KTH ROYAL INSTITUTE
OF TECHNOLOGY

Characterization of particles in the gas exchange system of DI/SI engines

Arun Prasath Karuppasamy

Supervisors: Anders Christiansen Erlandsson, Ola Stenlåås

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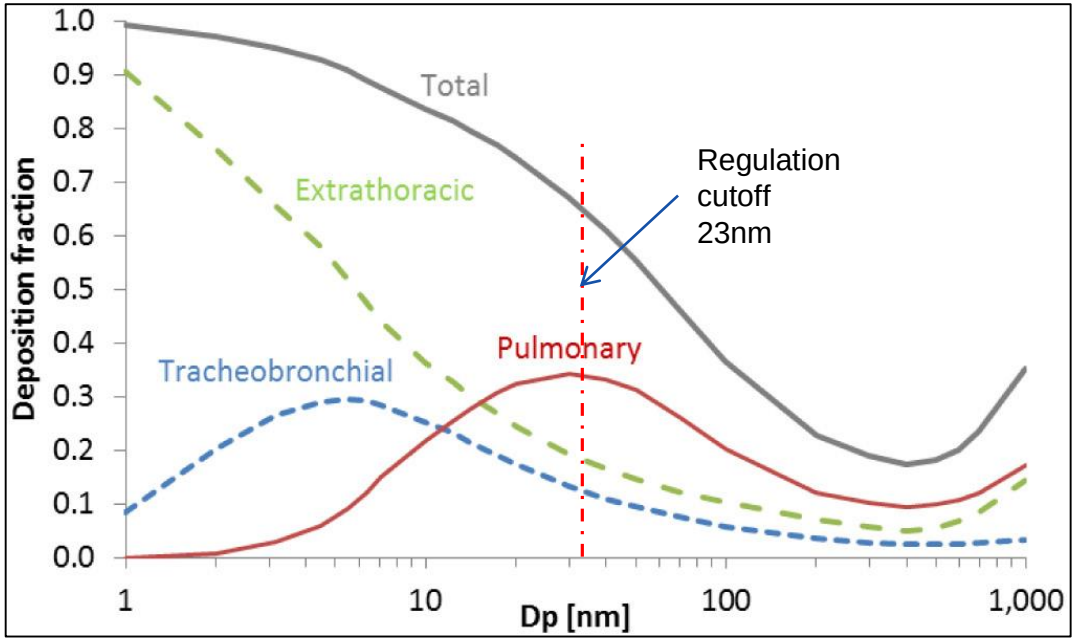
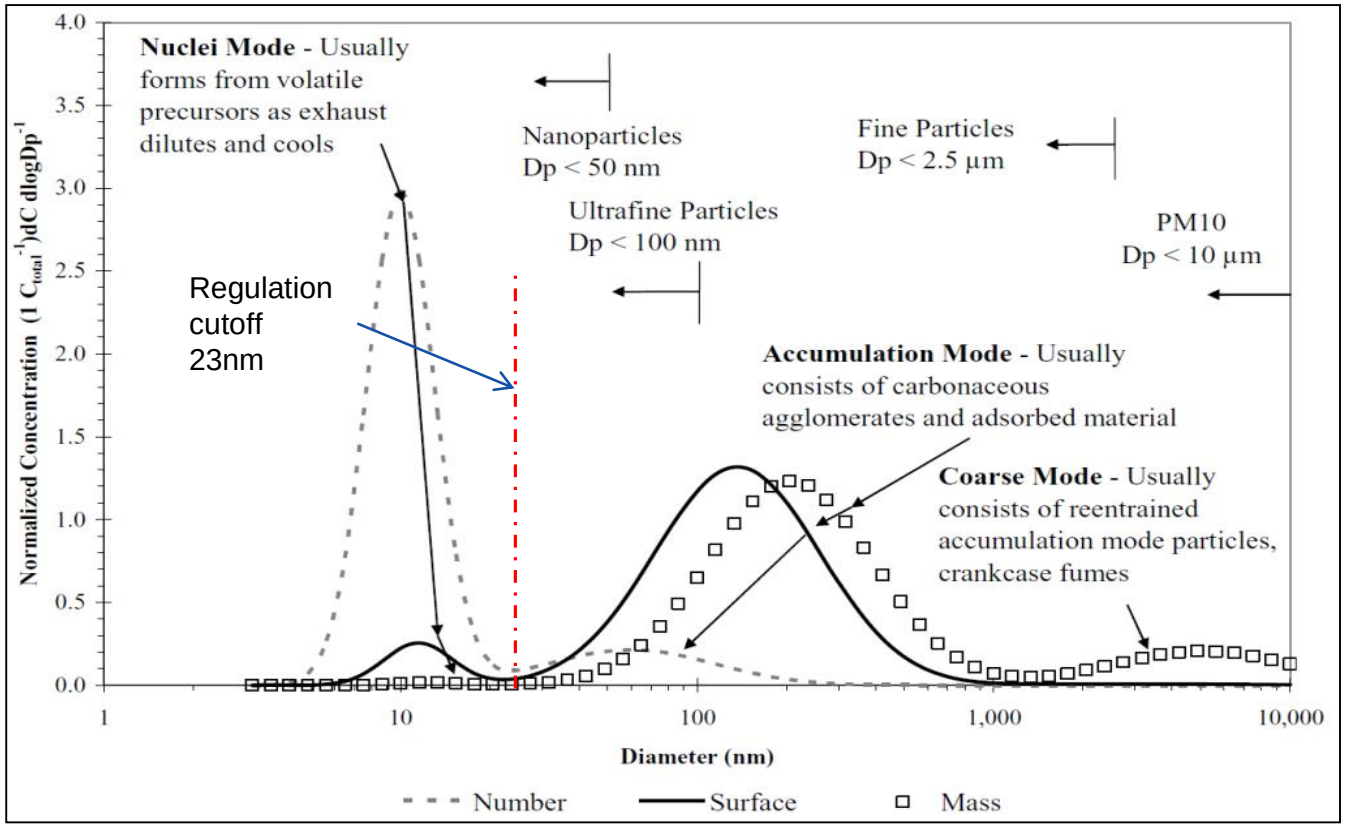
Particles Emissions and Health



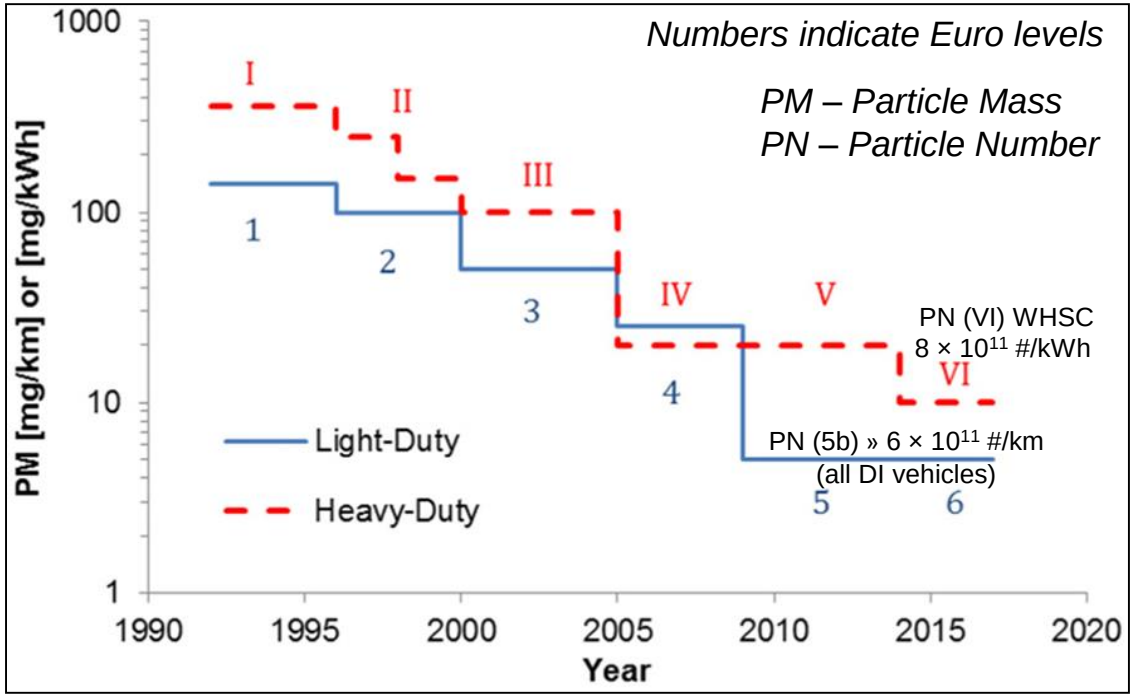
Giechaskiel, B., Manfredi, U., and Martini, G., "Engine Exhaust Solid Sub-23 nm Particles: I. Literature Survey," SAE Int. J. Fuels Lubr. 7(3):950-964, 2014, https://doi.org/10.4271/2014-01-2834.

Particles Emissions and Health



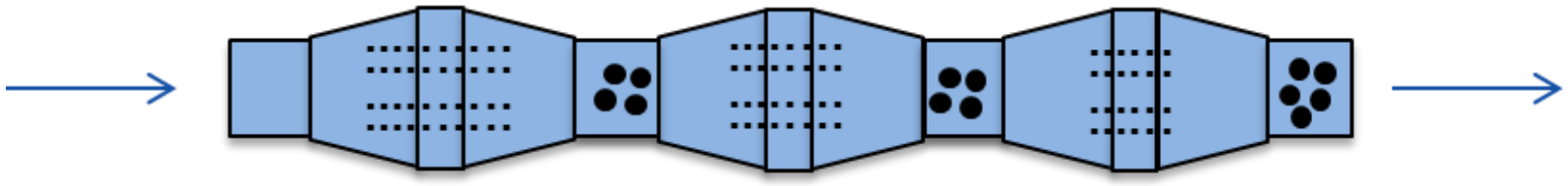
Kittelson, D., Watts, W., Johnson, J., Rowntree, C. et al., "Driving Down On-Highway Particulate Emissions", SAE Technical Paper 2006-01-0916, 2006, doi:10.4271/2006-01-0916

Particles Emissions and Health



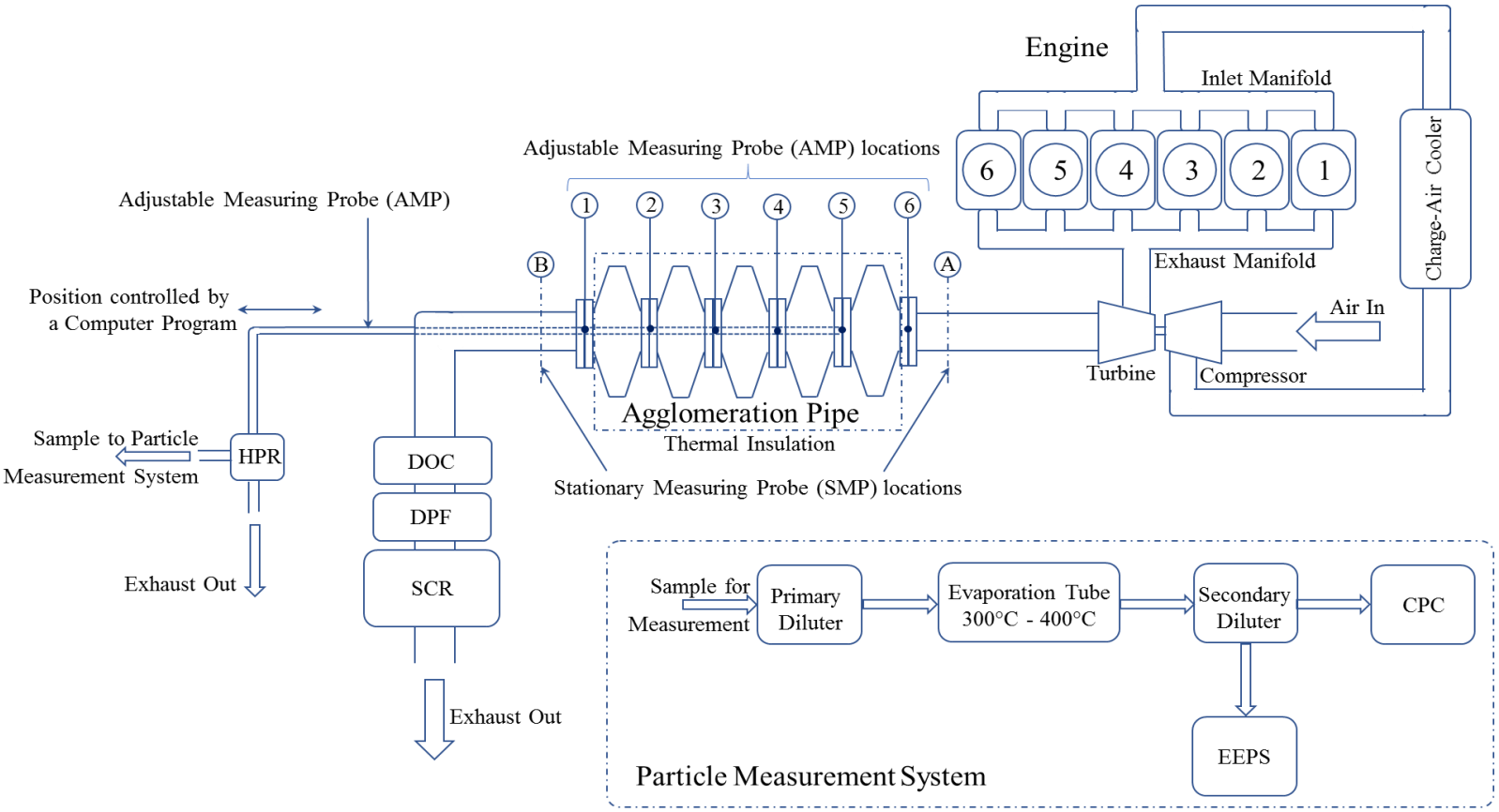
Giechaskiel, B., Schiefer, E., Schindler, W., Axmann, H. et al., "Overview of Soot Emission Measurements Instrumentation: From Smoke and Filter Mass to Particle Number", SAE 2013-01-0138

Agglomeration Pipe (AP)

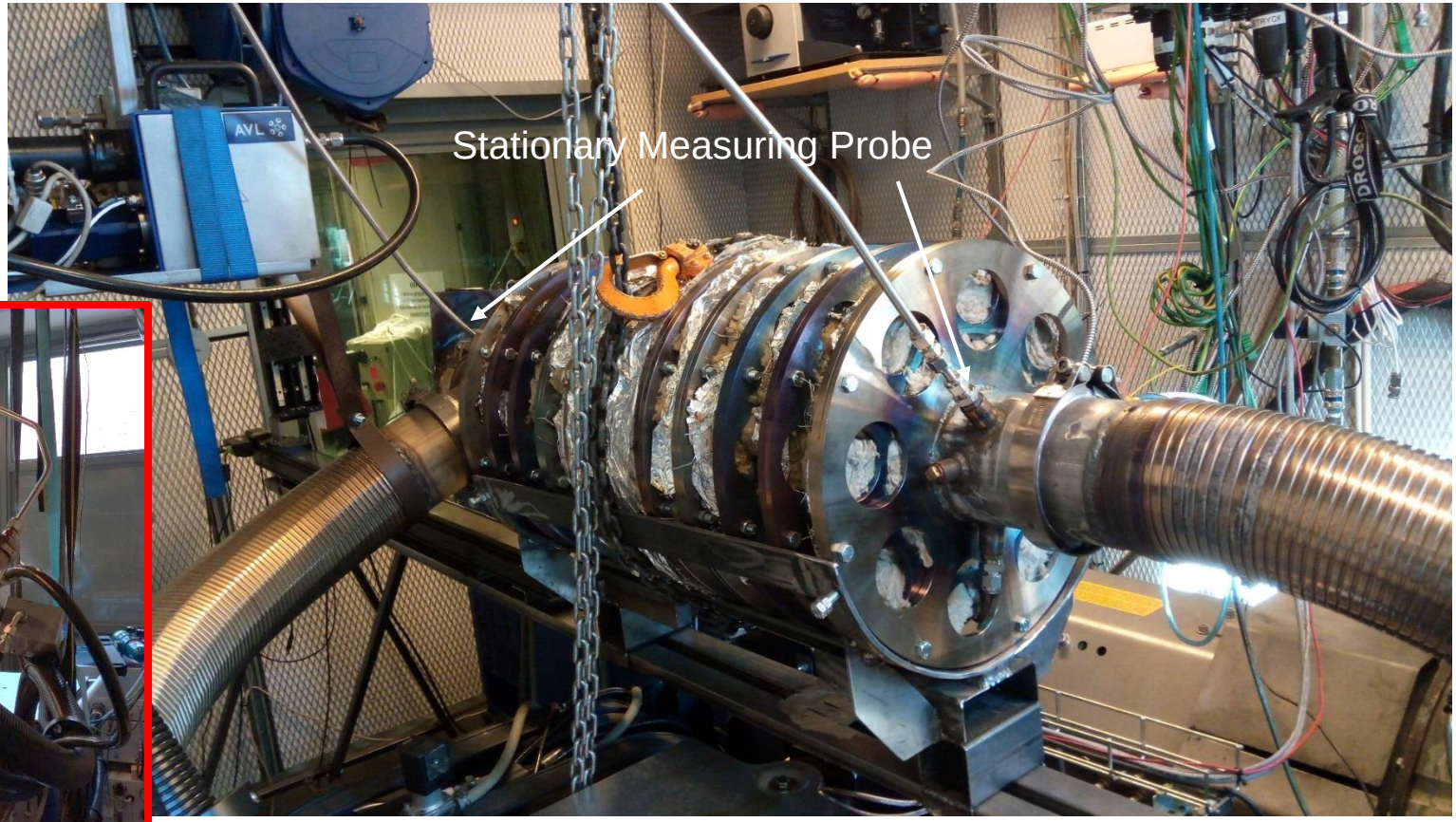


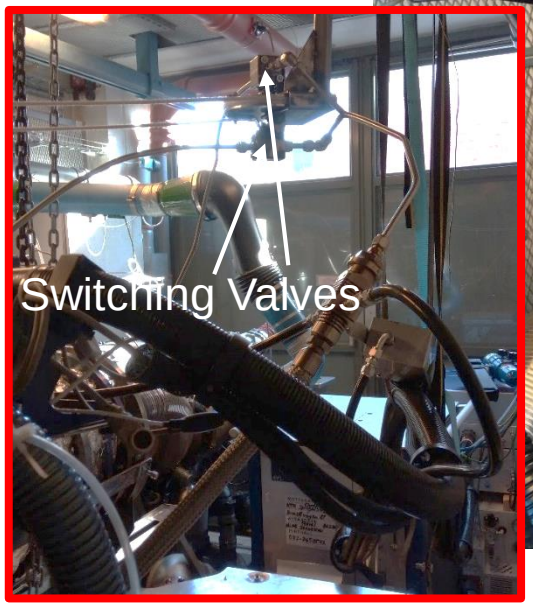
***Agglomeration**: Process of combining particles to form larger particles*

Schematic of The Setup



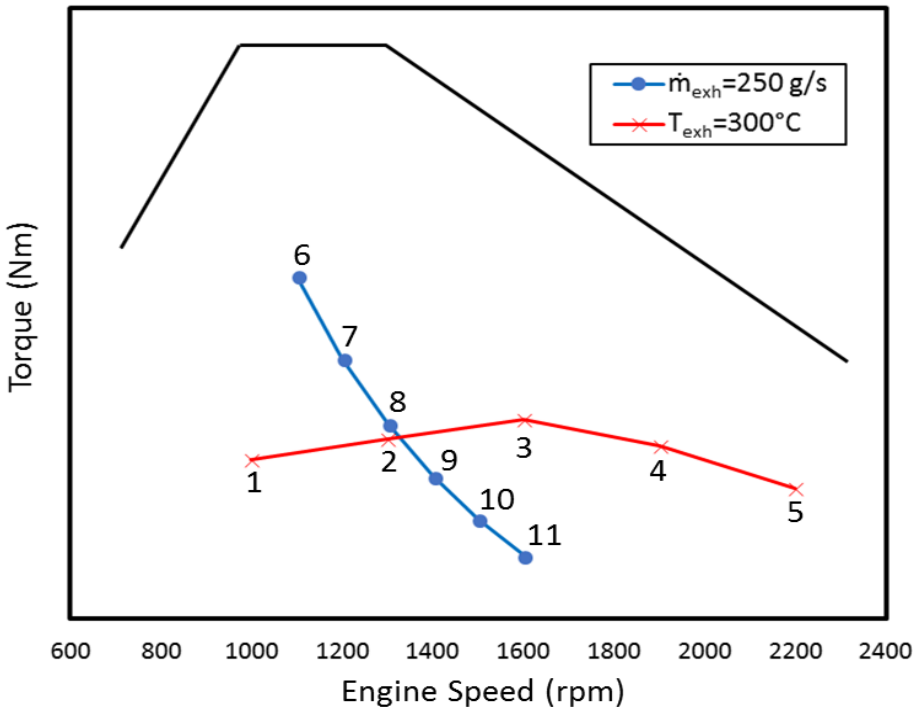
Setup with Stationary Measuring Probe



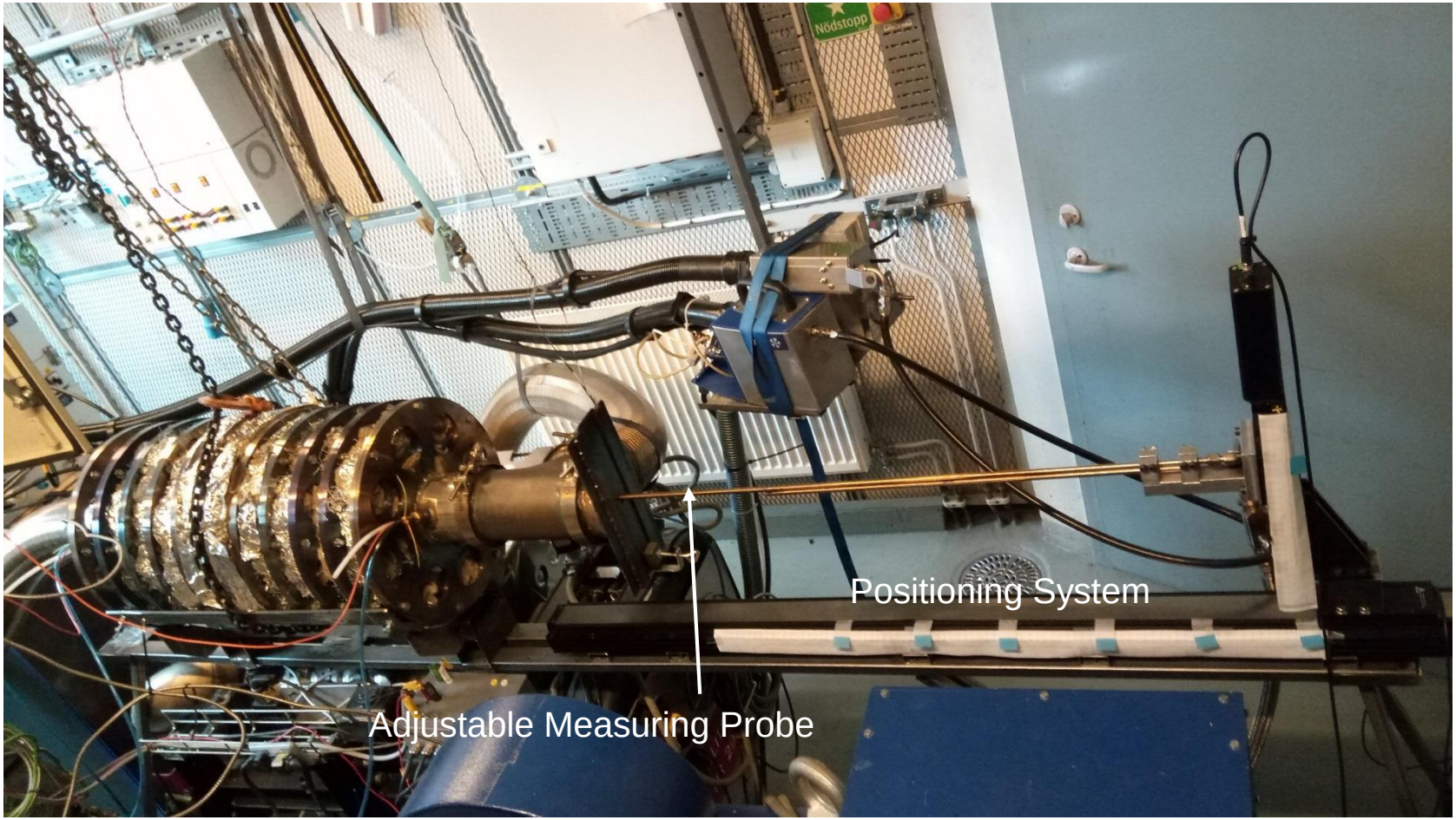


Engine Operating Points

Sl. No.	Engine Speed [rpm]	T_{exh} [°C]	$\dot{m}_{exh}$ [g/s]	Remarks
1	1000	300	154	Constant T_{exh}
2	1300	300	241	Constant T_{exh}
3	1600	300	340	Constant T_{exh}
4	1900	300	425	Constant T_{exh}
5	2200	300	481	Constant T_{exh}
6	1100	396	250	Constant $\dot{m}_{exh}$
7	1200	350	250	Constant $\dot{m}_{exh}$
8	1300	312	250	Constant $\dot{m}_{exh}$
9	1400	274	250	Constant $\dot{m}_{exh}$
10	1500	236	250	Constant $\dot{m}_{exh}$
11	1600	201	250	Constant $\dot{m}_{exh}$



Setup with Adjustable Measuring Probe



Conclusion

- The SP case in comparison with the AP case shows that the AP behaves like the SP with regards to non-volatile PN reduction
- The grouping phenomenon observed in previous literatures with the AP might be due to three possibilities
  - The size range of most particles emitted are larger than 50nm. As grouping is noticed only after those sizes
  - The grouping particles in previous studies might have been mostly volatile particles. This study used particle measurement systems with evaporation tube as a volatile particle remover
  - The grouping might have been favoured by the increase in colder surface area of the AP. This was avoided in this study by using a double walled and insulated AP

Competence Center for Gas Exchange

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