

**European Network on New Sensing Technologies for Air Pollution
Control and Environmental Sustainability - *EuNetAir*
COST Action TD1105**

INTERNATIONAL WG1-WG4 MEETING on

New Sensing Technologies and Methods for Air-Pollution Monitoring

European Environment Agency - EEA

Copenhagen, Denmark, 3 - 4 October 2013

Action Start date: 01/07/2012 - Action End date: 30/06/2016 - Year 2: 2013-2014 (*Ongoing Action*)

**Recent Trends in Measuring Particulate Metrics in
Urban Air**



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**Function in the Action: Sub-WG 3.3 Leader
IUTA e.V./ Germany**

Outline



Introduction:

Particle metrics

Health aspects

Trends

New instrumentation

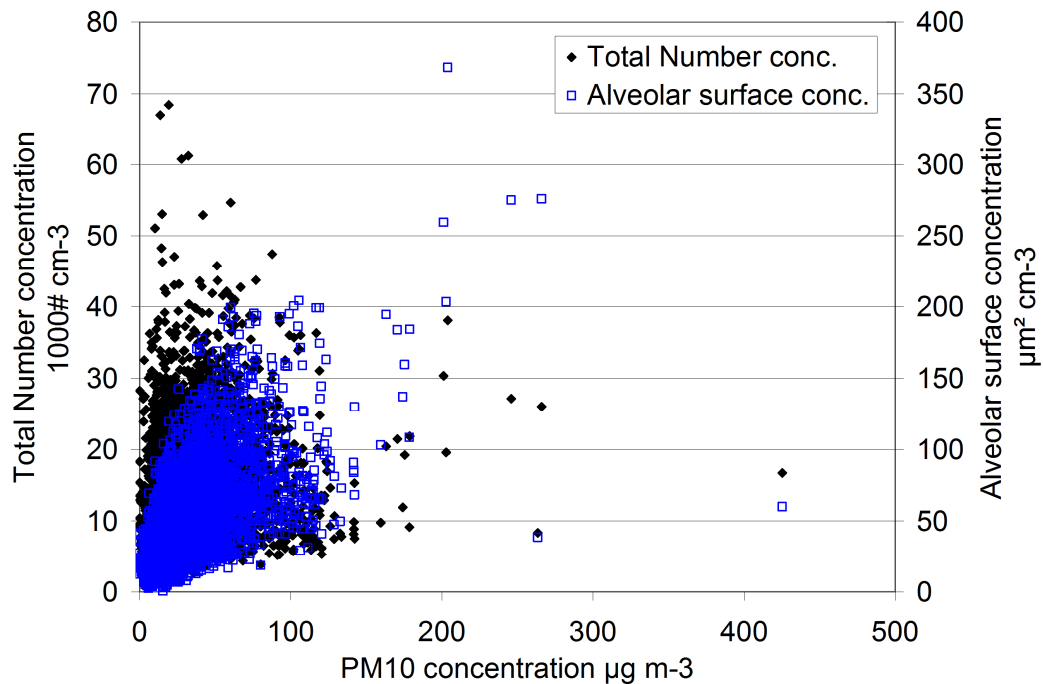
New metrics

Challenges & Outlook

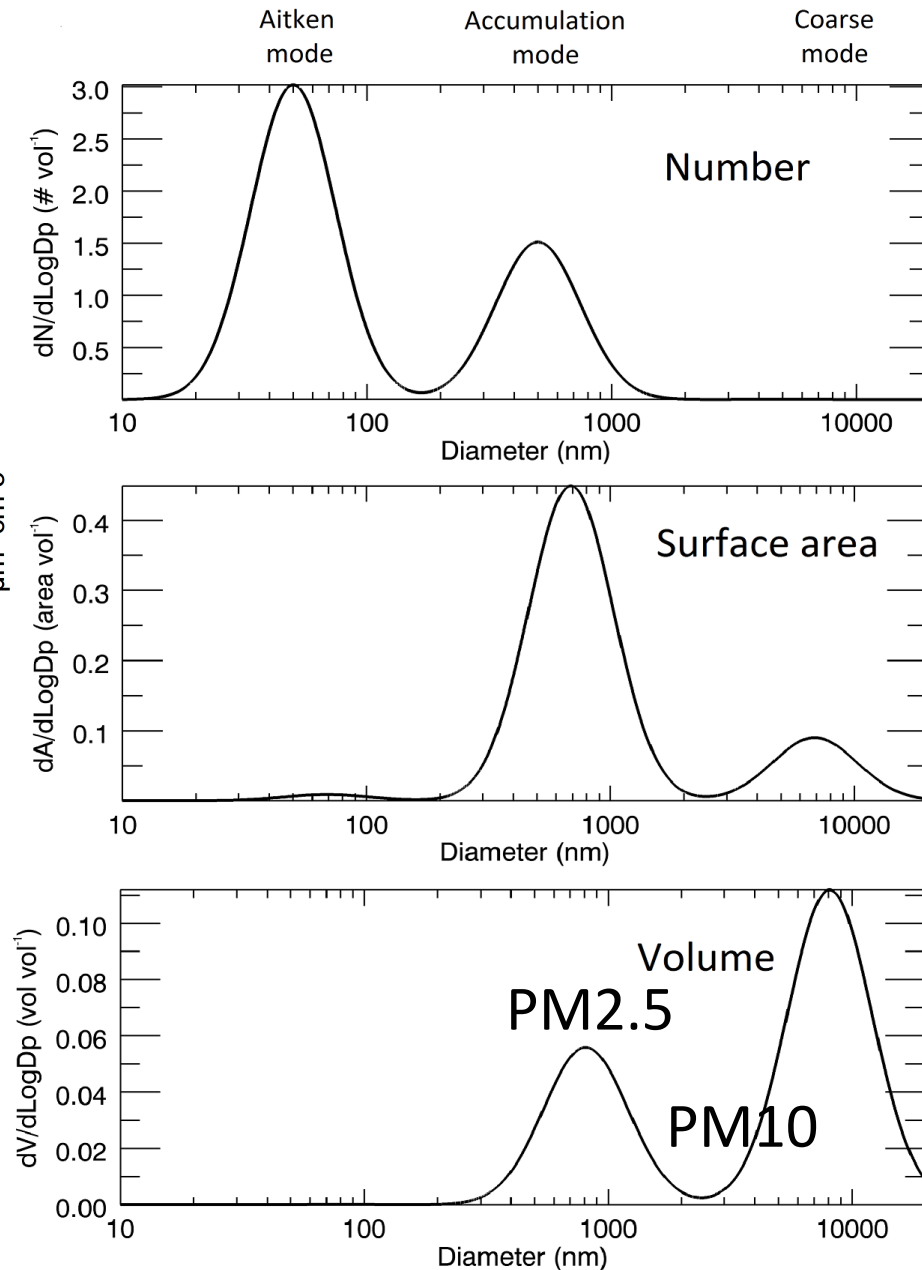


Introduction:
Particle metrics
Health aspects

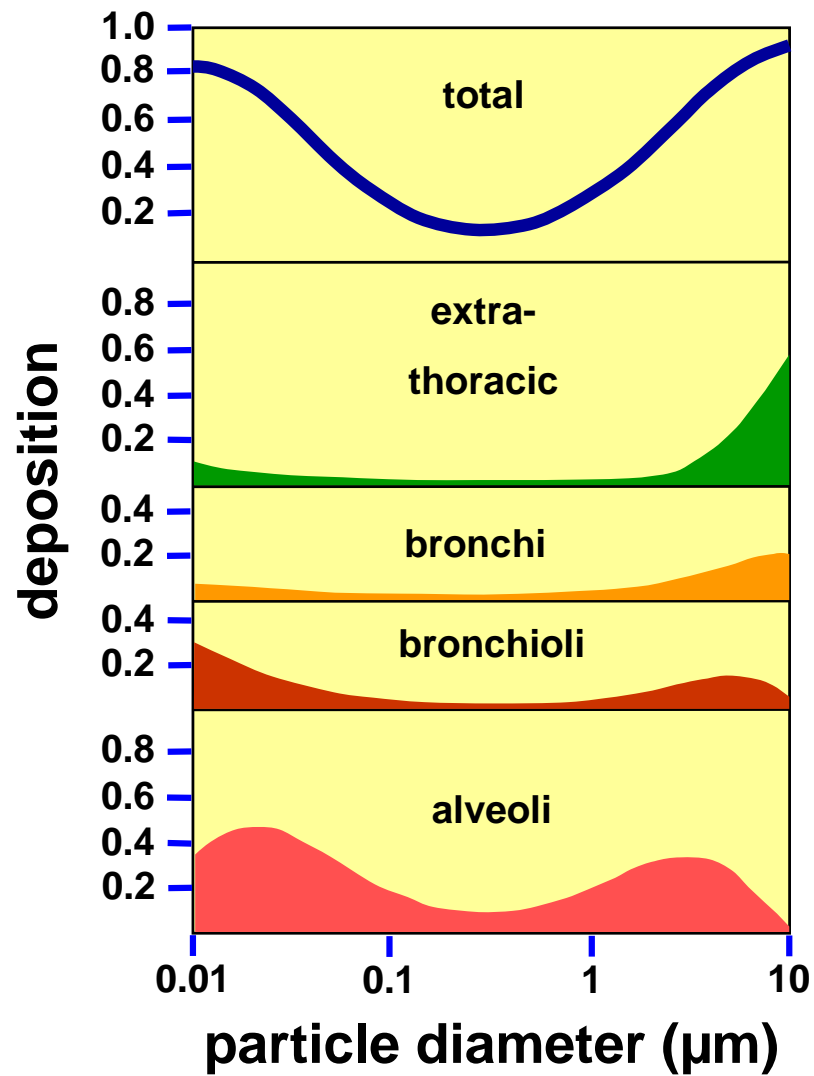
Particle Metrics



3 year data from urban background site
Ruhr area, Germany



Deposition of Particles in the human airways



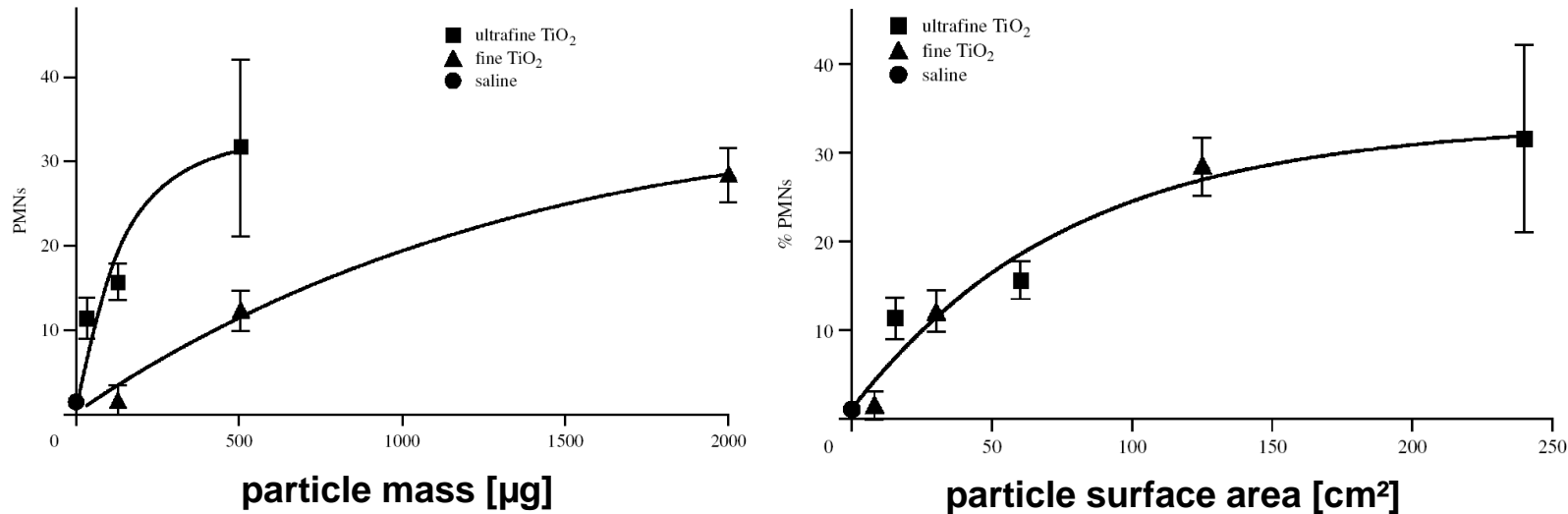
ICRP 66 (1994); MPPDep (2000)

Health effects relations



Volume (mass)-concentration: well-proven epidemiology

Surface area: tox hints, epi not yet enough explored

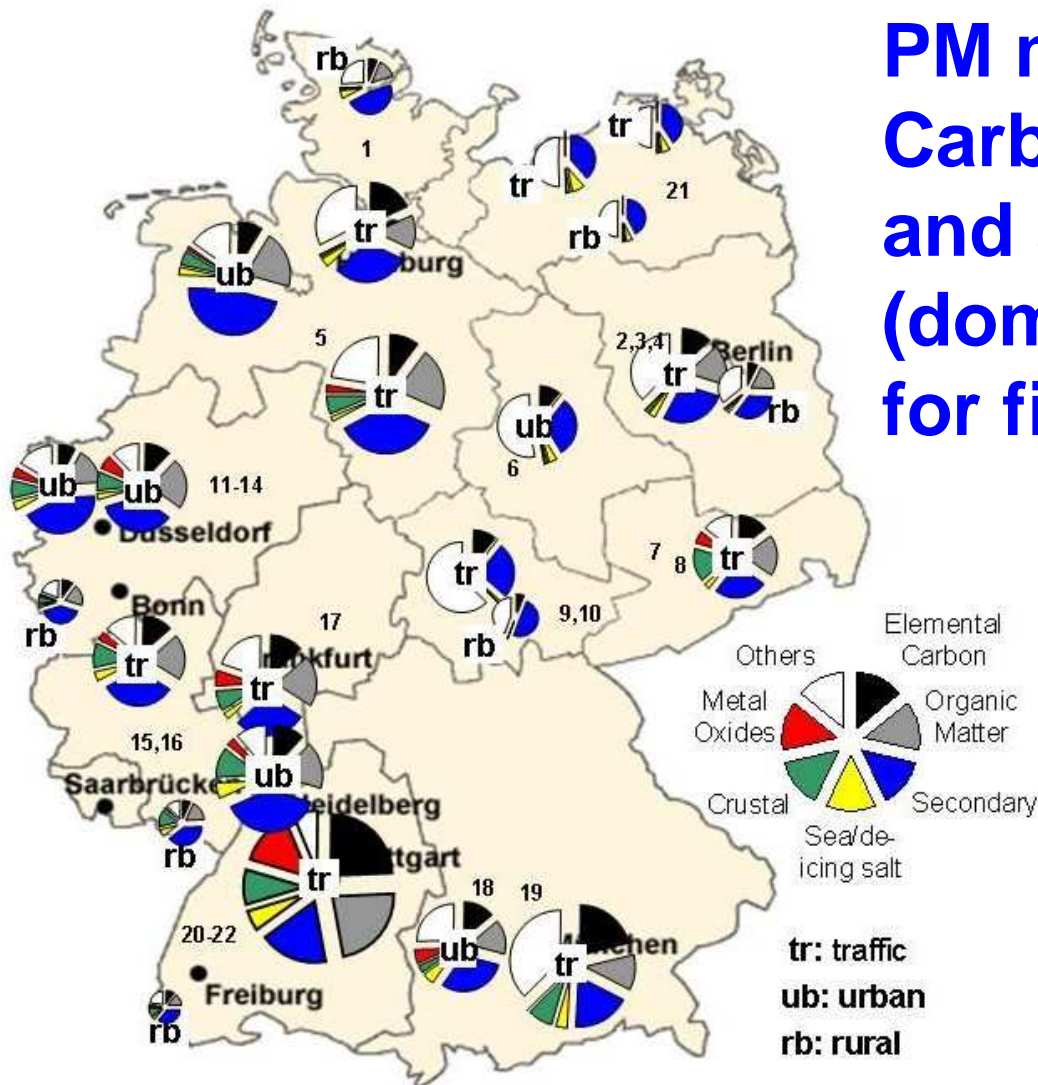


Oberdörster *et al.*, *Phil. Trans. Roy. Soc.* (2000) **358**: 2719

Number: tox & epi indications, less than for mass

Particle composition

PM mass dominated by Carbonaceous (prim. & sec) and sec. inorganic compounds (dominance larger for finer fractions)



Particles are carriers for toxic species (HM, PAHs, POPs)

Quass et al, Handbook of Env. Chemistry, Springer , 2013

Outline



Trends

New instrumentation

New metrics

New Instruments for networks

- Increased use of particle sizers in dedicated networks (e. g. in UK (Defra), DE (GUAN), JOAQUIN project, UFIREG project)
- PM mass measurement by optical devices; equivalency proof is needed

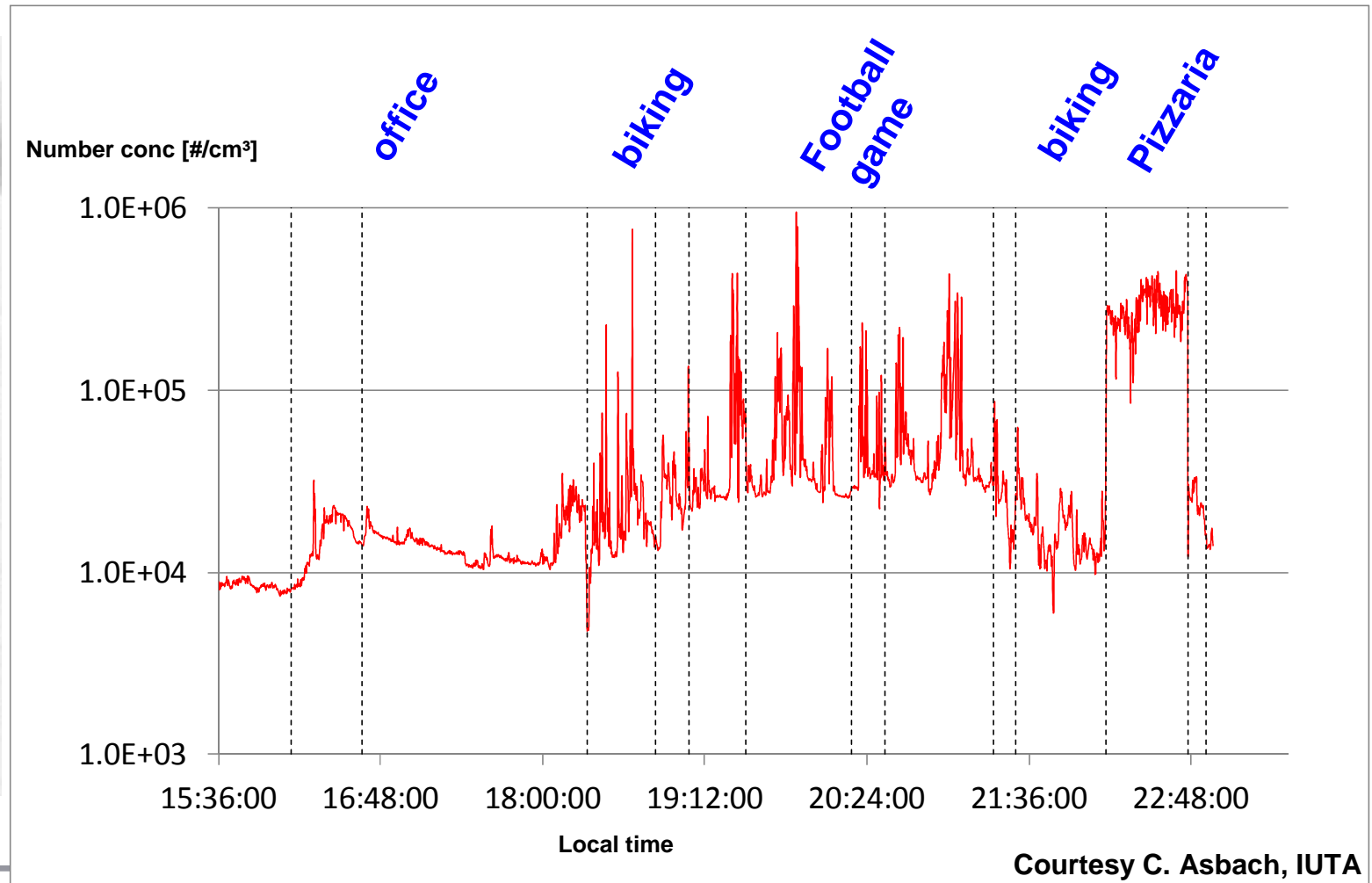


Main problems:

- assumption of particle densities
- Particle surface alterations, e.g. humidity influence

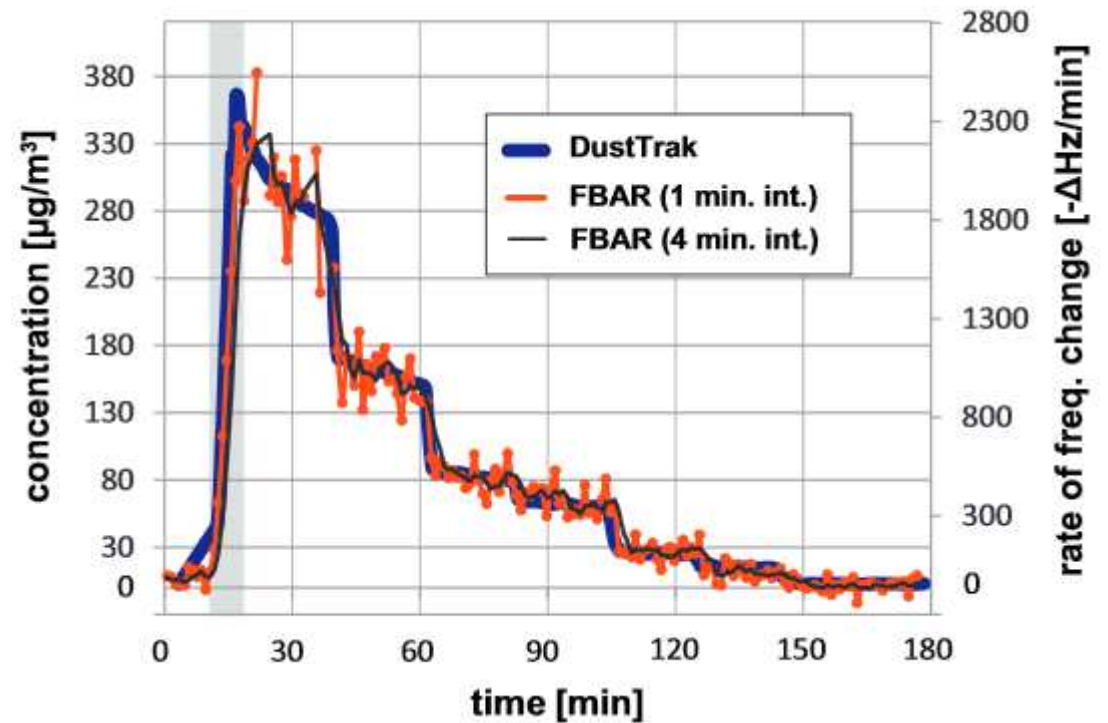
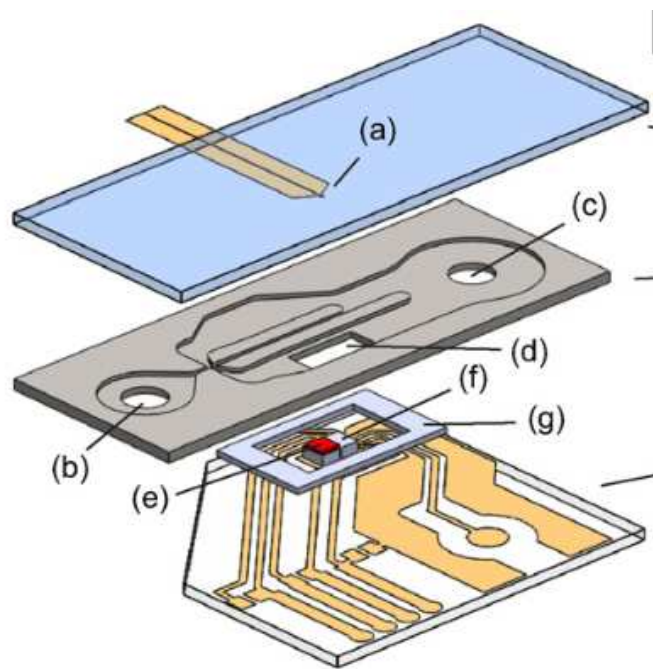
New instruments for alternative metrics

- Direct reading instruments for lung-deposited surface concentration (dose-related measurement! Small devices for personal sampling available)



Miniaturisation and sensors

Miniaturisation by micro-fabrication to build personal monitors



E.g., thermophoretic collection with film bulk acoustic resonator as mass sensor 2.5 x 2 mm² size!

On-line chemical information

Light absorption,
a proxy for elemental carbon



MAAP

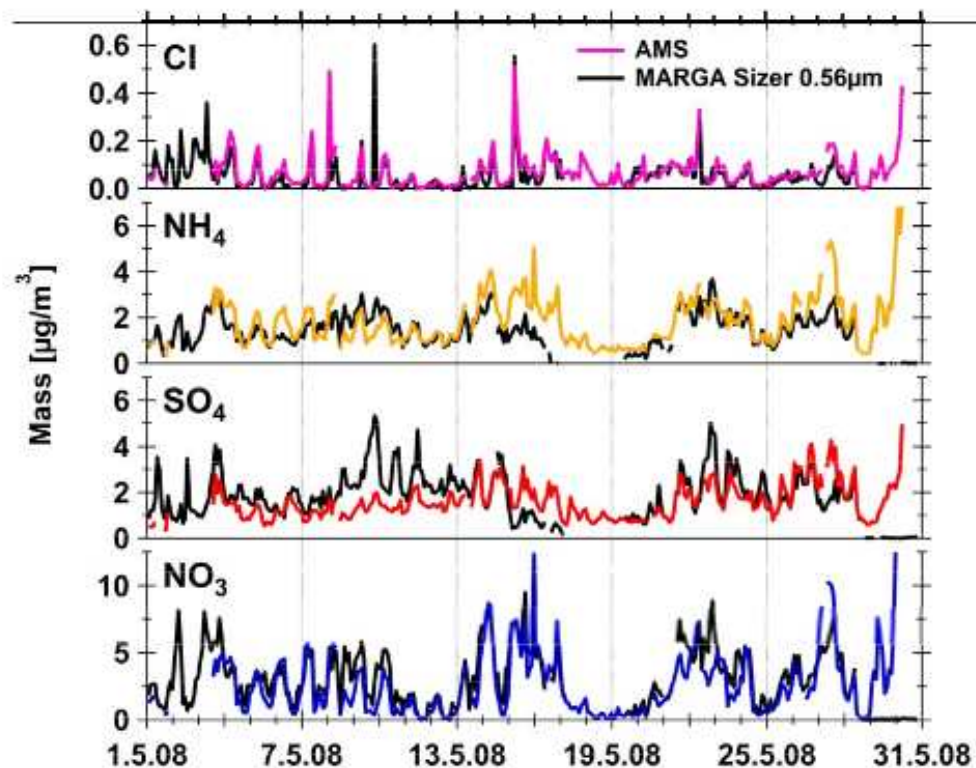


Aethalometer

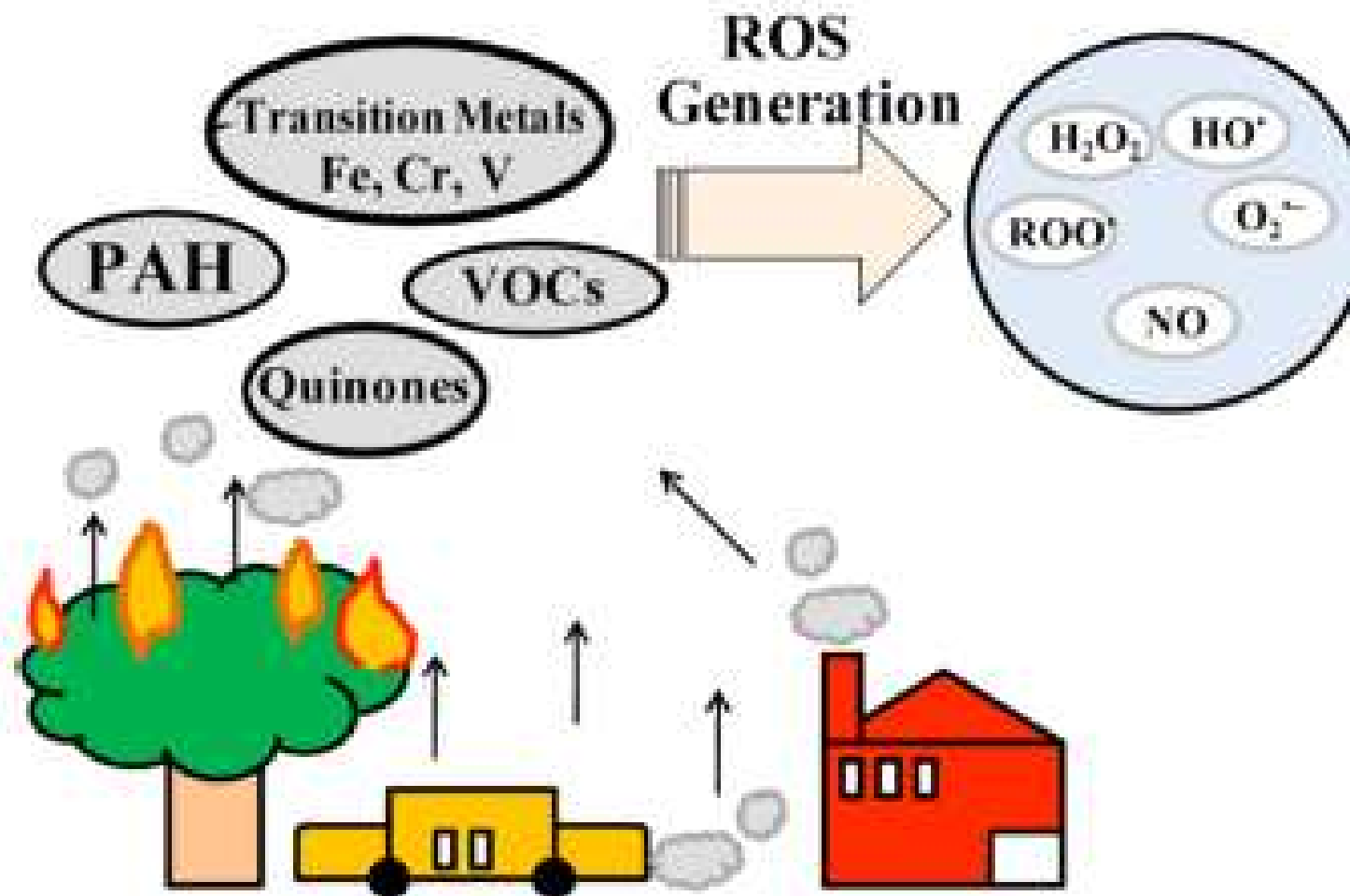


Photoacoustic Extinctionmeter

Multi-component analysers:
AMS, ACSM, MARGA, PILS-IC, etc.



Oxidative capacity / radical formation potential





Challenges & Outlook

Challenges



On-line (heavy) metal detection → filter tape XRF, LIBS

Particle shape and morphology → DMA/APM combination

Better spatial representation for highly variable metrics → sensor networks

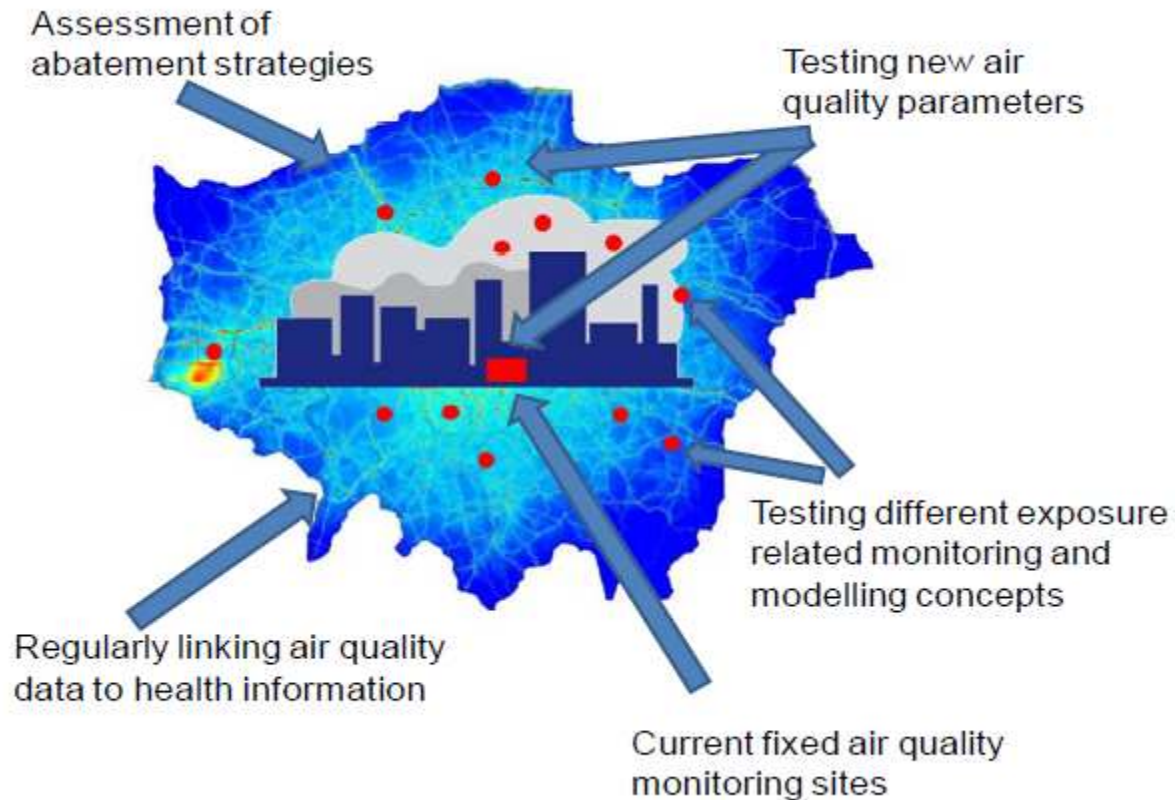
Assessment of „true“ personal exposure → personal samplers, models

Modelling and mapping of pollutant concentrations within urban areas

Better link between (routine) measurement and health effect studies

Outlook

Areas for Research and Monitoring of Air Quality (ARMAQ)



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