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THE SEA & LAND SURFACE TEMPERATURE RADIOMETER (SLSTR) TECHNOLOGIES

Abstract

SLSTRs are high accuracy radiometers selected for the Sentinel-3 component of the GMES mission. They will provide climatological data continuity following previous ESA environmental missions that embarked AATSR, ATSR-2 and ATSR.

SLSTR has an improved design affording large near nadir and oblique view swaths (1400 and 740 km) for global coverage of Sea and Land Surface Temperature (SST/LST) with a daily revisit time appropriate for both climate and meteorology (1 km spatial resolution). Clouds screening and other products are implemented via the double spatial resolution (0.5 km) visible and SWIR channels. Moreover two additional channels have been included using dedicated elements within the detectors to monitor high temperature events such as forest fires.

Two dedicated telescopes and scan mirrors generate the two swaths and they are combined optically at the prime focus by means of a fast switching flip mirror which is synchronised with the scan mirrors. This technology is housed in the Opto-Mechanical Enclosure(OME).

The OME feeds into the Focal Plane Assembly (FPA) which spectrally separates eleven channels (3 VIS, 3 SWIR, 2 MIR, 3 TIR) with dichroics. There are nine Detector Units (DUs) each of one with a precision filter to define its spectral response. The IR channels optics/detectors are cooled down to 80 K by an active Cryo-cooler that has vibration compensation. The separated housed visible channels need to be run at a stabilised uncooled temperature.

SLSTR comprises two physical units: first the Optical Scanning Unit, which forms the main instrument structure holding telescopes, calibration units, radiators, FPA, Front End Electronics (FEE) and the cooling system; second the Control Processor electronics unit which controls all subsystems and manages the data interface with the satellite. The FEE electronics has been optimised for required performance with the best compromise between redundancy and power consumption.

The paper highlights the technological developments that have been necessary to implement the SLSTRs. For instance, high efficiency ROICs with PV HgCdTe detector technology are used for the SWIR and MIR channels, while the TIR channels have high quantum efficiency HgCdTe PC detectors. The VIS detectors use hybrid TIA amplifiers with low noise and high electronic bandwidth.