Dosimetric Mapping

Radiation constitutes one of the most important hazards for man in long term space missions. Dosimetric data of the proposed experiment will constitute essential information for the application of radiation protection standards for manned space flight and for any radiation susceptible experiment in space. In addition, the measurement will contribute to the understanding of radiation transport through matter and for the radiation field characteristics, e.g. composition and anisotropy.

Due to the variety of particles and energies in space, no single detector system is capable of providing sufficient information. Therefore the proposed experiment is a dosimetry package consisting of several nuclear track detector packages (NTDP) and a detector telescope (DOSTEL). Using two silicon detectors, up to four small single silicon detector units (MDUs) and a TLD-Reader with eight bulb thermoluminescence dosimeters. The use of well known passive detector systems in the NTDPs, thermoluminescence dosimeters (TLDs), plastic detectors (cellulose nitrate, CR39, and polycarbonate), allows mission integrated measurements of the absorbed dose, neutron dose, the heavy ion fluences and its spectral composition with respect to charge, energy and linear energy transfer (LET). In addition, target fragmentations for different absorber materials inside the detector stack will be studied to understand the fragmentation systematics. Mounting of the stacks in different orientations allows the measurement of angular distributions of heavy ions and target fragments. DOSTEL and the MDUs provide the flux of charged particles and the corresponding dose rate as a function of time. In addition, DOSTEL as a telescope is used for the measurement of time dependent LET spectra separately for galactic cosmic particles and trapped particles in different directions at defined shielding locations. DOSTEL is used as a reference instrument for the MDUs. The MDUs are designed as small lightweight personal dosimeters but may be used also at different locations inside the spacecraft. The measurement set is completed by an onboard small compact TLD-Reader for the study of spatial distribution and time dependence of absorbed doses and for neutron dose measurements. The whole dosimetry set shall be used for routine environmental, individual and EVA dosimetry. The single detector systems complement each other in their recording characteristics.

The different systems allow for in-flight cross-calibration of measurements at different shielding configurations. This is absolutely necessary when recognizing that the comparison of available data is often not possible due to not well known regular response of detector systems combined with unknown angular incidence of radiations and only approximate knowledge of shielding distributions. On-ground cross-calibration of the equipment with well-known sources is an indispensable part of the work.