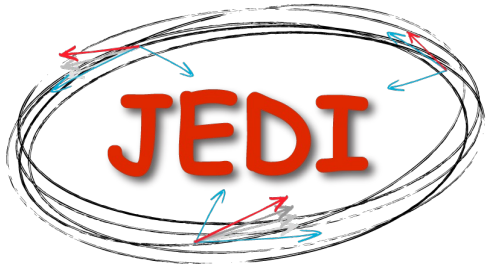
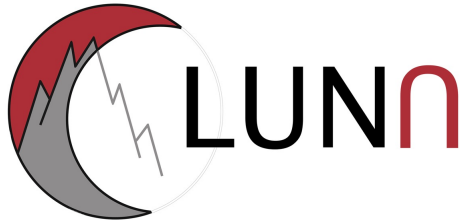
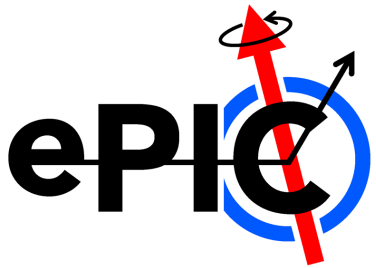
Consiglio di Sezione INFN Bari





Gruppo III: attività e preventivi 2025



Giacomo Volpe

03/07/2025

FTEs and budget request of gruppoIII

Ricercatori	ALICE	ePIC	FOOT	JEDI	JLab12	LUNA	nTOF
Acharya Shreyasi	100						
Barile Francesco	70	30					
Bruno Giuseppe Eugenio	80						
Chirilli Giovanni Antonio	30						
Colamaria Fabio	90						
Colella Domenico	50	50					
Colelli Agelo	100						
Colonna Nicola							100
De Cataldo Giacinto	100						
Di Bari Domenico	70	30					
Di Ruzza Benedetto	70	10	20				
Elia Domenico	50	50					
Galati Giuliana			70				
Kumar Shyam	70	30					
La Rocca Marianna			20				
Liotino Rocco	70	30					
Maggipinto Tommaso			20				
Manzari Vito	70	30					
Masromarco Mario							100
Mastroserio Annalisa	70	30					
Mazzilli Marianna	100						
Mazziotta Nicola	20						
Mazzona Anna Maria							50
Muccila Riccardo							100
Nappi Eugenio	70	30					
Nicassio Nicola	70	30					
Palasciano Antonio	100						
Pappagallo Marco			20				
Perfetto Giuluio							100
Perrino Roberto		30			70		
Saha Arkaprabha	100						
Salma Umme							100
Tagliente Giuseppe				30			70
Terrevoli Cristina	80	20					
Triloki Triloki	80	20					
Variale Vincenzo							50
Vivek Patel		100					
Volpe Giacomo	70	30					

Tecnologi	ALICE	ePIC	FOOT	JEDI	JLab12	LUNA	nTOF
Camerlingo Maria Teresa	70	30					
Ciani Giovanni Francesco	20	30					
De Robertis Giuseppe	30						
De Venuto Daniela	50						
Diacono Domenico		30					
Khatun Anisa	70	30					
Licciulli Francesco	20						
Loddo Flavio	20						
Marzocca Cristoforo	30						
Pastore Cosimo	35	20					
Spinoso Vincenzo		30					
Torresi Marco	50						

+0.8 from ASPIDES synergical to ALICE

FTEs and budget request of gruppoIII

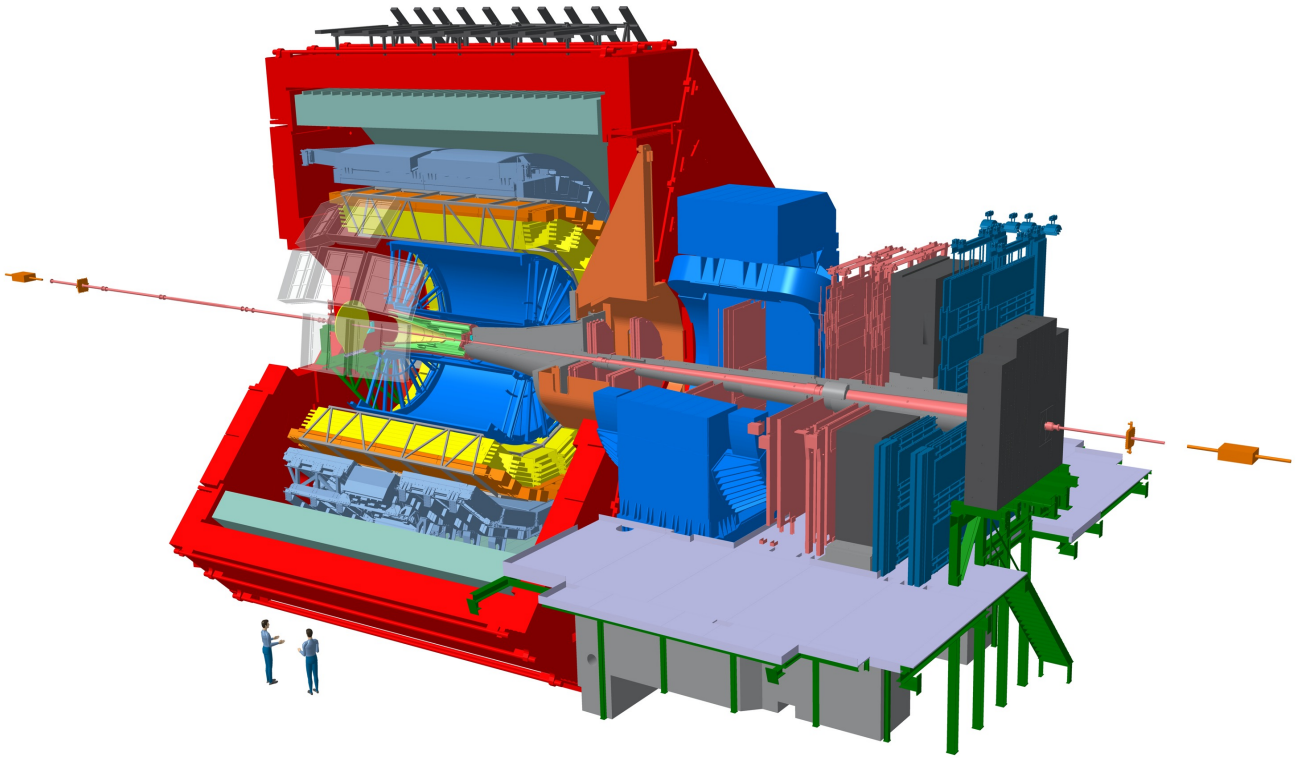
FTE TOTALI		
	2025	2026
Ricercatori	**28.3**	**32.5**
Tecnologi	**4.4**	**6.45**
Totale	**32.7**	**38.95**

	Missioni (k€)	Consumo, trasp., inv., costr. app (k€)	Totale (k€)
Dotazioni	23.5	56.5	80


ALICE

ALICE

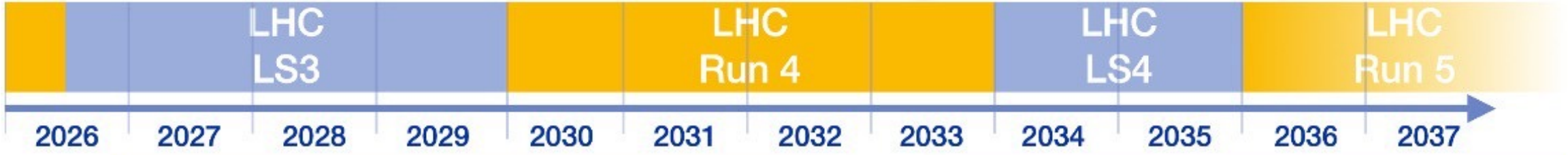
ALICE is designed to study the physics of strongly interacting matter under extremely high temperature and energy densities to investigate the properties of the quark-gluon plasma.



Significant Contributions from INFN Bari to ALICE

- Detectors
  - Trackers (ITS → ITS2)
  - Cherenkov counter (HMPID)
- Data analysis
  - Light flavour
  - Heavy flavour
- Several responsablity roles

ALICE upgrades timeline



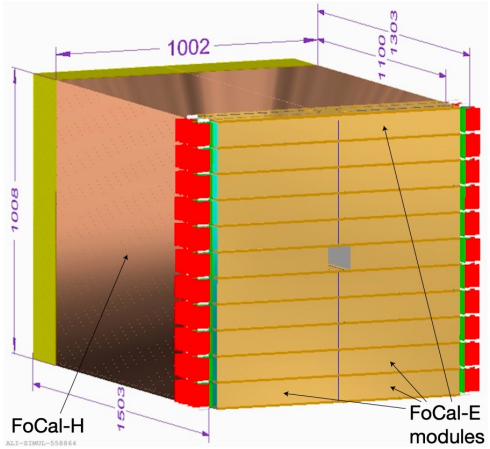
LS3: FoCal & ITS3

- Specific upgrade for Run 4
- TDRs approved in March 2024
- Now proceeding towards final sensor in view of start of production

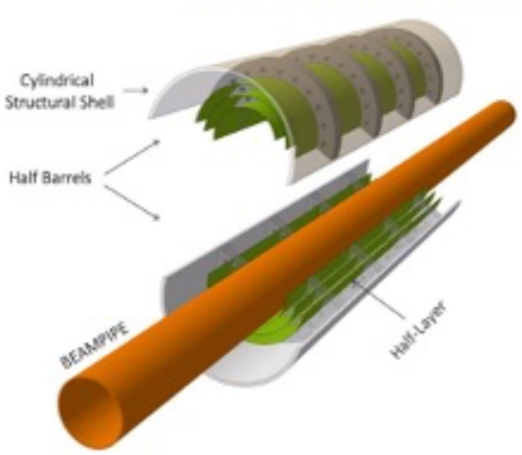
LS4: ALICE 3

- New detector for Run 5
- LoI reviewed in 2022
- Scoping document reviewed in March 2025

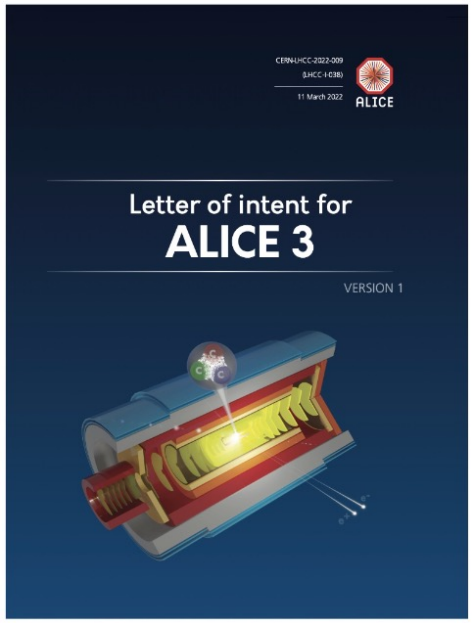
FoCal TDR: ALICE Coll. CERN-LHCC-2024-



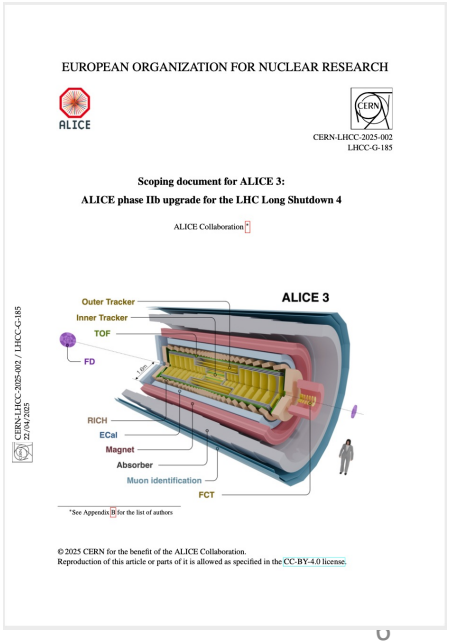
ITS3 TDR: ALICE Coll. CERN-LHCC-2024-003



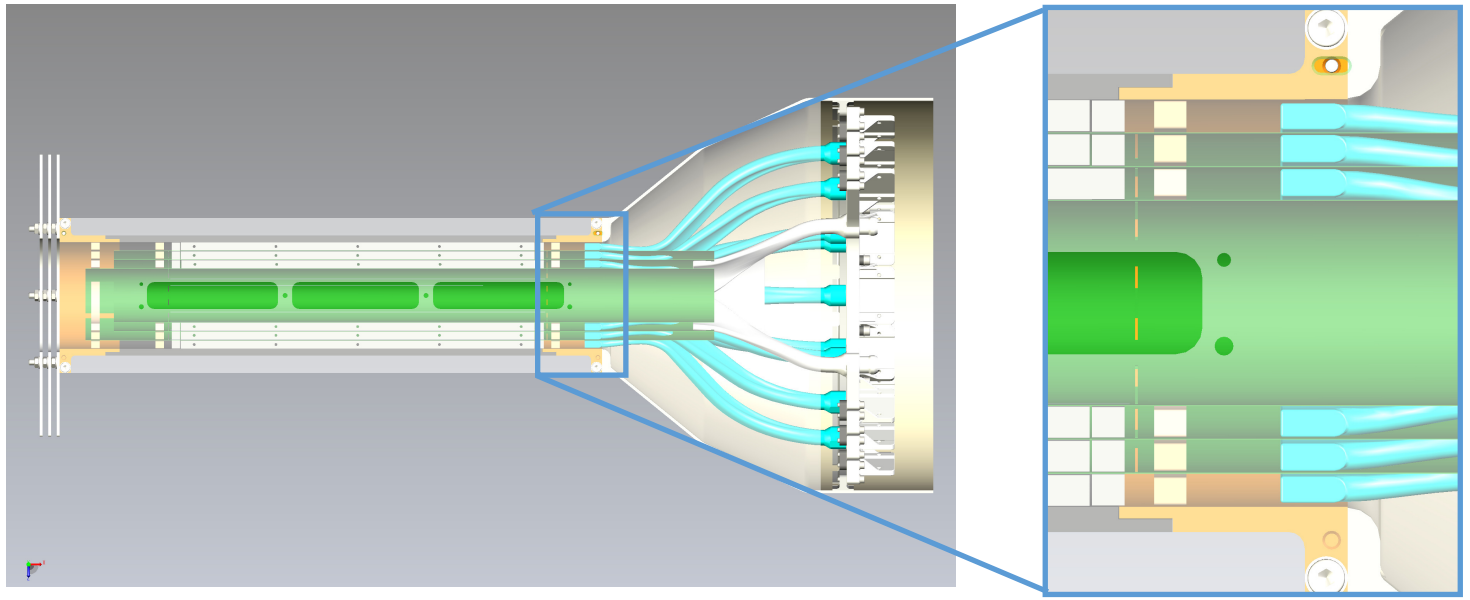
ALICE Coll. CERN-LHCC-2025-002

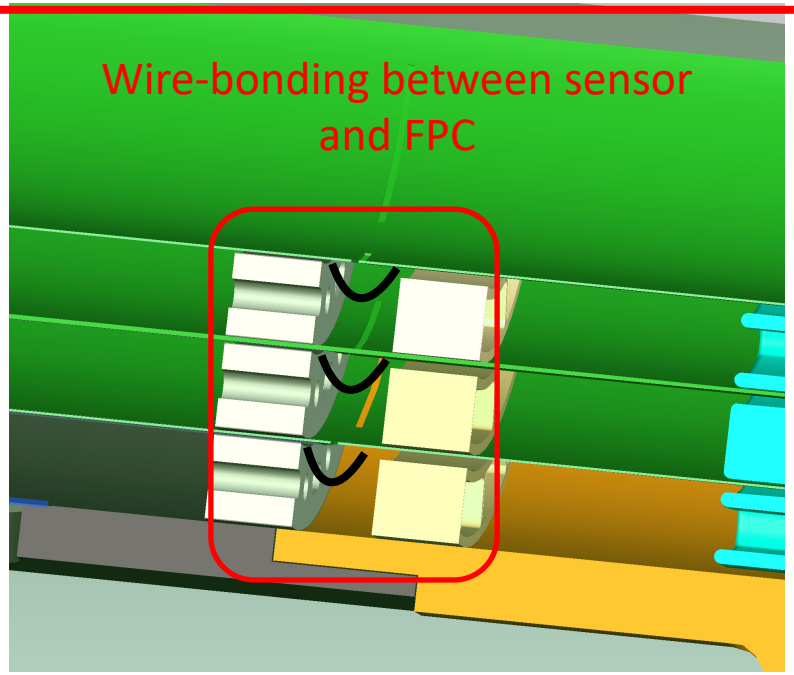


ALICE Coll. CERN-LHCC-2025-002



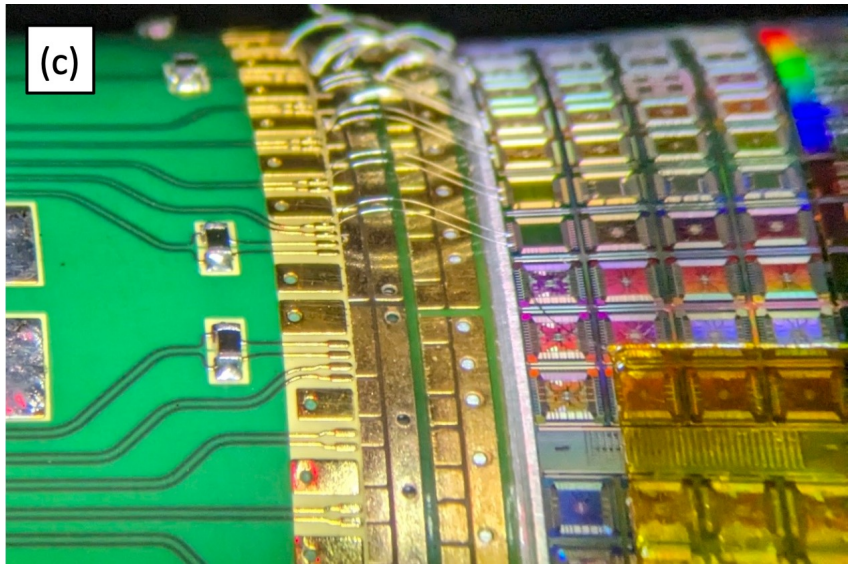
ALICE – ITS 3





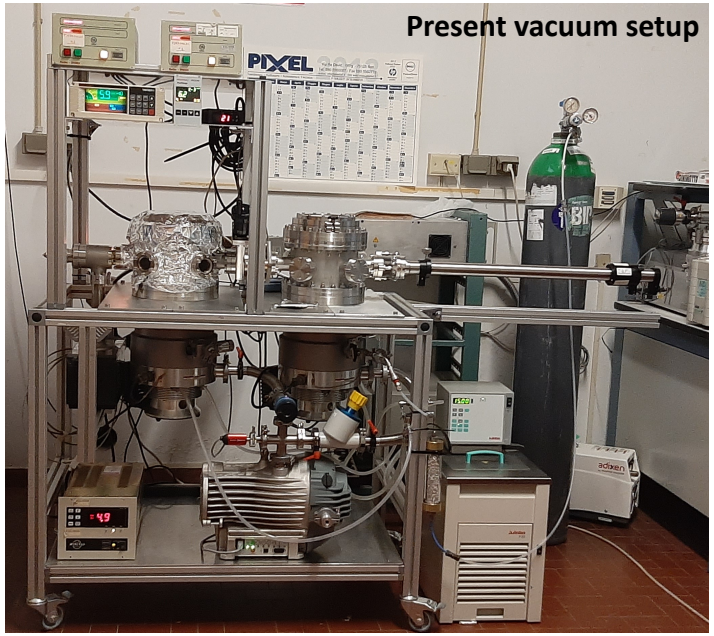
Setup to qualify the wire-bonding between sensor and FPC:

- Goal is to establish potential effects from air-flow (used for cooling) on the wire-bonding strength
- Small wind tunnel, equipped with flow-meter
- Pull-force measurements



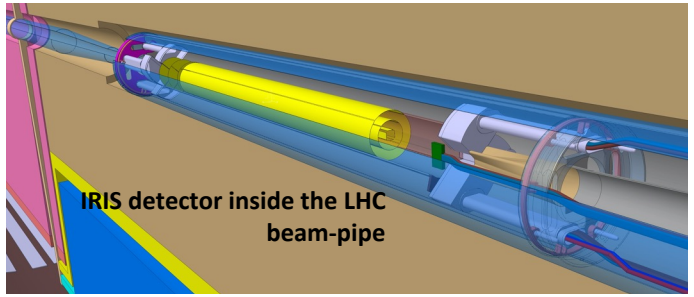
ALICE 3 – tracker

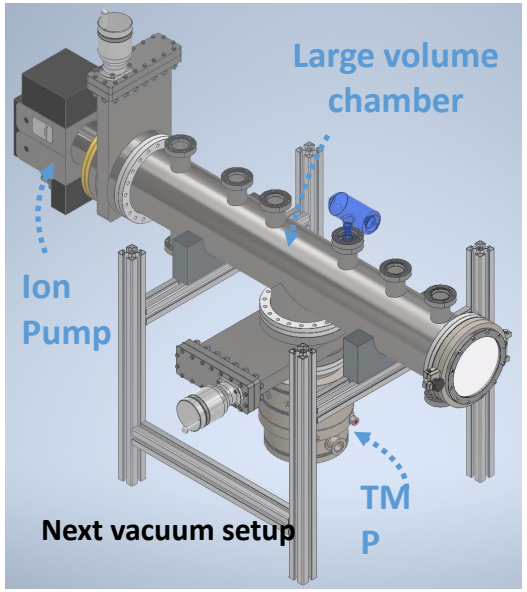
IRIS - Vertexer under vacuum



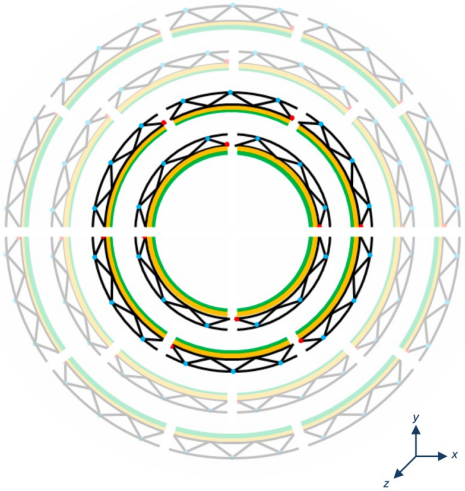
Outgassing studies:

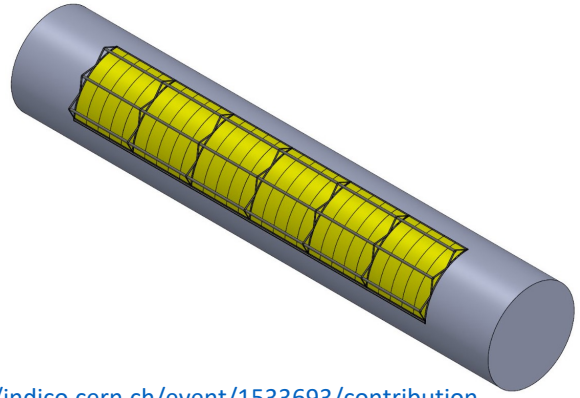
- Move from small samples to full IRIS prototype
- New setup with large volume chamber required





Tracker Middle Layers - Curved sensors immediately outside beam-pipe





https://indico.cern.ch/event/1533693/contributions/6453372/attachments/3071980/5435362/20250521_Agarwal_ALICE3Days_NoBackup.pdf

First studies on the procedure to assemble modules

- Stitched sensor ~10 x 10 cm^2
- Development strongly connected with ePIC-SVT-L2

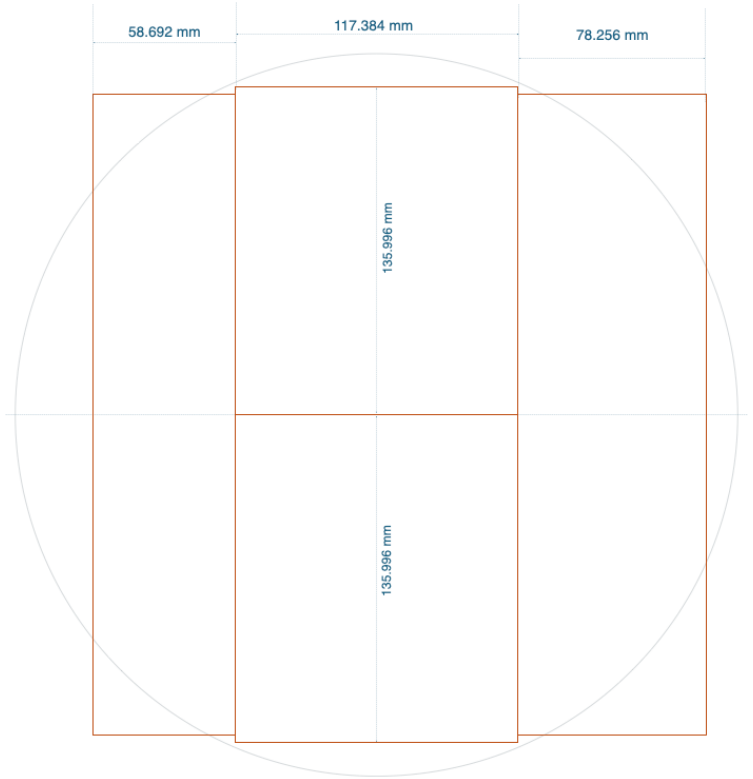
Tracker technology application: Compton Camera (PRIN project)

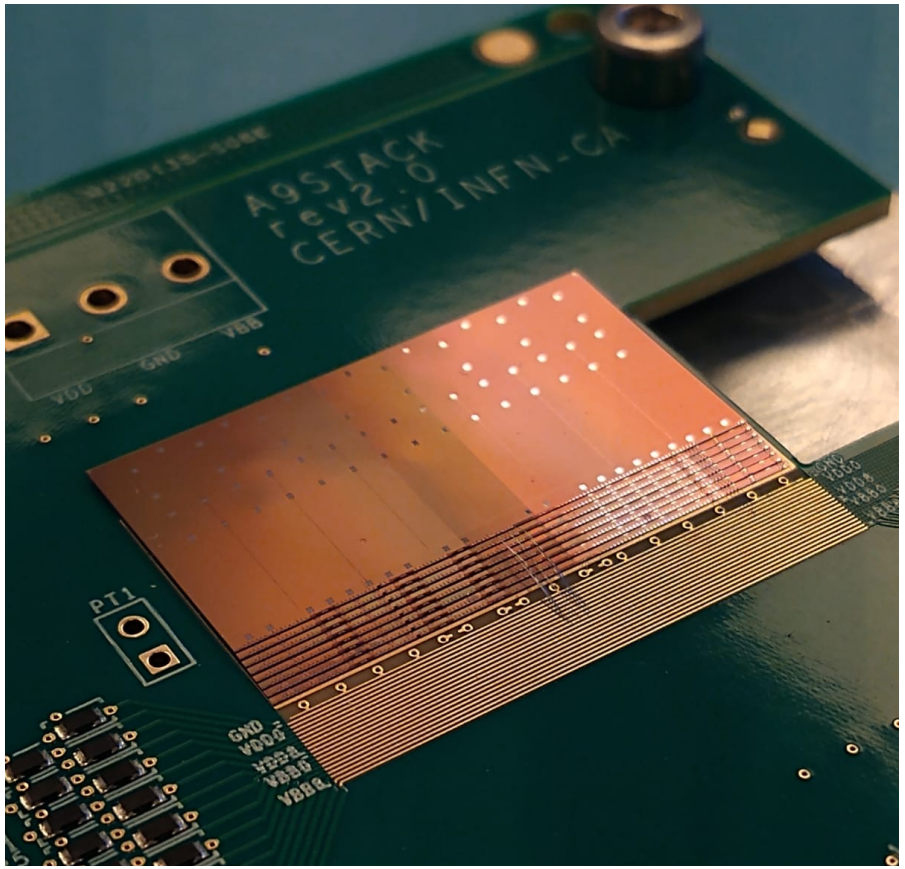
Stack of MAPS to be used in a Compton Camera to track the electrons:

- Move from functioning small size sensors
  (1.5 x 3.0 cm^2) to large size (~10 x 10 cm^2) mechanical assemblies

- Test beam with small size sensors by end of this year

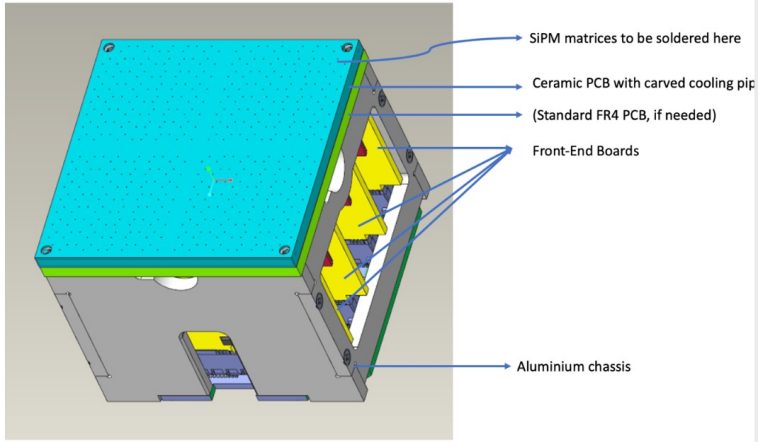
- <u>Assemblies of large size dummies in 2026</u>

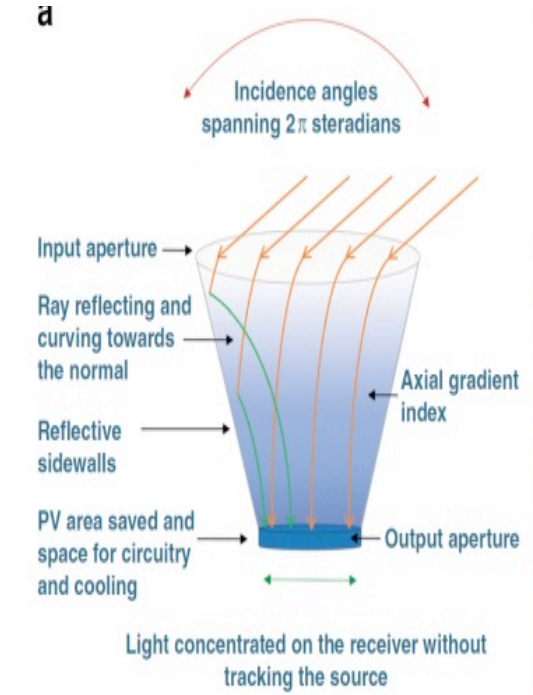


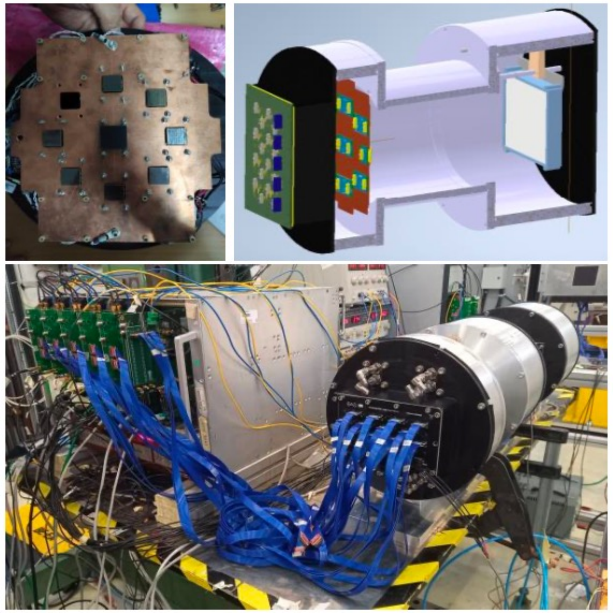


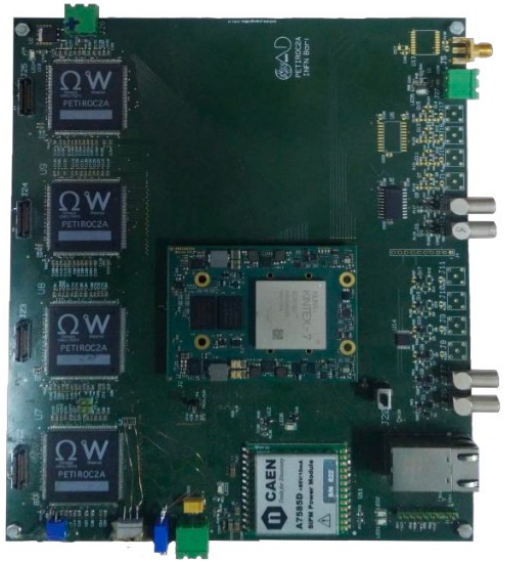
ALICE 3 - RICH

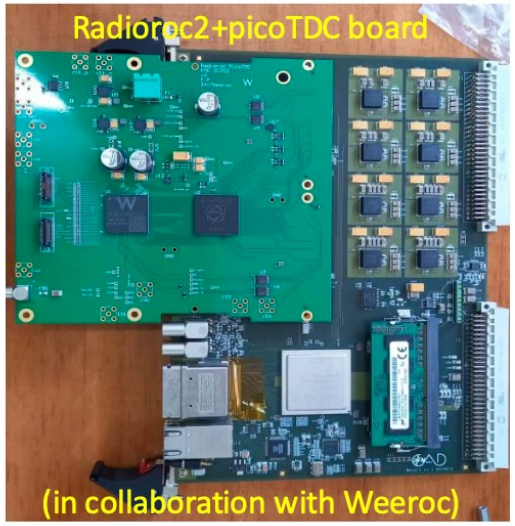
- Improve SiPM radiation hardness.
  - SiPM technology (Back Side Illuminated, CMOS-SPAD).
  - SiPMs irradiation campaign.
  - Light concentrators.
  - Development of cooling/annealing systems
    - ***operating temperature -40 °C***.
- PS beam test in October 2024
  - Relevant contribution of the mechanical and electronical services
- Mechanical structure study
- ASIC FEE: ALCOR for DUNE (DENED)

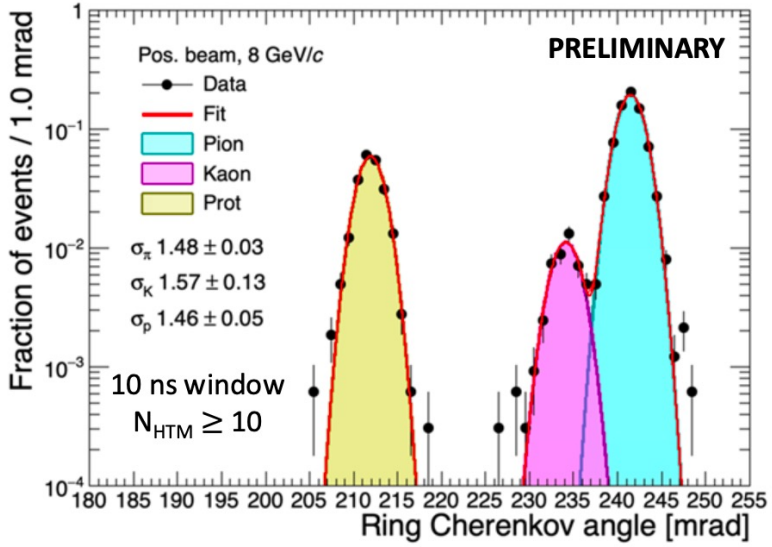








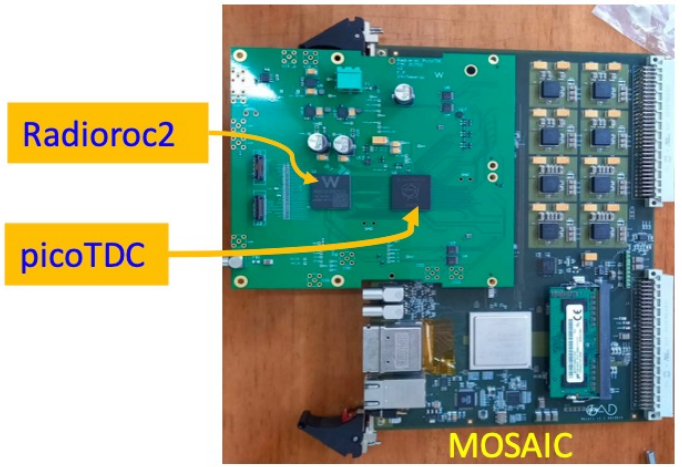


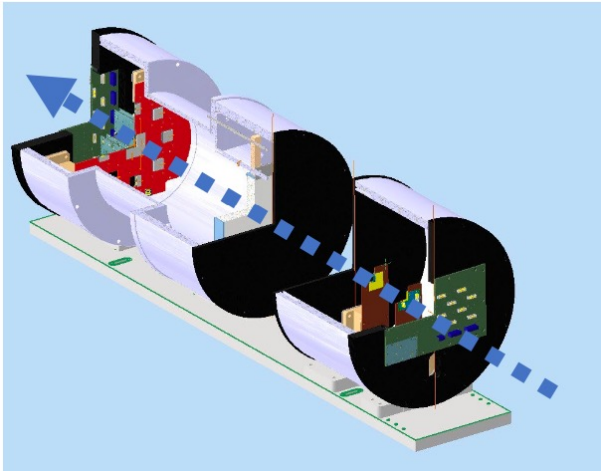


ALICE 3 – RICH

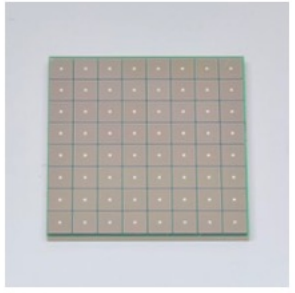
Plans

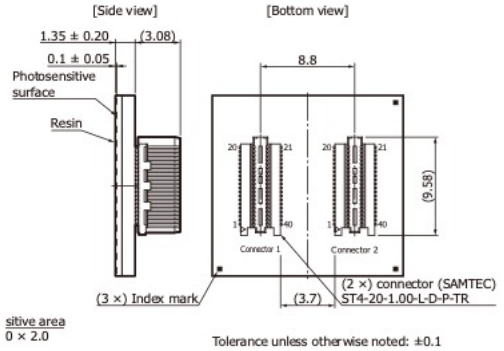
- Beam tests 2025 (July and September)
  - Electron ID performance with gaseous radiator
  - Reconstruction performance with irradiated arrays
  - Performance studies with ALCOR v2 ASIC (Sept)
- 2026
  - Simulation studies
  - Beam tests
    - Testing radiation hard SiPMs, ASIC ALCOR
  - Module prototype studies
  - Mechanical structure study
  - Cooling/annealing studies in lab.

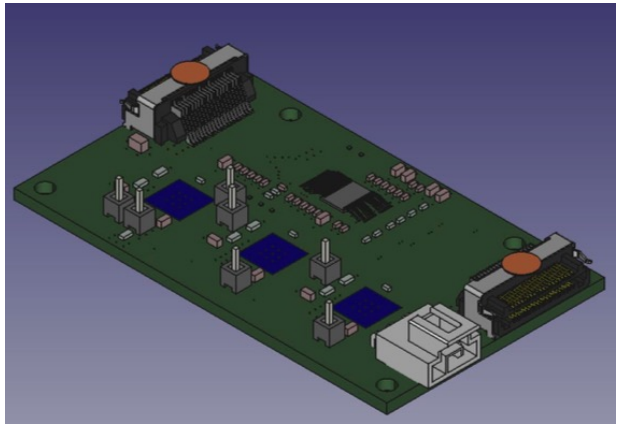


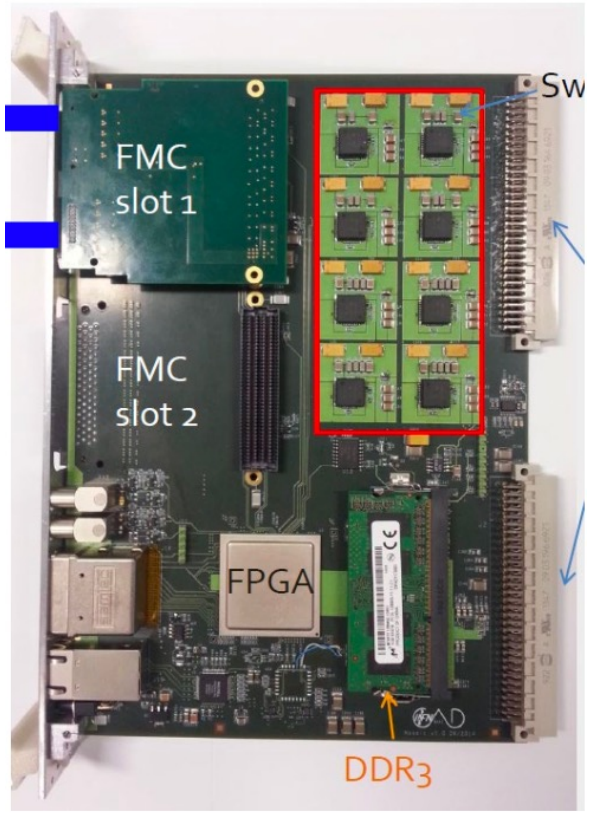


ALCOR board









ALICE requests to the INFN technical services

Project	Activity	Servizio elettronico	Servizio meccanico	Officina	Alte tecnologie
ITS3	Setup to qualify the wire-bonding between sensor and FPC with small wind tunnel				
ITS3	Support for baby-MOSAIX setup				
ALICE 3 - Tracker	Vacuum setup for IRIS prototype				
ALICE 3 - Tracker	Definition of assembly procedures for the middle-layer modules				
ALICE 3 - RICH	Design of a new front-end board for the new ASIC				
ALICE 3 - RICH	Re-work on the current boards				
ALICE 3 - RICH	Mechanical support structure for the ALICE3 RICH detector				
ALICE 3 - RICH	Development of the mechanical components required for test beam and laboratory testing of detector prototypes				
PRIN project	Assembly of A9 mechanical modules with large-area sensors and development of dedicated handling tools				

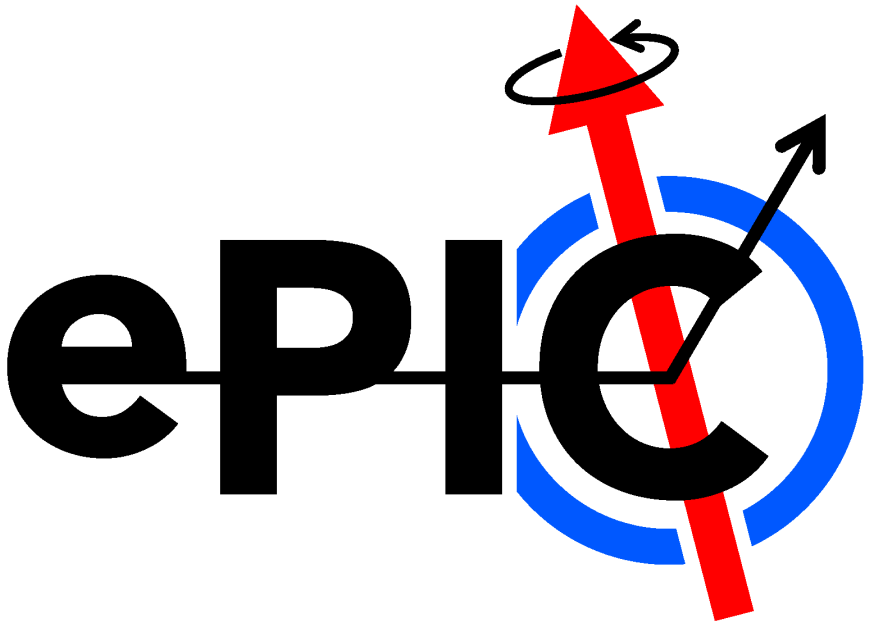
FTEs

Ricercatori	ALICE
Acharya Shreyasi	100
Barile Francesco	70
Bruno Giuseppe Eugenio	80
Chirilli Giovanni Antonio	30
Colamaria Fabio	90
Colella Domenico	50
Colelli Agelo	100
De Cataldo Giacinto	100
Di Bari Domenico	70
Di Ruzza Benedetto	70
Elia Domenico	50
Kumar Shyam	70
Liotino Rocco	70
Manzari Vito	70
Mastroserio Annalisa	70
Mazzilli Marianna	100
Mazziotta Nicola	20
Nappi Eugenio	70
Nicassio Nicola	70
Palasciano Antonio	100
Saha Arkaprabha	100
Terrevoli Cristina	80
Triloki Triloki	100
Volpe Giacomo	70

Tecnologi	ALICE
Camerlingo Maria Teresa	70
Ciani Giovanni Francesco	20
De Robertis Giuseppe	30
De Venuto Daniela	50
Khatun Anisa	70
Licciulli Francesco	20
Loddo Flavio	20
Marzocca Cristoforo	30
Pastore Cosimo	35
Torresi Marco	50
Totale	**3.95**

+0.8 from ASPIDES synergical to ALICE

Local responsible: A. Mastroserio



EIC_NET

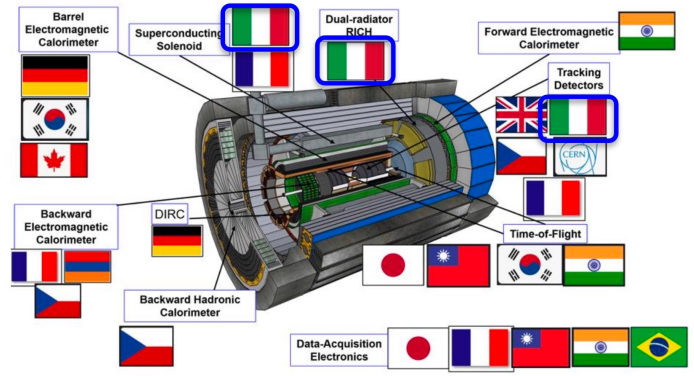
Status of EIC project and ePIC collaboration

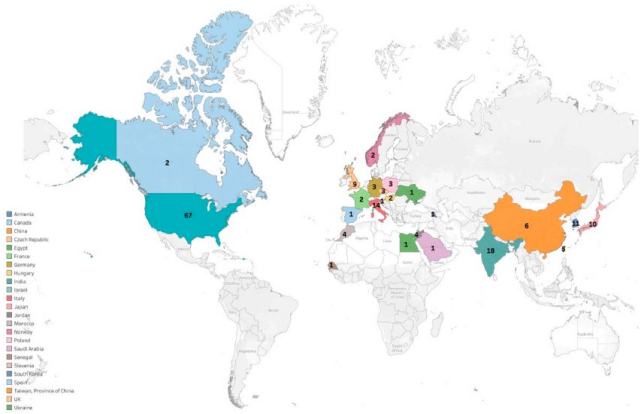
- EIC Reference Schedule
  - project on track, navigating through financial constraints
    - CD-2 (60% design maturity, pre-TDR) : ~Q2 2026
    - CD-3 (full TDR → start construction) : **~Q1 2028**
    - Early CD-4 (first beams → early physics): **~Q2 2034**

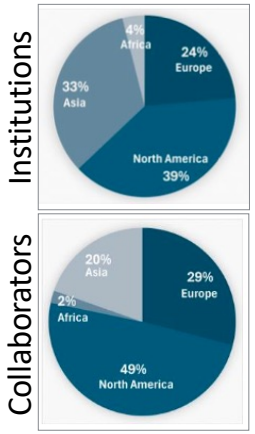
→

6 months delay
- June RRB (wrt last November RRB)
- Delivery of subprojects
- Revised annual funding assumption

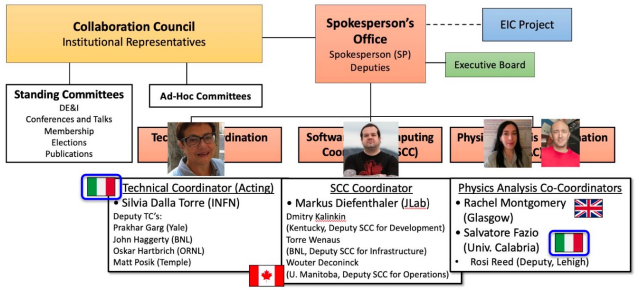
- IKC for subdetector project
  - Target for detectors is ~30% of the total scope: ~100M$
    - Italy (procurement) and France (design) detector solenoid
    - UK, IT, FR, KR, CA and JP scope in several detector areas
    - Other IKCs are being discussed with IN, IL, TW and potentially others could follow





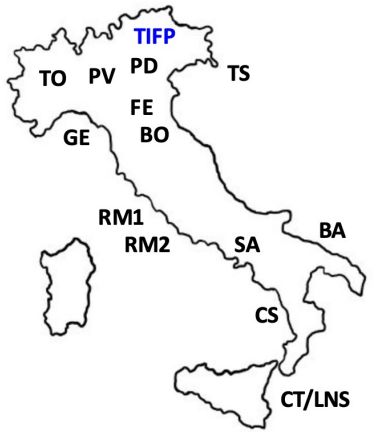


- **A new (growing) collaboration**
  - 2025 survey: > 1k collaborators, 173 institutions, 25 countries, 4 world regions

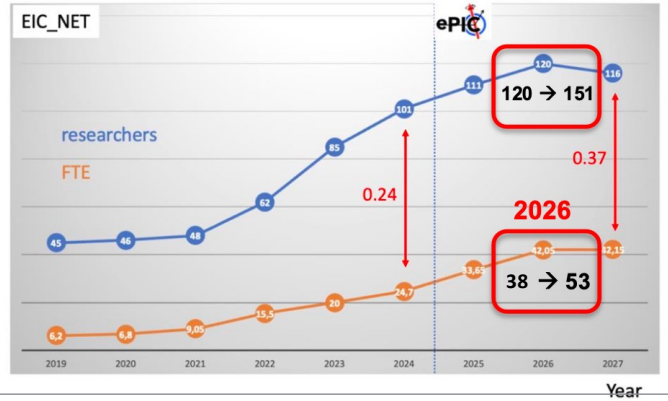


ePIC Italia and activities in Bari

- 15 INFN units:
  - largest cluster within CSN3



- Large increase in FTE: 35% (expected ~20%)
  - increasing FTE of collaborators (avg FTE 0.31 → 0.35)
  - including new interested colleagues/groups (new FTEs)
  - doing quite well with DOE-funded contracts (new FTEs)
  - doing quite well with DOE-funded contracts (new FTEs)
  - prepare for further increase (PhDs, outreach activity etc)



- In-kind contribution for detectors from INFN
  - **dRICH**: 5.8 k€ [BA BO CS CT LNS FE GE RM1 RM2 SA TO TS]
  - **SVT**: 900 k€ [BA PD PV TIFP TS]
  - **uRWELL-ECT**: 500 k€ [CT GE RM2]

} TOT: 7.2 M€

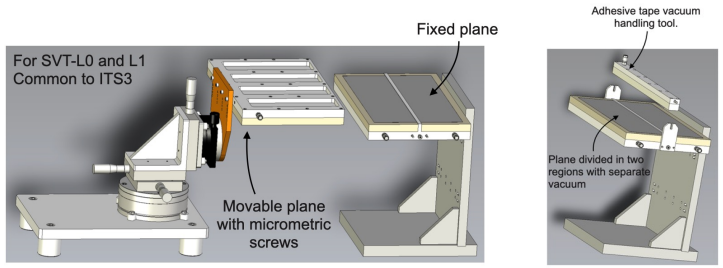
- In-kind contribution for solenoid magnet from INFN: ~15 M€

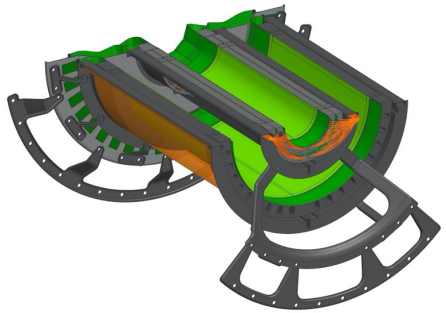
Total of 21 INFN people *in various coordination roles both in ePIC Italia and in the ePIC Collaboration*

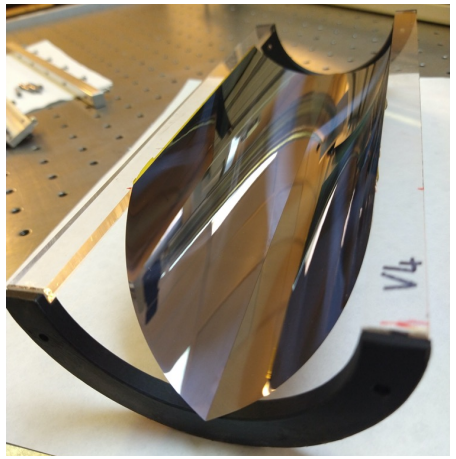
ePIC Italia and activities in Bari

Domenico Elia → Responsabile Nazionale + ePIC Election Committee
Domenico Colella → Responsabile Locale
Annalisa Mastroserio → ePIC Publication Committee chair
Shyam Kumar → ePIC HF-Jets PWG convener

- Defining procedures for SVT L0-L1 HB assembly
  - Prototyping campaign ongoing
  - Synergy with ALICE-ITS3 and ALICE3-ML



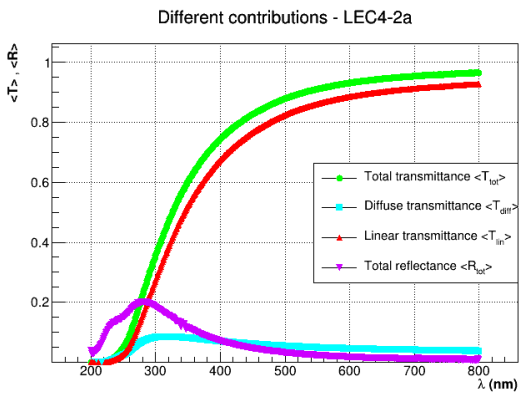




Domenico Elia → ePIC SVT DSC IB responsible
INFN Bari → ePIC SVT L0-L1 half-barrels construction responsibility

- Aerogel tile characterization
  - Synergy with ALICE3 bRICH

Giacomo Volpe → ePIC dRICH DSC QA aerogel convener
INFN Bari → ePIC dRICH QA aerogel responsibility



FTEs and request ePIC Bari 2026

Cognome	Nome	FTE
RICERCATORI		
Barile	Francesco	0.3
Bruno	Giuseppe Eugenio	0.2
Chirilli	Giovanni	0.3
Colella	Domenico	0.5
Di Bari	Domenico	0.3
Di Ruzza	Benedetto	0.1
Elia	Domenico	0.5
Kumar	Shyam	0.3
Liotino	Rocco	0.3
Manzari	Vito	0.3
Mastroserio	Annalisa	0.3
Nappi	Eugenio	0.3
Nicassio	Nicola	0.3
Perrino	Roberto	0.3
Terrevoli	Cristina	0.2
Triloki	Triloki	0.2
Vivek	Patel	1.0
Volpe	Giacomo	0.3

Cognome	Nome	FTE
TECNOLOGI		
Pastore	Cosimo	0.2
Camerlingo	Maria Teresa	0.3
Ciani	Giovanni Francesco	0.2
Spinoso	Vincenzo	0.3
Diacono	Domenico	0.3
Khatun	Anisa	0.3

Tot.: 7.6

Local responsible: D. Colella

FTEs and request ePIC Bari 2026

Attività	Richieste Servizi			
	Elettronico	Meccanico	Officina	Alte Tecnologie
SVT - L0-L1 prototypes, including heaters and more advanced versions				
SVT - L2 bending/assembly studies				
dRICH - Aerogel Refractive Index Measurement Setup				

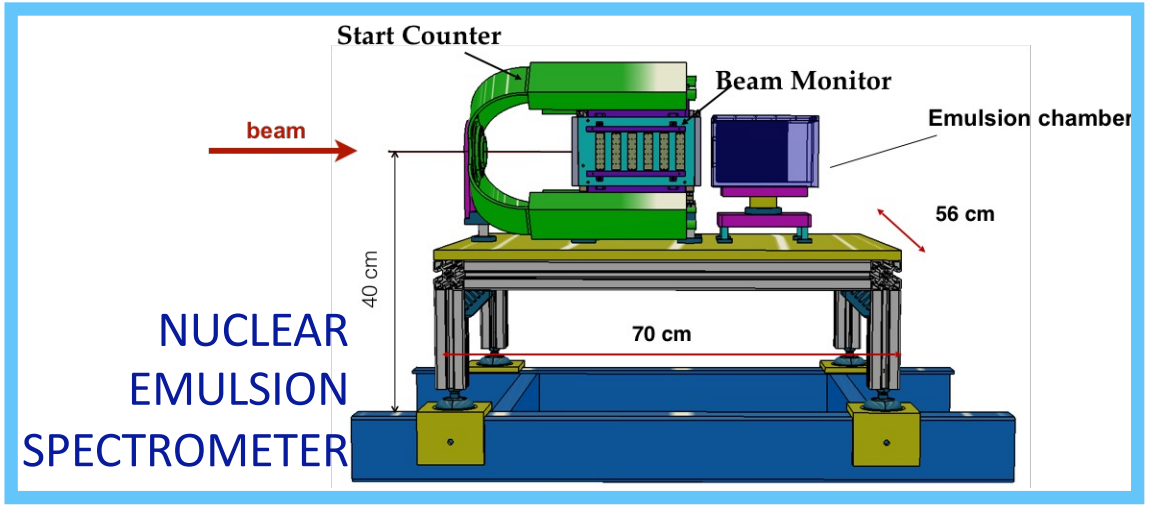
FTEs and request ePIC Bari 2026

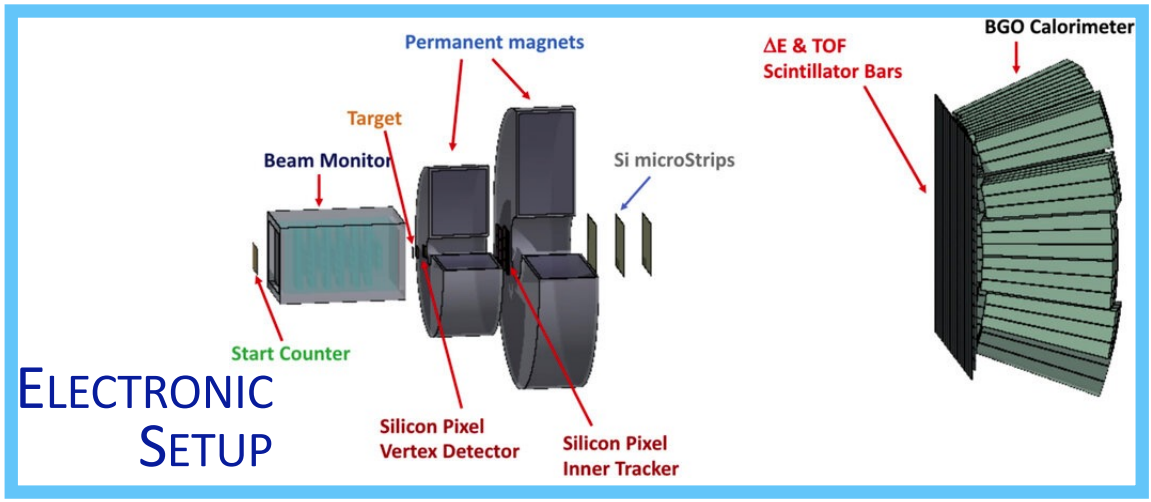
Capitolo	Descrizione	Parziali (k€)		Rimuovi	Modifica	Totale (k€)	
		Richieste	SJ			Richieste	SJ
apparati	SVT - Contributo run di produzione sensori	50.00	0.00			60	0
	SVT - Acquisto carbon foam per local support structures	10.00	0.00				
consumo	SVT - Stampe 3D strutture di supporti meccanici per costruzione prototipi L0-L1 e studi piegamento L2	1.00	0.00			28	30
	SVT - 2 Mandrini piegamento sensori a raggi L0-L1 ed 1 Mandrino per studi piegamento sensori a raggi L2	5.00	0.00				
	SVT - Sviluppo e produzione jig incollaggio L0-L1 e studio piegamento L2	3.00	0.00				
	SVT - Carbon foam (Allcomp K9 std density e ERG Duocell, con lavorazione) per local support structures	5.00	0.00				
	SVT - Silicio blank (10 wafer) per prototipi L0-L1 e studio piegamento L2	10.00	0.00				
	dRICH - Sviluppo tile di aerogel di grandi dimensioni (20x20 cm2)	0.00	30.00				
	dRICH - Equipaggiamento banco ottico per misure di precisione di indice di rifrazione aerogel	4.00	0.00				
missioni	Partecipazione riunione annuale EICUG/ePIC (USA) 2.5 x 7gg x 4 persone	10.00	0.00			57.5	5.5
	Partecipazione riunione annuale collaborazione ePIC (USA) 2.5 x 7gg x 4 persone	10.00	0.00				
	Contatti tra sedi INFN per sviluppi dedicati SVT e dRICH: 2 viaggi x 3 persone	3.00	0.00				
	Contatti ITS3 per sviluppi dedicati SVT (CERN): 5gg x 4 persone	4.00	0.00				
	RN: Tasca indivisa (supporto piccoli gruppi e mobilitÃ RN escluso RRB)	20.00	0.00				
	RN: Partecipazione riunioni RRB (2 viaggi in USA 2 x 2.5 KEU)	5.00	0.00				
	Partecipazione test beam campioni aerogel (CERN): 7gg x 3 persone	0.00	3.00				
	Partecipazione riunione DSC SVT (USA): 7gg x 1 persona	0.00	2.50				
trasporti	Trasporto materiali per assemblaggio prototipi verso PD/PV/TS	2.00	0.00			2	0
Totale						147.5	35.5

The FOOT (FragmentatiOn Of Target) experiment

Aim of the FOOT experiment

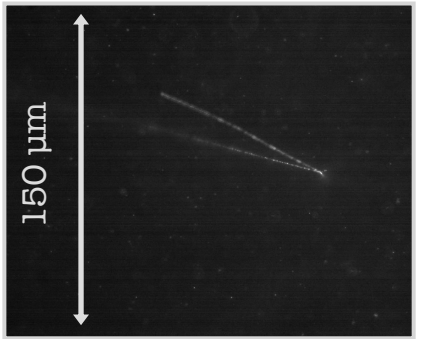
- Charge Particle Therapy efficiency currently limited by the lack of knowledge of the nuclear fragmentation cross sections in body tissues
- **The FOOT experiment aims at measuring nuclear fragmentation cross sections, in inverse kinematics, to develop more precise Treatment Planning Systems for proton and ion therapy and Radio Protection in Space**
- 2 complementary table-top setups: **nuclear emulsion spectrometer** (Z≤3, <70°) + **electronic setup** (Z≥3, <10°)





Spin off:
PRIN "DAMON: Direct meAsureMent of target fragmentatiON"

- **Feasibility study for making a direct measurement of target fragments produced by a proton beam using Nano Imaging Trackers and optical microscopes overcoming the diffraction limits**
- People involved from Bari: G. Galati (PI), T. Maggipinto, S. My. Other 2 units: INFN (LNGS), UniNA
- PRIN ends on 28/02/2026, but activities will continue under FOOT



Bari Activities (I)

Nuclear emulsion Spectrometer

- New Monte Carlo simulations: Fluka + Geant4 [BIC, INCLXX, QMD].
- Article under EB review to be submitted to PRC (G.Galati first author): first reaction and production cross sections of Oxygen@200MeV/n on C, C_2H_4 and (through inverse kinematic) on H in the energy range 80-180 MeV/n

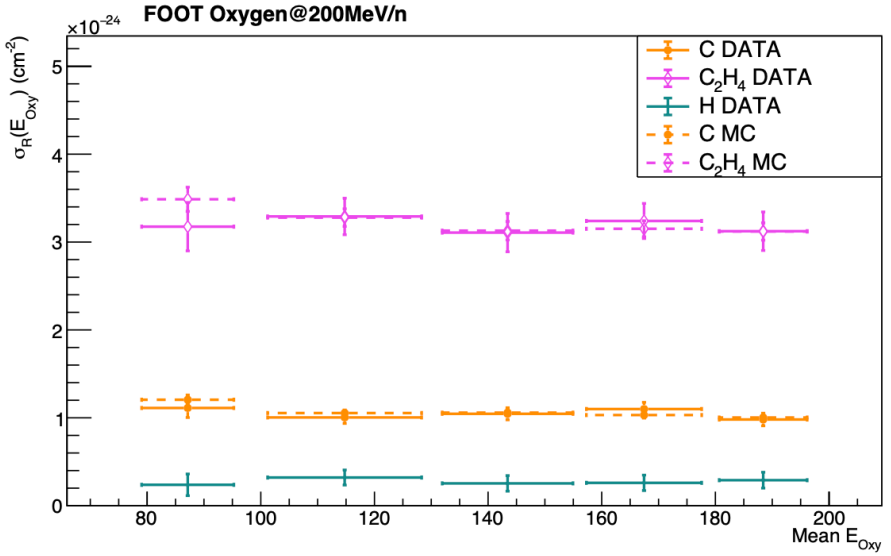
Measurement of 200 MeV/n ^{16}O nuclear reaction cross-section on carbon and polyethylene targets with the nuclear emulsion detector of the FOOT experiment

G. Galati,[1,2] V. Boccia,[3,4] A. Alexandrov,[4] B. Alpat,[5] G. Ambrosi,[5] S. Argir'o,[6,7] M. Barbanera,[5] N. Bartosik,[7] G. Battistoni,[8] M.G. Bisogni,[9,10] S. Brambilla,[8] F. Cavanna,[7] P. Cerello,[7] E. Ciarrocchi,[10,9] N. D'Ambrosio,[11] A. De Gregorio,[12] G. De Lellis,[3,4] A. Di Crescenzo,[3,4] B. Di Ruzza,[13,2] M. Dondi,[14,15] M. Donetti,[16,7] Y. Dong,[8] M. Durante,[3,17] R. Faccini,[18,12] V. Ferrero,[7] C. Finck,[19] E. Fiorina,[7] M. Francesconi,[4] M. Franchini,[15,14] G. Franciosini,[20,12] L. Galli,[10] M. Ionica,[5] A. Iuliano,[4] K. Kanxheri,[5] B. Kharpuse,[7] A.C. Kraan,[10] A. Lauria,[3,4] E. Lopez Torres,[21,7] T. Maggipinto,[1,2] M. Magi,[20,12] A. Manna,[14,15] M. Marafini,[22,12] S. Masci,[11] M. Massa,[10] C. Massimi,[14,15] I. Mattei,[8] A. Mengarelli,[14] A. Mereghetti,[16] R. Mirabelli,[18,12] A. Moggi,[10] M.C. Morone,[23,24] M. Morrocchi,[10,9] S. Muraro,[8] N. Pastrone,[7] V. Patera,[20,12] F. Pennazio,[7] F. Peverini,[5,25] C. Pisanti,[14,15] P. Placidi,[5,26] M. Pullia,[16] F. Quattrini,[18,12] L. Ramello,[27,7] C.A. Reidel,[17] R. Ridolfi,[14,15] L. Sabatini,[28] L. Salvi,[5,25] C. Sanelli,[28] A. Sarti,[20,12] O. Sato,[29] S. Savazzi,[16] L. Scavarda,[30] A. Schiavi,[20,12] C. Schuy,[17] E. Scifoni,[31] L. Servoli,[5] G. Silvestre,[5,25] M. Sitta,[27,7] B. Spadavecchia,[6,7] R. Spighi,[14] E. Spiriti,[28] L. Testa,[18,12] V. Tioukov,[4] S. Tomassini,[28] F. Tommasino,[32,31] M. Toppi,[20,12] G. Traini,[12] A. Trigilio,[28] G. Ubaldi,[14,15] A. Valetti,[7,6] M. Vanstalle,[19] M. Villa,[15,14] U. Weber,[17] R. Zarrella,[14,15] A. Zoccoli,[14,15] and M.C. Montesi[33,4]
(FOOT Collaboration)

[1] *University of Bari, Department of Physics, Bari, Italy*
[2] *Istituto Nazionale di Fisica Nucleare (INFN), Section of Bari, Bari, Italy*

Electronic Setup (MSD subdetector)

- Calculation of the common-noise of the readout system and the channel efficiency in the Micro Strip Detector subdetector using data collected at TIFPA-INFN by irradiating the subdetector with protons in the energy range of 70-230 MeV.



Next Data taking

- CNAO, November 2025: p and C beams available

Collaboration Meeting

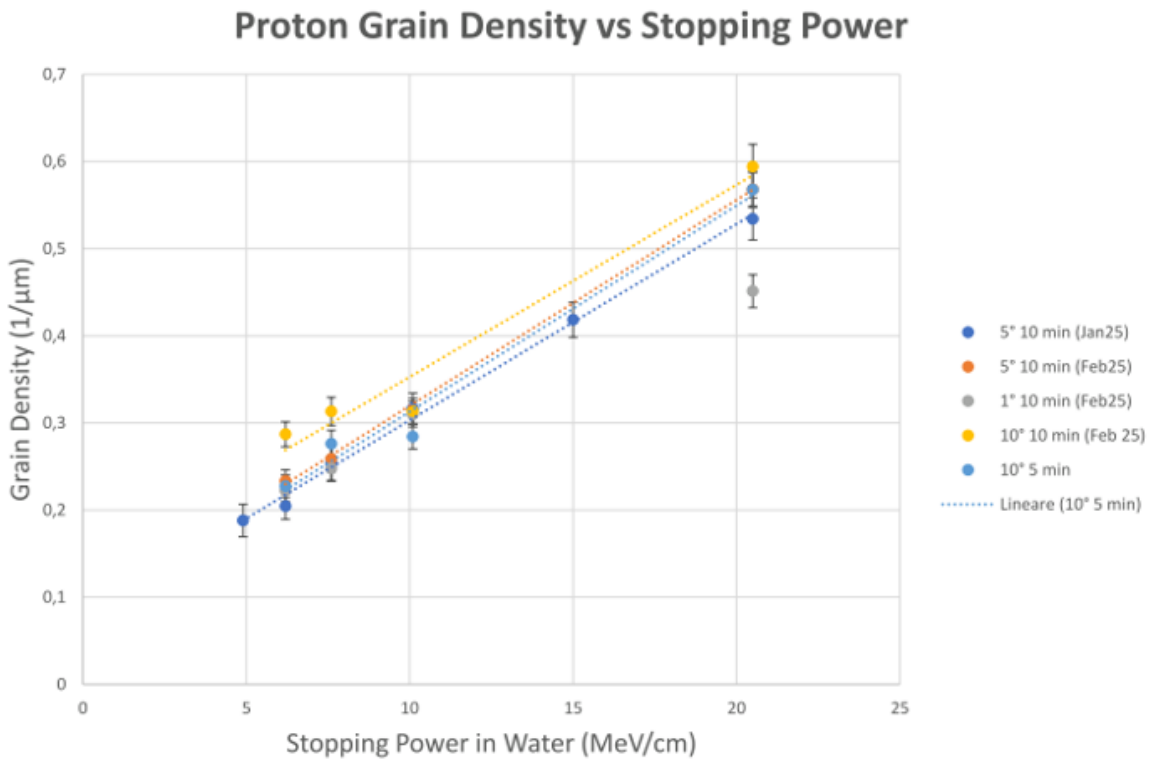
- XIX FOOT Collaboration Meeting will be held in Bari in December 2025

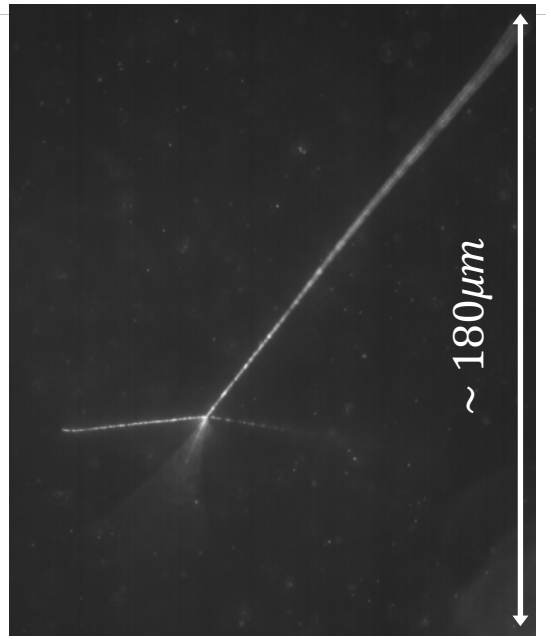
Bari Activities (II)

Direct Kinematics Measurement

- Nano Imaging Trackers (NIT) R&D at LNGS and test beam at CNAO (protons from 15 MeV to 200 MeV + Carbon @200 MeV/n)

- NIT R&D at Toho University and Nagoya University (Japan) [1 month staying, February 2025]
  - 3 exposure slots at Nagoya Proton Therapy center:
    2 test beam + 1 data taking with p@70MeV
  - Characterization of the detector's response as a function of proton energy (particle ID, energy measurement)
  - From R&D: enough material for a detector paper
  - Data taking: Analysis on-going





Future activities

- Data analysis and detectors R&D
- Study of nuclei alpha-cluster structures, never explored in the energy regime accessed by FOOT (publication foreseen)
- Cross section measurements in direct kinematics with NIT (publication foreseen)
- Plan A: Data Taking at GSI ESA PAC: Cross-Section Measurements for Space Radioprotection (12C@0.7 GeV/n and 1.5 GeV/n on Aluminium)
- Plan B: Data Taking at CNAO (p @100-220 MeV/n, 12C@200-300 MeV/n)

Participants and Requests

FTE 1.5

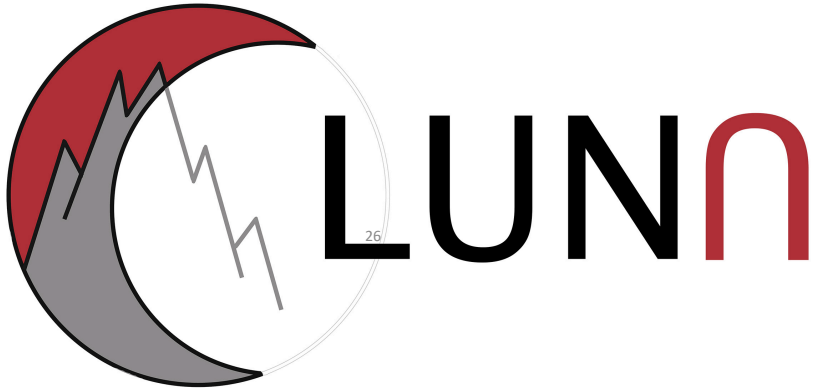
PEOPLE INVOLVED:

Giuliana Galati: 70% (local responsible)
Benedetto Di Ruzza (UniFg): 20%
Tommaso Maggipinto: 20%
Marco Pappagallo: 20%
Marianna La Rocca: 20%

- Financial request:
  Missions 12000 Euro
- Technical Support: none
- Laboratories: none

DETAILS:

Collaboration Meetings: 1.5k€
Software meetings: 1k€
NIT R&D and data taking (LNGS, GSI/CNAO): 3k€
GSI or CNAO Data Taking in 2026: 6.5k€ sub-judice



In dotazione 3

Main results and ongoing measures

- Technical paper of the $^{14}N(p,\gamma)^{15}O$ submitted on EPJ A and peper with physics results on PRL

Anteprima allegato

a comprehensive study of the $^{14}N(p,\gamma)^{15}O$ astrophysical key reaction: Description of the experimental technique including novel target preparation

A. Compagnucci[1,2], A. Formicola[3], M. Campostrini[4], J. Cruz[5], M. Aliotta[6], C. Ananna[7,8], F. Barile[9], D. Bemmerer[10], A. Best[7,8], A. Boeltzig[10], C. Broggini[11], C.G. Bruno[6], A. Caciolli[11,12], F. Casaburo[13,14], F. Cavanna[15], G.F. Ciani[16], P. Colombetti[15,17], P. Corvisiero[13,14], L. Csedreki[18], T. Davinson[6], R. Depalo[19], A. Di Leva[7,8], Z. Elekes[18], F. Ferraro[1], Zs. Fülöp[18], A. Guglielmetti[19], C. Gustavino[3], Gy. Gyürky[18], G. Imbriani[7,8], M. Junker[2], M. Lugaro[20,21], P. Marigo[11,12a], E. Masha[10,19], R. Menegazzo[11], V. Paticchio[16], D. Piatti[11,12], P. Prati[13,14], D. Rapagnani[7,8], V. Rigato[4], D. Robb[6], L. Schiavulli[9,16], R. S. Sidhu[6,22], J. Skowronski[11,12], O. Straniero[23], T. Szücs[4], S. Turkat[11,12], and S. Zavatarelli[13]

Anteprima allegato

gments

This work was supported by HUN-REN Researcher Mobility Program 2023; NKFIH grant K134197; by Fundação para a Ciência e Tecnologia (FCT, Portugal) through national funds to the Associated Laboratory in Translation and Innovation Towards Global Health REAL (LA/P/0117/2020). The work of the CAD service (M. Mongelli) and the mechanical workshop (C. Pastore, S. Martiradonna, N. Lacalamita and M. Franco) of INFN Bari is acknowledged.

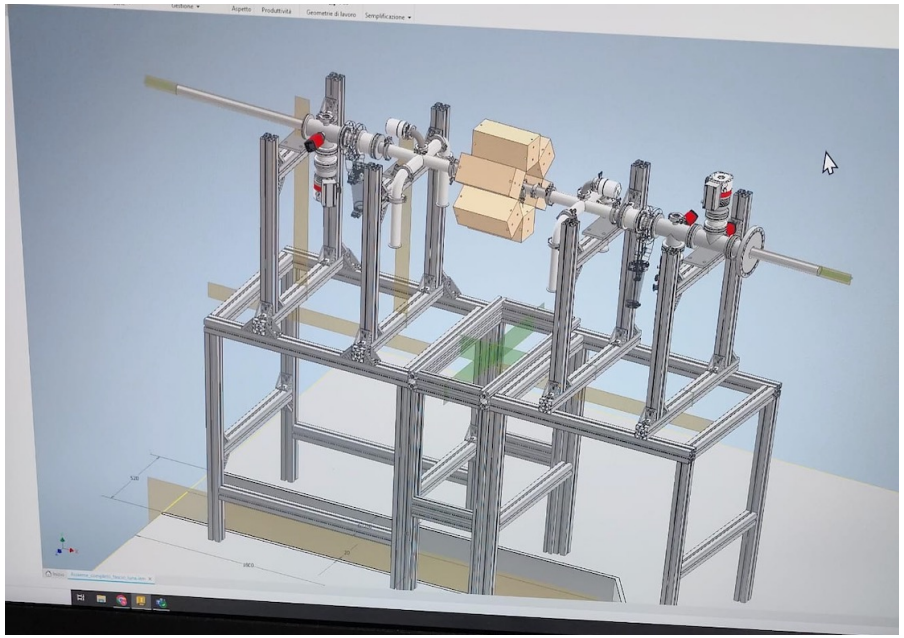
- SHADES experiment: Measurement of the $^{22}Ne(\alpha,\gamma)^{26}Mg$ reaction in progress.
  Energy range measured closer to Gamow Peak than in the literature
- The measurement campaign of $^{12}C+^{12}C$ has begun, which will be carried out for the first time in an underground laboratory

Ciani Giovanni Francesco 0.3

Sigla in dot3

Outlook for 2026

- Co-coordination of $^{22}Ne(a,g)^{26}Mg$.
- Design of the experimental setup in collaboration with the CAD service and the mechanical workshop in Bari.
- Characterization of the experimental setup of 6 NaI



Richiesta preventivi

Consumo	5 kEuro
Trasporti	2 kEuro
Missioni	6 kEuro

Request to INFN services

- Mechanical design and mechanical workshop:
  - design, construction and installation at LNGS of the support of the second beam line and the target gas of the Ion Beam Facility for the measurement of $^{22}Ne(\alpha,\gamma)^{26}Mg$ at the Bellotti Ion Beam Facility in continuity with 2025 activities. The system must be finely adjustable (tolerance a few mm) to facilitate the alignment of the beamline

In dotazione 3

Activities

Activities to 2024-2025:

- **SBS Program Completion: GEp Measurement (until August 2025: Shifts, GEM Tracker Group Support, Analysis)**
- **SBS beyond EM form factors (2027+):axial form factor (full expt proposal → PAC53, July 21-25)**

Activities 2026+:

- **Transfer of HallA→C equipment for Moller installation (2025/26)**
- **2026-2027 Development of small-scale neutron TOF counter and axial form factor test-run preparation, if approved by PAC53**
- **Analysis of SBS experiments and publications**
- **Preparation of hypernuclei experiments**

JLab SBS beyond EM form factors

Measurement of the Nucleon Axial Vector Form Factor at $Q^2 = 1$ (GeV/c)^2

J. Napolitano,[1,*] B. Wojtsekhowski,[2,†] and
P. Degtiarenko, A. Deur, J. Golak, D. Jones, C. Keppel, D.E. King,
E. Cisbani, R. Perrino, O. Benhar, D. Armstrong, T. Averett, M. Bukhari

A Proposal to Jefferson Lab PAC53

July 21-25, 2025

The Nucleon Axial-Vector Form Factor from the $p(\vec{e}, n)\nu_e$ Reaction

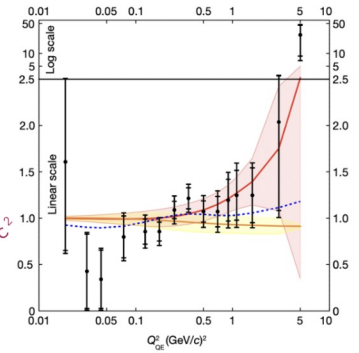
The Physics Case

Lepton-Proton Probe

electro: Charge and magnetization distributions (in terms of the well known EM form factors)

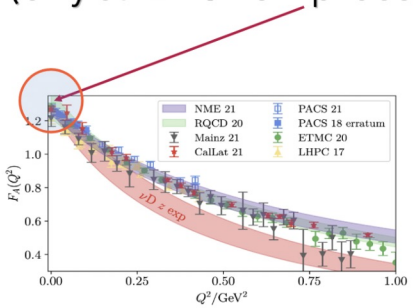
weak: Axial structure depending on spin distribution → AVFF: the experimentally least known form factor (only at Q^2=0 from β⁻-decay)

- Only known experimental data on AVFF deriving from PCAC π electro-production and neutrino scattering (νA,νp,νD): dated (1980, except Minerva, 2023), poor statistics, affected by systematic uncertainties (neutrino flux, initial state broad ν energy, nuclear effects, bound proton).



Ratio wrt dipole cross-section with axial mass

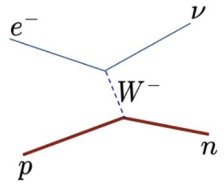
(T. Cai et al., Nature 614, 48, 2023)



A. Meyer, A. Walker-Loud, C. Wilkinson *ARNPS.* 72 (2022) 205-232

On the other hand, theoretical models, including *z-expansion fit* and *LQCD*, display large variability and uncertainties.

$e^- + p \longrightarrow n + \nu$ $\quad \langle n|A^+_\mu(0)|p\rangle = \bar{u}_{S_n}(\vec{p}_n)\left(\gamma_\mu\gamma_5 F_A(q^2) + i\frac{q_\mu\gamma_5 F_P(q^2)}{m_\pi}\right)u_{S_p}(\vec{p}_p)$



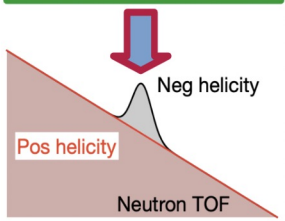
AVFF yields ~67% of the cross section

F_P suppressed by m_e/m_N

Bonus selection from beam helicity

$\left.\frac{d\sigma_{pn}}{dQ^2}\right|_\lambda = (1-\lambda)\left.\frac{d\sigma_{pn}}{dQ^2}\right|_{unp}$

$\lambda = \pm 1 \langle {right\ handed \atop left\ handed}$



Concept of the Measurement

- free proton target (no Fermi motion) - high precision intense electron beam
- constrained kinematics, beam calibrated neutron max energy $E^{rec}_{beam} = \frac{E_n + (M_p^2 + M_n^2)/2M_p}{1 + (P_n \cos\theta_n - E_n)/M_p}$
- recoiling neutron detection with high time resolution (~100 ps)
- suppression/veto of EM processes ($\sigma_{EM}/\sigma_\nu \sim 10^7$)

Overview of expt key numbers

25 cm LH2 target, collimated to 10 cm
- 120 uA beam – longitudinally polarized
- 55 days, E = 2.2 GeV, Q^2 = 1 GeV^2

Dominant processes to control
- elastic **ep** removed by sweep magnet
- γp→π⁺ n (reduced by veto arm)
- np→np scattering
- …

> Current activity:

- **Weekly Monte Carlo meetings – Advanced level**
- **Preparation of ~10 scintillators+PMT @ Jlab for characterization**
- Evaluation of in-kind contributions (**FINUDA TOFONE, CLAS Calo Scint.,** BNL STAR Calo, …)
- **Undergraduate student awarded INFN support for Jlab stay (scint. Tests + MC)** - (D. GE n.14287, Bando n. 27321 CSN3)
- **Dissemination, call for interests** (meetings, conferences, workshops: APS meetings, Lepton Interactions with Nucleons and Nuclei @ Marciana Marina/Elba, EuNPC @ GANIL/Caen, BARYONS2025)

> Collaboration Matters:

- 100+ members signing the PAC proposal (Jlab, Temple, W&M, Shandong, INFN, Uva, ANL, MSU, VT, …)
- Attracting cross interests of neutrino oscillations community
- Organizing Mini-Workshop within SBS meeting Nov-Dec. 2025

> INFN involvement:

- Most of INFN JLAB12 members (22) from several Units signed the proposal
- Commitments in terms of FTE to be developed according to timeline of the experiment

BARI – Preventivi 2026

- Personale: R. Perrino 70% (30% ePIC)
- Attività:
  - Axial-Vector Form Factor
  - GEM/Tracker-SBS

- Missioni:

Richiesta	Progetto	Motivazione
– 6000	AVFF	sviluppo rivelatore neutroni 2 x 2 settimane @Jlab
– 3000	SBS	trasfer. strumentazione HallA→C 1 x 2 settimane @Jlab

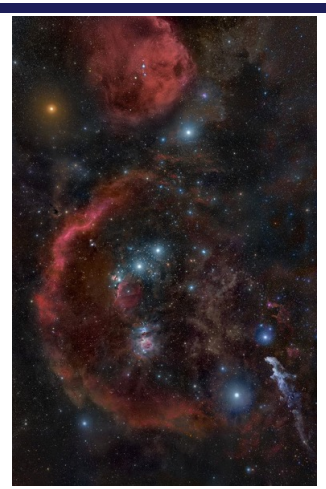
- Consumabile:

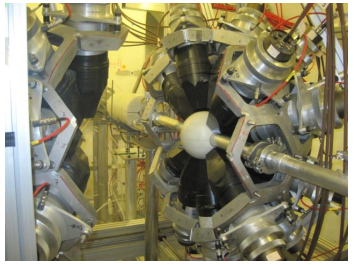
Richiesta	Progetto	Motivazione
– 7500	AVFF	sviluppo rivelatore neutroni, scintillatori, sensori ottici, caveria, materiali per wrapping, accessori

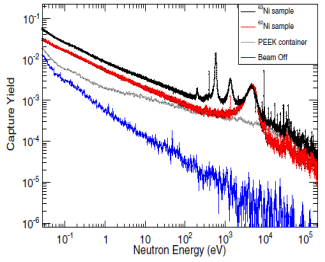
- L'attività di sviluppo del rivelatore di neutroni, data la esigua consistenza di FTE/BA sul progetto, sarà incentrata su laboratori a Roma, LNF e prevalentemente a JLAB.
- Pertanto non si fanno, per il 2026, richieste di accesso ai servizi di Sezione.

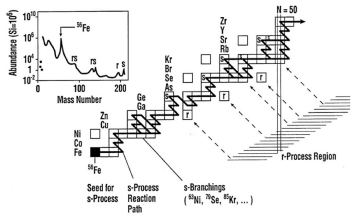
Esperimento n_TOF

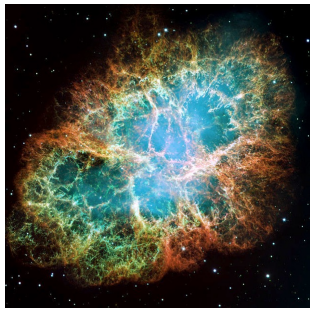
neutron Time Of Flight











Activities n_TOF Ba 2025

- Measures ^{nat}Mo(n,γ), ^{96}Mo(n,γ), ^{98}Mo(n,γ)
- ^{24}Mg(n,n') and LiF(n,n’) measures
- Development of Slow Control micromegas detectors
- Proposal for Capture Cross Section Measure ^{121,123}Sb(n,g), ^{19}F(n,n') and ^{28}Si(n,n') approved by the INTC
- Test for X17 measurement
- Data analysis

Activities n_TOF Ba 2026

- Cross section measurements ^{121,123}Sb(n,γ)
- Measures ^{19}F(n,n'), ^{28}Si(n,n') of interest for nuclear technologies
- x17 measurement
- Data analysis

Request n_TOF Ba 2026

Partecipanti

- N.Colonna 100%
- A.M. Mazzone 50%
- G. Tagliente (RL) 70%
- V. Variale 50%
- R. Mucciola 100%
- U. Salma 100%
- M. Mastromarco 100%
- G. Perfetto 100%

FTE 6.7

PRIN associati a n_TOF

Supporto Tecnico

- Non ci sono richieste specifiche

- Missioni 44 k€
- Apparati 12 k€
- Consumo 14 k€

Backup

Richieste 2026 discusse con i Servizi

Progetto	Officina Meccanica	Progett. Meccanica	Servizio Elettronico	Alta Tecnologia
RICH	1 mp	2 mp	2 mp	-NO-
Silici (*)	5 mp	5 mp	0,5 mp	4 mp
Totale	**6 mp**	**7 mp**	**2,5 mp**	**4 mp**

FTE and request ePIC Bari 2026

Attività	Richieste Servizi			
	Elettronico	Meccanico	Officina	Alte Tecnologie
SVT - Prototipi L0-L1, incluso modello integrante heaters e versioni più evolute	0.5	1	1	3
SVT - Studi piegamento/assemblaggio L2	0	1	1	1
dRICH - Setup misura indice di rifrazione aerogel	0	0	0.5	0

RICHIESTA SERVIZI

- 1 mese/uomo per servizio progettazione e 1 mese/uomo per officina meccanica: progettazione, costruzione e installazione ai LNGS del supporto del supporto della seconda linea di fascio e del gas target della Ion Beam Facility per la misura della $^{22}Ne(a,\gamma)^{26}Mg$ alla Bellotti Ion Beam Facility in continuità con attività 2025.
  Il sistema deve essere regolabile di fino (tolleranza qualche mm) per facilitare l'allineamento della beamline