Determination of depth - dose distribution in a human phantom onboard the ISS using a particle telescope to measure radiation dose and LET

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Space radiation effects to crew health, performance and life expectancy are a limitation to the duration of man's sojourn in space. Predicting the effects of radiation on humans during a long-term space mission requires accurate knowledge and modelling of the space radiation environment, calculation of primary and secondary particle transport through shielding materials and though the human body, and assessment of the biological effect of cosmic particles, especially HZE particles. Depth-dose curves in space flight are known to be a result of GCR, SCR and trapped radiation contribution.

The ISS internal radiation environment is complex, with incident external space radiation field modulated by widely varying amounts of shielding and internal material, including the astronaut's bodies. For the estimation of the organ doses, and thus the radiation risk, measurements in human phantoms are essential.

Described is the current status of an experiment in preparation, using a particle telescope Liulin-5 for investigation of the radiation environment dynamics within the Russian spherical tissue-equivalent phantom on ISS. Liulin-5 experiment will be a part of the international project MATROSHKA-R on ISS. The aim of Liulin-5 experiment is long term investigation of the depth - dose distribution inside the spherical tissue-equivalent phantom, mounted in the Russian Segment of ISS. Energy deposition spectra, LET spectra, flux and absorbed dose rates for protons and the biologically-relevant heavy ion components of the cosmic radiation will be measured simultaneously with near real time resolution at different depths of the phantom's radial channel. Dose equivalent rates at these depths will be calculated from the absorbed dose rates multiplied by Q(LET). The doses in intermediate points will be determined by interpolation. Data obtained together with data from other active and passive dosimeters will be used to estimate the radiation risk to the crewmembers, verify the models of radiation environment, validate body transport model and correlate organ level dose to skin dose.

Liulin-5 is planned to be flown on the ISS in 2006 year.