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 Modelling for Air-Pollution Monitoring

Institute for Environment and Development - IDAD

Aveiro, Portugal, 14 - 15 October 2014

Action Start date: 01/07/2012 - Action End date: 30/06/2016 - Year 3: 2014-15 (*Ongoing Action*)

A Versatile Outdoor Platform for MOX Sensor Field Tests

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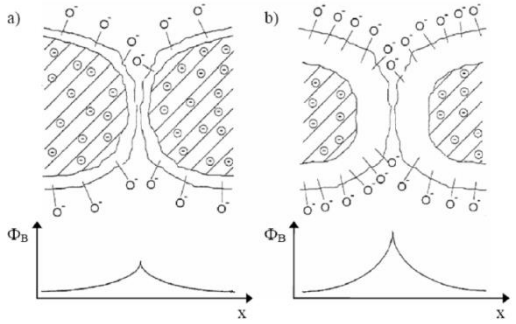
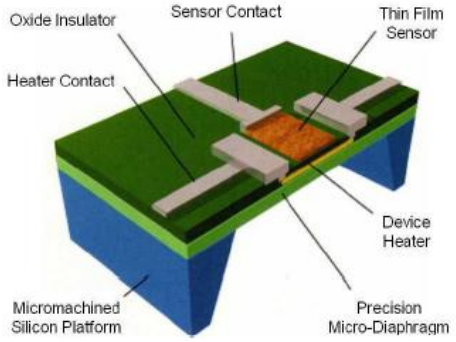
Background of 3S GmbH

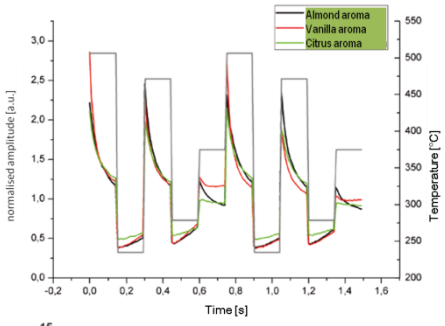
- **Spin-off company founded 2006**
  by members of Prof. Andreas Schütze's lab for measurement technology at Saarland University (USAAR)
- Most developments based on **MOX sensor technology,** combining USAAR and own research
- **Providing hardware systems for research** at USAAR
- Main commercial fields of application:
  - **Leakage** detection
  - **Odour** assessment

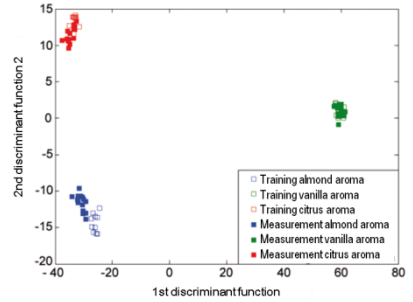
Temperature cycled MOX sensors

- Metal oxide gas sensors:
  working principle redox reactions
  with surface adhesed oxygen
  → unspecific, broadband reaction
- Temperature dependency can
  be used for “thermal spectroscopy”
  → selectivity
- Transient behaviour most interesting,
  current research shows vast
  increase in sensitivity
- Temperature cycle results in
  response pattern
  → pattern recognition correlates
  reaction with substances / odours



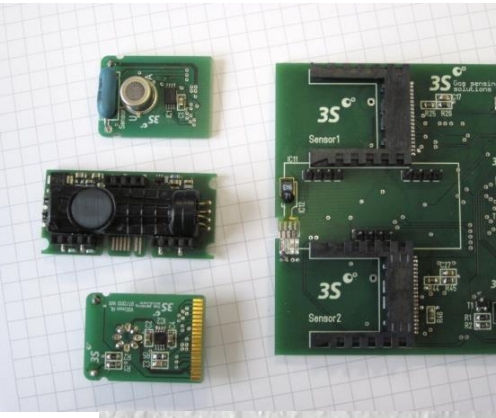


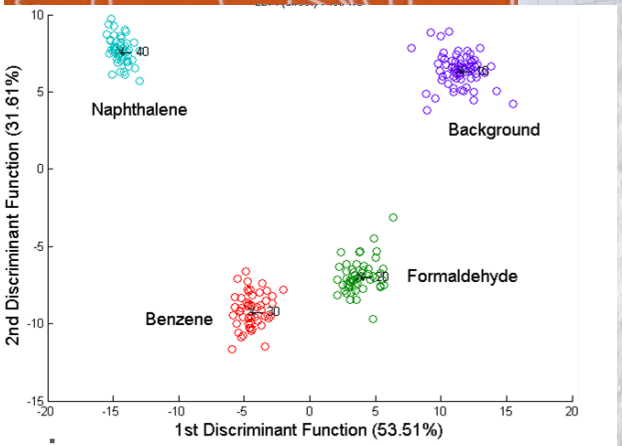




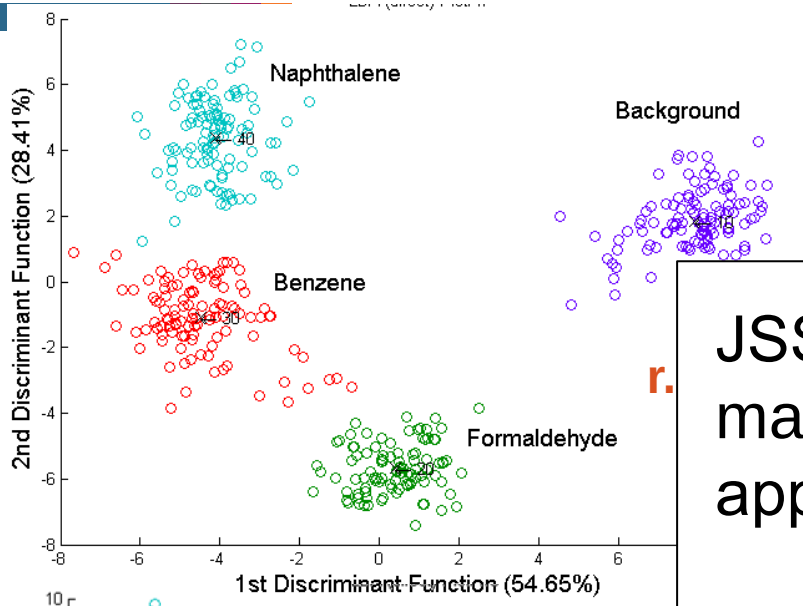
Field test experience in IAQ

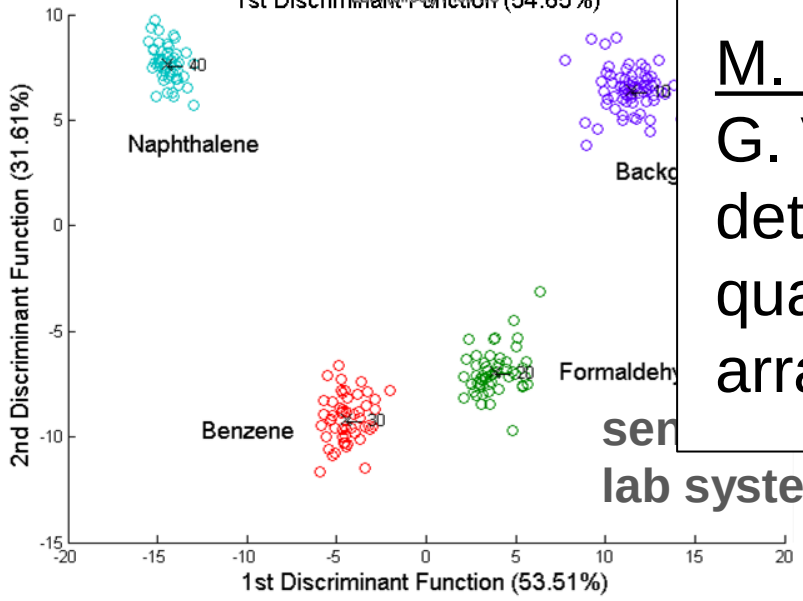
- mnt-era.net project VOC-IDS
  - objective: VOC identification
  - goal: pollutant control, energy saving
- Integrated but modular test platform with application adapted housing
  - 2 MOX independently controlled sensors
  - r.H./T and CO_2 reference sensors
  - Stand-alone operation with SD card
- Classification works, two-step analysis improves results
- Problem: Housing and PCB give off interfering gases

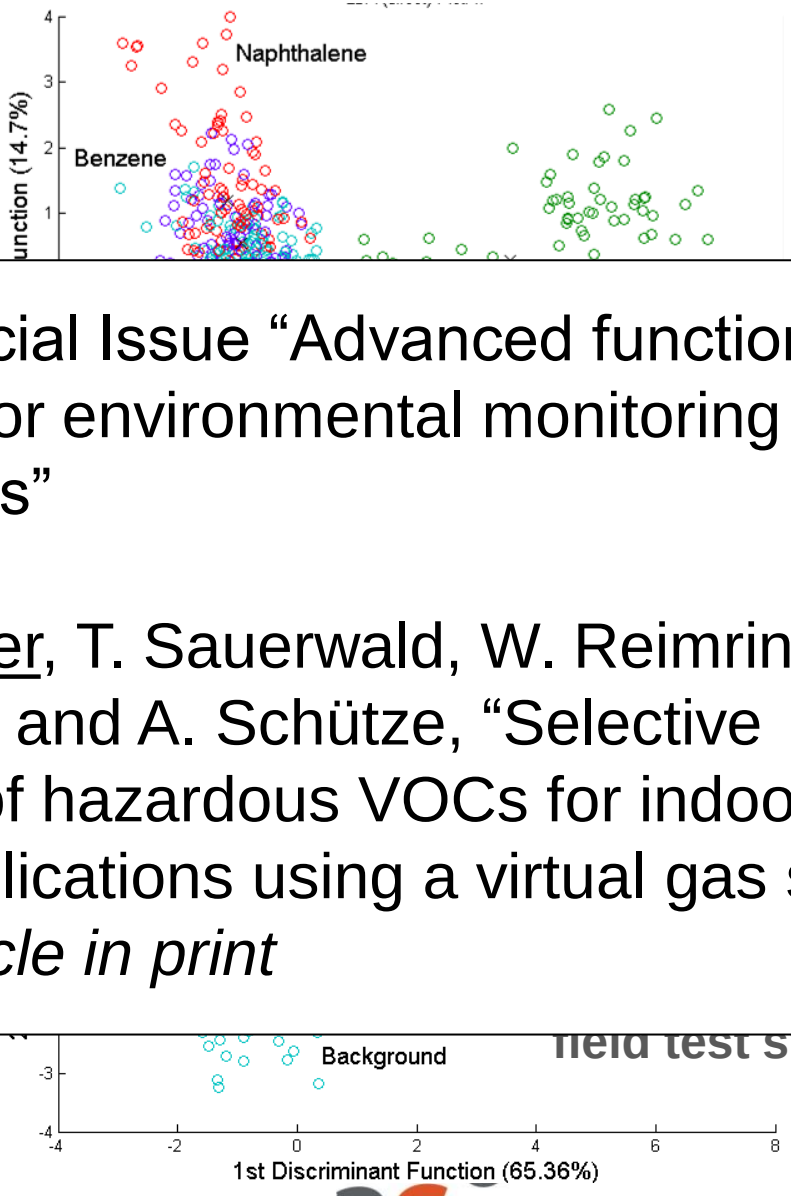




Field test experience in IAQ







JSSS Special Issue “Advanced functional materials for environmental monitoring and applications”

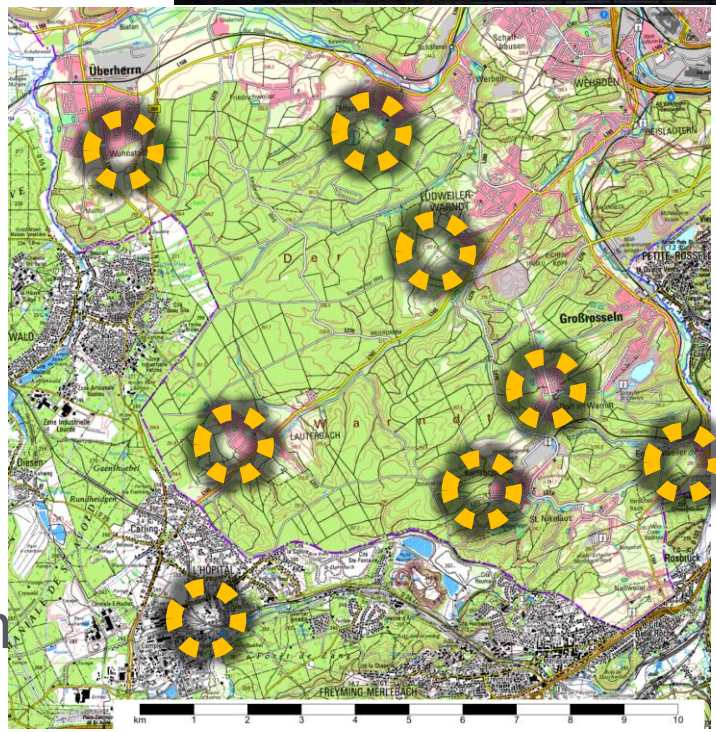
<u>M. Leidinger</u>, T. Sauerwald, W. Reimringer, G. Ventura and A. Schütze, “Selective detection of hazardous VOCs for indoor air quality applications using a virtual gas sensor array“, *article in print*

Context and objectives for outdoor device

- **Can temperature cycled MOX sensors be used for immission monitoring?**

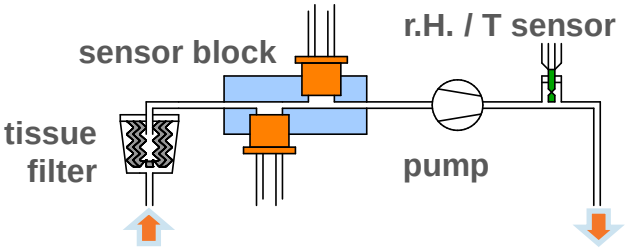
- Immission / odour nuisance reported by residents
- Sensor network for objective monitoring with sufficient time and location resolution

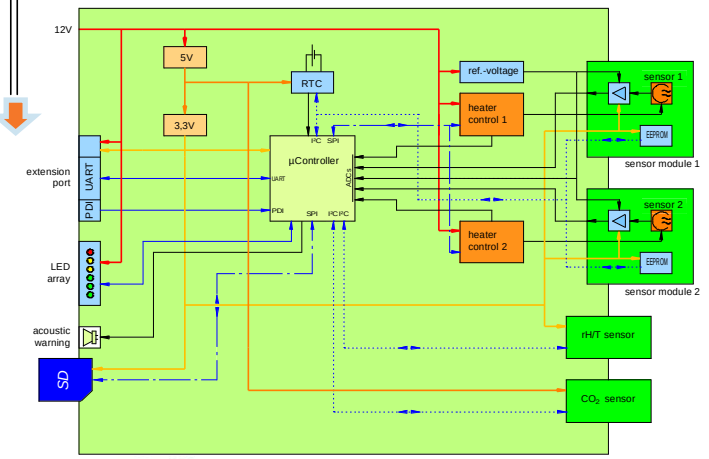
- Immission means:
  - Small concentrations
  - Climate parameters influence transport from emission site to immission location
  - Strong local disturbance



Outdoor device

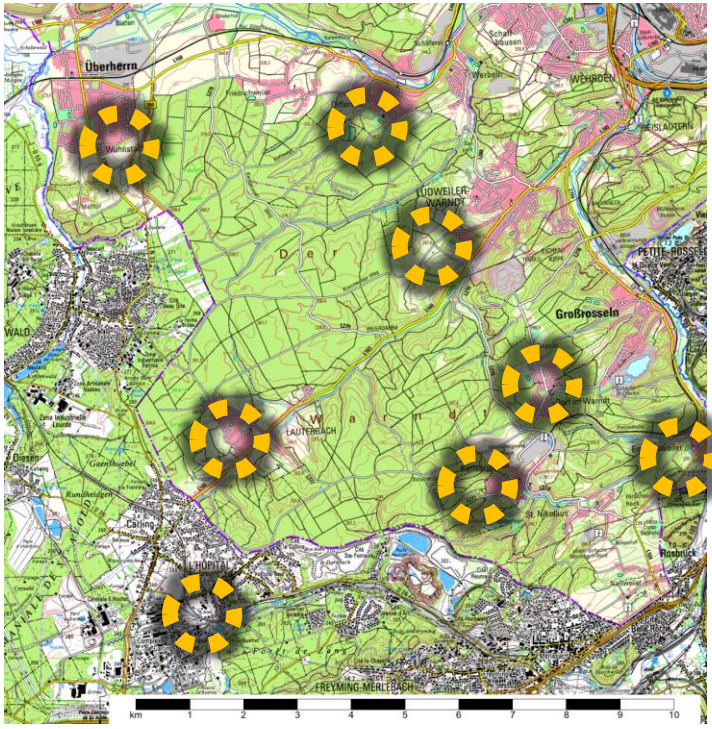
- Modular electronics from IAQ
  - MOX sensors:
    - 1 thick film ceramic type
    - 1 thin film on micromachined Si platform
  - r.H./T sensor
- Outdoor adaptation
  - Rugged housing
  - Pumped system
  - Energy and expansion options

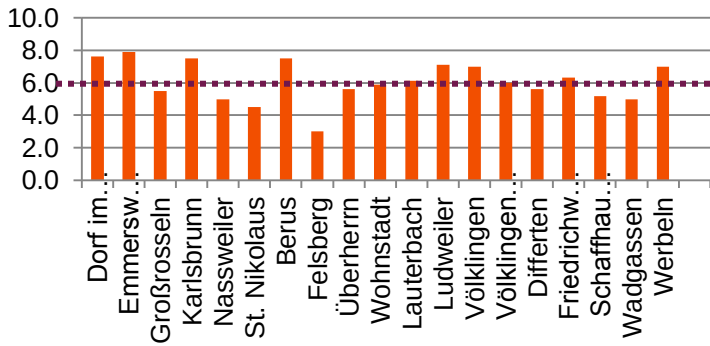




Human odour panel

- **First step: Questionnaire campaign**
  - 171 participants
  - 7 severely impacted villages
- **Second step: Odour survey**
  - 53 participants
  - Online form provided by Odometric SA
  - Feedback on odor type, intensity, nuisance with time and location
- **Other information taken into account**
  - Climate (meteo networks and local wind data)
  - Official German and French measurement stations





CONCLUSIONS – Field test system

- Goals of taking part in the **COST intercomparison exercise**
  - Comparison of sensitivity with analyser data as a reference
  - Algorithm evaluation for selectivity concerning known pollutants

- Goals of using device in **odour monitoring project**
  - Evaluation of sensitivity in comparison to human senses
  - Evaluation of possible pattern recognition according to odour types from human panel → Andreas Schütze's team of USAAR
  - Overall system evaluation over project duration

CONCLUSIONS – Odour monitoring project

- Field test duration
  - October 2014 – February 2015
- Data analysis
  - Algorithm development until February
  - Data analysis until March
- Primary goal
  - Objectified overview of situation for further (political) steps
- Outlook
  - Finding key issues for development of outdoor sensor platform
  - Establishment of sensor network in local problem areas