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Rapid characterization of SiPMs for noble liquid experiments

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Silicon photomultipliers (SiPMs) are emerging as the photodetector technology to be used in upcoming noble liquid experiments. Newly developed SiPMs sensitive to vacuum ultraviolet (VUV) light will be directly used for the readout of scintillation photons ($\lambda = 175\text{nm}$) from liquid xenon in future tonne-scale experiments such as nEXO searching for neutrinoless double beta decay in ^{136}Xe . In this research project, VUV-SiPMs from two different vendors are characterized using current-voltage (IV) and pulse-level measurements performed at TRIUMF, from room temperature to liquid xenon temperature. These data are analysed to extract the SiPM's features like breakdown voltage, gain, crosstalk, afterpulsing and dark noise rates. The IV and pulse-level results are compared. A method is proposed for rapid quality control of large numbers of SiPM using IV measurements.

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