

# ALMAR Dosimeter for Space Application

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Space Station  
6-8 September 2022, Mons**



# ALMAR Active Dosimeter specifications



**High Stability in pulsed radiation fields**



**No Electromagnetic interference**



**Lower detectable limit 0,6  $\mu$ Sv**



**Very low power consumption/ Long battery lifetime/rechargeable**



**Linearity up to 10 Sv**



**Compact Size and weight**



**Measure the different types of radiation.**



**Selection of the alarm levels**



**calibrated (Los Alamos, HIMAC,)**



**software/ no need for installation**



**Dose rate and angular dependence < 5%**



**User friendly**



CE

# ALMAR characteristics

## Power consumption

Active mode typical current: 5mA

Stand-by mode typical current: below of 0.5  $\mu$ A

## Measurement of protons and neutrons

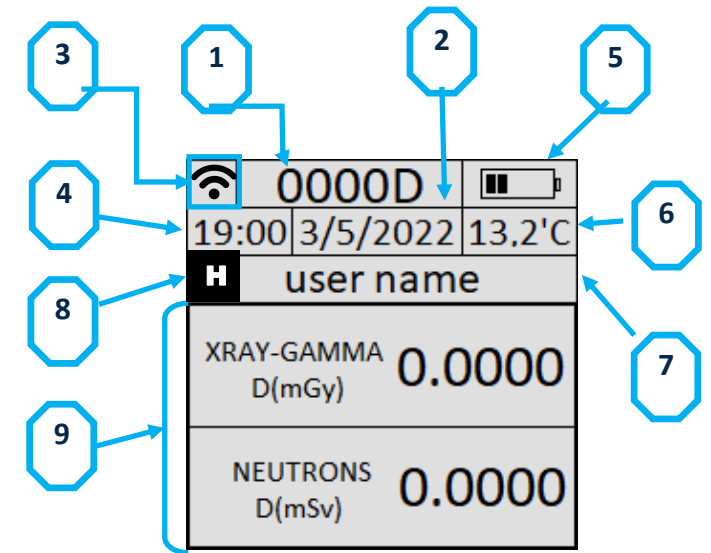
The battery may last for more than 3 months

## Dimensions

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

# 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.



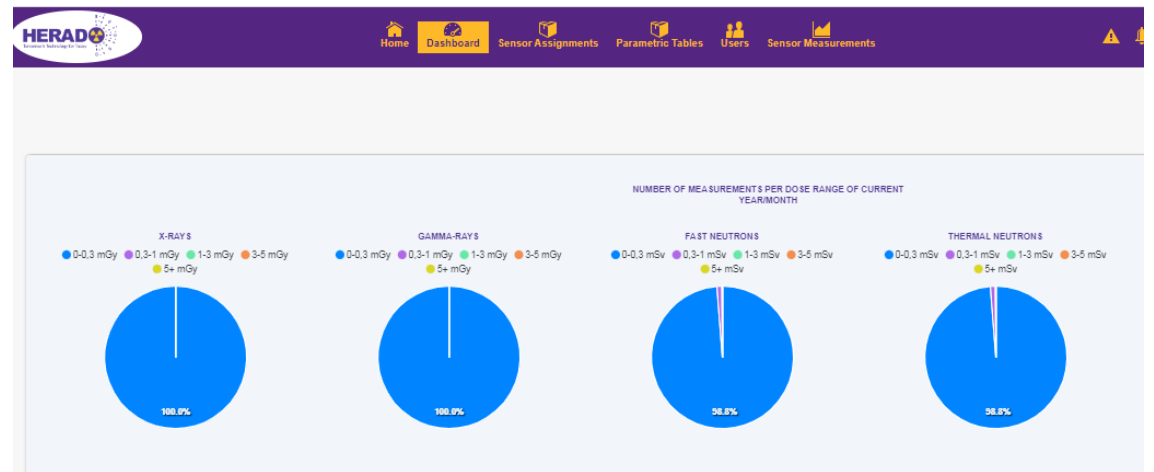
# HERADO Monitoring Platform (HRDS)

HERADO Monitoring Platform (HRDS) - Measurements Table

Serial Number: 000010 | User: [Select value] | Date from: 18/03/2022 00:00 | Date to: 18/03/2022 12:00 | Search

Serial Number	Creation Date	GammaRays (mGy)	GammaRays (mGy)(STP)	GammaRays (mGy)(STP)(C)	XRays (mGy)	XRays (mGy)(STP)	XRays (mGy)(STP)(C)	Fast Neutrons (mSv)	Fast Neutrons (mSv)(STP)	Fast Neutrons (mSv)(STP)(C)	Temperature (°C)	Battery (V)	Thermal Neutrons (mSv)	Thermal Neutrons (mSv)(STP)	Thermal Neutrons (mSv)(STP)(C)
000010	06/04/2022 19:11	0.00065	1	23597	0.00065	1	23597	0.00000	0	23742	28.25	3650.00			
000010	06/04/2022 19:10	0.00000	0	23596	0.00000	0	23596	0.00000	0	23742	28.25	3650.00			
000010	06/04/2022 19:09	0.00000	0	23597	0.00000	0	23597	0.00000	0	23742	28.25	3650.00			
000010	06/04/2022 19:08	0.00065	1	23597	0.00065	1	23597	0.00000	1	23742	28.25	3650.00			
000010	06/04/2022 19:07	0.00000	0	23596	0.00000	0	23596	0.00000	0	23741	28.25	3650.00			
000010	06/04/2022 19:06	0.00000	0	23597	0.00000	0	23597	0.00000	0	23742	28.25	3650.00			
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000010	06/04/2022 19:03	0.00000	0	23597	0.00000	0	23597	0.00000	0	23742	28.25	3650.00			
000010	06/04/2022 19:02	0.00000	0	23597	0.00000	0	23597	0.00000	0	23742	28.25	3650.00			

per page: 10





# 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)

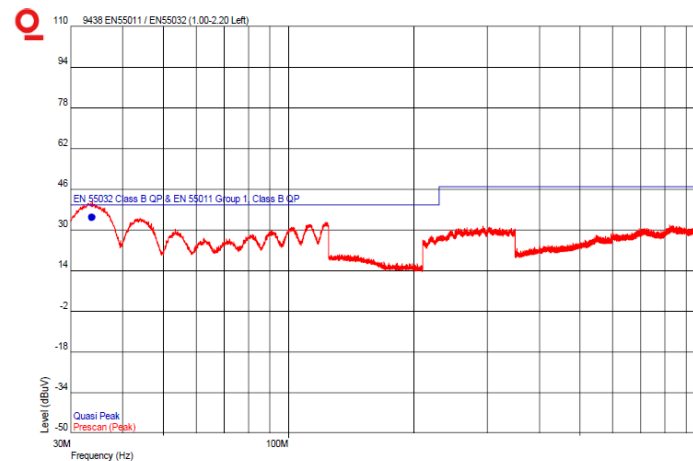


Fig. 8.3: Results for left side (90°), frequency range: 30MHz-1GHz.

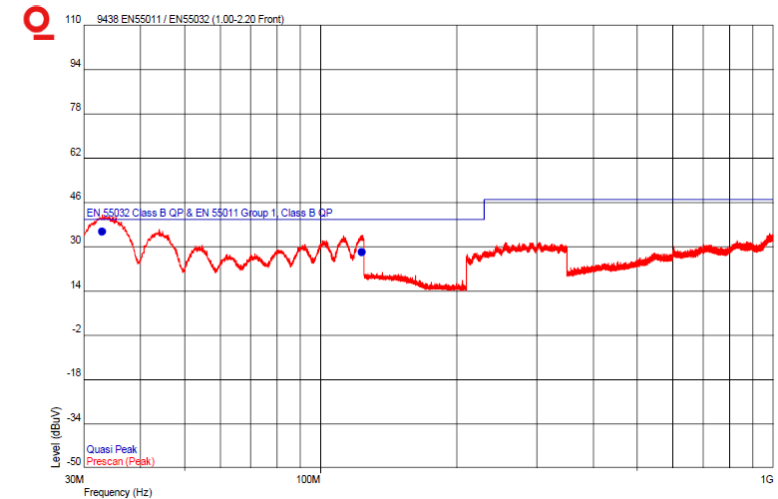


Fig. 8.2: Results for front side (0°), frequency range: 30MHz-1GHz.

# Pilots results from hospitals in comparison with Passive and other PED

## Results from running Pilots

	ALMAR	Passive (TLD)	APDs
Full month comparison at <b>nuclear medicine</b> department	(0,13 ± 0,01 ) mGy	0,14 mGy	
Full month comparison at <b>cardiovascular department</b>	(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



The biggest hospital  
in Weat Flanders, Belgium



Oklahoma State University Hospital US



The biggest hospital group (CVC  
Capital Partners) in Greece



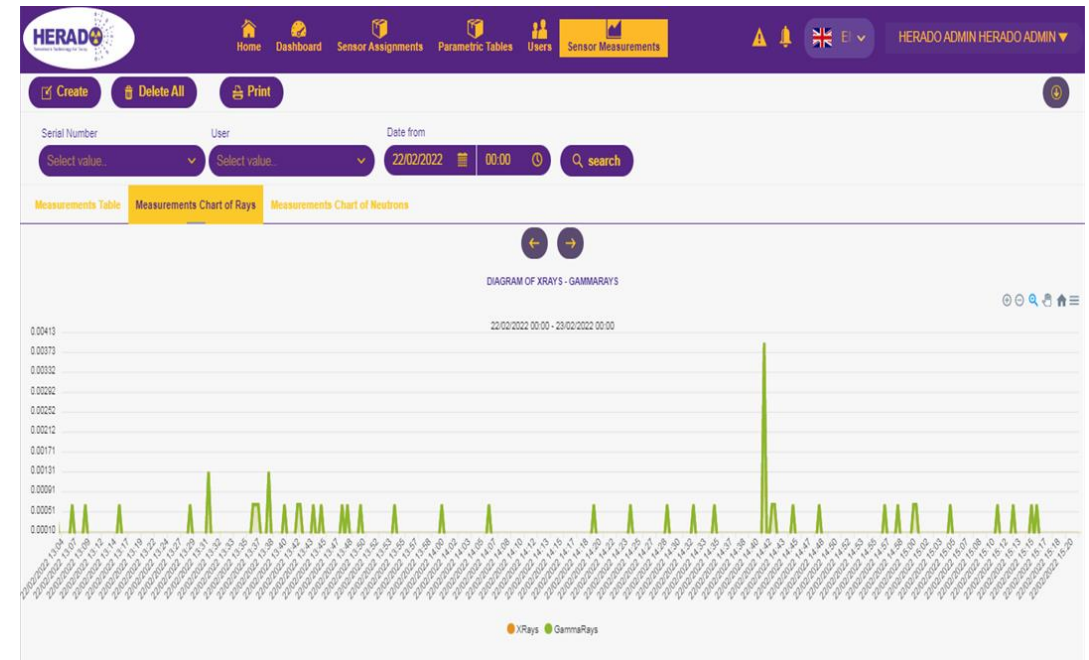
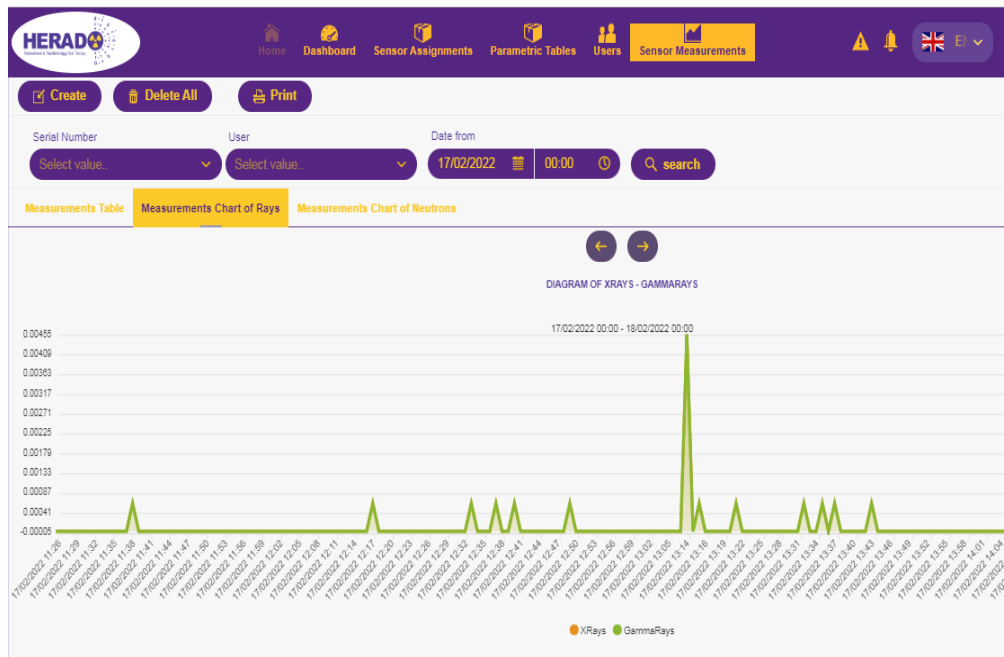
The biggest Goverment hospital  
in Greece



ΕΛΛΗΝΙΚΗ ΕΠΙΤΡΟΠΗ ΑΤΟΜΙΚΗΣ ΕΝΕΡΓΕΙΑΣ  
GREEK ATOMIC ENERGY COMMISSION



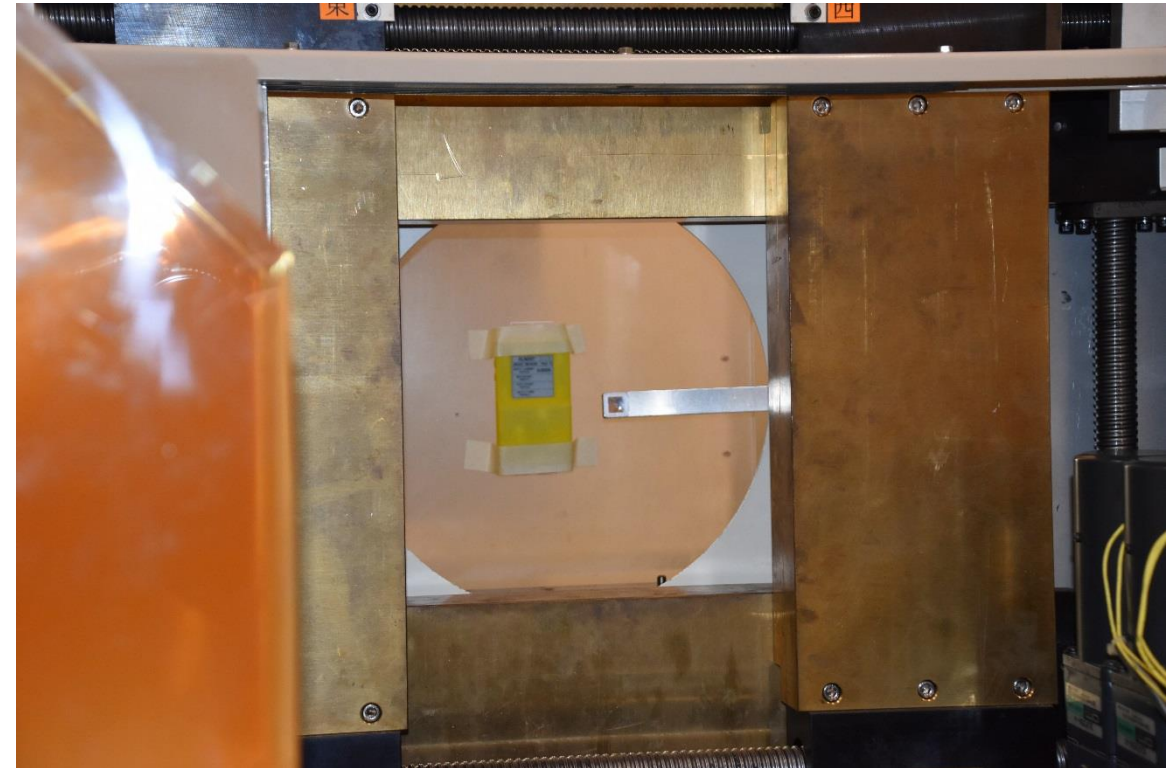
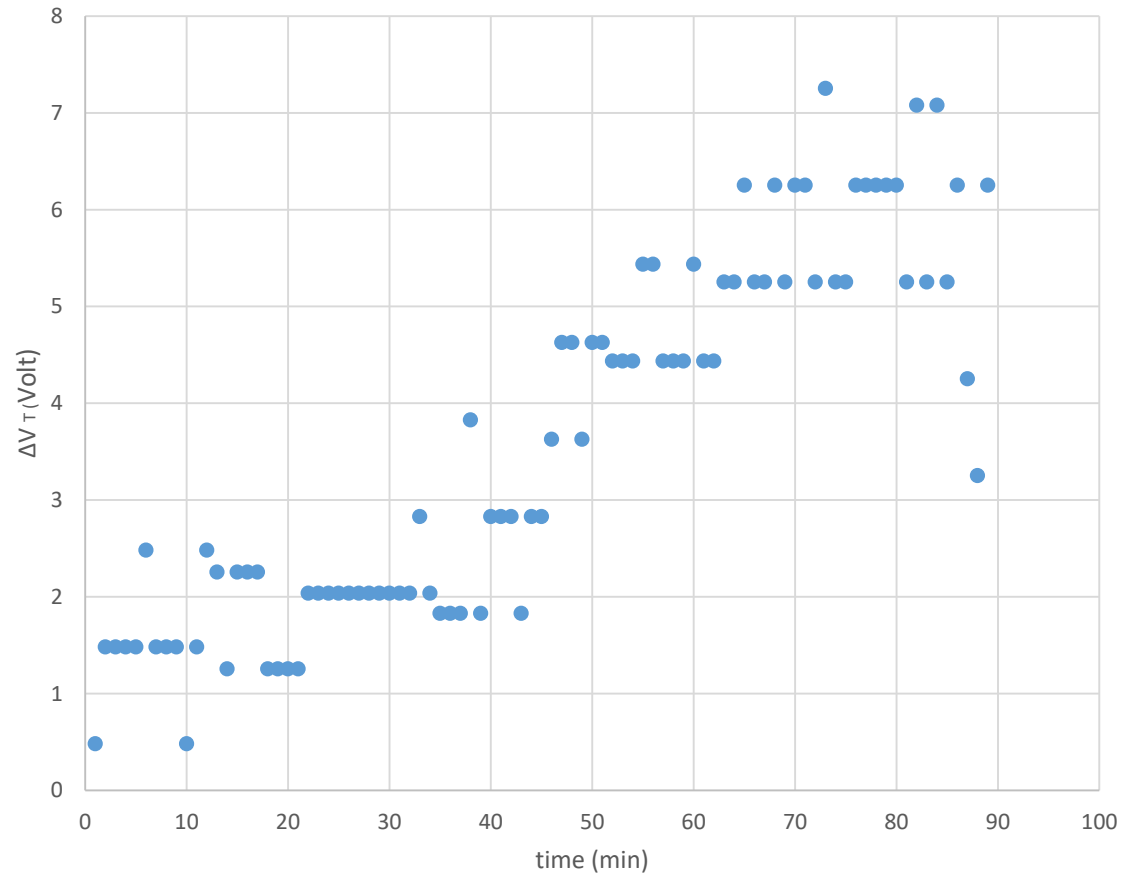
# Pilots results from hospitals in collaboration with Greek Atomic energy



**Figures.** pilot result in different gamma rays fields

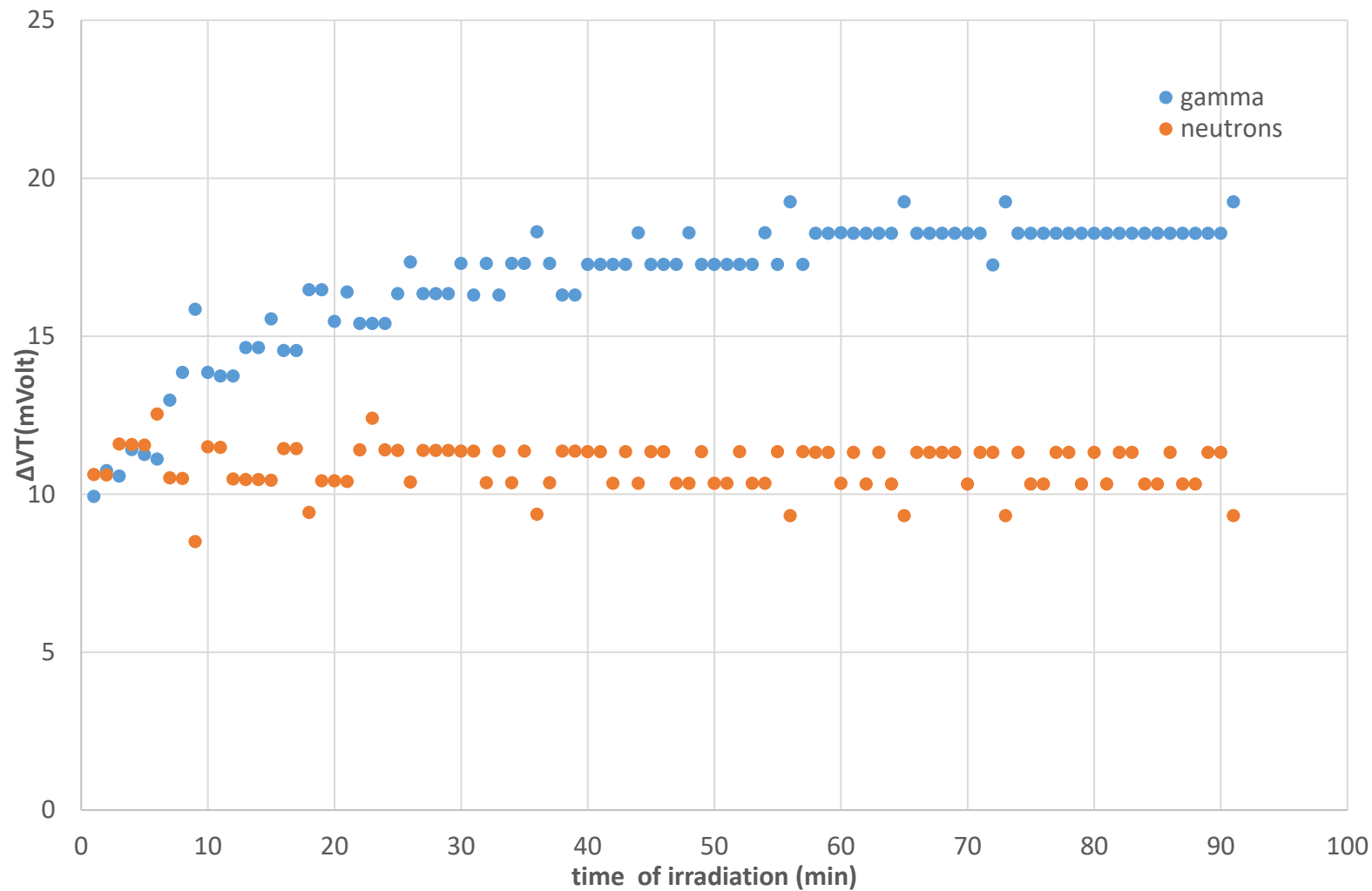


# Irradiation at 150 MeV/n He (Los Alamos)

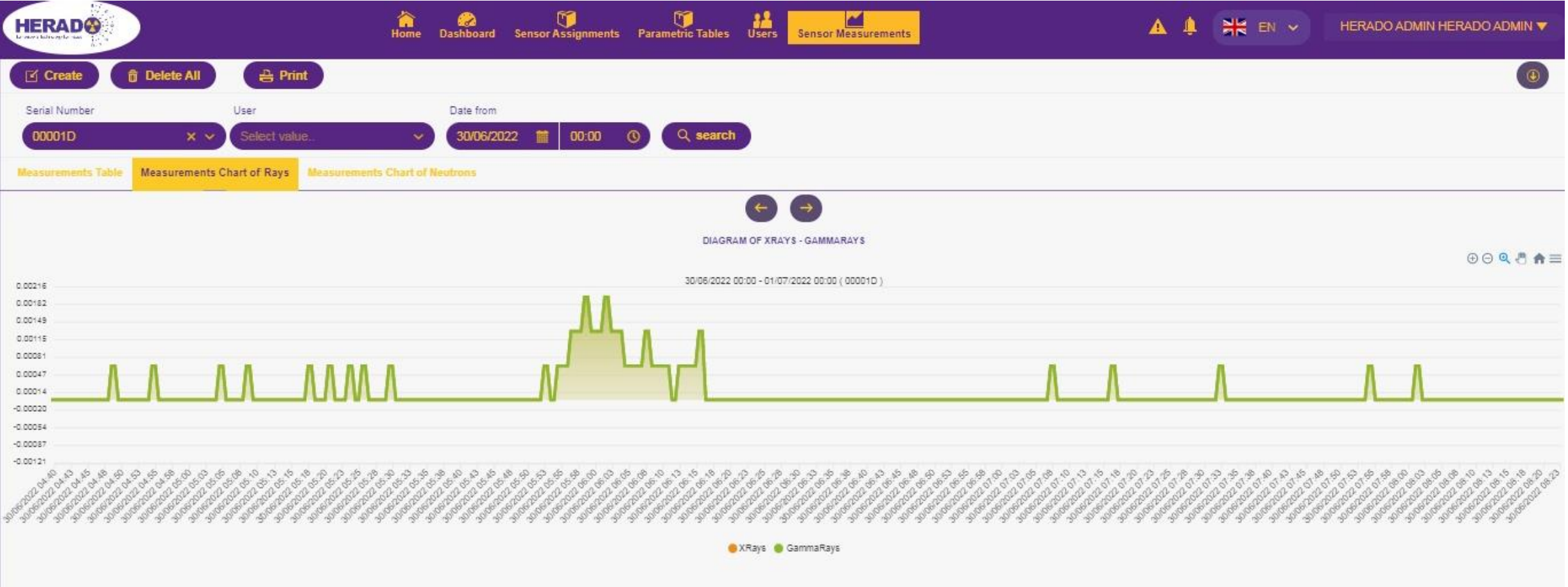


The detector in the beam line with the 1 cm<sup>-2</sup> plastic scintillator, for beam monitoring.

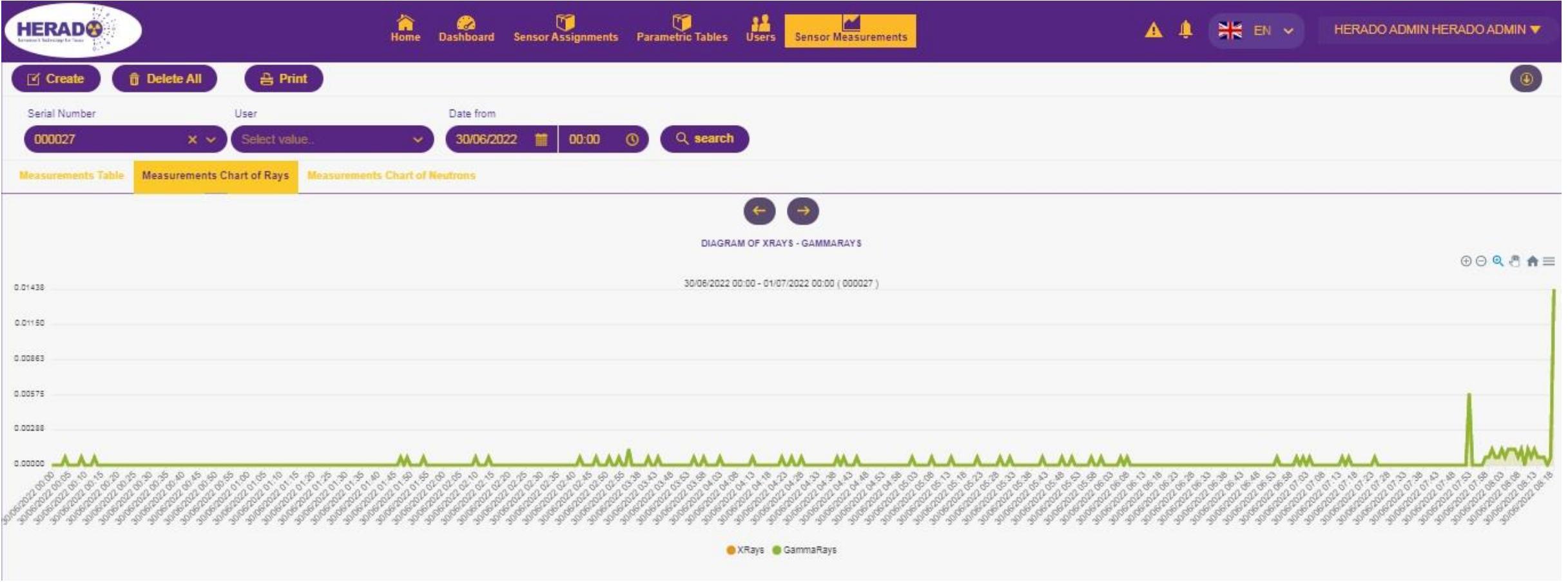
# Irradiation at Los Alamos LANSCE



# Irradiation at HIMAC Carbon (preliminary results)



# Irradiation at HIMAC Si (preliminary results)



# ALMAR Active dosimeter Properties According to IEC61526

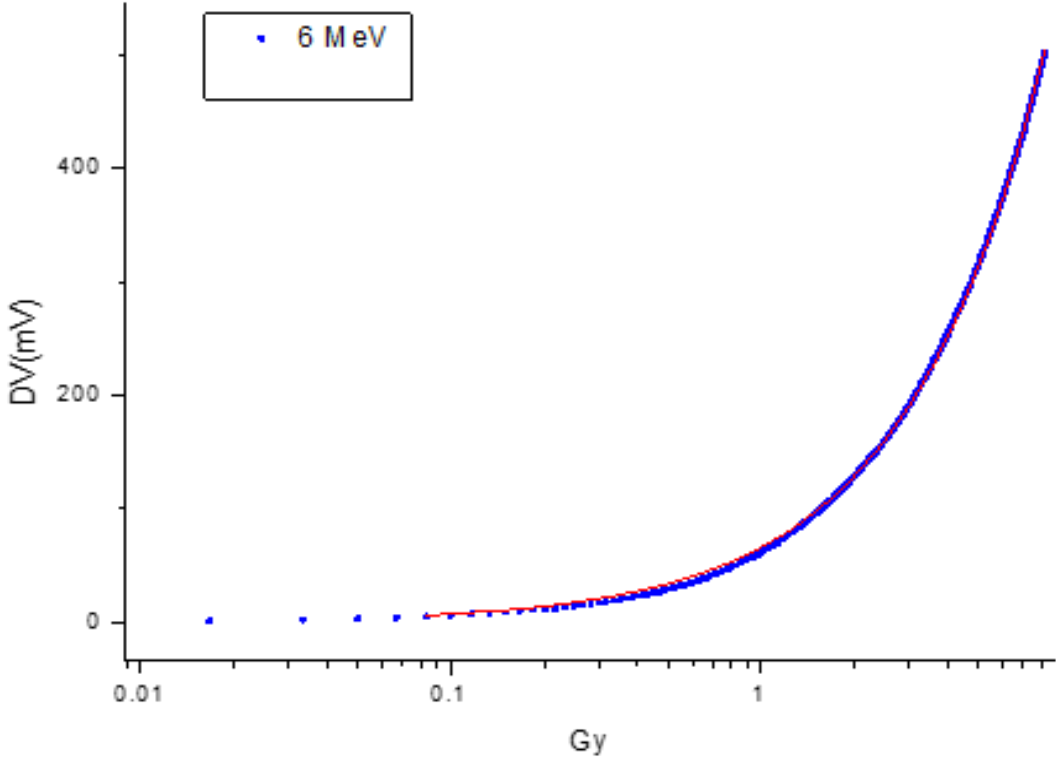
SPECIFICATIONS	ALMAR+ NEUTRONS	ALMAR
	Neutron Hp(10)	Gamma X-Rays Hp(10)
DETECTOR	Silicon based	Silicon based
MEASUREMENT RANGE	Dose: 1,5 µSv-10 Sv	Dose: 0,65 µSv-10 Sv
ACCURACY	Dose rate 1 µSv/h-10 Sv/h	Dose rate: 1 µSv/h –10 Sv/h
DOSE RATE	Dose Rate : 5% AmBe	Dose Rate : 5% Cs-137
LINEARITY		
ENERGY 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





# ALMAR Active dosimeter Properties According to IEC61526

SPECIFICATIONS	
	Beta Hp(0,07) and Hp(10)
DETECTOR	Silicon based
MEASUREMENT RANGE	Dose: 1,5 µSv-10 Sv Dose rate 1 µSv/h-10 Sv/h
ACCURACY	Dose: ± 10% <sup>90</sup> Sr/ <sup>90</sup> Y
DOSE RATE LINEARITY	Dose Rate : 5% <sup>90</sup> Sr/ <sup>90</sup> Y
ENERGY RESPONSE	Linear up to 10 Sv 0.2 Mev-15 MeV
ANGULAR DEPENDENCE	5 %
WEIGHT	25 gr
BATTERY	Rechargeable 14 days (continuously)
TEMPERATURE	-30° to 50°
ALARM	Visual and audio
ENVIROMENTAL PROTECTION	IP68



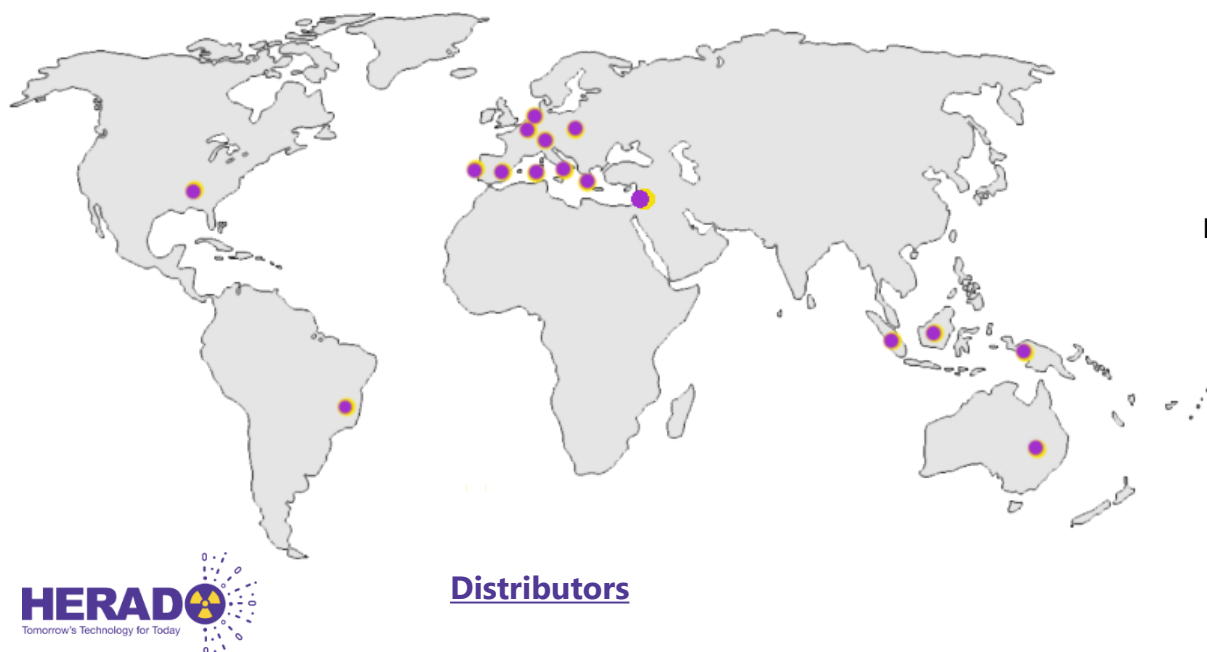
# HERADO Certifications Patents and Compliance

**HERADO** is **fully licensed CE** (EN 61526) and **accredited**.

**Collaborating** with **Radiation Federations, EEAE** (Greek Atomic Energy) running **pilots** with **hospitals**. At the forefront of the **new EU legislation** about the necessity of active dosimeters (October 2021).

Established **distributors Agreements** (Companies with extended portfolio of customers in radiation protection in the medical sector): Belgium, Netherland, Germany, Luxembourg, Italy, Portugal, Switzerland, Spain, Malta, Singapore, Indonesia, Israel, Malaysia, Australia Greece, Brazil and USA. (23,017 **Group** hospitals)

**HERADO has the seal of excellence** as one of the **top startups**



Fully licensed CE (EN 61526)



Patented granted  
(PCT/GR2021/00053)



HERADO's Platform GDPR  
compliant



Sustainability



Environmental, Social,  
Governance



ΕΛΛΗΝΙΚΗ ΕΠΙΤΡΟΠΗ ΑΤΟΜΙΚΗΣ ΕΝΕΡΓΕΙΑΣ  
GREEK ATOMIC ENERGY COMMISSION

# Collaboration with AIRE Institute

The Atmospheric Ionizing Radiation Environment (AIRE) Institute, headquartered at Oklahoma State University, is the first research institute in the US focused primarily on the study of the steady state ionizing radiation environment in the atmosphere and its effects on life, the greater environment and on technology.

**ALMAR Air** Personal Aviation Dosimeter

**Each Dosimeter contains 1 to 4 Si MOSFET radiation detectors**

**ALMAR Air** will have one bare detector, one covered with polyethylene radiator and one covered with a  $^6\text{Li}$  radiator.

WiFi and USB connectivity

The aviation version of Almar Air dosimeter can thus serve as a personal dosimeter for future space tourists, as we as pilots, flight attendants and passengers on commercial, business and military aircraft.

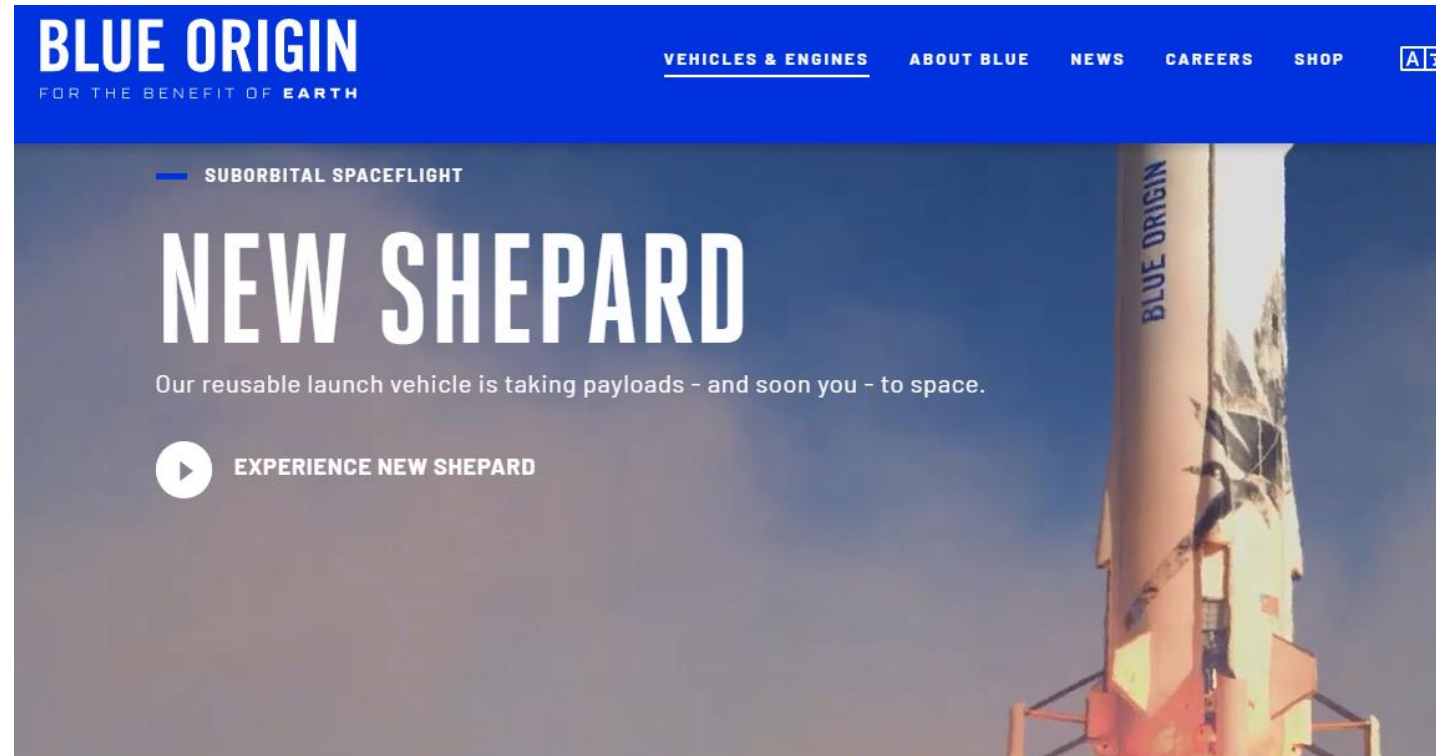
# Upcoming Flight Opportunities:

**Excited to be included in:**

Blue Origin New Shepard suborbital flight

Named after Mercury astronaut Alan Shepard, the first American to go to space, New Shepard is \suborbital rocket system designed to take astronauts and research payloads past the Kármán line – the internationally recognized boundary of space.

<https://www.blueorigin.com/new-shepard/>



# Upcoming Flight Opportunities:

Excited to be included in:

Artemis II mission





# Contact and Disclaimer

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### Continued focus on ESG

Lower power consumption, rechargeable batteries



### Portfolio evolution

towards higher-growth end markets,  
mitigating business risks



### Enhance returns to shareholders

Continuous investment in organic and inorganic growth



### Accelerated growth in line with global megatrends

IoT clever device, Digital AI protocol

**DISCLAIMER** | The data and conclusions contained in this presentation do not purport to contain or incorporate all the information that may be required to evaluate the proposed business decision; accordingly, any potential business partner should conduct more detailed analyses for purposes of its review of a possible partnership or business.

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