

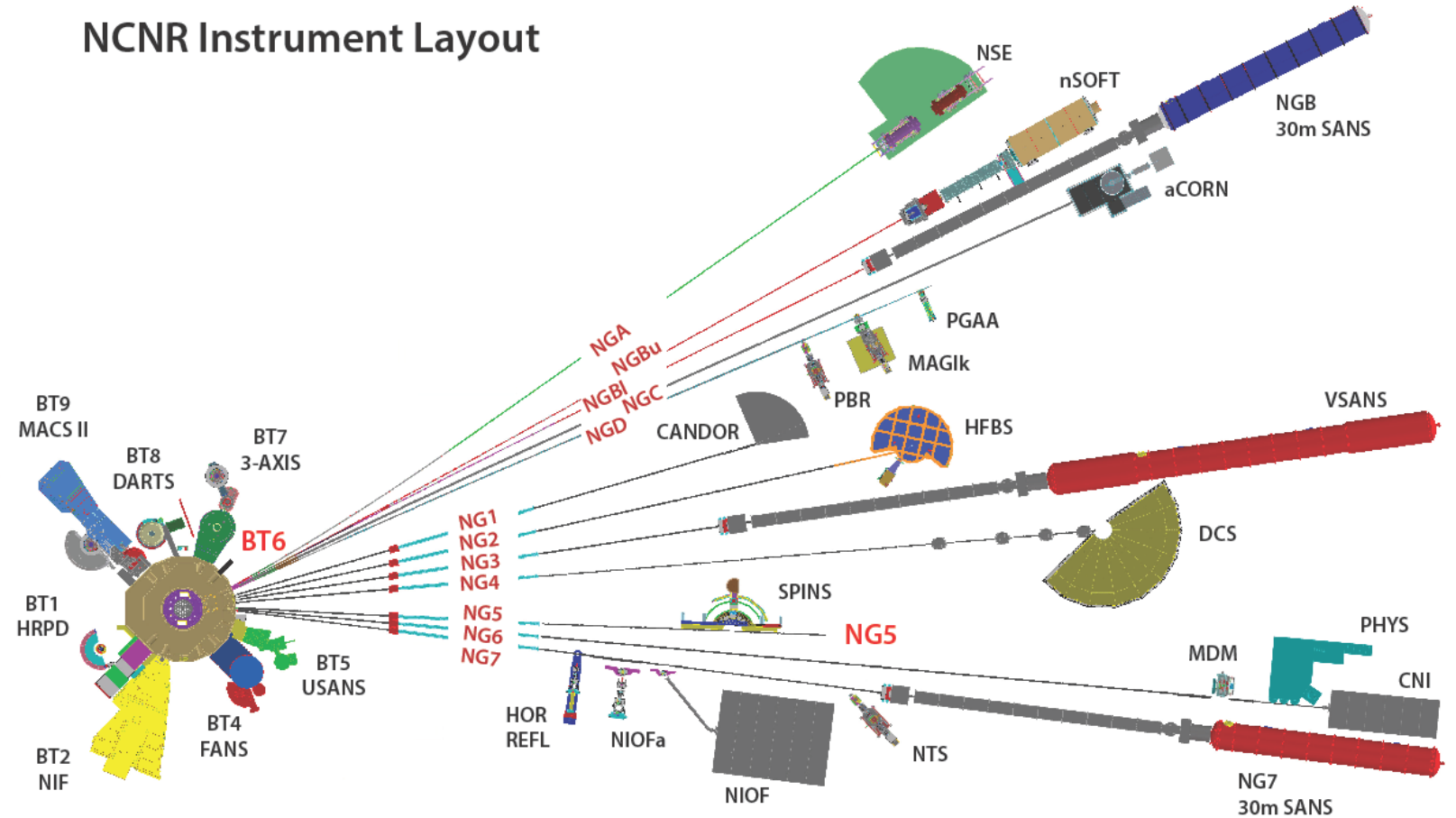
NBSR Recovery and Restart

Thomas Newton, Ph.D.

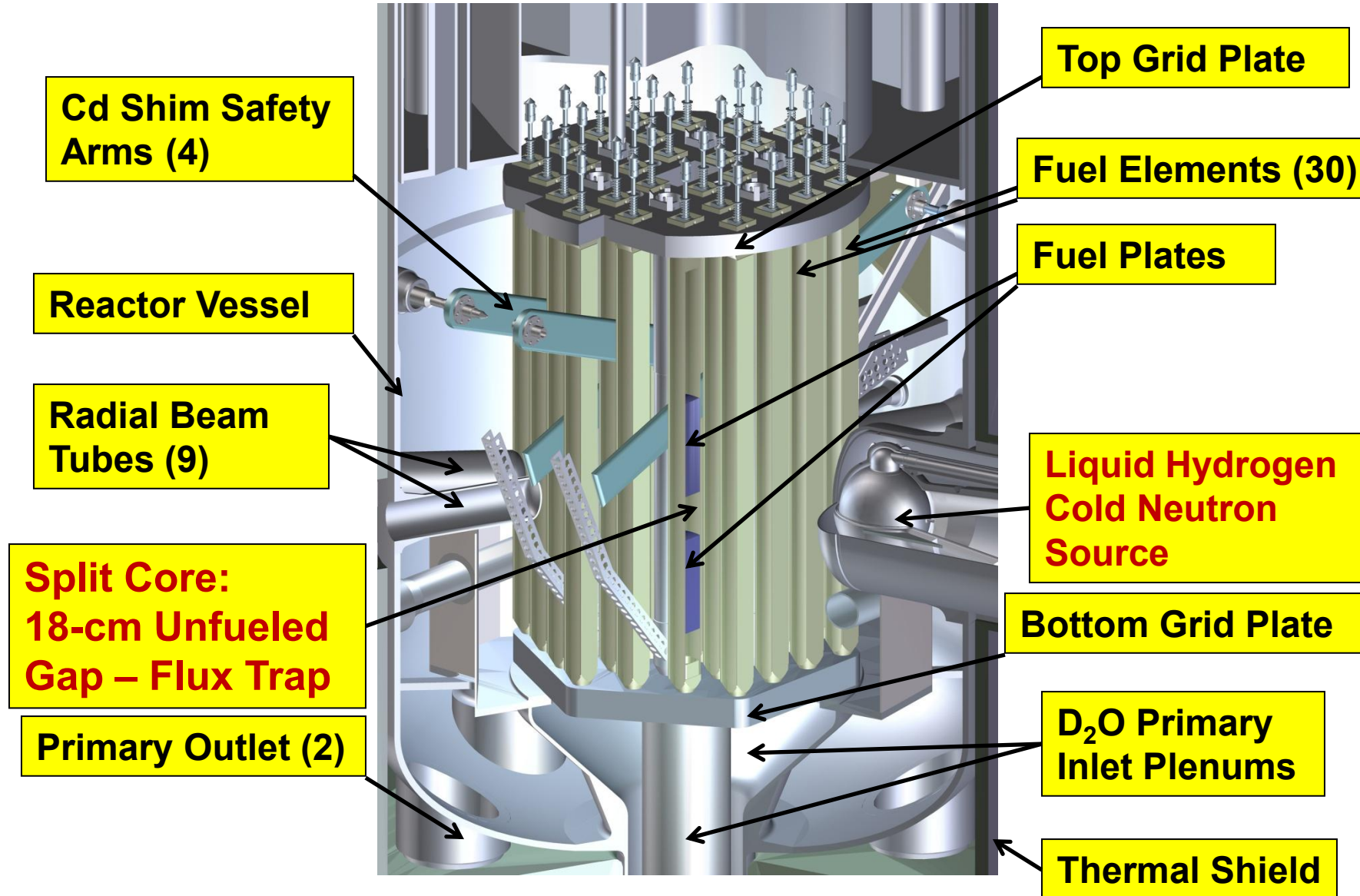
Deputy Director and Chief of Reactor Operations and Engineering
NIST Center for Neutron Research

- One of Three Major Neutron Science Centers in the US
- Hosts > 3000 research participants annually
- Neutrons supplied by 20 MW reactor
- Reactor operates on a 38 day fuel cycle
- Fuel in for 7 or 8 cycles

NCNR Instrument Layout



Cut-away View of the NBSR Core



Refueling

D₂O coolant: refueling is done blind

All 30 elements are moved each refueling

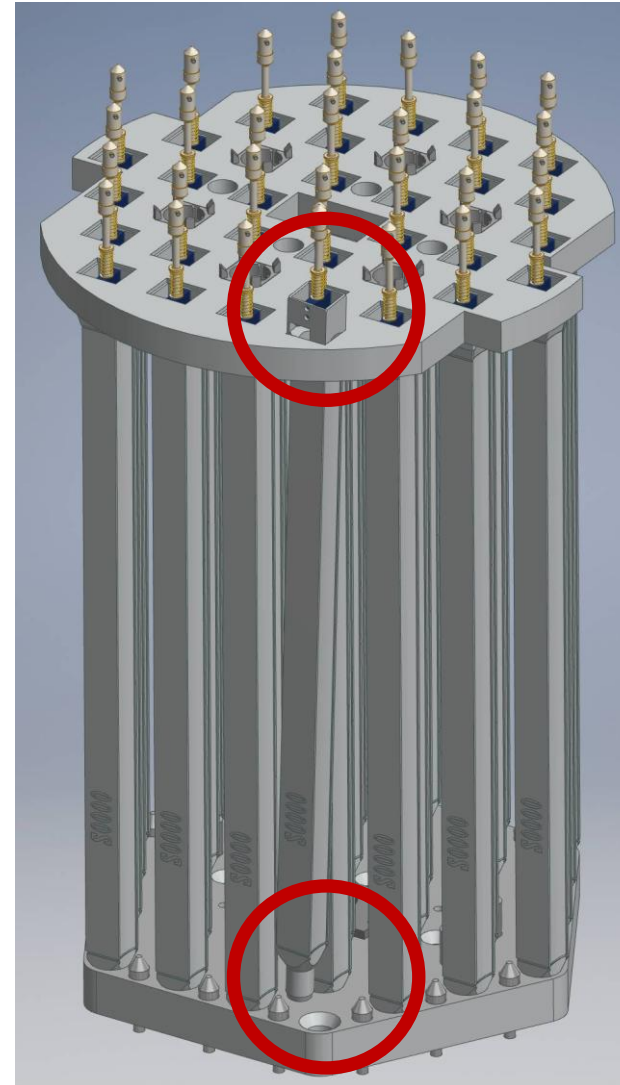
- Each core position has its own transfer tool
- Elements are moved via transfer arms, lowered into core, then latched into position



Refueling the NBSR (2010)

Dislocated Fuel Element in Core

- Latching and latch checks were done incorrectly during a refueling on Jan 4, 2021.
- Routine starting and stopping of primary pumps “pushed” the element into an area outside of flow.
- Feb 3, 2021 startup to near full power resulted in fuel element melting, declaration of an Alert and evacuation of confinement.
- Subsequent analysis determined that 450°C Fuel Safety Limit had been exceeded



- **Change management program**
- **Inadequate management oversight**
- **Culture of complacency, lack of ownership of continuous improvement.**
- **Operator training and qualification program**
- **Procedure use and adherence.**
- **Equipment and tools.**

Restart Request

- **October 1, 2021:** restart request submitted to NRC including root causes, and corrective actions
- **NIST provided further supplements by letters between June through November, 2022, discussing the completion of actions necessary to support restart.**
- **Three license amendments:**
 - Revised fuel latching checks (approved July 2022)
 - Operation with debris (approved February 2023)
 - Non-standard fuel loading (approved March 2023)
- **NRC supplemental inspection began August 15, 2022**
- **Nov. 28, 2022:** NRC completes restart audit process
- **March 6, 2023:** Restart permission given



Refueling in preparation for reactor restart

Confirmatory Order

Issued August 1, 2022.

- 1. Communications to staff**
- 2. Nuclear Safety Program Assessments (8 over three years)**
- 3. Training improvements**
- 4. Procedure enhancement (600+)**
- 5. Benchmarking with other facilities**
- 6. Employee engagement (rewards and recognition)**
- 7. Leadership accountability**
- 8. Engineering technical issues**

All items completed May, 2026

Enclosure A

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	Docket No.: 05000184
National Institute of Standards and Technology)	)	License No.: TR-5
Center for Neutron Research)	)	
U.S. Department of Commerce)	)	EA-21-148

CONFIRMATORY ORDER MODIFYING LICENSE
EFFECTIVE UPON ISSUANCE

The National Institute of Standards and Technology (NIST), Center for Neutron Research (NCNR or licensee), U.S. Department of Commerce (DOC) is the holder of License No. TR-5, issued by the U.S. Nuclear Regulatory Commission (NRC or Commission) pursuant to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR). NIST refers to the larger National Institute of Standards and Technology organization while NCNR refers specifically to the licensee and operator of the National Bureau of Standards Test Reactor (NBSR or reactor). The license authorizes the operation of the NBSR in accordance with conditions specified therein. The facility is located on the NIST campus in Gaithersburg, Maryland.

This Confirmatory Order (CO) is the result of an agreement reached during an Alternative Dispute Resolution (ADR) mediation session conducted on May 10, 2022, May 19, 2022, and June 2, 2022, to address seven apparent violations.

Return to Operations -- 2026

- In early 2026, NCNR had one SRO with an active license
- Engagement of NRC to requalify 8 SROs
- Low power operations to bring quals current
- April: Internal operations and written exam– monitored by NRC
- May: short-term power ascension to 20 MW
 - Fission products still present, much better containment in reactor He sweep system
 - Effluents much lower
- July: NRC licensing exam for 6 candidates (5 RO and 1 SRO)
 - All passed
 - Sufficient (barely) to run 24/7
- August: Return to 20 MW neutron science operation
- Completion of first cycle Sept. 13.
- Return to “routine” operations cycles in October



Summary and Discussion

- After 5 years of outstanding efforts by Reactor Operations, Engineering, Health Physics staff (and NRC!), the NCNR is back to 20 MW science operations
- Vast improvements made in procedures, training, safety culture, and corrective action plans
- Fission products from small amounts of residual material remain, but better sealing of He sweep system has greatly reduced effluent releases

