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LUCA

LASER AND ULTRASOUND CO-ANALYZER FOR THYROID NODULES

NEWSLETTER

This Issue's CONTENT

Common Dissemination Booster

In mid-2018, the LUCA consortium was invited to participate in a new initiative called Common Dissemination Booster (CDB). This programme is a pilot promoted by the European Commission to encourage projects to come together to identify a common portfolio of results, show them how best to disseminate to end-users, with an eye on exploitation opportunities, boost their dissemination capabilities and maximise the effectiveness and reach of a group of European projects that are aligned regarding their research topic.

The CDB is a brand-new service which is free of charge and available to all, ongoing or closed, European, National, Regional funded Research & Innovation (R&I) projects. For this initiative, LUCA joined forces with two other European projects:

SOLUS: it is a four-year, trans-disciplinary collaborative research project. It brings together highly-experienced engineers, physicists and radiologists to develop an innovative imaging system which combines cutting-edge developments in diffuse optics, ultrasound and shear wave elastography for high-specificity diagnosis of breast cancer.

PAMMOTH: it brings together applied physicists, technology developers, mathematicians, algorithm developers, ultrasound detection experts, laser specialists, epidemiologists and radiologists to work on a new generation system for imaging the breast using both photoacoustics and ultrasound.

The three projects LUCA, PAMMOTH and SOLUS all aim to develop innovative devices combining ultrasonography technologies and photonics, as well as image reconstruction algorithms, for a multi-parametric characterization of thyroid and breast cancer. These technologies will also be validated in a clinical setting

Under the lead of LUCA, the project cluster hired all five services offered by the consultancy agency and is currently undertaking the last of the services putting in practice all the advice and suggestions given by the booster to maximize the impact of the projects. ■

LUCA 5th Consortium Meeting

Tours, France - July 4-5, 2018

From July 4-5 2018, partners of the LUCA consortium gathered in Tours, France, for the 5th General Assembly Meeting to discuss the progress of the project, reviewing the needs for the LUCA device development and proposing possible solutions to advance and take the next steps of completion towards the project.

The coordinator of the project, ICREA Prof. at ICFO Turgut Durduran, welcomed all partners and reported on the current status and progress of the project. All work package leaders gave updates on the different achievements and results as well as the risks they had had to overcome to ensure that the ultimate goals of the project will be reached. Aiming to reach the complete development of the device at the beginning of year 4, early in 2019, and verify that LUCA is ready for clinical validation, there were detailed explanations regarding the development of components and sub-systems, the integration of components into the final demonstrator, the ex vivo phantom validation and standardization as well as validation in real setting.

The consortium also discussed about the project management, the dissemination activities as well as the exploitation agenda, highlighting a survey conducted among different stakeholders to identify the unmet medical needs, which could benefit from the LUCA technology. At the end of the meeting, the LUCA consortium set the goals for the upcoming first tests of the LUCA device in early January 2019, right before its transfer to the hospital IDIBAPS and the commencement of clinical validation. ■

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www.luca-project.eu www.photonics21.org

An interview with Dr. Udo Weigel

CEO and Co-founder of HemoPhotonics

Could you give a brief explanation of the mission and vision of Hemophotonics?

HemoPhotonics was founded in 2013 as spin-off company of ICFO with the mission to develop non-invasive optical technology for biomedical research applications. The vision behind this venture was to pave the way for optics-based diagnostic devices providing new and/or complementary medical information to established diagnostics which will have an important positive impact on the outcome of the management, treatment of and rehabilitation from diseases and critical conditions of the neurovascular system with a signature in the tissue oxygenation and hemodynamics. The field of diagnostic applications include stroke, traumatic brain injury, neonatal neuropathologies, other neurologic injuries and various types of cancers.

What is your main market?

The biomedical research community represents at the present stage our most important customer group. There are two good reasons for this: Research-oriented communities are not only open to adoption of new technology with potential in their field, they are also potential collaborators in studies on the way to support the process for gaining approval from the legal authorities to introduce the optical technology to the medical market on a larger scale.

Why are you betting on this technique and not any other?

The measurement of the thyroid gland with diffuse optics is challenging due to the fact that it has significant overlying tissue and there is a high variability of internal structure and conditions among a patient group. However, it has been recently shown that optical methods can characterize the thyroid and there is potential to differentiate healthy from diseased conditions in this application with a high prevalence in the adult population. Despite having a powerful routine diagnostic method (ultrasound imaging), optical examination can help to improve this differentiation based on the tissue blood flow and oxygenation and as a consequence reduce unnecessary surgeries on the thyroid gland. Another strength of our optical technology is that it can be in general well combined with other diagnostic technologies (e.g. ultrasound imaging), allows to minimize alterations of current routine examinations in order to provide the complementary hemodynamic information. This was the origin of a dedicated European project that brought together several European research institutes (ICFO, Politecnico di Milano) and SMEs to develop for the first time a combined ultrasound optical scanner for thyroid glands and bring it in few years to the medical market. HemoPhotonics had the responsibility for the integration and commercialization.

How would you describe the development of the technique you use and what stage you are currently in?

Near-infrared spectroscopy (NIRS) has been used in science for a while to determine optical parameters of turbid media. Major steps for application to biological problems were made when people became aware of the accessibility of deeper tissue (few cms) in the physiological window. A multitude of illumination and detection configurations in NIRS have been developed to measure tissue constituents and their concentration, mainly oxygen for research on many medical problems. In combination with NIRS measured tissue oxygen saturation, diffuse correlation spectroscopy (DCS) -a specific technology commercialized by HemoPhotonics- offers to derive a tissue oxygen metabolism parameter, which can be considered a tissue health indicator or a biomarker for certain diseases or tissue damage conditions.

How long will it take to integrate the technique in ERs in hospitals? Are there any current devices being tested in hospitals?

Presently, there are already hybrid prototype devices used in intensive care units of hospitals in Barcelona, Copenhagen and Milan for research studies. Feedback from medical end-users is the recognition that providing an indication about tissue health can make an important impact on their work and help to personalise the patient management. Some concern may be shared by end-users related to the complexity of the new devices and the possible impact on the established clinical workflow, which are certainly aspects addressable by good engineering solutions.

What are the main obstacles that you believe you need to overcome to have these devices used in as many hospitals as possible?

Besides the technological challenges and concentrating on the right medical application, a major obstacle is undoubtedly the regulations for medical devices that require important investments over several years to successfully fulfil the approval process.

Can the device be implemented in other markets of interest? What other applications could it have?

The most important impact will be achieved in applications with high prevalence in the population like stroke, neurodegenerative diseases, and cancer. In addition, other very specific fields might also have commercial interests, e.g. vascular and sports medicine, hemodynamic monitoring during surgery. ■

First Tests of the LUCA Device

The LUCA device capability and performance in humans validated for the first time.

After three years of hard and intensive work, the international and interdisciplinary LUCA team of clinical endocrinologists, radiologists, physicists, and engineers, together with industrial partners, have now realized the first LUCA prototype and reached the final phase of their ambitious endeavour: testing the performance of the LUCA device in humans.

The first in vivo human tests were carried out in January 2019 validating the capability and performance of the LUCA prototype as well as the quality of the measurements. To accomplish the next step in the validation process, which is introducing the LUCA device into the routine processes for clinical use, a feasibility study will be conducted on healthy volunteers and patients at the Hospital Clínic de Barcelona. This study will be carried by the LUCA partners at Institut d'Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS) in Barcelona, Spain.

"**With the LUCA prototype ready for clinical testing, we have completed a major milestone in our project. The study in humans will help us to validate and refine the LUCA device. In the end, we expect that LUCA will help to significantly reduce the number of invasive procedures and enable improved clinical decision-making**," says LUCA's Scientific Coordinator Turgut Durduran. ■