

## SPECIFICATION SHEET

### Supply, installation and starting-up of a Laser System for TGVs and cavities fabrication for the Pilot Line PIXEurope at ICFO

FILE NUMBER: ICFO-2026-046

CLAUSE 1. Object of the contract .....	1
CLAUSE 3. Technical requirements.....	2
CLAUSE 4. Power distributions and safety .....	3
CLAUSE 5. System layout and services .....	3
CLAUSE 6. Transportation, installation, start-up and training.....	4
CLAUSE 7. Warranty and Follow-on Support .....	5
CLAUSE 8. Training .....	5
CLAUSE 9. Delivery and Installation Time .....	5
CLAUSE 10. Tender budget.....	6
CLAUSE 11. Environmental clause.....	6

## CLAUSE 1. Object of the contract

The purpose of this contract is the supply, installation and commissioning of a Laser system for Laser Induced Deep Etching (LIDE) processing for the Pilot Line PIXEurope for ICFO's laboratory.

The types of items supplied are linked to the CPV (Common Public Procurement Vocabulary), **38000000-5** Laboratory, optical and precision equipment (except glasses).

## CLAUSE 2. Needs to satisfy

PIXEurope is a European pilot line initiative aimed at establishing a fully integrated, open-access manufacturing chain for the development and industrialization of advanced photonic integrated circuits (PICs).

Within this context, the development of glass-based interposer technology for advanced co-packaged optics is of crucial importance, affecting directly the outcomes of the project and the impact of the whole initiative. Glass-based interposers are in fact emerging as key components for applications like high-performance computing, telecommunications, sensing, and quantum technologies. In particular, glass-based interposers enable high-density electrical and optical interconnections, respectively through Through Glass Vias (TGVs) and advanced fiber-based I/O interfaces.

To develop efficient and scalable TGVs, for electrical interconnection, and optical fiber-based interfaces, precise and high-throughput glass micro-structuring is required. LIDE processing is the ideal approach to this kind of manufacturing, enabling high-aspect-ratio and high-precision structuring of glass by combining laser modification with selective wet etching, allowing the fabrication of dense and accurate TGVs and microfeatures. In particular, LIDE process, compared to standard laser induced selective etching, enables lower TGV roughness and reduced defects in glass structures, while keeping high throughput and micrometric accuracy; because of this, LIDE is particularly suitable for reliable electrical interconnections and high-performance optical integration in high volume manufacturing of glass interposers.

In the development of the project, ICFO is in charge of the fabrication of the glass-based interposer, including the micro-structuring of the substrate for electrical and optical interconnections. Therefore, ICFO needs to acquire a **laser system compatible with LIDE processing**.

The laser system to be acquired must be:

- compatible with LIDE process
- performing maskless, direct-write laser modification of glass substrates across their full thickness
- enabling the fabrication of high-aspect-ratio structures (typically in the range of 1:10 to 1:50)
- structuring a wide variety of glass types and thicknesses, compatible with semiconductor and photonic applications
- generating high-density TGV arrays with high throughput (up to several thousand vias per second depending on layout)
- achieving high positional accuracy (on the order of a few micrometers over large substrates)
- producing structures with low surface roughness and minimal defectivity
- enabling the fabrication of features such as through vias, blind vias, cavities, grooves, and cut-outs within the same process flow
- compatible with 300 mm wafer-level processing

- ensuring compatibility with cleanroom operation and integration into pilot-line manufacturing environments
- providing integrated monitoring of laser parameters to ensure process stability and repeatability
- operating in automatic and semi-automatic modes

### CLAUSE 3. Technical requirements

#### Technical proposal structure - minimum mandatory equipment characteristics

The equipment shall combine a laser, high-precision motion stages, and a vision/alignment system in order to perform maskless glass structuring with the following minimum capabilities:

System capabilities and requirements:

1. Capability to perform laser-induced modification of transparent materials without or partial material removal during the laser step, enabling subsequent selective wet etching
2. Proven track record of application to LIDE glass processing
3. Compatibility with a wide range of glass materials, including (but not limited to) borosilicate, fused silica, alkali-free and display glass
4. Capability to process glass substrates with thickness up to at least 500  $\mu\text{m}$
5. Capability to fabricate high-aspect-ratio structures (minimum 1:10, target up to 1:50)
6. Compatible with at least 300 mm (diameter) wafer-level processing
7. Capability for real-time process monitoring and alignment correction
8. Capability to generate:
  - a. TGVs
  - b. Blind vias
  - c. Cavities and cut-outs
  - d. Grooves and micro-optical features

Dimensional and performance requirements:

9. TGV diameter tolerance within  $\pm 5 \mu\text{m}$
10. TGV positional accuracy at least  $\pm 5 \mu\text{m}$  over the full working area
11. Sidewall roughness  $R_a \leq 0.3 \mu\text{m}$
12. Capability to process dense via arrays with high throughput ( $>3000$  vias/second, depending on layout)
13. Cavity depth  $> 250 \mu\text{m}$

System integration and automation:

14. Integrated laser power monitor for process stability assessment
15. Compatibility with cleanroom operation (ISO 7 or better)
16. Capability to operate in automatic and semi-automatic modes, with manual loading of substrates

Additional requirements:

17. System shall ensure minimal thermal load and avoid crack formation or damage to the glass substrate
18. Capability to maintain high structural quality (low defectivity, absence of microcracks) suitable for subsequent metallization (e.g., copper filling of TGVs) and optical integration
19. Provision of initial tooling, process recipes, and training for system operation and process development
20. Supply of spare parts and maintenance support for pilot-line operation
21. Transfer of wet-etching processes for LIDE glass processing
22. Delivery of onsite training of the wet etching processes required after laser exposure to implement LIDE processing

### Software requirements

23. The system must include the software required to manage all required functionalities and capabilities described above and shall be supplied with a permanent (non-expiring) license.
24. The software shall be installed on the system.
25. Software backup must be included.

### Technical documentation or manuals to be delivered

A set of documentation shall be provided, covering the following topics:

- Comprehensive system user manual, including both hardware and software descriptions, routine servicing and troubleshooting.

### CLAUSE 4. Power distributions and safety

- The system should be configured for EU (Spain) power grid (voltage, sockets, etc.) and be CE marked.
- Component wiring routed to a centralized power distribution panel.
- EMO protection.
- Appropriate hardware and software safety interlocks. Extended error diagnostics.
- The system will be fully protected against unexpected power cuts and, in that case, will be fully safe for the operators. A quick and easy turning on of the system has to be possible after a power cut.

### CLAUSE 5. System layout and services

The proposal shall include a set of “system layout and services documentation”, containing the following information:

- System layout, including overall footprint, weight, drawings and detailed description of the different system components.
- Installation and start-up requirements, including required utilities, service connections, and any applicable environmental specification.

## CLAUSE 6. Transportation, installation, start-up and training

- The proposal will include transportation to ICFO's facilities including insurance and all export/import and customs duties. **DAP incoterm will apply.**
- The machine will be placed in the designated location by ICFO. The contract winner shall cover all costs, organization, and coordination related to the placement, including the provision of any required specialized equipment or vehicles, as well as any necessary component disassembly and reassembly for unloading and transportation inside the building, strictly following the route specified by ICFO. The machine will be equipped with its own wheels to facilitate transportation and with levelling pads to ensure a stable and properly levelled position once installed.
- Depending on the size, machine crate may need to be disassembled outside ICFO building. The contract winner will be responsible for taking accurate measurements of the transportation route outside and inside ICFO and plan in advance any required component dis-assembly and re-assembly. The contract winner will be responsible for checking the selected location and for taking any required measurements to guarantee the suitability of it for the offered system. The compatibility with the operation of the systems already installed in the lab and the mobility of users will have to be guaranteed as well.
- Installation and start-up of the system, including system checking, functional tests and process qualification
- The contract winner will be responsible for the removal and proper disposal of the packaging when the machine is delivered and unpacked, or its storage during the warranty period in case the original packaging needs to be kept.

### **Process qualification**

Factory Acceptance Test (FAT) and Site Acceptance Test (SAT) will be required as part of the delivery and acceptance process of the equipment.

It shall include, at minimum, the following:

- Machine parameters verification, such as laser operational parameters, axis calibration, measured placement accuracy, etc. demonstrating compliance with the specification.
- Documentation. All test results, reports and data shall be included in the documentation delivered to ICFO.

### **Protocol in the event of SAT failure and remediation deadlines**

Should the equipment fail any of the tests or verifications established in the SAT, the following protocol shall apply:

1. Formal notification of failure (Day 0): ICFO shall notify the contractor in writing and through a verifiable channel of the deficient results obtained, specifying in detail the parameters that did not meet the required values and attaching the corresponding measurement reports.
2. Corrective Action Plan (deadline: 5 working days from notification): the contractor shall submit to ICFO a written corrective Action Plan, identifying the root cause of the non-compliance, the proposed corrective

measures, and an implementation schedule not exceeding 30 calendar days from the date of failure notification.

3. Re-execution of the SAT (deadline: maximum 30 calendar days from notification): once the corrective measures have been implemented, the contractor shall repeat the SAT in the presence of ICFO technical staff, within the aforementioned deadline. All costs associated with this repetition shall be borne entirely by the contractor.

## CLAUSE 7. Warranty and Follow-on Support

- **1-year Full Warranty** on all parts and components of the system irrespective of the manufacturer. The warranty will include the replacement of any faulty or damaged part(s) during normal use of the system, no matter the manufacturer of the component(s). It will cover any cost related with the disassembly, transportation, reparation and re-assembly of the damaged component(s), including all travelling and living costs of the required service engineer(s). An on-site repair, or a justified alternative to reduce the system down time to the minimum, will always be the first service option. A team of properly qualified and skilled service engineers will have to be available.
- System lifetime support available during, at least, 10 years:
  - By phone and e-mail with a response within 3 hours.
  - Emergency visit after a system breakdown within 10 working days.
- Spare parts will be available during, at least, 10 years after system supply and, in case of failure, will be delivered within 10 working days.
- An estimation of the cost of a warranty extension or available support contract options after warranty period will be included in the proposal.

## CLAUSE 8. Training

- The contract includes training for ICFO staff. A minimum of 5 days of mandatory training for ICFO staff is established, scheduled on a mutually agreed date. The training will cover both the operation of the system and the use of processes for ICFO users, as well as specific maintenance, preventive tasks and essential troubleshooting. Training will take place at the ICFO facilities.

## CLAUSE 9. Delivery and Installation Time

The maximum execution period of the contract shall be **NINE (9) MONTHS**, counted from the day following the date of its formalisation.

Within this period, the supplier must complete the manufacturing, transportation, delivery, installation, integration, commissioning of the system, and the execution of the Site Acceptance Tests (SAT). The delivery time shall

therefore be understood as the full period required to complete all contractual obligations up to the successful acceptance of the equipment at ICFO facilities.

At the same time as the delivery of the equipment, the contractor must deliver the technical documentation and manuals indicated in clause 5.

### Installations record

- Such a system must have been fabricated at least 3 times by the same provider in the last 3 years, with a proven record of installation. The record list should be provided upon request.
- For these systems, compliance with the specifications set out in paragraph “Process qualification” (clause 6) must be demonstrated in the phase of installation and start-up.

### CLAUSE 10. Tender budget

- The tender budget (maximum bid price) for the supply is **1.050.000,00 €** (VAT excluded).
- Payment terms:
  - Payment on order - 30% total price. This payment is optional for the contractor, but in case the contractor requests a payment of 30% of the contract, he will have to constitute a guarantee for an amount equivalent to the amount that was advanced. The payment of this amount does not imply conformity in the equipment, is an advance payment that the contractor must return in the event of non-compliance or deficient compliance.
  - Payment on delivery, commissioning and training - 70% total price

### CLAUSE 11. Environmental clause

It is hereby stated that, in compliance with the provisions of the Recovery Plan, Regulation (EU) 2021/241 of 12 February 2021 establishing the Recovery and Resilience Facility, and its implementing regulations, in particular Commission Communication (2021/C58/01) Technical guidance on the application of the principle of “do no significant harm”, as well as the requirements of the Council Implementing Decision concerning the approval of the assessment of Spain’s Recovery and Resilience Facility (RDF), all financed actions carried out under this contract must respect the principle of not causing significant harm to the environment (the “Do No Significant Harm” principle). This includes compliance with the specific conditions set out in component 17, measure I1, under which this contract falls. During the execution of the actions covered by the contract, no significant damage will be caused to the environment, in accordance with Article 17 of Regulation (EU) 2020/852.

The activities carried out will not cause direct environmental impacts, nor will they have primary indirect impacts throughout their life cycle, understood as those that may materialize once the activity has been completed.

The activities carried out by the successful bidder under this contract will not generate waste that, in its long-term disposal, could cause environmental damage, as this is one of the situations excluded from funding by the Recovery, Transformation and Resilience Plan, in accordance with the Technical Guidance on the application of

the principle of “not causing significant harm” under the Regulation on the Recovery and Resilience Facility (2021/C 58/01), the Council's Proposal for an Implementing Decision on the approval of the assessment of Spain's recovery and resilience plan, and its annex. The activities carried out by the successful bidder will be adapted, where appropriate, to the characteristics set for the measurement and sub-measure of the assigned component, and reflected in the Recovery, Transformation and Resilience Plan.

The activities carried out will comply with all applicable environmental regulations in force.

For the transport, installation, and commissioning of the equipment covered by this contract, the contractor will implement waste minimization measures and, should any waste be generated, will be responsible for its collection, preparation for reuse, recovery, or recycling, or appropriate treatment.

#### Methods for monitoring and controlling compliance with the conditions

With regard to compliance with environmental and social requirements, the contractor remains obligated to:

- The contractor must sign, before the contract is formalized, the declaration of commitment regarding the implementation of actions under the Recovery, Transformation, and Resilience Plan (RTRP) and compliance with the principle of not causing significant harm to the environment, included as Annex of the Special Administrative Clauses.
- Issue a manual detailing the dismantling instructions for the equipment, including the reuse, recovery, or recycling operations, or appropriate treatment, including the disposal of fluids and selective treatment, applicable to each of the materials or parts that comprise it. The manual must include a table summarizing, expressed as a percentage by weight, the expected fate of the materials that make up the equipment at the end of its useful life, according to the following options: reuse (including recovery and recycling), energy recovery, and rejection/disposal.
- For the transport, installation, and commissioning of the equipment covered by the contract, the contractor will implement waste minimization measures and, should any waste be generated, will be responsible for its removal and management.

Castelldefels, on the date of its digital signature

**Prof. Dr. Valerio Pruneri**

Group Leader Optoelectronics – ICFO