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Cryogenic detector monitoring and calibration with internally mounted LEDs

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As dark matter searches aim to achieve lower energy thresholds, it is important to understand the behaviour of the detectors in these new regimes. Light-emitting diodes (LEDs) offer a simple and flexible source of photons with energy ranges from 0.3 eV (mid-infrared) to 5 eV (near ultraviolet). Prototype cryogenic silicon detectors developed by the SuperCDMS collaboration have been able to achieve energy resolutions below 3 eV. By taking advantage of the Neganov-Trofimov-Luke (NTL) effect, the effective resolution can be reduced to well below the bandgap of silicon at mK temperatures of 1.2 eV. At our R&D facility at TRIUMF, we have been testing two of these "HVeV"detectors using a range of LEDs at mK temperatures. We have demonstrated the LEDs suitability for detector calibration and have applied them to investigate the detector response to photons ranging from sub-gap infrared to near ultraviolet.

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