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Radiation Fields, Effects and Risks in Human Space Missions (5)

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THE LIDAL EXPERIMENT ON BOARD ISS

Abstract

A reliable and detailed radiation monitoring in space is a mandatory step for the development of countermeasures and long-duration mission planning in human spaceflight. This paper provides the status of the LIDAL (Light Ion Detector for ALTEA) experiment on board the International Space Station (ISS) , whose aim is to study the radiation environment, including radiation quality, in the living habitat of the Station. The LIDAL detector is based on scintillators for fast time applications, designed to work paired with three ALTEA Silicon Detector Units (SDU). The aim is to extend the ALTEA detection capability for the lower Z-part of the radiation spectrum onboard ISS (LIDAL is capable to detect and study ions from protons to iron and above) and to enhance particle discrimination through the measurements of the Time of Flight of the detected ions. The system has been installed and left in the Columbus module of the ISS since Jan 19th, 2020; its position during the first year has allowed to monitor particles arriving in a cone (about 23 centre angle) directed along the Z ISS-axis of the ISS. From January 2021 LIDAL has been moved along the Columbus longitudinal axis (which is the Y ISS direction), and it is planned to remain in this position at least for 6 months, then LIDAL will be put along X ISS for additional 6 months and finally a position will be selected for the following 2 years to follow the radiation modulation with the solar cycle. The downlink rate from the LIDAL instrument to the ground stations has been increased up to 2 Mbps (it was initially thought a rate of 1 Mpbs as former ALTEA high peaks), highlighting the good performances of the instrument. Data are transmitted to UHB in Rome in both real time and dump mode. The science team is then able to monitor the ISS radiation environment through both a preliminary real time analysis and a detailed offline analysis, which requires longer computations. The LIDAL measurements are going to be coupled with those from a NASA REM device, (deriving from a Timepix device) aboard ISS communicating through USB with ISS laptops. This payload selected for the mission “BEYOND” has been funded and coordinated by ASI, resulting from a public call open to the industrial and scientific research communities. ASI, in the frame of its national mission of promoting and fostering the culture of space across the Country, provided access to the ISS as a laboratory in space. The utilization support services were provided thanks to a contract, awarded by ASI, to ARGOTEC/Telespazio (UTISS Team). This team supported safety evaluation and payload manifesting and qualification processes leading towards a safe and efficient delivery, utilization, integration on board the ISS and recovery of the payload on ground, allowing scientists to access and retrieve experimental data and instruments after they return to Earth.