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Lunar Electromagnetic Monitor in X-rays (LEM-X)

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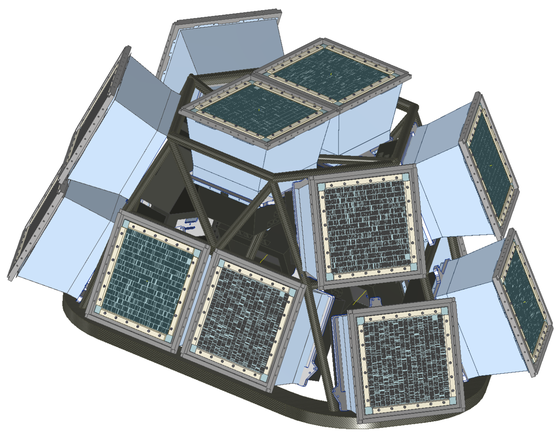
Project outline

The **Lunar Electromagnetic Monitor in X-rays** (LEM-X) is a proposed all-sky observatory on the surface of the Moon for the identification and localization of high-energy transients, and the long-term monitoring of X-ray sources. It will take advantage of Moon's stable environment and rotation to continuously observe all the accessible sky.

LEM-X has a modular structure based on independent **coded-mask cameras**. Each camera is active in the 2-50 keV range, has a 2-sr Field Of View and is able to achieve 4-arcmin angular resolution, and 1-arcmin Point Source Location Accuracy.

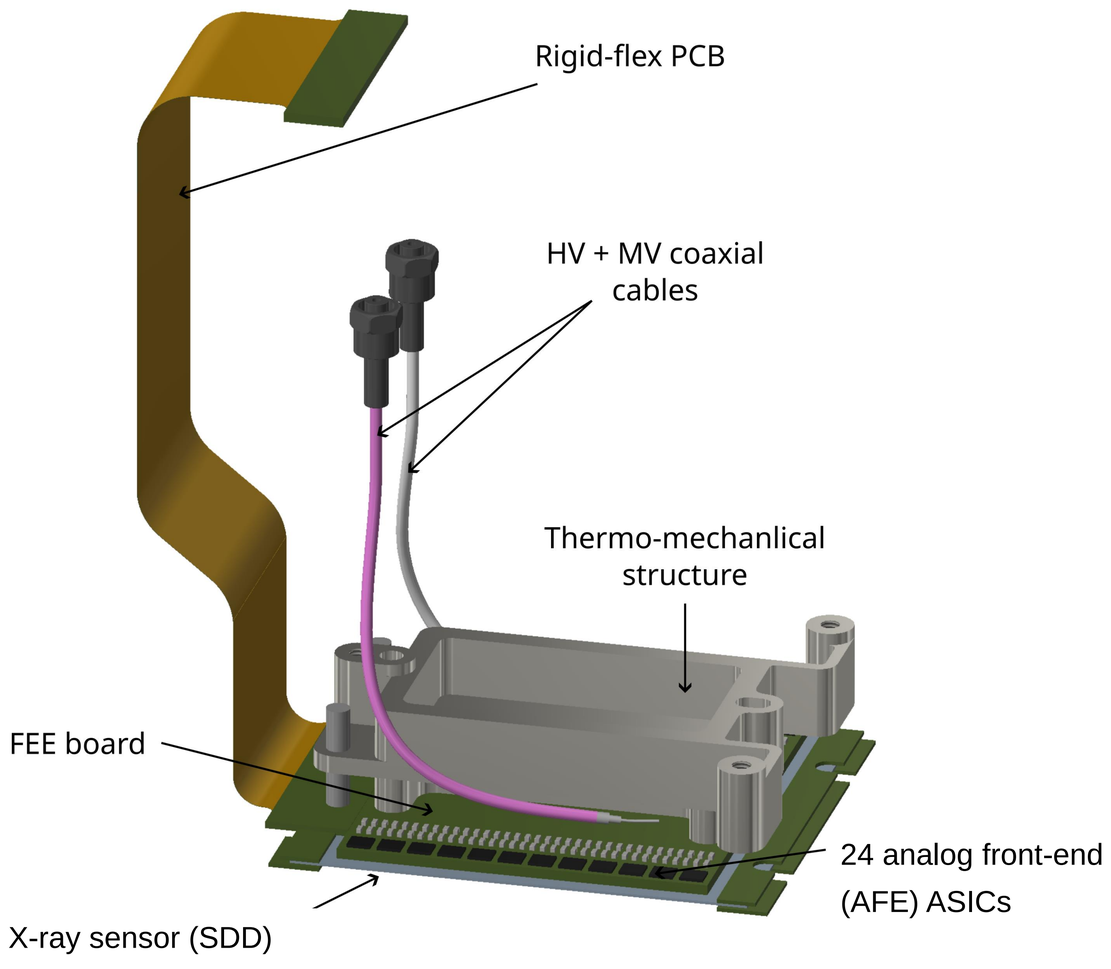


Current configuration of LEM-X

Project status and key technologies

The project is currently focused on demonstrating key technologies essential for the mission. The component under development is the Detector Assembly (DA), with four DAs forming the focal plane of each camera.

State-of-the-art X-ray sensor and Front-End Electronics are being designed and developed by the collaboration for this project.



Drawing of the Detector Assembly

X-ray Sensor

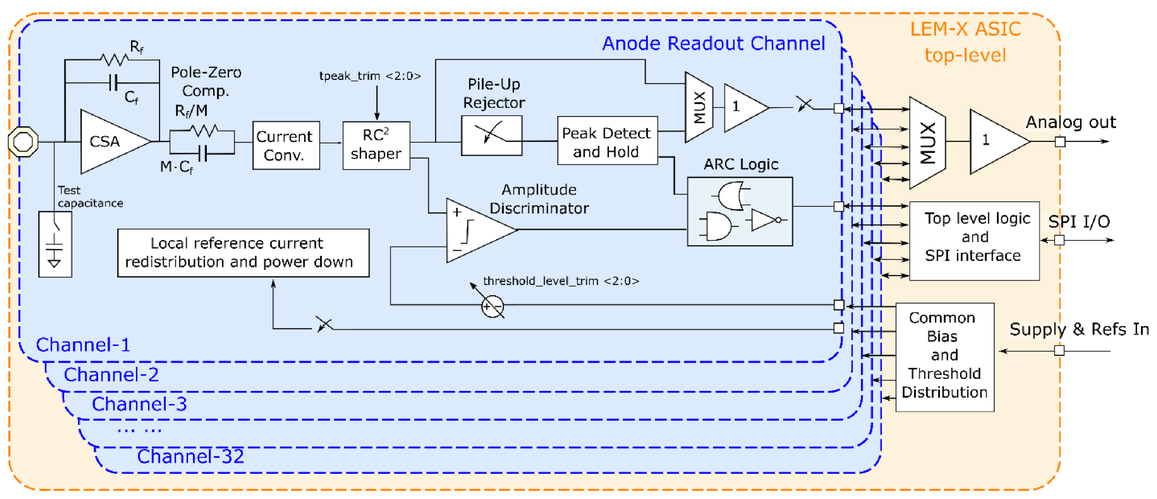
The sensor is a large-area linear **Silicon Drift Detector** (SDD) [see Poster by E. Del Monte].

Parameter	Value
Active volume (X × Y × Z)	64.90 mm × 70.18 mm × 450 µm
Number of anodes	384 per side
Anode pitch	169 µm
Anode capacitance	~90 fF
Drift field	360 V/cm
Drift speed	~7×10^6 mm/s
Spatial resolution at 2.5 keV	< 150 µm (anode) < 8 mm (drift)

Main parameters of the detector

Front-End Electronics

Each half of the SDD is read out by 12 **Analog Front-End** (AFE) **ASICs**. Each ASIC has 32 independent input channels, to be wire-bonded to as many detector anodes.



Functional block diagram of the AFE ASIC

Parameter	Value
Chip dimensions	4900 × 4320 μm^2
Number of channels	32
Channel pitch	150 µm
Equivalent Noise Charge	< 17 e^-_{rms}
Time resolution	< 10 µs

Main parameters of the AFE ASIC

FE board and support structure

The **Front-End Board** (FEB) is designed to support the detector and ASICs, while ensuring low thermo-elastic distortion across operational temperatures. The selected FEB material is thick-film substrate on Al_2O_3, but alternatives are under consideration (CIC, MCL-E-770G). A titanium structure bonded to the FEB provides mechanical and thermal interfaces to the camera, allowing alignment and cooling of the DA.

Acknowledgements

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