

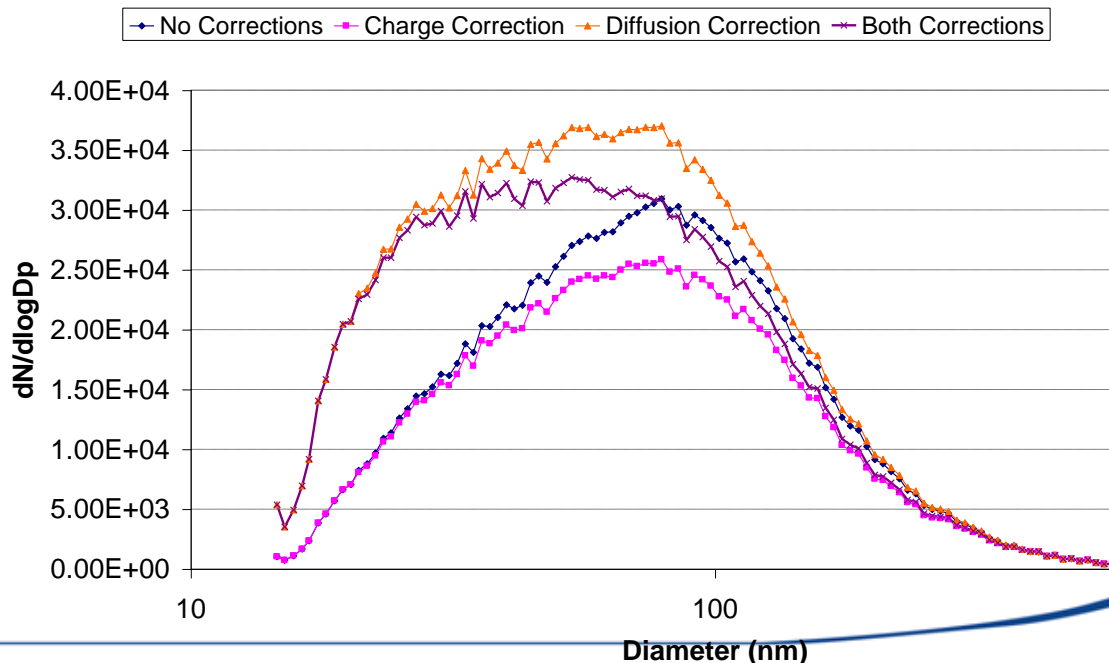
Particle measurement for ambient air regulation: current and future techniques

Paul Quincey

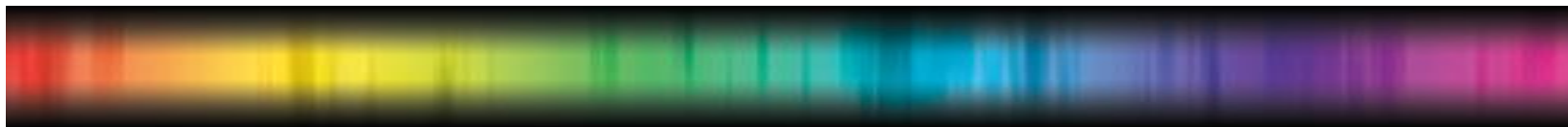
Cambridge Particles Meeting
13th May 2011

Outline

1. What do we mean by accuracy?
2. Update on airborne particle metrology and standardisation.
3. AirMonTech – an opportunity to bring new technology to Ambient Air regulation



A measurement spectrum

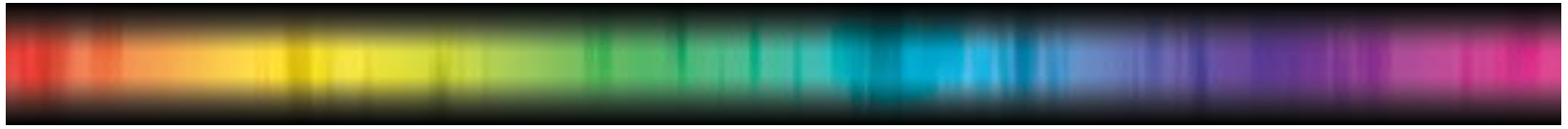


Simple: mass



instrument

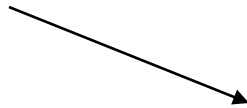
A measurement spectrum



Simple: mass



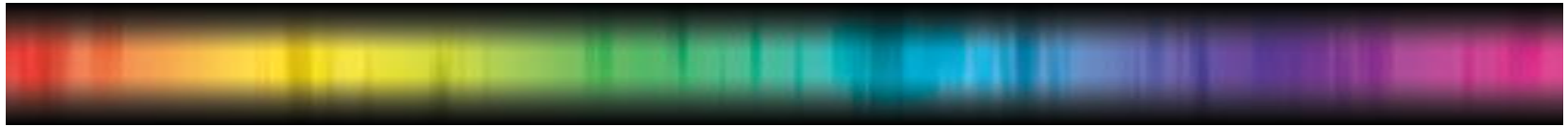
instrument



Local calibration



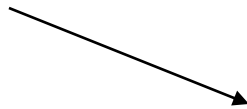
A measurement spectrum



Simple: mass



instrument



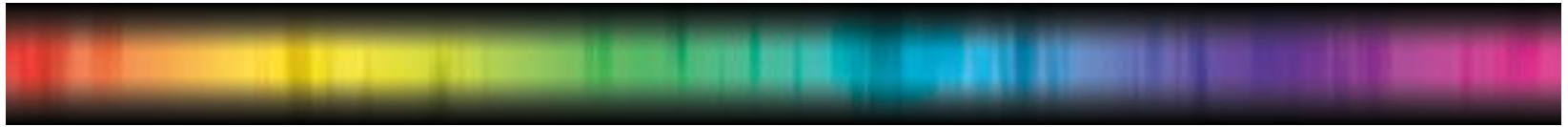
Traceable calibration
is all you need

Local calibration



Traceable to National
Measurement Institutes
(NMIs) and internationally

A measurement spectrum

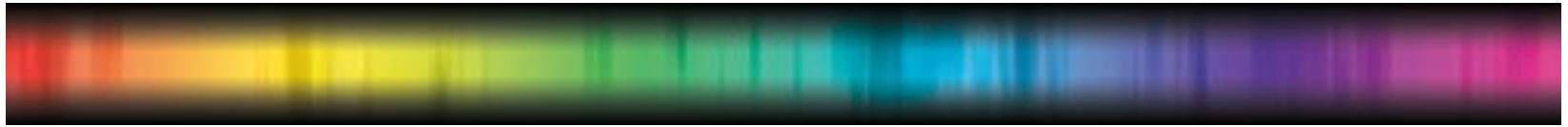


Tricky: particle number
concentration

instrument



A measurement spectrum

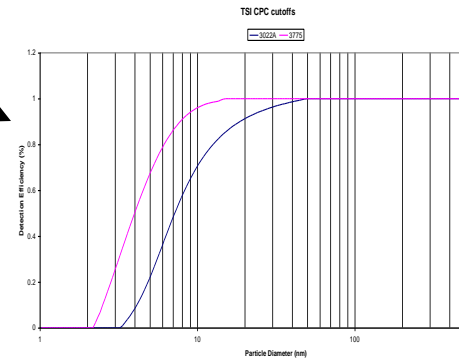


Tricky: particle number concentration

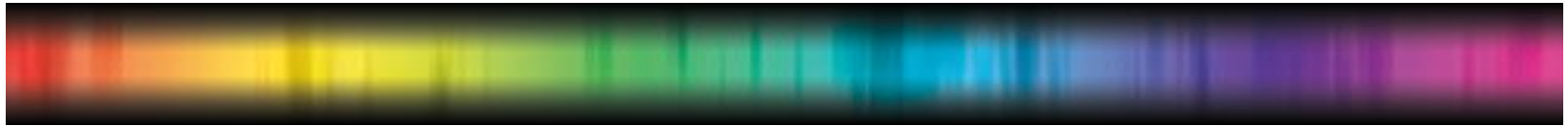
instrument



Calibration – how and what?



A measurement spectrum



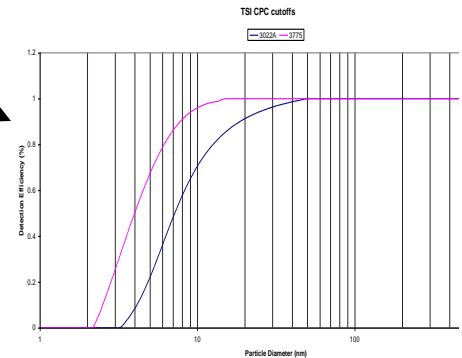
Not just calibration
Standardisation
needed, including
agreement on what
we are trying to
measure
Role for NMIs ?

Tricky: particle number
concentration

instrument



Calibration – how and
what?



sampling



Ambient ozone analogy

regulation

EU Ambient Air Quality Directive
2008/50/EC – target value
concentrations

standardisation

EN 14625:2005 ...measurement of
ozone by ultraviolet photometry

Sampling, QA/QC

calibration

Traceability to NMIs – without a
reference artefact





Field users produce results $\pm 10\%$

Transfer standard photometers maintained by specialist calibration labs $\pm 5\%$

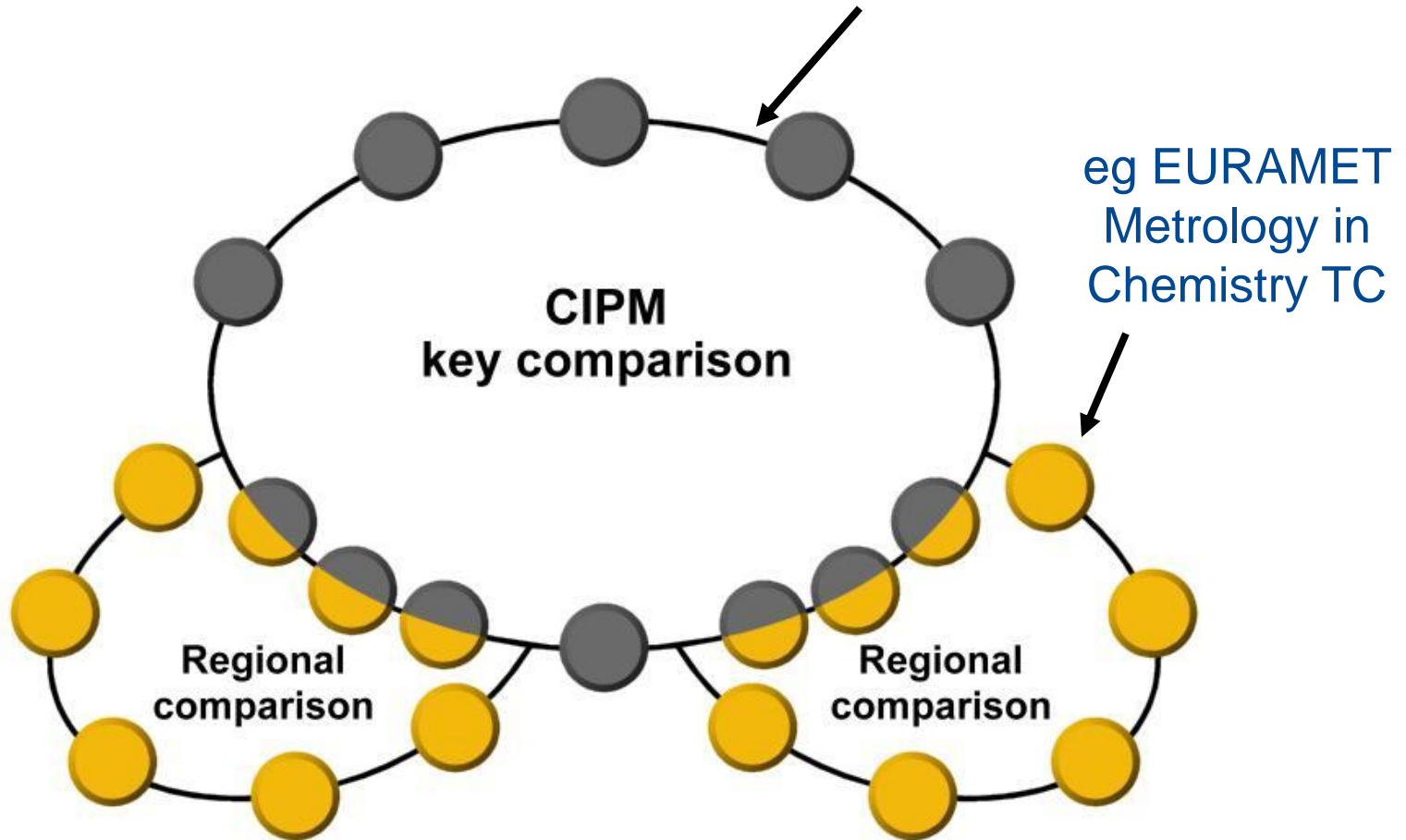
NMI reference photometer $\pm 2\%$



O₃

Coordination is through
CIPM, based in Paris

For gas analysis
through CCQM



International standardisation for size and number

ISO TC 24 Particle characterisation including sieving

SC4 Particle characterisation

WG12 – Electrical mobility and number concentration analysis for aerosol particles

ISO 15900:2009

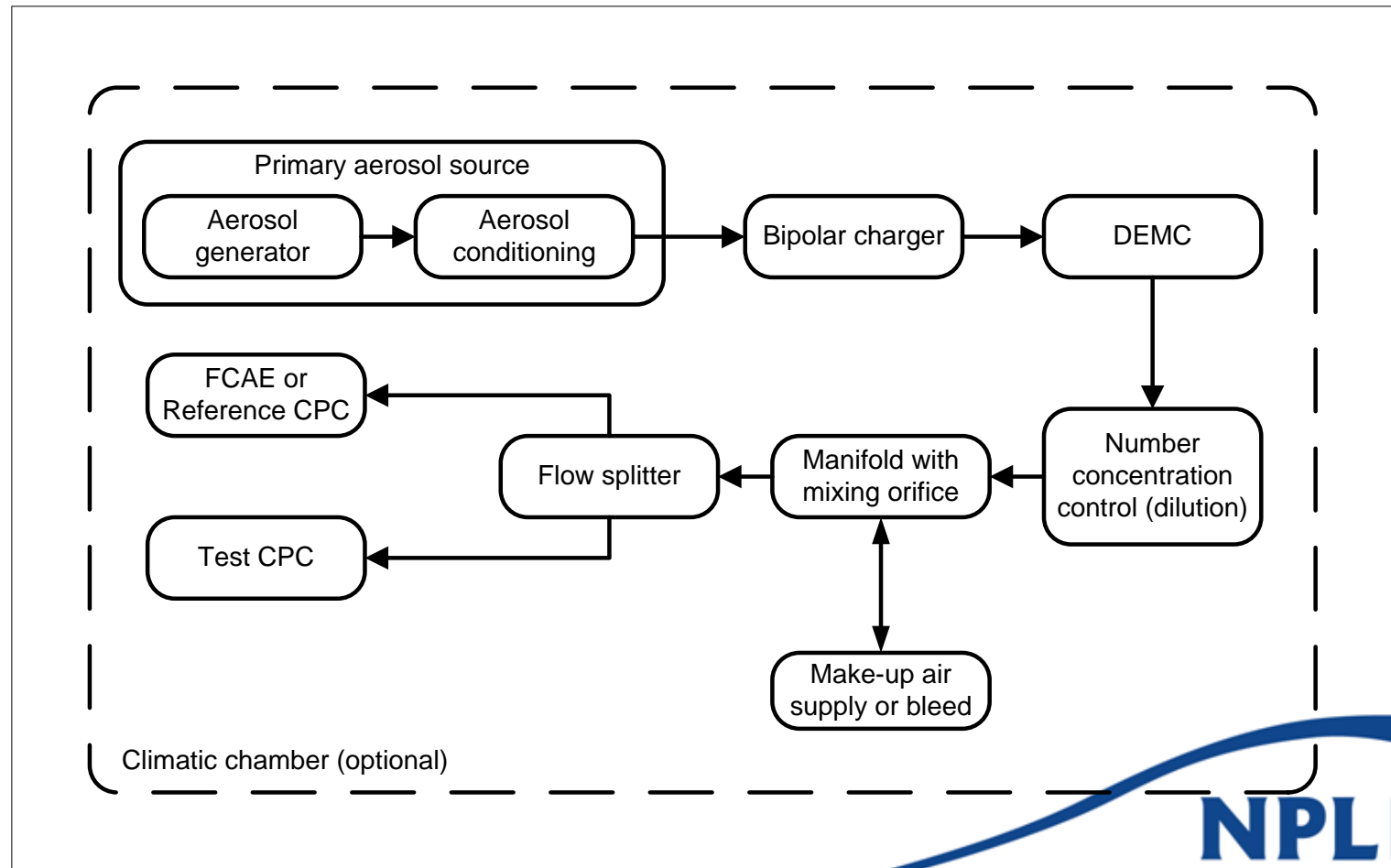
Determination of particle size distribution -- Differential electrical mobility analysis for aerosol particles

ISO/NP 27891

Aerosol particle number concentration -- Calibration of condensation particle number counters

International standardisation

ISO/NP 27891 Aerosol particle number concentration -- Calibration of condensation particle counters



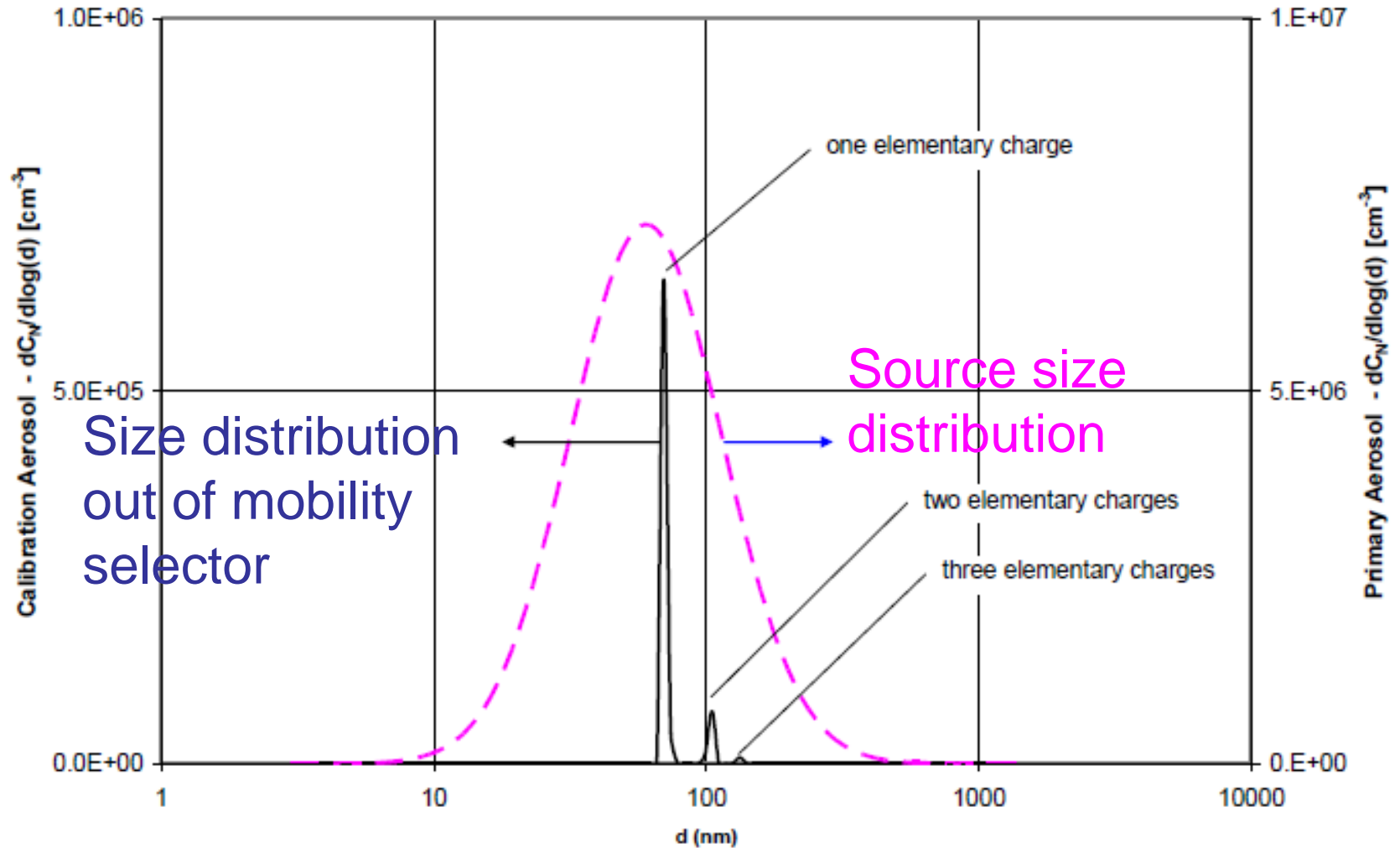
International standardisation

ISO/NP 27891 Aerosol particle number concentration -- **Calibration of condensation particle counters**

General method – wide range of particle size and materials

Key topic: treatment of multiply charged particles

Basic complications – size and charge of test aerosol



International standardisation

ISO/NP 27891 Aerosol particle number concentration -- Calibration of condensation particle counters

General method – wide range of particle size and materials

Key topics: treatment of multiply charged particles

Unequal flow splitting

Validity of reference certificate ...

Role of NMIs recognised

International standardisation

CEN TC 264 Air Quality

WG32 – Air quality - Determination of the particle number concentration

Draft Technical Specification:

Key topics: sampling line requirements and tests

low size cut-off (~ 7 nm)

CPC calibration according to ISO 27891

calibration particle material

Effect of different particle materials

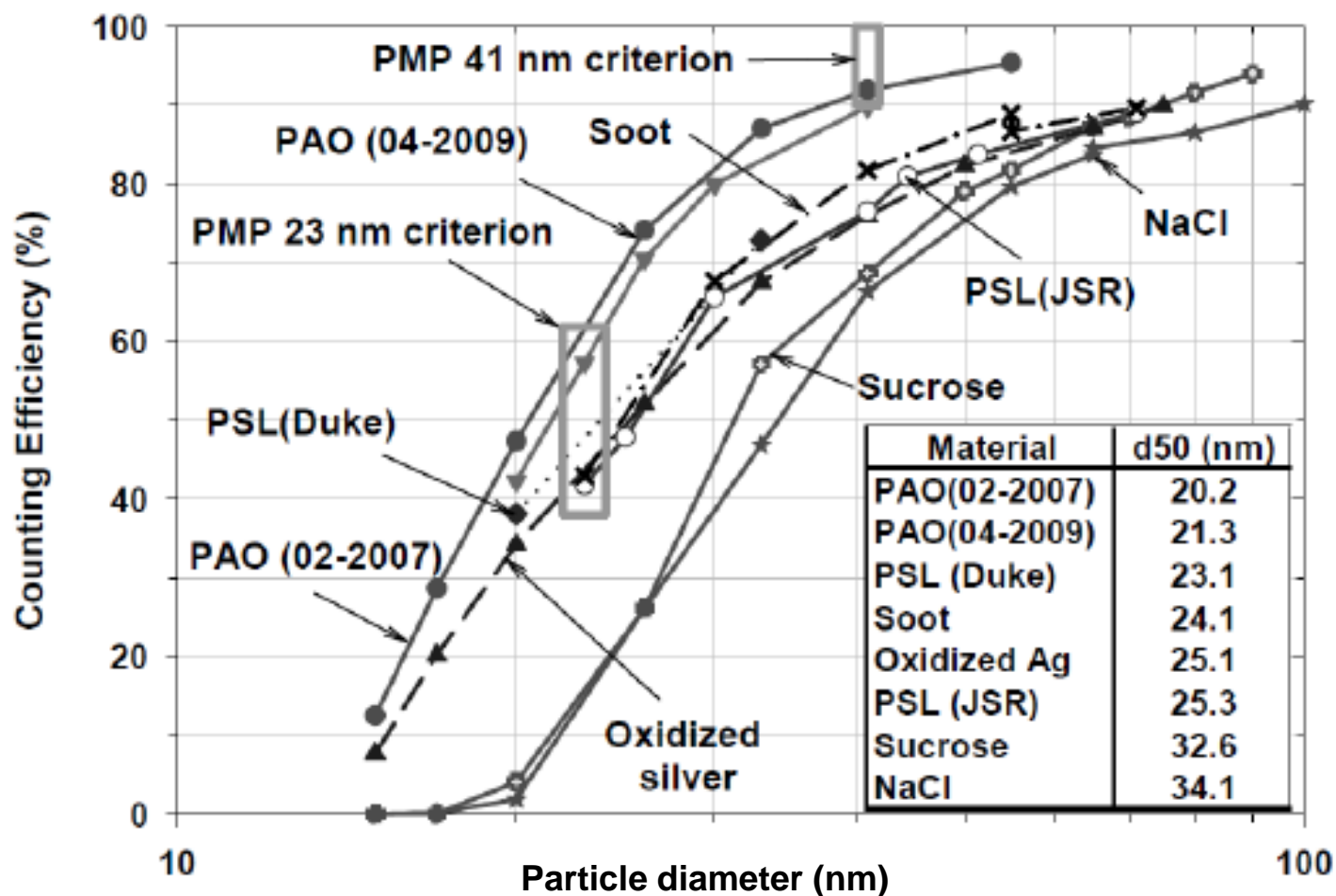
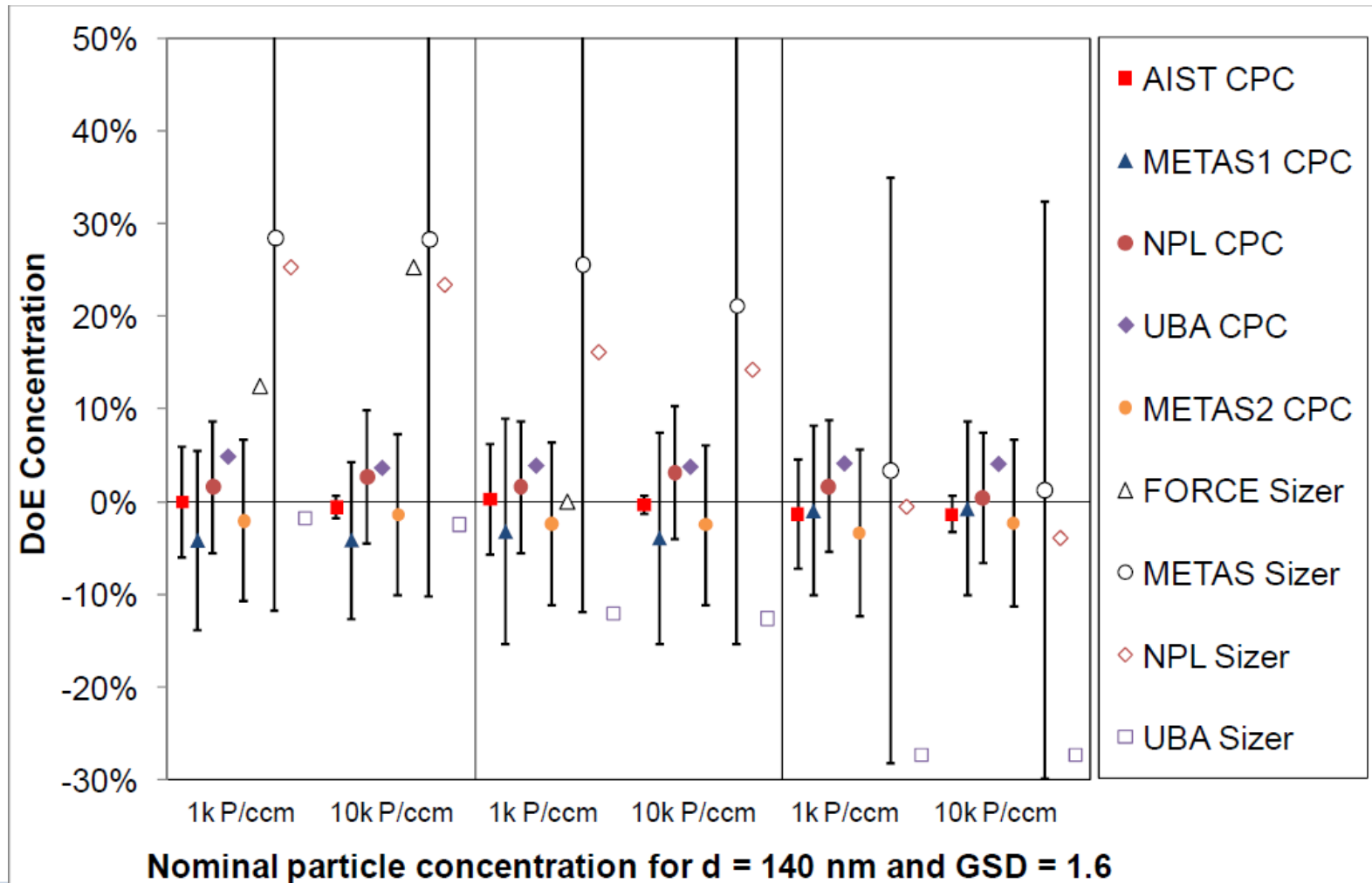


Diagram from AIST Japan, adapted from Wang et al 2010

International metrology

Several NMIs active: 1st EURAMET comparison in 2008

<http://www.euramet.org> >TC Project Database> reference 1027



NPL capabilities



NPL has ISO 17025
accreditation for
CPC calibration
service

< 100 nm

1000 – 200,000 cm⁻³

Uncertainty (95% CI)

± 7%

A new European NMI project (on
vehicle particle emissions) starts in
June, led by PTB (Germany)

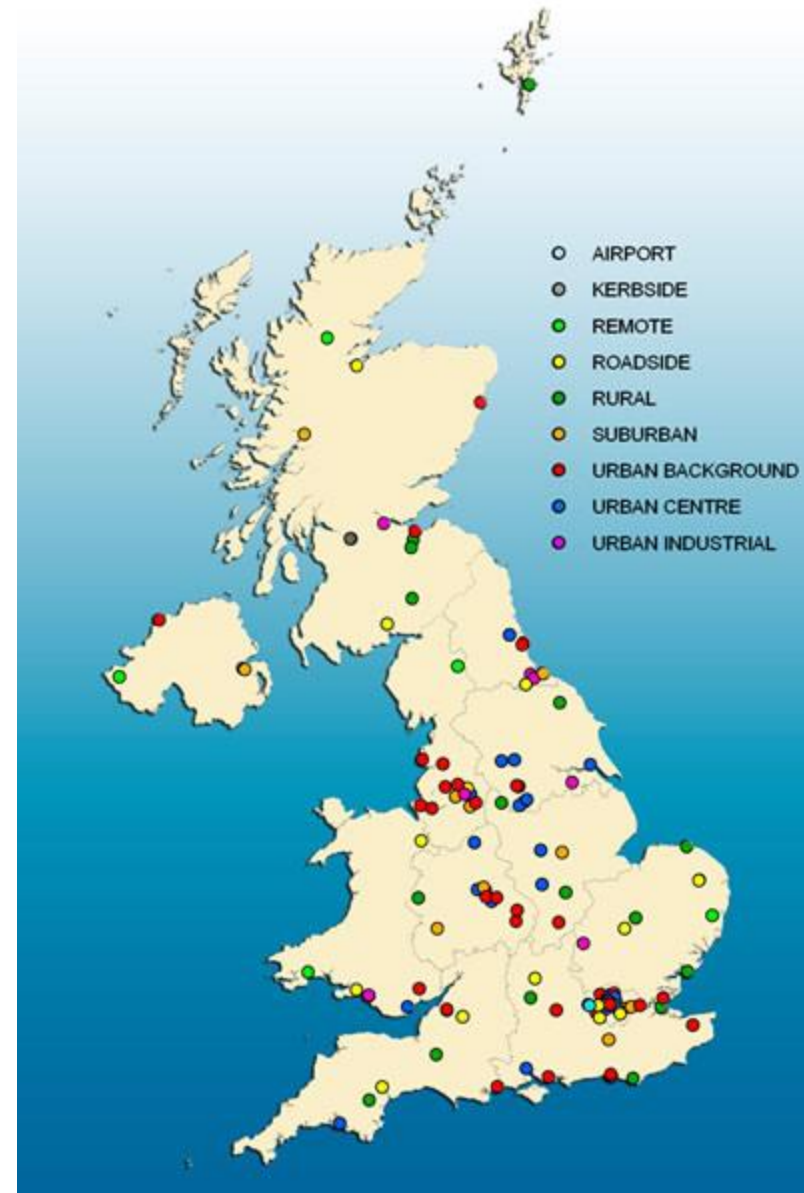
Defra Air Quality Networks

Specific gases + PM

EU Directives

CEN standards +

Continuous live data

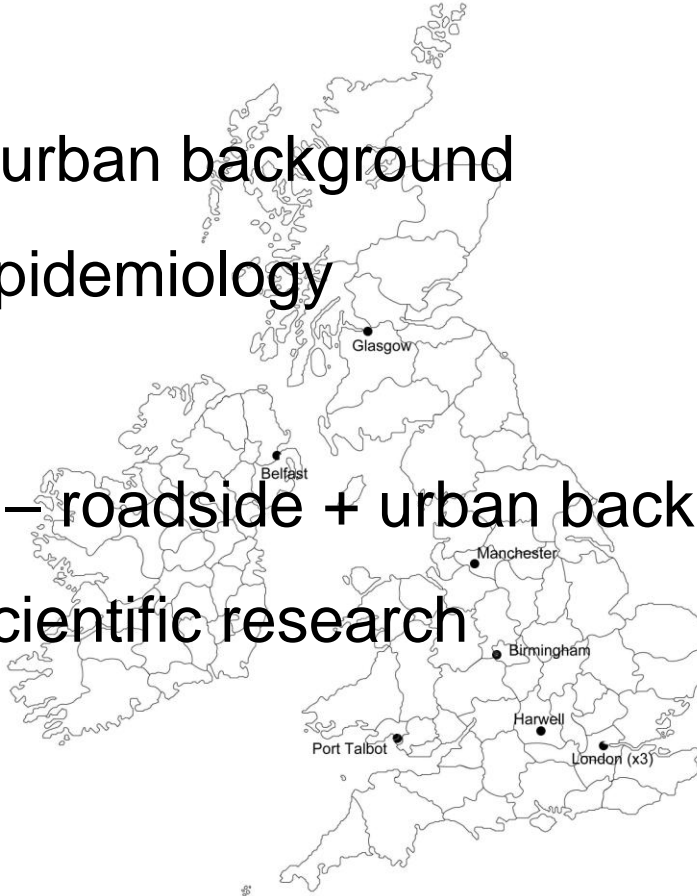


The Defra particle counting and sizing network – non-regulatory, run by NPL and KCL

Aims

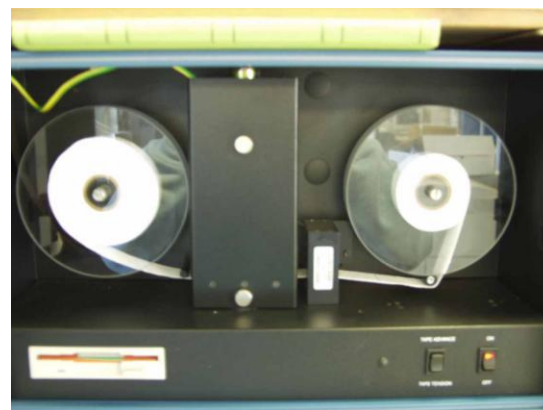
4 CPC sites - urban background
primarily for epidemiology

3 SMPS sites – roadside + urban background + rural
primarily for scientific research



Defra Black Carbon network (aethalometers)

Run by NPL and KCL



Absorption of specific wavelengths by collected PM_{2.5} particles : 880 nm (near-ir) and 370 (near-uv)

High precision and time resolution (reported hourly)


Real time data

The future of ambient air particle regulation: the AirMonTech project 2010 - 2013



Air Pollution Monitoring Technologies
for Urban Areas

Partners



A map of Europe is shown with various partner logos overlaid on different geographical locations. The logos include:

- NILU**: Located in the north of Europe.
- NPL National Physical Laboratory**: Located in the United Kingdom.
- ECN**: Located in the Benelux region.
- iuta**: Located in Central Europe.
- UNIVERSITÄT DUISBURG ESSEN**: Located in Central Europe.
- EMPA**: Located in Central Europe.
- JRC EUROPEAN COMMISSION**: Located in Southern Europe.
- CSIC CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS**: Located in the Iberian Peninsula.
- National and Kapodistrian UNIVERSITY OF ATHENS**: Located in Greece.

- 9 Partners from some of the leading research organisations in Europe
- Complementary skills and expertise in the areas of air quality measurements and in instrument development
- Air quality monitoring experts, measurement technique developers and health effect researchers from renowned research institutions

The AirMonTech project – geared to the revision of the Air Quality Directive in 2013

WP1 Provide up-to-date information on the best implementation of current monitoring technologies (led by Christoph Hueglin, Robert Gehrig, EMPA)

WP2 Assess new technologies for current parameters and possible new parameters (led by Thomas Kuhlbusch, IUTA)

WP3 Make the information from WPs 1 and 2 available in a public Database (led by Annette Borowiak, JRC Ispra)

WP4 Provide scientific input to the revision of the AQ directive, and identify areas of research needing to be covered before future changes and improvements can be made (led by NPL)

The AirMonTech project – geared to the revision of the Air Quality Directive in 2013

Information on new technologies, suggestions for new ways of regulating air quality etc now being sought:

<http://www.airmontech.eu/>

(the stated deadline is 30 April but it is not too late)

Summary

Airborne particle measurements can be brought within the international metrology infrastructure

Standardisation and metrology are being put in place

EU Air Quality legislation is being reviewed via the AirMonTech project

<http://www.airmontech.eu/>

Thank you

