CdS 09 luglio 2024

Note

Flavia Groppi

Sigle presso la Sezione di Milano 2024

Continuano con responsabilità locale:

~~*ASTRACT~~	~~(2021)~~	~~RL~~	~~Marco Prioli~~
CUPRUM_TTD	(2023)	RL	Flavia Groppi
DIODE	(2022)	RL	Alberto Fazzi
FUSION	(2023)	RL	Davide Bortot
IONS	(2022)	RL	Andrea Locatelli
MATHER_3D	(2023)	RL	Ivan Veronese
MICRON	(2022)	RL	Alberto Bacci
* NAMASSTE		RL	Manuel Mariani
NEXT_ AIM	(2022)	RL	Cristina Lenardi
* QUANTEP	(2021)	RL	Valentino Liberali
QUB_IT	(2022)	RL	Stefano Carrazza
SAMARA	(2022)	RL	Michele Bertucci

TUTTI APPROVATI

Nuovi con responsabilità locale:

HardLife	(2024)	RL	Vera Bernardoni
Plasma4Beam2	(2024)	RL	Massimiliano Romè
SL_betatest	(2024)	RL	Andrea R. Rossi

Nuovi con responsabilità Nazionale:

ANNA	(2024)	RN e RL	Carlo Fiorini
SPOC	(2024)	RN e RL	Giacomo Borghi
T4QC	(2024)	RN e RL	Simone Cialdi

Continuano con responsabilità Nazionale:

* ASTAROTH		RN	Davide D'Angelo
		RL	Andrea Zani
ETHIOPIA	(2022)	RN e RL	Gianluca Galzerano
MOONLIGHT	(2023)	RN e RL	Bruno Paroli
* TRAMM		RN e RL	Daniele Sertore

CALL:

FRIDA	(2022)	RL	Silvia Muraro
HASPIDE	(2022)	RL	Valentino Liberali
HB2TF	(2023)	RN e RL	Dario Giove
HYDRA2	(2022)	RL	Romualdo Santoro
* N3G	(2021)	RL	Stefano Capra
SIG	(2022)	RN	Marco Prioli

Grant Giovani:

MUSICA	(2023)	Davide Mazzucconi
FERRAD	(2024)	Luca Frontini

Delle 29 sigle in corso nel 2023 ne chiudono 6: 4+1 chiedono prolungamento
6 nuove sigle e1 Grant Giovani per un totale di 29

Legenda

Acceleratori e Tecnologie Applicate:	7 + 2
Rivelatori, elettronica e informatica:	7 + 3 + 1
Fisica Interdisciplinare:	7 + 1

* Chiede prolungamento per il 2024

Previsione sigle presso la Sezione di Milano 2025

Continuano con responsabilità locale:

CUPRUM_TTD	(2023)	RL	Flavia Groppi
FUSION	(2023)	RL	Davide Bortot
HardLife	(2024)	RL	Vera Bernardoni
MATHER3D	(2023)	RL	Ivan Veronese
Plasma4Beam2	(2024)	RL	Massimiliano Romè
SL_betatest	(2024)	RL	Andrea R. Rossi

Continuano con responsabilità Nazionale:

ANNA	(2024)	RN e RL	Carlo Fiorini
~~MOONLIGHT~~	~~(2023)~~	~~RN e RL~~	~~Bruno Paroli~~
SPOC	(2024)	RN e RL	Giacomo Borghi
T4QC	(2024)	RN e RL	Simone Cialdi

Grant Giovani:

FERRAD	(2024)	Luca Frontini

Nuovi con responsabilità locale:

AIM_MIA	(2025)	RL	Cristina Lenardi
ASIX	(2025)	RL	Alberto Stabile
ASPIDES	(2025)	RL	Romualdo Santoro
ATHENAE	(2025)	RL	Dario Giannotti
HASPIDE_Next	(2025)	RL	Valentino Liberali
MOZART	(2025)	RL	Francesco Broggi
NEXT_NAMASSTE	(2025)	RL	Paolo Arosio
QUARTET	(2025)	RL	Stefano Carrazza
SELENE	(2025)	RL	Mario Caresana

Nuovi con responsabilità Nazionale:

ASTAROTH-BEYOND (2025) RN, RL D. D'Angelo

CALL:

* FRIDA	(2022)	RL	Silvia Muraro
HB2TF	(2023)	RN e RL	Dario Giove
*HIDRA2	(2022)	RL	Romualdo Santoro
SIG	(2022)	RN	Marco Prioli

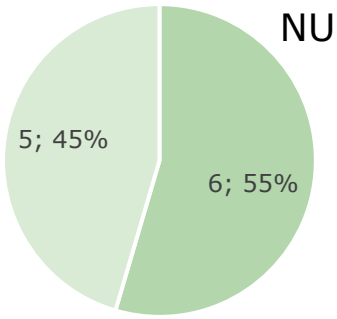
Delle 29 sigle in corso nel 2024 ne chiudono 14
10 nuove sigle e 2 richieste di prolungamento
per un totale di 25

Legenda

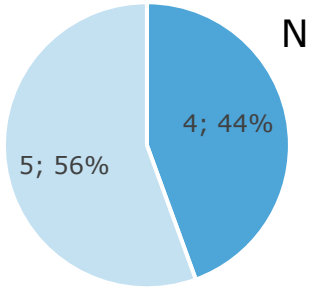
Acceleratori e Tecnologie Applicate:	5
Rivelatori, elettronica e informatica:	8 +1
Fisica Interdisciplinare:	10 + 1

* Chiede prolungamento

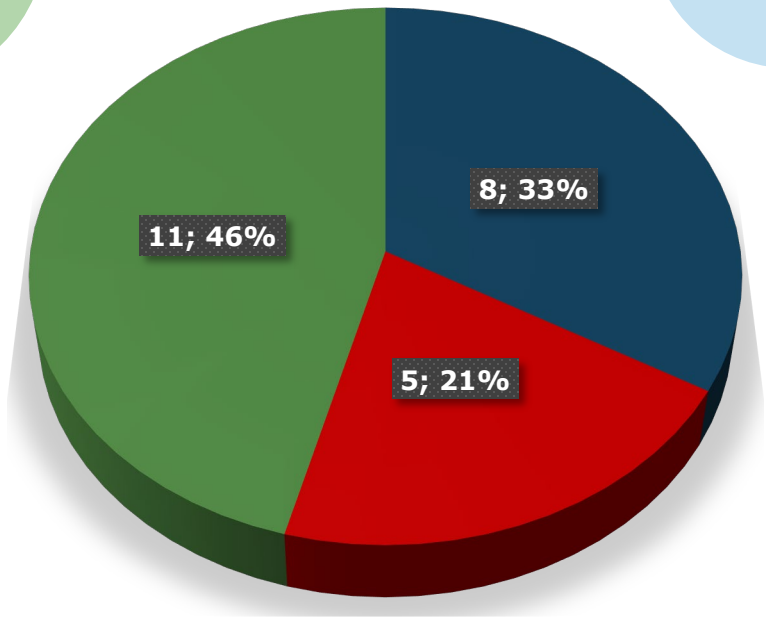
PREVISIONE PROGETTI 2025



NUOVI 6/11



NUOVI 4/9



- Detectors and electronics
- Accelerators and related technologies
- Interdisciplinary Physics

NUOVI ESPERIMENTI con

Responsabilità NAZIONALE e LOCALE

ASTAROTH_BEYOND

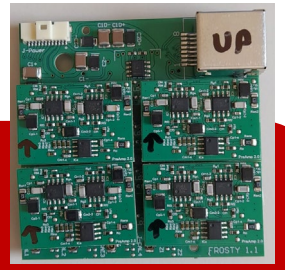
ASTAROTH in 2023-24

WP1

- Coating of crystals with epoxy **resins** developed successfully at small (21mm) scale. In progress for 50mm scale
- Acquired cryogenic facility to repeat measurements of LY and PS vs Y and doping level

WP3 (@LASA)

- Cryostat commissioned and operated multiple times
- Temperature stable at 0.1K !!!



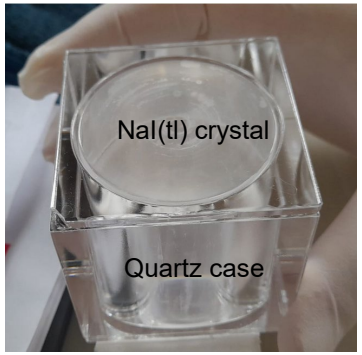
WP2

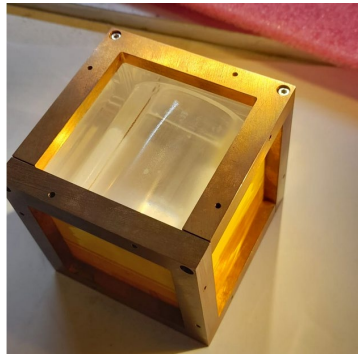
- Front-end for SiPM type 2: debugged and operational
- ASIC line:
  - Digital test chip for 110nm fully characterized across 80-150K range

Several runs at LASA: March->June 2024

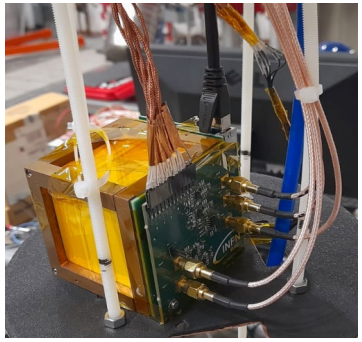
Performed with:

- Cylindrical 5×5 cm ($H \times \varnothing$) NaI(Tl) crystal
- Copper frame for SiPM array installation
- SiPM arrays
- Teflon reflector on the other faces

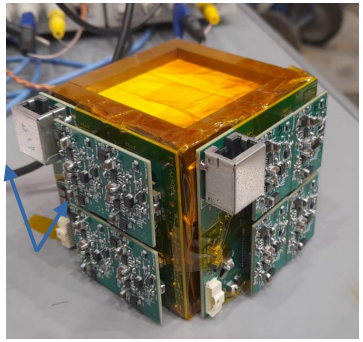




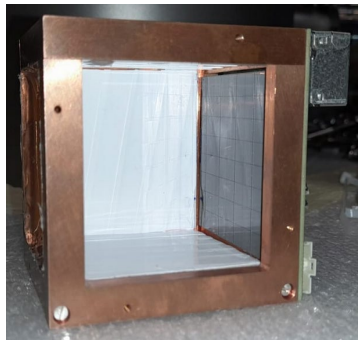
Copper frame



SiPM FBK type-1 array

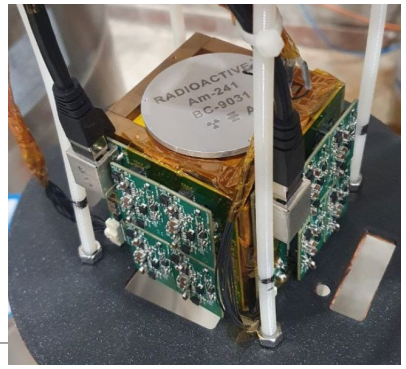


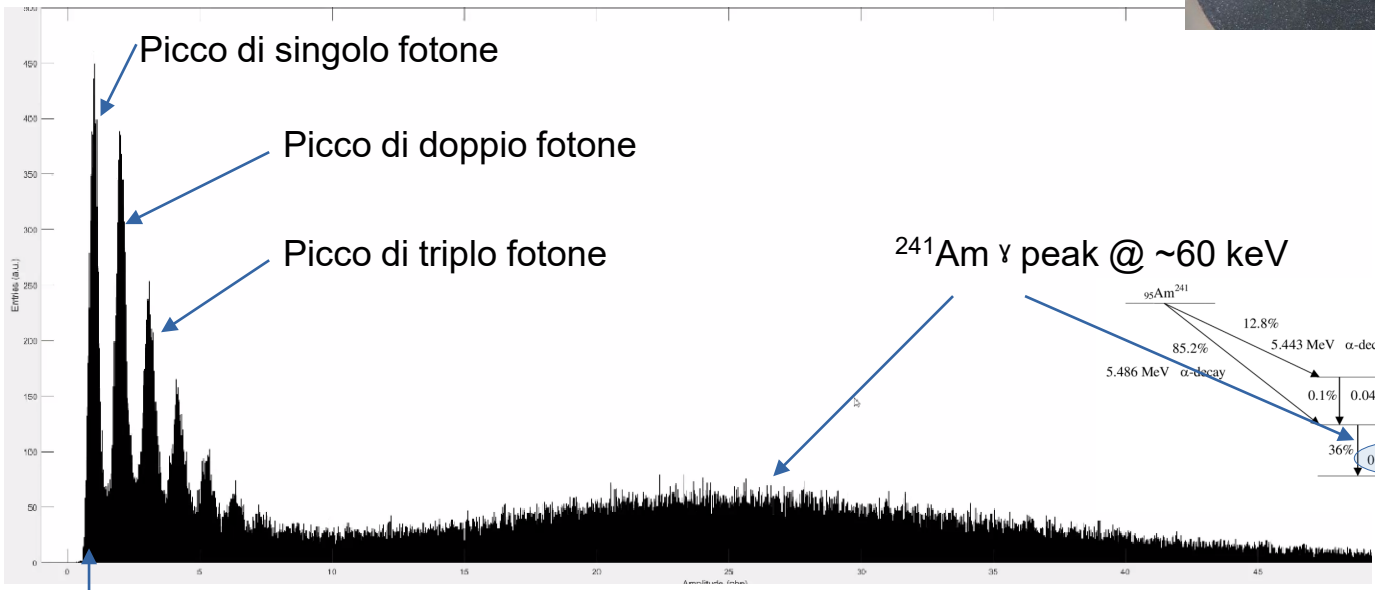
SiPM FBK/HPK type-2 arrays



Blank run setup

^{241}Am cryogenic source run





ASTAROTH_BEYOND

After 4.5 yr, ASTAROTH will close at the end of 2024 having completed ~ 75% of the program.
New proposal to be submitted to CSNV for 2025-27: ASTAROTH_BEYOND
Focus bring the technology of ASTAROTH to ready level for rare events physics

Program under finalization:

- Detector design:
  - Completion of the R&D on epoxy coating
  - Measurements of Light Yield in Milano / LNGS with low/high doping crystals
  - Optical coupling with SiPM
- Upgrade to two high-purity crystals
- SiPM and Electronics:
  - Discrete front-end to be redesigned based on acquired experience with V1.
  - ASIC-based analog front-end to be characterized
  - Design of Digital readout
- Veto:
  - Instrument the outer vessel with SiPMs and operate in liquid argon: demonstrate the gamma catcher veto concept
- Take the detector underground (LNGS or LSC) during the final year.

Anagrafica 2025

Personale	Ruolo	% impegno	Sezione	FTE
D. D'Angelo (RN)	PA	40%	Milano	**3.0**
A. Zani	Tecnologo	10%		
V. Toso	AdR UNIMI	40%		
E. Martinenghi	AdR tecn.	80%		
A. Stabile	PA	25%		
V. Liberali	PA	15%		
Chiara Guazzoni	PA Polimi	20%		
Andrea Castoldi	PO Polimi	20%		
V. Trabattoni	Dottoranda	50%		

AdR su PRIN 2022 bandito:
Scadenza 4 settembre 2024

Richieste per il 2025 in fase di definizione: ~40k

- Missioni ~5k
- Consumo ~15k
- Apparati: ~10k
- Inventario: ~10k

Servizi:
Officina/progettazione mecc.: 2 s.u.
Elettronica/progettazione el.: 2 s.u.

NUOVI ESPERIMENTI con

Responsabilità LOCALE

Milano Unit

INFN Istituto Nazionale di Fisica Nucleare

INFN CSN5
Proposal 2025-2027

AIM_MIA
(Artificial Intelligence in Medicine: focus on Multi-Input Analysis)

National Responsible:
Alessandra Retico - Sezione di Pisa
Participating Units:
Sezioni/Laboratori INFN di BA, BO, CA, CT, FE, FI, GE, LE, LNS, MI, PI, PV

Milano Unit

INFN Istituto Nazionale di Fisica Nucleare

INFN CSN5
Proposal 2025-2027

AIM_MIA

Research context

Artificial intelligence (AI)-based solutions have become pervasive in the field of Medicine due to the broad opportunities they can offer, including enhanced diagnostics, personalized treatments, and improved patient care. However, to fully realize this potential, several challenges must still be addressed.

Objectives

The **AIM_MIA** project will focus on the following scientific open issues related to the development and validation of AI-based tools for medical data analysis:

1) **mining multi-input data.** To make progress in this field it is also necessary to address some key aspects such as:
2) **handling incomplete/missing/limited datasets**;
3) **developing a dedicated data and IT platform** for secure data management and access to adequate computing resources. To achieve these goals, sharing data and knowledge within a broad scientific community (**networking**) will be a fundamental ingredient.

Milano Unit

INFN Istituto Nazionale di Fisica Nucleare

INFN CSN5
Proposal 2025-2027

AIM_MIA – Activity

Contribution to AIM_MIA project

WP2 Handling incomplete/missing/limited datasets

Task2.2 GAN for Medical Image Augmentation

Generation of synthetic images that are highly realistic but different from those already present in the dataset. Among the models used for this purpose, the Generative Adversarial Network (GAN) will be used for its image generation performance, especially in medical image augmentation.

Working group: MI, FE

Milano Unit

INFN Istituto Nazionale di Fisica Nucleare

AIM_MIA - Participants

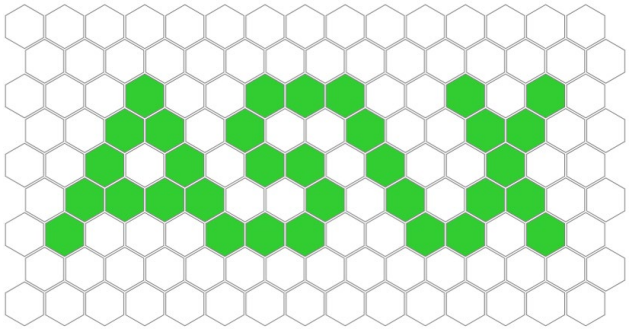
		FTE/year
Cristina Lenardi	**PO**	0.30
Flavia Groppi	PA	0.05
Paolo Arosio	PA	0.10
Manuel Mariani	PA	0.20
Francesco Orsini	PA	0.10
Ivan Veronese	PA	0.10
AntonioSarno	RTT	0.40
Ilaria Mattei	INFN	0.10
Simone Manenti	Tecnico	0.05
Mancosu Pietro	Dir. Fisico Medico	0.20
Alberto Torresin	Consulente	0.20
Yunsheng Dong	Post-doc	0.10

AIM_MIA – Expenses 2025

2.5 k€: capitolo consumo
Materiale informatico (update licenza SW, espansione memoria di massa locale HD SSD)

2.5 k€: capitolo missioni

- 1.0 k€ trasferta per lavoro in collaborazione
- 1.5 k€ partecipazione di 3 persone



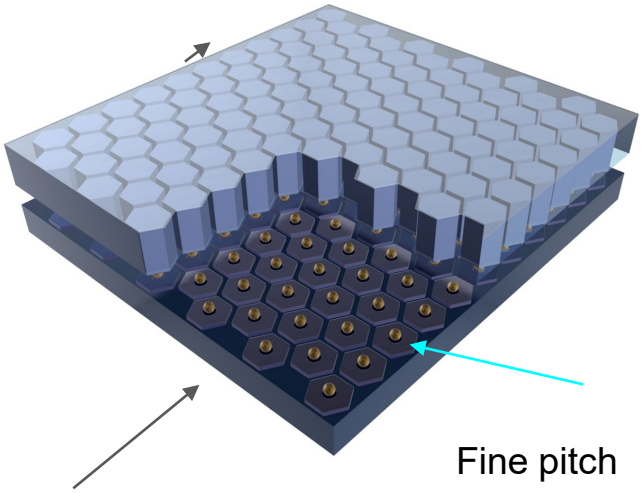
Istituto Nazionale di Fisica Nucleare
Sezione di PISA

Analog Spectral Imager for X-rays

ASIX

Analog Spectral Imager for X-rays

Pixelated sensor



Fine pitch bump-bonding

full custom large area

ASIX will deliver a technology demonstrator for new class of **high channel density (~50 kpixels/cm^2), hybrid pixel detectors** (2D) with fast, event-driven analog read-out and single-photon sensitivity for **X-ray based material science**, **XRD**, **X-ray spectral imaging, fluorescence and micro-tomography of industrial, chemical and biological samples**.

!Single Photon Position, Energy and Time in one shot!

-) Hybrid, extended energy range (2-60 keV)
-) ≥ 20.000 e$^-$ dynamic range
-) high spatial (~10 μm) and spectral (~350eV FWHM at 8 keV) resolution
-) 50u pixels with analog readout (sub-pixel resolution)
-) low readout noise (< 30e- ENC)
-) High speed event-driven readout for one-shot single photon energy, position and time-of-arrival measurement
-) better than 10^8 hit/cm^2/ s maximum hit rate

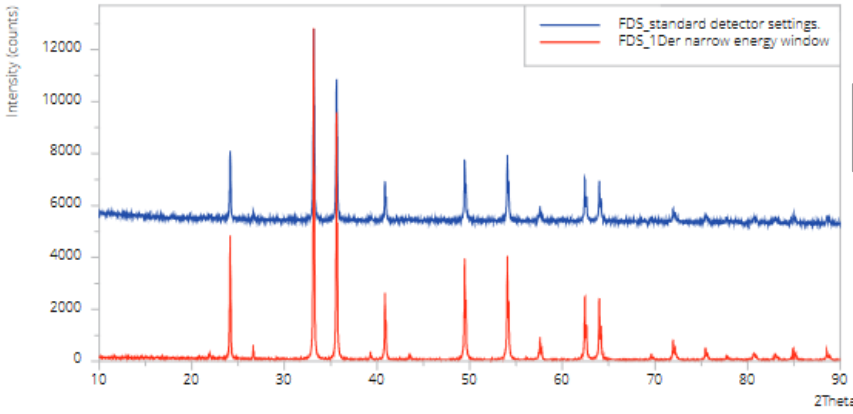
Duration 3 yrs (2025 - 2027)

ASIX Applications

X-ray Diffraction (Cu, Ag XRD)
3D X-ray Fluorescence (3D-XRF)
Micro-CT (Computed Tomography)
phase-contrast X-ray imaging
K-edge imaging

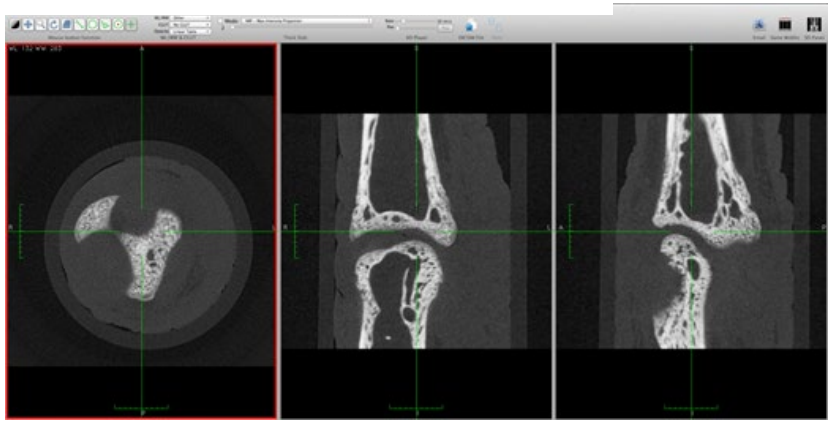
Industrial Interests

Companies which design, produce and sell integrated systems (X-ray source plus 2D sensor) for X-ray imaging, XRD, XRF, micro-CT
Microelectronics industry
Pharmaceutical companies
Research laboratories



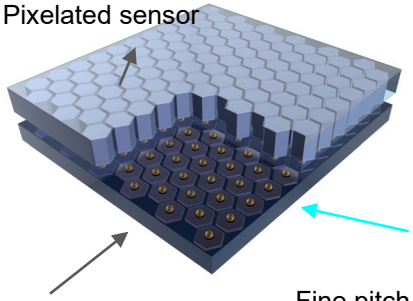
$n\lambda = 2d \sin\theta$

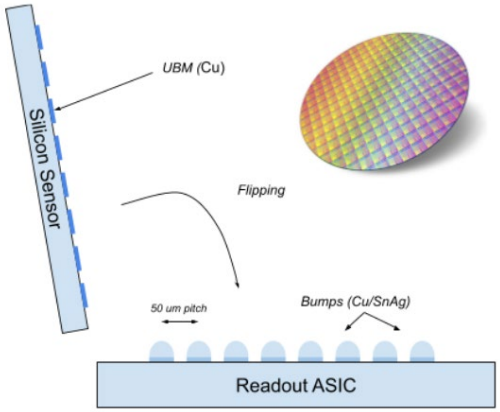
XRD looks for "d"



ASIX adds high spatially and spectrally resolved information along with high detection efficiency to the standard XRD, XRF and micro-CT systems

ASIX Goals 1/2





Silicon Hybrid pixel sensor (2D) >= 5 x 5 mm^2 overall die size

Edgeless Silicon sensor

- advanced trench-edge technology
- n-o-p 50um pixels pitch (hexagonal pattern), 270 um thickness
- low-leakage current

Readout ASIC

- Low noise (<30e- ENC, Cd 100-150fF, shaping time 0.5-1 us)
- 10-12 bits, 5-10Msps ADC
- Single Photon detection and event driven analog readout (On-Chip Analog-to-Digital conversion)
- rate capability (>= 10^8 hits/cm^2/s)

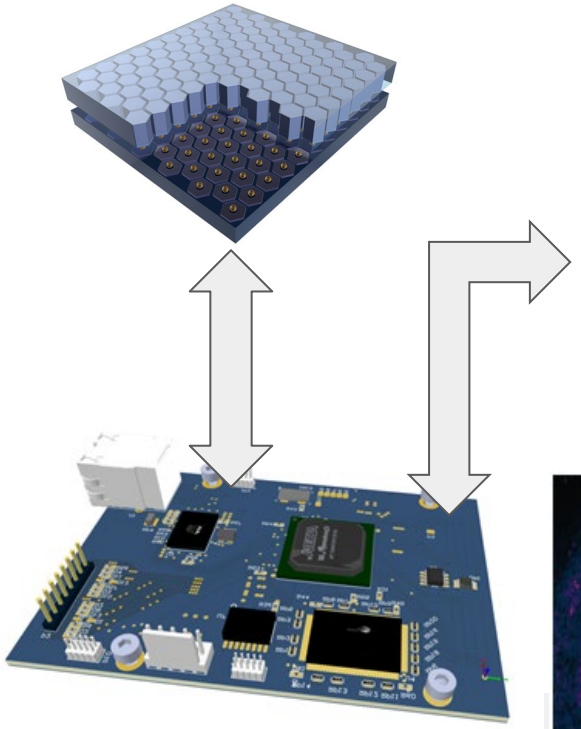
Flip Chip Assembly

- ASIC support wafer fabrication (due to MPW policy)
- ASIC Al pads preparation (TiW/Cu) and bumps (Cu/SnAg) deposition
- Sensor UBM deposition (Cu)
- ASIC release from support wafer, Sensor dicing, flip-chip assembly

Sensor Assembly on Cip On Board

- Hybrid assembly on the PCB (gluing and micro-bonding)
- Connection to the DAQ electronics
- Cooling and Housing

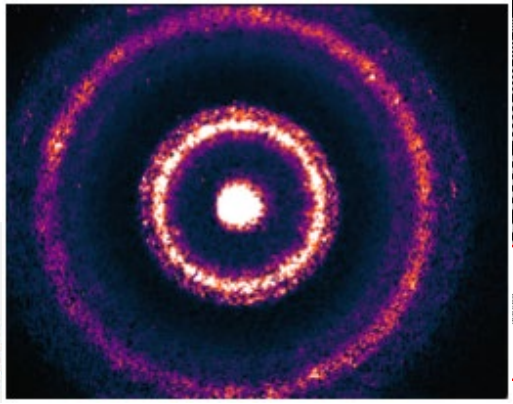
ASIX Goals 2/2

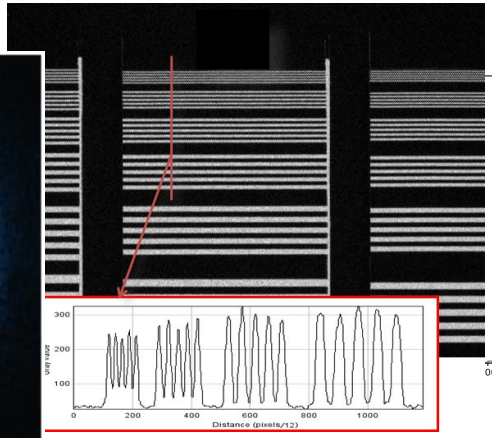


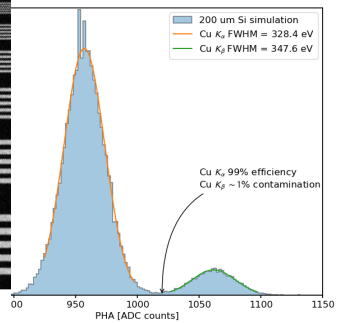
DAQ and SDK

internally developed carrier boards will connect the sensor modules to a **FPGA based daq system** in charge to perform level-0 data processing and stream data to a user PC.

A user friendly **DAQ SW and SDK will allow for sensor control, data storage, visualization and analysis**. Portability of the DAQ system will be a main driver for the development.







Richieste e FTE

- Fabbricazione scheda di test per chip prototipo e approvvigionamento componenti per PCB: 1500 €

- FTE:
  - Gabriella Trucco: 0.5 FTE;
  - Alberto Stabile: 0.25 FTE;
  - Valentino Liberali: 0.25 FTE;

ASPIDES:
A CMOS SPAD and Digital SiPM Platform for High Energy Physics

Responsabile nazionale: Lodovico Ratti (sez. di Pavia)

Romualdo Santoro
Univeristà dell'Insubria and INFN-MI

ASPIDES

Main Goal:

Develop digital SiPMs in CMOS technology for high dynamic range counting and high accuracy timing, targeting dual readout calorimetry, RICH and detectors for dark matter and neutrino experiments

Participating units:

Bari (N. Mazziotta), Bologna (L. Rignanese), Milano (R. Santoro), Pavia (L. Ratti), Trento (L. Pancheri), Napoli (G. Fiorillo), Padova (G. Collazuol), Torino (M. Da Rocha Rolo)

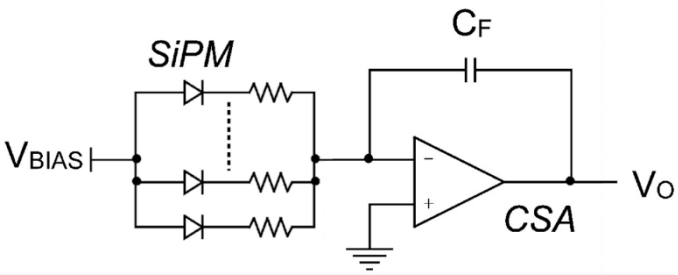
Research area:

Detectors and electronics

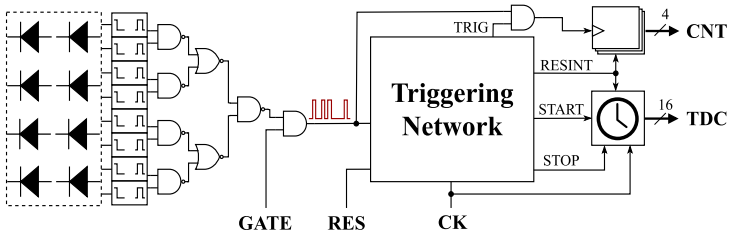
Duration: 3 years

SiPMs: analog vs digital

SiPMs: analogue signal proportional to number of fired cells. Readout performed externally



Digital (CMOS) SiPMs: readout functionalities implemented in the sensor substrate (e.g. binary counters, SPAD masking, TDCs …)

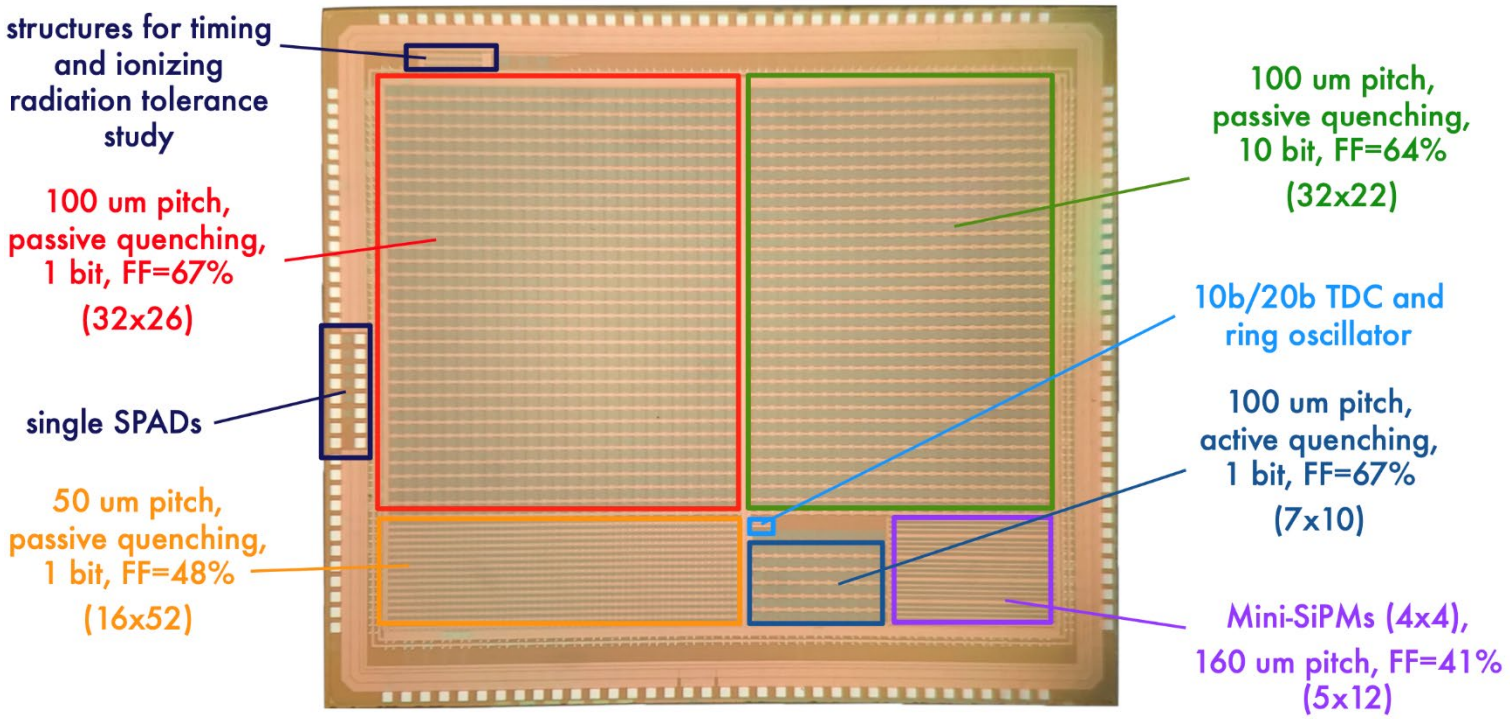


M. Perenzoni et al. 2017 – IEEE JSSC

- SPAD array in CMOS technologies may offer the following benefits:
  - front-end can be optimized to preserve signal integrity (especially useful for timing)
  - Easier linearization and calibration – direct digital output vs digital/analog (including noise + non uniformity)/digital conversion
  - the monolithic structure simplifies the assembly for large area detectors
  - development costs can be kept relatively low if the design is based on standard process

Technological node: CMOS 110 nm

- Known technological node, already used for a test chip (ASAP110LF) that includes SPAD arrays with different features (passive and active quenching, different active area, structures for investigating timing properties and ionizing radiation tolerance)
- Chip under test and results will be used to guide the new development



ASPIDES Requirements

Requirements	Dual readout calorimetry	Cherenkov (eg RICH, IACT)	DM	neutrino
SiPM Unit area (mm^2)	1x1	mm scale	10x10	6x6
Micro-cell pitch (um)	10-15	40-50	25-30	50-150
Macro-pixel area (μm^2)	500x500			
PDE (%)	>20	> 40	>45	>35
DCR (kHz)	<100 kHz/mm^2	very low for single pe detection	<0.1 Hz/mm^2 (at LN)	<0.2 Hz/mm^2 (at LN)
AP (%)	<1	Few	Total Correlated Noise Probability (Xtalk + AP) < 60 %	<5%
Xtalk (%)	few			<35%
Trigger	external, self	self, external	self	
Output data: light intensity	no. of fired cells in 1 or 2 time windows (10's of ns long)			
Output data: time	time of arrival of the first photon in the window, possibly of the last photon (TOT)	ToA and ToT	ToA and TOT	
Time resolution (ps)	<100	< 100 single pe		
Module size and form factor	strip with 8 units (1mm x 16 mm), pitch of 2 mm			

Activity program

2025-26

- Development of a small scale prototypes of CMOS SiPMs consisting of about 1000 SPADs with 15-20 um pitch
  - for the readout, both a fully digital and a mixed analog and digital approach will be explored -> best compromise between detection efficiency (fill factor) and functional density
  - On-sensor electronics to be provided with event detection, counting, thresholding and time stamping capabilities, possibly together with the ability to follow the time evolution of light pulses
  - specific structures included to test the chip functionalities
  - **submission 3Q 2025, characterization 1Q 2026**

2026-27

- Development of a demonstrator chip including 8 dSiPMs, each with 1 mm^2 area and 2 mm pitch (64x64 cells, 15 μm pitch) –> dual readout calorimetry application
  - inter-SiPM region used for integrating most of the electronics, to minimize the impact on the fill-factor
  - smaller versions of dSiPMs for application to RICH, DM and neutrino experiments (larger SiPMs)
  - characterization to be performed in the lab and in a beam test
  - **submission 4Q 2026, characterization 2Q-4Q 2027**

Persone coinvolte (Milano)

	ASPIDES (GR5 - to be submetted) (DRD4)	Hydra2 (Possible extension) (DRD6)	RD_FCC	Percentuali / persona	commenti:
Romualdo (PA)	40	30	10	80	Hydra2 ed ASPIDES sinergiche con RD_FCC
Massimo (PO)	10	20	20	50	Hydra2 ed ASPIDES sinergiche con RD_FCC
Aleksandr Burdyko (assegnista/PhD)	50	50	0	100	Hydra2 ed ASPIDES sinergiche con RD_FCC
Leonardo Carminati (PA)			10	10	attività sinergiche conHidra2
Ruggero Turra (Ric)			10	10	attività sinergiche conHidra2
Laura Nasella (PhD)			10	10	attività sinergiche conHidra2

A T H E N A E

(**A**dvanced **TH**z Imaging for **E**arly Scree**N**ing of Hum**A**n Tissu**E**)

THz spectroscopy is well assessed as a diagnostic tool for the noninvasive detection and differentiation of healthy, dehydrated, burned and pathological human tissues

Strong optical absorption of T-waves however limits the application of THz spectroscopy at the diagnosis of specific, surface diseases

Future of THz imaging for early screening of diseases in human tissues must go in the direction of the development of advanced tools, that will allow *in vivo*, harmless, and fast measurements with enhanced sensitivity

The project aims at the development of two different THz novel techniques:

1) A polarimetric imaging method based on a ellipsometric configuration, significantly enhancing characterization capabilities on the basis of an accurate model of the skin tissue under test
2) An hyperspectral reflectometry imaging method for the evaluation of the drying process in the corneal tissue of the eye anterior chamber and for detection of keratosis

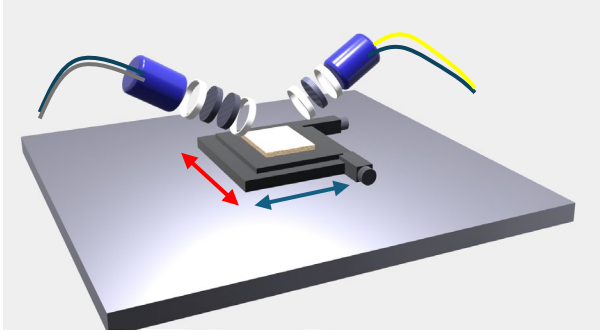
This proposal can be considered as a natural progression from a previous INFN research project, “ETHIOPIA”, aimed at the realization of a tabletop THz source and the development of different spectroscopic configurations for hyperspectral imaging of biological samples

THz polarimetric imaging using ellipsometry

Probing the hydration and cellular structure of skin for *ex vivo* and *in vivo* complementary diagnosis for human patients

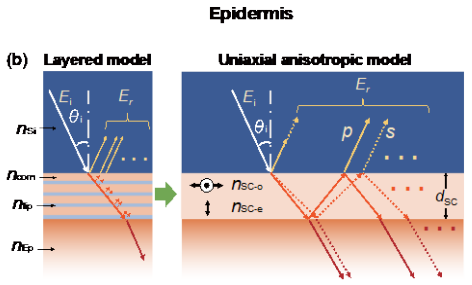
In vivo THz standard imaging have demonstrated potential for diagnosing numerous conditions such as cancer, skin burns and scars, diabetic foot syndrome. THz polarization imaging already proved to enable precise and fast surface topography and is currently under use in different industrial applications

We plan to develop a one-of-a-kind time domain ellipsometer to carry out in vivo, harmless, and fast polarimetric imaging with enhanced sensitivity



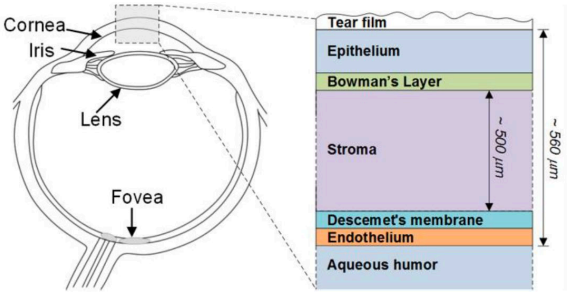
By changing polarisation states and angles of the incident beam, multiple highly uncorrelated configurations are possiblel

To significantly increase characterization capabilities, we will develop an (uniaxial) anisotropic model of the skin tissue under test



THz hyperspectral reflectometry imaging

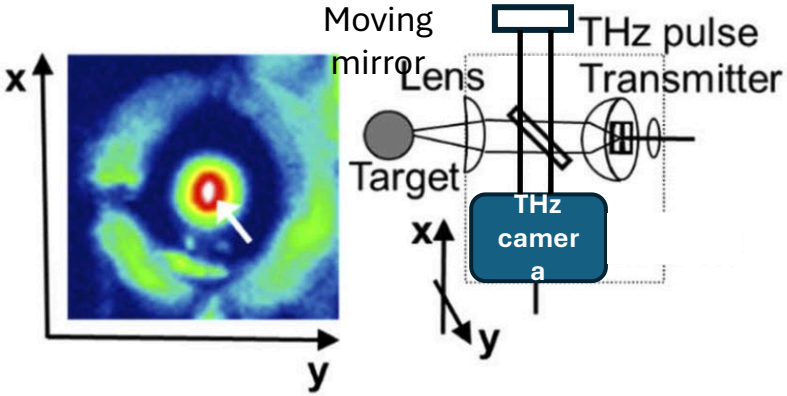
Evaluation of the drying process in the corneal tissue of the eye anterior chamber and for detection of keratosis in the THz region

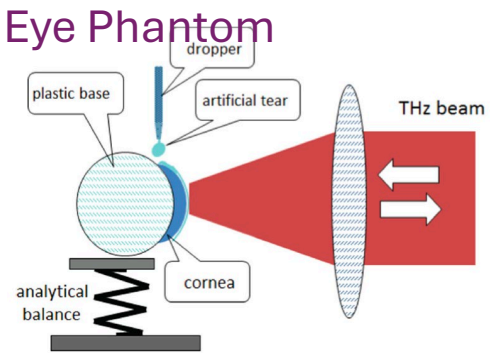


Corneal disorders are characterized by increased **corneal tissue water content (CTWC)** and subsequent swelling of the cornea

Traditional THz TDS for the cornea analysis is based on ex-vivo measurements of cornea samples mainly in transmission configuration

The proposed THz hyperspectral reflectometry approach will surpass the main limitations of traditional THz TDS (ex-vivo and low SNR)





INFN-Napoli unit FTE and budget

INFN-NAPOLI	FTE
Antonello Andreone, PA UniNA (national and local coordinator)	50%
Zahra Mazaheri, RTDa UniNA	50%
Junaid Yaseen, PhD student UniNA	30%
Can Koral, RTDb UniBAS	30%
Paolo Russo, PO UniNA	20%
Vincenzo Galdi, PO UniSannio	20%
	Tot. 2

1st year	INFN-Napoli
Missioni	**3 k€**
Inventariabile	**14 k€** (High power PCA emitter antenna);
Consumo	8 k€ (THz components: polarizers, waveplates, lenses, off-axis parabolic mirrors, mechanical mounts) 5 k€ (linear and rotational motorized stages) 3 K (miscellanea: purging gas, chemical products, etc.) Subtotal: **16 k€**
TOTALE	**33 k€**

INFN-Milano unit FTE and budget

INFN-MILANO	FTE
Dario Giannotti, RTDa PoliMI (local coordinator)	40%
Gianluca Galzerano, DR CNR-IFN	30%
Edoardo Suerra, Post-doc UniMI	30%
Francesco Canella, RTD CNR-IFN	20%
Simone Cialdi, PA UniMI	30%
	Tot. 1.50

1st year	INFN-Milano
Missioni	**3 k€**
Inventariabile	-
Consumo	10 k€ (Non linear crystals); 8 k€ (THz components: polarizers, waveplates, lenses, offaxis parabolic mirrors) 8 k€ (near infrared optical components: achromatic waveplates, dielectric mirrors, lenses) 4 k€ (Mechanical mounts) Subtotal: **30 k€**
TOTALE	**33 k€**

HASPIDE-Next

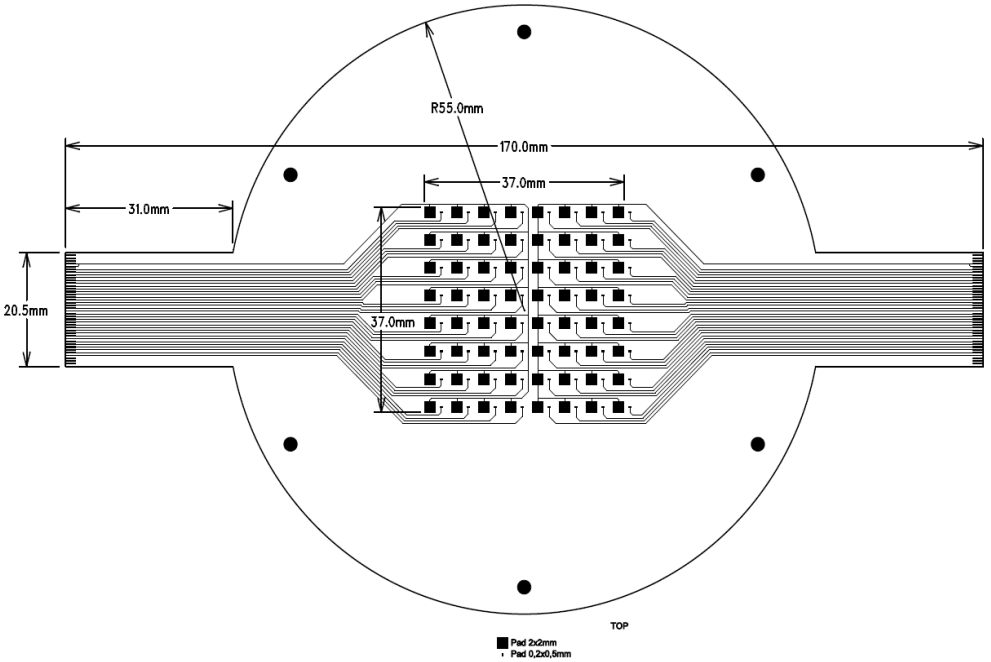
Nuova sigla – Area ricerca: **Detectors** – Durata proposta: **3 anni**
Responsabili nazionali: **Mauro Menichelli, Leonello Servoli** (PG)
Unità partecipanti: **Perugia, Firenze, Lecce, LNL, Milano, Padova, Roma 1, TIFPA, Torino**
Partecipazioni esterne: **CNR Istituto Officina dei Materiali – Perugia, EPFL Neuchatel (Switzerland), University of Wollongong (UoW) (Australia)**

Obiettivi:

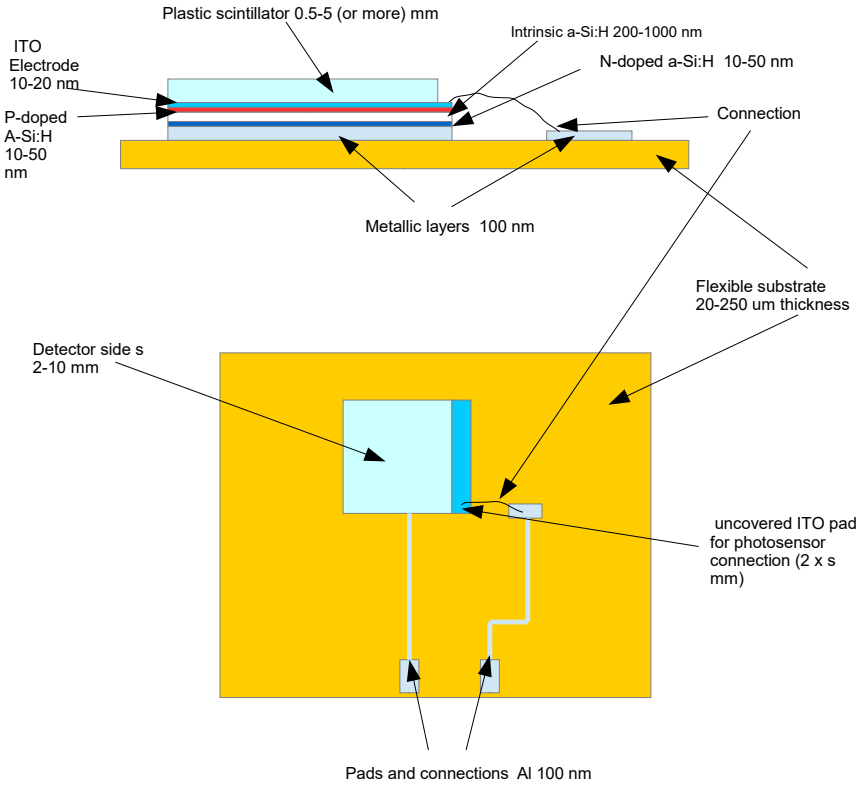
1) Costruzione e caratterizzazione di rivelatore indiretto (fotorivelatore in Silicio amorfo idrogenato + scintillatore) su substrato flessibile per la rivelazione di radiazione e per dosimetria
2) Continuazione dell'esperimento HASPIDE, per arrivare alla costruzione di un prototipo di flangia attiva

HASPIDE-Next: active flange

Preliminary drawing of an active flange. The detector is composed of a PCB on Polyimmide where the pads for a 8 x 8 device matrix is shown in the center of the drawing. Six holes for the fixation of the membrane to the flange are present and two lateral extroflections are also present in order to interconnect the detectors to the readout electronics, which is located away from the beam.



HASPIDE-Next: indirect detector



Layout of a single indirect detector, made of hydrogenated amorphous silicon (a-Si:H) p-i-n diode, covered by a plastic scintillator.

Top: side-view; bottom: view from top.

HASPIDE-Next: workpackages

- Design, production and qualification of the a-Si:H detectors and photosensors
- Design, production and qualification of the scintillators and integration with the photosensor
- **Design and optimization of front-end electronics for direct and indirect detectors, and for the application in FLASH therapy beam monitoring (Milano + Torino + Perugia)**
  - FLASH therapy beam monitoring in real time, with time step = 500 ns
  - New version of the TERA chip (designed in Turin and in use at CNAO) in 65 nm
- Qualification and radiation test of the assembled detector
- Simulation of the detector and photosensor response
- Medical physics application-oriented tests
- Space weather and astrophysics application-oriented tests

HASPIDE-Next: unità di Milano

Persone:

- **Valentino Liberali** (resp. WP3 – Electronics): 0.4 FTE
- **Gabriella Trucco**: 0.5 FTE; **Andrea Mazzanti** 0.1 FTE; **AdR HASPIDE**: 1 FTE
- **Luca Frontini** e **Alberto Stabile** (0 FTE nel 2025)

Attività e obiettivi 2025:

- Progetto della scheda di test per caratterizzazione della versione finale del chip HASPIDE, in laboratorio e sotto radiazione
- Caratterizzazione dei prototipi e delle schede e interfacciamento con PC tramite la FPGA evaluation board

Richieste 2025:

- 5 k€ per 1 scheda di test (progettazione, fabbricazione e montaggio)
- 2 k€ per 1 FPGA evaluation board
- + spese per missione: da definire in base ai test di irraggiamento – da concordare con le sedi di Torino e Perugia

MOZART:
(**MO**nitoraggio con **Z**eoliti **A**dsorbenti **R**adon e **T**oron)

- Area ricerca: **Interdisciplinare**
- Durata proposta: **2 anni** (01/2025 – 12/2026)
- Responsabile nazionale: **Fabrizio Ambrosino - rtdA (NA)**
- Unità partecipanti: **Napoli, Milano**

Stato dell'arte, motivazioni e obiettivi

In letteratura solo 7 articoli trattano dell'efficacia delle zeoliti nell'adsorbimento di ^{222}Rn ed 1 di ^{220}Rn.

- Nessuno di questi lavori tratta di ^{222}Rn+^{220}Rn insieme in atmosphere miste.
- Nessuno di questi lavori ha lo scopo di realizzare un sistema di misura di Rn indoor.

In ottemperanza ai vigenti:

- D.lgs 101/2020 (Attuazione 2013/59/Euratom - norme di sicurezza riguardo le radiazioni ionizzanti),
- PNAR - Piano nazionale d'azione per il radon (DPCM 11 Gennaio 2024),

richiedenti la misura annuale (2 semestri) della concentrazione di attività di Rn con rivelatori passivi

↓

il progetto MOZART propone di investigare il processo di adsorbimento di ^{222}Rn e ^{220}Rn tramite zeoliti, minerali con struttura porosa ed alta resistenza alle radiazioni e capacità di scambio ionico.

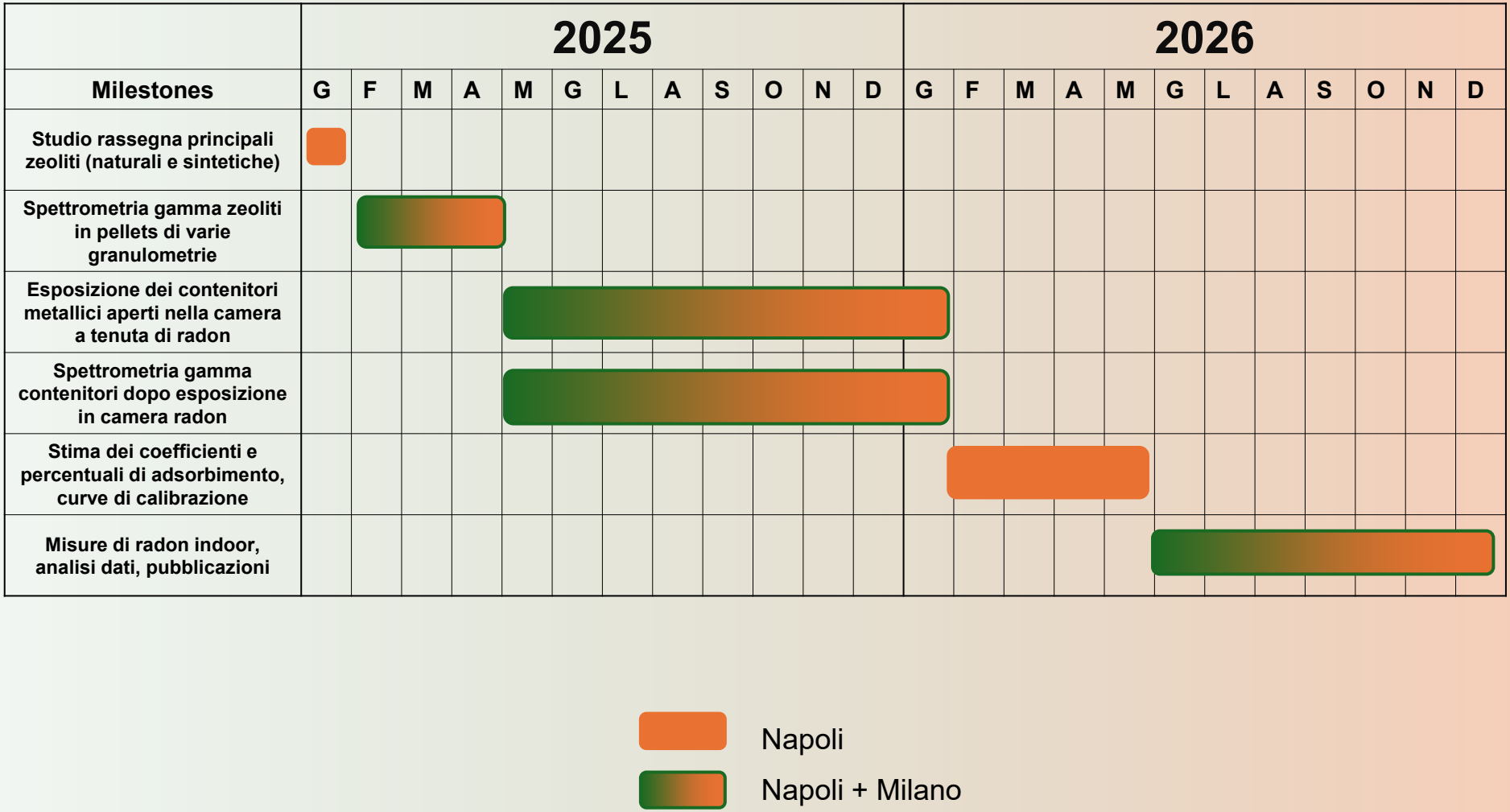
↓

Il progetto MOZART permetterà di monitorare il gas Rn in ambienti indoor col duplice scopo di:

(i) progresso scientifico nello studio di adsorbimento di radon tramite zeoliti

(ii) sviluppo di un nuovo sistema di misura passivo low cost (principale risultato atteso).

GANTT - MOZART



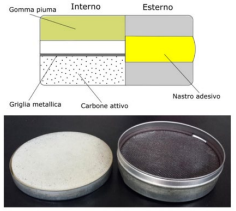
MOZART: unità di Milano

Attività e obiettivi 2025:

- Misure di spettrometria gamma con rivelatori HPGe presenti presso il Laboratorio di Misure Fisiche del LASA delle zeoliti di diverse granulometrie
- Esposizione in camera radon in atmosfera controllata di ^{222}Rn mediante sorgente Pilon – Miam da 106,40 kBq di ^{226}Ra dei contenitori contenenti zeoliti di diverse granulometrie per interconfronto con l'esposizione presso la sezione di Napoli.
- Confronto con i dati di adsorbimento con canestri a carbone attivo in dotazione della Sezione di Milano.

Prototipo dei contenitori delle zeoliti

Canestri a carbone attivo



	FTE - MOZART
Francesco Broggi - Ricercatore Dip. - RL	0.70
Groppi Flavia - PA	0.10
Michele Colucci - PhD/Assegnista	0.10
Manenti Simone - Prof. Contratto	0.05
Cagnetta Fiorella - Docente	0.05

Richieste 2025:

- 5 k€ per 1 HV Power Supply per avere un HPGe dedicato a queste misure
- 2 k€ per materiale di consumo di laboratorio
- 2 k€ per manutenzione e contributo per azoto per sistema di raffreddamento HPGe
- 14.0 k€ missioni –:
  - presso le sedi INFN di Napoli (Caserta compresa) 2 persone; 5 missioni/a 7.5 k€
  - Riunione di collaborazione per discussione/analisi dei dati: 2.5 k€
  - Missioni internazionali presso accreditati centri di ricerca esteri, quali National Radiation Protection Institute-SURO di Praga e Federal Office for Radiation Protection – BfS di Berlino, per effettuare interconfronti del nuovo sistema di misura proposto: 4.0 k€

NEXT_NAMASSTE

NEXT_NanoMagnets for quantum SEnsing and Data SToragE

RN Pavia unit: A. Lascialfari
RL Milano unit : P. Arosio

General information

Project duration:
2025-2027

INFN Units:
BO, FI, MI, PV

External collaborators :
Manuel Mariani, INFN-MI and UNIPV
Paolo Santini, UNIPR

FTE Milano 2025		1.1
Paolo Arosio, **RL**	PA UNIMI	0.6
Francesco Orsini	PA UNIMI	0.4
Ivan Veronese	PA UNIMI	0.1

Results from NAMASSTE (same Units, RN M. Mariani)

Quantum sensing by NMR and SQUID

Magnetic techniques for quantum sensing using single molecule magnets

Single crystals of Mn12-tbu
A.-L- Barra et al., JACS 129, 10754 (2007)

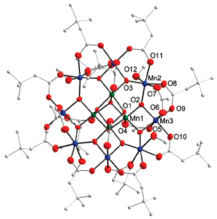
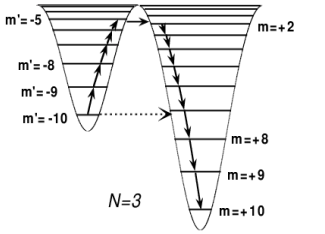


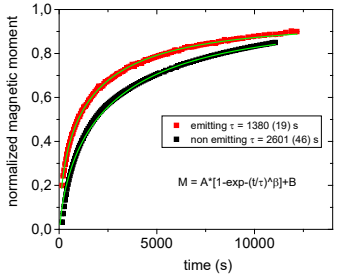
Figure 1. ORTEP view of the molecular structure of $[Mn_{12}O_{12}(Bu^t\text{-}CO_2)_{16}(CH_3OH)_4]\cdot 2CH_3OH$. Mn^{III} sites are reported in blue, Mn^{IV} in green, oxygen in red, and carbon atoms in pale gray. Three *tert*-butyl groups in the labeled region have been omitted for clarity sake.

$$[Mn_{12}O_{12}(O_2CCH_2Bu^t)_{16}(CH_3OH)_4]\cdot CH_3OH$$



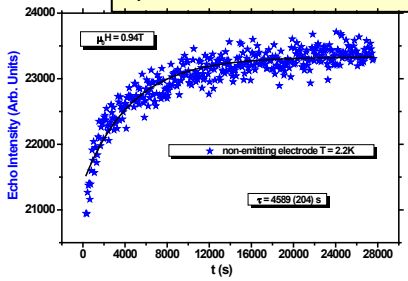
$$\mathcal{H} = -DS_z^2 - BS_z^4 - g_z\mu_B\mu_0 S_z H_z + \mathcal{H}_{trans}$$

Thermal activation :
$\tau_{Magn} = \tau_0 \exp[-\Delta/(k_B T)]$
Quantum tunneling : τ_T

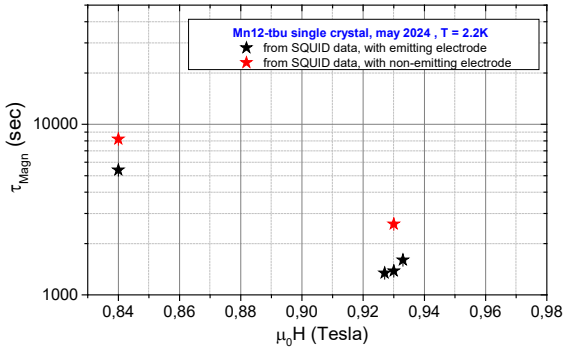


M recovery :
SQUID
NMR

(PRL, to be submitted)

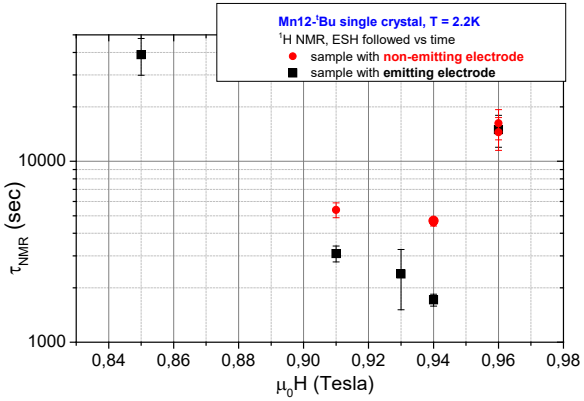


Recovery time τ vs field, by SQUID



In SQUID and NMR experiments, at B_0~0.94(1) T **we observed a difference in the magnetization recovery time among the cases of ionizing particles impinging and non impinging**.

Recovery time τ vs field, by NMR



Results from NAMASSTE (same Units, RN M. Mariani)

Spin dynamics by NMR and DC magnetization

On the spin dynamics of Ln-based single ion magnets : magnetization slowing down and low temperature energy gap

(PRB, to be submitted)

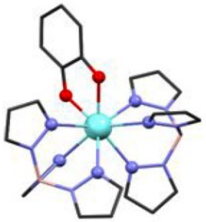
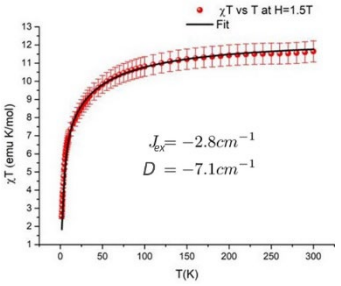


Fig. 1 Structure of the Ln(DTBSQ)(HBPz3)2, Ln-SQ system, where Ln=Tb,Dy

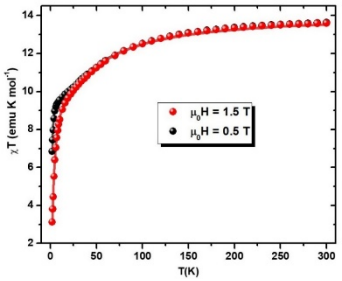
Energy levels of Tb-SQ

	$\lvert J_{z,Tb}\rvert$	Spin orientation	Energy (cm^{-1})	Energy (K)
E0	6	antiparallel	0	0
E1	6	parallel	36	52
E2	5	antiparallel	231	332
E3	5	parallel	267	384
E4	4	antiparallel	420	604
E5	4	parallel	456	656
E6	3	antiparallel	567	816
E7	3	parallel	603	868
E8	2	antiparallel	672	967
E9	2	parallel	708	1019
E10	1	antiparallel	735	1058
E11	0	antiparallel	756	1088
E12	1	parallel	771	1109
E13	0	parallel	792	1140

Tb-SQ



Dy-SQ



	$\lvert J_{z,Tb}\rvert$	Spin orientation	Energy (cm^{-1})	Energy (K)
E0	15/2	antiparallel	0	0
E1	15/2	parallel	54.2	78
E2	13/2	parallel	142.3	204.7
E3	13/2	parallel	191.5	275.6
E4	11/2	antiparallel	264.3	380.3
E5	11/2	parallel	309	444.6
E6	9/2	antiparallel	366	526.5
E7	9/2	parallel	406.7	585.3
E8	7/2	antiparallel	447.	643.1
E9	7/2	parallel	484.9	697.7
E10	5/2	antiparallel	506.7	729.1
E11	5/2	parallel	543.8	782.4
E12	3/2	antiparallel	544	782.8
E13	1/2	antiparallel	556.9	801.2
E14	3/2	parallel	583.9	840.1
E15	1/2	parallel	606.6	872.7
E16	1/2	antiparallel	613.7	883

Energy levels of Dy-SQ

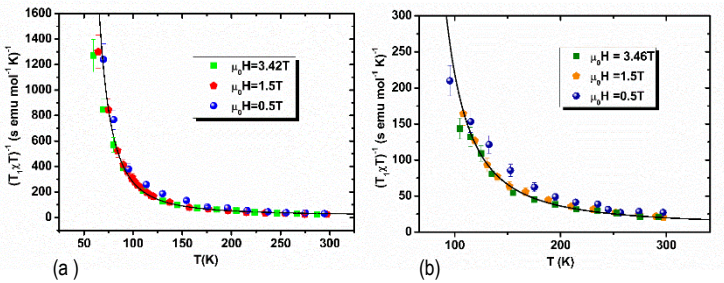


Fig. 4 Spin lattice relaxation rate $1/T_1$ data divided by (experimental) χT drawn as a function of temperature at different applied fields, for TbSQ (a) and DySQ (b). The solid lines are fit to the data, obtained following the model cited in the text.

^{1}H NMR spin-lattice relaxation "feels" different gaps in Tb-SQ and Dy-SQ (i.e. different correlation times τ_c)

- Tb-SQ : good fit of M vs T. NMR τ_c follows an Arrhenius law with a gap ~ 2nd excited level gap
- Dy-SQ : relatively good fit of M vs T. NMR τ_c follows an Arrhenius law with a gap ~ 4th excited level gap

Results from NAMASSTE (same Units, RN M. Mariani)
Spin dynamics by MUSR and ac χ

μSR evidence of a marked exchange interaction effect on the local spin dynamics of Tb-based single ion magnets

(PRB, to be submitted)

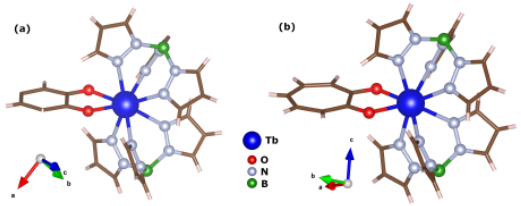
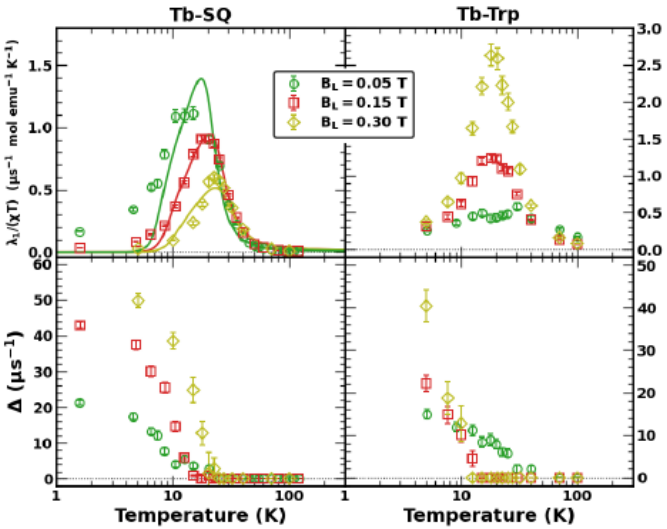


FIG. 1. (Color online) Molecular structure of (a) Tb-SQ and (b) Tb Trp. Hydrogen (pink) and Carbon (brown) are represented in stic mode for the sake of clarity.



$$\lambda_1 \equiv \left(\frac{1}{T_1}\right)_{\mathrm{BPP}} = \int_{-\delta}^{+\delta} \rho(E_A)\lambda_1(E_A)dE_A$$
$$= K \cdot \frac{1}{2\omega_L \ln b}\left[\arctan(b\omega_L\tau_c) - \arctan\left(\frac{\omega_L\tau_c}{b}\right)\right],$$

Tb-SQ and Tb-trp show opposite effects on muon Intensity relaxation rates !!

- Tb-SQ : in presence of exchange interaction ⇒ BPP law, with distribution of correlation times
- Tb-trp : effect of the "absence" of exchange interaction on spin dynamics (and magnetization slowing down)
- Thus, peculiar field effect on the relaxation time τ for Tb-trp

Planned activities for NEXT_NAMASSTE. I

Quantum Sensing of particles and radiation

- Mn12- tbu sample, B//c : use of proper shielding for α (combined **effect of impinging β particles and γ radiation)** and for β (**effect of γ radiation only**) particles (NMR, SQUID, continuous and pulsed EPR)
- Mn12-tbu sample, **$(B_{ac},c) \sim 10°$ & $(B_{DC},c) \sim 10°$: effect on MUSR** spectra and **SQUID** magnetization (ν_{ac}=1-1000 Hz)
- Mn12-tbu sample : **MUSR relaxation at T<1K** ($B=B_{cross}$), **with and without impinging particles**
- Development of theoretical models **to simulate the impact of radiation** on Molecular Nanomagnets spin dynamics

$[Mn_{12}O_{12}(O_2CCH_2Bu^t)_{16}(CH_3OH)_4] \cdot CH_3OH$

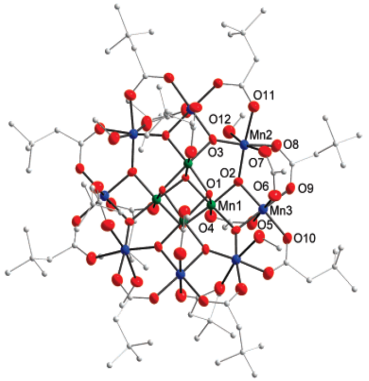


Figure 1. ORTEP view of the molecular structure of $[Mn_{12}O_{12}(^tBu-CH_2-CO_2)_{16}(CH_3OH)_4]\cdot 2CH_3OH$. Mn^{III} sites are reported in blue, Mn^{IV} in green, oxygen in red, and carbon atoms in pale gray. Three *tert*-butyl groups in the labeled region have been omitted for clarity sake.

Planned activities for NEXT_NAMASSTE. II

Spin dynamics vs temperature (data storage)

- [DyNITpPy]2: DyNIT **units coupled by small (bias) interaction** (tunneling in zero field reduced, slow relaxation favoured), MUSR+NMR+magnetometry
- [Dy(18-C-6)(1-AdO)2][I3] : a system based on a **single Dy ion BUT with a higher barrier**, MUSR+NMR+magnetometry
- **Very low-frequency (ν <5 MHz) spin dynamics by NMR-FFC**, of diluted systems TbSQ, Tb-trp, DySQ, Dy-trp

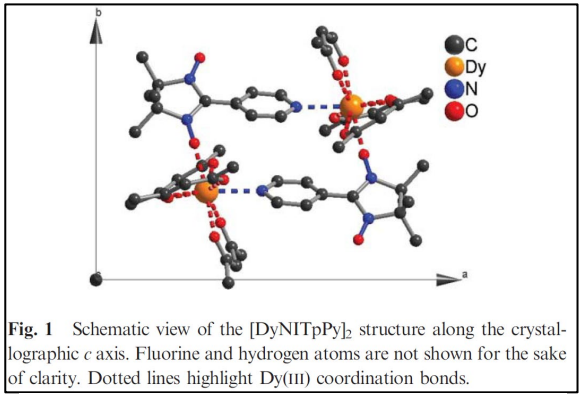


Fig. 1 Schematic view of the $[DyNITpPy]_2$ structure along the crystallographic *c* axis. Fluorine and hydrogen atoms are not shown for the sake of clarity. Dotted lines highlight Dy(III) coordination bonds.

A rational approach to the modulation of the dynamics of the magnetisation in a dysprosium–nitronyl-nitroxide radical complex†

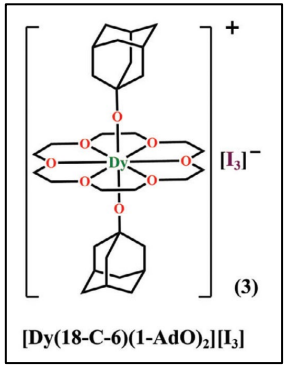
Giordano Poneti,[a] Kevin Bernot,[a,b] Lapo Bogani,[a] Andrea Caneschi,[a] Roberta Sessoli,[a,c] Wolfgang Wernsdorfer[c] and Dante Gatteschi[a]

Chem. Commun., 2007, 1807–1809 | 1807

Bis-Alkoxide Dysprosium(III) Crown Ether Complexes Exhibit Tunable Air Stability and Record Energy Barrier

*Wen-Jie Xu, Qian-Cheng Luo, Zi-Han Li, Yuan-Qi Zhai, and Yan-Zhen Zheng**

Adv. Sci. **2024**, *11*, 2308548



[Dy(18-C-6)(1-AdO)$_2$][I$_3$]

Tentative 3-yrs tasks

Synthesis of SMM for sensing	1-24
Synthesis of rare-earth compounds	1-24
NMR experiments with impinging β and/or γ	3-36
SQUID exp.s with impinging β and/or γ	3-36
CW/pulsed EPR exp.s with impinging β and/or γ	6-36
MUSR exp.s with impinging α, β and/or γ	12-36
MUSR exp.s with ac+DC fields applied, B_{ac} & B^{DC} not parallel to c	12-36
SQUID exp.s with ac+DC fields applied, B_{ac} & B^{DC} not parallel to c	6-36
MUSR+NMR on DyNIT units coupled by small (bias) interaction	12-36
MUSR+NMR+magnetometry on high-barrier [Ln(18-C-6)(1-AdO)2][I3]	12-36
NMR-FFC of diluted systems TbSQ, Tb-trp, DySQ, Dy-trp	3-28

Tentative 3-yrs budget Milano

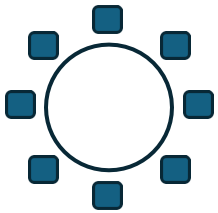
Milano	Capitolo	kEuro	Motivazione
2025	Consumables Instrumentation Missions	2.5 2 2	Cooling liquids (Galden) and spare electronics and glasses Gaussmeter + dedicated special oscilloscope for FFC-NMR Collaboration meetings/measurements, MUSR experiments, outreach
2026	Consumables Missions	2.5 2	Cooling liquids (Galden) and spare electronics and glasses Collaboration meetings/measurements, MUSR experiments, outreach
2027	Consumables Missions	2.5 2	Cooling liquids (Galden) and spare electronics and glasses Collaboration meetings/measurements, MUSR experiments, outreach

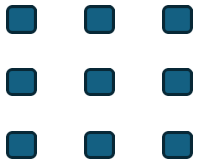
QUantum Architectures for Theory & Technology

QUART&T

Sezioni	Numero Ricercatori	FTE
MIB	14	6.4
NAPOLI GC SALERNO	6	2
FERRARA	4	1.1
FIRENZE	4	1.4
MI	2	1.4
TIFPA	9	3.2
LNL	3	1.5
PISA	11	2.1
Lecce	4	1
Bologna	9	2.2
LNF	10	4.05

Numero Sezioni	Totale Persone	TOTALE FTE
11	76	26.35





INFN
Istituto Nazionale di Fisica Nucleare

CSN5
Technological
research

QUART&T: Goal

The QUantum Architectures for Theory & Technology (QUART&T) project aims to develop demonstrator quantum architectures, establishing the foundation for experimental platforms where theoretical models and phenomena of interest to the INFN can be tested.

A ***quartet*** of crucial optimizations:

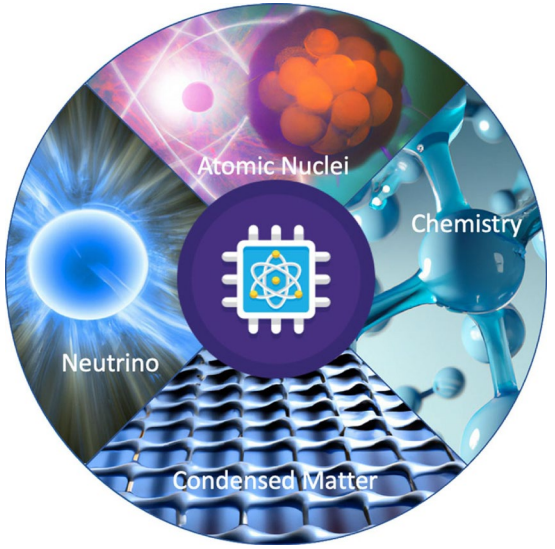
1. All-to-all connectivity;
2. Tunable couplings;
3. Higher-dimensional systems (Qudits);
4. Circuit Quantum Electrodynamics

The **project goal** and the **crucial optimizations** will be reached through:

1. Design and simulation of a superconducting quantum systems;
2. Fabrication of the designed quantum systems;
3. Control and readout of the quantum systems with quantum limited electronics and FPGA-based boards;
4. Simulations experiment with the developed quantum systems

QUART&T: Motivation

- Quantum many-body systems are one of the most daunting computational challenge in theoretical physics;
- This class of problems is characterized by a Hilbert space size that increases steeply when the number of one-body (particle) increases;
- Many-body systems are relevant in nuclear physics, atomic physics, astrophysics, low dimensional gravity, condensed-matter physics, and quantum chemistry;
- This large size leads to severe restrictions in the class of many-body systems that one can solve exactly on classical computers;
- Quantum computers contain an exponential complexity:
  ➡ suitable for tackling many-body;
  ➡ second quantization share many formal aspects with qubits;



Eur. Phys. J. A 59, 227 (2023)

QUART&T: Involved Groups

8 INFN Units

- INFN Bologna
- INFN Ferrara
- INFN Firenze
- INFN Lecce
- INFN Milano
- INFN Milano Bicocca
- INFN Gruppo Collegato di Salerno (INFN Napoli)

2 INFN National Laboratories

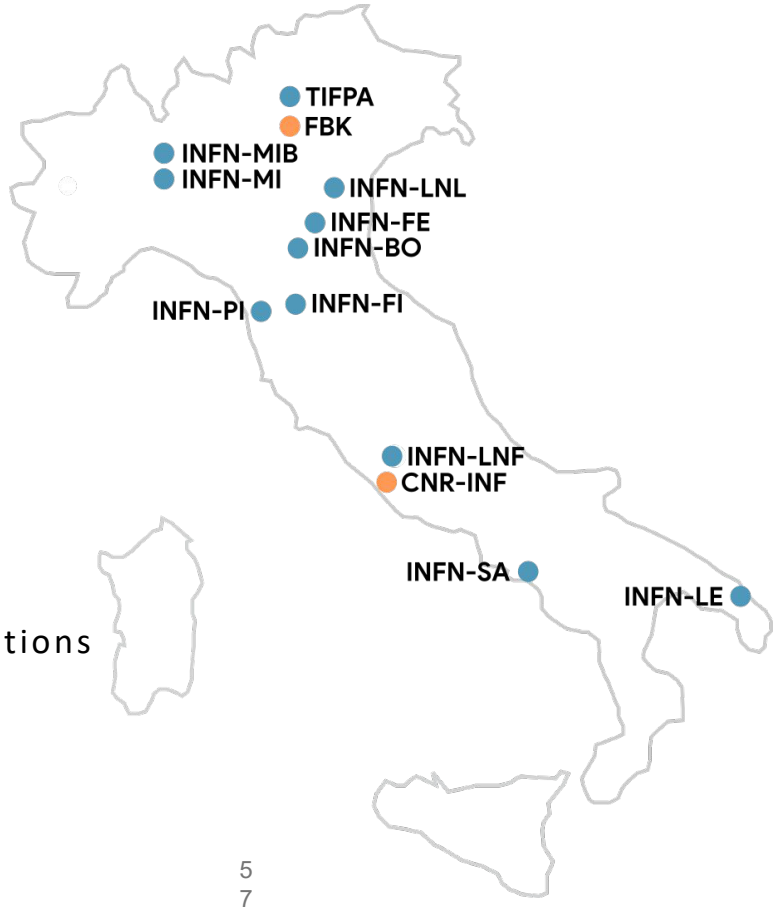
- INFN Laboratori Lazionali di Frascati (LNF)
- INFN Laboratori Lazionali di Legnaro (LNL)

1 INFN Research Center

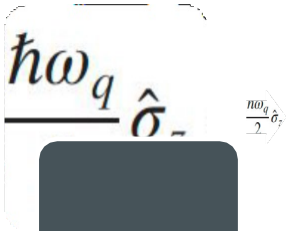
- Trento Institute for Fundamental Physics and Applications (TIFPA).

2 External Research Centers

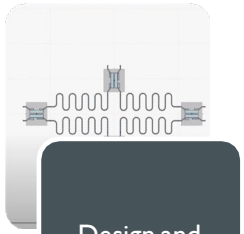
- Fondazione Bruno Kessler (FBK, Trento)
- Istituto di Fotonica e Nanotecnologie (CNR-IFN, Roma)



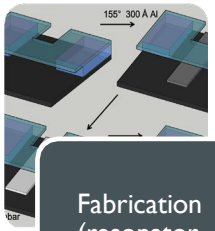
QUART&T: challenges



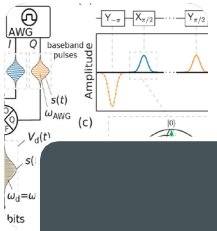
Theory



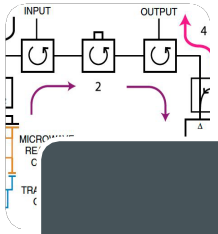
Design and Simulations



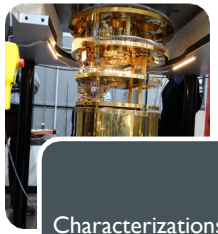
Fabrication (resonator, qubit, 3D cavities)



Control



Readout



Characterizations, Experiments and Demonstrations

INFN-Bo
INFN-Fi
INFN-MI
INFN-TIFPA

INFN-FI
INFN-LNF
INFN-MIB
INFN-PI
INFN-SA
INFN-TIFPA

FBK
CNR
INFN-LNL

INFN Bo
INFN-FE
INFN LNF
INFN MI
INFN MIB
INFN-PI
INFN-SA

INFN-MIB
INFN-LNF
INFN-PI
INFN-LE
INFN-SA
INFN-TIFPA

QUART&T: Conclusion, FTE, Funds

DESCRIZIONE RICHIESTE ECONOMICHE MI	VALORE (EURO)
Viaggi presso laboratori INFN e conferenze.	5K
Materiale informatico per sviluppo software.	5K
Materiale elettronico per testing.	5K
TOTALE MI	15K

- Analog quantum simulation is a fundamental tool for theoretical computation in fields of interest to the INFN;
- Superconducting planar and 3D qubits coupled by a tunable coupler can be used to implement analog quantum simulations;
- The implemented architecture will be exploited for applications in quantum sensing and quantum machine learning;
- Several challenges will need to be addressed, but the collaboration can rely on the expertise from two INFN National Laboratories, nine INFN Units, and two of the main micro and

SELENE

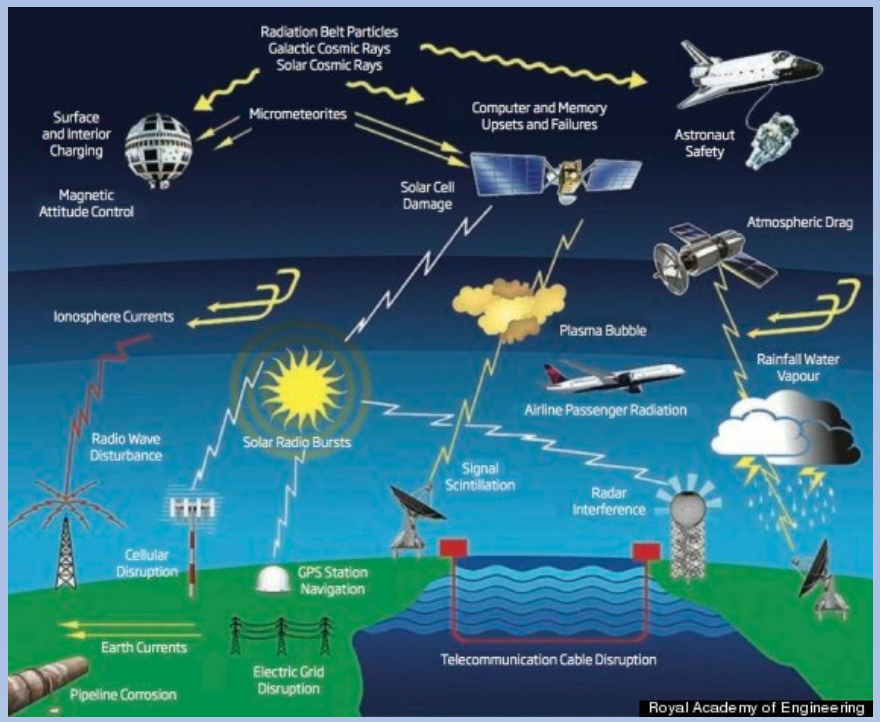
Space Weather Effect at different altitude LEvels measured by a Newtron and muon Detectors network

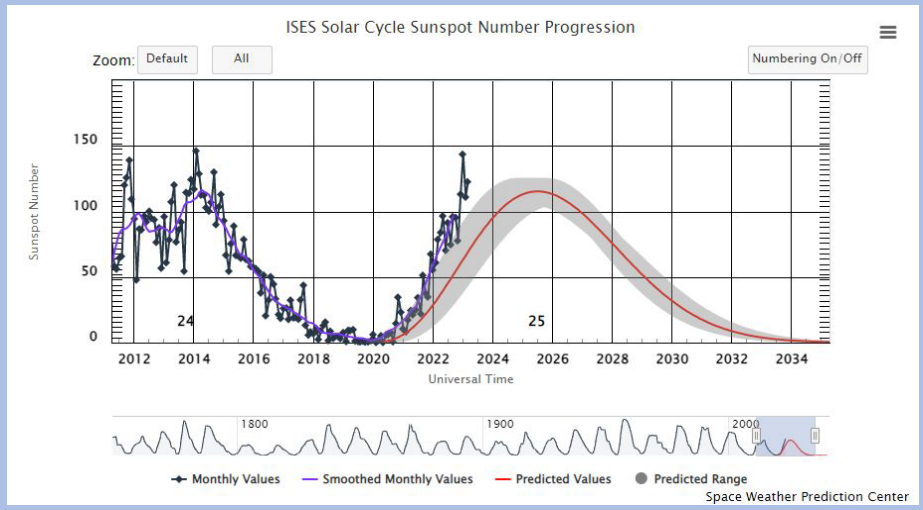
Davide Grandi

On behalf of
INFN Milano Bicocca group

INFN CV Meeting

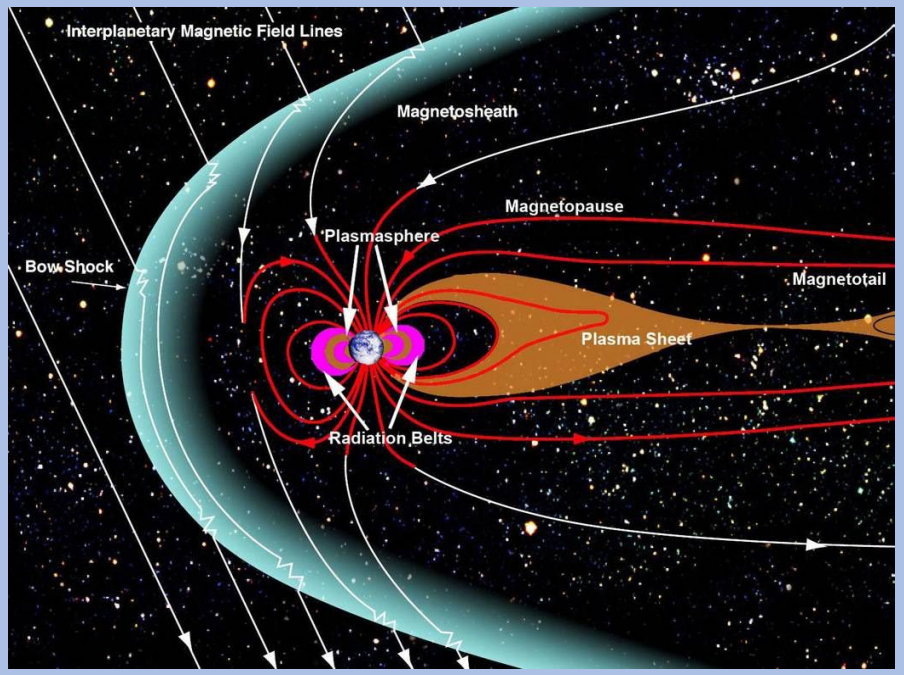
Space Weather and Cosmic Rays

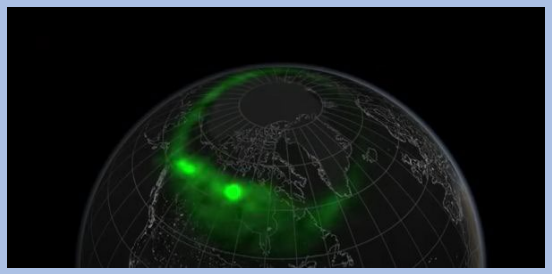




Current solar cycle 25 is ramping up; currently on the high side of the forecast margin of error

Geomagnetic Field



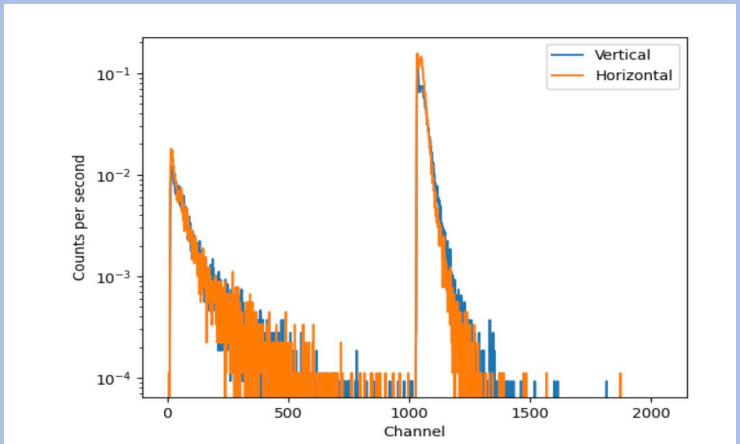


GEOMAGNETIC STORM:
can lead to outer atmospheric changes that can cause satellite drag, collision avoidance issues; ionospheric electron density changes that may impact SATCOM, GNSS; DC current buildup on power grid; and more

Selene - the Muon Cosmic Hunter

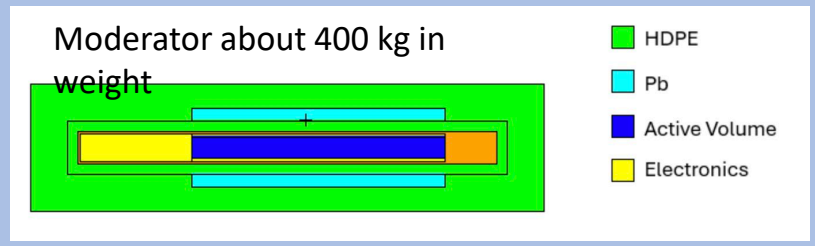
«our» Neutron Monitor

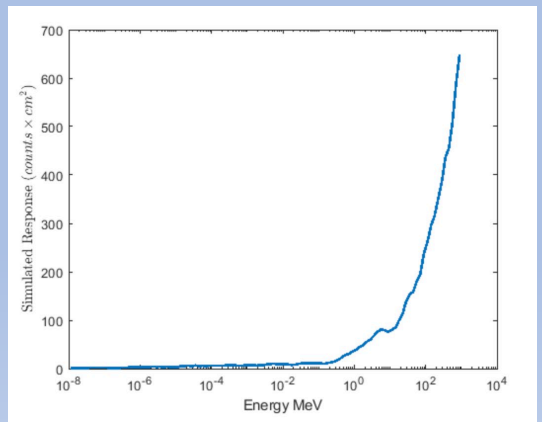
with added capability of measuring the muon flux



Example of the PSD output. The channels in the range 0-1000 represent the pulse high spectrum for the neutron signal. The channels in the range 1001-2000 represent the pulse high spectrum for the muon signal. The neutron signal is independent of the detector position. The muon signal is, as expected, lower for the vertical position.

Rod of acrylic light-pipe coated with ZnS(Ag) scintillator mixed with B-10 to make it sensitive to thermal neutrons. The detector is also sensitive to muons scintillating in the acrylic rod





Simulated response function in counts per unit of neutron fluence

Expected a sensitivity per Kg of moderator about 1.5 times higher than existing NM

Selene WP

- ***WP1 IMPLEMENTAZIONE SISTEMI DI RIVELAZIONE E DAQ***
  - ***Creazione rete rivelatori a basso costo***
  - ***calibrazione e test dei rivelatori e efficienze di misura***
  - ***costruzione della rete e installazione rivelatori***
  - ***accessibilità dati online***
- ***WP2 Ottimizzazione dei sistemi***
  - ***Caen***
- ***WP3 SIMULAZIONI MONTE CARLO***
  - *Dipendenza dello spettro dei muoni a terra dall'energia del primario*
- ***WP4 TEST SISTEMI DI MISURA***
- ***WP5: Development of a Modular and Transportable Neutron Monitor with capability of measuring the muon flux***
- ***WP6 MISURE E ANALISI DATI***
  - ***Distribuzione angolare muoni in corrispondenza di eventi solari***
  - ***Confronto con misure esistenti (CRC/NM)***
- ***WP7 - Monitoring the Neutron Spectrum and Cosmic Ray induced Dose in the South Atlantic Anomaly and Testa Grigia Laboratory***

Our “possible” network

Our “possible” network

- ***Finland***
  - ***Oulu NM site - Muon Cosmic Hunter – Low Rigidity cutoff (0.8 GV) - Comparison with NM data***
- ***Slovakia***
  - ***Kosice/Lomnicky Stit NM site - Muon Cosmic Hunter – Mid Rigidity Cutoff (4 GV) - Altitude study***
- ***Australia***
  - ***Melbourne - Monash University - Muon Cosmic Hunter – Mid Rigidity Cutoff (4.2 GV) - Correlation study***
- ***Italy***
  - ***Milano Bicocca - Muon Cosmic Hunter + Neutron Detector - Correlation study***
  - ***Testa Grigia Laboratory - Muon Cosmic Hunter - Altitude and Correlation study***
- ***Bolivia***
  - ***Muon Cosmic Hunter - NM site – Comparison with NM data - Altitude and SAA study***
- ***Dubai***
  - ***High Rigidity Cutoff (14,9 GV) - Detector Calibration and Correlation Study***
- ***Antarctica***
  - ***Low Rigidity Cutoff - Muon Cosmic Hunter***
- ***Maldive***
  - ***High Rigidity Cutoff (16,9 GV)- Detector Calibration and Correlation Study***

INFN sites involved

- ***Milano Bicocca***
  - ***1,7 FTE***
- ***Milano Celoria***
  - ***1.05 FTE***
- ***Pavia***
  - ***FTE***
- ***Cagliari***
  - ***FTE***
- ***Napoli***
  - ***1,1 FTE***
- ***Torino***
  - ***2,3 FTE***
- ***Trieste***
  - ***1 FTE***
- ***LNF***
  - ***1 FTE***

Richieste economiche per 2025
In fase di definizione

<u>Sezione di Milano Bicocca</u>

***Missioni*:**

- **40k€ 4 persone per installazione rivelatori nei principali siti**

***Consumo*:**

- **15k€ per sviluppo schede dE/dx per Cosmic Hunter,**
- **5 k€ per DHL (shipping Cosmic Hunter)**

***Inventariabile*:**

- **40 k€ x 8 Cosmic Hunter**

CALL

FRIDA

FLASH Radiotherapy with hIgh Dose-rate particle beAms

Call 2022-2024. Resp. Naz.: A. Sarti (RMI)

Resp. Loc.: S. Muraro

FRIDA aims to address several challenges posed by FLASH therapy: i.e. radiotherapy in which treatments are delivered with dose rates much larger (100 times or more) with respect to the conventional ones, motivated by the experimental evidence of a considerable normal tissue sparing effect with respect to standard radiotherapy

WP1: Investigation of the FLASH mechanism (radiobiology)

WP2: Beam delivery (acceleration techniques)

WP3: Beam Dose Monitoring (dosimetry)

WP4: FLASH treatment planning

Milano

2024: 3rd year of activity

BA, CT, LNS, MI, PI, RM1, TIFPA, TO: *87 researchers/7 tech, ~31 FTE (total)*

CdS 9 Luglio 2024

Status and plans

- **Il 2024 doveva essere l'anno conclusivo di FRIDA, ma, con l'accordo del Pres. della CSN5 e dei referees, si chiede un anno di prolungamento per completare alcuni obiettivi**

A short summary:

WP1:
Ongoing research is dedicated to the in vitro analysis of proton FLASH response in different oxygenation condition.
TIFPA is developing a radiobiological model (**MS-GSM^2: MultiScale - Generalized Stochastic Microdosimetric Model).**
It seems to be the only able today to describe the observed in vitro FLASH radioprotection for different particle types.

WP2:
Realisation of a demonstrator for the VHEE section of an RF – LINAC. Phase 2 accelerator prototyping has been completed: VHEE travelling wave section with 12 cells and couplers has been built and tested. Further tests in 2025

WP3:
Pisa 2025: Several activities of characterization of monitoring detectors were delayed because of administrative reasons (order delays)
Roma 2025 activites: measurement on FLASH beams at BTF, TO-lInac and others facilities
Bari 2025 activities: beam tests with FLASH protons (Manchester? Trento?)

WP4: next page….

WP4 program

Goals to be completed:

- evaluation of FLASH potential in clinical-like conditions: treatment of pancreatic and lung cancer with very high dose per-fraction are likely to profit significantly from the FLASH effect

Program 2025:

- Implementation in Treatment Plans of DMF (Dose Modifying Factor) factors provided by the work of WP1 based on the radiobiological model developed in TIFPA

Anagrafica & Richieste 2025

RL: Silvia Muraro,	Ricercatore INFN:	20%
Mattei Ilaria,	Ricercatore INFN:	15%
Dong Yunsheng,	AdR INFN:	10%

Per le attività WP4 di Milano si chiede solamente una limitata quantità di fondi di missione, come per il 2024:

1 Meeting di collaborazione 2g x 2 persone:	2.5 k€
Attività WP4 in collaborazione con Roma1: 2 incontri x 2 persone	1.5 k€
Tot:	**4.0 k€**

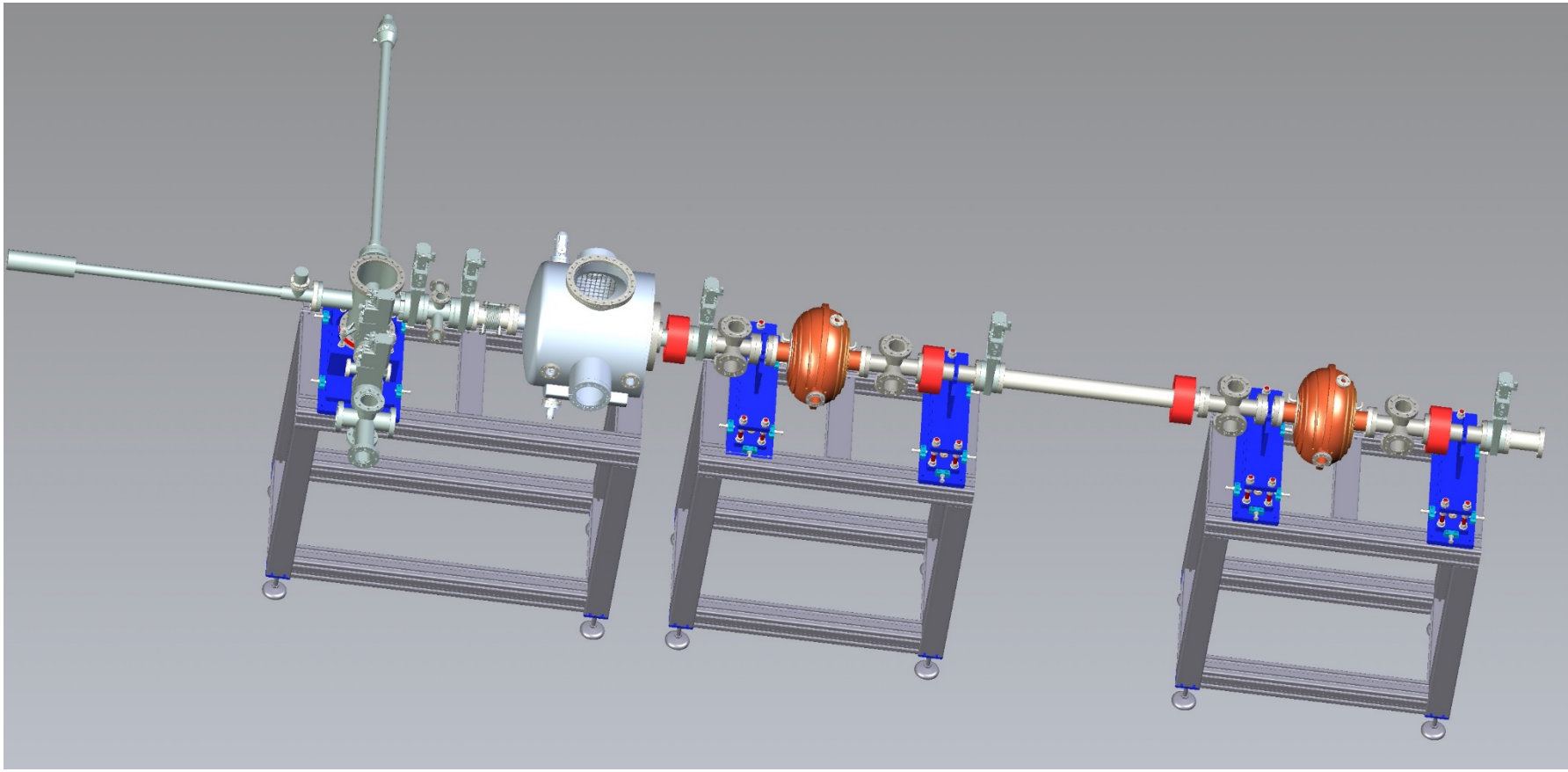
HB2TF Project Update Report

Dario Giove

On behalf of the HB2TF collaboration (Milan, LNL, LNF, LNS, Pavia)

10th July 2024

Status



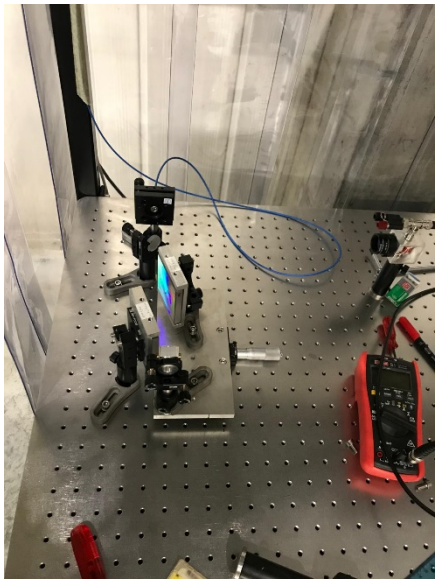
Status

The first year of the project (2023) resulted in an improved design of the injector and of the next booster stage to focus toward a 10 MeV electron beam. **The main problems** related to the identification of the commercial elements to be purchased or to be specifically designed for the scope and then identifying constructors to be involved in the process **have been solved**.

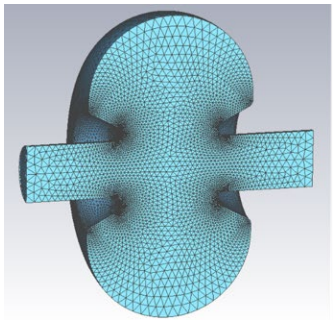
During 2024 the main events may be summarized as in the follow:

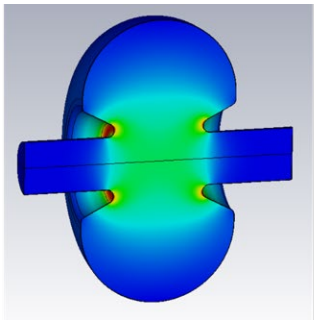
- the experimental area at LASA started to be ready for use
- received the 350 kV DC power supply for the photocathode and the SF6 insulating gas vessel is redy to be ordered
  the optical table in the experimental area has been assembled an is in use
- the laser beam has been transported in the experimental area and the quality seems suitable (150 m path !)
- the photocathode chamber will be available for the end of 2024 (remarkable delay due to administrative issues)
- the ceramic high voltage machining is in progress: we expect to receive in November 2024
- supports for the accelerators will be delivered in September
- main vacuum pumps and valves are going to be delivered
- the design of the first RF buncher has been frozen and we will order in September
- the RF power amplifier characteristics has been defined radioprotection simulations have been performed in detail (we expect to send the documentation for 200 kV operations in September (one month expected to obtain the permission)

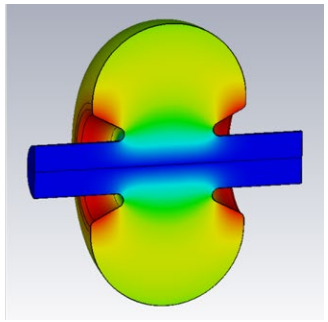
Status



	Buncher 1	Buncher 2
f0 (π-mode) [MHz]	650	
β (v/c)	0.74	0.906
Input beam energy [MeV]	0.3	0.638
E-field ampl. [MV/m]	2.7	
Cell per cavity	1.0	
Active cavity length [m]	0.171	0.209
Cavity quality factor Q_0	$3.2\ 10^4$	$3.67\ 10^4$
Ext.quality factor Q_{ext}	$3.02\ 10^4$	$3.24\ 10^4$
R/Q [Ω]	195.7	223
Geometry factor G [Ω]	211	244
E_{pk}/E_{acc}	3.07	3.88
B_{peak}/E_{peak} [mT/(MV/m)]	0.96	0.96
B_{peak}/E_{acc} [mT/(MV/m)]	2.94	3.73







3D mesh and profile for E and H field in Buncher 1.
Parameter “g ” is the effective gap length that is 17 cm corresponding to a cavity beta 0.74.

Activities for 2025

The main activities foreseen in 2025 may be summarized as below:

- Buying elements for the laser/RF synchronization
- Reworking of few mechanical elements after the first assembly
- Mains power rack
- DC gun additional vacuum pumps and beam line vacuum pumps
- Health physics monitors
- Shielding materials
- Solenoids and related power supplies
- RF amplifier

The CALL will end in 2025 and we have
to keep funds for unexpected events during the first tests

Richieste economiche per il 2025: ~ 395,00 k€

		2024	2025
Bacci		20	20
Bertucci		10	10
Bosotti		10	10
Del Core		10	10
Drebot		15	15
Ferragut		10	10
Fiorina		10	10
Giammarchi		10	10
Giove		35	45
Monaco		10	10
Paparella		10	10
Petrillo		30	10
Puppin		20	20
Rossetti		30	30
Rossi		20	20
Samsam		30	30
Serafini		20	20
Sertore		10	10
Spada		10	10
Cialdi		0	20
TOTALE		320	330

HiDRa:
High-Resolution Highly Granular Dual-Readout Demonstrator

Romualdo Santoro
Univeristà dell'Insubria and INFN-MI

HiDRa: main goal

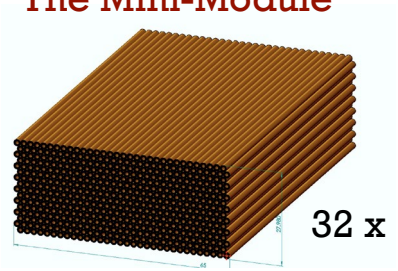
The project aims at designing, constructing and qualifying on beam a longitudinally unsegmented, highly granular, fibre-sampling DR calorimeter prototype

- PI: Roberto Ferrari (PV)
- WP1: Mechanics and fibre characterisation (MI, PI, PV)
  - Responsible: G. Gaudio (PV)
- WP 2: Light sensors (SiPM) (BO, CT, MI, TIFPA)
  - Responsible: M. Caccia (MI)
- WP 3: FEE and DAQ development (BO, CT, MI, PV, TIFPA)
  - Responsible: R. Santoro (MI)*
- WP 4: Performance assessment (MI, PV, RM1)
  - Responsible: G. Polesello (PV)

*Responsabile Locale INFN-MI

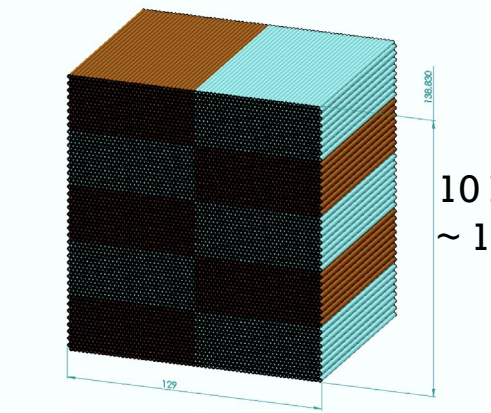
Prototype with hadronic containment

The Mini-Module



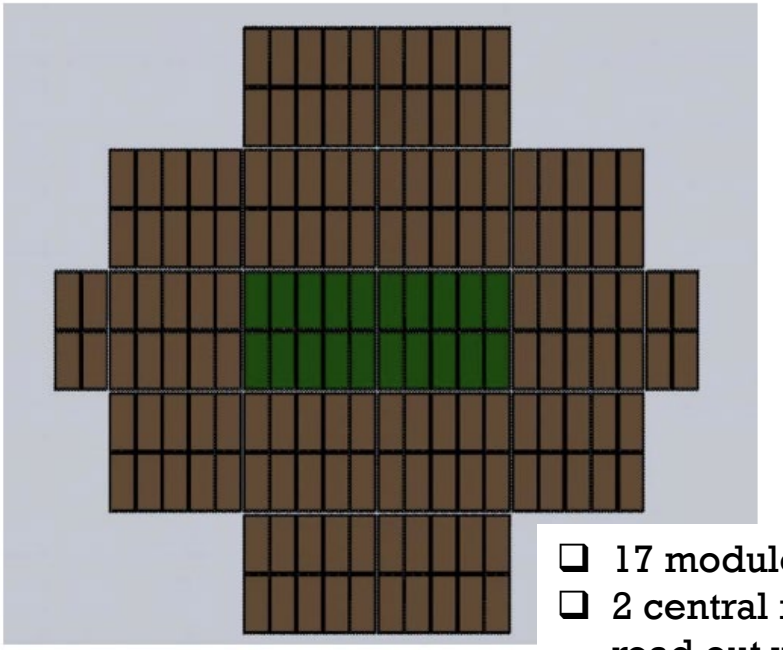
32 x 16 capillaries

The Module



10 Mini-modules
~ 13 x 13 x 200 cm^3

The hadronic prototype



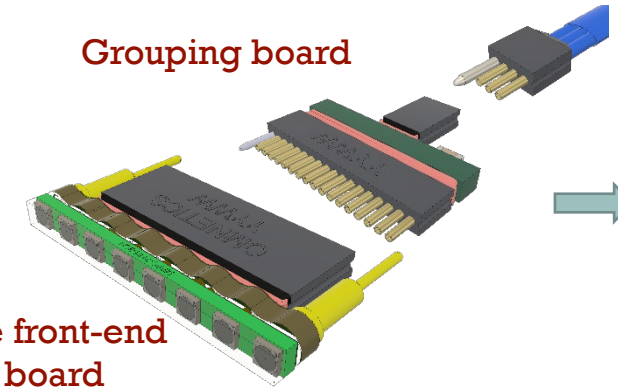
- 17 modules in total
- 2 central modules read out with SiPMs
- 15 modules read out with PMTs
- ~ 65 x 65 x 200 cm^3

FEE-board and cabling

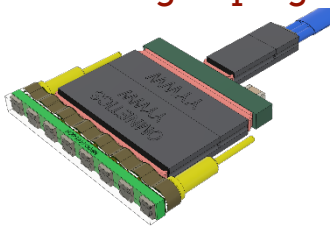
Grouping board

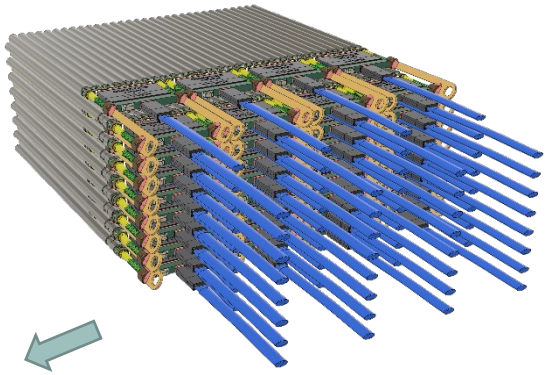
The front-end board with grouping

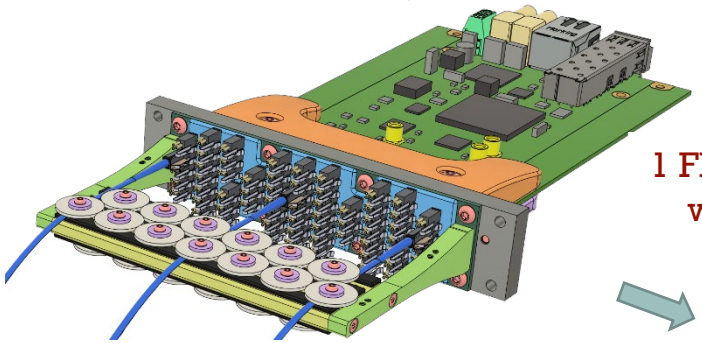
The mini-module



The front-end board





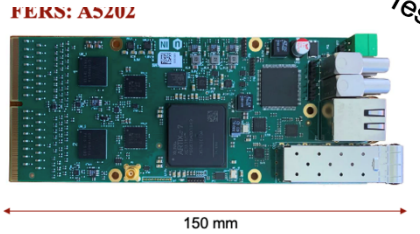


1 FERS serves 64 front-end boards with grouping: 1 Mini-module

Baseline solution

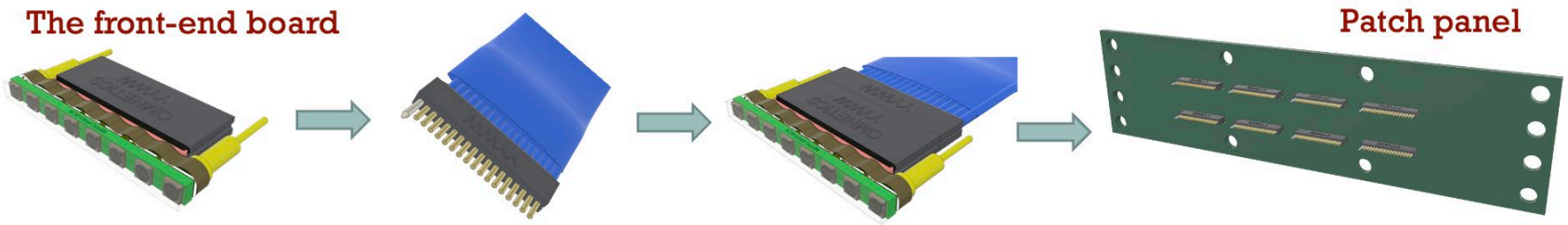
- Each bar of SiPMs will be operated at the same voltage
- The signals from 8 SiPMs is summed up in the grouping board
- 1 FERS operates the full mini-module

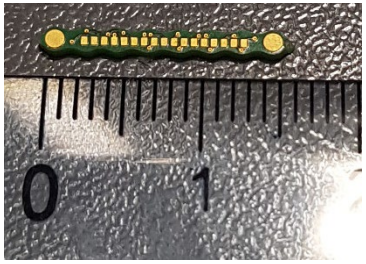
Tested on beam

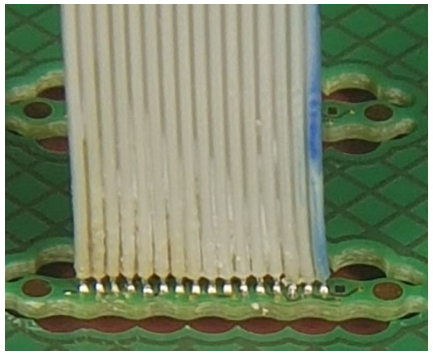


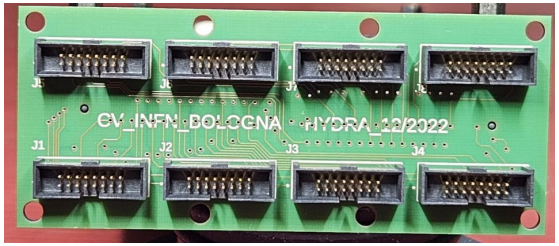
- Two Citiroc1A for reading out up to 64 SiPMs
- One (20 – 85V) HV power supply with temperature compensation
- Two 12-bit ADCs to measure the charge in all channels
- Timing measured with 64 TDCs implemented on FPGA (LSB = 500 ps)
- 2 High resolution TDCs (LSB = 50 ps)
- Optical link interface for readout (6.25 Gbit/s)

From the design to the real components









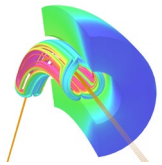
- Prototypes of front-end boards for SiPM qualification (expected in July 2023)
- Prototypes of grouping board in production (2 designs for comparison)
- SiPMs with custom package (to be ordered this year)

Calorimetria Dual Readout

- Attività prevista per il 2025
  - Analisi dei dati del TB 2024
  - Qualifica dei SiPM + front-end board per costruire il dimostratore Hydra2
  - Test beam 2025

Dipendente / Associato	Hydra2	RD_FCC	Totale (%)	Commenti
Attilio Andreazza		30% tbc	30% tbc	
Alberto Bacci		15%	15%	
Francesco Broggi		10%	10%	
Massimo Caccia	20%	20%	20%	Sinergica con Hydra2
Illya Drebot		15%	15%	
Agnese Giaz				Sinergica con Hydra2
Romualdo Santoro	30%	20%	50%	Sinergica con Hydra2
Aleksandr Burdyko	50%	50%	100%	Sinergica con Hydra2
Leonardo Carminati		10%	10%	Sinergica con Hydra2
Ruggero Turra		10%	10%	Sinergica con Hydra2
Elena Mazzeo		10%	10%	Sinergica con Hydra2
Laura Nasella		10%	10%	Sinergica con Hydra2
Totale FTE:	1	2	3	

La Call SIG

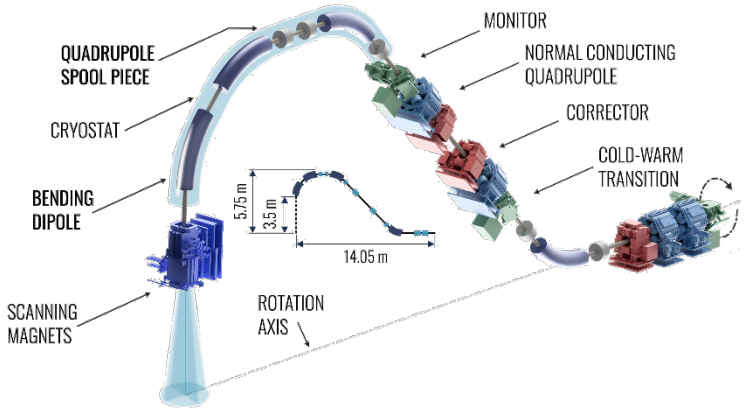


Superconducting Ion Gantry

- SIG è il frutto di una Call INFN di gruppo 5
- Scopo: sviluppo di alcune tecnologie chiave per gantry per ioni (Bρ = 6.6 Tm) di prossima generazione
- È inserito in un framework agreement internazionale tra
- Responsabile nazionale: M. Prioli (INFN-LASA)

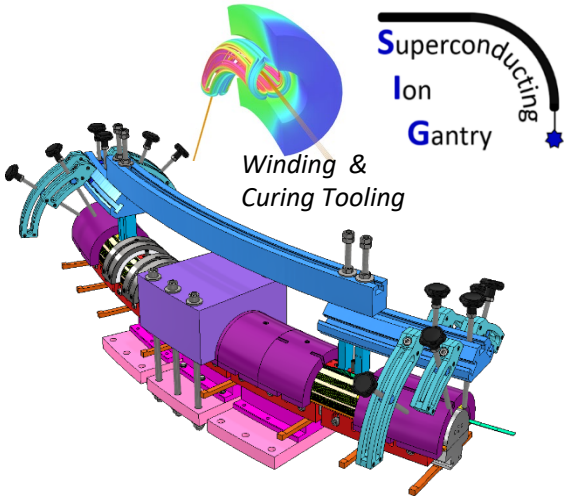
INFN, CERN, CNAO (Centro Nazionale di Adroterapia Oncologica), MedAustron

- Principali dimostratori
  - WP2: magnete superconduttore curvo (R_{bend} = 1.65 m, B_0 = 4 T) → M. Prioli, INFN-LASA
  - WP3: magneti di scansione → L. Sabbatini, INFN-LNF
  - WP4: Dose Delivery System (DDS) → S. Giordanengo, INFN-TO
  - WP5: Range Verification System (RVS) → E. Fiorina, INFN-TO



La Call SIG: Status del WP2 - Milano

- 12/2023: Conceptual Design Report (CDR) del magnete completato
- 04/2024: CDR review con 3 revisori internazionali
  → Feedback positivo e via libera all'avvolgimento
- 07/2024: Ricezione di cavo isolato, tooling e componenti per le bobine
  → Inizio avvolgimento della prima bobina curva
- 12/2024: Completamento del Technical Design Report (TDR) con l'ingegnerizzazione del magnete (definizione procedure e disegno componenti)



Conceptual Design Report

INFN

ISTITUTO NAZIONALE DI FISICA NUCLEARE

Sezioni di Milano e Genova

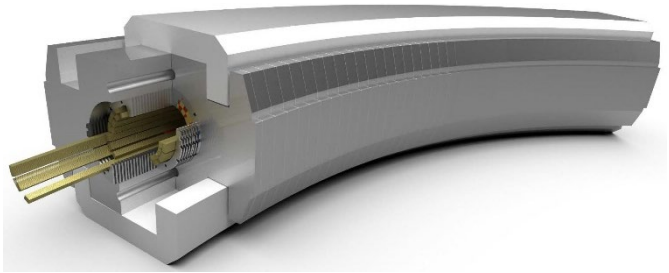
INFN-23-32/MI
29 November 2023

EuroSIG FRAMEWORK
-
CONCEPTUAL DESIGN REPORT OF THE SUPERCONDUCTING ION GANTRY (SIG) DIPOLE DEMONSTRATOR MAGNET

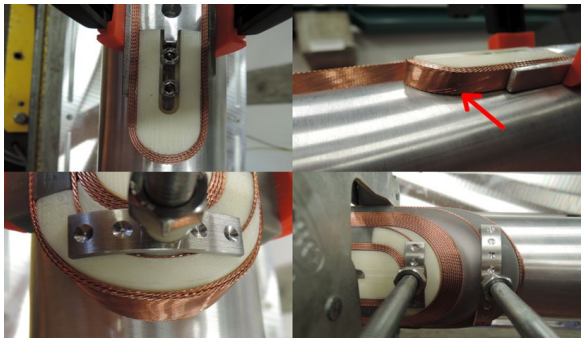
Marco Prioli[1], Emma Bianchi[2,3], Anna Giulia Carloni[1], Roberto Cereseto[2], Stefania Farinon[2], Andrea Gagno[2,3], Filippo Levi[2], Samuele Mariotto[1,4], Alessandra Pampaloni[2], Lucio Rossi[1,4], Carlo Santini[1], Riccardo Umberto Valente[1], Enrico Felcini[5], Guglielmo Frisella[5], Alessio Mereghetti[5], Simone Savazzi[5], Marco Pullia[5], Elisavet Oursoula Kavoura[6], Ioannis Georgiadis[6], Charilaos Kokkinos[6]

[1)]INFN LASA, Viale F.lli Cervi 201, I-20054 Segrate (MI), Italy
[2)]INFN, Sezione di Genova, Via Dodecaneso 33, I-16146 Genova, Italy

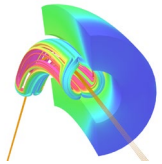
SIG Superconducting Demonstrator Magnet



Winding Trial



La Call SIG: i numeri



Superconducting Ion Gantry

Budget interamente assegnato al t_0

- INFN (PNR): ~1 M€ (da MUR-PNR, CSN5 continua però il referaggio)
- Esterni (CNAO + CERN) sul WP2: ~600 k€
- Non ci sono richieste aggiuntive a preventivo

Pianificazione WP2

- Ritardo consistente rispetto alla pianificazione originale: 12 mesi
  - Fattori esterni: +12 mesi agreement con CERN e CNAO per differente visione, +12 mesi consegna del cavo isolato da parte CERN
  - Fattori interni: +6 mesi ritardo acquisto tooling e componenti
  - Sforzo consistente per contenere la propagazione del ritardo
- La Call si conclude nel 2025 e il budget MUR-PNR deve essere speso entro metà 2025
- Il budget esterno può essere speso anche successivamente

Richieste servizi 2025

- Supporto progettazione meccanica: 6 mu
- Officina meccanica: 3 mu

FTE 2025

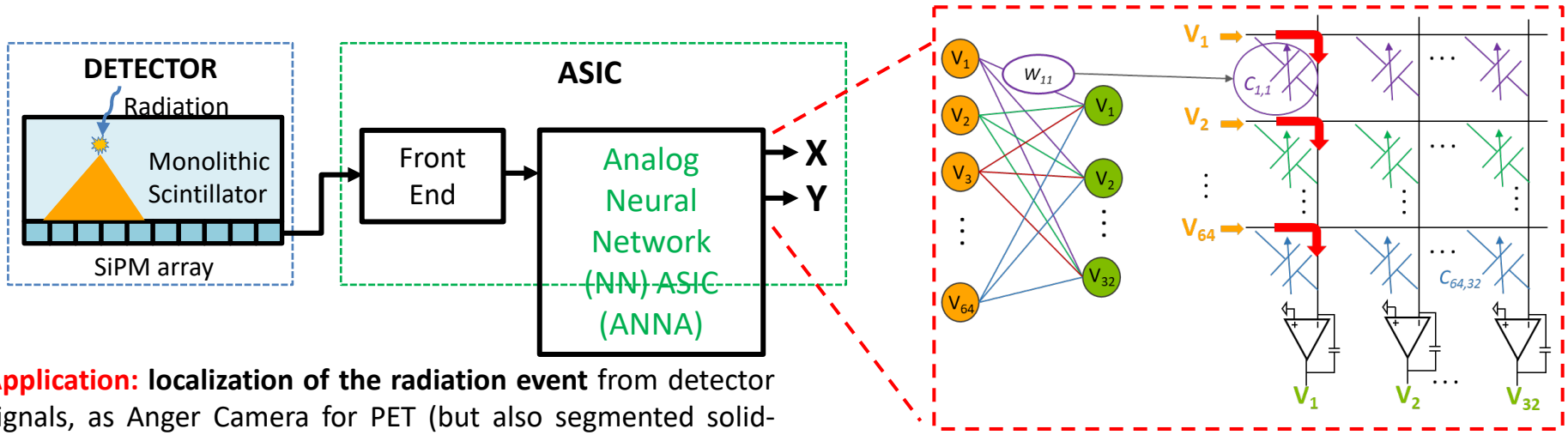
	Ric & Tecnologi		SIG
1	Lucio Rossi	PO	10%
2	Massimo Sorbi	PA	10%
3	Massimiliano Cannavò	T (EP3)	20%
4	Enrico Beneduce	T (D3)	10%
5	Marco Statera	T2	10%
6	Marco Prioli	T3	60%
7	Riccardo Valente	T3 TD	30%
8	Carlo Santini	T3 TD	30%
9	Todor Gusvitskii	PhD RM1	60%
	TOT Ricercatori		***240%***
	TECNICI		
1	Danilo Pedrini	C4	20%
2	Augusto Leone	C4	20%
3	Alessandro Pasini	C6	20%
4	Arsenio Palmisano	C6 TD	50%
5	Ahmed Gad	C6 TD	20%
6	Alessandro Ruggiero	C6 TD	30%
7	Nicola Cavaliere	C1 UNIMI	10%
8	Nicola Ciarchi	C1 UNIMI	20%
	TOT Tecnici		***190%***

ESPERIMENTI che continuano con

Responsabilità NAZIONALE e LOCALE

ANNA
Analog Neural Network ASIC

GOAL: development of an ASIC for full-analog NN reconstruction of detector events



Application: **localization of the radiation event** from detector signals, as Anger Camera for PET (but also segmented solid-state detectors).

Strategy:

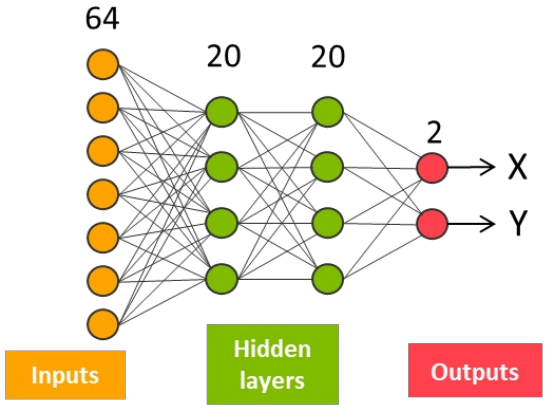
→ Crossbar array of **programmable switched capacitors**

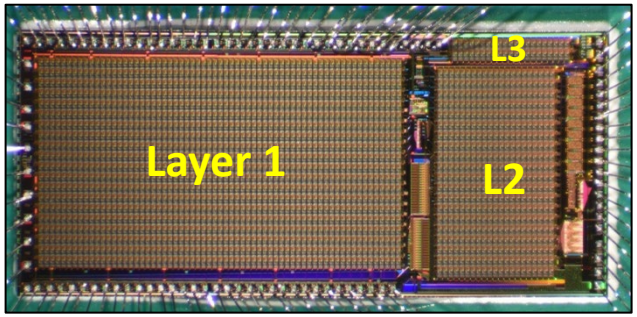
→ **Analog operations** performed directly on **analog signals** coming from photodetectors

→ **No need for ADC and FPGA** for embedded processing

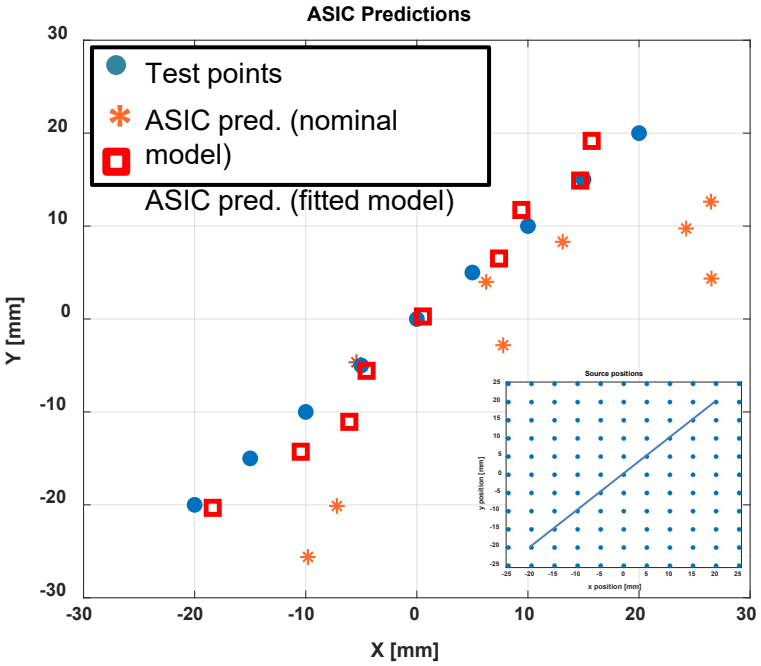
→ **Interaction coordinates (X,Y)** directly at the output of the **ASIC**

Preliminary results on a Prototype-0 chip (proof-of-concept)



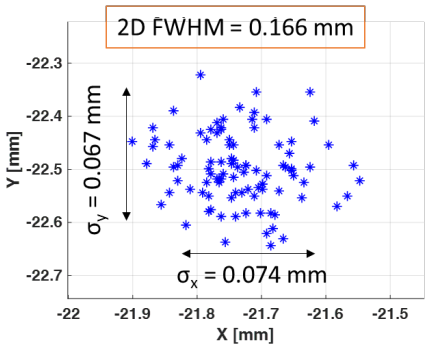


CMOS 0.35 µm, 24 mm²



Subset along diagonal of a **grid points** reconstructed by the ASIC NN. The average **bias** for these 9 points when using the model for training is **2.3 mm**.

Single point precision



- **100 inferences** of the same input.
- Std. dev. of predictions (X ± σ_x, Y ± σ_y) to evaluate **effect of noise** on ASIC NN positioning precision.
- The fluctuations produced by noise can be considered **negligible** if we target a spatial resolution of ≈**1.5 mm** FWHM.

ANNA: Participants and costs

Participants:

Milano

C.Fiorini (RN, PO)	40%
S.Di Giacomo (PhD)	100%
B.Pedretti (PhD)	100%
M.Ronchi (PhD)	100%
M.Amadori (PhD)	100%

Pisa

N.Belcari (RL, PA)	50%
G.Sportelli (PA)	50%
P.Carra (Ric.)	80%

TOT. 6.2 FTE

Costs 2025:

Milano	
Missioni *(missioni Pisa)*	**1,5k**
Inventario *(Strumentazione Lab.)*	**1,5k**
Consumo	**15,0k**
(PCBs e componenti 10k, bonding e setup 5k)	
Licenze SW	**2,0k**
Pisa	
Missioni	**3,0k**
(missioni Milano)	
Consumo	**20,0k**
(Detector demonstrator and integration with ASIC)	

Total **43,0 k**

Activities:

2025

- ASIC (Prototype-1) tests, design revision
- Prototyping and manufacturing of front-end boards and detector demonstrator
- First experimental detector+ASIC tests in Pisa

2026

- Second ASIC production
- Review of the front-end board
- Further experimental tests

Quantum protocol via local detection of OAM entangled states in pulsed light

MOONLIGHT

Sezioni coinvolte: **Milano**
Coordinatore Nazionale: **Bruno Paroli (INFN-MI)**
Durata**: 2 anni**

Obiettivi previsti per il 2024:

- Sviluppo di un protocollo quantistico di comunicazione totalmente ottico che sfrutta il momento angolare orbitale della radiazione per il trasferimento d'informazione ad alta densità.

- Implementazione del protocollo e del ricevitore che sfrutta solo una piccola porzione del fascio ricevuto.

- **Esperimento finale** che dimostri realmente la possibilità di trasferire informazione quantistica, codificata nel momento angolare orbitale, per trasmissioni a lunga distanza e ad alta densità d'informazione.

Obiettivi raggiunti (Giugno 2024)

- **Sviluppo del modello del protocollo quantistico** (architettura protocollo e regole protocollo).

- **Sviluppo della sorgente laser impulsata** (realizzazione dell' allungamento degli impulsi per mezzo di uno stretcher a reticoli, realizzazione dell' amplificazione per mezzo di un amplificatore in fibra fino a 5W di potenza media e compressione tramite compressore monolitico, generazione di seconda armonica, e generazione di coppie via PDC.

- **Sviluppo del sistema elettronico per la rivelazione dei conteggi in contemporanea** (misura del repetition rate)

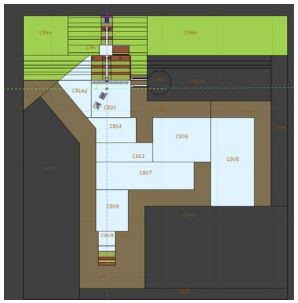
- **Sviluppo del sistema di proiezione degli stati di momento angolare orbitale e codifica** (misura sperimentale dell' efficienza di proiezione degli stati) sono state completate le misure dell'efficienza assoluta per i modi +-1, +-2 e +-4.

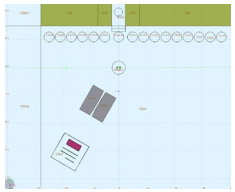
Personale Milano

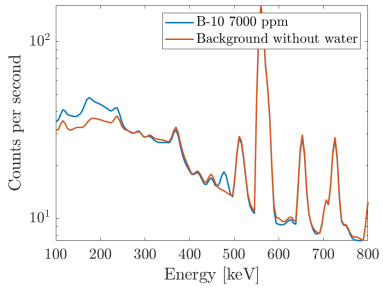
B. Paroli (Resp.N.) (PA)	60%
M. Paris (PO)	20%
S. Olivares (PA)	20%
M. Potenza (PA)	40%
S. Cialdi (PA)	20%
Mirko Siano (RTDA)	10%
TOTALE FTE	**1.7**

Main Outcomes of the SPOC Experiment in 2024 (Spect for Online boron dose verification in bnCT)

WP1 – Monte Carlo Simulations / WP3 – Tomographic Reconstruction

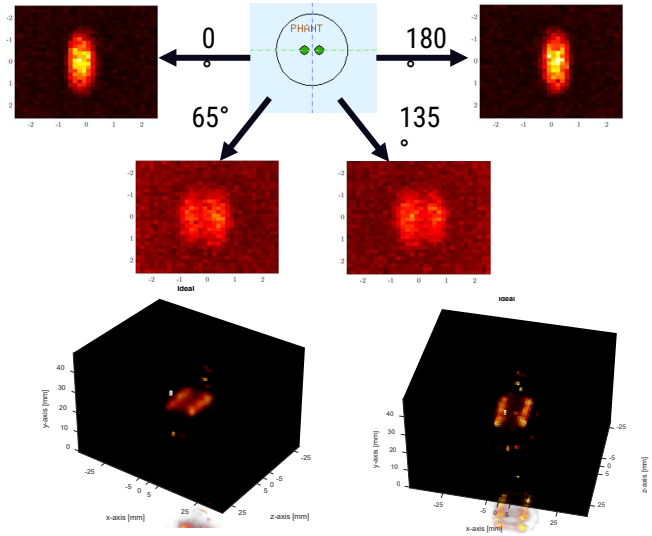






WP1: Monte Carlo simulations of tomographic measurements to be performed at LENA in Autumn

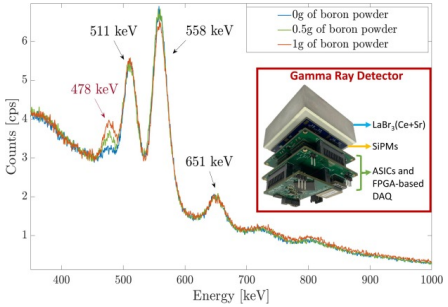
- Full implementation of the irradiation environment (geometry of the room + experimental spectrum of the thermal neutron beam)
- Simulation of the tomographic acquisition of different ^{10}B samples (small vials with B solutions, w/o and possibly inside a small water phantom)
- Study to optimize the detector shielding
- Final simulation to estimate the background and signal acquired by the detection module during measurements (in different positions and configurations)
- (Initial simulations of possible experimental campaign in Nagoya)

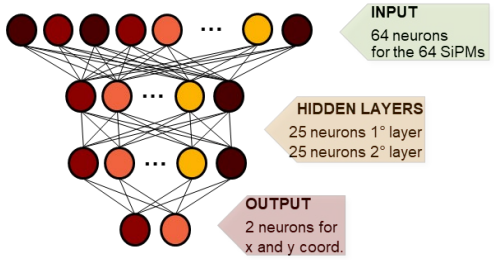


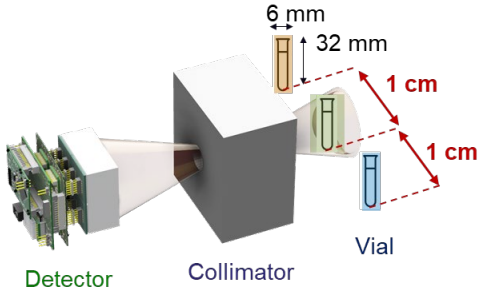
WP3: Image reconstruction

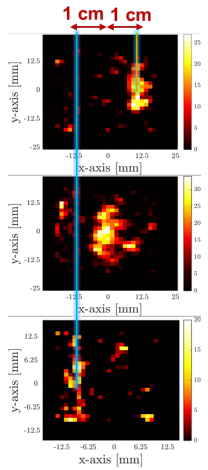
- Different software for SPECT image reconstruction studied and adapted to our detection module
  - Standard software based on maximum likelihood (Pytomography / STIR)
  - Software based on machine learning (DeepRecon o SPECTnet)
- Simulated date used to perform tomographic reconstruction of simulated data

Main Outcomes of the SPOC Experiment in 2024
WP1 – SPECT System / WP4 – Beam Testss









WP2: Development of the first prototype of the detection module

- Developed first prototype of the detection module: square $LaBr_3$ crystal (50mm x 50 mm x 20 mm) coupled with array of 64 SiPM
- Readout electronics fully developed by Polimi – Elettronica (GAMMA ASIC)
- Excellent energy resolution (2.7% @ 662 keV) and good detection efficiency (60% @ 478 keV)
- Estimation of gamma-ray position of interaction performed using Artificial Neural Networks (ANN)
- Full detector characterization performed in Polimi lab (also imaging performance with prototype collimator) and during prelimary measurements at LENA (with Boron powder)

WP4: Beam tests

- Several preliminary test performed at Prompt Gamma Neutron Activation Analysis facility of the TRIGA Mark II nuclear reactor (Pavia University)
  - Measurements with vials containing Boron powder
  - Measurements with vials containing ^{10}B aqueous solution (7000 pm), imaged using a preliminary channel-pinhole collimator
- Started discussion with clinical BNCT facility of Nagoya to perform measurements with a clinical beam
  - Initially foreseen in Autumn 2024, delayed because accelerator stopped working, still to be repaired
- Started discussion with BNCT facility of Birmingham to perform measurements with a clinical beam

Polimi Budget Requests and FTE

2025

Consumo: tot. 27.0 keuro

- Componenti elettronici per nuovi moduli di rivelazione + assemblaggio presso azienda esterna 10.0k
- Nuovi moduli FPGA per ricostruzione online 2.0k
- Nuove matrici SiPM per costruzione nuovi moduli 10.0k
- Nuovi collimatori di piombo ottimizzati per riduzione background (multi modulo) 5.0k

Inventario: tot 15.0 keuro

- Cristalli scintillatori LaBr3 per costruzione moduli di rivelazione 15.0k

Missioni: tot 6.0 keuro

- Missioni Italia (meeting di progetto + misure al LENA) 1.0k
- Missioni Estero (sub-judice: misure a Birmingham e/o Nagoya su fasci di intensità clinica) 5.0k

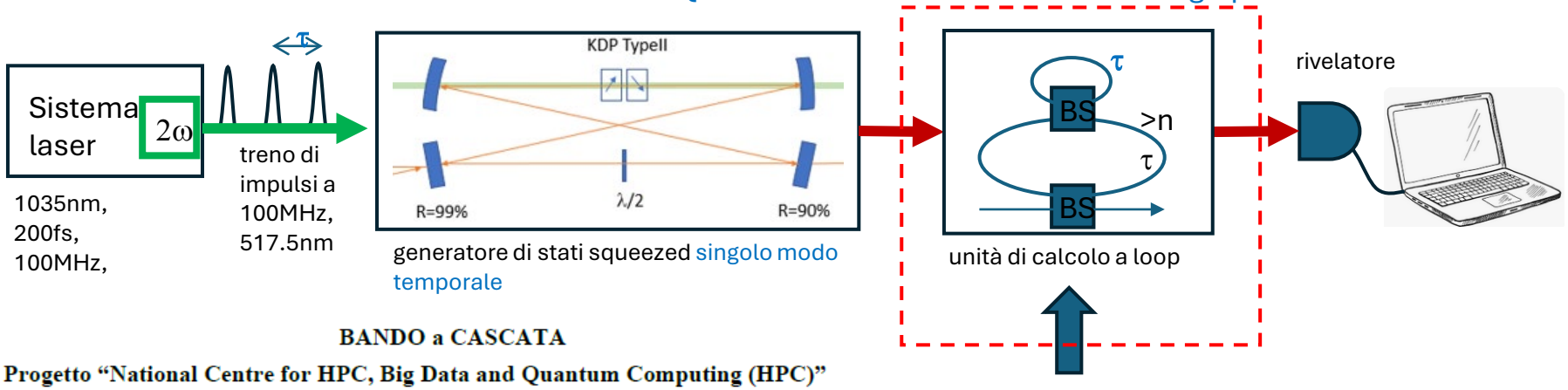
Totale Milano: 48.0keuro

FTE: tot. 6.7

- Giacomo Borghi (responsabile locale e nazionale) 0.5 FTE
- Carlo Ettore Fiorini 0.2 FTE
- Stefano Agosteo 0.2 FTE
- Andrea Pola 0.2 FTE
- Davide Bortot 0.2 FTE
- Davide Mazzucconi 0.4 FTE
- Aicha Bourkadi Idrissi 1.0 FTE
- Anita Caracciolo 1.0 FTE
- Tommaso Ferri 1.0 FTE
- Martina Piroddi 1.0 FTE
- Luca Grisoni 1.0 FTE

Schema di T4QC

E’ stato finanziato il progetto LOOQ che riguarda la realizzazione dell’unità di calcolo di T4QC in collaborazione con la ditta Camgraphic



BANDO a CASCATA

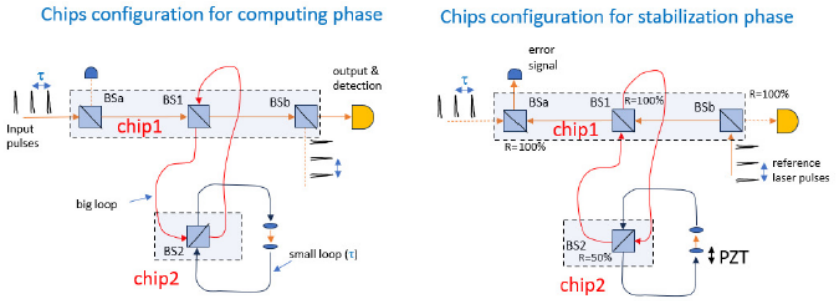
Progetto “National Centre for HPC, Big Data and Quantum Computing (HPC)”

Codice progetto CN00000013 – SPOKE 10

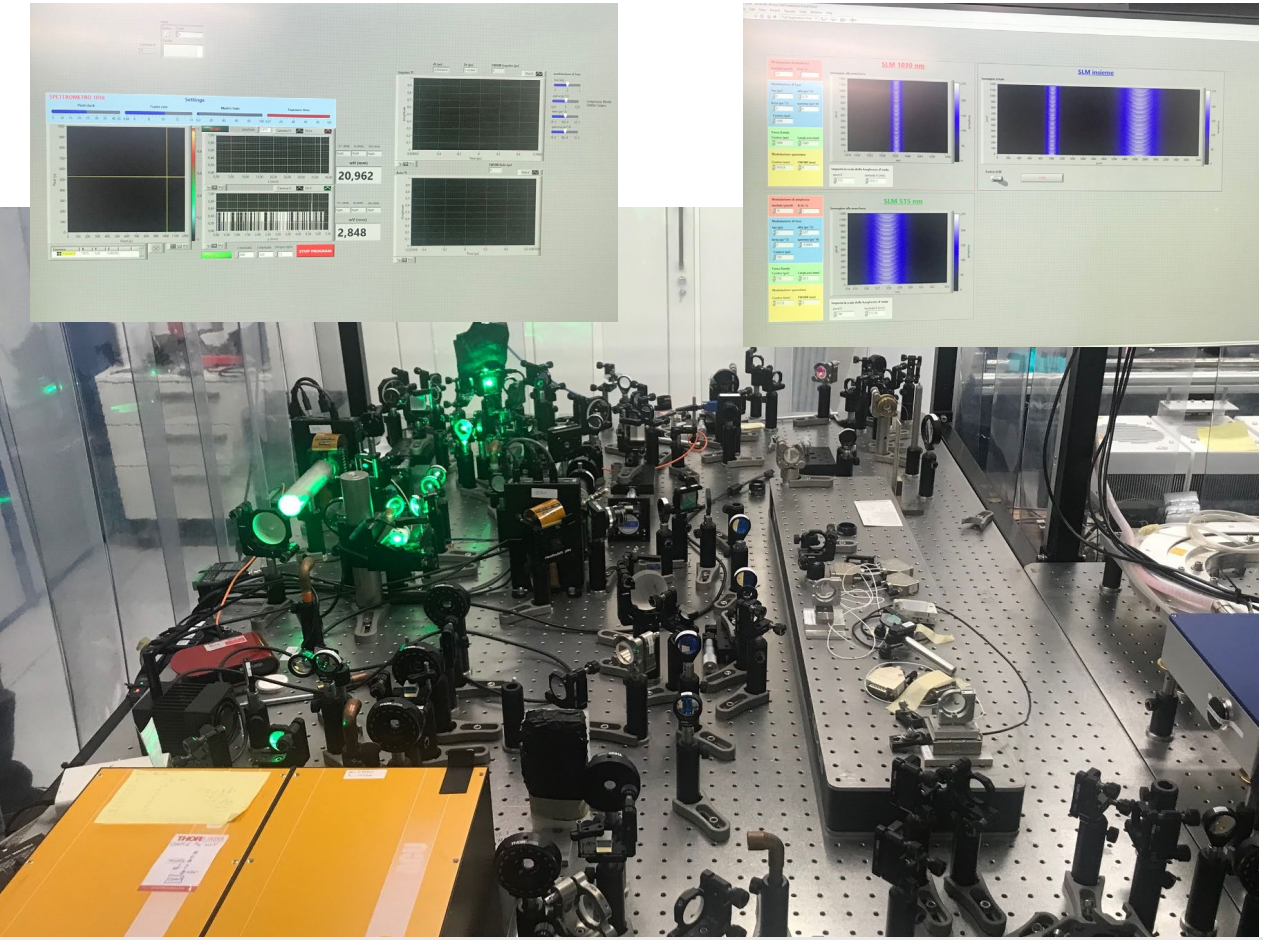
CUP D43C22001240001

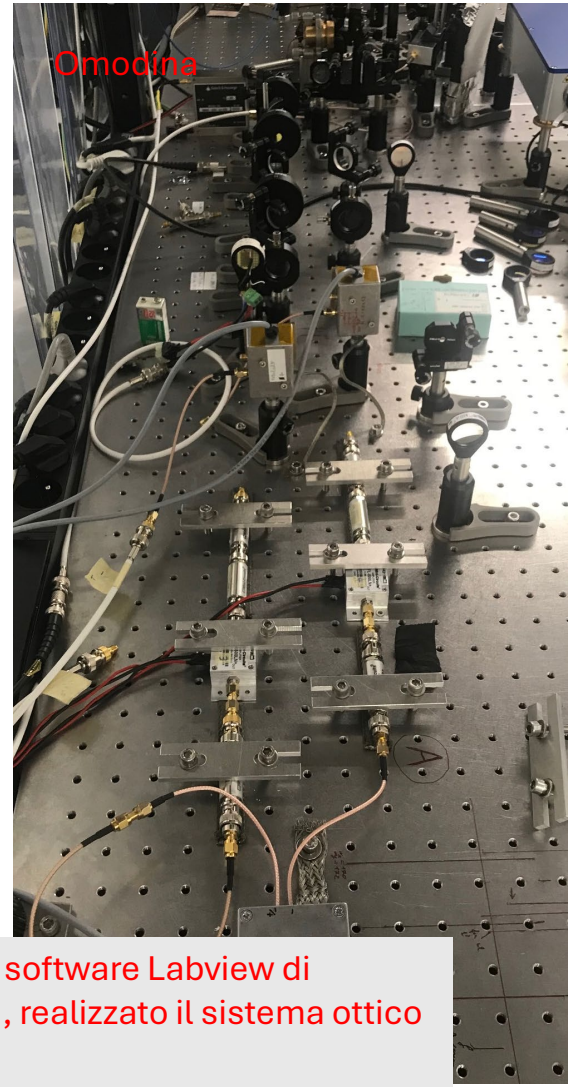
TITOLO PROGETTO: High velocity and high transmittivity loop unit for optical quantum computing	
Acronimo	LOOQ
Durata Progetto	12
Composizione del partenerariato (solo per progetti in collaborazione, indicare tutti i partner del progetto)	Università degli Studi di Milano Camgraphic SRL
Costo totale progetto (*Euro*)	299013 EUR

Unità di calcolo di T4QC



Stato dei lavori T4QC 1° anno





Realizzato il sistema ottico per lo shaping temporale della 1° e 2° armonica e relativo software Labview di controllo, allineata la cavità dell'OPO e stabilizzata attivamente tramite sistema PDH, realizzato il sistema ottico e elettronico per la rivelazione omodina degli stati squeezed

Richieste finanziamento per il 2025 e il 2026

Le richieste sono state completamente ridefinite sulla base del fatto che è stato finanziato il progetto LOOQ. Il fine fine della ridefinizione è l'acquisto di un rivelatore superconduttivo (con alta QE >90% e alto rep rate di rivelazione >100MHz) per il 2026

Richiesta 2025: 33k (consumo)

Richiesta 2026: 162k (inventariabile) per rivelatore superconduttivo

FTE 2025

cognom	nome	note	struttura	aff	perc 2025	perc 2024
Altilia	Samuele		MI	5	100%	
Benedet	Claudia		MI	5	30%	
Canella	Francesco		MI	5	20%	
Castelli	Fabrizio		MI	3	20%	
Cialdi	Simone		MI	5	50%	30%
Ferracin	Davide		MI	5	100%	
Ferraro	Alessandro		MI	5	100%	
Galzerar	Gianluca		MI	5	20%	
Genoni	Marco Giovanni		MI	4	60%	
Giannott	Dario		MI	5	20%	
Giove	Dario Augusto		MI	5	10%	
Olivares	Stefano		MI	4	40%	
Paris	Matteo		MI	4	30%	50%
Paroli	Bruno		MI	5	20%	
Piovella	Nicola		MI	5	30%	
Potenza	Marco Alberto C		MI	5	20%	
Prati	Enrico		MI	5	30%	
Siano	Mirko		MI	5	30%	
Smirne	Andrea		MI	4	20%	
Suerra	Edoardo		MI	5	70%	30%
Tamasc	Dario		MI	5	100%	
Vacchini	Bassano		MI	4	20%	10%
Paolo	Milani		MI	5	10%	
Alberto	Pullia		MI	5	10%	
Capra	Stefano		MI	5	10%	
Uboldi	Lorenzo		MI	5	100%	
Manzon	Cristian		MI	5	100%	
					11.7 FTE	

in giallo ho indicato chi ha richiesto una variazione di percentuale rispetto al 2024
in rosso ho indicato le nuove collaborazioni a T4QC

ESPERIMENTI che continuano con

Responsabilità LOCALE

CSN5 INFN new research project proposal
(2023-2025)

CUPRUM-TTD

Planned activities and Budget Requests 2025

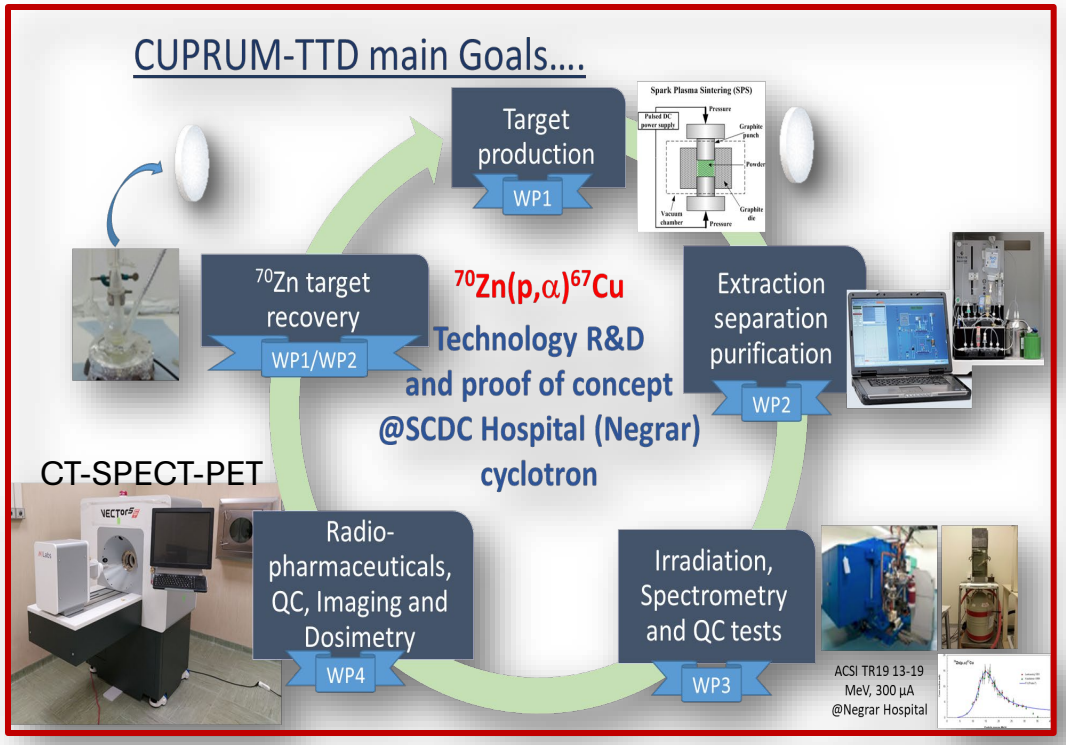
$^{67/64}$CU PRoduction and Use in Medicine – Target Technology Development

J. Esposito on behalf of INFN/ UNIPD / UNIFE /UNIMI/ SCDC Hospital (Negrar, VR) /IOV/ Padua Univ. Hospital /
ICMATE CNR Padua and collaboration network.

CSN5 INFN, LNL meeting, July 04th , 2024

CUPRUM-TTD (2023-2025) main project goals

In view of the next preclinical/clinical applications the goal of the current research proposal is therefore to develop beforehand a reliable technology aimed at **producing clinical-grade batches of ^{67}Cu-^{64}Cu, by small medical cyclotrons on a routine basis.**



a) to acquire a **robust and reliable target manufacturing technology to produce ^{70}ZnO target**

b) To assess targets are able to sustain **beam power levels from medical cyclotrons (i.e. 18-20 MeV, 2/3 kW max)**;

c) to develop/optimize the **radiochemistry separation/purification methods: Zn→Cu** to achieve a clinical-grade **^{67}Cu radionuclide**;

d) in-vitro cells studies with **67Cu-labelleded RPs using NOTA derivate as chelating agent;**

e) Phantom imaging studies of produced ^{67}Cu with pre-clinical and clinical SPECT;

f) to develop /optimize technology for the **costly ^{70}Zn-enriched target material recovery.**

CUPRUM-TTD project organization

CUPRUM-TTD project is organized in Work Pakages (WP),interacting each-other in a synergic way

CUPRUM-TTD project
(Juan Esposito)

WP1	
Sara Cisternino Juan Esposito Alisa Kotliarenko Giorgio Keppel	LNL
Umberto A. Tamburini	UNIPV

WP2	
Petra Martini Alessandra Boschi Francesca Porto Teresa Ghirardi Licia Uccelli Lorenza Marvelli	INFN-FE UNIFE
Emiliano Cazzola Giancoarlo Gorgoni	HSCDC

WP1
Target manufacturing
INFN-LNL/UNIPV
(Sara Cisternino)
- Target R&D and design
- Target manufacturing @ UNIPV
- Target material recovery

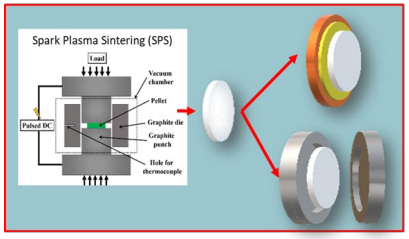
WP2
Radiochemistry processing
INFN-FE/SCDCH
(Petra Martini)
- Radchem separation/purification procedure @UNIFE
- Automation @SCDCH Negrar
- QC tests

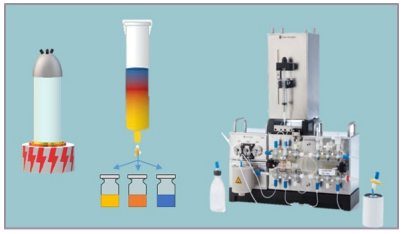
WP3
Irradiation/spectrometry/QC tests
INFN-LNL/SCDCH/UNIPD/INFN-PD/UNIMI/INFN-MI
(Liliana Mou)
- Target Irradiations tests @TR19 cyclotron SCDCH
- γ-spectrometry analyses @SCSCH
- xs measurements with alpha beams

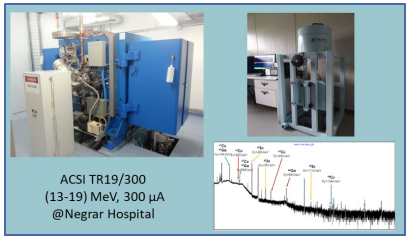
WP4
RPs, QC, Imaging and Dosimetry
IOV/UNIPD/INFN-PD/ICMATE-CNR/UNIFE/INFN-FE
(Laura de Nardo/Laura Melendez)
- synthesis of NOTA-PSMA conjugates @ ICMATE-CNR
- Radiolabelling studies @LARIM
- Image quality @Negrar Hospital (Padua University Hospital)

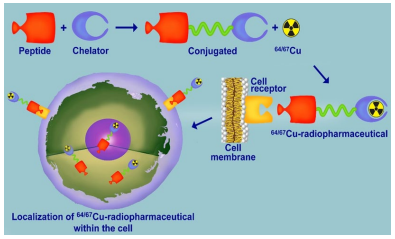
WP3	
Liliana Mou Gaia Pupillo Juan Esposito	LNL
Emiliano Cazzola Giancarlo Gorgoni	HSCDC
Luciano Canton Francesca Barbaro Lucia De Dominicis	UNIPD INFN-PD
Flavia Groppi Simone Manenti Fiorella M. Cagnetta Michele Colucci	UNIMI INFN-MI

WP4	
Laura De Nardo/ Laura Melendez-A.	INFN-PD IOV
Alessandra Zorz Marta Paiusco	IOV
Michele Bello Diego Cecchin	UNIPD INFN-PD
Cristina Bolzati	ICMATE CNR
Giov. Di Domenico Angelo Taibi	UNIFE INFN-Fe







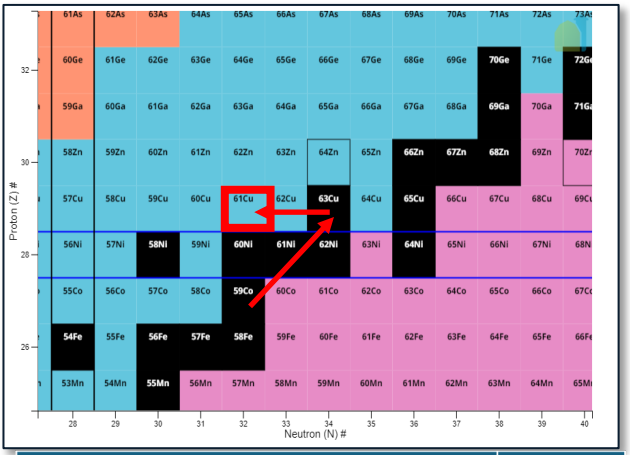


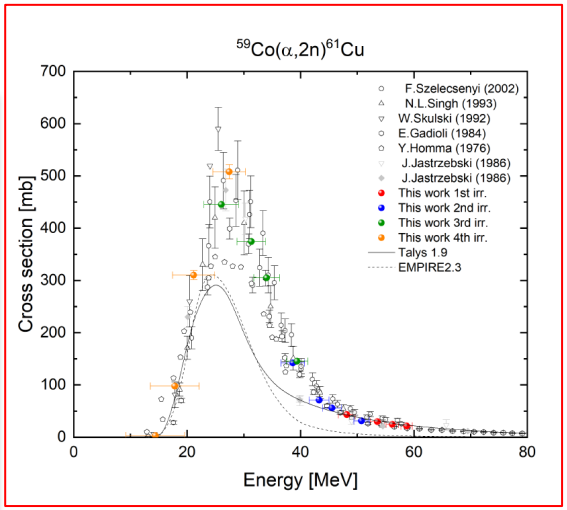
J. Esposito on behalf of collaboration meeting CUPRUM-TTD (2023-2025) project proposal CSN5 INFN 04.07.2024

CUPRUM-TTD WP3 (MI): Investigations on alternative nuclear reaction routes with alpha beams $^{59}Co(\alpha,2n)^{61}Cu$

Four irradiation performed with α particles in the 14-59 MeV energy range at GIP ARRONAX.

Gamma spectrometry continued at LASA labs for 4/8 months after irradiations for long lived RN.

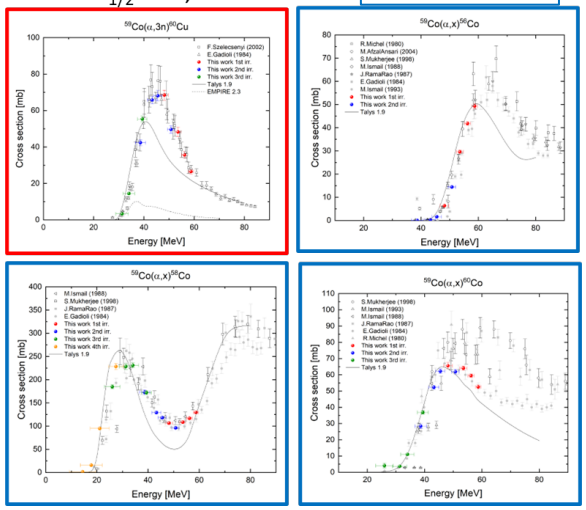




$T_{1/2}$ = 23,7 min

Copper isotopes

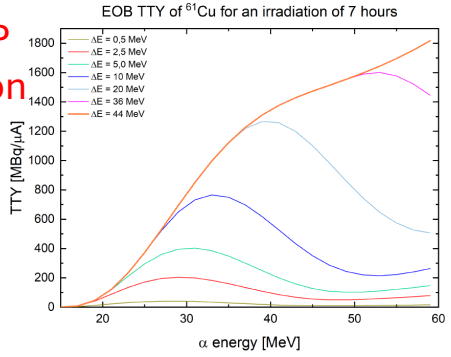
Other contaminants

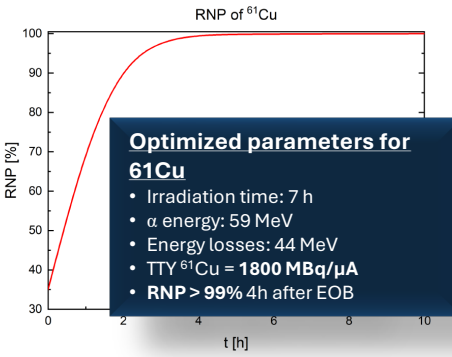


What	Status
Study of the literature	100%
Measurement of the $^{59}Co(\alpha,x)$ at GIP ARRONAX for the production of ^{61}Cu	100%
Measurement of the $^{59}Co(\alpha,x)$ at CAS for the production of ^{61}Cu to obtain precise measurements at low energy (10-30 MeV)	In contact with CAS
Measurement of the $^{64/nat}Ni(\alpha,x)$ at CAS for the production of ^{67}Cu	0%

TTY and RNP determnation

To do in 2024/2025





Optimized parameters for ^{61}Cu

- Irradiation time: 7 h
- α energy: 59 MeV
- Energy losses: 44 MeV
- TTY ^{61}Cu = **1800 MBq/μA**
- **RNP > 99%** 4h after EOB

J. Esposito on behalf of collaboration network for CUPRUM-TTD (2023-2025) project proposal CSN5 INFN

04.07.2024

CUPRUM-TTD project 2025 FTE (subject to further refinement)

Personnel and FTE distribution expected among units taking part

LNL	FTE
Esposito J. (R.Naz.-Loc.)	0.50
Pupillo G.	0.25
Mou L.	0.20
Cisternino S.	0.70
De Dominicis L.	0.40
Melendez-Alafort L.**	1.00
Bello M.	0.80
Piteo G.	1.00
Anselmi-Tamburini U.	0.20
Cazzola E. #	1.00
Gorgoni G.#	1.00
Cecchin D. §	0.20
	7.25

INFN-Fe	FTE
Martini P. (R. Loc)	1.00
Taibi A.	0.10
Di Domenico G.	0.20
Boschi A.	1.00
Uccelli L.	1.00
Marvelli L.	1.00
Porto F.*	1.00
Speltri G.*	1.00
	6.30

INFN-Mi	FTE
Groppi F. (Res. Loc)	0.40
Manenti S.	0.25
Cagnetta F.M.	0.45
Colucci M.****	0.60
	1.70

INFN-Pd	FTE
De Nardo L. (R. Loc)	0.80
Canton L.	0.20
Barbaro F.	0.60
Paiusco M. **	0.20
Zorz A. §	0.20
Bolzati C.***	0.20
Lashko Y.	0.10
	2.30

TOTALE FTE 17.55

* studenti PhD associate INFN-Fe (da nov 2023)
** personale IOV associato LNL
*** personale CNR associato INFN-Pd
**** studente PhD associato INFN-MI
§ personale UNIPD associato INFN-LNL
# personale SCDCH associato INFN-LNL

Summary overall budget request CUPRUM-TTD FY2025

Sezioni / Lab	Missioni	Consumo/ Altri consumo	Trasporti	Manutenzione	Inventario	apparati	Sp- servizi	Tot. per sez/lab	FTE previsto
LNL	7,0	10,0	0,0	0,0	0,0???	0,0	0,0???	**17,0**	**7.25**
FE	4,0	15,0	2,0	0,0	17,0	0,0	0,0	**38,0**	**6.30**
PD	1,0	7,0	0,0	0,0	0,0	0,0	0,0	**8.0**	**2.30**
MI	8,5	8,0	8,5	4,0	0,0	0,0	0,0	**29,0**	**1.80**
TOTALE	**20.5**	**40.0**	**10.5**	**4.0**	**17.0**	**0.0**	**0.0**	**92.0**	**17.55**

HardLiFE - Highly characterised study of Liquid Fuel Emissions for carbonaceous aerosol source apportionment (anni 2024-2026)

Sezioni partecipanti:

- Genova, RN: Dario Massabò; RL: Federico Mazzei
- **Milano, RL: Vera Bernardoni**
- Firenze, RL: Giulia Calzolai

HardLiFE si pone l'obiettivo finale di **mettere a punto e ottimizzare metodologie** allo stato dell'arte che dovranno essere in grado di **individuare le conseguenze** della transizione "verde" sull'aerosol atmosferico, con particolare attenzione alle **emissioni da biocarburanti**. L'interesse è rivolto alla caratterizzazione di queste emissioni (composizione, contenuto di ^{14}C) da sfruttare in prospettiva per studi di impatto (e.g. su bilancio energetico terrestre e salute) e di identificazione e quantificazione di sorgenti in aria ambiente.

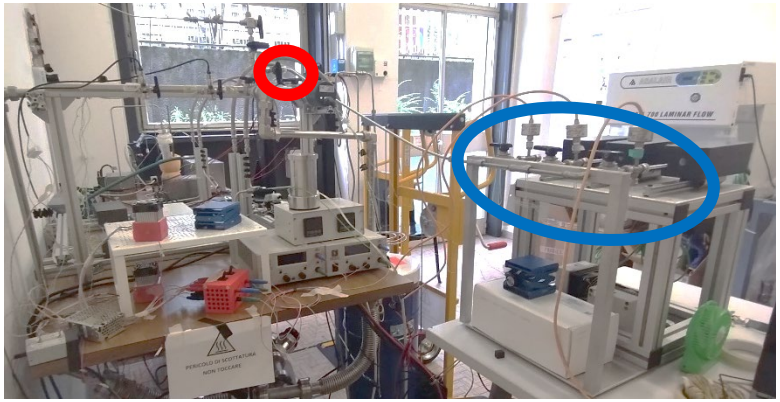
Lavoro in corso a Milano 2024

(da proseguire nel 2025):

a) **Adattamento della linea di preparazione campioni MISSMARPLE per misure di ^{14}C**
b) **preparazione di campioni da combustibile e di campioni raccolti in camera di simulazione**

HardLiFE a Milano nel 2024

1) È stato realizzato un opportuno *main oven* per questo tipo di campioni (più grandi di quelli per cui è stata originariamente progettata la linea di preparazione campioni MISSMARPLE). L'utilizzo di opportuno giunti (Ultratorr Swagelok) consente un rapido cambio di set-up, in funzione dei campioni da analizzare)



2) È stata aggiunta una **nuova linea di grafitizzazione** campione per campioni più grandi (circa 600-700 µgC) utilizzabile in alternativa a quella originale grazie a **valvola di switch**). La linea è in funzione.

3) Entro fine 2024: verranno preparati i primi campioni di interesse

4) Previsioni 2025: preparazione di ulteriori campioni e analisi presso facility AMS dell'INFN LABEC (Sesto Fiorentino)

INFN-HardLiFE @ MILANO 2025

Anagrafica:

Vera Bernardoni – PA UNIMI – Responsabile locale **(100%)**

Roberta Vecchi – PO UNIMI **(80%)**

Gianluigi Valli – Tecnico laureato UNIMI **(80%)**

Federica Crova – Assegnista UNIMI **(30%)**

TOTALE: 2.9 FTE

Budget Milano 2025:

Consumi (consumabili per preparazione campioni)	5.5 k€
Altri servizi (noleggio bombole gas tecnici)	0.5k€
Missioni (a Genova per raccolta campioni in camera di simulazione o a Sesto Fiorentino per misure AMS	2.0k€

TOTALE: 8.0k€

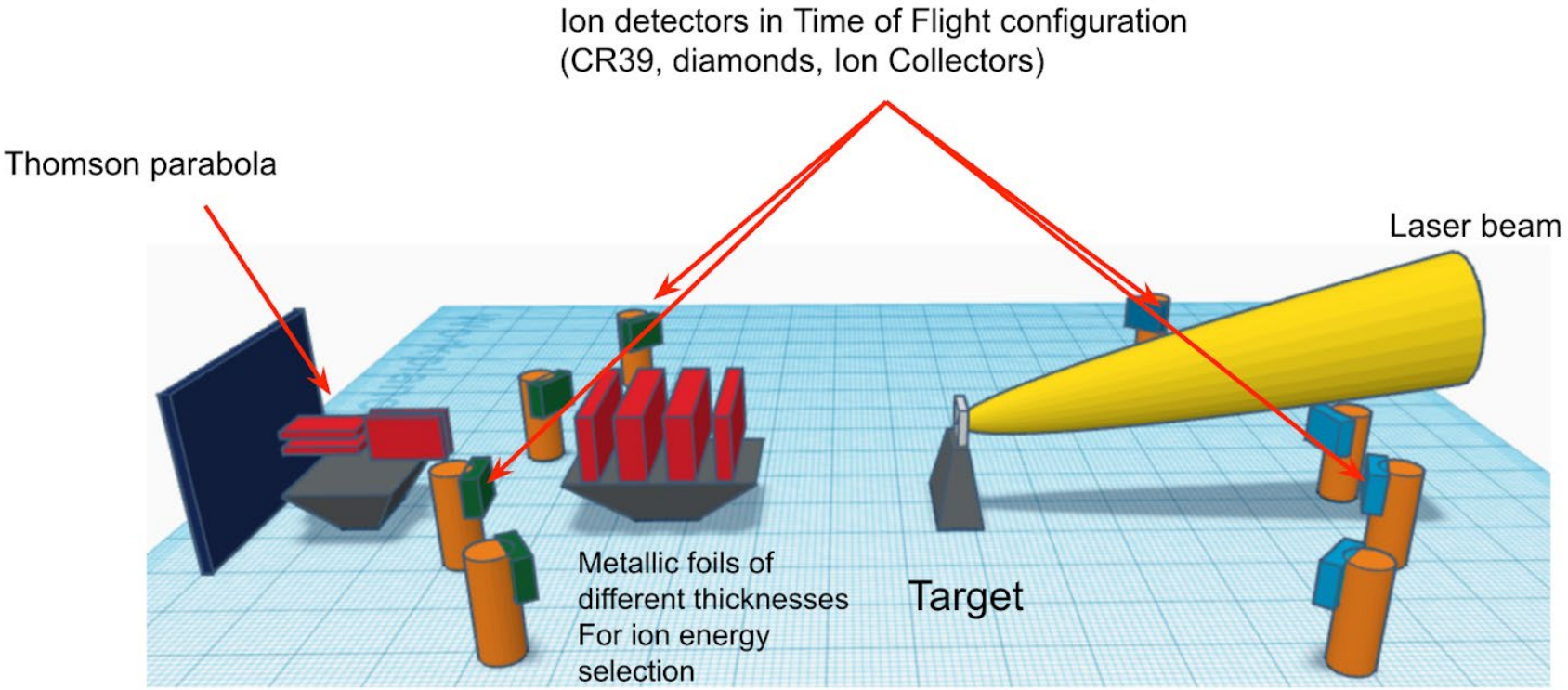
FUSION

FUsion StudIes of prOton boron Neutronless reaction in laser-generated plasma
2023-2025

Sezioni INFN partecipanti: Catania, Lecce, LNS, **Milano**, Roma2, Torino, TIFPA, Bologna, LNGS, Firenze
Istituti in collaborazione: ELI-Beamlines, HILASE, Physic Institute of Czech Academy of Science (CZ)

Resp. Nazionale: Pablo Cirrone - LNS + Fabrizio Consoli - ENEA
Resp. Locale: Davide Bortot - INFN Milano e PoliMi

Study of the p-11B reaction in a laser generated plasma in order to investigate its possible applications for energetic and multidisciplinary applications



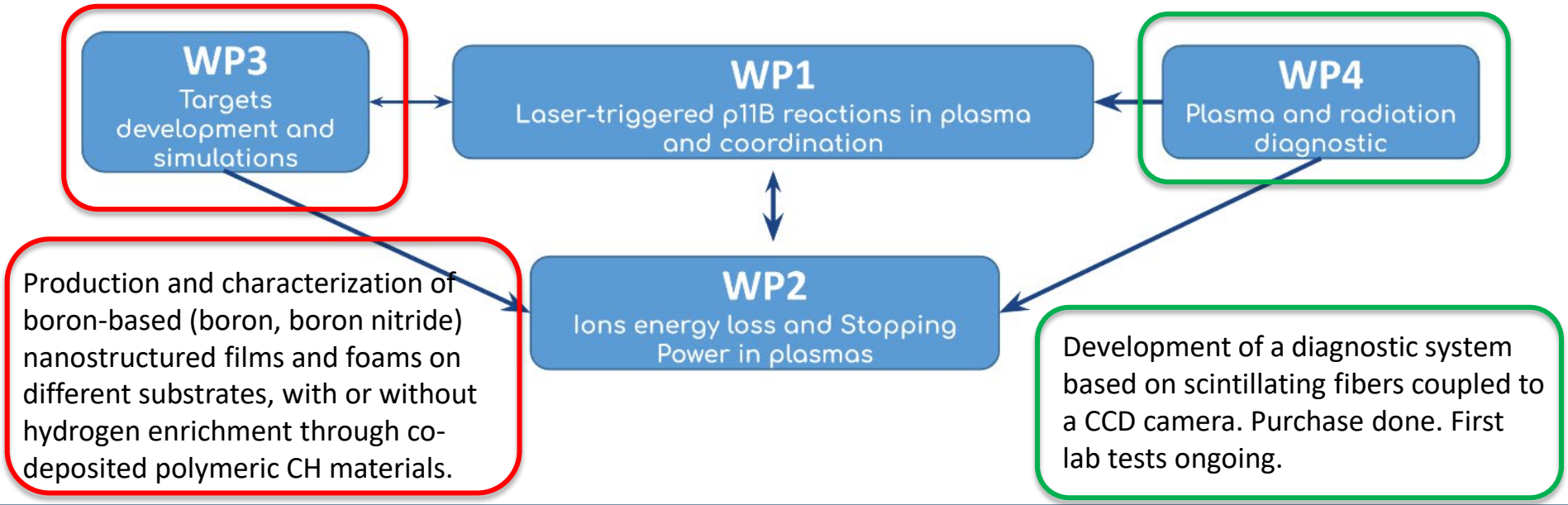
Objectives of the FUSION project and INFN-Milano activities

POLITECNICO MILANO 1863

- ***Maximization of the p-11B reaction rate in plasma.***
- ***Development of innovative diagnostic able to estimate the p-11B reaction rate.***
- ***Understanding of the physics laying at the basis of the observed p-11B reaction rate.***

INFN-Milano

- The POLIMI-NanoLab group is expert in nanostructured and novel materials and on their interaction with lasers.
- The POLIMI-Laboratory of Nuclear Measurements and Electronics group and the INFN-LASA group are expert in radiation diagnostic.



Activities and requests for 2025

- ***Test of the developed boron-based nanostructured films and foams for the experiment in laser facilities;***
- ***Preliminary test of a new imaging system based on scintillating fibers.***

Nominativo	Qualifica	FTE
Davide Bortot (RL)	RTDb PoliMi	30
Stefano Agosteo	Prof. Ordinario PoliMi	20
Alberto Fazzi	Prof. Associato PoliMi	10
Dario Giove	Ricercatore INFN-LASA	0
Andrea Pola	Prof. Ordinario PoliMi	20
Davide Mazzucconi	RTDa PoliMi	10
Matteo Passoni	Prof. Ordinario PoliMi	20
Alessandro Maffini	RTDa PoliMi	30
Davide Orecchia	Dottorando PoliMi	0
Giovanni d'Angelo	Tecnico PoliMi	50

3rd year (2025)		k€
Travels (4.0 k€)	Exchange and collaboration meetings	1
	Experimental campaigns	3

MATHER3D: MAgnetic hyperthermia and hadron THERapy applied to 3D cellular scaffolds

RN – Alessandro Lascialfari (PV) → next: Francesca Brero (PV)

Sezioni Coinvolte e RL:

Pavia – F. Brero → next: A. Lascialfari
Milano – I. Veronese
Firenze – C. Sangregorio

Durata del progetto:

2023-2025

Anagrafica e budget MI

Anagrafica 2025

Milano – 2.4 FTE

Ivan Veronese (RL) – PA – UNIMI	0.6
Paolo Arosio – PA – UNIMI	0.1
Flavia Groppi – PA- UNIMI	0.05
Cristina Lenardi – PO – UNIMI	0.2
Silvia Locarno – postdoc - UNIMI	0.6
Simone Manenti – tecnologo UNIMI	0.05
Manuel Mariani – RU- UNIPV	0.3
Francesco Orsini – PA- UNIMI	0.1
Recordati Camilla, PA-UNIMI	0.1
Sala Laura, PostDoc-UNIMI	0.3

Budget

Milano

21 keuro

Consumables **13 keuro**

Immunohistochemistry (primary and secondary antibodies, detection kit, chromogen), Optical components for microscopy and imaging, Consumables for hyperthermia experiments and AFM probes, Consumables and reagents for bioprinting

Services ICP/TEM/imaging; **6 keuro**

Missions **2 keuro**

Attività 2025

Milestones

- Advanced preparation of natural and synthetic scaffolds with MNPs loaded cells (Month 36)
- First results of migration and invasion capability in 2D after single or combined treatments (Months 30)
- Imaging of cells-loaded scaffolds before and after irradiation with combined or not therapeutic techniques. (Month 30)
- Synthetic and natural scaffolds irradiation with photons (2 times) and protons (2 times) combined or not with MFH. (Month 36)
- First results of morphology-changes of cells, and (also after scaffolds decellularization) their viability, clonogenic survival, kinetics of DSB-rejoining and apoptosis after exposure to photons/protons/carbon ions and/or Magnetic Fluid Hyperthermia (Month 36)

PLASMA4BEAM2 [2024-2026; BA, LNL, LNS(dot)*,MI, MIB]
*dal 2025

Optimization of selected ion sources and devices based on ions and neutrals (gas) interactions.
WP1) Cooling of ions in buffer gas - radiofrequency traps, and in magnetic traps;
WP2) Production of H^- for Negative Beam Ions and high current ion beams;
WP3) High Voltage Breakdown detection with GEM and their application to Negative Beam Ion;
WP4) Theoretical modelling and simulations.

Attività Luglio 2023 – Giugno 2024

Completamento montaggio componenti linea di fascio, sorgente di Cs e diagnostica pepperpot. Installazione RFQC prevista per Settembre 2024.

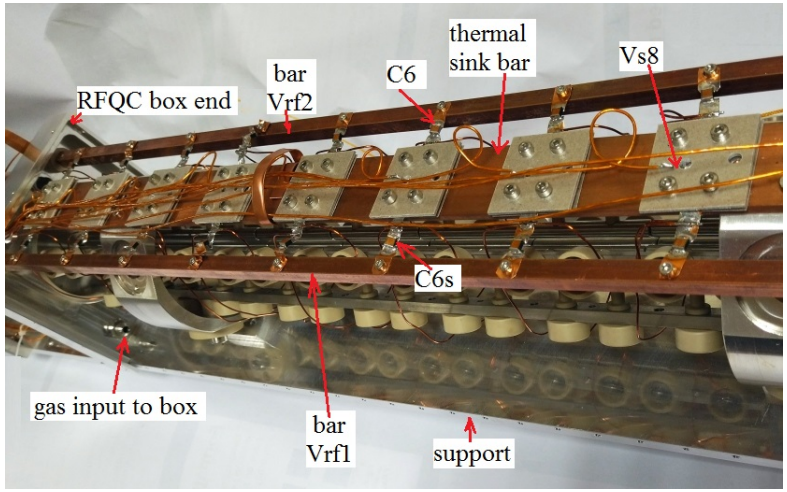


Fig. 1: Detail of RF multiplexer (gas tight RFQC cover removed); the resistors are sandwiched between mica foils for heat disposal towards a large copper bar; capacitors as C6 and C6s stay in He gas region.

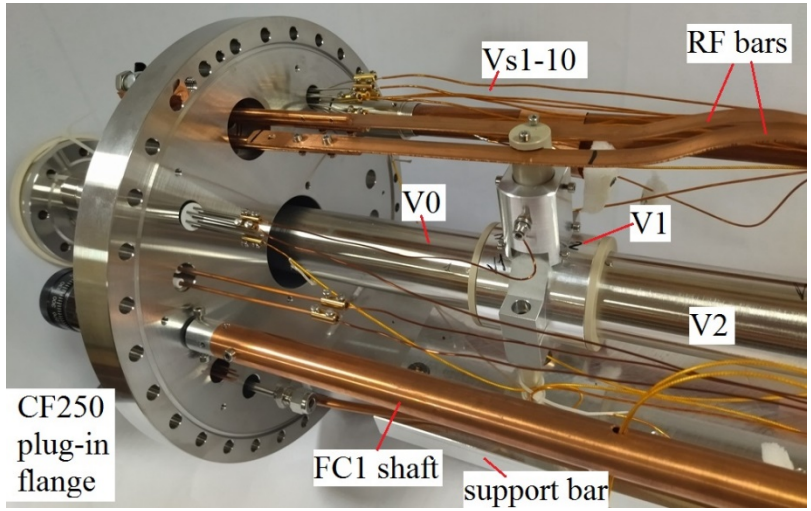


Fig. 2: The plugin flange, seen from vacuum side, with one CF40 flange RF input, and 12 CF16 flanges for other connections. The ion beam enters from drift tube V0 connected to ion source and isolated from plugin flange.

Attività Luglio 2023 – Giugno 2024 - continua

L'attività sui plasmi non neutri si è focalizzata principalmente **sulla macchina ELTRAP**. Nel sistema di diagnostiche sono stati introdotti un **nuovo oscilloscopio digitale e una nuova camera CCD** (finanziata da UNIMI, in seguito a guasto per obsolescenza della camera precedente). Inoltre sono stati **progettati i circuiti di stabilizzazione per i potenziali di tensione medio/alta (100-800 V)** che si intende utilizzare per confinamento di plasmi a elevata carica/densità. La **campagna sperimentale** è stata dedicata a studi sistematici sulla perturbazione selettiva di modi di Kelvin-Helmholtz (KH) in regime non-lineare (V-state); in particolare: a) si è confrontata l'efficacia di diversi campi multipolari sulla crescita del modo selezionato (cfr. Fig. 3); b) è in corso lo studio dell'evoluzione libera di un V-state e delle sue proprietà di stabilità, in funzione del grado di deformazione e del profilo di vorticità. I risultati sono di interesse per la fluidodinamica 2D e il controllo del confinamento di sample di particelle cariche a bassa temperatura.
Nell'ultima parte dell'anno, l'attività sarà spostata sulla macchina Eltrappino, e dedicata alla generazione, accumulazione e auto-organizzazione di plasmi di elettroni da ionizzazione del gas residuo tramite eccitazione RF, con l'obiettivo di ottimizzare i processi già implementati in ELTRAP e di analizzare la dinamica della formazione di alcune strutture particolarmente interessanti osservate durante precedenti esperimenti (cfr. Fig. 4).

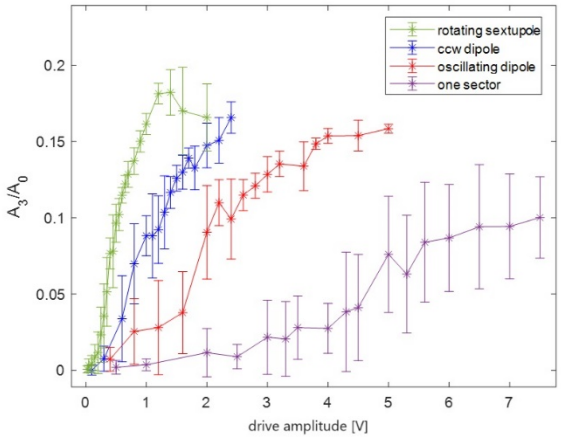


Fig. 3: ampiezza del modo KH = 3 vs ampiezza del campo di drive per diverse configurazioni di eccitazione, dal regime lineare a saturazione.

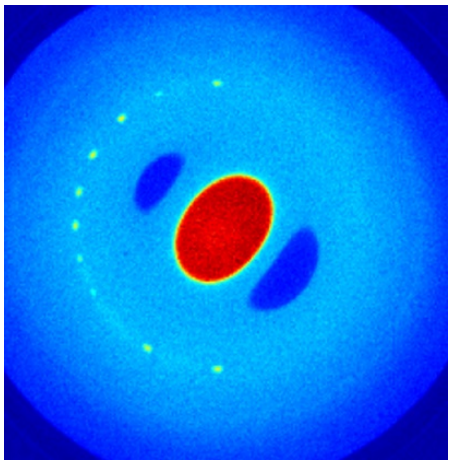


Fig. 4: struttura di modo KH = 2 con scia di vortici generata per interazione tra instabilità ionica del plasma e feedback a parete.

Pubblicazioni

M. Cavenago et al., J. Phys.: Conf. Ser. **2743**, 012073 (2024)
G. Maero et al., ECA Vol. 47A, P4.011 (2024) [Proc. 49thEPS Conference on Plasma Physics, Bordeaux, France, 2023]
G. Maero et al., ADV PHYS-X **9**, 1 (2024)

Partecipazione a conferenze

49th EPS Conference on Plasma Physics (July 2023, Bordeaux, France) [GM, poster]
CMD30 - FisMat 2023 (September 2023, Milano, Italy) [GM poster, MR oral]
Global Plasma Forum (October 2023, Aomori, Japan) [MR, invited]

Tesi di laurea

2 LT, 1 LM (V.O.)

Preventivo MI – 2025 (preliminary)

	ITEM	k€
Inventariabile	2x alimentatori da banco almeno 500 V per stabilizzatori di tensione sviluppati in house [1.5 kEuro]; generatore di funzioni 30 MHz due canali (per obsolescenza vecchi generatori e aumento complessità manipolazioni di plasma attraverso campi elettrici oscillanti) [5.0 kEuro s.j.].	1.5+ 5.0 s.j.
Manutenzione	Riparazione pompa scroll [3.0 kEuro]; riparazione high-voltage switch per commutazione potenziali di confinamento del plasma nel range 100-800 V [2.5 kEuro].	5.5
Consumo	Minuteria elettronica [0.5 kEuro]; minuteria vuoto (gaskets, flange fittings, flexible connectors) [1.0 kEuro], minuteria idraulica [0.5 kEuro]; 4x power splitter per multiplexing e inversione di fase dei segnali [0.5 kEuro]; 6x cavi coassiali SHV-SHV e SHV-BNC per integrazione sia in RFQC che Eltrappino [1.5 kEuro]; right angle valve per isolamento vuoto [1 kEuro].	5.0
Missioni	2x partecipazione Non-Neutral Plasma Physics Workshop 2025 (conferenza triennale di riferimento per la fisica dei plasmi non neutri; organizzatori precedente workshop 2022; un membro nel board della conferenza) [4.0 kEuro]; viaggi a LNL per esperimenti apparato RFQC per SPES e TRIPS (previsti 3 viaggi x 2 persone) [1.0 kEuro].	5.0
	TOT	17.0+ 5.0 s.j.

Anagrafica MI – 2025

Ricercatore	Qualifica	%
CAVALIERE Francesco	PT E.P. Unimi	20
MAERO Giancarlo	PA Unimi	50
ROME' Massimiliano	PA Unimi	50

SL_betatest: a betatron radiation source from beam-driven PWFA at SPARC_LAB: a test-bed for a plasma undulator device:

Resp. Naz. LNF: *Enrica Chiadroni* (Sapienza Univ., Ass. LNF); Resp. Loc. RM1: *Andrea Mostacci*; Resp. Loc. RM2: *Alessandro Cianchi*; Resp. Loc. Mi: *Andrea Renato Rossi*

4-years experiment: 2024-2027

Motivation

The EuPRAXIA@SPARC_LAB project focuses to realize a compact plasma-based FEL and radiation user facility.

- ➔ Conventional undulators are still too long and cumbersome => not compact and expensive
- ➔ *betatron* motion of electrons in an **ion-channel to emulate an undulator => very compact device**

The idea behind SL_betatest

The underlying principle:

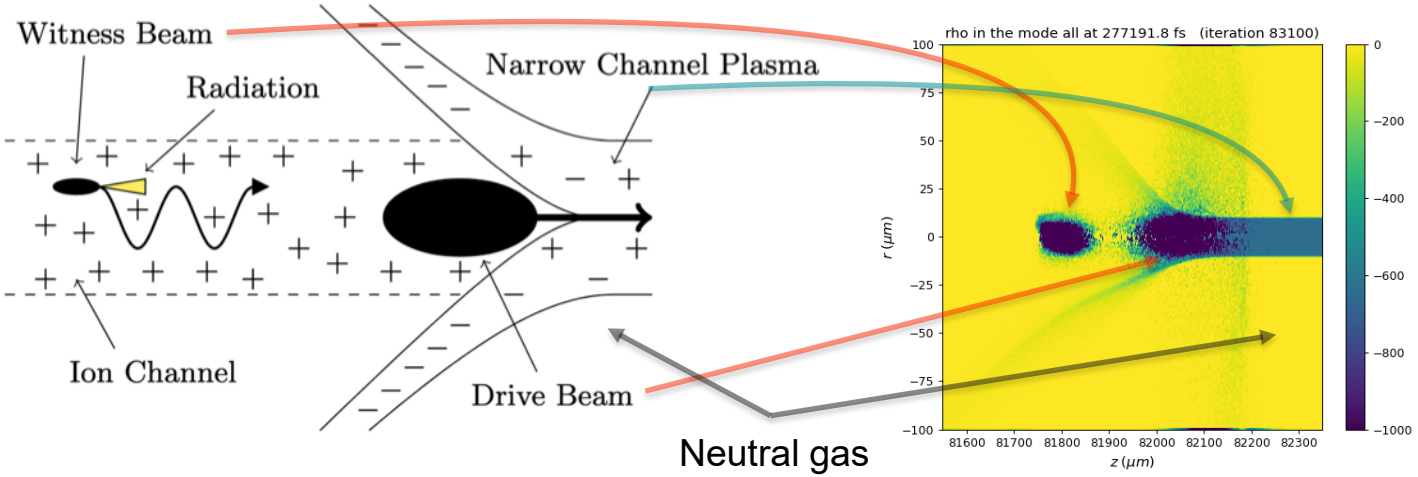
- Betatron radiation in plasma acceleration delivers broadband (like a synchrotron source) and short (like an FEL) radiation pulses due to acceleration itself and electron radial position emission frequency dependency trough undulator strength
- Reduce bandwidth by:
  1. Avoiding acceleration by means of a narrow plasma channel (no longitudinal electric field)
  2. Employing a (radially) tiny emitting bunch

Undulator strength

$$K_u = \gamma k_\beta r_\beta$$

How does it work:

- A “drive” electron bunch depletes the plasma by electrons
- A properly tailored “witness” electron bunch emits betatron radiation



Simulations and numerical design done in Milan

Radiation yield will also be estimated

Milan activities, person-power and fundings

- Simulations of the possible working points and radiation properties retrieval
- Definition of radiation properties <-> beam properties links
- Participation to experimental runs
- Experimental data interpretation and beam properties retrieval

A. Bacci	20	INFN
I. Drebot	30	INFN
V. Petrillo	30	UniMi
E. Puppin	20	PoliMi
A.R. Rossi (RL)	40	INFN
L. Serafini	20	INFN (senior)
	TOT: 160	

Funding request: 3 k€ for travel to LNF for meetings and experimental activity at SPARC_LAB

Grant Giovani

FERRAD: FPGA Embedded Resistente a RADiazioni per applicazioni nella fisica delle alte energie

Grant giovani 2024-2025; P.I. Luca Frontini

Obiettivo: Implementare all'interno di ASIC eFPGA (FPGA embedded) resistenti a radiazioni (10 MGy) per i futuri front-end per la fisica delle alte energie

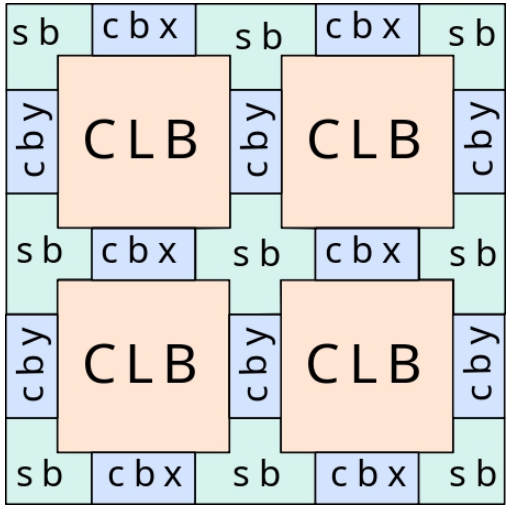
Principali WP:

- Definizione di un flusso di progettazione in tecnologia 28nm per eFPGA utilizzando il framework OpenFPGA
- Sviluppo di FERR1, un ASIC dimostratore contenente un'eFPGA
- Sviluppo ed implementazione di algoritmi di compressione dati
- Caratterizzazione di FERR1 per la resistenza a radiazione

Architettura proposta:

I blocchi logici che compongono una eFPGA sono:

- CLB (configurable logic blocks) che contengono la parte computazionale (LUT, FF e adders)
- CB (connection blocks), SB (switch boxes) che contengono gli switch per le interconnessioni



Avanzamento del progetto:

Avanzamento milestones:

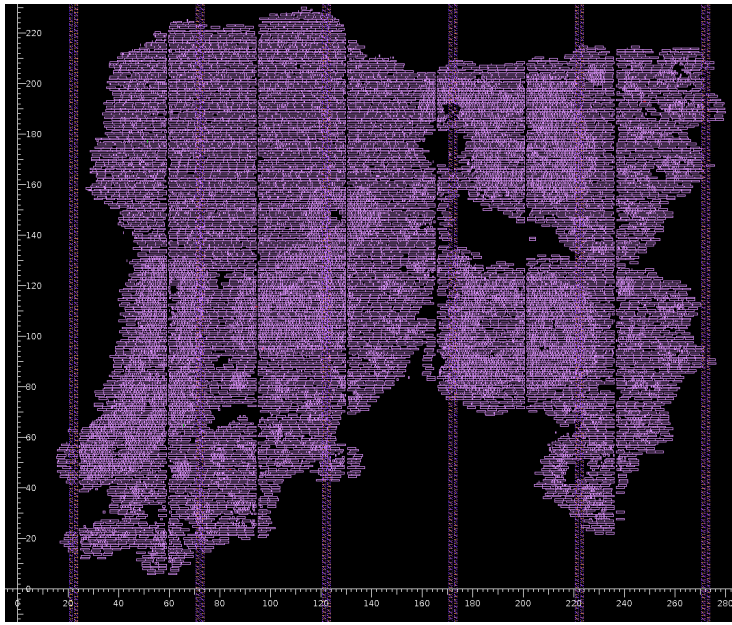
- milestone 30.06.2024 *completata* : Integrazione della tecnologia 28nm in openFPGA e flusso di progettazione completo di openFPGA (a dx il place una eFPGA in tecnologia 28nm)
- milestone 31.12.2024 *parzialmente completata*: Definizione tecniche di radiation hardness. Abbiamo implementato la triplicazione delle celle di configurazione all'interno del flusso digitale

Stato del progetto:

- Abbiamo implementato una versione di dimensione ridotta (2x2 clb), ma con funzionalità complete di una eFPGA.
- Considerando gli ingombri e la triplicazione sarà possibile implementare una eFPGA di circa 10x10 clb all'interno di FERR1 (4 mm^2 di silicio)
- Abbiamo simulato (post-sintesi) la programmazione del bit-stream ed il funzionamento della eFPGA con esito positivo

Prossimi passi:

- Ingrandire la eFPGA ad una dimensione 10x10 che rispettando le specifiche di timing e scegliere l'architettura migliore
- Implementare algoritmi di clustering per valutare le prestazioni e gli ingombri necessari
- Testare il circuito così ottenuto valutando prestazioni e radiation-hardness



FTE e richieste economiche

FTE (2025):

1	Luca Frontini	INFN-MI
0.4	Andrea Mazzanti	INFN-MI (Swinburne university)
0.1	Valentino Liberali	INFN-MI
0.1	Alberto Stabile	INFN-MI
0.1	Alessandra Camplani	Niels Bohr Institute

Richieste economiche:

2024:

- 5200 €: FPGA KCU105 (RdA in corso)
- 39000 €: Fabbricazione del chip FERR1 in tecnologia 28nm

2025:

- 1900 €: Scheda mezzanina per il collegamento con KCU105
- 1220 €: Materiale per allestimento della piattaforma di test
- 1500 €: costo per il bonding
- 7500 €: missioni per irraggiamento

RICHIESTE SERVIZI GR5 - 2024

SIGLA	OFFICINA mesi-uomo	PROGETTAZIONE mesi-uomo	Elettronica mesi-uomo
ASTAROTH_BEYOND	2	2	
CUPRUM_TTD	0.2	0.2	
SIG	3	6	
RADIOLAB_C3M	0.3		
TOTALE	**5.5**	**8.2**	

VARIE

Dalla riunione dell'8 luglio 2024

Grant Giovani: da due anni c'è stato un calo nelle applications. Si è passati dalla trentina alla quindicina dell'anno scorso e quest'anno con 7 domande.

La Giunta Esecutiva ha quindi accolto di riaprire il bando sino a:

VENERDì 2 AGOSTO ALLE ORE 11:59.

Chi ha già sottomesso e desidera modificare, aggiungere, migliorare il progetto può farlo.

I progetti vengono valutati prima da un pannel esterno successivamente gli aspiranti vengono valutati a seguito di una presentazione orale durante la riunione del 19-20 dicembre in Presidenza.

CALL: l'anno scorso 1 sola CALL non finanziata e anche quest'anno una sola application.

Concorso Ricercatori: non con posti riservati rispetto a a GR I, II, III.

Borsa Più Donne nella Fisica - per CSN5 su 14 partecipanti la prima in graduatoria è Silvia Cereda di Milano – Fisica Sanitaria e Medica

VARIE

Calendario futuro 2025

- **22-24 luglio in presenza -** LNGS - Selezione proposal per 2025.

- **Nei primi giorni di settembre on line su Zoom** – Presentazione dello stato delle CALL in corso e discussione dei proseguimenti; Inderogabile la presenza dei referees di tutte le CALL, che dovranno commentare le richieste di prolungamento.

- **9 - 13 Settembre Trieste -** (Org. Fulvia ARFELLI).

- **19 - 20 Novembre in Presidenza** - Grant Giovani 2024 – al momento ricevute 7 domande; riapertura del Bando sino al 2 agosto ore 11:59 per chi desidera presentarsi. Chi ha già applicato può modificare per completare/modificare quanto sottomesso.

- **Workshop Computing@CSN5** che si terrà a **Bari dal 13 al 16 ottobre**. https://agenda.infn.it/event/42127/

Sul sito della CSN5 trovate ulteriori dettagli e le news più aggiornate.

Grazie per l’attenzione