



Pille Measurements on ISS

I. Apáthy¹, S. Deme¹, P. Szántó¹, T. Pázmándi¹
Y. A. Akatov², V. V. Arkhangelsky²,
Igor Nikolaev³

¹HAS Centre for Energy Research, Budapest, Hungary

²Institute for Biomedical Problems, Russia

³RSC Energia, (Russia)

szanto@energia.mta.hu

18th WRMIS – Budapest, Hungary



Outline

The Pille TLD System

Pille on ISS

Results of Exp. 31-34

Summary



The Pille thermoluminescent dosimeter system

Space qualified, on-board TLD system

Dosimeters and the reader device

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

Reader	
Measuring range ($\delta < 10\%$):	3 μGy $\div$ 10 Gy (CaSO ₄ :Dy)
TLD Efficiency ($\epsilon = 1 \pm 10\%$):	$\text{LET}_{\infty}(\text{H}_2\text{O}) < 10 \text{ keV}/\mu\text{m}$
Accuracy (above 10 μGy):	$\delta < 5\%$



High sensitivity

Even hourly read-outs are possible

On board of every space station since Salyut-6

More than 36 000 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 on every orbit

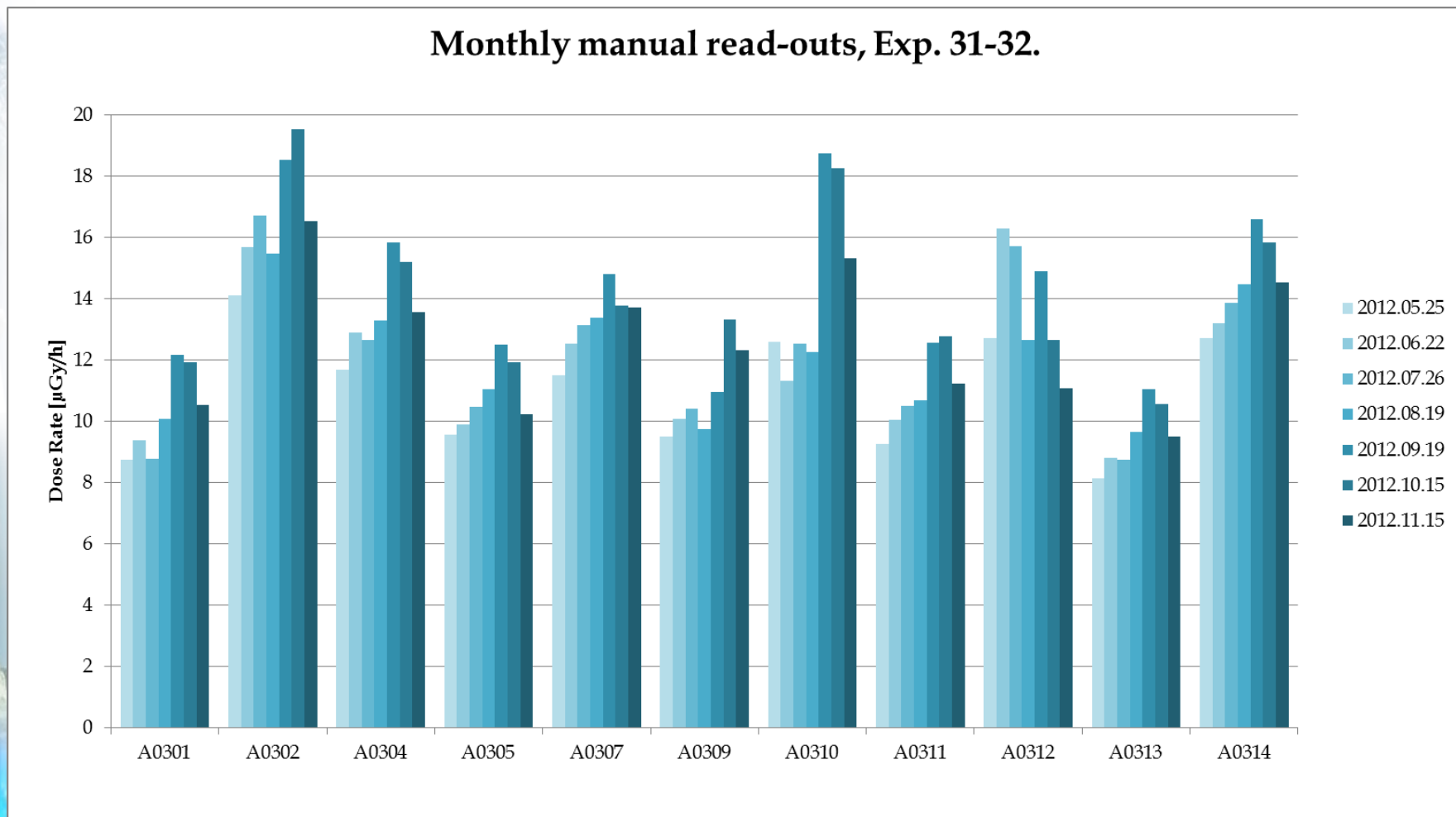
New dosimeters carried to ISS

- Currently 12 dosimeters onboard



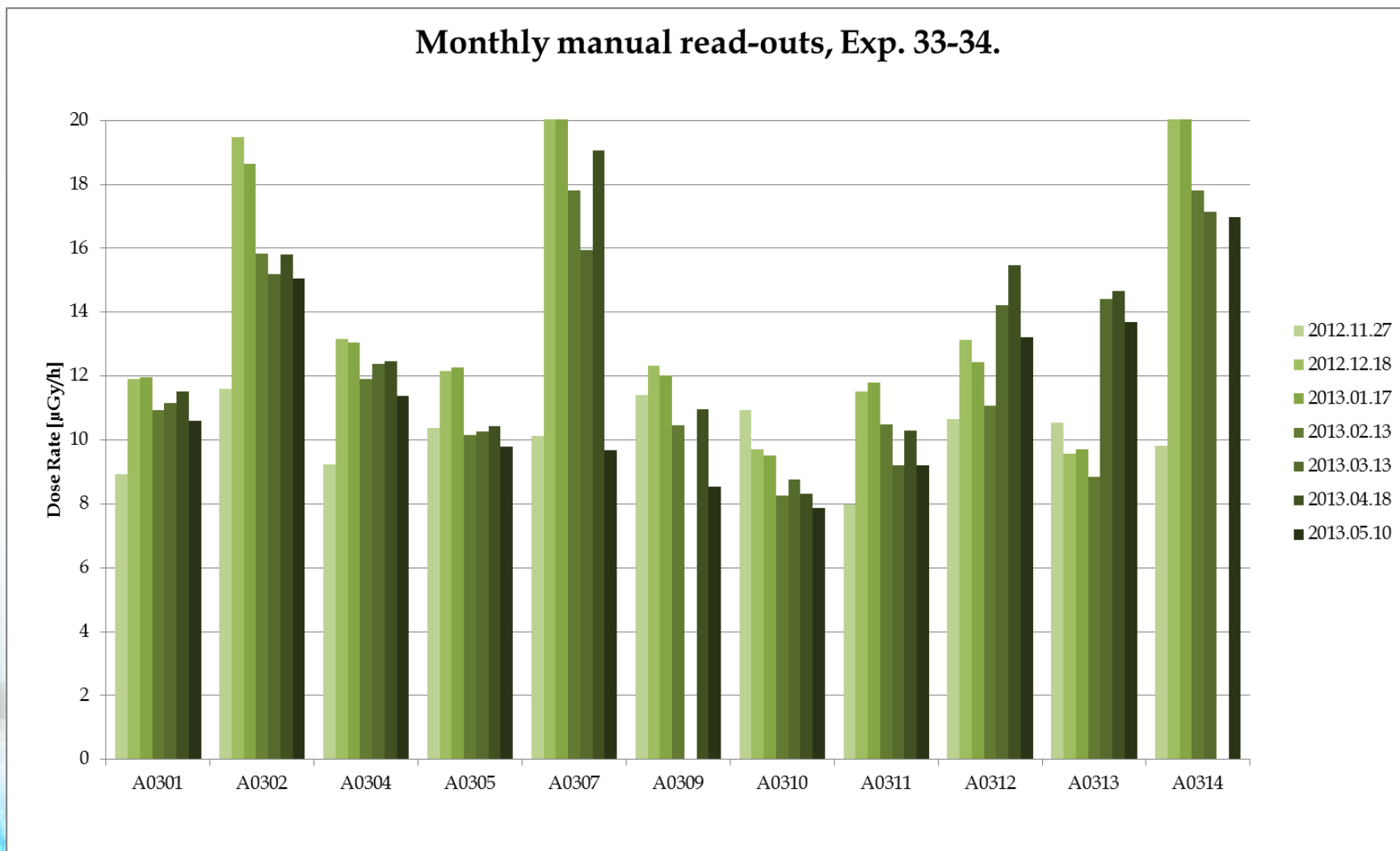


Monthly manual read-outs, Exp. 31-32.



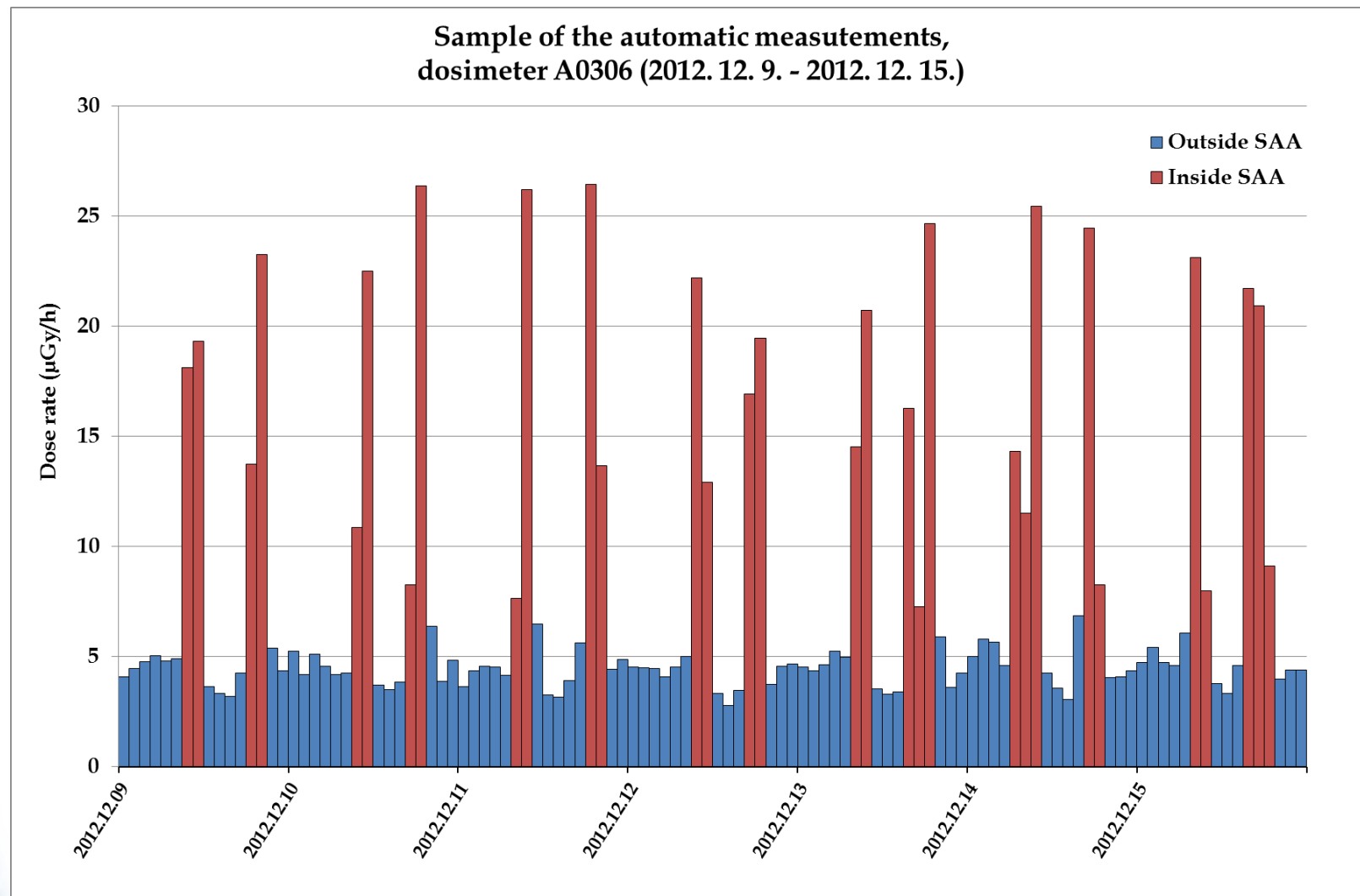


Monthly manual read-outs, Exp. 33-34.



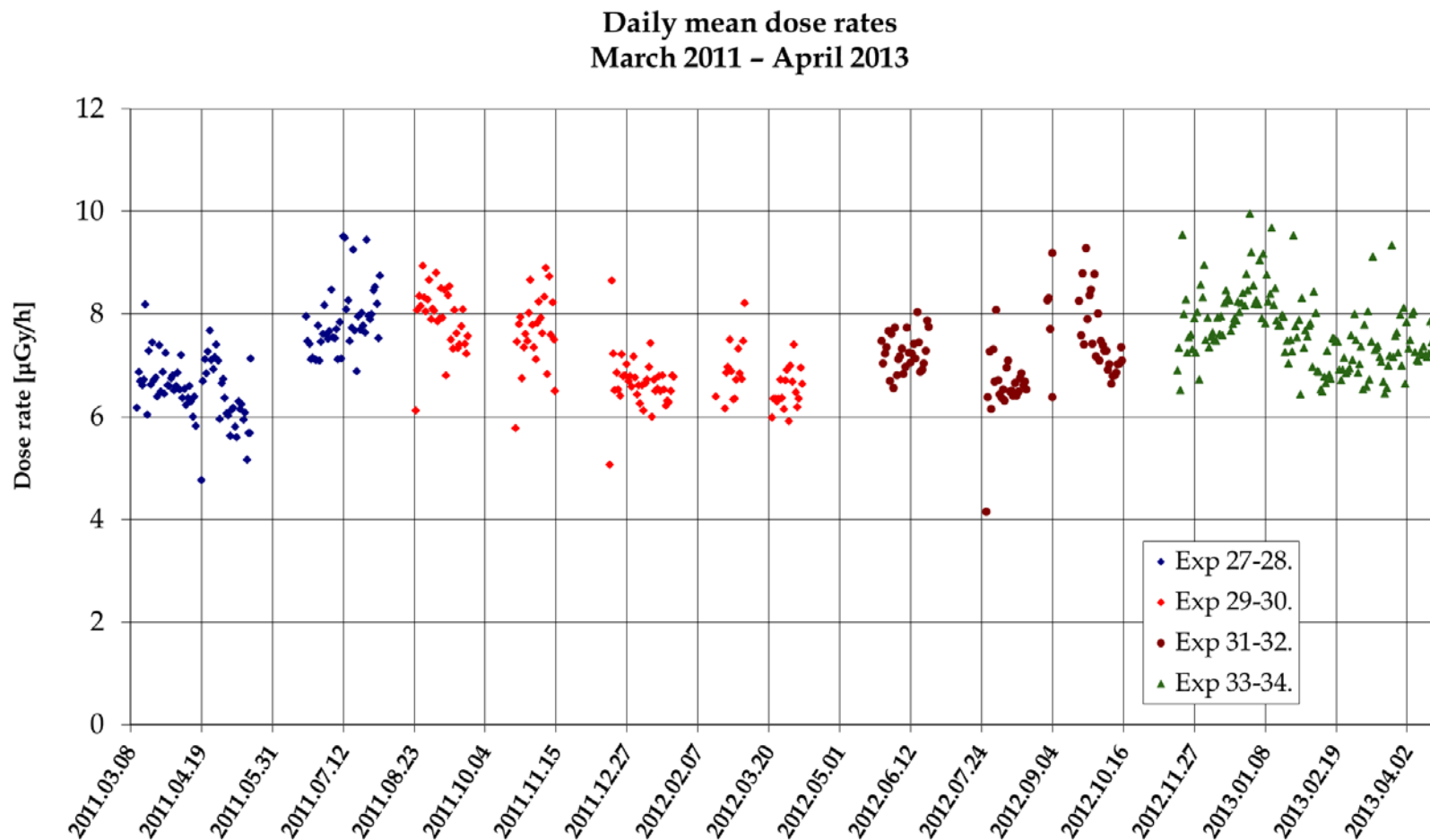


Sample from the automatic measurements, Exp. 33-34.

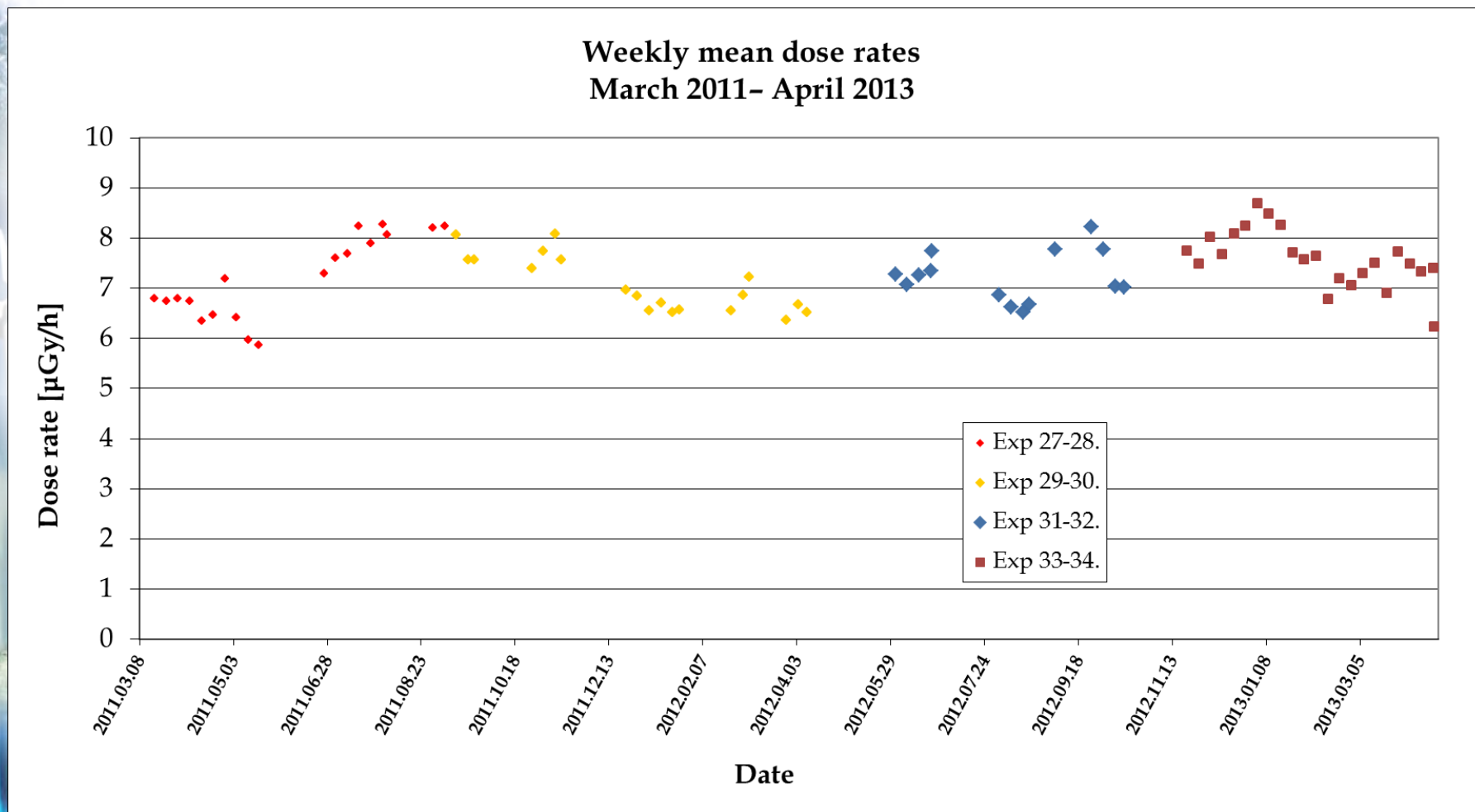


One third of the dose of the astronauts are caused by the South Atlantic Anomaly.

Daily average dose rates, Exp. 27- 34.



Weekly average dose rates, Exp. 27-34.





EVA measurements

EXP. 31-32.

4 EVAs were measured

Aug. 20. 2012. 11:37 – 17:28 EDT

Reference dosimeter: A0306

EVA date	Total EVA dose [μGy]	Extra EVA dose [μGy]	Total Dose rate [μGy/h]	Extra dose rate [μGy/h]
Dosimeter A0309	887	852	152	146
Dosimeter A0310	787	752	135	129

Aug. 30. 2012. 08:16 – 16:33 EDT

Reference dosimeter: A0306

EVA date	Total EVA dose [μGy]	Extra EVA dose [μGy]	Total Dose rate [μGy/h]	Extra dose rate [μGy/h]
Dosimeter A0307	268	218	32	26
Dosimeter A0309	141	91	17	11
Dosimeter A0310	153	103	18	12



EVA measurements

EXP. 31-32.

4 EVAs were measured (continued)

Sept. 4. 2012. 07:06 – 13:34 EDT

Reference dosimeter: A0301

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 A	193	150	29	23
Dosimeter B	135	92	21	14

Nov. 1. 2012. 08:29 – 15:07 EDT

Reference dosimeter: A0301

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	252	206	39	32
Dosimeter A0314	132	86	20	13



EVA measurements

EXP. 33-34.

1 EVA was measured (continued)

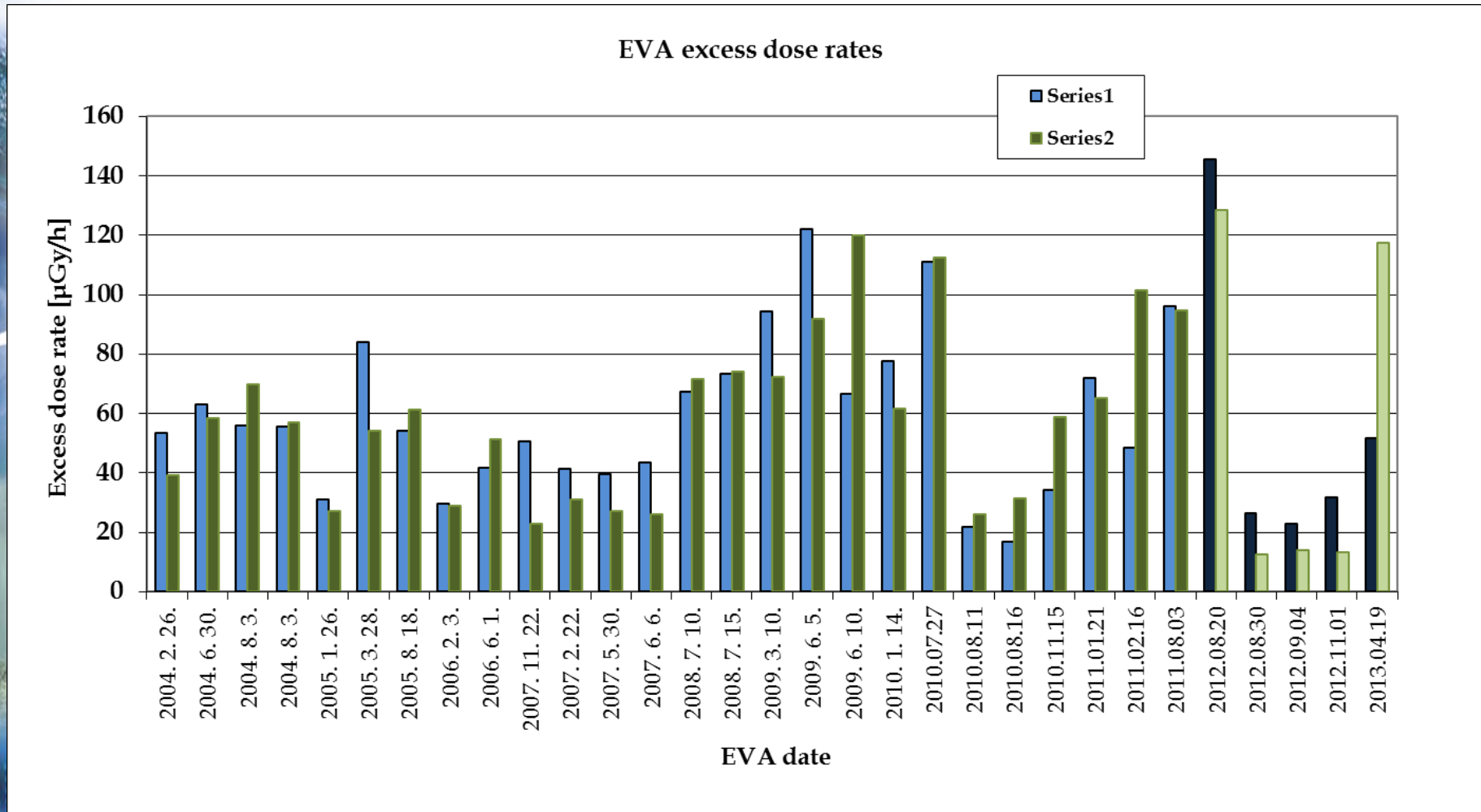
Apr. 19. 2013. 10:03– 16:41 EDT

Reference dosimeter: A0306 (A0307 ???)

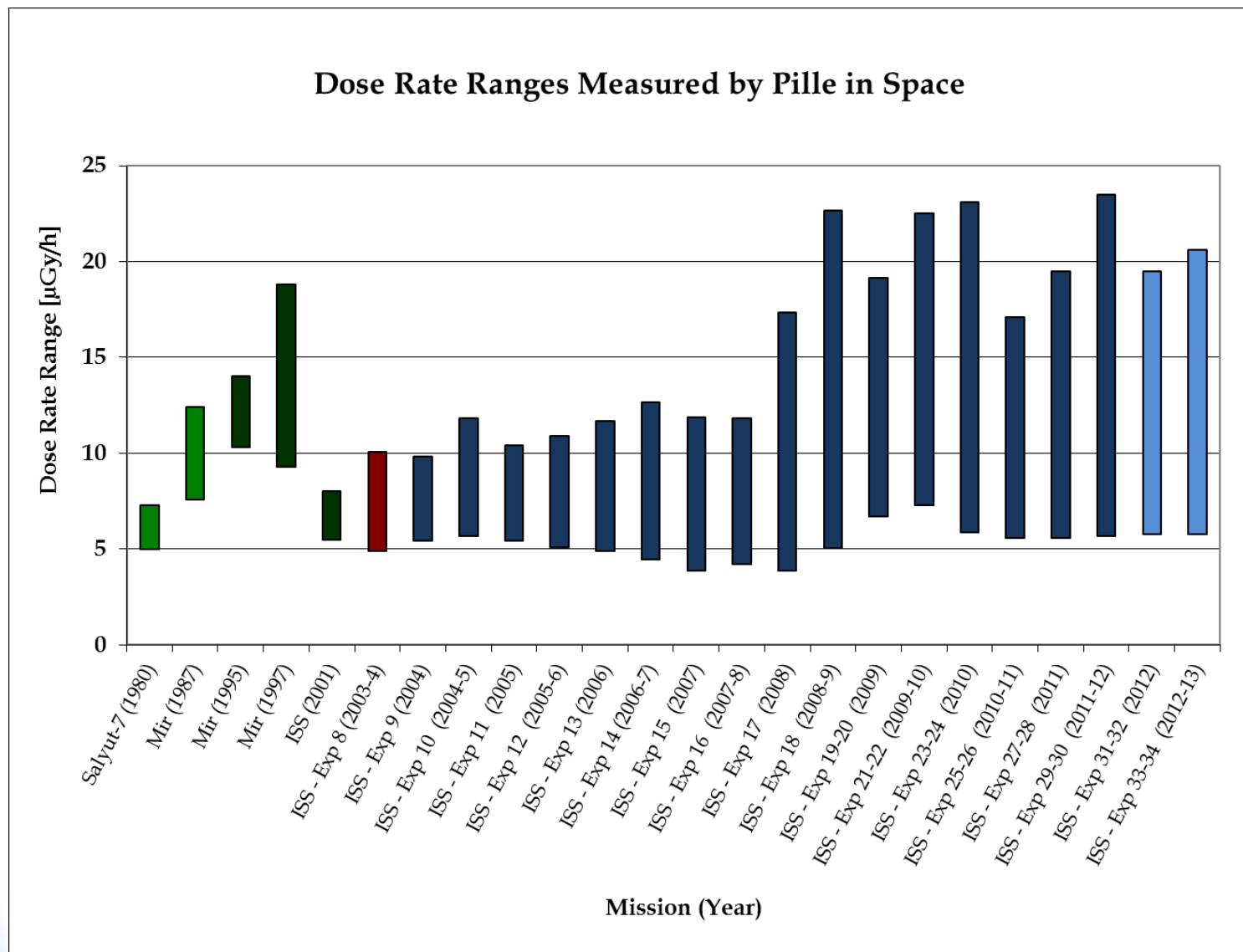
EVA date	Total EVA dose [μGy]	Extra EVA dose [μGy]	Total Dose rate [$\mu\text{Gy/h}$]	Extra dose rate [$\mu\text{Gy/h}$]
Dosimeter A0307	389	344	59	52
Dosimeter A0309	826	781	124	117
Dosimeter A0310	816	771	123	116

- It is not recommended to use Dosimeter A0306 as EVA reference dosimeter
 - It's properties (remanent dose) differ due to the continuous automatic read-outs
- EVA on Aug. 20. 2012 was probably during SAA crossing
- EVA on Apr. 19. 2013 was probably during SAA crossing

EVA excess dose rates



Dose ranges measured by Pille





Further work and summary

Dose rates of Exp. 31-34. were similar to the previous measurements

EVA's were performed during SAA crossing

More information would be appreciated

- on the exact positions of the dosimeters
- EVA activities and dosimeters used during EVA's

Thank you for your attention



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