



# INTRODUCING EXAIL

# Stronger together

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**1500**

EMPLOYEES

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**250+**

MILLIONS EUROS  
OF TURNOVER

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**20+**

% OF TURNOVER  
INVESTED IN R&D

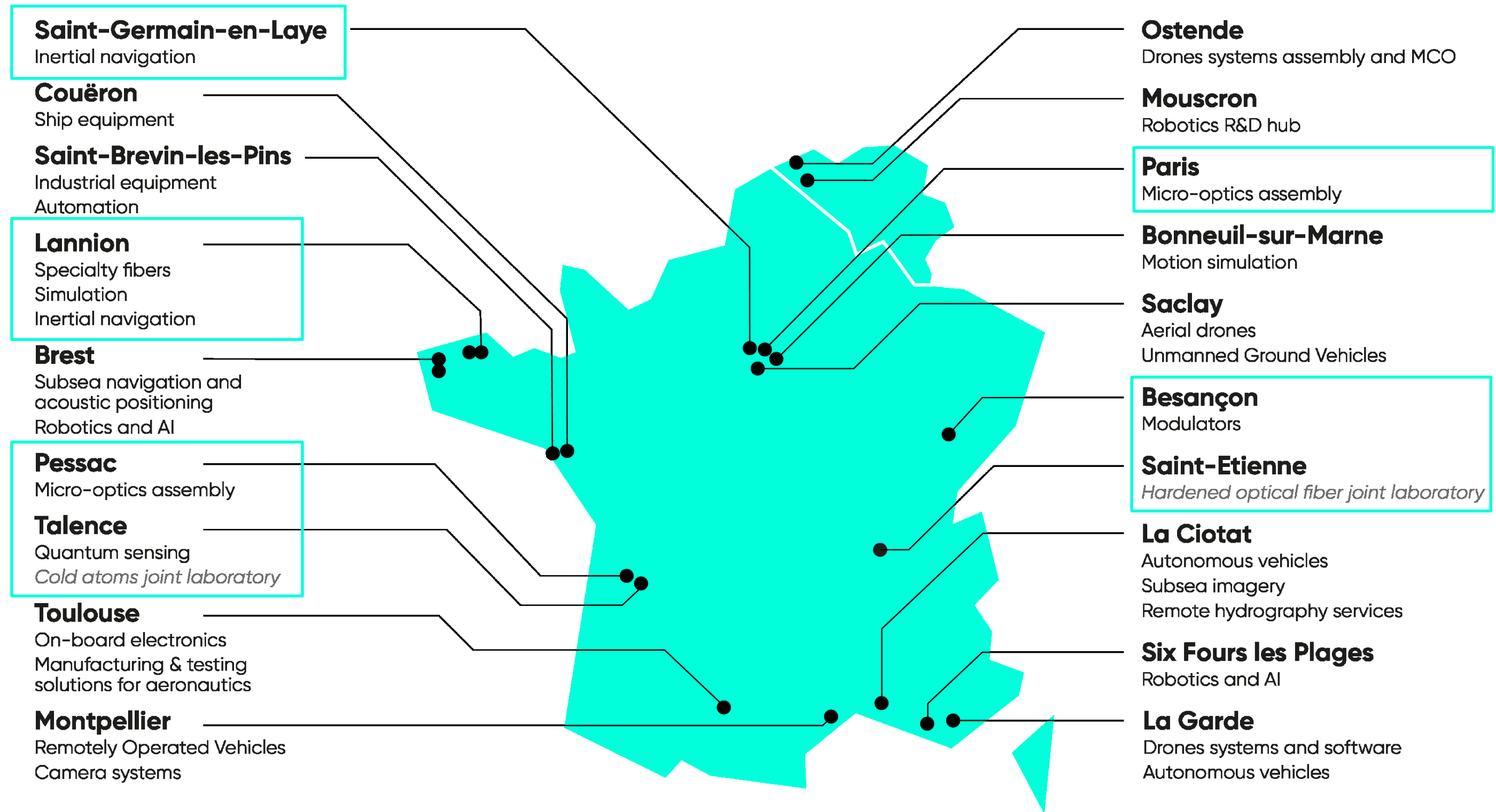
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**80%**

OF TURNOVER  
IN EXPORT

## Cutting-edge technologies







# OVERVIEW PHOTONIC ACTIVITIES

From components to integrated systems

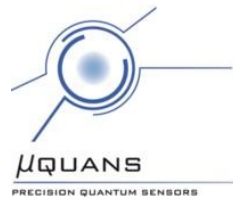
# The Exail Photonics activities



**Specialty Fibers - Lannion**  
 Fibers and FBG  
 60 employees  
 2 500 sqm



**Quantum Sensors - Talence**  
 Instruments and Lasers  
 35 employees  
 560 sqm



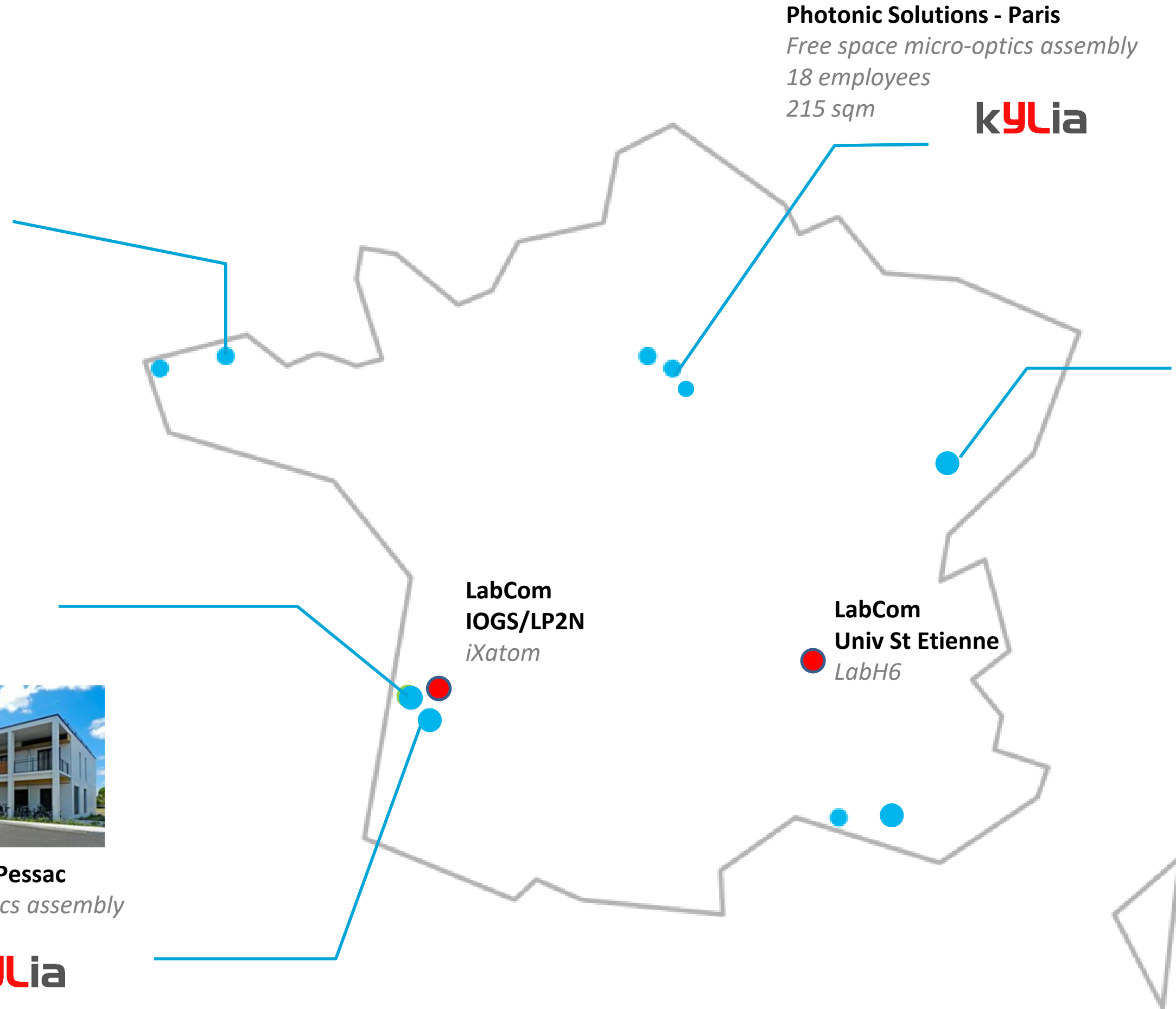
**Photonic Solutions - Pessac**  
 Free space micro-optics assembly  
 15 employees  
 200 sqm



**Photonic Solutions - Paris**  
 Free space micro-optics assembly  
 18 employees  
 215 sqm



**Modulation Solutions - Besançon**  
 75 employees  
 1000 sqm clean space  
 300 sqm clean room



**LabCom**  
 IOGS/LP2N  
 iXatom

**LabCom**  
 Univ St Etienne  
 LabH6

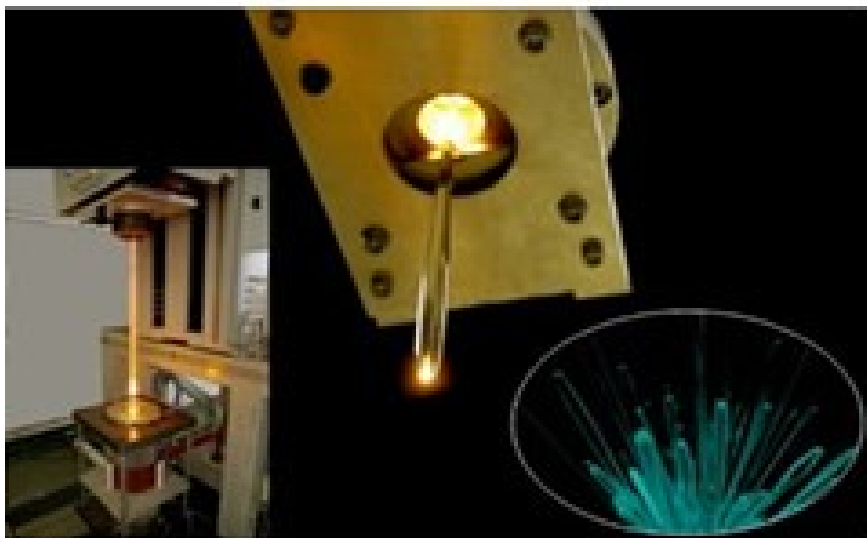
- > **Four key technologies**
  - Optical Modulation solutions
  - Specialty optical fibers
  - Free space integrated systems
  - Quantum sensors & lasers

- > **Revenue & Staff**
  - 40 M€ for the 4 divisions of the photonic perimeter
  - >190 for the 4 divisions of the photonic perimeter

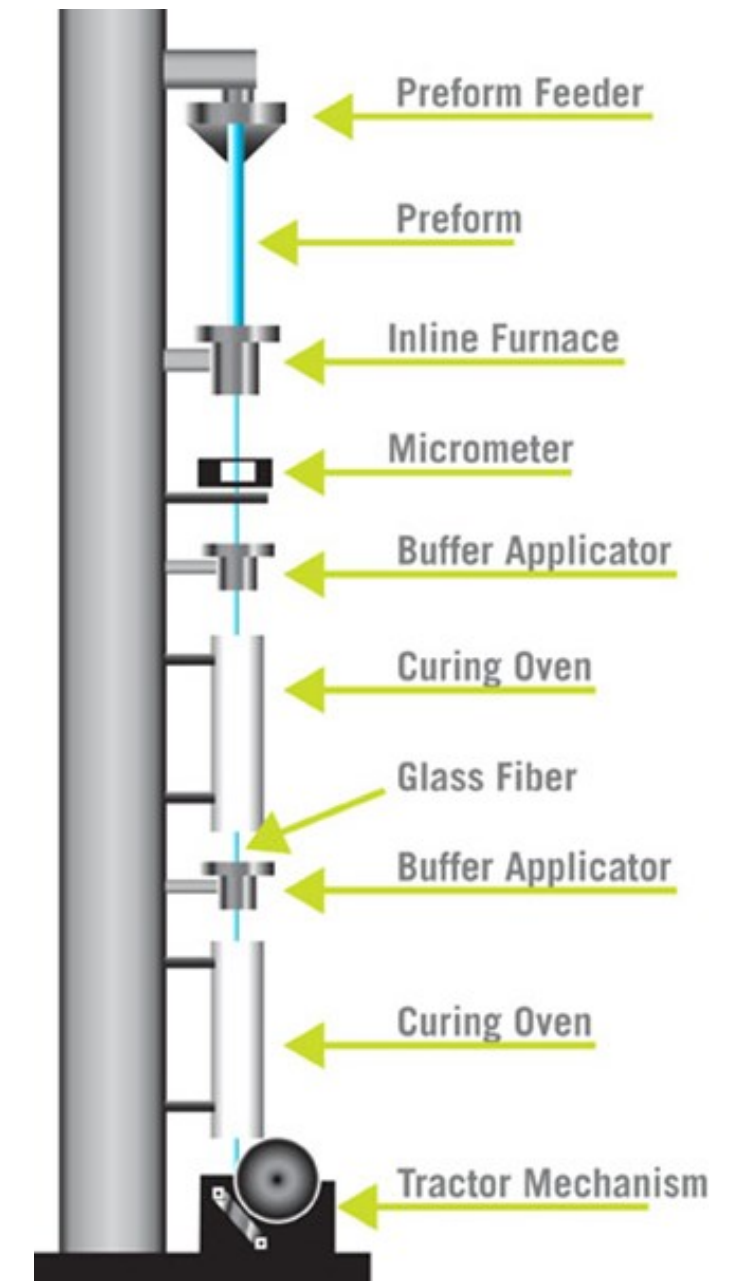


# Exail Specialty fibers solutions

➤ From fibers to amplifier



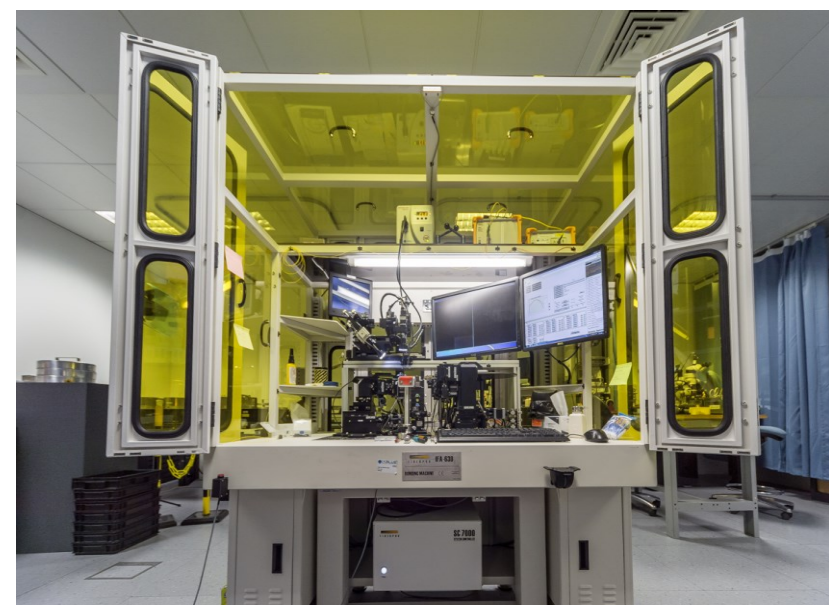
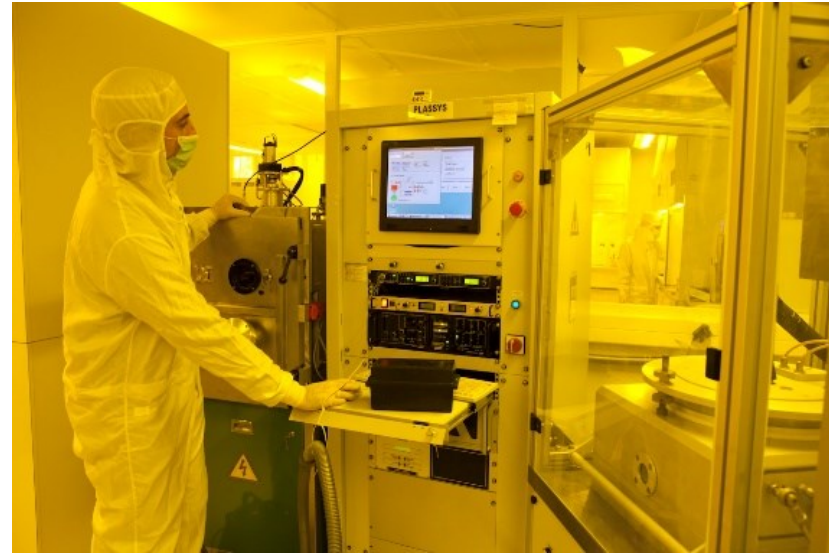
- Core Competencies
  - Specialty Fiber based on silica
  - Fiber Bragg Technologies
- MCVD, SPCVD, drawing towers
- FBG lasers prod. line
- High Scientific skills
  - 2 on-going PhD thesis per year
  - 10-20 scientific papers published every year





# Exail Modulation Solutions

➤ From low to high-speed LiNbO<sub>3</sub> modulation



LiNbO<sub>3</sub> Modulator technology: in-house design and manufacture

- Front-End : photolithography, dicing, polishing, Titanium in-diffusion & Proton Exchange manufacturing processes, characterization
- Back-End : microbonding, chip pick & place, hermetic sealing, assembly and pigtailed, long-term characterization

RF Components and Modulation solution assemblies

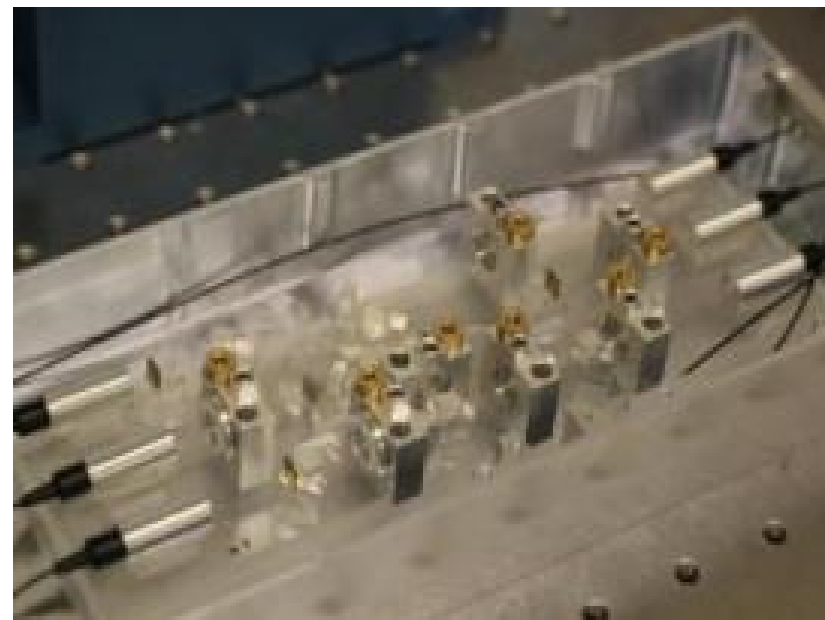
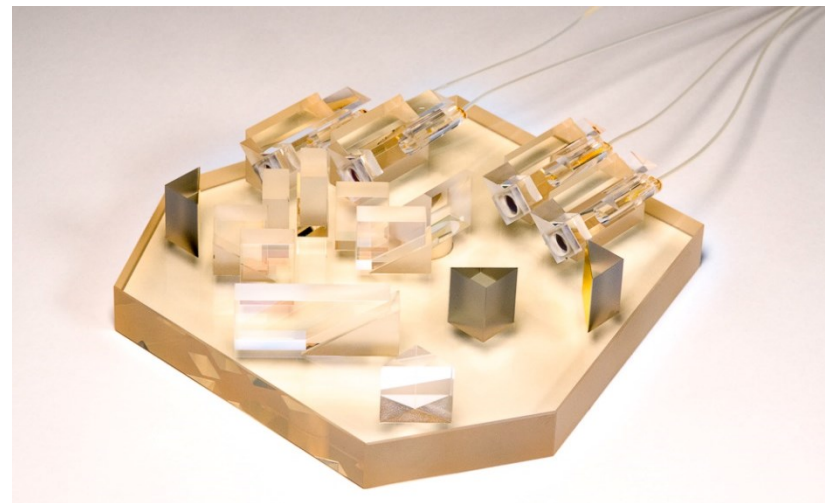
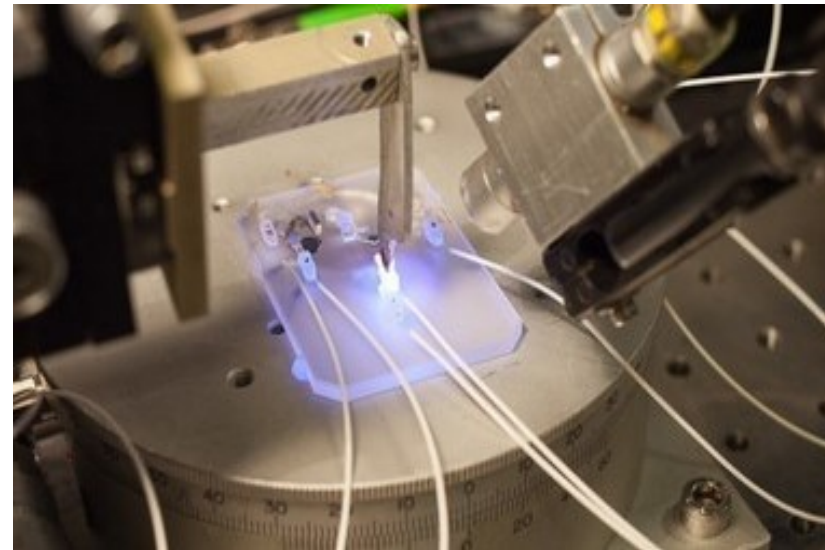
- MMIC GaAs based Microwave Amplifiers - Proprietary design, fabless chips
- High speed electronic assembly: turn-key modulation solution



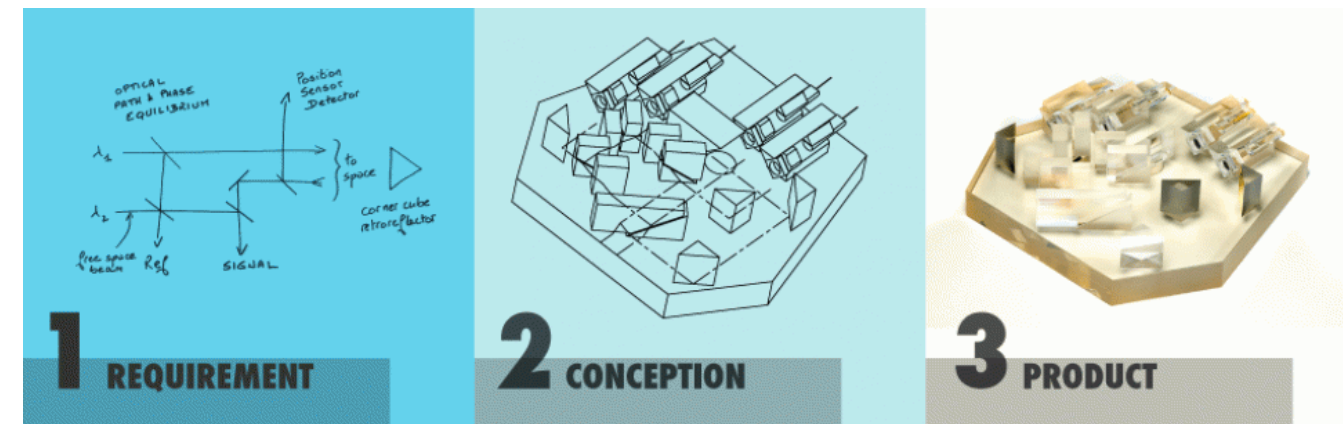


# Exail Photonics solutions

## ➤ OEM fiber pigtailed free space optical assemblies



- Monolithic assembly of optical elements fixed thanks to UV epoxy
  - Design and manufacturing
  - Wide scope of optical components and functionalities
- Free Space Optical Assembly can be compared to **optical LEGO!**



- Ultra precise optical alignment
  - Manual adjustment assisted by 6 axis alignment tools and Piezo-electrics allowing high accuracy positioning
  - Active alignment





# Exail Quantum Sensors

➤ Providing basic tools to top of the line rugged quantum instruments



iXblue Quantum Sensors has acquired a deep expertise in the design, integration and characterization of high performance metrological instruments based on laser-cooled atoms.

- quantum physics: laser cooling and trapping, matter-wave interferometry, time and frequency metrology, inertial measurements
- Optics and lasers: integration of fibered lasers, optical amplification, non-linear frequency conversion, frequency stabilization, phase-locking of lasers, optical detection, collimator design
- Mechanical engineering and ultra-high vacuum
- Electronics: ultra-low noise laser drivers and photo-detection, frequency stabilization, PLL, temperature stabilization, low noise power supplies & power electronics
- Microwave: ultra-low phase noise microwave oscillators, implementation of DDS
- Real-time software: automatic sequence control, real-time compensation of vibration, ultrafast digital feedback loops.



# Photonics and Quantum solutions, from components to instruments

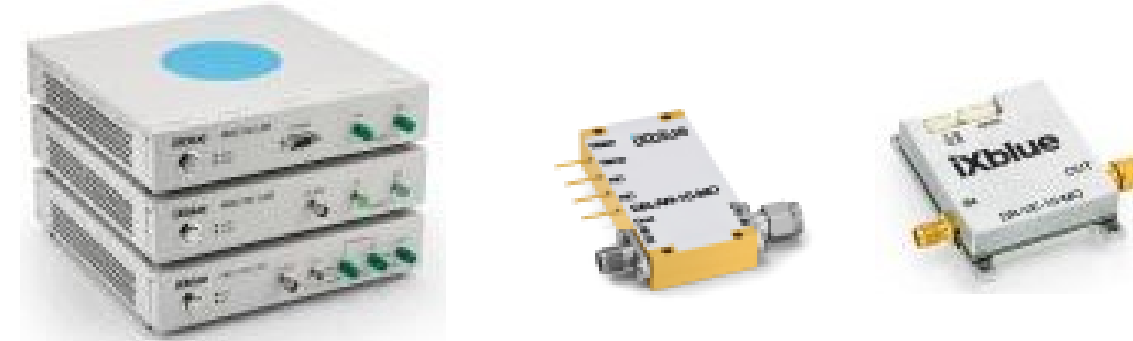
➤ Scalable technologies to address a full range of applications

## Components

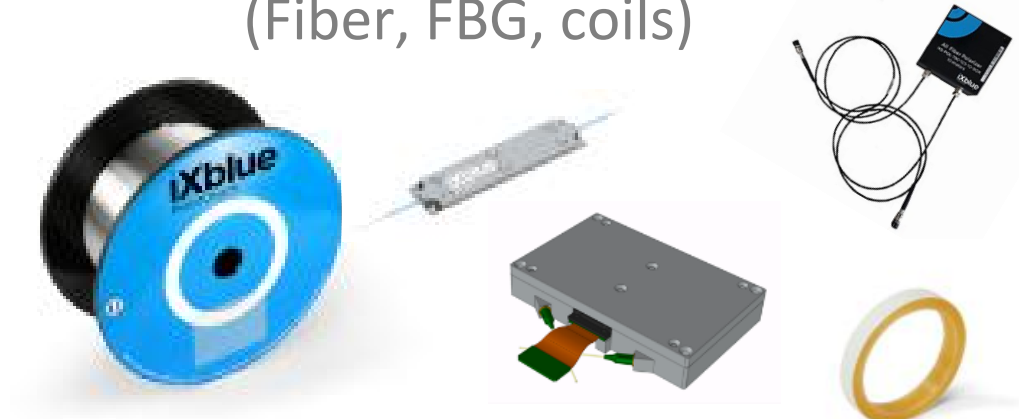
LiNbO<sub>3</sub> Phase, Amplitude, IQ Modulators (COTS, Space model)



Modulators Matching components (RF Amplifier, Low Noise Electronic)



Fibers and fiber solutions (Fiber, FBG, coils)



## Turn-key devices and systems

μoptics and passive optics integration



Transmitters, transceivers, laser pilot, coherent regeneration station



Lasers (Narrow-linewidth, high-power) Optical Low Noise & Power amplifiers



## Instruments

Absolute Quantum Gravimeter



Cold atom frequency metrology





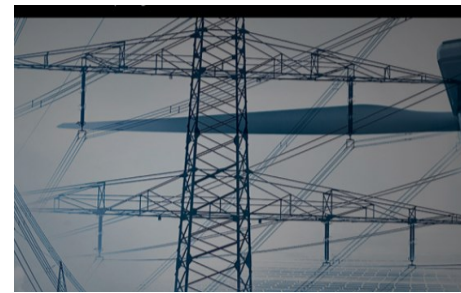
# MARKET FOCUS



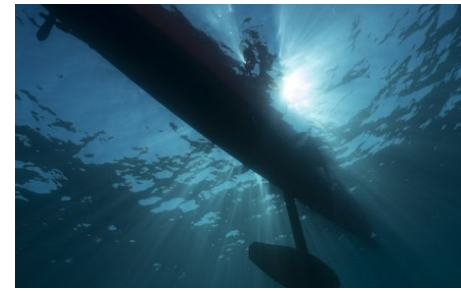
# Exail Photonics: Markets & applications

## Sensors

FOCS



FOGS



Distri P & T°



Telemetry & Range finding



Auto Lidar



Wind Lidar

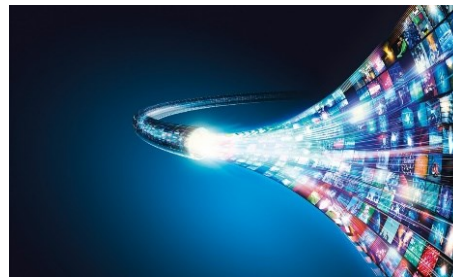


## Communication

Long-Haul



Broadcasting CATV



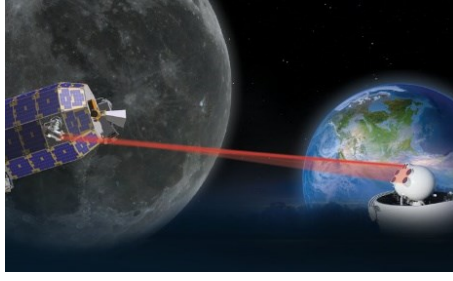
Data-Com



RFoF



Laser com

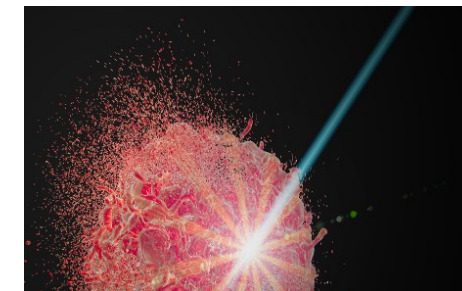


Space Com



## Lasers

Medical Laser



Scientific laser



Cutting Welding



High En Laser



Directed En Laser



- Sensing Market
- Space Market
- High power laser market
- Quantum Market

## Quantum

Gravimeter



T & F connect



QKD



Computing simulator

