

Development of a gamma camera based on silicon photomultipliers

Content

The utilization of silicon photomultipliers (SiPM) in the detection module opens up a new possibilities of using a gamma camera. Two prototypes of gamma camera were developed. In the first prototype takes place a direct reading of monolithic scintillator NaI(Tl) using SiPM matrix and signal digitizing from this matrix utilizing a multichannel ASIC Maroc 3. This readout method allows to collect a large amount of light emitted from the scintillator volume, but makes it necessary to use a large number of photomultipliers and special multichannel electronics. In the second prototype between the scintillator NaI(Tl) and silicon photodetectors orthogonally related wavelength shifting fibers (WLS) are placed. They reduce the number of photodetectors but also they decrease the amount of light detected by the system.

Study of prototypes is essential to understanding the processes occurring inside the detecting section of the gamma camera, in consideration of the characteristics of silicon photomultipliers. The presence of dark count and optical crosstalk between SiPM pixels forms a excess noise factor (ENF) of the detector, which leads to decrease of the number of photoelectrons. Therefore, the number of initial triggered SiPM cells have to be determined using a statistical analysis based on the ENF of the silicon photomultiplier. The resulting experimental data for the both prototypes will be presented.

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