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EIBIR projects spearheading medical photonics research and innovation

The European Institute for Biomedical Imaging Research (EIBIR) supports two multi-disciplinary, technology innovation projects leading towards the development of low-cost, point-of-care imaging systems for breast and thyroid screening, building on key enabling photonic technologies.

EUROPEAN INSTITUTE FOR BIOMEDICAL IMAGING RESEARCH

Photonics research has proven a major driver for innovation across several industries, not least in the medical field. Acknowledging this potential, the European Commission and the European Technology Platform Photonics21 formed a Public Private Partnership (PPP) under the EU-funding programme Horizon 2020 to implement a common photonics strategy and tackle Europe's health challenges through photonics research.

Benefitting from this scheme, the EIBIR-supported projects 'Laser and Ultrasound Co-analyser for Thyroid Nodules (LUCA)' and 'Smart Optical and Ultrasound Diagnostics of Breast Cancer (SOLUS)' are developing multi-modal imaging systems for cancer classification. The increased sensitivity and specificity of these novel devices will provide enhanced information to differentiate between benign and malignant tumours to avoid unnecessary biopsies, thereby reducing the socio-economic burden related to cancer.

LUCA

The LUCA project aims to develop and bring to the clinic a state-of-the-art portable device for thyroid cancer screening that enables more specific and more accurate thyroid nodule diagnosis. Increasing the sensitivity and specificity of the screening process is of major importance as current methods lead to a large number of non-diagnostic and/or false positive biopsy results (about 750,000/year in Europe), resulting in about 150,000 unnecessary surgeries in Europe each year. The final LUCA device will combine two photonics systems, near-infrared diffuse correlation spectroscopy (DCS) and time-resolved spectroscopy (TRS), with a clinical ultrasound (US) system and a hand-held probe that permits multi-modal data acquisition for the screening of thyroid nodules for cancer.

Entering its fourth and final year, the LUCA project has successfully finished building a fully functional prototype. Over the past three years, the consortium developed and validated new TRS and DCS components (lasers, detectors, and electronics) and subsystems, as well as a combined optical US probe. The optical system was integrated with the US system and the software and data analysis suites were completed. During the past months, all subsystems have been brought together and integrated into the LUCA demonstrator that will be utilised for the clinical studies during the last year of the project. The studies will focus on upgrades, final tests and the validation of the device in real-world settings. The project results will also be presented during an international innovation conference on biomedical optics for cancer screening and monitoring. To find out more about the LUCA project and conference, visit www.luca-project.eu.

SOLUS

The SOLUS project is developing a new hybrid imaging system that can detect and classify breast lesions in a non-invasive manner. The new system offers a significant improvement in the ability to differentiate between benign and malignant tumours over current imaging systems. Similarly to thyroid nodule screening, invasive procedures, such as biopsies, are currently carried out in an unnecessarily high number of cases. SOLUS can help avoid such unnecessary biopsies in breast cancer screening by improving the characterisation of lesions in the breast.

The innovative, multi-modal tomographic system that SOLUS is developing combines diffuse optical tomography and ultrasound/shear wave elastography to support the in vivo diagnosis of breast cancer. This will achieve a substantially improved in-depth diagnosis of breast lesions with higher specificity, as well as more effective treatment of breast cancer than conventional ultrasound or MRI imaging.

The SOLUS project recently entered its third year, and has completed the development of novel components and subunits for the system prototype. A newly designed, highly sensitive photon detector and high-speed laser drivers were designed, manufactured, and integrated into a smart optode for optical tomography measurements. The smart optode is combined with a regular ultrasound probe to form the multimodal probe of the device.

Additionally, new measurement procedures and phantoms for testing have been developed and validated.

In the coming year, the integration of components and manufacturing will continue, and the project's initial validation efforts will begin in a pilot clinical study at the end of 2019.

To find out more about the SOLUS project visit www.solus-project.eu.

The LUCA and SOLUS projects are featured at the **EIBIR Lounge** in the entrance hall. Here, you can view the projects' latest cutting-edge results. On display are the LUCA multi-modal probe and SOLUS components and subunits. Come by and take a look at these exciting innovations, which are expected to find their way into clinics after the conclusion of the projects.