



Ground calibrations of the X-ray detector system of the Solar Intensity X-ray Spectrometer (SIXS) on board BepiColombo

Juhani Huovelin (1), Arto Lehtolainen (1), Maria Genzer (2), Seppo Korpela (1), Eero Esko (1), and Hans Andersson (3)

(1) Department of Physics, Helsinki University, Helsinki, Finland, (2) Finnish Meteorological Institute, Earth Observation, Helsinki, Finland, (3) Oxford Instruments Analytical Oy, Espoo, Finland

SIXS includes X-ray and particle detector systems for the BepiColombo Mercury Planetary Orbiter (MPO). Its task is to monitor the direct solar X-rays and energetic particles in a wide field of view in the energy range of 1-20 keV (X-rays), 0.1-3 MeV (electrons) and 1-30 MeV (protons). The main purpose of these measurements is to provide quantitative information on the high energy radiation incident on Mercury's surface which causes the X-ray glow of the planet measured by the MIXS instrument. The X-ray and particle measurements of SIXS are also useful for investigations of the solar corona and the magnetosphere of Mercury.

The ground calibrations of the X-ray detectors of the SIXS flight model were carried out in the X-ray laboratory of the Helsinki University during May and June 2012. The aim of the ground calibrations was to characterize the performance of the SIXS instrument's three High-Purity Silicon PIN X-ray detectors and verify that they fulfil their scientific performance requirements. The calibrations included the determination of the beginning of life energy resolution at different operational temperatures, determination of the detector's sensitivity within the field of view as a function of the off-axis and roll angles, pile-up tests for determining the speed of the read out electronics, measurements of the low energy threshold of the energy scale, a cross-calibration with the SMART-1 XSM flight spare detector, and the determination of the temperature dependence of the energy scale. An X-ray tube and the detectors' internal Ti coated ^{55}Fe calibration sources were used as primary X-ray sources. In addition, two external fluorescence sources were used as secondary X-ray sources in the determination of the energy resolutions and in the comparison calibration with the SMART-1 XSM.

The calibration results show that the detectors fulfill all of the scientific performance requirements. The ground calibration data combined with the instrument house-keeping data, spacecraft attitude data in relation to the Sun, and the in-flight calibration spectra measured during the operations contain all required information for the final analysis of the solar X-ray data.