Brenden Heidrich,
Director

NSUF Users Organization Meeting

March 27, 2025

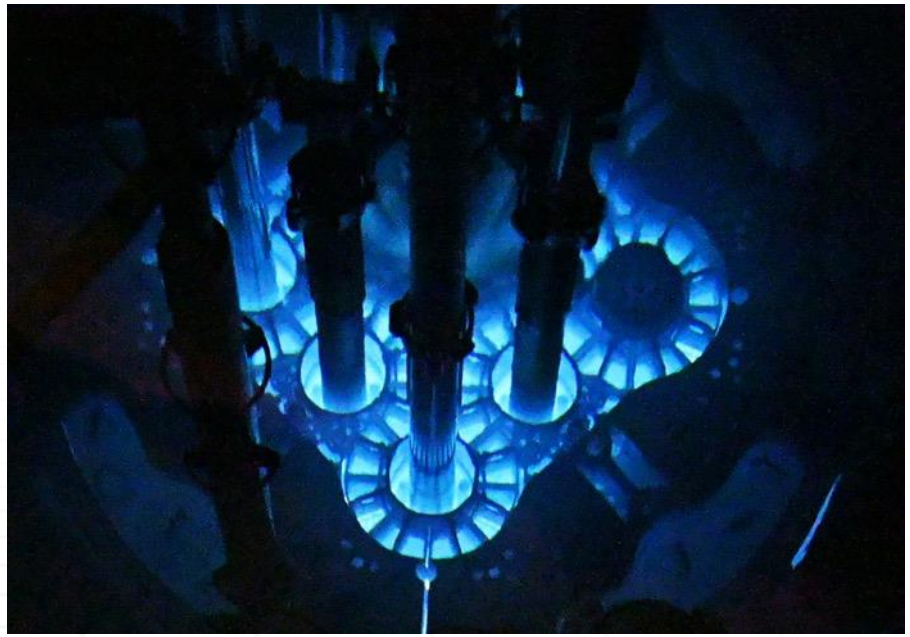
NSUF Program Overview and Update

Nuclear Science User Facilities

INL/MIS-25-83964

The Nuclear Science User Facilities (NSUF) Program

- **Established in 2007**
  - U.S. Department of Energy Office of Nuclear Energy's first & only user facility
- **Founded at Idaho National Laboratory (INL)**
  - INL remains the lead and primary institution
- **NSUF operates similarly to other user facilities in the United States**
  - Fundamental Research - basic and applied research in science and engineering, intended to be published and shared broadly with the scientific community
  - Competitive proposal processes
  - No cost to user for accessing capabilities
  - No travel funding to users, etc.



The Nuclear Science User Facilities (NSUF) Program

Unique aspects of NSUF

Consortium of facilities/capabilities

- 21 institutions across the United States
- >50 major facilities and laboratories
- NSUF efficiently leverages existing investment in physical capabilities by utilizing excess capacity.
- Funding to partners covers only the costs for the awarded access project

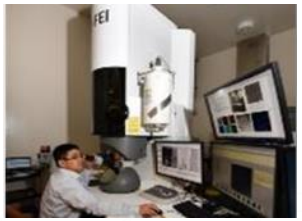
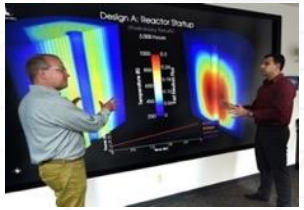
NSUF offers multiple capabilities to a single scientific area

- Fundamental irradiation effects in nuclear fuels and materials important to US nuclear energy development

Projects can last many years

- Major projects can include design, fabrication, transport, irradiation, post-irradiation examination and final disposition.
- All projects are fully forward funded at the start.

NSUF research areas cover all technical readiness levels

Neutron Reactors		12 reactor facilities at national laboratories and universities including the Advanced Test Reactor at INL
Gamma & Ion Irradiation		7 gamma irradiation facilities and 7 ion beam facilities at national laboratories and universities
Post-Irradiation Examination		Multiple hot cell and broad post-irradiation examination facilities including advanced characterization methods
Beamlines		Synchrotron and neutron beamlines for nuclear fuel and materials studies
Computational Resources		Scientific high-performance computing capabilities for advanced modeling and simulation at INL

NSUF offers the best capabilities across the nation

Cutting-Edge Resources: Access to infrastructure and associated capabilities across 21 partner sites

Open access: Available to industry, academia, and national labs for non-proprietary R&D

Education and training: Workshops, webinars, and hands-on skill development

Impact: Increase understanding to drive innovation across nuclear energy technologies

High Performance Computing (HPC) resources

- **NSUF HPC systems support a wide range of users and programs**
- **Windriver (2025)**
  - 6 Petaflops performance (Linpack)
  - 94,416-core Dell CTS-2 system
  - 211 TB total memory
- **Bitterroot (June 2024)**
  - 2 Petaflops performance (Linpack)
  - 43,008-core Dell CTS-2 system
  - 90 TB total memory
- **Hoodoo (2021)**
  - Machine Learning Cluster
  - 108 A100 GPUs
- **Sawtooth (2020)**
  - 5.6 Petaflops performance (was #37 on Top 500 list in 2020)
  - 99,972 compute cores HPE SGI 8600 system
  - 395 TB total memory

Bitterroot & Windriver

Sawtooth

High Performance Computing (HPC)

- **New supercomputer Bitterroot**
  - Over 2000 TFlops of performance
  - 43,008-core Dell Commodity Technology Systems-2 (CTS-2) with each of its 384 nodes having 256 GB of RAM
  - 90 TB of total memory
- Delivered **1,004 million core hours** in FY-24 (65 million core hours more than in FY-23)
- **18 additional nodes added to the Hoodoo system** each with four 40 GB A100 GPUs to further support machine learning workloads
- **Supported 16 trainings** relying on HPC resources
- Procured **two new HPC Systems:**
  - Wind River (deployed in 2024)
  - Teton (to be deployed in 2025)

Image of Bitterroot

NSUF User Access Opportunities –Prior Year Accomplishments

NSUF Funding Calls

- **Consolidated Innovative Nuclear Research (CINR NOFO)**
  - One call per year
  - Projects include design, analyses, fabrication, transport, irradiation, disassembly, PIE, disposition
  - Possibility to also receive user R&D funding on university topic areas
  - Guidance on project costs and timelines

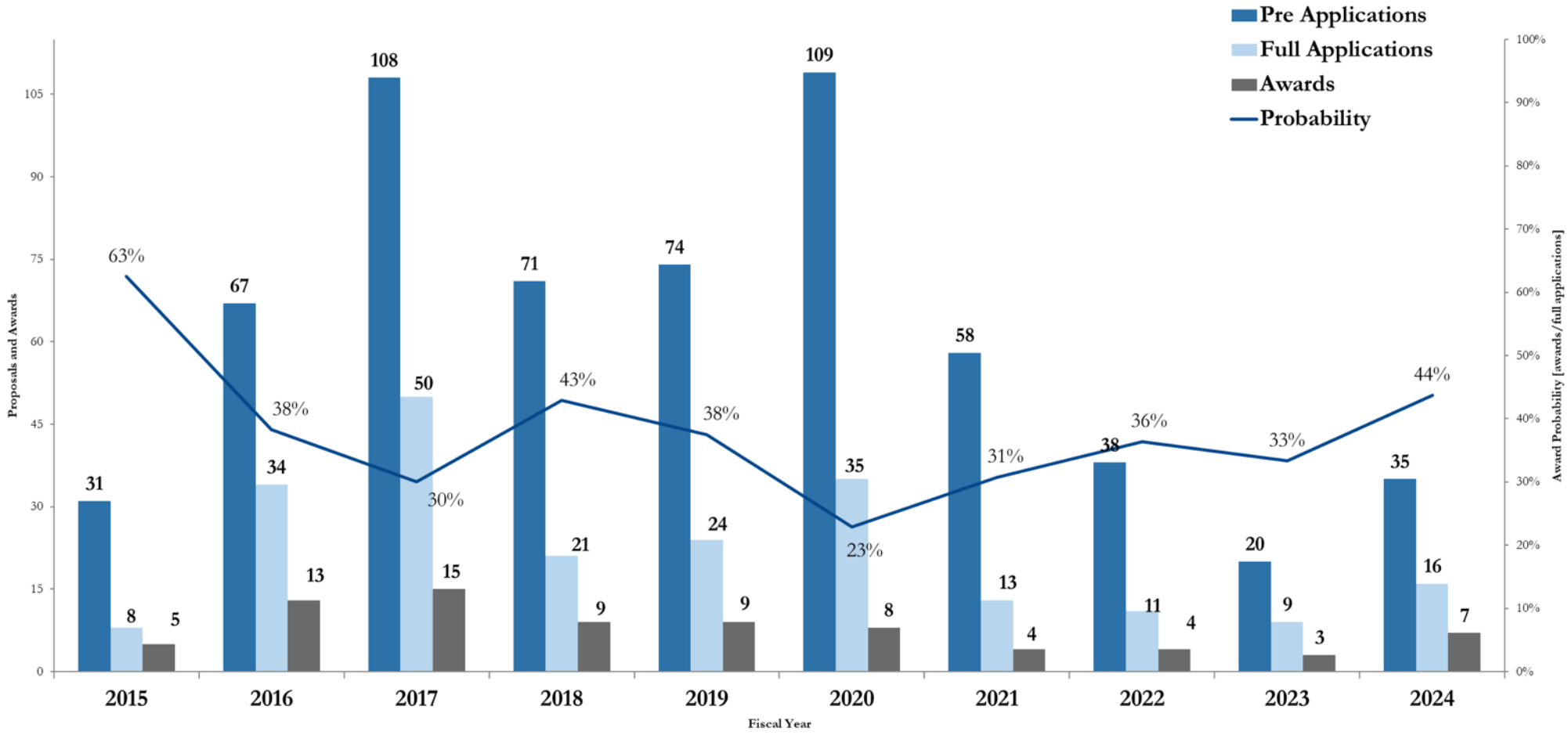
Neutron Irradiation + PIE	$0.5M - $4.0M	≤7 years
Neutron Irradiation only	up to ~$750K	3 years
PIE only	up to $250K	3 years
Ion or Gamma Irradiation + PIE	up to $250K	3 years
Ion or Gamma Irradiation only	up to $100K	3 years
Beamlines at other user facilities	(cost included)	3 years

NSUF Access Award Projects Summary: FY07-FY24

- Total NSUF Access Award Funding: **$137M**
- **823** total projects awarded
  - **45** CINR type projects executed
  - **32** CINR type projects currently ongoing
  - **661** RTEs executed
  - **78** RTEs ongoing
- Awards distribution by institution type
  - **495** projects to **55** U.S. universities
  - **253** projects to **10** national laboratories
  - **35** projects to **13** industrial users*

* All NSUF access awards support non-proprietary fundamental science and are intended for full public release

NSUF User Access Awards - CINR
Large Projects

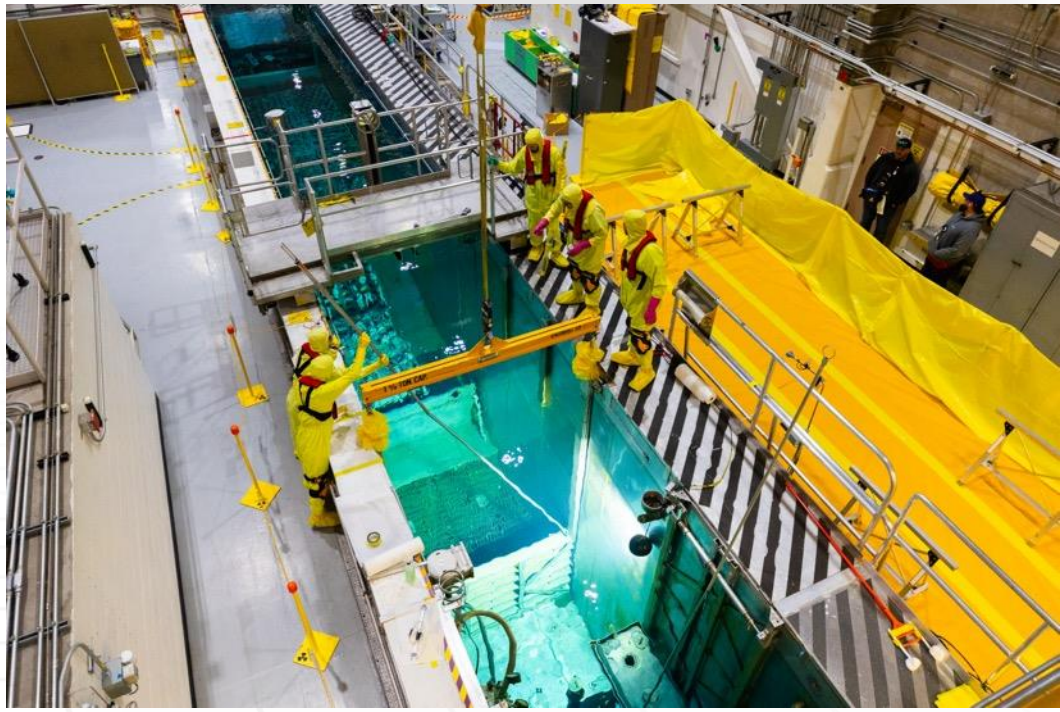


Summary of CINR work in various technical areas

Technical Areas	Number of Awards	Award Years	Access Funding
Fundamentals for Reactor Materials	33	FY15, 16, 17, 18, 19, 20, 21, 22, 23, 24	$26,976,388
Additive / Advanced Manufacturing	11	FY15, 16, 17, 18, 19, 21, 24	$16,928,001
Advanced Fuel Development	12	FY15, 16, 17, 19, 20, 23, 24	$14,494,994
Sensor Development	15	FY15, 17, 18, 19, 20, 21, 24	$9,030,941
Computational Model Development and Validation	6	FY17, 18	$4,714,455
Welding & Joining Advanced Cladding	3	FY16, 17	$1,656,984
Nuclear Materials Discovery & Qualification Initiative	2	FY20, 21	$995,514

NSUF User Access Opportunities:
Rapid Turnaround Experiments

- **Rapid Turnaround Experiments (RTEs) historically have had up to 3 calls/year and 1 SuperRTE (new in FY 24)**
  - Limited funding, executed within 9 months (or 12 months for the SuperRTE)
  - Projects are selected through open competitive proposal processes
  - Proposals welcome from university, government laboratory, industry, and small business researchers
  - Only non-proprietary projects accepted. All awarded projects are fully forward funded



FY24 Rapid Turnaround Experiments Metrics

Standard RTE

Awarded 79 of the 161 proposals (52%)

Metrics for the three FY24 RTE calls:

- 43 awards (out of 94 submitted) to PIs from **U.S. universities** (46%)
- 29 awards (out of 53 submitted) to PIs from **U.S. national laboratories and government entities** (55%)
- 3 awards (out of 7 submitted) to PIs from **U.S. industry** (43%)

SuperRTE

Awarded 13 of the 49 proposals (27%)

Metrics for the single FY24 SuperRTE :

- 7 awards (out of 27 submitted) to PIs from **U.S. universities** (26%)
- 5 awards (out of 17 submitted) to PIs from **U.S. national laboratories and government entities** (29%)
- 1 award (out of 4 submitted) to PIs from **U.S. industry** (25%)

NSUF SuperRTE FY24

SuperRTEs offer a broader scope than a traditional RTE and allow for more time at NSUF facilities:

- Twice the allowable access time at NSUF partner facilities
- Two NSUF partner institutions for post-irradiation examination
- 12-month project duration
- Support for shipping between multiple NSUF partner institutions
- Increased page limit for project narrative

Lessons Learned:

- More interest in SuperRTE than anticipated (49 proposals submitted)
- Subsequent 3rd RTE call received many proposals that did not align with guidelines and were deemed infeasible, irrelevant, or disqualified
- Subsequent 3rd RTE call showed a reduction in overall technical review scores

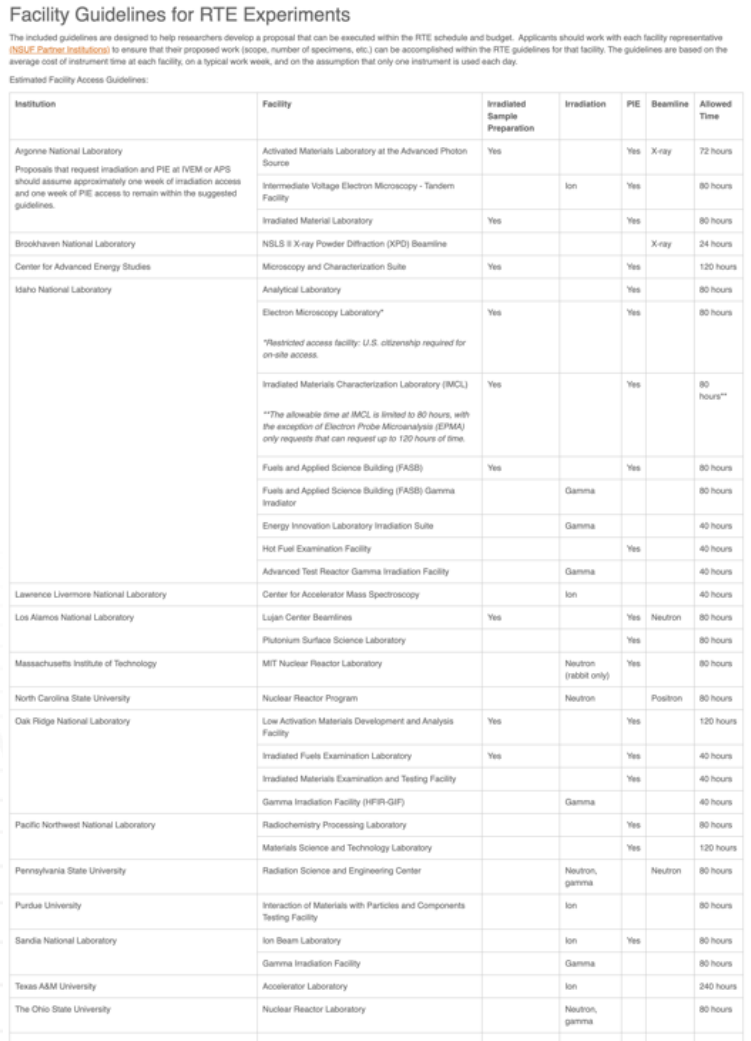
NSUF User Access Awards: Rapid Turnaround Experiments
Small projects

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Proposals	49	75	180	280	185	168	79	77	150	210
Awards	30	39	92	105	99	56	29	30	74	92
Success Rate	61%	52%	51%	38%	54%	33%	37%	39%	49%	44%

NSUF RTE Proposal Updates

RTE rule clarifications

- **Material development** is outside the scope of an RTE
- Proposals requesting **irradiation** without an NSUF post-irradiation facility must include significant in situ monitoring of the device under irradiation sufficient to result in a measurable scientific outcome
- Proposals from **non-U.S. institutions** must have a U.S.-based collaborator who is not an NSUF partner facility point of contact
- **CVs** limited to 2-pages and suggested format is the NSF Biographical Sketch



Facility Guidelines for RTE Experiments

The included guidelines are designed to help researchers develop a proposal that can be executed within the RTE schedule and budget. Applicants should work with each facility representative (NSUF Partner Institutions) to ensure that their proposed work (scope, number of specimens, etc.) can be accomplished within the RTE guidelines for that facility. The guidelines are based on the average cost of instrument time at each facility, on a typical work week, and on the assumption that only one instrument is used each day.

Estimated Facility Access Guidelines:

Institution	Facility	Irradiated Sample Preparation	Irradiation	PIE	Beamline	Allowed Time
Argonne National Laboratory Proposals that request irradiation and PIE at IVEM or APS should assume approximately one week of irradiation access and one week of PIE access to remain within the suggested guidelines.	Activated Materials Laboratory at the Advanced Photon Source	Yes		Yes	X-ray	72 hours
	Intermediate Voltage Electron Microscopy - Tandem Facility		Ion	Yes		80 hours
	Irradiated Material Laboratory	Yes		Yes		80 hours
Brookhaven National Laboratory	NSLS II X-ray Powder Diffraction (XPD) Beamline				X-ray	24 hours
Center for Advanced Energy Studies	Microscopy and Characterization Suite	Yes		Yes		120 hours
Idaho National Laboratory	Analytical Laboratory			Yes		80 hours
	Electron Microscopy Laboratory* *Restricted access facility: U.S. citizenship required for on-site access.	Yes		Yes		80 hours
	Irradiated Materials Characterization Laboratory (IMCL) **The allowable time at IMCL is limited to 80 hours, with the exception of Electron Probe Microanalysis (EPMA) only requests that can request up to 120 hours of time.	Yes		Yes		80 hours**
	Fuels and Applied Science Building (FASB)	Yes		Yes		80 hours
	Fuels and Applied Science Building (FASB) Gamma Irradiator		Gamma			80 hours
	Energy Innovation Laboratory Irradiation Suite		Gamma			40 hours
	Hot Fuel Examination Facility			Yes		40 hours
	Advanced Test Reactor Gamma Irradiation Facility		Gamma			40 hours
Lawrence Livermore National Laboratory	Center for Accelerator Mass Spectroscopy		Ion			40 hours
Los Alamos National Laboratory	Lujan Center Beamlines	Yes		Yes	Neutron	80 hours
	Plutonium Surface Science Laboratory			Yes		80 hours
Massachusetts Institute of Technology	MIT Nuclear Reactor Laboratory		Neutron (rabbit only)	Yes		80 hours
North Carolina State University	Nuclear Reactor Program		Neutron		Positron	80 hours
Oak Ridge National Laboratory	Low Activation Materials Development and Analysis Facility	Yes		Yes		120 hours
	Irradiated Fuels Examination Laboratory	Yes		Yes		40 hours
	Irradiated Materials Examination and Testing Facility			Yes		40 hours
	Gamma Irradiation Facility (HFIR-GIF)		Gamma			40 hours
Pacific Northwest National Laboratory	Radiochemistry Processing Laboratory			Yes		80 hours
	Materials Science and Technology Laboratory			Yes		120 hours
Pennsylvania State University	Radiation Science and Engineering Center		Neutron, gamma		Neutron	80 hours
Purdue University	Interaction of Materials with Particles and Components Testing Facility		Ion			80 hours
Sandia National Laboratory	Ion Beam Laboratory		Ion	Yes		80 hours
	Gamma Irradiation Facility		Gamma			80 hours
Texas A&M University	Accelerator Laboratory		Ion			240 hours
The Ohio State University	Nuclear Reactor Laboratory		Neutron, gamma			80 hours

NSUF RTE Project Award Updates

Publicizing the Awards

- Application items intended for **public release** (300-word limit):
  - Technical Abstract → Project Summary
  - Program Relevance Statement
- After award announcements are made, some information may be **publicly shared**:
  - Names, institutions, and expertise of principal investigator and team members
  - Hypothesis
  - Work description

NSUF RTE Project Award Updates

Project Timelines and Expectations

- Guidelines provided on RTE page and award announcement letters:
  - To achieve the **9-month RTE project timeline**:
    - Post-irradiation examination (PIE) should be scheduled within 3 months
    - Samples should be sent to the PIE facility within 5 months
    - Project scope should be completed within 9 months
  - To achieve the **12-month SuperRTE project timeline**:
    - PIE should be scheduled within 4 months
    - Samples should be sent to the PIE facility within 7 months
    - Project scope should be completed within 12 months

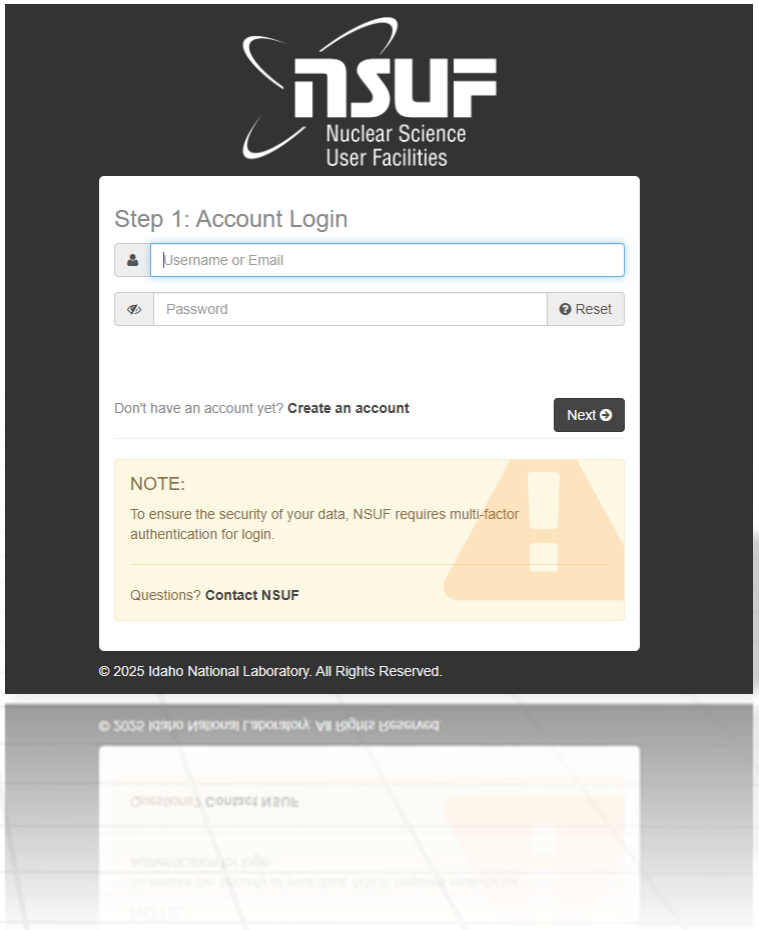
NSUF RTE Completion Reports

- New Completion Report template provided at https://nsuf.inl.gov/Page/rte:
  - Title and Authors
  - Technical Abstract
  - Project Description
  - Results
  - Publications and Presentations
  - Program Relevance
  - References
- Completions reports to be used in NSUF annual reporting
- Delayed public release of the report is possible
  - Notify nsuf@inl.gov upon submission of completion report

NSUF Website Updates

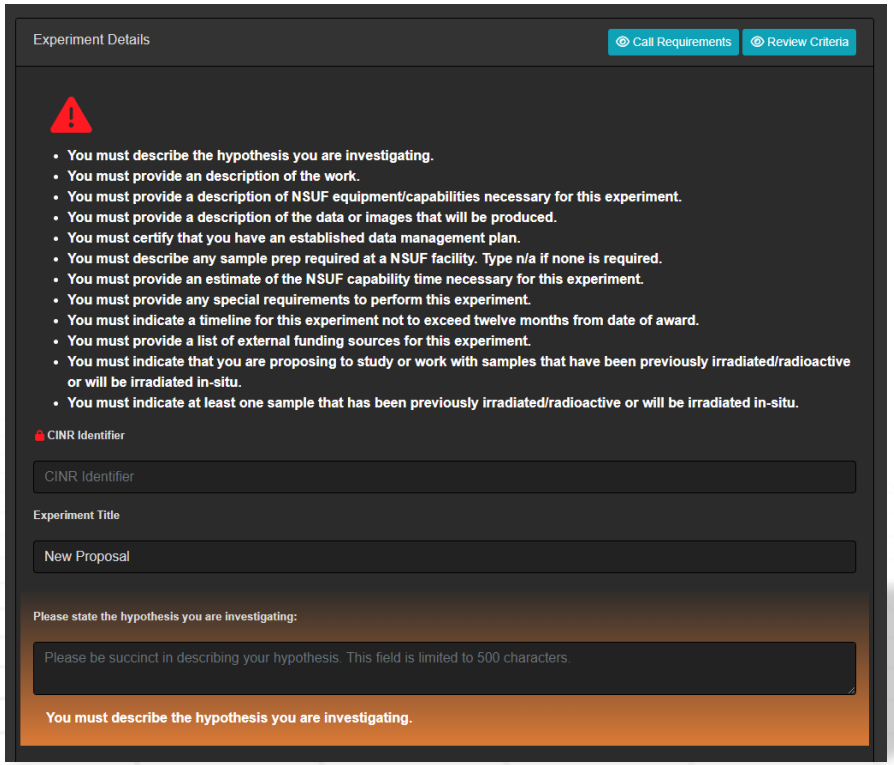
Multi-Factor (MFA) Authentication: A New Secure Login Process

- Data breaches require additional security
- Security features need to be ‘phish proof’
- MFA tokens are:
  - Time based
  - Secure
  - Open source
- Authenticator apps are free, easy to use, and are widely used



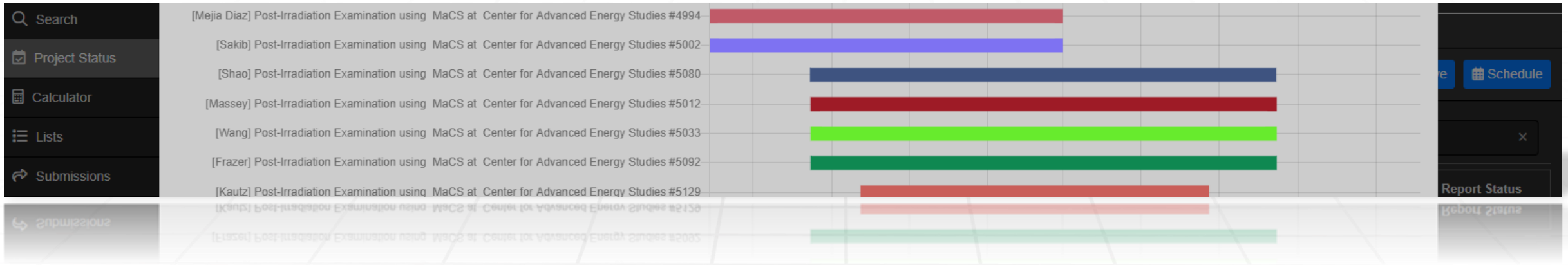
Proposal Validation: Simplifying the Process of Proposing Research

- Validation improvements:
  - Intuitive visual cues
  - Clear messaging
  - Real-time validation
- Proposal process is easier
- User support has improved



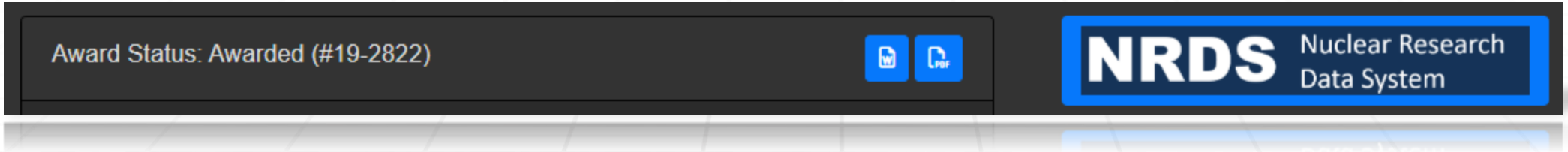
Project Status: Tracking, Scheduling and Reporting

- Project status reporting now officially launched
- Multi-year pilot program completed
- Status reports trigger completion reports
- Easy, simple process



NRDS Integration: The Future of Research Data

- NRDS is now directly integrated with proposals
- This integration fully supports single-sign-on (SSO) with NRDS
- Research data is directly connected with your awarded proposal



NSUF Community Interactions

NSUF Hosts Workshop on Irradiation Testing

Pilot Workshop: May 20-23, 2024 at the Center for Advanced Energy Studies (CAES)

- Outreach to non-nuclear energy specific university-affiliated material science researchers.
- Hosted undergraduate students and faculty from four institutions and five NSUF university partners
- **Participants were introduced to nuclear fuels and materials research through:**
  - Learning from INL staff presentations and tours of the Advanced Test Reactor, Materials and Fuels Complex, Transient Reactor Test Facility
  - Performing hands-on work at the CAES Microscopy and Characterization Suite
  - Collaborating with faculty and NSUF partner representatives to design proposals suitable for an NSUF Rapid Turnaround Experiment

2024 Irradiation Testing Pilot Workshop participants at the Center for Advanced Energy Studies

NSUF Hosts 2024 Science Review Board

August 6-8, 2024 at the Center for Advanced Energy Studies (CAES)

- The **NSUF Science Review Board (SRB)** consists of 10 members from national laboratories, universities and industry to receive program updates, ask questions and discuss opportunities for growth.
- The SRB report provided **assessment and feedback** to the NSUF program in the areas of:
  - Scientific portfolio
  - Data management and sharing
  - Strategic planning
  - Proposal and award policies
  - Instrument Scientist and Nuclear Fuels and Materials Library programs

2024 Science Review Board closing day participants gather for a photo at the Center for Advanced Energy Studies.

Communications Highlights

- Started reconstruction of content **website** pages
  - New format will modernize look and feel, simplify navigation, provide more consistency throughout site
- Initiated a new system for **communications** through **GovDelivery**
  - New templates improve look, feel and brand consistency
  - System provides better efficiency, analytics
- Increased efforts in **brand consistency**
  - New templates for presentations, reports, event planning
  - Brand guide improved to include clearer guidance and best practices

The first Rapid Turnaround Experiment (RTE) call for fiscal year 2025 is now open.

Proposals must be submitted by 4 p.m. MT Oct. 31, 2024.

This award process offers an avenue for researchers to perform irradiation effects studies of limited scope on nuclear fuels and materials of interest utilizing NSUF facilities. Completion of RTE projects is expected within 9 months of award. Prospective researchers are strongly encouraged to request samples from the NSUF Nuclear Fuels and Materials Library.

RTE proposals are typically solicited and awarded three times per year. They are reviewed and evaluated for technical merit, relevancy and feasibility. The number of awards is dependent on the availability of funding. Further explanation of the review process can be found here. Proposals must support the DOE Office of Nuclear Energy mission.

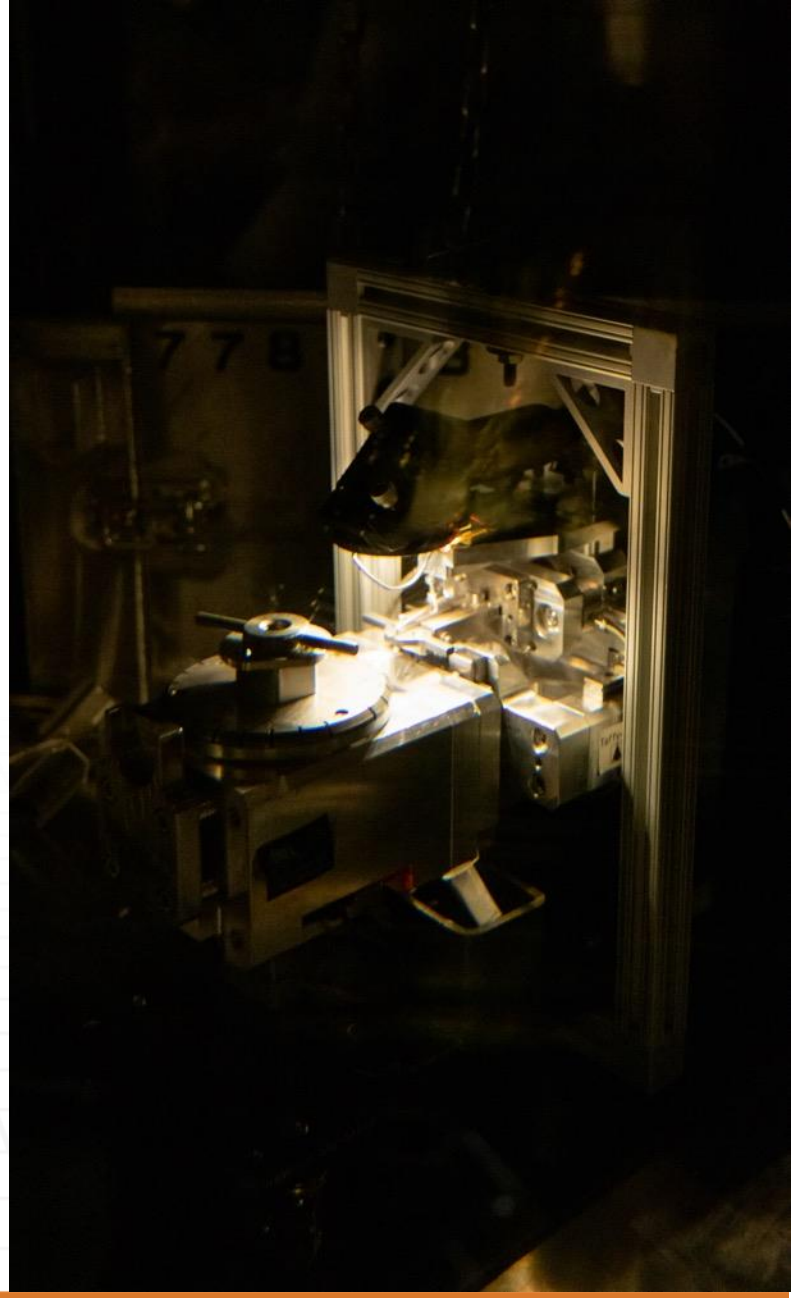
For more information about the RTE rules and requirements, please click here or contact Anna Podgorney (anna.podgorney@inl.gov).

2024 proposal submittal and review schedule

- Oct. 1: Solicitation period opens
- Oct. 15 (10 a.m. MT): RTE Call Seminar
- Oct. 21: Individual Q&A sessions (must be scheduled in advance)
- Oct. 31 (4 p.m. MST): Proposal due date
- Dec. 1 (estimated): Selection review completed
- Feb. 1 (estimated): Proposals awarded

Communications Highlights

- **LinkedIn** page has reached over **900 followers** since its inception in April 2024
- Increased efforts to collect **high quality images and videos** of ongoing NSUF experiments at INL for communication materials
- High-reaching **feature stories**, including:
  - *A smooth ride to the future of nuclear* (INL and DOE-NE news)
  - *U.S. and UK Researchers Fabricate First Capsules for Advanced Reactor Materials Testing* (DOE-NE news)



Nuclear Fuels and Materials Library

Harvesting and Donations

NSUF Nuclear Fuels and Materials Library

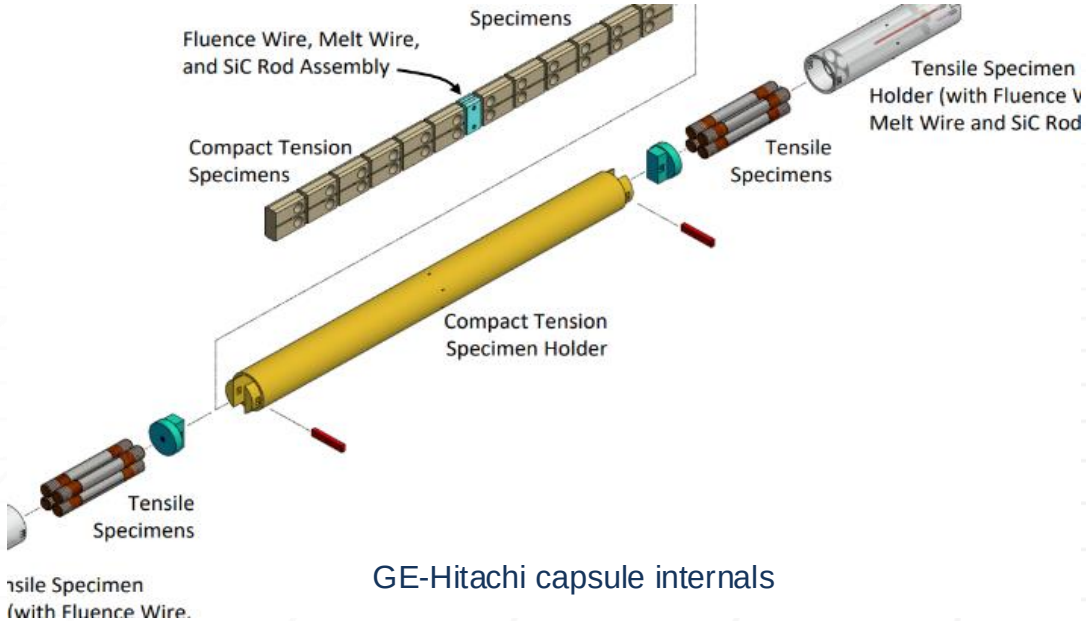
FY24 Additions: Awarded NSUF Project Samples – GE Hitachi

Irradiation Testing of LWR Additively Manufactured Materials

Direct Metal Laser Melting (DMLM) fabricated using 3D printer technology

Compact Tension and Tensile specimens

- Inconel 718 Nickel-base material
- 316L Stainless Steel
- Unirradiated (baseline) specimens



GE-Hitachi capsule internals

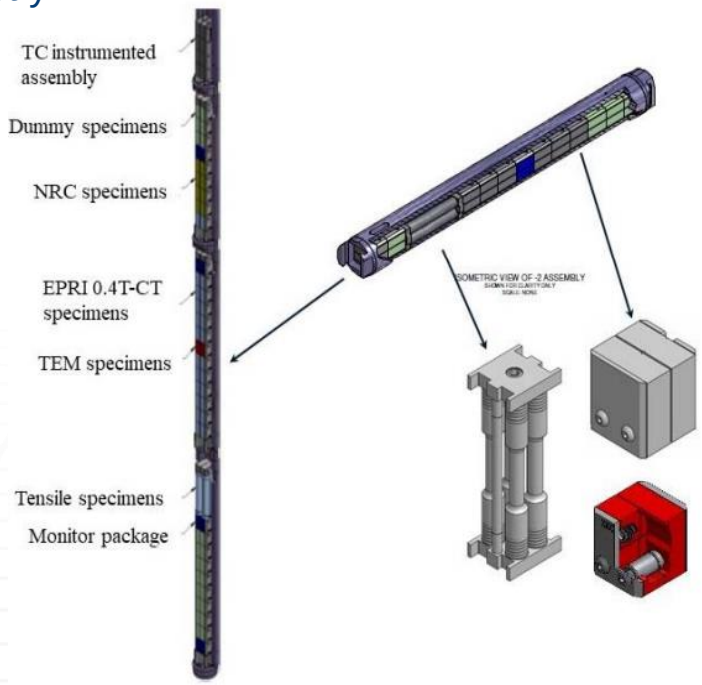
Program	NSUF
Project	Irradiation Testing of LWR Additively Manufactured Materials
Reactor	ATR
Reactor Position	B11
Sample Id Code	16-GEH-001
Material Code	8VT
Material Name	Inconel 718
Material Type Id	Structural Material
Material Description	Inconel 718 Tensile Tested/Broken
KGT Num	EDC-0067 7467
Specimen Type	Tensile
Dimensions	3" x .375" w/ 0.25" gauge (DWG#605755)
Number Of Samples	1
Available for Research	Yes
Availability Date	06/01/24
Certification	Yes
Facility Id	Fuels and Applied Science Building
Notes	LIMS ID = GEH-8VT-718 EDC-0067 7467
Planned Temp	290
Planned Dose	0.5
Planned Fluence	3.5E+20
Planned Flux	1E+21
As Run Total Dose	1
As Run Flux	5.28E+14

NSUF Nuclear Fuels and Materials Library

FY24 Additions: Cooperative Research and Development Agreement

Electric Power Research Institute/NSUF CRADA Pilot Project

- Cooperative Research & Development Agreement (CRADA) between DOE NSUF and EPRI made ATR's capabilities available to universities and the commercial nuclear industry.*
- Research on the samples provided a chance to gather data needed for reactor licenses to be extended 40, 60, and 80 years.
- The project showed that both materials retain a high level of integrity even at the highest fluence.
- Valuable experience was gained in testing protocol and processes, and paved the path for future NSUF experiments on structural materials involving Irradiation Assisted Stress Corrosion Cracking.



Experiment capsules and specimen stack-up

Program	NSUF
Reactor	ATR
Reactor Position	Center Flux Trap
Sample Id Code	EP-1-009
Capsule	EPRI-1
Packet	EPRI-1C-9
Material Code	CT North, BKUP-C 10A0002
Material Name	X-750 and XM-19
Material Type	Structural Material
Specimen Type	Compact Tension (L-T) and Tensile
Number Of Samples	1
Samples Remaining	1
Specimen Availability	Yes
Availability Date	6/1/2021
Date Added	9/23/2024
Facility Id	Hot Fuel Examination Facility

* In 2010 the ATR was primarily used for U.S. Navy and DOE experiments, so opening it up for broader access significantly advanced nuclear research opportunities.

NSUF Nuclear Fuels and Materials Library

FY24 Acquisitions: Continued deliveries from BWXT NOG

Harvested LWR Core Shroud Material

Donor: EPRI/Southern Nuclear/BWXT

- 304 SS core shroud samples (weld and base metal and Heat Affected Zones (HAZ) from a commercial LWR NPP
- Legal transfer of Title and Ownership signed in FY 2022
- Samples delivered in batches from BWXT to INL
- Last shipment arrived in early March, 2025

Program	NSUF
Reactor Id	LWR
Reactor Position	core shroud
Sample Id Code	22-BWXT-01
Material Code	Piece A1
Material Name	304 SS
Material Type Id	Structural Material
Material Description	Piece A Base Metal
Specimen Type	remnant
Dimensions	2" x 1" x 0.063"
Number Of Samples	1
Samples Remaining	1
Specimen Availability Id	Yes
Availability Date	12/5/202
Date Added	3/12/2024
Facility Id	Hot Fuel Examination Facility
Notes	Skim cut of wetted surface. Weight 16 g. Estimated Dose Rate at1' = 8 R/hr
As Run Temp	288
As Run Dose	3.25
As Run Fluence	2.3E+21
As Run Flux	1.00E+10
Material Tags	In-Service LWR, 304, Core Shroud

NSUF Nuclear Fuels and Materials Library

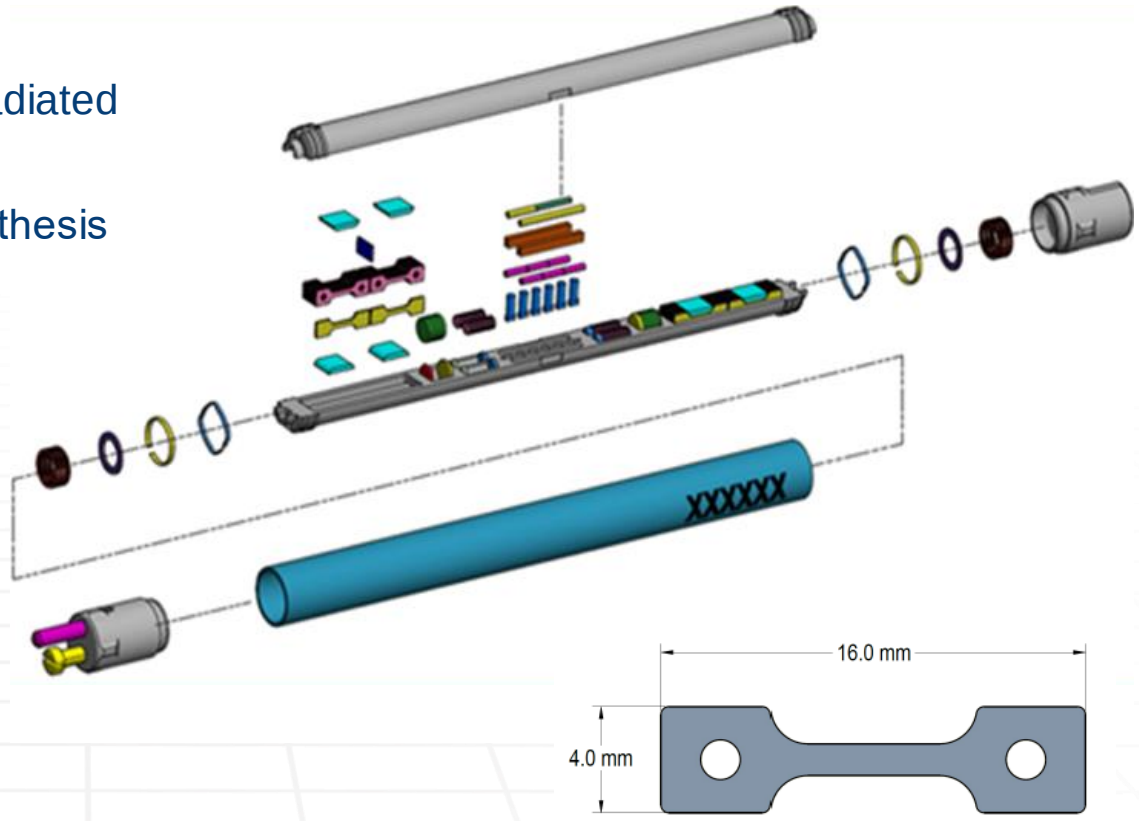
FY24 Acquisitions: LDRD Donation

Tensile Testing Using the Standard Capsule (TTUSC)

Donor: LDRD-Irradiation/NSUF PIE

- ATR-irradiated multi-principal component alloys (MPEA)
- SSJ tensile samples of five or more main components irradiated in the SMSC standard capsule
- LDRD “Combinatorial and High Throughput Materials Synthesis to Advance Nuclear Materials Discovery”

Ti14.60Zr27.82Mo29.26Nb28.33
Cr12.31Ti11.33Zr21.59Mo11.36Nb21.99Ta21.42
Cr15.31Ti14.09V15.00Mo28.25Nb27.35
Ti14.60Zr27.82Mo29.26Nb28.33
Ti12.63Zr24.08V13.44Mo25.32Nb24.52
Ti20.22Mo40.53Nb39.25
Cr13.94Al7.23Zr24.45Mo25.72Nb24.90C3.75
Fe23.45Cr21.83Ni24.64Al3.4Cu26.68
Cr9.63Al5.0Zr16.89Mo17.77Nb17.2Ta33.51
Cr14.48Al7.51Zr25.41Mo26.72Nb25.88
Fe24.33Cr22.65Ni25.56Mn23.93Al3.53
Fe27.83Cr26.31Ni28.96Al16.4Co0.5
Fe21.73Cr20.23Ni22.83Al10.5Cu24.72



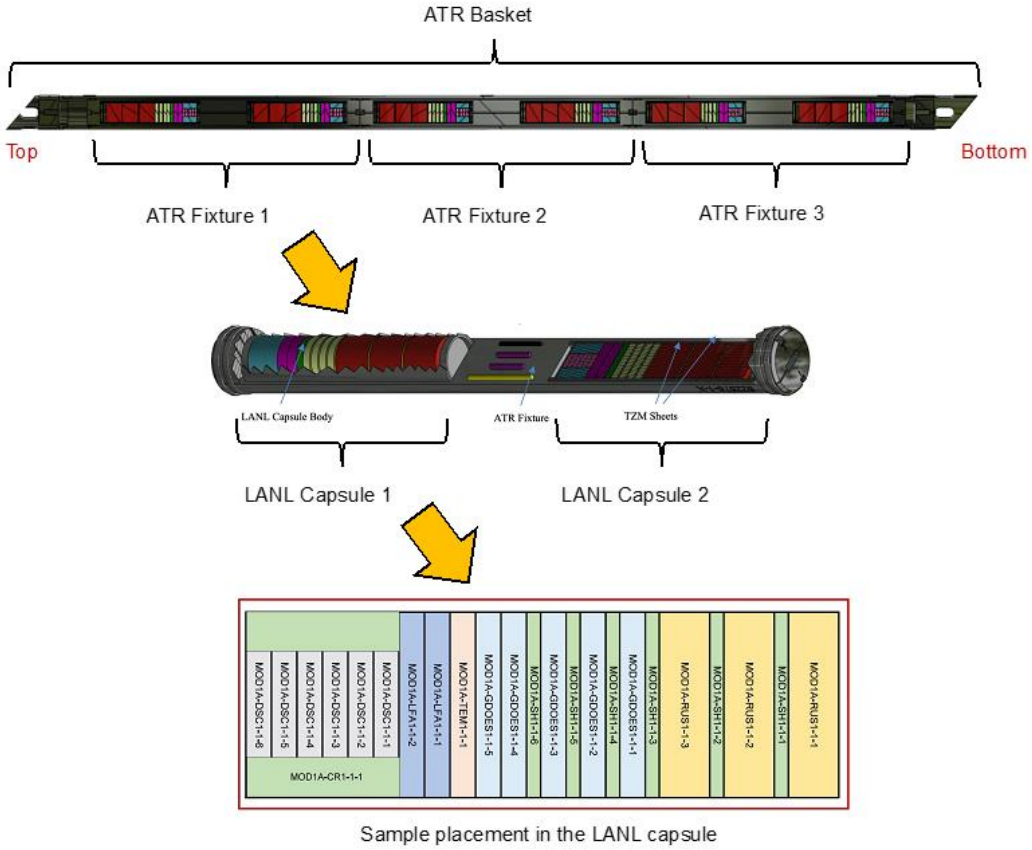
NSUF Nuclear Fuels and Materials Library

FY24 Acquisitions: Microreactor Program Donation

Yttrium-Hydride Solid Neutron Moderator

Donor: DOE-NE Microreactor Program

- ATR-irradiated samples fabricated by LANL
- Yttrium-hydride can be used as a moderator for microreactors or space reactors due to its stability at higher temperatures.



Sample placement in the LANL capsule

SAM-3 Collaborative ATR Irradiation Campaign

- **Objective**
  - Irradiate various structural/cladding materials important to current and advanced civilian nuclear energy technologies
  - Add highly interested/demanded structural/cladding materials from donations and harvesting
    - Materials will be characterized to accelerate nuclear structural/ cladding materials development / qualification / deployment.
- **Approach**
  - Select high priority nuclear structural/cladding materials for irradiation
  - Utilize a standard irradiation capsule design and bounding safety analyses to irradiate structural/cladding material specimens, such as SSJ tensile bars, and 3 & 6 mm disks

Specimen Identification and Prioritization (SIP) Working Group

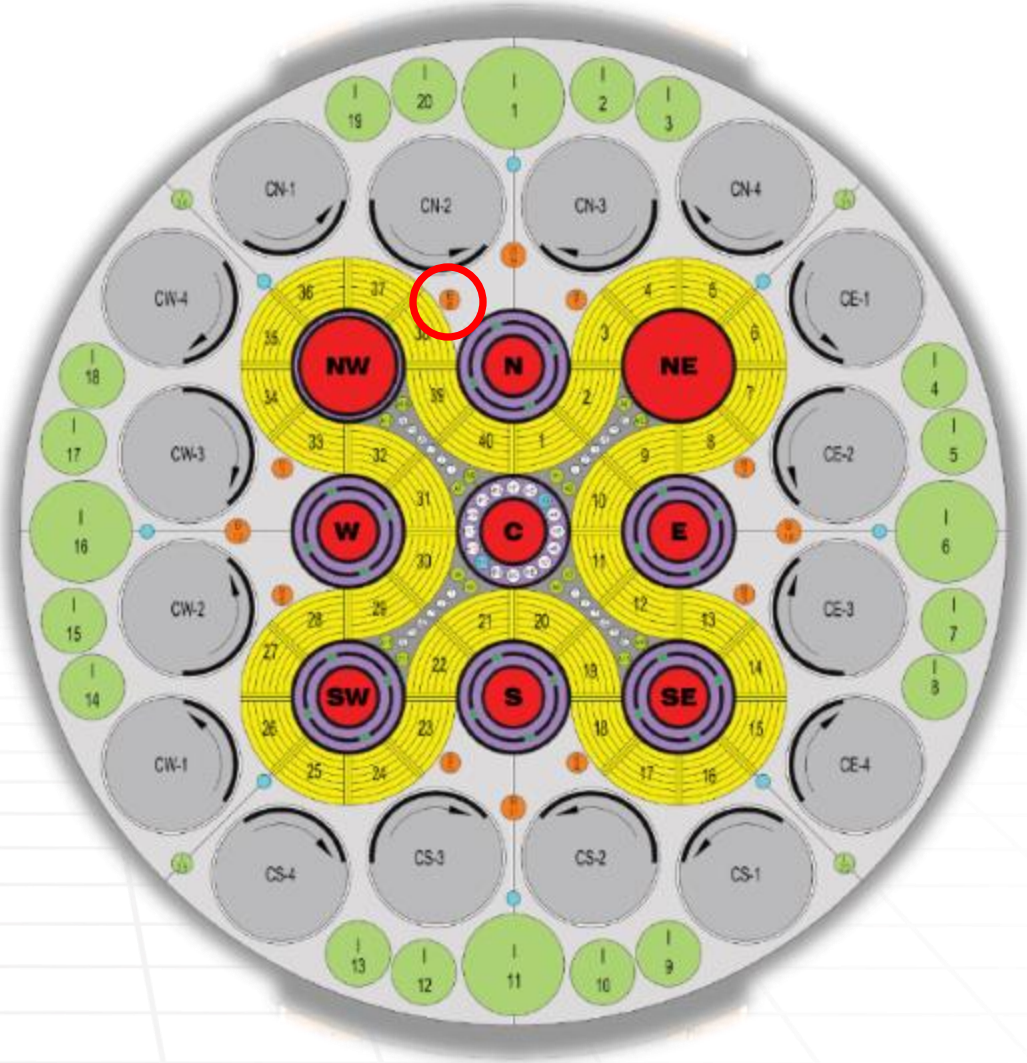
- NSUF has convened a SIP WG of structural/cladding material experts from NSUF stakeholders (DOE-NE, NRC, EPRI, National lab, University) to assist in identifying materials and conditions for the SAM-3 irradiation campaign
- The SIP WG will make recommendations to NSUF and leadership of the DOE-NE for the final prioritization and selection of test materials

Objective of SIP WG

- Determine information on materials of interest for US domestic nuclear energy (fission) applications
- Material data needs and priorities
    a. Materials should be important to the development and deployment of US nuclear reactor technologies
    b. Materials with limited (or no) irradiation testing data
    c. Materials identified as critical or desirable over existing alternatives for advanced reactors
    d. Materials in use, but with an untested manufacturing or treatment process
- Irradiation testing conditions
    a. Specimen geometry needs to fit NSUF Structural Material Standard Capsule (SMSC) (SMSC is limited to 6 mm and 3 mm disks, and SSJ3 tensile specimens)
    b. Irradiation conditions (temperature, fluence, spectrum, dpa, etc.) need to be provided and be achievable at ATR
    c. Special conditions (limited capability for special environments while using the SMSC)

SMSC Capsule Materials and Irradiation Limits

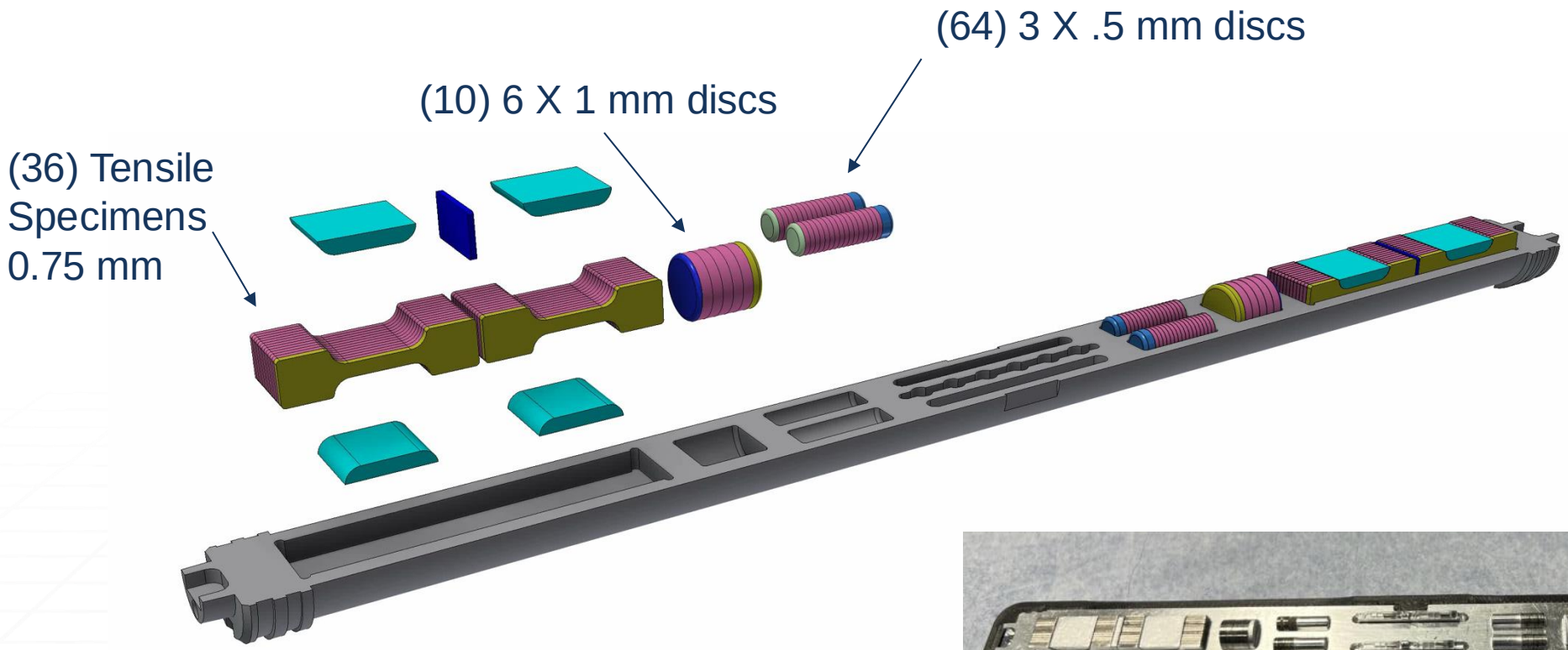
- **Materials**: non-fuel, structural and cladding materials, materials should not be brittle.
- **Maximum dpa**: 6 dpa (in stainless steel)
- **Temperature range**: ~200-700 ˚C.



Experimental Overview

- Drop In materials experiment
  - 6 capsules (initial loading)
- 60 days ATR cycle
- B8 position (“small B”)
- Concept maximizes the efficiency of the ATR, utilizing all three dimensions available

5/8” NSUF Structural Material Standard Capsule (SMSC)



Expected Impacts of the SAM-3 Campaign

- Improved utilization of the NSUF NFML
- Increased integration of NSUF with relevant DOE-NE programs
- Scientific publications
- Talent pipeline (graduate student training, recruitment)
- The knowledge gained from the SAM-3 and resultant PIE studies will accelerate structural materials development/qualification/deployment for advanced nuclear reactor technologies in the US

Questions?

Brenden Heidrich
Director, NSUF
Brenden.Heidrich@inl.gov

NSUF Nuclear Science User Facilities

INL/MIS-25-83964