OAK RIDGE
National Laboratory

How to write a neutron scattering user proposal

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U.S. DEPARTMENT OF ENERGY

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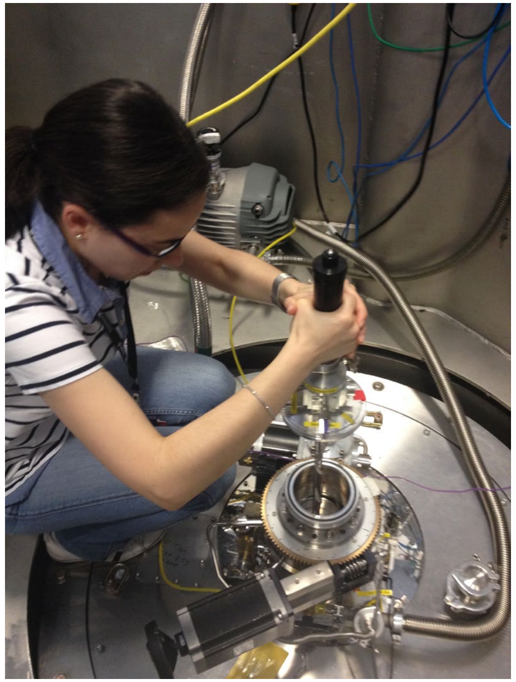
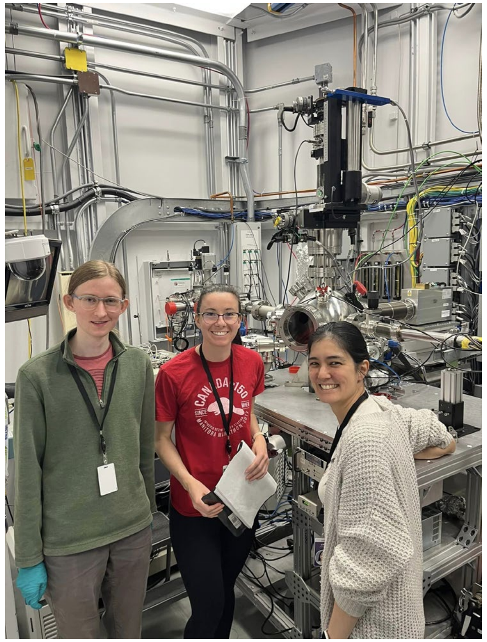
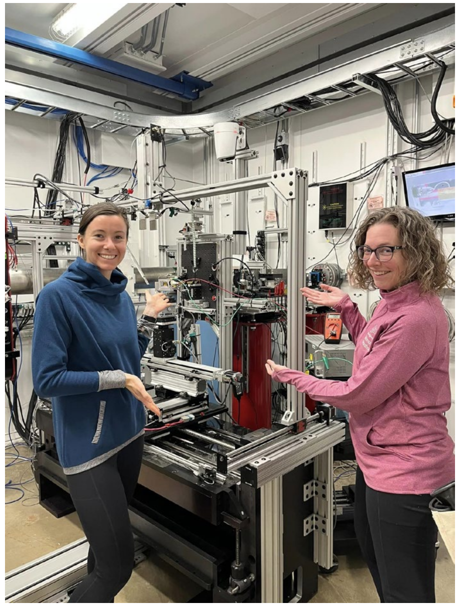
A little bit about me

- PhD in Chemistry from Ohio State University
- Professor of chemistry for 12 years
  - University of Calgary
- Research area: solid state chemistry
  - Ferroelectrics
  - Piezoelectrics
  - Structural characterization techniques
- Current position: User Outreach Lead for Neutron Science







Two leading-edge complementary facilities

Spallation Neutron Source

World's brightest pulsed source

18 user instruments

Time-of-flight incident beam

Key technical strengths

- High resolution for precise structural determination
- Low background noise
- Complex sample environments possible

High Flux Isotope Reactor

World's brightest reactor source

12 user instruments

Crystal monochromators for incident beam

Key technical strengths

- Structural determination of large objects
- Understanding slow dynamics
- Using polarized neutrons to study magnetic materials

Step 1: Plan your proposal

1) What are you trying to learn from neutron scattering?

2) Which instrument do you need?

3) What sample environment do you need?

4) What type of proposal will you submit?

5) Discuss with instrument scientist

Step 1: Plan your proposal

What are you trying to learn from neutron scattering?

Where are the atoms and the spins? (Elastic neutron scattering)

- Diffraction (atomic structure, spin structure)
- Small angle neutron scattering (SANS) (assemblies, nanostructures, polymers)
- Reflectometry (structure of layers, magnetic layers, polymer films)

What are the atoms and the spins doing? (Inelastic neutron scattering)

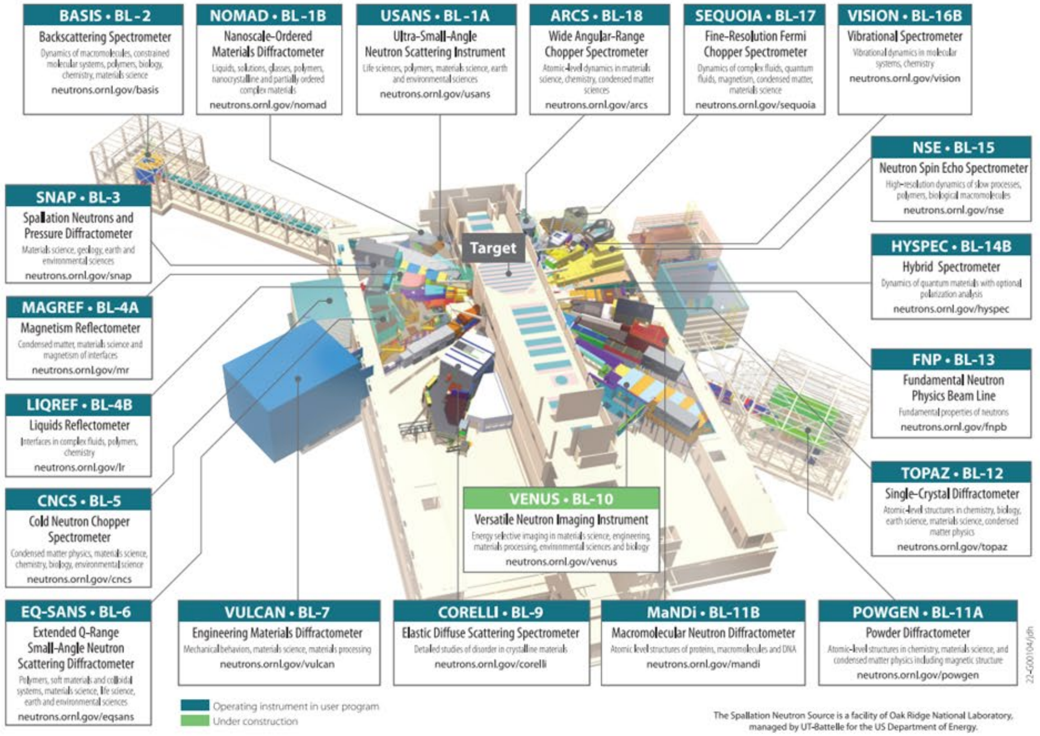
- Spectroscopy (lattice vibrations, magnetic excitations, diffusion)

What does an object look like under real world operating conditions?

- Imaging (static or time dependent changes under pressure, temperature, tensile and compressive loading)

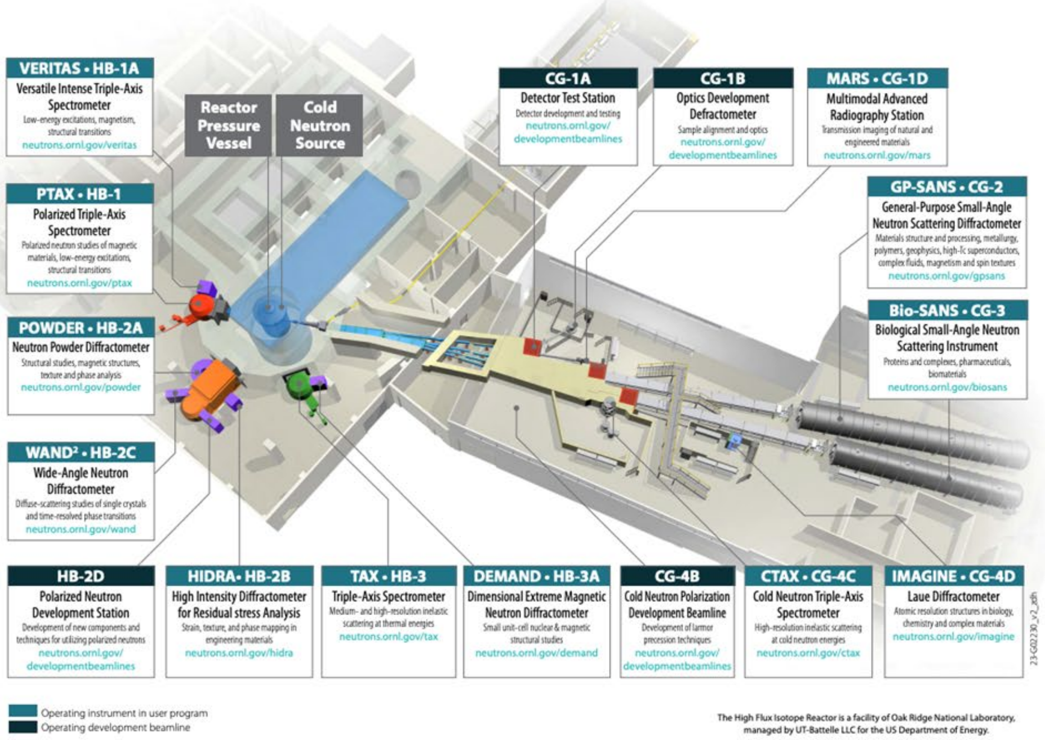
Step 1: Plan your proposal

Which instrument do you need?



SNS Instrument Layout

HFIR Instrument Layout



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Step 1: Plan your proposal

Which instrument do you need?

Elastic Scattering

SNS:
NOMAD
POWGEN
SNAP
VULCAN
EQ-SANS
uSANS
MAGREF
LIQREF

HFIR:
POWDER
$WAND^2$
GP-SANS
Bio-SANS

Powder sample	Single Crystal
Resolution needed?	Unit cell size?
Sample environment needs	Bragg or diffuse scattering?
Local structure?	Sample environment needs
Structural length scale	
Sample type (crystalline vs. amorphous; bulk vs. thin film)	
Spatial resolution (Eng. Materials)	

SNS:
TOPAZ
MANDI
CORELLI

HFIR:
VERITAS
$WAND^2$
DEMAND
IMAGINE

Inelastic Scattering

SNS:
VISION
BASIS
NSE
ARCS
SEQUOIA
CNCS
HYSPEC

Powder sample	Single Crystal
Energy scale?	Energy scale?
Q dependence important?	Q coverage
Sample environment needs	Sample environment needs

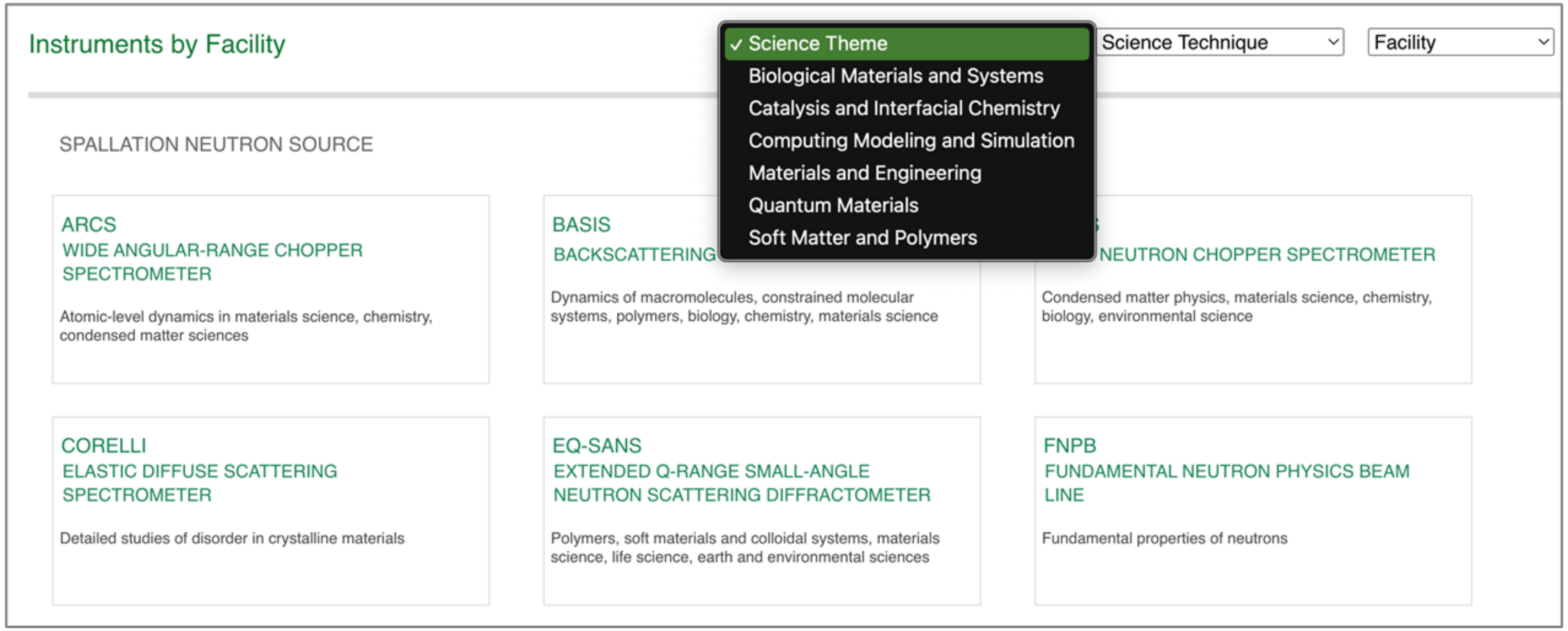
SNS:
ARCS
SEQUOIA
CNCS
HYSPEC

HFIR:
HB-1
HB-3
CTAX

Step 1: Plan your proposal

Which instrument do you need?

neutrons.ornl.gov/instruments



Step 1: Plan your proposal

Which instrument do you need?

neutrons.ornl.gov/instruments

Wide-Angle Neutron Diffractometer WAND² | HB-2C | HFIR

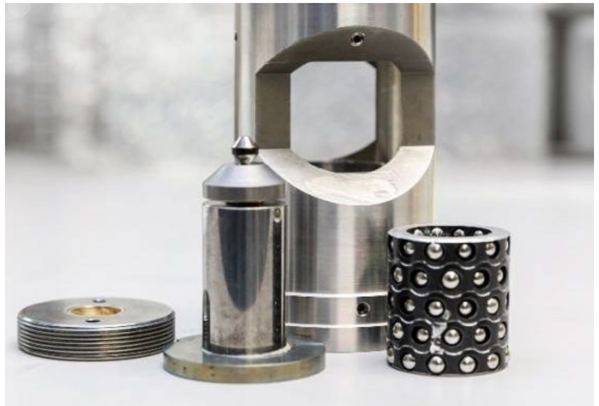
APPLICATIONS

WAND² is ideal for parametric studies on powder samples, observing small signals (including due to small mass) in single crystal samples, and the study of time-resolved phenomena. It is a powerful instrument for the study of quantum materials and magnetism but has broad applications with recent research including the growth of ferroelectric ice-XI, hole and charge ordering in colossal magnetoresistance materials, and studies of magnetic structures and correlations in low-dimensional magnetic systems.

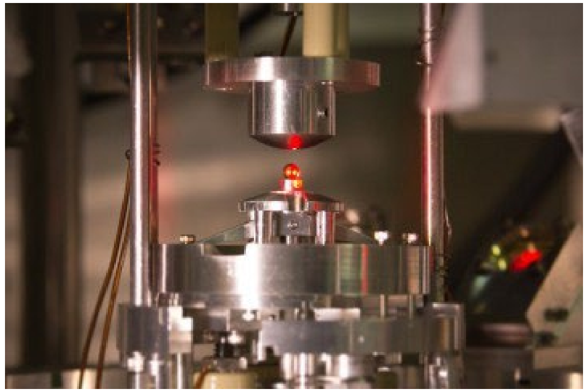
Step 1: Plan your proposal

Which sample environments do you need?

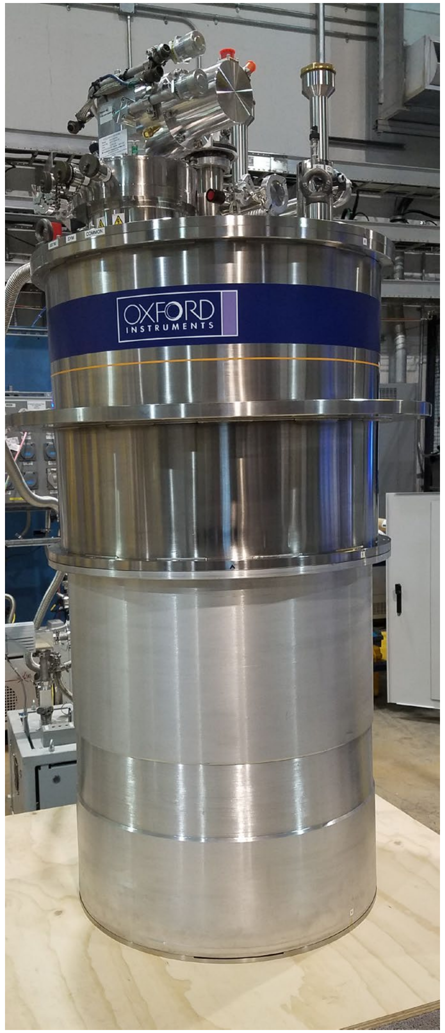
Furnaces up to 1600 C



Pressure cells up to 100 GPa



high temperature levitation
devices up to 2400 C



Applied magnetic fields up
to 14 T and low temperature
cryostats down to 0.05 K

Step 1: Plan your proposal

Which sample environments do you need?

Sample Holders

Various sample holders are used for the sample environment equipment mentioned below. For photos and detailed information about materials and dimensions, please refer to the document Powgen sample cans.

Powgen Automatic Changer

The Powgen Automatic Changer (PAC) is the second generation sample changer that was developed for Powgen. The changer has a carousel that holds a maximum of 24 sample-filled vanadium cans, and data may be collected in a temperature range of 20 to 300 K. The cool down time from room temperature to 20 K is 30 minutes. The sample may be changed at 20 K, which takes about 20 minutes.

Vacuum Furnace / Gas Insert

A traditional vacuum furnace built with vanadium heating elements is available for high-temperature measurements from room temperature to 1200°C. Cooling to 100°C takes approximately 4 hours. The vacuum level of the furnace is ~2 x 10^{-5} torr. The aluminum tail of the furnace has been modified with vanadium windows for the primary beam. Installing a niobium heating element increases the maximum temperature to 1600ºC; however, Q coverage is limited due to the Nb peaks observed in the back- and forward-scattering detectors.

This furnace can also be configured to have a quartz insert that allows flow of various gas mixtures through the sample using the gas handling system. Approved gases include H_2, CH_4, CO, CO_2, N_2, Ar, He and O_2. The sample is loaded in a quartz basket with frit at the bottom and quartz wool on top to allow flow of gas through the sample. The furnace is capable of heating up to 850°C with this insert.

Orange Cryostat

The orange cryostat is a standard 50 mm bore cryostat with modified tails similar to the vacuum furnace to eliminate aluminum in the path of the primary neutron beam. The temperature range is 2 to 300 K.

Cryofurnace (JANIS)

The Janis cryofurnace is a top loading CCR with two different stick setups. The cold stick has a temperature range of 5 to 500 K, while the hot stick can go from 30 to 750 K.

MAG-08 (7T Magnet)

MAG-08 is a 7T vertical magnet with a cryo-stick with a temperature range of 2 to 300K. This magnet has a vanadium tail for clean neutron diffraction patterns without contamination from aluminum peaks.

Step 1: Plan your proposal

Which sample environments do you need?

https://neutrons.ornl.gov/sample

To only show available items for specific beamline, use this filter.

- Any -

ID	Sample Space Dia.	Temp Range	Instruments	Associated Resources	Subcategory	Description
MAG-001	32mm	1.7 to 300 K	BL-11A, BL-14B, BL-17, BL-18, BL-2, BL-5, BL-9, BL-11A, BL-14B, BL-17, BL-18, BL-2, BL-5, BL-9, CG-2	ULT-010, ULT-014, ULT-010, ULT-014	Top Loading	34mm 5T Vertical Field Self-Shielded, Asymmetric SC Magnet.
MAG-003			BL-4A	CCR-011	Other	1.15T with the gap of 50 mm (CCR Compatible), 3.78T with 10 mm pole gap (Room Temperature Only) Consult Beam Line Staff for Different Configurations
MAG-004		1.7 to 325 K	BL-14B, BL-5		Top Loading	7T Vertical Field
MAG-005	32mm	1.7 to 300 K	BL-14B, BL-17, BL-18, BL-5, BL-9, BL-14B, BL-17, BL-18, BL-5	ULT-010, ULT-C, ULT-010, ULT-C	Top Loading	8T Vertical Field, Symmetric, Self-Shielded SC Magnet.
MAG-006		1.7 to 300	BL-17, BL-18, BL-2, BL-5, BL-9	AE-015, CRYO-005, CRYO-006, CRYO-007, CRYO-009, CRYO-011	Bottom Loading	
MAG-009	42mm	1.5 to 400 K	BL-14B, BL-17, BL-5	ULT-011, ULT-012	Top Loading	14T Vertical Field symmetric/asymmetric (12T)
MAG-A	mm	1.7 to 300 K	HB-1, HB-1A, HB-2A, HB-3	ULT-C	Top Loading	6 Tesla Vertical Field Magnet- Symmetric
MAG-B	mm	1.7 to 300 K	CG-4C, HB-1, HB-1A, HB-2A, HB-2C, HB-3, HB-3A	ULT-E, ULT-G, ULT-H	Top Loading	5 Tesla Vertical Field Magnet- Symmetric
MAG-E	mm	1.7 to 300 K	CG-2, CG-4C, HB-1, HB-1A, HB-3	ULT-E, ULT-H, ULT-K	Top Loading	8T Vertical Asymmetric Field Cryomagnet
MAG-F			CG-2		Other	
MAG-G		1.7 to 300 K	CG-2, CG-4C	ULT-E, ULT-H, ULT-K	Top Loading	11T Horizontal Field Magnet
MAG-H			CG-2, CG-4B	CCR-W	Other	5T Horizontal Field Warm Bore Magnet
MAG-I	50mm	1.5 to 300 K	CG-4C, HB-1, HB-1A, HB-2A, HB-2C, HB-3, HB-3A	ULT-G, ULT-H, ULT-K	Top Loading	6T Vertical Field Asymmetric Magnet

Step 1: Plan your proposal

Which type of proposal will you submit?

	Access	Publish?	Details
Twice yearly	General User	✓	Majority of available beam time External peer review
	Collaboration	✓	Ongoing projects for new resources or capabilities
All year	Industrial access	✓	Proprietary (full-cost recovery) or non-proprietary Contact industry liaison to begin
	Mail-in*	✓	Sample mail-in Available on 12 instruments at SNS
	Proof of principle*		Testing the feasibility of an experiment

* shorter measurements

Step 1: Plan your proposal

Discuss with an instrument scientist

Home » Wide-Angle Neutron Diffractometer » WAND² Instrument Team

Wide-Angle Neutron Diffractometer WAND² | HB-2C | HFIR

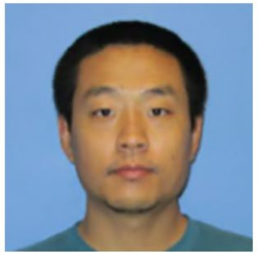
Overview Team Capabilities User Guidance Live Instrument Data Sample Environment Publications Spec Sheet Contact Us

WAND² Instrument Team

Matthias Frontzek
Instrument Scientist

Yan Wu
Instrument Scientist

Si Athena Chen
Instrument Scientist



Yuanpeng Zhang
Computational Instrument Scientist

Zachary Morgan
Computational Instrument Scientist

Emily Kroll
Scientific Associate

Jie Xing
Scientific Associate

Step 2: Write Research Statement

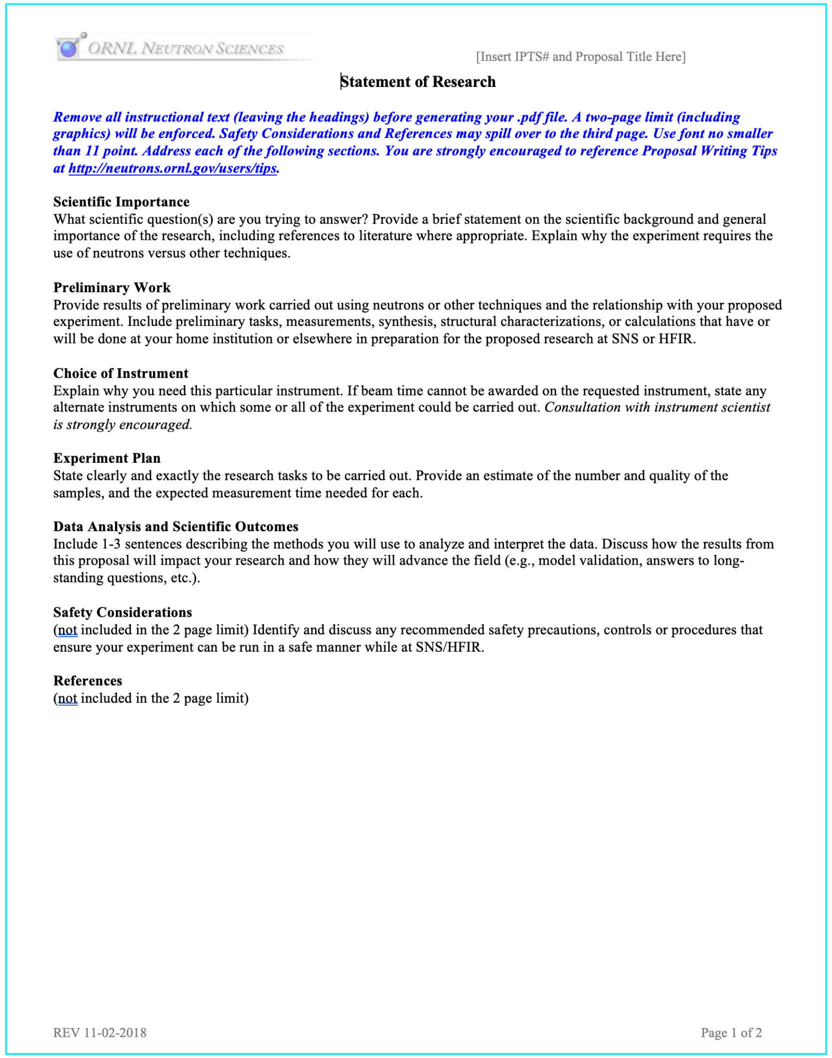
Refer to our website for tips:
https://neutrons.ornl.gov/users/tips

Use the provided Word doc template for statement of research

Limit to two pages and font no smaller than 11 point

Required sections:

- Scientific Importance
- Preliminary Work
- Choice of Instrument
- Experiment Plan
- Data Analysis and Scientific Outcomes
- Safety Considerations
- References


ORNL NEUTRON SCIENCES [Insert IPTS# and Proposal Title Here]

Statement of Research

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.).

Safety Considerations
(not included in the 2 page limit) Identify and discuss any recommended safety precautions, controls or procedures that ensure your experiment can be run in a safe manner while at SNS/HFIR.

References
(not included in the 2 page limit)

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Step 2: Write Research Statement

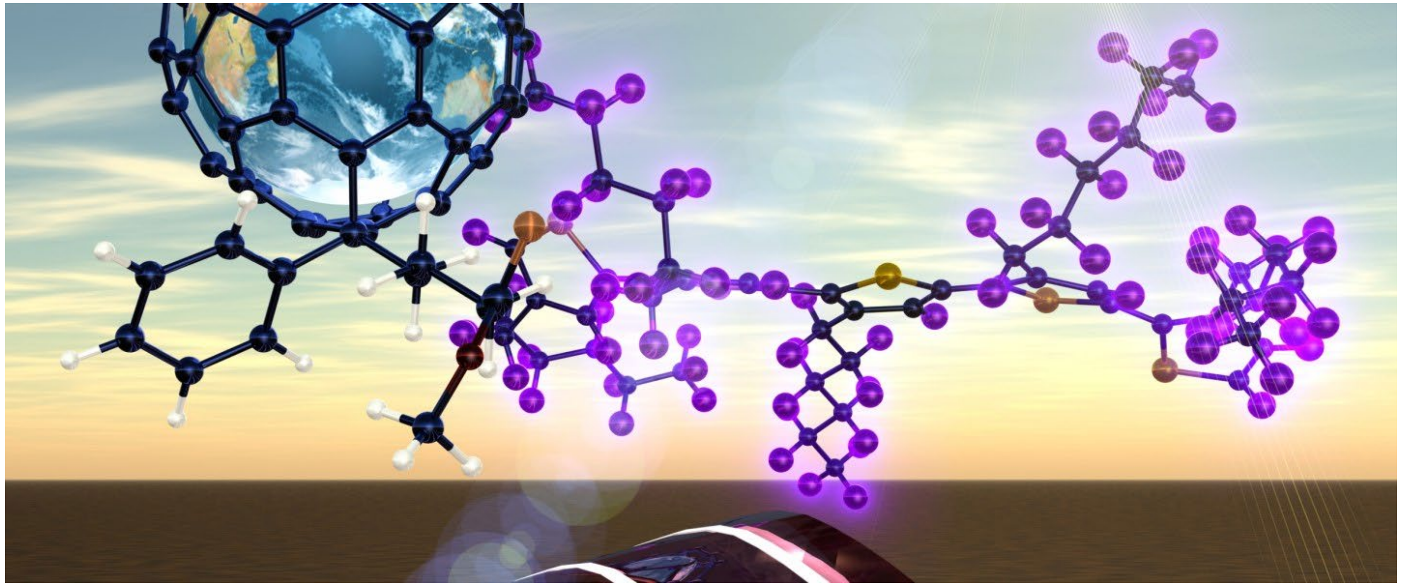
Scientific Importance

What are you trying to learn?

Why is it important?

How does it extend from recent literature?

Why are neutrons needed?



Credit: Phoenix Pleasant/ORNL, U.S. Dept. of Energy

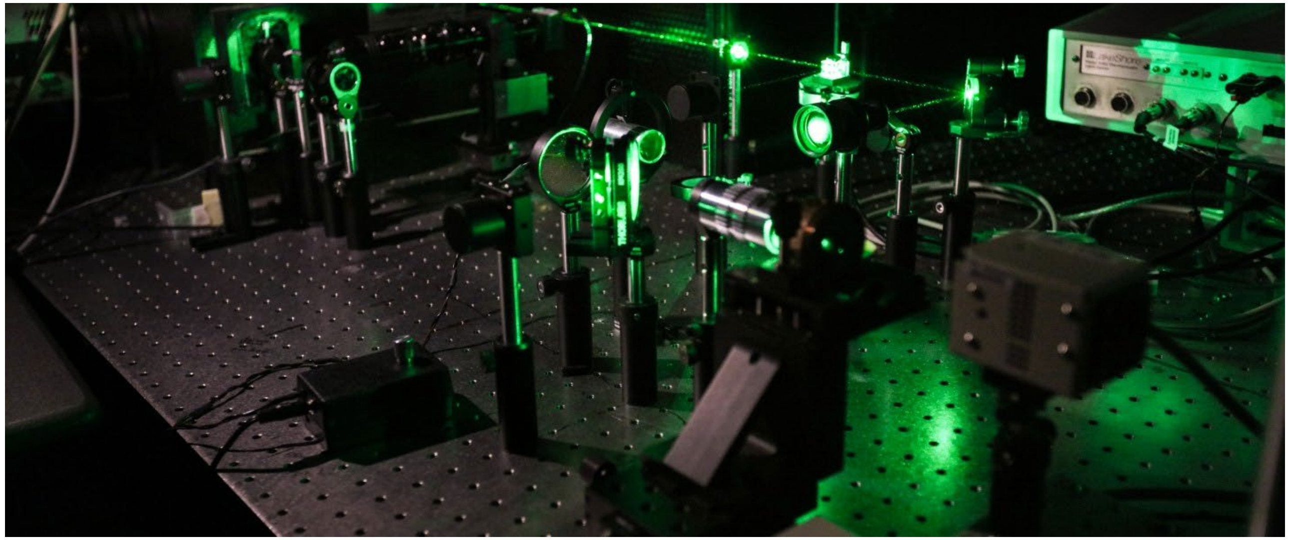
Step 2: Write Research Statement

Preliminary Work

What have you done so far?

- Synthesis
- X-rays or other structural characterization
- Property measurements
- Calculations

How does this relate to proposed research?



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Step 2: Write Research Statement

Instrument Choice and Experiment Plan

Why do you need this instrument?

Research tasks to be carried out

Number of samples and measuring conditions

Expected time for each measurement

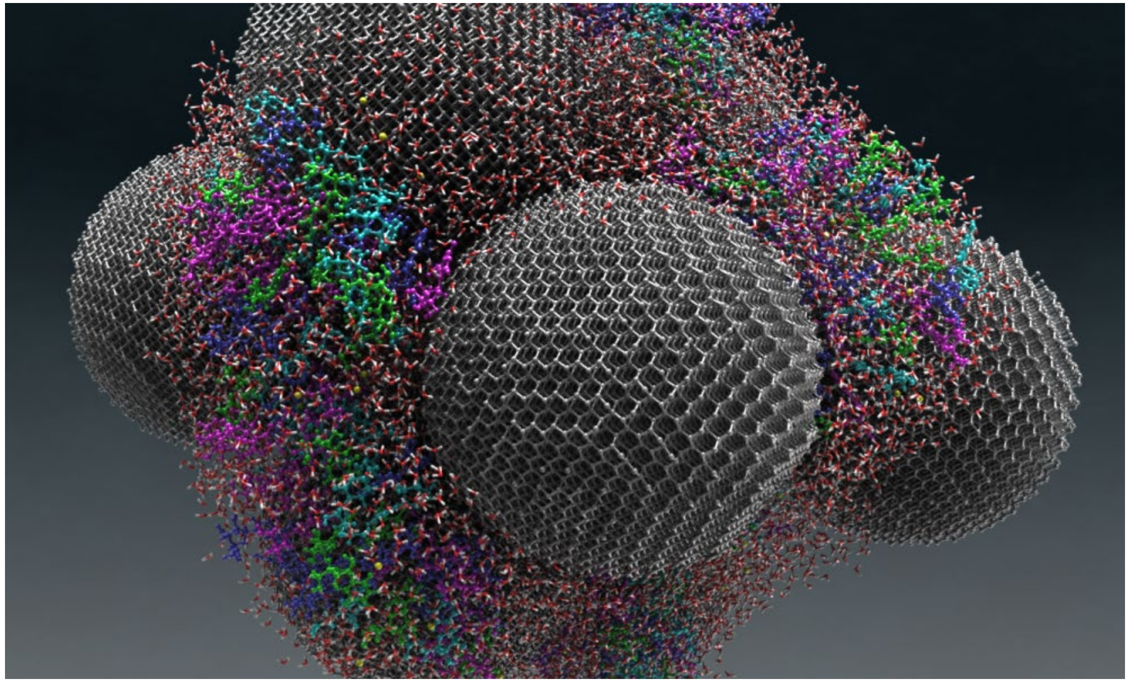
Consultation with Instrument Scientist is important

Step 2: Write Research Statement

Data Analysis and Scientific Outcomes

How will you analyze and interpret data?

How do the results fit into the bigger research picture?



Credit: Phoenix Pleasant/ORNL, U.S. Dept. of Energy

Step 2: Write Research Statement

Safety Considerations and References

Are there any safety precautions or procedures necessary?

List all Sources

*** These two items are not included in 2-page limit

Step 3: Submit the Proposal

General Information

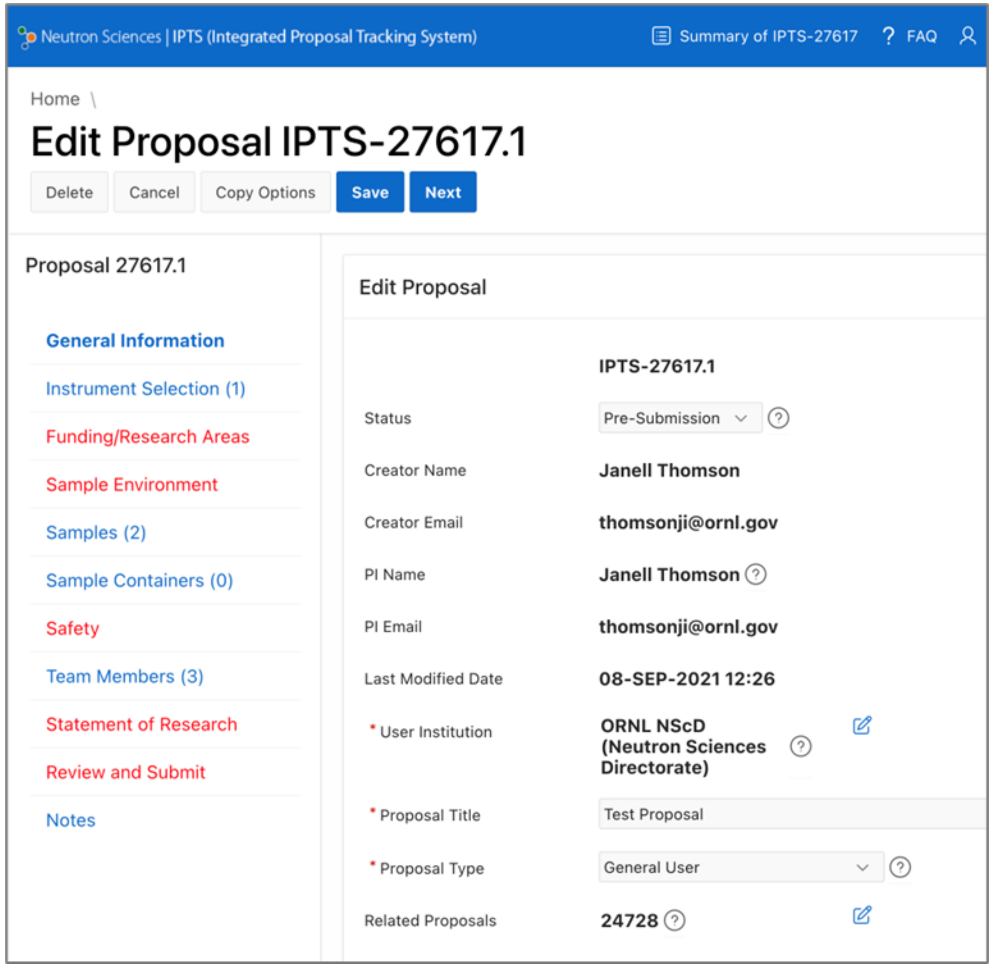
Log in to the IPTS system using your ORNL User ID and password

Fill out all required sections

Submit before the proposal call deadline

- The next proposal call closes on September 23, 2026

Contact the User Office (neutronusers@ornl.gov) or your instrument contact with any questions.



Step 3: Submit the Proposal

New User Pilot Program!!

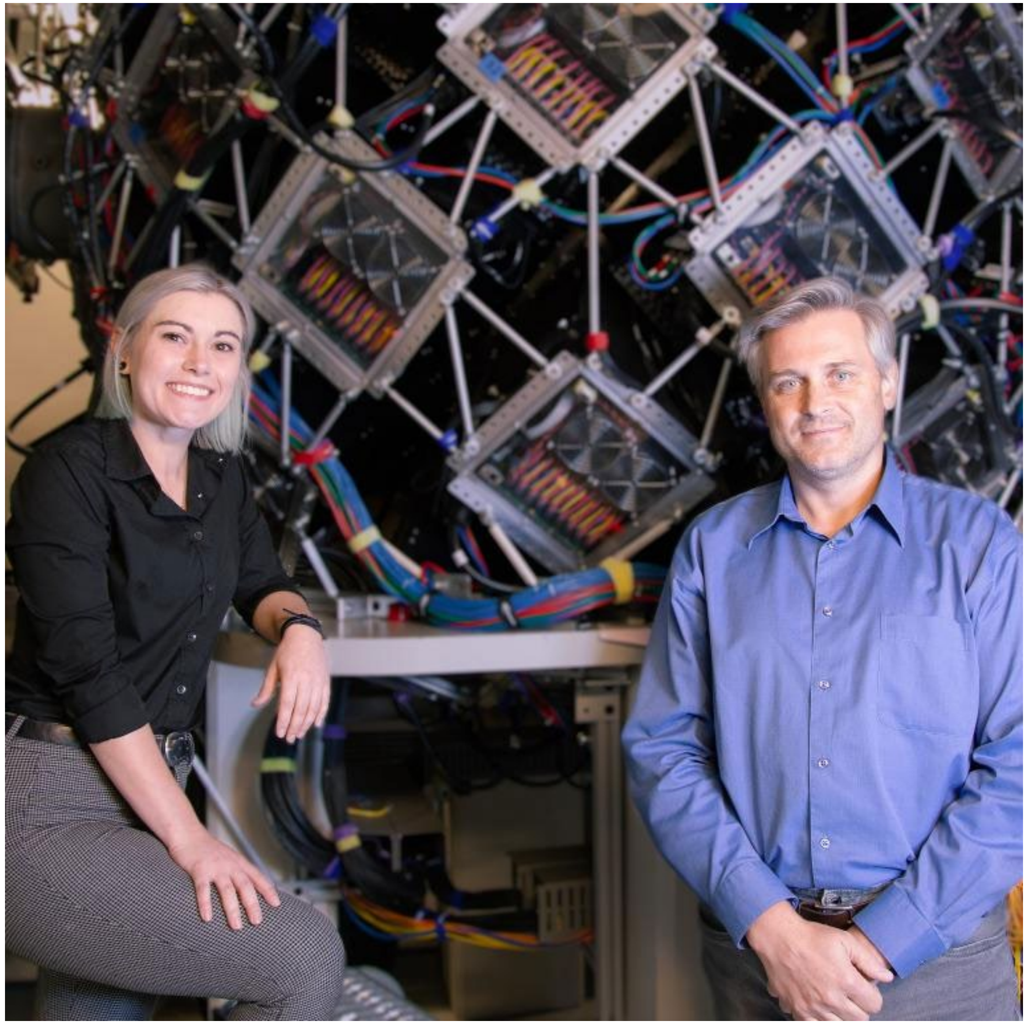
Time set aside for groups new to neutron scattering

PI is any rank faculty or staff who has had 0-1 General User Proposals accepted

PI must commit to coming onsite for experiment

Proposal goes through typical review process

Best new user proposals are allocated beamtime



Credit: Sumner Brown Gibbs /ORNL, U.S. Dept. of Energy

Updates on Proposal Submission

NEW STATEMENT OF RESEARCH TEMPLATE – IMPORTANT FOR MULTI-INSTRUMENT PROPOSALS!!!!

There is a two-page limit (including graphics) for single instrument proposals. Proposals where two or more instruments are requested for the same project are allowed three pages to thoroughly explain the rationale and experiment plan. Requests for multiple instruments must be adequately justified in each section of the Statement of Research. Safety Considerations and References are not part of the page limit and may spill over to an additional page.

OrcID is required to submit a proposal

This is for the submitter plus anyone who will need to get into IPTS system

Check Proposal Call Announcements

List of new capabilities or any limitations on sample environment/time run during cycle, etc

If you need help

Contact **User Office**	Contact **Instrument Scientist**
Accessing/creating/managing IPTS	Information about instrument capabilities
Questions/issues with Proposal System	Instrument choice
Proposal submission process	Sample environment requests
Team member participation	Advice related to samples
When you don’t know who to ask	Scheduling questions

Step 4: Proposal Review Process

Internal review

Done by instrument team and health and safety professionals

- Scientific and operational feasibility
- Health and safety concerns

Reviewers may reach out of clarification needed

Step 4: Proposal Review Process

Scientific Review Process

3-4 External reviewers per proposal

External Science Review Committee (SRC)

Internal Beam Allocation Committee

Result notification

Award statuses are:

- Approved (facility commits to running during the upcoming 6 month cycle)
- Alternate status (potential to run if time allows)
- Not awarded time

Step 4: Proposal Review Process

Rating System

Rating	Score	Description
Extraordinary	5	The proposal involves cutting-edge research of great scientific importance. Proposed research will significantly advance knowledge in a specific field or scientific discipline. The neutron scattering capabilities of HFIR and/or SNS are essential to the success of the proposed work. This proposal must be supported with the highest priority.
Excellent	4	The proposed research is of high quality and has potential for making an important contribution to a specific field or scientific discipline. The work is innovative and is likely to be published in a leading scientific journal. The use of HFIR and/or SNS is highly desirable for the success of the proposed work. It is strongly recommended that this proposal should be supported.
Good	3	The proposed research is inventive and likely to produce publishable results. Impact on a specific field or scientific discipline is likely. The proposed work will greatly benefit from access to HFIR and/or SNS. This proposal should be supported if sufficient resources are available.
Fair	2	The proposed research is interesting but may not significantly impact a specific field or scientific discipline. Publication may or may not result from this research. Neutron scattering capability is required, but the proposed work could be performed at other facilities. This proposal should not be supported if the required resources are limited.
Poor	1	The proposed research is not well-planned or is not feasible. Results would not make important contributions to fundamental or applied understanding, and work is not likely to result in publication. This proposal should not be supported.

How to make sure you have an effective beamtime!

Based on interviews with 12 instrument scientists

Work done by Samuel Adegboyega
GRO Intern summer 2026
1st National Neutron School student

Oak Ridge National Laboratory

General Findings

Common recommendations for maximizing beamtime efficiency

1. DEFINE THE SCIENTIFIC QUESTION

- ❖ Define the research question and expected outcome.
- ❖ Identify measurements required to answer the question.
- ❖ Develop a detailed experimental plan.
- ❖ Distinguish essential from secondary measurements.

2. KNOW THE SAMPLE

- ❖ Understand composition, purity, structure, lattice and symmetry.
- ❖ Know orientation, expected reflections and structure factors.
- ❖ Understand expected signal, contrast and sample limitations.

3. KNOW THE INSTRUMENT

- ❖ Understand instrument capability and technique.
- ❖ Know relevant experimental parameters.
- ❖ Review instrument-specific guidance and tutorials.

4. COMMUNICATE & PREPARE

- ❖ Contact the instrument scientist before arrival.
- ❖ Confirm sample readiness and discuss the plan.
- ❖ Prepare reduction, refinement, modeling and analysis tools.

5. ANALYZE & ADAPT

- ❖ Reduce and plot data continuously.
- ❖ Evaluate results against expectations.
- ❖ Adjust measurement time or parameters when necessary.

1. Preparation Before Beamtime

❖ Define the research question and what the experiment is expected to establish.

❖ Identify the specific measurements required to answer the scientific question.

❖ Understand the sample: composition, purity, crystal structure, lattice parameters, symmetry and orientation.

❖ Know expected reflections, relevant structure factors, signal/contrast and sample limitations.

❖ Understand the instrument's capabilities, measurement technique and relevant experimental parameters.

❖ Review instrument-specific user guides, tutorials and experiment simulators.

❖ Develop a detailed experimental plan and a realistic Plan B.

Design the experiment around the scientific question—not simply around collecting more data.

2. Communication with the Instrument Scientist

BEFORE ARRIVAL

❖ Contact the instrument scientist well before beamtime.

❖ Discuss the scientific objective and experimental plan.

❖ Ask questions about uncertainties and experimental limitations.

❖ Confirm sample readiness and that the sample has arrived.

❖ Discuss experimental parameters and realistic expectations.

DURING BEAMTIME

❖ Maintain communication as the experiment progresses.

❖ Share evolving plots and experiment details.

❖ Discuss data quality and unexpected observations.

❖ Use the instrument scientist's expertise to optimize the experiment.

❖ Adapt the measurement strategy when evidence supports a change.

Effective beamtime is a partnership: prepared users + engaged instrument scientists.

3. Data Analysis During Beamtime

MEASURE
Collect planned data

REDUCE
Begin reduction early

PLOT
Visualize continuously

EVALUATE
Assess quality & signal

ADJUST
Modify time/parameters

- ❖ **Prepare familiarity with data-reduction tools, refinement software, modeling tools and instrument-specific analysis before arrival.**
- ❖ **Assess data quality as measurements are collected and compare results with expectations.**
- ❖ **Determine whether additional measurements are necessary.**
- ❖ **Share evolving results with the instrument scientist so the experiment can be optimized in real time.**

4. Use Beamtime Strategically

AVOID

- ❖ Excessive data collection on the same sample.
- ❖ Redundant measurements.
- ❖ Measurements unrelated to the primary scientific objective.
- ❖ Waiting until after beamtime to discover that the experiment did not answer the question.

PRIORITIZE

- ❖ Critical measurements that directly address the research question.
- ❖ Measurement time according to scientific priority.
- ❖ Experimental changes supported by real-time data.
- ❖ A realistic contingency strategy if the original plan does not work.

The objective is not to collect MORE data — it is to collect the RIGHT data.

5. Facility Training, Resources & User Support

TRAINING & PREPARATION

- ❖ Neutron schools and workshops
- ❖ Tutorials and recorded lectures
- ❖ Instrument-specific user guides
- ❖ Experiment simulators
- ❖ Modeling and computational resources

USER SUPPORT

- ❖ Instrument-specific checklists
- ❖ Preparation guides, videos and tutorials
- ❖ Accessible data-support resources
- ❖ Scientific and computational support

POST-EXPERIMENT

- ❖ Organized analysis resources
- ❖ Data-reduction and refinement tutorials
- ❖ Follow-up support
- ❖ Links to relevant computational resources
- ❖ Accessible resources through the user portal

Overall Message

PREPARE → COMMUNICATE → MEASURE → REDUCE → PLOT → EVALUATE → ADAPT

- ❖ **Users should arrive with a defined scientific question, a well-understood sample, and a realistic experimental plan.**
- ❖ **Data reduction and analysis should be integrated into beamtime rather than postponed until afterward.**
- ❖ **Instrument scientists should be engaged before and during the experiment to help users optimize measurements.**
- ❖ **Facility resources should be organized around the complete user journey, from preparation through post-experiment analysis.**

Maximize scientific value of data collected.

Proposal Call

Contact: neutronusers@ornl.gov

https://neutrons.ornl.gov/users

We look forward to seeing how neutrons can help you with your science!