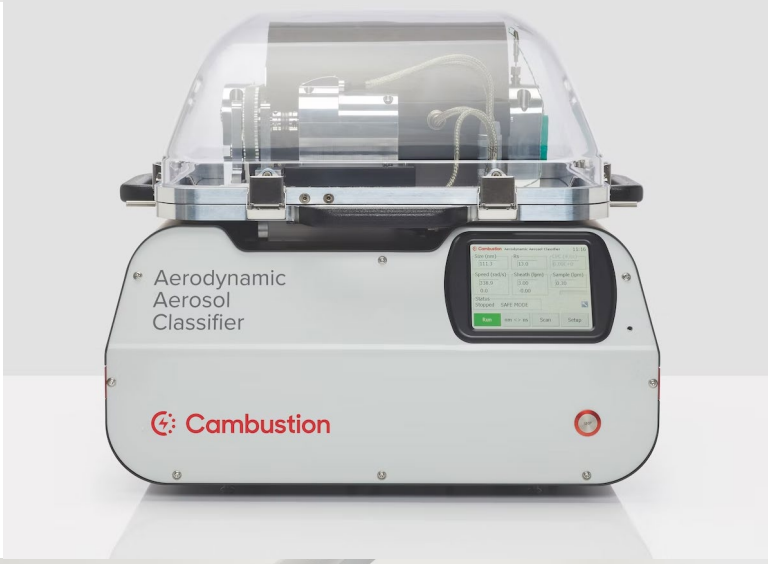
Cambustion

Particulate Filter Test System - the DPG

Cambustion Company Background

Founded in 1987 by a research group from Cambridge University Engineering Dept.

- Initially to develop fast-response FID (HC analyser), more gas and aerosol products followed
- Later broadened scope to include testing and engineering services focussed on emissions
- Long established connections with US motor industry
- We pride ourselves on our technical support, especially with the DPG!



Cambustion DPG Particulate Filter Test System

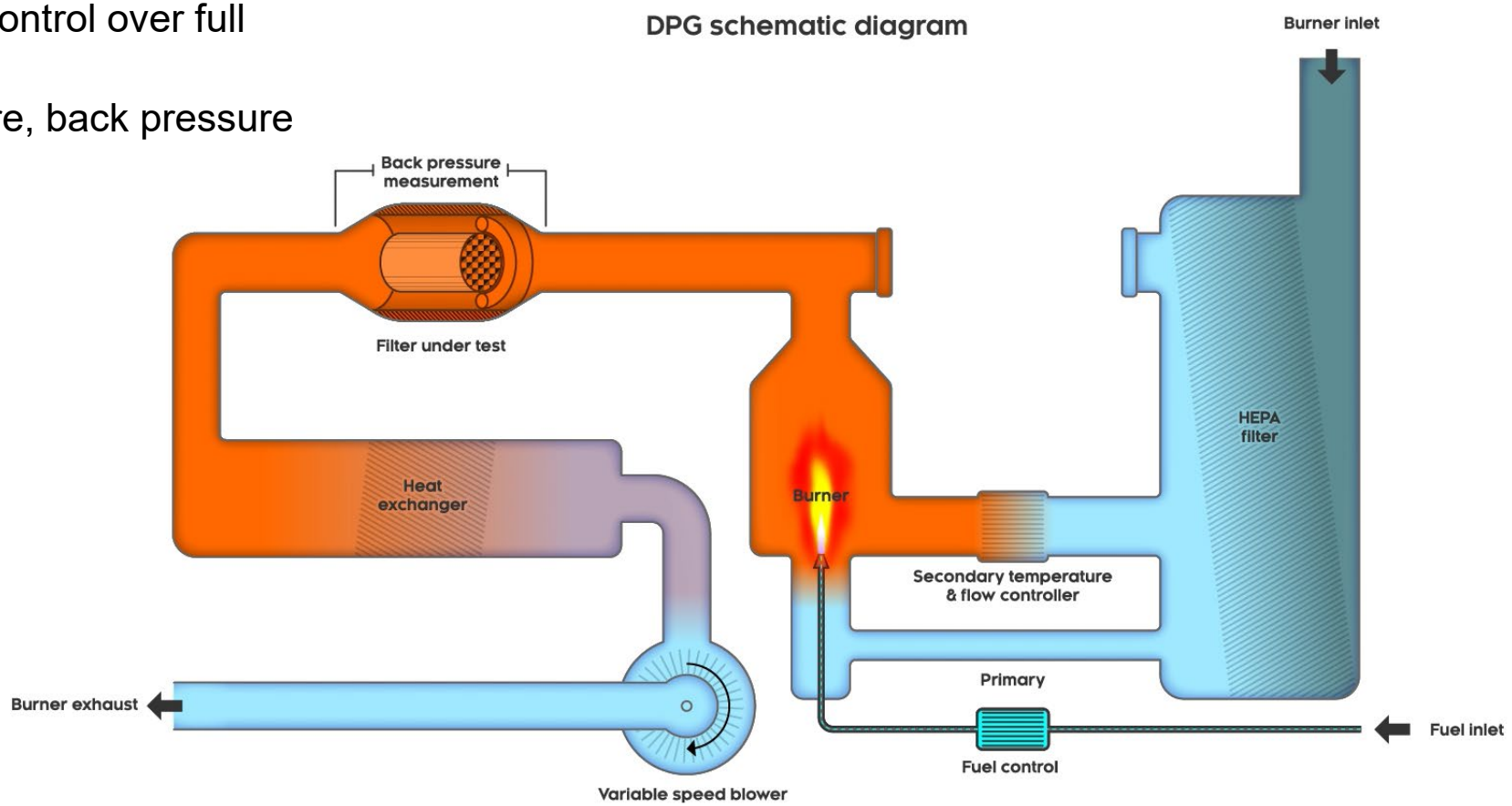
Topics of discussion:

- **The DPG hardware**
- Soot loading
- Filtration efficiency
- Regeneration simulation
- Automated durability cycles
- Ash loading

Cambustion DPG Particulate Filter Test System Hardware

The DPG system incorporates

- Diesel fuelled burner for particulate matter generation
- Temperature and flow control over full engine range
- Test internal temperature, back pressure and filtration efficiency



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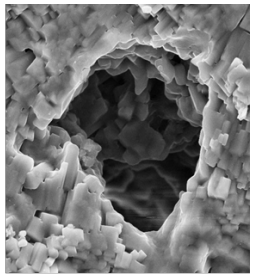
DPG Soot Load vs Pressure Drop Testing

Pore filling phase – pressure drop rises rapidly as pores block with soot. Low filtration efficiency.



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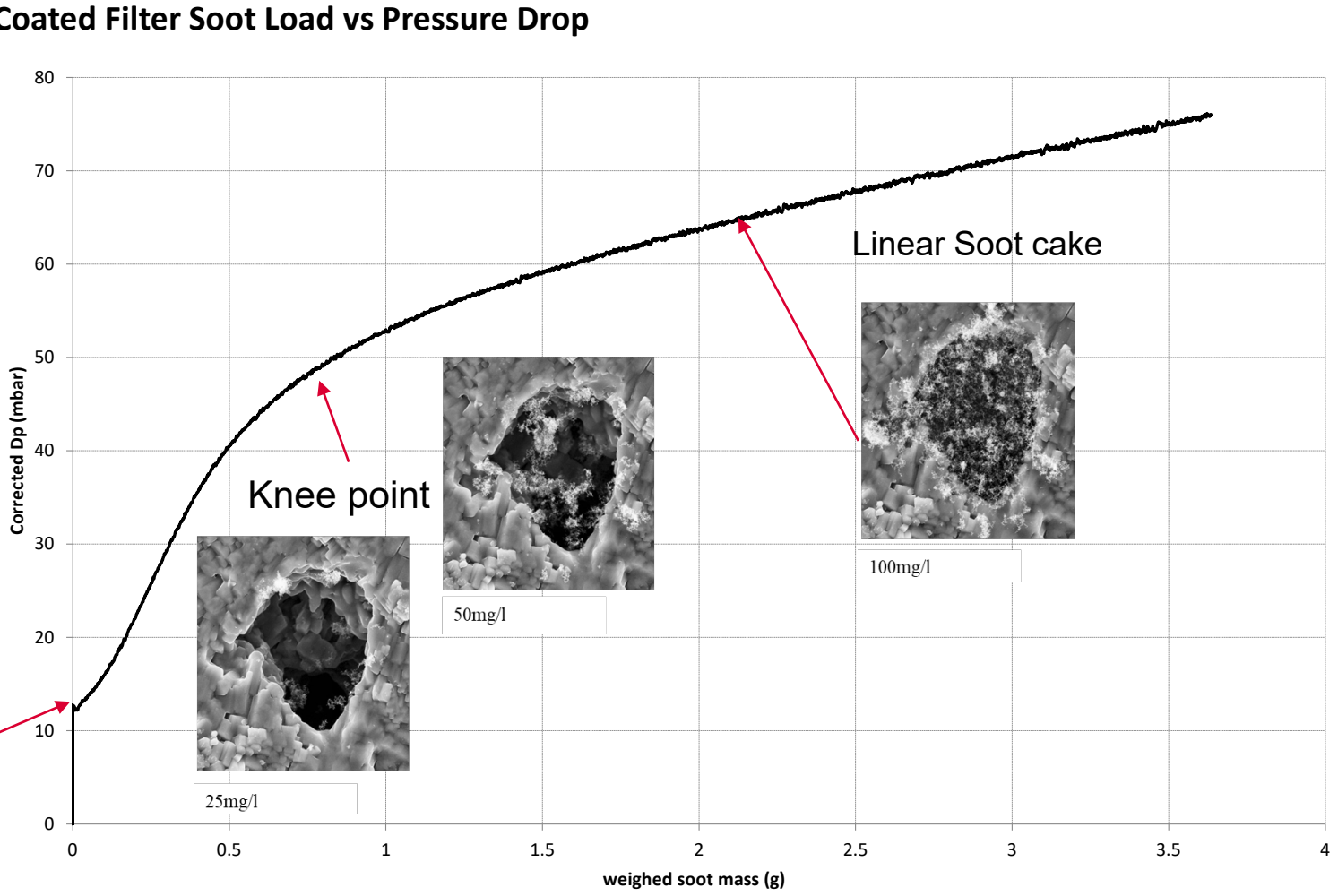
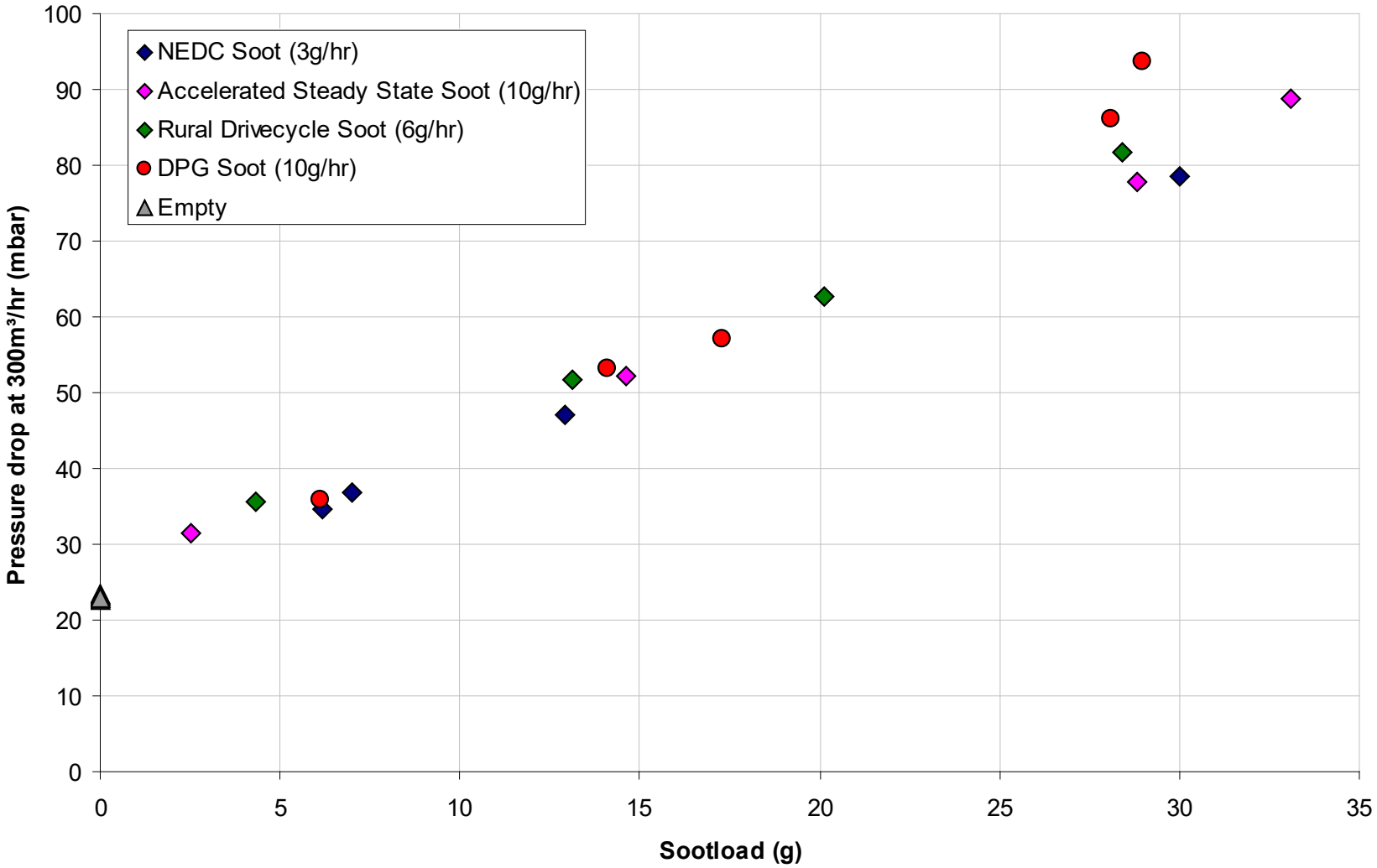
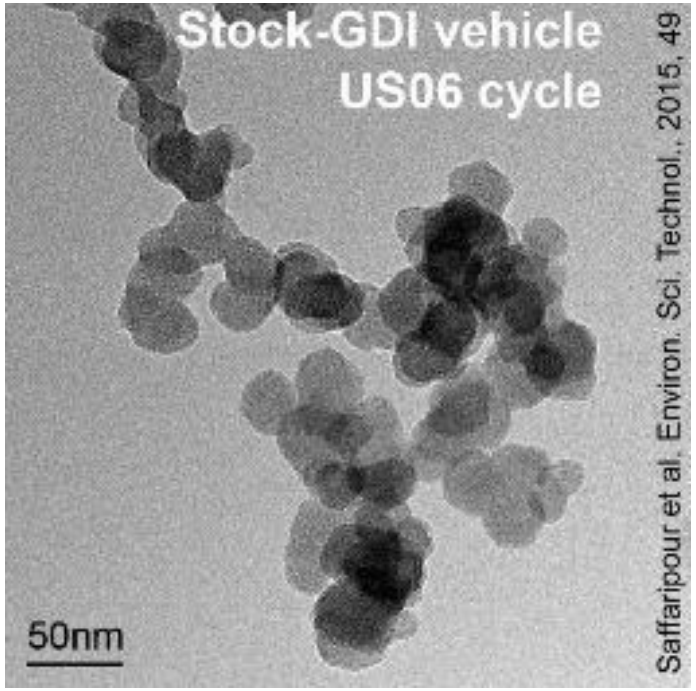


DPG Soot Behaves the Same as Engine Soot

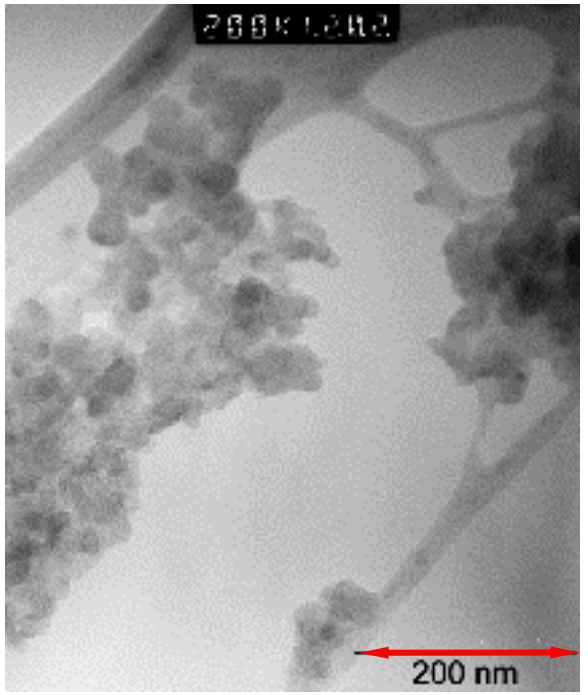


DPG Soot Structure is Representative of Engine Soots



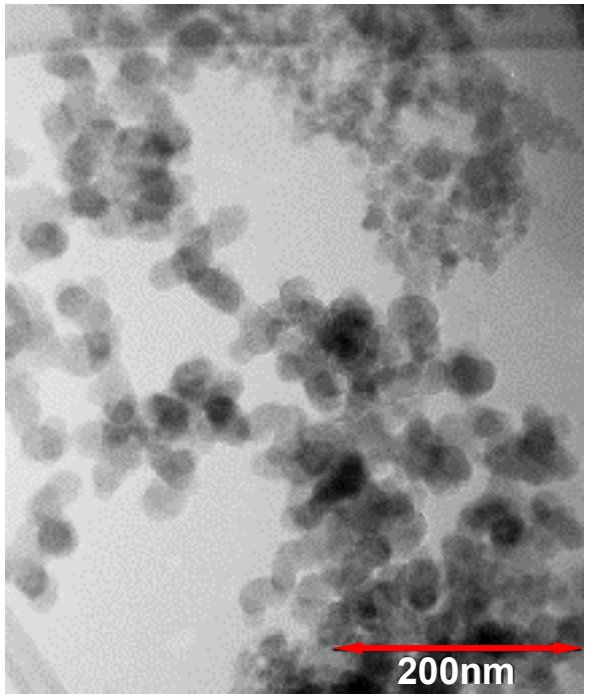
GDI engine soot

Saffaripour et al, Environ. Sci. Technol., 2015, 49



Diesel engine soot

Dr Peter Harris, Centre for Advanced Microscopy, University of Reading



Cambustion DPG soot

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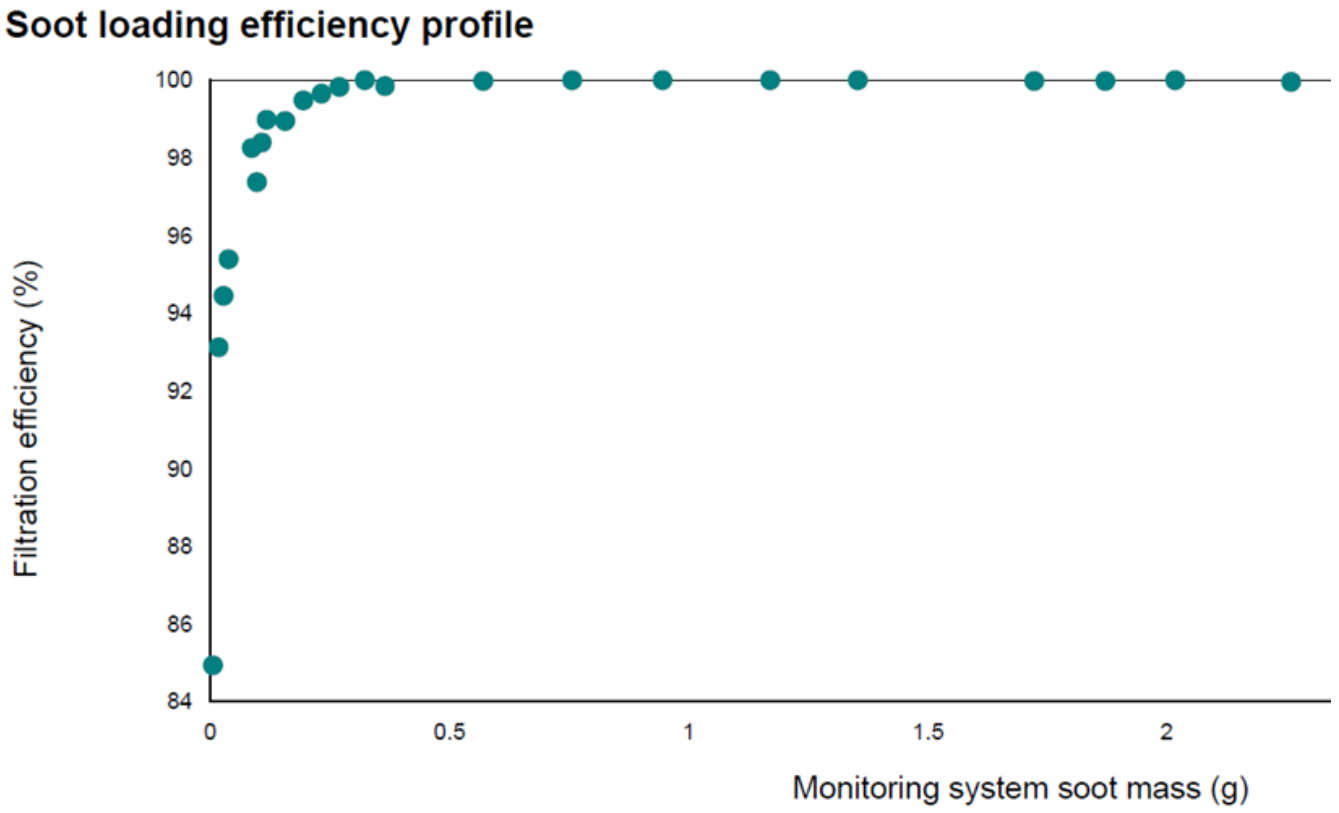
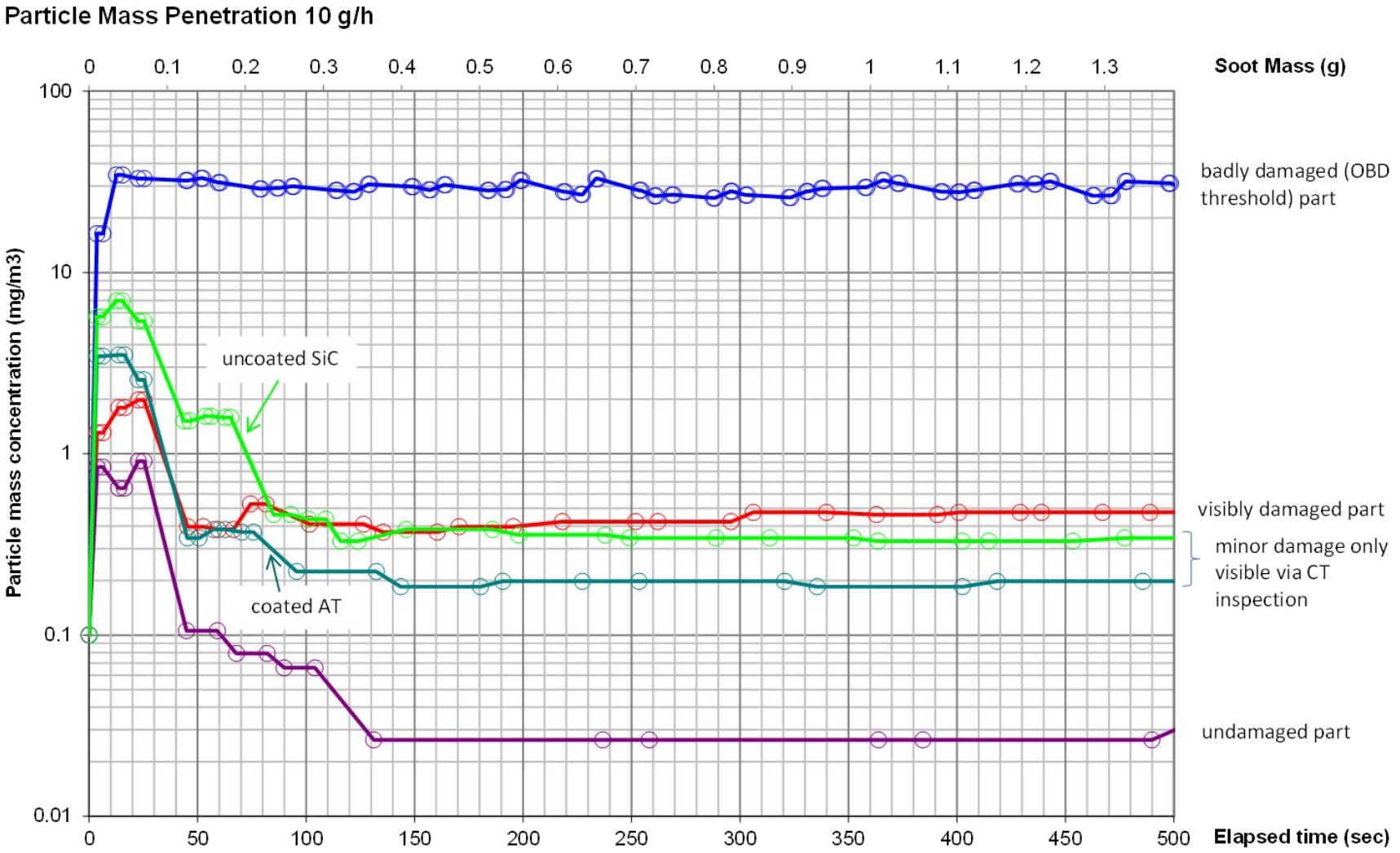
Filtration Efficiency Measurement – Integrated mass concentration

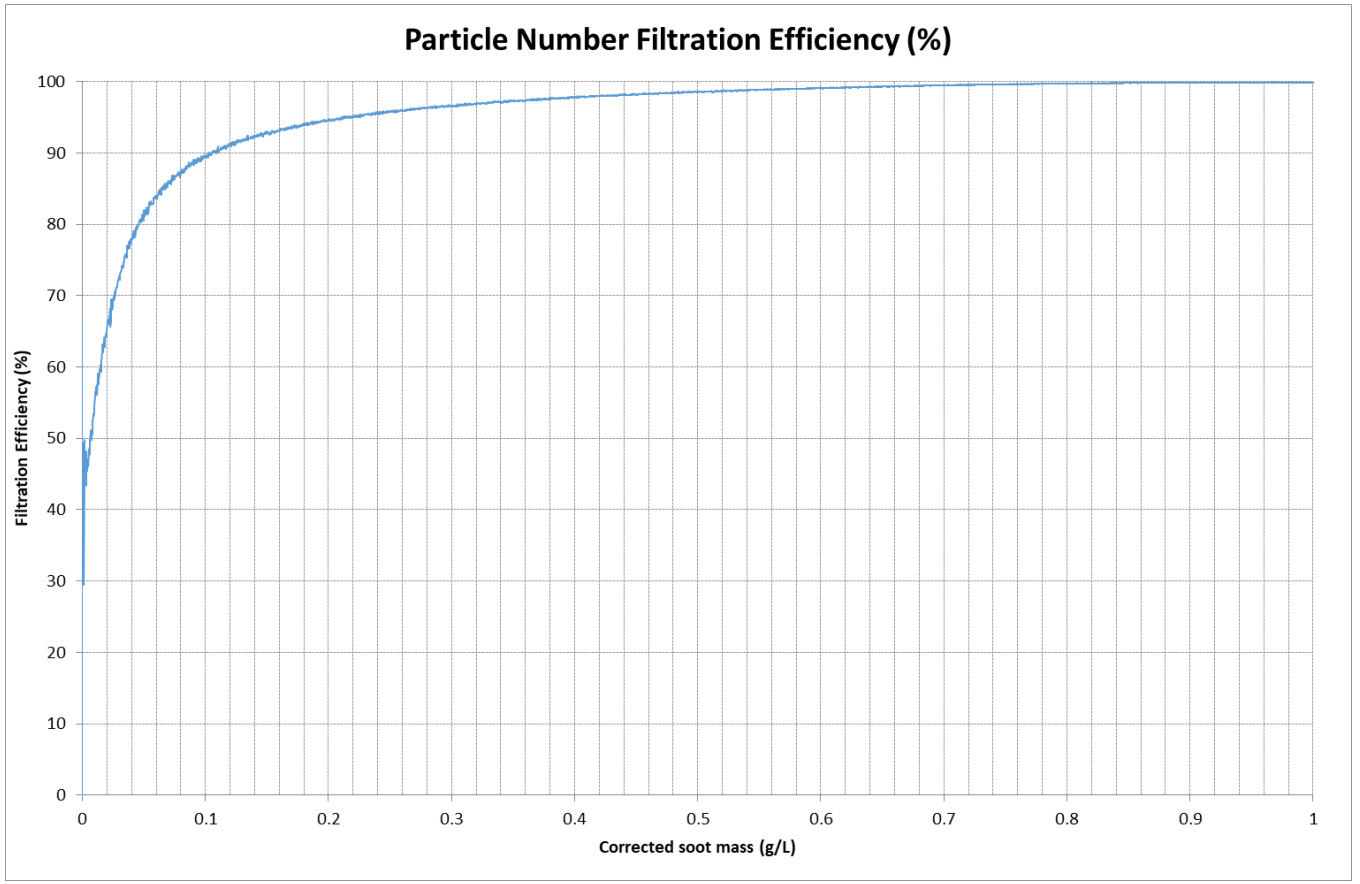


Filtration Efficiency Damage Assessment

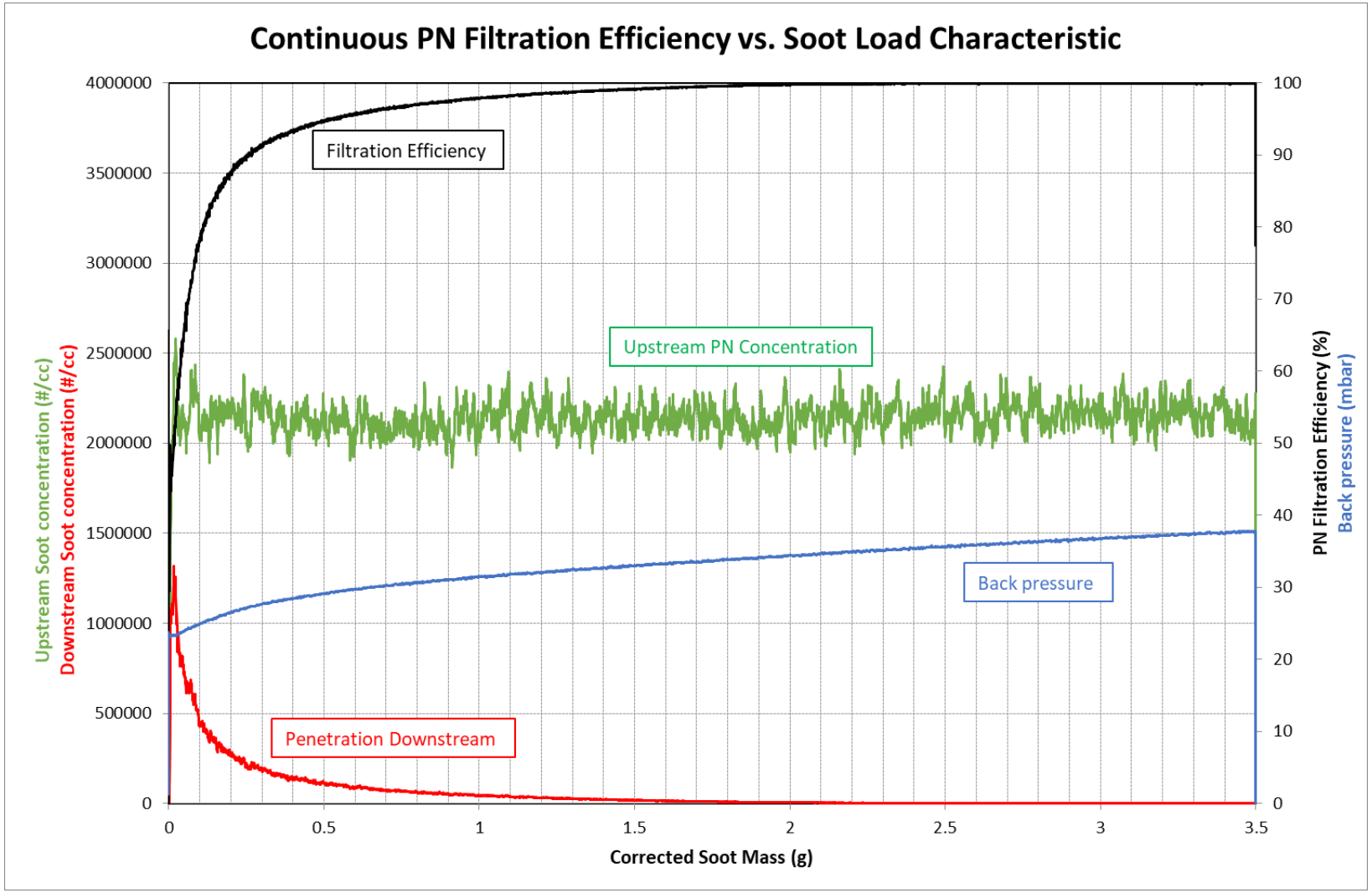
Filtration efficiency with soot load is strongly affected by damage to the filter.



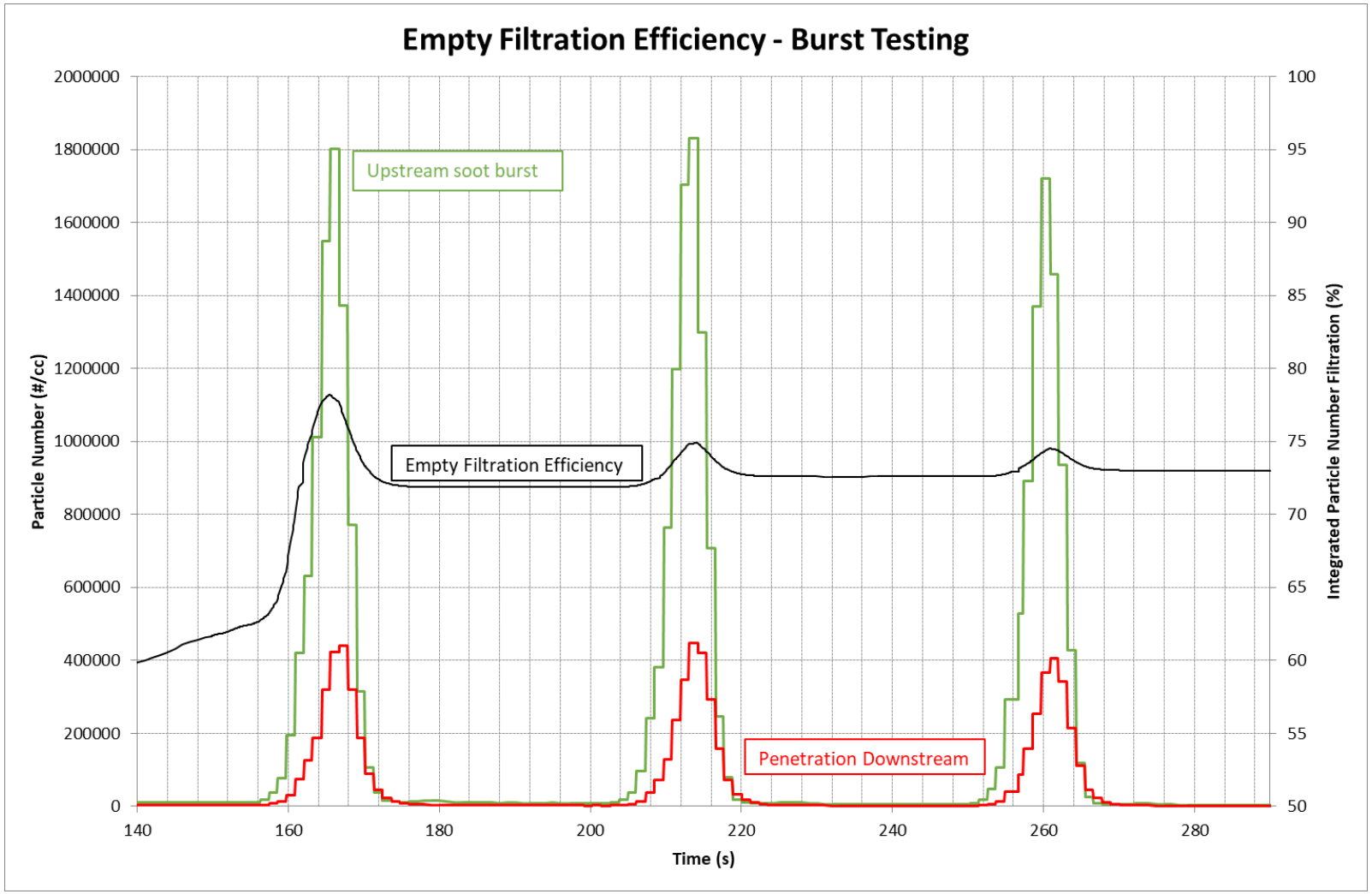
Particle number (PN) base Filtration Efficiency



Soot Load – Back Pressure and PN Filtration Efficiency



Empty Filtration Efficiency – Integrated Particle Number



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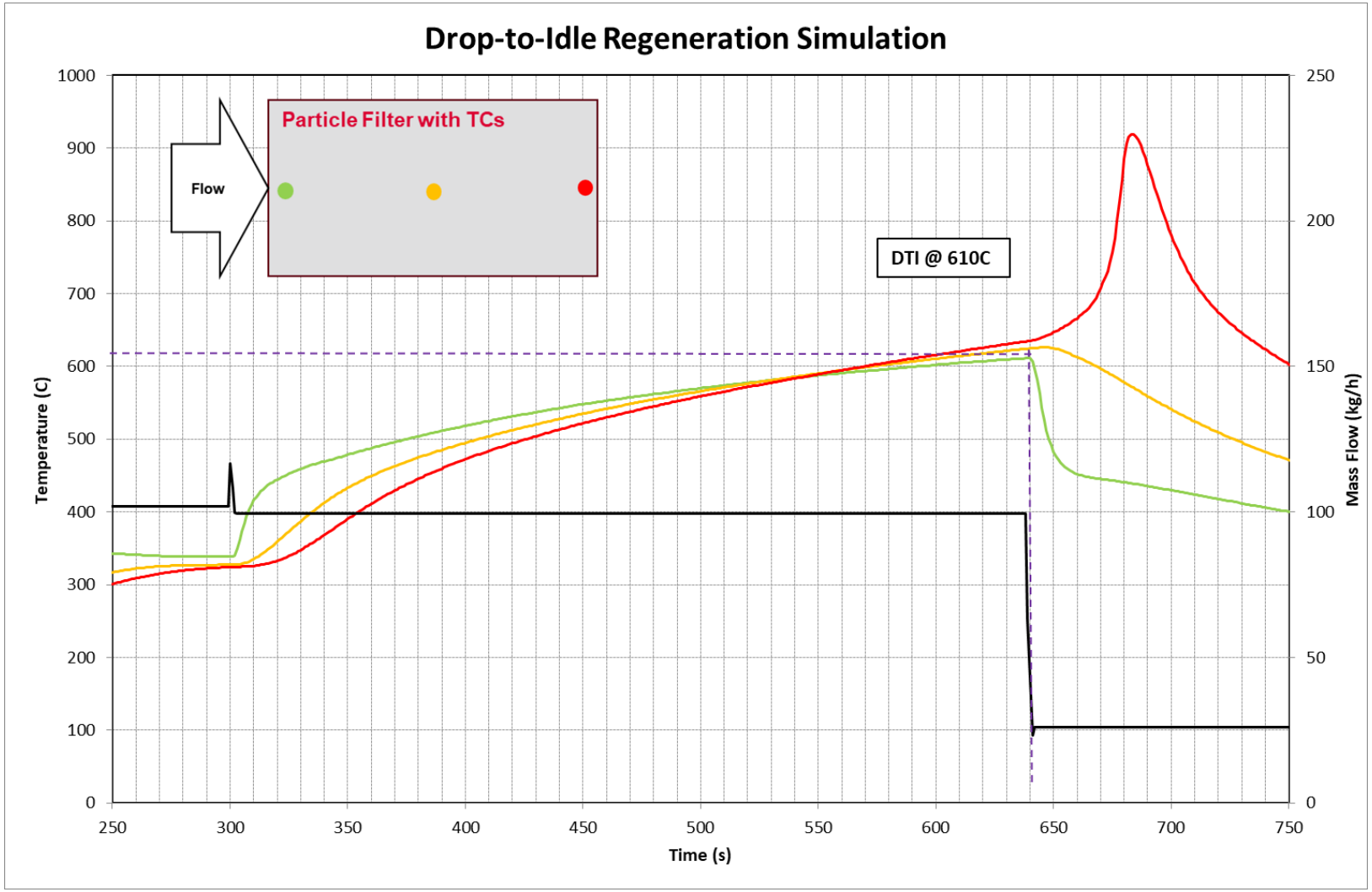
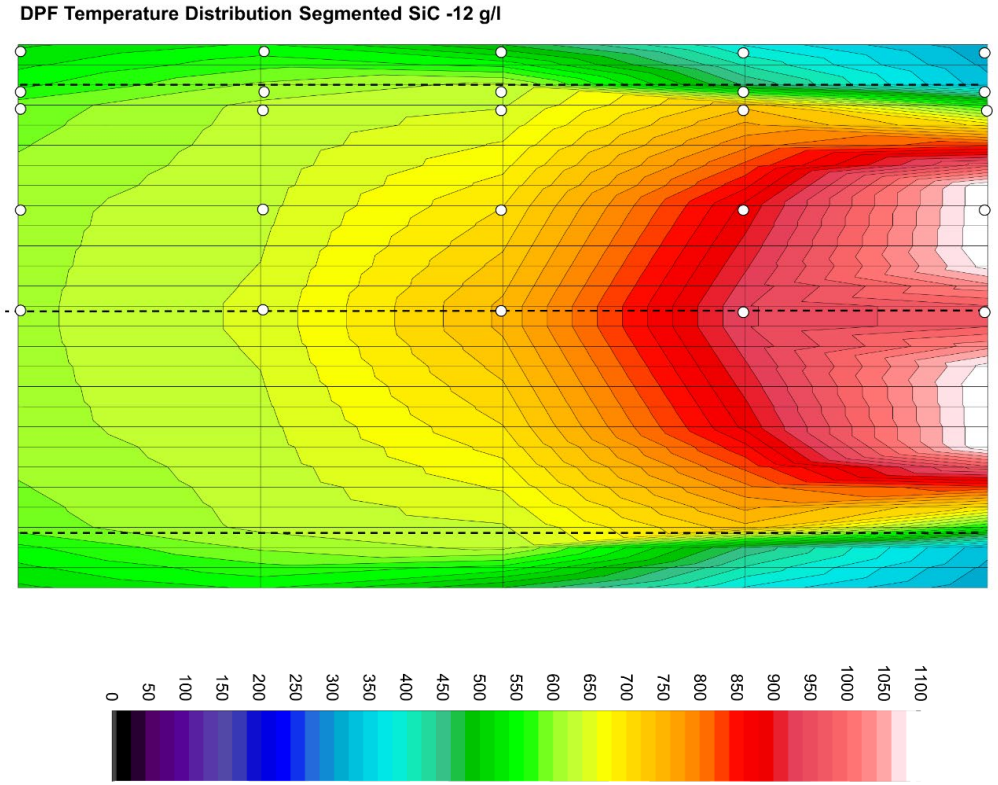
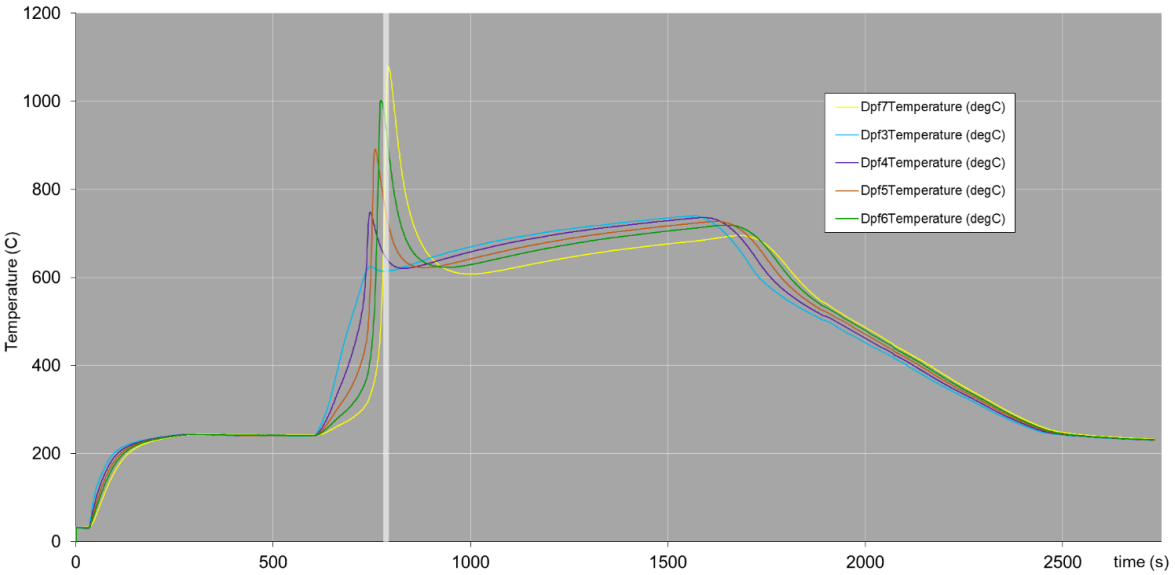
Simulation of Drop-to-Idle Regeneration



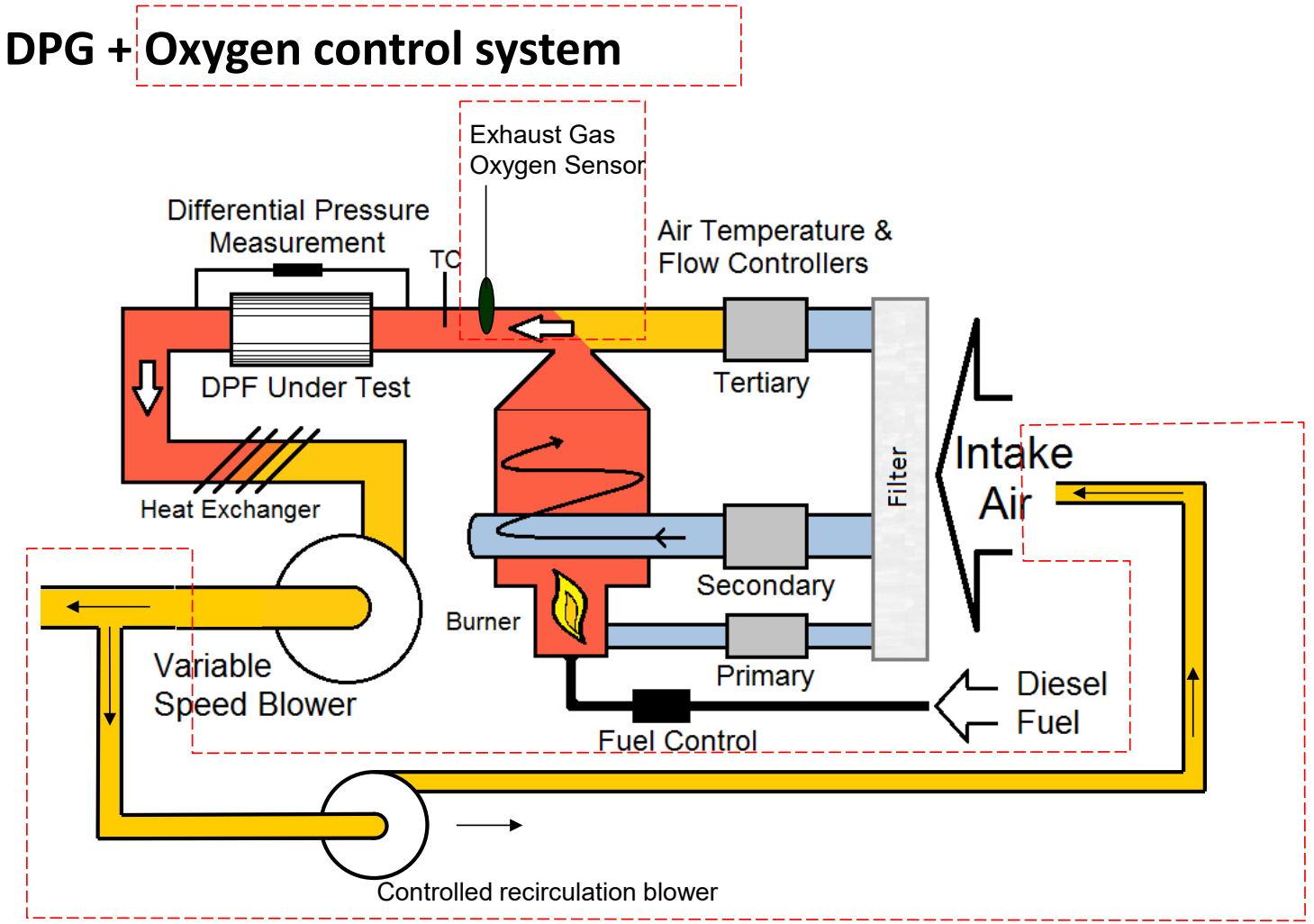
Used in development filter robustness.

Regeneration Temperature Distribution Measurement

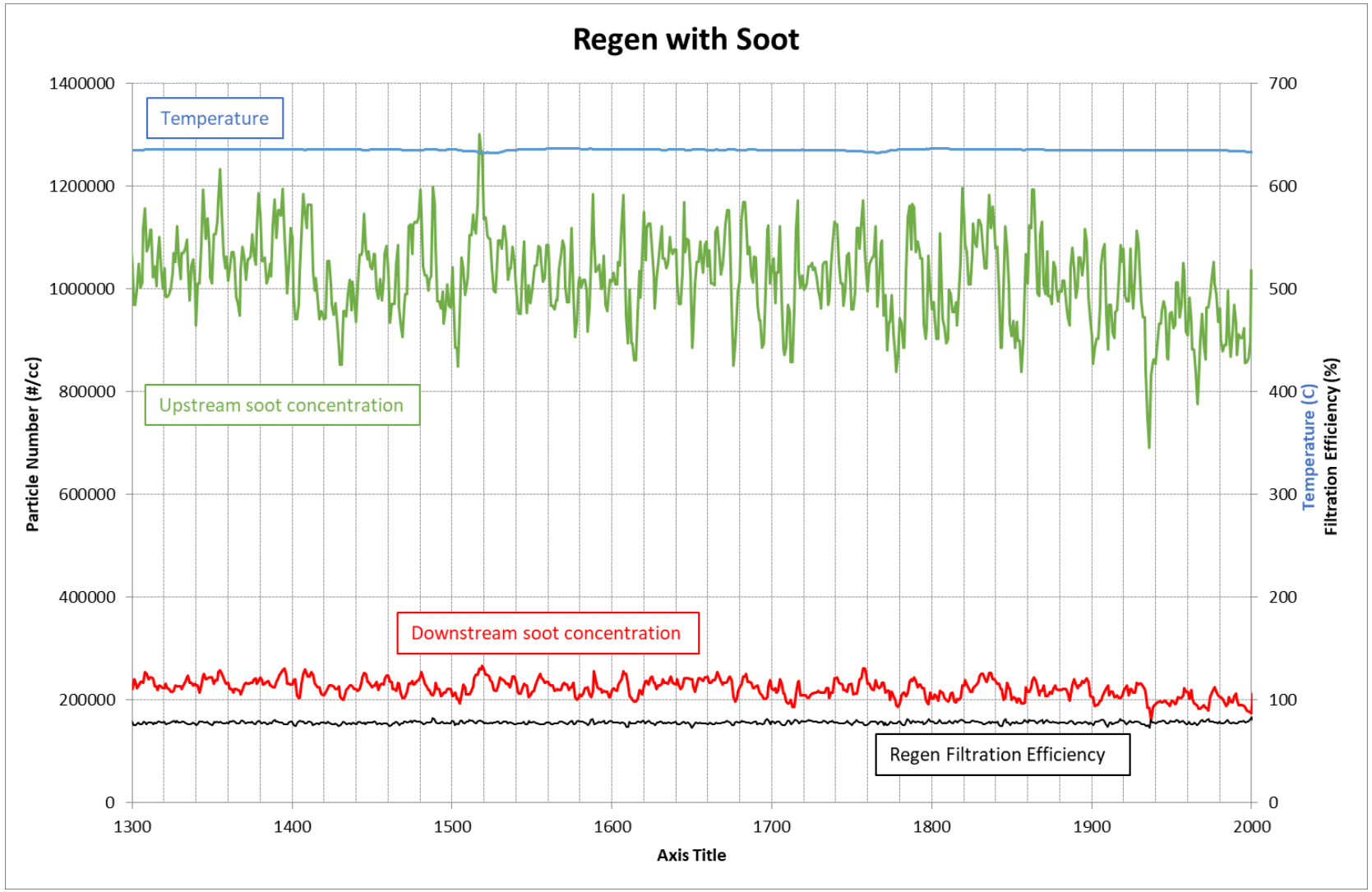




Optional Control System allows simulation of Exhaust O_2



Regen with Soot Load Filtration Efficiency



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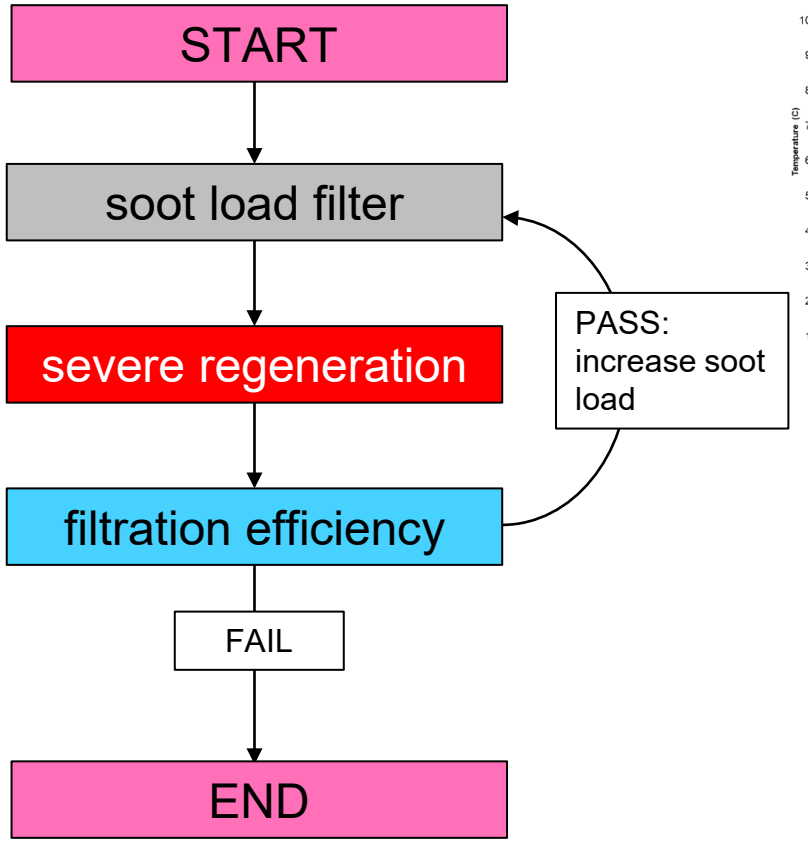
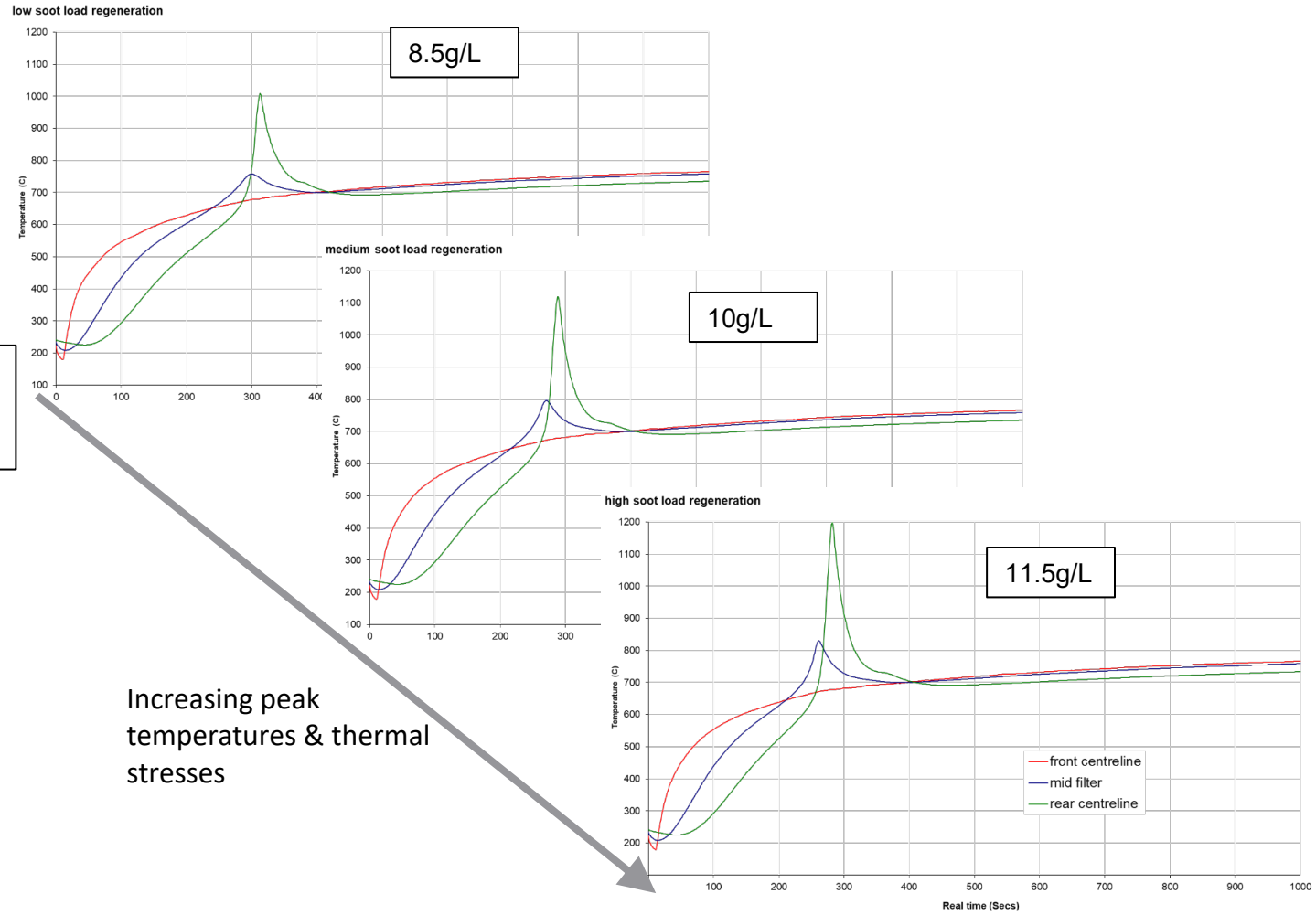
- **Automated durability cycles**
- Ash loading

Durability Cycles - Soot Mass Limit Testing (SML)





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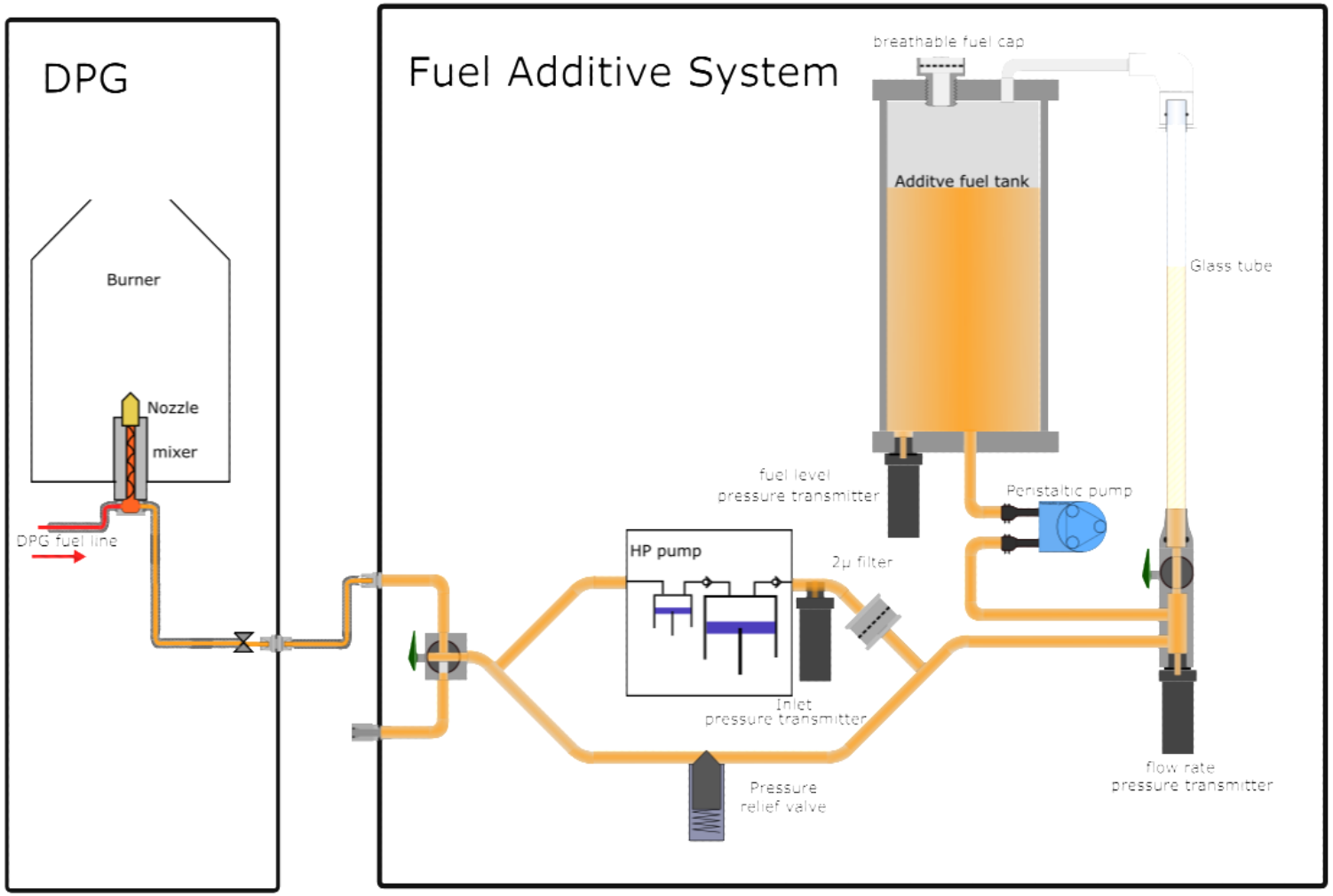
DPG Fuel Additive System

Combustion of Lubrication Oil to create Plug and/or layer Ash

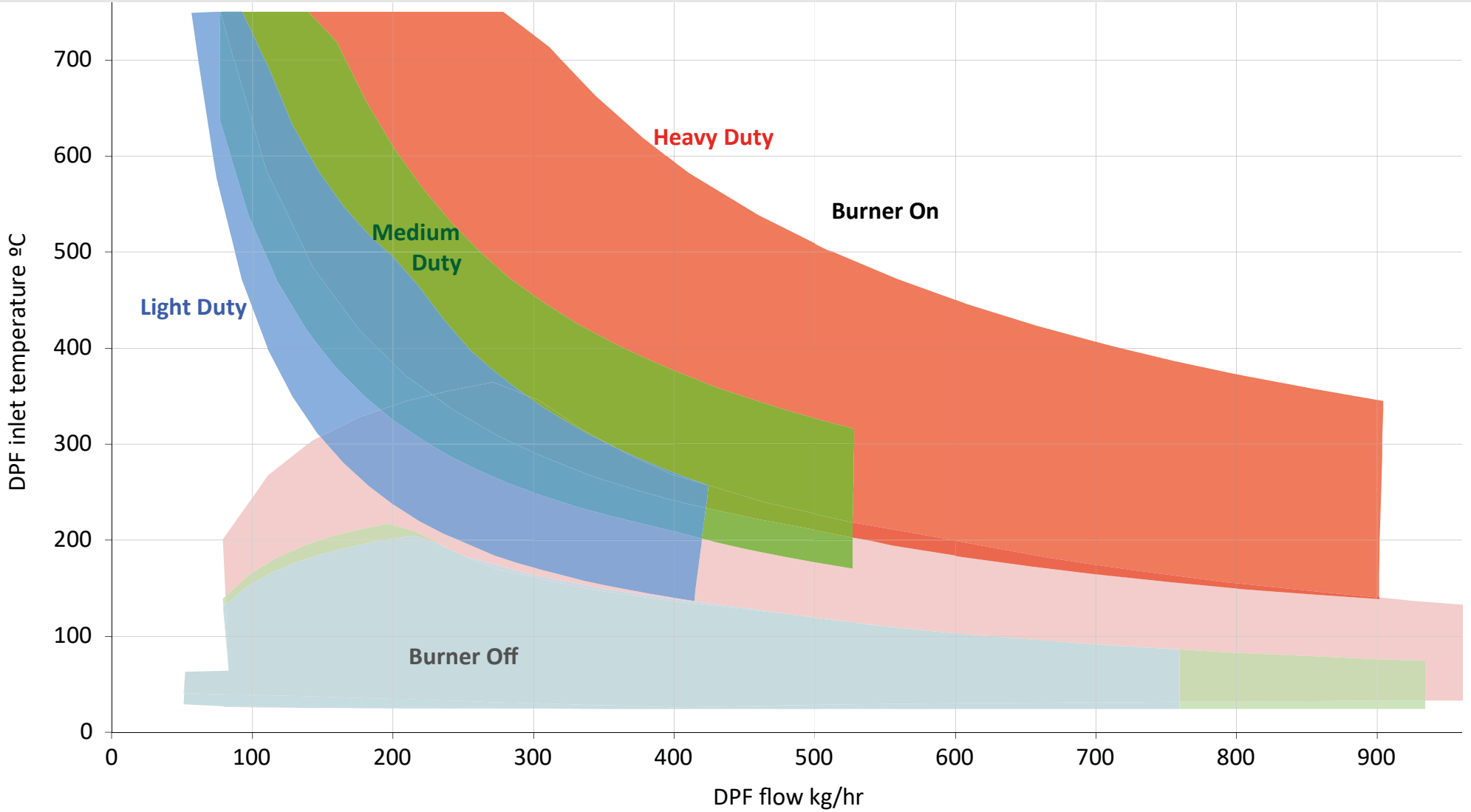
Other liquids can be combusted inside the DPG, such as:
Fuel Born Catalysts
Adblue
Water



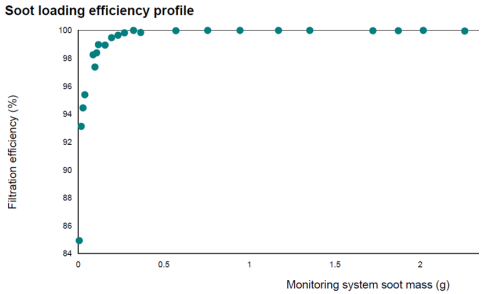
Automated Ash Loading of Filters

Primary air flow into flame reduced to generate soot.
Fuel additive system used to inject oil additive into flame to generate Ash.

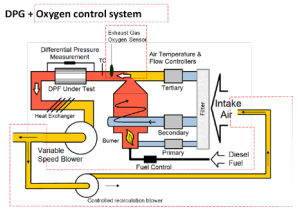
Light, Medium & Heavy Duty Versions

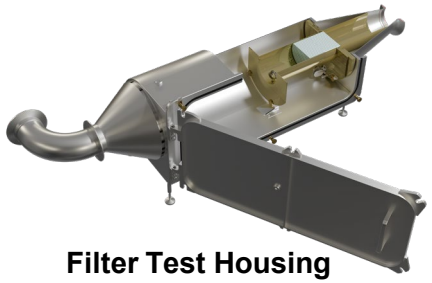


DPG Specification Range



Particle Mass Measurement

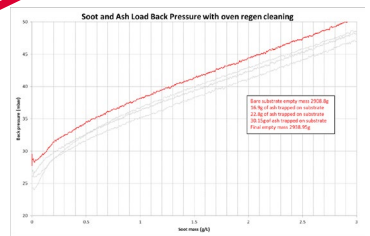




Filter Test Housing

DPG Baseline Specification:
The basic offering which will allow the user to load pre-canned particle filters with soot, run regeneration schedules and measure a basic level of filtration efficiency measurement.

Ashing

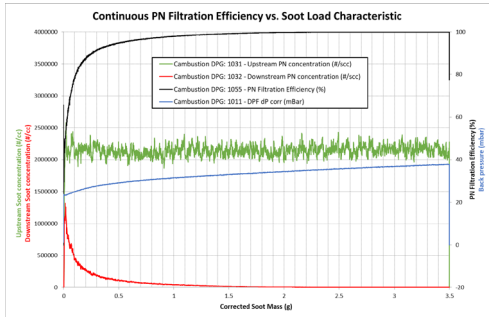


Additional exhaust blowers

Stage 7 - Stability upgrade

DPG Stage 7 Specification:
Intended for end-of-line production or quality control environment where stability and repeatability are the key focus. Higher accuracy pressure measurement, with control of all air system temperatures, fuel flow metering and automatic internal temperature management for absolute control of the burner conditions.

Particle Number Measurement



Thank you! Any Questions?