



**The 19th Annual WRMISS
Workshop on Radiation Monitoring for the International Space Station
September 9-11, 2014, Kraków, Poland**

Study Of Dose Distribution In ISS Compartments With Passive Detectors

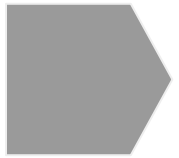
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Dose characteristics depend on:

- phase of solar cycle;
- orbit parameters;
- shielding of spacecraft.



It's necessary to study dose distribution at various compartments of ISS



SPD : Set of Passive Detectors (6 boxes)

dimensions: 118 x 63 x 43 mm
no electricity supply

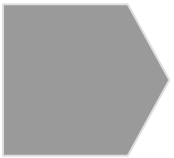


List of participants

- IBMP, Russia
- NPI, Czech republic
- NIRS, Japan
- CER MTA, Hungary
- DLR, Germany
- TU Wien , Austria

Instruments

- TLD (LiF:Mg,Ti ; $\text{CaSO}_4\text{:Dy}$; $\text{Al}_2\text{O}_3\text{:C}$)
- PNTD

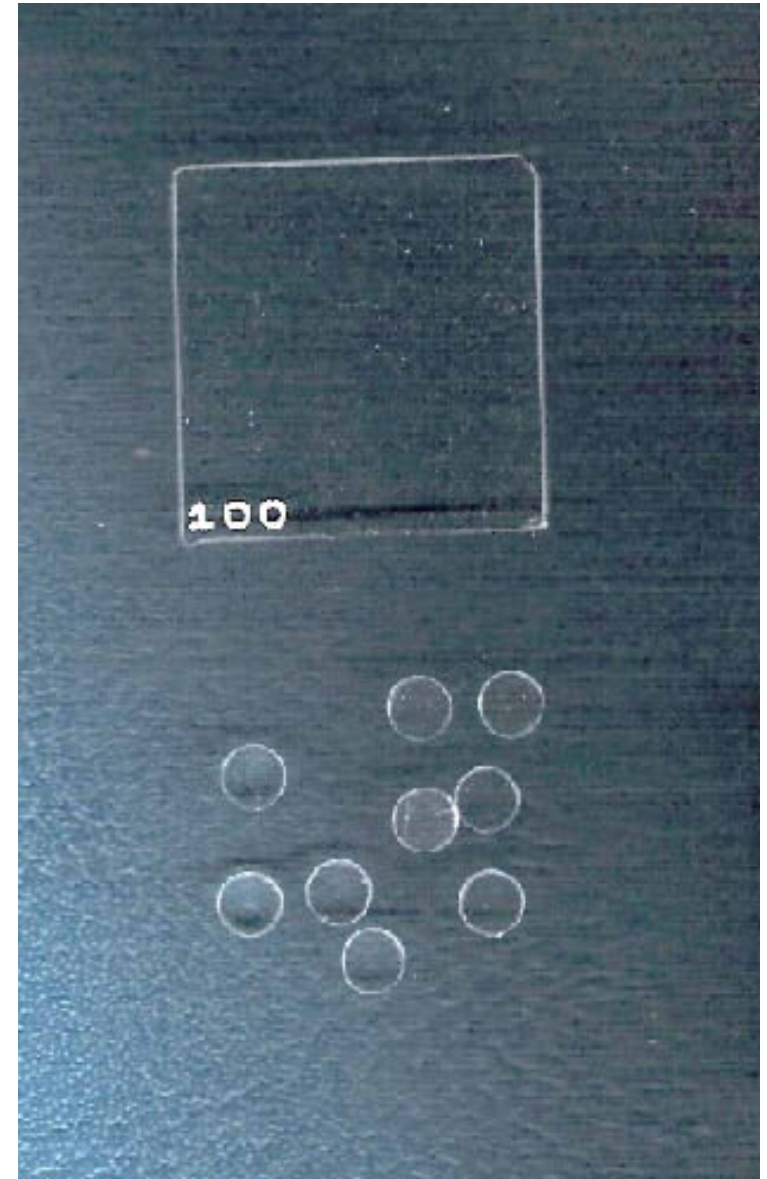


Measured characteristics:

- absorbed dose;
- equivalent dose;
- quality factor

In current presentation only TLD data* by IBMP is presented

*For sessions 1,2,4,5,6 measurements were done by Yu. A. Akatov

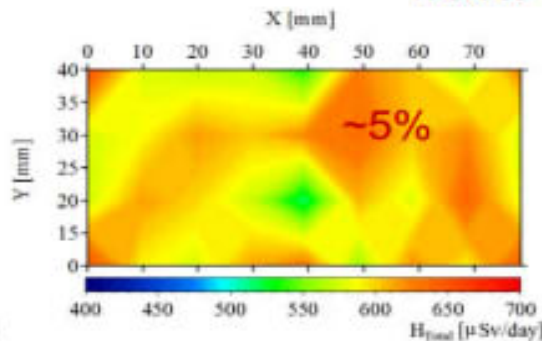
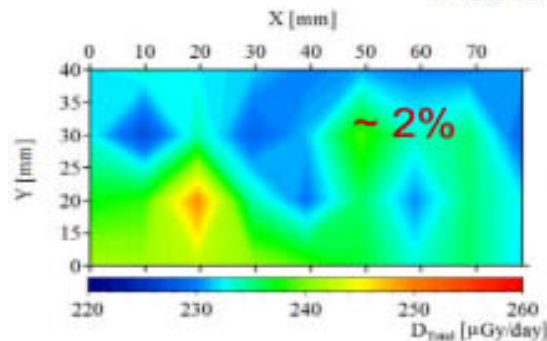
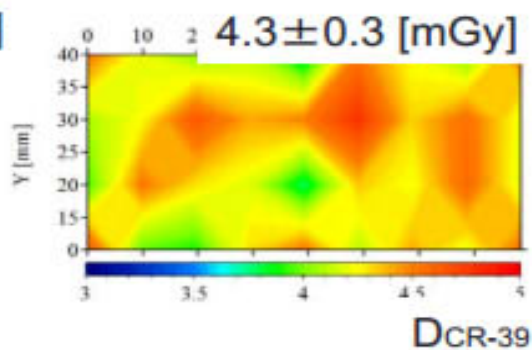
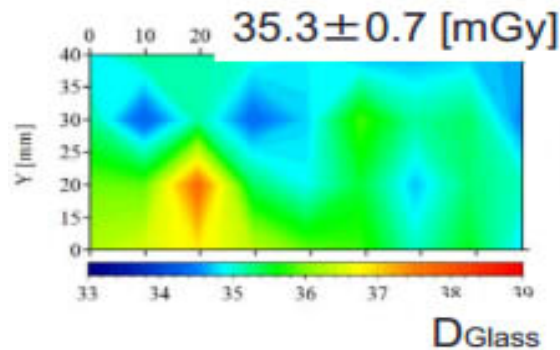
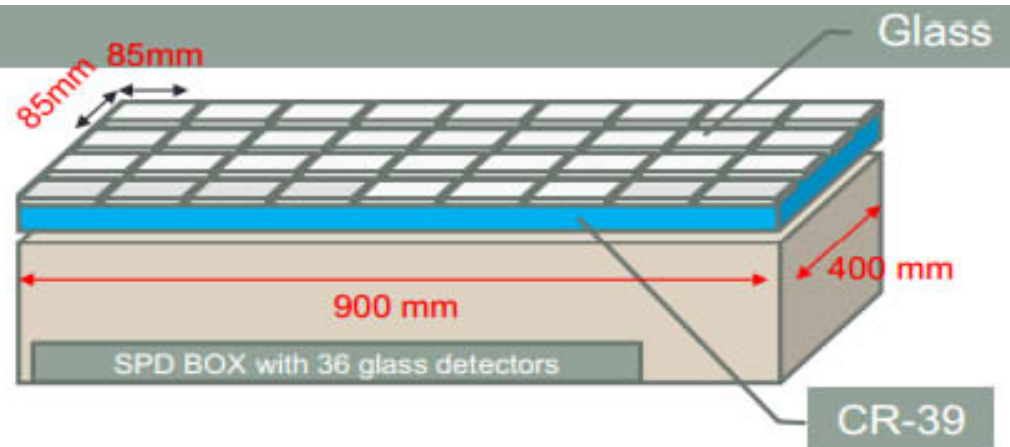


Set of passive detectors...



Homogeneity of dose distribution inside SPD box

Variations of radiation field - SPD BOX -



- We verified variations on dose in SPD box (DOSEMAP-SPD).
- This is an indicator to verify detectors stacking in the SPD box.
- Luminescence detectors were measured by Chiyoda Technol.
- CR-39 detectors were measured by NIRS.

Variations in dose were verified

- Glass $\sim 2\%$
- CR-39 $\sim 6\%$ in dose.

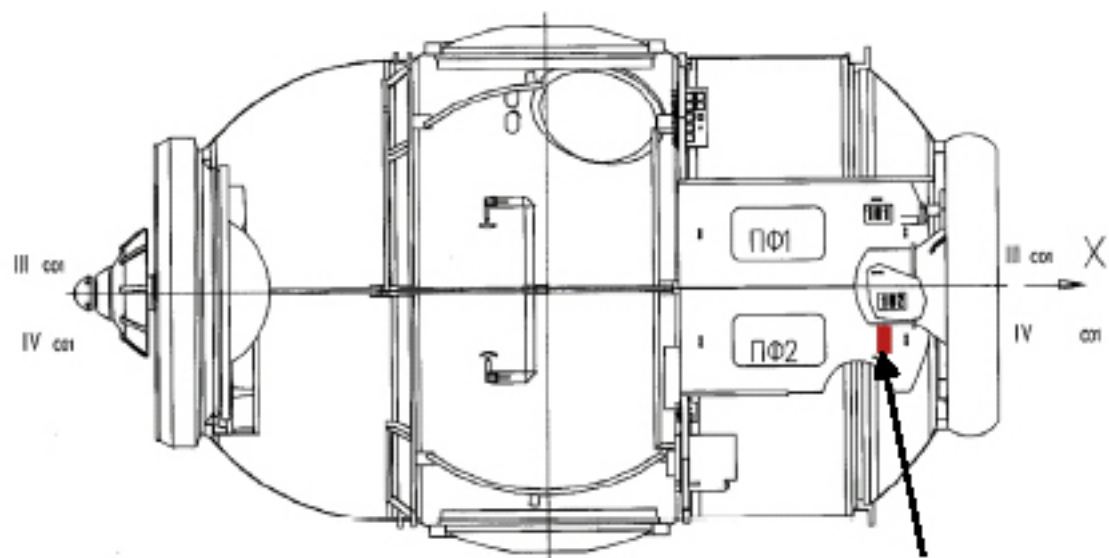
- These will be a kind of variations (errors) that can be targeted.

Flight data

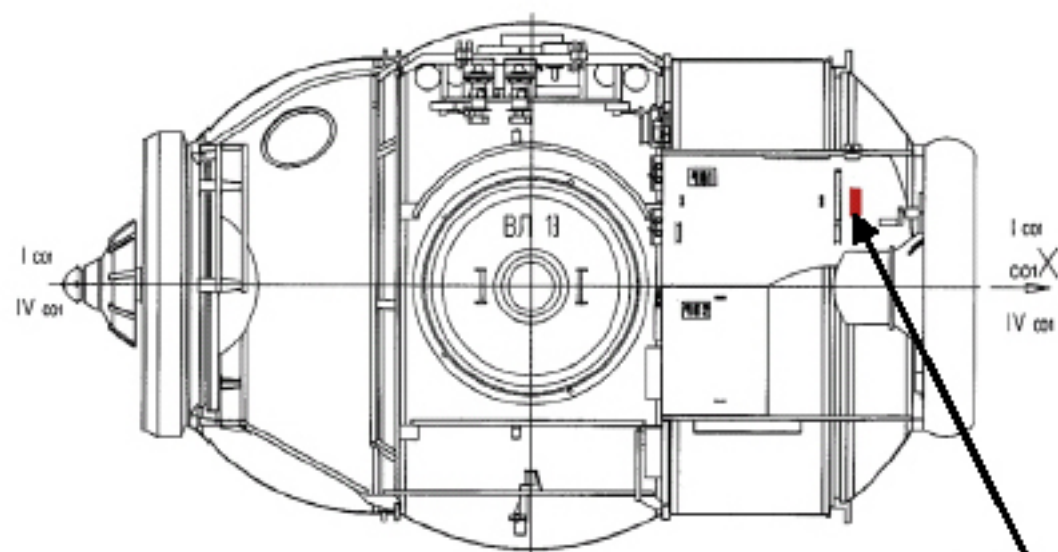
# session	Launching	Landing	Duration, days
1	29.01.2004	30.04.2004	92
2	11.08.2004	09.04.2006	606
4	12.05.2007	22.10.2007	163
5	14.05.2008	24.10.2008	163
6	22.04.2009	11.10.2009	172
7	28.04.2010	26.11.2010	212
8	05.04.2011	22.11.2011	231
9	15.05.2012	14.05.2013	364
10	11.09.2013	30.04.2014	231

Locations (for sessions 1,2,4,5,6)

SPD box #	Coordinates [cm]	Panel, position	Average shielding [g/cm ²]	Standart deviation [g/cm ²]
1	(327,-54.48)	#102, Piers Module 1, floor	35	34
2	(301, 37, -43)	#401, Piers Module 1, the star board	34	32
3	(786, 135, -108)	#325, SM, cone, ceiling, close to R-16	47	42
4	(1216, 22, -81)	#461, SM, the star board	32	42
5	(786, 129, 97)	#323, SM, cone, ceiling, close to R-16	41	37
6	(317, 54, 27)	#305,SM, ceiling, small diameter	33	31



Сборка "СПД" (А01) на пан 102

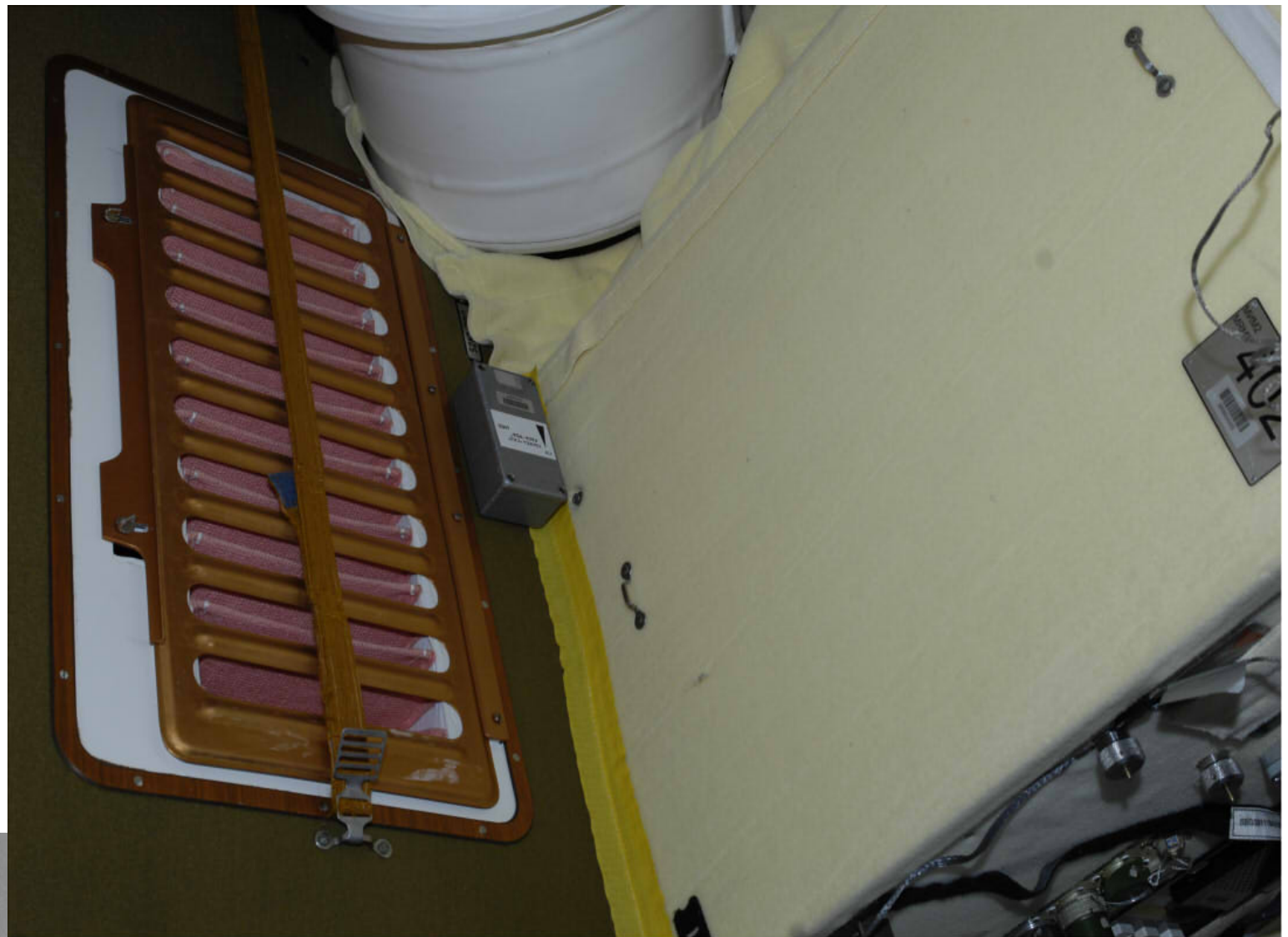


Сборка "СПД" (А02) на пан 401

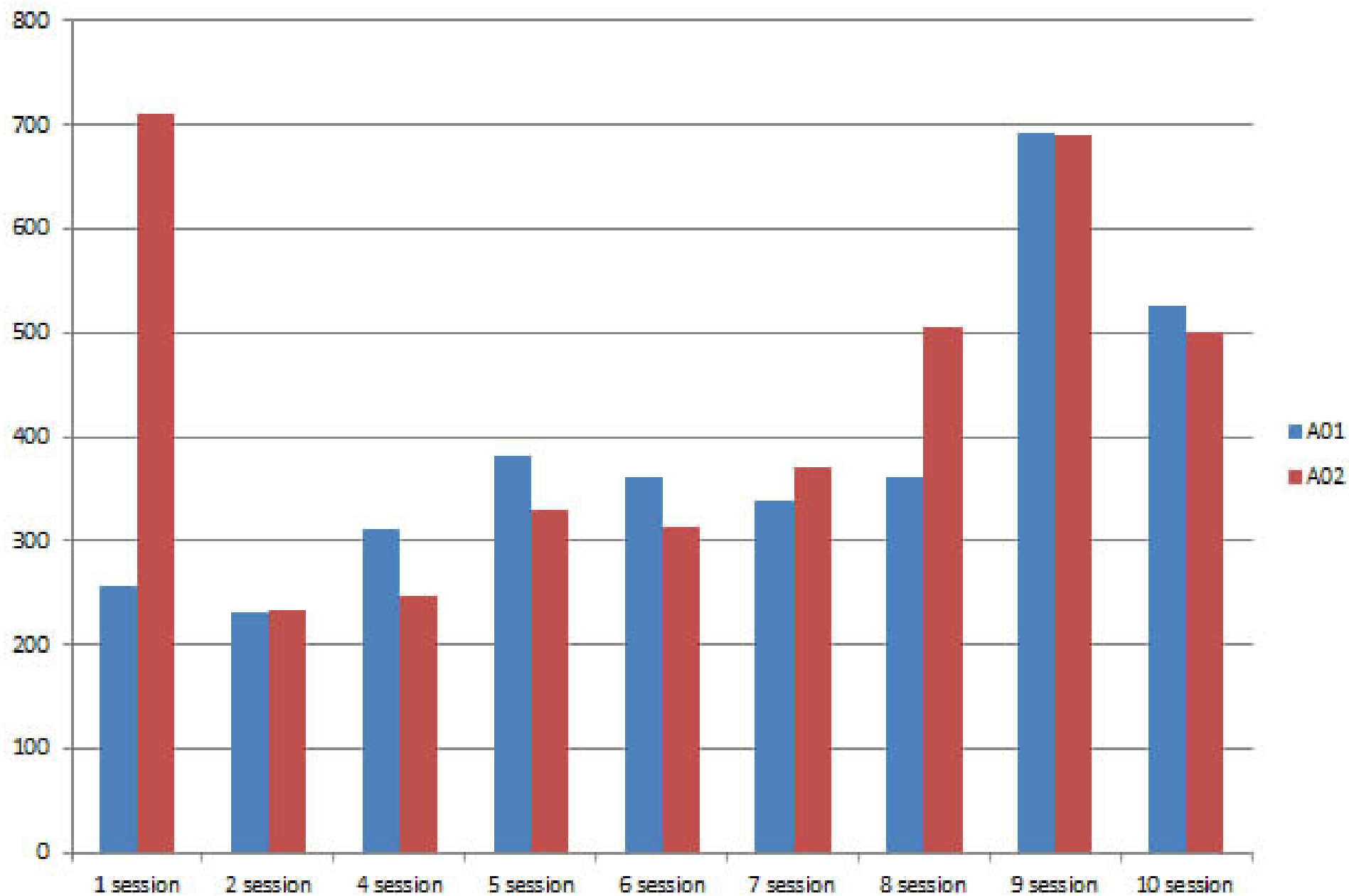
A01 location



A02 location

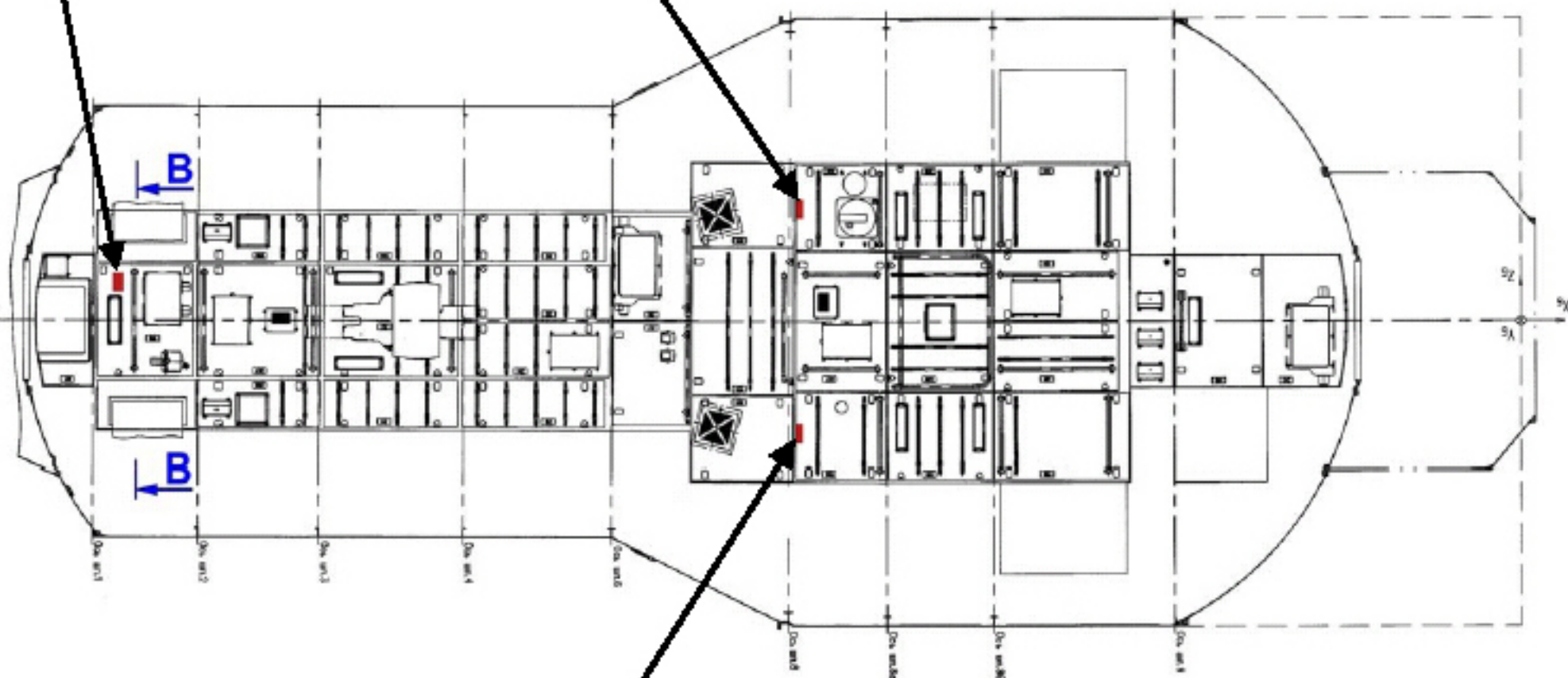


D, $\mu\text{Gy/day}$



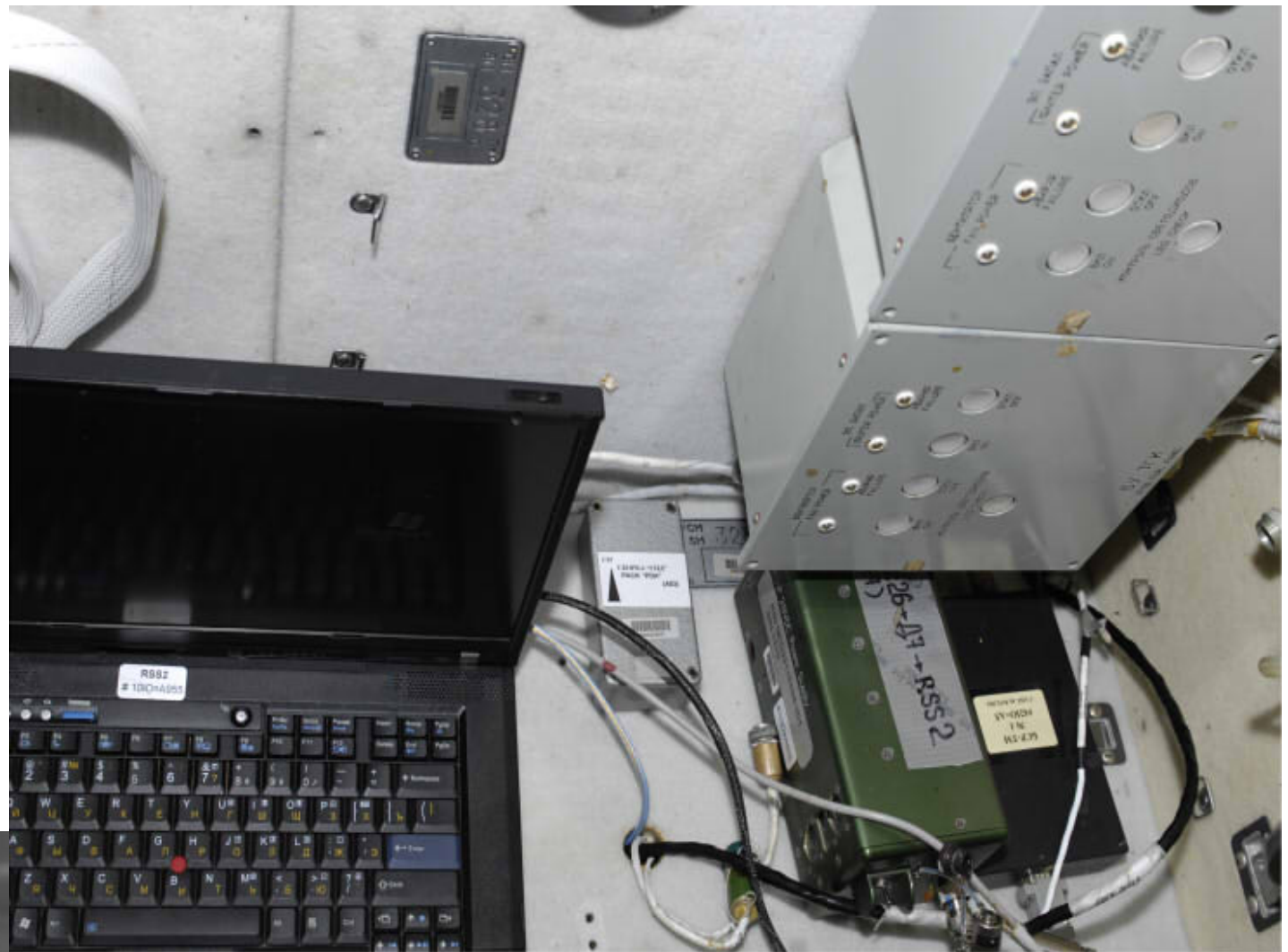
Сборка "СПД" (A06) на пан 305

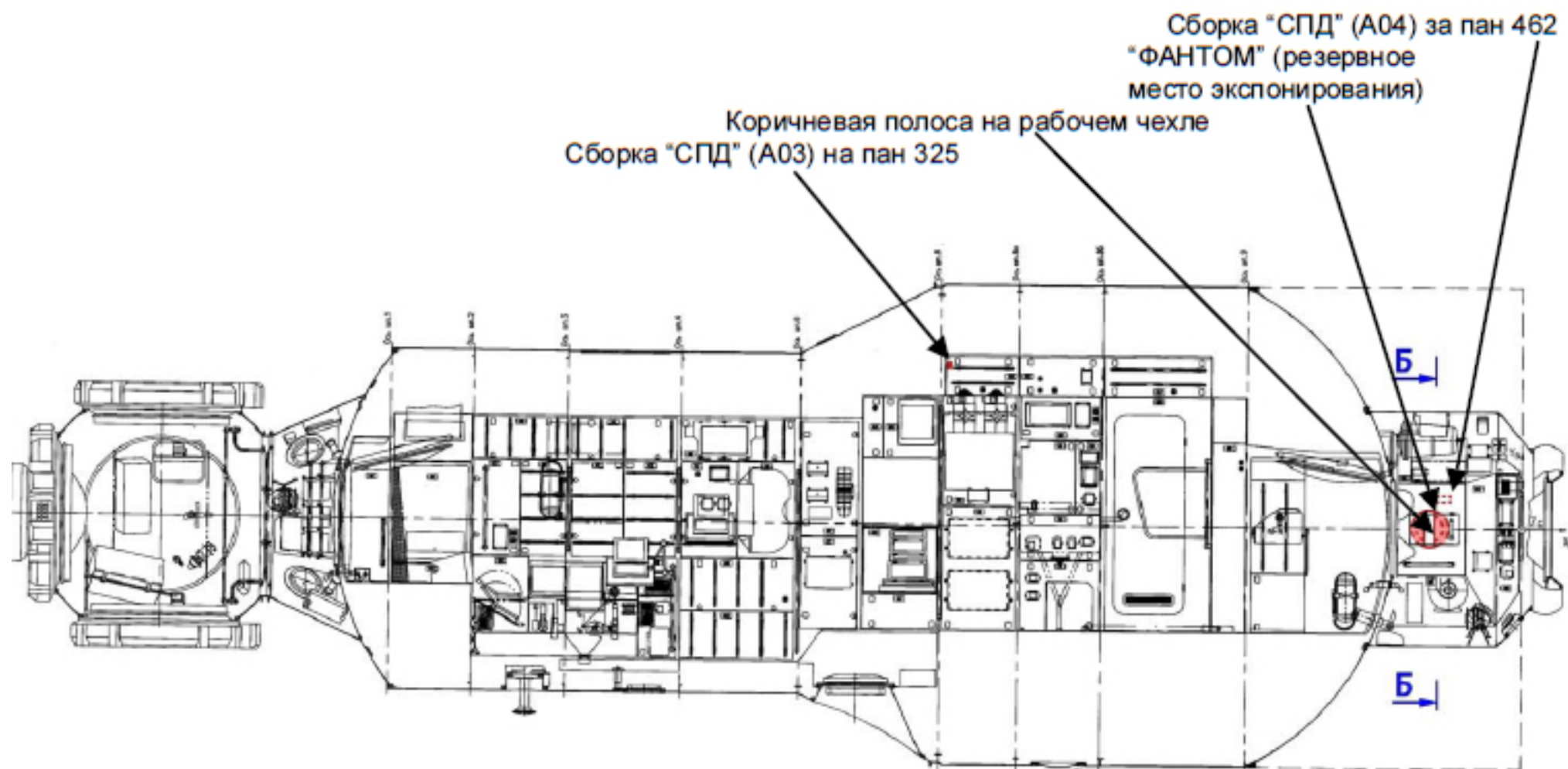
Сборка "СПД" (A05) на пан 323



Сборка "СПД" (A03) на пан 325

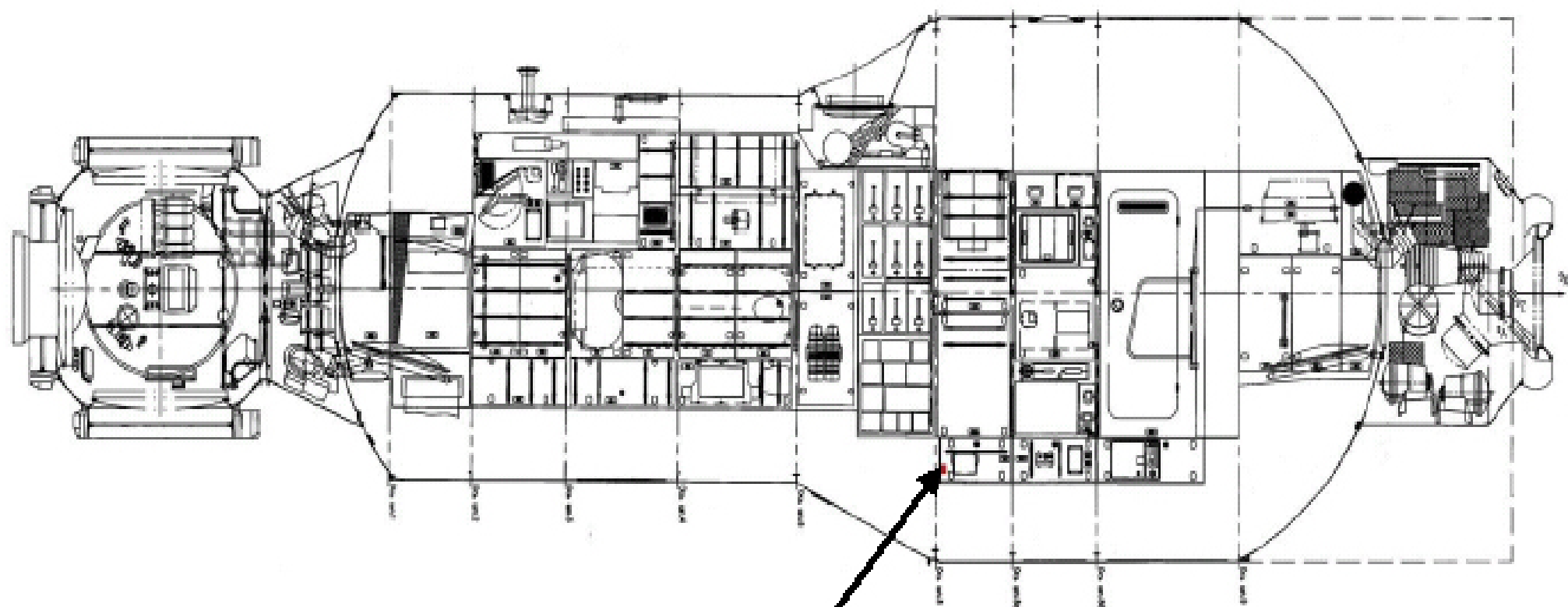
A03 location





A04 location





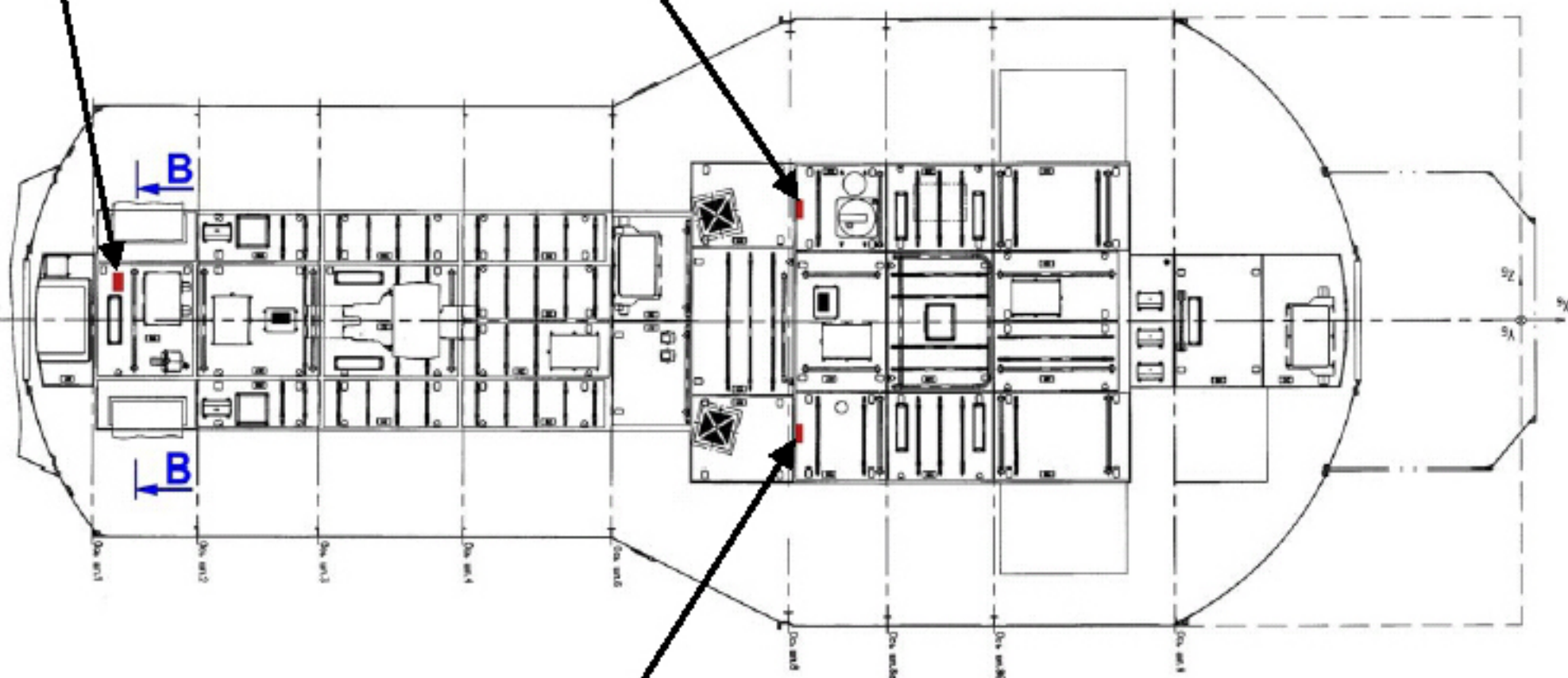
Сборка "СПД" (А05) на пан 323

A05 location



Сборка "СПД" (A06) на пан 305

Сборка "СПД" (A05) на пан 323

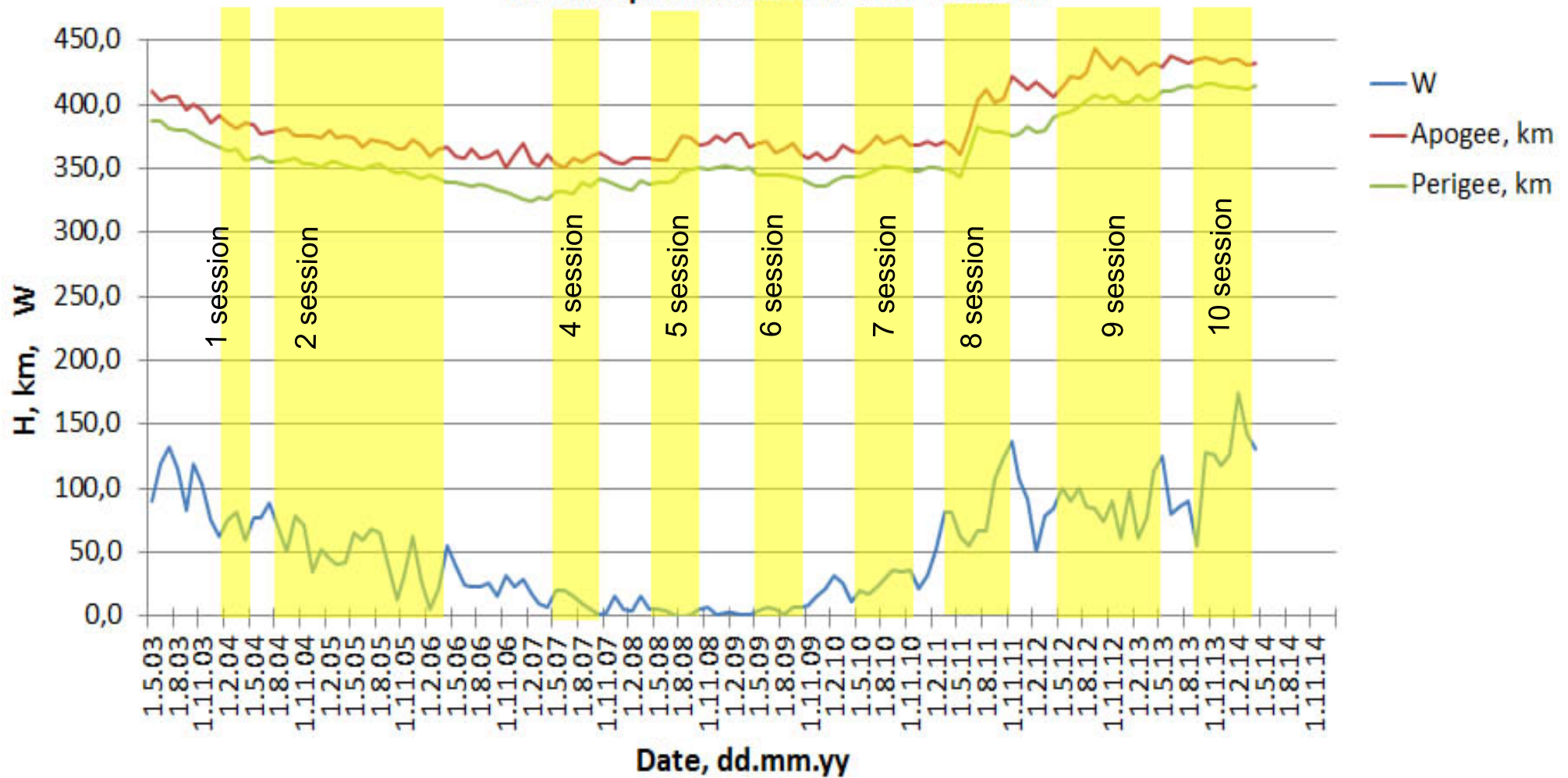


Сборка "СПД" (A03) на пан 325

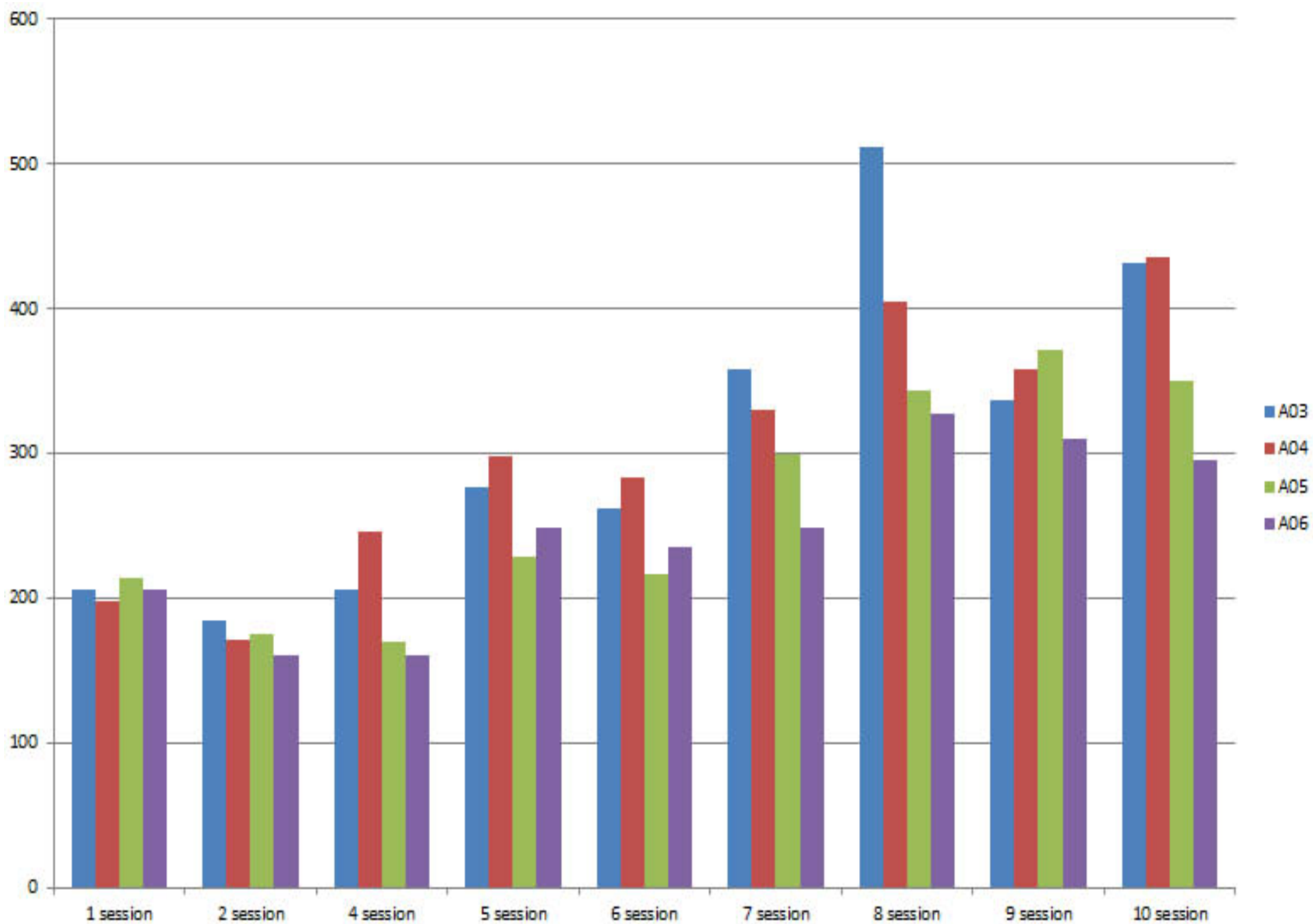
A06 location

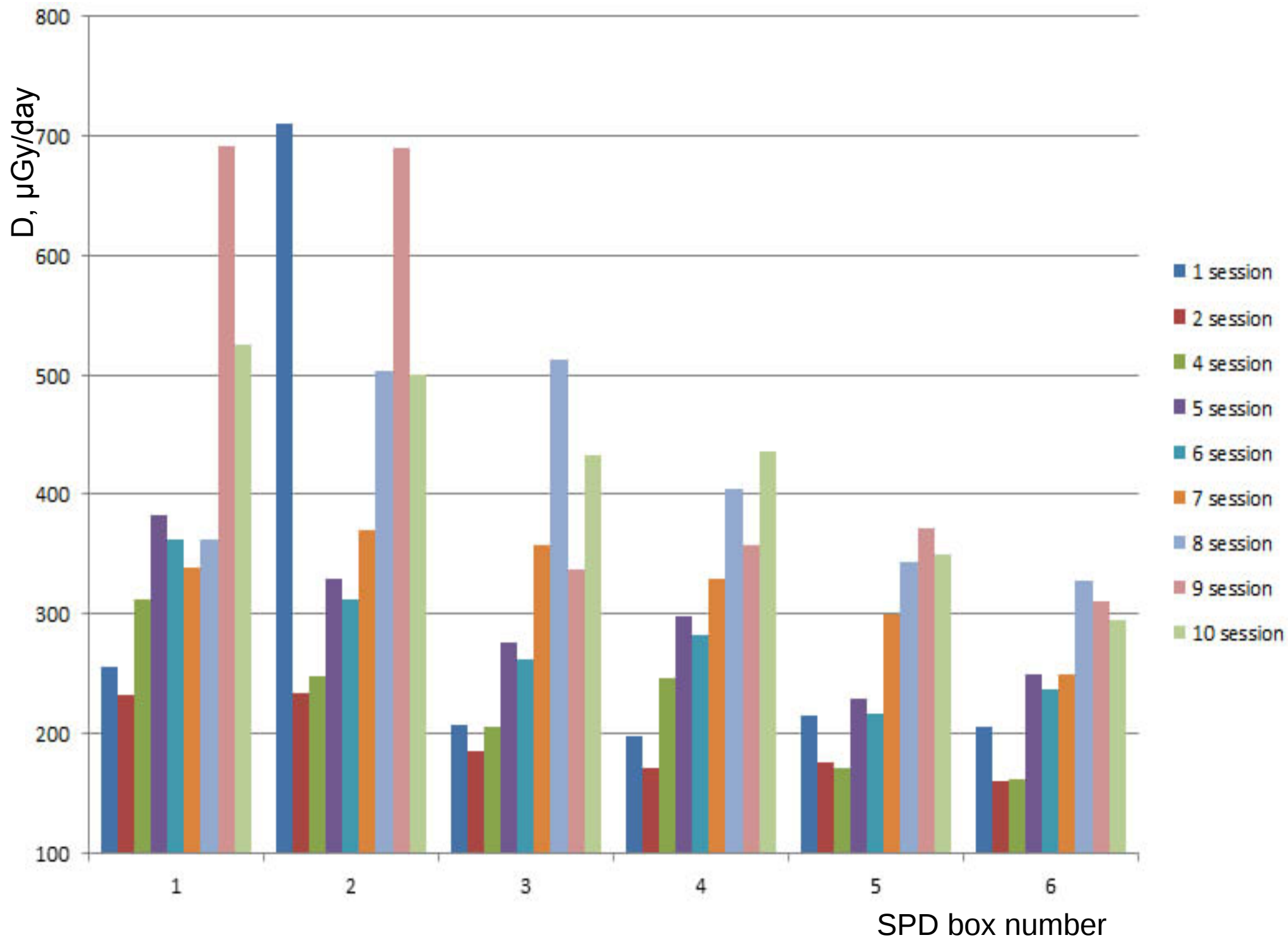


ISS orbit parameters and Wolf numbers

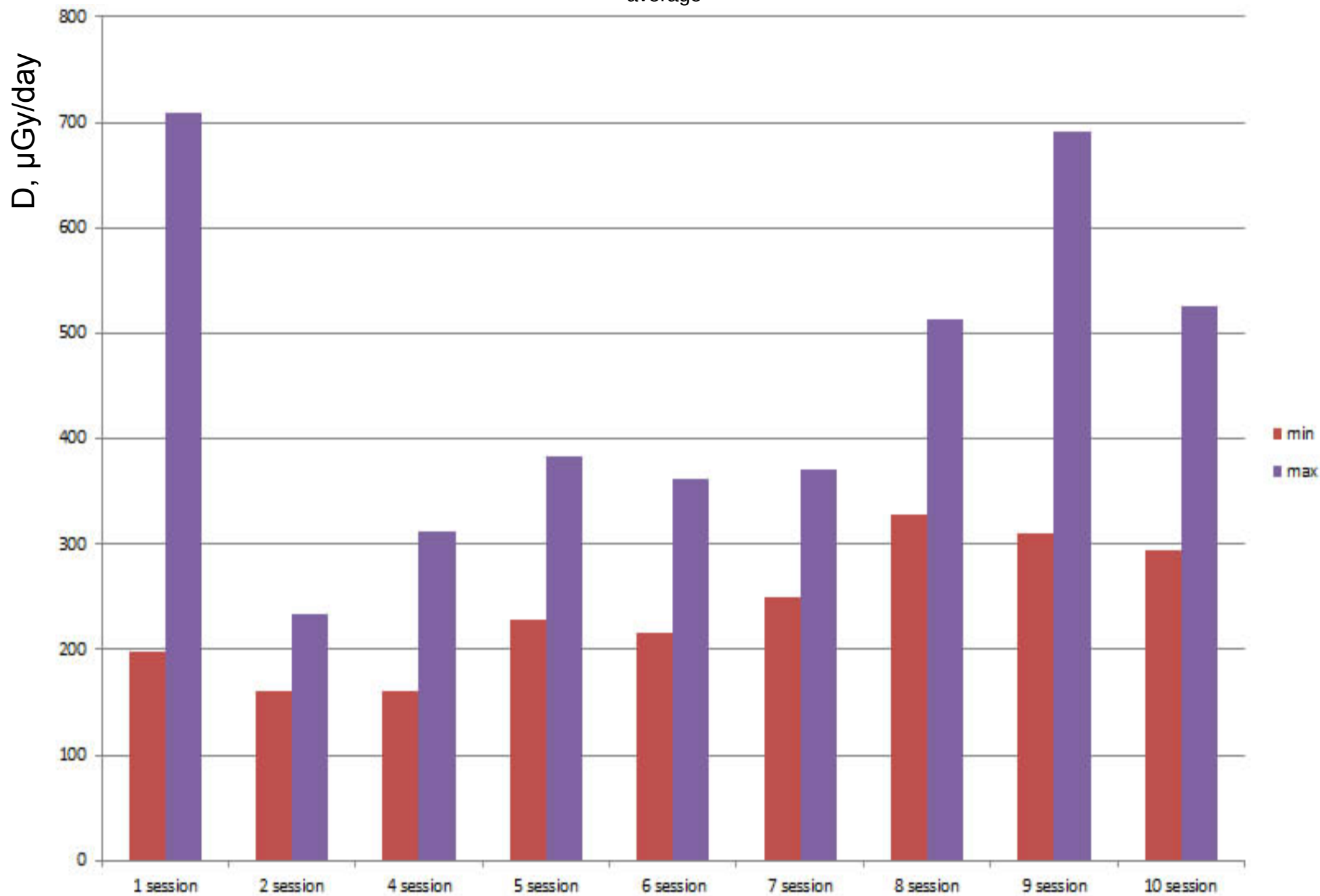


D, $\mu\text{Gy/day}$





Max/Min_{average} = 1,9 ± 0,6



Conclusions

- The duration of experiment cover almost 10 years of exposure. Total duration of detector exposure onboard ISS is 2234 days
- The ratio of maximum dose observed to minimum is
- $\text{Max/Min}_{\text{average}} = 1,9 \pm 0,6$
- Biological objects that do not require special care and nutrition can be used more intensively in future (seeds, insect larvae)
- Intercomparison in real space conditions
- In this report IBMP TLD data was presented. Though, the presented above data is not complete yet and can be corrected when the detector processing and analysis by all space intercomparison participants is completed. Track detector processing that requires more time and efforts can give us additional important information on the LET spectra and thus on radiation quality factors and dose equivalents

THANK YOU.

Protective curtain do protect!

