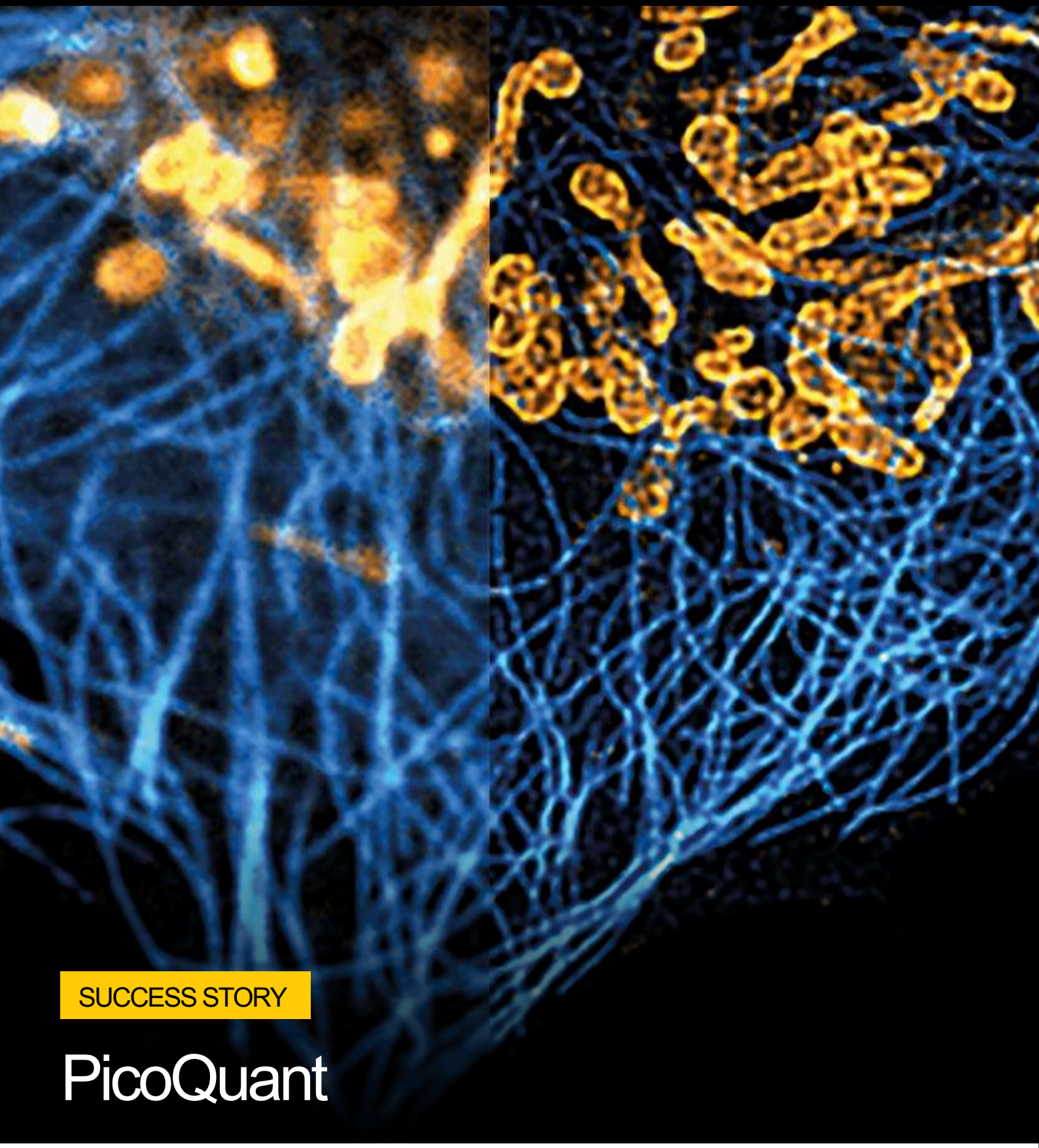
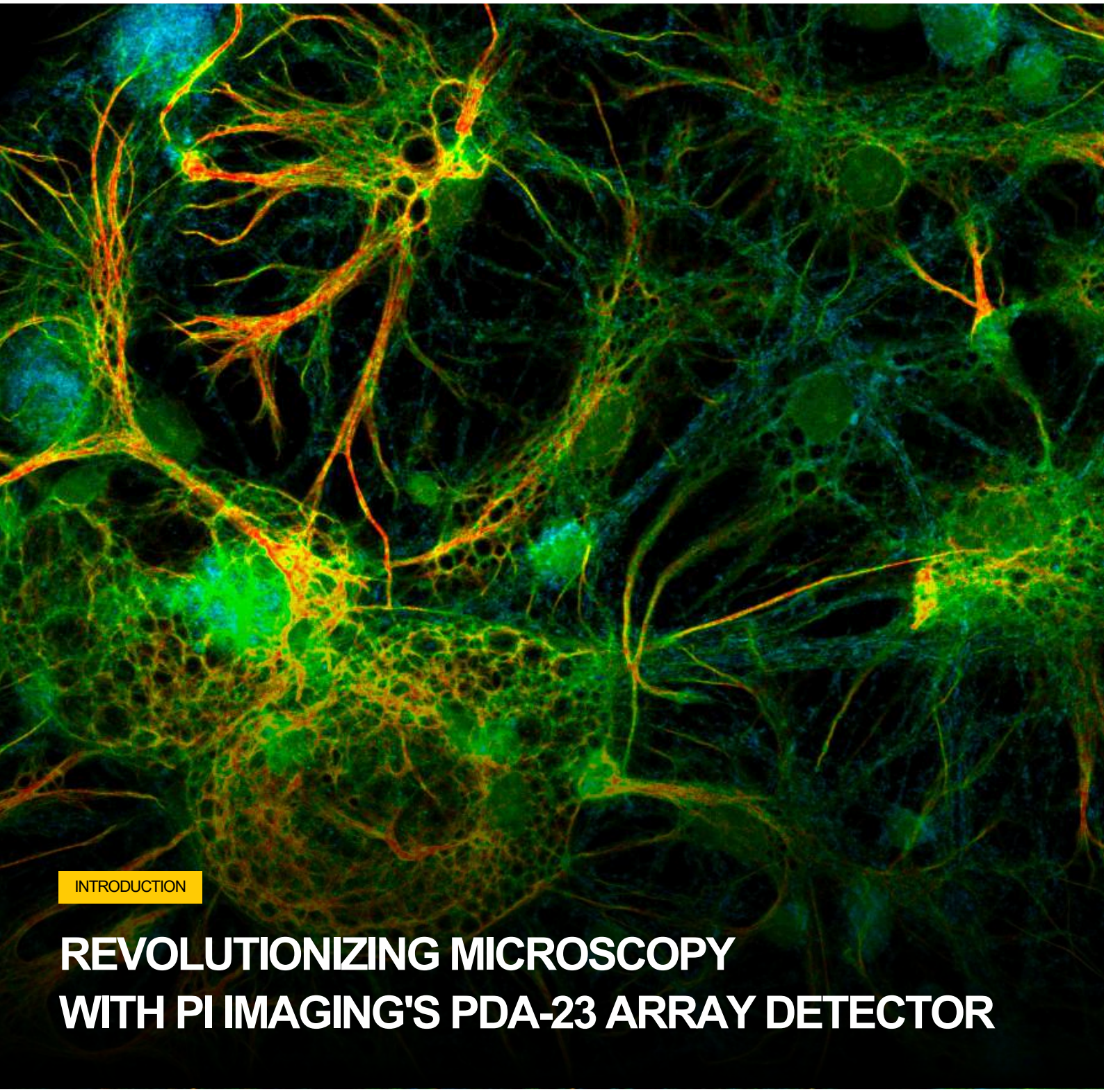
pi imaging



SUCCESS STORY

PicoQuant

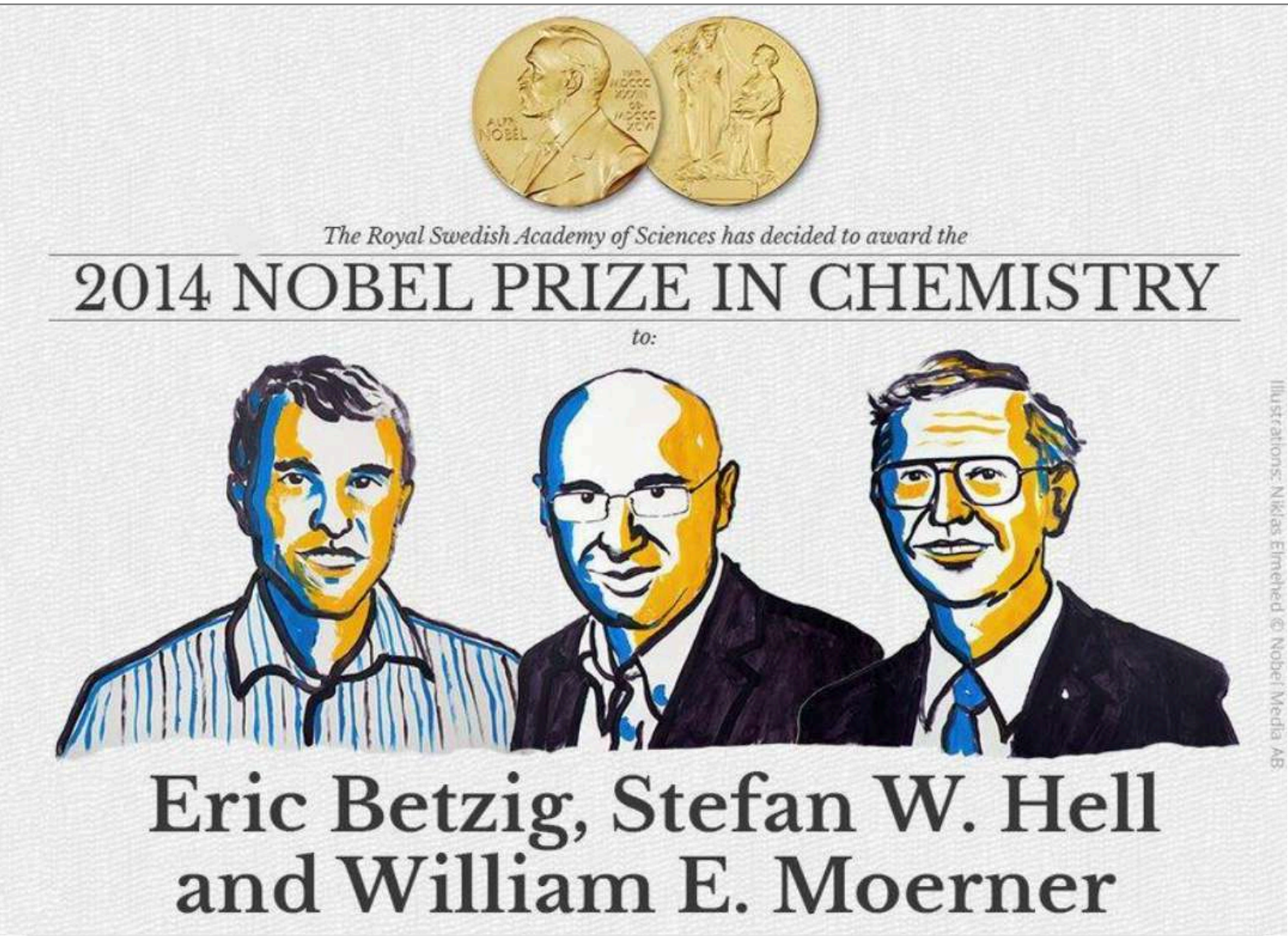
UNLEASHING UNPRECEDENTED RESOLUTION AND CONTRAST IN CONFOCAL FLIM WITH THE PDA-23 SPAD ARRAY



INTRODUCTION

REVOLUTIONIZING MICROSCOPY WITH PI IMAGING'S PDA-23 ARRAY DETECTOR

In the ever-evolving landscape of microscopy, researchers are constantly seeking new tools to unlock deeper insights into cellular dynamics and molecular interactions. PicoQuant, a leader in state-of-the-art scientific instrumentation, was looking for a solution to enhance the performance of their new microscope. Pi Imaging, a leader in advanced SPAD array and image sensor solutions, has answered this call with the introduction of the groundbreaking PDA-23 Array Detector. This success story showcases how the PDA-23 transforms time-resolved confocal microscopy, enabling researchers to achieve unprecedented resolution and contrast in fluorescence lifetime imaging.



BACKGROUND

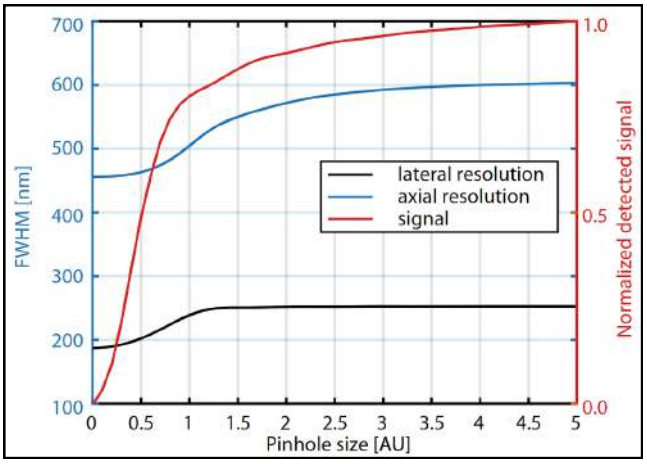
THE GROWING NEED FOR ADVANCED IMAGING TOOLS

The need for super-resolved microscopy imaging beyond the diffraction limit has grown rapidly since the Nobel Prize in Chemistry 2014, awarded for bypassing the aforementioned limit. The microscopes can now delve into the nanoworld, with resolutions below 200 nanometers, observing individual molecules, viruses and proteins. Recognizing this demand, Pi Imaging introduced the PDA-23 Array Detector, targeted at the super resolution microscopy technique termed Image Scanning Microscopy (ISM). Designed to seamlessly integrate with the renowned Luminosa microscope from PicoQuant, PDA-23 enables combining ISM with functional imaging by using Fluorescence Lifetime Imaging (FLIM). ISM and FLIM combined enable exploration of complex cellular and molecular processes, without any changes to the traditional sample preparation techniques.

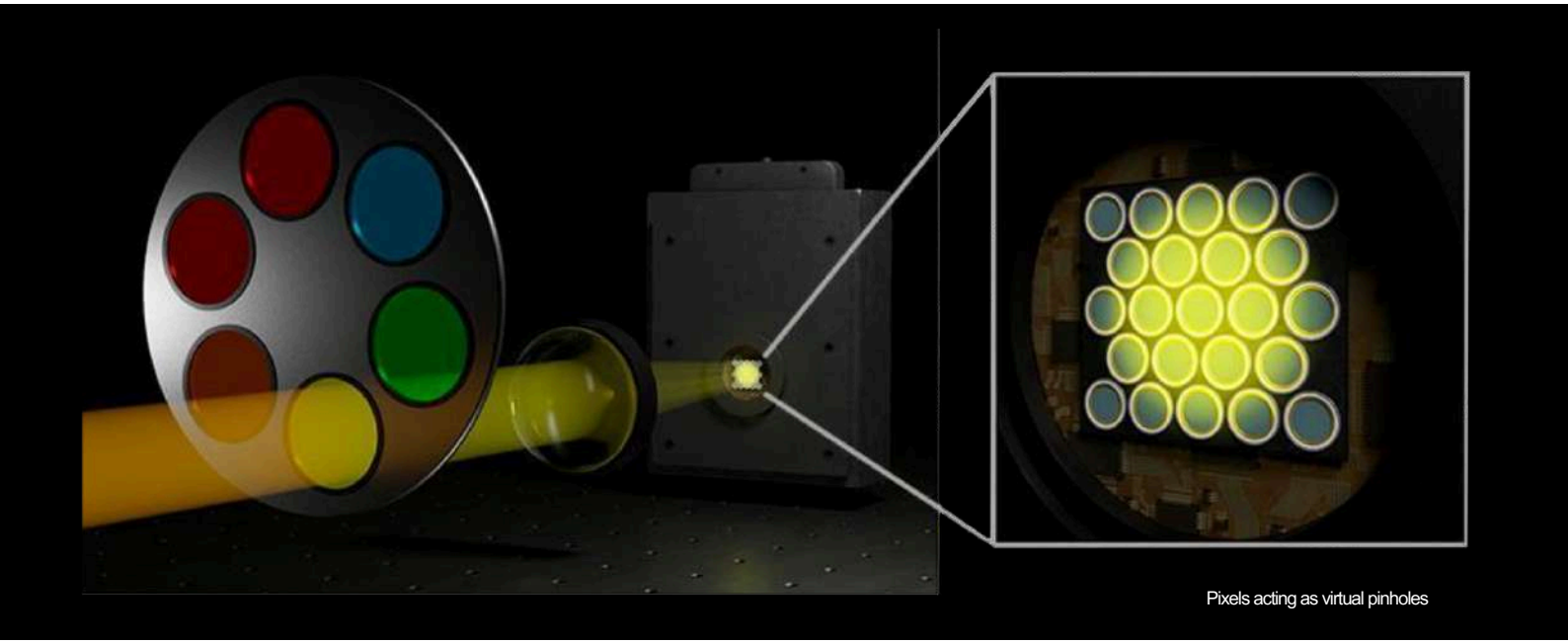
THE CHALLANGE

OVERCOMING LIMITATIONS IN TRADITIONAL CONFOCAL MICROSCOPY

Confocal microscopes are the most used high-end microscopes in the world. However, traditional confocal microscopes have a fundamental trade-off between image resolution (small pinhole) and signal intensity (large pinhole). Researchers faced challenges in achieving high spatial resolution without suffering from low signal-to-noise ratio.

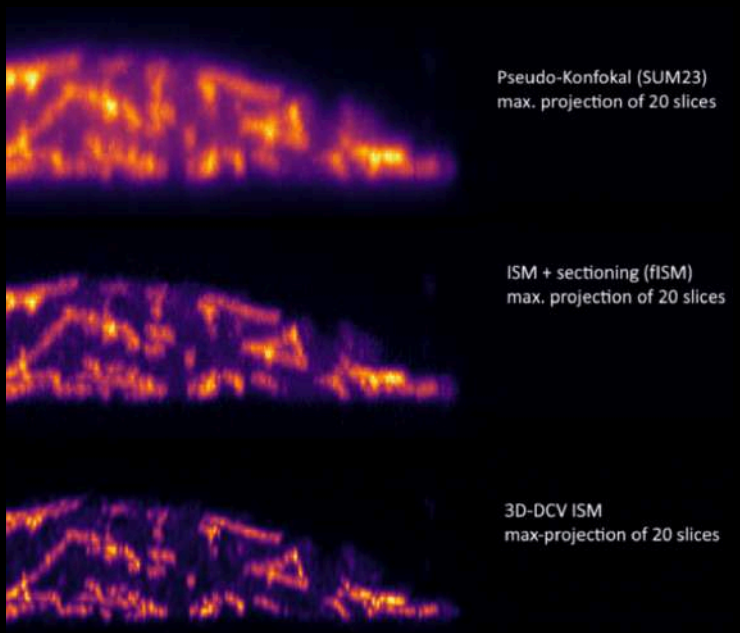


A fundamental tradeoff between image sharpness (resolution) versus signal intensity. Image extracted from Egner et at. “STED microscopy”, DOI:10.1007/978-3-030-34413-9_1.

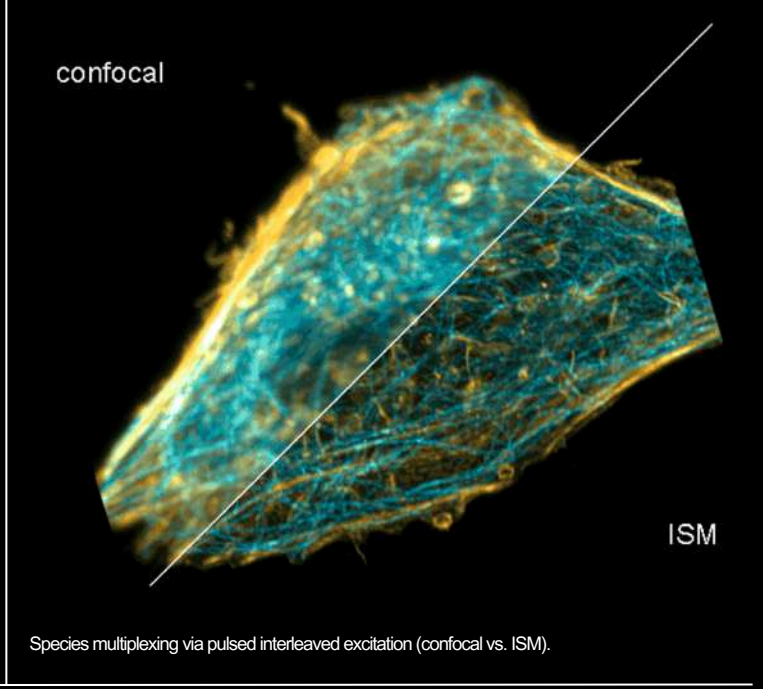


Pixels acting as virtual pinholes

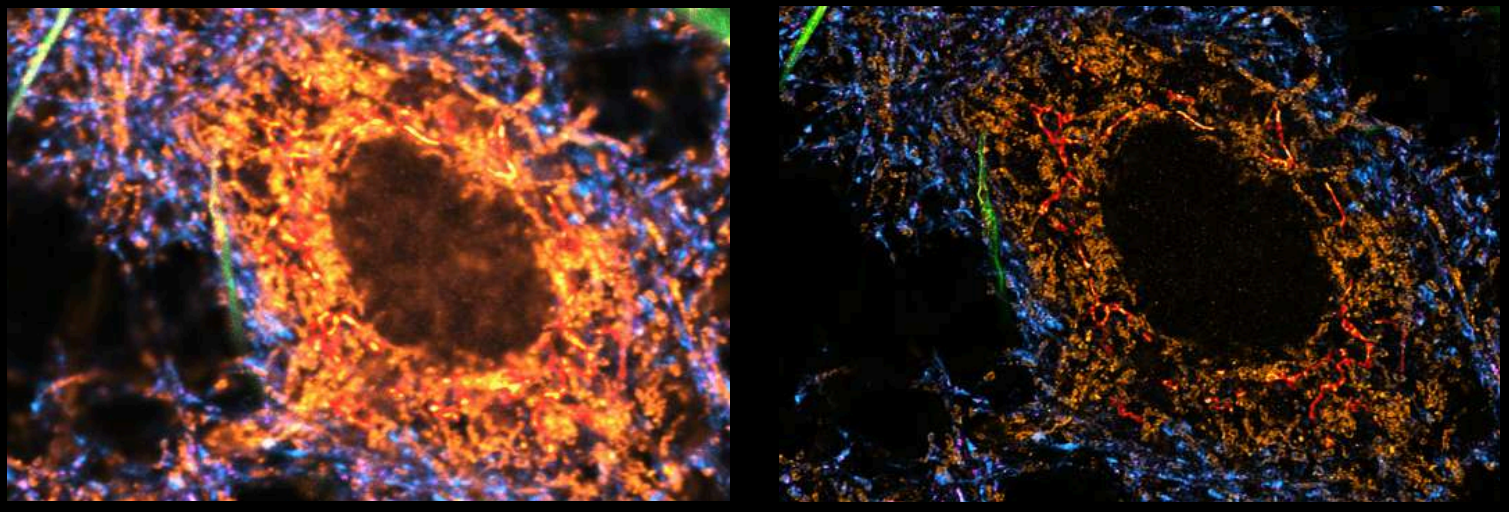
Pixels of the SPAD array now act as virtual pinholes while collecting all of the fluorescence signal, enabling us to solve the fundamental tradeoff between image sharpness (resolution) and image intensity, achieving lateral super resolutions down to 155 nm with high intensity. The high signal collection efficiency can either be used to increase the speed of FLIM acquisition, or to reduce the excitation laser power for gentle live cell imaging.



Improved sectioning / axial resolution in addition to improved lateral resolution.



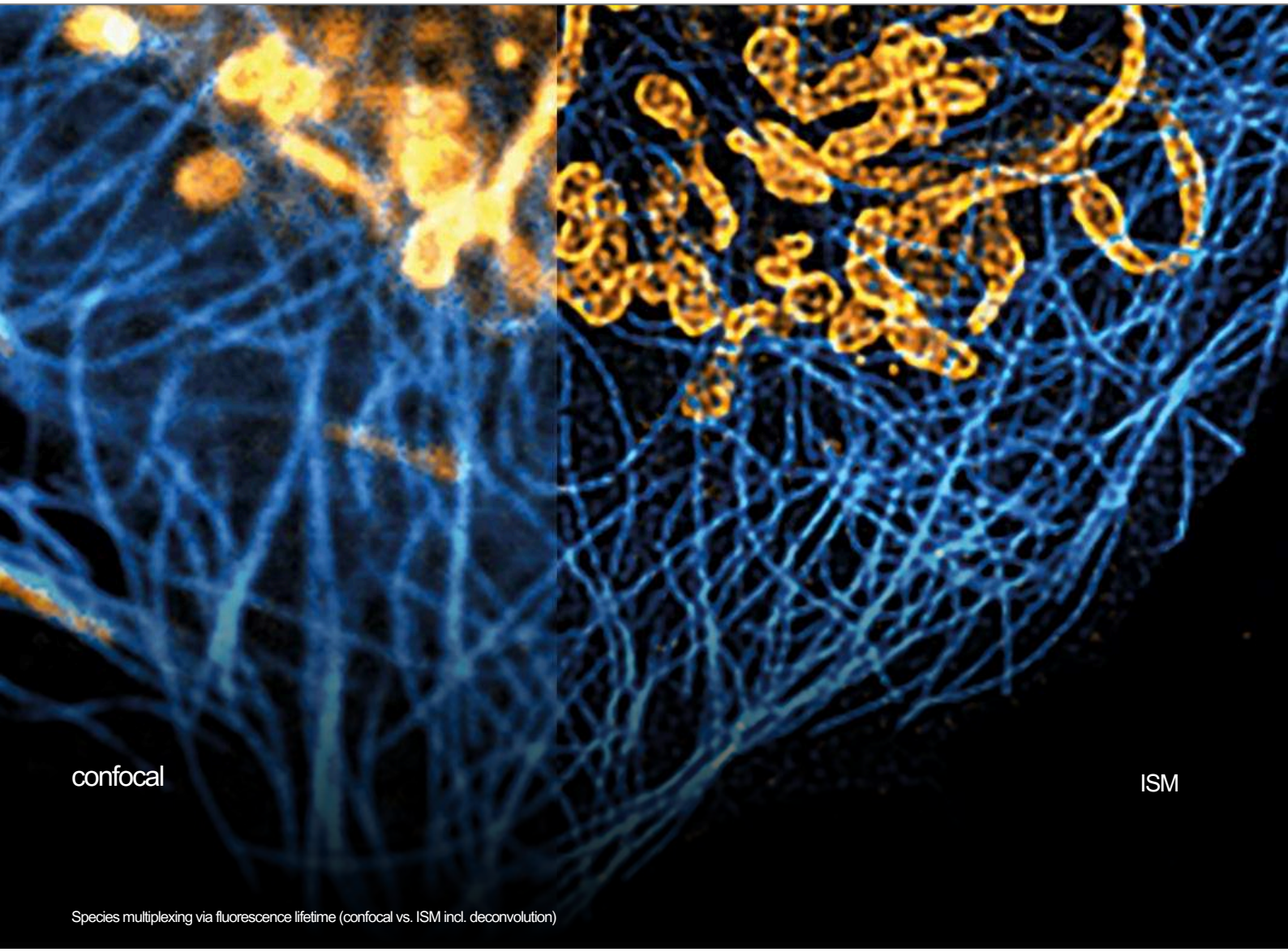
Species multiplexing via pulsed interleaved excitation (confocal vs. ISM).



Species multiplexing via a combination of fluorescence lifetime and pulsed interleaved excitation (PIE, 3 excitation lasers, confocal vs. ISM incl. deconvolution).

The seamless integration of the PDA-23 with the Luminosa microscope and PicoQuant's MultiHarp 160 TCSPC module ensures high data quality and reliability. The dedicated ISM-FLIM software workflow provides a hassle-free operation, with a daily auto-alignment process that makes the PDA-23 add-on a robust tool for any research setting.

PDA-23.



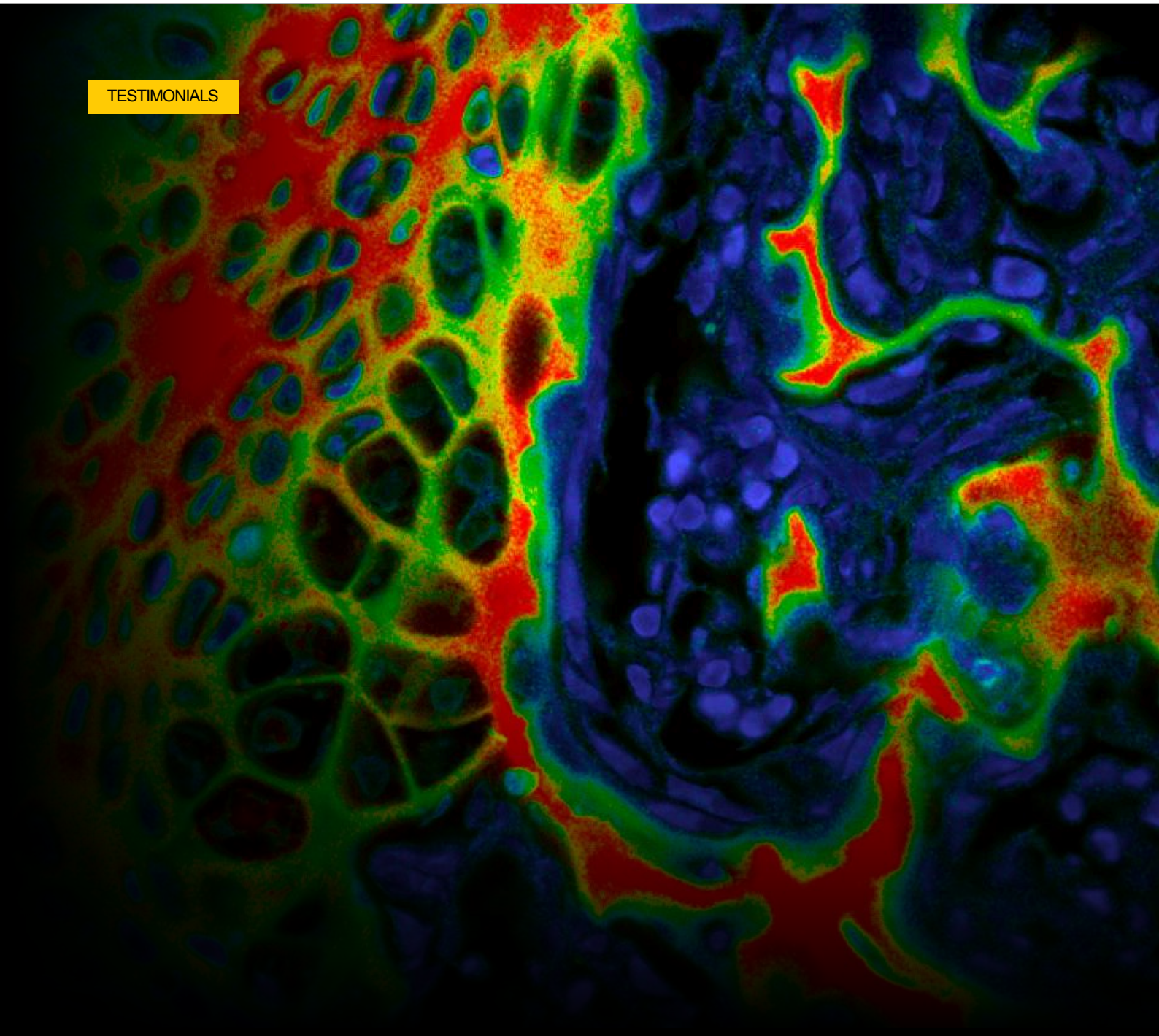
Species multiplexing via fluorescence lifetime (confocal vs. ISM incl. deconvolution)

RESULTS

TRANSFORMATIVE ADVANCEMENTS IN MICROSCOPY

The PDA-23's introduction revolutionized time-resolved confocal microscopy, delivering significant advancements in imaging capabilities. Researchers experienced:

- Enhanced spatial resolution up to 30% without changing fluorophores.
- Improved contrast, enabling detailed visualization of cellular structures.
- Reliable and high-quality data, thanks to the seamless integration with Luminosa and MultiHarp 160 TCSPC module.
- Streamlined operation with the dedicated ISM-FLIM software workflow.
- Customizable platform for innovation, allowing adaptation of new time-resolved methodologies.

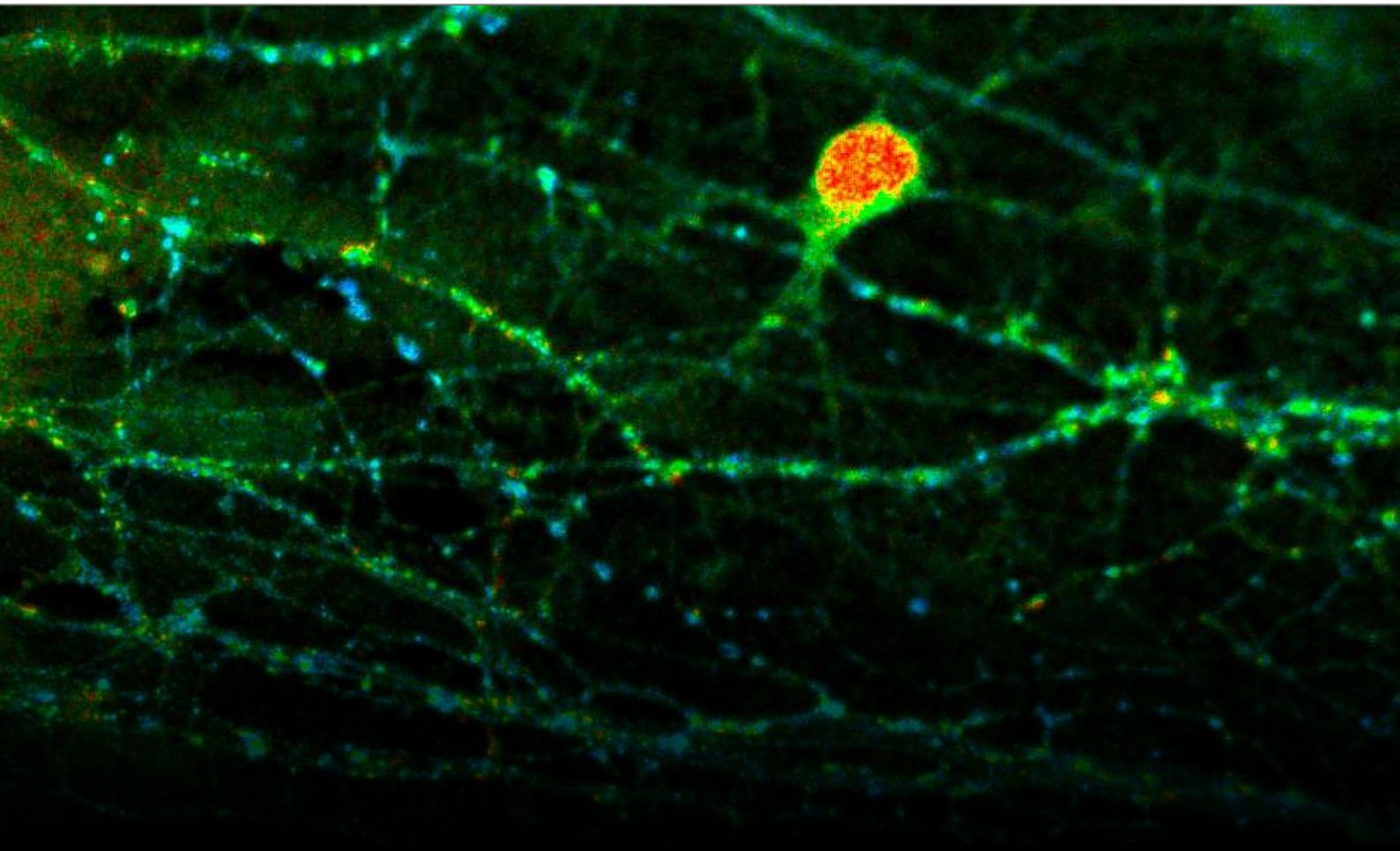


TESTIMONIALS

“We believe that the integration of the PDA-23 with our new Luminosa microscope is more than just a technological advancement. It shows our commitment to pushing boundaries of scientific discovery and represents a significant leap forward in understanding complex cellular and molecular processes with the use of time-resolved confocal microscopy.”

RAINER ERDMANN

CEO at PicoQuant

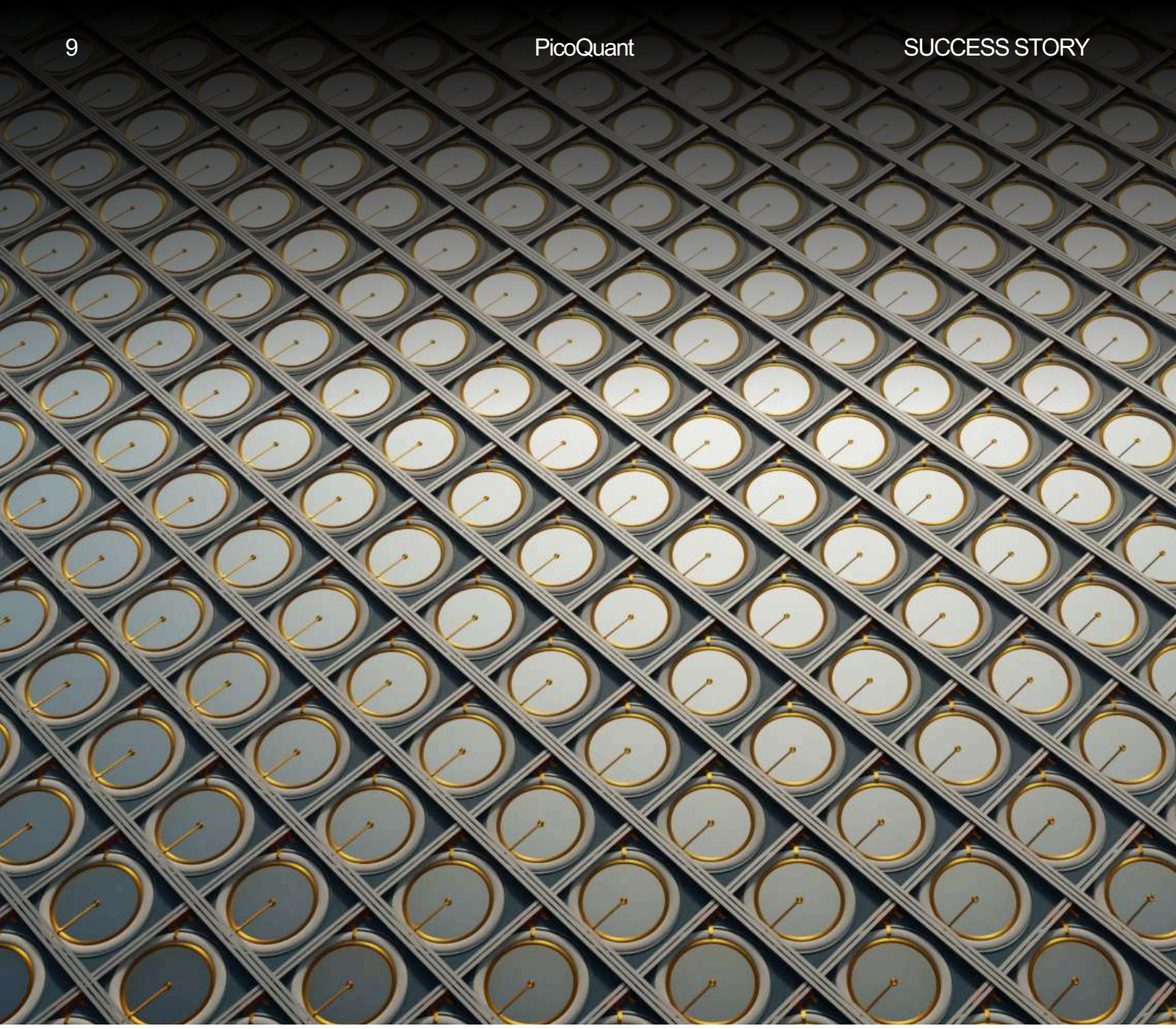


"Researchers can focus on their experiments, confident that the system will deliver consistent, high-quality results day after day. The combination of our SPAD array detectors and PicoQuant's TCSPC technology ensures unparalleled precision, with a timing resolution of 100 ps and best-in-class dark counts.

The PDA-23 is more than just a high-performance detector. It's a transformative tool that empowers researchers to explore the unknown, to uncover new insights, and to drive scientific progress in ways we've yet to imagine. By putting the power of cutting-edge technology in the hands of the research community, we're opening up new frontiers in the study of cellular dynamics and molecular interactions."

DR. MICHEL ANTOLOVIC

CEO at Pi Imaging



ABOUT

PI IMAGING

Pi Imaging Technology is a leading innovator in the field of optical imaging, revolutionizing light detection through our SPAD technology. Our cutting-edge solutions offer unparalleled sensitivity and minimal noise, setting new industry standards. Founded on over two decades of research at TU Delft (Netherlands) and EPFL (Switzerland), we empower partners to introduce innovative products, enabling advancements in life sciences, quantum information, and beyond. With a focus on innovation and excellence, we continue to push the boundaries of what is possible in optical imaging, serving research and industrial communities worldwide.

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