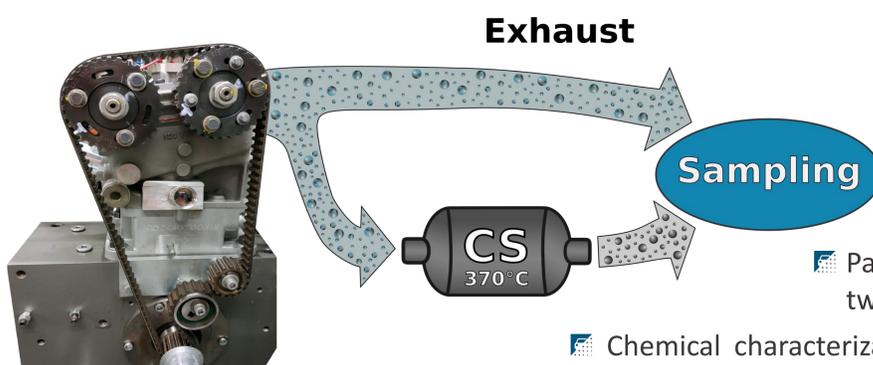




## Impact of a catalytic stripper on chemical composition of particulate matter emitted by a single cylinder gasoline engine

### Context & objectives

- Particle emissions from on-road vehicles represent an acknowledged health risk and significant societal concern due to their high toxicity and climate impact.
- There is a critical lack of certification procedures under **real driving** conditions and for the smallest particles, **down to 10 nm**.
- The goal of the H2020 PEMs4Nano project ([www.pems4nano.eu](http://www.pems4nano.eu)) is the development of a measurement procedure down to 10 nm in real driving conditions.
- The development of a precise and reliable measurement procedure requires a deep understanding of emitted particle characteristics, in particular the size variation of the chemical composition and the impact of after-treatment systems (e.g. catalytic stripper).
- The impact of the catalytic stripper (CS) on the chemical composition of particles emitted by a single cylinder gasoline engine is presented.

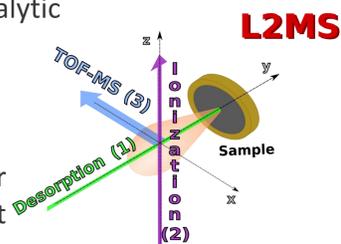


Single cylinder engine

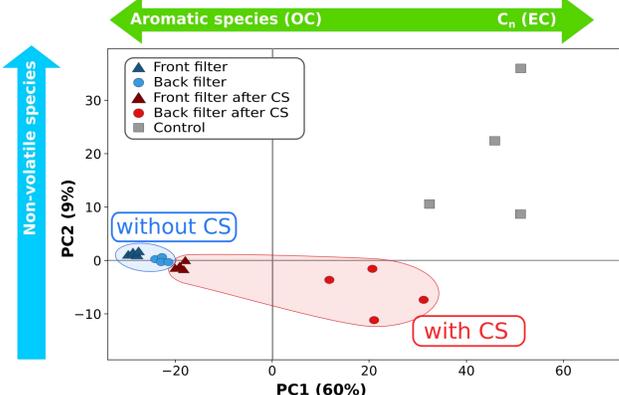
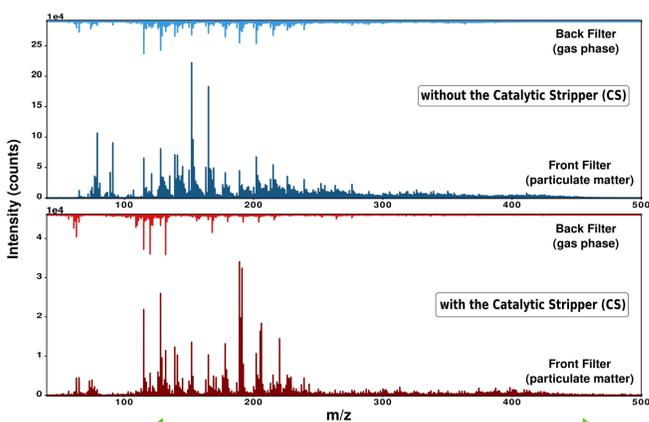
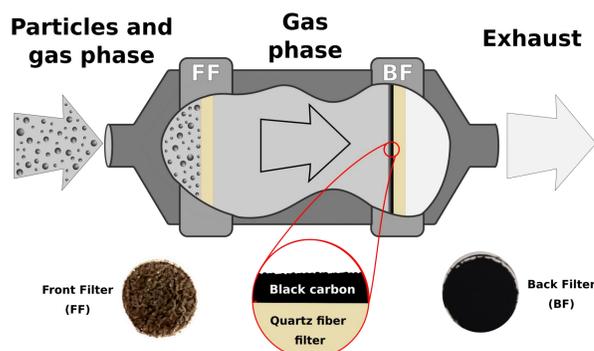
### Experimental setup

- Investigated particles (i.e. soot) were generated by a single cylinder engine operated in different regimes.
- Size-selected particles were sampled with and without a catalytic stripper by a cascade impactor (NanoMoudi-II, TSI).
- Particulate and gas phases were separated and samples with a new two-filter sampling setup.

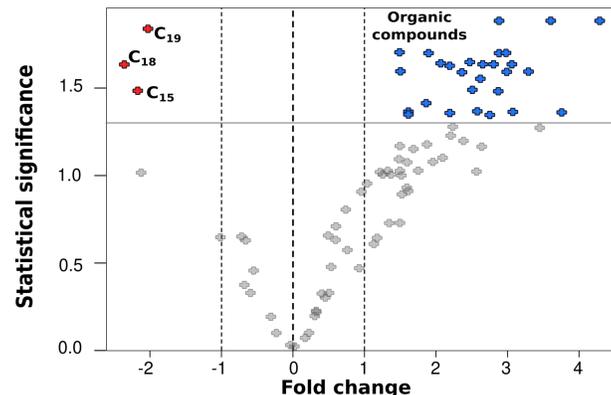
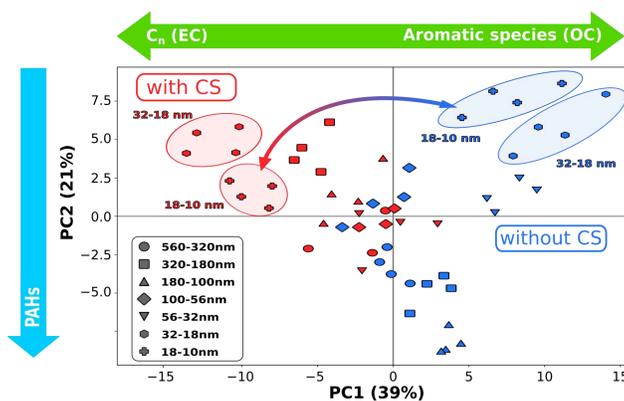
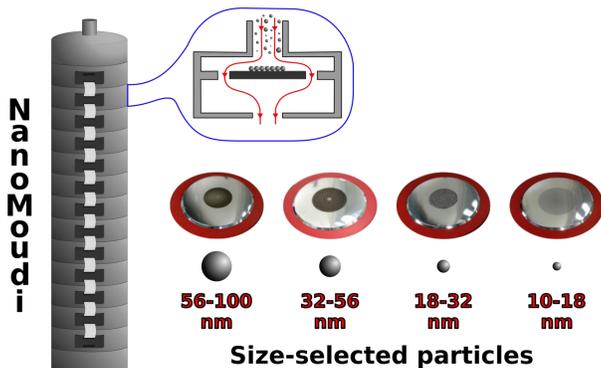
- Chemical characterization was performed with a two-step laser mass spectrometer (L2MS) allowing an in-depth molecular analysis of chemical classes of critical interest [1].



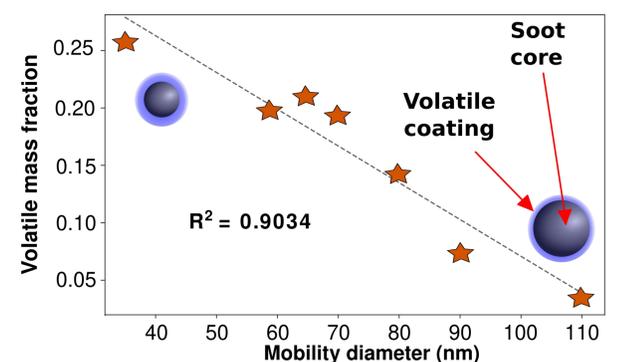
### Particle / Gas phase sampling



### Size-selected sampling



### Online aerodynamic-mass-mobility measurements



### Conclusions

- The combination of L2MS, SIMS and PCA allows determination of detailed molecular level surface chemical composition of soot particles.
- The new two-filter sampling setup enabled the separation and characterization of both particulate matter and gas phase emissions.
- The use of size-selective sampling allowed us to chemically characterize surface chemistry of particles down to 10 nm.
- The impact of the catalytic stripper on particles of different sizes and on the gas phase was identified.
- The smallest particles hold the highest surface organic fraction and therefore are the most affected by the catalytic stripper (confirmed by online and offline measurements).

[1] A. Faccinetto et al. Progress toward the Quantitative Analysis of PAHs Adsorbed on Soot by Laser Desorption/Laser Ionization/Time-of-Flight Mass Spectrometry, Environmental Science and Technology 49, pp. 10510–10520, 2015.