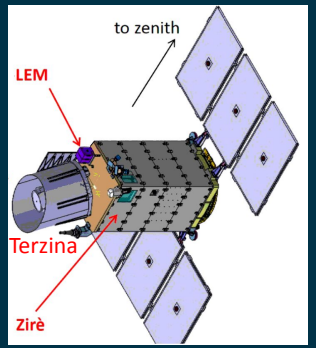
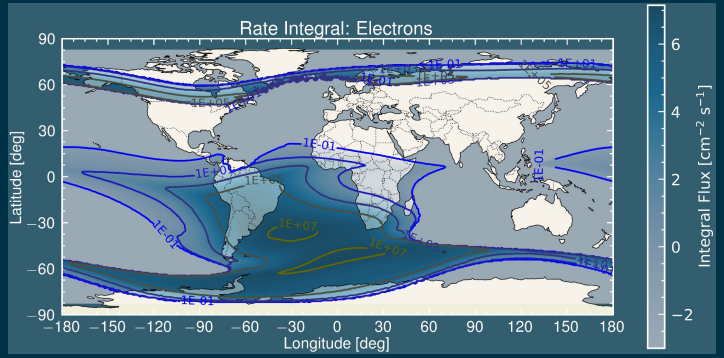
NUSES: nuova sigla in CSN2. Il nostro gruppo è coinvolto con la responsabilità del LEM

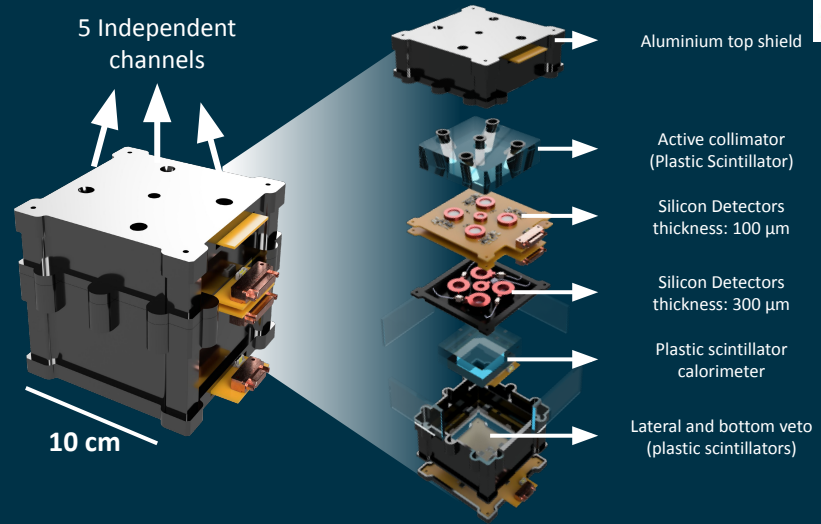
NUSES collaboration dentro INFN:

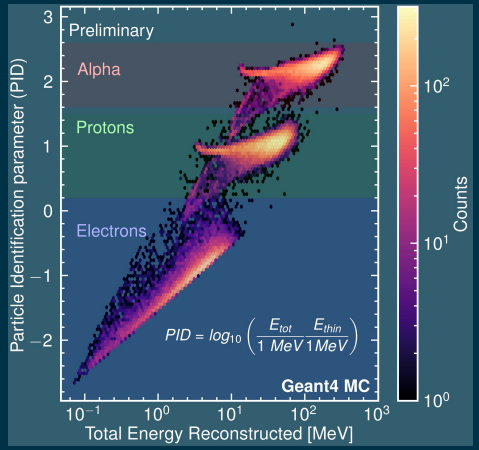
- **LNGS(GSSI): 12 FTE**
- **TIFPA, Torino, Bari , Napoli, Lecce (ognuna apre con 1.5 FTE)**

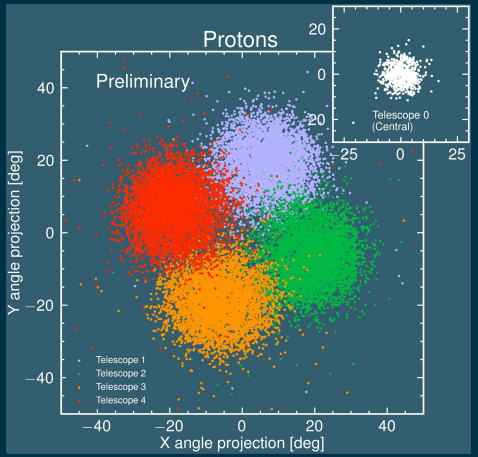
Zirè: charged particles / γ (range: MeV-sub-GeV)
Terzina: optical telescope for neutrino investigation
The (10x10x10 cm³) Low Energy Module (LEM), performs event-based measurements of energy, direction, and composition of low-energy charged particles down to 0.1 MeV.









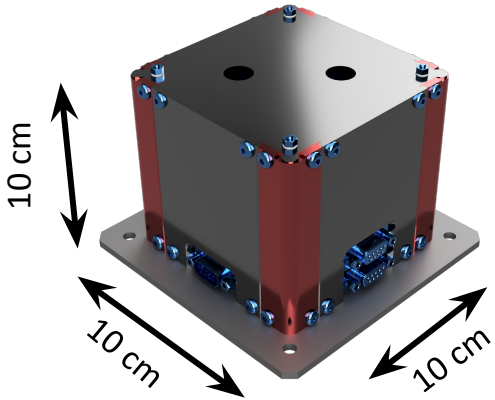


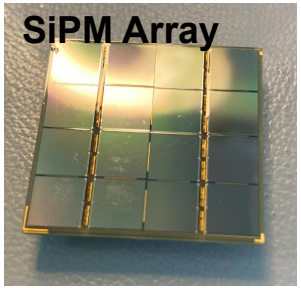
SPaRKLE (UniTN student team selected for the ESA Academy Experiments Programme)

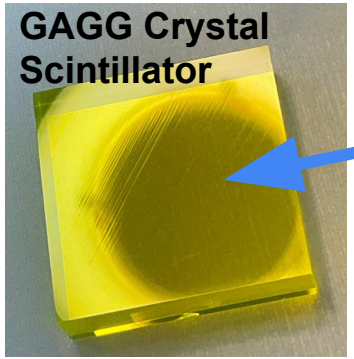
Small
Particle
Recognition
Kit for
Low
Energies

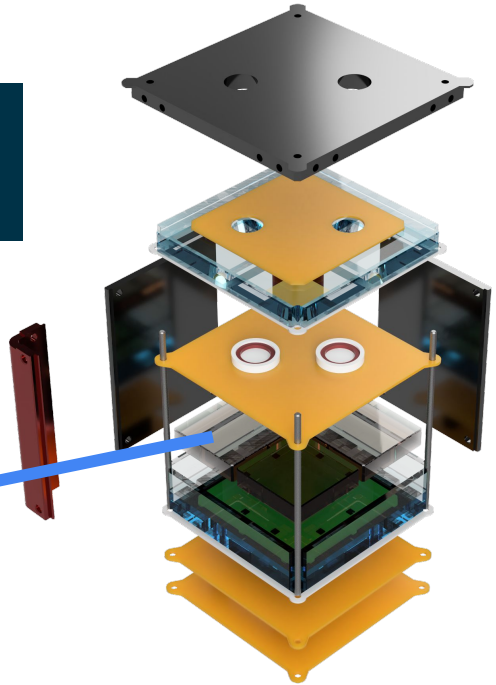
- Interdisciplinary student team working on the realization of the P/L
- Same detection concept of the LEM
- SPaRKLE will be installed on Space Rider
- Space Rider is an uncrewed robotic laboratory in orbit

Plastic Scintillator in the core replaced by inorganic scintillator (GAGG) → **Possibility to do gamma-ray Physics: GRB, TGF**









NUSES @ TIFPA

Lo scorso anno NUSES era in CSN5 ed eravamo inclusi a 0 FTE.

Composizione preventivata del gruppo:

F. Nozzoli: 0.3 FTE (Resp. Loc.)
R. Nicolaidis: 0.3 FTE (PhD al terzo anno scrive la tesi sul LEM)
L. Ghezzer: 0.4 FTE (PhD al primo anno, ha sviluppato un nuovo cherenkov da testare su Zirè)
D. Shledevitz: 0.5 FTE (PhD al primo anno, affiancherà Nicolaidis per i test del LEM)
Supportano il gruppo (ma con 0 FTE): R. Battiston, R. Iuppa, P. Zuccon.

Pubblicazioni:

-*"Progress Status of the NUSES Space Mission"* submitted to **Adv. Sp. Res.**
-*"The Low-Energy Module of the Ziré Instrument Onboard the NUSES Space Mission: A Compact Detector of Low-Energy Electrons and Protons in High-Radiation Environments"* submitting soon to **Adv. Sp. Res.**
-*"The Low-Energy Module of the Zire Instrument Onboard the NUSES Space Mission: A Compact Detector of Low-Energy Electrons and Protons in High Radiation Environments"* accepted for publicaton in **Centr. Eur. Astroph. Bull.**
-*"The Ziré instrument onboard the NUSES space mission"* **Nucl.Instrum.Meth.A 1068 (2024) 169794**
-*"The Terzina instrument on board the NUSES space mission"* **PoS ICRC2023 (2023) 391**
-*"The Low Energy Module (LEM) of the Zire payload on board the NUSES space mission"* **PoS ICRC2023 (2023) 1316**
-*"A Compact Particle Detector for Space-Based Applications: Development of a Low-Energy Module (LEM) for the NUSES Space Mission"* **Instruments 7 (2023) 4, 40**
-*"Characterizing Low-Energy Charged Particles in the Magnetosphere with the LEM CubeSat Spectrometer Project: Detector Concept and Hardware Characterisation"* **Universe 9 (2023) 7, 331**

NUSES Richieste

TDR in corso di formulazione:

	Funds (M€)	Item/Activity
Restart Program/CIPE (to GSSI)	7.0	Scientific Payloads
Ministero Sviluppo Economico (to TAS-I) TAS-I contribution	11.0 9.0	Satellite Platform
Agenzia Spaziale Italiana	4.0	Launch and ground segment
INFN (requests for 2026-2030)	**1.0**	Tests, Operation and data analysis
Total	**32.0**	

GSSI -> INFN	Motivation	Notes
2021: 400k€ 2022: 100k€	Refurbishment of a 250m² space in the external LNGS facilities ("ex autorimessa 2") to host NUSES activities	Works finished in 2025. Now transferring equipments. Activity: starting tests & integration
2021: 150k€ 2022: 100k€ 2022: 200k€	Part of the costs relate to the experimental activities in GSSI/LNGS and the other INFN units (LNGS, GSGC, TO, TIFPA, PD, RM2 till 2024, NA, BA, LE)	About 50k€ foreseen to be available after 2025
Total 950k€		

Ipotesi di richieste ad INFN (globali da confermare)

Requests to INFN (k€)	2026	2027	2028	2029	2030
Travels (Integration, Qualification tests, Beam tests, Radhard test, Simulation & Data analysis,…)	110	130	80	80	50
Lab consumable, equipments, clean room costs,…	40	50	50	30	15
EQM → FM : test/calibrations	50	20	30	30	10
Storage and computing	30	30	30	30	20
Equipment transportation	20	20	10	10	5
Total	**250**	**250**	**200**	**200**	**100**
Additional contribution left from GSSI→INFN funds	50				