Some problems to be solved for automatic analysis of a CR-39 nuclear track detector in space radiation dosimetry

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ABSTRACT

At the 9th WRMISS, we reported the present status of a PADLES (Passive Dosimeter for Life-Science Experiments in Space) system in JAXA's Space Utilization Research Center, which newly includes a series of programs (AUTO PADLES) for fast and systematic analysis of the PADLES dosimeters (CR-39 and TLD). The AUTO PADLES has the following functions: 1)both the automatic and semi-automatic analyses of the opening mouths of etch pits on CR-39 etched surfaces with an ellipse-fitting algorism, 2) database of the TLD and CR-39 responses for heavy ions obtained from ground-based experiments simulated inside the Japanese Experiment Module (JEM) environments with HIMAC heavy-ion accelerator, and 3)automatic calculation of LET distributions, absorbed doses, dose equivalents, using combined the TLD and CR-39 data. Consequently the PADLES system can drastically reduce the maximum analysis time down to about two weeks for each flight experiment.

In 2008 after JEM is attached to the International Space Station (ISS), the PADLES system will be widely applied for monitoring radiation environments inside JEM, a personal dosimetry for Japanese astronauts and space radiation experiments such as MATROSHKA, along with ISS biological research experiments proposed in the international announcements of opportunity. We are addressing the problem of validating the PADLES system using on-board verification CR-39 samples and is improving that system up to 2008.

We encountered so far some problems to be solved for the analysis of CR-39 recovered form ISS or space-shuttles. At this meeting we discuss the following three subjects: 1) etching depth dependence of LET distributions above several keV/μm and its effect on dosimetric results, 2) threshold of bitmap images to get etch-pit mouths as binary objects of and its effect on calibration curves of CR-39, 3) bubble-like etch pits increasing with the exposure time in space and its effect on dosimetric results.