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Calibration Concepts for Particle Concentration Measurement at Vehicles - a Comparison

Jürg Schlatter
Swiss Federal Office of Metrology and Accreditation, metas Lindenweg 50, CH-3003 Bern-Wabern, Switzerland

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Objectives:

Continuous measurement of the solid particle number concentration at vehicles in the size range from 20 to 1000 nm (mobility diameter) and the concentration range of 0 to 10000 1/ml. Concepts for the calibration hierarchy in order to perform traceable and reliable measurements.

Swiss Concept:

According to the draft Swiss regulation for the particle measurement project (PMP-CH): "Ordinance on the determination of the particle number emission level of passenger cars with compression ignition engines", *BUWAL,* Draft, 1. March 2004

National Particle Concentration Standard

- competitive measuring principles for well defined measuring unit: High performance electrometer, CPC, or optical counter (e.g. LAPAZ)
- Metrologically validated against each other (future)
- International (key-)comparison (future)
- Known uncertainties for the whole size range
- Smaller uncertainty
- Higher costs

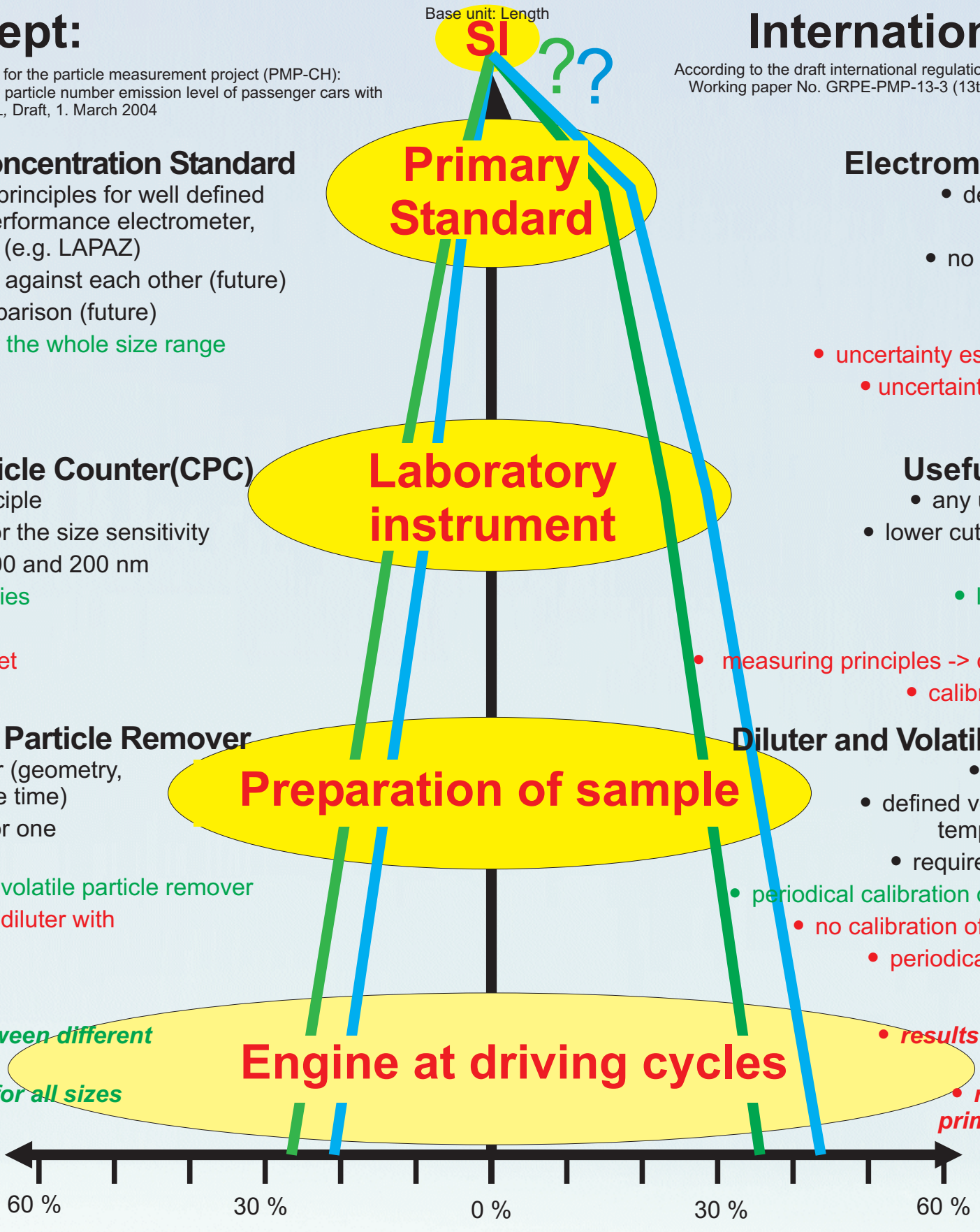
Condensation Particle Counter(CPC)

- defined measuring principle
- general requirements for the size sensitivity
- calibration @ 30, 50, 100 and 200 nm
- identical cross sensitivities
- cut off insufficient
- limited instrument market

Diluter and Volatile Particle Remover

- defined volatile remover (geometry, temperatures, residence time)
- general requirements for one single diluter
- periodical calibration of volatile particle remover
- periodical calibration of diluter with gas instead of particles

- *Small differences between different instrument types*
- *Uncertainties similar for all sizes*



International Concept:

According to the draft international regulation for the particle measurement project: Working paper No. GRPE-PMP-13-3 (13th PMP meeting, Geneva, 1 June 2004)

Electrometer as a Standard

- defined measuring principle
- commercial instrument
- no metrological requirements
- Lower costs
- No traceability to SI
- uncertainty estimated only below 80 nm
- uncertainty unknown above 100 nm

Useful Particle Counter

- any useful measuring principle
- lower cut off definition with 4 points
- calibration @ < 80 nm
- larger instrument market ?
- precise cut off
- measuring principles -> different cross sensitivities
- calibration limited in size range

Diluter and Volatile Particle Remover

- secondary dilution tunnel
- defined volatile remover (geometry, temperatures, residence time)
- requirements for series of diluter
- periodical calibration of volatile particle remover
- no calibration of secondary dilution tunnel
- periodical calibration of diluter with gas instead of particles

- *results may differ with different instrument types*
- *results traceable only to primary standard and not SI*