



# BIST Ignite Project Progress

January 2020

## 1. Title of the project

BIOSPAD: A fast monolithic multi-channel ASIC for diffuse optical blood flow measurement

## 2. Acronym

BIOSPAD

## 3. Names and centres of the PIs

ICFO, IFAE, IMB-CNM (non BIST institute)

## 4. Abstract

Diffuse correlation spectroscopy (DCS) and related methods use the statistics of the temporal fluctuations of near-infrared light to non-invasively measure blood flow in deep tissues allowing the estimation of important biomarkers in applications such as functional brain monitoring, neuro-intensive care monitoring, characterization of cancers and the evaluation of muscle injury and fatigue. This non-invasive technique enabled a growing number of biomedical and clinical applications. However, in order to fully exploit the potential benefits of DCS in the clinical area it is critical to develop more advanced instrumentation. The project aims to develop novel depleted CMOS sensors for single photon detection to overcome the shortcomings of the present state of the art technologies in terms of detection efficiency, time resolution, design geometry and cost effectiveness. These sensors will be specifically designed for DCS, targeting a monolithic multi-channel detector with small pixel sizes fabricated using commercial technologies. Furthermore, the use of a CMOS process enables on-chip integration of the quenching mechanism and of the readout electronics in the immediate surroundings of the detector, thus limiting parasitic capacitances and suppressing noise while reducing the overall volume of the device. Here, we plan to exploit the fact that DCS does not need a large fill factor. We also foresee that the auto-correlator could be implemented on-chip to produce ultra-low cost integrated wearable devices.