



3<sup>th</sup> Intelligent Systems for Quality of Life information  
Services Workshop (ISQL 2012)  
8<sup>th</sup> AIAI Conference, September 27- 30, 2012,  
Halkidiki, Greece



EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY



**ENEA**

ITALIAN NATIONAL AGENCY  
FOR NEW TECHNOLOGIES, ENERGY AND  
SUSTAINABLE ECONOMIC DEVELOPMENT

## **Overview of the COST Action TD1105 EuNetAir**

**ISQL 2012 - Halkidiki, 29 September 2012**

**Call Full Proposal reference oc-2011-1-9706 for a COST new Action TD1105**

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

**Proposer/Chair: Dr. Michele Penza**

**ENEA**

***Italian National Agency for New Technologies, Energy  
and Sustainable Economic Development***

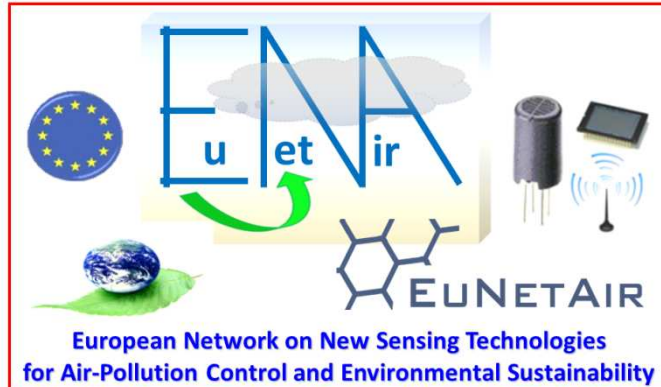
**Technical Unit Brindisi Technologies for Materials**

**SS. 7, APPIA, Km 714 - PO BOX 51 Br-4, I-72100 Brindisi, Italy**

**Tel.: +39 0831 201422**

**Email: [michele.penza@enea.it](mailto:michele.penza@enea.it)**

European Network on New Sensing Technologies for Air-  
Pollution Control and Environmental Sustainability - EuNetAir



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## OUTLINE

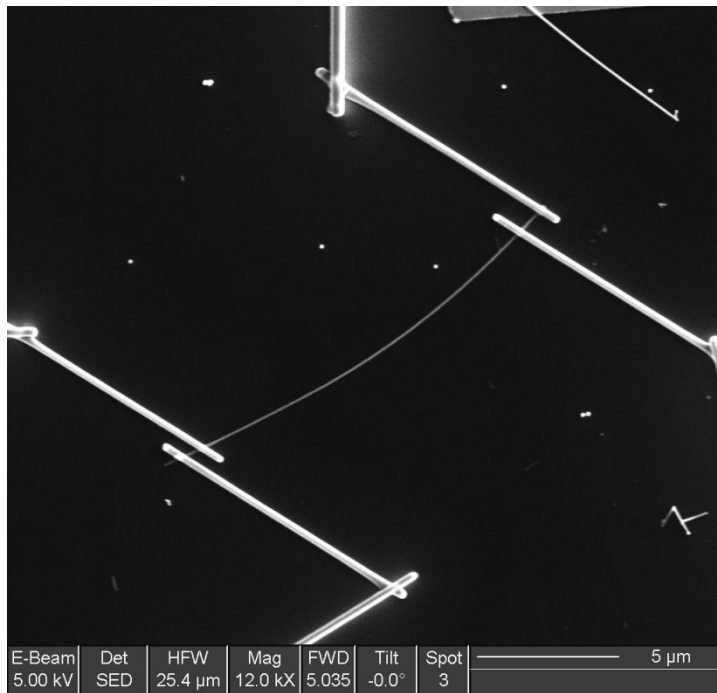
- ***State-of-the-Art on Air Quality Control Technologies***
  - ***What is Program COST ?***
  - ***Objectives of a COST Action***
  - ***COST Action TD1105 EuNetAir:***
    - Objectives, WorkPlan, Structure and Coordination,***
    - Gender Balace, Early Stage Researchers, Short Term***
    - Scientific Missions, Timetable, Dissemination Plan***
  - ***Conclusions***

## NANOSENSORS

J. D. Prades, et al., J. R. Morante, *Sensors and Actuators B* 144 (2010) 1-5

Courtesy from University of Barcelona and IREC.

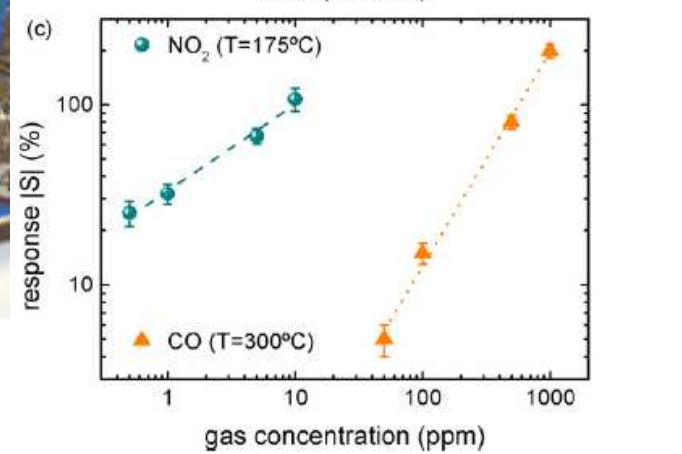
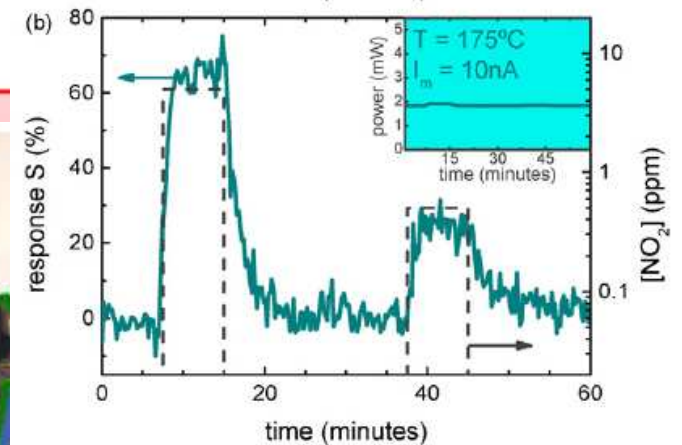
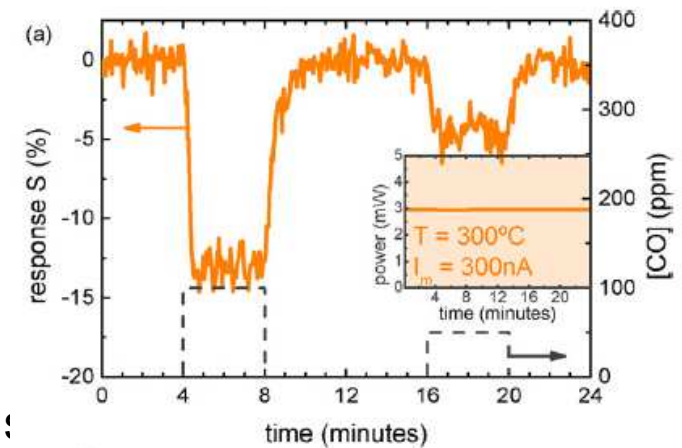
### SnO<sub>2</sub> Nanowires



### Self-heating of Nanowire

Temperature gradient of 20°C generates 5 mW to operate nanosensor, including electronics.

### Micro-Nano



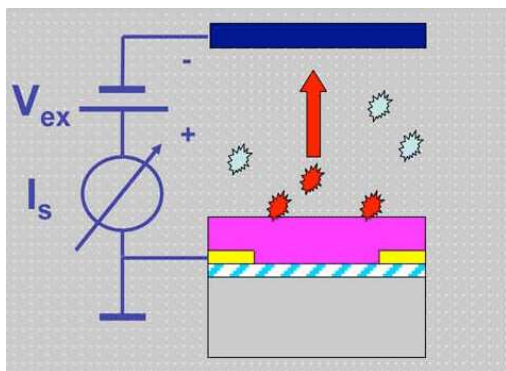
### nit



## SURFACE IONIZATION (SI) device: Vertical Layout

A. Ponzoni, et al., IMCS-2012, Nuremberg, 20-23 May 2012

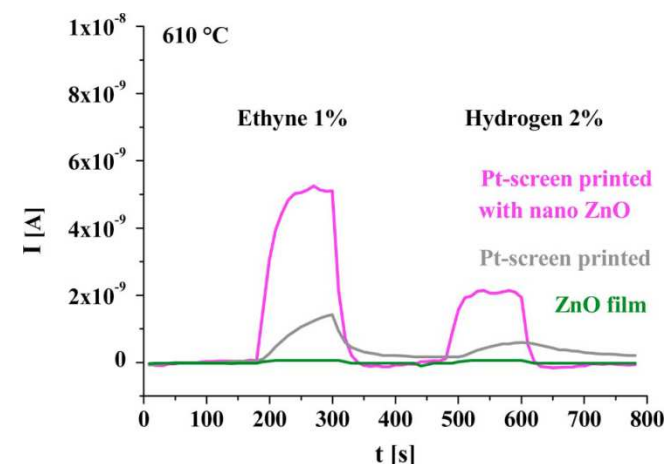
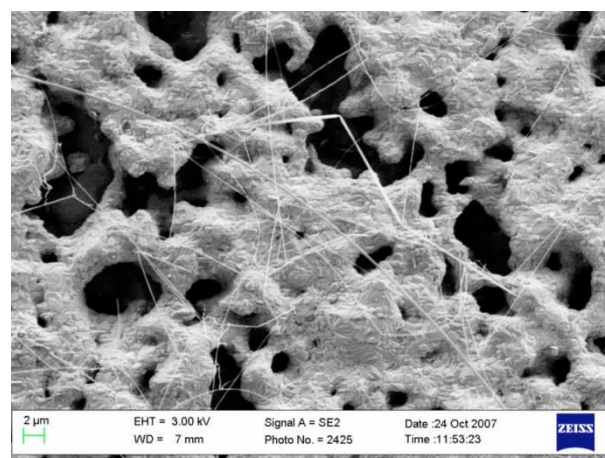
Courtesy from University of Brescia



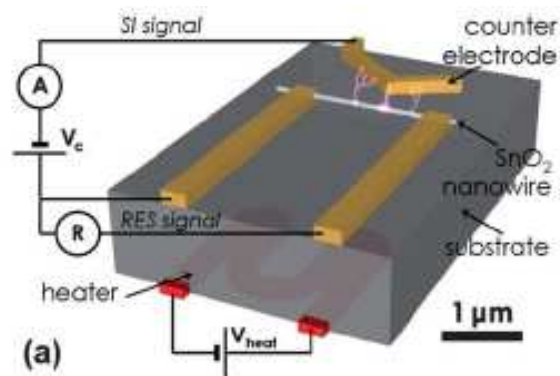
### Typical experimental parameters

- Bias Voltage: 1000V
- Electrode-oxide spacing:  $d = 1\text{ mm}$  →  $E = 10^6\text{ V/m}$
- Sensor Temperature: 500-700°C

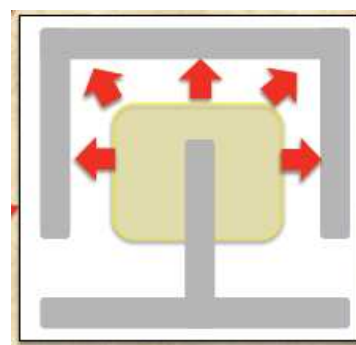
### ZnO nanowires on Pt electrode to Ethyne and Hydrogen



## SI Single Nanowire device: Planar Layout

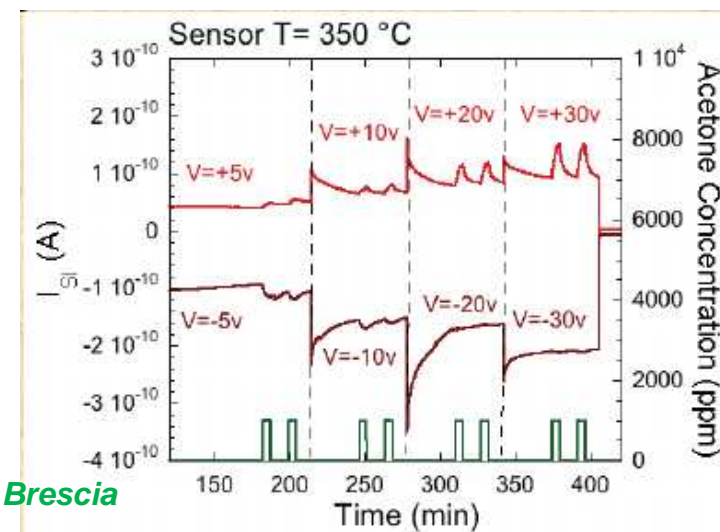


F. Hernandez-Ramirez, et al., *Nanoscale* 3 (2011), 630  
 Courtesy from IREC



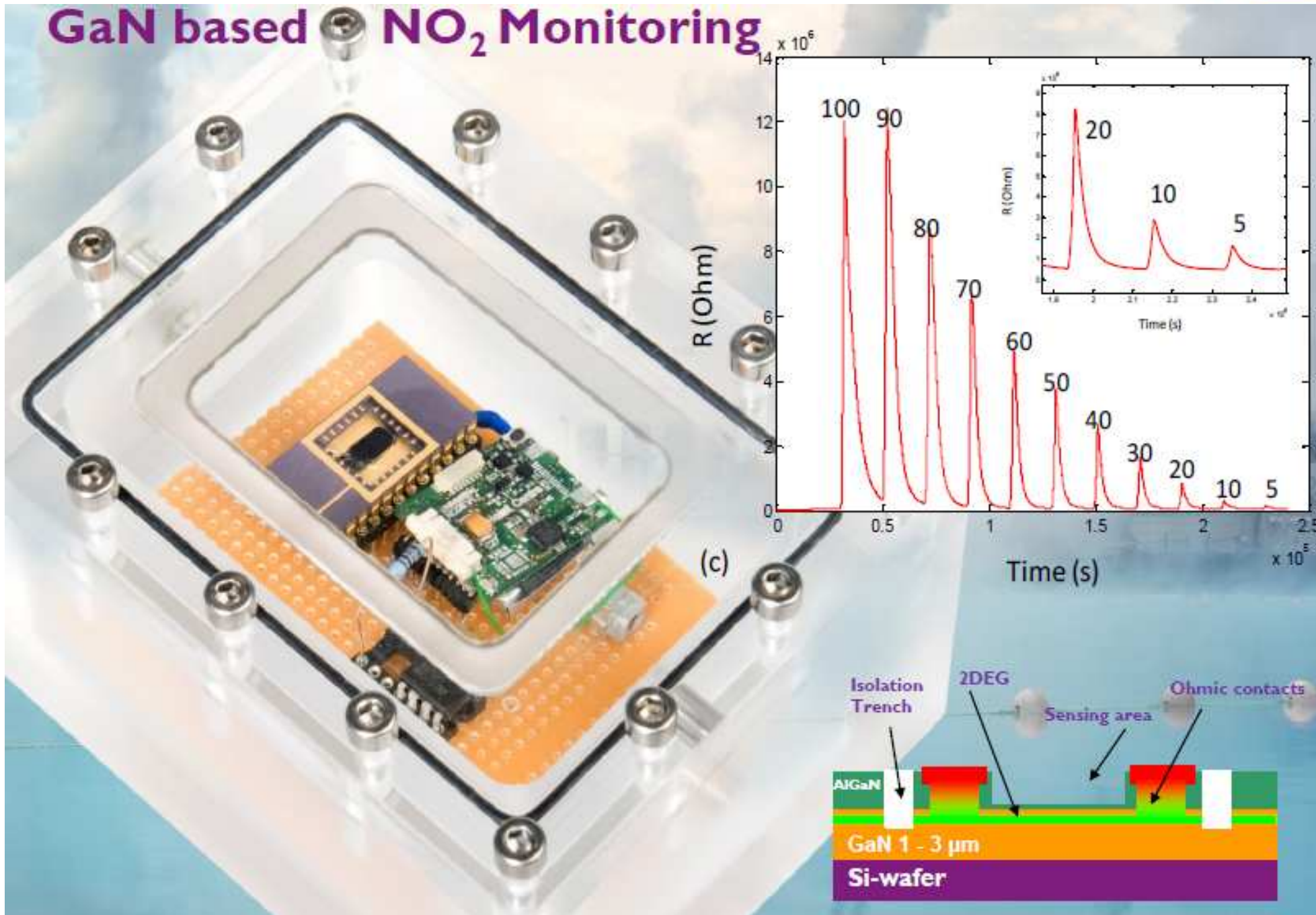
A. Ponzoni, et al.,  
 Courtesy from University of Brescia

### CuO nanorods to Acetone



# ACTION TD1105: STATE OF ART ON AQC - GAS SENSORS

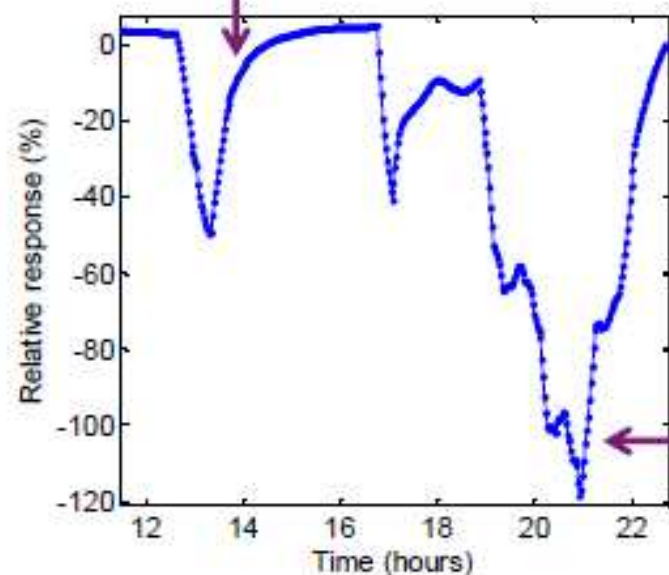
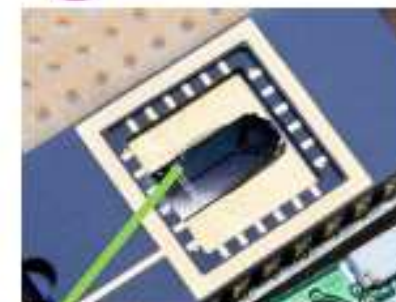
## GaN based NO<sub>2</sub> Monitoring



## Low-ppb environmental monitoring



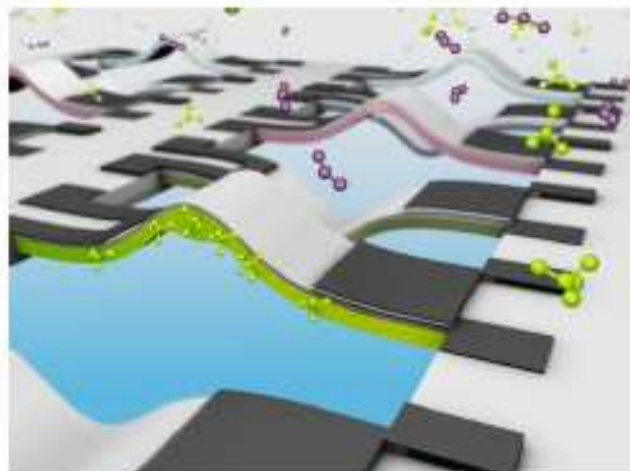
Parking garage



Clean air in nature

- ✓ Battery operated
- ✓ On-chip data storage
- ✓ Humidity and temperature
- ✓ Simple resistive readout
- ✓ Reversible
- ✓ Sub-ppb detection limit
- ✓ Very low cross-sensitive to e.g. SO<sub>2</sub>, CO<sub>2</sub>, NH<sub>3</sub>

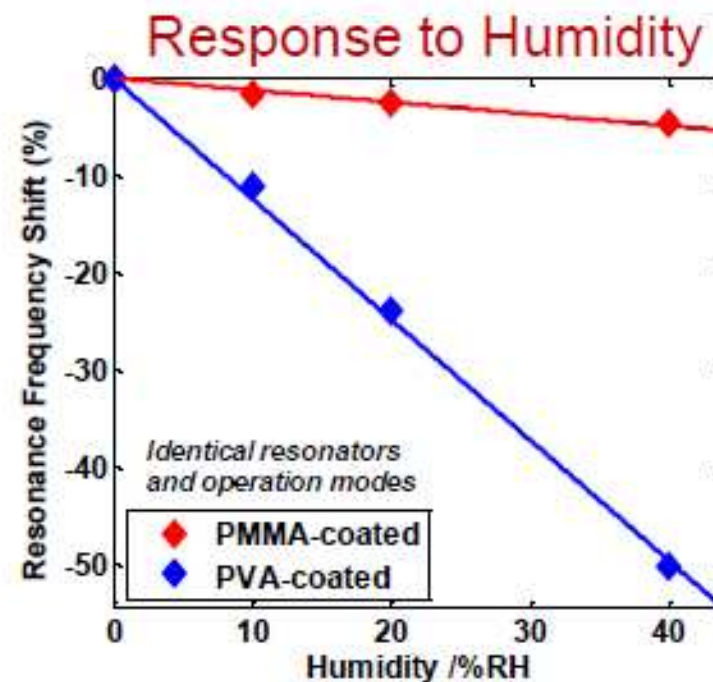
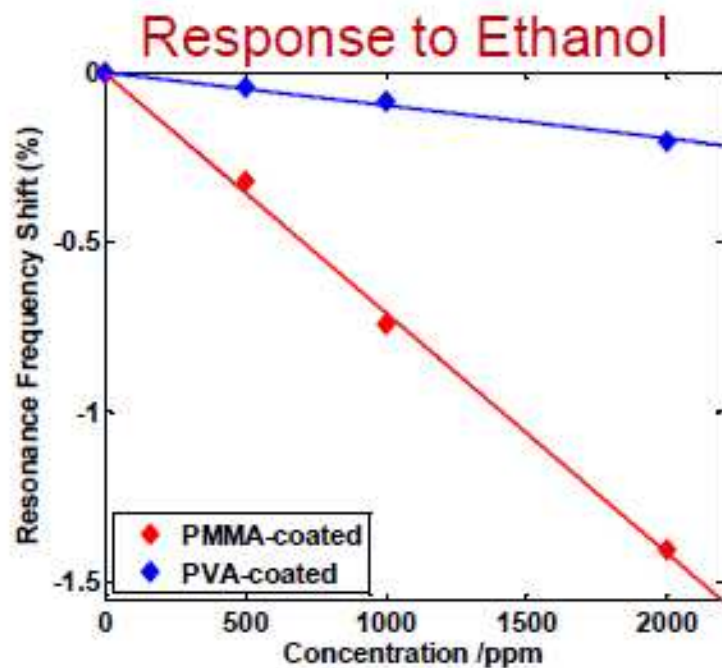
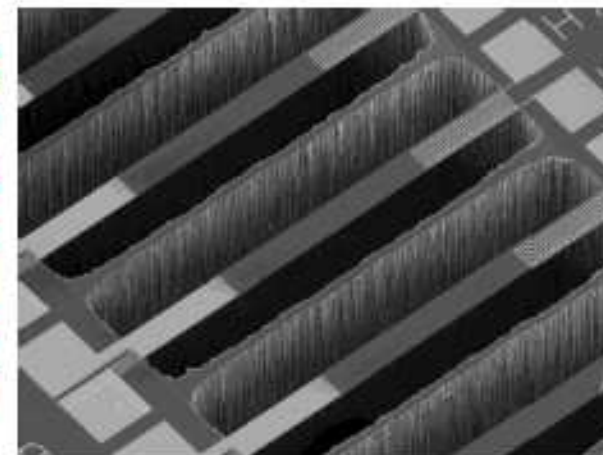
## Towards a miniaturized MEMS e-nose



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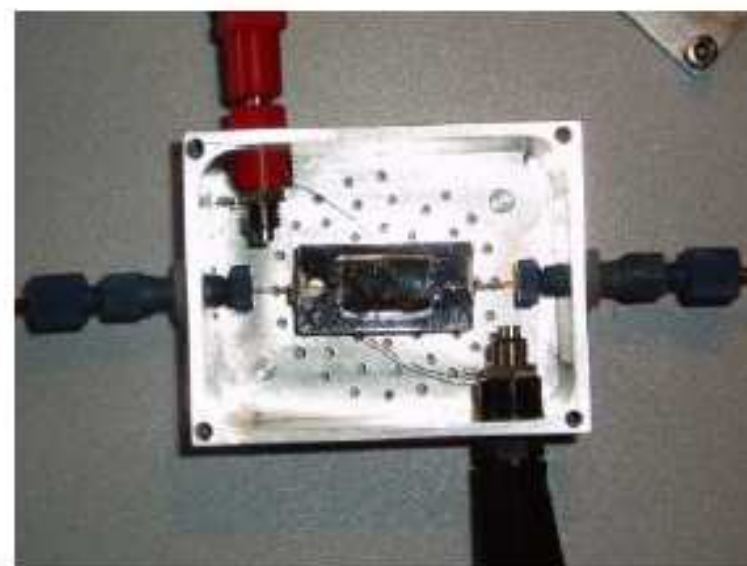
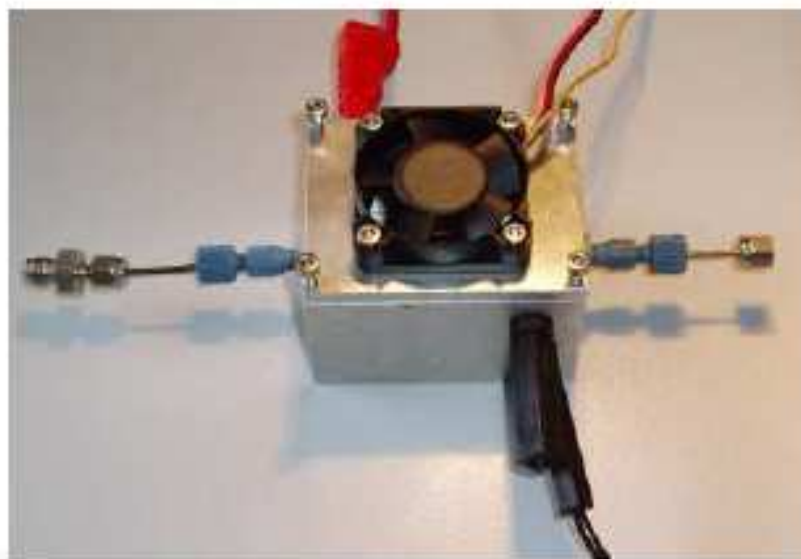
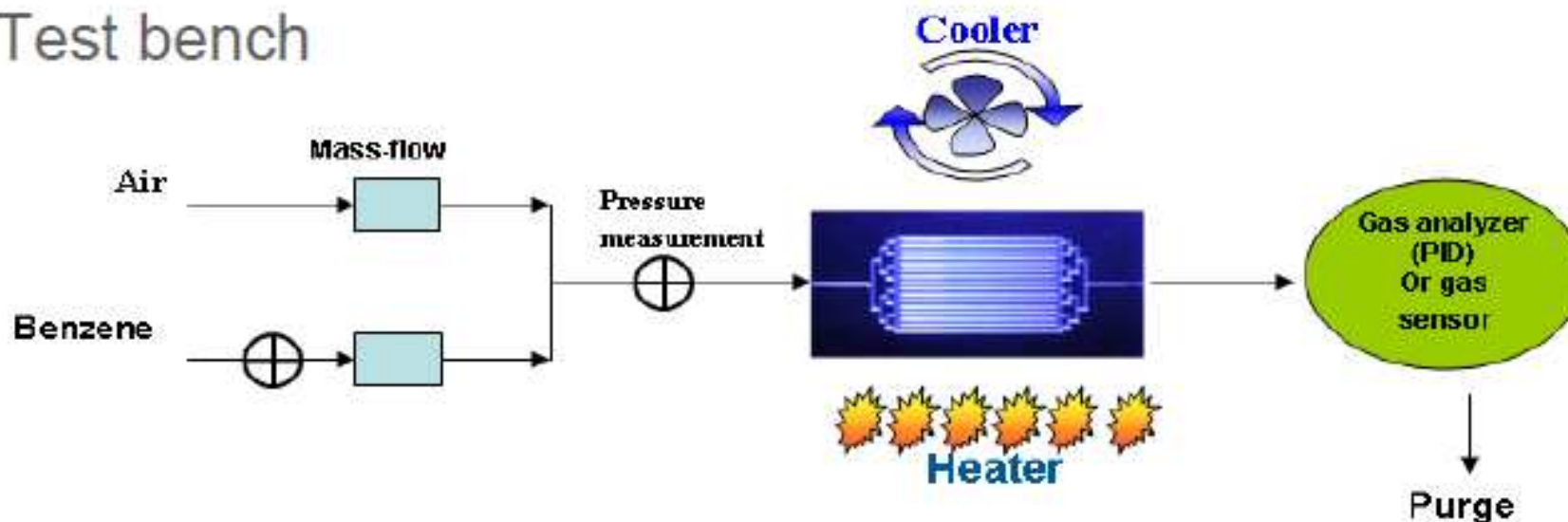


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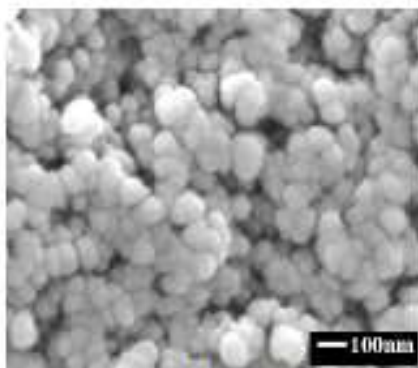
## Micro gas preconcentrator

### ■ Test bench

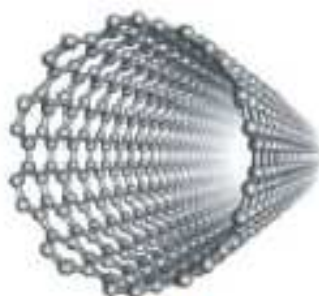




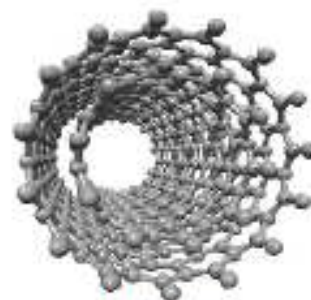
## Micro gas preconcentrator



Carbon nanopowder



SWCNT

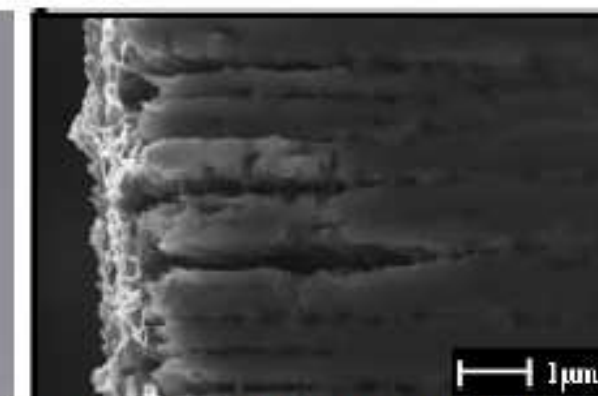
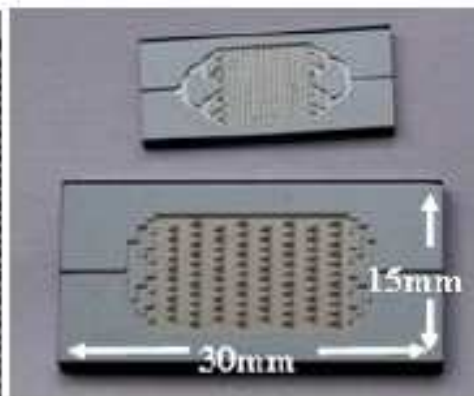
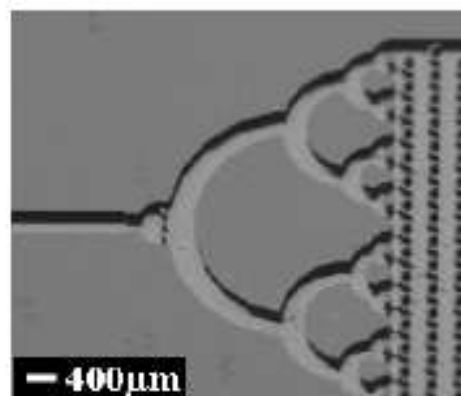


MWCNT



Polymer Tenax TA.

- Absorbent choice based on specific surface and affinity to gases
- Deposition method chosen according to particles size
- Test under exposure to benzene, xylene, nitrobenzene

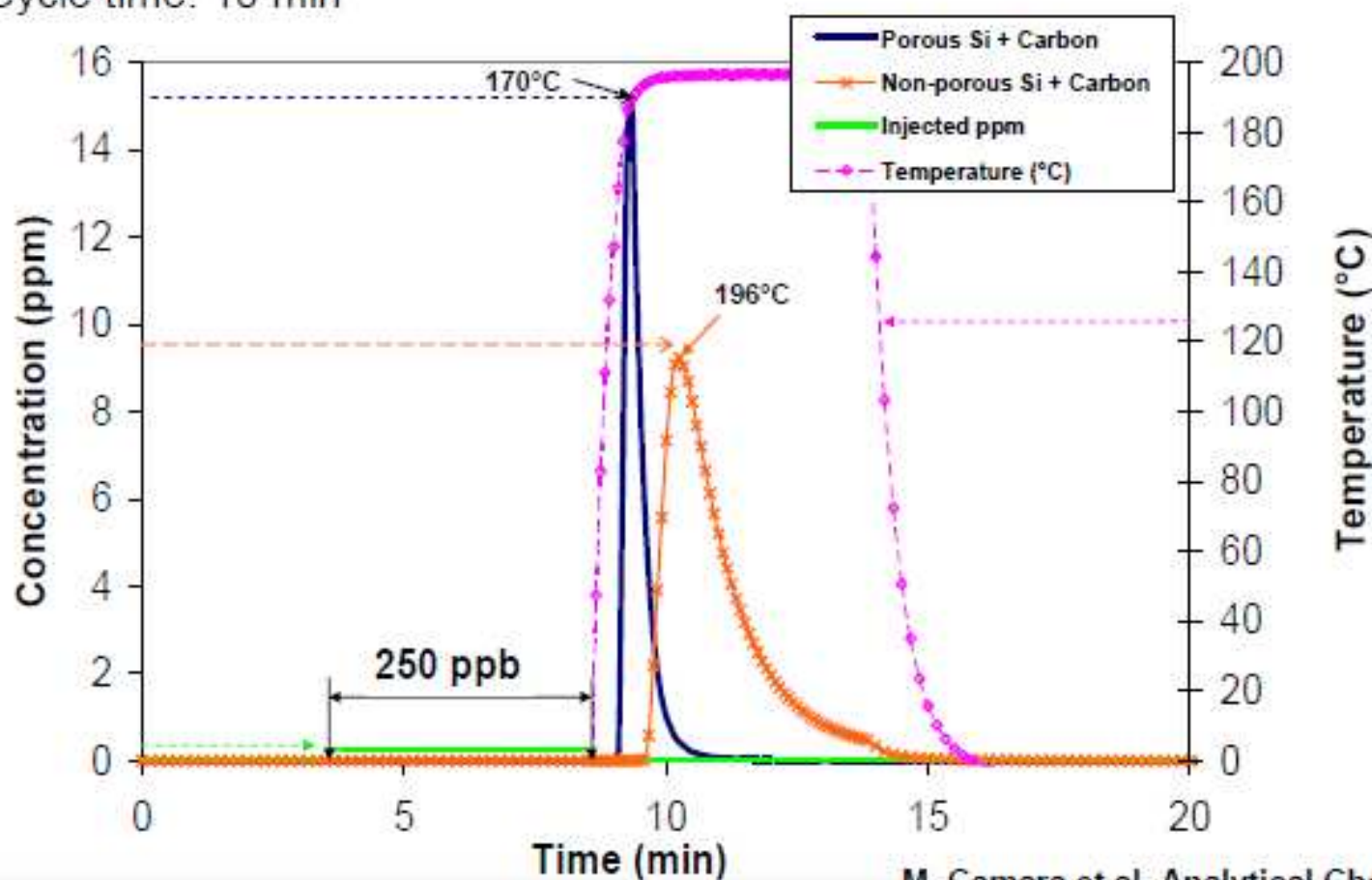


Porous Si: Micro and Macro

## Micro gas preconcentrator

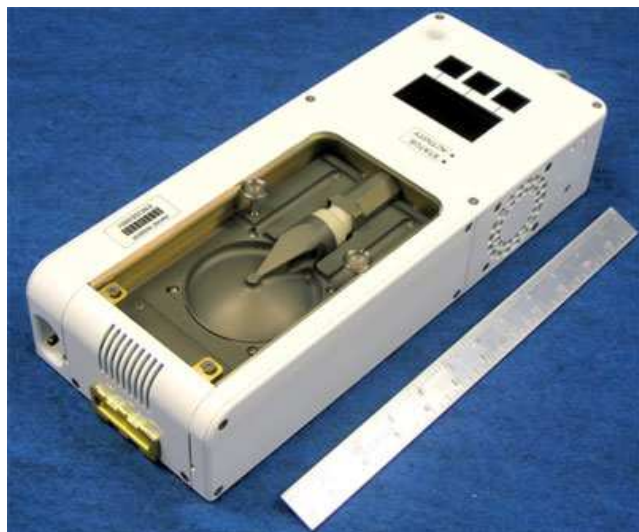
### ■ Standard vs. Porous silicon

- Flow absorption: 10 L/h, desorption: 2 L/h
- Temperature ramp: 160°C/min
- Cycle time: 10 min

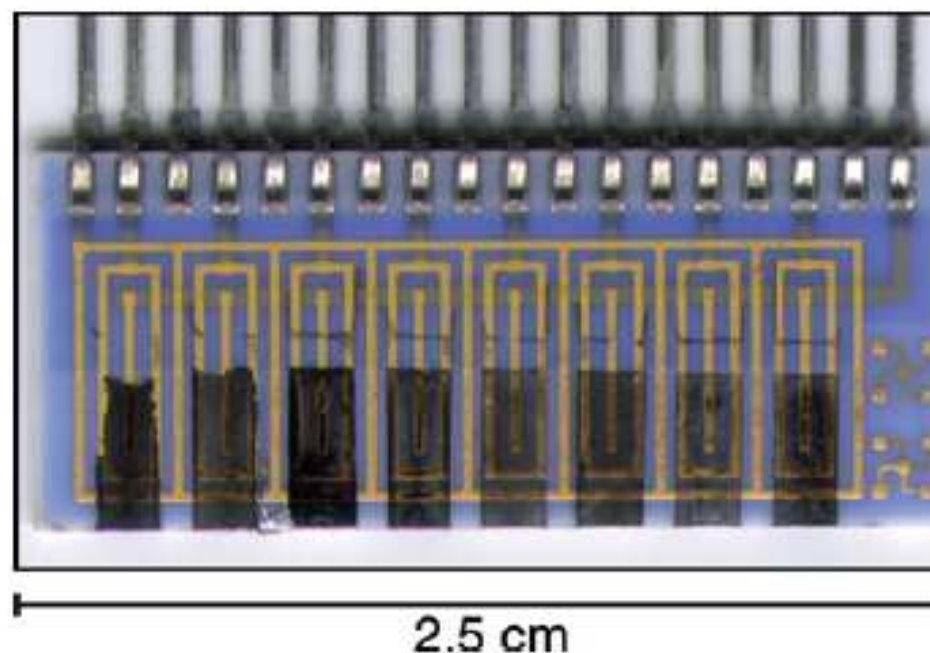


M. Camara et al. Analytical Chemical Acta, 2010

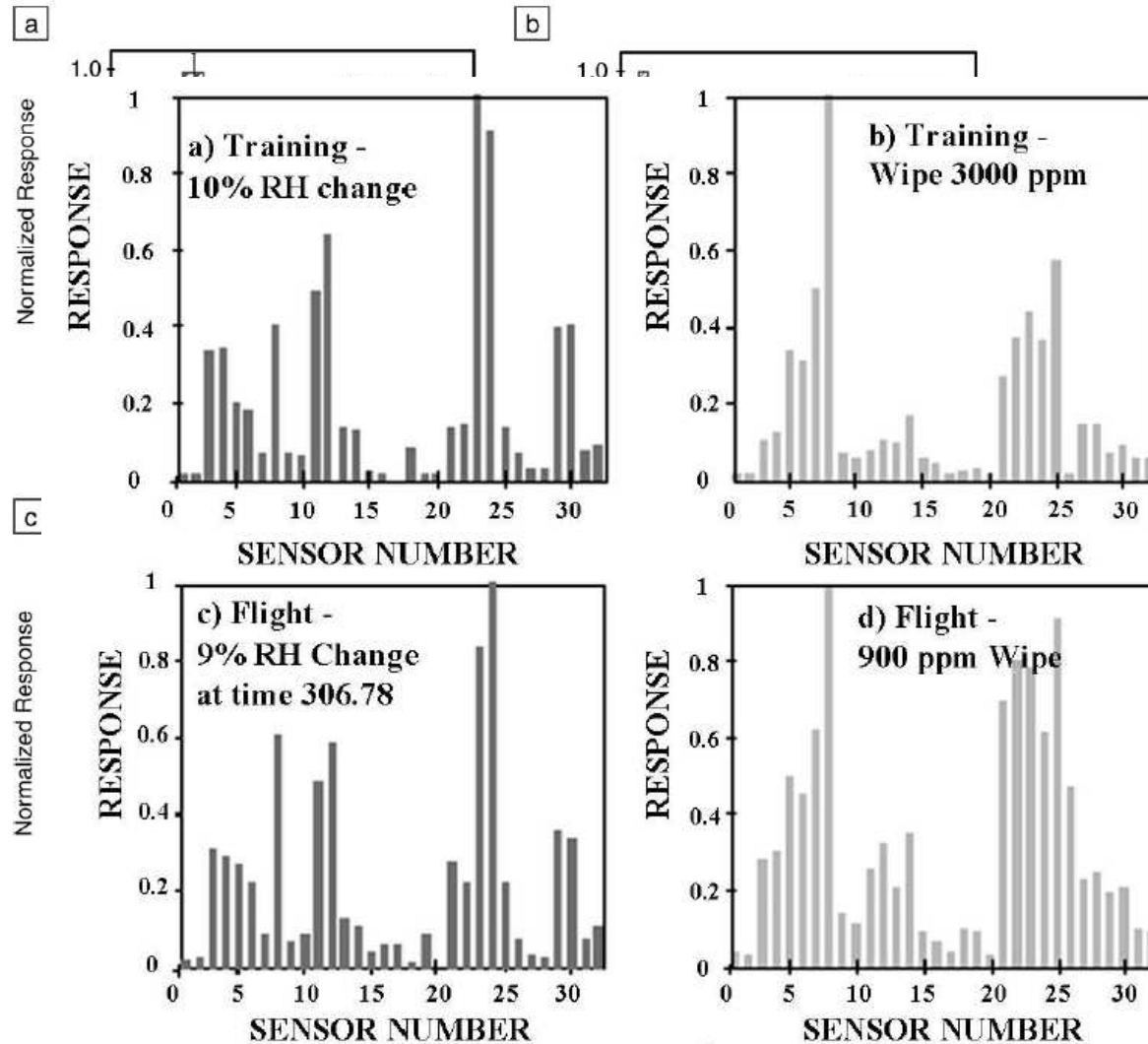
## **Monitoring Space Shuttle Cabin Air Quality using the Jet Propulsion Laboratory NASA Electronic Nose**



The sensor ceramic substrate is 25 mm x 10 mm.  
Sensing area of each electrode: 2 mm x 1 mm.  
Eight Au-Pd electrode sets.  
**Polymer-carbon black composite films.**  
JPL NASA E-Nose: 32 sensor array.



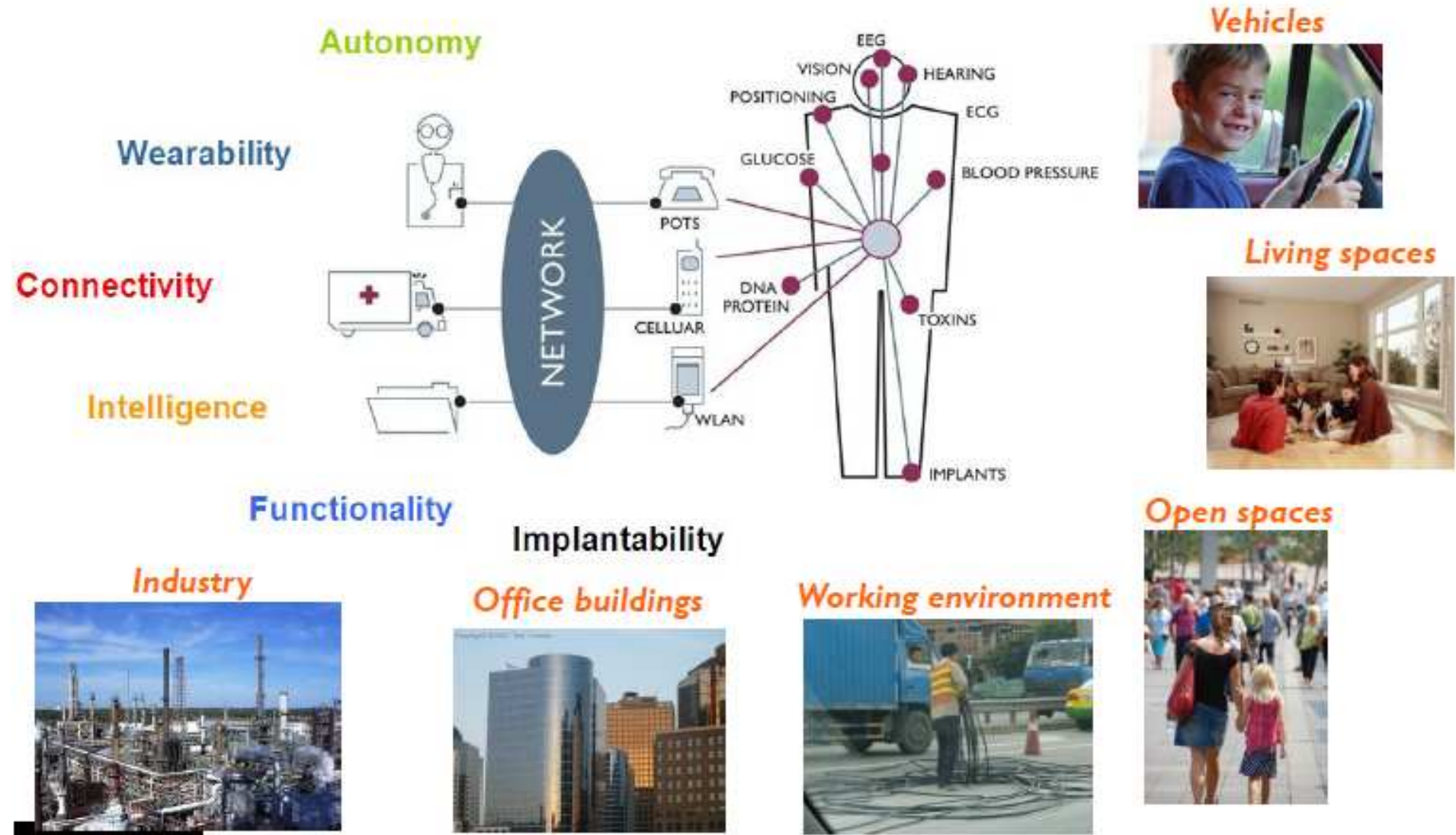
## Monitoring Space Shuttle Cabin Air Quality using the Jet Propulsion Laboratory NASA Electronic Nose



- The sensor ceramic substrate: 25 mm x 10 mm.
- Sensing area of each electrode: 2 mm x 1 mm.
- 16 or 32 Au-Pd electrode sets.
- Polymer-carbon black composite films.
- JPL NASA E-Nose: 32 sensor array.

*Wipe is a mixture of alcohols*

# From Body Area Network to Personal Area Network



# ACTION TD1105: STATE OF ART ON AQC - GAS SENSORS

## The future is coming...!



**NASA adapt iPhone**  
to smell chemicals  
(Nov 17, 2009)



**NTT DoCoMo**  
A Cell Phone that  
spots Bad Breath



**Nokia EcoSensor Concept**  
Wearable sensor unit to sense  
(environment, health..), and a  
dedicated mobile phone (not an e-nose yet)



**Other concepts:**  
Health conscious phone  
that smells food properties

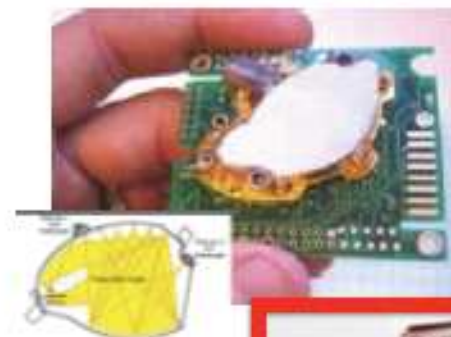
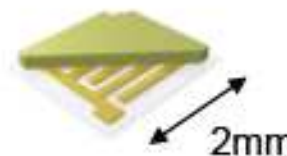
**Nokia Scentsory Concept**  
e-nose samples the odor of  
caller environment and transmit  
to recipient electronically



## Basis for sensor network system approach:

### Low cost miniature gas sensor technologies

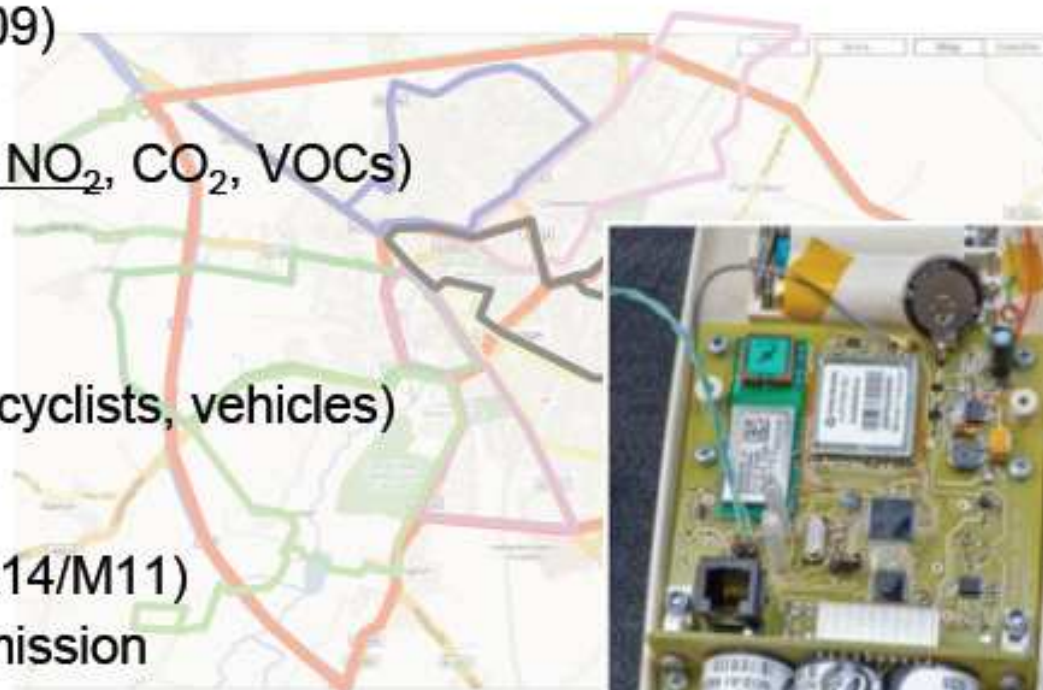
- **Electrochemical**
- Non Dispersive IR
- Photo-ionisation Detection
- Metal Oxide
- SAW
- .....



>factor of 100 cheaper (and smaller) than traditional methods  
- if they can be made sensitive enough

## Mobile sensor network deployment: Cambridge (UK)

- 4 hour deployment (2009)
- > 40 sensors (CO, NO, NO<sub>2</sub>, CO<sub>2</sub>, VOCs)
- 3 transport modes  
(walkers, cyclists, vehicles)
- Inner city, outer loop (A14/M11)
- Real time GPRS transmission
- >200,000 measurements





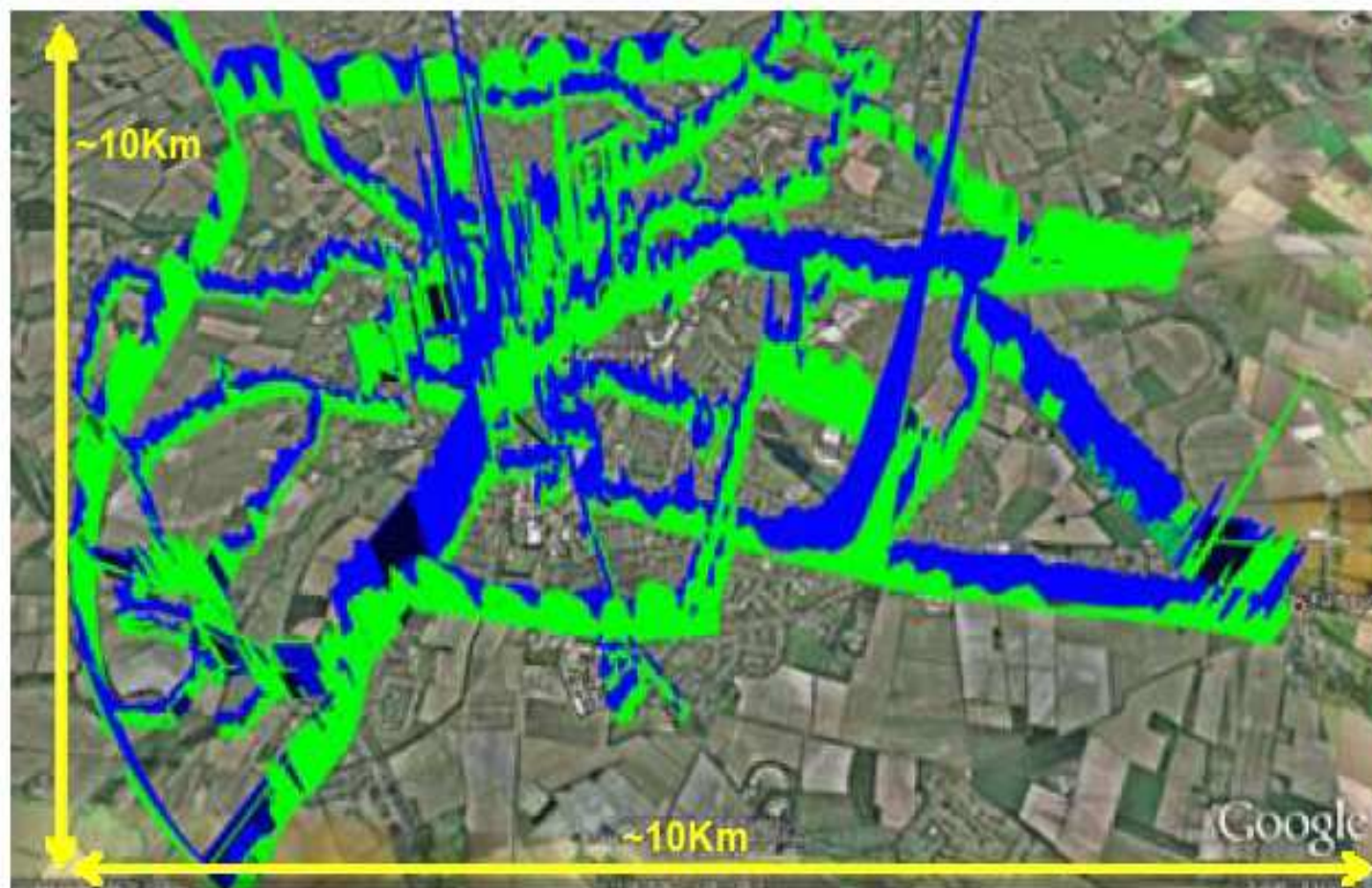
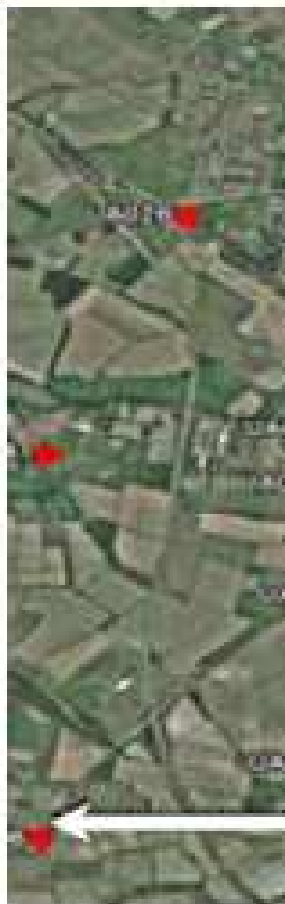
# **ACTION TD1105: STATE OF ART ON AQC - APPLICATIONS**

## Sensor Network based Urban Pollution Monitoring System at Cambridge (UK)

47 senso

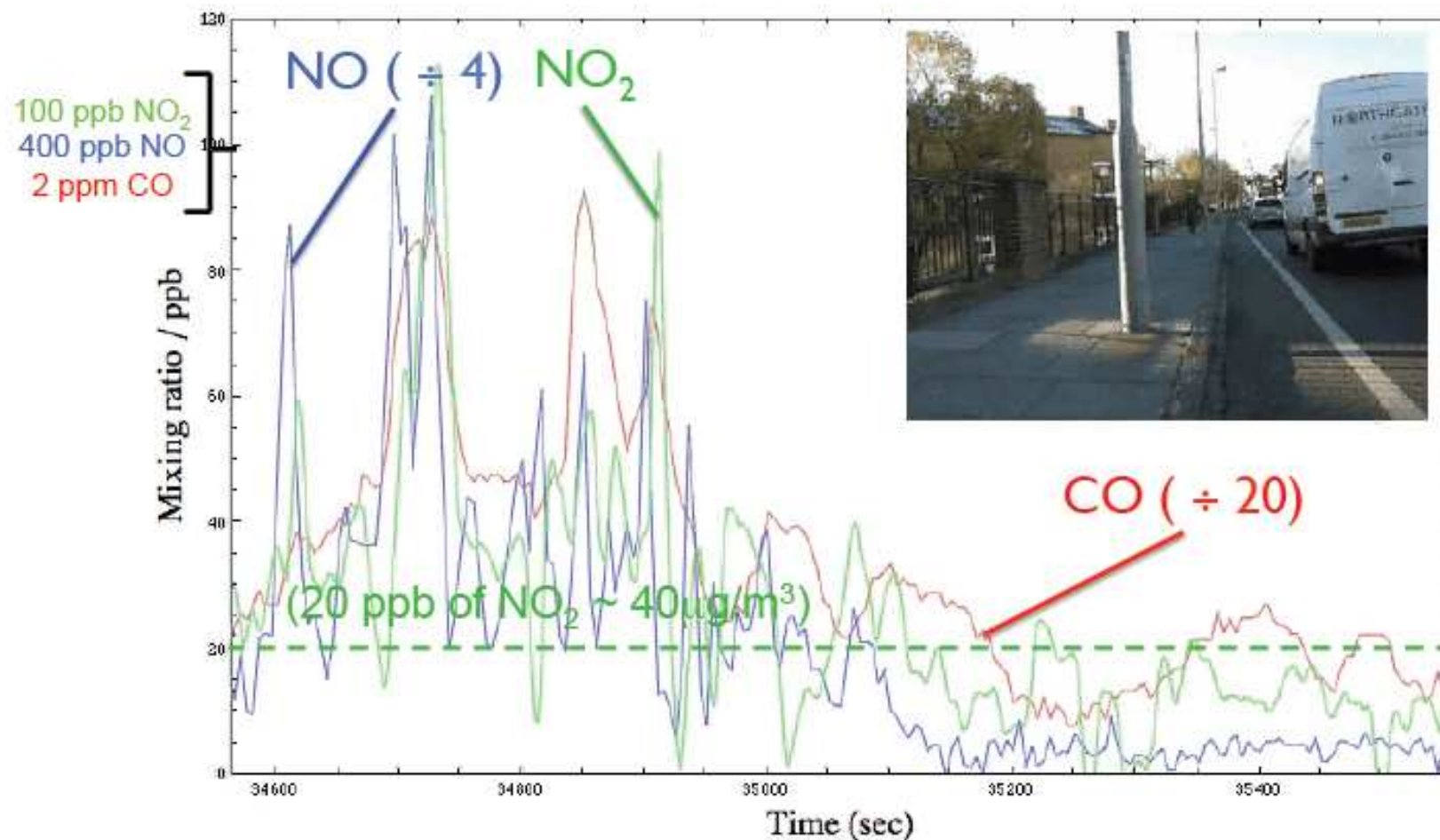
Cambridge deployment August 2009

NO (Blue) – NO<sub>2</sub> (Green)



*Courtesy by Rod L. Jones from University of Cambridge*

## Multi-species real time mobile measurements of air quality in complex environments



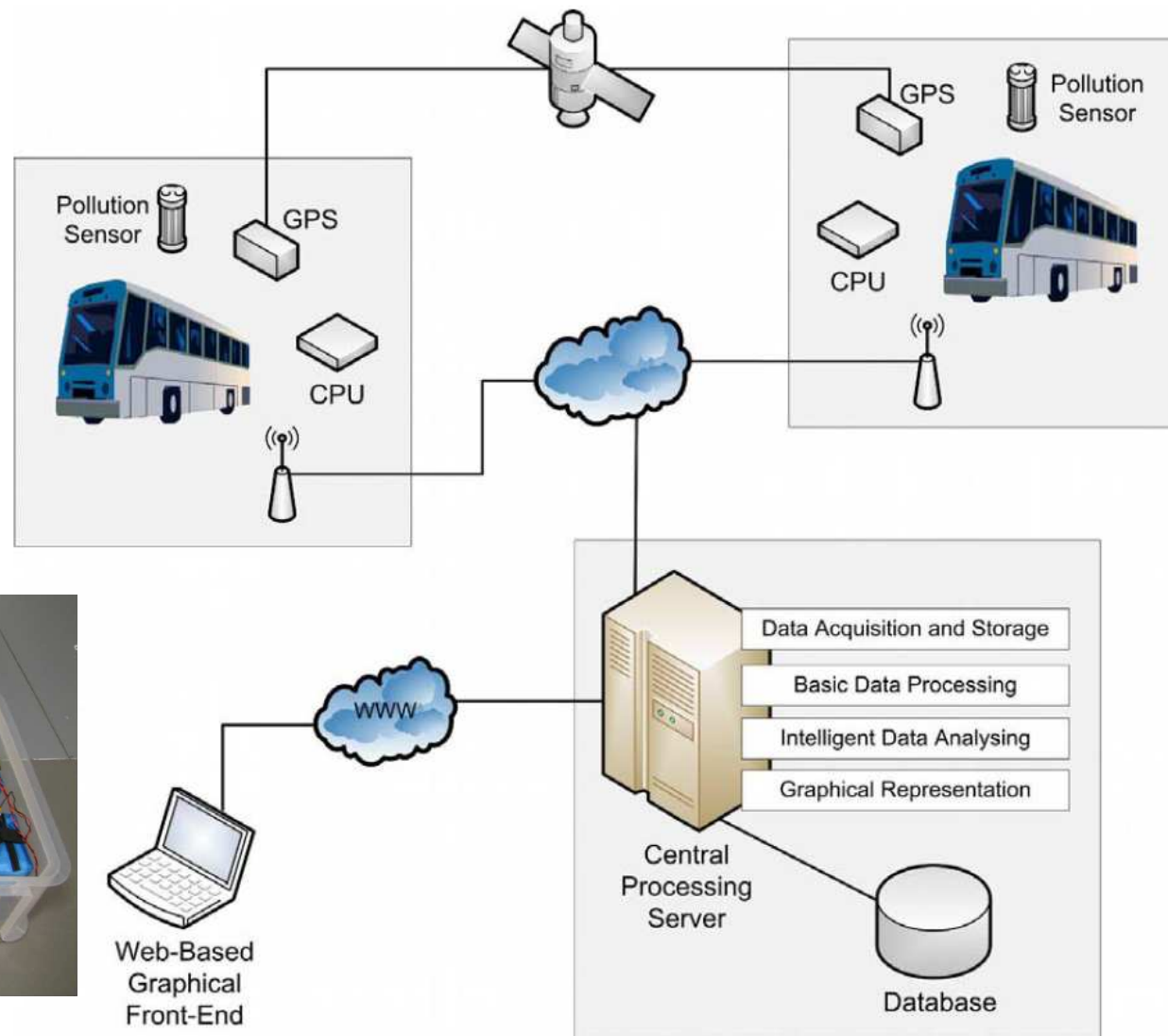
## Public Transportation based Dynamic Urban Pollution Monitoring System at Vigo and A Coruna (Spain)

Vaisala Sensor

CO<sub>2</sub>

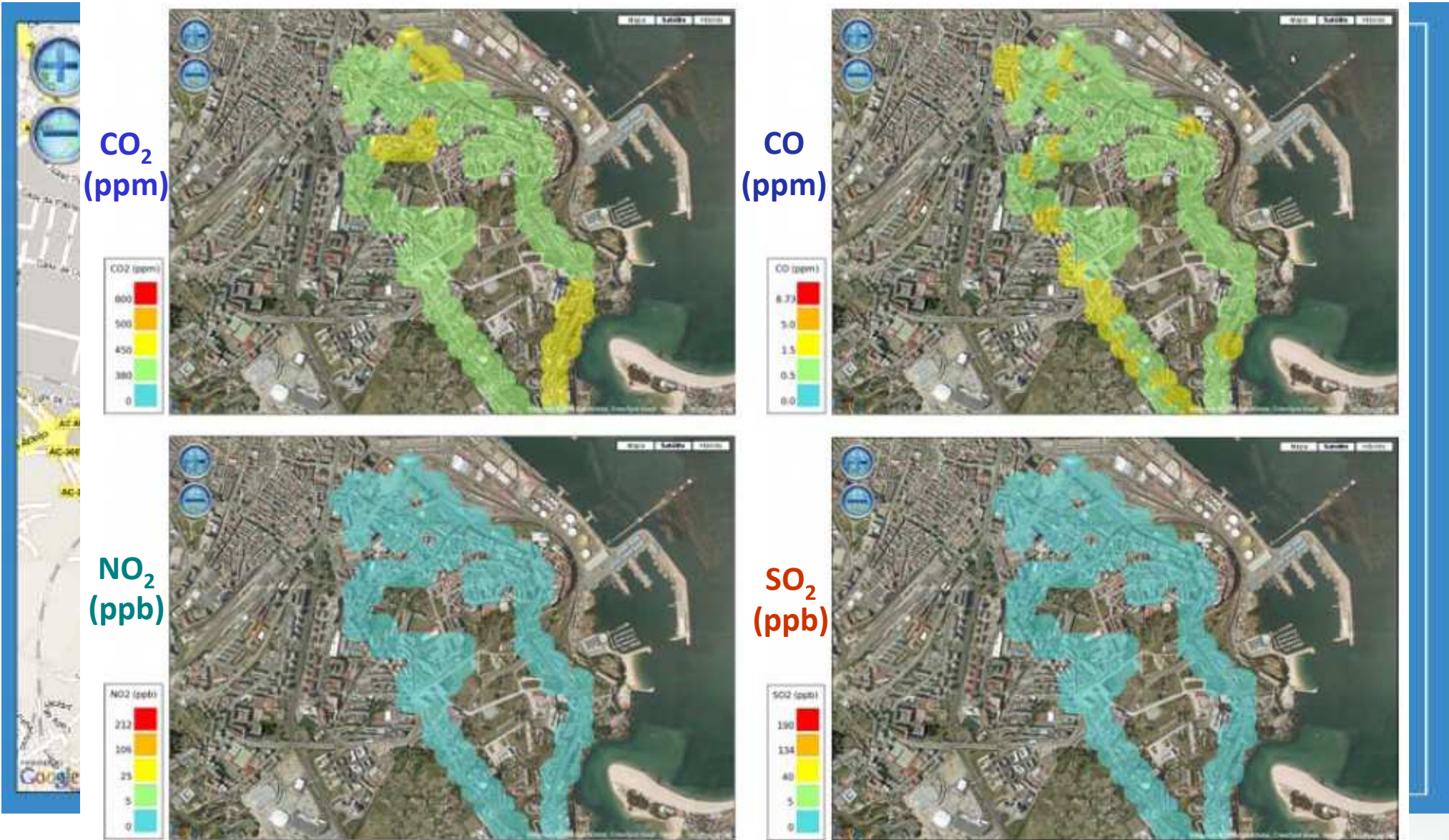
Sontay EC Sensors

CO, NO<sub>2</sub>, SO<sub>2</sub>,  
Temperature, RH



# ACTION TD1105: STATE OF ART ON AQC - APPLICATIONS

## Public Transportation based Dynamic Urban Pollution Monitoring System at Vigo and A Coruna (Spain)



## NanoTera OpenSense

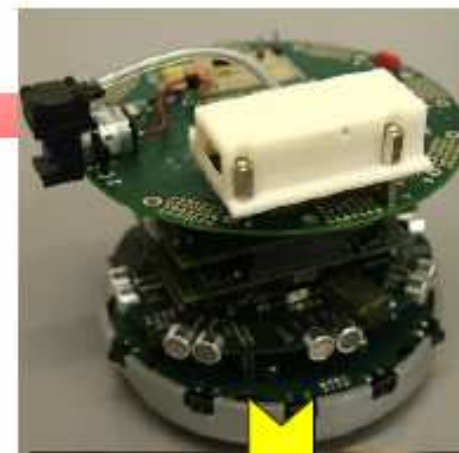
Coordinator Karl Aberer - EPFL

### ■ Lausanne deployment

8 mobile stations

- NO<sub>2</sub>, CO, CO<sub>2</sub>, Humidity, Temperature
- Positioning module
- Communication: GSM

1 prototype station mounted on bus

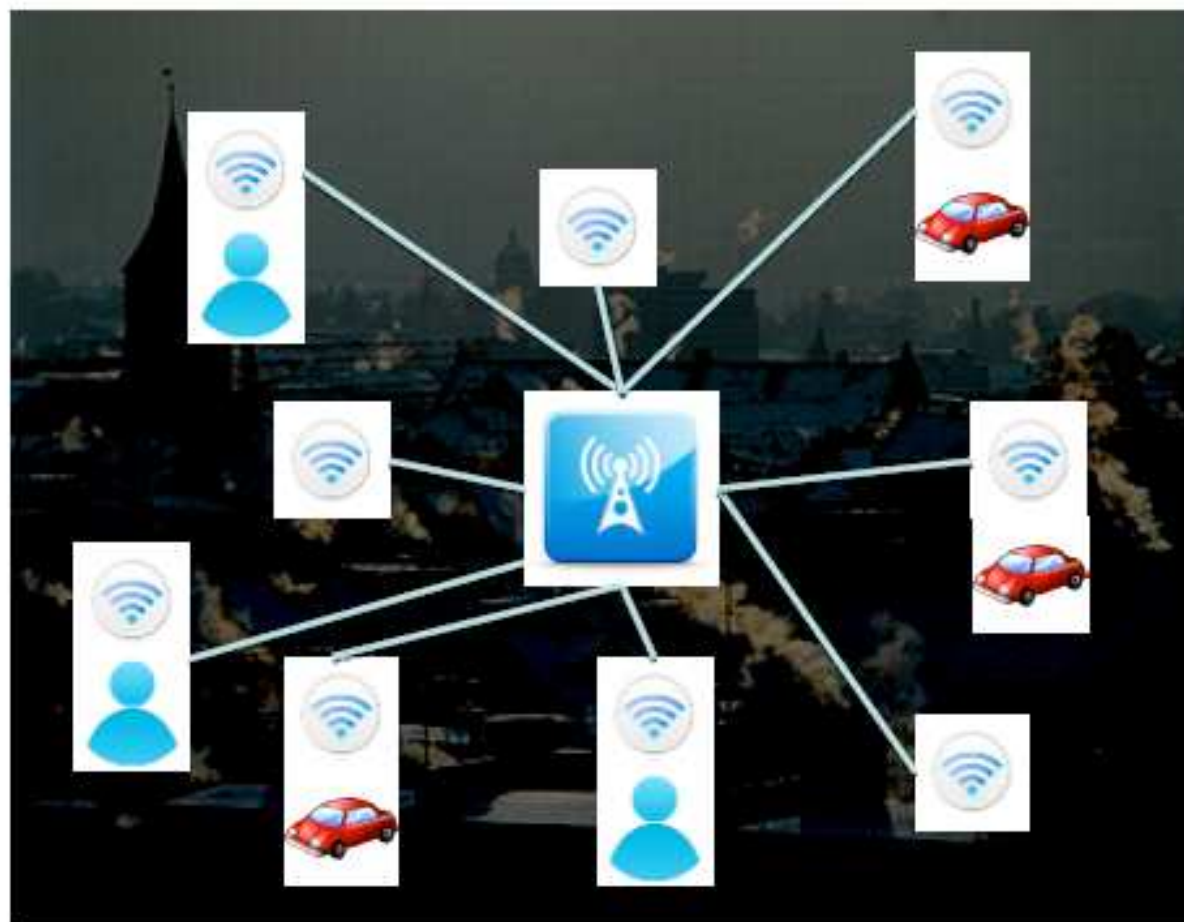


Mobile Urban Sensors Network deployed at Lausanne (CH) - OPENSENSE Project

## Opportunities



- *Wireless communication and low cost sensors:*  
deploy larger numbers of stations
- *Mobility:*  
deploy mobile stations to increase spatial coverage
- *Communities:*  
citizens as data producers and information consumers



Mobile Urban Sensors Network deployed at Lausanne (CH) - OPENSENSE Project

## **Air pollution monitoring**



- **Sensing system**
  - With sufficient temporal and spatial resolution
  - With sufficient precision
  - At reasonable cost
  
- **Data analysis**
  - Interpolate air quality parameters from raw data
  - Ensure data quality
  - Reduce acquisition cost
  
- **User concerns**
  - Correlate with activity and mobility data
  - Consider privacy concerns
  - Provide individualized information
  
- **End-to-end system architecture**



# WHAT IS COST ?

**COST is an intergovernmental framework for European Cooperation in Science and Technology, allowing the coordination of nationally-funded research on a European level.**



**COST has a very specific *mission and goal*.**  
**It contributes to reducing the fragmentation in European research investments and opening the European Research Area to cooperation worldwide.**



# MISSION OF A COST ACTION

As a precursor of advanced multidisciplinary research, COST plays a very important role in building a European Research Area (ERA). It anticipates and complements the activities of the EU Framework Programmes, constituting a “bridge” towards the scientific communities of emerging countries. It also increases the mobility of researchers across Europe and fosters the establishment of scientific excellence in the nine key domains:

- Biomedicine and Molecular Biosciences
- Food and Agriculture
- Forests, their Products and Services
- Materials, Physics and Nanosciences
- Chemistry and Molecular Sciences and Technologies
- Earth System Science and Environmental Management
- Information and Communication Technologies
- Transport and Urban Development
- Individuals, Societies, Cultures and Health

In addition, Trans-Domain Proposals allow for broad, multidisciplinary proposals to strike across the nine scientific domains.



# Eligible Costs and Reimbursement Rules



**Costs are incurred along these following categories:**

- Travel and subsistence allowances for meeting participants
- Organisation of meetings (Local Organiser Support)
- Short-Term Scientific Missions (STSMs)
- Training Schools
- Dissemination, e.g. Scientific Publication, Action website, Action promotion for Meetings and Training Schools, Communication, Outreach activities
- Other Expenses Related to Scientific Activities (such expenses need an approval from the COST Office)
- Financial and Scientific Administration and Coordination of the Action (*Fee up to 15% of the actual science expenditure*)

**NO FUNDING FOR RESEARCH !!**

***Estimated TOTAL BUDGET for 4 Years: € 560.000***



# HISTORY: SELECTION STEPS FOR COST ACTION *EuNetAir*



- OPEN COST CALL: 5 FEBRUARY 2011
- COLLECTION DATE FOR FIRST STAGE PROPOSAL: 25 March 2011  
*ABOUT 2000 PROPOSALS IN THE 10 COST DOMAINS*
- INVITATION FOR FULL PROPOSAL: 15 MAY 2011  
*80 PROPOSALS INVITED TO SUBMIT FULL PROPOSAL*  
***Score EuNetAir: 31.64/36.00 (88%) - Threshold: 25/36 (70%)***
- DEADLINE FOR FULL PROPOSAL: 29 JULY 2011  
*FULL PROPOSAL EUNETAIR SUBMITTED !*  
***Score EuNetAir: 69/75 (92%) - Threshold: 55/75 (73%)***
- HEARINGS AT TRANS-DOMAIN COMMITTEE: 30 SEPTEMBER 2011  
*5 TD PROPOSALS INVITED TO HEARINGS at BRUSSELS:*  
***3 TD PROPOSALS SHORTLISTED TO BE APPROVED:***  
***(EuNetAir ranked to 3rd place)*** approved together 30 new Actions by  
*Committee of Senior Officials (CSO) Meeting on 1 DECEMBER 2011*
- KICK-OFF MEETING OF ACTION *EuNetAir*: 16 MAY 2012 !!



# COST ACTION *EuNetAir*: WHY ?



## PROPOSED SOLUTION

Networking of Coordinated Action on Integrated and Multidisciplinary Scale of Science and Technologies:

**NANOMATERIALS, GAS SENSORS, WIRELESS TECHNOLOGY,  
AIR-QUALITY MODELLING, STANDARDS & PROTOCOLS**

## TARGETED OPEN PROBLEMS

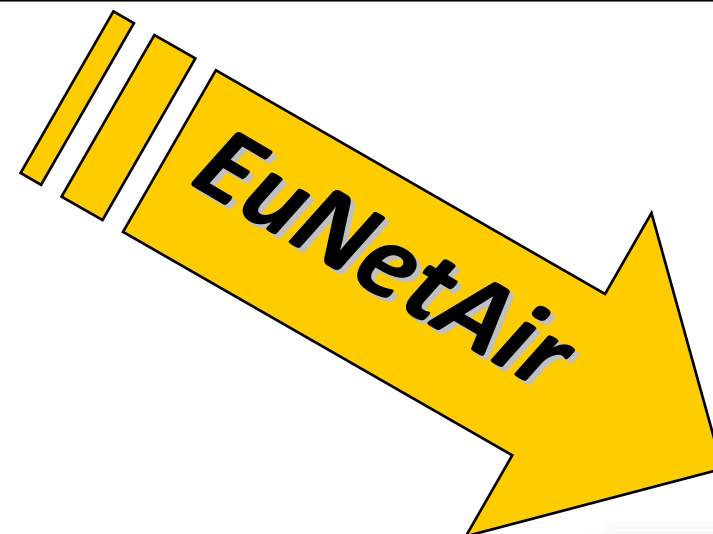
**AIR QUALITY CONTROL**

**INDOOR/OUTDOOR ENERGY EFFICIENCY**

**ENVIRONMENTAL SUSTAINABILITY**

**CLIMATIC CHANGES MONITORING**

**HEALTH EFFECTS OF AIR-POLLUTION**



## BENEFIT & IMPACT

**European Leadership on AQC Science & AQC Technologies**

**Development of Green-Economy**

**Support to Sustainable Development**

**Monitoring System for Clean Air for Europe**

European Network on New Sensing Technologies for Air-Pollution Control and Environmental Sustainability- EuNetAir



# ACTION *EuNetAir* KEY ISSUES



- Research and Development on **New Sensing Technologies for low-cost Air-Pollution Control** through field studies and laboratory experiments.
- Innovation and Transfer of the results in **preventive real-time control practises** and **global sustainability for monitoring climate changes** and **outdoor/indoor energy efficiency**.
- Networking of international experts and Coordination of AQC Research for **development of new environmental technologies** and **industrial applications**.

# COST ACTION *EuNetAir*: AIM



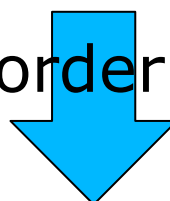
***Increase scientific and technological knowledge  
at integrated and multidisciplinary scale***

to develop



- **Nanomaterials for AQC sensors**
- **Improved gas sensor systems & sensing microdevices**
- **Wireless Sensor Networks & Distributed Intelligence**
- **Air-Quality Modelling & Chemical Weather Forecasting**
- **New Protocols, Standards & Methods for AQC sensors**
- **Harmonisation of environmental measurements**
- **Guidelines for AQC systems & transducers**
- **Environmental Sustainability & Energy Efficiency**

in order to



**implementation in real-world applications**  
support **green-economy of European Countries**  
*and competitiveness of European SMEs*



# COST ACTION *EuNetAir*: OBJECTIVES

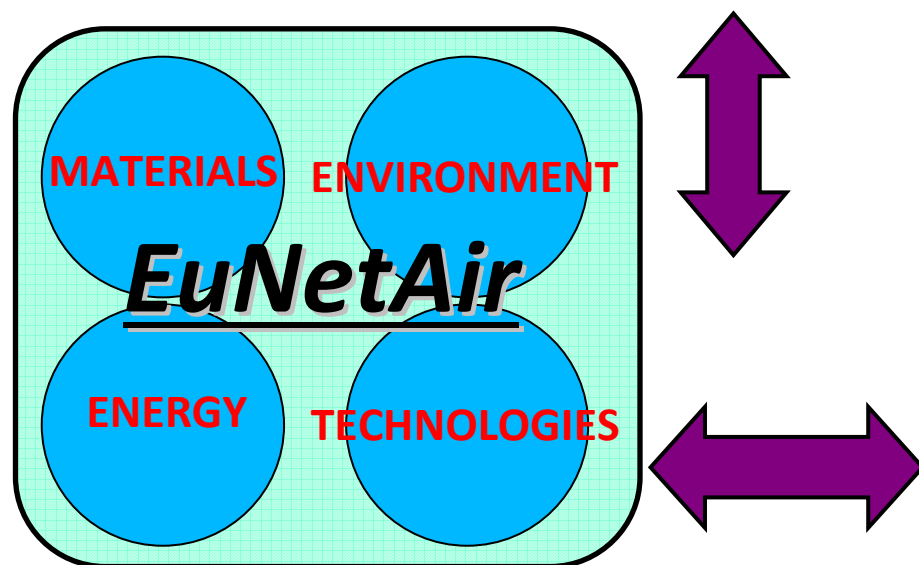


- ❑ **Establishment** of a ***Pan-European and multidisciplinary research*** and technological platform including research institutions, universities, agencies, industries, stakeholders and policy-makers.
- ❑ **Achievement** of a ***common understanding and knowledge*** at the European level of requirements on AQC and global sustainability.
- ❑ **Definition** of ***protocols and pre-standardised methods for AQC sensors*** and ***harmonisation of environmental measurements***.
- ❑ **Training** and involvement of ***Early Stage Researchers*** in the Coordinated Action at multidisciplinary style and international level.
- ❑ **Creation** of long standing ***collaborative research teams*** in the area of nanomaterials, AQC sensors and systems, AQ modelling, environmental measurements, standards and protocols for AQC, commercialisation of AQC sensors and environmental technologies.
- ❑ **Razionalization** of ***European research on AQC*** with emphasis on environmental sustainability and energy efficiency, ***including top-level worldwide collaborations***.
- ❑ **Promotion** of ***women's participation*** in S&T for ***gender balance***.
- ❑ **Dissemination** activities on AQC for ***sustainable development***.

# COST Action EuNetAir: SPECIFIC FEATURES AND INNOVATION

## Complementarity with other COST Actions:

- ES0602 Chemical Weather Forecasting and Information Systems
- MP0701 Composites with Novel Functional and Structural Properties by Nanoscale Materials
- MP0901 Designing Novel Materials for Nanodevices: From Theory to Practice
- TU0902 Integrated Assessment Technologies to Support the Sustainable Development of Urban Areas



## RELATED FP6-FP7 PROJECTS:

- NANOS4, NMP
- S3, EU-RUSSIA COOPERATION
- ORAMA, NMP
- NANO2HYBRIDS, NMP
- AIRMONTECH, ENV
- AQUILA, ENV
- OFFICAIR, ENV
- GOSPEL, Network of Excellence in Artificial Olfaction
- FLEXSMELL, PEOPLE Marie-Curie Action

## INNOVATION of ACTION:

**Integrated approach** on AQC for environmental sustainability by **cooperative networking of multidisciplinary research** on nanomaterials, gas sensing technologies, wireless sensor technologies and networks, environmental measurements, ambient intelligence, air quality modelling, chemical weather forecasting, harmonisation of measurements, protocols, methods, standards and procedures for commercialisation of low-cost AQC sensors.



# ***COST Action EuNetAir: Some National Research Projects***

Nat. Res. Project:  
NDIR-GAS SENSORS  
Sector: ENV TECH, ICT  
Lead Partner: CCMOS Ltd  
Country: UK

Nat. Res. Project: SMART-GAS  
Sector: ENV TECH  
Lead Partner: SenseAir  
Country: Sweden

Nat. Res. Projects: SMS-Nase, DFG  
Sector: MATERIALS, AQC SENSORS  
Lead Partner: ...

Nat. Res. Project: NANOSENSORS  
Sector: NANOMATERIALS, GAS SENSORS  
Lead Partner: SIC - Chinese Academy of Science  
Country: China

**COST Action EuNetAir**

Nat. Res. Project: SNAQ-Heat  
Sector: ENVIRONMENTAL SECURITY  
Lead Partner: ... of Cambridge  
Country: UK

Nat. Res. Project: ... ENERGY EFF. CY  
Sector: ...  
Lead Partner: 3S GmbH  
Country: Germany

Nat. Res. Projects: ...-SENS, INTEGROSENS  
Sector: ENV, GAS SENSORS, CONTROL  
Lead Partner: University of Bayreuth  
Country: Germany

Nat. Res. Project: SMART SENSORS  
Sector: MATERIALS, GAS SENSORS  
Lead Partner: NRC - Kurchatov Institute  
Country: Russian Federation

Nat. Res. Project: HTS&M  
Sector: Materials, NanoDevices  
Lead Partner: IMEC  
Country: Netherlands

Nat. Res. Projects: VOC-IDS (EraNet), IGF  
Sector: ENV, SECURITY, ICT  
Lead Partner: LMT-Saarland University  
Country: Germany

Nat. Res. Project: SMART NANOSENSORS  
Sectors: CNT NANOSENSORS FOR SPACE,  
COMMERCIAL/INDUSTRIAL APPLICATIONS  
Lead Partner: NASA Ames Research Center  
Center for Nanotechnology  
Country: USA

Nat. Res. Project: CAPBTX  
Sector: GAS SENSORS, ENV  
Lead Partner: ...  
Country: ...

Nat. Res. Project: CABTURES  
Sector: NANO, SENSORS  
Lead Partner: EPFL  
Country: Switzerland

Nat. Res. Projects:  
IDEA, MOBILE SENSING  
Sector: ENV, ICT  
Lead Partner: VITO  
Country: Belgium

Nat. Res. Project: NAWACS, ...  
Sector: NANO, GAS SENSORS  
Lead Partner: IREC  
Country: Spain

Nat. Res. Project: VALTEC, TEC  
Sector: NANO, GAS SENSORS  
Lead Partner: UB, IREC  
Country: Spain

Nat. Res. Projects:  
FC Aeth, Air Pollution  
Sector: ENV TECHNOLOGIES  
Lead Partner: Aerosol ...  
Country: Slovenia

Nat. Res. Project: InTechFun  
Sector: MATERIALS, SENSORS  
Lead Partner: SUT  
Country: Poland

Nat. Res. Projects:  
VAMOS, CARIATI  
Sector: ENV  
Lead Partner: CSIC  
Country: Spain

Nat. Res. Projects:  
VOC&ODOR, SIMPA  
Sector: ENV  
Lead Partner: UNIBA  
Country: Italy

Nat. Res. Projects:  
SIMS, SISEDARE,  
Sector: ICT, Materials, ENV  
Lead Partner: ENEA  
Country: Italy

Lead Partner: ...  
Country: Italy

Nat. Res. Projects: NOVANA, ARCTIC  
Sector: AQC, ENV, AQ-MODELLING  
Lead Partner: Aarhus University  
Country: Denmark

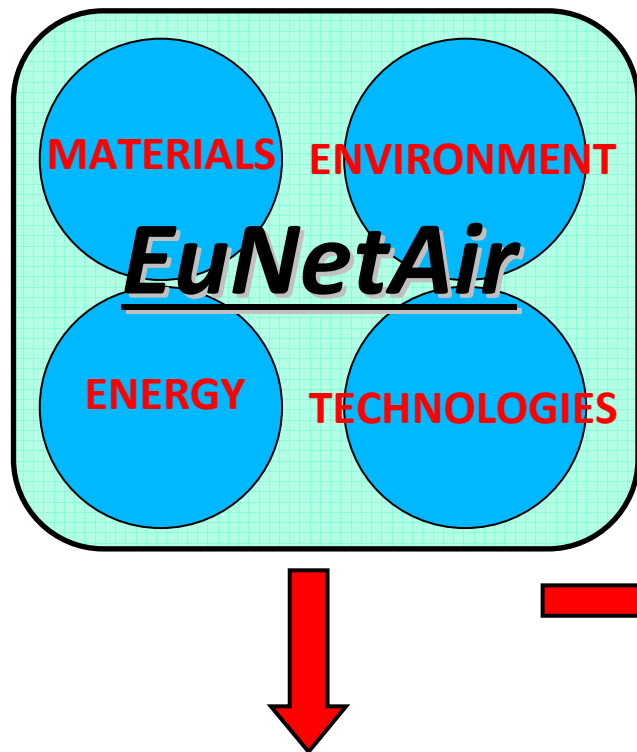
Nat. Res. Projects: FIRB, NANOTHER, CARIPLO  
Sector: NANOMATERIALS, GAS SENSORS, ENERGY  
Lead Partner: UNIBS; ...  
Country: Italy

Nat. Res. Projects: EXO-THERMO  
Sector: MATERIALS, GAS SENSORS, ENERGY  
Lead Partner: FORTH; ...  
Country: Greece

Nat. Res. Projects: CWFIS, SFO  
Sector: ENV, AQ Modelling  
Lead Partner: NIMH  
Country: Bulgaria

**COST Action EuNetAir**

# COST Action EuNetAir: EXPECTED IMPACT



## Benefit of Concerted Action:

- Better integration of researches in the ERA on AQC
- Mutual enrichment, cross-validation and linking
- Identifying important areas for future AQC research
- Providing a flexible forum for planning future activities

## Benefit in Science & Technology:

- New sensing technologies
- Identification of sensing mechanisms
- Increased knowledge in nanomaterials for AQC sensors
- Improvement of sensor technologies
- Harmonisation of environmental measurements
- Standards, methods, protocols for calibration
- Experimental datasets for evaluating models in coordination

## Benefit for Society:

- Sensing technologies for AQC at rural, remote, traffic, road networks in smart cities
- Improved AQ modelling and chemical weather forecasting
- Real-time mapping of Air Pollution by wireless sensor networks or GSM
- Innovation into preventive practises to monitor climate changes and outdoor/indoor energy efficiency

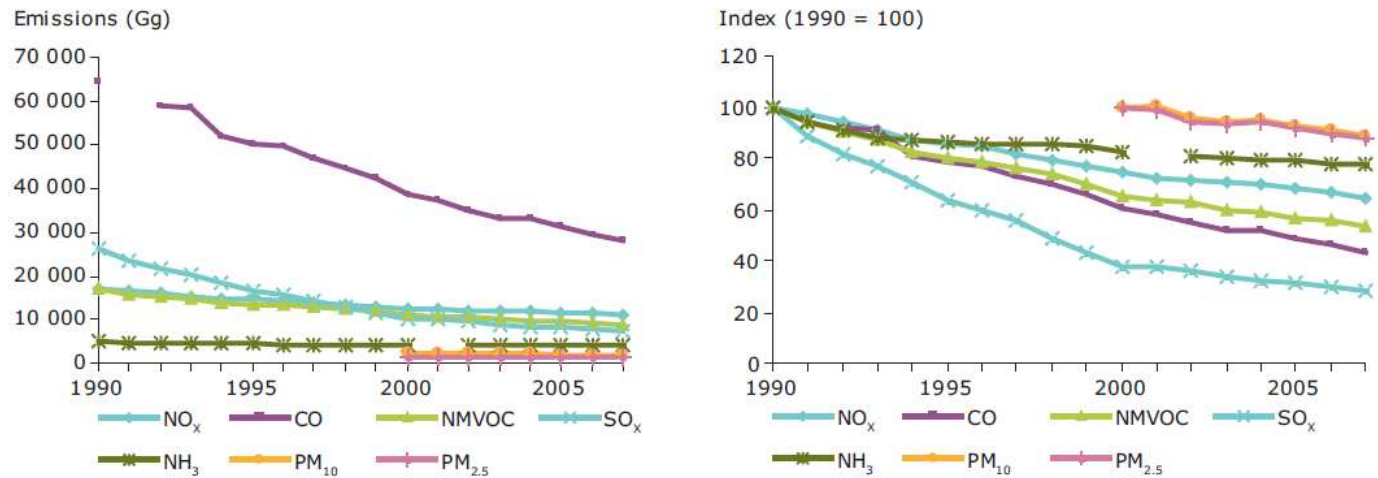
## Specific scientific impacts of Action:

- A list of strengths and weaknesses of the existing knowledge-base
- Established strengthened communications between different research fields involved
- Enhanced connections with end-users and beneficiaries (citizens) of distributed AQ sensors technology
- A mid-to-long term common research agenda for the future

# EuNetAir BACKGROUND: AIR QUALITY CONTROL



**Figure ES1 EU-27 emission trends in absolute (Gg) and relative terms for NO<sub>x</sub>, CO, NMVOCs, SO<sub>x</sub> and NH<sub>3</sub> between 1990 and 2007 (index year 1990 = 100), and for PM<sub>10</sub> and PM<sub>2.5</sub> between 2000–2007 (index year 2000 = 100)**

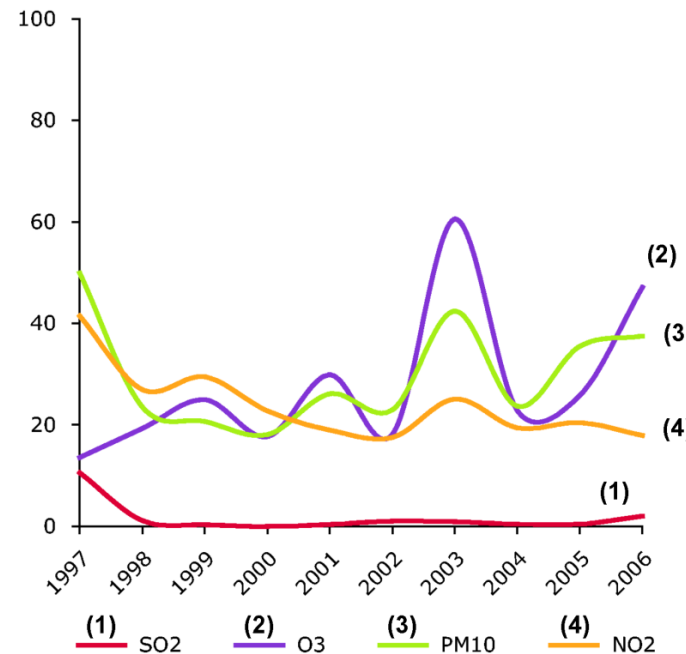


*European Environment Agency, EEA Report 8/2009*

## Some Environmental Emergencies:

- 1930 - Meuse Valley (Belgium)
- 1952 - Great London Smog (UK)
- 1954 - Los Angeles (USA)
- 1984 - Bhopal (India)
- 2005 - Teheran (Iran)
- 2006 - Hong Kong (China)
- 2008 - Shanghai, Peking (China)
- 2009 - Taranto (Italy)

% of urban population

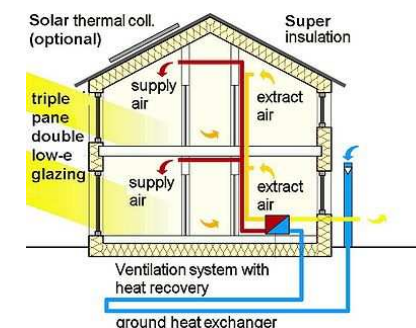
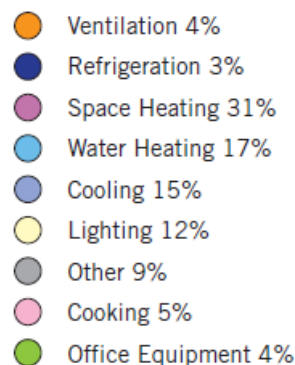
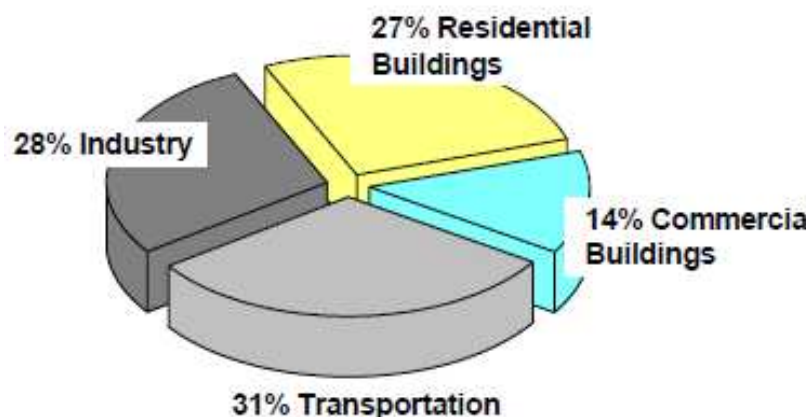


Pollutant	Limit Level
NO <sub>x</sub>	100, 200 ppb
CO	8 ppm
SO <sub>2</sub>	130, 190 ppb
O <sub>3</sub>	120 µg/m <sup>3</sup>
PM <sub>10</sub>	50 µg/m <sup>3</sup>
BTEX	6 µg/m <sup>3</sup>
PAH (BaP)	1 ng/m <sup>3</sup>
PM <sub>2.5</sub>	-

**AMBIENT AIR QUALITY  
EU DIRECTIVE 2008/50/EC and Daughters**

# EuNetAir BACKGROUND: INDOOR/OUTDOOR ENERGY EFFICIENCY

Figure 2 – Total Energy Consumption by End Use  
Adapted from E Source, 2006



Source: Environmental Protection Agency's National Action Plan for Energy Efficiency Sector Collaborative on Energy Efficiency Hotel Energy Use Profile

Primary energy consumption in the EU<sup>1</sup>

<sup>1</sup> O. Seppanen,

11<sup>th</sup> Conference on Indoor Air Quality  
2008, Copenhagen, Denmark

**41% Primary Energy consumed in Buildings:**

- 2/3 in Residential Buildings
- 1/3 in Commercial Buildings

Energy Performance of Buildings EU Directive  
EPBD 2010/31/EC

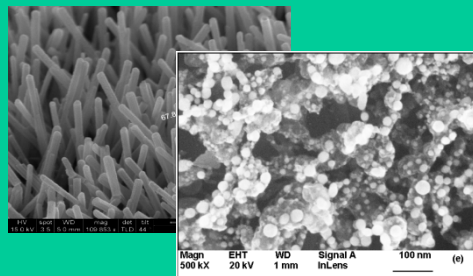
Indoor Air		Typical Substances		Cure
Contamination Source	Emission Source	VOCs	Others	
• Human Being	• Breath	Acetone, Ethanol, Isoprene	demand controlled ventilation	
		CO <sub>2</sub>		
		Humidity		
	• Skin Respiration & Transpiration	Nonanal, Decanal, α-Pinene		
		Humidity		
	• Flatus	Methane, Hydrogen		
		• Cosmetics		Limonene, Eucalyptol
• Household Supplies	• Combustion (Engines, Appliances, Tobacco Smoke)	Alcohols, Esters, Limonene		
		Unburnt Hydrocarbons		
	CO			
	CO <sub>2</sub>			
• Building Material • Furniture • Office Equipment • Consumer Products	• Paints, Adhesives, Solvents, Carpets	Humidity	permanent 5-10% ventilation	
		Formaldehyde, Alkanes, Alcohols, Aldehydes, Ketones, Siloxanes		
	• PVC	Toluene, Xylene, Decane		
• Printers, Copiers, Computers	• Printers, Copiers, Computers	Benzene, Styrene, Phenole		

Table 1 – Typical Indoor Air Contaminants (VOCs and others)

**IAQ by WORLD HEALTH ORGANIZATION**

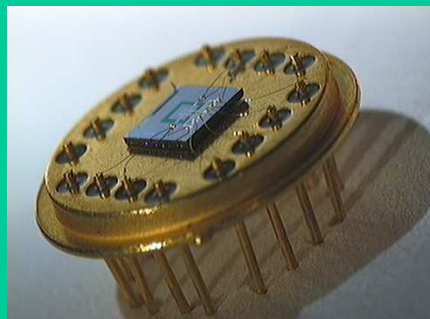
# COST Action EuNetAir: CHALLENGES

## MATERIALS & GAS SENSORS



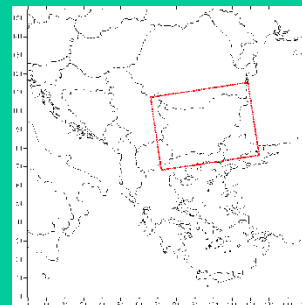
MOX by UNIBS IREC UB SICCAS  
CNT by ENEA NASA URV CSIRO

## AQC SENSORS & SYSTEMS



GasFET by EPFL, Switzerland

## AQ MODELLING

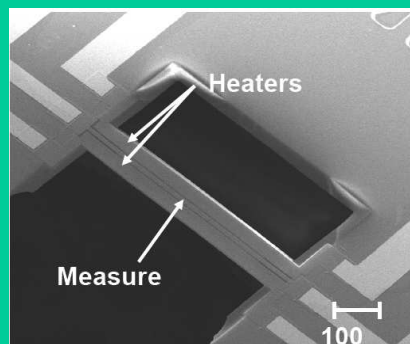


CMAQ Calculations  
by NIMH, BG

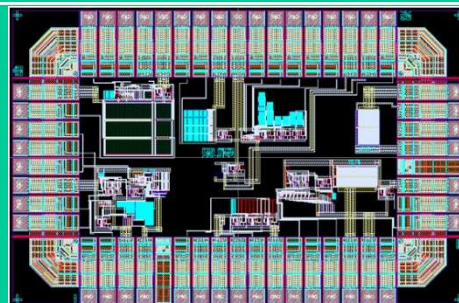
## STANDARDS & PROTOCOLS



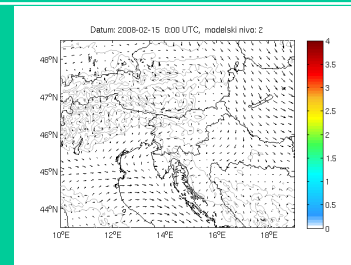
Dynamic Olfactometry (EN 13725/2003) by Univ. of Bari and Lenviros srl, IT



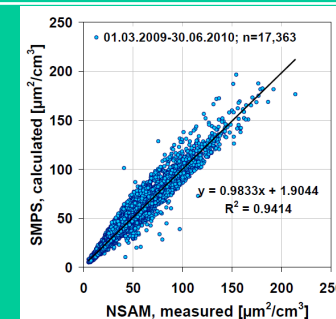
Cantilever Sensor by DTU, DK



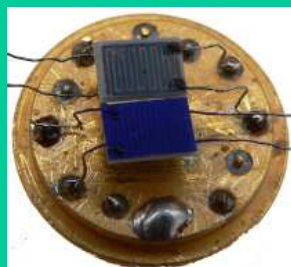
ASIC Circuit: CMOS SOI  
by WARWICK & CCMOS Ltd, UK



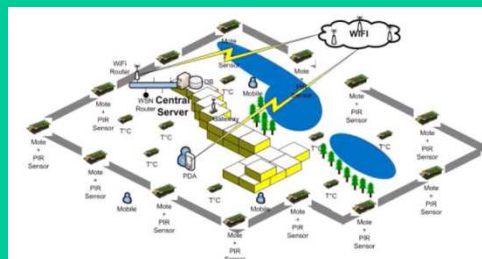
AQ Modelling dispersion in meteorological mesoscale by University of Ljubljana, SL



Particle Surface Area Measurements by IUTA eV, DE



Phtalocyanine Gas Sensors  
by CNRS UBP-LASMEA, FR



WIRELESS SENSORS NETWORK  
by ISI, Greece



Chemical Weather Forecasting and Information System  
by Hungarian Meteo Service



**HARMONISATION:**  
Definition of protocols and standards for gas sensing measurements and gas sensors

# EuNetAir SOLUTIONS: NANOMATERIALS AND NANOTECHNOLOGIES

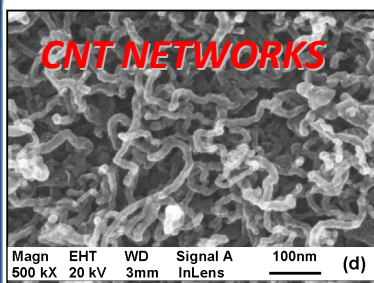
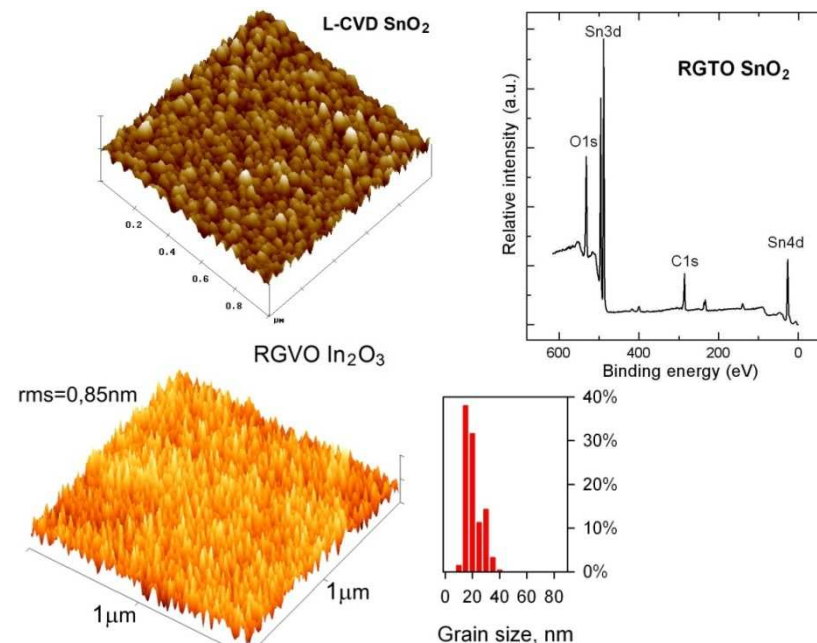
Metal Oxides Nanostructures by University of Brescia, Italy.



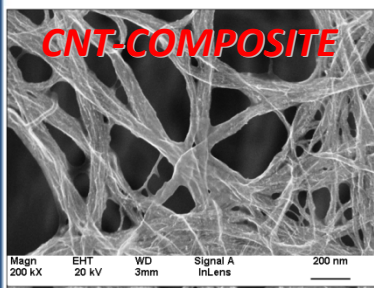
The increasing scientific interest in **1-D systems** (**nanowires, nanobelts, nanorods, nanotubes**) and single-crystalline 1-D nanostructures ( $\text{SnO}_2$ ,  $\text{ZnO}$ ,  $\text{WO}_3$ ,  $\text{In}_2\text{O}_3$ ,  $\text{MoO}_3$ ,  $\text{TiO}_2$ , etc.) are nowadays emerging as building blocks for a new generation of electronic, and optoelectronic **nanometer-scaled devices** with superior performances for gas sensing and energy applications.



**RGTO (RGVO)  $\text{SnO}_2$  and  $\text{In}_2\text{O}_3$  nanolayers** by Silesian University of Technology, Poland



**Carbon nanotubes (CNT) in the form of networks and composite as filler in an organic matrix by ENEA, Italy.**



PROPERTY OF CNTs	VALUE
<b>High surface area</b>	<b>100 - 1800 m<sup>2</sup>/g</b>
Hollow structure	1 - 5 nm diameter
Nanosized morphology	10 - 1000 Aspect ratio
High electron mobility	up to 10000 cm <sup>2</sup> Vs <sup>-1</sup> , at 300K
High structural/chemical reactivity	Bending at high angle (< 40°)
High thermal stability	1800 - 6000 Wm <sup>-1</sup> K <sup>-1</sup> therm. cond.
Electrical Resistivity	1 - 100 kΩ (p-type Semiconductor)

# EuNetAir SOLUTIONS: WIRELESS TECHNOLOGY



Production version of the mote technology from EPSRC MESSAGE.

3 electrochemical gas sensors, temperature, humidity & noise.

IEEE 802.15.4 wireless mesh networking of up to 100 motes (up to 100 m between motes).

Custom network protocols for routing and power management.

Solar rechargeable battery + Lithium D cell backup.

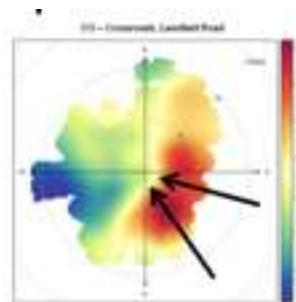
Designed for easy deployment on lighting columns etc.

Low cost, rapid deployment and high spatial resolution.

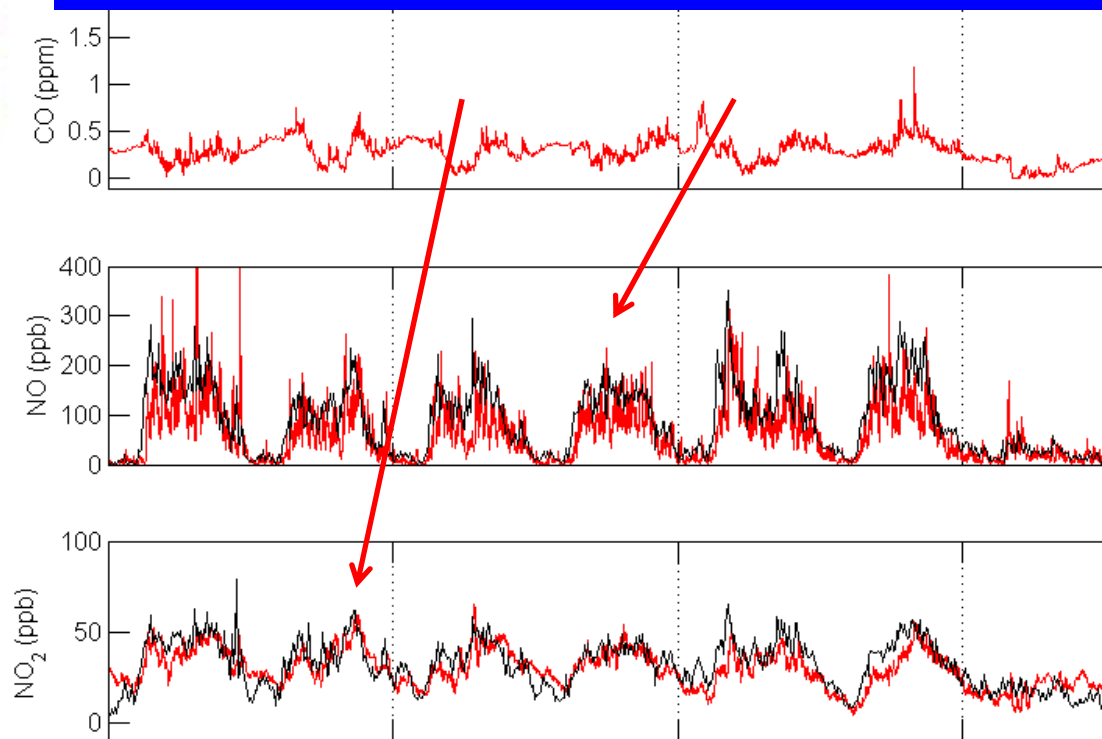
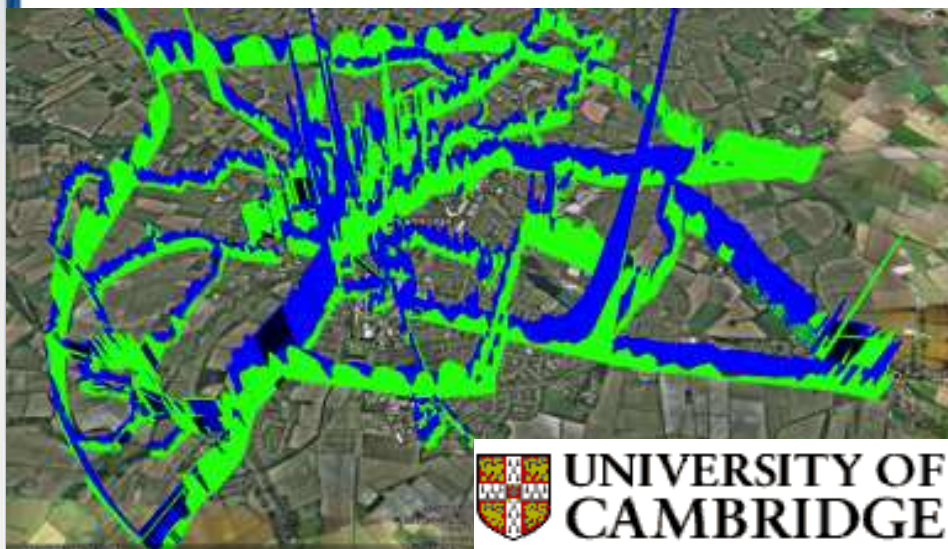
## The Envirowatch mote

Automatically corrects mote electrochemical sensor data for temp and humidity (red) to achieve excellent agreement with precision instruments (black)

High granularity evaluation of air quality (e.g.  $\text{NO}_x$ , below), source attribution (right).

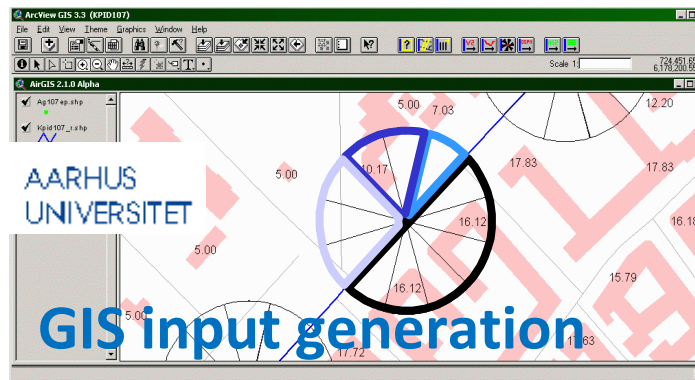
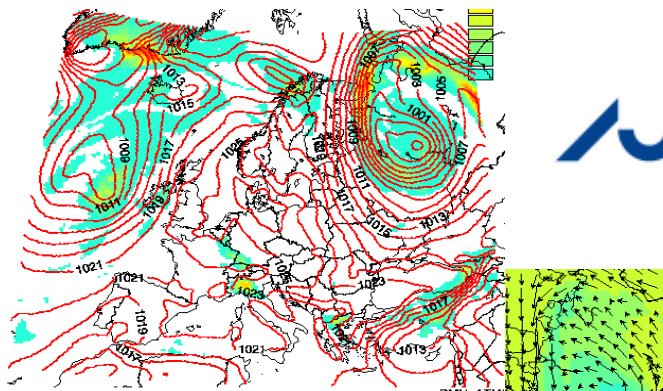


## WIRELESS SENSORS NETWORK for AQC

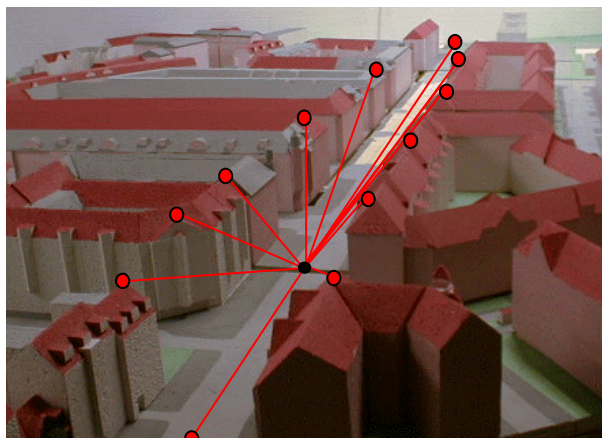


# EuNetAir SOLUTIONS: AIR QUALITY MODELLING

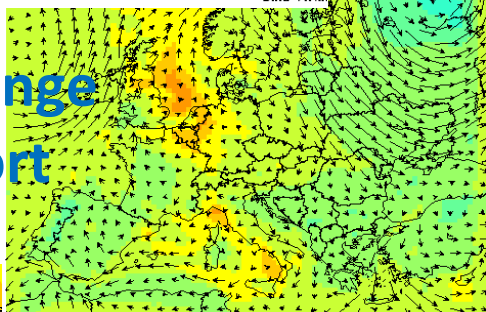
## Chemical weather



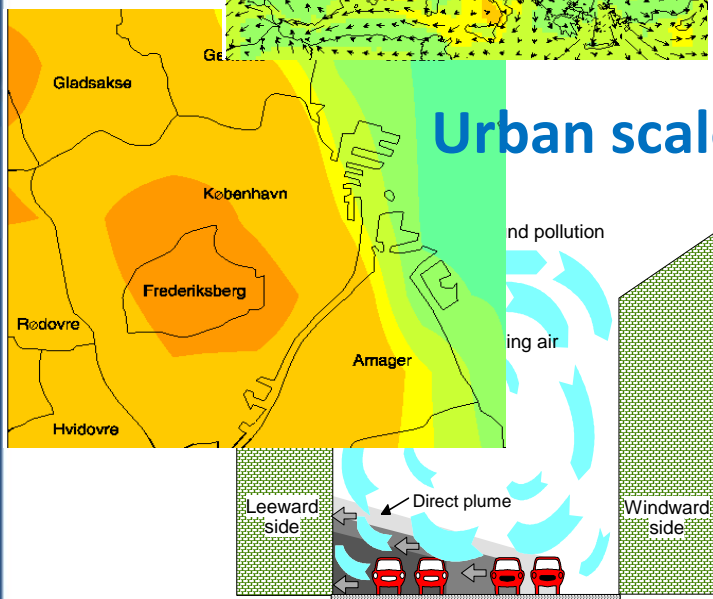
## Mapping addresses



## Long-range transport



## Urban scale

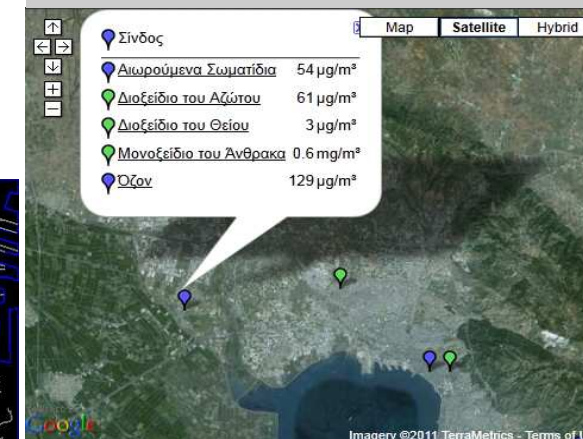


## Street scale



**AirTHESS:** operational AQ management and information system for Thessaloniki, Greece, employing Computational Intelligence for AQ forecasting and mobile phone technology for early warning messages.

*By Aristotle University, Greece.*





# ***COST Action TD1105 EuNetAir:*** **Working Groups (WGs) and Special Interest Groups (SIGs)**



**WG1:**  
**Sensor Materials  
 &  
 Nanotechnologies**

**WG2:**  
**Sensors, Devices  
 & Systems for AQC**

**WG4:**  
**Protocols &  
 Standardisation  
 Methods**

**WG3:**  
**Env. Measurements  
 &  
 Air Pollution Modelling**

**INTERDISCIPLINARY  
 SPECIAL INTEREST GROUPS**

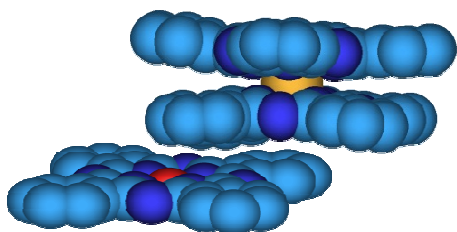
## **MANAGEMENT COMMITTEE:**

### **CORE-GROUP and STEERING COMMITTEE**

- *Editorial Board*
- *Dissemination*
- *Training Schools*
- *Gender Balance*
- *Early Stage Researchers (ESR)*
- *Short-Term Scientific Mission (STSM)*
- *Intellectual Property Rights (IPR)*
- *Local Organizing Committee (LOC)*
- **SIG 1:** *Network of Spin-offs*
- **SIG 2:** *Smart Sensors for Urban Air Monitoring in Cities*
- **SIG 3:** *Guidelines for Best Coupling Air Pollutant-Transducer*
- **SIG 4:** *Expert comments for the Revision of the Air Quality EU Directive*

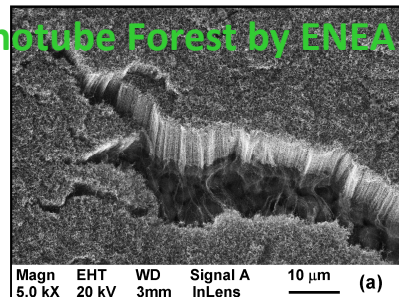
## WG1: Sensor Materials and Nanotechnology

- **Sub-Working Group 1.1:**  
Metal oxides nanostructures for AQC gas sensors.
- **Sub-Working Group 1.2:**  
Carbon nanomaterials for AQC gas sensors.
- **Sub-Working Group 1.3:**  
Emerging sensor materials (organic/inorganic, hybrid, nanocomposites, polymers, functional, etc.).

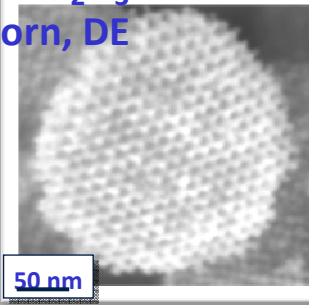


New molecular materials of polymer-macrocycles as transducers for polluting gas sensing by University of Bourgoigne

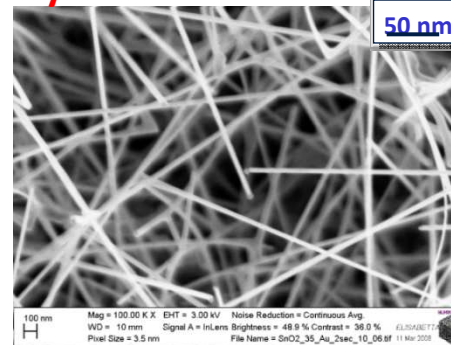
Carbon Nanotube Forest by ENEA



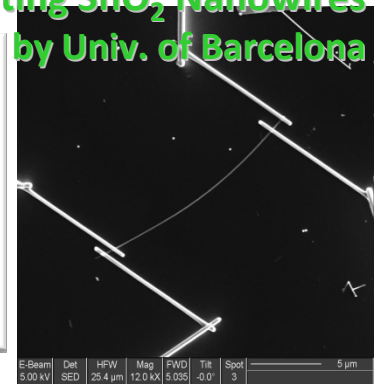
Mesoporous  $\text{In}_2\text{O}_3$  by Univ. of Paderborn, DE



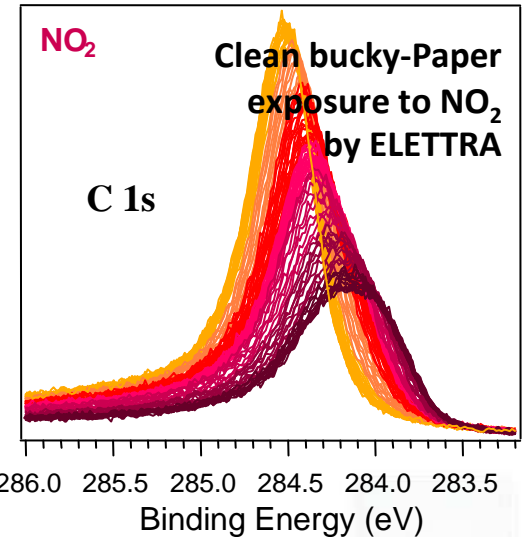
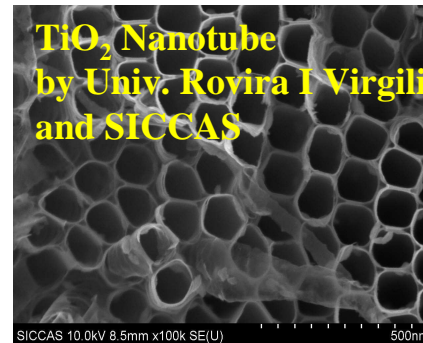
Metal oxide ( $\text{SnO}_2$ ) Nanowires nets by Univ. of Brescia



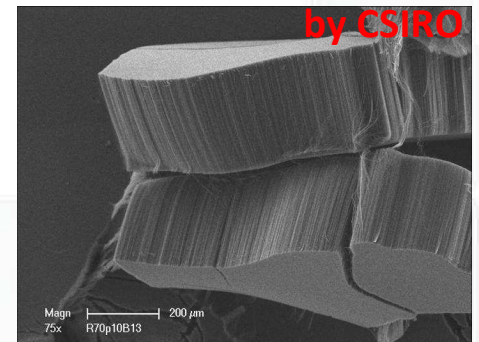
Self-heating  $\text{SnO}_2$  Nanowires by Univ. of Barcelona



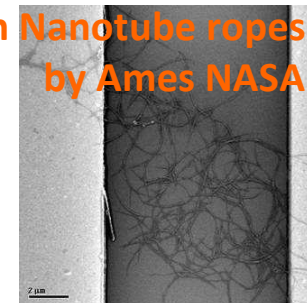
$\text{TiO}_2$  Nanotube by Univ. Rovira I Virgili and SICCAS



Carbon Nanotube yarns by CSIRO



Carbon Nanotube ropes by Ames NASA

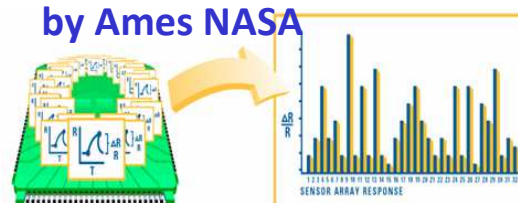


## WG2: Sensors, Devices and Systems for AQC

- **Sub-Working Group 2.1:** Gas sensors and new transducers.
- **Sub-Working Group 2.2:** Portable gas sensor-systems.
- **Sub-Working Group 2.3:** Wireless technology and AQC sensors network.
- **Sub-Working Group 2.4:** Intelligence algorithms and distributed computing for networked AQC gas sensors.



Warwick University in collaboration with Cambridge University, EPFL, PennState.



by Ames NASA  
Using pattern matching algorithms, the data is converted into a unique response pattern

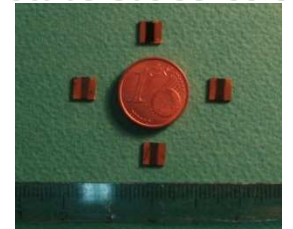
A versatile platform for the efficient development of gas detection systems based on automatic device adaptation by University of Saarland.

Environmental Sensor demo by IMEC, NL

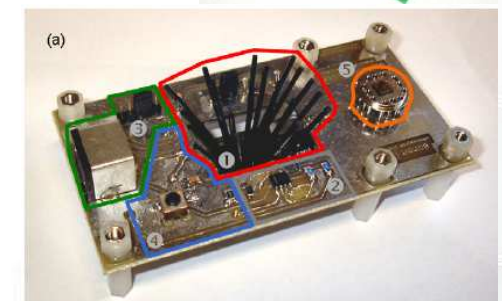
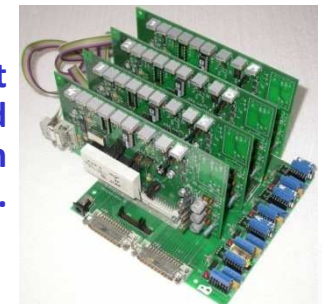


Low-ppb sensitivity for NO<sub>2</sub> GaN-based sensor concept

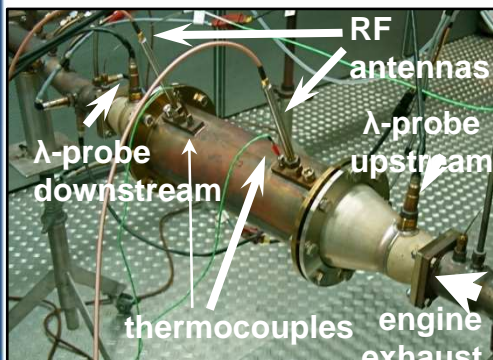
IT PATENT ENEA  
Carbon Nanotube Gas Sensors



EnviroWatch mote by Newcastle University



Autonomous Gas Sensor System by IREC and Univ. of Barcelona



Direct status measurement of automotive catalysts by radio-frequency technique by University of Bayreuth, DE.

## WG3: Environmental Measurements and Air-Pollution Modelling

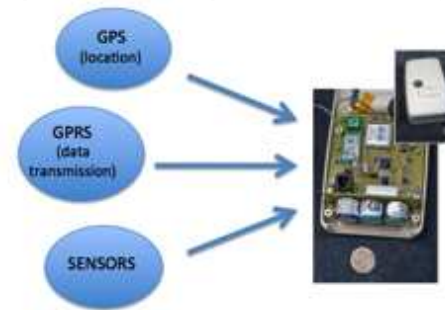
- **Sub-Working Group 3.1:** Environmental measurements at laboratory and in field air-quality stations.
- **Sub-Working Group 3.2:** Air-quality modeling and chemical weather forecasting.
- **Sub-Working Group 3.3:** Harmonisation of environmental measurements

by Aristotle University, EL

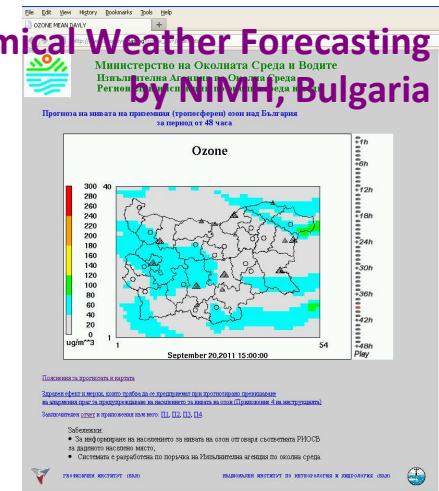


**AirMerge system for Chemical Weather Models**

Mobile and static sensor network configurations by University of Cambridge.



**Chemical Weather Forecasting**  
by NIMH, Bulgaria



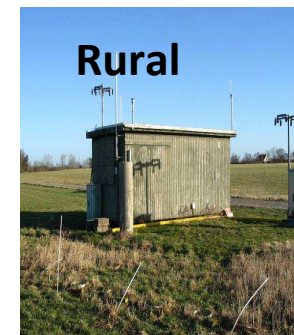
**AQ Modeling: Tracking routes**  
by Aarhus University, DK



**Environmental measurements of PM and air pollution: Protocols and standardisation methods by CSIC, ES**



**AQ monitoring station by ARPA-PUGLIA, IT**



**AQ monitoring station by Aarhus University, DK**

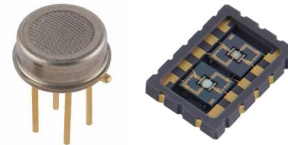


**AQ monitoring station by Lithuanian EPA**

## WG4: Protocols and Standardisation Methods

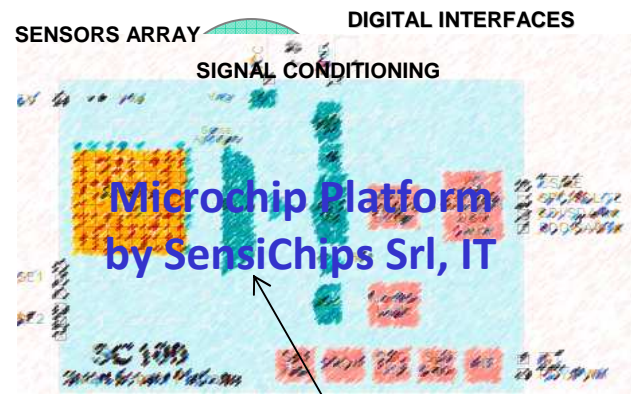
- **Sub-Working Group 4.1:** Protocols, standards and methods for AQC by analyzers/instruments (no-sensors) technologies.
- **Sub-Working Group 4.2:** Protocols, standards and methods for AQC by sensors (no-analyzers) technologies.
- **Sub-Working Group 4.3:** Benchmarking of new products and market of commercial AQC sensors.

European Directive 2008/50/EC: Ambient Air Quality  
EU standard EN 13725/2003: Dynamic Olfactometry  
Protocols and Standardised Methods for Gas Sensors  
Guidelines of Best Transducers applied to specific gases

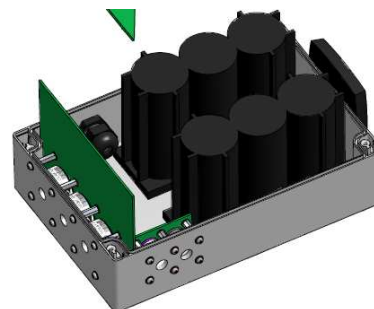


Packaged sensors by E2V, CH

Dynamic olfactometry EN13725 by Univ. of Liege, Odometric SA, Univ. of Bari, Lenviros srl.



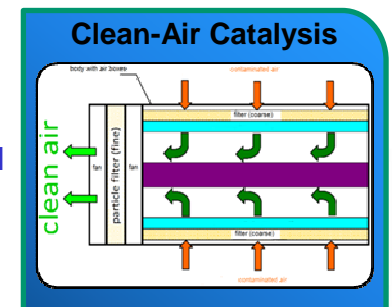
New precision multi-parametric analytical tool



Battery-Powered Sensors by Alphasense Ltd, UK

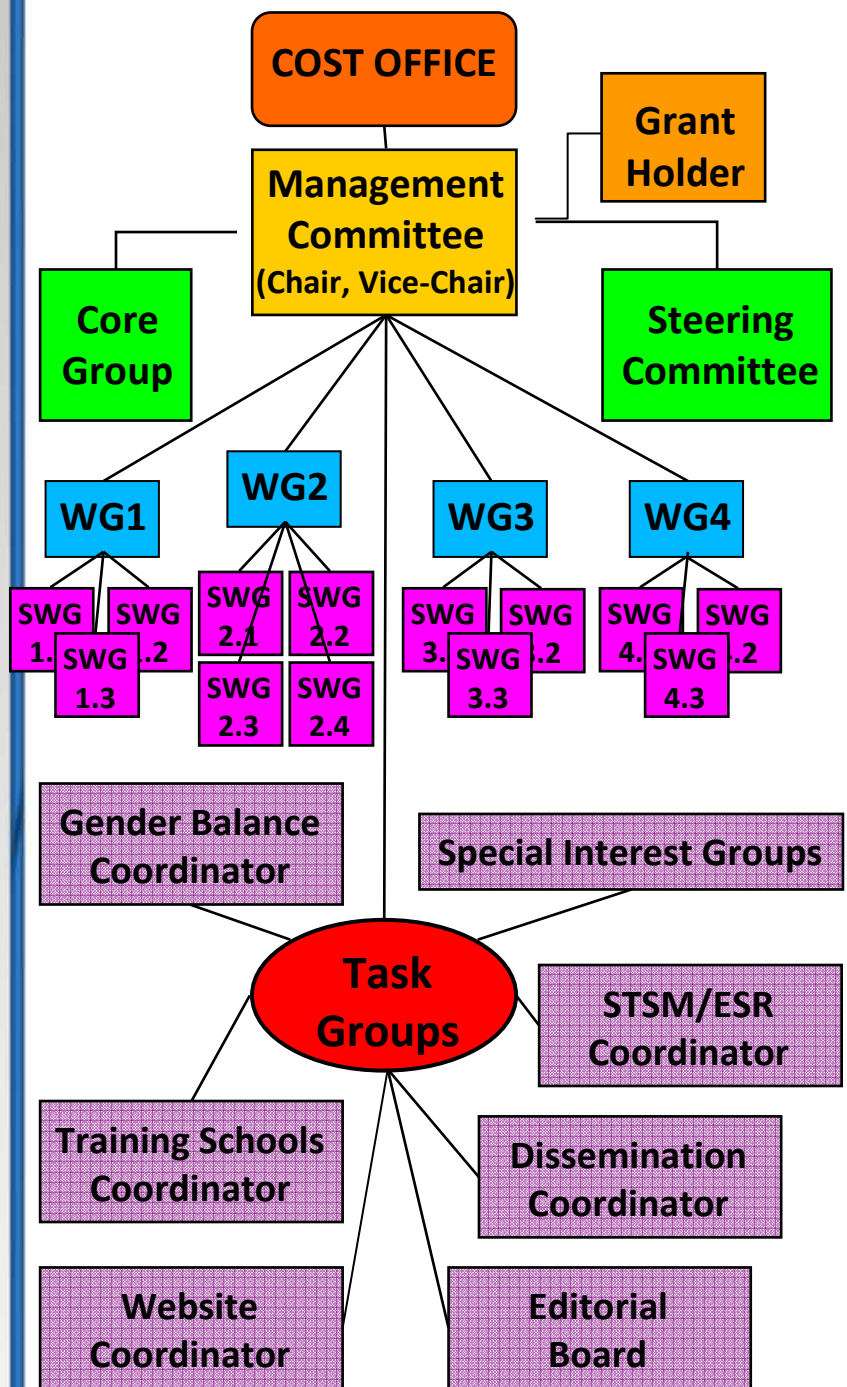


CO<sub>2</sub> IR sensor for alarm System by SenseAir AB, Sweden



Becker Gruppe, DE

# COST Action EuNetAir: COORDINATION AND ORGANIZATION



## MANAGEMENT COMMITTEE

**2 Representatives of participating Countries**

### Steering Committee:

- ✓ Action Monitoring
- ✓ Milestones settings
- ✓ Prepare MC meetings
- ✓ Management of IPR issues

### Core Group:

- ✓ Prepare Documents for MC
- ✓ Prepare MC meetings
- ✓ Executive tasks in Action

- Meet every 6 months
- S&T exchange
- Cooperation
- Researcher mobility (STSM)
- Budget management
- Report to COST Office
- Organize Workshops/Conferences
- Organize Training Schools
- Promote Gender Balance
- Action Results Dissemination
- Evaluation plans

## CORE GROUP

Action Chair  
Action Vice Chair  
Secretary

### WGs Coordinator

- Organize WG meetings
- Coordination
- Monitoring
- Promote joint-activities
- Report to MC and SG

### STSM/ESR Coordinator

- STSM/ESR agenda
- Training agenda

### Gender Coordinator

- Gender agenda
- Care for gender balance

### Dissemination Coordinator

- Dissemination activities
- Action Website
- Local Organizing Committee

### NETWORKING

- Special Interest Groups (SIGs)
- Network of spin-offs
- International Experts
- Keynote Speakers

# ***COST Action EuNetAir: EARLY STAGE RESEARCHERS***



The Action adopts the “***COST Strategy towards increased support for Early Stage Researchers***” - *COST 295/09* giving ESRs support and measures like STSMs, Training Schools, Action Think Thank, Conference Grants, inclusion of ESR as WGs Chair, ESRs as national MC delegates.

## ***In order to increase visibility of ESRs in this COST Action:***

- **ESR Coordinator** will be preferably one of the *ESRs MC-members*
- Nomination of an **ESR as WG Coordinator** will be encouraged
- Workshop participation of ESRs
- Selection of **best independent ideas** from ESRs will be awarded with ***grants for participation in S&T events***
- **Invitation** of high schools and University students to the *training sessions and training schools*
- **Social Scientific Network services** based on free web software to promote cohesion inside ESRs community in order to outline needs and overcome
- Proposals to **European Research Council - Starting Independent Research Grant** from Action ESRs will be encouraged

# ***COST Action EuNetAir: GENDER BALANCE***



At the moment **20% of the participants are female** with the final aim to reach hopefully up to **50% female participation**.

## ***In this COST Action:***

- **Gender Coordinator** will be preferably one of the *female MC-members*
- Female Nomination in Working Groups and Sub-Working Groups, including **WG Coordinator**, will be encouraged
- **Female scientist will be encouraged to top-management**
- **Networks of women in S&T**
- **Career advice of women**
- **Set target numbers and quotas**
- **Awards for women in S&T**
- **Childcare supports (travel with children)**
- **Support for female scientists with family**





# COST Action EuNetAir: DISSEMINATION

## Target Audience

- *Research community*
- *Industry*
- *End-users*
- *Environmental agencies*
- *Policy makers and regional planners*
- *International organizations*
- *Students and Early Stage Researchers*
- *General Public*
- *Local and Government Authorities*

## Methods

- *Website*
- *Electronic communications*
- *Publications*
- *Meetings*
- *International Conferences*
- *Workshops and Side-Events*
- *Industrial Forum and ILOs*
- *Training Schools*
- *Short Term Scientific Missions*
- *Media*

## Publications

- *State-of-the-Art on AQC*
- *Roadmap for future research on AQC technologies*
- *Guidelines for Transduction Methods on AQC*
- *Books and Reviews*
- *Scientific and Technological Joint-Publications*
- *Non-Technical Publications*



## Other Partners interested to COST Action EuNetAir:

- **JRC Ispra**, Institute for Environment and Sustainability, EU
- **ARPA-PUGLIA**, Regional Environmental Protection Agency, IT
- **World Health Organization Europe**,  
by Centre for Air Quality Management and Air Pollution Control, Federal Environmental Agency, Germany.
- **VDI DIN**, Commission on Air Pollution Prevention  
Standard Committee, DE
- **European Environment Agency**, Copenhagen

# COST Action EuNetAir: TIMETABLE



YEAR	Quarter 1	Quarter 2	Quarter 3	Quarter 4
1	<p><b>M:</b> Kick-Off Meeting. <b>MC Meeting 1.</b></p> <p><b>D:</b> MC setup and Action Workplan established</p>	<p><b>M:</b> Editorial Board for Leaflet, Brochure, Newsletter. Action website setup.</p> <p><b>D:</b> Definition of WGs and WGs Workplans</p>	<p><b>M:</b> MC Meeting 2. <b>WGs Meeting 1.</b></p> <p><b>D:</b> Scientific activities, ESR/STSM program, Dissemination</p>	<p><b>M:</b> Workshop 1. <b>Training School 1.</b></p> <p>State-of-Art on AQC.</p> <p><b>D:</b> Evaluation and Activity Report.</p>
2	<p><b>M:</b> MC Meeting 3. <b>WGs Meeting 2.</b> Update Action website.</p> <p><b>D:</b> Scientific activities. Liason with EU Programs</p>	<p><b>M:</b> Editorial Board meeting. ESR/STSM.</p> <p><b>D:</b> Dissemination. Newsletter. Reporting</p>	<p><b>M:</b> MC Meeting 4. <b>WGs Meeting 3.</b> <b>Workshop 2. Training School 2.</b></p> <p><b>D:</b> S&amp;T strategies</p>	<p><b>M:</b> International Conference 1. Edit. Board. ESR/STSM.</p> <p><b>D:</b> Dissemination. Reporting</p>
3	<p><b>M:</b> MC Meeting 5. <b>WGs Meeting 4.</b></p> <p><b>D:</b> Dissemination. Strategies &amp; Activities</p>	<p><b>M:</b> Edit. Board: State-of-art AQC. ESR/STSM</p> <p><b>D:</b> Dissemination. Strategies. Reporting</p>	<p><b>M:</b> MC Meeting 6. <b>WGs Meeting 5.</b> <b>Workshop 3. Training School 3.</b></p> <p><b>D:</b> S&amp;T strategies</p>	<p><b>M:</b> Edit. Board: Newsletter. ESR/STSM</p> <p><b>D:</b> Dissemination. Reporting</p>
4	<p><b>M:</b> . MC Meeting 7. <b>WGs Meeting 6.</b></p> <p><b>D:</b> S&amp;T strategies. Link to EU programs, Industry</p>	<p><b>M:</b> Workshop 4. <b>Training School 4.</b></p> <p><b>D:</b> Dissemination. ESR/STSM. S&amp;T strategic activity.</p>	<p><b>M:</b> WGs Meeting 7.</p> <p><b>D:</b> S&amp;T strategies and activities. ESR/STSM. Dissemination</p>	<p><b>M:</b> International Conference 2. MC Meeting 8.</p> <p><b>D:</b> Final Evaluation. Reporting</p>

**M:** Milestones    **D:** Deliverables

# ROADMAP 2012-2016. Year 1: 1 July 2012 - 30 June 2013



***Start of Action TD1105: Kick-off Meeting on 16 May 2012***

YEAR	MILESTONES	DELIVERABLES
<b>Year 1</b>  <b>from</b>  <b>07/2012</b>  <b>to</b>  <b>06/2013</b>	<b><u>Quarter 1: July 2012 - September 2012</u></b>  Kick-off Meeting. MC setup. Action Workplan established. MC Meeting 1.	<b><u>Quarter 1: July 2012 - September 2012</u></b>  MC setup Action Workplan established.
	<b><u>Quarter 2: October 2012 - December 2012</u></b>  Action website setup. Start-up of Editorial Board for Leaflet, Brochure, Newsletter.	<b><u>Quarter 2: October 2012 - December 2012</u></b>  Definition of WGs and WGs Workplans. <i>Newsletter: Issue 1. Leaflet/Brochure: Release 1.</i>
	<b><u>Quarter 3: January 2013 - March 2013</u></b>  MC Meeting 2. WGs Meeting 1. Scientific activities.	<b><u>Quarter 3: January 2013 - March 2013</u></b>  Publication of the List of EuNetAir Action R&D <i>Infrastructures</i> and main <i>Facilities</i> . Scientific Activities. ESR/STSM Report and Dissemination.
	<b><u>Quarter 4: April 2013 - June 2013</u></b>  Scientific strategies: State-of-art on AQC. Training School organization. Workshop organization.	<b><u>Quarter 4: April 2013 - June 2013</u></b>  Action website fully operational with publication of <i>Curricula</i> of partners. <i>Newsletter: Issue 2.</i> <i>State-of-Art on AQC tech: Release 1.</i> <i>Training School 1. Workshop 1. Annual Report.</i>

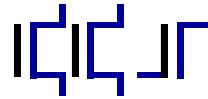


# ***COST Action: EuNetAir PARTICIPANTS***



 BE - Belgium	VITO, Université de Liège, Odometric S.A.
 BG - Bulgaria	National Institute of Meteorology and Hydrology - BAS; Institute of Electronics - BAS
 CH - Switzerland	Ecole Polytechnique Fédérale de Lausanne; e2v Microsensors S.A.; EnvEve S.A.; EMPA
 CZ - Czech Republic	Institute of Computer Science, Academy of Sciences of the Czech Republic
 DE - Germany	Institute of Energy and Environmental Technology – IUTA eV; Saarland University; University of Bayreuth; University of Paderborn; UST GmbH; Alfred Becker GmbH; 3S GmbH
 DK - Denmark	Aarhus University; Technical University of Denmark - DTU
 EL - Greece	Aristotle University; Foundation of Research and Technology; Industrial Systems Institute
 ES - Spain	Catalonia Institute for Energy Research - IREC; Spanish National Research Council - CSIC; University Rovira i Virgili; University of Barcelona, Worldsensing S.L.
 FI - Finland	University of Oulu; University of Helsinki; Tampere University of Technology
 FR - France	University of Bourgogne; University Blaise Pascal
 HU - Hungary	Hungarian Meteorological Service
 IS - Iceland	Agricultural University of Iceland
 IL - Israel	AirBase Systems
 IT - Italy	ENEA; ELETTRA; Univ. of Bari; Univ. of Brescia; Univ. of Trieste; Lenviros srl; Sensichips srl
 LT - Lithuania	Lithuania Environmental Protection Agency
 LV - Latvia	University of Latvia
 NL - Netherlands	IMEC - Holst Centre; ECN
 NO - Norway	NILU - Norwegian Institute for Air Research
 PL - Poland	Silesian University of Technology; Warsaw University of Life Science
 PT - Portugal	University of Coimbra
 RO - Romania	National R&D Institute for Nonferrous and Rare Metals; SC IPA SA - Research & Development
 SE - Sweden	Linkoping University; Chalmers University of Technology; SenSiC AB; SenseAir AB
 SI - Slovenia	University of Ljubljana; Aerosol d.o.o.
 UK - United Kingdom	Imperial College London; Newcastle University; University of Manchester; University of Cambridge; University of Warwick; Cambridge CMOS Sensors Ltd; Alphasense Ltd
 TR - Turkey	GEBZE Institute of Technology

# COST Action EuNetAir PARTICIPANTS



CAMBRIDGE CMOS SENSORS



Landbúnaðarháskóli Íslands  
Agricultural University of Iceland



UNIVERSITY OF HELSINKI



ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

e2v



Materials Science & Technology



FUNCTIONAL MATERIALS



UNIVERSITÄT DES SAARLANDES



UNIVERSITÄT PADERBORN  
Die Universität der Informationsgesellschaft



UMWELT SENSOR TECHNIK



AARHUS UNIVERSITET



Aristotle University Thessaloniki



Industrial Systems Institute



Institut de Recerca en Energia de Catalunya  
Catalonia Institute for Energy Research



CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS



UNIVERSITAT DE BARCELONA



UNIVERSITY of OULU  
OULUN YLIOPISTO



UNIVERSITÀ DEGLI STUDI DI TRIESTE  
Dipartimento di Scienze Chimiche e Farmaceutiche



sensichips

Univerza v Ljubljani



Linköpings universitet

CHALMERS



SenSiC AB  
sensors for a clean environment



Imperial College London



WARWICK




# Non-COST EuNetAir PARTICIPANTS




**University of Waterloo  
Systems Design Engineering**

**National Research Center Kurchatov Institute  
Institute of Applied Chemical Physics**



 CA - Canada

 RU - Russian Federation

 US - United States



 CN - China

**Chinese Academy of Sciences  
Shanghai Institute of Ceramics**




**Southern  
Illinois University  
Carbondale**

**Department of Physics**

 US - United States



**NASA Ames Nano Research Center  
Center for Nanotechnology**

 AU - Australia



**CSIRO**

**Materials Science and Engineering**

# COST Action EuNetAir: List of Experts

(\* Reciprocal Agreement)



**Total of Experts: 101** from **24 COST Countries** and **5 Non-COST Countries**

## BE - Belgium

Prof. Anne-Claude ROMAIN  
Dr. Jan THEUNIS  
Dr. Julien DELVA

## BG - Bulgaria

Dr. Dimiter SYRAKOV  
Dr. Ivan NEDKOV

## CH - Switzerland

Dr. Danick BRIAND  
Dr. Marco BRINI  
Dr. Christine ALEPEE  
Dr. Nicolas MOSER  
Dr. Christoph HUEGLIN

## CZ - Czech Republic

Dr. Vera KURKOVA

## DE - Germany

Dr. Thomas A. J. KUHNBUSCH  
Dr. Ulrich QUASS  
Prof. Andreas SCHUETZE  
Dr. Tilman SAUERWALD  
Prof. Ralf MOOS  
Dr. Daniela SCHONAUER-KAMIN  
Dr. Thorsten WAGNER  
Dr. Olaf KIESEWETTER  
Dr. Thorsten CONRAD  
Dr. Thomas BECKER

## DK - Denmark

Prof. Ole HERTEL  
Dr. Lise Lotte SORENSEN  
Prof. Anja BOISEN  
Dr. Silvan SCHMID

## EL - Greece

Prof. Kostas KARATZAS  
Prof. George KIRIAKIDIS  
Dr. Christos KOULAMAS  
Prof. George PAPAPOPOULOS

## ES - Spain

Prof. Juan Ramon MORANTE  
Dr. Francisco HERNANDEZ  
Dr. Xavier QUEROL  
Dr. Mar VIANA  
Prof. Eduard LLOBET  
Dr. Radu IONESCU  
Prof. Albert ROMANO  
Dr. Juan Daniel PRADES  
Dr. Jordi LLOSA

## FI - Finland

Prof. Heli JANTUNEN  
Prof. Jyrki LAPPALAINEN  
Dr. Jari JUUTI  
Prof. Kaarle HAMERI  
Prof. Jorma KESKINEN

## FR - France

Prof. Marcel BOUVET  
Prof. Jerome BRUNET  
Prof. Alain PAULY  
Dr. Jean SUISSE  
Dr. Amadou NDYAE

## HU - Hungary

Dr. Zita FERENCZI  
Dr. Krisztina LABANCZ

## IS - Iceland

Dr. Arngrimur THORLACIUS

## IL - Israel

Dr. Liad ORTAR

## IT - Italy

Dr. Michele PENZA  
Dr. Marco ALVISI  
Dr. Saverio DE VITO  
Dr. Andrea GOLDONI  
Dr. Livia TRIZIO  
Dr. Annamaria DEMARINIS  
Dr. Gianluigi DE GENNARO  
Dr. Luigi BARBIERI  
Dr. Roberto SIMMARANO  
Prof. Giorgio SBERVEGLIERI

## LV - Latvia

Prof. Iveta STEINBERGA

## NL - Netherlands

Dr. Sywert BRONGERSMA  
Dr. Ernie WEIJERS

## PL - Poland

Dr. Monika KWOKA  
Prof. Stanislaw GAWRONSKI  
Prof. Jacek SZUBER

## PT - Portugal

Prof. Bernadete RIBEIRO

## SE - Sweden

Prof. Anita LLOYD SPETZ  
Dr. Marina VOINOVA  
Dr. Mike ANDERSSON  
Dr. Ruth PEARCE  
Dr. Ulf THOLE  
Prof. Ingrid BRYNTSE

## SI - Slovenia

Prof. Rahela ZABKAR  
Dr. Grisa MOCNIK  
Prof. Andrej DOBNIKAR

## UK - United Kingdom

Prof. Julian GARDNER  
Prof. Roderic JONES  
Prof. Krishna PERSAUD  
Prof. John POLAK  
Dr. Robin NORTH  
Dr. Jeff NEASHAM  
Dr. Fabio GALATIOTO  
Prof. Florin UDREA  
Dr. John SAFFELL

## NO - Norway

Dr. Nuria Castell-BALAGUER  
Dr. Philippe SCHNEIDER

## RO - Romania

Dr. Roxana Mioara PITICESCU  
Dr. Marcel IONICA  
Dr. Cristina RUSTI  
Dr. Radu Adrian IONICA

## TR - Turkey

Prof. Zafer Ziya OZTURK

## AU - Australia

\* Dr. Phil MARTIN

## CA - Canada

Prof. John YEOW

## CN - China

Dr. Yongxiang LI  
Dr. Zhifu LIU

## RU - Russian Federation

Dr. Alexey VASILIEV

## US - United States

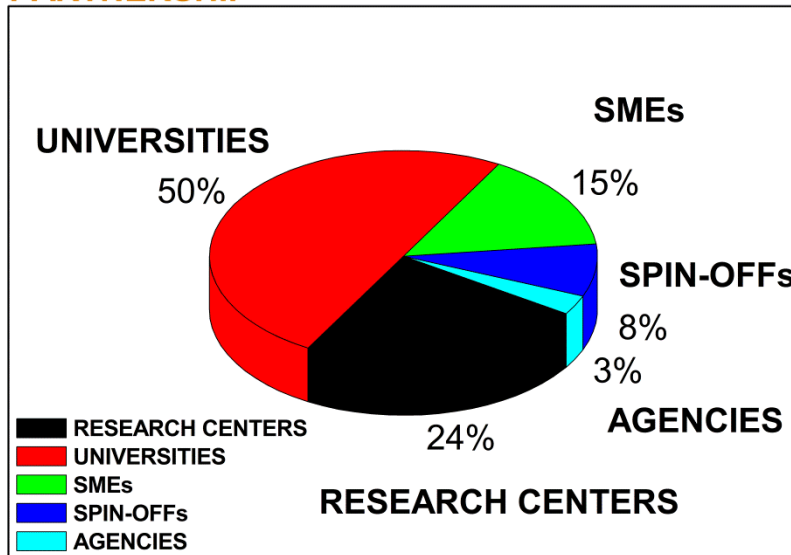
Prof. Andrei KOLMAKOV  
Dr. Meyya MEYYPAN



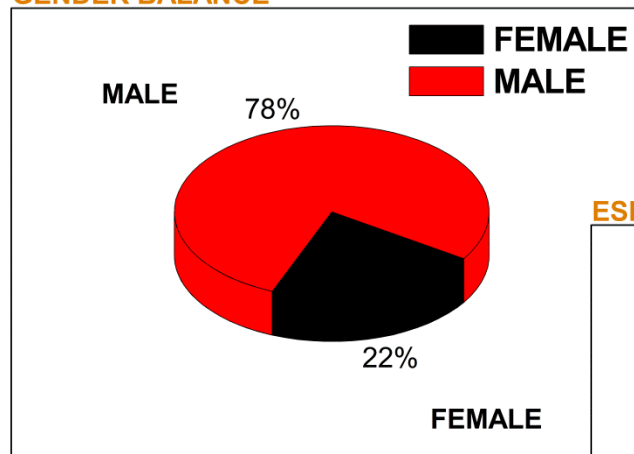
# COST Action EuNetAir: STATISTICS



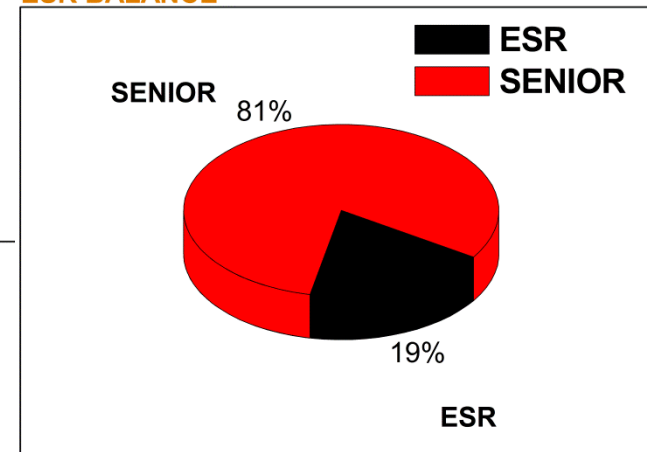
## PARTNERSHIP



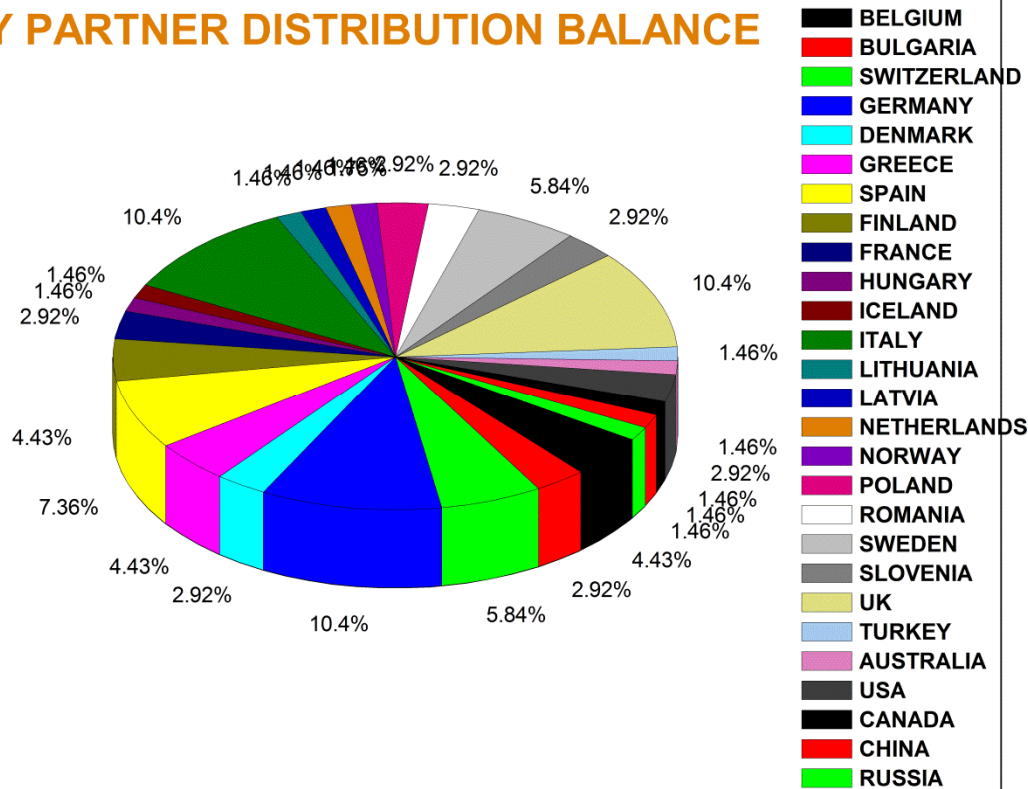
## GENDER BALANCE



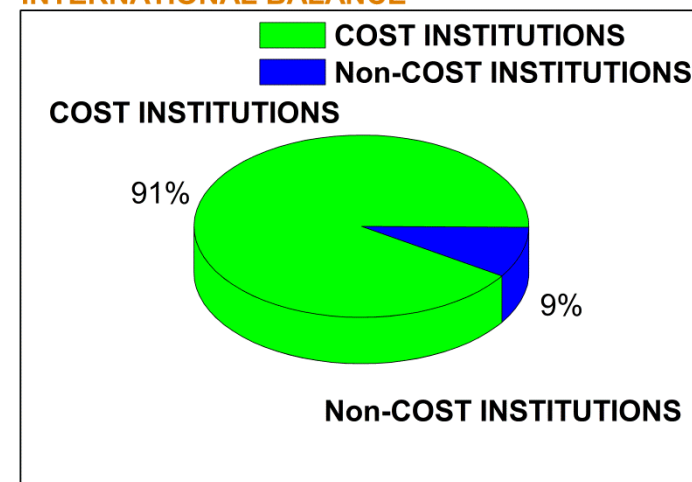
## ESR BALANCE



## COUNTRY PARTNER DISTRIBUTION BALANCE



## INTERNATIONAL BALANCE



# ACTION TD1105 EuNetAir MANAGEMENT COMMITTEE



## COST Countries that signed MoU: 24 (Sept. 2012)

<u>Country</u>	<u>MC Members (42): Male (71%) - Female (29%)</u>
Belgium	Dr Jan THEUNIS; Dr Anne-Claude ROMAIN
Bulgaria	Dr Dimiter SYRAKOV; Dr Ivan NEDKOV
Czech Republic	Dr. Vera KURKOVA
Denmark	Prof. Ole HERTEL
Finland	Prof. Kaarle HAMERI; Prof. Jyrki LAPPALAINEN
France	Prof. Marcel BOUVET; Prof. Jerome BRUNET
Germany	Prof. Andreas SCHUETZE; Dr Thorsten CONRAD
Greece	Prof. George PAPADOPOULOS; Prof. Kostas KARATZAS
Hungary	Ms Krisztina LABANCZ; Dr Zita FERENCZI
Iceland	Dr Arngrimur THORLACIUS
Israel	Dr. Liad ORTAR
Italy	Dr Michele PENZA; Prof. G. SBERVEGLIERI; Dr. G. DE GENNARO
Latvia	Dr Iveta STEINBERGA
Netherlands	Dr Sywert BRONGERSMA; Dr. Ernie WEIJERS
Norway	Dr Nuria CASTELL BALAGUER; Dr. Philipp SCHENEIDER
Poland	Dr Monika KWOKA; Prof. Janislaw GAWRONSKI
Portugal	Prof. Bernadete RIBEIRO
Romania	Dr Marcel IONICA; Dr Roxana Mioara PITICESCU
Slovenia	Dr Grisa MOCNIK; Dr Rahela ZABKAR
Spain	Prof. Juan Ramon MORANTE; Prof. Eduard LLOBET VALERO
Sweden	Prof. Anita LLOYD SPETZ; Prof. Ingrid BRYNTSE
Switzerland	Dr Danick BRIAND; Dr. Nicolas MOSER
United Kingdom	Dr John SAFFELL; Prof. Roderic JONES
Turkey	Prof. Zafer ZIYA OZTURK

**MC Chair:** Michele Penza, ENEC, IT

**MC Vice Chair:** Anita Lloyd Spetz, Linkoping University, SE

**Grant Holder:** University of Bari, IT

*Kick-off Meeting on 16 May 2012 at Brussels*

<u>Country</u>	<u>MC Substitutes (23)</u>
Belgium	Dr Julien DELVA
Denmark	Dr. Lise Lotte SORENSEN
Finland	Prof. Jorma KESKINEN
France	Dr Jean SUISSE Prof. Alain PAULY
Germany	Dr. Daniela SCHONAUER-KAMIN Dr. Thomas KUHMBUSCH
Greece	Prof. George KIRIKIADIS Dr. Roberto SIMMARANO
Italy	Dr. Marco ALVISI Dr. Saverio DE VITO
Poland	Prof. Jacek SZUBER
Romania	Dr. Cristina RUSTI Dr. Marcel Adrian IONICA
Slovenia	Prof. Andrej DOBNIKAR
Spain	Prof. Albert ROMANO-RODRIGUEZ Dr. Jordi LLOSA
Sweden	Dr Ulf THOLE Dr. Marina VOINOVA
Switzerland	Dr Christoph HUEGLIN Prof. Julian GARDNER
UK	Dr Robin NORTH Prof. Florin UDREA

# ELIGIBLE PARTICIPANTS



- **MANAGEMENT COMMITTEE MEMBERS**

*Each Country participating in an Action can nominate up to 2 MC Members (**in addition to the MC Chair**) and up to 2 MC Substitutes (Deputies). Members are nominated by COST National Coordinator (CNC).*

*In Italy, CNC is MIUR - Ministry of Education, University and Research.*

- **WORKING GROUP (WG) MEMBERS and NEW PARTICIPANTS (Rules)**

*The Working Groups usually consist of a small number of researchers selected by the MC or by a procedure decided by the MC.*

*WG members may be MC members or **other researchers from a participating Country** contributing to the achievement of the objectives of the Action, under balance of COST Countries, that have signed MoU.*

*As a general rule, **2 Experts per participating Country** could be included in a **Working Group**. **More flexibility** could be explored to enlarge partnership in a WG coming from the same COST Country, that signed Memorandum of Understanding (MoU).*

- **KICK-OFF MEETING of COST Action TD1105 at Brussels on 16 May 2012.**

**Visit Link of COST Action TD1105 EuNetAir:**

**[http://www.cost.eu/domains\\_actions/essem/Actions/TD1105?](http://www.cost.eu/domains_actions/essem/Actions/TD1105?)**

# COST ACTION TD1105 MANAGEMENT COMMITTEE

**KICK-OFF MEETING of COST Action TD1105 at Brussels on 16 May 2012.**



# ACTION DISSEMINATION EVENT: IMCS 2012, Nuremberg



IMCS 2012

The 14<sup>th</sup> International Meeting on Chemical Sensors  
May 20 - 23, 2012, Nürnberg/Nuremberg



Special Session: **Chemical Sensors and New Technologies for Air-Pollution Control**

*COST Action TD1105 EuNetAir*

*European Network on New Sensing Technologies for Air-Pollution Control  
and Environmental Sustainability*

**IMCS 2012** - The 14<sup>th</sup> International Meeting on Chemical Sensors  
May 20-23, 2012 - Nuremberg, Germany



**Tuesday 22 May 2012**

**10.30 - 12.30**

## **SPECIAL SESSION PROGRAM**

Session Chair(s): Prof. G. Sberveglieri and Dr. Michele Penza

### **PART I: Sensor Materials and Techniques**

Speaker 1: Dr. Michele Penza, ENEA, IT - Action Coordinator

Speaker 2: Prof. Juan Ramon Morante, IREC, ES

Speaker 3: Prof. Eduard Llobet, University Roviri I Virgili, ES

Speaker 4: Dr. Daniela Schonauer-Kamin, University of Bayreuth, DE

Speaker 5: Dr. Andrea Ponzoni, SENSOR Lab. CNR-IDASC, Brescia, IT

Speaker 6: Dr. Danick Briand, EPFL, CH

**Wednesday 23 May 2012**

**10.30 - 12.30**

## **SPECIAL SESSION PROGRAM**

Session Chair(s): Prof. G. Sberveglieri and Dr. Michele Penza

### **PART II: Sensor-Systems, Technologies and Applications**

Speaker 7: Prof. Andreas Schütze, Saarland University, DE

Speaker 8: Prof. Anita Lloyd Spetz, Linköping University, SE

Speaker 9: Dr. Sywert Brongersma, IMEC-Holst Centre, NL

Speaker 10: Prof. Rod Jones, University of Cambridge, UK

Speaker 11: Dr. Saverio De Vito, ENEA, IT

Speaker 12: Prof. Julian W. Gardner, University of Warwick, UK

# ACTION DISSEMINATION EVENT: SGS 2012, Cracow (PL)



## SPECIAL SESSION PROGRAM

Session Chair(s): Prof. Eduard Llobet (MC Member) and Dr. Michele Penza (Action Chair)

## Nanostructures & Sensing Technologies for Environmental Gas Sensors

Half-a-Day Session at one day during Conference on 11-15 September 2012

Friday 14 September 2012

**Talk 1:** 30 minutes (14.00 - 14.30)

Tentative Title: *Overview of COST Action TD1105 EuNetAir*

Speaker: Dr. Michele Penza, ENEA, IT - [michele.penza@enea.it](mailto:michele.penza@enea.it)



SGS 2012  
VIII International Workshop on  
Semiconductor Gas Sensors  
September 11 - 15, 2012, Cracow, Poland

**Talk 2:** 30 minutes (14.30 - 15.00)

Tentative Title: *Nanowires for low power consumption gas sensors*

Speaker: Dr. J. Daniel Prades, University of Barcelona, ES - [dprades@el.uv.es](mailto:dprades@el.uv.es)

**Talk 3:** 30 minutes (15.00 - 15.30)

Tentative Title: *Carbon nanotubes-based gas sensors for pollutants: Elaboration methods for NO<sub>2</sub> and BT detection*

Speaker: Dr. Amadou L. Ndiaye, LASMEA, Aubiere, France - [amalat2005@yahoo.fr](mailto:amalat2005@yahoo.fr)

**Talk 4:** 30 minutes (15.30 - 16.00)

Tentative Title: *TiO<sub>2</sub> Nanotubes Based Heterostructures For Gas Sensing Applications*

Speaker: Prof. Zafer Ziya Ozturk, GEBZE Institute of Technology, Kocaeli, Turkey - [zozturk@gyte.edu.tr](mailto:zozturk@gyte.edu.tr)

**Talk 5:** 30 minutes (16.00 - 16.30)

Tentative Title: *Array of Polycyclic Aromatic Hydrocarbons and Carbon Nanotubes for Accurate and Predictive Detection of Volatile Organic Compounds under Real-World Environmental Humidity Conditions*

Speaker: Dr. Radu Ionescu, TECHNION, Haifa, Israel; and University Roviri I Virgili, Tarragona, Spain - [radu.ionescu@urv.cat](mailto:radu.ionescu@urv.cat)

**Talk 6:** 30 minutes (16.30 - 17.00)

Tentative Title: *Tailoring of WO<sub>3</sub> and V<sub>2</sub>O<sub>5</sub> Nanostructures for Gas Sensing Applications*

Speaker: Jyrki Lappalainen, Microelectronics and Materials Physics Laboratories, University of Oulu, Finland - [jyrki.lappalainen@oulu.fi](mailto:jyrki.lappalainen@oulu.fi)



# ACTION DISSEMINATION EVENT: ISQL 2012, Halkidiki (EL)



3<sup>th</sup> Intelligent Systems for Quality of Life information Services Workshop (ISQL 2012)  
8<sup>th</sup> AIAI Conference, September 27- 30, 2012, Halkidiki, Greece

## TUTORIAL SESSION PROGRAM

Tutorial Chair(s): Dr. Michele Penza (Action Chair) and Prof. Kostas Karatzas (MC Member)

### **Environmental Sensors for Air Quality Control Applications**

**Two-hour Session on 29 September 2012 (Tentatively)**

30 minutes (10.00 - 10.30)

Tentative Title: *Overview of COST Action TD1105 EuNetAir*

Speaker: Dr. Michele Penza, ENEA, IT - [michele.penza@enea.it](mailto:michele.penza@enea.it) (Chair Delegate or MC Member)

**CONFIRMED**

30 minutes (10.30 - 11.00)

Tentative Title: *New approaches in outdoor air quality monitoring: mobile sensing, participatory sensing and sensor networks*

Speaker: Dr. Jan Theunis, VITO, BE - [jan.theunis@vito.be](mailto:jan.theunis@vito.be)

**CONFIRMED**

30 minutes (11.00 - 11.30)

Tentative Title: *Applications of sensors for urban air quality monitoring*

Speaker: Dr. Christoph Hueglin, EMPA, CH - [christoph.hueglin@empa.ch](mailto:christoph.hueglin@empa.ch)

**CONFIRMED**

30 minutes (11.30 - 12.00)

Tentative Title: *Standards for AQC Sensors, creating a more Healthy Environment*

Speaker: Prof. Ingrid Bryntse, SenseAir AB, SE - [ingrid.bryntse@senseair.com](mailto:ingrid.bryntse@senseair.com)

**CONFIRMED**



# ACTION DISSEMINATION EVENT: TCM 2012, Crete (EL)



## SPECIAL SESSION PROGRAM

Open Satellite Workshop Chair(s): Prof. Giorgio Sberveglieri (MC Member), Prof. Juan Ramon Morante (MC Member) and Dr. Michele Penza (Action Chair)

### Materials, Nanostructures and Technologies for Environmental Sensors

Two-and-half-hour Session on 21 October 2012 (Sunday) - Tentatively

**Talk 1:** 30 minutes (14.00 - 14.30)

Title: *Overview of COST Action TD1105 EuNetAir*

Speaker: Dr. Michele Penza, ENEA, IT - [michele.penza@enea.it](mailto:michele.penza@enea.it) (c

**CONFIRMED**



TCM 2012  
The 4<sup>th</sup> International Symposium on Transparent  
Conductive Materials  
October 21- 26, 2012, Hersonissos, Crete, Greece

**Talk 2:** 30 minutes (14.30 - 15.00)

Title: *Carbon nanotubes as chemical sensors: true and false stories*

Speaker: Dr. Andrea Goldoni, ELETTRA, Trieste, IT - [goldonia@elettra.trieste.it](mailto:goldonia@elettra.trieste.it)

**CONFIRMED**

**Talk 3:** 30 minutes (15.00 - 15.30)

Title: *Localized growth and in situ integration of metal-oxide nanowires for gas-sensing applications*

Speaker: Prof. Albert Romano-Rodriguez, University of Barcelona, ES - [aromano@el.ub.es](mailto:aromano@el.ub.es)

**CONFIRMED**

**Talk 4:** 30 minutes (15.30 - 16.00)

Title: *Materials advances for ppb gas detection*

Speaker: Dr. John Saffell, Alphasense Ltd, Essex, UK - [jrs@alphasense.com](mailto:jrs@alphasense.com)

**CONFIRMED**

**Talk 5:** 20 minutes (16.00 - 16.30)

Title: *High pressure chemical processes for the development of new nanostructured complex systems*

Speaker: Dr. Roxana Mioara Piticescu, IMNR, Pantelimon, RO - [roxana@imnr.ro](mailto:roxana@imnr.ro)

**CONFIRMED**



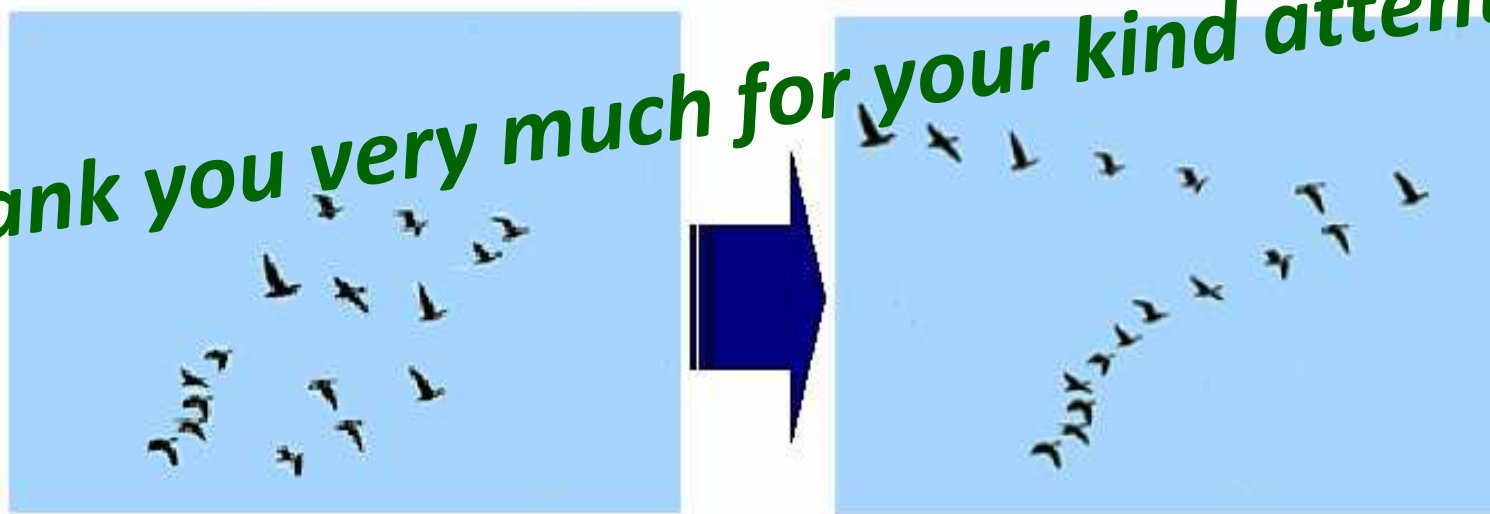


# FINAL CONSIDERATIONS

**NETWORKING of INTERNATIONAL EXPERTS in a Multidisciplinary Framework of COORDINATED ACTION on AQC RESEARCH with special focus on SMEs for Exploitation of Results to support Green-Economy and Sustainable Development for growth in Europe.**

**SPIRIT of COST Action EuNetAir .....**

**Thank you very much for your kind attention !**



**COORDINATED EFFORTS ENHANCE  
SYSTEM EFFICIENCY !**

