

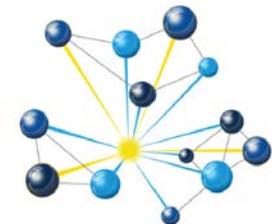
**Manufacturing of Nano-enabled Microsystems for Bio-sample Analysis**

**Wolfgang Eberle, NeMs4BIO demo case leader**

[Wolfgang.Eberle@imec.be](mailto:Wolfgang.Eberle@imec.be), +32 16 28 8137, imec, Leuven, Belgium



# The Vanguard Initiative



**VANGUARD INITIATIVE**  
New growth through smart specialisation

# The Vanguard Initiative

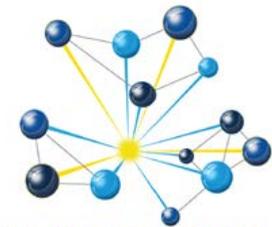
**Regional  
Cooperation**

**Smart specialisation**

**Industrial Innovation,  
networks of  
demonstration and  
pilot infrastructures**

**Entrepreneurship**

**Political commitment**



**VANGUARD INITIATIVE**  
New growth through smart specialisation



# Methodology of the Pilot Projects

UPSCALE

## COMMERCIALISE

- Launch of new ventures and start - ups
- New value chains
- TRL 9

## DEMONSTRATE

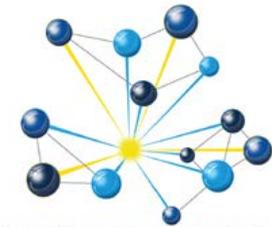
- Networked demonstration
- Pilot lines and first of a kind factories
- TRL 6 – 7 – 8

## CONNECT

- Matching events for complementary partners
- Developing demonstration cases

## LEARN

- Developing a scoping paper
- Mapping questionnaire
- Identify lead regions and actors



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Website: <http://www.s3vanguardinitiative.eu>

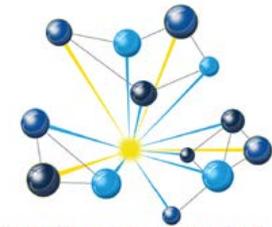
# Vanguard Initiative - Current pilot projects and demo cases

New Nano-enabled Products	3D-printing	ADMA (Advanced Manufacturing for Energy-Related Applications in Harsh Environments)	Efficient and Sustainable Manufacturing	Bioeconomy
Nanowires for ICT and energy applications	3D-printed hybrid component Additive-subtractive platform	Corrosion	De-and Remanufacturing	Bio-aromatics
Nano enabled Micro System for Bio Analysis (NeMs4Bio)	3D-printed automotive components for large, medium and small complex parts	Manufacture of large-scale components	Smart and adaptive assembly and manufacturing systems	Lignocellulose biorefinery
Shapetronics	Machinery, tooling and complex shapes	Operations and maintenance	Advanced sustainable surface and material technologies 4 functional polymer components	Turning (waste)gas into value
	Healthcare case	Sensing, instrumentation and remote monitoring	Digital and virtual factory integrating planning and stimulation into operative environments	Biogas beyond energy production
	Creative industries – mass-customized consumer products		Energy-flexible and resource-efficient factory operation	Bio-aviation fuel
	3DP in textile			Food & feed ingredients from agrofood waste
				Food & feed ingredients from algae

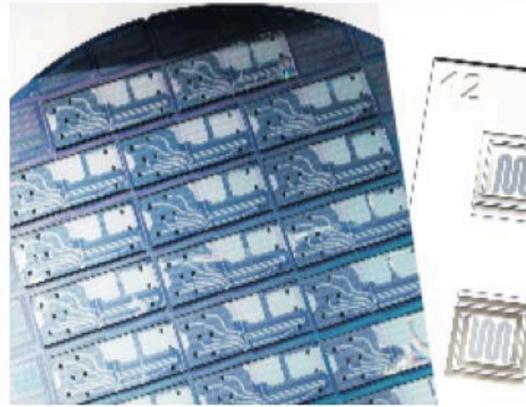
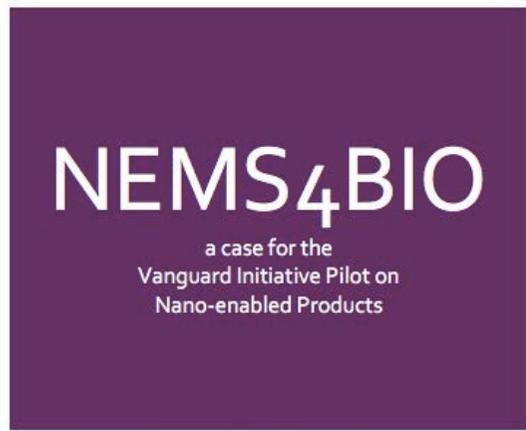
# Nano-Pilot - Member Regions

- Auvergne-Rhône-Alpes
- North Rhine-Westphalia
- Baden-Württemberg
- Skåne
- East Netherlands
- South Netherlands
- Emilia Romagna
- Tampere
- Flanders
- Wallonia

New members  
are welcome!



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**Manufacturing of Nano-enabled Microsystems for Bio-sample Analysis**

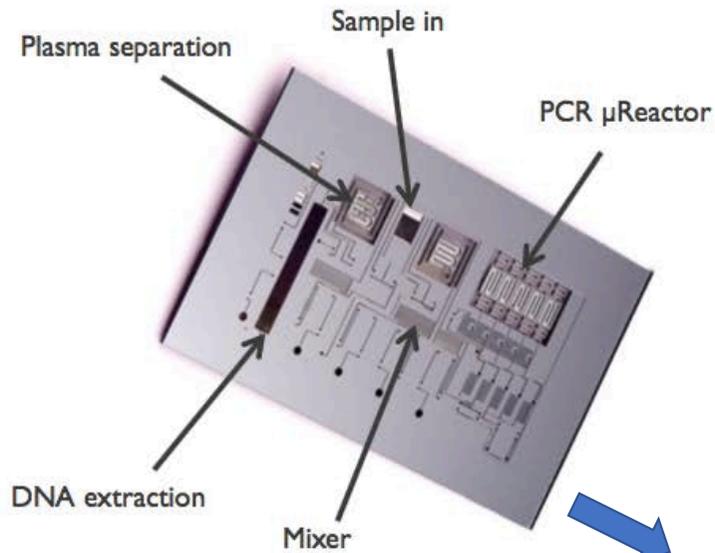
**Wolfgang Eberle**

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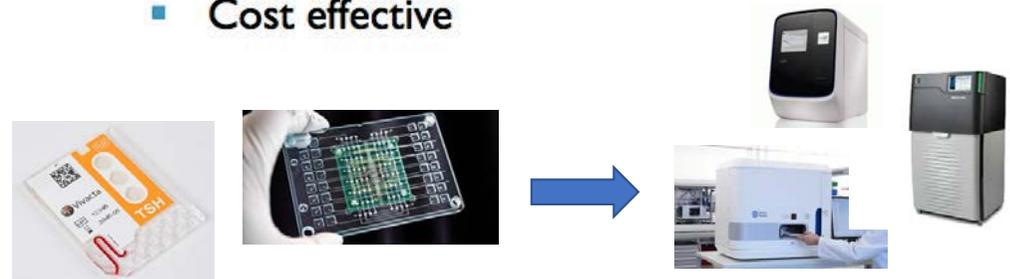
# NeMs4Bio - objective

## TOWARD FULLY INTEGRATED SAMPLE-PREP & ANALYSIS



Source: imec

- Minimal sample loss between steps
- Contamination-free
- Reliable
- Automated
- Efficiency
- Cost effective



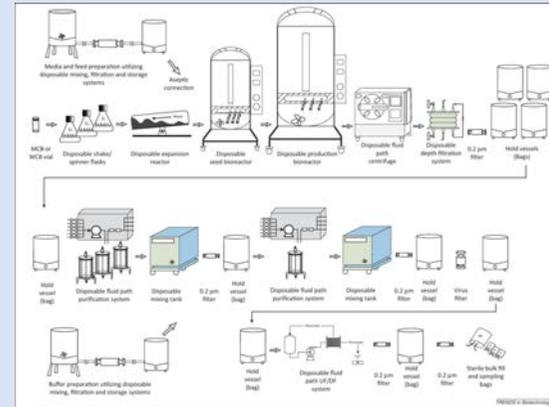
## ENVIRONMENTAL LAB ANALYSIS

fluid sample monitoring for e.g. contamination, composition, ...



in flow or batch, continuous or repeated monitoring (mostly excluding single-use)

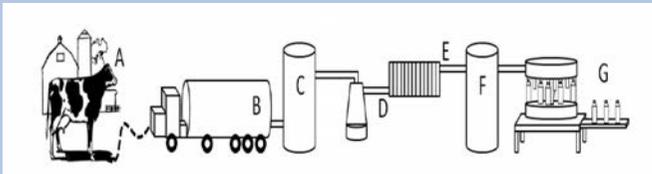
## ANALYSIS FOR BIO-MANUFACTURING PROCESSES



e.g.  
bioreactor  
monitoring  
for contamination,  
harvesting

## ANALYSIS IN FOOD PRODUCTION

fluidified samples for analysis of ingredients, quality, safety, toxicology, authenticity



## ANALYSIS FOR MEDICAL APPLICATIONS

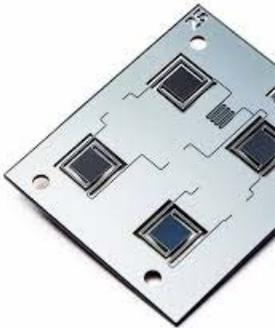
fluid analysis, dialysis, cell therapy



blood, urine, saliva, sweat, ...

# Modular concepts – system partitioning

## Where to put which function?



chip



cartridge



Diagnostic / measurement instrument



(Bioprocess) production equipment



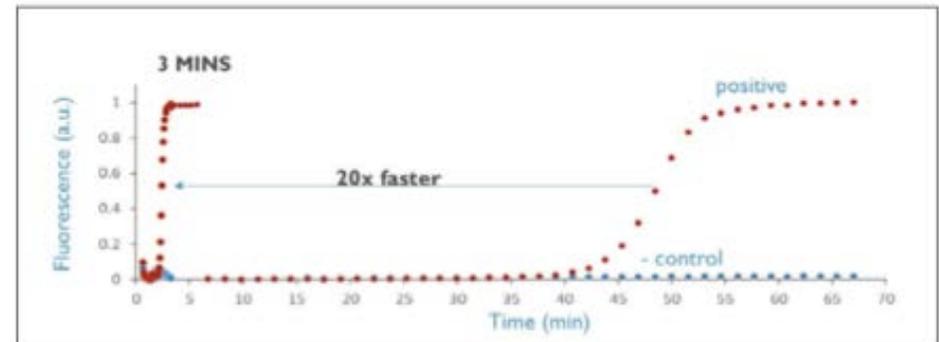
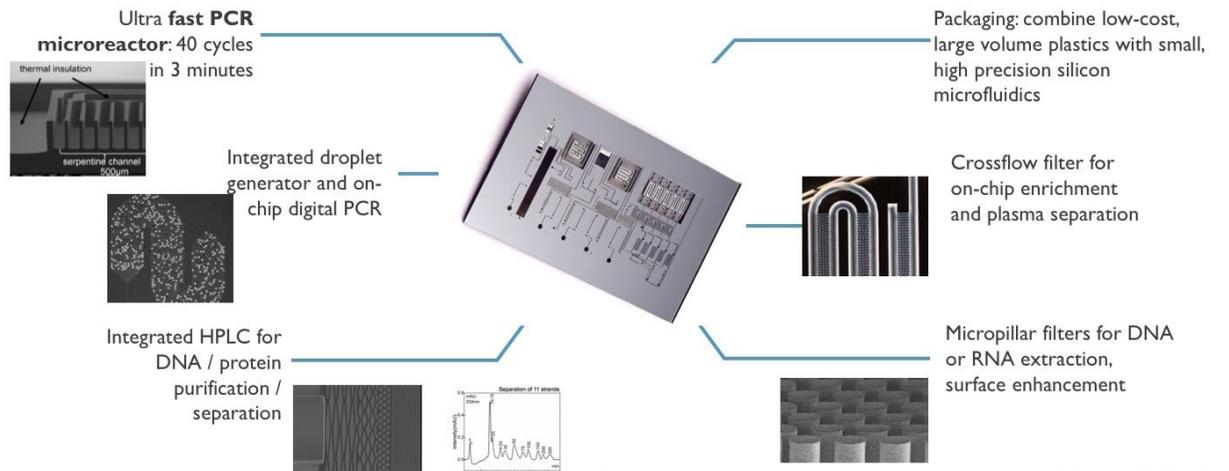
Food/beverage analysis equipment

# High silicon integration



Chip

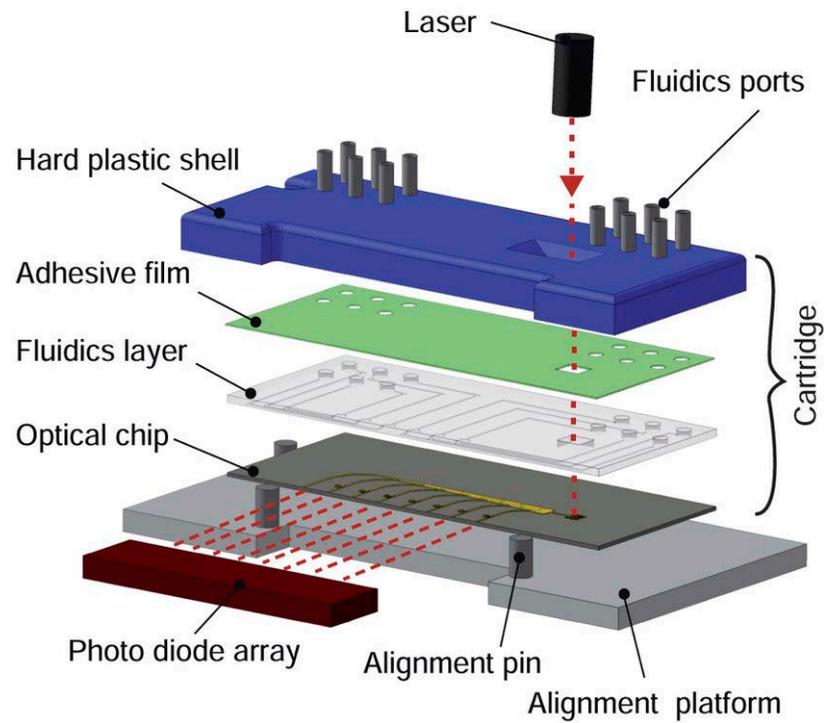
External functions:  
Consider sample input + optical read-out



Ultra-fast DNA-amplification: 40 cycles in 3 minutes.

Source: imec

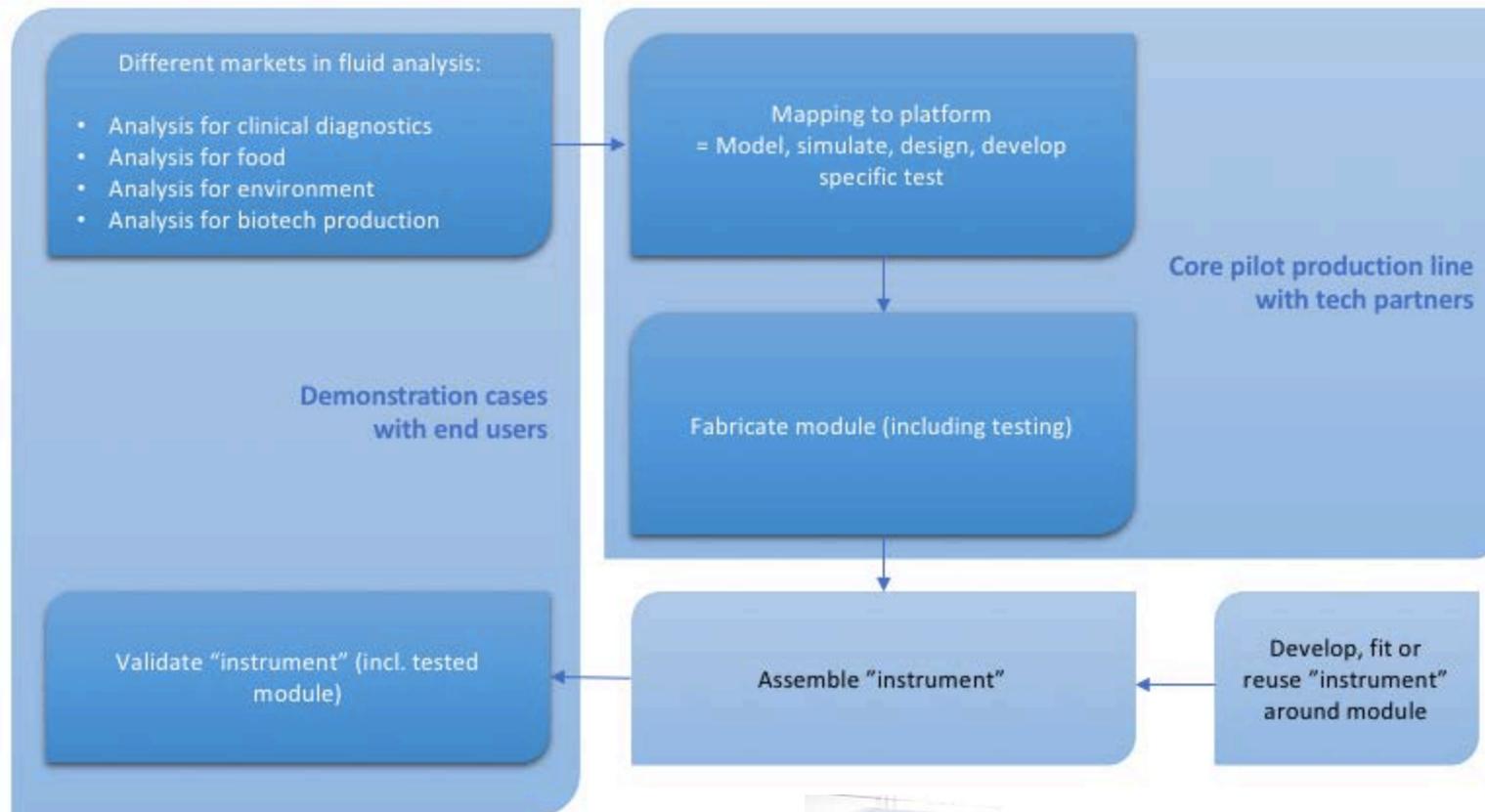
## Hybrid integration effort with high integration complexity & cost



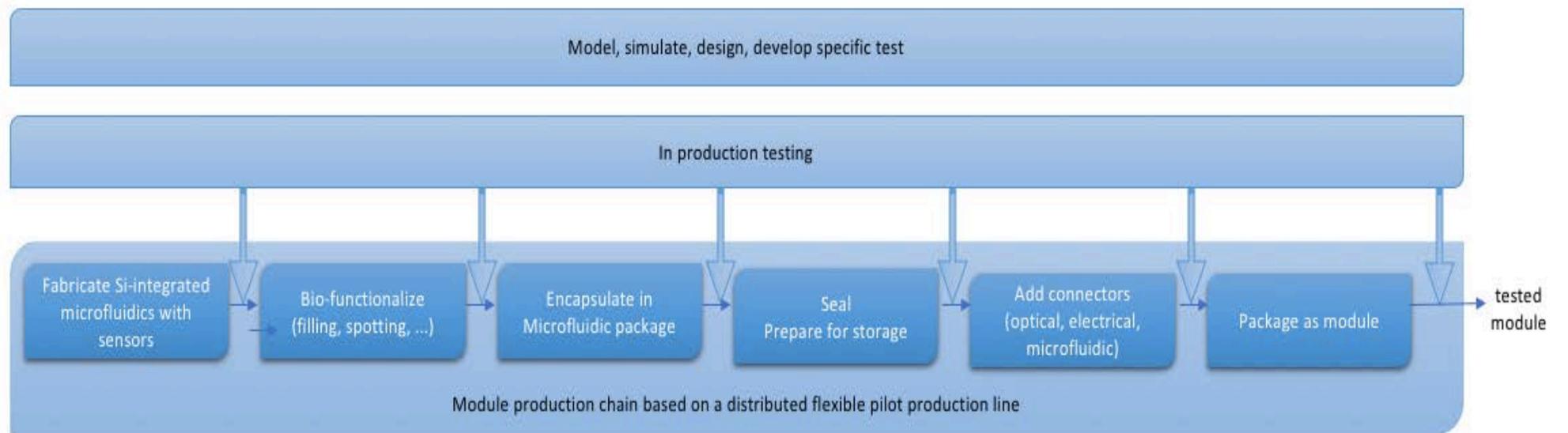
SABIO cartridge

Sohlström, Highly sensitive lab-on-chip for rapid diagnosis, 2010 - SPIE

# Outline demo case concept – demonstration vs product

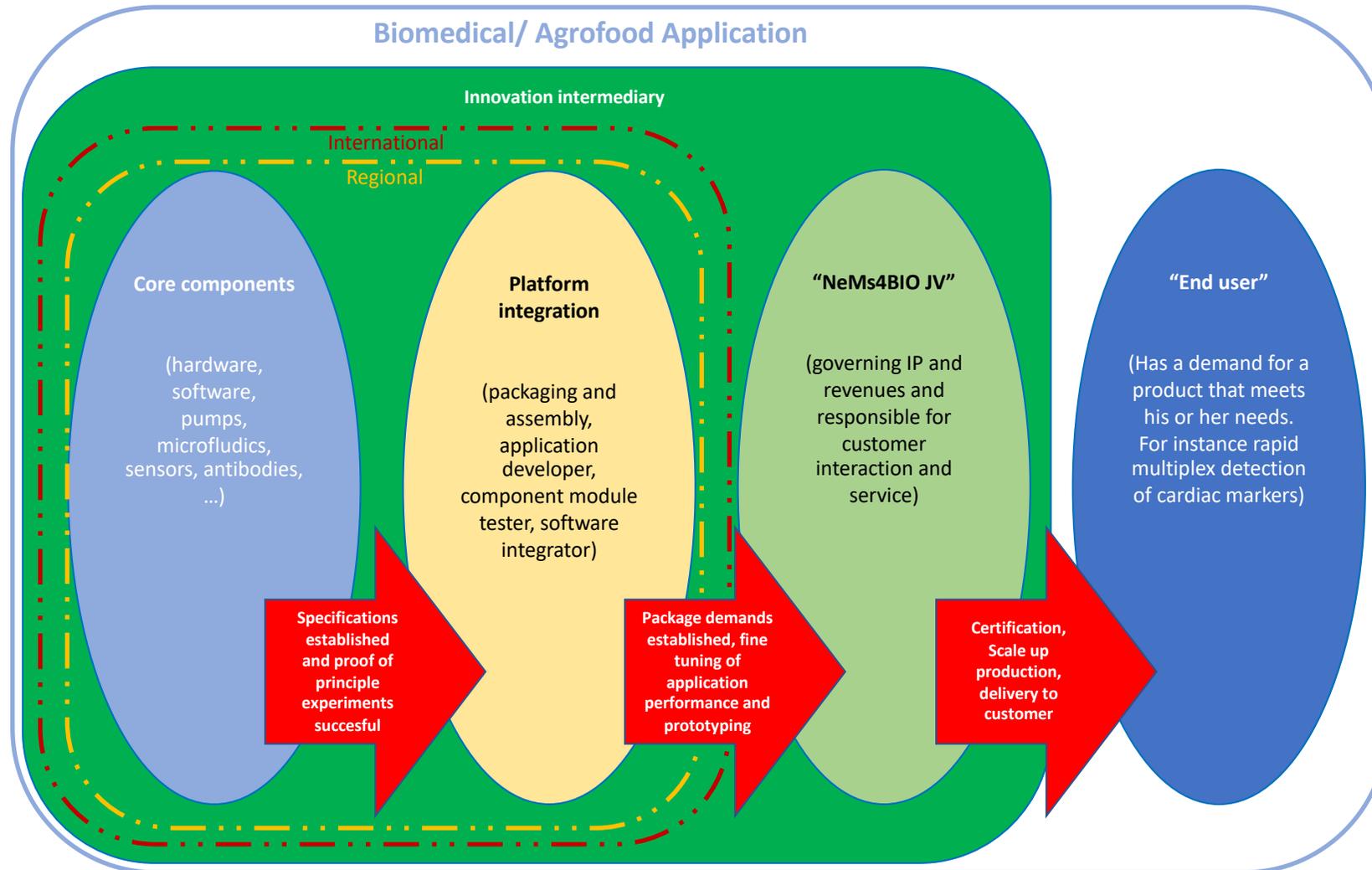


# Detailed view on core pilot production line with technology tasks



Open invitation: Looking for technology contributors.

# The NeMs4Bio business case model



## Advantages for suppliers that build on NeMs4BIO solutions

Access to standardized building blocks and interfacing methods

- Shorter time to delivery and cost-efficient and rapid customizations
- Easier and faster interaction on specifications with the client
- Certification where needed and easier qualification
- Same or more client value at lower costs
- Improved scalability
- Expanded market reach



# NEMS4BIO

Organization chart as OF 2019.10.16

Role	Region		Contact	Contact's organization	Organization type
Lead	<b>Flanders</b>	BE	<b>Wolfgang Eberle</b>	imec	RTO
Co-Lead	<b>East Netherlands</b>	NL	<b>Henri Janssens, Ivan Stojanovic</b>	Oost NL	Investment Agency
Partner region	<b>Emilia Romagna</b>	IT	<b>Fabrizio Ciarmatori</b>	ART-ER	Consortium for innovation, attractiveness and internationalization
			<b>Carlo Augusto Bortolotti</b>	University of Modena and Reggio-Emilia	University
Partner region	<b>Navarra</b>	ES	<b>Begoña Vicente</b>	University of Navarra	University
Partner region	<b>Wallonia</b>	BE	<b>Marc Dechamps</b>	BioWin	Cluster
Interested partner region	<b>North Rhine-Westphalia</b>	DE	<b>Dirk Kalinowski</b>	NMWP.NRW	Cluster
Interested partner region	<b>Auvergne-Rhone Alpes</b>	FR	<b>Julien Balsen</b>	La Région Auvergne-Rhône-Alpes	Region
			<b>Nicolas Verplanck</b>	CEA Leti	RTO
Network partner			<b>Els Van de Velde</b>	IDEA Consult	

## Connections of the NeMs4BIO demo case

- Eco-systems in the participating regions
- European Organ-on-Chip Society
  - Further pursuing efforts from the H2020 ORCHID CSA on standardization, regulatory aspects, use & business cases – [www.h2020-orchid.eu](http://www.h2020-orchid.eu), [www.euroocs.eu](http://www.euroocs.eu)
- ECSEL and follow-up in Horizon Europe
  - Health.E Lighthouse and H2020 HELOS CSA with mission on ECS Technologies for Emerging Medical Domains - Whitepaper and roadmaps under definition – [www.health-lighthouse.eu](http://www.health-lighthouse.eu)
  - Moore4Medical ECSEL project with a.o. a microfluidic platform case – [www.moore4medical.eu](http://www.moore4medical.eu)
- Microfluidics standardization efforts
  - Series of Workshops on Microfluidics Standards; continuing efforts from the MFManufacturing project; a.o. Leti and several European companies have been driving forces;
  - Microfluidics association for standardization continuing efforts from the MFManufacturing project; series of workshops on microfluidics standards – [www.microfluidics-association.org](http://www.microfluidics-association.org)

## Identified challenges

- Funding for cross-regional collaboration partnerships
- Governance model of cross-regional collaboration partnerships

with respect to, in particular

- Adaptation of distributed infrastructures for compatibility
- Standardization
- Contractual flow along the value chain

# Thanks

[www.s3vanguardinitiative.eu](http://www.s3vanguardinitiative.eu)

## Contacts:

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