

ILL news @ ICNS 2025

recent facility news + conference highlights

Green light for operations until the end of 2033



Just over a month ago, the ILL received the firm commitment from France, UK and Germany to continue operations until the end of the 6th Protocol period, in December 2033. The process of securing the fuel for reactor operation as of 2031 has been started immediately. The ILL is now in a position to plan scientific operation for the next decade. With the completion of the Endurance upgrade programme at the end of 2024, the ILL is in great shape - with a suite of 43 state-of-the-art instruments, a reactor with vessel which was changed in 1995 (and has an expected lifetime of over 60 years) and a comprehensive set of support facilities. At the forefront of neutron science and technology for nearly 60 years, the ILL now, more than ever, is ready to contribute to European competitiveness as a pillar of the European neutron landscape.



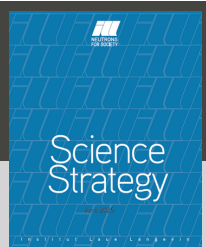
Celebrating the completion of the Endurance upgrade programme at the ILL, November 2024

More info at ICNS 2025

ILL update talk by Ken Andersen, session: Facilities Updates and Instrumentation (Tue 2 pm)

Talk on the ILL Science Strategy by Jacques Jestin, session: Neutron Landscape and Facility Roadmaps (Wed 11 am)

Keynote talk by Frank Gabel: Support Facilities for Biology, Deuteration, Chemistry and Soft Matter (Thu 10 am)



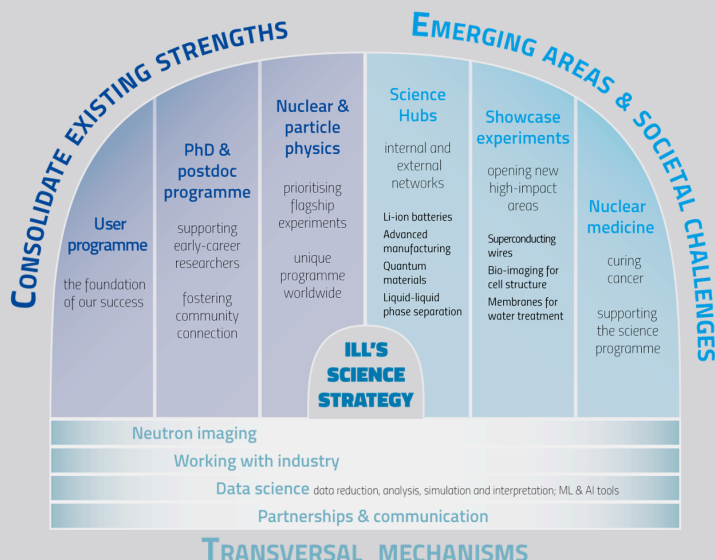
The ILL Science Strategy

The recently published ILL Science Strategy outlines the approach that will be taken to leverage the ILL's extensive instrument and facility upgrades. Developed with the help of external experts, it provides a vision for scientific operation for the coming decade, reflecting a balance between consolidating existing strengths and establishing new structures and mechanisms to support emerging scientific areas of societal importance. It is meant to serve as a guide for resource allocation, demonstrating and strengthening ILL's importance to European science and innovation, and supporting political decisions on the future European neutron landscape. The aim is to enhance the science programme in order to expand our user community and address some of today's major societal challenges. The Science Strategy is available at our ICNS 2025 booth (booth no.7, 'Neutrons for Europe', ILL+ESS) or online in the ILL website.

www.ill.eu



Scientific Coordinator of the Li-ion Battery Hub
 Scientific Coordinator of the Advanced Manufacturing Hub
 Head of the Applied Science group



ILL (data) @ ICNS2025 - selected highlights

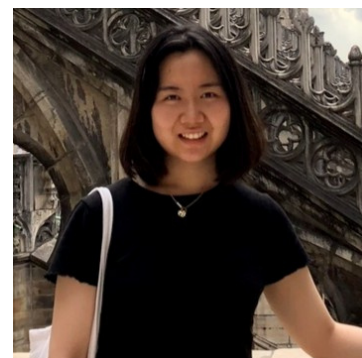
One of the impressive aspects of neutron science is the wide variety of fields of research in which it is essential, and its impact in addressing societal challenges in areas such as health, energy and the environment, quantum materials, as well as in the understanding of our universe. This is reflected in the diversity of sessions at ICNS2025. It'd be impossible to choose just a few examples! The best part is really seeing how ILL data underpins so many of the contributions presented.

SLH - Soft Matter, Life sciences and Health

Plant-based meat analogues: the challenge of the imitation game

As consumer concerns about sustainability, health and animal welfare rise, the challenge of developing convincing plant-based meat analogues is increasingly relevant for the food industry. One of the challenges is how neutrons can help improve texturisation.

At ICNS2025 **Tong Guan (ETH Zurich)** presents a comprehensive multi-scale study by neutron small angle scattering through in-situ real-time observations (*SLH02, Mon 2 pm*). The study started when she was a PhD student at the ILL and ETH Zurich, in a collaboration with the Swiss company Planted Foods AG, within the EU-funded project InnovaXN (its follow-up project NextStep has recently started).



Food science is an active research field, and this is well illustrated in the two sessions on the topic at this conference, where three other studies will be presented by ILL scientists: **Leonardo Chiappisi** will reveal how neutrons can help us dive deep into the mysterious world of foams - complex, multiscale states whose applications are far reaching, from food to sustainability in industrial processes. The same can be said about lipase-catalysed lipolysis of triglycerids (i.e. the degradation of fat molecules into smaller components in the presence of enzymes), of interest for the food and pharmaceutical industry and the focus of **Ben Humphreys'** talk, or hair dyes used by the cosmetic industry, investigated in the study presented by **Ralf Schweins**. (*SLH01, Mon 11 am*)

If you take a glance at the other SLH session, you'll see that the variety is immense, and so are the neutron techniques used: from QENS studies of liquid-liquid phase separation, a crucial phenomenon in the formation of membraneless organelles as well as in triggering pathological protein aggregation, a hallmark in neurodegenerative diseases (**Tilo Seydel**, *SLH04, Tue 2 pm*), to oscillating cell membrane studies with neutron spin-echo (**Ingo Hoffmann**, *SLH06, Wed 2 pm*) and polymer nano-material studies using neutron reflectometry (**Apostolos Vagias**, *SLH05, Wed 11 am*).

QM - Electronic Phenomena and Quantum Materials

Doubts about multiband superconductivity? D33 can fix it!

Superconductivity describes the extraordinary ability of certain materials to conduct an electric current with zero resistance and thus no energy loss. Applications are limited, however, by the need to cool most superconducting materials to very low temperatures.

The discovery of superconductivity in the rather simple binary compound magnesium diboride (MgB_2) at a relatively high transition temperature of 39K ignited significant interest due to the existence of multiple energy bands.

At ICNS2025, **Ahmed Alshemi (Lund University)** presents recent findings from experiments carried out at the ILL and SINQ confirming monochromatic small-angle neutron scattering (SANS) as the definitive go-to method to characterise multiband superconductivity in a material. (*QM05, Wed 11 am*)



Neutrons are perfect probes to study the magnetic properties of materials at atomic level, as well as for measurements under the extreme conditions under which exotic quantum effects usually become apparent. To transform promising applications into the information technology devices of the future, fundamental studies are essential. The vitality of this area of research is well illustrated by the **ENSA prizes** awarded at this conference - couldn't be more appropriate in the UN's International Year of Quantum Science and Technology!

Multiferroic materials, in which electric and magnetic properties are combined in promising ways, will be at the heart of new solutions for data storage. In her talk, **Adheena Painganoor**, PhD student at the ILL and the Technical University of Denmark, will discuss ferrotoroidicity magnetic order (characterised by an intrinsic magnetoelectric effect) as a route towards non-volatile, energy-efficient memory devices. The study uses spherical neutron polarimetry to pinpoint the domain distribution after cooling in combined magnetic and electric fields. (*QM06, Wed 2 pm*)

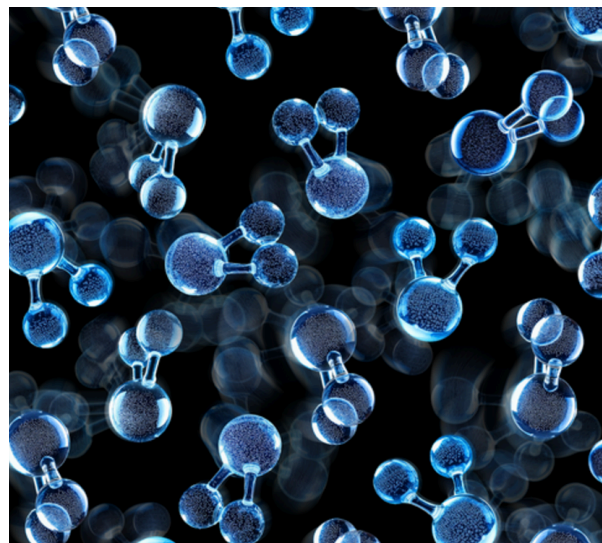
Neutron polarisation analysis is a powerful method to separate magnetic scattering from nuclear scattering. In neutron inelastic scattering, it makes it possible to distinguish between phonons (lattice vibrations) and magnetic excitations (e.g. magnons, spinons, triplons, crystal-field excitations, spin transitions). In her talk, **Ursula B Hansen (INSTRO6, Wed 2 pm)** presents PASTIS3, a new setup for wide-angle XYZ-polarisation analysis developed at the ILL and commissioned at thermal triple-axis instrument IN20.

MAT - Material Engineering and Chemistry

Plastic ice, an exotic phase of water & more on the physics and chemistry of materials

Plastic phases are hybrid states that blend properties of both solids and liquids: water molecules are tightly held within an ordered structure yet retain the freedom to rotate, akin to a liquid state. Plastic ice VII was originally predicted more than 15 years ago by molecular dynamics simulations as a phase of water that could exist under high temperature and pressure. State-of-the-art neutron spectrometers and sample environment equipment at the ILL have enabled the first experimental observation of one of these exotic phases – plastic ice VII. The results were published in Nature in 2024.

At ICNS2025, **Livia E Bove** (CNRS, La Sapienza University, EPFL), the main author of this study, will discuss how plastic water behaves in diverse environments and under varying pressure and temperature conditions. High-pressure QENS experiments have unveiled varying degrees of plasticity in diverse environments and under varying P-T conditions. Also an author of this study, **Maria Rescigno** will focus on the splitting of hydrogen's quantum rotational levels revealed by High-Pressure Inelastic Neutron Scattering. (MAT03, Tue 11 am)



Neutrons are indeed great explorers of the physico-chemical properties of many materials over a wide range of length and time scales. This makes them a powerful tool for developing new functional materials that can address societal challenges, namely in the domain of environmental sustainability.

That's the focus of the presentations of two PhD students currently at the ILL. **Aliki Gerakianaki** reports on her study of a low-cost option for catalysts optimising hydrogen production from water electrolysis, which emerges as a vital energy carrier as the urgency for decarbonisation intensifies. **Kirstin Wilson** reports on the use of neutron diffraction analysis of metal-organic frameworks (MOFs) comprising multiple metal elements to unveil their unique structural features and role in catalysing CO₂ reduction (converting CO₂ and H₂ into CO and water). ILL researcher **Laura Cañadillas Delgado** investigates the magnetism on aperiodic metal-organic coordination polymers. (MAT06, Wed 2 pm)

Universe Essentials

Prizes

Juan Rodriguez Carvajal (ILL)

Walter Hålg Prize for his extraordinary impact in materials structure determination as the "father of FullProf".

Dalila Bounoua (LLB)

Erwin Félix Lewy Bertaut Prize for her outstanding contribution to the field of novel magnetism in high-temperature copper oxide superconductors.

Iurii Kibalin (ILL)

Neutron Instrumentation and Innovation Award for his significant impact on polarised neutron diffraction techniques.

Neutrons in a box

The uniqueness of the ILL nuclear and particle physics (NPP) programme is recognised in the 'Long Range Plan for European Nuclear Physics', published in 2024 by the Nuclear Physics European Collaboration Committee (**NuPECC**). This European strategy document clearly recommends the exploitation of ILL well beyond 2033 – due to its scientific relevance, competitiveness in nuclear (and particle) physics, and its capabilities for producing radioisotopes for research and cancer treatment.

At ICNS2025, **Joachim Bosina (Wien)** will represent the qBounce collaboration, which in recent years successfully commissioned a new Ramsey-type spectrometer setup at the ILL. Ultra-cold neutrons form bound quantum states on flat surfaces in the gravitational field of Earth. The technique of gravitational resonance spectroscopy enables the measurement of the transition frequencies between two of these states, which can be sensitive to hypothetical variations of the Newtonian potential at the micrometer scale. The results provide constraints on various dark matter or dark energy models. (Universe Essentials, Mon 11 am)

In the same session but on the nuclear physics side, **Caterina Michelagnoli** will show the path to answer many fundamental questions about atomic nuclei through experiments on the nuclear physics instruments at ILL. The science programme on the FIPPS instrument will be presented, together with future possibilities for fission studies.

Last but by no means least, congratulations to **Valentin Czamlar** for winning the **Best PhD Thesis Award 2025 of the SFN** (French neutron scattering association), for the quality and impact of his work investigating new very cold neutrons sources. Valentin completed his PhD within the ILL's NPP group and is now as a postdoctoral researcher at LPSC in Grenoble.

Neutron technologies at the ILL

In-house developed technologies and capabilities have been key to successful and efficient instrument upgrades and will continue to form the backbone of post-Endurance maintenance and upgrades, ensuring the ILL instrument suite remains world leading.

This is highlighted in the new brochure 'Neutron Technologies at the ILL', which is available at our ICNS 2025 booth (booth no. 7, 'Neutrons for Europe', ILL+ESS) or online on the ILL website. www.ill.eu



Early in 2024, a collaboration agreement was signed between the ILL and the ESS to supply a TYREX station for the production of polarised Helium-3. In July 2024, another agreement was signed between the two facilities for ILL to manufacture the detector for the ESS's CSPEC instrument. Each of the 12 detector modules will be manufactured and tested at the ILL, delivered to the ESS by the end of 2027, and then filled with detection gas before installation on the instrument. The agreement includes also training for ESS staff. This group photo was taken during the ILL team's visit to the ESS experimental hall in October 2024.

Recent advances in neutron optics have led to the development of an innovative bent silicon crystal technology. This breakthrough enables new designs for monochromators and analysers specifically tailored to enhance inelastic neutron scattering experiments. Two key applications highlight the potential of this technology: the MARMOT analyser system on the ThALES triple-axis spectrometer and a new analyser proposed for the IN8 spectrometer. The MARMOT system marks a significant step forward in energy analysis for multiplexed neutron spectrometers.

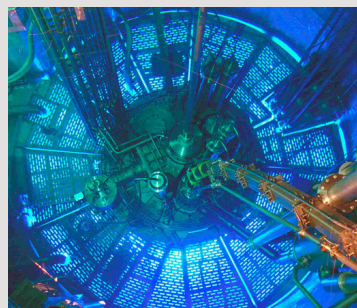


More info at INCS 2025

Talks by Pierre Courtois (*INST04, Tue 2 pm*) and Ursula B. Hansen. (*INST06, Wed 2 pm*)

Related posters by:

Thierry Bigault, Bruno Guérard, David Jullien, Eddy Lelièvre-Berna, Julien Marchal, Paul Steffens



Reactor operation

Reactor cycle number 197 at the ILL has just ended (7 July 2025). Over the last two months, more than 600 scientists from 28 countries conducted over 350 experiments. The 2024-2025 inter-cycle shutdown was a busy period, with the completion of a number of large projects necessary to comply with the ever more stringent safety regulations. The projects included, among many others, installation of a new fire sprinkler system for the reactor building, refurbishment of the polar crane, and reinforcement of neutron guide casemates. The next cycle will start on 26 August and run until 28 October.

www.ill.eu/reactor-cycles

Radioisotope production

In June 2025, Isotope Technologies Munich SE (ITM) and the ILL announced the extension of their collaboration for medical radioisotope production, established in 2009. Under the terms of the renewed agreement, ITM will receive priority access to half of the available neutron irradiation capacity at the ILL's High-Flux Reactor for the production of non-carrier-added Lutetium-177, a critical medical radioisotope used in radiopharmaceutical therapies for cancer treatment and diagnosis.

EU projects

- Among the scientists who came to the ILL during the first 2025 cycle were the first NEPHEWS project 'novice users' from Poland, Portugal, and Ukraine. For more info on this transnational access scheme, check out www.beamtime.eu
- ReMade@ARI, the hub for research into circular economy materials: look out for Bettina Schwaighofer's poster at ICNS 2025
- AMBER, Advanced Multiscale Biological imaging using European Research infrastructures: postdoc positions open at the ILL
- ACTNEXT, Accelerating the green transition via Power-to-X (PtX) technologies: a 3-year Physicist engineer position available



European Conference
on Neutron Scattering
28 June - 3 July 2027

www.ecns2027.eu

Grenoble 2027

The perfect time & place
to celebrate neutrons in Europe

Institut
Laue-Langevin
60 years
1967-2027

