

Development of the lightning and airglow camera using an APD detector for the Venus Climate Orbiter

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We are developing a lightning and airglow camera (LAC) onboard the Venus Climate Orbiter (VCO). LAC is a high-speed imaging sensor and measures lightning flashes and airglow emissions on the nightside disk of Venus when VCO is located within the umbra of Venus. The goal of the LAC is to measure lightning events with an intensity of 1/100 of standard lightning events on the Earth from 1000 km altitude and to measure 100-R (Rayleigh) airglow with signal to noise ratio (S/N) more than 10.

The LAC has a field of view (FOV) of 16 degrees in the full angle. As a candidate of the detector, we are testing a multi-anode avalanche photo-diode (APD). It has 8 by 8 matrix of 2-mm square pixels, out of which 44 pixels covers the circular FOV of LAC. We adopt single lens optics and use interference filters for selecting a wavelength of 777 nm [OI] for lightning flash measurement and wavelengths of 551 nm [O₂] and 558 nm [OI] for nightglow measurement. The bandwidth of the interference filter (FWHM) is 8 nm. Individual lightning flash events are recorded with a 50-kHz pre-trigger sampling, while airglow images are recorded continuously at intervals of 10 seconds. The LAC has a spatial resolution of about 35 km for measurement at 1000 km altitude and 850 km at 3 R_v altitude (R_v: Venus radius). The total weight of LAC is 1.5 kg.

We are investigating the optical and electrical performance of APD and testing the pre-trigger sampling logic using an electrical breadboard model. We report a design concept of LAC and the results of these tests.