



MESOMORPH

ALL-IN-ONE MACHINE FOR HYBRID TECHNOLOGIES ENABLING HIGH VALUE-ADDED MULTI-SCALE INTEGRATED MICRO-OPTOELECTRONICS

THE MANUFACTURING PARTNERSHIP DAY
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SUPSI



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 958417

MISSION OF MESOMORPH

Enable a new generation of micro-electromechanical systems, micro-sensors and micro-devices.

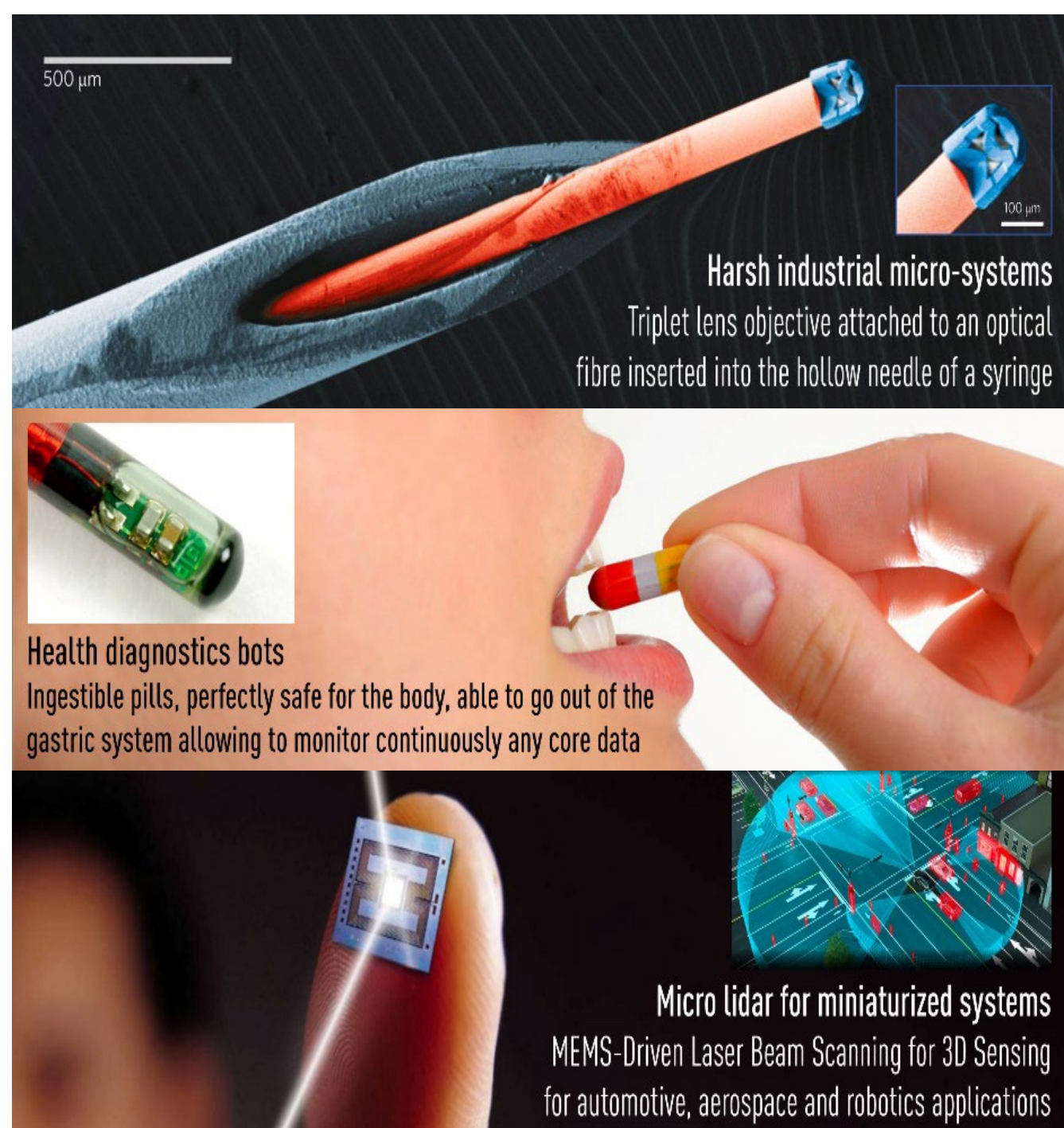
Applications in Electronics, Health diagnostics, Optics, and Environmental monitoring.

Necessity of combining different technologies:

- Multi-material deposition
- Multi-material subtraction/modification

MESOMORPH MACHINE

MESOMORPH

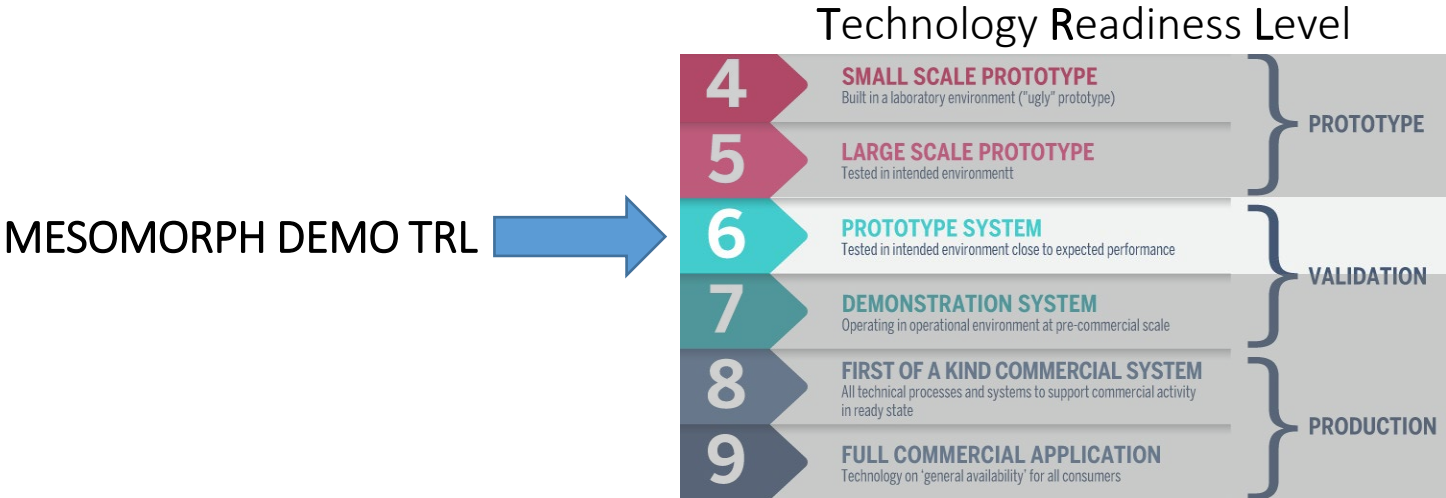


PROJECT OBJECTIVES

Mesomorph will deliver a TRL6 demo of a new generation of **all-in-one machine** integrating three disruptive technologies:

- Femto-laser treatments
- Two-Photon Polymerization (2PP)
- Atomic layer 3D nano-printing (Selective Area Direct Atomic Layer Processing - SADALP)

In a small self-contained *room*, implemented with a complete a sensing system able to both close the loop on the process execution, and check the partial results to quick react to deviation correcting the production processes accordingly.



MESOMORPH EXPECTED IMPACT

20% reduction of production time

- Multiscale 3D printing
- High throughput ablation
- Sensor-guided assembly
- -70% assembly steps

Increased automation level

- All technologies integrated into one machine

Higher precision

- 100nm z resolution
- 300nm x; y resolution
- Submicron accuracy

Zero rejection rate

- Adaptive control +3D in-line inspection

Mesomorph product solutions will result from a **fully automated compact process chain** ensuring:

- lead-time for a new product <4 weeks;
- scrap rate <0.01%.





They will present enhanced performances as a consequence of the ability to reach:














- 50'000 Parts/year throughput;
- 300 nm x; y resolution;

The number of technologies available on board and the number of materials that can be processed will widely enlarge the opportunity for:

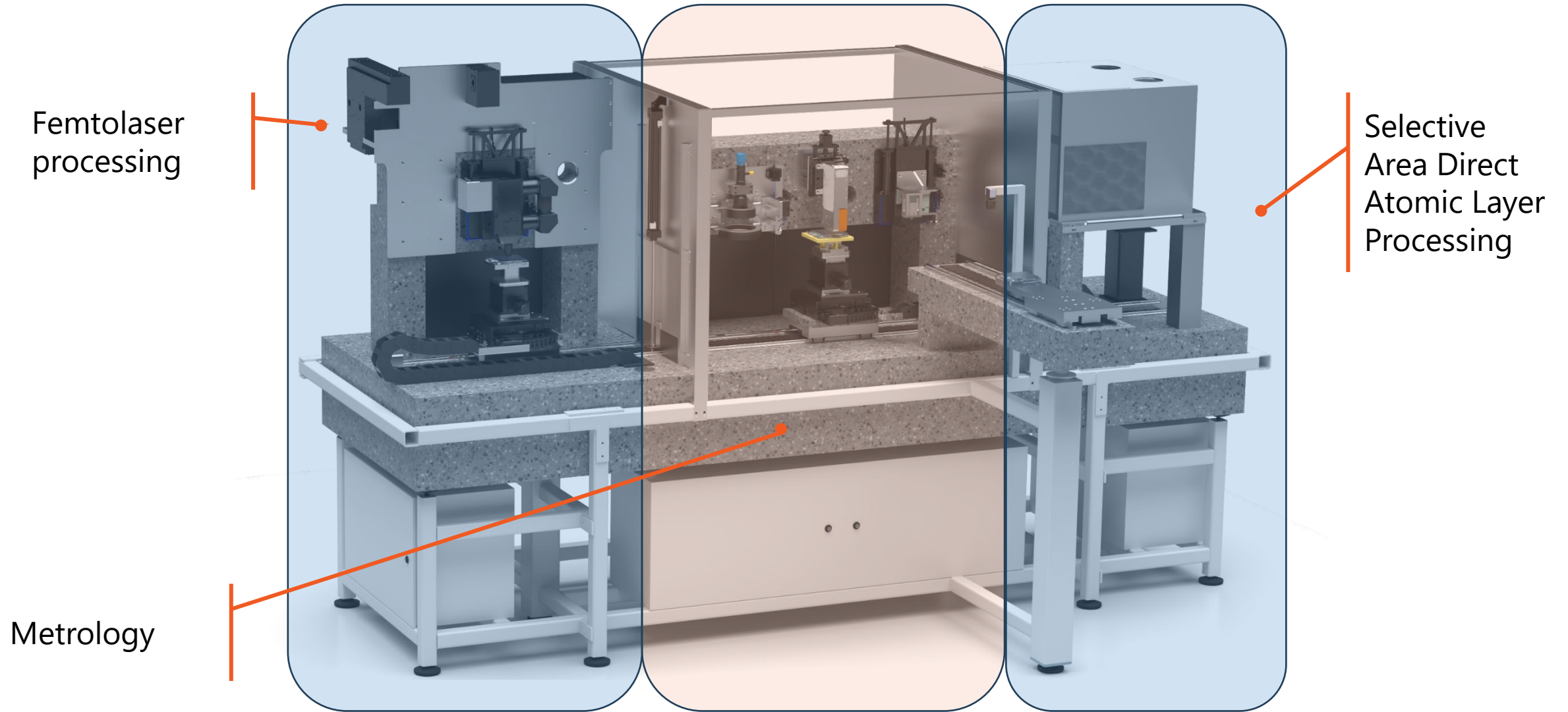
- Rapid evolution of products;
- Quick and automated industrialization and ramp-up <1 week.

PROJECT CONSORTIUM

-  END-USERS
-  SYSTEM DESIGN & INTEGRATION
-  PROCESS DESIGN & ENGINEERING
-  MULTI-TECH PRODUCT DESIGN

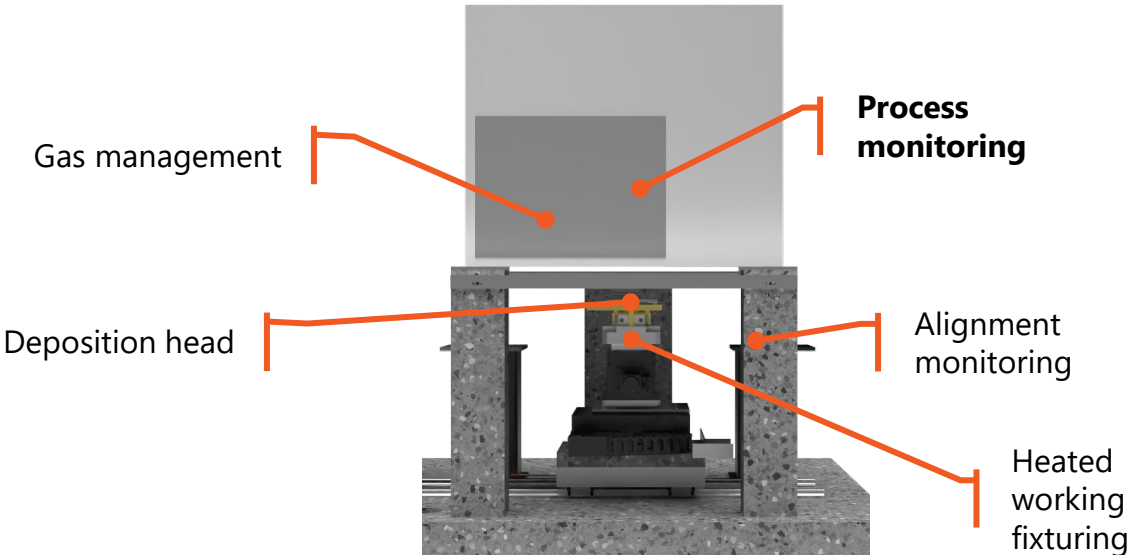
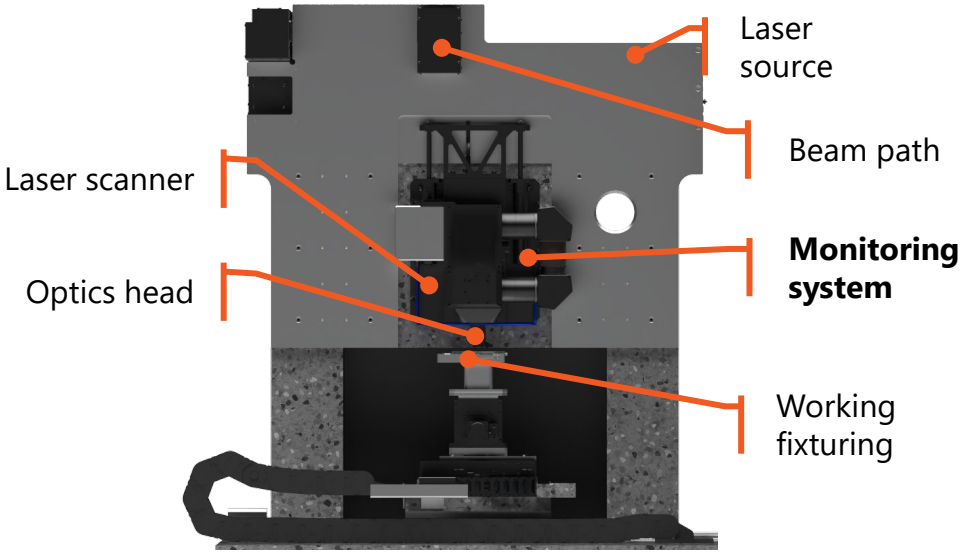
	Participant legal name	Short Name	Country	Organization type
	1 Prima Electro	PE	IT	LE - Integrator of the machine and control platform
	2 Scuola Universitaria Professionale della Svizzera Italiana	SUPSI	CH	RTD - Machine designer, integrator and process engineering
	3 IRIS	IRIS	IT	SME - Design and engineering process of microfluid sensors for water applications. Overall standardization features.
	4 Femtika	FEMTIKA	LT	SME – Provider of Femto laser and 2PP processing technology and know-how
	5 Atlant 3D	ATLANT	DK	SME – Provider of SADALP processing technology and know-how
	6 nLight	NLIGHT	IT	SME - Design for assembly of micro-systems
	7 Morphica	MORPHICA	IT	SME - Design/Manufacturing-to-Lifetime Platform and exploitation support
	8 Friedrich-Alexander-Universität Erlangen-Nürnberg	FAU	DE	RTD - Chemical processes engineering of SADALP process
	9 Politecnico di Torino	POLITO	IT	RTD – Expertise provider on microsystems design
	10 STMicroelectronics	ST	IT	LE – Design and engineering process support on the next generation industrial and automotive sensors
	11 Yalosys	YALOSYS	CH	SME - Support to the engineering of health and medtech sensors
	12 Heliotis	HELIOTIS	CH	SME – Technology provider and integrator of ultra-fast scanners for micro inspection
	13 MCH-TRONICS	MCH	CH	SME - Integrators of the machine and control platform

INTERNAL STRUCTURE

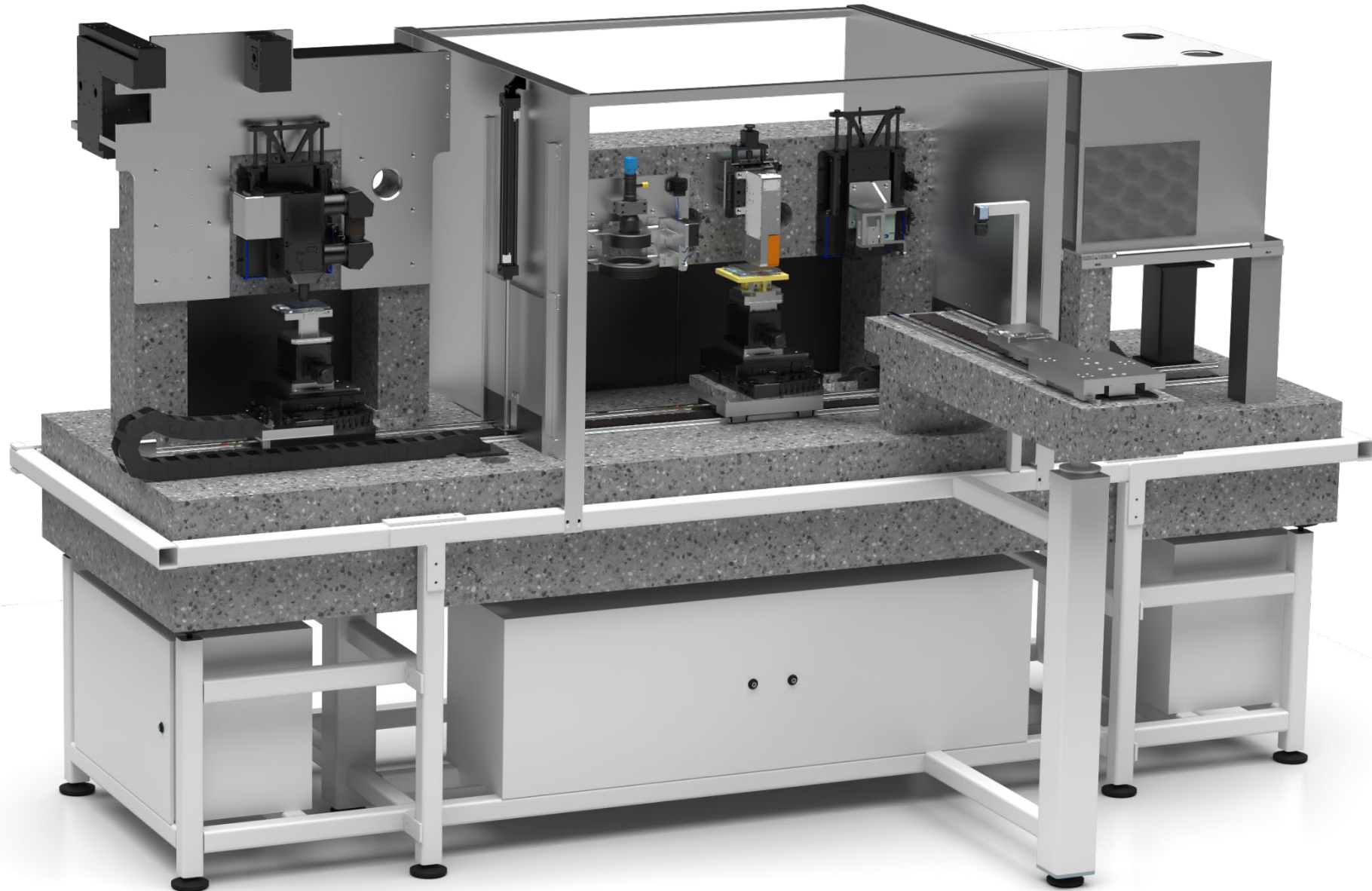


MESOMORPH "PRODUCTION" MODULES

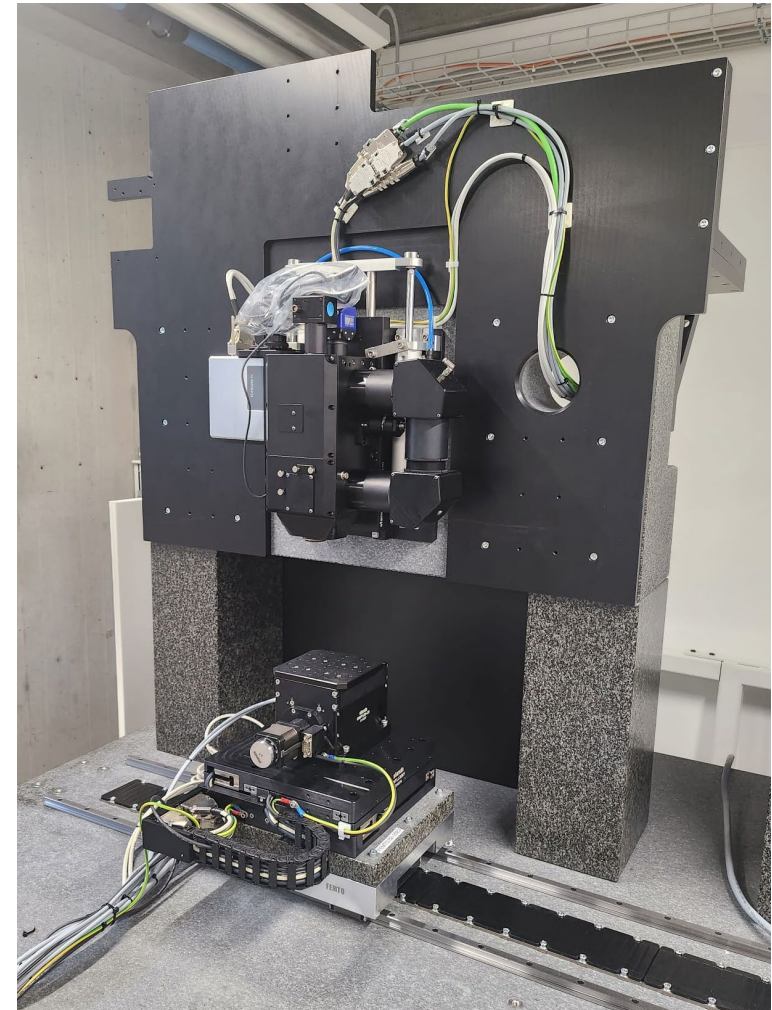
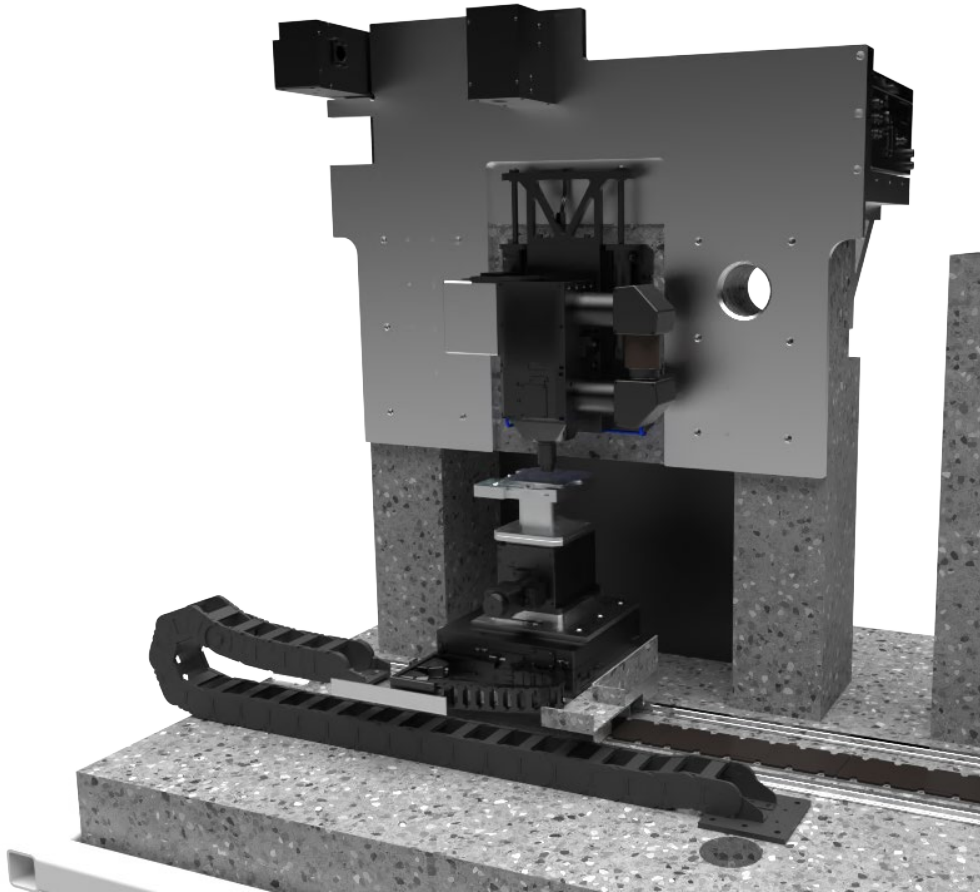
Process	Module	Basic function	Definition	Resolution	Material
Two-Photon Polymerization (2PP)	FEMTO	Add	Fusing and curing processes	300nm	Any photosensitive precursor
Femtosecond ablation		Subtract	Ultra-short laser ablate material enabling superficial structuring, grooving and marking		Any material (\nearrow reflectivity = \searrow throughput)
Selective Area Direct Atomic Layer Processing	SADALP	ADD	Molecules are deposited in a vapour form and reactions are directly triggered on the deposition site.	300nm (100nm z-resolution)	400 precursors to deposit 150 oxides
Verification	Metrology	Check	Three different technologies able to measure all the materials with high resolution		



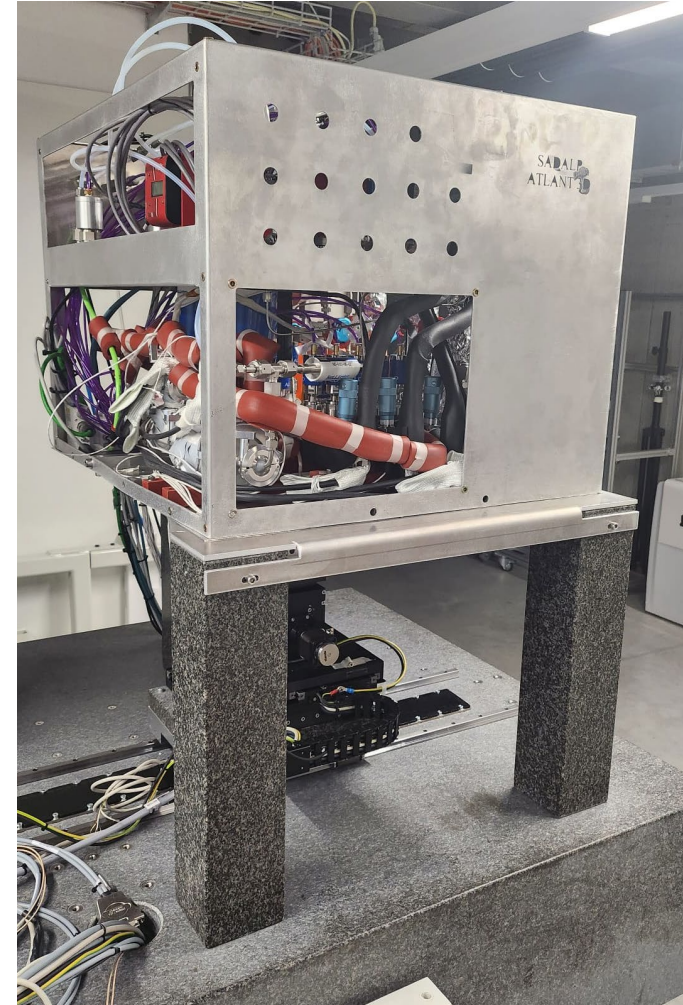
MESOMORPH FULL INTERNAL MACHINE



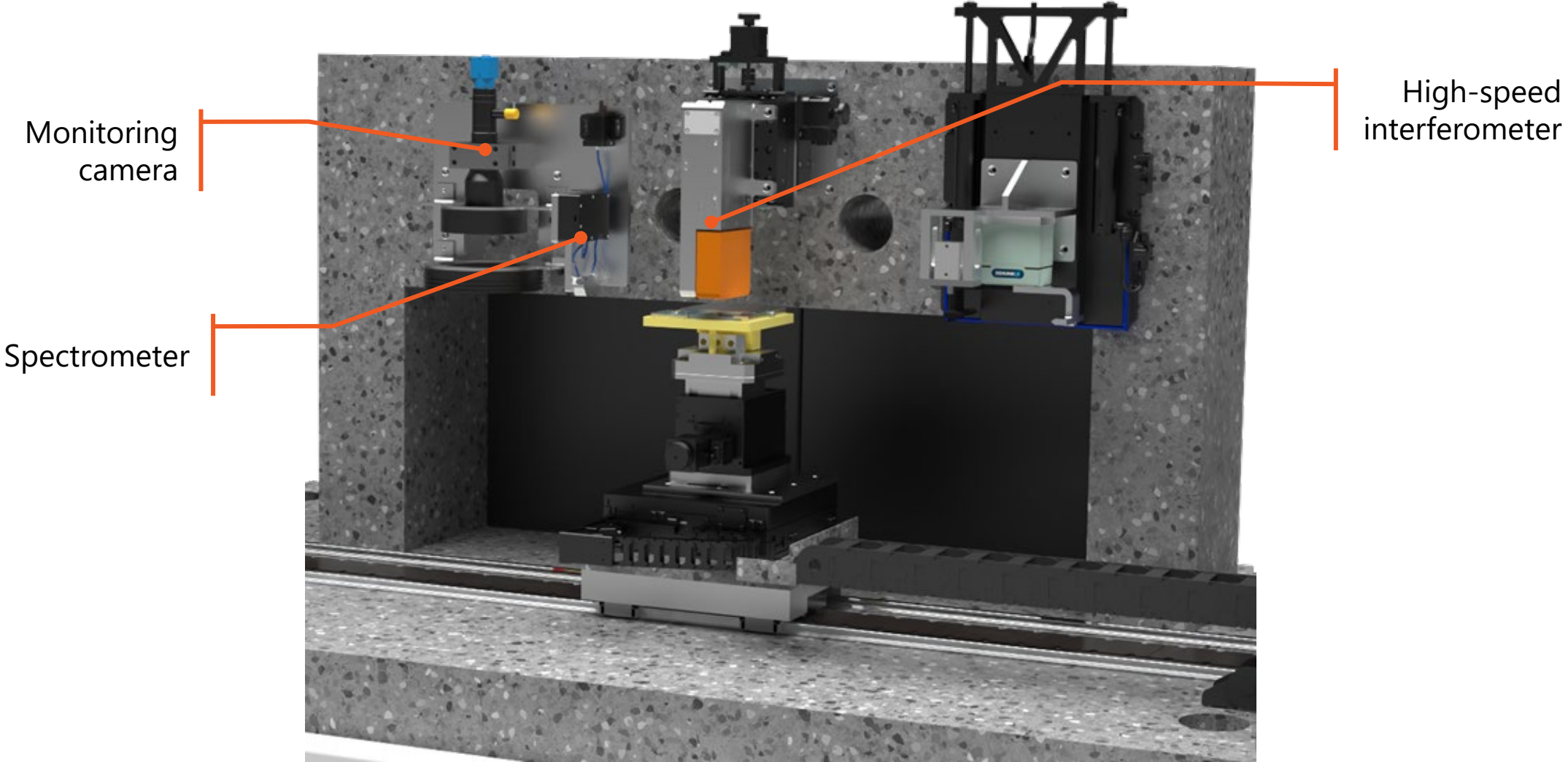
FEMTOLASER MODULE



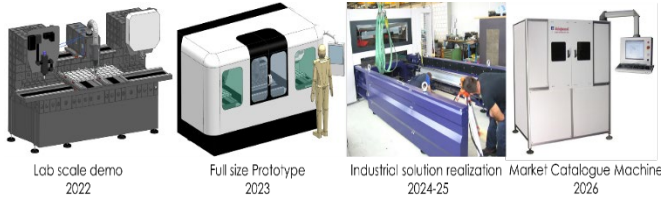
SADALP MODULE



METROLOGY AREA



MESOMORPH EXPLOITABLE RESULTS



Exploitable result	Leader	Partners involved	Means of exploitation
Mesomorph integrated concept equipment	PE	MCH, SUPSI	New product (integrated equipment), Commercial agreements with RTD providers
SADALP process and unit	ATLANT	FAU, MCH	New product (equipment for SADALP process), Licensing / IPR agreements
Femtosecond laser and 2PP process and unit	FEMTIKA	SUPSI, MCH	Adaptation of own processes to ease integration in Mesomorph concept, commercial agreements with PE
Gripping and moving unit	NLIGHT	POLITO, MCH	Adaptation of own processes to ease integration in Mesomorph concept, commercial agreements with PE
Scanners for micro inspection	HELIOTIS	MCH	Adaptation of own product to ease integration in Mesomorph concept, commercial agreements with PE
Design/Manufacturing-to-Lifetime Platform	MORPHICA	ST, SMOLSYS, IRIS	Adaptation of own digital platform to ease integration in Mesomorph concept, commercial agreements with PE
New corrosion sensor	ST	SUPSI	New product (microsensors for industrial applications)
New Health sensor	SMOLSYS	SUPSI	New product (ingestible microsensors for smart diagnosis)
New Water sensor	IRIS	SUPSI	New process (real time monitoring of water quality)

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THANK YOU



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