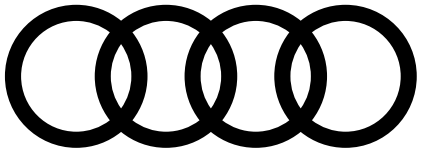


Tackling Non-Exhaust Emissions – An OEM Perspective

Dr.-Ing. Sebastian Gramstat, I/EM-67, AUDI AG

Background

Non-Exhaust Emissions

Brake

Tires

Resuspension

Sustainability

Unleash the beauty of sustainable mobility

Regulation

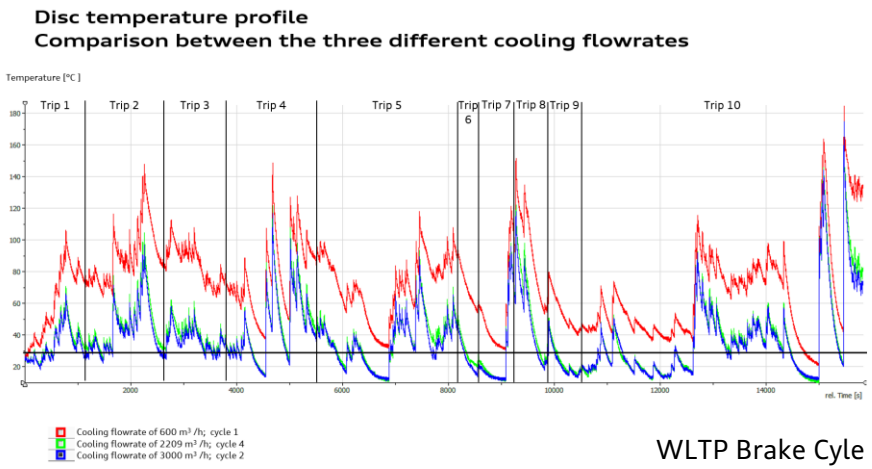
World Forum for Harmonization of Vehicle Regulations (WP.29)

Working Party on Pollution and Energy (GRPE)

Department for Transport

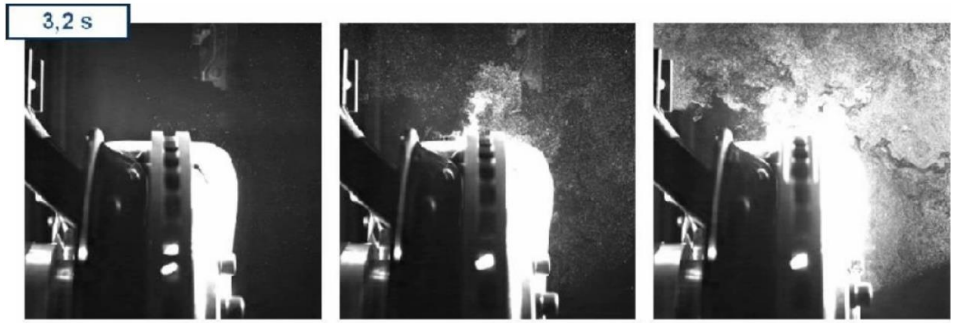
CALIFORNIA AIR RESOURCES BOARD

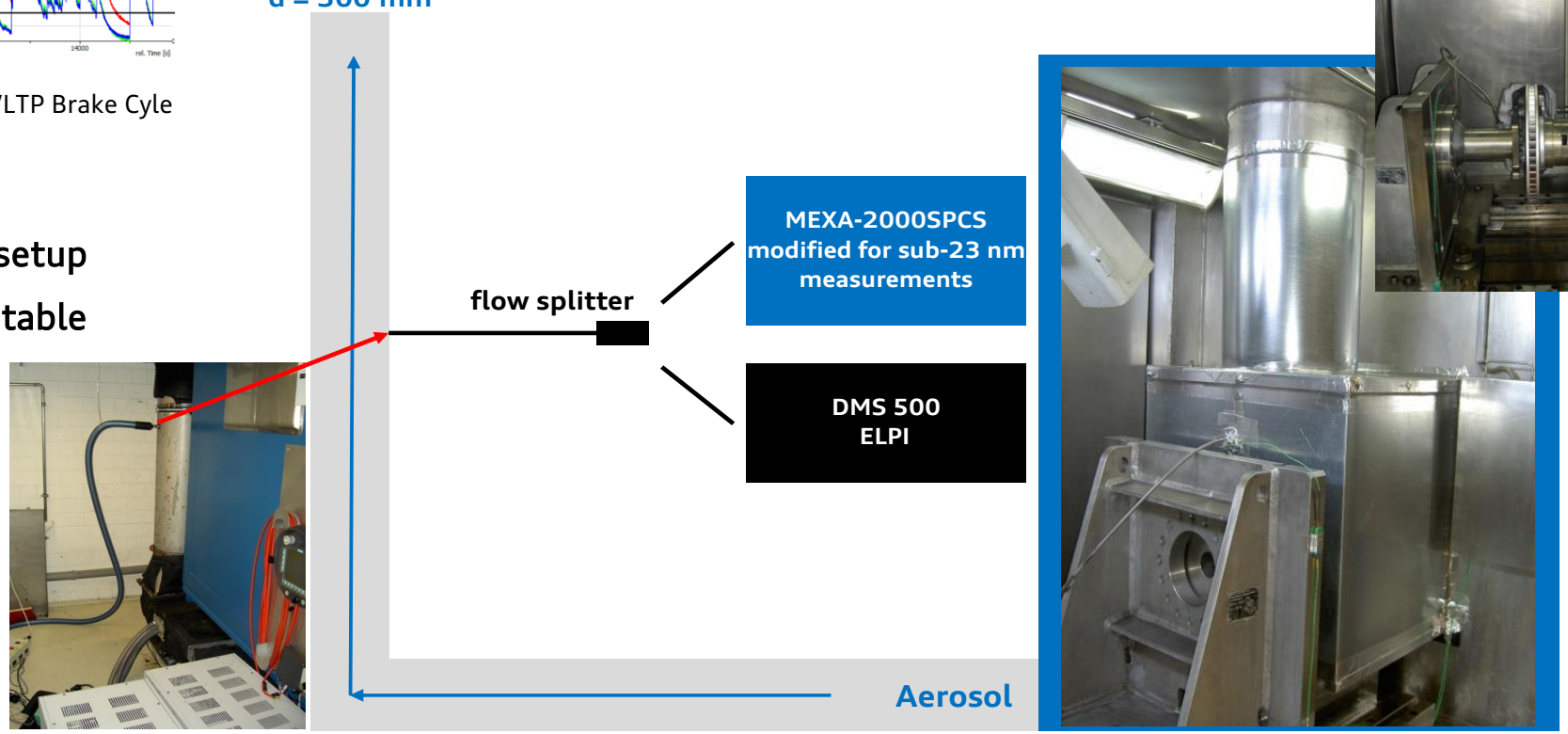
Brake Particle Emissions – How to measure?



WLTP Brake Cyle

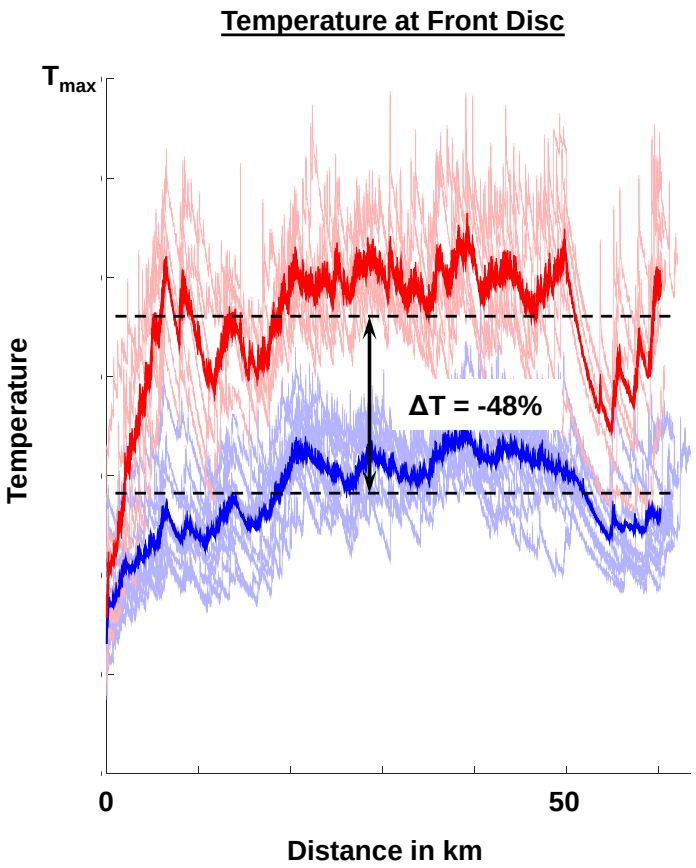
- Definition of an appropriate cycle
- Definition of a robust measurement setup
- Ensure to be: reproducible and repeatable

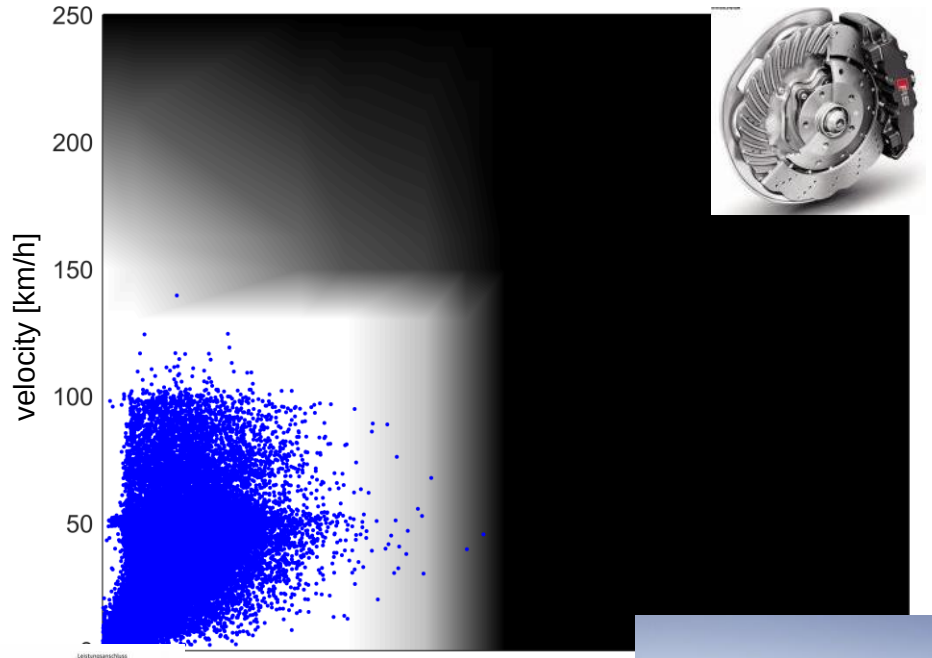


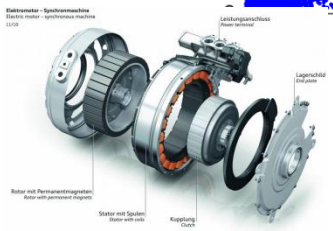


Brake friction couples behave highly non-linear and very sensitive to environmental conditions!

Emission Reduction – Impact of Regen Braking







29.837 brake applications
Endurance run: customer-oriented city-rural profile

Status Tire

Tire Emissions – Summary

H2020 Project

- ✓ The LC-MG-1-14-2020 call aims in addressing the issue of **particle emissions** and noise from tyres. Starting date is 01.06.2021 and LEON-T will work among others on the following topics.
  - Assessment and characterization of tyre wear particles emitted under different driving conditions both in the lab and on-road
  - Development of reliable and repeatable methodologies for the assessment of tyre emissions in the laboratory and on-road and for measuring tyre abrasion rate
  - Particles tracing and quantification in different environmental compartments with focus on microplastics emissions

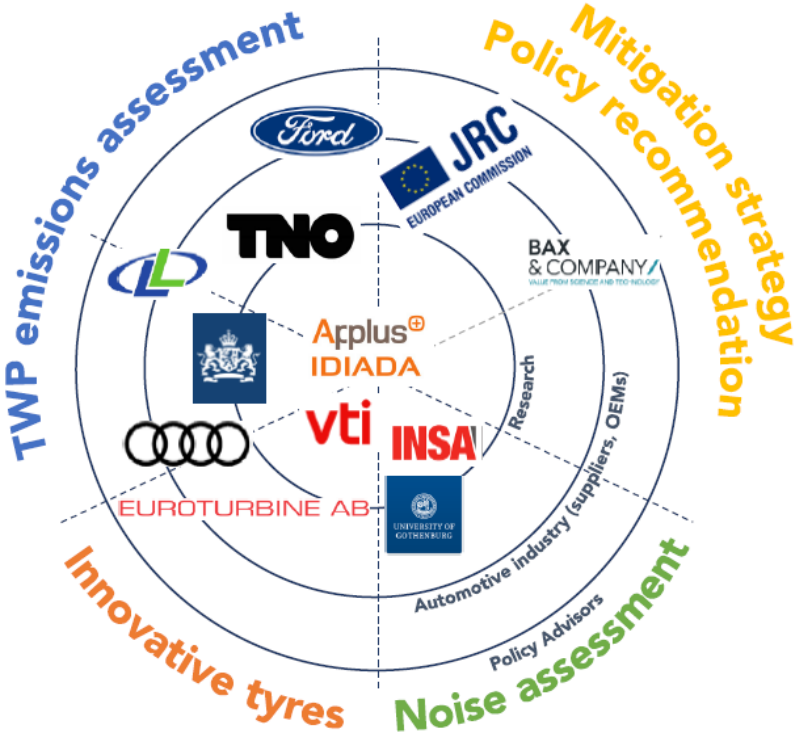
Abrasion Rate

- ✓ DG-GROW is assessing the proposals regarding the development of a tyre abrasion methodology. The winning consortium will be announced and the project is expected to start soon
- ✓ PMP's target remains to explore the possible correlation of tyre abrasion rate with PM_{10} and $PM_{2.5}$ emissions as soon as the method becomes available

European Commission

https://wiki.unece.org/download/attachments/123667515/PMP%20Update%20Exhaust%2024.03.2021.pdf?api=v2

Low particle Emissions and lOw Noise Tyres - Project at a glance



- 12 partners (industry and academia)
- Budget: approx. 4 Mio. € funding, funding rate 100%
- Duration: 36 months
- Expected project start: June 2021
- Fields of technology
  - Wear / particle emission behaviour of tyres
  - Environmental dispersion of microplastics
  - Noise emission behaviour of tyres
  - Health effects in regards of tyre noise (psycho-acoustic approaches, physiological and metabolic data)
  - New tyre concept (air-less design)
- Plus: mitigation strategies and policy recommendations

Thank you very much for your attention!

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Development Foundation Brake (I/EM-67)
AUDI AG
sebastian.gramstat@audi.de

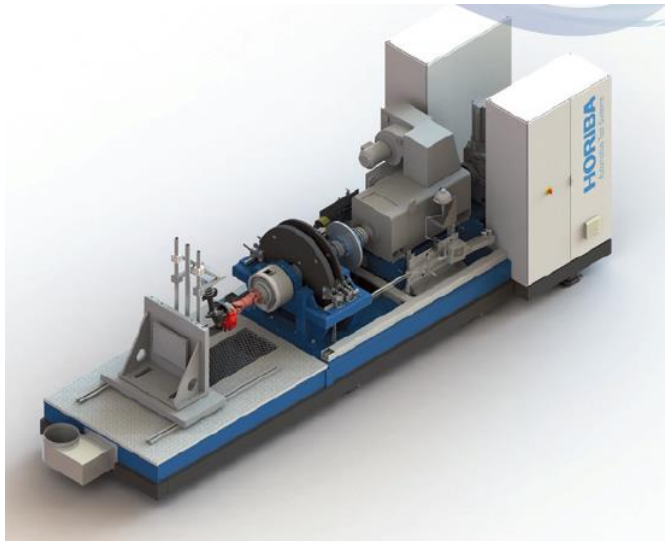
Back up

Übersicht Meßkonzepte

Tribometer

IDS Braunschweig

Brake Dynamometer



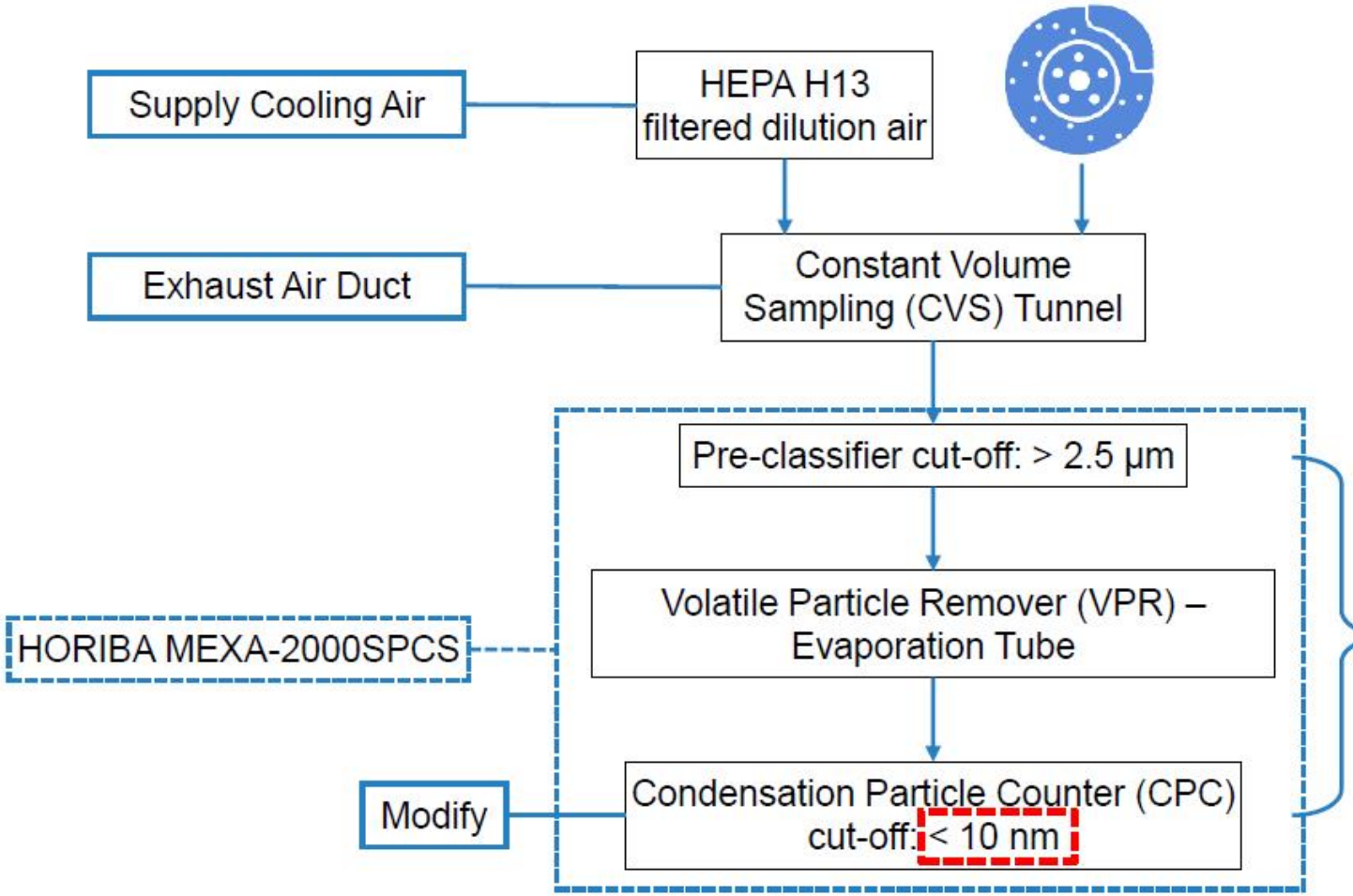
Horiba Automotive Test Systems

Chassis Dynamomter

Vehicle Road Test

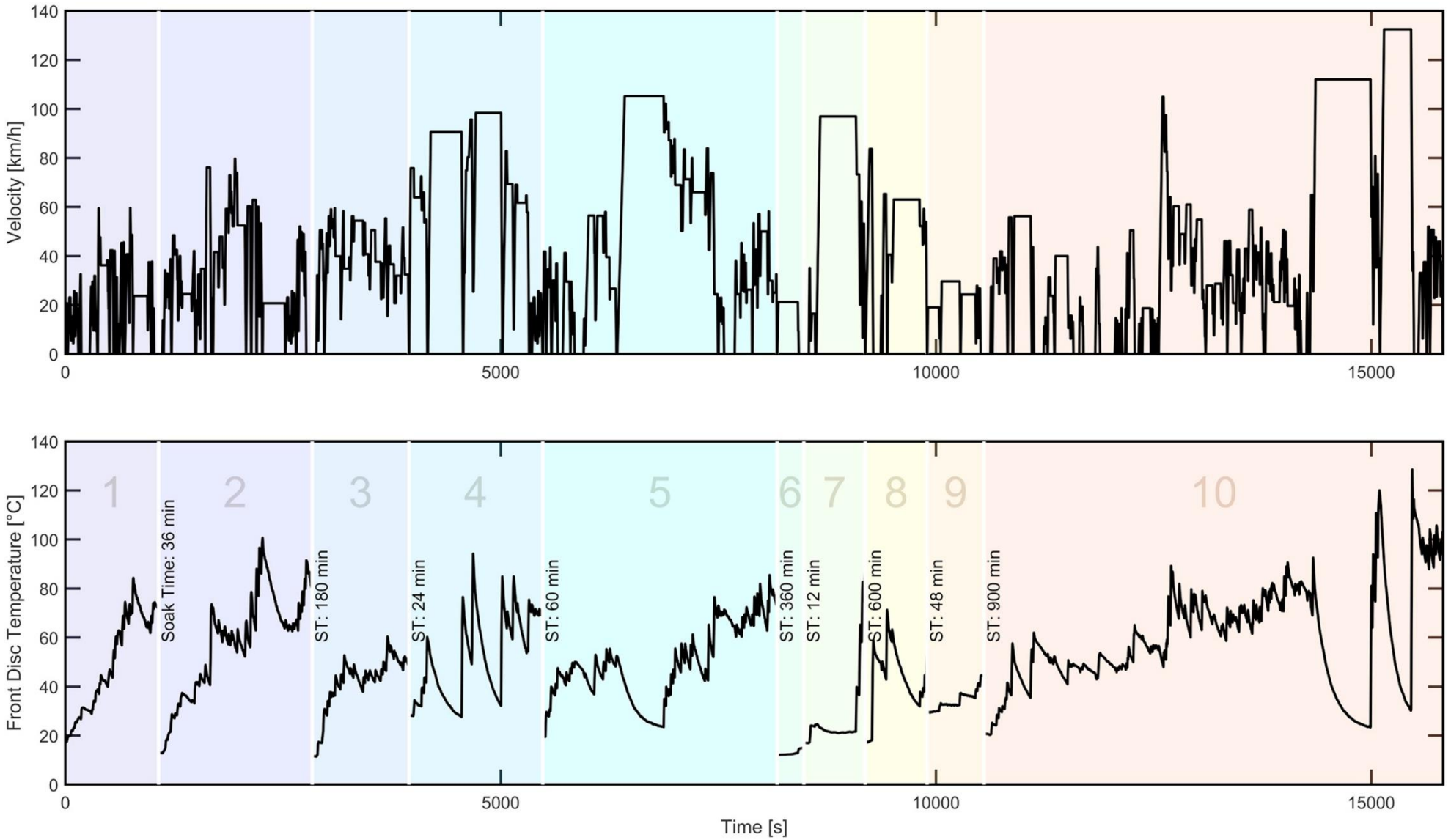
Complexity

Measurement setup



Horiba Automotive Test Systems

WLTP Brake Cycle

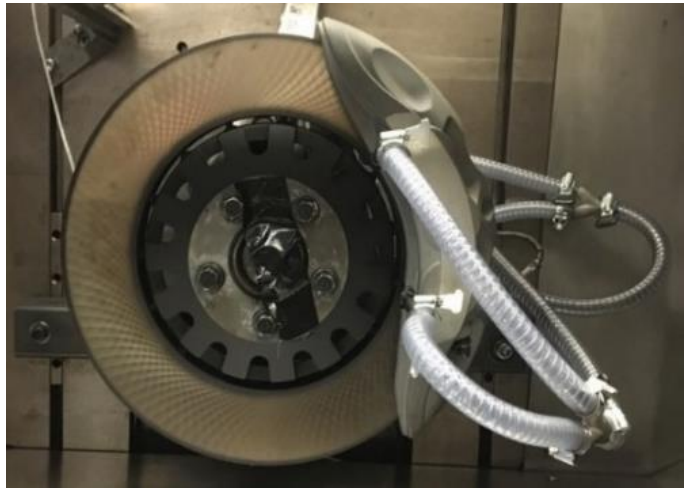


Mathissen, M.; Grochowicz, J.; Schmidt, C.; Vogt, R.; Farwick zum Hagen, F.H.; Grabiec, T.; Steven, H.; Grigoratos, T. A novel real-world braking cycle for studying brake wear particle emissions. *Wear* **2018**, *414–415*, 219–226, ISSN 0043-1648, doi:10.1016/j.wear.2018.07.020.

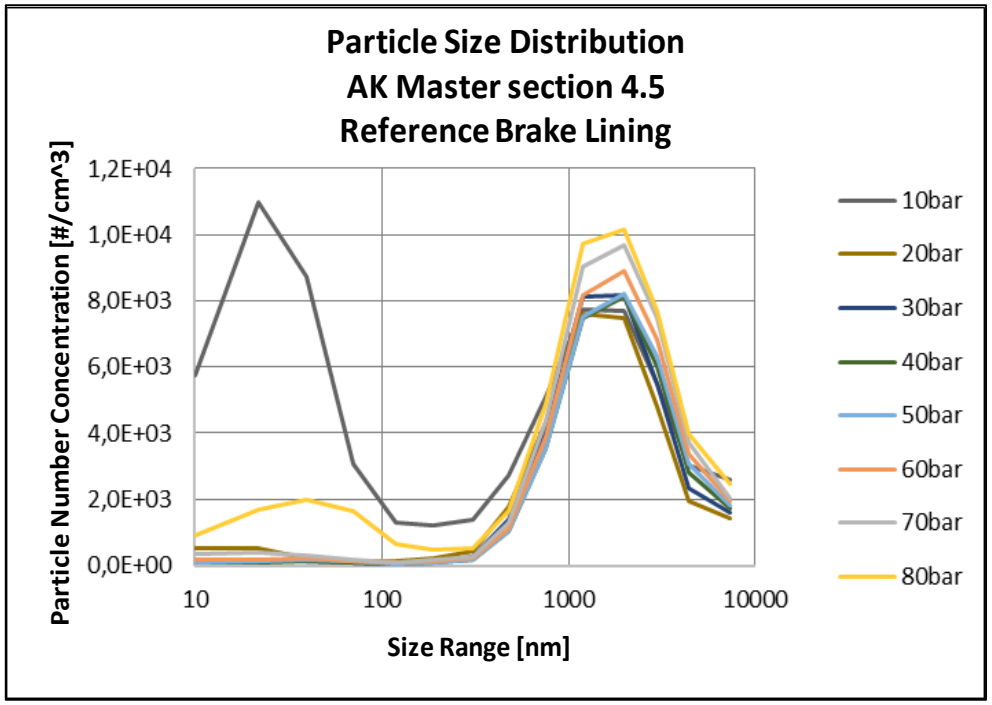
Impact of Filtration Systems

Gramstat, S., Hascoet, M., Rocca-Serra, C., and Adamczak, L., "Potentials and Challenges of a Brake Particle Emission Collecting System," SAE Technical Paper 2020-01-1635, 2020, https://doi.org/10.4271/2020-01-1635.

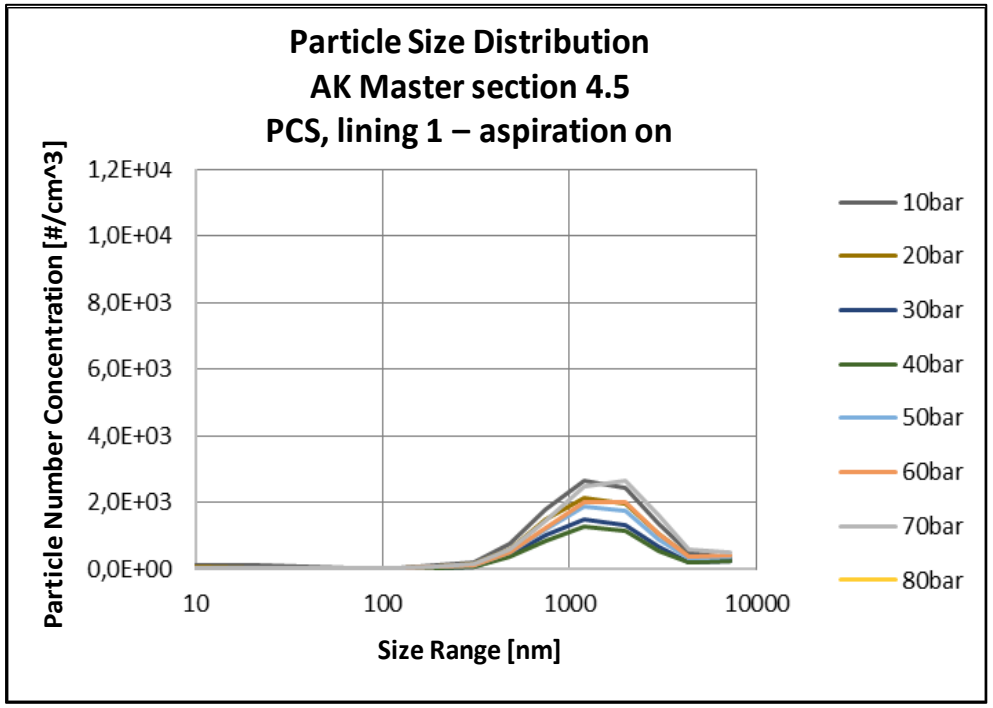
Vehicle application



Dyno application



Without activated filtration



With activated filtration