

Bulgarian Build Spectrometry-Dosimetry Instruments for Radiation Monitoring in Space and on Aircrafts

TSVETAN DACHEV, BORISLAV TOMOV, YURY MATVIICHUK,
PLAMEN DIMITROV

Solar-Terrestrial Influence Laboratory (STIL), Bulg. Acad. Sci.(BAS), Sofia, Bulgaria

The Liulin type instruments main purpose are to measure the specter (in 256 channels) of the deposited energy from primary and secondary particles at the aircraft altitudes, at Low Earth Orbits, outside of the Earth magnetosphere on the route and on the surface of the planets of Solar system. They are a miniature spectrometer-dosimeter containing: one semiconductor detector, one charge-sensitive preamplifier, 1 or more microcontrollers, a flash memory and batteries. Pulse analysis technique is used for the obtaining of the deposited energy specter, which further is converted to deposited dose and flux from primary and secondary particles in the silicon detector. The spectrometers were calibrated against gamma radiation, electrons, protons, neutrons, and heavy Carbon Neon and Iron ions with energies of tens and hundreds of MeV. The covered dose range is from the natural background radiation up to few mGy.

Different modifications of the spectrometer were developed to support the Bulgarian Space Research Program including the Mobile Radiation Exposure Control System - Liulin-E094, flown inside of the Dosimetric Mapping experiment on American Laboratory module of ISS in May-August 2001. Next use of Liulin-4 type system in space is scheduled for middle of 2005 in Liulin-ISS instrument, which will be used as a part Space Radiation Service System of the Russian segment of ISS for 15 years. Two smaller modifications, named R3D-B and R3D, were developed for use on the ESA Biopan and EXPOSE facilities on Foton M2/3 satellites and Columbus module of ISS, respectively. Launches to space of these instruments are scheduled for 2005 and 2006. Another experiment at the Indian Chndrayaan-1 Lunarsatellite at 100 km above the lunar surface is scheduled for 2007-2009.

Liulin type instruments are further developed, calibrated and used by scientific groups in different countries for the radiation monitoring at aircraft altitudes and at groundbased monitoring stations. The last modification of them uses a Global Positioning System (GPS) receiver and its 3D positioning and UT-time data are stored together with the spectrometry data on the flash memory of the instrument.

Keywords: spectrometer; dosimeter; silicon detector; space and aircraft radiation monitoring; galactic cosmic rays, accelerometers calibrations.