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Visible Emission Line Coronagraph (VELC) on board India's first space solar mission Aditya-L1 is an internally occulted reflective coronagraph designed for solar coronal studies. VELC is capable performing the observations in imaging, spectroscopic and spectro-polarimetric modes closer to the solar limb (50arcsec). Super polished off-axis parabolic mirror is chosen as primary mirror (M1). Due to the off-axis primary, the payload structure deviates from the cylindrical structure. VELC consists of 21optical assemblies, 4 detectors and 4 baffles. The payload volume is 1.71m (L) x 1.07m (W) x 0.540m (H). All the payload components should be aligned to tight tolerances (<20 arcsec) in order to meet the performance requirements. Payload global stiffness has to be > 100 Hz to withstand the launch loads. The in-orbit thermo-structural (check) stresses should be minimal such that the payload performance is not compromised. Thermal gradient in the optical cavity is around 6˚C (22±3˚C), this gradient should not affect the inter separation between the optical elements. The optical components are spread out over the optical bench of size 1.6m x 1m and to keep the interface stress to minimum, the flatness demanded is ~10 microns. The overall mass budget of the payload is about ~172 kg. The results of the optical tolerance analysis calls for the CTE of the optical bench to be < 8ppm.
VELC includes three sCMOS (visible channels) and one InGaAs (IR channel) detector systems. Each of the detectors has four packages consisting of Detector Head Assembly (DHA), Control and Data Processing Electronics (CDPE), Power Supply Electronics (PSE) and Interface to BMU (CERT). The sensor, Detector Proximity Electronics (DPE) and interface with payload thermal control system constitute the DHA. Considerable efforts are made in the selection of sensors (to meet the proposed science goals), configuring electronics design and interface, mechanical interface, thermal interface, optimizing camera electronics, on-board data processing protocols, etc.
All of these systems have to be integrated, tested and calibrated to achieve the designed system performance. Sub-system level tests and calibrations are being developed. Stringent contamination control protocols have been evolved and implemented to minimize the scatter due to particulate and molecular contaminants. Sub-system level tests and payload integration will be carried out in class-10 clean facility. Vacuum calibration of VELC is critical and hence its final performance test will be carried out in vacuum environment. Several system-level calibration protocols such as PSF/MTF measurements, spectroscopic, radiometric/photometric, polarization calibrations, etc. are planned and also being implemented.
The science goals, overall instrumentation, criticalities and challenges faced in each domain will be presented across various sessions by the concerned authors.