Correction technique and quality evaluation of CCD radiation damage

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We are developing a Ultra Violet Imager (UVI) which is one of the 5 cameras onboard the Venus Climate Orbiter (VCO). The VCO is the first planetary meteorological spacecraft and the cameras measuring different wavelength reveal atmospheric dynamics by cooperating with each other. The UVI is designed to measure the ultraviolet scattering lights at 283nm and 365nm wavelengths from cloud top altitude. SO_2 at the cloud top absorbs the radiation in the region between 200nm and 320nm but the absorption above 320nm is due to “unknown” absorber. Identification of the absorber is important for the energy balance and dynamics of the Venus atmosphere. Tracking the cloud motion is used to investigate the dynamics of cloud, winds and wave phenomena.

The performance of UVI aims at the horizontal space resolution tens of the km and S/N 100 to catch to the meso-scale phenomenon. On the other hand, when the radiation is bathed in, the performance of CCD is known to be deteriorated in general. We have experimentally confirmed that UVI CCD has dark spikes from 30% to 40% in the pixels after be exposed to 5 Krad proton which is maximam dose expected for the mission period. Shielding to protect the CCD from radiation is needed but the decrease of the charge transfar efficiency which is caused even under 1 Krad dose cannot be completely prevented.

In this presentation, we show how to correct dark spikes in the pixel and the performance achieved after the correction. Even when we added imitated dark spikes from 40% to 50% in pixels of Venus images, we could obtain the images which have half spacial resolution of original images. And we will discuss the verification of the influence on S/N caused by the charge transfer efficiency decrease.