PHAST-NEWS

WORK PACKAGE 3

By the PHAST-ETN Team

Dear reader, welcome back to PHAST NEWS!

In this issue we present the activities of **Work Package 3 team**, focused on '**Tissue diagnostics and functional monitoring**'.

WHO IS INVOLVED?

Matteo Calvarese (ESR 7), **Aida Amantayeva** (ESR 8), ***Aybuke Calikoglu*** (ESR 9), **Arno Krause** (ESR 10).

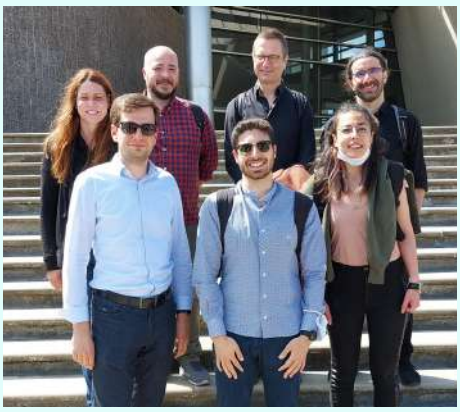
WHAT DO THEY DO?

- Matteo is involved in ***Multimodal nonlinear imaging for clinical diagnosis in combination with laser tissue ablation for selective tissue removal***

-Aida's work deals with ***Micro-optical imaging system for multimodal non-linear endospectroscopy***

- Aybuke's activity is focused on ***Multimodal endo-microscopy for improved in-vivo colorectal cancer diagnosis***

-*Arno* is involved in ***Multimodal intraoperative handheld forward-imaging probe***



WP3 ESR fellows together with some of their Supervisors: Angelika Unterhuber (MUW), Marco Andreana (MUW), Caglar Ataman (ALU-FR), Bernhard Messerschmidt (GRINTECH), Arno Krause, Aybuke Calikoglu, Matteo Calvarese

IN THIS ISSUE

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WP3 ESR FELLOWS

Matteo Calvarese

I am originally from a small town in central Italy, Montepulciano. I received my bachelor's and master's degrees in Engineering Physics from Politecnico di Milano in 2018 and 2020, respectively, with a specialization in Photonics and Nano-optics. I have always been fascinated by the applications of photonics in health science. Therefore, in February 2020, I joined a European project (PROCHIP) working on femtosecond laser micromachining of glass substrates for micro-optics fabrication and its application to integrated microscopy. In early 2021, I continued my work as a fellow at the National Research Council (CNR-IFN), developing integrated optical components for structured illumination microscopy. In September 2021, I joined the spectroscopy and imaging group of the Leibniz-Institut für Photonische Technologien (IPHT) in Jena as a PhD student within the PHAST project. My work focuses on the combination of nonlinear multimodal imaging platforms (microscopes and endoscopic probes) and laser ablation of tissues for intraoperative diagnosis and removal of tumors

Aida Amantayeva

I am from Astana, Kazakhstan. I hold a BSc (2018) in Electrical and Electronic Engineering and a MSc (2020) in Electrical and Computer Engineering from Nazarbayev University (NU), Astana, Kazakhstan.
My interest in photonics began when I attended a photonics course as part of my bachelor's degree and observed for the first time how single-mode fibers (SMF) transfer light. From 2020 to 2022, I worked as a research assistant in a laboratory of Biosensors and Bioinstruments at NU. There, I gained experience with fiber optics, particularly with Fiber Bragg Gratings (FBG). I also tried my hands in interdisciplinary areas involving medicine and engineering. I assisted in the repair of hematology analyzers such as Mindray BC 5800 and Sysmex XP 300 in a local medical service company in Kazakhstan.
In August 2022, I joined the R&D team at GRINTECH in Jena, Germany to participate in the PHAST Ph.D. program and started my research work on the development of a micro-optical imaging system for multimodal non-linear endospectroscopy.

Aybuke Calikoglu

I come from Antalya, a city located on the Mediterranean coast of southwest Turkey. As an electrical and electronics engineer, I earned both my BSc and MSc degrees from Bogazici University in Istanbul. From 2017 to 2021, I worked as an R&D Engineer at GlakoLens, a company dedicated to providing non-invasive monitoring solutions for intraocular pressure. During my time there, I gained extensive interdisciplinary knowledge in healthcare and biomedical applications while collaborating with engineers, academics, ophthalmologists, and chemists.
My interest in the innovative and ever-evolving field of biomedical optics inspired me to explore the field further and led me to join the Laboratory for Micro-optics at the University of Freiburg, Germany within the PHAST-ETN project. My research project is dedicated to improving in-vivo colorectal cancer diagnosis by multimodal endoscopy. To this end, I design and fabricate miniaturized dynamic/reconfigurable optical systems, such as bistable optomechanical devices, that allow switching between multiple optical configurations within multimodal endoscopy probe heads.
Joining PHAST has given me the opportunity to conduct cutting-edge research alongside world-class researchers and access top-quality training opportunities across Europe, allowing me to develop valuable networking connections. Being a part of such a group has inspired me to pursue my research goals with greater dedication and enthusiasm.

Arno Krause

I received my BSc and MSc degrees in physics from the Friedrich-Schiller-University, Jena, Germany, in 2017 and 2019, respectively. There I developed a professional knowledge in the field of optics and photonics, especially in optical coherence tomography. In order to broaden my practical experience also in the field of biomedical optics, I completed my master's thesis at the research and development department of Carl Zeiss AG, Jena, Germany. There I had the opportunity to be involved in the development of a novel ophthalmic OCT setup based on photonic integrated circuits. Afterwards I enrolled as a PhD student at the Center for Medical Physics and Biomedical Engineering at the Medical University of Vienna. In the Leitgeb/Drexler group I am developing multimodal imaging approaches and their translation to endoscopic probes.
PHAST really does live up to the name as an innovative educational network – working together, benefiting from additional training, and sharing a unique time with all members. Great to be part of it.

More info about PHAST-ETN are available at www.phast-eu.unipr.it

MT4 and Engagement Workshop

PHAST-ETN organized an Engagement Workshop at Friedrich Schiller University in Jena, Germany.
Johannes Swartling of SpectraCure AB presented Photodynamic Therapy as a routine clinical method.

The PHAST-ETN MT4 General Meeting hosted an interesting presentation from Luis Arnaut (University of Coimbra) of Laserlab Europe Infrastructure about the activities of the infrastructure and the opportunity provided to all researchers.

The PHAST-ETN MT4 General Meeting at Leibniz Institute of Photonic Technology was a success: we had great presentations from international scientists and from the ESR Fellows. It was a great pleasure to meet again and to acknowledge the intense research and training activities going on, which include strong networking among the project partners.
Thanks to everyone for attending and to Juergen Popp, Gabriele hamm and Michael Schmitt for their great hospitality and kindness!

The PHAST-ETN ESR Fellows were able to witness a live surgery procedure during their Engagement Workshop to the University of Jena

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Çağlar Ataman
UNIVERSITY OF FREIBURG

– What is your role in the PHAST project and why did you decide to be involved in the PHAST?

My primary responsibility in PHAST is to supervise ESR9, Aybüke Çalıkoğlu. Joining the project was a natural progression for us, as we had already been collaborating with several other partners involved in the project. Together, we have developed a wealth of knowledge and expertise in numerous key technology platforms for multimodal endomicroscopy. PHAST provided an excellent opportunity for us to apply this expertise to the training of talented young scientists, who will in the future propagate and improve upon this body of work

- What type of skills should be prioritized for the research activity?

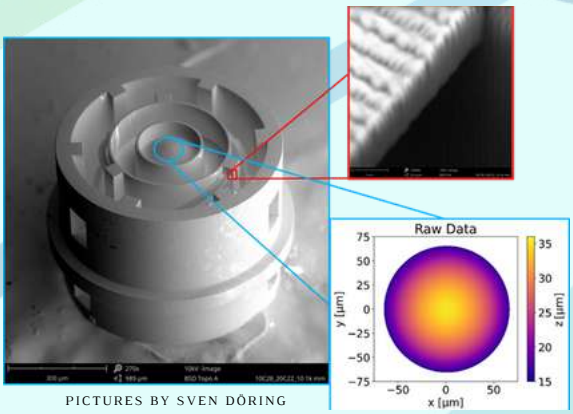
Multimodal medical imaging is a truly interdisciplinary field involving the extraction of diagnostically relevant information on a range of pathologies from the observable results of complex light-tissue interactions using sophisticated, purpose-built instruments. There is so much to unpack in that sentence, right? While it's not reasonable to expect any one person to be an expert in all aspects of the field, having the ability and willingness to learn about all relevant technical aspects is crucial. It's also important not to lose sight of the medical context and the real reasons for using these advanced imaging techniques. In addition, the ability to overcome the many challenges of taking a technical prototype, however effective, into clinical use is becoming increasingly essential. Ultimately, the goal of everything we do in this field is to improve the efficacy of clinical practices through our methods and tools. Therefore, anyone working in this field should have a good understanding of the basic processes and hurdles associated with the clinical translation of new medical technologies.

– Could you tell us your background and why you started working on Multimodal Imaging?

'I am an electrical engineer by training, and have been involved in optical MEMS and micro-optics research for 20 years. Naturally, my entry into multimodal imaging, which happened about 8 years ago, was through the instrumentation research. Endomicroscopy had always been a high-potential application in my scope. Of course, a multi-modal imaging system relies on various technologies, from light sources to data acquisition systems to advanced image processing algorithms. With parallel advances in all these aspects, multimodal endomicroscopy slowly became a concrete alternative to traditional histopathological methods in my view. I eventually was convinced that the technological landscape was ripe to make contributions with real application potential in this field through my expertise. That's how I ended up working in multimodal imaging.

– I.What has been the most difficult aspect of doing research on Multimodal Imaging?

The most challenging aspect of our work is undoubtedly clinical translation, from two different but related perspectives. If your ultimate goal is for the fruits of your research to actually have a positive impact on people's lives, you need to clearly demonstrate that what you are developing actually works. This means, of course, conducting clinical trials with prototype devices. To ensure patient safety, regulators hold prototype systems to very similar standards as commercial medical products. As a result, in addition to our scientific work, we have to devote considerable engineering and bureaucratic effort to regulatory compliance. Doing this in a university research group has been a real challenge. These hurdles increase with the complexity of the specific methods and tools we develop. On the other hand, it is natural for a researcher to choose the most interesting and sometimes challenging problems to work on. Finding a balance between the thrill of building more sophisticated tools and the reassurance of finding the most "sensible" path to clinical translation can be difficult. I must confess that I occasionally tend to lean towards the former.



PICTURES BY SVEN DÖRING

– In your perspective, what is the future of multimodal imaging?

There is a growing awareness among both the public and governments in highly developed countries of the challenges posed by an ageing society and the burden this places on healthcare systems. As a result, there is a real interest in developing new technologies that can assist in preventive medicine and screening, particularly in the fight against cancer. Multimodal imaging has significant potential to achieve these goals. Over the past decade, there has been considerable investment in research into multimodal imaging and I expect this trend to continue. However, it is imperative that we demonstrate real progress for the resources we invest in our research, and I expect the field in general to place greater emphasis on clinical translation in the coming years.

Bernhard Messerschmidt
GRINTECH

- What is your role in the PHAST project, and why did you decide to get involved in PHAST Project?

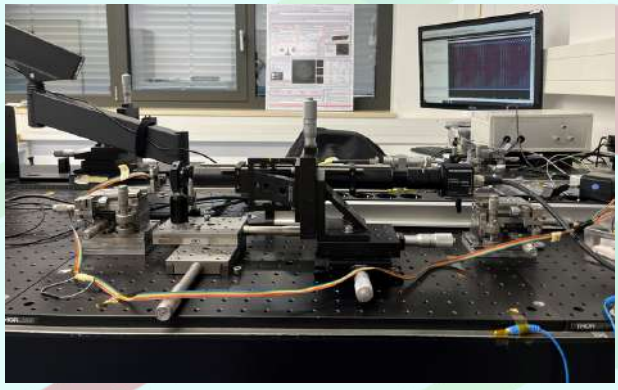
I am the technical supervisor of Aida Amantayeva, our ESR8 at GRINTECH. I got involved in the PHAST project by Prof. Michael Schmitt of Friedrich-Schiller-University in Jena, who asked me to participate. We are in close collaboration in several developments for multimodal endoscopy, and there seemed to be a close match with the goals of PHAST.

-What type of skills should be prioritized for the research activity?

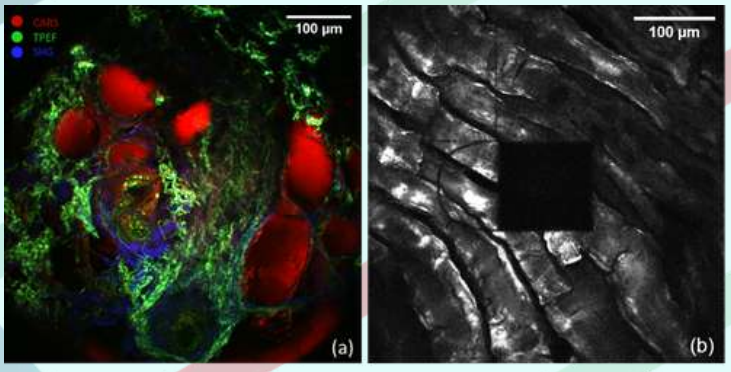
Independent self-motivated research activity should be the goal for the project. Reading the relevant literature about the state of the art in the field in appropriate journals is also important to understand the context of the research. The project is challenging in the respect that it covers mechanical and electrical engineering, micro-optics, micro-technologies, biology, and medicine. So, it is very interdisciplinary.

-Could you tell us your background and why you started working on Multimodal Imaging?

My original background is physics with a specialization in optics. But using optical technology to improve medical diagnostics and treatment is a very motivating field to be involved.



micro-electro-mechanical systems



Multimodal imaging

-What has been the most difficult aspect of doing research on Multimodal Imaging?

Understanding the needs in medicine and biology and translating them into feasible technological approaches is the most challenging part. The technologies involved, such as miniature optical scanners and high NA micro-optics, short-pulsed lasers, etc. are quite complex and not straightforward to implement in a medical setting

-In your perspective, what is the future of multimodal imaging?

It will help to identify cancer diseases in an early stage to improve patient survival times significantly. It will be a standard technology in the everyday practice of hospitals and procedures hopefully will be paid by health insurance companies. But, this is a long way to go.

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