

Pille Measurements on ISS (May 2013 – May 2014)

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Content

- The Pille TLD system
- Pille on the ISS
- Results of May 2013 – May 2014



The Pille thermoluminescent dosimeter system

Space qualified, on-board TLD system

Dosimeters and a reader device

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



Reader	
Measuring range (s<10%):	3 μGy ÷ 10 Gy (CaSO ₄ :Dy)
TLD Efficiency (ε=1±10%):	LET _∞ (H ₂ O) < 10 keV/μm
Accuracy (above 10 μGy):	δ < 5%



High sensitivity

Even hourly read-outs are possible



Pile on board ISS

On board every space station since Salyut-6

More than 43 000 comparable read-outs from different space stations

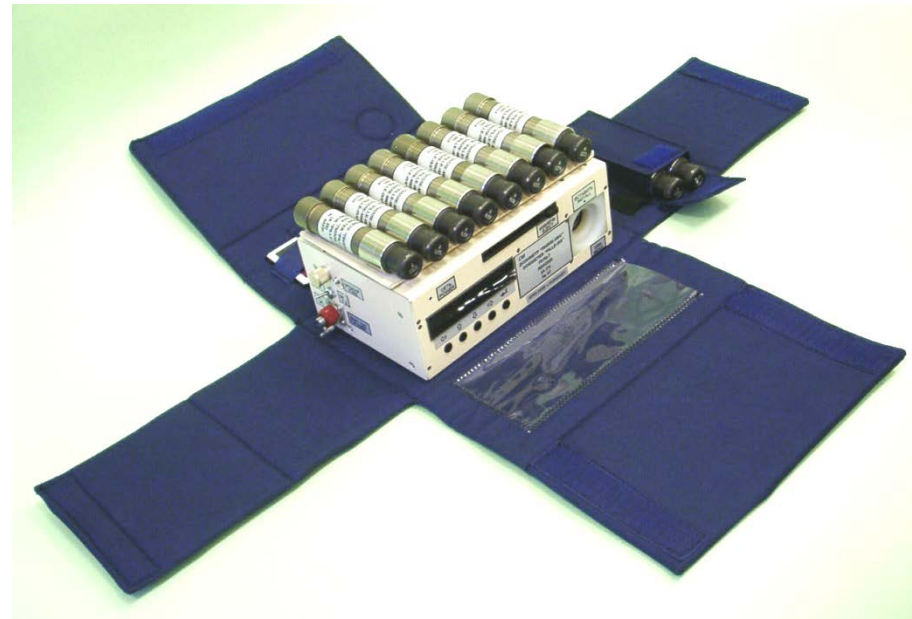
DOSMAP project

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

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

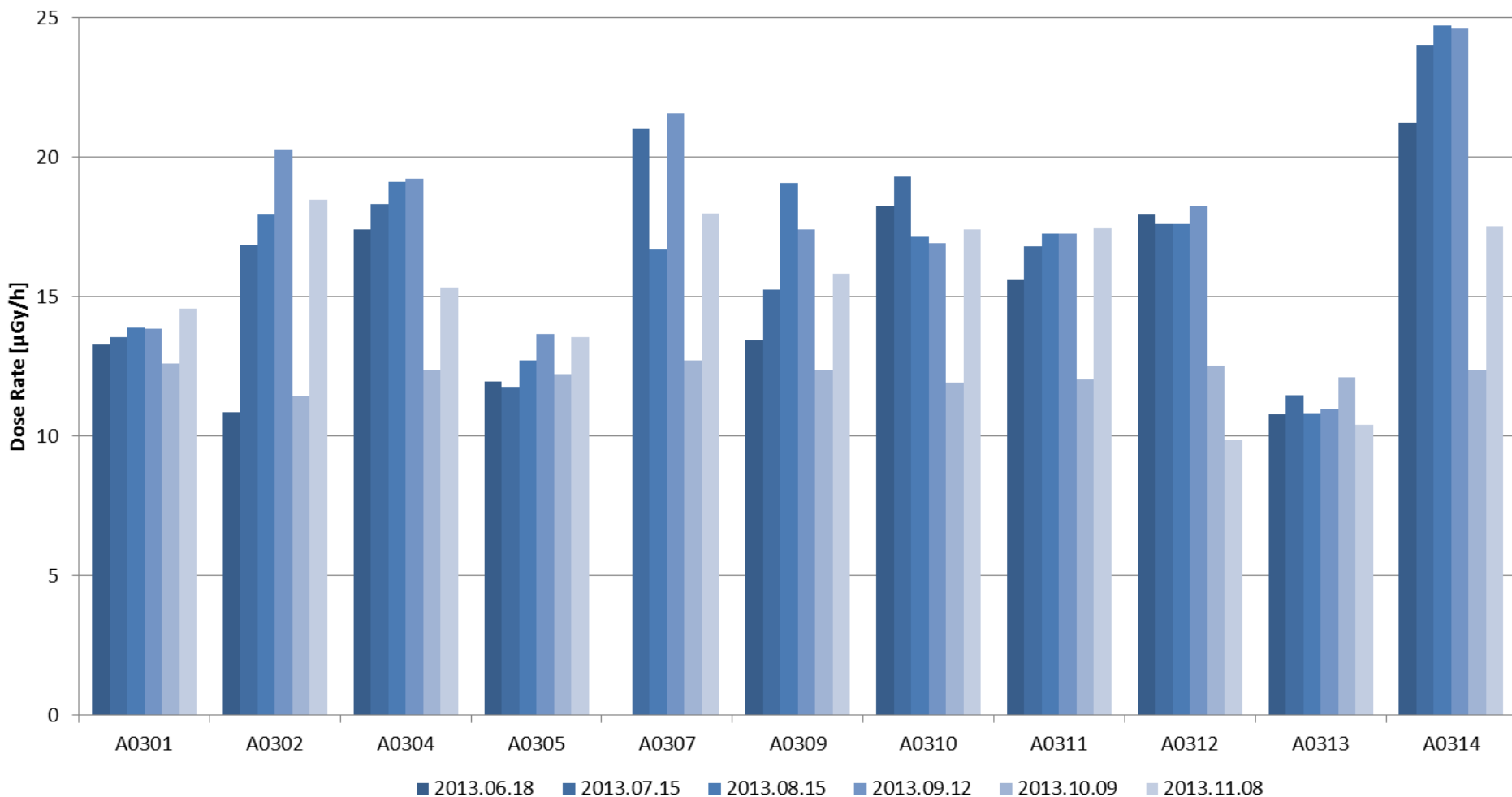
New dosimeters were delivered to ISS in 2009

- Currently 12 dosimeters on board



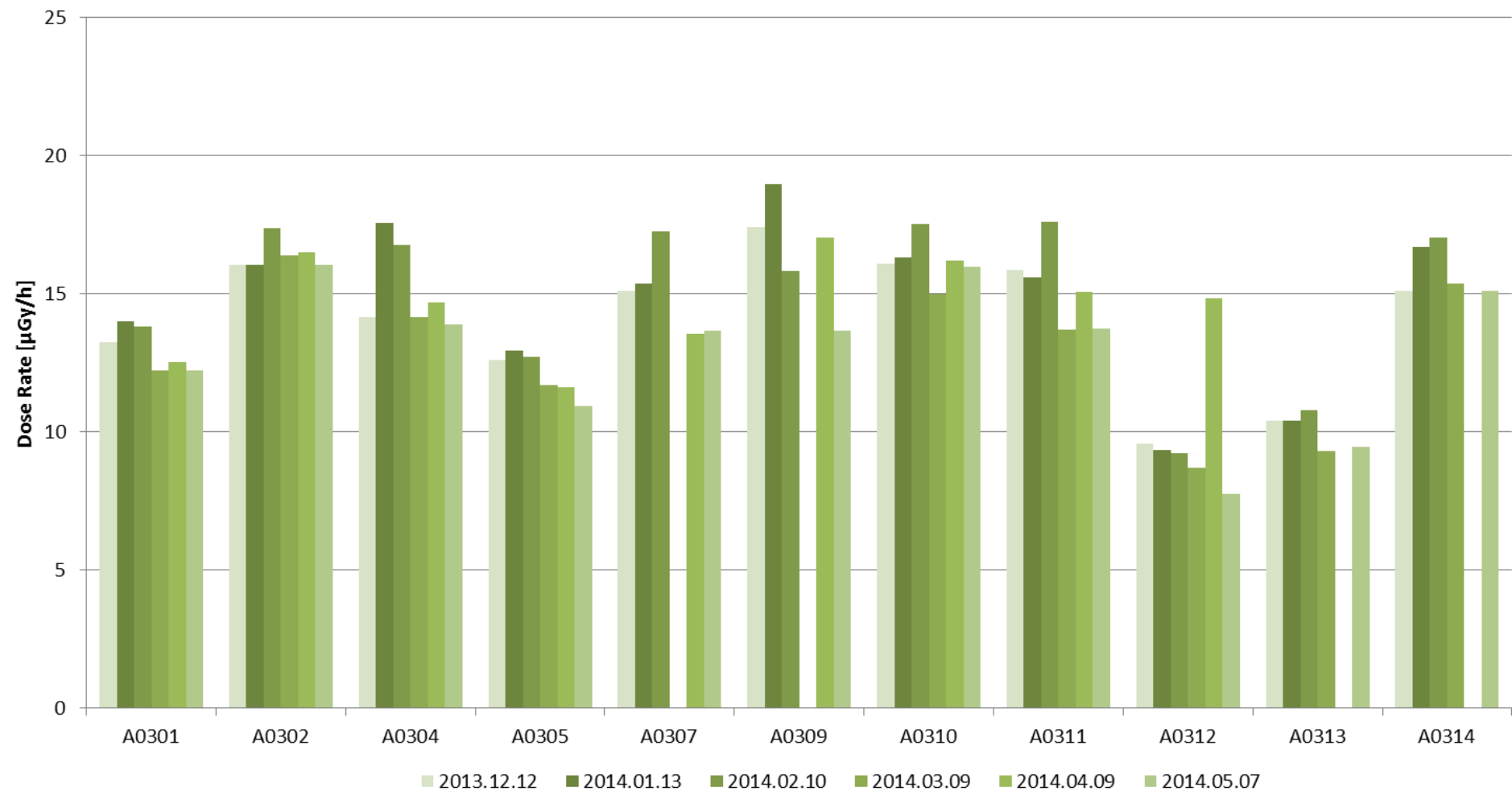
Monthly manual read-outs

Monthly manual read-outs, June 2013 - November 2013

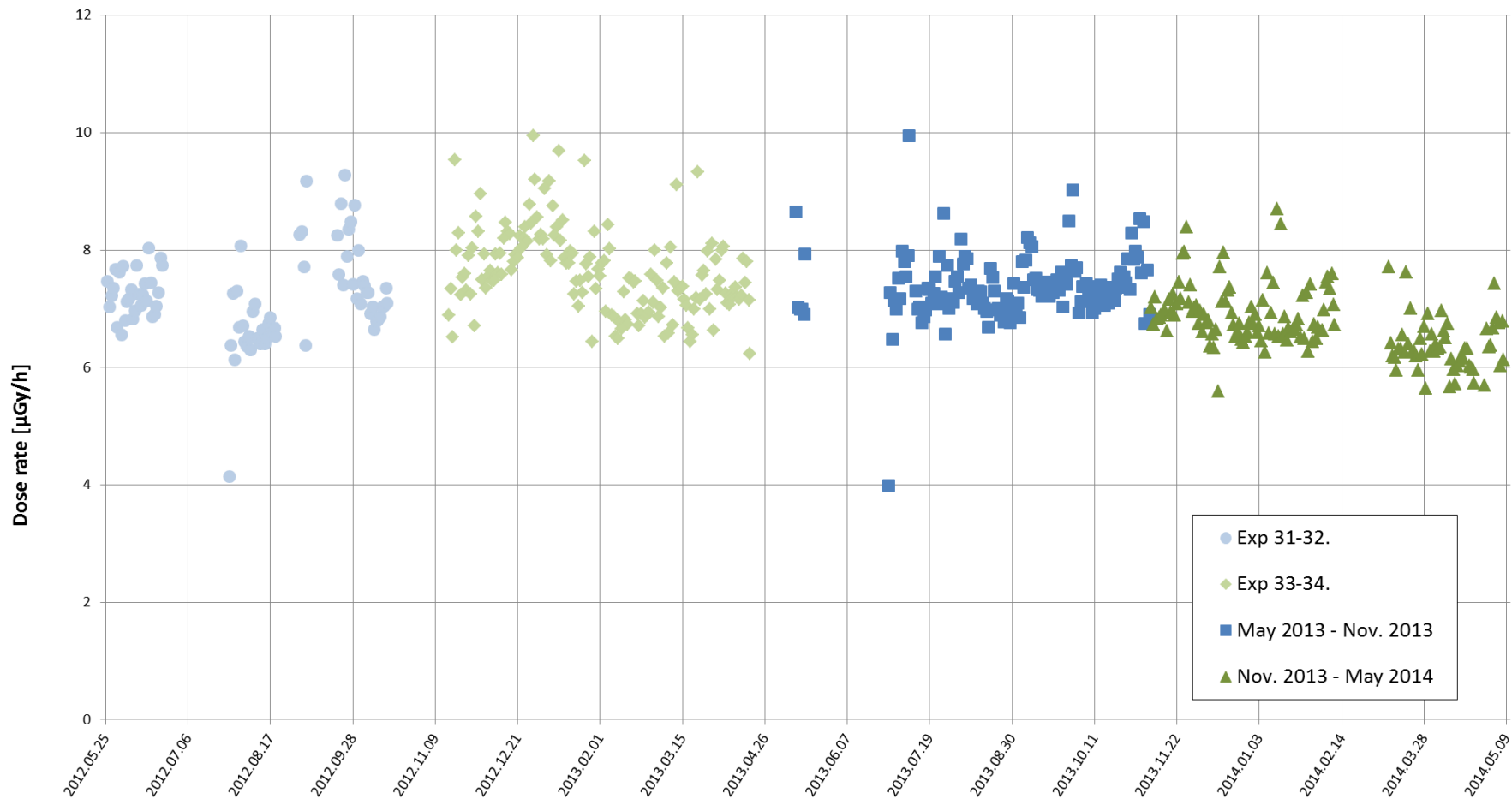


Monthly manual read-outs

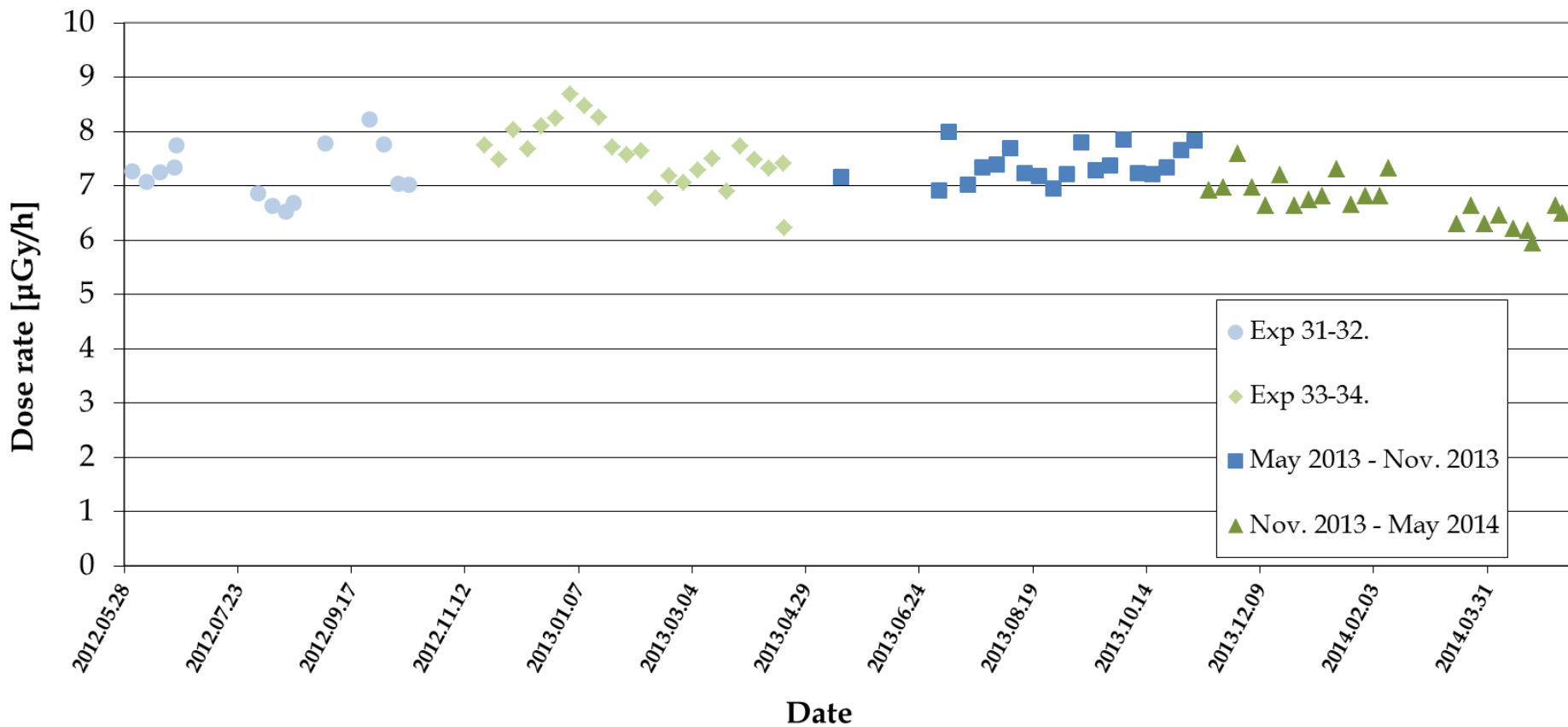
Monthly manual read-outs, December 2013 - May 2014



Daily mean dose rates May 2012 – May 2014



Weekly mean dose rates May 2012- May 2014



EVA measurements

EVA at (UCT)	Duration	C	Pille dosimeters used
May 11, 2013 12:44 – 18:14 (UCT)	5.5 h	US	A0307: ??? A0309: ??? A0310: ???
Jun. 24, 2013 13:32 – 20:06 (UCT)	6.6 h	RU	A0302: personal A0310: personal A0312: CO-1 of Pirs-1 (Panel III) ??? A0311: reference ???
Jul. 9, 2013 12:02 – 18:09 (UCT)	6.1 h	US	A0309: personal ??? A0310: personal ??? A0301: reference ??? where?



EVA measurements

EVA at (UCT)	Duration	C	Pille dosimeters used
Jul. 16, 2013 11:57 – 13:29 (UCT)	1.5 h	US	A0309: personal ??? A0310: personal ??? A0301: reference ??? where?
Aug. 16, 2013 14:36 – 22:05 (UCT)	7.5 h	RU	A0309: personal A0312: personal A0307: CO-1 of Pirs-1 (Panel III) A0302: reference
Aug. 22, 2013 11:34 – 17:32 (UCT)	6.0 h	RU	A0309: personal A0312: personal A0307: CO-1 of Pirs-1 (Panel III) A0302: reference



EVA measurements

EVA at (UCT)	duration	C	Pille dosimeters used
Nov. 9, 2013 14:34 – 20:24 (UCT)	5.8 h	RU	A0309: personal A0310: personal A0307: reference
Dec. 21, 2013 12:01 – 17:29 (UCT)	5.5 h	US	A0307: ??? A0309: ??? A0310: ???
Dec. 24, 2013	7.5 h	US	A0307: ??? A0309: ??? A0310: ???



EVA measurements

EVA at (UCT)	duration	C	Pille dosimeters used
Dec. 27, 2013 13:00 – 21:07 (UCT)	8.1 h	RU	A0309: personal A0310: personal A0307: reference
Jan. 27, 2014 14:00 – 20:08 (UCT)	6.1 h	RU	A0309: personal A0310: personal A0307: CO-1 of Pirs-1 (Panel III) A0302: reference
Apr. 23, 2014 13:56 – 15:32 (UCT)	1.6 h	US	A0309: personal A0310: personal A0306: ref.? where? A0312: ref.? where?



EVA measurements (RUS)

PRELIMINARY

Jun. 24, 2013. 13:32– 20:06 UCT

Reference dosimeter: A0311 (A0312: @Pirs-1)

EVA date	Total EVA dose [μGy]	Extra EVA dose [μGy]	Total Dose rate [$\mu\text{Gy}/\text{h}$]	Extra dose rate [$\mu\text{Gy}/\text{h}$]
Dosimeter A0312	945	21.1	-99.9	-15.2
Dosimeter A0302	1298	30.3	253.2	38.6
Dosimeter A0310	1092	24.4	47.2	7.2

Aug. 16, 2013. 14:36– 22:05 UCT

Reference dosimeter: A0302 (A0307: @Pirs-1)

EVA date	Total EVA dose [μGy]	Extra EVA dose [μGy]	Total Dose rate [$\mu\text{Gy}/\text{h}$]	Extra dose rate [$\mu\text{Gy}/\text{h}$]
Dosimeter A0307	1392	687.1	27.4	90.6
Dosimeter A0309	1740	1026	34.4	137
Dosimeter A0312	1463	749.1	28.9	100



EVA measurements (RUS)

PRELIMINARY

Aug. 22, 2013. 11:34– 17:32 UCT

Reference dosimeter: A0302 (A0307: @Pirs-1)

EVA date	Total EVA dose [μGy]	Extra EVA dose [μGy]	Total Dose rate [$\mu\text{Gy/h}$]	Extra dose rate [$\mu\text{Gy/h}$]
Dosimeter A0307	1284	25.2	624	105
Dosimeter A0309	1584	31.0	924	155
Dosimeter A0310	1155	22.6	495	83.0

Nov. 9, 2013. 14:34– 20:24 UCT

Reference dosimeter: A0307

EVA date	Total EVA dose [μGy]	Extra EVA dose [μGy]	Total Dose rate [$\mu\text{Gy/h}$]	Extra dose rate [$\mu\text{Gy/h}$]
Dosimeter A0309	1440	31.2	816	140
Dosimeter A0312	1181	25.7	557	95.5



EVA measurements (RUS)

PRELIMINARY

Dec. 27, 2013. 13:00– 21:07 UCT

Reference dosimeter: A0307

EVA date	Total EVA dose [μGy]	Extra EVA dose [μGy]	Total Dose rate [$\mu\text{Gy/h}$]	Extra dose rate [$\mu\text{Gy/h}$]
Dosimeter A0309	1380	27.1	566	69.8
Dosimeter A0310	1147	22.6	334	41.1

Jan. 27, 2014. 14:00– 20:08 UCT

Reference dosimeter: A0302 (A0307: @Pirs-1)

EVA date	Total EVA dose [μGy]	Extra EVA dose [μGy]	Total Dose rate [$\mu\text{Gy/h}$]	Extra dose rate [$\mu\text{Gy/h}$]
Dosimeter A0307	1078	19.6	249	40.6
Dosimeter A0309	1548	28.2	720	117
Dosimeter A0312	1692	30.8	864	141





Thank you for your attention



From April 2013



From June 2013



From October 2013

Dosimeter No.	Location in Zvezda module
A0301	On Panel 406
A0302	Starboard (right side) crew quarters, left of window
A0304	MIM1 (Small Research Module Rassvet) , under Panel 204
A0305	In the saloon of large diameter on Panel 327
A0306	“Service” dosimeter, inserted in the Reader (fixed on the floor, right to illuminator № 9)
A0307	Docking port 1 (to module Pirs-1), hemisphere, on panel III
A0309	MIM2 (Small Research Module Poisk), cylindrical part at the entrance
A0310	Behind panel 447 at detector DB-8 No.3
A0311	Port (left side) crew quarters, left of window
A0312	NOD of the crew quarters
A0313	On panel 435 (table)
A0314	MIM2 (Small Research Module Poisk), cylindrical part on Plane III

