

# DOSE MEASUREMENTS ON BOARD THE ISS WITH THE PILLE TLD SYSTEM

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# Outline

The Pille TLD System

Pille on ISS

Position of the dosimeters

Results of Exp. 23-26

# The Pille thermoluminescent dosimeter system

Space qualified, on-board TLD system

Dosimeters and the reader device

Dosimeters	
Type:	bulb
Material:	CaSO <sub>4</sub> :Dy
Dimensions:	φ 20 mm * 60 mm
Mass:	70 g (with carrying case)

Reader	
Measuring range ( $\delta < 10\%$ ):	3 $\mu\text{Gy}$ $\div$ 10 Gy (CaSO <sub>4</sub> :Dy)
TLD Efficiency ( $\epsilon = 1 \pm 10\%$ ):	LET <sub><math>\infty</math></sub> (H <sub>2</sub> O) < 10 keV/ $\mu\text{m}$
Accuracy (above 10 $\mu\text{Gy}$ ):	$\delta < 5\%$



High sensitivity

Even hourly read-outs are possible

On board every space station since Salyut-6

More than 30 000 comparable read-outs from different space stations

# Pille on ISS

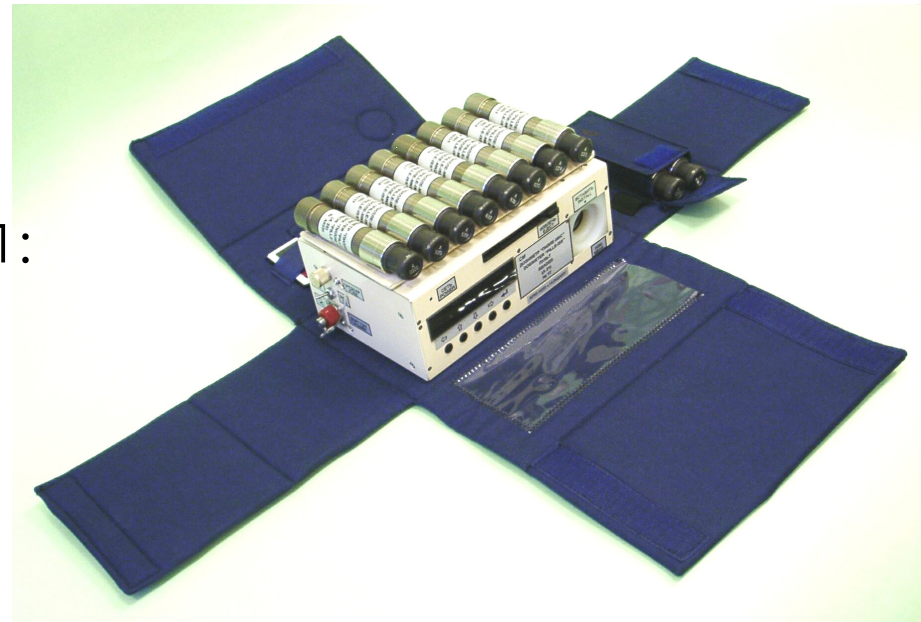
DOSMAP project

Service dosimetry system on Zvezda since 2003. (Exp. 8)

- Dose mapping
- Personal dosimetry during CME-s
- Personal dosimetry during EVA-s
- Automatic read-out in every orbit

New dosimeters carried to ISS

Results presented on WRMISS 2011:  
Exp. 23-26



# Allocation of the dosimeters

A0301: At detector DB-8 No. 1, behind panel No. 410

A0302: Starboard crew quarters, left side of window

A0304: Port crew quarters, left side of window

A0305: Next to radiometer R-16 behind panel No. 327

A0306: Docking module, hemisphere, plane III, at a place free of equipment  
*Dedicated for EVA reference measurement inside ISS*

A0307: In pouch „Simonyi”

2010. 02. 14.: **relocated to docking module Pirs**

A0309, A0310: In the transporting case of the Reader, left to illuminator N° 9  
*Dedicated for EVA personal measurements*

2010. 02. 14.: **relocated to docking module Poisk**

A0311: Inside the reader, *dedicated for automatic measurements*

A0312: In ASU (automatic control system) zone, on panel No. 457

A0313: **In Reentry module of Transport spacecraft Soyuz No. 226**

A0314: At detector DB-8 No.1 behind panel No. 447

# Allocation of the dosimeters (2010.11.16 -)

A0301: At detector DB-8 No. 1 behind panel No. 410

A0302: Starboard (right side) crew quarters, on the left side of Panel 444 (non-protected location) parallel to the sensor located under the valve "K7"

A0304: Port (left side) crew quarters, left side of window

A0305: In the saloon of large diameter on panel No. 327

A0306: "Service" dosimeter, inserted in the Reader (**automatic measurements**)

A0307: Starboard (right side) crew quarters, on the lower storage unit located under the valve "K7"

A0309: Right board, beside of the cabin, on ceiling of the lavatory (ASU on panel 457) – *Dedicated for EVA personal measurements*

A0310: Behind panel No. 447 at detector DB-8 No.3 – *Dedicated for EVA personal measurements*

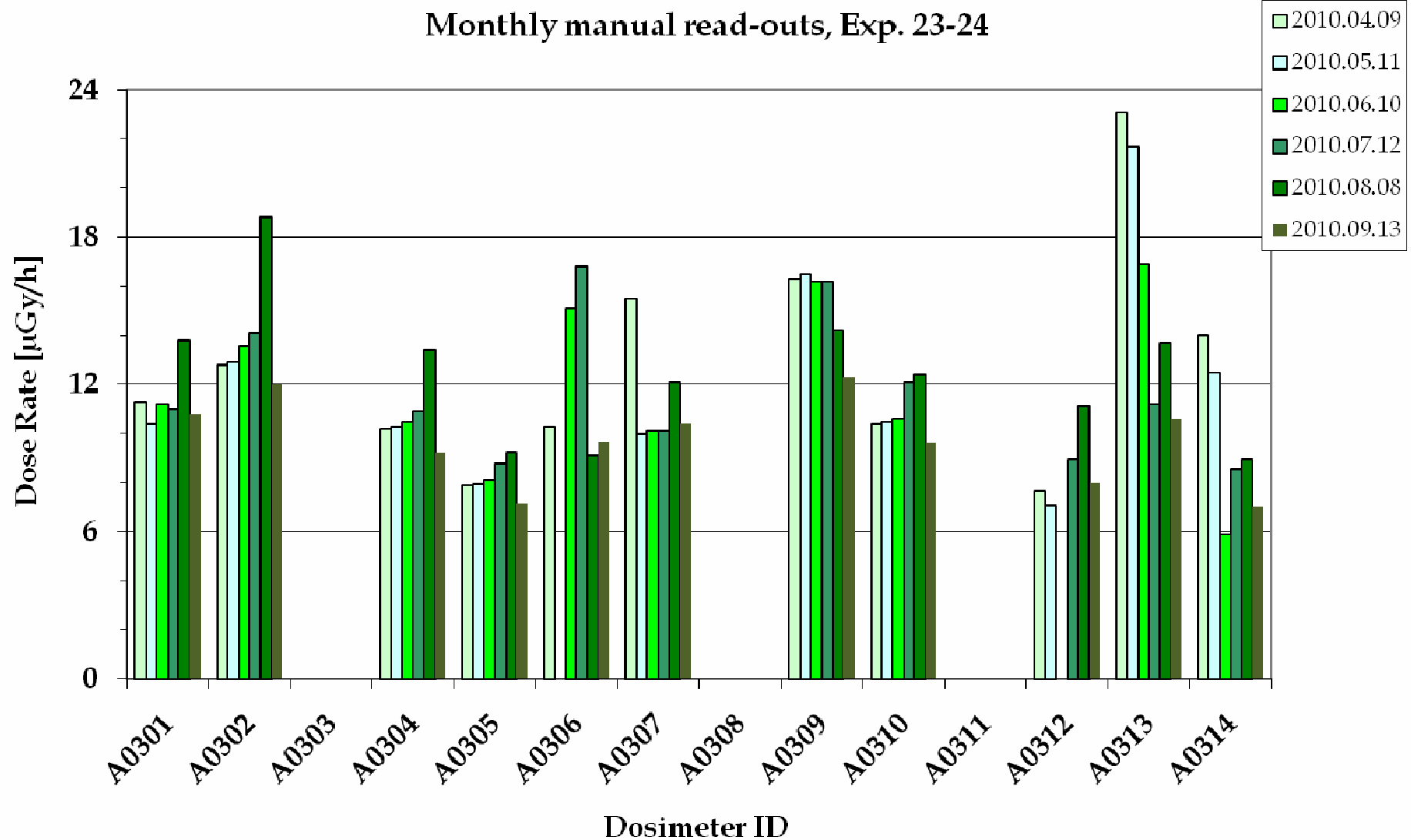
A0311: In the *Pirs* docking compartment, hemisphere, on Plane III

A0312: MIM2 (Small Research Module *Poisk*), cylindrical part on Plane III

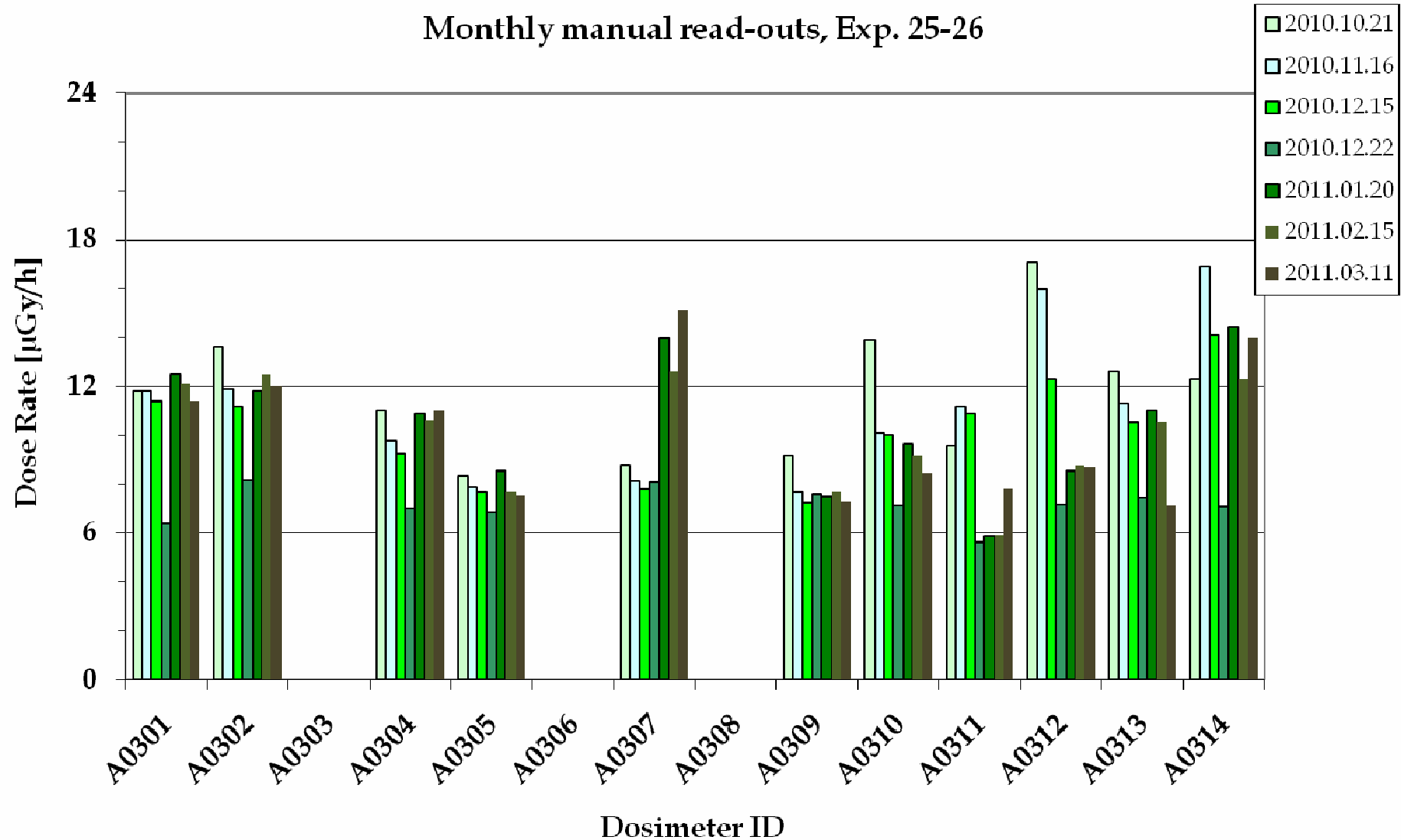
A0313: MIM1 (Small Research Module *Rassvet*) , on Plane III

A0314: MIM2 (Small Research Module *Poisk*), cylindrical part on Plane III

# Monthly manual read-outs, Exp. 23-24



# Monthly manual read-outs, Exp. 25-26

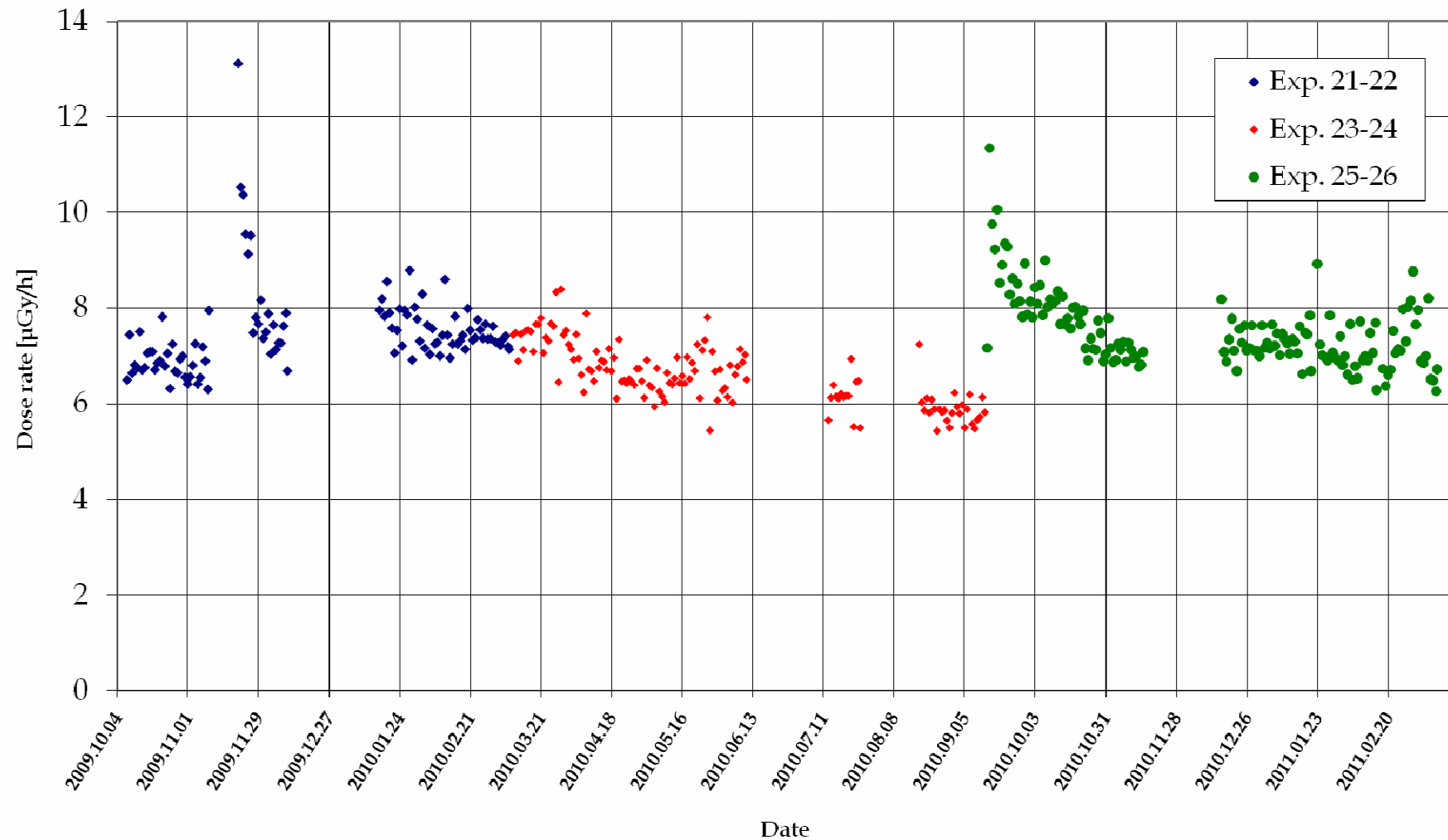




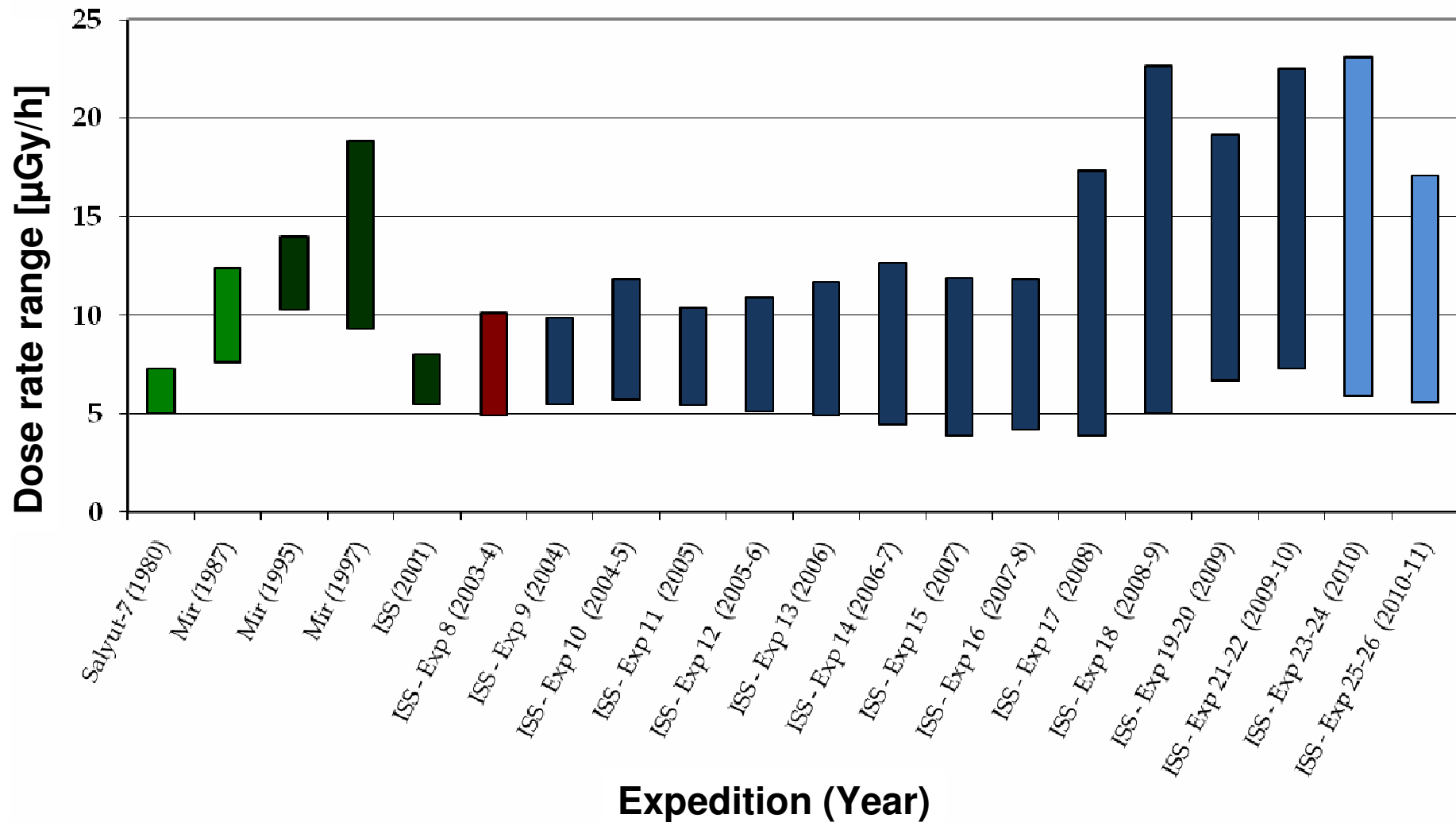
- Until 2010.09.13: № A0311 for automatic measurements
- After that: № A0306 for automatic measurements
- 2010.12.15. Temporary allocation: all dosimeters except № A0306 are located side by side on the upper surface of the Reader for crosscalibration
- 2011.02.17. Big CME reaching the Earth, but missing data in the automatic measurements ☹  
(2010.02.15. 10:29 – 2010.02.17. 15:40)

# Daily average dose rates, Exp. 21-22, 23-24, 25-26

Daily average dose rates, October 2009 – March 2011



# Dose rate ranges measured by Pille



# EVA measurements

## EXP. 23-24

4 EVAs were measured (no post readout for the EVA on 2010.08.11 )

- Dosimeters A0306, A0311 (twice) were used as reference dosimeters

<b>EVA date</b>	<b>Extra dose [μGy ]</b>	<b>Extra dose rate [μGy /h]</b>	<b>Extra dose [μGy ]</b>	<b>Extra dose rate [μGy /h]</b>
2010. 07. 27.	743	111	753	112
2010. 08. 07.	176	21.9	210	26.1
2010. 08. 16.	122	16.6	231	31.1

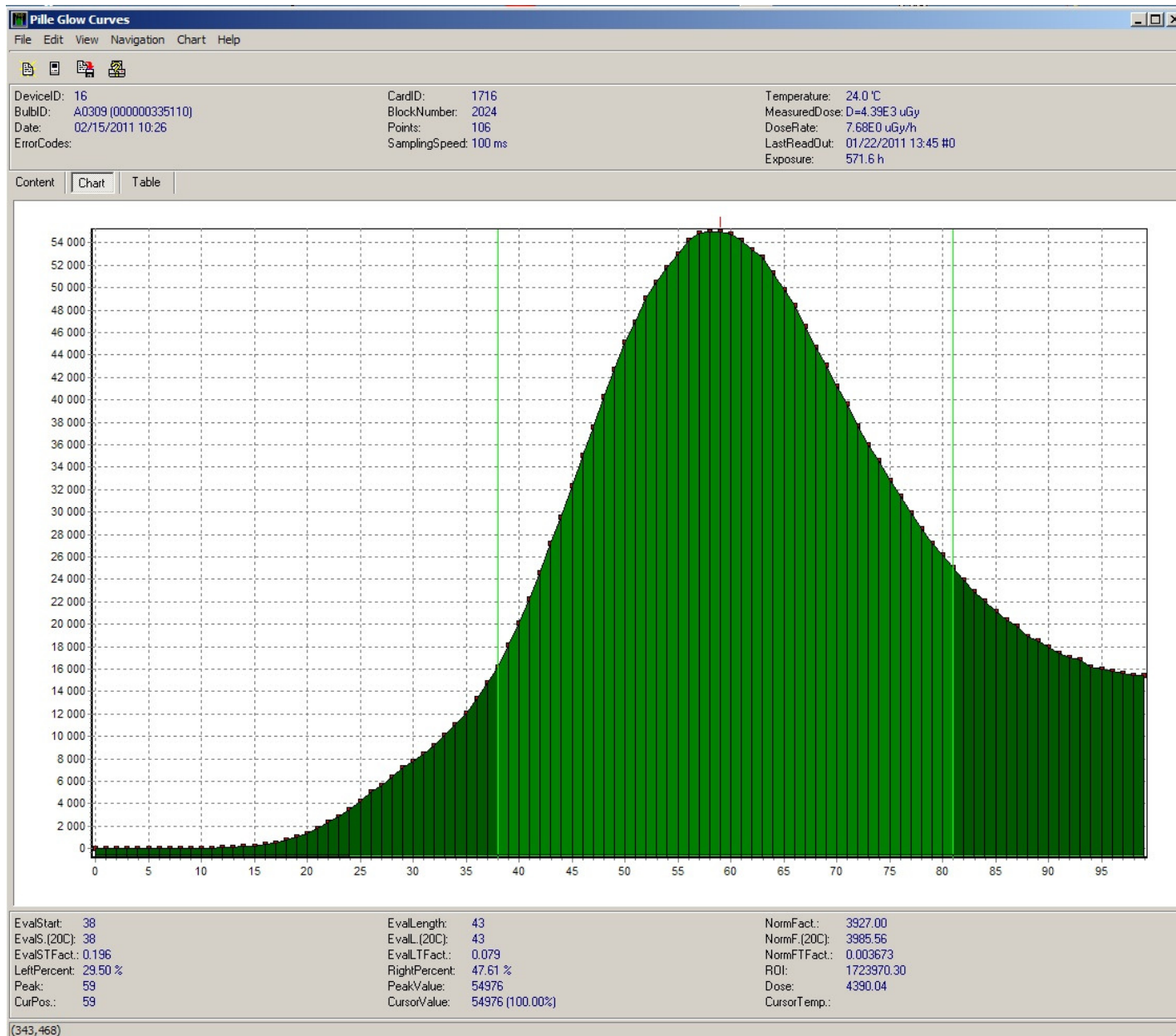
## EXP. 25-26

3 EVAs were measured

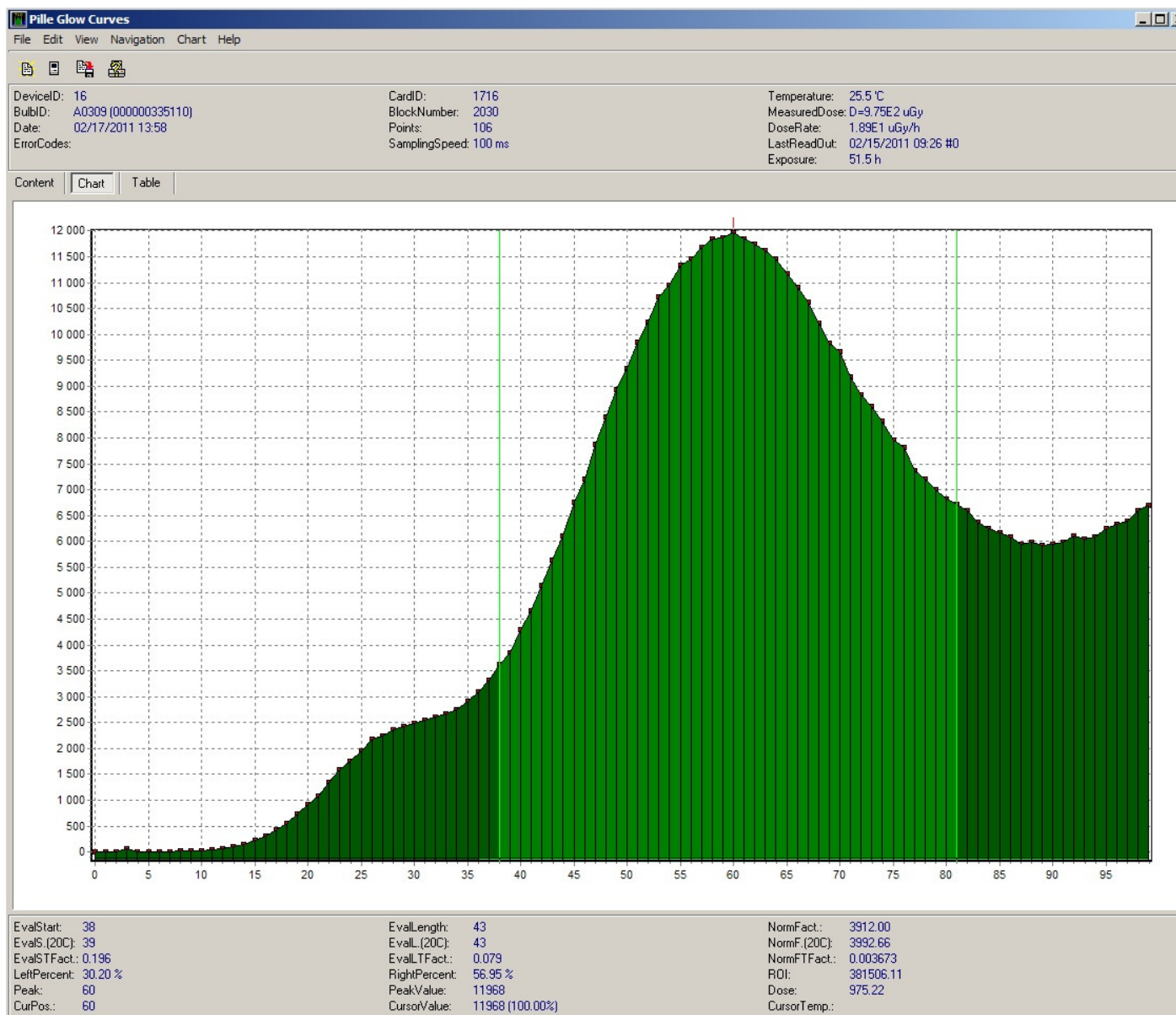
- Dosimeters A0313, A0305 (twice) were used as reference dosimeters

<b>EVA date</b>	<b>Extra dose [μGy ]</b>	<b>Extra dose rate [μGy /h]</b>	<b>Extra dose [μGy ]</b>	<b>Extra dose rate [μGy /h]</b>
2010. 11. 15.	221	34.3	380	58.9
2011. 01. 21.	386	71.7	351	65.2
2011. 02. 16.	235	48.5	492	101

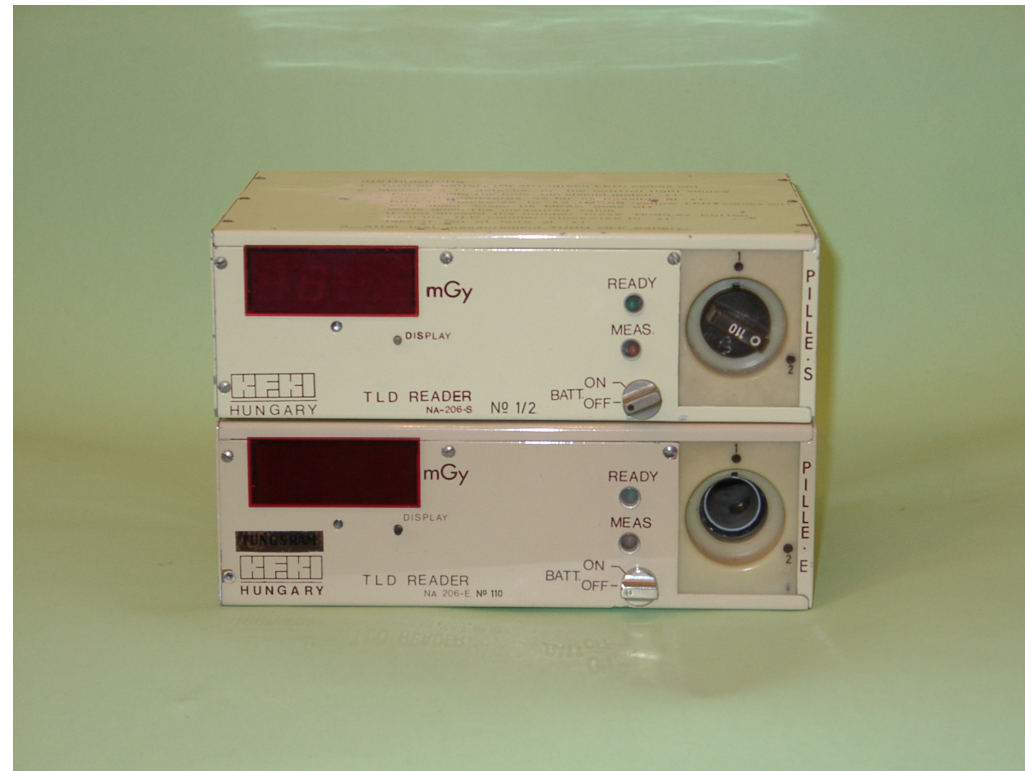
# Glow curve (no pre-peak before EVA)



# Glow curve (pre-peak after EVA)



(2 oldtimers)



**Thank you for your attention**