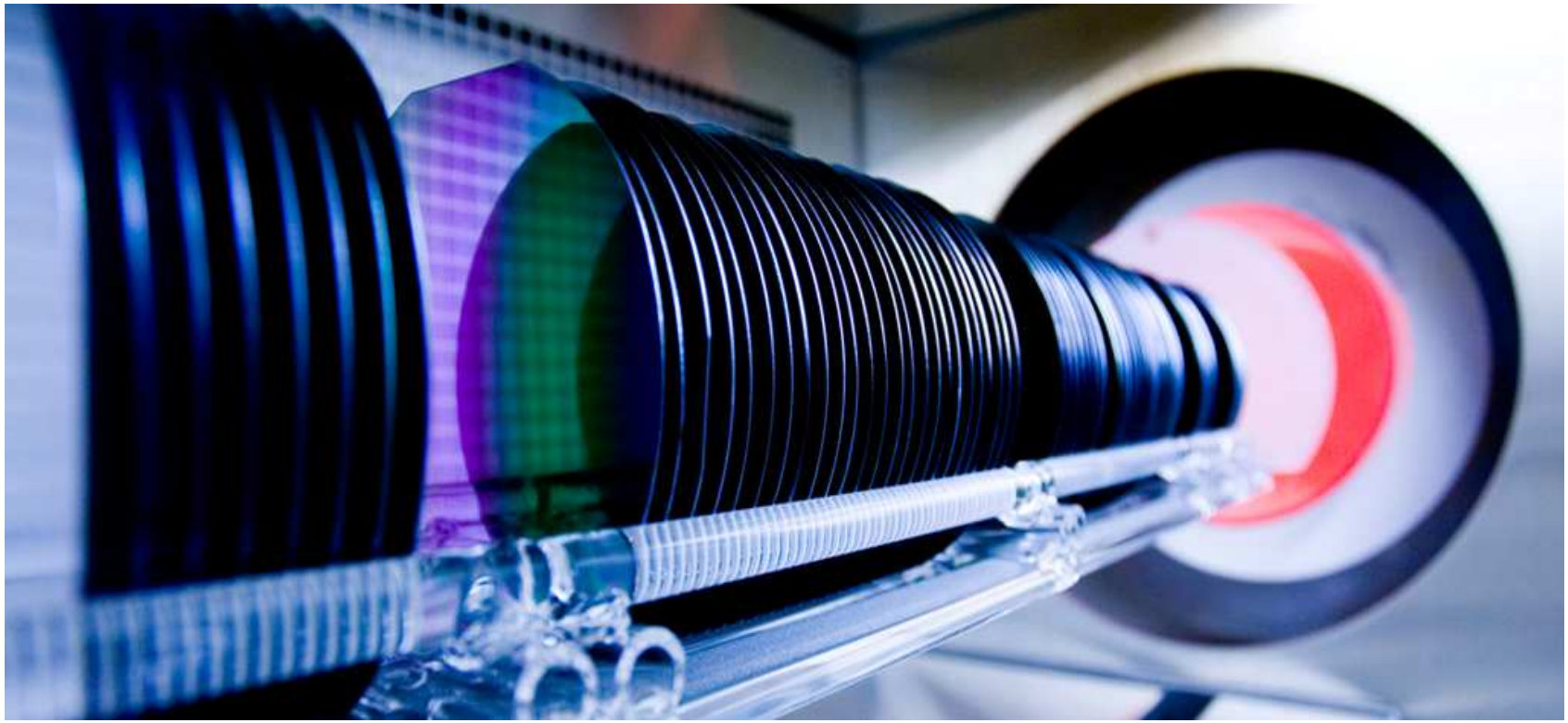

Technologische Plattformen der Mikrosystemtechnik für die schnellere wirtschaftliche Wirksamkeit von Ergebnissen der Grundlagen- und angewandten Vorlaufforschung

Technology platforms of microsystems technology– a key for results of basic research featuring fast economic efficiency

A.Steinke, A.Albrecht, O.Brodersen, Th.Ortlepp

Forschungsinstitut für Mikrosensorik und Photovoltaik GmbH

18. Leibnizkonferenz "Sensorsysteme 2014" 16.-17.10.2014, Lichtenwalde

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- Product driven technology platform – present and future
- Summary

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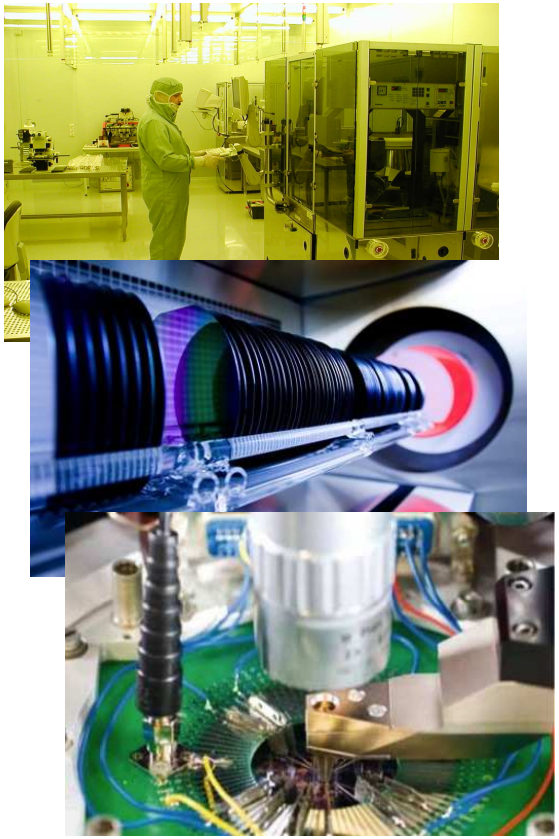
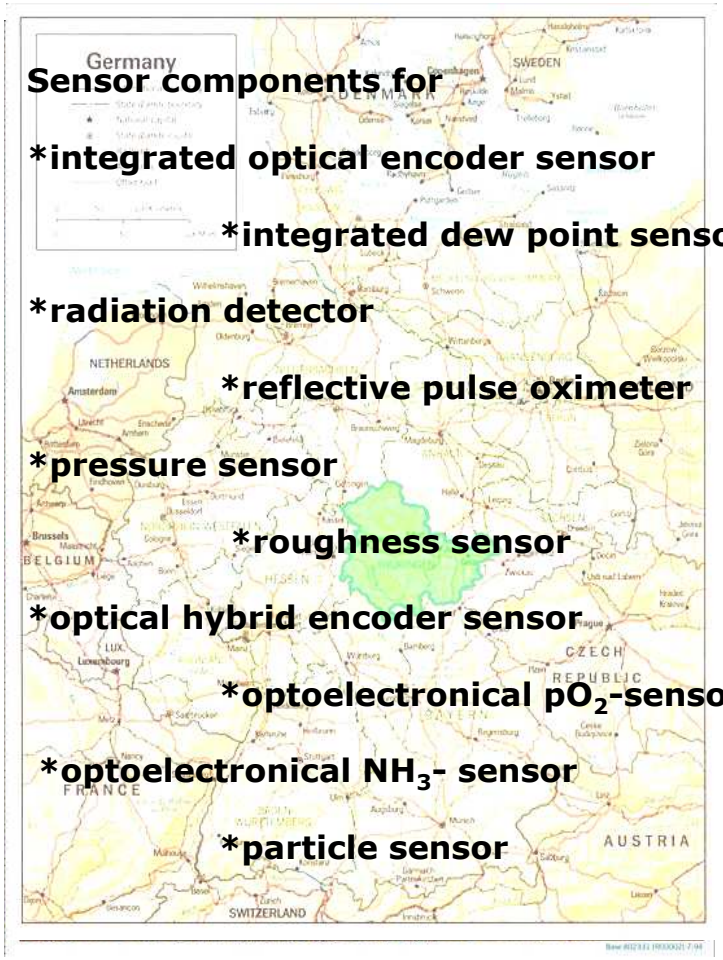
- CiS practical experiences -





Sensor components for

***integrated optical encoder sensor**

***integrated dew point sensor**

***radiation detector**

***reflective pulse oximeter**

***pressure sensor**

***roughness sensor**

***optical hybrid encoder sensor**

***optoelectronical pO_2-sensor**

***optoelectronical NH_3- sensor**

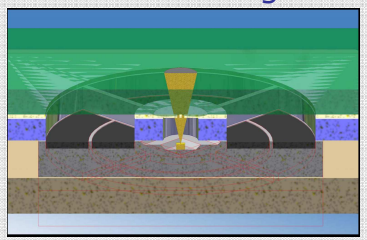
***particle sensor**

0 CiS at a glance – experiences with microsystem based innovation

Business Unit amos: MORES® Technology platform

Particle Sensors

- Measurement of particle concentration in fluidics
- Customer specific solutions
- Simulation and design

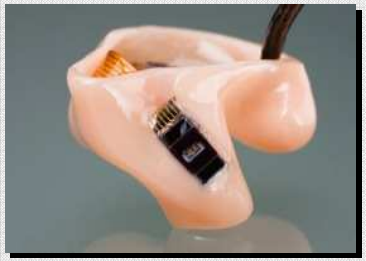


Levelling Sensors

- Levelling for balances
- +/- 10° accuracy for levelling
- Customer specific solution

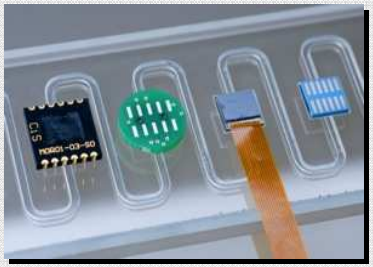
Life Science Sensors

- Monitoring of cardiovascular parameters
- Customer specific solutions
- Simulation and design



Fluorescence Sensors

- Biological and chemical sensors
- Measurement in micro fluidic systems
- Customer specific solution

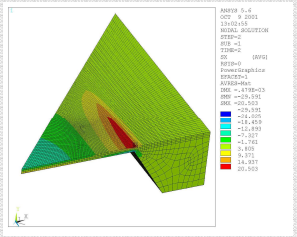


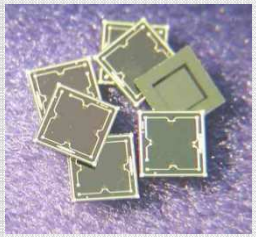
0 CiS at a glance – experiences with microsystem based innovation

Business Unit MEMS: piezoresistive & impedimetric platform

Piezoresistive Sensors

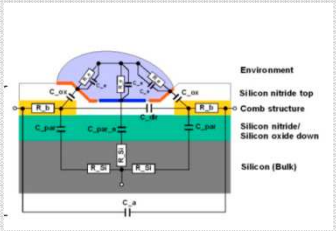
- High stability pressure sensors
- Customer specific solutions
- Simulation and design





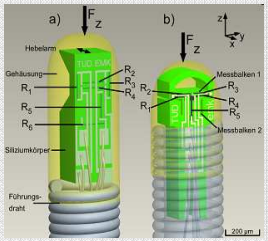
Impedimetric Sensors

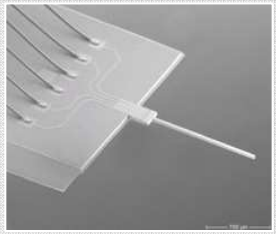
- Micro condensation / Dew point sensors
- sensitive layer based sensors
- in-line micro fluidic sensors

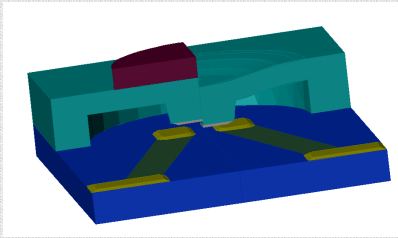


Micro mechanical Components / Modules

- Cantilever, probe tips, force sensors
- Bi-stable zero power sensors





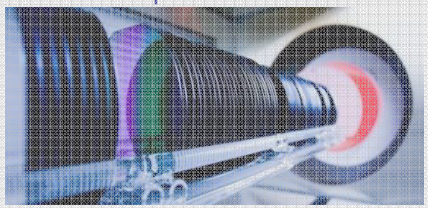
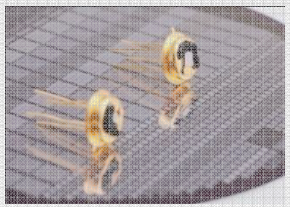


0 CiS at a glance – experiences with microsystem based innovation

Business Unit: Silicon Detectors

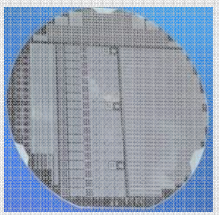
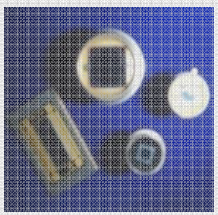
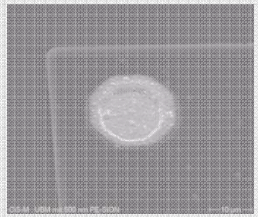
Silicon-Photodiodes

- planar photodiodes and photodiode arrays: custom specific geometry / layout and housing
- Silicon-Photomultiplier
- Avalanche Photodiodes, Geiger-Mode-APD
- On-chip Filter

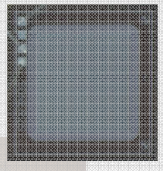
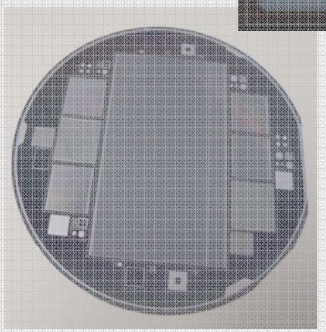



Additional Services

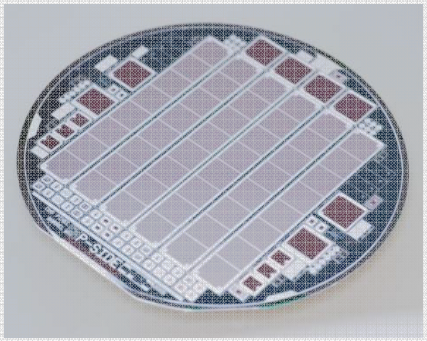
- Multi-Project-Wafer Services
- Device and defect analysis
- Under-Bump-Metallization, coating & plating, Through-Silicon Vias

Radiation and Particle Detection

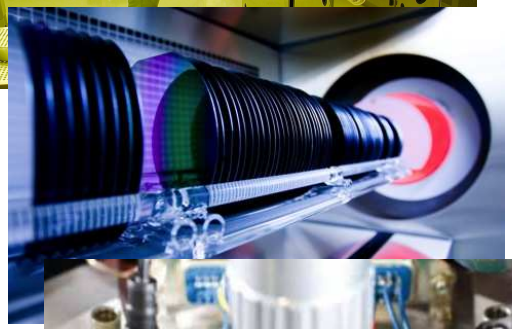



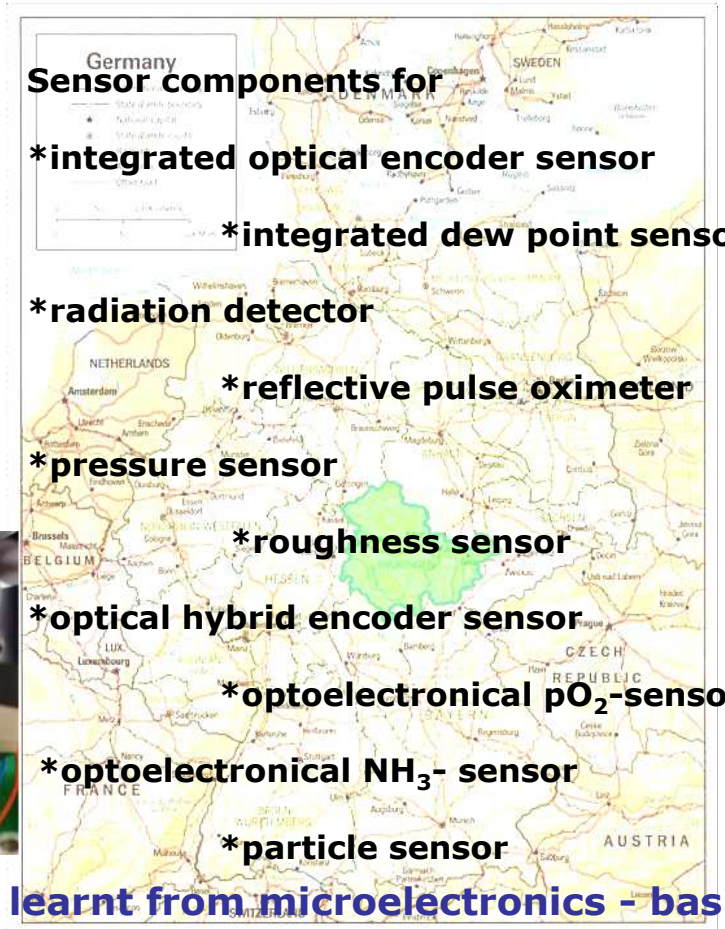
- large area Micro-strip detector chips
- Pixel detector chips
- Thin detectors
- detection of high energy and cosmic radiation
- detection of low light flux and scintillator pulses
- detection of alpha, beta and gamma radiation
- X-ray detection
- instrumentation for high-energy and space astrophysics,
- nuclear medicine, nuclear safety, security, environment, material science



0 CiS at a glance – experiences with microsystem based innovation

- CiS practical experiences -





Sensor components for

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***radiation detector**

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***optical hybrid encoder sensor**

***optoelectronical pO_2-sensor**

***optoelectronical NH_3- sensor**

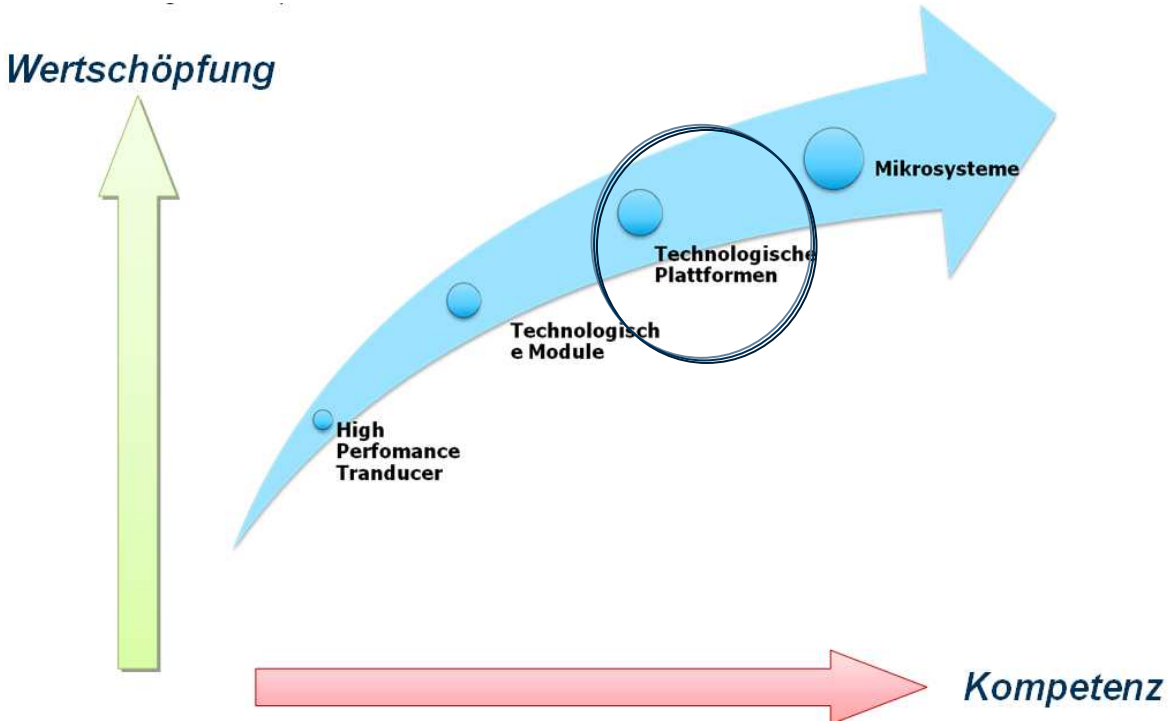
***particle sensor**

Most important demands
of our customers
SMEs and larger enterprises:

- High performance parameters
- Low volume/low cost
- Innovation in system components
- Fast market entrance

Solution ? **lessons learnt from microelectronics - basic technologies *(platform)***
- step-by-step *(innovation)*
- shorter cycles *(„1,5" years)*

0 CiS at a glance – experiences with micro system based innovation



Content

0 CiS at a glance – experiences with microsystem based product innovation

1 Open technology platform – common denominator for market demand and economic efficiency of R&D

- Product driven technology platform – present and future
- Summary

1 Open technological platforms common denominator

What are our SMEs looking for?

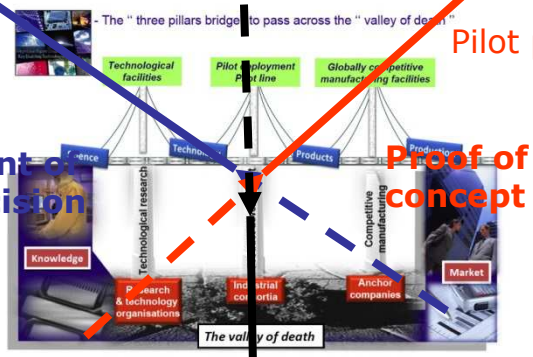
Time-to-Market

- **Reduced risk**
- **Transparency of cost**
- **Road Map available**

Mass production

- **Feasibility**
- **Compatibility**
- **stem integrativeness**

Pilot productio



Point-of-decision

Proof of concept

Platform

- **Non exotic technology**
- **Confidence**
- **„Second source"**

Customer specific diversity

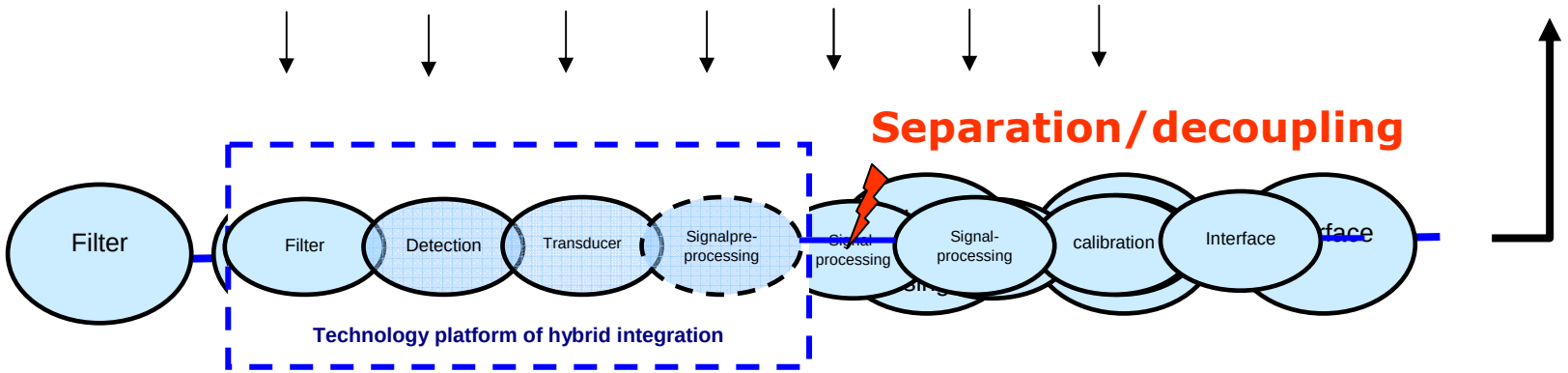
Contrary to MEMs law: one process, one product, one technology

1 Open technological platforms common denominator

Open for

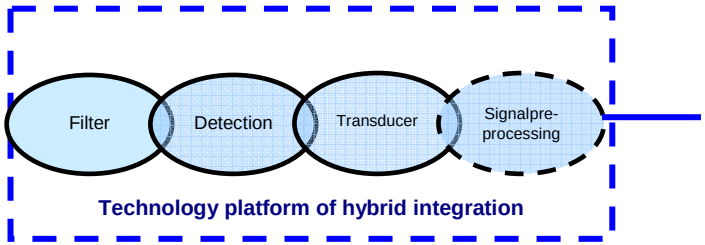
High temperature
High humidity
Contaminated air
Polluted condensate
High pressure
Corrosive liquids
UV irridiation
.....

Higher selectivity
Higher sensitivity
Higher long term accuracy
Higher reliability



1 Open technological platforms common denominator

Open for

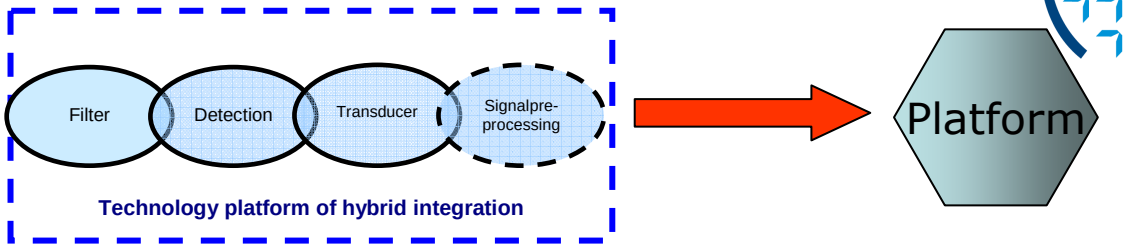


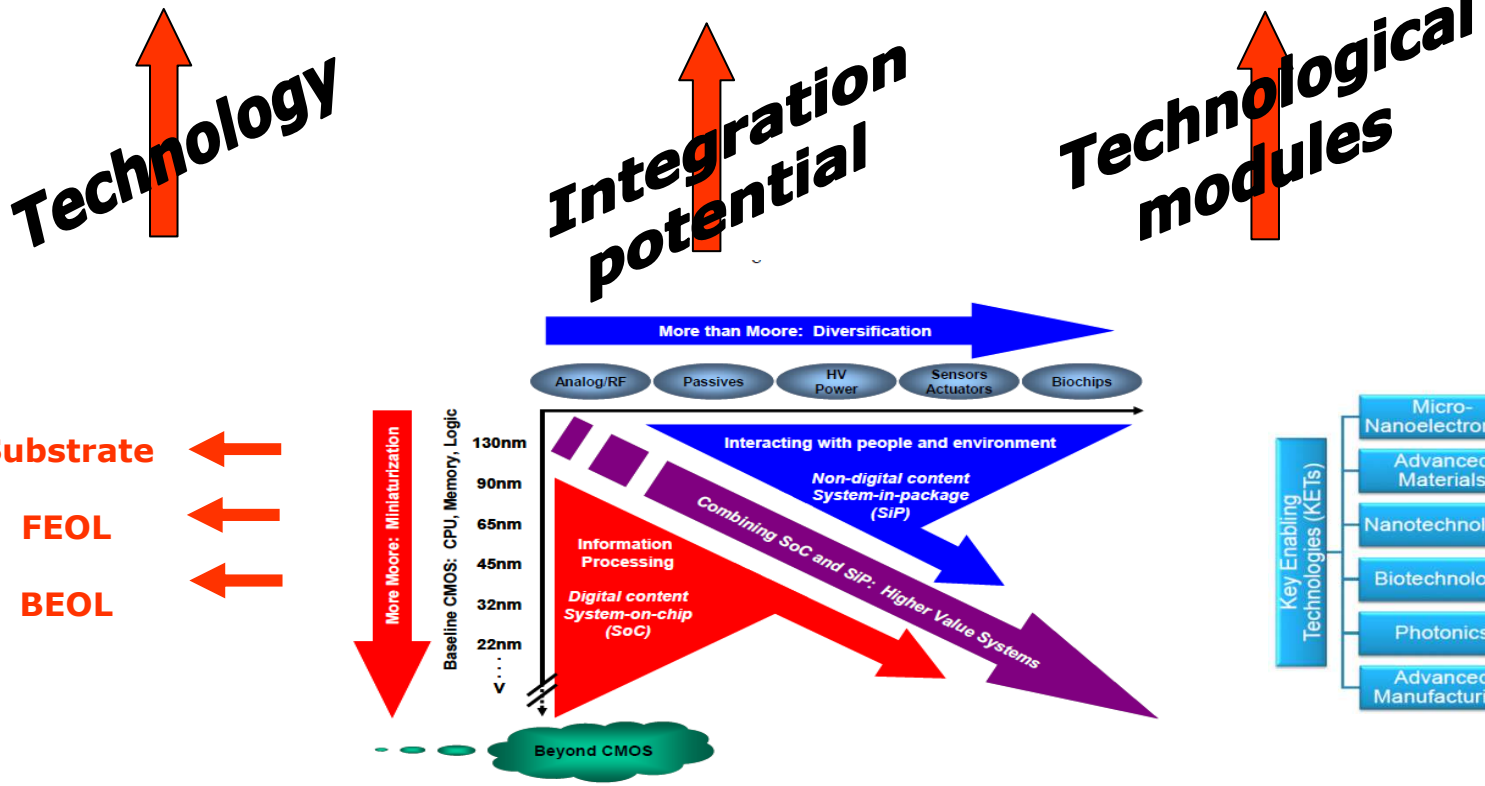
Selected areas of basic research

Technology module:	Technology module:	Technology module:	Technology module:
Membran	Passivation	Lowered bond pads	ChipinChip
Functional layers	Planarization	ThroughSiliconVias	SiP
Selective housing	Nano protective stuctures	MESA- Structure	……
Sensitive nano layers	3D- IDE	Anodic Bonding	
Sensitive nano surfaces	ITO	SiliconFusionBonding	
incl. Selective filter	Antireflection	BackSideContact	
……	……	……	

1 Open technological platforms common denominator

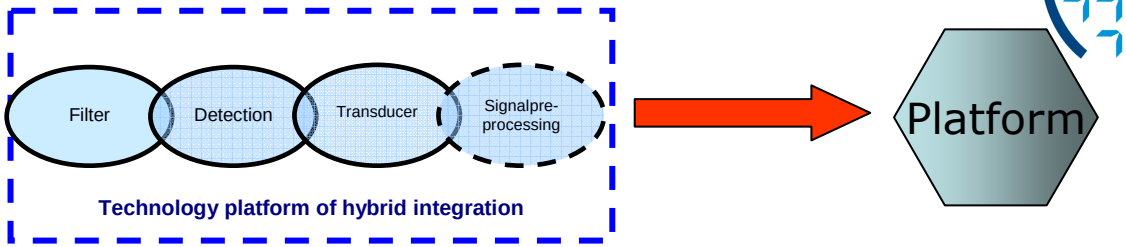
Open for





1 Open technological platforms common denominator

Open for



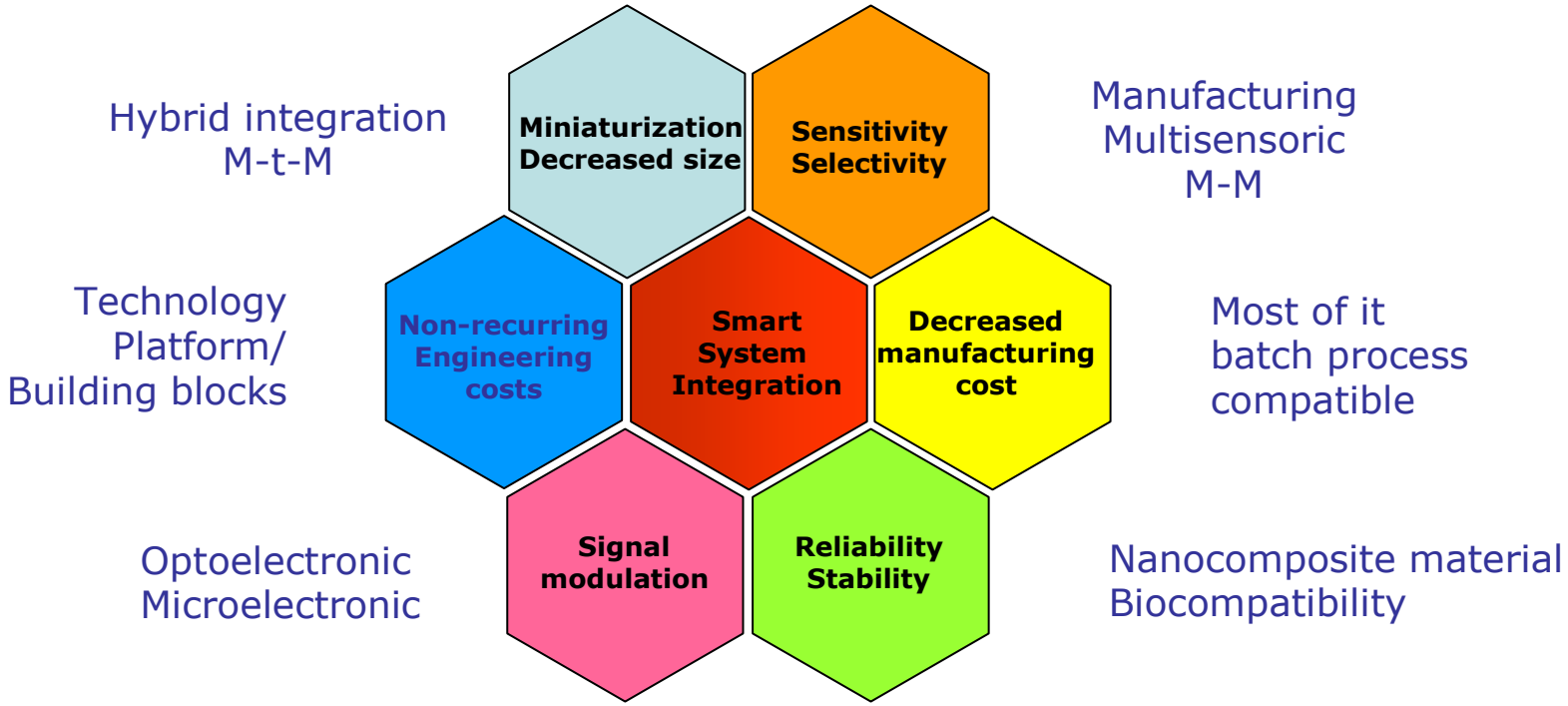
- ICP
- SFB
- AB
- UBM
- ALD
- SiC
- .....

- Integration of different transducers
- Integration of transducer arrays
- Error compensated transducer signal
- Integrated and decoupled transducer
- .....

- TSV
- Lowered bond pads
- Chip-in-chip
- MCM
- .....

1 Open technological platforms common denominator

To bring all these needs under one roof



Integration of knowledge from different disciplines necessary

Content

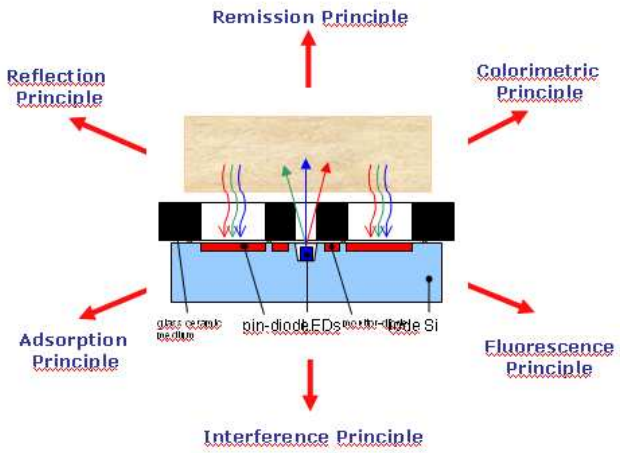
0 CiS at a glance – experiences with microsystem based product innovation

1 Open technology platform – common denominator for market demand and economic efficiency of R&D

- **Product driven technology platform – present and future**
- Summary

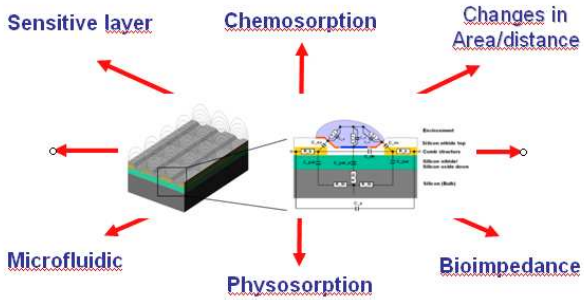
2 Product driven technology platform – present and future

MORES™
microoptical
remission sensor



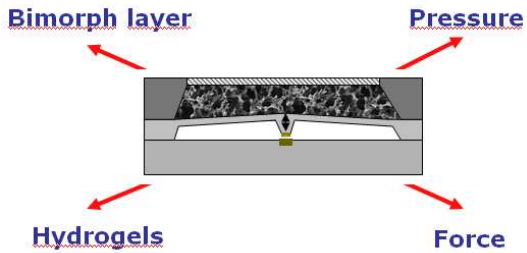
Example:
Levelling sensor

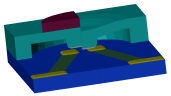
CCC™
condensate controlled
capacitance



Example:
Dew point sensor

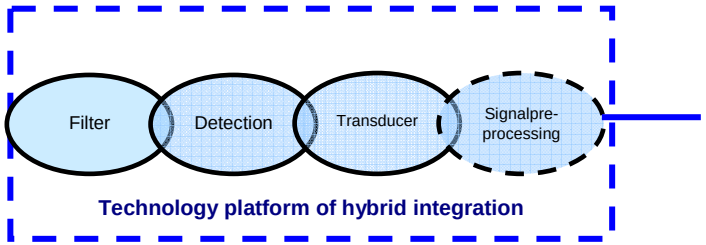
BiZEPS™
bistable zero power
sensor





Example:
Hygrostat

2 Product driven technology platform – present and future



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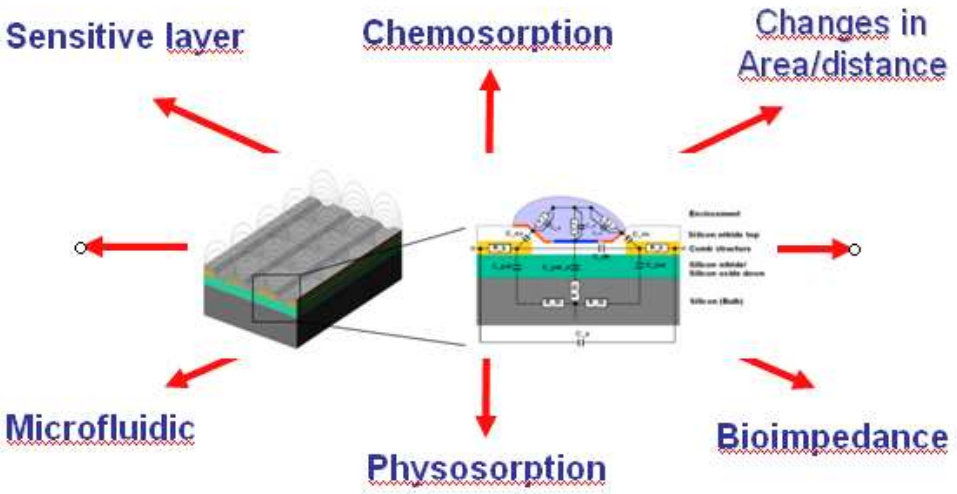

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Dew point sensor

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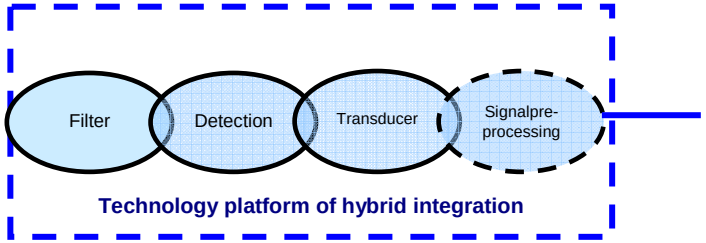

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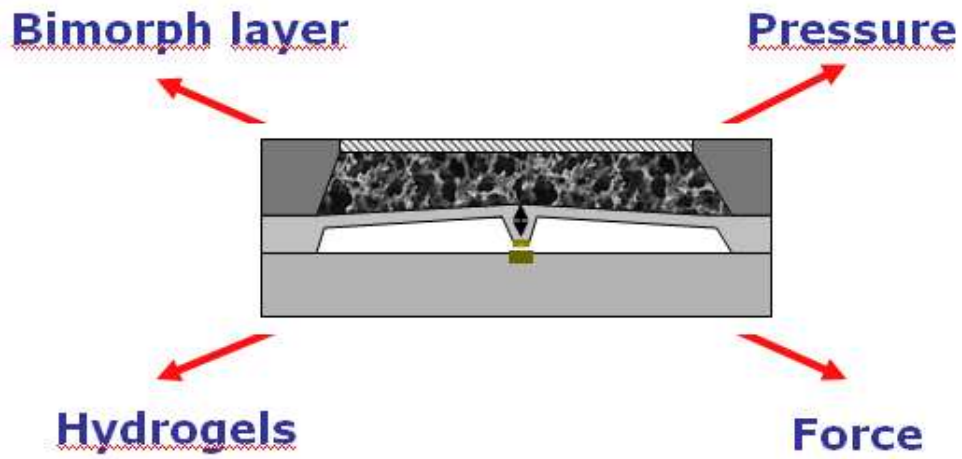
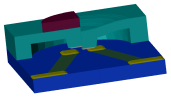
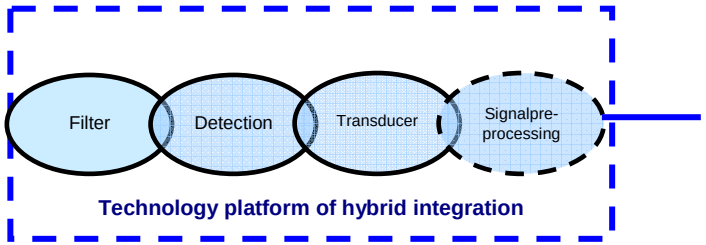




Example:
Hygrostat

2 Product driven technology platform – present and future



MORES™
microoptical
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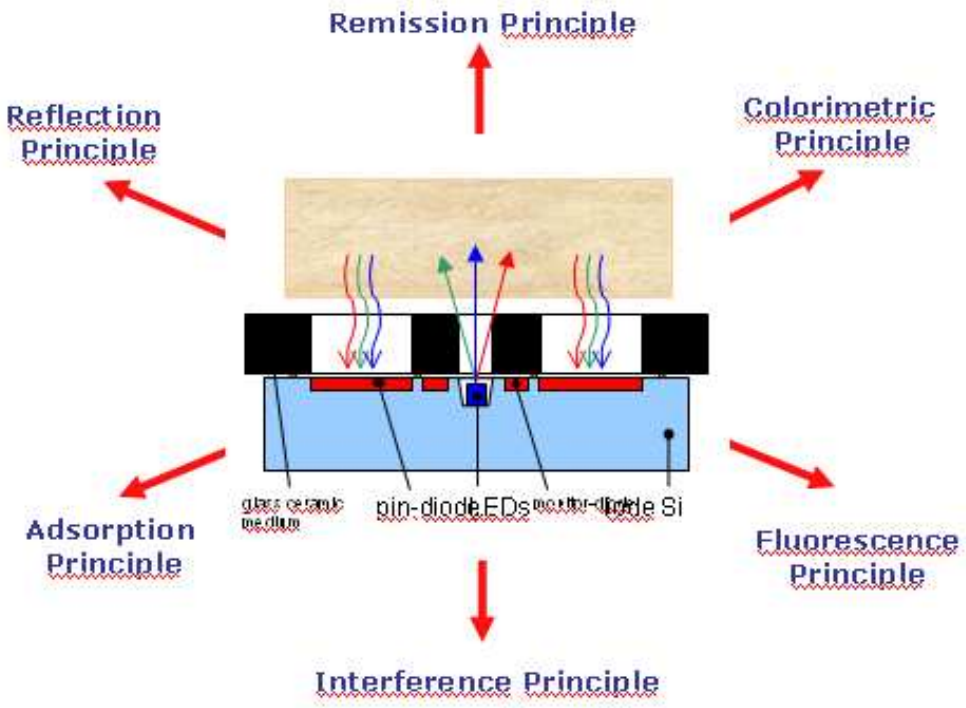
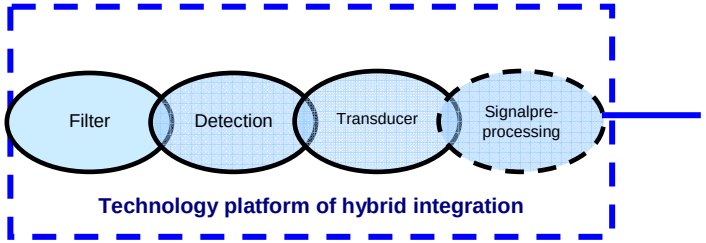
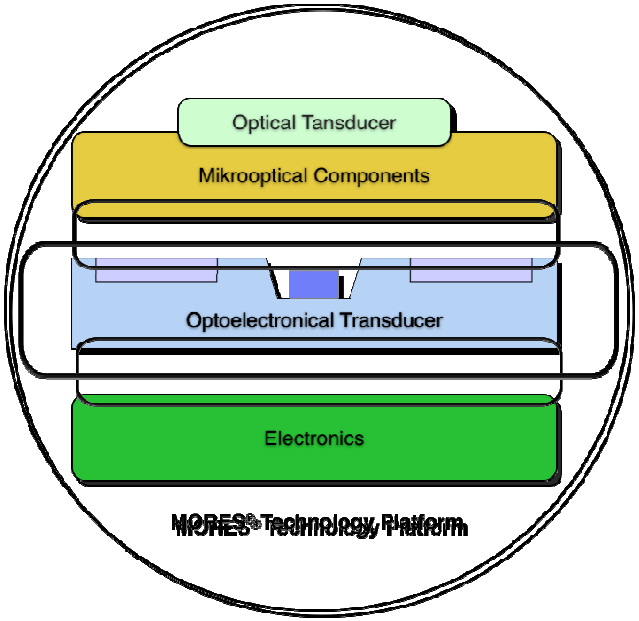


Example:
Levelling sensor

2 Product driven technology platform – present and future



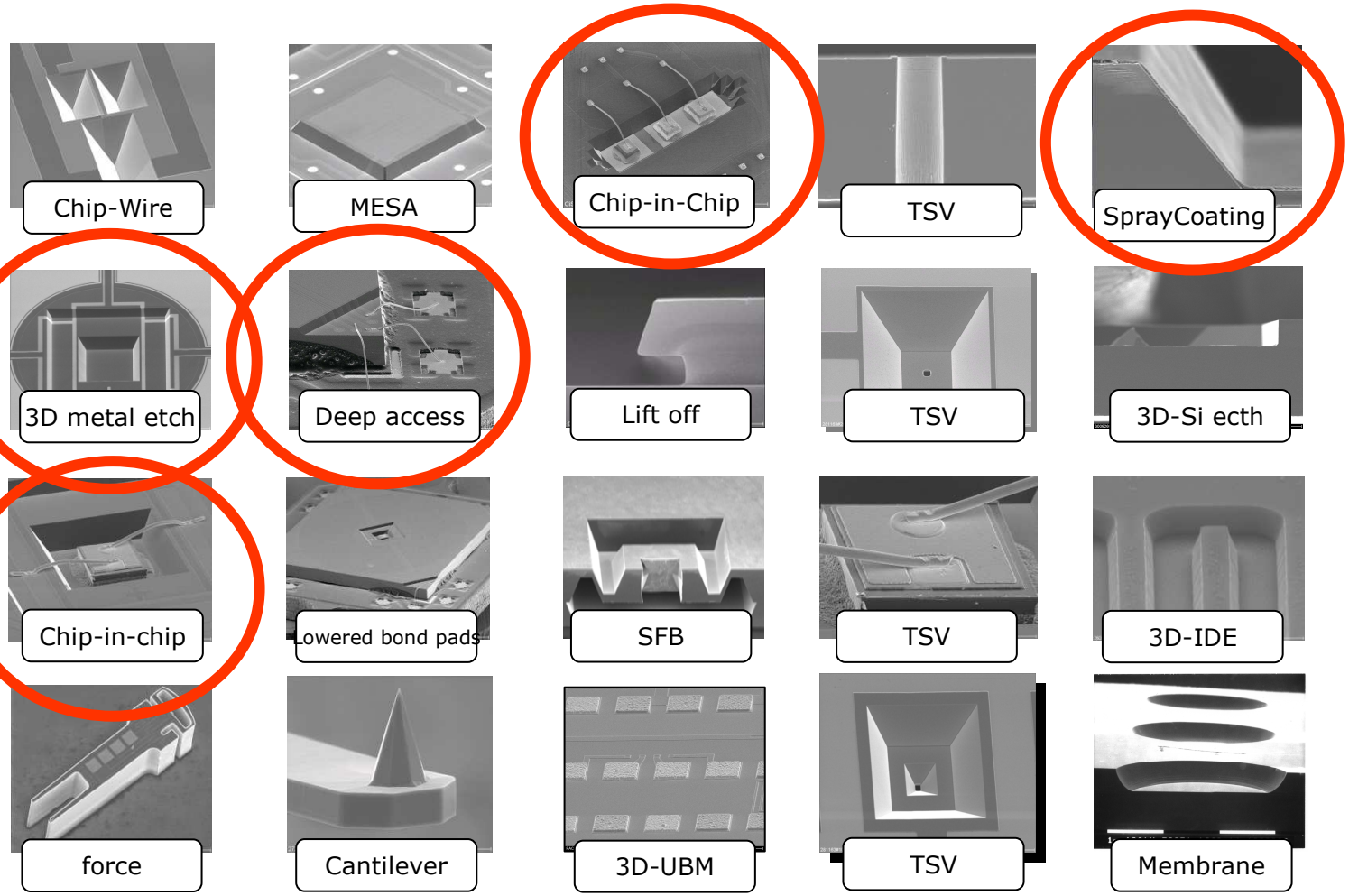
MORES™
microoptical
remission sensor



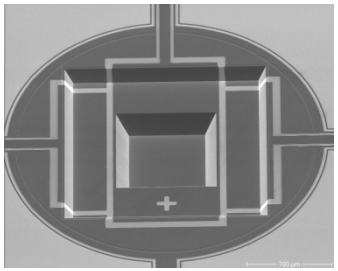
Example:
Levelling sensor

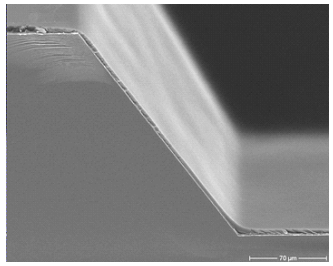
2 Product driven technology platform – present and future

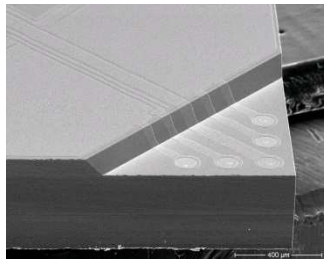
Selection of technological modules – building blocks

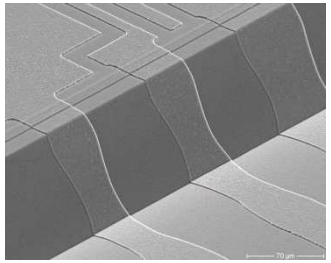


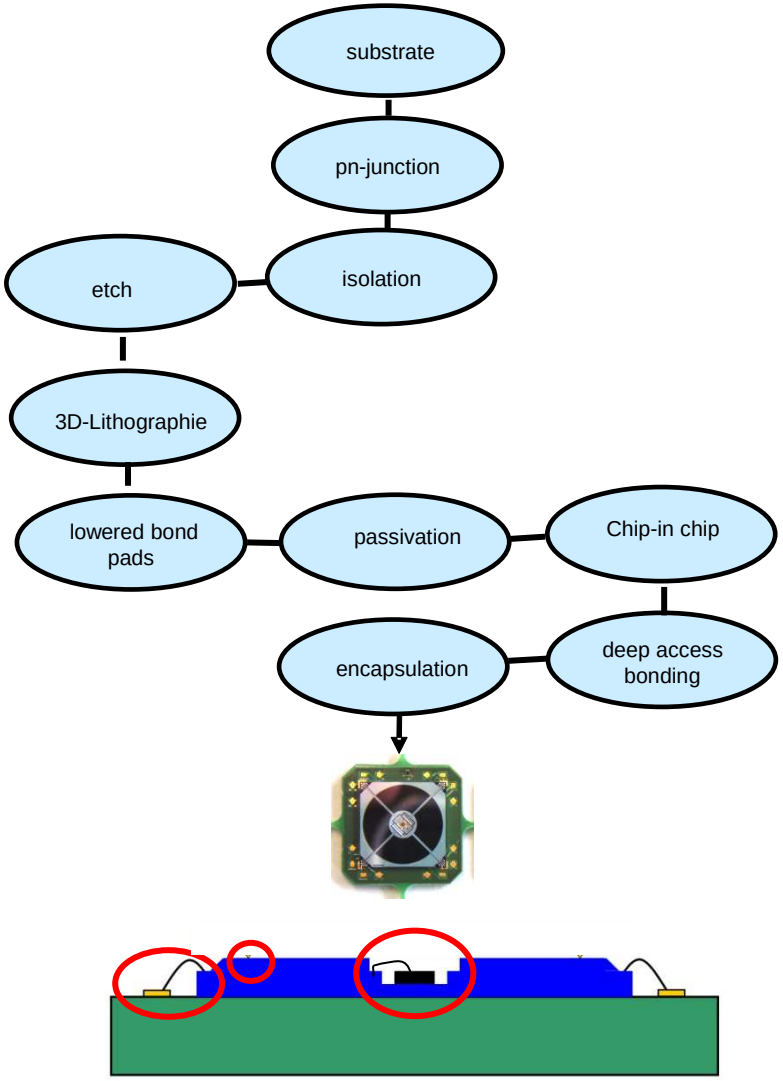
5 Example of hybrid Integration

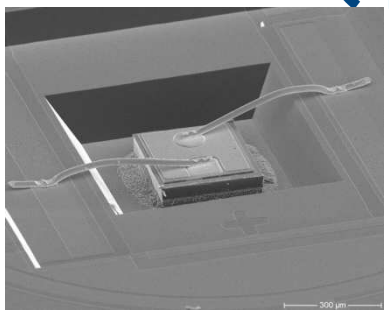


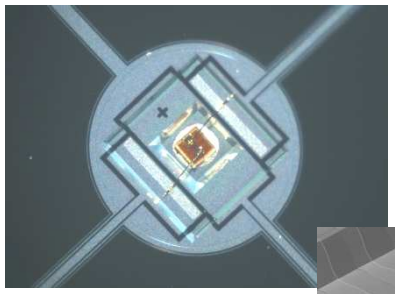


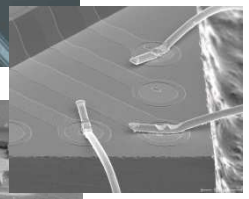


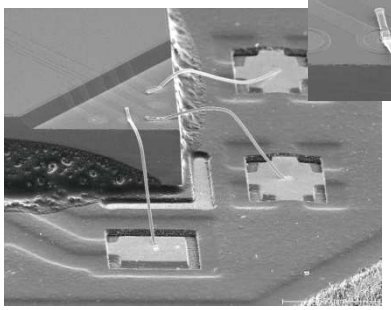






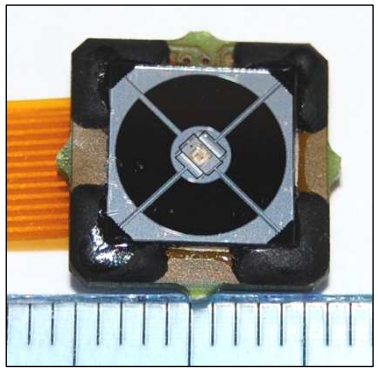


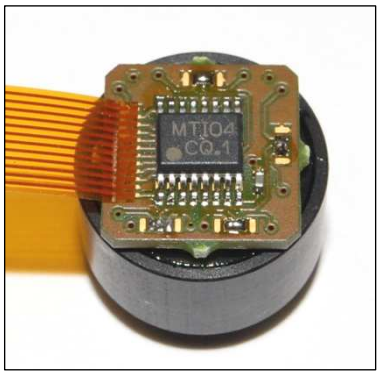


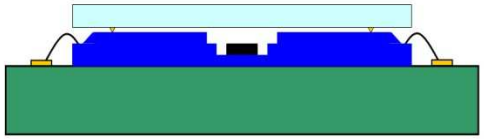


5 Example of hybrid Integration

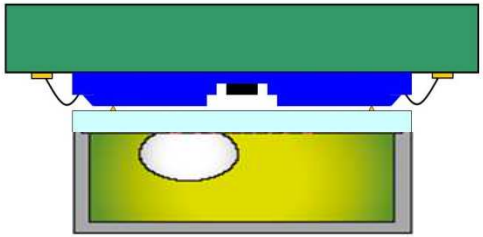
Bubble Level System







➢glas assembly
➢flex connector



➢assembly on bubble Level

➢complete bubble level system

2 Product driven technology platform – present and future

Levelling sensors

- Levelling for balances
- +/- 10° accuracy for levelling

Particle sensors

- Measurement of particle concentration in fluidics

Oxygen sensors

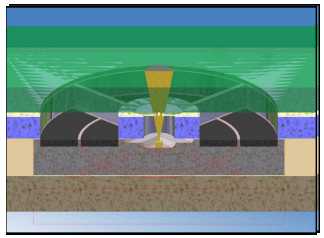
- Fluorescence based sensors
- Measurement in micro fluidic systems

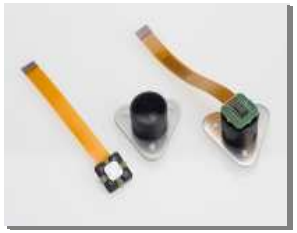
Life science sensors

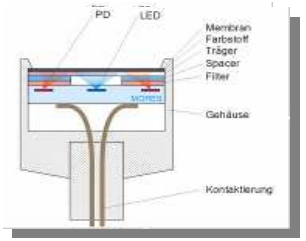
- Monitoring of cardiovascular parameters

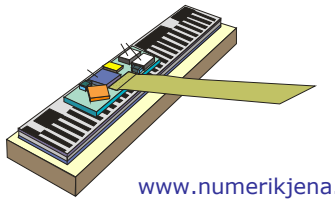
Linear encoder

- High interpolation
- Compensation of misalignment









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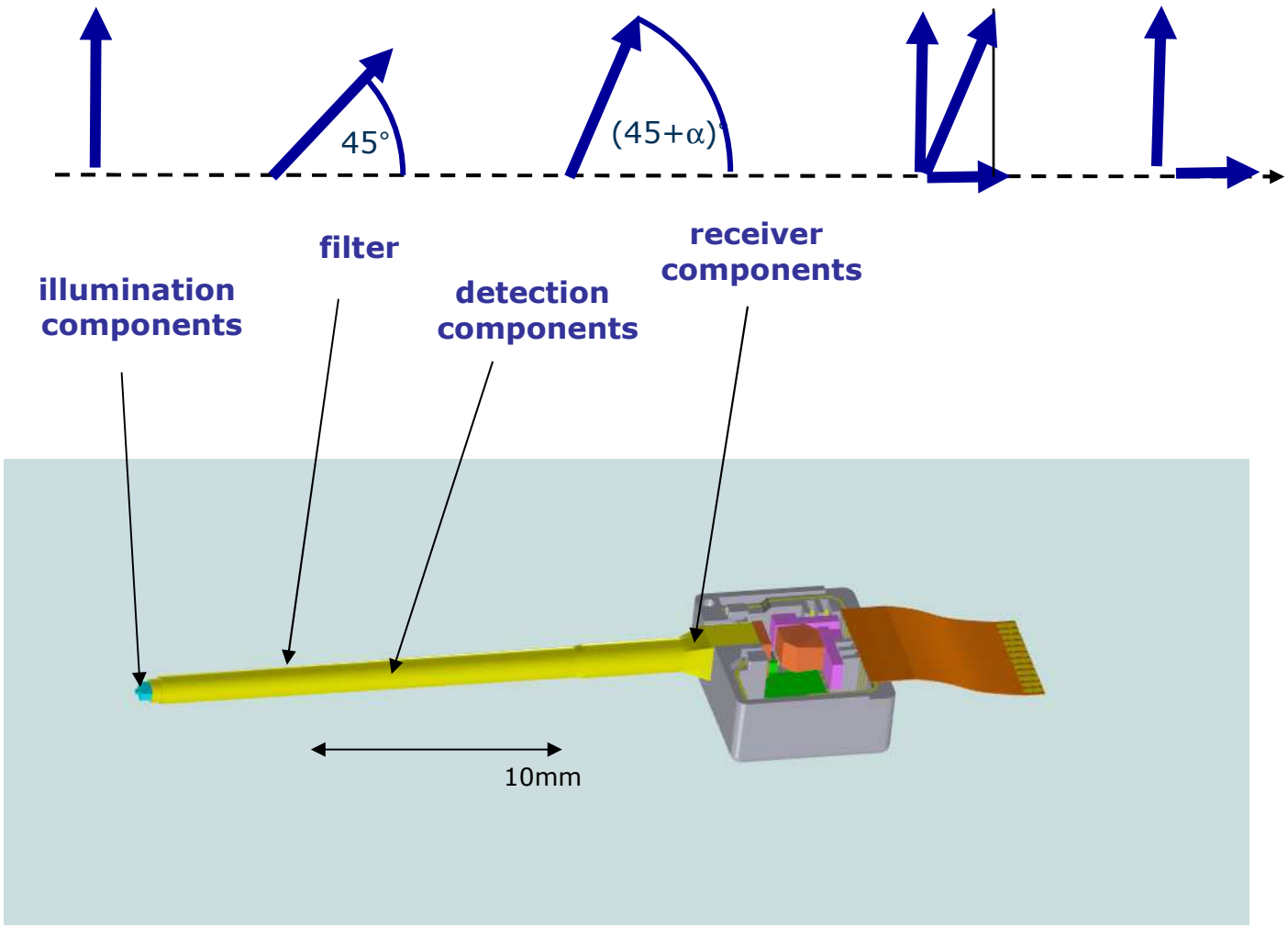
First hopeful application tests with technological platform

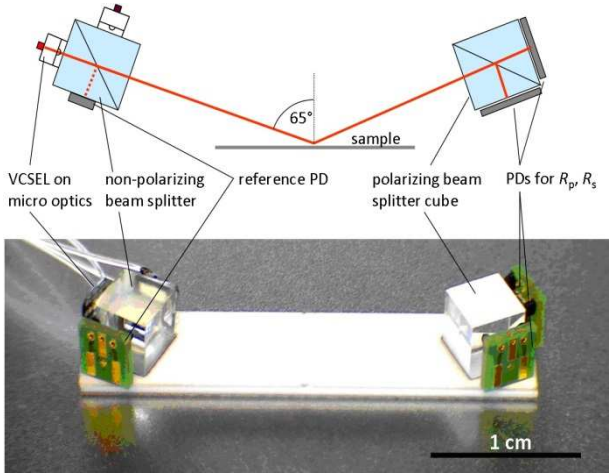
Miniaturized glucose sensors

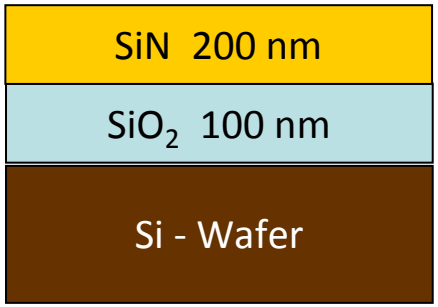


2 Product driven technology platform – present and future

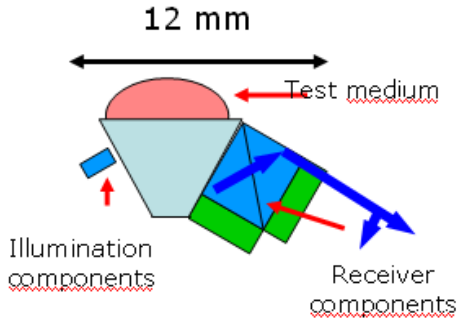
First hopeful application tests with technological platform

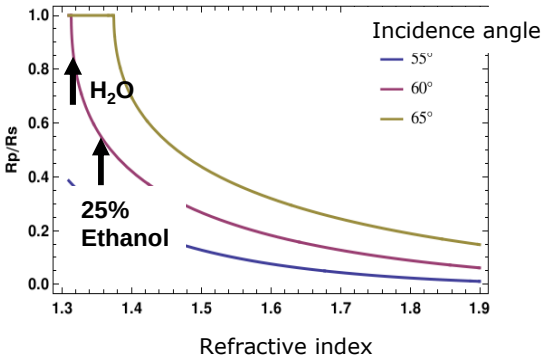
Miniaturized optical film thickness monitor



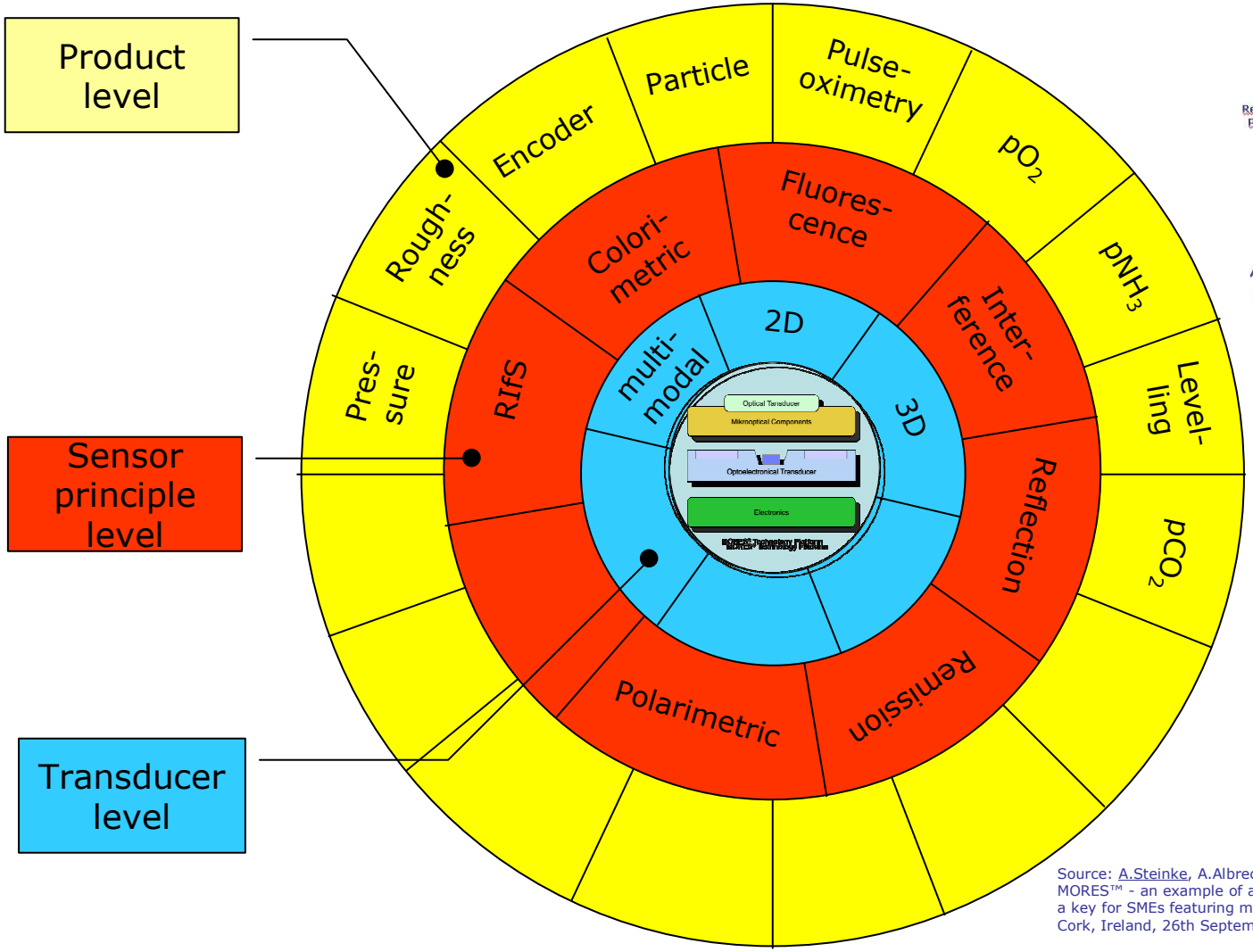


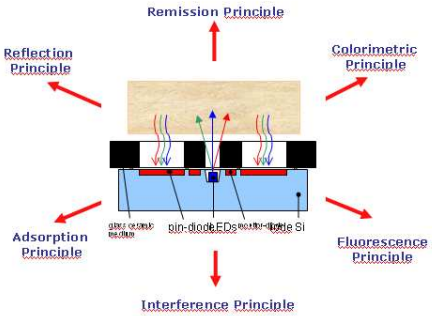
Miniaturized refractometer
Measurement of concentration in pure medium e.g.





2 Product driven technology platform – present and future





Source: A.Steinke, A.Albrecht, O.Brodersen, Th.Ortlepp;
MORES™ - an example of a product driven technology platform –
a key for SMEs featuring microsystem innovation, EPoSS Annual Forum 2013,
Cork, Ireland, 26th September 2013

Content

0 CiS at a glance – experiences with microsystem based product innovation

1 Open technology platform – common denominator for market demand and economic efficiency of R&D

- Product driven technology platform – present and future
- **Summary**

3 Summary

- It is absolutely necessary to reduce the **entrance barriers** (technological, commercial..) for SMEs regarding access to smart system technology (e.g. high performance)
- We have to accept the **boundary conditions** of SMEs (e.g. low volume, system components only, fast market entrance)

Solution:

An open technology platform for

interfaces, components and with high diversification

and

access to state-of-the-art technology

Thank you very much for your attention

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