VoxelSensors

Active Event Sensors

an Event-based approach to Single-Photon Sensing of Sparse Optical Signals

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October 7th, 2024

EPIC Online Technology Meeting on Neuromorphic Cameras

Company

- Brussels-based, founded March 2020
- 20-person team across Brussels, UK and USA
- VC funded, €13m Seed

- Inventor of SPAES: Single Photon Active Event Sensors
- Extensive IP portfolio - 82 patents: 29 granted, 53 pending.

- Focus on Low Power Spatial Sensing and Eye Tracking for XR Perception

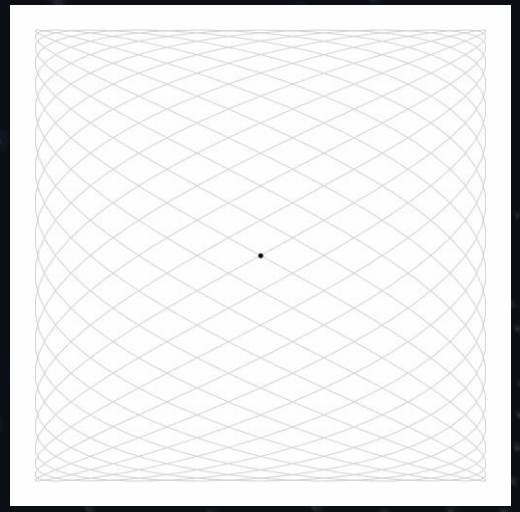
Challenges in Spatial Awareness

1. Simultaneously low power, high resolution & low latency	All-day-use battery life, no lag between digital and real world Target to reach 75mW perception power consumption for AR
2. Accurate, robust & durable	1. Quality of the data directly impacts quality of the function 2. Works with concurrent systems in any light condition
3. Small mechanical/physical footprint	Integration in stylish eyewear, wearable devices
4. Multi-function	One sensor modality to provide multiple features: 3D depth, passive monochrome image (e.g., for natural interactions), tracking of controllers

VoxelSensors Target Sensing System

Laser Beam Scanner

scans the world at high speed
(e.g., 2D MEMS mirror)

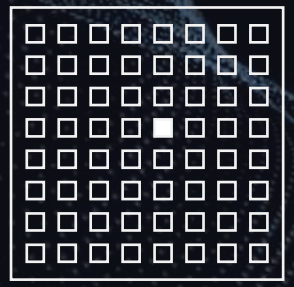


➡ $S_1(x,y,t)$

Transmitter

Single Photon Active Event Sensor

Single Photon Sensitive
Output: dot position (x,y,t)
Sample Rate: up to 100MSps

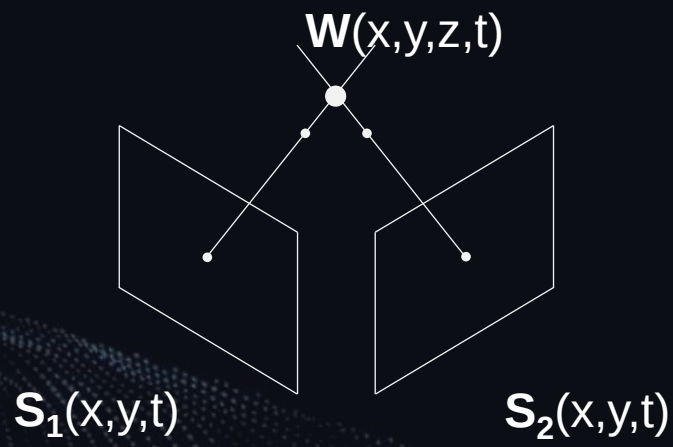


➡ $S_2(x,y,t)$

Receiver

Serialized triangulation

based on S_1 & S_2
generating a 3D datapoint at
up to 100Mpts/s



➡ $W(x,y,z,t)$

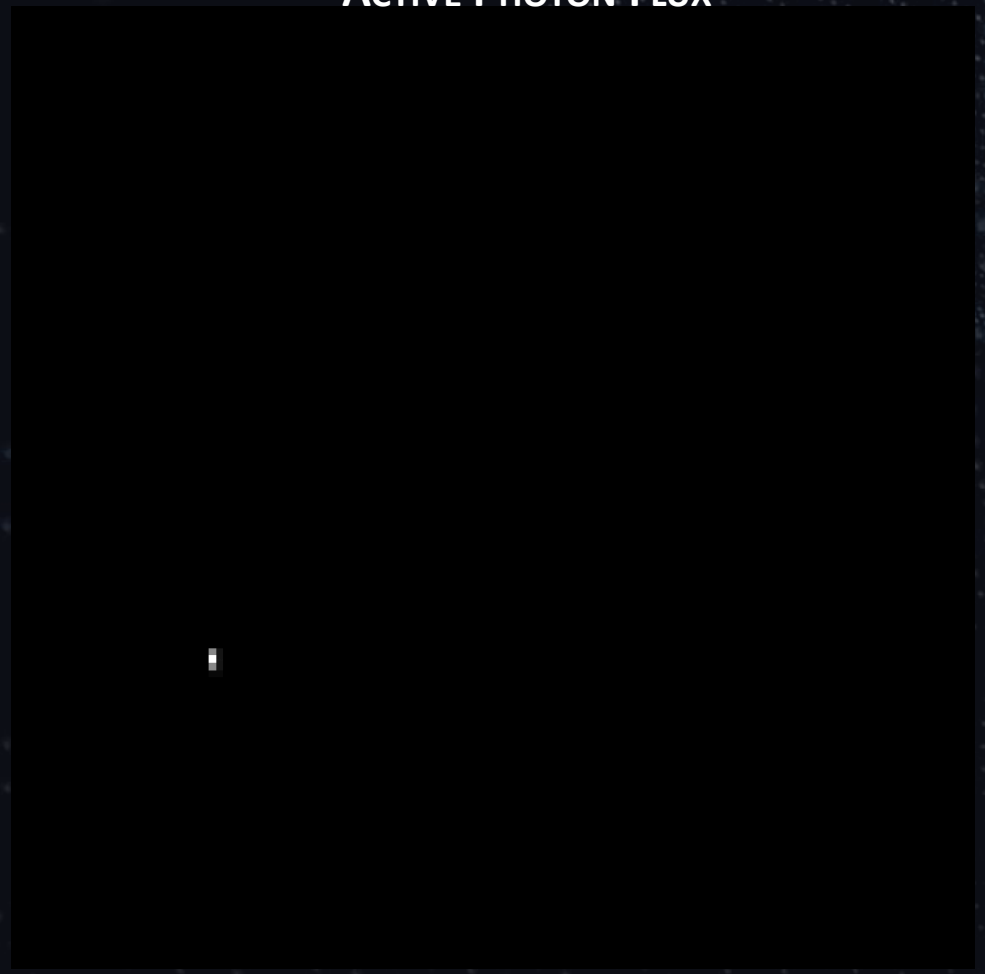
Processing

Sensor & System requirements

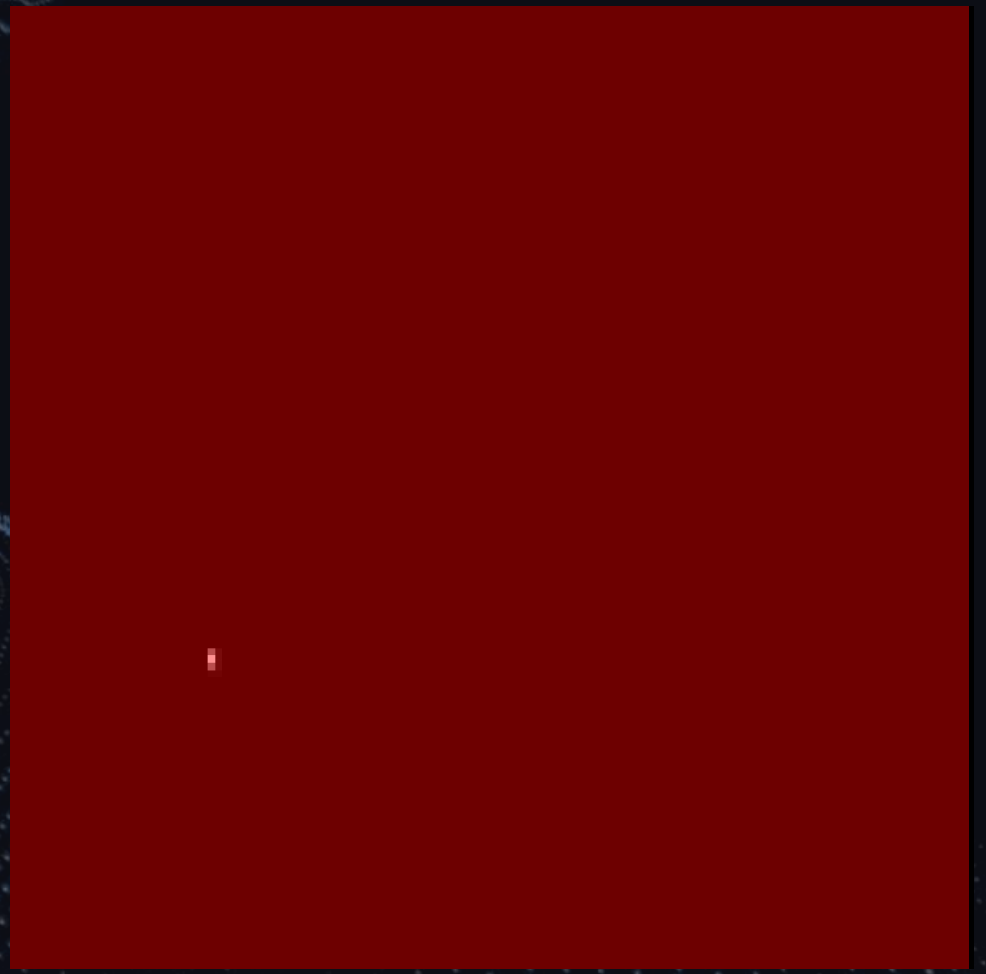
1. Low Optical Power	Detection of laser beam with minimum photon budget : SPAD
2. Density of acquisition	At laser beam Scan speed > 20kHz, signals spend less than 100ns on pixel => fast detection => SPAD
3. Ambient conditions	On-chip processing and isolation of active photons = active event detection
4. Low Sensor Power	Reduce to relevant data as early as possible and only output relevant data = event-based readout

Single-Photon Active Event Sensor

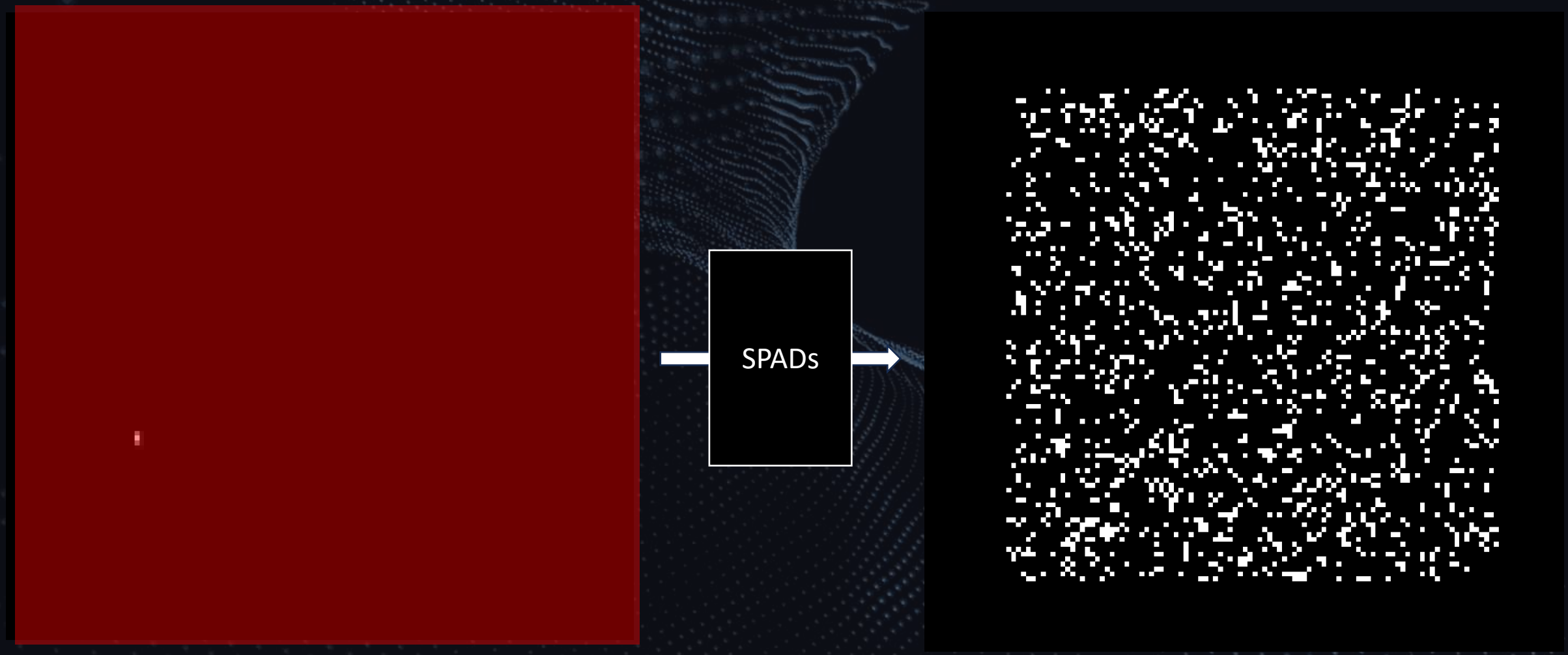
ACTIVE PHOTON FLUX



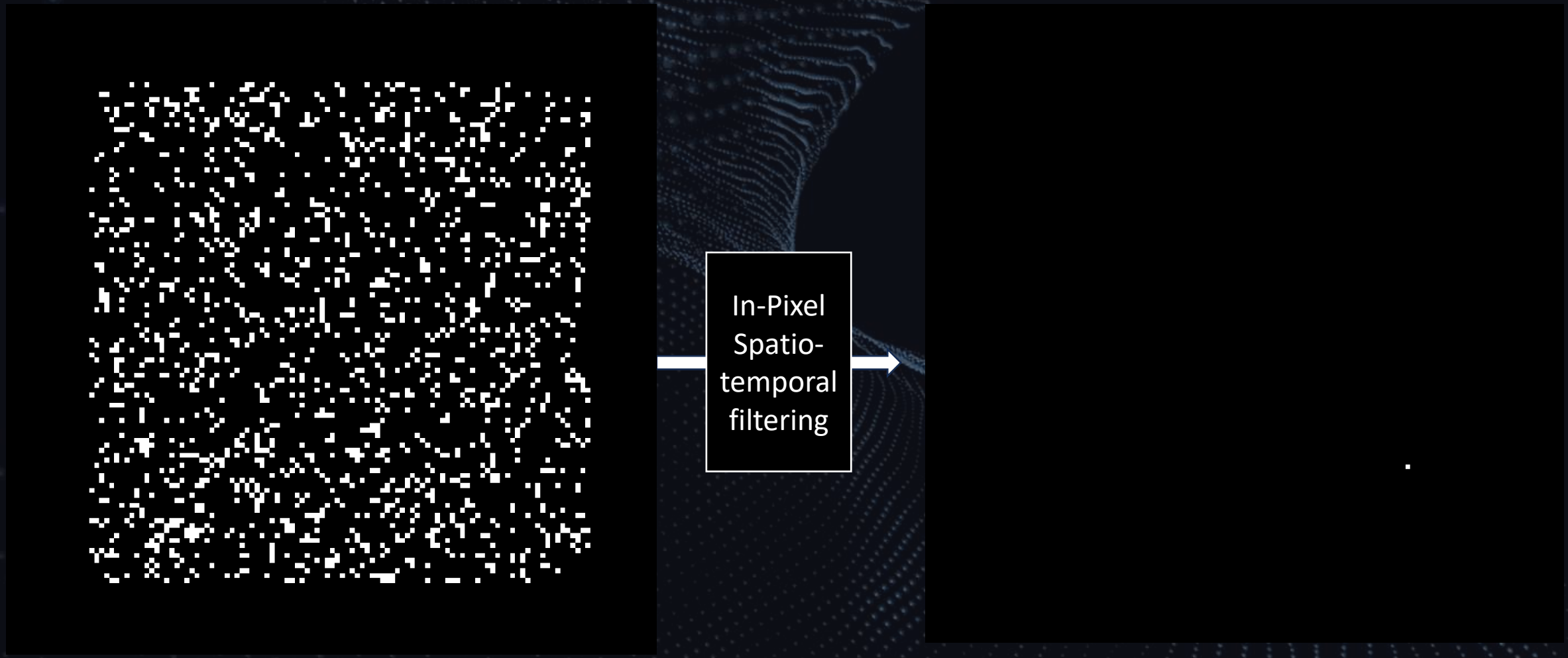
ACTIVE + AMBIENT PHOTON FLUX



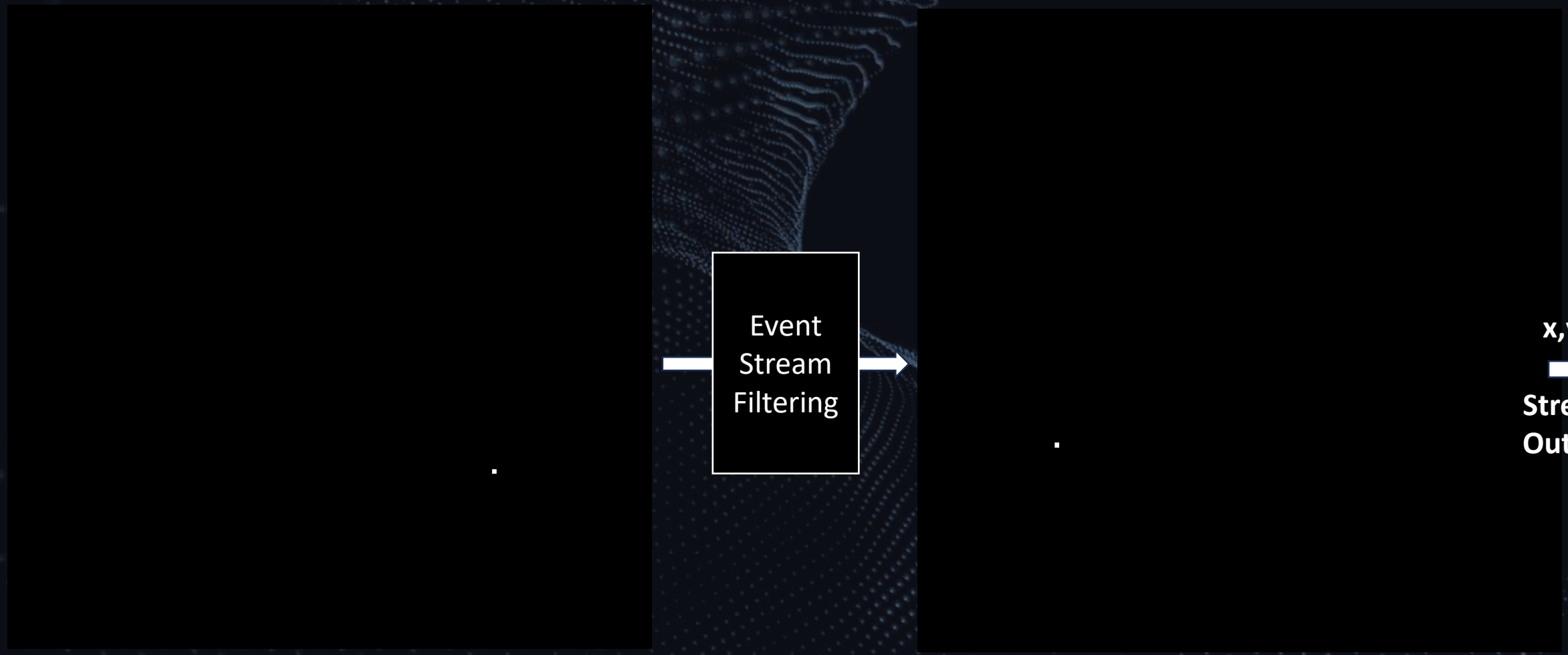
Single-Photon Active Event Sensor



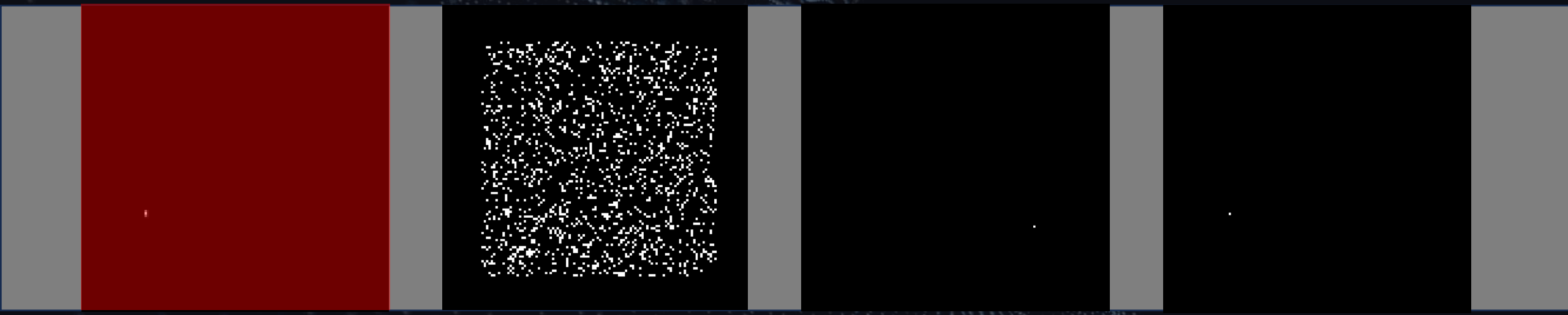
Single-Photon Active Event Sensor



Single-Photon Active Event Sensor



Full Flow Without ROI Knowledge



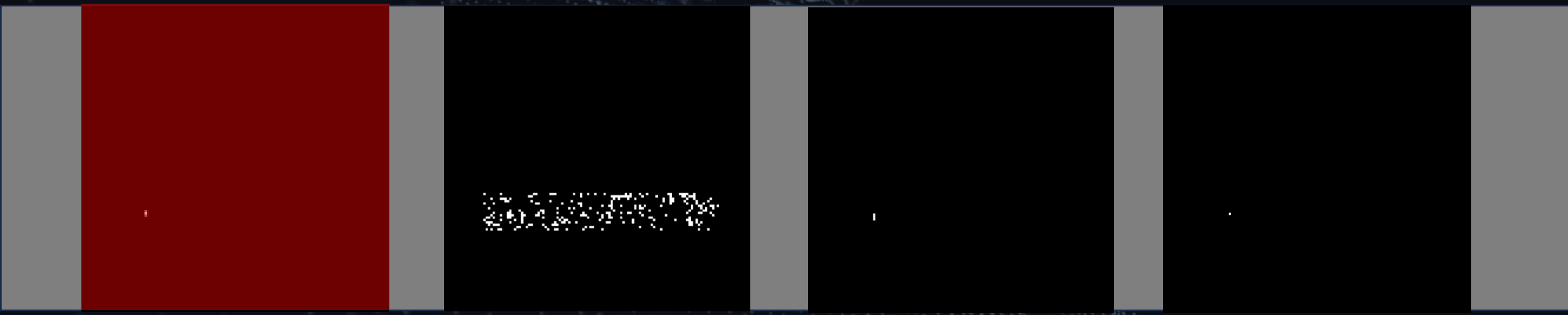
Active Photon Flux
+
Ambient Photon Flux

SPAD Activations

in-pixel SpatioTemporal Filter

Event Filter

Full Flow With ROI Knowledge ➡ Lower Power Lower Noise



Active Photon Flux
+
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SPAD Activations

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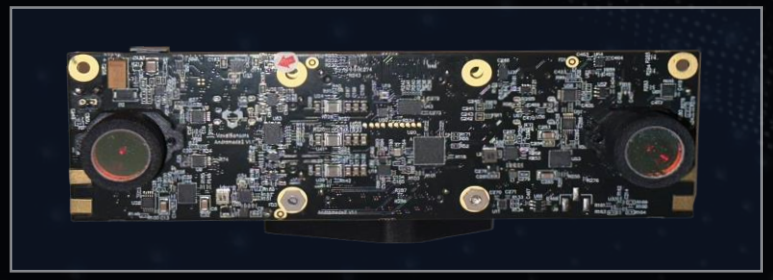
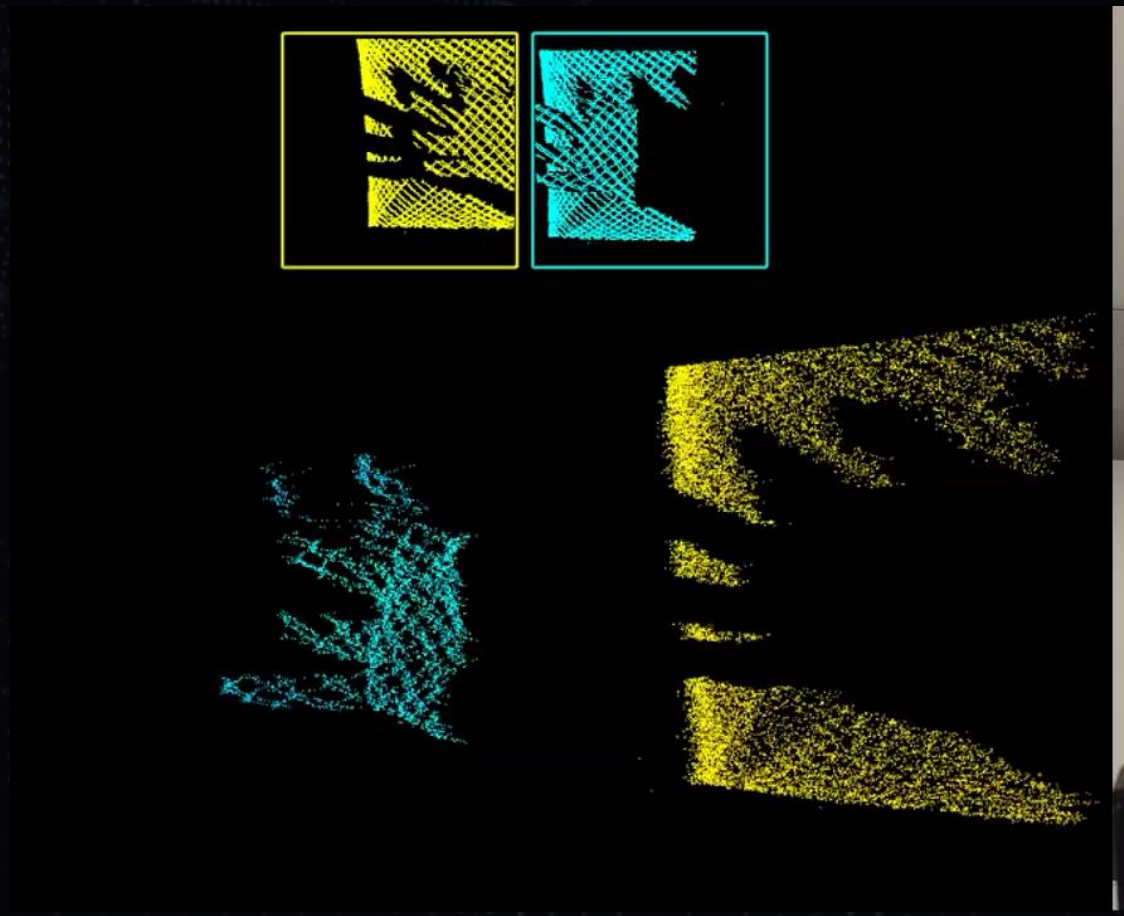
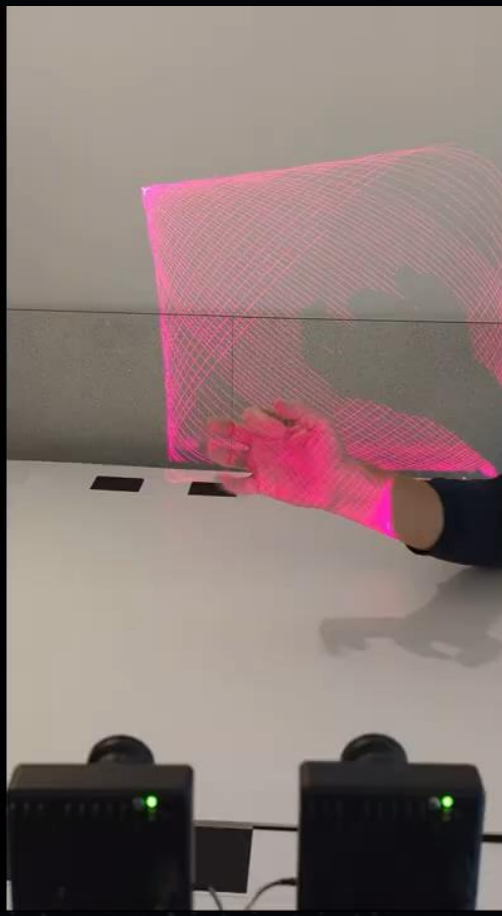
SPAES in 3D Sensing



Evaluation Kits available





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Evaluation kits today

Andromeda 1

- 2 SPAES cameras + 1 LBS system
- USB3 output, Flexible setup
- VoxelSensors SDK
- Point cloud streaming
- Standard depthmap

Available today

Andromeda 2

- Stereo SPAES sensors + 1 LBS system
- RGB sensor included
- USB3 output, Fixed baseline
- VoxelSensors SDK
- Point cloud streaming
- Standard depthmap

Courtesy of Trilite

Available June 2024

Andromeda 3

- SPAES module + 1 LBS module
- MIPI CSI-2 output, Flexible baseline
- VoxelSensors SDK
- Point cloud streaming
- Standard depthmap

Courtesy of Trilite

Available Jan 2025

Get in touch

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