



Quasi-stable radiation belt in the slot region observed by MATROS HKA

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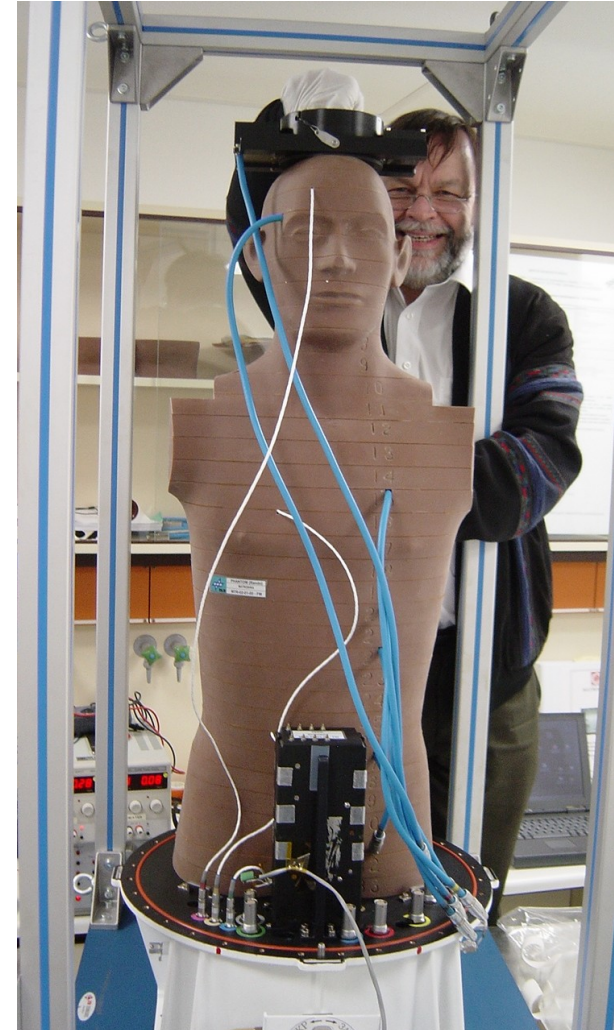
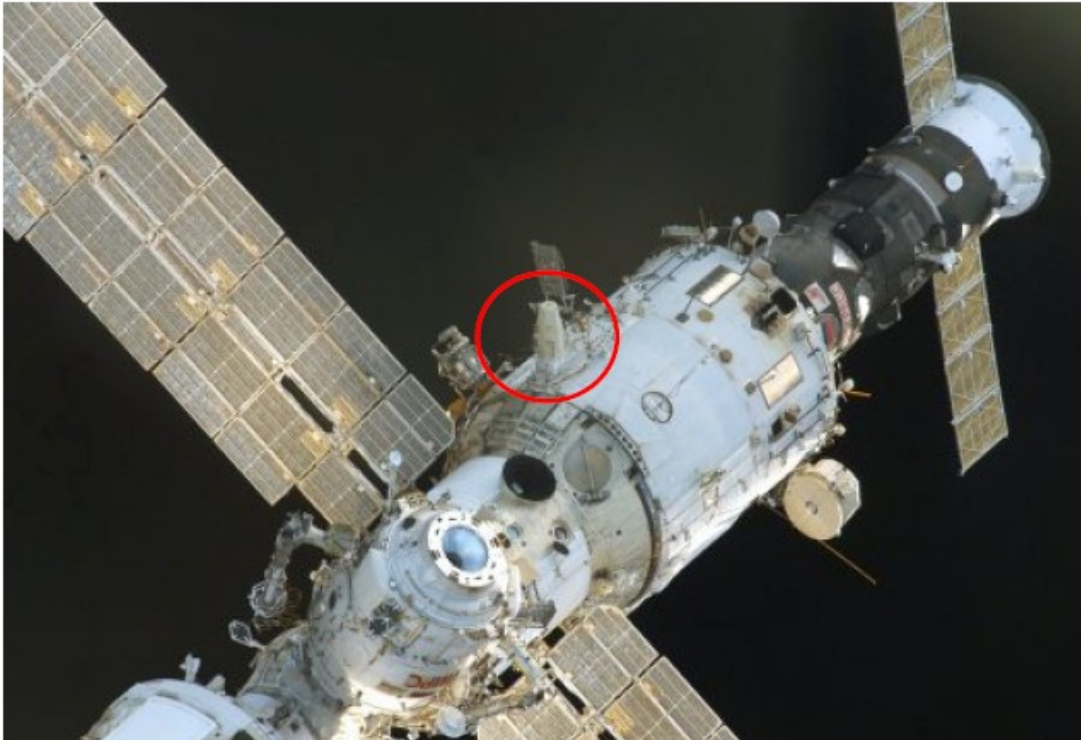
Outline

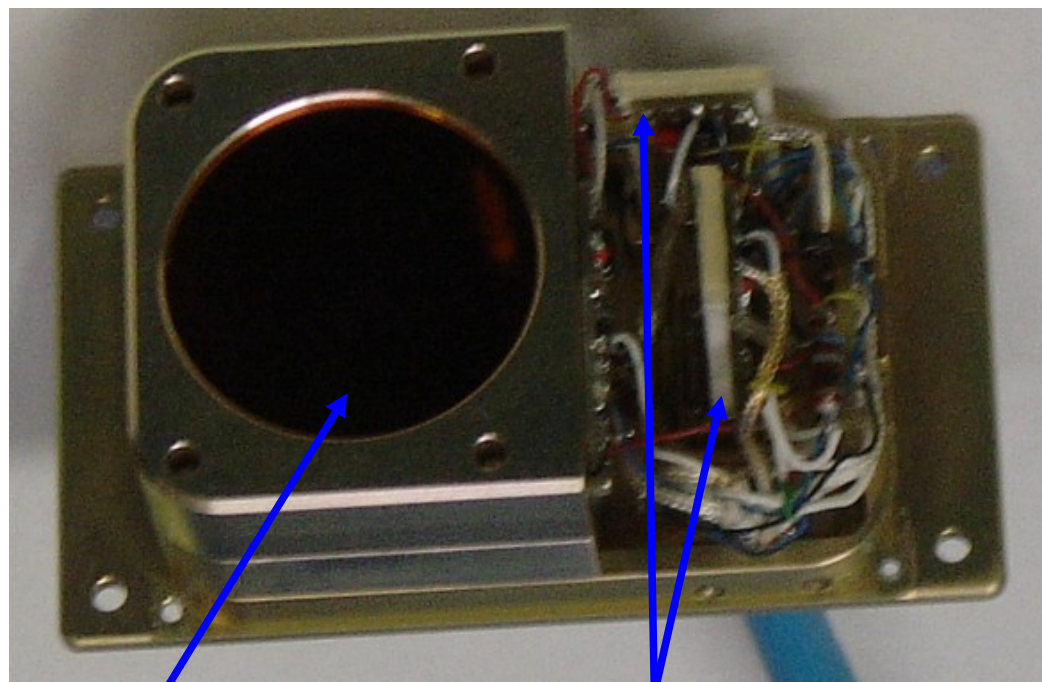
- MATROSHKA and DOSTEL
- L-Parameter
- DOSTEL data at regular conditions
- DOSTEL data in September/October 2004
- Summary

Matroshka is in space since jan. 2004.

There were two experiment phases with use of active detectors:

- MTR 1: feb 2004 – august 2005 outside the ISS
- MTR 2B: since may 2008 inside the ISS

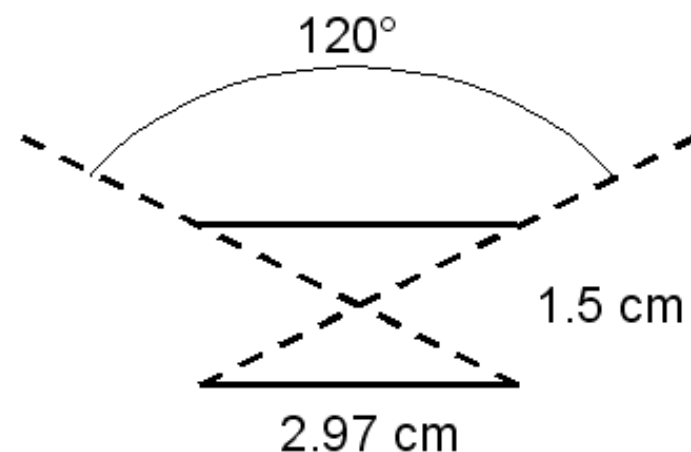
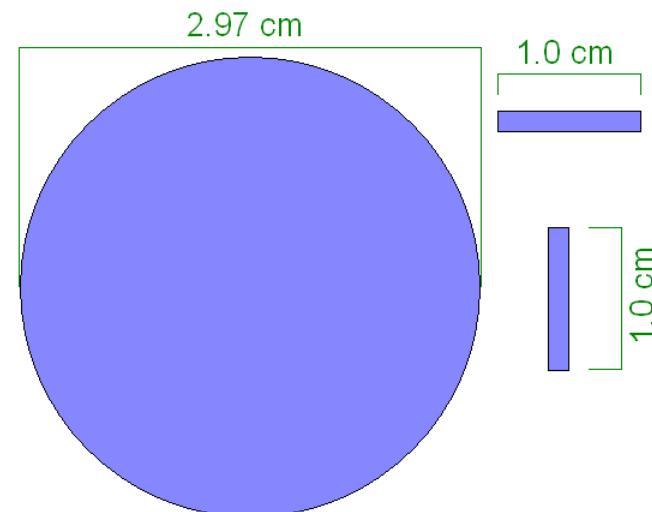




Canberra PIPS
behind capton foil

HAMAMATSU
PIN diodes

- two silicon detectors (Canberra PIPS) in a telescope geometry.
- upper detector has a thickness of $150\text{ }\mu\text{m}$, the lower one is $300\text{ }\mu\text{m}$ thick
- 2 Hamamatsu PIN diodes perpendicular to the telescope

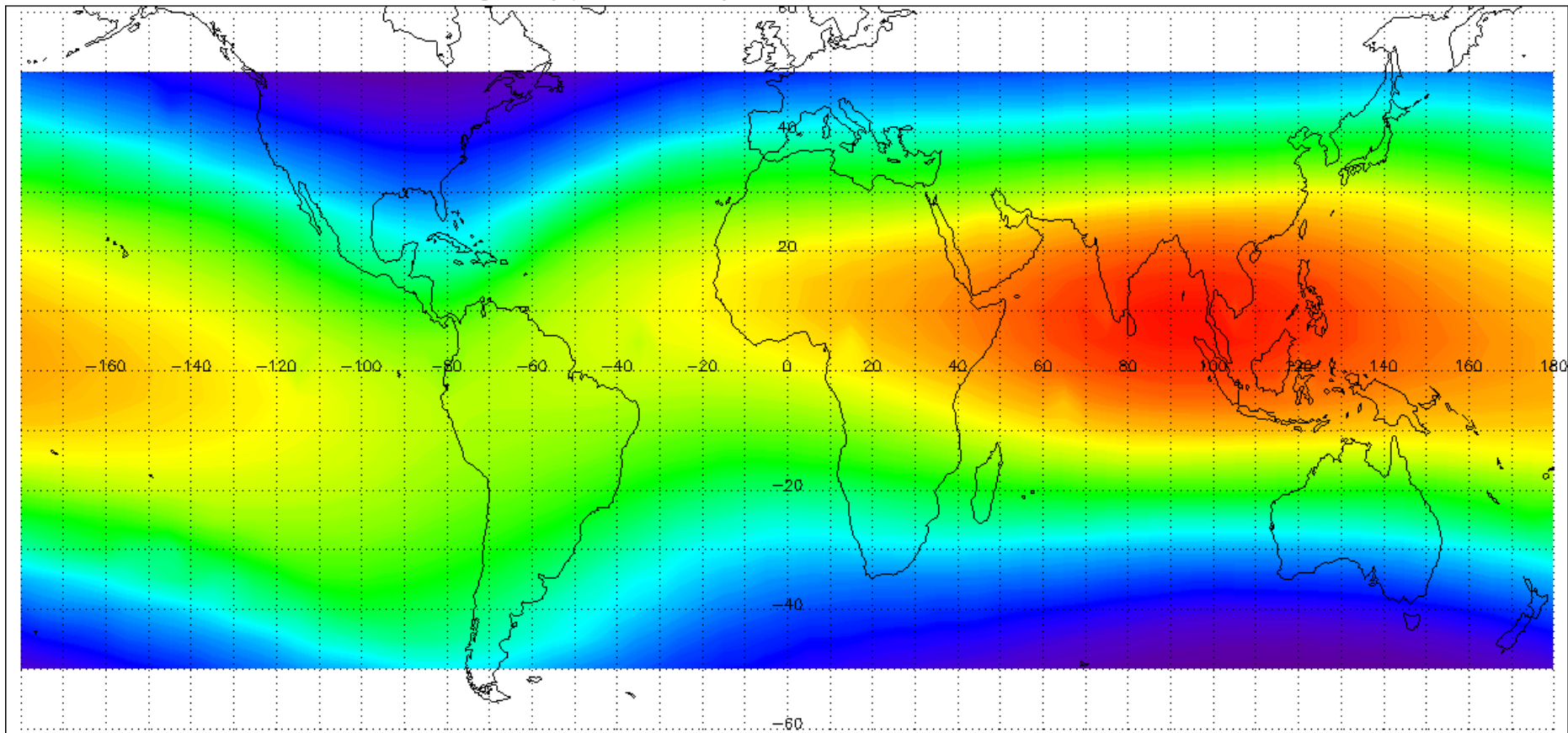


Vertical cutoff rigidity

- Rc simulated by Klaudia Herbst (CAU Kiel)



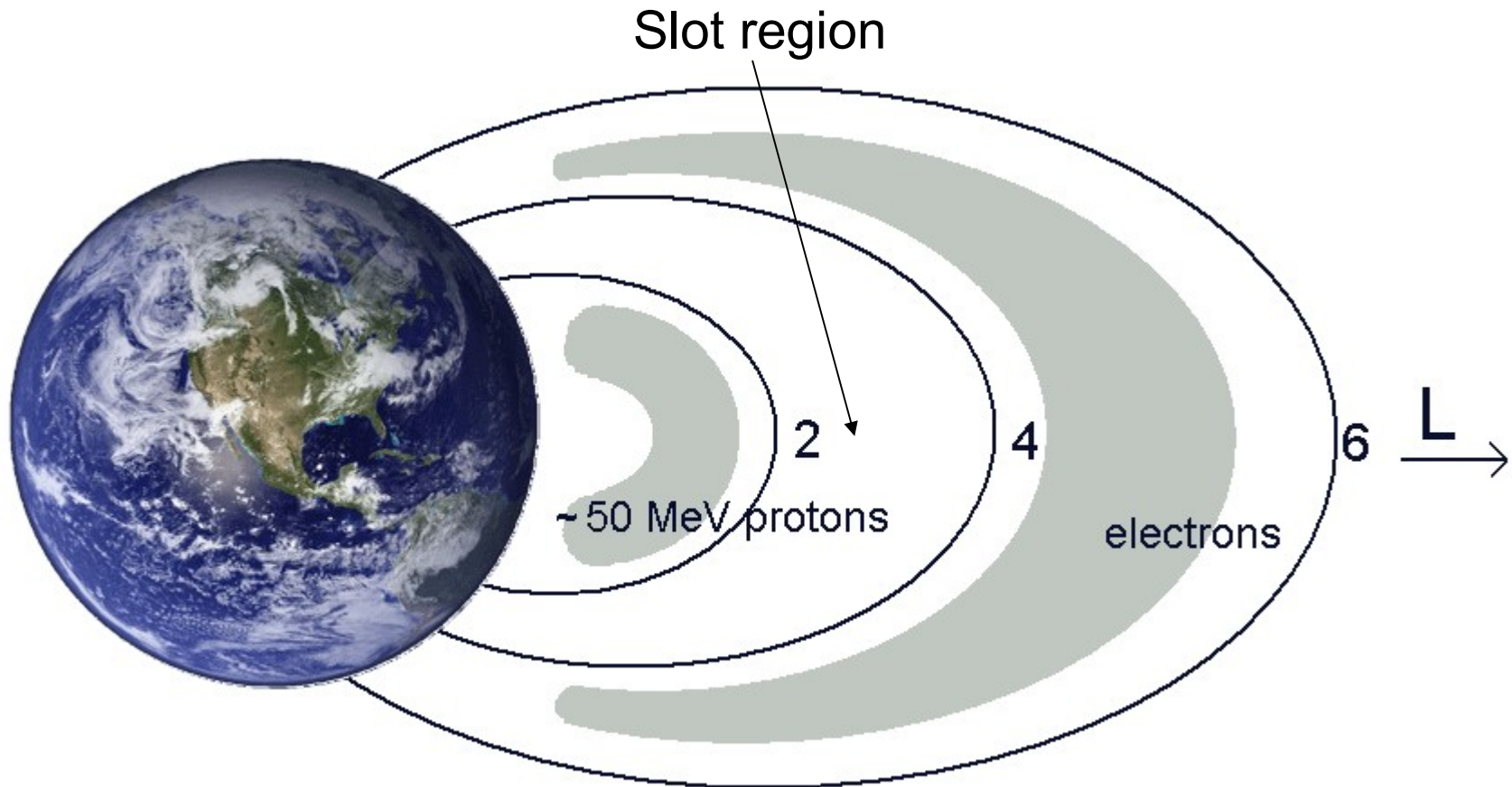
0 2 4 6 8 10 12 14
cutoffrigidity/GV may 2004 alt=400km 5° Grid



Radiation belts / L-Parameter

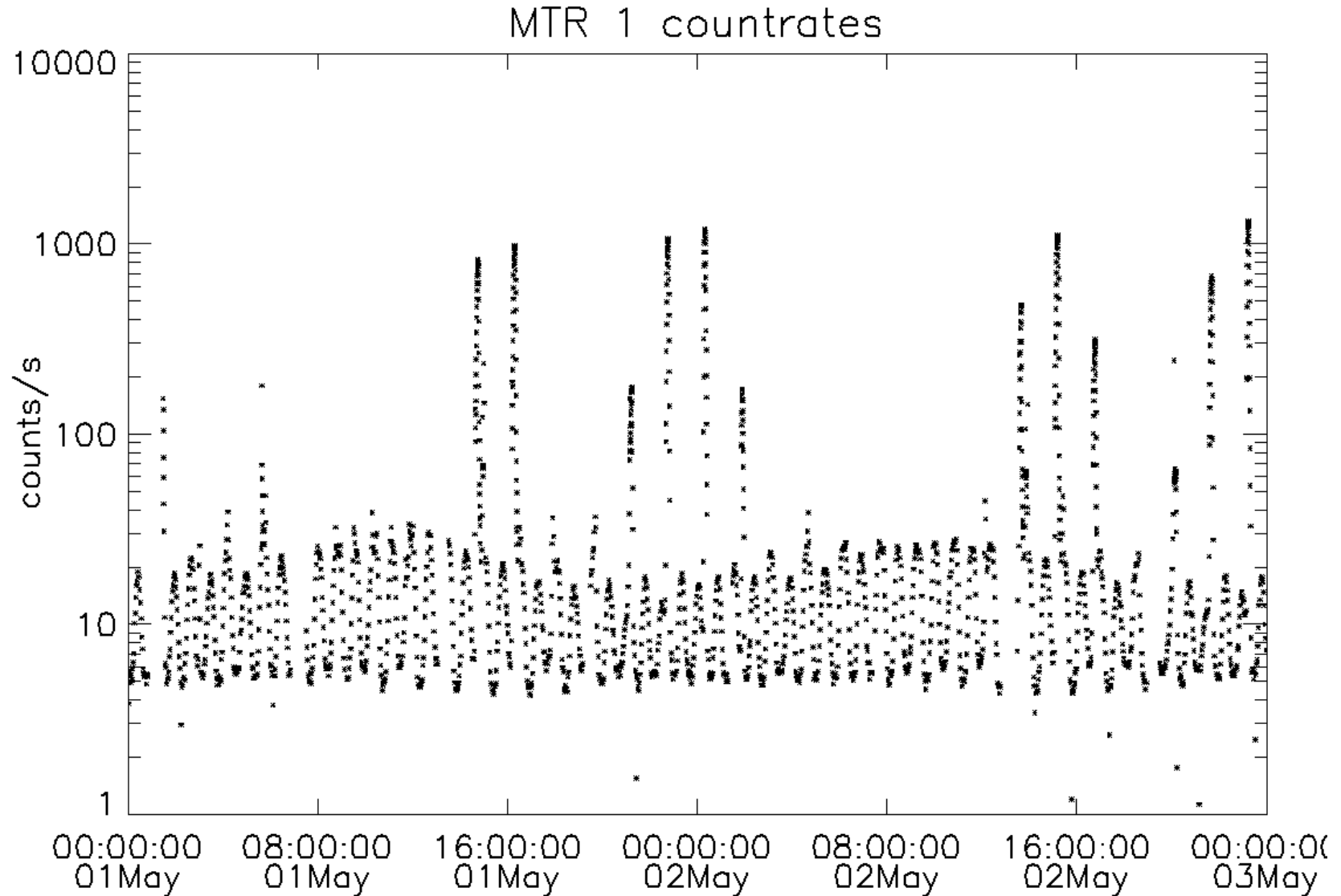
-L-shells calculated from vertical cut-off rigidity R_c via :

$$L = (R_c / 16.237)^{-1/2.0352} \text{ (Smart, Shea)}$$

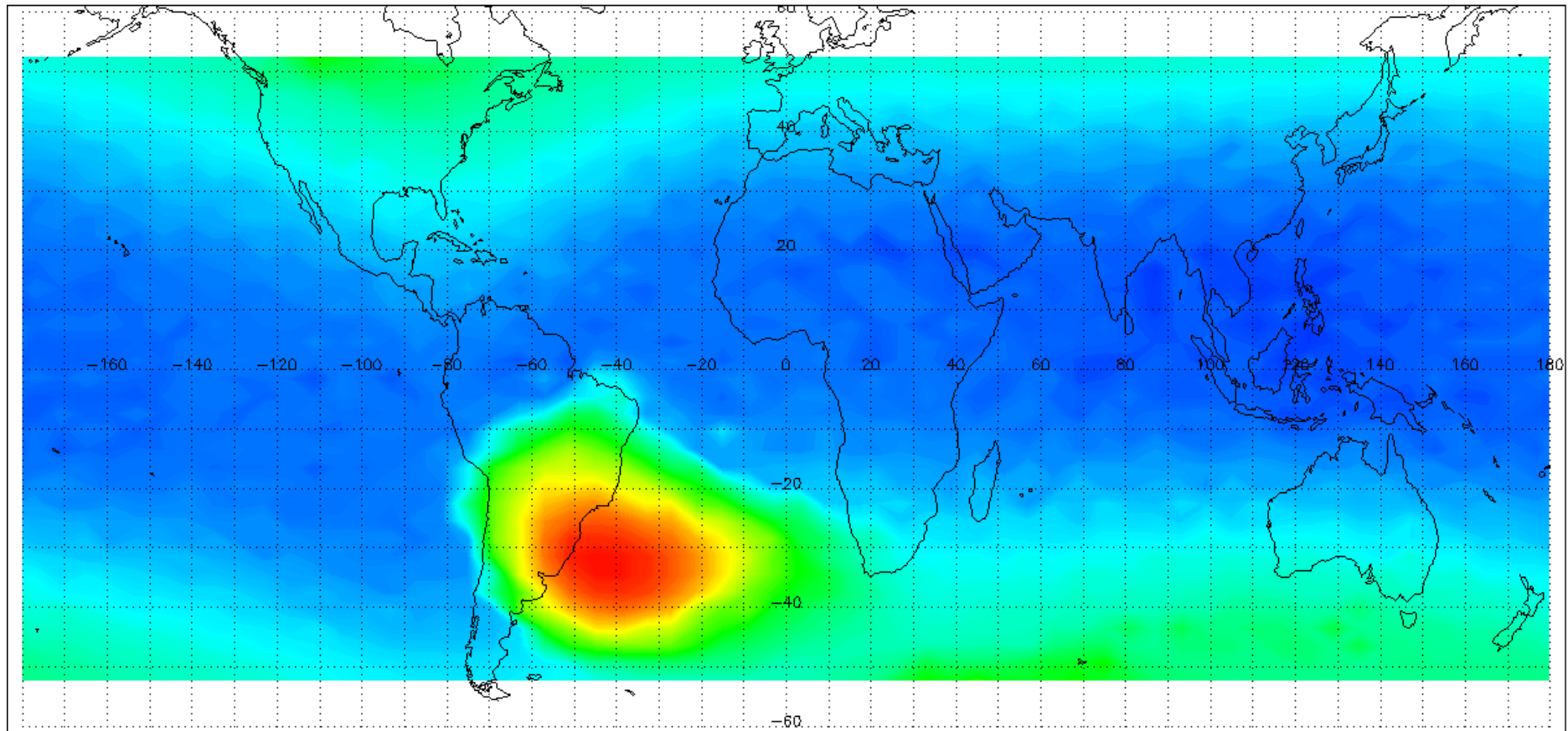


May 2004 count rates

- 6 hour data packages including count rates and spectra



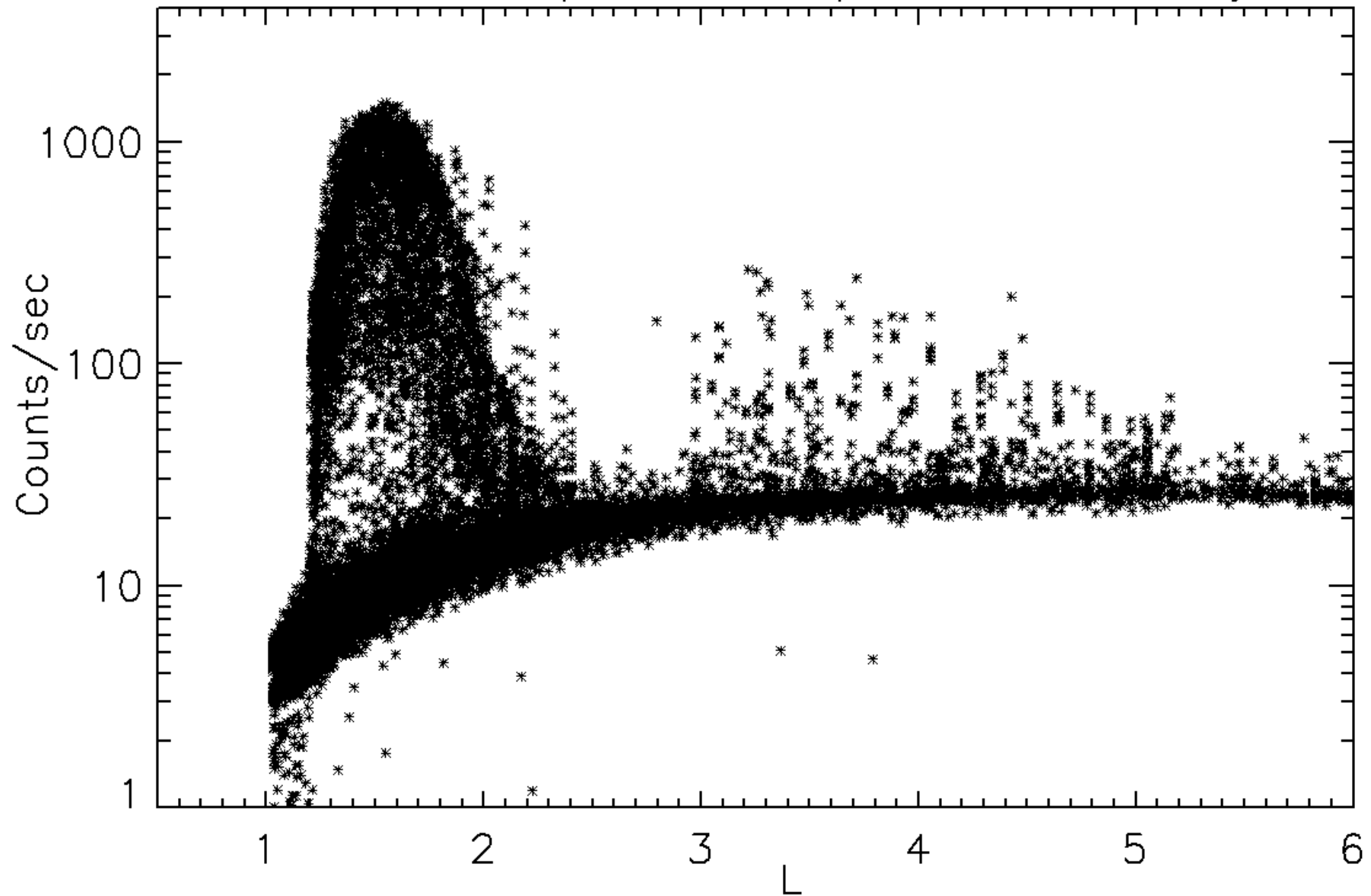
May 2004 2D count rate



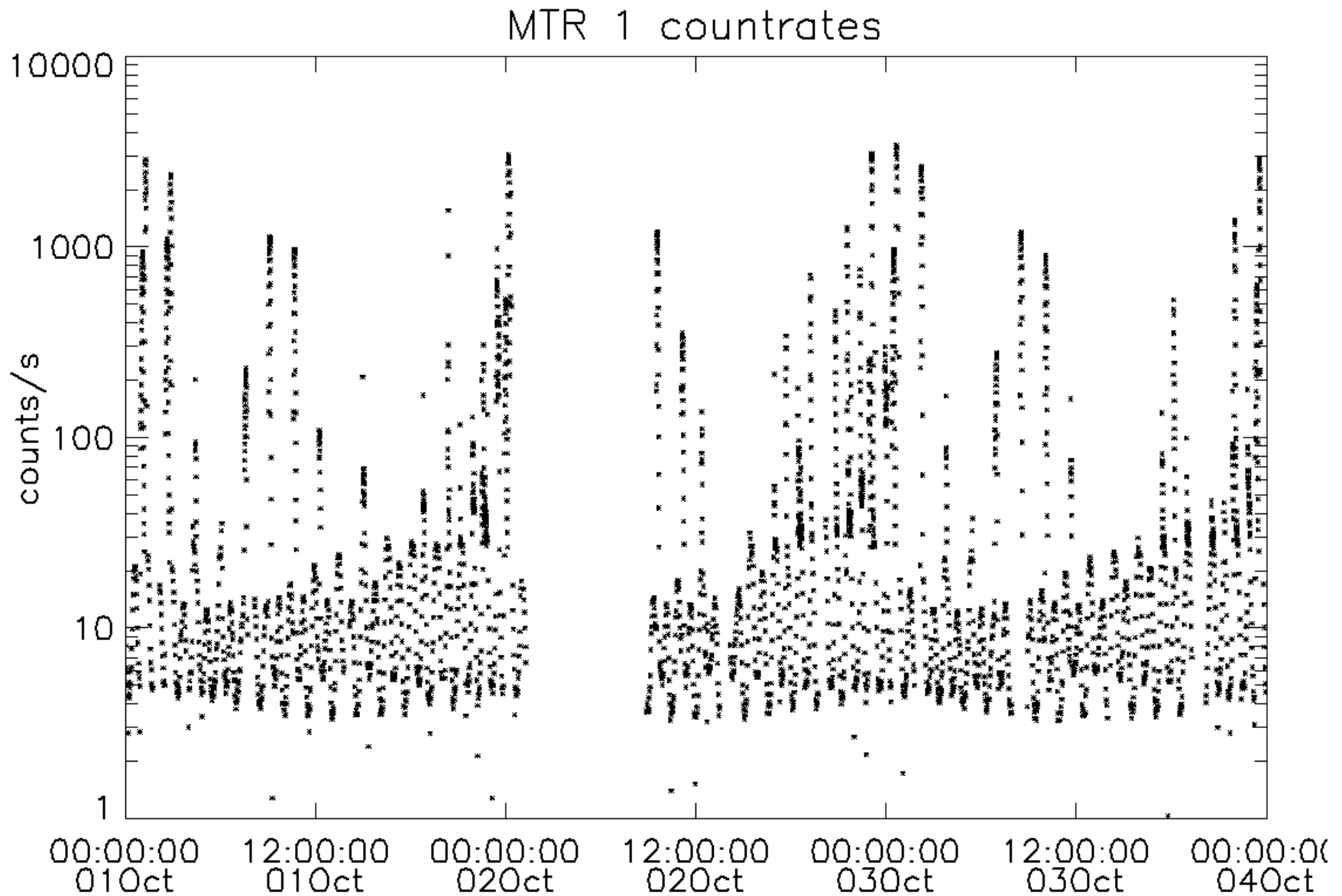


May 2004 count rate / L-parameter

MTR DOSTEL counts/sec vs. L-parameter for May 2004

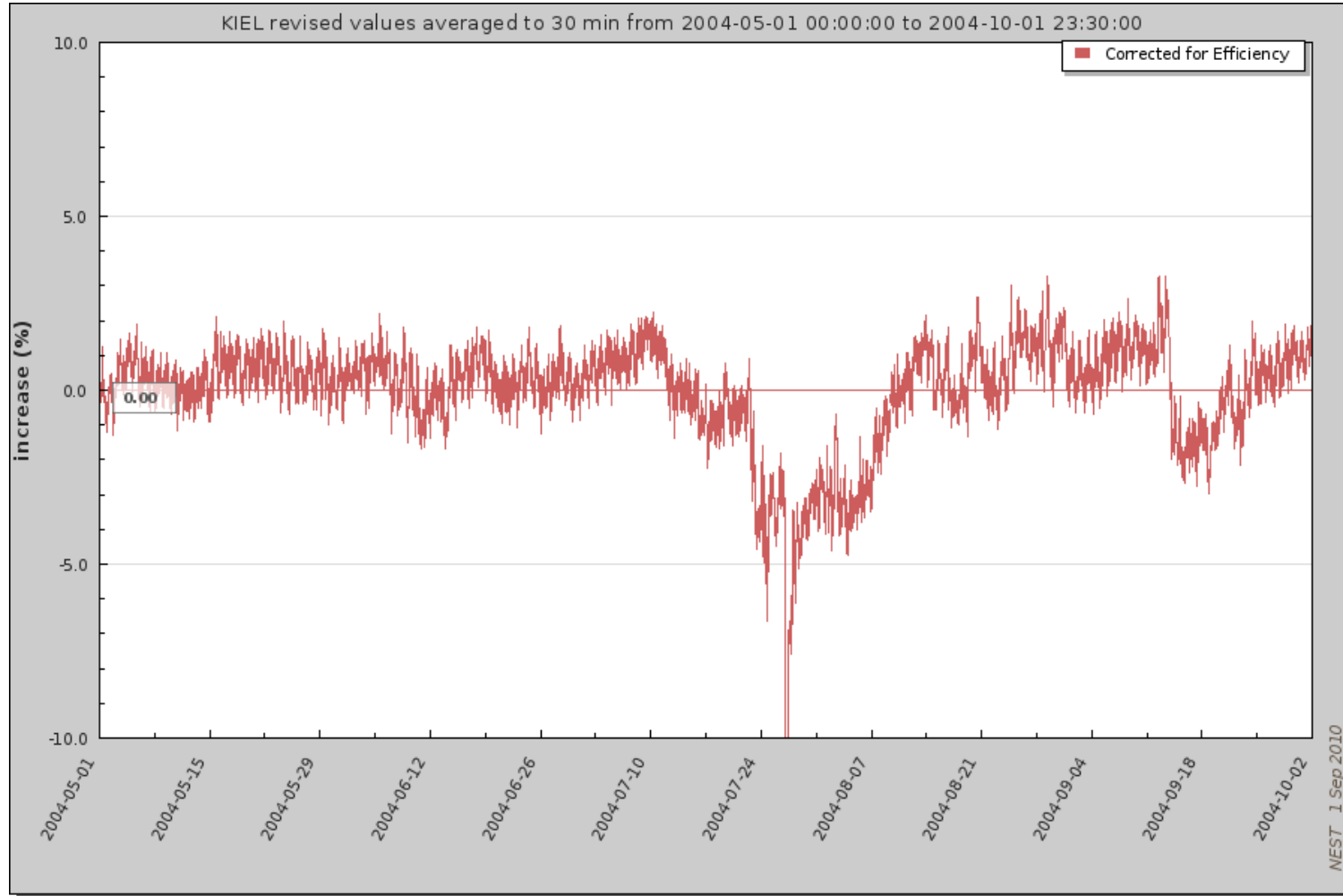


October 2004 count rates



Observations by other instruments

- Kiel neutron monitor showed a Forbush decrease in end of July 2004.

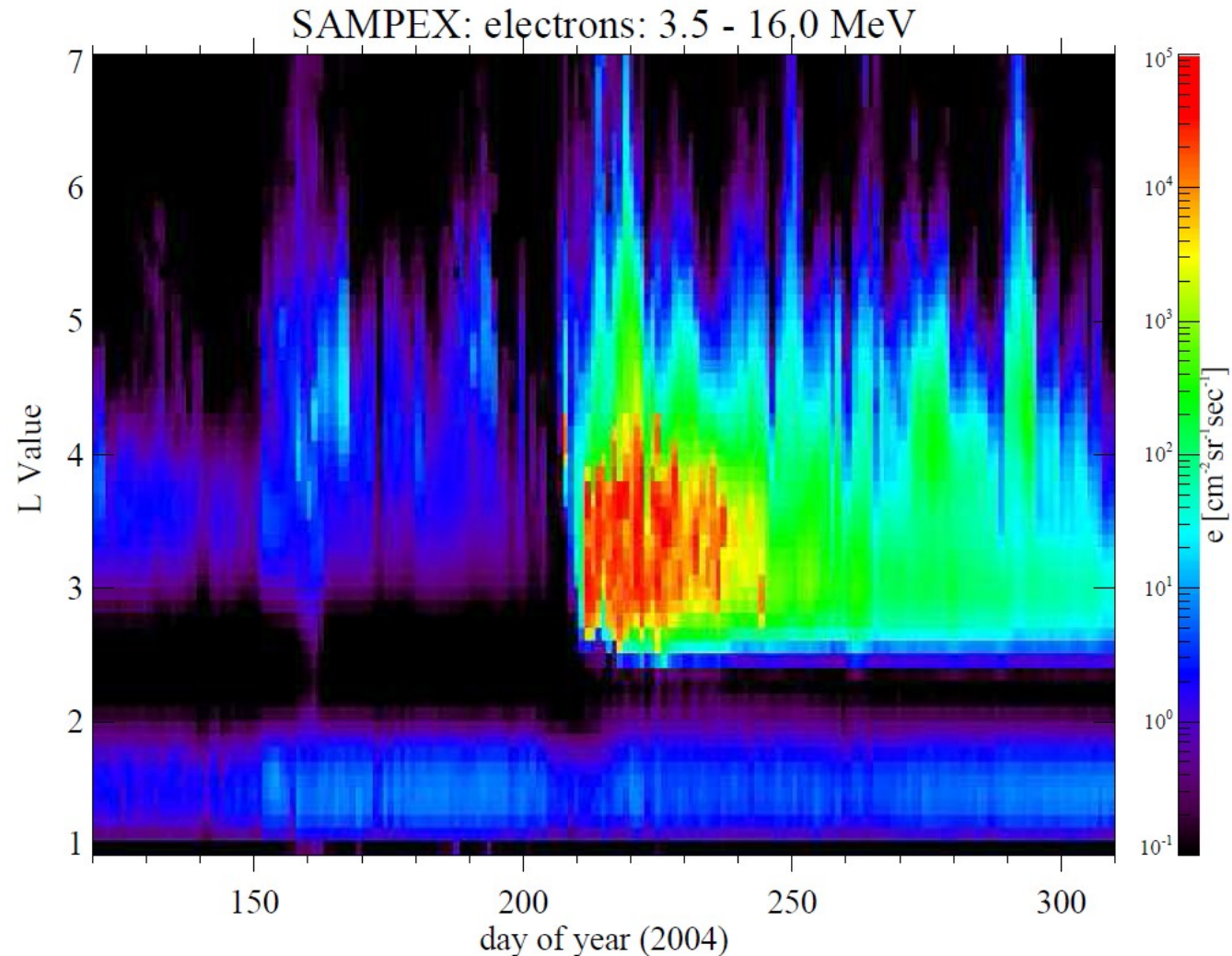


<http://www.nmdb.eu/nest/search.php>

Observations by other instruments

-The SAMPEX data showed that earth's magnetic field was Filled with electrons around DOY 210 (end of July) 2004.

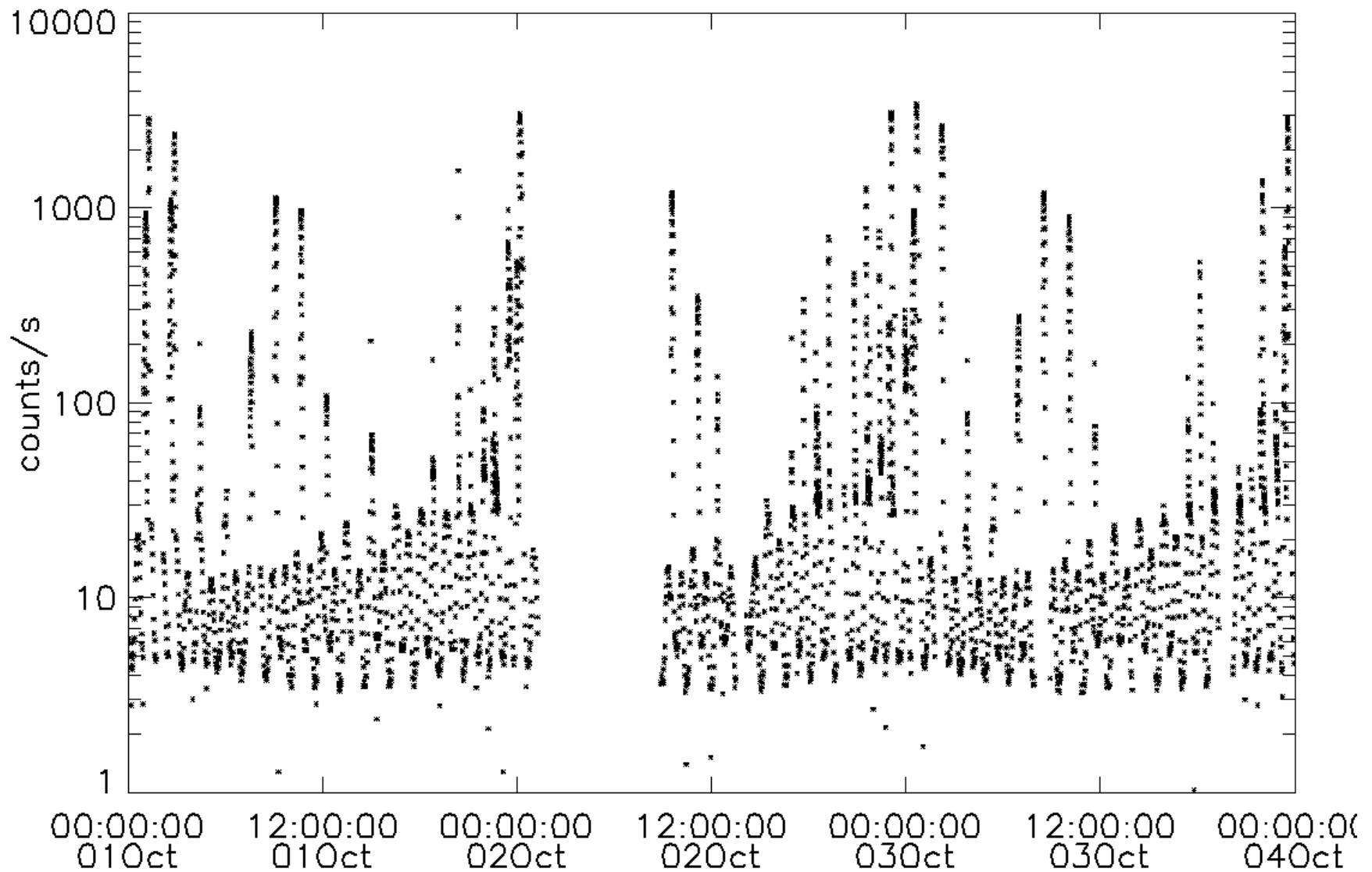
-These electrons formed a radiation belt, which was observed to end of 2004.



<http://www.srl.caltech.edu/sampex/DataCenter/>

October 2004 count rates

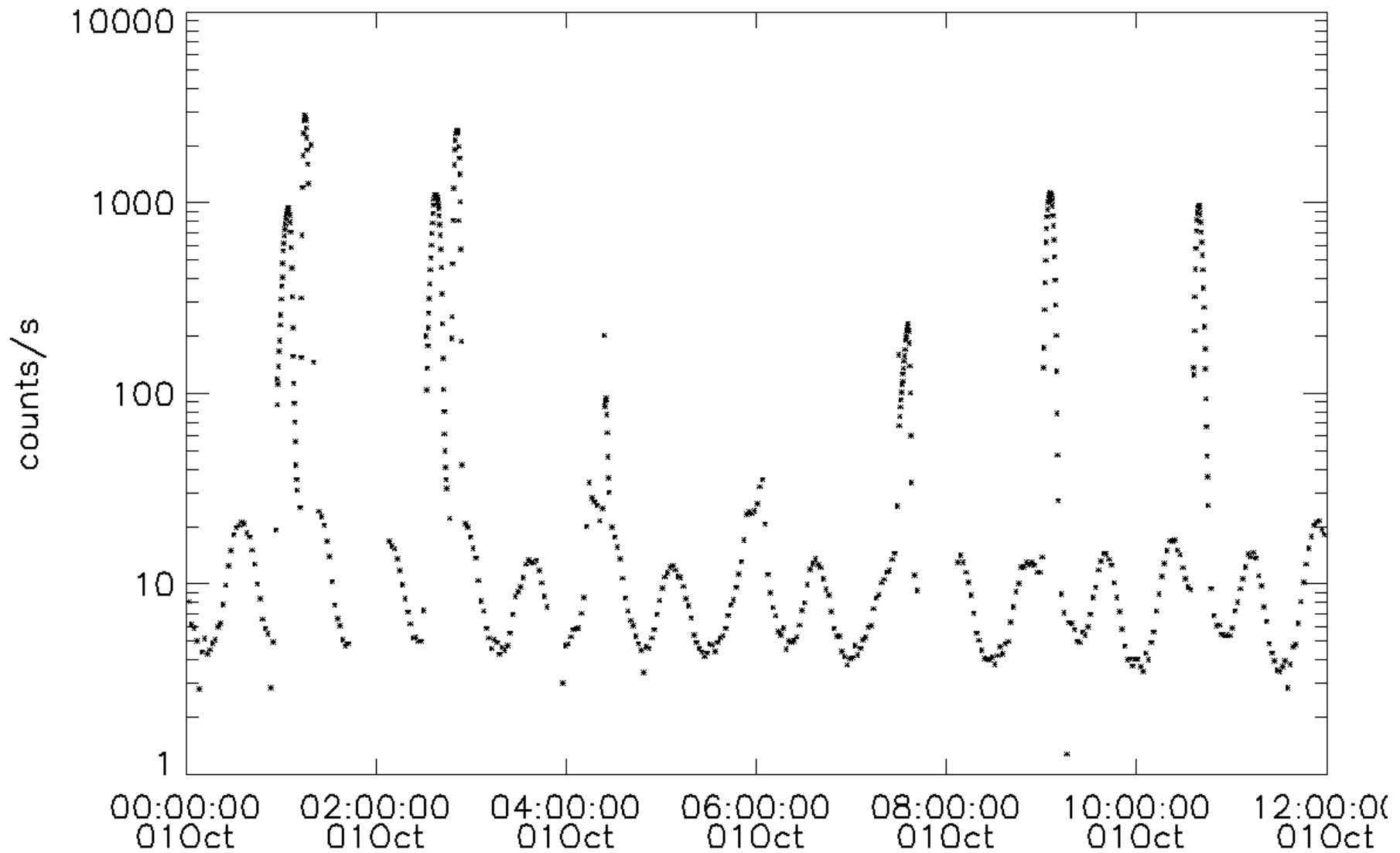
MTR 1 countrates





October 2004 count rates

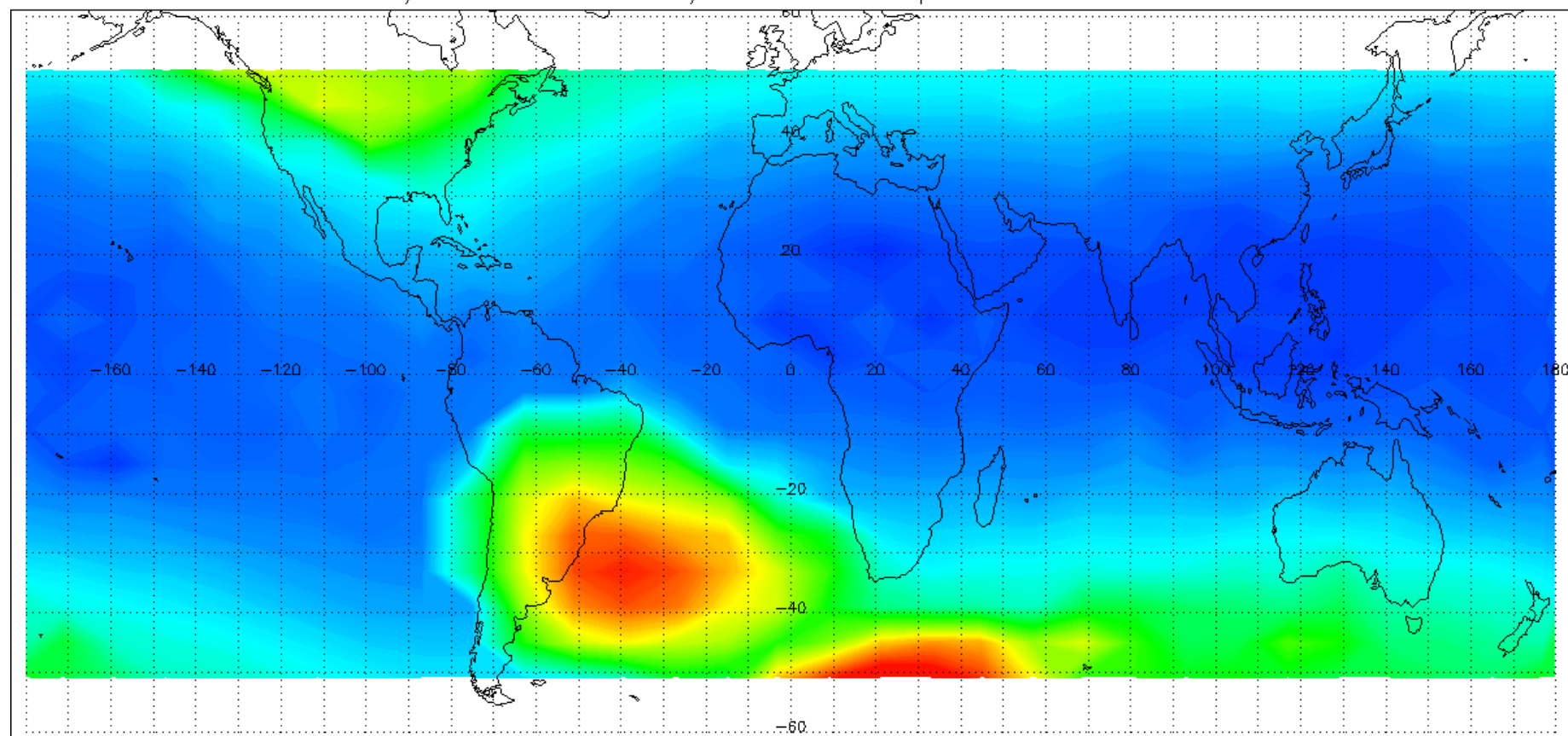
MTR 1 countrates



October 2004 2D count rate

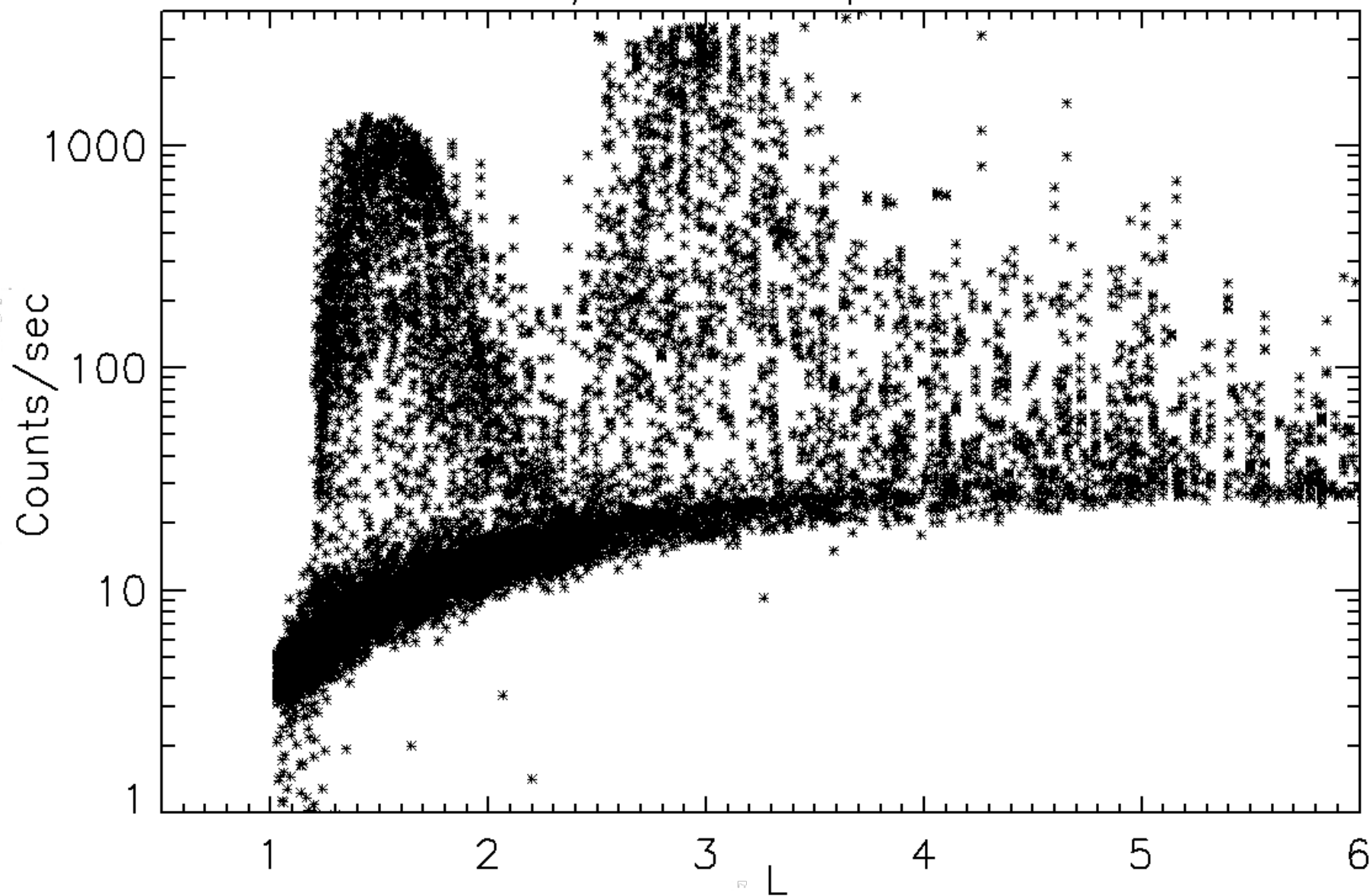


1 10 100 1000
counts/s MATROSHKA/DOSTEL Sept. 24th to Oct. 8th



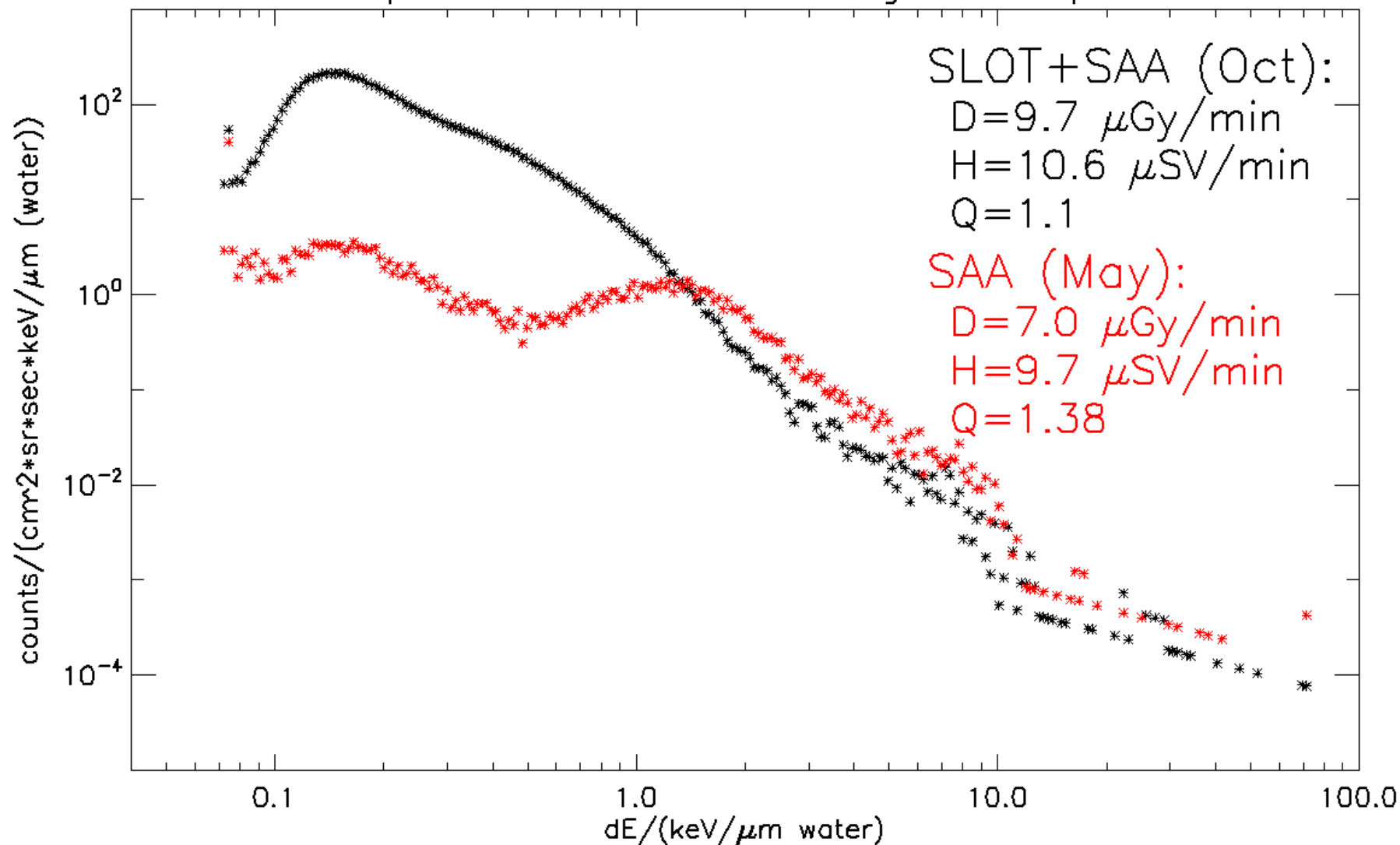
October 2004 count rate / L-parameter

MTR DOSTEL counts/sec vs. L-parameter for Oct 2004



Spectra of SAA and SAA+SLOT

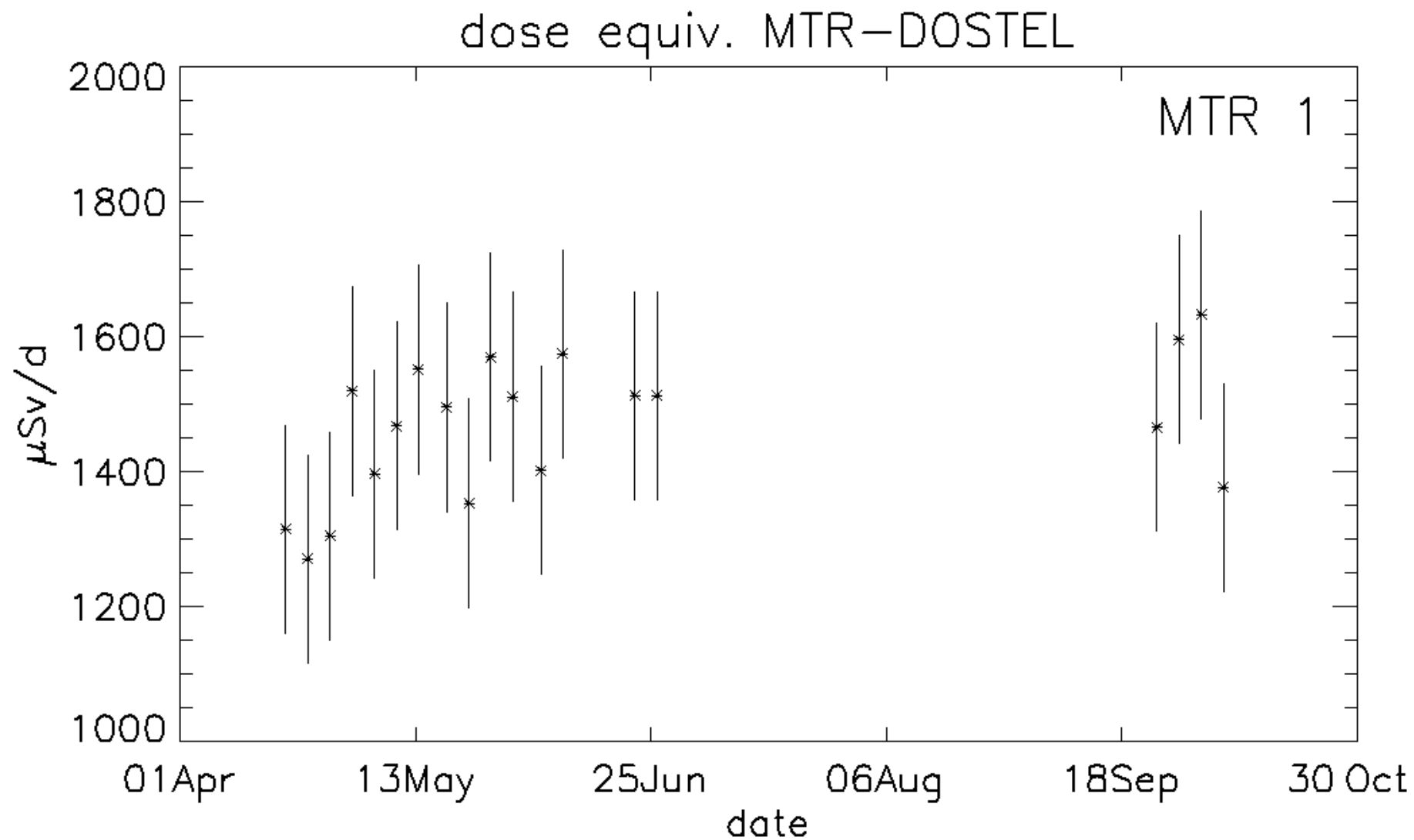
Comparison of SAA and SLOT region belt spectra



- In September and October 2004 MTR-DOSTEL data show an additional radiation belt observed in ISS altitudes.
- This radiation belt has a L-parameter between $L \sim 2.5-3.5$, the so called “Slot Region”.
- The observed dose equivalent outside the ISS increased due to the additional radiation belt.

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Dose equivalent for MTR1



Dose equivalent II

	all			GCR			SAA		
	$\mu\text{Sv/d}$	$\mu\text{Gy/d}$	Q	$\mu\text{Sv/d}$	$\mu\text{Gy/d}$	Q	$\mu\text{Sv/d}$	$\mu\text{Gy/d}$	Q
MTR I	1260	655	1.9	780	310	2.6	480	345	1.4
MTR IIb	580	300	1.9	(460)			(120)		