NIST Center for Neutron Research (NCNR) Restart Update

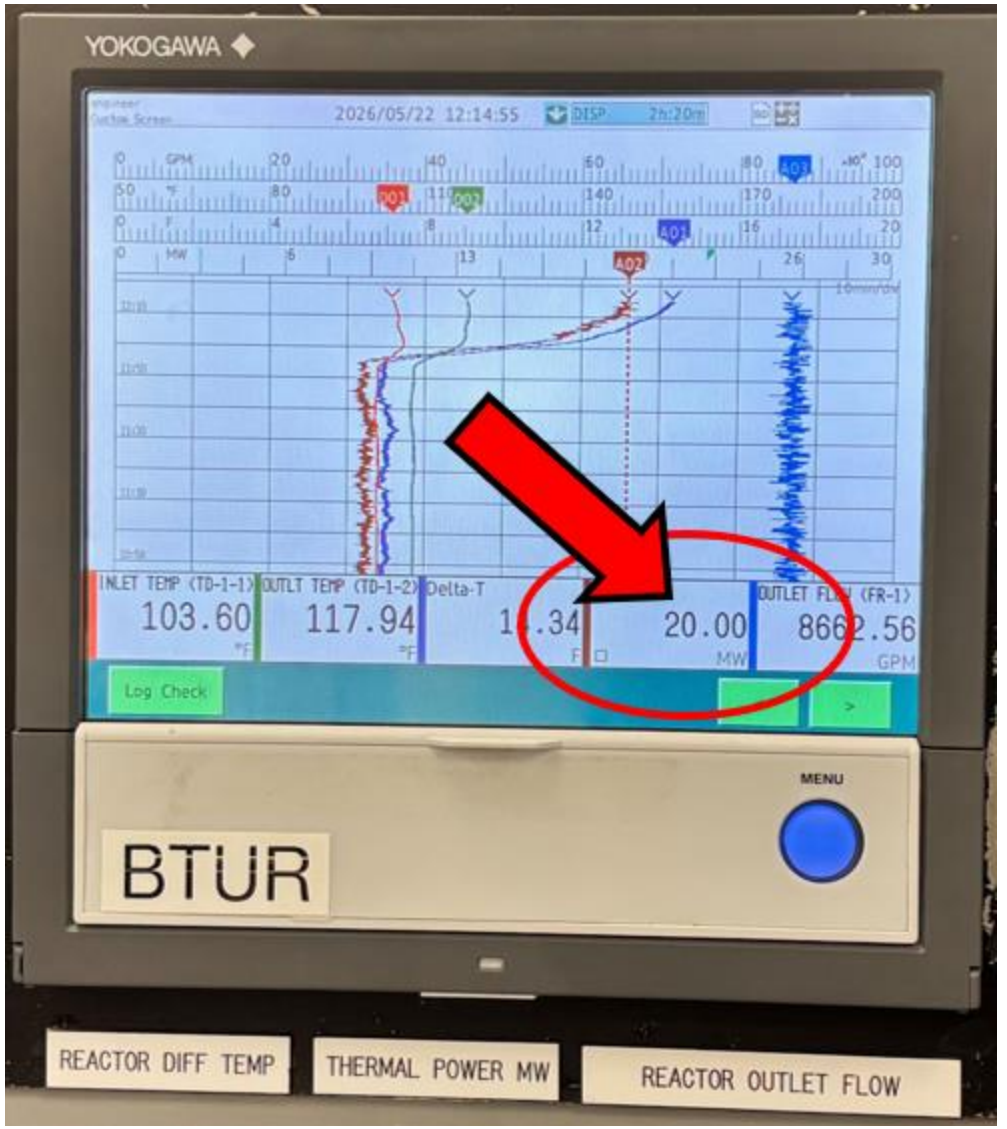
Jim Adams
Director, NCNR
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NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

October 27, 2026

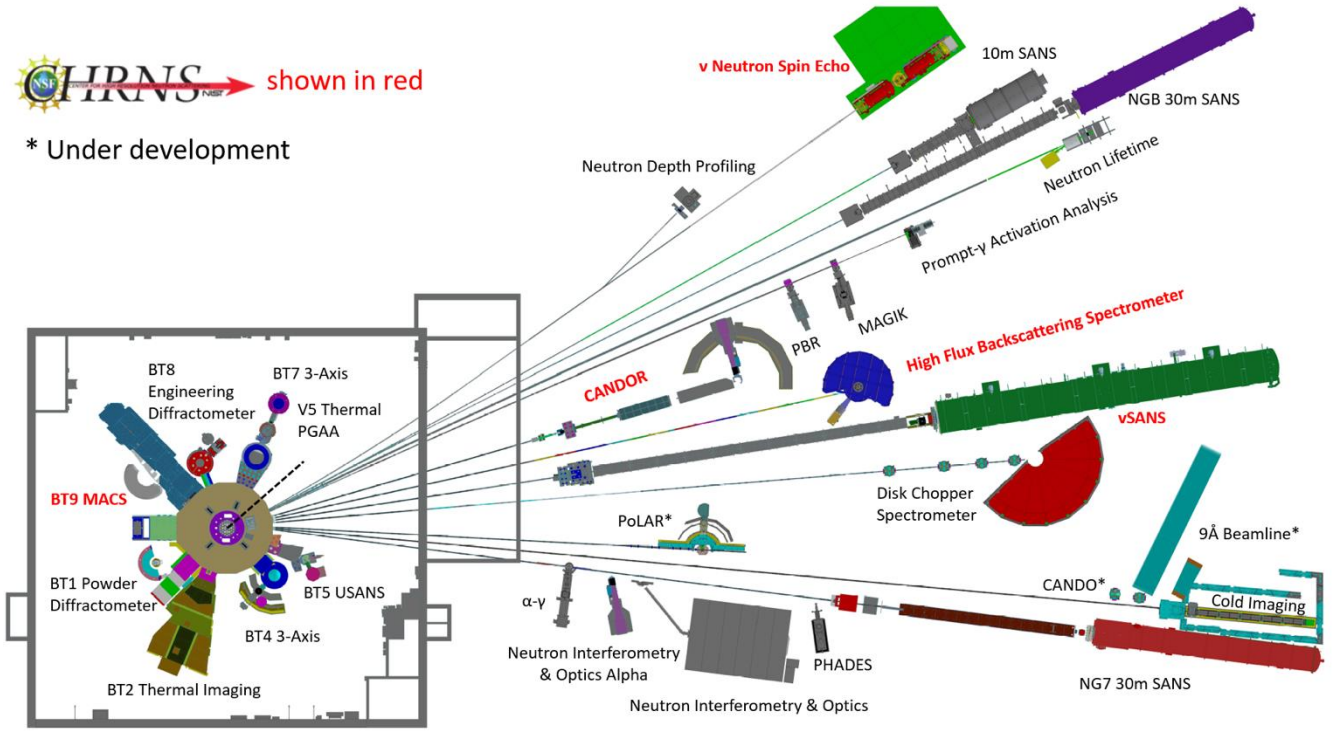
Executive Summary

Open for Business!



Credit: NIST

NCNR: By the Numbers



*Under Development

NCNR Neutron Instruments

- One of two major neutron science centers in the U.S.
  - Emphasis on supporting U.S. industry
- Neutrons supplied by 20 MW **<u>Research</u>** Reactor
  - Recategorized under NRC NPUF Rule
- 29 beam instruments
- ~40% of the nation's cold neutron instruments

- ~60% of U.S. scientific productivity in neutron science
- Annually:
  - > 3000 beamline users
  - ~50 companies

Reactor Recovery Timeline

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2021	• Fuel element failure event • Multiple root cause investigations • Extensive communications with NRC, including formal correspondences, request for fuel loading and reactor restart • **License amendment request** for latch verification—rotation and visual: approved July 2022
2022	• Major reactor cleanup and inspection efforts • Confirmatory order negotiated with NRC and issued • Submittal of restart plan and **license amendment request** for operation with debris: approved February 2023
2023	• Third **license amendment request** submittal for alternate core loading and fuel management: approved March 2023 • Fuel shipment received in preparation for restart • NRC grants permission to restart: March 2023 • Low-power testing March through August revealed **significant fission product inventory in primary system**: operations far from effluent activity regulatory limits • Helium Sweep System and confinement ventilation system leaks identified and repaired: minimize contamination • Shim arm alignment issue: shim arm dropout
2024	• Shim arm alignment work completed • Operations for training • Shutdown for further cleanup efforts and **concurrent guide replacement**
2025	• **Second reactor vessel cleanup performed** • Component improvements: ventilation closure valves, primary system modifications, confinement door seal replacement • **Refurbishment of refueling plug and He seals** • Restart for training and testing • Completed requirements of Confirmatory Order

2026: Return to Operations

Reactor Operator Licensing & Power Escalation

- **Engagement of NRC to requalify nine licensed Senior Reactor Operators**
- **January-March: low power operations to bring reactor operator quals current**
- **April: Reactor operations and written exams– monitored by NRC**
- **May 22: short-term power ascension to 20 MW**
  - Fission products still present, significantly improved containment within reactor He sweep system
  - Effluent activities significantly lower
- **June 24: 20 MW operations with initial shutter openings for science**
- **July 6-9: NRC licensing exam for 6 candidates**
  - All passed
  - Sufficient to run 24/7—but just barely
  - Hiring of additional candidates in progress
- **August 19: Return to 20 MW neutron science operation**
  - Completion of first operations cycle September 13
- **Return to "routine" operations cycles October 19**









All photos credit: NIST

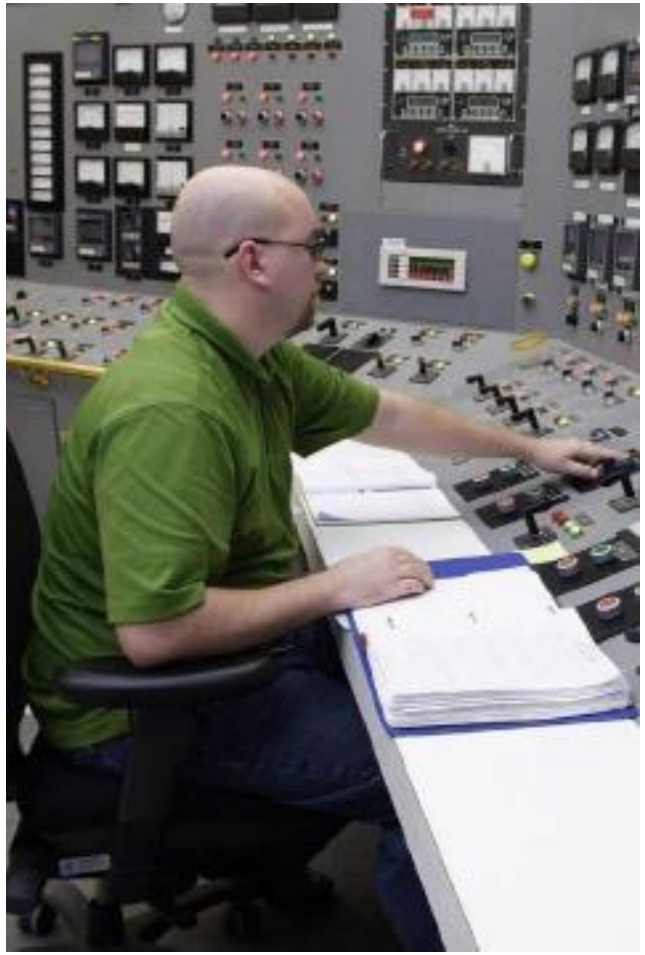
Major Accomplishments

- Six nuclear safety program assessments by independent consultants over 3 years
- Revision of over 600 procedures to meet nuclear industry standards
- Implementation of Corrective Action Program
- Multiple safety culture improvements, including NCNR Safety Culture Monitoring Panel and Benchmarking Program
- Satisfaction Letter to NRC Confirmatory Order: May 2026

NCNR ROE Staffing

Over the past 18 months, NCNR Reactor Operations and Engineering has seen a 20% reduction in staff

- Efforts to hire four additional operators in progress
- Critical levels in Engineering, Aging Reactor Management, and Safety
    - Single resignations can have significant impact on reactor reliability
- In the most recent inspection, NRC highlighted the need to continue the safety culture momentum, including with appropriate resourcing



Credit: NIST

1st Call for Proposals

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- First NCNR Call for Proposals for beam time on the Center for High Resolution Neutron Scattering (CHRNS) instruments issued summer 2026
- Requests commensurate with pre-incident levels!

Instrument	Submitted #	Days		expected days	over subscription
CANDOR	42	158		60	2.65
HFBS	30	178		60	3.08333333
MACS	35	186		60	3.16666667
NSE	11	97		30	3.4
vSANS	50	196		60	3.46666667
Total	168	815		270	

Restart of NCNR User Program



Credit: NIST

Call for Proposals

- July – September 2026
- Demand similar to 2019
- First on-site users arrived 10/22

New or improved capabilities

- 2x increase in data rate since 2020
- Development of autonomous platforms
- New spin-echo spectrometer (NSF mid-scale – University of Delaware)
- 12 of 16 instruments operating
- New cold 3-axis (2030)

Building Investment at NCNR

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nMat Consortium

- Launched early summer 2026 (led by MML)

NSF Center for High Resolution Neutron Scattering

- Final year of current project
- Renewal proposal submitted to NSF

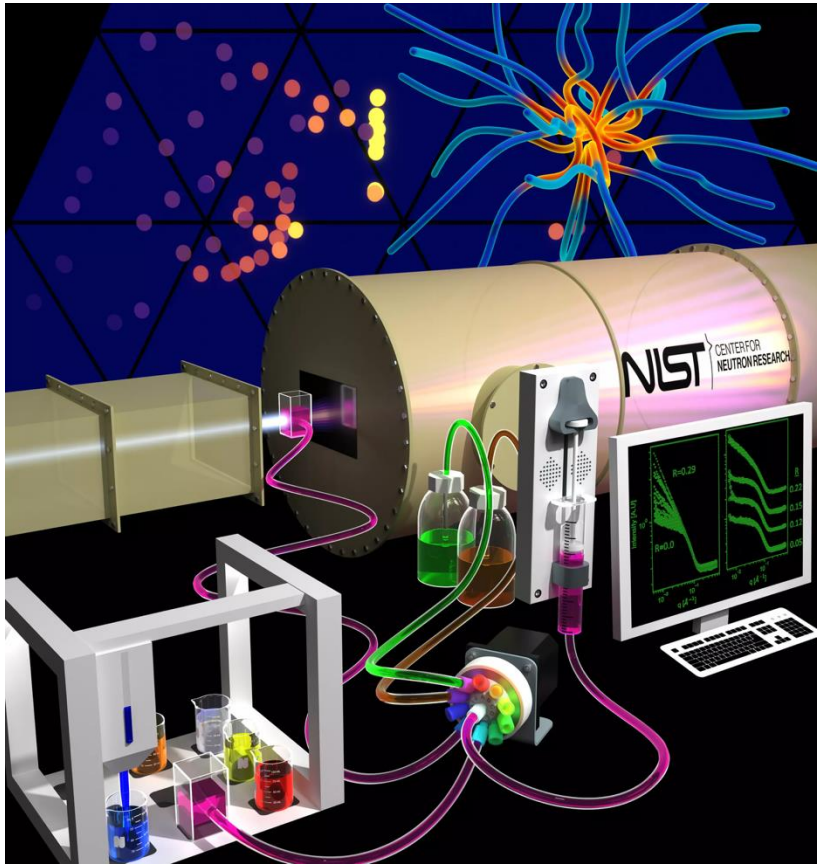
Dept of Energy / Oak Ridge National Laboratory

- Offer to support 5-year High Flux Isotope Reactor (HFIR) shutdown

The nMat Consortium

NIST CENTER FOR NEUTRON RESEARCH

Enabling industry to leverage the power of neutrons



Credit:
NIST/NCNR

Membership

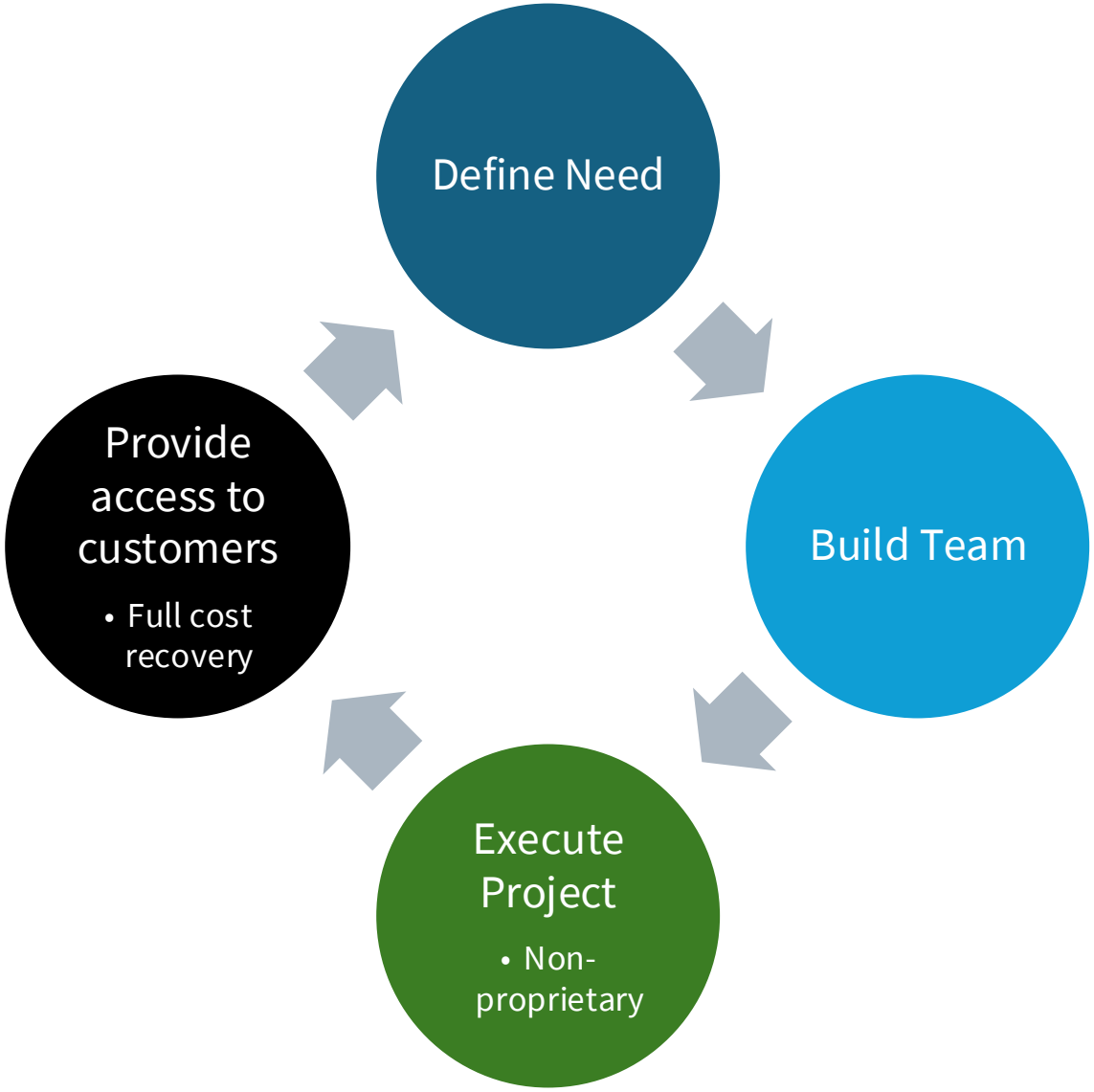
- $36k/yr to join; accelerated tasks option
- Members define projects
- >$2M/yr/project, 3-5 years
- Industry, Other agencies, consortia

Startup projects

- Protein Stability
- Damage in Fusion Energy Reactors

www.nist.gov/nmat

nMat Project Cycle



NIST Staff

- Experts in instrumentation
- Gaps in technology expertise

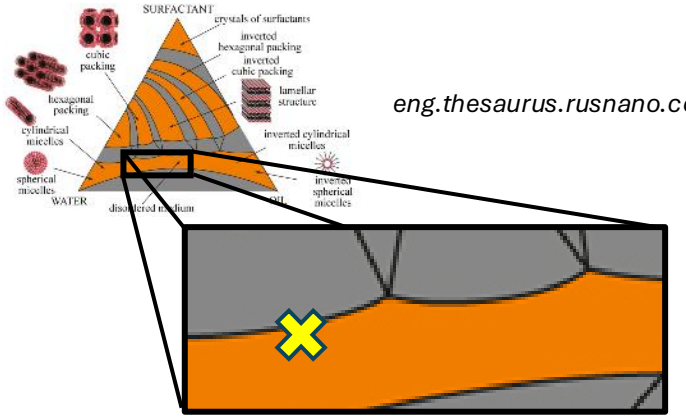
Member Staff

- Companies have reduced research teams
- Expectation that NIST will staff projects

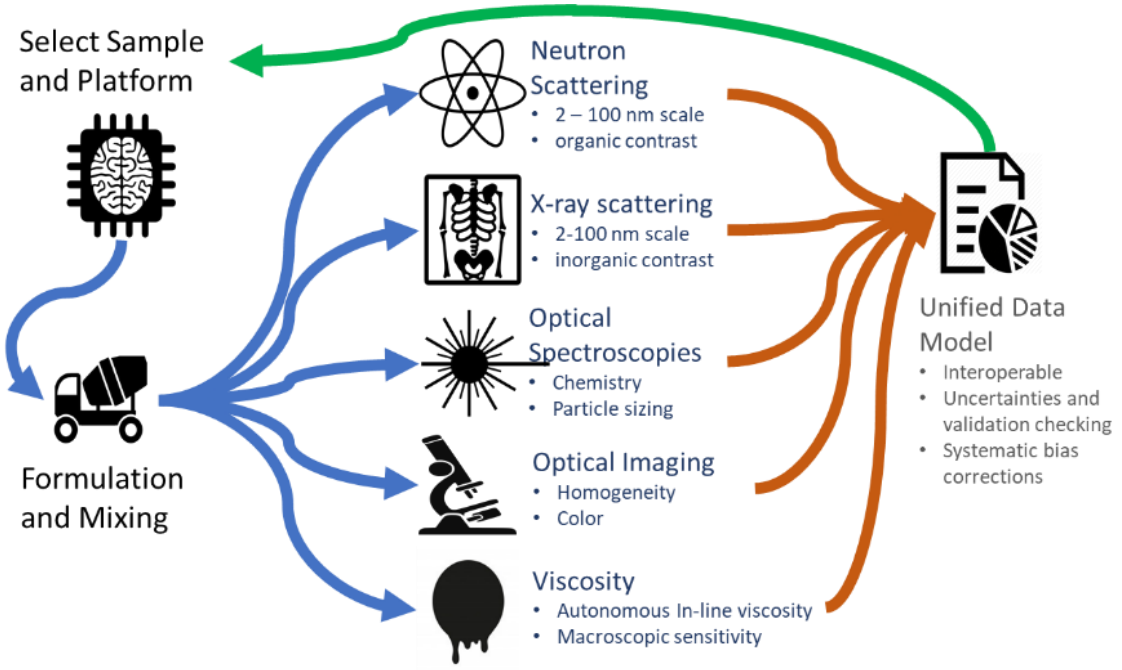
General Users

- Very wide base of technology expertise
- Often available for funded collaborations
- Many have side agreements with members
- Rapidly fill gaps in staffing, expertise
- Pool of day one ready candidates for future NIST openings

Autonomous Formulation Lab (AFL)



eng.thesaurus.rusnano.com/wiki/article513



AFL concept based on member input

- Focus on formulation stability rather than phase mapping
- Develop modules that address industrial processes
- Algorithms to address systematic instrument bias

Long range targets

- Routine mapping of boundaries for >10 dimensions
  - Dimensions can be composition or processes
- Focus on biotherapeutics, chemicals
- Integration into member autonomous efforts

Questions?



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