

REQUEST FOR EXPRESSION OF INTEREST TO PARTICIPATE IN THE NEGOTIATED PROCEDURE FOR THE AWARDING OF SERVICES FOR THE MLM (MULTI LAYER MASK) FABRICATION OF CMOS DEVICES

In compliance with the principles of publicity, transparency, equal treatment, non-discrimination and proportionality, Fondazione Bruno Kessler intends to acquire expressions of interest in participating in the negotiated procedure that will be activated for the awarding of services involving the simulation and fabrication of ASIC chips for electronic control activities involved in the H2020 EPIQUS Electronic-photonics integrated quantum simulator platform (GA No. 899368) project.

This request is aimed exclusively at receiving expressions of interest to encourage the participation of an adequate number of contractors potentially interested in the awarding of the work.

This request does not entail any shortlisting or scoring and is not binding for the Foundation which reserves the right, in any case and at any time, to suspend, interrupt, modify or terminate this survey without that this may constitute a right or claim of any kind, indemnity or reimbursement of any costs incurred.

The submission of an expression of interest has the sole purpose of communicating to the Foundation the willingness to be selected in order to participate in the negotiated procedure that will be activated pursuant to Prov. Law 2/2016 and Prov. Law 23/1990.

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1. INTRODUCTION

The EPIQUS project (www.epiqus.eu) aims to demonstrate a cheap, easy-to-use, performant Quantum Simulator (QS) based on full integration of silicon nitride photonics with silicon electronics. The core objective of EPIQUS is to set a cornerstone technology - demonstrate the first breakthrough device - which will simulate quantum mechanical problems in a compact device operating at ambient temperatures.

Our vision is to develop a Quantum Simulator by bringing onto a unique semiconductor platform the mature silicon microelectronic (CMOS, digital) and the silicon nitride quantum micro-photonics functionalities. Within EPIQUS we will develop a 3D-integrated quantum simulator hardware, where (1) a photonic quantum interference circuit, hosting (1a) scalable entangled photon sources (pumped by a NIR pulsed diode laser to produce on-chip photon pairs via nonlinear four wave mixing), (1b) the state preparation stage and (1c) the 16 qubit reconfigurable quantum interference circuit, will be monolithically integrated on the same Si photonic chip with (2) scalable arrays of single photon avalanche detectors (Silicon SPADs) operating at ~ 850nm and at room temperatures. Around this, our consortium will build an integrated system, in which on the “software level” a quantum algorithm will sustain the quantum simulation results from the hardware. In the latter, a custom Analog chip will control the QS module by managing the pulsed pump laser, phase shifters (needed to reconfigure the QS) and the SPADs in order to actively control the quantum optical circuit. Finally, the output data will be handled by the digital chip to feed the software algorithm. EPIQUS will envision scalability up to 50 qubits using the proposed breakthrough technology.

Project Partner TUW designs the analog control circuits for the quantum chip in advanced CMOS technology in one chip for optimal synchronization of external pump laser and integrated SPAD gating/synchronization on the time scale far below 1ns. These are low-jitter laser driver, heater control circuits for phase shifters, SPAD control circuits and temperature sensor/control of SPADs via a Peltier cooler. One DAC per phase shifter due to mismatch is needed. Design of a buffer amplifier for the DAC outputs.

For the completion of this specific task, the EPIQUS Consortium requires the following activities to be subcontracted using an external service provider.

1. The project will require an R&D development through **specific device simulations** of a high-PDP SPAD before ^{the} 1st fabrication run starts
2. **A first fabrication run** has to produce the ASIC chip in a 0.18 μ m CMOS technology and characterized by TUW.
3. In a redesign (**2nd^{fabrication} run**), the control circuits will be adapted to flip-chip bonding and be optimized.

2. OBJECT OF THE CONTRACT, DURATION AND ESTIMATED VALUE OF THE CONTRACT:

The requested service consists of simulation and manufacturing of electronic control ASIC chips for the activities of the H2020 EPIQUS project (GA No. 899368), as specified below:

- **Simulations**

Simulations of a high-PDP SPAD (Single-Photon Avalanche Diode) device. Process and device simulations for determination of implantation parameters for the avalanche region in order to deplete the thick absorption zone and for determination of the breakdown voltage. Typical parameters of absorption zone should be $>20\mu\text{m}$, $> 500 \text{ Ohm}\cdot\text{cm}$, at 850nm wavelength.

- **Fabrication**

1st Fabrication RUN:

Technology node $\leq 0.18\mu\text{m}$

4 metal layers (4th layer: thick metal)

Wafer split: usual substrate - thick low-doped p- epitaxial layer (thickness $> 20\mu\text{m}$, $> 500 \text{ Ohm}\cdot\text{cm}$) on p+ bulk, $> = 2$ wafers each guaranteed.

High-voltage capability (high isolation capability of MOSFETs towards negative substrate $> 40\text{V}$)

High-voltage MOSFETs (drain-source voltage $> 10\text{V}$)

Chip size: $10 * 10\text{mm}^2 / 20 * 10\text{mm}^2$

2nd Fabrication RUN:

Technology node $\leq 0.18\mu\text{m}$

4 metal layers (4th layer: thick metal)

Wafer split: usual substrate - thick low-doped p- epitaxial layer (thickness > 20µm, > 500 Ohm*cm) on p+ bulk, > = 2 wafers each guaranteed.

High-voltage capability (high isolation capability of MOSFETs towards negative substrate > 40V)

High-voltage MOSFETs (drain-source voltage > 10V)

Chip size: 10 * 10mm² / 20 * 10mm²

- **Duration**

The contract will have a duration of 24 months with effect from the date of signing up to the conclusion of the fabrication of the 2nd RUN.

- **Contract amount:**

The estimated amount for the overall implementation of the simulation and fabrication activities is estimated at € 200,000.00 (VAT exempt pursuant to Article 72, paragraph 1 letter c) of Presidential Decree 633/1972).

3. CONTRACTOR SELECTION CRITERIA:

The tender procedure will be carried out according to the most economically advantageous offer criterion pursuant to art. 16 of PL n.2 of March 9, 2016 and art. 95 of Legislative Decree No. 50 of April 18, 2016.

Each offer will be awarded a maximum of 100 points, divided as follows:

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|---|--------|
| A) TECHNICAL ELEMENTS (technical score) | 90/100 |
| B) ECONOMIC ELEMENTS (economic score) | 10/100 |
| OVERALL SCORE | 100 |

The attribution of the technical score will be defined based on the specifications identified in the previous point.

4. REQUIREMENTS:

In order to participate in the negotiated procedure, competitors must meet the following requirements:

- Absence of grounds for exclusion from participation in tender procedures pursuant to Article 80 of Legislative Decree 50/2016 (art.57 of Directive 2014/24/EU).
- Registration, for above activities, in the register of the Chamber of Commerce, Industry, Crafts and Agriculture, or similar professional or commercial register of another Member State where the Contractor is based.

5. METHOD OF SUBMISSION OF EXPRESSIONS OF INTEREST AND SELECTION OF APPLICANTS:

Expressions of interest must be submitted by completing the online form at <https://www.fbk.eu/it/manifestazione-di-interesse-per-lavori-servizi-e-forniture/> no later than Wednesday, April 7, 2021 at 11.59 pm.

It should be noted that, in the event that only one expression of interest is received, the Foundation - since these are activities related to the execution of research programs with a high technical or scientific content - reserves the right to proceed directly with the supplier deemed suitable pursuant to the provisions of art. 21 paragraph 2 lett. d) and paragraph 4 of Provincial Law n. 23 of July 19, 1990.

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The data provided by bidders will be processed for the only purposes related to the completion of the procedure concerned pursuant to art. 13 of EU Regulation n. 2016/679 (GDPR).

For further information, please write to_gare@fbk.eu.

Officer in charge of the procedure for the contract award: Paola Angeli.

Trento, March 22, 2021

Paola Angeli

Tenders and Contracts Service

(digitally signed)