Performance of the three-stage ADR that provides cooling of the soft X-ray spectrometer aboard Astro-H.

Mark O. Kimball and Peter J. Shirron
Cryogenics and Fluids Branch, NASA Goddard Space Flight Center
8800 Greenbelt Road, Greenbelt MD, 20771

The requirements levied upon the cooling system for the soft X-ray spectrometer (SXS) aboard the Astro-H satellite are demanding: Provide an operating temperature of 0.050 K for a minimum of 24 hours, recycle in less than 2 hours (less than 1 hour in some cases), produce a dipole moment of less than 10 $A \cdot m^2$ at the detector location, and do all this with a mass less than 15 kg. This is further complicated by the availability of both a 1.3 K helium bath and a 4.5 K JT cooler to recycle the refrigerator. Here we detail the performance of the adiabatic demagnetization refrigerator (ADR) built specifically for SXS that is capable of meeting, and often significantly exceeding, the requirements placed upon it.