TC for Metrology in Chemistry:

Highlights and challenges

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8th EURAMET General Assembly

Cavtat, Croatia, 3 to 5 June 2014

Outline

- TC-MC: some general information

- Project examples:

- EURAMET project n. 1244 “Comparison of aerosol electrometers”,
- EURAMET project n. 1282 “Comparison of condensation particle counters”,
- JRP ENV 02 “PartEmission – Emerging requirements for measuring pollutants from automotive exhaust emissions”

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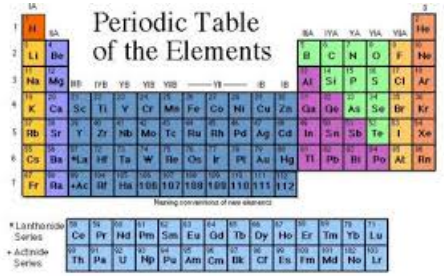
Metrology in Chemistry

EURAMET Technical Committee

EURAMET Projects:
Ongoing Regional and Supplementary Comparisons



Basic Science

- EURAMET.QM-S7 “Electrolytic conductivity at pure water level”
- EURAMET-QM-S8 “Analysis of impurities in pure and balance gases used to prepare primary standard gas mixtures by the gravimetric method ”

Energy

- EURAMET.QM-S9 “Comparison on natural gas”

Environment

- EURAMET.QM-K26a “Reactive gases: NO in N_2”

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Background

- Aerosol particle number concentration has recently featured in vehicle emission legislation and is also important in atmospheric measurements

- ISO/DIS 27891 “Aerosol particle number concentration - Calibration of condensation particle counters” describes a calibration procedure for condensation particle counters (CPCs)
  - CPCs measure particle number concentration in the size range from a few nm to a few µm
  - The DIS refers to the role of NMIs in providing certification for reference CPCs, and aerosol electrometers, which can be used to calibrate CPCs

- EURAMET 1244 and 1282 have been organised as part of EMRP ENV02 (‘PartEmission’)

EMRP Project ENV02 PartEmission

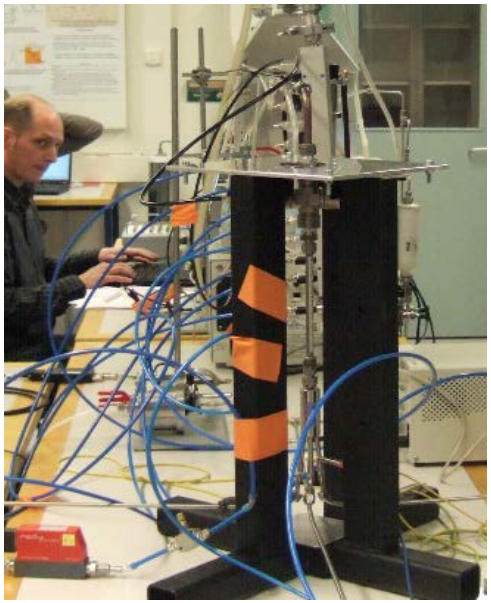
"Emerging Requirements for Measuring Pollutants of Automotive exhausts emissions" (**PTB**, BAM, DFM, METAS, IJS, JRC, LNE, MIKES, NPL , VSL) is articulated in 6 WPs:

- WP1 "Automotive particle emission metrics"
- WP2 "Methods for periodic emissions testing"
- WP3 "Primary measurement of PGE" (Platinum Group Elements)
- WP4 "Traceability for mercury vapour measurements"
- WP5 "Creating impact"
- WP 6 "Management and coordination"

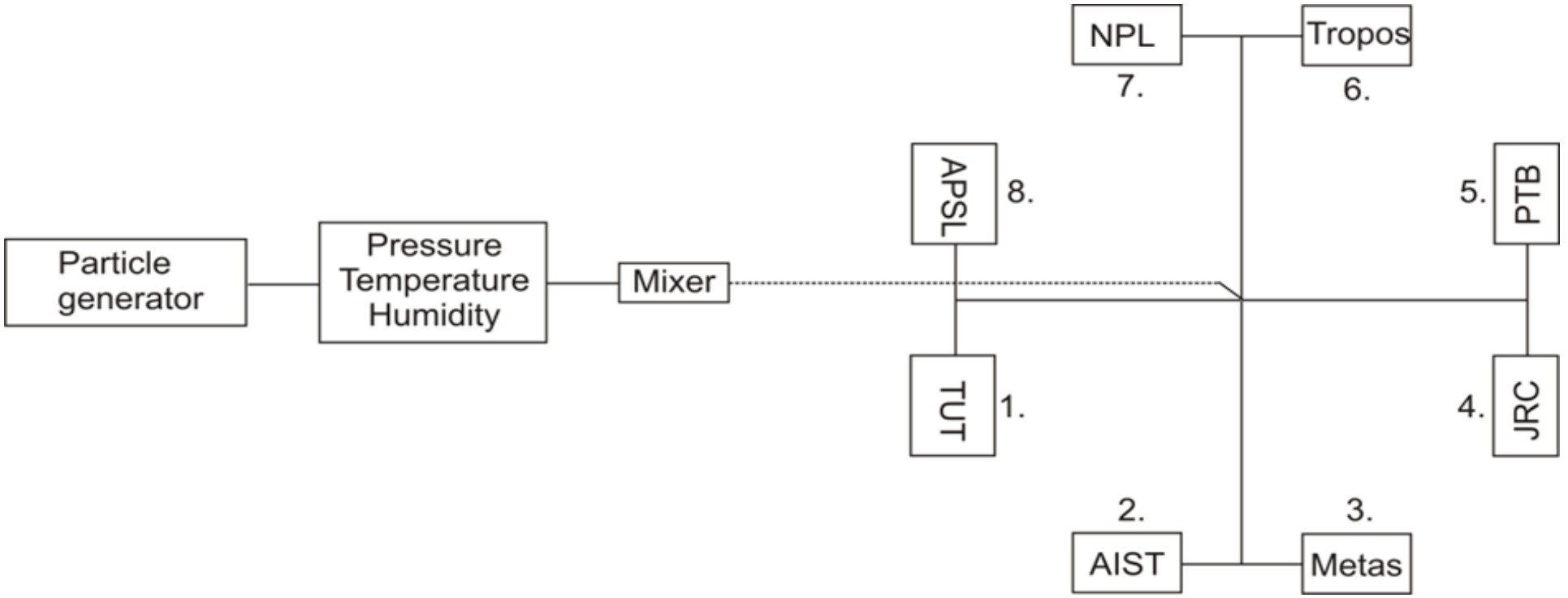
Two WPs address "**soot**", defined as the impure carbon particles resulting from an incomplete hydrocarbon combustion. In 2012 WHO defined it as carcinogenic. It is the 2nd largest cause for global warming

EURAMET project 1244 (NPL): "Comparison of aerosol electrometers" (FCEs)

- EURAMET 1244 compared measurements of airborne charge concentration (in $fC \cdot cm^{-3}$). **First comparison of this kind!**
- The comparison was based on measurements of a common aerosol source and was hosted by the Tampere University of Technology (TUT) in Finland on 18-22 March 2013
  - aerosol sources:
    SCAR (single charge aerosol reference)
    Multiple charge soot generator
  - Particle sizes from 6 nm to 200 nm.
  - Concentration range from 0.15 $fC \cdot cm^{-3}$ - 3 $fC \cdot cm^{-3}$ (equivalent to around 1000 particles cm^{-3} to 20000 particles cm^{-3})
  - 22 comparison runs

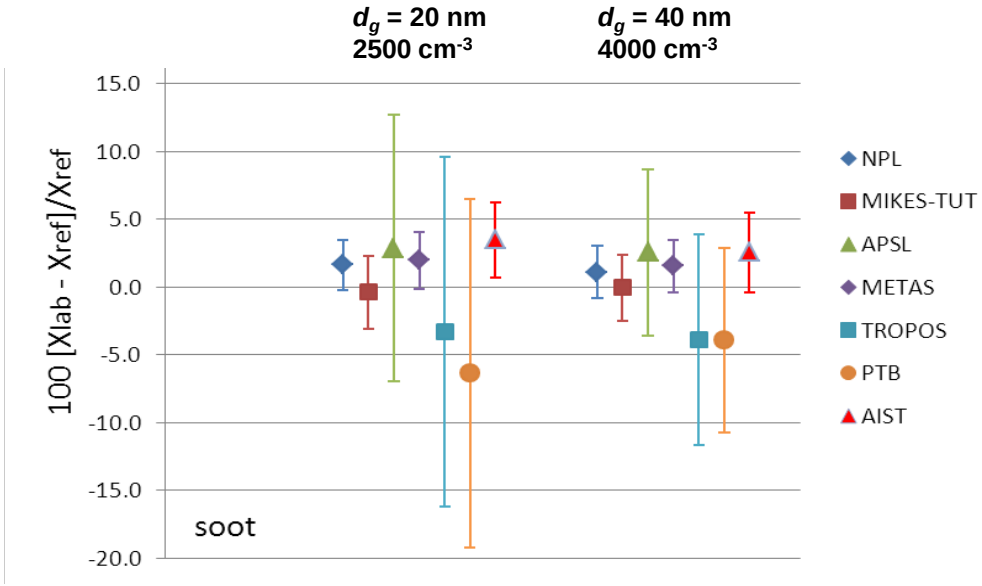


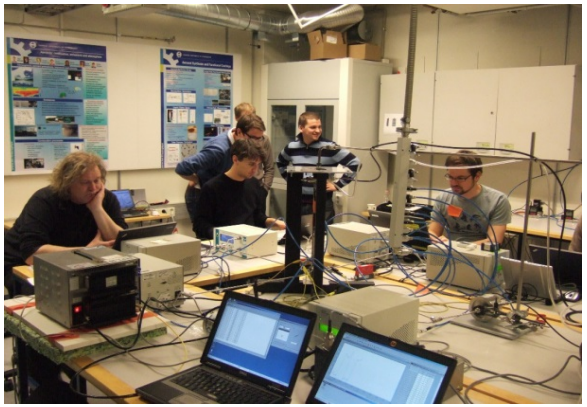
Experimental design



EURAMET 1244: some results

- Participants generally agree within 2 % in the size range 20 nm to 100 nm and number concentrations above 5000 cm^{-3} for singly charged synthetic particles.
- Larger deviations result at lower particle sizes and particle concentrations and soot particles.

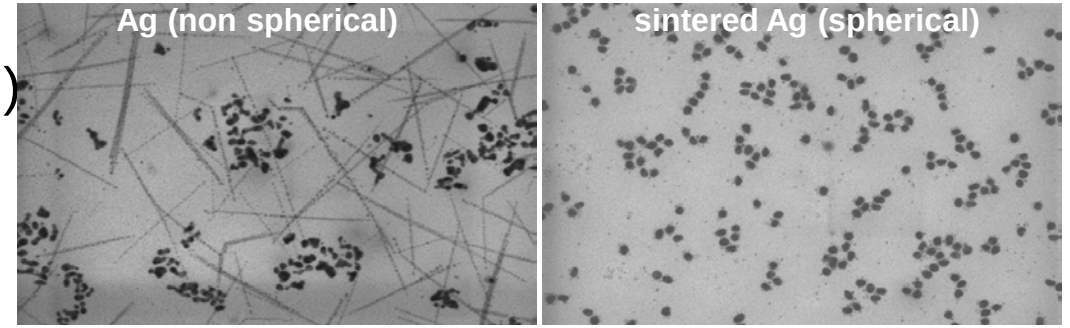




EURAMET project 1282 (NPL): "Comparison of condensation particle counters" (CPCs)

- EURAMET 1282 compared measurements of particle number concentration (in cm^{-3})
- The comparison was based on measurements of a common aerosol source and was hosted by TROPOS in Leipzig on 14-18 October 2013.

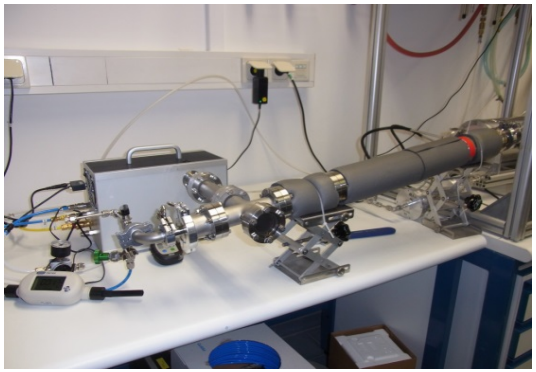
- aerosol sources:
  sintered silver (more spherical)
  silver (unsintered)
  soot



- Particle sizes from 6 nm to 100 nm.
- Concentration range 100 particles cm^{-3} to 20000 particles cm^{-3}
- 52 runs

EURAMET 1282: some results

- Preliminary results suggest that the agreement of participants is less good than in the FCE comparison.
- Increased uncertainties down the traceability chain from primary FCE → reference CPC (ISO/DIS 27891).



- Promising results, but a lot of work still needs to be done…..

A special thank to

- Paul Quincey (NPL, coordinator of the EURAMET projects), Hanspeter Andres (METAS, ENV02 WP1 leader), Hugo Ent (VSL, EURAMET TC-MC SC-GA Convenor) for their fundamental support in preparing the slides

- Paola Fisicaro (LNE)
  Past Convenor of the TC-MC Sub-Committee for Inorganic Analysis

Thank you for your attention!