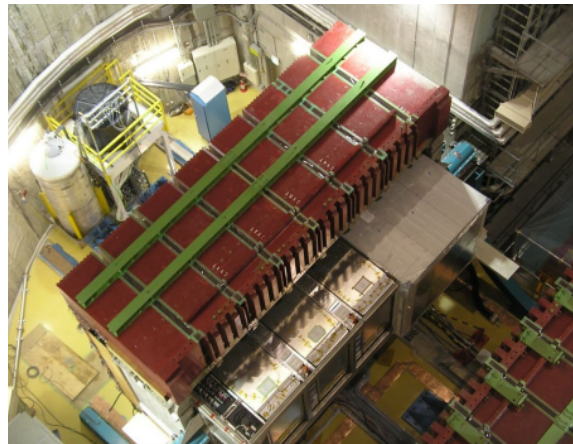
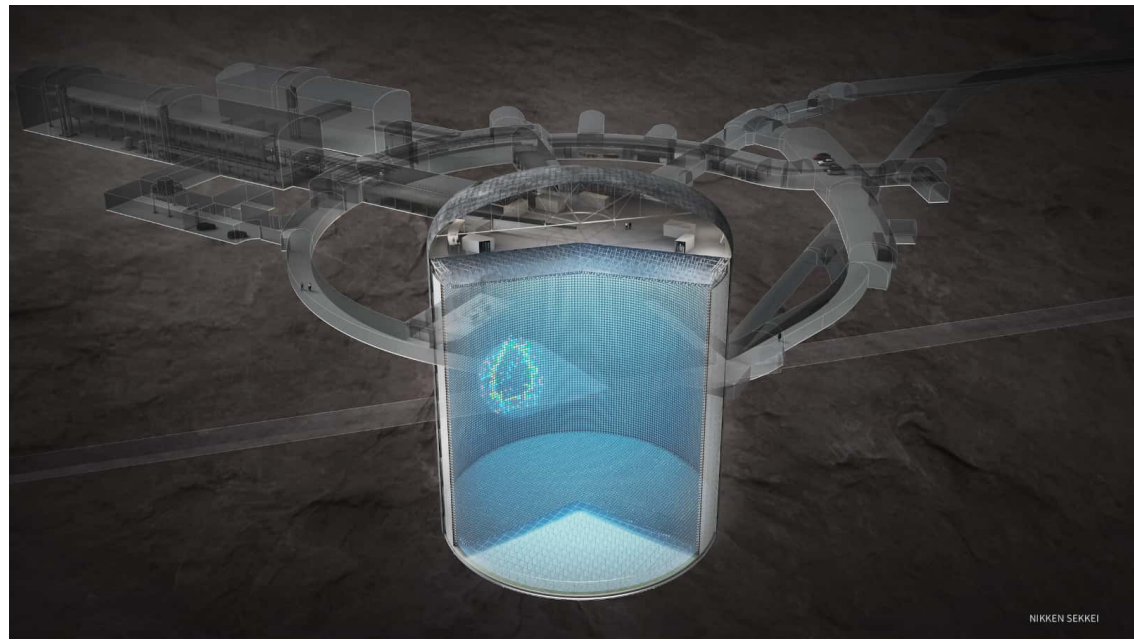


Presentation of new candidate HK members from INFN

14 November 2025



The candidates new members

Surname	Name	Affiliation
Tangaro	Sabina	INFN and Bari University
Amoroso	Nicola	INFN and Bari University
Monaco	Alfonso	INFN and Bari University
Bellotti	Roberto	INFN and Bari University
Cavoto	Gianluca	INFN and Univ. Roma1
Pandolfi	Francesco	INFN Roma1
Bellini	Fabio	INFN and Univ. Roma1
Renga	Francesco	INFN Roma1
Casali	Nicola	INFN Roma1
Bigongiari	Gabriele	INFN Pisa & Univ. of Siena
Maestro	Paolo	INFN Pisa & Univ. of Siena
Pupilli	Fabio	INFN Padova

Cavoto



Pandolfi



Renga



Casali



Bellini



Pupilli



Monaco



Bellotti



Tangaro



Amoroso



Bigongiari



Maestro



Candidate members from Bari



The research interests of the new members focus on applying **Artificial Intelligence and Machine Learning techniques to the analysis of heterogeneous data**, spanning medical [1,2], pharmaceutical [3,4], economic [5], and remote sensing applications [6,7].

The group leader, **Prof. Bellotti** — former Director of the Department of Physics in Bari — is currently serving as Rector of the University of Bari. The group is strongly engaged in third-mission activities and technology transfer, particularly through its academic spin-off.

Prof Roberto Bellotti and **prof. Alfonso Monaco** have a long-standing interest in astroparticle physics. In particular, they have actively participated with leading roles in the **MACRO** and **PAMELA** experiments.[8,9,10].

Prof. Sabina Tangaro served as coordinator of the **Technological Research** experiments of the **INFN Bari** for the period 2019-2025.

Prof. Nicola Amoroso teaches **Machine Learning for Physics** at the Department of Physics, University of Bari. One of his PhD students has been already actively involved in Hyper-K activities for over a year.



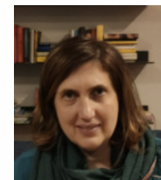
Bellotti



Amoroso



Monaco



Tangaro

Candidate members from Bari: contributions



- Given their field of expertise, the new members would like to contribute to the **development of reconstruction and analysis software**, making use of new technologies wherever possible.
- In particular, they are interested in the design, development and implementation of **algorithms based on machine learning and artificial intelligence**.
- The new members have already been collaborating with other colleagues from the Bari Group (Nicola Calabria and Nataly Ospina) involved in the development of Hyper-Kamiokande reconstruction programs. **The idea is indeed to strengthen this activity by broadening the range of possible contributions.**
- They also plan to **participate to the common effort of the construction of the Hyper-Kamiokande detector in Japan for their quota**

Candidate members from Bari: contributions



- With regard to specific analysis tools that can be developed for Hyper-Kamiokande, the following areas can be highlighted:
 - **Supervised classification** (e.g., event classification; binary or multi-label problems).
 - **Regression algorithms** (e.g., estimation of continuous quantities of interest).
 - **Anomaly detection** (e.g., identification of anomalies or outliers).
- Another important aspect will be the **training of young colleagues** (e.g., supervision of Master's or PhD candidates).
 - One PhD student, Emanuele Amato, has already been involved in pattern-recognition studies of electron candidates.
- On average, the research group is engaged with **different FTE ratios equivalent to about 50%, with the possibility of increasing in the future.**

Candidate members from Rome



SAPIENZA
UNIVERSITÀ DI ROMA

Fabio BELLINI	0.2 FTE
Nicola CASALI	0.2 FTE
Gianluca CAVOTO *	0.3 FTE
Francesco PANDOLFI *	0.3 FTE
Francesco RENGÀ	0.2 FTE

Proposal endorsed by the CSN1 (our Funding Board)
in the 2026 budget meeting

(*) Guests at the last Collaboration Meeting



New Members in INFN Roma & Sapienza U.



Fabio BELLINI. Professor of Experimental Physics at Sapienza University
Member of KLOE, BaBar: CP Violation and BSM search
Member of the CUORE Collaboration since 2008: rare event search, Majorana neutrinos
National INFN PI of CUPID experiment since 2019: development of scintillating cryogenic calorimeter
2019-2025 Rome branch coordinator in the INFN National Astroparticle Physics Committee (CSN2)



Nicola CASALI, Senior Staff researcher at INFN Roma
Member of CUORE/CUPID collaboration from 2010 (Majorana neutrinos)
Local PI of NUCLEUS experiment (Neutrino-nucleus coherent scattering)



Gianluca CAVOTO. Professor of Experimental Physics at Sapienza University
BaBar, UA9, since 2008 MEG (charged lepton number violation)
PTOLEMY: detectors development for cosmological neutrino search and neutrino mass measurement
Development of innovative detectors for direct dark matter searches
Director of the PhD school in Accelerator Physics at Sapienza

New Members in INFN Roma & Sapienza U.



Francesco PANDOLFI. Senior Staff researcher at INFN Roma
Since 2009 CMS (Higgs, SUSY searches, exotics)
Member of Ptolemy (electron detection with solid-state devices)
Founder and responsible of TITAN Lab: research on nanostructures applications to particle physics
PI of ANDROMeDa: dark matter novel detector development based on aligned carbon nanotubes



Francesco RENGA. Senior Staff researcher at INFN Roma
2005-2009 Member of the BaBar collaboration: data analysis
2009-now Member of the MEG and MEG II collaborations: Physics Coordinator, development of gaseous detectors and related infrastructures
INFN Roma contact person in the DRD1 collaboration (gas detectors R&D)
Rome Branch coordinator in the INFN Physics at Accelerator National Committee (CSN1)

Contributions and expertise



SAPIENZA
UNIVERSITÀ DI ROMA

The new members in Rome bring extensive experience to the group and the collaboration in data analysis, management, and detector development, including TPCs, gas detectors, cryogenic detectors, and innovative dark matter detectors.

Their contribution will further strengthen the commitment of the Rome group and its Italian partners in Hyper-K to the timely delivery and successful commissioning of both the mPMTs and the front-end electronics for the 20-inch PMTs.

The new members will initially contribute to the construction, commissioning and operation of the hardware, as well as to the development of simulation and reconstruction software.

In parallel they will start preparing for the physics analysis, leveraging their experience (BaBar, CMS, CUORE, CUPID, KLOE, MEG)

Software and Analysis

The plan to develop the new members contribution to Hyper-K, moves from our construction responsibilities. The initial focus will be on integrating the new electronics and mPMTs into the simulation and reconstruction software. In parallel, they will progressively begin to invest into the analysis preparation, developing tools and recruiting new Master's and PhD students.

A natural starting point is the characterization and calibration of the Time Over Threshold (ToT), a feature provided by the new design of the Hyper-K digitization electronics. Comparison between integrated charge and ToT measurements can be used to discriminate the signal shape against the expected waveform and to tag pre- and after-pulses.

This ToT feature is a key advancement over Super-K. While standard charge reconstruction is limited by an integration and conversion time of 500–600 ns, about 2MHz, the ToT measurement allows secondary pulses separated by only 10–20 ns to be individually timestamped and their charge reconstructed. The impact of this new capability on physics analyses has yet to be fully assessed. To make this tool available for analysis, the ToT must be precisely calibrated and integrated into the simulation and reconstruction software, in close coordination with FD4 and FD1.

Additionally, test beam data from the WCTE (Water Cherenkov Test Experiment) allow to understand the performance of the mPMTs and to develop the specific software for their reconstruction and calibration.

In preparation for the physics analysis, the scope is expected to broaden as they build their knowledge base and new Master and PhD students join the group.

Construction, commissioning and operations



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UNIVERSITÀ DI ROMA

The new members will support the group and Italian commitment to the production, calibration, installation, and commissioning of the front-end digitizers and the mPMTs.

They will contribute to the assembly of the underwater electronics vessels at CERN and the mPMTs in Naples.

They will share the detector installation work in Kamioka.

Some members (F. Renga, possibly others) intend to leverage their experience with gas TPCs by joining the TPC group in view of the ND280 operation in the Hyper-K era.

Candidate members

Paolo Maestro and **Gabriele Bigongiari** are **Associate Professors** at the **University of Siena** and members of **INFN-Pisa**

As for the other members their participation has already been **endorsed by INFN** and presented during the budgetary annual meeting in September. Recently joined T2K. 0.5+0.5 FTE.



Paolo Maestro



Gabriele Bigongiari

Candidate members from Siena



- Design, construction, testing, and operation of **space-based calorimeters**
- MC modeling of detectors, development of **reconstruction software** for tracking and particle-ID

Major astroparticle physics experiments: **CALET**, **AMS-02** on the ISS, and **CREAM** (stratospheric balloons over Antarctica)

INFN R&D programs on **Si pixel detectors** and **micro-pattern gaseous detectors**

Prof. Maestro contributed to the **CDF experiment at Fermilab**, where he played a key role in heavy-flavor physics analyses, such as studies of **D^0 meson oscillations and CP violation in charm decays**



Maestro



Bigongiari

Candidate members from Siena: contributions

Participate in the activities of the INFN–Pisa group

- functional testing + quality control of the digitiser boards at the manufacturing company
- integration + assembly of the digitiser boards into the underwater vessels at CERN
- development of new prototyping clock/trigger electronics for ND280

High-Angle Time Projection Chambers (HATPCs) of the ND280 near detector

Calibration and performance evaluation of the detectors, development of tracking, reconstruction, and simulation software, as well as the operation and maintenance of the TPC hardware → supporting the continued use and optimisation of the ND280 detectors in the Hyper-K era.

Development of the software framework and detector simulation tools for Hyper-K, with a particular focus on **physics analyses related to neutrino astrophysics, in line with their scientific background.**



Maestro



Bigongiari

Candidate member from Padova



Fabio PUPILLI, INFN researcher (primo ricercatore) at INFN of Padova. He has participated in many important neutrino physics experiments/projects: OPERA, ENUBET, nuSCOPE, ESSnuSB+. In OPERA he was the coordinator of the LNGS emulsion scanning facility. He is an expert in the field of monitored and tagged neutrino beams having had a pivotal role in the simulation, detector construction and tests for the ENUBET ERC project, and more recently, nuSCOPE. He is an active T2K member since 2021 and he has given an important contribution to the construction and tests of the N280 upgrade HA-TPC at CERN.

Present commitment = 0.4 FTE

Proposed activities in Hyper-K: contribute to the Italian effort in the construction, commissioning and operation of the hardware (tests of digitizers at CERN, construction of mPMT in Naples) as well as being committed to HK construction shifts. Support the team of TPC experts for the ND280.

Having a strong experience in beamline simulations with GEANT4 he can apply this expertise in the refinement of the beam flux systematics and/or the development of the far detector simulation.

Three “new” universities for HK

The inclusion of the **University of Bari**, **University of Siena** and **University Rome** as a new institutional member of HK is of significant added value.

These institutions, with their long-standing traditions of excellence in research and education, will provide robust support for the group’s scientific activities.

Increased involvement of **young colleagues**: several graduate students are expected to join HK under the supervision of the new members with a direct link with academia.

Their involvement will not only expand the personnel available for detector operation and analysis but will also ensure that HK serves as a vital training ground for the next generation of Italian and European neutrino physicists.



Backup

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