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New bi-dimensional SPAD arrays for Time Resolved Single Photon Imaging

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Time resolved imaging up to the single photon sensitivity is one of the most ambitious and important goals of photonics. In the last decades the time correlation analysis has been fundamental for the study of many scientific topics. Actually it has performed only by using the information of few points in the image.
The implementation of such devices based on SPADs (Single Photon Avalanche Diodes) technology, has been recently proposed. The key point for this aim is the read-out strategy; it should be easy, in order to read a great number of elements, and able to address the information of each individual sensor, in order to get its time response.
The simplest strategy is to address each diode, with a consequent requirement of a great number of channels, n^2 for a square matrix of n x n diodes. We proposed an alternative solution, initially based on the signals collection from both anode and cathode of the same diode [1]. Signal extracted from anode is used to determine the row position while the cathode signal for the column position. The rows x columns strategy require a number of reading channels of 2n instead of n^2. In respect to the original idea, several improvements have been performed (signal collection, technology, etc.).
In this contribution we present the new bi-dimensional array of SPADs for imaging applications, realized in collaboration with the FBK–Trento (Fondazione Bruno Kessler).

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