High-energy electron instrument for the exploration of the Mercury's magnetosphere by BepiColombo-MMO

Takeshi Takashima[1]; Takefumi Mitani[2]; Masafumi Hirahara[3]; Kana Nishimura[4]
[1] ISAS, JAXA; [2] ISAS/JAXA; [3] STEL, Nagoya Univ.; [4] Earth & Planetary Science, Tokyo Univ.

The design of High-energy Electron Instrument(HEI) is on the basis of a simple measurement principle; to measure an energy of incident particle only using solid-state detector (SSD) and to determin a direction of one using pin-hole camera principle, that is similar to the previous high-energy electron instruments, for instance, RAPID-IES on CLUSTER. The HEI consisting of a rectangle-shaped slit for incident angle selection of electrons, two inclined SSD arrays which of thickness is 450 um by Hamamatsu Photonics, each of which has five discrete areas corresponding to five readout electronics with ASIC. The SSD arrays are being newly developed by the design concept called single-sided silicon strip detector(SSSD) suitable for the particle energy analysis at the energy range of less than a few MeV. Every incident side surface of SSD is coated by alumunum to reduce the ions with energies of less than about 700 keV from intruding into the sensitive layer of SSD. Each of five areas of the SSD array has 32 strips in order to improve the energy resolution of SSD and achieve the adequate energy distribution measurements even under the severe thermal condition(up to 80 degreeC) at the Mercury orbit.

The HEI system performance was tested by 137Cs using X-rays and internal conversion electrons without collimator. All energy deposited signals in the same block SSSD(32 channels) were summed up to correct deposited energy for divided into two strips. The peak of 32keV is K-alpha of Ba, the peak of 624keV is from Ba-K shell and the last one of 656keV is from Ba-L shell in Figure3. The energy resolution (FWHM) for electron is about 15keV and the energy thresh-hold is less than 20keV. This performance satisfies the requirement of high-energy electron instrument for Mercury explore mission.