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Gain stabilization of Silicon Photomultipliers and Afterpulsing

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The gain of silicon photomultipliers (SiPMs) increases with bias voltage and decreases with temperature. To operate SiPMs at stable gain, the bias voltage can be adjusted to compensate temperature changes. We have tested this concept with 30 SiPMs from three manufacturers (Hamamatsu, KETEK, CPTA) in a climate chamber at CERN varying the temperature from 1°C to 50°C. We built an adaptive power supply that used a linear temperature dependence of the bias voltage readjustment. With one selected bias voltage readjustment, we stabilized four SiPMs simultaneously. We fulfilled our goal of limiting the deviation from gain stability in the 20°C-30°C temperature range to less than $\pm 0.5\%$ for most of the tested SiPMs. We have studied afterpulsing of SiPMs for different temperatures and bias voltages.

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