Application Summary

Title: **CMOS single-photon time-correlated SPAD arrays for biomedical applications**

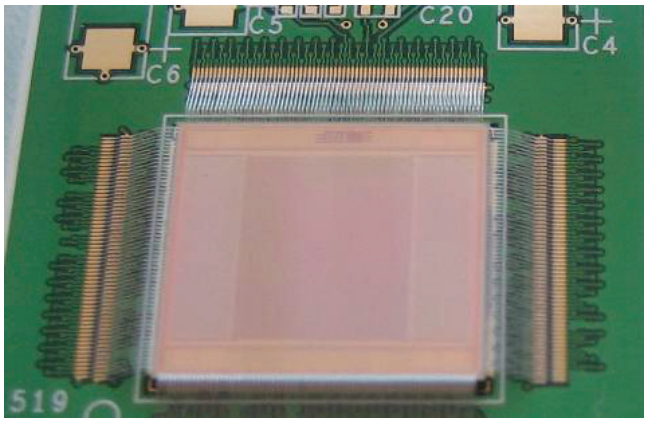
Participating entity: European R&D projects MEGAFRAME and SPADnet

Innovation: **Background**: A core group of European universities and research centres (EPFL Lausanne/TU Delft, University of Edinburgh and Fondazione Bruno Kessler, Trento) have laid in the past years, together with industrial partner STMicroelectronics, the foundations for SPAD based (Single Photon Avalanche Diode) single-photon time-correlated imagers and 2D arrays. This expertise has been and is being complemented by experts in the respective domains such as CEA-LETI in Grenoble, University of Pavia, Mediso in Budapest, and University of Budapest. The core technology has been pioneered in the European FP6 FET Open MEGAFRAME project, and it now being transitioned to biomedical imaging systems, in particular PET (Positron Emission Tomography), in the European FP7 ICT Photonics SPADnet project.

Description: The MEGAFRAME camera (www.megaframe.eu), available in two versions (32x32 and 128x160), contains pixels which can detect a single photon a million times per second. In addition, the camera is also capable of computing their time of arrival with picosecond precision over an array of up to twenty thousand pixels operating simultaneously and independently. The SPADnet (www.spadnet.eu) module will contain an array of tessellated single-photon TSV chips, connected in a token ring structure.

Representative: Claudio Bruschini (EPFL) or Edoardo Charbon (EPFL and TU Delft)

Picture of innovation:



***Left*: Chip-on-board bonding of the MEGAFRAME 160x128 image sensor to the daughter card. *Below*: Main system features (bottom-up display). From left to right: SPAD pixel; microlenses; sensor array (32x32 version); system level overview; examples of results (lifetime images in selected applications). *Right*: Conceptual design of a possible SPADnet full pre-clinical PET implementation.**