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

COST Action TD1105

1ST TRAINING SCHOOL

Universitat de Barcelona, Spain, 13 - 15 June 2013

organized by UB, MIND-IN2UB - Dept. of Electronics and CSIC-IDAEA

Action Start date: 01/07/2012 - Action End date: 30/06/2016

Year 1: 2012 - 2013 (*Ongoing Action*)

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ENEA UTTP-MDB / ITALY

COST is supported by the EU Framework Programme

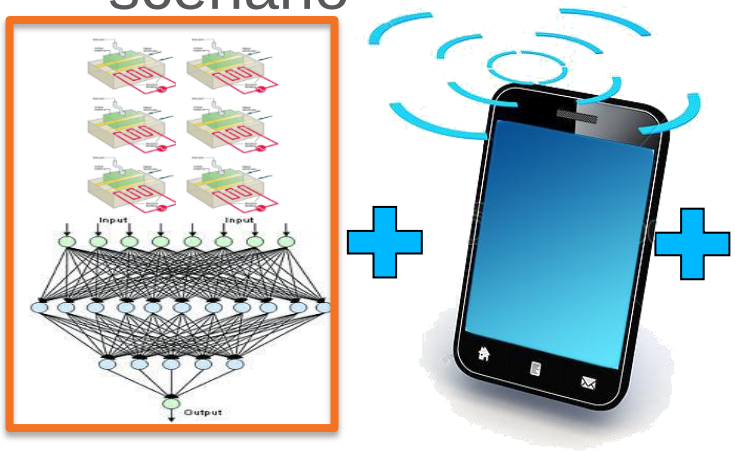
ESF provides the COST Office through a European Commission contract

Expertise

- **Chemical Sensing**
  - Development and characterization of multi-sensor devices
  - Design and realization of Electronic Noses
  - Multivariate data Analysis for identification and quantification of chemical compounds
- **Intelligent sensing & Wireless Networks**
  - Distributed air quality monitoring
  - On Board Computational intelligence for situational awareness
- **Aerospace industry: safety and quality**
  - Cleanliness surface monitoring with Artificial Olfaction tools

Current research activities

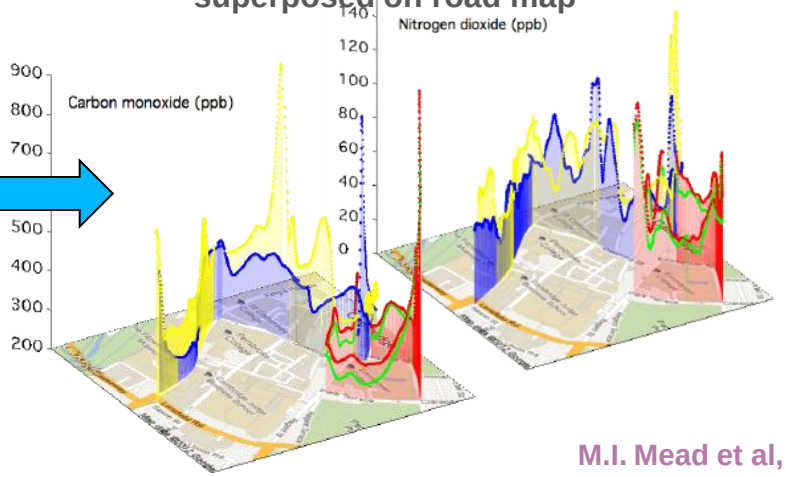
- Intelligent distributed monitoring of air quality in city air pollution scenario



Mobile Air Quality Station

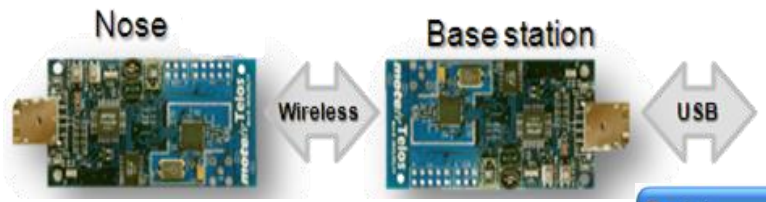
Spatial and Temporal monitoring

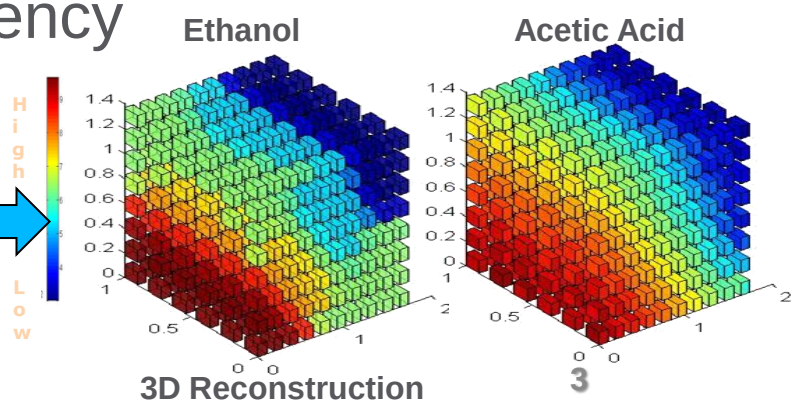
Three-dimensional plots od Co and NO_2 superposed on road map



M.I. Mead et al, *Atmospheric Environment*, Vol. 70, May 2013

- Distributed networks of small multi-sensors nodes for indoor 3D Air Quality assessment and for Energy Efficiency





3D Reconstruction

Current research activities

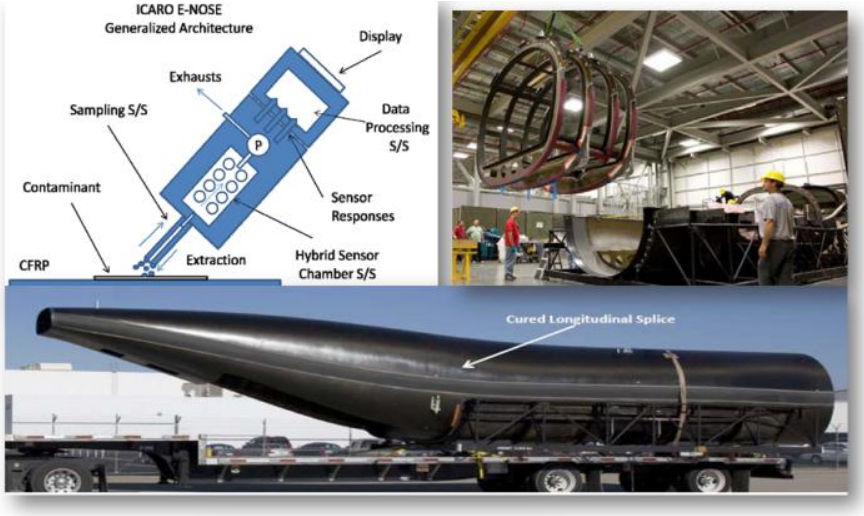
ICARO

SEVENTH FRAMEWORK PROGRAMME

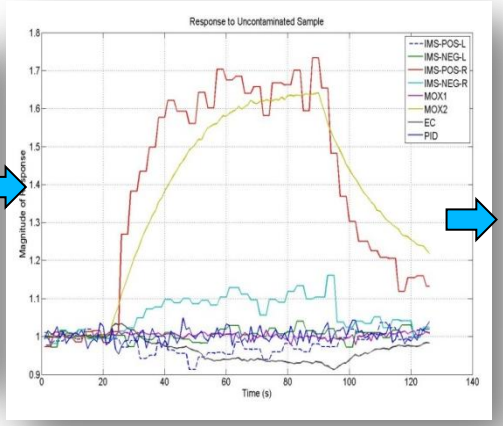
ENCOMB

During the FP7-ENCOMB project, ENEA participate in a EU partnership together with Airbus, Fraunhofer Institute and 14 outstanding research and industrial bodies to investigate the development of electronic noses for CFRP adhesive bonds quality assessment. Primary impacts are expected in the extension of rivetless assembly and composite usage in aircraft primary structures with consequently reduction of fuel usage and co2 emissions.

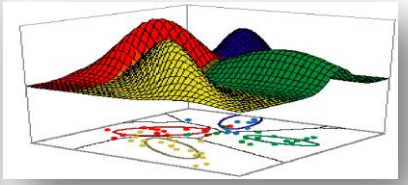
- Suitability of Artificial Olfaction technology as a potential adhesive bond quality assurance tool.
- Investigation, design and development of e-nose specifically designed for surface contamination detection

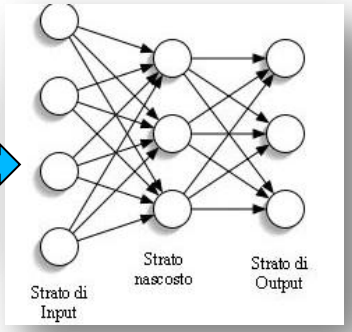


Hybrid sensor array



Sensor Responses





Pattern recognition system

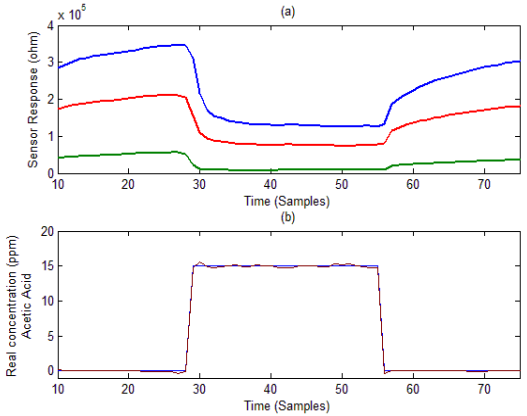
Results

Classification and Concentration estimation of contaminants

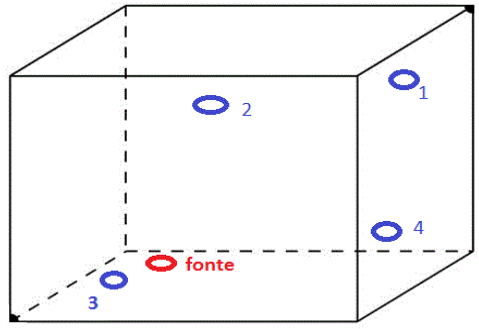
cost
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

RESULTS

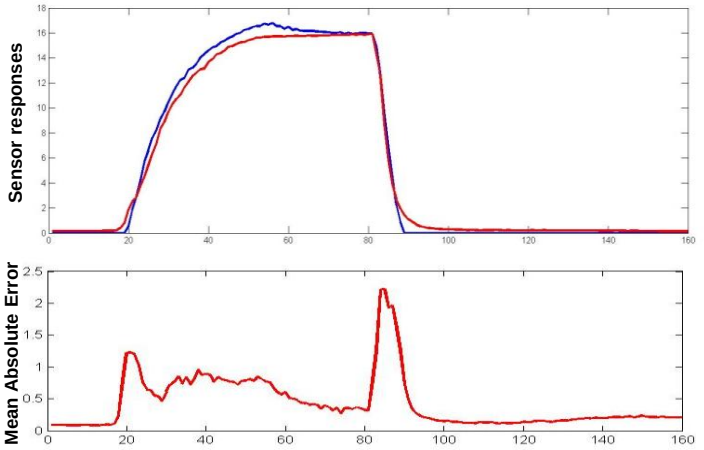
- **Wireless Monitoring System**



Each w-nose was calibrated (in lab) towards the target analytes. An ANN component was embedded on board.

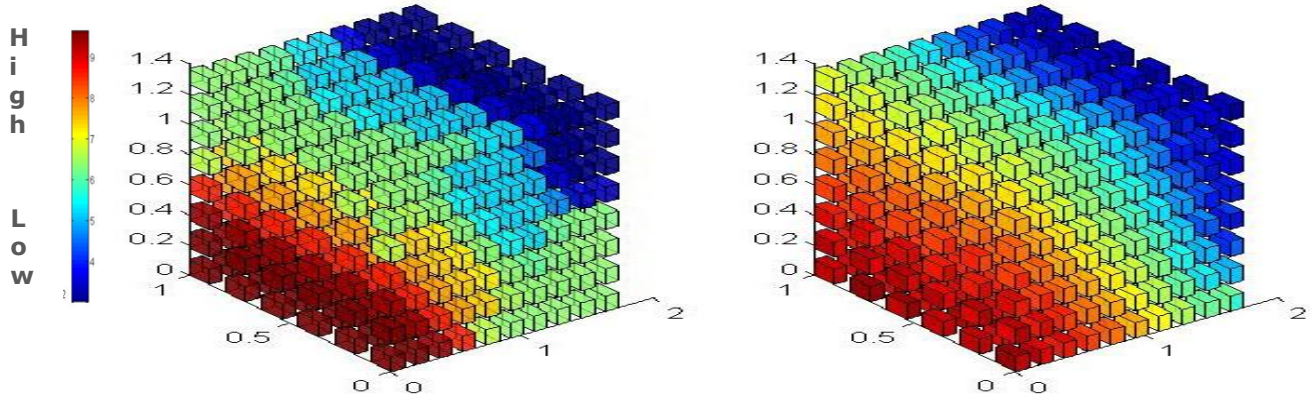


W-noses were deployed in a glass box simulating a 3D ambient. A VOC mixture is let evaporate within the box.



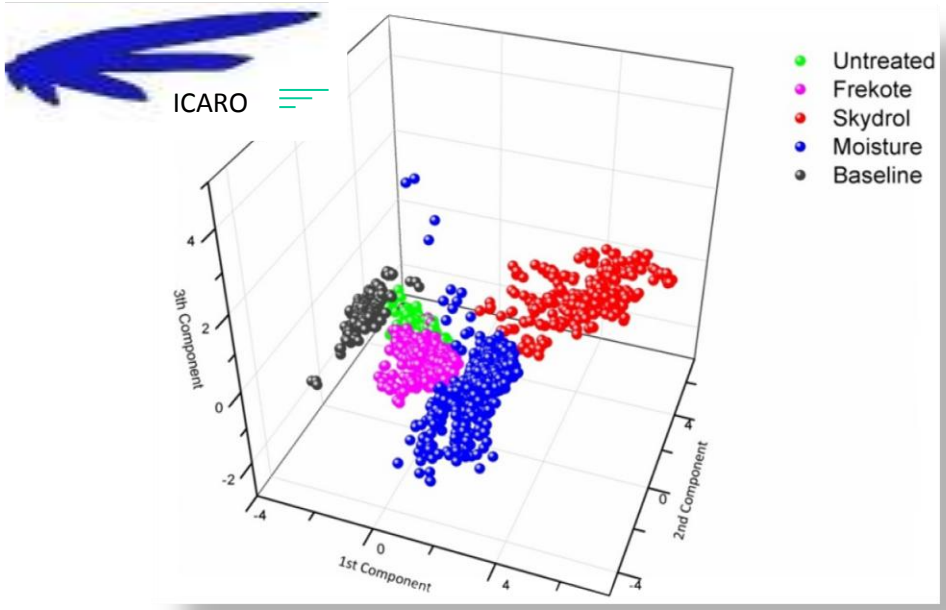
Sensors cross calibrate their Kernel parameters (simulated @ datasink)

Istantaneous 3D Ethanol (right) and Acetic Acid (left) concentration images (computed @datasink) using a 4 w-nose deployment in the glass box experimental setup.



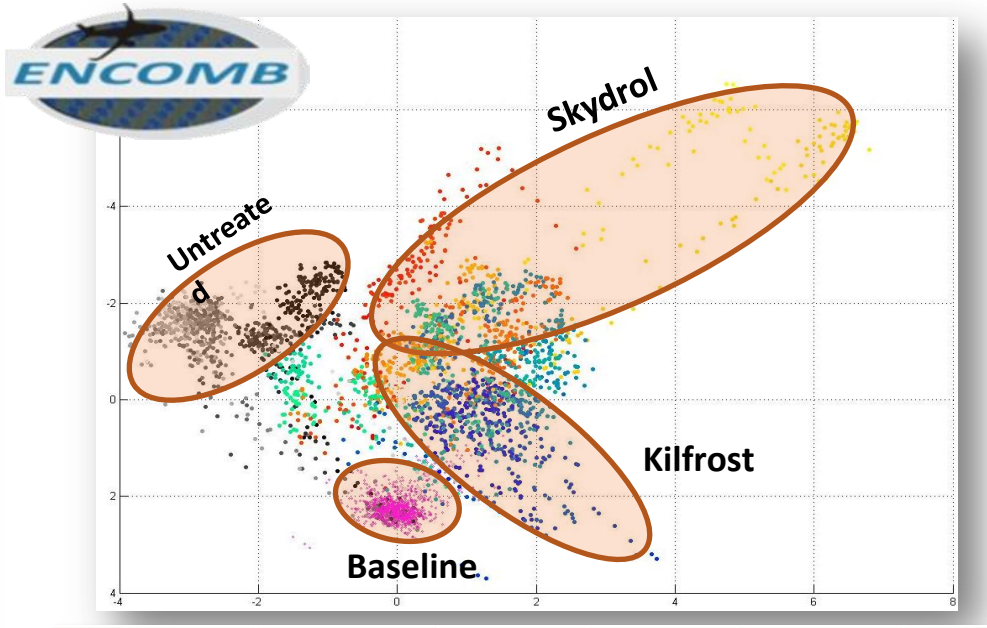
RESULTS

E-nose as a potential quality assurance technology



	Untreated	Kilfrost	Skydrol	Total
Untreated	**744**	5	0	749
Kilfrost	1	**793**	1	795
Skydrol	0	9	**512**	521
Total	745	807	513	**2065**

Correct classification rate: 99,2%



	Untreated	Frekote	Skydrol	Moisture	Total
Untreated	**159**	2	0	0	161
Frekote	7	**543**	0	1	551
Skydrol	0	0	**208**	0	208
Moisture	0	0	1	**483**	484
Total	166	545	209	484	**1404**

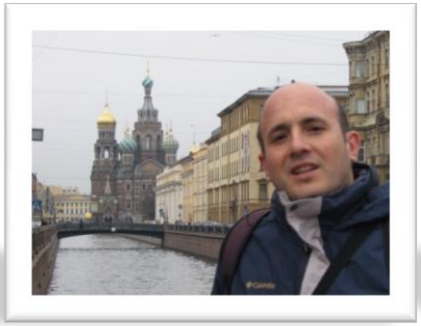
Correct classification rate: 99,4%

CONCLUSIONS & work in progress…

- **In city air pollution**
  - At present, we are developing devices, software architectures and components for the intelligent distributed monitoring of air quality.
  - In the next future, we will evaluate the personal exposure and reconstruct atmospheric pollution in cities by social sensing and interaction with networks and cloud computing systems.
- With **Wireless sensor networks** we are able to reconstruct the olfactive image of the sensed environment.
- **E-nose tools** can be successfully used in detecting surface contaminants on CFRP panels for pre-bonding quality assurance.
  - Further technical improving of the ENEA e-nose prototype in terms of environmental influences in the measurement phase.

ACKNOWLEDGMENTS

- My Research Team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