3D Photonic integration platform based on multilayer PolyBoard and TriPleX technology for optical switching and remote sensing and ranging applications

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Promotion video availability

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Executive Summary

We have prepared and made available a video that addresses the general public, and describes the need for 3PEAT technology and the basic approaches of this technology for the development of 3D photonic integration methodology applying on the optical switching and sensing applications.
The video has a total duration of 5 min and 34 sec and is based on the use of 2D and 3D graphics and animations. The video was made available through the main page of 3PEAT website and through the YouTube account of the Photonics Communications Research Laboratory.
The video is also available from the special page of the website called, which will possibly include soon technical videos from the experimental demonstrations of the project.

Keywords: Promotion video, dissemination, general public

List of Acronyms

PIC	Photonic integrated circuit
EC	European Commission
LDV	Laser Doppler Vibrometer
PZT	Zirconium Titanate
ICT	Information and Communications Technology

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1. Introduction

The present document reports on the preparation and the availability of 3PEAT promotion video. In the next paragraphs, we provide a short description about the motivation for its preparation, about its structure and content, and about the ways it will be used for increasing the visibility of the project. Finally, at the end of the present document we append the text that accompanies the video (voice-over).

2. Motivation

The preparation of a video about 3PEAT has been chosen as an efficient way to increase the visibility of the project. The video intends to address the general public and to communicate in a simple and easy way the following points:

The basic features, challenges and requirements of the 3D photonic integration methodologies.

The importance of having a PZT modulators with high frequency values.

The functionality of the basic 3PEAT devices that will serve as the interface between the optical and the electrical parts enabling optical switching and laser Doppler vibrometer-based measurements.

The innovations that 3PEAT introduces at the material and integration level in order to develop a platform that can support in the best possible way the system vision of the project.

The overall impact (scientific, technical, economic, social) that the project may have for the European industry and the European citizens

The basic information about the consortium (organizations and countries of origin).

3. Use of promotion video

The video has a total duration of 5:34 (five minutes and thirty-four seconds) and is based on 2D and 3D graphics. It will be made available to the general public through the project website (http://www.ict-3PEAT.eu) and through the YouTube account of the project.

Going beyond the original idea for preparing just one promotion video and making this video available through the main page of the project website, 3PEAT has additional plans for creating a separate webpage, called video gallery, where videos in additional to the present one will be uploaded in the future. The videos that will follow will have a pure technical character and will present scenes from the experimental procedures and demonstrations that will take place within the framework of the project. Possible demonstrations to this end include the testing of PZT-based phase shifters in TriPleX platform, the operation of the switching modules and the measurement of surface vibrations with the LDV modules.

4. Appendix – Text of the video

Over the last two decades photonic integration has been a story of astounding success in turning the potential of optical technology into technical breakthroughs. However, applications like optical switching or remote sensing remain still at a state of expectation for an integration technology that can help them boom.

What they need is a powerful integration platform that can offer low optical loss, a very broad range of optical functionalities and high integration density in order to facilitate a very large number of processing components on-chip. A kind of platform that is not available today.

3PEAT aims to disrupt this scene, by developing a powerful photonic integration technology with all size, functionality and quality credentials to fill this gap. 3PEAT invests on the combination of the polymer platform from Heinrich Hertz Institute, called PolyBoard, and the silicon-nitride platform from LioniX, called TriPleX, which are both passive, very flexible and feature low loss as motherboards in hybrid Photonic Integrated Circuits.

The project develops a methodology for heterogeneous integration of the polymer material inside small depth etched windows on TriPleX chips and offers the possibility for truly hybrid integration of the two platforms into single-die PICs of ultra-high functionality and compactness.

For the PolyBoard section of these PICs, 3PEAT aims to develop a disruptive methodology for the fabrication of a fully functional 3D photonic integrated structure with multiple waveguiding layers.

For the transition of light from a waveguiding layer to another, 3PEAT offers a solution based on the use of vertical Multimode Interference Couplers (MMIs).

3PEAT works along a number of further key achievements on the PolyBoard and TriPleX platforms, targeting on two main applications: Switching and sensing.

3PEAT aims to develop ultra-compact 3D PICs as the basis for the development of optical switching modules that can replace their electronic counterparts in intra-data center networks, as already proposed by major players like Facebook and Google, and realized by system vendors like the project partner MELLANOX.

The TriPleX part on each PIC will comprise a 16by8 matrix with PZT-based MZIs. The PolyBoard section will comprise eight 1by16 MMIs at multiple layers, enabling the drop of an input stream at each output port without waveguide crossings and with minimum optical loss.

3PEAT is developing a new generation of high speed phase shifters based on the deposition of short thin PZT films on top of Triplex chips with ultra-low power consumption, 100 times lower than thermal phase shifters, allowing to further increase the integration scale.

3PEAT consolidates the development of Optical FlexLines on the PolyBoard platform, long arrays of up to 36 single-mode waveguides, for the interconnection of the active optical switching modules. Based on the same technology 3PEAT also develops a single 3D PolyBoard as the basis for a passive 72by72 Arrayed Waveguide router with 100 GHz channel spacing on the ITU-grid.

In the same time 3PEAT aims to develop a number of multi-functional PICs as the basis for the development of integrated Laser Doppler Vibrometer systems, to meet performance requirements in sensing applications met today only by bulk optical systems. LDV systems are typically employed in high-end applications, where the precise vibration profile of a surface has to be extracted and tiny displacements across the surface have to be resolved.

The Photonic Integrated Circuits comprise both TriPleX and PolyBoard sections and support the generation of laser light with linewidth lower than 1 kHz and output power more than 10milliWatt, including 3 high Q-factor Microring resonators.

The light is modulated with the PZTs developed within the project, at a modulation frequency of 40 MHz. Passing through the 3D multilayer Polyboard structure the light exits through the optical phased array section and performs a 2D scanning of the surface under investigation with a field of view close to 12times12 degrees.

The collected light passes through a high-performance integrated isolator developed within 3PEAT with over than 25dB optical isolation and waveguide-to-waveguide loss lower than 2dB. The light is combined with a local reference beam and is forwarded to the photodetectors, where is detected with heterodyne detection techniques.

By the end of 2021 3PEAT aims to develop two final 3D integrated modules, one for switching and one for sensing applications. By developing this cutting-edge integration platform and the relevant system concepts, 3PEAT aims to place Europe at the forefront of photonic 3D integration research and the forefront of switching and sensing technology, with excellent perspectives for short-term industrialization and commercial impact.

In order to achieve these goals, 3PEAT has set up a consortium consisting of nine partners from Greece, Netherlands, Germany, Israel and Italy.

For more information, please visit the 3PEAT website at www.ict-3peat.eu