WRMISS 29: UPDATE ON THE M-42 INSTRUMENT FAMILY AND FUTURE MISSIONS

Moritz Kasemann for the DLR M-42 Team

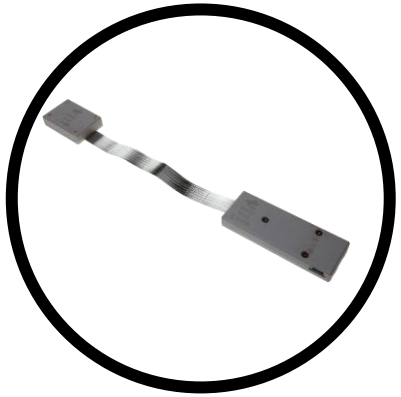
German Aerospace Center (DLR), DLR-ME, Cologne, Germany

NOTE: All data preliminary and confidental

DLR M-42 Detector Family



M-42 Compact



M-42 Split

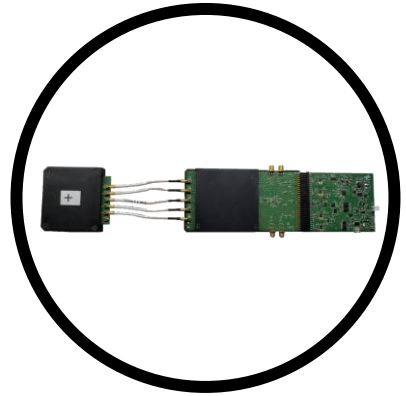
M-42 EXTended



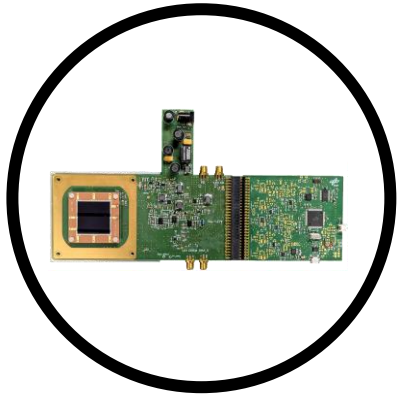
M-42 Pocket



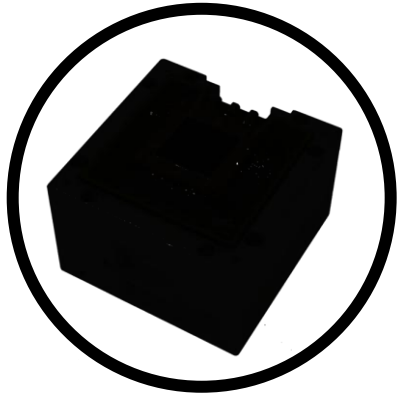
M-42 POSITION



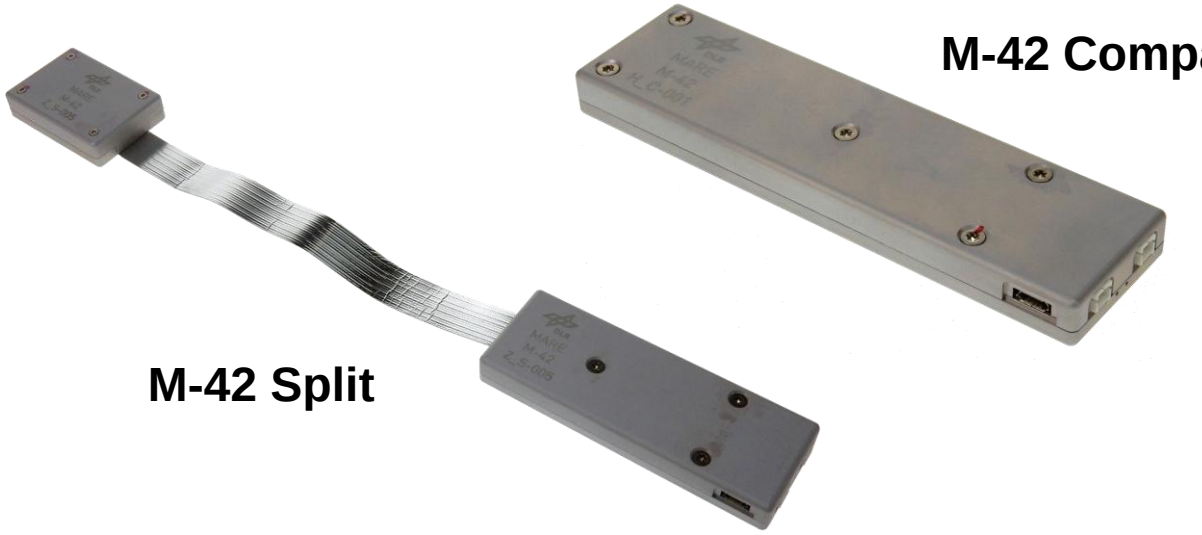
M-42 BIG

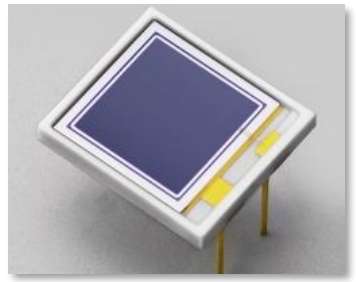


M-42 CUBE



DLR M-42 Detector Family





	M-42 Compact/Split
Energy Range (in Si)	0.06 - 20 MeV
Sensor thickness	300 µm
Sensitive Area	1.22 cm²
Power Consumption	10.44 mW

DLR M-42 Detector Family



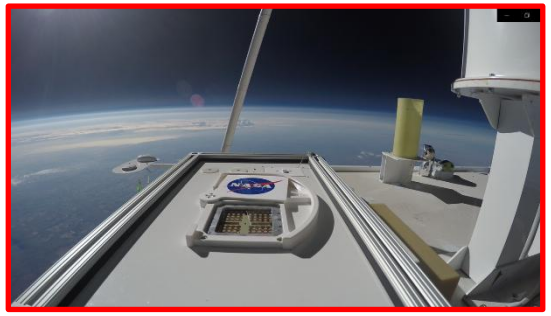
M-42 Compact

M-42 Split

RadMap (*DLR M-42*)

RadMap: Losekamm et al. (2023)
https://doi.org/10.22323/1.444.0099





MARSBOx: Berger et al. (2021)
https://doi.org/10.1002/essoar.10506355.1



ARTEMIS I: George et al. Nature 634, 48-52 (2024) https://doi.org/10.1038/s41586-024-07927-7; Jordan M. Houri *et al, Sci. Adv.***12**,eadz1892(2026).DOI:10.1126/sciadv.adz1892



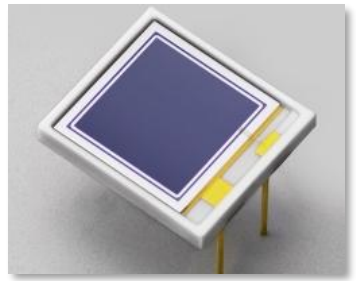


MAPHEUS

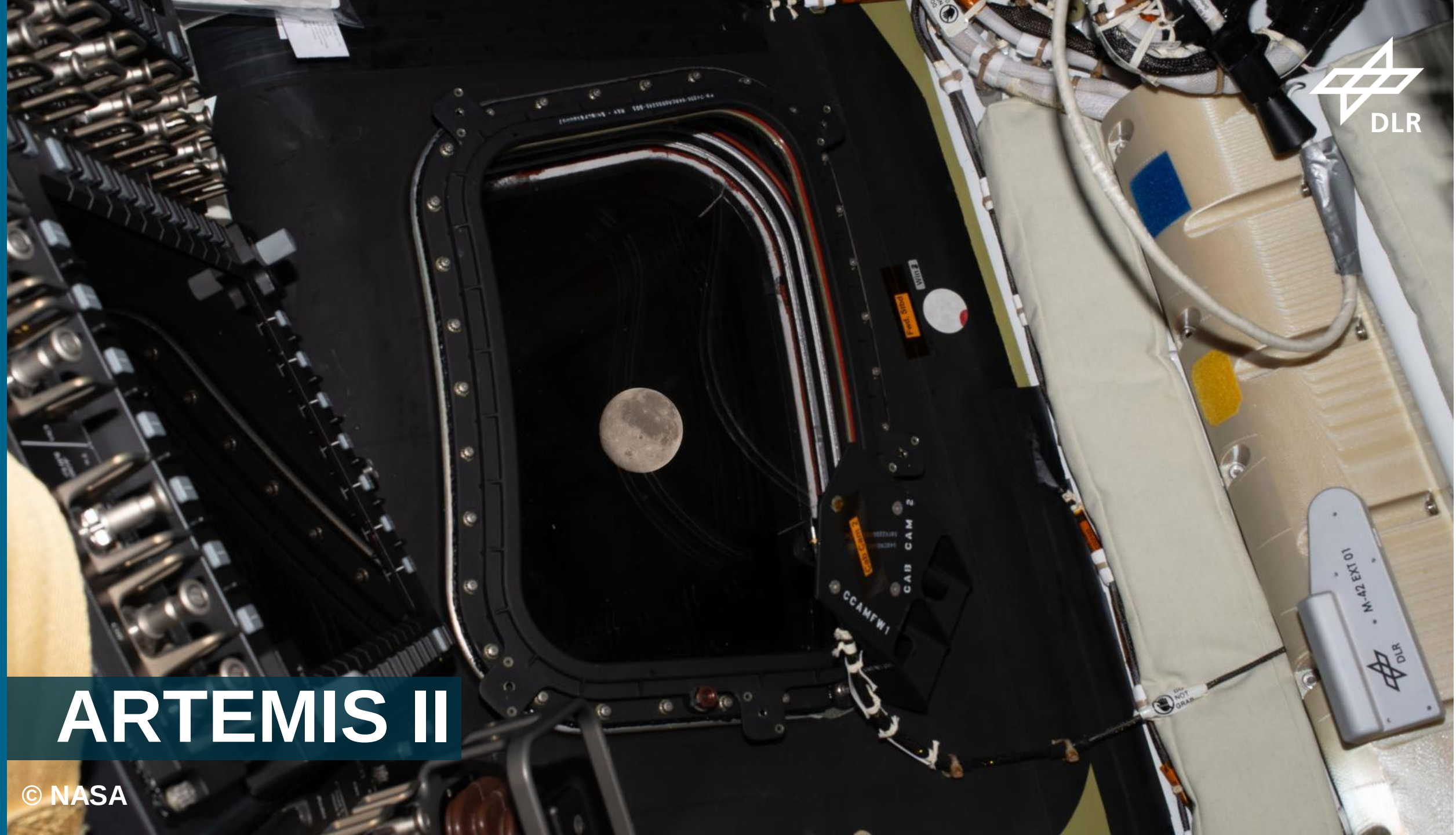
DLR M-42 Detector Family



M-42 EXTended



	M-42 Compact	M-42 EXT
Energy Range (in Si)	0.06 - 20 MeV	0.06 - **135** MeV
Sensor thickness	300 µm	
Sensitive Area	1.22 cm²	
Power Consumption	11 mW	



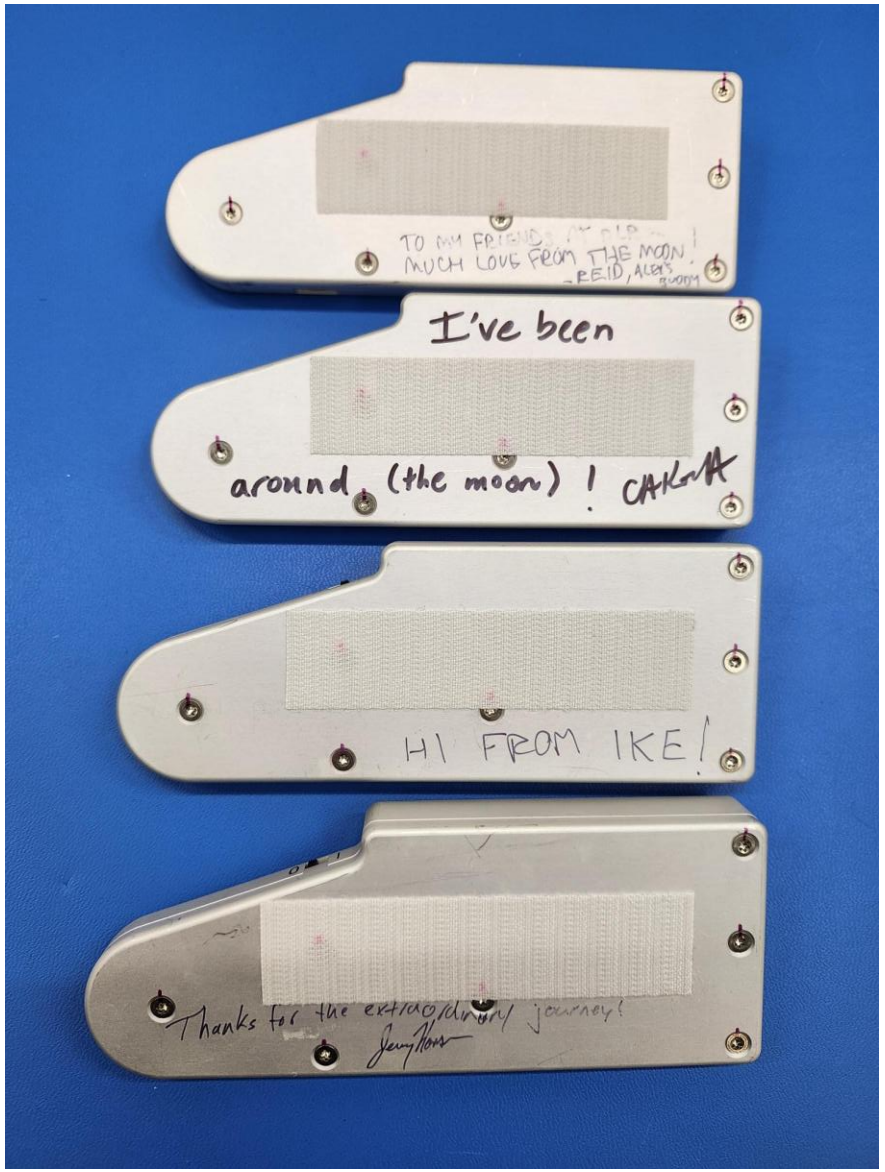
ARTEMIS II

© NASA

M-42 EXTended: Artemis II



M-42 EXTended: Artemis II

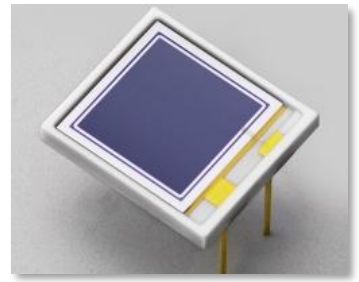


DLR M-42 Detector Family

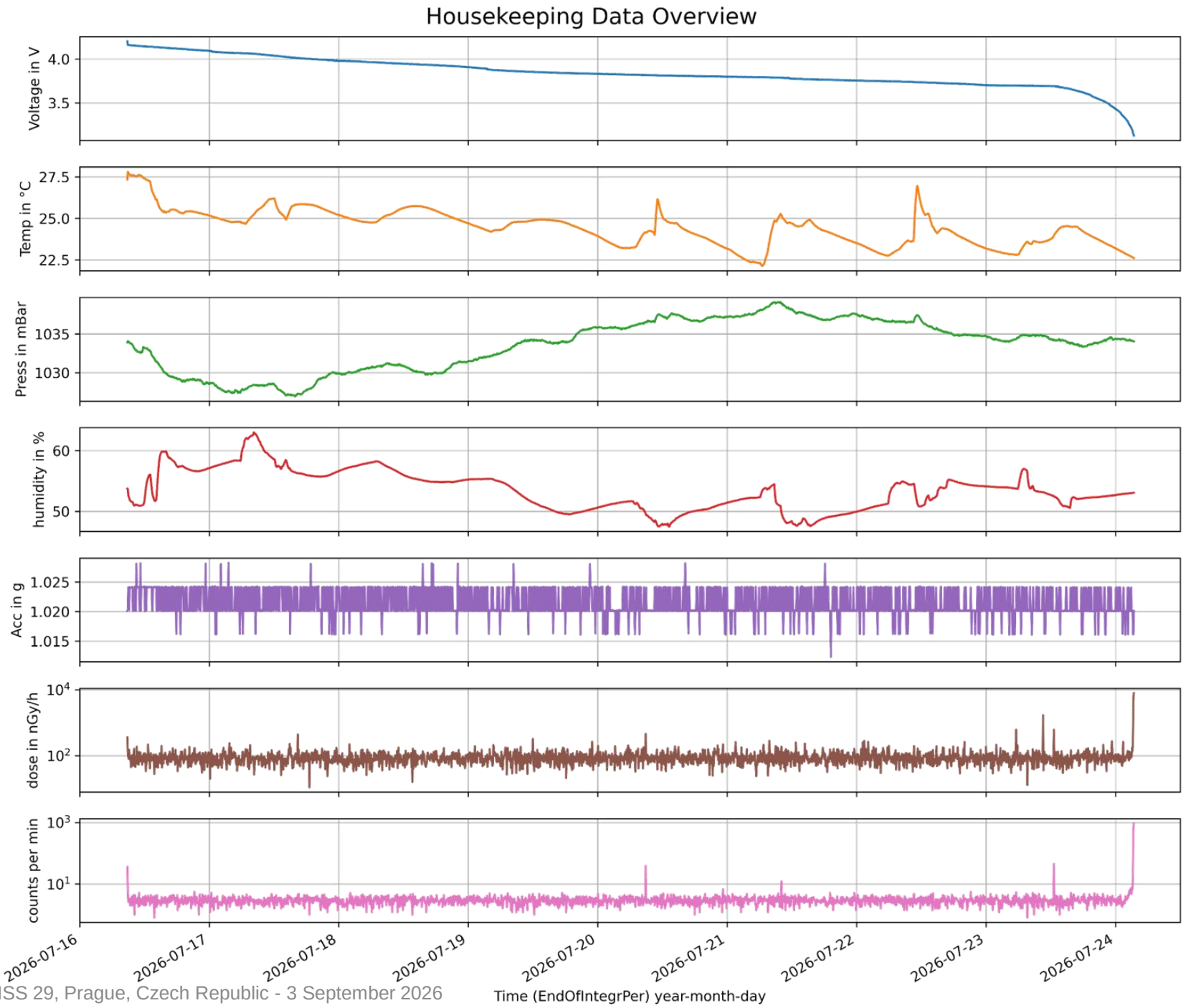
M-42 Pocket





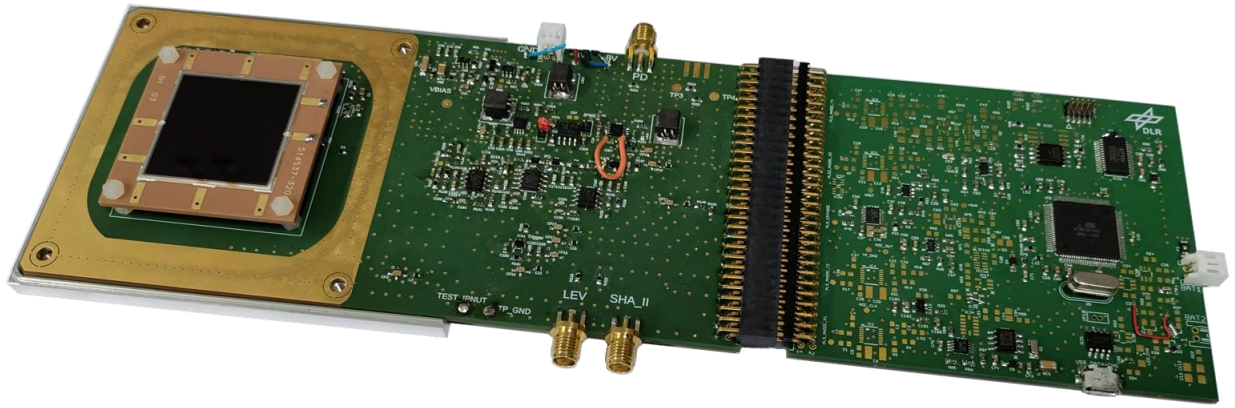


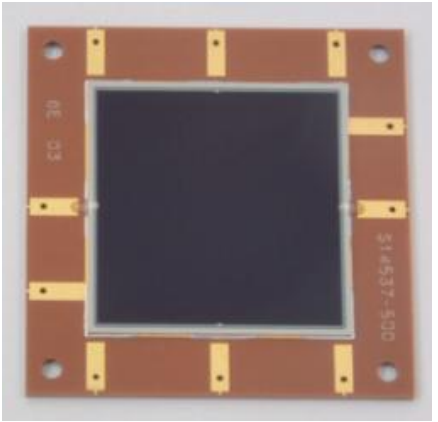
	M-42 EXT	M-42 Pocket
Energy Range (in Si)	0.06 - 135 MeV	
Sensor thickness	300 µm	
Sensitive Area	1.22 cm²	
Power Consumption	11 mW	TBD


Housekeeping Data Overview
Voltage in V
4.0
3.5
Temp in °C
27.5
25.0
22.5
Press in mBar
1035
1030
humidity in %
60
50
Acc in g
1.025
1.020
1.015
dose in nGy/h
10^4
10^2
counts per min
10^3
10^1
2026-07-16
2026-07-17
2026-07-18
2026-07-19
2026-07-20
2026-07-21
2026-07-22
2026-07-23
2026-07-24
Time (EndOfIntegrPer) year-month-day

DLR M-42 Detector Family

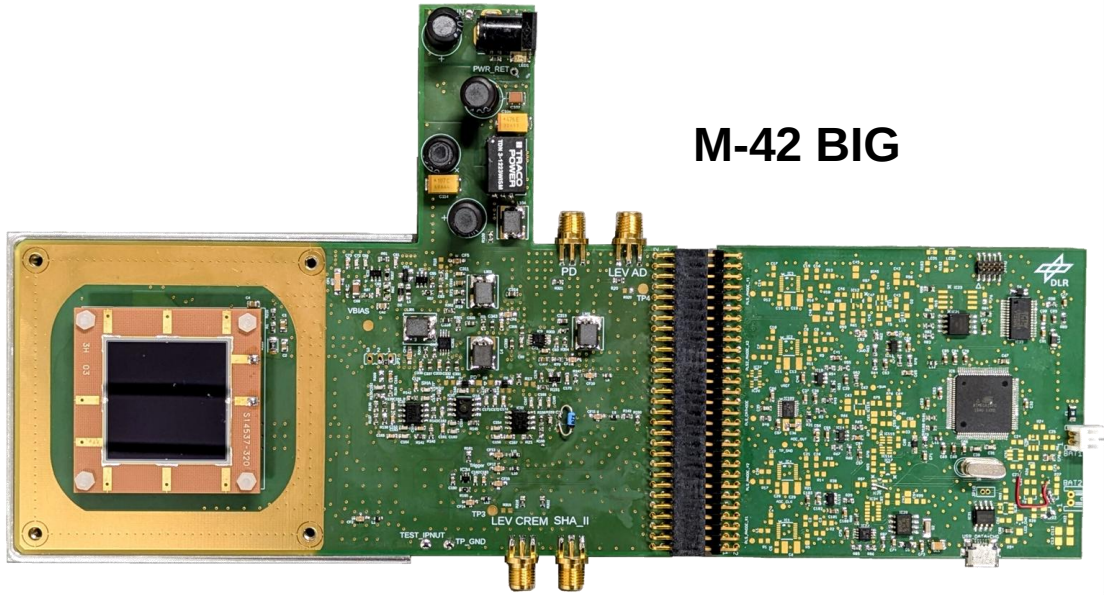
M-42 BIG



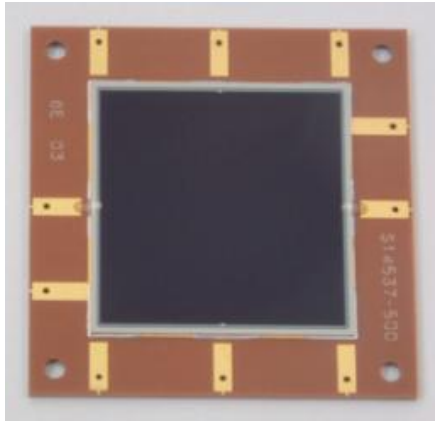


	M-42 EXT	M-42 BIG
Energy Range (in Si)	0.06 - 135 MeV	0.06 - **250** MeV
Sensor thickness	300 µm	320 µm
Sensitive Area	1.22 cm²	**7.84** cm²
Power Consumption	11 mW	500 mW

DLR M-42 Detector Family



M-42 BIG

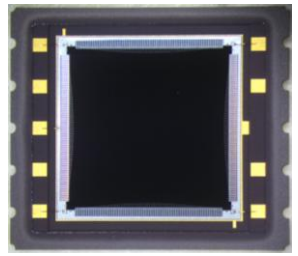


	M-42 EXT	M-42 BIG
Energy Range (in Si)	0.06 - 135 MeV	0.06 - **500** MeV
Sensor thickness	300 µm	320 µm
Sensitive Area	1.22 cm²	**7.84** cm²
Power Consumption	11 mW	500 mW

DLR M-42 Detector Family

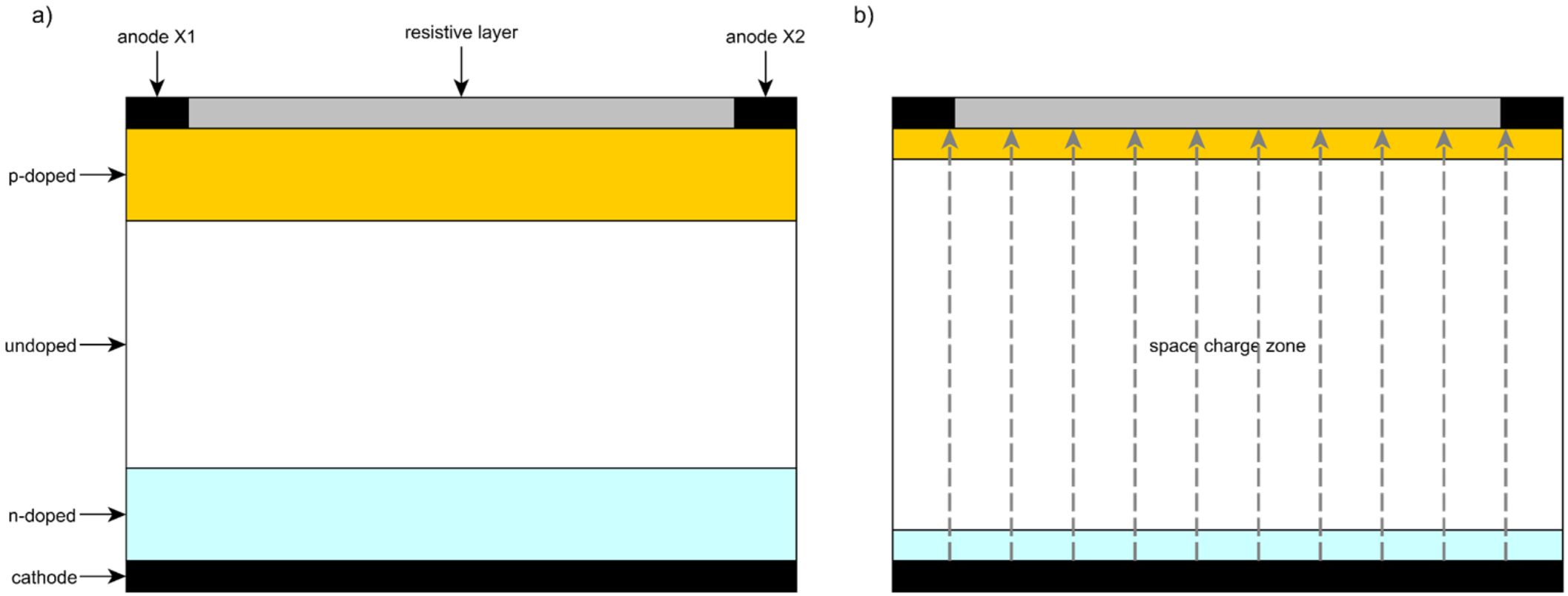
M-42 Position





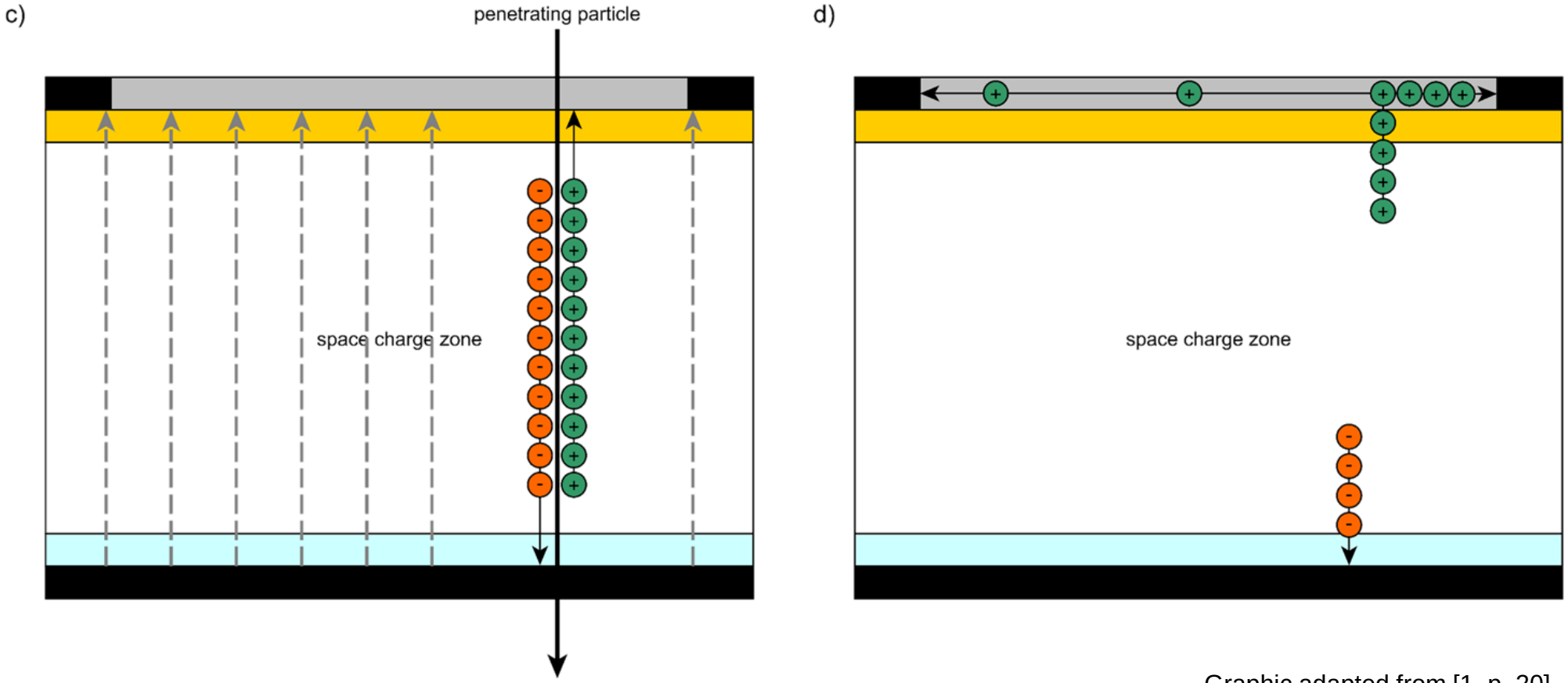
	M-42 EXT
Energy Range (in Si)	6 – 150 MeV
Sensor thickness	300 µm
Sensitive Area	1.00 cm²
Power Consumption	~220 mW

Position Sensitive Diode - PSD



Graphic adapted from [1, p. 20]

Position Sensitive Diode - PSD



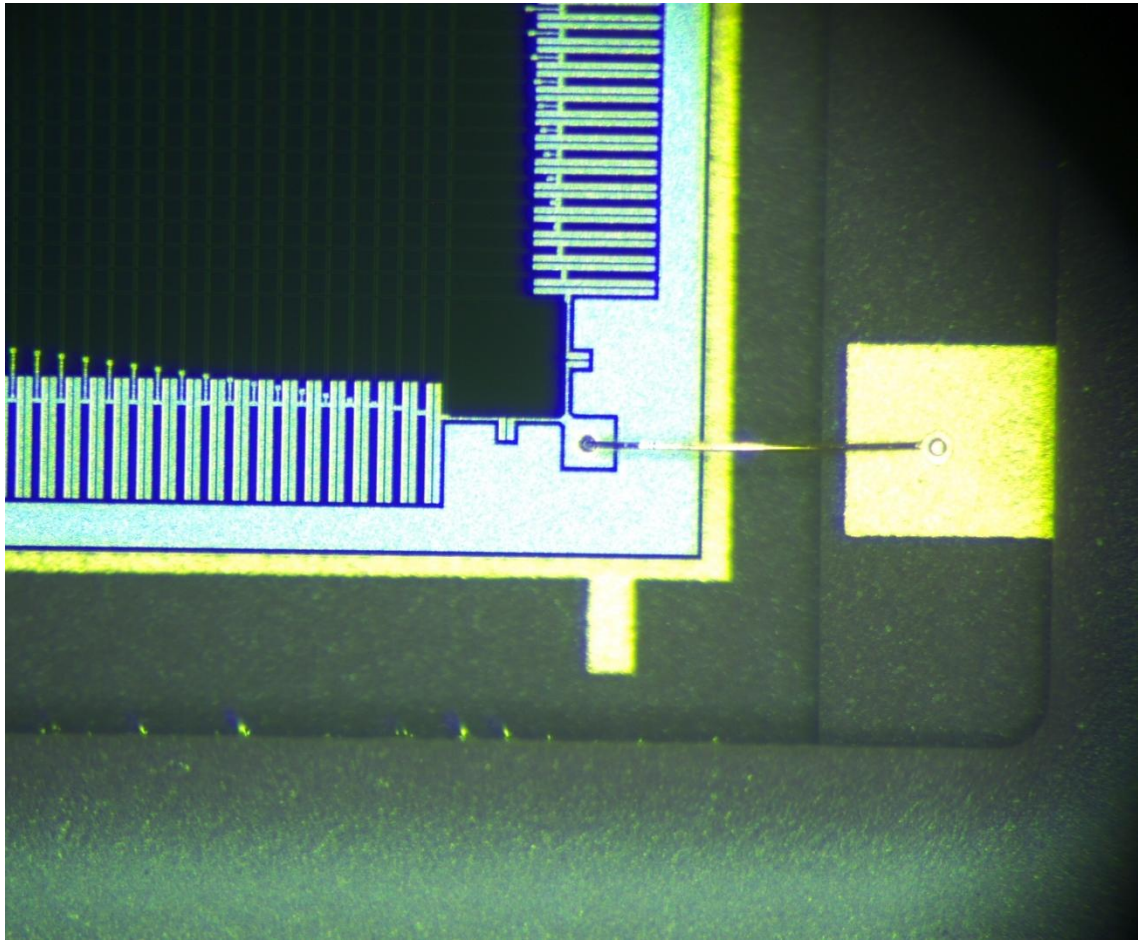
Graphic adapted from [1, p. 20]

Position Sensitive Diode - PSD

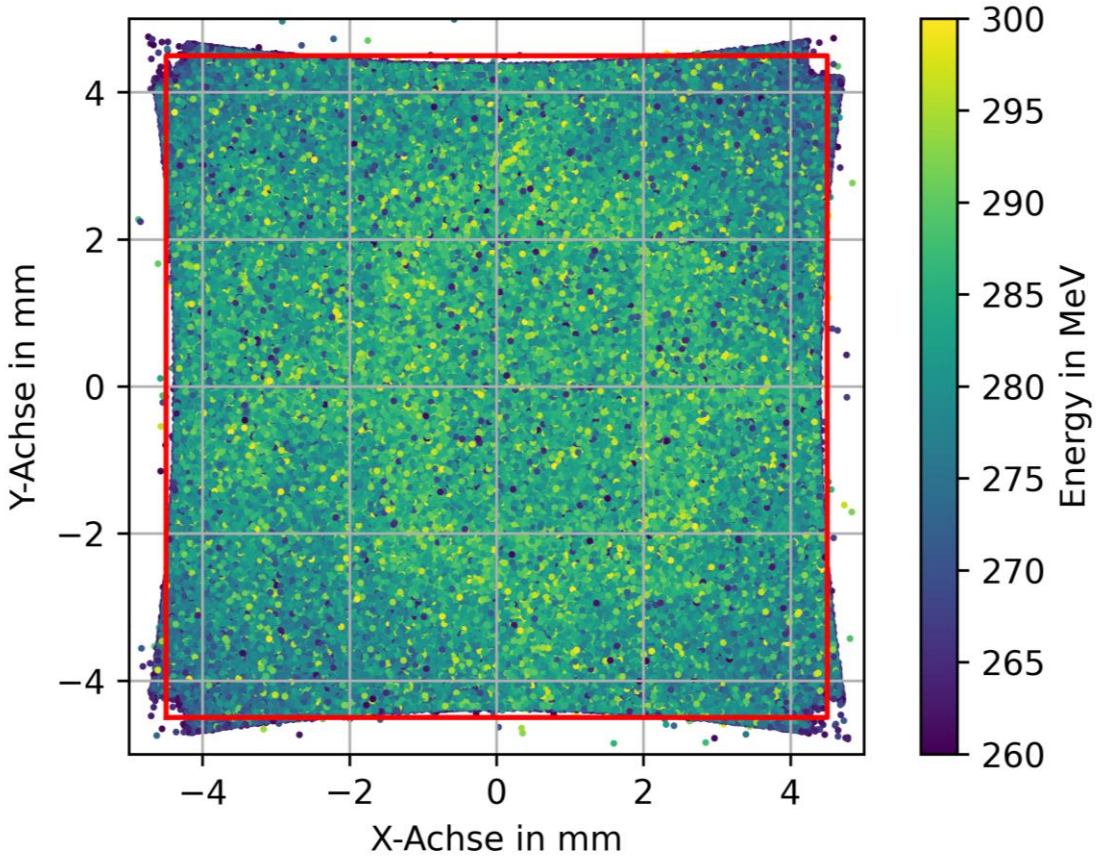
$$X = \frac{L}{2} \cdot \frac{\left(I_{X_2} + I_{Y_1}\right) - \left(I_{X_1} + I_{Y_2}\right)}{I_{X_1} + I_{X_2} + I_{Y_1} + I_{Y_2}}$$

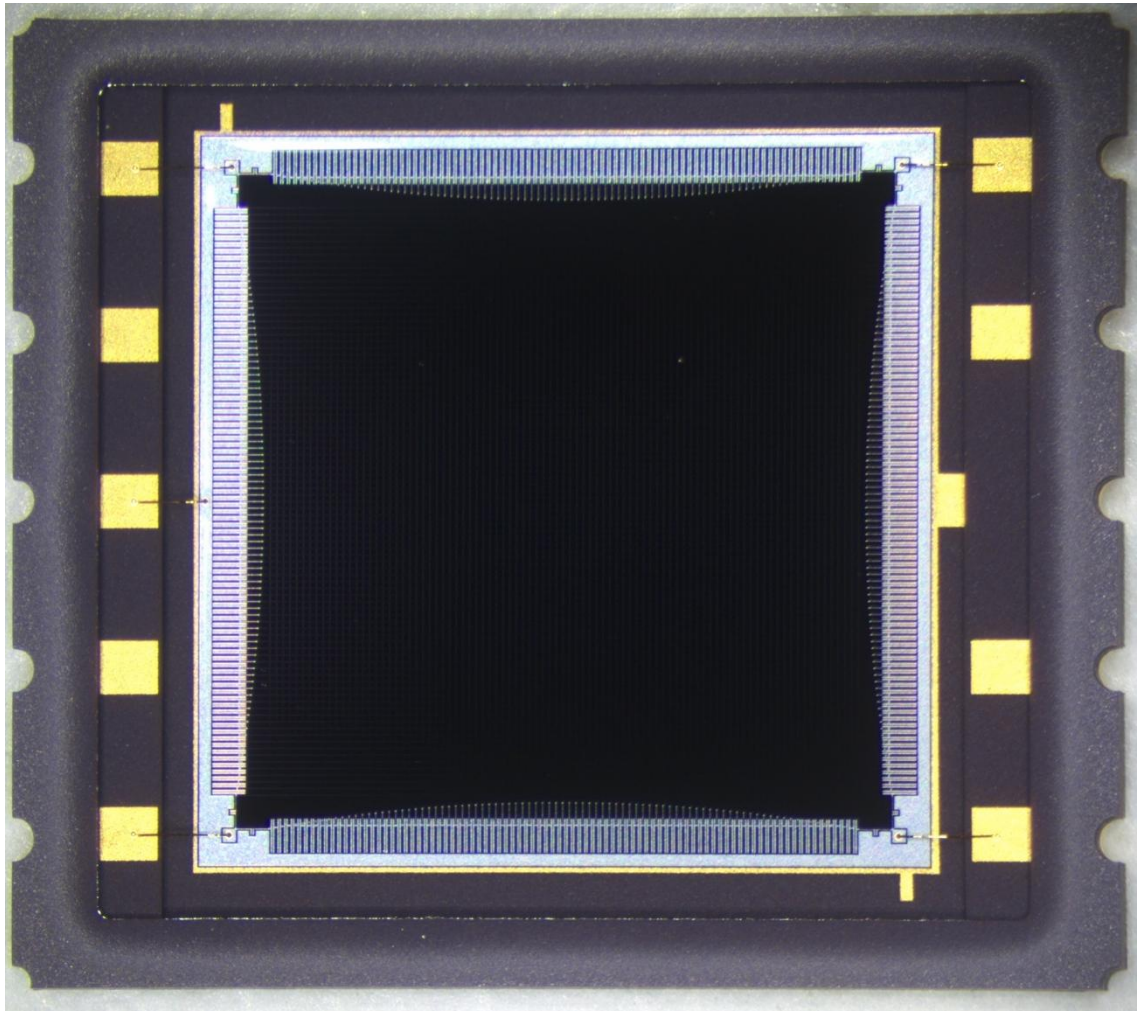
$$Y = \frac{L}{2} \cdot \frac{\left(I_{x_2} + I_{Y_2}\right) - \left(I_{X_1} + I_{Y_1}\right)}{I_{X_1} + I_{X_2} + I_{Y_1} + I_{Y_2}}$$

[2]



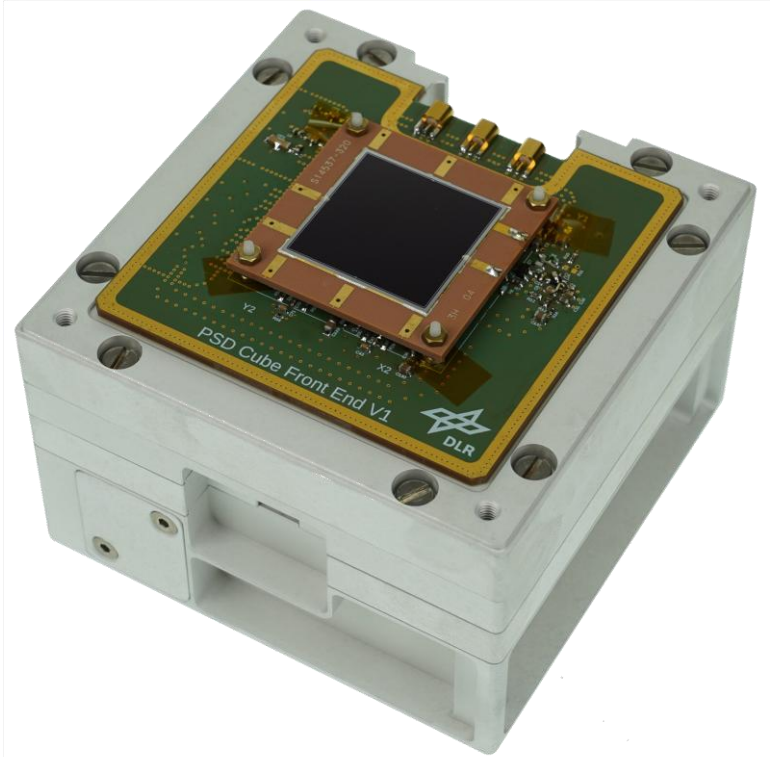
Position Sensitive Diode - PSD





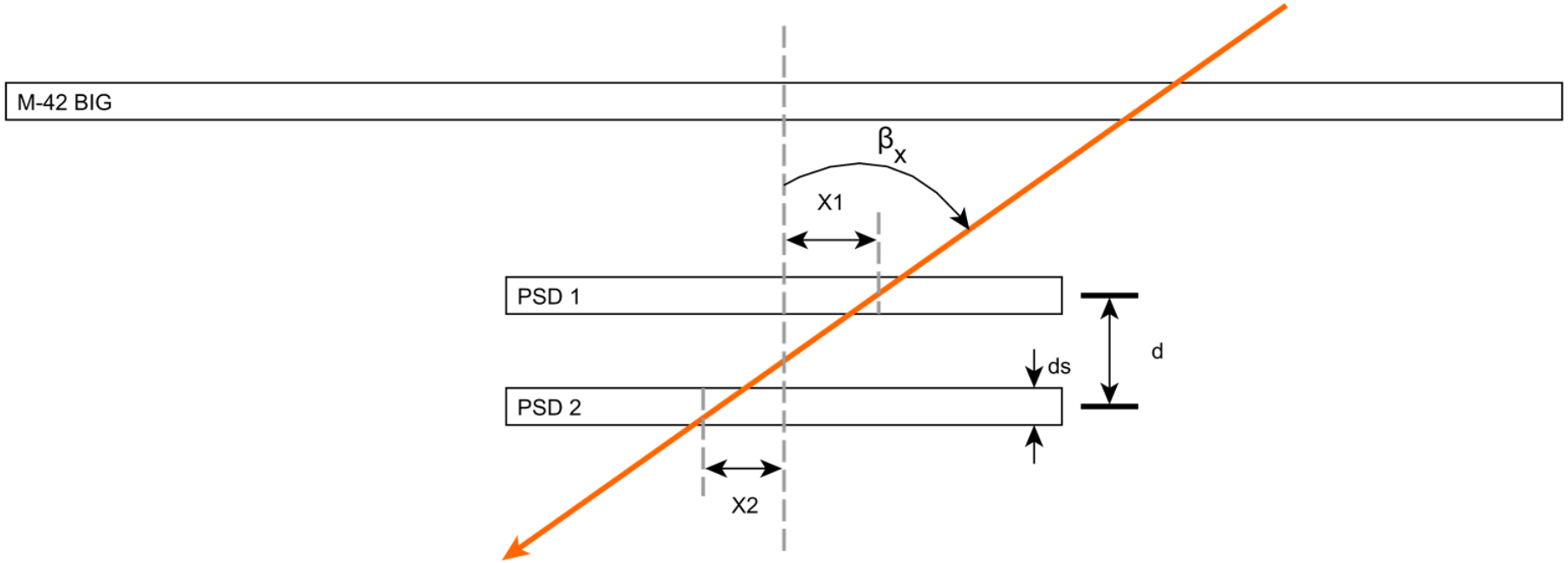
DLR M-42 Detector Family

M-42 CUBE



	M-42 CUBE
LET Range (in H2O)	10 – 260 keV/µm
Sensor thickness	320 µm 2 x 300 µm
Geometric Factor	2.07 cm²sr
Power Consumption	~ 850 mW

M-42 CUBE: Principle



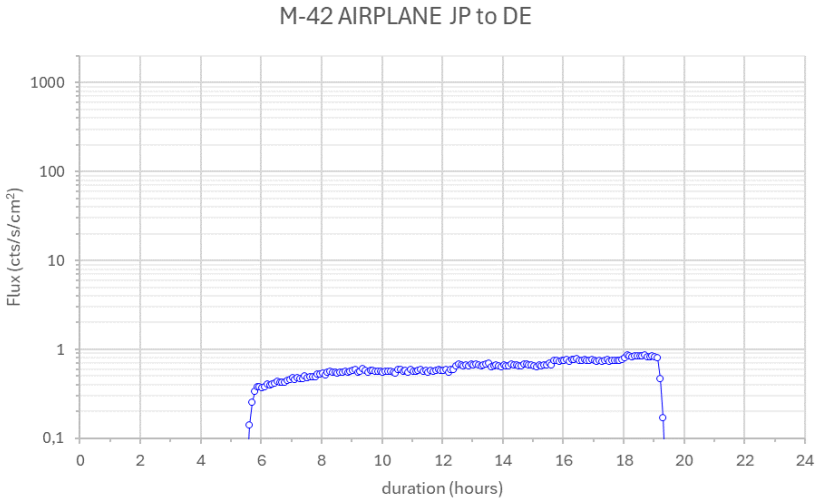
Patent: 102024135685.5

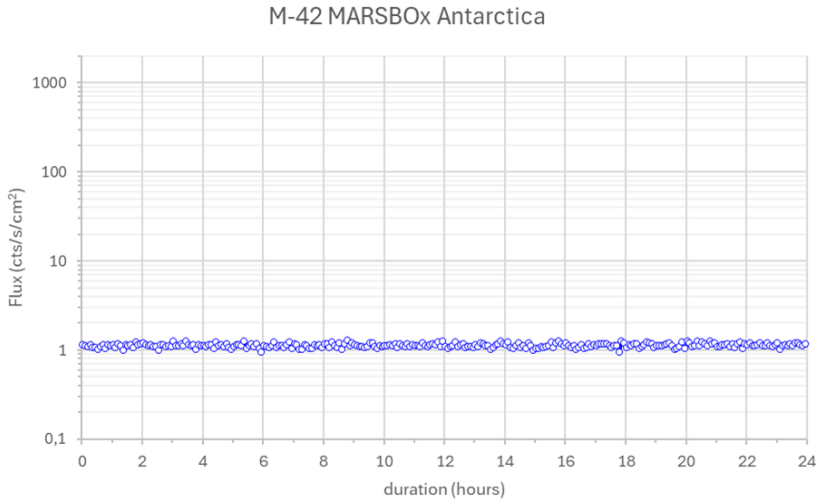
DLR M-42 DETECTOR FAMILY

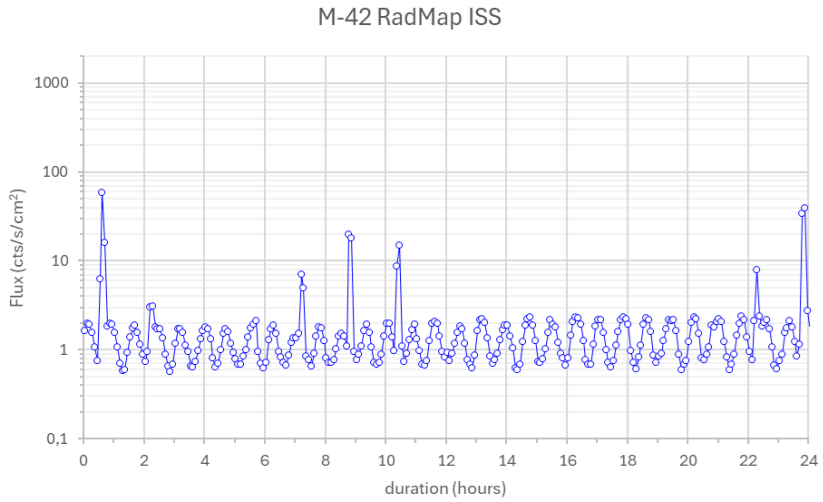
	MISSION								
M-42[1]	ISS	ARTEMIS I	ARTEMIS II	ASTROBOTIC PEREGRINE I	ATMOS I	MAPHEUS	AIRPLANE	ANTARCTICA BALLOON	HEAVY ION FACILITY
COMPACT		X[4]				X[1]	X[5]	X[6,7]	X[1]
SPLIT	X[2,3]	X[4]					X		X
ASTROBOTIC				X[a]	X				
EXTENDED			X[b]			X	X		X
BIG							X		X
DISPLAY							X		X
POCKET							X		X
POSITION							X		X
CUBE							X		X

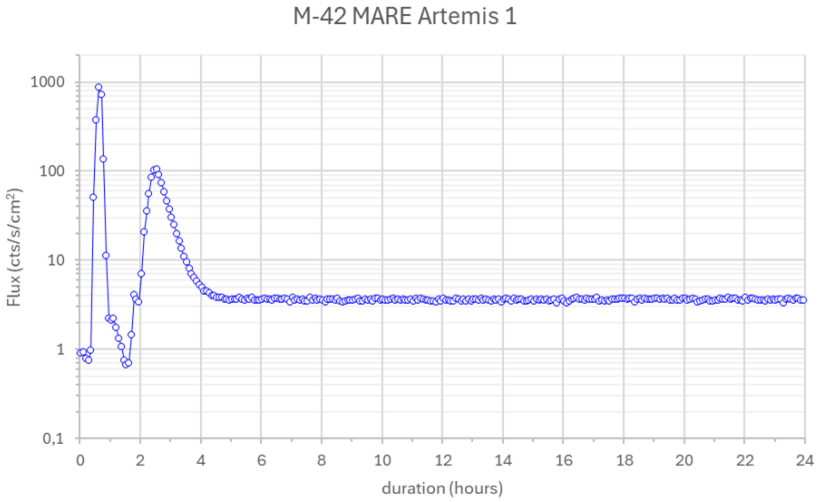
[1] *RSI* (2019) https://doi.org/10.1063/1.5122301 [2] *ICRC* (2023) https://doi.org/10.22323/1.444.0099 [3] *ICRC* (2025) https://doi.org/10.22323/1.501.0073 [4] *NATURE* (2024) https://doi.org/10.1038/s41586-024-07927-7 [5] *Sci Rep* (2023) https://doi.org/10.1038/s41598-023-36190-5 [6] *Front Microbiol* (2021) https://doi.org/10.3389/fmicb.2021.601713 [7] *ESSOAR* (2021) https://doi.org/10.1002/essoar.10506355.1 [a] https://www.dlr.de/en/latest/news/2024/m-42-radiation-detector-flies-to-the-moon [b] https://www.dlr.de/en/latest/news/2025/dlr-and-nasa-continue-joint-space-radiation-research-with-dlr-radiation-detector

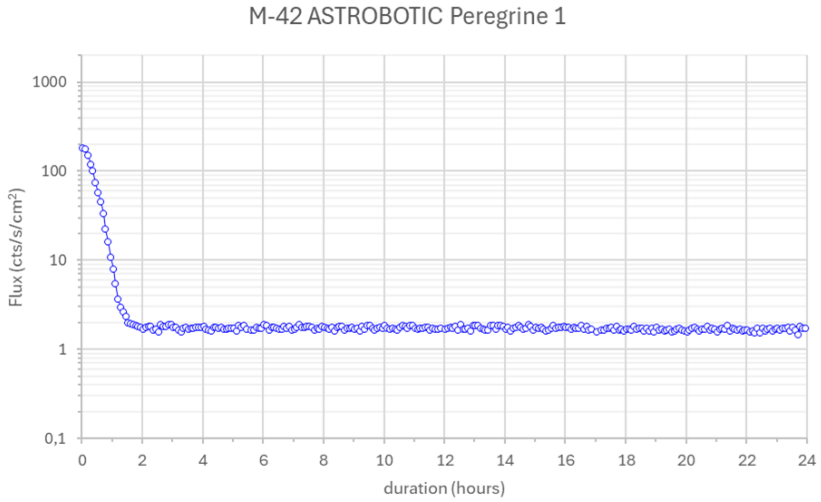
M-42 Family: Different Missions

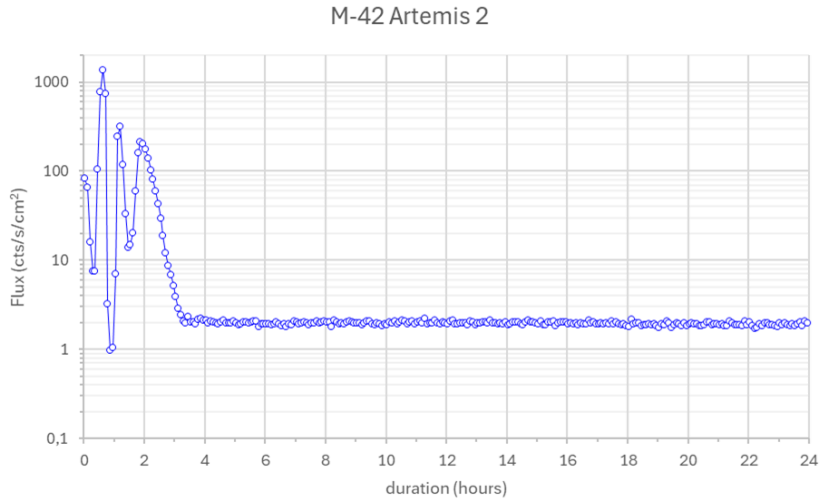












Imprint

Topic:	**DLR M-42 instrument family and future missions** WRMISS 29, Prague, Czech Republic
Date:	2026-09-10
DLR-Team:	Thomas Berger, Bartos Przybyla, Joachim Aeckerlein, Karel Marsalek, Moritz Kasemann*, Markus Rohde, Daniel Matthiä, Aleksandra Rutczynska, Maximilian Radenhäuser
Institutes:	DLR-ME

Image sources: © DLR (unless otherwise noted)

Additional sources

[1]: M. Kasemann, Untersuchung zur Umsetzung und Kalibrierung eines LinearEnergy-Transfer-Spektrometers unter Verwendung von Position Sensitive Diodes, Sankt Augustin: Hochschule Bonn-Rhein-Sieg, 2023.

[2]: Hamamatsu Photonics, "data sheet Photodiode S14537-320," 12 2024. [Online]. Available: https://www.hamamatsu.com/content/dam/hamamatsu-photonics/sites/documents/99_SALES_LIBRARY/ssd/s14536_series_etc_kpin1090e.pdf [Accessed 19 8 2026].