Amplitude

Developing new multimodal imaging systems to meet unmet clinical needs

PHOTONICS[21]
PHOTONICS PUBLIC PRIVATE PARTNERSHIP

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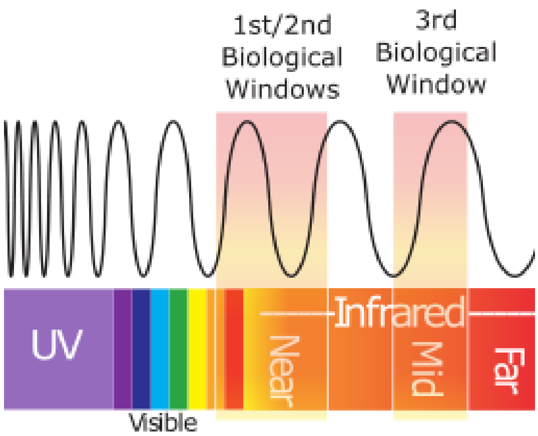
New lasers for imaging in the 3rd biological window

There is growing demand in biomedicine for deeper tissue imaging, and Amplitude partners Tampere University, Aston University and Ampliconyx are currently working to meet this demand.

These partners are developing novel laser technology, combining ultra-short and high repetition rate pulses to produce near infra-red (NIR) light. This technology will enable optical imaging of tissues at depths up to **10 times greater** than is possible with existing technology.



The optical properties of tissue affect the ability of light to penetrate tissue, with optical scattering profoundly affecting the depth light can reach. Unlike visible or UV light, the NIR wavelengths being investigated by Amplitude fall within biological windows where light has much higher penetration. Within these windows, three distinctive wavelength regions have been identified; the first biological window spans the wavelength range from 700 nm to 950 nm, the second biological window between 1000 to 1350, and the third biological window between 1550 to 1870, with each window providing increased transparency with respect to biological matter.

Biological windows 1 and 2 have been extensively investigated using widely available light sources. However, the 3rd biological window, which promises advantages including increased penetration depth and reduced optical scattering is poorly understood, due to a critical lack of suitable and/or affordable light sources that can access the 170nm wavelength range. Amplitude will overcome this barrier and deliver a compact and affordable new laser source, designed for routine imaging in the 3rd biological window.

IMAGING SYSTEM

Guided by our commercial partners FEMTONICS and LEONI, Amplitude is developing an innovative multi-modal imaging platform, that will be implemented in both benchtop microscopes and endoscopic probes, offering breakthrough diagnostics and therapy monitoring possibilities.

The systems will combine multi-photon imaging with deep penetration depth, Raman spectroscopy and fluorescence imaging to offer unparalleled specificity and sensitivity compared to existing imaging systems.

The project

The Amplitude project is funded by the European Commission under the Photonics Public Private Partnership. It is scheduled to last for 4 years and is implemented by a consortium of industrial and academic partners.

The aim of Amplitude is to develop a compact and efficient multi-modal microscopy and endoscopy platform that uses novel ultrafast light sources, to deliver a new concept of label-free, multi-modal imaging.

For further details, visit our website at:

www.amplitude-imaging.com

And follow us at:

LinkedIn: Amplitude-Project

Twitter: @AMPLITUDEProje1

The partners

Coordinator:
Tampere University - Finland

Partners:

Aston University - United Kingdom

CNR - Italy

Amplyconyx - Finland

Femtonics - Hungary

ICFO - Spain

University of Milano Bicocca - Italy

University of Florence - Italy

LEONI - Germany

HC Photonics - Taiwan

Modus Research and Innovation - United Kingdom

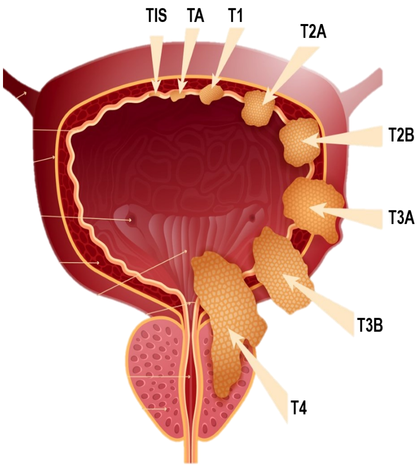
Contact details

Project Office:
amplitude@modus.ltd

Coordinator:
regina.gumenyuk@tuni.fi

The need for improved detection and monitoring of bladder cancer

Urothelial carcinoma is the 11th most diagnosed cancer worldwide. Early diagnosis means patients have a greater chance of survival, but we currently lack accurate and reliable diagnostic tests for the disease.



Urothelial cancer accounts for more than 90% of all bladder cancers, with only a 50% 5-year survival rate. The keys to improved prognosis are early diagnosis, and accurate identification of aggressive disease forms, to ensure prompt and appropriate treatment.

To correctly diagnose and treat urothelial cancers it is essential to understand how deep the tumor penetrates the bladder tissue. The deeper the penetration, the lower the survival rate. But urothelial cancers are especially difficult to spot early, before deep penetration occurs. This is because they have a wide variety of visual presentations, from simple superficial skin reddening, to flat bumpy patches, to solid lumps.

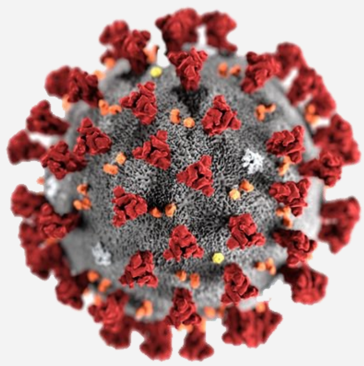
Distinguishing between urothelial tumours is not always possible with conventional imaging techniques. Shallow, very early stage carcinomas are often undistinguishable from advanced deeply penetrating tumours from the surface view. Currently, invasive surgery must be performed to remove suspected tissue samples before they can be diagnosed, delaying the start of treatment. As only a few months of delay can considerably impact patient survival, there is a clear need for new approaches to improve our capacity to detect and treat these cancers.

NEWS

Progress During Coronavirus

Like most research projects, Amplitude has been affected by lockdowns across partner countries. Initial work to establish technical and performance requirements was completed on schedule, but the next steps to develop the laser sources has been delayed several months, as parts are unavailable and researchers have been unable to work. Almost all further project work depends on the novel laser sources, so the entire project is impacted by the delay in delivering this most crucial component.

However, our partners are creatively overcoming these issues. Those whose work is reliant on these delayed laser sources, have procured access to devices called optical parametric oscillators (OPOs). These expensive and cumbersome devices, whilst not suitable for the final Amplitude system, can temporarily fill the role of the delayed laser source, allowing partners to bypass the bottleneck.



Other partners working to identify imaging biomarkers for clinical use have less pressing need for the novel laser sources, and are making steady progress to develop preclinical bladder cancer cell models.