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The Latest Developments in Low Cost, Low-Power Cooling to below 1 Kelvin

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Self-contained, sealed 4He sorption modules, interfaced to low-power mechanical precoolers, provide simple, reliable and economical access to temperatures below 1K. The technology for low-power sub-Kelvin cooling is well established and available products offer fully automated operation, require no special supporting infrastructure and little or no cryogenics expertise. In this paper we present breaking developments with the very latest products of this type. CRC's compact GL4 modules are designed to interface to the Sumitomo RDK101 cold head, run from a CNA-11 compressor, which is air-cooled, utilises single-phase electricity, and is small enough to fit under a desk or even into a 19-inch rack. A medium-size GL4 module runs at a base temperature of approximately 800mK and typically provides around 40 hours run time under a 100μW applied load. We are testing a new design of GL4 incorporating many improvements to give more consistent performance. We also compare and contrast the performance obtained using the RDK101 cold head with a new cold head in development by Sumitomo, the 2KGM. This new cold head, an evaluation version of which has kindly been made available to us by Sumitomo, is even smaller than the RDK101. It has superior cooling power to the RDK10I at the second stage, and hence reaches a lower operating temperature while still using the compact CNA-11 compressor. Our results clearly demonstrate that the lower temperature of the 2KGM produces significantly better performance from our GL4 modules, enabling longer run times and greater heat lift. Operational characteristics such as cooldown time and GL4 recycling time are the same for both RDK101 and 2KGM. The new medium-size GL4 provides a run time of around 45 hours when operated under a 100μW applied load with the RDK101/CNA-11 combo, but the 2KGM further improves the new GL4's performance under all load conditions.