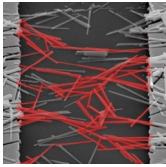


## ◆ Grenoble INP/FMNT

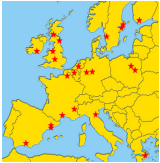
*Academic Lab*



- Project coordination
- Nanonets fabrication
- Nanonets bio-functionalization
- Device Characterization and Modelling

## ◆ SINANO Institute

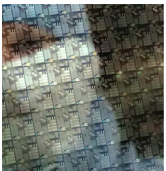
*European Nanoelectronics Association*



- Management and dissemination

## ◆ Kungliga Tekniska Högskolan

*Academic Institute*

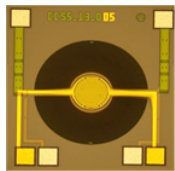


- CMOS compatible process development
- Circuit design
- Demonstrator for biosensing

## ◆ Cambridge CMOS Sensors

*SME*

*(now member of the ams group)*



- Micro hot plates for gas sensing
- Demonstrator for acetone in breath

## ◆ ams AG

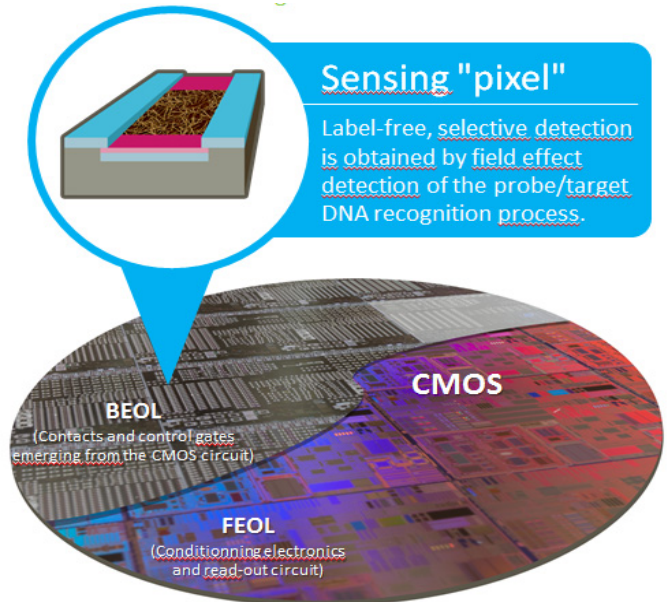
*Large Foundry*



- Wafers fabrication with dedicated CMOS readout
- Exploitation of results



## Nanonet-based sensors for medical applications



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Edition October 2016

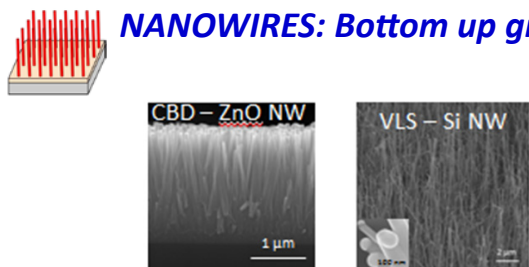


# Summary of concept

# Project presentation

# Applications

## NANOWIRES: Bottom up growth



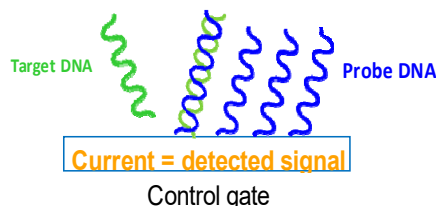
## NANONETS: Random networks of sintered nanowires

- Bottom-up fabrication by filtration followed by standard, low-cost, patterning and processing
- Benefits of thin crystalline nanowires with easy integration above CMOS wafers

## LABEL FREE SENSING: Field-effect detection

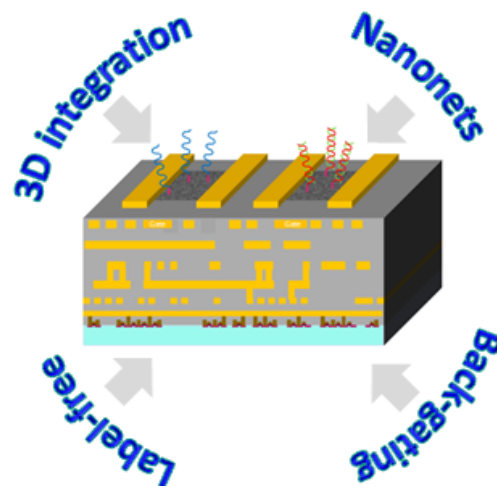
- Surface potential variation:** surface modification of ZnO nanonets under specific atmosphere e.g presence of a target gas such as acetone
- Surface charge variation** e.g detection of hybridization of target molecules with probe DNA by functionalized Si Nanonets

### Hybridization leads to change in surface charge and current variation



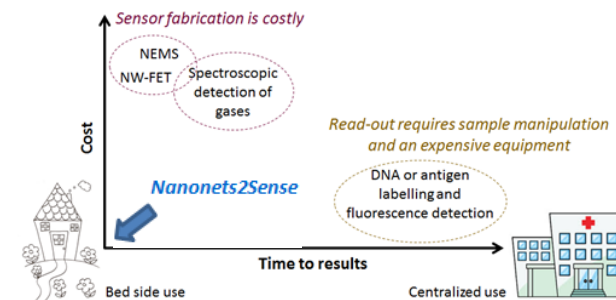
## A new technological brick for 3D integration of sensors

- Small footprint
- Compact
- Co-design, optimized read-out
- Adapted to multiplex detection with different target molecules
- Nanophysics with microtechnology
- Crystalline nanowires as sensing element, sensitivity
- Easy adaptation to other target molecules



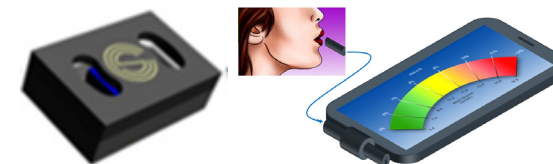
- Fully electrical
- Direct read-out, no expensive detection equipment or detection system integration
- Robust
- Biosensing: functionalization is carried out on completed device
- Breath analysis: nanonets can be fabricated with a variety of nanowires
- Optimized operation point: sensitivity and power consumption
- Reduced operation temperature for metal oxide gas sensors

## Low-cost smart sensors for pre-diagnostic or monitoring at bed side (Point of Care)



## Two model molecules are used to evaluate the potential of this generic technology.

- Gaseous phase:** breath biomarkers such as acetone for diabetes prediagnostics.  
ZnO nanonets on micromachined heater



- Liquid phase:** Biomarkers such as micro RNAs, hormones, proteins (in blood, sweat, urine...)

### Functionalized Si Nanonets

