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An observation performance study of NIRS3 on Hayabusa-2 based on low temperature examination data for InAs detector

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The Near Infrared Spectroscopy (NIRS3) will be equipped to survey hydrated mineral on an asteroid in the next mission : Hayabusa2. It will provide the data for selecting the sampling positions, making global map of abundance of water and observing difference of surface minerals. The reflectance spectra of minerals have absorption features in the visible and near infra-red region. For example, near 2.7um region has many absorption features related to hydroxyl stretching and H_2O bending, and near 1.9um and 3.0um region have bending of molecular H_2O. The absorption near 1.9um is weaker than near 3.0um. In addition, the feature near 1.9um is more vulnerable to heat than near 3.0um.

One of the scientific objective of the NIRS3 is to determine the amount of water and hydrated minerals. It requires the enough quality for remote sensing to extract both strong and weak absorption features from the data, thus we designed the signal to noise ratio (SNR) of more than 50.

This SNR mainly depend on performance of devices. The performance of InAs linear image sensor used NIRS3 has been measured in the factory, however the operating temperature during the measurement was higher than estimated actual one. So we confirmed performance of engineering model (EM) and flight model(FM) under -70^{o}C.

The total performance of observation of NIRS3 has been considered based on environmental test for EM sensor until now, and the SNR has not reached 50. The major factor in decreasing SNR is fluctuation in the dark current. If we could not achieve that required SNR, we were required changing the sampling methods of signal or optical design or temperature setting.

Recently, the FM sensor was supplied and we did same test with EM sensor. This examination shows that FM sensor has smaller noise and dark current than EM's. Furthermore, the deference of FM sensor arrays sensitivity was smaller than EM's. Thus we compared the quality of EM and FM, and considered SNR which will be obtained on mission.

Keywords: Hayabusa-2, NIRS3, asteroid, 1999JU3, spectro, near infrared