First data from SREM in space

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The Standard Radiation Environment Monitor, SREM is a particle detector developed for satellite applications [1]. It measures high energy electrons and protons of the space environment with a fair angular and spectral resolution and provides the host spacecraft with radiation information. SREM was developed and manufactured by Contraves Space in cooperation with Paul Scherrer Institute under a development contract of the European Space Agency. SREM is the successor of REM [2].

On 16 November 2000 a first SREM instrument was launched aboard the UK-satellite STRV-1c into space by an Ariane-5 rocket. The satellite reached its foreseen Geostationary Transfer Orbit, GTO with apogee and perigee altitudes of 600 and 39000 km, respectively, an inclination of 6°, and a period of approximately 12 h (figure 1). During the check-out of all STRV-1c experiments, SREM has been switched on and was operated for a short period. The data received during that period indicate that the instrument works well.

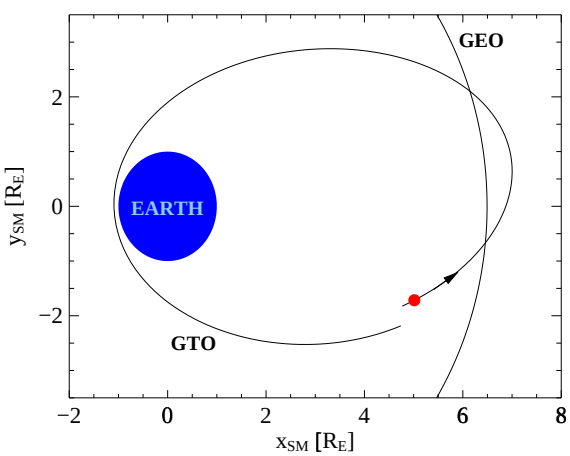

Figure 1: GTO of Strv1c on 22 November 2000. The red dot marks the position of the satellite at 13:13 when the electron spectrum shown in figure 2 was taken.

The orbit of Strv-1c is ideal for investigations of the radiation belts, because it covers a large spatial area and allows to trace the radial distribution of the trapped particles. Especially now, during solar maximum it allows to investigate the influence of spontaneous solar ejections on the Earth's magnetosphere. The Strv-1c/SREM data promises to be a valuable extension of the database obtained by REM aboard Strv-1b from 1994 to 1998, which covered the last solar minimum period.

Figure 2 shows an example of an electron spectrum measured by SREM aboard Strv-1c during the commissioning phase. The position of the satellite during the measurement is indicated in figure 1 by a red spot. The satellite is at a distance of 5.3 R_E from the center of the earth, in the outer radiation belt zone. The SREM spectrum is plotted in red and is approximated by an exponential function and a step-function. The black dotted line shows the electron spectrum described by the radiation environment model AE8 from NASA. This example demonstrates the power of SREM for monitoring and characterizing the electron space radiation environment.

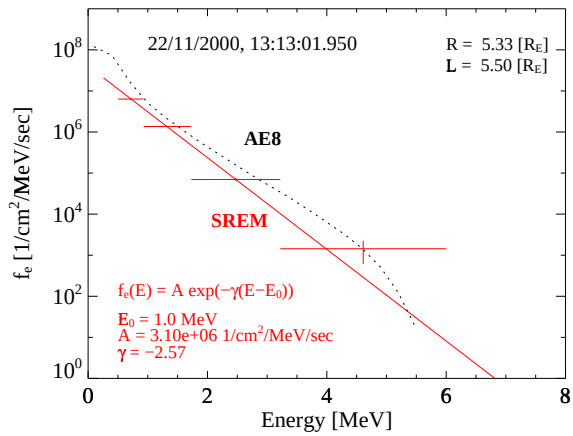

Figure 2: Comparison of the differential electron spectra measured with SREM and predicted with the standard radiation environment model AE8 from NASA. In case of SREM the spectrum is approximated by an exponential function and a step-function.

Prior to launch the instrument was fully calibrated at the Proton Irradiation Facility, PIF of PSI. In addition the instrument including the host spacecraft were simulated with GEANT to accurately determine the response functions to electrons at energies between 0.5 to 10 MeV and to protons in the 10 to 600 MeV range. These are needed to compute the incident particle spectra from the measured detector count rates.

In order to ease the exploitation of the scientific data we developed the Data Management and Analysis System, DMAS. DMAS is a software tool written in PV-WAVE, which allows to maintain the databases of multiple SREMs but also other space science data sets. DMAS is modular and can be updated to work with new experiment data. It includes instrument specific functions for the reduction of the raw data and general functions for e.g. the computation of earth magnetic field parameters and satellite orbits. A GUI allows to define experiment parameters, execute data analysis functions, display the data, and to produce data products for the presentation on the Internet.

Further SREMs will be launched aboard Proba in 2001 and the ESA M2 mission Integral in 2002. News and data can be found at

http://www1.psi.ch/www_srem_hn/srem_home.html.

REFERENCES

[1] W. Hajdas, *PSI Annual Report* (1997)

[2] P. Bühler et al., *Nucl. Instr. and Meth. in Phys. Res. A* **368**, 825 (1996)