Performance testing of the Flight Model Astro-H 3-stage ADR

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Abstract – The (SXS) is one of four instruments that will be flown on the Japanese Astro-H satellite, planned for launch in late 2015/early 2016. The SXS will perform imaging spectroscopy in the soft x-ray band using a 6x6 array of silicon microcalorimeters operated at 50 mK, cooled by an adiabatic demagnetization refrigerator (ADR). NASA/GSFC is providing the detector array and ADR, and Sumitomo Heavy Industries, Inc. is providing the remainder of the cryogenic system (superfluid helium dewar (<1.3 K), Stirling cryocoolers and a 4.5 K Joule-Thomson (JT) cryocooler). The ADR is unique in that it is designed to use both the liquid helium and the JT cryocooler as its heat sink. The flight detector and ADR assembly have successfully undergone vibration and performance testing at GSFC, and have now undergone initial performance testing with the flight dewar at Sumitomo Heavy Industries, Inc. in Japan. This paper summaries the performance of the flight ADR in both cryogen-based and cryogen-free operating modes.

Keywords – Cryocooler, adiabatic demagnetization refrigerator, Soft X-ray Spectrometer, Astro-H satellite