ICFO

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SPECIFICATION SHEET

SUPPLY, INSTALLATION AND STARTING-UP OF A “HIGH-PEAK-POWER GHZ-RATE PICOSECOND BENCHTOP POLARIZATION MAINTAINING FIBER LASER SYSTEM", FOR A LABORATORY OF THE CATALAN INSTITUTE OF PHOTONIC SCIENCES, FINANCED BY MCIN/AEI/10.13039/501100011033 AND EUROPEAN UNION “NEXTGENERATIONEU”/PRTR

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1. Object of the contract

The purpose of this contract is the Supply, installation and starting-up of a "High-peak-power GHz-rate picosecond benchtop polarization maintaining fiber laser system", for a laboratory of the Catalan Institute of Photonic Sciences. The required equipment is a benchtop ultrafast optical laser source delivering picosecond pulses in the C-band (1530–1565 nm). The system must be fiber-coupled, turnkey, and include monitoring ports and synchronization outputs. It must be suitable for integration into ICFO's laboratories for quantum and telecommunication applications

2. Needs to satisfy

The Optoelectronics Group at ICFO is developing advanced protocols in the field of quantum cryptography and quantum communications. In particular, several experimental implementations of quantum communication protocols, such as Quantum Key Distribution (QKD) and Quantum Oblivious Transfer (QOT), as well as novel sources of quantum light, require stable, high-repetition-rate pulsed laser sources operating in the telecom band (C-band). While laboratory prototypes exist, commercially available benchtop fiber lasers are now sufficiently mature to enable robust and reproducible experiments. The acquisition of such a system will provide the essential optical clock and pulse source needed to validate QOT protocols and to integrate them into ICFO's broader research activities in secure quantum communication.

The requirement of a powerful high-speed picosecond benchtop fiber laser system is essential to advance ICFO's research in quantum cryptography and secure communications. The laser is useful for research of different types of sources, mainly for those based on non-linear effects needing a high pump to produce entanglement for example. We plan to use it in Quantum Key Distribution (QKD) as well as other protocols beyond QKD. The first use case will be an implementation of beyond QKD protocols, in particular Quantum Oblivious Transfer (QOT) protocol in the Noisy Quantum Storage Model. This protocol constitutes a fundamental cryptographic primitive, enabling tasks such as secure multi-party computation (SMPC) where untrusted parties want to collaborate to obtain a common output without revealing its private input. Its experimental realization requires extremely high repetition rates, which can only be achieved through a stable, pulsed laser source operating in the telecom band. One of the principal functions of the laser will be to serve as the pump in quantum light sources (e.g. correlated or entangled photon sources, as well as single-photon sources) that utilize nonlinear optical phenomena including, but not limited to, spontaneous parametric down conversion (SPDC), second harmonic generation (SHG), and spontaneous four-wave mixing (SFWM). For this purpose, the laser must provide sufficiently high peak and average output power to enable such nonlinear optical effects. Moreover, the laser must have sufficiently adjustable high temporal coherence, spectral bandwidth, and pulse length as required by the specific applications. This is fundamental to the entanglement-based approach to quantum cryptography and quantum communication pursued by the research group. Finally, the laser must combine turnkey operation with robustness and reliability, ensuring continuous operation under laboratory conditions with minimal maintenance.

In order to demonstrate the feasibility of QOT in realistic communication scenarios, the Optoelectronics Group requires a benchtop laser source with high-power GHz-level pulse repetition rates and sub-10 ps pulse widths, suitable for integration into existing quantum optics and fiber communication setups for the proof-of-concept of new cryptographic schemes proposed in the group. The system will be deployed in experimental testbeds designed to connect quantum nodes in real-world networks, thereby providing the optical clock necessary to synchronize photon generation, transmission, and detection at the speeds demanded by QOT and other advanced

quantum communication protocols because having a stable optical pulse train ensures that all parties operate in the same time frame.

3. Technical requirements:

A high-power GHz-rate picosecond benchtop polarization maintaining fiber laser system with the following characteristics:

- Center wavelength tunable by user inside the C band centered around 1550 nm.
- Pulse width is tunable from 2 ps to 10 ps.
- Spectral bandwidth tuneable in a range of at least 0.6 nm to 8nm.
- Repetition rate tunable from 100 MHz or less and up to at least 5 GHz.
- The laser clock should be compatible with TTL logic.
- Laser must be mode-locked.
- High peak power must not decrease with repetition rate. The laser must come with a specification sheet that guarantee that at the highest repetition rate (1 GHz and above) provided by the laser the peak power is around 1 W.
- The spectrum must be the same when changing the repetition rate. If alignment is needed, we should be provided with the tools to optimize the wavelength again.
- The user should be able to optimize the peak power by tuning the current of the laser / some laser itself or /and an integrated EDFA.
- Pulse amplitude stability < 1% RMS.
- Polarization extinction ratio ≥ 15 dB.
- It must accept an external clock and have the possibility to output the clock signal as well.
- Output termination: PM 1550 fiber pigtail with FC/APC connector, keyed to slow axis.
- Operating temperature range: 15–30 ºC.
- Dimensions suitable for benchtop rackmount (≤ 50 × 50 × 10 cm).
- Weight ≤ 15 kg.

The improvements made to these basic characteristics will be evaluated in accordance with the provisions of Annex 2.

4. Transport, installation and start-up

The awarded supplier must provide transport, customs clearance, and delivery to ICFO facilities in Castelldefels. On-site installation, verification, and acceptance testing are mandatory. The supplier will also provide training sessions for ICFO personnel on the operation and maintenance of the system.

List of essential requirements:

1. The proposal should include transportation to ICFO's facilities and all export/import and customs duties.

2. The equipment should be placed in the selected locations by ICFO. Contract winner should cover all costs, organization and coordination of devices' placement.

3. Support for Installation and start-up of the system, including for system checking, functional tests and process qualification (Preferably in person)

5. Warranty

Minimum 2-year warranty. The warranty will include the replacement of any faulty or damaged part(s) upon delivery 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.

6. Delivery Time

Delivery time is defined as the time elapsed since the signature of the contract until the system delivery at ICFO facilities. It includes the manufacture of the system, the acceptance test at company's premises, transportation, installation and start-up.

The equipment must be delivered at ICFO within a maximum period of 5 weeks from the formalization of the contract. Without prejudice to the above, the deadline of the contract will be 28 February 2026.

In the event that this date is exceeded, the contract will be automatically terminated, without the contractor being able to claim from ICFO any concept linked to the contract.

7. Target price

75,000 EUR (VAT excluded).

Castelldefels, at the date of digital signature.

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