Results – DPF Operation and Regeneration



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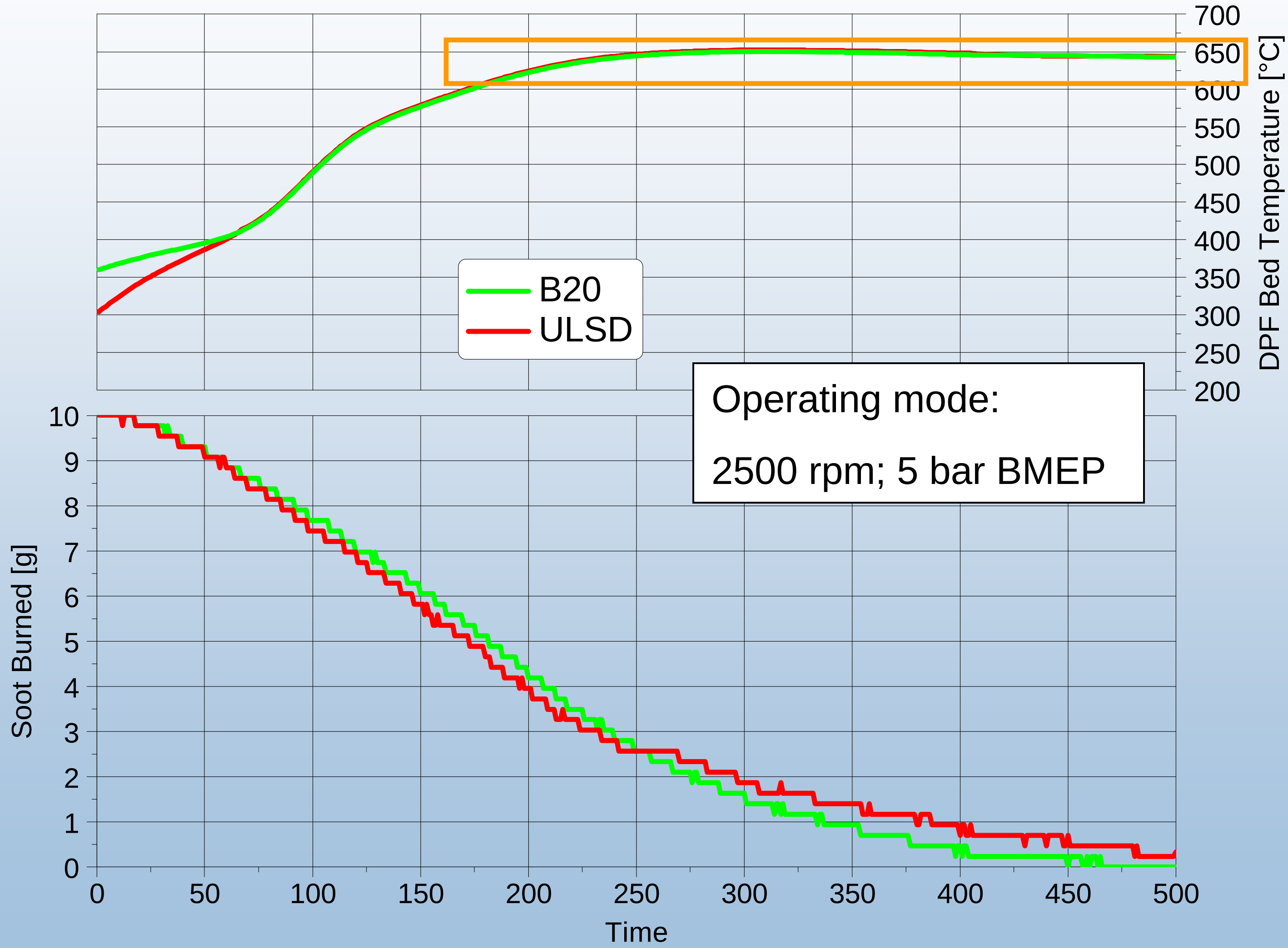
Test Results – DPF Operation and Regeneration



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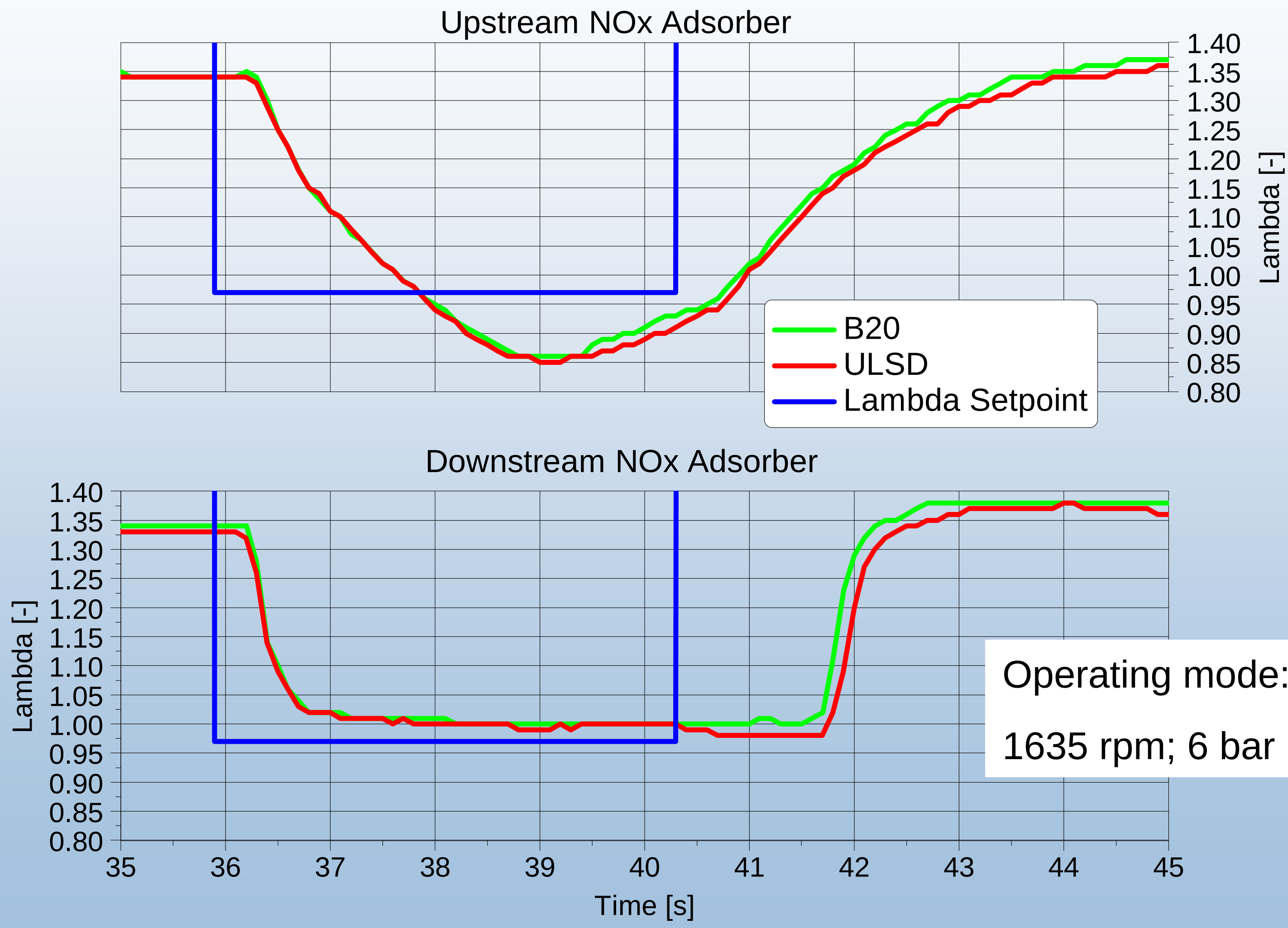
Test Results – NOx Adsorber Regeneration



Operating mode:

1635 rpm; 6 bar BMEP

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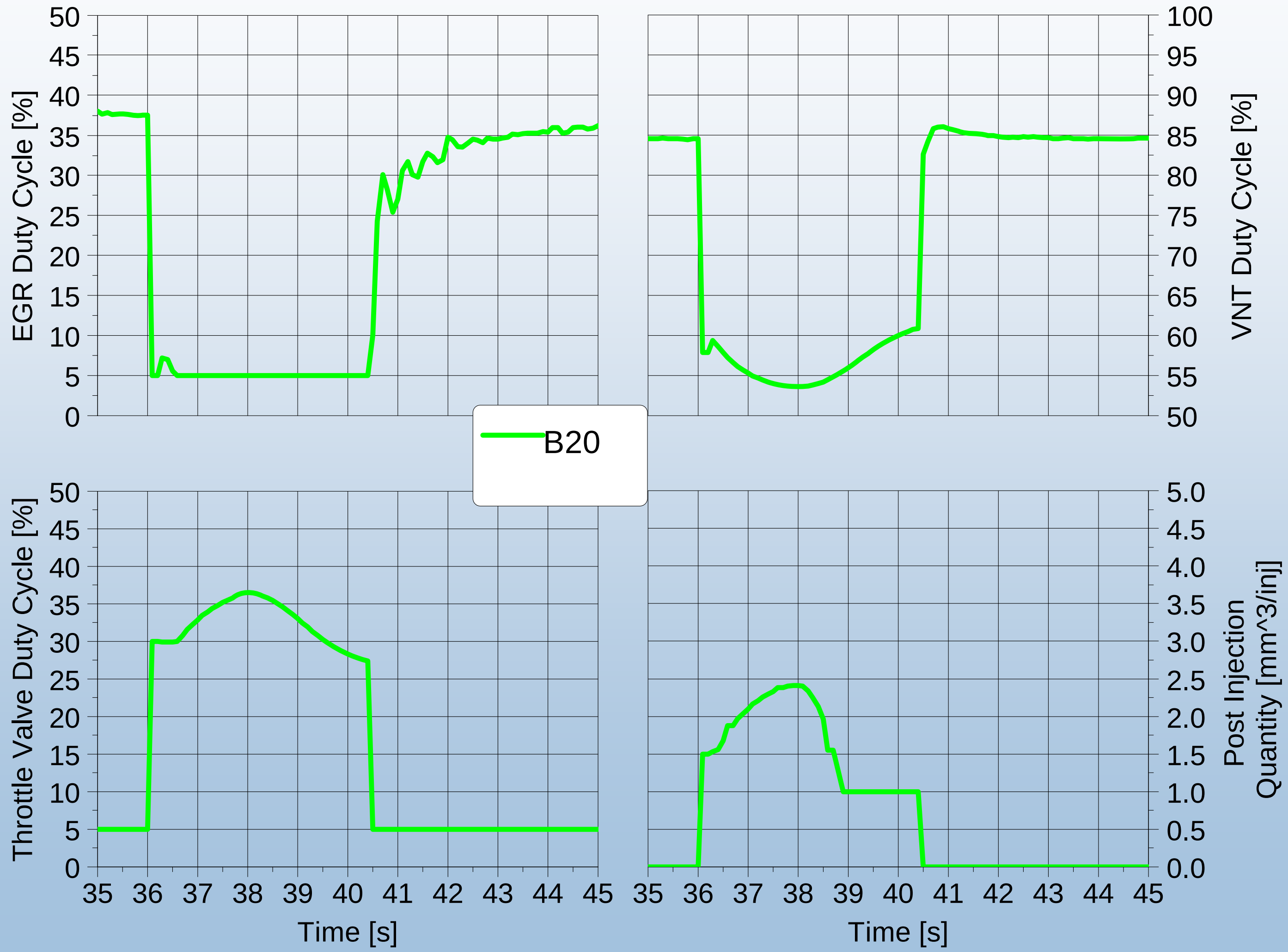
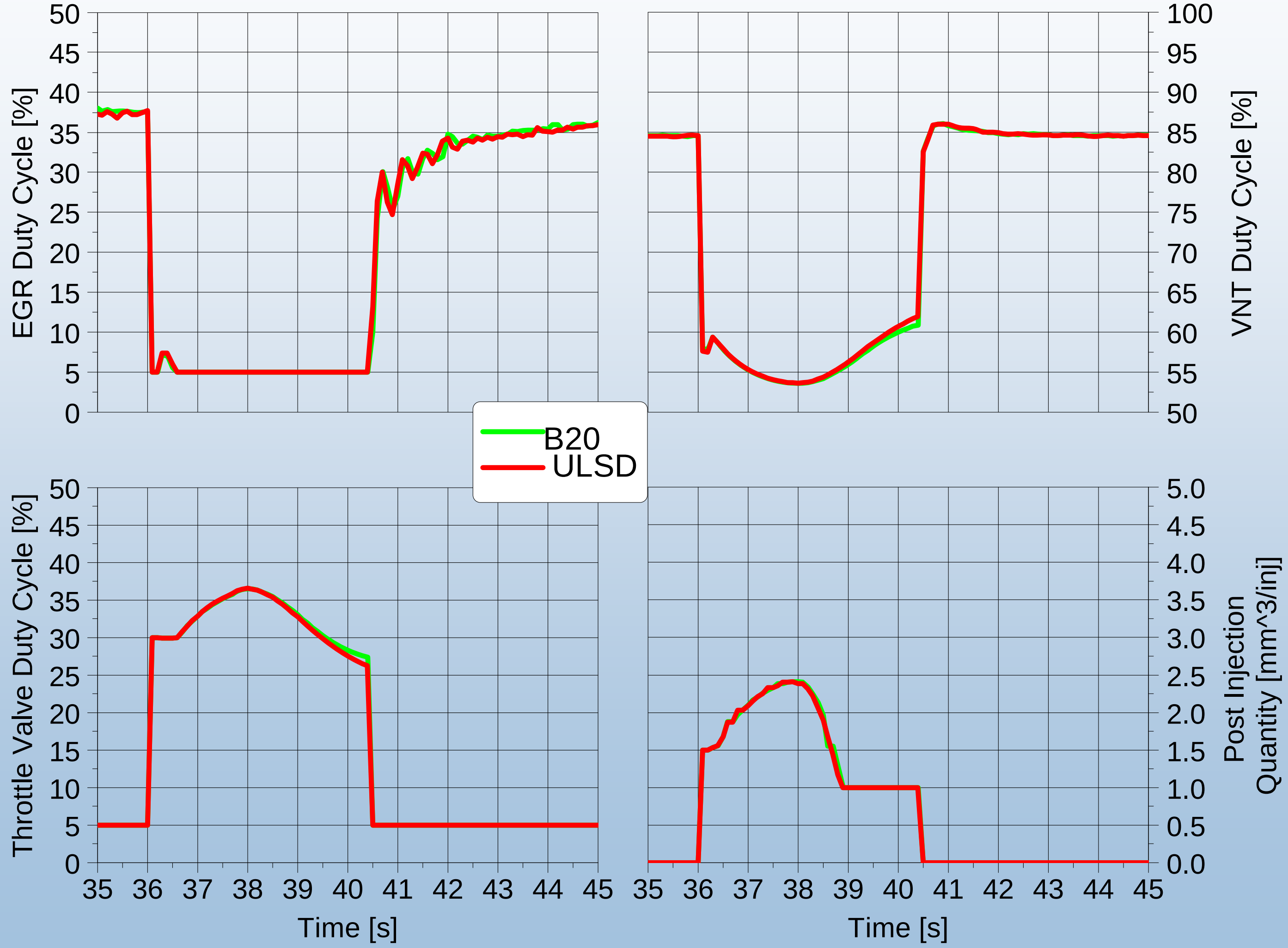
Test Results – NOx Adsorber Regeneration



Test Results – NOx Adsorber Regeneration



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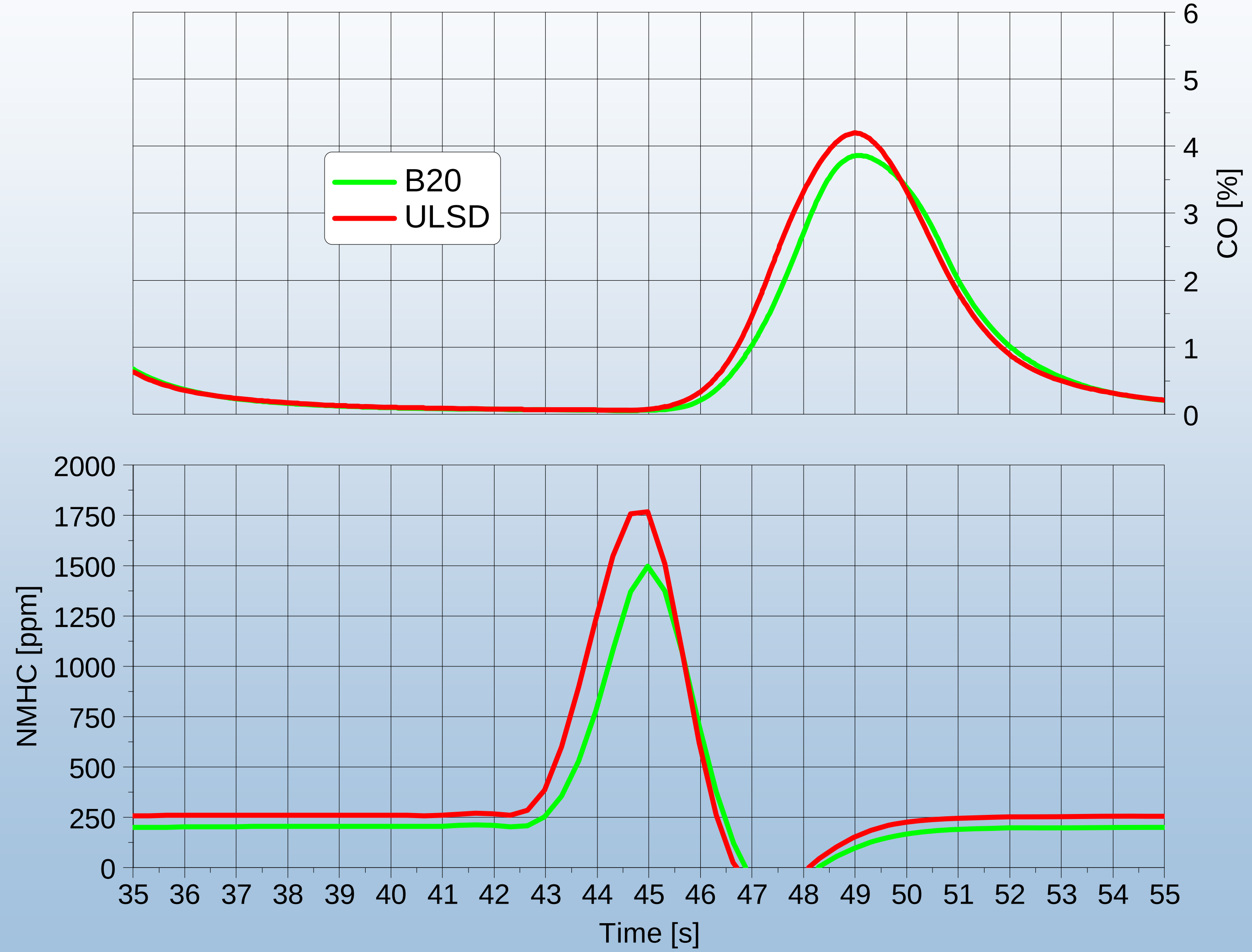
Test Results – NOx Adsorber Regeneration



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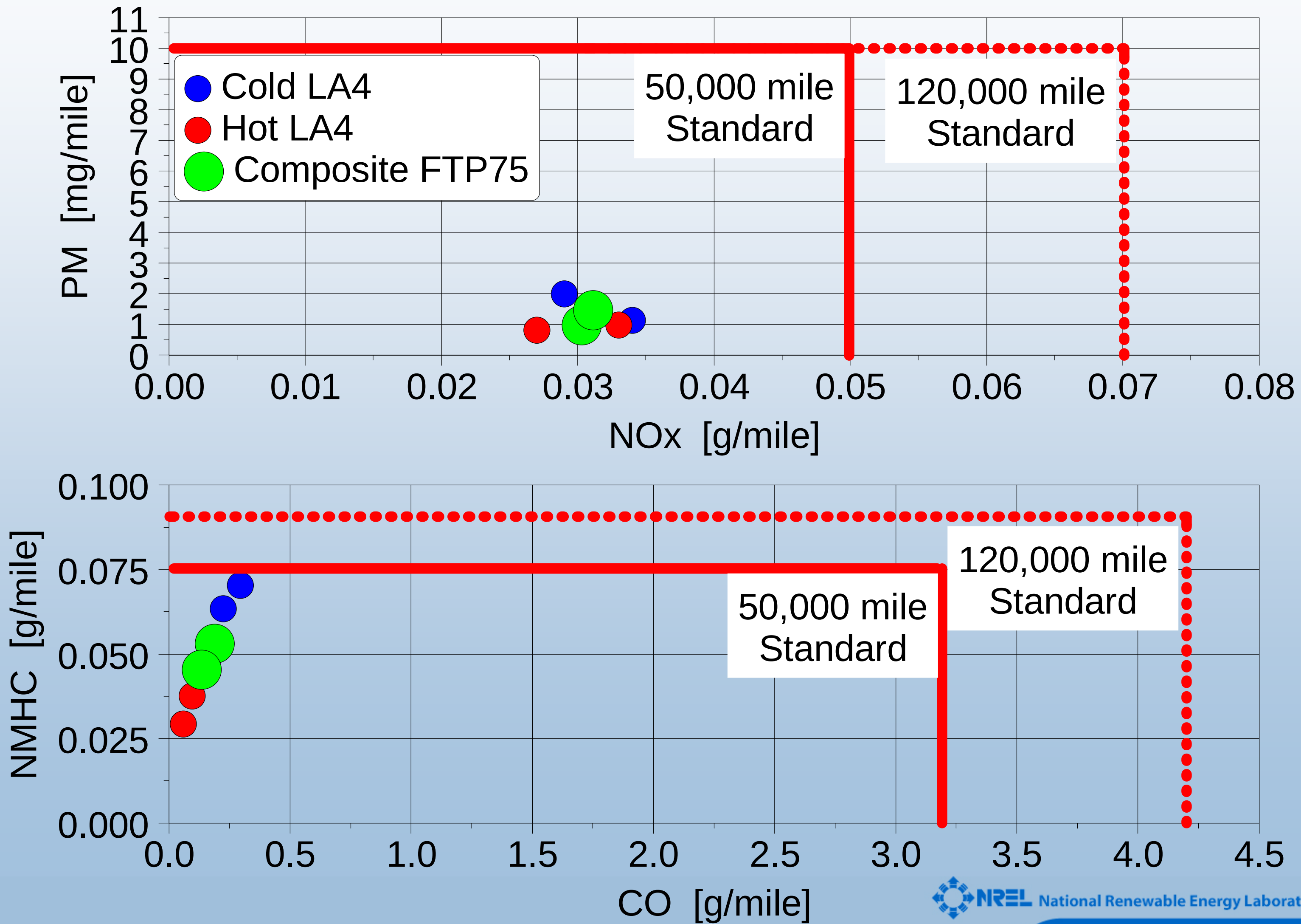
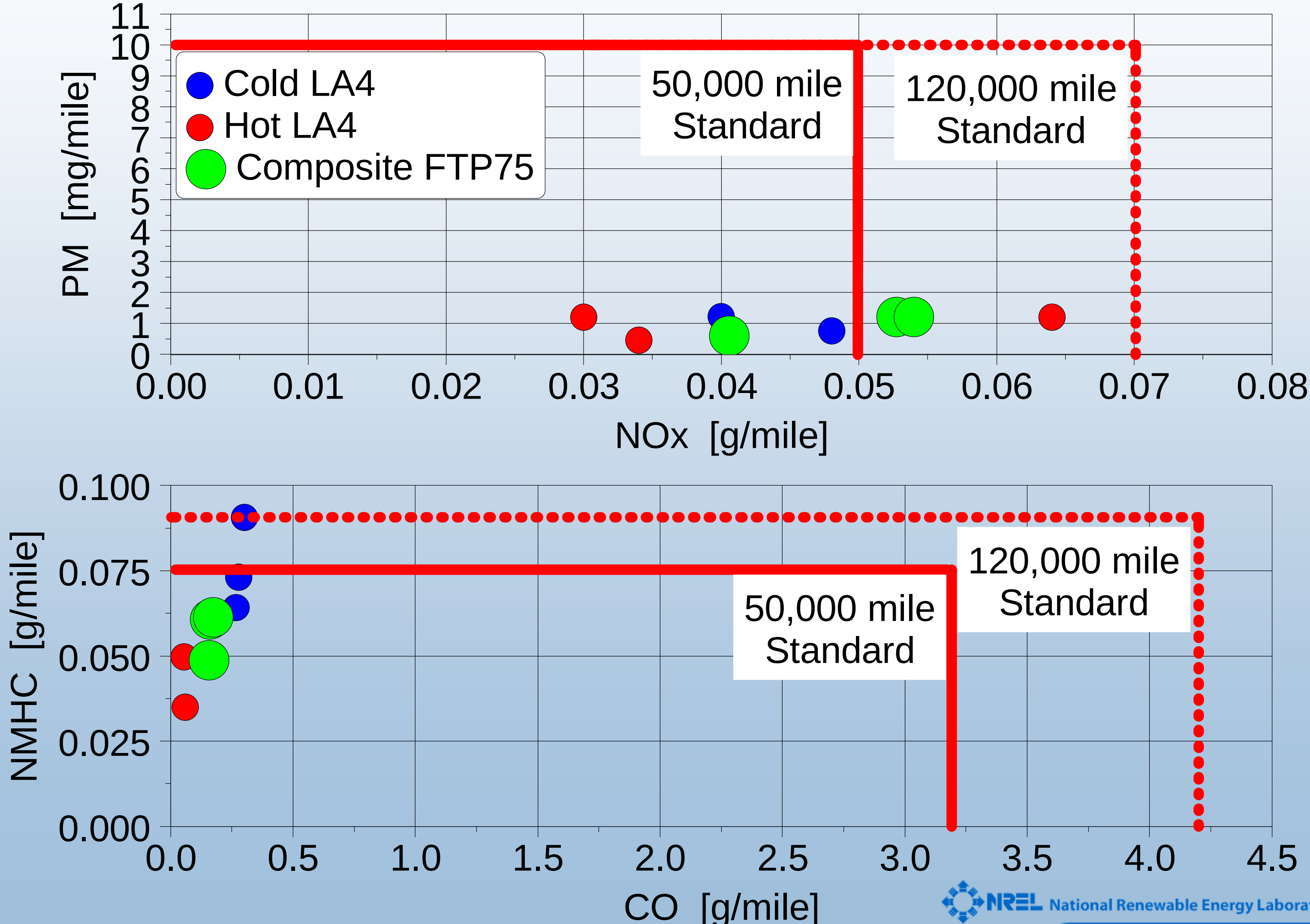
Test Results – EPA Chassis Dynamometer B20 Fuel



Test Results – EPA Chassis Dynamometer ULSD



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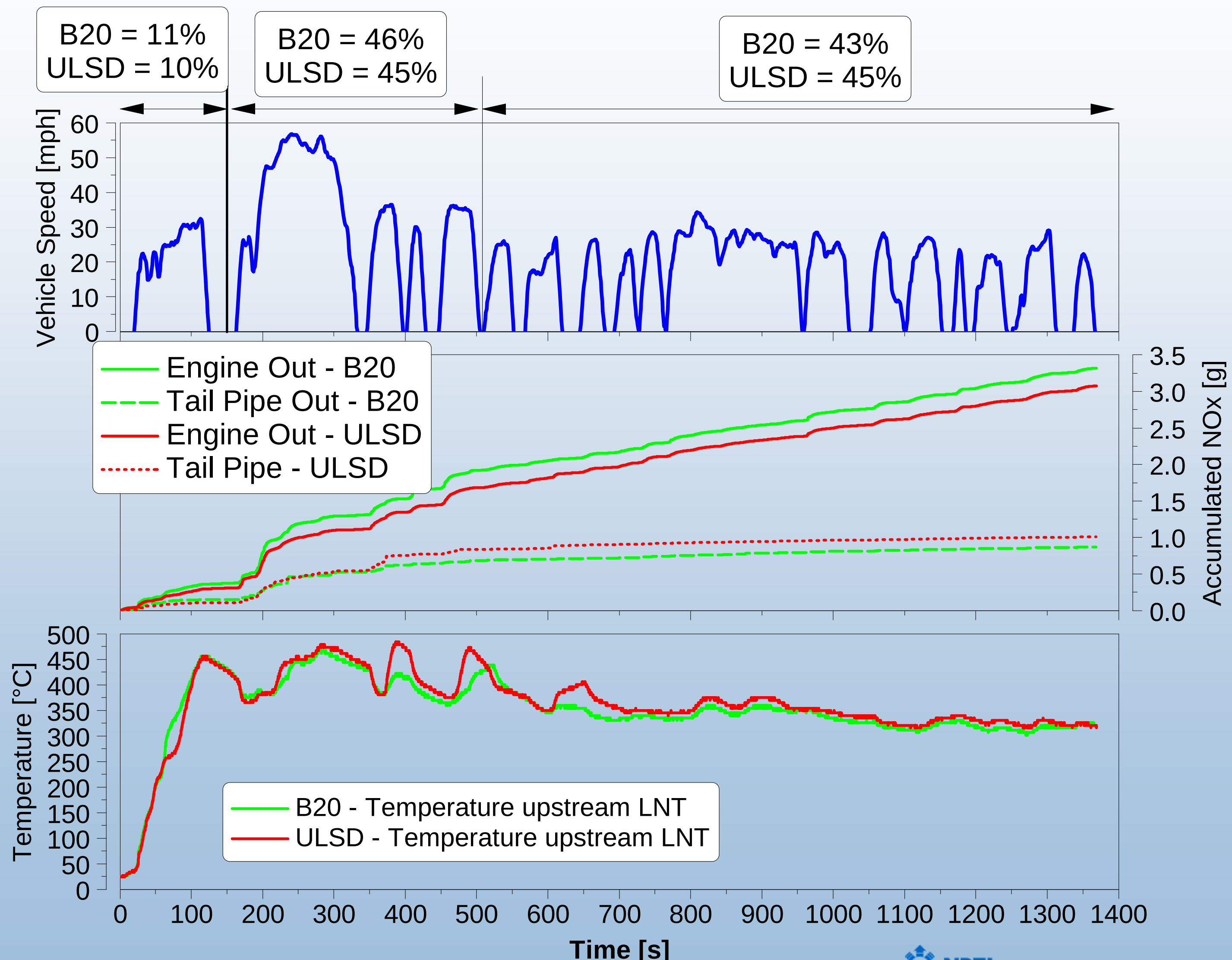
Test Results – EPA Chassis Dynamometer



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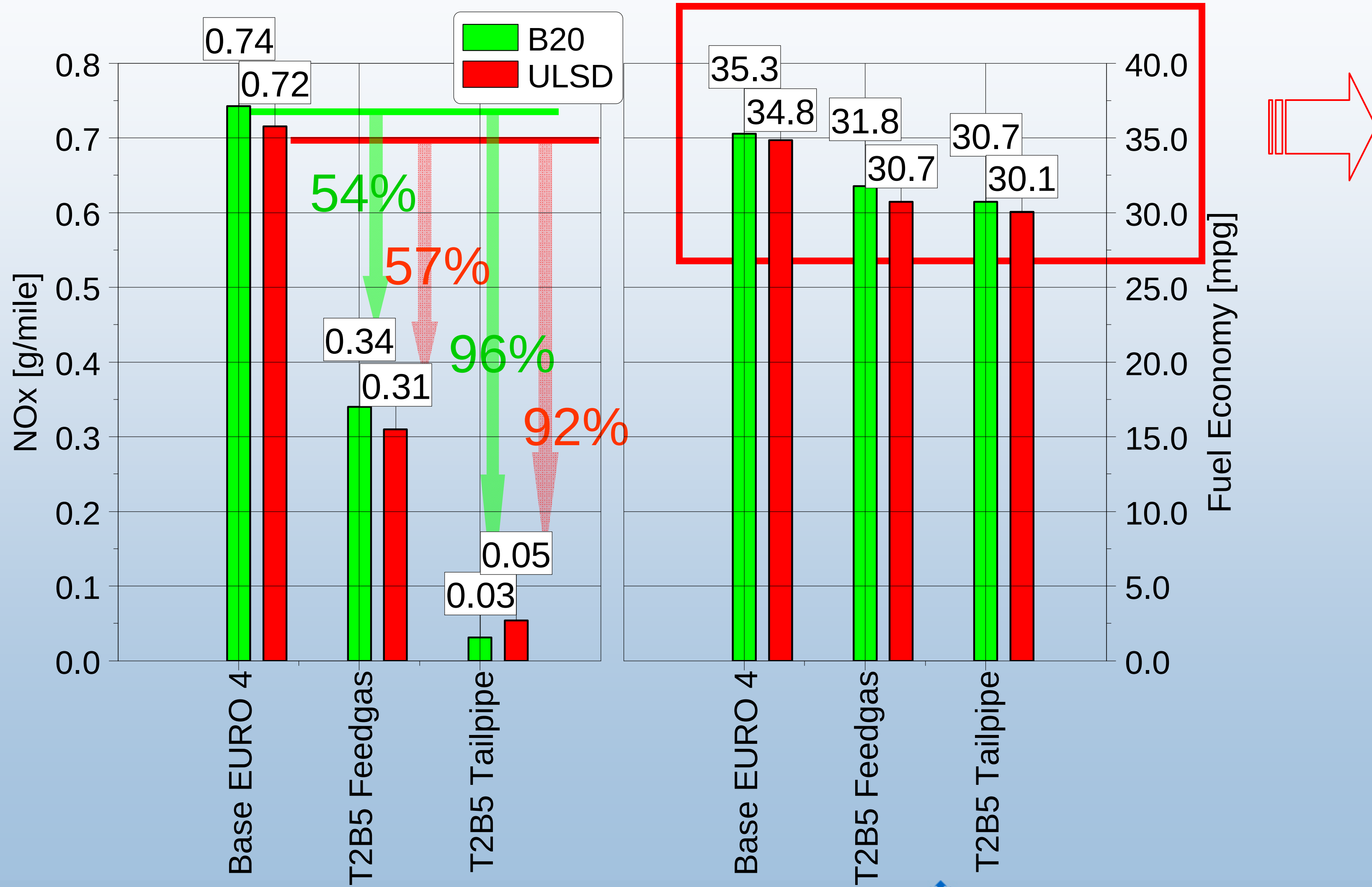
Test Results – EPA Chassis Dynamometer



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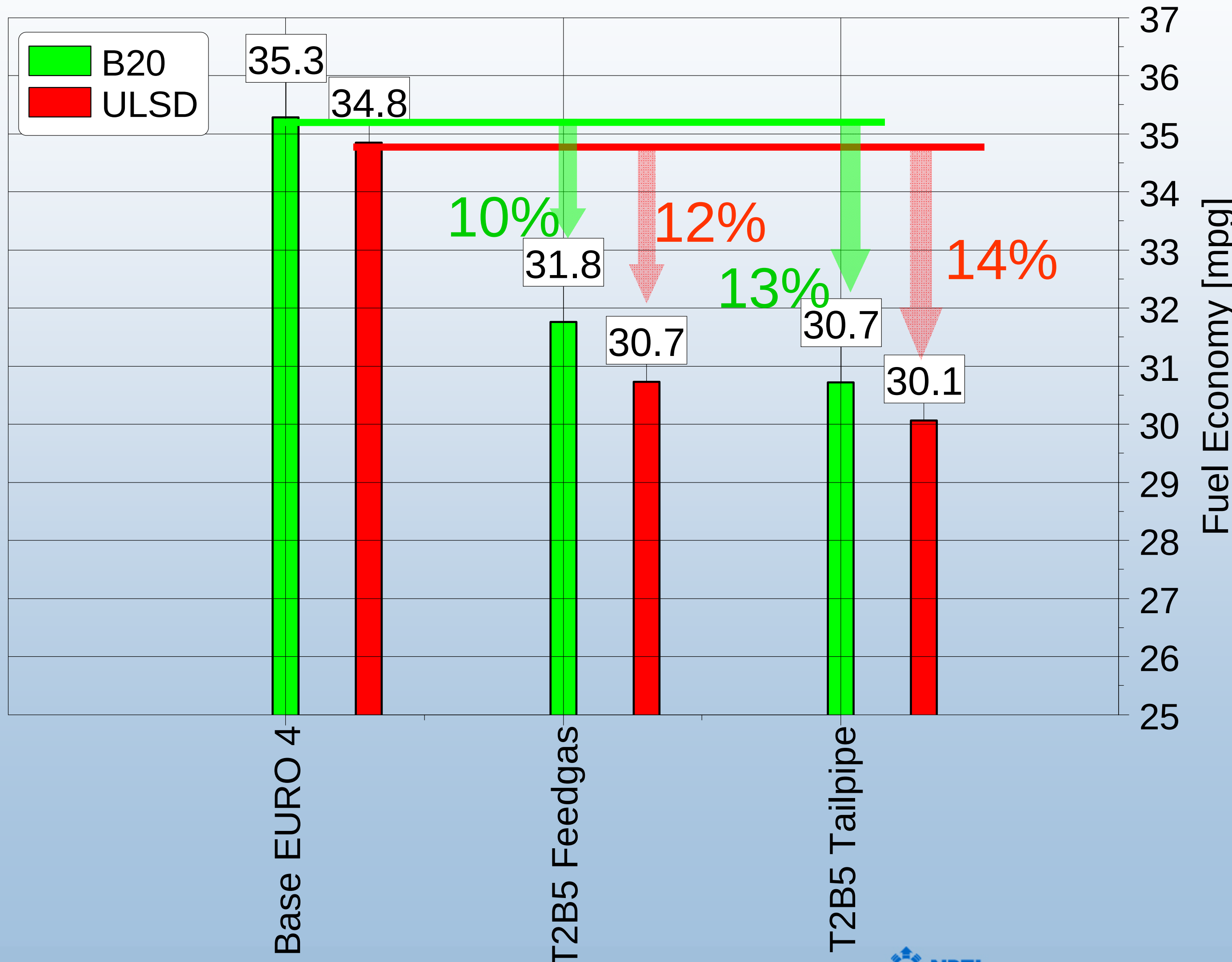
Test Results – EPA Chassis Dynamometer



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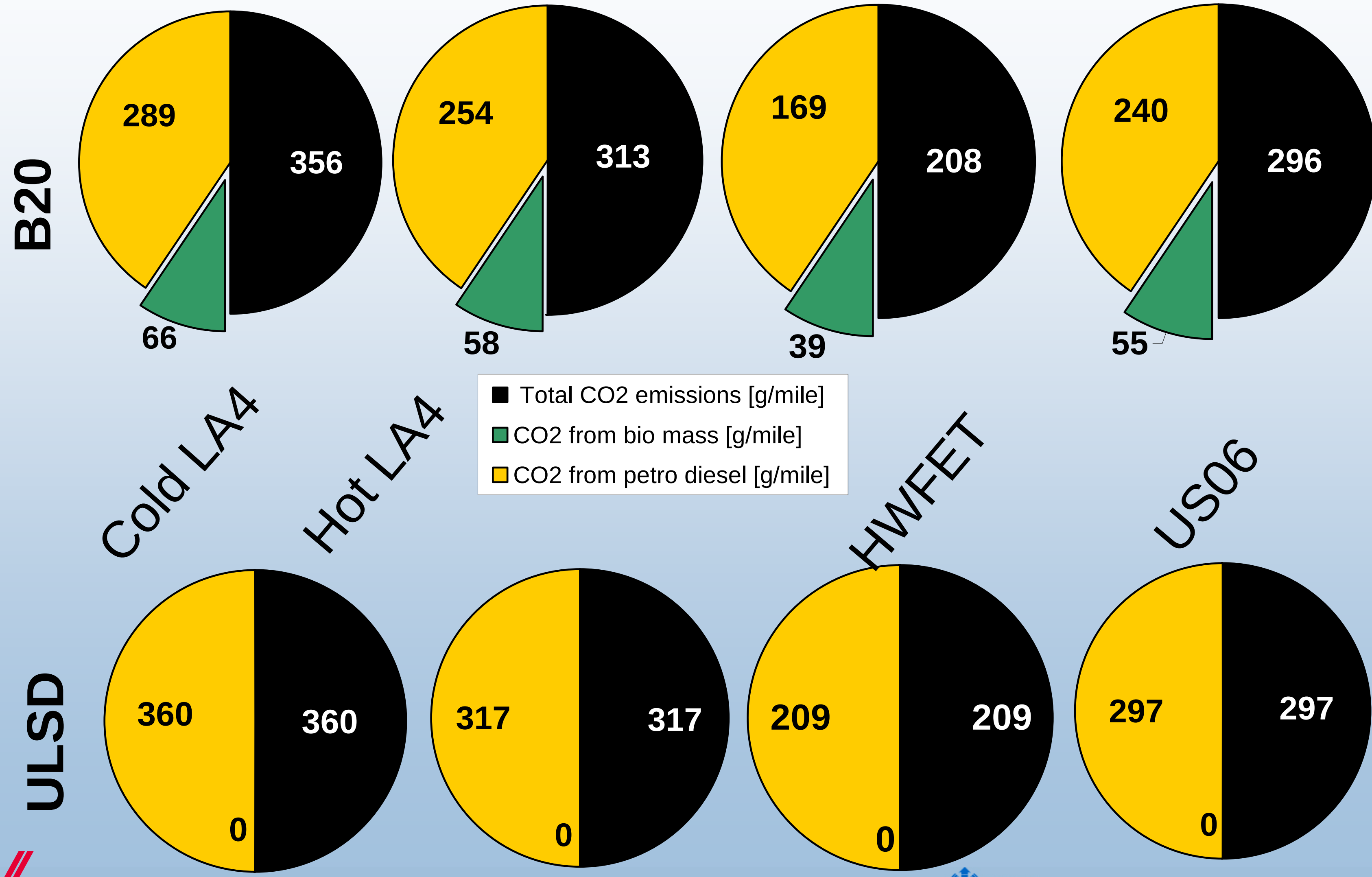
Test Results – CO_2 Contribution



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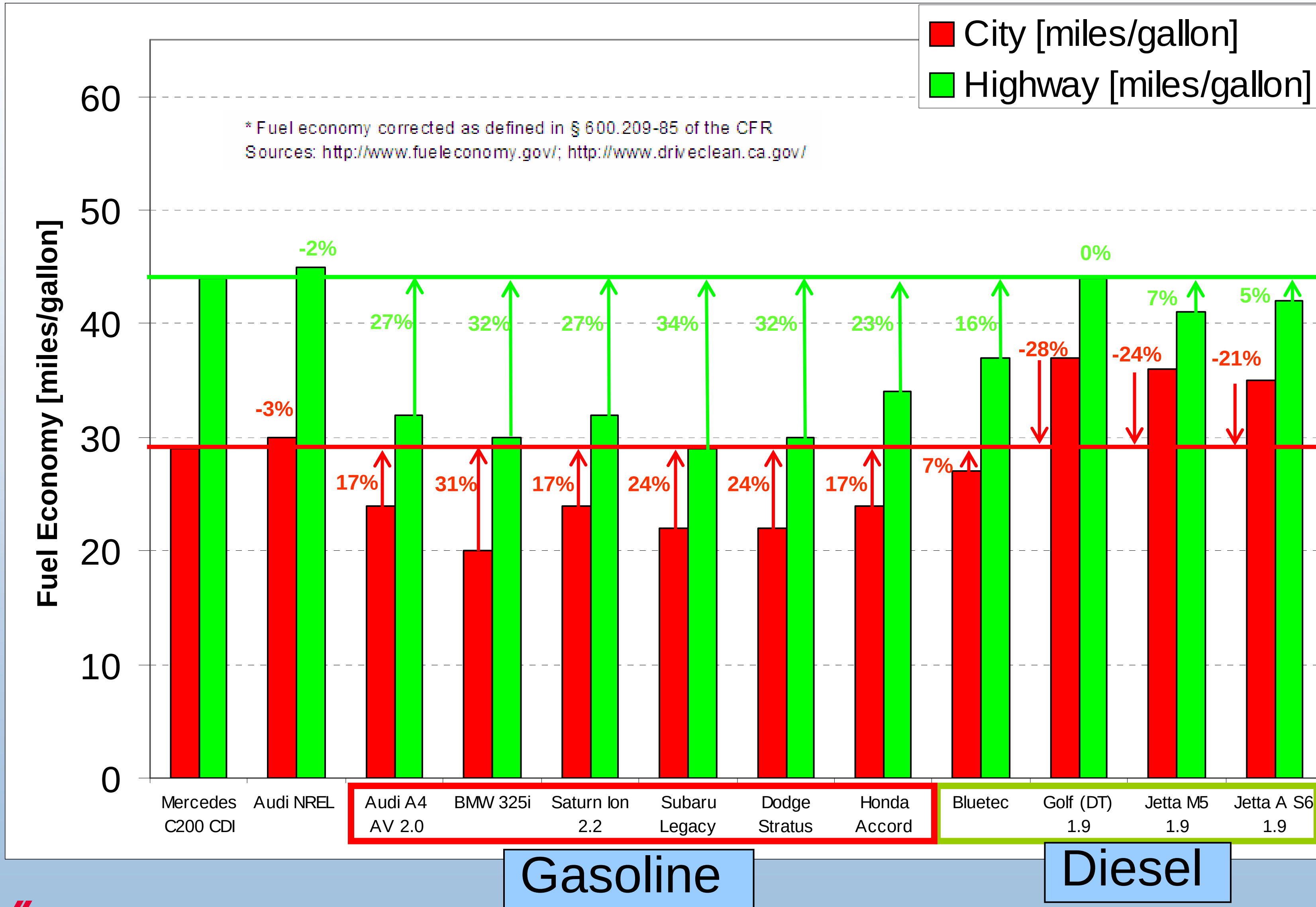
Test Results – Fuel Economy Comparison



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Summary and Conclusions

- ❑ Vehicle as well as test cell results indicate an increase in NOx and decrease in PM using Biodiesel blends – the greater the Biodiesel portion the more pronounced is this effect. This effect does not translate into greater tailpipe emissions with the NOx adsorber aftertreatment system.

- ❑ In the investigated configuration the DPF loading and regeneration performance did not change using Biodiesel fuel.

- ❑ NOx adsorber regeneration control remains the same comparing petroleum based and Biodiesel blended fuel.

- ❑ Fuel economy impact using Biodiesel fuel is marginal using an integrated Tier 2 Bin 5 system.

- ❑ Durability investigations focusing on Biodiesel effects on engine and aftertreatment system are currently underway.

- ❑ SCR system development and improvement currently underway.

Acknowledgments

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