LABOSAT: AN ELECTRONIC PLATFORM TO PERFORM EXPERIMENTS ON SATELLITES

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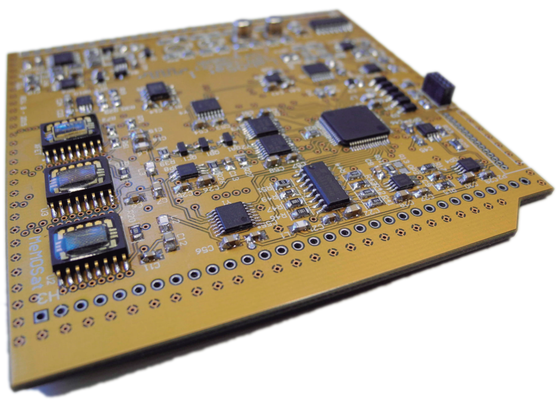
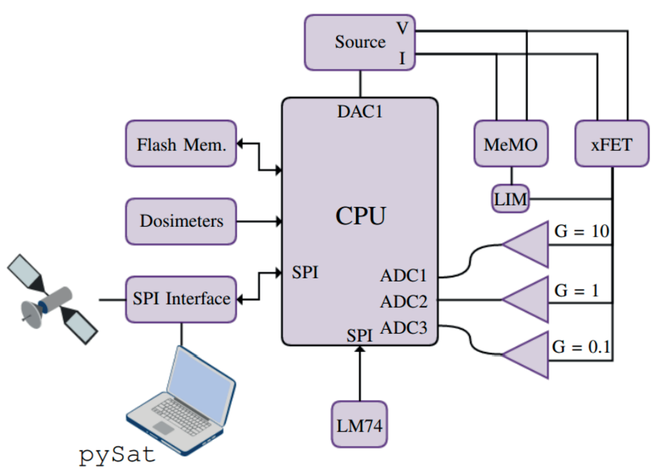
What is LabOSat?

- **LabOSat-01** (acronym for "Laboratory On a Satellite") is an electronic platform designed to perform experiments in harsh environments.
- Built to **operate under extreme conditions**: low pressure, thermal stresses, ionizing radiation and accelerations produced during launching.
- **Objective:** test and validate both custom and commercial electronic devices.
- **Small size, light weight**.
- Used to perform **experiments** on board small satellites.





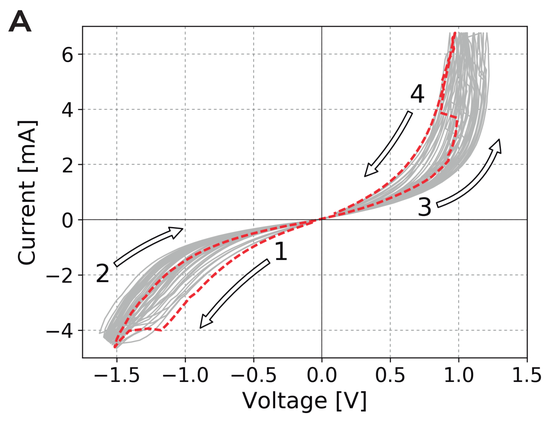
Width: 10cm Height: 10cm Weight: 36gr

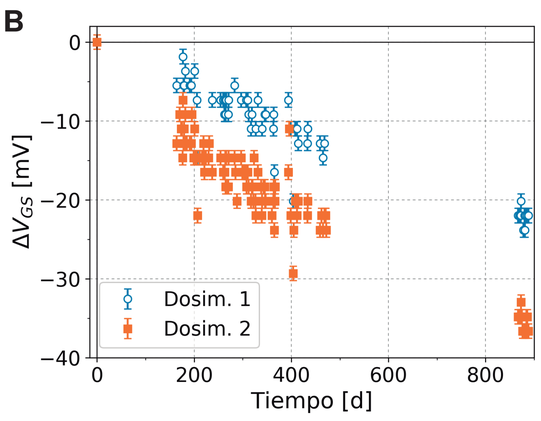
Missions in Space

Since 2014, seven LabOSat-01 have been launched on board of spacecrafts developed by the Argentinian company Satellogic [1]. All the electronic boards and the devices on them are still fully operational in Low Earth Orbit sending data daily for analysis.

Current experiments:

- **MeMO**: IV curves and endurance tests for **RRAM** (Resistive Switching) devices (or any 2-ports device!). **Figure A.**
- **xFET**: IV curves for **TFT** (Thin Film Transistor) devices (or any 3-ports devices!).
- **Dosimeters:** TID measurements using COTS **pMOSFETs**. **Figure B.**





Main electrical characteristics

The platform as an SMU (with 12 V DC supply) can provide:

Current source	Voltage source
Power (over load): 230 mW	Power (over load): 185 mW
Max. current: 23 mA	Max. voltage: 9.25 V
Resolution (low): 320 nA	Resolution: 2.26 mV
Resolution (high): 5.62 µA	

Rad-Hard electronics

- Withstood 10 MeV proton fluences of up to 1.03×10^{11} p/cm^2 [5]
- Withstood thermal neutron fluences of up to 3.58×10^{12} /cm^2 [5]

Contact

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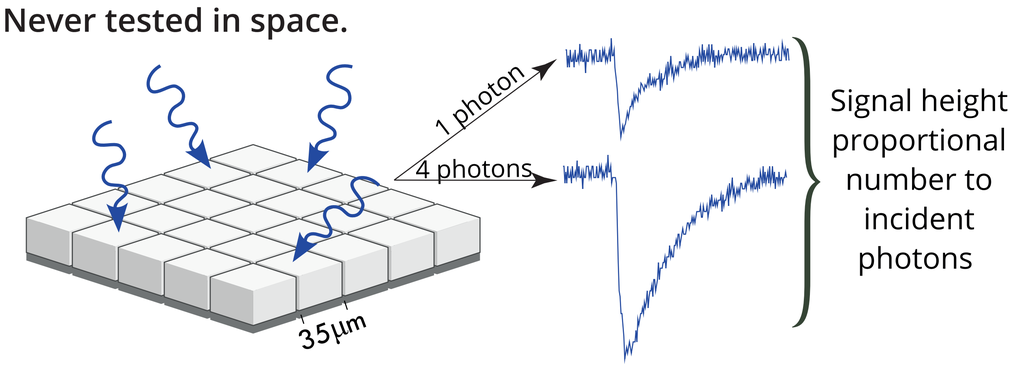
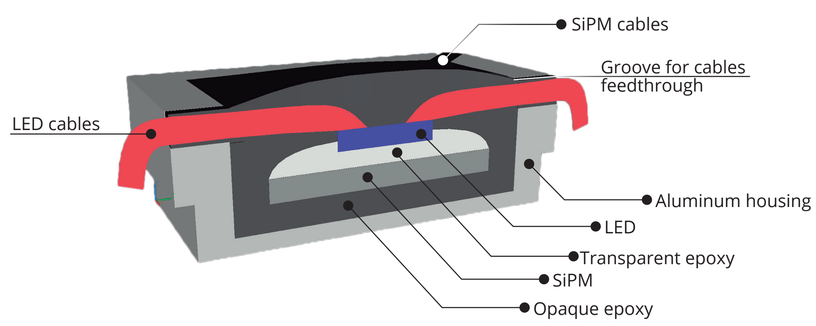
In Development

- The **next mission** to be launched is set to test the **Silicon Photo-Multiplier**.
- Design is finished. Now in **prototyping phase**.
- Planned to be delivered to Satellogic for integration in December and to be **launched into orbit in April**.

Silicon Photo-Multiplier

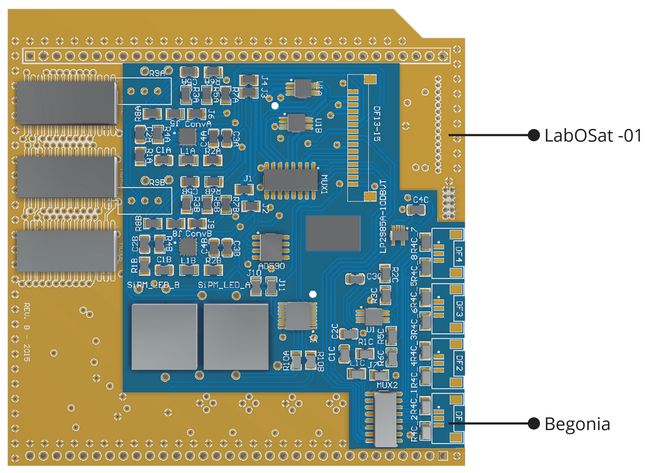
- **Novel optoelectronic device.**
- **Sensitive to single photons.**
- Array of avalanche photodiodes on Geiger mode connected in parallel.
- Used in high energy particle physics, nuclear medicine, ...
- **Perfect for space applications**: small size, light weight, insensitive to magnetic fields, mechanically robust.
- **Never tested in space.**





Begonia Payload

- Will **characterize and validate** the use of **SiPMs** and its DC power supply **on satellites**.
- Integrates **two SiPMs** within the LabOSat platform.
- **In orbit, measures the SiPM's response to a range of light intensities** in order to quantify the effects of temperature variation, and of the total ionization dose.



Future work

Begonia is the first step towards the larger goal of the design and implementation of an SiPM-based high-energy particle detector for spaceborne applications.

References

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[5] M. Barella. TiO2 based memory devices: fabrication and characterization in hostile environments via a dedicated controller, PhD Thesis, Universidad de Buenos Aires, 2018.