Paul Scherrer Institute	Memo	Strv1c/SREM first results
12 DEC 2000	1.2	Author(s): P. Bühler (PSI)
		Addressee:

Strv1c/SREM first results

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1 Introduction

SREM was launched aboard Strv1c on November 15, 2000 into a geostationary transfer orbit, GTO. During the check-out of the satellite and the payload instruments, which lasted until November 24, 2000, SREM was switched on and was operated for one hour. Results of this first test are presented in this report.

The data indicate that SREM works well!

1.1 Timing

The instrument was operated with an accumulation time of five minutes. Start and stop accumulation times are listed in table 1. There are 14 observation points. DERA has confirmed that SREM will be operated with 50-second accumulation periods during routine operation.

Table 1: Times of start and stop accumulations

22/11/2000	
Start	Stop
13:00:31.700	13:05:31.900
13:05:32.000	13:10:31.900
13:10:32.000	13:15:31.900
13:15:32.000	13:20:32.400
13:20:32.500	13:25:33.200
13:25:33.300	13:30:31.900
13:30:32.000	13:35:31.900
13:35:32.000	13:40:31.900
13:40:32.000	13:45:31.900
13:45:32.000	13:50:31.900
13:50:32.100	13:55:31.900
13:55:32.000	14:00:32.400
14:00:32.500	14:05:33.200
14:05:33.300	14:10:00.200

2 Orbit

The orbit parameters of the Strv1c orbit on November 22, 2000 are listed in table 2. During the SREM measurements, Strv1c was in the outer radiation zone at an altitude of 4 to 5 Earth radii. The black line in figure 2 shows the Strv1c orbit during one day. The red dots mark the SREM observations and the blue line shows the corresponding L-values.

Table 2: Orbit parameters of the Strv1c orbit on November 22, 2000.

Parameter	value
Height of apogee	599 km
Height of perigee	39284 km
Inclination	6.42°
Period	11h 50'
UT of perigee	
Minimum L-value	1.06 R_E
Maximum L-value	7.13 R_E

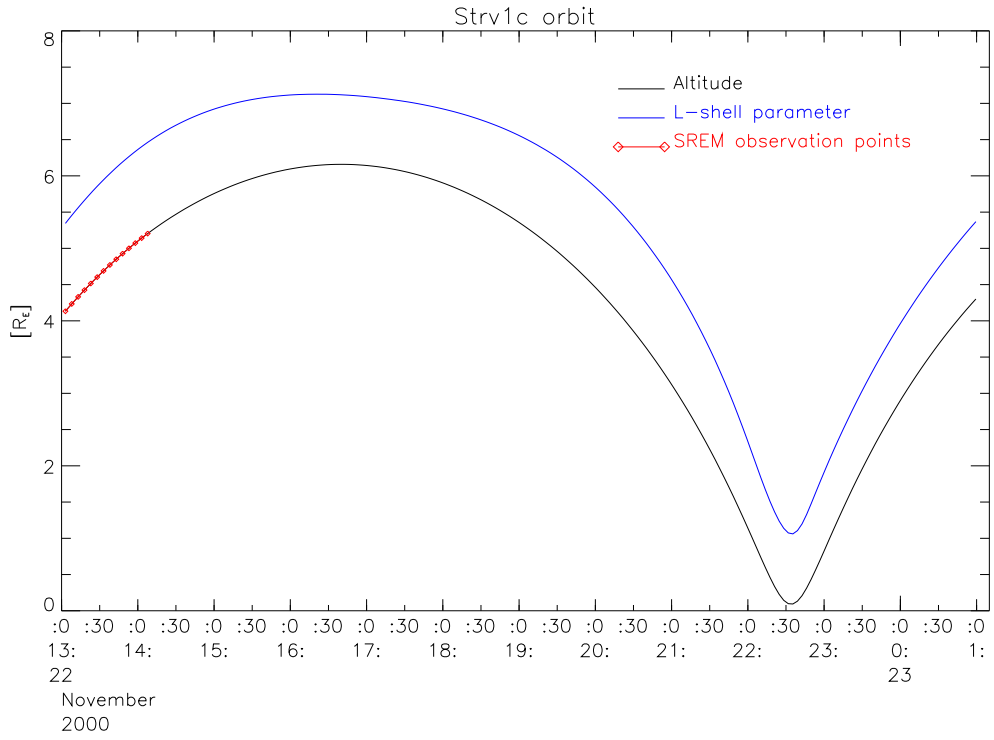

Figure 1: Altitude (black line) and L-value (blue line) as function of time of Strv1c during one day. The red dots show the 14 SREM observations.

3 HK data

The values of the two detector temperatures T12 and T3, and the four supply voltages, -6, +6, +5, and +150 V are shown in figure 3. The values are stable and within the expected range.

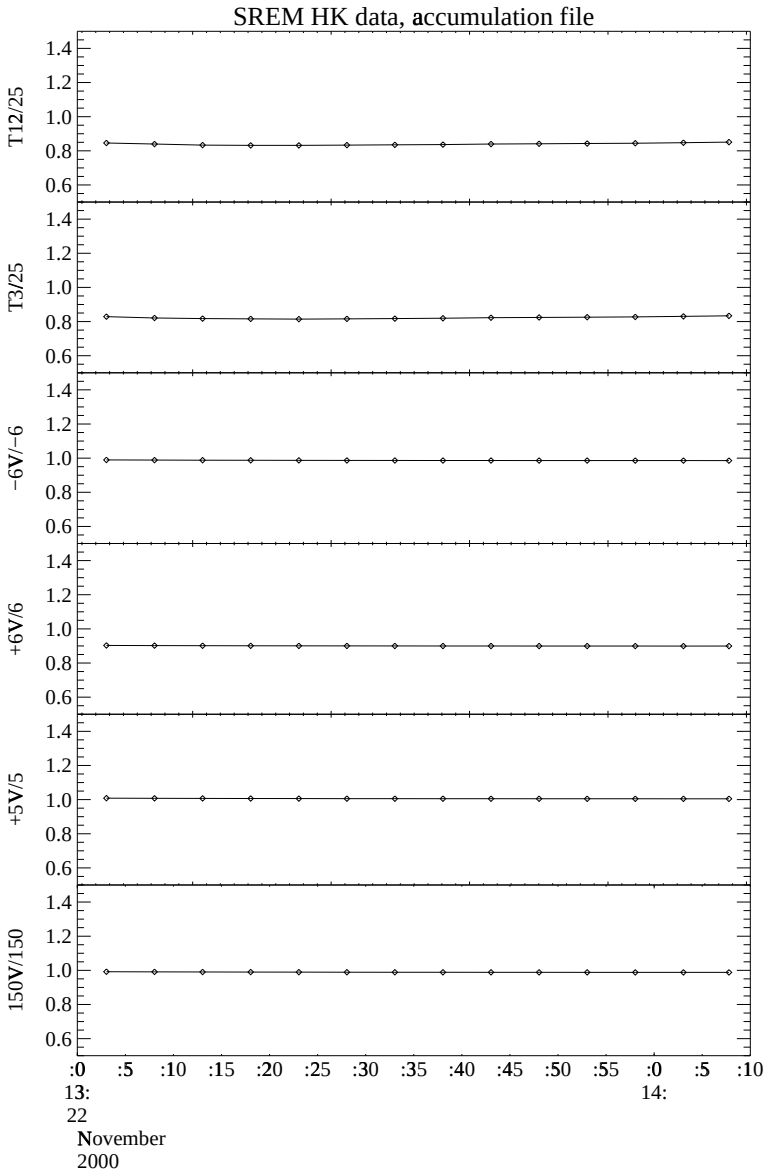

Figure 2: SREM housekeeping parameters as function of time.

4 Deadtime

The dead times of the three SREM detectors are shown in figure 4. In all cases the deadtime is small. The highest count rate of 2.2E4 is detected in counter TC3 (see figure 5), and causes a deadtime of 2.1%.

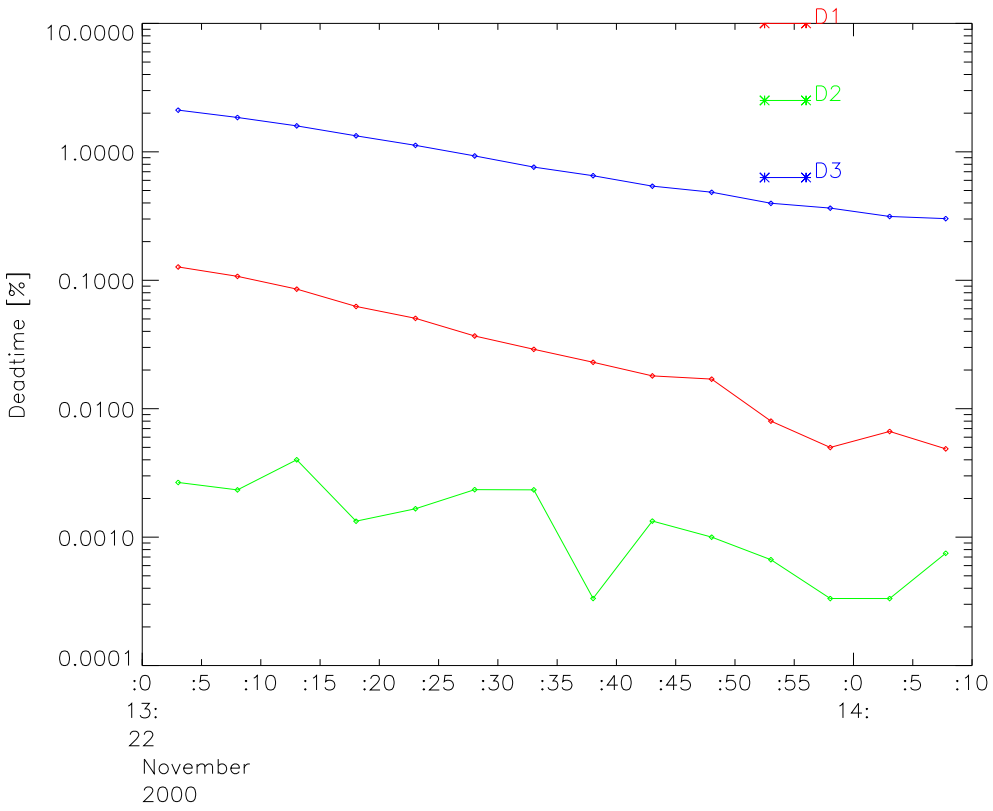

Figure 3: Deadtime of the three SREM detectors. The deadtime is in all cases below 3%.

5 Count rates

The count rates in the 15 SREM counters shown in figure 5 indicate that detections are mainly due to electrons. This is in agreement with the fact, that the data have been taken in the outer radiation belt.

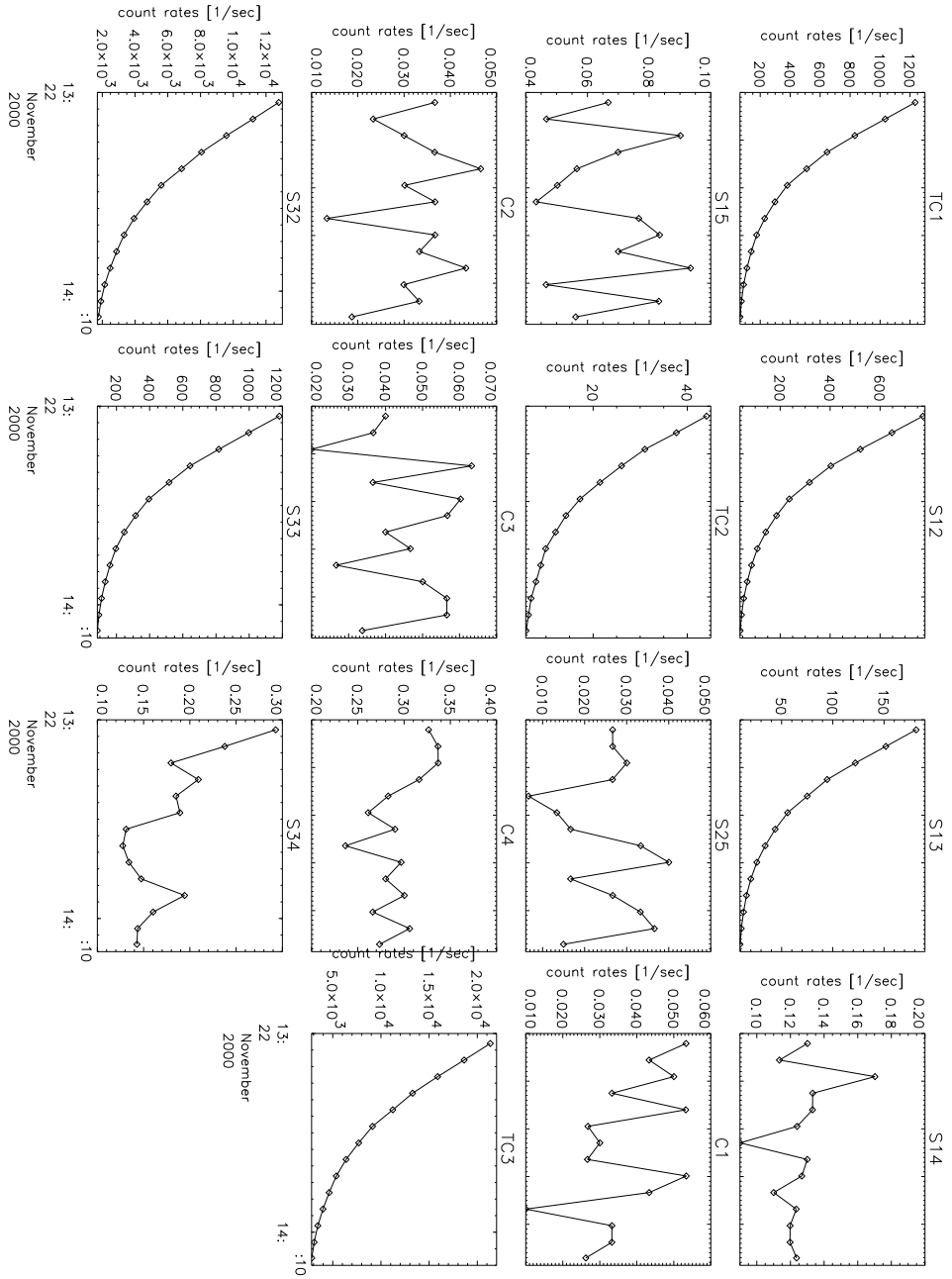

Figure 4: Count rates in the 15 SREM counters. The high rates in TC1, S12, S13, TC2, TC3, S32, and S33 and the much lower rates in the other counters indicate that the detections are dominated by electrons.

6 Electron spectra

6.1 Exponential spectral model

In order to extract the incident particle spectra, the differential electron spectra, $f_e(E)$ are approximated by an exponential function

$$f_e(E) = A \cdot exp(-\gamma \cdot (E - E0_e)) \tag{1}$$

and the proton spectra, $f_p(E)$, by a power law

$$f_p(E) = A \cdot \left(\frac{E}{E0_p}\right)^{-\gamma} \tag{2}$$

.

Using a fitting procedure the spectral parameters can be determined. The resulting normalizations at 1.0 MeV and spectral indices of the electron spectra are shown in figure 6.1. The error bars are the statistical errors and do not include errors due to the limited accuracy of the applied detector response functions or due to the use of the simple spectral approximations.

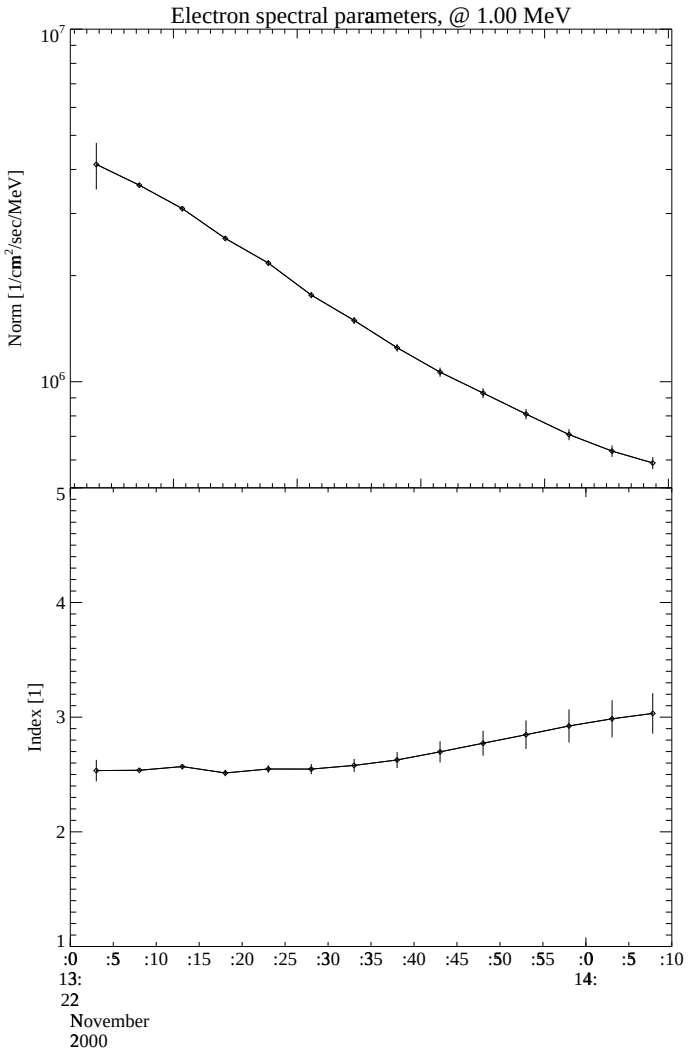

Figure 5: Normalisation at 1.0 MeV and spectral index of the electron spectra deduced from the SREM measurements.

6.2 Step function spectral model

The incident spectra can also be approximated by a step function, which is constant in given energy bins. Using a optimization algorithm the flux levels in the energy bins are determined. In figure 6.2 the results of this and the exponential function approach are compared. Black lines are the exponential functions and the red bars mark the flux levels of the step function approximation. The agreement is excellent.

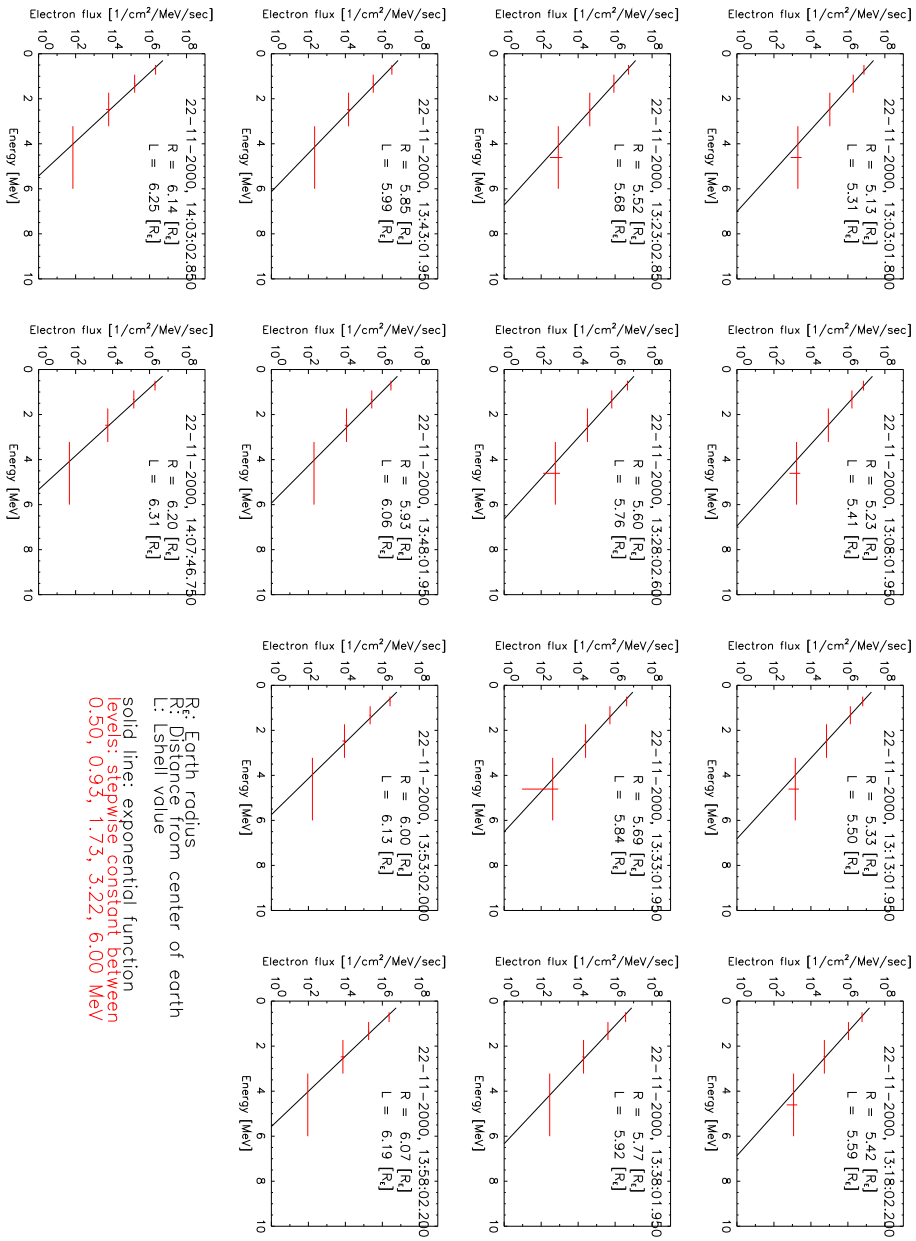

Figure 6: Comparison of the exponential electron spectra with the step-function spectra.

7 Comparison with AE8/max

In figure 7 the SREM electron spectra are compared with the AE8/max model spectra. The agreement is remarkable. Since the radiation environment in the outer belt is strongly variable, an absolute agreement between model and actual measurements can not be expected. However, this is a nice demonstration of the power of SREM to resolve particle spectra.

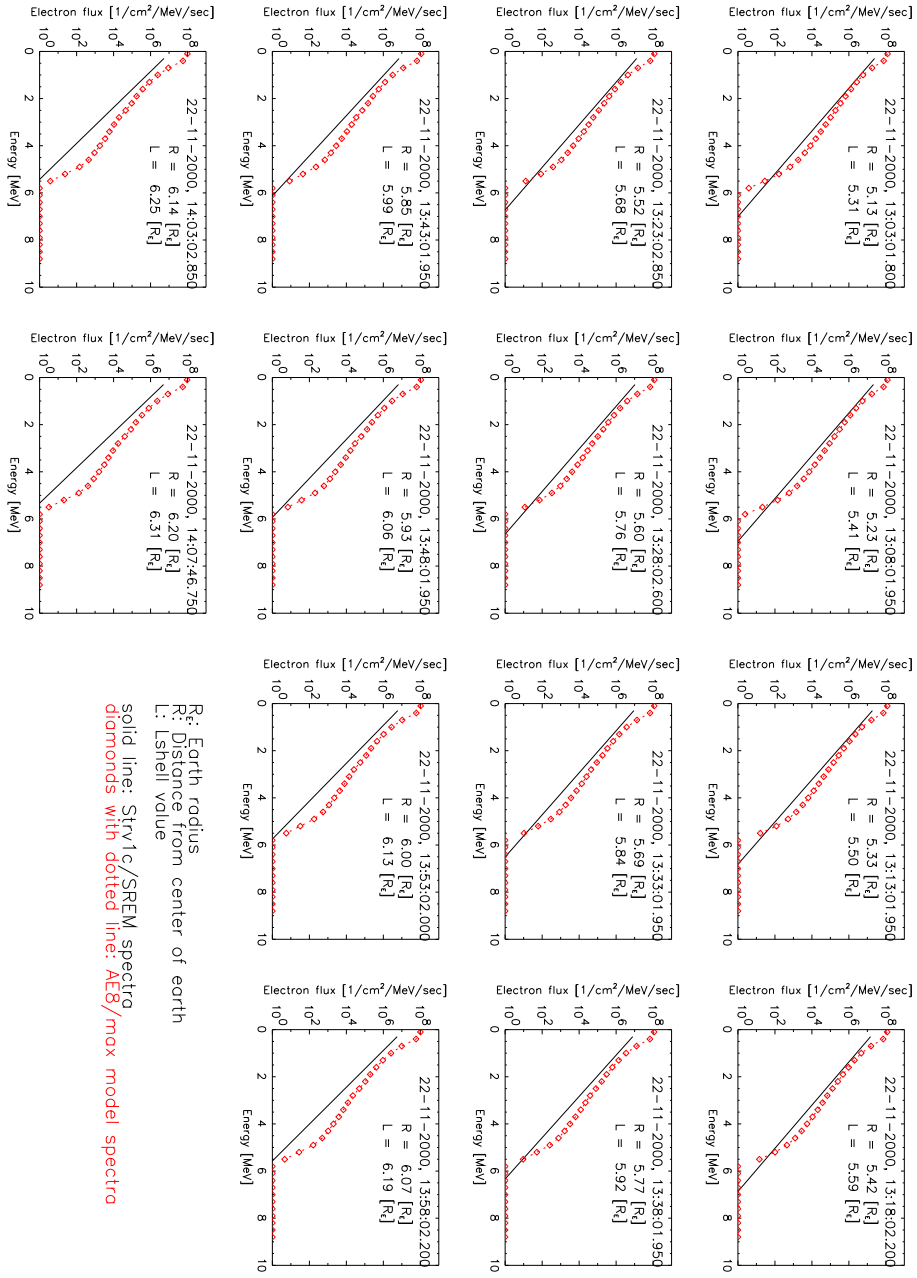

Figure 7: Comparison of SREM electron spectra (black lines) with AE8/max model spectra (red lines).

8 Comparison with GOES

Strv1c crosses GEO four times per day. SREM measurements of the GEO environment can be compared with data from instruments aboard GOES.

During the here investigated period Strv1c was close to GEO but did not cross it. The situation is shown in figure 8. Throughout the three panels the black dots show GOES8 data and the red points show SREM data. The green dots show GOES8 data during the SREM accumulation periods and the blue dots mark the GOES8 data taken at the closest approach with Strv1c.

The upper most panel shows the Strv1c and GOES positions, in the second panel the GOES8 and SREM integral fluxes above 0.6 MeV and 2.0 MeV are plotted versus time and in the lowest most panel the integral fluxes are plotted versus L.

With the actual data it is difficult to quantitatively compare the two data sets, because there is no overlap of the orbits. Future SREM data at GEO will have to be used to make a more detailed comparison.

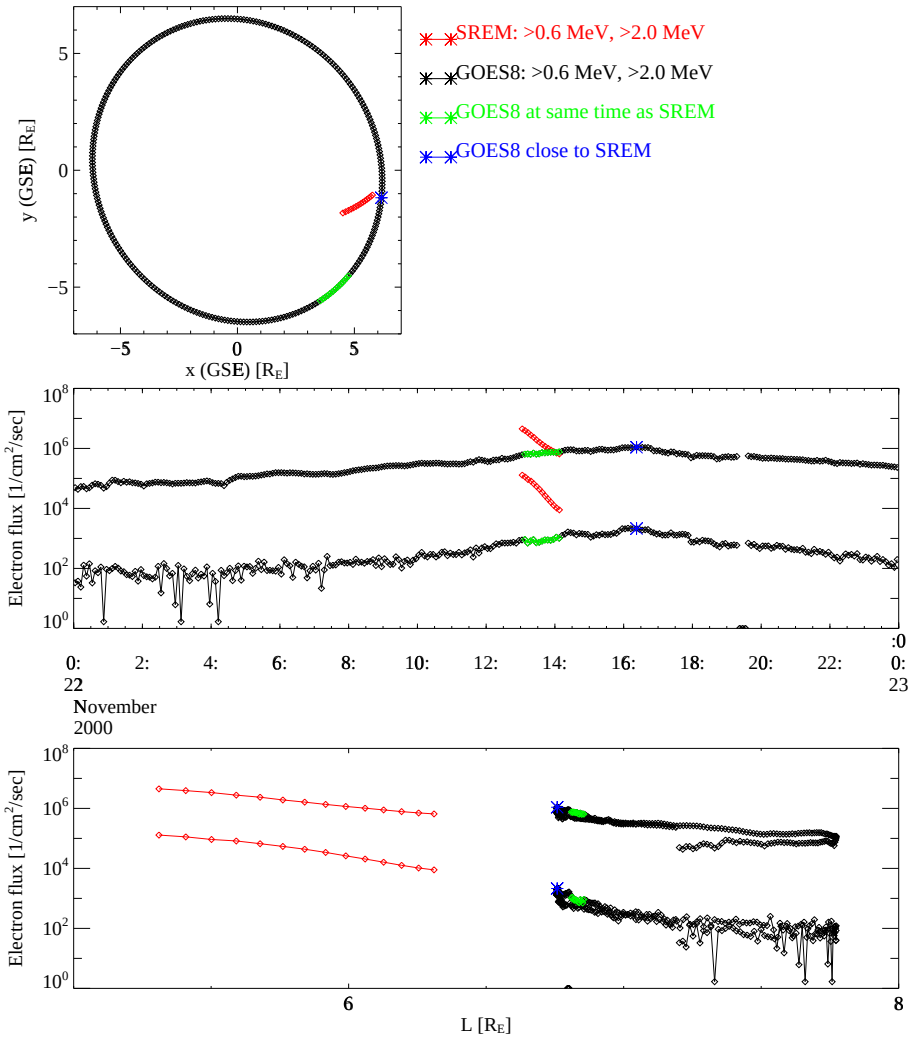

Figure 8: SREM and GOES8 integrated electron fluxes above 0.6 and 2.0 MeV.

9 RadFETs

The RadFET data have not been analyzed yet.