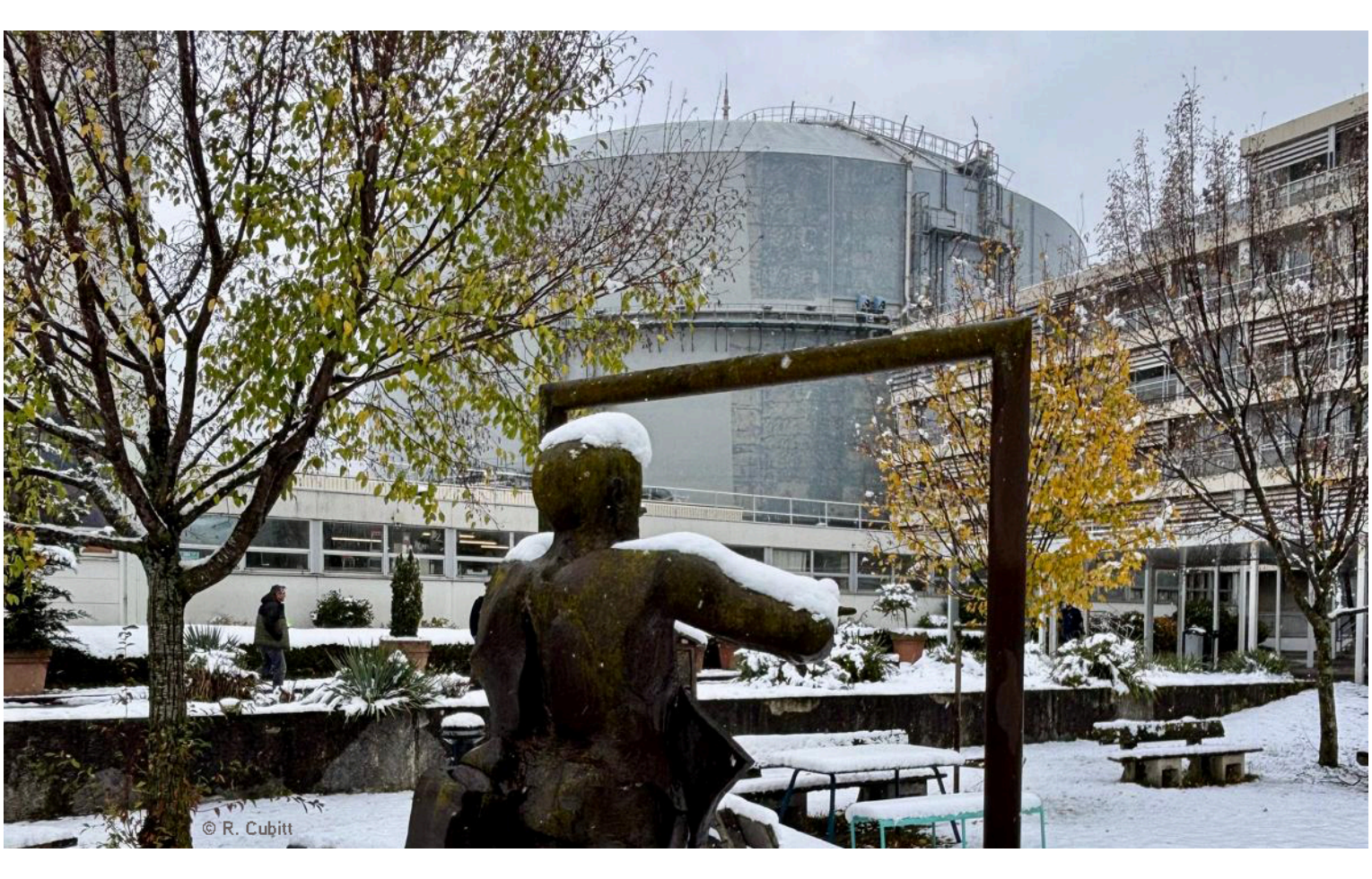
ILLnewsletter

NEUTRONS FOR SOCIETY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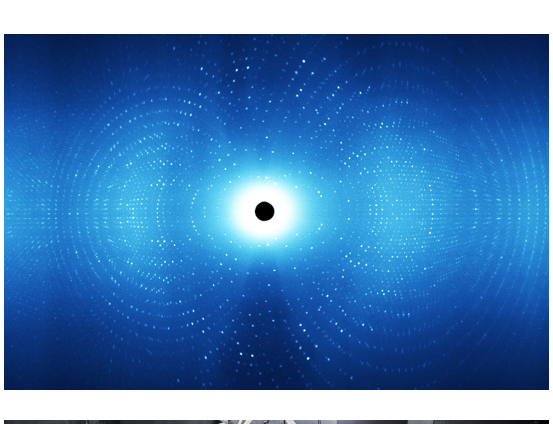
ILL in focus

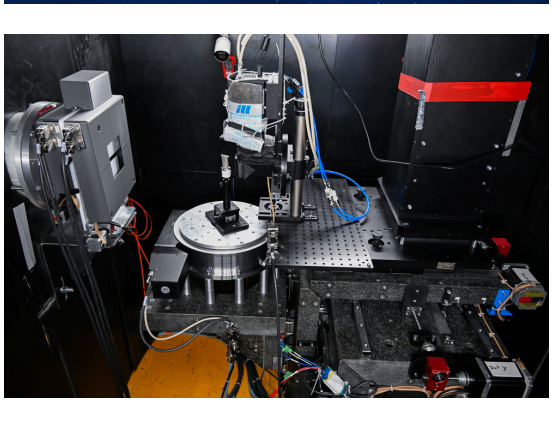
Beamtime access news
Just a week after the end of 2025 reactor operations, in early November, the ILL welcomed on site the members of the subcommittees of the ILL Scientific Council responsible for assessing experiment proposals, as well as the ILL Scientific Council itself. In this round, 369 proposals were accepted, corresponding to 393 experiments and a total of 1539 days of neutrons (to be delivered in parallel by the over 40 instruments in ILL's instrument suite).
The next proposal submission deadline is 15 February 2026. As a reminder, this date concerns standard beam time access requests – specific access modes are available for fast access, namely DDT and EASY. More information can be found here.

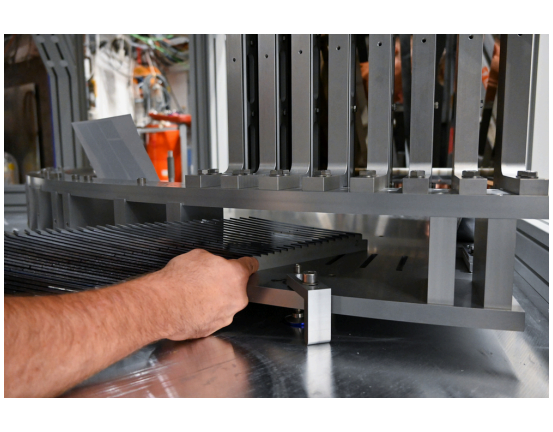
Next proposal submission deadline: 16 February 2026. Fast access mode available all year round.

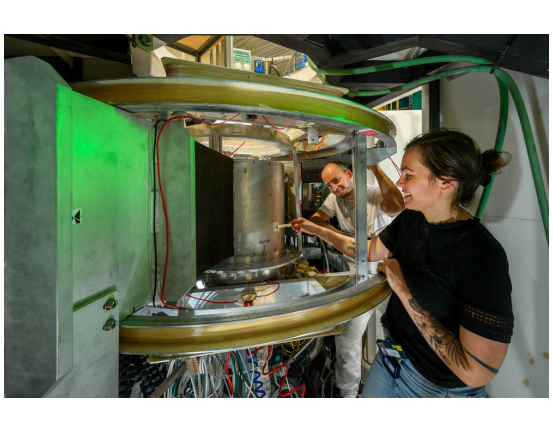
End of 2025 operations
The ILL concluded 2025 operations at the end of October. The High-Flux Reactor restarted in early May and operated for 126 days, divided equally into two cycles of 63 days. In total more than 1800 scientists came on site to perform close to 1400 experiments. With the official conclusion of the Endurance upgrade programme in 2024, the last instruments and systems are now coming into operation - see '2025 operation highlights' below. The High-Flux Reactor will restart in late March 2026 for a year with 3 reactor cycles in the programme.

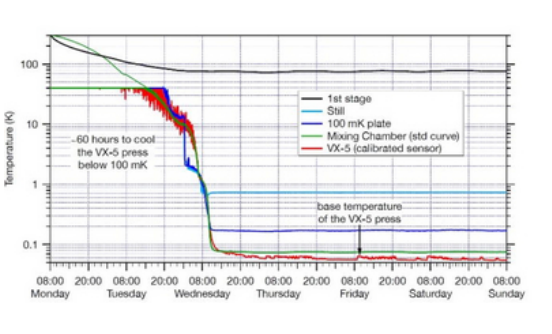
2025 operation highlights

A huge advance for high-resolution neutron crystallography of large proteins

In October 2025, a completely new neutron-sensitive cylindrical image plate detector was built and installed on the DALI instrument at the ILL. This is a major upgrade that significantly improves instrument performance. Built in the framework of the ILL upgrade programme Endurance (2016-2024), DALI is a quasi-Laue diffractometer designed for high-resolution studies of large proteins. Read more

PorTo: new high-resolution neutron tomograph for micro-imaging

The ILL's new cold neutron micro-tomography instrument - PorTo - has just been commissioned, marking a significant expansion of the Institute's neutron imaging capabilities. PorTo is designed to deliver high-resolution 3D imaging for a broad range of applications, from materials science and engineering to life sciences. In its first week of operation, PorTo joined MoTo and NeXT in running user experiments simultaneously for the first time. PorTo alone welcomed nine experiments spanning cultural heritage, energy storage, and next-generation battery materials, with users coming from 15 different academic and research institutes. Read more

MARMOT in full swing

During the last cycle, the MARMOT system was successfully tested and validated on a prototype (with seven detection channels). The next step will more than triple the detector's active surface area, making MARMOT even more efficient. MARMOT is the latest major technical breakthrough in neutron spectrometers. Designed and built in-house at the ILL, it offers a new way to analyse the energies of neutrons across a wide range of angles. It is based on an innovative bent silicon crystal technology, which enables new designs for monochromators and analysers specifically tailored to enhance inelastic neutron scattering experiments. Read more

SHARPER and D007 welcome their first users

Two other instruments welcomed their first teams of users to perform experiments: SHARPER, during the first cycle, and D007, during the second cycle. The first user measurements on SHARPER were performed with PhD student Phillip Eckstein, working on a joint PhD project between the ILL and the Institute of Frontier Materials of the German Aerospace Center (DLR) - see dedicated news item here. On D007, diffraction data obtained on powders and single crystals were visualised and processed using algorithms developed using the Mantid software, and at least one publication has already been submitted to a scientific journal. Read more

A powerful tool to explore new magnetic states and quantum phenomena


Neutrons are the ideal probe to explore matter under the extreme conditions in which new magnetic or quantum states emerge. A neutron diffraction experiment down to the unprecedented low temperature of 160 mK under a pressure of 20 GPa has been made possible by novel in-house developments in cryogenic and high-pressure techniques at the ILL. Read more

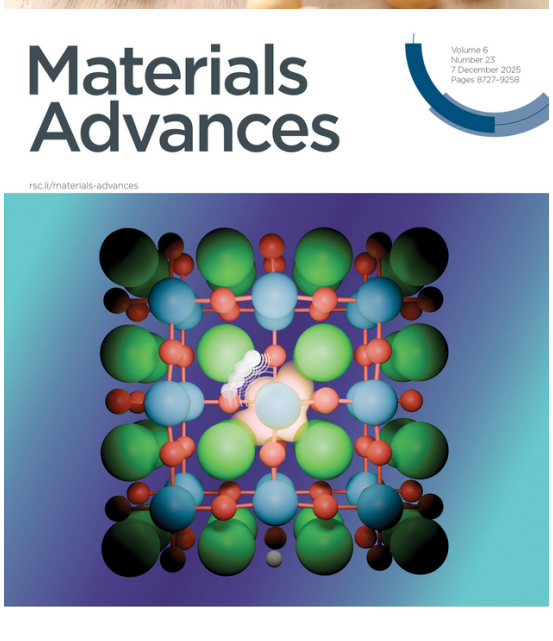
Recent science news

Life in the cold: How microbes thrive—and die—at extreme temperatures

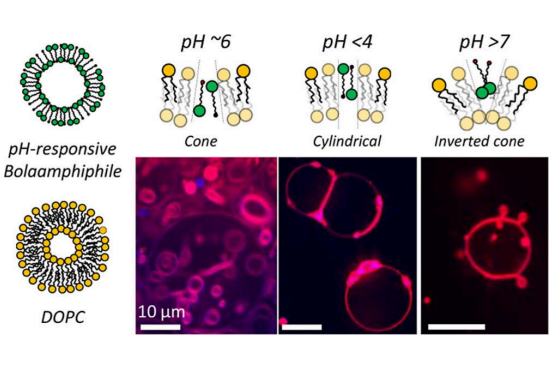
Life on Earth has evolved in response to environmental conditions. In particular, many species have adapted to very cold or very hot environments. A new study based on neutrons provides valuable insights into the thermal vulnerability of different bacterial families. It shows that organisms adapted to very low temperatures are also surprisingly fragile: even a slight rise in temperature can be lethal, long before any structural damage appears. Such studies are key to informing strategies for food preservation, bioremediation, and the sustainable use of cold-adapted microbes in biotechnology. Read more

Neutrons reveal how the human body processes plant proteins

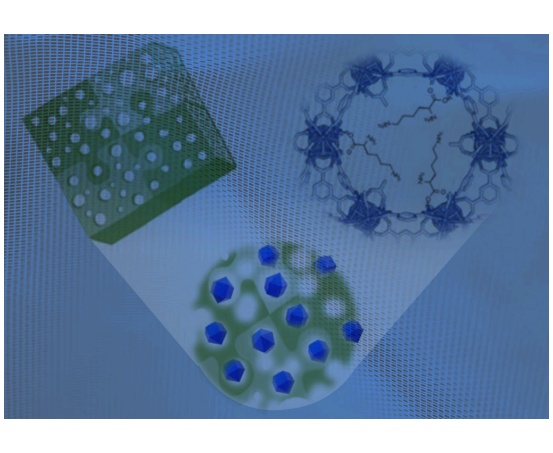
A recently published study makes an important contribution to the understanding of the physiological processing of plant-based foods. The results can be used to optimise production, improving the digestibility of plant proteins and thus the nutritional value of vegetarian and vegan dishes. The basic idea was to simulate a human stomach "on a laboratory bench" and to observe what happens to plant-based products during digestion in an acidic environment. Read more

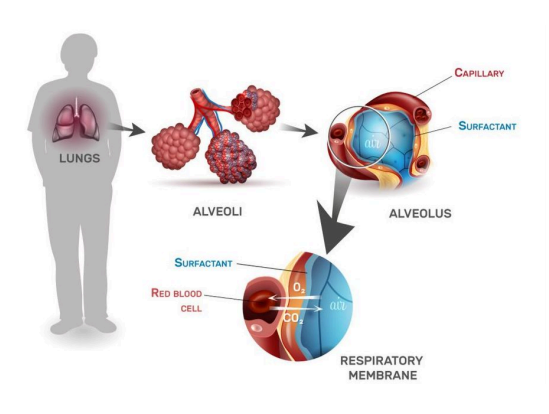
New insights into ion transport in next-generation solid electrolytes


Mixed-anion materials are chemical compounds that contain positive ions and more than one kind of negative ion within a single crystal structure. This offers great tunability of their physical and chemical properties. The most widely studied class are oxyhydrides, containing both oxide ions (O^{2-}) and hydride ions (H^-). Using density functional theory calculations, researchers from the ILL and Chalmers University of Technology (Sweden) modeled how hydride ions diffuse under different conditions. Their results provide design principles for tailoring the hydride ion conductivity in oxyhydrides. By engineering the degree of electron localisation, materials scientists may be able to fine tune ionic transport properties to meet specific technological needs in catalysis and solid-state energy devices. Read more

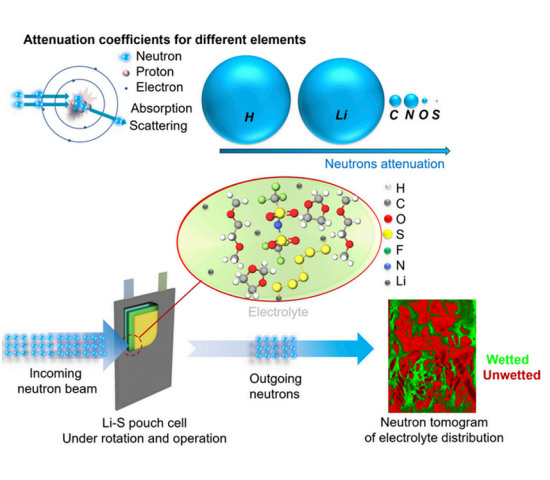
Bacteria can be surprisingly resistant - neutron-based techniques show why.


Some bacteria survive extreme heat, cold, pressure or acidity thanks in part to special membrane molecules called bolaamphiphiles. A France-USA research team, including ILL scientists, used advanced microscopy and neutron scattering (SANS and NSE) to uncover how these molecules alter membrane thickness, flexibility and structure. They found that bolaamphiphiles mix into membranes at all pH levels, thinning them and changing their rigidity in pH-dependent ways. The mixtures also formed striking new shapes, such as tubules and nested vesicles. These results shed light on how early cell membranes may have gained resilience and responsiveness to their environment. Read more

Neutrons for the energy transition

The removal of CO_2 from methane-rich (CH_4) gas streams is key in the purification of varied biogas sources, an alternative to fossil-derived natural gas that can play an important role in the energy transition. Metal-organic frameworks, or MOFs for short, have recently been brought under the spotlight by the 2025 Nobel Prize in Chemistry. A study now published demonstrates that incorporating MOF decorated with biological building units as amino acids in a polymer membrane significantly enhances CO_2/CH_4 separation performance. Neutron scattering measurements at the ILL instrument IN1/Lagrange were key to unveiling the reasons behind this. Read more

Breathing together: The potential of multidisciplinary collaboration


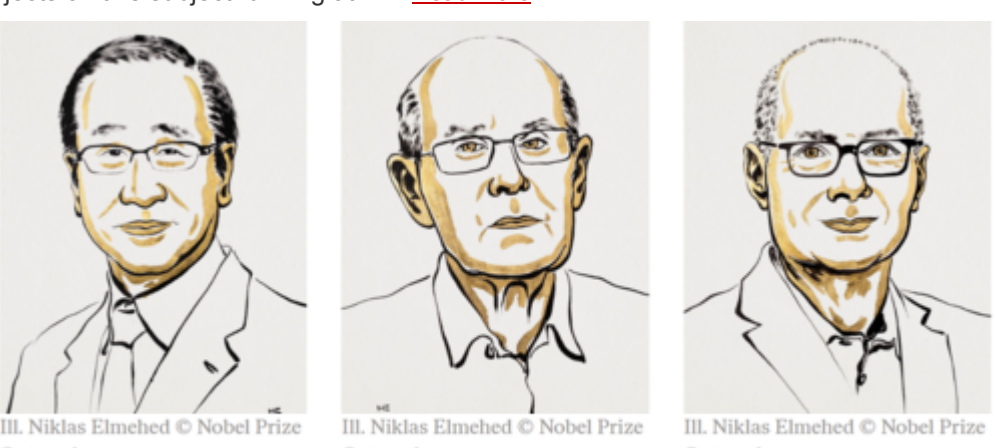
Neutron reflectometry has provided new insights into pulmonary surfactants, advancing the development of therapies for surfactant-deficient lung disorders. In collaboration with the Complutense University of Madrid, researchers used the ILL's FIGARO instrument to study the key surfactant proteins SP-B and SP-C, which prevent alveolar collapse. The results, published in the Journal of Colloid and Interface Science, revealed that SP-B drives the formation of multilayered lipid reservoirs essential for breathing, while SP-C plays a supportive role - marking a major step towards novel therapeutic materials. Read more

How batteries breathe


Scientists used neutron imaging on ILL's NeXT instrument to study lithium–sulfur (Li-S) batteries in real time. Li-S batteries promise high performance but face challenges under "lean electrolyte conditions," which improve energy density but shorten battery life. The study revealed that electrolyte wetting inside the battery is uneven but improves during charge/discharge cycles, almost as if the battery were "breathing." This breathing effect redistributes the electrolyte solution and explains why battery life is reduced. Neutron imaging, highly sensitive to lithium and hydrogen, provides unique insights into these processes and paves the way for designing longer-lasting, next-generation batteries. Read more

Nobel Prize

The Nobel Prize in Chemistry, awarded to Susumu Kitagawa, Richard Robson and Omar Yaghi for their 'development of metal organic frameworks' (MOFs), is of particular relevance to neutron science and the ILL
MOFs are porous materials that are made up of metal atoms linked by organic (carbon-based) molecules called ligands. Together, the metal ions and the ligands form crystals with large cavities in which molecules can flow in and out. By varying the building blocks used in the MOFs, chemists can design them for different purposes - harvesting water from desert air, extracting pollutants from water, capturing carbon dioxide or storing hydrogen. Neutrons are ideal probes of MOFs since they 'see' the metals and organic molecules equally well. Many scientists at ILL are involved in research concerning a variety of MOFs for a wide range of applications. Worth mentioning in this context is the work of ILL scientists with the now Nobel laureate Susumu Kitagawa and his colleagues on a spin crossover MOF in which the magnetic (spin) state of the iron centre can act as a switch for the rotation dynamics of a ring-shaped molecule. MOFs have been, are and will continue to be an important area of activity at ILL - we estimate that several hundred experiments have been performed on MOFs at ILL, leading to about one hundred publications, and there are currently three PhD projects on this subject running at ILL. Read more


Ill. Niklas Elmehed © Nobel Prize Outreach — Susumu Kitagawa | Ill. Niklas Elmehed © Nobel Prize Outreach — Richard Robson | Ill. Niklas Elmehed © Nobel Prize Outreach — Omar M. Yaghi

Training

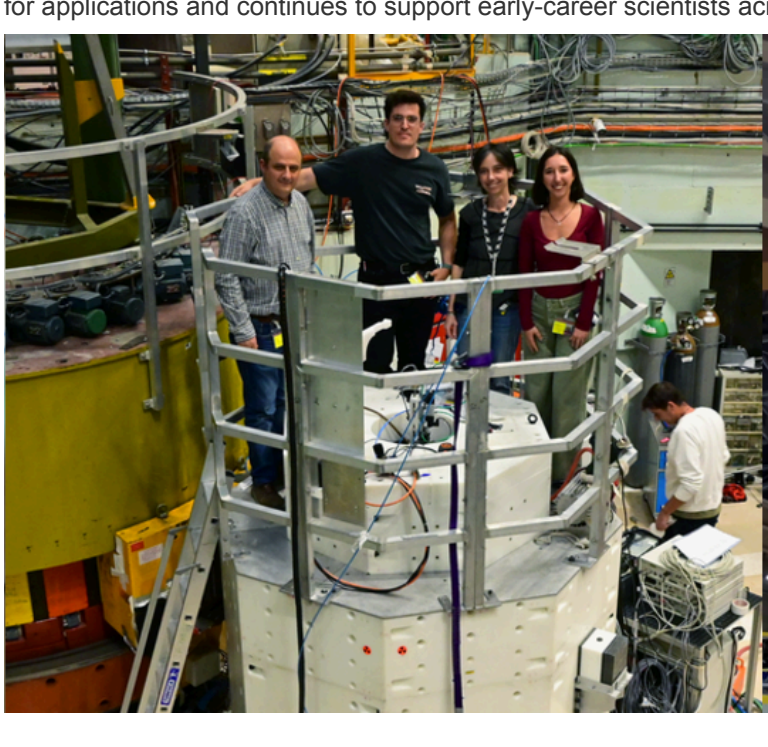
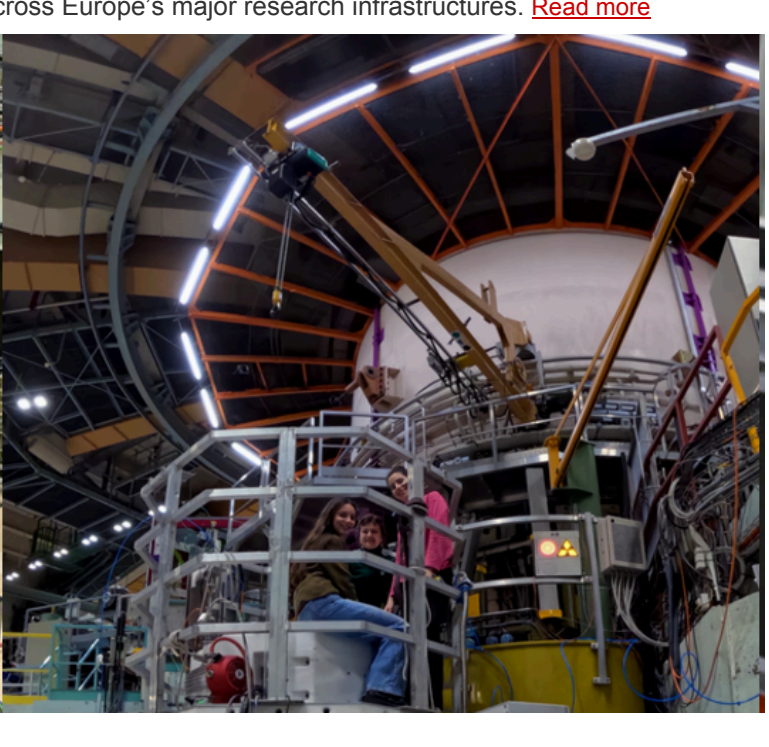
IGS news

At the end of one more year, the ILL Graduate School (IGS) is pleased to congratulate all the students that defended their theses in 2025.
25 news students started their PhD projects during 2025 - welcome to all of them!
In the photo, two of the winners of the 2025 Clip Session Prizes, Lewis Giannelli (2nd year winner, on the left) and Lucas Fine (3rd winner winner, on the right) with the IGS coordinator Peter Fouquet. For the 1st PhD year, the winner was Florian Ott.

28 January | **Elhoucine Hadden**, U. Vienna
28 March | **Riccardo Morbidini**, U. Manchester
18 April | **Ananthapadmanabhan Unnikrishnan**, U. Montpellier
7 May | **Firoz MALAYIL Kalathi**, U. Grenoble Alpes (UGA)
13 May | **Ilaria Mosca**, U. Tübingen
27 August | **Lucas Fine**, Chalmers U.
27 October | **Lorenzo Domenichetti**, UGA
04 December | **Matteo Chamchoum**, TU Berlin
12 December | **Dat Le Thanh**, U. Montpellier
15 December | **Laura Mateo Minarro**, UGA
15 December | **Xamuel Lund**, U. Montpellier

Europe

Two NEPHEWS Twinning participants on the IN1-Lagrange spectrometer at the ILL
The NEPHEWS Twinning Programme offers researchers short, hands-on placements at the ILL, giving them direct experience with neutron experiments and guidance from beamline scientists. Recent participants Giorgia Cariati (Spain) and Morgana Müller de França (Brazil) joined experiments on the IN1-Lagrange spectrometer, gaining insight into how neutron techniques enrich their studies of zeolites and adsorption phenomena. Both highlighted the value of seeing experiments performed step by step and understanding how INS reveals hydrogen-related vibrational modes. Their experiences show how NEPHEWS helps researchers broaden their skills, plan future experiments, and connect with the international neutron community. The programme remains open for applications and continues to support early-career scientists across Europe's major research infrastructures. Read more

Visit from EU DG Research & Innovation Leadership

On Friday 21 November, we were pleased to welcome Maria Cristina Russo, who has recently been appointed Deputy Director-General for Innovation at the European Commission, along with Laurent Obresse, Policy Analyst, for a visit to the ILL, together with our partners from the ESRF, CEA, and the GIANT Innovation Campus. The visit provided an excellent opportunity to discuss the future European Innovation Act and to exchange views on ways to facilitate industrial access to research and technology infrastructures, including both proprietary access and collaborations through the user programme.

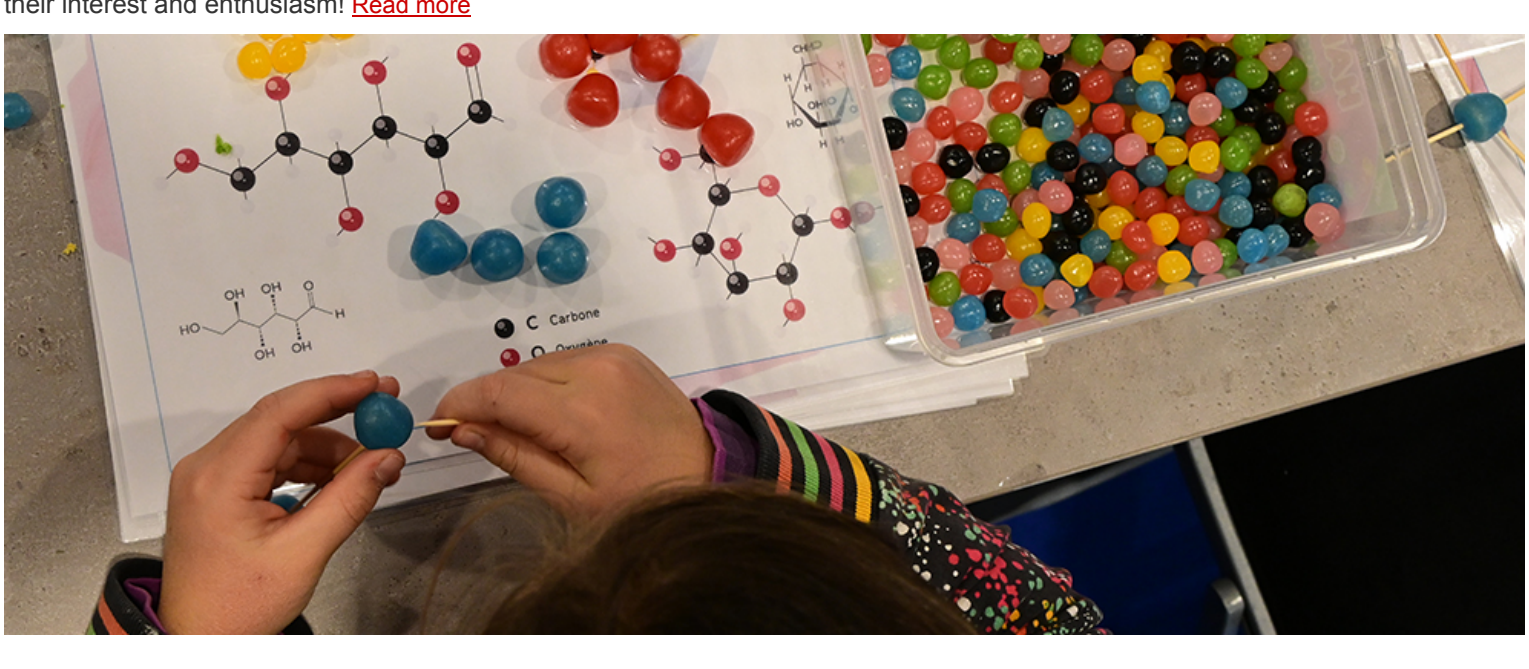
Visit of French European MP Raphaël Glucksmann

Also on 21 November, we had the pleasure of welcoming Raphaël GLUCKSMANN, Member of the European Parliament, and Christophe Ferrari, President of Grenoble-Alpes Métropole, to the ILL. This visit highlighted the scientific, industrial and strategic challenges associated with the ILL's unique role for France and Europe. "Europe is currently analysing the large-scale investments needed to ensure its future competitiveness, and closing the innovation gap is a fundamental challenge. The ILL has thrived over the decades by adapting to a changing world. Modernising and optimising its infrastructure and scientific instruments is a key aspect of this," said Ken Andersen, Director of the ILL.

RePSO visit to ILL
On Thursday, 20 November, ILL's European Office hosted local counterparts from the Research Project Support Office (RePSO) of Université Grenoble Alpes and Grenoble INP. At the end of RePSO's General Assembly at IBS, research managers and administrators (RMAs) attended a short presentation on research activities across the EPN campus, featuring representatives from EMBL, ESRF, IBS, and ILL. In the afternoon, 28 participants toured the instrument halls with great interest and curiosity. This visit enhanced local connections and networks, creating opportunities for collaboration to support the local scientific community through current and future European projects.

Events

Parvis des Sciences 2025
The ILL took part in the 2025 edition of the Parvis des Sciences, on the subject of 'Intelligence(s)', which was held last October in Grenoble at Minatec. As every year, we were present at the EPN campus booth, alongside our colleagues from ESRF and EMBL Grenoble. It was a pleasure to work together and to welcome all the visitors (1765 in a single day). We warmly thank them all for their interest and enthusiasm! Read more



DENIM XIV: discussing neutron instrument engineering challenges
The Design and Engineering of Neutron Instruments Meeting (DENIM XIV) is an annual rotating workshop hosted and organised by the world's leading neutron scattering research facilities. This year, the ILL organised the event, which took place from 20 to 23 October at the Minatec Congress Centre. More than 150 engineers from all over the world enjoyed three days of presentations, exchanges and friendly moments to discuss the engineering challenges and lessons learned in the design and construction of scientific equipment. Ten industrial sponsors participated in and supported the event. Read more

Calendar

16-17 December | StereoXN: A stereo approach to elucidating complex fluids at the nanoscale with Neutrons and X-rays
11-16 January | ADD2026 - School and Conference on Analysis of Diffraction Data in Real Space
22 February - 29 March January 2026 | Hercules School
10-13 March 2026 | HIRES 2026 - Synergies in HIgh RESolution Spectroscopy
16-20 March 2026 | FASEM 2026 for Energy Materials

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