PRESS RELEASE

Fraunhofer IPMS drives innovation in medical and industrial imaging through OASYS project

High-Tech Imaging in Scattering Media for Medical Applications

In the OASYS joint project, *Optoelectronic Sensors for Application-Oriented Systems for Life Sciences and Intelligent Manufacturing*, Fraunhofer Institute for Photonic Microsystems IPMS is collaborating with research and industry partners to develop state-of-the-art optoelectronic sensor technologies. A key focus is given to the flagship project B1, *MEMS-based Imaging in Scattering Media*, which employs novel spatial light modulators (SLMs). These enable precise control of the light phase in highly scattering environments, enabling accurate wavefront correction and high-resolution imaging for biomedical diagnostics.

Fraunhofer IPMS serves as the central research partner in the OASYS project, which aims to develop compact, energy-efficient, and highly integrated optoelectronic sensor components for applications in the life sciences and smart manufacturing. The project concentrates on two main research areas: MEMS-based hyperspectral imaging for industrial and agricultural use, and high-resolution optical techniques for the life sciences, with a particular focus on imaging in scattering media. Both areas are based on pioneering microelectromechanical systems, photonic technologies, and adaptive optics concepts, from which new methods and systems are being developed.

Flagship Project B1 – MEMS-based imaging in scattering media

The flagship project B1, in which Fraunhofer IPMS plays a key role, develops imaging systems for highly scattering media such as biological tissue. In these environments, light scattering, absorption, and reflection by molecules, pigments, or cells cause wavefront distortions, significantly limiting imaging depth and image quality.
To tackle this challenge, Fraunhofer IPMS has developed specialized spatial light modulators (SLMs). Comprised of thousands to millions of individually controllable micro-mirrors, these SLMs operate at high speeds (kHz range) to precisely adjust the light wavefront. This enables targeted correction of optical distortions, allowing high-resolution imaging even in deep, highly scattering tissue layers.
Applications include microscopy and endoscopy for deep tissue imaging. The ultimate goal of the project is to enhance non-invasive diagnostics, such as cancer detection, support treatment monitoring, and advance biomedical research.

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"The challenges in optical imaging are diverse and complex. With this project, our goal is to develop technical solutions and explore the boundaries of what is possible," explains Prof. Dr. Harald Schenk, Managing Director of Fraunhofer IPMS and Professor of Micro- and Nanosystems at BTU Cottbus. "Only the high speed and precision of the microscopic, movable micro-mirrors enable decisive image corrections and increased resolution, expanding diagnostic possibilities in medicine. This makes it possible to examine deep tissue layers for changes that were previously inaccessible to optical methods."

The OASYS joint project, funded with approximately €12.5 million by the German Federal Ministry for Research, Technology, and Space (BMFTR), will run for five years, from 1 September 2023 to 31 August 2028. The project is coordinated by Brandenburg University of Technology Cottbus-Senftenberg (BTU). In addition to Fraunhofer IPMS, the consortium includes the Ferdinand Braun Institute (FBH) and the IHP - Leibniz Institute for Innovative Microelectronics.

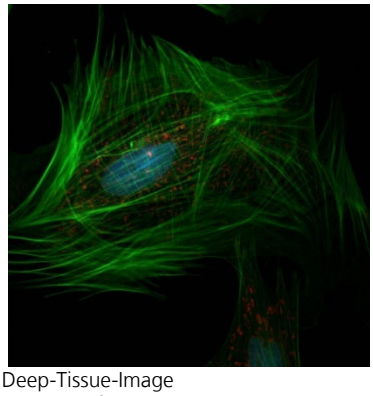
OASYS, and flagship project B1 in particular, exemplify Fraunhofer IPMS's innovative strength in optical systems. "Fully in line with our guiding principle of making novel research results available for innovative applications, we are developing solutions for specific applications in collaboration with partners in the field," concludes Prof. Dr. Harald Schenk.

More information about the OASYS project and its partners can be found at https://oasys-cottbus.com/en/home-english/.

About Fraunhofer IPMS

Fraunhofer IPMS is a leading international research and development service provider for electronic and photonic microsystems in the application fields of Smart Industrial Solutions, Bio and Health, Mobility as well as Green and Sustainable Microelectronics. Research focuses on customer-specific miniaturized sensors and actuators, MEMS systems, microdisplays and integrated circuits as well as wireless and wired data communication. The institute develops systems and components on 200 and 300 mm wafers in their state-of-the-art clean rooms. Services range from consulting and design to process development and pilot series production.

Images



Deep-Tissue-Image
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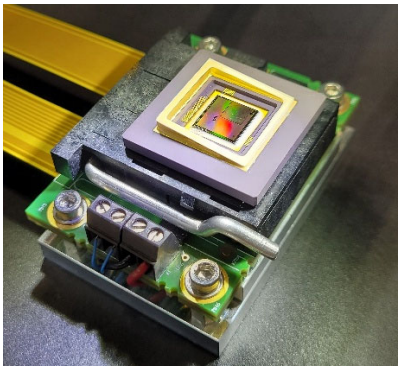

Spatial Light Modulator, SLM
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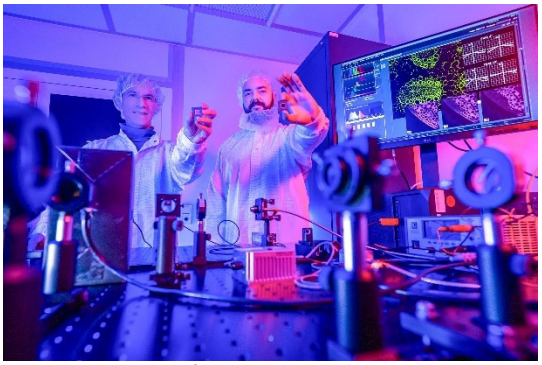

Scientists at Fraunhofer IPMS with a spatial light modulator in the laboratory
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