

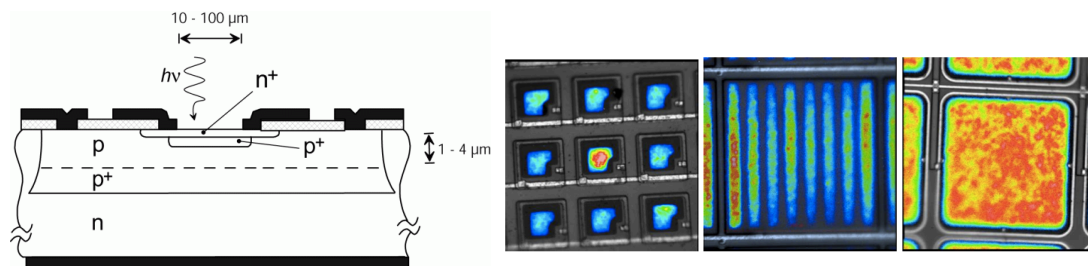
Master / Diploma thesis

at the
Detector laboratory of the Institute for Experimental Physics

Quantification of the radiation damage on SiPM

The aim of this thesis is to study the effect of radiation on silicon photomultipliers (SiPM). Various samples of SiPM will be characterized before and after several steps of irradiation with photons, protons and neutron beams, in order to determine the induced radiation damage. While some studies exist to quantify the radiation damage in SiPMs as a function of the fluence¹, little is known about the exact mechanism of the radiation damage in silicon photo-multipliers.

The measurements will involve the basic characterization parameters of SiPM: dark rate, optical-crosstalk, after-pulse, gain and photo-detection efficiency². Additional parameters can be introduced and studied to be more sensitive to the understanding of the microscopic effects in the silicon bulk. For instance deep-level transient spectroscopy (DLTS) or thermally stimulated current spectroscopy (TSC) techniques could be tested for the first time on SiPMs.



Discuss:

- Describe the techniques available to investigate radiation damage in silicon.
- Define SiPM characteristic parameters (dark rate, optical-crosstalk, after-pulse, gain and photo-detection efficiency) and their measurement technique.
- Why are some SiPM more sensitive to green light and other to blue light?
- What is the response signal expected for 10 incident photons on a “typical” SiPM? And for 100 or 1000 photons?

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¹ M. Angelone and M. Pillon, “Silicon Photo-Multiplier radiation hardness tests with a beam controlled neutron source”, <http://arxiv.org/pdf/1002.3480v2.pdf>

² P. Eckert et. al, “Characterisation Studies of Silicon Photomultipliers”, <http://arxiv.org/abs/1003.6071>