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Mission data processing and attitude control of the SPRINT-A/EXCEED mission

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The mission data processing and attitude control of extreme ultraviolet (EUV) spectroscope (EXCEED) onboard the SPRINT-A satellite are presented. SPRINT-A is an earth-orbiting extreme ultraviolet spectroscopic mission being developed by ISAS/JAXA. Two mission instruments are installed in EXCEED, an EUV spectrograph and a target guide camera, and the final quantification of them has been completed in the beginning of 2013. It is planned to launch on August 2013 and will begin observation of Venus and Jupiter on October. Collaboration with Hubble Space Telescope is approved on January 2014. The target guide camera is designed to capture a part of a target planet disk whose light is reflected from the front side of a slit. Mission data processor (MDP) acquires the image every 3 seconds, calculates the centroid position of the disk on the image, and sends it to the attitude control system. While the pointing accuracy of the bus system is at most 2 arc-minutes, scientific requirement for spatial resolution is 10-arcsec to derive radial structure of Io plasma torus and detect plasma emissions from ionosphere, exosphere and tail separately (Venus and Mars). The attitude control system keeps the centroid position with an accuracy of 10 arc-seconds to achieve the spatial resolution required. This pointing correction algorithm is applied to correct slow changes in the pointing direction which is mainly caused by changing thermal input from the sun and earth to the satellite. Though vibrations from reaction wheels installed in the bus system could cause random pointing error, the amplitude is estimated to be 1 arc-second for SPRINT-A. To test the centroid calculation algorithm, a small pinhole image was taken by the guide camera with flight-model optical layout. The size and brightness of the pinhole were equivalent to those of Jupiter. Changing the pinhole position, acquiring and processing of the image and centroid calculation were repeated many times. The designed algorithm has been confirmed to work well and the stability of the centroid position was found to be less than 0.3 arc-second. Final interface test between EXCEED and attitude control system is planned on March 2013.