LASER ZENTRUM HANNOVER e.V.

PRESS RELEASE

Detecting cancerous cells faster and more accurately with multimodal imaging

- **Press release**
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Improving the detection of cancerous cells during surgery – this is the goal of the European research project CARMEN. The research institutes Laser Zentrum Hannover e.V. (LZH) from Germany and Multitel asbl from Belgium work together with companies from both countries, JenLab GmbH, DELTATEC, and LaserSpec, to develop a novel, compact and multimodal imaging system. This could even allow the examination of tissue samples directly during surgery.

Laser-based microscopes usually use only one imaging method, such as confocal microscopy, multi-photon microscopy or Anti-Stokes Raman Spectroscopy (CARS). Combining different imaging techniques in a single device makes it possible to obtain faster, more, and more reliable information about tissues and possible diseases. However, the various excitation lasers needed would make a complete system very complex, bulky, and expensive.

One laser source for three microscopy methods

The partners in the CARMEN project want to develop an innovative laser system that generates several excitation wavelengths and different pulse durations. This would allow them to combine CARS with multi-photon and super-resolution STED (Stimulated Emission Depletion) microscopy in one compact device.

Such a complete system would make it possible to examine tissue samples directly after the surgery or even during it. This would help to recognize tumor margins more accurately, for example. Combining three methods allows superimposing several levels of information and thus obtaining a more precise picture of the cells. This makes it easier to distinguish cancerous cells from healthy cells.

Basis: novel tunable ultrashort pulse source

In cooperation with the Belgian research institute Multitel the scientists of the LZH are working on a novel fiber-based ultrashort pulse source for the novel laser system. The source will synchronously pump two optical parametric oscillators from the Belgian company LaserSpec.

The entire laser system will have multiple beam outputs with tunable wavelengths and be able to generate pulses simultaneously in both the femtosecond and picosecond range. This would be the basis for combining the three imaging methods in a multimodal system, which will be designed by JenLab. DELTATEC will develop an extremely fast electronic system, which will control the multimodal system. The electronic system also links the laser system with the scanner technology of the microscope.

Goal: cost-effective, energy-efficient, and small

Due to glass fibers' favourable thermal properties, air-cooling will be sufficient for this novel fiber laser-pumped ultra-short pulse laser. This would make the imaging system cheaper, more energy-efficient and smaller than comparable microscopes with titanium-sapphire lasers, for example.

The range of applications could also be expanded enormously: The system could track drugs and nanoparticles in tissues and cells, or could be used for microscopic testing of the effectiveness of cosmetic products.

About CARMEN

JenLab GmbH (Berlin/Germany), DELTATEC (Ans/Belgium), Multitel asbl, (Mons/Belgium), LaserSpec, (Malonne/Belgium) and Laser Zentrum Hannover e.V., (Hannover/Germany) are involved in the joint research project "CArs and Multiphoton microscopy Enabled" (CARMEN). The project is funded by the German Federal Ministry of Education and Research (BMBF) and the Belgian Wallonian region Public Service (SPW) within the framework of the Eurostars™ funding program of the EUREKA member states and the Horizon 2020 Framework Program of the European Union.

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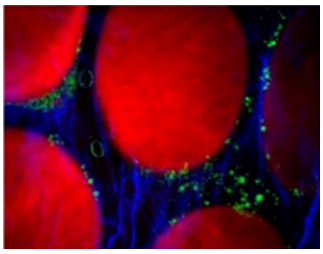
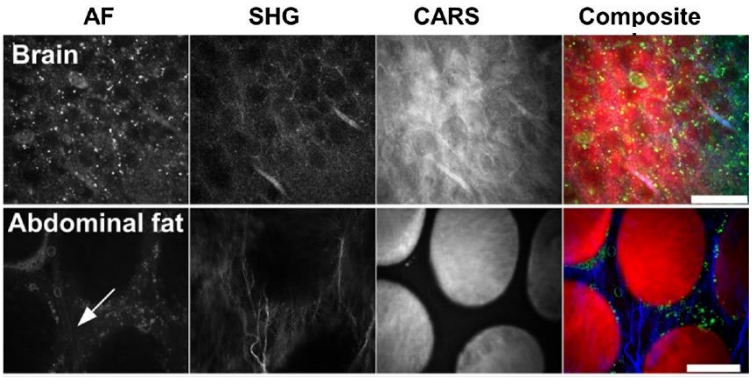
There are two figures for this press release.



Caption Figure 1: In the EU-project CARMEN scientists and companies work on a multimodal imaging system for three imaging methods. (Graphic from J. of Medical Imaging, 2(1), 016003 (2015))



Caption Figure 2: A typical overlay of different imaging methods. Within the EU-project CARMEN scientist and companies work on combining three imaging methods in a novel multimodal imaging system. (Graphic from J. of Medical Imaging, 2(1), 016003 (2015))

Laser Zentrum Hannover e.V. (LZH)

As an independent, non-profit research institute, the Laser Zentrum Hannover e.V. (LZH) stands for innovative research, development and consulting. The LZH is supported by the Niedersachsen Ministry of Economic Affairs, Employment, Transport and Digitalisation and is dedicated to the selfless promotion of applied research in the field of photonics and laser technology. Founded in 1986, over 170 employees are now working for the LZH.

The focus of the LZH lies on the fields of optical components and systems, optical production technologies, and biomedical photonics. Interdisciplinary cooperation between natural scientists and mechanical engineers makes innovative approaches to challenges from the most different areas possible: from the development of components for specific laser systems to process developments for the most diverse laser applications, for example for medical technology or lightweight construction in the automotive sector. Eighteen spin off companies have emerged

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from the LZH up to now. Thus, the LZH has created a strong transfer between fundamental science, application oriented research, and industry.

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