Interreg North-West Europe
EUROPEAN UNION
OIP4NWE
European Regional Development Fund

OIP4NWE
Open Innovation PIC Pilot

Webinar on PICs for Medical Devices and in Life Science applications

3rd February 2021

Agenda

- **Welcome** (5 min.)
  Dr. Victor Dolores-Calzadilla - Eindhoven University of Technology (TU/e)

- **Towards Optical Coherence Tomography on a Chip** (15 min.)
  Prof. Wolfgang Drexler
  Center of Medical Physics and Biomedical Engineering, Medical University Vienna

- **Photonic integration and societal challenges** (15 min.)
  Prof. Cees Ronda
  Philips

- **Open Discussion (15 min.)**
  Giuseppe Coppola – PhotonDelta

- **OIP4NWE Voucher Introduction (10 min.)**
  Prof. Jürgen van Erps - Vrije Universiteit Brussel

Welcome

Dr. Victor Dolores-Calzadilla

Photonic Integration Technology Center
Eindhoven University of Technology (TU/e)

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Open -Innovation Photonics pilot for North West Europe

Victor Calzadilla, TU/e

27.01.2021

Open -innovation photonics consortium

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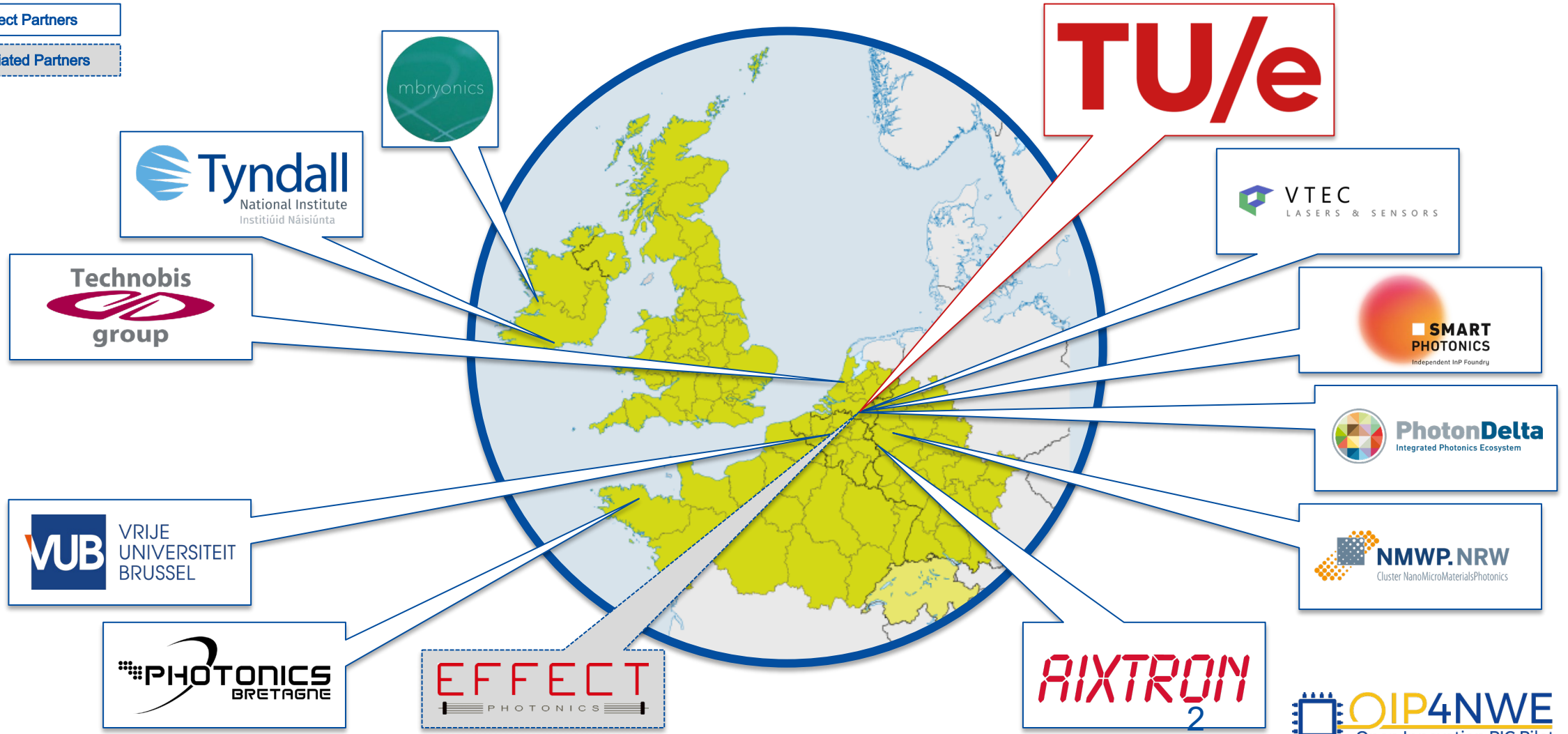
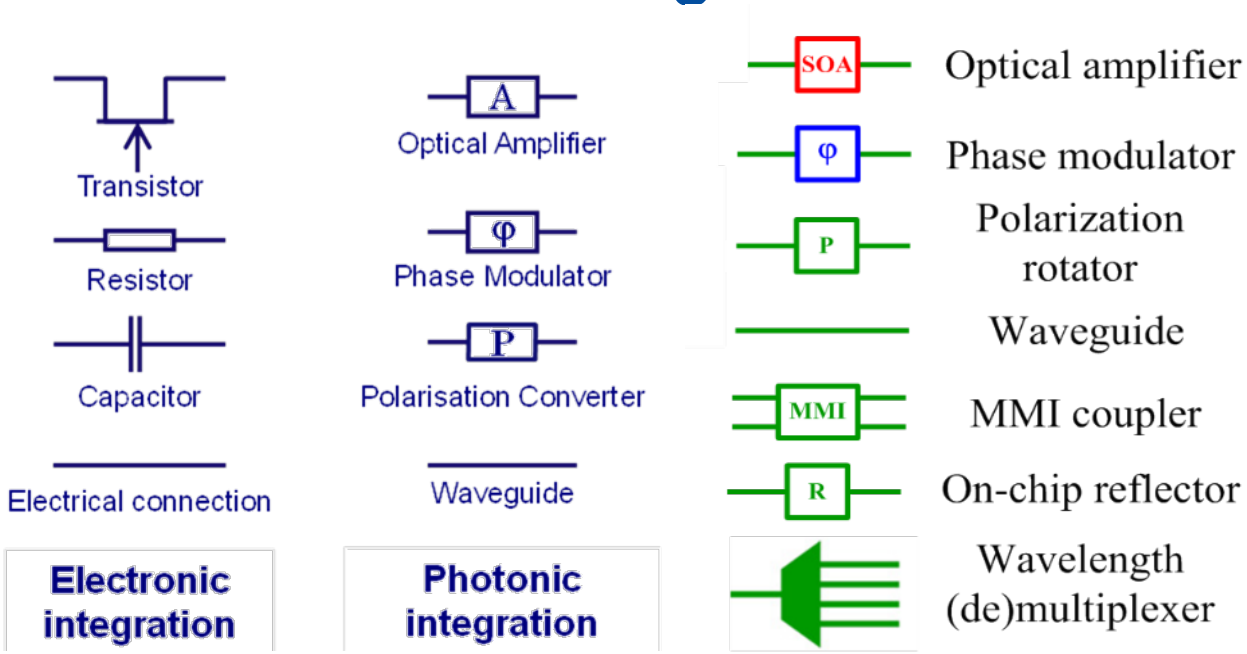
Project Partners
Associated Partners

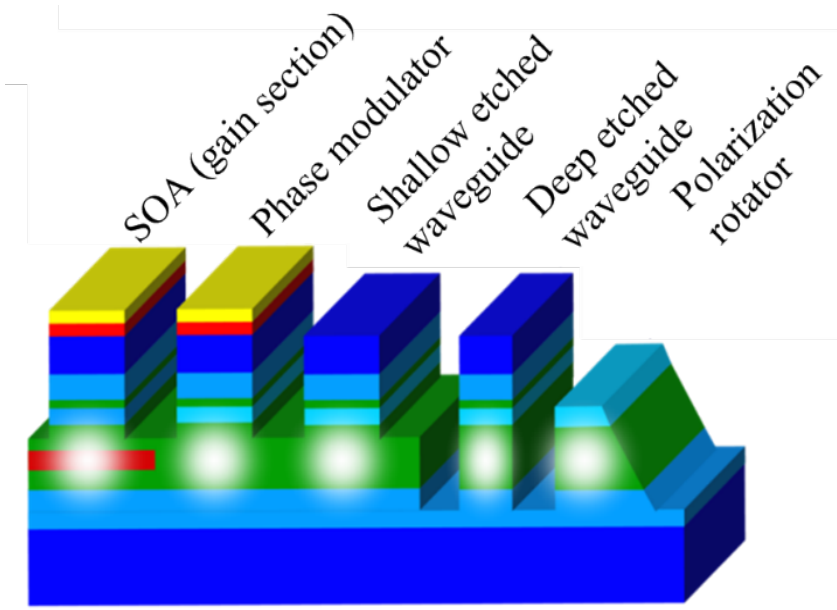


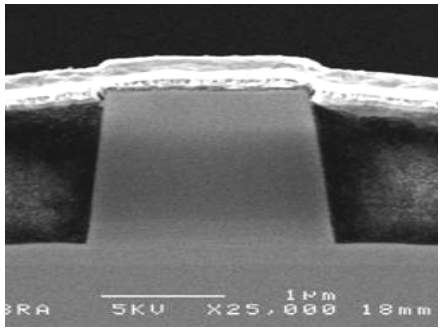
Our targets

- Contribute to increase maturity and scaling of open access InP Photonic Integrated Circuits (PICs).
- Provide technology support to SMEs looking to mature their PIC -based products through open collaboration
- Establish an open innovation environment for InP PIC technology in Europe:
  - Collaborative ecosystem: researchers, foundries, equipment manufacturers, application developers
  - Working on state -of-the-art equipment development and fabrication methods

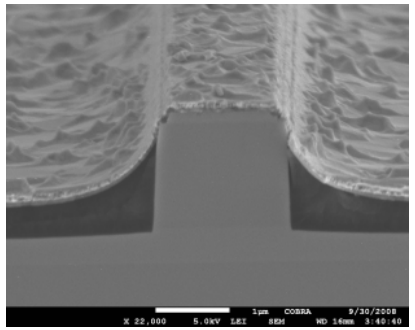
Generic Photonic Integration in InP



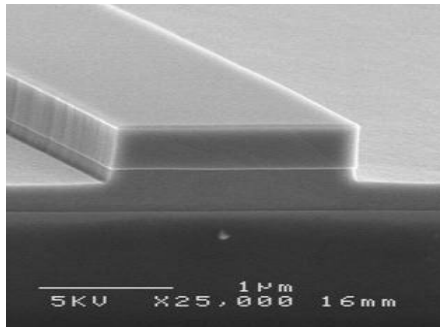




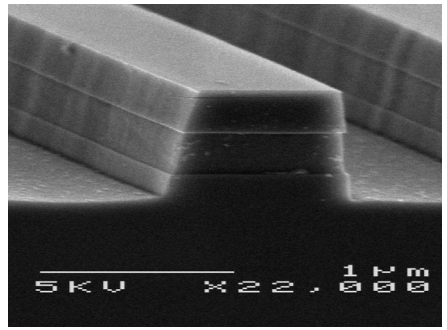
Amplifier



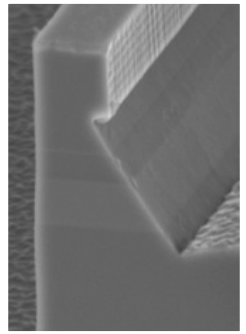
Phase Modulator



Shallow waveguide

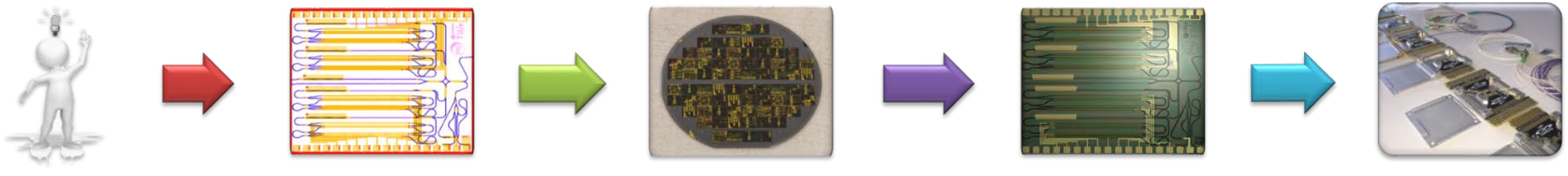


Deep waveguide



Polarization converter

The design cycle in photonic ICs



Application needs
- Market demand
- Application idea

Design
- Design support
- Design automation
- Simulations

Fabrication
- Foundry services
- Crystal growth
- Device fabrication
- Accessibility via MPW

Packaging
- Assembly processes
- Electrical interconnects
- Optical interconnects
- Thermal management

Product
- Integration of PIC into product
- Functional module
- Application specific

Accelerate PIC industry through open innovation

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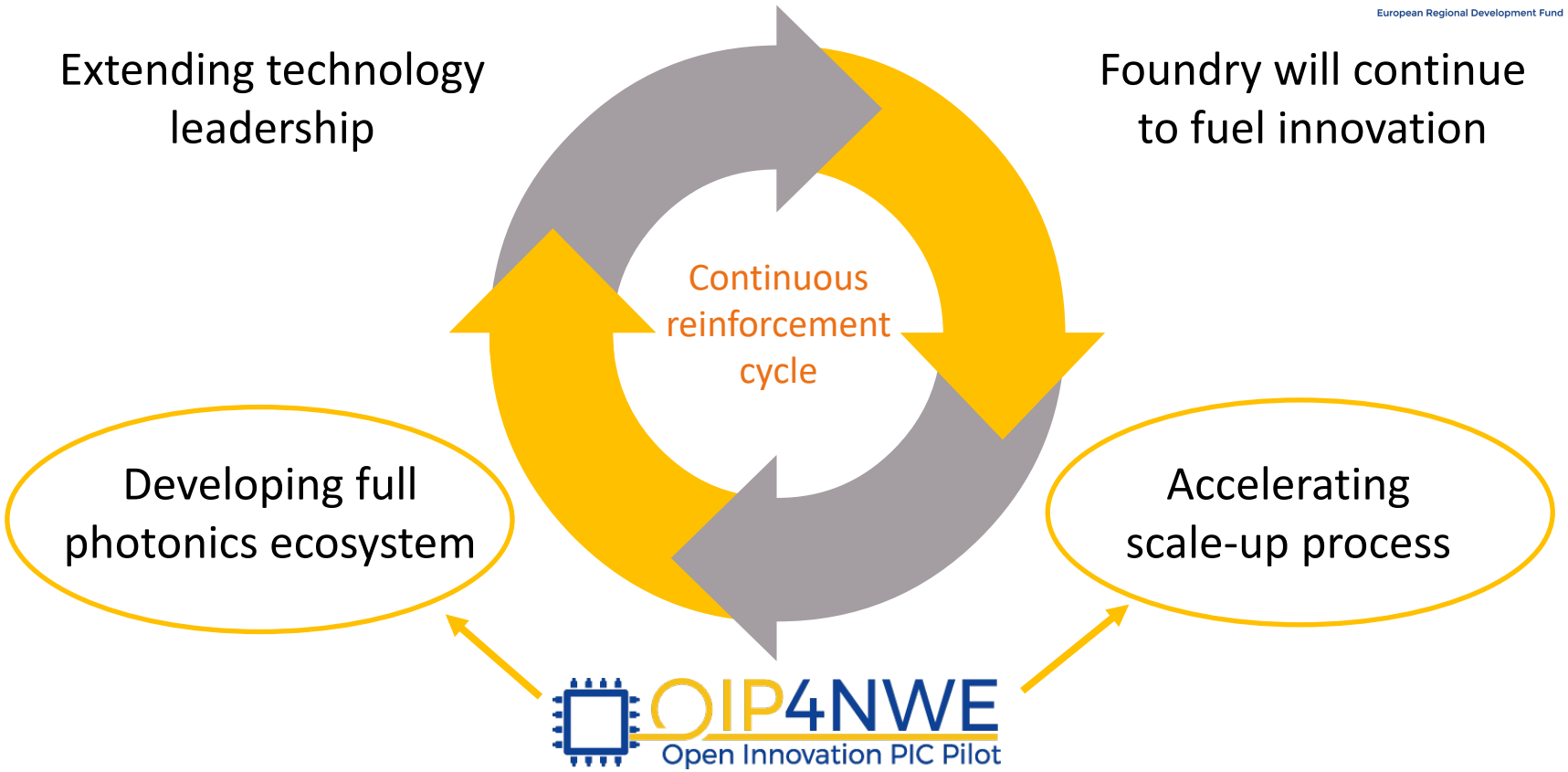

Photonic Integrated Chips (PIC's) based on Indium Phosphide (InP) will play a key role in the lives of many people as they enable new and improved functionalities, ultimately making our world better, greener and safer

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Design and manufacturing of photonic ICs

Process Design Kit with Building blocks

- Broad set of building blocks for Integrated Photonics
- Process Design Kit
  - Design manual and Functional building block description
  - Enables Circuit simulation and Mask design in a full layout -aware design flow
- Technology developments
  - Process improvements
    - Epitaxy
    - Yield
    - Stability
  - Functionality (new building blocks)

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SMART PHOTONICS Independent InP Foundry

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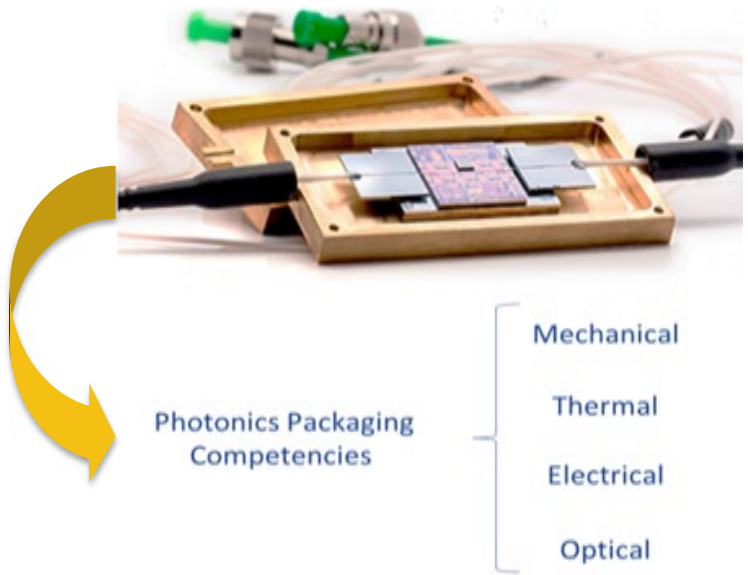
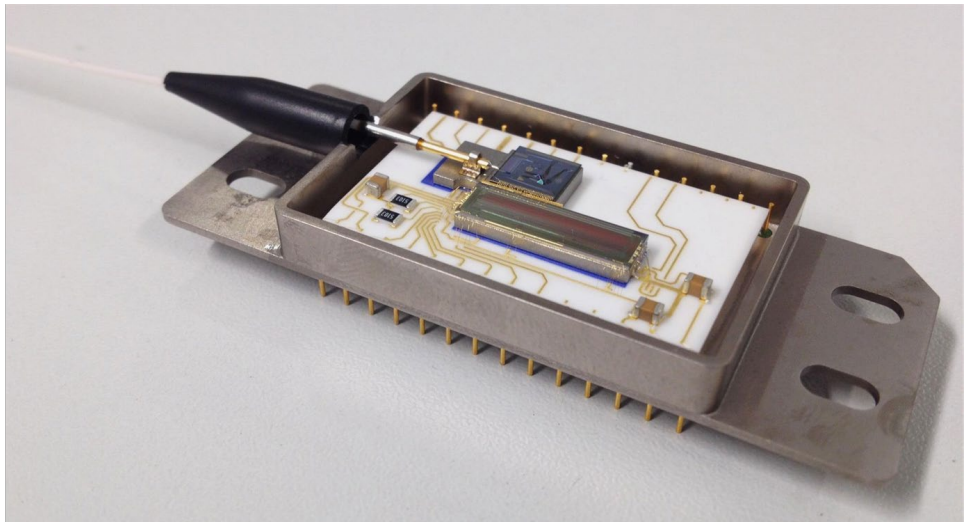
Packaging of photonic integrated circuits

Photonic packaging is the catch -all term used to describe the range of techniques to make the optical, electrical, thermal, mechanical (and sometimes chemical) connections between a PIC and the outside world.





Images courtesy of Tyndall National Institute

Packaging of photonic integrated circuits

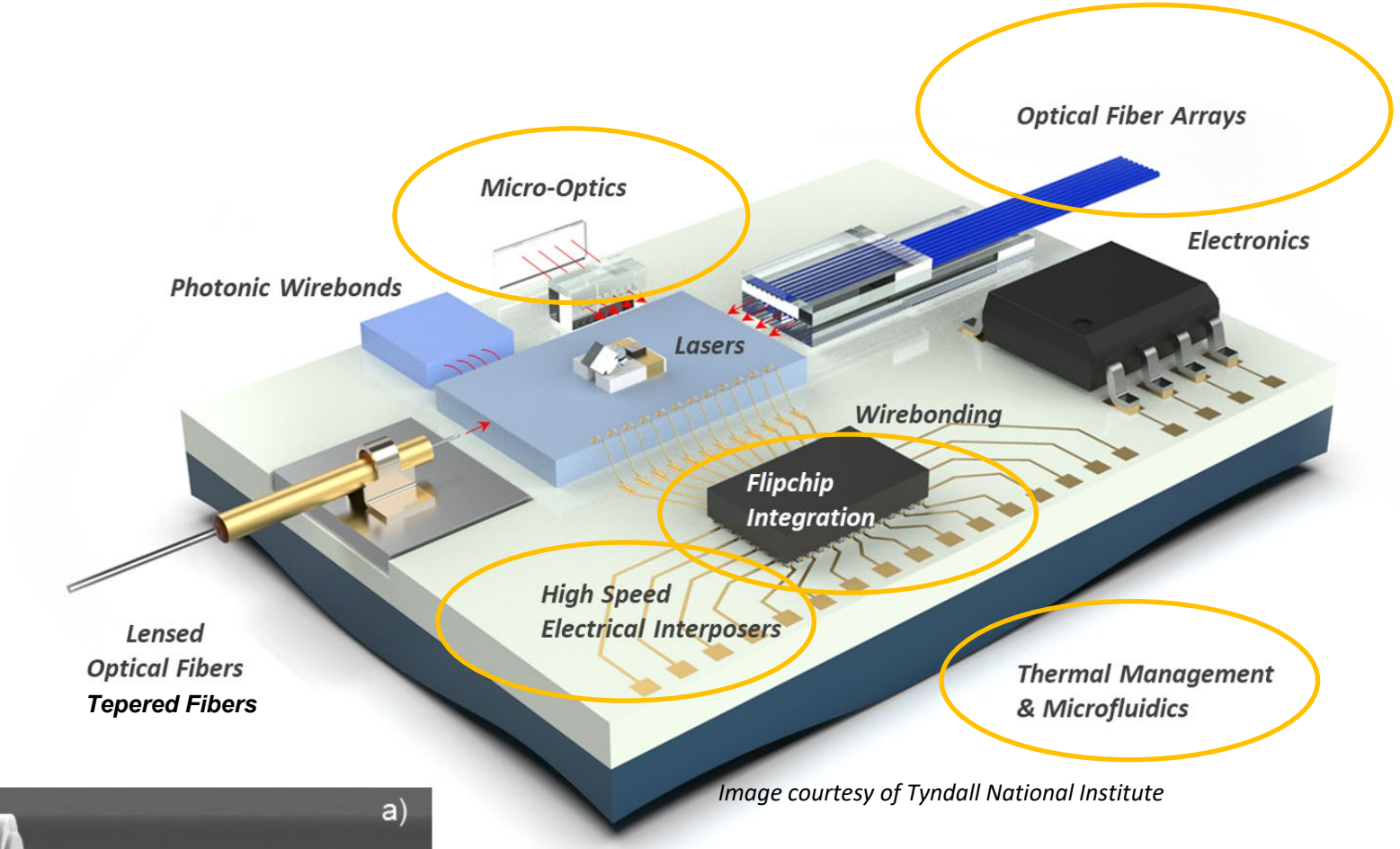
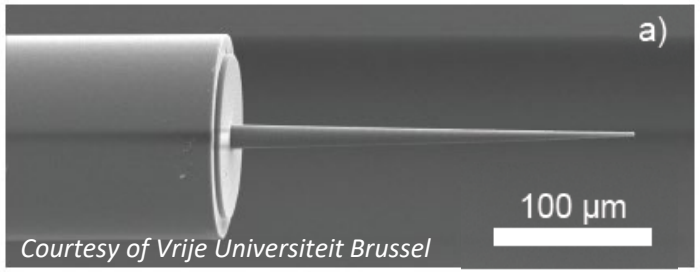


Image courtesy of Tyndall National Institute



Courtesy of Vrije Universiteit Brussel

Developments in the project:

- Optical connections:
  - Fiber to Edge Coupler (horizontal)
  - Micro-lenses
  - Microfluidic channels
- Electrical connections:
  - Flip Chip Bonding
- Thermal management

http://www.oip4nwe.eu

Presentation

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Towards Optical Coherence Tomography on a Chip

Prof. Wolfgang Drexler

Center of Medical Physics and Biomedical Engineering
Medical University Vienna

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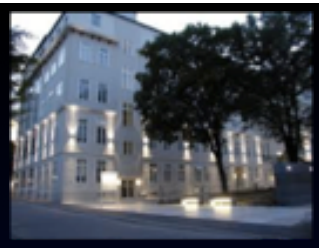


CENTER FOR MEDICAL PHYSICS
AND BIOMEDICAL ENGINEERING
MEDICAL UNIVERSITY OF VIENNA

Towards Optical Coherence Tomography on a Chip

Wolfgang Drexler

THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION
HORIZON 2020

SEVENTH FRAMEWORK PROGRAMME

FWF Der Wissenschaftsfonds.

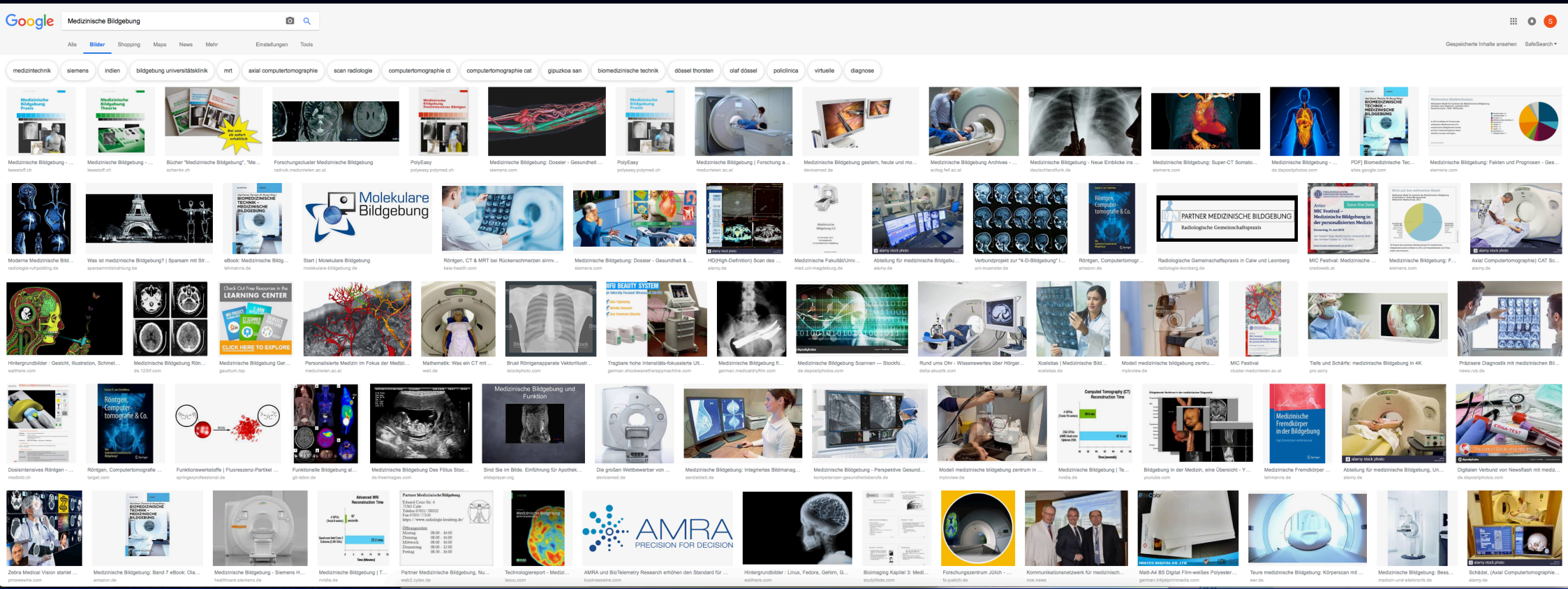
FFG FORSCHUNG WIRKT.

Top 10 liveable cities in the world

Rank	City	2018
1	Vienna	
2	Melbourne	
3	Osaka	

The Economist

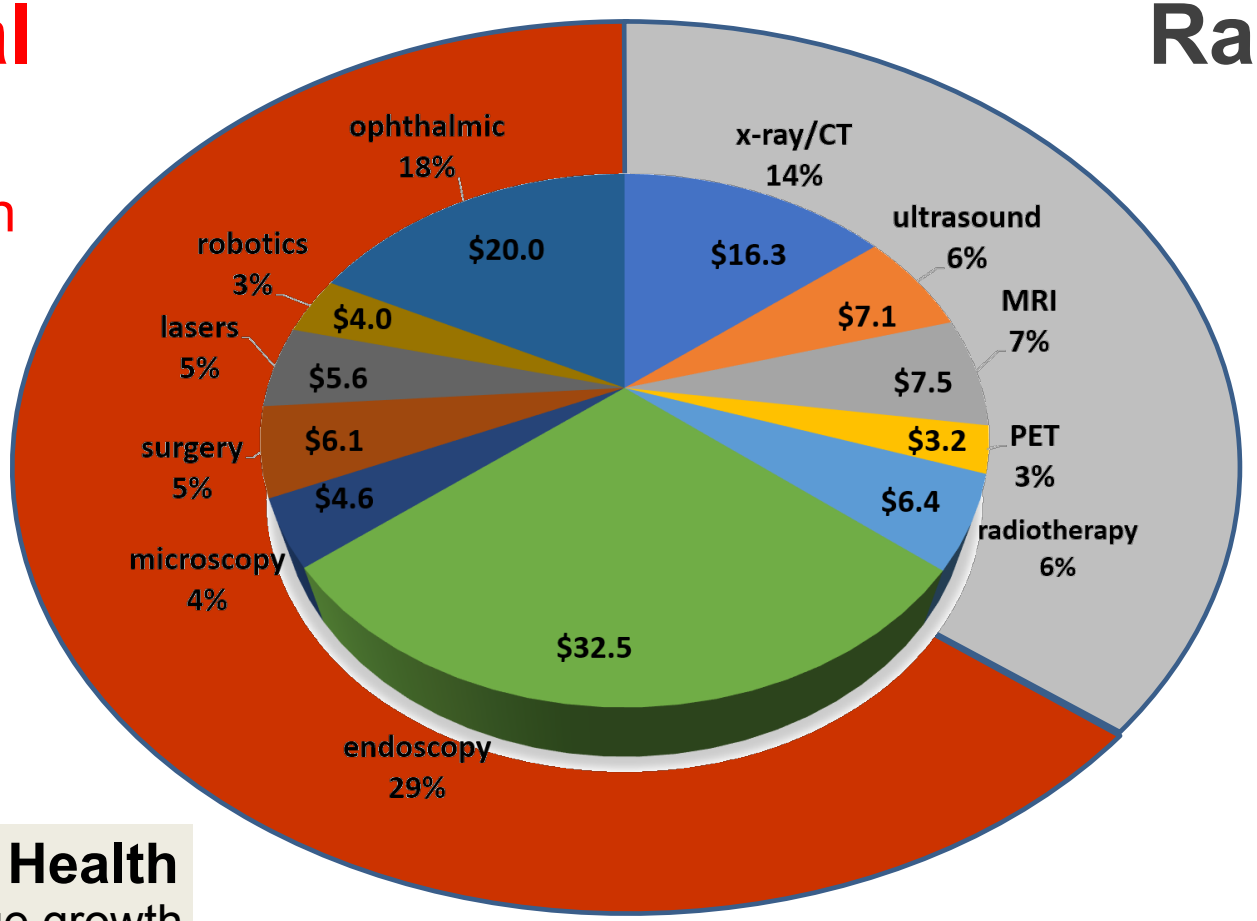
Medical Imaging



Global Market for Medical Imaging Technologies

Optical
64%
$73 billion

Radiological
36%
$40 billion

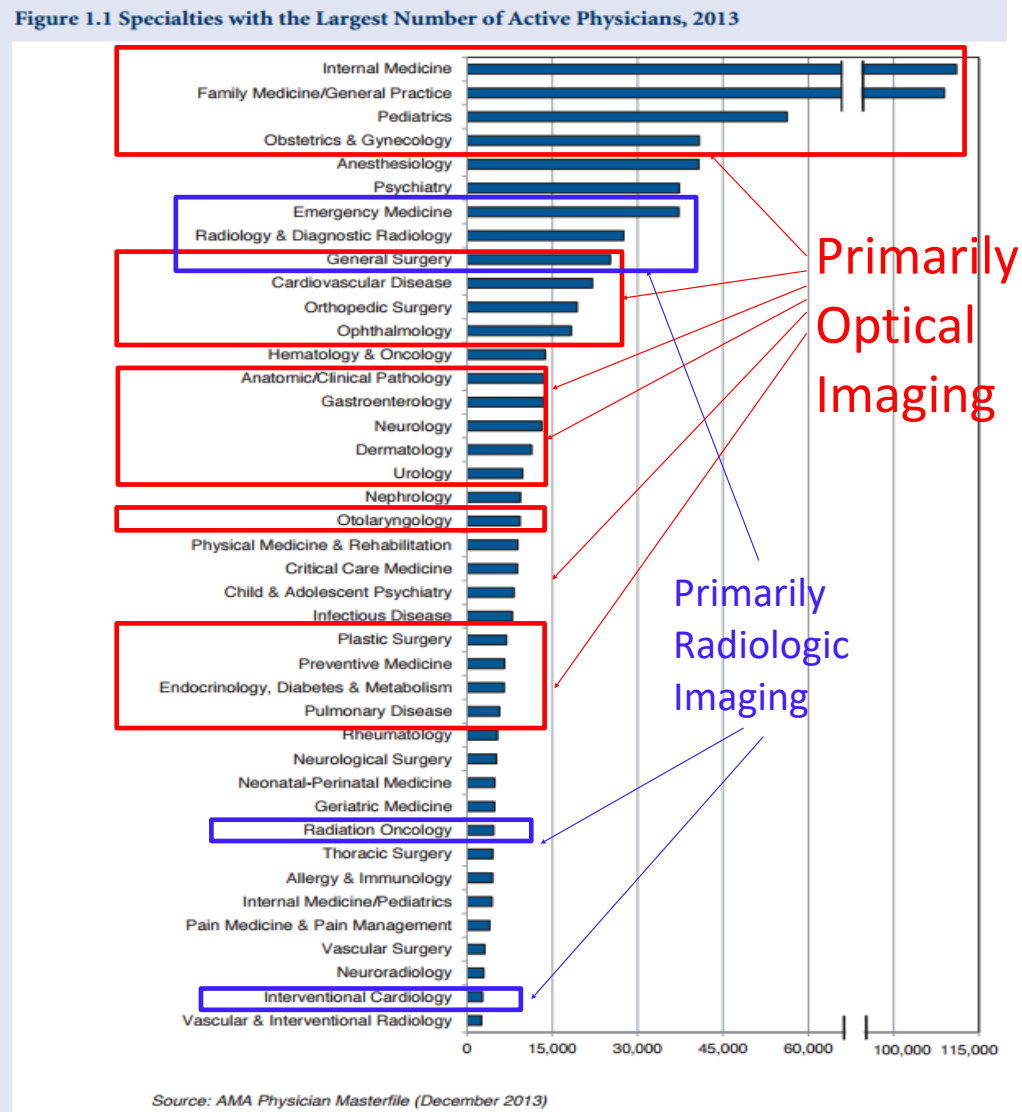


+ Mobile/Home Health
$20-40 billion + large growth

Pogue, SPIE Professional, January 2018

How important is Optical Imaging in Medicine?

Number of physicians



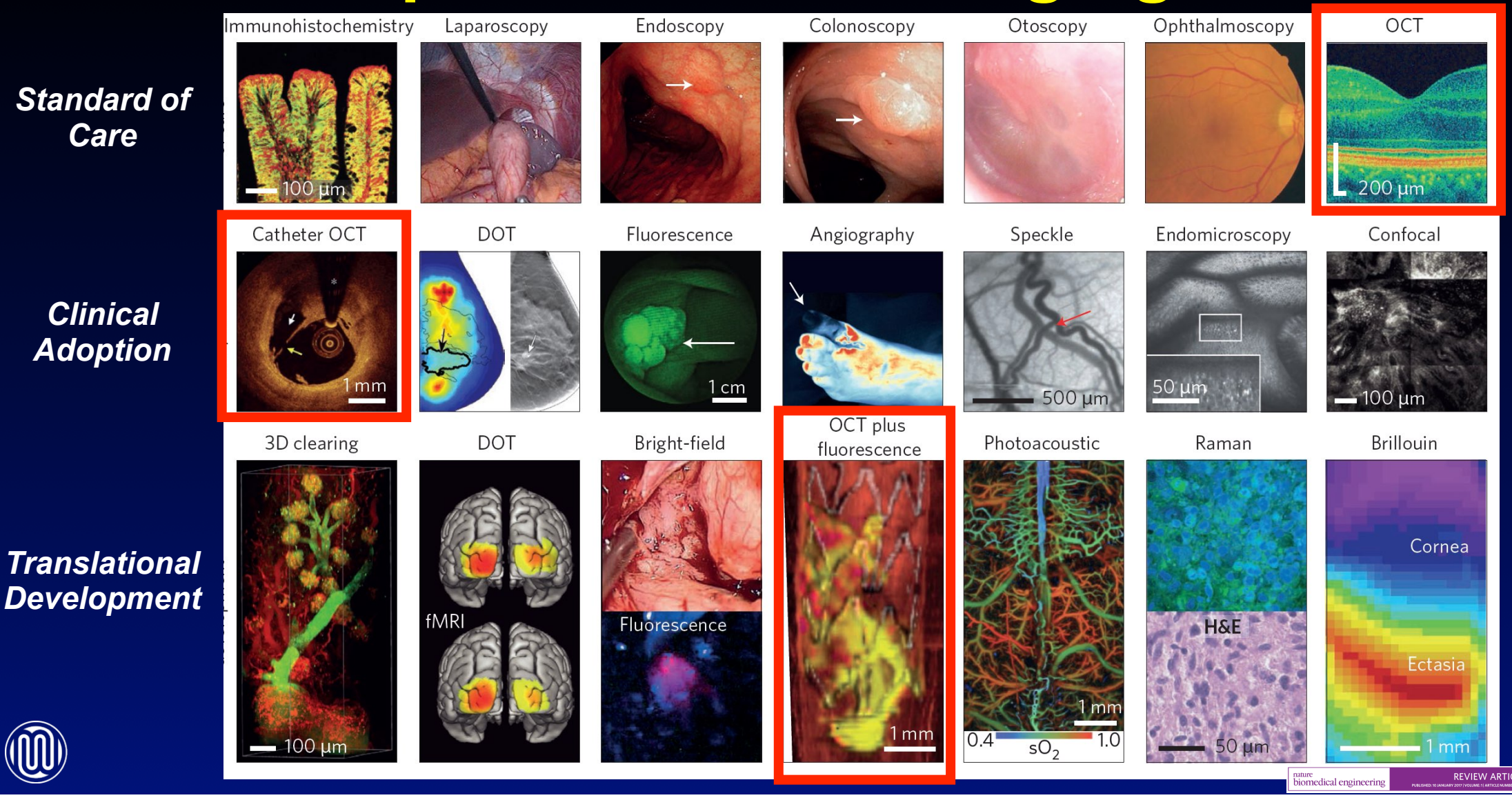
450,000

130,000 use both

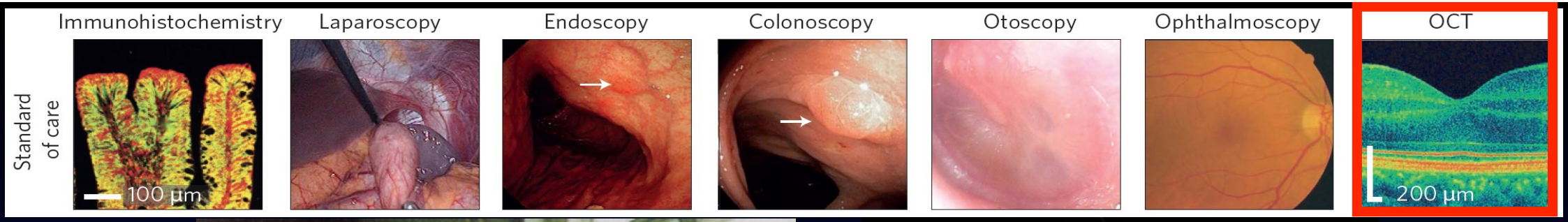
60,000

Pogue, SPIE Professional, January 2018

Optical Medical Imaging



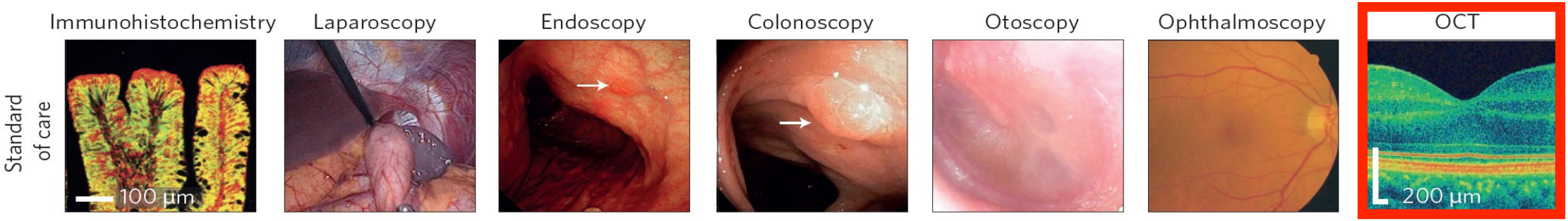
nature biomedical engineering
REVIEW ARTICLE



A.F. Fercher, E. Roth E, *Proc. SPIE 658*, 48 (1986)

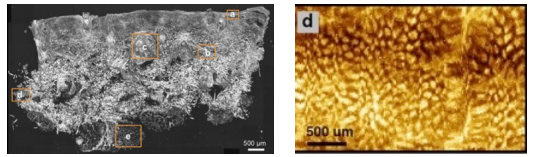
A.F. Fercher, K. Mengedoht, et al. *Opt Lett* 13, 186 (1988)

J.G. Fujimoto, S. De Silvestri, et al. *Opt. Lett* 11, 150 (1986)

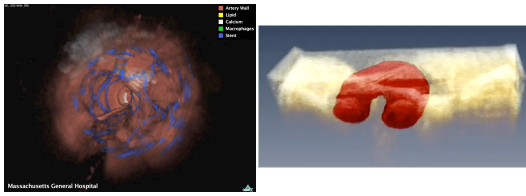


Optical Coherence Tomography

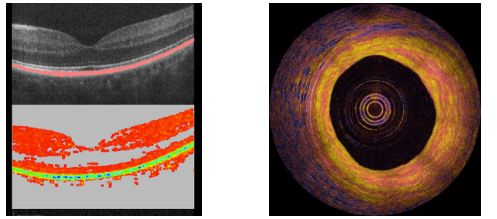
"Non-invasive, high resolution analogue to ultrasound"



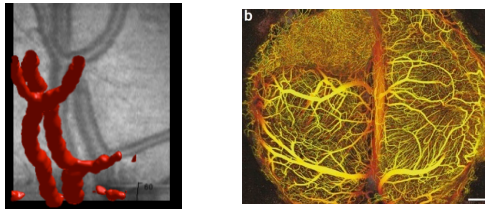
Micrometer Resolution (≈ 1 µm)



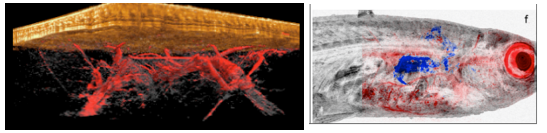
High Speed Imaging
(up to 600 million A-scans/s)



Contrast enhanced OCT
(polarisation, phase,..)



***Depth resolved* functional OCT**
(blood flow, physiology,..)



Multi-modal OCT
(fluorescent, PAT/PAM, MPM, CARS,….)

Miniaturisation of OCT using Photonic Integrated Circuits

Current commercial OCT devices:

- Many individual components
- Bulky device (~1m³)
- High costs (up to 100k)

Using PIC technology OCT can be 3x cheaper, 4x faster and 5x smaller than momentary OCT systems

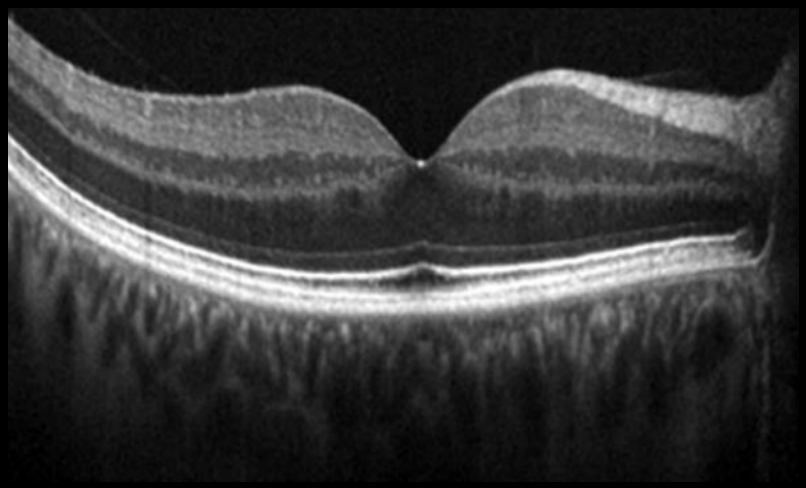
Silicon-based photonic integrated circuits (PIC):

- Miniaturization & integration of functionalities
- Co-integration with CMOS electronics

Cost-effective mass fabrication

Low power consumption

Commercial Compact Ophthalmic OCT



Easy on the Patient

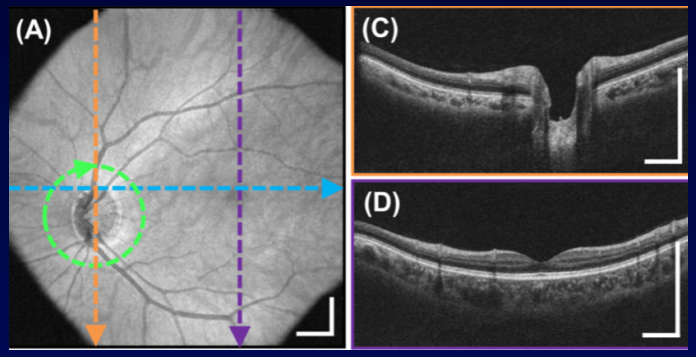
Leica

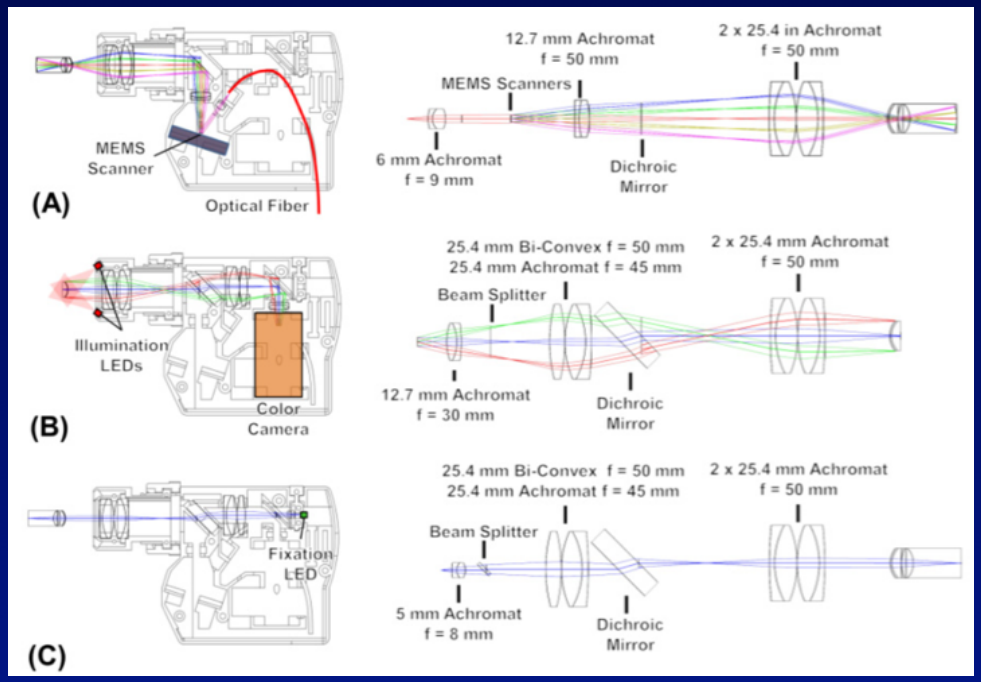
OCT for Ophthalmology

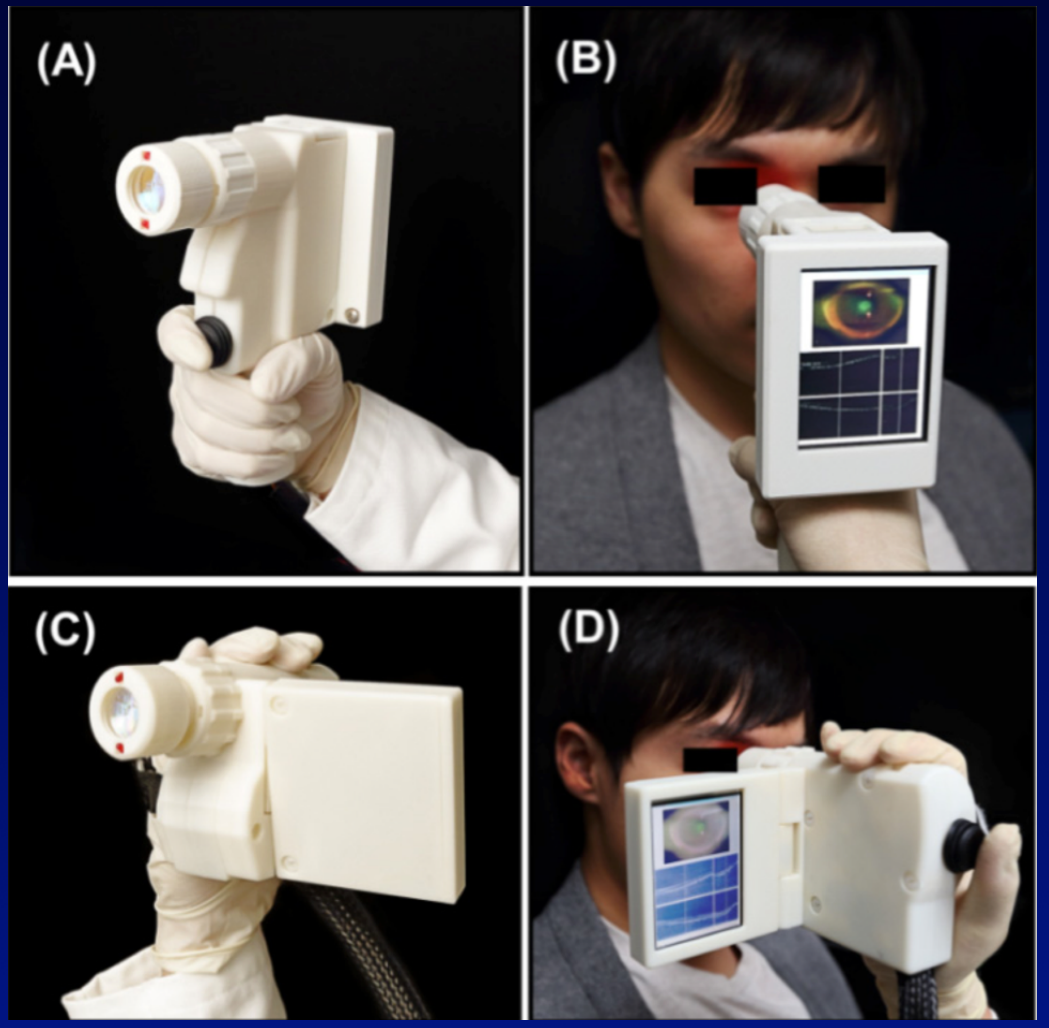
Envisu C-Class

Handheld ultrahigh speed SS OCT using MEMS scanning

1060nm VCSEL @ 350 kHz axial scan rate and 10 µm axial resolution in tissue

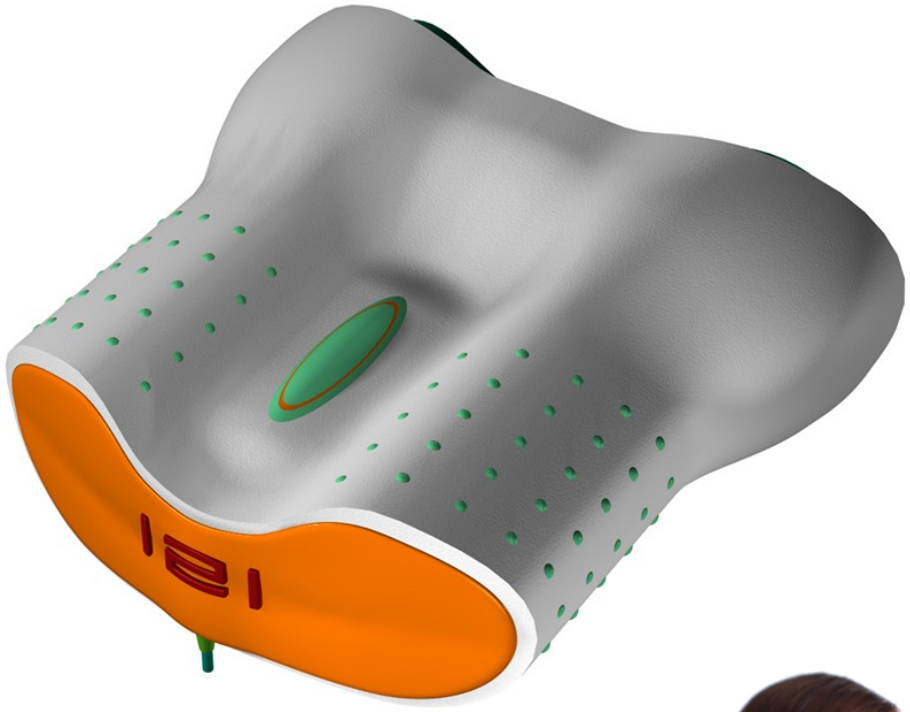






Lu, C. D. , **J.G. Fujimoto *et al.*** *Biomed Opt Express* **5,** 293 (2014).

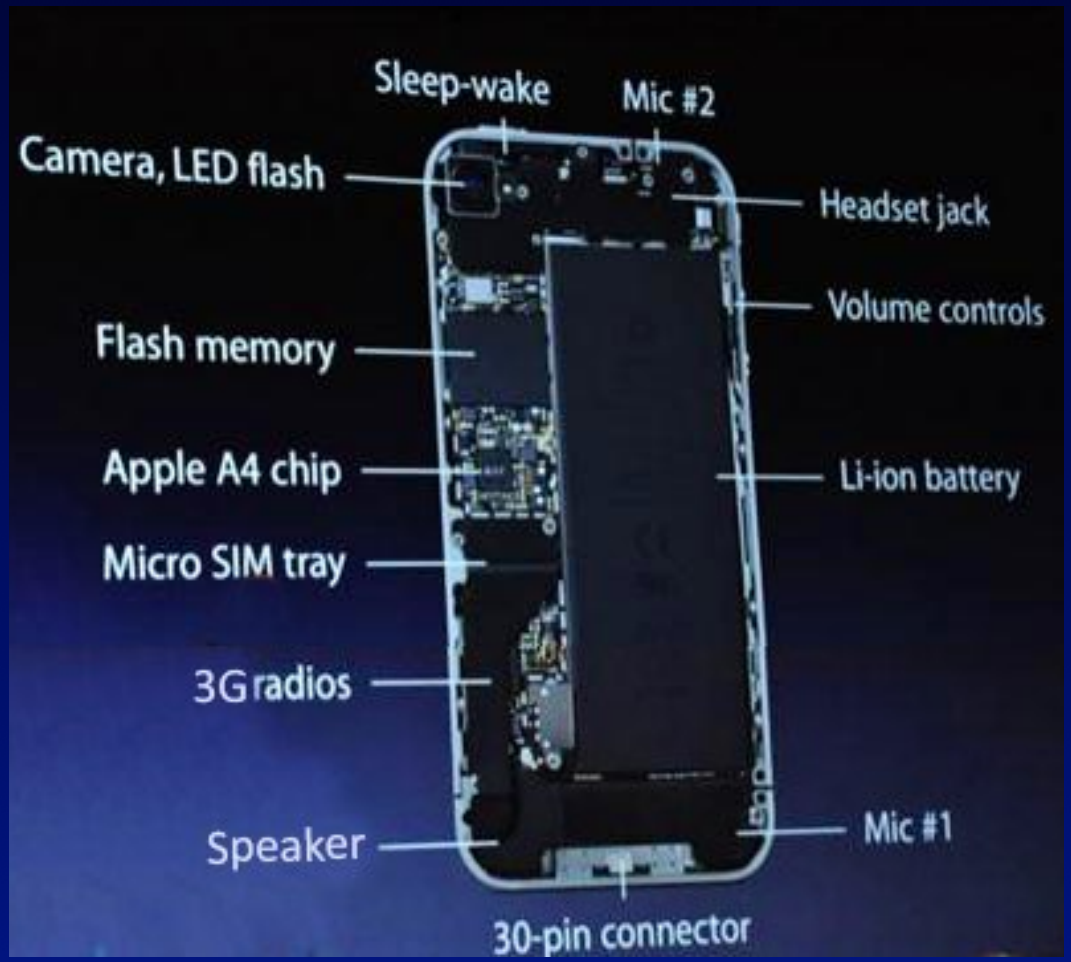
Automating the Eye Exam with Binocular OCT



Alexander Walsh, MD
President and CEO
Envision Diagnostics, Inc

"We hope to have the device ready and available for CE marking and subsequent commercial availability around 2018," Dr Keane (Consultant Ophthalmologist, Moorfields Eye Hospital UK)

Motivation: Miniaturised OCT

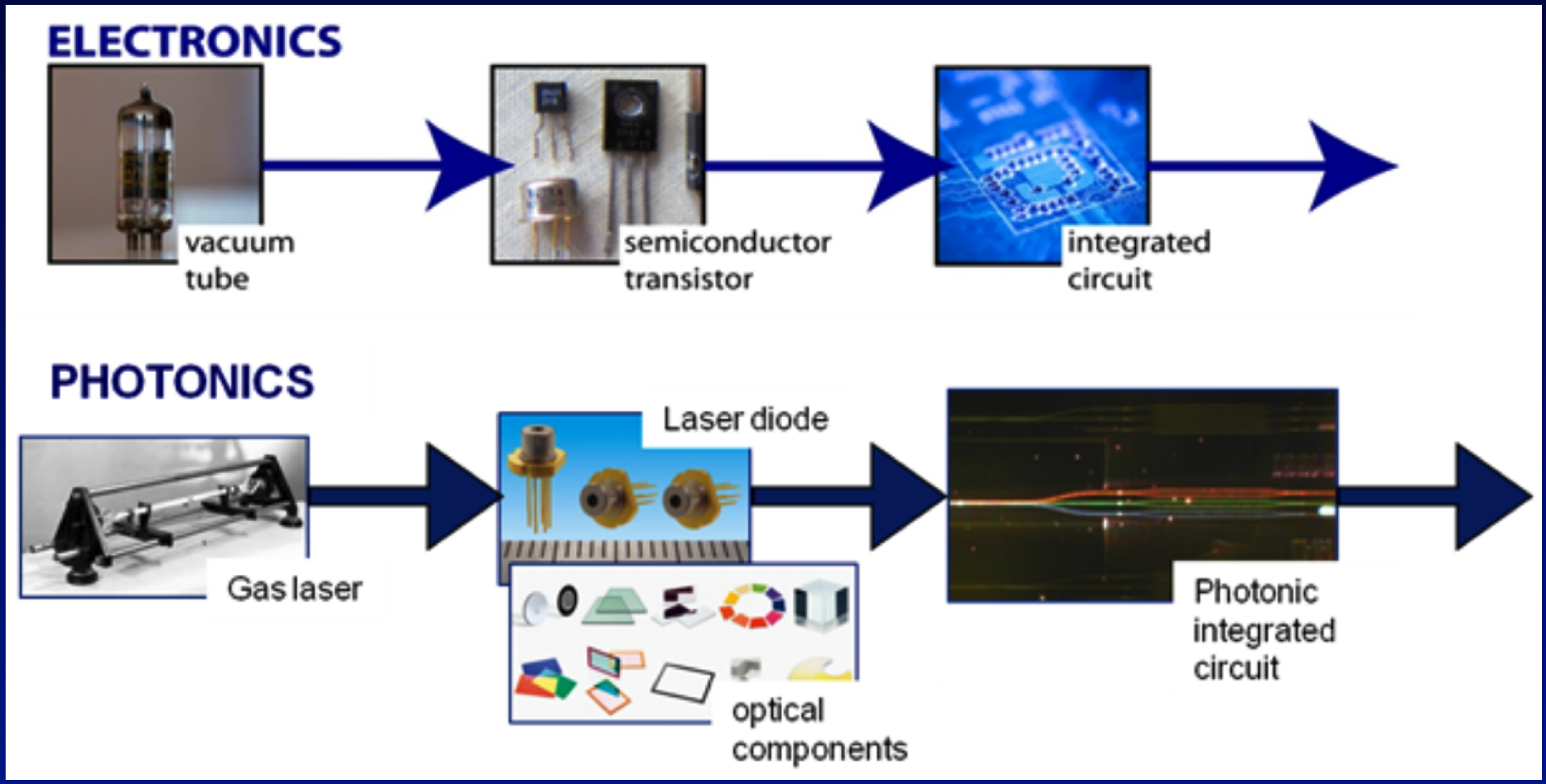


https://bhslookout.files.wordpress.com/2012/10/iphone5inside2.jpg

Largest part in a mobile is the battery because of microelectronics

Photonic Integrated Circuit (PIC)

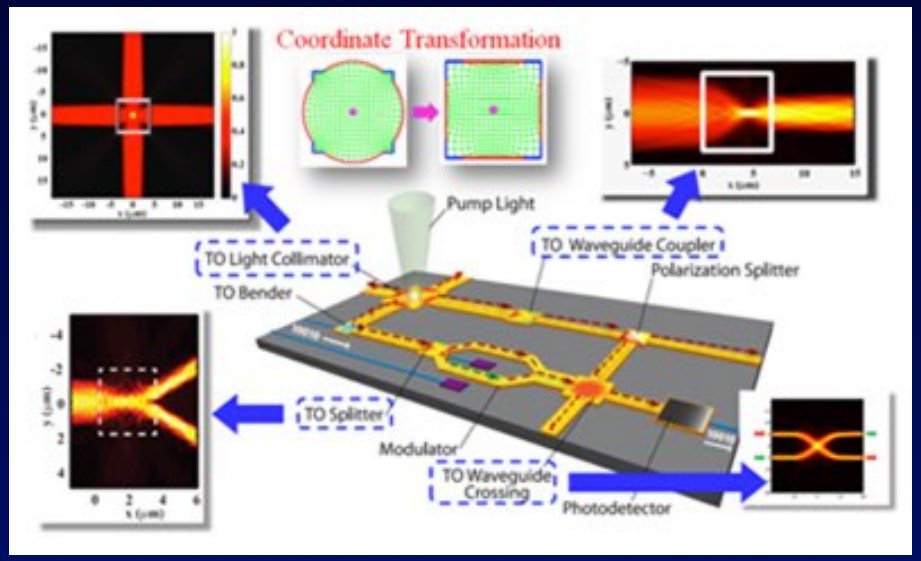
Integrated Optical Circuit / Waveguides



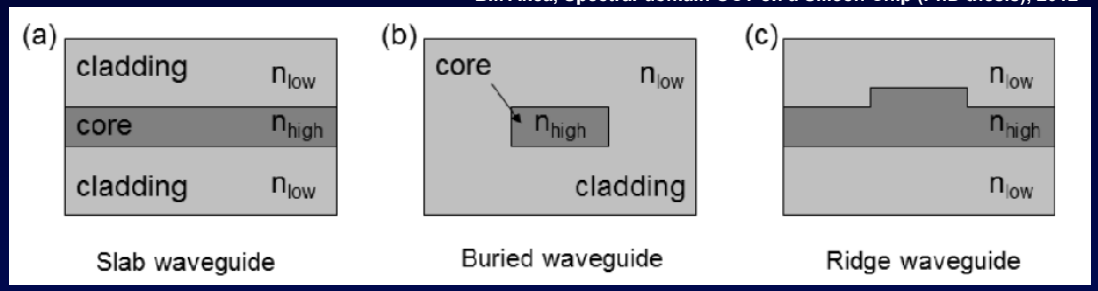
http://www.xiophotonics.com/index.php/technology

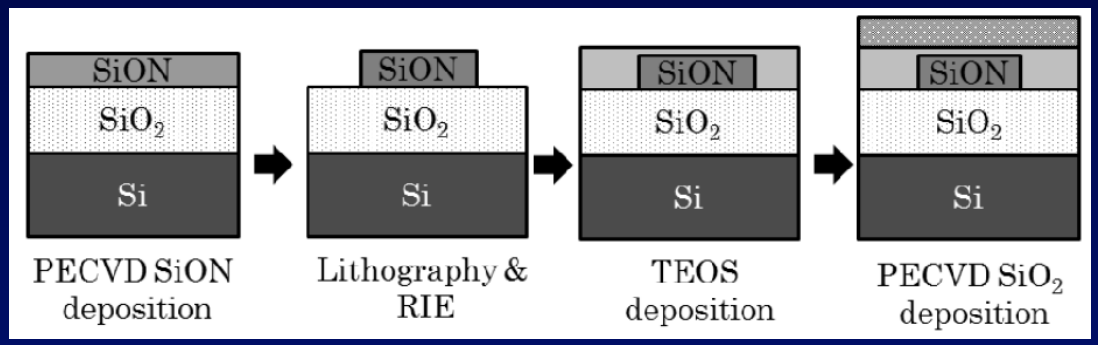
Photonic Integrated Circuit (PIC)

http://www.mrsec.psu.edu/research/irg4/images/optics.jpg

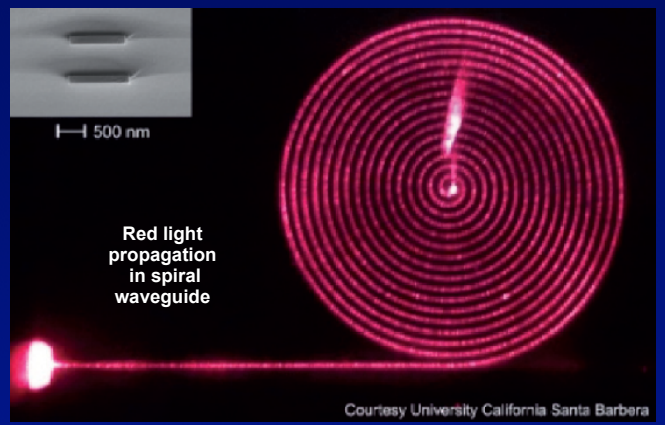


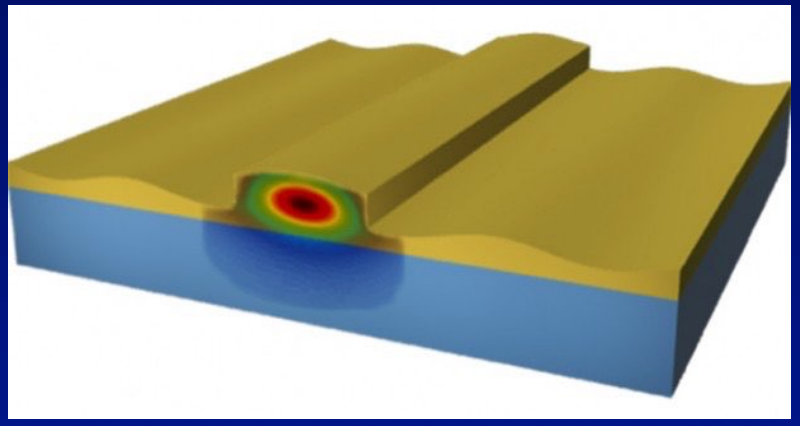
B.I. Akca, Spectral-domain OCT on a Silicon Chip (PhD thesis), 2012

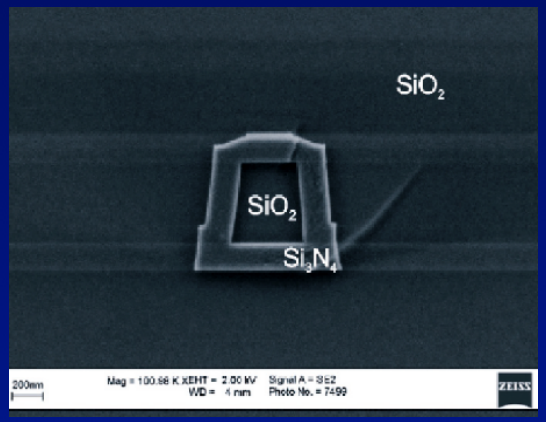




Constructing optic devices and circuits on substrates, light is transformed through waveguides



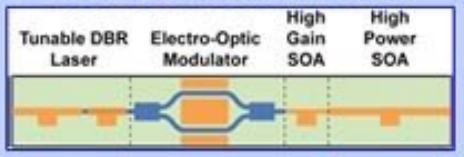




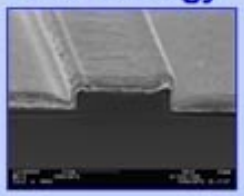
Hybrid Electronic-Photonic Integration for OCT

Compound Semiconductor (III-V) Photonic Integration

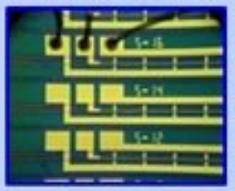
Monolithic III-V PICs



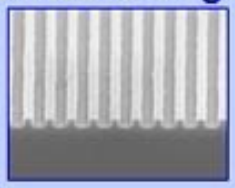
SCOW Technology



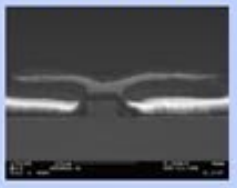
Modulators



DBR Gratings



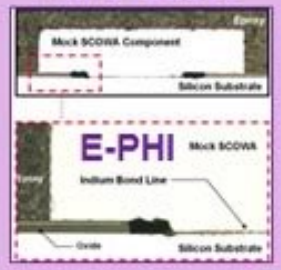
Photodiodes



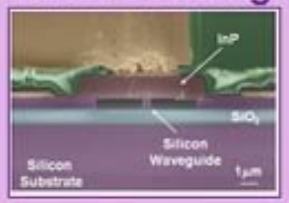
Hybrid Electronic-Photonic Integration

Si Photonics + CMOS

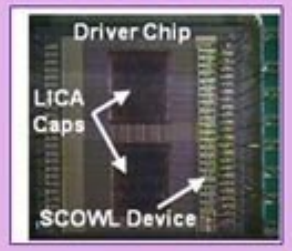
Si Photonics + III-V Laser



Hybrid Si / III-V Wafer Bonding

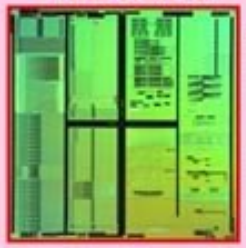


III-V Laser + CMOS Driver



Silicon Photonic Integration

Multi-Project Fab Runs



Low-Loss Waveguides

Optical Filters

Germanium (Ge) Photodiodes

THE BELL SYSTEM

TECHNICAL JOURNAL

DEVOTED TO THE SCIENTIFIC AND ENGINEERING
ASPECTS OF ELECTRICAL COMMUNICATION

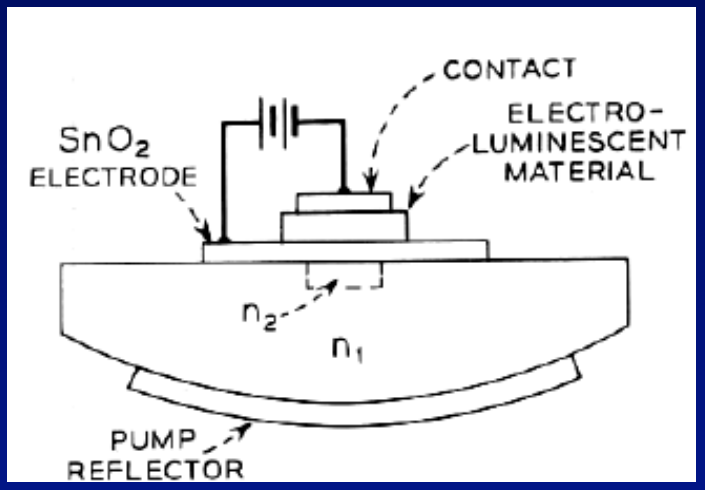
Volume 48 September 1969 Number 7

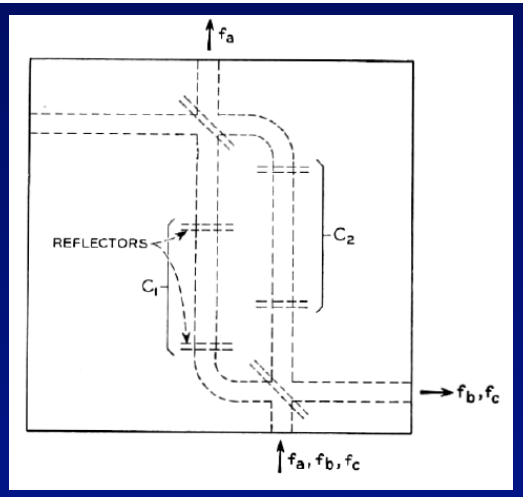
Integrated Optics: An Introduction

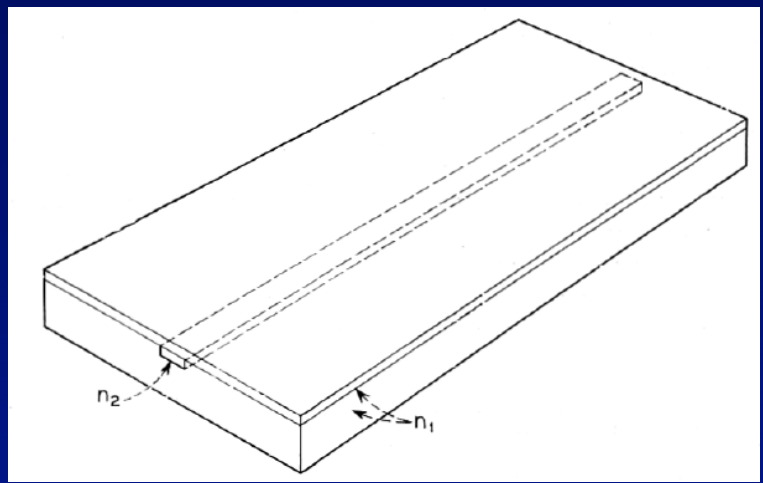
By STEWART E. MILLER

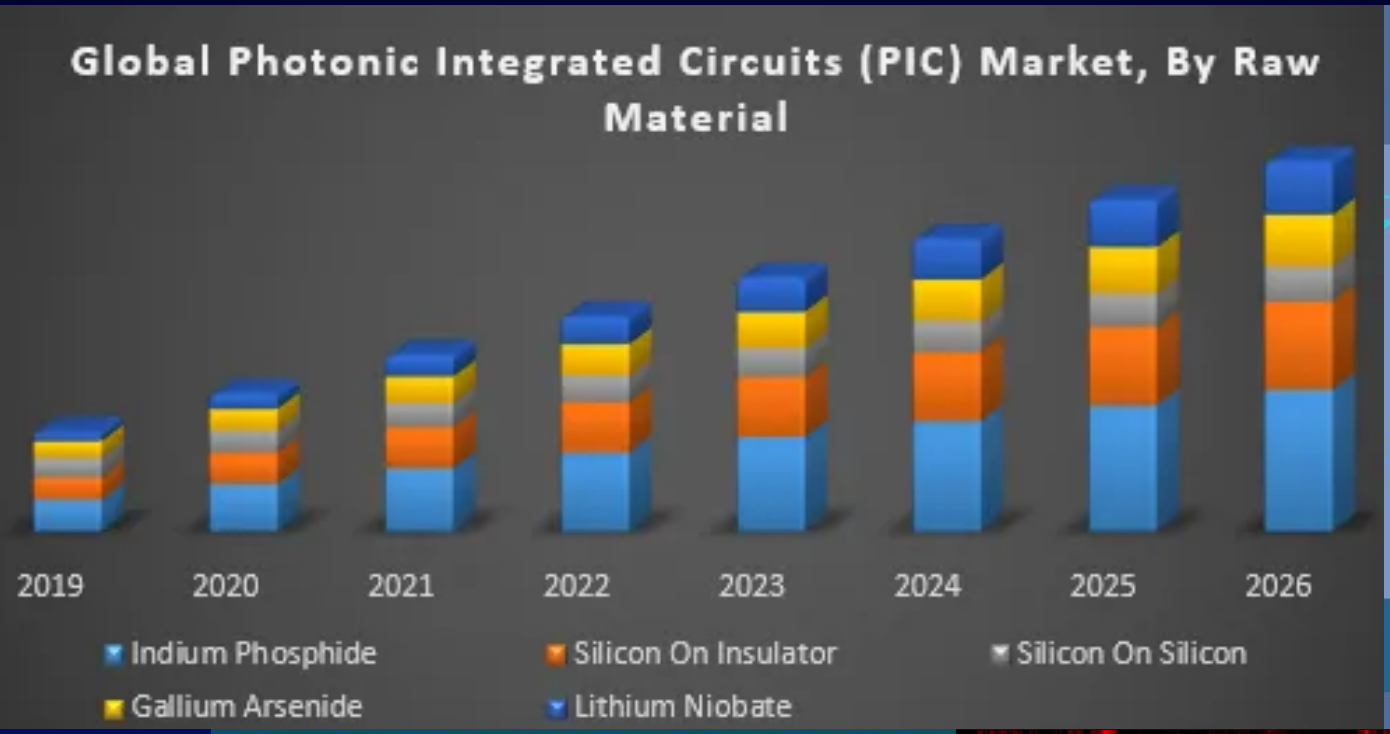
(Manuscript received January 29, 1969)

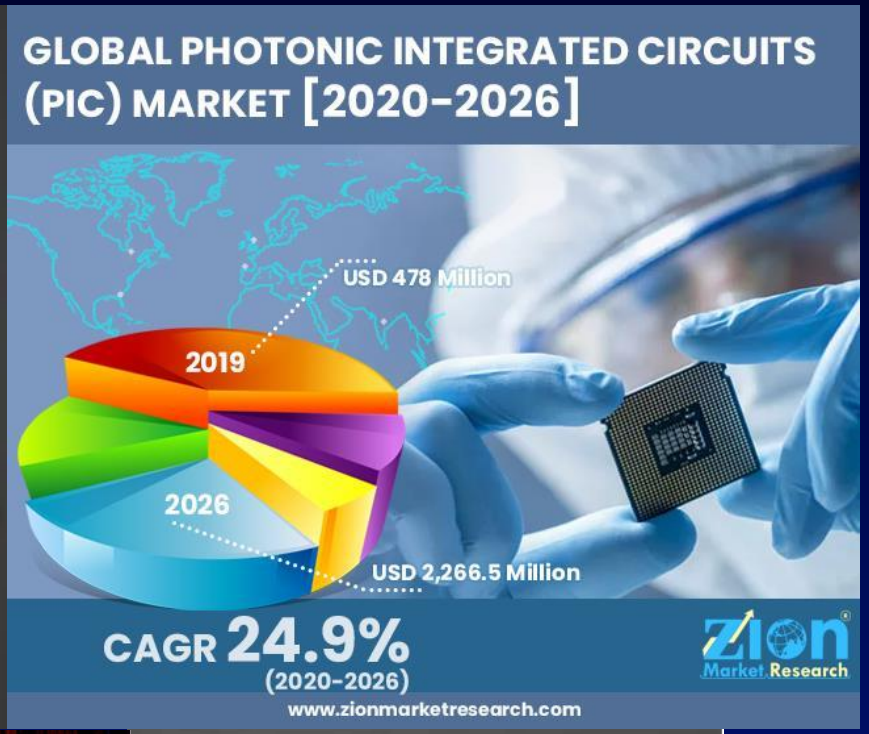
"There is a conviction that the new miniaturized optical circuitry will prove useful... We must wait a while longer to find out how useful this new technology will become."

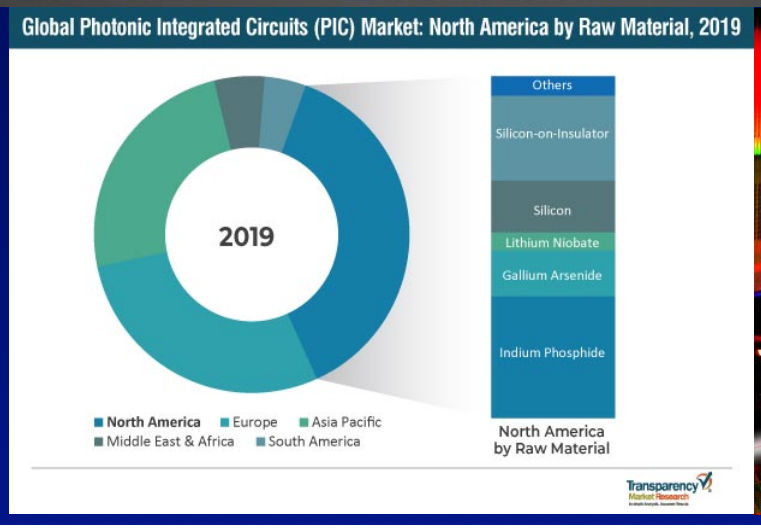


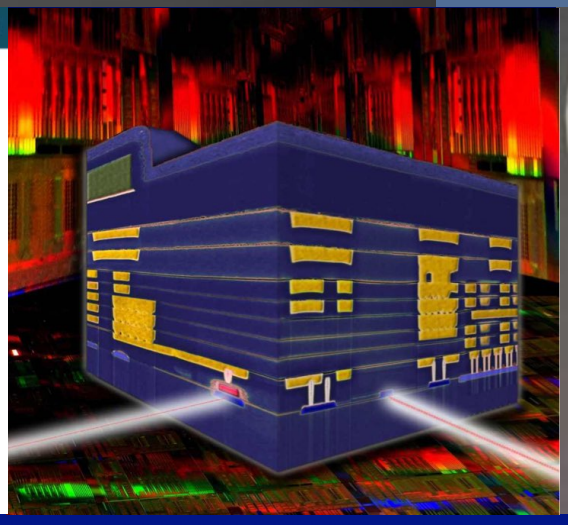


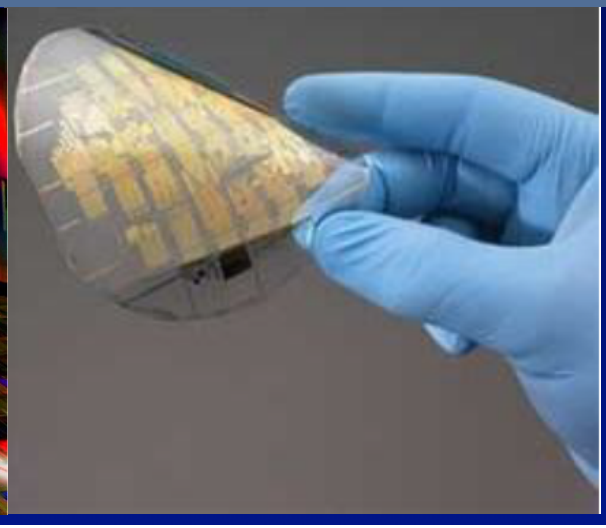



Global Photonic Integrated Circuits (PIC) Market, By Raw Material
2019
2020
2021
2022
2023
2024
2025
2026
Indium Phosphide
Silicon On Insulator
Silicon On Silicon
Gallium Arsenide
Lithium Niobate


GLOBAL PHOTONIC INTEGRATED CIRCUITS (PIC) MARKET [2020-2026]
USD 478 Million
2019
2026
USD 2,266.5 Million
CAGR 24.9%
(2020-2026)
Zion Market Research
www.zionmarketresearch.com


Global Photonic Integrated Circuits (PIC) Market: North America by Raw Material, 2019
2019
North America
Europe
Asia Pacific
Middle East & Africa
South America
Others
Silicon-on-Insulator
Silicon
Lithium Niobate
Gallium Arsenide
Indium Phosphide
North America by Raw Material
Transparency Market Research



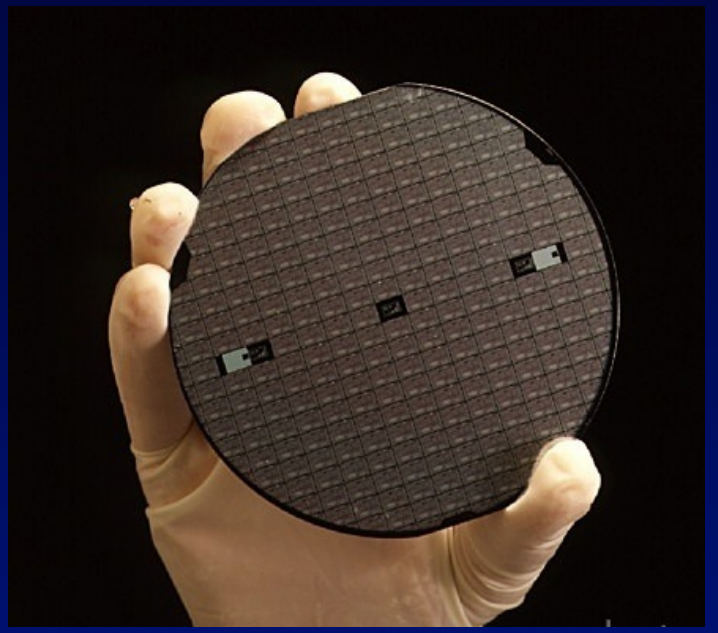


Motivation: Miniaturised OCT

Commercial OCT system

Cost: ~60.000 €
Bulky

Miniaturised OCT system
based on PIC



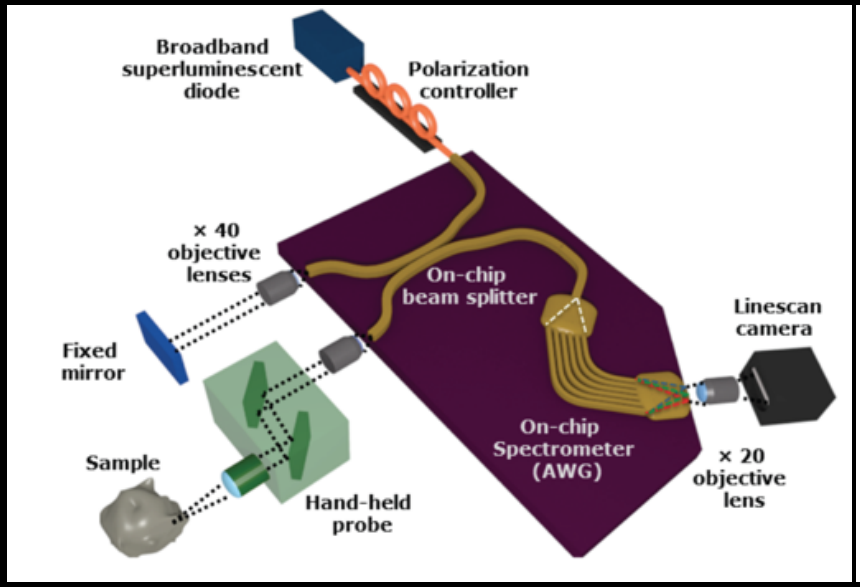
Cost: ~5000 €
4-inch wafer-size

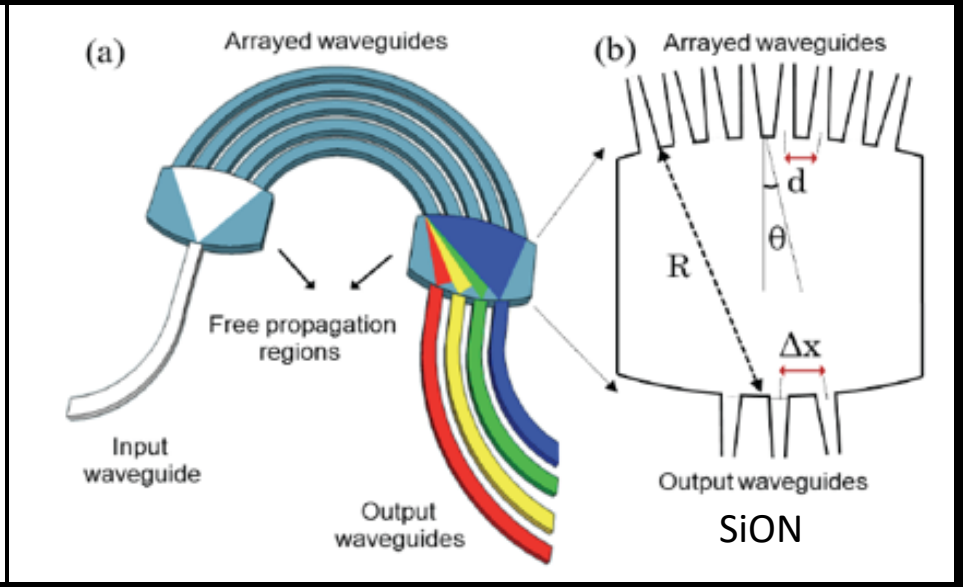
Robust, maintaince-free, alignment-free, small form factor, handheld, battery driven, high-volume production, even more widespread, new applications / markets

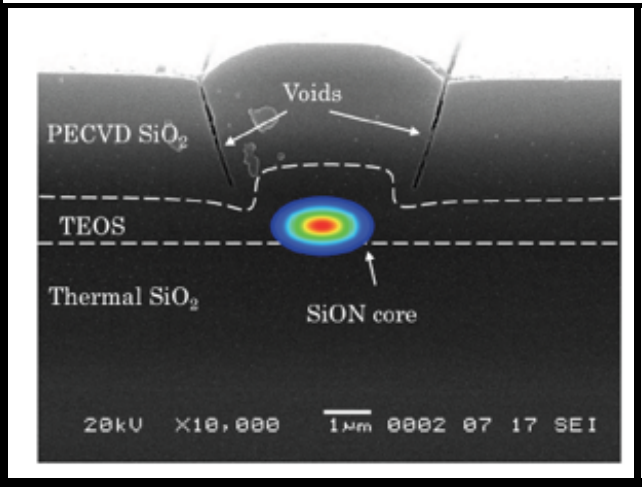
OCT based on Integrated Optics @ 1300nm

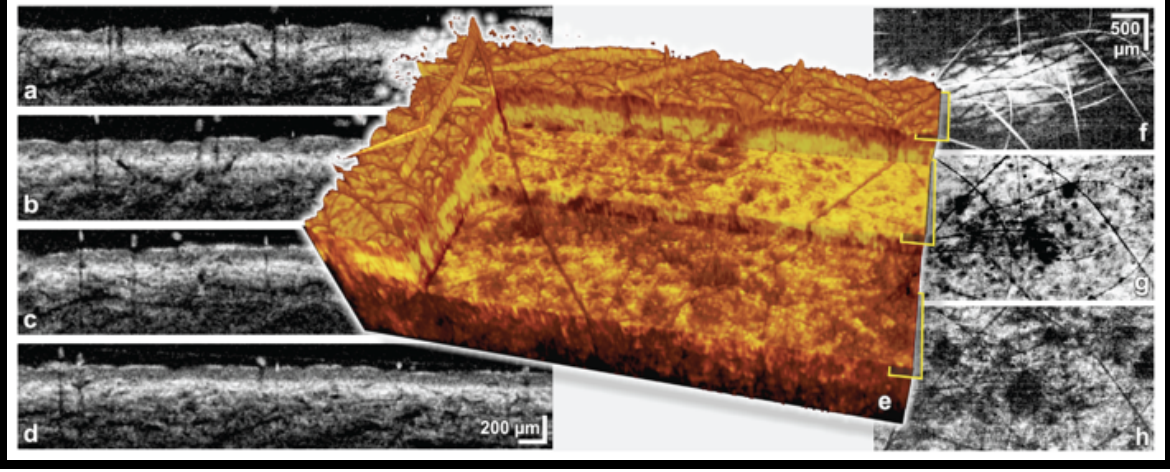
B. Imran Akca, B. Považay, A. Alex, K. Wörhoff, R.M. de Ridder, W. Drexler, M. Pollnau

University of Twente, Enschede, The Netherlands; Medical University of Vienna, Austria







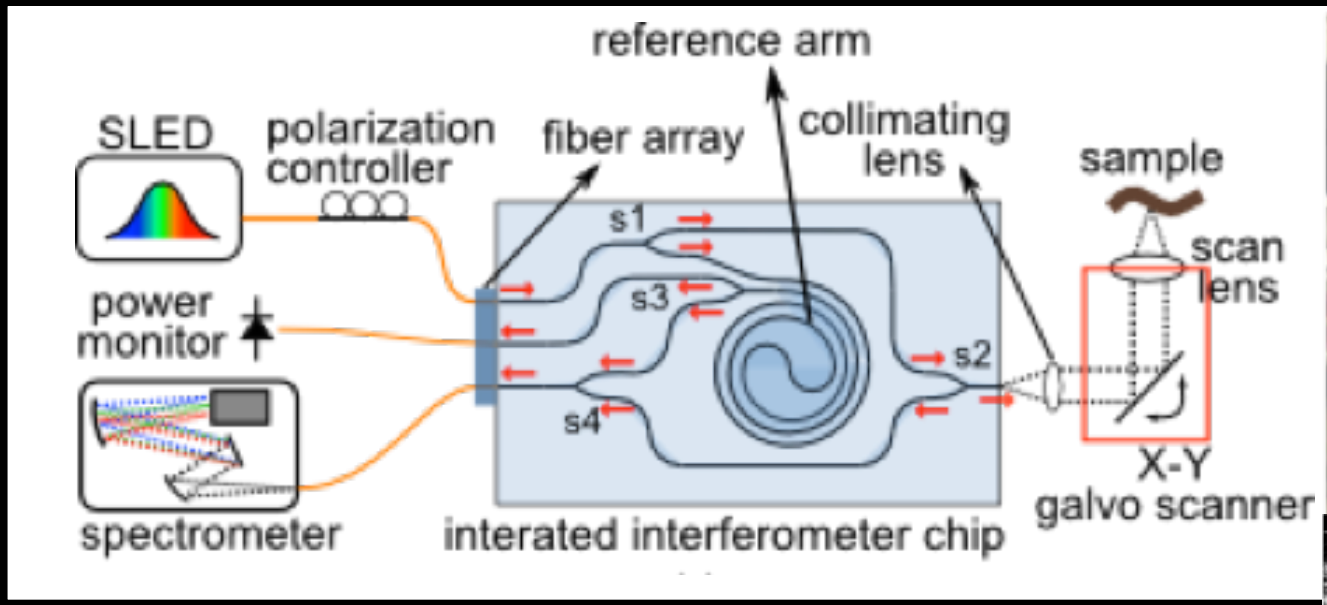


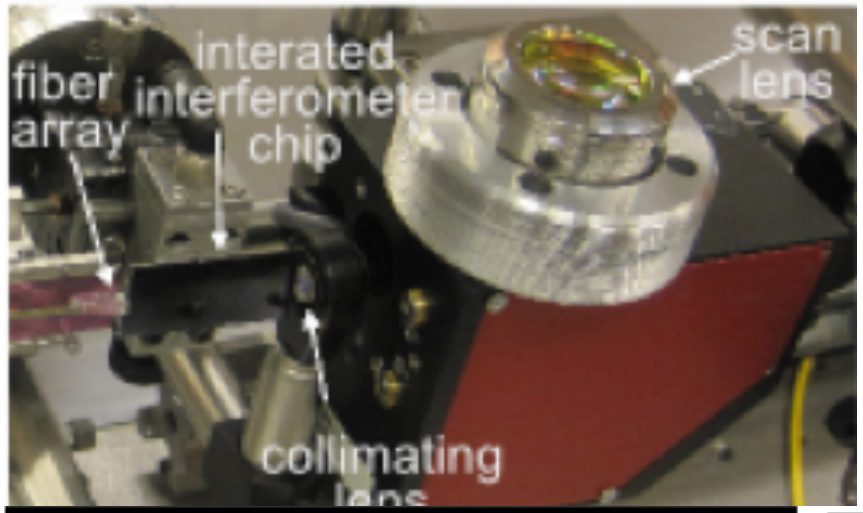
B.I. Akca, W. Drexler, M. Pollenau et al. *OE 21(14)* (2013)

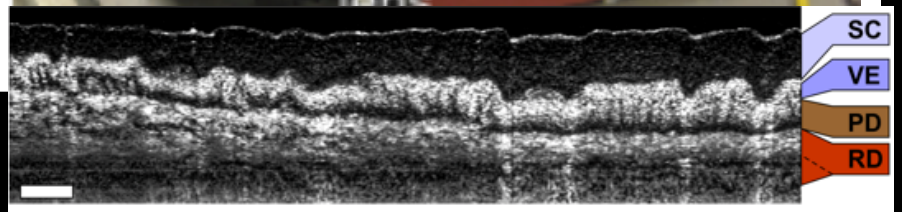
Photonic Integrated Mach-Zehnder Interferometer in Si_3N_4/SiO_2 for OCT @ 1300nm

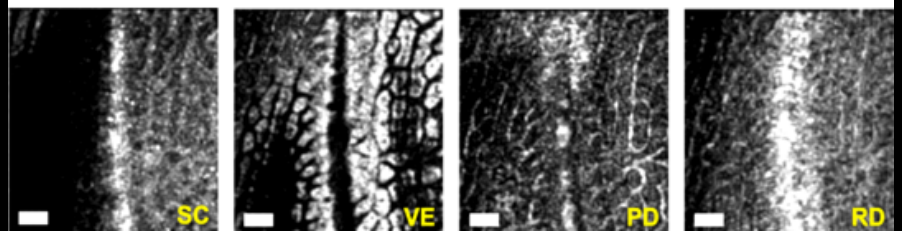
Günay Yurtsever, Boris Považay, Aneesh Alex , Behrooz Zabihian, Wolfgang Drexler, and Roel Baets

Photonics Research Group, Ghent University-imec, Belgium Center for Nano- and Biophotonics (NB-Photonics), Ghent University, Ghent, Belgium







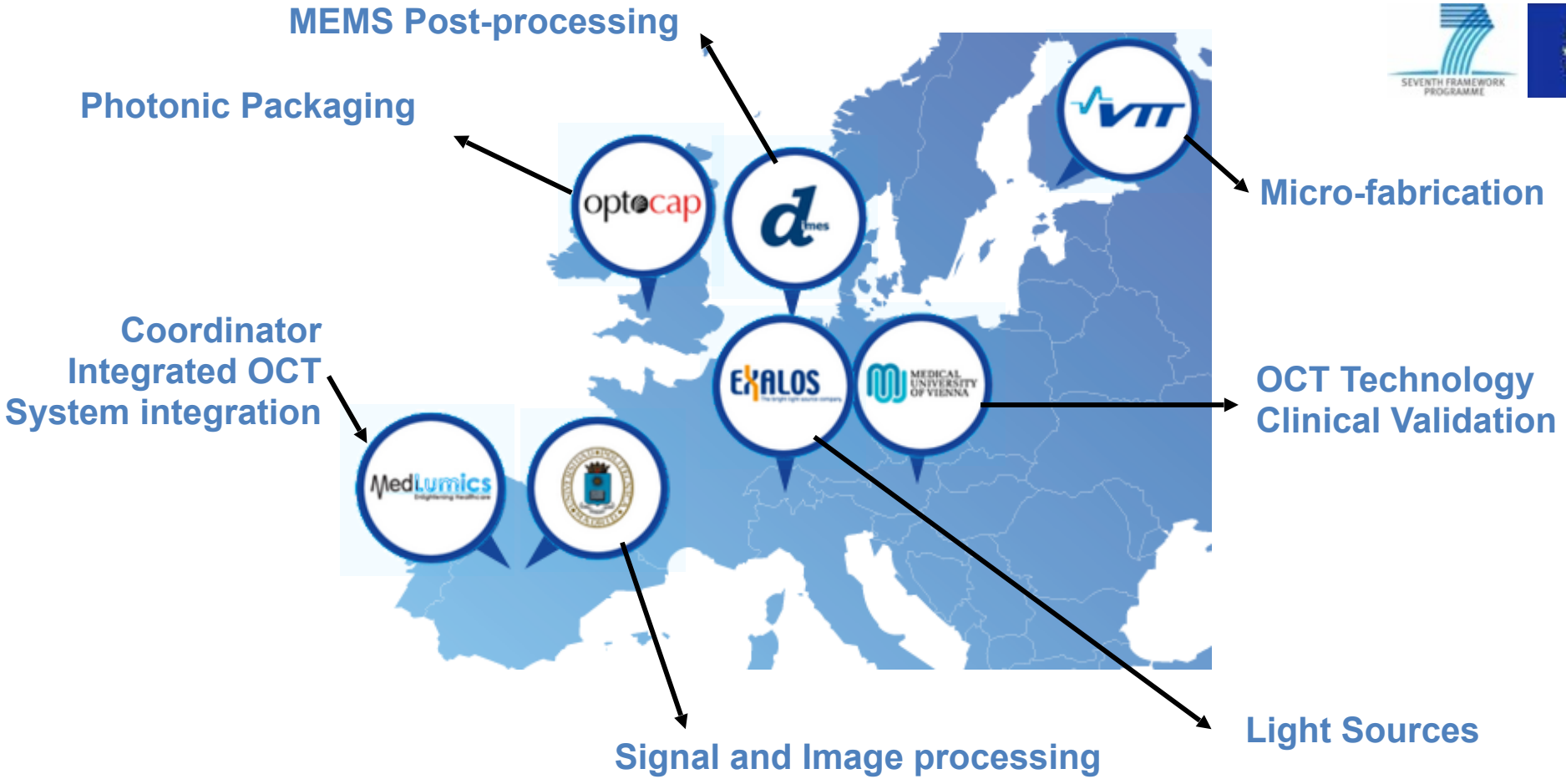


SD OCT system consisting of an SLD centered at **1320 nm** with 100 nm bandwidth, a spectrometer with 1024 channels

65 dB with 0.1 mW on the sample

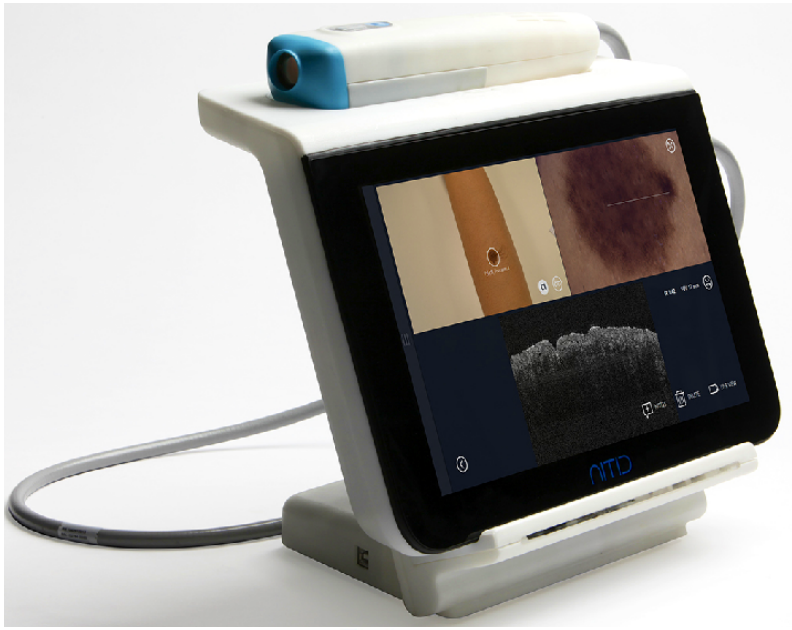
#204303 - $15.00 USD Received 6 Jan 2014; revised 25 Feb 2014; accepted 25 Feb 2014; published 3 Mar 2014
(C) 2014 OSA1 April 2014 | Vol. 5, No. 4 | DOI:10.1364/BOE.5.001050 | BIOMEDICAL OPTICS EXPRESS 1050

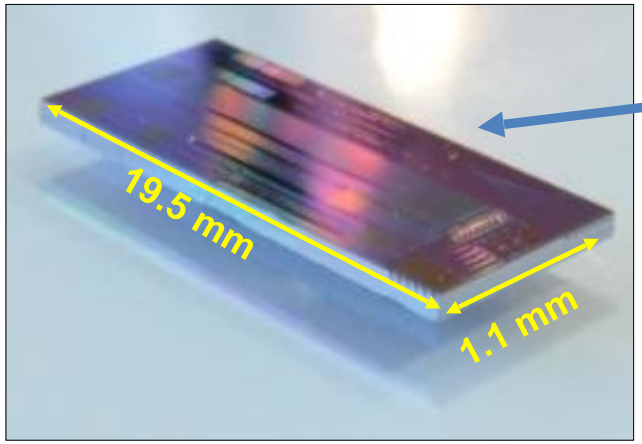
BiopsyPen: Consortium (FP7: 2013-17)

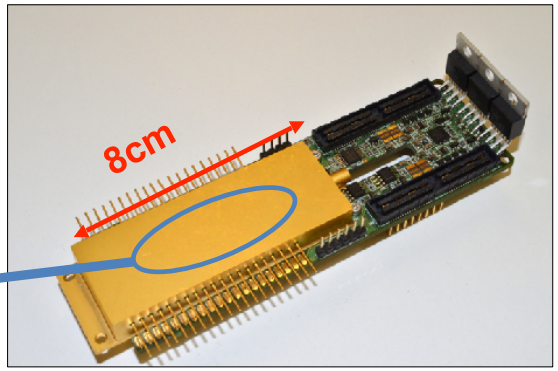


Handheld OCT System for Dermatology

- Monitoring and diagnostic of Non-Melanoma Skin Cancer
- Improved clinical workflow integration
- Promote widespread adoption in clinical practice







”Worldwide smallest OCT”

Compact, Low-cost and Reliable OCT engine

- Based on Silicon-On-Insulator (SOI) photonic technology
- Akinetic axial scanning, MEMS lateral scanner, battery driven
- Ultra-low propagation (0.15 dB/cm) and coupling (0.7 dB) losses

DermaLumics Enlightening Skincare

”OCT in the hands of everyone”

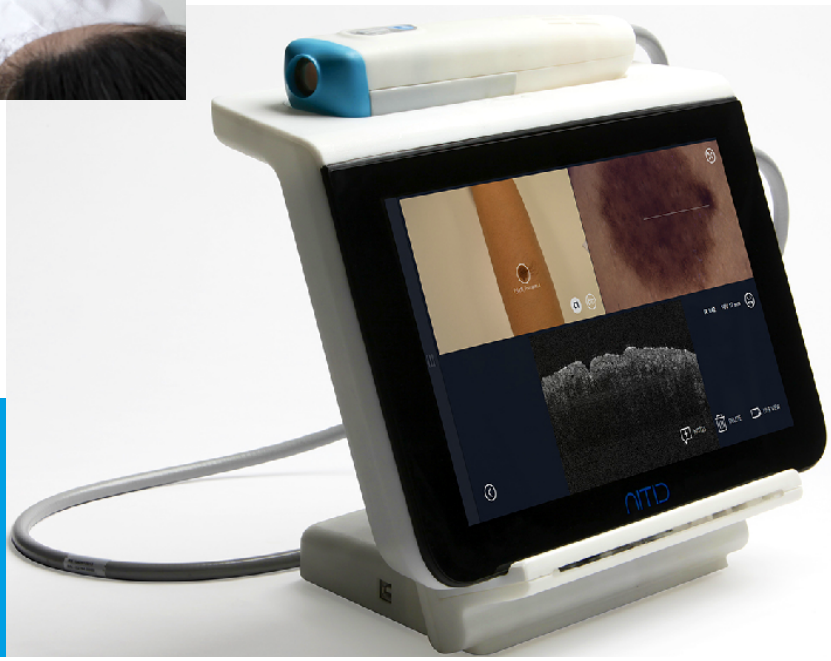
BiopsyPen

SEVENTH FRAMEWORK PROGRAMME

DermaLumics

Enlightening Skincare

NTID



BiopsyPen Specifications

Parameter	Value
Center wavelength	1310nm
Bandwidth	60nm
SNR	93dB @ 3.5mW on sample
Isotropic resolution	~11μm
Scanning depth	2.8mm (air)
Speed	1.7-2.4kHz

Miniaturized BiopsyPen

vs.

Commercial standard dermatological OCT (*Michelson Diagnostics*)

OCTCHIP

Ophthalmic OCT on a chip

Wolfgang Drexler *(coordinator)*

Start: 1.1.2016; 48 months duration
Total funding: € 4.889.950

MEDICAL UNIVERSITY OF VIENNA

EXALOS
The bright light source company

Fraunhofer IIS

AIT AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY

Tyndall National Institute

ZEISS

amun

PHOTONICS21
PHOTONICS PUBLIC PRIVATE PARTNERSHIP

Ophthalmic OCT on a Chip

PIC Design

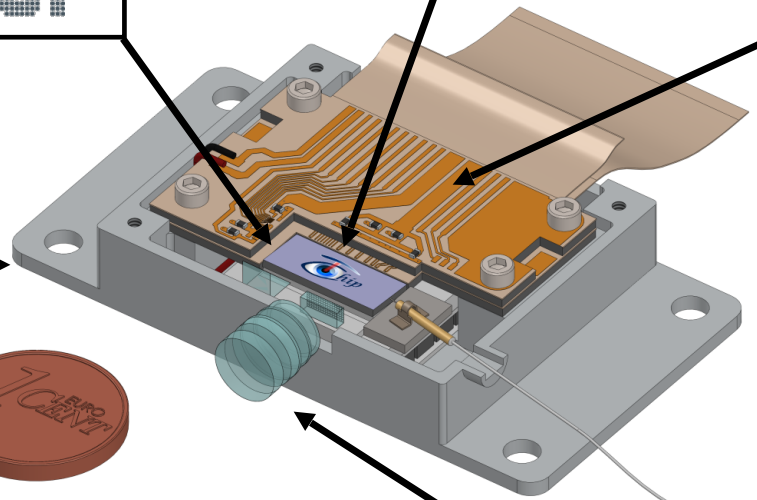
AIT AUSTRIAN INSTITUTE OF TECHNOLOGY

PIC Fabrication

amu

Electronics

Fraunhofer IIS



Packaging

Tyndall National Institute

Clinical Translation

MEDICAL UNIVERSITY OF VIENNA

Optics

ZEISS

Laser Source

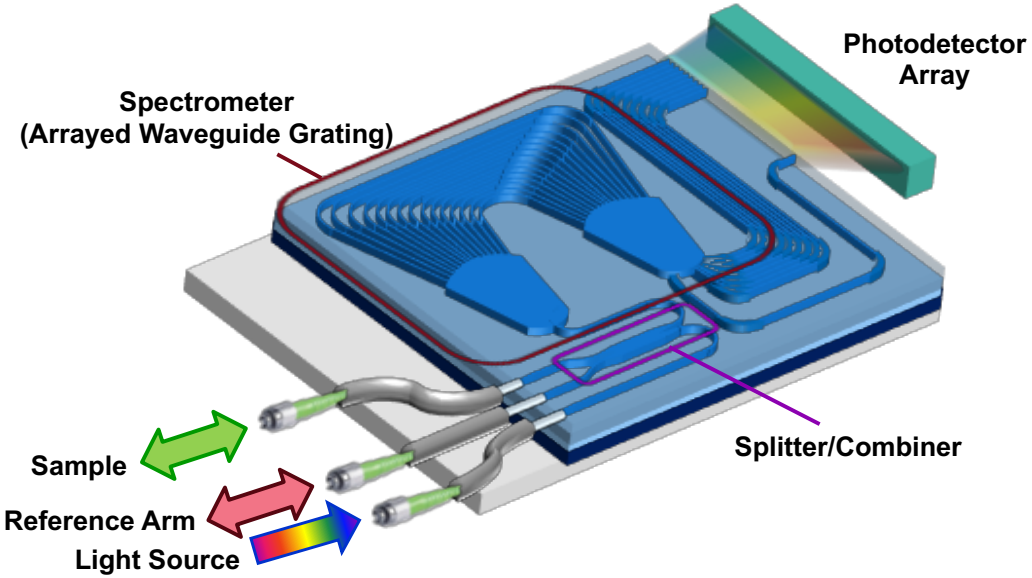
EXALOS The bright light source company

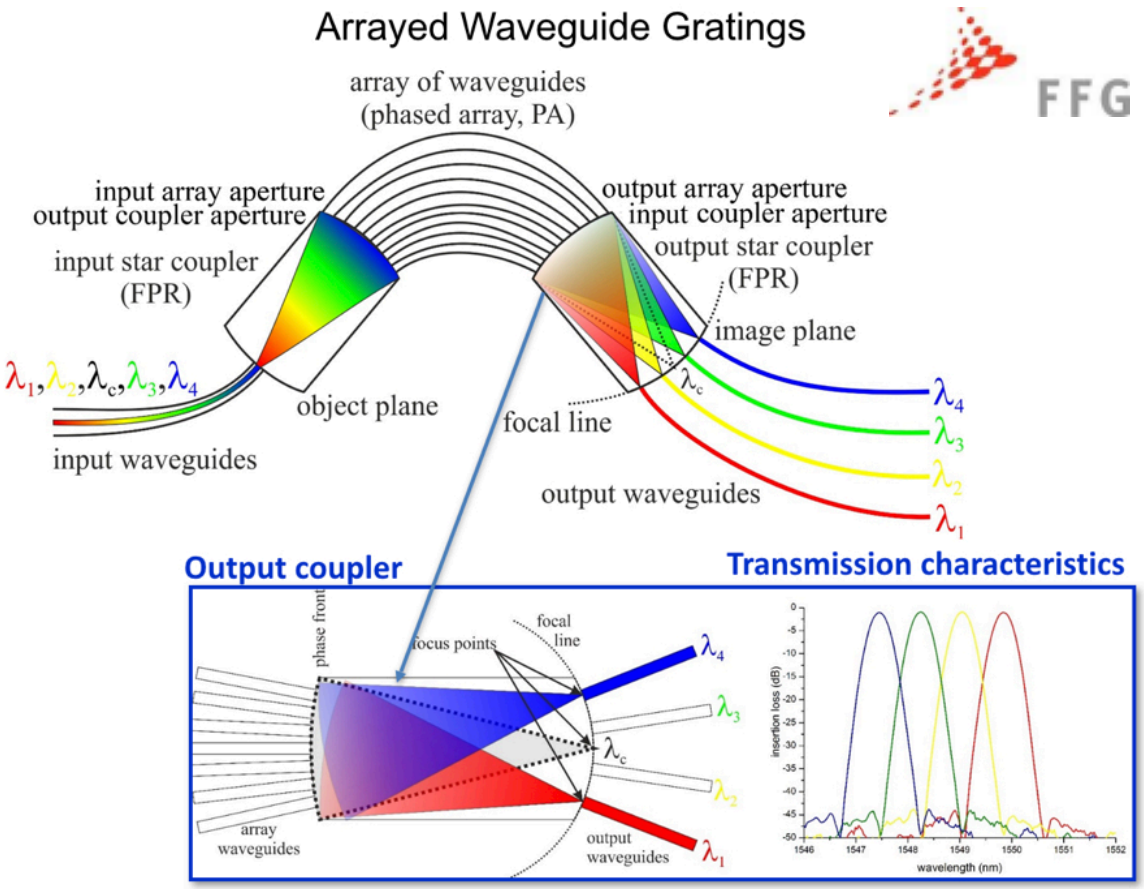
PHOTONICS 21

PHOTONICS PUBLIC PRIVATE PARTNERSHIP

Arrayed waveguide grating (AWG)
for OCT application

- Phased array splits up a spectrum in individual wavelengths.
- Tradeoff between losses and cross talk



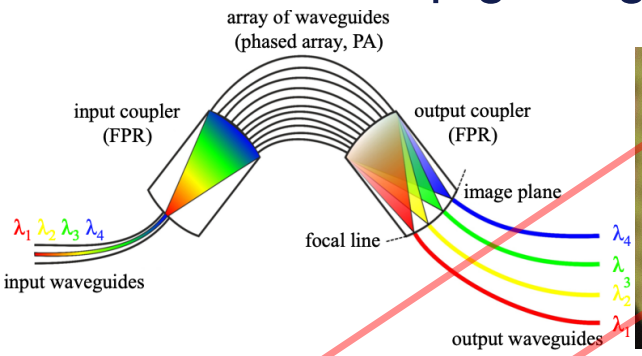


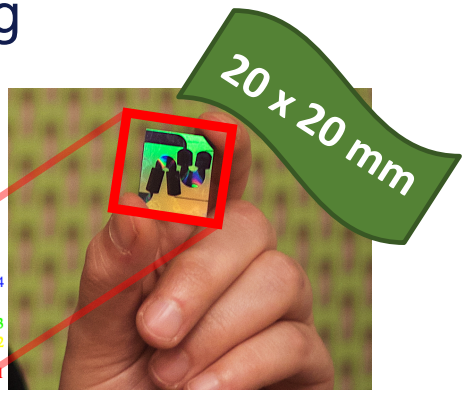
* D. Seyringer et al., doi: 10.1117/12.2319670

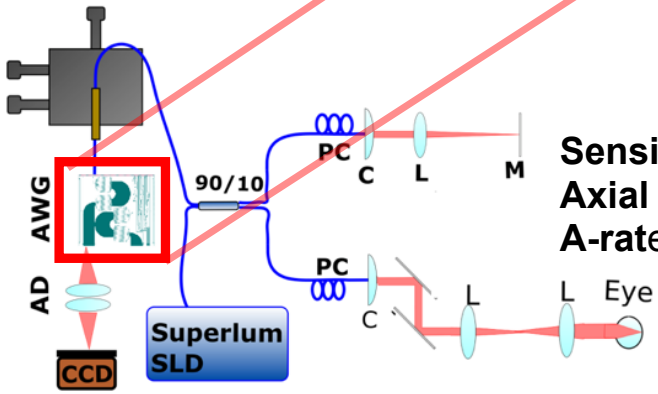
Towards miniaturised OCT using PIC

Spectral Domain OCT

on-chip grating





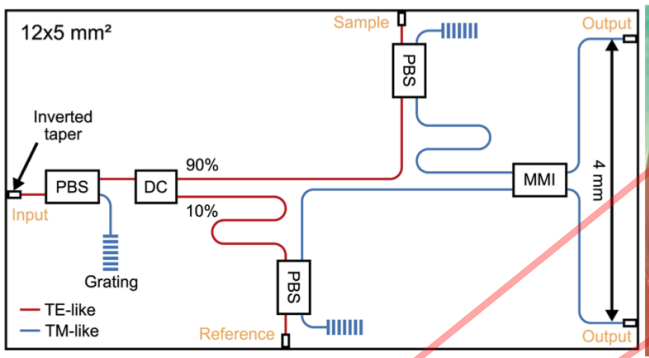


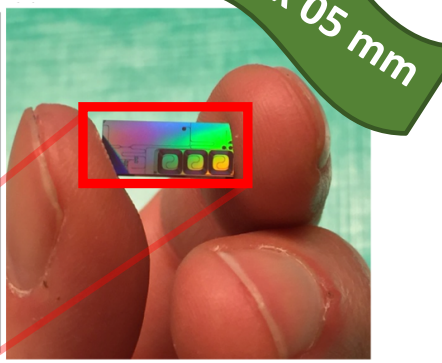
Sensitivity: up to 91 dB
Axial resolution: 6.5 – 10.7µm
A-rate: 20 – 67kHz

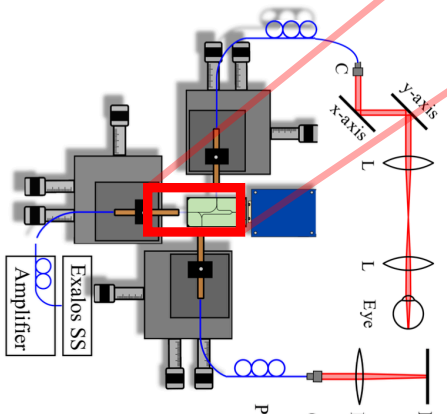
Austrian Research Promotion Agency (FFG), project COHESION, **No 848588.**

Swept Source OCT

on-chip interferometer[1]





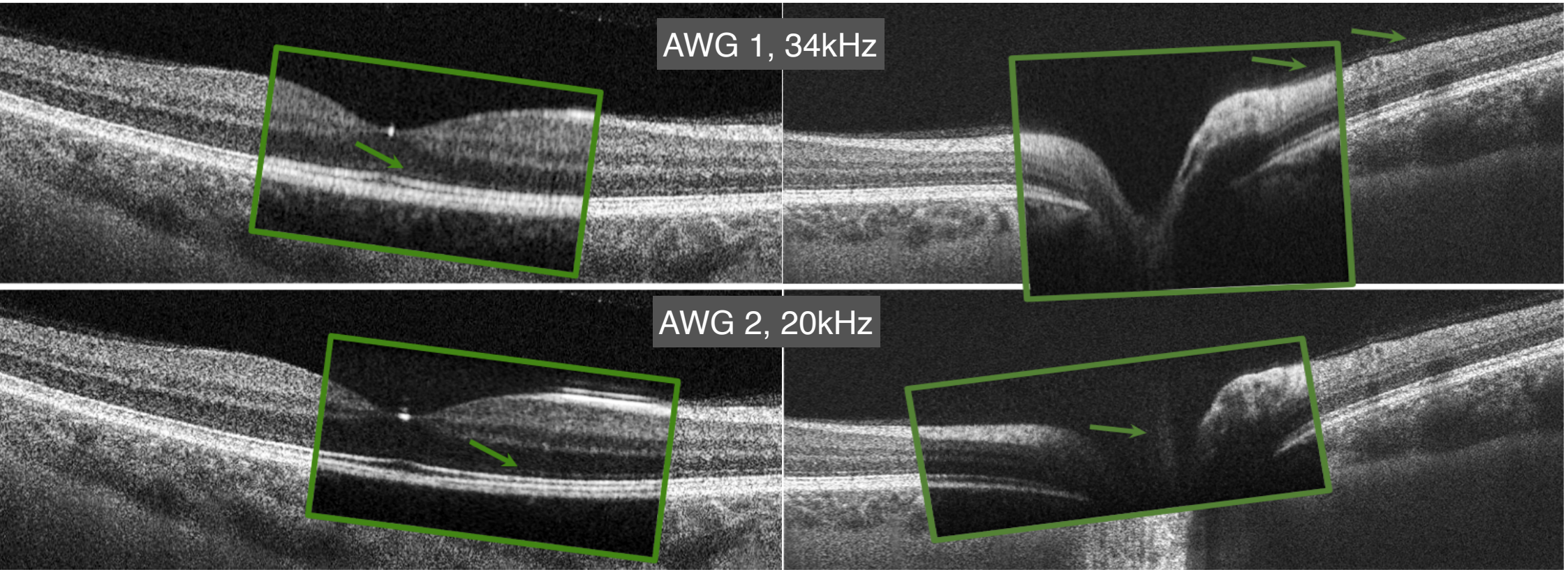


Sensitivity: 94 dB @ 750µW
Axial resolution: 5.5 µm
A-rate: 50 kHz Exalos SS

European Union Horizon 2020 research and innovation program OCTChip under grant agreement **No 688173**

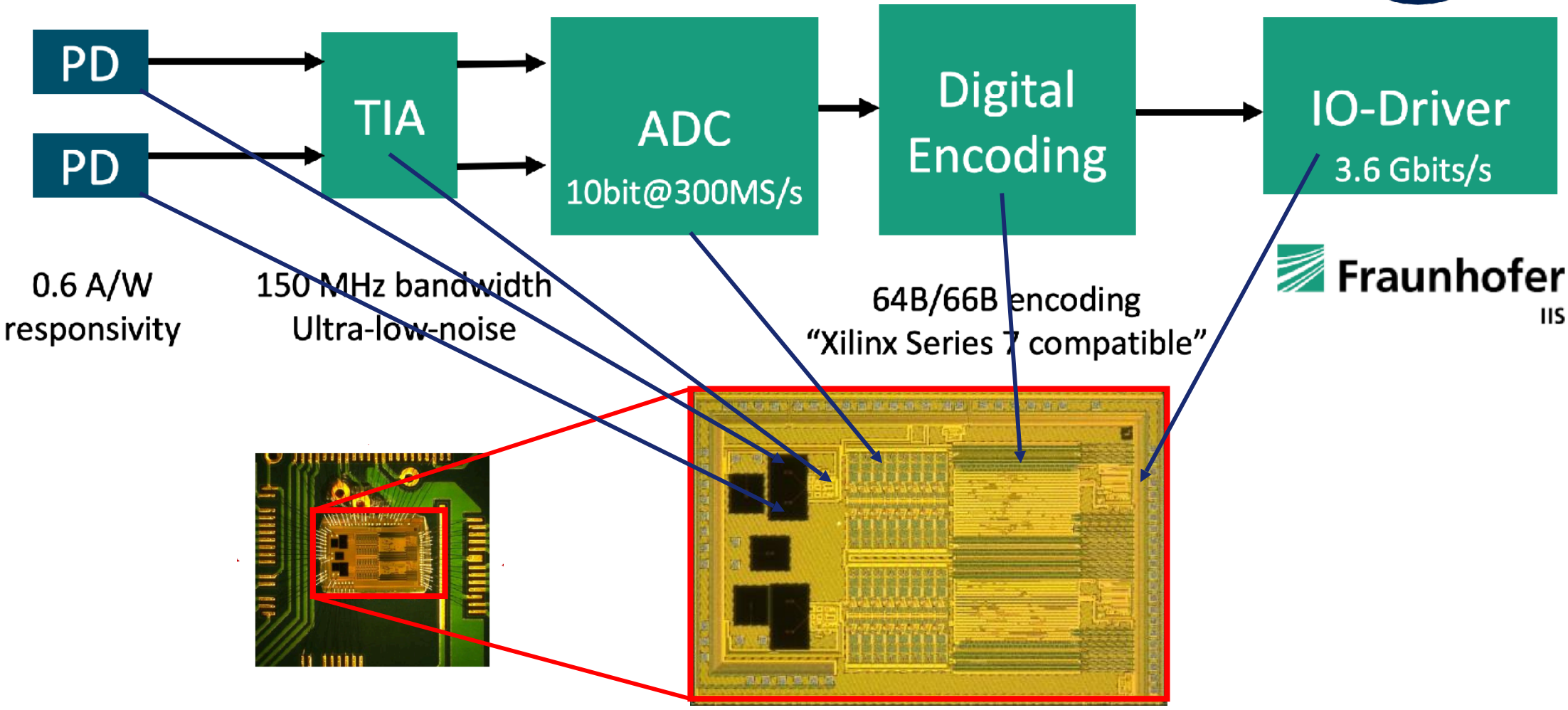
[1] Nevlacsil et al. (2020), Opt. Express 10.1364/OE.404588.

SD OCT on a Chip benchmarked to Zeiss Cirrus 4000



Zeiss Cirrus 4000: 5um axial resolution

Integrated electronics on the Chip



Handheld Optical Coherence Tomography

***HandheldOCT** (#871312, H2020-ICT-2019-2, ICT-05-2019)*

- **Optical coherence tomography (OCT)** is a revolutionising in-vivo 3D imaging technique for **non-invasive optical biopsy** addressing early diagnosis and effective disease management
- Based on **photonic integrated circuit technology**, HandheldOCT will enable a **new generation of handheld OCT systems** in the 1060nm wavelength region for optimum tissue penetration with step-changes in imaging performance: **4x faster imaging speed, 10x smaller** and **2-5x cheaper**
- HandheldOCT will contribute to a **widespread adoption of OCT in point-of-care diagnostics**
- **Solid expertise** in silicon foundry technology, miniaturized laser sources, photonic design and packaging, electronics, and medical OCT system integration

MEDICAL UNIVERSITY OF VIENNA

ZEISS

AIT AUSTRIAN INSTITUTE OF TECHNOLOGY TOMORROW TODAY

Tyndall National Institute

nanoscribe

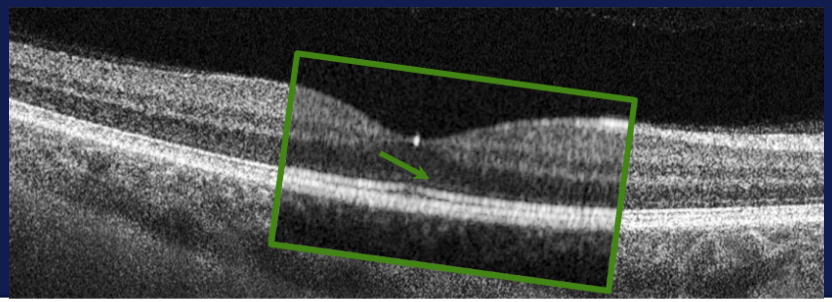
INNOLUME

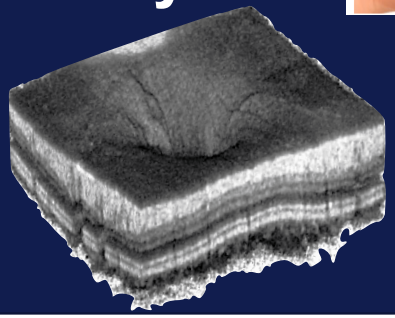
imec

Project start: **January 2020** - Project duration: **5 years** - Total costs: **€ 5.99 million**

Take home messages

- *In-vivo retinal* spectral domain (SD OCT) on a chip demonstrated
- *In-vivo retinal* swept source (SS OCT) on a chip demonstrated
- Both operating in the 840 nm wavelength range - unique for SS
- Comparable axial resolution (6 µm) to commercial instruments
- Up to 67 kHz A-scan rate - 98 kHz (SD) - 100-400 kHz (SS) possible
- Sensitivity *range of >90 dB*
- Handheld OCT @ 1060nm on its way





Acknowledgements

Elisabet Rank

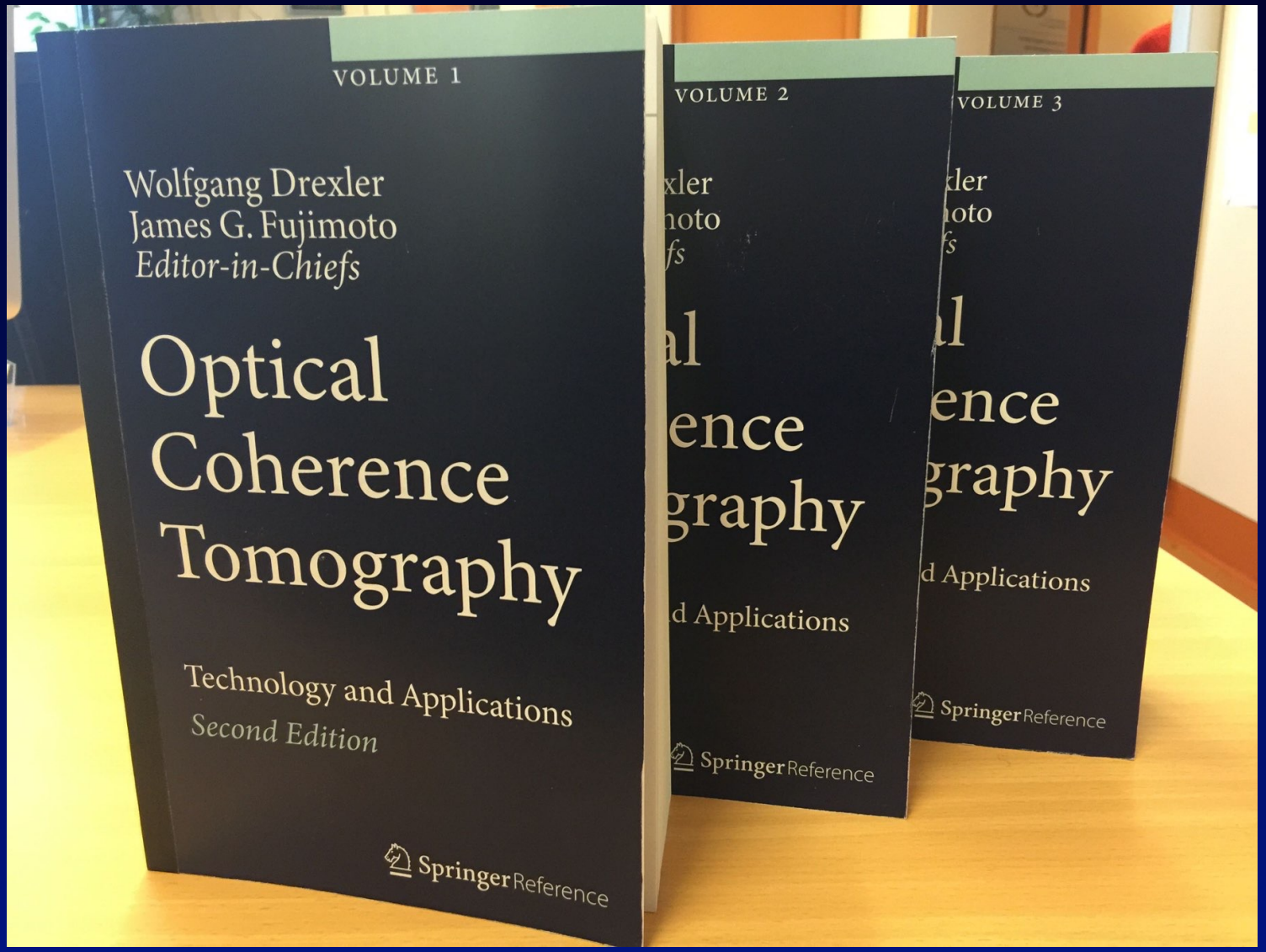
Leitgeb / Drexler Lab *(November 2018)*

Financial support

Medical University Vienna (MUW)
FFG COHESION (848588), ESA (RFP/3-16776/20)
FFG 3D PAT INTRAOP (BRIDGE)
FAMOS (FP7 ICT, 317744)
BiopsyPen (FP7 ICT 611132)
OCTChip (H2020, ICT 688173)
HandheldOCT (H2020, ICT 871312)
SWIMMOT (H2020, FETOPEN 899612)

Financial support

MIB (H2020, HEALTH 667933)
FWF SFB (SFB-F68), FWF (P26687-N25)
FBI (H2020, ITN 721766)
ESOTRAC (H2020, ICT 732729)
PROSCOPE (H2020, ICT 871212)
MOON (H2020, ICT 732969)
PHAST (H2020, ITN 860185)
REAP (H2020, ICT 101016964)



> 435.000 chapter downloads

> 5000 books sold / downloaded

2nd edition (June 2015) – 84 chapters – 2600 color pages - 3rd edition in preparation

Presentation

Photonic integration and societal challenges

Prof. Cees Ronda

Philips

Photonic integration and societal challenges

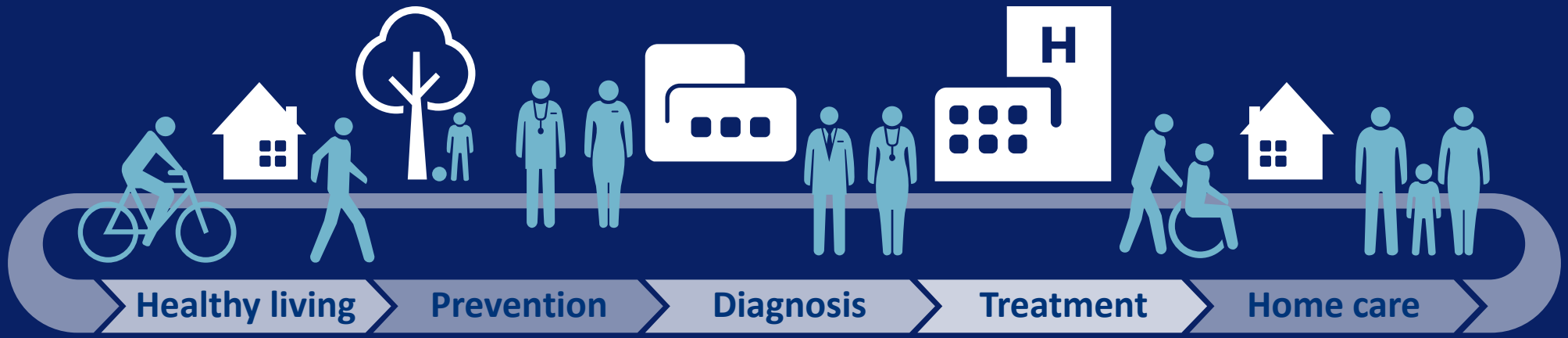
Philips Research, CoE Sensorization

February 3rd, 2021

innovation + you

PHILIPS

Healthcare continuum



Oral Care

Diagnostic Imaging

Ultrasound

Pathology, Neuro, Oncology

Healthcare Informatics

Image Guided Therapy

Monitoring & Analytics

Therapeutic Care

Sleep & Respiratory Care

Population Health Management

Agenda

- Technological developments in optical sensors, roadmaps, driving industries
  - Gas sensors
  - Particle sensors
  - Cameras
  - Multispectral sensors
  - Fiber based sensors

PHILIPS

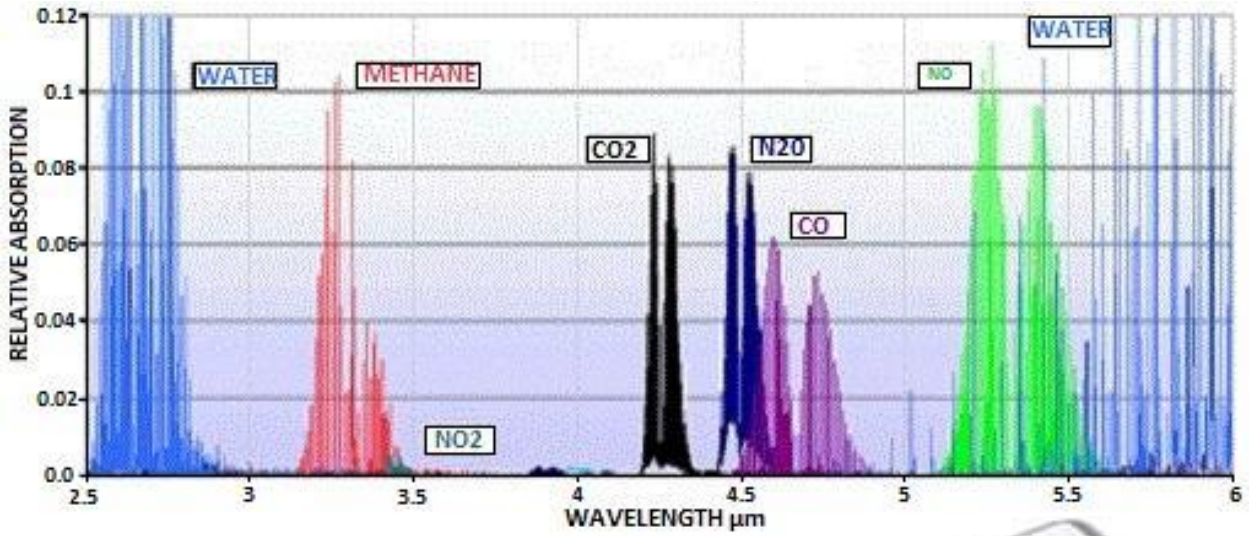
Driving industries for many sensors

- Automotive
- Mobile devices

- In many cases, Philips not developing sensors anymore, especially in ‘Personal Health’, given low volumes needed
- Roadmap driven by other industries and applications

PHILIPS

Optical gas sensing



Wavelength selectivity at source or detector

Example for CO_2 sensing, potential applications
- Breath
- Indoor air quality
- Green houses
- Additional relevance due to Covid-19: CO_2 as proxy for aerosols in indoor air

- NDIR
  - Broadband IR source and band pass filter or IR LED, IR detector
- PAS
  - IR light source and bandpass filter or IR LED, MEMS microphone

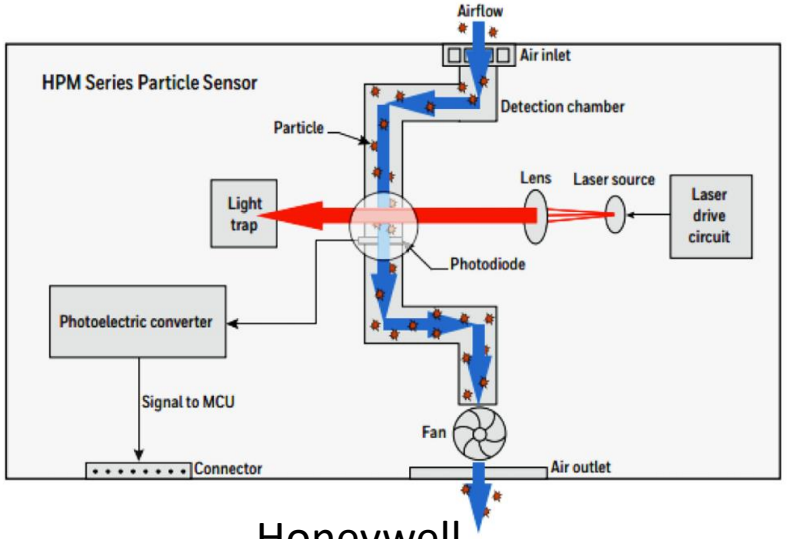
- Drivers
  - Professional and consumer applications
  - Further miniaturization and integration (including e.g. electronics and RH and T sensors), more gases per chip
  - Costs

Sensirion

Smart2zero.com

PHILIPS

Particle sensors

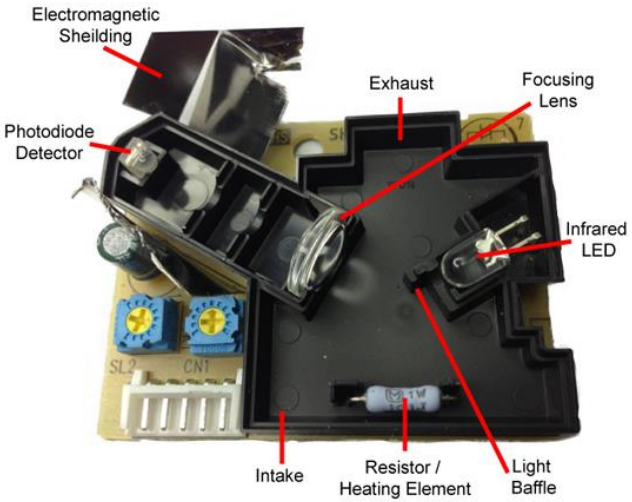


Honeywell

- Air pollution considerable in many parts of the world, also indoors
- People spend significant amount of time indoors
- Negatively impacts life expectancy by up to several years
- Many sources of particle pollution
- Aerosols in Covid-19 times

- Increased body of evidence that smallest particles (PM 1 and smaller) are very dangerous (may enter blood stream, organs and brains, even encountered in fetuses)

- Drivers:
  - Particle sensors that can measure particles smaller than 250 nm or even 100 nm reliably
  - Sensor fusion concepts to enable this
  - Chemical/biological nature of particles (potential danger, origin of particles)
  - Increased awareness (legislation, consumers)
  - Costs
  - Integration in devices



aqicn.org

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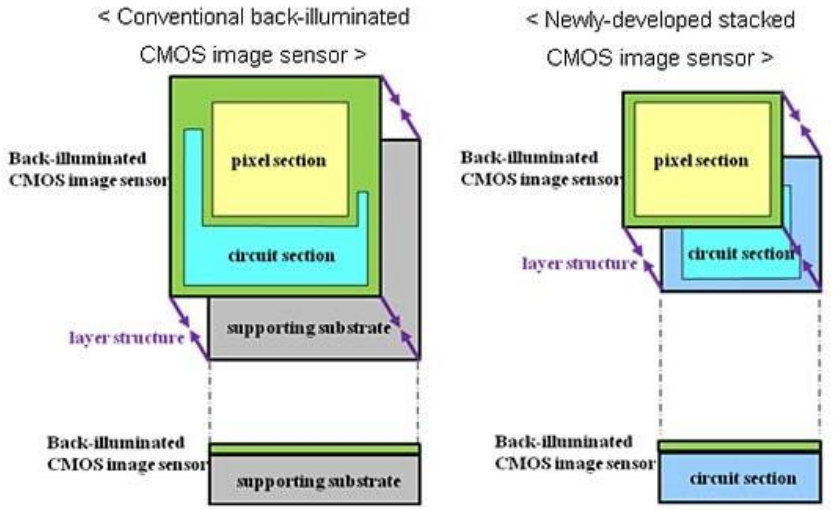
Cameras

- Examples for applications
  - Surveillance
  - Agriculture
  - Automotive
  - Smart phones
  - 2D/3D, ToF, LiDAR
  - Overlay in imaging

Photoarena.com

- Decrease pixel dimensions
- Increase number pixels per chip (f.e. in smart phones)
- Stacked logic over multiple layers
- Back-side illumination (differs from structure of human eye)
- Increase SNR for professional applications, based on Organic Photoconductors
- Add AI on camera chip



https://www.sony.net/SonyInfo/News/Press/201201/12-009E/

- Drivers
  - Smart phones and mobile devices
  - Self driving cars
  - 3D applications

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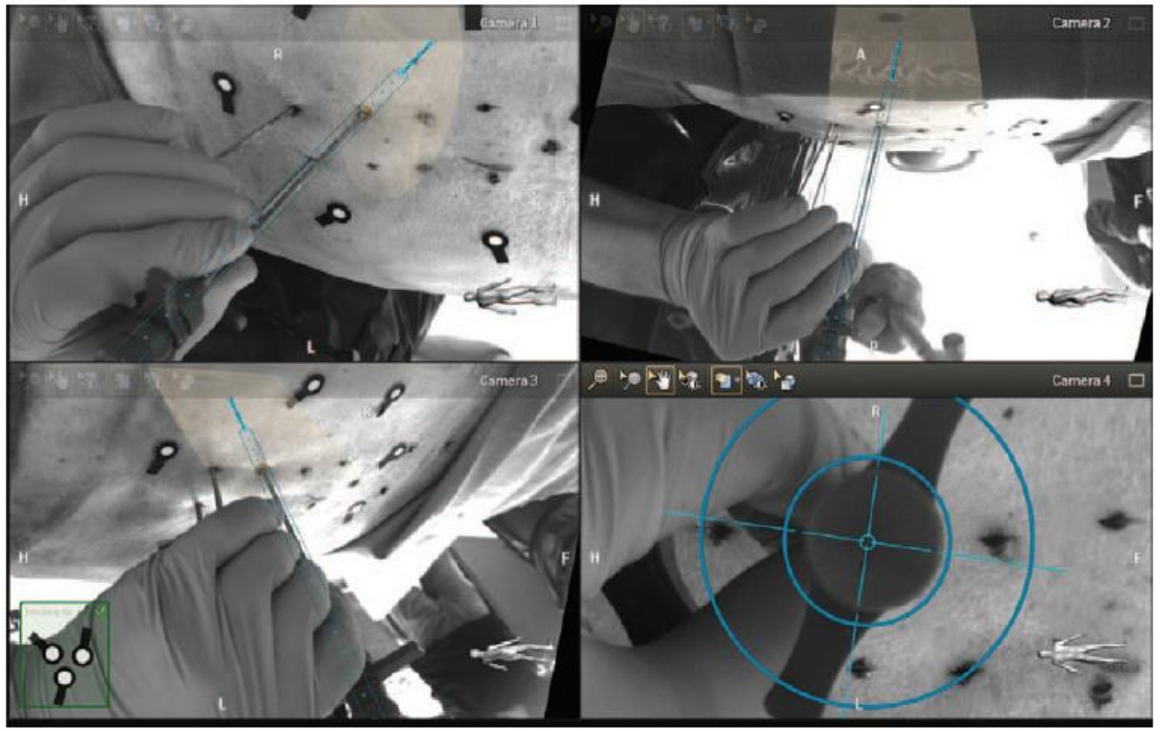
3D AR overlay of X-ray images in surgical navigation



Minimally invasive screw placement, with significantly improved accuracy

SPINE Volume 43, Number 14, pp 1018–1023

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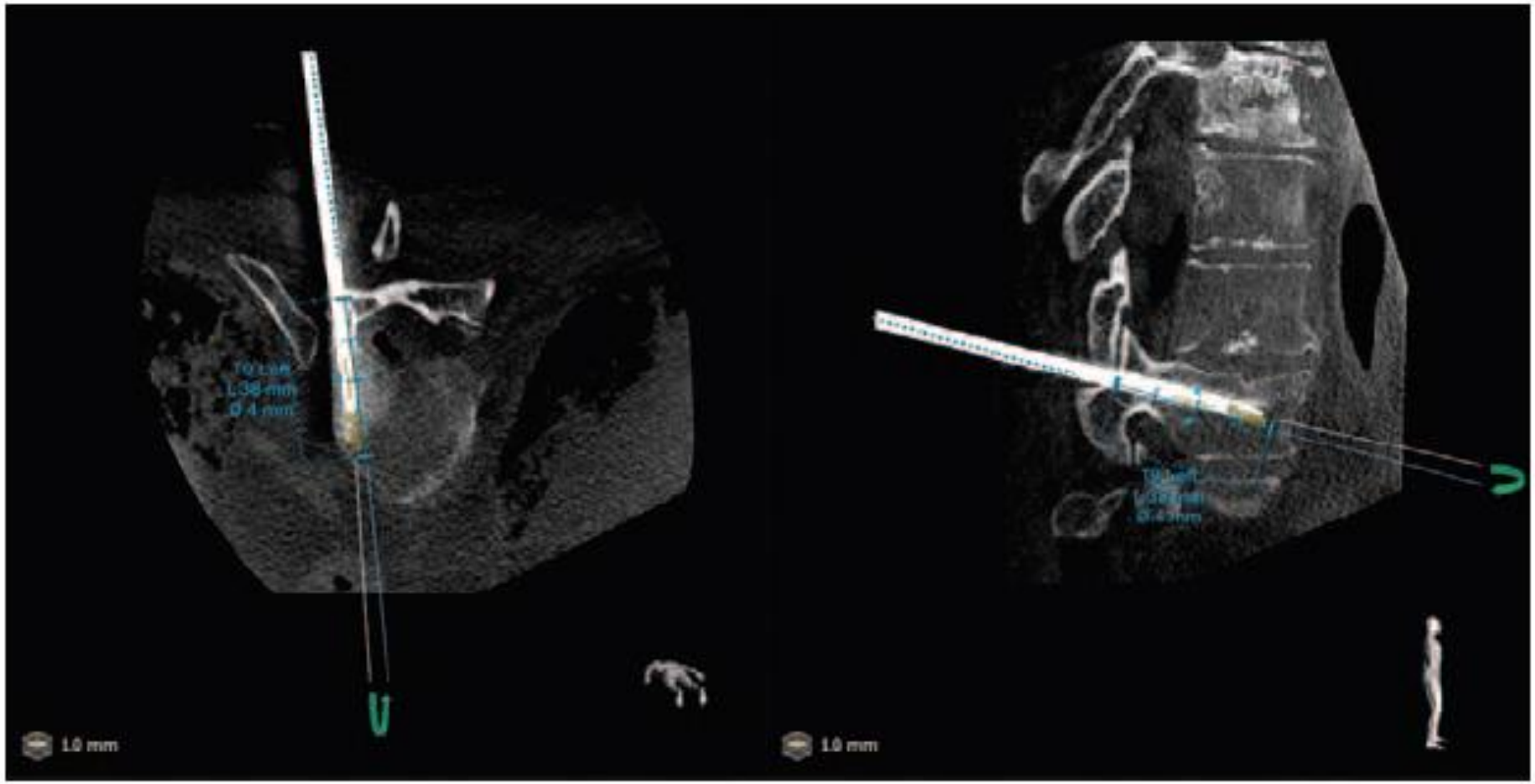
- Accuracy of 3D AR assisted screw placement (direction, position)



Standard camera resolution sufficient

Angulation error < 0.3°, distance error < 2mm

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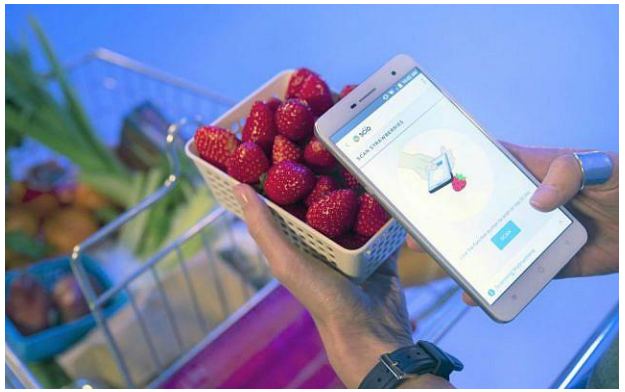
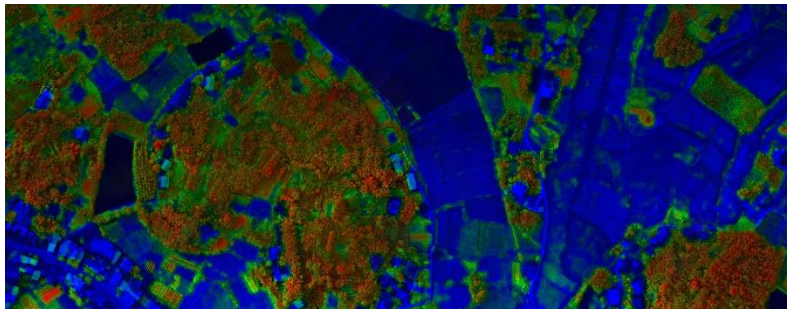
Multispectral sensors

- Examples for applications
  - Monitoring Health Status Crops
  - Waste sorting
  - Body sensing, including body liquids
  - Nutrient characterization
  - …

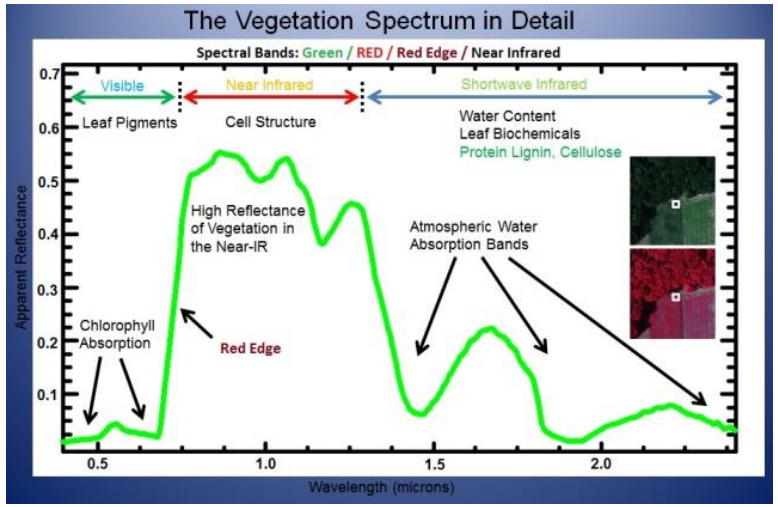


Consumer Physics



Cubert-GmbH.com

- Drivers/needs
  - Professional and consumer applications
  - Miniaturization multispectral sensors
  - Increased number of wavelengths per chip
  - Broad spectral detection range, beyond Si photonics
  - Spectral width optical filters
  - Broad band light sources



Dronezon.com

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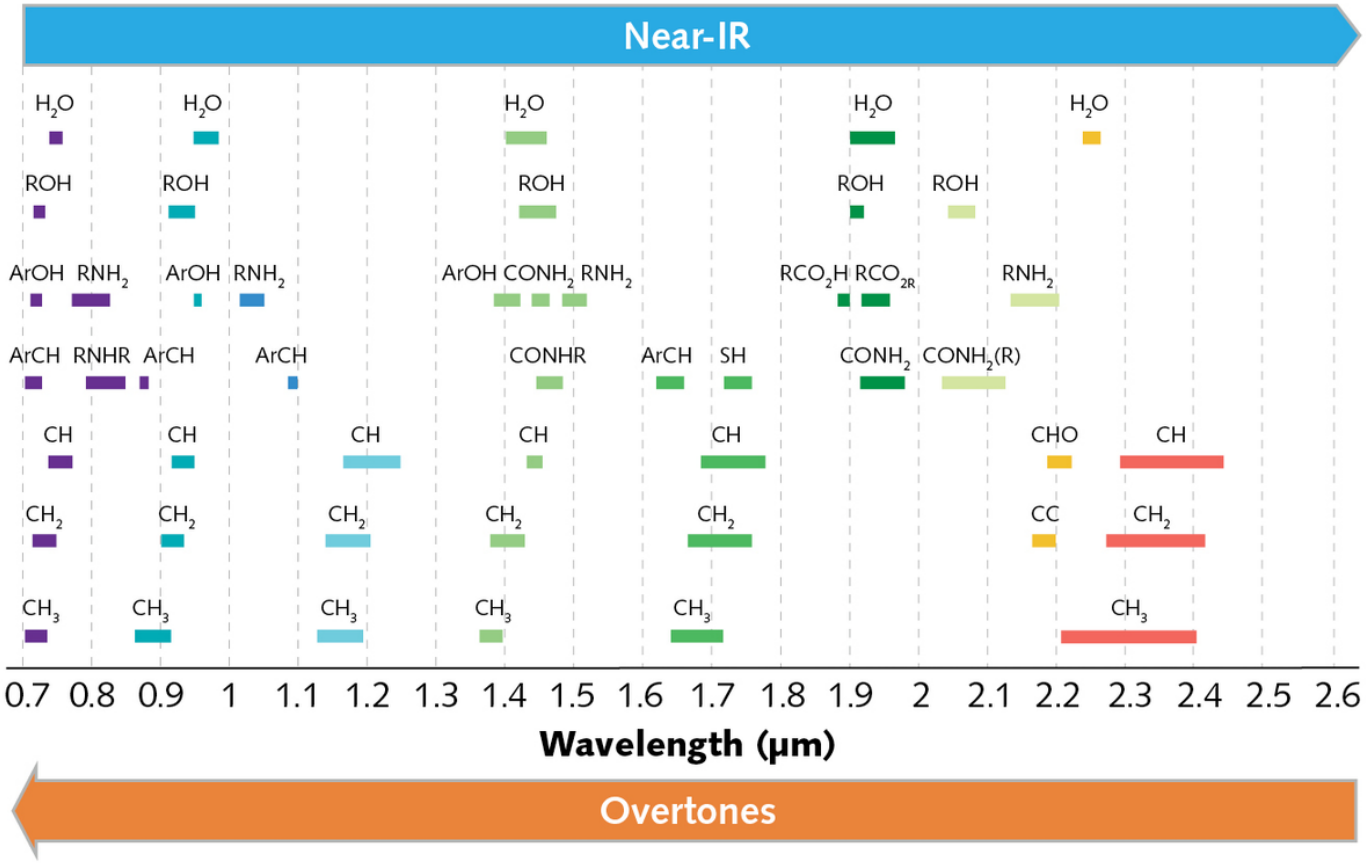
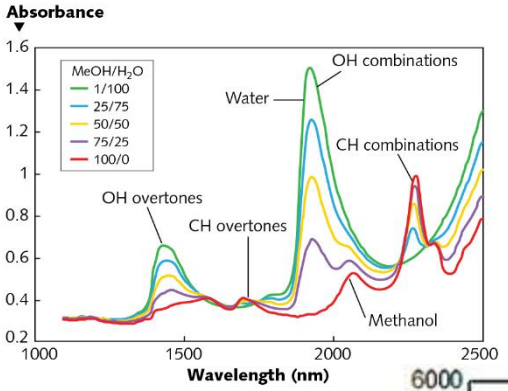
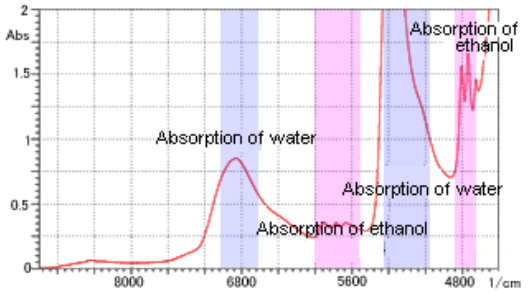
NIR spectra (including overtones)



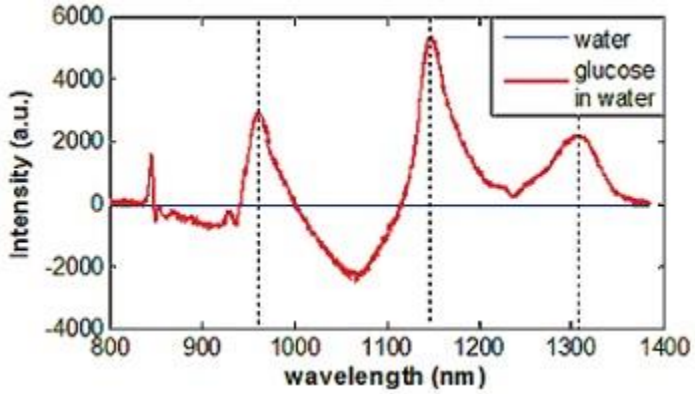
- Use (N) IR spectroscopy at selected wavelengths to identify functional groups
- Use AI to determine presence and concentrations of compounds of interest



Buchinir.conm



Shimadzu.com



Andor.oxinst.com

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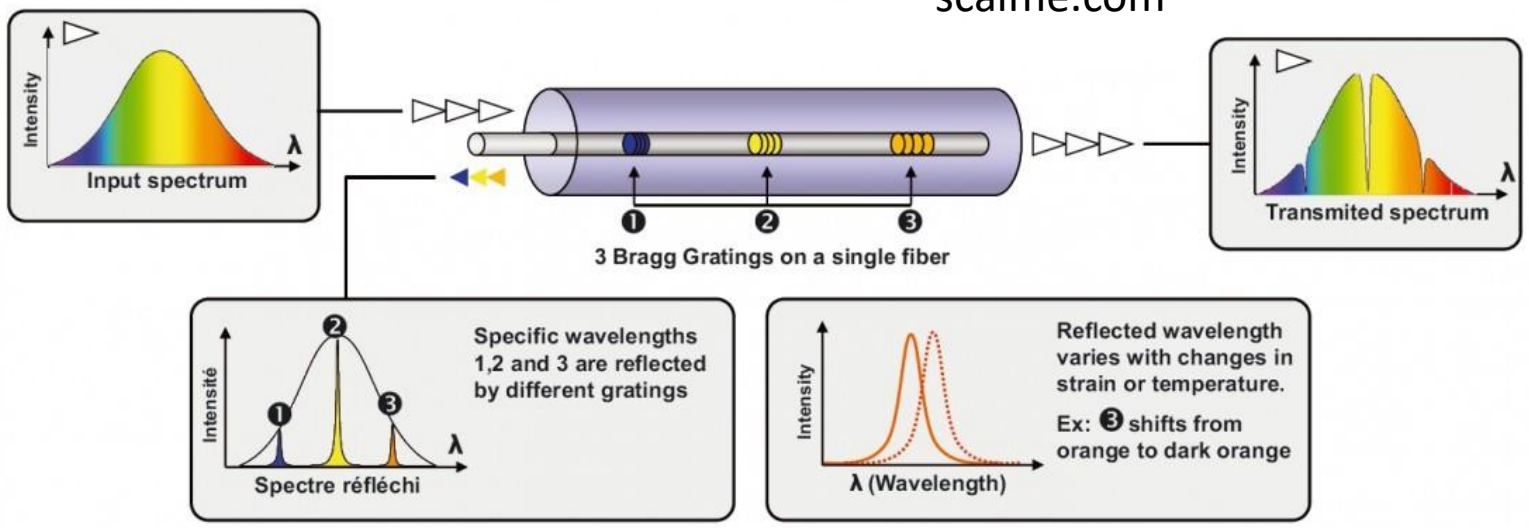
Fiber based sensors

- Examples for applications
  - Biosensors, f.e. by modified cladding layers and functionalization
  - Forces exerted on fiber, f.e. Bragg grating based
  - Distributed sensing

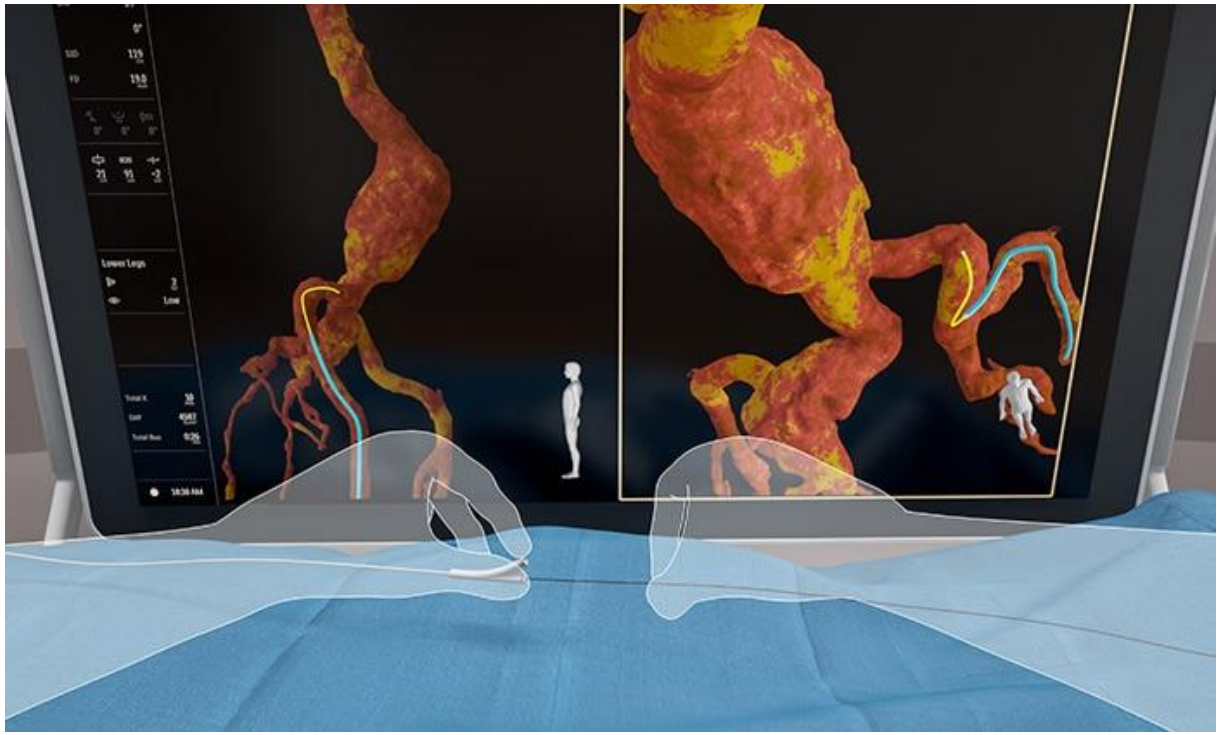
- Drivers
  - Professional applications
  - Acoustic-, temperature-, strain sensing

scaime.com



Fiber Optics Real Shape Technology

- Based on hair-thin fibers with integrated Bragg reflectors in intra-body devices
- Tunable laser
- Integration into images of other modalities (CT MR, C-arm)
- 3D imaging, without X-rays



https://www.philips.com/a-w/research/research-programs/fors.html

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Conclusions

- In many cases, sensor roadmaps driven by few application fields only (like smart phones, self-driving cars)
- Further miniaturization, integration, sensor fusion and cost down needed, especially in case of consumer products
- New options in medical applications, based on fusion of sensor concepts and sensor developments driven by other fields as well

- Thanks to Jean Schleipen, Benno Hendriks, Alwin Verschueren

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Open Discussion

Giuseppe Coppola

Photon Delta

OIP4NWE Voucher Introduction

Prof. Jürgen van Erps

Photonics Campus Grooik
Vrije Universiteit Brussel

Interreg North-West Europe
EUROPEAN UNION
OIP4NWE
European Regional Development Fund

OIP4NWE
Open Innovation PIC Pilot

Open-Innovation Photonics pilot for North West Europe

Innovation Support Fund – Call for applications

Jürgen Van Erps, VUB

Innovation Support Fund - Call for applications

Are you an SME in the NWE region wanting to scale up production of PICs to a trial series beyond proof-of-concept demonstration?

Apply now to receive 1 of 7 vouchers providing you with up to 50k€* support and access to the OIP4NWE open innovation pilot line, covering

1) Design verification to check compatibility of the PIC design with the OIP4NWE pilot line
2) Manufacturing of the PICs, external optics and packaging

22/1/2021
Call opens

27/01/2021
03/03/2021
10/2/2021
Webinars

Submit
Expression
of interest

Submit
application
form & sign
Proxy NDA

15/04/2021
Call closes

Evaluation
by
OIP4NWE
selection
committee

30/06/2021
Announcement
of winners

Voucher
execution

For more information, visit www.oip4nwe.eu/vouchers

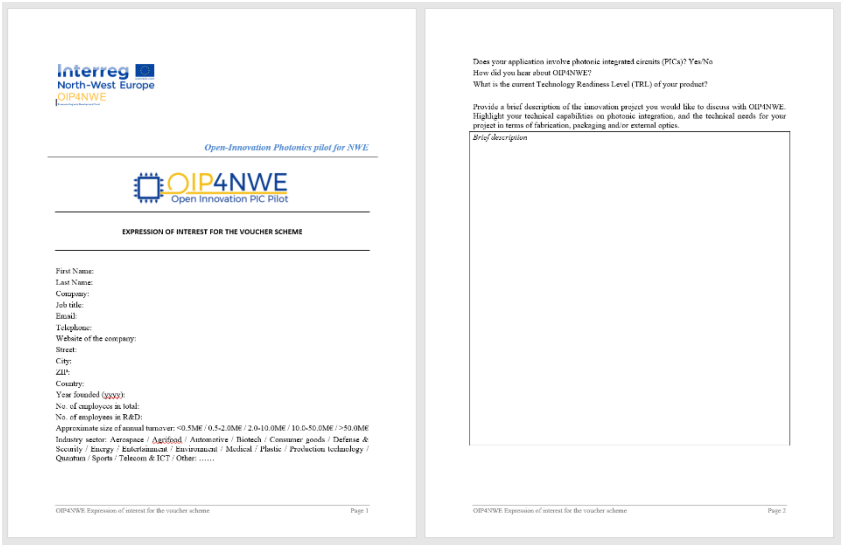
* A financial contribution of 20% will be required from the SME on the total project cost and of 100% for anything above the 50k€ max support.

Requirements for application

1. The applicant should be a **small or medium-sized entreprise (SME)**, according to the European definition, which can be found at https://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition
2. The applicant should be **based in the North-West Europe** region, as defined on https://www.nweurope.eu/about-the-programme/the-nwe-area/
3. The applicant should have demonstrated the technical feasibility of their application proposal, i.e. the applicant should have a PIC design ready and preferably a validated prototype. This means that the technology readiness level **(TRL) of their current PIC should be 4 or higher**. Proposals for proof-of-concept type demonstrators are not eligible.
4. The applicant should **demonstrate a business case** for scale-up to volume production and/or how the funded project will positively **impact** their future business, either through increased revenues or through the creation of new jobs.
5. The applicant should **comply with the minimis criterion for state aid** and provide a self-declaration to that end. A "De Minimis" award letter will be issued by the OIP4NWE consortium when complying.
6. The applicant should **submit a fully completed "Voucher application form"** and should **sign a "Proxy NDA"** to allow evaluation of the proposal by the OIP4NWE voucher selection committee.
7. Voucher recipients should **agree to collaborate on documenting their use case**. This is to be used as dissemination material to attract other users of the pilot line, during as well as after the project.

Application procedure

→ Fill out a pre-registration "**expression of interest**" form to allow early follow-up and eligibility check prior to preparing a full proposal. Send the form to voucher@oip4nwe.eu


Open-Innovation Photonics pilot for NWE

EXPRESSION OF INTEREST FOR THE VOUCHER SCHEME

First Name:
Last Name:
Company:
Job title:
Email:
Telephone:
Website of the company:
Street:
City:
ZIP:
Country:
Year founded (yyyy):
No. of employees in total:
No. of employees in R&D:
Approximate size of annual turnover: <0.5M€ / 0.5-2.0M€ / 2.0-10.0M€ / 10.0-50.0M€ / >50.0M€
Industry sector: Aerospace / Agrifood / Automotive / Biotech / Consumer goods / Defense & Security / Energy / Entertainment / Environment / Medical / Plastic / Production technology / Quantum / Sports / Telecom & ICT / Other: .....

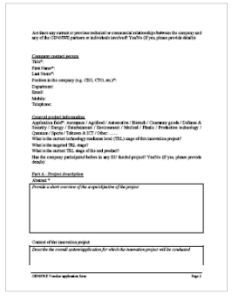
Does your application involve photonic integrated circuits (PICs)? Yes/No
How did you hear about OIP4NWE?
What is the current Technology Readiness Level (TRL) of your product?

Provide a brief description of the innovation project you would like to discuss with OIP4NWE. Highlight your technical capabilities on photonic integration, and the technical needs for your project in terms of fabrication, packaging and/or external optics.

Brief description

→ Fill out application form and send it to voucher@oip4nwe.eu before the call closure (15/04/2021)


1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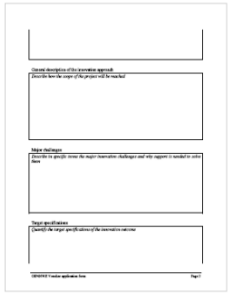
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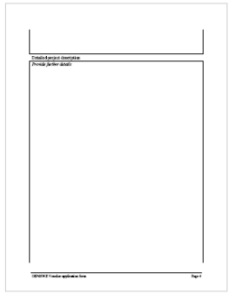
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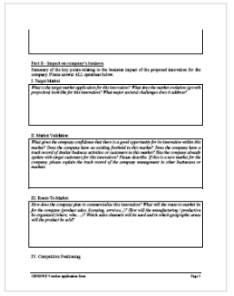
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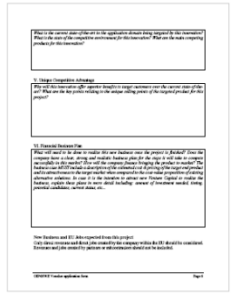
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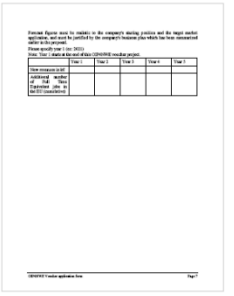

7

Application form

Open-Innovation Photonics pilot for NWE

VOUCHER APPLICATION FORM

Note that fields marked with an asterisk (*) will be used in public communications about OIP4NWE and the company should be aware of this in advance.

Company Information *

Company name:
Company type:
Main industry sector of the company:
Street:
City:
ZIP:
Country:
Website:
Year founded (yyyy):
No. of employees in total:
No. of employees in R&D:
Size of annual turnover:
First time photonics innovation with PICs? Yes/No
Is there any cause for concern over potential conflicts of interest between the company and any of the OIP4NWE partners or individuals? Yes/No (If yes, please explain)

Are there any current or previous technical or commercial relationships between the company and any of the OIP4NWE partners or individuals involved? Yes/No (If yes, please provide details)

Company contact person

Title*:
First Name*:
Last Name*:
Position in the company (e.g. CEO, CTO, etc.)*:
Department:
Email:
Mobile:
Telephone:

General project information

Application field*: Aerospace / Agrifood / Automotive / Biotech / Consumer goods / Defense & Security / Energy / Entertainment / Environment / Medical / Plastic / Production technology / Quantum / Sports / Telecom & ICT / Other: ……
What is the current technology readiness level (TRL) stage of this innovation project?
What is the targeted TRL stage?
What is the current TRL stage of the end product?
Has the company participated before in any EU funded project? Yes/No (If yes, please provide details)

Part A - Project description

Abstract *

Provide a short overview of the scope/objective of the project

Context of the innovation project

Describe the overall system/application for which the innovation project will be conducted

Application form

General description of the innovation approach

Describe how the scope of the project will be reached

Major challenges

Describe in specific terms the major innovation challenges and why support is needed to solve them

Target specifications

Quantify the target specifications of the innovation outcome

Detailed project description

Provide further details

/

Application form

Part B - Impact on company's business

Summary of the key points relating to the business impact of the proposed innovation for the company. Please answer ALL questions below.

I. Target Market

What is the target market application for this innovation? What does the market evolution (growth projection) look like for this innovation? What major societal challenges does it address?

II. Market Validation

What gives the company confidence that there is a good opportunity for its innovation within this market? Does the company have an existing foothold in this market? Does the company have a track record of similar business activities or customers in this market? Has the company already spoken with target customers for this innovation? Please describe. If this is a new market for the company, please explain the track record of the company management in other businesses or markets.

III. Route-To-Market

How does the company plan to commercialize this innovation? What will the route-to-market be for the company (product sales, licensing, services...)? How will the manufacturing / production be organized (where, who, ...)? Which sales channels will be used and in which geographic areas will the product be sold?

IV. Competitive Positioning

What is the current state-of-the-art in the application domain being targeted by this innovation? What is the state of the competitive environment for this innovation? What are the main competing products for this innovation?

V. Unique Competitive Advantage

Why will this innovation offer superior benefits to target customers over the current state-of-the-art? What are the key points relating to the unique selling points of the targeted product for this project?

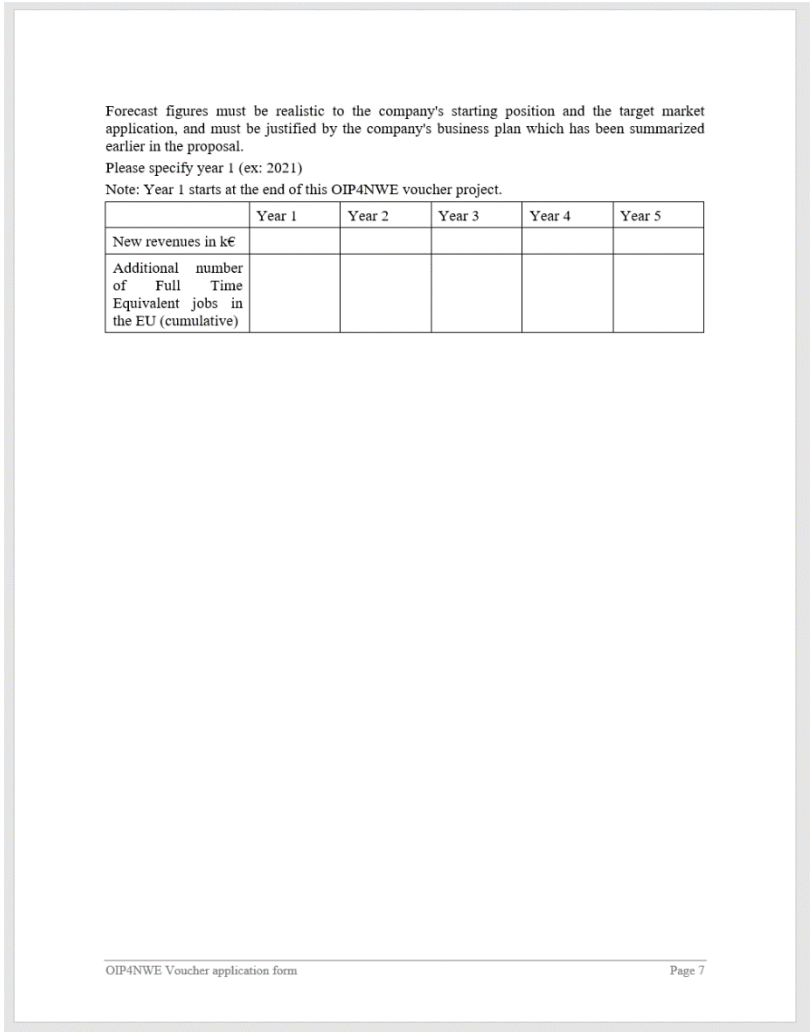
VI. Financial Business Plan

What will need to be done to realize this new business once the project is finished? Does the company have a clear, strong and realistic business plan for the steps it will take to compete successfully in this market? How will the company finance bringing the product to market? The business case MUST include a description of the estimated cost & pricing of the target end product and its attractiveness to the target market when compared to the cost-value proposition of existing alternative solutions. In case it is the intention to attract new Venture Capital to realize the business, explain these plans in more detail including: amount of investment needed, timing, potential candidates, current status, etc...

New Business and EU Jobs expected from this project

Only direct revenues and direct jobs created by the company within the EU should be considered. Revenues and jobs created by partners or subcontractors should not be included.

Application form



Forecast figures must be realistic to the company's starting position and the target market application, and must be justified by the company's business plan which has been summarized earlier in the proposal.

Please specify year 1 (ex: 2021)

Note: Year 1 starts at the end of this OIP4NWE voucher project.

	Year 1	Year 2	Year 3	Year 4	Year 5
New revenues in k€					
Additional number of Full Time Equivalent jobs in the EU (cumulative)					

Selection criteria

Evaluation criteria and associated weight:

1. **The innovative character of the project (weight 1)**:
   Is the proposed solution new to the marked?
   Is the project creating valuable knowhow?
   Are PICs key enabling elements in this project?
2. **Technical feasibility and quality of the project plan (weight 1)**:
   Compatibility with the OIP4NWE pilot line?
   Current TRL level of the PIC?
   How should the PIC be interfaced with the outside world?
   Is the proposed technological approach in line with the project goals?
3. **Credibility and level of commitment of the company (weight 2)**:
   Level of financial commitment?
   Does the company have a proven track record of bringing new products/solutions to the market?
   Does the company have a proven track record of successfully completing public or public-private funded project?
4. **Added value on the business case and potential impact (weight 2)**:
   The target market (target customers/segments, purchasing decision-makers, ...)?
   The market validation (experience and relationship of the company with these customers; is the target market an existing one or a new one?)?
   The route to market (what channels will the company use to sell and deliver its products to its target customers?)
   The value proposition (competitive positioning and unique selling point)?
   Financial aspects of the business plan (increase in revenues or new jobs created)?

Each criterion is scored with a value from 0 (strongly underperforming) to 5 (excellent). The score is multiplied with the weight.
The individual score of each criterion should be at least 2,5/5.
The total score should be at least 20/30.

The selection committee will take into account **geographical distribution in the NWE region** as well as **distribution over different application sectors** of the voucher grantees.

Need more information?

→ Visit our website: www.oip4nwe.eu/vouchers

→ Contact voucher@oip4nwe.eu

http://www.oip4nwe.eu

Thank you!