CAEN
Tools for Discovery

CAEN EDUCATIONAL
edu.caen.it



HANDBOOK OF EXPERIMENTS

SG6013A Silicon Photomultiplier (SiPM)

Temperature Effects on SiPM Properties

Particle Detector Characterization

EDUCATIONAL KIT

SP5600E

CAEN S.p.A. · Via Vetraia 11, 55049 Viareggio (LU) Italy · www.caen.it — © 2026 CAEN S.p.A. All rights reserved.
Specifications are subject to change without notice.

CAEN EDUCATIONAL · SG6013A

Temperature Effects on SiPM Properties

Categories: CAEN Experiments, Particle Detector Characterization | Tags: Photon detector, Physics detector, SiPM, SiPM Characterization

Difficult	Execution Time	Data Analysis	Radioactive Sources
		Yes	No

Hardware setup

This experiment guide is referred to the **SP5600E** educational kit.

Equipment: SP5600 – Educational Photon Kit

Model	SP5600	DT5720A	SP5601	SP5650C
Description	Power Supply and Application Unit	Desktop Digitizer 250 MS/s	LED Driver	Sensor Holder for SP5600 with SiPM

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.

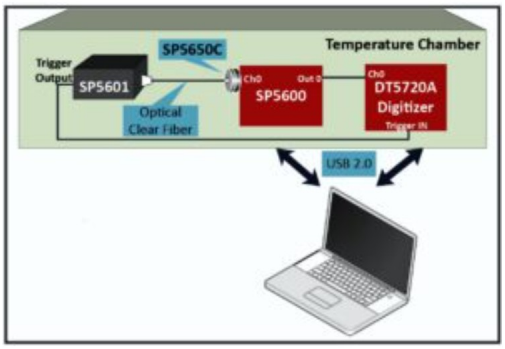
Fundamentals

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.

Requirements

A temperature controlled box/room is essential.

Carrying out the experiment

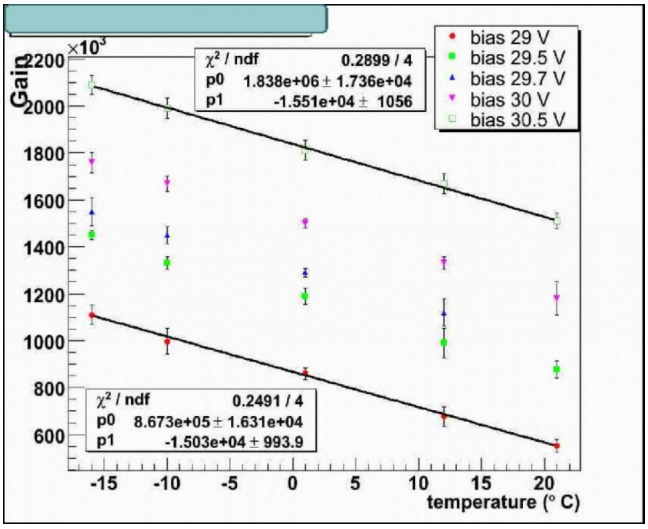


Experimental setup block diagram

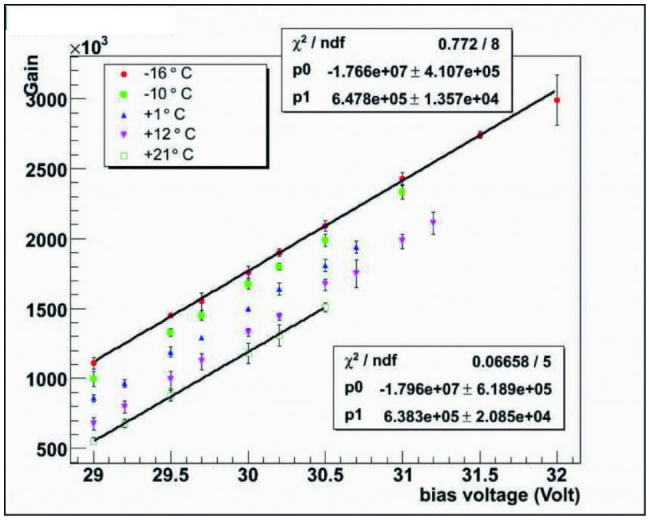
In a temperature controlled box, mount one of the sensors (SP5650C) on the SP5600 and connect the analog output to the input of the DT5720A digitizer. Optically couple the LED and the sensor via the optical fiber, after having used the index matching grease on the tips. Set the internal trigger mode on the SP5601 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.

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.



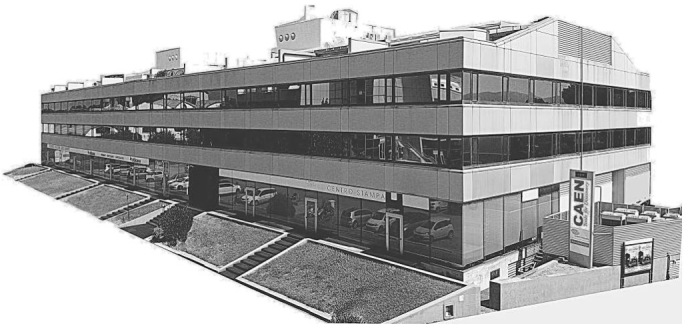
SiPM gain as a function of the bias voltage, at different temperature values.

HEADQUARTERS

CAEN S.p.A.

Via Vetraia 11
55049 - Viareggio
Italy

Phone +39 0584 388 398
Fax +39 0584 388 959
info@caen.it
www.caen.it



WORLDWIDE

CAEN GmbH

Brunnenweg 9
64331 Weiterstadt
Germany
Phone +49 212 254 40 77
Fax +49 212 254 40 79
info@caen-de.com
www.caen-de.com

CAEN Technologies, Inc.

1 Edgewater Street - Suite 101
Staten Island, NY 10305
USA
Phone: +1 (718) 981-0401
Fax: +1 (718) 556-9185
info@caentechnologies.com
www.caentechnologies.com

CAENspa INDIA Private Limited

B205, BLDG42, B Wing,
Azad Nagar Sangam CHS,
Mhada Layout, Azad Nagar, Andheri (W)
Mumbai, Mumbai City,
Maharashtra, India, 400053
info@caen-india.in
www.caen-india.in

CAENsn SAS

Gare du Nord Business Centre 14,
Rue De Dunkerque
75010 Paris
France
info@caen-sn.fr
www.caen-sn.fr