

Centre for Energy Research

25th WRMISS, 6 - 8 September @ Mons, Belgium

Pille Measurements on ISS July 2019 – August 2022

A. Strádi¹, A. Hirn¹, I. Apáthy¹, V. A. Bondarenko², S. Deme¹,
O. Gorokhova³, O. Ivanova², V. Mitrikas², I. V. Nikolaev³,
V. A. Shurshakov², V.V. Tsetlin²

 ¹ Centre for Energy Research, Eötvös Loránd Research Network, Hungary
 ² State Scientific Center, Institute for Biomedical Problems, Russian Academy of Sciences, Moscow, Russia
 ³ Rocket and Space Corporation, Energia, Russia









- Part of the service dosimetry system of the Russian segment
 - ✓ Dose mapping

✓ Personal dosimetry during SPE-s

- ✓ Personal dosimetry during EVA-s
- ✓ Automatic read-out on every orbit



- TL material: CaSO₄:Dy
- Measuring range (σ <10%): 3 µGy 10 Gy
- Regular on-board cross-calibrations
 → deviations within ±10%
- The raw data does not include conversion to absorbed dose in water, Russian specialists use a conversion factor of 1.1



NEW dosimeters

2018



Dosimeter ID	Location since 2022.02.21
A0301	Nauka (MLM), cabin, under remote control console
A0302	SM, panel No. 327
A0304	Nauka (MLM), panel No. 310
A0305	Poisk (MRM 2), entrance, behind the handrail 6111
A0306	Nauka (MLM), panel No. 314
A0307	"Belgorod cup" 2, inside
A0309	SM, left cabin, ~ 20-25 cm to the left of the porthole
A0310	Panel No. 447
A0311	"Belgorod cup" 1, outside
A0312	"Belgorod cup" 2, outside
A0313	Zarya, starboard side, panel 415 (middle of the corridor under the green bag)
A0314	Rassvet (MRM 1), under panel No. 204
A0151	In the reader
A0152	Space suit
A0153	Space suit
A0154	"Belgorod cup" 1, inside
A0155	SM, right cabin

^I Automatic measurements since August, 2018

EVA and reference dosimeters (A0305 RUS reference, A0310 US reference)



No. of EVAs between 2019 – 2022 (so far):

Year	US	US === +EU/CAN/JP	RUS	RUS+EU	EU+JP	Sum
2019	6	4	1	0	0	11
2020	6	1	1	0	0	8
2021	5	4	3	0	1	13
2022	1	1	5	1	0	8

Average length: 6 hours 40 min ± 42 min

/Pirs decommission + Nauka & Prichal fitting: 7h 18min ± 25 min/

✤ Readouts regularly performed ~44 hours afterwards the EVAs!
→ time resolved data are less realistic

✤ Reference dosimeters are placed at different locations
→ variations in the "background" dose

Photo: Roscosmos



EVA Total Doses (μ Gy) 08/2019 - 08/2022

	RUS spacesUS spacesu	uit it	Decommis the Pirs Ai	ssioning rlock	Series of spacewalks to outfit Nauka	Connecting the Prichal Node Module	Series to activate Nauka & Prichal, commission European Robotic Arm
Gy)	2500						EVA terminated early Σ 4h 1min
Total Absorbed Dose (µG	1800 1700 1600 1500 1400 1300 1200 1100 900 800 700 600 500 400 300 200 100						
79±10 μ(Gy J	2019	2020		2021		2022











Monthly readouts 2022

Sorry - the memory card has not yet arrived at our lab



Pille dosimeters' calculated correction factors:

	Dosimeter ID	09/2020	01/2021	08/2021	02/2022
	A0301			1.0	1.1
•	A0302	1.0	1.0	1.0	1.0
	A0304	1.1	1.1	1.1	1.0
	A0305	1.1	1.0	1.0	1.0
	A0306		1.0	1.3	1.4
	A0307	1.0	0.9	1.0	0.9
L	A0309	1.0	1.1	0.9	0.9
ע	A0310	1.1	0.9	1.1	1.1
	A0311		1.0	1.4	1.6
	A0312	1.0	1.0	0.9	0.9
	A0313	1.1	1.3	1.0	1.0
	A0314	1.1	1.0	1.0	1.1
	A0151	1.3	1.0	1.3	1.2
Ν	A0152	1.1	1.0	1.0	0.9
Ε	A0153	1.1	1.0	1.0	1.1
W	A0154	1.0		1.0	1.0
	A0155	1.1		0.9	1.0
cross-calibrated with DB-8					latest

✓ Average deviation in the 4 sessions: -6 %

- old dosimeters: -7 % (without aut.read.): -2.6 %
- new dosimeters: -4 % (without aut.read.): -0.01 %

← automatic readouts 2010 - 2018

← automatic readouts 2009 - 2010

← automatic readouts since 2018



Dosimeter locations in the Service Module





Monthly Pille measurements are averaged





✓ The new reader and dosimeters are functioning properly

Average deviation in the last 4 cross-calibration sessions: -6 %
 old dosimeters: -2.6 % (without aut.read.)
 new dosimeters: -0.01 % (without aut.read.)

 \checkmark Slow degradation can be observed in case of the intensively used dosimeters

 Pirs decommissioning → EVAs resulting in > 1 mGy (in 3 cases > 2 mGy) absorbed dose



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Thank you for your attention!

