



Innovation & Technology



Francisco Gontad, PhD

[EPIC Online Technology Meeting on Emerging Trends in Laser Micromachining](#)

## AIMEN - Asociación de Investigación Metalúrgica del Noroeste

- One of the main Spanish R&D centres in:

**Advanced Materials, Joining Technologies and Laser Manufacturing.**



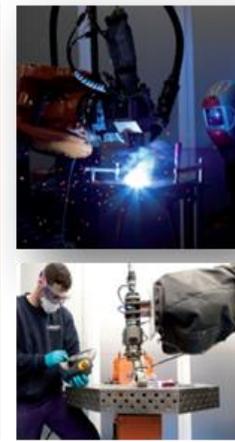
- Private Centre supported by industry
- 112 Associated Companies
- 2 buildings located in Porriño
- 5 national business offices
- More than 800 industrial clients.
- More than 60 R&D Projects by year



## R&D



## Industrial Services



## Testing and analysis



## Training





NAVY



AUTOMOTIVE



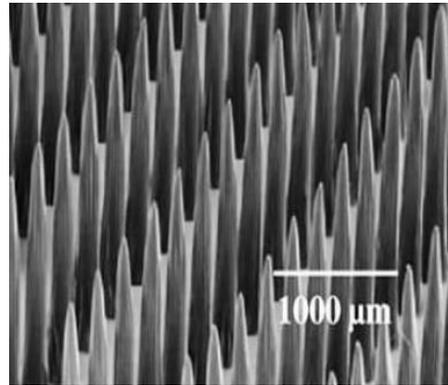
METAL-MECANICAL



ENERGY



TIC



BIOMEDICINE



TEXTILE



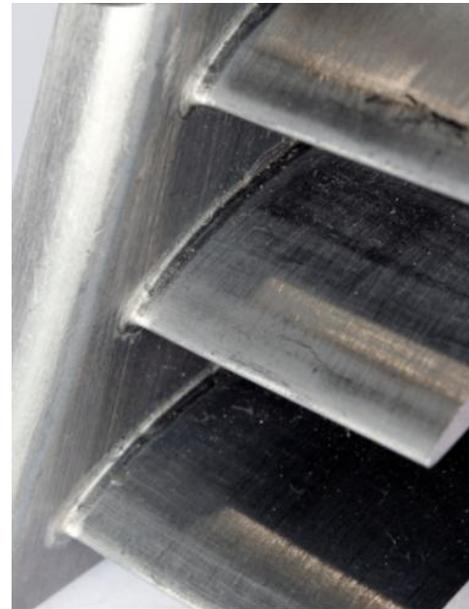
AEROSPACE

## R&D

- Applied research
- Wide web of Industrial partners an R&D
- R&D Funding Programs Management

### Areas of Expertise

- **Advanced Materials**
- **Robotics and Control**
- **Advanced Manufacturing Processes**
- **Environment**



## ADVANCED MANUFACTURING PROCESSES

- **Laser macro processing:**
  - Welding & Cutting
  - Cladding & heat treatment
- **Laser micro processing:**
  - Surface texturing
  - 3D manufacturing
- **Joining Technologies:**
  - FSW
  - Brazing
  - Hybrid Processes
- **Other Processes:**
  - FSP
  - Heat assisted forming
  - Robotized machining

## Zero defects micromachining large 3D pieces with high throughput and precision

### What do we need?

- **High positioning precision at large speeds**
- **Fast and reliable beam guiding systems**
- **Online monitoring**
- **Optimizing beam shaping**

## High positioning precision at large speeds:

- Use of positioning systems beyond XYZ tables
- Use of robots (larger freedom but lower resolution)
- Ultrafast positioning-control loops

## Fast and reliable beam guiding systems:

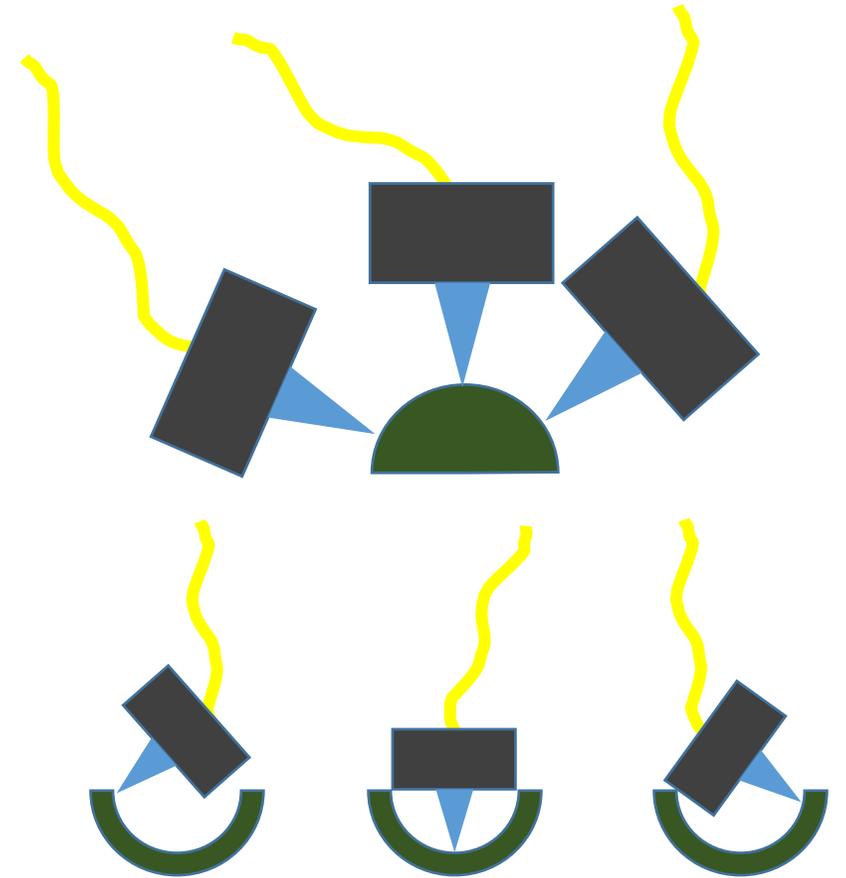
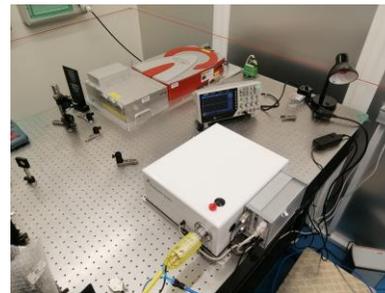
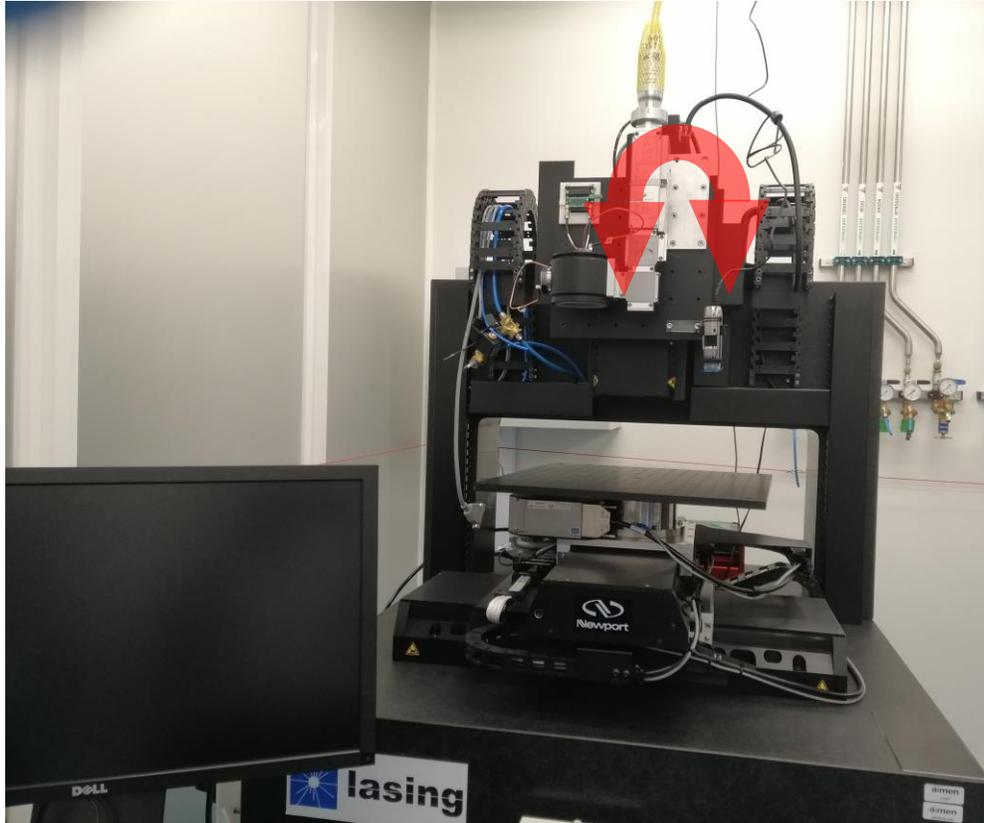
- Laser guiding fibres for ultrashort pulses
- Fast galvanometric scanners

## Optimizing beam shaping:

- Static: use of Diffractive optical elements (DOEs)
- Dynamic: use of Spatial Light Modulators (SLMs)

## Online monitoring:

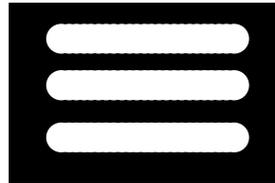
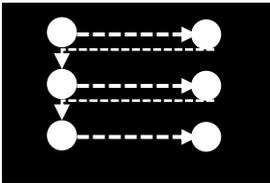
- High quality sensors
- Real time monitoring
- AI capabilities for the identification of correlations between beam parameters and quality measurement



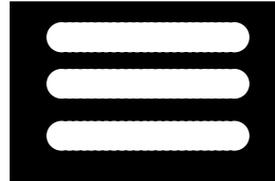
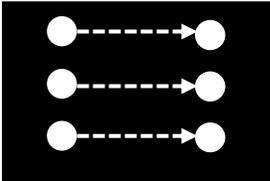
## Scanning the parallel beams through the resin

Example: writing parallel lines

Single beam

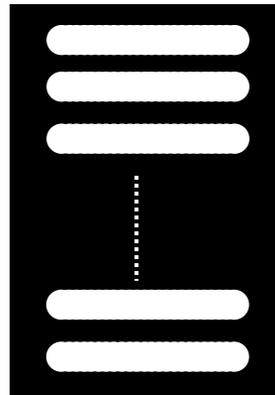
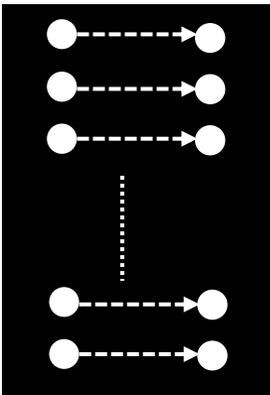


3 parallel beams



3×faster!

n parallel beams

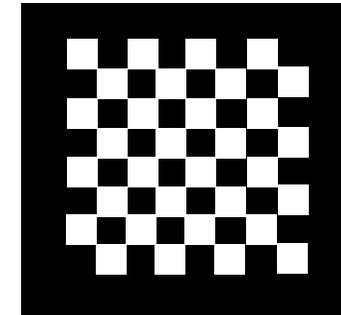
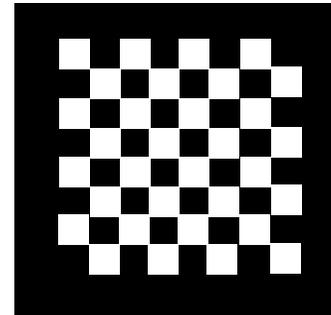
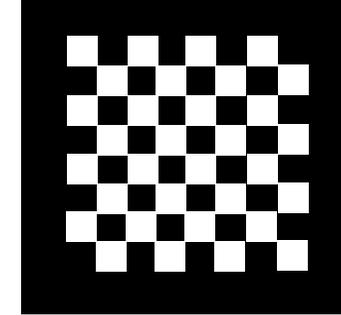
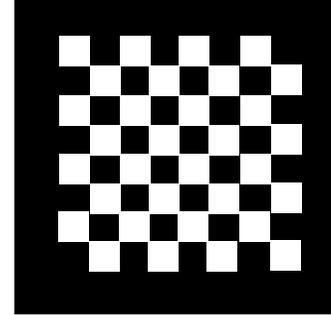


n×faster!

## Step and scan strategies

Example: chessboard

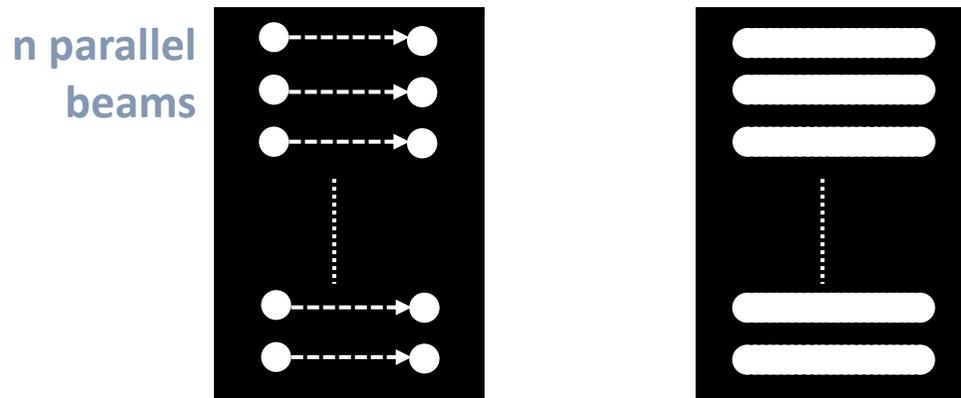
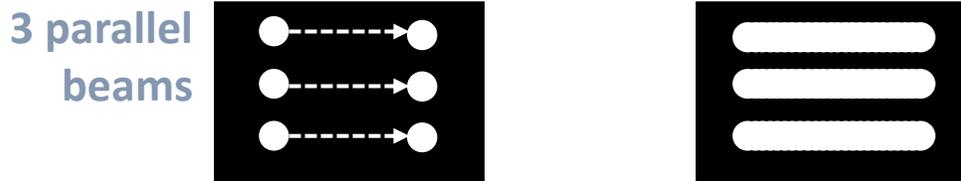
Single beam



Select design pattern and flash it on different areas

## Scanning the parallel beams

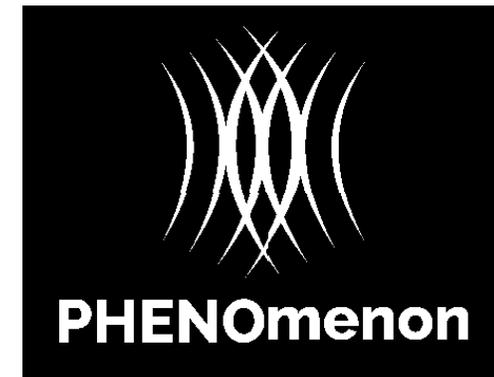
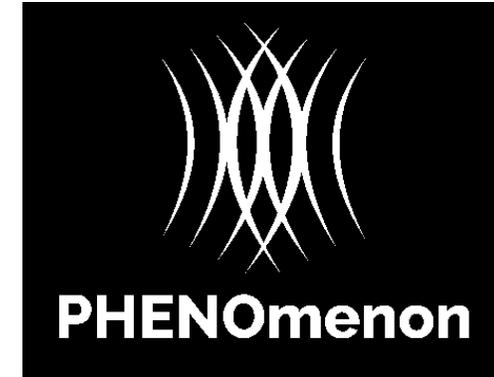
Example: writing parallel lines



3×faster!

n×faster!

## Step and scan strategies

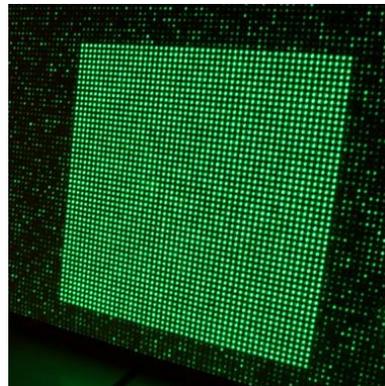
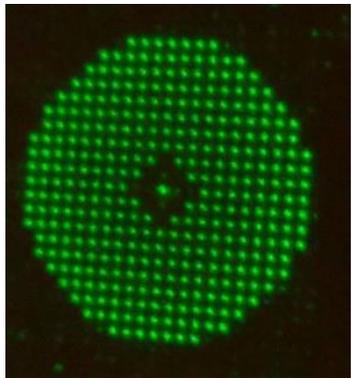
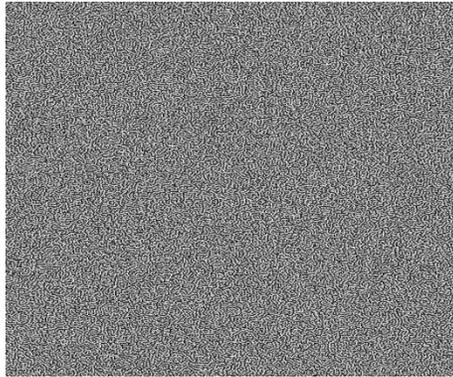


Select design pattern and flash it, then successively change pattern and flash it on the next area

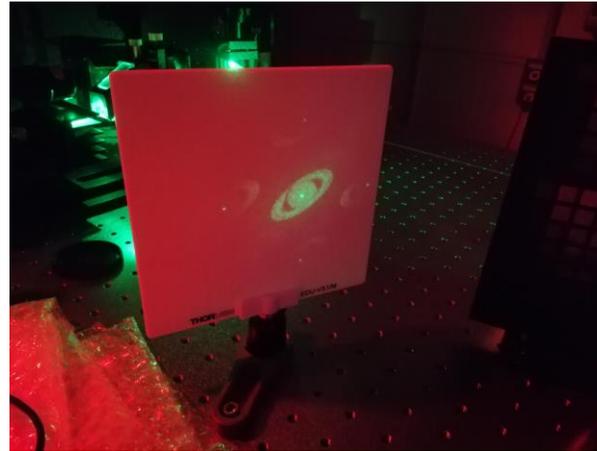


**PHENOMenon**  
LASER MANUFACTURING OF 3D NANOSTRUCTURED OPTICS USING  
ADVANCED PHOTOCHEMISTRY

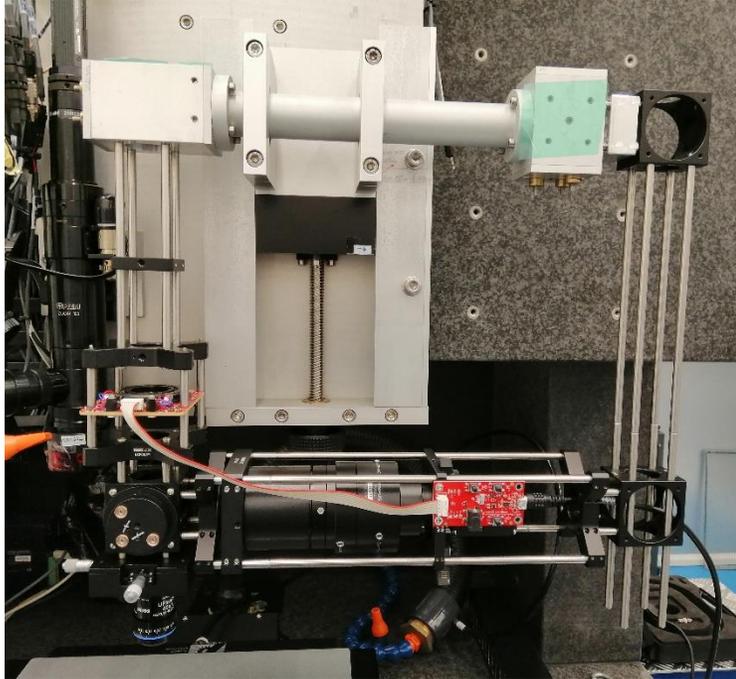
Static: DOEs



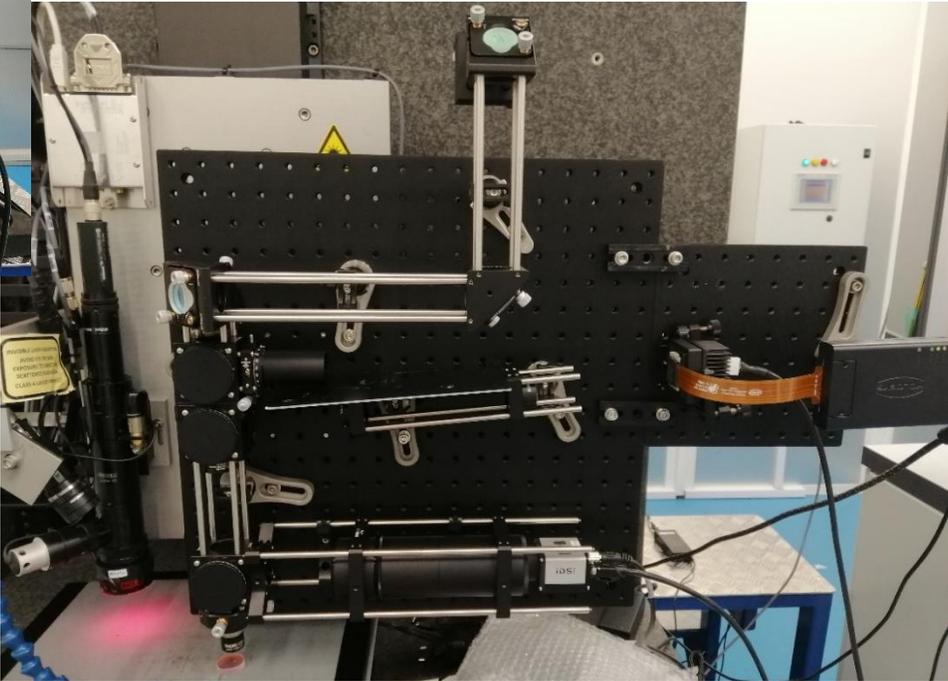
Dynamic: SLMs



Courtesy of Kevin Heggarty IMT-Atlantique



DOEs processing head



SLM processing head



- **Robots gives you extra freedom but current positioning accuracy is not good enough for high precision application**
- **The use of systems with rotary axes provides enough freedom for texturing applications**
- **Online monitoring is necessary for large pieces**
  - **Ultrafast control of positioning with high accuracy**
  - **Continuous feedback to avoid deviations from the desired topology**
- **Optimizing beam guiding and shaping is crucial to achieve extremely high throughputs**

**Headquarters**

**Laser Applications Centre**

Polígono Industrial de Catoboi  
SUR-PPI-2 (Sector 2) Parcela 3  
E36418 O PORRIÑO  
Pontevedra - Spain  
Phone +34 986 344 000

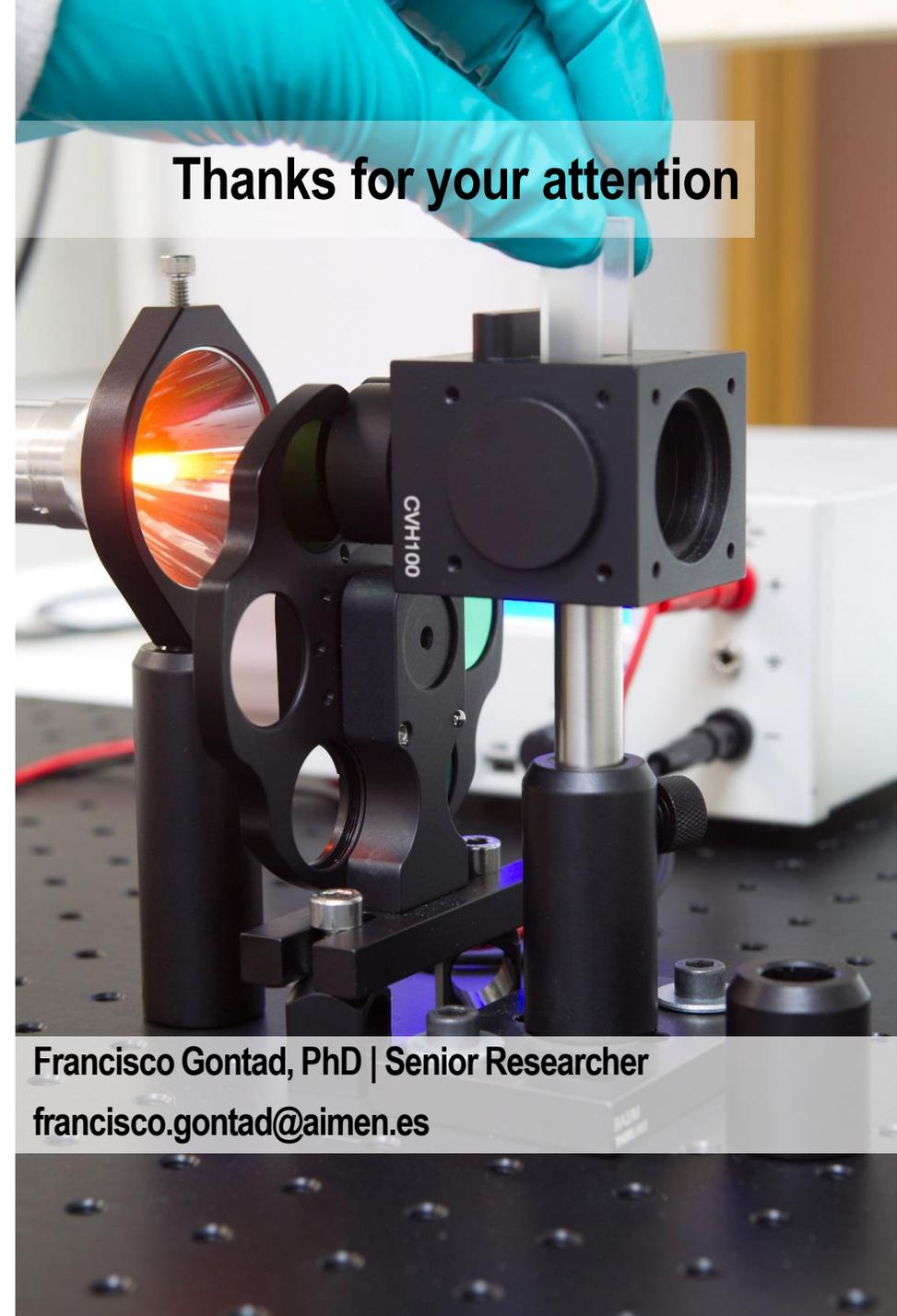
**Torneiros Facilities**

**Armando Priegue Building**

Relva 27 A – Torneiros  
E36410 O PORRIÑO  
Pontevedra – Spain  
Phone +34 986 344 000



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 862100 (NewSkin). The output reflects the views only of the author(s), and the European Commission cannot be held responsible for any use which may be made of the information contained therein.



**Thanks for your attention**

**Francisco Gontad, PhD | Senior Researcher**

**[francisco.gontad@aimen.es](mailto:francisco.gontad@aimen.es)**