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Europees Fonds voor Regionale Ontwikkeling

GROW!

René Elfrink, project coördinator GROW!

Programma

Programma:

10.00 uur Ontvangst

10.15 uur Opening en toelichting op project GROW!

10.30 uur Toelichting op de ontwikkelde sensoren

11.00 uur In gesprek met elkaar over huidige ontwikkeling per sensor en wensen voor toekomst

12.15 uur Terugkoppeling op de wensen

13.00 uur Afsluiting met aansluitend de gelegenheid de proef in de HAS Kas te bezoeken en te lunchen.

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Goal

“to monitor, optimize and enhance the yield and quality of horticulture products by developing and deploying smart wireless sensor- and datanetworks (Internet of Things, IoT”

Innovative sensor systems and **big-datanetworks** will be developed within the GROW!-project and **plant growth models** will be optimized.

Implementation of both

- Currently available cost-effective sensors
- Newly developed sensors

To monitor other processes (nutrient monitoring).

The sensor- and datanetworks will be **tested and valorized in fieldlabs** together with SME horticulture companies.

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Partners

1. Nederlandse organisatie voor Toegepast Natuurwetenschappelijk Onderzoek TNO
2. Universiteit Antwerpen
3. LTO Glaskracht,
4. Katholieke Universiteit Leuven,
5. Stichting IMEC Nederland
6. HAS Hogeschool
7. Proefcentrum Hoogstraten
8. Vlaams Centrum voor Bewaring van Tuinbouwproducten

TNO innovation for life
VCBT VLAAMS CENTRUM VOOR BEWARING VAN TUINBOUWPRODUCTEN
Universiteit Antwerpen
KU LEUVEN
PROEFCENTRUM HOOGSTRATEN
LTO Glaskracht Nederland
imec
has hogeschool

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Samenhang

Technology R&D → integration → Test & grow → diseases/plagues, growth models

TNO innovation for life

imec

Universiteit Antwerpen

PROEFCENTRUM HOOGSTRATEN

KU LEUVEN

has hogeschool

LTO Glaskracht Nederland

VCBT VLAAMS CENTRUM VOOR BEWARING VAN TUINBOUWPRODUCTEN

Link to agriculture → Quality / validation

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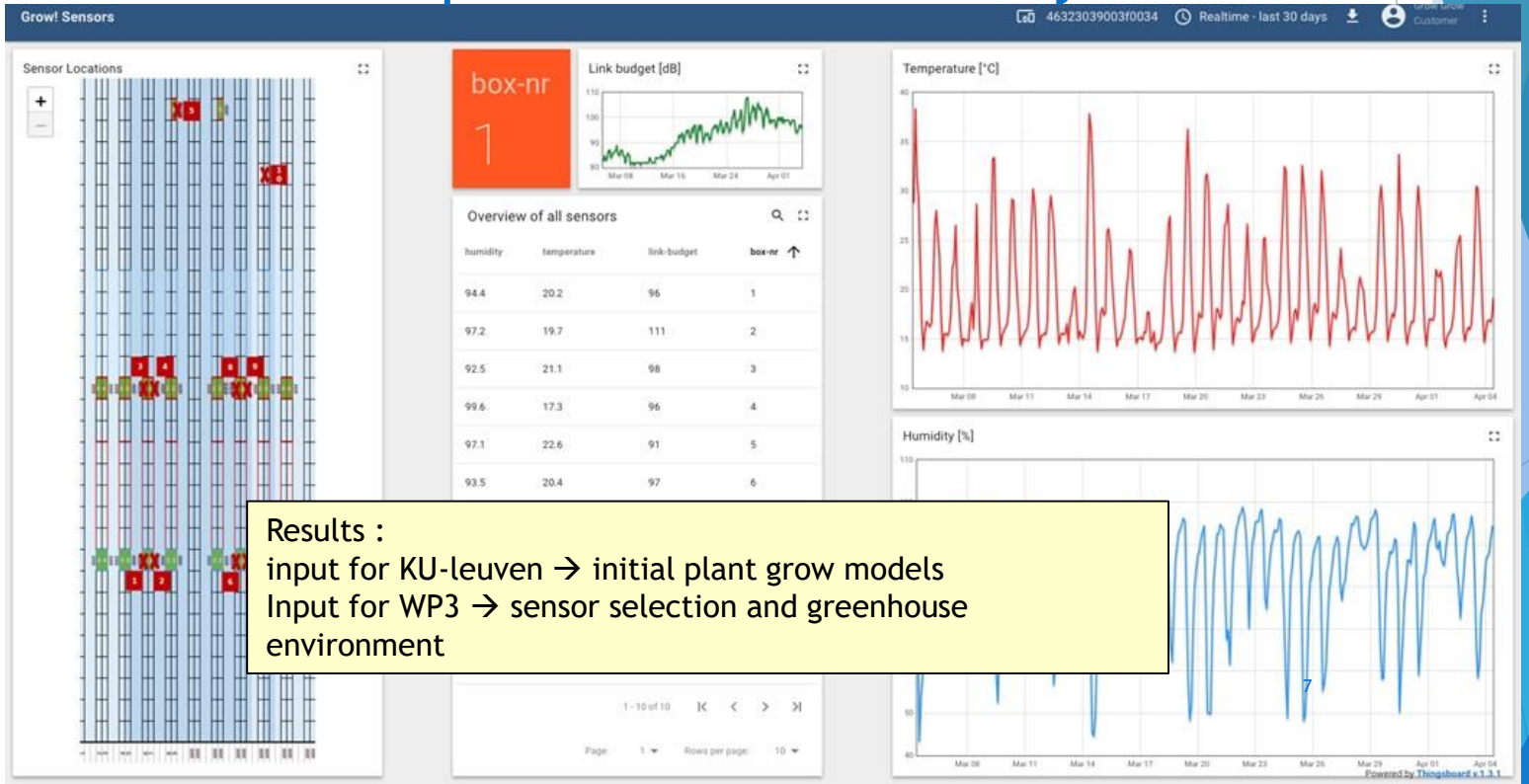
Beta system deployment at PCH : 10 sensor boxes with Temperature and Humidity



Results :
input for KU-leuven → initial plant grow models
Input for WP3 → sensor selection and greenhouse environment

Sensors

- Temperature
- RH

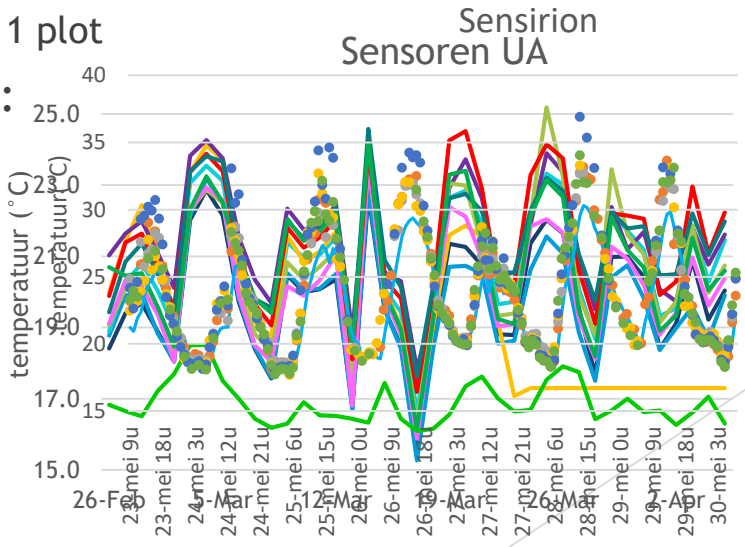
Sensoren KUL

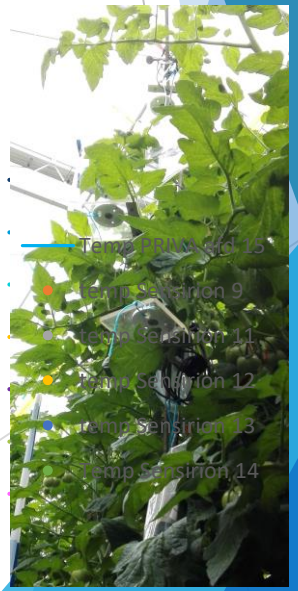
Sensirions

Sensoren UA

Three types of sensors being tested (38 in total)

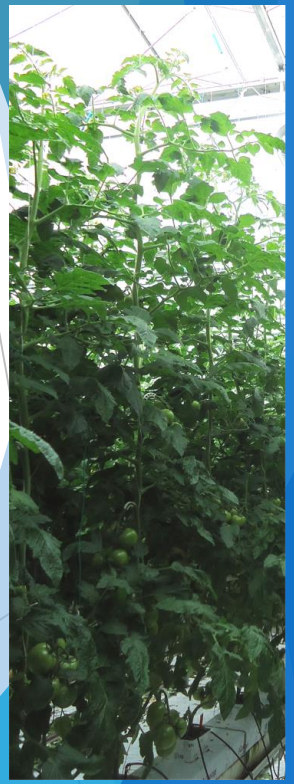
- Light: 3 sensors present op 1 plot
- Nutrients (in development):
  - EC
  - Nitrate
  - K, N, Ca, Mg
  - pH
- CO_2





Plantmodel

- Measured properties of plant growth and development:
  - Stem thickness
  - Length
  - Bunch settlement
  - Yield (weight, dry mass)
  - Fruit Growth
  - Ripeness
  - Fruit quality (color)
- Measured at 42 plots



Pathogenmodel

- Pathogens measured:
  - White fly
  - Macrolophus (with and without enthomophthora)
  - Nesidiocoris
  - Powdery mildey
- Counts with sticky plates and in the plants
- Total 100 plots

SHORT SUMMARY 2018

2018

- Snelle start met enkele 10-tallen T en RH sensoren in PCH tomaten teelt
- Gecombineerd met
  - plantmetingen (Stengeldikte, Lengte, Troszetting, LAI, Opbrengst,Groei van de vruchten, Rijping van de vruchten,Vruchtkwaliteit)
  - Pathogeen metingen
- Model opgesteld
- Technology ontwikkelingen :
  - Sensor platform : Octa2.0
  - Printed sensors
  - EC, pH and Ion sensors
  - CO2 sensors
- Kontakten opgebouwd
  - Telers
  - Kassenbouwers
  - Klimaat besturings systeem bouwers

KOMENDE MAANDEN (PRACTICAL)

2018-Q4

- Ion sensing : Laboratoriumtesten in voedingsmedium voor stabiliteit en kruisgevoeligheden
- Eerste laboratoriumproeven voor tweede ion
- Prepare 100 Octa nodes for the deployment + Deployment and field testing at PCH and HAS
- Voorbereidingen nieuwe teelt PCH and HAS Q1-2019 (inzaaien oktober, planten in December)

2019

- Plant model validatie (model opgesteld 2018, toegepast op teelt 2019)
- Samenwerkingen met enkele telers starten
- Demo dag + kennis sessie (14 februari)

2019-Q2

- integration with printed strip sensors + test in kas
- Eerste proeven ion sensoropstelling in kas + Tweede ionconcentratie testen in lab

2019-Q3

- Tweede ionconcentratie testen in kas

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GROW!

Toelichting ontwikkelde sensoren

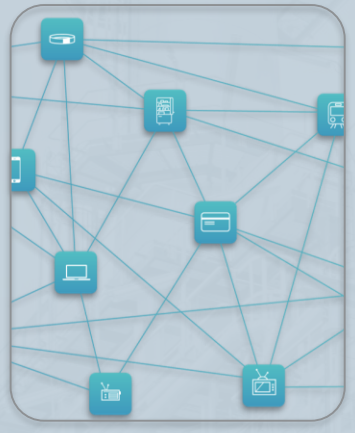
Marcel Zevenbergen, imec-nl, Program Manager gas & liquid sensor solution

Marieke Burghoorn, TNO, GROW! werkpakket lead WP3

IOT CONNECTED SENSOR NETWORKS

Cost effective

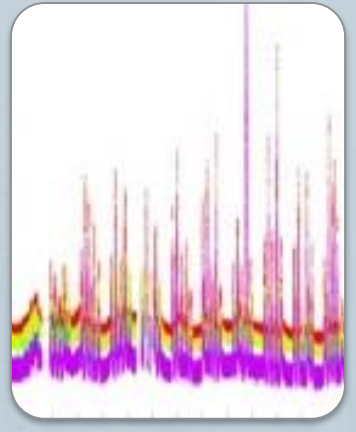
air & liquid sensors



Sensor network

&

Calibration



Cloud Storage

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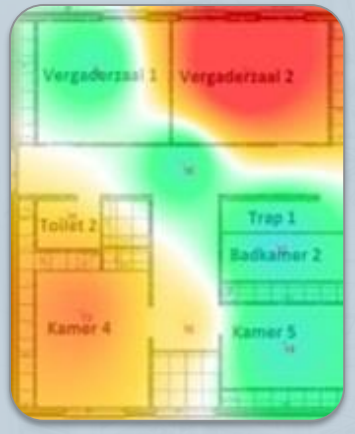
Monitoring



Visualization

&

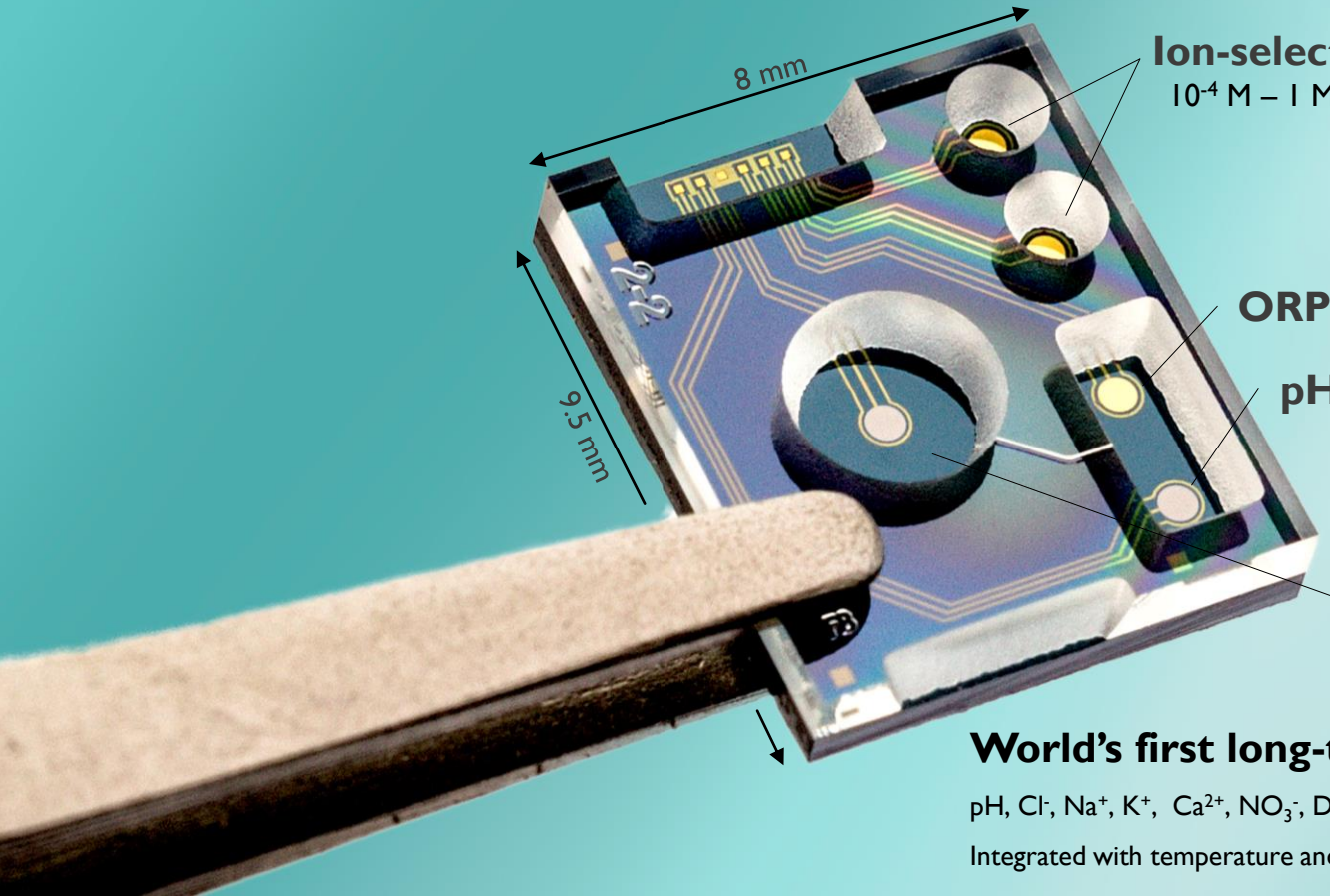
Analytics

Easy access

&

applications

Nutrient analysis by cost-effective liquid sensors



Ion-selective electrodes
10^{-4} M – 1 M range, 10% accuracy

ORP

pH: 2-10 pH range, 0.1 accuracy

Microfluidic Reference electrode

World's first long-term stable multi-sensor chip

pH, Cl^-, Na^+, K^+, Ca^{2+}, NO_3^-, DO, extension to other ions possible → Mg^{2+}, NH_4^+

Integrated with temperature and conductivity: 5 – 100000 µS/cm

QUALITY DATA ENABLED BY LARGE-SCALE LIQUID SENSOR NETWORKS

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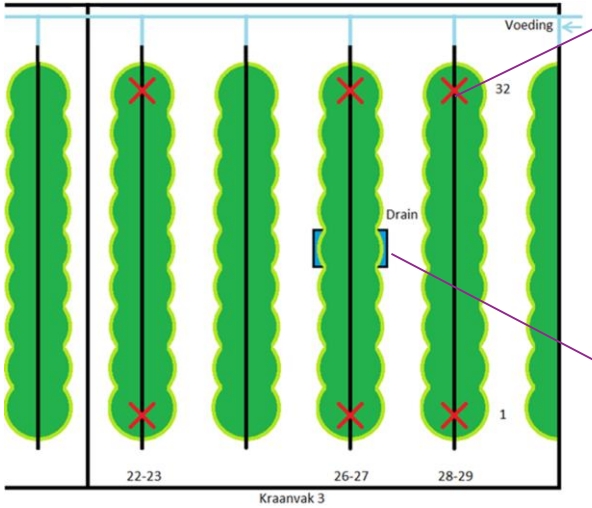
First field tests in greenhouse



Various samples obtained from irrigation lines which were subsequently analyzed for pH, EC, and potassium level

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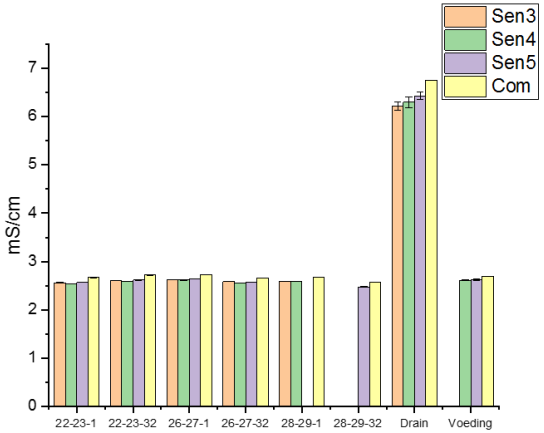
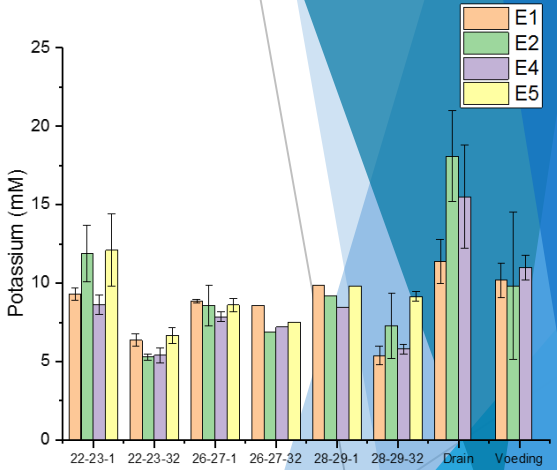
Preliminary results



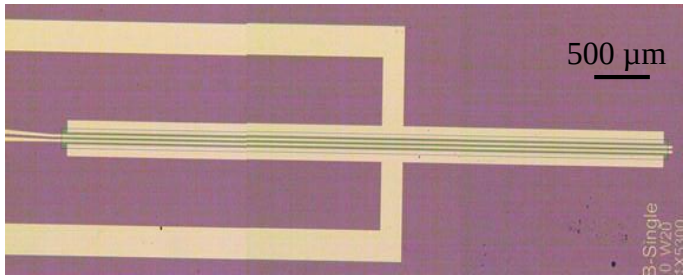


Difference pH < 0.1, EC < 0.1 mS/cm compared to state of the art sensors
Reproducible results for different samples from the irrigation lines, as expected
Drain EC and potassium significant higher

Next challenge: integrate these sensors in an IoT network for continuous and real-time data!

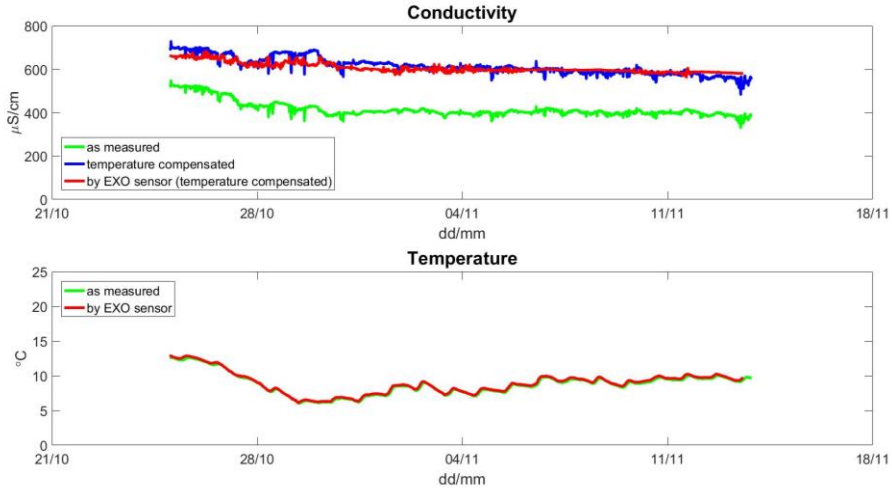
FIRST DATA FROM THE BLANKAART

USING IMEC'S CONDUNCTIVITY SENSOR



imec analytics and imec low cost sensor

brings equal accuracy as 10'sk$ professional equipment



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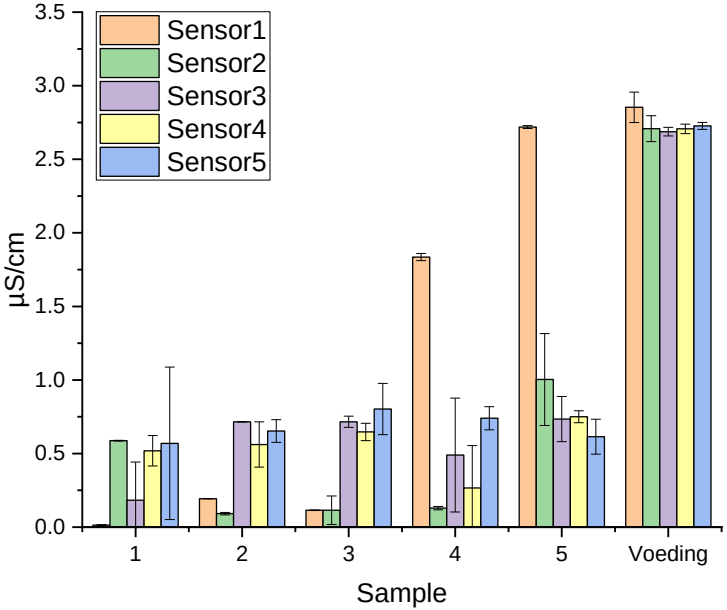
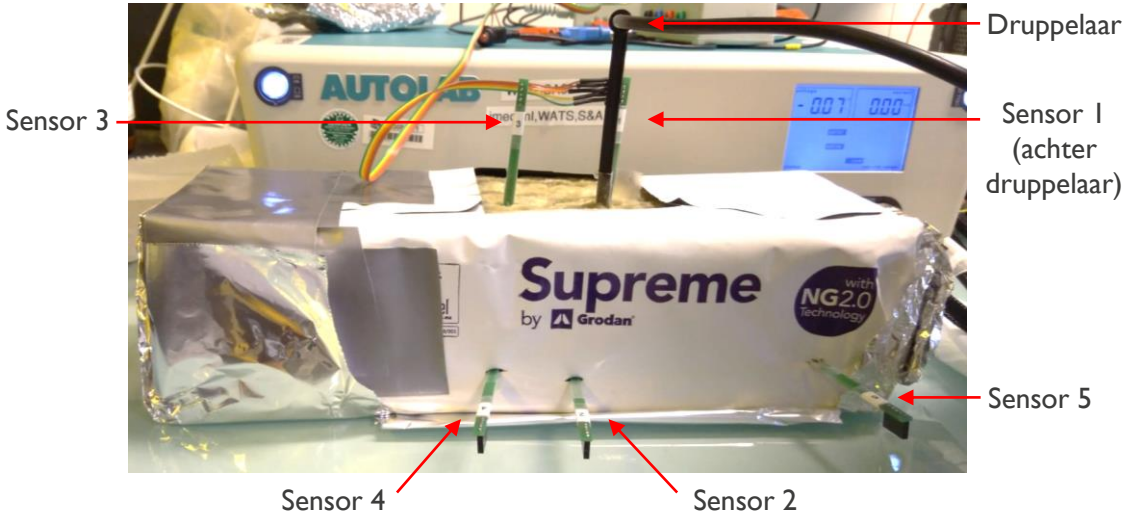
SUBSTRAAT METINGEN



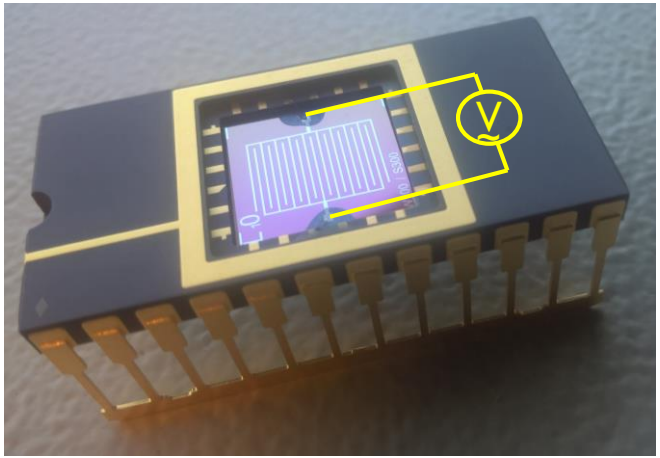


Sample 1 : 5x 20 mL Voeding
Sample 2 : 15 min na meting1
Sample 3 : 30 min na meting1
Sample 4 : 5x 20 mL Voeding (3h 30 min na meting 1)
Sample 5 : 5x 20 mL Voeding (3h 50 min na meting 1)

- Het substraat moet eerst goed verzadigd zijn om iets te meten, sensoren moeten vochtig zijn.
- Pas na de 2e voeding (sample 4) is er iets te zien bij sensor 1.
- Na de 3e voeding (sample 5) lijkt sensor 1 goed te meten, deze zit direct naast de druppelaar.
- Sensoren 2 t/m 5 meten veel ruis, hier is het niet vochtig genoeg.

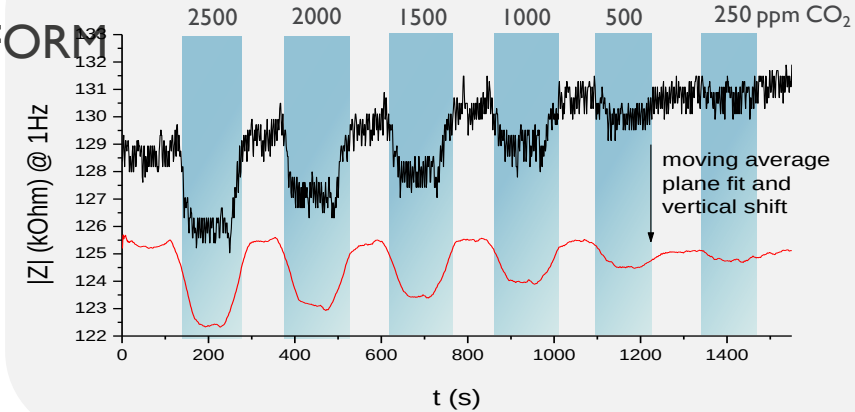
IMEC CO2 SENSOR

MINIATURE, LOW COST GAS SENSOR PLATFORM

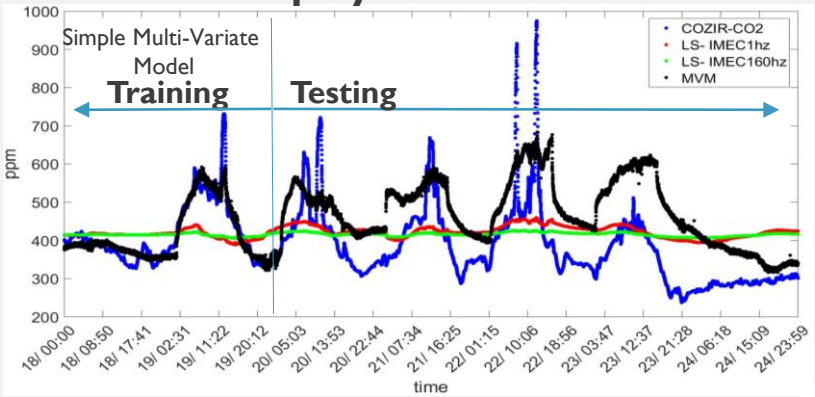


- Interdigitated electrodes covered by ionic liquid film
- Impedance change in ionic liquid film

Controlled environment



Real Life deployment in imec offices



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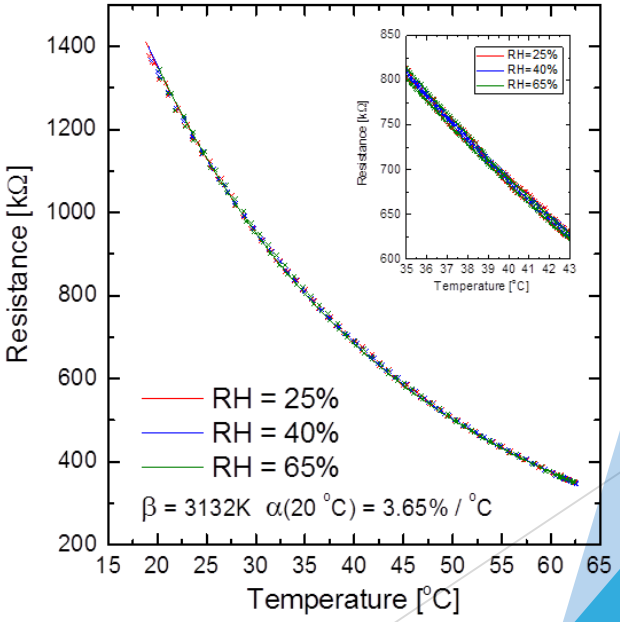
Printed temperature sensoren (TNO)

- Nearly no dependence on relative humidity till 65%
- Measurement in climate chamger at 95% RH conducted
- Sensirion SHT31 as benchmark
- Material optimization in progress



Printed sensor strips

- Foil strip dimension 50 x 4 cm
- Printted temperature sensors
- Sensirion sensors as benchmark and for RH
- Lightsensor will we added
- Easily connectable: tailored length
- Connected to readout unit that transfers data wirelessly

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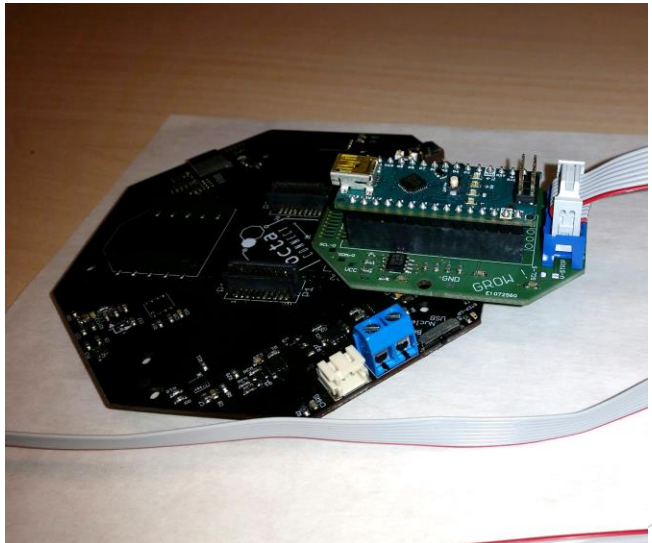
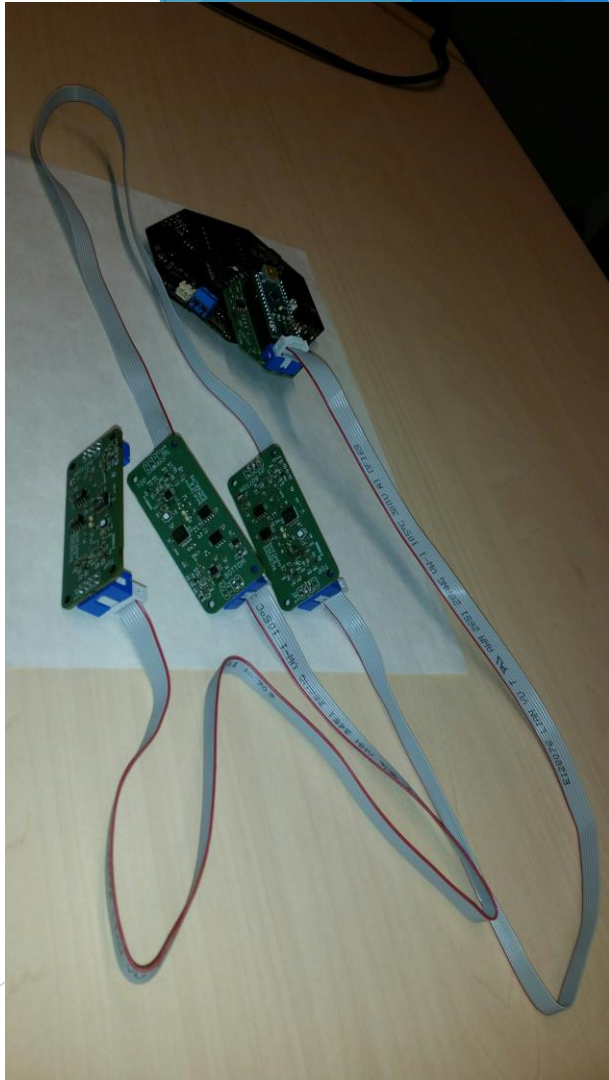
Sensor strips today

- Interconnected PCB connected to Octa-platform





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Thank you!

contact

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