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C3Or2A-07: Design of re-condensing cryostats for long term use in magnet beamline applications

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With the advent of high-power pulse tube refrigerators cryogen free research tools providing mK temperatures and moderate applied magnetic fields have become commonplace. For large scale applications, complex and ultra-high field superconducting magnets liquid helium reservoirs remain a well-considered design option. Truly zero loss, re-condensing cryostats for such large-scale applications are also now possible. Through improved understanding of system cryogenics, magnet design and system peripherals such systems have been demonstrated to show spare capacity for additional heatloads such as continuous sweeping, superconducting switches and high current capacity leads. Furthermore, full re-condensation of helium flow through cryogenic inserts can be achieved, with experimental temperature ranges extended below 100 mK in continuous operation.

This paper will identify the benefits of re-condensing designs and present data on a variety of design configurations and performance. Techniques for optimizing their use and efficiency for various experimental regimes of magnetic field and temperature will also be described.

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