APBF-DEC NOx Adsorber/DPF Project: *SUV/Pick-Up Platform*

Project Status

Principal Investigators:
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DEER
August 25, 2003

Program Goals / Objectives
Light-Duty SUV / Pick-Up Truck

- Determine the Influence of Diesel Fuel Composition on the Ability of NO_X Adsorber Technology, in Conjunction With Diesel Particulate Filters, to Achieve Stringent Emissions Levels

- The goal is to develop a highly efficient emission reduction system that will approach LD Tier 2 Bin 5: NO_X <0.07 g/mi, PM <0.01 g/mi

Southwest Research Institute APBF-DEC SUV/Pick-Up Truck Project

Scope:

One Pick-Up Truck + One Emissions Control System Configuration

Vehicle and Engine:

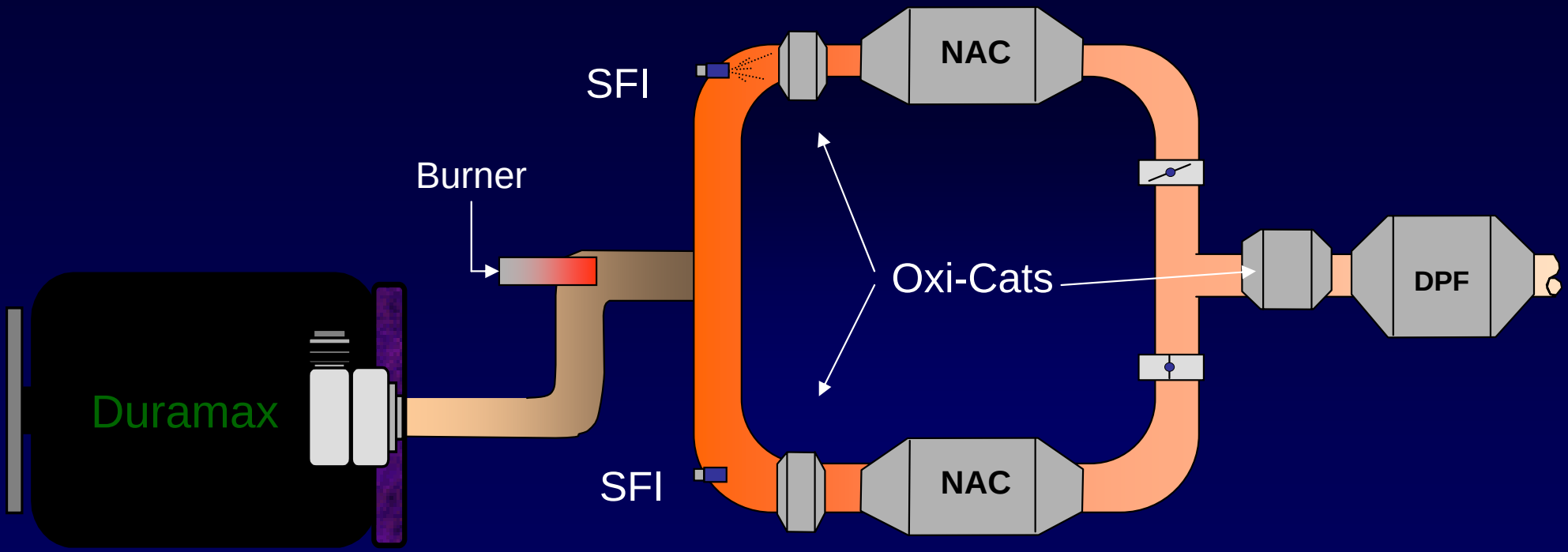
2002 Chevrolet Silverado,
2500 Series

2002 Isuzu Duramax.
6.6L with EGR

+

Dual Leg NAC - DPF
Emissions System

Emissions Control System:



Volume (2nd Generation System):

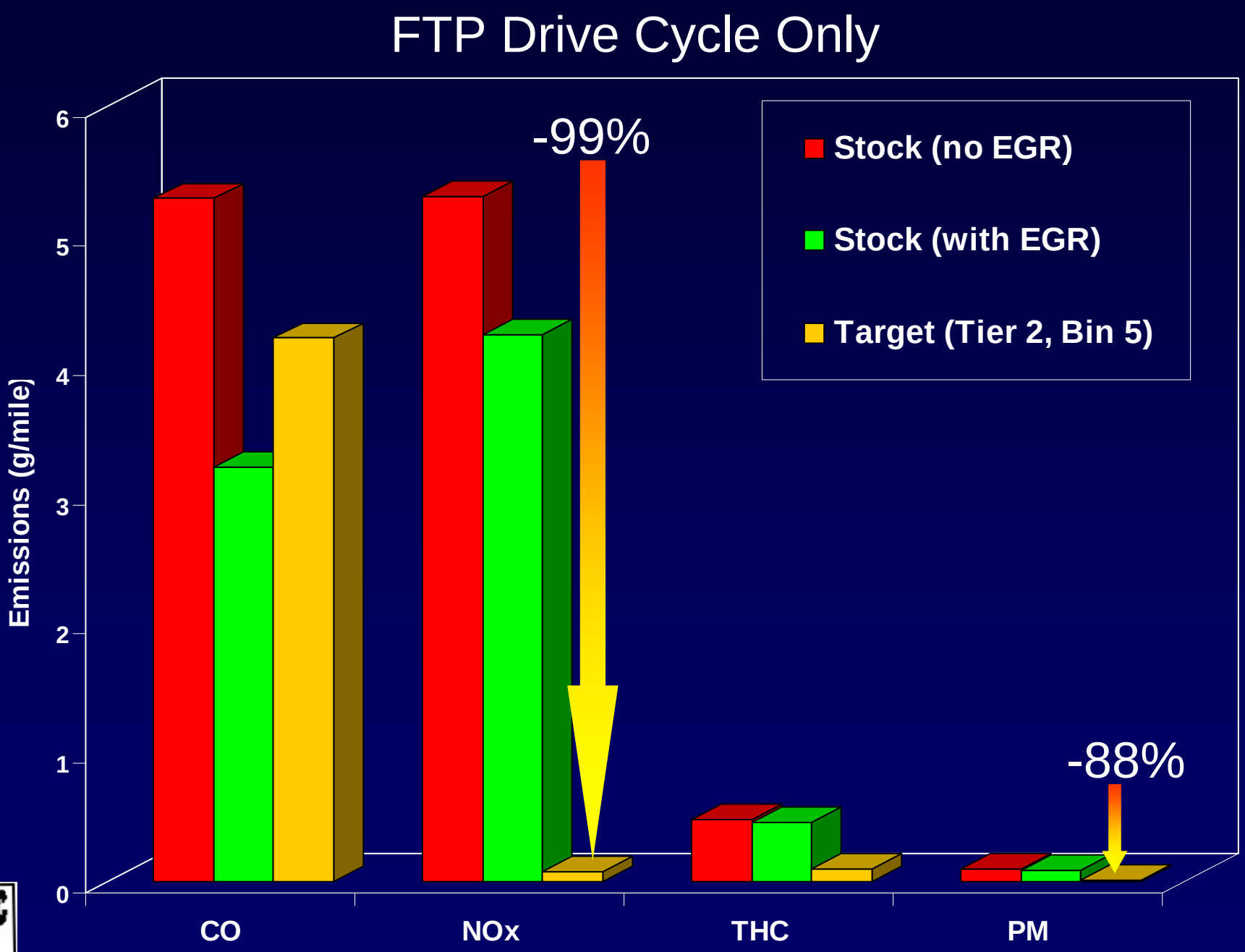
3.5L x 2 + 7L x 2 + 3.5L + 12.5L = 37L

Front Oxi NAC Rear Oxi DPF

Project Achievements

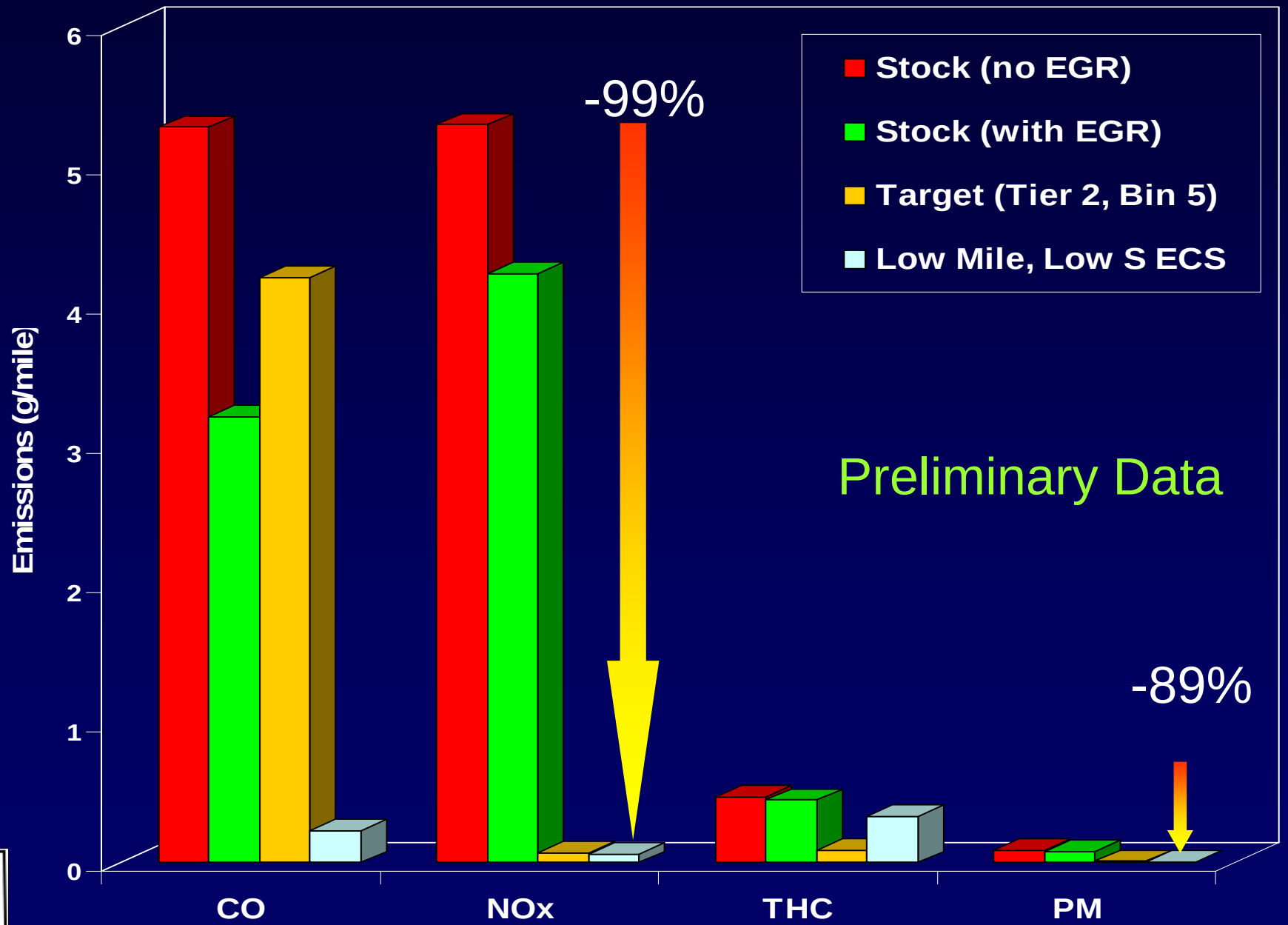
- All temperature control and NAC regeneration management calibration has been completed.
- Desulfation strategy development near completion.
- Aging cycle developed.
- Aging methodology check-out in progress (aging to 300 hours on 0.6 ppmS fuel)

Engine-Out Emissions vs. Tailpipe Goals

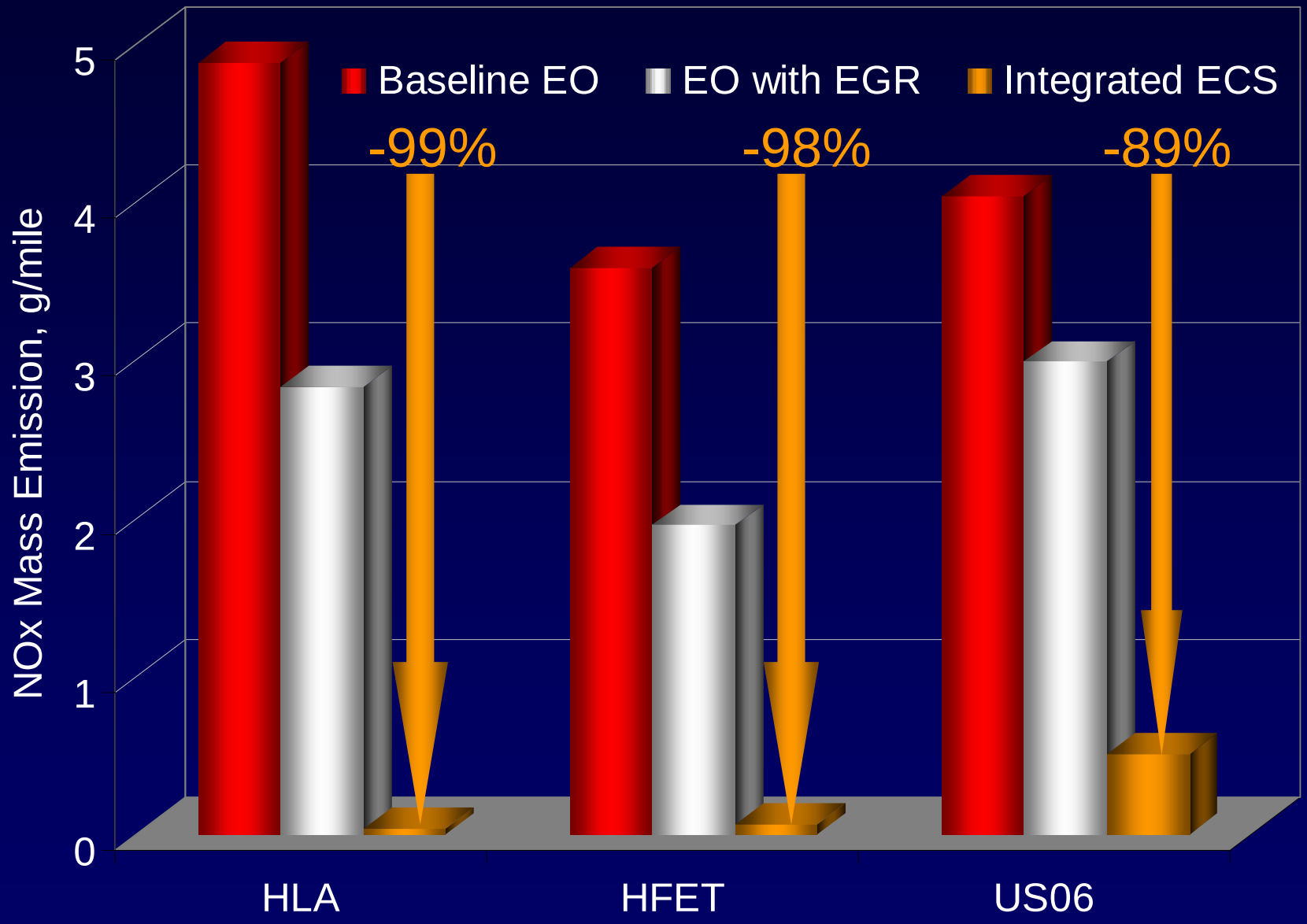


Status of Transient ECS Calibration--

Cold + Hot Composite FTP Emissions



Program Achievements
Low Mileage, <1ppmS DECSE Fuel



Preliminary Data

NAC Management

A Brief Overview of ECS Management Approach

NAC Control Requirements:

- Temperature: Activity Window
- Inlet Concentration: Capacity and Breakthrough

- Regeneration: Periodic Rich Excursion to Clean Adsorber

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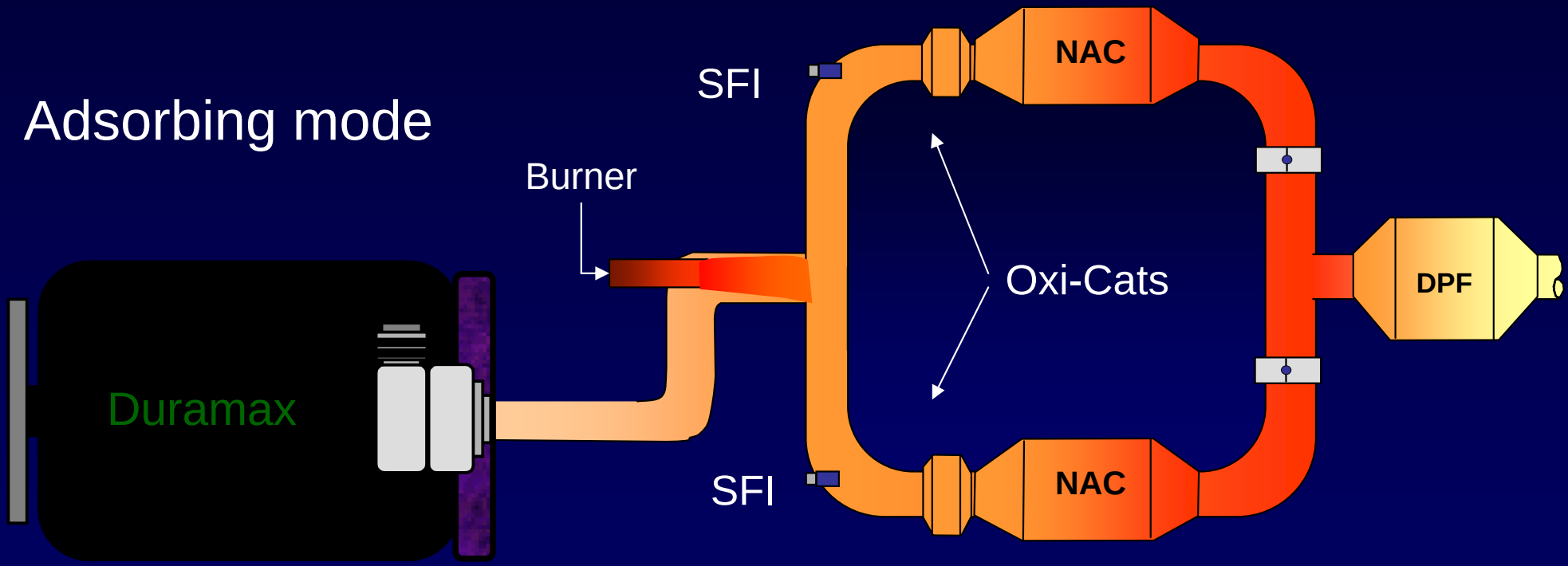
NAC Management

NAC Regeneration Goals:

- $\lambda<1$
- Reductant Into NAC
- Reduced O_2 into NAC
- Manageable Exotherm within Catalysts

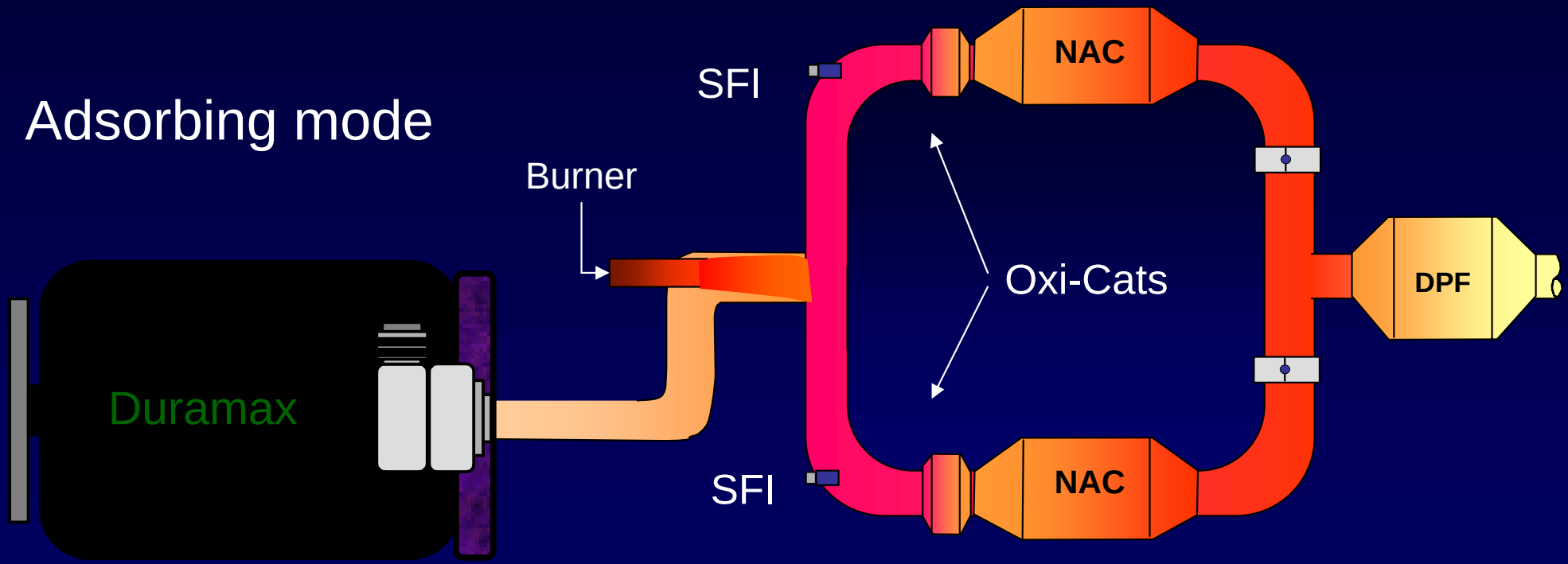
Regeneration Control: SFI + Burner + Flow Control

Two Regeneration Approaches



Burner Regeneration Triggered

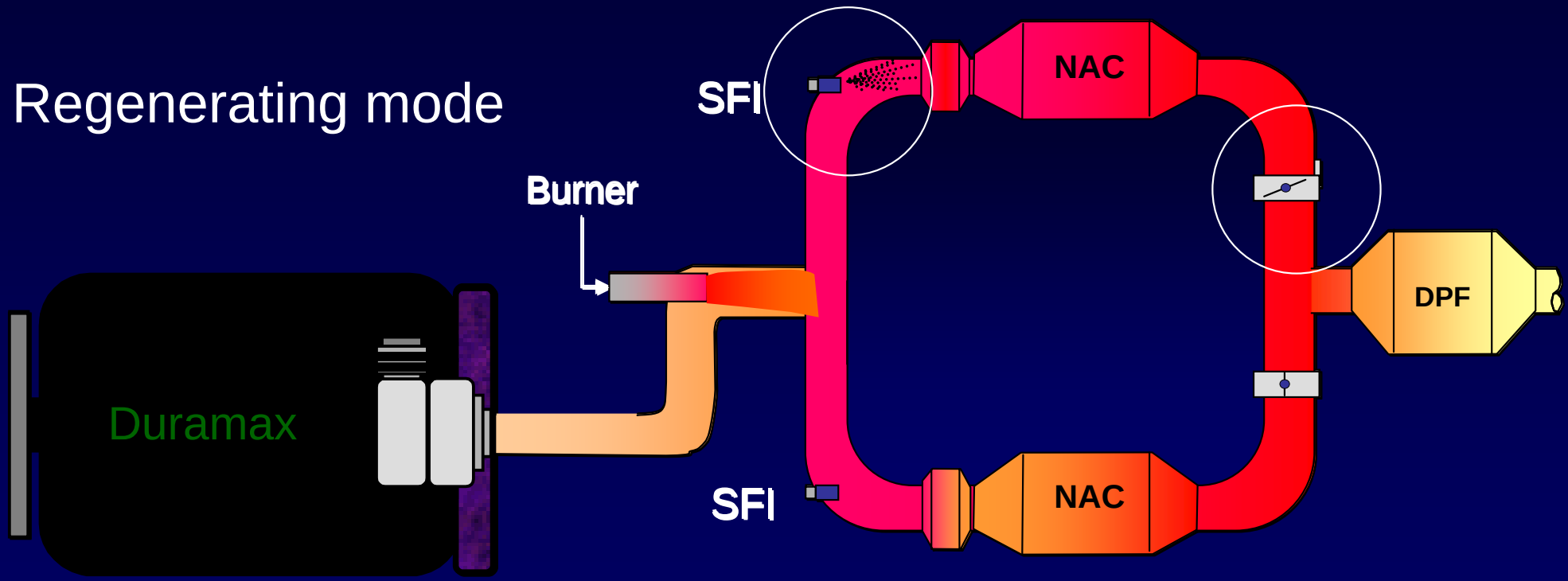
Two Regeneration Approaches



Burner Regeneration Triggered

Two Regeneration Approaches

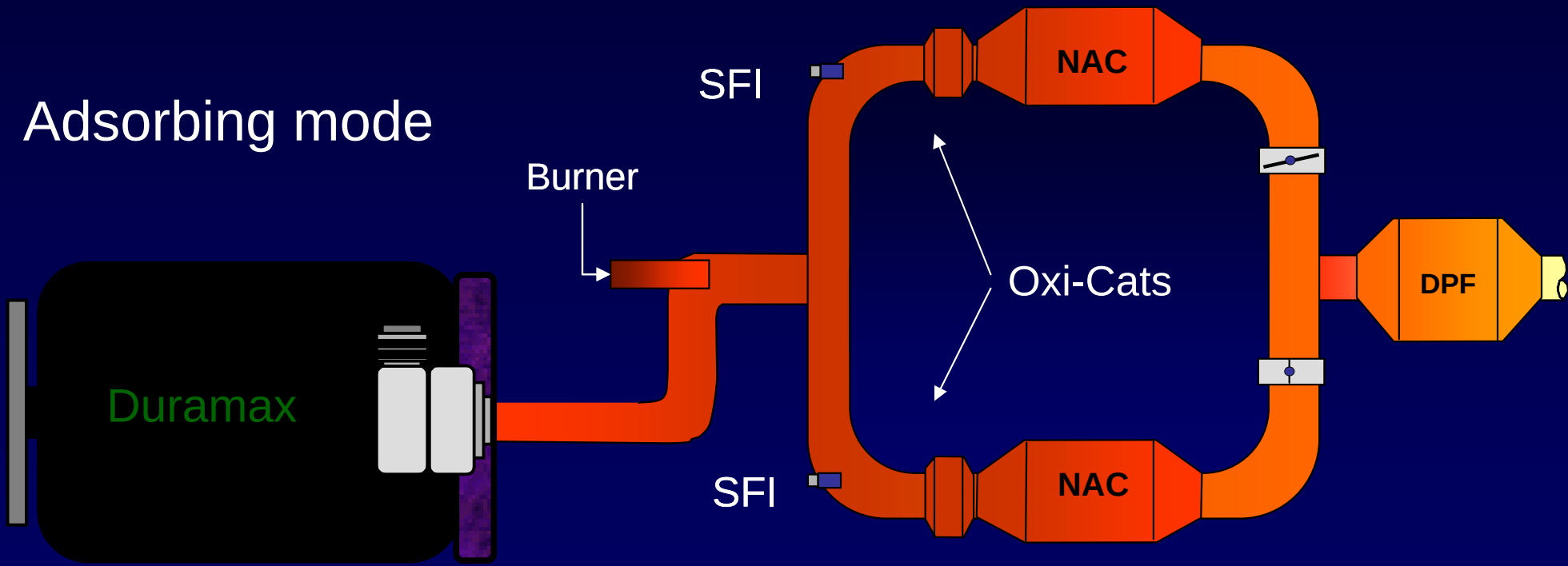
Regenerating mode



Burner Regeneration Triggered

Pulsed Burn Mode

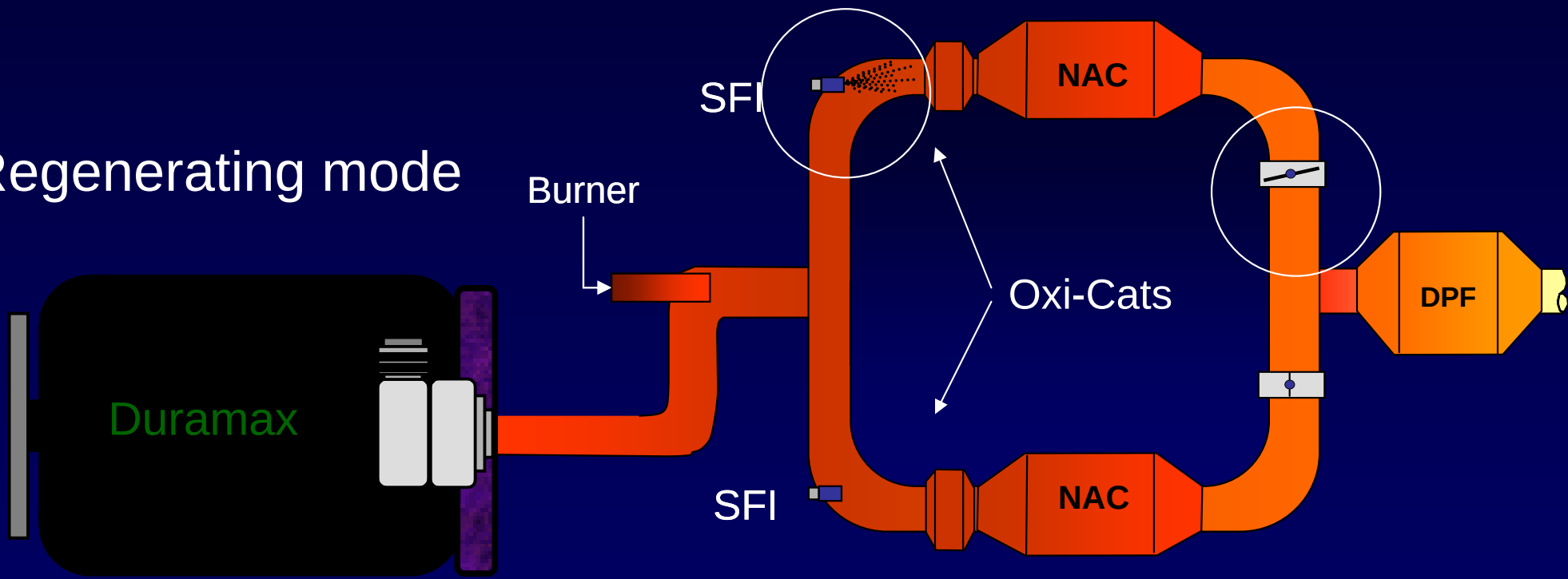
Two Regeneration Approaches



SFI Regeneration Triggered

Supplemental Fuel Only Mode

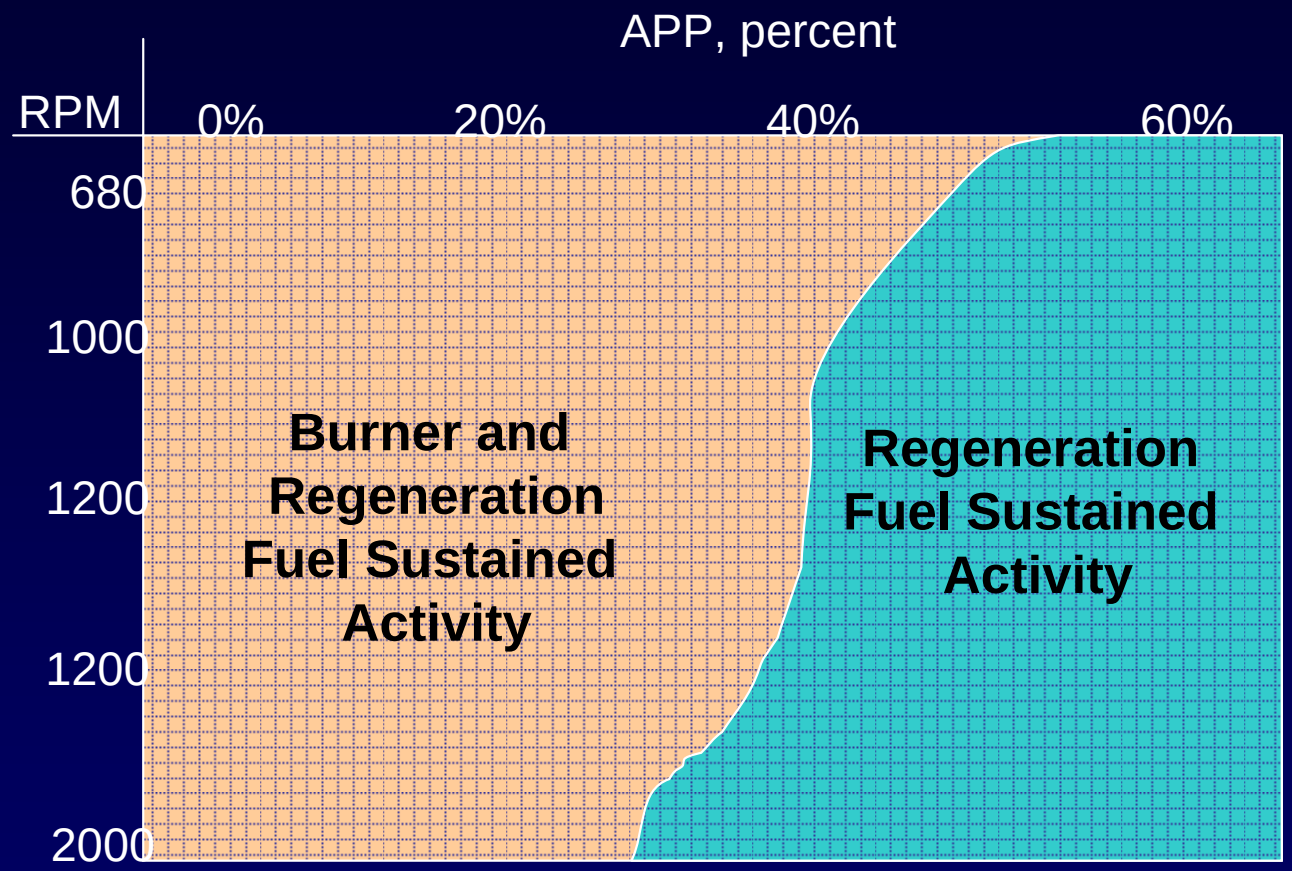
Two Regeneration Approaches



SFI Regeneration Triggered

Supplemental Fuel Only Mode

NAC Management - Approach



Steady-State Mapping Shows Two Basic Regions Driven by Thermal Management of NAC

How do you decide when to regenerate?

Strategy 1:
Rich Time / Lean Time

Strategy 2:
NOx Mass Storage Model

How do you decide when to regenerate?

Approach 1:
Rich Time / Lean Time

Approach 2:
NOx Mass Storage Model

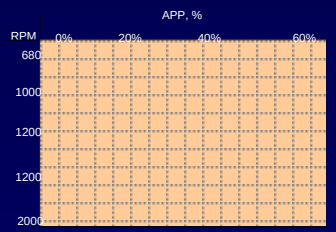
Rich Time / Lean Time

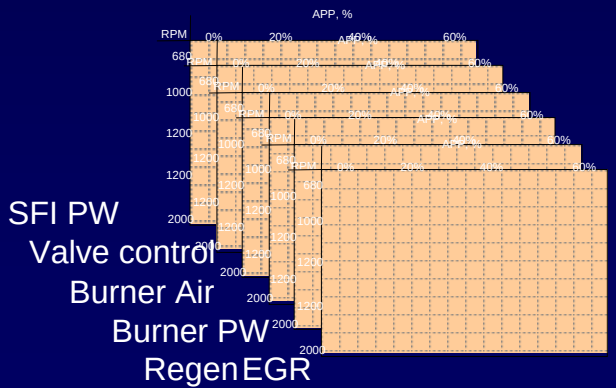
- Meter ratio of time spent lean to time spent rich.
- Can tune for all speed and load combinations.

Base Strategy

Lean Time

Rich Pulse Character





SFI PW
Valve control
Burner Air
Burner PW
Regen EGR

Not so good for transient

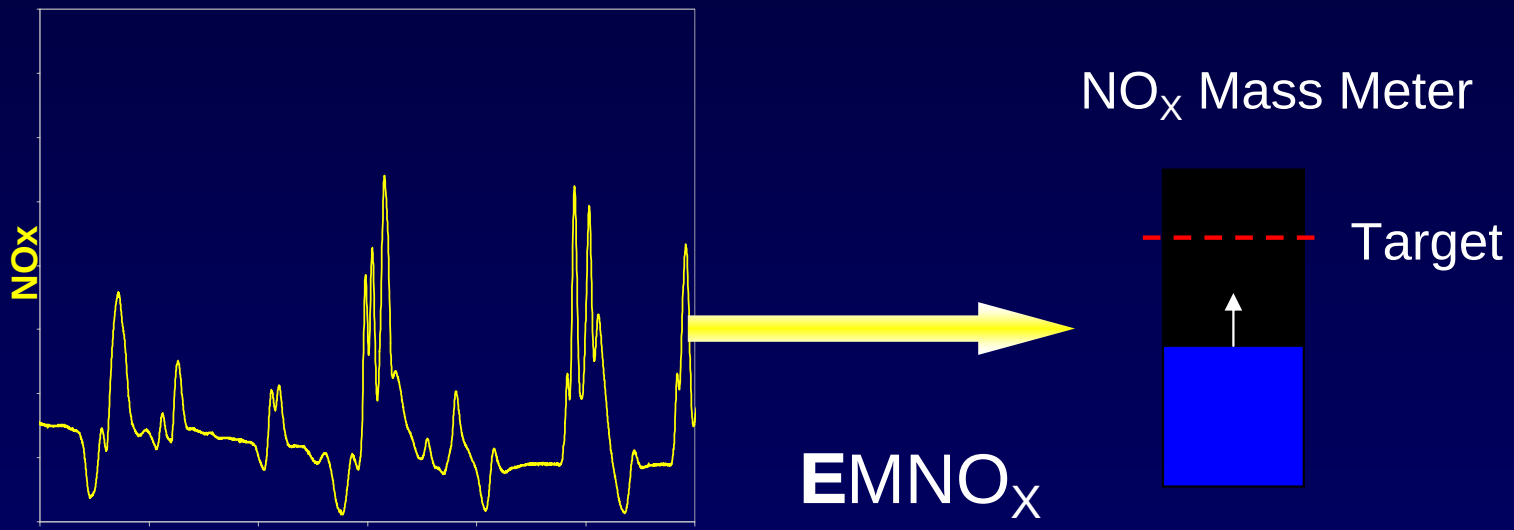
How do you decide when to regenerate?

Approach 1:
Rich Time / Lean Time

Approach 2:
NO_X Mass Storage Model

NO_X Mass Storage Model

Integrate Mass of NO_X Stored in NAC.
A Target Mass is Set to Trigger Regeneration.

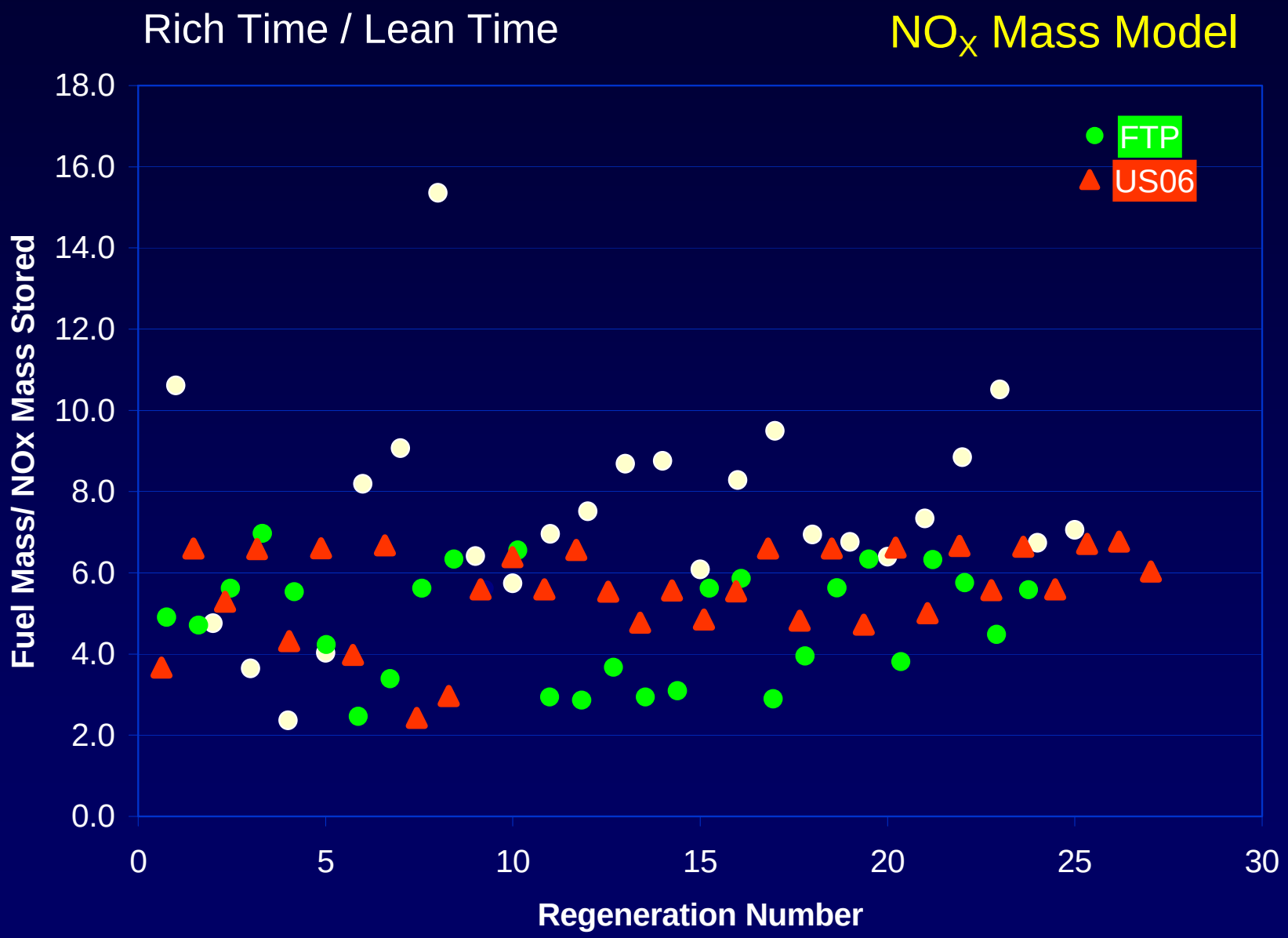


Better for Transient - Good for Any Combination of Driving

Reductant Control

Integrate Mass of NO_X Stored in NAC.
A Target Mass is Set to Trigger Regeneration.

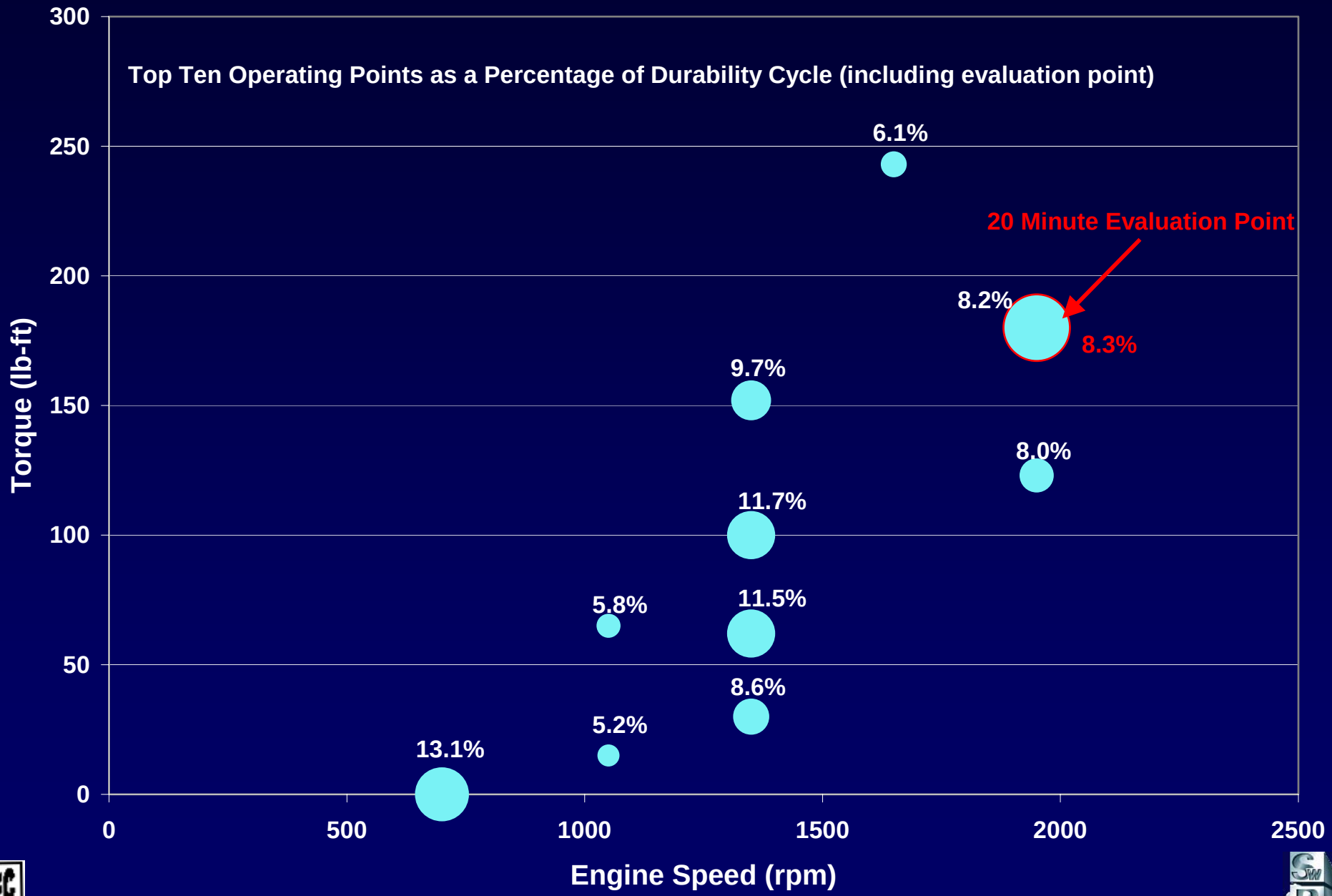
How Much Fuel?



Durability

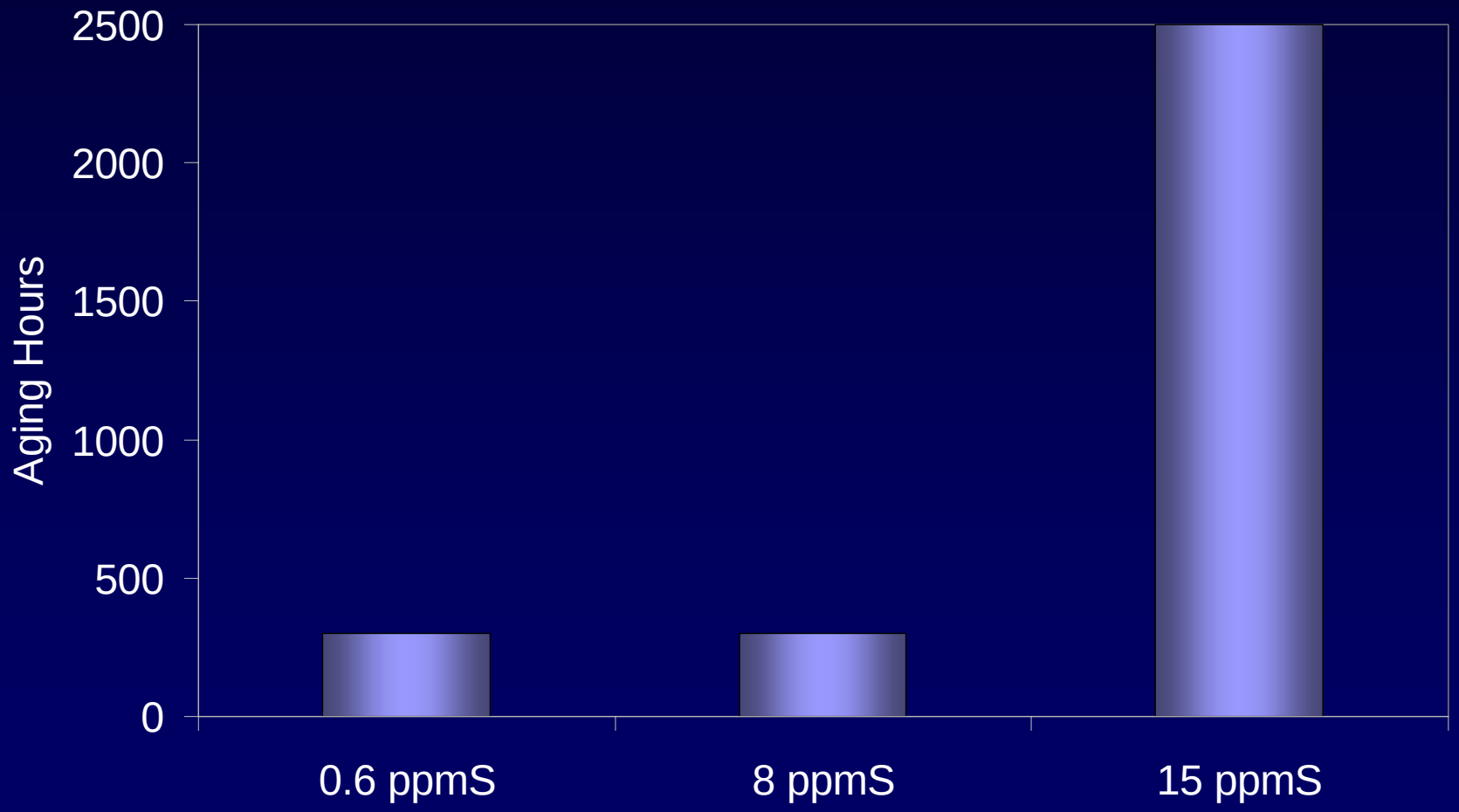
Set-up, Strategy Development, and Tuning Phase of Project Completed.
Durability Phase will Begin Next.

Aging Cycle - Based on LA92 Driving Cycle



Durability Goals for this Year

0.6 ppmS Aging in Progress. Desulfation Strategy in Progress.



End Date: May 2004

Thank-you for your attention.