DOSIMETRY SCIENCE PAYLOADS FOR EXOMARS TGO & SURFACE PLATFORM. UNIFIED WEB-BASED DATABASE WITH LIULIN TYPE INSTRUMENTS' COSMIC RADIATION DATA ("DOSIMETRY")*

DOSIMETRY is a complex project (URL: http://esa-pro.space.bas.bg/), combining investigations of space radiation environment, development of new instrumentation for space radiation measurements, and creating a database with Bulgarian cosmic radiation data obtained in different space missions from 1988 till nowadays.

The impact of the project objectives is in the area of Space Science, Human Spaceflight and Exploration, Robotic Space Exploration. The project is under realization in the Space Research and Technology Institute at the Bulgarian Academy of Science (SRTI-BAS).

ExoMars is a joint ESA-Roscosmos programme for investigating Mars (URL: http://exploration.esa.int/mars/46048-programme-overview). Two missions are foreseen within this programme: one consisting of the Trace Gas Orbiter (TGO), plus an Entry, Descent and landing demonstrator Module (EDM), launched on 14 March 2016; and the other, featuring a rover and a surface platform, with a launch date of 2020. The SRTI-BAS participates in both missions with experiments for investigation of the space radiation environment, conducted by dosimeters of *Liulin*-type instruments. The experiment *Liulin-MO* for measuring the radiation environment onboard the ExoMars 2016 TGO is a part of the Russian Fine Resolution Epithermal Neutron Detector (FREND) onboard TGO. The second envisaged experiment is *Liulin-ML* experiment for investigation of the radiation environment on Mars surface. The experiment will be conducted with the *Liulin-ML* dosemeter as a module of the Russian active detector of neutrons and gamma rays (ADRON-EM) on the surface platform of ExoMars 2020 mission. The objectives of DOSIMETRY are:

1. Development, manufacture, and testing in relevant environments of the dosimeter *Liulin-ML* of ADRON-EM instrument of ExoMars 2020 surface platform science payload;
2. Flight operations and handling the data of the dosimeter *Liulin-MO* of FREND instrument on ExoMars 2016 TGO. The dosimeter *Liulin-MO* of FREND instrument for ExoMars TGO has been developed and manufactured in SRTI-BAS under contracts with Space Research Institute (SRI-Moscow); FREND including its dosimeter Liulin-MO has been launched aboard ExoMars TGO on 14 March 2016. Presently TGO is in orbit around Mars.

3. Development of unified, web-based database with *Liulin* data

The objective is to develop a web-based database with the Liulin type instruments data sets from *Mir* space station, International Space Station, BION, Photon, and Chandrayan-1 satellites and to add *Liulin-MO* ExoMars TGO data to the database.

The geometrical mass and thermal equivalent models of *Liulin-ML* have been already developed and tested at SRTI-BAS. The external view of *Liulin-ML* is shown in Fig. 1.

Fig. 1. External view of Liulin-ML dosimeter

During main part of TGO cruise to Mars the *Liulin-MO* was turned on. The average dose rate in Si in the interplanetary space is 372 ± 30 mGy d^{-1} and 390 ± 31 mGy d^{-1}; the average flux is 3.12 cm^{-2} s^{-1} and 3.29 cm^{-2} s^{-1} in two perpendicular directions. The average measured dose rate from 01.11.2016 till 18.01.2017 in high elliptic Mars' orbit is respectively 405.6 ± 41 μGy d^{-1} and 422.4 ± 42 μGy d^{-1}, the particle flux is 3.3 and 3.4 cm^{-2} s^{-1}. The particle fluxes in high elliptic Mars orbit from 01.11.2016 to 04.01.2017 and comparison with SIS instrument on ACE satellite (URL: https://helios.gsfc.nasa.gov/ace/sis.html) are shown in Fig. 2.

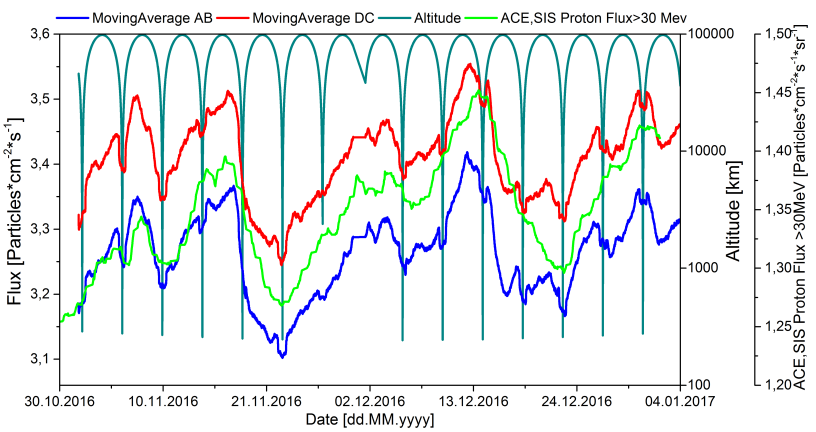

Fig. 2. Particle flux in the perpendicular detectors of Liulin-MO. Comparison with the proton flux of SIS instrument on ACE satellite. SIS data is shifted back by 4 days.

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