

Comparative particle characterisation of modern gasoline and diesel passenger cars at different chamber temperatures

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Cold start effect

In Europe, about 50% of the trips using a passenger car are typically shorter than 3 km, which is close to the warm up distance of the three-way catalyst

[Kyriakis and André, 1998 / Laurikko, 1998]

«Comprehensive particle characterization of modern gasoline and diesel passenger cars»

[Urs Mathis et al. (submitted)]

Experimental set-up was according to the project «PARTICULATES»

Experimental

Particle emission in the exhaust

Five modern EURO 3 passenger car

- 2 gasoline passenger car (port-injection)
- 1 gasoline passenger car (direct-injection)
- 1 diesel passenger car without DPF
- 1 diesel passenger car with DPF

Real world driving cycle

IUFC15 : Inrets 15x urban fluid court

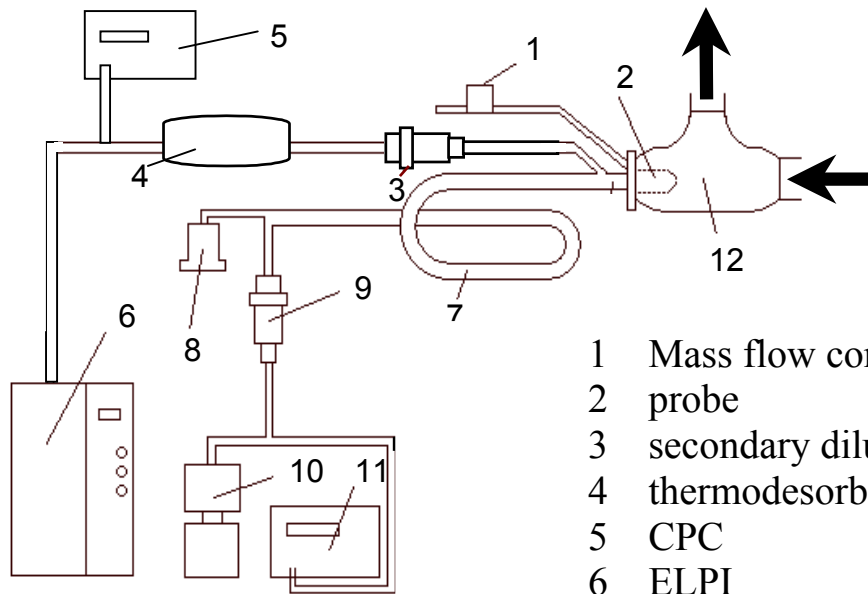
Three different chamber temperatures

-20 °C / -7 °C / +23 °C

Experimental set-up

Sampling method

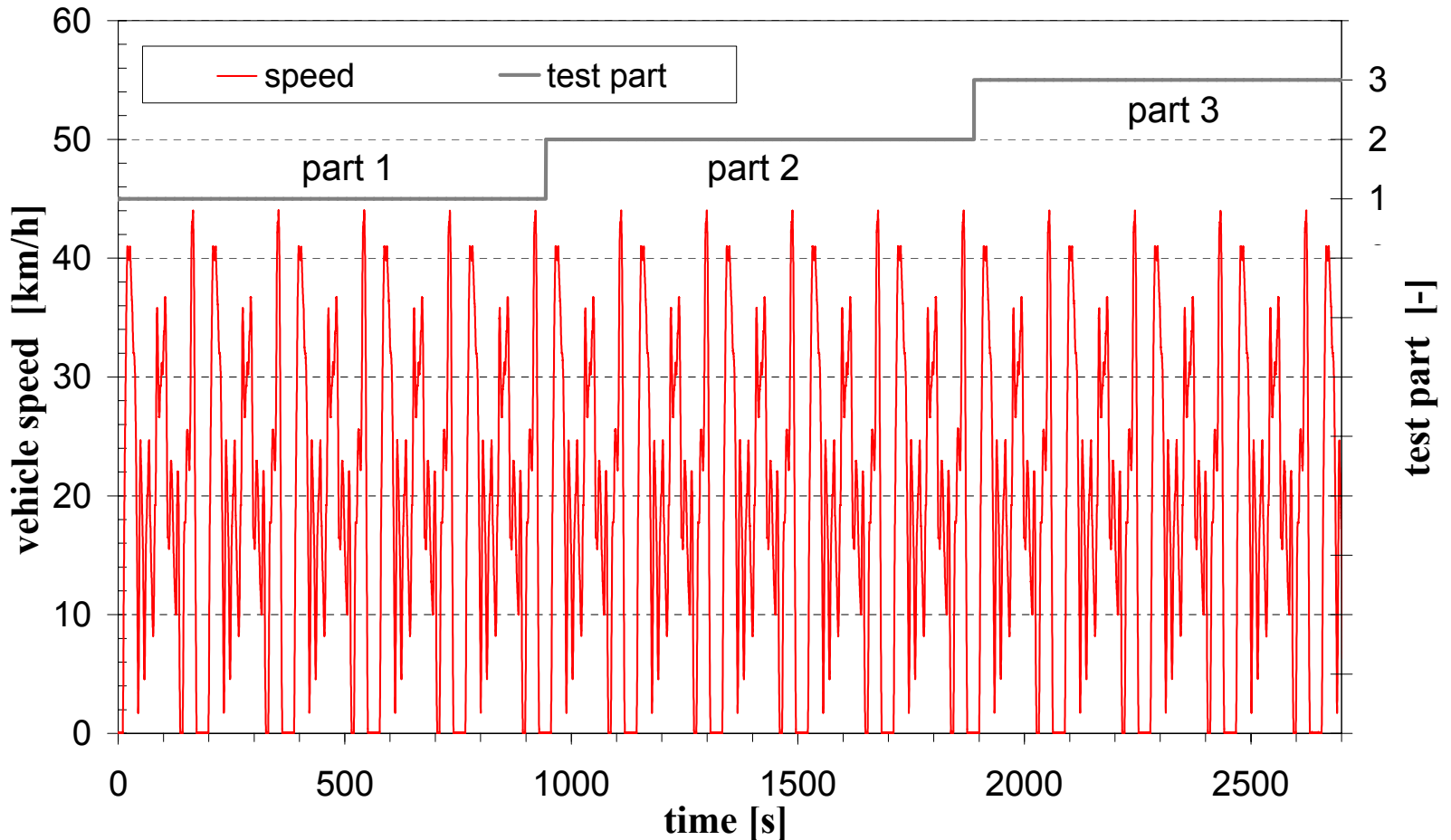
From the tailpipe
porous tube diluter
[prototype, Dekati Ltd]



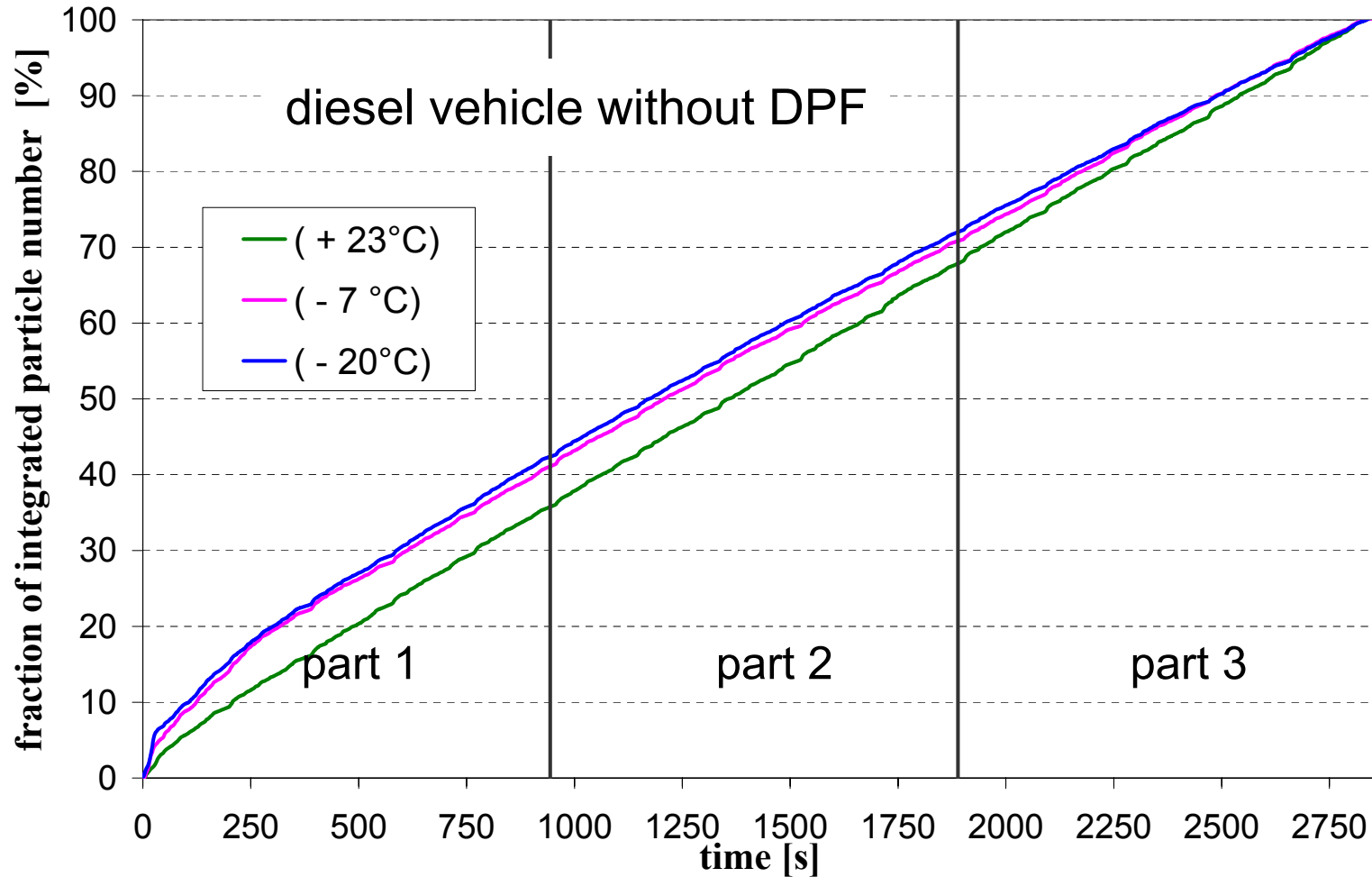
- 1 Mass flow controller for dilution air
- 2 probe
- 3 secondary diluter at dry air
- 4 thermodesorber
- 5 CPC
- 6 ELPI
- 7 ageing chamber (additional residence time)
- 8 Impactor for mass measurement at the wet line
- 9 Secondary diluter at the wet line
- 10 Diffusion charger
- 11 CPC
- 12 porous tube diluter

Set-up according to
« PARTICULATES »

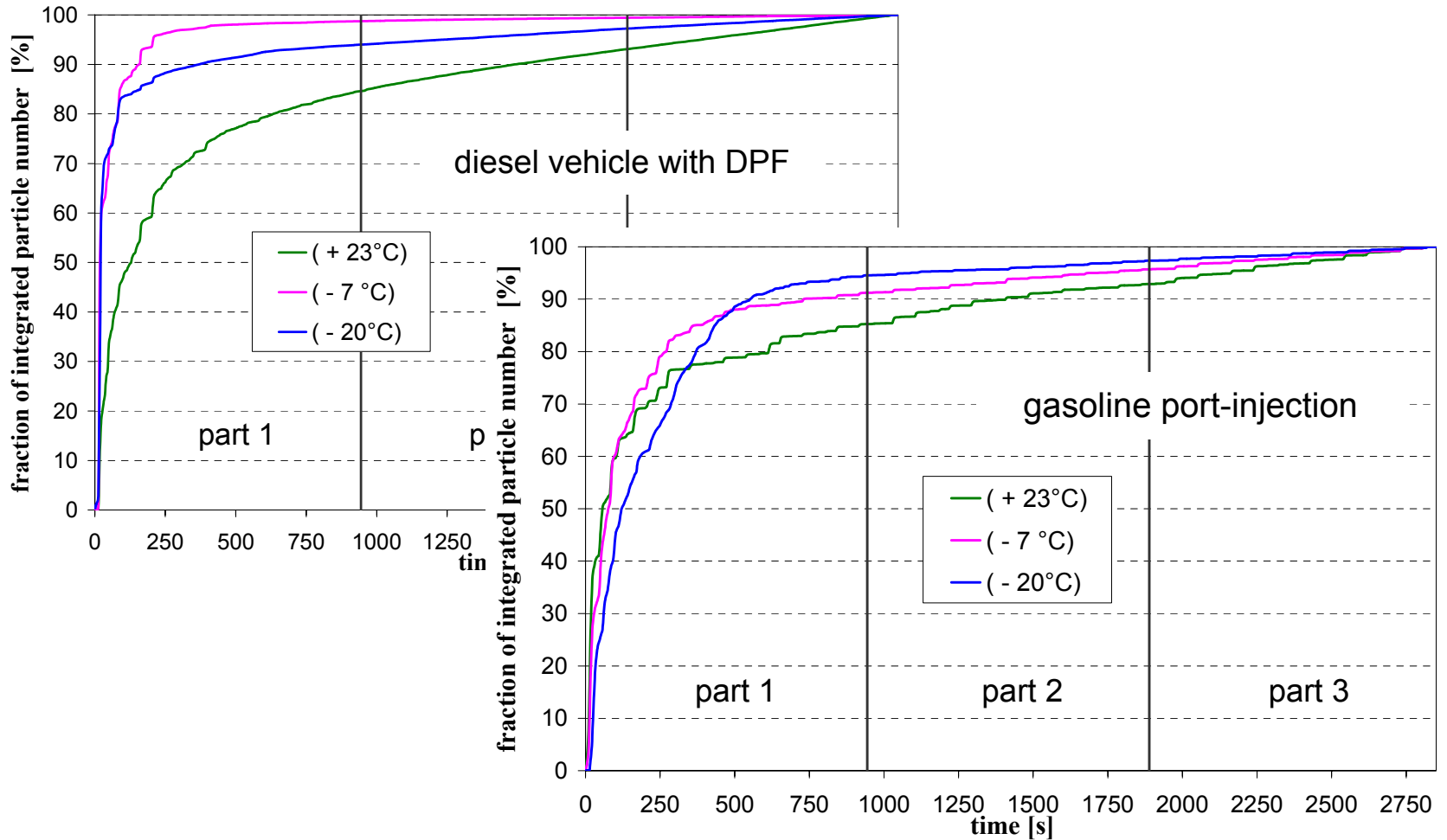
Real world test cycle (IUFC15)



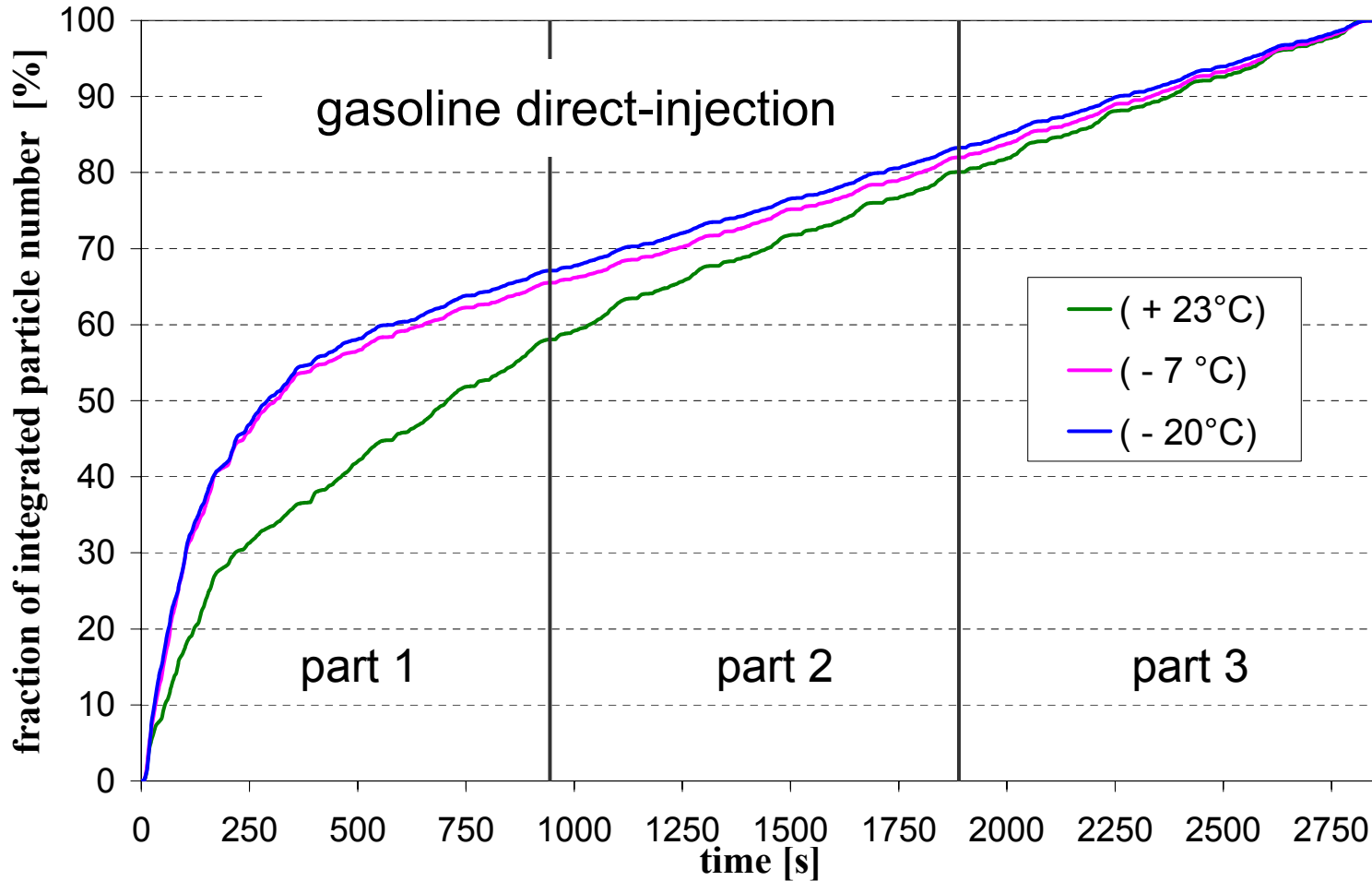
cold start particle number emissions



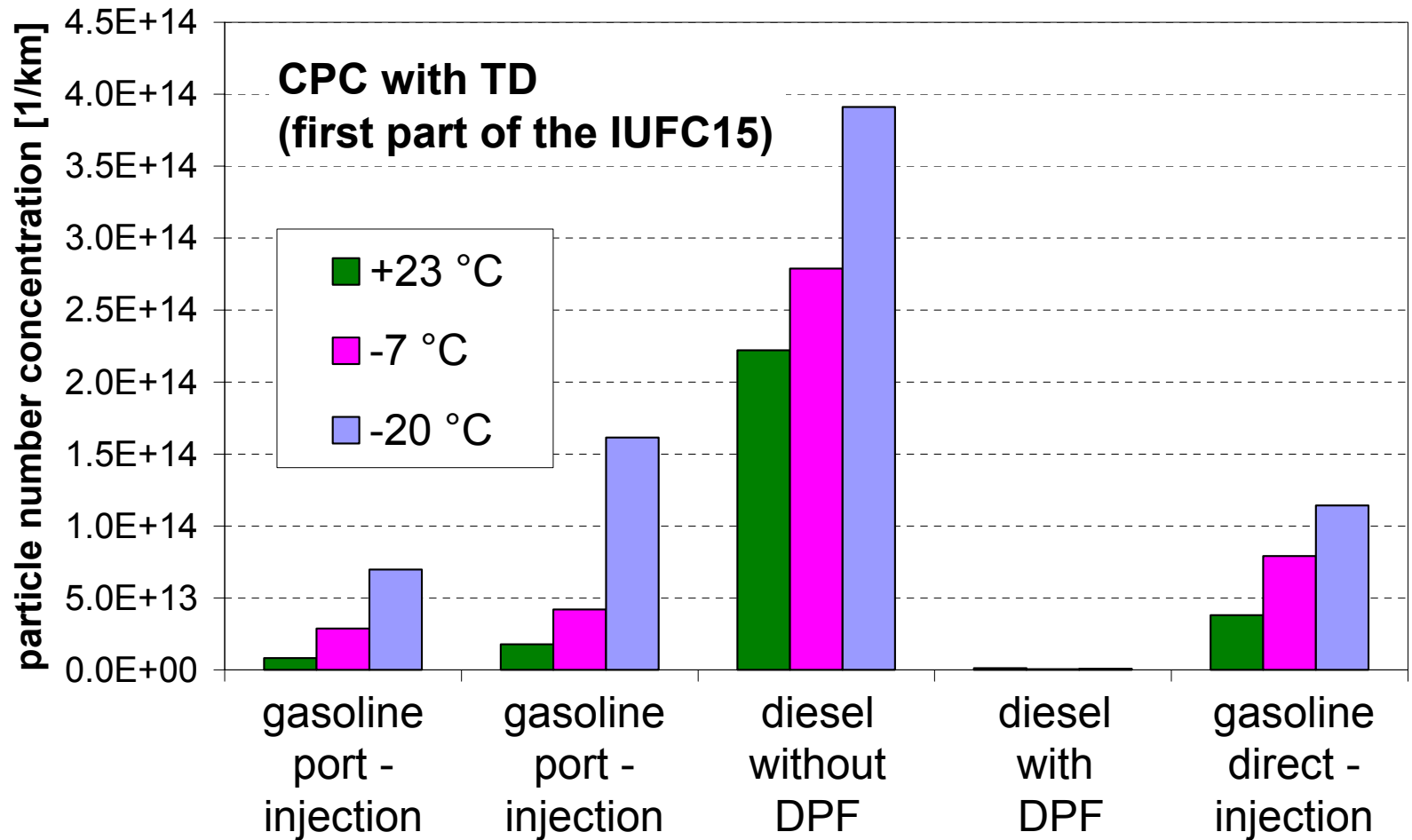
cold start particle number emissions



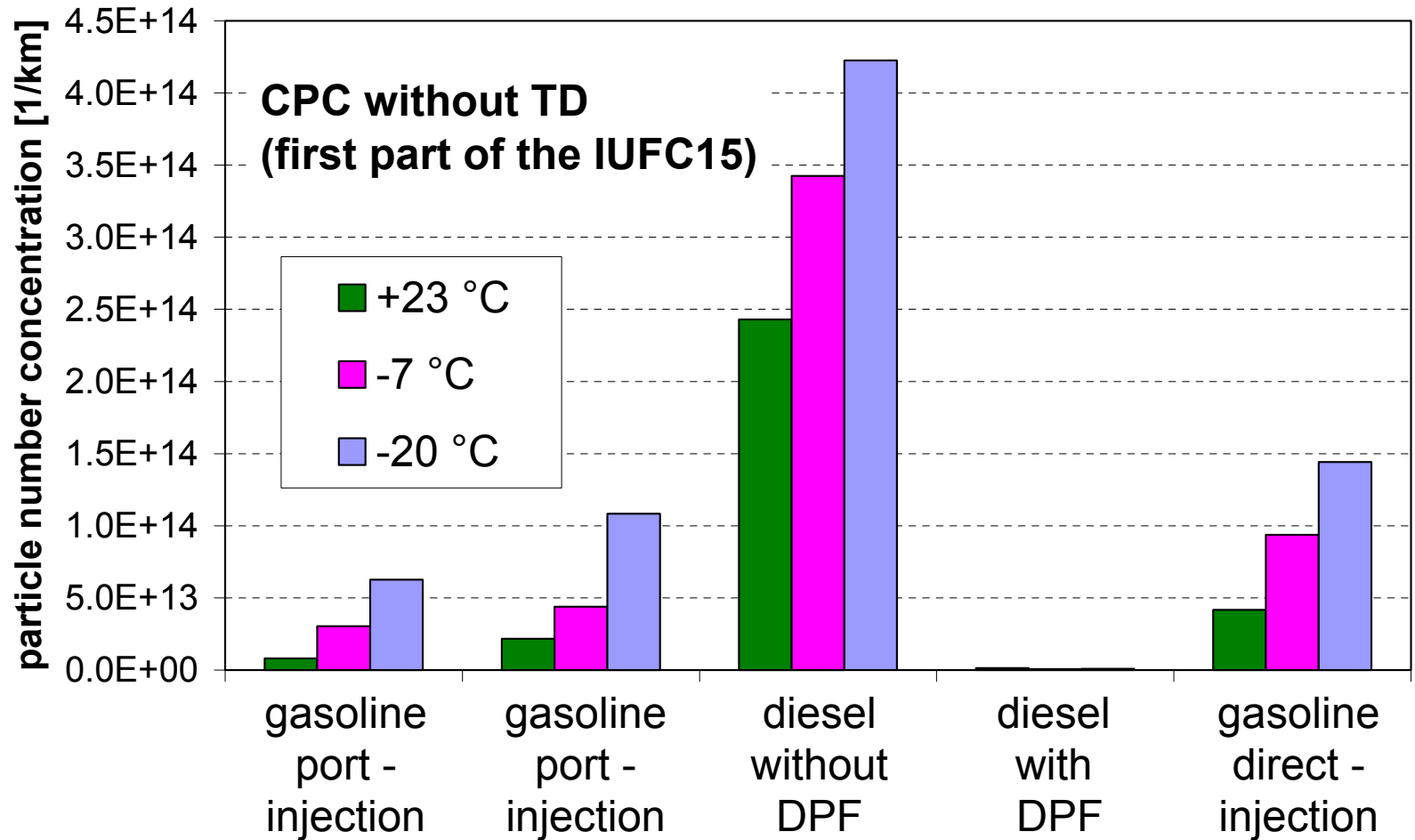
cold start particle number emissions



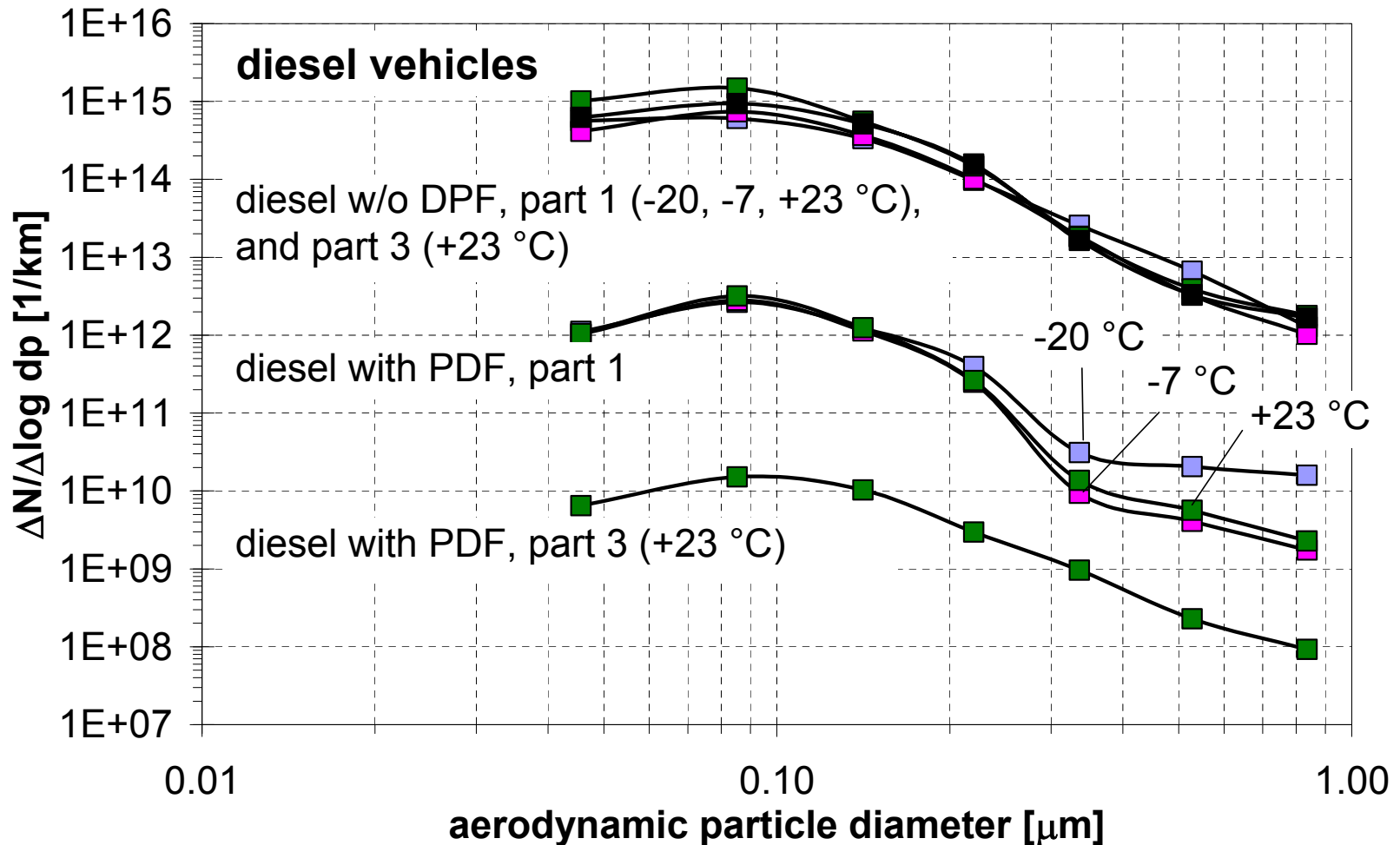
Total particle number concentration (CPC)



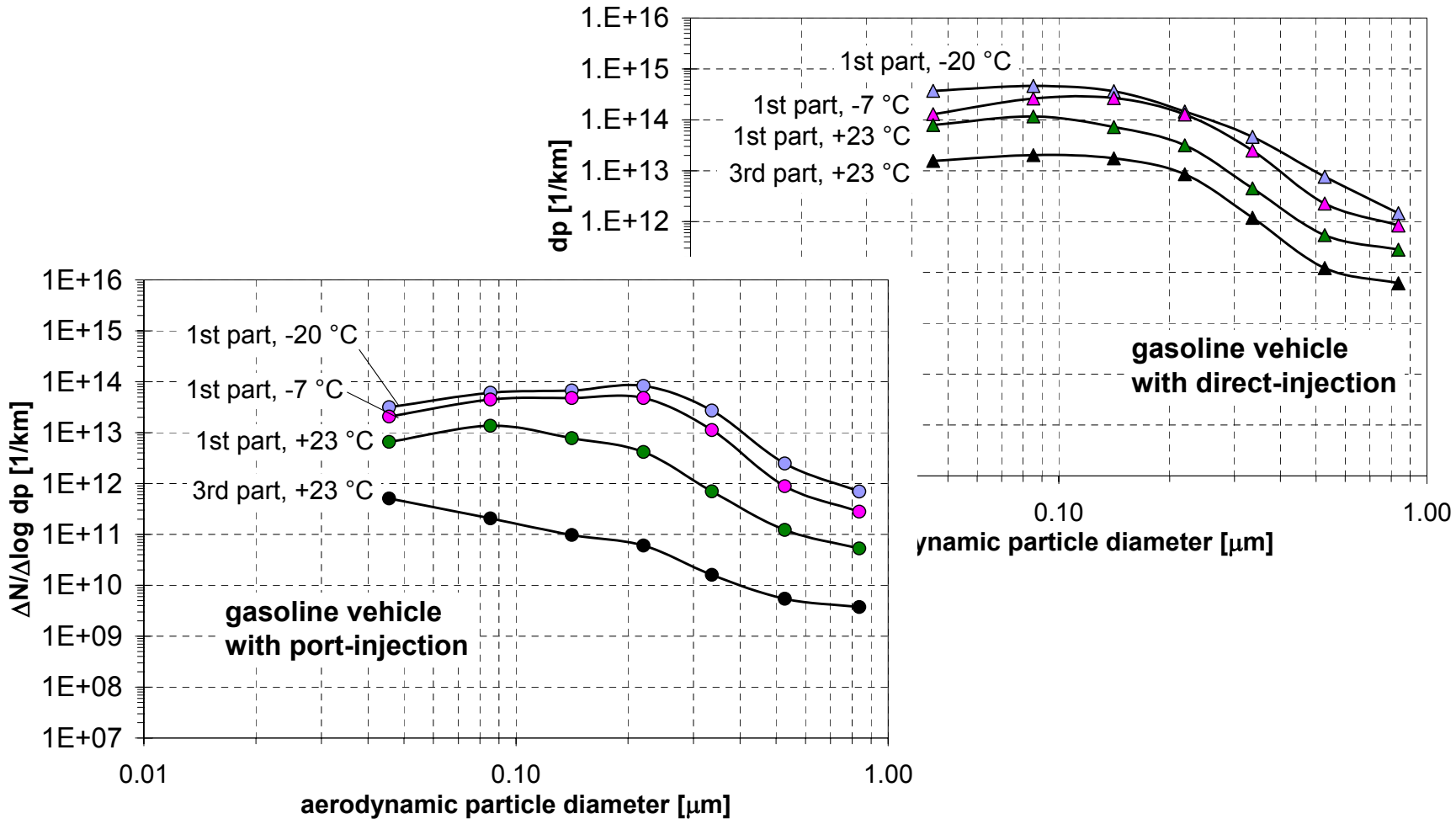
Total particle number concentration (CPC)



Particle number size distribution (ELPI)



Particle number size distribution (ELPI)



Conclusion I

- The **two gasoline vehicles with port-injection** emitted the main portion of particle emission in the first part of the IUFC15 driving cycle.
- The **diesel vehicle with DPF** emitted the main portion of particle emission in the first part of the IUFC15 driving cycle.
- The **diesel vehicle without DPF** hardly showed cold start effect regarding the emission of particles.
- The **gasoline vehicles with direct-injection** emitted moderate cold start emissions of particles.

Conclusion II

- A increase of cold start particle emission was found when decreasing the chamber temperature.
- The chamber temperature had no significant effect on the particle emissions as soon as the engine was warmed up.
- No nucleation mode particles were observed at subzero chamber temperatures.
- The shape of the particle number size distributions measured by the ELPI was only affected for the two **gasoline vehicle with port-injection** during high emissions of particles in the cold start phase.

Thank you for your attention

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