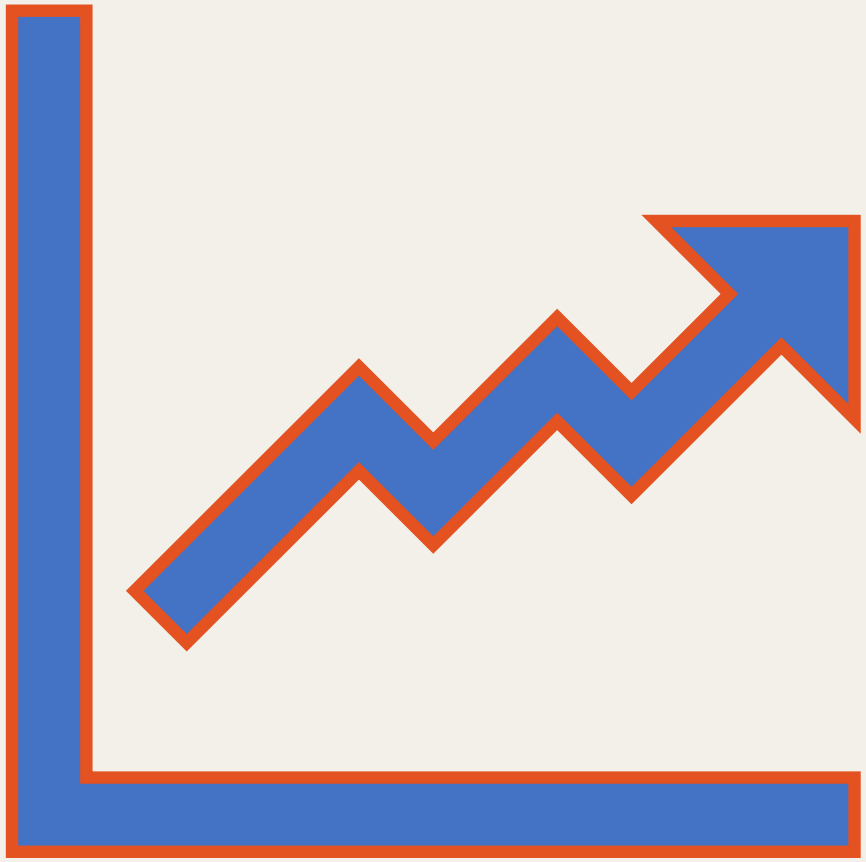
Report CSN5

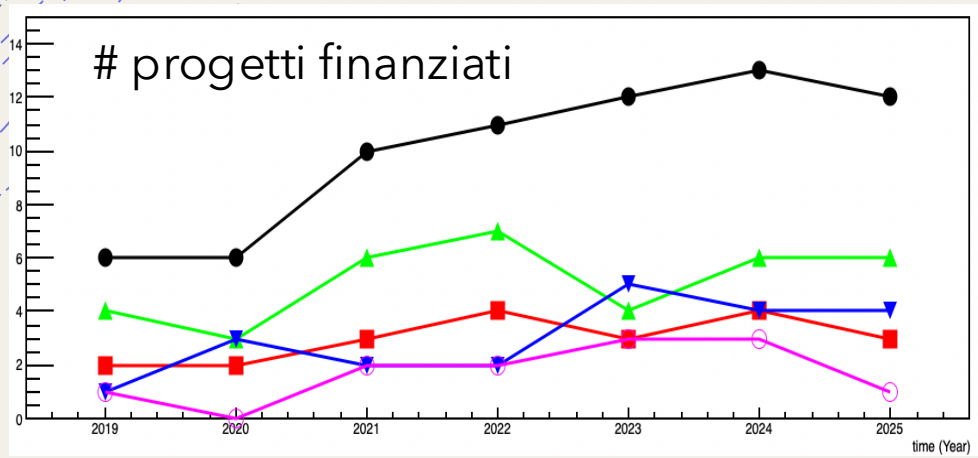
C. Sbarra

Bologna, Assemblea di Sezione del 11/07/2025

- Notizie generali
- Highlighs progetti in corso
- Benvenuto al nuovo Coordinatore



Storico CSN5-BO 2019-2025



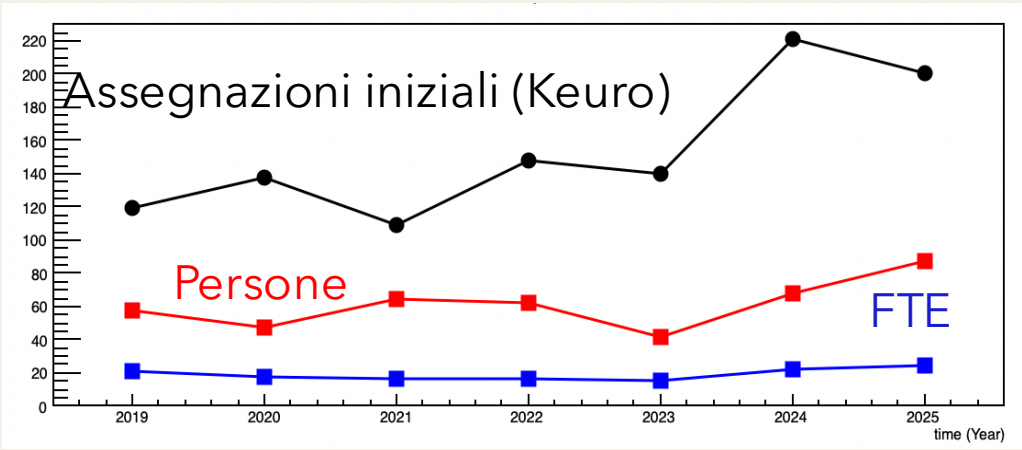
Progetti finanziati

Resp Nazionale

Rivelatori, elettronica & computing

Acceleratori

Interdisciplinare & quantum



Sito Web Ricerca Tecnologica

- Dettagli su ogni sigla **che li fornisce**
- **FAQ funzionamento CSN5**

Per ricevere informazioni sottoscriversi alla lista

gruppo5@lists.bo.infn.it

1 riunione all'anno come CSN5 per condividere attività

CSN5- BO nel 2025

ESPERIMENTI FINANZIATI	#FTE BO	#Persone BO	FTE/ Teste
DOTAZIONI	0.8	**4**	0.2
ADMIRAL	1.6	6	0.27
AI_INFN	1.1	9	0.12
AIM_MIA	6.95	13	0.53
ASPIDES_DTZ	0.3	3	0.1
FUSION	0.4	**2**	0.2
HIDRA2_DTZ	0.5	4	0.125
IBIS_NEXT	1.95	13	0.15
NEXT_NAMASTE	1	**3**	0.33
PROVIDE	1.5	4	0.32
QUARTET	2.2	13	0.170.41
RIPTIDE	3.3	8	0.41
TEMPURA	2.1	6	0.35
Totale	**23**	**88**	**0.26**

12 progetti attivi: 10 con sigla locale, 2 sotto dotazioni

6 nuove proposte anno scorso, FINANZIATE da quest'anno

Rosso: 3 progetti in chiusura (2 con sigla, 1 sotto DTZ)
Viola: 1 progetto in chiusura con richiesta di prolungamento
Verde: 3 sigle al primo anno

Attività senza sigla specifica (nodo di BO della rete CHNet) non in questa tabella

HB2TF continua senza assegnazioni dunque senza sigla locale: 1 FTE, 2 persone (non riportata in tabella). Attività officina per linea **ISOL@SPES** senza sigla specifica

Stato fondi (DB@10/07)

SIGLA	Assegnato missioni (kE)	Disponibile missioni (kE, no sj)	Assegnato altro (kE)	disponibile altro (kE, no sj)
DOTAZIONI	5	1,28	5	2.7
ADMIRAL	2	1,68	10	7
AI_INFN	1	1	-	-
AIM_MIA	4	3,4	1	1
ASPIDES_DTZ	2	2	5	4,3
FUSION	1	1	3	3
HIDRA2_DTZ	2 sj	-	10	6,3
IBIS_NEXT	3	0,26	14+2 sj	7,8
NEXT_NAMASTE	3,5	3,5	2 sj	-
PROVIDE	5,5	3,6	22	20,3
QUARTET	4	3,16	13	5,8
RIPTIDE	1	1	31,5 +20 sj	28,9
TEMPURA	-	-	28,5	19
Totale (escluso SJ)	32	21.9	142	96.2

Frazione dei fondi (pre)impegnati non ancora **in linea con aspettative** sul profilo temporale spesa (~30% missioni, 32% altri capitoli -escluso SJ)

Consumo Dotazioni a supporto bisogni oltre assegnato (CHNET, code LLMCP, strumentazione lab) e servizi generali (spedizioni)

Missioni Dotazioni per viaggi coordinatore, PI consuntivi, nuovo coordinatore

MISSIONI NON IMPEGNATE A INIZIO SETTEMBRE SARANNO STORNATE SOTTO DOTAZIONI

Verso il 2026…

Notizie locali:

Una nuova proposta di area rivelatori con **RN** di Bologna, **F. Lasagni:**
SLBP (**S**apphire semiconductor detectors for **L**uminosity and **B**eam **P**rofiling**)**

Una nuove proposta area interdisciplinare con partecipazione BO, **RL M. Negrini:**
Isolpharm_APEX passo successivo del progetto Admiral nello studio dell' 111Ag come possibile radiofarmaco

Notizie generali:

4 progetti presentati al bando **CALL**
Nuovo template per bando **GRANT GIOVANI** – disponibile su pagina web CSN5.
Uscita bando aspettata per **15-20 luglio**

10 nuove proposte area rivelatori
8 nuove proposte area Acceleratori
7 nuove proposte area Interdisciplinare

Tematiche progetti iniziati nel 2025 a BO

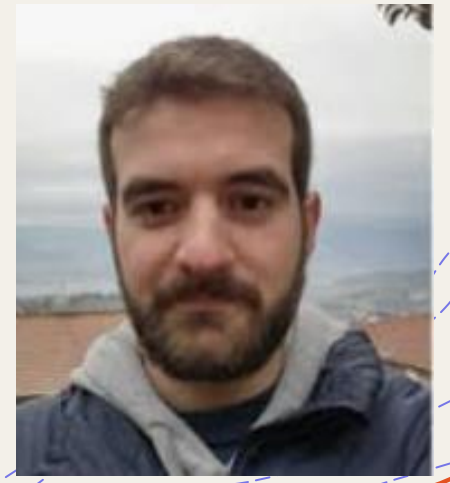
AIM-MIA, ASPIDES, NEXT-NAMASTE, PROVIDE, QUARTET, TEMPURA

Dettagli su gruppo di ricerca ed attività nelle slides in backup di chi le ha mandate (o info minimali nel sito web di sezione per le sigle locali)

+ **AIM-MIA** prosegue le attività del progetto Artificial Intelligence in Medicine con particolare attenzione all'uso di insiemi di dati provenienti da sorgenti eterogenee, oppure limitati e/o incompleti

D. Remondini

+ **ASPIDES** sviluppo di una piattaforma tecnologica CMOS per la realizzazione di sensori 2D monolitici con SPAD e digital SiPM orientati a utilizzo in calorimetria, rivelatori RICH e rivelatori criogenici. 110 nm LFoundry



L. Rignanese

+ **NEXT-NAMASTE** (RL BO: S. Sanna) prosegue la ricerca su nanomagneti molecolari e ioni magnetici come sensori quantistici per radiazione ionizzante e campi magnetici, o come memorie quantistiche, capitalizzando i risultati precedenti

S. Sanna

+ **PROVIDE** (RL BO:Beatrice Fraboni) ottimizzazione della fabbricazione di rivelatori sottili flessibili per dosimetria e monitoraggio fasci terapeutici, basati su perovskite a base di alogenuri, sia diretti che indiretti. Fa leva su tecniche, strumentazione e gruppo ricerca FIRE/ANEMONE

B. Fraboni

+ **QUARTET** (RL BO: M. Franchini) sviluppo di architetture quantistiche basate su risonatori superconduttivi e qbits controllati da impulsi generati da dedicate schede con FPGA

M. Franchini

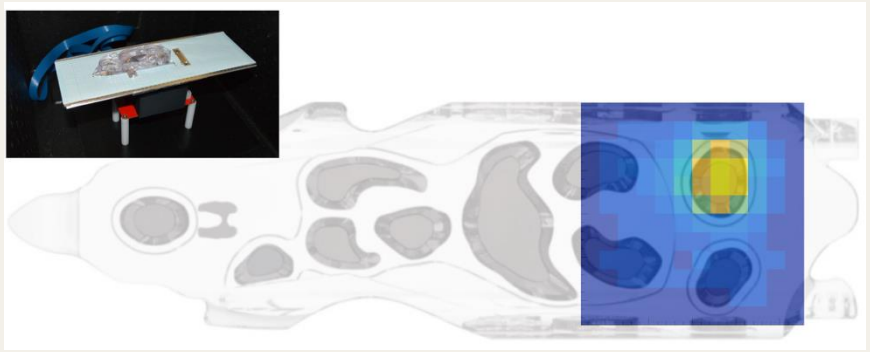
+ **TEMPURA** (RN BO: Andrea Candini - CNR) sviluppo di sensori di temperatura quantistici basati su diamante opportunamente ingegnerizzato (risoluzione spaziale e temporale di 1mm e 0.1K) per studiare la risposta delle cellule alla radiazione ionizzante (tubi X in dotazione alla rete locale CHNET). Primi campioni in autunno

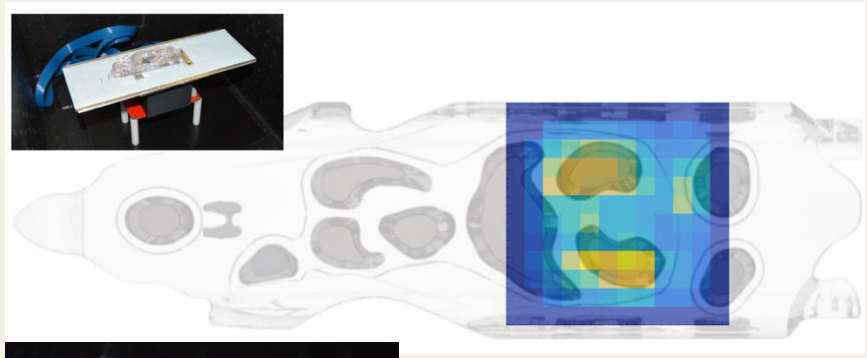
A. Candini

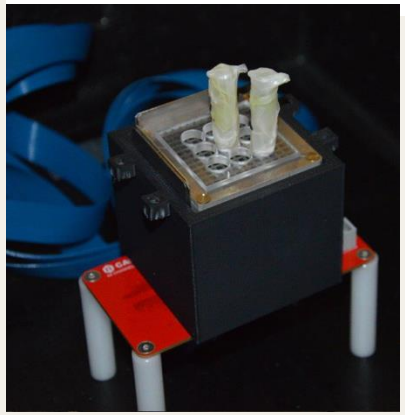
Highlights (alcuni) progetti in corso

Admiral, Hidra2_dtz, Ibis_next, Riptide

ADMIRAL (2023-2025)







Aprile 2025

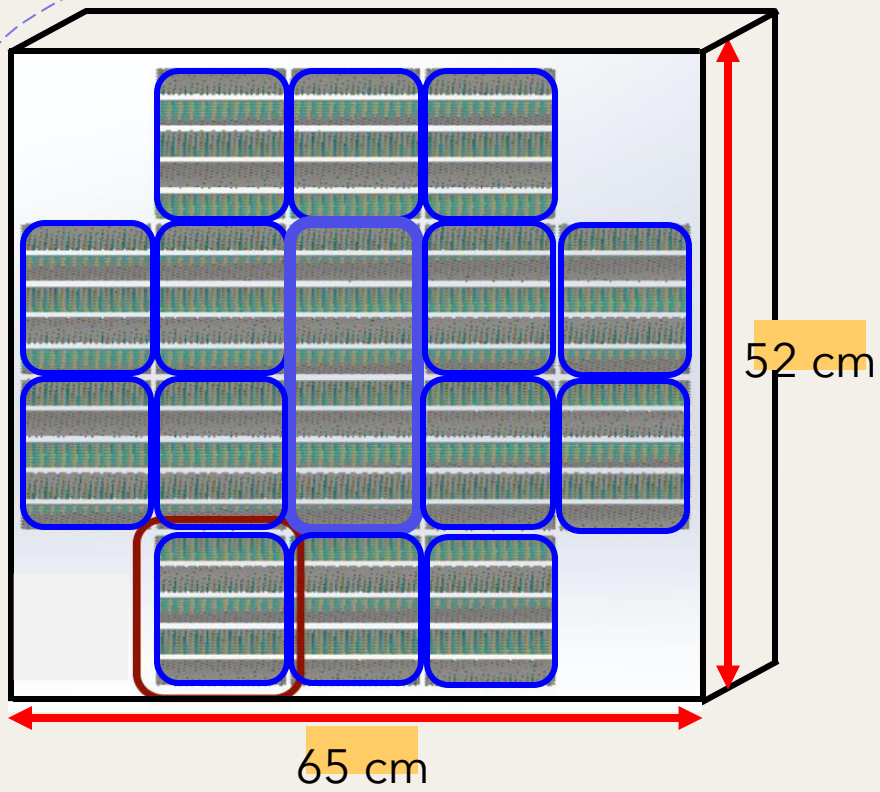
Caratterizzazione della gamma camera (GAGG, collimatore e matrice SiPM) con ^{111}Ag presso il LENA di Pavia

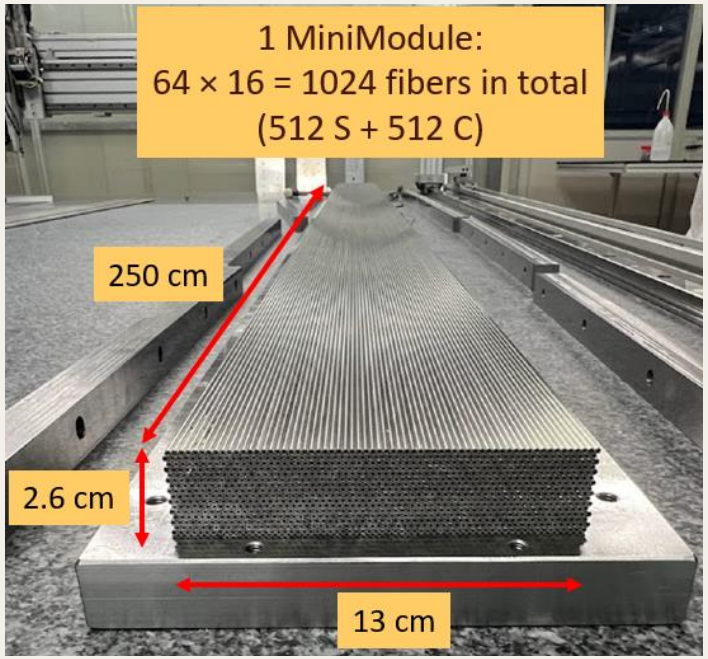
HIDRA2 (2022-2024+2025)

Progetto di tipo Call. **Test beam** del dimostratore completo del dual-readout Calorimeter (fibre scintillanti + cherenkov) previsto a **settembre** sulla linea **CERN H8**

D. Falchieri

A. Gabrielli



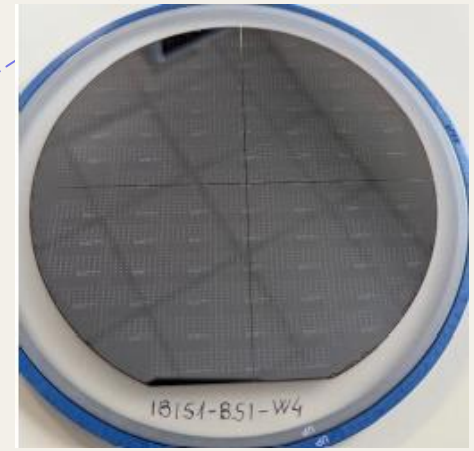


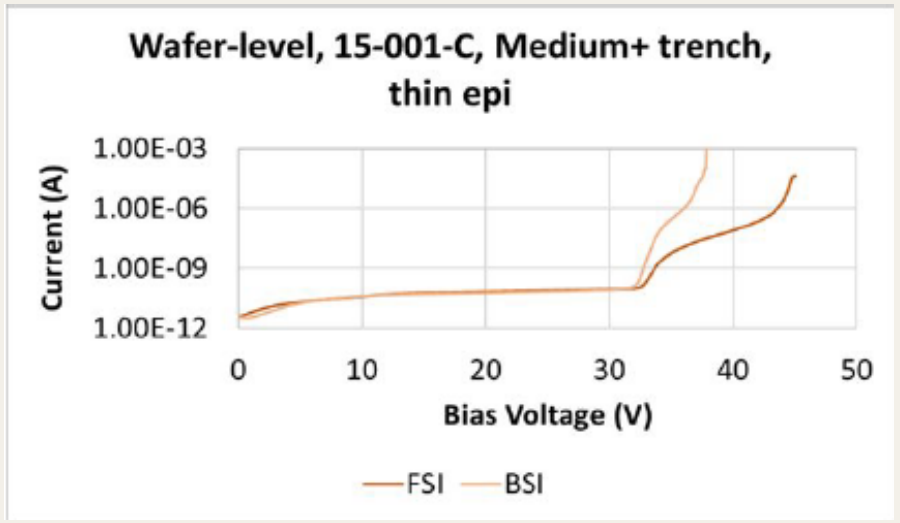
high-granularity core: fibers individually read-out by SiPMs

each minimodule is readout by 2 PMTs (1 for Cherenkov and one for scintillation)

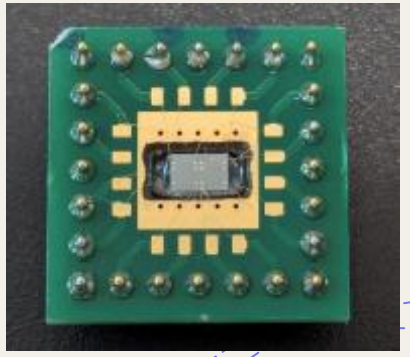
IBIS-NEXT (2024-2025)

Primo campione di SiPM *back-side illuminated* prodotto da FBK
tagliato in maggio 2025 e attualmente sotto test





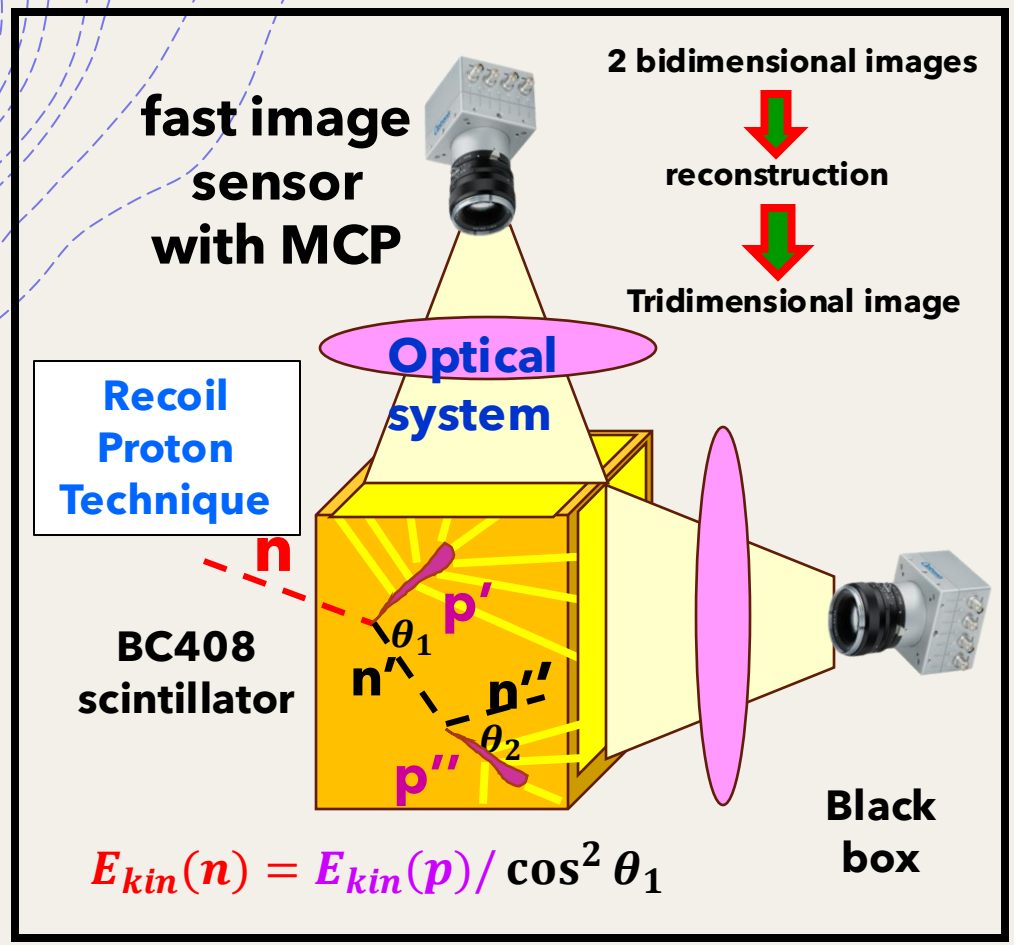
A. Montanari

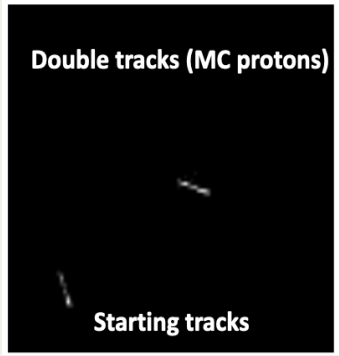


Esempio di sinergia tra gruppi diversi (ALICE, DUNE, EPIC)

A. Montanari Team Leader DRD4
R. Preghenella Resource Coordinator DRD4

Riptide (2024-2026)





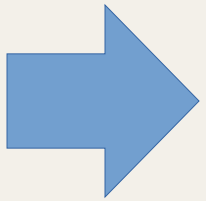
R. Spighi

Benvenuto, e buon lavoro, al Coordinatore entrante (ottobre 2025)…

Nicolò Tosi

… E grazie a tutti per il supporto e la pazienza degli ultimi 6 anni

Backup Slides con dettagli su attività e componenti dei progetti in corso – grazie a chi le ha mandate



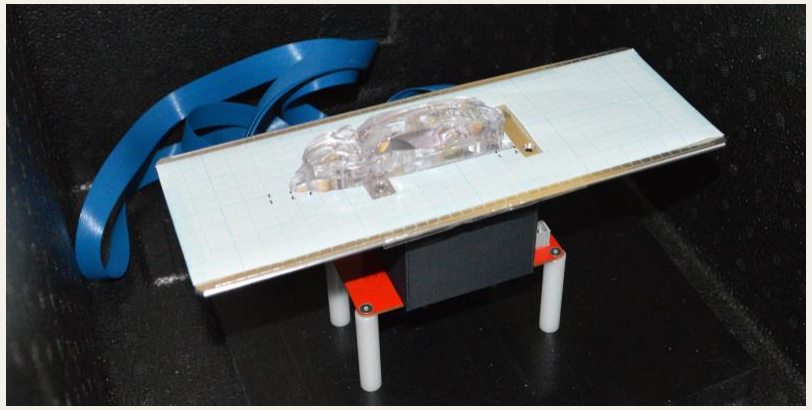
ISOLPHARM: Activities and prospects

A. Andrighetto, G. Baldazzi, E. Borciani, G. Grosso, N. Lanconelli,
A. Margotti, M. Negrini, C. Sbarra, D. Serafini

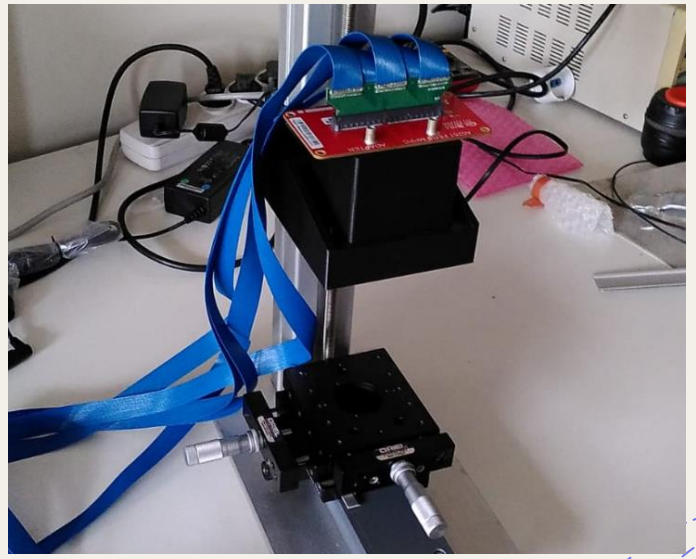
ADMIRAL

- **Overall goal of WP3 of ADMIRAL**
  - Build the prototype of a γ-camera, optimized for the Ag111 γ emission (342 keV)
- **Targets for 2025 (last year of ADMIRAL)**
  - Detector design optimization based on the experimental results obtained during 2024
  - Final assessment of the detector performance on Ag111.

UNIBO / INFN-BO participants
G. Baldazzi, E. Borciani,
N. Lanconelli, A. Margotti,
M. Negrini, C. Sbarra,



Test of the gamma camera using mouse phantom with Ag111 at LENA



Gamma camera prototype

ISOLPHARM_APEX

Main goals

1) Understanding the dosimetry of ^{111}Ag-PSMA-617 in living systems such as cells, small animals and human patients.
2) Studying this radiopharmaceutical in cancer cell cultures in 2D monolayers and in 3D tissue-mimicking scaffolds.
3) Observing the biodistribution and the effects of theranostic ^{111}Ag-PSMA-617 on small animals.
4) Investigating the radiobiological response to low-dose-rate radiation using the first nuclides obtainable at SPES.

- **UNIBO / INFN_BO team involved in the In-vivo Work Package of the project (WP3)**
- Biodistribution *ex vivo* of ^{111}Ag-PSMA-617
- Preclinical experiments *in vivo* with ^{111}Ag-PSMA-617 and ^{177}Lu-PSMA-617 for comparison
- γ imaging and radiomics

- **Activities at INFN-BO**
- Double the size of the gamma-camera prototype
- Use the gamma-camera developed by INFN-BO on small animals

Richieste ai servizi 2026

- 1MU lab. elettronica: connettore per alloggiamento di 2 SiPM
- 1MU off. meccanica: costruzione del supporto per nuova gamma camera

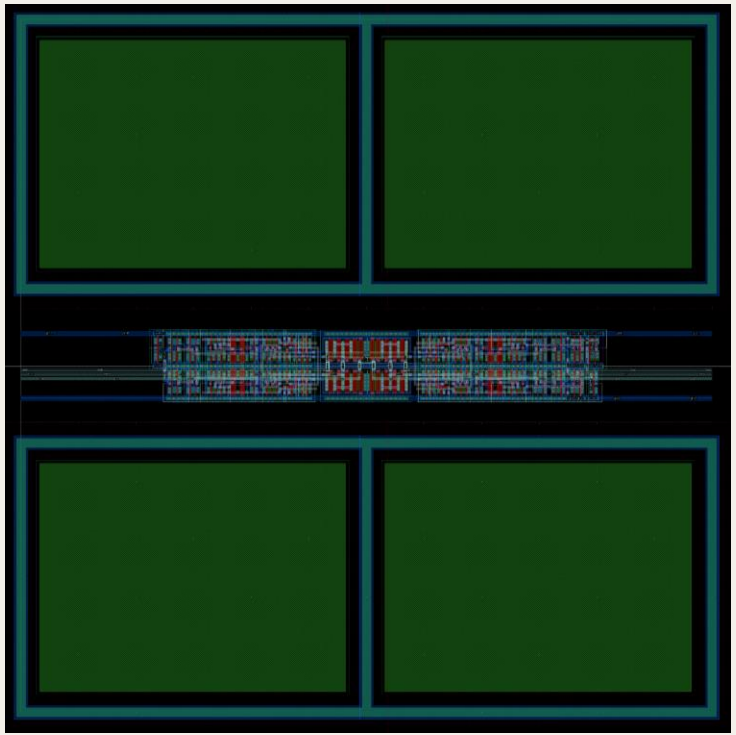
ASPIDES -1

A CMOS SPAD and Digital SiPM Platform for High Energy Physics

(Ba, Bo, Mi, Na, Pd, Pv, To, Tn)

Development of a monolithic **SiPM** in **CMOS** technology, with **single photon** sensitivity and **integrated electronics** optimized for dual-readout calorimetry and RICH.

- **110 nm LFOUNDRY**
- CMOS **SPAD structure** under study by the collaboration seeking for **improvements**



- 2 different designs one for calorimetry and one for RICH (single photon)
- Integrated electronics: **parallel counters** and **<100 ps resolution TDC**
- Investigate **radiation hardness** and **cryogenic**
- **Run** to be submitted this **winter**

ASPIDES

ASPIDES -2

Bologna 2026

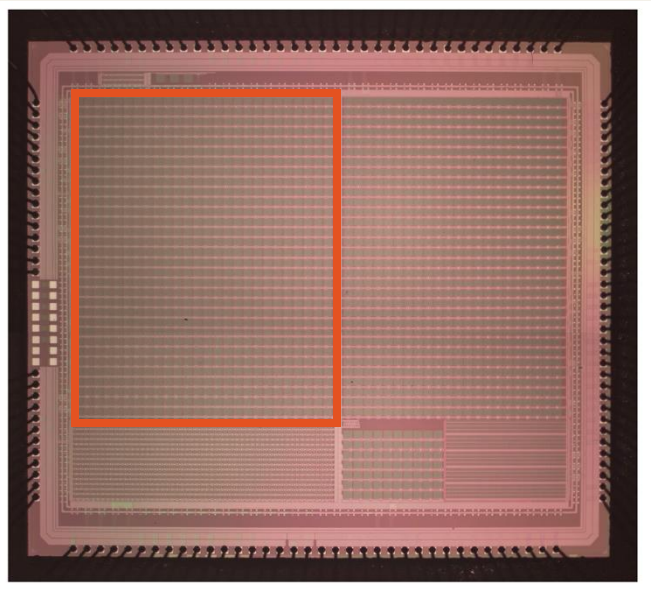
People 1 FTE : R. Achari, , D. Falchieri, S. Giminiani, R. Preghenella, R. Ricci, L. Rignanese

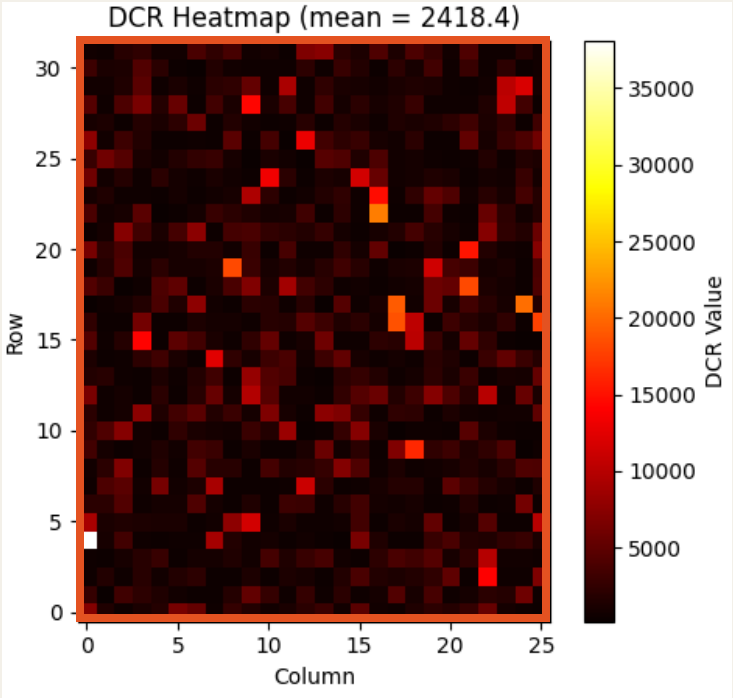
Main tasks:

- **DAQ** development
- **Radiation damage** studies

2025 Activities

- **Firmware/SW** dev for DAQ of the demonstrator chip (**ASAP LF110**)
- Characterization of demonstrator prior and after **irradiation** (winter 2025)

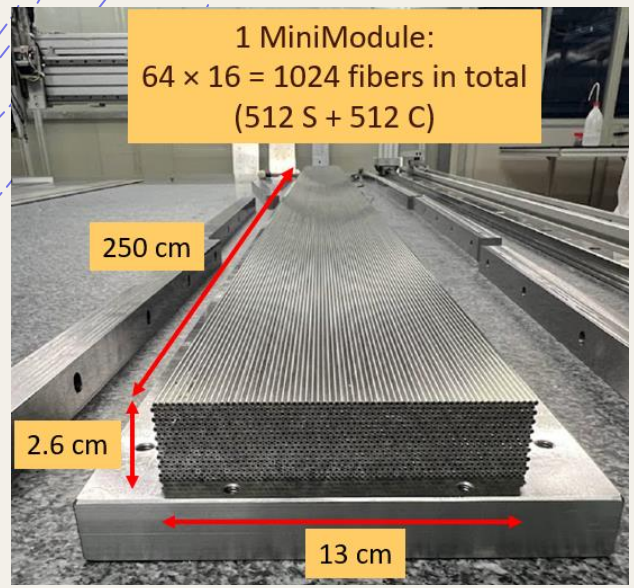




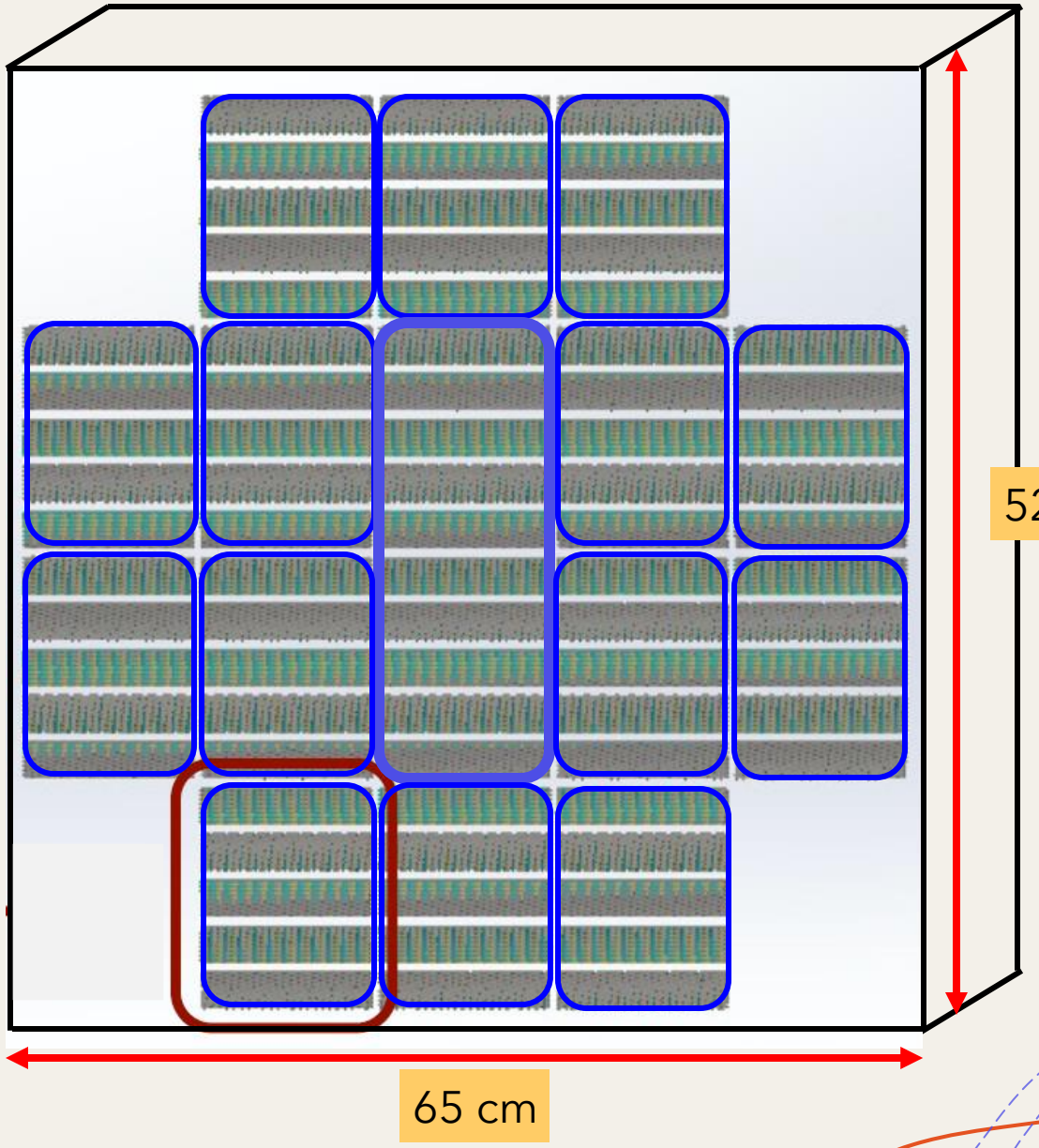
2026 requested **3 MU** (Servizio Elettronica) for development of Front-End and interconnection board for the new chip

HiDRa2: High-Resolution Highly Granular Dual-Readout Demonstrator

Towards the complete Hidra2 demonstrator with test-beam at CERN H8 (24/09/25 – 8/10/25)



with fibers inside



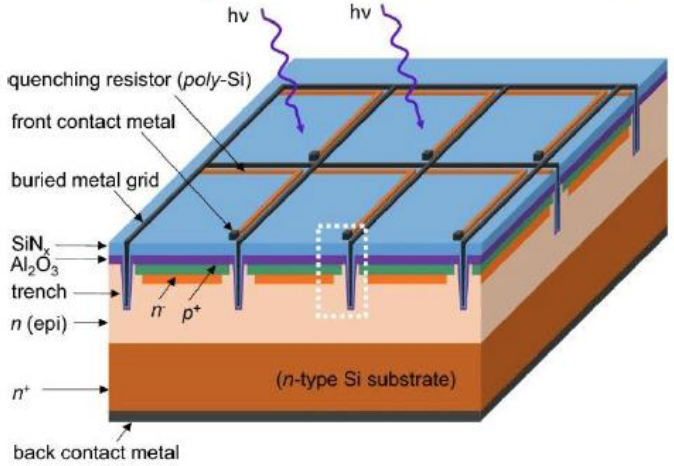
Sylvie Braibant,
Alessandro Gabrielli,
Paolo Giacomelli,
Iacopo Vivarelli
RL: Davide Falchieri

high-granularity core: fibers individually read-out by SiPMs

each minimodule is readout by 2 PMTs (1 for Cherenkov and one for scintillation)

IBIS_NEXT project (2024-2025)

- Develpment of **BackSide Illuminated SiPM**:
  - Clear entrance window → **Better Fill Factor**
  - Small SPAD size → **Improved radiation tolerance**
  - Contacts on one side → **Vertical integration with Readout Chip**
  - Optimization of Entrance window → **VuV Photon Detection Efficiency**



Applications

- *Liquid Scintillators TPC (VuV)*
- *Imaging in Liquid Scintillators*
- *High Radiation environments*
- *Cherenkov detectors*
- *Timing detectors*

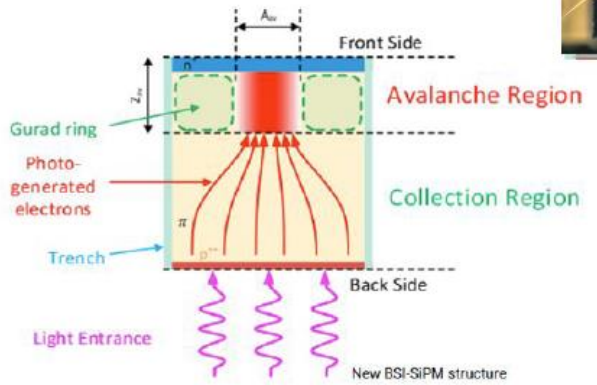
UNITS: ***Bologna, Milano Bicocca, Torino, Napoli, TIFPA*** *(33 ric/tecn, 6.7 FTE)*

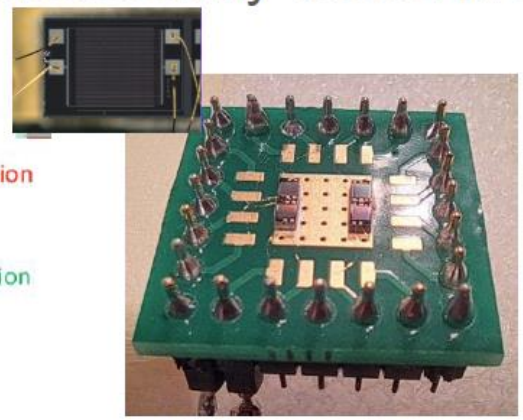
Gruppo, FTE e ruoli rilevanti di Bologna

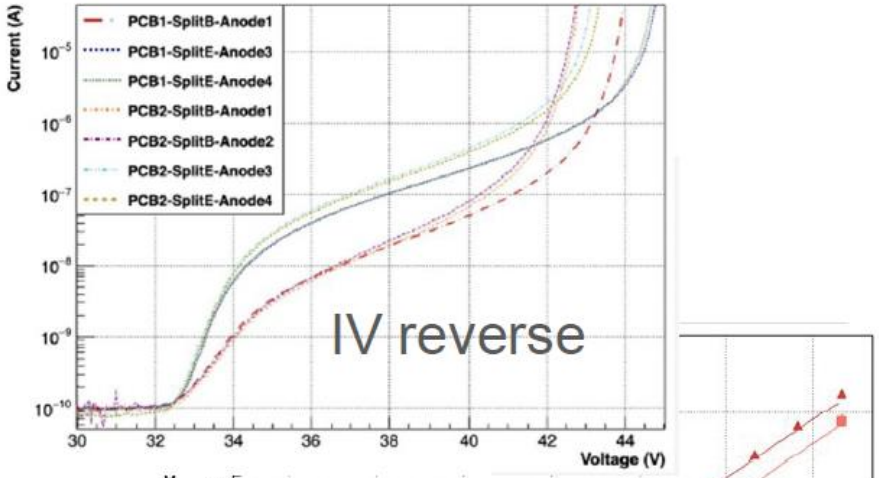
- **Responsabile Nazionale:** Alessandro Montanari
- **Responsabile Locale:** Roberto Preghenella
- **Consistenza Gruppo:** 15 persone (3.0 FTE)
- **Fonte di sinergie e collaborazioni tra più gruppi della Sezione**
  - ALICE, DUNE, EPIC
- **1 studente PhD PNNR industriale al 100% afferente alla sigla**
  - progetto in collaborazione con FBK
  - assegno co-finanziato equamente da EPIC e DUNE
  - esempio di condivisione tra gruppi in Sezione
- **Attività IBIS_NEXT rilevante per la Collaborazione DRD4 e DRD2**
  - si segnala inoltre che per il DRD4
    - Alessandro Montanari è il Team Leader di INFN
    - Roberto Preghenella è il DRD4 Resources Coordinator

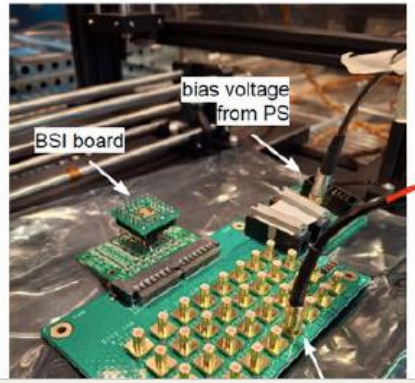
IBIS_NEXT: partially processed wafers

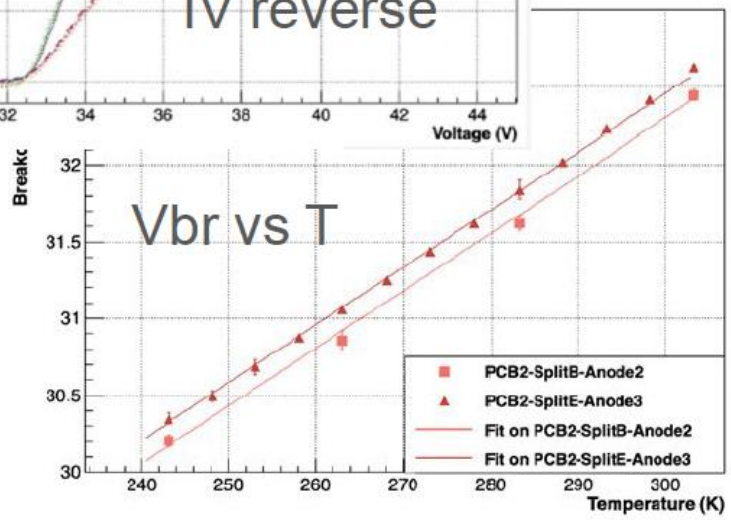
- New microcell successfully tested in a wide range of temperatures [40C,-200C]





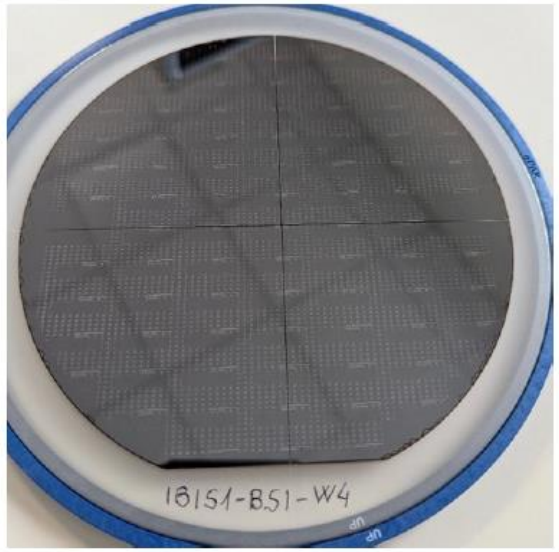


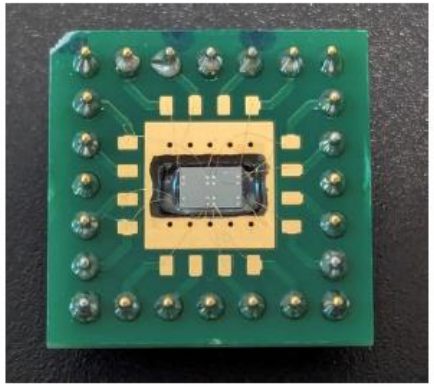


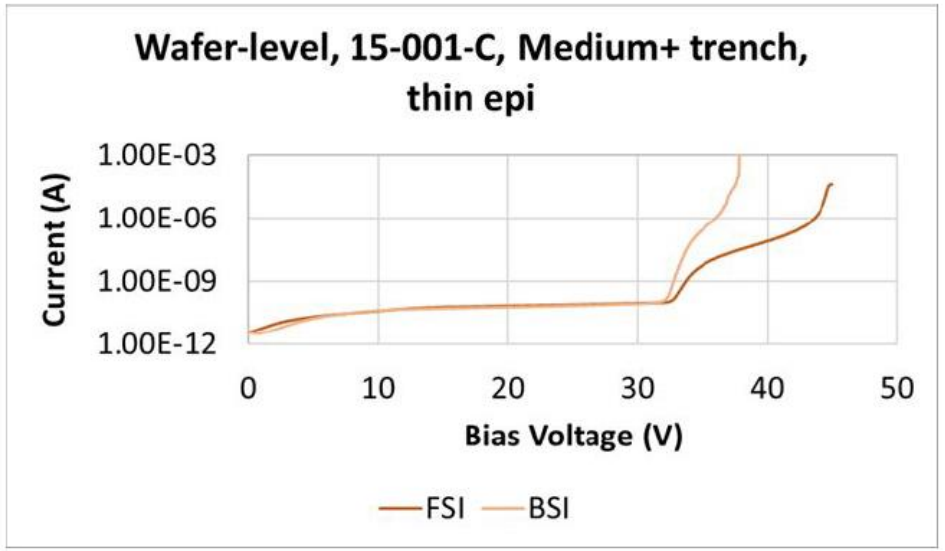


IBIS_NEXT: fully processed wafers

- First fully processed SiPM Backside Illuminated samples diced on last May !
- Preliminary IV curves characterization quite promising: devices are alive!
- Systematic characterization will start soon.
- In order to conclude the program, an extension of 1 year was requested for 2026





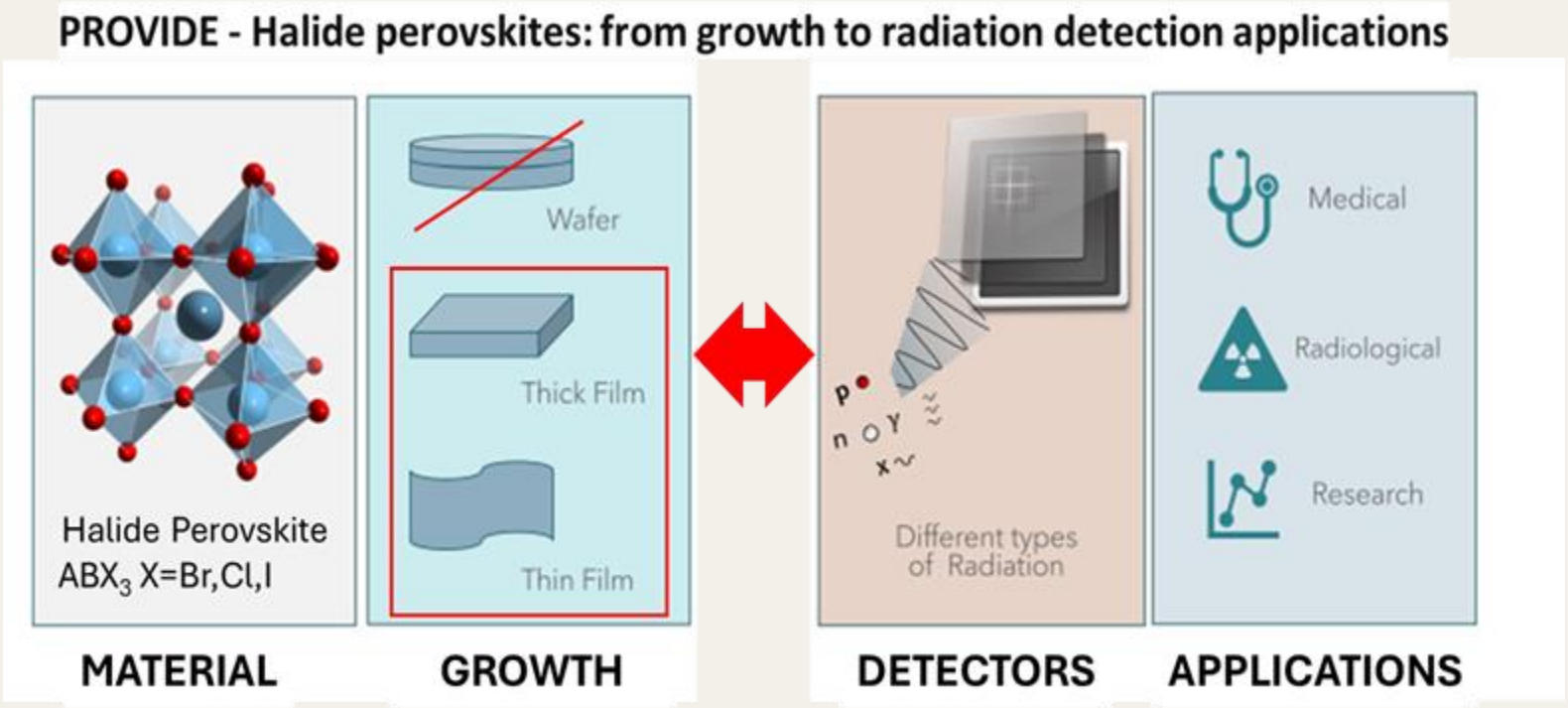


PROVIDE - PeROVskIte DEtectors for innovative strategies in radiation therapy and diagnostics

Durata 3 anni
Responsabile nazionale: Mara Bruzzi INFN-FI
Unità partecipanti BO – FI – LE - PI – TIFPA

Nome e Cognome	Ruolo	FTE
Beatrice Fraboni RL	PO	0.4
Laura Basiricò	RTD	0.4
Andrea Ciavatti	Tecn.	0.4
Ilaria Fratelli	Ass. R.	0.3
Totale FTE		**1.5**

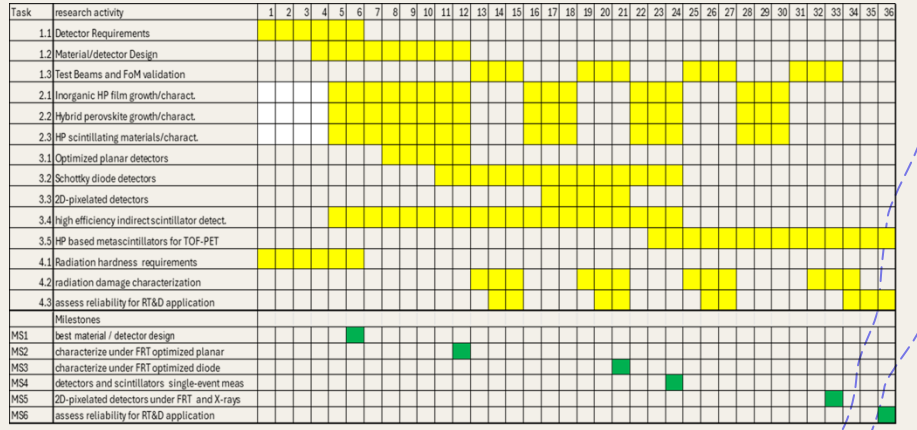
REPORT M1- M6



WP1 Matching HP*-based detectors to radiation therapy and diagnostics requirements BO-**FI**-PI-LE-TIFPA
Responsible: Mara Bnruzzi (FI)

WP2: Materials growth Sections involved: BO-FI-**LE**
Responsible: Anna Paola Caricato (LE)

WP3 HP Detectors development sections involved: **BO**-FI-LE-PI
Responsible: Beatrice Fraboni (BO)
Task 3.1 Optimized planar detectors Manufacturing
Task 3.2 First Schottky-diode HP detectors.
Task 3.3 2D-pixelated HP detectors.
Task 3.4 high efficiency indirect scintillator detectors (LE)
Task 3.5 HP based metascintillators for TOF-PET application (LE-PI)

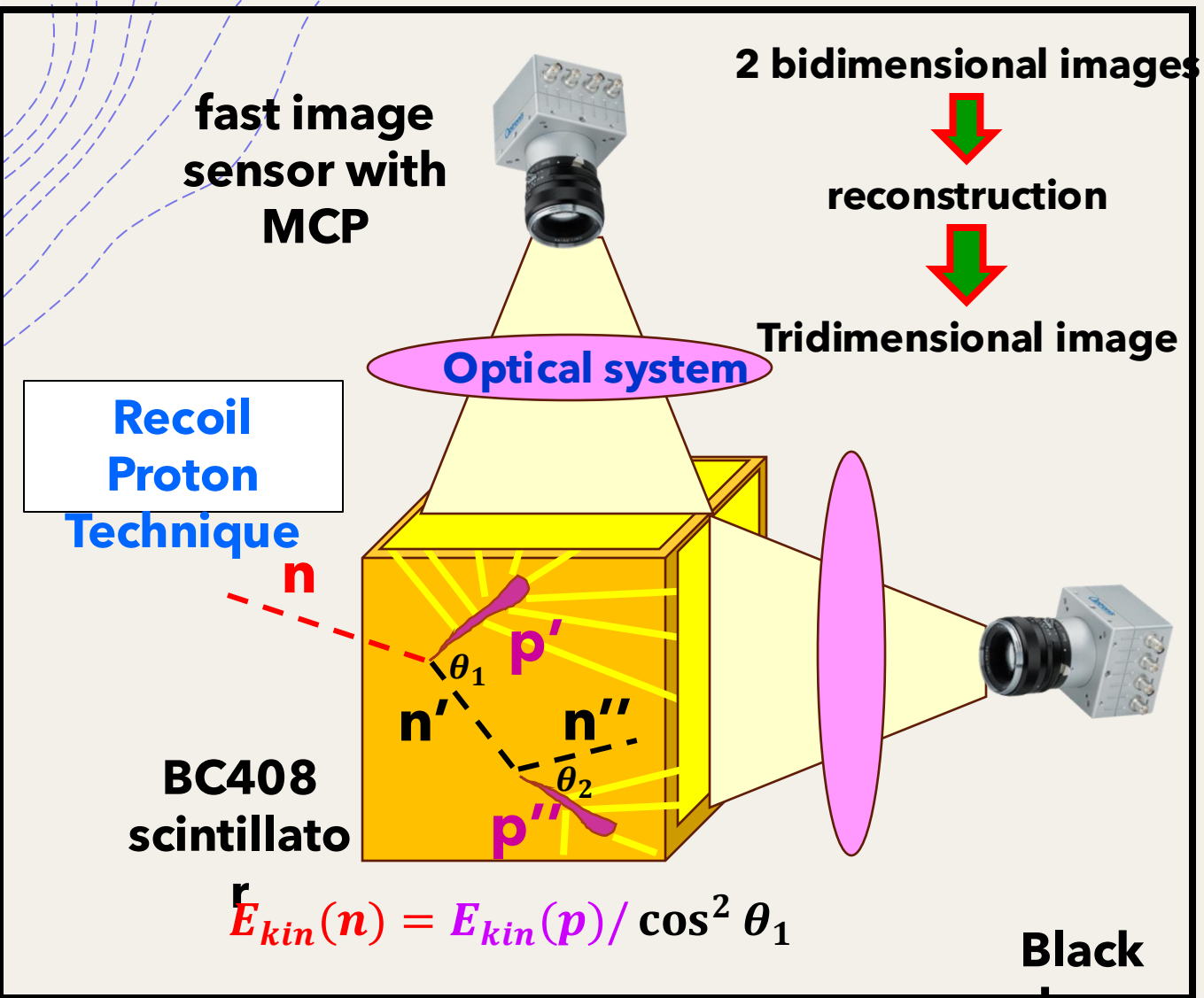


WP4 Radiation hardness and mitigation strategies
Sections involved: FI-PI-LE-**BO**-TIFPA
Responsible: Andrea Ciavatti (BO)
Task 4.1 define radiation hardness requirements
Task 4.2 Radiation Damage Characterization
Task 4.3 Assess reliability of novel detectors for each RT&D application.

RIPTIDE: *Recoil ProTon Imaging DEtector*

GOAL:

- **Energy, momentum → visualize neutron**



Members	Role	FTE 2026
Console Camprini Patrizio	Ric ENEA Bologna	0.2
Giacomini Francesco	Primo Tecn. CNAF	0.1
Lanzi Samuele	Dott. CNAF	0.5
Massimi Cristian	Prof. Ass.	0.3
Mengarelli Alberto	Tecn. INFN	0.2
Pisanti Claudia	Dott.	1.0
Ridolfi Riccardo	Ass. Ric.	0.5
Spighi Roberto	Dir. Ric. INFN	0.5
Terranova Nicholas	Ric ENEA Frascati	0.5
Villa Mau		0
TOTALE F		3.8

3 years project (2024-26)
we are in the second

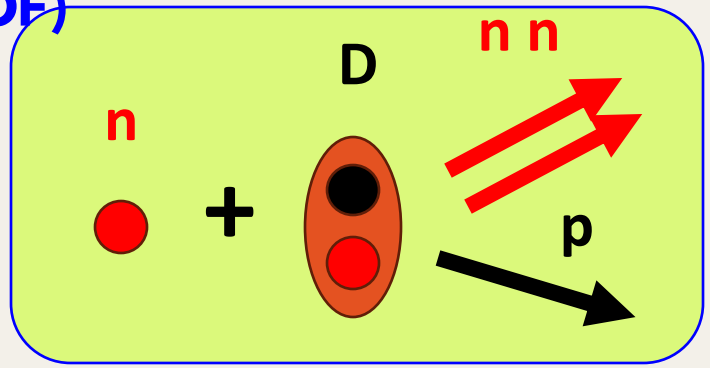
Timeline

- 2024: define the detector structure
- 2025: detector realization
- 2026: data taking

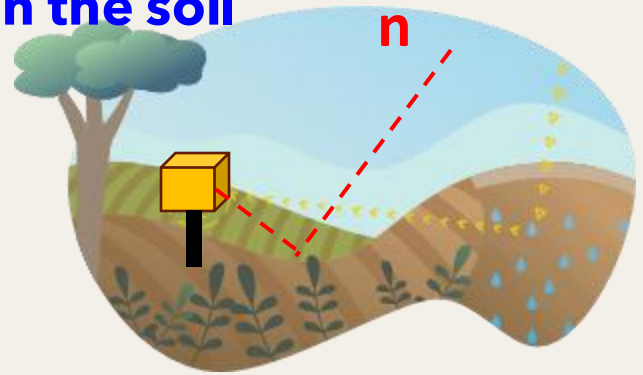
Multidiscipline applications

Solar neutrons (necessary to have the direction)

Scattering lenght of neutron (n-TOF)



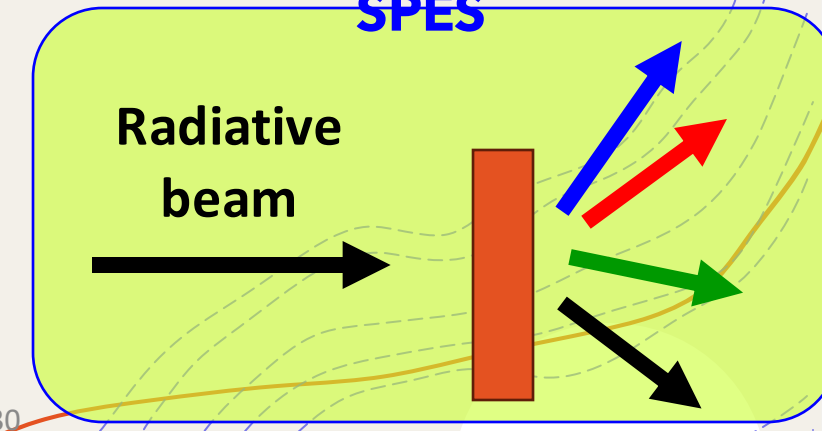
Soil Moiture: measure of the quantity of water in the soil



Hadrontherapy: monitor the delivered dose

Space Radioprotection: astronauts exposure from GCR

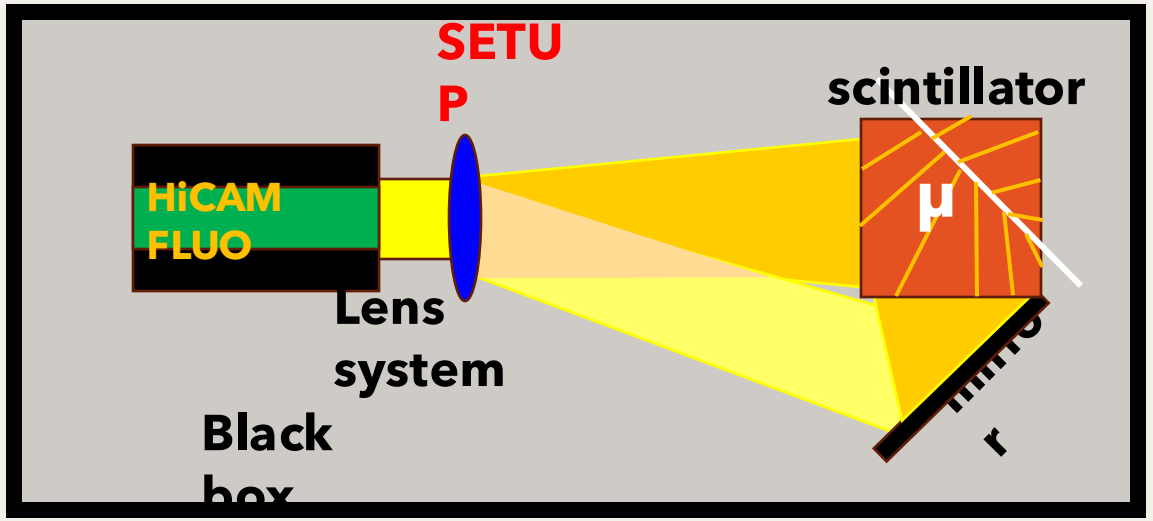
Radiative beams: crucial with the beginning of SPES



Preliminary Results

HiCAM FLUO (Integrated detector)

Photocathode, Image Intensifier, phosphor screen, optical fibers, CMOS sensor

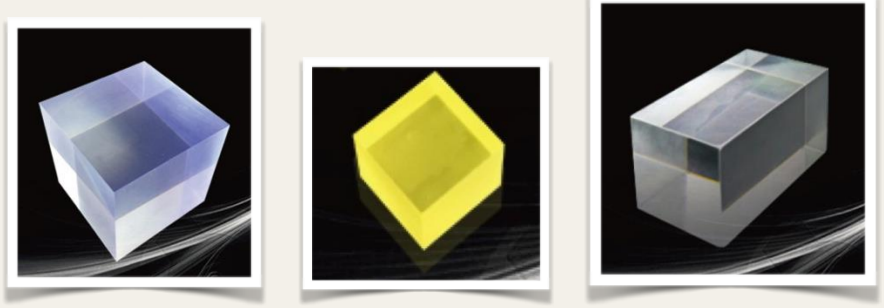


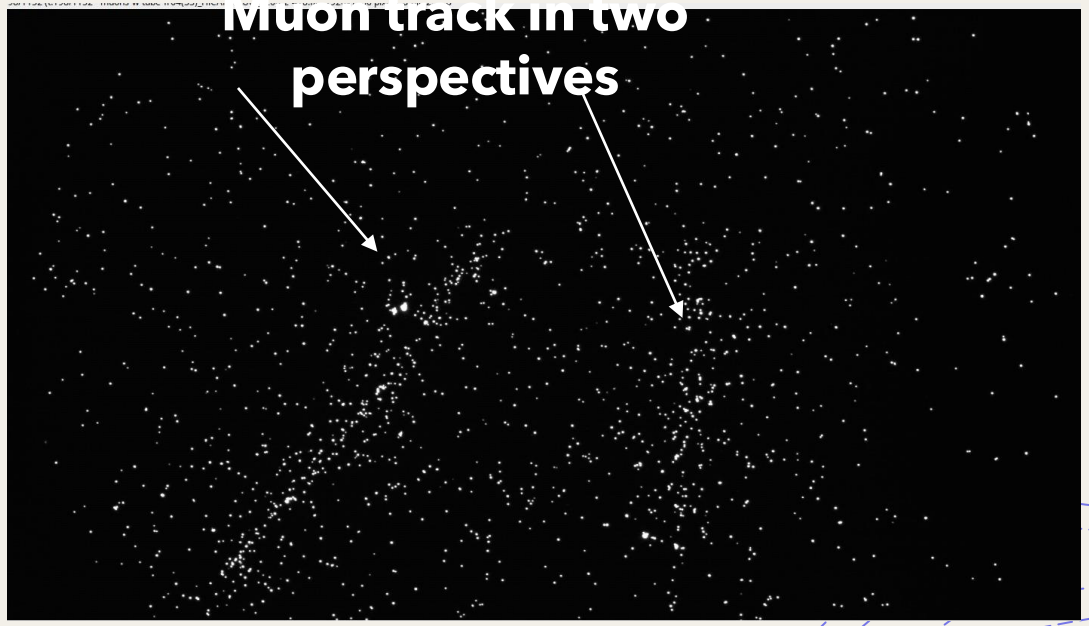
MEASURE with different SOURCES:

- Cosmic muon
- Am241 (α)
- Sr90(β)
- Cs137(γ)

MEASURE with different SCINTILLATORS:

- PVT (BC-408): 4x4x4 cm^3
- GAGG: 1x1x1 cm^3
- CsI(Tl): 2x2x2 cm^3



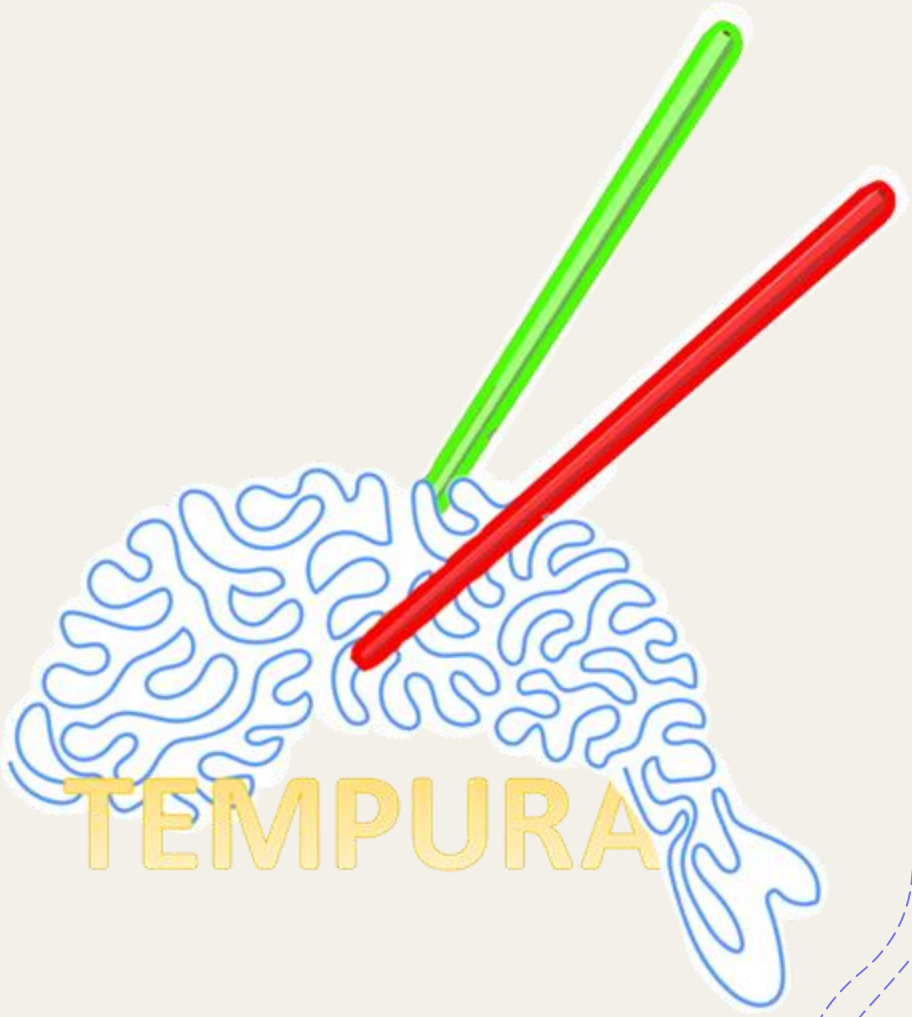


~ 400 tracks to analyze

MC Simulation → Detect muons with CsI(Tl) means it is possible to see neutron with BC-408

TEMPURA

Development of a diamond-based TEMPerature qUantum sensor to evaluate the effect of RAdiation in brain cells



INFN-BO (national coordinator: A. Candini, CNR)

core expertise: *Quantum sensing, X-ray irradiation, neuroscience*

facilities: *ODMR set-up, biological laboratories, X-ray source*

INFN-TO (local coordinator: F. Picollo, UniTO)

core expertise: *Ion beam implantation; material processing and characterization*

facilities: *Solid State Physics laboratories*

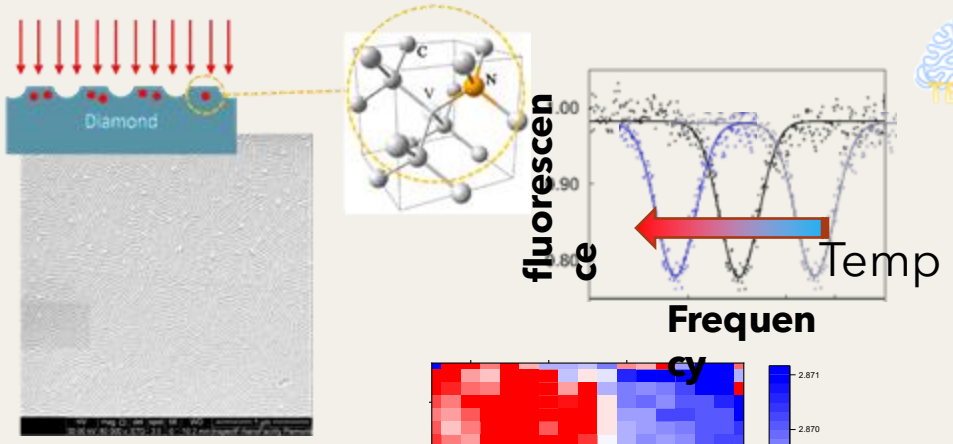
Main Research Areas:
Quantum Sensors
Medical Physics

TEMPURA: OBJECTIVES

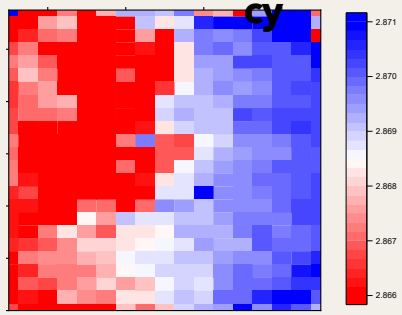
- To **develop** a novel **Temperature Quantum Sensors** based on **engineered diamond** to perform spatially resolved thermometry
TARGET → 0.1 K ; 1 µm.

- To assess **if** the **ionizing radiation** (same doses of radiotherapy) has **effects** on the **cells functioning** that can be **detected by** (local) **temperature variations**.

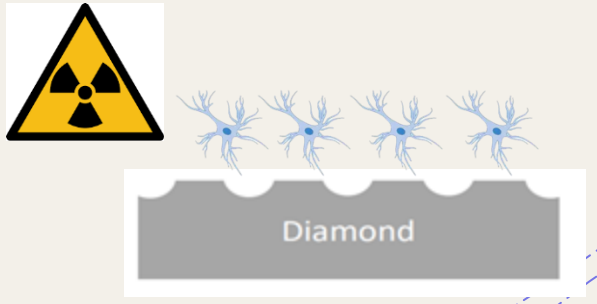
→ Demonstrate **an innovative way** to study **cells' responses to radiation** (impact on radiotherapy effects).



Nanopatterned diamond for temperature maps (INFN-TO)

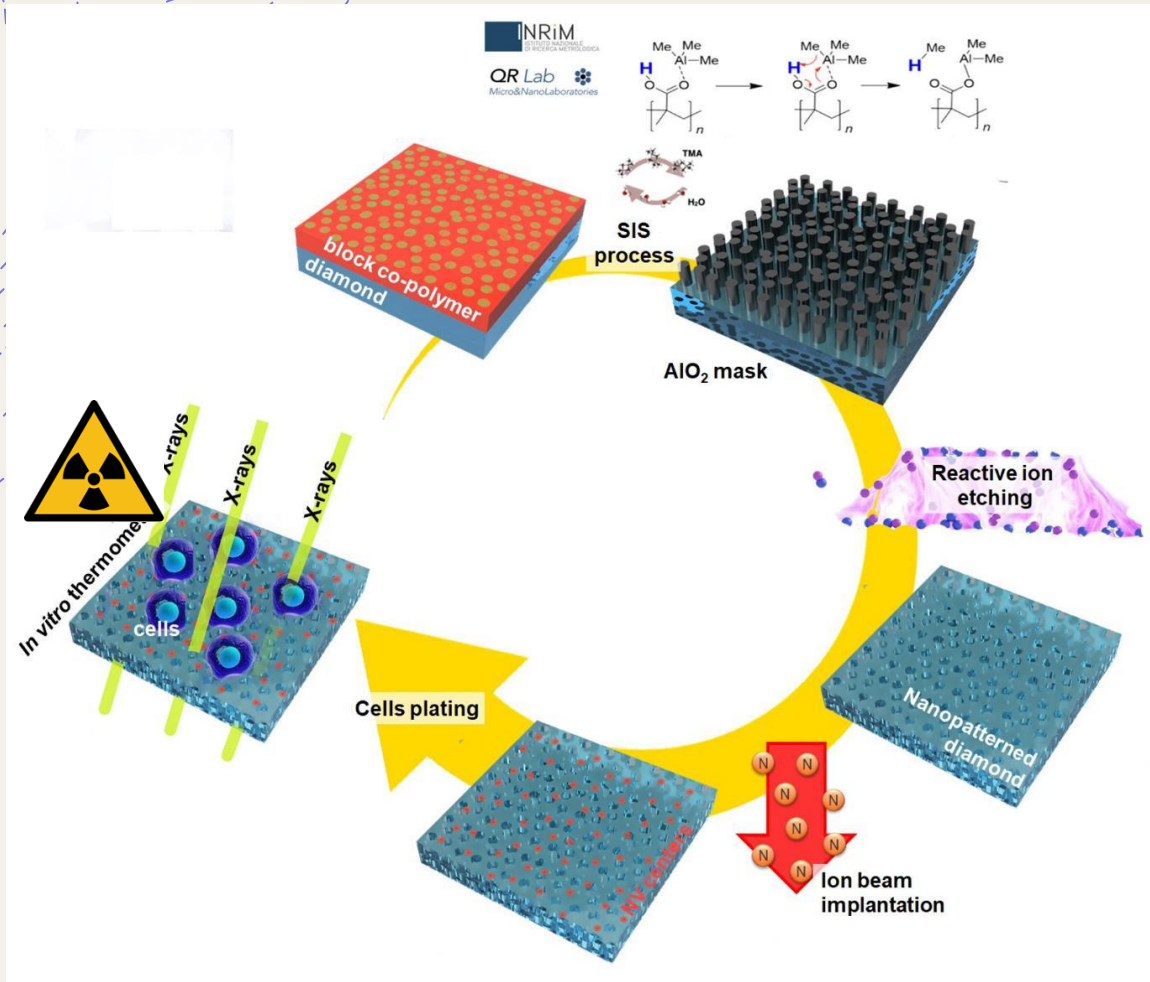


Preliminar Temperature Maps performed @ INFN-BO with unoptimized nanodiamond films



We will perform temperature maps on cells exposed to IR and plated on the diamond substrate

TEMPURA: METHODS



Work Packages 1,2: Development of enhanced quantum sensing platform

Fabrication (assisted by numerical simulations) of diamond substrates optimized for sensing (**implantation + post-processing annealing**) and nanopatterned by **block copolymer + Al masks** and **RIE** for spatially resolved (quantum) thermometry

Work Packages 3,4: NV-based thermometry maps and radiation effects

Spatially resolved (quantum) thermometry of cells *in vitro*. → Evaluation of **ionizing radiation effects** (same doses used in radiotherapy for tumour treatments).
Use of the radiation sources @INFN-BO.
Parallel fluorescence microscopy and cytofluorimeter

TEMPURA: NUMBERS

Budget Request (BO)

	2025 (granted)	2026 (request)	2027 (plan)
Equipment	27000 €	24000 €	24000 €
Consumable	1500 €	5000 €	5000 €

Equipment

- Dedicated microscope with pulsed measurement for optimized sensitivity and minimal cell damage

Consumables

- Cell culturing and characterization
- Running costs for radiation facilities

Staff involved in the Project (BO Unit)

Name	Working position	Role	FTE
INFN- BO			**1.9**
Andrea Candini	PR CNR-ISOF	Project coordinator	0.6
Alessandro Kovtun	R CNR-ISOF	Participant	0.4
Maria Pia Morigi	PA UniBO	Participant (radiation facilities)	0.2
Matteo Bettuzzi	Tech UniBO	Participant	0.2
Ignacho Del Rio	Research grant CNR	Participant	0.5

ACTIVITY UPDATE (JULY 2025):

TO Unit: Diamond preparation. First samples to be sent to UnitBO for characterization in July 2025

BO Unit: Equipment setup: acquisition of the instrumentation and testing

Organization of thematic Workshop: "Nanomaterials and quantum technologies at the interface with biological studies**"**

@FisMAt 2025 (https://eventi.cnism.it/fismat2025/thematic-workshop)