



Accessing beam time at large scale neutron facilities

Giovanna Cicognani - ILL



Europe enjoys a versatile and broad network of neutron sources



Large-scale research facilities equipped with neutron sources, such as reactors or spallation sources, used for scattering experiments

The neutron is a unique and irreplaceable probe, with characteristics that cannot be supplanted by other methods

Neutrality

As neutral particles neutrons can **penetrate deep** within materials to reveal buried structures and interfaces

Magnetism

As magnetic particles neutrons are **sensitive to magnetism** and magnetic processes in materials

Energy

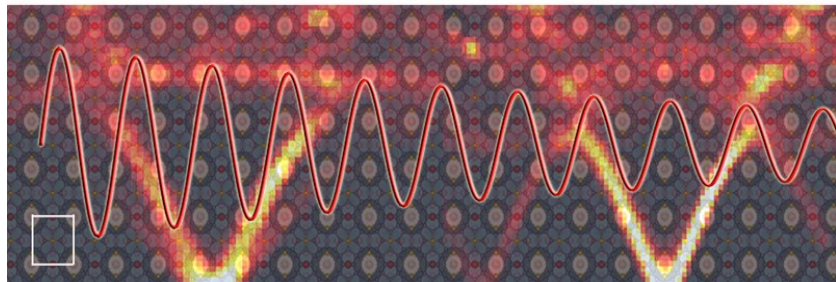
Exchanges of energy between neutrons and samples can be detected and used to follow the **dynamics** of atomic, molecular and lattice processes

Wavelength

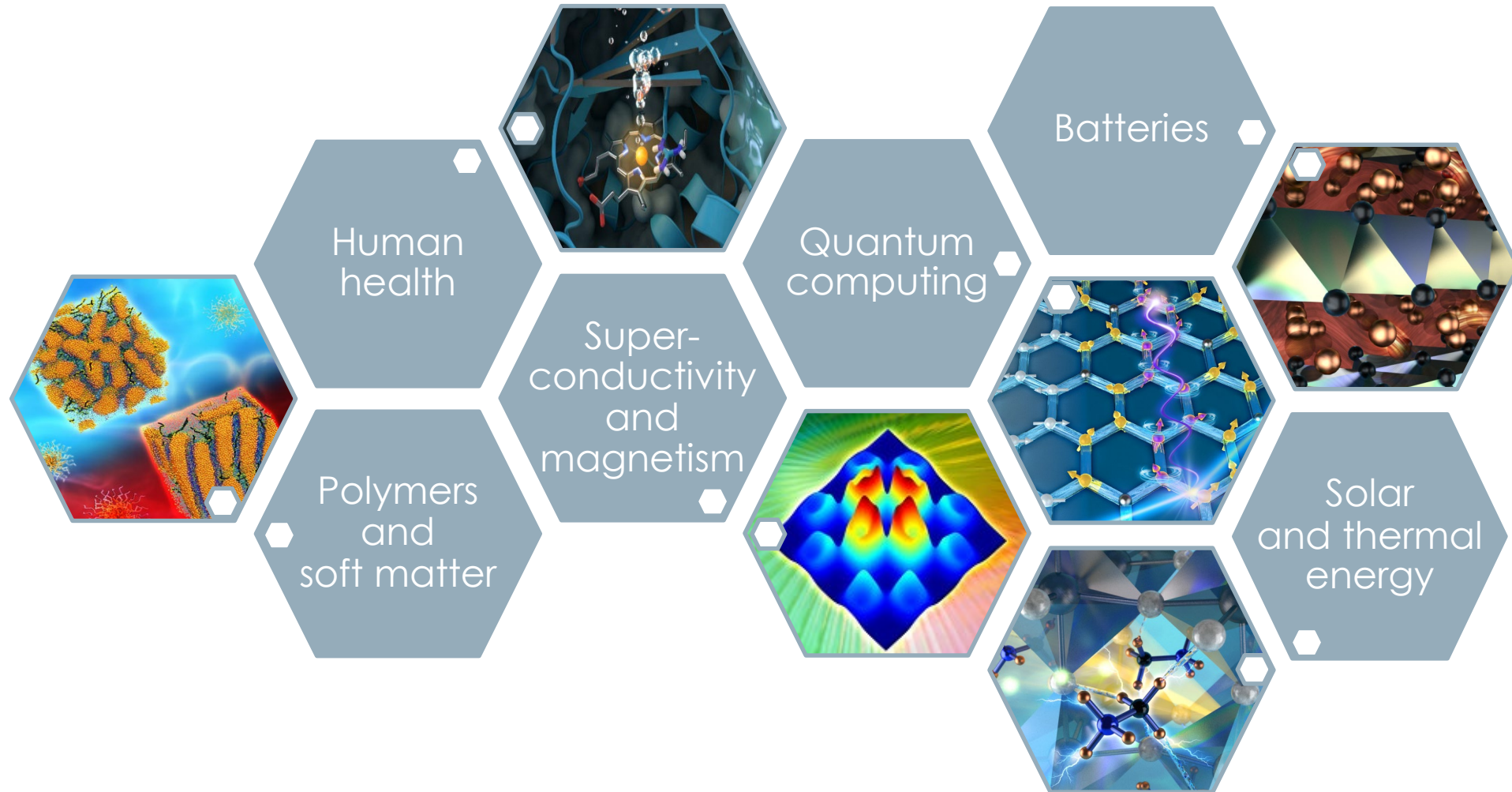
Neutrons have a **broad range of useful wavelengths**, allowing examination of structures as small as atoms and as large as biological cells

Selectivity

The ability of neutrons to see **light elements**, to distinguish between elements with similar atomic number and to distinguish between specific **isotopes** can provide unique structural and dynamic information



Neutrons provide information needed to solve challenging problems across a variety of research areas



After 50 years of operation, we are still number one

BECAUSE THE ILL:

- Is the most intense neutron source in the world
- Adapts to scientific trends and the needs of the user community
- Offers the best cutting-edge instrumentation
- Attracts and benefits from the best researchers on the international stage



Key figures about the ILL



1400 users from an active community of 12 000 scientists



1000 experiments/year



600 publications/year
of which 20% in high impact journals



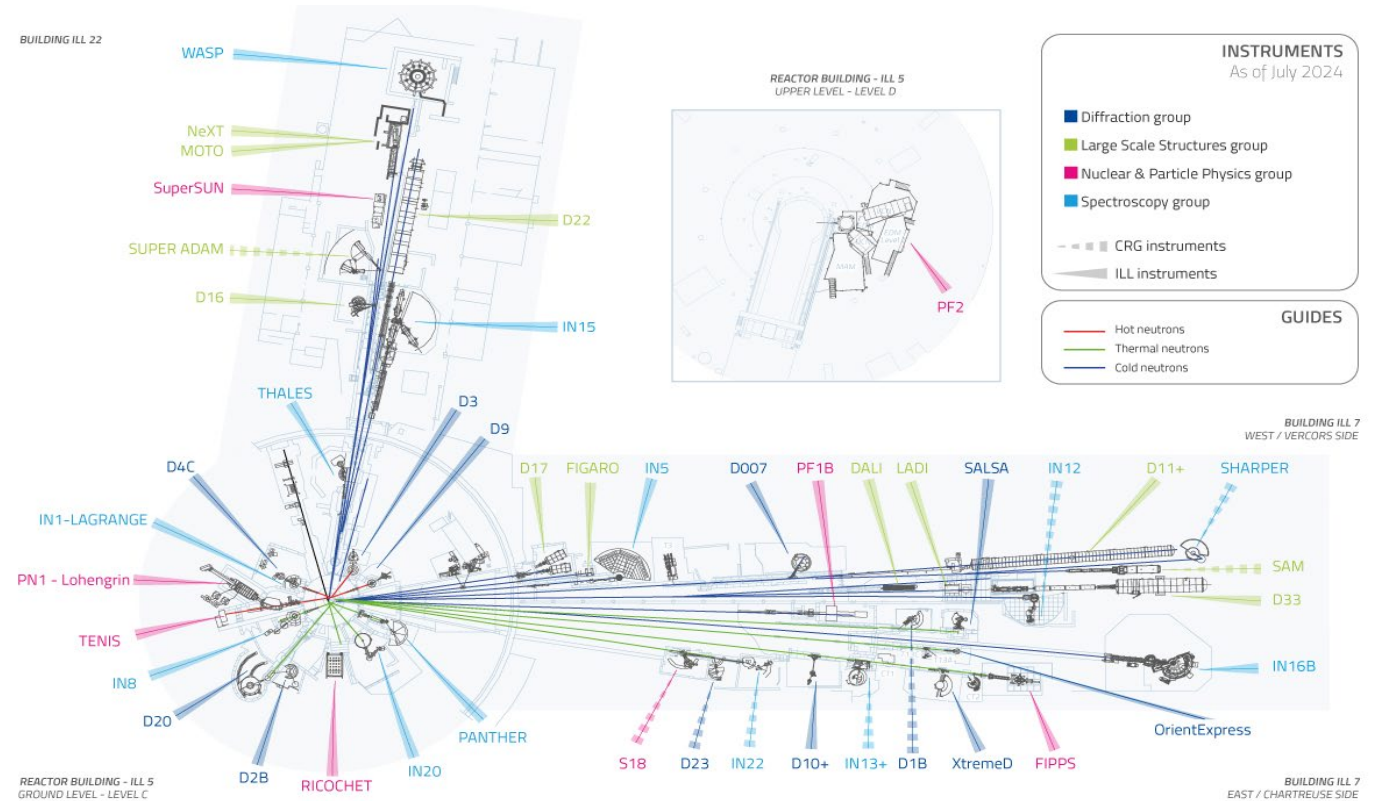
65 countries



28 instruments + 10 CRG



160 reactor days for experiments

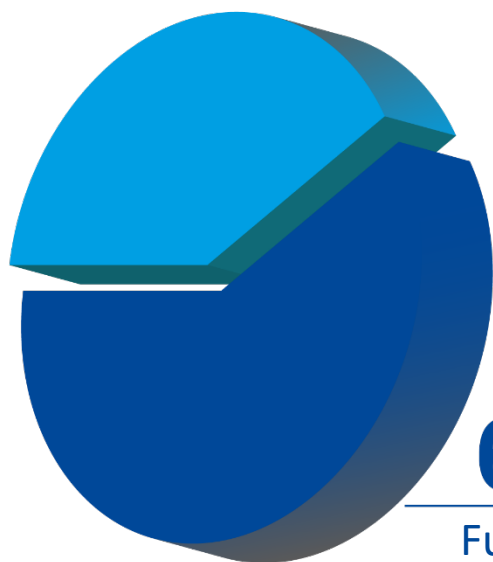


Research areas covered by the ILL

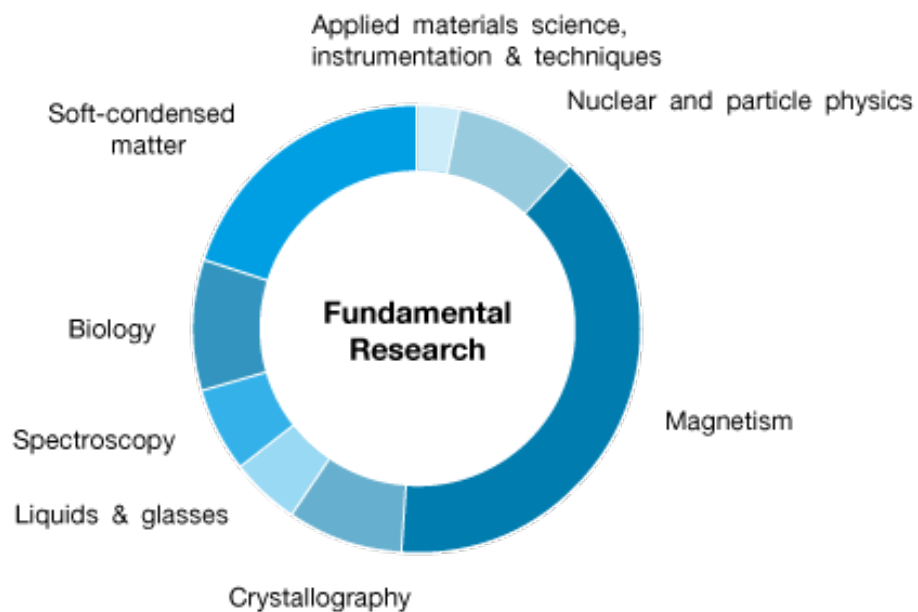
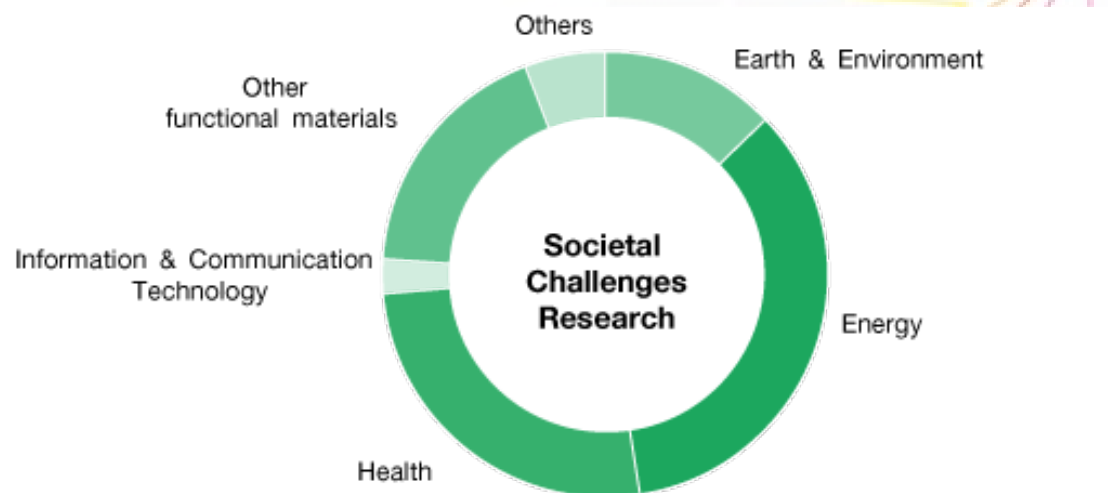
As per accepted proposals

Research for societal challenges

40%



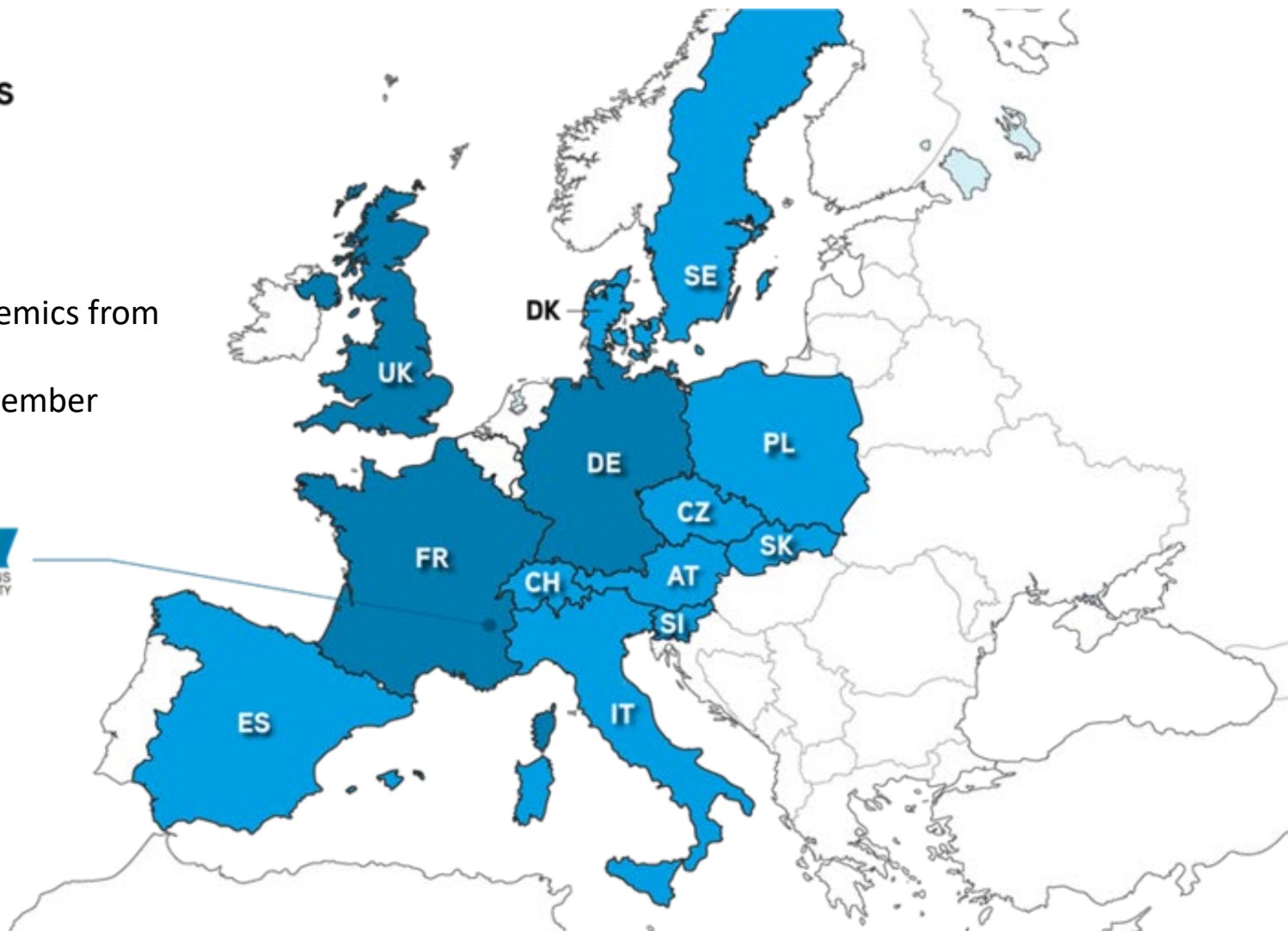
60%
Fundamental research







The ILL member countries

- ASSOCIATE COUNTRIES
- MEMBER COUNTRIES

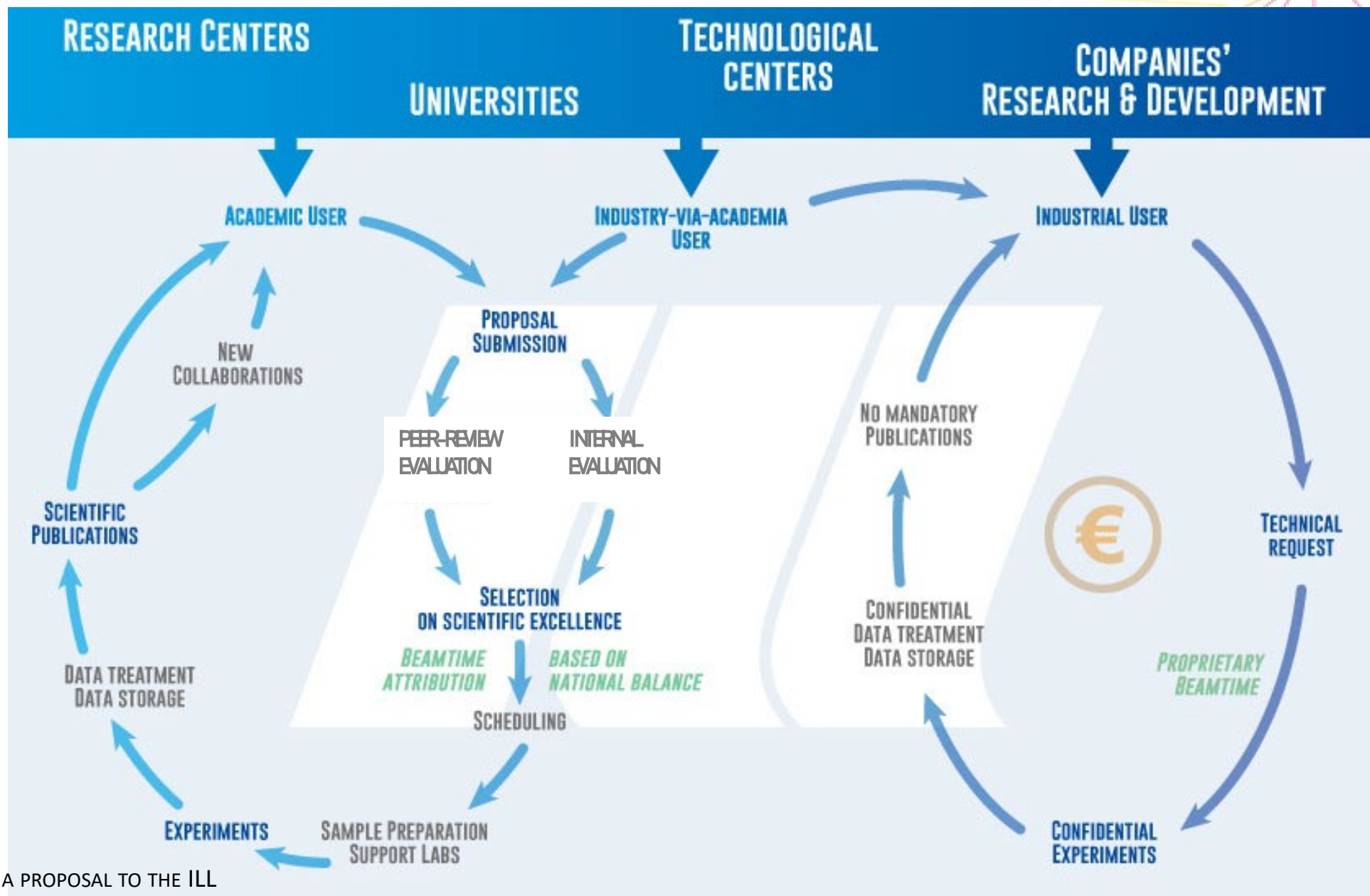
- Free of charge access to academics from member countries
- Conditioned access for non member countries
- Purchased commercial access



Types of beamtime

	APPLIES TO	WHEN	WHO FOR	RESPONSE TIME
External peer review				
<u>Standard</u>	All experiments, all instruments, all conditions. Next deadline 15 February 2025.	Deadlines twice a year, spring and autumn	All users from member countries	4 to 8 months after deadline
<u>BAGs</u>	College 8 proposals on D22	Deadlines twice a year, spring and autumn	All users from member countries	4 to 8 months after deadline
<u>CRG</u>	All experiments, CRG instruments, all conditions	Depends on <u>CRG</u> policy	All users from CRG collaboration	Depends on <u>CRG</u> policy
<u>D-Lab</u>	Access to the ILL sample deuteration lab	All year	All users from member countries	
Internal peer review				
<u>DDT</u>	Urgent experiments, hot topics, excellent science from non-member countries, all instruments, all conditions	All year	All users	ASAP 
<u>EASY</u>	A small amount of beamtime, not a full experiment; must be very simple measurements, all instruments, limited number of configurations	All year	All users from member countries	From one to a few weeks 
<u>LTP</u>	All instruments, for projects over several cycles if it can be demonstrated that they bring extra resources or capabilities that are of benefit to all users	Once a year, autumn round	All users from member countries	4 to 8 months after deadline
No peer review				
<u>TEST</u>	Test of sample, equipment, instrument configuration, all instruments	All year	All users from member countries	Usually on same day 
<u>INDU</u>	Proprietary beamtime	All year	Contact the <u>Industrial Liaison Office</u>	ASAP 
<u>INTER</u>	Internal beamtime, available for ILL scientists to do their own research. Must have an ILL scientist involved but can also have external people as co-proposers (form available on the intranet).	All year	ILL scientists (possible collaboration with users from member countries)	Anytime during reactor cycles

How to request beamtime at the ILL?



Review criteria

- Scientific excellence: Novelty, significance, and potential impact
- Feasibility: Experimental design, required resources, and preparatory work
- Neutron suitability: Appropriateness of neutron methods for the research question
- Potential Outcomes: Clear hypothesis and potential for high-quality publications
- Team qualifications and previous track record



The ILL User Club

[Proposals](#)[Review processes](#)[Experiments](#)[Instrument](#)[Personal data/Training](#)[Experimental report](#)[ILL User Club administration](#)

Proposal management

Create new proposals

Electronic Proposal Submission

Easy Proposal Submission

CRG Proposal Submission

TEST submission

Handle existing proposals

Current proposals

Proposal search

User Office access

Proposal integration

<https://userclub.ill.eu/>

User Office Quick Proposal Access

Proposal

Proposal Description

- 1. Characteristics
- 2. Proposers
- 3. Instruments
- 4. Sample
- 5. Safety
- 6. Environment
- 7. Abstract
- 8. Description

Actions

- Save
- Submit
- Delete
- Transfer

Proposal #93027 (Guidelines)

Main information

Title (8 / 140 ch.)

College

Category

Main research area

Already submitted to other facilities Yes No

- Societal Indicators**
- Fundamental Science
 - Earth & Environment
 - Energy
 - Health
 - ICT*
 - Other functional materials (please specify)
 - Other (please specify)

Proposal history

Type of proposal New Continuation Resubmission

Laboratory support

Mechanical preparation support needed Yes No (0 / 250 ch.)

ILL RESEARCH PROPOSAL

Title: Organic cation segregation and degradation in perovskite solar cells: anion scattering study 1.04.179 Printed: 09/07/2019

Proposer (to whom correspondence will be addressed):

Name and first name	Address	Phone	Email
José María FORERO AZPILARU	BCHMATERIALS DIERO MATERIALS DIVISION ILL-CEA BP 156 F-38000 Grenoble France		forero@ill.eu

Co-proposers:

Name and first name	Laboratory	Country
BARBERCK Thomas	ILL, GRENOBLE	FRA
BLANCO Manuel	BCHMATERIALS DIERO	ESP

Lead contact: BARBERCK Thomas

Suggested period: number: 1-04

This proposal is: A new proposal A continuation proposal A modification

Main research area: Materials

Submitted to other facilities: No Societal indicators: Earth & Environment/Energy

Laboratory support facility: SANS support through I2B Continuum level 2 hallways lab Chemistry Lab PSC4 lab EMBL lab IASL PSC4 lab EMBL lab

Requested instrument D17 D33

Requested starting time 1. Jan/Feb 2. Mar/Apr 3. May/June 4. Jul/Aug 5. Sep/Oct 6. Nov/Dec

Comment: The reflectometry measurements will be performed in D17 and the SANS ones in D33

Sample availability: Ready

Instruments' logical connection: D17 AND D33

Experimental details:
Energy/Wavelength range: 2-27kV
Resolution in energy or wavelength: 2-100eV
Range of momentum transfer:
Resolution in momentum transfer:

To be filled in by ILL:

Single environment code	Comments by Health Physics Office and Safety Engineer
ASL	

Abstract:
In recent years, perovskite solar cells (PSCs) have attracted the photovoltaic field owing to their unique combination of high performance and low-cost fabrication process. Compared with the existing technologies, PSCs have demonstrated their potential by exhibiting an overall efficiency in the power conversion of PSCs that is 23.1% in less than 4 years. Typically, layered perovskites are used, where the organic cations inside the perovskite lattice the Octahedra tolerance factor, but previous structural studies on the metal halide perovskites with the inorganic part of the perovskite lattice of the solar cells, giving special attention to the degradation of the perovskite and the organic cation segregation inside the perovskite structure. We will use the results of these experiments with measurements of the PSC of each sample fresh and degraded. This will provide us with a scenario where we will be able to correlate the efficiency of the PSC with the degradation and organic cation distribution in the perovskite layer.

Quantitative Textures of porous YBaCuO bulk prepared by infiltration and melt growth process
M. Sestini, D. Chittagipand and J.G. Nouzaud, *CRISMAT ASSOCIATION UMR 6566 GSC*

Introduction
Yttrium compounds of the so-called "Y-123" phase (Y_{1-x}Ba_xCu₃O₇) are the most promising high-T_c superconductors to date, for several practical applications. Quantitative texture inputs focussed up to now on single-domain bulk and/or coated-coating conductors tapes, in view of their potential use as motors, fault current limiter (FCL), current leads (1, 2, 3) or cables (4, 5). However, Dybuck and current leads or limiters need large Y123 ceramics with a grain oriented texture. We have developed a new methodology of artificially patterned holes for bulk sinteration based on an infiltration process (figure 1a). Using this technique, highly anisotropic Y123 single-domains are obtained with c-axis perpendicular to the sample surface, favouring the (a,b) planes current transport. Furthermore, thanks to the relative ease in the parameters control (sample composition, oxygenation, temperature, and time), the Y123 phase is amenable to a very high degree of preferred orientation, as controlled using classical X-rays, as necessary for transport applications.

Problematic
The critical current of such compounds remains closely sensitive to the quality of the grain boundaries, somehow linked to such factors like growth rate, textural and microstructural relationships between phases, composition variations ... However, if diffraction gives access to the structure, texture, particle sizes, microstrains, phase ratio, residual stresses ... all these influencing parameters have to be treated together in a non destructive way in order to understand the behaviour of real, application samples such as ours. The use of the so-called "omniscient" approach, which we developed for some years now (6), is then essential in order to take account of all the above-mentioned contributions. In order to prepare this work aiming to relate texture-microstructure-structure and physical properties, we operated preliminary 4-circle XRD measurements using a curved position sensitive detector at our laboratory. The (0051)04014) multiple figure measured on the surface of disc samples revealed a strong single-domain like texture with c-axis parallel to the axial pressure (figure 1b). However, only poor grain and phase representativity (statistics) could be obtained using X-rays, mainly because of a too much low number of grains in the probed volume, strongly highlighting the necessity of neutron investigations. Also, if the surface characterisation will be probed with x-rays, samples cores are very fastidious to reliably characterise this and the additional information of both probes will be a plus to detect displacement variations. We then want to determine on our samples, the textures, microstructures, structures, phase ratios, of all the phases in presence, in order to correlate them to the resulting macroscopic properties (transport critical current density, resistivity, magnetotransport and trapped field measurements).

Samples and required beam time allocation
Approximately 40 samples prepared in various temperature, P₀₂ and annealing conditions have been obtained, and their transport critical current densities and magnetic properties measured. From the the x-ray estimated texture strength and thanks to our experience of such systems at ILL (D18), each samples will represent approximately 4 hours of acquisition time, mounting and motor position dead-time included. These mounting estimates allow the 40 samples to be measured in approximately 7 days. If the motor dead-time could be reduced,

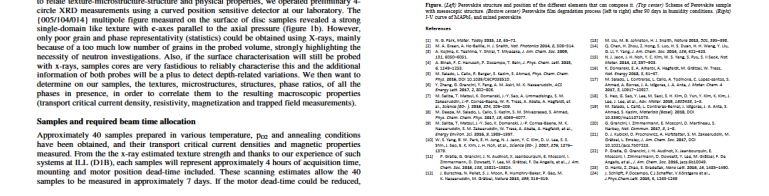


Figure 1(a,b) Perovskite structure and position of the different domains in the sample. (a) Top view: Schematic of perovskite sample structure. (b) Side view: Schematic of perovskite sample structure. The organic cations (green) are located in the perovskite lattice. The inorganic framework (blue) is composed of octahedra and tetrahedra. The c-axis is perpendicular to the page. The graphs show the intensity of the X-ray diffraction peaks for different samples. The left graph shows the intensity of the peaks for different samples, and the right graph shows the intensity of the peaks for a single sample, highlighting a sharp peak at a specific angle.

<https://userclub.ill.eu/>

Proposal writing – plan your proposal

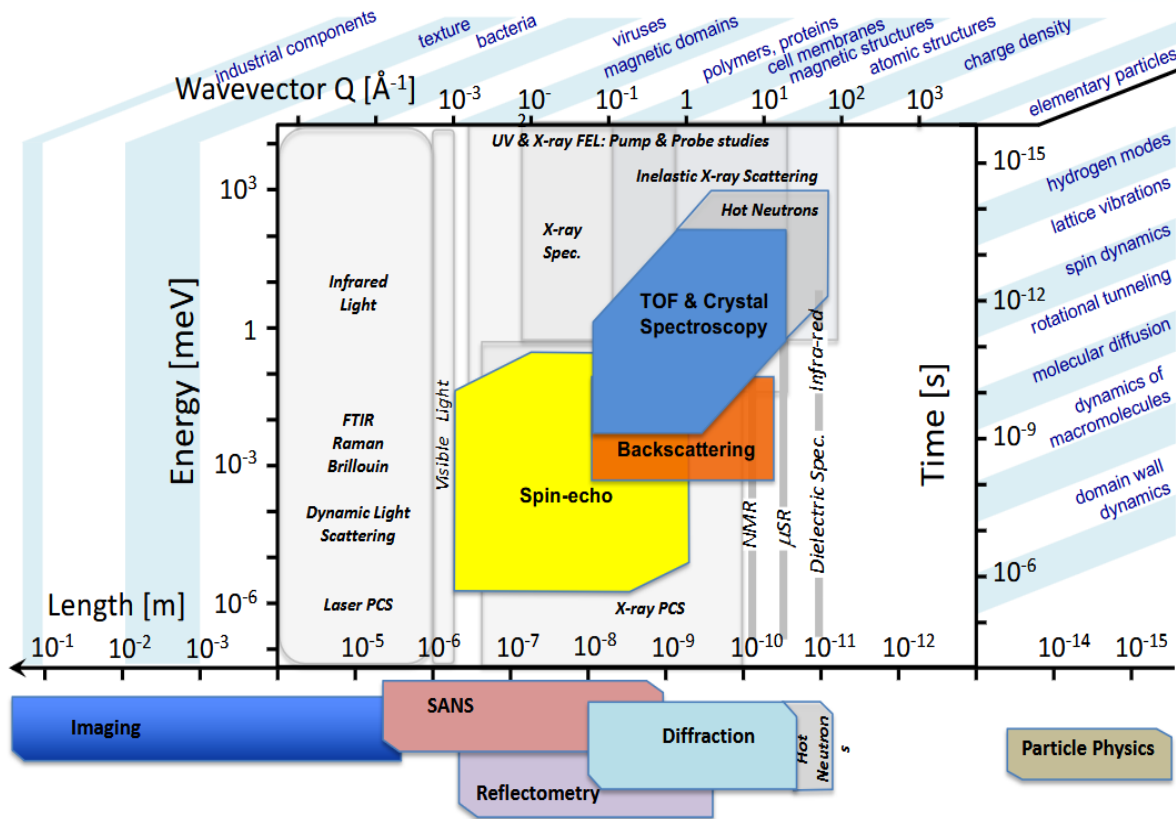
- What are you trying to learn from neutron scattering
- Which technique best matches your needs
- Which instrument do you need
- What sample environment do you need
- Discuss with instrument scientist

The screenshot shows the website <https://www.ill.eu/for-ill-users/information-for-new-users>. The navigation bar includes: ABOUT THE ILL, FOR ILL USERS, NEUTRONS FOR SOCIETY, REACTOR AND SAFETY, INDUSTRY, EDUCATION, CAREERS.

The main content area is titled "Information for new users". On the left is a sidebar menu for "FOR ILL USERS" with the following items: WELCOMING USERS AT THE ILL (News & updates for users, Information for new users), APPLYING FOR BEAMTIME, YOUR EXPERIMENT FROM A TO Z, COLLEGES, SCIENTIFIC GROUPS, INSTRUMENTS, SUPPORT LABS & INFRASTRUCTURE, USER CLUB, CONTACTS.

The main content includes a video player titled "WHAT THE ILL OFFERS:" with a duration of 0:00 / 0:44. Below the video are three expandable sections: "What can neutrons do for your science?", "Neutron techniques", "How do I access ILL's instruments?", and "Standard proposals submission deadlines".

Text content on the page includes: "The neutron is a subatomic particle with no net electric charge and a mass slightly larger than that of a proton. It also forms part of the nucleus of an atom. The unique properties of this particle can help solve all sorts of scientific questions. In particle and nuclear physics and by scattering neutrons from samples to learn about the structure and dynamics of condensed matter systems in physics, chemistry, biology, engineering, etc." and "In the **Neutrons for Society** pages, you'll find general information on the neutron, on experimental techniques using neutrons, and how they have made decisive contributions to science: - **neutrons in general** - **neutron techniques** - **science at the ILL**".



FOR ILL USERS

- WELCOMING USERS AT THE ILL >
- APPLYING FOR BEAMTIME >
- YOUR EXPERIMENT FROM A TO Z >
- COLLEGES >
- SCIENTIFIC GROUPS >
- INSTRUMENTS >

Instruments list

To maintain its status as leader in neutron science, the ILL has constantly upgraded its instruments and infrastructures over the last 50 years. The latest modernisation exercise - the ENDURANCE programme (2016-2023) - will continue to develop instrumentation and support services with a view to maintaining the Institute's world-leading position for another decade at least. The instruments which have been/are being upgraded within the ENDURANCE programme show its logo in their main page.

Select your instrument v

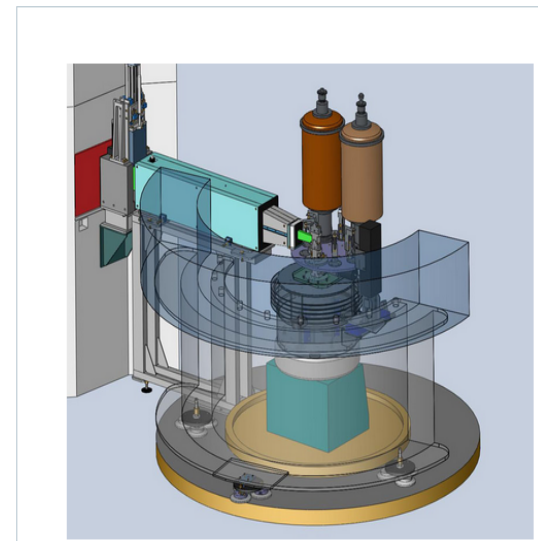
INSTRUMENT OVERVIEW

D2B v

D2B

High-resolution two-axis diffractometer

Description	Characteristics	How it works	Examples	Publications	More	Contacts
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D2B - HIGH-RESOLUTION TWO-AXIS DIFFRACTOMETER

D2B is very high-resolution powder diffractometer designed to achieve the ultimate resolution, limited only by powder particle size ($\Delta d/d \approx 5 \times 10^{-6}$), but it was built so that an alternative high flux option, with resolution comparable to that of D1A, but much higher intensity, could be chosen at the touch of a button.

Applications

- The structural chemistry of non-rigid molecules
- Ab-initio structure solution from powders
- Crystal and magnetic structure determination of powder compounds (even small samples)
- Dependence in temperature/pressure/magnetic field structural (or magnetic) studies for powders

Instrument layout

D2B seen from behind the detector, i.e. from the opposite of the normal access to the experimental area.

Proposal writing – structure and content

- Clear objective

 - Clear, concise summary of the project

 - Brief mention of the scientific aims and expected outcomes

- Scientific rationale

 - Highlight the novelty of the proposed work

 - Why is this experiment important ?

 - What gap in knowledge does it fill ?

- Methodology

 - Detailed description of the experimental setup

 - Specify the neutrons scattering technique to be used

 - Explain how the technique address your research question

- Expected results and impact

 - What outcomes are anticipated from the experiment?

 - How will these results contribute to the field ?

- Timeline and Beam Time Request

 - Estimate the required number of days for the experiment

 - Suggest a feasible timeline for completing the work

- Preliminary data and background

 - Include relevant previous work and literature

 - Provide any initial data or pilot studies to strengthen your case

- References

 - Cite literature that supports the experimental approach

Tips for writing successful proposals

Common mistakes to avoid



- Start early

Proposals require careful planning and preparation. Give yourself time to gather necessary data and refine your ideas

- Know your audience

Reviewers may not always be experts in your specific field, so make sure the proposal is accessible to a broad scientific community

- Be concise

Stick to the point and avoid excessive jargon

- Provide supporting data

Include any preliminary results that shows the experiment is feasible

- **Contact the experts!**

Engage with facility staff or experienced users to refine your proposal and increase its strength

- Unclear objectives

Vague or poorly defined scientific aims

- Overly ambitious

Be realistic about what can be achieved

- Lack of feasibility

Failing to clearly explain how the experiment can be performed at the facility

- Weak rationale

Insufficient background or literature support can undermine the proposal's impact

We are looking forward to welcoming you

