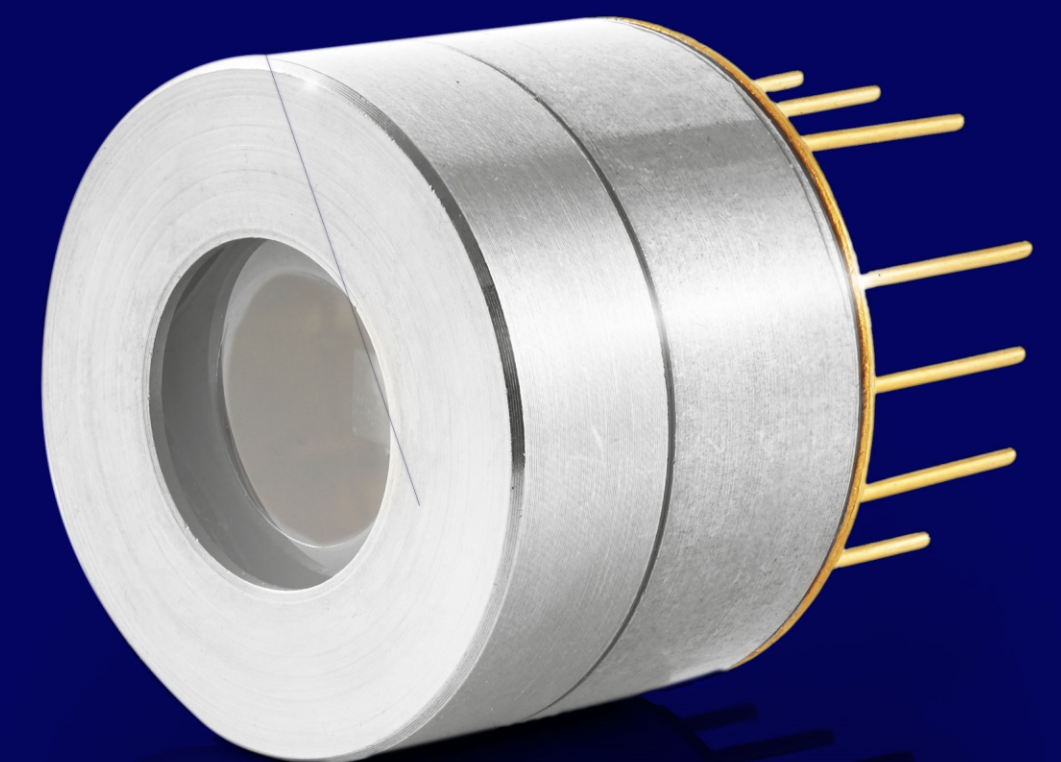
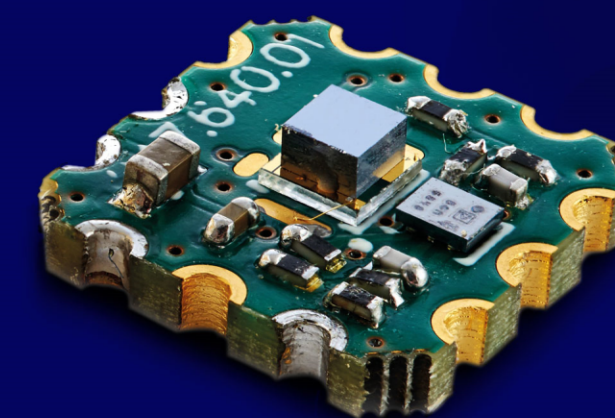
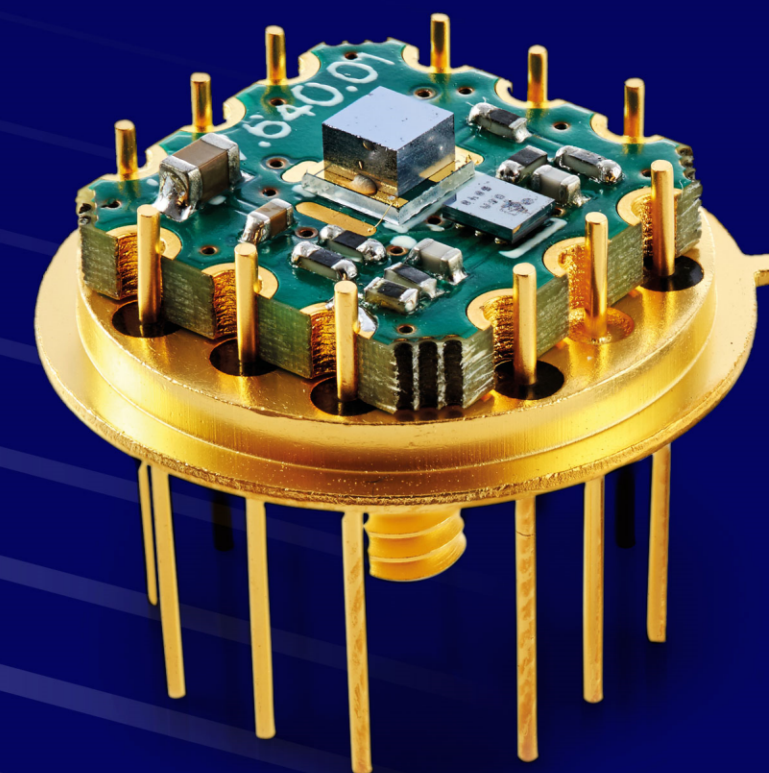


THE LEADER  
IN IR TECHNOLOGY

**VIGO**  
PHOTONICS





# VIGO IN A NUTSHELL

**35** years of experience  
and operations

**Headquarters in Poland**  
and branch office in USA

**220** highly qualified  
and experienced experts  
(1 Professor, 14 PhDs and >60 engineers)

**25** distributors in **18** countries  
supporting sales of solutions

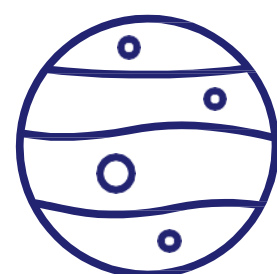
Listed on the WSE since **2014**

Approx. **PLN 500** million  
capitalisation

Support for stable long-term  
**shareholders**

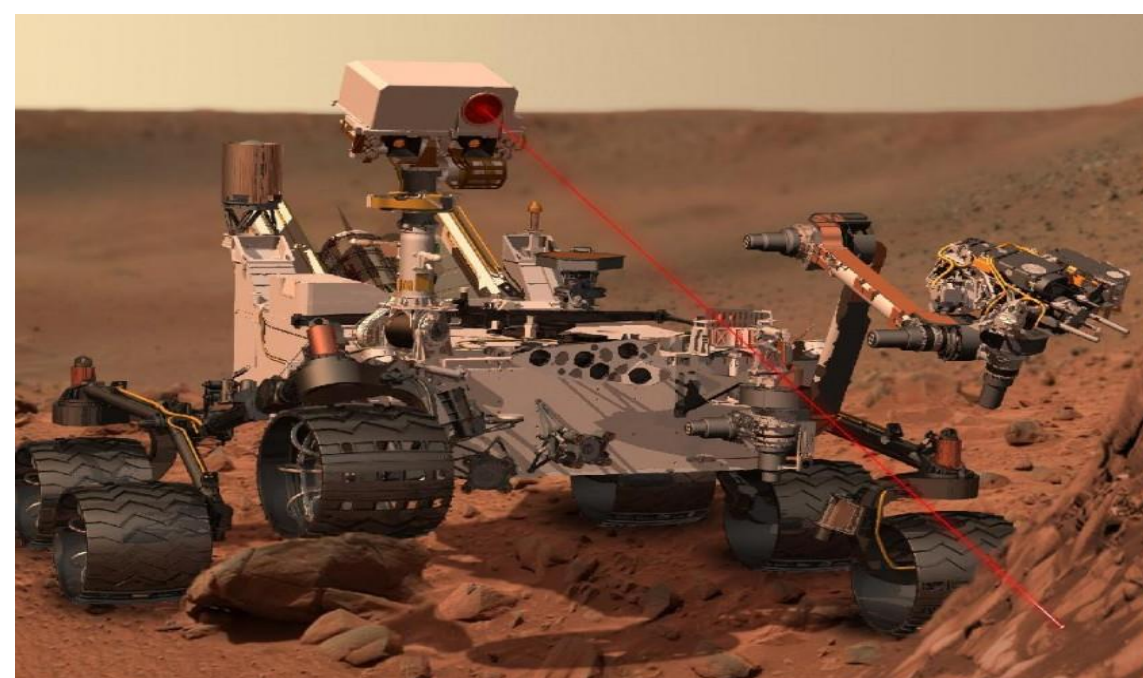


**VIGO is a world leader in high-tech solutions - the most advanced mid-infrared photonic detectors, detection modules and semiconductor materials**



## 6 Detectors successfully used in Mars missions

- NASA 2012 - Curiosity Science Laboratory mission
- ESA 2016 - ExoMars mission



## VIGO Detectors approved in NASA Artemis Mission

- Orion Spacecraft - return humans to the Moon



Ambitious development strategy to maintain a 20-30% annual growth rate



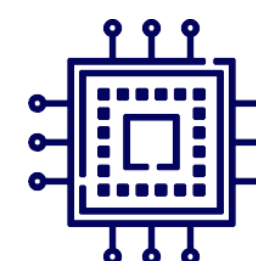
Business relationships with global corporations (Safran, Emerson, Caterpillar, TRUMPF, to name a few)



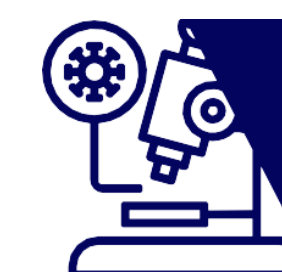
Over 2.5 times growth in revenue and EBITDA over the last 5 years (2017-2021)



6,500 m<sup>2</sup> of production space - complete production line for semiconductors



Unique technology and innovative, high-end solutions, tailored to customer needs



Operating in a fast-growing infrared market supported by demand and economic-technology trends



# GLOBAL RANGE

BUSINESS RELATIONS WITH GLOBAL CORPORATIONS  
VIGO SYSTEM HAS BECOME



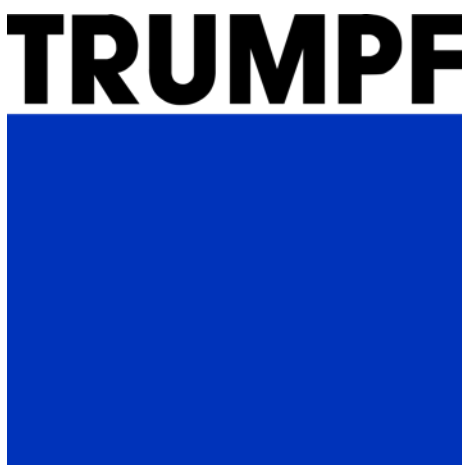
Safran Aerotechnics  
(optoelectronics systems)



Emerson Electric Co.  
(industrial gas analysers)



Caterpillar  
(railway sensor systems)

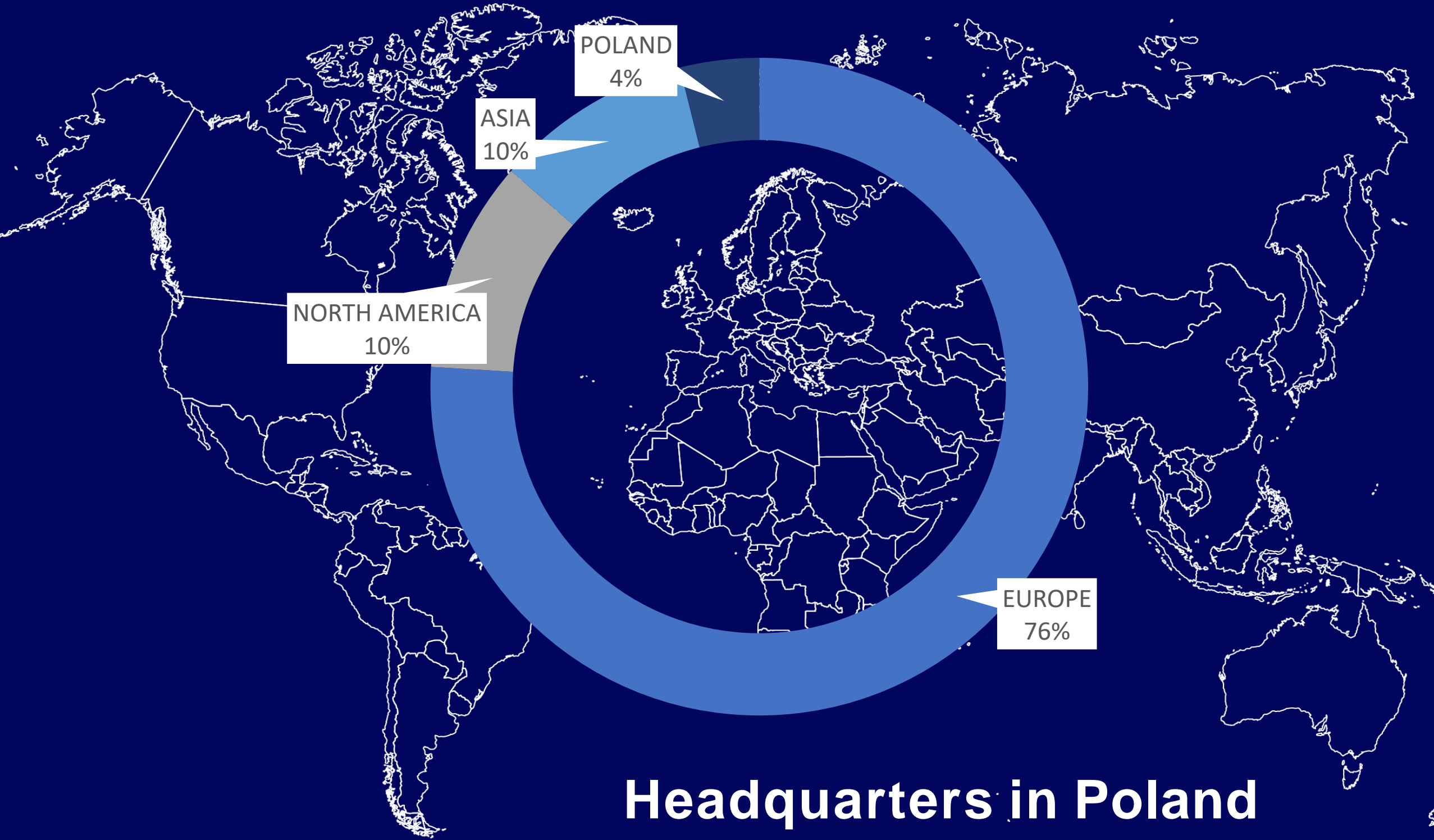


TRUMPF  
(laser industry)

VIGO System has become a supplier of the high-tech components for the most demanding customers.



## MARKET SPLIT 2021



Headquarters in Poland  
and branch offices in USA and Taiwan

25 distributors in 18 countries supporting commercialization of VIGO products and solutions



# TECHNOLOGY AND PRODUCTION OF PHOTONIC INFRARED PRODUCTS



## PHOTONIC PRODUCTS AND INFRARED (IR) MATERIALS

### Semiconductor materials

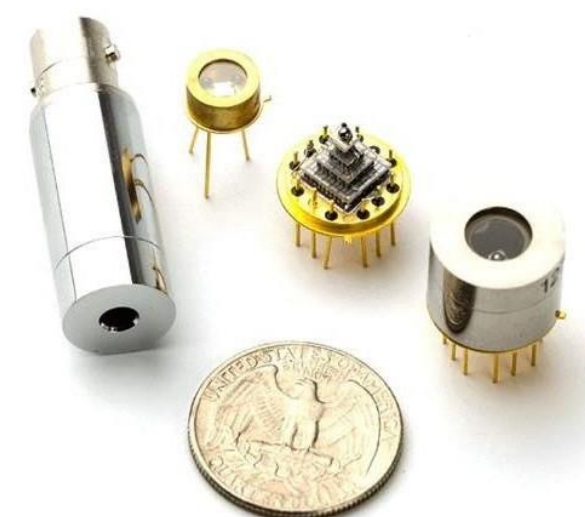


Materials of crystalline structure whose electrical conductivity is between conductors (usually metals) and insulators (most ceramic materials).

Elements for semiconductors: silicon (Si), germanium (Ge), gallium arsenide (GaAs), gallium antimony (GaSb), indium antimony (InSb).

### Infrared detector

An electronic component made up of semiconductors that allows the conversion of infrared radiation energy into electrical energy.



### Infrared module

An integrated system containing an infrared photodetector, signal processing electronics, optics, heat dissipation systems and other components.



## VALUE CHAIN IN THE SEMICONDUCTOR INDUSTRY - VIGO'S COMPLETE LINE FOR SEMICONDUCTORS AND PHOTONIC DEVICES

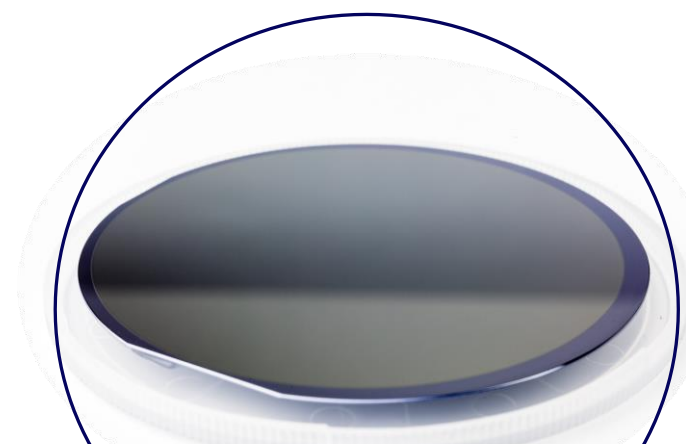
Semiconductor layers as one of the key intermediates in the value chain of VIGO's semiconductor-based products (e.g. wireless communication systems or optoelectronic systems)



1

### Culture of GaAs, InP substrates

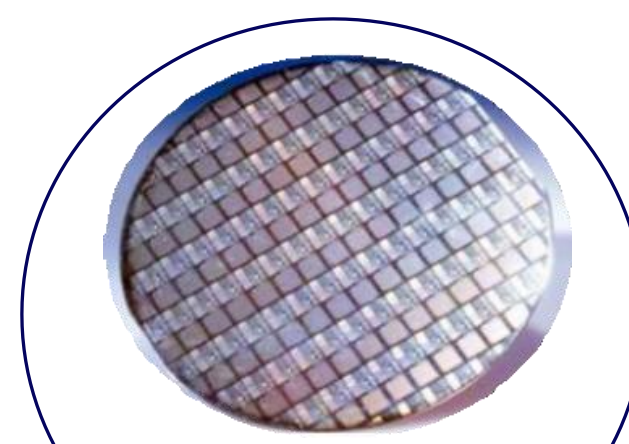
A suitable crystalline structure on which the proper layers are then grown. III-V compound semiconductors are grown on monocrystalline substrates of gallium arsenide (GaAs) or indium phosphide (InP).



2

### Epitaxy

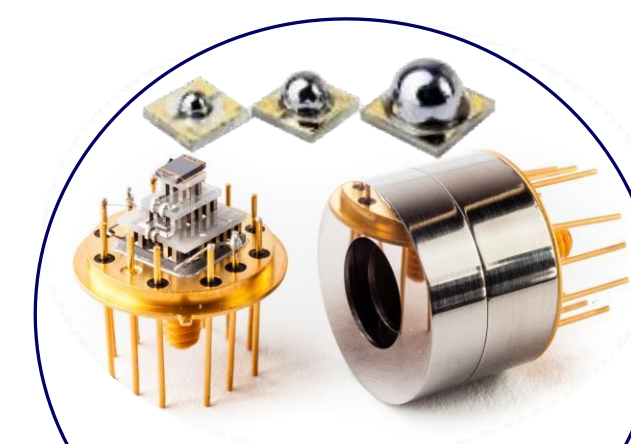
Deposition of the required semiconductor layers with the target parameters. The number of layers can be up to several hundred.



3

### Processing

of epitaxial layers and fabrication of detector and laser chips through a range of physical and chemical processes.



4

### Packaging

Automated assembly of chips on suitable substrates and in housings. Components (detector, laser) capable of processing an optical/electrical signal are created at the end of this stage.



5

### Integration with electronics

Complete detection modules - Electronics integrated in the infrared detector. Production by specialised companies assembling electronic or optoelectronic modules..



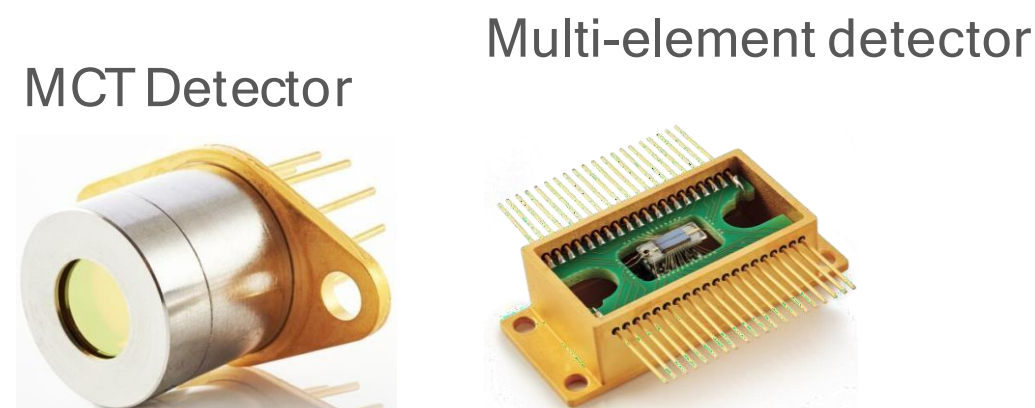
# VIGO PRODUCTS TAILORED TO THE NEEDS OF INTERNATIONAL CLIENTS



## SIGNIFICANT DIVERSIFICATION OF VIGO'S OFFER THANKS TO INVESTMENTS IN INFRASTRUCTURE BETWEEN 2014 AND 2020 (MBE LAB, EFFICIENT MOCVD IN THE III-V EPITAXY DEPARTMENT)

- Manufacture of MCT, InAs, InAsSb and InGaAs detectors, dedicated electronics, detection modules, accessories and semiconductor materials.
- Devices with high sensitivity over a wide spectral range from 1 to 16  $\mu\text{m}$  and high speed in frequency bands up to 1 GHz.
- 90% Customised\* sales - approx. 10% are sales of standard products.

### MCT



Detectors and detection modules with the semiconductor layer made of MCT/HgCdTe (mercury cadmium telluride) materials

- A range of photoconductive (PC) and photovoltaic (PV) detectors used in many market sectors
- Radiation spectrum: MWIR
- Reactor: MOCVD (MCT)

### III-V InAsSb



Detectors and detector modules with the semiconductor layer made of InAs (indium arsenide) or InAsSb (indium arsenide antimonide) materials.

- A range of photoconductive (PC) and photovoltaic (PV) MWIR and LWIR type II super lattice (T2SL) detectors, operating at room temperature or thermoelectrically cooled
- Radiation spectrum: MWIR and LWIR
- Reactor: MBE (InAs, InAsSb)

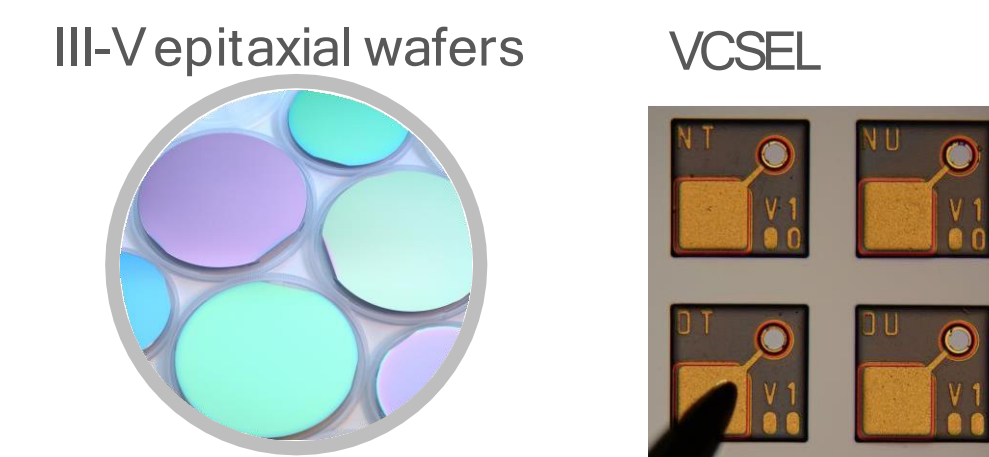
### III-V InGaAs



Detectors and detector modules with the semiconductor layer made of InGaAs (indium gallium arsenide) materials.

- A variety of detectors for the SWIR range designed for mass applications
- Radiation range: SWIR (new MOCVD)
- Reactor: MOCVD (III-V)

### III-V\* EPITAXY



High-quality epitaxial structures of III-V semiconductor materials (InGaAs, InAsSb) offered directly to clients for in-house production of detectors/chips and VCSEL lasers as well as production of SWIR (VCSEL), including VCSEL VIGO lasers.

- A wide range of top quality products: laser layers, detectors, quantum dots, Bragg reflectors. Poland's first VCSEL laser chips.
- Radiation range: MWIR, SWIR
- Reactor: MOCVD (III-V)

**NIR/ SWIR / MWIR / LWIR**



# FOCAL PLANE ARRAY PROGRAM

## TECHNOLOGY DEVELOPMENT

Objective of the initiative

- Becoming a major supplier of detectors for the Polish army/armament industry, winning customers outside Poland (industry, space).
- Development of the technology for manufacturing cooled arrays

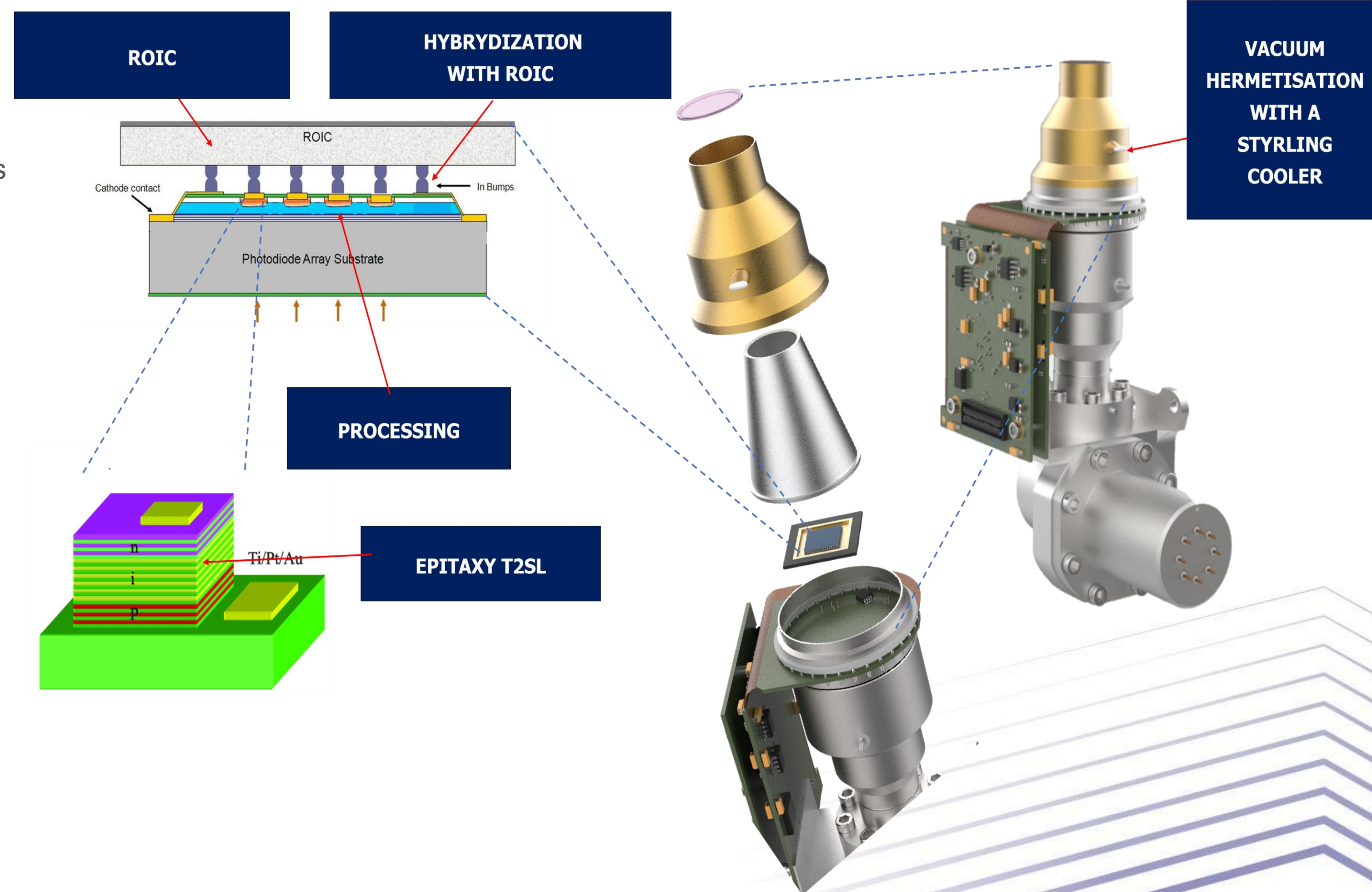
## NEW BUSINESS LINE

Thermal imaging sensors for the MWIR and LWIR range

- Cryogenically cooled
- Based on T2SL technology and III-V materials
- A wide range of resolutions from 320x256 to 1280x1024
- Long working time and stable response
- Resistance to external conditions.

Short-infrared (SWIR)

- Based on InGaAs technology
- Temperature stabilized (thermoelectrically)





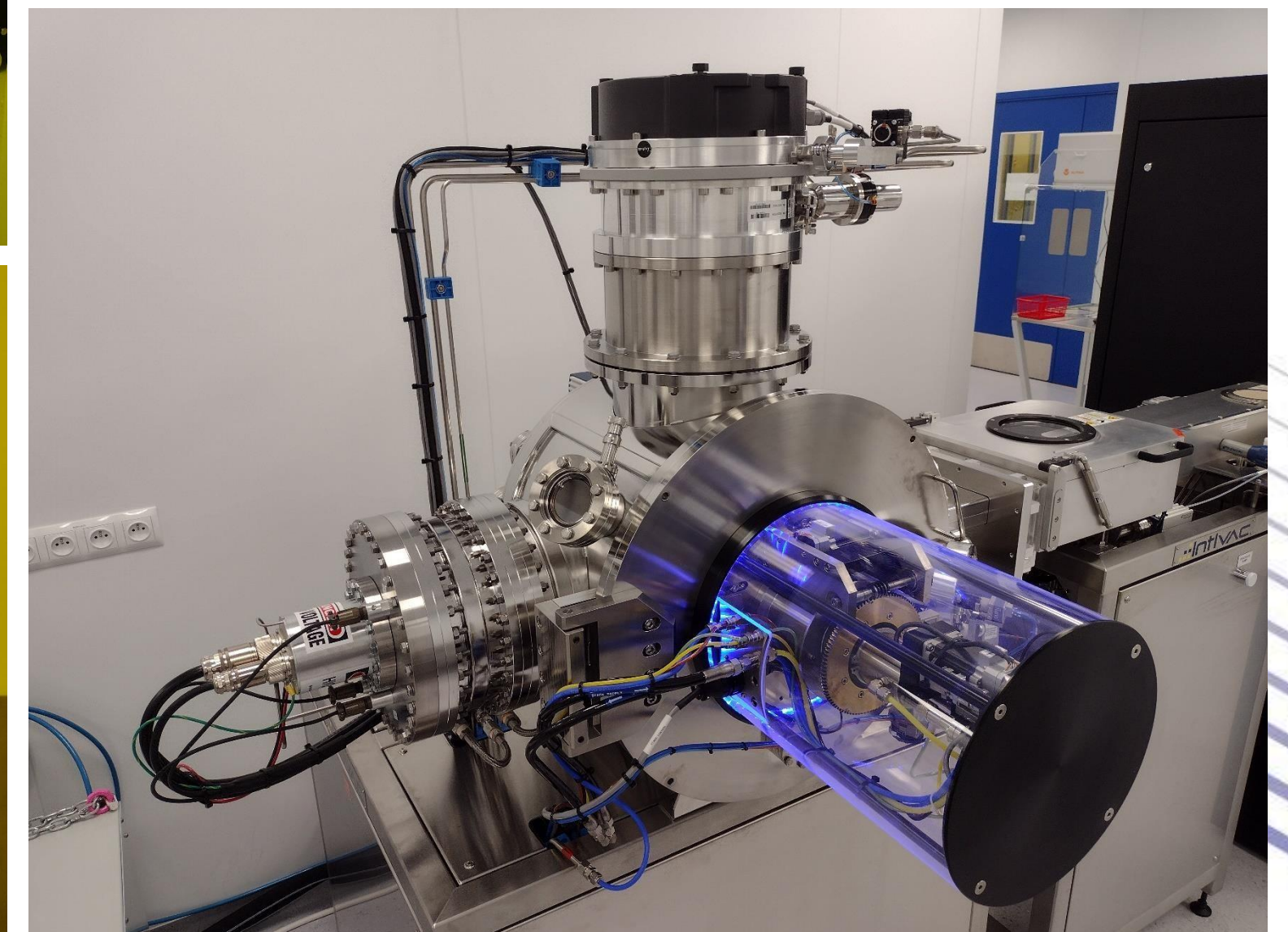
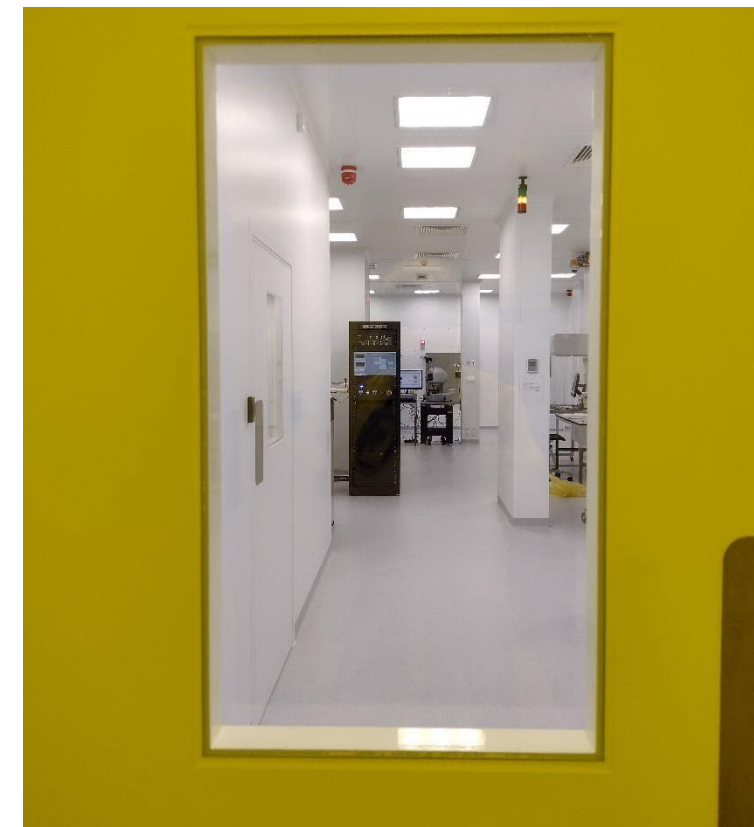
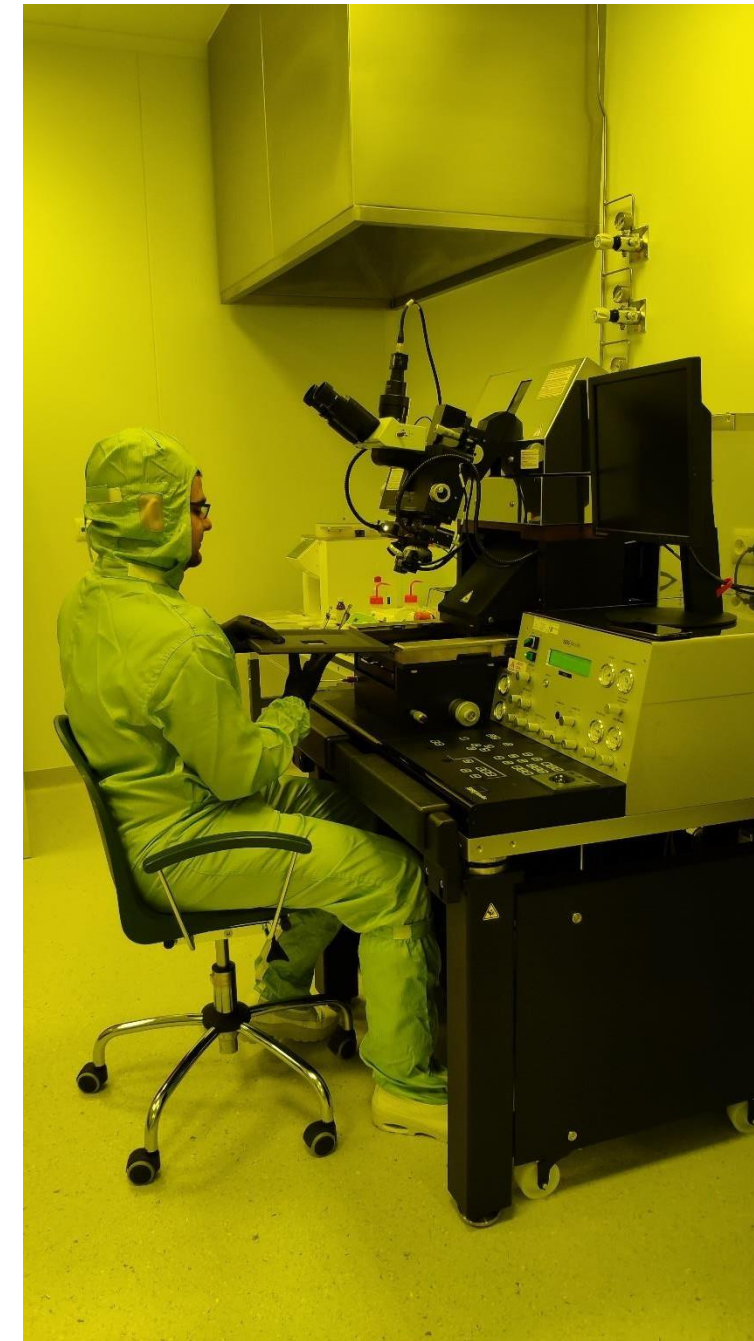
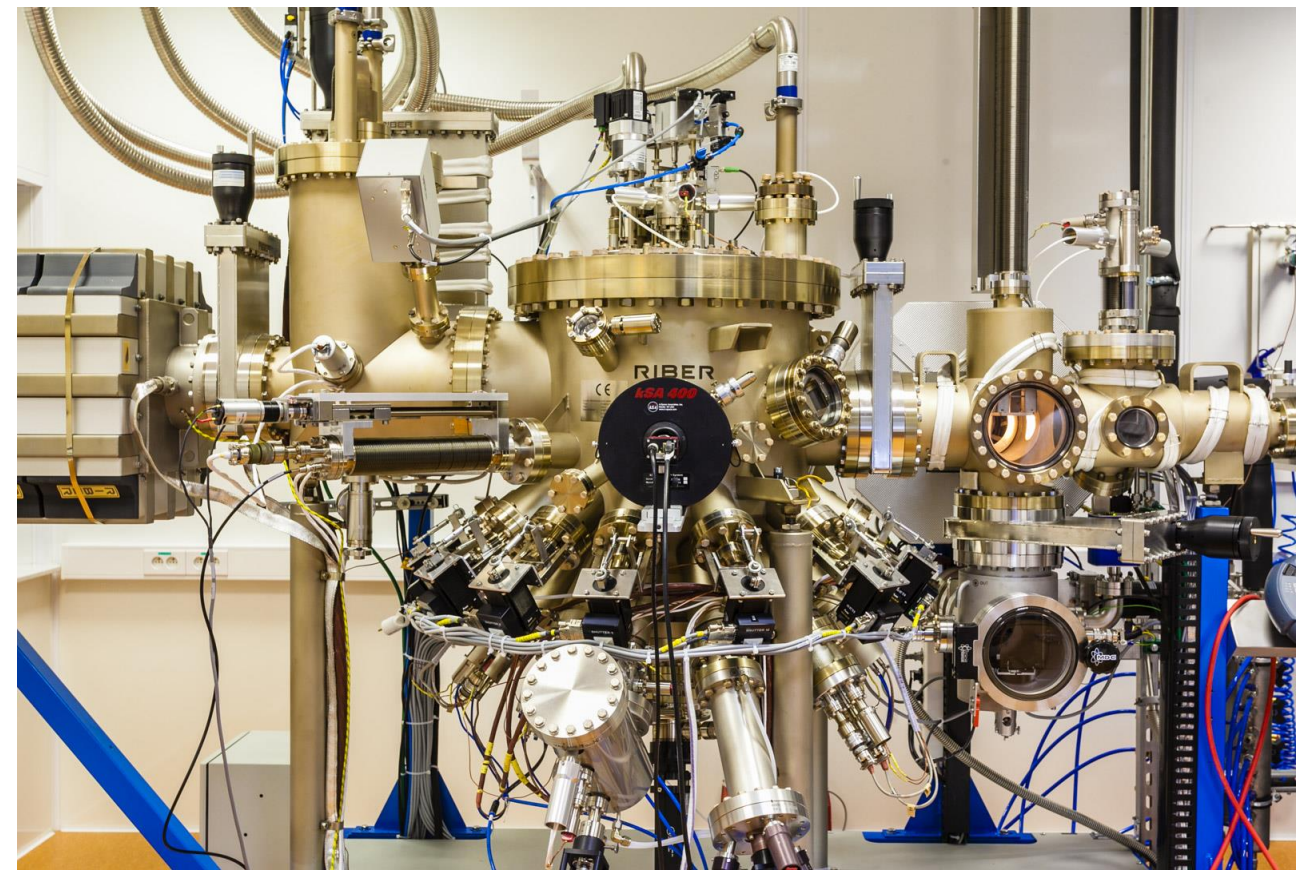
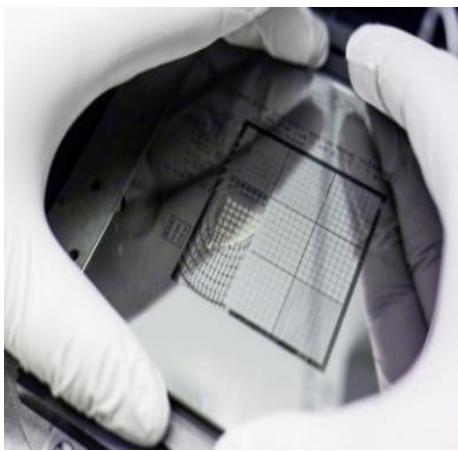
# TECHNOLOGY AREA

**250 sqm OF CLEANROOMS AND 6500 sqm OF TECHNOLOGY DEVELOPMENT SPACE IN TOTAL**

## **FURTHER INVESTMENT OBJECTIVES**

1. Increase in production repeatability
2. Detector chip manufacturing technology
3. Reduction of production costs
4. Meeting the highest quality requirements (military, space, semiconductor industries)

**VIGO**  
PHOTONICS







LET'S CREATE  
THE FUTURE TOGETHER!

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