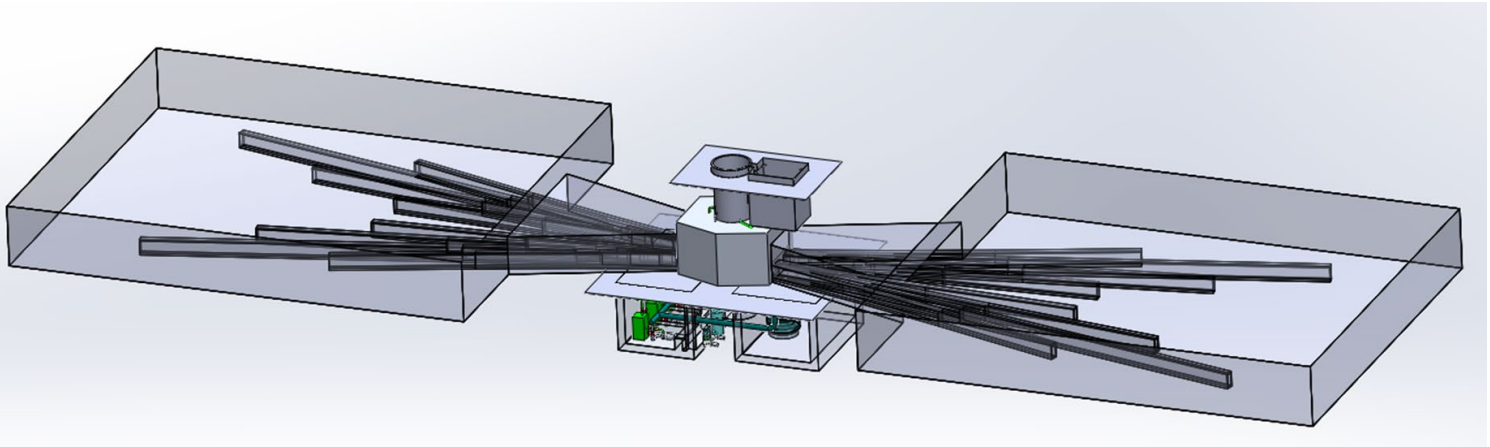
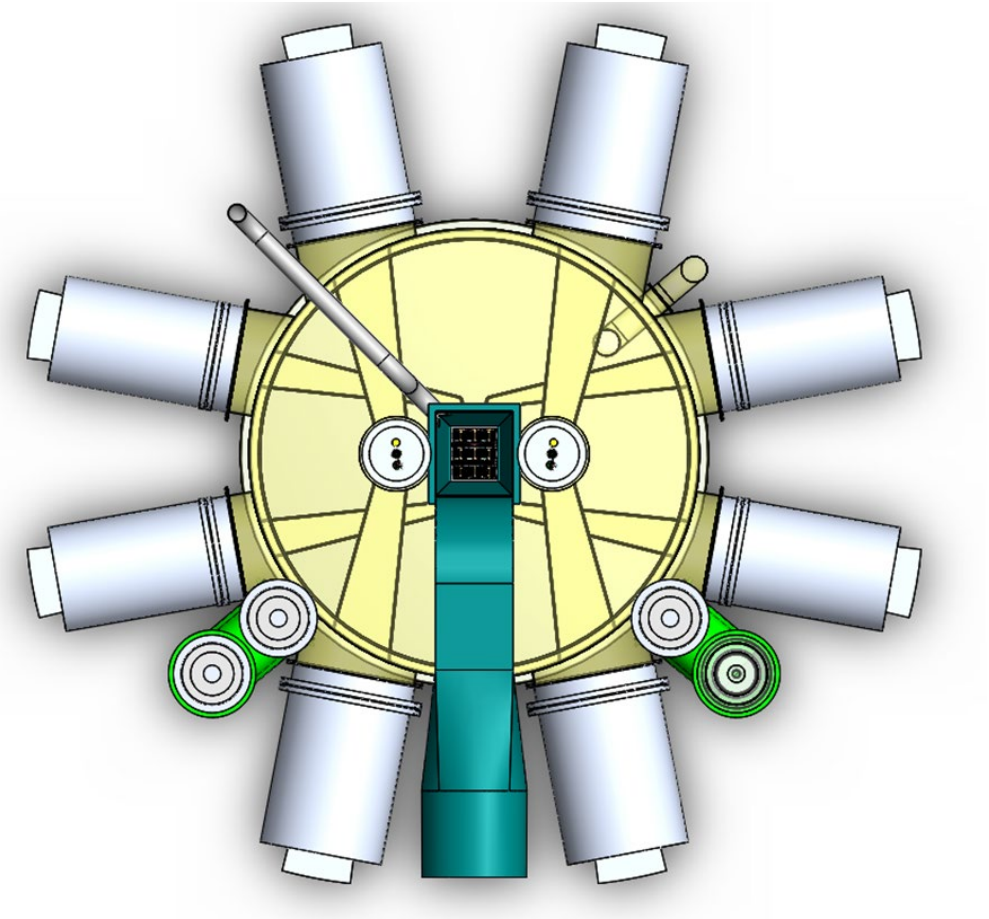
A replacement reactor for NIST and the Nation





CHIPS and Science Act

SEC. 10231. NEUTRON SCATTERING.

(a) STRATEGIC PLAN FOR THE INSTITUTE NEUTRON REACTOR.— The Director shall develop a strategic plan for the future of the NIST Center for Neutron Research after the current neutron reactor is decommissioned, including—

(1) *a succession plan for the reactor, including a roadmap with timeline and milestones*;
(2) *conceptual design of a new reactor and accompanying facilities, as appropriate*; and
(3) *a plan to minimize disruptions to the user community during the transition*.

(b) COORDINATION WITH THE DEPARTMENT OF ENERGY.— The Secretary, acting through the Director, shall coordinate with the Secretary of Energy on issues related to Federal support for neutron science, including estimation of long-term needs for research using neutron sources, and planning efforts for future facilities to meet such needs.

(c) REPORT TO CONGRESS.—
Not later than 30 months after the date of enactment of this Act, the Director shall submit to Congress the plan required under subsection (a), and shall notify Congress of any substantial updates to such plan in subsequent years.

2021 NASEM Panel

Recommendation from the 2021 Assessment of the NCNR

The Director of the NCNR should take a leadership role in advance planning for a replacement reactor with full support of NIST. The Director of the NCNR should commission a study to define what the research community needs for the next 50 years in addition to the economic study already commissioned.

Abbreviated outline for the “plan”

I. EXECUTIVE SUMMARY

II. GOAL → “What do we want to do?”
- A. Summary of the Succession Plan for the NIST Reactor
- B. Roadmap (incl. estimated timeline)
- C. Cost Estimates

III. JUSTIFICATION → “Why do we want to do it?”
- A. Economic Benefits to the Nation
- B. Benefits to NIST & other agencies (NIH, DOD, DOT, …)
- C. Benefits to US scientific community

IV. EXECUTION → “How will we do it?”
- A. Pre-conceptual Design of a Replacement Reactor and Accompanying Facilities
- B. Plan to Minimize Disruptions to the User Community during the Transition

Approach to producing this plan

1) Pre-conceptual Design Report for a New Reactor
   incl. a chapter on conventional facilities (nearing completion)
2) Economic Impact Study (nearing completion)
3) NIST Needs Assessment
4) Scientific Community Workshop
5) Interagency Coordination

Neutrons for NIST

NIST Needs Assessment

- Neutrons for industrial stakeholders
  - Neutron imaging
  - Neutron scattering
  - Radiochemistry
- Nuclear Chemistry & Radiochemistry
  - Standard Reference Materials
- Standards and Calibrations
  - National neutron fluence standard
  - Standard cross-sections
- Neutron Physics
  - Precision measurements of neutron β-decay

NIST SRM 2706 - New Jersey Soil

Organics and Trace Elements includes trace elements, rare earth elements, polycyclic aromatic hydrocarbon, and chlorinated dibenzo-p-dioxin congeners necessary for environmental science

Neutrons for NIST

Empanel a NIST working group with representation from:

1) Standards Coordination Office

2) Material Measurement Laboratory

- Chemical Sciences Division
- Materials Science and Engineering Division
- Materials Measurement Science Division
- Biomolecular Measurement Division

3) Physical Measurement Laboratory

- Radiation Physics Division

4) NIST Center for Neutron Research

5) Program Coordination Office

Workshop - Neutrons for the Future

Neutrons for the Future

Program Co-chairs

Stephen Wilson
Mike Hore

Organizing Committee

Rob Briber
Lisa Press
Peter Gehring
Dan Neumann
Pappannan Thiyagarajan
Jim Rhyne
Joe Dura

https://neutronsforthefuture.umd.edu/

What we need from this workshop

I. EXECUTIVE SUMMARY

II. GOAL → "What do we want to do?"

- A. Summary of the Succession Plan for the NIST Reactor
- B. Roadmap (*incl*. estimated timeline)
- C. Cost Estimates

III. **JUSTIFICATION → "Why do we want to do it?"**

- A. Economic Benefits to the Nation
- B. Benefits to NIST & other agencies (NIH, DOD, USGS, DOT, …)
- C. **Benefits to US scientific community**

IV. EXECUTION → "How will we do it?"

- A. **Pre-conceptual Design of a Replacement Reactor and Accompanying Facilities**
- B. **Plan to Minimize Disruptions to the User Community during the Transition**

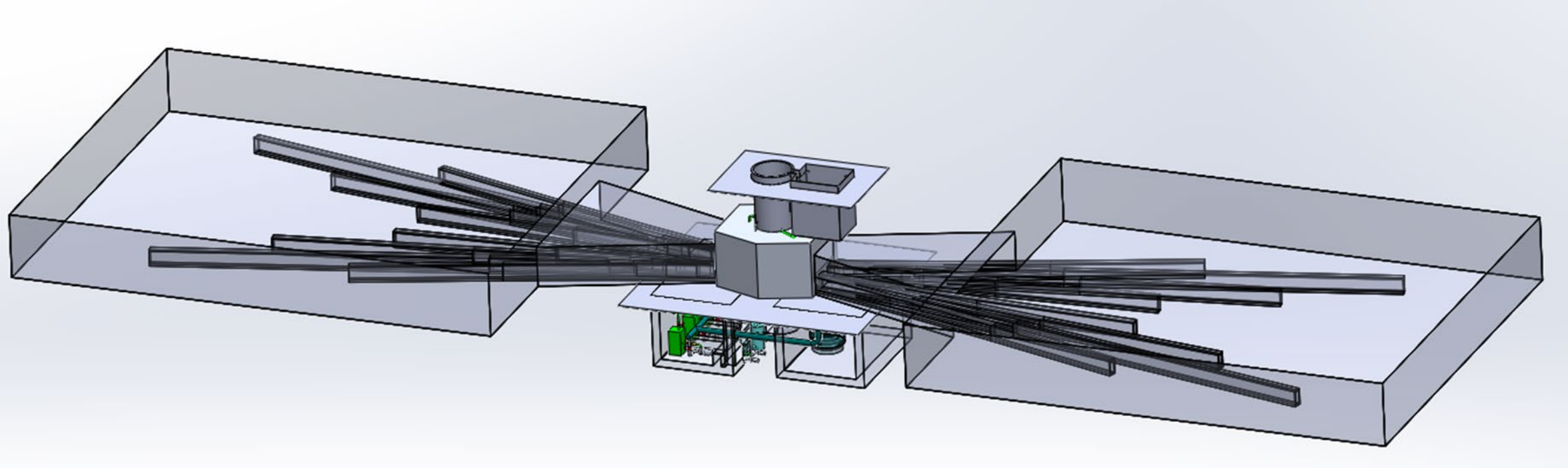
Design Principles

1) *Reliable, Simple, Safe, and Cost-effective* reactor operations
2) Significantly *increase capacity* for US neutron research
3) Significantly *increase data rates* compared to our current instruments
   a) Improved instrument design (incl. optics)
   b) Place cold sources in a higher flux region

Preconceptual Design

2 guide halls along with the 2 cold neutron sources

=> space for 40 cold neutron instruments



8 thermal beam tubes

=> space for 10 thermal neutron instruments

What should this workshop accomplish

The main vehicle for input will be a Workshop Report

We will use this report to inform “the plan”

We intend that your report will be a NIST Special Publication

It will be available to NIST and DoC Senior Leadership & Congress

Each of the breakout groups will produce a chapter (5 pages or so) which will address the charge to your group

The program co-chairs (with our help) will produce an Executive Summary

Reports are due to Stephen Wilson and Mike Hore by November 8.

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Each of the 9 science-based breakout groups will produce a chapter that addresses:

Science Drivers for Neutron-Based Research

Describe the scientific and technical drivers for future neutron-based research in the focus area of your panel. Include the expected impact of neutron measurements on science and technology and their ability to address emerging national priorities.

Societal Impact and National Benefit of Neutron-Based Research

Identify the benefits to US economic development, national priorities, and infrastructure that are enabled via neutron research.

New instruments and new reactor's ability to facilitate science

Assess the ability of the current plans for the reactor and cold source(s) to provide industrial, academic, and government researchers with the necessary tools and infrastructure to address the identified national priorities in the focus area of your panel. What changes or other specialized facilities would you like to see?

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The Source Performance breakout group should address:

National need for a new reactor

Assess the ability of the current plans for the new reactor and cold source(s) to provide industrial, academic, and government researchers with the necessary tools and infrastructure to address national priorities.

Reactor and source design recommendations

Identify the key attributes of the reactor design and their impact on national priorities and science needs. What changes or other specialized facilities would you like to see?

The Transition breakout group should address:

Recommended pathways for transitioning to new reactor source

Describe the considerations and steps required to minimize disruptions to the user community during the transition from the current facility to a future one.

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The Accompanying Facilities breakout group should address:

Transition process impacts

Estimate the potential impacts to the operation of existing facilities, and the development of new ones, during the transition to a new reactor.

Recommended suite of accompanying facilities at a new reactor

Identify the-accompanying facilities (including labs, sample environments, IT, shops, etc.) required to provide industrial, academic, and government researchers with the necessary tools and infrastructure to impact science and technology.

Identify any technological and instrument developments required in the early stages of the project to address emerging national priorities effectively.

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12 breakout groups

Soft Matter – Structure
Monroe Room
Xiadan Gu & Lynn Walker
Scribe: Peter Beaucage

Soft Matter - Dynamics
Truman Room
Matt Helgeson & Gerald Schneider
Scribe: Liz Kelley

Biosciences
Wilson Room
Frank Heinrich & Hugh O'Neil
Scribe: David Hoogerheide

Energy and the Environment
Lincoln Room
Kate Page & Efrain Rodriguez
Scribe: Hayden Evans

Hard Matter - Structure
Jackson Room
Dustin Gilbert & Stuart Calder
Scribe: Jonathon Gaudet

Hard Matter - Dynamics
Adams Room
Martin Mourigal & Chen Li
Scribe: Rebecca Dally

Engineering
Randolph Room
Adrian Brugger
Scribe: Jake LaManna

Neutron Physics
Twinbrook Room
Brad Plaster
Scribe: Shannon Hoogerheide

Source Characteristics
Jefferson Room
Chris Stock & Megan Robertson
Scribe: Osman Celikten

Accompanying Facilities
Montrose Room
Mark Lumsden
Scribe: Ryan Murphy

Transition Process
Democracy Room
Drew Marquardt
Scribe: Dan Adler

Nuclear Chemistry & Radiochemistry
Executive Lounge
Raymond Cao
Scribe: Jamie Weaver

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A replacement reactor for NIST and the Nation

The “plan” is due to the NIST Program Coordination Office by November 1, 2024