Polymer based electro-optic PCB motherboard integration with Si_3N_4 chiplets, InP components and electronic ICs enabling affordable photonic modules for THz sensing and quantum computing applications

The POLYNICES project was officially inaugurated with the kick-off meeting that took place on 12th and 13th of January 2023. All the eight (8) members of the consortium were gathered for a two-day productive meeting at the premises of TOPTICA in Munich to analyze POLYNICES's workplan in depth, specify in detail the role of each partner in the project's deployment and define the next actions.

POLYNICES is a research and innovation action that aims to provide a general-purpose photonic integration platform with all the cost, performance, scalability and manufacturability credentials for the next generation photonic modules. More specifically POLYNICES for the first time will spin-coat Fraunhofer's PolyBoard material on PCBs, to realize a low-cost Electro-Optic PCB (EOPCB) motherboard with low-loss single mode waveguides and good HF properties, that will host in properly formed pockets, silicon nitride chiplets, InP components and micro-optical elements for advanced functionalities. POLYNICES takes advantage of LioniX's Si_3N_4 platform with PZT actuators to realize matrices, as well as novel narrow linewidth external cavity lasers in 1×1 cm^2 chiplets with ultra-low power consumption. The grid array arrangement of the chiplets' electrode pads and the use of flip-chip integration on vertical alignment stops will allow passive optical alignment and electrical connection to the EOPCB's electrical pads in one assembly step. Although the chiplets will accommodate different structures for different functionalities, they will all share the same size, optical and electrical interfaces, thus defining standard building blocks, leading to a tremendous customization and scalability potential with minimal effort and cost. Different functionalities can be installed in the motherboard by selecting the chiplets, or the same chiplet can be installed multiple times to scale the circuit. Most importantly, POLYNICES provides a unified approach to photonic integration and packaging, as the electronic ICs are co-packaged on the same EOPCB, greatly reducing packaging costs. On the other hand, the good HF properties of the EOPCB allow THz antennas to be integrated directly on the substrate.

Using the above concepts and building blocks, POLYNICES will develop a fully integrated FMCW THz spectrometer with > 2 THz bandwidth, 8 THz antenna array and beam steering abilities for plastic quality inspection, a 16x16 quantum processor with integrated 780 nm light source and non-linear crystals and a 24x24 quantum processor with integrated squeezed light state source.

POLYNICES technology provides a holistic approach in photonic integration and packaging and can certainly make advanced photonic modules affordable to SMEs.

Funded by the European Union

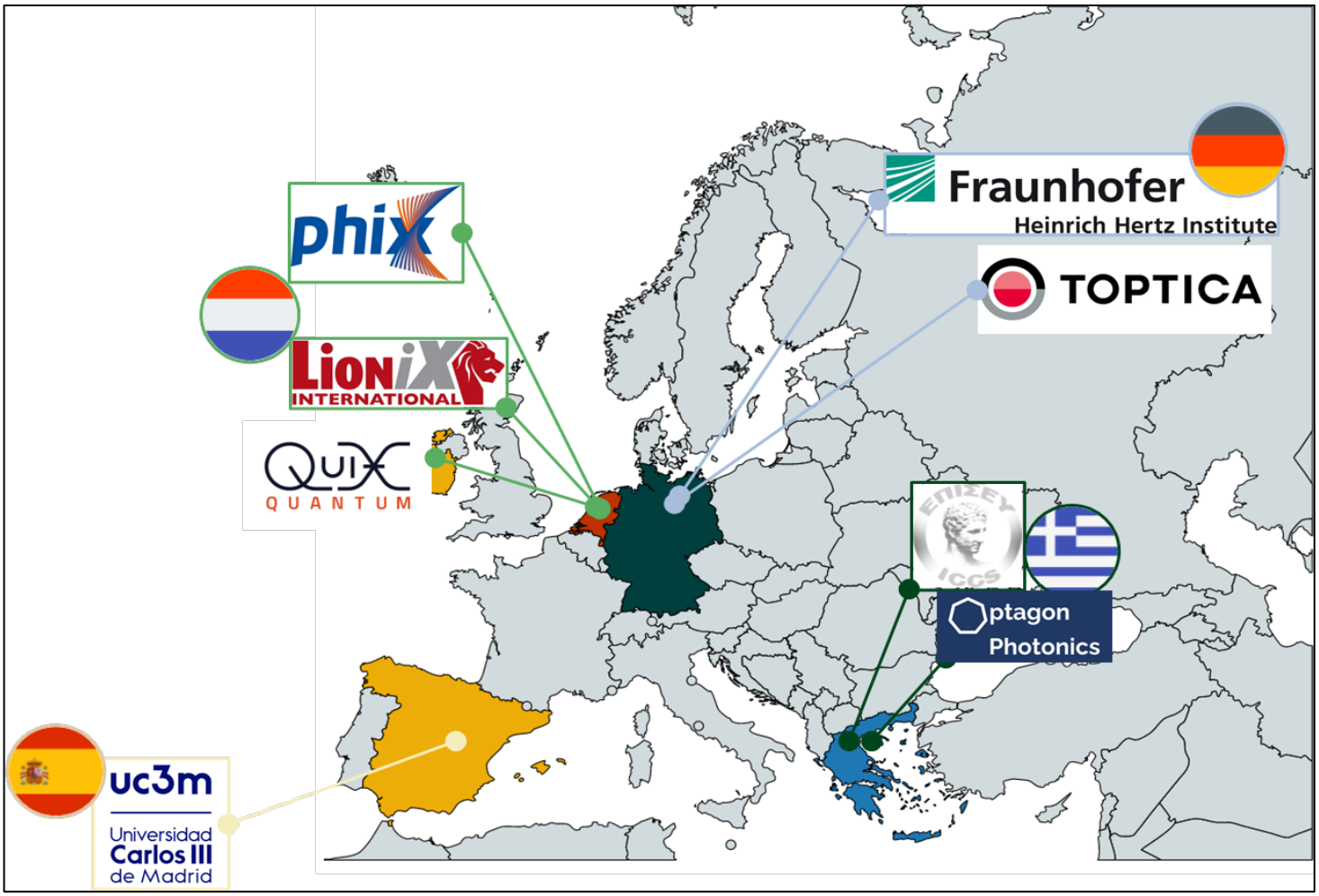
POLYNICES project comprises eight (8) partners from four (4) countries among which:

2 Large companies: TOPTICA Photonics AG (DE) and LioniX International (NL)

3 SMEs: QuiX Quantum BV (NL), PHIX Photonics Assembly (NL), and Optagon Photonics (GR)

1 Industry-oriented research institute: Fraunhofer Heinrich-Hertz Institute (DE)

2 Academic organizations: Universidad Carlos III de Madrid (ES) and the Institute of Communications & Computer Systems of the National technical University of Athens (GR) that coordinates the action.



Project Facts	
	Topic: HORIZON-CL4-2021-DIGITAL EMERGING-01-07: Advanced Photonic Integrated Circuits (Photonics Partnership) **Project No**: 101070549 **Start date**: 1 January 2023 **Duration**: 42 months **Total cost**: 4,963,701.75 E **Beneficiaries**: 8 Partners from 4 countries

For more information, visit POLYNICES website https://horizon-de-polynices.eu/

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