NovoViz
Beyond sensing

Unleash the Full Potential of SPAD Technology

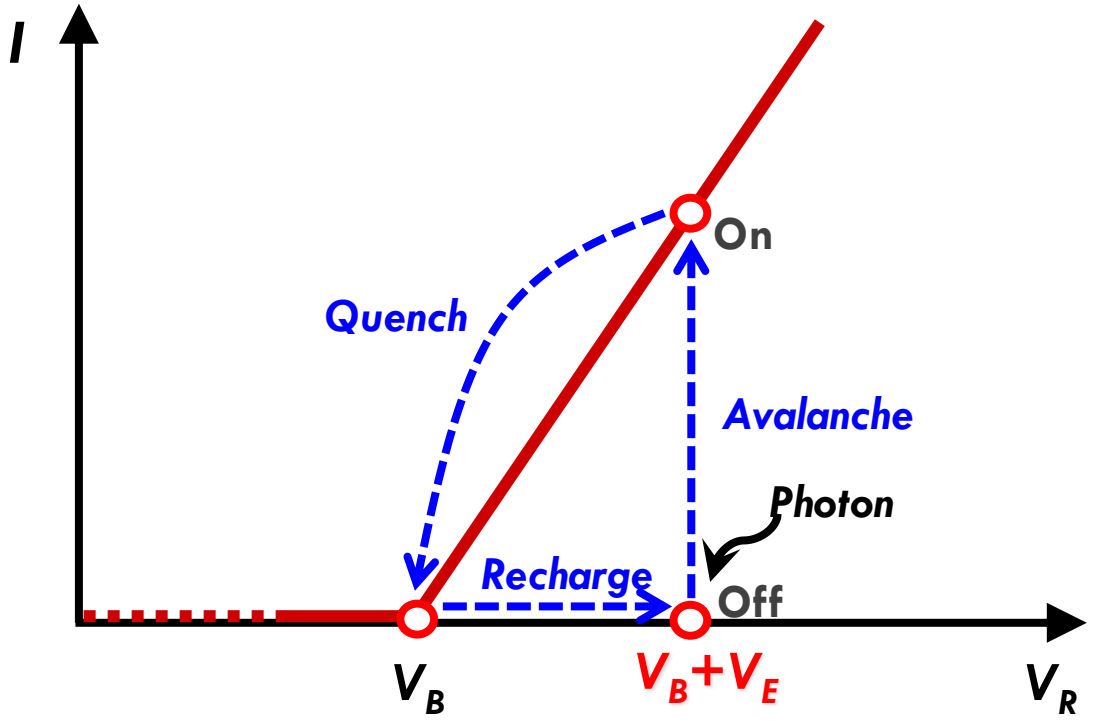
ABOUT US

- Based in Neuchâtel, Switzerland
- Fabless semiconductor
- Computational SPAD imagers

https://www.j3l.ch/

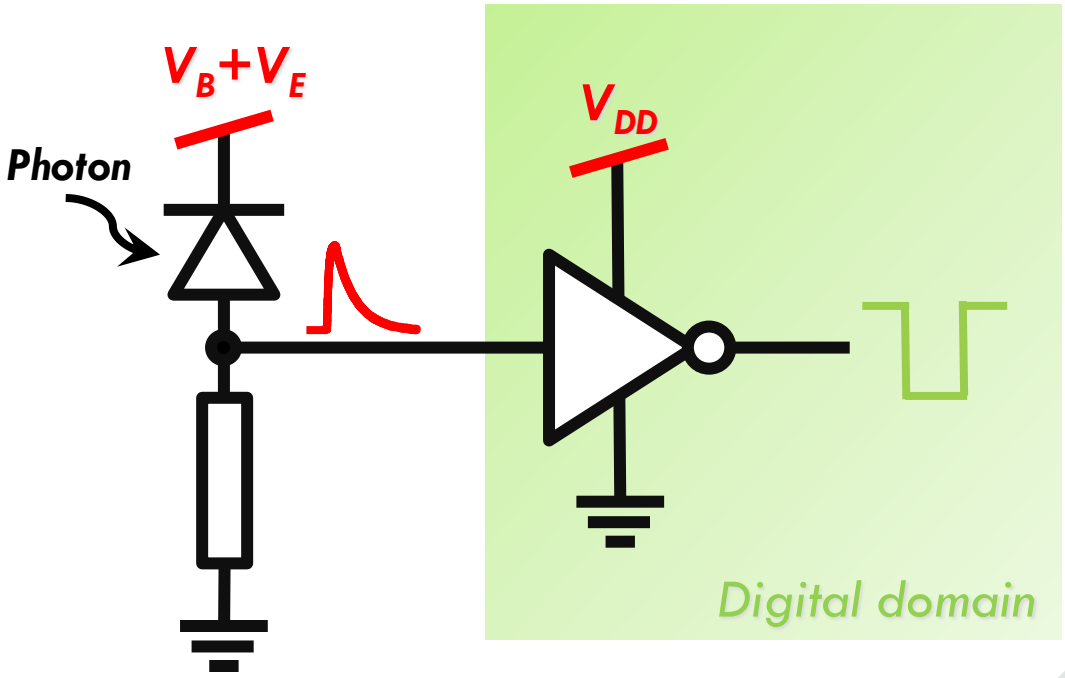
SINGLE PHOTON AVALANCHE DIODE (SPAD)

- Special APD structure
- Reverse-biased above breakdown
- An absorbed photon will cause a self-sustaining avalanche



SINGLE PHOTON AVALANCHE DIODE (SPAD)

- SPAD acts as a digital device
- No readout noise!
- Millions of events per second
- High dynamic range
- Picosecond output jitter

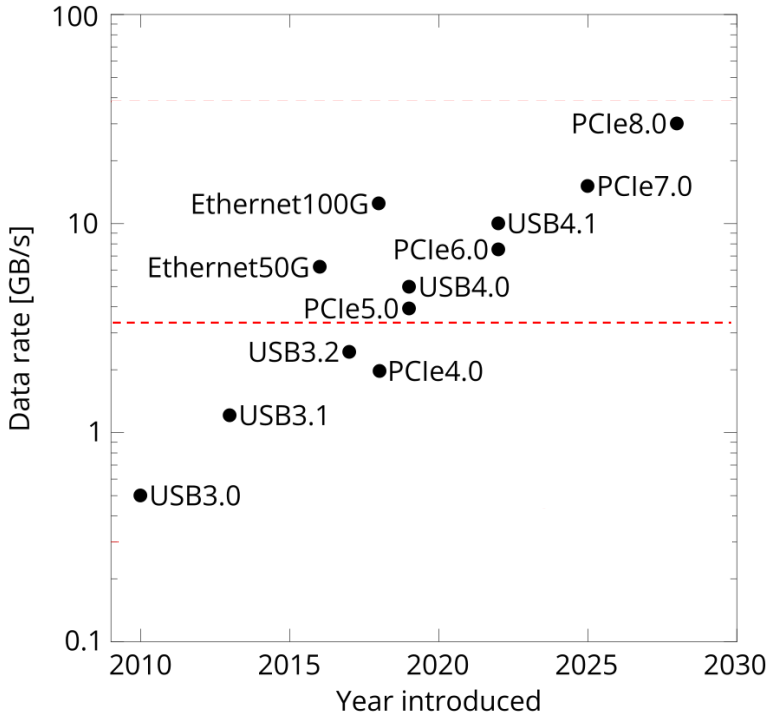


USE CASES

- Face recognition
- Laser ranging
- Surveillance
- Microscopy

PROBLEMS

- Unmanageable data rate
  - A 512x512 SPAD array from 2017 generates more than 3.2GB/s at full speed (100kfps) [Ulku et al, JSTQE 2019]
- Compromise
  - Operate in bursts OR slow down OR sacrifice single-photon information

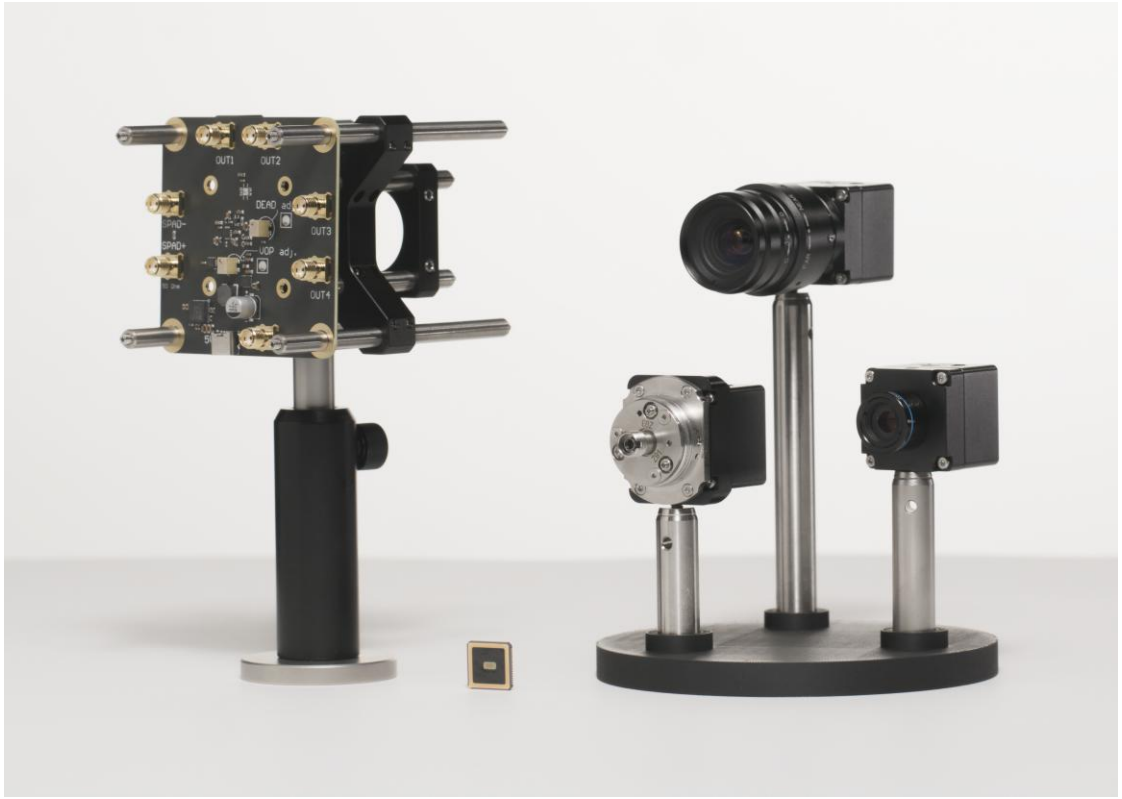


PROBLEMS

- Complex
  - Developed in academia for research purposes
- Expensive
  - High-performance electronic components

NOVOVIZ SOLUTION

- Computational SPAD sensor
  - High speed parallel processing on the sensor plane
  - Easy system integration
  - Reduction in power
  - Increase in speed

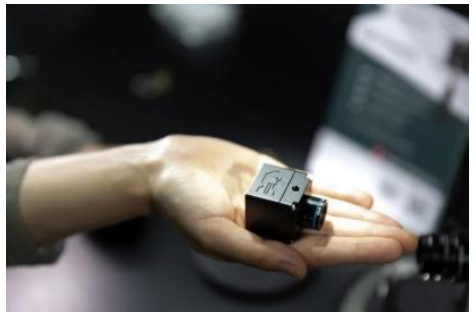


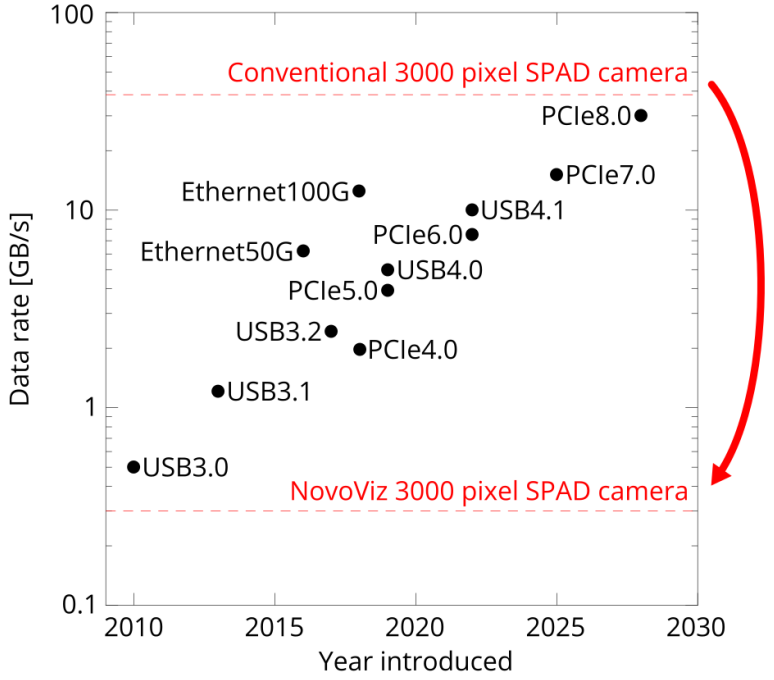
NV04ASC – ASYNCHRONOUS SPAD CAMERA

- 64x48 SPAD array
- Event-driven output
- 100 million binary frames per second
- USB 3.0

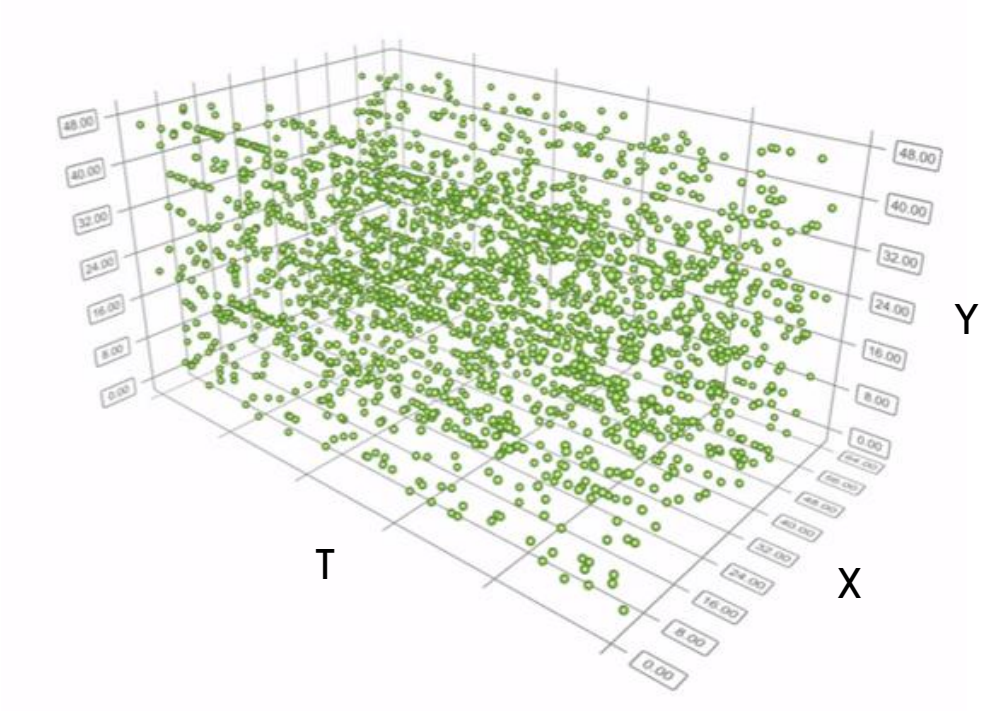
NV04ASC – ASYNCHRONOUS SPAD CAMERA

- Output consists of (x,y,t) photon event information
- No photon hits → no output data
- 100x bandwidth reduction
- Path for miniaturization

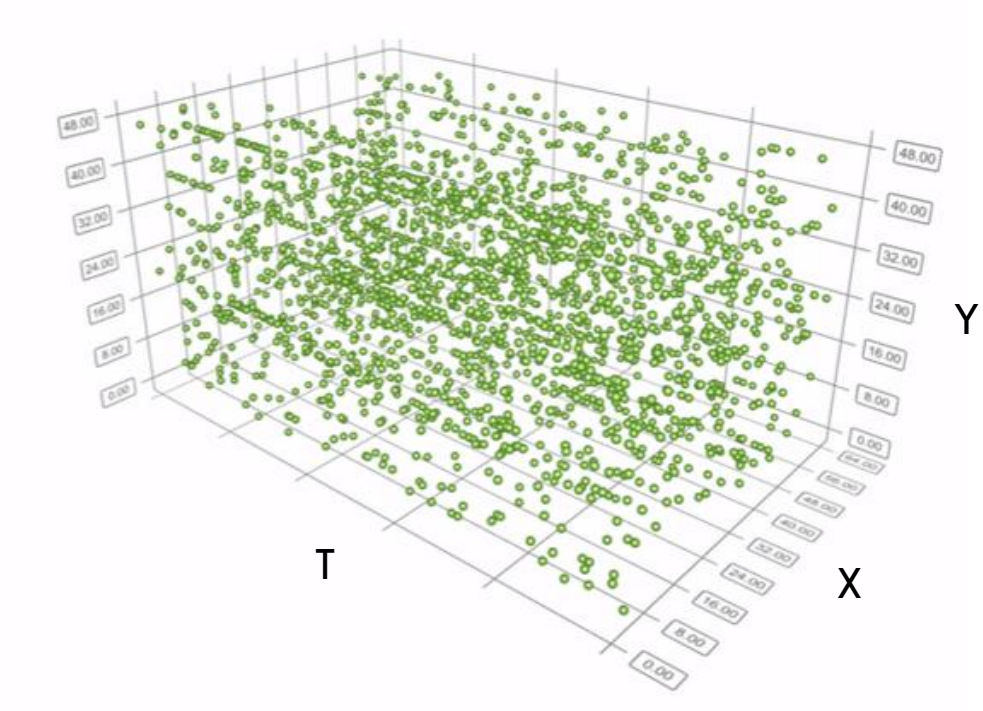




NV04ASC – ASYNCHRONOUS SPAD CAMERA

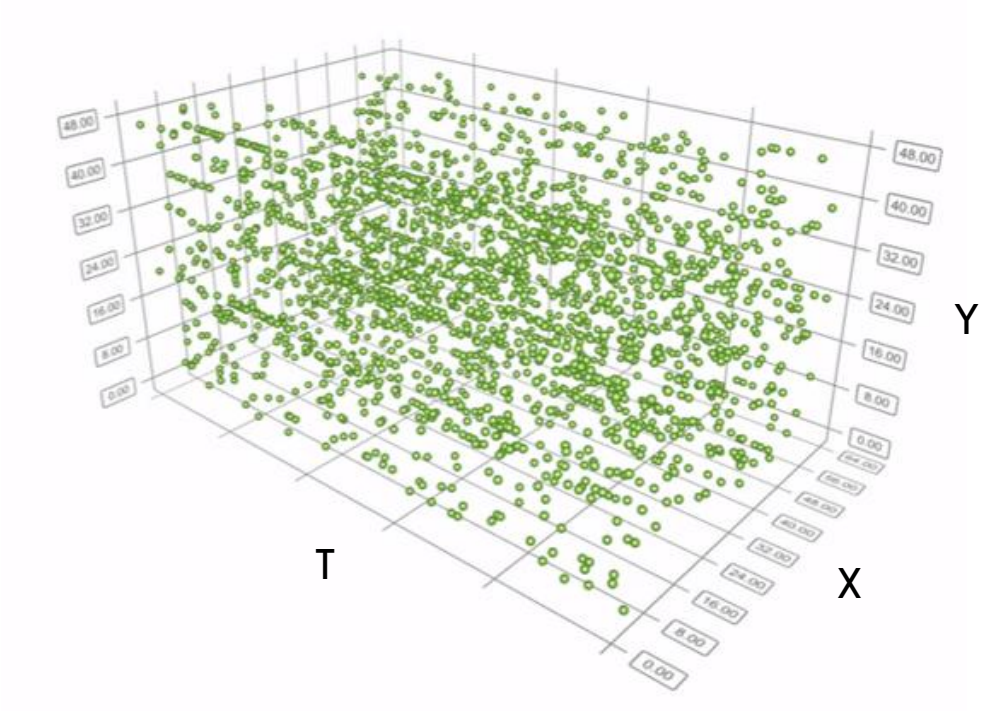


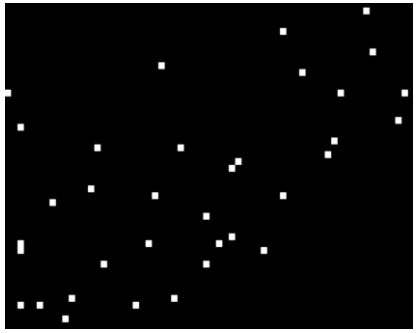
NV04ASC – ASYNCHRONOUS SPAD CAMERA



10ns (100 Mfps)

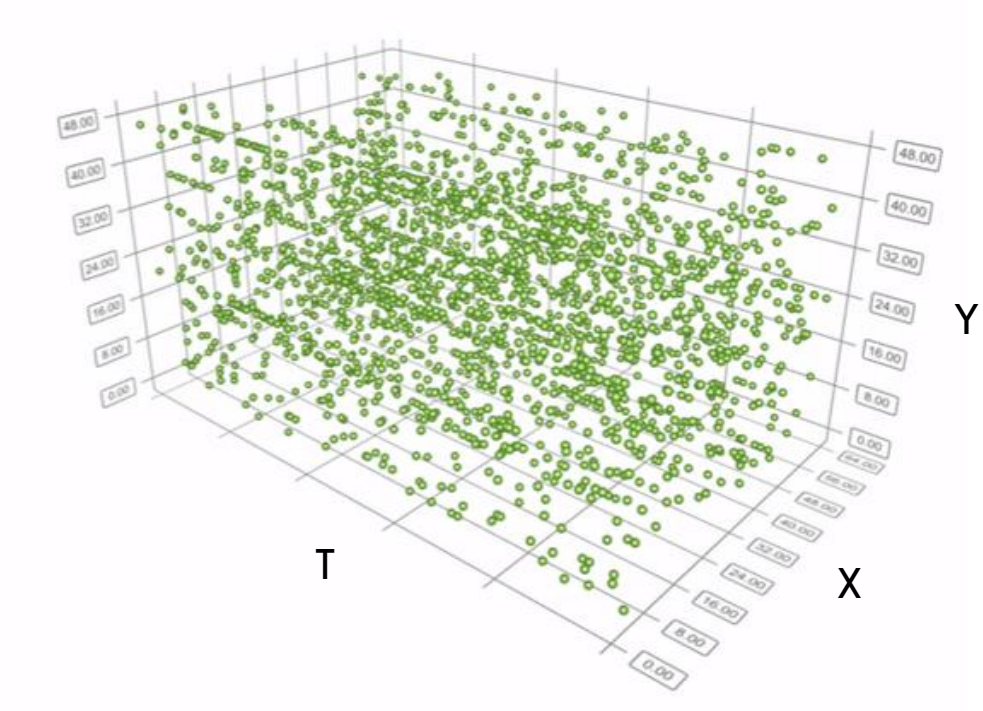
NV04ASC – ASYNCHRONOUS SPAD CAMERA

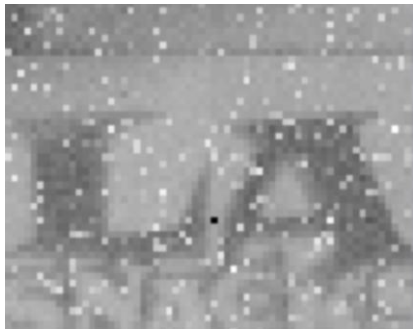




2µs (500 kfps)

NV04ASC – ASYNCHRONOUS SPAD CAMERA





50ms (20 fps)

BEYOND (CONVENTIONAL) IMAGING

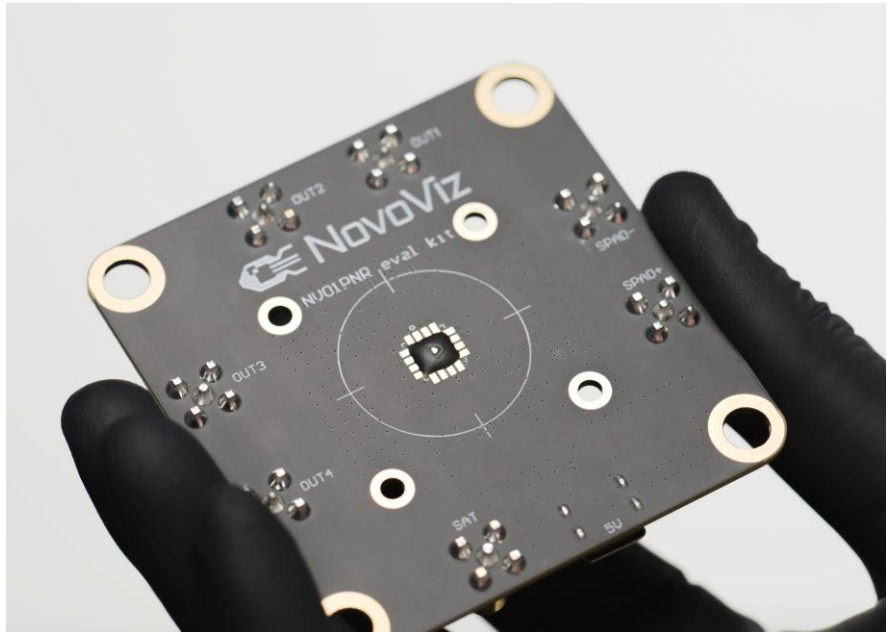
- Software defined cameras
  - Compensate for motion
  - Emulate event cameras
  - Data compression

[Sundar et al., arXiv, 2023]

[Sundar et al., arXiv, 2023]

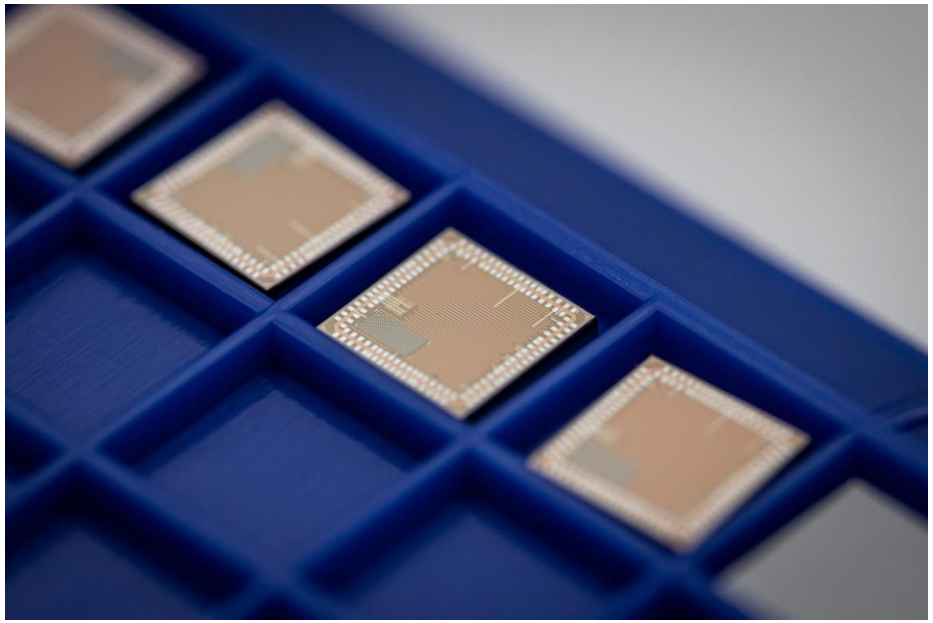
NOVOVIZ DEVELOPMENT MODULES

- Photon burst detector
- Two-pixel correlator
- Photon number resolver
- Small line sensor



FUTURE

- Fully customizable on-chip processing
- Processor array under the SPAD array



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THANK YOU!

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