IJCLab Yearly Report 2025

Written by the Directorate

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1. IJCLab Year 2025: introduction and organization of the document

For the YR 2025 we followed the same structure as the one adopted for YR2024 based on a **Manifesto** defining the **missions of IJCLab** which can be summarized in five points:

- **To lead and play a major role on world-class flagship projects in high-energy physics, nuclear physics, astroparticles and cosmology by contributing at all levels, including theory**
- **To lead and play a major role in the conception, design and construction of current and future accelerators.**
- **To develop and exploit research infrastructures and technological platforms supporting these lines of research as well as, thanks to their irradiation performances, original research in health physics, material sciences and energy.**
- **To promote the development of new technologies for science and the valorisation of our research for the benefit of society, thereby supporting national and European industrial competitiveness.**
- **To welcome the students that the laboratory trains through and for research at the heart of a world-class university environment.**
- **The most relevant results for Year 2025 related to these five manifesto's points are discussed in Chapter 2. More extensively the Technical and scientific Highlights of the laboratory for Year 2025 are presented in Chapter 3.**

The possibility of fulfilling these missions depends on the laboratory's capability:

- **To set up an efficient and smooth organization of the laboratory, respectful of rules and aimed at enabling the optimal fulfilment of research and teaching missions and ultimately, a laboratory where it is pleasant to live. (Chapter 8).**
- **To preserve and increase the technical and scientific staff and to offer them excellent opportunities for career evolution. (Chapter 5).**
- **To have the necessary fundings and in particular we have to be able to better position ourselves and succeed in different calls for tenders. (Chapter 6).**
- **To have a favourable working environment in the tertiary sector and the ability to have infrastructure capable of housing our instruments and our technological and research platforms (Chapter 7).**

And to be able to work in an efficient collaborative manner. For that it is crucial for the laboratory (**Chapter 4**)

- **To be an important partner in the network of the largest European laboratories. To also stimulate targeted collaborations with other European laboratories and worldwide.**
- **To increase the national collaborations with the other laboratory of IN2P3, and more largely to CNRS, RFU/CEA and the CNES.**

In the annual report we discuss the actions and the results connected to the missions of IJCLab expressed in the Manifesto in the Chapters indicated in the previous items.

2. IJCLab Missions and success criteria

- **Leading world-class flagship projects in high-energy physics, nuclear physics, astroparticles and cosmology by contributing at all levels, including theory**

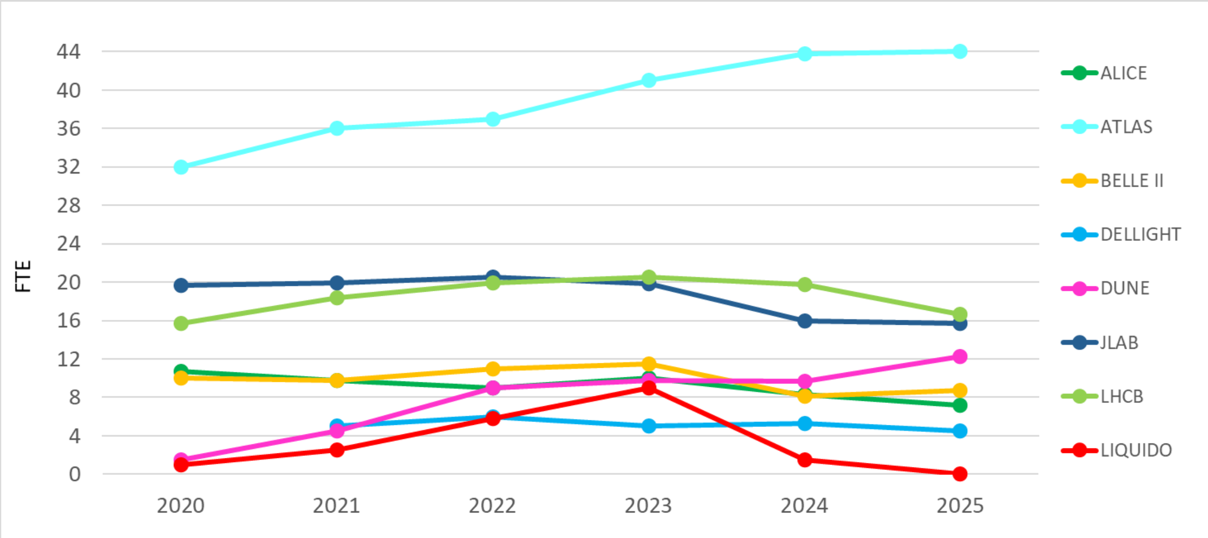
The projects and their evolution are monitored by a dedicated service (CEMAP) through a dedicated software (OSITAH-NSIP) allowing IJCLab members to declare their activity each semester.

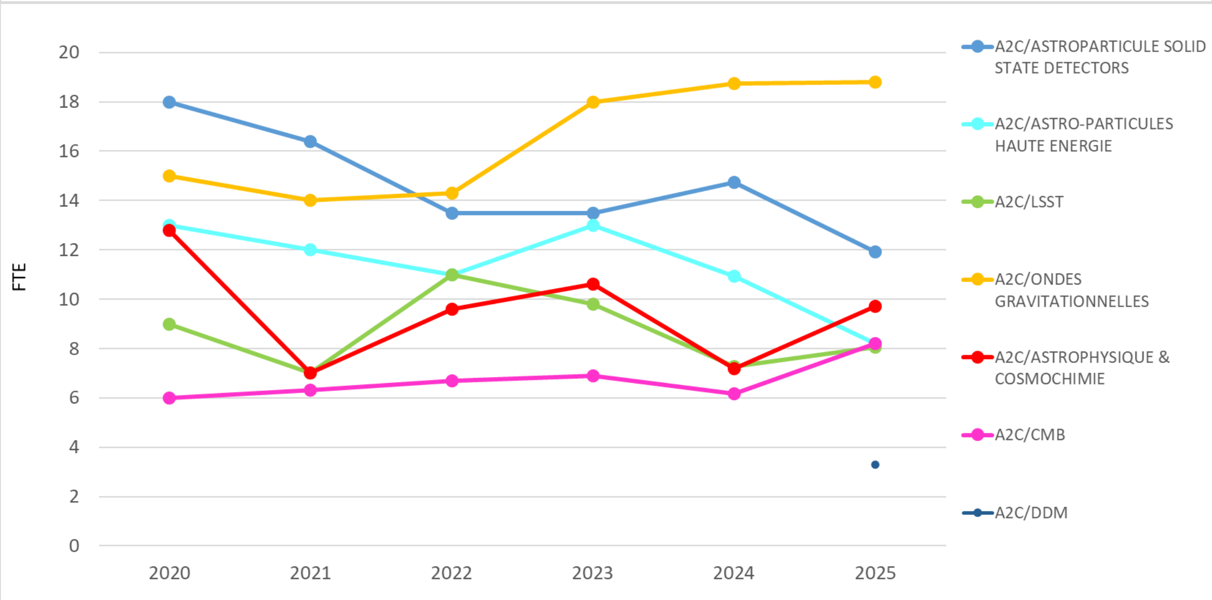
The number of FTE implied on the high-energy physics, nuclear physics, astroparticles, astrophysics and cosmology and also in theory activities are summarized in Table 1.

	RESEARCHERS	TECHNICAL STAFF	TOTAL
HIGH ENERGY PHYSICS	91	30	121
ASTROPHYSICS & COSMOLOGY	48	21	69
NUCLEAR PHYSICS	45	31	76
THEORETICAL PHYSICS	60	0	60

Table 1. FTE involved in the high-energy physics, nuclear physics, and A2C (for Astroparticles, Astrophysics and Cosmology) and Theory activities. In the number of researchers, the PhD students are included. For PHE, notice that 68 FTE are involved in CERN-based experiments and for Nuclear Physics 14 FTE in GANIL experiments.

The Figure 1 shows the evolution of the FTE for the main project at IJCLab. It globally shows that the implication has remained stable over the last years. Please note that these fluctuations are often linked to non-permanent personnel and typically correspond to the start or completion of ANR and ERC projects.


FTE
44
40
36
32
28
24
20
16
12
8
4
0
2020
2021
2022
2023
2024
2025
ALICE
ATLAS
BELLE II
DELLIGHT
DUNE
JLAB
LHCB
LIQUIDO


FTE
20
18
16
14
12
10
8
6
4
2
0
2020
2021
2022
2023
2024
2025
A2C/ASTROPARTICULE SOLID STATE DETECTORS
A2C/ASTRO-PARTICULES HAUTE ENERGIE
A2C/LSST
A2C/ONDES GRAVITATIONNELLES
A2C/ASTROPHYSIQUE & COSMOCHIMIE
A2C/CMB
A2C/DDM

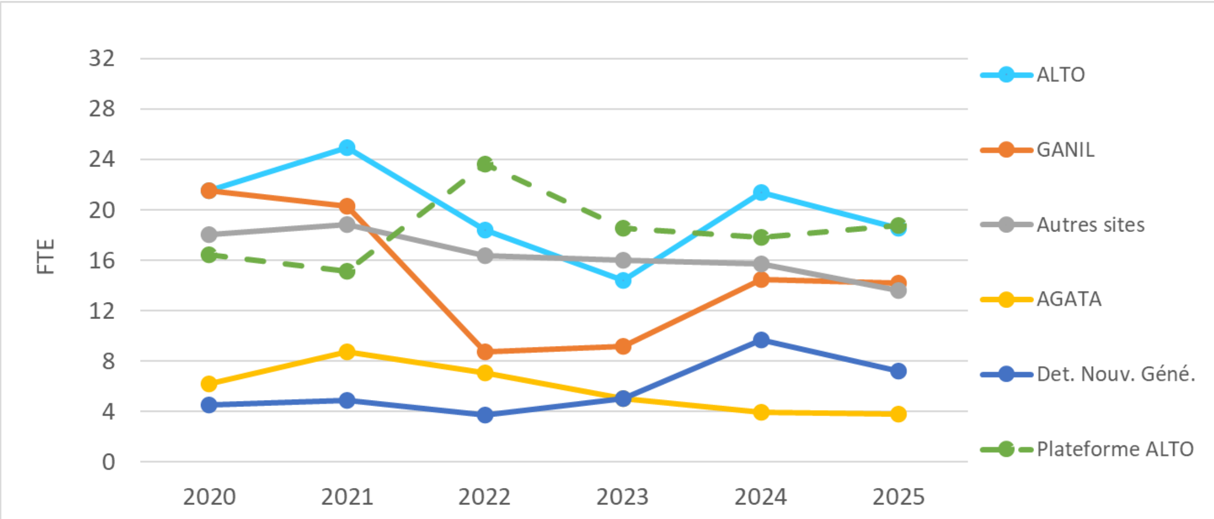


Figure 1. The Evolution of the FTE as a function of the years for PHE, A2C, Nuclear Physics projects.

One can make a few comments and observations:

- We are keeping a high level of involvement on the LHC projects ALICE, ATLAS and LHCb entering the upgrade phase
- Notice that the LIQUIDO activity (for future neutrino experiment but also with applications on Health physics) has been stopped in the laboratory and the technical staff working on this activity has been effectively reabsorbed in other laboratory projects.
- IJClab has put a strong priority on DUNE, hiring new researchers and engineers to work on this project. Quantitatively the number of FTE increased from 1 to around 10 in the last years.
- There is a constant and important participation in the GANIL and ALTO. Consider that the people working on ALTO are often in view of an experiment to GANIL. The oscillations over the years on these two facilities depend also mainly on the different experiment campaigns. To be also consider an important work done in order to upgrade the ALTO platform in the last two years with the aim of improving the capacity of ALTO to run in parallel stable and radioactive beams but also for the opening of ALTO to other applications thanks to the irradiation capabilities. We recall here that (as shown in the plot) 18 FTE have actually worked on the ALTO platform in 2025.
- The activities on the Gravitational Waves are continuing with an important implication of the laboratory, including SVOM, GRANDMA and moving forward with a growing implication in Einstein Telescope. The activities in Adcanced Virgo which are diminishing.
- The new Direct Dark Matter team has been created in 2025.

In addition to the experimental projects a strong theoretical pole has been created at the beginning of IJCLab. The activities of this pole are summarized in Figure 2.

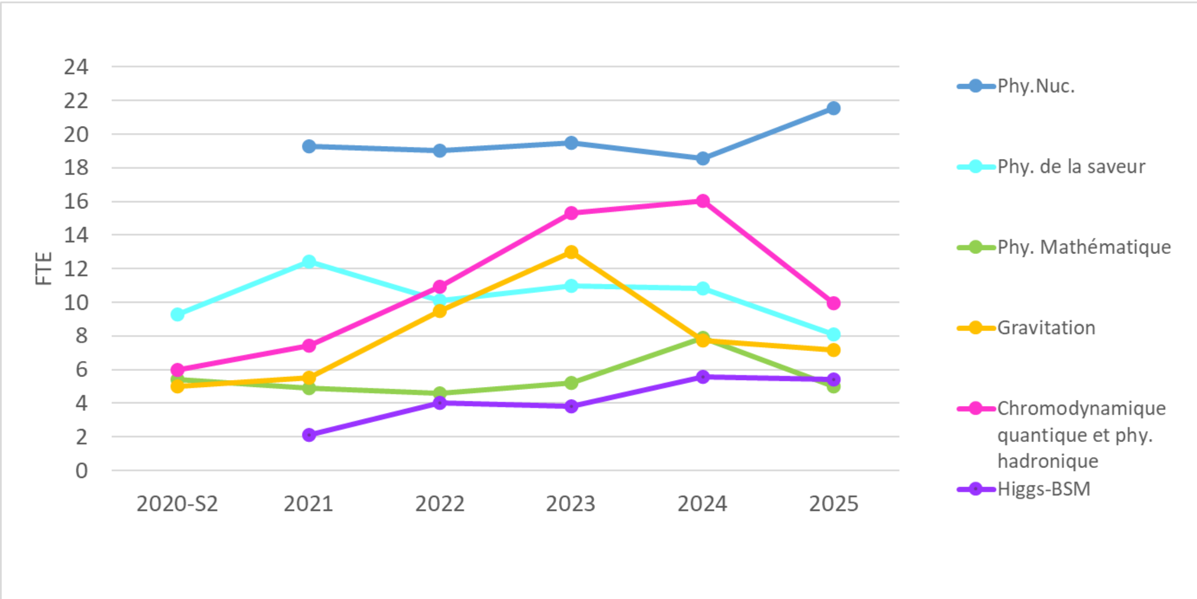


Figure 2. The Evolution of the FTE as a function of the years for Theoretical Physics.

As it can be noticed from this plot about 85% of the pole corresponding to about 60FTE is working on theoretical subjects on nuclear physics, Higgs, BSM, flavor physics, QCD and Cosmology/Gravitation. The research activities are often related to the experimental projects and activities of the laboratory

- **Play a major role in the conception, design and construction of current and future accelerators.**

We are running and contributing to several of the major accelerator programs in the world.

The main observations (see Figure 3) concerning very recent changes (mostly in the last year) are:

- ThomX will end activities in summer 2025 but and the involvement of the laboratory is kept until that to complete the project and get the results from X-rays.
- The ESS (end of the production phase) contribution is reduced to less than 1FTE and we keep part of the facility in order to intervene in case of reparation.
- A still significant activity on MYRRHA

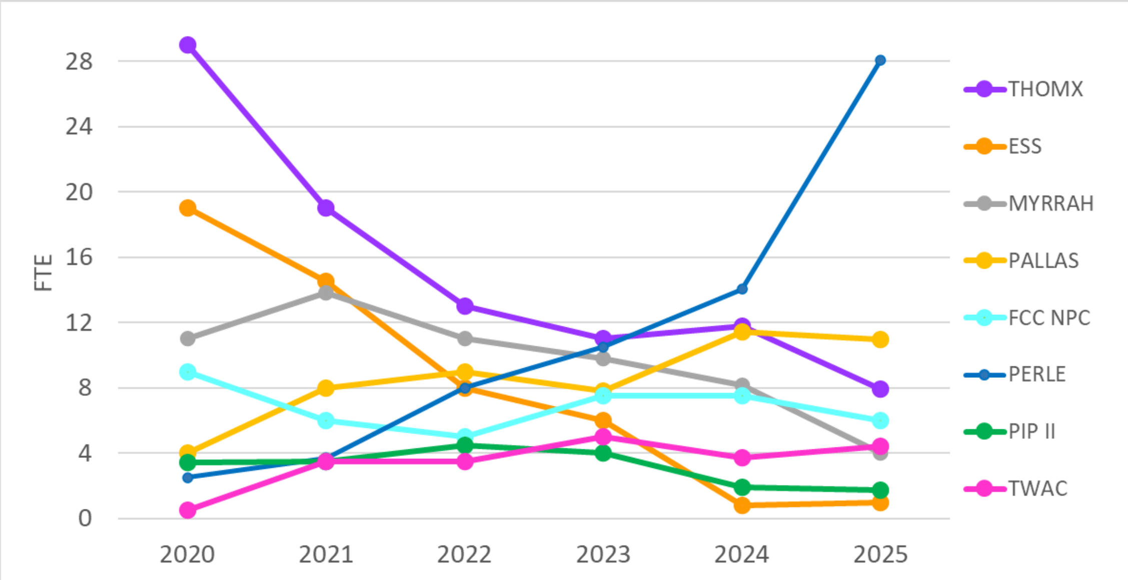
- A significant increase of the contribution to new project: PERLE, with today about 28 FTE
- A stabilization over the last 3 years of the needed forces on PALLAS.
- Important participation to international accelerator PIP II,
- a regain of activity under the umbrella of FCC-NPC, which is today very synergetic with PERLE
- 

Figure 3. The Evolution of the FTE as a function of the years for Accelerator Physics projects

Besides that, we have several technological platforms which are essential for accelerators physics activities:

- **SUPRATECH.** Throughout the year, the platform confirmed its key role in supporting accelerator projects in the construction and operational phases (SPIRAL2, PIP-II, MYRRHA, ESS), while also preparing future initiatives (PERLE, FCC, EIC) through sustained R&D activities. Work carried out within the SRF R&D programmes (MP-SRF, TYL-FJPPL, EPITA) enabled progress in process development and equipment qualification, supported by strong synergies between Vide & Surface and Supratech. Beyond accelerator applications, the platform also contributed to several cross-disciplinary projects, including the restart of the calibration station within the framework of PEPR Cryonext, detector integration for CROSS, and helium supply activities. The work on the HPR Cobot evolution is ongoing. The upgrade of key facilities is currently in progress and includes the refurbishment of the cleanroom for cavities, the refurbishment of the XFEL cleanroom, the upgrade of the RF sources chiller system (building 106), and the refurbishment of the thermometer calibration station.

- The **LaseriX** platform is hosting PALLAS project to build a compact laser plasma section accelerating electrons up to 200 MeV. LASERIX is participating in the TWAC project for electron acceleration in a dielectric waveguide. For the DELLIGHT project, LASERIX is used to demonstrate experimentally that the electromagnetic field carried by an ultra-intense laser pulse can modify the refractive index of a vacuum.
- **Vacuum & Surfaces platform** has been inaugurated in 2023 and is now fully operating. The aim of this platform is to maintain, acquire and adapt surface analysis resources to provide the best possible response to gas accelerator materials issues, with particular emphasis on dynamic vacuum and superconducting RF cavities. Installed in Halls D3 and D4 of Building 209C, this unique space houses a variety of equipment.

The number of FTE involved in these platforms is shown in Figure 4.

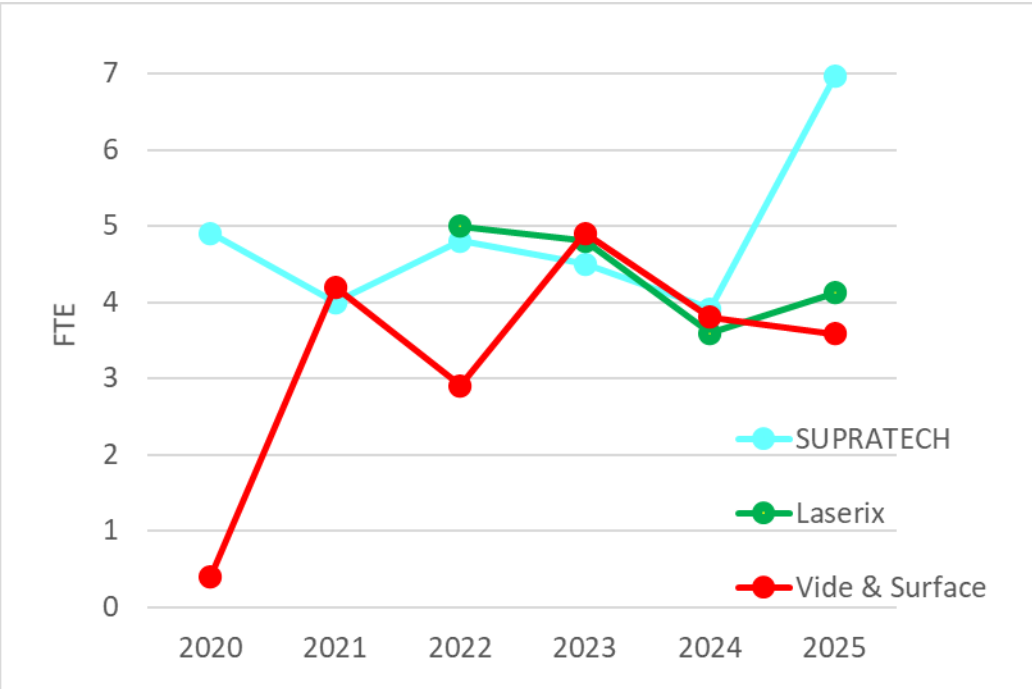


Figure 4. FTE as a function of the years for LaseriX, SupraTech, and Vide &Surface Platforms

- **To develop and exploit research infrastructures and technological platforms supporting these lines of research as well as original research in health physics, material sciences and energy, thanks to their irradiation performances.**

Significant investments are undergoing to operate and upgrade the **detector platform of IJCLab** both from the infrastructure and the equipment viewpoints.

- **PSI** (**Platforme SIlicium**) for the characterization, the preparation and the test of the silicon detectors, mainly for the ATLAS upgrade, but also for contributing to EIC.
- **DQC (Détecteurs Quantiques Cryogéniques)**. A Platform for study and test of innovative cryogenic quantum detectors (mainly bolometers) for neutrino physics and the search for dark matter.
- **Myrtho.** In this platfrom we storage of the Antarctic micro-meteorite collection to perform analyses of the properties of micro-meteorite samples. We also develop the detectors for MeV gamma-ray astronomy

ALTO.

Following the severe flooding that affected the site in October 2024, and in particular the ALTO platform, a major infrastructure renovation program was launched in 2025. Its objective is to streamline the distribution of the CVC system and upgrade the overall infrastructure of the facility. Following the failure of one of the chillers in 2025, and while studies for the HVAC rationalization were underway, it became necessary to rent temporary cooling units to ensure the continuity of operations. The long-term solution has now been identified, and the new systems are scheduled to be installed by mid-2026.
In parallel, work has begun on the complete refurbishment of the main entrance area and the dismantling of the control room. These activities are expected to be completed by spring 2026. In addition, the upgrade of the entire heating system has been approved, with work scheduled to begin at the end of 2026.
From a scientific perspective, the ALTO Program Advisory Committee (PAC) meeting will be held in February 2026. We have already received a record number of proposals, with a total of 30 submissions.

The MOSAIC platform was created in 2023 from the merging of JANNuS-SCALP and Andromede. It **groups 5 accelerators and unique equipment,** focusing on ion beams for synthesis, modification and characterization of materials, and ion-matter interactions studies. The diversity of available elements, more than 70 from protons to gold nanoparticles, and the energy range, from 50 eV to 32 MeV, makes it unique. This platform is a founding member of the EMIR&A French ion and electron accelerator federation for analysis and irradiation of materials and molecules, a Research Infrastructure. MOSAIC is located on two sites. Building 108 hosts a 2 MV Tandem/Van de Graaff home-made accelerator (ARAMIS), an ion implanter of 190 kV (IRMA), a 200 kV in situ Transmission Electron Microscope and a future in situ X-Ray Diffratcometer (all coupled together in the JANNuS-Orsay experimental hall), a 40 kV mass spectrometer (Sidonie) recently renovated and upgraded (see YR2022) and SEM- EDX - AFM microscopes. The Hall SuperACO in building 201 hosts: a 4 MV Pelletron (Andromède), an accelerator of 30 kV for aggregates (Tancrède), and a new 400 kV ion implanter (Némée) coming from IP2I, Lyon.

ALTO and MOSAIC are efficiently functioning and the personnel employed is shown in Figure 5.

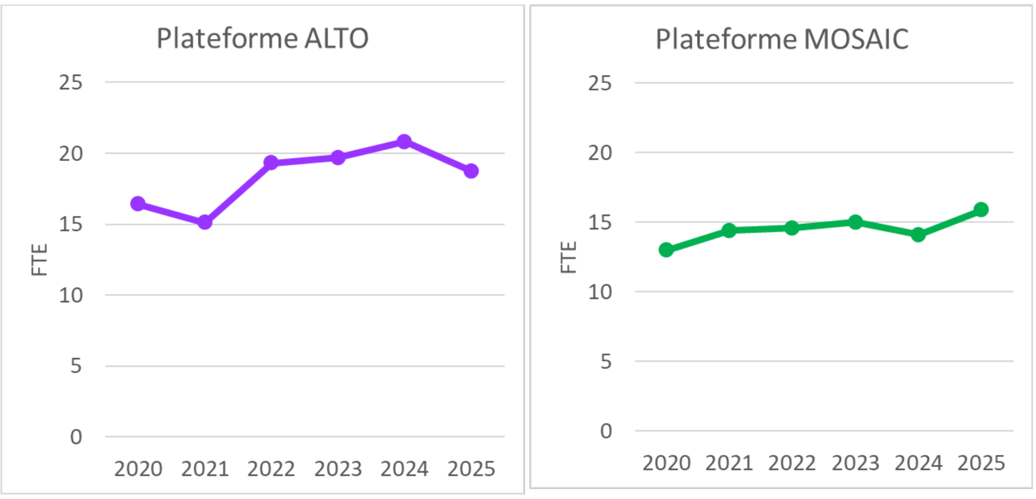
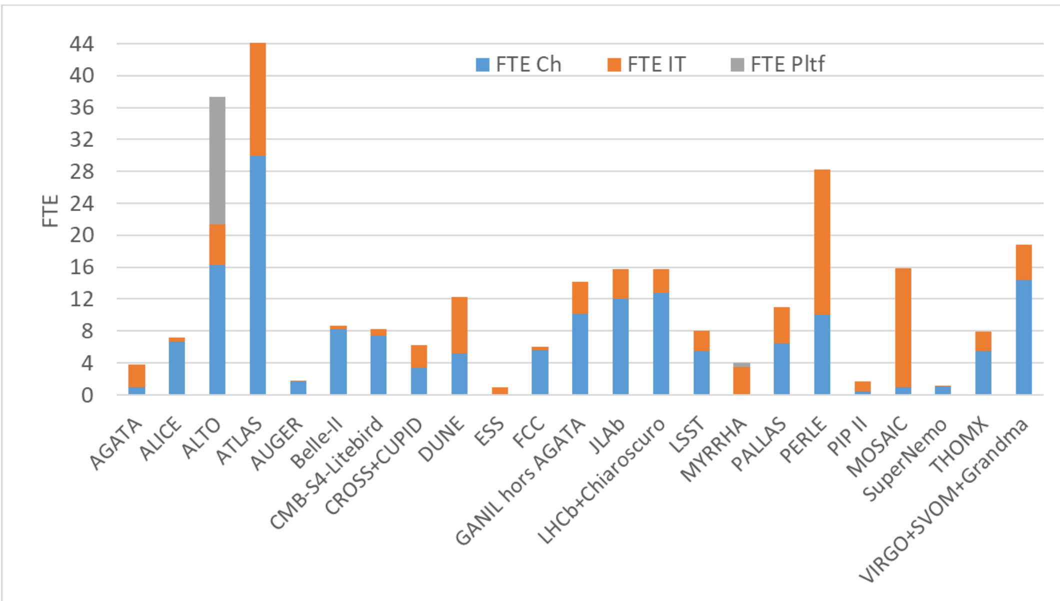


Figure 5. FTE as a function of the years for ALTO and MOSAIC Platforms

An interesting plot as a summary in Figure 6 shows the distribution of FTE for the projects with the highest need for human resources at IJCLab.



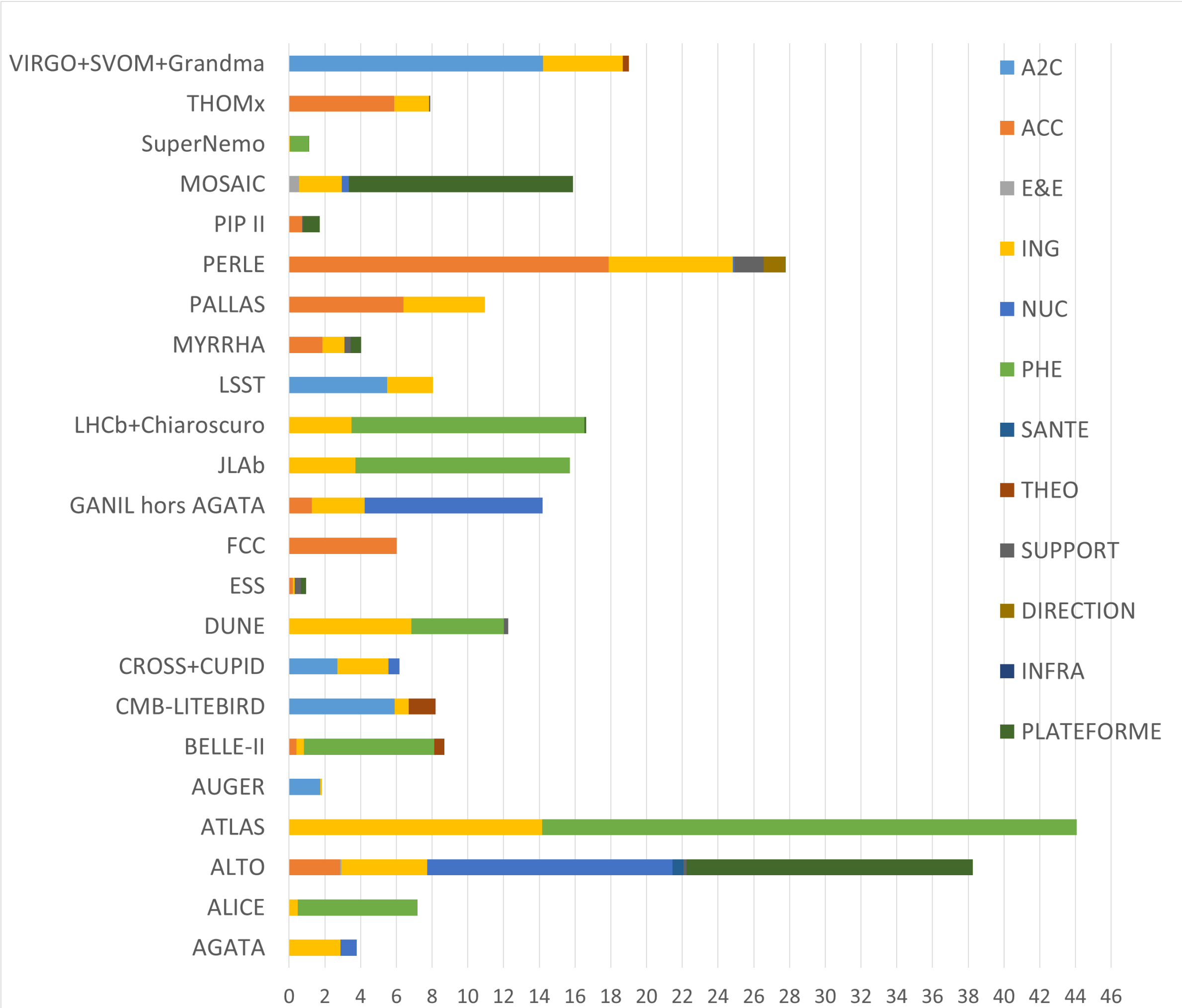


Figure 6. (Top figure) The distribution of FTE for the projects with the highest need for human resources at IJCLab. (Bottom figure). Same distribution indicating the IJCLab departments/poles involvement.

- **To promote the development of new technologies for science for the benefit of society, thereby supporting national and European industrial competitiveness.**

Several activities in laboratory are developed and/or transferred to Industrials. The industrial partnerships are summarized in the following chapters

- **To welcome the students that the laboratory trains through and for research at the heart of a world-class university environment.**

The number of PhD students has stayed constant over the last year with about 120 PhD students present at the same time at the laboratory. More than 30 PhD thesis are defended per year and more than 30 new PhD students are starting their thesis every year. The laboratory has also put a strong priority on welcoming internship students.

PhD Students.

In Figure 7 we show the number of new PhD entering IJCLab and PhD defenses over the years.

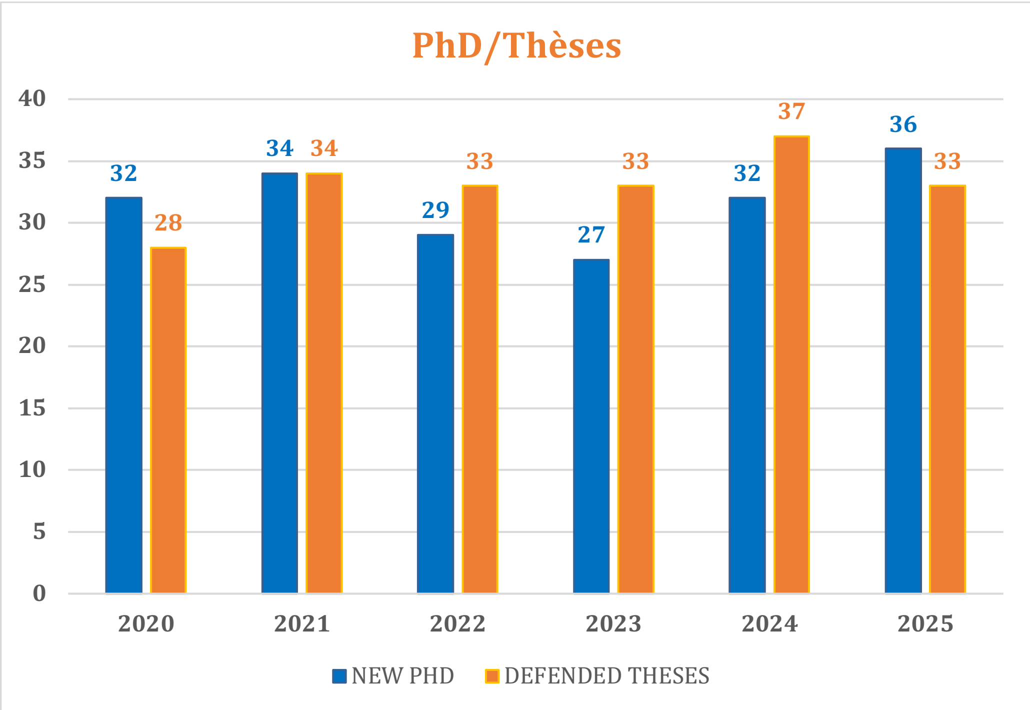


Figure 7. Number of PhD students and theses defended per year since 2020

Interesting to underline that the PhD students are from about 30 nationalities.

INTERNSHIPS

IJCLab has also a strong involvement in internships as a gateway to research for students. Table 2 indicates the number of internships from licence to Master.

	2020	2021*	2022	2023	2024	2025
Number of internships	125	213	142	167	131	142
Number of months	375	641	483	397	357	437
Licence	24%	32%	34%	43%	35 %	42%
Master 1	28%	36%	32%	30%	37%	35%
Master 2	47%	32%	34%	27%	28%	23%

Table 2. Quantitative data for internships: total number, number of month and percentage of internship student from Master 2, Master and Bachelor. In 2021 due to the Covid pandemic, all the French students could not travel abroad and did their internships in France.

The full number of students from College up to Master visiting the laboratory is shown in Figure 8 . Beside the Licence and Master students we welcome more than 100 young students from College, Lycée…

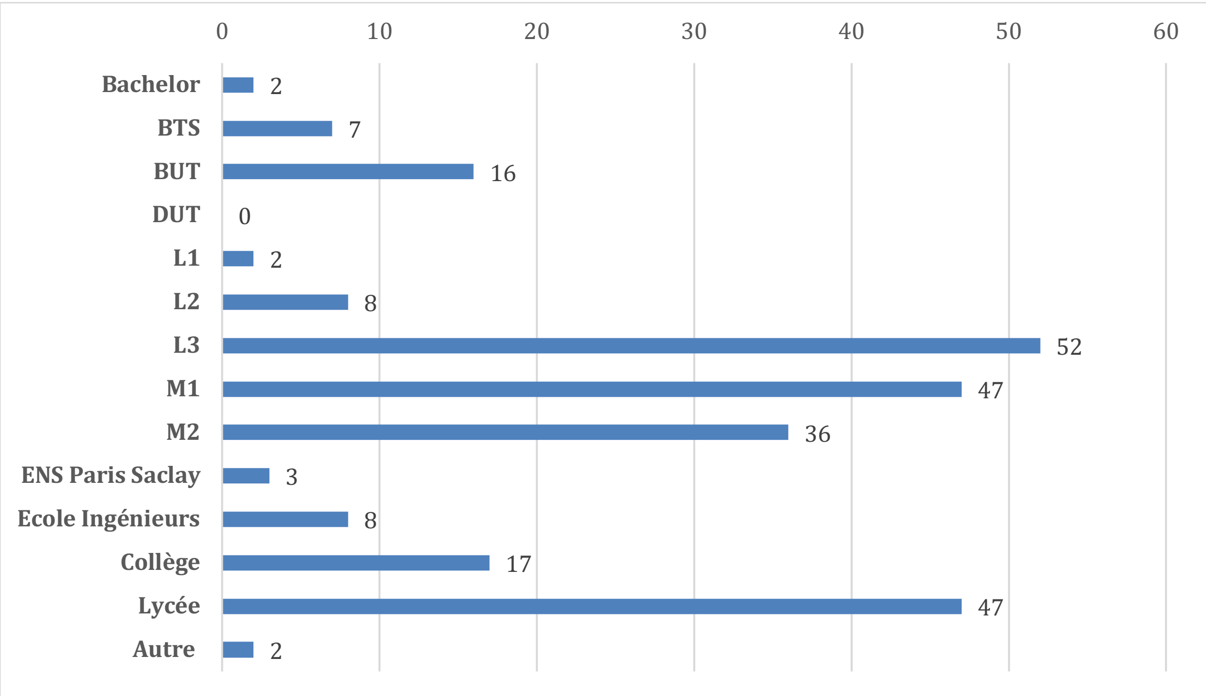


Figure 8 Number of visiting students at IJCLab in 2025: 247

MASTER and DOCTORAL SCHOOLS

We have in particular important responsibilities in the following Master programs:

- M2 NPAC (Nuclei Particles Astroparticles and Cosmology) (around 35 students/year) directed by Fabien Cavalier
- M2 Grands Instruments/PLATO (around 15 students/year) directed by Kevin Dupraz
- M1 Nuclear Energy (around 25 students/year)
- M2 Nuclear Energy (around 50 students/year with 5 different majors)
- M1 General Physics (around 40 students/year)

One of the main Doctoral School in Physics of the Paris-Saclay University, ED PHENIICS, with more than 200 registered PhD students is directed by David Verney.

INTERNATIONAL PROGRAMS TO ATTRACT STUDENTS

Several international training activities are also led by IJCLab researchers/teachers. We mention here the largest ones and those who attract most the international students:

- **Trans-European School in HEP** (mostly East European countries), Winter School in HEP (**WISHEPP**) (Palestine), International **QCD school**.
- International student exchange networks: **Erasmus+ MIC Colombia, Georgia, Ukraine and Palestine** (globally more than 50 students/year)
- **Erasmus Mundus Lascala** (large-scale instruments) and **Quarmen** (quantum research)

3. Scientific and Technical highlights and events in 2025

3.1 The Scientific Poles and the Engineer Pole

NUCLEAR PHYSICS

FIIRST Team. At ALTO-LEB, the team achieved a first milestone for the platform with the **first neutron spectroscopy measurements**, using the **MONSTER array** for β-delayed neutron studies of **^{82}Ga**. These results directly supported the **PhD defense of E. Cantacuzène.** In parallel, the **IRENA3 prototype** was successfully commissioned at the **CERN offline separator**, representing a key step toward future applications with radioactive beams.

Major efforts were also devoted to next-generation experimental setups and instrumentation. For the **AGATA at 0° campaign at LNL**, IJCLab led the **mechanical design** and launched the **production phase** for integrating **PARIS and NEDA** with AGATA. The **HINA project** progressed significantly, combining beamline development with **successful ionic propulsion tests** in collaboration with industry.

FIIRST further advanced **high-precision mass measurements near N=50** at **ISOLDE/CERN**, supported by new **digital acquisition developments**, and contributed to the installation of the **first position-sensitive Schottky detector at RIBF (RIKEN/GSI collaboration)**. In parallel, pioneering neutron-induced studies of the **pygmy dipole resonance** supported the **PhD defense of P. Miriot-Jaubert**. The team also contributed to community-wide perspective building through the review article "History of the concept of nuclear shape" Eur. Phys. J. A61 (2025), placing the evolution of nuclear-shape concepts in the context of the emerging use of ultra-relativistic heavy-ion collisions as a novel probe of nuclear deformation; the paper rapidly reached a broad readership across nuclear-structure and heavy-ion communities. Finally, FIIRST continued its long-term contribution to **nuclear data** through ongoing updates to **atomic mass evaluations**.

NEXT Team. In 2025, the NEXT team strengthened its detector and analysis R&D for **advanced γ-ray tracking arrays and superheavy-element spectroscopy**. Key γ-ray analysis techniques were refined and adapted for **AGATA/GRETA**, and a new method improving the accuracy of angular-distribution measurements was developed and validated through high-impact applications (Lauritsen, Korichi et al., Eur. Phys. J. A 61, 2025). Within the IJCLab-Argonne National Laboratory collaboration, a machine-learning-based γ-ray tracking algorithm was developed, yielding clear improvements in efficiency and signal-to-background performance; further optimizations are ongoing.

Several experiments on superheavy elements were carried out at Argonne National Laboratory, combining **AGFA with Gammasphere and GRETA with the FMA**. These efforts led, among other results, to a complete spectroscopy of ^{254}No (Wahid et al., Phys. Rev. C 111, 2025), as well as additional studies on several isotopes (presentation at the TASCA25 workshop). An experiment was also initiated to measure entry distributions in ^{253}No to constrain the **fission barrier** and its spin dependence, using GRETA γ-ray tracking for the first time. The analysis is ongoing, with the aim of extracting key observables using the newly developed techniques.

In addition, the team made significant progress toward **gSPEC**, a project dedicated to precision measurements of **nuclear moments**, initially around **doubly-magic nuclei**. Simulations and preparatory work were carried out at **IJCLab** and **GSI/FAIR**. A new magnetic setup was assembled and successfully commissioned offline with strong contributions from IJCLab's technical and engineering teams. The first prototype of ancillary detectors, developed at IJCLab, was successfully tested in **2025**, and further online tests are scheduled for **2026**. A first international workshop on nuclear moments (**WNM'25**) took place at IJCLab in 2025, gathering experts in the field; a resulting **strategy document** is being prepared for open public release.

Finally, within the ongoing research on nuclei in the **A≈110–120** region close to the **proton drip-line**, a new **fusion-evaporation reaction** was performed and analyzed with the **MARA-JUROGAM3** setup at **Jyväskylä**, with the **search for isomers** as a primary objective.

SDF Team. SDF team contributed to scientific outreach and visibility through an article on the **synthesis of superheavy nuclei** for the special issue of *La Recherche* (published September 18, 2025: "New Superheavy Elements Within Reach Tomorrow," *Au Coeur des Atomes* special issue, *La Recherche*, October–December 2025, No. 583). On the experimental side, the team benefited from **record beam intensity** at the **RITU separator** (University of Jyväskylä), with beam currents up to **460 pnA** used to produce the exotic nucleus **^{217}Pa**.

In terms of strategic developments, the **"D-SHEXI"** project was funded by the **ANR**, enabling the validation of the **SHEXI concept** for **Z-identification of superheavy nuclei**. The team also celebrates the **CNRS Bronze Medal** awarded to **Vladimir Manea**, recognizing both scientific excellence and strong contributions to the community.

NESTAR Team. The NESTAR team strengthened its scientific visibility with an outreach article on **nuclear clustering** for the special issue of *La Recherche* (September 18, 2025: "L'architecture cachée du noyau"). Experimentally, the team conducted a **successful MUGAST campaign at LISE**, including **one commissioning and two experiments**, notably featuring the **search for the isobaric analog state of the tetra-neutron**.

On the instrumentation side, the team completed the **replacement of the legacy Split-Pole DAQ** with the newer **FASTER digitizer boards**, enabling improved performance and operational reliability; a first experiment in this configuration was successfully carried out in the context of **neutrinoless double-beta decay** studies. In parallel, the configuration and integration of **GRIT with AGATA and VAMOS** for the **2029–2030 GANIL campaign** have been finalized.

Finally, the analysis of the multi-nucleon transfer reaction **^{48}Ca + ^{238}U at 10 MeV/u** revealed, for the first time, indications of **survival against fission** of heavy reaction products, with candidates extending up to **^{251}Es** (+6n +7p channel) and **^{255}Lr** (+6n +11p channel), in collaboration with **DPhN/CEA**.

HEP (High Energy Physics)

The PHE pole is involved in major running experiments located at CERN (ALICE, ATLAS, LHCb), JLab (ALERT), KEK (Belle II), GSI (HADES), the Laboratoire Souterrain de Modane (SuperNemo) and is involved in the local experiment DeLLight. In parallel, the pole has strong commitments on the future upgrades of some of these detectors and on the design or construction of new ones (DUNE, EIC or for the FCC-ee project).

The **ALICE** team at IJCLab has performed, in 2025, some important measurements in pp and Pb-Pb collisions and submitted preliminary results for DD and $D\overline{D}$ production cross-sections in pp collisions at $\sqrt{s} = 13.6$ TeV and midrapidity. Preliminary results on the ψ(2s) - J/ψ production ratio in Pb-Pb collisions at $\sqrt{s_{NN}} = 5.36$ TeV, at forward rapidity, have also been obtained. These measurements have been presented in major conferences. The publications are in preparation. The success of the recent light ion collision runs, in pO and OO, whose data sample are being analyzed at present, gives interesting perspectives to study the Quark-Gluon plasma in intermediate nuclear systems. The ALICE team also contributed to detector works and to the maintenance of the muon chambers during the recent LHC technical stops. The maintenance during the Long Shutdown 3 was established and a quadrant of one muon system will be replaced.

The 2025 data-taking by **ATLAS** was an important milestone with a recorded luminosity of 119 fb^{-1} at an energy in the centre of mass of 13.6 TeV. The IJCLab ATLAS group contributed efficiently to this campaign.

Concerning the detector upgrade and the future HL-LHC runs, the three projects, HGTD, LAr and ITk, made valuable progress. The robot constructed by the IJCLab team, in collaboration with BNL, for qualifying chips of the future LAr Front-End boards upgrade, has started testing parts from October. The activity should be completed in May 2026 and followed by the validation of the chips for the calibration boards, whose design has made significant progress.

In-depth investigations with the probe station (at PSI, one of the IJCLab platforms) established that the limitations of non-industrial-grade setup prevents its use for the specific wafer qualification at the laboratory. There was also good progress on the production and testing for the HGTD and ITk projects.

On the physics analysis side, in addition to developments on machine learning and other cutting-edge techniques (neural simulation-based inference, ...), and teaching or outreach activity, the group contributed to Standard Model analyses, with W physics and constraints on proton pdf, the VBS production, and continued its long-standing investigations of the Higgs sector (single Higgs on-shell, off-shell, and double Higgs production with 2 channels). Run 3 data are exploited in several analyses released in the group ($H \rightarrow ZZ^* \rightarrow 4l$ STXS, $H \rightarrow Z\gamma$, $HH \rightarrow bb\gamma\gamma$).

The **LHCb** team has performed a Lepton Universality test in the decay $B \rightarrow K^* ll$ at large dilepton masses. The group also measured the inclusive production of charmonium states in b-hadron decays via their decay into $\phi\phi$ final state. Finally, an evidence for the $B \rightarrow D^{**0}\tau^-\overline{\nu_\tau}$ decay was obtained.

In 2025, the LHCb calorimeter system and the plume detector have been smoothly operated with an efficiency larger than 95%. As part of the electromagnetic calorimeter enhancement foreseen during the Long Shutdown 3, the production of 60 new Front-End boards was prepared. The new boards will readout new channels for the Run 4 of the LHC, in 2030. The

full production of ten control boards was received, all preliminary tests were done and were successful.
Regarding the Upgrade II, two versions 0 of the SPIDER ASIC for the PicoCal upgraded calorimeter were tested during a test beam campaign at DESY. Alongside the traditional clustering in the PicoCal has been implemented in HLT1. The first results are encouraging.
The SuperKEKB accelerator restarted operations in November 2025, after several technical issues have been resolved. This run will continue until June 2026, targeting to accumulate 425 fb^{-1} of data, which will be added to the existing **Belle II** sample to reach a total luminosity of 1 ab^{-1}, equivalent to the ~10 year run of the previous experiment, Belle. The IJCLab Belle II group continues working on physics of tau lepton and bottomonium, as well as on precision measurements of g-2 or B meson masses. It also contributes to the R&D of mechanics for the upgrade of the vertex detector, which is foreseen in 2032.
The **HADES** team of IJCLab plays an important role in the scientific production of the collaboration through the coordination of two of the key Physics Working Groups dedicated to the analysis of dileptons and exclusive hadron channels, and related contributions. After the two-pion production and inclusive e^+e^- production measured by HADES in pion induced experiments on the nucleon at pion momenta close to 0.7 GeV/c, the analysis of the exclusive $\pi^- p \rightarrow n e^+ e^-$ channel has been also published, providing complementary information on hadronic and electromagnetic couplings of baryons in the second resonance region (baryon mass around 1.5 GeV/c^2). In parallel, the team also started dedicated studies of virtual photon polarization in heavy-ion experiments, as a complementary tool to characterize the hot and dense hadronic matter.
In April 2025 the HADES team participated in the new data taking campaign devoted to Au+Au collisions at low collision energies from 0.2 to 0.8 GeV/nucleon. The primary goal of this experiment is to investigate the traces of critical fluctuations of conserved baryon number when approaching from above in the temperature-density plane the nuclear liquid-gas phase transition. But the new data set will also allow to extend the energy and system-size scan of all the analyses in the dilepton Physics Working Group, including the dilepton polarization.
After the completion of the assembly of **A Low Energy Recoil Tracker** (**ALERT**) in 2024, the experiment using this new detector, largely developed at IJCLab, ran in 2025 at Jefferson Lab. The Orsay physicists and technical staff were deeply involved and the experiment was a success: the detector was commissioned in time, reached the expected performances, and the data taking went as planned with only minor incidents.
The preparation work for the experiments at the future **Electron Ion Collider** (EIC) made significant progress. A new engineering run was launched in 2025 for the EICROC ASIC. It provides a set of ASIC versions to be tested in the coming year at IJCLab. The team also validated many aspects of the barrel endcap electromagnetic calorimeter with the test of a new prototype. This work paves the way to the finalization of the design and the start of construction for this detector.

The PHE pole is deeply committed to scientific research in the field of neutrinos. **DUNE** activities are structured around two pillars: the hardware productions for the Vertical Drift detector and the analysis of the data produced with the prototypes at CERN.
Concerning the hardware, the year 2025 has been dedicated to the reception, test and qualification of the long-life production components: the steel tanks for the chimneys and the cathode half-frames. About 75% of the total production (105 chimneys) has been validated, eventually after some round trips between the lab and the companies. Several dimensions and the mechanical behaviour (bending under load) are checked for each half frame. Half of the production (172 parts to be received) has been validated. In parallel to these productions and validations, other components for the cathode (metallic and resistive meshes, suspension system, transport boxes) and for the chimneys (guiding system, PCBs, blades supporting the Front-End boards) have been finalized and most of them underwent Production Readiness Reviews which trigger the start of the productions.
The team also contributed to the first installation tests at CERN with a scale 1 structure. Thanks to the training done at IJCLab, the team has been able to successfully install two cathodes faster than expected, which will positively impact the installation schedule of the final detector.
On the data analysis side, the team is strongly involved in the reconstruction and the characterization of the ProtoDUNE detectors (NP02 Vertical Drift and NP04 Horizontal Drift) operated at CERN, and in the identification of electrons for a better calibration at low energy (in the [0-60] MeV range). Thanks to a dedicated pipeline developed at IJCLab for radiological sources, the team also performed calibration studies with 39Ar for which the spectrum is reconstructed down to ~300 keV or estimated structural contamination.
The **SuperNEMO** demonstrator has started its data taking in April 2025. The goal was to determine the performances reachable by a detector combining tracking and calorimeter, to search for the neutrinoless double-beta decay ($0\nu2\beta$), whose observation would prove the Majorana character of the neutrino and also to get physics results on the ^{82}Se $0\nu2\beta$.
The detector is performing well, with 98.6% of the tracker cells and 97.4% of the calorimeter channels operational. The average $\beta\beta$ duty cycle is 92%, taking into account the 5% weekly ^{207}Bi calibration and the 1% daily light-injection system calibration.
The first backgrounds have been measured, in particular the Radon contribution. At the time of this measurement, the Radon free-air was not operational, and the lowest ^{222}Rn activity, obtained with a tracker gas-flux of 10 L/min, was on the order of 21 mBq/m^3, compared to the specification of 0.15 mBq/m^3.
A double-electron spectrum had been acquired and as expected the $0\nu2\beta$ RoI is dominated by the ^{222}Rn contribution.
Quantum Electrodynamics predicts that the speed of light in vacuum should decrease when it is subjected to an intense external electromagnetic field. The **DeLLight** project aims to measure it by using intense and ultra-short laser pulses delivered by the LASERIX facility at IJCLab.
The innovative approach consists in measuring by interferometry the deflection of a low-intensity probe laser pulse when crossing the optical index gradient created in vacuum by its non-linear coupling with an external intense pump laser pulse.

The DeLLight team has completed two major achievements in its program. A high spatial resolution is needed to ensure a high sensitivity for the interferometric measurement of the deflection signal. However, the spatial resolution is strongly degraded by the interferometric phase noise induced by mechanical vibrations. To suppress that noise, a novel method has been developed, and consists in introducing, in the interferometer, a delayed replica at high frequency of the prompt probe pulse. Correlated noise between prompt and delayed pulses is then removed via post-processing.

A prototype has been developed to validate this technique, achieving the ultimate spatial resolution required for the experiment, limited only by the quantum noise of the CCD camera. This result is an important milestone of the DeLLight project and has been submitted for publication in Phys Rev A.

The second achievement concerns the start of the installation of the DeLLight setup, in June 2025, in the new dedicated experimental room funded by IJCLab. Commissioning of the experiment using intense laser pulses is expected to begin by the end of 2026.

On the longer term, the PHE pole is committed to R&D activities for future projects in particle physics.

The **SiW ECAL** is the baseline for the ILD Concept that studies variants for linear e+e- colliders and for circular e+e- colliders. Its activity progressed in 2025, with the successful operation, in test beam, at DESY, of two new Active Signal Units (ASU) consisting of sensors, PCB and front-end electronics. The new versions benefit from an updated routing of the PCB and power management, which reduce the noise rate. In earlier versions around 5% of cells had to be masked due to high noise. This number dropped down to 1-2 per mille. Thirteen more layers are to be produced in 2026, for a test beam at CERN, with a full stack.

Originally designed for a Higgs factory, the adaptation of the SiW ECAL technology, for its use in a project of calorimeter for the SHiP Experiment, at CERN, has started.

Two teams are involved in **FCC** R&D, through the **ALLEGRO** and **GRAiNITA** detector concepts. The former recently completed the full characterisation of the readout electrode prototypes reaching the expected performances and improved the simulations, alongside GRAiNITA, has achieved analyses of test beam data leading to the submission of a JINST paper.

The R&D for all three activities are carried out in the DRD Calo, hosted by CERN. Further, the FCC, ALLEGRO, GRAiNITA and SiW ECal teams made visible contributions to the update of the European Strategy of Particle Physics and provided major inputs to the discussion and for the elaboration of this strategy.

A2C: ASTROPARTICLES, ASTROPHYSICS AND COSMOLOGY

Astroparticles and solid-state detectors (ASSD)

The A2C/ASSD team is actively involved in several cutting-edge experiments exploring neutrino physics beyond the Standard Model and direct dark matter detection. These efforts build on the group's extensive expertise in low-temperature detectors and superconducting technologies.

In the field of neutrinoless double beta decay research, the A2C/ASSD team has successfully completed the construction and installation of the **CROSS** demonstrator at the Canfranc laboratory. Following a successful commissioning phase, CROSS is now taking physics data. It offers significant sensitivity for the study of the candidate isotope Mo-100 and serves as an excellent test bench for **CUPID** light detectors. Within the CUPID collaboration, the group has continued optimizing light detectors and conducting related studies aimed at background reduction, while also laying the groundwork for their large-scale production. The group has also made major contributions to CUPID assembly components, prototype tests at Gran Sasso, and background modeling studies.

The group has developed state-of-the-art HPGe detectors operating at 10 mK, currently deployed in the **RICOCHET** experiment at the ILL Grenoble nuclear reactor to precisely measure coherent elastic neutrino–nucleus scattering (CEvNS). Multiple data-taking campaigns have enabled thorough characterization of the instrument and comprehensive background calibration. In parallel, the team has developed a new generation of HPGe detectors with single-electron sensitivity, based on superconducting transition-edge sensors. These devices are now being considered for high-precision CEvNS measurements in the sub-100 eV energy range. Their exceptional sensitivity also makes them strong candidates for next-generation direct dark matter detection experiments. The group is a key contributor to the **TESSERACT** project, scheduled for deployment at the Laboratoire Souterrain de Modane (LSM) in 2028.

The team has demonstrated that novel types of non-equilibrium states can be generated in superconducting devices by the application of voltage gradients. These electronic states are characterized by a fluctuating order parameter and are therefore expected to act as sources of electromagnetic radiation. They have also conducted separate experiments probing the impact of microwave radiation on superconducting lines - which was seen to give rise to a DC voltage signal even without the application of any DC current. As a part of the SEMISURF project (PhOM Paris-Saclay), the team has been studying the properties of ion-implantation-doped semiconductors in collaboration with the MOSAIC platform at IJCLab.

High-energy astroparticles (APHE)

The **Cherenkov Telescope Array Observatory (CTAO)** will explore the high-energy (gamma-ray) universe. The two arrays of telescopes will start collecting data in 2027. At IJCLab, the experimental work has focused on characterizing the first NectarCAM camera in preparation for its deployment. This includes developing test procedures and software, qualifying and operating calibration sources, and testing sampling technologies for integration into the intensity interferometry network of the CTAO (leading as well as the corresponding science working group). The IJCLab CTAO group is also responsible for acquiring, analyzing and publishing data from thermal tests, preparing on-site operations and camera verification, and developing the real-time system for transient follow-up. In 2025, the group led the publication of the results of research on fast radio bursts using a CTAO precursor, the prospects for detecting star-forming galaxies with the CTAO and the expected constraints that the CTAO will place on the acceleration of heavy cosmic rays in Galactic sources.

Using more than twenty years of data collected with the **Pierre Auger Observatory**, the Auger group continues to uncover the physics of ultra-high energy cosmic rays. A previously hinted-at feature in the spectrum at energies around 10 EeV, the instep, is now clearly established and found to be consistent across all observed directions. The uniformity over the sky suggests that it does not originate from a small number of nearby sources. Instead, it points toward a population of extragalactic sources that accelerate particles to extreme energies through similar physical mechanisms. Future measurements, in particular those enabled by the AugerPrime upgrade, will enable the energy spectrum of the various elements that make up ultra-high energy cosmic rays to be studied. Using artificial intelligence, novel insights into the mass composition have been unlocked, revealing, as the energy increases, a becoming heavier and purer. In parallel, motivated by two “anomalous” radio pulses observed by the ANITA flights I and III that appeared inconsistent with the Standard Model of particle physics, a search for upward-going air showers at zenith angles exceeding 110 degrees has been performed. The absence of signal places strong constraints in strong disagreement with the interpretation of the anomalous events as upward-going showers.

Astrophysics and cosmochemistry (AC)

The development of the **COMCUBE-S** mission in collaboration with ESA is progressing steadily. In 2025, Phase A of the mission’s preliminary design, covering the overall architecture and the microsatellites, was successfully carried out. Mission performance simulations (PhD Nathan Franel) were conducted to define the CubeSat constellation. The proposed swarm of 27 interconnected CubeSats will represent a major step forward for gamma-ray burst physics, time-domain astronomy, and multi-messenger astrophysics. The development of the scientific payload for the microsatellites relies on coordinated efforts across the four departments of IJCLab’s Engineering Pole.

Following the European Space Agency's (ESA) call for ideas for Innovative Radiation Monitoring Concepts, the **PRISE** project (Particle Radiation Instrument and Spectrometer for Europe, ONERA/IJCALB/H) was selected. The ongoing studies should demonstrate improvements in particle identification (electrons, protons, and heavy ions) using the shape of the transient current from silicon detectors mounted in telescope, in addition to the total deposited charge.

With the support from CNES and ANR ASTRO-AFMIR, the A2C/AC team pursued the analyses of **asteroid Ryugu** samples brought back by the **Hayabusa2** space mission, at the sub-micron level using infrared nanospectroscopy (AFM-IR) and nanoscale secondary ion mass spectrometry (NanoSIMS). Experiments at GANIL (PhD Julien Rojas) showed that it is possible to transfer isotopic heterogeneity of H, C and N initially present in cometary ices to refractory organic residues formed by heavy ion irradiation of ices. The **MEDOR+** project (collection of micrometeorites in the stratosphere) was initiated with the support of CNES Balloon division and DIM ORIGINES (Ile de France region). The project relies on external industrial support for the design and development of the experiment, planned to fly at the autumn of 2027. In the frame of the COM&Min ANR project, the team is also involved in the interpretation of **Rosetta/COSIMA** data on the composition of dust particles from comet 67P/Churyumov-Gerasimenko.

Dark energy (LSST)

The year 2025 marked a historic milestone for the IJCLab's LSST team with the **Rubin-LSST** telescope becoming operational in April. The first images, unveiled during the global "Rubin First Light Event," were presented to the public, the media, and influential figures. In France, several public events were organized to celebrate this achievement, including a notable event at the Cité des Sciences et de l'Industrie in La Villette, led by Jérémy Neveu.

In 2025, the telescope alternated between phases of technical optimization (engineering) and observation periods dedicated to scientific validation. Beginning in October 2025, the first alerts were generated and transmitted to alert brokers, including **Fink**, whose data was made public in February 2026. In June 2025, the first Data Release (DP1), based on a commissioning version of the telescope's camera, was released to the scientific communities associated with the Rubin Observatory. These data enabled the LSST team to publish several scientific papers. In particular, the team has estimated photometric redshifts using an innovative method involving "SED templates" dynamically generated at different redshifts by stellar population synthesis models (PhD Joseph Chevalier). At the same time, a study of galaxy image generator models was published in MNRAS.

The LSST team also worked on the **auxiliary telescope (Auxtel)** to combine CALSPEC and Gaia calibration standards. Through careful sampling of atmospheric transmission, we have identified rapid variations in precipitable water, resulting in dispersions of several tens of millimagnitudes in the Y-band. This work led to the submission of a scientific article on the design and characterization of the holographic disperser installed on Auxtel, while a second article on the measurement of atmospheric parameters and transmission is in preparation. A key element of photometric calibration relies on the characterization of instrumental filters and atmospheric transmission. In this context, the Travelling Collimated Beam Projector (TCBP) project, funded by the ANR and DIM-Origines (Post-doc Enya Van den Abeele), was launched. The TCBP was built in the LPNHE experimental facilities, then sent to the Haute Provence

Observatory to measure the StarDICE telescope (three times) and the ZTF telescope. For the latter, a three-week campaign by six members of IN2P3 enabled the measurement of the photometric filters for this survey of Type Ia supernovae. It is now the best-calibrated telescope in the world, and the calibrated light curves of its SNIa will serve as a milestone in the cosmological distance ladder for decades to come.

On-going work (PhD Angelo Lamure Fontanini) focuses on determining the PSF (Point Spread Function) to refine the forward model of the spectra estimated by the Spectractor program. This research utilizes AI-based techniques, strengthening the expertise in spectroscopic data reduction (for LSST as well as Euclid and JWST). It is also part of the **StarDice** project, aimed at obtaining spectra of standard stars that will serve as benchmarks for the cosmological distance ladder.

Direct dark matter (DDM)

In 2025, the **DAMIC-M** collaboration published strong constraints on sub-GeV dark matter interacting with electrons using the Low Background Chamber (LBC), the DAMIC-M prototype detector. These results, based on data collected during a science run in late 2024, exclude for the first time theoretically motivated benchmark scenarios for dark matter production via freeze-in and over a large fraction of the freeze-out parameter space in the Dark Sector. The A2C/DDM team contributed directly to the data analysis. In parallel, the coordination and development of the data acquisition system for the final detector installation, planned for 2026, was completed at IJCLab. The group also grew substantially in 2025, with the arrival of an external senior researcher, a doctoral student, and a postdoctoral researcher.

In 2025, the **MADMAX** collaboration has published its two first competitive scientific results based on Axion and Dark Photon search campaigns conducted in 2024 at CERN and UHH respectively. At that time, fixed encapsulated dielectric disks prototypes at warm were used as proof-of-principle. The prototyping phase is continuing in order to extend the Axion phase space reach of MADMAX in the 15-40 GHz frequency range. In particular, the collaboration is developing an open booster setup with movable disks of 30 cm diameter that will be inserted in a 1 m large 4 K cryostat. The IJClab team delivered and tested at UHH in October 2025 a set of RF absorber panels that fits in this cryostat. This contribution is part of the overall critical RF noise mitigation strategy of MADMAX. It follows a fruitful collaboration with the cryogenics department from which the glued absorbers were successfully mechanically tested at 4 K and with IAS where a shared VNA was used to validate their RF response. The IJClab team will participate in the 4 K commissioning of the prototype at UHH and further strengthen its collaboration with IAS with the procurement of specific 20 GHz RF hardware through UPS fundings.

Cosmic microwave background (CMB)

The A2C/CMB team led the analysis of the latest data release (DR6) from the **Atacama Cosmology Telescope**, which was published in March 2025.

The **Simons Observatory** achieved first light with the deployment of its three small-aperture telescopes in 2024 and its large-aperture telescope in 2025. Preliminary results, based on the analysis of 180h of observation, demonstrate remarkable consistency across frequencies and sensitivity exceeding initial goals. These findings were presented at the conference "Moriond Cosmology 2026". In parallel, the team is working on the design of a magnetically levitated half-wave plate rotation system operating at 4 K, intended for a future ground-based CMB experiment, with the engineering department, and in collaboration with LPSC/Grenoble.

For the **LiteBIRD** space mission, following a redesign phase aimed at reducing risk and cost, the team contributed to the JAXA Key Decision Point in mid-2025 and is now preparing for a major JAXA review (MDR2) in mid-2026. The A2C/CMB team continues to actively participate in design studies and scientific forecasting activities.

As part of the ANR BATMAN, the A2C/CMB team published an analysis of the combination of current CMB datasets, propagating uncertainties from foreground residuals, which provides robust constraints on the sum of the neutrino masses. Additionally, the team published updated constraints on the epoch of reionisation using Planck PR4 and a study on cosmological tensions when combining CMB, BAO and SN data.

Gravitational waves (OG)

The **Virgo** interferometer, together with its counterpart collaborations LIGO and KAGRA, completed the fourth observing run (O4) at the end of 2025, resulting in the discovery of hundreds of gravitational-wave signals consistent with compact binary mergers. Virgo members at IJCLab contributed significantly to the production of analysis software, results and publications from O4, in the context of 1) the fourth release of the Gravitational Wave Transient Catalog, 2) the search for unmodelled gravitational-wave transients, and 3) the search for gravitational waves associated with gamma-ray bursts, to be published in 2026.

The work of the **CALVA** team has focused on three main areas: the theoretical and experimental study of a three-mirror optical cavity, motivated by future generations of gravitational-wave detectors; the development of control systems in a 50-meter suspended cavity as part of Virgo's sensing and control subsystem (PhD Fangfei Liu); and the continuation of efforts to achieve optical squeezing, in particular through the improvement of the control loop for the squeezing-ellipse angle and the development of a fully-digital control system based on FPGA controllers.

With regards to the **Einstein Telescope** (ET) project, IJCLab was involved in the drafting of the so-called "blue book" detailing ET's science case, now published in JCAP. Gravitational-wave search prospects were studied with a project on the analysis of ET's mock data challenge (Post-doc Adrian Macquet). On the experimental side, two projects were started on the quantum-noise-reduction system (new geometry of filter cavity and vertical suspended periscope).

In 2025, the **SVOM** satellite started collecting science-quality data. Many gamma-ray bursts and other high-energy transient sources have been detected and studied. The IJCLab team contributed to manage alerts and to publish GCN circulars to promptly disseminate results in the community. Moreover, the IJCLab development team has prepared software patches to improve the performance of the on-board X-ray telescope (MXT) and to better process satellite data sent to the ground.

GRANDMA is a global coordination of optical telescopes covering all the time zones and both hemispheres. In 2025, the scientific output was highlighted by the publication of a paper on the follow-up to the O4 multi-messenger campaign, the submission of two collaborative papers on the study of long gamma-ray bursts from the Swift mission, and several contributions in partnership with the SVOM mission. Activities are now focused on preparing for kilonova and multi-messenger science with the LSST (PhD Alex Jacquesson). Finally, the team is currently enhancing in-house tools (Skyportal) and updating a citizen science website (KNC).

ACCELERATOR PHYSICS

The **ThomX** inverse-Compton source is now delivering a stable X-ray flux ($\approx 10^{10}$ ph s^{-1}) and is scheduled for dismantling in May 2026. While the facility is already usable, it remains in its commissioning phase as we resolve the remaining hardware and modelling issues that limit the beam quality. Following the replacement of the accelerating section during the technical stop in 2024, a subsequent realignment of the ring dipoles and the accelerating section (early 2025) removed some magnetic-axis offsets and improved the orbit, although the orbit at the interaction point is still circular, a major drawback for the X-ray beam quality because it hampers perfect overlap of the electron and laser beams. New diagnostics have been commissioned: a streak-camera measures bunch length, synchrotron-light imaging gives transverse beam size, and the X-ray source size measurement from laser wire and X-ray imaging. Matching optics between the linac and the storage ring have been refined, but the machine model still fails to reproduce the linac dynamics, which remains a key weak point. A major hardware improvement was the replacement of the copper photocathode by a magnesium cathode (mid-2025). The new cathode operates flawlessly and produces roughly five times more charge per injection, directly boosting the X-ray flux. The optical cavity, already synchronised with the stored electron beam, routinely stores ≈ 90 kW of laser power; the final increase to the design maximum is scheduled for late April 2026. User operations began in late February 2025 with Alberto Bravin (formerly ESRF) performing X-ray imaging experiments. This was followed by Jenny Spiga (dosimetry) and Dominique Bazin (medical fluorescence) in the spring of 2025. Early results are promising and confirm the feasibility of the concept. Electromagnetic-compatibility (CEM) problems affect several subsystems (laser drivers, RF electronics, diagnostics) and generate interference that can degrade performance; extensive shielding and grounding improvements are ongoing, but the issue persists. Planned activities before de-commissioning are limited to concluding the data taking and the final power-ramp of the optical cavity in April 2026. No further hardware upgrades are foreseen before the planned shutdown in May 2026.

For **PERLE**, significant effort was made in 2025 to finish the installation of the DC gun, its high-voltage system, the load-lock photocathode fabrication facility, and the photocathode laser system. Commissioning of this assembly, started in the last quarter 2025 and will continue in first quarter 2026, so that the electron source will be ready to deliver the first beams by April 2026. The achieved milestones toward the installation and commissioning allowed the validation of the Go/No-Go milestone of ERL4ALL project and the starting the transition to the development phase in which the completion of the injector installation is foreseen. In another hand, in the framework of European project iSAS, the procurement of the four 5-cell SRF cavities for the main linac was performed. Their reception is foreseen end 2027. Other systems are also ready for the call for tenders in 2026, as the buncher cavity, the four mono-cell SRF booster cavities, and other RF systems. Lattice consolidation and Beam dynamics studies are ongoing and two PhD students + 1 post-doc joined the team. Design of other systems is also progressing well, as the main linac cryomodule, the booster, and the magnets. The TDR drafting is progressing; it is foreseen to submit it for publication in 2026.

An additional contract has been signed between FNAL and CNRS to perform cryogenic test of 4 additional SSR1 cavities for **PIP-II**. 1 production SSR1 cavity has been tested but was not validated due to problem of surface cleaning done at cavity producer. 2 pre-production SSR2 cavities from a different manufacturer have been as well tested but not validated due to again problem of surface treatment by the company. R&D on in-situ plasma cleaning of a SSR1 cavity has been initiated as a collaborative effort between PIP-II project and Maverics team SRF PhD student. Its impact on cavity performance has been assessed on a prototype cavity shipped by FNAL. Preparation for production phase is still on-going. This consists in upgrading several equipment of the cryostat CV800.

For the **MYRRHA** project, IJCLab continued the preparation of the experimental areas dedicated for the series validation of the MINERVA RF couplers to Spoke cavities and for the Cold Tuning Systems. First pre-series of couplers and CTS will start mid-2026.

IJCLab's research activities in the area of **High-Energy Physics (HEP) Collider R&D** over the past year have been primarily focused on the future Higgs factory, CERN's flagship project FCC-ee. This R&D programme is carried out within the framework of the FCC-ee collaboration, in close coordination with CERN and other collaboration members, including PSI, among others. Furthermore, through the EAJADE programme, secondments have been undertaken in Japan, notably at SuperKEKB and ATF2. The main areas of focus of the programme encompass **Interaction Region (IR) optics design and beam dynamics,** monochromatization operation schemes, **polarimetry, positron production**, as well as **superconducting RF** (SCRF) material studies and cavity development. The past year has been particularly significant for the HEP community, owing to the ongoing European Strategy for Particle Physics Update process, which is expected to conclude in 2026 and will define the strategic direction of the field for the coming years. Finally, two doctoral theses were successfully defended in December 2025 and February 2026, covering the topics of positron production and beam-beam studies for FCC-ee, respectively.

R&D activities aimed at improving the surface properties of materials for accelerator components (SRF cavities and beamlines) have focused on four main areas: (i) **mitigation of multipacting** via thin coatings, (ii) in-situ **plasma cleaning of superconducting cavities**, (iii) development of **superconducting thin films**, and (iv) **dynamic vacuum studies**, including electron- and ion-stimulated desorption. A published study clarified the role of copper oxides on secondary electron yield (SEY) and beamline conditioning in high-energy colliders. An ongoing PhD project (Camille Cheney) has demonstrated that activating specific RF modes enables efficient removal of carbon contamination from cavity surfaces. In the SRF domain, recent work has investigated the formation of niobium carbides during thermal treatments, while collaborative efforts with ICMMO are exploring NbN thin film deposition by CVD directly inside SRF cavities. Finally, electron-stimulated desorption experiments using the PHIL photo-injector are planned for 2026, and the new OSIRIS setup (EQUIPEX PACFICS) will enable advanced studies of desorption processes and SEY at cryogenic temperatures. In addition, the PERLE project will provide a strong framework for developing R&D activities dedicated to the investigation and enhancement of photocathode performance, with a particular emphasis on lifetime and quantum efficiency.

The **PALLAS laser-plasma injector electron source** achieved a major milestone in late spring 2025 by producing its first electron beam, delivering tens of picocoulombs at 150 MeV with remarkably low divergence, powered by a 1.5 J laser driver at 1Hz. This laser-plasma electron source used double cell gas target fully developed at IJClab. Later, in the year, the high-energy laser amplifier underwent an upgrade, though progress was briefly hindered by damage to a Ti:Sa crystal; after its replacement, characterization efforts validated the team’s model for spatio-spectral coupling caused by thermal load on the optical compressor—a critical insight for future high-repetition-rate laser systems. Despite this setback, the second commissioning phase was rescheduled to early 2026, culminating in the successful generation of electron beams reaching 220 MeV with up to 40 pC charge at 1 Hz.

The year also brought promising developments on the funding front, with two grants secured under WP5 of the EPITA project, focusing on laser control for accelerators and advanced plasma devices for compact accelerators, while PALLAS continued its strong support for the EuPRAXIA project, which is set to enter its implementation phase in 2026. Looking ahead, the team is advancing new target designs for 2026 beam time to enhance electron beam quality and control, with a parallel focus on refining laser quality—currently the limiting factor in beam performance. These improvements are expected to benefit all experiments on the LASERIX platform. On the simulation front, the team has established a robust workflow for the direct integration of laser data into particle-in-cell (PIC) modelling, a development that is pivotal for enhancing our understanding of the influence of laser parameters on electron beam performance and stability.

All commissioning activities conducted in 2025 were carried out without active stabilisation of the laser system, with the electron beam propagated in free drift through the characterisation beamline. In 2026, the first beam pointing stabilisation module and spectral phase feedback system will undergo testing, while the capture and focusing section -comprising four refurbished quadrupoles featuring a novel pole fabrication process developed at IJCLab- will be installed.

Within **TWAC** project, the aim is to demonstrated THz acceleration of electrons inside a millimetre waveguide, called ZITA and to explore the impact of such a device: flash therapy, compression system for electron, beam shaper. Electron beam has been successfully focused and transmitted through the zita under vacuum. The interaction chamber gathering THz source, zita and electrons is integrated and operational on the electron accelerator line. 40% of THz coupling into ZITA has been achieved. Installation of passive streaking is in progress to measure the bunch duration compression due to the THz. Dosimetry of the electron beam coming the photoinjector has been realised with CSIC reaching few Gy/s. It is a first step towards biological experiment using such an electron beam. Major experimental campaign for THz acceleration and compression measurements will be held for 2026.

Within the Equipex+ **PACIFICS** (2022-2029), the multi-technique setup for advanced characterization of materials (even at low temperature) was commissioned and the routine XPS is now widely used, especially for a new PhD student. A new cryostat was designed, installed and is now operational to perform mechanical tensile tests at liquid nitrogen temperature. It will be used next year at helium temperature. Design of a cryostat dedicated to thermal characterization is on-going might be commissioned next year.

ENERGY AND ENVIRONMENT

The launch of the national master project PRECY (Physique des REacteurs et du CYcle) at Nuclei and Particles Institute, CNRS, now federates, within a single framework, our activities in ***reactor physics, fuel cycle physics, and scenarios***. Sarah Eveillard defended her thesis in 2025 on the modelling of heterogeneous Pressurised-Water-Reactor cores for nuclear scenario studies. Two members of the team contributed to major international conferences: Marc Ernoult presented his work on efficient sensitivity analysis via multidimensional linear regression and served on the workshop's scientific committee at TWoFCS in Tokyo, and Baptiste Durox, his PhD student, addressed the improvement of French plutonium inventory assessment through a Metropolis-Hastings algorithm at PHYSOR in Turin. The APESE project (*Analyse Physique et Economique de Scénarios Energétiques*) aims to quantitatively analyse different energy transition scenarios in light of the consumption of embodied energy, consumed to produce and assemble the materials needed for energy installations, as well as to operate them. At the 33rd CIRP conference on Life Cycle Engineering in Kamakura, Elsa Cohen (PhD student, under the direction of Guillaume Roux (LPTMS) and supervision of Sandra Bouneau) presented her work on the embodied energy of energy facilities required for transition scenarios.
The **nuclear physics experimental training platform**, co-led by Sandra Bouneau and Sylvain David (who passed away early 2025), and supported within the framework of the NExIF project funded by BPI France, was inaugurated in November 2025 during the General Assembly of the *Campus des Métiers et des Qualifications d'Excellence (CMQE) Énergie Durable d'Île-de-France* at Université Paris-Saclay. The key features of this platform are two high-activity neutron sources for the production of radioactive nuclei through neutron activation and the study of moderation in matter, secured by shielding designed at IJCLab; radioactive sources emitting gamma radiation for studying their behaviour in matter, and alpha particle emitters for measuring energy loss; and several sets of probes dedicated to radiological risk prevention and dosimetry. These experiments, similar to those conducted in nuclear research and industry, are now accessible in an educational setting.

An international collaboration involving radiochemists researchers from the Energy and Environment department (C. Le Naour, M. Maloubier) has resolved ambiguities that have intrigued the scientific community for decades concerning the nature and stability of the characteristic chemical bond of protactinium. The mono-oxo bond persists with an unexpected stability under extreme chemical conditions, highly acidic chloride solutions. This result, published in *Angewandte Chemie*, opens new perspectives for understanding the behaviour of this singular actinide, a radioactive element discovered over a century ago. This ***Radiochemistry of the Fuel Cycle and Environment*** topic is currently being strengthened at IJCLab with the creation of a joint research laboratory (*LRC*), in partnership with CEA-DES and CEA-DAM, to develop common research projects in radiochemistry and reinforce the training of young researchers in radiochemistry.

Concerning the topic related to ***chemistry of d- and f-elements in non-conventional solvents***, two highlights are worth to be noted in 2025. First, the chemistry of f-element compounds is poorly understood in deep eutectic solvents (DES) despite their unique physicochemical properties, constituting a new class of promising solvent-electrolytes for the treatment and storage of radioactive waste, that can be easily prepared from cheap, low toxicity, low volatility and biodegradable compounds. The objective of our work is therefore to explore the speciation and redox properties of lanthanides and actinides in these media. This year the chemistry of europium (III) compounds as an analogue of trivalent minor actinides was studied in a series of DES based on diols (with different hydrogen bond acceptor (HBA) to hydrogen bond donor (HBD) molar ratios). Secondly, within the ANR WH-RECOLTE project and the PhD thesis of Ceren Alpaydin co-supervised by Veronika Zinovyeva, an interesting way for the direct conversion of low-grade heat into electricity is studying using thermogalvanic cells containing ionic liquids as electrolyte. Indeed, energy production and consumption are accompanied by significant heat losses which generate a direct nuisance on the environment and contribute to climate change. One of the promising routes to new energy resources is the use of this waste heat. Our recent work showed that new Cu (I and II) complexes could be identified as promising redox species for thermoelectrochemical applications.

The ***Chemistry of Molten Salt*** and ***Nuclear Waste Management*** topics were reinforced in 2025 with the arrival of a technician (Tracy Bellande) and a junior permanent CNRS researcher (Charly Carrière), along with two PhD students (supervised by Céline Cannes and Sylvie Delpech) and 3 temporary-contract research engineers funded by BPI France projects (SELF, ALIS and ISAC). One patent and 7 peer-reviewed publications were published. Joëlle Costantine and Letissia Hamza defended their PhD thesis related to respectively, chloride molten salts chemistry, and reactivity of UNGG reactors' nuclear wastes in molten hydroxides, both funded by Orano. The *Innovation Molten Salt Lab* (IMS Lab), a joint laboratory (LabCom) dedicated to molten salt chemistry, inaugurated in October 2024, was stopped due to the liquidation of the deeptech NAAREA. New studies are being developed with STELLARIA, in particular for the analysis of gas present in molten salt during the reactor operation, for which a dedicated experiment is being planned.

Three projects submitted by the Energy and Environment department were accepted at the 2025 internal call of the **CONNECT-NM European programme**, focusing on **nuclear materials**. ENHARMONY aims to address the lack of standardized corrosion testing protocols for candidate structural materials, a critical challenge in the deployment of Molten Salt Reactors. FIGARO proposes to study the evolution of an Accident Tolerant Fuel (Cr-doped UO_2) microstructure and the fission products behaviour under irradiation. NEUTION aims to develop a faster qualification of materials exposed to neutrons, by testing a method based on neutron irradiation of small volume samples in a reactor, which will not require the use of hot cells for structural analysis, and compare the neutrons-induced microstructural effects with those induced by heavy ions delivered by accelerators.

Within the ***Materials and Irradiation*** topic, the effects of crystalline quality on ion implantation induced modifications in AlN single-crystalline layers were investigated. Native dislocations have no visible effect on microstructural changes at low damage levels. However, when extended defects are formed, they have a significant influence on point defects, and can then lead to surface amorphization under certain conditions (see S. Jublot-Leclerc *et al*, Journal of the European Ceramic Society **45** (2025) 117627). Mathis Hitier defended his PhD thesis funded by the NEEDS programme on the impact of irradiation on the chemical durability of UO_2, $UThO_2$ and $UNdO_2$ sintered pellets, co-supervised by Frederico Garrido and Claire Le Naour. Dr Stéphanie Jublot-Leclerc defended her *Habilitation à Diriger des Recherches*, entitled "Microstructural modifications induced by ion beams in materials of interest for applications in current and future nuclear reactors". The SIXPAC project (**S**et-up for **I**n situ **X**-ray diffraction cou**P**led to an ion **AC**celerator), coordinated by the Energy and Environment department and the MOSAIC ion beam facility, is running smoothly, with the arrival of the high performance Brucker D8 X-Ray Diffractometer in March 2025 and various tests and studies during the year to develop and fabricate the vacuum chamber and components of the new ion beam line to be connected to the ARAMIS 2MV ion accelerator.

Last but not least, the **SciAM project** (*Science Amont pour le Nucléaire de Fission*), led by CNRS and CEA, was selected mid 2025 to be funded through a 5-years PEPR national programme (*Programmes et Equipements Prioritaires de Recherche, France 2030 roadmap*) starting in 2026. The Energy and environment department at IJCLab is involved in most of its work packages, on nuclear data, radiochemistry, and materials and irradiation with post-docs and PhD students fundings, along with funding for infrastructure and equipment for both the hot chemistry lab (named as "bâtiment 107") and the MOSAIC ion beam facility. This initiative to fund fundamental research is supporting our work and facilities, and will help in accelerating discoveries in nuclear science.

<u>HEALTH PHYSICS</u>

REV Team

In 2025, the REV Team advanced its work on the PRISM/TTRIP project, focusing on the production of radioisotopes and medical imaging. Measurements of the excitation functions for the Gd-155(p,x)Tb-yyy reaction in the 5–27 MeV energy range, conducted using ultra-pure Gd-155 targets, enabled the determination of the optimal isotopic composition for the production target. This composition maximizes Tb-155 production while minimizing contaminants. Additionally, preclinical SPECT imaging measurements were performed using both pure and Tb-156-contaminated Tb-155 solutions. These experiments served to validate GATE Monte

Carlo simulations, assessing the impact of contamination on Tb-155 SPECT imaging performance. The team also investigated Tb(III) complexation with hydroxamic and pyridinecarboxylic ligands using affinity capillary electrophoresis. The goal was to develop more effective ligands for terbium chelation in nuclear medicine applications.
A first clinical evaluation of the THIDOS camera was completed in March 2025, involving 20 patients with benign thyroid diseases. Preliminary results demonstrated unprecedented image quality at energies around 400 keV, providing directly quantitative information—a capability lacking in standard cameras. A preliminary evaluation of this camera was also conducted in collaboration with CHUV (Lausanne) for prostate cancer treatment using Lu-177.
The year 2025 marked a significant milestone for the BioALTO project, which secured a SESAME regional grant. This funding will support the upgrade of the ALTO facility, the development of the BioALTO irradiation beamline, and the creation of new beam monitors. One of the new initiatives, the PROFIL project (Photomultiplier Ring Monitor using N2 Fluorescence from Ion Trail), was launched as part of Louis Hardouin's doctoral thesis.
The MODERATO project led to the development of a high-potential open-source algorithm for tracking individual cells in time-lapse videomicroscopy of *in vitro* populations exposed to ionizing radiation. Applied to over 6,300 MCF7 breast cancer cells irradiated from 0 to 5 Gy, this Cell Lineage Tracking (CLT) approach enabled single-cell identification, lineage reconstruction, and the classification of three distinct responses—proliferative, transiently arrested, and long-term arrested—associated with changes in cell size and motility. Published in *PLOS One*, these results highlight the power of large-scale lineage-based videomicroscopy in detecting correlations between irradiation conditions, cellular interactions, and heterogeneous radiation responses.

IMIT Team

The IMIT team made significant progress in 2025 at the intersection of multimodal optical imaging and biomedical applications, with a strong translational focus.
Research on brain metastases resulted in a publication in *Scientific Reports*, demonstrating the ability to link the optical signatures of metastatic tissues to their primary organ of origin. This breakthrough is particularly valuable in clinical settings, where metastases are often detected before the primary tumor. The findings open new avenues for identifying tumor origins and tailoring therapeutic strategies accordingly.
Building on these results, the team is analyzing data from an experimental campaign conducted on the DISCO beamline at the SOLEIL synchrotron, using excitation–emission matrix measurements. The goal is to refine the spectral characterization of tissues and enhance the robustness and predictive power of classification approaches.
Significant progress was achieved in multimodal imaging through a collaboration with the Institut Langevin (Claude Boccara's group). This partnership focuses on coupling nonlinear fluorescence with imaging modalities such as Optical Coherence Tomography (OCT) and Optical Transmission Tomography (OTT). Supported by funding from the AUGUSTA Foundation, these developments aim to improve tissue characterization by integrating structural

and functional information. Last but not least, the MAPSSIC project has successfully achieved the miniaturization of the backpack module, ensuring low power consumption and sufficient autonomy, as well as the development of a user-friendly interface for the acquisition station.
Two complementary PhD projects were launched: the first, in collaboration with NeuroPSI, investigates the optical signatures of brain tissues in murine models under controlled conditions, contributing to the preclinical validation of the team's approaches. The second focuses on endomicroscopy, emphasizing the design and implementation of an optical probe. This work, oriented toward clinical applications, currently involves analyzing the differences between one-photon and two-photon excitation on human biopsies to determine the most robust and clinically relevant optical signatures for *in situ* diagnostics.

MoV Team
The MoV team initiated the development of a new model to account for the effects of hypoxia on irradiated cell populations, building on its expertise in cell population outcomes under normal oxygen conditions (Marianne Billoir's PhD defense, Fall 2025). Hypoxia is known to increase the radioresistance of gliomas, contributing to poor patient prognosis. A deeper understanding of hypoxia could lead to improved treatment strategies.
The team conducts in vitro time-lapse fluorescence microscopy, tracking hypoxic and normoxic glioma cells after high-dose irradiation. Results indicate that hypoxic cells exhibit greater survival post-irradiation compared to normoxic cells, with this effect depending on initial cell density. Additionally, the team is developing a mathematical model to better reproduce and understand this phenomenon. Integrating these insights into treatment planning could enhance the effectiveness of radiotherapy and improve patient outcomes.

THEORY

Mathematical Physics: A loop vertex representation of the cumulants associated with stable random matrix theories has been obtained and studied. Besides, the Conic Hulls and Triangulation computational methods of the Mathematica package *MBConicHulls* have been extended to allow the automatic calculations of a more general class of integrals which involve products of polygamma functions ψ of arbitrary order. This kind of integrals appear, among other things, in the ε-expansion of the dimensionally regularized Feynman integrals. Next, star products have been obtained for a large family of Lie-algebraic quantized Minkowski space-times paving the way for the systematic study of Quantum Field Theory on those quantized space-times. Finally, a group homomorphism has been constructed between toroidal braid groups and the automorphism groups of quantum toroidal algebras of corresponding Cartan types.

Laboratoire de Physique des 2 infinis
Irène Joliot-Curie

Cosmology and Gravitation: The group has been advancing along several directions of research over the past year: development of gravity theories, black hole physics beyond General Relativity, the cosmic microwave background, and topological defects in the early Universe. Notable results include the construction of exact black hole solutions with primary hair in four-dimensional regularized Gauss-Bonnet gravity, as well as the study of perturbations of black holes with primary hair in higher-order scalar-tensor theories. These results are particularly relevant in the context of the rapidly growing field of gravitational wave astronomy. In the same context, significant progress has been made in understanding the evolution of melting domain walls, which were previously shown to be a promising candidate for explaining the recent stochastic gravitational wave signal detected by Pulsar Timing Arrays. Finally, a new collaborative project on gravitational wave turbulence has been initiated with specialists in plasma turbulence.

Physics Beyond the Standard Model: The group maintained strong and diverse research activity across several interconnected areas of particle physics and cosmology. A broad range of topics was tackled, including effective field theory approaches to new physics, dark matter phenomenology, neutrino physics, and precision tests of the Standard Model. Theoretical frameworks addressing neutrino masses and mixings were further developed, as well as their implications for leptogenesis and physics beyond the Standard Model. In particular, right-handed neutrinos as dark matter candidates were explored in a scenario relying solely on the presence of neutrino mixing. In the field of dark matter models and their phenomenology, the work spanned a variety of scenarios, including portal models, early-Universe dynamics, and connections between dark matter and other sectors such as inflation or reheating. Notably, the UFO model (Ultrarelativistic Freeze-Out) proposed by our group introduces a novel mechanism for dark matter production. Such production during reheating may lead to observable signatures in DAMIC-M-like experiments, where IJCLab plays a key role. Finally, the interplay between effective field theory and on-shell amplitude methods was also explored, resulting also in a novel on-shell approach to gauge anomalies in gauge and gravity theories.

Flavor physics: The flavor physics team has continued its activity on the theory and phenomenology of flavor processes in the Standard Model (SM) and beyond. Recent advances include precise lattice QCD determinations of matrix elements for radiative heavy-quarkonium decays, providing new insight into their internal structure and dynamics, as well as opportunities to search for light beyond-SM particles at BES-III. We have also pursued studies of B-meson form factors, from first-principles calculations to advanced parameterizations, and explored the phenomenological implications of recent LHCb and Belle II data in semileptonic and non-leptonic decays. Moreover, we have successfully designed an alternative algorithm to Markov chain Monte-Carlo, so-called Event-Chain Monte-Carlo, which is beneficial to mitigate the critical slowing down of simulations of lattice gauge theories close to the continuum limit. The purpose is to access B physics on the lattice while keeping under control at few % level cut-off effects.

Effective Field Theory remains our main framework for studies of physics beyond the SM. In particular, we have been actively investigating opportunities to probe flavor-changing transitions through high-pT processes at the LHC. Recently, we showed for the first time that processes such as diboson production and associated Higgs production with an electroweak boson can place meaningful constraints on well-motivated flavor-physics operators. These developments are implemented in public tools for flavor phenomenology that are continuously maintained and widely used in the field (https://highpt.github.io/ and https://eos.github.io/).

Finally, the team has actively contributed to defining the physics case for future experiments such as FCC-ee. In this context, we are involved as conveners and participants in the "Flavours at FCC" workshop series at CERN, whose goal is to assess the potential of FCC-ee for heavy-flavor physics in both the quark and lepton sectors, and to produce a report that will serve as input to the future TDRs.

QCD: The past year has seen major advances in both theoretical and computational approaches to quarkonium physics. The first complete next-to-leading-order (NLO) calculation of BFKL impact factors for quarkonium hadroproduction in NRQCD was achieved opening the door to next-to-leading-logarithmic-precision studies for forward-backward quarkonium associated production at hadron colliders. For the first time, two-loop form factors for P-wave quarkonium production and decay were derived analytically, enabling NNLO-accuracy computations for $\chi(Q)$ states. For the $\eta(c)$ transition form-factor, both relativistic and NNLO perturbative QCD corrections were computed, with all-order v^2 resummation, providing new insights for charmonium and comparing favorably with BaBar data. Finally, the first NLO phenomenological study of exclusive quarkonium electroproduction in electron-proton collisions was performed, successfully comparing cross-section results to HERA data and providing predictions for the forthcoming Electron-Ion Collider (EIC).

In hard exclusive photoproduction of photon-meson pairs, compact analytical expressions for pseudoscalar mesons (π, η, η') were obtained, revealing strong sensitivity to generalized parton distributions and emphasizing the need for NLO corrections.

Finally, the QCD team has been a major actor in the publication of a review promoting the case for more proton-lead-collision data at the LHC and supporting a contribution to the 2025 European Strategy for Particle Physics Update.

Nuclear Physics: Efforts have been made to connect relativistic density functionals with ab initio developments by using ab initio pseudo-data to constrain functional fits and improve the description of exotic nuclei, while in parallel major progress has been achieved in the development of microscopic techniques for describing large-amplitude non-equilibrium processes in atomic nuclei such as nuclear fission, as well as in advanced ab initio many-body approaches—both classical and quantum—to treat strongly interacting systems including atomic nuclei, neutrinos, and electrons on lattices. A new few-body method that can be adapted to many-body solvers was developed and efficiently treats continuum effects, supporting the overall robustness of our methodology. Tools were implemented to handle antiprotons in support of related experimental programs, with future extensions envisaged for data analysis in astroparticle physics experiments. Predictions of the dipole response in neutron-rich clustered systems have been improved, as well as quantifying uncertainties in nuclear reaction calculations relevant to both experimental analysis and astrophysical applications, in close collaboration with experimental groups and through the development of efficient and accurate theoretical formalisms. In addition, significant effort has been devoted to building a collaborative network linking theory, computational science, and experiment around a predictive simulation protocol for intermediate-energy nuclear reactions at FRIB, aiming at future PhD and master's projects, alongside a more exploratory and high-risk direction based on wavefunction dynamics in the presence of large-amplitude fluctuations for collective nuclear processes. Further work has advanced the study of neutron-star superfluidity, combining ab initio descriptions of uniform matter with calculations of the superfluid fraction in the crystalline crust. Finally, preliminary results from the double-alpha experiment have been obtained, and the study of alpha clustering in dilute nuclear matter at finite temperature has also been explored, contributing to a unified understanding of clustering phenomena in nuclear systems.

Statistical Physics: The serial and parallel association of thermodynamic devices in irreversible stationary states have been translated to open chemical reaction networks. This extension calls for numerical testing to compare the relative computational efficiency of the global versus modular approaches. On the other hand, a collaboration has been developped with mathematicians (project financed by CNRS-MITI) on the use of Mean Field Games for pedestrian modeling.

RESEARCH and TECHNOLOGY (2025 Engineering Pole highlights)

Mechanical Departement:
In 2025, the Mechanical Department achieved several significant milestones and advancements across various projects.
For the **ALERT** experiment, the final interventions on the hyperbolic drift chamber were completed before the experiment concluded in September, marking the culmination of activities that began in 2015.
The **DUNE** project had an exceptionally busy year, with the integration of the dedicated team and the appointment of two agents for AIVT (Assembly, Integration, Verification, and Testing) activities. Complete testing procedures for the cathodes were defined, and factory acceptance reports validated the production of all cathodes. The assembly of the first pair of cathodes in the CERN test setup was another major step in experimental validation. Additionally,

significant progress was made on the chimneys, including the awarding of production contracts for the V24 and V48 series, the completion and validation of factory acceptance tests for prototypes, and the reception, inspection, and internal testing of a large portion of industrial production before integration.
For the **EIC Calo** project, the first twenty-five-crystal prototype was produced, assembled, and tested during a beam test at GSI.
In the **SOFIA** project, a new chamber equipped with CEM caps was installed at GSI.
At GANIL, the redesigned **ZDD** chamber was successfully mounted in collaboration with English partners and local technical teams, paving the way for future commissioning and experimental operation phases.
For the **PERLE** injector, all six technical milestones—critical for securing continued **ERL4ALL** funding—were achieved, with remarkable performance in vacuum systems, high voltage, photocathodes, safety systems, and lasers.
Finally, the **Comcube-S** project reached a strategic milestone by successfully closing Phase A, confirming the continuation of studies and developments for the space program.

Detectors and associated instrumentation Department:
The Detector Department of IJCLab designs and develops detection instruments dedicated to particle physics, nuclear physics, astroparticle physics, and cosmology. It plays a crucial role in the implementation of cutting-edge experiments, integrated into the scientific activities of the institute and its partners. The department also has confirmed expertise in R&D projects aimed at emerging new technologies and the design of innovative detectors.
Among the highlights of 2025, we note the installation and commissioning of the **CROSS** detector, dedicated to the search for double beta decay, and the production and characterization of the first **NectarCAM** for the CTAO (Cherenkov Telescope Array Observatory), a very high-energy gamma-ray observatory.
The CROSS demonstrator consists of 36 Li_2MoO_4 crystals containing the double beta isotope ^{100}Mo, plus 6 TeO_2 crystals enriched in ^{130}Te, coupled with Ge and Si wafers as light detectors. CROSS enhances light detectors through the Neganov-Trofimov-Luke effect, a technology developed and tested at IJCLab. Installed in a cryostat at a temperature of approximately 20 mK at the Canfranc Underground Laboratory in Spain, the demonstrator was successfully commissioned at the end of 2025 and is now in the data-taking phase.
For the CTA project, the department was involved in the production and characterization of calibration devices (single photoelectron/flat-field sources). This characterization included an evaluation campaign to assess the IDROGEN board as a sampling technology for the CTAO's intensity interferometry network. The calibration sources were installed in NectarCAM 2, the second completed CTA's medium size telescope.

Computing Departement:
In 2025, the Comupting Department played a key role in advancing the Engineering Pole's projects by strengthening infrastructure reliability and automation, while supporting the growing needs of scientific experiments.
The **FINK** project marked a decisive milestone with the start of the Rubin Observatory commissioning, processing over 10 million queries in 2025 and producing 5 scientific publications. This success was accompanied by €200k in funding (ANR ASTRID, IEA/CNRS, Royal Society) and the hiring of 2 fixed-term research engineers and one apprentice, confirming the department's ability to attract and train new talent.
In the experimental areas, the first milestone of the **PERLE** project was achieved with the operational deployment of the PhotoGun, reaching 300 kV on the cathode. The department also accomplished numerous objectives involving automation development, including the finalization of the vacuum system for **PALLAS**, the operation of a thermal test bench for IRENA, and improvements made to CTA's **NectarCam**.
These advancements are part of a comprehensive platform modernization policy, with particular attention given to IT system security (digital bastions, preparation for two-factor authentication) and web application updates.
The organization of the WLCG/HSF meetings at IJCLab (May 2025), the second ONLINE workshop (November 2025), and participation in the Gray Scott Reloaded School (July 2025)—involving 31 countries with 928 active participants—strengthens the link between software development, infrastructure, and research, while positioning IJCLab as a leading player in high-performance computing and data analysis for particle and astroparticle physics.
Additionally, the successful onboarding of the department's first two apprentices highlights the commitment to training the next generation of engineers.
These advancements, combined with continuous resource optimization, pave the way for future challenges, particularly the scaling up of the Rubin Observatory and the increasing integration of artificial intelligence into scientific workflows.

Electronics Departement:
The Electronics Department is responsible for the study, development, production, and integration of specific electronic instrumentation for the research projects of the physics departements and the laboratory's platforms.
As part of a joint IN2P3 R&T project and the LHCb Calorimeter Upgrade Phase II, the first version of the **SPIDER** ASIC (65 nm CMOS technology), developed through a collaboration of several IN2P3 laboratories and dedicated to time measurement, was successfully produced and tested in autumn 2025 at DESY with a prototype of the PicoCAL detector. The ASIC enables sampling of an analog signal at LHC frequency between 2 and 20 Giga Samples/s and offers a time resolution ranging from 7 to 10 ps RMS.
For the **ATLAS-HGTD** project, the test board used to test all 8,000 modules was successfully finalized and distributed to the international collaboration (China, Germany, Portugal, Spain, and Morocco).

In the **ATLAS-LAr** project, the new 128-channel calibration board for the Liquid Argon Calorimeter, which must generate calibration pulses with 0.1% precision across the full 16-bit dynamic range of the detector signals, was produced and tested successfully. A slightly modified version is expected soon before moving to the production phase (120 boards).
For the **ATLAS-ITk** project, the automation of the test benches for the modules is almost complete. The goal is to test 2,200 modules for ITK Upgrade Phase I.
In the **AGATA** project, 130 STARE boards for high-throughput data acquisition (4×10 Gb/s) were produced, tested, and validated on a test bench provided to the manufacturer. Performance tests, conducted jointly with the Computing Department, successfully achieved a data rate of approximately ~90 Gb/s over a 100 Gbps fiber deployed between two IJLab's building, thus validating lossless UDP packet transfer.

3.2 The Transverse Groups

The Transverse Groups are a group of people working on projects/activities on a theme which, by its very nature, cuts across the divisions.
An evaluation is ongoing in order to decide the relevance of renewing these working groups with new mandates.

4. Collaborations@IJCLab

- **To be an important partner in the network of the largest European laboratories. To also stimulate targeted collaborations with other European laboratories and worldwide.**

We will not discuss extensively the existing and ongoing historical collaborations with most of the large research centers and laboratories in Europe, USA and Asia (mainly Japan).
IJCLab is part of the LDG group, which brings together the 10 major European laboratory and CERN and provides a forum to synchronize the laboratories respective strategies, projects and priorities, with the aim of maximizing cooperation in the planning, preparation and execution of future projects. In addition, LDG oversees the European accelerator roadmap activities, aimed at developing technologies and concepts for future particle collider infrastructures. IJCLab played an important role in the ESP2026 being part of the LDG and coordinating some of the Working Groups and the one on the implementation of the European Strategy by the Large European Laboratories.
An important partnership including the full laboratory has been started with a similar size laboratory, the IFJ PAN, in Krakow (Poland). A collaboration agreement was signed between the 2 parties in 2023 and is organized with regular meetings among the teams and an annual joint workshop. About ten joint projects were presented.

In the same spirit, a delegation from IJCLab visited Oslo from November 5 to 7 to discuss the basis for an equally rich and promising collaboration with the University of Oslo and the NNRC laboratory, focused on training. A collaboration agreement was also signed on this occasion.

- **To increase the national collaborations with the other laboratory of IN2P3, and more largely to CNRS, IRFU/CEA and the CNES.**

With IRFU/CEA the links and the common activities are numerous and in general IN2P3/CNRS and CEA participate together to large Research infrastructures IR* such as: HL-LHC (CERN), GANIL/SPIRAL 2 (Caen), CTA (Spain and Chile), FAIR (Germany), ESS (Sweden).

5. Human ressources

5.1 Manpower: global picture and evolutions

The repartition of IJCLab staff by status is broadly summarized in Figure 9.

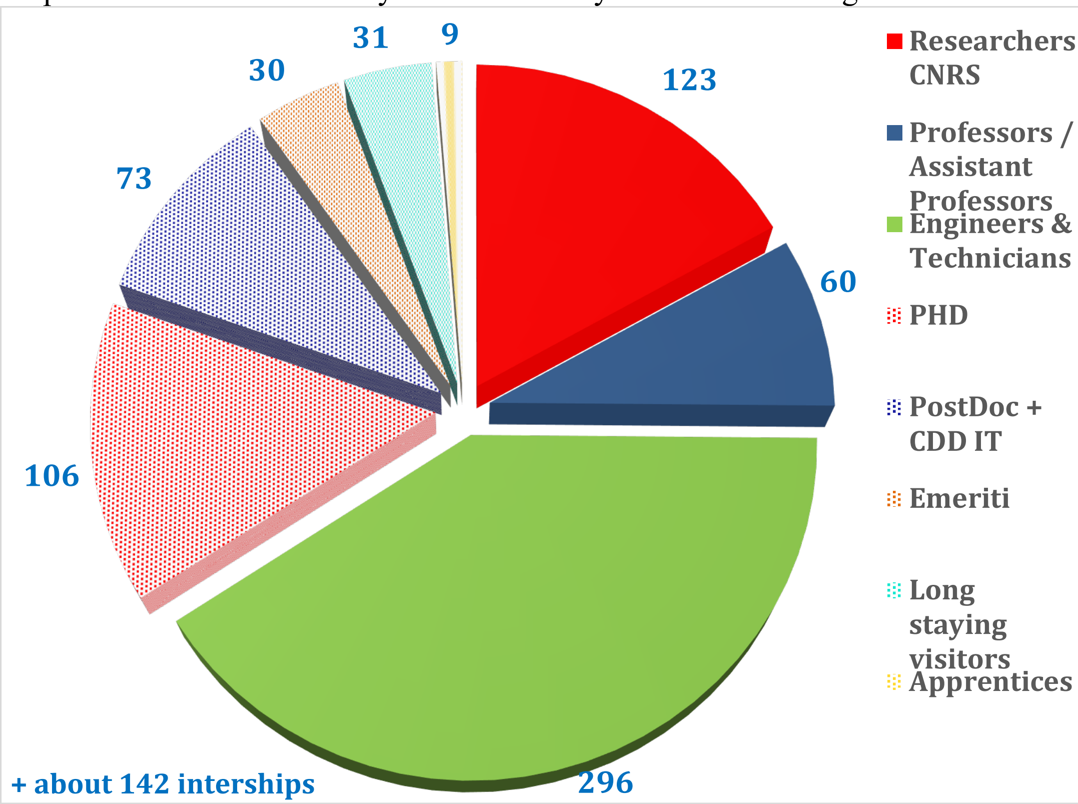
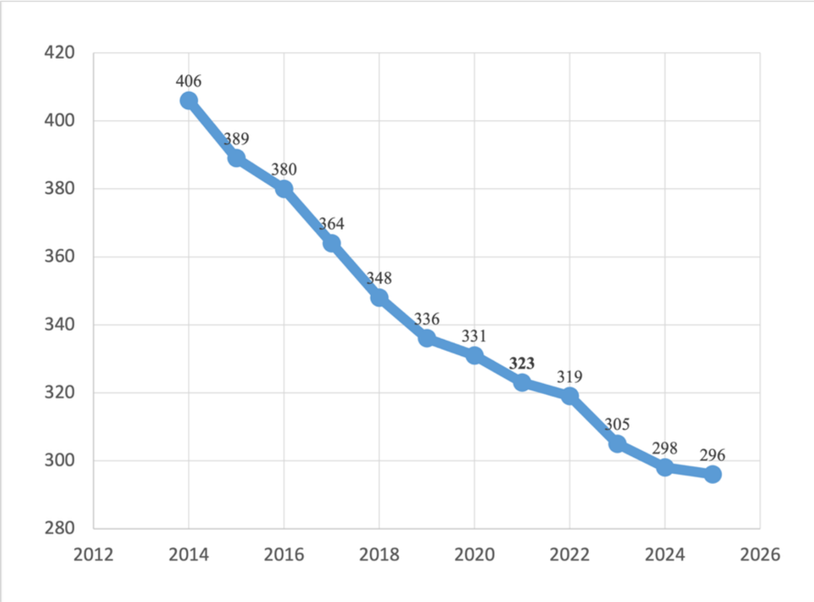


Figure 9. IJCLab staff status.

PERMANENT STAFF:

The yearly evolution of technical staff is shown in Figure 10 and of researchers in Figure 11.



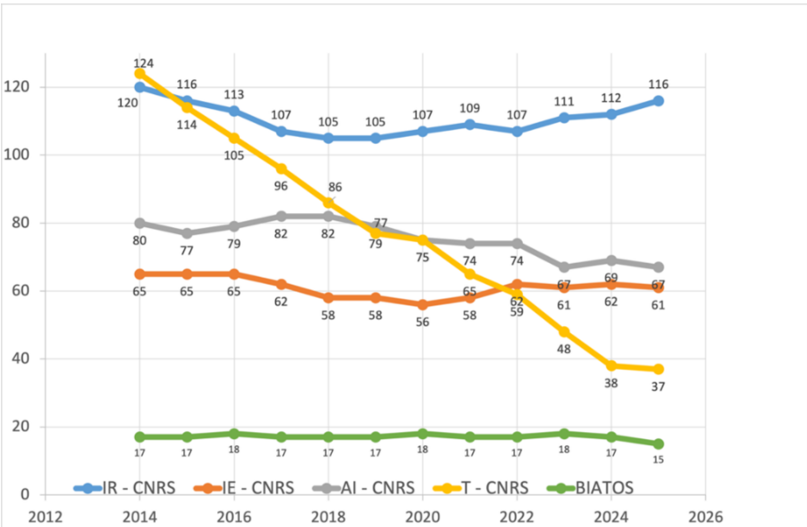


Figure 10. Yearly evolution of the technical staff. For CNRS staff : IR = Ingénieur de Recherche (Blue), IE = Ingénieur d'étude (orange), AI = Assistant Ingénieur (grey), T= Technicien (yellow). For University staff: BIATSS include all categories (green). The indicated numbers are given at the end of the year indicated in the x-axis.

For the permanent technical staff and for several years before the creation of IJCLab, there was a -13 balance on average between hiring and departures. This is mainly due to retirements which are impossible to compensate with the current level of recruitment at CNRS and University (about 30 openings each year at the national level).

On average since the creation of IJCLab there is a loss of about 7 persons per year. Most of the lost are in the technical staff. In the last two years it is compensated hiring non permanents staff on own IJCLab resources. Over the last two years, a very proactive effort coordinated with CNRS/IN2P3 regarding the recruitment of technical staff has had a significant impact, further slowing the decline in technical personnel.

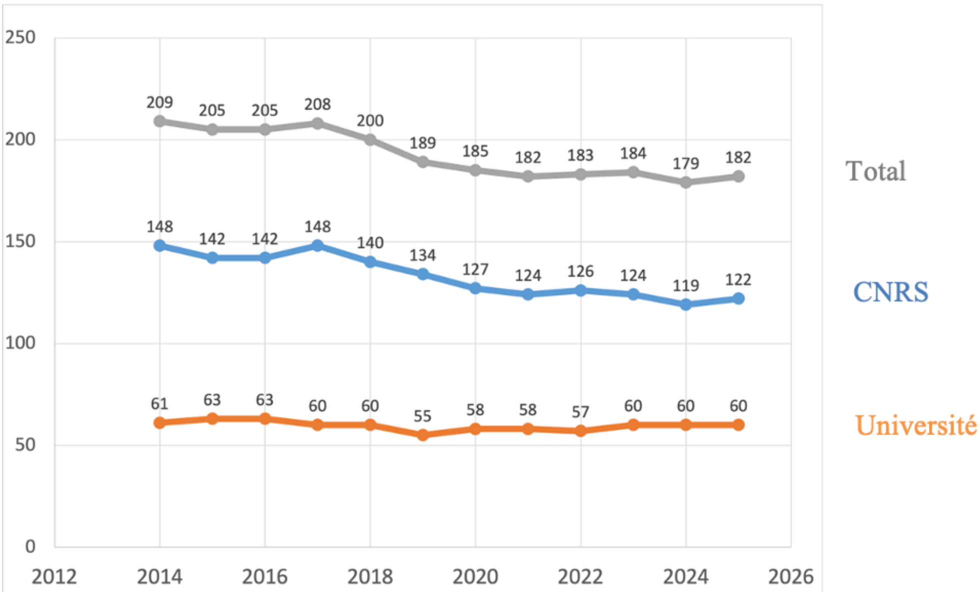


Figure 11. Yearly evolution of the research staff. In brown (blue) for CNRS researchers (University lecturers/professors), in green for the total. The decrease of the number of CNRS researcher from 2023 to 2024 is due to the fact that 3 researchers will be actually hired formally beginning of 2025.

As far as permanent researchers (CNRS and University) are concerned, prior to the creation of IJCLab, we had a period of stability (until 2017) in terms of HR, followed by a loss of about 6-7 researchers per year due to retirements and mobilities to other laboratories.

In the last years, since the creation of IJCLab we have again reached stability thanks to a quite important number of new recruitments and incoming mobilities.

NON-PERMANENT STAFF

The non-permanent members of the laboratory gather PhD students on three-year contracts, PostDoc (often with two-year contract), technical CDD (fixed-term contracts), emeriti, long-stay visitors and internships. PhD and internships are detailed in **Chapter** 2.

Post-Doctoral fellows, Temporary Technical staff contracts and apprentices. Figure 12 shows the number of post-Doctoral fellows; Temporary Technical staff contracts and apprentices present in the laboratory over the last 3 years given at the end of the year. For completeness, we also indicate the number of emeriti.

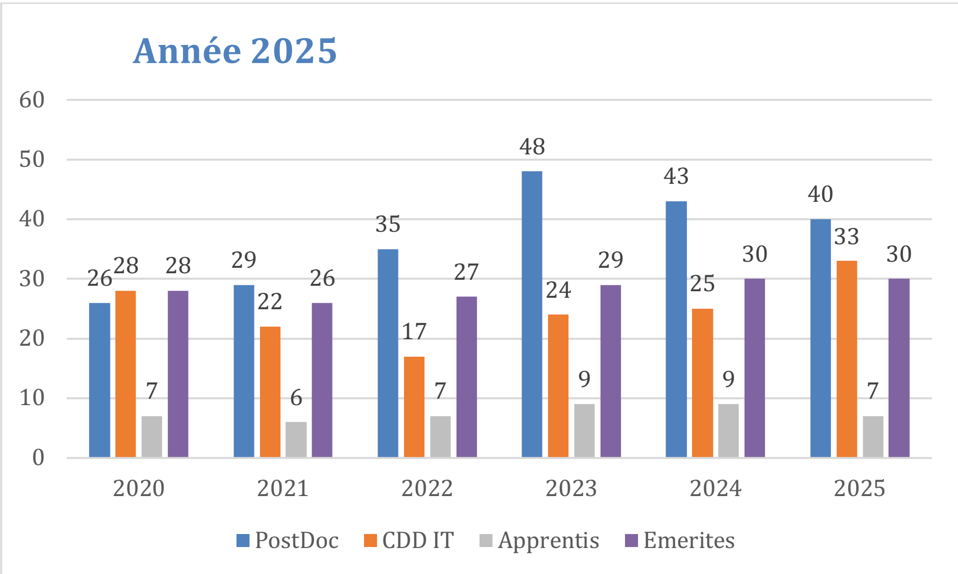


Figure 12. The number of new PostDoc, Technical CDD, Apprentices and Emeriti at IJCLab

Finally, the evolution of the IJCLab staff (permanents and non-permanents) is shown in Figure 13. As already comment this plot summarized what has been already shown before, namely a general reduction of the permanent technical staff a slight increase of the permanent researcher staffs and an increase of non-permanents position (mainly Postdoc).

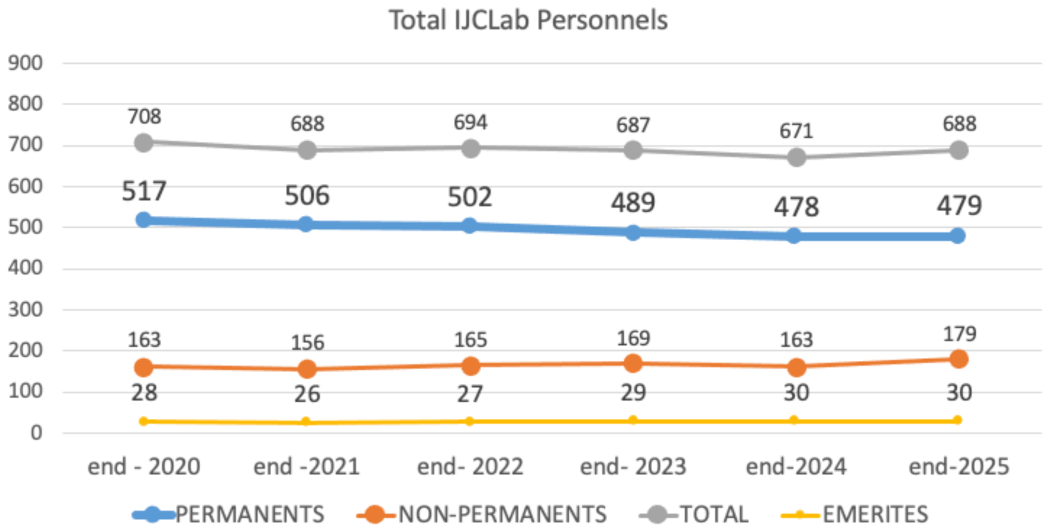


Figure 13. Evolution of the IJCLab staff

5.2 Career of permanent technical staff

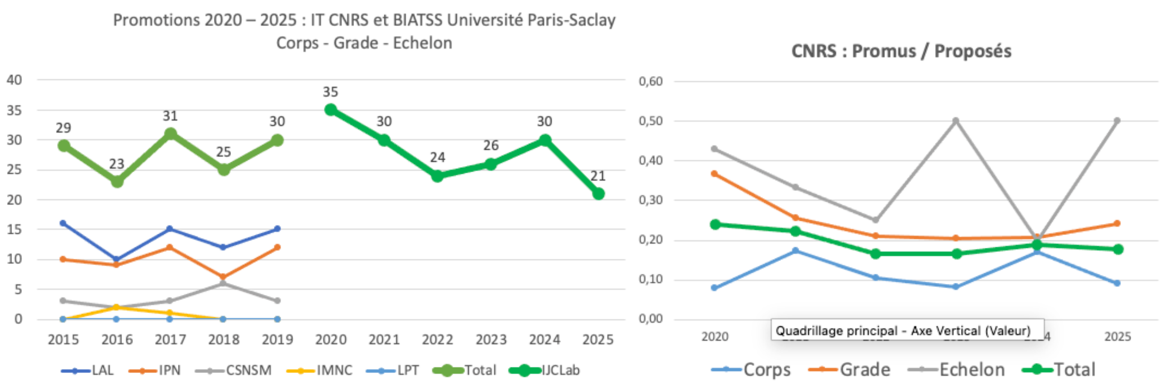


Figure 14: (left) Number of promotions as a function of the year summing up the two types of promotion: "changements de corps" (top) and "changements de grade" (bottom). (right) The ratio between the number of promotions and the number of proposed person for the promotions.

We have performed an analysis concerning the careers of the technical staff at IJCLab. At the creation of IJCLab a major concern was that the number of promotions of technical staff could decrease. The results of the last three years are shown in the plots showing that the situation is at least similar compared to those of the earlier laboratories (see

Figure 14)

A plot for the researcher and teachers since 2020 is also shown in Figure 15.

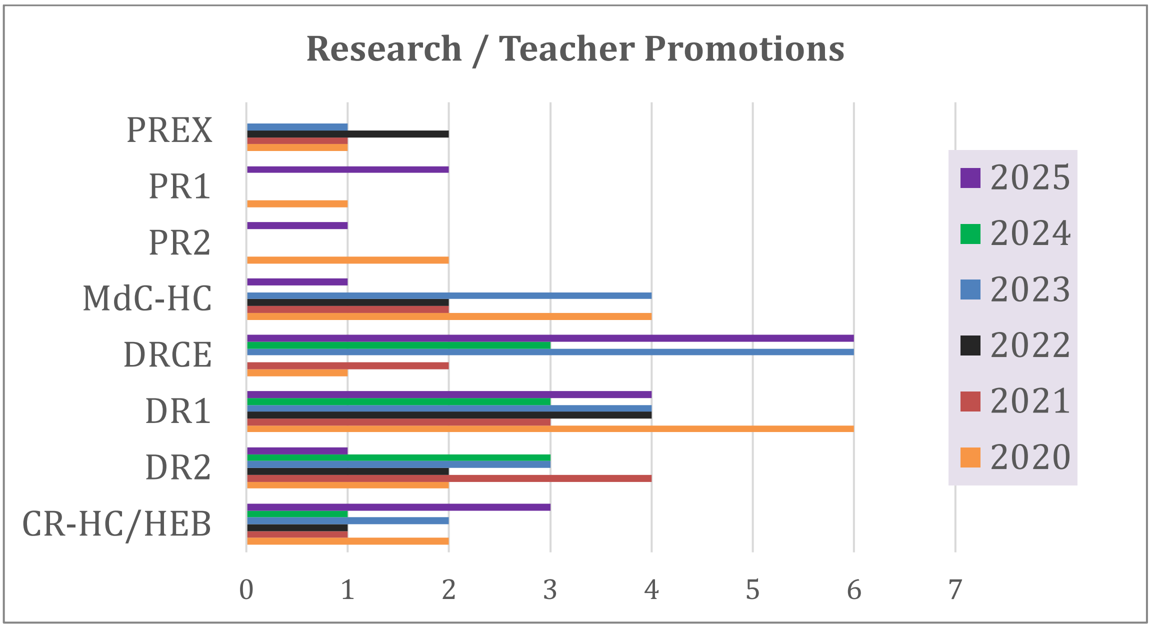


Figure 15: Number of promotions as a function of the year for researchers and teachers-researchers.

6. Budget

6.1 Global Budget

The budget is shown in Table 3. IJCLab budget implemented in Year 2025 as compared to previous years.
Erreur ! Source du renvoi introuvable. *and Figure 16 and compared with the budget for previous years (without the salaries). The first part of the budget is the one attributed by IJCLab Governing Bodies ("tutelles") every year. It is dedicated to the normal functioning of the laboratory (infrastructures, equipment and missions) and for the execution of the specific research/project activities.*

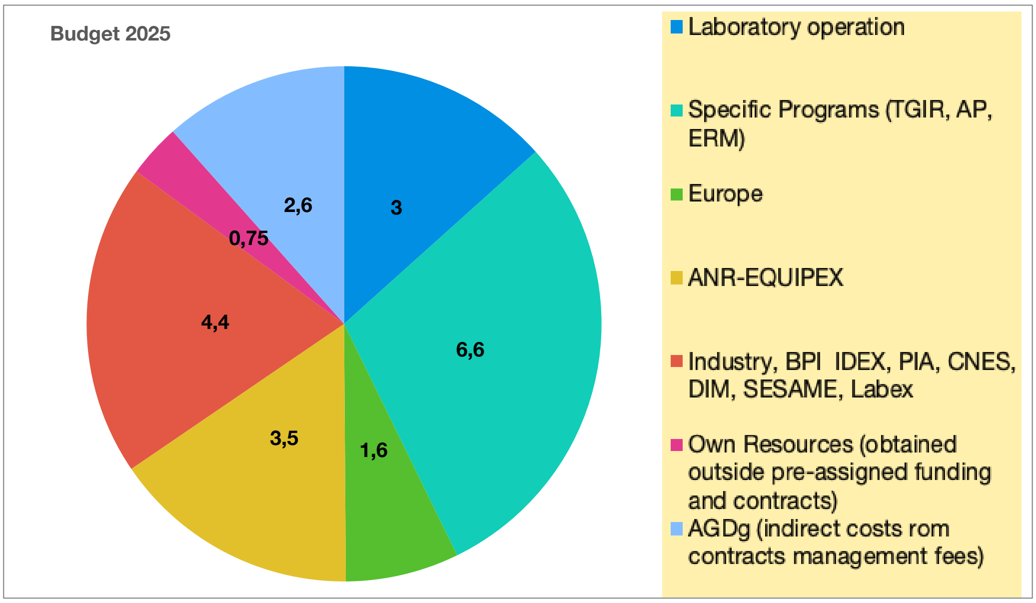


Figure 16. Budget implemented in 2025 as shown in the previous table.

This budget is complemented by funding coming from different contracts (ANR, Europe, Industry, Region...), which must be spent on pluriannual basis. The IJCLab budget is completed by what we call "own resources" ("Ressources propres"), which comes from the contract overheads and from the different services provided by the laboratory to external academic and industrial partners. This last part of the budget is mainly used for hiring personnel (technical and research, theses, internships), to impulse/help emerging projects punctually and to acquire new equipment outside of pre-assigned project funding. Finally IJCLab has received a budget from Region/State/Department "CPER 2015-2022 CD91, RIDF, ETAT)" which can be used for the renewal of the IJCLab infrastructures.

6.2 Focus on the success to different external calls

We would like to focus on external contracts obtained thanks to the success of IJCLab teams to some important calls. presents a summary of the situation in 2024 and 2025.

Contracts	Year 2025	Budget [M€] YR 2025	Budget [M€] YR 2024

ANR	DALEAS, COMPO, D-SHEXI, FLAV-ORIGINS, GRAiNITA, HINA, FBCUBES	2,76	1,81
	PEPR : no contract in 2025	-	-
BPI	No contract in 2025	-	-
Europe	Infrastructures: ODISSEE, PACRI	0,66	1,66
	Euratom: no contract in 2025	-	0,07
	MSCA: JENNIFER3	0,03	0,21
Ile-de-France Region	SESAME: BioALTO	0,20	-
	DIM ORIGINES Equipements: CREP-SUSET, PARIS-CCDs, MEDOR+	0,12	-
TOTAL		**3,77**	**3,75**

Table 4. Contracts obtained in 2025. The budget is to be spent on a multiannual basis. As a comparison we give the budget obtained in 2024 for the same type of contracts.

***ANR**: DALEAS (Détection automatique large échelle d'anomalies spatiales), COMPO (A Compton polarimeter for polarized beams at SuperKEKB), D-SHEXI (Demonstrator for SuperHeavy Element X-ray Identification), FLAV-ORIGINS (Unveiling the origin of flavor of quarks and leptons at low and high energies), GRAiNITA (A calorimeter for High Energy Physics), HINA (Highly-charged Ions for Nuclear physics and Astrophysics), FBCUBES (France-Brazil Collaboration on Universal Behavior of Exotic nuclear Systems)*
***Europe Infrastructures:** ODISSEE (Online Data Intensive Solutions for Science in the Exabytes Era), PACRI (Plasma Accelerator systems for Compact Research Infrastructures)*
***Europe MSCA**: JENNIFER3 (Japan and Europe Network for Neutrino and Intensity Frontier Experimental Research 3)*
***Ile-de-France Region SESAME**: BioALTO (ALTO line dedicated to Health Physics)*
***Ile-de-France DIM ORIGINES Equipements**: CREP-SUSET (Cavités Résonantes pour l'Etude et la Production de Squeezing Utile au Système Einstein Telescope), PARIS-CCDs (Plateforme Avancée de Réception d'Images Skipper CCDs), MEDOR+ (MicromEteorites Dans la StratOspheRe+)*

The actions regarding industrial partnerships are summarized in Table 5:

Interaction with socio-economic world / impacts on economy, society and culture					
Category	**Title**	**Partners**	**Date**	**Budget [k€] / Program**	
Platforms for industrial use	X-SPACE ALTO		04/25 – 03/28	100+IT	CNRS/DGD-I
	Peroperative sensing head adapted to be coupled to an ablation tool	Beams	2022 - 2032	-	Licenced patent
Technologies transfer	Cryomodule assembly	CNIM	11/03/22 – 10/03/32	-	
	DOSIMOEMS – Real-time dosimeter for radiotherapy	CSIC	04/21 - 10/27	35	DECLIC – IN2P3 -IJCLab
Start up	BEAMS		Created on march 21	-	
Industrial Contracts					
NDA	Radiation effects	Spin-Ion Technologies	28/06/22 (extended to 06/25)	-	
	Test de dégazage	PASQAL	2025-2026		
	Development of vanaduim for fusion reactor	TOKAMAK	01/25 – 01/27	-	
	Energy recovery linacs and sustainable and energy efficient accelerator technologies	HBZ	12/23 – 12/26	-	
	Energy recovery linacs and sustainable and energy	LTE	2025-2026		

	efficient accelerator technologies			
Research collaboration	Optimization of DC photo injectors	Research Instruments	28/06/23 – 27/06/26	
	Design and production of a plasma thruster demonstrator	OsmosX	12/23 – 04/27	30
	Acceleration of adiabatic quantum algorithms for describing strongly entangled systems	Bull SA	2025-2029	62
	SuperChooz Pathfinder	EDF	9/22 – 08/26	-
	Online Analysis of Molten Salts	NAAREA-IUMTEK	2024-2026	270
	Medical imaging based on the use of nuclear detection technology	Beams	02/22 - 02/24 (extended up to 08/26)	-
	corrosion resistance of structural materials in an environment containing inactive salts	STELLARIA	2025-2027	75
	LHB In Situ Liquid Sample Holder	Eloise SA	2025-2026	
	Graphite chemistry	ORANO CYCLE	10/21- 03/25	200
	Mosarwaste	ORANO SUPPORT/CEA	2024-2026	131
	Development of innovative systems for the real-time monitoring and control of the superconducting cavities in the PERLE project	ACS	2025-2028	21
	Accelerator technologies and photogun R&D	Research Instruments	09/23 – 08/26	

Joint laboratory	Innovative Molten Salt Laboratory (IMSLab)	NAAREA	05/2024 – 04/2029	800
Service contract				
	Test de cavités accélératrices	FermiLab	05/25 – 04/27	250

Table 5. Industrial partnerships obtained in the last years.

7. CPER: Operations for the renovation of infrastructures

IJCLab is located in the Orsay Campus of Université Paris-Saclay in buildings that belong mainly to the University (a few are CNRS property), dating back to 1960-70. Financial support was obtained in 2015 in the framework of CPER (Contract Pluriannuel État Region) for the period 2015-2021 for a total amount of 20.6M€. This project was essentially oriented towards the extension/renovation of different buildings to host scientific equipment. Most of the operations are completed by now. The execution of this plan is almost completed. We suffer a delay for the movement of the "Theory" department which could be done on summer 2026. The list of the operations is given in the Table 6

Operation	Budget used [M€]	Budget available [M€]	End date	
IGLEX (D1-D2)	3.6		May-21	Completed
Renovation of Building 104	4.3		Sep-23	Completed
Virtual Data (Bat 206)	2.2		Aug-20	Completed
Workshop Vacuum& Surface (D3-D4)	1.2		Apr-22	Completed
Mechanical Workshops (Bdg 100, 200)	2.4		Apr-22	Completed
Extension SCALP-JANNuS Platf. (Bdg108)	1.5		Apr-22	Completed
Construction of the PSI Platform (Bdg 200)	0.4		Jul-19	Completed
Renovation Bdg 100, 102, 103, 200, 208	1.6		Dec-21	Completed
Laser area and infrastructure work in Bdg 200 / 201	1.4		Feb-21	Completed
Renovation "Theory" bdg 100	0.53	0.05	Jun_25	End 2026

RENOVATION CONSTRUCTION HALL BDG 106	0.5		Mar-20	Completed
TOTAL	19.63	0.05		

Table 6. Implementation of the budget for the operation of CPER 2015-2022. We mention here that a 1.0M€ of this program was used for renovating a building for IAS laboratory.

In 2021 we have obtained an additional financial support of 9.1 M€ in the framework of the next CPER 2022-2027. This financial support has been confirmed. After a long delay due to Covid and the difficulty from the University to find the programmers, the project has recently received a green light and could effectively start in 2025. About 7M€ will be mainly oriented to the renovation/restructuring of different IJCLab buildings to improve their energetic performances and the quality of work; the other 2M€ will be used for the infrastructure work for the installation of the PERLE project in the IGLOO building.

Laboratory Master plan « Schéma directeur »

Following the severe flooding that affected the Orsay valley in October 2024, several of the laboratory's infrastructures were significantly impacted. The main consequences included major refurbishment work required to restore the ALTO facility to operation, the temporary abandonment of Buildings 208 and 209 pending their renovation, and major heating issues in Building 200.

In the aftermath of this event, and in response to requests from several staff members wishing to consolidate their teams and services, it was decided to establish a master plan for IJCLab's premises in order to optimize the organization of the laboratory's office and experimental spaces.

To support this effort, an Infrastructure Steering Committee (COPIL Infra) was created to monitor all ongoing construction and infrastructure projects and to provide an operational body meeting on a monthly basis. Chaired by Laurent Pinot and the laboratory management, the committee brings together around fifteen members. Its composition may evolve according to needs: new members may join its activities, while others may cease to participate. The participants are primarily the coordinators of the various infrastructure and construction projects currently underway within the laboratory.

Decisions proposed by the COPIL are validated by the Directorate.

To provide an overview of the activities carried out in 2025.
The definition and planning of the projects benefiting from the €7 million CPER funding have progressed significantly during the programming phase. The main projects planned under the

CPER framework are as follows. For all of these projects, work is scheduled to begin in summer 2027:

- Building 208 will undergo a complete renovation, with its usable floor area reduced to approximately 800 m².
- Building 209 will be converted into a technical building.
- The corridor of Building 200, commonly referred to as the "Electronics Corridor", will be demolished.

In addition, several operations were completed during 2025. Among the most significant were:

- The Operations Department (IT Department) relocated from the first floor of Building 100A to the north wing of the first floor of Building 104, accompanied by refurbishment work.
- Removal of heritage objects from Room 104 in Building 102 and Room M901 in Building 100M, followed by their installation in Rooms A905 and A907 after these rooms became available.
- Completion of the relocation of the storage facility from Building 205, including the processing and transfer of archives.
- Refurbishment of offices M929, M905 and M925 in Building 100M to accommodate staff from the Mechanical Engineering Design Office.
- Refurbishment of offices M903 (former experimental room), M927, M919C and M924 in Building 100M to accommodate staff from the Detectors Department.
- Renovation of Room M901 in Building 100M and installation of a practical teaching laboratory for nuclear physics.
- Refurbishment work in offices C203, C210 and C225 in Building 102.
- Installation of a secure access system in Building 103.
- Renovation of the former CLUPS area in Building 106.
- Renovation of Rooms 161, 1A and 1B in Building 200, together with the creation of a collaborative workspace within the library.

These operations involved major relocations of staff, teams and equipment in order to enable the work to be carried out while maintaining laboratory activities under the best possible conditions.

At the same time, a major roof repair and refurbishment programme was undertaken on several laboratory buildings, notably Buildings 100, 106 and 200. This work addressed a number of waterproofing issues and helped preserve the infrastructure against the deterioration observed in recent years.

In 2026, construction and refurbishment activities will continue across the entire laboratory site, in accordance with the campus master plan.

8. Concise view of the organizational aspects of the laboratory

At a global level, the IJCLab organization built during 2020/2021 has not significantly changed in 2025. We can give some significant information. In IJCLab there are about 70 positions of responsibility, with mandates and mission letters and in the last years we have a rotation rate of 25%.

In 2025, the direction of IJCLab was renewed for a new five-year mandate covering the period 2026–2030. This renewal involved several changes in key management and leadership positions. As part of this reorganization, the position of Technical Director evolved significantly. The Technical Director is now a member of the laboratory's direction and is responsible for overseeing all technical activities across the laboratory, while also serving as the line manager of the Engineering Division. Giulia Hull was appointed as the new Technical Director.

The 2025 Organigramme is given in Appendix 1.

9. Appendix 1 - IJCLab organisational chart in 2025

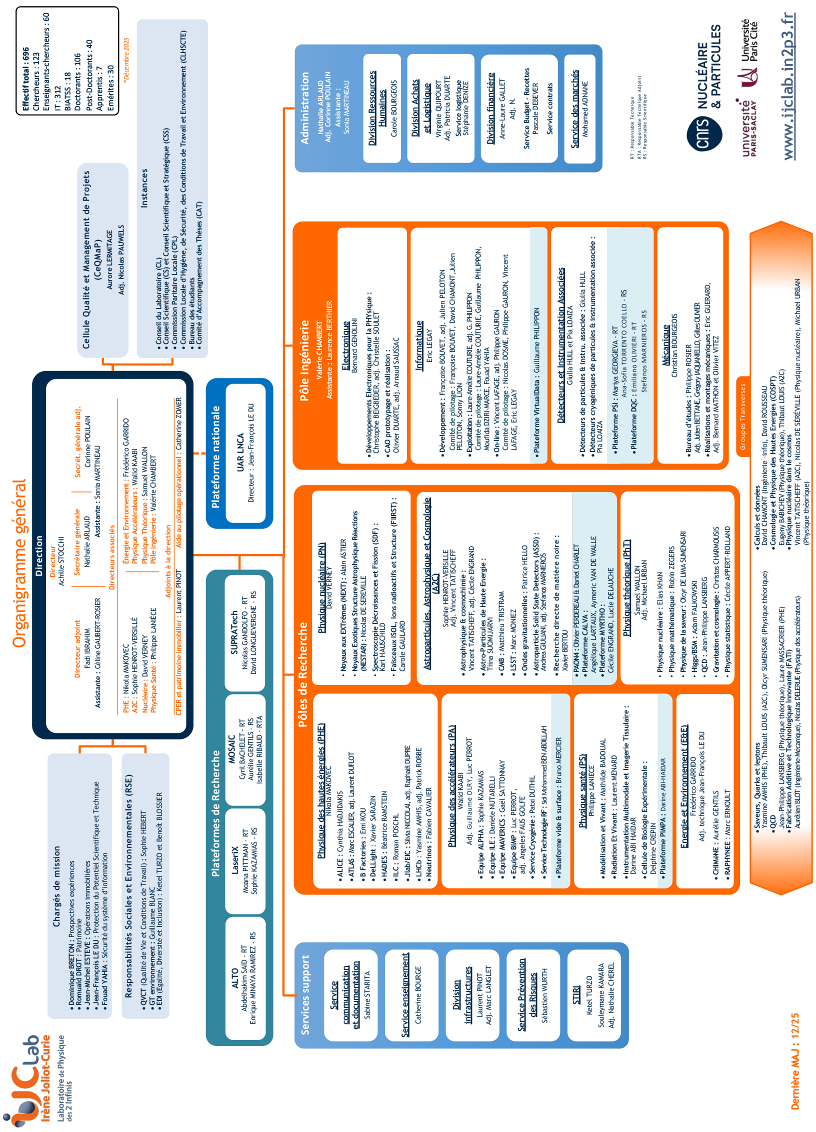


Figure 17. Organigramme of IJCLab

10. Appendix 2 - Subjects of IJCLab Scientific Councils (2020-2025)

Several project and activities have been examined by the Scientific Council:

- Scientific Council 19 November 2020
  - Participation to EIC (Electron Ion Collider) experiment
  - The activities in laser/plasma project PALLAS

- Scientific Council 12 Mars 2021
  - Participation to DUNE
  - GRIT and Direct Nuclear Reactions

- Scientific Council 13-14 October 2021
  - The activities on BAO-Radio
  - The project PARIS
  - The participation to MYRRHA

- Scientific Council 15-16 December 2021
  - The activities on Material under Irradiation for Energy
  - The activities on Material for Accelerators
  - R&D Bolometers and the CUPID project.

- Scientific Council 31March-1 April 2022
  - The Andromede Platform and Physics
  - The activity on Radionuclei on PRISM
  - The Super Heavy Elements

- Scientific Council 15-16 December 2022
  - The Calorimeter Upgrade of LHCb
- Scientific Council 16-17 March 2023
  - DELIGHT
  - PERLE

- Scientific Council 5-6 July 2023
  - Einstein Telescope
  - Physique des réacteurs et du cycle électronucléaire

- Scientific Council 16-17 October 2023
  - S3-LEB et physique ISOL basse énergie
  - Engineering Division @IJCLab Structure and Activities

- Scientific Council 10-11 June 2024
  - TESSERACT
  - Radiochimie au 107
  - SUPRATECH

- Scientific Council 12-13 November 2024
  - Radiochimie des sels fondus
  - COMCUBE-S
  - MadMax
- Scientific Council 4-5 June 2025
  - EIC
  - IDROGEN
  - Physique Nucléaire Théorique

11. Appendix 3 - Subjects of IJCLab Scientific and Strategic Councils (2021-2025)

- Scientific and Stragegic Council 21 May 2021
  - JCLab local and international landscape
  - An overview of the technical equipment and ressources
  - IJCLab : scientific and technical overview

- Scientific and Stragegic Council 18-19 October 2022
  - Return on 2021 CSS Recommendations and Scientific News – Yearly
  - Panorama of the Accelerator Activities at IJCLab: Panorama / Scientific activities / Large Project
  - Panorama of the Accelerator Activities at IJCLab: Skills and Competences for Accelerator activities
  - Activities and accelerator Projects within ESPP: Platforms supporting Accelerator R&D and construction
  - Activities and accelerator Projects within ESPP: Links with Industries and Technological Transfers
  - Visit of platforms (restricted to CSS members)
  - Activities and accelerator Projects within ESPP: ERL : PERLE@Orsay
  - Activities and accelerator Projects within ESPP: ERL : PALLAS@Orsay
  - Activities and accelerator Projects within ESPP: Contribution to future Large Accelerators (LHC, FCC, ILC, PIP II, muon colliders) (including also positron, polarimetry GF activities…)

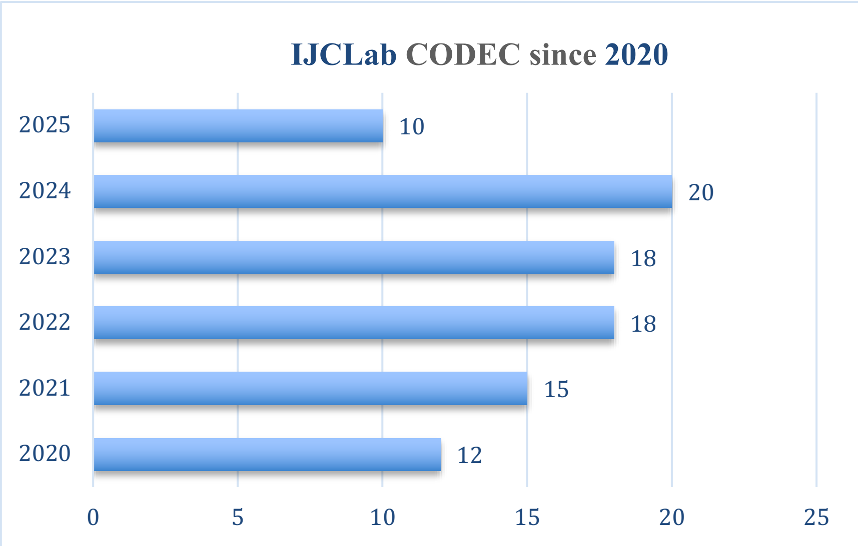
    - Wrap up : Timeline and RH for the next 5 years and beyond

- Scientific and Stragegic Council 18-19 December 2023
    - Return on 2022 CSS Recommendations and Scientific News – Yearly Report 2023
    - The ALTO research platform
    - The MOSAIC facility
    - Visit of platforms (restricted to CSS members)
    - VirtualData
    - DQC (Détecteurs Quantiques Cryogéniques) installation for low temperature detectors
    - PSI

12. Appendix 4 - Subjects of IJCLab CODEC (2020-2025)

This is a body made up of members of the Management Board, heads of departments and project leaders. The CODEC examines projects - for decisions on the allocation of resources/adequacy - following the Scientific Council, to analyze major changes or the launch of new phases, the launch of new projects, etc.

More than **90 CODEC**, listed below, have been organized since the beginning of 2020.



2020

24 juin : CODEC des projets PLUME et FINK
15 juil. CODEC des projets SPACE-ALTO et PALLAS
02 sept. CODEC THIDOS
17 sept. CODEC des projets FASTIME, DARWIN et CHANGE
25 sept. CODEC CUPID
30 sept. CODEC PRISM
08 oct. CODEC ThomX
14 oct. CODEC PIP-II et LiquidO
05 nov. CODEC Myrrha
18 nov. CODEC GRIT
25 nov. CODEC TULIP
09 déc. CODEC IMOP et ATLAS-HGTD

2021

27 janv. CODEC ATLAS-ITK
10 févr. Réunion Préparation COPIL IN2P3 ALTO
10 mars REVUE SCALP & ANDROMEDE
24 mars CODEC SUPRATECH
31 mars CODEC DAMIC et EIC
13 avr. CODEC NuBall & AGATA
05 mai CODEC PERLE-TDR
12 mai CODEC CAPTINNOV
19 mai CODEC ComptomCAM
16 juin CODEC THOMX
01 juil. CODEC ILE
07 sept. CODEC ALICE et LHCB
22 sept. CODEC SIXPAC
30 sept. COPIL ThomX
08 oct. CODEC ANR STIRI
10 nov. CODEC FINK
23 nov. CODEC GRANDMA
08 déc. CODEC MINERVA (PA6)
15 déc. Revue de suivi de projet CV1250

2022

26 janv. Revue JUNO
26 janv. CODEC PARIS
09 févr. CODEC PACIFICS
09 févr. CODEC SpaceALTO
16 févr. Préparation COPIL ALTO ANNULE
07 mars Préparation ANR phase 2
07 mars Préparation COPIL JANNuS-SCALP
09 mars CODEC Liquido : Mini Gamma, TEP-Otech, AM-Otech
23 mars CODEC SQUEEZING
30 mars CODEC Revue PALLAS
30 mars CODEC TWAC
13 avr.CODEC DUNE
13 avr. Préparation Revue KDP2 PIP-II
20 avr. CODEC ANDROMEDE installation finale 201
20 avr. CODEC GRAINITA
11 mai CODEC PERLE
25 mai CODEC Fabrication Additive
25 mai CODEC Astro-Chimie
08 juin CODEC création d'une plateforme TP pour les L3 énergie
22 juin New COMET
22 juin ReX Projets : Direction / CeMaP
13 juil. CODEC INSPIRER
20 juil. CODEC - projets MOGLIH et MODERATO
14 sept. Présentation projets R&T
14 sept.Réunion de préparation KDP2 CALICE
21 sept. CODEC ThomX

30 nov. CODEC BIO-ALTO

2023

01 févr. CODEC préparation KDP2 DUNE
01 févr. CODEC LUXE
15 févr. CODEC EINSTEIN TELESCOPE
07 mars Préparation ANR phase 2
08 mars CODEC CUPID
08 mars Préparation COPIL ANDROMEDE/JANNuS-SCALP
22 mars CODEC FAIR
05 avr. Revue de Lancement production pour Atlas HGTD / ITK sur PSI
19 avr. CODEC FRIENDS3
19 avr. CODEC OPALIS - ex IMOP
10 mai CODEC TETRA/FROZEN
24 mai CODEC SPLIT-POLE
24 mai CODEC ATLAS à PSI
07 juin CODEC Dellight
14 juin CODEC BELLE2
14 juin CODEC SIXPAC
04 oct. Demandes R&T
18 oct. CODEC ThomX
18 oct. CODEC IRENA
15 nov.CODEC COMCUBE/Ballon
22 nov. CODEC PIONEER SIRIUS
22 nov. CODEC MONSTER

2024

10 janv. CODEC SUCO (COBOT)
10 janv. CODEC MYRRHA proto.
24 janv. CODEC IA/Artifact
14 mai CODEC IDEAS3
14 mai CODEC ASSD salle blanche
10 juil. CODEC LHCb
10 juil. CODEC PIP2, la phase test de cavités SSR1 et la série SSR2.
11 sept. EIC information ACCELERATEURS
11 sept. CODEC EPIC Roman Pots
11 sept. CODEC EPIC Calo
09 oct. CODEC Plateforme TP 102
02 oct. CODEC SIMONS OBSERVATORY (SO)
02 oct. CODEC TESSERACT
20 nov. CODEC COMCUBE-S
20 nov. CODEC Einstein Telescope
04 déc. CODEC DOSIMOENS
04 déc. CODEC GRIT
11 déc. CODEC PRISM/TTRIP
11 déc. CODEC PERLE-ISAS
18 déc. CODEC HINA
18 déc. CODEC Plateforme Vide et Surface (Validation du modèle économique)

2025

29 janv. CODEC remise à neuf du cryomodule ESS (CM02)
2 avril CODEC PALLAS
2 avril CODEC TWAC
28 mai CODEC EIC Accélérateur
28 mai CODEC Bio ALTO SESAME
11 juin CODEC DUNE
11 juin CODEC THESEUS
25 juin CODEC STIRI – propositions de projets européens de type infrastructures
3 déc. CODEC CAMAIRA
3 déc. CODEC ICE TEA

13. Appendix 5 - Various IJCLab awards 2020-2025

2020

- Médaille de bronze du CNRS : Nicolas Morange
- Several Prix ED Pheniics Maira DUTRA (TH/LPT) "Origins for dark matter particles : from the "WIMP miracle" to the "FIMP wonder" ; Vitalii LISOVSKYI (PHE/LAL) "Study of rare b-baryon decays and test of lepton universality at LHCb¨; Carlotta TRIGILA (PS) "Development of a portable gamma imaging system for absorbed radiation dose control in molecular radiotherapy"; Ho san Ko (pôle PHE, équipe JLab/EIC) : prix jeune chercheur/se, Laboratoire Franco-Coréen de Physique des particules, pour ses travaux de thèse en co-tutelle SNU et UPSay.

2021

- Cristal du CNRS : Véronique Puill
- Prix SFP Joliot Curie 2020 : Marcella Grasso
- Prix fondé par l'Etat de l'Académie des Sciences : Marie-Hélène Schune
- Hélène Langevin-Joliot a été élevée à la dignité de Grand'Croix dans l'ordre national du mérite.
- Several Prix ED Pheniics 2021 : Christine AGAPOPOULOU (PHE) "Recherche de la supersymétrie avec le détecteur ATLAS et développement du High Granularity Timing Detector¨; Pierre CHATAGNON (PHE) "Etude de la structure du nucléon avec CLAS12 à Jefferson Lab"; Angélique VOLLARD (A2C) "Dépasser la Limite Quantique Standard pour le détecteur d'ondes gravitationnelles Advanced Virgo.

2022

- Médaille d'argent du CNRS : Vincent Tatischeff
- Cristal du CNRS : Jihane Maalmi
- Prix Jean-Louis Laclare : David Longuevergne
- Prix Académie des Sciences - Madeleine Lecoq : Suheyla Bilgen

- Sylvain David, nommé au grade de chevalier de l'Ordre des Palmes académiques.
- ATLAS Awards : Prix « Outstanding achievement awards 2022 d'ATLAS » décernés à des personnels IN2P3, dont Stefan Simion, pour ses "contributions exceptionnelles au système électronique numérique de déclenchement du calorimètre à argon liquide"
- Prix collaboration LHCb à Valeriia Zhovkovska pour le prix remis aux scientifiques en début de carrière et à Guillaume Pietrzyk pour le prix de la meilleure thèse LHCb

2023

- Prix André Lagarrigue : Daniel Fournier
- Médaille d'argent du CNRS : Araceli Lopez-Martens
- Prix Jaffé - Institut de France : Zhiqing Zhang
- Prix Mid-Career Award 2023 de la conférence Radiation Effects in Insulators (Fukuoka, Japon) décerné à Aurélie Gentils
- La start-up Beams issue d'IJCLab est lauréate du concours d'innovation i-Lab 2023 dans la catégorie « Technologies Médicales».Fink a reçu le prix science ouverte du logiciel libre de la recherche 2023, espoir de la catégorie « Coup de cœur » du jury, décerné par le ministère de l'Enseignement supérieur et de la Recherche
- Prix Suzanne Bella Srodogora 2023 de la Fondation CNRS et la mission pour la place des femmes au CNRS : Véronique Puill
- FINK : prix science ouverte du logiciel libre de la recherche 2023, espoir de la catégorie « Coup de cœur » du jury, MESR

2024

- Cristal du CNRS : Nathalie Arlaud
- Médaille de Bronze du CNRS : Vladimir Manea
- Sylvain David nommé au grade de chevalier de l'Ordre des Palmes académiques
- Yann Mambrini, prix Bourrienne 2024 vulgarisation scientifique
- Marc Winter Prix Instrumentation ICFA 2024

2025

- Cristal du CNRS : Olivier Olivieri
- Cristal collectif du CNRS : équipe projet de l'accélérateur ESS : Sébastien Bousso, Sylvain Brault, Frédéric Chatelet, Patricia Duchesne, Sylvie Durand, Patxi Duthil, Nicolas Gandolfo, Gilles Olivier, Guillaume Olry, Matthieu Pierens, Virginie Quipourt et David Reynet
- Attribution du prix Gemini : projet « Kilonova-Catcher » porté par Damien Turpin (CEA Saclay) et Sarah Antier de l'Observatoire de la Côte d'Azur et d'IJCLab (Pôle A2C) et Arnaud Leroy (astronome) ainsi que l'ensemble du réseau constitué de 200 astronomes amateurs répartis sur les 5 continents.
- Prix Jaffé : Louis Fayard

14.Appendix 6 - Events and seminars at IJCLab in 2025

A dedicated service in laboratory organizes several conferences, workshops or collaboration meetings. These events last from one day to a week. In the last three years (2021, 2022, 2023, 2024) the laboratory has organized about 20 events/year with variable number of participants. The events organized in 2025 are shown in Table 7.

January	LHCb Computing Workshop	75 attendees in person	3 days – Fees
March	Journées MOSAIC	70 attendees	2 days
April	IRN Terascale	60 attendees	2 days
June	IRN Neutrino Meeting	80 attendees	1,5 days
June	Journées réseau semi-conducteurs	50 attendees	1 day
June	Fête du laboratoire		1 day
July	Ecole d'été des 2 infinis	35 attendees	5 days (2 days in IJCLab)
September	Higgs Hunting	110 attendees	3 days – Fees
September	PhAse	60 attendees	3 days – Fees
October	MadMax	30 attendees	3 days – Fees
November	Conf. On Many-Body systems in memory of Nguyen Van Giai	50 attendees	2 days

Table 7. Large events organized in 2025.

Other events as collaborations meetings and small scientific workshops are also organized and are not yet reported in this plot.

In Figure 18 we report the seminars organized at IJCLab in 2025. There are different categories going from seminars in the scientific poles, between different poles, of general interest, the ERL series and the Colloquium.

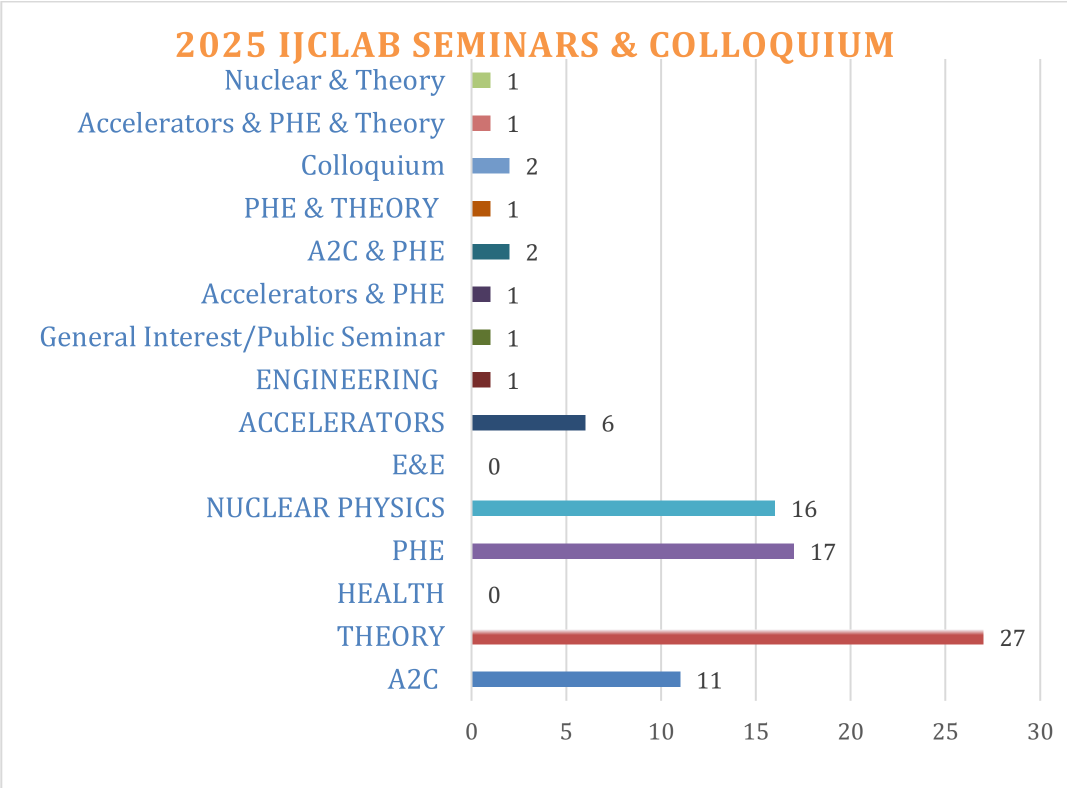


Figure 18. Number of Seminars & colloquium organized by IJCLab in 2025.

15. Appendix 7 - Publications at IJCLab

LODEX-IN2P3 (https://in2p3.lodex.fr/instance/2606/) is a visualization tool that provides graphical access to IN2P3 publications since 2016, allowing users to explore the data according to various criteria and to extract bibliographic lists. The data displayed in LODEX-IN2P3 are sourced from INSPIRE, the reference database for IN2P3 publications since 2016, alongside HAL-IN2P3. These databases provide curated and validated publication metadata, enabling comprehensive analyses of the institute's scientific output.

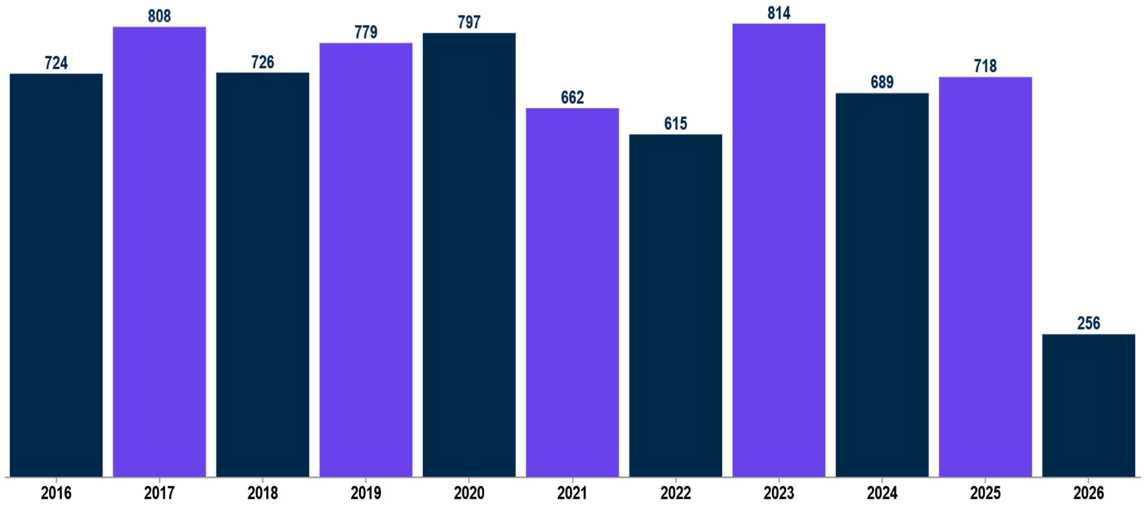


Figure 19. Evolution of the IJCLab publication over the year.

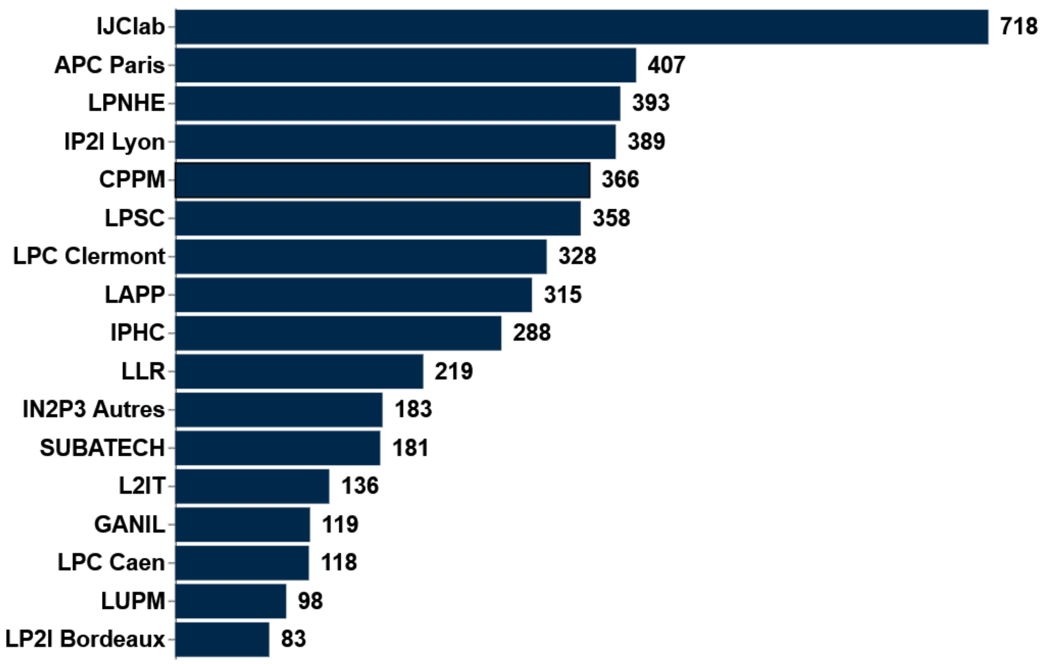


Figure 20. IJCLab and the other IN2P3 publications in 2025.

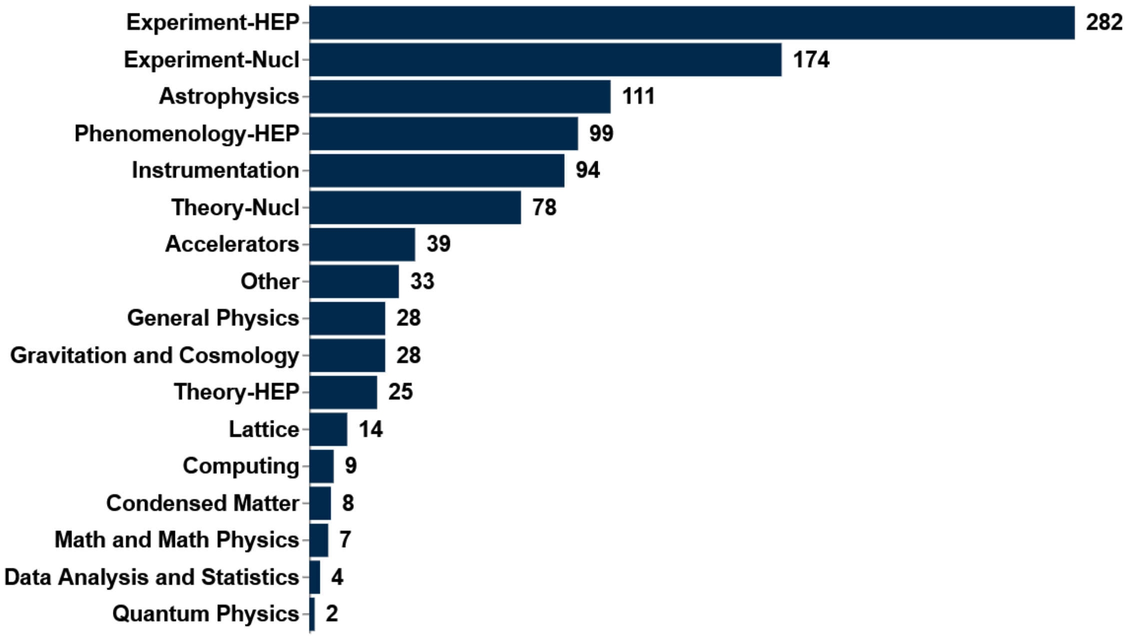


Figure 21. IJCLab publications in 2025 divided in categories. Note: A publication may belong to more than one category.