16th International Workshop on Low Temperature Detectors
20 24 July 2015

Temporal gain correction for x-ray calorimeter spectrometers

Main author:

PORTER Frederick

Co-authors:

Chiao Meng, NASA/GSFC
Eckart Megan, NASA/GSFC
Fujimoto Ryuichi, Kanazawa University
Ishisaki Yoshitaka, Tokyo Metropolitan University
Kelley Richard, NASA/GSFC
Kilbourne Caroline, NASA/GSFC
Leutenegger Maurice, NASA/GSFC
Mitsuda Kazuhisa, ISAS
Porter Frederick, NASA/Goddard Space Flight Center
Sawada Makoto, Aoyama Gakuin University
Tsujimoto Masahiro, ISAS
Watanabe Tomomi, NASA/GSFC
Yoh Takei, ISAS

Calorimetric x-ray detectors are very sensitive to their environment. The boundary conditions can have a profound effect on the gain including heat sink temperature, the local radiation temperature, bias, and the temperature of the readout electronics. Any variation in the boundary conditions can cause temporal variations in the gain of the detector and compromise both the energy scale and the resolving power of the spectrometer. Most production x-ray calorimeter spectrometers, both on the ground and in space, have some means of tracking the gain as a function of time, often using a calibration spectral line. For small gain changes, a linear stretch correction is often sufficient. However, the detectors are intrinsically non-linear and often the event analysis, i.e. shaping, optimal filters etc..., add additional nonlinearity. Thus for large gain variations or when the best possible precision is required, a linear stretch correction is not sufficient. Here we discuss a new correction technique based on non-linear interpolation of the energy scale functions. Using Astro-H/SXS calibration data, we demonstrate that the correction can recover the x-ray energy to better than 1 part in 10^4 over the entire spectral band to above 12 KeV even for large scale gain variations.

This method will be used to correct any temporal drift of the on-orbit per-pixel gain using on-board calibration sources for the SXS instrument.