Agenzia Spaziale Italiana

SPACE IT UP!

Space It Up!

Politecnico di Torino

Space It Up!

Richiesta servizi 2026

Simone Maldera

Space It Up! - Project overview

Objectives

PROMOTE INNOVATION AND EXTEND FUNDAMENTAL KNOWLEDGE

-

FOSTERING A SUSTAINABLE FUTURE

ENSURE LONG-TERM HUMAN PERMANENT IN EXTRATERRESTRIAL SPACE

STRENGTHENING THE SPACE 'ECOSYSTEM' IN ITALY

-33 partners - valore 80M€ - durata 30 mesi (estesi a 42)

- iniziato ufficialmente a Luglio 2024

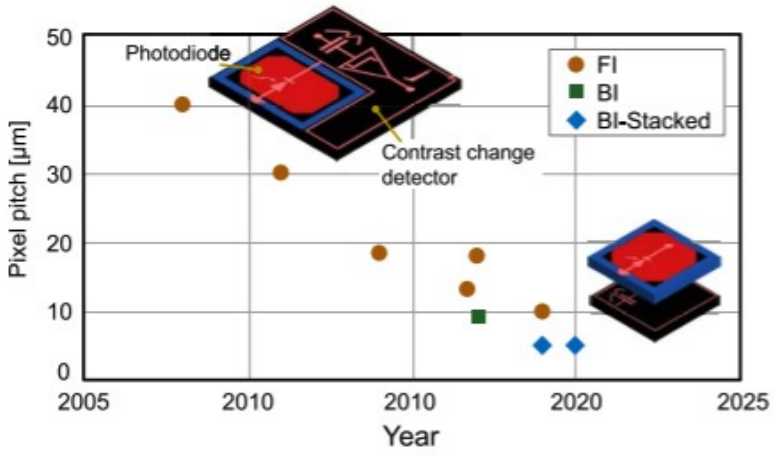
- progetto organizzato a "spoke and hubs"

INFN capofila spoke 4
"Next Generation Detectors of Ionizing Radiation and Fields for Remote Sensing"

+ coinvolgimento in altri spoke

Spoke 4
Next Generation Detectors of Ionizing Radiation and Fields for Remote Sensing

Mission statement Design, **develop and qualify high resolution, miniaturized detection systems for the next decades satellite missions** observing ionizing radiation around the Earth and water reservoirs on the Planet. **Establish a reliable supply chain of national manufacturers** for all critical components of the integrated sensors, electronics and mechanical units, on the basis of successful heritage projects.



Y. Oike, *Evolution of image sensor architectures with stacked device technologies*, IEEE, 2022, Vol69, N. 6

- Development and test high efficiency, high resolution (position and energy), low power, miniaturized particle detectors using silicon semiconductor manufacturing processes commercially available in Italy
- High sensitivity breadboard of a gravitational reference system with increased sensitivity with respect to existing satellite geodesy missions
- Innovative miniaturized detectors for monitoring the Sun radiation and its transient emissions.

Spoke 4 -Next Generation Detectors of Ionizing Radiation and Fields for Remote Sensing

WP 4.2

High-density, low-power silicon sensors for tracking ionizing particles in space

- Sensor design and fabrication
- Data Acquisition systems and Back End Electronics
- TRL assessment
- Sensor performance calibration

L: INFN, TL: UNIPI, UNITN, Others: FBK, UNITO (Art.15)

WP 4.3

SiPM based detectors for ionizing radiation in space

- Detector design and characterization
- Readout and Data Acquisition Electronics
- Prototype Integration
- Tests and TRL assessmenet

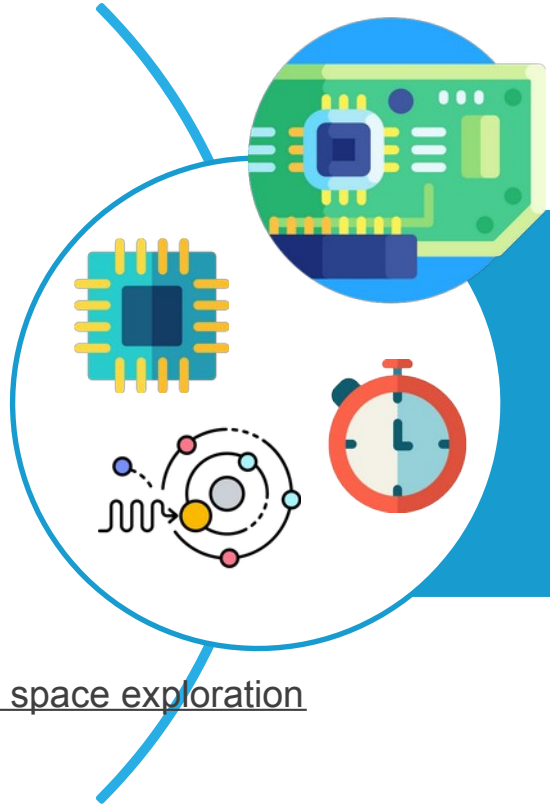
L: GSSI, TL: UNINA, Others: FBK, INAF, TASI

WP 4.6

New time and frequency references for detector synchronization and deep space exploration

- Analysis of requirements for microfabricated clock in space
- Analysis and design of critical components
- Critical components procurement, fabrication and testing

L: INRIM, Others: TASI, GSSI, INFN



Compact enabling detectors for space

Spoke 4 -Next Generation Detectors of Ionizing Radiation and Fields for Remote Sensing

WP 4.2

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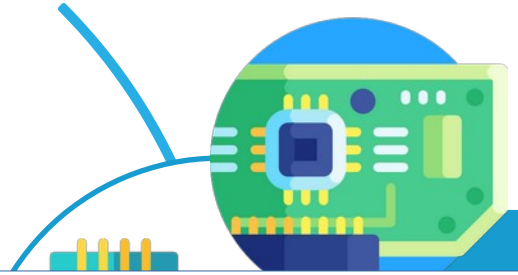

Compact
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Main activities @ INFN-TO:

4.2.1 Sensors design and fabrication

Design and produce arrays of large area (~cm^2), low-power (<20mW/cm^2), high-granularity (~10^5 channels/cm^2) radiation sensors using commercially standard 110nm CMOS manufacturing sites in Italy and LGAD detectors for timing and low-energy X-ray detection.

(@TO: sviluppo MAPS)

4.2.3 TRL assessment:

Define a strategy to assess the technology readiness and the path towards space qualification for the CMOS tracking sensors developed in this WP

(@TO: prototipi meccanici, unita' integrate e eventuali test qualifica)

INFN Torino roles & responsibilities

- Manage INFN participation - L. Latronico - Spoke4 Leader & INFN representative
- Administer INFN funds - P. Mauro, R. Porcu - Financial Officers
- Lead Task 4.2 – Manuel Rolo

Personale coinvolto:

- 1.2 FTE staff (25% da rendicontare ad ASI per Latronico, Rolo,Di Salvo, Coli, Maldera)
- 2 FTE TD: 1 AdR senior meccanico, con presa di servizio a Settembre 2025, 1 AdR senior tecnologico elettronico (Mandurrino)
- 1 tecnologo TD full-time Unito (su fondi del progetto) esperto di integrazione e test di rivelatori

Richieste servizi 2026

Responsabile scientifico locale
Manuel Rolo

Laboratorio Elettronica:

- 3 mesi/anno di Manuel Rolo:

  WP4.2 management, definizione requisiti MAPS, gestione acquisti in fonderia
- 3 mesi/anno di Andrea Di Salvo:

  disegno elettronica digitale nei MAPS

Progettazione meccanica:

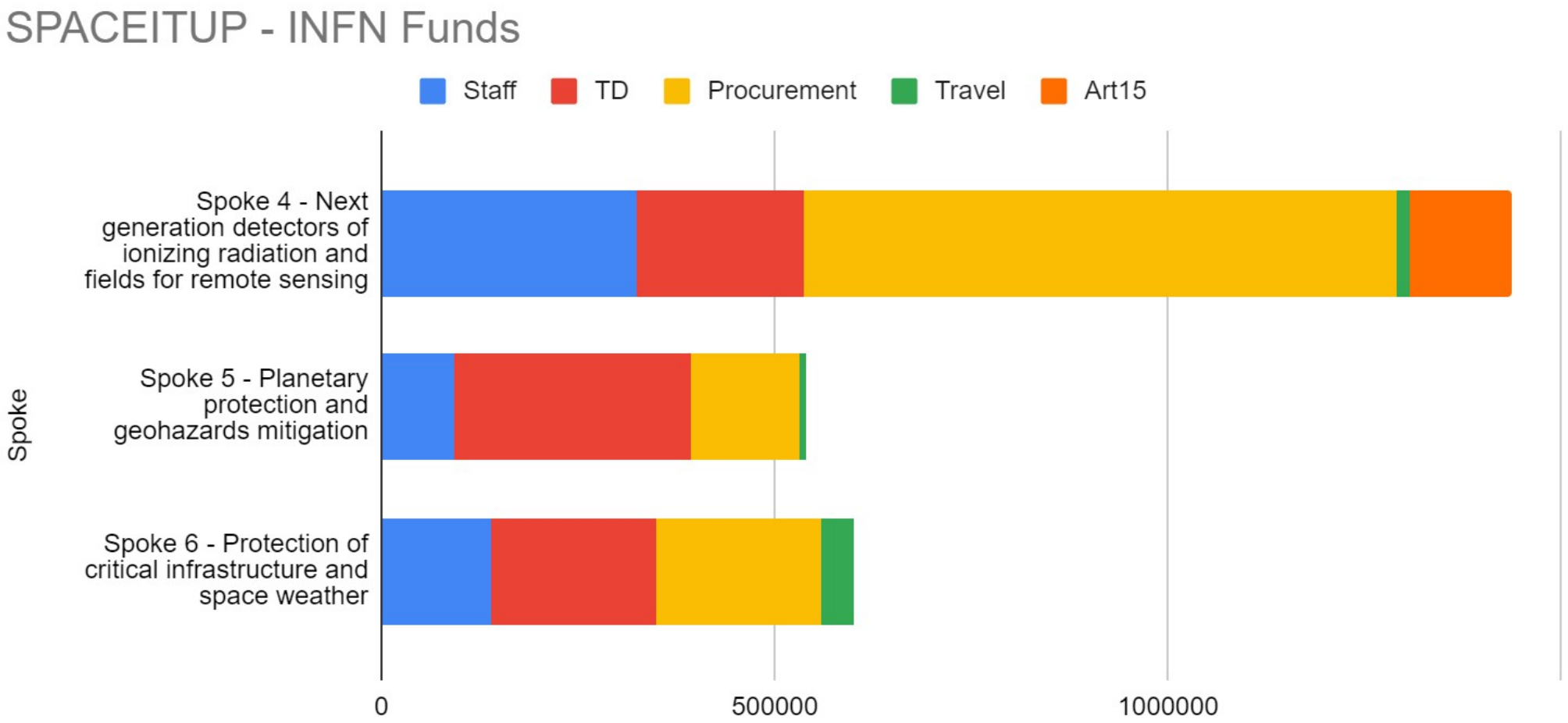
- 3 mesi/anno di Silvia Coli:

  studio ed ottimizzazione di strutture meccaniche di alloggiamento di dispositivi MAPS per spazio e meccaniche di supporto ai test funzionali dei dispositivi e supervisione AdR meccanico
- 3 mesi CTER meccanico

  per piccole costruzioni tools assemblaggio e parti di moduli

Reference material

INFN Budget


SPACEITUP - INFN Funds
Staff
TD
Procurement
Travel
Art15
Spoke
Spoke 4 - Next generation detectors of ionizing radiation and fields for remote sensing
Spoke 5 - Planetary protection and geohazards mitigation
Spoke 6 - Protection of critical infrastructure and space weather
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Spoke 5 vs Spoke 4 and 6 : Earth Observation Synergies and Complementary Approaches

Spoke 4
Sensors for non imaging remote sensing

Spoke 5
Science and Research on Natural Hazards

Spoke 6
Space Weather

Technology-Driven Science
Enabling the deployment of instruments, for data collection, sample analysis, and remote sensing.

Science-Informed Technology
Tech aligned with the needs of space exploration; efficiency, safety, and sustainability of technology development.

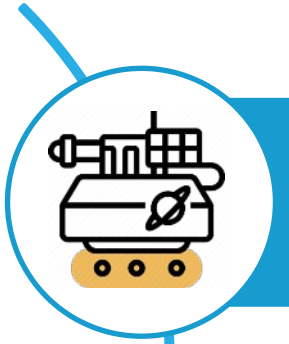
Interdisciplinary Collaboration
Interdisciplinary exchange, facilitating the integration of technological advancements

Spoke 5: Technical WP's
WP 5.3 & WP 5.5 - Technologies for multipoint remote sensing and data analysis

WP 5.3

- On board processing advanced architectures
- Miniaturization of instrumentation and measuring devices.
- Environmental sensing based on signals of opportunity

L: UNITN, CL: INGV, TL: UNIROMA1, INAF, UNIPI, INFN
. Others : CNR, FBK, LINKS, UNIFI, TAS-I, PoliTo



Technology developments for nanosatellite remote sensing

WP 5.5

- integrating physical modelling, data assimilation and AI for multimodal systems
- AI techniques for multitemporal data
- Advanced DInSAR and GNSS techniques

L: UNITN, CL: INGV, TL: UNIROMA1, CNR, UNIPI, PoliTo, UNICAL
Others: EGEOS, INAF, UNIFI, LEONARDO, LINKS, CMCC

Technology developments for remote sensing data analysis

Spoke 5: Technical WP's
WP 5.2 & 5.4 – Downstream and upstream advanced strategies and tools

Strategies for bridging gaps in current EO systems

- Available ground and satellite data on Earth natural hazard
- Understand gaps in planned EO constellation
- Identify requirements for nano-satellites constellation

L: UNITN, CL: INGV, TL: UNITN, INGV
Others: CNR, UNIROMA, UNIFI, UNIPI, POLITO, CMCC, INFN, LINKS, CIRA, LEONARDO, ARGOTEC

WP 5.2

New services based on advanced data and IT technologies

- Physical and AI tools for EO big data analysis
- Cross database and data fusion tools and products
- Role of inflatable for EO
- Advanced EO data processing

L: UNITN, CL: CNR, TL: UNITN, CNR
Others: INGV, UNIROMA, UNIFI, UNIPI, POLITO, CMCC, INFN, LINKS, EGEOS

WP 5.4

Spoke 6: Technical WP's
WP 6.2 & WP 6.3 - Enabling Science Innovative Space Architectures

WP 6.2

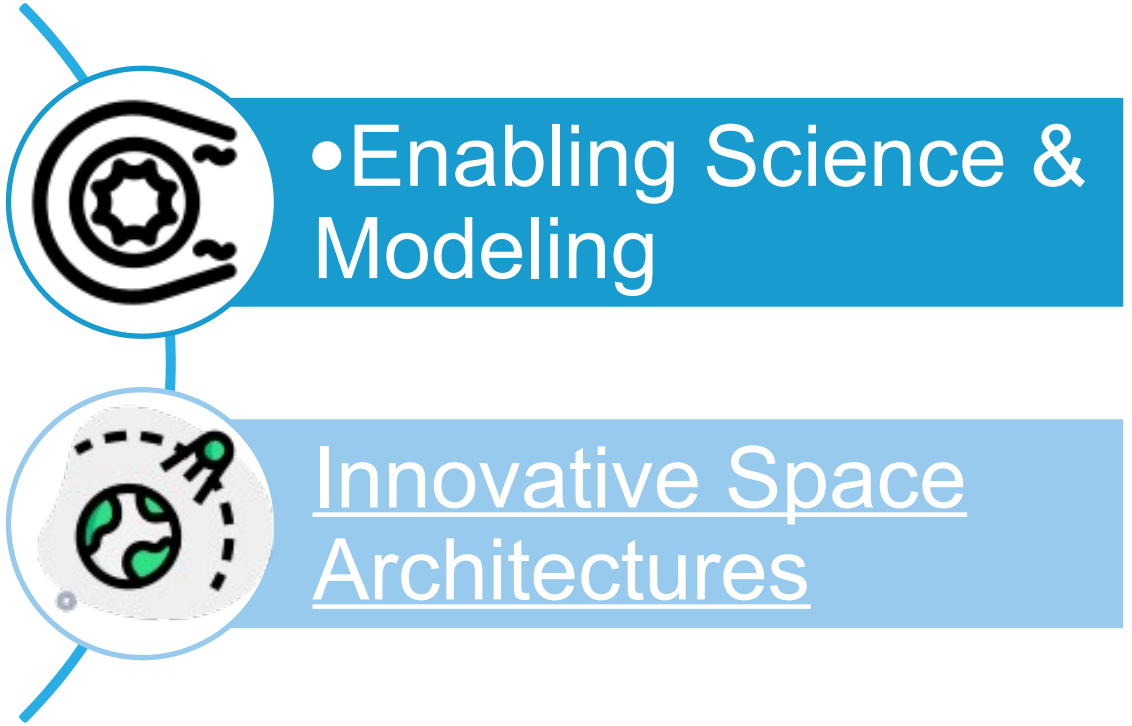
Study of the
- •solar atmosphere conditions (or Active Sun)
- •interplanetary medium
- •particle radiation environment
- •solar wind-magnetosphere-ionosphere coupling
- •thermosphere-ionosphere response
- •

L: INAF, CL: UNICAL, INGV, UNIROMA2, Telespazio

WP 6.3

- Scientific requirements
- Payload trade-off analysis
- Orbits and Mission Profile Definition
- System-level SWE instruments breadboarding

L: INAF, CL: UNICAL, UNIROMA2, INFN, UNITN



Spoke 6: Technical WP's
WP 6.4 & 6.5 – Advanced Applications for SWE nowcasting and forecasting & Experimental activities

- Advanced Applications for SWE nowcasting and forecasting

- Forecasting techniques
- Automated nowcasting of SWE drivers
- Assessment of SWE effects on near-Earth and ground infrastructures
- Forecast Networking

L: INAF, CL: INGV, UNIROMA2, ALTEC, Telespazio

WP 6.4

Experimental activities

- System-level SWE instruments breadboarding
- Forecast Networking

L: INAF, CL: INFN, INGV, UNIROMA2, ALTEC

WP 6.5

Spoke 4
Next Generation Detectors of Ionizing Radiation and Fields for Remote Sensing

High sensitivity breadboards for geodesy

Gravitational reference test mass system for geodesy and gravitational remote sensing of the Earth water cycle

- Requirement analysis of a GRS system
- Design and performance analysis
- Electrode housing prototype
- GRS test and performance verification

L: UNITN

WP 4.4

Miniaturized detectors for the Sun

Emerging technologies devoted to Earth-Sun interation phenomena and Space Weather monitoring

- Technology for sensors of Energetic Neutral Atoms
- Technology for sensors of polarized X-rays
- Technology for plasma sensors

L: INAF, CL: INFN

WP 4.5

Additional INFN Torino roles & responsibilities

- Contribute to T4.2.2 (UNIPI) - BEE and DAQ deployment:
  - develop specific Back-End Electronics (BEE) and a general purpose Data AcQuisition (DAQ) system with a space-ready architecture and deploy prototypes to support functional and performance verifications of tracking systems with O(10^6) analog channels
- Contribute to T4.2.3 (INFN-PI) with UNITO (via Art15) - TRL assessment
  - define a strategy to assess the technology readiness and the path towards space qualification for the CMOS tracking sensors developed in this WP
- Contribute to T4.2.4 (INFN-TN) - Sensor performance calibration
  - plan and execute comprehensive performance verifications and calibrations.