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GPF Technology to meet BSVII

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GPF Technology to meet BSVII

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Three-Way Filters (TWF®)

A Three-Way Filter (TWF®) is a gasoline particulate filter (GPF) with a JM catalyst coating. Gasoline vehicles fitted with Johnson Matthey TWF technology can reduce particulate numbers by up to 99%.

A TWF also displays catalytic activity, providing significant reductions of gaseous emissions (HC, CO, NO_x), as well as filtration of fine particles.



Composition

Typically, precious metals (Pd, Pt or Rh) with alumina and rare earth oxide supports, coated on filter substrate.

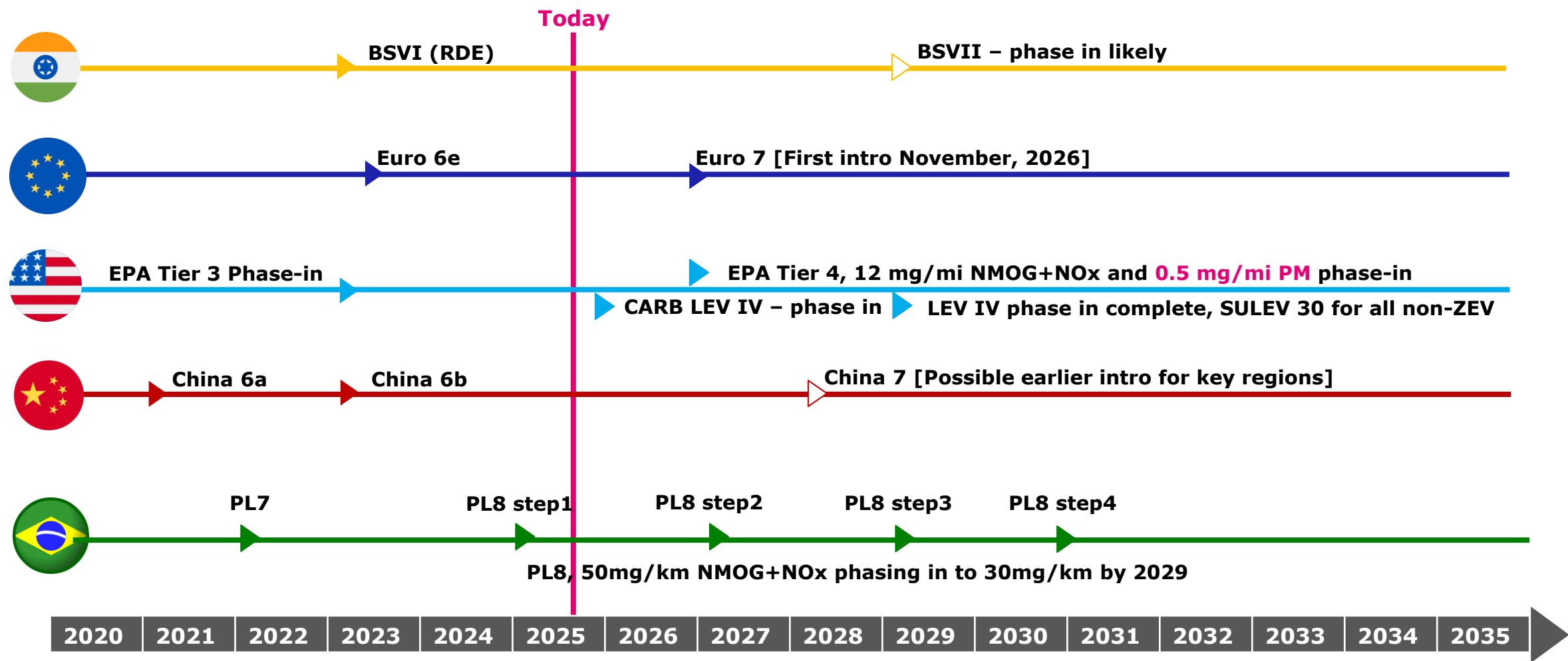
Key requirements

Tailored coatings optimised to customer needs. They balance filtration, three-way conversion and backpressure performance as well as durability needs.



Reference URL
<https://matthey.com/products-and-markets/transport/mobile-emissions-control/gasoline-applications#read-more>

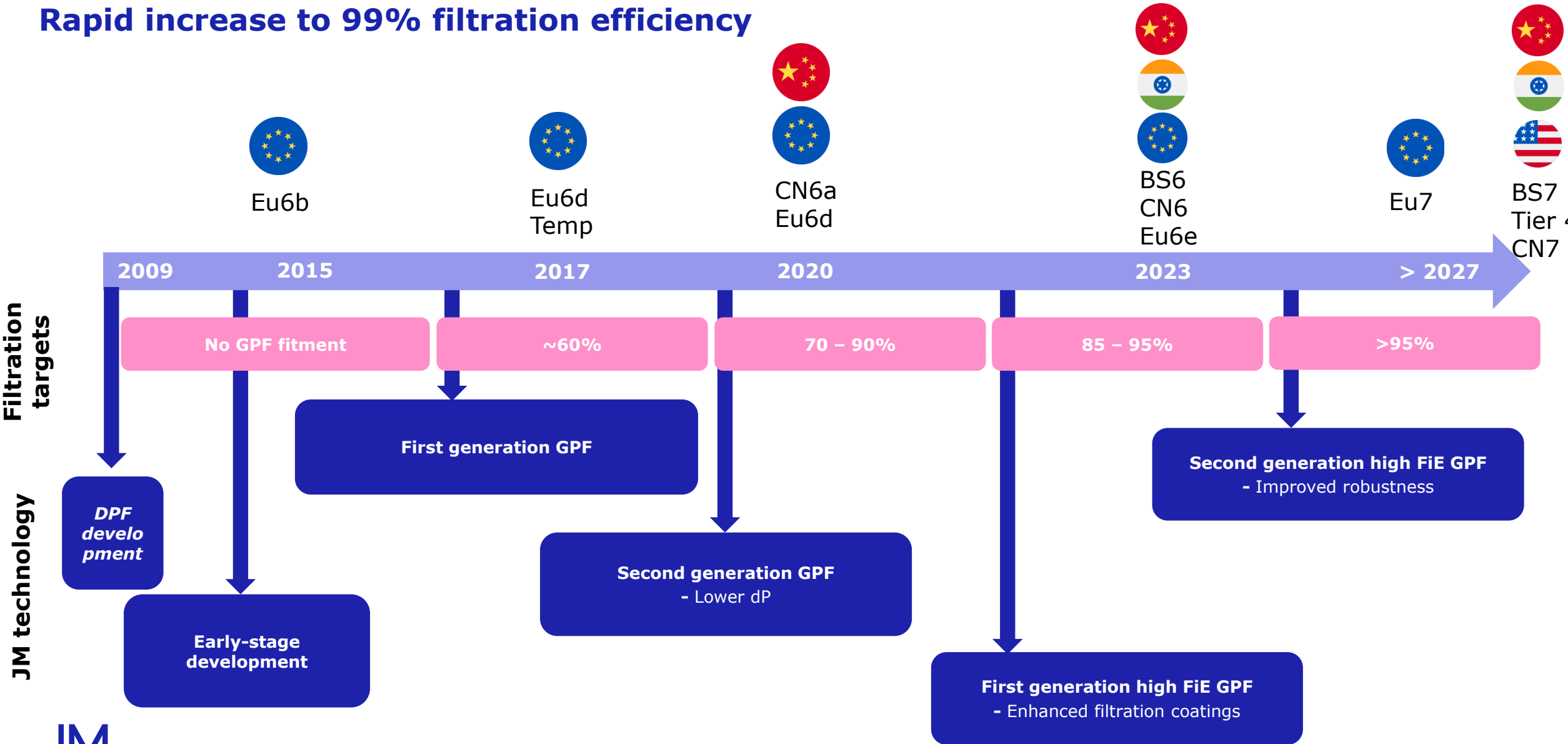
Global emissions regulations for Light Duty passenger cars



Criteria emissions (NOx, PN etc.)

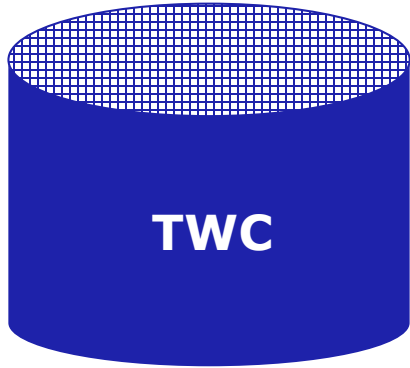
Timeline of gasoline particulate requirements

Rapid increase to 99% filtration efficiency

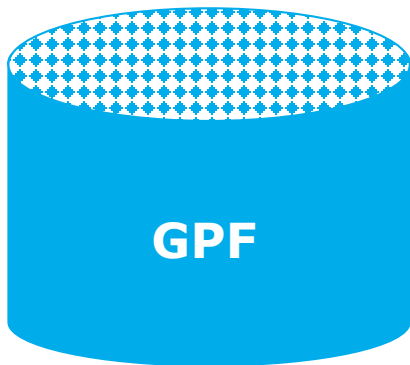


Gasoline Product portfolio

Technology Summary



- Automotive supplier for >50 years
- **High temperature resistant technology** ready for BSVII deployment
- Global presence with market leading technology
- Working to supply the industry with **optimised PGM levels**
- Development for alternative fuels (CNG/Ethanol) catalyst continues

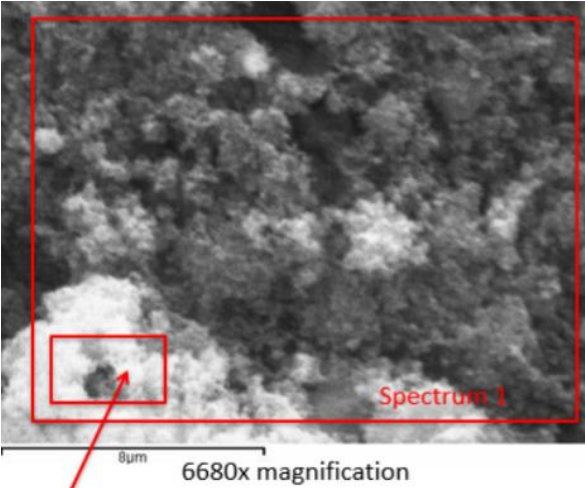


- Automotive supplier since Euro 6d (2017)
- **High filtration efficiency** technology ready for BSVII deployment
- Global presence with market leading technology
- Tailored technology solutions, **balancing backpressure, filtration and conversion**

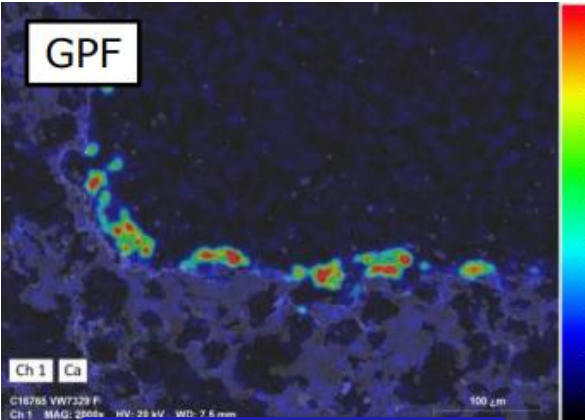
Particulate Matter and Number

What is Gasoline particulate?

Feature	Particulate Mass (PM)	Particulate Number (PN)
Definition	Total weight of particulate matter emitted	Total count of particles emitted
Size Sensitivity	Captures larger particles & volatile organics	Sensitive to ultrafine particles (<0.1 µm)
Measurement Method	Gravimetric filters or microsoot sensors	Condensation particle counters (CPC) or diffusion chargers
Regulatory Use	Widely used in BS6 and earlier standards	Expected to be included in BS7 (aligned with Euro 7)
Technology Response	Engine calibration, particulate filters	Particulate filters, advanced combustion control



Soot



Ash

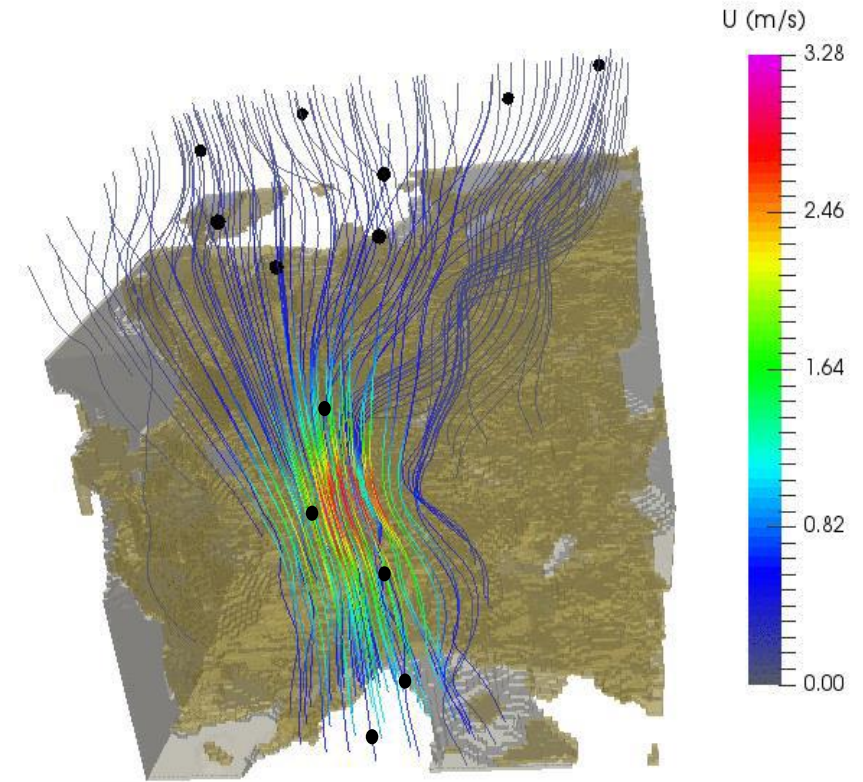
Particulate emissions

The Filtration Challenge

Filter through-wall characteristics often result in more exhaust gas flow travelling through the easier (open) routes.

In conditions such as fresh performance or high exhaust gas flow it may be challenging to meet filtration legislation limits or engineering target.

Advanced filtration technologies have been developed for Euro 7 with RDE and cold start emissions as the focus.



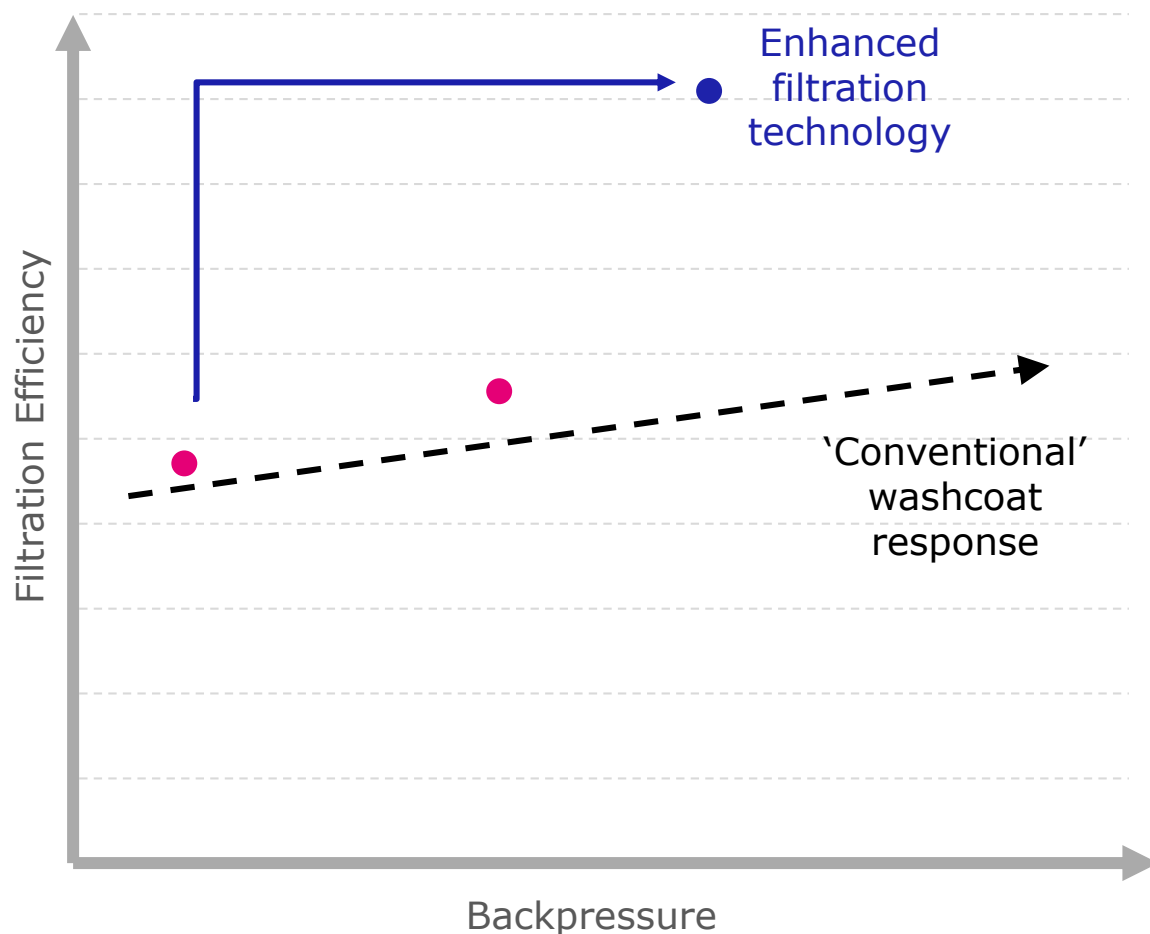
3D-Image of filter wall and gas flow simulation

Shows potential for particulate slip through the filter wall

<https://doi.org/10.1016/j.cattod.2017.12.025>

Particulate emissions

Eu7 development solutions for high fresh filtration efficiency



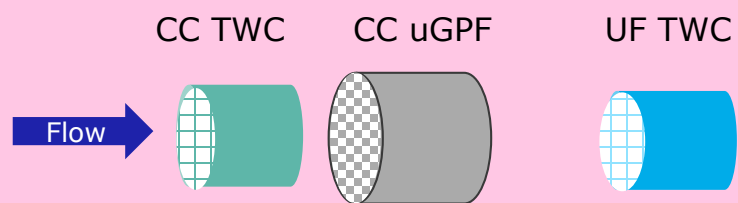
Traditional washcoat designs correlate between filtration efficiency and backpressure response.

Applying coating to the area of highest flow breaks the traditional relationship and significantly increase filtration with less impact to pressure drop.

Very high levels of filtration >99% can be achieved.

Gasoline Aftertreatment system designs

Dependant on engine, calibration and requirements



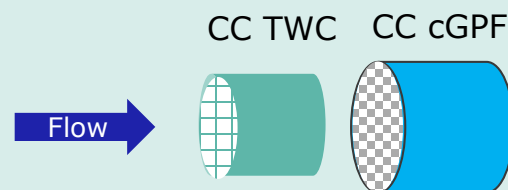
'Eu7 type system'

Boundaries Coating

- Coatings well designed for requirements
- Latest GPF technology offers potential to eliminate 3rd brick

Expectations

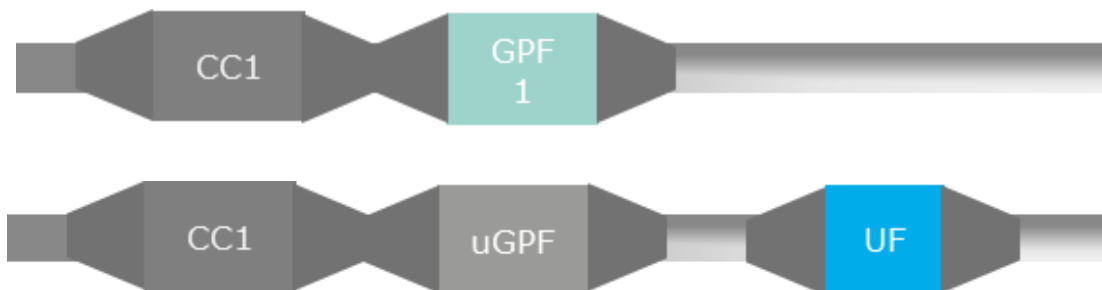
- Reduced max temperature
Less lambda swings
- Reduced flow
- Focus on cold start and re-start



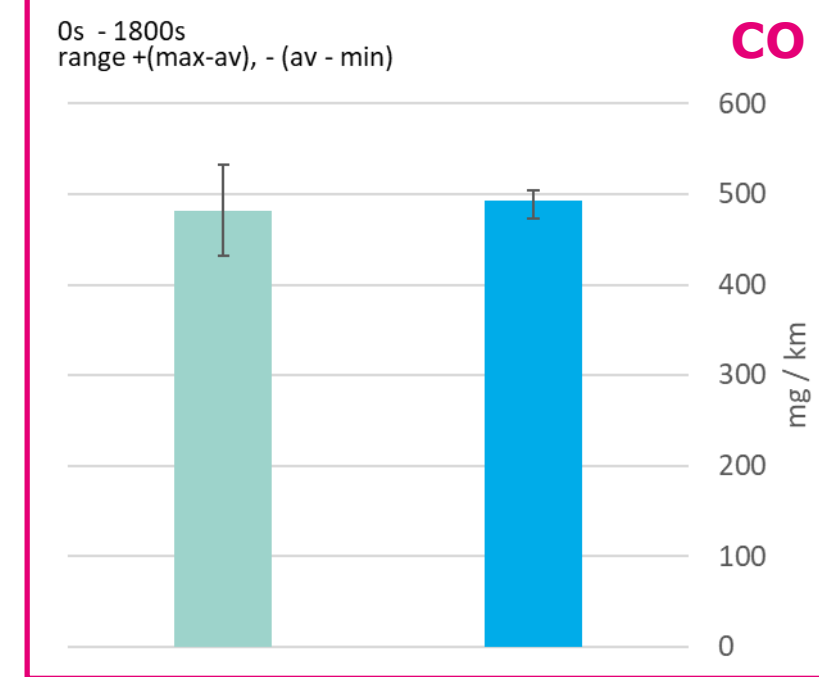
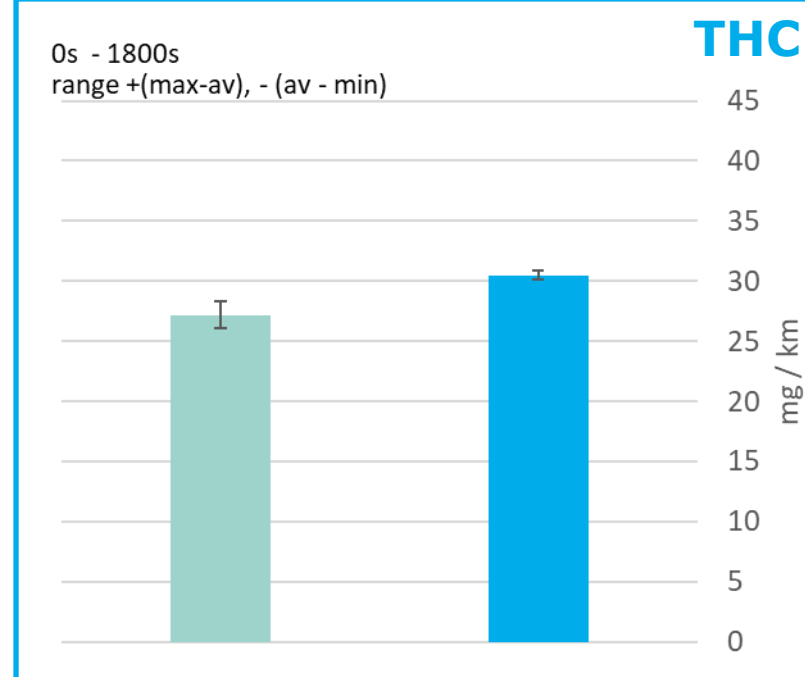
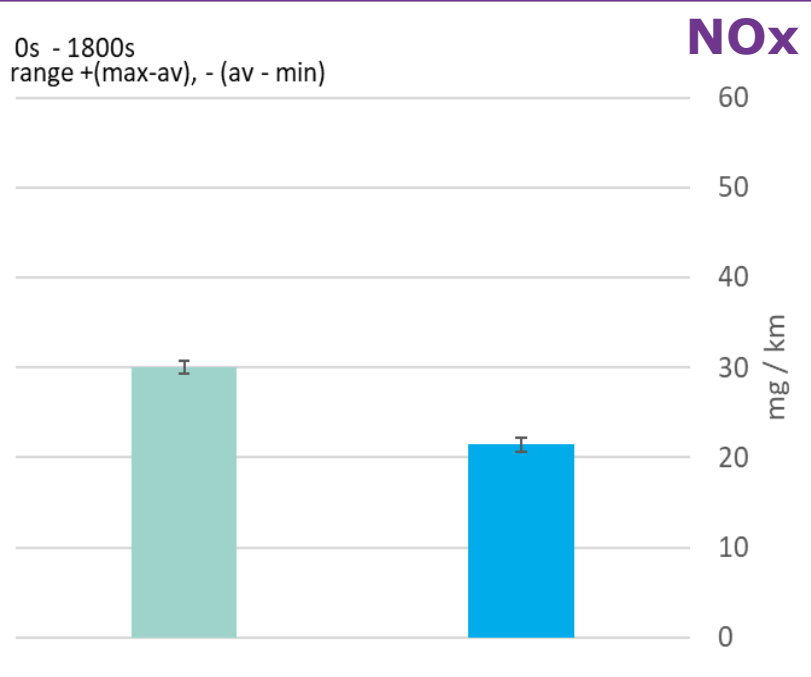
Consolidated system

Round, Oval or
Race-track
substrate contours
can be used
depending on
package constraints

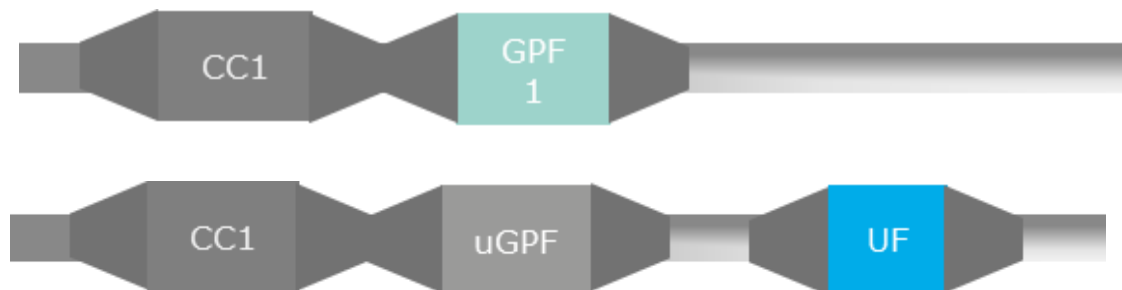
Coated GPF creates opportunity to reduce number of catalysts whilst maintaining performance



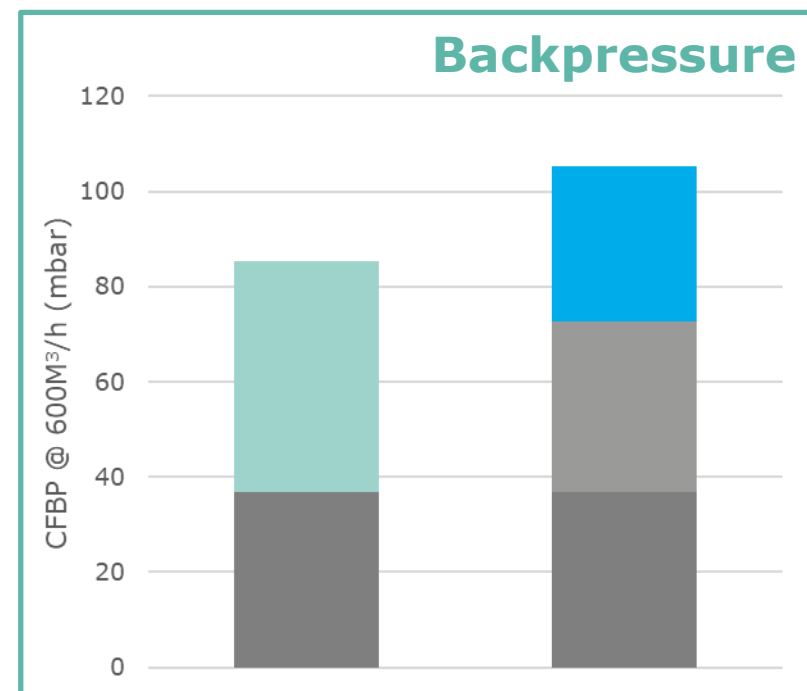
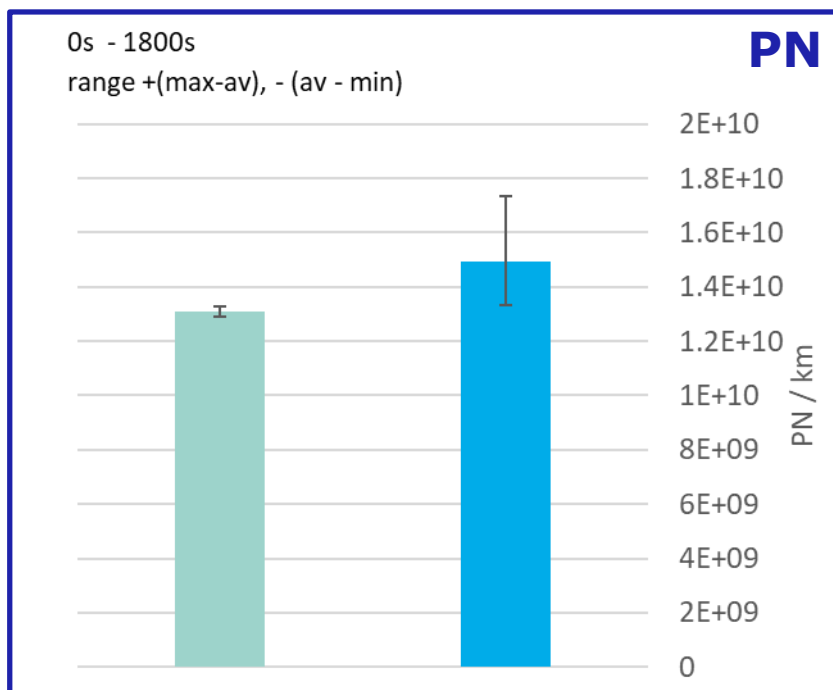
- Comparison of catalysed 2 brick system with a 3-brick system
- Systems have same mass of PGM
- High filtration GPFs tested



Coated GPF creates opportunity to reduce number of catalysts whilst maintaining performance



- Comparison of catalysed 2 brick system with a 3-brick system
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Summary

GPF technology for BSVII

- GPFs have been a **successful** component of DI aftertreatment systems since 2017
- The rapid increase in filtration requirements across global regulations has necessitated the need for **advanced filtration solutions**
 - Balancing pressure drop, robustness and emissions
- Coated GPFs offer a solution to legislation compliance with benefits of **maximising catalyst volume** in space constrained systems
- **Hybrid applications** can utilise GPFs to pass emissions and particulate legislation

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