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Developing new multimodal imaging systems

For unmet clinical and research needs

Frequency mixing

A specific feature of the new light sources developed by Amplitude is the ability to frequency double the fundamental wavelength (1700nm), to allow for simultaneous emission in the near infrared region (850nm). This feature is only possible thanks to the development of a unique frequency mixing device by our partner HC Photonics.

HC Photonics (HCP), founded in 2000, specializes in the design, manufacture and applications of Periodically Poled Lithium Niobate (LiNbO₃)/PPLN and Periodically Poled Lithium Tantalate (LiTaO₃)/PPLT. It provides cost-effective and fast turnaround products for full spectrum wavelength conversion applications, ranging from UV to mid-IR and THz. The solution could fit both Continuous Wave (CW) and Pulsed pump lasers, including ultrafast femtosecond (fs), picosecond (ps) and nanosecond (ns), to enable new applications.

For AMPLITUDE, HCP designed and developed a Second Harmonic Generation (SHG) mixer, which further extends the newly developed novel ultrafast light sources. The 40% conversion efficiency supports dual-output, which enables simultaneous emissions at 1700nm and 850nm with the required power, pulse width, spectrum and other key features to enhance the quality of the high-resolution non-linear imaging systems.

Due to dispersion consideration, the mixer was optimized with free space input and output to keep the pulse width. This compact, robust and ready-to-use mixer passed the typical quality standard such as temperature cycling and vibration/shock test. With the design and manufacturing flexibility, the device could be tailored to other wavelengths for further applications in the future.



Current work

Delivery of the 1700nm Laser

Amplitude partner Ampliconix OY will shortly deliver the first Amplitude laser. This laser will go to Femtonics for integration with the multimodal microscope.

Packaging of a second 1700nm laser is also now ongoing. It will soon be sent to ICFO to further explore what is possible in terms of imaging within the 3rd biological window.



The Project

Amplitude aims to develop compact and affordable multimodal microscopy and endoscopy platforms that use novel ultrafast light sources operating at wavelengths around 1700nm, to deliver a new concept of deep tissue, 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

Ampliconix - Finland

Femtonics - Hungary

ICFO - Spain

University of Milano Bicocca - Italy

University of Florence - Italy

WEINERT Industries - Germany

HC Photonics - Taiwan

Modus Research and Innovation - United Kingdom

Contact Details

Project Office:

amplitude@modus.ltd

Coordinator:

regina.gumenyuk@tuni.fi

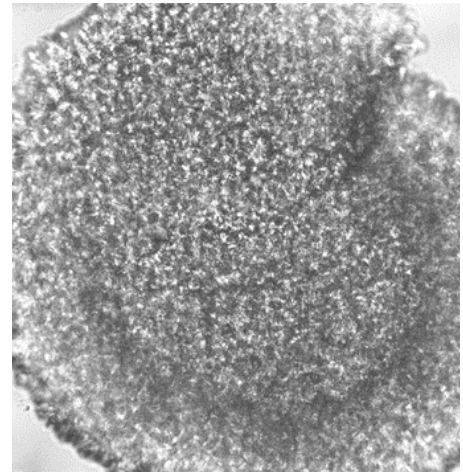
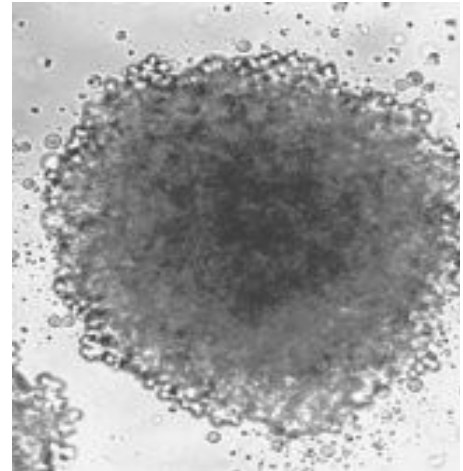
Current Work

Imaging Bladder Cancer Models

Amplitude partners CNR and ICFO have recently begun a series of experiments to image bladder cancer spheroids produced by our partner UNIMIB. These initial studies are designed to evaluate the capacity of the different techniques to discriminate between spheroids representing different grades and stages of bladder cancer.

In these experiments the spheroids will be imaged with the different modalities (3-Photon imaging, 2-Photon imaging, Raman Spectroscopy) that are offered by the imaging systems, resulting in the generation of a spectroscopic, morphologic and functional dataset.

The results of the imaging experiments will be correlated with the results of the detailed metabolomic and transcriptomic data prepared for each of the spheroids. Comparison with this data will allow us to evaluate the reliability of the imaging results and will be a starting point for the identification of possible imaging biomarkers that may be used to detect different grades and stages of bladder cancer.



Current Work

Developing Imaging System Prototypes

Amplitude technology partners Femtonics and WEINERT Fiber Optics GmbH are in the process of manufacturing prototypes of the Amplitude multi-modal microscope and endoscopic probe.

The multi-modal microscope, developed by Femtonics, can be used for multi-photon imaging at 1700nm, autofluorescence imaging at 850nm and Raman imaging at 785nm. With this system it will be possible to capture high resolution images deep within tissue and discriminate metabolic markers and molecular signatures in bladder cancer tissue.

The probe offers the same modalities as the microscope but in a 2.4mm probe. Engineering this compact device has been a particular challenge. However, the first prototypes are now ready for testing and work is underway to develop a second prototype with additional functions.

In the next phase of the project these prototypes will be tested on clinical samples to demonstrate their ability to detect and discriminate bladder cancer.



Future Work

Clinical Proof of Concept

The next phase of the Amplitude project is focused on delivering proof of concept experiments using the prototype microscope and endoscopic probe. Our clinical partner the University of Florence is leading this task. The prototype systems will be installed within the microscopy facilities at the University of Florence and will be used to analyse bladder cancer biopsies to evaluate the capacity of the imaging systems to discriminate the grade and stage of tumours in comparison to conventional histology microscopes.



Other News

Amplitude coordinator, Dr Regina Gumenyuk, was invited to present Amplitude at the Photonics21 Annual General Meeting in Brussels on the 27th April 2023.

Dr Gumenyuk presented the progress of Amplitude, and emerging results, to Photonics21 members with an interest in the use of photonics for medical applications. There was strong engagement during Dr Gumenyuk's session and it led to some interesting discussion around the use of Photonics for bio-medical applications. We look forward to sharing our future results with the Photonics21 community as we move towards demonstration of the Amplitude technology.



In the coming year the Amplitude partners will be presenting at the events below. Come say hello!

- CLEO Europe 2023, 26 – 30 June 2023 Munich, Germany
- Medica 2023, 13–16 November 2023, Dusseldorf, Germany
- UROtech24 – 25–27 January 2024, Vienna, Austria
- SPIE Photonics West, 27 January—1 February 2024, San Francisco, California
- EAU 2024, 5—8 April 2024, Paris France

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www.amplitude-imaging.com

<https://www.linkedin.com/in/Amplitude-Project>