pi imaging

ENABLING INNOVATION

SIMTRUM

SPAD512²

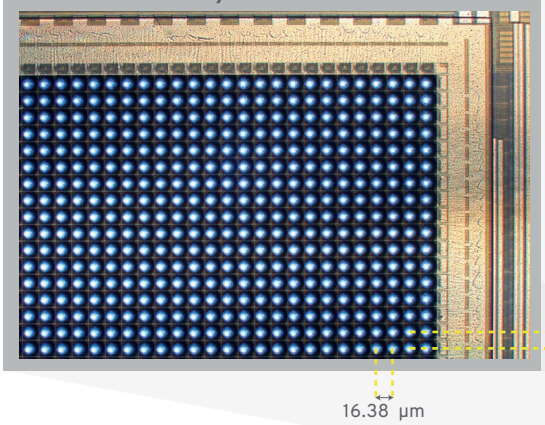
Description

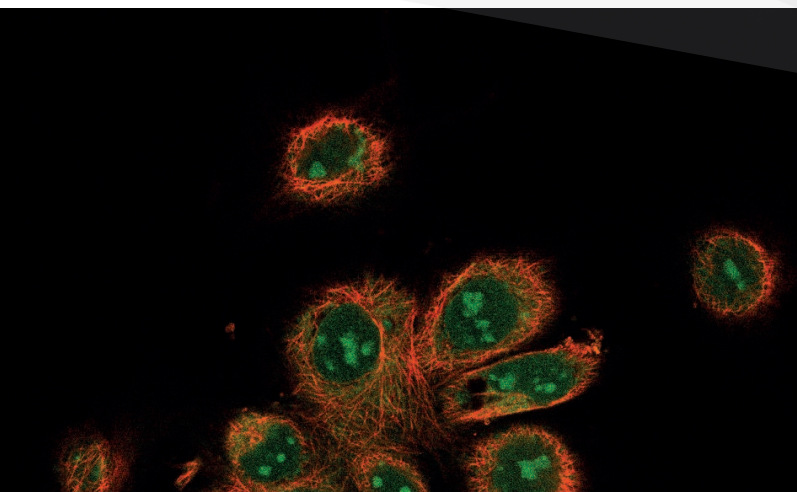
SPAD512² is a photon-counting camera for high-speed imaging. The core of the camera is a SPAD image sensor with 512×512 pixels. Photon counting with up to 100'000 frames per second and zero readout noise is achieved.

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.

- 512×512 SPAD pixels with wide detection spectra and low noise
- Time-gating with 17 ps shifts

SPAD array with microlenses





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Applications

Widefield fluorescence lifetime imaging

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 cameras?

- Simplify FLIM setup
- Increase FLIM frame rate

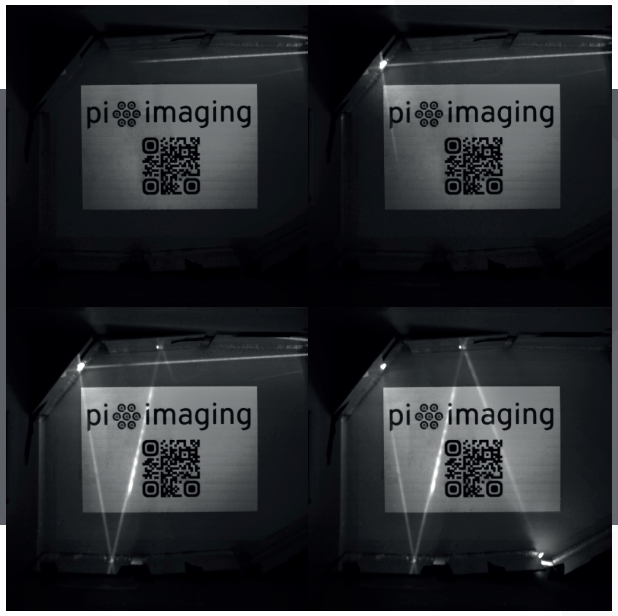
High-speed imaging

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

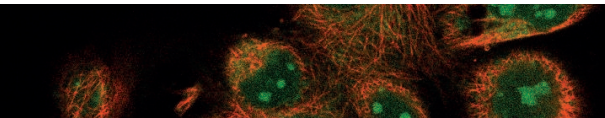
Why SPAD arrays?

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

Change the frame rate from 400 fps to 100’000 fps to capture fast moving objects.



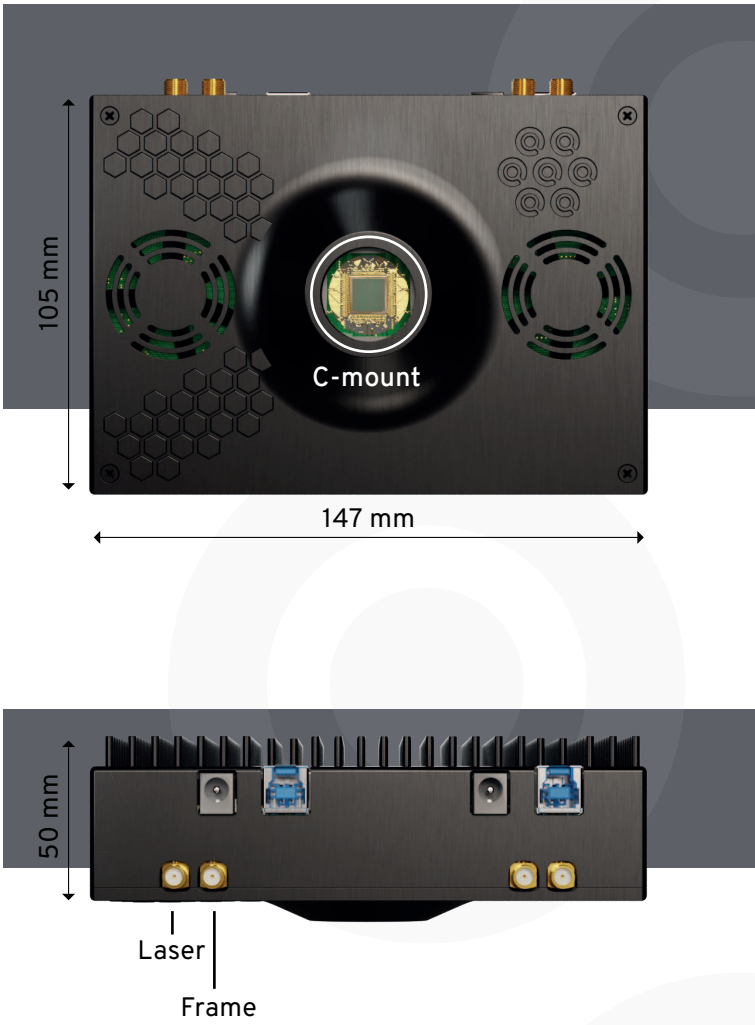
Track short bursts of light scattering in water, traveling at 225 million m/s and imaged with 17 ps time resolution.



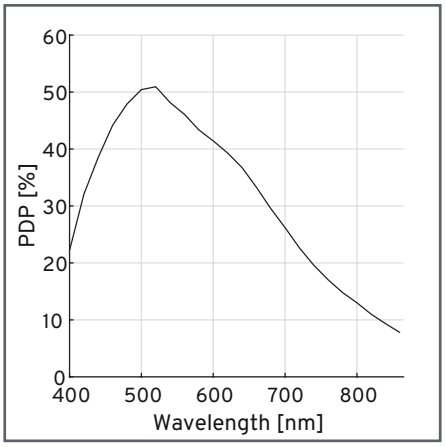
Technical specifications

Typical technical specifications

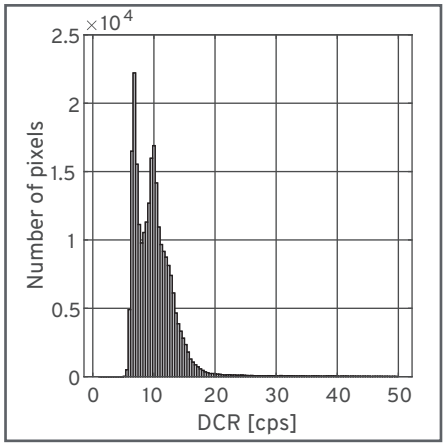
SENSOR	SPAD IMAGE SENSOR WITH IN-PIXEL GATE
Image array	512 × 512
Pixel pitch	16.38 µm
Sensor wavelength range	400 to 900 nm
Peak photon detection probability	50% @ 520 nm
Fill factor with microlenses	>50 % for collimated light
Median dark count rate at room temperature	<25 cps
Percentage of pixels with >1 kcps	1.5%
Frame rate (max.)	100'000 fps @ 1-bit for 1 s 5'000 fps @ 4-bit semi-continuous 400 fps @ 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
Exposure rise / fall time (20/80%)	350 ps / 150 ps
Lens type	C-mount



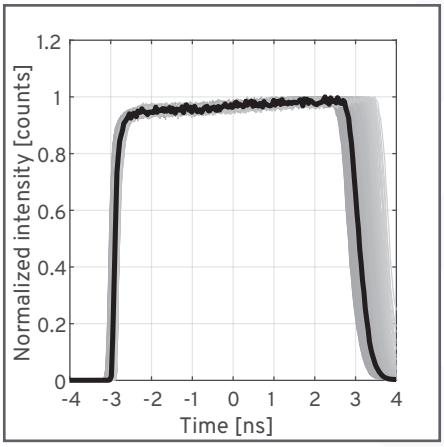
Typical performance characteristics



Photon detection probability.



Distribution of dark count rate over the image sensor.

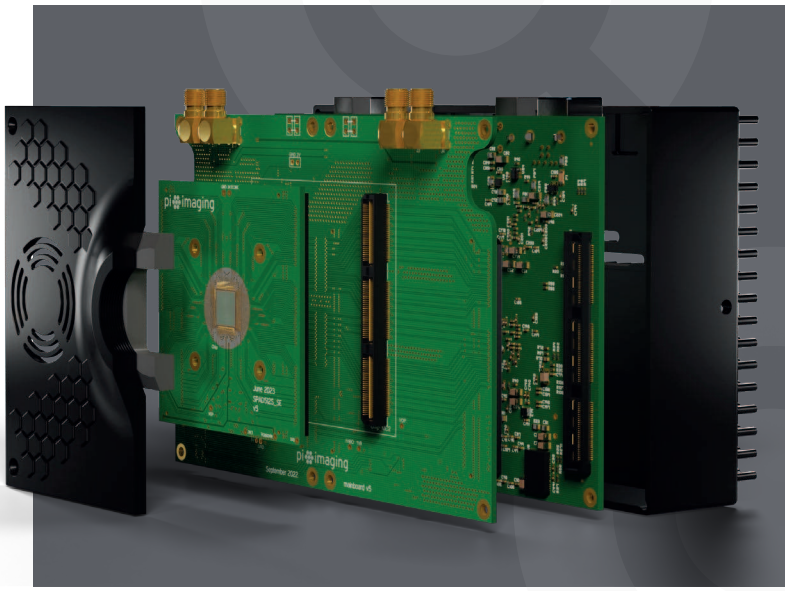


Time gating with typical 6 ns width, 150 ps rise time and 350 ps fall time. The figure shows all the gate shapes over the image sensor.

System integration

For operation, only three plugs are required, a 5 V power supply and two USB3 connections. The system software provides functionalities for photon-counting, time-gating and fluorescence lifetime imaging.

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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