Extending Particle Number Limits to below 23 nm: First Results of the H2020 DownToTen Project

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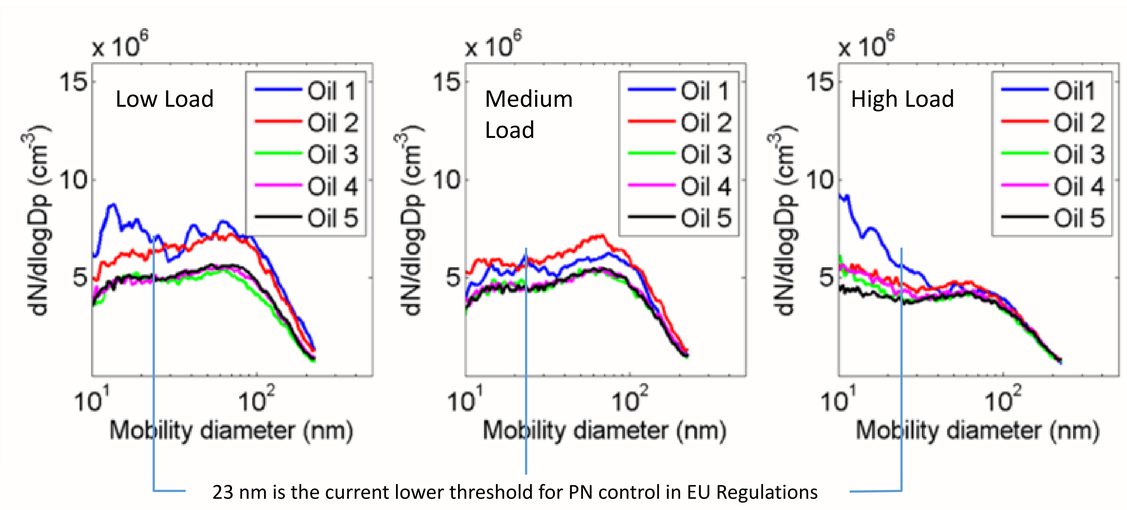
Project Objectives

- Propose an appropriate sampling and measurement methodology for sub 23 nm particles from both CVS and RDE
- Compare and evaluate a number of possible sampling and sample conditioning configurations
- Evaluate the suitability of particle measurement instruments
- Set-up the DownToTen PN-PEMS demonstrator
- Describe the nature and characteristics of nanoparticles <23 nm
- Understand particle transformation from the tailpipe to the inlet of measurement equipment in CVS and raw exhaust

Issue to address

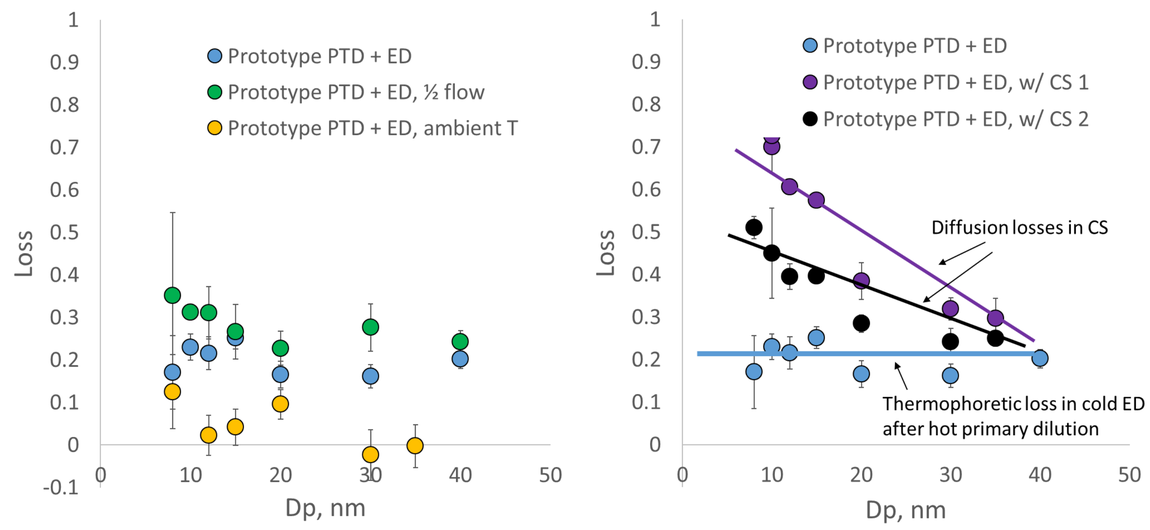


The current lower size-limit of ~23 nm potentially leaves out a large fraction of exhaust particles observed in real vehicle operation. For example, shown above, elevated <23nm PN can be seen from a GDI passenger car with specific oil formulations.

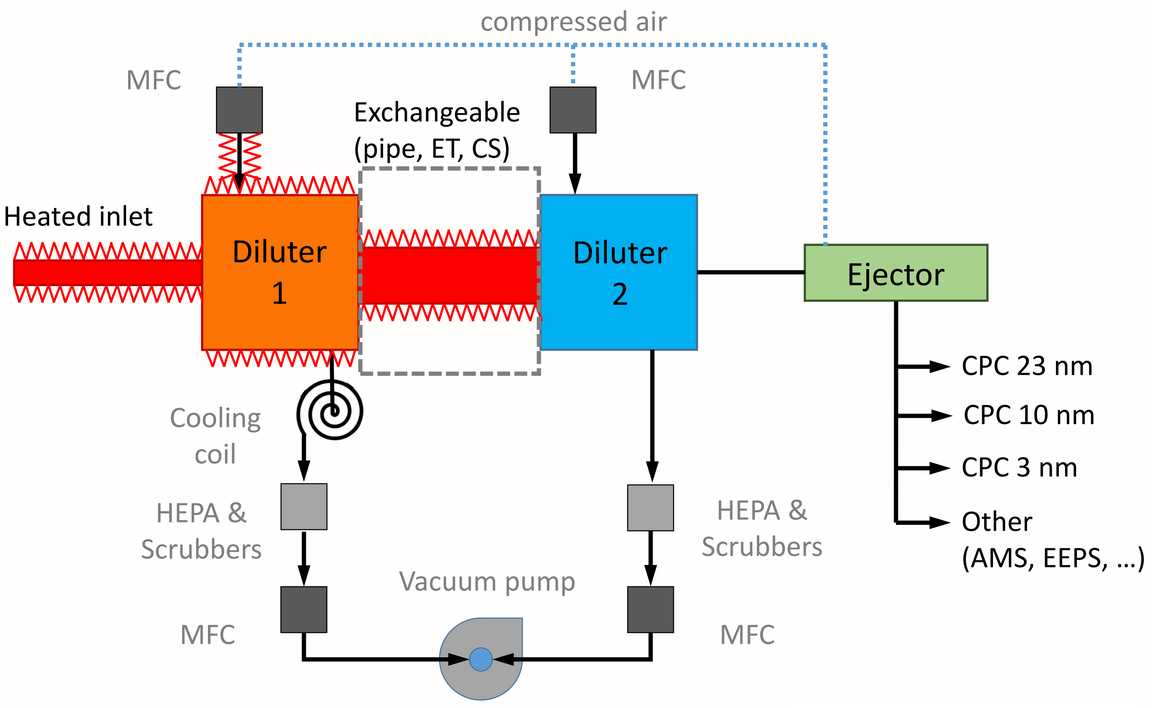
Source: Adapted from Pirjola, et al. (2015), ES&T, DOI: 10.1021/es505109u (w. permission)

Results

A primary aim has been to develop a sampling system with minimized losses in the sub-23nm size region. Hot primary dilution is prioritized to avoid condensation, and then a number of configurations considered in order to define the non-volatile particles for measurement, and to accommodate various PN sizing and counting instrumentation that could be used in a regulation.



Prototype Sampling System



PROJECT PARTNERS

In collaboration with:

The University of California at Riverside

National Traffic Safety and Environmental Lab (Japan)

National Metrology Institute (Japan)

HORIZON 2020
Call: H2020-GV-2016-2017
Technologies for low emission light duty powertrains
Action:
"Measuring automotive exhaust particles down to 10 nanometres – DownToTen"