



The **future**
belongs to those
who **create** it



Open Innovation by imec and TNO



Yellow Cats @ Holst Centre

Sywert Brongersma



- **Site-sharing:** >100 companies, >10000 researchers
- **Facility-sharing:** Philips Innovation Services (including >8000m² cleanrooms)
- **Program Sharing:** Holst Centre

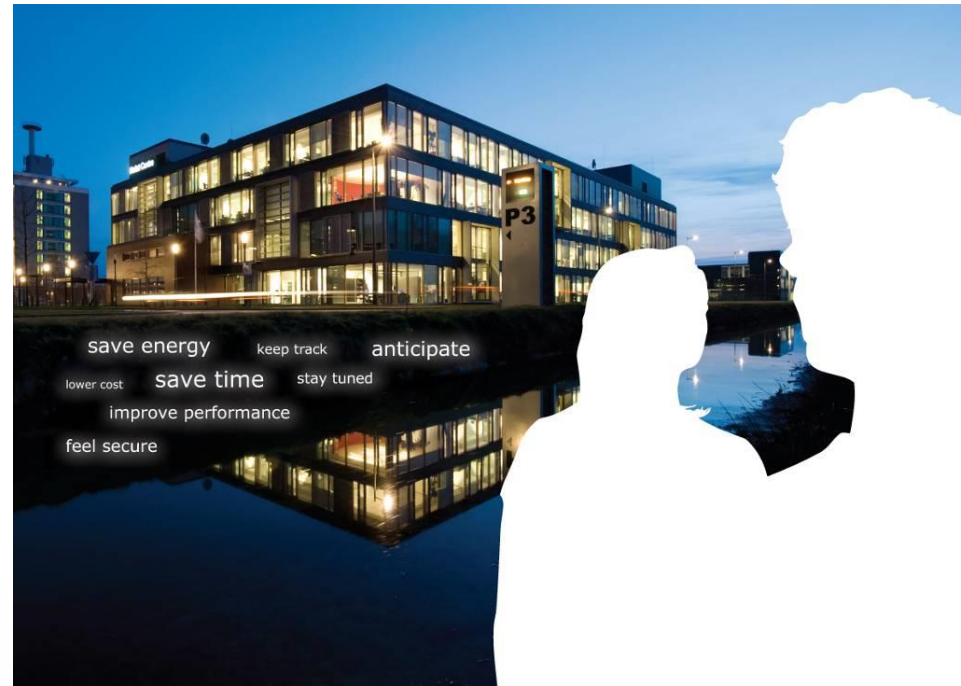
Holst Centre Open Innovation

Independent, with reputed parents

- Founded by imec (Belgium) and TNO (The Netherlands)
- Operational since 2006

Focus on industry-relevant topics

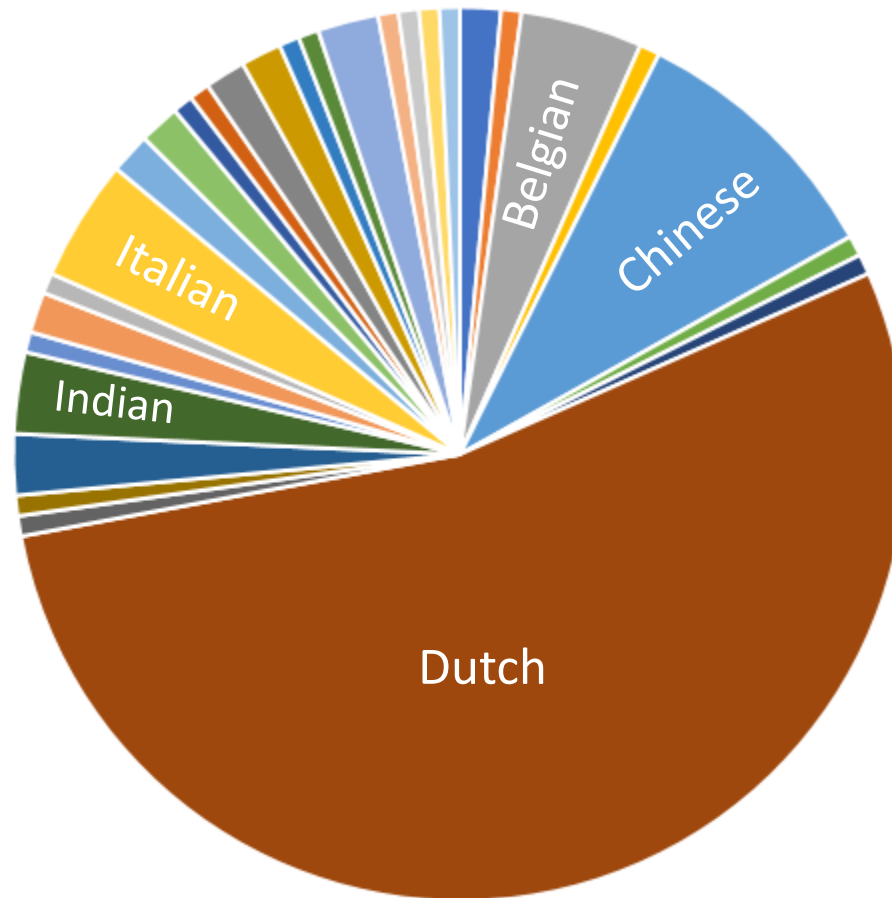
- Ultra-low-power and flexible electronics
- Health Care , Energy, Consumer Electronics



Agentschap NL
Ministerie van Economische Zaken



International Innovation

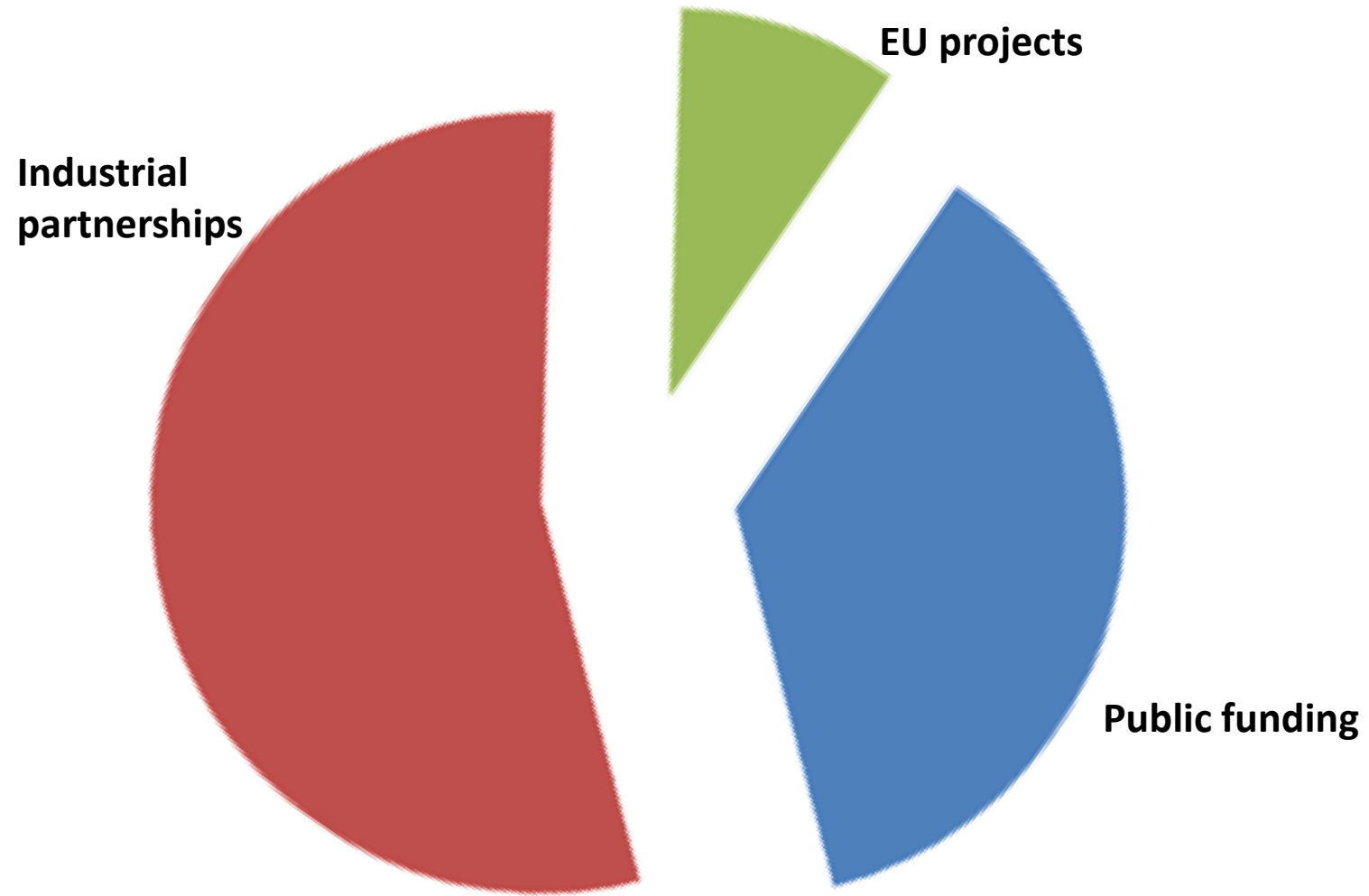


- Argentinian
- Austrian
- Belgian
- British
- Chinese
- Cypriot
- Danish
- Dutch
- Finnish
- French
- German
- Indian
- Indonesian
- Iranian
- Irish
- Italian
- Korean
- Moroccan
- Nepalese
- Peruvian
- Polish
- Russian
- Serbian/Monten.
- Singaporean
- Spanish
- Swiss
- Taiwanese
- Venezuelan
- Vietnamese

Present industrial partners

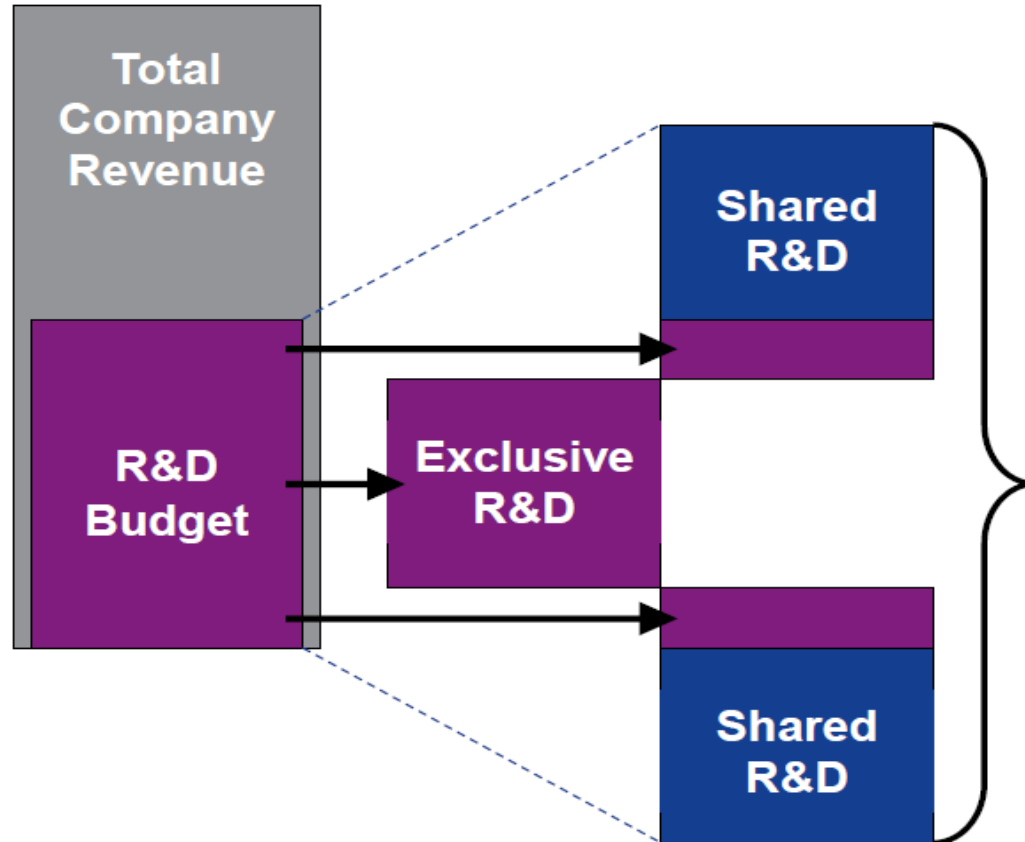


Budget sources



JOINT R&D: TACKLING THE R&D COSTS AND RISKS

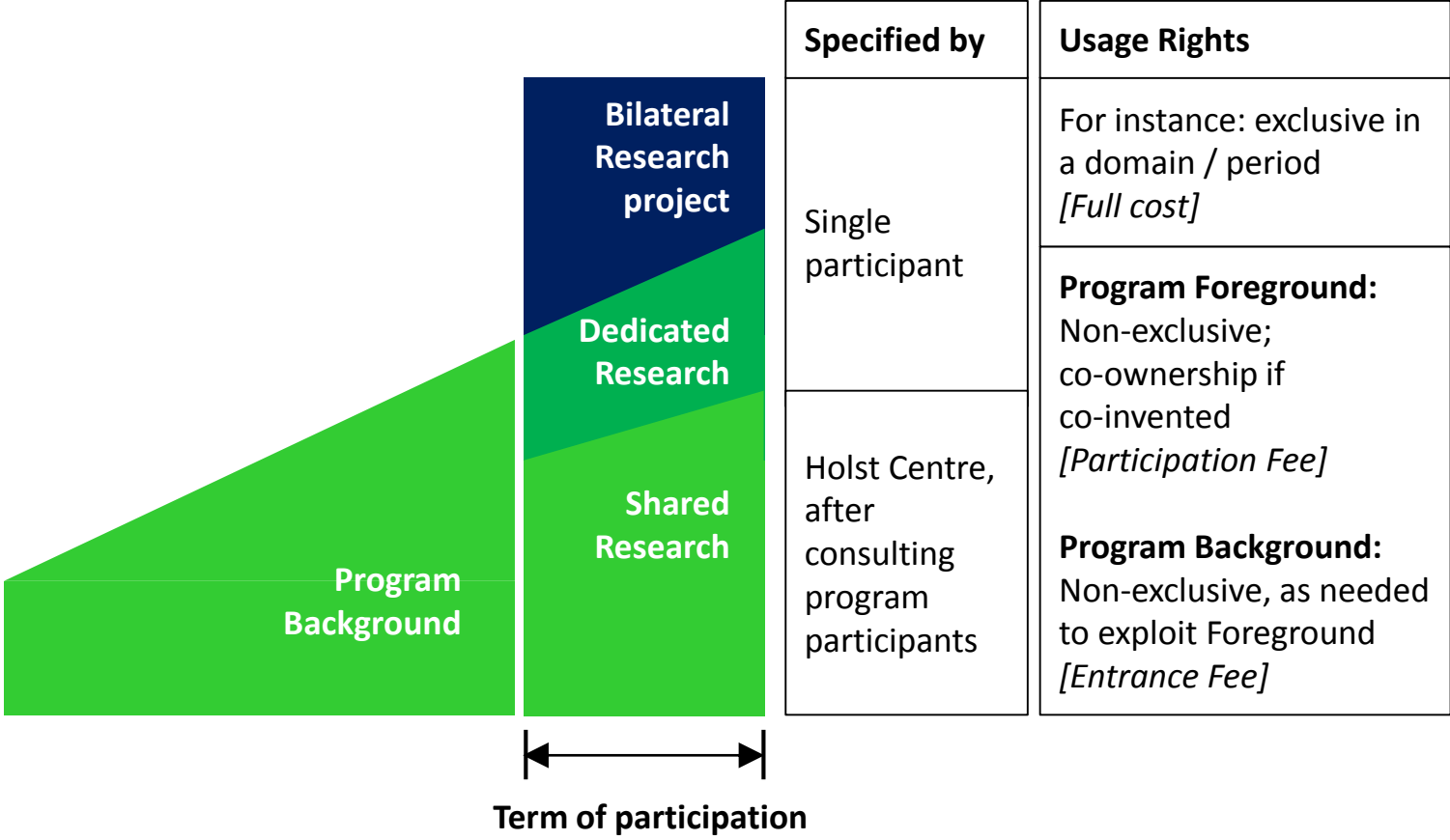
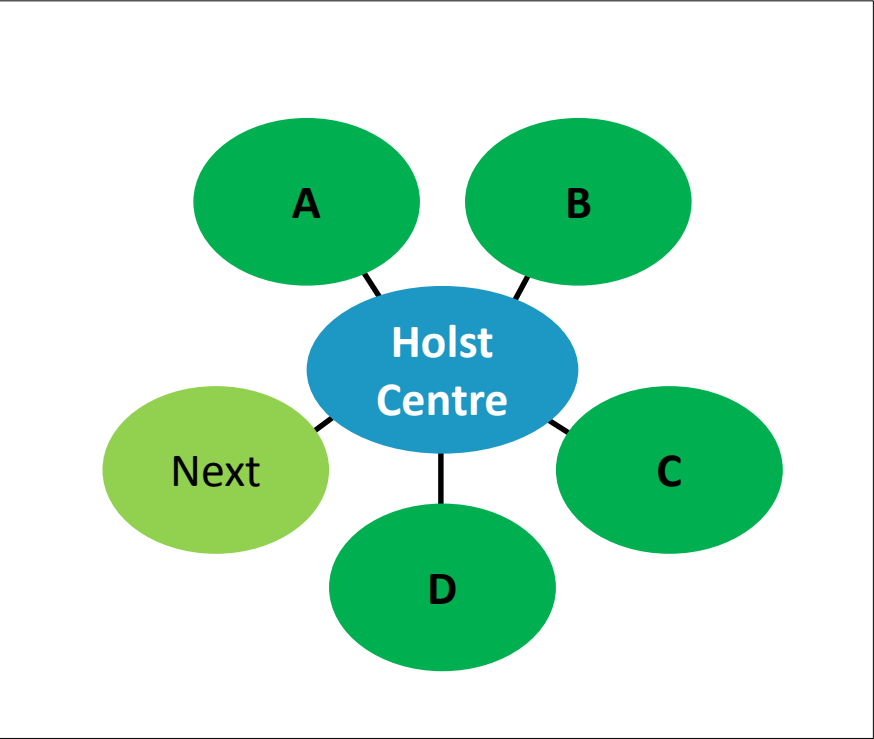
Innovation becoming more complex:
we can't stop innovating...
...but we can't bear the costs and risks anymore



Leverage:

1. Innovating by combining ideas
2. Sharing of facilities and competencies
3. Reducing time to market
4. Sharing of R&D costs and risks

Programmatic R&D, virtual consortia



Building ecosystems



German Heart Centre



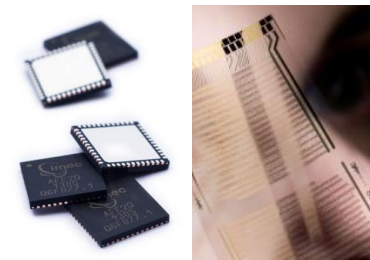
Validation



Applications

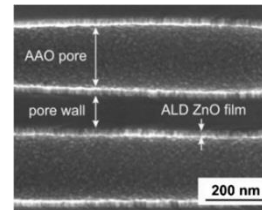


Systems



MegaChips

Components



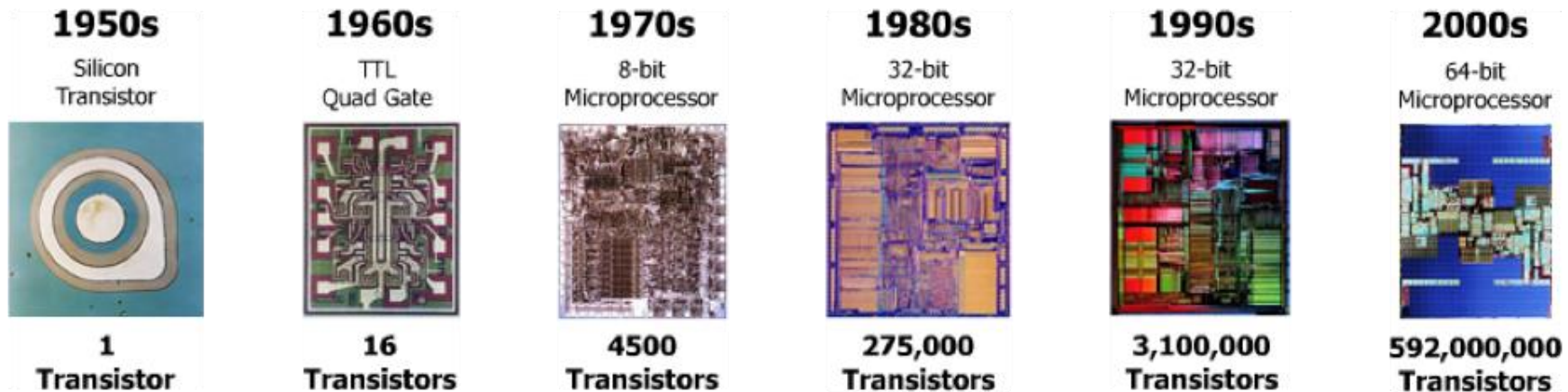
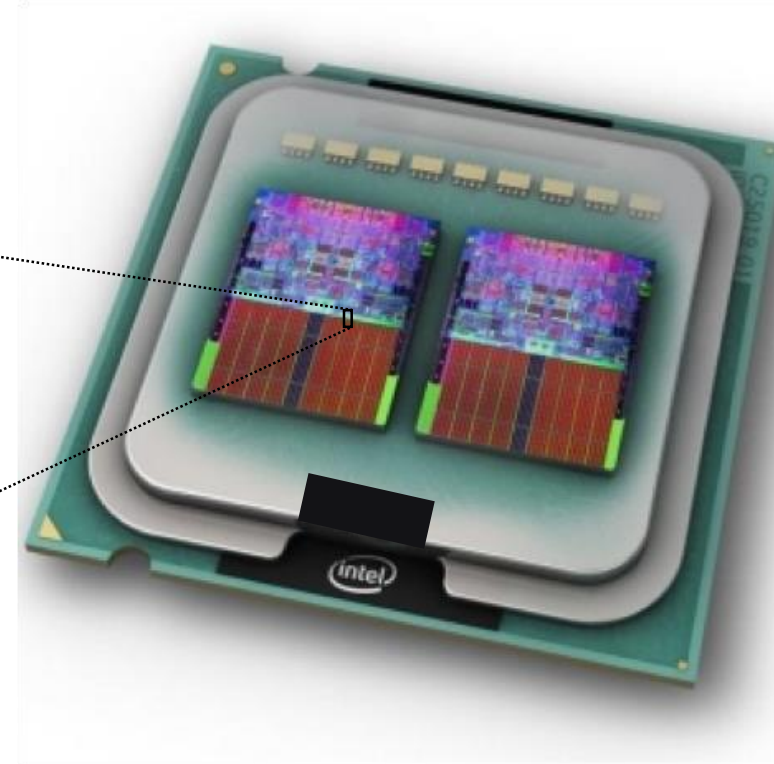
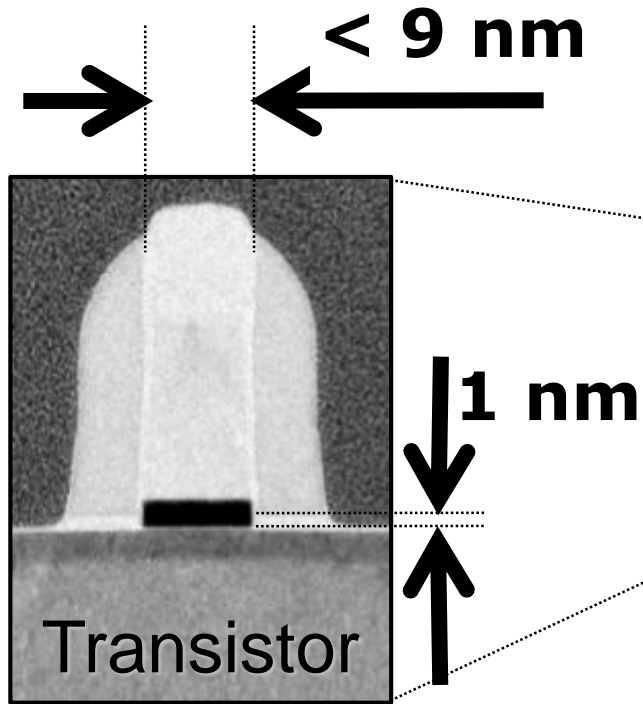
Materials



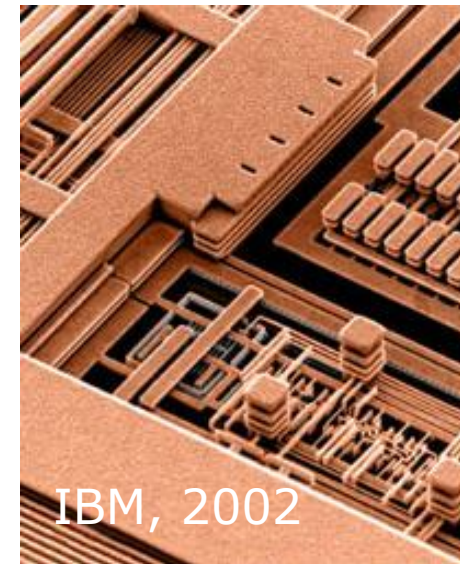
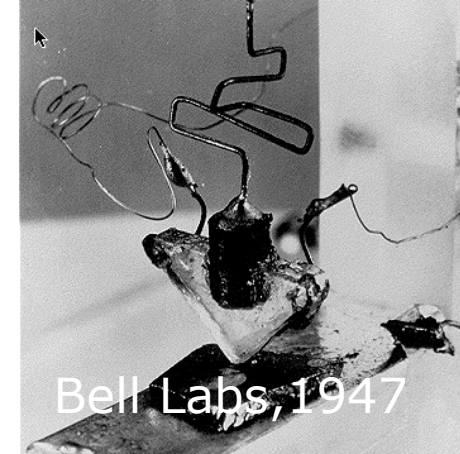
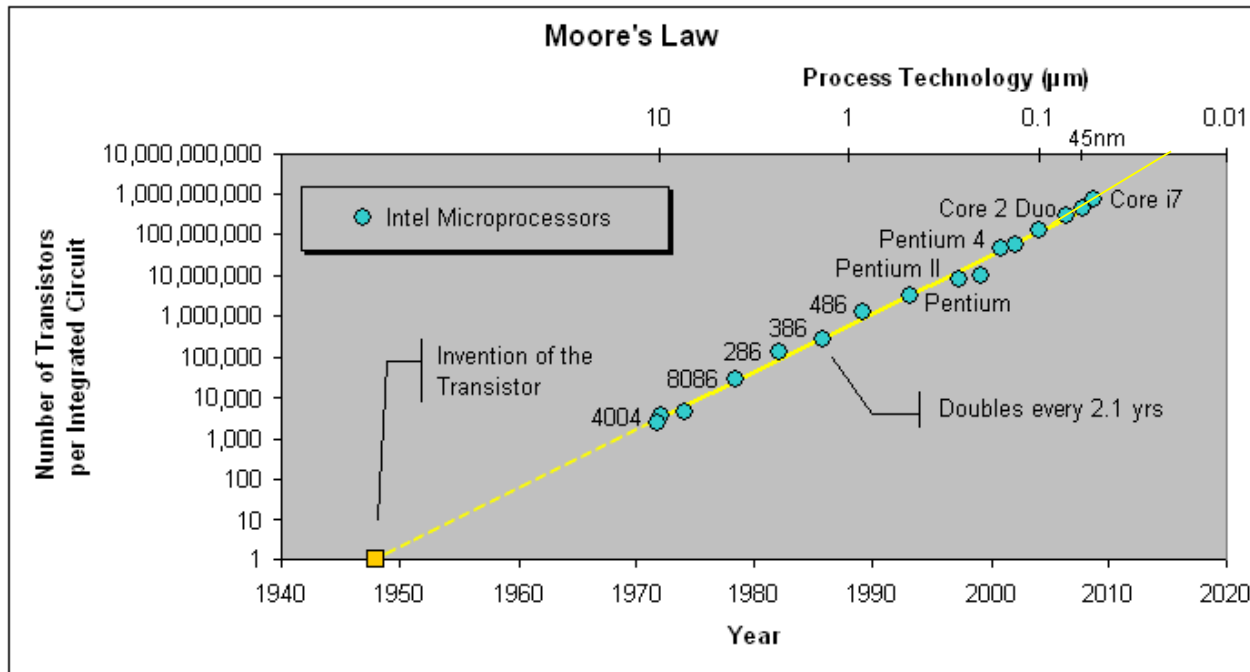
Tool manufacturing



CMOS scaling: More Moore



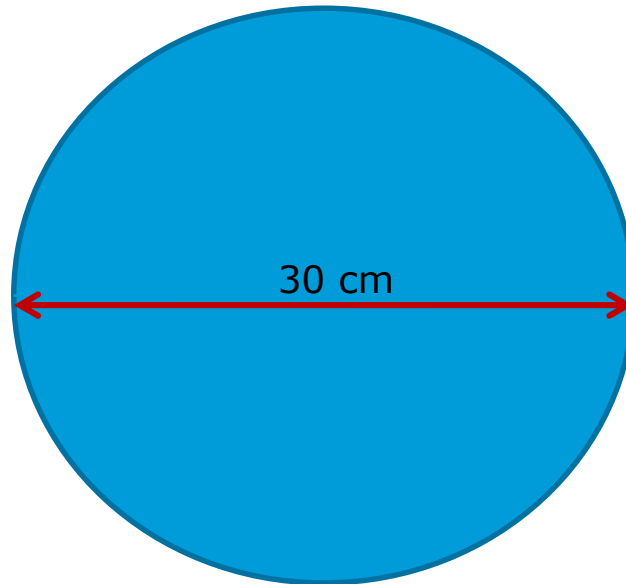
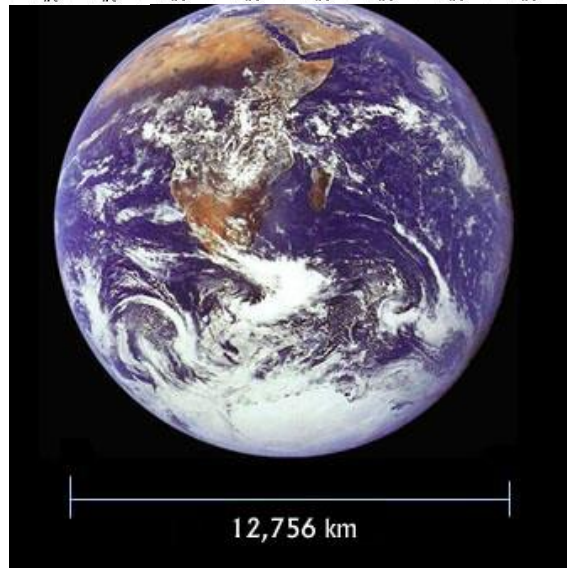
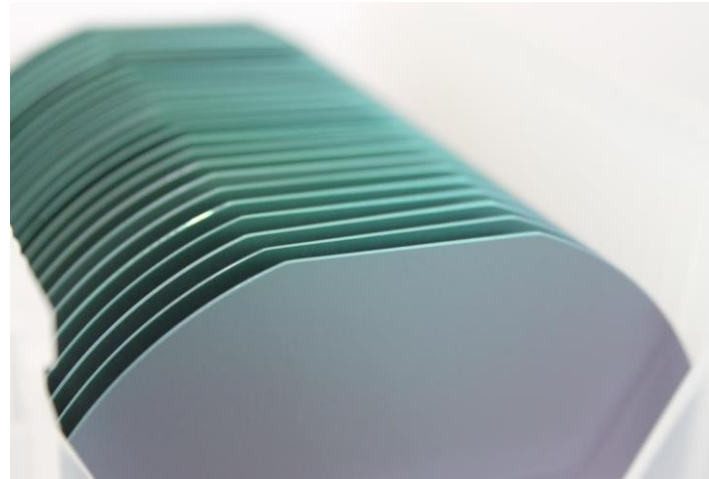
MOORE'S LAW



"It'll be at least a human generation before Moore's Law begins to run out of gas at around the 9 nm in 2024 and even then it may thrive."

Calvin Chenming Hu,

Semico Summit conference, March, 2002.

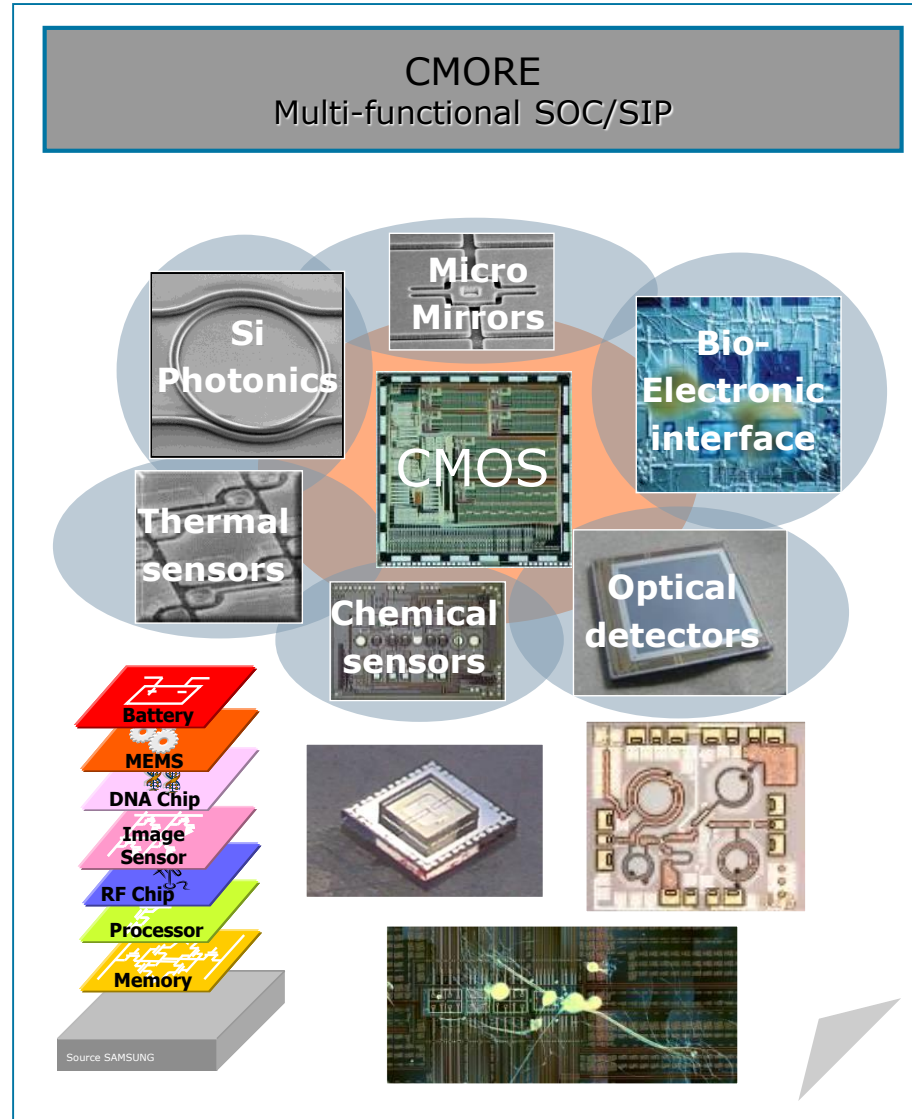
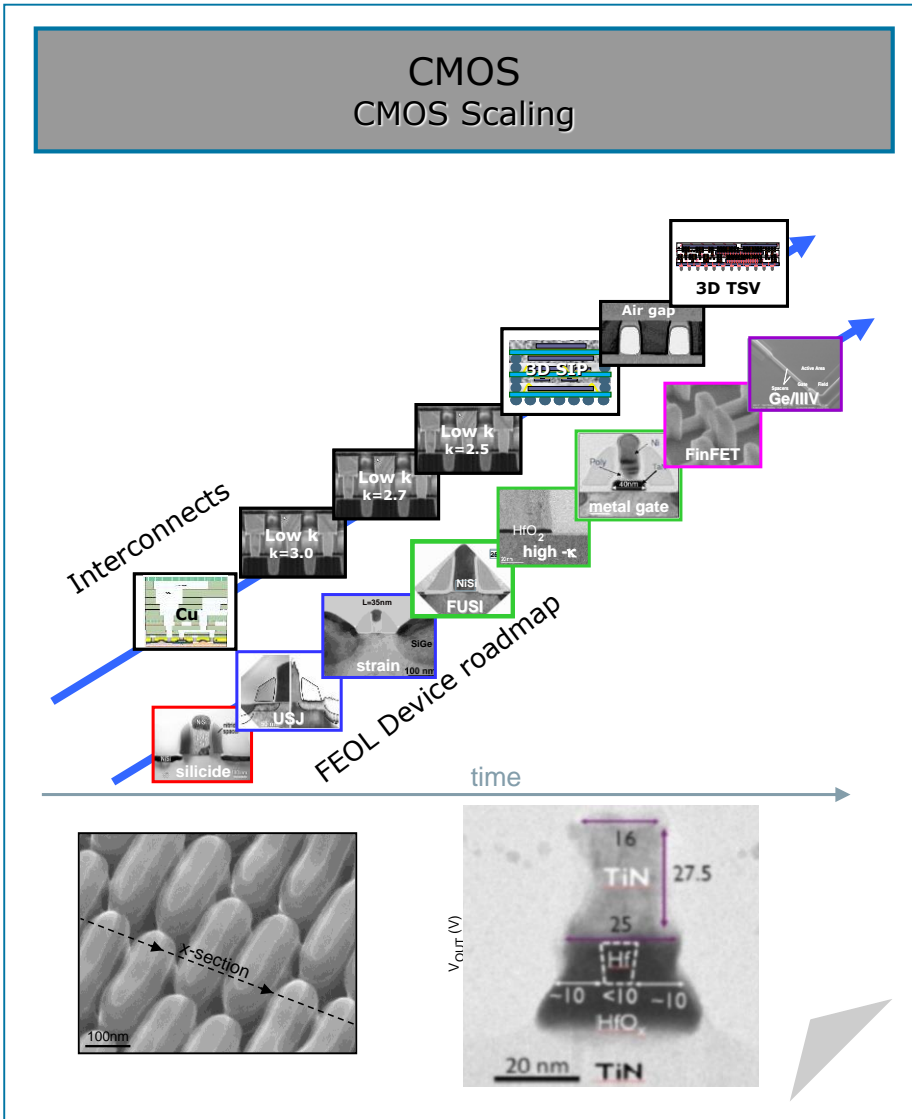


$$30 \text{ cm} / 30 \text{ nm} = 10 \text{ million}$$

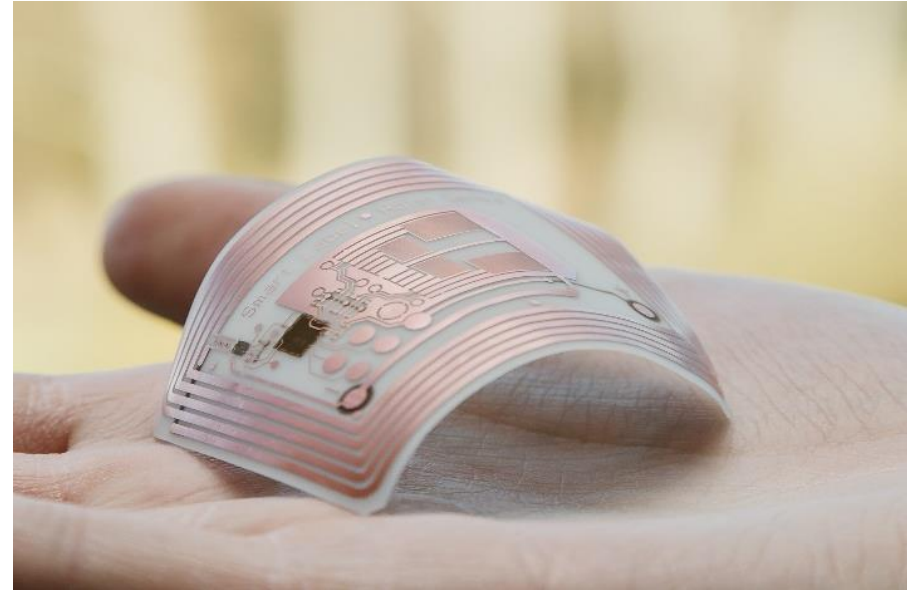
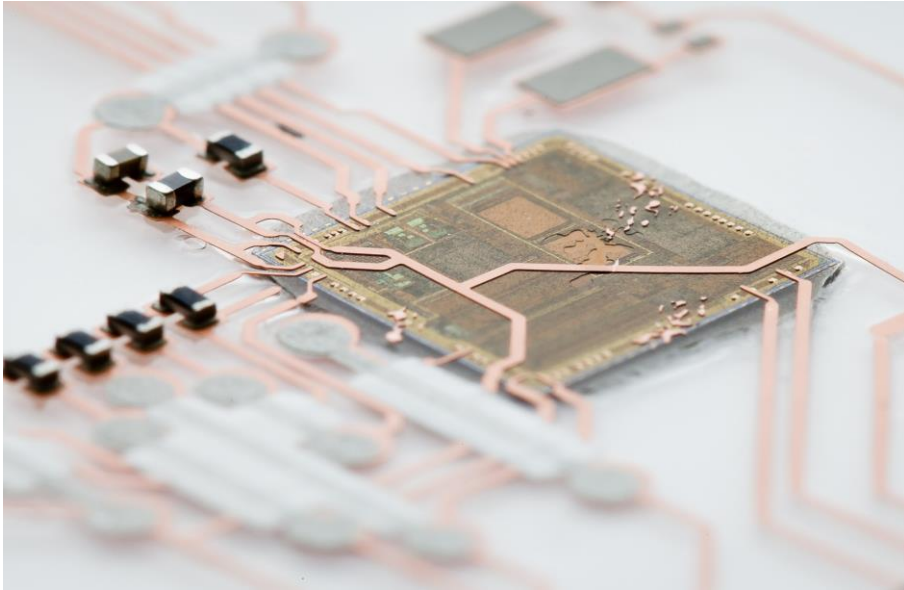
~

$$12.756 \text{ km} / 1.27 \text{ m} = 10 \text{ million}$$

More Moore vs. More *than* Moore

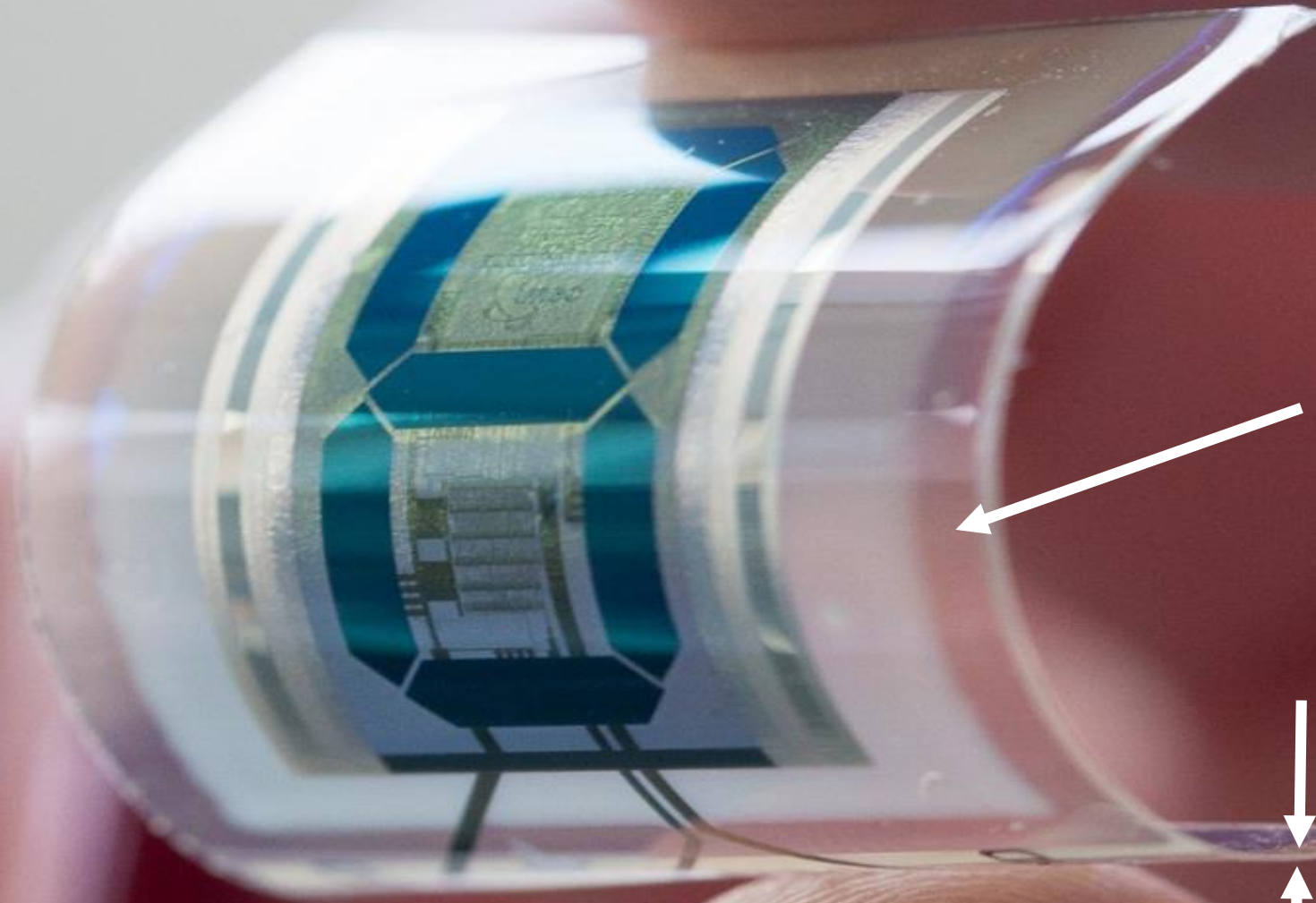


The power of hybrid integration



Holst Centre's vision ten year ago,
now a growing trend worldwide

Flexible display with driver electronics



Very flexible



Very thin



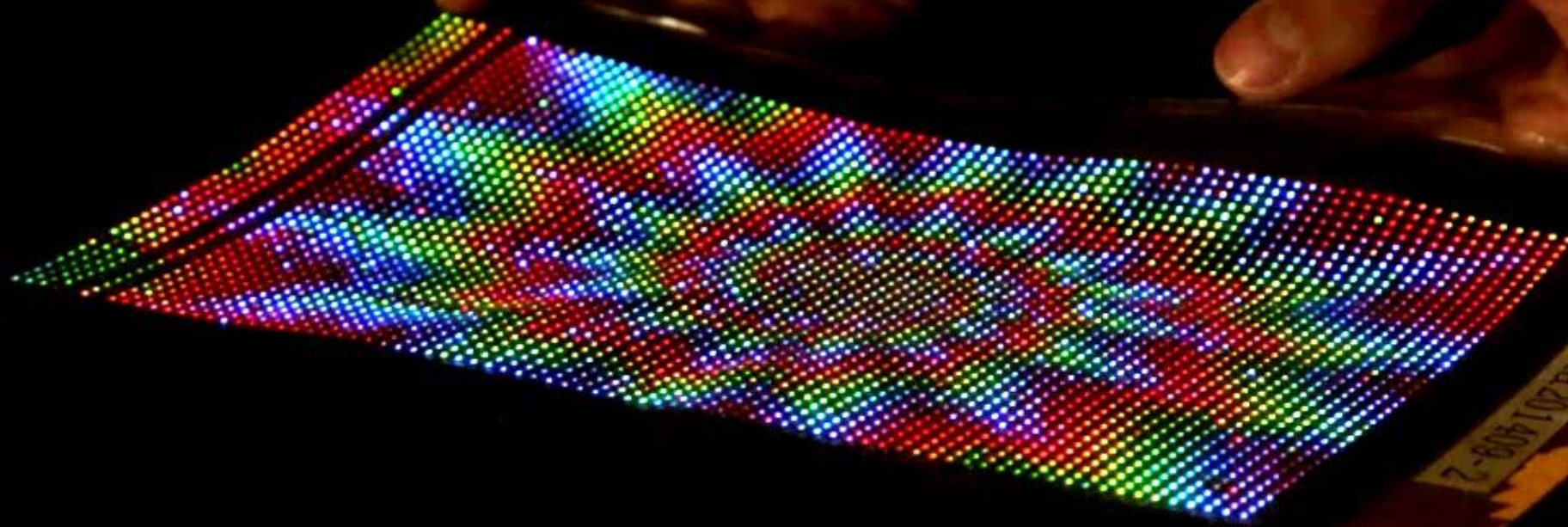
~30 μ m



Flexible OLEDs



LED signage device for clothing





Electricity Harvesting Foils

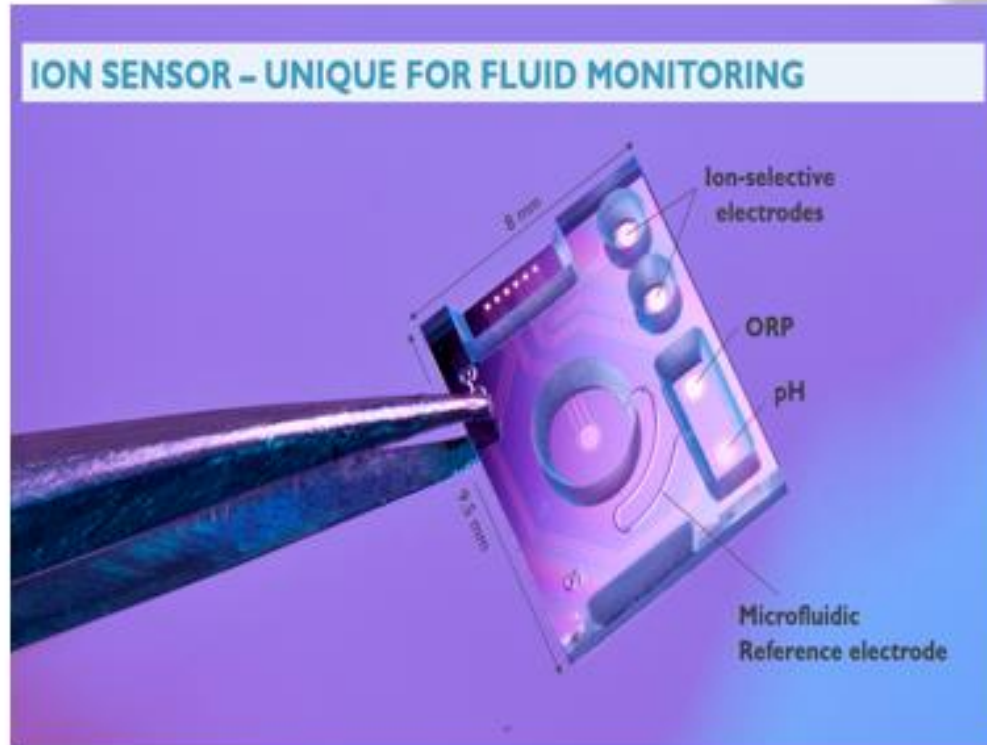
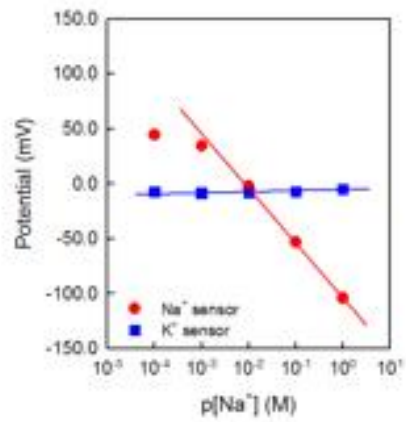
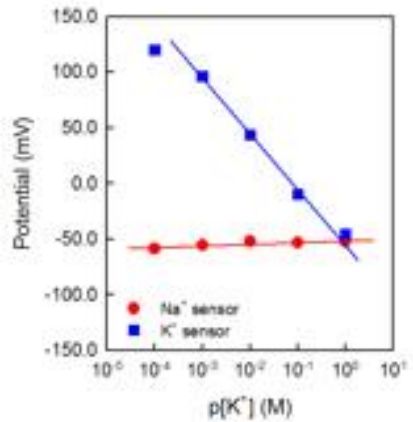




Sweat analysis

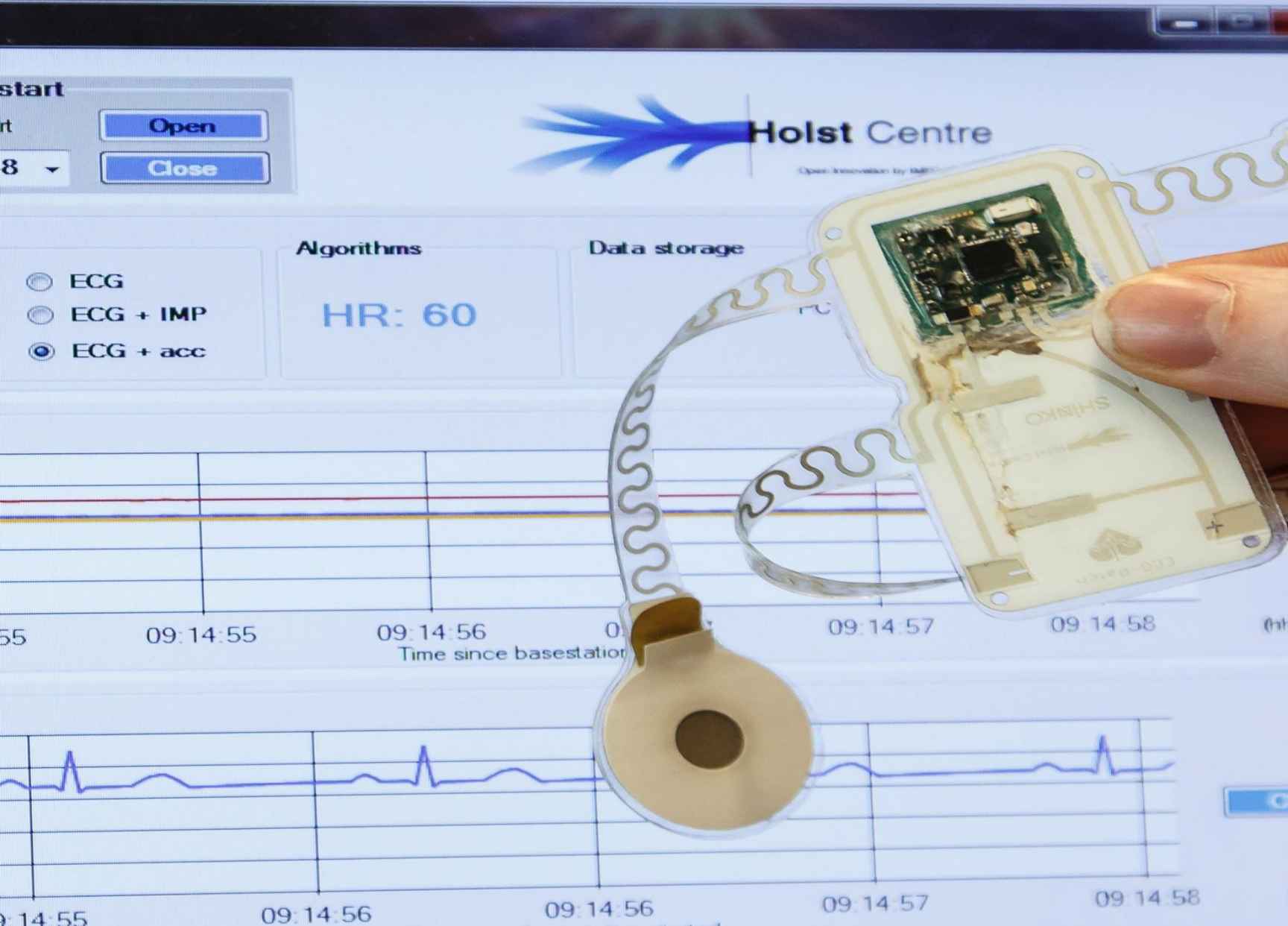


- Miniaturized reference electrode !!
- pH, Cl^- , Na^+ , K^+ , NO_3^-
- Extension to other ions possible
- Solid and flexible



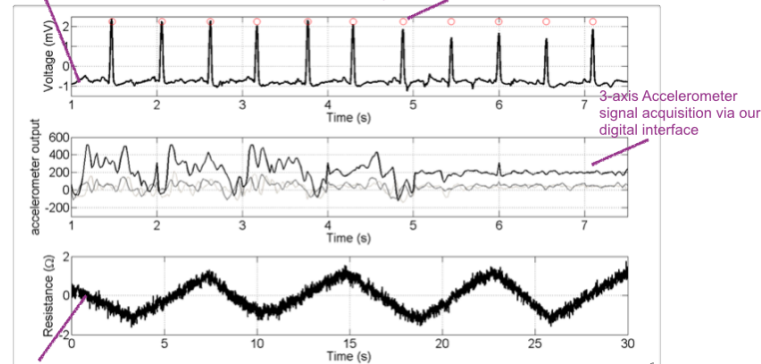
Ultra Low Power is key for Flexible Wireless Systems

< 1mW in total



ECG measurements are done with our high resolution analog front-end

RR Interval algorithm for HRV Analysis running in MUSEIC



Respiration Measurements using Bio-Impedance

FLEXIBLE WRISTBAND



**SAMSUNG SIMBAND
HOLST CENTRE SENSING TECHNOLOGY**

Most advanced sensor platform at the wrist (2015)

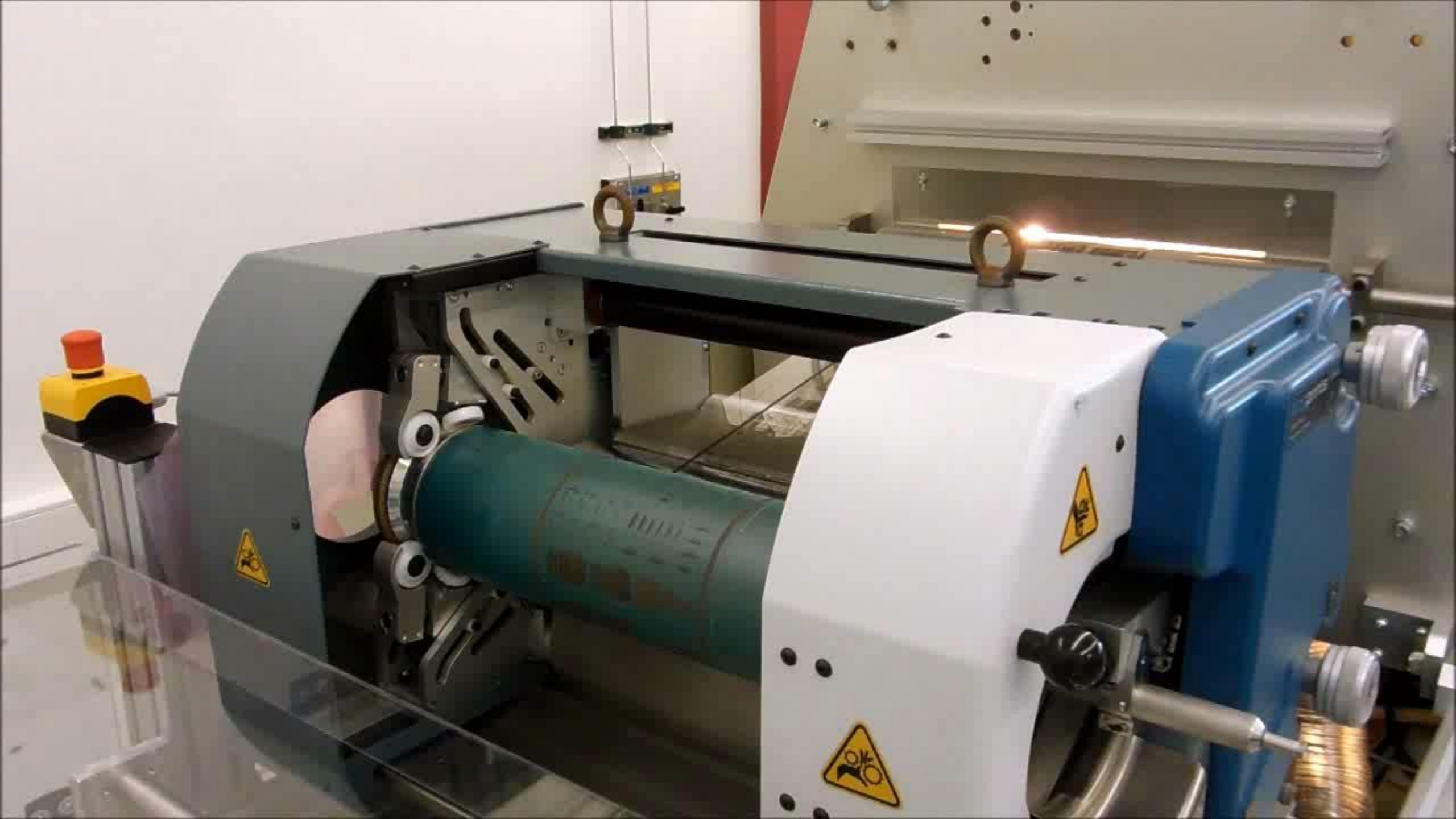
Next steps: large-scale user trials for algorithm validation



Flexible Electronics: going to pilot production



Enabling production of hybrid systems in the region



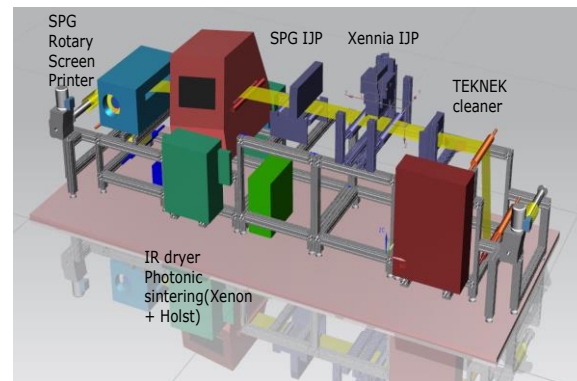
Roll to Roll production tools

R2R Barrier Deposition



*Bringing tool development
to the region*

R2R Printing & Photonic Curing



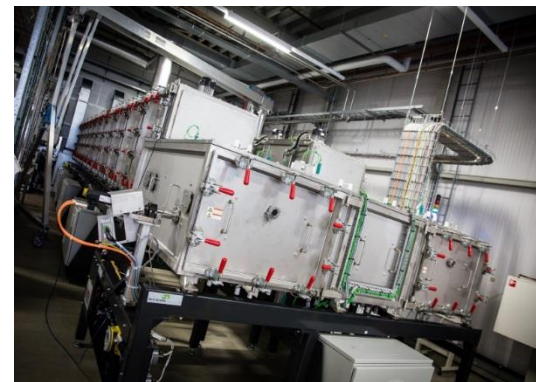
spgprints®

R2R Spatial Atomic Layer Deposition



MEYER BURGER

R2R Production



Rexroth
Bosch Group



MEYER BURGER



Smart Blister

can record and wirelessly
notify doctors when
medicines are taken

Industry: Medical
Pharmaceutical

Enabling Factors:
Flexible and hybrid
printed electronics



MATURE WEARABLE HEALTH SYSTEMS

 NIHON KOHDEN




APPROVED



BioTelemetry^{inc.}

BioTelemetry, Inc. Announces FDA Approval of Its Next Generation Device, the MCOT™ Patch

Company provides best in class arrhythmia detection in a patch form factor


APPROVED



2 DEVICES GOT MEDICAL CERTIFICATION !

Start-up: bloom Technologies



WHAT WILL YOU FIND in the box

BLOOMLIFE SENSOR

High tech. Low profile. So cute. The rechargeable sensor translates your contractions into easy to understand information.



BLOOMLIFE PATCH

Gentle and designed with pregnant skin in mind. Each patch can be used for up to seven days.

CHARGING CORD

For when the sensor needs a little extra juice. A fully charged sensor can last up to seven days.



STEP-BY-STEP INSTRUCTIONS

Everything you need to know to get started.

THE BOX

This humble box contains everything you need to get started with Bloomlife. Hang onto it to mail your Bloomlife system back when you're done.





Start-up: Lifesense Group

Prevention

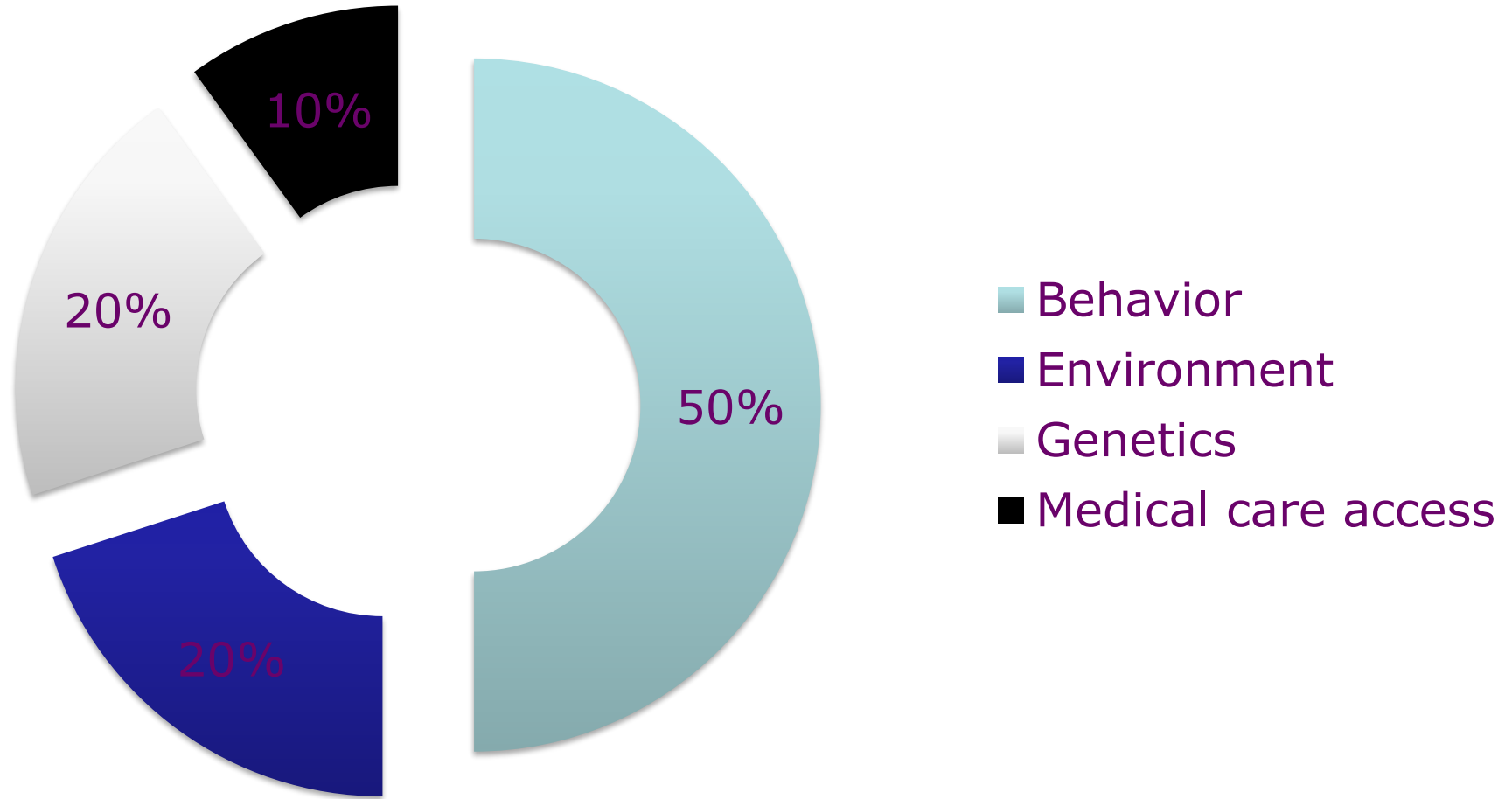
Treatment / Cure

Care

“ A LONG HEALTHY LIFE ! ”



BEHAVIOR IS *THE* MAJOR CONTRIBUTOR TO YOUR HEALTH



I CHANGE

Providing the right feedback at the right time based on data analytics from contextual and physiological data



STOP SMOKING



STOP DRINKING



MEDICATION COMPLIANCE



MANAGE EATING DISORDERS



LOSE WEIGHT



BALANCED DIET



INCREASE FITNESS



ATHLETE PERFORMANCE



THERAPY FOLLOW-UP

BURNOUT, DEPRESSION



PREVENT BURNOUT



PERSONAL INSIGHTS



INCREASE ENGAGEMENT



GET IN THE ZONE
OPTIMIZE PERFORMANCE



PERSONALIZATION IS ESSENTIAL

WE ARE ALL DIFFERENT AND UNIQUE

**FIND AND add TRIGGERS
TO ACCOMPLISH
BEHAVIOR CHANGE**

*when and
where should
we motivate
you ?*

personal behavioral technology for disease interception and preventive health

826 SUBJECTS



7 COMPANIES



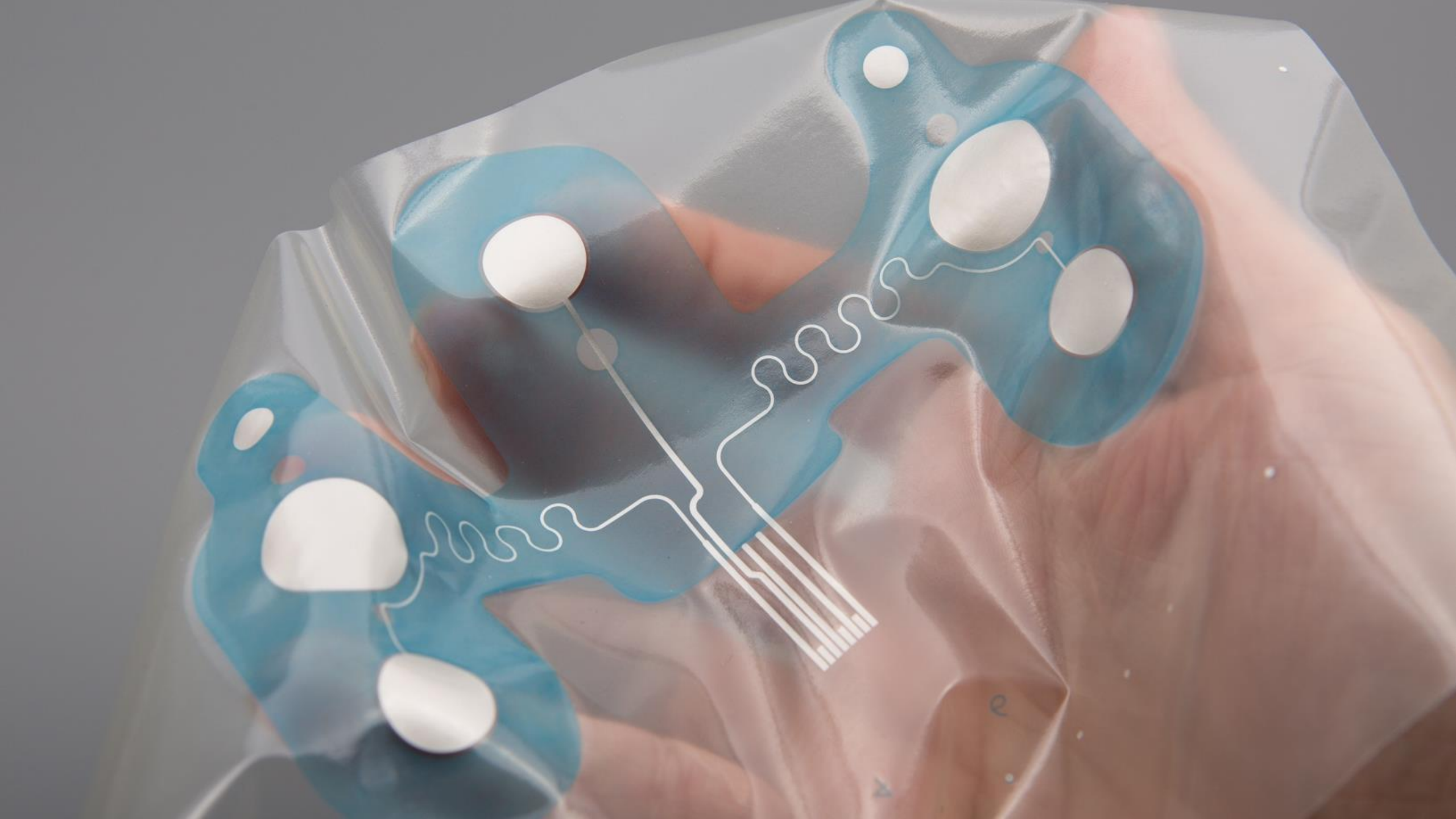
22,000 SELF-
REPORTED
STRESS
RESPONSES



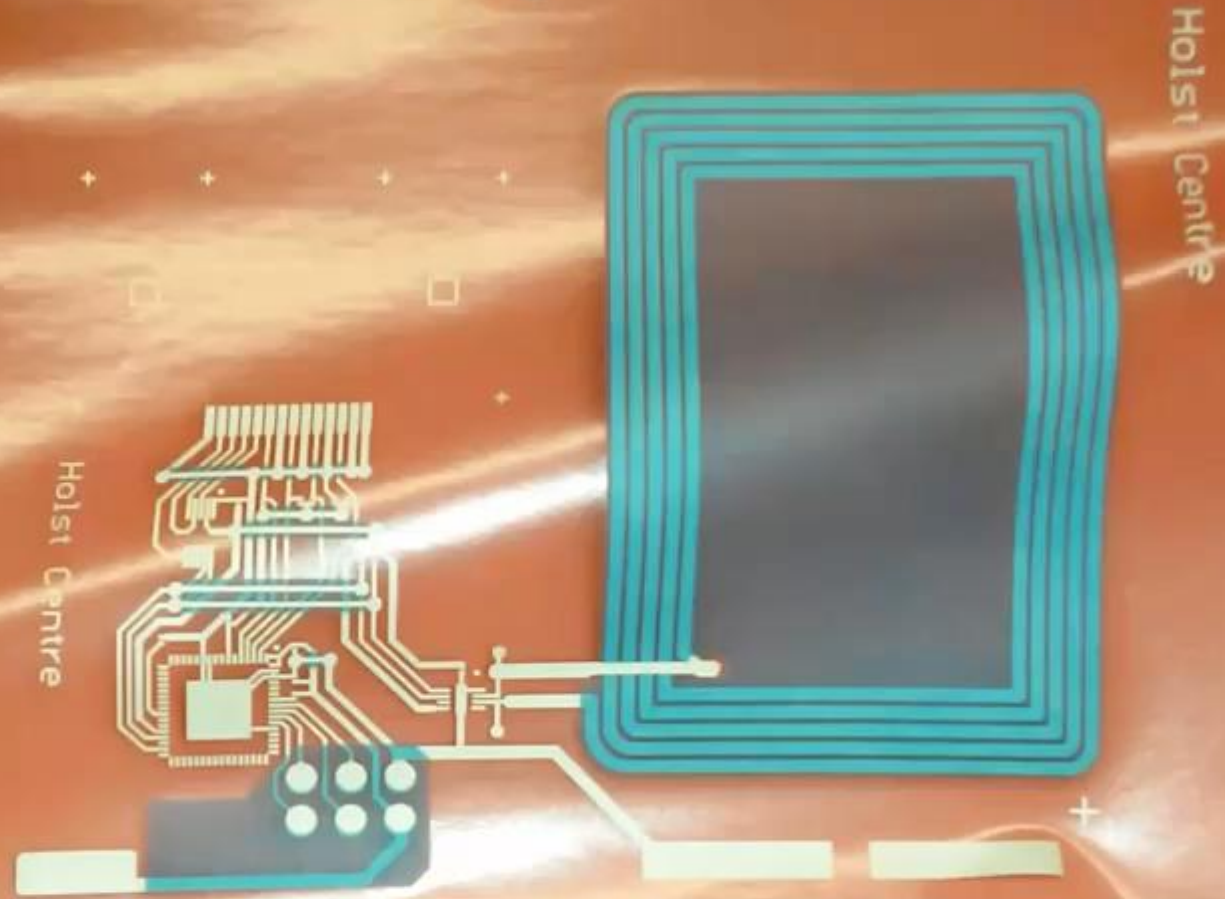
90,000 HOURS
PHYSIOLOGICAL
DATA



A very large study on
mental stress in free living conditions ...



Stretchable electronics 2.0




Smart shirt: beyond patches



 **Holst Centre**
Open Innovation by imec and TNO

ECG + bioZ + movement monitoring
stretchable inks on stretchable substrates for electrodes

Please do not touch
"scientific laundry"
Washability experiments ongoing

In case of questions contact  (0651815368 Holst Centre 2-52)
Or Linda van Peppel

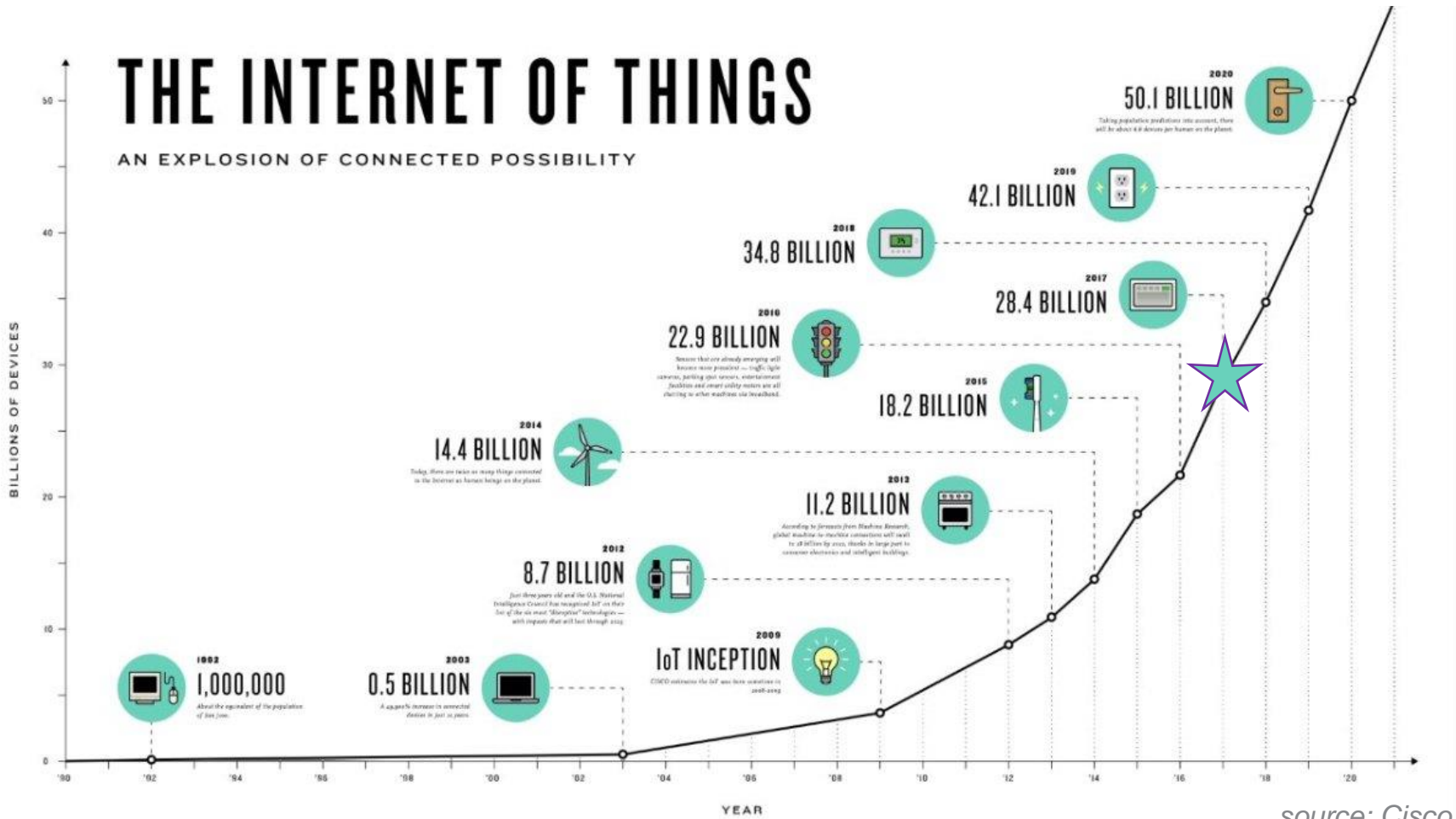
TP 3 program on interconnection technologies and textile integration of
electronics

Responsible program manager Jeroen van den Brand



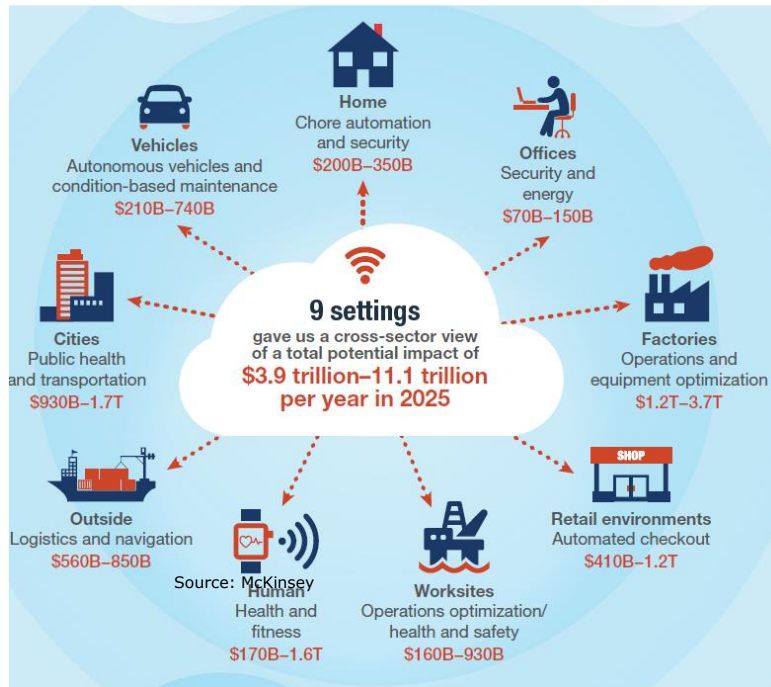
THE INTERNET OF THINGS

AN EXPLOSION OF CONNECTED POSSIBILITY

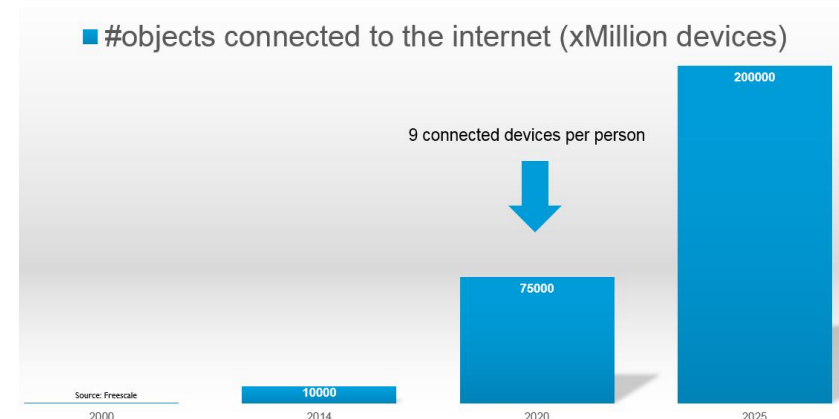
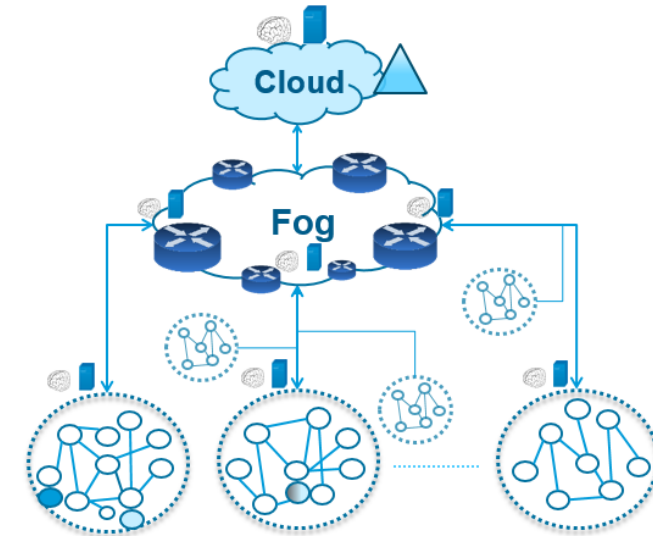


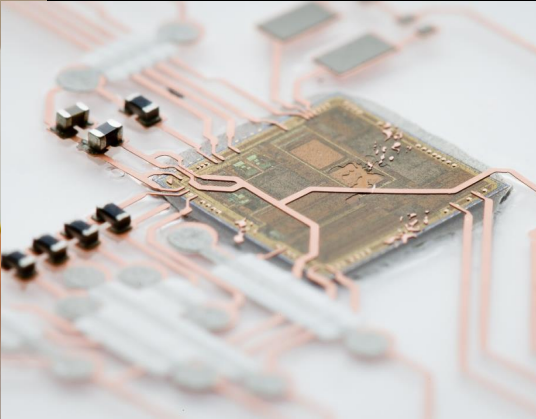
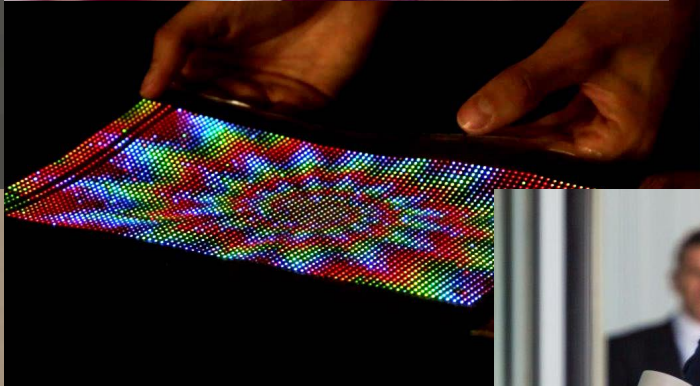
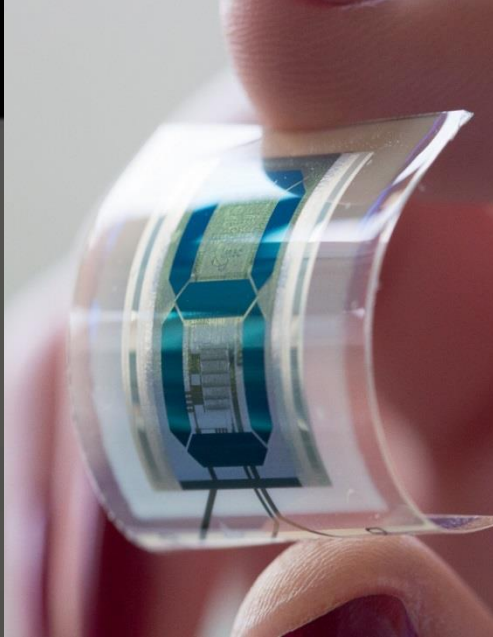
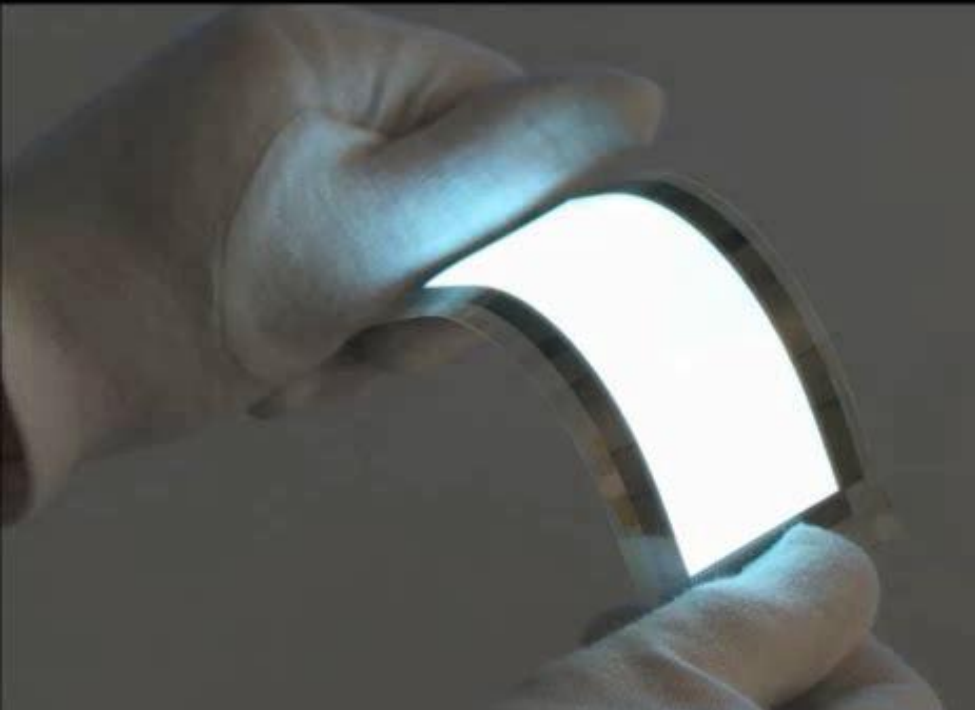
source: Cisco

lot Value : Can it really happen ?

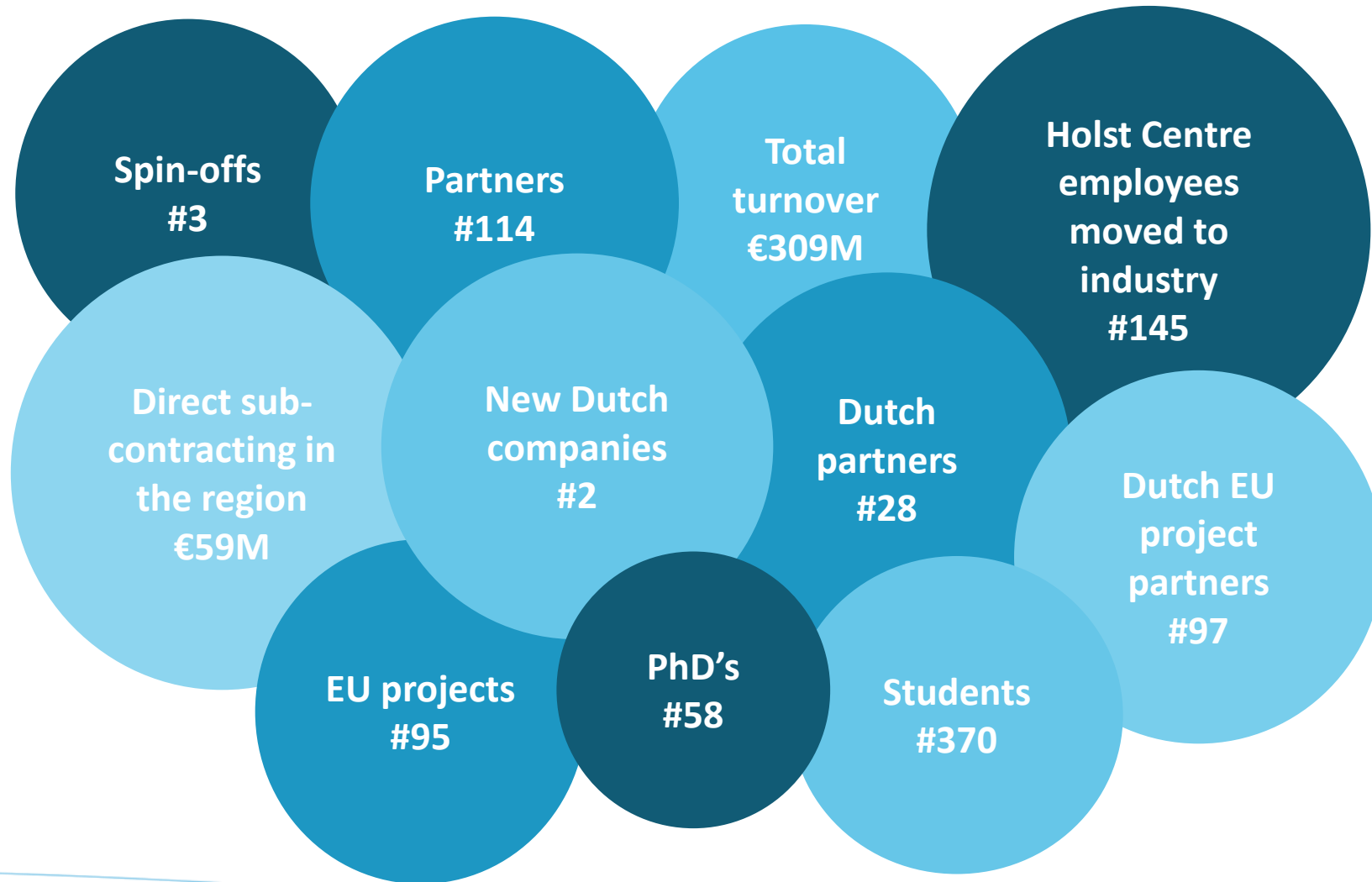


Cost
Power
Connectivity
Security
Privacy





Holst Centre numbers 2006-2015





fastforwarding
innovation

10

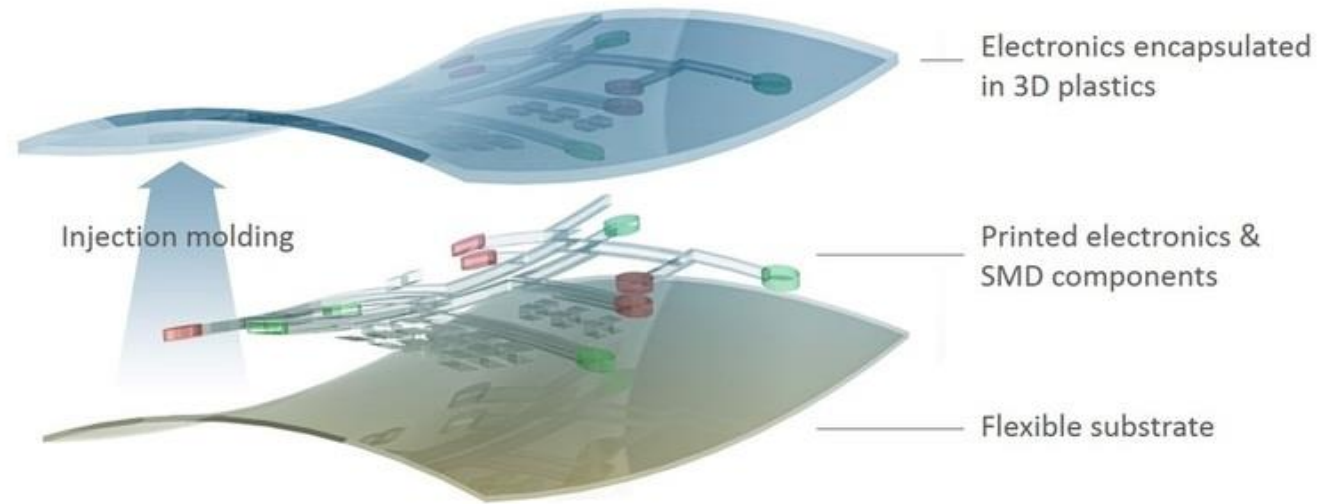
YEARS



Holst Centre

Open Innovation by imec and TNO

Structural electronics



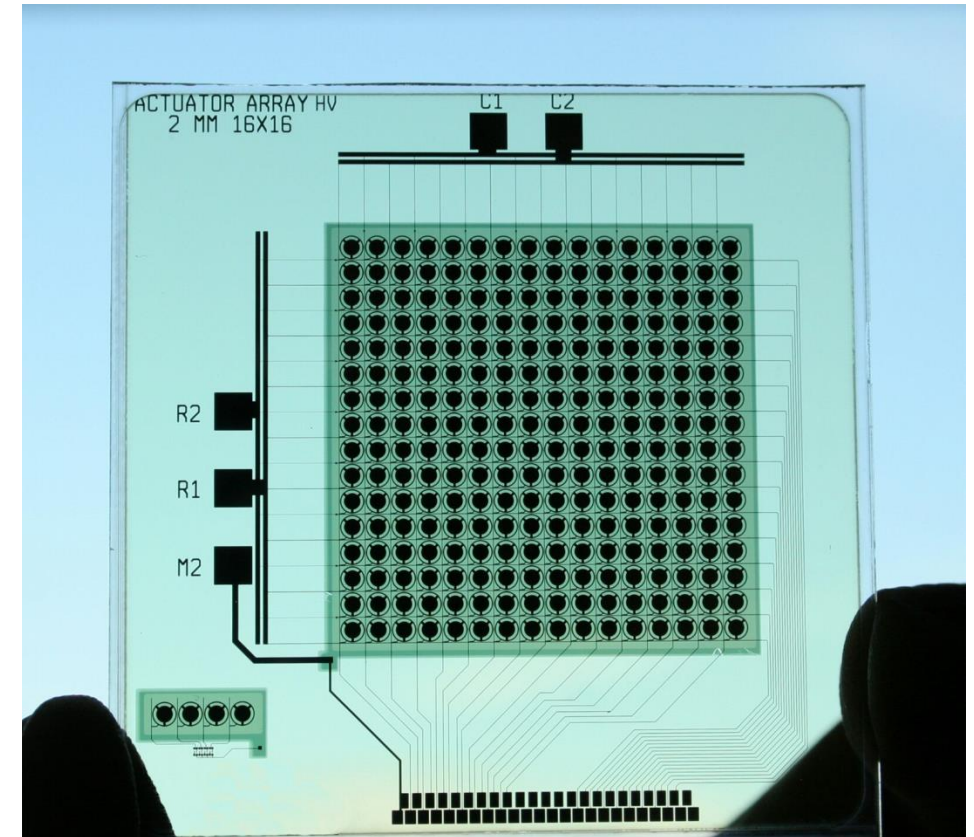
Flexible ultrasound sensor arrays

Technology

- Metal-oxide TFT backplane
- Coated piezo-electric front plane

Target applications

- Haptic feedback
- Medical ultrasound imaging



16x16 active matrix sensor array on flexible substrate



Holst Centre

Open Innovation by imec and TNO