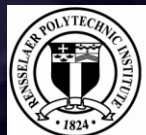


# How to Apply for Neutron Beamtime (Tips for Writing a Winning Proposal)

Emily Liu, Dr.

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Professor, Department of Mechanical, Aerospace, and Nuclear Engineering  
Rensselaer Polytechnic Institute, Troy, New York



**Rensselaer**



ENGINEERING PHYSICS  
IN CHARACTERIZATION

Croucher Summer Course on Neutron Scattering  
10-16 August 2025, City University of Hong Kong

# When considering applying for neutron beamtime

## Why?

- Talk to colleagues ( incl. approaching user associations e.g. AONSA\*) \* [www.aonsa.org](http://www.aonsa.org)
- Literature review on similar experiments, facility webpages

## Where?

- Research available instruments worldwide - i.e. where should I go and get my neutrons?
- What instrument and at which facility is 'best' suited to address my science case?
  - Instrument specifications - resolution, flux
  - Instrument capabilities - polarisation, time-resolved
  - Sample environment equipment - T, P, *in-situ*, specialised cells
  - Technical and user support
  - Laboratories for sample preparation/characterisation tools
  - Software available

## Logistics?

- Geographical proximity/ease of access
- Cost - travel, funding arrangements, PhD programmes...
- Personal connections and/or collaborations
- Food and scenery

## Application?

- Access route and proposal type

An aerial photograph of a city, likely Chicago, showing a dense urban landscape. In the foreground, there is a large, multi-story building complex with a prominent circular structure. The image is overlaid with a dark blue filter. The text "Why Apply for Neutron Beamtime?" is centered in the image in a bright green, serif font.

**Why Apply for Neutron Beamtime?**

# 1st Step

Sample ... that I understand somewhat



Idea / Research Question

# 1<sup>st</sup> step

Sample ... that I understand somewhat



Idea / Research Question



Can neutron scattering help me?

## 2<sup>nd</sup> Step

Sample ... that I understand somewhat



Idea / Research Question



Can ~~neutron~~ scattering help me?



the unique information obtained  
from neutron experiments

## 3<sup>rd</sup> Step



Idea / Research Question



Can ~~neutron~~ scattering help me?



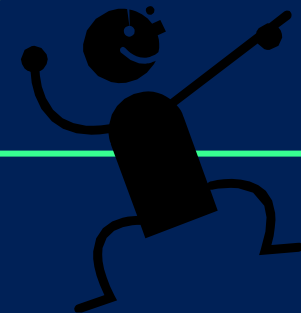
the unique information obtained  
from neutron experiments



Am I sure?

Could I obtain the information I need  
from a different technique?

Am I completely sure?



# Find out what neutrons can do for your science area

Search the websites, read the literature.

## Properties of neutrons

Neutrons are used as an analytical tool [across science and technology disciplines](#), where their unique properties help scientists to understand the world around us at the atomic- and molecular-level.



### Study structure

Neutron wavelengths are comparable to the spacings of atoms and molecules.



### Study dynamics

Neutron energies are comparable to the time scales of molecular diffusion, vibrations and rotations.



### Study magnetism

The neutron's magnetic moment can be used to study the microscopic magnetic properties of materials.



### Penetration power

Neutrons can penetrate deep into matter (including many different metals) enabling the study of large samples - even within complex sample environments.



### Non-destructive

Neutrons are suitable for the characterisation of delicate and precious samples - including biological materials.



### Versatile sample environments

Sophisticated sample environments enable studies under operating conditions, including extreme temperatures and pressures.



### Sensitivity to light elements

The neutron scattering power of nuclei varies in a quasi-random manner such that lighter atoms (e.g. H, Li) can be studied in the presence of heavier atoms.



### Isotopic contrast

Neutrons are sensitive to different isotopes of the same element, so isotopic substitution (e.g. H/D) can be used to highlight specific features.



### Complementarity

Neutron scattering is highly complementary to other techniques, such as X-ray scattering, electron microscopy, magnetic resonance and computational methods.

### Climate change and the environment

Human activity has widespread and sometimes disastrous effects on the environment, many of which are linked to climate change. The versatility of neutron techniques is allowing for better understanding of our climate and environment, as well as progress in developing cleaner technologies and processes, including emissions reduction, catalysis and carbon sequestration.

### Energy

Neutrons contribute significantly to the development of a sustainable energy economy by exploring novel materials and technologies. Examples include hydrogen storage systems, next-generation batteries and improved materials for nuclear, solar and wind power, along with energy materials containing light elements, such as hydrogen, lithium and oxygen, that are ideal for use with neutrons.

### Transport

Neutron techniques are particularly valuable for the development of safer, lighter and more resilient high-performance materials that are needed by the transport sector. Neutrons also contribute to reducing the carbon footprint of products, materials and processes.

### Health

The sensitivity of neutrons to the biologically crucial hydrogen atom, together with the powerful selective absorption contrast method, enables major advancements in a wide-ranging area of health, including cancer and neurodegenerative diseases.

### Information and communication technologies

The future of information technology in quantum devices will rely on the discovery of new materials and on understanding their behaviour, further advancing the development of next-generation IT solutions.

### Particle physics

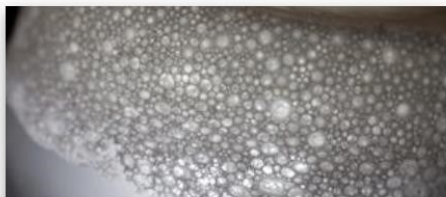
Neutron particle physics challenges the Standard Model of particle physics and contributes to a deeper understanding of the universe in which we live.

### Heritage science

The non-destructive nature of neutrons makes them valuable tools for historical artefacts and fossils, providing insights into the place of origin and date of manufacture of a sample, in addition to how it was produced and what it is made from.

# Find out what neutrons can do for your science area

Search the websites, read the literature.



## Advanced Materials Science Highlights

More new materials have been made in the last 20 years than in the rest of history. ISIS provides scientists with unique views of these materials.



## Bioscience Science Highlights

From the structure of small molecules to the shape of large molecular machines to develop drugs for controlling disease.



## Natural World Science Highlights

Research at ISIS Neutron and Muon Source is also being used to answer current questions about the Earth's natural environment.



## Industrial Science Highlights

Read the latest stories on how our industrial partners have benefitted from research at ISIS Neutron and Muon Source.



## Materials Engineering Science Highlights

Neutrons are used to probe the stresses and material properties deep inside engineering components and materials.



## Energy Science Highlights

Neutrons can be used to study hydrogen storage materials, battery materials, solar cell films, fuel cells and more.



## Heritage Science Highlights

Neutrons and muons are well suited for the non-destructive analysis of archaeological, historical & art objects and conservation materials.



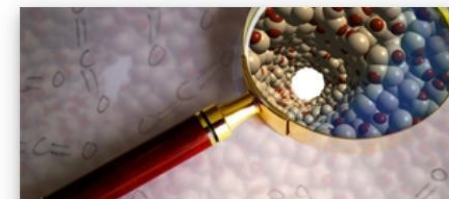
## Chemistry Science Highlights

Chemistry science at ISIS Neutron and Muon Source ranges from studies of catalyst action to atmospheric reactions.



## Physics Science Highlights

From ancient artifacts to future technologies; atomic scales to astrophysics, physics at ISIS covers a diverse range of science.



## Soft Matter Science Highlights

Soft matter encompasses a wide range of substances including polymers, surfactants, liquid crystals, micelles, and microemulsions.

# When considering applying for neutron beamtime

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- Access route and proposal type

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**Where to Go for Neutron Beamtime?**

# Where should I go and get my neutron beamtime<sup>1</sup>

<http://neutronsources.org>\*

- Europe (7)
- Africa (1)
- Americas (3)
- Asia-Oceania (8)

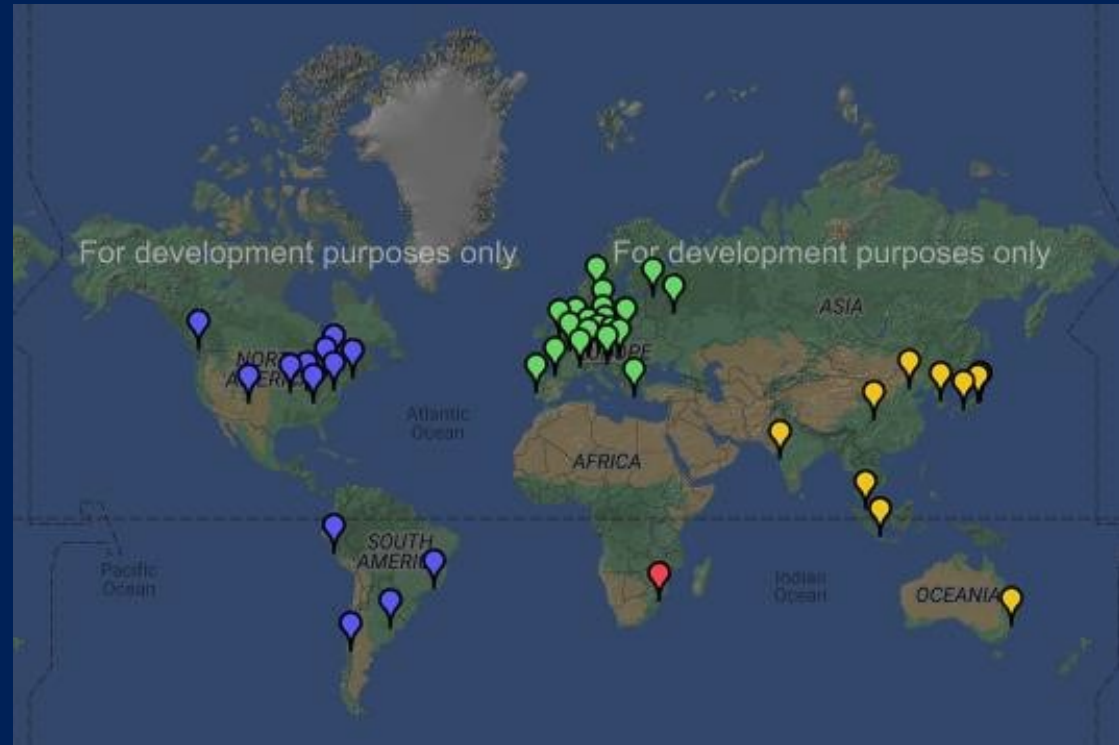
<sup>1</sup>those with user programmes (that I am aware of)

A bit of history....

.... early programmes were 'parasitic' at materials testing reactors, mainly used by local scientists (staff).

.... In the UK, the UK Neutron Beam Research Committee expanded access to the broader university research community in 1966.

... The Institut Laue Langevin (1971) was the first (high flux) research reactor purpose built for an external community!



\* Unfortunately has not been updated since 2012!

# Europe and Africa

- ISIS Pulsed Neutron and Muon Source (UK)
- Swiss Spallation Neutron Source - SINQ (Switzerland)
- European Spallation Source - ESS (Sweden - expected end '25)

Spallation sources

- Institut Laue Langevin - ILL (France)
- Heinz Maier-Leibnitz Zentrum - MLZ (Germany - expected Aug'24)
- Budapest Neutron Centre - BNC (Hungary)
- Nuclear Physics Institute - NPI (Czech Republic)
- Laboratoire Leon Brillouin - LLB (France)\*
- Helmholtz-Zentrum Berlin - HZB (Germany)\*

Research reactors

- South Africa Nuclear Energy Corporation - Safari-1 (South Africa)

\* Reactors closed in the last 5 years but institutes continue working as research institutes with many neutron scattering experts. Some instruments have moved or are in discussions about future move

# ISIS Pulsed Neutron and Muon Source (UK)



Science and  
Technology  
Facilities Council

ISIS Neutron and  
Muon Source

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## About

ISIS Neutron and Muon Source is based at the [STFC Rutherford Appleton Laboratory](#) in Oxfordshire and is a world-leading centre for research in the physical and life sciences. It is owned and operated by the Science and Technology Facilities Council, one of the councils that forms UK Research and Innovation (UKRI).

Our mission is for neutrons and muons to advance knowledge and improve lives.  
Our vision is that ISIS will lead the way in the innovative development and exploitation of neutron and muon sources, science, instrumentation and technology.

ISIS Neutron and Muon Source produces beams of neutrons and muons that allow scientists to study materials at the atomic level using a suite of instruments, often described as 'super-microscopes', each of which is individually optimised for the study of different types of matter. Neutron and muon experiments are non-destructive and provide results that cannot be achieved by other techniques. We support a national and international community of more than 2000 scientists who use neutrons and muons for research in physics, chemistry, materials science, geology, engineering, and biology. For some recent examples, see our [Science Highlights](#).  
To find out more about how ISIS generates neutrons and muons, visit our ["How does ISIS work?"](#) webpage.

We work with both academia and industry to deliver [scientific](#), [socio-economic](#) and [environmental impact](#), addressing global challenges and answering fundamental questions. The [ISIS Strategy 2030](#) outlines the priorities and activities needed to ensure the UK continues to have access to a world-leading centre of excellence in neutron and muon science to 2030 and beyond.

ISIS neutron and muon instruments are [free to use](#) for researchers provided the results from experiments are published in the public domain. Fully confidential use of the instruments is also available for [industrial](#) and [commercial customers](#).

A typical year at ISIS involves:



1200  
experiments

by



3000  
users

from



30  
countries

generating



600  
publications

<http://www.isis.stfc.ac.uk>

# Americas

- High Flux Isotope Reactor - HFIR (USA)
- NIST Centre for Neutron Research - NCNR (USA-expected fall'25?)
- Canadian Neutron Beam Centre - CNBC (Canada)\*
- Spallation Neutron Source - SNS (USA)
- Los Alamos Neutron Science Centre - LANSCE (USA - reduced user programme)

Research reactors

Spallation sources

\* Reactors closed in the last 5 years but continue working as research institutes with many neutron scattering experts. Some instruments have moved or are in discussions about future move

# Asia - Oceania

- J-PARC Materials and Life Science Facility - MLF (Japan)
- China Spallation Neutron Source - CSNS (China)

Spallation sources

- Japan Research Reactor 3 - JRR3 (Japan)
- China Advanced Research Reactor - CARR (China)
- China Mianyang Research Reactor - CMRR (China)
- High flux Advanced Neutron Application Reactor - HANARO (South Korea)
- Bombay Atomic Research Centre - BARC (India)
- Australia Nuclear Science and Technology Organisation - ANSTO (Australia)

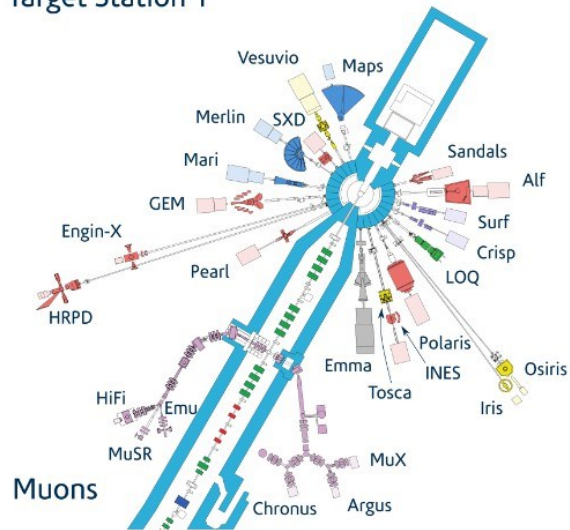
Research reactors

# Which instrument is best for me?

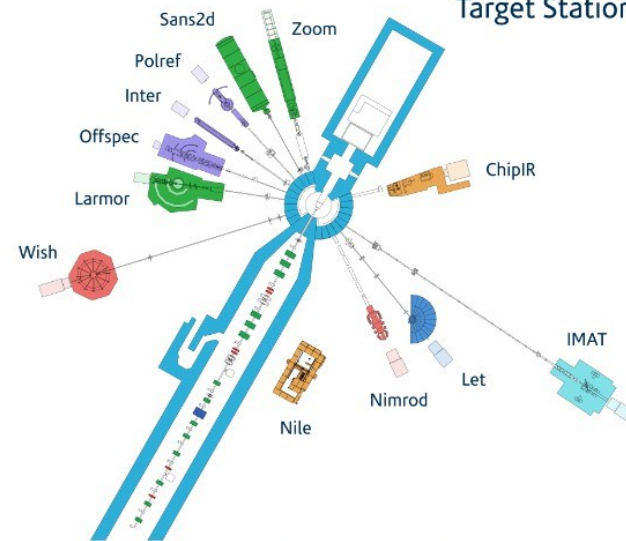
## ISIS Instruments

ISIS Neutron and Muon Source currently has over 30 neutron and muon instruments and more are planned through the Endeavour programme.

### Target Station 1



### Target Station 2



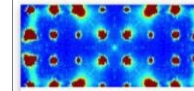
**Chip irradiation**  
ISIS offers a facility for rapid testing of high energy neutron effects. ChipIR looks at how silicon microchips respond to cosmic neutron radiation.



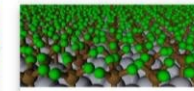
**Imaging**  
ISIS instrument IMAT provides a unique combination of neutron imaging and neutron diffraction techniques.



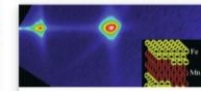
**Muon spectroscopy**  
Muon Spectroscopy provides a probe of materials at an atomic level.



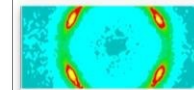
**Neutron diffraction**  
Neutron diffraction experiments determine the atomic and/or magnetic structure of a material. This technique can be applied to study crystalline solids, glasses, liquids or amorphous materials.



**Neutron spectroscopy**  
Neutron spectroscopy measures the atomic and magnetic motions of atoms.



**Reflectometry**  
Neutron reflectometry is a technique for measuring the structure of thin films.



**Small angle scattering**  
Small angle neutron scattering is a neutron technique able to probe structures at length scales from around 1 nanometre to more than 100 nanometres.



**Which technique to use?**  
Read an overview on the different types of instruments at the facility and the merits of each technique.

ISIS is now seeking its next phase of new instruments and significant instrument developments: a portfolio of projects that has been called the Endeavour programme. Endeavour will see the ISIS instrument suite developed to meet current and future challenges in areas such as Materials for the Future; Smart, Flexible and Clean Energy Technologies; Advanced Manufacturing; and Biosciences and Healthcare. More information can be found on the [Endeavour webpage](#).

► Browse Instruments By Technique

► Contacts and Support



**Experimental Support and Sample Environment**  
Support with equipment, general procedures and supplementary techniques related to the preparation of samples for experiments.



**Instrument Scientists**  
This page lists the contact details for all instrument scientists and instrument cabins.

# Which instrument is best for me?

**NIST**

Search NIST

Menu

## High Flux Backscattering Spectrometer



Maximizing access for the scientific community to transformative neutron scattering instrumentation

The NCNR backscattering spectrometer is one of the highest intensity instruments of its kind. It enables very high energy resolution studies of the low frequency dynamics of many systems. The High Flux Backscattering Spectrometer is well-suited for investigations in soft condensed matter, chemical physics, polymer dynamics, and biology. A backscattering spectrometer is an inverse-geometry instrument in which only those neutrons with a particular final energy (2.08 meV in this case) are detected in the counting process. The motions in the sample are probed by varying the energy of the incident neutrons (by Doppler motion of the monochromator) and measuring the gain or loss in energy that they undergo in their interaction with the sample. The backscattering spectrometer at the NCNR is located on neutron guide NG2. The photograph below shows the instrument as seen from the north-east corner of the Guide Hall.



 **NCNR AFFILIATIONS**

NIST Center for Neutron Research  
Center for High Resolution Neutron Scattering

 **INSTRUMENT SCIENTISTS**

Madhusudan Tyagi  
[madhusudan.tyagi@nist.gov](mailto:madhusudan.tyagi@nist.gov)  
(301) 975-2046

Richard Azuah  
[richard.azuah@nist.gov](mailto:richard.azuah@nist.gov)  
(301) 975-5604

 **Current Instrument Schedule**

 **NCNR Reactor Schedule**

**INSTRUMENT DETAILS**

Instrument Design and Concept

Instrument Performance

**EXPERIMENT PLANNING**

How to obtain beamtime

Accessing the NCNR

Sample Environment

**RESEARCH PROGRAM**

CHRS HFBS Publications

**DATA ANALYSIS**

Data Reduction and Analysis Software (DAVE)

- Contact the instrument scientist
- Ask about instrument specifications
- Ask about sample characteristics
- Ask about ancilliary capabilities
- Ask about counting times
- Ask, ask, ask ...

Instrument scientist/responsible are the experts and are there to help you, to answer all relevant questions!

# Common access types

- General user proposals - peer reviewed - twice per year (dates depends on facility).
  - Rapid access (open access, mail-in, director's discretionary time) - for urgent requests or 'hot topics' - can be submitted at any time.
  - Xpress access (mail-in, discretionary) - use depends on facility - can be submitted any time.
    - Test measurements (new sample, unclear result)
    - Last measurement for publication
    - Last measurement for PhD completion
    - Standard instrument setting and sample environment
    - Starting collaboration with new user to technique and/or neutrons
  - Industrial access (collaborative or paid)
  - Joint access with other facilities - ask (e.g. ISIS neutrons with Diamond Light Source, UK)
  - Programme access (collaborative access) - long term proposals.
- 
- 1-10 days typical depending on the technique
- 1-3 days typical depending on the technique
- < 1 day typical depending on the technique
- 1-10 days typical depending on the technique
- Up to 3 years

# Example – Proposal type for HFIR and SNS, USA

| Access Mode                                                                                                                                | Proposal Type                                                                         | Who can apply                                                         | Duration      | Available Instruments                                                                                                                                                                        | Who Approves the Review?                             | Further information                                                                                                                                                                                                                                                                                                     | Template                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Proposal call                                                                                                                              | General user                                                                          | All                                                                   | Single cycle  | All                                                                                                                                                                                          | External Peer Review and Internal Science Management | For individuals and groups who require the HFIR and/or SNS instruments to carry out their research in a single cycle. Peer reviewed and recommended for beam time by an external peer review. Internal science management designates final beam time allocations.                                                       | <a href="https://neutrons.ornl.gov/sites/default/files/Statement%20of%20Research%20Template%20CD.docx">https://neutrons.ornl.gov/sites/default/files/Statement%20of%20Research%20Template%20CD.docx</a>                                                       |
|                                                                                                                                            | Collaborative development                                                             | All                                                                   | Up to 3 years | All                                                                                                                                                                                          | External Peer Review and Internal Science Management | Reserved for projects that will bring new resources or capabilities that are of benefit to HFIR and SNS user communities, such as a new technique or sample environment. Work done over several cycles. Requires a progress report between each cycle. Work must include at least one SNS or HFIR Instrument scientist. | <a href="https://neutrons.ornl.gov/sites/default/files/Statement%20of%20Research%20Template%20CD.docx">https://neutrons.ornl.gov/sites/default/files/Statement%20of%20Research%20Template%20CD.docx</a>                                                       |
| Rapid<br>(for potential high-impact science outside of the periodic proposal calls. Reviewed and allocated by internal science management) | Mail-in                                                                               | All                                                                   | One day       | BL-1B NOMAD; BL-3 SNAP; BL-6 EQ-SANS; BL-7 VULCAN; BL-11A POWGEN; BL-14B HYSPEC; BL-16B VISION; BL-17 SEQUOIA; BL-18 ARCS; CG-2 GP-SANS; HB-2C WAND*<br>*Not currently accepting submissions | Internal Science Management                          | Users send samples by mail for instrument staff to collect data on the user's behalf. It is anticipated Mail-In experiments will lead to a publication.                                                                                                                                                                 | <a href="https://neutrons.ornl.gov/sites/default/files/Mail-In%20Statement%20of%20Research%20Template%5B1%5D.doc">https://neutrons.ornl.gov/sites/default/files/Mail-In%20Statement%20of%20Research%20Template%5B1%5D.doc</a>                                 |
|                                                                                                                                            | Proof-of-principle                                                                    | All                                                                   | One day       | All                                                                                                                                                                                          | Internal Science Management                          | For testing feasibility of a potential experiment prior to submitting a full proposal. The experiment cannot require a complex sample environment.                                                                                                                                                                      | <a href="https://neutrons.ornl.gov/sites/default/files/Proof-of-Principle%20-%20Statement%20of%20Research%20Template%5B1%5D.docx">https://neutrons.ornl.gov/sites/default/files/Proof-of-Principle%20-%20Statement%20of%20Research%20Template%5B1%5D.docx</a> |
|                                                                                                                                            | Discretionary time                                                                    | Neutron Sciences Staff**<br>** external collaborators may participate | Single cycle  | All                                                                                                                                                                                          | Internal Science Management                          | Reserved for research with the potential to further national scientific agenda, industrial partnerships, collaborations, and development of the instrument, sample environment, or technique. External scientists must submit in partnership with an ORNL Neutron Sciences staff member.                                |                                                                                                                                                                                                                                                               |
| Industrial                                                                                                                                 | <a href="http://swc.ornl.gov/industry/access">http://swc.ornl.gov/industry/access</a> |                                                                       |               |                                                                                                                                                                                              |                                                      |                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                               |

# Logistics?

- ❖ Geographical proximity/ease of access
- ❖ Cost - travel, funding arrangements, PhD programs...
- ❖ Personal connections and/or collaborations
- ❖ Food and scenery

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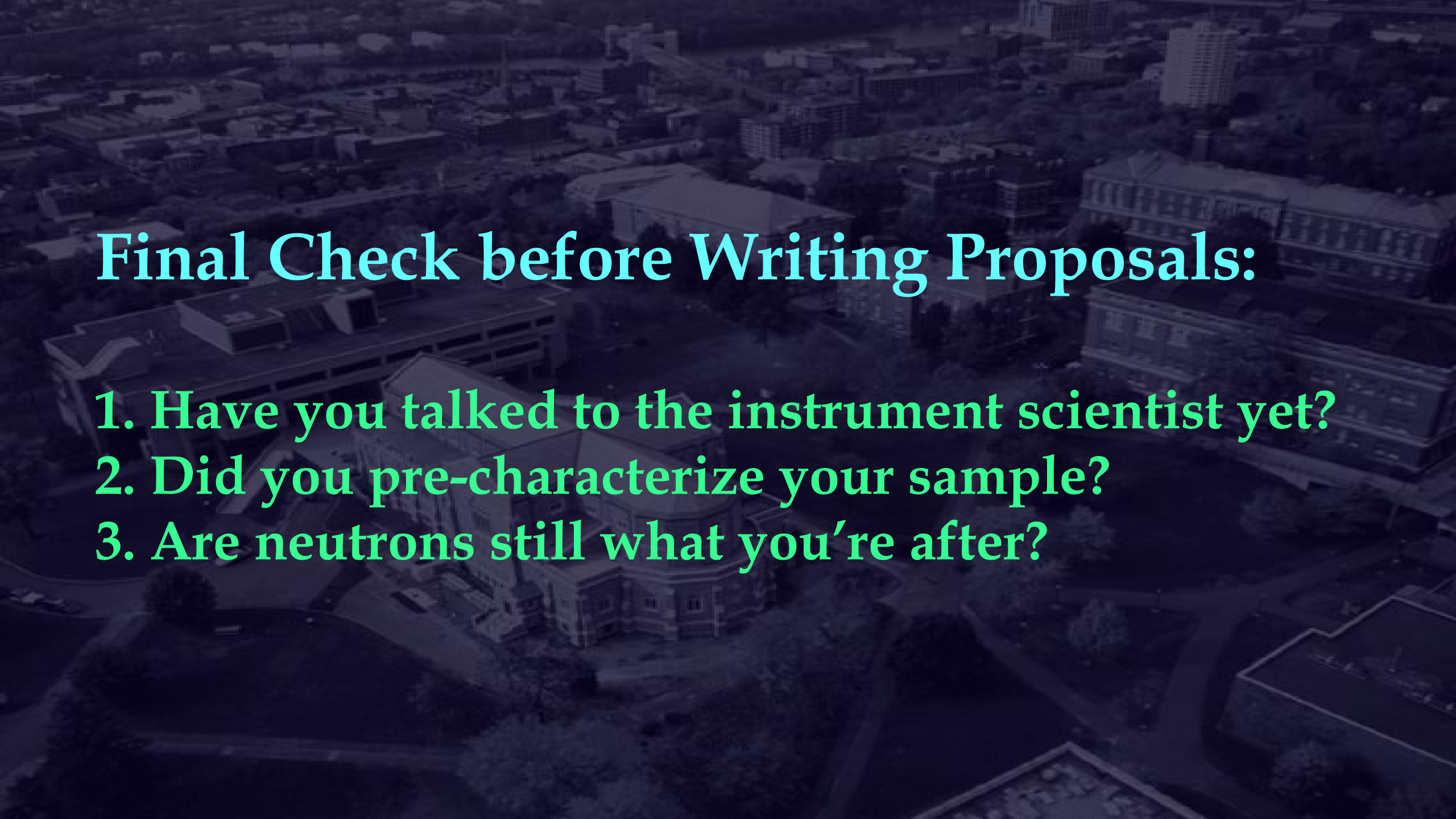
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## Application?

- Access route and proposal type

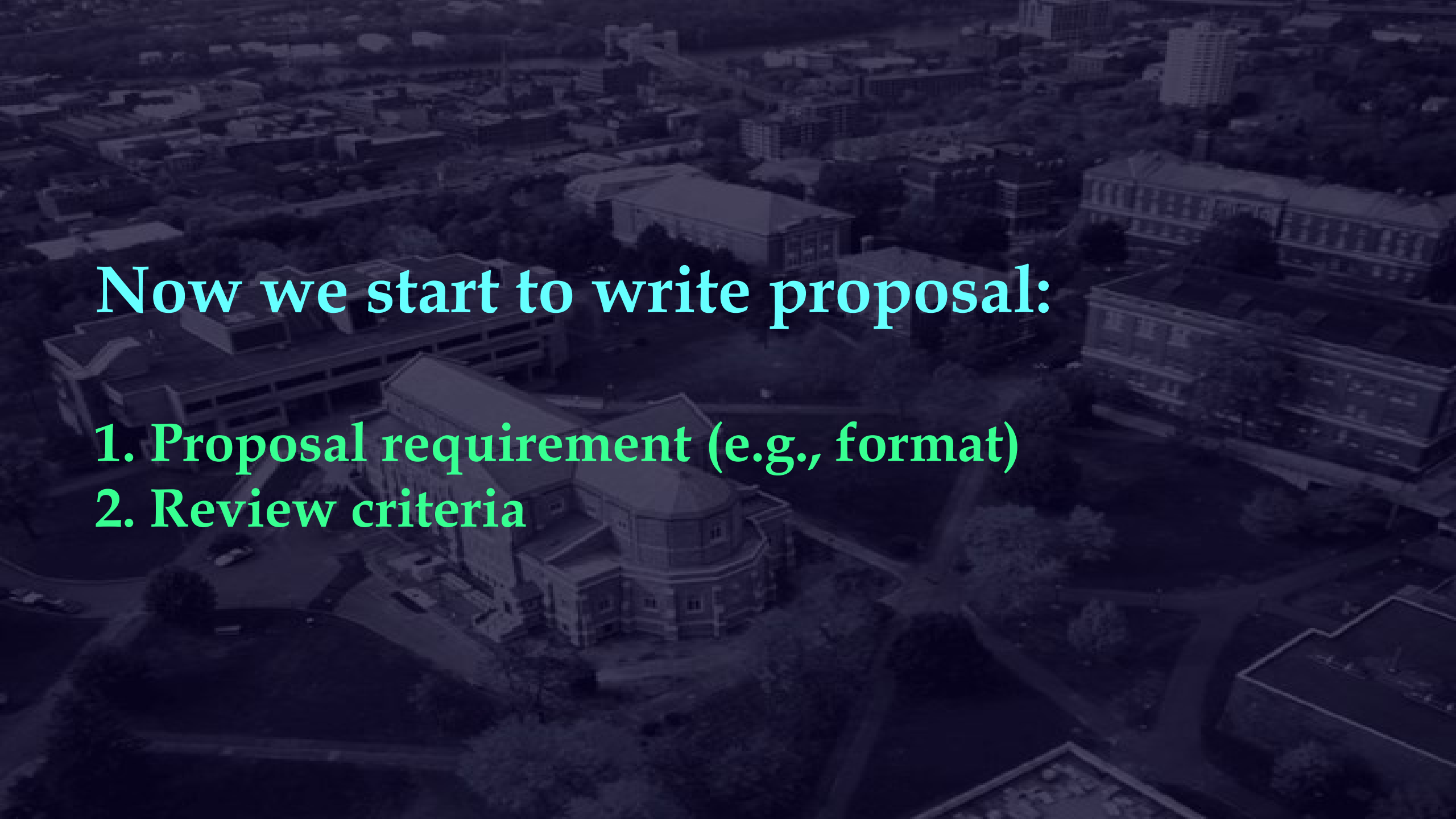
An aerial photograph of a city, likely Chicago, showing a dense urban landscape. In the foreground, a large, multi-story building complex with a prominent circular structure is visible. The image is overlaid with a dark blue tint. The text "Application: How to Obtain Neutron Beamtime?" is centered in a light red, serif font.

# Application: How to Obtain Neutron Beamtime?

An aerial photograph of a city, likely New York City, with a blue overlay. The image shows a dense urban landscape with various buildings, including a prominent white building with a dome in the lower center. The text is overlaid on this image.

# Final Check before Writing Proposals:

1. Have you talked to the instrument scientist yet?
2. Did you pre-characterize your sample?
3. Are neutrons still what you're after?

An aerial photograph of a city, likely New York City, showing a dense urban landscape with various buildings and green spaces. A large, prominent building with a circular dome is visible in the lower center of the frame. The image is overlaid with a semi-transparent dark blue filter.

**Now we start to write proposal:**

- 1. Proposal requirement (e.g., format)**
- 2. Review criteria**

# Normal peer-reviewed proposals (typically)

---

- Two proposal calls per year - submission via the online system. Each facility is different!
- Deadline is real!
- Technical reviews (by facility scientists) - feasibility, safety, check for time requested
- Peer review by a panel of scientific experts (or by internal management)
  - Classification is done by subject or technique
  - At least 2 reviewers per proposal
  - ??Depends: Panel meetings at facilities (or by video conference)
- Time recommended or not
  - All requested time allocated
  - Partial time allocated or allocation in a different (but similar) instrument at the facility
  - Time not allocated
  - Rejected
- Final facility balance can be applied (eg. national funding, strategic decisions)

# Proposal ingredients (part 1) – typically filled online

---

- User/participant information
- Title and abstract
- Sample description and availability
- Safety aspects of sample and/or measurement
- Sample environment equipment requirements
- Instrument specifications requested
- Time requested (be realistic)
- Publication record, number of student thesis, scientific area, grant information, similar submission to other facility/instrument, re-submission.

# 2-page case including references and figures/tables

## Statement of Research (for SNS & HFIR)

Remove all instructional text (leaving the headings) before generating your .pdf file. A two-page limit (including graphics) will be enforced. Safety Considerations and References may spill over to the third page. Use font no smaller than 11 point. Address each of the following sections. You are strongly encouraged to reference Proposal Writing Tips at <http://neutrons.ornl.gov/users/tips>.

## Scientific Importance

What scientific question(s) are you trying to answer? Provide a brief statement on the scientific background and general importance of the research, including references to literature where appropriate. Explain why the experiment requires the use of neutrons versus other techniques.

## Preliminary Work

Provide results of preliminary work carried out using neutrons or other techniques and the relationship with your proposed experiment. Include preliminary tasks, measurements, synthesis, structural characterizations, or calculations that have or will be done at your home institution or elsewhere in preparation for the proposed research at SNS or HFIR.

## Choice of Instrument

Explain why you need this particular instrument. If beam time cannot be awarded on the requested instrument, state any alternate instruments on which some or all of the experiment could be carried out. Consultation with instrument scientist is strongly encouraged.

## Experiment Plan

State clearly and exactly the research tasks to be carried out. Provide an estimate of the number and quality of the samples, and the expected measurement time needed for each.

## Data Analysis and Scientific Outcomes

Include 1-3 sentences describing the methods you will use to analyze and interpret the data. Discuss how the results from this proposal will impact your research and how they will advance the field (e.g., model validation, answers to long-standing questions, etc.).

# Reviewers are looking for

---

- Why this project?
- Why you (your team)?

# Things to remember as you get ready to write

Scientific reviewers are not always experts in your specialty since science at the facilities is so diverse.

Don't assume they know everything, so tell them what you want them to know.

Reviewers will have a bunch of proposals to read, so assume that they will spend 10-15 minutes per proposal. They will probably not read through the references.

Tell them what you want them to know.



So, you must get ALL relevant information in the proposal. Make your point, make it clearly and succinctly.



# Proposal ingredients (Part 2)

- Two-page description of proposed research (including references)
  - Brief background, state the problem clearly and **why it is important**, why will it make a difference - **why should one care?**
  - Clear justification of **need for neutrons** and particular technique - **why do you need beamtime?**
  - Describe what **data you have/preliminary characterisation** or work on the sample/system other than neutrons - **do you understand your sample?**
  - Describe the **aims of the experiment**- what and how are you going to measure, and is the time requested justified?
  - Describe your plans with **data analysis/modelling or theoretical description** - what will you do with the data? Sometimes you can write what you expect the results will be?
  - Evidence the team's productivity and experience - **will you publish** your work in a timely manner?
  - **Be clear and specific** - not vague and general.
  - **Don't waste words/space**, write what is necessary to justify your case for beamtime.
  - Only add figures/graphs if necessary/added value.
  - **Think of yourself as a reviewer.** What would you like to read in a proposal?

# 2-page case including references and figures/tables

## Background

### Changes in lipid dynamics induced by melittin absorption on membrane surfaces

The rise of infectious bacterial strains resistant to current antibiotic treatments is a growing concern universally. This has spurred an intensified interest both in the discovery and understanding of naturally occurring anti-microbial agents and the molecular mechanism by which they function. Most anti-microbial compounds associate with the cellular membrane and disrupt the delicate electro-chemical balance required for bacterial cellular life. One such naturally occurring molecule is melittin (MLT), found in the venom of honeybees. MLT poses many characteristics shared among known anti-microbial peptides. It is a single domain  $\alpha$ -helix with a strong amphipathic quality (Fig. 1a). Structural studies from X-ray diffraction experiments [1] show partitioning into the lipid membrane of cells - intercalating with the headgroup region (Fig. 1b). Significant perturbations to the lipid chains are also observed: a thinning of the hydrocarbon region as well as a broadening of the terminal methyl distribution suggest an increase in chain disorder due to MLT's presence. At higher concentrations, MLT fully penetrates the membrane as self-assembled helical bundles that form large pores in the membrane, leading to cell death.

Detailed structural data from diffraction experiments has helped elucidate the function of MLT. However the mechanism for biological activity stems from the dynamics. We propose to use quasielastic neutron scattering (QENS) to characterize the changes in mobility of a model dioleoylphosphatidylcholine (DOPC) phospholipid membrane, in the presence of MLT. The protein:lipid system will be divided into three major components, the phospholipid headgroups, the lipid hydrocarbon tails and the MLT itself. Selective deuteration will allow us to follow the mobility of each of the three components separately. Regions of lipid that interact with MLT the most will be identified by comparison of dynamical changes with the pure DOPC bilayer measurements. Furthermore a study combining molecular dynamic (MD) simulations with neutron results on a similar system [2] suggests that regulating the mobility of phospholipid headgroups controls melting transitions. Measuring the effect on the membrane  $T_m$  provides another method for probing the balance between headgroup and chain interactions with MLT.

Previous QENS measurements of ordered lipid systems have used a combination of several dynamic models to describe motions in the ps to ns range of accessible time scales [1,3-4]. Given the sub ns dynamic range of the IRIS backscattering instrument our experiments will primarily be sensitive to methyl rotations, dihedral isomerization and localized diffusion (Fig. 2a). Despite the use of selective deuteration, the dynamical processes are still complex and may prove difficult to dissect into their individual contributions. Therefore, we will use an experimentally validated MD simulation [5] to provide a powerful method for aiding in the interpretation of QENS data, since there is total overlap in time and length scales accessed by both methods. Preliminary analysis of a DOPC/MLT simulation already provides some insights into potential perturbation in lipid dynamics caused by the peptide. Fig. 2b shows a snapshot of the simulation in which lipids within the vicinity of the protein are either highly kinked or extended. Furthermore the less mobile headgroups adjust their packing behavior around MLT. The results already suggest a possible framework for interpreting QENS data for this system.

We propose to perform experiments on the following samples:

- (1) Fully hydrogenated DOPC [hh-DOPC]
- (2) Fully hydrogenated DOPC with melittin [hh-DOPC+h-melittin]
- (3) Hydrogenated head-group DOPC [hd-DOPC]
- (4) Hydrogenated head-group DOPC with melittin [hd-DOPC+h-melittin]

The experiments proposed are presented in turn below:

(a) Elastic window scans (10-350K): elastic scans will give us a number of preliminary results. A comparison of the scans of the non-labeled lipid with and without MLT (samples 1,2), will show changes in  $T_m$  and in the dynamic regimes within the timescale of the IRIS spectrometer. Comparing head labeled with fully hydrogenated (signal dominated by tail protons) DOPC will indicate if the gel-to-fluid transition is characteristic to a specific part of the lipid (samples 1,3). Addition of the MLT to the labeled DOPC will show any differences in mobility in the presence of MLT that are specific to the individual components of the lipid (samples 2,4). Finally, mean-square displacement data for all samples will reveal changes in the mobility of all three components in the system (all samples). Elastic scans will require 3 days.

(b) Dynamic runs: we propose to measure the dynamics of each of samples 3-6 at two temperatures, below and above  $T_m$ . The measurements will allow analysis of the mobility of the DOPC head and tail groups quantitatively (samples 1,3), allowing for precise assessment of their response to the addition of MLT (samples 2,4). These experiments require 4 days (assuming 12hr per temperature run based on sample quantities).

The samples will consist of multilayers of DOPC and DOPC/MLT mixtures containing 1.5 mol % MLT per mol DOPC, plated onto a series of silicon wafers. Around 15 wafers are stacked in an aluminium slab-shaped cell with the face area of the same dimensions as the neutron beam. Such a cell has already been used for experiments on the backscattering spectrometer at the NIST Center for Neutron Research. The cell is contained in a humidity chamber and the samples are kept at 66 % r.h. with a  $\text{NaNO}_2$  solution in  $\text{D}_2\text{O}$ . Use of  $\text{D}_2\text{O}$  allows minimization of incoherent scattering from the buffer and also from the exchangeable protons in the MLT. The concentration of MLT and the humidity is chosen to match the MD simulations and diffraction experiments.

We propose to use the IRIS spectrometer with the PG002 configuration at a resolution of 8.8  $\mu\text{eV}$  (HWHM) and an energy range of 1.0 meV, giving us access to timescales between ca. 0.5-100 ps. The Q-range accessible is 0.3-1.8 inv. Ang. These distances and times are directly comparable to the MD simulations. For the completion of the proposed work we are requesting a total of 7 days.

We note that this is a resubmission of R8 0720585 which was awarded 7days. Since then we have been trying to synthesize MLT and encountered some difficulties, thus we have not used our beamtime and we thought it would be better to resubmit. We now have a successful route for expressing MLT and will be ready to perform the experiment.

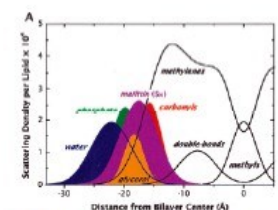
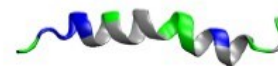


Figure 1: (a) The amphipathic MLT monomer is shown with polar residues in green, basic residues in blue and non-polar residues in grey. (b) X-ray scattering length density profiles show MLT partitioning into the lipid headgroup region of a dioleoylphosphatidylcholine (DOPC) bilayer [1].

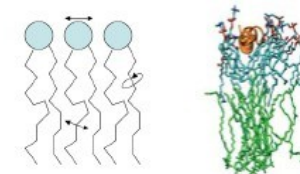


Figure 2: (a) A schematic of accessible motions on the sub ns time scale. Straight arrows represent localized mobility and circular arrows represent dihedral isomerization or terminal methyl rotation. (b) Snapshot of a DOPC/MLT MD simulation. Perturbation to lipid tail conformation and packing defects in lipid headgroups are evident.

### References:

- [1] K. Hristova et al, *Biophysical J.* **80** 801 (2001).
- [2] M. Doxastakis et al, *Biophysical J.* **92** 147 (2007).
- [3] S. König et al, *J. Phys II France* **2** 1589 (1992).
- [4] S. König et al, *Biophysical J.* **68** 1871 (1995).
- [5] R. W. Benz et al, *Biophysical J.* **91** 3617 (2006).

## References

## Samples

## Instrument configuration

## Other info

## Relevant/useful figures/data

## Previous measurements

## Experiment

# Summary – Do's and Don't's

- ✓ Use all necessary space
- ✓ Justify the need for neutrons with specific arguments
- ✓ Add readable figures if graphs if they bring added value
- ✓ Add references
- ✓ Follow guidelines for a given facility
- ✓ Read, revise, re-read before submission
- ✓ Be honest about submissions

- ✗ Use miniature font
- ✗ Include stuff if it does not add to the proposal
- ✗ Use generic arguments
- ✗ Expect the reader to go through the references
- ✗ Make silly mistakes
- ✗ Play any tricks (meet the deadline\_

## Submit online

### Using the "New" Proposal System

Instructions and guidance on using the New Proposal System - ISIS Rapid, Direct and Dutch Access routes only

If you wish to carry out an experiment at our facility, you need to submit a proposal. This is done using the proposal system.

**The new proposal system is available for Rapid, Direct and Dutch Access submissions only.** All other access route proposals still need to be submitted via the "old" system.



Guidance on using the "New" proposal system:

 [New Proposal System User Documentation](#)

Please note: this guidance will be updated, so we recommend you always come here to find it rather than downloading a copy.

Submitting proposals

The new proposal system web portal can be access via the user dashboard: <https://users.facilities.rl.ac.uk/>

If you are struggling with submitting a proposal, please be aware that there are three possible routes for help:

- **Scientific:** e.g. *What is the capability of equipment x at the facility?*  
Please look on the appropriate website ([www.isis.stfc.ac.uk](http://www.isis.stfc.ac.uk)), contact any STFC staff contacts you already have, or if you cannot find an answer, contact the user office to be put in touch with someone who can help
- **Practical:** e.g. *Which call should I submit to? What information is required for question x? How do I arrange a visit from place y?*  
Please contact the ISIS User Office
- **Software:** e.g. *Why do I see an error message? Why can't I follow these instructions?*  
Please contact our support team via email: [FacilitiesBusinessSystem@stfc.ac.uk](mailto:FacilitiesBusinessSystem@stfc.ac.uk)

If in doubt, please contact the ISIS User Office, who will be able to redirect your query if required.

Email: [isisuo@stfc.ac.uk](mailto:isisuo@stfc.ac.uk)  
Tel: +44(0)1235 445592 (ext. 5592 )

#### Related Sections

- ▶ User Information
- ▶ Beamtime access routes
- ▶ User Programme Software
- ▶ Calls for access to ISIS Neutron and Muon Source

#### Related Content

- ▶ User Information
- ▶ 1. Apply for beamtime

# External Proposal Review Process

- Panel review organised by technique or by science area or a mixture
- Typically two per year
- Mainly in person, but also online or hybrid



## @ the Institute Laue Langevin, France

|            |                                                           |
|------------|-----------------------------------------------------------|
| College 1  | Applied materials science, instrumentation and techniques |
| College 2  | Theory                                                    |
| College 3  | Nuclear and particle physics                              |
| College 4  | Magnetic excitations                                      |
| College 5a | Crystallography                                           |
| College 5b | Magnetic structures                                       |
| College 5c | Nanoscale magnetism and superconductivity                 |
| College 6  | Structure and dynamics of disordered systems              |
| College 7  | Spectroscopy in solid state physics and chemistry         |
| College 8  | Structure and dynamics of biological systems              |
| College 9  | Structure and dynamics of soft-condensed matter           |

## @ the ISIS Pulsed Neutron and Muon Source, UK

|        |                                          |
|--------|------------------------------------------|
| FAP 1  | Crystallography                          |
| FAP 2  | Disordered materials                     |
| FAP 3  | <i>Discontinued (split into 8 and 9)</i> |
| FAP 4  | Magnetic excitations                     |
| FAP 5  | Molecular spectroscopy                   |
| FAP 6  | Muons                                    |
| FAP 7  | Engineering                              |
| FAP 8  | Small angle scattering                   |
| FAP 9  | Reflectometry                            |
| FAP 10 | Chip irradiation                         |
| FAP 11 | Cultural heritage                        |

# External Proposal Review Process

- Proposal is give a numerical rating or grade
- Cut-off decided by the panel to match complete allocation of available days

## @ the NIST Center for Neutron Research, USA

|   |    |           |                                                                                                                                                               |
|---|----|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | E  | Excellent | Experiment must be carried out. Highest priority for beamtime.                                                                                                |
| 2 | VG | Very good | Experiment is highly deserving of beamtime. No reason to deny beamtime except under conditions of unusually high demand.                                      |
| 3 | G  | Good      | May receive beamtime under normal circumstances, but may not, depending on demand.                                                                            |
| 4 | F  | Fair      | While scientific merit does not appear to be exceptionally high, the experiment may receive beamtime if its is available, but will probably not receive time. |
| 5 | P  | Poor      | Scientific merit not convincingly documented. Beamtime should not be allocated to the proposal.                                                               |

## @ the ISIS Pulsed Neutron and Muon Source, UK

|    |                                                                                                                    |                          |
|----|--------------------------------------------------------------------------------------------------------------------|--------------------------|
| 10 | Beamtime allocation is essential.                                                                                  | Outstanding, world class |
| 9  |                                                                                                                    |                          |
| 8  | Beamtime allocation is recommended.                                                                                | Excellent                |
| 7  |                                                                                                                    |                          |
| 6  | Beamtime allocation is possible.                                                                                   | Good                     |
| 5  |                                                                                                                    |                          |
| 4  | Beamtime allocation should not be made.                                                                            | Fair                     |
| 3  |                                                                                                                    |                          |
| 2  |                                                                                                                    | Uncompetitive            |
| 1  |                                                                                                                    | Unsatisfactory           |
| R  | Panel would like to see a resubmission with panel comments addressed. Rapid or Xpress routes could be recommended. | Resubmit                 |
| X  | Panel do not want to see a resubmission.                                                                           | Reject                   |

# Examples of reviewers comments

This is a very well described proposal, system is well pre-characterised. The use of neutrons is justified to look at the Q-dependence and discern the origins of the changes induced by confinement in a strongly H-bonded system. There is clear justification about the need to perform a concentration dependence study and compare with their previous studies on QENS on the bulk samples.



The scientific context of the proposal is nicely set out and the main aim of the experiment as well. I recognise the difficulty of perdeuterating the protein as well as the substrate, but it is unclear why the choice of 6 samples. For example, why do the authors need to measure samples (3) and (6) - it is not clear to me what additional information they will learn. In particular I think that it will be hard to separate out the dynamics of the two individual components in sample (6), given that there will be two collective responses. For samples (4) and (5) it would have been helpful to have added what the relevant incoherent scattering contributions are. In addition, the authors point out that samples (2-4) and (6) will be measured only at one temperature of 300K and samples (1) to (5) at many. This needs be explained.



This proposal makes very little experimental sense. 1) they propose to do elastic scans on a chopper machine. This is the wrong instrument in my opinion. 2) A clear plagiarism and non-referencing from Mr Y's original work refers to the wrong spectrometer for performing the measurement! They do not even know how the instrument works, never mind being capable of analyzing the data after even if they get help from the local scientists. I have no confidence in this group being able to successfully use this time if allocated.



The importance of understanding the effect of nanoparticles in polymer nanocomposites is clear for a number of applications. This proposal aims to differentiate between the roles of chemi- and physi-sorption in the dynamics of the polymer. Polymer A is the chosen polymer whose dynamics in the melt clearly falls within the NSE window based on their earlier measurements. The authors mention two ways of differentiating this: with temperature and by replacing the -OH terminal groups by -CH<sub>3</sub>s. It seems to me that the latter would provide a much more cleaner difference, and hence there is no need to do the different temperatures. This would also reduce their beamtime to around 10 days rather than 15. All in all I believe this proposal is well thought out and presented, very systematic and the data will be analyzed in terms of well-established models.



I'm afraid that I found this proposal very hard to review: it was difficult to read and understand it, the scientific case was not properly justified, I couldn't understand why this was not a 'continuation' proposal since the authors have already measured two crystallinities before - assuming that this is what they are asking to do in this current proposal, the reason for multi Ei was not justified. From a more scientific point of view, the previous data has not really been explained except to say that at higher crystallinity there is stronger phonon intensity. I can see how there seems to be a change in the Boson to QENS at around 230K but I don't understand that "this suggests that the transition of side chains might be below 230K." Finally I would suggest that if you want to look at the QENS of the side chains below 230K you try a higher resolution machine so you can move away from the Boson peak intensity - try DNA at J-PARC. All in all I think that although the experiment is do-able it is not clear what the authors want to learn and how they will elucidate this.



# Success



- Quality of the proposal and scientific merit
- Days available and oversubscription
- Panel's decision (or steer from facility) about high risk-high reward proposals versus more routine and less cutting edge but high probability of publication
- Mood of reviewers
- Country balances

... and remember...

An unallocated proposal does not mean it is bad or not worth doing!  
Get feedback, talk to the instrument scientists, try again or at a different facility.  
Good science deserves neutrons, we just don't have enough of them!

An aerial photograph of a university campus, heavily tinted with a dark blue color. In the foreground, a large, multi-story building with a prominent central dome and classical architectural features is visible. To its left is a long, modern-looking building with a flat roof and several skylights. The campus is surrounded by dense greenery and trees. In the background, a city skyline with various buildings and a tall skyscraper is visible under a hazy sky. The text "Any Questions?" is centered over the image in a bright green, serif font.

Any Questions?