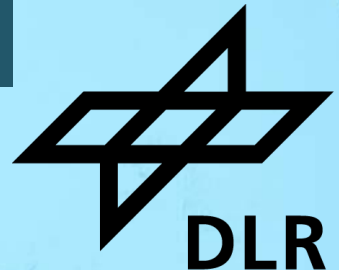


UPDATE ON THE M-42 INSTRUMENT FAMILY AND FUTURE MISSIONS

DLR M-42 Team

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

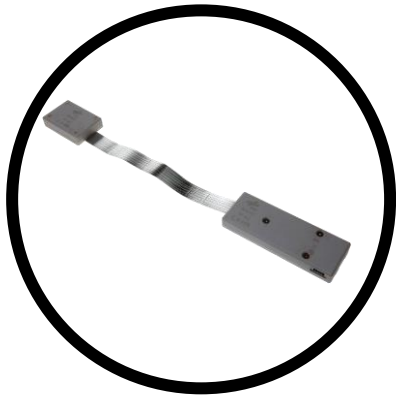
NOTE: All data preliminary and confidential



DLR M-42 Detector Family



M-42 Compact



M-42 Split



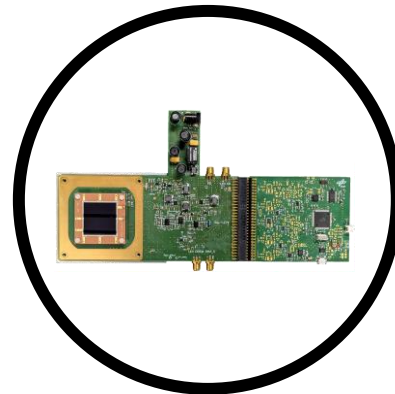
M-42 Display



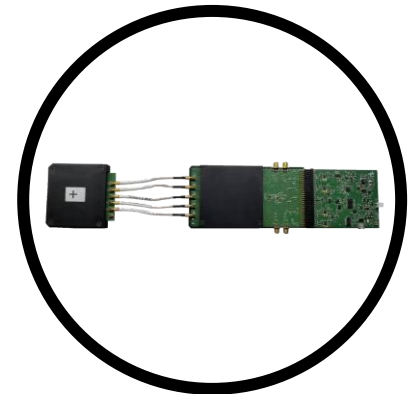
M-42 EXTended



M-42 Pocket



M-42 BIG



M-42 Position

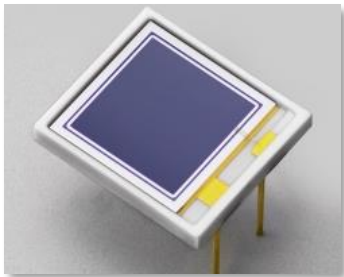
DLR M-42 Detector Family



M-42 Compact

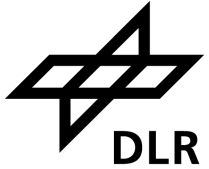


M-42 Split



	M-42 Compact/Split
Energy Range (in Si)	0.06 - 20 MeV
Sensor thickness	300 μm
Sensitive Area	1.22 cm^2
Power Consumption	10.44 mW

DLR M-42 Detector Family



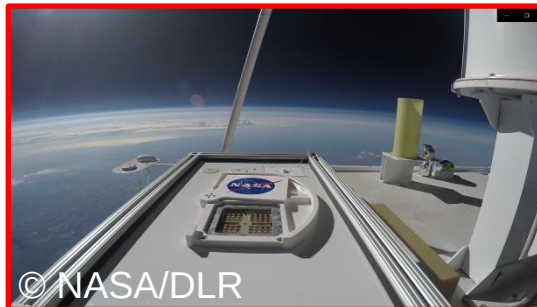
M-42 Compact

M-42 Split

RadMap (DLR M-42)

MARSBOx: Losekamm et al. (2023)

<https://doi.org/10.22323/1.444.0099>



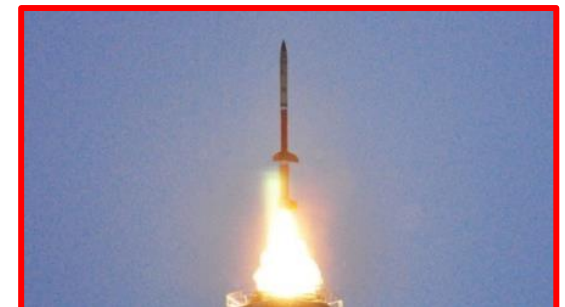
MARSBOx: Berger et al. (2021)

<https://doi.org/10.1002/essoar.10506355.1>



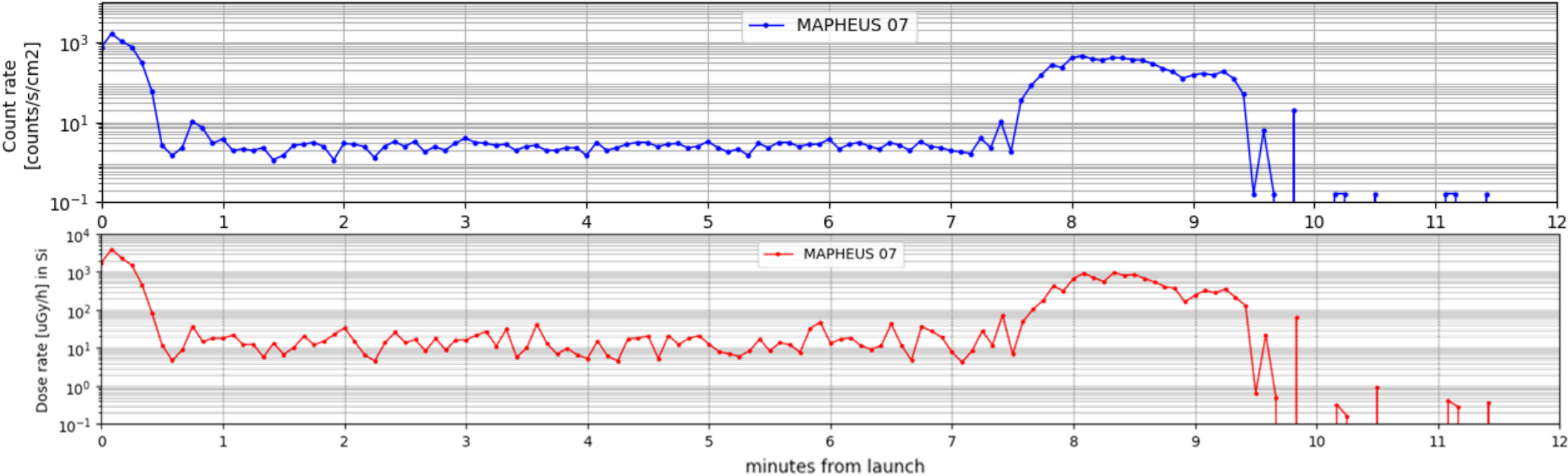
ARTEMIS I: George et al. Nature 634, 48-52

(2024) <https://doi.org/10.1038/s41586-024-07927-7>



MAPHEUS

DLR M-42 Detector Family



M-42 Compact

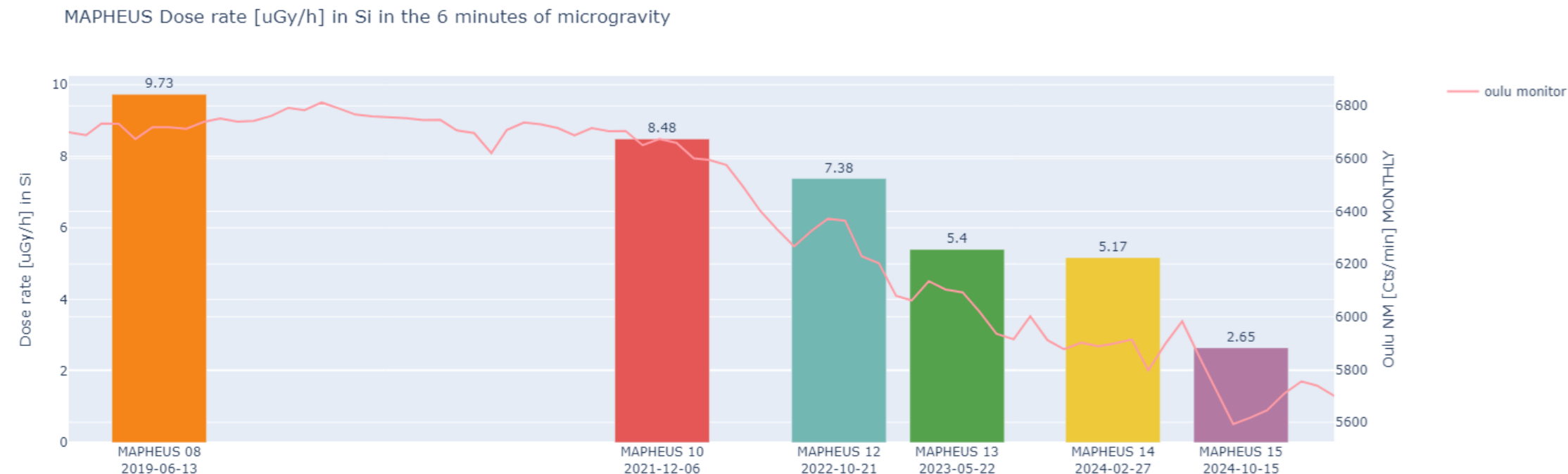


M-42 Split



MAPHEUS

DLR M-42 Detector Family



M-42 Compact



M-42 Split

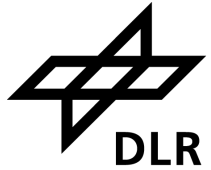


MAPHEUS

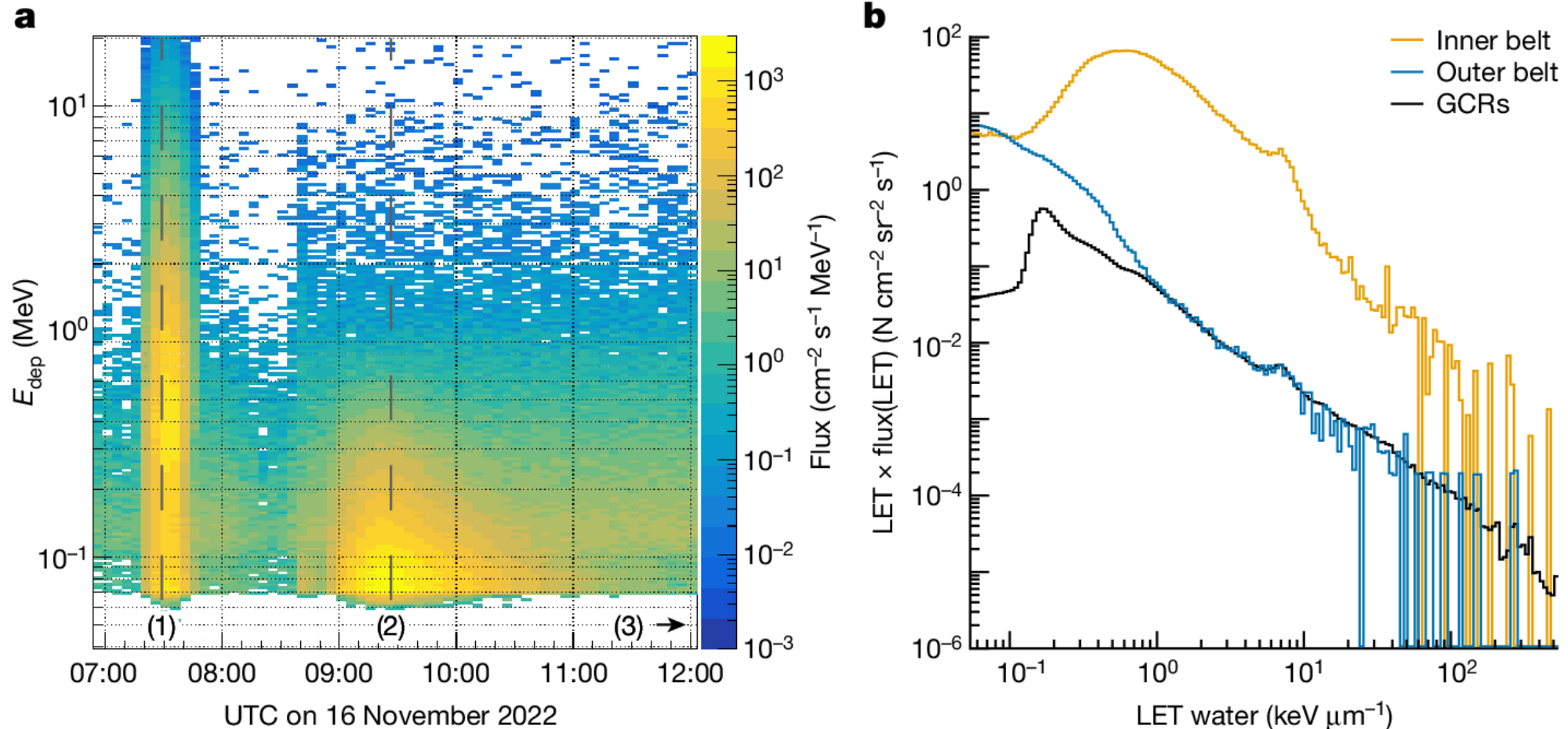
Artemis I



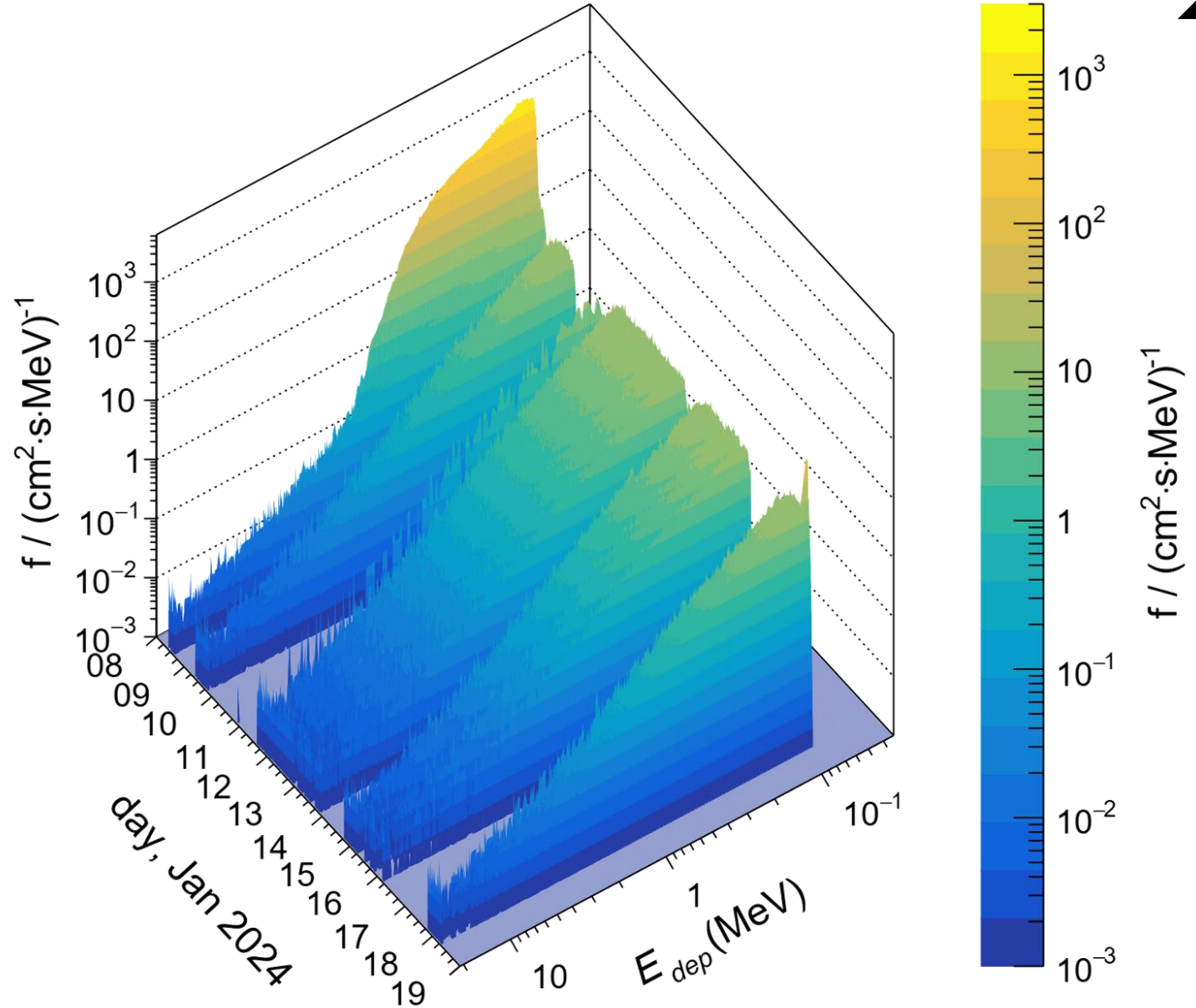
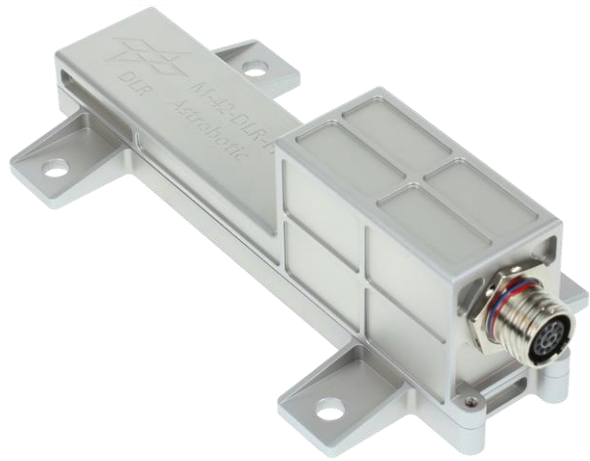
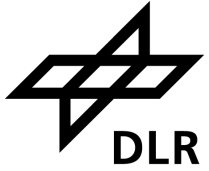
Stuart P. George, et al. (2024) *Space radiation measurements during the Artemis I lunar mission*. *Nature* **634**, 48–52 (2024) <https://doi.org/10.1038/s41586-024-07927-7>



a, Energy deposition (E_{dep} , in $\text{F cm}^{-2} \text{s}^{-1} \text{MeV}^{-1}$) spectra measured by M-42 SN126 for the inner (1) and outer (2) belt passes and for the subsequent free-space GCR environment (3). The inner-belt spectra peak at approximately 350 keV energy deposition in Si owing to the dominant proton contribution, whereas the peak for the outer belt is at roughly 70 keV in Si owing to the dominant electron (X-ray) contribution. b, LET spectra (in water) for the three flight phases inner belt, outer belt and GCRs, as shown in a from the HERA HSU2 instrument. The LET spectra are shown as a lethargy-style representation to preserve the area-normalization feature of the histogram across the logarithmic x axis.

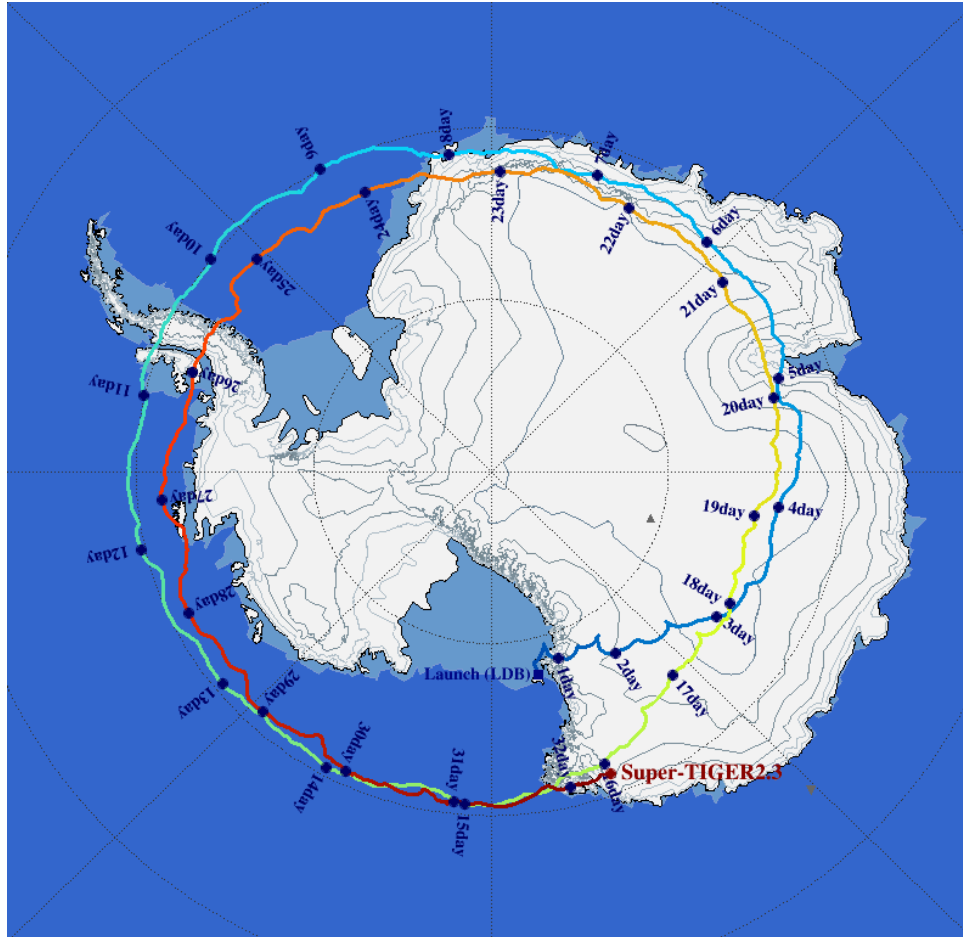


Astrobotic

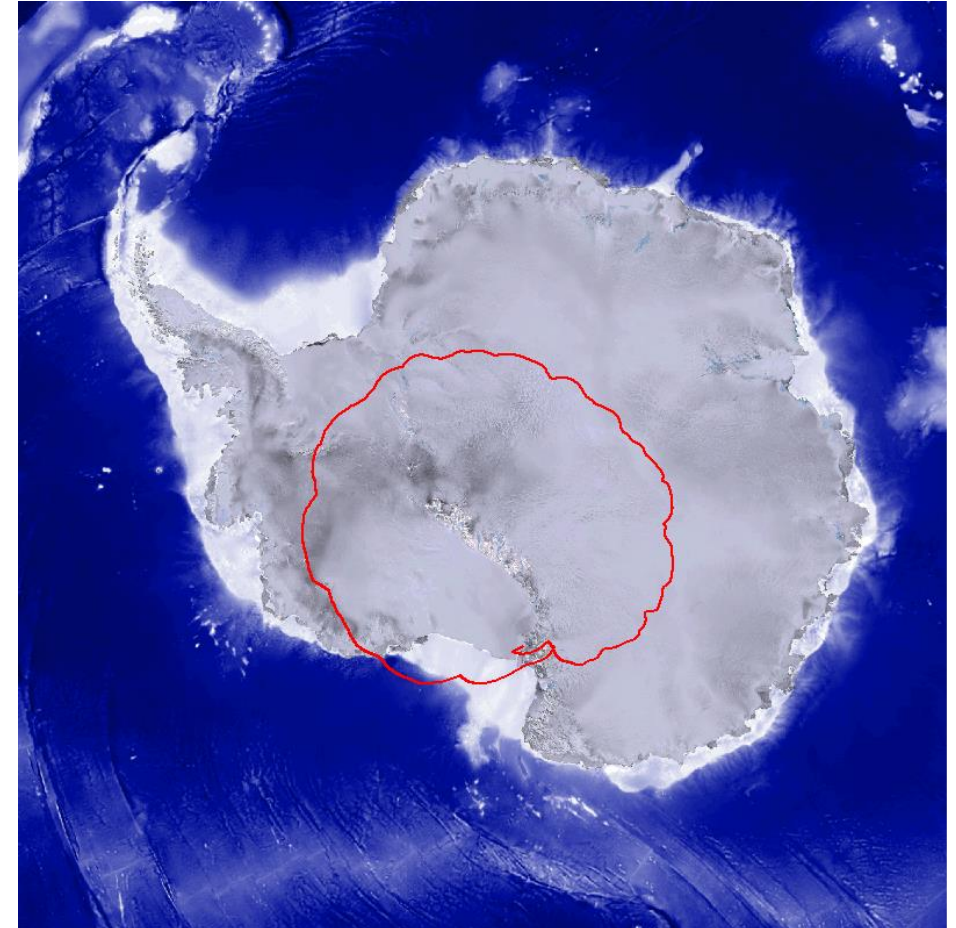


Antarctica

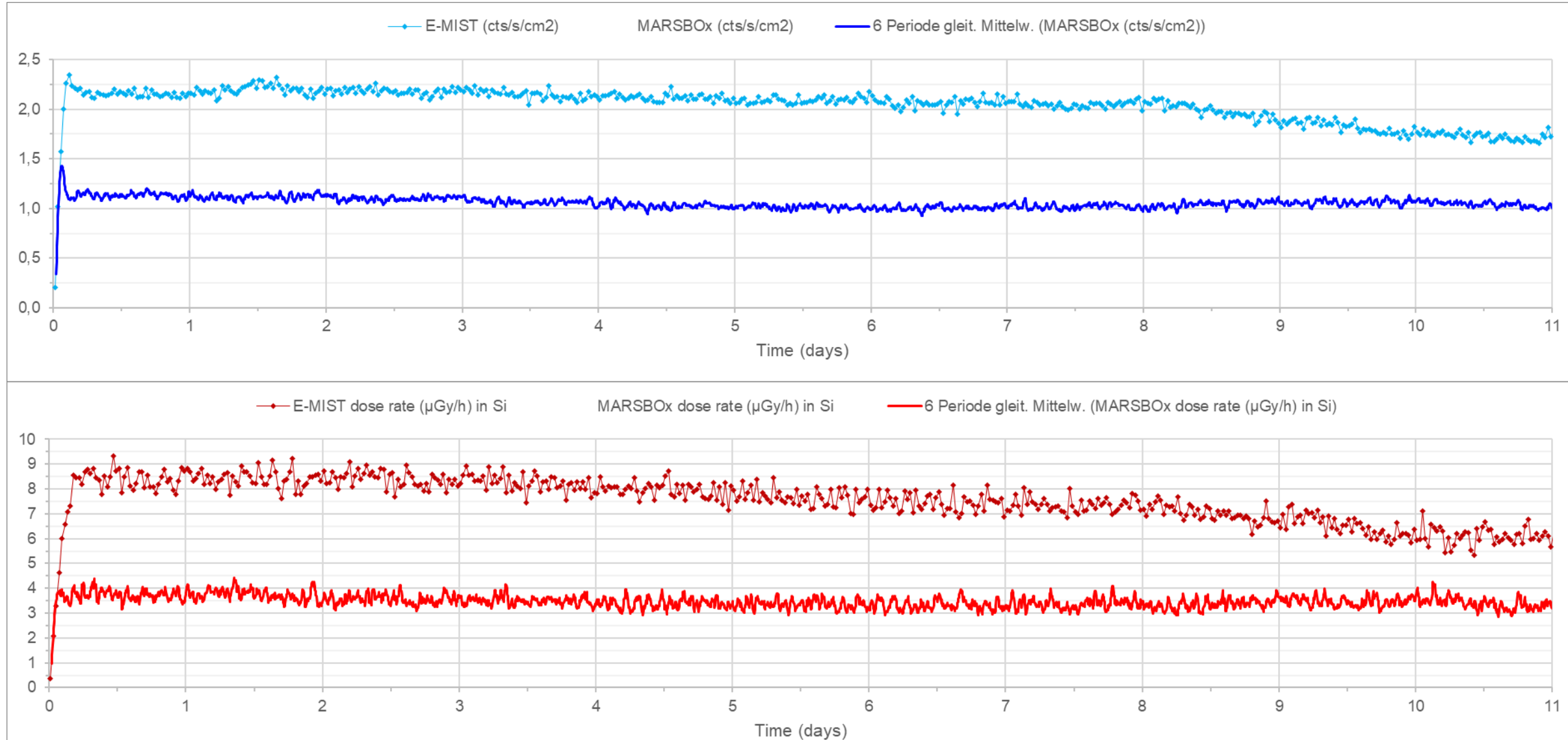
E-MIST end of 2019



MARSBOX end of 2024



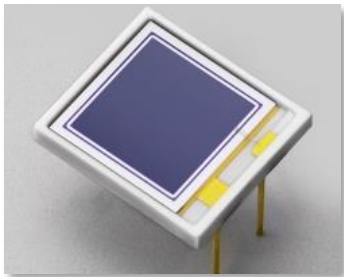
Antarctica (end of 2019 E-MIST / end of 2024 MARSBOX)



DLR M-42 Detector Family



M-42 Display

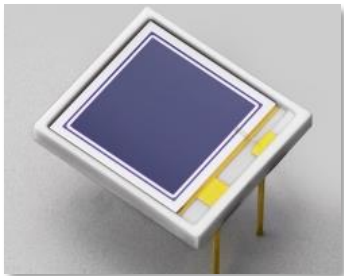


	M-42 Compact	M-42 Display
Energy Range (in Si)	0.06 - 20 MeV	0.06 - 43 MeV
Sensor thickness	300 μm	
Sensitive Area	1.22 cm^2	
Power Consumption	11 mW	36 mW

DLR M-42 Detector Family



M-42 EXTended

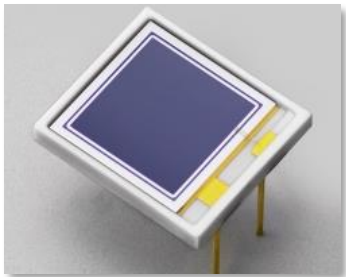
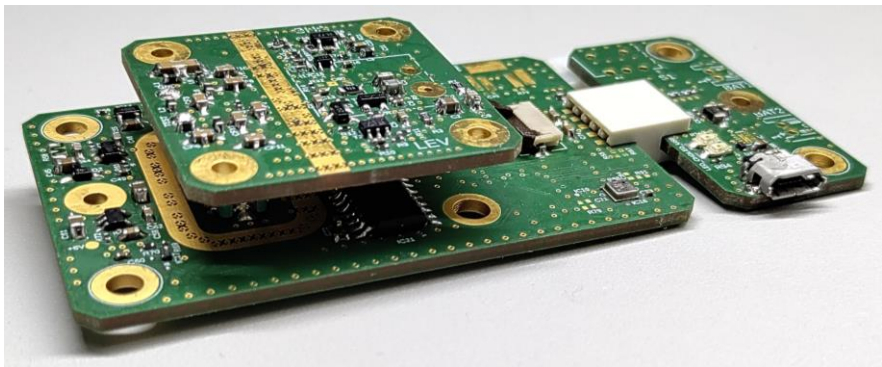
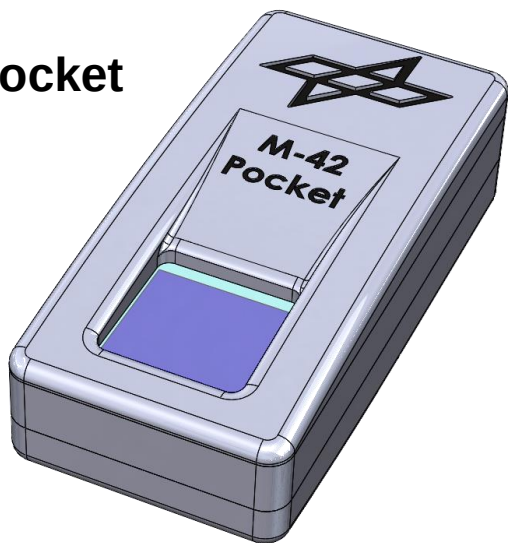


	M-42 Compact	M-42 EXT
Energy Range (in Si)	0.06 - 20 MeV	0.06 - 135 MeV
Sensor thickness	300 μm	
Sensitive Area	1.22 cm^2	
Power Consumption	11 mW	11 mW

DLR M-42 Detector Family



M-42 Pocket

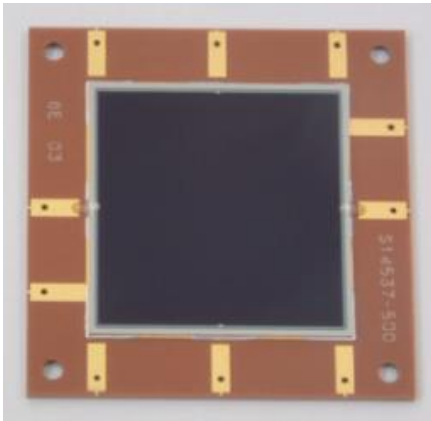
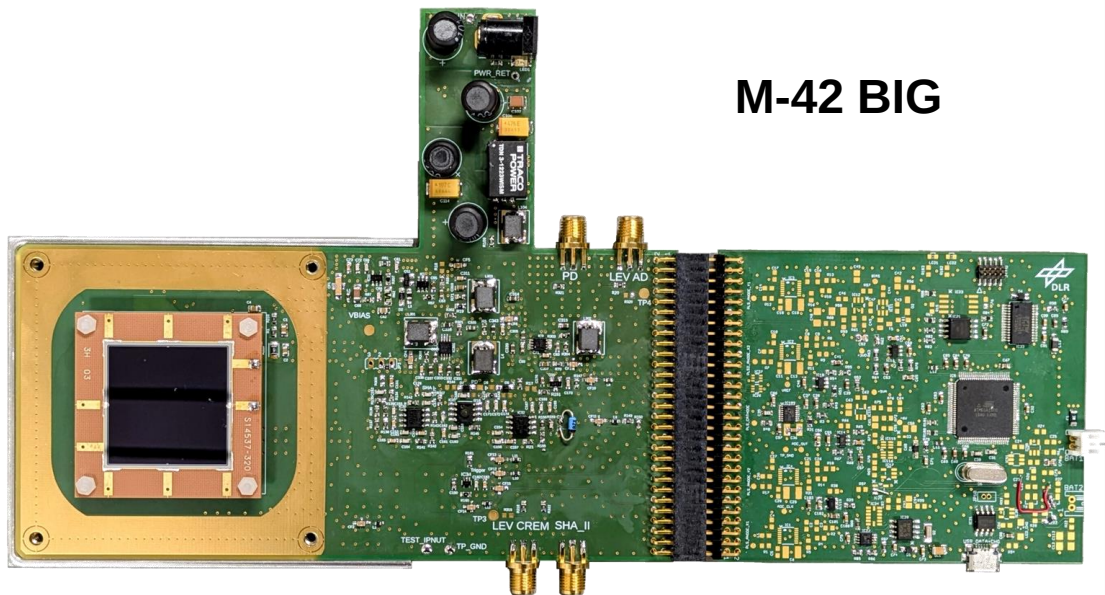


	M-42 EXT	M-42 Pocket
Energy Range (in Si)	0.06 - 135 MeV	
Sensor thickness	300 μm	
Sensitive Area	1.22 cm^2	
Power Consumption	11 mW	???

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 cm^2	7.84 cm^2
Power Consumption	11 mW	500 mW

DLR M-42 BIG Measurements @ HIMAC

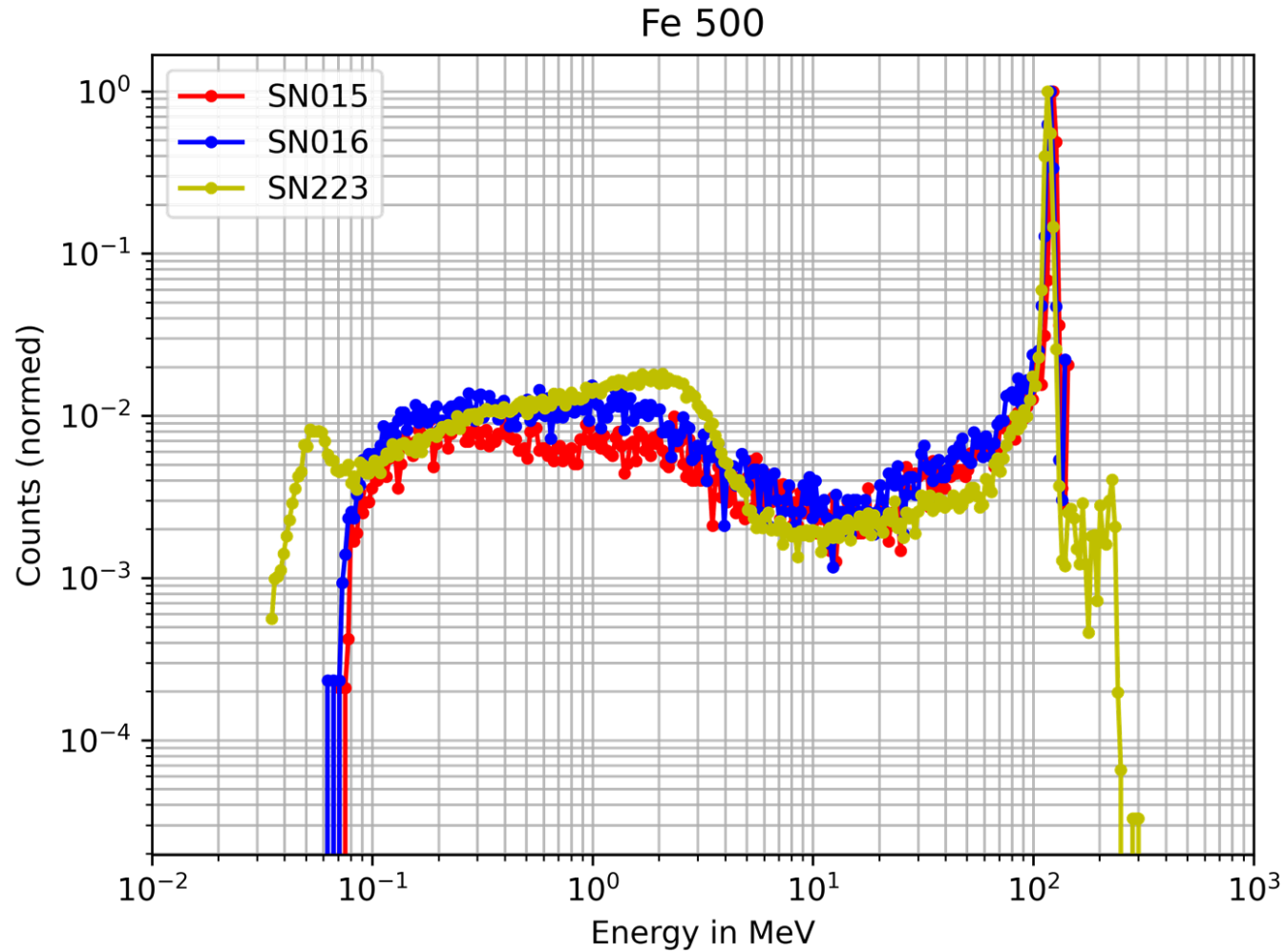
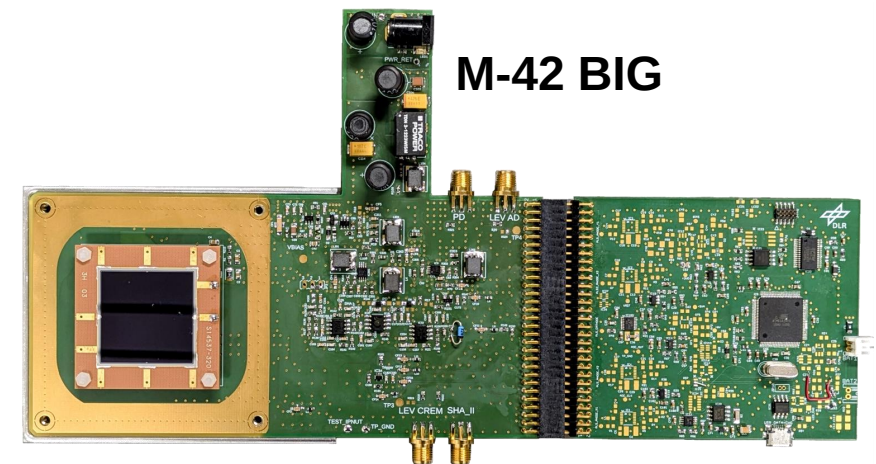


Figure: 500 MeV/n Iron @ HIMAC



DLR M-42 BIG Measurements @ HIMAC

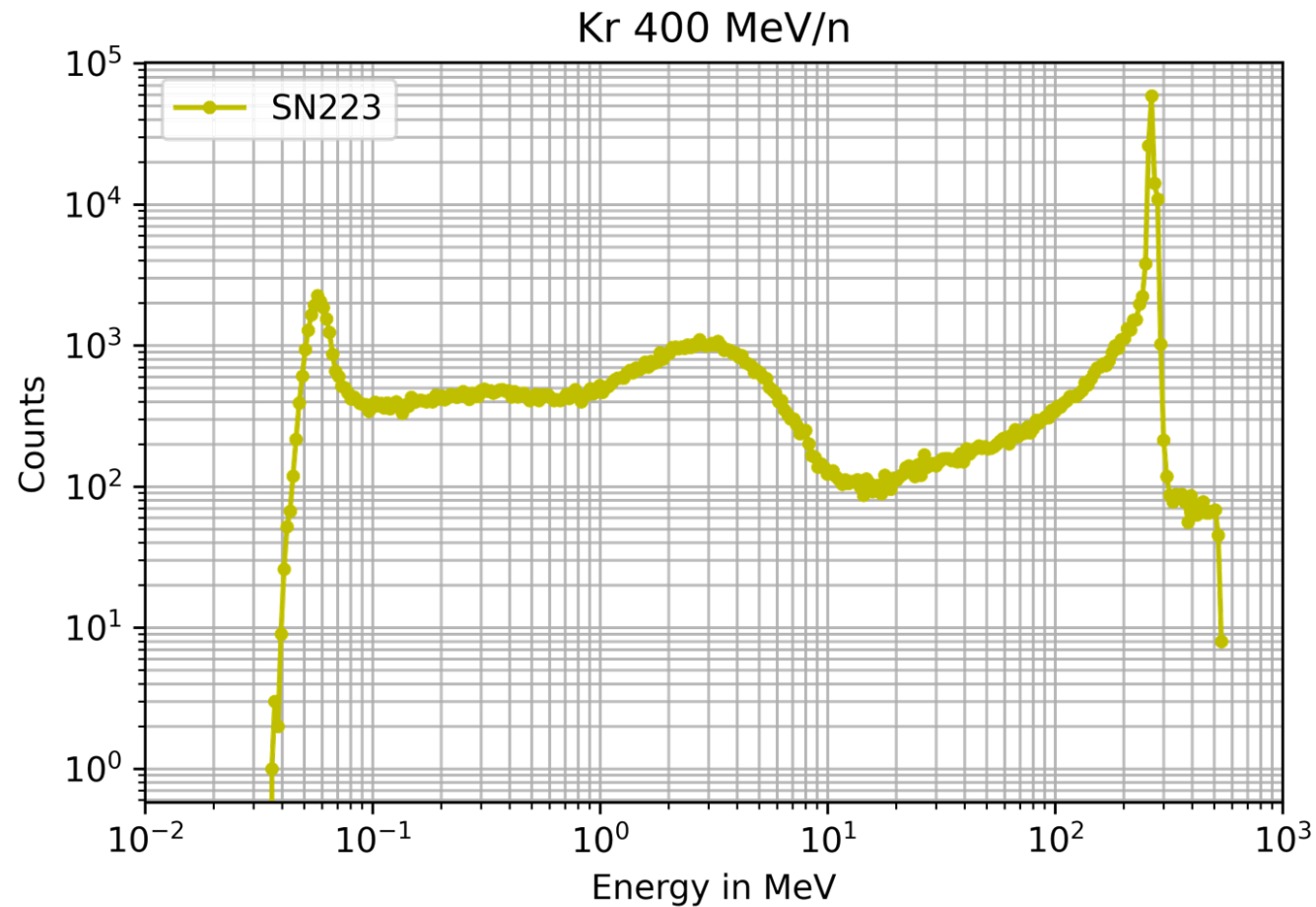
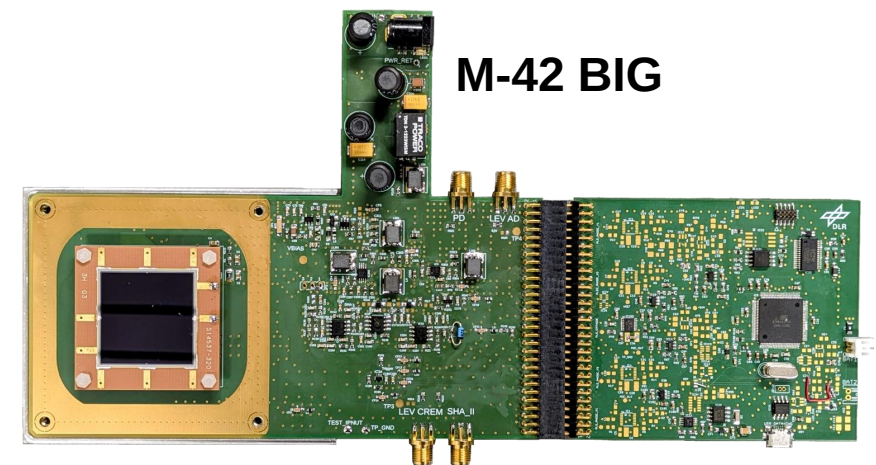


Figure: 400 MeV/n Krypton @ HIMAC



DLR M-42 BIG Measurements @ HIMAC

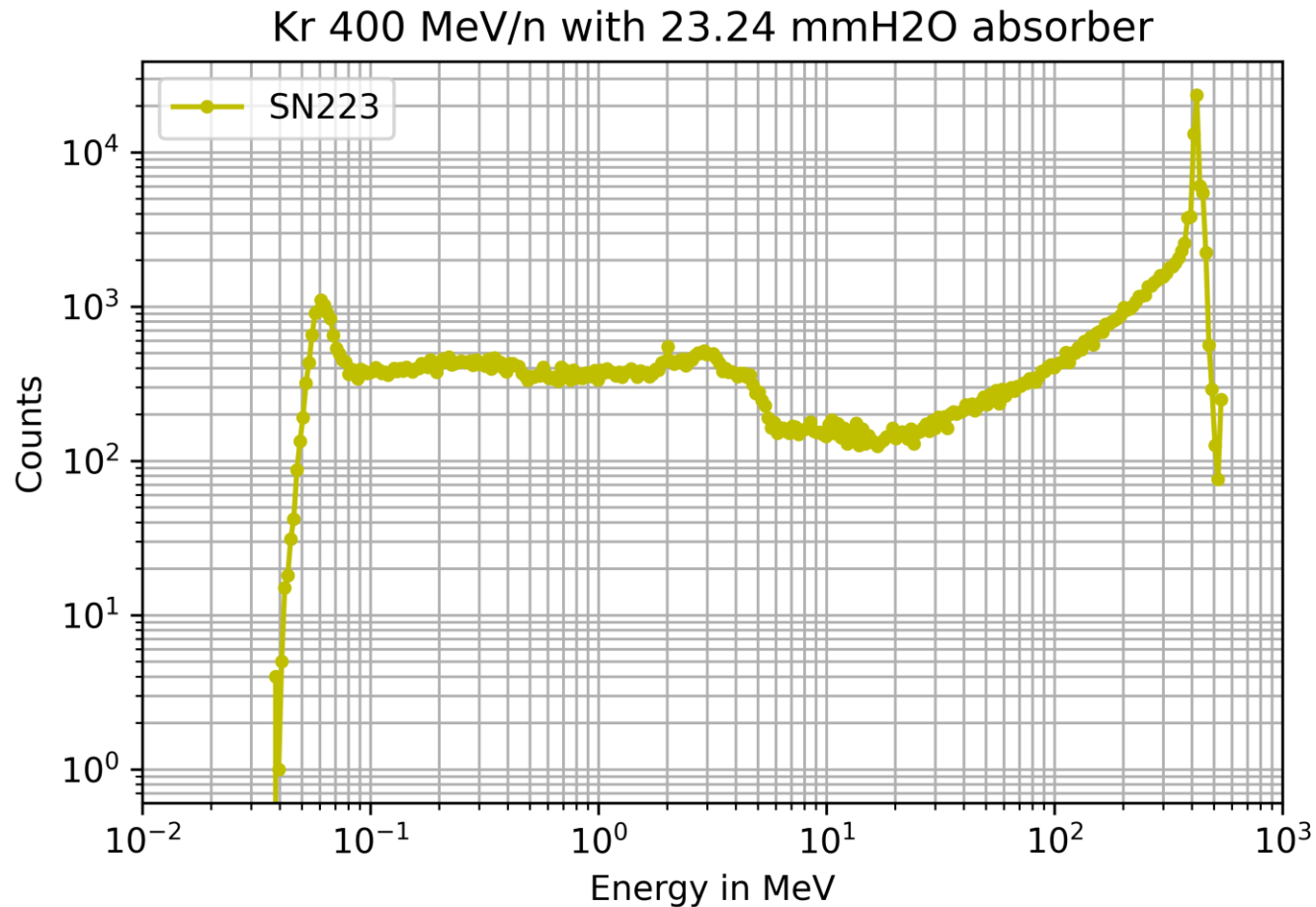
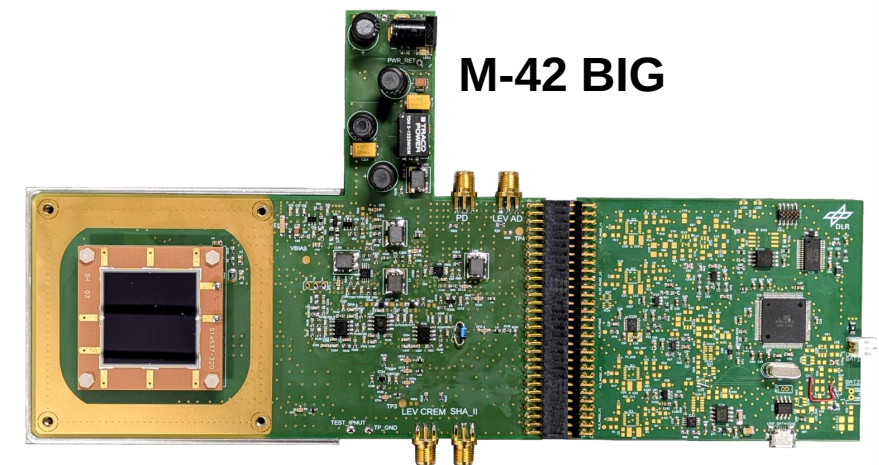


Figure: 400 MeV/n Krypton with 23.24 mmH₂O absorber @ HIMAC



DLR M-42 BIG Measurements @ PSI

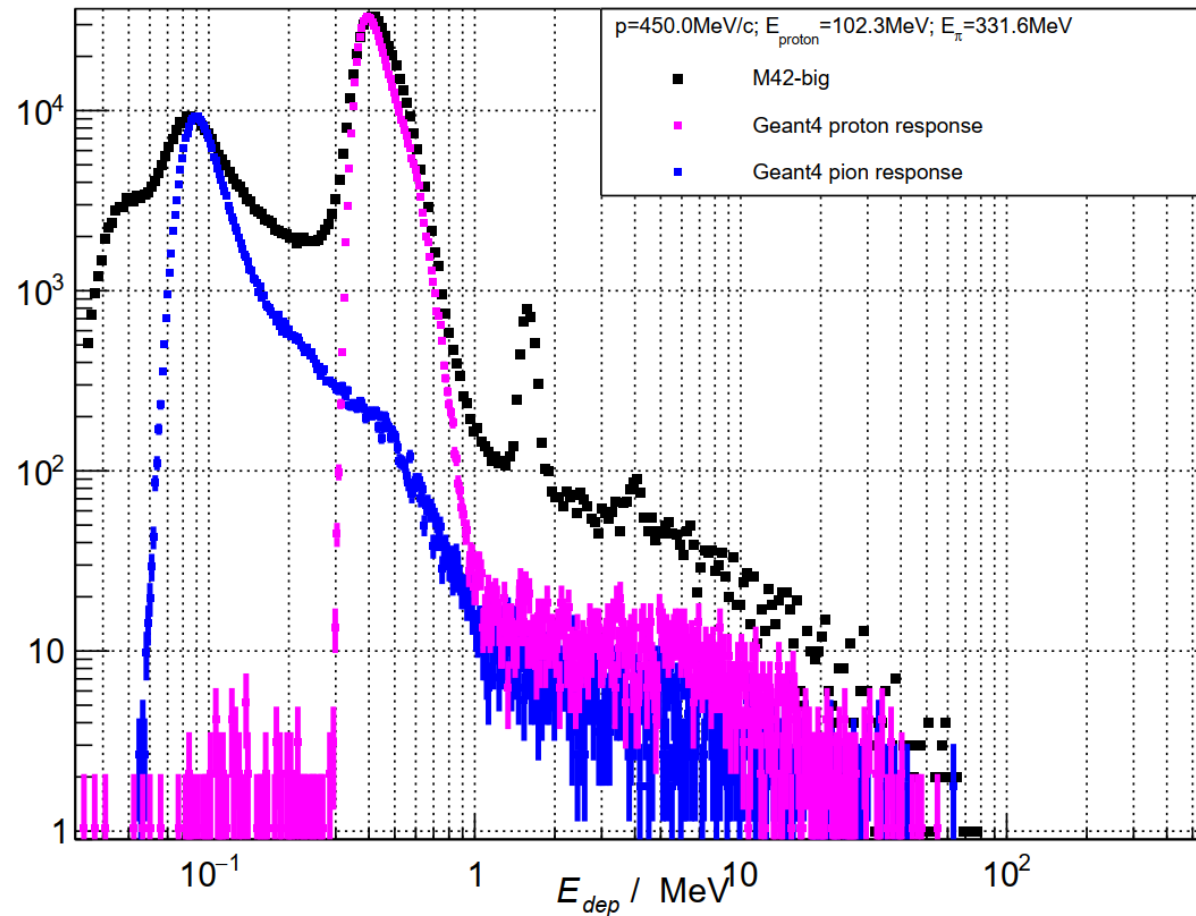
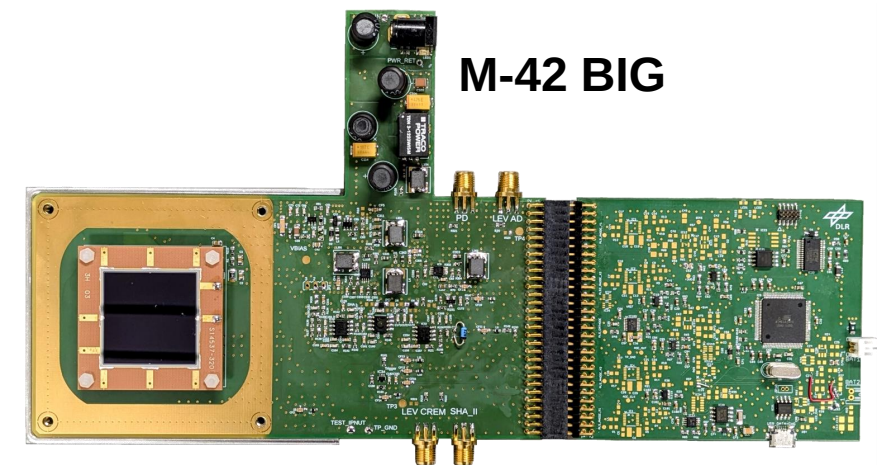


Figure: 450 MeV/c Protons and Pions @ PSI



DLR M-42 BIG Measurements @ PSI

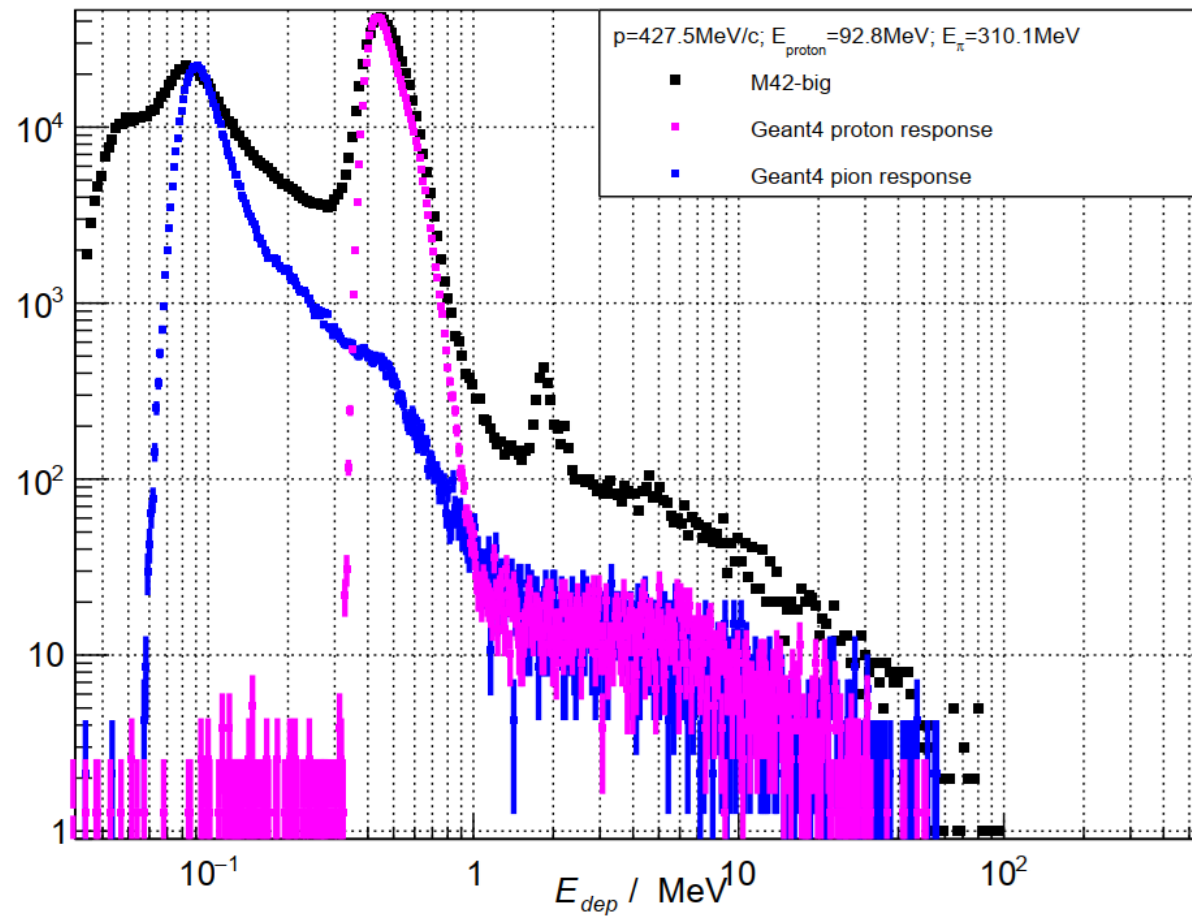
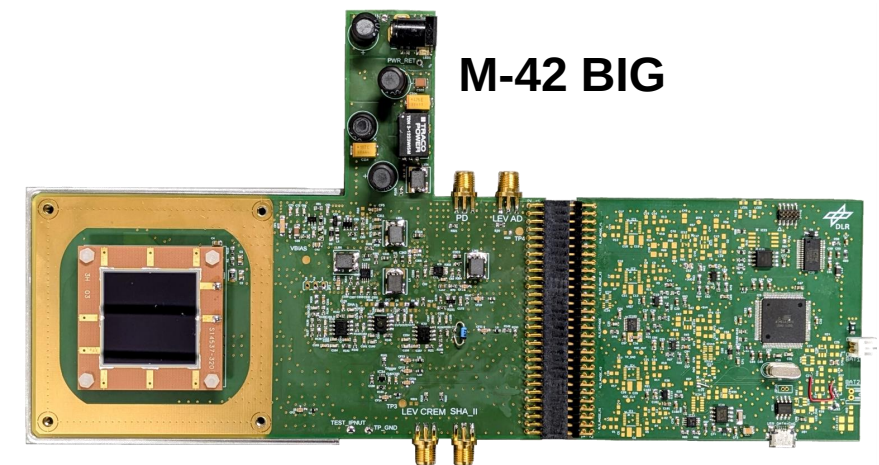


Figure: 428 MeV/c Protons and Pions @ PSI



DLR M-42 BIG Measurements @ PSI

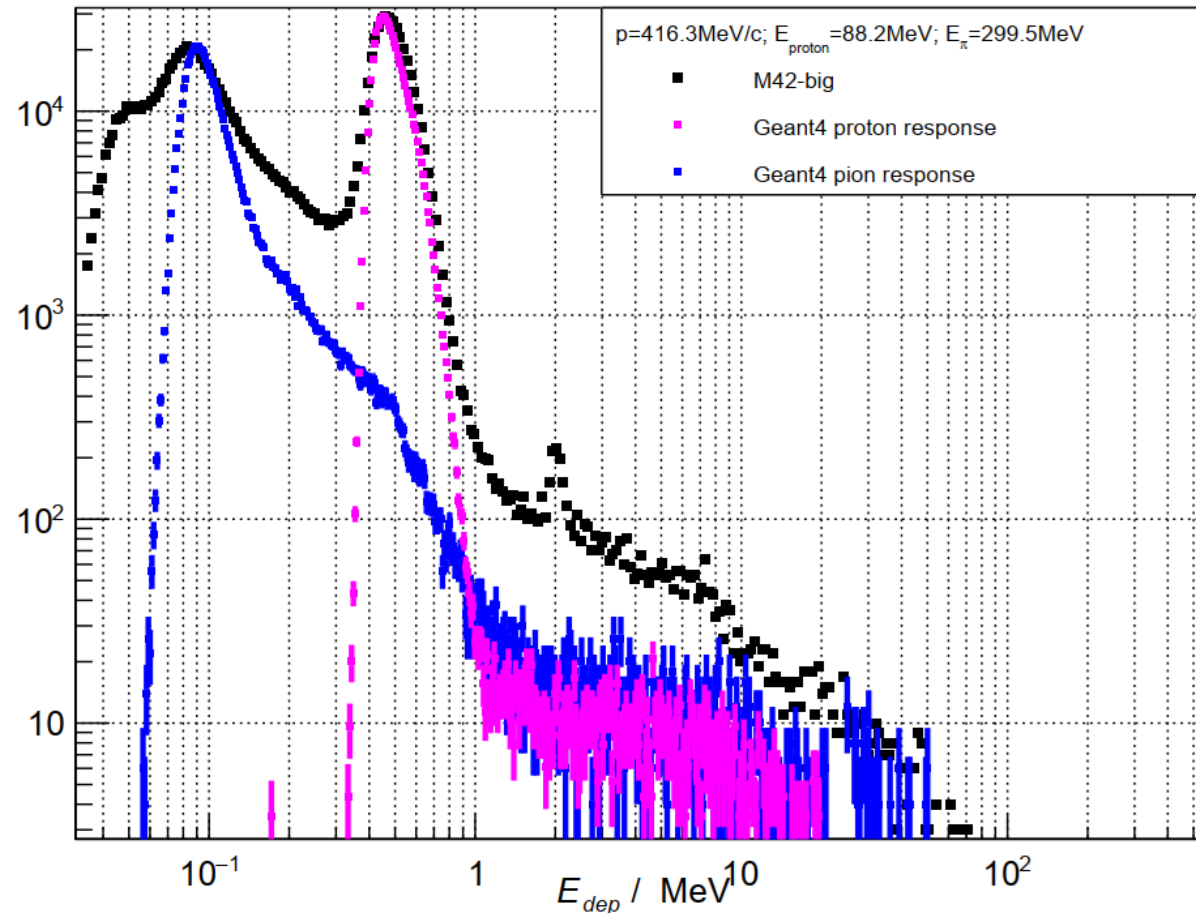
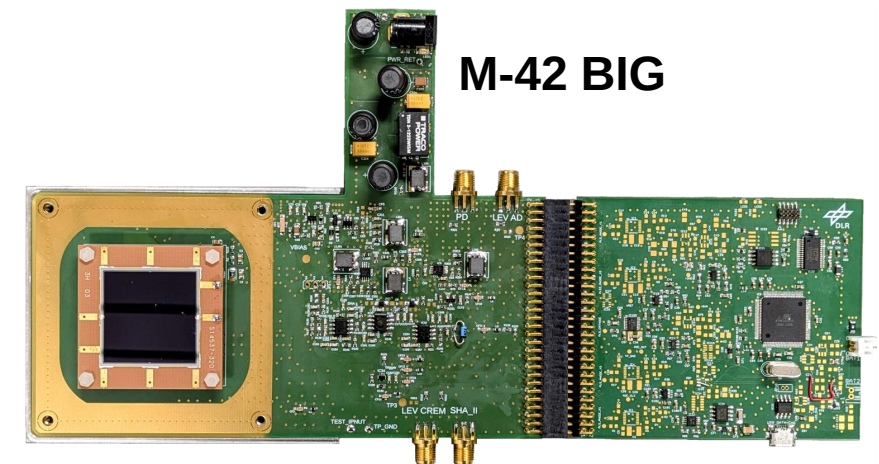


Figure: 416 MeV/c Protons and Pions @ PSI



DLR M-42 BIG Measurements @ PSI

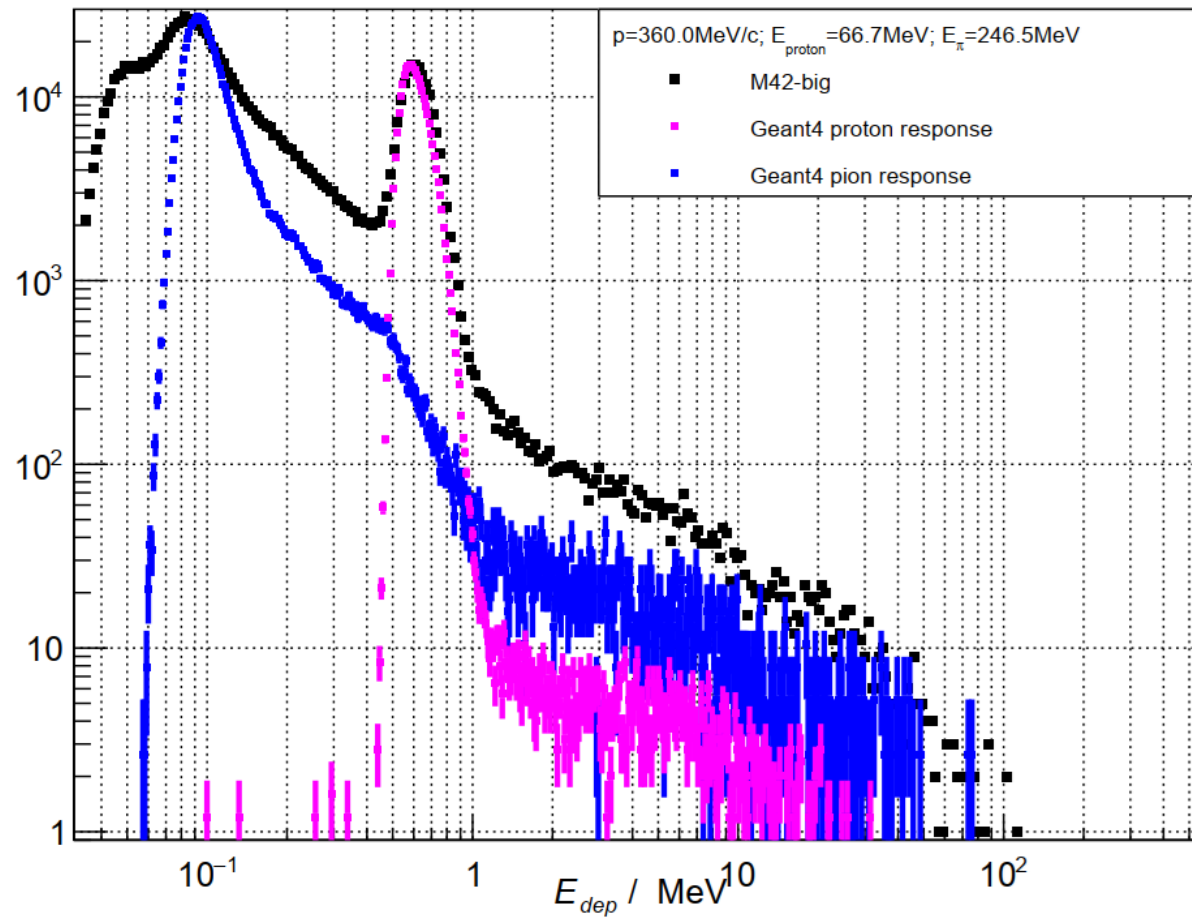
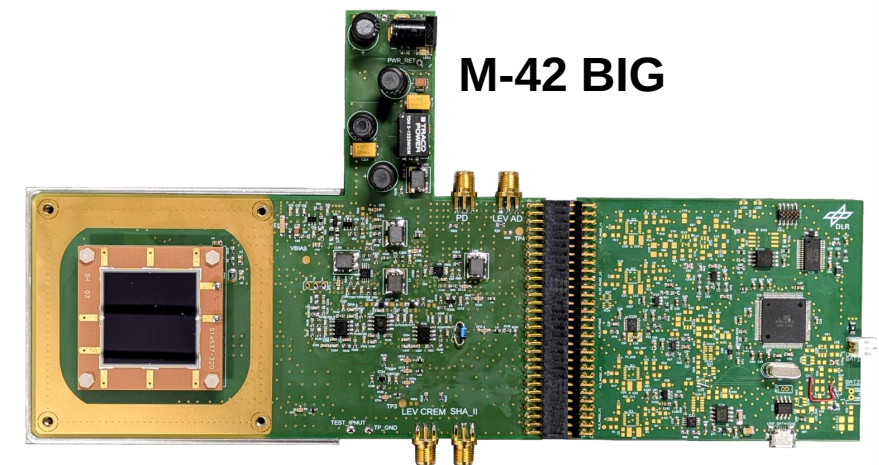


Figure: 360 MeV/c Protons and Pions @ PSI



DLR M-42 BIG Measurements @ PSI

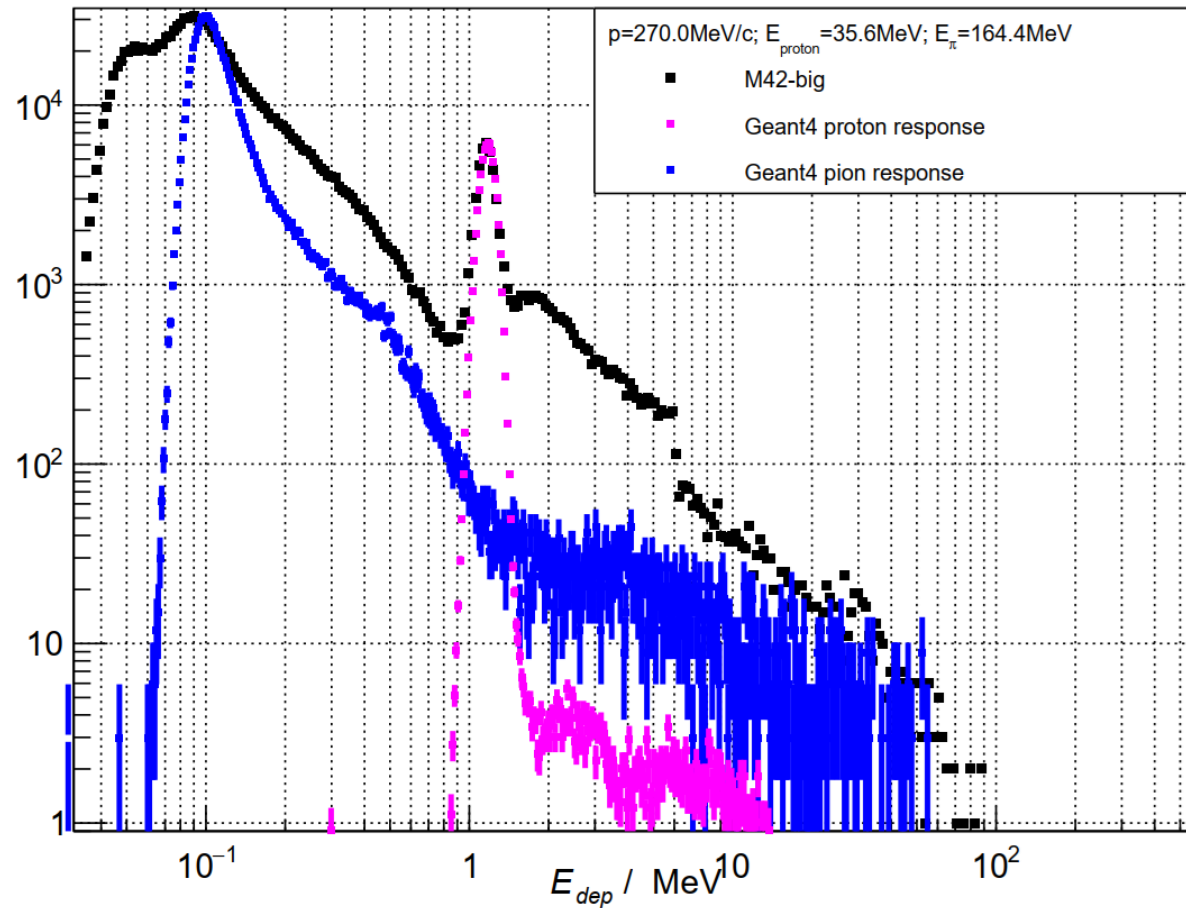
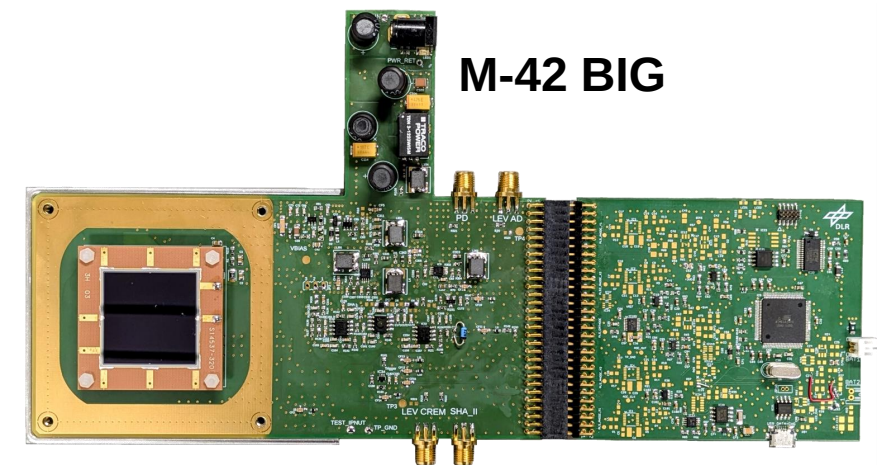


Figure: 270 MeV/c Protons and Pions @ PSI



DLR M-42 BIG Measurements @ GSI

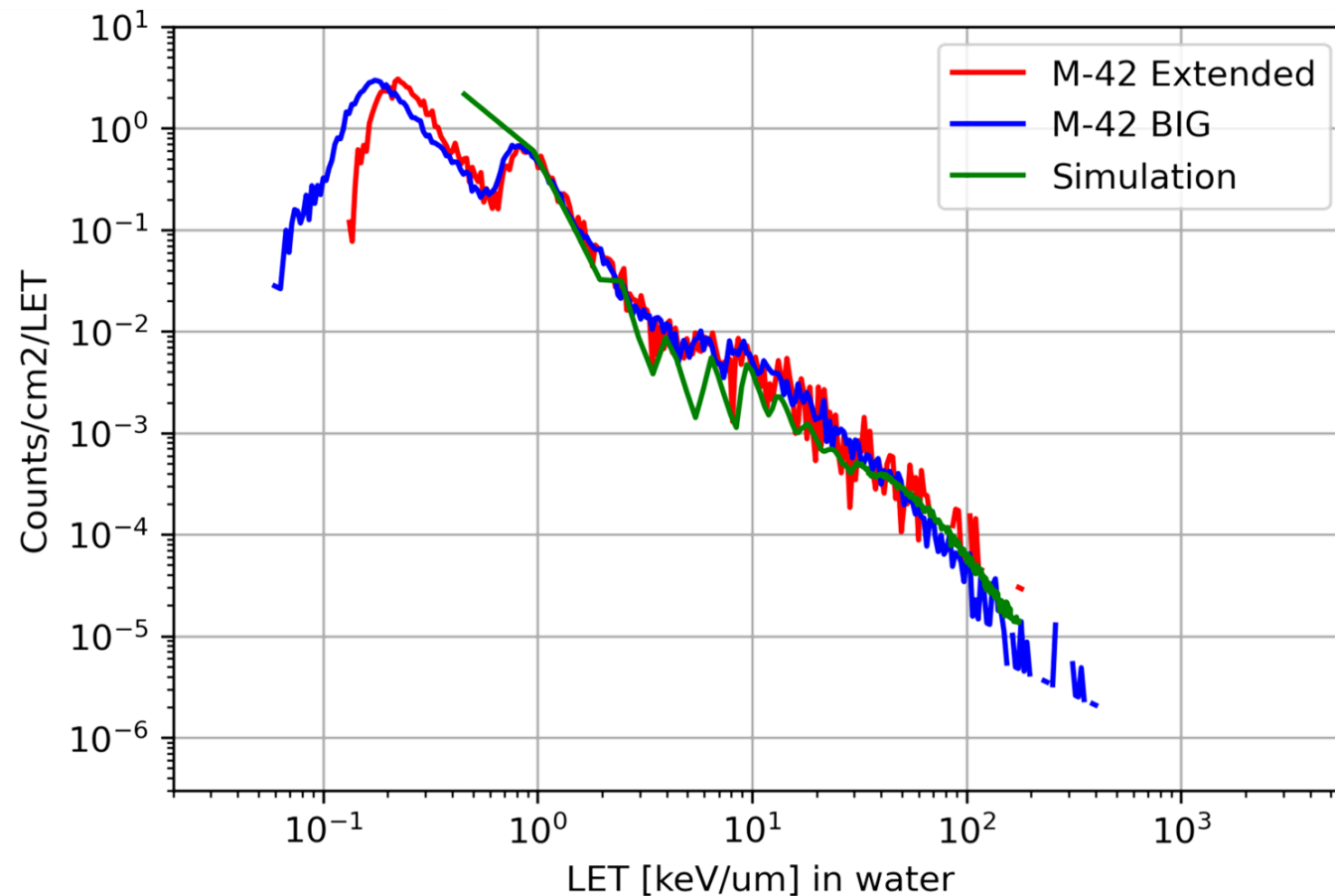
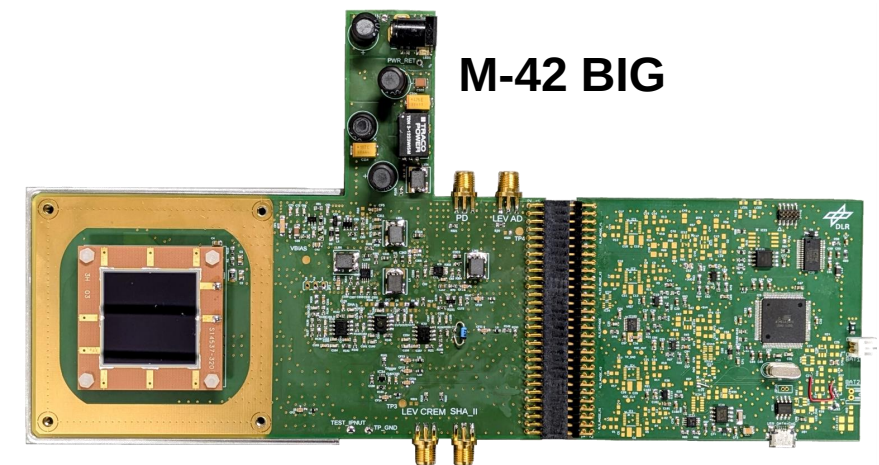


Figure: Data from one irradiation geometry of the GCR-Simulator @ GSI



DLR M-42 BIG Measurements @ GSI

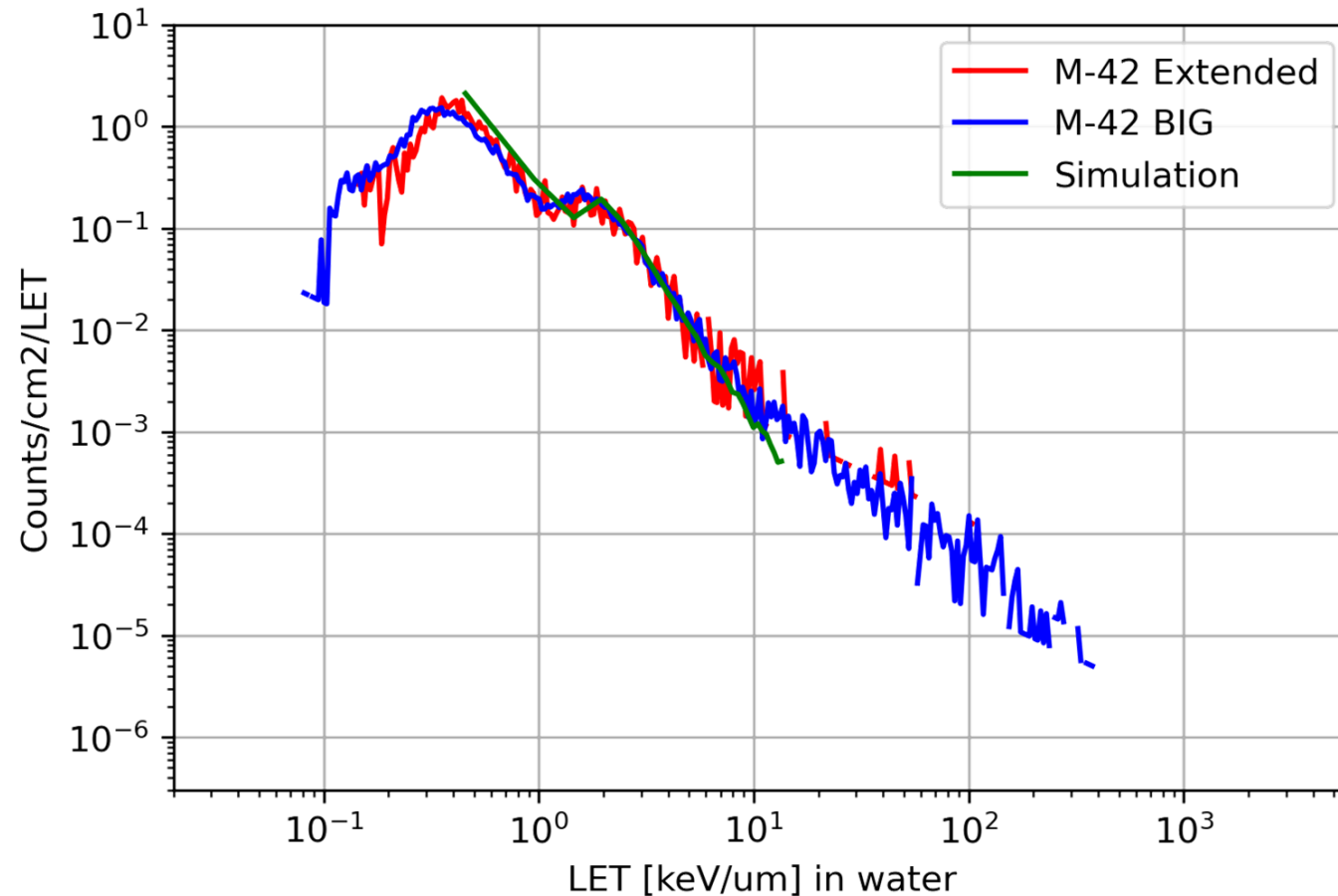
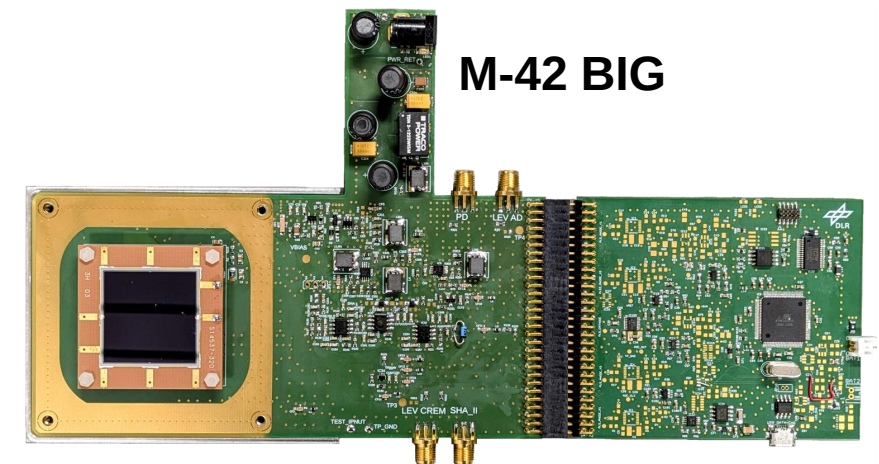
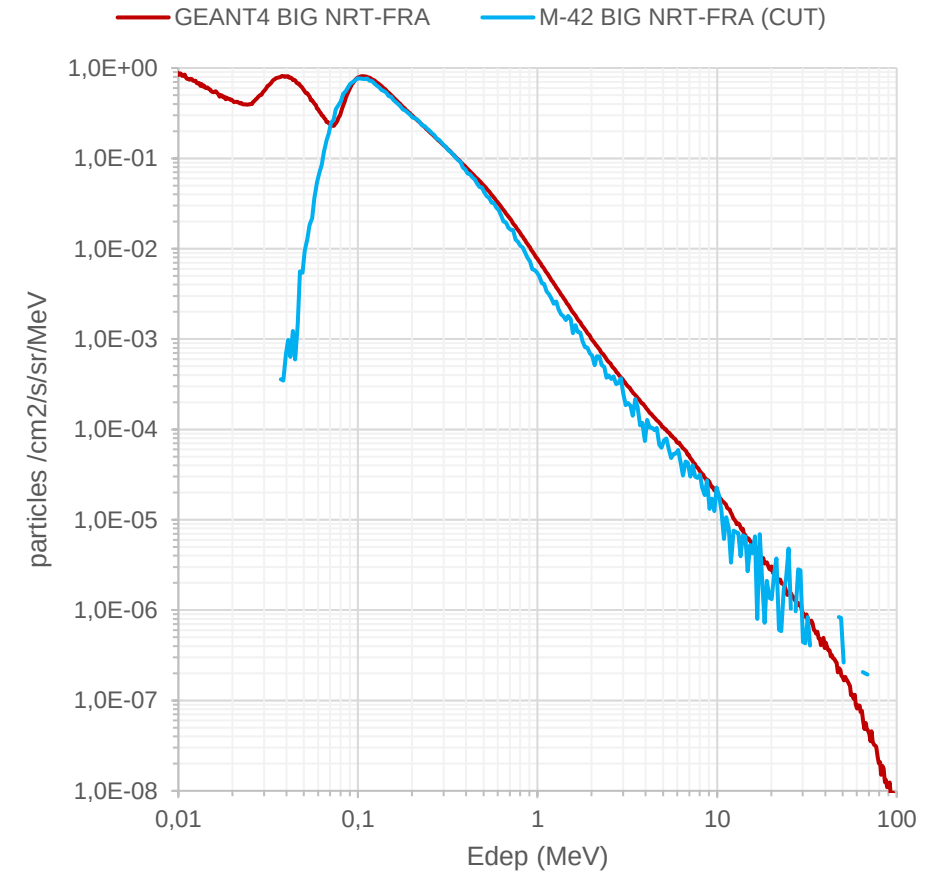
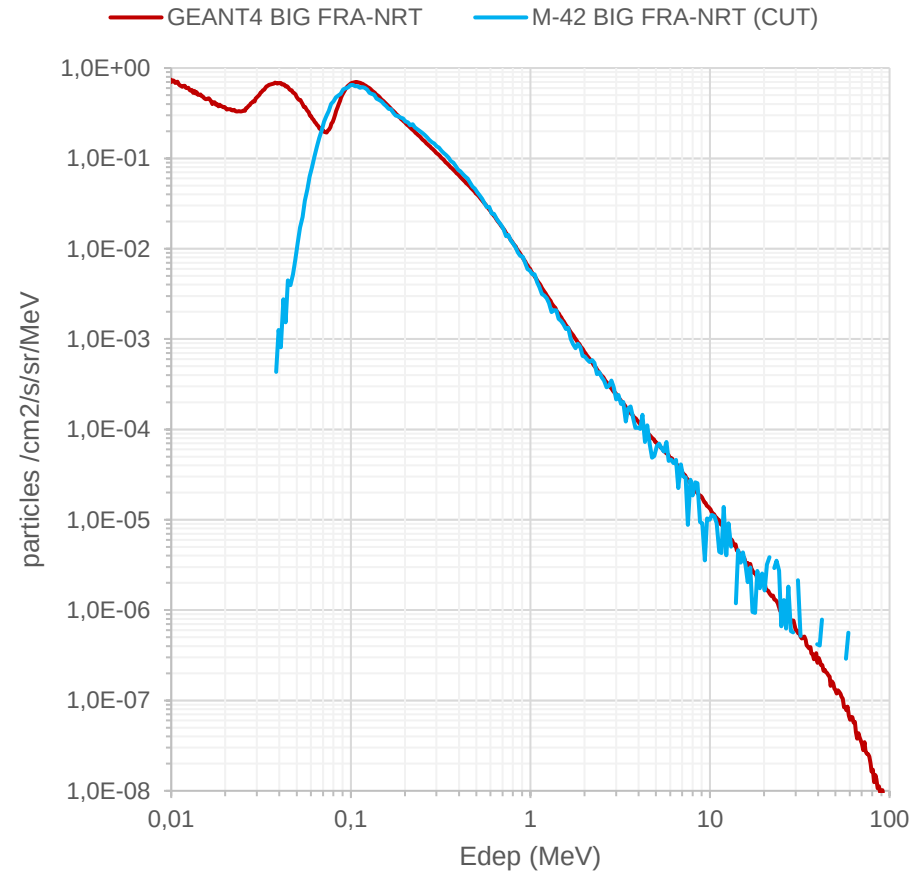


Figure: Data from one irradiation geometry of the GCR-Simulator @ GSI



DLR M-42 BIG flight data



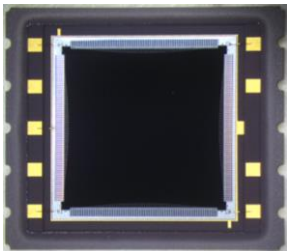
Comparison GEANT4 vs. M-42 BIG on flight to and from Tokyo



DLR M-42 Detector Family



M-42 Position



	M-42 EXT
Energy Range (in Si)	???
Sensor thickness	300 μm
Sensitive Area	1.00 cm^2
Power Consumption	???

Position Sensitive Diode - PSD

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

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

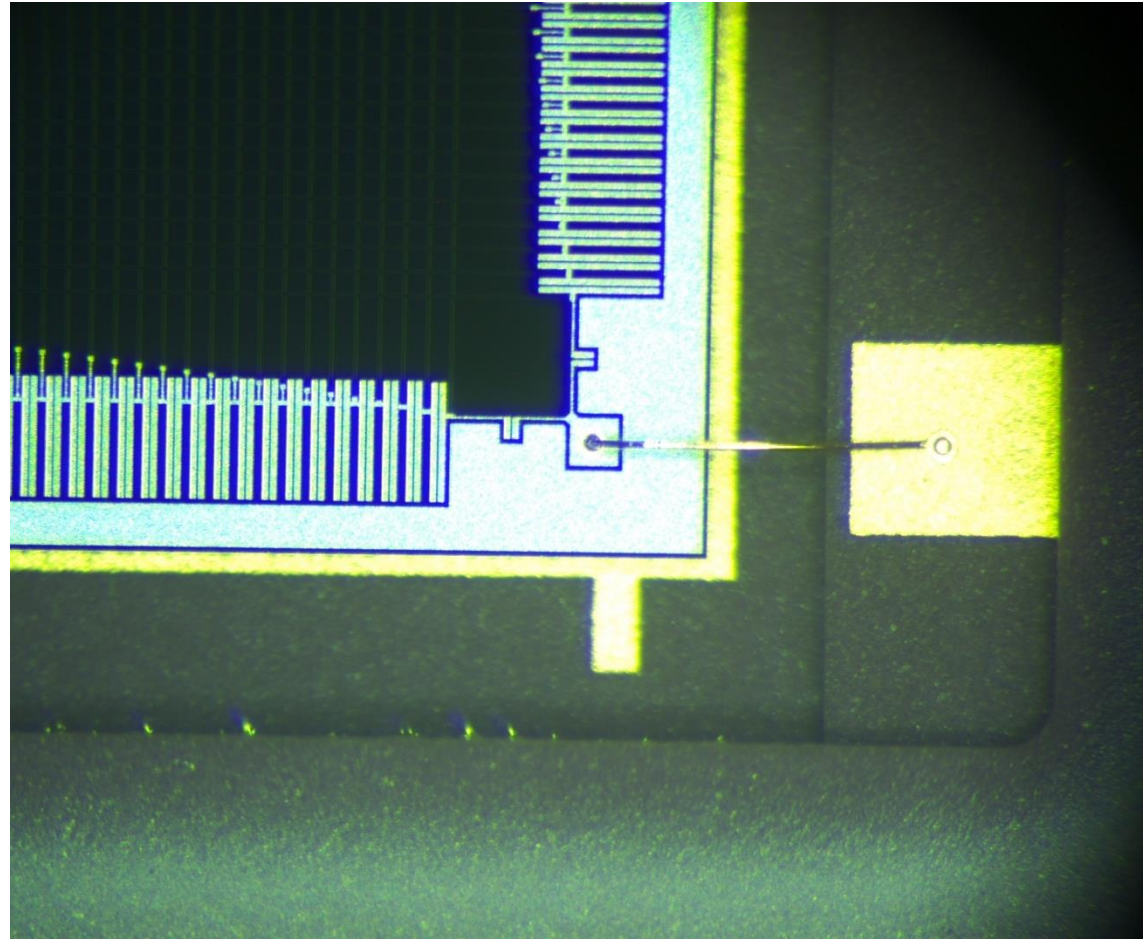
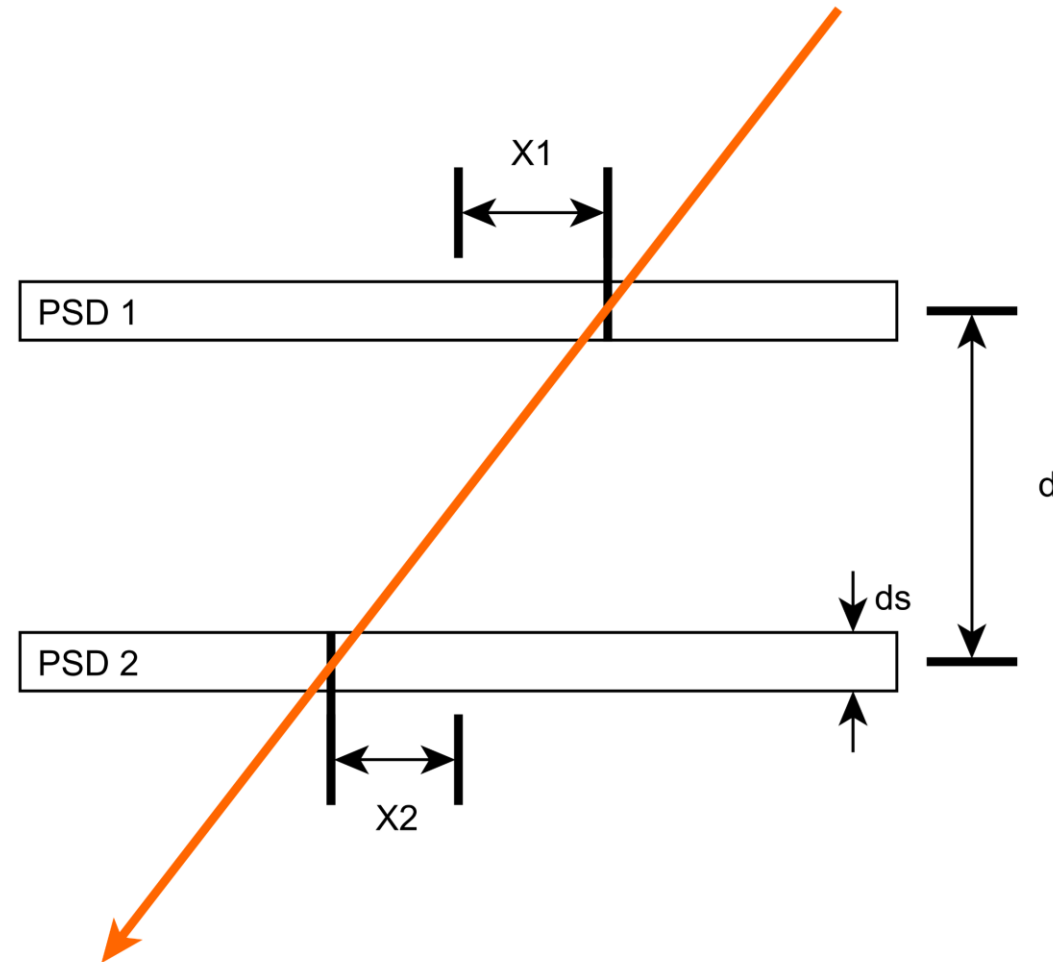


Figure: Corner of the position sensitive detector

M-42 Position Telescope



Patent Pending

Topic: **DLR M-42 instrument family and future missions**
WRMISS 28, Cologne, Germany

Date: 2025-09-04

DLR-Team: Thomas Berger, Bartos Przybyla, Joachim Aeckerlein, Karel Marsalek, Moritz Kasemann, Markus Rohde, Daniel Matthiä, Aleksandra Rutczynska, Maximilian Radenhäuser

Institute: DLR-ME

Image sources: © DLR