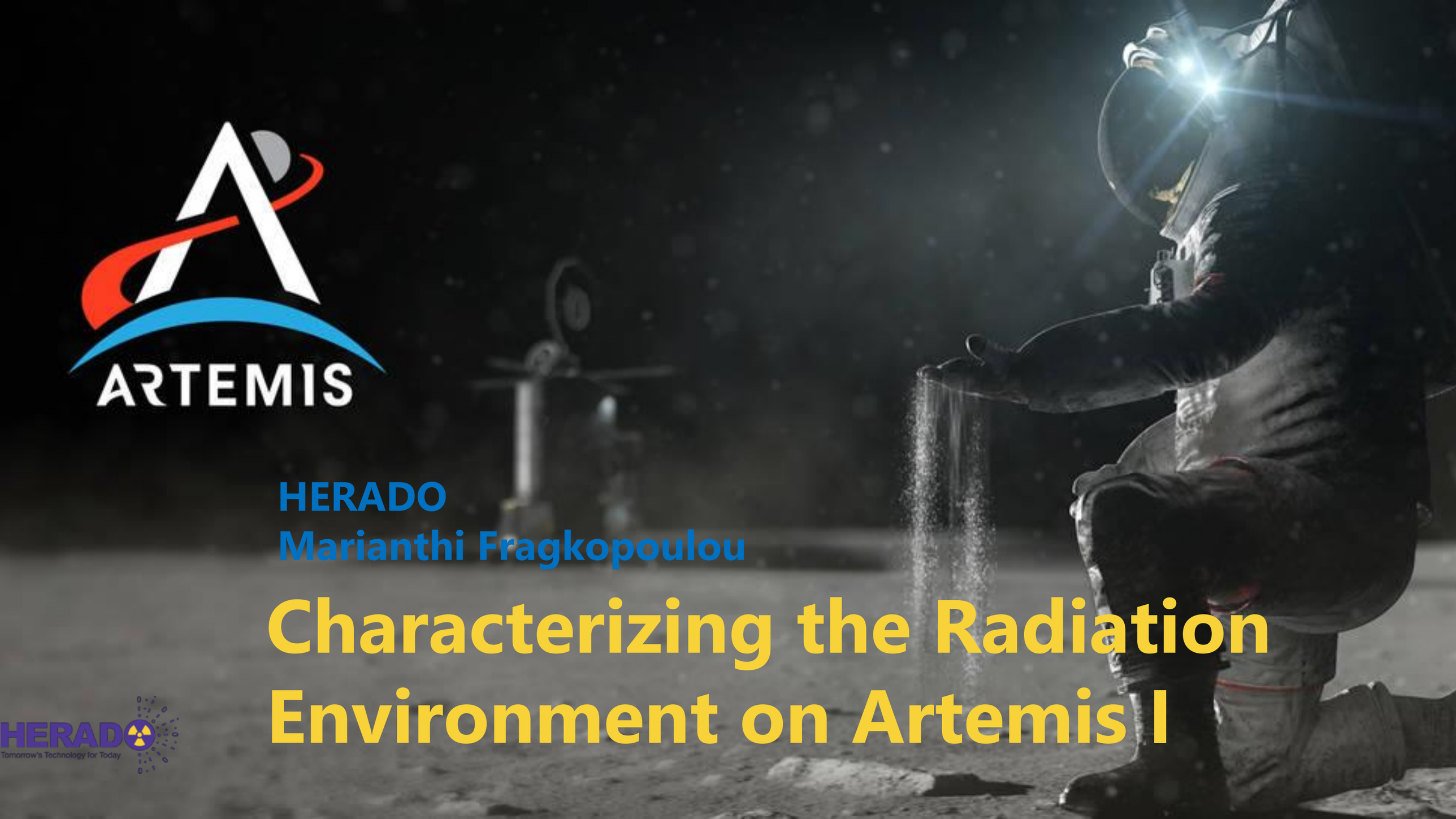

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Marianthi Fragkopoulou

Characterizing the Radiation Environment on Artemis I

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ALMAR history

2016
Prototype

2017
Ver.1

2017
Ver. 2

2018
Ver. 3

2018
Ver. 4

2019
Ver. 5

2020
Ver. 6

2023
Ver. 7

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Why to use ALMAR in space

- High Stability
- Lower detectable limit 0,6 µSv
- Linearity up to 10 Sv
- Measure the different types of radiation.
- Fully calibrated (Los Alamos, HIMAC,)
- Dose rate and angular dependence < 5%
- No Electromagnetic interference
- Very low power consumption/ Long battery lifetime/rechargeable
- Compact Size and weight
- Selection of the alarm levels
- software/ telemetry system
- User friendly

CE

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ALMAR characteristics

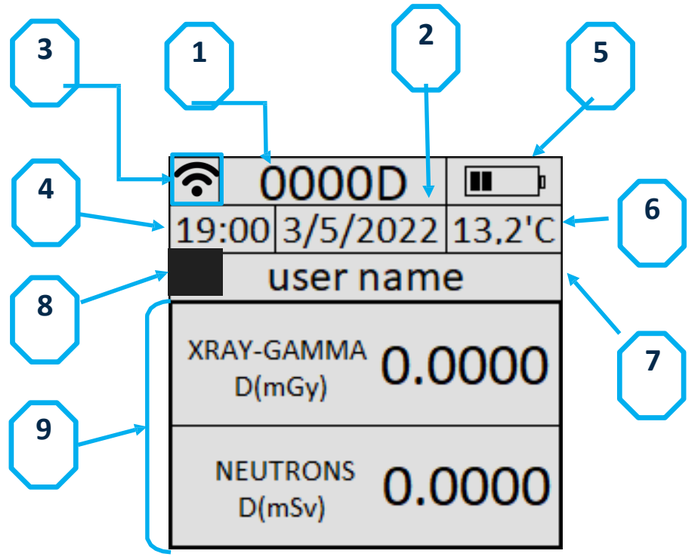
Power consumption
Active mode typical current: 5mA
Stand-by mode typical current: below of 0.5 µA

Measurement of protons and neutrons

The battery may last for more than 3 months

<u>Dimensions</u>
Compact size & weight Weight: 25 gr
Length: 65 mm
Width: 15 mm
Height: 48 mm

WiFi and USB connectivity



1. .Unique Device ID
2. .Date
3. .WiFi ON indicator
4. .Time
5. .Battery level indicator
6. .Temperature
7. .User name
8. Mode H
9. .Measurement Area

ALMAR test and measurements reports

ALMAR is **fully licensed CE** (EN 61526) and **accredited, meets ICRU 95 recommendations**.

Conforms with the following Harmonized standards:

EMC: EN 55032, Class B :2015+A11:2020
EN 55011, Class B/Group 1:2016+A11:2020
EN 61326-1:2020
RED: ETSI EN 300 328 V2.1.1(2016-11)
RoHS: EN 50581:2012
HUMAN EXPOSURE: EN 62311:2008

Photo 8.1: Setup for radiated emissions test (30MHz-1GHz)

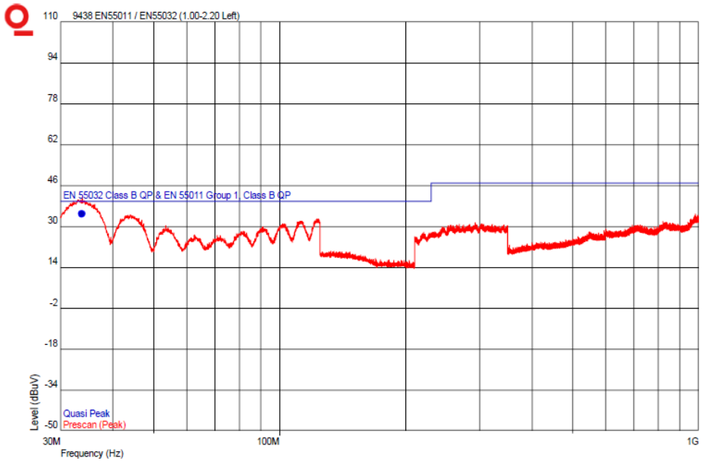


Fig. 8.3: Results for left side (90˚), frequency range: 30MHz-1GHz.

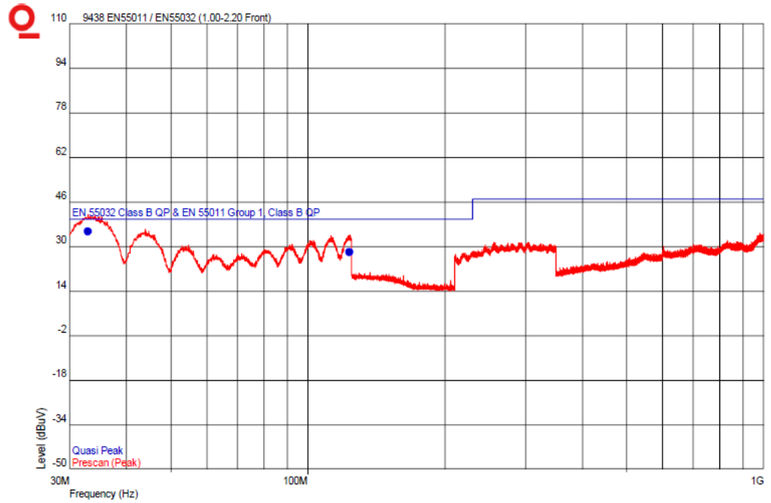


Fig. 8.2: Results for front side (0˚), frequency range: 30MHz-1GHz.

Inter-comparison with Passive and other PED

Results from running Pilots

	ALMAR	Passive (TLD)	APDs
Full month comparison at **nuclear medicine** department	(0,13 ± 0,01) mGy	0,14 mGy	
Full month comparison at **cardiovascular department**	(1,85 ± 0,013) mGy	1,9 mGy	
APD in nuclear waste storage room (+/- 3 days), dose rate at start = 12-17 μSv/h)	0,108 ± 0,011 mGy		0,1385 mGy

ΕΛΛΗΝΙΚΗ ΕΠΙΤΡΟΠΗ ΑΤΟΜΙΚΗΣ ΕΝΕΡΓΕΙΑΣ
GREEK ATOMIC ENERGY COMMISSION

Oklahoma State University Hospital US

The biggest hospital in Weat Flanders, Belgium

The biggest Goverment hospital in Greece

Greek Red Cross Government Hospital

The biggest hospital group (CVC Capital Partners) in Greece

ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
ΠΕΡΙΦΕΡΕΙΑΚΟΣ ΣΥΝΔΕΣΜΟΣ
ΦΟΡΕΩΝ ΔΙΑΧΕΙΡΙΣΗΣ
ΣΤΕΡΕΩΝ ΑΠΟΒΛΗΤΩΝ (ΦΟΔΣΑ)
ΚΕΝΤΡΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ

Solid Waste Management Bodies (FODSA) in Greece

ALMAR Active dosimeter Properties According to IEC61526

SPECIFICATIONS	ALMAR+ NEUTRONS	ALMAR
	Neutron Hp(10)	Gamma X-Rays Hp(10)
DETECTOR	Silicon based	Silicon based
MEASUREMENT RANGE	Dose: 1,5 µSv-10 Sv Dose rate 1 µSv/h-10 Sv/h	Dose: 0,65 µSv-10 Sv Dose rate: 1 µSv/h –10 Sv/h
ACCURACY	Dose: ± 10% AmBe	Dose: ± 10% Cs-137
DOSE RATE LINEARITY	Dose Rate : 5% AmBe	Dose Rate : 5% Cs-137
ENERGY RESPONSE	Linear up to 10 Sv Thermal-epithermal 0.025 eV to 100 keV intermediate fast 100 keV to 5 MeV	Linear up to 10 Sv From 3 KeV
ANGULAR DEPENDENCE	5 %	5 %
WEIGHT	25 gr	25 gr
BATTERY	Rechargeable 14 days (continuously)	Rechargeable 14 days (continuously)
TEMPERATURE	-30o to 50o	-30o to 50o
ALARM	Visual and audio	Visual and audio
ENVIROMENTAL PROTECTION	IP68	IP68

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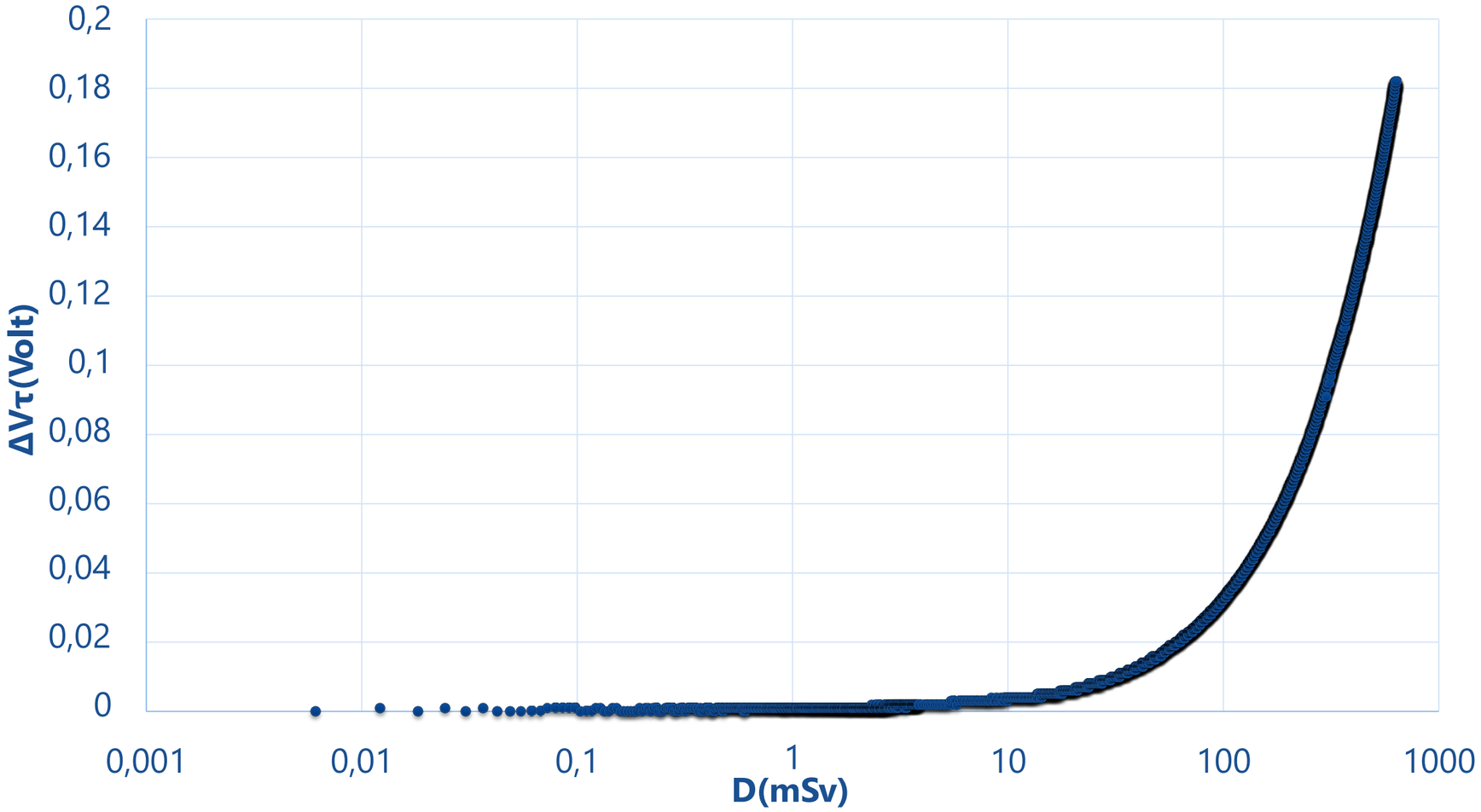
Linear Test of ALMAR



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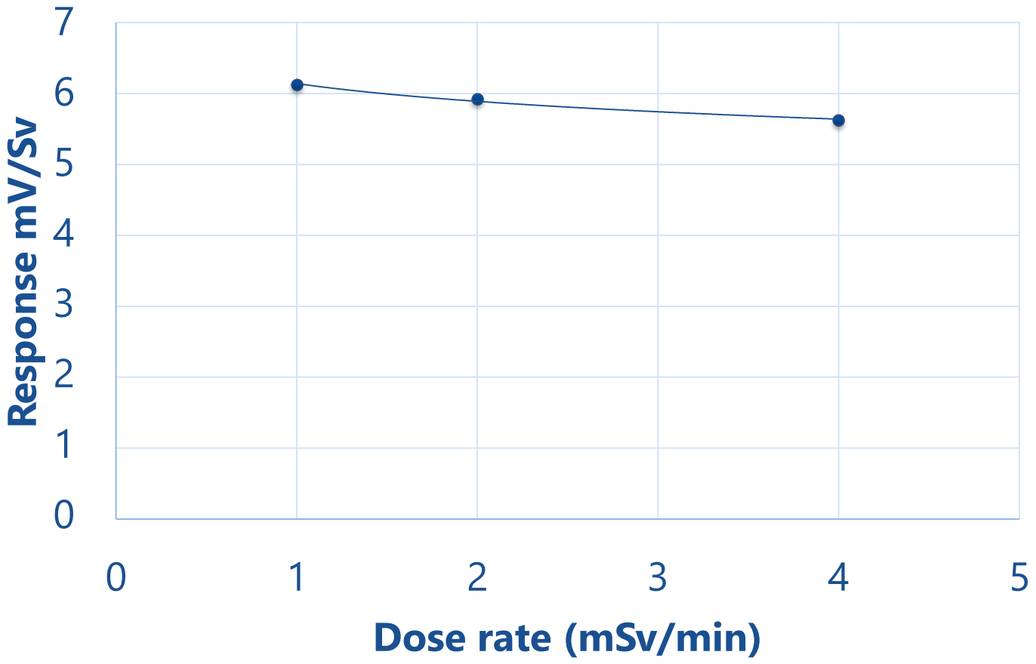
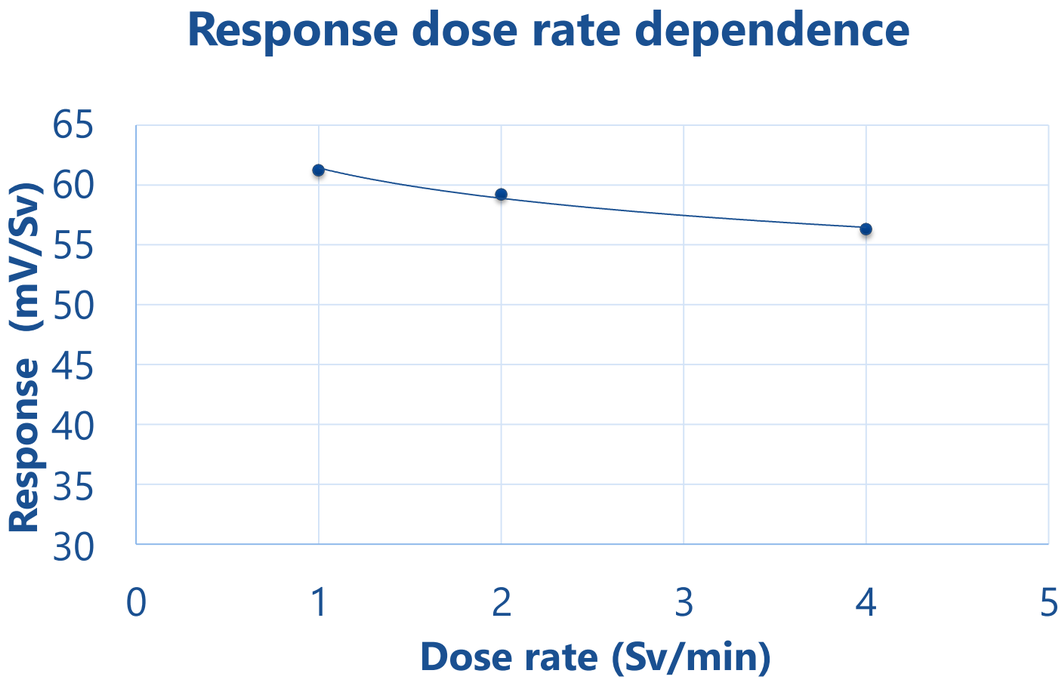
Dose Rate Test



Low Dose



High Dose mode

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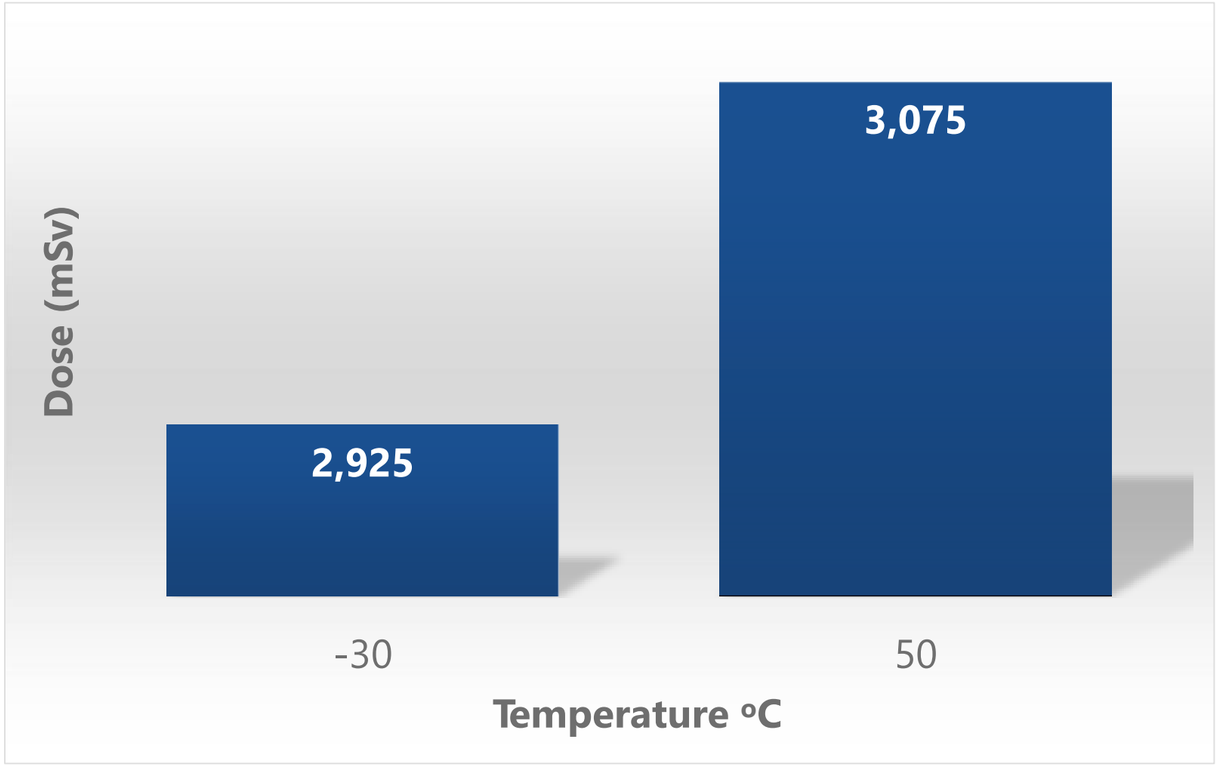
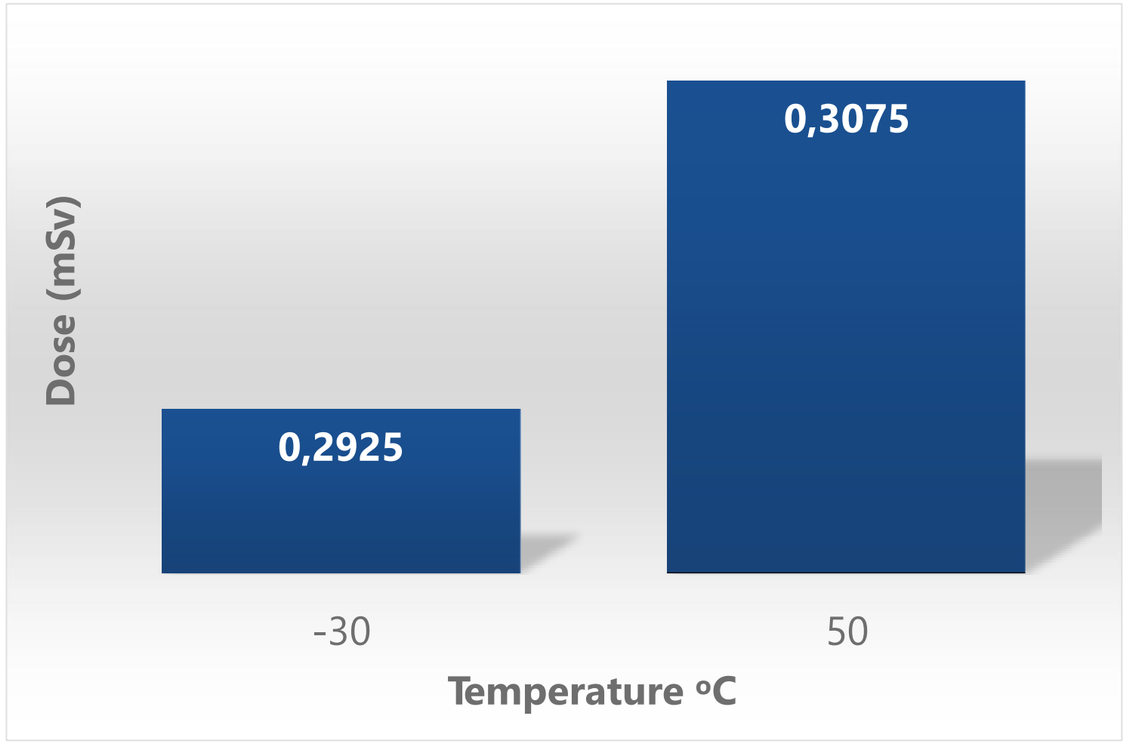
Temperature Test





High Dose (3 mSv irradiated)

Low Dose (0,3 mSv irradiated)

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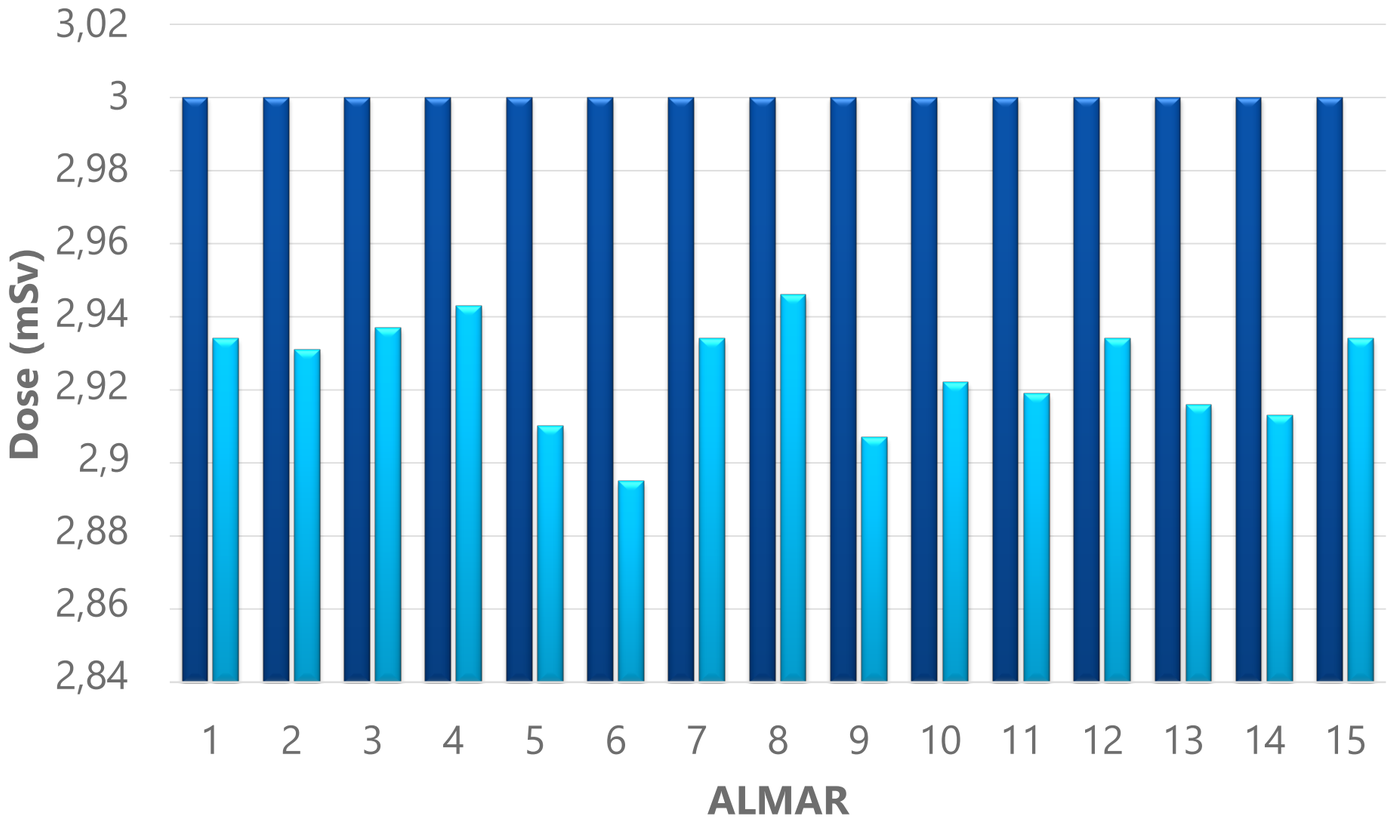
Drop Test

Drop testing:
was performed to ensure that if **ALMAR** was **dropped** from a distance of **one meter** that it will still be able to **accurately report dose** that was currently stored on the dosimeter as well as future doses (**irradiated dose 3mSv after dropped**).



Drop test (3 mSv irradiated)

HERADO Monitoring Platform (HRDS)

On top of **active radiation dosimeter ALMAR**, we have developed a **cloud radiation data management platform (HRDS**).

HRDS provides **organizations** with an **instant overview** of **radiation potential safety issues**. It also allows the users to **analyze in real-time** the data and produce reports and statistics for their **organizations** and **government institutions**.

Automatic transmission of **radiation data** and a **complete radiation monitoring program** that can send **data** to the **National Dose Registry** using **AI-** and **cloud-** based technologies.

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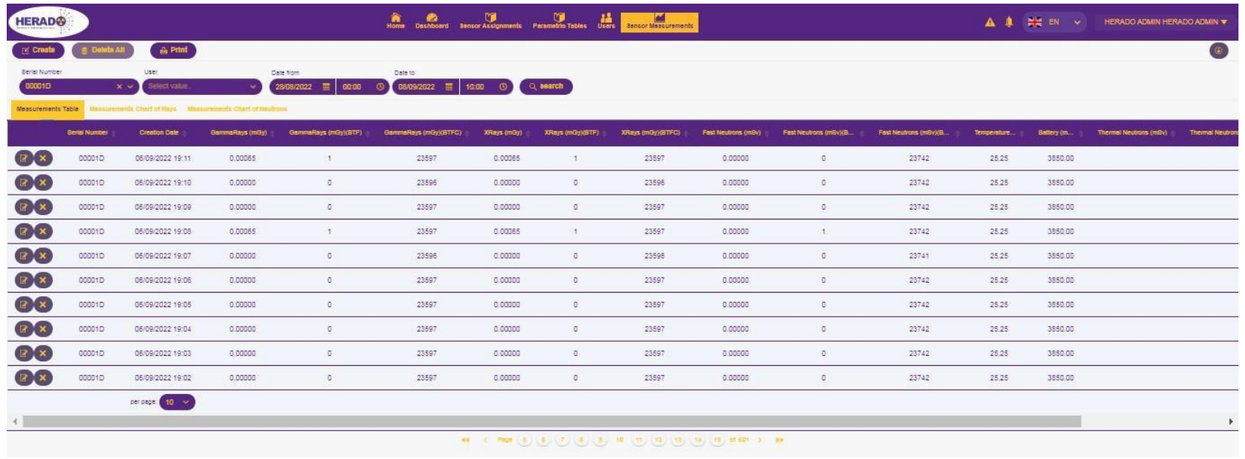
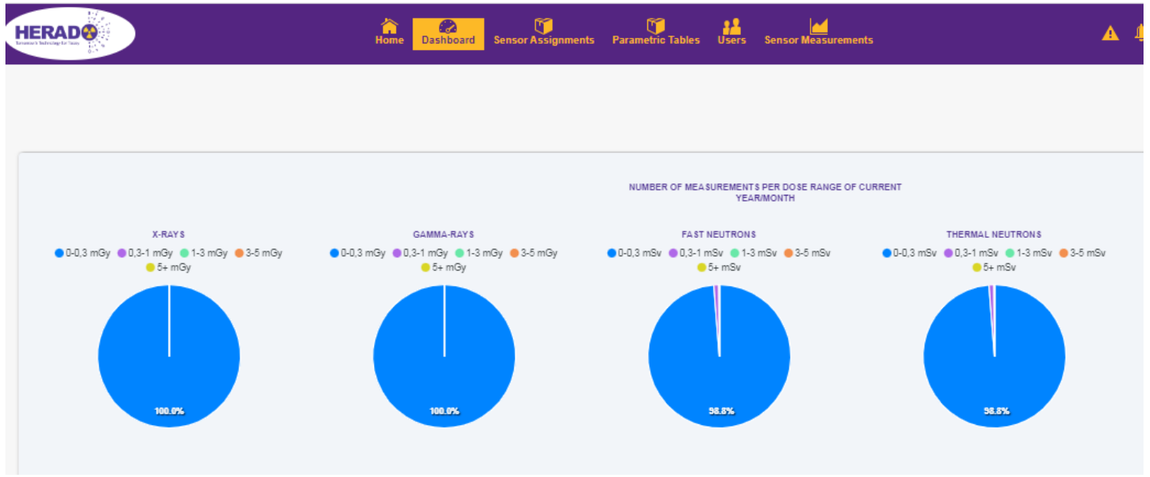
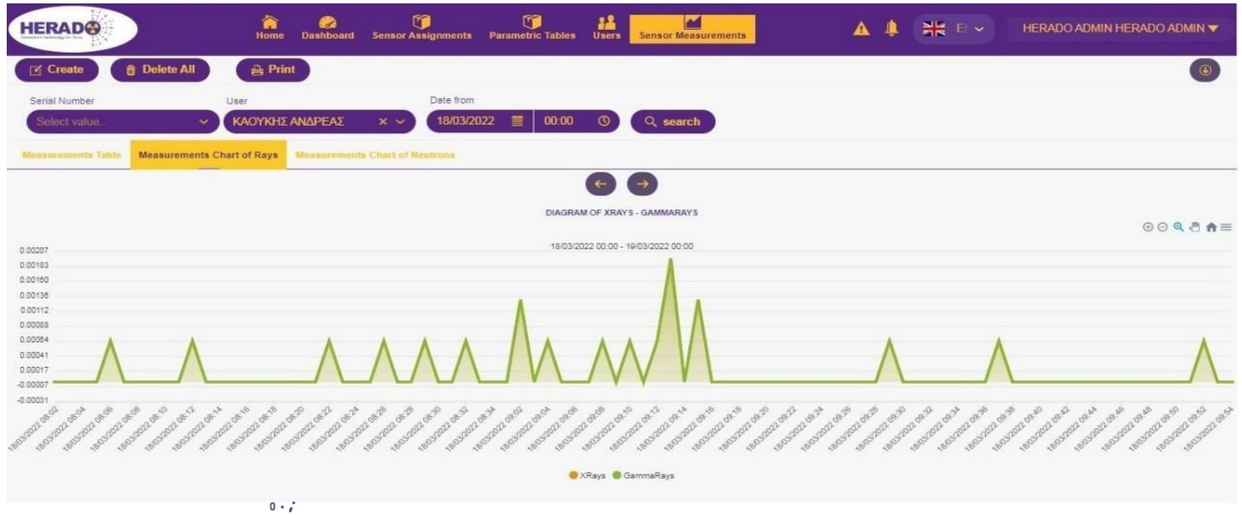
HERADO Monitoring Platform (HRDS)







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EDF-2022-RA-MCBRN-HICP: Diagnostics, Treatment, Transport and Monitoring of Highly Contagious, Injured and /or Contaminated Personnel (R)

HERADO developing high innovative portable **devices** for **detection** and **monitoring different types of radiation (x-rays, gamma rays, neutrons, heavy ions)**. We support in this topic the Research, development, detection, and monitoring of ultra-portable telemedicine devices and diagnostics sensors, For Radiological and Nuclear (CBRN) containment systems, 'porter' or load- carrying Unmanned Vehicles (UVs) and battlefield casualty extraction devices. We make research in order to developed custom solutions according to the needs of the call even with very small dimensions.

Artemis-1 HERADO detectors

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Artemis-1 HERADO detectors ALMAR preliminary results

BOX 1	
Detector 34	D (mSv)
	10,27 ± 1,02

BOX 1	
Detector 33	D (mSv)
	118,95 ± 11,895

BOX 1	
Detector 13	D (mSv)
	10,27 ± 1,03

BOX 1	
Detector 36	D (mSv)
	89,368 ± 8,936

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Artemis-1 HERADO detectors ALMAR preliminary results

Helga

BOX 2	
Detector 38	D (mSv)
	38,935 ± 3,89

BOX 2	
Detector 25	D (mSv)
	42,325 ± 4,23

Zohar

BOX 2	
Detector 35	D (mSv)
	7,956 ± 0,794

BOX 2	
Detector 28	D (mSv)
	11,05 ± 1.1

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Artemis-1 HERADO detectors ALMAR preliminary results

BOX 3	
Detector 32	D (mSv)
	11,837 ± 1,183

BOX 3	
Detector 9	D (mSv)
	11,87 ± 1,18

Contact and Disclaimer

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Continued focus on ESG
Lower power consumption, rechargeable batteries

Enhance returns to shareholders
Continuous investment in organic and inorganic growth

Portfolio evolution
towards higher-growth end markets, mitigating business risks

Accelerated growth in line with global megatrends
IoT clever device, Digital AI healthcare protocol

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ARTEMIS ORION

Co-investigator with NASA and DLR


ARTEMIS