

## A comparative study on various methods for SiPM gain calibration

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Silicon photomultipliers (SiPM) are the photo detectors of choice for many applications thanks to their excellent performance in counting photons. To use SiPMs as photon counters, the gain must be known beforehand and the stability of the gain must be constantly monitored.

The gain is commonly determined by resolving the single photoelectron peak in the detected charge distribution. Although this method has shown high accuracy and reproducibility, a good signal to noise ratio (S/N) and an appropriate light level are required so as to resolve each peak in the charge distribution. The purpose of our study is to compare the performance of alternative calibration methods.

In our study, two additional methods to calibrate the gain of SiPMs are studied. One method uses the statistical fluctuation of detected charge in measurements with a Poisson distributed light. As shown in a previous study, we confirmed that the linearity between the mean and the variance can be used to obtain the gain. We also found some issues to be addressed.

In the other method, the gain is calculated from the shape of the signal waveform, which was tested for PMTs in a previous study. In this study, we applied this method to SiPMs. It was found that this method works for SiPMs, although there are some issues specific to SiPMs.

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