Workshop on Radiation Monitoring for the International Space Station (WRMISS)

Abstracts

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ISS Hardware Certification Process and Challenges

Mark Weyland, Lockheed Martin at NASA/Johnson Space Center

The current process to certify hardware for flight aboard the International Space Station (ISS), such as passive and active radiation dosimeters, is tedious, expensive, and difficult to follow. Philosophically, the process used by the Johnson Space Center (JSC) has changed little over the past decade , however in practice dramatic changes have resulted from JSC's adoption of the ISO-9000 quality system. Currently, the JSC certification process can take from approximately 1 year for a well-documented piece of commercial off-the-shelf (COTS) equipment that encounters NO certification problems, to over 5 years for complex custom designed and built hardware, such as charged particle telescopes. Excessive certification costs are also an issue. Several recently implemented initiatives are aimed at streamlining hardware certification, notably for COTS and non-critical hardware such as dosimeters. This presentation willprovide potential ISS investigators with an overview of the certification process, recently implemented changes, and highlight the types of problemsthat can be encountered using examples from several recent hardware projects.

Data on Radiation Belt and Solar Energetic Particles deduced from Dosimetry in Low Earth Orbits

R. Beaujean[1], J. Kopp[1], S. Burmeister[1], F. Petersen[1] and G. Reitz[2]
[1] *IEAP/Extraterrestrik, Universität Kiel, 24118 Kiel, Germany*
[2] *Strahlenbiologie, DLR Köln, 51147 Köln, Germany*

A small particle telescope based on two silicon detectors was flown on three NASA Shuttle-to-MIR missions and on the Russian orbital station MIR behind a shielding of about 10-20 g/cm^2 in low Earth orbits at 51.6 degree inclination during 1996/98. The instrument was designed to measure count rates and dose rates as well as energy deposit spectra (in silicon) of the radiation inside the spacecraft. The count rate dependence on the L-parameter for crossings of the inner and outer radiation belts as well as preliminary results from the Nov 6, 1997 SEP event are presented.

On-board TL Dosimetry: Possibilities and Limitations

Sándor Deme, István Apáthy and Tamás Pázmándi
(KFKI Atomic Energy Research Institute / AEKI, Budapest, Hungary)

The paper shortly describes the application of TLDs for the ISS, e.g. personal dosimetry, phantom measurements, mapping, monitoring and neutron dosimetry. The main characteristics of the on-board and ground evaluation are compared. The main advantages and disadvantages of the on-board evaluation are summarized. Finally improvements of the Pille system planned in the future are discussed like the development of an RS485 interface for alternative data transfer, introducting of smaller dosimeters (capsules), applying a more use-friendly display (80 characters), the use of an internal memory for data storage instead of the memory card and improving of the dosimeter evaluation (glow curve fit, background subtraction).

CALIBRATION RESULTS OBTAINED WITH LIULIN-4 TYPE DOSIMETERS

Ts. Dachev[1], B. Tomov[1], Yu. Matviichuk[1], Pl. Dimitrov[1], J. Lemaire[2], Gh. Gregoire[3], M. Cyamukungu[3], H. Schmitz[3], K. Fujitaka[4], Y. Uchihori[4], H. Kitamura[4], G. Reitz[5], R. Beaujean[6], V. Petrov[7], V. Shurshakov[7], V. Benghin[7], F. Spurny[8]

[1]Solar-Terr. Influences Laboratory-BAS, Sofia Bulgaria, tdachev@bas.bg
[2]Institut d'Aeronomie spatiale de Belgique, Bruxelles, jl@oma.be
[3]Institut de Physique, Universite Catholique de Louvain, Belgique, gregoire@fynu.ucl.ac.be
[4]National Institute of Radiological Sciences-STA, Chiba, Japan, fujitaka@nirs.go.jp
[5]DLR, Institute fuer Luft-und Raumfahrtmedizin, Cologne, Germany, guenther.reitz@dlr.de
[6]Institute fuer Kernphysik des Universitaet Kiel, Germany, r.beaujean@email.uni-kiel.de
[7]Institute of Biomedical Problems, Moscow, Russia, petrov@mmcc.ibmp.rssi.ru
[8]Nuclear Physics Institute, Czech AS, Praha, Czech republic, spurny@ujf.cas.cz

The Mobile Radiation Exposure Control System's (Liulin-4 type) main purpose is to monitor simultaneously the doses and fluxes at 4 independent places. It can also be used for personnel dosimetry. The system consists of 4 battery-operated 256-channel dosimeters-spectrometers. We describe results obtained during the calibrations of the spectrometers at the Cyclotron facilities of the University of Louvain, Belgium and of the National Institute of Radiological Sciences-STA, Chiba, Japan with protons of energies up to 70 MeV. The angular sensitivities of the devices are studied and compared with Monte-Carlo predictions. We also present the results obtained at the HIMAC accelerator with 500 MeV/u Fe ions and at the CERN high energy radiation reference fields. Records made during airplane flights are shown and compared with the predictions of the CARI-6 model.

Some questions of the radiation weighting factor determination using silicon telescopes

Tamás Pázmándi, Edit Láng, Sándor Deme
(Atomic Energy Research Institute (AEKI), Budapest, Hungary)

Since the space radiation mainly consists of charged heavy particles (protons and heavier particles), the effective dose significantly differs from the physical dose. The recently used measuring equipment is not fully suitable to measure both quantities simultaneously. A new combined device is under development, which consists of an on board thermoluminescence (TL) dosimeter reader (PILLE) and a three axis silicon linear energy transfer (LET) spectrometer. This paper deals with the main computed characteristics of the silicon telescope.
Up to the present the 1D silicon linear energy transfer spectrometer was studied. In this paper the mathematical method and the first results (eg. geometric factor, the response function for isotropic and directional fluxes) are discussed.
In the combined device the telescope is used basically for the measurement of the LET spectra and the TLD system for the determination of the absorbed dose. Combination of this datas give the opportunity to access both to the radiation weighting factor and to the equivalent dose. The development of the flight unit is planned in co-operation with the DLR and the Kiel University (G. Reitz and R. Beaujean).
Such systems can be applied for dosimetry of the ISS and aircrew as well.

Potential Exposures Aboard ISS During the July 14, 2000 SPE

A. Steve Johnson, Tom Lin,. Mike Golightly Mark Weyland and Will Maxson

Estimating exposures to the astronauts aboard the International Space Station (ISS) during operations will be an important task with consequences that may influence on-board activity schedules. Real-time operational projections may have significant uncertainties due to limitations in model assumptions and shield model accuracy. The importance of real-time radiation measurements to reduce those uncertainties will be illustrated using the July 2000 Solar Proton Event (SPE). Projections of doses aboard the ISS are presented as a function of time using the JSC "Solar Proton Event in Real Time" (SPERT) SPE dose estimation tool. Actual ISS trajectory is applied in the analysis to assess the impact of the event using the recently updated kp-dependent geomagnetic cutoff models from Smart and Shea. For comparison purposes, results using the Mir trajectory are applied to illustrate the dependence upon trajectory for phasing on exposures. Recent measurements aboard ISS are applied to interpret the accuracy of the shield model and SPE dose prediction models.

MS REM: A Database and Web Site for Manned Space Flight Radiation Environment Measurements

M.J. Golightly[1] and C.B. Dardano[1,2]

[1]NASA Johnson Space Center and [2]Lockheed-Martin, Houston, TX USA 77058

The NASA Space Radiation Analysis Group is developing MS REM—the "Manned Space flight Radiation Environment Monitoring" web site and database. The purpose of the database is to collect radiation environment monitoring data made aboard manned spacecraft, or spacecraft in similar orbits, and make it available to the general public, ISS support personnel, and researchers. The interface to the database is through a web page. The preliminary database design includes raw and processed numerical datasets, data plotted in various temporal and spatial coordinates, LET spectra, instrument descriptions, photos, measurement locations, points of contact, and references/citations. The initial security model for the web site includes three levels of access: general public, ISS program personnel, and an embargoed data area. Each level of access provides progressively more detailed/sensitive data; the last two access levels are password protected. The initial emphasis is on making available data from the International Space Station (ISS) radiation monitoring core system and NASA-funded radiation experiments and support equipment, followed by radiation measurements made aboard the U.S. Space Shuttle. Investigators who are interested in sharing and publicizing their data are encouraged to participate in the design and population of this database. A follow-on project will be the development of a standard for certification of dosimetry as part of the ISS operational radiation monitoring system.