

# Radiation Damage Assessment of SiPMs for the Ziré Experiment on board the NUSES space mission

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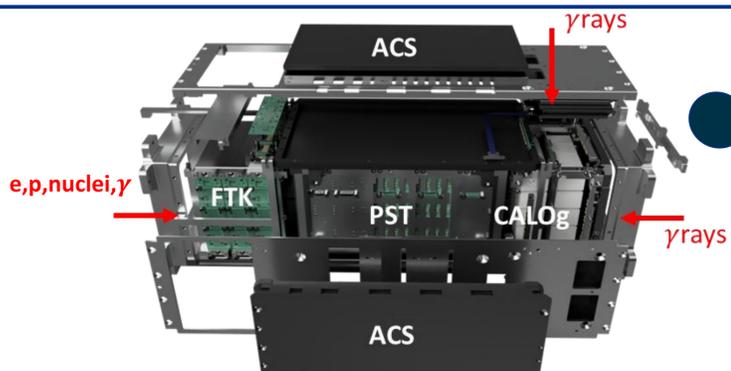
NUSES is a space mission that employs a novel technology in the field of space instrumentation: SiPMs. SiPMs offer significant advantages over traditional PMTs, as they are lighter and require lower power consumption. However, they are more sensitive to radiation, making dedicated radiation studies necessary to assess their performance and reliability in the space environment.

## The NUSES collaboration

Counts 60+ members from: GSSI, several INFN division, Thales Alenia Space Italy, Italian Institutions, University of Geneva (CH), Columbia University, NYU Abu Dhabi, Pennsylvania State University, NASA Goddard Space Flight Center

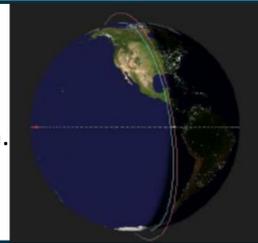
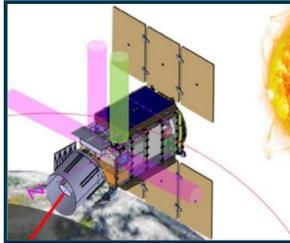
## Ziré

Possibility to study solar/galactic cosmic rays. Pathfinder of future missions to measure MeV gamma-rays from stable and transient astrophysical sources. Monitor of the variations of the flux of protons and electrons ( $E < 250$  MeV) in the ionosphere and magnetosphere, possibly correlated with seismic activity.



## The Orbit

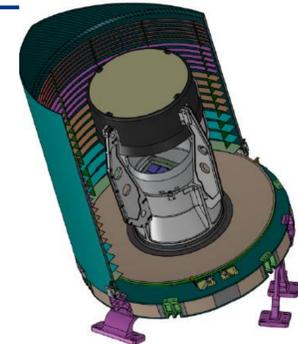
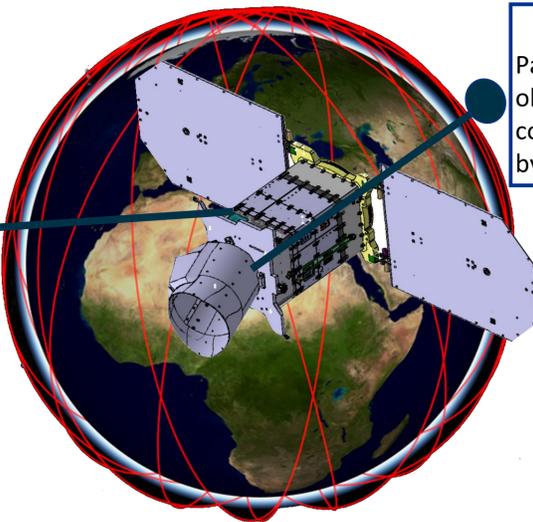
3.25Y Mission, 535 km LEO, sun-synchronous orbit 97.7° on the day-night border. Orbit optimization for Cherenkov photon detection. Ballistic mission (no propulsion for orbital control)



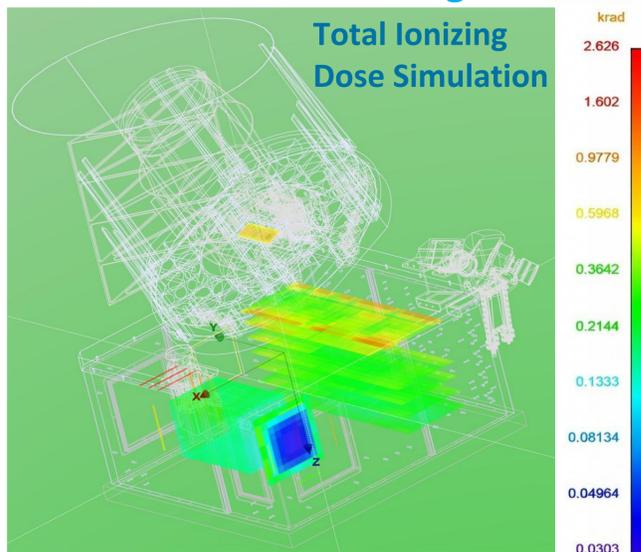
## NUSES hosts 2 payloads:

## TERZINA

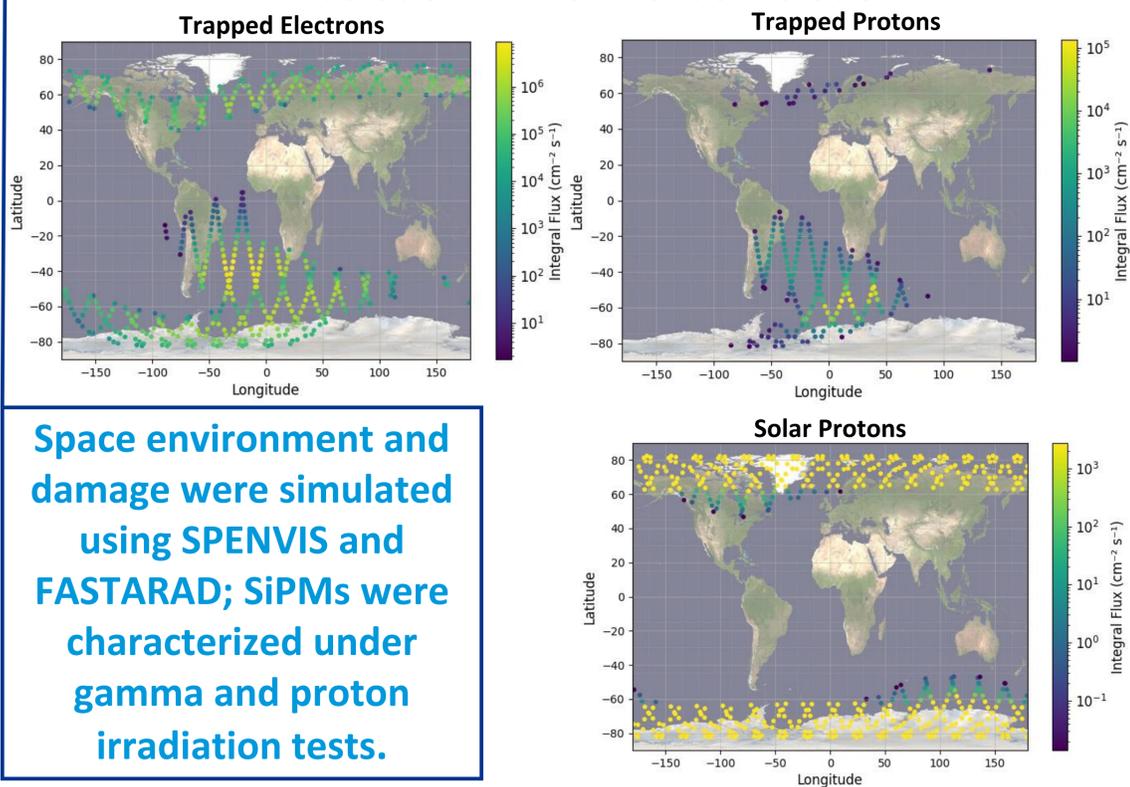
Pathfinder of future missions devoted to testing new observational techniques to study ultra-high energy cosmic rays (UHECRs) and perform neutrino astronomy by detecting atmospheric Cherenkov light from orbit.



## Radiation Damage



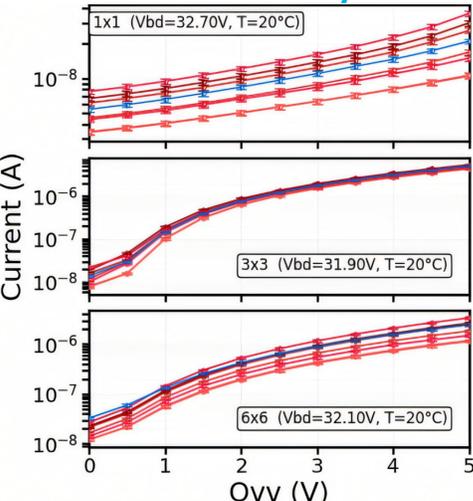
## Radiation Environment Simulation



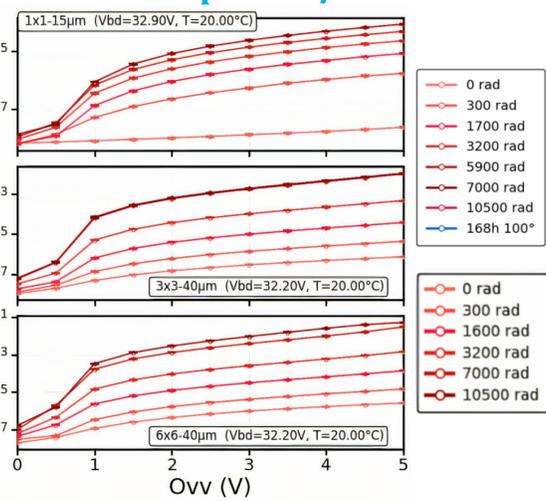
Space environment and damage were simulated using SPENVIS and FASTARAD; SiPMs were characterized under gamma and proton irradiation tests.



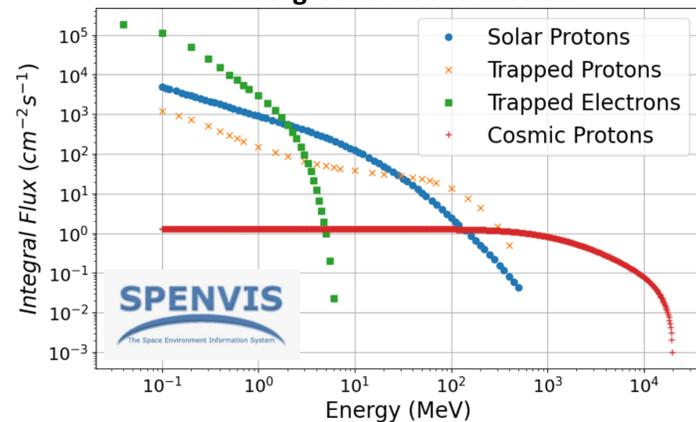
## Co-60 Analysis



## 100 MeV p+ Analysis



## Background NUSES mission



Integral Flux of trapped p, e- and solar p as a function of the energy. Geographical distribution of trapped particles. Expected data for 3Y mission along the nominal orbit.

## References:

- [1] Instruments 2023, 7(4), 40
- [2] EPJ Web of Conferences 283, 06006 (2023)
- [3] J. Cosmol. Astropart. Phys. 2025, 07, 073