Contribution ID: **471** Type: **Contributed Oral Presentation**

Cool-down acceleration for G-M cryocoolers with thermal oscillations passively damped by helium

Wednesday, 1 July 2015 11:45 (15 minutes)

4 K Gifford-McMahon cryocoolers suffer from inherent temperature oscillations which can be a problem for certain attached electronic instrumentation; Sumitomo Heavy Industries has exploited the high volumetric specific heat of super-critical He to quell these oscillations (approx. 10 dB) by strongly thermally linking a separate vessel of He to the second stage; no significant thermal resistance is added between the payload and the working gas of the cryocooler. A noticeable effect of the helium damper is to increase the cool-down time of the second stage, particularly below 10 K when the heat capacity of the He is dominant. For the operation of niobium-based superconducting electronics (NbSCE), a common practice is to warm the circuits above the critical temperature (˜9 K) and then cool to the operating point in order to redistribute trapped magnetic fluxons, so for NbSCE users, the time to cool from 10 K is important. The gas in the helium damper is shared between a room-temperature canister and the 2nd stage vessel, which are connected by a capillary tube. We show that the total cool-down time below 10 K can be substantially reduced by introducing a combination of thermal linkages between the cryocooler and the capillary tube and in-line relief valves, which control the He mass distribution between the warm canister and cold vessel. The time to reach operating temperature from the superconducting transition has been reduced to <25% of the time needed without these low-cost modifications.

Primary author: WEBBER, Robert (Hypres, Inc.)

Co-author: Mr DELMAS, Jean (Applied Materials, Inc.)

Presenter: WEBBER, Robert (Hypres, Inc.)

Session Classification: C3OrD - 4K Cryocoolers

Track Classification: CEC-03 - Cryocoolers (Non-Aerospace)