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Energy Gain Scale of the Astro-H Soft X-ray Spectrometer: wide-bandpass measurements and optimal fitting function

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Microcalorimeter spectrometers enable high-resolution non-dispersive spectroscopy in the soft x-ray waveband (~0.1-12 keV), an important tool for x-ray astrophysics. The Soft X-ray Spectrometer (SXS), which uses a 36-pixel array of silicon thermistor microcalorimeters, will launch aboard the Japanese-led Astro-H mission in 2016. Many of the primary science goals of the mission, and of future microcalorimeter missions, will be highly dependent on the instrument calibration. In this contribution, we present measurements of the energy gain scale - the relationship between the measured signal and the incident photon energy - of the SXS array based upon a combination of ground calibration measurements. These include wide-bandpass (4-25 keV) measurements in the final flight-like configuration of the instrument at Tsukuba Space Center (March 2015) and extensive parametric measurements in the science bandpass (0.3-12 keV)

from the detector sub-system calibration campaign at NASA/GSFC (2012-2013). We use these data to derive a non-linear function that describes the gain scale, and to understand how the shape of the function changes with instrument operating conditions, incident photon flux and event grade. We will present the results of the gain scale measurements and discuss the uncertainties on our knowledge of the energy gain scale, with an emphasis on the optimal fitting functions for both the primary science bandpass and the extended bandpass over which the instrument operates (to >30 keV). These results will be used in conjunction with the non-linear drift correction technique (described in the contribution by F.S. Porter et al.) in the software pipeline processing of the on-oribit SXS data.