TRITEL measurements in the Russian Service Module (April – July 2013)

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Content

• The TRITEL-RS system

• TRITEL-RS on the ISS

• From the results of April 2013 – July 2013
The TRITEL 3D Silicon Detector Telescope

- "\( \Delta E - \Delta E \)" detector
- \( \Sigma \Delta E \rightarrow \sim D \)
- \( \Delta E / x_{\text{avg}} \approx \text{LET}_{\text{Si}} \)

- \( 3 \times 2 \) Canberra FD PIPS det.
- \( r = 8.4 \text{ mm} \)
- \( p = 8.9 \text{ mm} \)
- \( w = 300 \mu\text{m} \)
TRITEL (interior)
The TRITEL 3D Silicon Detector Telescope

• ΔE measurements: 60 keV – 83 MeV (nominal) (quasi logarithmic spectra; total and coincidence) → LET: 0.2 keV/μm – 120 keV/μm in water

• ΔE spectra every 10 minutes → 90-min and daily spectra are stored

• Time spectra (total and coincidence); 1-min resolution
  • Contribution from SAA crossings → collected separately
TRITEL in the Russian SM of the ISS

TRITEL-RS (in the frame of Matroshka-R) was developed in cooperation with the Institute of Biomedical Problems, Moscow and with the former financial support of the Hungarian Space Office.
TRITEL in the Russian SM of the ISS
TRITEL in the Russian SM of the ISS

Location: CM 221 and CM222 panels

Photo: NASA

Photo: IBMP/Roscosmos/Energia
Time spectra - anisotropy

14/06/2013

total count rate (s⁻¹)

Time (GMT)
Time spectra - anisotropy

14/06/2013

coincidence count rate (s⁻¹)

04:00 06:00 08:00 14:00

Time (GMT)
Switching to “SAA” spectra

- Based on time spectra
- Criterion on the relative change in total number of counts → 1 parameter (δ)
- Systematic error → switching realized one minute later
- Value of the parameter (δ_{flight} = 17) → optimized based on earlier DOSTEL time spectra in different missions
Switching to “SAA” spectra

\[ \delta_{\text{flight}} = 17 \]
Switching to “SAA” spectra

$\delta_{\text{test,1}} = 14$

$\delta_{\text{test,2}} = 10$
Switching to “SAA” spectra

\[ \delta_{\text{flight}} = 17 \]

\[ \delta_{\text{test,3}} = 26 \]
TRITEL-RS daily abs. dose rates

Absorbed dose rate (µGy/d) in Si

- nSAA TRITEL X
- SAA TRITEL X
- total TRITEL X
- nSAA TRITEL Y
- SAA TRITEL Y
- total TRITEL Y
- nSAA TRITEL Z
- SAA TRITEL Z
- total TRITEL Z

Dates from 2013.04.06 to 2013.07.17.
TRITEL-RS IU failure

- Soft error in the operating system
  → data corrupted after 17/07/2013
  → possible SEE due to HZE particle?

- Error detected: in September 2013 (in downloaded data)

- Switch-off and restart attempt by cosmonauts on 14/11/2013
  → stuck reboot process...

- Returned on Soyuz-TMA-11M in May 2014

- Tests showed: soft failure in the CF card
  (used for OS and data storage)

- CF card changed to more reliable version

- Return of the unit planned with Progress M-27M…
Failed delivery to ISS

- Cargo: Progress M-27M
- Injection to proper orbit: Failed 😞
Thank you for your attention