

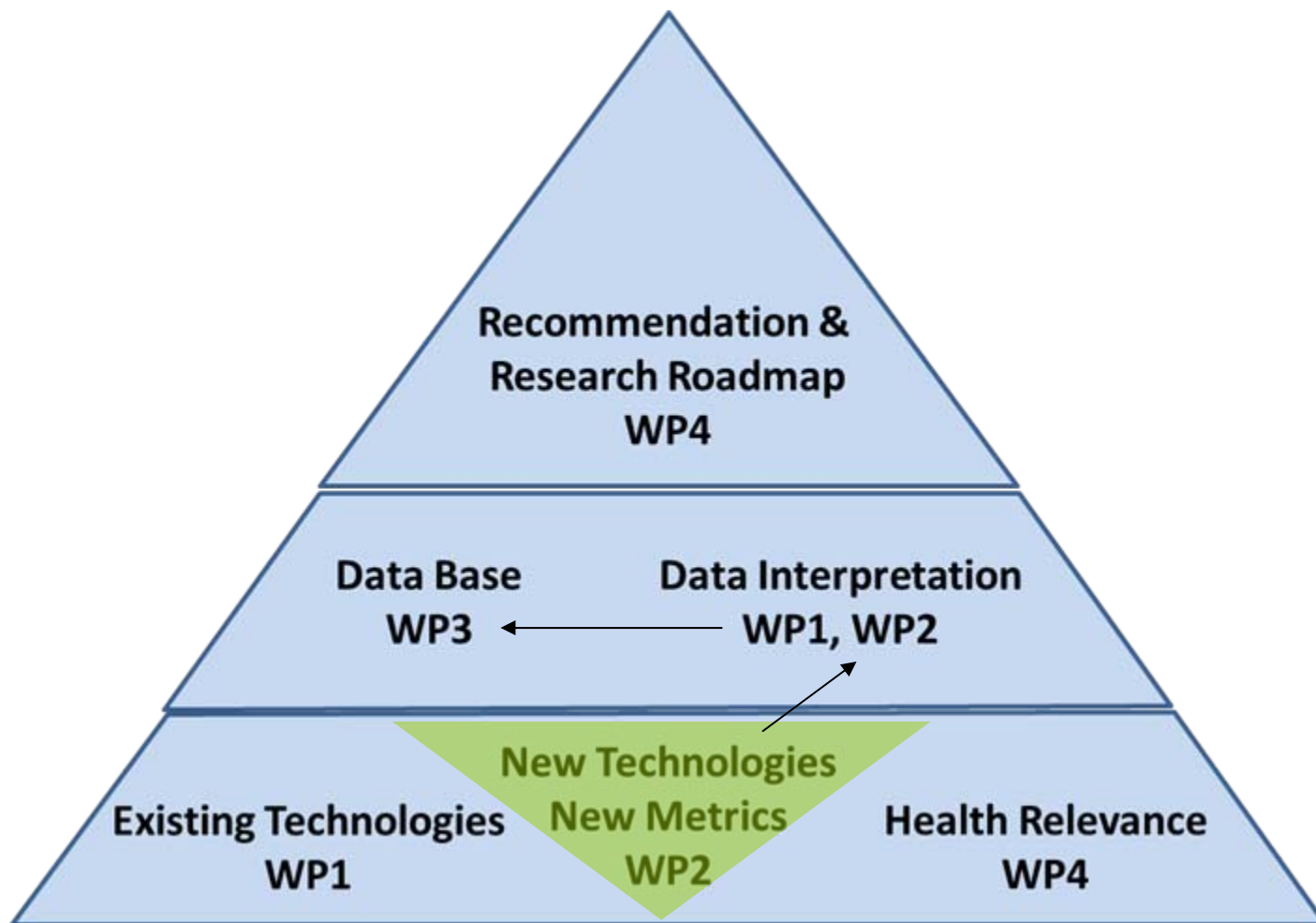
# Air Quality Monitoring Technologies for Urban Areas

*Ulrich Quass*

## **Workshop and Conference „Current and future Air Quality Monitoring“ Day 2**

### **AirMonTech Work Package 2: The future of AQ Monitoring**

# Project overview



## Goals of AirMonTech Work Package 2

- New instruments improving current monitoring capabilities? (→ yesterday)
- New (health relevant) metrics to be included
- Research needed to further develop instruments and their applicability
- New approaches/strategies for exposure assessment?  
→ WP 4

# New monitoring technologies for regulated compounds

- Gas-phase species (NO<sub>x</sub>, VOCs, Ozone):
  - optimisations of established techniques
  - laser-based methods
  - miniaturised instruments (sensors)
  - Mobile in-situ measurements (eg portable DOAS)
- Particle mass concentration:
  - Combination of real-time monitors with gravimetry or  $\beta$ -absorption



Taken from MESSAGE website

## Potential new metrics: particulate matter

- Ultrafine particles...number concentration
- Submicron particles...surface concentration
- Coarse/fine fraction...oxidative potential, ROS generating activity
- Exposure breakdown to source categories
- Carbonaceous compounds from traffic and wood combustion
- Heavy metals, PAHs, other toxic compounds
- Bioaerosols

## Potential new metrics: gas-phase components

- PAHs (to complete gas/particle partition)
- Oxygenated hydrocarbons  
(aldehydes, ketones, peroxides  
→ ROS!)
- Water soluble compounds  
(WSOC, Ammonia )
- Mercury

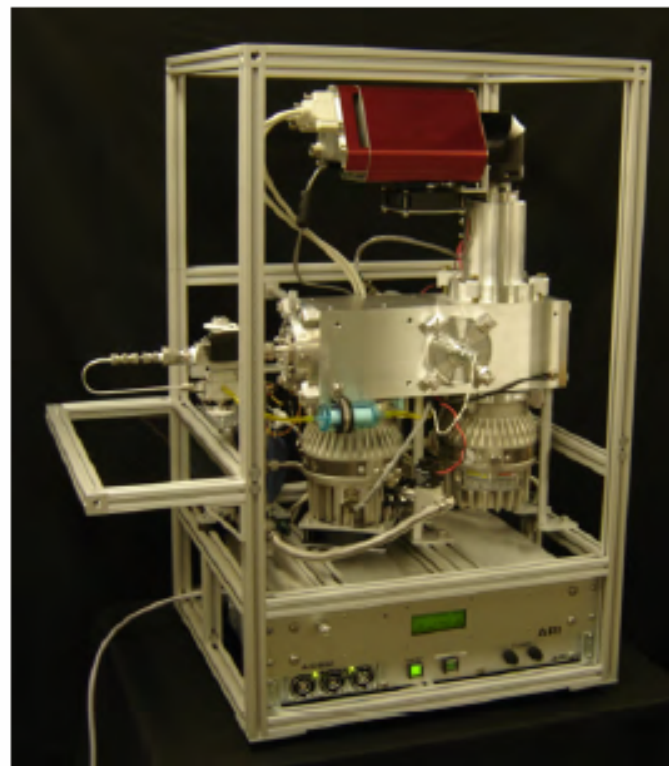
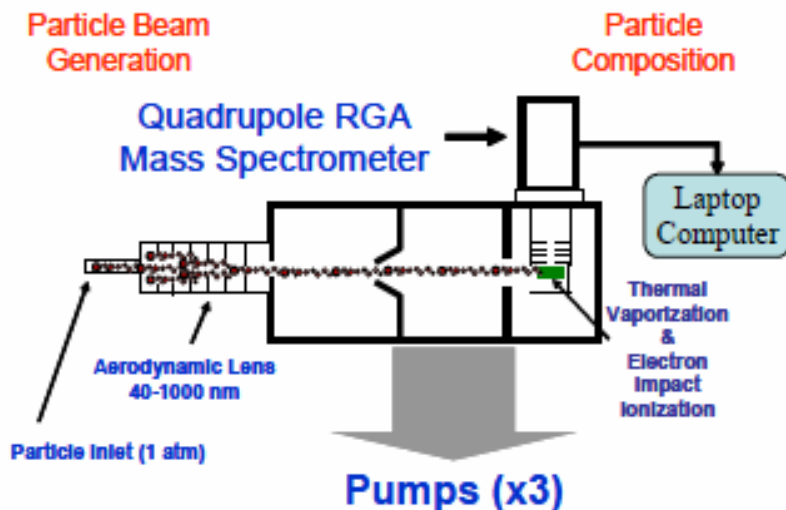


# Some innovative monitoring systems: „Mini“ AMS

## ACSM

### Aerosol Chemical Speciation Monitor

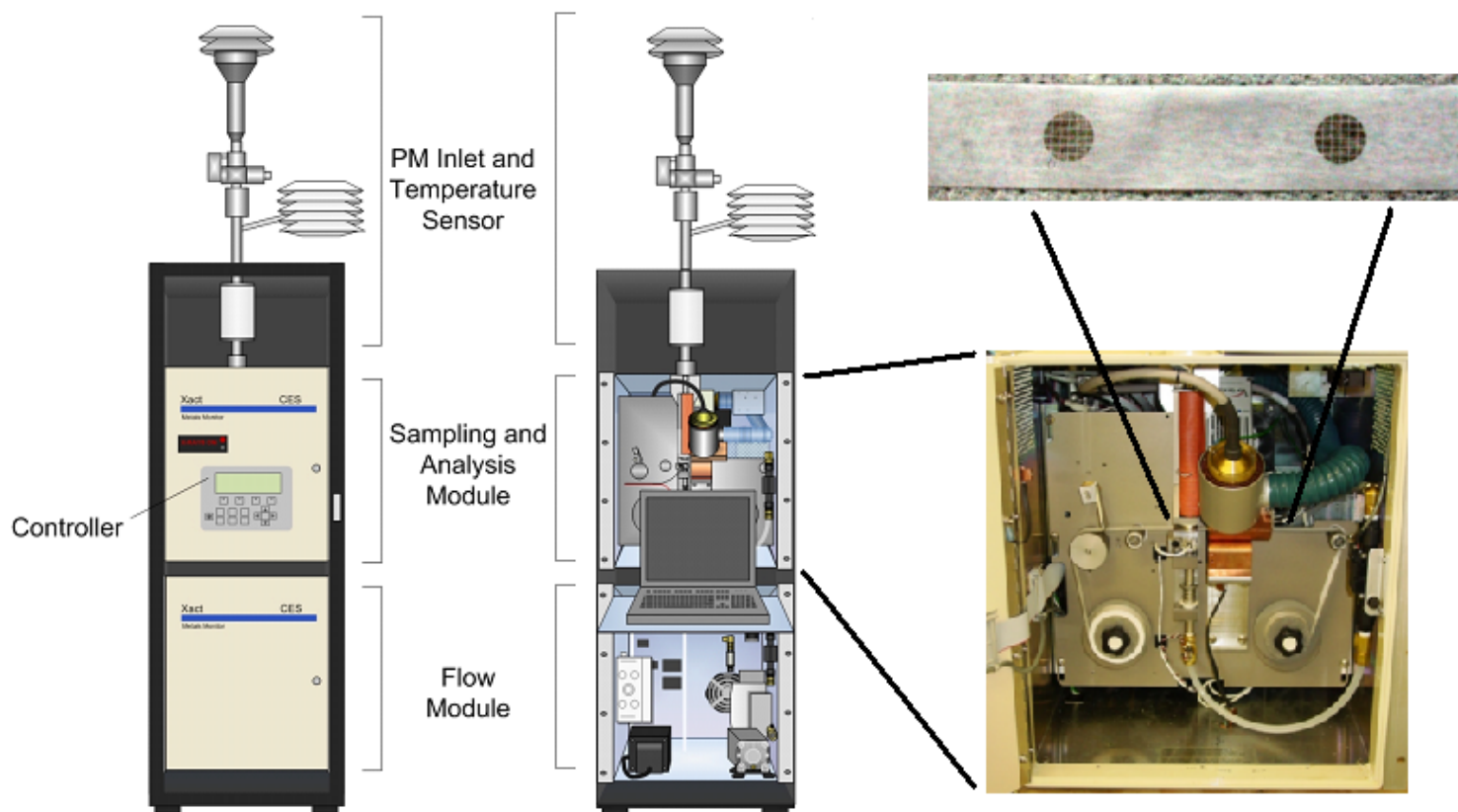
*Measure real-time, non-refractory aerosol particle mass and chemical composition.*



Taken from Aerodyne Research website



# Some innovative monitoring systems: On-line XRF analyser



Manufacturer: Cooper Environmental Systems, Australia ;Figure taken from Yadav et al., AAAR 2010



# Some innovative monitoring systems: aerosol ions & precursors

URG 9000 IC



Taken from URG web site

MARGA



Taken from Applikon web site

PILS-IC

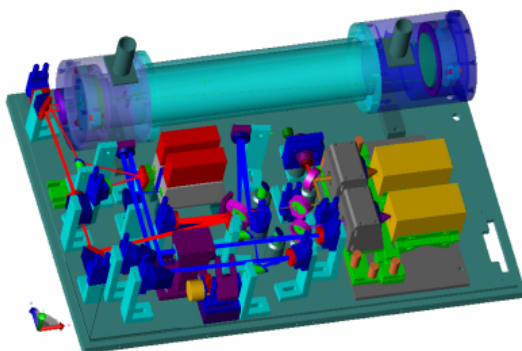


Taken from Metrohm web site

# Some innovative monitoring systems: TDLAS

## QUANTUM CASCADE LASER TRACE GAS MONITORS

*Sensitive, rapid, highly specific and continuous measurements of atmospheric trace gases in ambient air.*



### DETECTED WITH PULSED-QCLS

TRACE GAS	$\text{cm}^{-1}$	1 s RMS ppb 76 m path	LoD ppb 100 s
$\text{NH}_3$	967	0.2	0.06
$\text{C}_2\text{H}_4$	960	1	0.5
$\text{O}_3$	1050	1.5	0.6
$\text{CH}_4$	1270	1	0.4
$\text{N}_2\text{O}$	1270	0.4	0.2
$\text{H}_2\text{O}_2$	1267	3	1
$\text{SO}_2$	1370	1	0.5
$\text{NO}_2$	1600	0.2	0.1
HONO	1700	0.6	0.3
$\text{HNO}_3$	1723	0.6	0.3
HCHO	1765	0.3	0.15
HCOOH	1765	0.3	0.15
NO	1900	0.6	0.3
OCS	2071	0.06	0.03
CO	2190	0.4	0.2
$\text{N}_2\text{O}$	2240	0.2	0.1
$^{13}\text{CO}_2$ / $^{12}\text{CO}_2$	2311	0.5 ‰	0.1 ‰

Taken from Aerodyne Research website

# Innovative monitoring strategies

- In-situ, wide range monitoring („Tomography“)  
(DOAS, LIDAR etc.)?
- Mobile monitoring?

DOAS measurement at Graz



VECTOR project

<http://www.vectorproject.eu>



Karlsruhe AeroTram

<http://www.aero-tram.kit.edu/>



<http://www.uni-graz.at/igam1www>

## AirMonTech WP 2 inputs and outputs

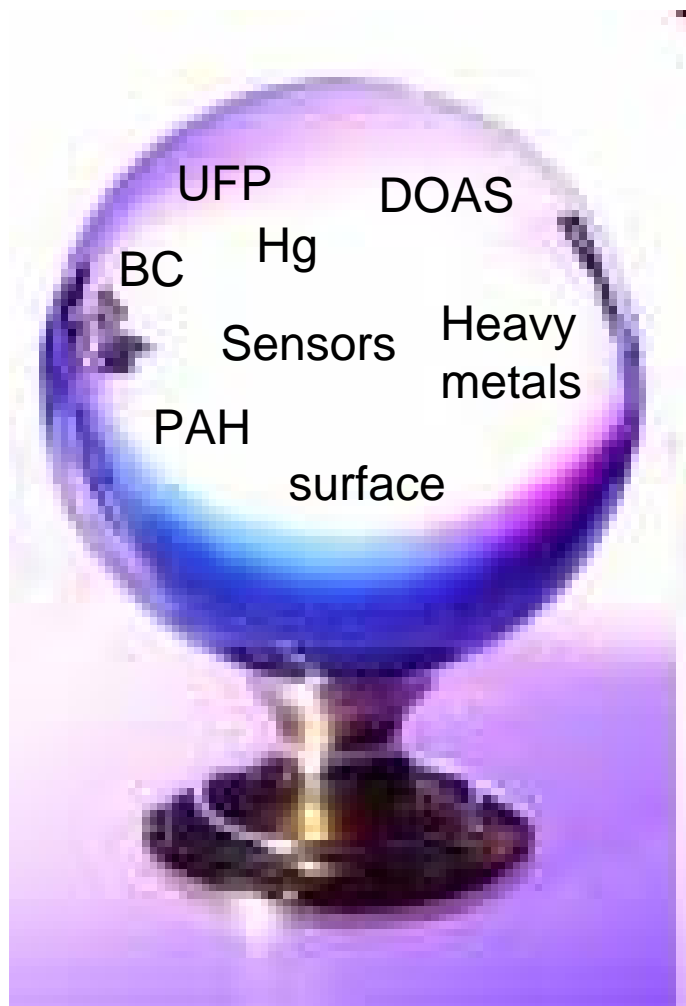
- Health relevance of pollutants and new metrics
- Monitoring techniques
  - state of development
  - technical information (DLs, uncertainties, validation results, maintenance effort, etc.)...to be stored in WP3 database
  - Improvement potentials
  - Application potentials
  - Ongoing and needed research activities
- Monitoring approaches/strategies
  - Examples and experiences

## Questions to answer...

- Which new techniques for established metrics shall be focussed on?
- How can we improve harmonisation with established methods?
- Which new metrics are of interest?
- What is needed to a) test the instruments b) prove their value?
- Do we see new online monitoring technologies, e.g. personal sampling, GPS,...linked to new strategies?

# So, let's start....

And thanks



for your attention!