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C2Po1A-01: Optimal Leveraging of Gifford McMahon Cryocooler's Regenerative Cooling Power for SNSPD Applications

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Superconducting nanowire single photon detectors (SNSPDs) offer unparalleled efficiency, minimal dark count rates, and picosecond jitter, making them ideal for single photon detector applications across the visible to mid-IR spectrum. A common cryogenic system used to reach these detectors' optimal operating temperatures (>1 K) consists of a Sumitomo's compact RDK101 Gifford McMahon Cryocooler (GMC) running on an Zephyr air cooled compressor, coupled with a 4He adsorption stage. In this work, we provide measurements of the RDK101 GMC second stage regenerator tube cooling power at several locations along its length. We then characterise the performance of the adsorption cooler with heat loads applied to the regenerator tube. Our measurements indicate that heat loads of 1.2 W can be intercepted at the tube's section near the GMC's first cooling stage, with negligible adsorption cooler performance degradation. The thermal conductivity of yellow brass coaxial was characterised from 4 K to 50 K. Here we show that the heat load from 64 coaxial cables can be optimally intercepted with the defined regenerator cooling power. These results demonstrate that a 1024-pixel SNSPD array using a 32x32 row column multiplexing architecture can be successfully implemented in this cryogenic platform.

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