

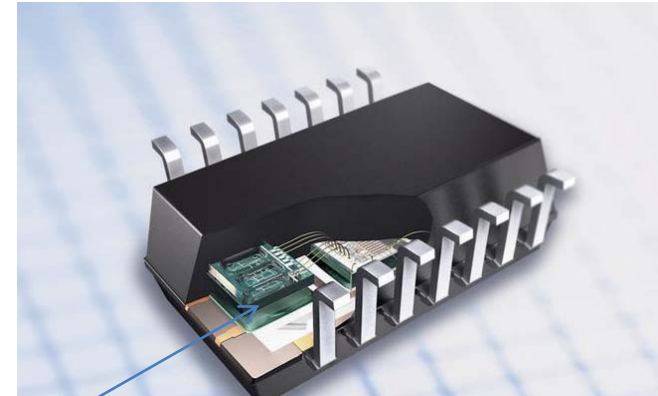
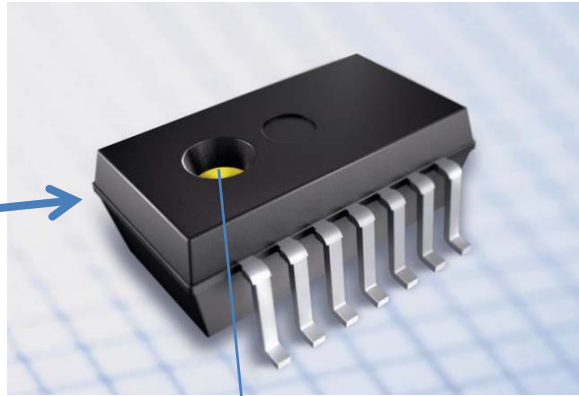


COHESI: microsystem development from concept to product

www.cohesi.be

Frederik.Ley@imec.be

Microsystem example I: Tire pressure monitor system



Pressure sensing window

Pictures courtesy of Infineon

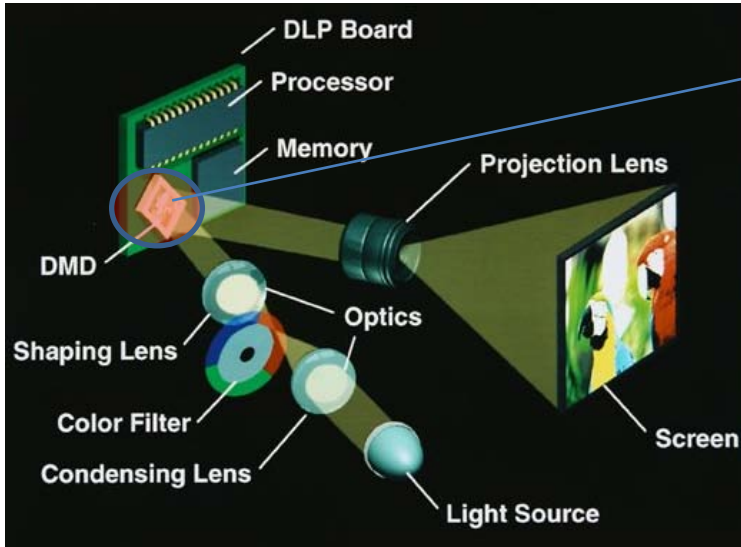
Example of a 'System in Package', containing:

- MEMS pressure sensor, radial accelerometer and temperature sensor
- Microcontroller and flash memory
- Wireless transceiver
- Battery or energy scavenging component

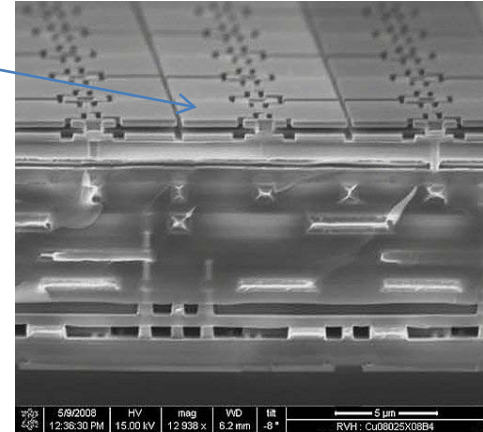
Mandatory on all new cars in Europe by 2014!

Microsystem example 2:

Micromirror chip (also known as 'Digital Micromirror Device', DMD)



Micro-mirror chip



Present in almost every modern projector!

Image courtesy of Texas Instruments

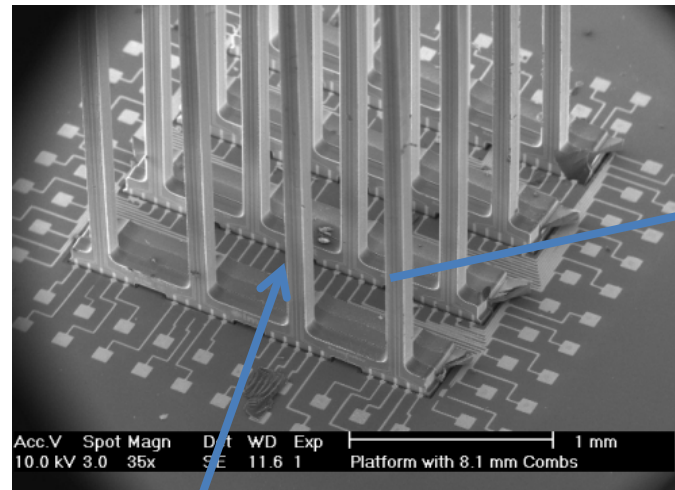
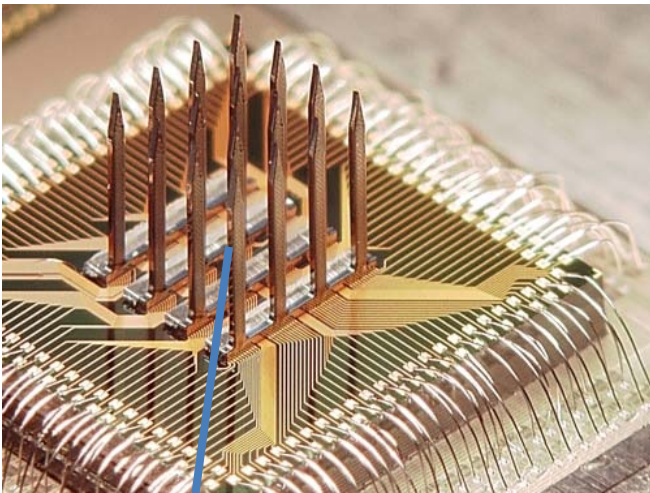
How does it work?

- The full chip is radiated subsequently by red, blue and green light
- Every micro-mirror in the chip creates one pixel on the screen:
 - The pixel is colored if the micro-mirror reflects incoming light to the screen (mirror 'on')
 - The pixel is dark if the mirror reflects incoming light away from the screen (mirror 'off')
- Every image is a superposition of a red, blue and green image. These are formed independently and directly after each other, faster than the human eye can resolve

Microsystem example 3: Neuroprobes

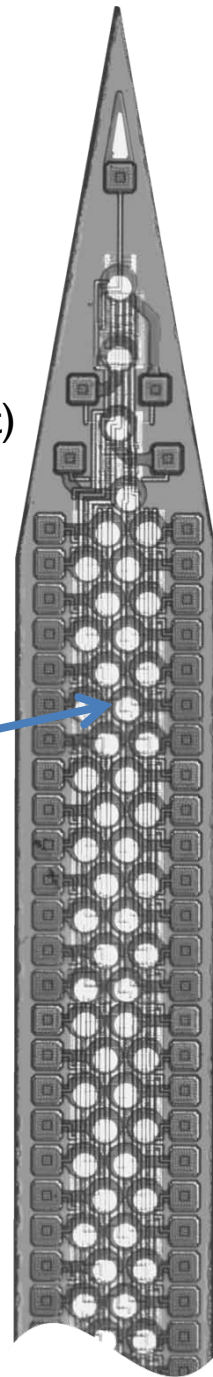
Already very effective in treating Parkinson, but also promising for many other neural disorders (typically diseases with huge human and economic cost)

Neuroprobes developed by imec:



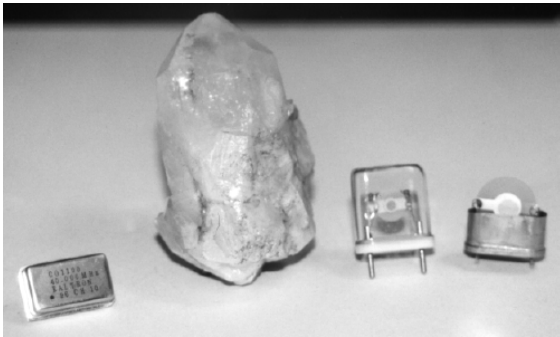
Each probe contains 112 electrodes that can be *separately* controlled by the interface circuits directly underneath the probes.

The probes are fabricated using MEMS micromachining technology



Microsystem example 4: a miniturized 'clock'

- Every computer, cell phone, CD player, quartz watch,... contains a quartz crystal that oscillates at a known fixed frequency → internal clock



Picture taken from 'Electronic Materials and Devices', McGraw-Hill

The same functionality can be obtained using an oscillating MEMS structure

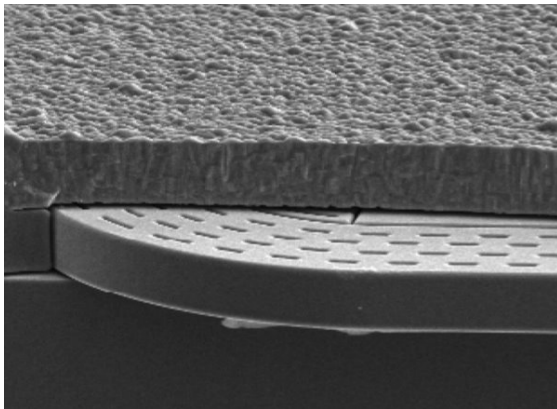


Photo courtesy of SiTime Corp

- More cost-effective and much smaller
- Can be integrated with other chip components in one package without PCB

Conclusions from the examples:

-The know-how to miniaturize complex heterogeneous systems is an important enabler for innovation in diverse areas:

- Transport
- biomedical & care
- consumer electronics (smart phones,Wii, ...)
- intelligent reduction of energy consumption
-

- Advanced microsystems require the state-of-the-art of very different types of components

→ requires both a **broad** and an **in-depth** technical expertise

→ **collaboration** between different actors each specialized in certain components (MEMS, photonics, bio-sensors, packaging, interface circuits...) **is essential**





UNIVERSITEIT
GENT

Prof. R. Baets :
silicon photonics

Prof. A. Van Calster :
flex stretch systems & smart power

Other universities,
technical high-schools
research centres....



KATHOLIEKE UNIVERSITEIT
LEUVEN

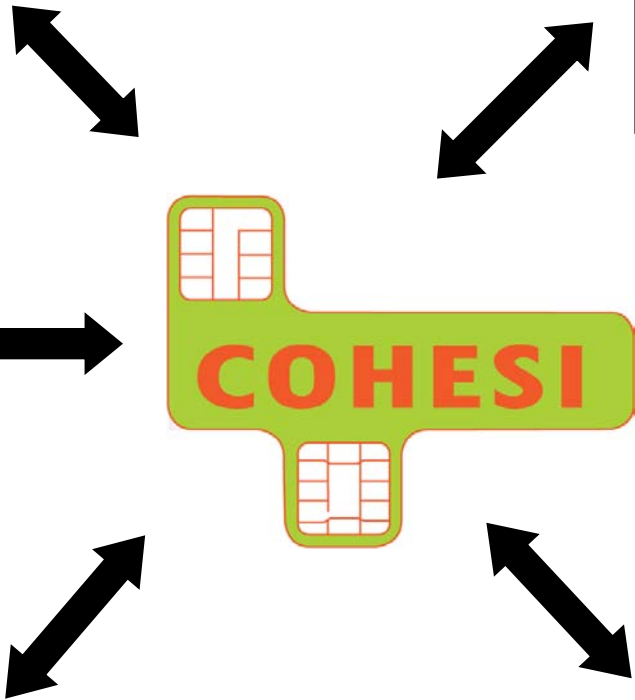
Prof. B. Puers :
MEMS & biomedical electronics

Prof. D. Reynaerts:
micro & precision engineering



Vrije
Universiteit
Brussel

Prof. H. Thienpont :
micro-photonics



COHESI

Flemish innovation-platform for **CO**mponents
and **CO**mplex **HE**terogeneous **S**ystem **I**ntegration

The innovation platform is a collaboration between:



Goal of COHESI is to support the local industry in the development
of heterogeneous micro-system products, with a focus on

the translation of mature research results into prototypes and products



Research projects

- silicon photonics (INTEC, UGent/imec)
- flexible and stretchable electronics (CMST, UGent/imec)
- MEMS (MICAS K.U.Leuven, imec)
- micro-optics (Vrije Universiteit Brussel)
- smart-power (CMST, UGent/imec)
- image sensors (imec)
- Micro- and precision engineering (PMA, K.U.Leuven)

research prototypes

.....
University cleanrooms & labs

Production prototypes

new design in CMORE technology

new design in 'standard' foundry technology

- ePIXfab
- EUROPRACTICE
- Design support service
- IMEC R&D :
Proof-of-concept studies

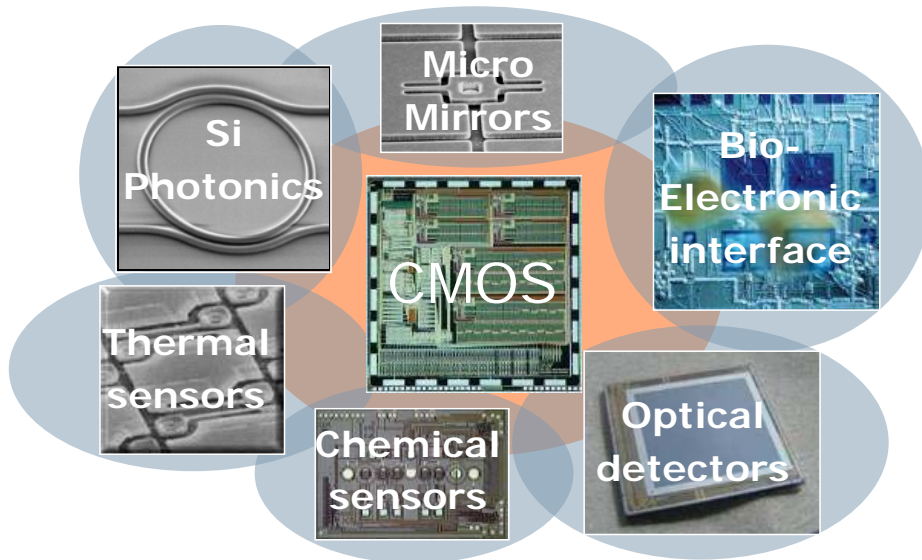
Broad and complete range of expertise, services and infrastructure

standard components

- IMEC's System integration-group
- Proof-of-concept studies at system level

CMORE : taking concepts to production

CMORE: A platform for integrating computing, sensing and actuation in a multi-functional System-in-a-Package



Offering:

- Process, component and system design
- Process & component build
- Testing, packaging
- Prototyping & product qualification
- Commercialization support including:
 - Low volume production @ IMEC
 - Process transfer for large volume manufacturing

IMECAMPUS



Clean Room 2

3200 m² Clean Room
300 mm pilot line
65 nm CMOS baseline

IMEC's 200/300mm platform:

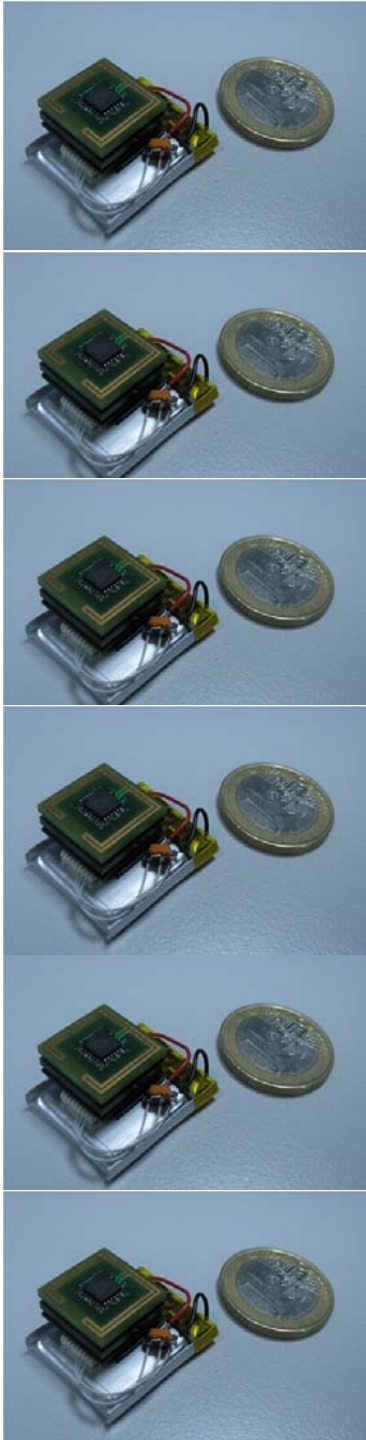
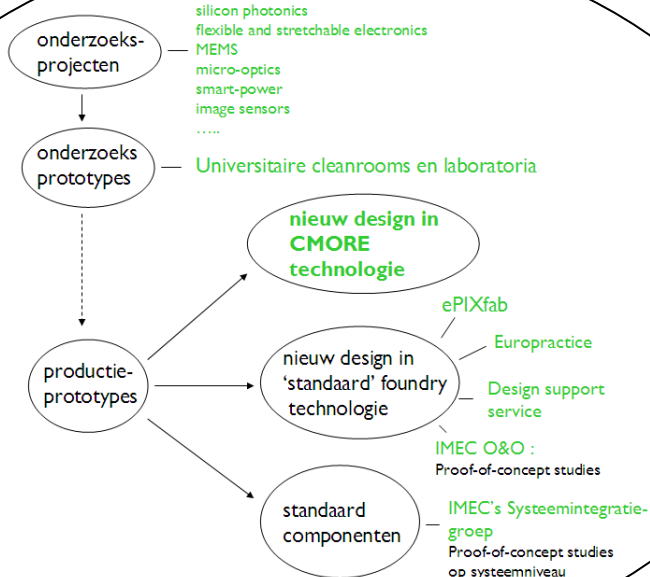
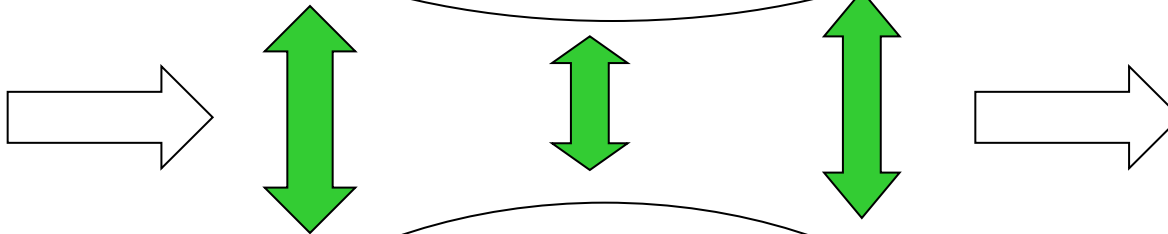
World's most advanced process tool set
24/7 fab operations
SPC-controlled Unit Process Library
Flexible System Design environment
Leveraging 25 years of semiconductor process and system R&D experience

Clean Room 1

4800 m² Clean Room
200 mm pilot line
130/90 nm CMOS baseline

Total: 8000 m² Clean Room

Flemish companies



COHESI innovation platform

Flemish companies

COHESI community

onderzoeks-
projecten

silicon photonics
flexible and stretchable electronics
MEMS
micro-optics
smart-power
image sensors
.....

onderzoeks
prototypes

Universitaire cleanrooms en laboratoria

productie-
prototypes

nieuw design in
CMORE
technologie

ePIXfab
Europractice
Design support
service

nieuw design in
'standaard' foundry
technologie

IMEC O&O :
Proof-of-concept studies

standaard
componenten

IMEC's Systeemintegratie-
groep
Proof-of-concept studies
op systeemniveau

COHESI innovation platform

The interaction between the platform and the local industry is stimulated via the formation of the **COHESI community**

Offering to the community consists of 4 elements:

Participation in the COHESI workshops (3-2/year)

Early insight in R&D developments and product development services in COHESI

Testimonials of successful product development by Flemish companies

Regular opportunity for technical discussions with players in the full micro system value chain



The **COHESI Technology Compass:**

Support from idea up to the start of the first feasibility study

A dedicated training programme

Tailored to the needs of the community

On-line platform and public website www.cohesi.be



ESSENSIUM



Tyco Electronics



Discover COHESI in the next workshop
November 18th @imec (contact Frederik.Leys@imec.be)

13:00	Registration & welcome coffee
13:30	Status of the COHESI community Frederik Leys, Innovation Program Manager Flanders, imec
13:45	Micro-optic components and micro-phonic systems: product innovation opportunities in Flanders and Europe Hugo Thienpont, Full Professor, Vrije Universiteit Brussel
14:15	Implantable Hearing Prosthesis: A case study on how interdisciplinary research and development revolutionise hearing Bart Volckaerts, Technology Research Coordinator, Cochlear Technology Centre Belgium
14:45	SBO call 2011; proposals in the field of microsystem technology Various presentors
15:00	Break + Coffee
15:45	Miniature, integrated, optical solutions for complex optical functionalities Danaë Delbeke, Technology Developer, UGent
16:15	European R&D programs on microsystem technology: what PICTOR can do for you. Tom Tourwé, Technology Advisor Software Engineering & ICT, Sirris
16:45	Imec's CMORE offering extended with SiGe-MEMS foundry service and MPW service Jan Bienstman, MEMS Design & Support Engineer, imec
17:00	Closing and networking Drinks and sandwiches
18:30	End of the work meeting