RadMon-on-ISS

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## **Polish Space Mission "IGNIS"**

#### Polish Space Mission "IGNIS" to the ISS

"IGNIS" (Latin for "fire") is the official name of Poland's first technological and scientific mission to the International Space Station.

Led by ESA project astronaut Dr. Sławosz Uznański as part of the Ax-4 mission, this endeavor will include 13 Polish experiments in fields such as medicine, biology, materials science, and AI.

RadMon-on-ISS is one of the experiments.

### **Experiment overview**

The objective of **RadMon-on-ISS (Phase-1)** project is to deploy the already existing, developed at CERN, **RadMon-NG** radiation monitor and measure the radiation environment inside ISS.

To be installed during crewed Axiom 4 mission.

Measurements of:

- Total Ionising Dose (TID) -> for online dosimetry, analysis of short-time radiation spikes.
- Flux and fluence of high energy hadrons (>20MeV) -> for monitoring potential drivers of electronics failure.
- HEH spectrum hardness -> by counting the SEUs and MBUs to detect malfunction conditions.

**RadMon-NG** has some initial flight heritage on nanosatellite missions Celesta and TriSat-R.

RadMon-on-ISS (Phase-2) to be deployed outside of the ISS in 2026 (TBC).



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## RadMon-on-ISS experiment

- Complex, Representative Space Environment:
  - The ISS orbits at ~400 km altitude in Low Earth Orbit (LEO),
  - within the Van Allen belts, crossing the South Atlantic Anomaly,
  - exposed to the Solar Particle Events (SPEs)
  - and to Galactic Cosmic Rays (GCRs).
- Cross-check against:
  - Other monitors at the ISS,
  - Space radiation models, e.g. SPENVIS.
- Potential extension of the experiment:
  - Different locations at the ISS,
  - Inside / outside monitoring.



#### **RadMon-on-ISS recap**





#### Short RadMon-on-ISS payload recap:

• Payload = Scalable Radiation Monitor + Cables + Mounting bracket

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- 1.470kg (instrument) + 800g (cables) + 160g (bracket)
- Power: 4.5W, powered from USB power supply
- Interfaces towards ISS: USB, Ethernet
- Crew interface: 2 switches and 3 LEDs
- Passively cooled
- 1 coin CR1220 3V RTC-Clock battery
- Operation: 3 modes of operation
  - Nominal mode: autonomous operation, no crew time needed

## **Technical/safety details**

#### The Scalable Radiation Monitor Payload consists of the following items:

Part Name	Part Number
Scalable Radiation Monitor Box	SRM-FM-01
Ethernet Cable	SRM-FM-02
USB Power Cable #1 (for PPS Mark 2)	SRM-FM-03
USB Power Cable #2 (for LISB Power Module and Multi-Port LISB Charger )	SRM-EM-04
Scalable Radiation Monitor Bracket	SRM-FM-05









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#### In the Columbus training module

Scalable Radiation Monitor installed in the Columbus training module at the European Astronaut Centre, Cologne, Germany

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#### **RadMon-on-ISS**

The Scalable Radiation Monitor consists of:

- Top cover
- SpacaRadMon-NG radiation detector
- EMC shield
- Carrier Card
- Main housing
- Switches, LEDs, switch guards, connectors, wire harnesses, screws, thermal pads



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## **Modes of operation**

#### Data via MPCC LAN (Ethernet), power via USB



Portable Power Suppy Mark 2 (COL-RIBRE-SPE-0164: 3.13.1) USB Power Module (COL-RIBRE-SPE-0164: 3.13.3.1) Multi-Port USB Charger (COL-RIBRE-SPE-0164: 3.13.3.2)

#### Scalable Radiation Monitor Power via USB

Portable Power Suppy Mark 2 (COL-RIBRE-SPE-0164: 3.13.1) USB Power Module (COL-RIBRE-SPE-0164: 3.13.3.1) Multi-Port USB Charger (COL-RIBRE-SPE-0164: 3.13.3.2)





**Operation: 3 modes of operation** 

- autonomous operation, data readout over MPCC network
- autonomous mode, data stored in the internal flash memory
- data readout to ZBOOK over USB

#### **Collected data**

**Radiation Monitor** generates raw data that, after processing, describe parameters of the radiation environment:

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- Total Ionising Dose (krad, Gy)
- High-Energy Hadron (HEH) fluence (cm<sup>2</sup>)
- CSV, ASCII-coded, text files (timestamp, raw readings from the sensor)





Axiom 4 mission launch postponed to 13/06/2025. SpaceX Falcon 9 on 39A launchpad in the Kennedy Space Center.



## Summary



- RadMon-on-ISS is part of Poland's first scientific mission to the ISS
- > Based on CERN-developed technology, the payload is compact, low-power, and already flight-proven on CubeSats
- Collects important radiation data inside the ISS:
  - Online monitoring of the radiation dose,
  - Number of high-energy (>20 MeV) particles.
- > The ISS offers a dynamic, semi-shielded space environment, ideal for real-world performance validation.
- RadMon can be used to support:
  - an improved radiation environment modeling,
  - development of radiation-tolerant electronics,
  - enhanced spacecraft and crew mission safety.

RadMon-on-ISS Phase-2, installed outside of the ISS, coming in 2026 (TBD)

#### **About SigmaLabs**

SigmaLabs offers strong competences in:

- mixed-signal, high-speed electronics design
- design of electronic systems to operate in radiation environment (including FPGAs, microprocessors)
- radiation environment analysis (modelling and simulation),
- electronic system reliability analysis
- test-beam campaign planning and execution
- in-orbit radiation data analysis

SigmaLabs, a team of former CERN engineers, is excited to collaborate on both ESA and private sector projects, supporting our partners and driving innovation. Our goal is to push the boundaries of state-of-the-art technology and contribute to establishing a strong, independent European presence in the space sector.

# SCALABLE **RADIATION MONITOR** 2025 ∕IX-ન IGNÌS 🛛 Labs

#### Thank you for your attention

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