NSUF Resources and the Combined Materials Experimental Toolkit (CoMET)

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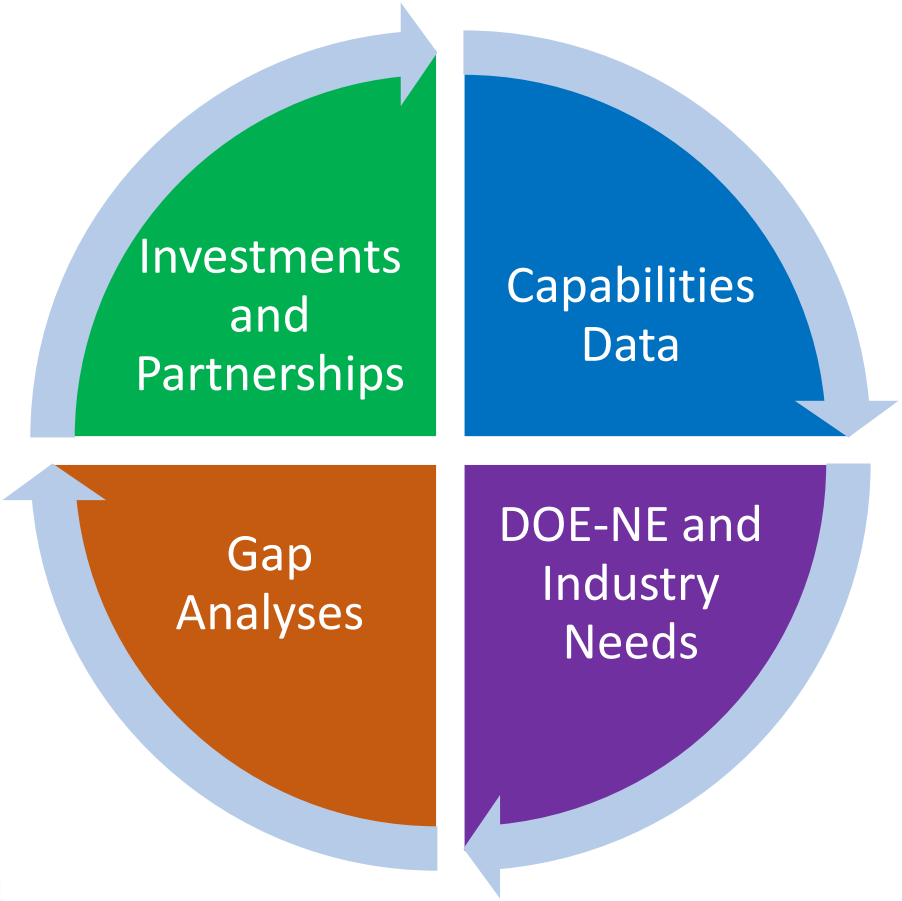
Chief Irradiation Scientist, NSUF
National Technical Director, I2

INL/MIS-18-51686

Integrated Infrastructure Enhancement

1. Gather Data on Nuclear Energy R&D Capabilities
2. Estimate DOE-NE R&D Directions and Industry priorities
3. Provide Gap Analysis Report for Nuclear Energy.
4. Assist funding decisions and incorporate the results into the NEID.

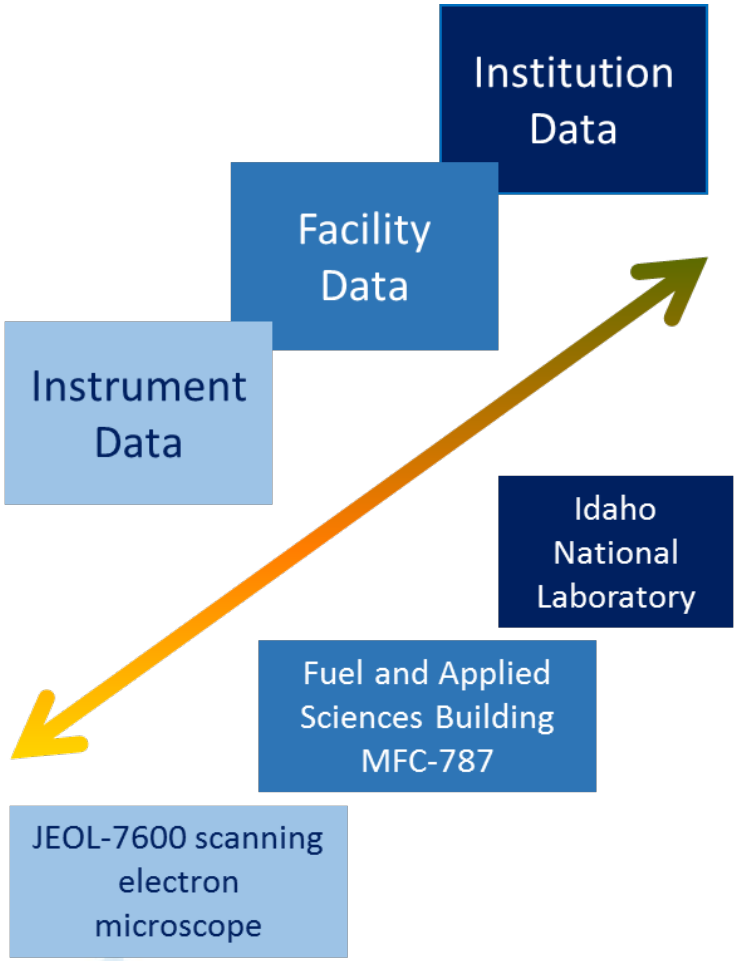


NSUF Information Mgmt Resources

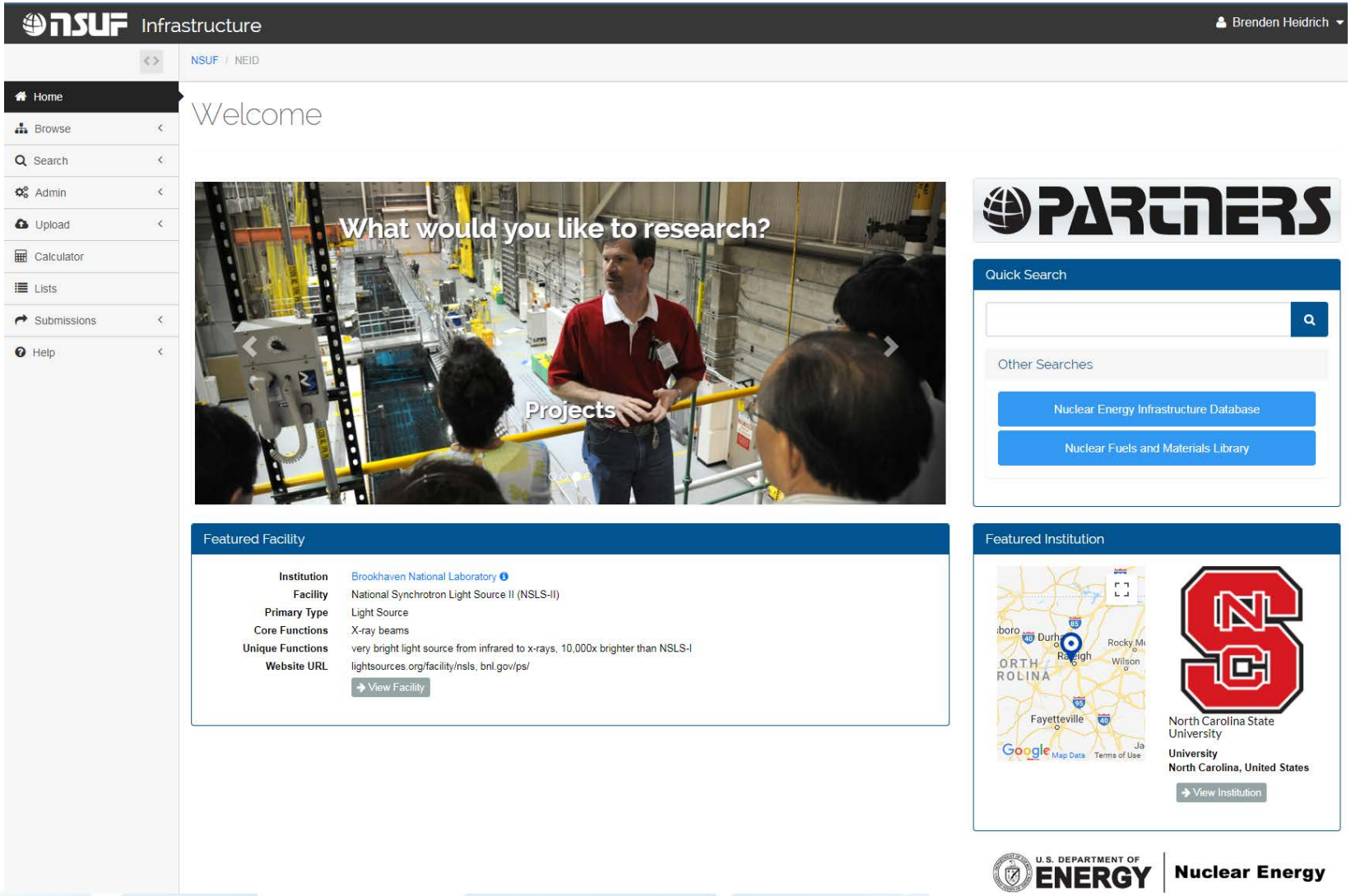
Data Collection and Structure

Direct Infrastructure Sources

1. IAEA Databases (RTF, RTR & Beamline databases)	≤ 2014
2. Facility Site web site	2014
3. Facility NSUF User's Guide	2014
4. Facility Fact Sheets/Annual Reports/etc.	2014
5. lightsources.org web site	2014
6. Hot Cell Strategy Report	2006
7. Alternatives to APIE report & raw data	2012
8. DOE Facilities Inventory Draft (6.16.2014)	2014
9. Required Assets for a NE Applied R&D Program	2009
10. NEUP RR Infrastructure Program Annual Reports	2012-3
11. INL Ten-Year Site Plans	2012-4
12. DOE-SC User Facilities Ten-Year Plan	2013
13. DOE-NE Infrastructure Awards	2014
14. INL iPIP Database	2012
15. INL NS&T Inventory System	2014
16. NRC TRTR Licensing Presentation	2014
17. NRC TRTR Licensing Presentation	2012
18. NS&E Education Sourcebook (ANS/DOE)	2013
19. Nuclear Regulatory Commission web site	2014
20. NRC Compliance Certificate (RAMPAC)	2014
21. Sunflower Property Management DB	2014



Nuclear Energy Infrastructure Database



NSUF Core Facilities and Partners

NSUF Infrastructure

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NSUF / NEID / Search / Facilities

- Home
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Facilities Search Result

Facilities Search Result

Modify | Reset | Export to Excel

50

Search...

Facility	Institution	Owner Type	Primary Type	Materials Allowed	NSUF Partner	Website
Advanced Test Reactor	Idaho National Laboratory	Dept of Energy	Reactor	beta/gamma only	NSUF	Website
ATR Critical Facility	Idaho National Laboratory	Dept of Energy	Reactor	beta/gamma only	NSUF	
Neutron Radiography Reactor	Idaho National Laboratory	Dept of Energy	Reactor	beta/gamma only	NSUF	
Transient Reactor Experiment and Test Facility	Idaho National Laboratory	Dept of Energy	Reactor	beta/gamma only	NSUF	Website
Massachusetts Institute of Technology Reactor	Massachusetts Institute of Technology	University	Reactor	beta/gamma only	PARTNER	Website
Nuclear Reactor Program, PULSTAR Reactor	North Carolina State University	University	Reactor	beta/gamma only	PARTNER	Website
High-Flux Isotope Reactor	Oak Ridge National Laboratory	Dept of Energy	Reactor	beta/gamma only	PARTNER	Website
Ohio State University Research Reactor	Ohio State University	University	Reactor	beta/gamma only	PARTNER	Website
Annular Core Research Reactor	Sandia National Laboratory	Dept of Energy	Reactor	beta/gamma only	PARTNER	Website
Sandia Pulse Reactor Facility Critical Experiment (Burnup Credit Critical Experiment)	Sandia National Laboratory	Dept of Energy	Reactor	beta/gamma only	PARTNER	Website

Showing 1 to 50 of 88 entries

Previous 1 2 Next

NEID Entry for the ATR

NSUF Infrastructure

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- Inventory
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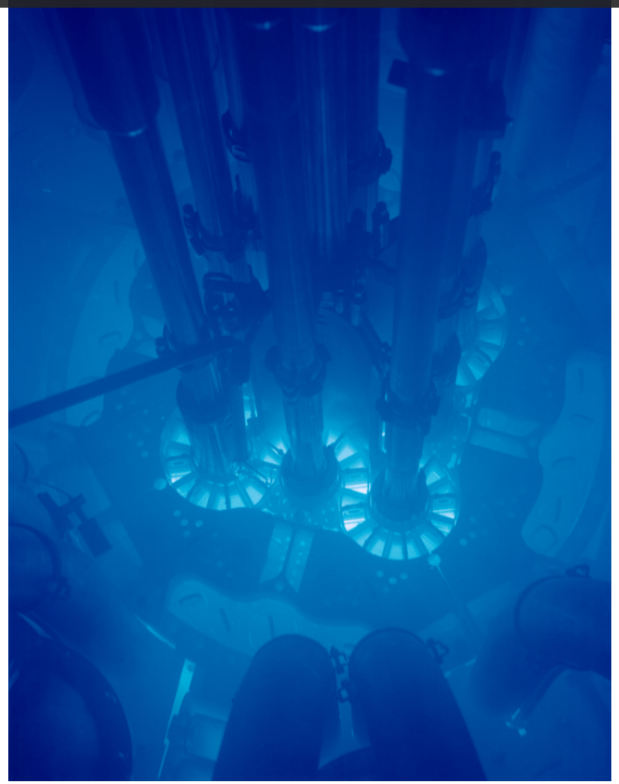
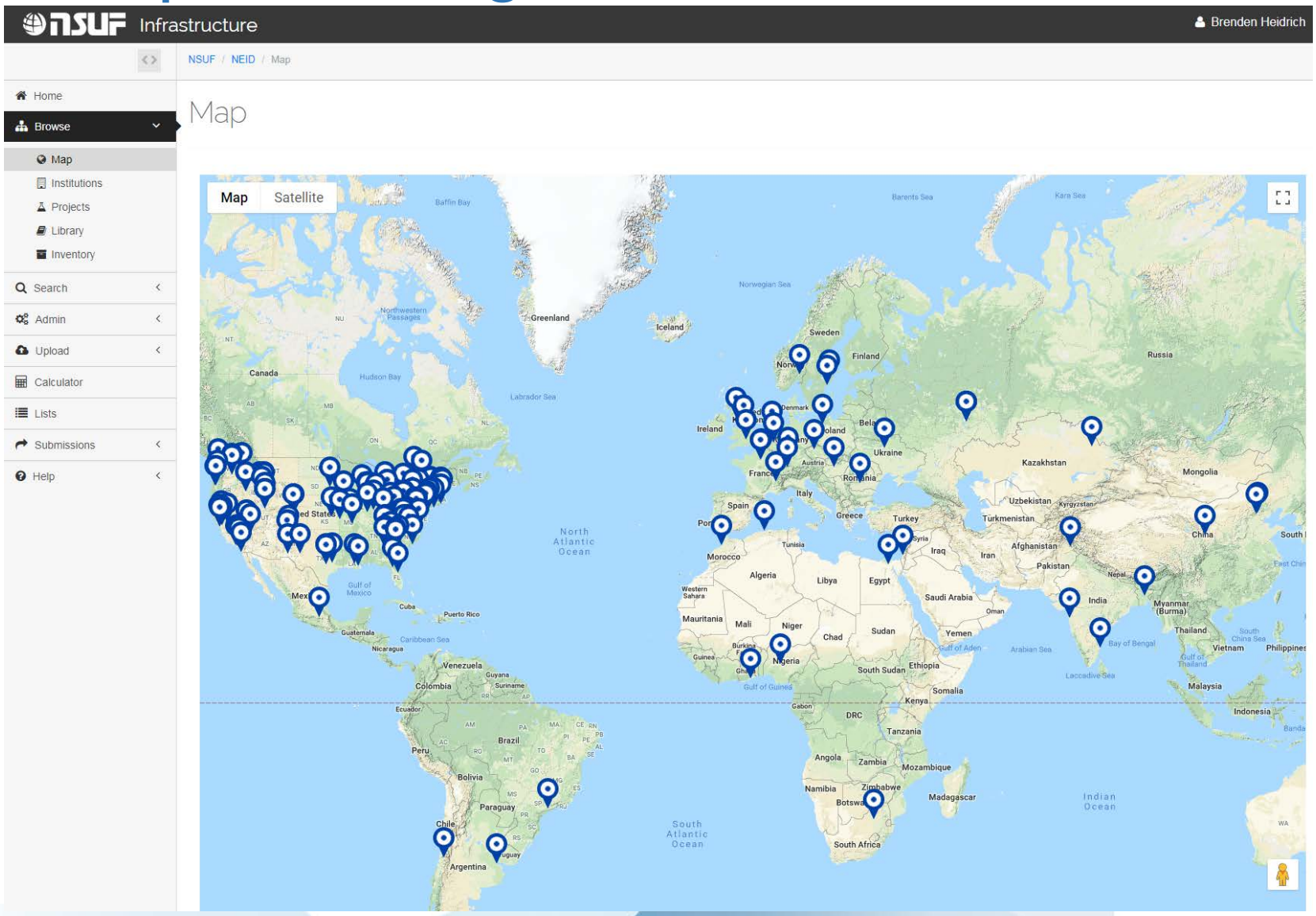
Institution	Idaho National Laboratory
Name	Advanced Test Reactor (ATR)
Building	TRA-670
Primary Type	Reactor
Reactor Type	test
Thermal Power (MW)	250
Pulse Power	0
Thermal Flux (n/cm^2/s)	1E+15
Fast Flux (n/cm^2/s)	5E+14
In Core Locations	66
Ex Core Locations	34
PTS	1
Flow Loops	5
Beam Ports	0
Core Functions	Advanced Fuels and materials irradiation. Water-cooled, high-flux test reactor.
Unique Functions	Five in-pile pressurized water loops currently provide prototypic PWR conditions (pressure, temperature, flow, water chemistry) for fuel and material samples with the ability to tailor the neutron flux to meet desired conditions. Each loop has a full range of instrumentation capabilities. Two of the five loops have transient testing capabilities. There are proposed plans to reactivate a sixth water loop. The ATR has a capacity for up to nine water loops.
Hotwork Facilities	HFEF
Support Equipment	MFC, Test Train Assembly Facility
Radiological Limit	>1R/hr @ 30cm
Materials Allowed	beta/gamma only
Sample Encapsulation	none
Atmosphere	gas/PWR
Commissioning Date	1967
Recent Upgrade	2013
RAM License	Department of Energy
License End Date	2099
Docket Number	0
User Facility	Yes
User Org Web Page	nsuf.inl.gov
Proposal Web Page	nsuf.inl.gov
Cost To Maintain	1,250,000
Cost To Replace	200000000
GAIN Partner	No
NSUF Partner	Yes
RTE Facility	No
NE Use Percentage	50
Funding Sources	• DOD • DOE-NE
Number Of Staff	305
Point Of Contact	Shawn Hill
Email	shawn.hill@inl.gov
State	Idaho
Website URL	https://factsheets.inl.gov/FactSheets/AdvancedTestReactorSafety.pdf
Data Sources	• DOE Facilities Inventory Draft (6.16.2014) • Facilities for the Future of NE Research • Facility NSUF User's Guide • IAEA Databases (RTF DB, RTR DB & Beamline DB) • INL TYSPs • Required Assets for a NE Applied R&D Program
Date Of Data	January 9, 2018
User Guide	ATRUsersGuide(2009).pdf



Instruments

Abbr	Name	Type
	Video Probe (boroscope)	Electromagnetic
	Instron Tensile Tester	Mechanical Properties
NRAD	MFC Neutron Radiography Facility	Radiation Detection and Measurement
ATR FFSC	ATR Fresh Fuel Shipping Cask	Cask
ATR-GF	Gamma Facility (ATR Canal)	Gamma/Neutron/Ion Irradiator
Loop 2A	Loop 2A	Reactor Irradiation Position
A (1-8)	A Positions (Inboard)	Reactor Irradiation Position
A (9-16)	A Positions (Outboard)	Reactor Irradiation Position

Map Browsing Tool



Text Search Tool for all Databases

NSUF Infrastructure

NSUF / NEID / Search

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  - NFML Search
  - People Search
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Index

Search: "co60" cobalt "gamma irradiation"

Instrument: Gamma Irradiation Facility
Oak Ridge National Laboratory / High-Flux Isotope Reactor / Gamma Irradiation Facility
Matches:
PrimaryCapability Gamma Irradiation
Instrument Gamma Irradiation Facility

Facility: Gamma Irradiator - FASB Irradiator Room
Idaho National Laboratory / Gamma Irradiator - FASB Irradiator Room
Matches:
CoreFunctions gamma irradiation

Instrument: Wet Gamma Irradiation Facility
Pennsylvania State University / Radiation Science and Engineering Center / Wet Gamma Irradiation Facility
Matches:
Model cobalt 60 pencil sources
Instrument Wet Gamma Irradiation Facility
CoreFunctions gamma irradiation of small samples using Co-60 or Cs-137 sources

Facility: Albany Cobalt 60 Facility
National Energy Technology Laboratory / Albany Cobalt 60 Facility
Matches:
Facility Albany Cobalt 60 Facility

Facility: Gamma Irradiation Facility
Sandia National Laboratory / Gamma Irradiation Facility
Matches:
Facility Gamma Irradiation Facility
WebSiteURL http://www.sandia.gov/research/facilities/gamma_irradiation_facility.html

Facility: Gamma Irradiation Facilities
Pennsylvania State University / Gamma Irradiation Facilities
Matches:
Facility Gamma Irradiation Facilities
CoreFunctions gamma irradiation of small samples using Co-60 or Cs-137 sources

Instrument: Dry Gamma Irradiation Facility
Pennsylvania State University / Radiation Science and Engineering Center / Dry Gamma Irradiation Facility
Matches:
Instrument Dry Gamma Irradiation Facility
CoreFunctions gamma irradiation of small samples using Co-60 or Cs-137 sources

Facility: Gamma Irradiation Facility
Savannah River National Laboratory / Gamma Irradiation Facility
Matches:
Facility Gamma Irradiation Facility

Infrastructure

Facility: Pulsed van-de-Graaff (5.5 MV)
University of Massachusetts-Lowell / Pulsed van-de-Graaff (5.5 MV)
Matches:
SupportEquipment proton, neutron and gamma irradiation facilities.

Project: Effect of Gamma Irradiation on the Microstructure and Mechanical Properties of Nano-modified Concrete
/ Effect of Gamma Irradiation on the Microstructure and Mechanical Properties of Nano-modified Concrete
Matches:
IrradiationFacility Oak Ridge National Laboratory Gamma Irradiation Facility
Project Effect of Gamma Irradiation on the Microstructure and Mechanical Properties of Nano-modified Concrete
Proposal Effect of Gamma Irradiation on the Microstructure and Mechanical Properties of Nano-modified Concrete

Instrument: Gamma Facility (ATR Canal)
Idaho National Laboratory / Advanced Test Reactor / Gamma Facility (ATR Canal)
Matches:
PrimaryCapability Gamma Irradiation using ATR fuel elements
UniqueFunctions ...the dry tube in place.

Instrument: Cs-137 Gamma Calibration Facility
Pennsylvania State University / Radiation Science and Engineering Center / Cs-137 Gamma Calibration Facility
Matches:
CoreFunctions gamma irradiation of small samples using Cs-137 sources

Facility: Nuclear Facilities Resource Center
Sandia National Laboratory / Nuclear Facilities Resource Center
Matches:
UniqueFunctions Associated with ACRR, Gamma Irradiation Facilities and Sandia Pulse Reactor/Critical Experiments

Facility: Materials Science and Engineering Center
Sandia National Laboratory / Materials Science and Engineering Center
Matches:
UniqueFunctions Associated with ACRR, Gamma Irradiation Facilities and Sandia Pulse Reactor/Critical Experiments

Facility: Radiation Science and Engineering Center
Pennsylvania State University / Radiation Science and Engineering Center
Matches:
CoreFunctions gamma irradiation of small samples using Co-60 or Cs-137 sources

Facility: McMaster Nuclear Reactor Hot Cell
McMaster University / McMaster Nuclear Reactor Hot Cell
Matches:
UniqueFunctions gamma irradiation in cell, large door with 13 ton crane and transfer rails to move casks

Facility: Fast Burst Reactor Facility
White Sands Missile Range / Fast Burst Reactor Facility
Matches:
Responses White Sands Missile Range: Flash X-ray associated as well as gamma irradiation facility, thermal test site, etc.

Facility: Massachusetts Institute of Technology Reactor
Massachusetts Institute of Technology / Massachusetts Institute of Technology Reactor
Matches:
CoreFunctions ...from start to finish.?

Facility: Deep Underground Science and Engineering Laboratory
South Dakota State University / Deep Underground Science and Engineering Laboratory
Matches:
UniqueFunctions ...as neutron radiography.

Project: Changes on viscoelastic behavior, morphology and chemical structure of gamma irradiated calcium silicate hydrates
Oak Ridge National Laboratory / Changes on viscoelastic behavior, morphology and chemical structure of gamma irradiated calcium silicate hydrates with respect to non-irradiated samples
Matches:
Abstract ...2 sessions of 5 days each.

NSUF Resource Browser

NSUF Nuclear Science User Facilities

ABOUT US

ANNOUNCEMENTS

USERS ORGANIZATION

CALL/SOLICITATION INFORMATION

RESOURCES

MY NSUF

DAIN WHITE

NSUF Resources

NSUF Resources

Reset NSUF Resources

Dept of Energy | - Select Facility Type - | - Select Instrument Type -

Idaho National Laboratory | Advanced Test Reactor | Gamma Facility (ATR Canal) - custom manufactured

Facility

Advanced Test Reactor (TRA-670)

Contact

Shawn Hill

Description

Advanced Fuels and materials Irradiation. Water-cooled, high-flux test reactor. Five in-pile pressurized water loops currently provide prototypic PWR conditions (pressure, temperature, flow, water chemistry) for fuel and material samples with the ability to tailor the neutron flux to meet desired conditions. Each loop has a full range of instrumentation capabilities. Two of the five loops have transient testing capabilities. There are proposed plans to reactivate a sixth water loop. The ATR has a capacity for up to nine water loops.

Instrument

Gamma Facility (ATR Canal) (ATR-GF) custom manufactured

Functions

Located in the ATR canal, the Gamma Facility is an aluminum dry tube projecting from the spent fuel rack to the top of the ATR canal. The tube contains a removable shielded plug at the top to block shine and is sealed at the bottom and weighted with lead. Spent fuel can be placed in the fuel grid around the gamma facility to generate high gamma fields. The gamma facility has historically been used to determine material degradation in a high gamma field. For example it has been used to determine effects on electronics, wire insulation, and even oil. Test samples must fit inside an aluminum dry tube sealed at the bottom and weighted with lead to prevent floating. The 21-foot tube has a useable inner diameter of 12.7 cm (5 inches) [or 8.9-cm (3.5-in)] and a useable length of 6 m (19 feet - 8 inches) from the top to the lead. The mid-plane of the gamma field is approximately 5.54 m (18 feet - 2 inches) from the top of the tube. During the test, the dry tube is inserted vertically into one of the gamma grid positions. Test samples are lowered through the open end of the dry tube to the gamma field. A shield plug caps the open end of the dry tube and shields the gamma beam emitted from the fuel elements near the lower end of the dry tube. Radiological control surveillance is required whenever the shield plug is removed for sample handling. The ATR Gamma Facility, formerly designated the ATR Small Gamma Facility, is located toward the east end and on the south side of the ATR storage canal. This is not the original EG&G "Large" Gamma Irradiation Facility, that has been decommissioned. The gamma field is produced by placing irradiated fuel elements in grid locations around the position where the test is inserted. The dose rate of the field produced is approximately 1E+6 R/hr., but can be varied (5E+6 R/hr. maximum) by varying the distance of fuel elements from the test or by selecting fuel of different gamma strengths. That intensity will fall off at the rate of approximately 5% per day as the fission products in the fuel elements decay away. The peak field at the center of the tube was recently measured to be approximately 2.5E+6 rad/hr. The dose rates are normally measured by using high range ionization chambers and instrumentation. These can be lowered into the dry tube for actual counting before installing the test sample hardware. Fuel elements can be moved from one location to another with the dry tube in place.

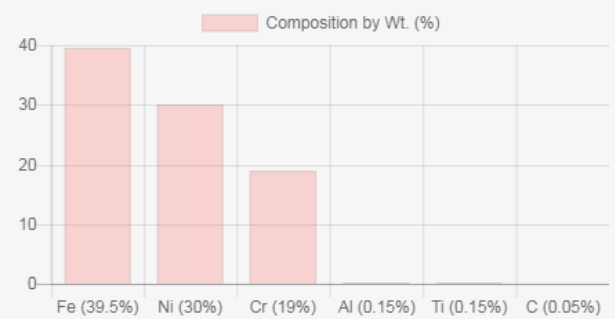
Nuclear Fuels and Materials Library

- Provides irradiated samples for users to access and conduct research through a competitively reviewed proposal process.
- The library includes >3500 specimens as part of the NSUF awarded research.

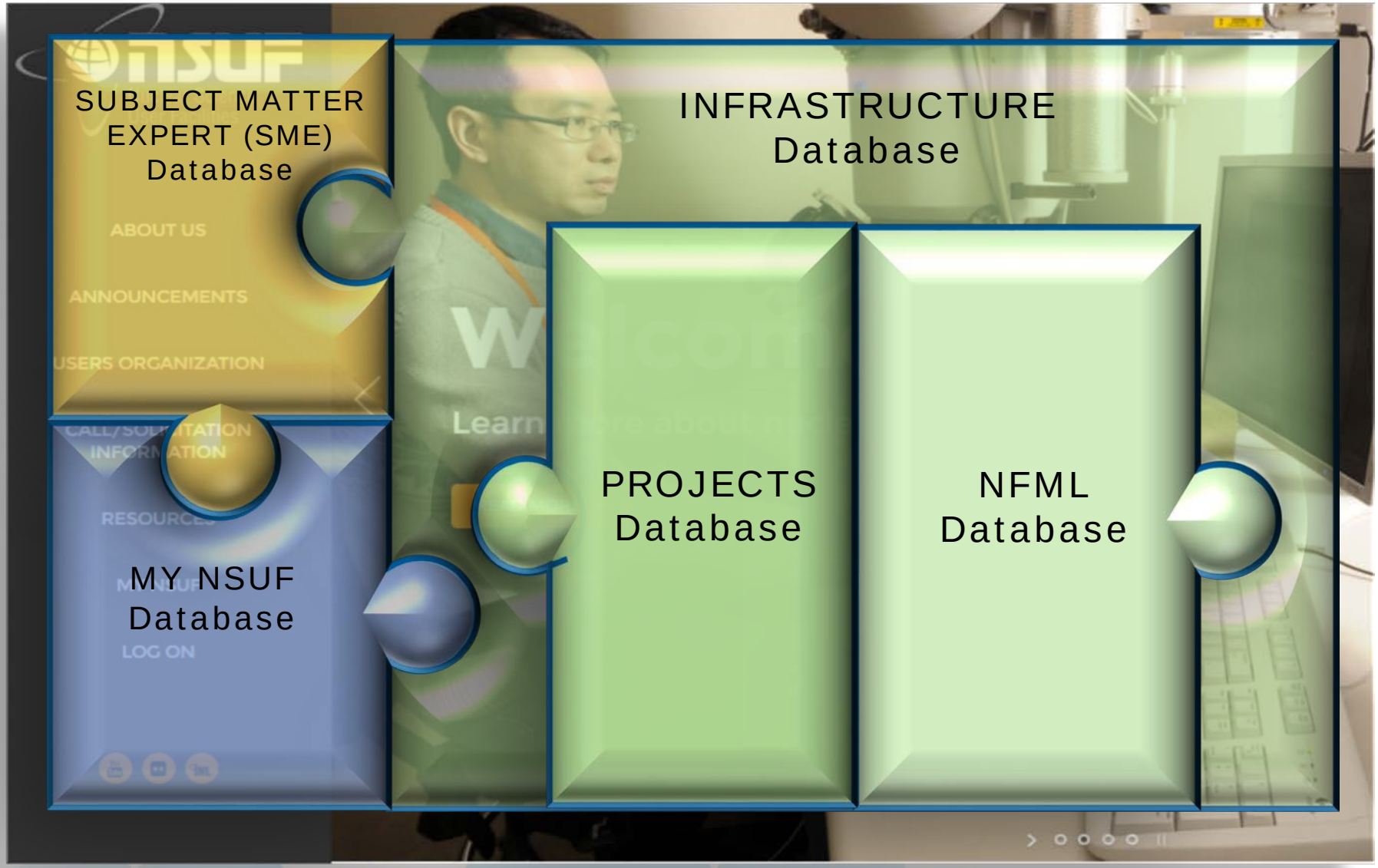
Steels	
17-4 PH SS	Fe-Cr Alloys
304 SS	HCM12-A
304 SS welds	HT-9
Super 304H	MA-956
316 SS	MA-957
347 SS	MAR-2008
416 SS	Mo-ODS
420 SS	nCr-YWT
9Cr ODS	NF616
Borated Steel	NF709
Carbon Steel	PM2000
Cast ASS	T-91
D9 ASS	Tool Steel T-1
Eurofer 97	XM-19
F82H-IEA	various model alloys

Other Alloys	Ceramics	Pure Materials
Al_3Hf	Al_2O_3	Copper
Al1100	MgO	Iron
Al6061	$MgO\text{-}ZrO_2$	Ni/Cu/Nb (DC)
Aluminum Bronze	$Mg_2\text{-}SnO_4$	Nickel
Berylco #25	$Mg0_{1.5}Al_2O_3$	Niobium
C276 Hasteloy	$MgTiO_3$	Silver
Incoloy 800H	$Nd_2Zr_2O_7$	Tantalum
Inconel X/X-750	SiC	Tungsten
Stellite	Ti_2AlC	Zirconium
	Ti_3AlC_2	
	Ti_2AlN	
	TiO_2	
	Ti_3SiC_2	

Is Approved	True
Project	Irradiation Test Plan for the Advanced Test Reactor National Scientific User Facility/University of Wisconsin Pilot Project
Reactor	ATR
Reactor Position	East Flux Trap
Sample Id Code	024-08-331
Capsule	Capsule 1
Packet	500 LO A
Material Code	N5
Material Name	800H
Material Description	Austenitic SS
KGT Num	276
Specimen Type	TEM
Dimensions (mm)	3d x .2
Number Of Samples	4
Specimen Availability	Yes
Availability Date	November 26, 2014
Certification	Yes
Storage Facility	Hot Fuel Examination Facility
Notes	only 1 tensile specimen each for 800H and 800H-TMP per irradiation condition
Planned Temp (°C)	500.00
Planned Dose (DPA)	3
Planned Flux (n/cm²s)	9.7E+13
Planned Environment	Helium/Argon
As Run Total Dose (DPA)	4.64
As Run Total Fluence (...	1.51E+22
Composition by Wt. (%)	Fe-30Ni-19Cr-0.15Al-0.15Ti-0.05C
Keyword Tags	Metallic Alloy, Alloy, Metal, Austenitic Alloy, Steel, Stainless Steel, INCOLOY Alloy, Ferrous, Control Rods, High Temperature Gas Reactor



NUCLEAR SCIENCE USER FACILITIES Website



Graphic courtesy of Kelly Cunningham

SME DATABASE

PI/SME Name

Research Area/Subject Matter

INSTITUTION

PROJECT DATABASE

PROJECT NAME

Project ID	Start Date	Project Type
Proposal	End Date	Material Type
CINR #	PI Name	Research Area
RTE #	Tech Lead	**INSTITUTION**
NSUF Call	Facility Tech Lead	**FACILITY**
Award Date	Collaborators	Documentation

NEID

INSTITUTION

FACILITY

REACTOR

REACTOR POSITION

FUELS & MATERIALS LIBRARY

PROJECT NAME

REACTOR

REACTOR POSITION

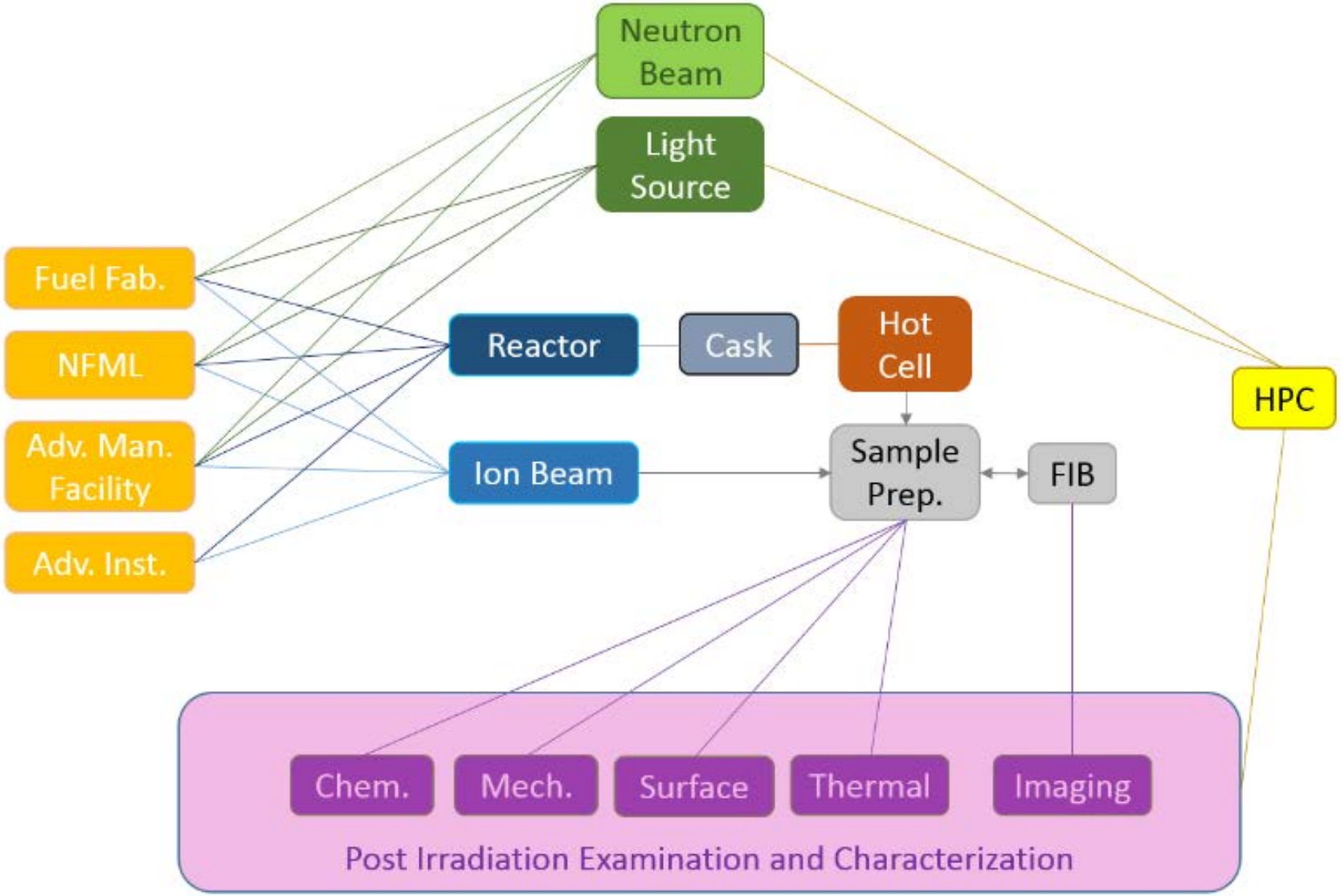
Sample ID Code	# of Samples
Capsule	Samples Remaining
Packet	Specimen Availability
Material Code	Availability Date
Material Name	Certification
Material Description	Certification Code
KGT #	Storage **FACILITY**
Specimen Type	Notes
Dimensions	

PLANNED	AS RUN DATA
Temperature	Temperature
Dose (DPA)	Actual Dose (DPA)
Fluence [$x10^{20}$]	Fluence [$x10^{20}$]
Flux [$x10^{14}$]	Flux [$x10^{14}$]
Environment	Environment

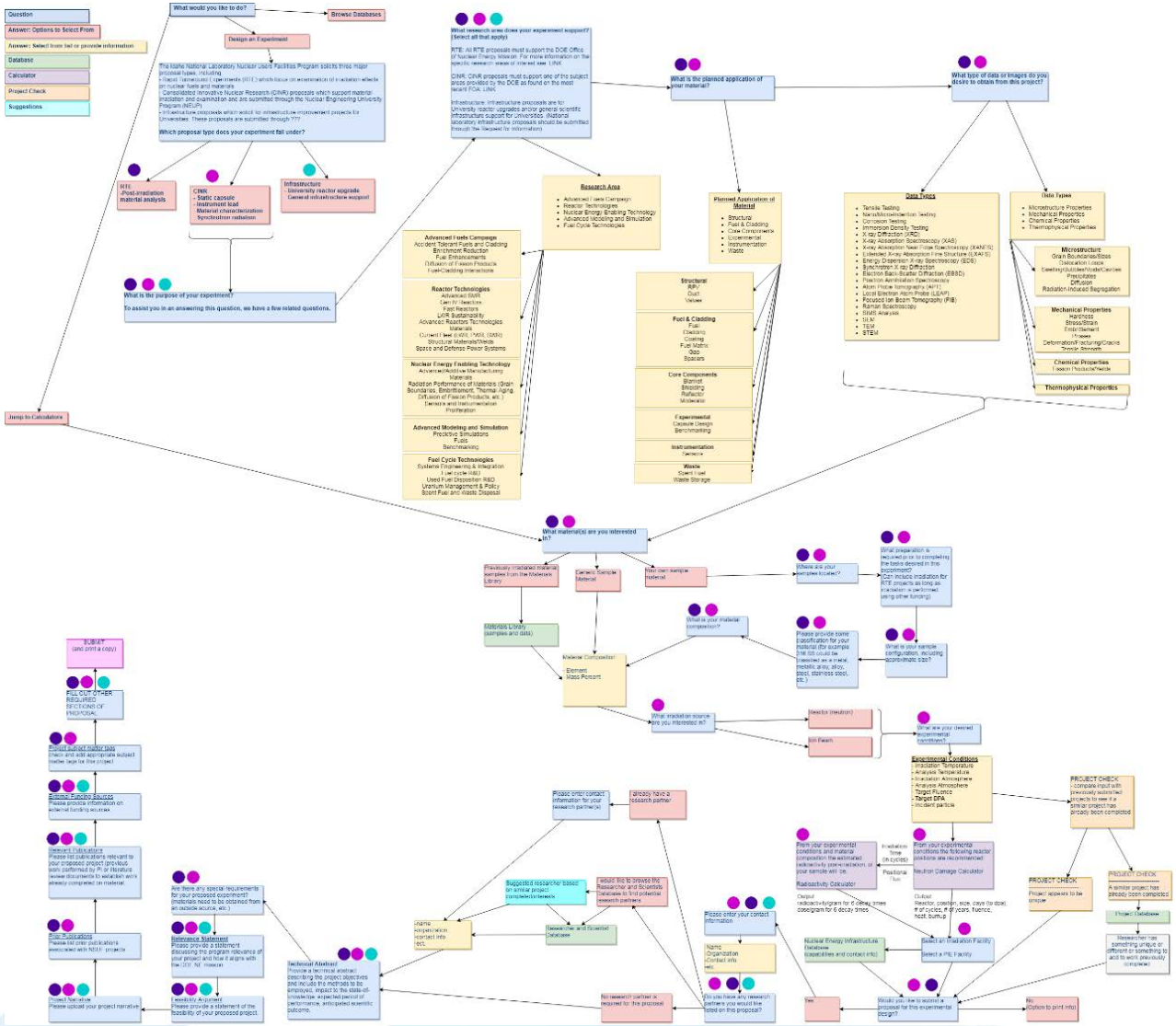
Nuclear Science User Facilities

EXPERIMENT WIZARD

NSUF Experiment Process (Simplified)



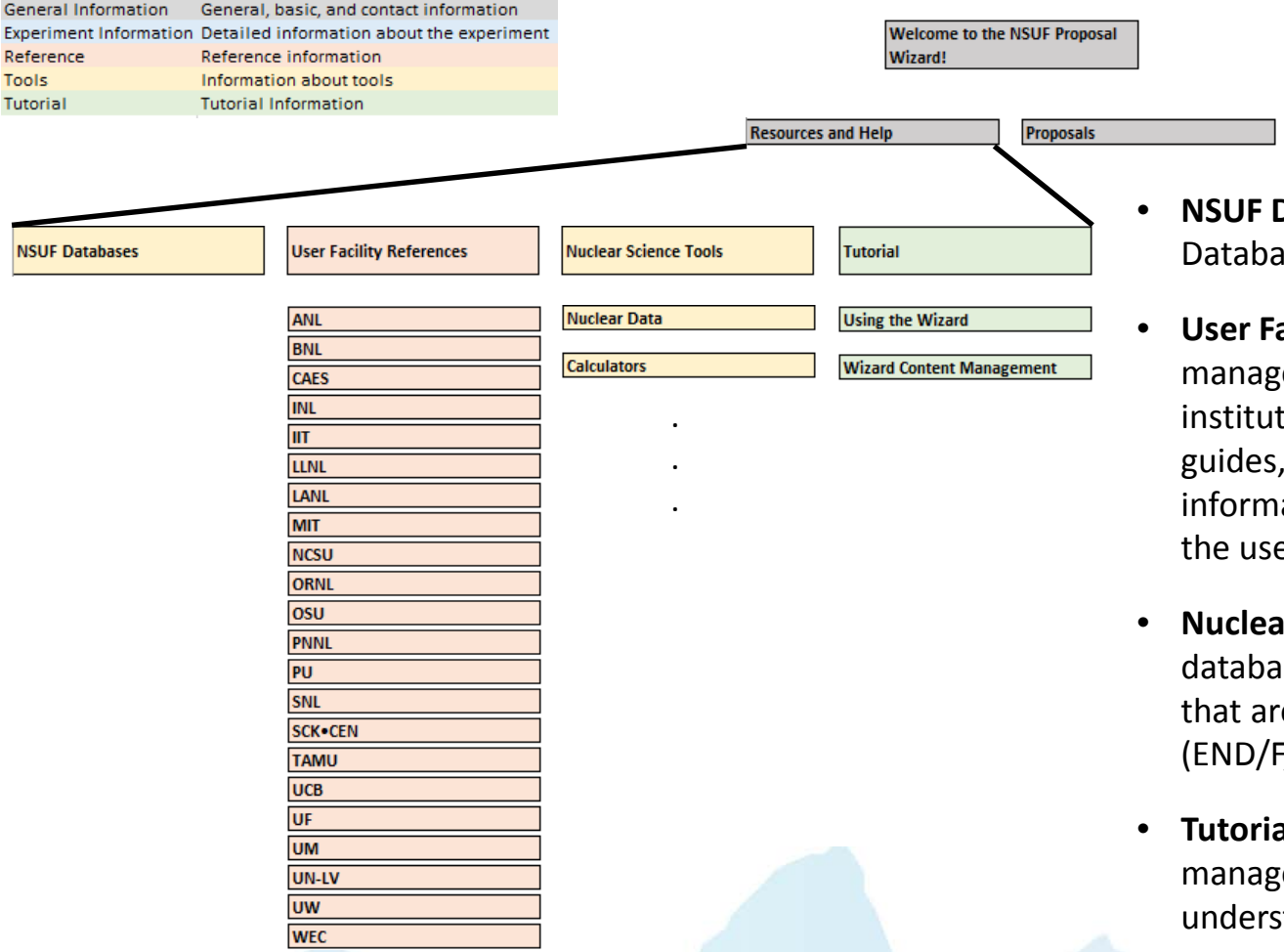
NSUF Experiment Process (Actual)



Graphic courtesy of Kaecee Holden

Wizard Guide through NSUF Resources

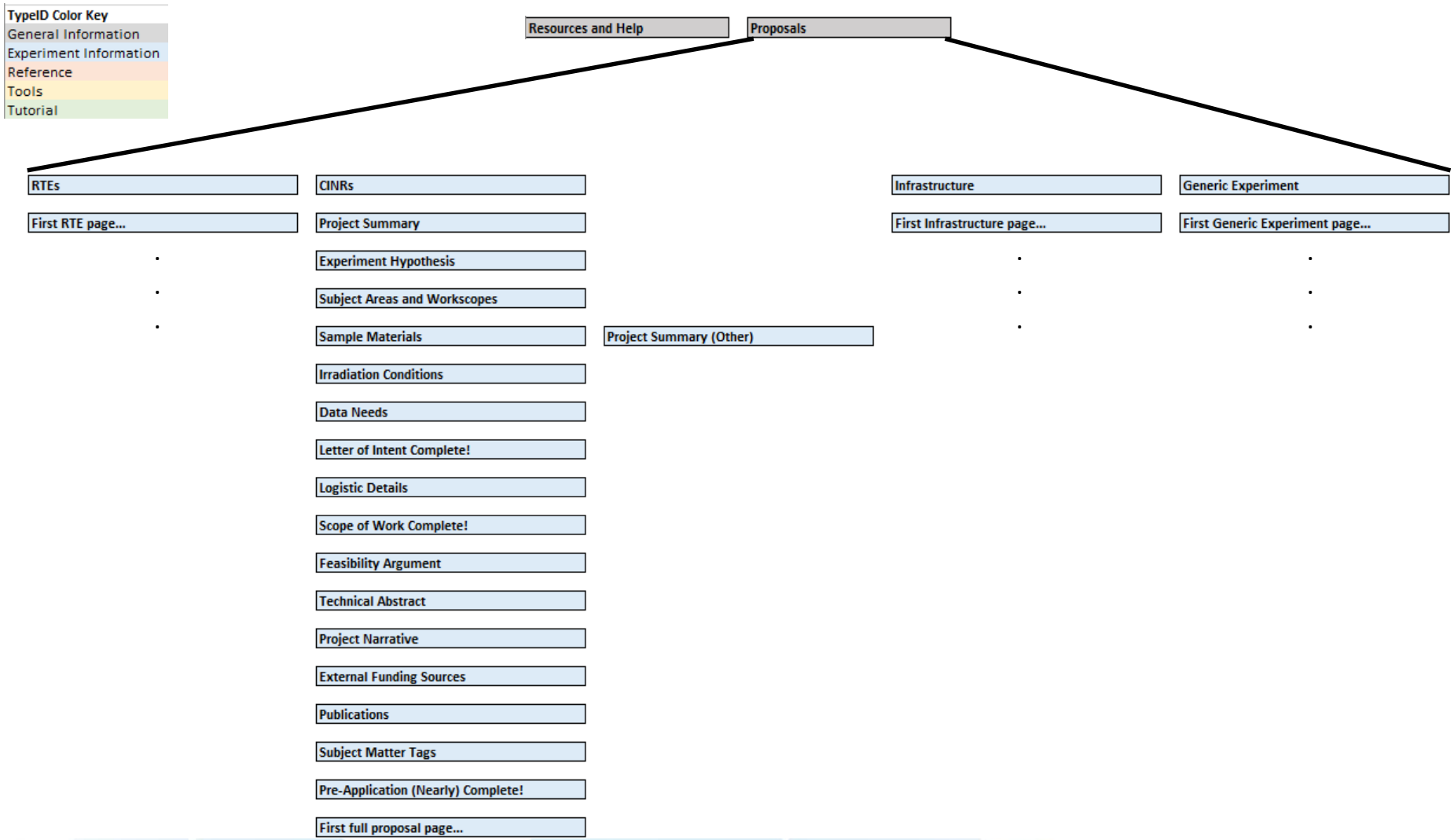
TypeID Color Key	
General Information	General, basic, and contact information
Experiment Information	Detailed information about the experiment
Reference	Reference information
Tools	Information about tools
Tutorial	Tutorial Information



- **NSUF Databases** – information about Databases managed by NSUF
- **User Facility References** – Pages co-managed with a representative at each institution, this section provides live user guides, interactive help, and other information that the facilities would want the user to know
- **Nuclear Science Tools** – Links to databases, codes, and other resources that are helpful for nuclear science (END/F, EXFOR databases, IAEA tools, etc).
- **Tutorial** – Helps the user and content managers (i.e. for User Facility References) understand how to use the wizard tool

Graphic courtesy of Jordan Argyle

Wizard Guide for Experiment Design



Graphic courtesy of Jordan Argyle

Wizard Guide to Proposal Submission

CINRs Guided CINR Proposal Help First, we'll collect some basic information common to all CINR proposals. *Help Text* *URL*	Consolidated Innovative Nuclear Research (CINR) proposals are submitted through the Nuclear Energy University Program (NEUP), not through NSUF. The CINR FOA can be found on their website [https://neup.inl.gov/SitePages/Home.aspx]. The CINR Funding Opportunity Announcement (FOA) covers multiple programs, including NSUF. As	*FORM*
Project Summary		

Project Summary The CINR project "at a glance" If you'd like to search for collaborators, you may browse the NSUF Researcher and Scientist Database here [button, /Account/List]. Be sure to save your form, then continue Help Text URL	This page provides an overview of proposed experiment. It is designed to give collaborators a place to start, and to help unify the team's understanding of the project before they begin to write up the project documents. For NSUF workscopes, this page will introduce the Technical Leads to your project. To best make use of this tool, review the information on this page often throughout the pre-proposal, and modify it as needed. Some of the fields on this summary will appear later in the	**[T]:** Project Title; What is the title of your project?; **[T]:** Applicable Workscopes/Techical Areas - List all that might apply; To which Workscopes are you applying?; i.e. NSUF 1.1 **[T]:** Contact Information; What is your role in the project? You name? Organization?; PI John Doe The Best University john.doe@tbu.edu (123) 456.7890
Experiment Hypothesis		

Experiment Hypothesis The purpose of the project Next, we will take another look at the subject areas to determine the best fit, and then we can begin gathering information for the pre-application. *Help Text* *URL*	A hypothesis is a clearly stated, testable, proposed explanation made on the basis of limited evidence. Defining a clear hypothesis will better facilitate collaborators to apply their knowledge and understanding to solving the correct problem, and avoid project scope creep.	**P:** Consider the following questions when writing your hypothesis: **[[T]]:** What is the question you aim to answer by performing this experiment?; ; **[[T]]:** Why is the answer to this question important?; ; **[[T]]:** Why has this question not been answered already?
Subject Areas and Workscopes		

Subject Areas and Workscopes Relevancy to DOE NE Goals Next, we will begin to gather and investigate the information needed for the Statement of Work. Help Text URL	CINR Proposals must support one or more of the subject areas provided by the DOE Nuclear Energy (NE) programs, as found on the most recent FOA. A Relevance Statement provides support for why your poposed experiment will support those subject areas, and is one of the three key criteria on which your application will be scored.	**CB:** Advanced Fuels Campaign; ; Accident Tolerant Fuels and Cladding, Enrichment Reduction, Fuel Enhancements, Diffusion of Fission Products, Fuel-Cladding Interactions **CB:** Reactor Technologies; ; Advanced SMRs, Gen IV Reactors, Fast
Sample Materials, Project Summary (Other)		

. . .

Project Summary

This page provides an overview of proposed experiment. It is designed to give collaborators a place to start, and to help unify the team's understanding of the project before they begin to write up the project documents. For NSUF workscopes, this page will introduce the Technical Leads to your project.

To best make use of this tool, review the information on this page often throughout the pre-proposal, and modify it as needed. Some of the fields on this summary will appear later in the wizard. You can return to this screen at any time by selecting it in history.

Project Title

Applicable Workscopes/Technical Areas

i.e. NSUF 1.1

PI Contact Information

PI John Doe, The Best University, john.doe@tbu.edu, (123) 456.7890

Please list the contact information for any research partners or collaborators, one per line, in the same format as your contact information.

Partners / Collaborators Contact Information

Co-PI Don Anyman, A Great Lab, don.anyman@agl.gov, (234) 567.8901...

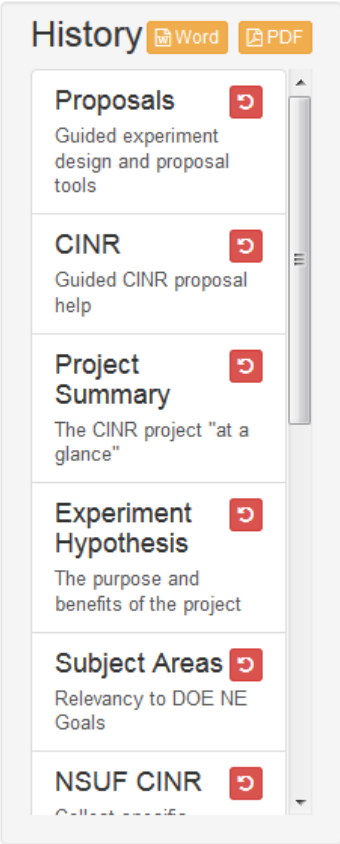
Provide a brief summary of your project. Note that this isn't the project narrative or the technical abstract--those will come later. This is a place for you and your team to capture what you want to do at a high level. This should also provide the technical leads with a few paragraphs to get on the same page as your team.

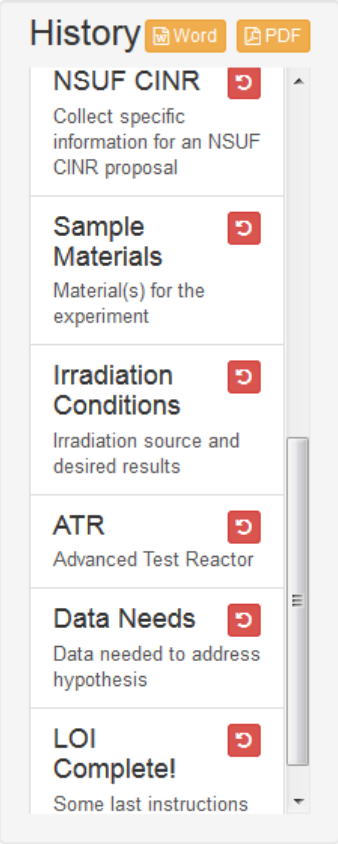
Project Summary

This should explain the purpose of the project general goals, and the benefits of the research to scientific advancement, as well as anything else you feel necessary to explain your project to your team.

Graphic courtesy of Jordan Argyle

Wizard as a Collaboration Tool





- This history shows how the tool is envisioned to be used. A main path is augmented with visits to references (ATR in this History) and other tools to accomplish their work.
- The tool allows multiple content creators to simultaneously manage content for their respective areas.
- Multiple users, Tech Leads, and others can all work on an experiment at the same time, keeping all information in one place.
- The Wizard clearly communicates requirements, expectations, and suggestions to help steer applicants to create more meaningful proposals.

Graphic courtesy of Jordan Argyle

Nuclear Science User Facilities

IRRADIATION TOOLKIT

Testing Strategy for Novel Materials

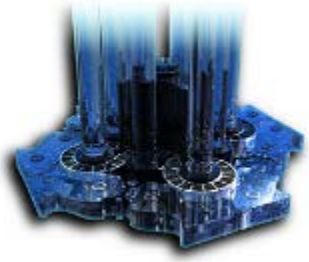
Irradiation Testing Hierarchy

1. **Ion Beams Irradiation Facilities**
   - Allow immediate feedback of performance
   - Ease of instrumentation
   - Ease of environmental tuning
2. **Low-Power Research Reactors**
   - Proof-of-concept (First 1% and 10% testing)
   - Instrumentation development (pulsing for TREAT)
   - Neutron radiography
   - Experiment modeling & validation efforts
3. **High-Performance Test Reactors**
   - Proof-of-performance
   - Prototypical environment

THE UNIVERSITY of WISCONSIN MADISON

NC State University Raleigh, NC

Massachusetts Institute of Technology

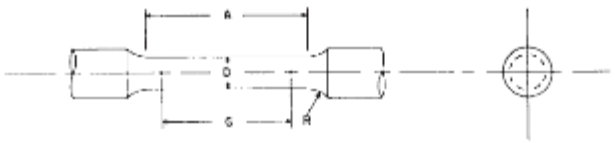


Small Specimen Tensile Testing Challenge

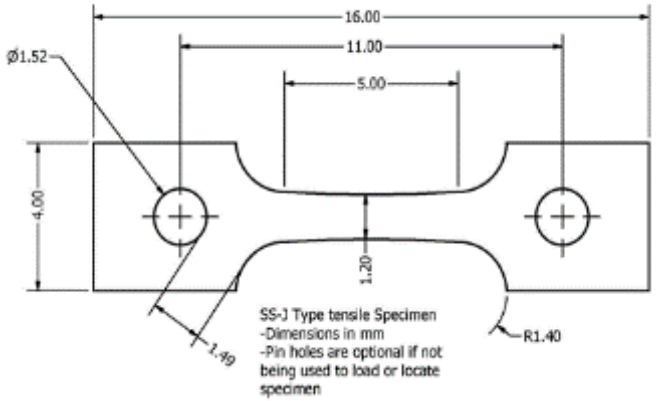
- Tensile testing has long been an important method for determining the material properties of different structural steel components.
- The effect of irradiation on these steel components is of particular interest to the nuclear power industry.
- The large (E8) specimens typically used are not efficient for test reactor irradiations. They also usually require a hot cell for performing post-irradiation examination.
- Research into using small-scale tensile specimens has been of great interest in the nuclear industry for quite some time.

Alloy	Dose Rate		6 dpa
	T=0	T=365	
SA 508	112	97	R/hr @ 30cm
625	75	28	
718	6.2	0.13	
690	1.5	0.10	
316L	3.8	0.10	
Grade 91	2.3	0.09	
304L	3.8	0.09	

E 8M – 04

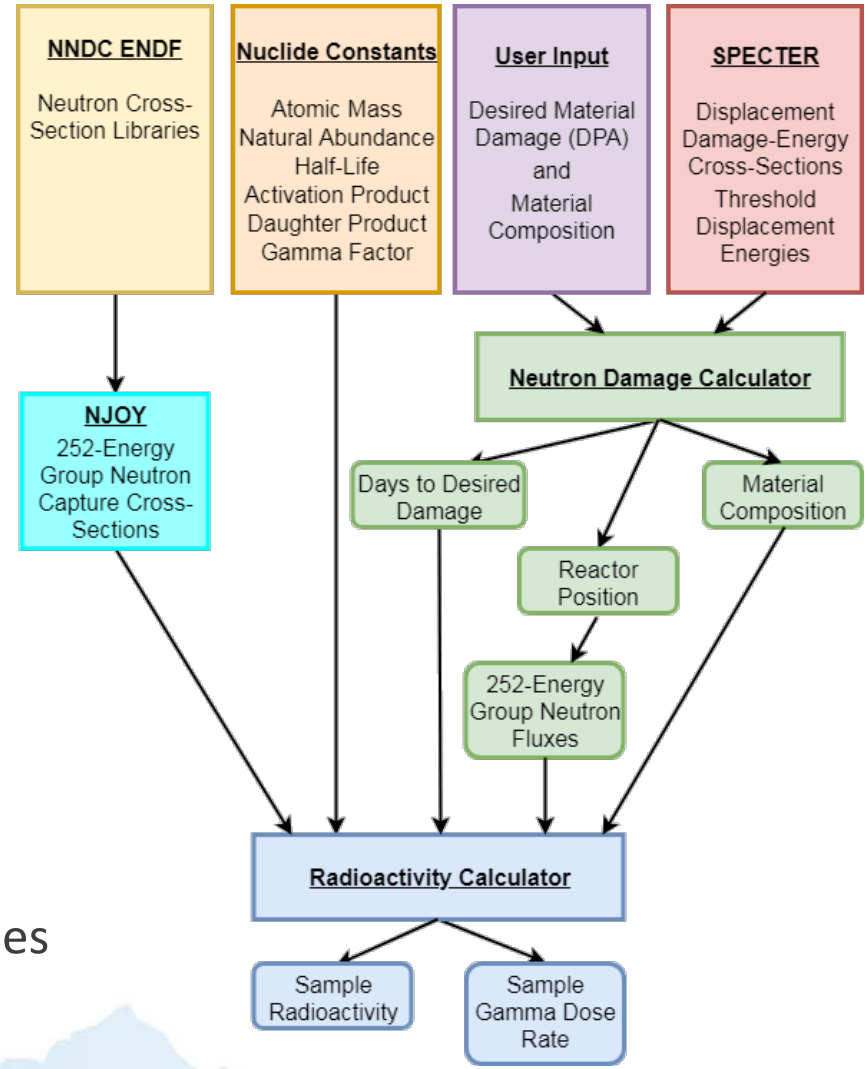


	Dimensions, mm				
	Standard Specimen	Small Size Specimens Proportional To Standard			
	12.5	9	6	4	2.5
G—Gage length	62.5 ± 0.1	45.0 ± 0.1	30.0 ± 0.1	20.0 ± 0.1	12.5 ± 0.1
D—Diameter (Note 1)	12.5 ± 0.2	9.0 ± 0.1	6.0 ± 0.1	4.0 ± 0.1	2.5 ± 0.1
R—Radius of fillet, min	10	8	6	4	2
A—Length of reduced section, min (Note 2)	75	54	36	24	20



Calculator Data Flow

- Neutron Damage Calculator
  - Input
    - Desired DPA
    - Material Composition
  - Output
    - Days to desired DPA
    - Reactor Positions
- Radioactivity Calculator
  - Input
    - Irradiation time
    - Material composition
  - Output
    - Radioactivity at set decay times
    - Gamma Dose Rate



Graphic courtesy of Kaecee Holden

Web Application – Position Selection

NSUF Calculator

Desired DPA

1

Material Composition

Fe-18Cr-8Ni-2Mn-0.75Si-0.1N-0.045P-0.03C-0.03S

Calculate

- Representative reactor positions for:
  - INL ATR
  - ORNL HFIR
  - MITR-II (coming soon!)
  - BR-2
  - OSURR
  - NCSU Pulstar

Select a row to calculate radioactivity and gamma dose rate:

Select	Reactor	Position	Diameter (cm)	Days	Cycles	Years	Thermal Fluence	Fast Fluence
○	ATR	A1	1.6	68.2	1.2	0.2	3.73e+020	3.10e+020
○	ATR	A13	1.6	77.9	1.4	0.2	3.55e+020	2.92e+020
○	ATR	B1	2.2	123.9	2.3	0.3	6.06e+020	3.16e+020
○	ATR	B9	3.8	402.5	7.3	1.1	8.35e+020	3.81e+020
○	ATR	I1	12.7	8024.7	145.9	22	1.26e+021	4.18e+020
○	ATR	I3	8.3	8227.6	149.6	22.5	1.75e+021	3.85e+020
○	ATR	I5	8.3	9833.6	178.8	26.9	1.76e+021	3.26e+020
○	ATR	I21	3.8	6699.3	121.8	18.4	3.96e+021	4.33e+020

Web Application – Final Results

Your sample contains **Fe-9.6Cr-0.03Y-0.01C-0.003N**

ATR

Position	B1
Diameter (cm)	2.2
Days	123.9
Cycle	2.3
Years	0.3
Thermal Fluence	6.06e+020
Fast Fluence	3.16e+020

The activity of your sample is as follows:

after 0 days: 2.47E+11 Bq/g or 6.66 Ci/g

after 30 days: 5.42E+10 Bq/g or 1.47 Ci/g

after 60 days: 2.64E+10 Bq/g or 0.714 Ci/g

after 90 days: 1.33E+10 Bq/g or 0.359 Ci/g

after 180 days: 2.67E+09 Bq/g or 0.0723 Ci/g

after 3098 days: 1.87E+08 Bq/g or 0.00505 Ci/g

The effective gamma dose rate of the sample at 30cm:

after 0 days: 882 mrem/hr/g

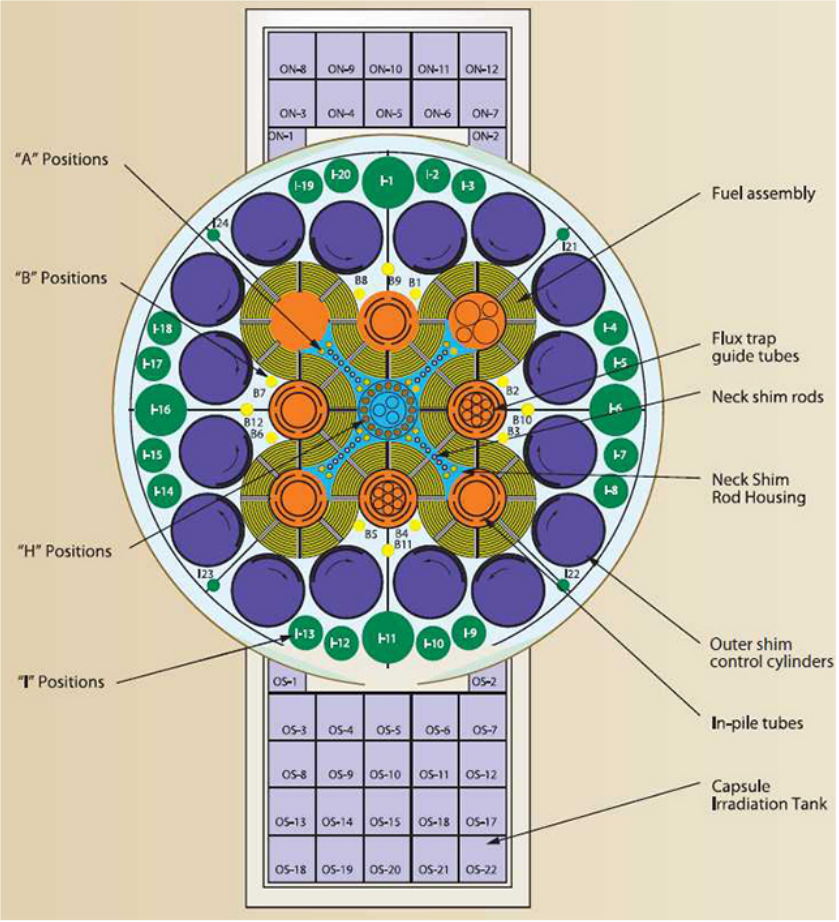
after 30 days: 431 mrem/hr/g

after 60 days: 213 mrem/hr/g

after 90 days: 107 mrem/hr/g

after 180 days: 14.8 mrem/hr/g

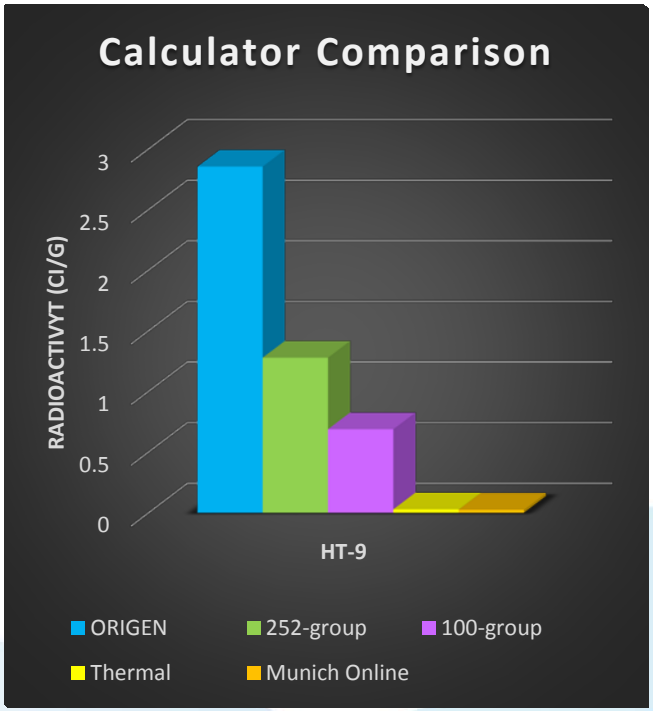
after 3098 days: 0.000901 mrem/hr/g

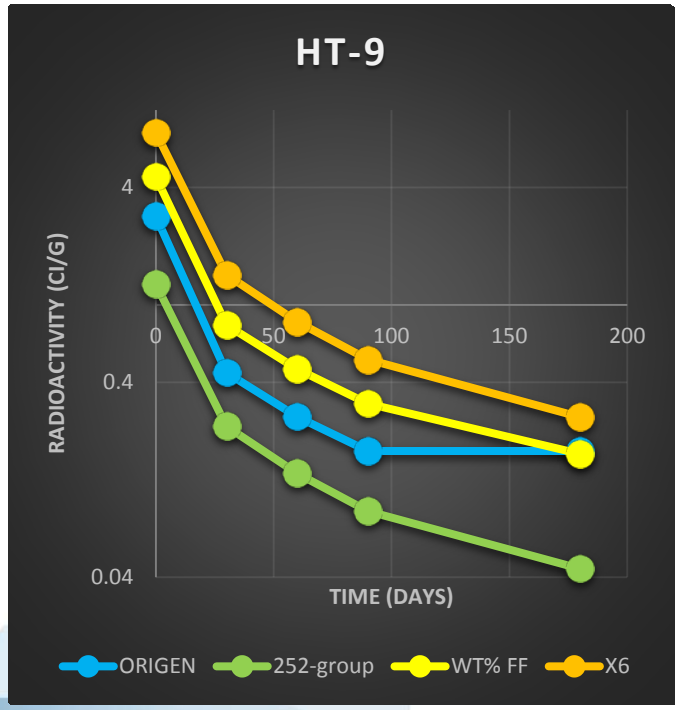


Select a different position

Radioactivity Calculator Validation

- Utilizes 252-energy group neutron flux and activation cross-sections (JEFF)
- Improvement over available online calculators and previous calculator iterations
- Added a **safety factor** to improve accuracy.
- Only neutron activation/capture reaction included
- Meta-stable states not included

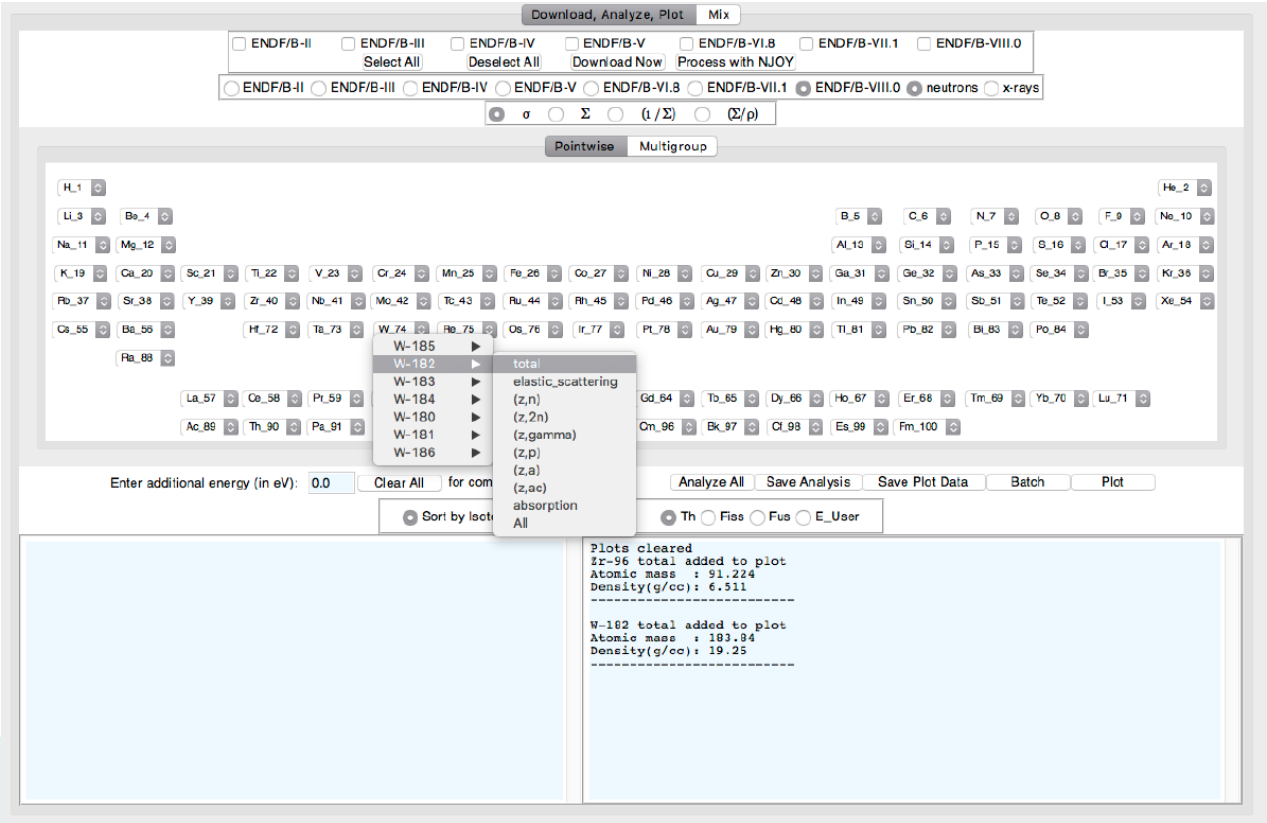




Technical University of Munich, "Calculate Activation," https://webapps.frm2.tum.de/intranet/activation/ (2017).

Future Work

- Internal and external validation of the calculators
- Build the experiment wizard & test on CINR proposals
- Incorporate other tools as needed (e.g. EXSAN from LANL)



Questions?