

Extraction of Activation Energies from Temperature Dependent Investigations of Dark Current and Dark Count Rate of Silicon Photomultipliers

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Content

For several years Silicon Photomultipliers (SiPM) have been attractive candidates in order to replace conventional Photomultiplier Tubes (PMT) in many experiments. Besides several advantages of SiPM over PMT, like the increased photo detection efficiency (PDE), the compact design and the insensitivity to magnetic fields, the dark count rate (DCR) of SiPM is still a large drawback. Especially concerning applications with the need of a large photosensitive area or applications for which cooling of the detector is not an option. Reducing the dark count rate of SiPM would lead to an enormous enhancement of the application range of this promising photo-detector. As a first step towards the reduction of the DCR, the main mechanisms leading to dark breakdowns of the micro-cells have to be understood. By monitoring the dark current and the dark count rate as a function of temperature, an extraction of activation energies of mechanisms responsible for dark events is possible, using Arrhenius plots. The goal of the presented work is to develop a reliable method for the investigation of dark events and their origins.

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