



imec

HAPPY **INNO**VERSARY

Imager Innovations at imec: beyond Human and Silicon Vision
(SWIR, Multispectral, Ultra-fast and Electron Imaging)

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IMEC: INDEPENDENT R&D HUB

SEMICONDUCTOR SCALING AND NANOELECTRONICS

FOUNDED 1984, HQ IN LEUVEN, BELGIUM

>5500 PEOPLE OF >95 NATIONALITIES

>600 PARTNERS

935 M€ REVENUE IN 2023
(70% FROM INDUSTRY)

FAB INVESTMENT >3.5 B€

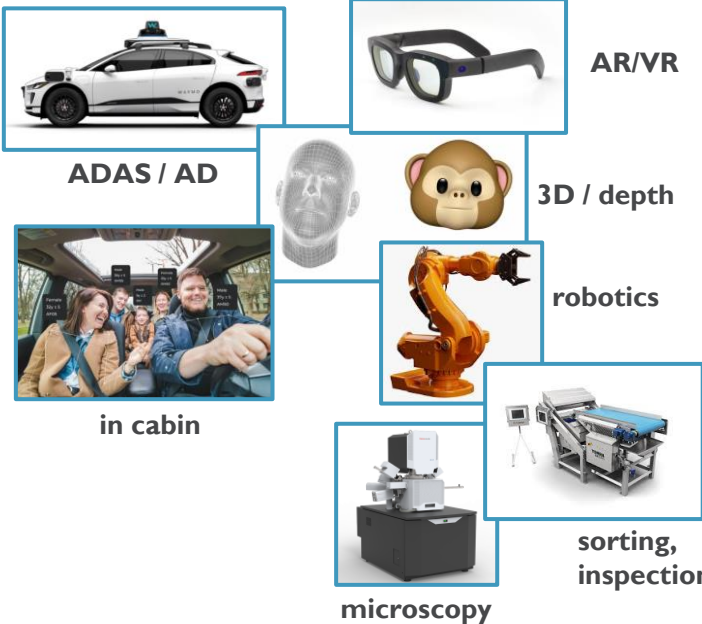


From Imaging to Sensing

Increasing importance of **machine vision** and **computed imagery**

from **photography**...

...to **acquiring information**



Beyond human vision and beyond silicon vision

SWIR, Spectral, Ultra-fast and Electron Imaging

from **visible...**

...to invisible



NIR / SWIR

1.0 – 2.0 μm
(>1.4 eye-safe)

EUV

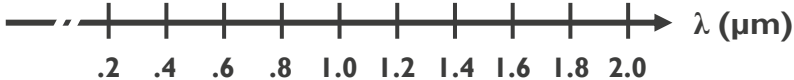
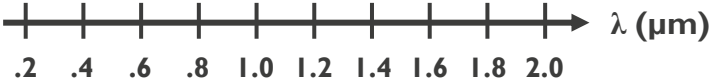
< 100 nm



photography:VIS



Spectral



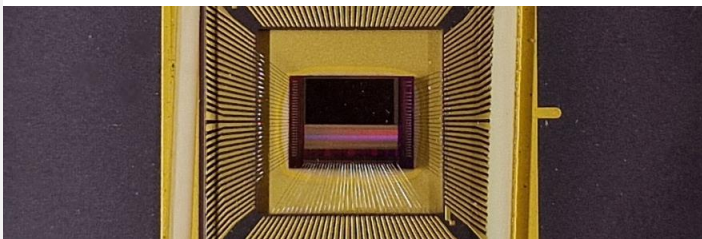
Beyond human vision and beyond silicon vision

SWIR, Spectral, Ultra-fast and Electron Imaging

Quantum Dot / Organic Image Sensors

Disruptive imagers for short-wave infrared (SWIR)

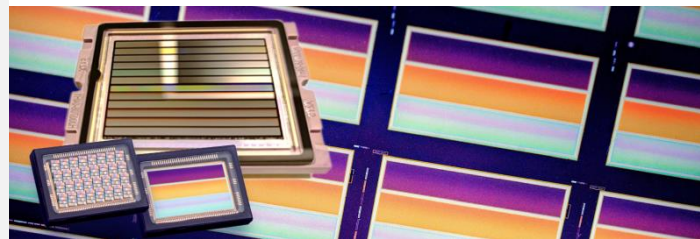
SWIR



On-Chip Spectral Imaging

Integration of filters directly on imager

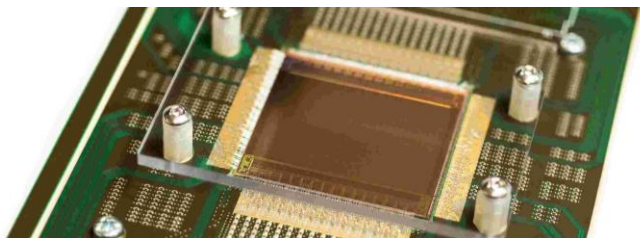
MULTISPECTRAL



Ultra-fast imagers

Fully custom products for scientific cameras

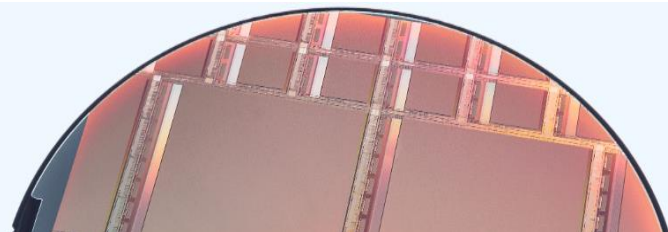
ULTRA-FAST



Electron imagers

Fully custom products for high-end microscopy

ELECTRON



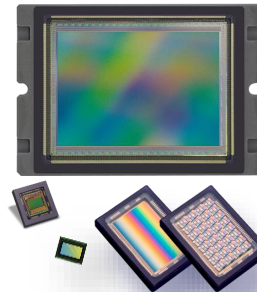
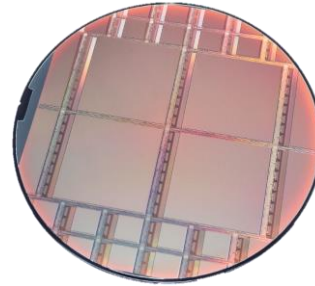
Beyond human vision and beyond silicon vision

SWIR, Spectral, Ultra-fast and Electron Imaging

from **concept** ...



...to **low volume manufacturing**



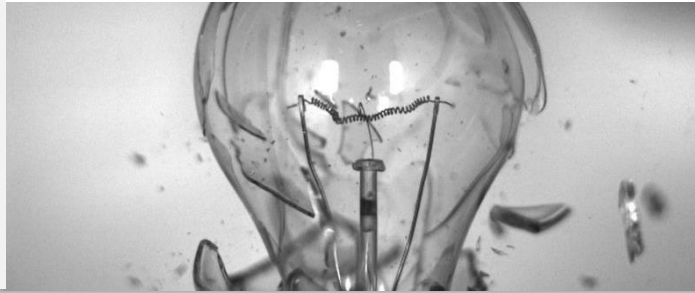
Beyond human vision and beyond silicon vision

SWIR, Spectral, **Ultra-fast** and Electron Imaging

Ultra-fast imagers

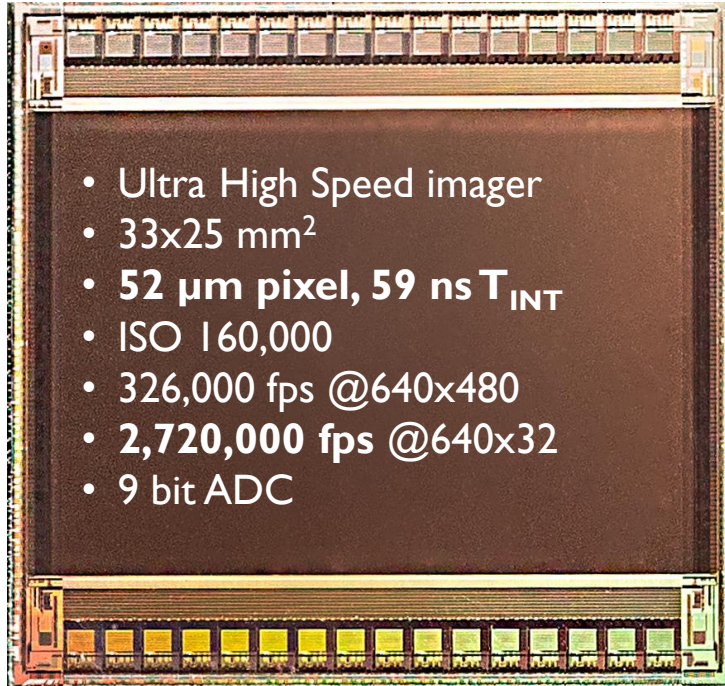
Fully custom products for scientific cameras

ULTRA-FAST



Ultra-fast imagers for scientific cameras

Highest datarate sensor in the world (1.2 Tbps / 2,720,000 fps ROI)



- Ultra High Speed imager
- 33x25 mm²
- 52 μm pixel, 59 ns T_{INT}
- ISO 160,000
- 326,000 fps @640x480
- 2,720,000 fps @640x32
- 9 bit ADC



PHARSIGHTED **Photron**

World's most Light-Sensitive Ultra High-Speed Camera

The Pharsighted E9-80S and E9-100S ultra high-speed cameras are the world's first backside-illuminated, full-frame high speed cameras. With unparalleled speed and unmatched light sensitivity the E9-80S and E9-100S are ideally suited for applications requiring visualization at over 100,000fps.

Model E9-80S and E9-100S

The Pharsighted E9-80S and E9-100S ultra high-speed cameras are the world's first backside-illuminated, full-frame high speed cameras. With unparalleled speed and unmatched light sensitivity the E9-80S and E9-100S are ideally suited for applications requiring visualization at over 100,000fps.

-  **Back Side Illuminated CMOS Image Sensor**
 640 x 480 pixels at 326,000fps (E9-100S)
 640 x 480 pixels at 272,000fps (E9-80S)
- Max Frame Rate 2,720,000fps at 640 x 32 (E9-100S)
 Max Frame Rate 2,457,000fps at 640 x 32 (E9-80S)
-  **Class Leading Light Sensitivity**
 ISO 160,000 Monochrome
 ISO 40,000 Color



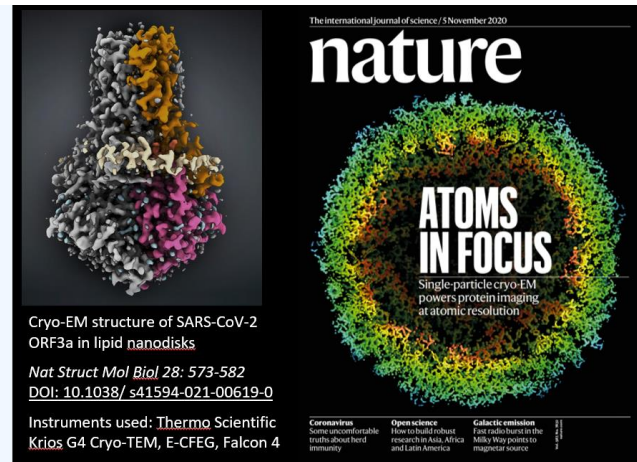
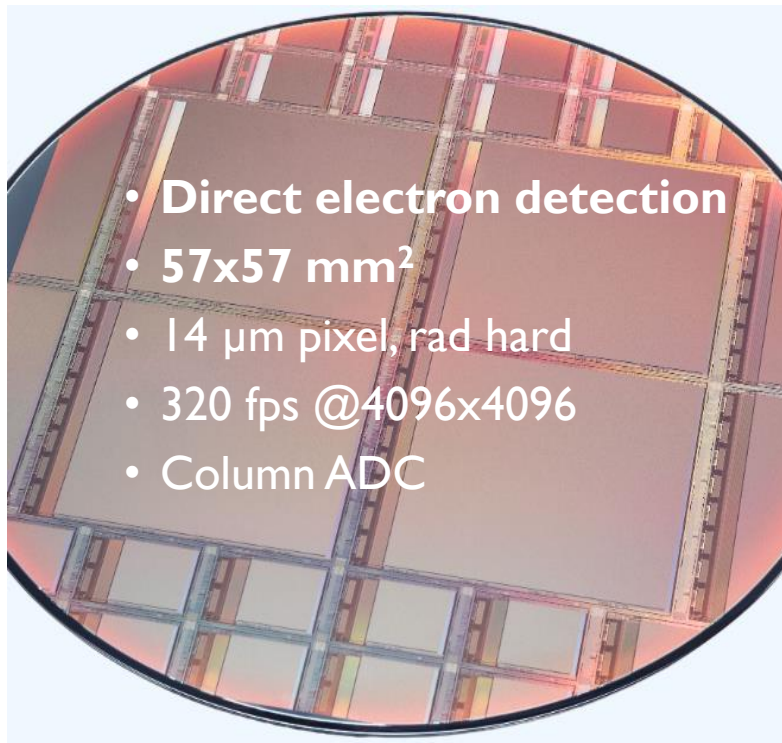
Beyond human vision and beyond silicon vision

SWIR, Multispectral, Ultra-fast and **Electron Imaging**



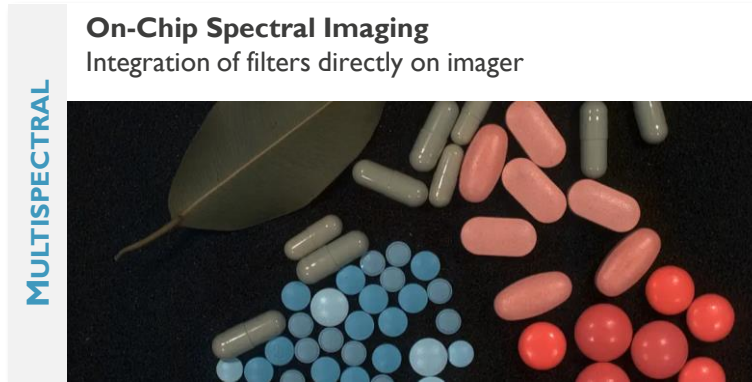
Electron imagers for high-end microscopy

World's most sensitive and most accurate sensor that can “see” atoms



Beyond human vision and beyond silicon vision

SWIR, **Spectral**, Ultra-fast and Electron Imaging



imec integrated approach

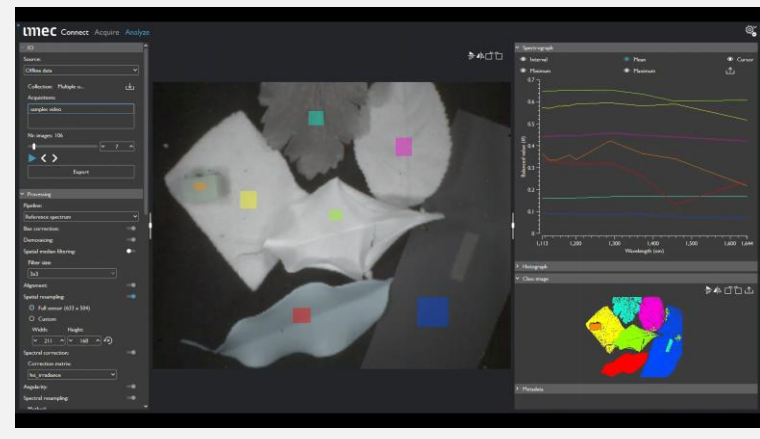
On-chip spectral imaging

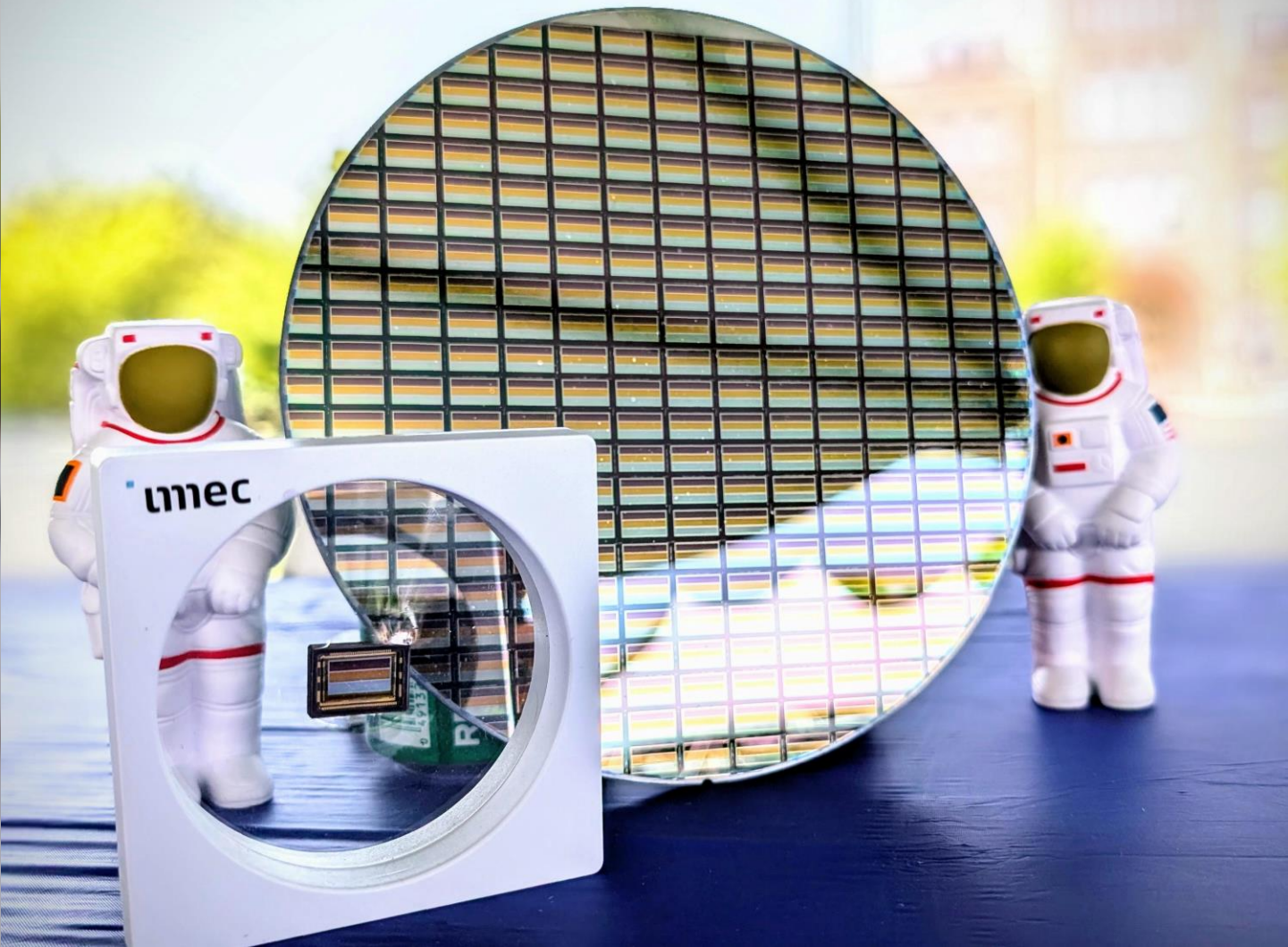
Wafer level patterned spectral filters

- Scalable CMOS process
- Snapshot, video & scanning
- Miniaturized and robust
- Easy to integrate @ application level
- VIS, NIR, SWIR and beyond



spectricity 





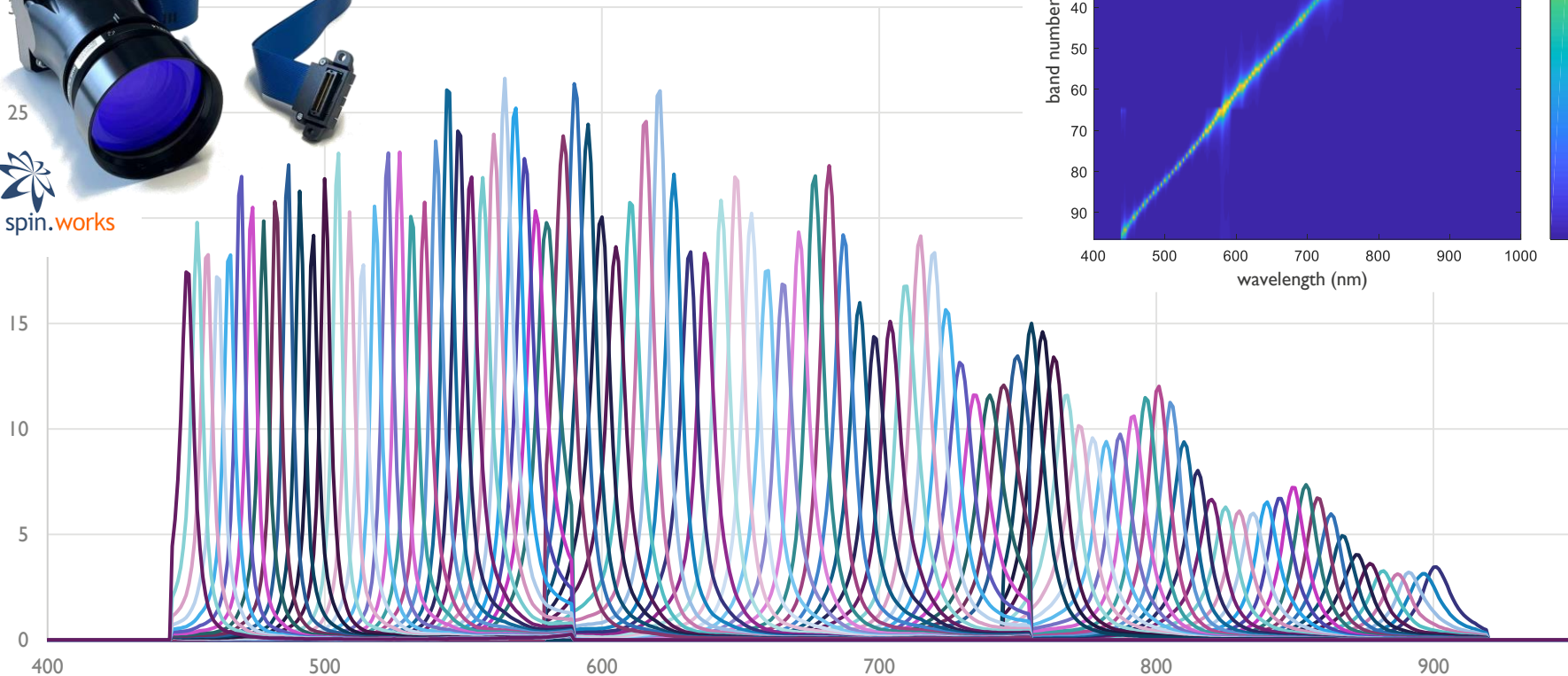
LS96 SPECTRAL RESPONSE



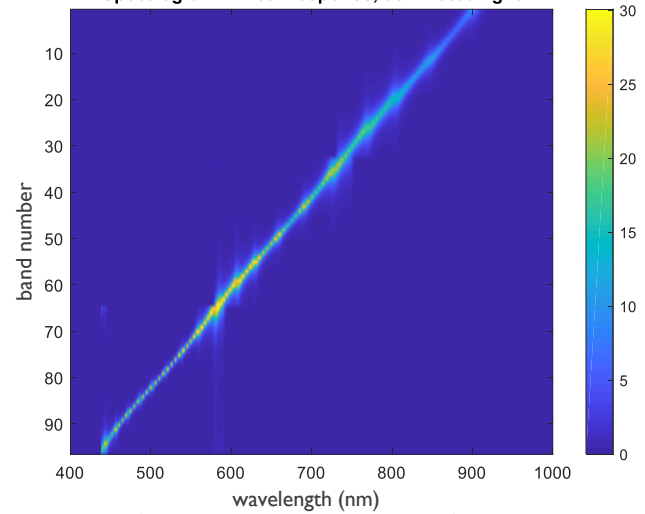
25



spin.works



Spectrogram - linear response, collimated light



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Quantum Dot / Organic Image Sensors

Disruptive imagers for short-wave infrared (SWIR)

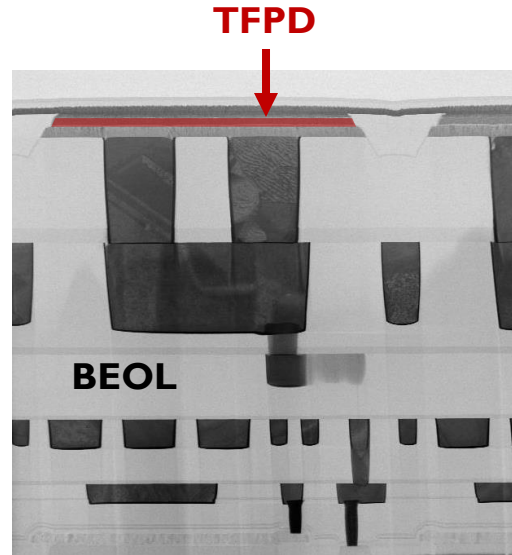
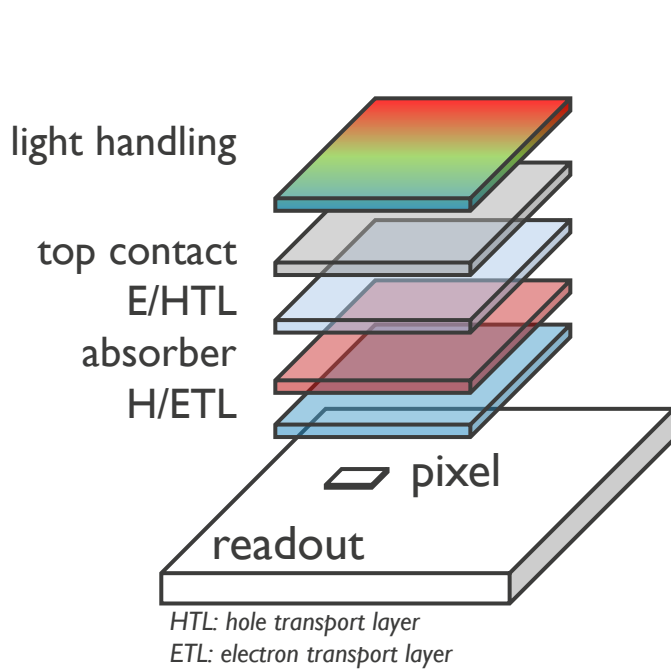
SWIR



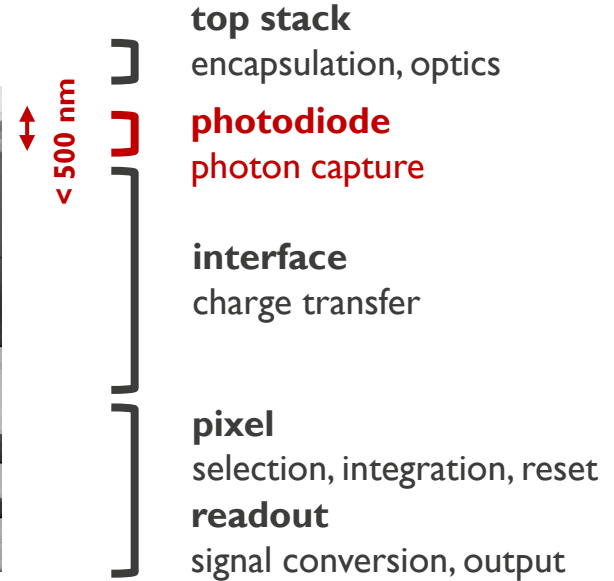
TFPD: Thin-Film Photodetector

Stack with thin-film absorber with thickness $<$ wavelength

New **image sensor platform** to expand CIS capabilities

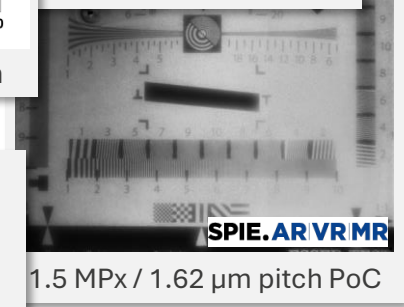
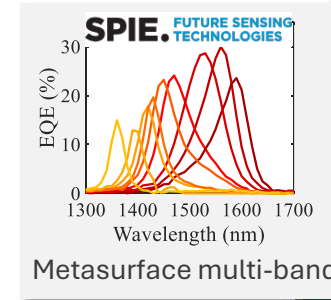
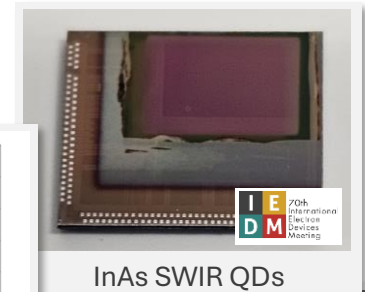
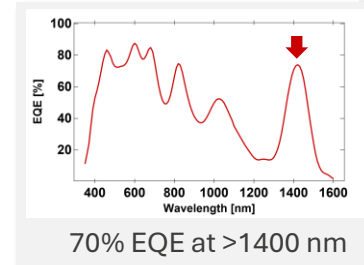
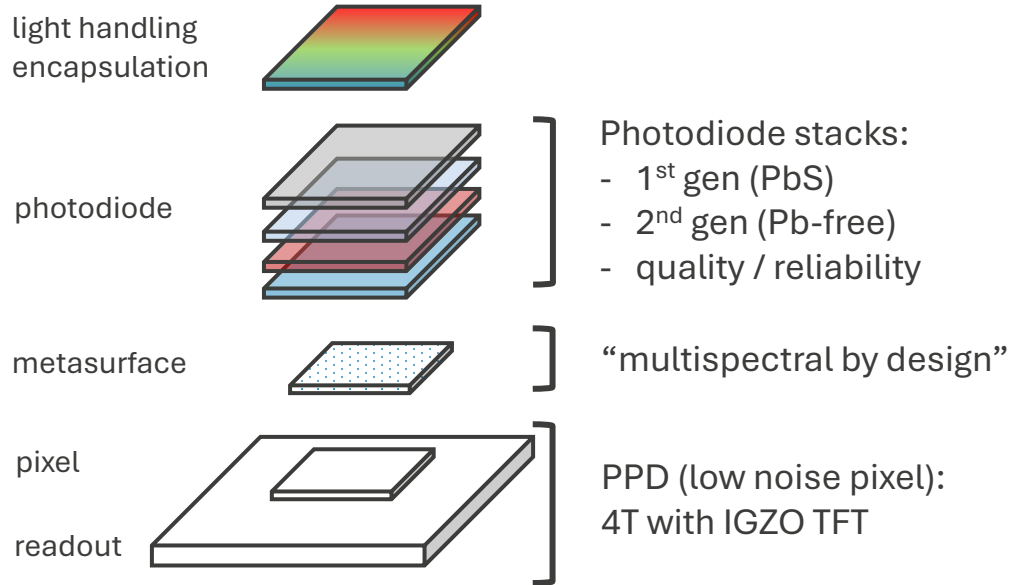


PD on top of ROIC



TFPD platform

Technology modules being developed at imec:



- Imaging activities **from exploration to high-end products**
- Expertise, infrastructure and ecosystem to tackle **specialty imagers**

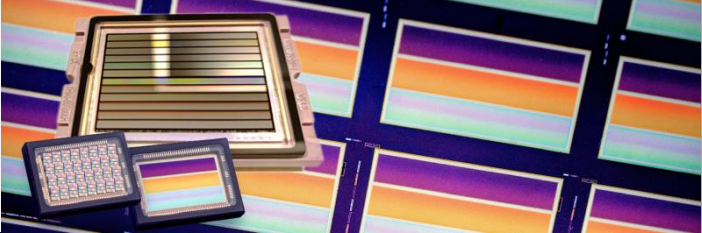
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SWIR



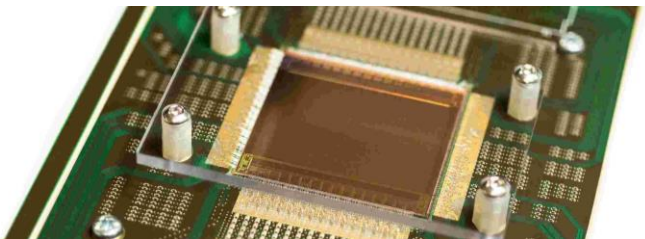
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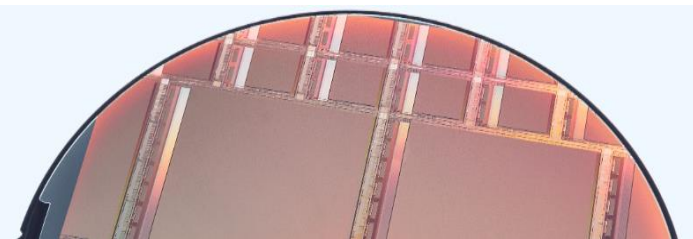
Ultra-fast imagers
Fully custom products for scientific cameras

ULTRA-FAST



Electron imagers
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ELECTRON



booth 8B11



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embracing a better life

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www.imec-int.com/infrared

www.imechyperspectral.com