

Charged particles detector based on a two-tier avalanche pixelated sensor

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In this work, carried out in the framework of APiX2 project funded by Istituto Nazionale di Fisica Nucleare (INFN), a pixelated device for the direct detection of charged particles is described and characterization measurements are reported. The working principle of the device is the discrimination between particle-triggered detections and dark counts, obtained with a coincidence circuit embedded at pixel level.

The device is composed of two arrays of Geiger-mode avalanche detectors vertically-aligned and bump bonded. Each array, fabricated in a 150nm CMOS process, is formed of 48 x 16 pixels with a pitch of 50 μm x 75 μm ; four different active areas were included from a minimum of 30 x 30 μm^2 to a maximum of 43 x 45 μm^2 . Pixel electronics consists of a quenching transistor, a programmable-length monostable, a coincidence circuit and a memory to store the coincidence events.

A preliminary campaign of measurements was performed to electrically characterize the functionality of the device. The DCR of each layer was measured together with the coincidence rate with different lengths of the monostable pulse. A validation of the sensor was performed with a 90Sr β source.

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