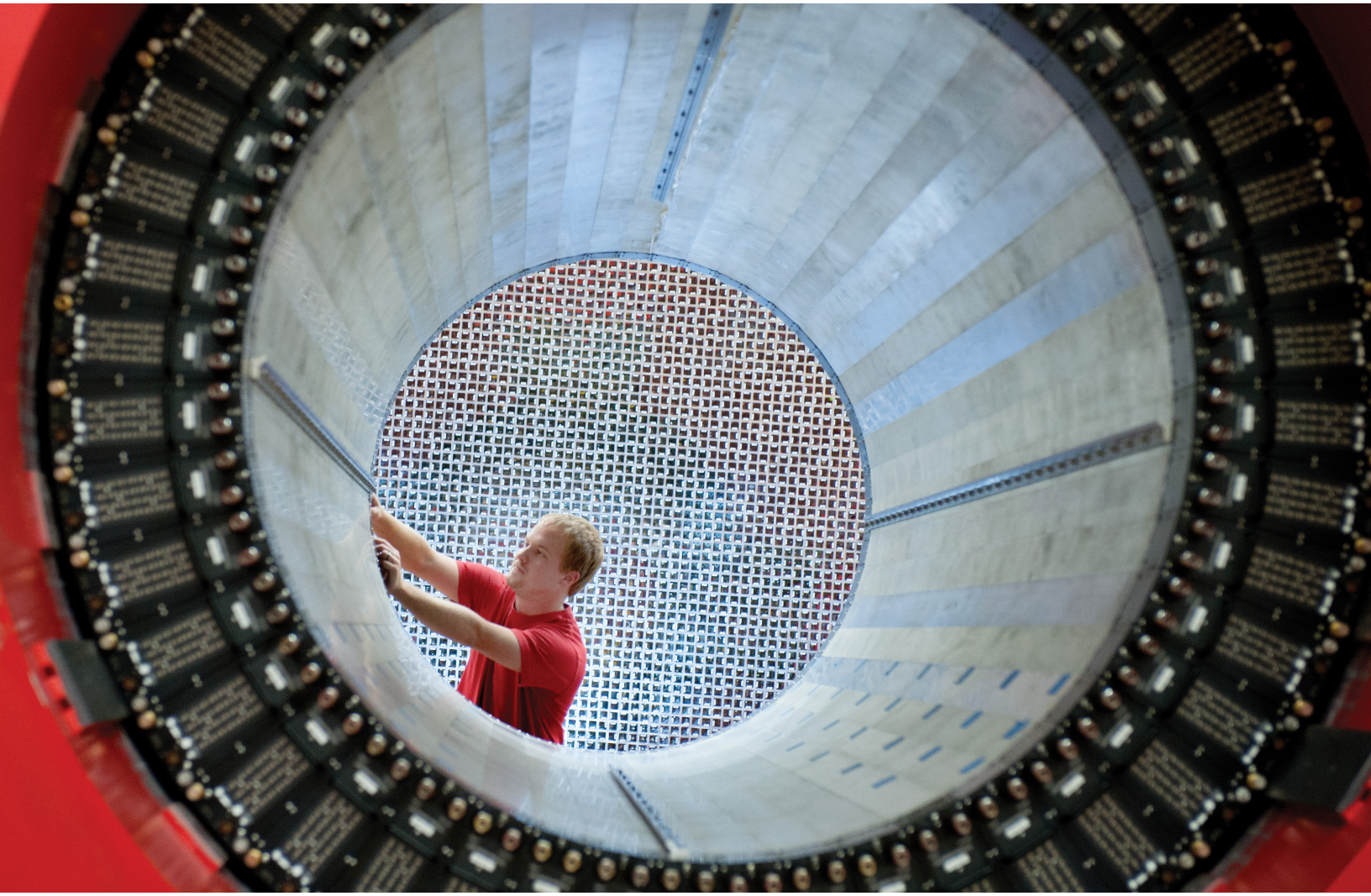
Jefferson Lab

TEMPERATURE-COMPENSATED SiPM

Modular Circuit Suitable for Large and Small Detector Applications



Technology Applications:

- Nuclear Physics Research
- Medical Imaging System Providers
- Remote Sensing System Providers
- Radiation Monitoring System Providers
- Industrial Safety
- Radioisotope Production
- Radiation Survey Instrumentation
- Portal Monitoring System Providers

Enables simple, low cost and near-zero-footprint temperature-stabilized SiPM detectors

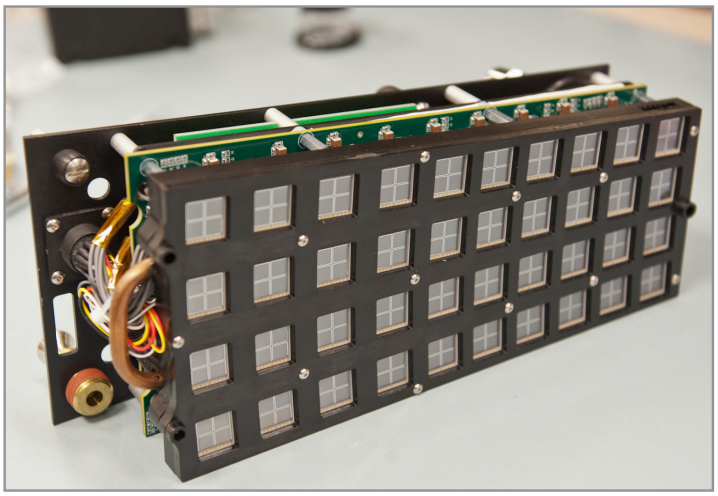
WHAT IT IS

This technology is a modular concept for a circuit coupled with the method for determining component values allowing one or several Silicon Photomultiplier (SiPM) devices to be temperature compensated to a near-zero-degree-temperature coefficient of gain. The module, which utilizes the passive compensation technique described in US Patent 9,123,611, requires neither microprocessor nor active circuitry and is capable of stabilizing the gain of a SiPM over a broad range with only a few components, and to match gains of SiPMs without requiring different bias supplies.

WHAT IT DOES

Making use of passive components and a stable, constant voltage power supply, the module can be used with a single SiPM or in moderately large groups to stabilize the SiPM gain over a temperature range of up to 20°C. The module is coupled thermally to the SiPM and small enough not to alter its footprint. It provides a temperature varying voltage divider that smoothly and continuously presents a bias voltage to the SiPM that assures that its gain remains stable.

The technique has already been proven in demanding applications. Nearly 4,000 SiPMs are stabilized using this technology as a part of the Barrel Calorimeter (BCAL) instrument for the GlueX experiment at Jefferson Lab. In that application groups of ten modestly matched SiPM devices shared power supplies with other matched groups. The design parameters allow the detector to be operated anywhere between 5°C and 25°C without adjusting bias voltages, and outside of that range with appropriate trimming of the bias supply voltages.



(Front page and above) The GlueX Barrel Calorimeter (BCAL) detector (front) presented a formidable challenge to maintaining SiPM gain uniformity and stability, however nearly 4,000 SiPMs (above) have been stabilized as a part of the BCAL detector at Jefferson Lab.

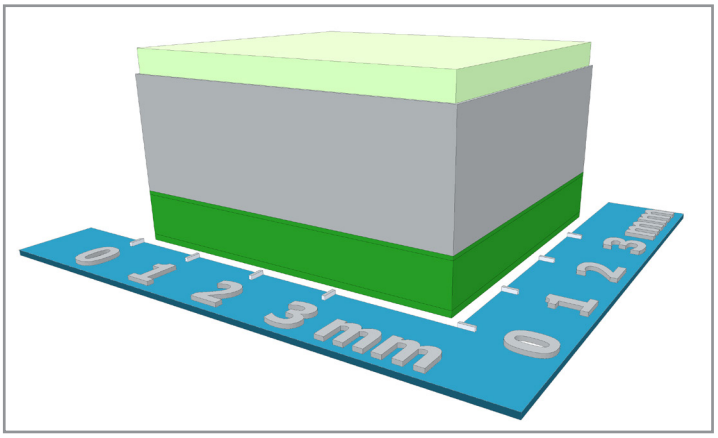


Illustration showing how a module fits under a single SiPM without altering its footprint.

Technology Highlights:

- Modularizable for single to dozens of SiPMs
- +/- 10°C temperature compensation range
- As low as 12 mW per SiPM power dissipation
- Adaptable for single SiPM or arrays
- Adapts to most SiPM readout configurations
- Allows gain matching of SiPMs across array

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