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Sensors: newest developments

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Principal member of the technical staff Emerging sensors

Belgian One Health seminar 'Innovation'

Imec

WORLD-CLASS INFRASTRUCTURE

> 12,000 M²

CLEANROOM

CAPACITY

MORE THAN

5,000 SKILLED PEOPLE

FROM OVER 95 NATIONALITIES

A

TRUSTED PARTNER

FOR COMPANIES, STARTUPS & ACADEMIA

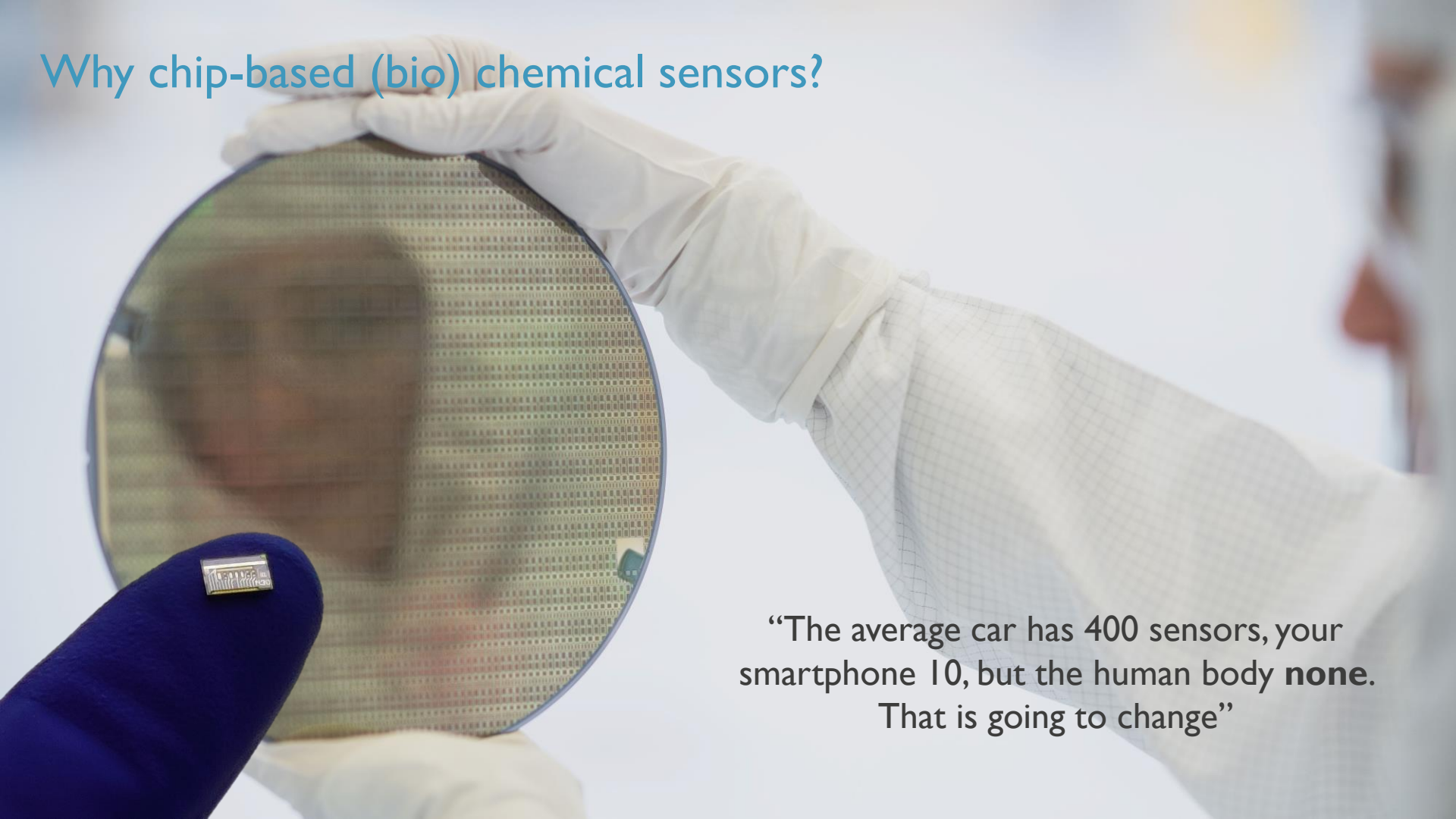
Overview imec-nl

And my role

Imec @ OnePlanet

Imec @ Holst Centre

Why chip-based (bio) chemical sensors?



"The average car has 400 sensors, your smartphone 10, but the human body **none**. That is going to change"

Three waves of analyte sensing

Clinical Analyzers

"Sample to the Lab"

driver: workflow efficiency

routine for 100+ analytes

Point-of-Care Diagnostics

"Lab to the Sample"

driver: rapid results

many analytes available

In-vivo Analyte Sensors

"Wear the Lab"

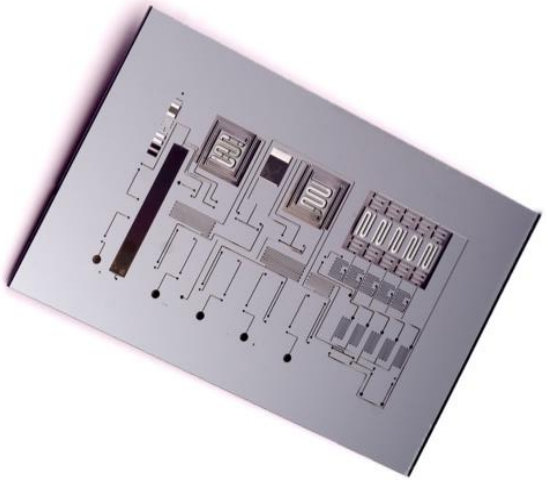
driver: frequent measurements

very few analytes available

technical challenges

- *Sensor technology suitable for repeated use*
- *Sensor technology bio-compatible and bio-robust*

Breath-based, fast PCR test for SARS-CoV-2



PCR analysis < 10 min!

Repeated use

What does that mean?

3 days

Smart Ingestible
Sweat patches
In-line blood monitoring (short-term)
Dialysis/Urine

1 month

Bioprocess monitoring
CAR-T
Food
Organ on a chip
In-line blood monitoring (long-term)

> 1 year

Implantable sensors
Air/(waste) Water quality monitoring

Impact and importance of gut health

Inflammatory Bowel Disease /
Irritable Bowel Syndrome

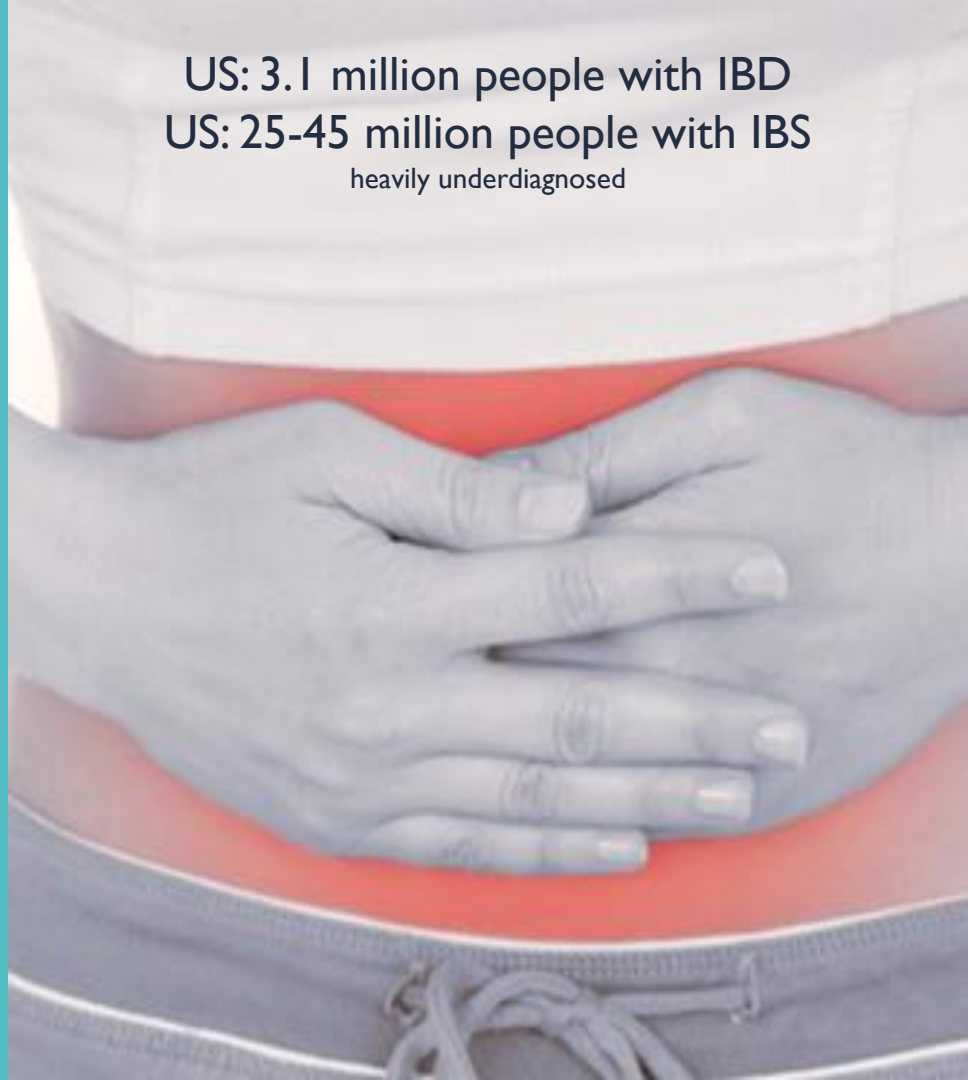
25%

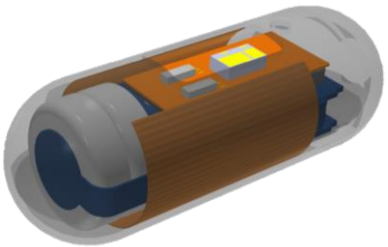
of population suffer from digestive complaints or disorders[1]

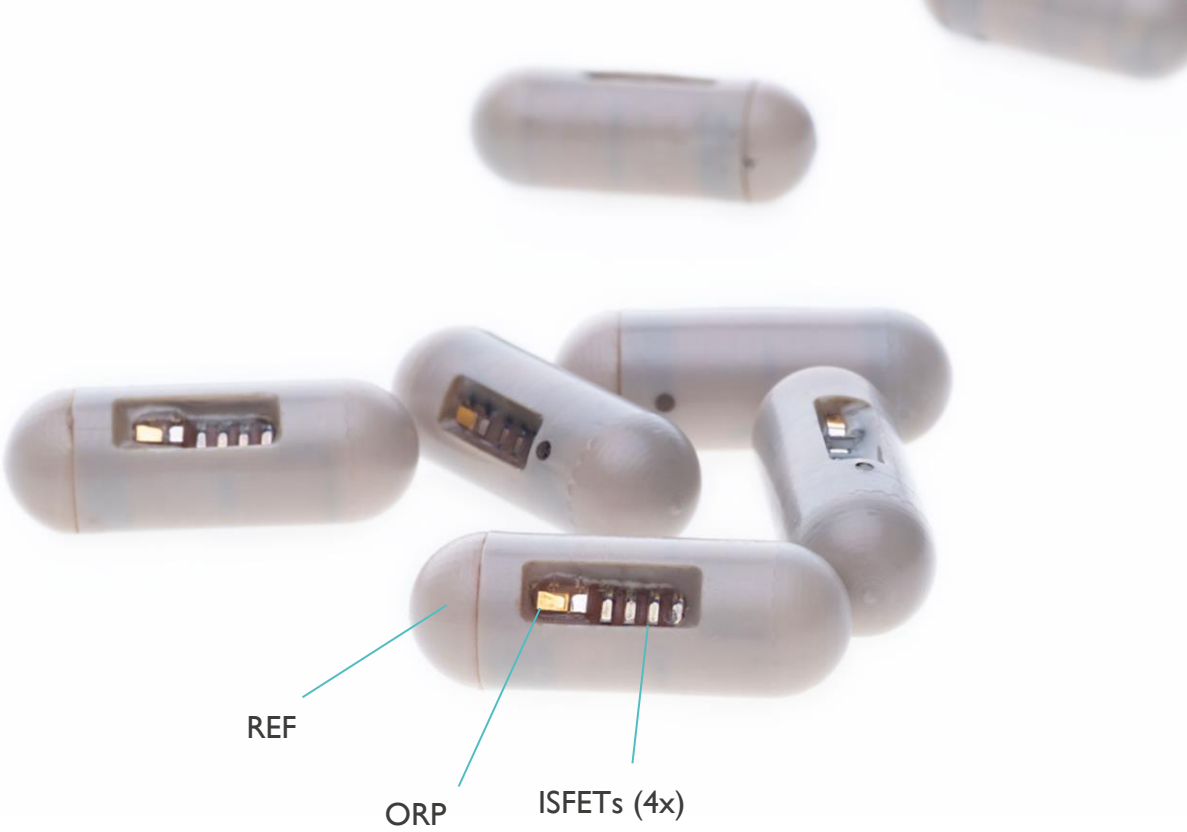
More Research and
Non-invasive tools are needed

[1]Sperber, A. D., et al. (2021). *Gastroenterology*

US: 3.1 million people with IBD
US: 25-45 million people with IBS
heavily underdiagnosed







On our roadmap: proteins, short-chain fatty acids

public

BIOSENSING @ HOME - INNOVATIONS FOR EARLY SIGNALING

Dehydration

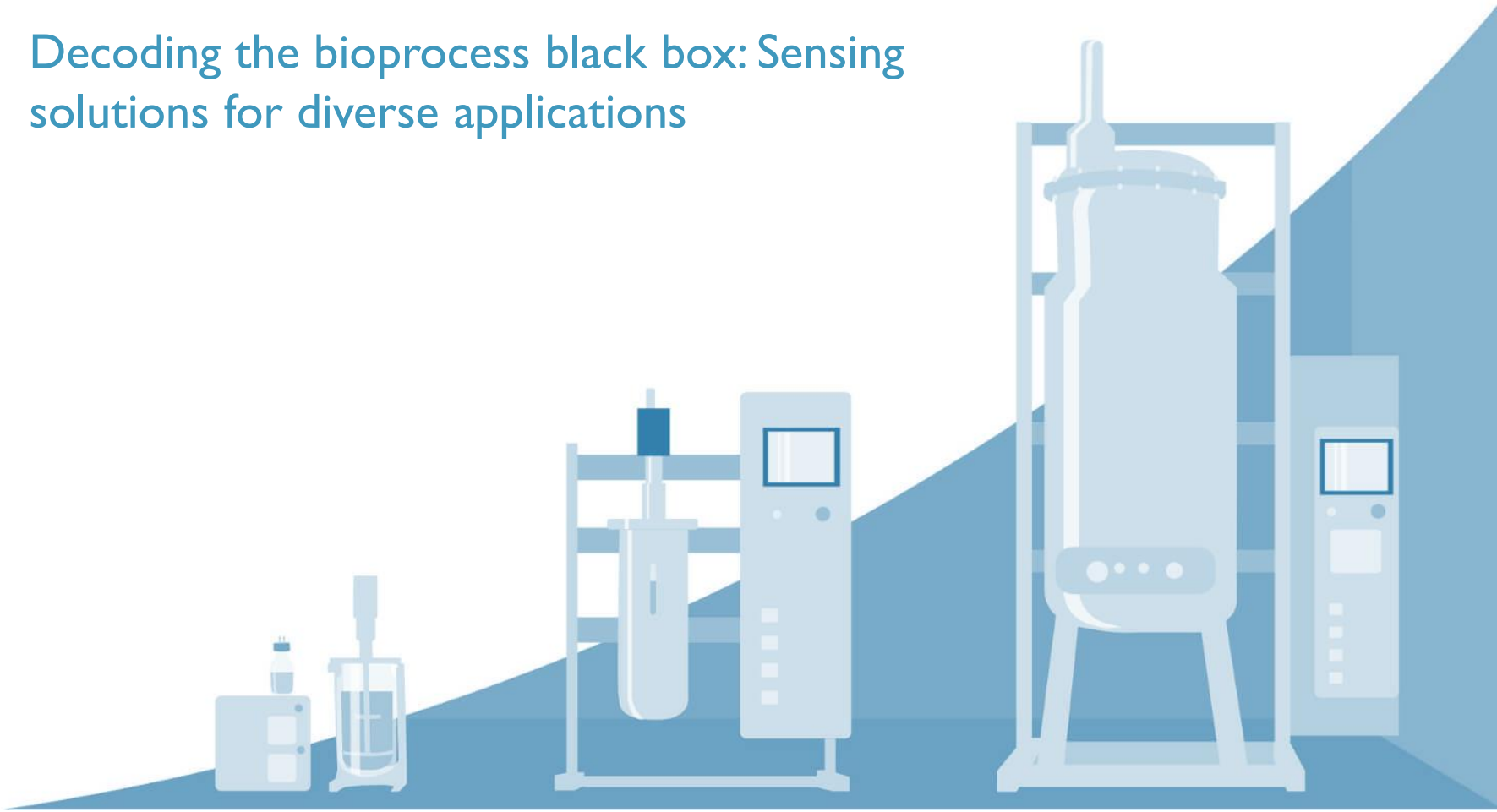
Kidney function

Urinary tract infections

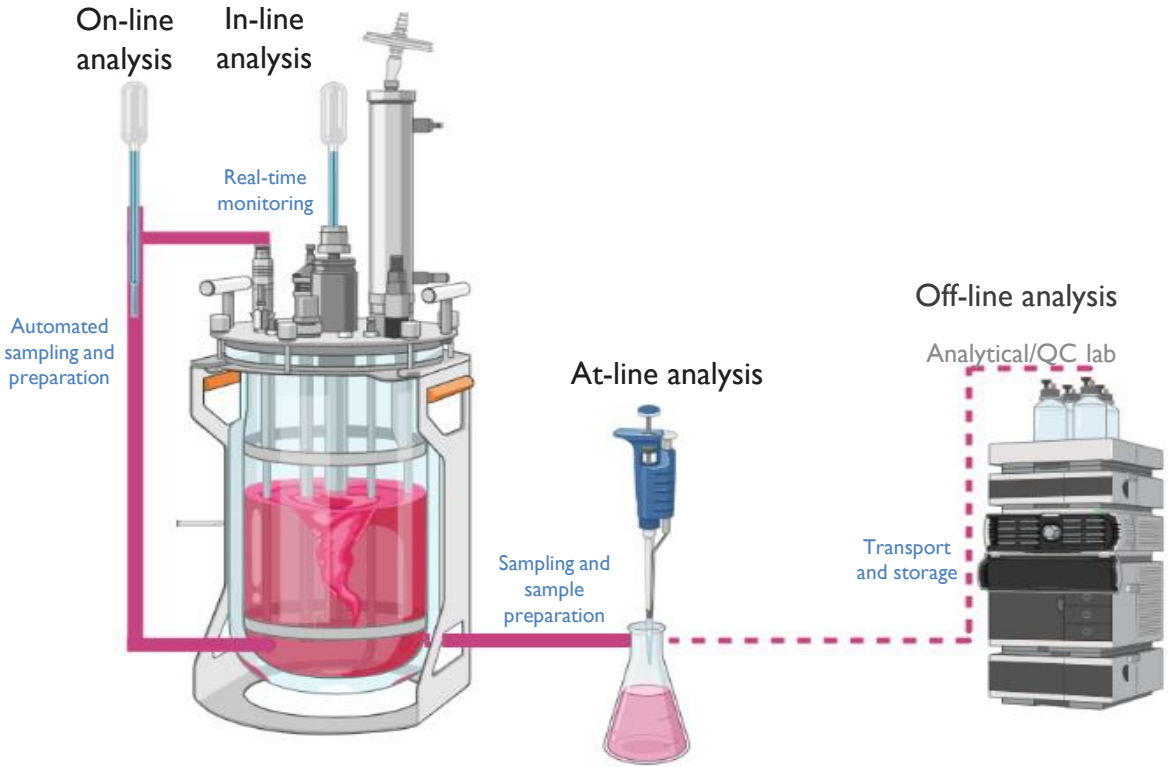
Low-grade Inflammation

Process Analytics Technology (PAT)

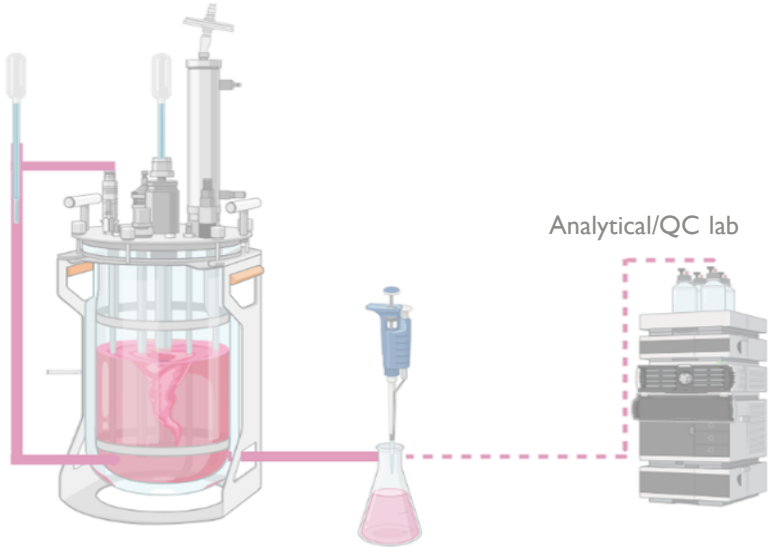
Decoding the bioprocess black box: Sensing solutions for diverse applications



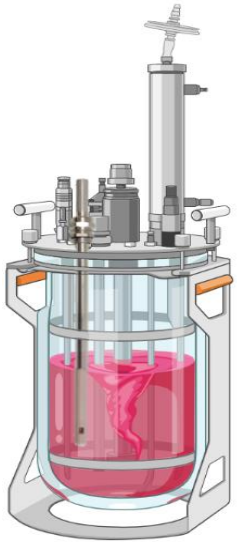
Q&C in and around the reactor



One probe, multiple sensors: revolutionizing bioprocess monitoring



Single probe measuring all critical parameters



PATcube Sensor Specifications & Performances

Air and Water quality

TRACK RECORD AIR QUALITY


NO2
Simulated
Real-time
OFF
Receptors off
NO2
PM2.5
µg/m³
<20
20-24
24-28
28-32
32-36
36-40
40-50
>50
25/09/2018 - 18:05
2D

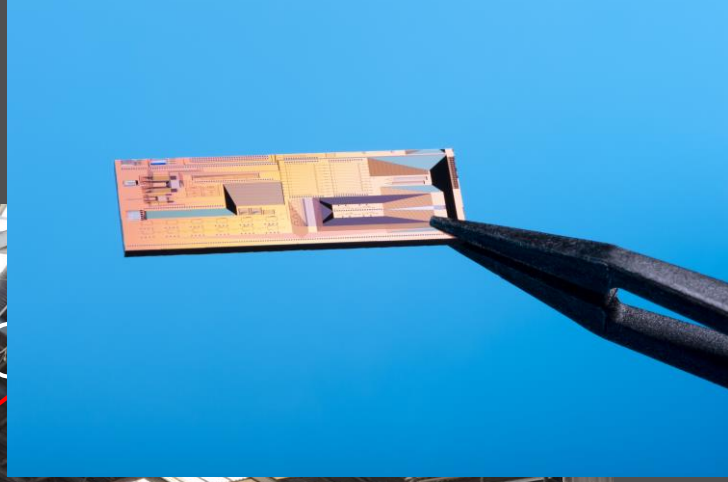
Technology & AI for Environmental Monitoring

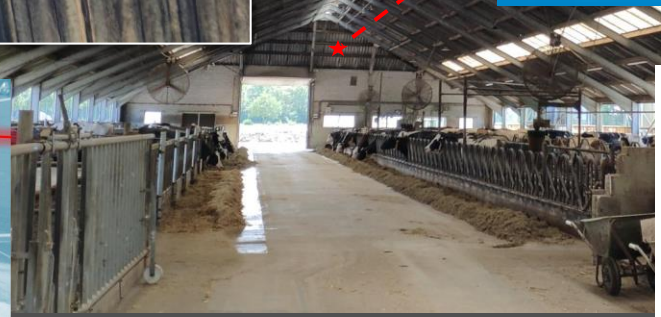
Air quality sensor

- Nitrogen oxides
- PM dust
- Ammonia
- Methane

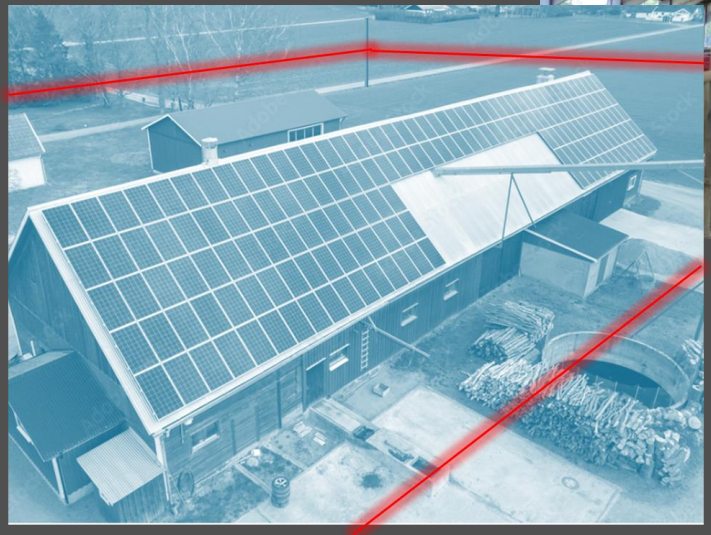
OPEN PATH GAS SENSING

AMMONIA AND METHANE SENSING **INSIDE** THE BARN

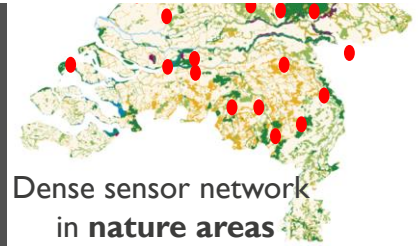




Open path laser-based gas sensing allows the coverage of a large distance using only a retroreflector.



AMMONIA AND METHANE SENSING **AROUND** THE BARN

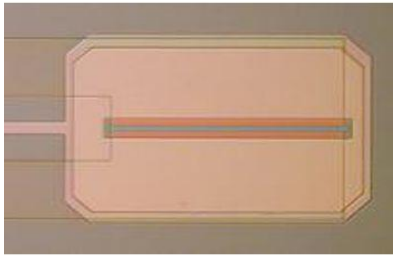


Dense sensor network in **nature areas**

Water Quality Monitoring

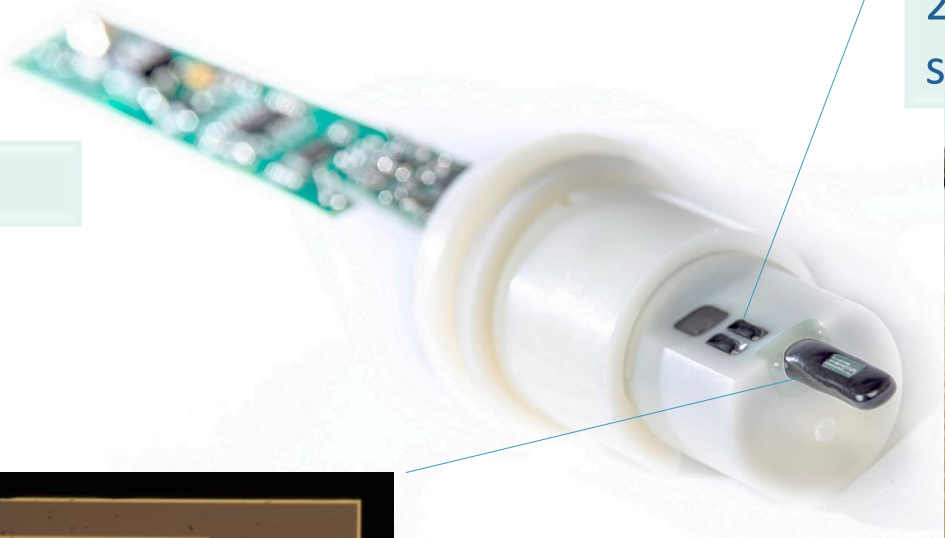
challenge: sensor technology robustness

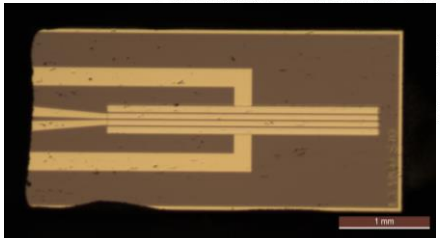
Sensor probe



2x ISFET pH-sensor

Readout





4-electrode EC sensor

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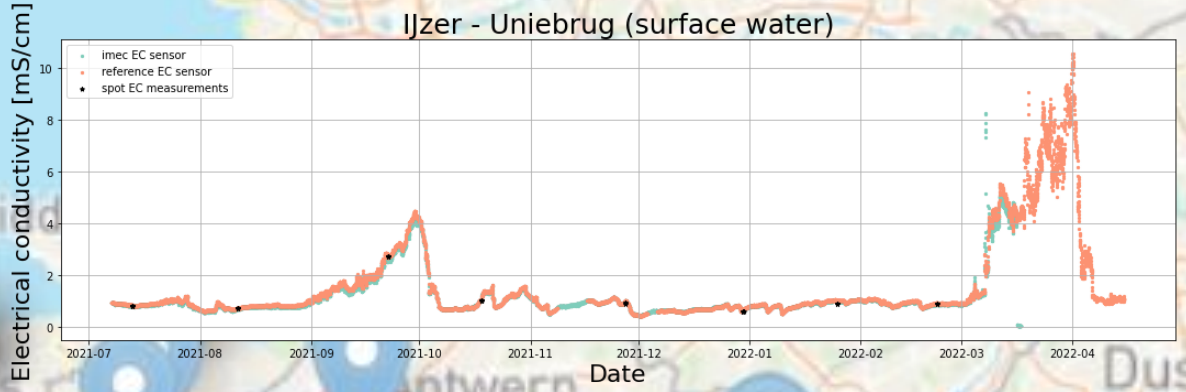
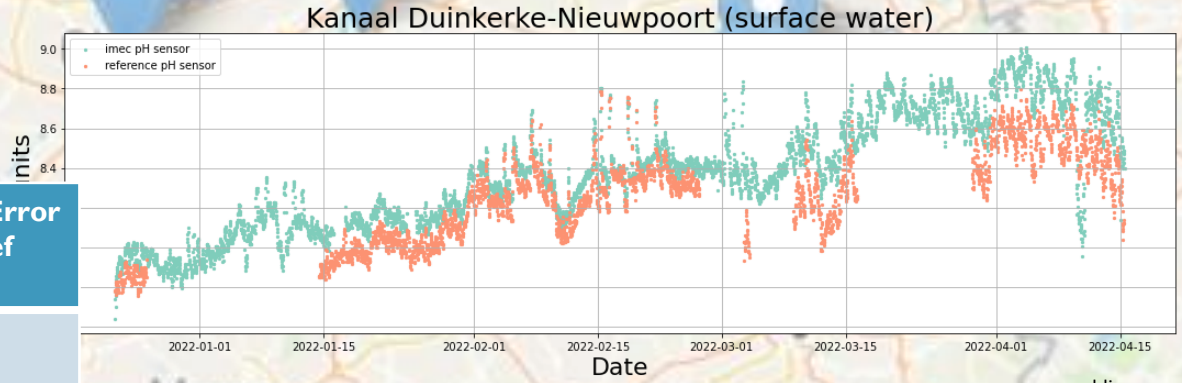
WQMD DEPLOYMENTS

- ✓ More than 40 WQMDs have been deployed in Flanders
- ✓ The Imec sensors are being validated against commercial sensors, which are installed next to the imec sensor probes
- ✓ The imec sensors provide **accurate** measurements **without maintenance** during their **>6 months** of operation in the field





	lifetime	Correlation	Mean Error w.r.t ref
EC sensor	Up to 14 mo.	> 95%	< 10 %
pH sensor	Up to 8 mo.	> 80%	< 0.2 pH

USE CASE: BLANKAART RESERVOIR & IJZER WEST-FLANDERS

imec vito De Watergroep WATER. VANDAAG EN MORGEN. Aquafin VLAAMSE MILIEUMAATSCHAPPIJ Vlaanderen is milieu

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embracing a better life

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