



**NEXUS Association:  
Microsystems Networking for Europe**

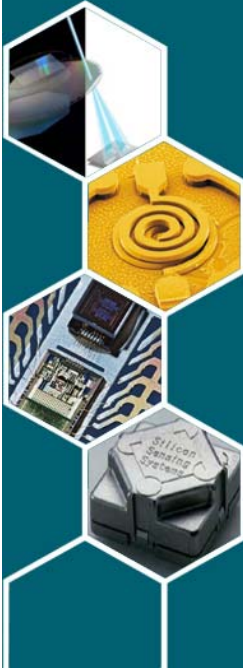


## *The NEXUS Approach of using “Expert Workshops and User Groups” to define R&D Roadmaps and IP Strategies*

### **Patric Salomon**

Director Business and Administration, NEXUS Association  
[www.nexus-mems.com](http://www.nexus-mems.com)

Managing Director, 4M2C PATRIC SALOMON GmbH  
enablingMNT Group, German office  
E-Mail: [patric.salomon@4m2c.com](mailto:patric.salomon@4m2c.com), [www.enablingMNT.com](http://www.enablingMNT.com)



## **Who is Nexus**



**Nexus is a Pan-European Microsystems Association based in Neuchatel, Switzerland.**

### **Mission:**

**To service the European microsystems community, (Research to Industrial Users) through networking & brokerage, providing market & intellectual property information, and helping organisations link into government & EC programmes.**

### **Special focus:**

- 1. Small companies (SMEs) and Eastern Europe**
- 2. Smart Health Applications**

**Contact: [office@nexus-mems.com](mailto:office@nexus-mems.com)**

**Membership is free at the moment. Please register online at [www.nexus-mems.com](http://www.nexus-mems.com)**



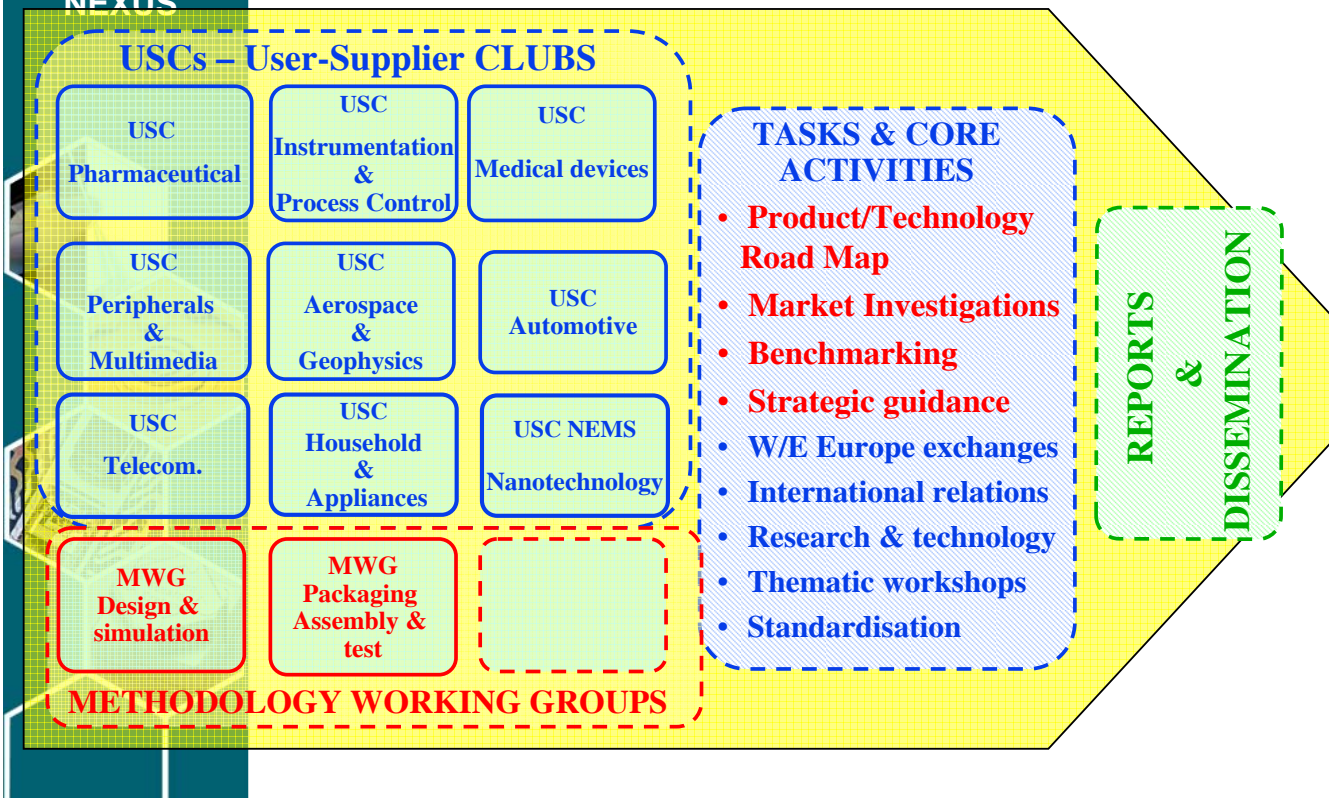


NEXUS

## Old NEXUS Core Activities



Information Society  
Technologies



NEXUS

## Development of The NEXUS Microsystems Association



Information Society  
Technologies



**1993: Launched as a European Network**

**1996: Move towards being driven by industry**

**2001: Move of NEXUS office from Berlin to Grenoble**

**2001: Launch of NEXUS Microsystems Association**

**2003: Termination of general funding through the EC**

**2004: *NEXUSplus* project to coordinate between EC MNT projects and help SMEs and Eastern Organisations**

**2005: New Steering Committee and Chairman**

**2005/2006: 3rd Market Analysis published**

**2005/2006: Launch of *SmartHealth* EC project**

**2006: Move of NEXUS office from Grenoble to Neuchatel**

**2007: Brokerage activities for EC programmes**

**2008: Expert Workshops**

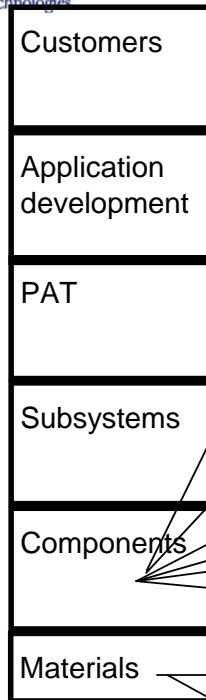
**2008/2009: Launch of SmartHealth Expert Group and Roadmapping**



## Microfluidics Workshop - Example Questions



Standards, design, modelling, cooperation, etc



Can we accelerate the prototyping phase? Can we prototype in one material and transfer?

Can we combine functions in blocks?

Do we have the right equipment?

Can we make the right components at the right price and with the right quality?

Do we have the right structuring technologies?

Hot emboss, injection, powder blasting, wet etch, DRIE, etc?

Silicon, glass, polymers?

Do we have the right materials at the right price and with the right quality?



## Identified specific barriers



- Work needed at materials level.
- Sample handling.
- Prototyping still takes too long.
- Integration?
- Design for reliability.
- Reusing existing technology – a library of functions.
- Roadmap is missing.
- Industrialization.
- Stakeholder involvement.
- Standards.





NEXUS



## Structural Health Monitoring: Geotechnical – Above surface



- ✓ Applications:
  - Dams, bridges, levees, roads, nuclear plants, buildings, ships, oil rigs, oil pipes, wind turbines, .....
- ✓ Drivers:
  - Large ageing infrastructure needs prioritized programme of repair
    - ✦ 3400 dams in USA classified to date as 'dangerous'
  - Insurance – Building/Shipping standards & codes exist, seismic survey infrastructure partially established
    - ✦ Public safety concerns amplified recently by evidence of non-compliance in China
- ✓ Application segmentation
  - External monitoring of environment (temp, humidity, windspeed, vibration – trucks, earthquakes etc)
  - Internal monitoring of effects (cracking, stress, corrosion - macro/micro modal analysis)
- ✓ Product families
  - Sensors, dataloggers, interconnects, modal software, data interpretation
- ✓ Primary problems
  - Consistent, standard modelling for fixed and variable structures.
  - How to interpret data
  - Significantly more difficult to retrofit into established structures
  - Adoption of new interconnect standards: RF; Analog or digital cabling



NEXUS



## Structural Health Monitoring: Geoscience - Subsurface



- ✓ Applications: Subsidence of mines, buildings
- ✓ Drivers:
  - Large ageing infrastructure needs prioritized programme of repair
    - ✦ 3400 dams in USA classified to date as 'dangerous'
  - Mining industry safety
  - Lower cost road maintenance
  - Increased security in Building construction
  - Application segmentation
  - Subsurface imaging
    - ✦ Radar, seismic, magnetic
  - Core sampling
  - GPS, LIDAR surface mapping
- ✓ Product families
  - Sensors, dataloggers, interconnects, software, data interpretation
- ✓ Primary problems
  - Speed of information/Surveying timescales, mobility, robustness, low power, integrated multi-imaging, precision/resolution



NEXUS



# Structural Health Monitoring: Aerospace



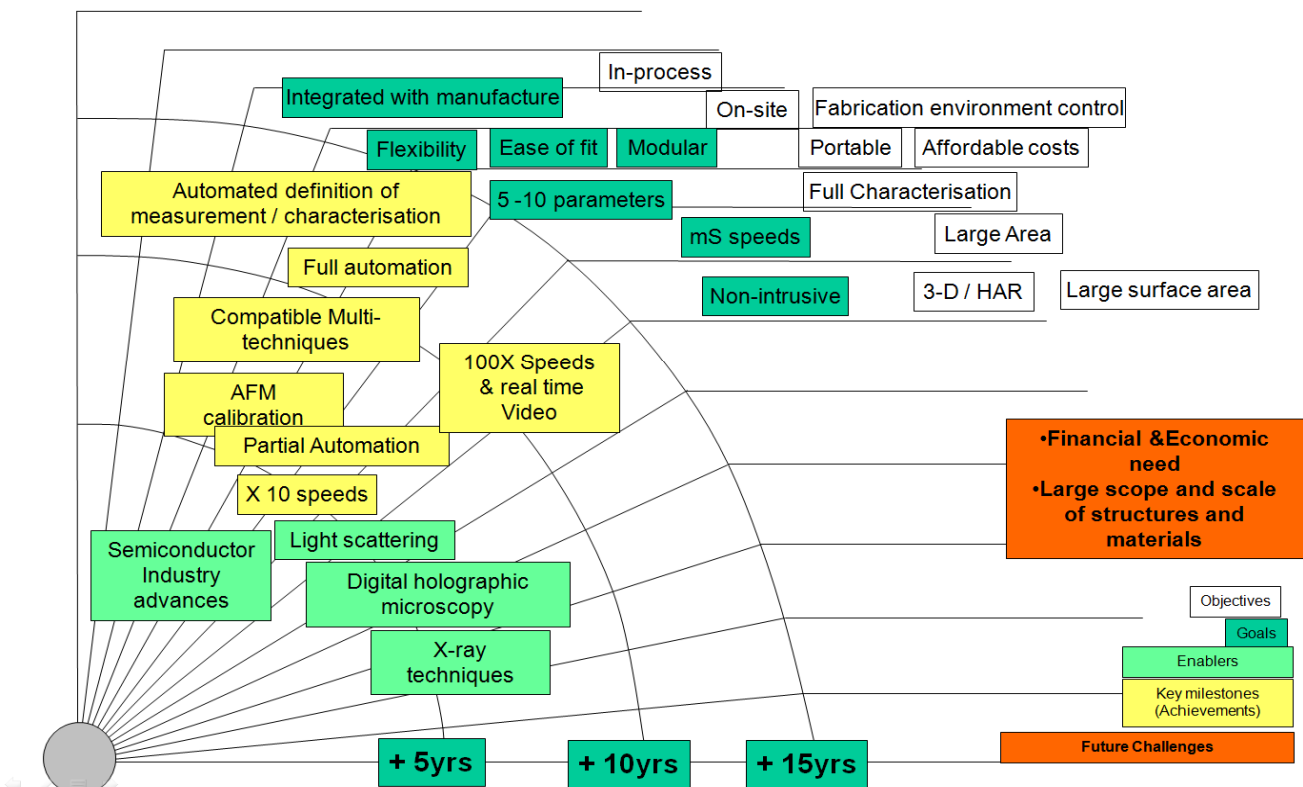
- ✓ Applications: In-flight and ground based health monitoring
- ✓ Drivers:
  - Cost effectiveness: Reduced ground time / increased airtime of aircraft
    - ✦ In flight dynamic measurement
    - ✦ Faster evaluation
  - Increased safety/reliability of aircraft
  - Diagnostic to prognostic
- ✓ Application segmentation
  - Interconnect reliability and weight
  - In flight monitoring (vibration, stress, corrosion - macro/micro modal analysis)
    - ✦ High and low temperature
  - Ground based instrumentation
- ✓ Product families
  - Sensors, interconnects, dataloggers, software
- ✓ Primary problems
  - Reliable reduced weight wiring
  - Small, low cost, high sensitivity, high reliability sensors
  - High temperature sensors
  - Predictive modal analysis



## CEMMNT

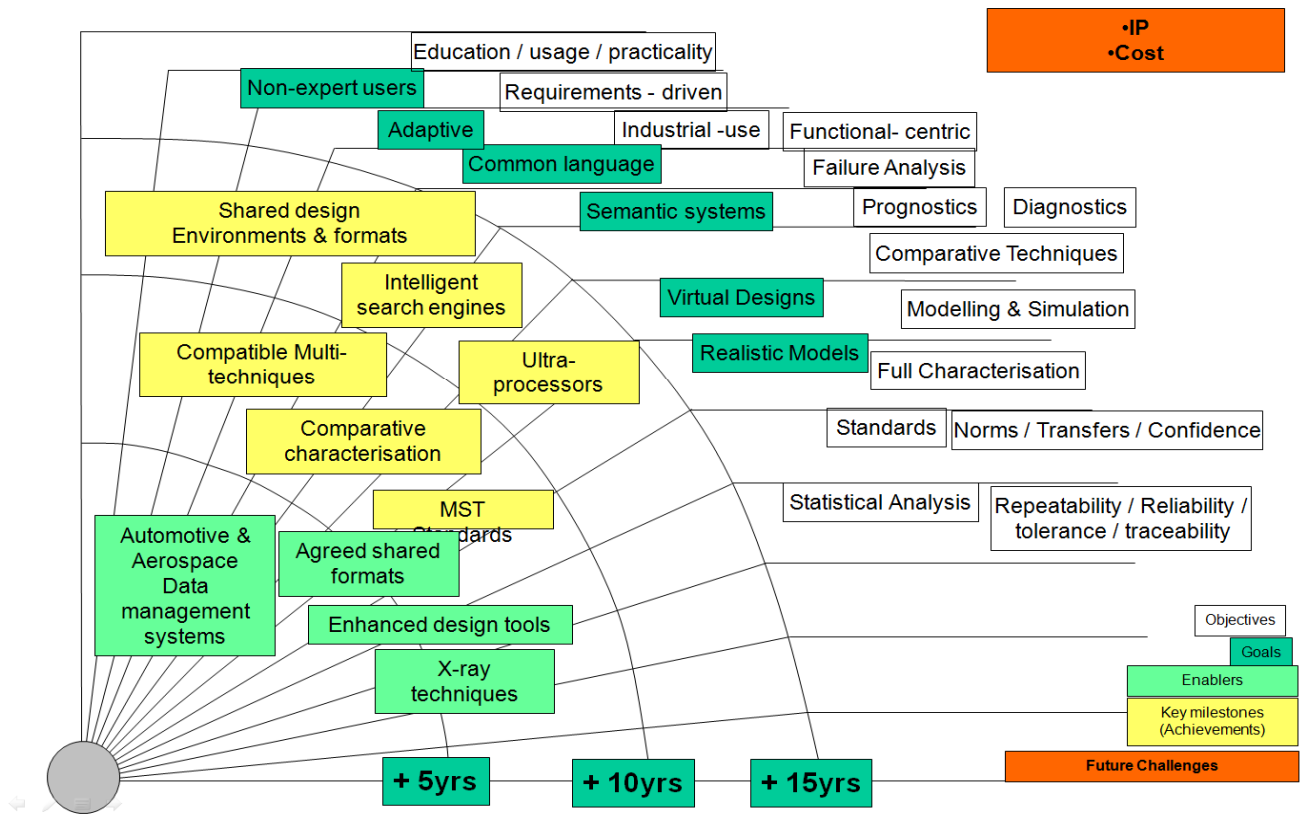
The Centre of Excellence in Metrology for Micro and Nano Technologies

### Primary Theme -1- : In-line Measurements (Where to measure and How)

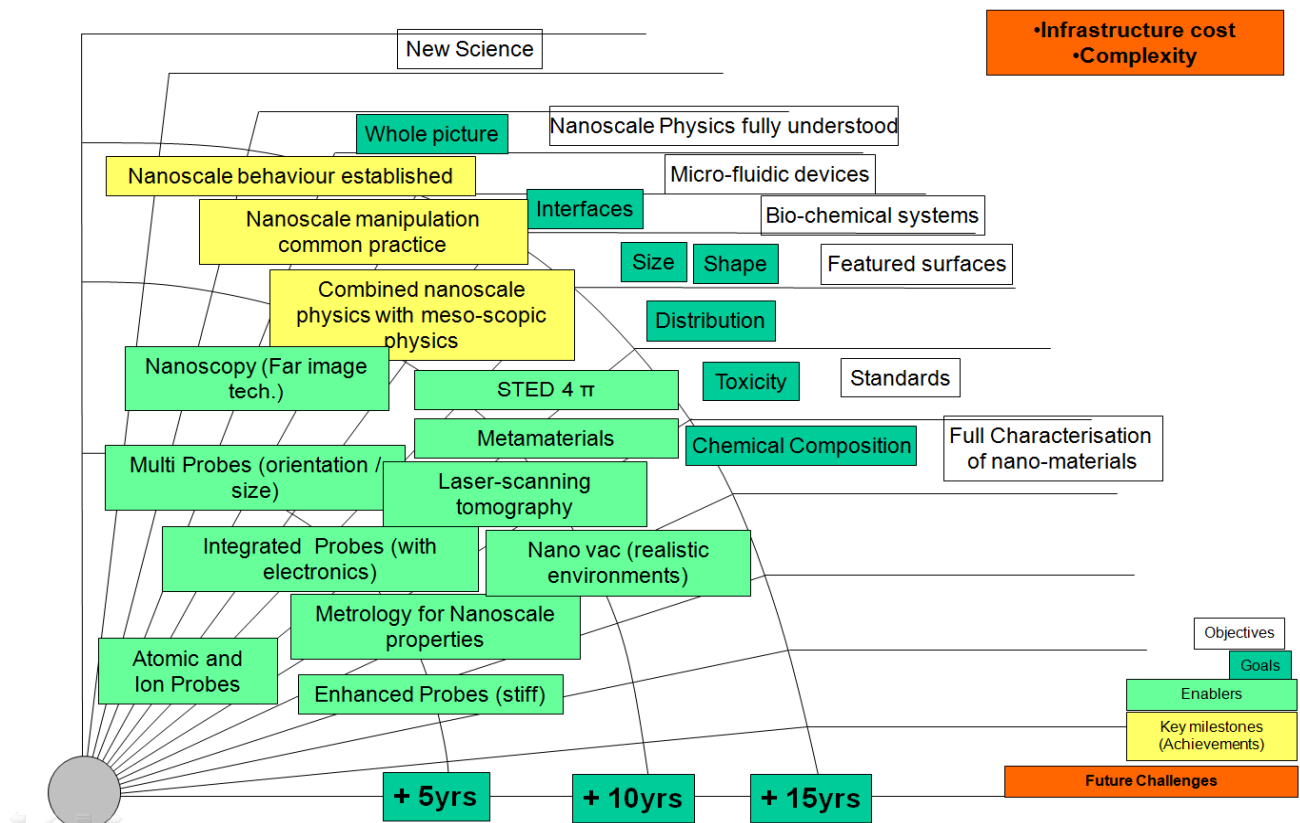




## Primary Theme -2- : Information & Knowledge Management (What to measure ?)



## Primary Theme -3-: Interactions, Background & Infrastructure (How to measure ?)





## NEXUS TODAY: Expert Working Groups



### Re-activate Expert Working Groups

#### Strategy Workshops for the European Commission:

- ✓  $\mu$ Fluidics 1, Braga, 19 Nov 2007
- ✓  $\mu$ Fluidics 2, Neuchatel, 10 Apr 2008
- ✓ Structural Health Monitoring 1, Lancaster, 17 Apr 2008
- ✓ Metrology in MNT, Loughborough, 19 May 2008
- ✓ Structural Health Monitoring 2, Neuchatel, 27 May 2008

#### Objectives:

- ✓ Assess commercial obstacles facing the adoption of technologies: User needs, R&D opportunities, roadmaps, strategy advice to EC
- ✓ Strategy reports have been sent to EC; waiting for clearance for wider distribution

#### Lessons learnt:

- ✓ There is an interest in discussing user strategies and development needs on a regular bases.
- ✓ Roadmapping would be the next step
- ✓ Link into activities of other organisations, i.e. Mancef, MIG



## SmartHEALTH Integrated Project



### FP6-2004-IST-NMP-2: Bio-sensors for Diagnosis and Healthcare

(Joint Call between thematic priorities 2 and 3, issued 15<sup>th</sup> June 2004)

#### SmartHEALTH objectives include:

- ◆ Introduce new SmartHEALTH sensor systems into future healthcare services to improve and better existing services.
- ◆ Demonstrate the role of Ambient Intelligent (AmI) medical devices and online services for pervasive healthcare provision.
- ◆ Demonstrate clinical evaluation of systems for targeted applications in breast, cervical and colorectal cancer.
- ◆ Demonstrate the economic benefits and means of healthcare provision for the targeted clinical applications.
- ◆ Develop new manufacturing technologies for realization of unique sensor solutions integrating fluidics, transducers and biological assays.
- ◆ Enable the effective, real-time communication between biological, electronic, mechanical and physical entities, thereby creating a new generation of intelligent systems.

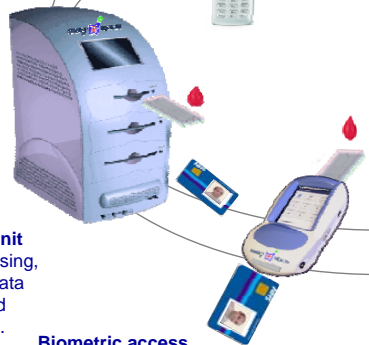
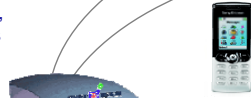


**Ambient environment** including electronic patient records, hospital and laboratory information systems, users home PCs, and on-line interface.

**Communications access**, utilising best local facilities available



**Base station / portable unit** integrating access, processing, control, sensor analysis, data analysis, user displays and interface, communications.



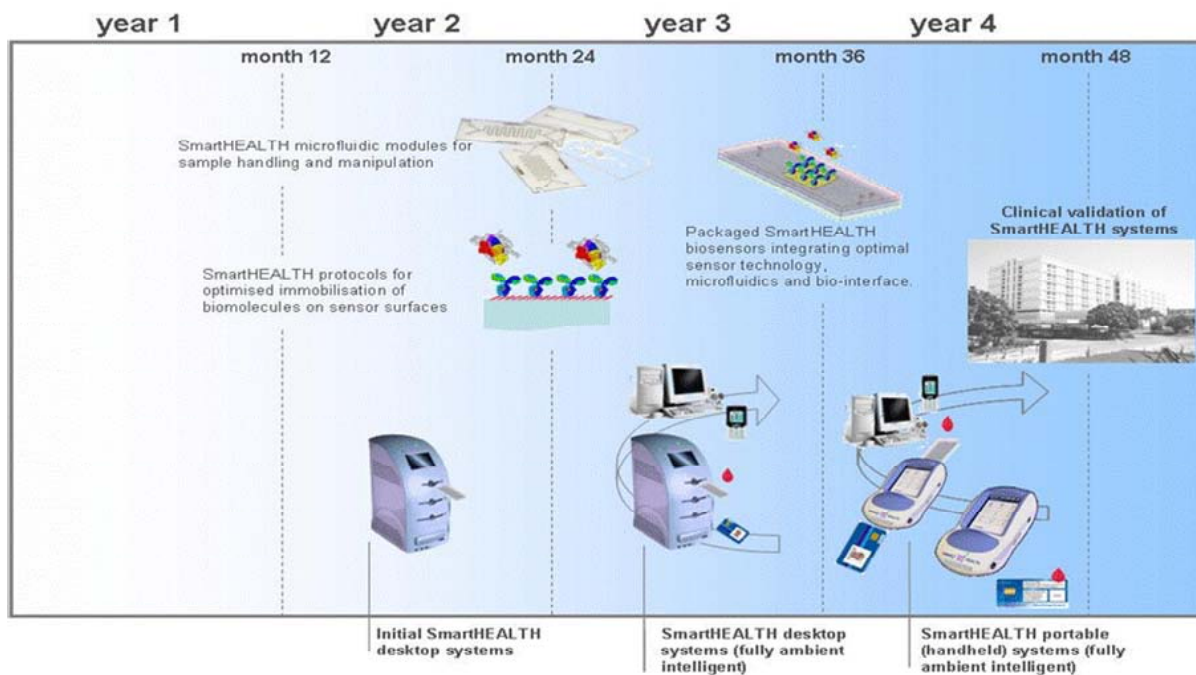
**Biometric access**, smartcard interface

**Clinical evaluation and integration** into healthcare systems

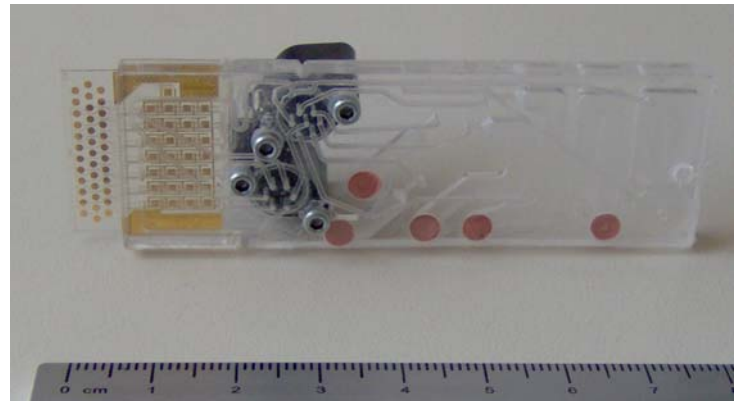
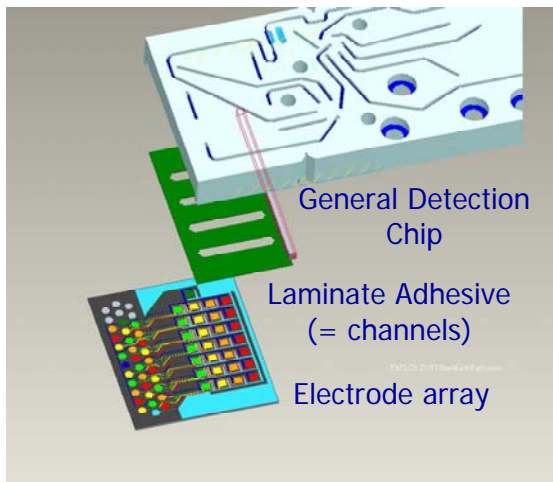


**Disposable fluidic cartridge** with integrated biosensors (contaminated with patient sample)

## SmartHEALTH Development Path

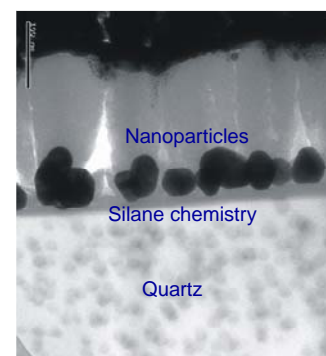
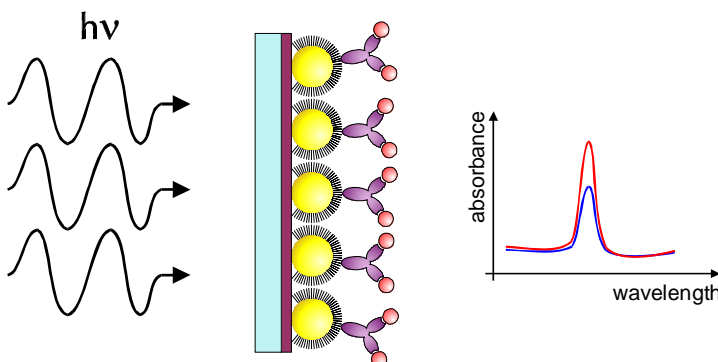






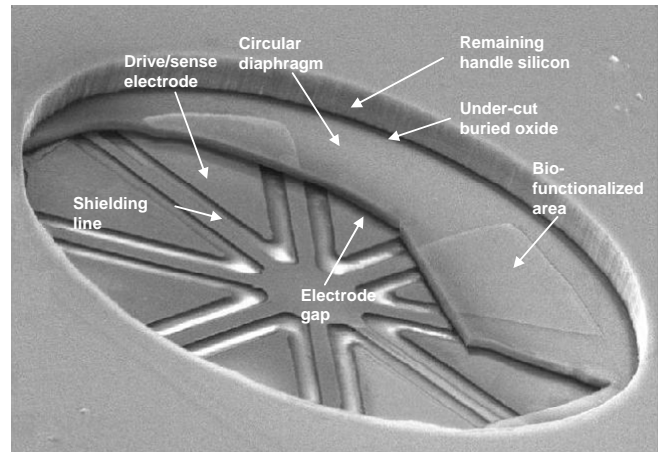
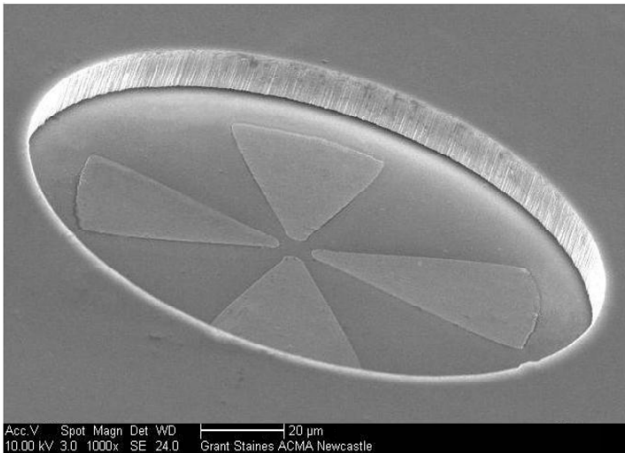
- ◆ Electrochemical detection based on amperometric and impedance measurements
- ◆ Successful integration of the EC sensor in the first prototype instrument (Dec 2007)
- ◆ First prototype instrument with integrated EC general detection cartridge (Feb 2008)

## Transmission Plasmon Biosensor

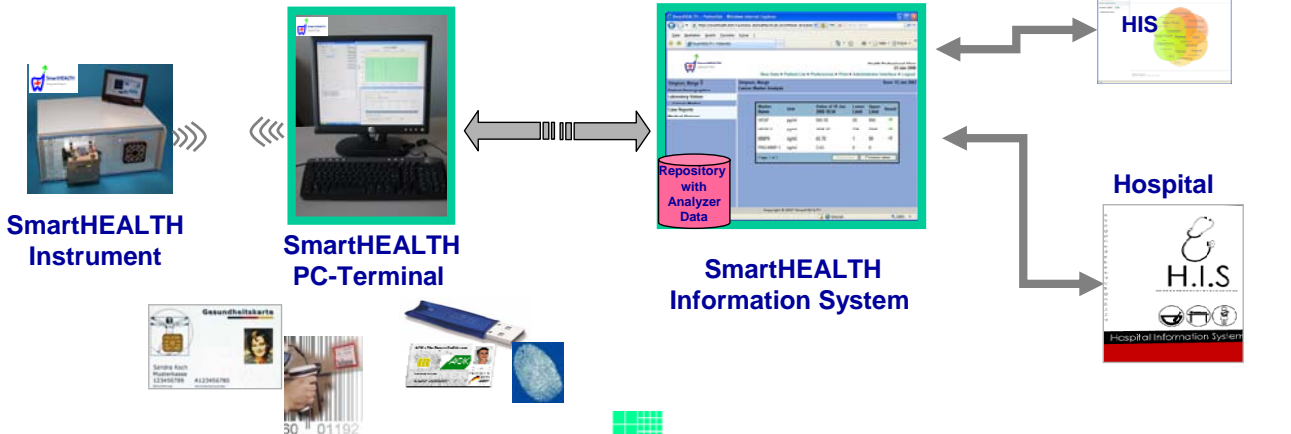
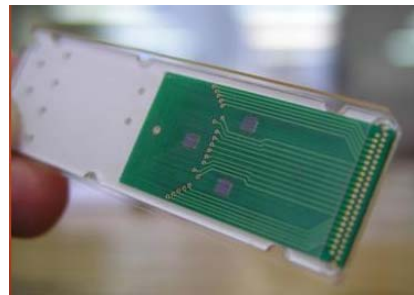


Left to right: light source, transparent substrate, adhesion layer, nanoparticle film, SAMs of functional thiols, antibodies, antigen and the resulting absorption increase and shift upon analyte binding.

An optical label-free biosensor technology which allows quantitative measurement of biomolecular interactions in **real time**, and has the potential to be highly multiplexed.



MEMS sensors engineered into microfluidic cartridges by MiniFAB, Australia



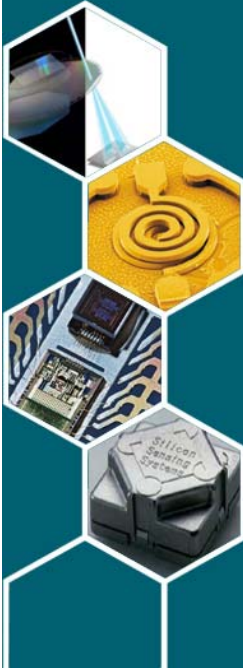
- ◆ Evaluation studies carried out on panel of protein markers for monitoring breast cancer
- ◆ Optimized RT-PCR assays for High Risk HPV and colorectal cancer markers
- ◆ Developed and characterized highly sensitive immunoassays for oncoproteins
- ◆ Established vertical integration teams to deliver application-driven sensor solutions
- ◆ Integrated electrochemical detection with prototype SmartHEALTH instrument
- ◆ Produced first integrated microfluidic cartridge
- ◆ Produced first prototype desktop instrument including software and GUI
- ◆ Completed first version of the integrated SmartHEALTH ICT platform including context awareness, security framework authentication and encryption
- ◆ Integrated trained neural networks for data analysis into ICT platform
- ◆ Quality Management System and documentation produced for product development and exploitation
- ◆ Initiated market analysis and commercialization strategy

- ◆ The SmartHEALTH project is partly funded by the European Commission (IST-NMP-2-016817)
- ◆ SmartHEALTH Web Page: [www.smarthealthip.com](http://www.smarthealthip.com)





NEXUS



## NEXUS TODAY / TOMORROW: User Group "Smart Health"



### Objectives of User Group:

- ✓ Advise SmartHealth EC project and guide towards a successful IP strategy and commercial exploitation of results:
  - User driven specifications and common standards?
  - Supply chain strategies including end user motivations (e.g. health insurances?)
  - Determine what technical, ethical and commercial barriers exist towards future exploitation of the SmartHEALTH technology
  - What are the best exploitation routes?
  - Who will commercialise the complete system without preventing exploitation of individual results through all partners?
  - Advise on license agreements and model for revenue sharing?
- ✓ Further development needs: Roadmapping approach

### Launch Event:

- ✓ User Group will be launched at Smart Health Roadshow, 28 Nov 2008, in conjunction with *21st Century Medicine: Breakthroughs and Challenges (26-27 Nov)*

### Contacts for User Group:

- ✓ Henne van Heeren, enablingMNT The Netherlands
- ✓ Patric Salomon, Nexus and enablingMNT Germany



NEXUS



## Contact information



### Patric Salomon

Director Business and Administration, NEXUS Association  
[www.nexus-mems.com](http://www.nexus-mems.com)

Managing Director, 4M2C PATRIC SALOMON GmbH  
enablingMNT Group, German office

E-Mail: [patric.salomon@4m2c.com](mailto:patric.salomon@4m2c.com), [www.enablingMNT.com](http://www.enablingMNT.com)

*My acknowledgements for inputs, discussion and slide contributions to:*

Henne van Heeren, enablingMNT, the Netherlands

Sean Neylon, CEO of Colibrys and NEXUS Chairman

### SmartHealth project

**Project Coordinator: Professor Calum McNeil**

University of Newcastle upon Tyne, UK

**Project Administrator: Ms Heather McGrath**

University of Newcastle upon Tyne, UK

**Project Manager: Mr David Wenn**

iXscient Ltd., UK

