

# MedPhab

Photonic Medical Devices

Funded by



 PHOTONICS<sup>21</sup>

PHOTONICS PUBLIC PRIVATE PARTNERSHIP



## Medical Applications of Integrated Photonics – MedPhab Pilot Line Use Cases

- 1 – General Information**
- 2 – Technological offer**
- 3 – Success stories**
- 4 – Open calls information**
- 5 - Summary**



## 1 – General Information

## 2 – Technological offer

## 3 – Success stories

## 4 – Open calls information

## 5 - Summary

## First European Photonics Pilot Line dedicated to medical devices

### Mission

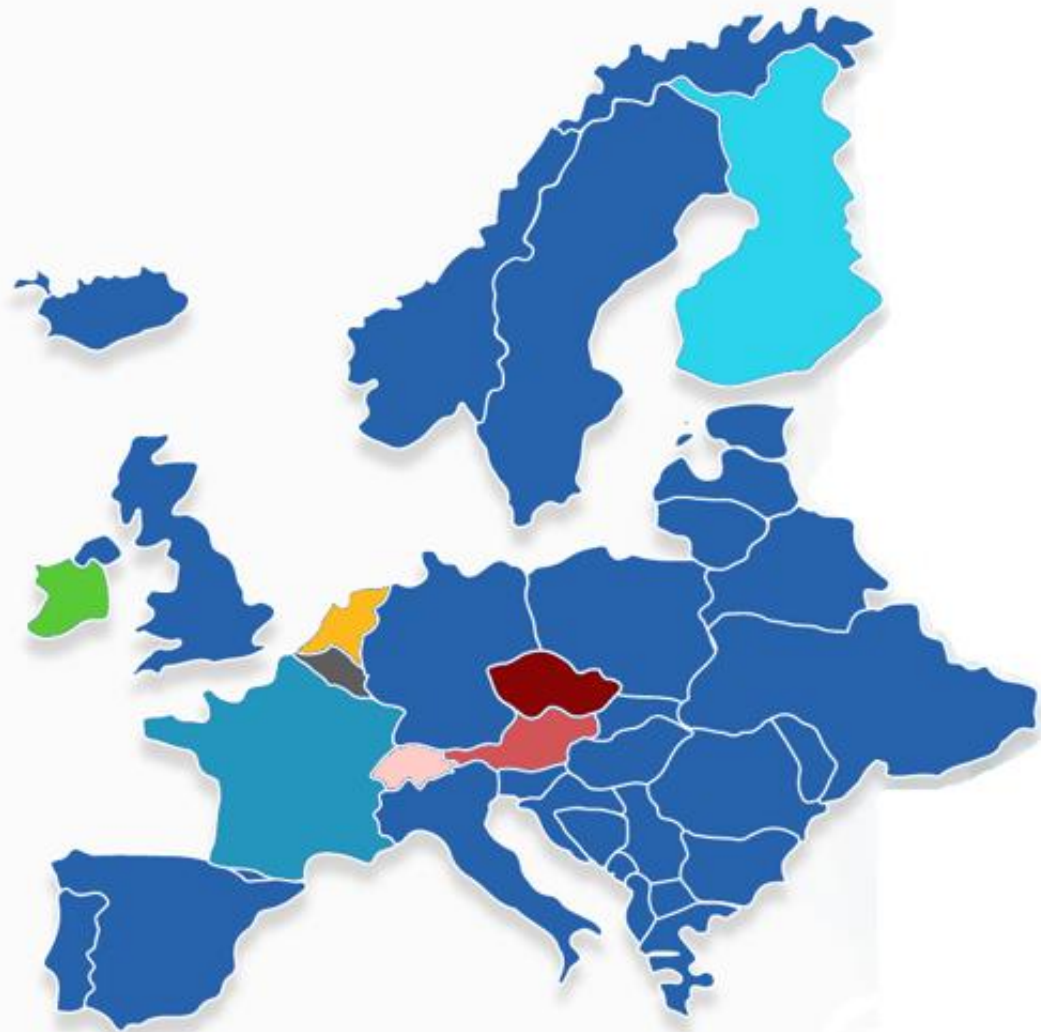
Aimed at reducing R&D costs and accelerating commercialization



### Benefits

- Enable cost effective development from prototype devices to manufacturing
- Several photonics and supportive technologies through a single entry-point
- Early adoption of new photonics technologies
- Develop and support the entire supply chain
- Provide unique training

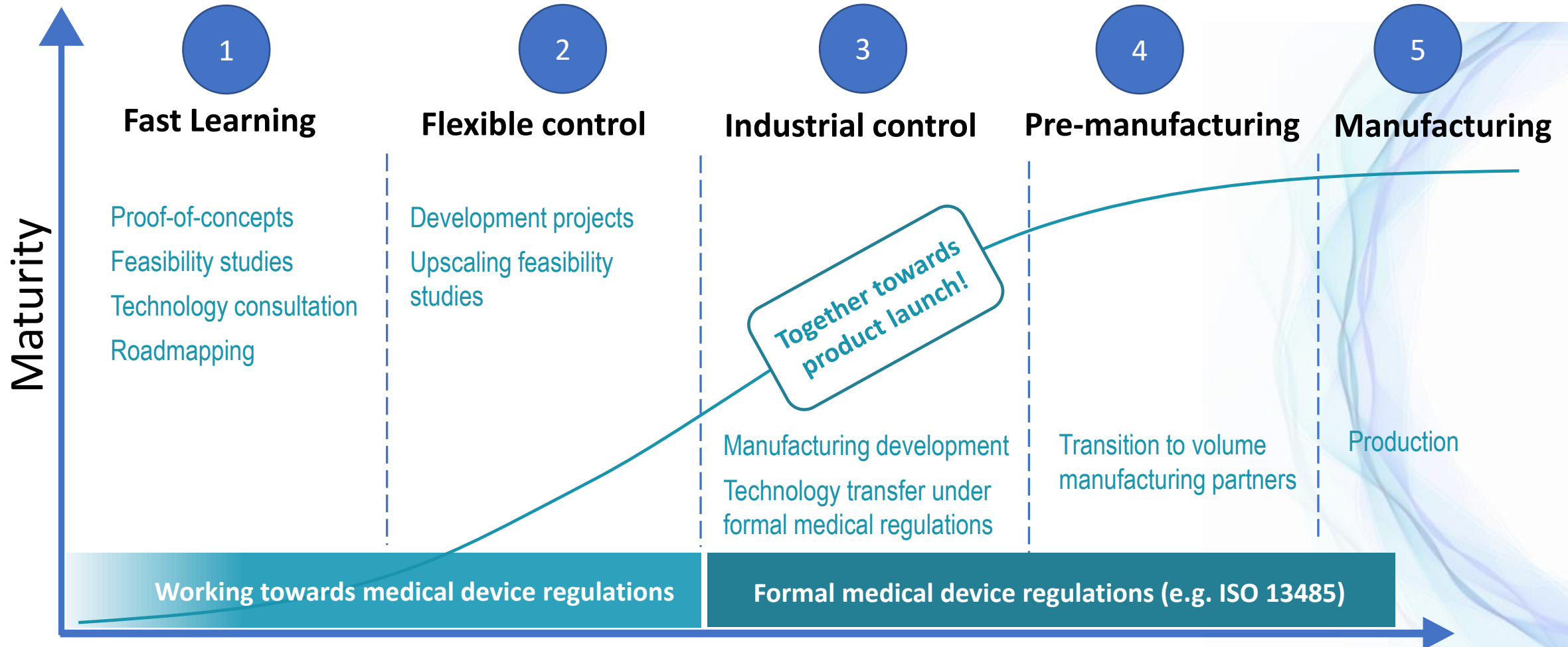
# Project Partners



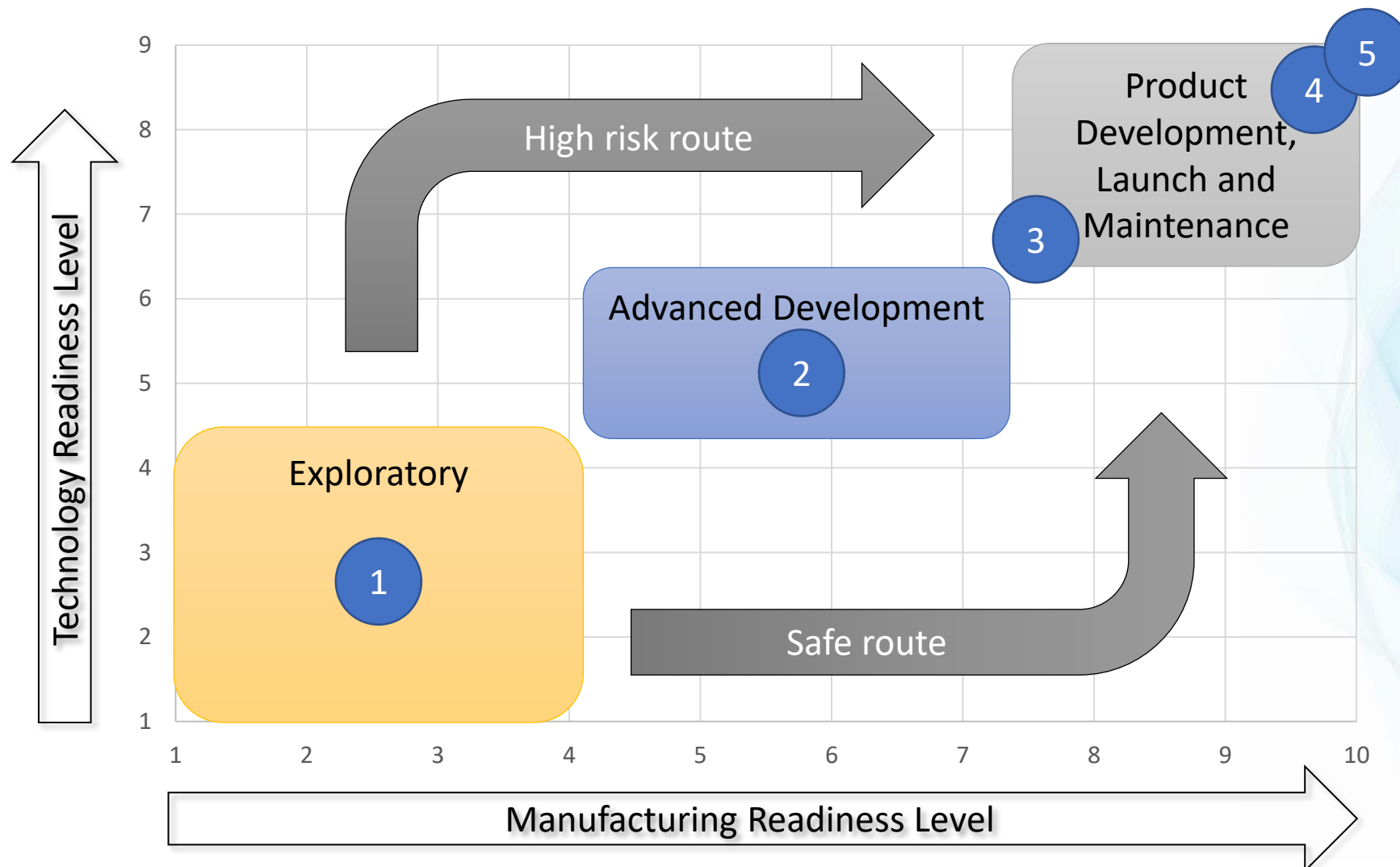
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871345. The presented results reflect only the author's view. The EU is not responsible for any use that may be made of the information it contains. [www.photonics21.org](http://www.photonics21.org)



# Single entry point across the whole development chain



# Innovation Maturity – Product vs. Process





## Hospital Use

---



Medical Professionals

Fiber optic modules



## Home Care Diagnostics Services

---



Citizens jointly with professionals

Miniaturized modules for wearables



## Equipment for Chemical Diagnostics

---



Professionals in laboratories

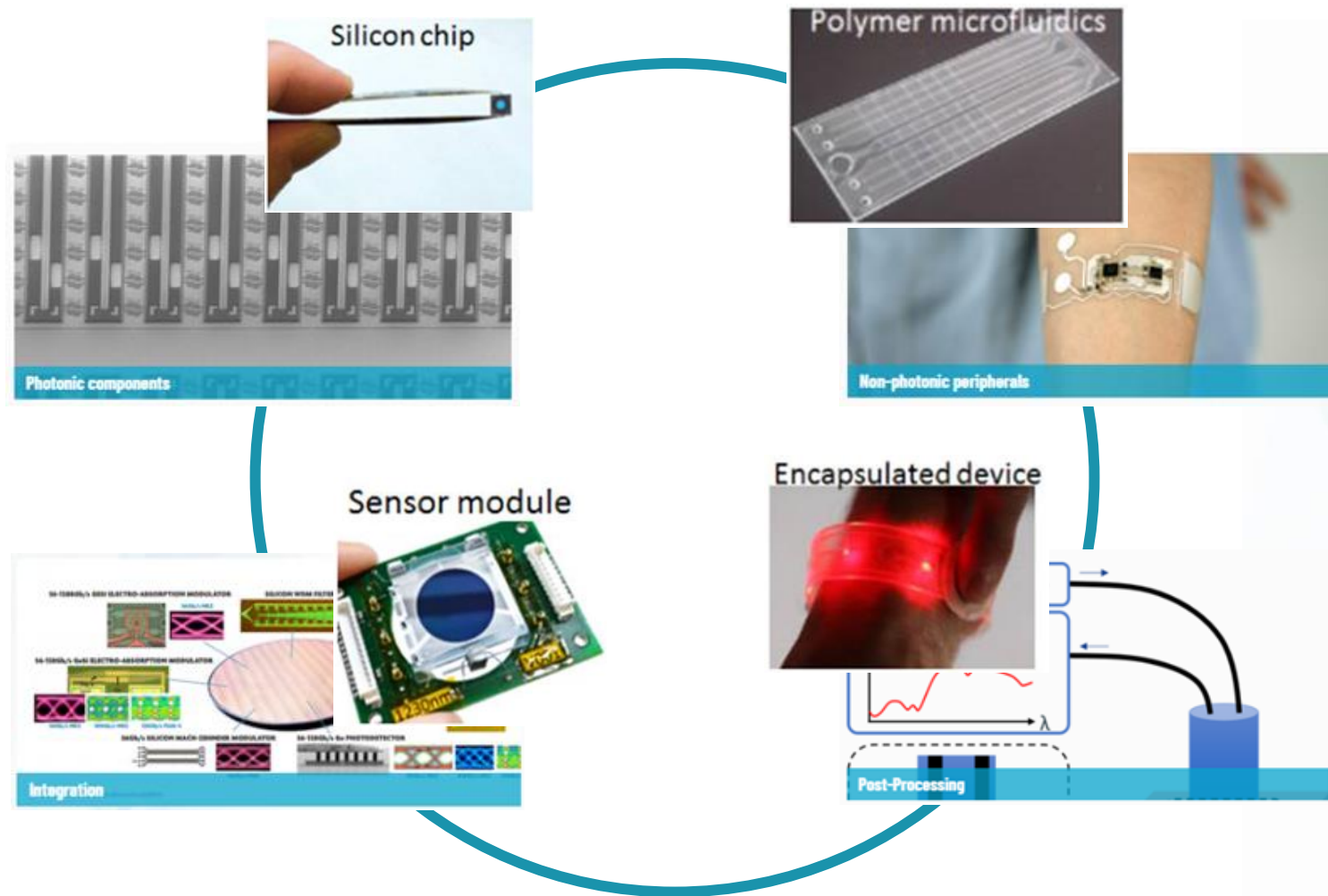
Disposable microfluidic cartridges  
Reader units



- 1 – General Information
- 2 – Technological offer**
- 3 – Success stories
- 4 – Open calls information
- 5 - Summary



# Technologies Overview



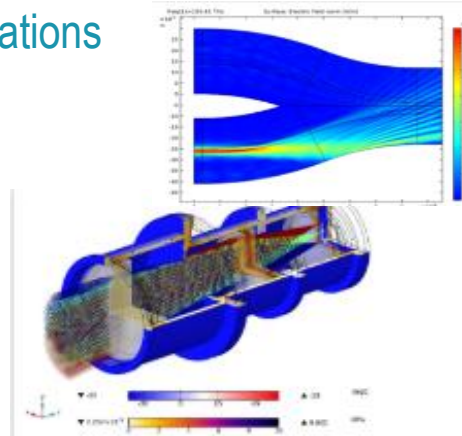
Integrated optics  
Micro-optics  
Fiber optics  
Lasers

Electronics  
Opto-mechanics  
Microfluidics

Waveguide coupling  
Assembly  
Surface functionalization

Hermetic sealing  
Over molding  
Opto-fluidic interfacing

Optical / elements simulations  
Thermal simulations  
Mechanical simulations  
Microfluidic simulations



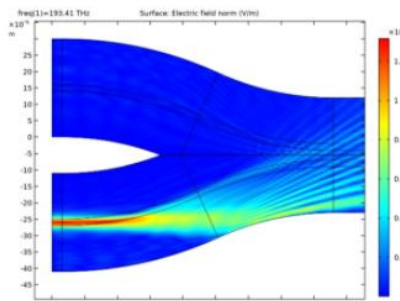
Functional design / Interface design  
PCB design / Module design  
Microfluidics / Mechanical design  
Free-space optics (systems)  
PICs / Optical elements



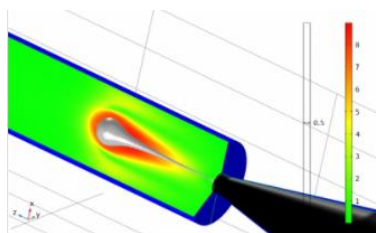
Analyze, measure, characterize  
(e.g.) microfluidics  
Optical, electronics, mechanics  
Realization & prototyping, new  
product introduction  
Supply chain management &  
sourcing

# From proof-of-concept to product

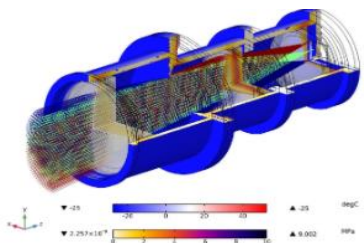
## SIMULATION & MODELLING



Optical simulation



Computational fluid dynamics (CFD)

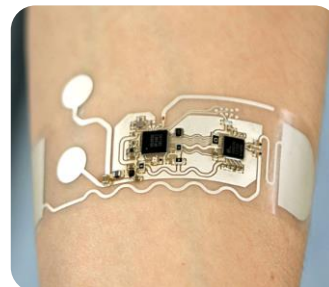


Mechanical simulation

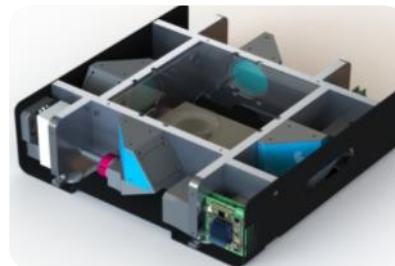
## PROTOTYPING



Integrated lab-on-chip devices



Electronics



Free-space optics

## DESIGN FOR MANUFACTURE & PILOT FABRICATION



Mobile optical reader + disposables



Roll-to-roll pilot manufacturing

## Development of Multiplex $\mu$ ELISA for Point Of Care Testing

- based on patented GENSPEED platform technology

### Product-areas:

- GENSPEED as OEM platform technology for customers
- Chair-side tests for fast detection of key pathogens in periodontitis at the dentist's office
- Multiplex Immunoassay Test-Portfolio for POC application in pharmacies/doctor's offices
- Rapid tests for detection of nosocomial infections



GENSPEED  
BIOTECH



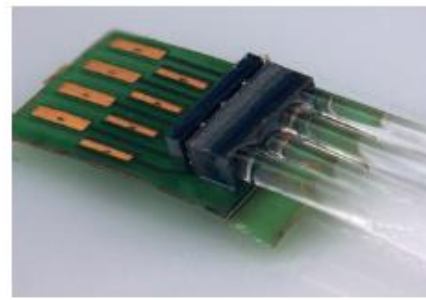
## Flex2Rigid MEMS at 6" wafer node, volume manufacturing

### Characteristics:

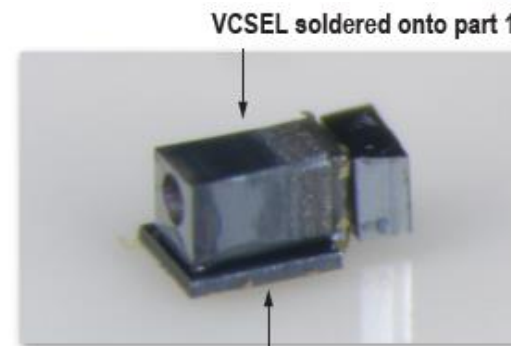
- Optical alignment / connection to fiber
- Passive fibre alignment with accuracy of MEMS process
- Electrical connection between Si parts
- Foldable
- Direct electrical connection to substrate



Fiber aligned to VCSEL and bonded

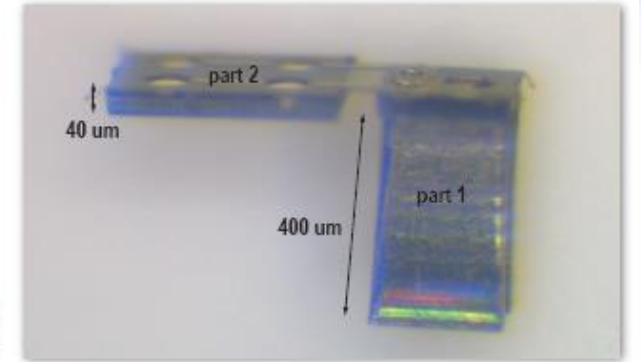


4-fold alignment and integration



Part 2 folded and bonded to part 1

Cut from wafer  
pre folded component

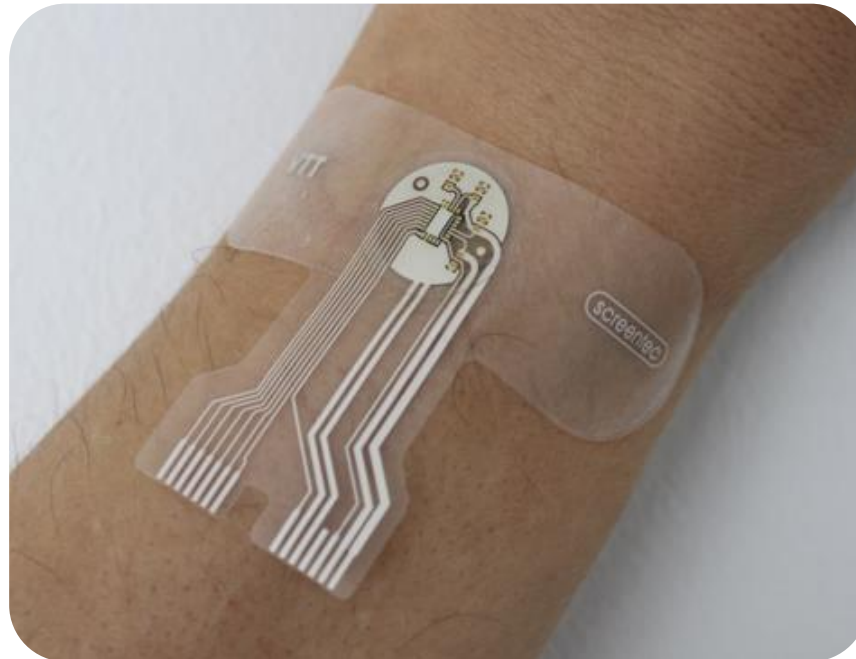


PHILIPS

## Heart rate skin patch sensor

### Description:

- Skin-conformable, non-invasive PPG sensor to track your heartbeat during the day.



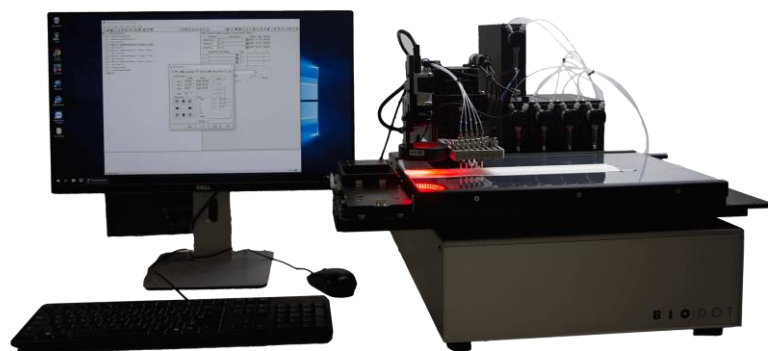
- 1 – General Information
- 2 – Technological offer
- 3 – Success stories**
- 4 – Open calls information
- 5 - Summary



# Multiplexing biosensor arrays in silicon photonics technology

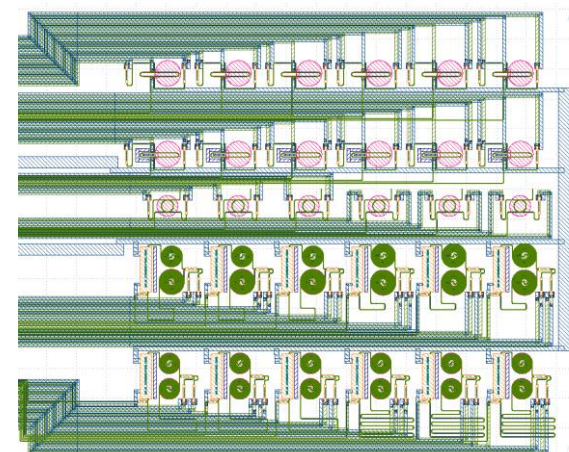
Objective: To demonstrate on-chip modulation for multiplexing SiPh biosensor arrays

MedPhab's role: Involvement in designing and characterization of SiPh chips



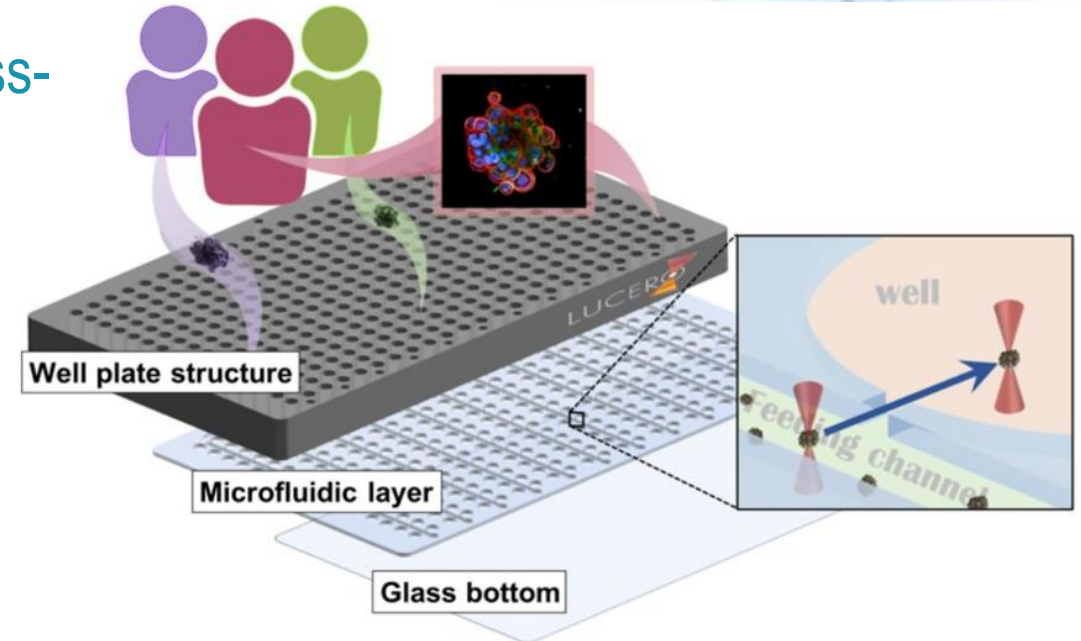
Each sensor can be independently functionalized to be selectively sensitive to a particular analyte.

30-sensor matrix, all individually selectable



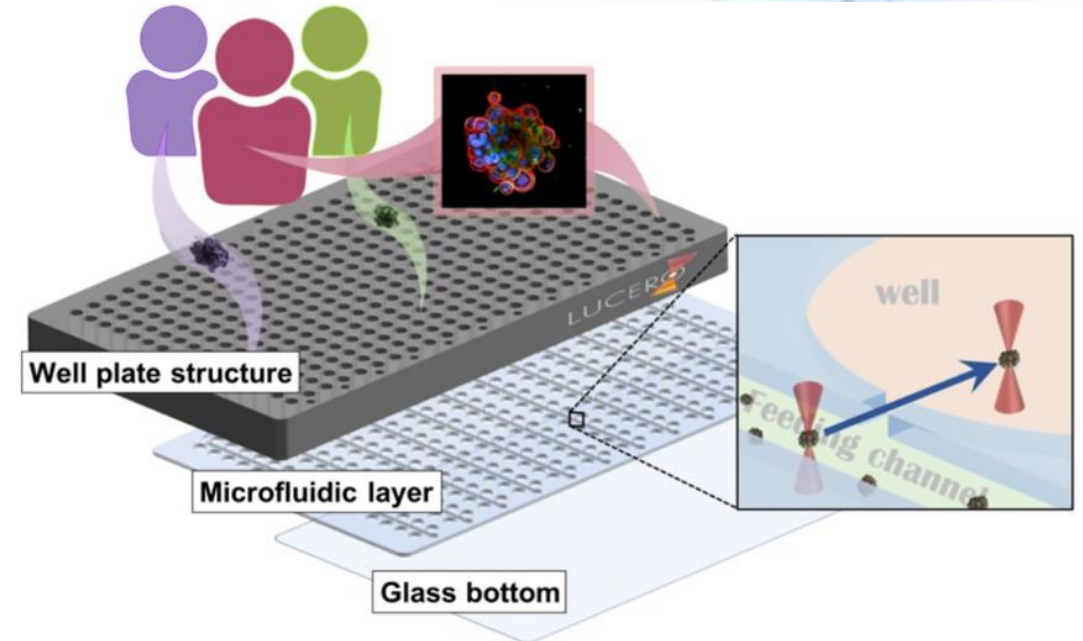
## Technological challenges

- Transition from hand-molded microfluidic chips to mass-producible well plate structures
- Provide customer-specific micromanipulation tools for high-throughput drug screening
- Comply with the industrial standards



## Project Goals

- Develop a roll-to-roll procedure to enable the automatic fabrication and bonding of a multi-layer system within a commercial well-plate structure
- Implement selected biocompatible materials that fulfill the specific requirements of the customer's cell cultures
- Enable specific, accurate and fast isolation of single cell models in a completely automatic manner



- 1 – General Information
- 2 – Technological offer
- 3 – Success stories
- 4 – Open calls information**
- 5 - Summary

# Open calls: Who can apply

Type of company	Staff headcount	(and) Turnover	(and/or) Balance sheet total
<b>Mid-cap</b>	< 3,000	N.A.	N.A.
<b>SME</b>	<b>Medium-sized</b>	< 250	≤ € 50 M
	<b>Small</b>	< 50	≤ € 10 M
	<b>Micro</b>	< 10	≤ € 2 M

The **Maximum EU-contribution** for a Demo case is **up to 125 k€**:

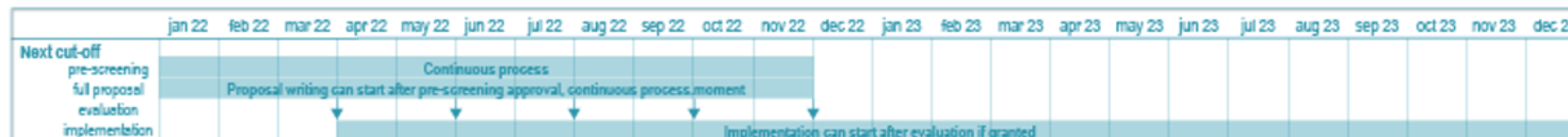
EU-contribution	Support for MedPhab services (via EU-demo case budget)	YOUR in-cash contribution
SME (EU-based)	75%	25%
Large company (EU-based)	50%	50%

# Open calls: How to apply

What



When



# Open calls: How to apply

What



When



- 1 – General Information
- 2 – Technological offer
- 3 – Success stories
- 4 – Open calls information
- 5 - Summary**





- MedPhab serves as Europe's first Pilot Line dedicated to manufacturing, testing, validation and up-scaling of new photonics technologies for medical diagnostics.
- The purpose of MedPhab pilot production line is to accelerate the commercialisation of diagnostic devices and instruments for treatment based on photonics, and to reduce the R&D costs.
- MedPhab is launching an Open Call for external companies developing medical products. The objective of the Open Call is to provide technology development services for the companies that are adopting advanced photonics technologies in the medical diagnostics solutions.