MEGAFRAME

A Million Frame Per Second Camera

The goal

Detect single photons and their time of arrival with picosecond timing resolution to achieve **quantitative sensing**, **measuring**, and **computing**.

The target device

A massive, parallel array of single-photon counters with in-pixel time-to-digital conversion and memory implemented in standard imaging CMOS technology.

Research fields

Single-photon imaging technology leverages advanced, deep-submicron, CMOS processes to create massive arrays of single-photon detectors and parallel processing units on the same chip. The target fields are biology, physics, and medical imaging.

Ultra-high speed native digital cameras are possible with the recent introduction of true photon counting detectors and processing circuitry integrated in CMOS technology.

Fluorescence lifetime imaging microscopy (FLIM) enables quantitative imaging of biological samples. For example, ionic concentrations such as calcium, one of the ions used in neuron signaling, tracking cell-level processes in real time.

Proteomics or the study of proteins. This field can be expanded thanks to the potentially increased speed of base sequencing.

3D imaging historical application of SPADs. The sensor's pixels independently measure a light pulse's time-of-flight (TOF)

Consortium

- ***Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland (Coordinator)***
- ***University of Edinburgh, Edinburgh, Scotland***
- ***Fondazione Bruno Kessler, Trento, Italy***
- ***Università di Pavia, Pavia, Italy***
- ***ST Microelectronics, Edinburgh, Scotland***