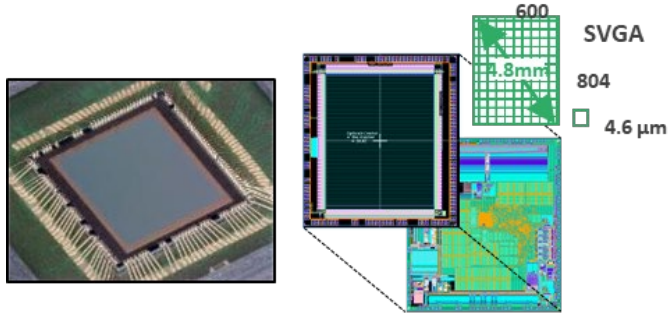
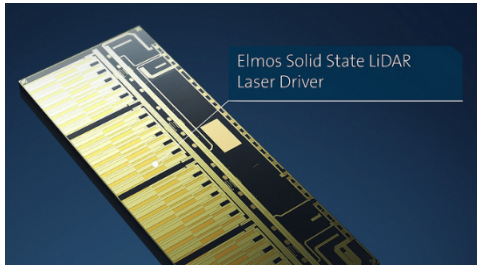
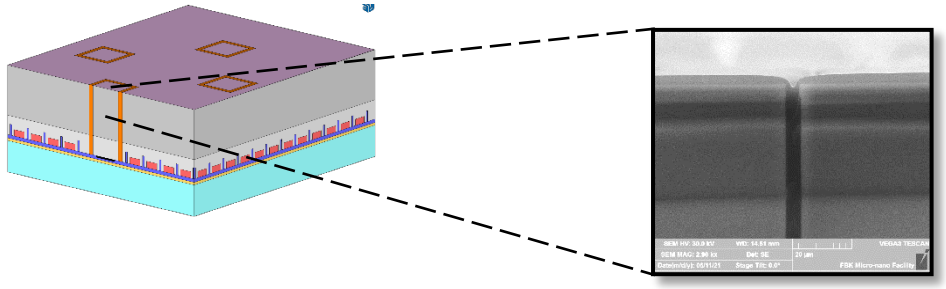
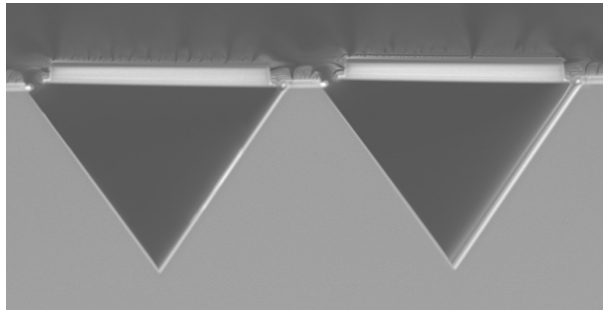
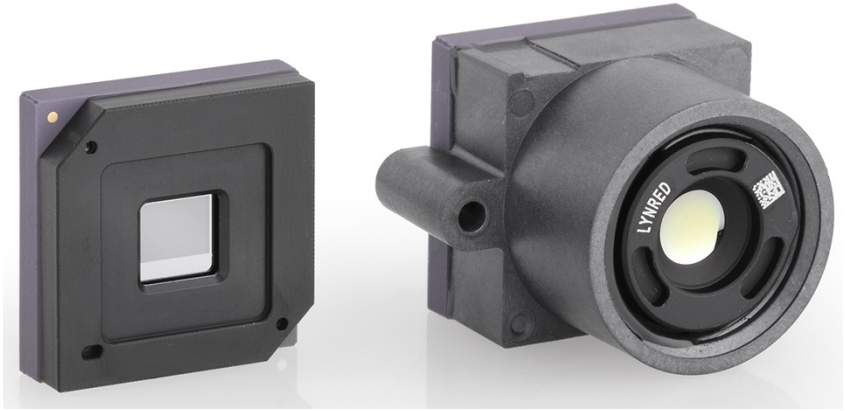
# Technology Field 3: Smart Sensors



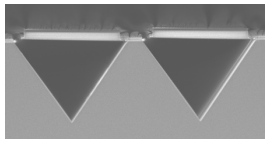





# Technology Field 3: Smart Sensors

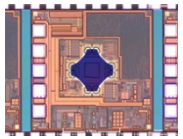
**Highlights of TF3 activities 1/2:**

xfab



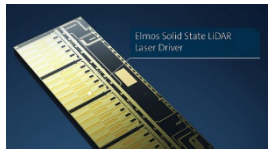
- Through-Silicon-Vias
  - Additional wafer-level process steps for packaging preparation introduced
  - First-time XFAB´s 180 nm CMOS chips plus “functional surface” plus TSV successfully fabricated

xfab



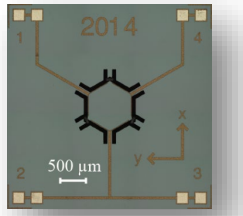
- X_FAB-F: Lower node next generation platform.
  - Activities ongoing to develop a new SOI based technology platform using the most advanced 200mm processes
  - Feasibility phase for key options to be reached by end of 2021

elmos




- Transferring the LiDAR research demonstrators into development started in Q1/2021
- Sensor data fusion of Elmos HALIOS® principal and ToF sensor enabling static and dynamic hand gesture detection

TDK

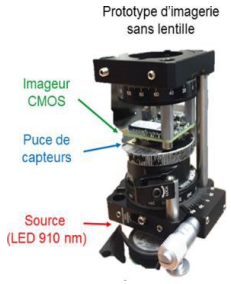



- Installation of new 3D Hall test handler finished, pilot production Nov. 2021

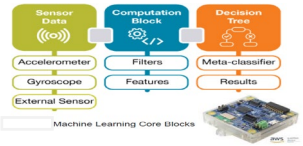
# Technology Field 3: Smart Sensors

**Highlights of TF3 activities 2/2:**

- LYNRED launches the ATI320, its first Advanced Thermal Imager with embedded image signal processing. It is aimed at saving camera makers time and effort in integrating thermal imaging in their products

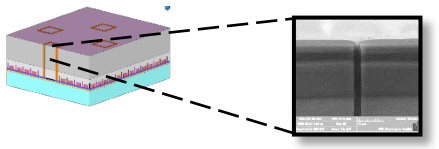



- Evaluation of CIS Imagers and LEDs for Bio-sensor applications




Integrated Machine Learning

- 3D-vision sensors developments with indirect Time-Of-Flight prototypes in sVGA format
- Next generation inertial sensor products including embedded ML processing
-



- IPCEI cleanroom for bonding, grinding and CMP
- Successful electrical characterization of thinned BSI NIR-HD SiPM with a 95% of yield

# Technology Field 3: Smart Sensors

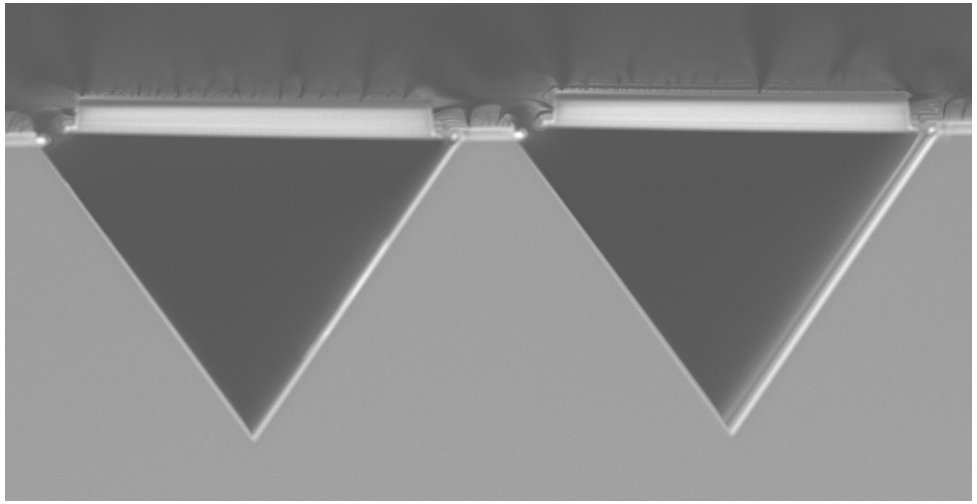
**SUMMARY DEVELOPMENT & COOPERATION**

IPCEI created substantial progress to the European Sensor Industry by

- Exploring new areas of sensing
- Reducing dimensions and energy consumption
- Increasing sensitivity and accuracy
- Triggering collaboration between partners
- Creating infrastructure like clean rooms, testing areas and pilot lines.

# Status TF3

## DEVELOPMENT & COOPERATION

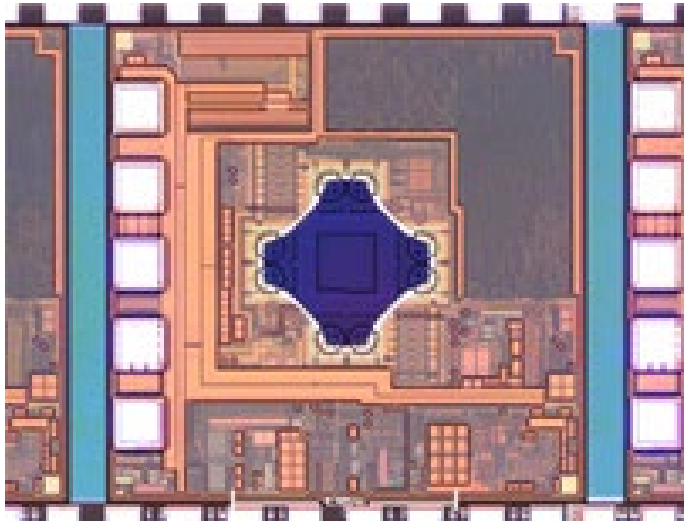


Print-ready 180 nm CMOS chiplets for heterogeneous integration

- **X-FAB Germany – Selected Highlights in Smart Sensing**
  - Functional Surfaces
    - Optimized process flow for noble metal interface metallization on CMOS
  - Through-Silicon-Vias
    - Additional wafer-level process steps for packaging preparation introduced
    - First-time XFAB´s 180 nm CMOS chips plus “functional surface” plus TSV successfully fabricated
  - Micro-Transfer-Printing
    - Proven process of record for “print-ready” 180 nm CMOS chiplets
  - Far Infrared Sensing
    - Introduction of new wafer-level-packaging approach for CMOS wafers

# Status TF3

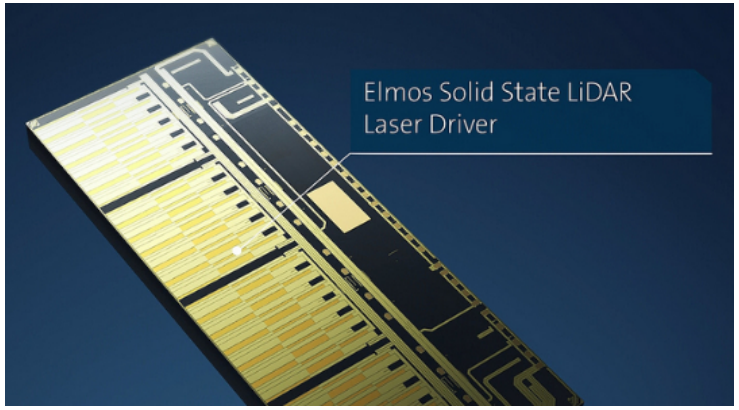
## DEVELOPMENT & COOPERATION

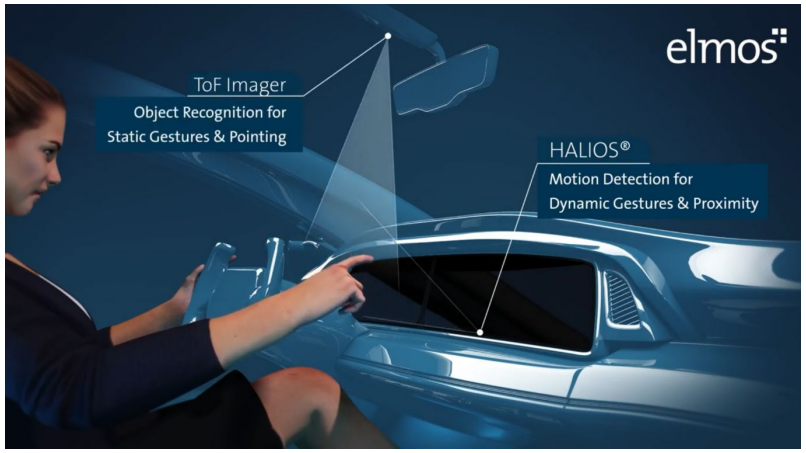


➢**X-FAB France – Selected Highlights in Smart Sensing**

- ➢Development of sensor technologies for automotive
  - ➢180nm high performance **SOI** multi purpose platform under development. This will target SoCs for automotive application with embedded sensors
  - ➢FID targeted in 2022
- ➢Lower node next generation platform.
  - ➢Activities ongoing to develop a new SOI based technology platform using the most advanced 200mm processes
  - ➢While providing denser digital density, this will also enable power reduction
  - ➢Feasibility phase for key options to be reached by end of 2021

# Status TF3



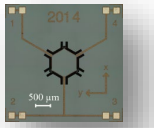




## DEVELOPMENT & COOPERATION

- Transferring the LiDAR research demonstrators into development started in Q1/2021
  - High resolution SPAD array
  - Ultrafast laser driver (1ns pulse width @ 50A peak current)
  - New optical process options
- Sensor data fusion of Elmos HALIOS® principal and ToF sensor enabling static and dynamic hand gesture detection

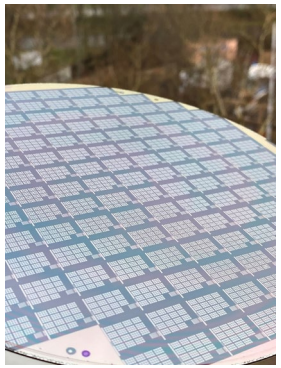
- R&D for intelligent high speed Automotive Ultrasonic Sensor IC and sensor data fusion using AI
- Cooperation with AT&S for new wafer carrier design started in 2021 (after hold due to COVID-19 restrictions)

# Status TF3




First prototype

Eng. Run 1




## DEVELOPMENT & COOPERATION

➢**TDK-Micronas – Selected Highlights in Smart Sensing**

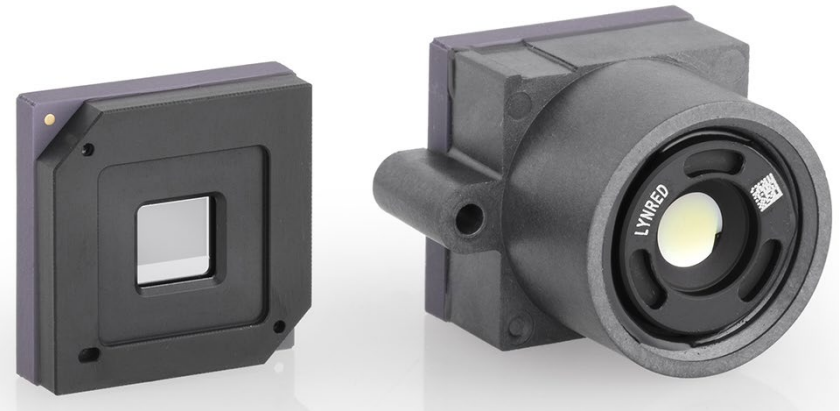
➢Isotropic 3D Hall LAB-to-FAB transition started with European Foundry

➢Installation of new 3D Hall test handler finished, pilot production Nov. 2021

# Status TF3

**DEVELOPMENT & COOPERATION**

➢**LYNRED – Selected Highlights in Smart Sensing**



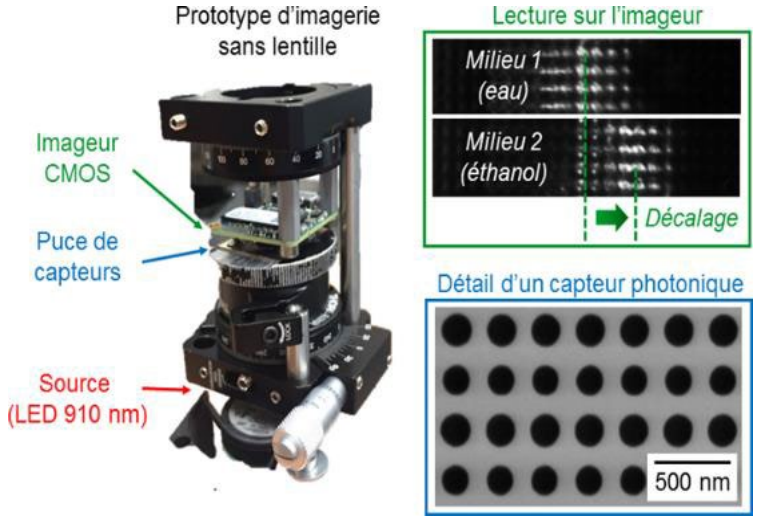

➢TRL2: new wafer level packaging method

➢TRL3: new ROIC architecture for small pitch sensors

➢LYNRED launches the ATI320, its first **Advanced Thermal Imager** with embedded image signal processing. It is aimed at saving camera makers time and effort in integrating thermal imaging in their products.

# Status TF3

## DEVELOPMENT & COOPERATION

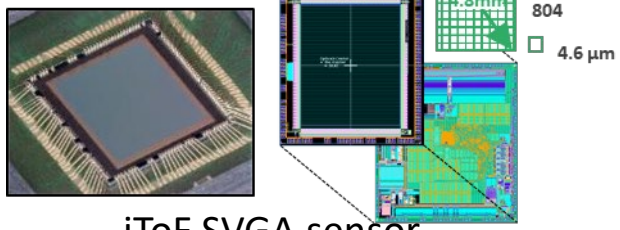



### ➢ CEA-LETI Selected Highlights in Smart Sensing

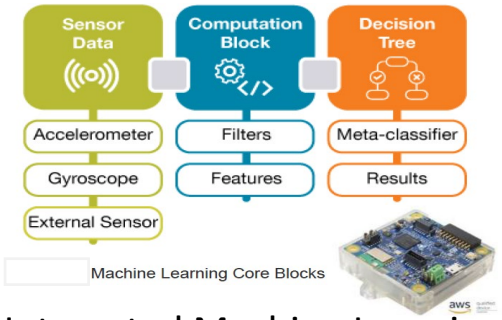
- ➢In collaboration with ST
  - ➢R&D on innovative pixel for imagers (CIS and ToF)
  - ➢Evaluation of CIS Imagers and LEDs for Bio-sensor applications
- ➢In collaboration with LYNRED
  - ➢R&D on technologies for next-generation micro-bolometers (faster and smaller sensor)

# Status TF3: ST

## DEVELOPMENT & COOPERATION




iToF SVGA sensor




Integrated Machine Learning

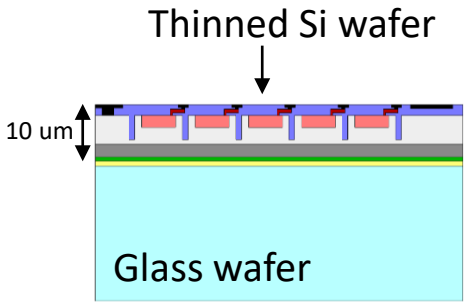
MEMS new materials/functions

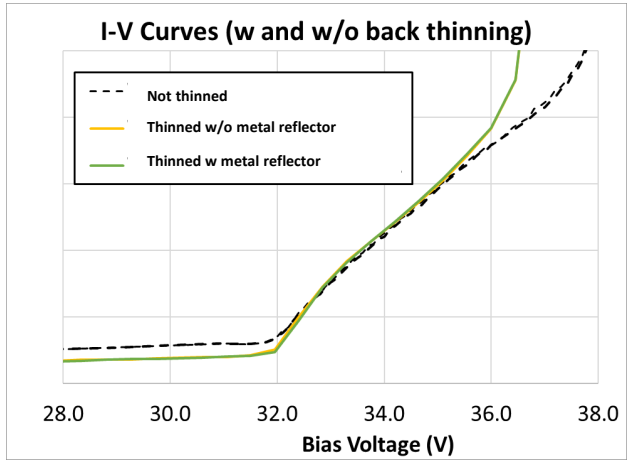
➢ **STMicroelectronics – Selected Highlights in Smart Sensing**

- ➢ Characterization and stabilization of the Quantum organic detection layer
- ➢ Enlargement of 3D-vision sensors developments with indirect Time-Of-Flight prototypes in sVGA format
- ➢ Next generation inertial sensor products for automotive and consumer & industrial application fields, including ML core blocks in the ASIC for power consumption optimization
- ➢ On product validation of the new technology platform for MEMS inertial sensors
- ➢ Piezo material optimization for the new PETRA technology in the fast and slow scan micromirrors

# Status TF3

## BSI NIR-HD SiPM



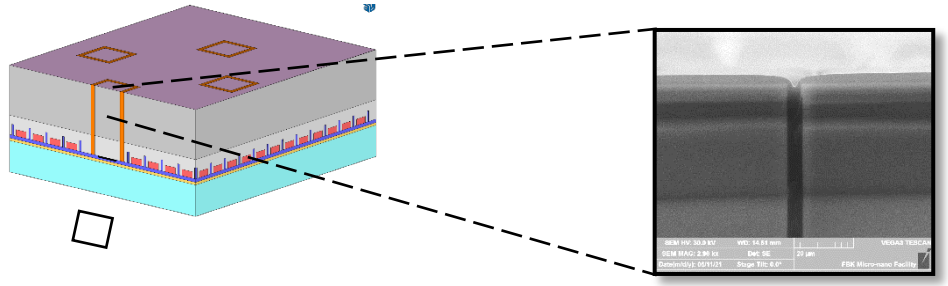


## DEVELOPMENT & COOPERATION

➢ **FBK – Selected Highlights in Smart Sensing**

➢ Successful electrical characterization of thinned BSI NIR-HD SiPM with a 95% of yield

➢ Ongoing short loops for Through Silicon Via (TSV) isolation



➢IPCEI cleanroom – bonding, grinding and CMP

# Technology Field 3: Smart Sensors

**SUMMARY DEVELOPMENT & COOPERATION**

IPCEI created substantial progress to the European Sensor Industry by

- Bringing innovative sensors FID
- Providing services to semiconductor community in Europe
- Increasing sensitivity and accuracy
- Triggering collaboration between partners
- Moving towards FID with clean rooms, testing areas and pilot lines.