

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
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CHARACTERIZATION OF HIGH INTENSITY SUN RADIATION FOR TV-TB TESTING IN A
LARGE VACUUM FACILITY

Abstract

Thermo-structural models of space-crafts are validated by testing. Thermal Vacuum facilities try in emulating the conditions that space-crafts will encounter during their operational lives, so to let the thermal engineers collect as much information as possible to verify the thermal models of complex structures and thermal protections. A well characterized facility becomes then a key aspect in the success of a Thermal Vacuum - Thermal Balance test. Such a characterization is even more crucial when the test involves the use of a Sun simulator with high to very high flux levels, as required by ESA missions such as BepiColombo and Solar Orbiter. The reliability of the knowledge of the Sun beam generated by the facility, in terms of both distribution and intensity, are critical aspects to assess the effectiveness of the thermal protections of the space-craft and the soundness of its thermal model. In the Test Centre Division of the European Space Research and Technology Centre (ESTEC) a methodology has been developed in order to characterize the Sun simulator in its biggest thermal vacuum facility, the Large Space Simulator. Such a method, based on cross reference of a calibrated radiometer with a visible camera, allows not only the possibility to adjust the intensity of the generated beam up to 16 kW/m² over multiple planes, but also to provide an accurate and reliable flux mapping over those planes with resolution of few cm over 6 meters. Given the intrinsically uneven distribution of the Sun beam, the mapping is vital to correlate the thermal data of the space-craft, either in the form of Infrared images or readings of contact based sensors, with the effective Sun radiation seen by the space-craft. This paper provides insights on the criticality of performing such an activity, and gives a detailed overview of the methodology developed for the Sun mapping. Finally, the results of the proposed method are presented and compared to what previously in place in the Test Centre Division.