

A.1.3 Temperature Effects on SiPM Properties

SG6013



Dedicated kit	
Description	pp.
SP5600E Educational Photon kit	179



Requirements

No other tools are needed.

Difficulty	Execution Time	Data Analysis	Radioactive Sources
		YES	NO

Equipment

SP5600E - Educational Photon Kit

Model	SP5600	DT5720A	SP5601	SP5650C
Description	Power Supply and Amplification Unit	Desktop Digitizer 250 MS/s	LED Driver	Sensor Holder for SP5600 with SiPM
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Purpose of the experiment

Gain, noise and photon detection efficiency (at fixed bias voltage) are affected by temperature. The student is driven through the measurement of the dependence of these critical figures.

See the Application

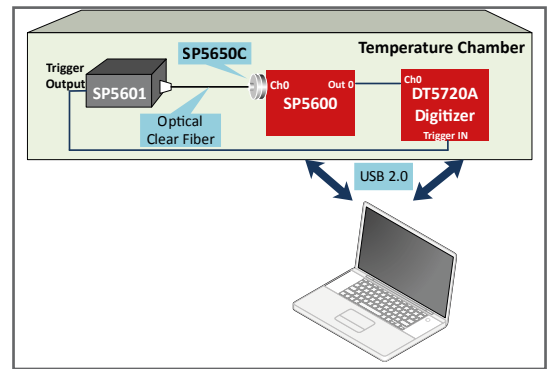


Fundamentals

The gain in a SiPM biased at fixed voltage changes with temperature since the breakdown voltage V_{br} does it. Gain stabilization is a must and can be pursued tracking the V_{br} changes and adjusting the bias voltage accordingly. The rate of variation depends on the sensor, through the material properties. Noise depends on the thermal generation of charge carriers, so a significant dependence is expected as well.

Carrying out the experiment

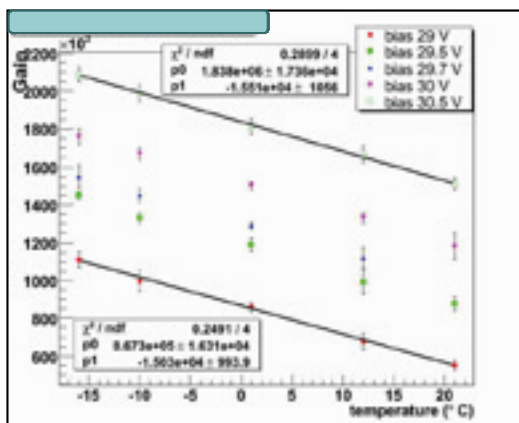
In a temperature controlled box, mount one of the sensors (SP5650C) on the SP5600 and connect the analog output to the input of the DT5720A digitizer. Optically couple the LED and the sensor via the optical fiber, after having used the index matching grease on the tips. Set the internal trigger mode on the P5601 and connect its trigger output on the DT5720A trigger IN. Connect via USB the modules to the PC and power ON the devices. Through the LabView graphical user interface (GUI), properly synchronize the signal integration and, for every temperature & voltage value, record the photon spectrum and measure directly the Dark Count and the Optical Cross talk.



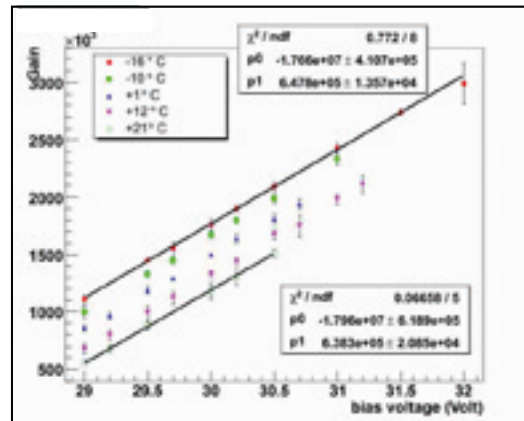
Experimental setup block diagram.

Results

Figures show the dependence of the gain upon temperature at various voltages and the voltage dependence at various temperatures. By the two set of results, the temperature coefficient of the sensor, i.e. the variation of the breakdown voltage with temperature, can be measured.



SiPM gain as a function of temperature, at different bias voltage values.



SiPM gain as a function of the bias voltage, at different temperature values.

This experiment is also possible with the following kits

B SP5600AN
Educational kits
★ PREMIUM



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