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ENABLING THE SPAD REVOLUTION



SPAD 512

A high-performance single-photon camera

DESCRIPTION

SPAD 512 is a photon-counting camera for high-speed imaging. The core of the camera is a SPAD image sensor with 512×512 pixels. Photon counting with up to 100’000 frames per second and zero readout noise is achieved. The global shutter enables nanosecond exposures with exposure shifts of 17 ps. The image sensor is optimized for low noise, with a typical dark count rate of less than 25 cps.

KEY BENEFITS

Widefield camera

Released in 2021, SPAD 512 is the first commercially available SPAD camera in the world. The camera features a 512×512 SPAD image sensor for both photon-counting and photon-time gating applications.

Wide detection spectra and low noise

Our single-photon detectors are fabricated in a state-of-the-art CMOS process and offer an ultra-low dark count rate of less than 25 cps. Microlenses enhance the sensor's detection efficiency.

Time gating

The sensor features time gating to study time varying signals of interest, such as FLIM. This makes it a perfect addition to any widefield FLIM microscopy setup.

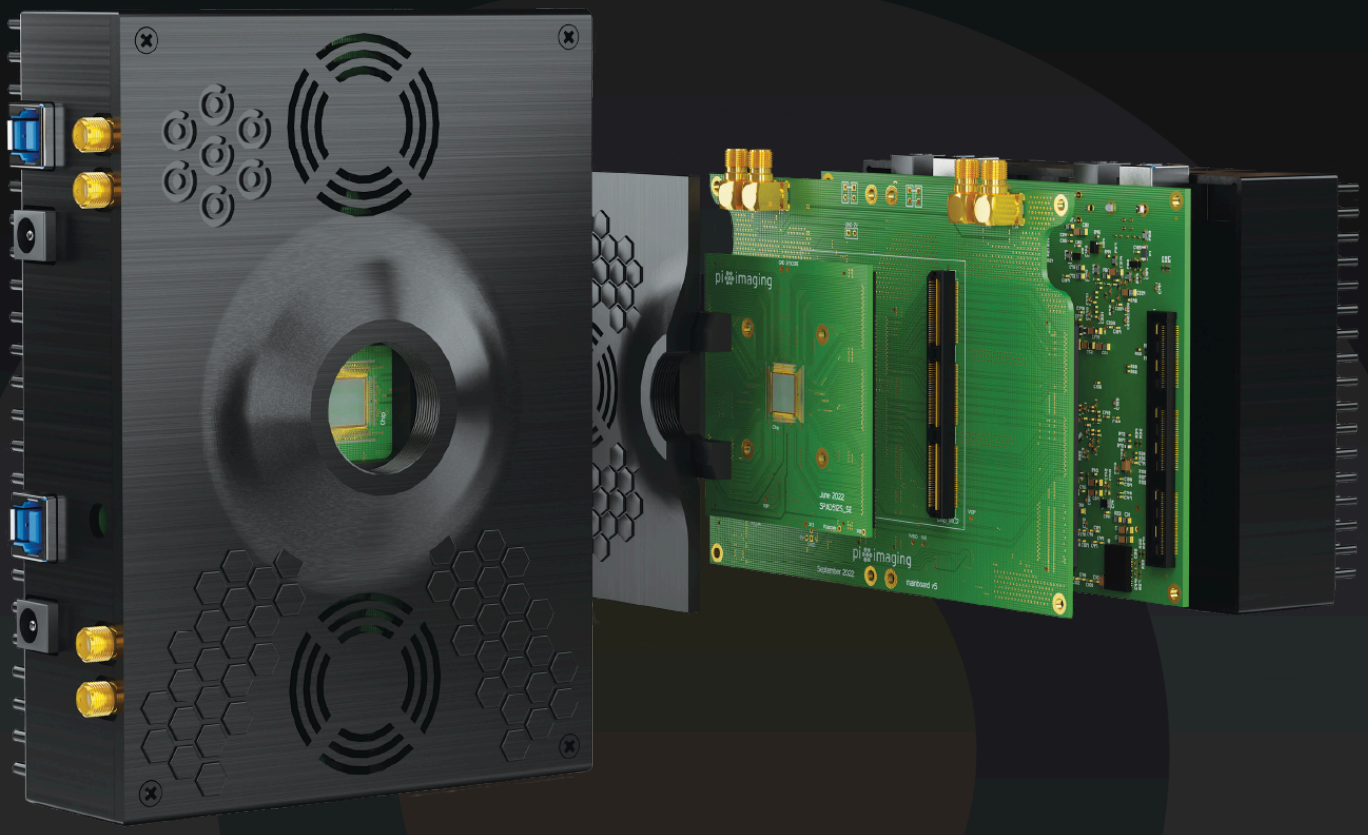
Plug and Play

The system requires just a 5V power adapter and two USB3 cables to run. For full flexibility, 2 additional control lines can be connected to the SMA connectors.

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APPLICATIONS

Widefield fluorescence lifetime imaging (FLIM)

SPAD cameras increase the overall photon throughput compared to scanned detection systems from the typical 10 Mcounts per second to 26 Gcounts per second.

Why SPAD 512?

- Simplify FLIM setup
- Increase FLIM frame rate

High-speed imaging

SPAD cameras enable high frame rates with global shutter at zero readout noise.

Why SPAD 512?

- Image fast phenomena in low light conditions
- Image light-in-flight

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TECHNICAL SPECIFICATIONS

SPAD 512	
Array dimensions	512 x 512 pixels
Pixel pitch	16.38 µm
Wavelength range	400 to 900 nm
Peak photon detection probability (PDP)	50% at 520 nm
Frame rate (max.)	• 100'000 fps at 1-bit for 1s (buffered) • 5'000 fps at 4-bit semi-continuous • 400 fps at 8-bit continuous
Maximal pixel count rate with exposure modulation	167 Mcps (400 Mcps with response linearization)
Maximal pixel count rate without exposure modulation	100 kcps (240 kcps with response linearization)
Minimum gate width	6 ns
Minimum gate shift	17 ps
Optical mount	C-mount

PARAMETER AT ROOM TEMPERATURE	MIN.	TYP.	MAX.
Median DCR	-	25 cps	50 cps
Percentage of pixels with >1 kcps	-	1.5%	2.5%
Fill factor with microlenses for collimated light	50%	70%	100%
Exposure rise / fall time (20 / 80%)	-	120 ps / 350 ps	200 ps / 400 ps

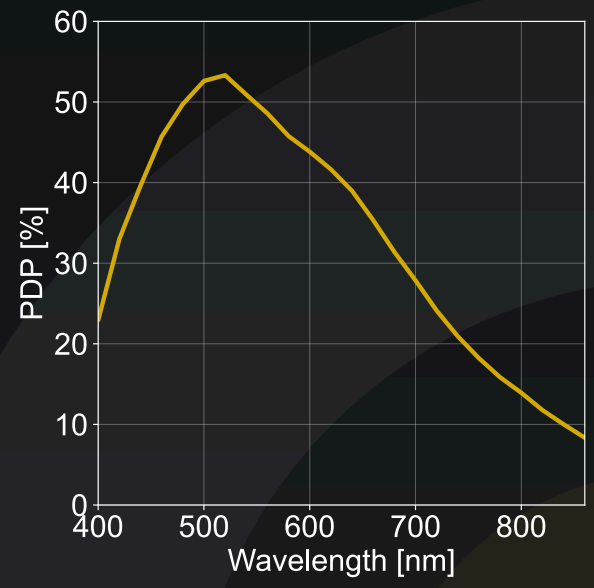
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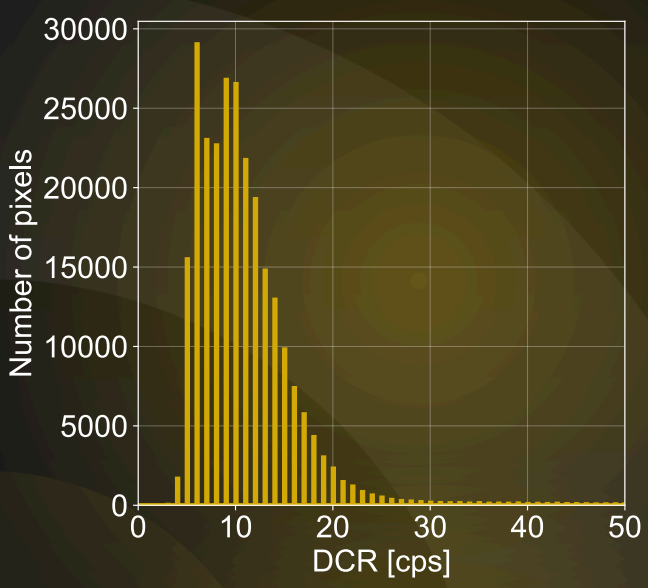
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TYPICAL PERFORMANCE

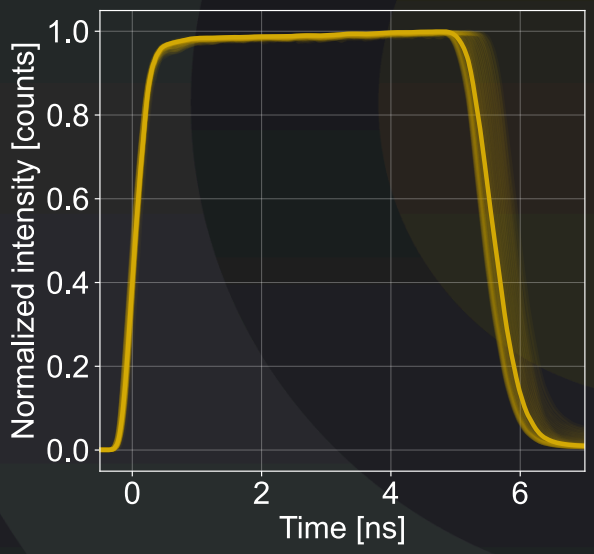
Photon detection probability



Dark count rate histogram



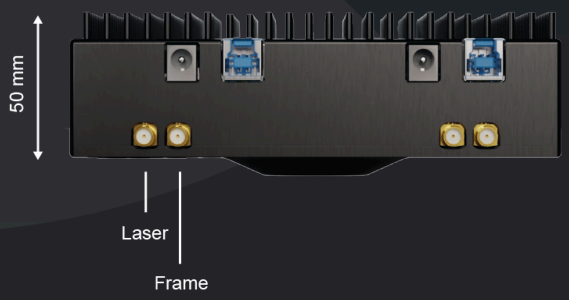
Gate profile





SYSTEM INTEGRATION

For operation, a 5 V power supply and two USB3 connections are required. The system software provides functionalities for photon-counting and time-gating. It enables 1-bit, 4-bit and 6 to 12-bit (time-gated) imaging modes and phasor FLIM processing. It can be accessed through TCP/IP for easy integration into LabVIEW, MATLAB or Python.



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