



# **The Radiation Monitoring System of the Russian Segment of the ISS. Current Status and Results.**

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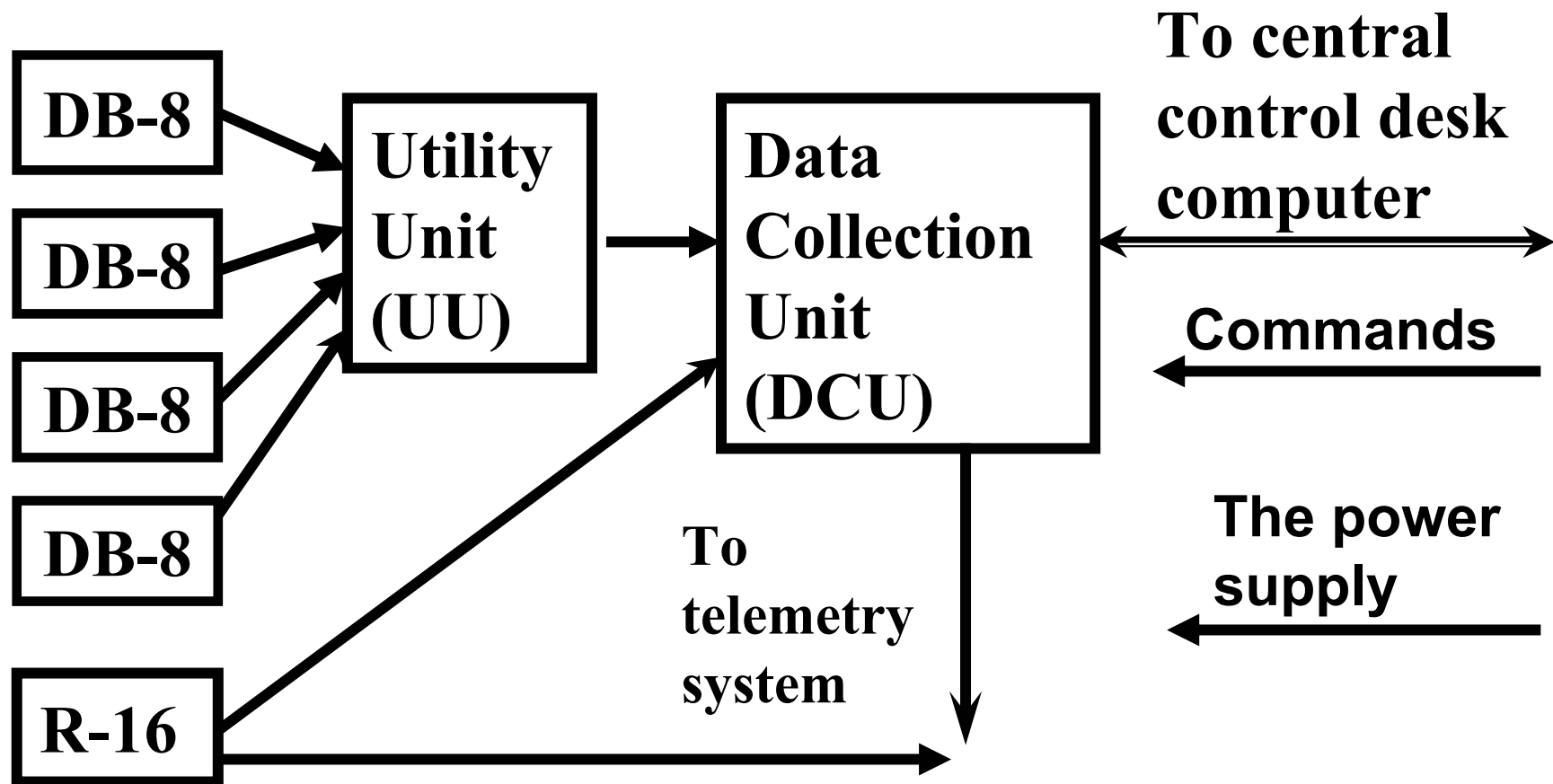
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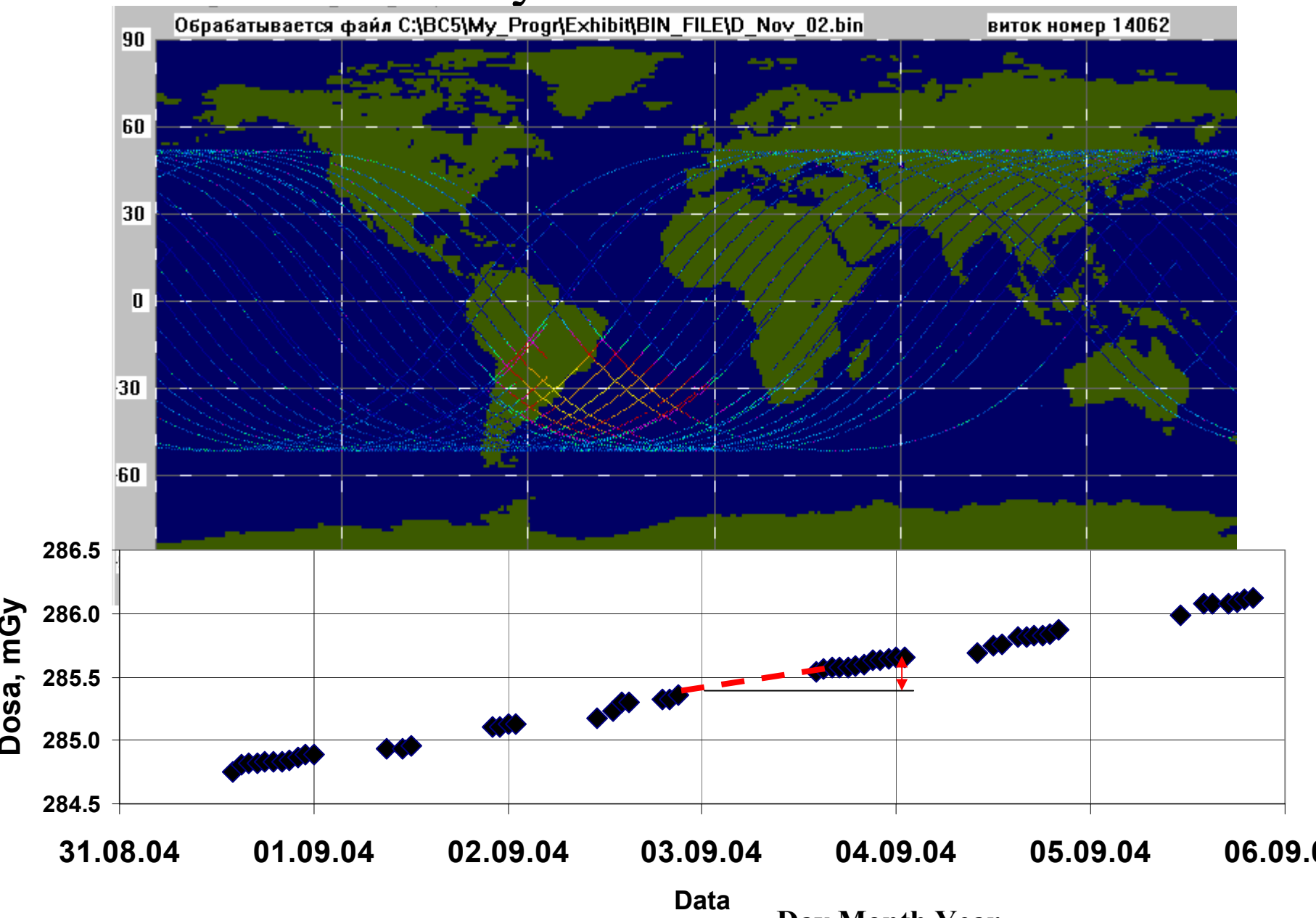
**3) Skobeltsyn Institute of Nuclear Physics of Moscow  
State University.**



# Current Configuration of the Radiation Monitoring System (RMS)

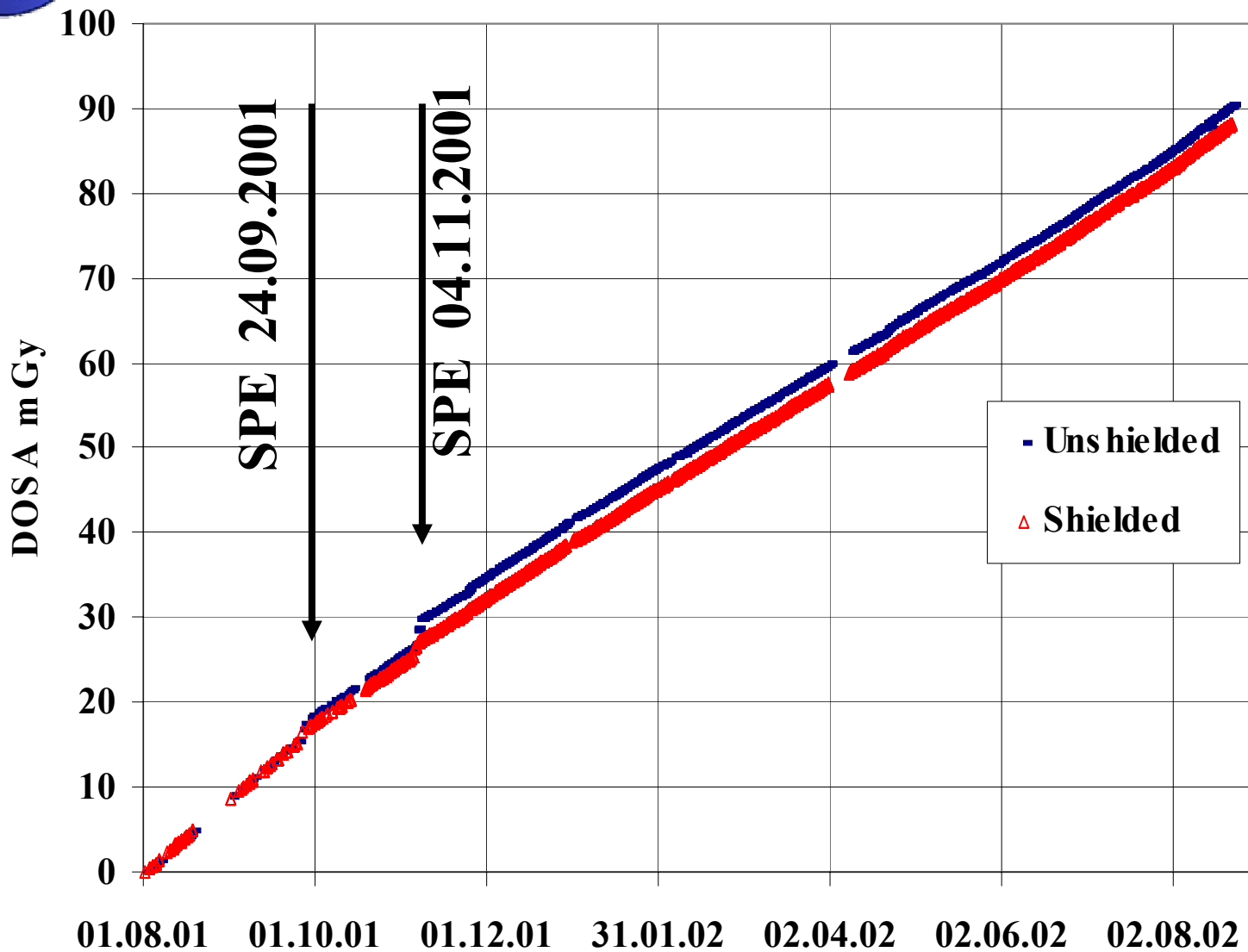


# Daily dose calculation



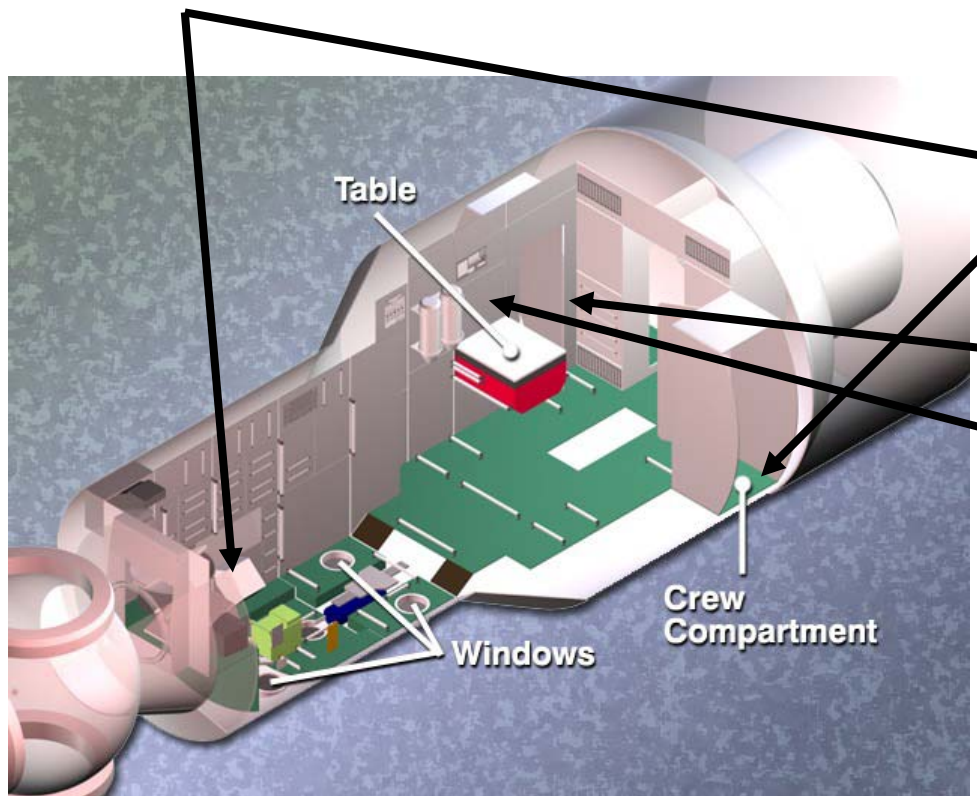


## Revised dose of DB-8 unit number 1





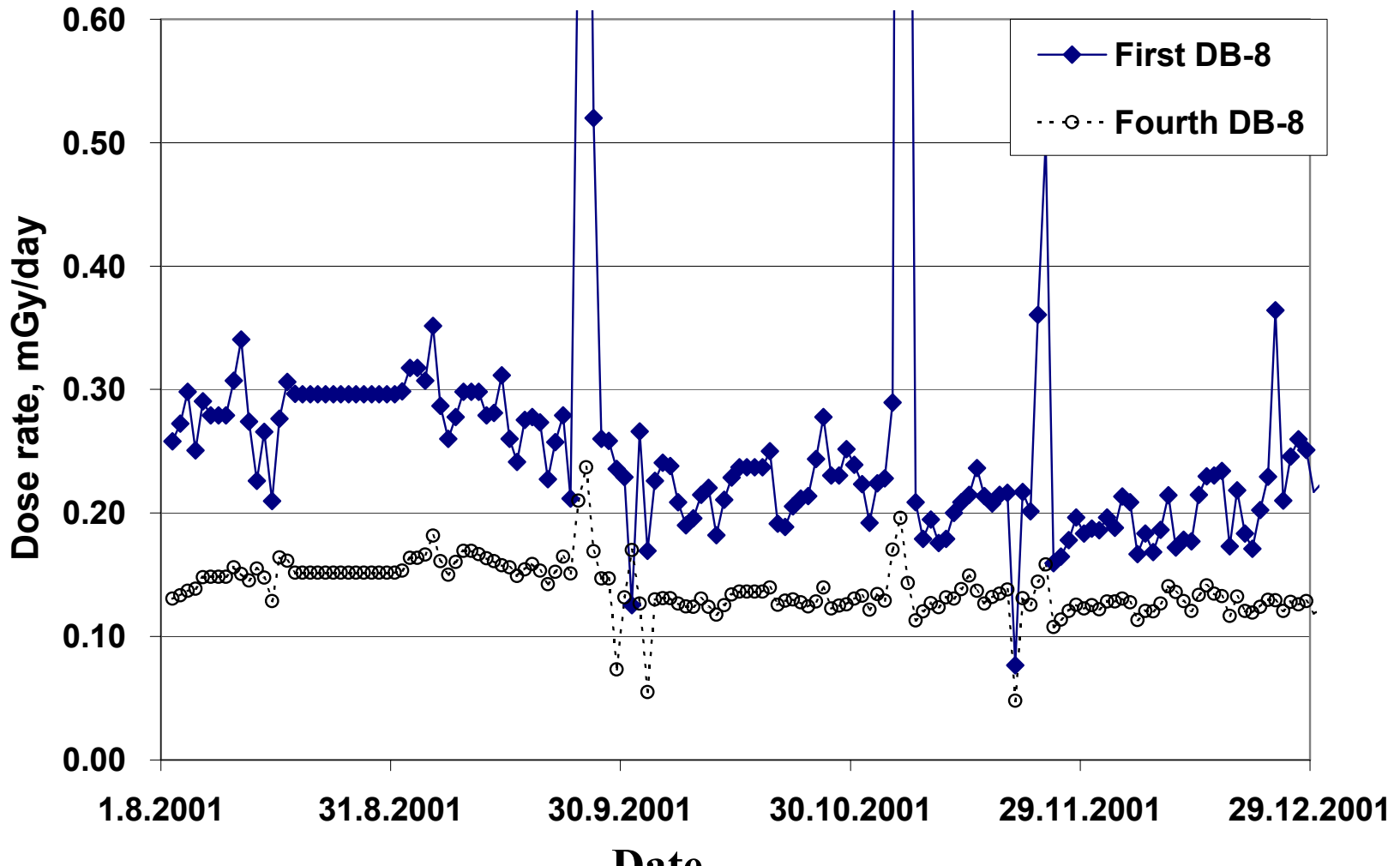
# Placements of the RMS Units



Block	Placement
DB-8 №1	Starboard side, behind board № 410
DB-8 №2	Port side, behind board № 244 (cabin)
DB-8 №3	Starboard side, behind board № 447 (cabin)
DB-8 №4	Starboard side, behind board № 435
R-16	Ceiling of Big diameter bay, behind board № 327
UU	Starboard side, behind board № 447 (cabin)
DCU	starboard side, behind board № 447 (cabin)

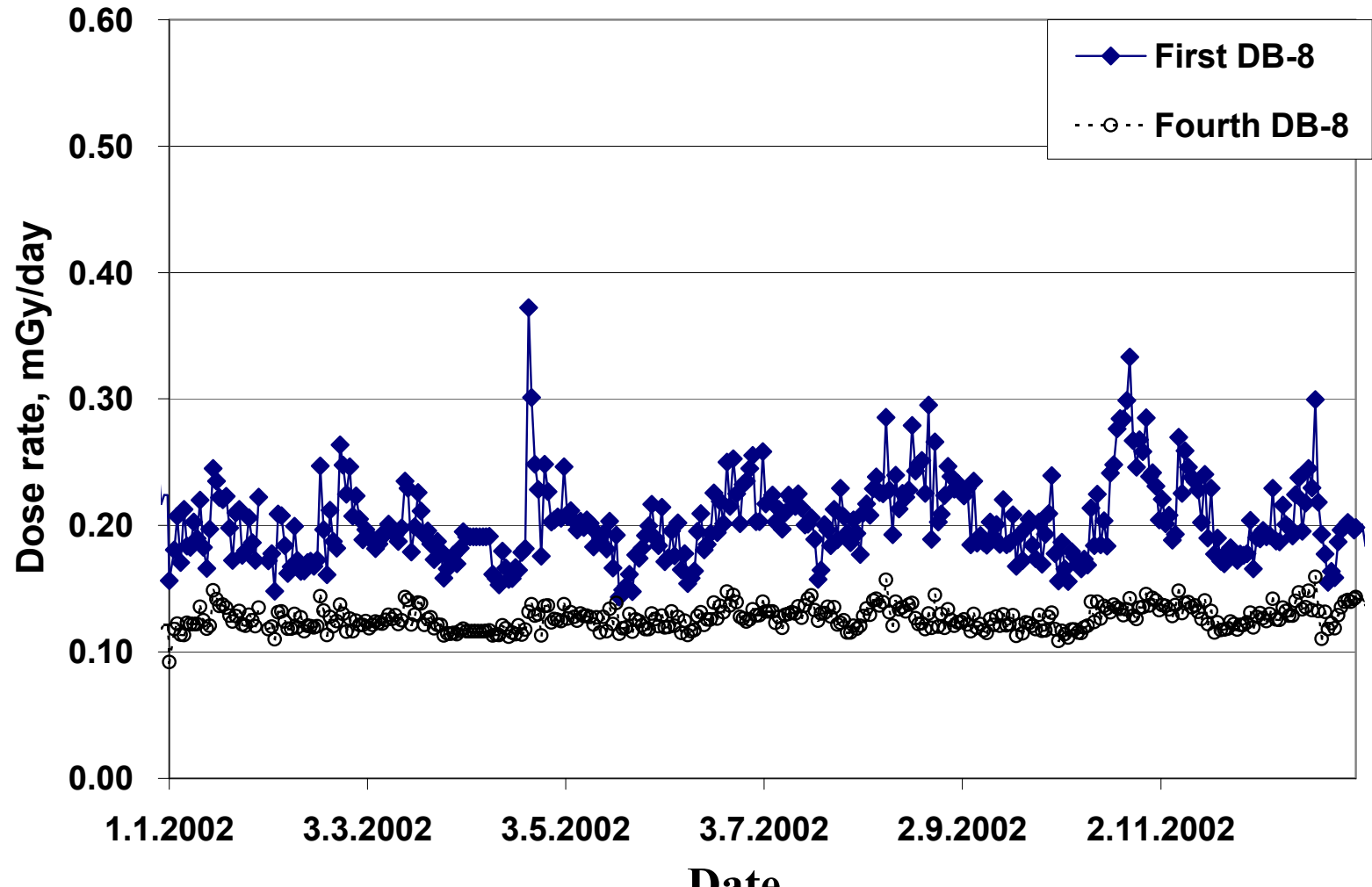


# Daily doses measured with unshielded detectors of the first and fourth DB-8 units since August 2 till December 31, 2001



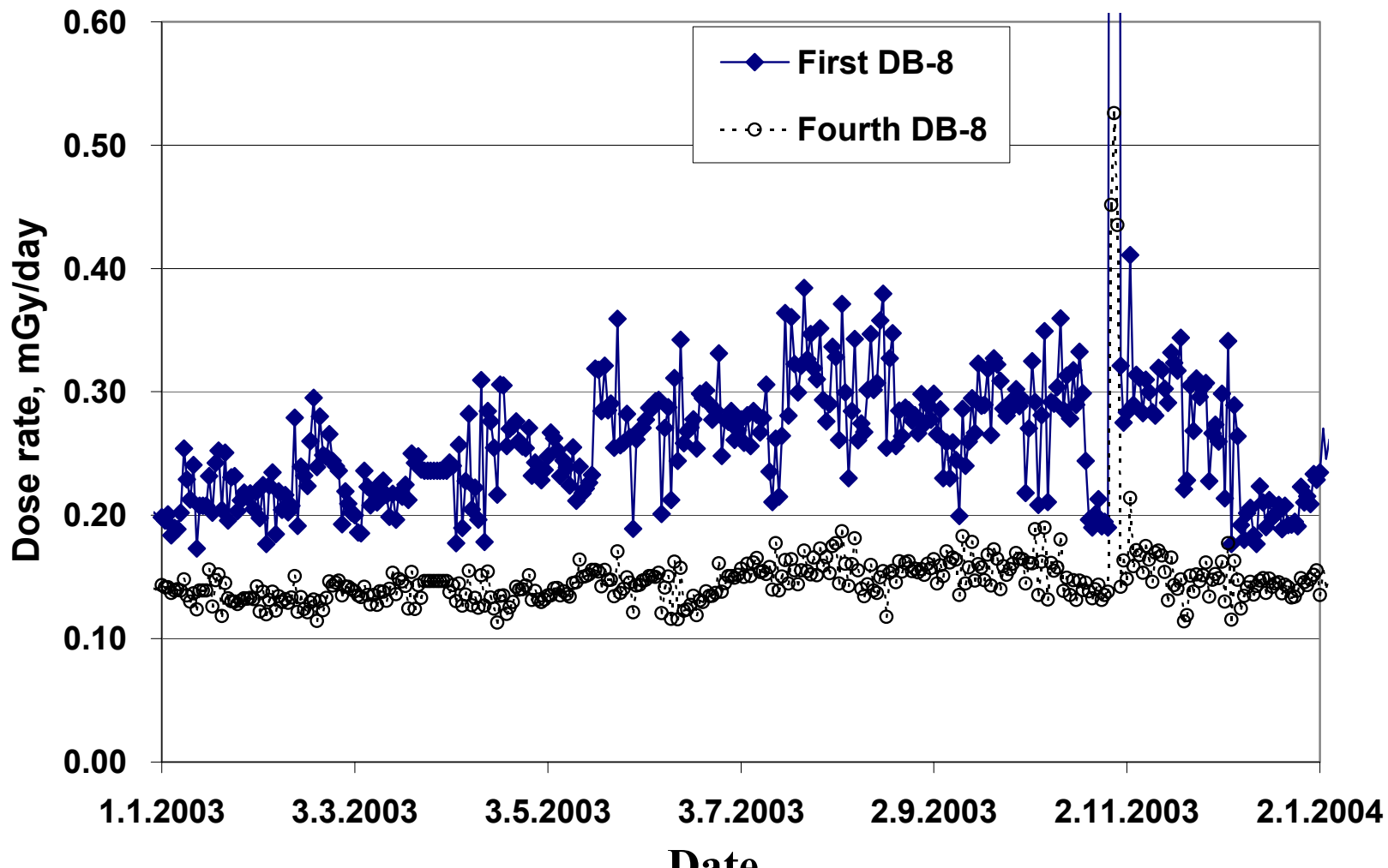


# Daily doses measured with unshielded detectors of the first and fourth DB-8 units since January 1 till December 31, 2002



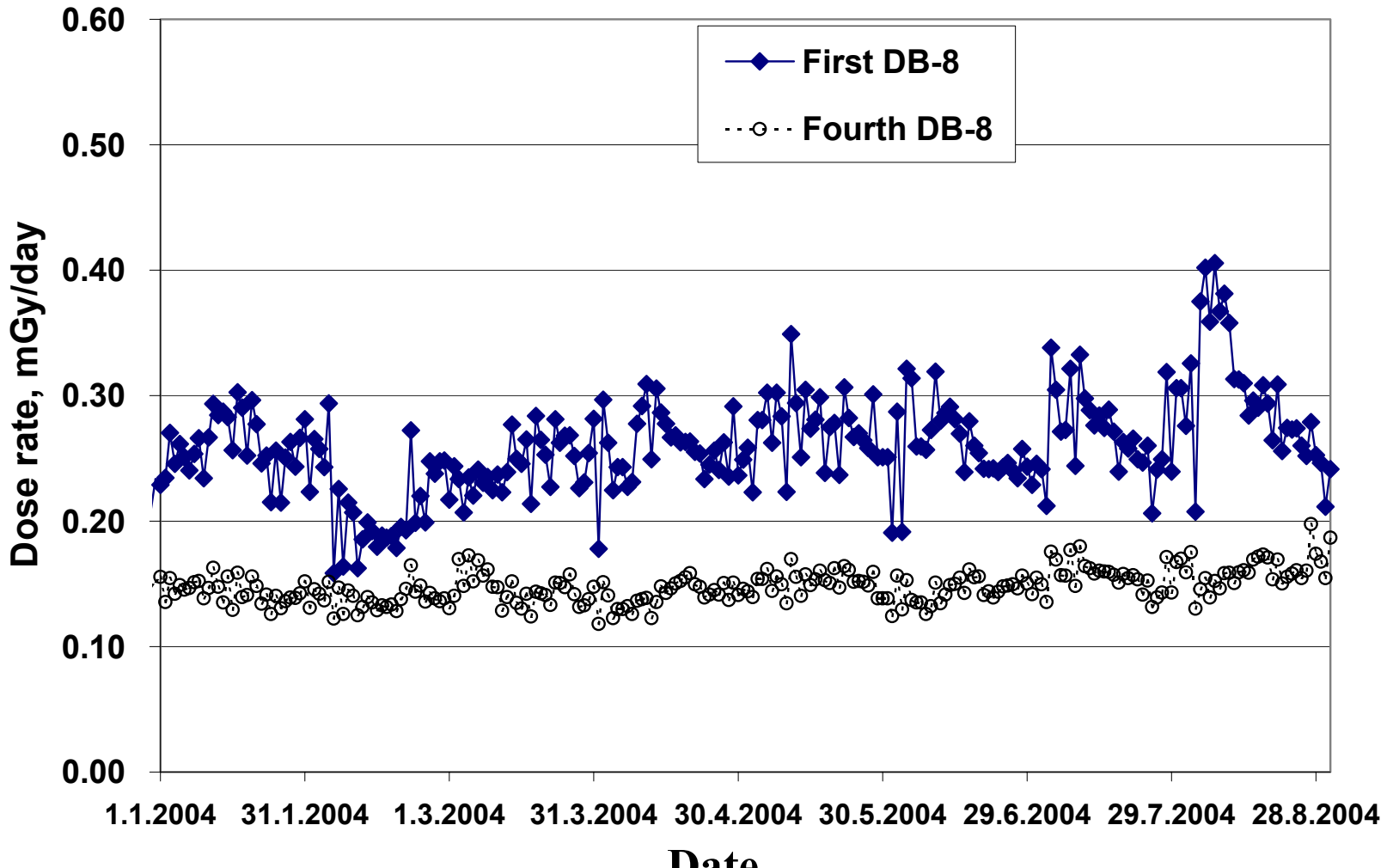


# Daily doses measured with unshielded detectors of the first and fourth DB-8 units since January 1 till December 31, 2003



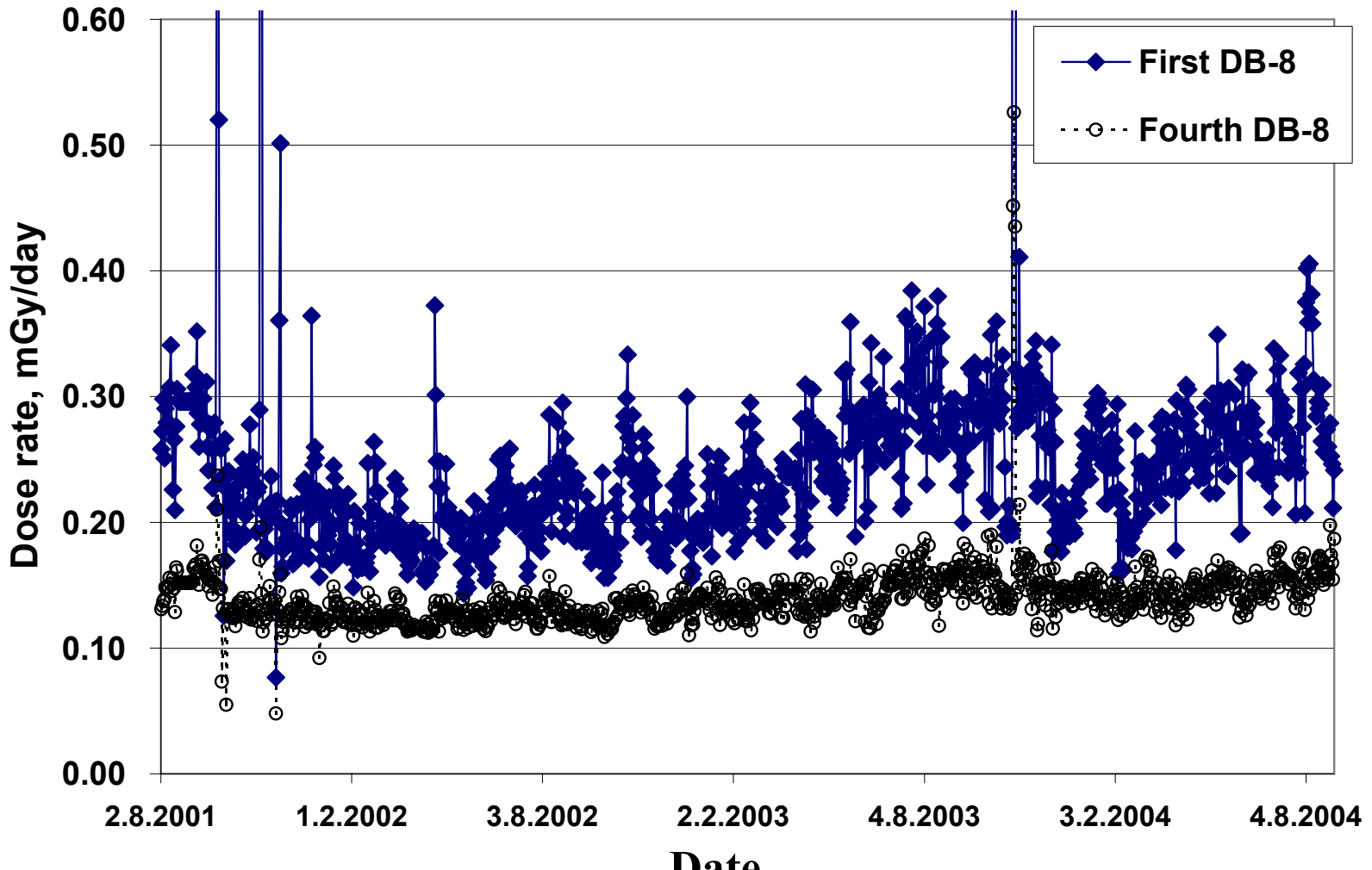


# Daily doses measured with unshielded detectors of the first and fourth DB-8 units since January 1 till August 31, 2004

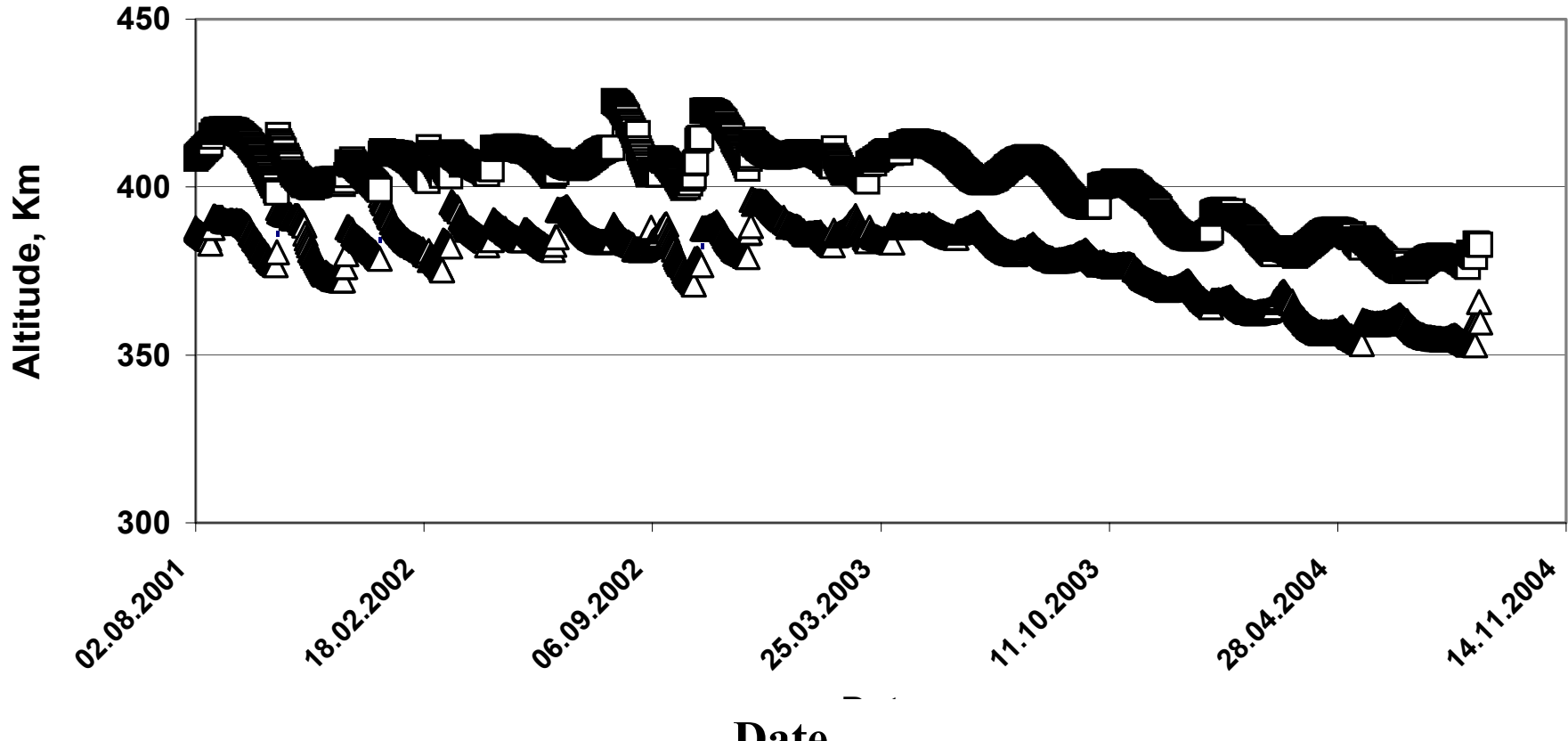




# Daily doses measured with unshielded detectors of the first and fourth DB-8 units since August 2, 2001 till August 31, 2004



# ISS Perigee and Apogee Altitudes during 3 years of the RMS operation



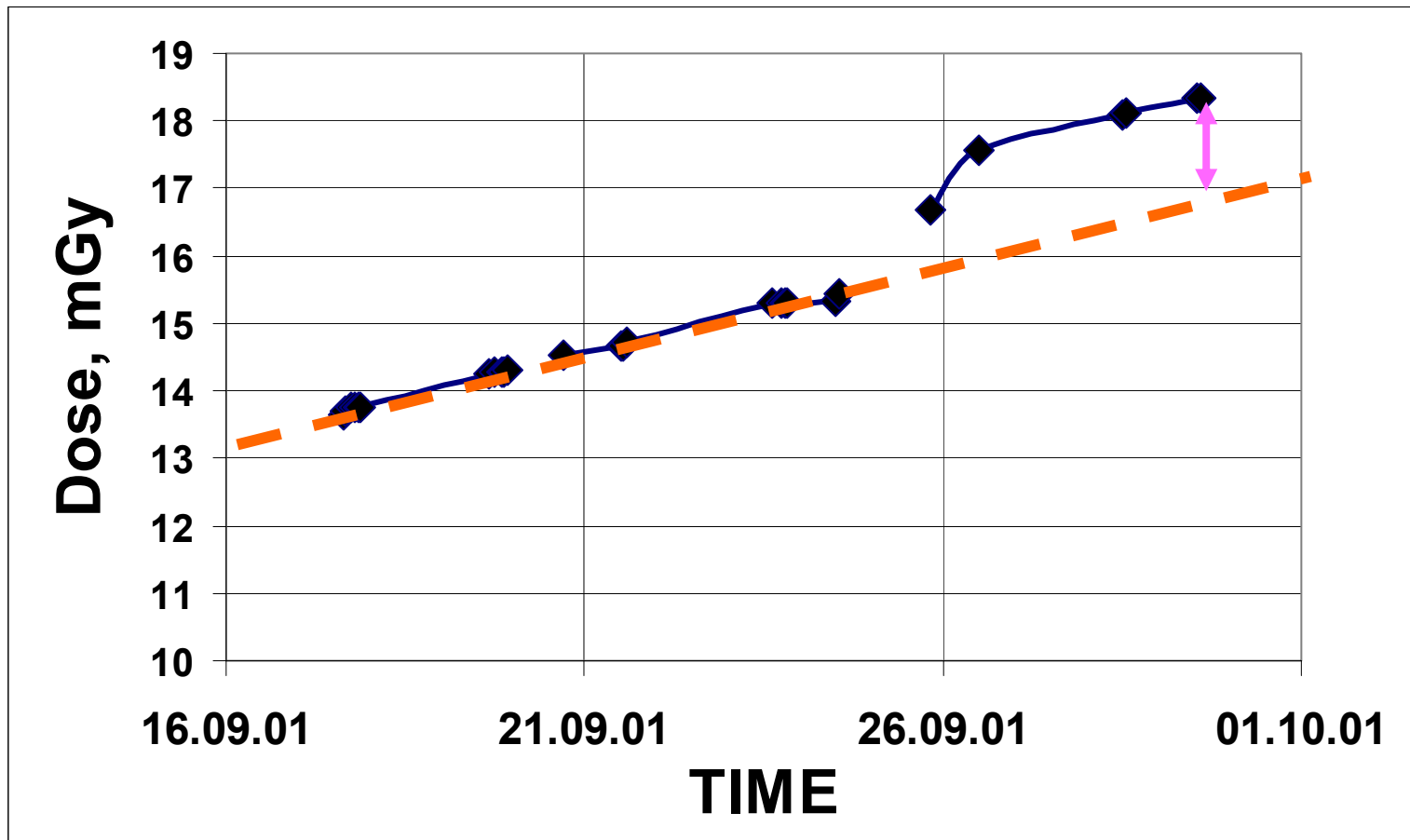


## Doses measured during three years of the RMS operation

Detector		Dose per three years, mGy	Mean dose rate, mGy/day
DB-8 number 1	Unshielded	275,8	0,252
	Shielded	265,0	0,242
DB-8 number 2	Unshielded	214,7	0,196
	Shielded	216,3	0,197
DB-8 number 3	Unshielded	224,5	0,205
	Shielded	234,7	0,214
DB-8 number 4	Unshielded	153,6	0,140
	Shielded	182,5	0,167

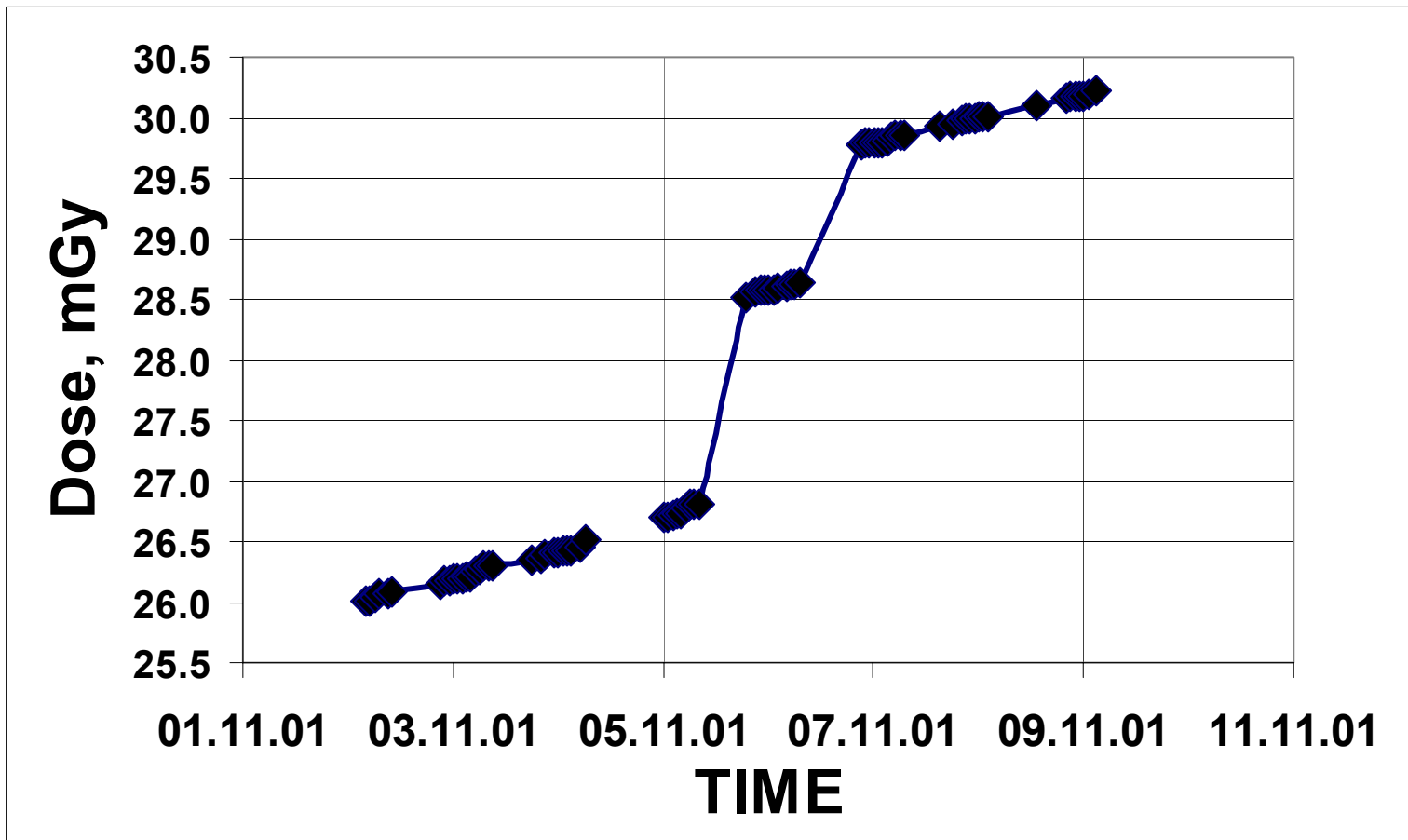


# Dose for SPE 24.09.2001, DB-8 unit number 1, unshielded detector



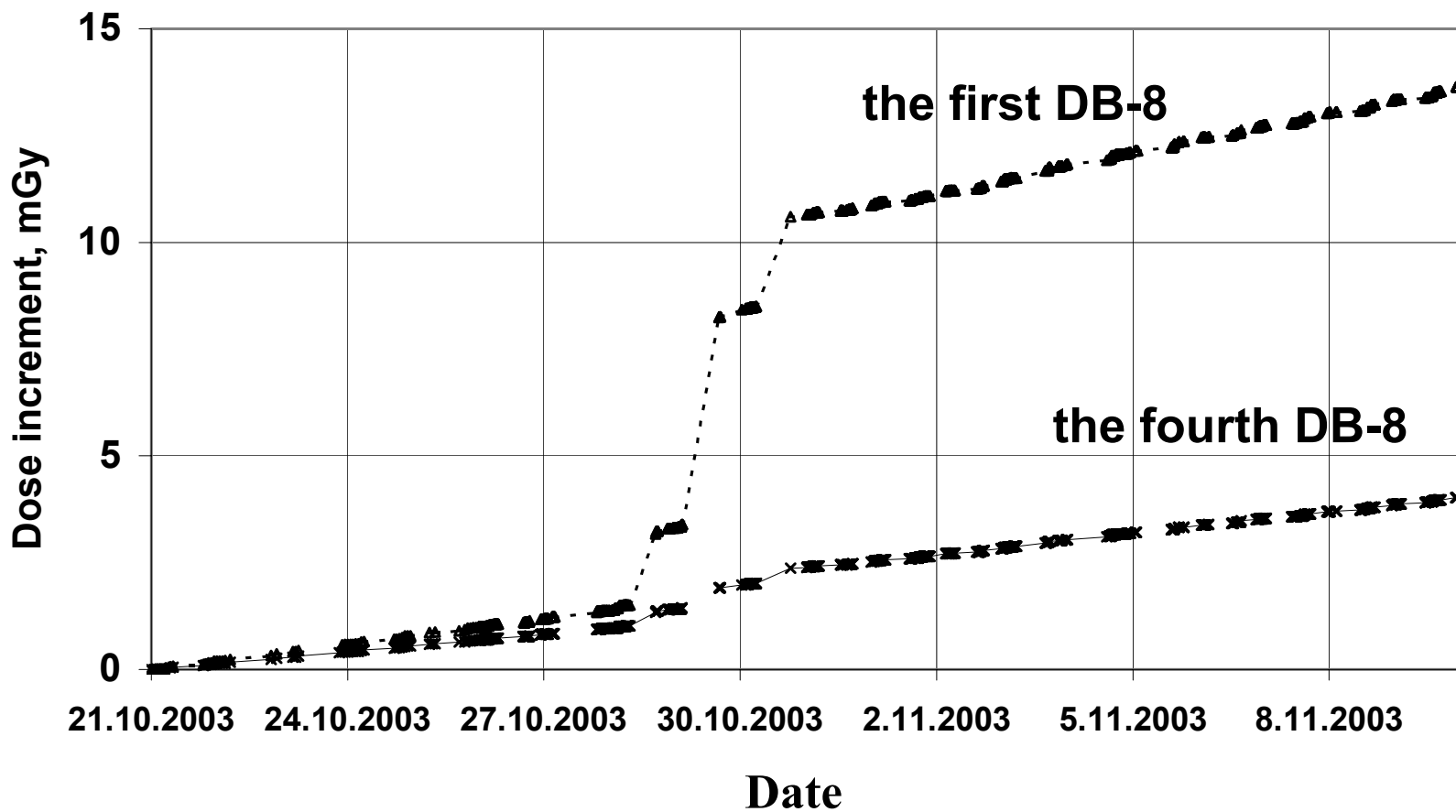


# Dose for SPE 04.11.2001, DB-8 unit number 1, unshielded detector





# Dose for October 28 and 29, 2003 SPE measured with unshielded detectors

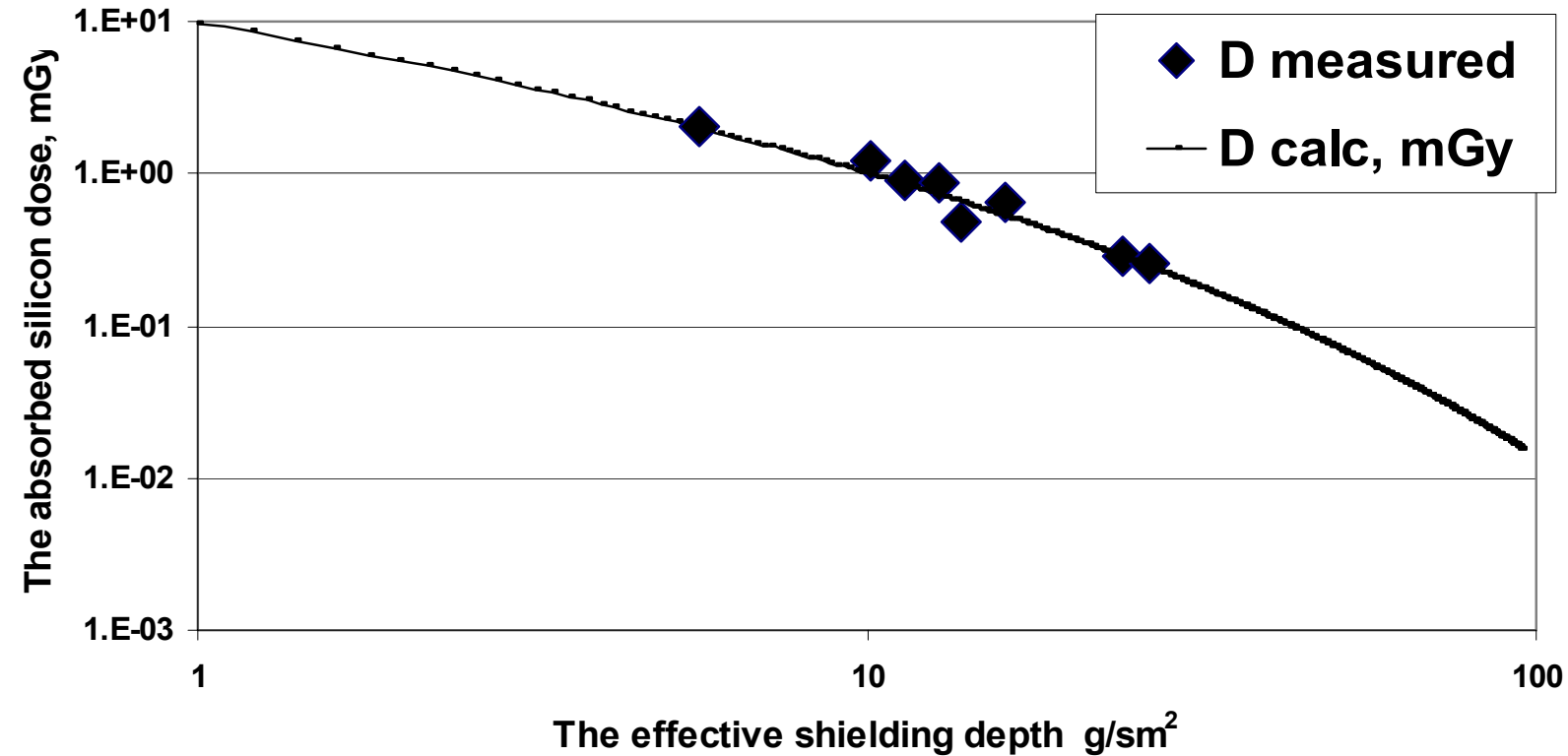




## Doses for SPEs

Detector		Dose per SPE 24.09.2001, mGy	Dose per SPE 04.11.2001, mGy	Dose per SPE 28.10.2003, mGy	Dose per SPE 29.10.2003, mGy
DB-8 number 1	Unshielded	1,65	2,60	6,63	2,02
	Shielded	0,75	1,10	3,19	1,20
DB-8 number 2	Unshielded	1,26	1,14	2,88	0,906
	Shielded	0,80	0,40	1,16	0,49
DB-8 number 3	Unshielded	0,59	0,75	2,20	0,86
	Shielded	0,41	0,39	1,45	0,64
DB-8 number 4	Unshielded	0,19	0,09	0,73	0,28
	Shielded	0,14	< 0,04	0,60	0,246
R-16	Unshielded	1,25	0,60	> 0,60	0,40
	Shielded	0,20	0,10-0,15	0,25-0,30	0,05 – 0,1

# Depth-dose curve estimated on the data obtained with the DB-8 units during Oct. 29, 2003 SPE





# RMS malfunctioning

- 27 events totally for the whole period of operation

That includes:

- Spontaneous rebooting of the onboard software = 14
- Power supply switching off = 5
- Dose measurement cancellation = 3
- Measured value alteration caused by the signal jam = 5

# Conclusion

- During past 3 years RMS performance provided the Russian Radiation Safety Service with the information for the cosmonauts radiation levels estimations, both in the quiet conditions, and during the Solar proton events. This information was transferred also to the NASA Space Radiation Analysis Group that is responsible for the ISS radiation safety now. The RMS structure has ensured reliability of the absorbed dose measurements onboard the ISS Service module.

# Conclusion

- RMS performance has allowed confidently to supervise radiation conditions onboard the ISS during large solar proton events of autumn, 2001 and October, 2003.
- For 2 day flight from 3 p.m. on October 28 to 3 p.m. on October 30, 2003 the absorbed dose values were
  - **0.85 mGy near working table in the Service module**
  - **8.65 mGy near Central control desk.**

**The above are the greatest dose values onboard the ISS for the period of dose registration.**

# Conclusion

The RMS data permits

- Estimating the depth-dose curves for calculation of the organ doses in various radiation conditions.
- Expanding and improvement of the radiation monitoring onboard the ISS,
- Obtaining of an additional information for verification of the radiation environment models and techniques of dose calculation for solar proton events.