

Experimental facility for testing nuclear instruments for planetary landing missions

Dmitry Golovin, Igor Mitrofanov, Maxim Litvak, Alexander Kozyrev, Anton Sanin, and Andrey Vostrukhin
Institute of Space Research, Moscow, Russian Federation (golovin@l503.iki.rssi.ru)

The experimental facility for testing and calibration of nuclear planetology instruments has been built in the frame of JINR and Space Research Institute (Moscow) cooperation. The Martian soil model from silicate glass with dimensions 3.82 x 3.21 m and total weight near 30 tons has been assembled in the facility. The glass material was chosen for imitation of dry Martian regolith. The heterogeneous model has been proposed and developed to achieve the most possible similarity with Martian soil in part of the average elemental composition by adding layers of necessary materials, such as iron, aluminum, and chlorine. The presence of subsurface water ice is simulated by adding layers of polyethylene at different depths inside glass model assembly.

Neutron generator was used as a neutron source to induce characteristic gamma rays for testing active neutron and gamma spectrometers to define elements composition of the model. The instrumentation was able to detect gamma lines attributed to H, O, Na, Mg, Al, Si, Cl, K, Ca and Fe. The identified elements compose up to 95 wt % of total mass of the planetary soil model.

This results will be used for designing scientific instruments to performing experiments of active neutron and gamma ray spectroscopy on the surface of the planets during Russian and international missions Luna-Glob, Luna-Resource and ExoMars-2020.