



# COST

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

COST Action TD1105

**WGs and MC Meeting at Cambridge, 18-20 December 2013**

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

Year 2: 1 July 2013 - 30 June 2014 (*Ongoing Action*)



**Nicolas Moser**

**Vice-chair WG4**

**SGX Sensortech / Switzerland**

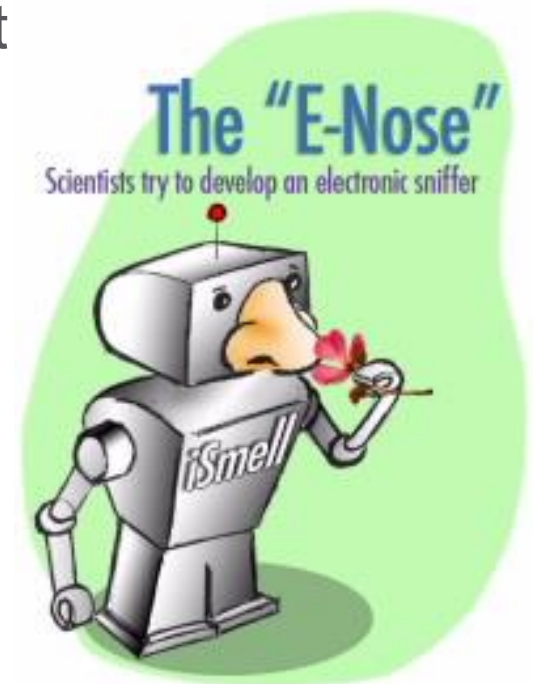
# Scientific context and objectives in the Action

- **Background / Problem statement:**

Development of gas sensor technologies able to fulfill target in terms of limit of detection for identified target gases, selectivity and low-cost

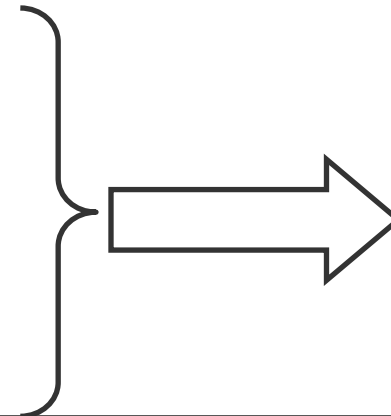
**Brief reminder of objective:**

- Development of miniaturized sensor systems for air quality monitoring



# Sensor System Definition

- Sensor (single or array of sensor)
- Pre-concentrator
- Sample delivery (pump, fan, ...)
- Data processing (filter, compensation, ...)
- Analysis



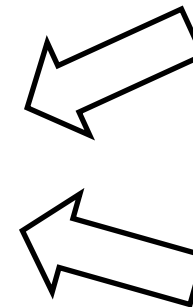
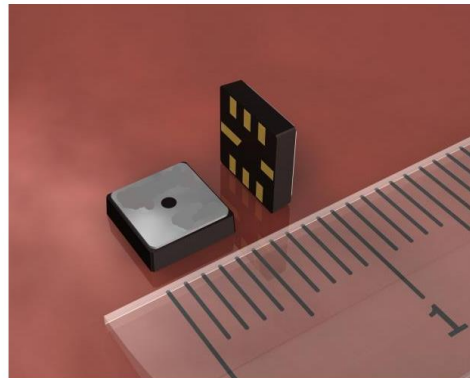
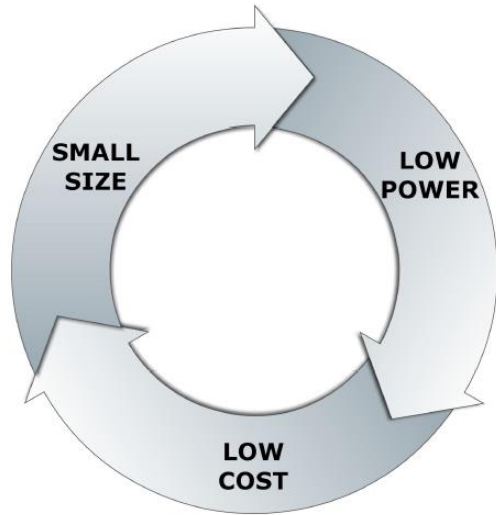
**Miniaturization**

- Readout unit (data acquisition, data storage)
- Power management unit (battery, battery charger, voltage regulator, ...)
- Data retrieval system (GPRS, Ethernet, hardwired, ...)
- Geo-localization chip
- Display
- Package (protection, fixture)

**Technically  
feasable**

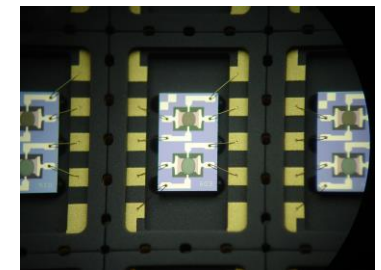
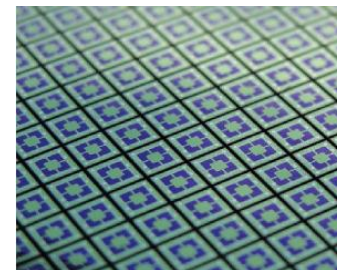
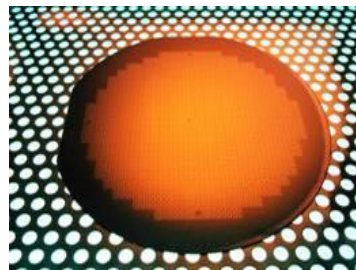
# Why miniaturize?

- **Need for:**
  - Compact monitoring station
  - Handheld detectors (standalone unit, portability feature)



# How miniaturize?

- **Electro-chemical cell**
  - Size is limited by electrolyte volume (define lifetime, sensitivity)
- **NDIR sensor**
  - Size is limited by rays path length (emitter and detectors can be miniaturized)
- **Nanomaterials onto electrodes (large specific area)**
  - Metal oxide, carbon nanotubes, GasFet sensors, Pellistor
  - Miniature size
  - Batch production possible



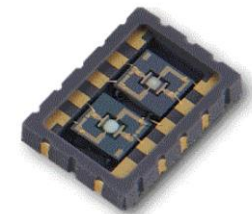


# Current development to miniaturize (1/5)

- Development of MEMS ultra-low power micro-hotplate using polysilicon, platinum, or tungsten heater resistor
- Use of intermittent operation mode for power savings
- Mass production sensitive layer deposition technique (screen printing, inkjet, dispense)
- Novel nanocrystalline materials deposition technique (evaporation)

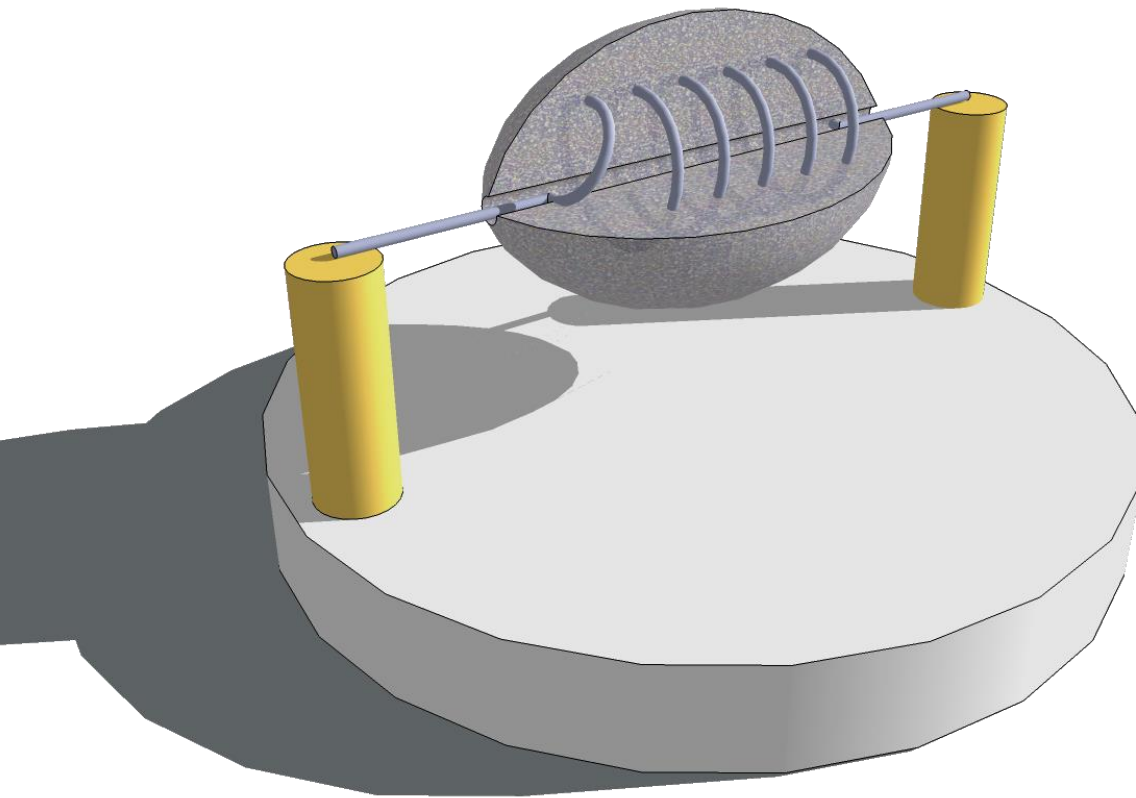
# Current development to miniaturize (2/5)

- Use of molecular imprinted polymers (MIPs) and metal-organic frameworks (MOFs) as pre-concentrators for improved selectivity of relevant molecules
- Combined technology to have MEMS sensor and analog/digital chip on the same substrate
- Sensor packaging improvement (cost effective solution with minimal volume)



# Current development to miniaturize (3/5)

Miniaturization applied to Pellistor (combustible gas detection):



## Pellistor

- Platinum Coil
- Ceramic Bead
- Catalyst

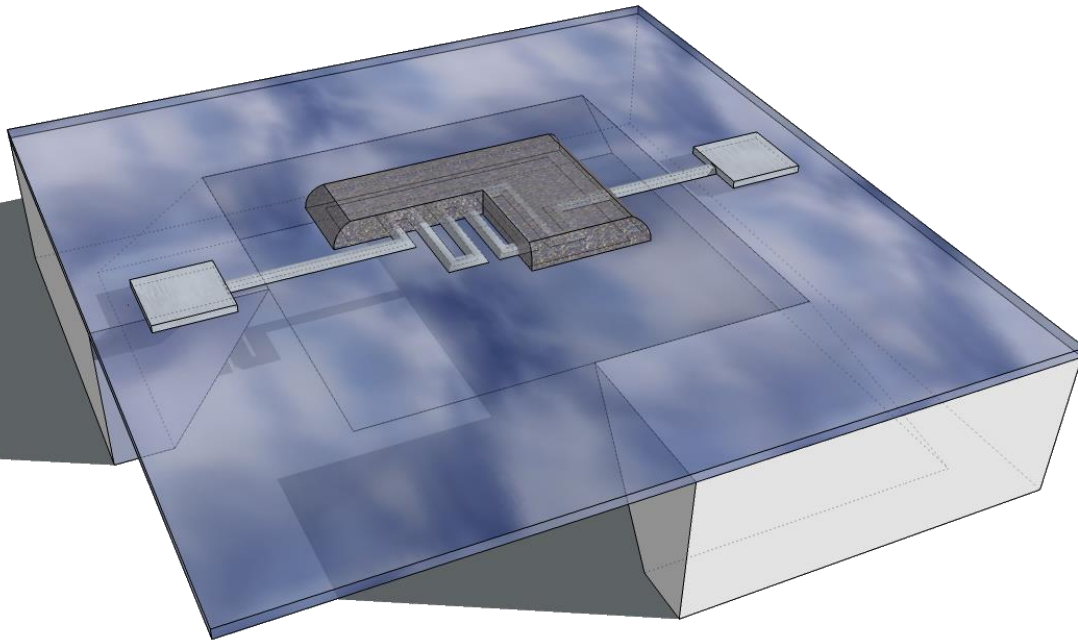


# Current development to miniaturize (4/5)

Miniaturization applied to Pellistor (combustible gas detection):

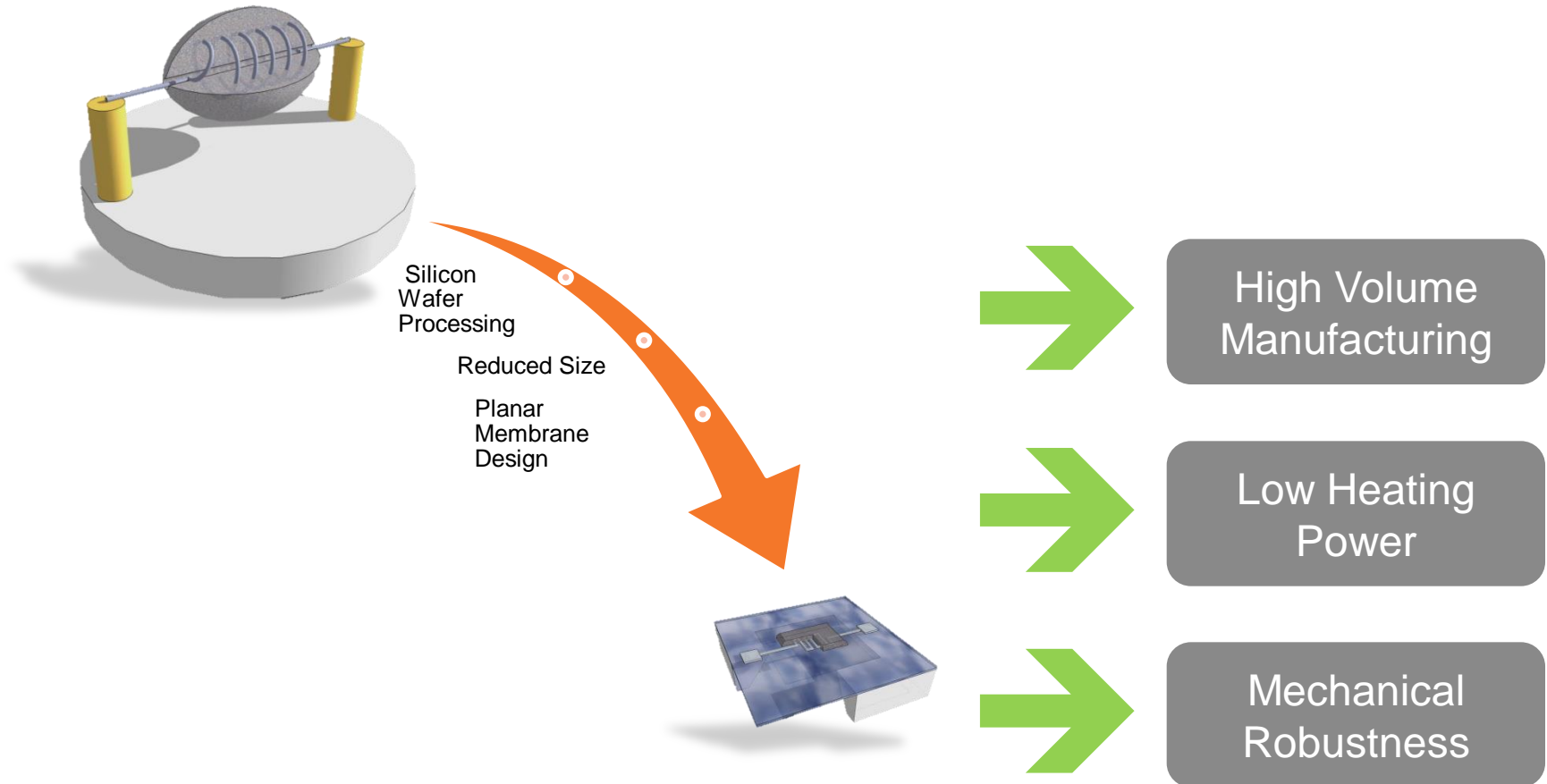
## MEMS

- Silicon Rim
- Dielectric Membrane
- Heater Structure
- Sensing Layer
- Catalyst



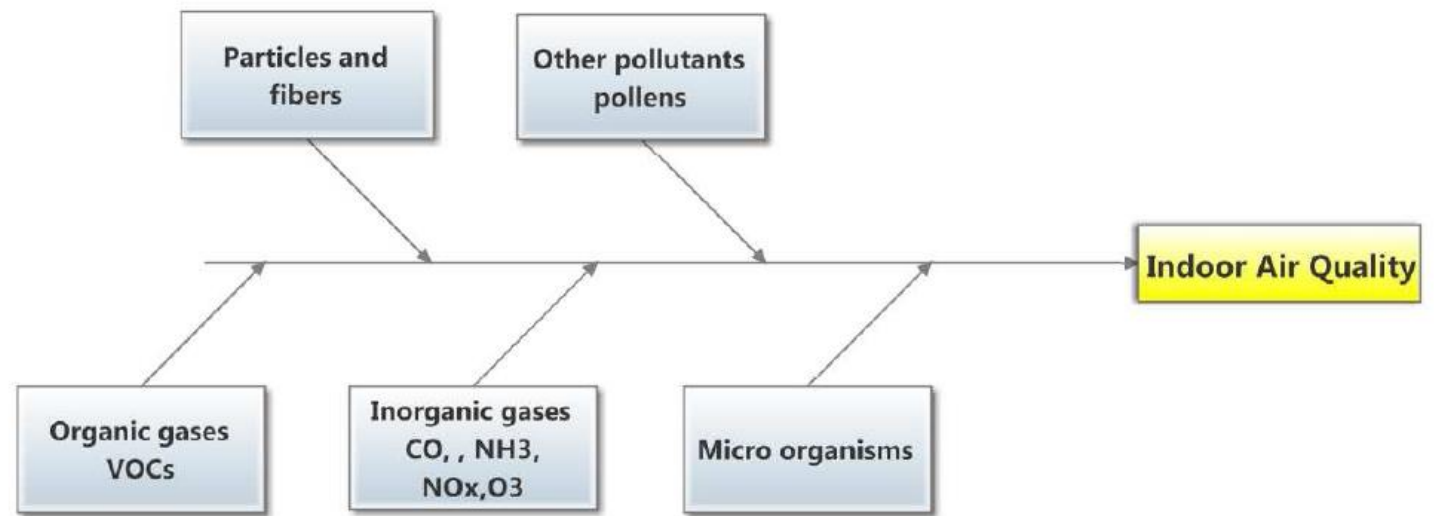
# Current development to miniaturize (5/5)

Miniaturization applied to Pellistor (combustible gas detection):



# Limitation of the reflexion

- Development of miniaturized gas sensors is not covering the solid detection
- Large part of pollutants are solid and miniaturized low cost particles detector is a must to monitor AQ at large scale



**Function of hygrothermal conditions:**

**T°air, relative humidity, air flow, air renewal**