1. SWIRP (Submm-Wave and long wave InfraRed Polarimeter); 2. development and characterization of a sub-mm polarimeter for ice cloud investigations

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A major source of uncertainty in climate models is the presence, shape and distribution of ice particles in the uppermost layers of the clouds. The effects of this component are poorly constrained, turning ice particles into an almost-free variable in many climate models.
NASA-GSFC is developing a new instrument aimed at measuring the size and shape of ice particles. The instrument consists of two sub-mm polarimeters (at 220 and 670 GHz) coupled with a long-wave infrared polarimeter at 10 micron.
Each polarimeter has identical V-pol and H-pol channels; the axes of polarization are defined geometrically by the orientation of the waveguide elements, and the purity has been measured in the lab.
The instrument is configured as a conical scanner, suitable for deployment as a payload on a small satellite or on a high-altitude sub-orbital platform. From a 400 km orbit, the instrument has a 3dB spatial resolution of 20 (10) km at 220 (670) GHz and a swath of 600 km over 180 degrees of view.
The BAPTA (Bearing And Power Transfer Assembly) carries heritage from the SSMIS design, now in its 22nd year of on-orbit operation, but with a much reduced SWaP (Size Weight and Power) footprint, suitable for a small satellite.
The main components of the instrument have been fabricated and are undergoing final testing prior to their integration as a single unit.
The sub-mm channels have dedicated secondary reflectors which illuminate a shared primary reflector. The receiving units are placed behind the focal point of the optical arrangement, so that all beams equally illuminate the primary reflector and are almost co-located on the ground (within a single 220 GHz footprint). Primary and secondary beam patterns have been measured and verified to match the as-designed expectations. A Zytex (TM) window is deployed to protect the secondary reflectors and the feed horns from debris and other contaminants, and to reduce the heat load from the active (hot) IR calibration unit. The insertion loss of Zytex has been measured and is accounted in the calibration equation of the sub-mm channels.
The radiometric performance of the sub-mm receivers has been characterized in the lab and under operational conditions of temperature and pressure.
This paper discusses the design constraints on the sub-mm components, details of the scientific goals and their flowdown, and describes the characterization of the polarimeters. Options to optimize the layout and distribution of the masses within the assembly, with the goal of making the instrument even more compact and fully-compatible with cubesat-class satellites will be presented.