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Data Storage, Sharing, Demonstration & Discussion

Nuclear Science User Facilities

INL/CON-25-83987

NSUF Nuclear Science User Facilities

Nuclear Science User Facilities – Expanding Value to Fundamental Research Data

- NSUF program has awarded over 800 user projects awarded since 2007
- Large investment to advance the fundamental and applied understanding of nuclear energy technologies
- Yet most of the data is **not** widely available, stored on local systems, and has limited reproducibility.
- NSUF sees an opportunity to expand access to fundamental research data to support re-use and long-term storage through the **Nuclear Research Data System (NRDS)**

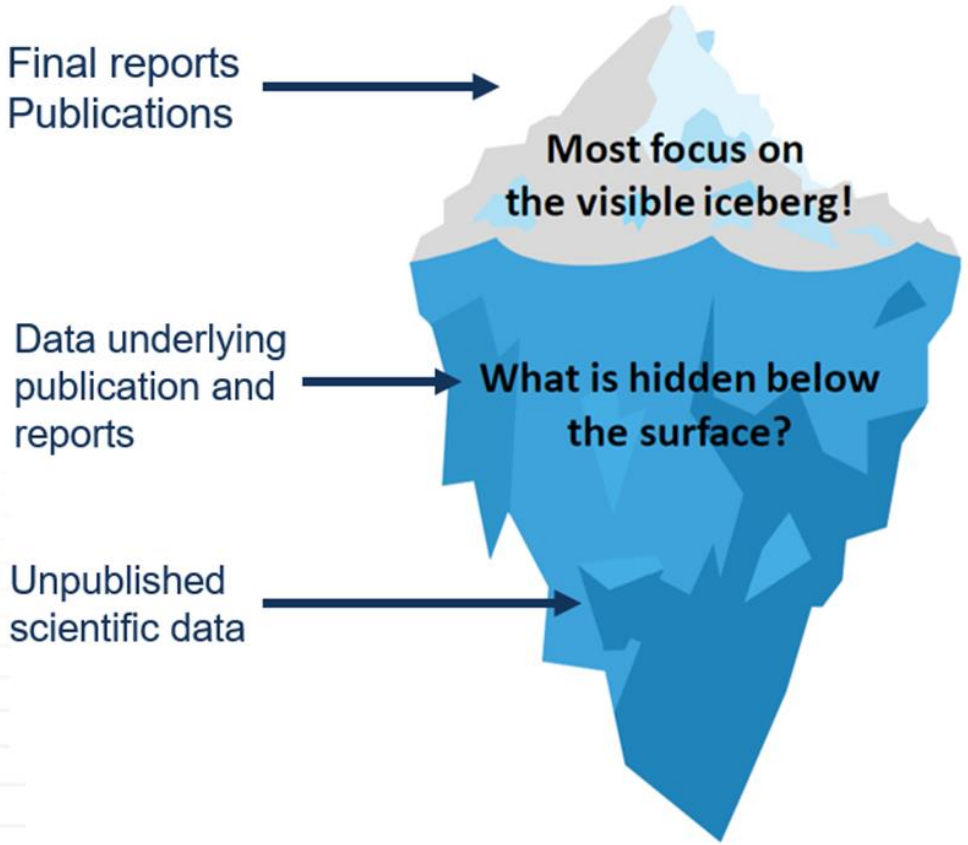


Image adapted from C. Rowan et al., NETL (2022)

Nuclear Research Data System (NRDS)

Two sites for appropriate data transfer and sharing

1. Private NRDS portal
2. Public Facing System

Long-term data storage and preservation

Integrated resources

- HPC capabilities at Idaho National Laboratory

Data Storage and Sharing within NRDS

Data generated at NSUF partner facilities will be uploaded to the *private* NRDS portal

- Helps to facilitate common data formats between facilities

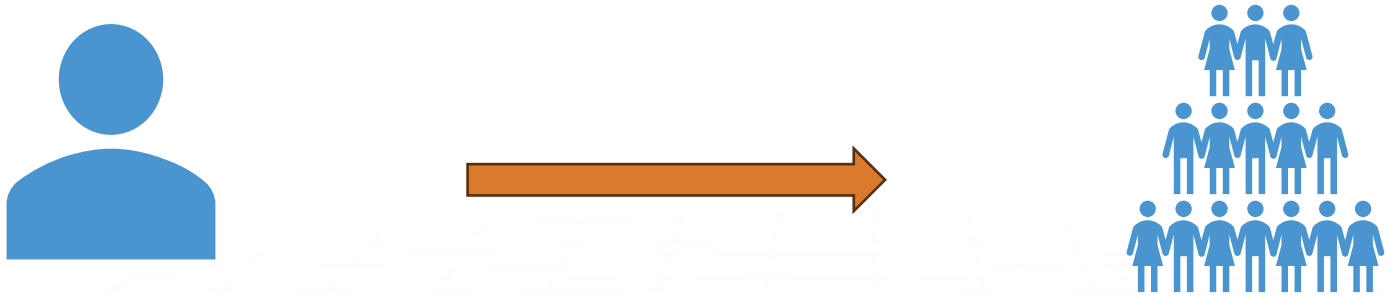
- Allows a consistent approach for users work and engagement with NSUF

Data will eventually be transitioned to the *public-facing* domain of NRDS

- **Not applicable to any competed, active, or under evaluation NSUF user access projects.**

- ✓ **Proposed consideration for future user access opportunities - to be implemented in close coordination and with additional upfront communication with user community**

Proposed Data Access Implementation



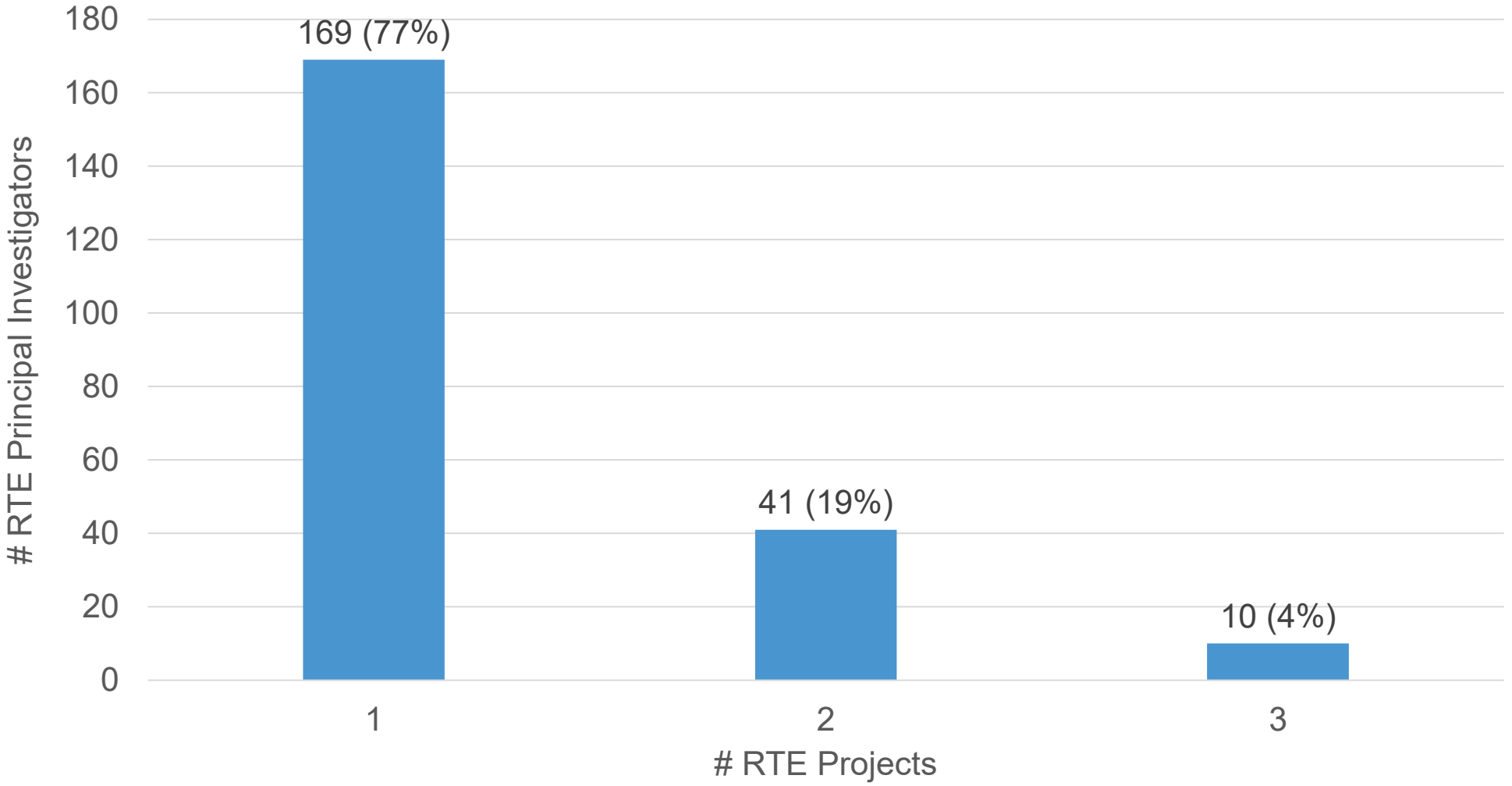
Exclusive access to data when:

- Project is active
- Data is actively being used by the project team with the intent to publish

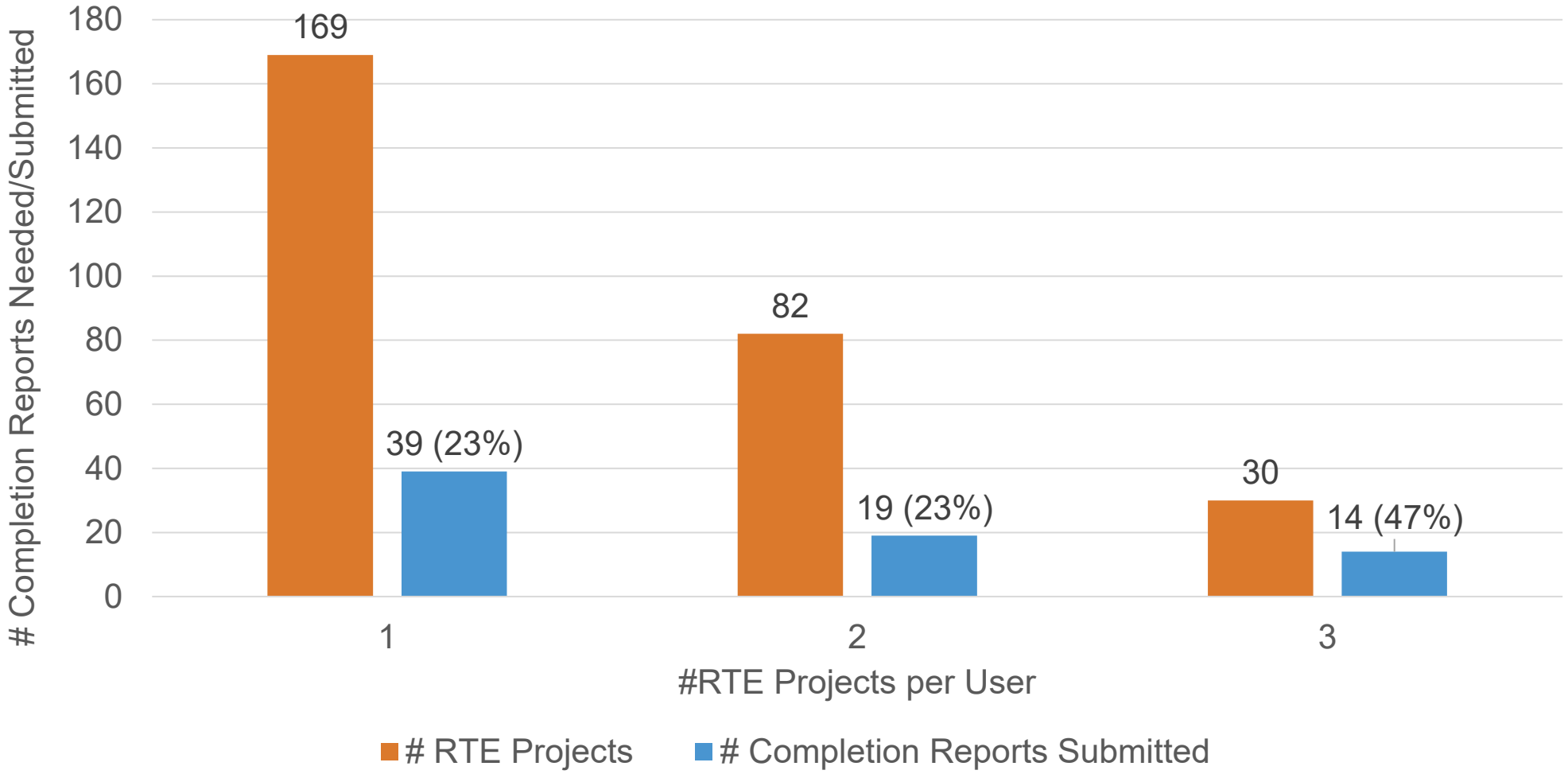
Public access to data when:

- Project is no longer active
- Data is not in use by the project team
- An appropriate exclusivity period has lapsed

NSUF Users with 1, 2 or 3 Awarded RTE Projects



Completion Reports Submitted (FY20 - present)



Period of Exclusivity *Discussion*

- Exclusivity for 6 months after RTE physical work is complete, then:
  - If a completion report is submitted and accepted, data will be released in 2 years
  - If a completion report is submitted and accepted **and** papers are being drafted or publications pending, data release will be delayed after consultation with PI and after publication is released
- If no completion report is submitted within 6 months, data will be released

NRDS Portal

data

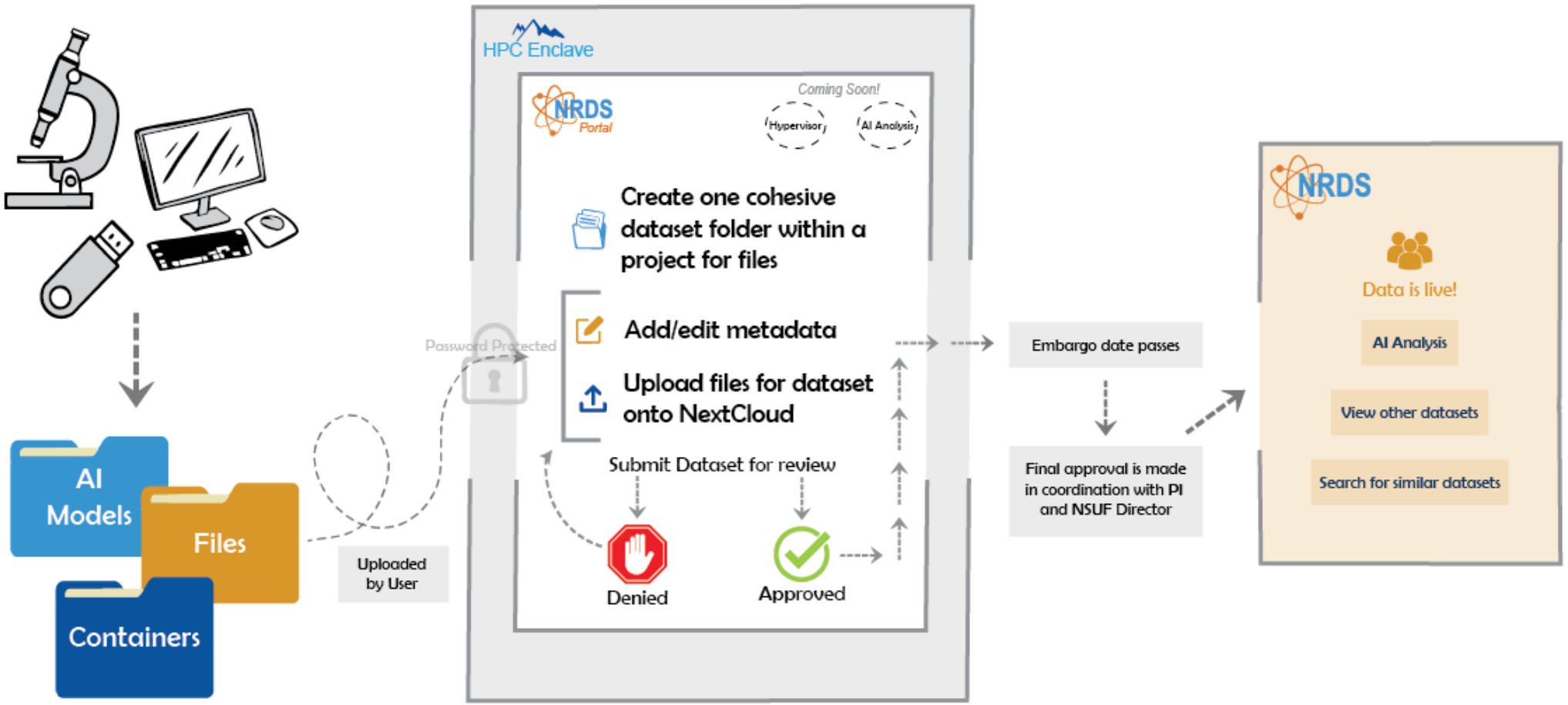
NRDS

- Site for registered NSUF PIs or co-PIs users
- Requires NSUF account to sign in
- Workspace for data uploads to allow for project user collaboration
- Place for datasets metadata

https://nrds-portal.inl.gov/

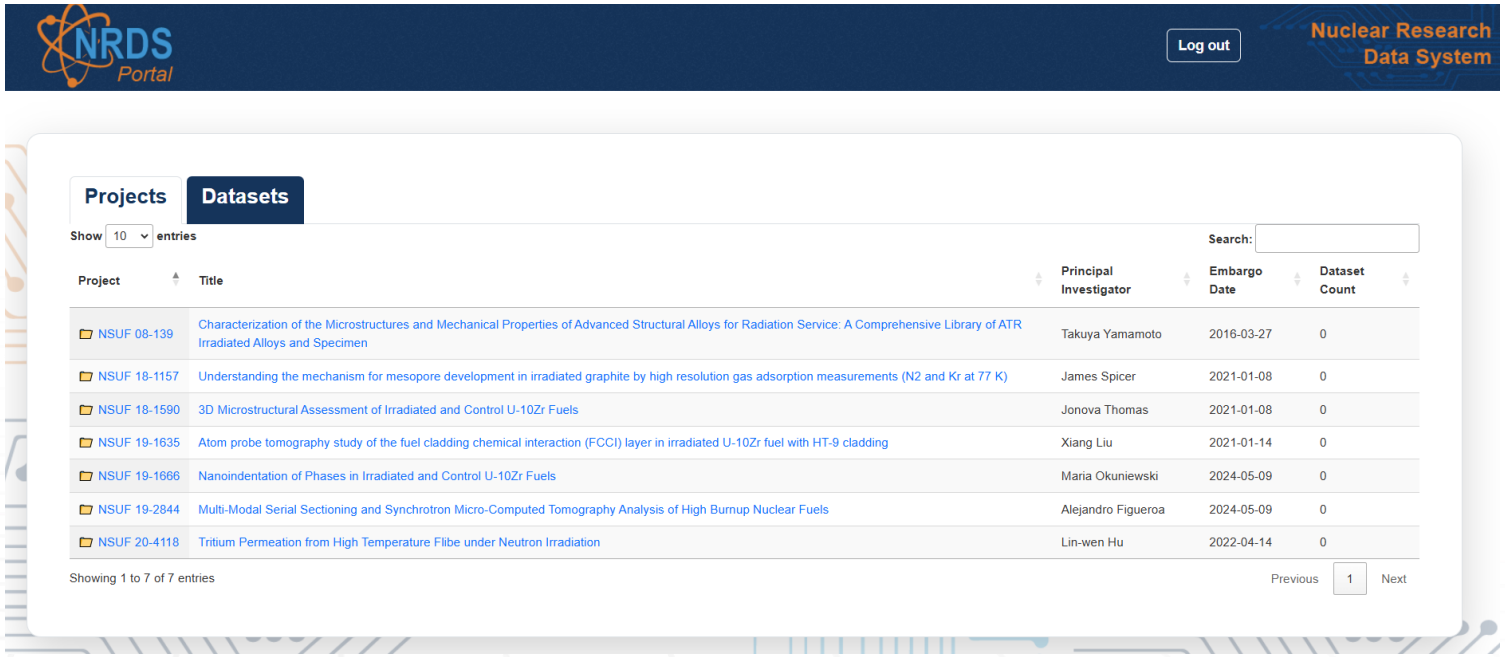
- Public science data gateway
- No password required
- Use of FpAIRe for data allowing for data to be:
  - Downloaded
  - Previewed
  - Enhanced through AI

https://nrds.inl.gov/


HPC Enclave
NRDS Portal
Coming Soon!
Hypervisor
AI Analysis
Create one cohesive dataset folder within a project for files
Add/edit metadata
Upload files for dataset onto NextCloud
Password Protected
Submit Dataset for review
Denied
Approved
Uploaded by User
AI Models
Files
Containers
Embargo date passes
Final approval is made in coordination with PI and NSUF Director
NRDS
Data is live!
AI Analysis
View other datasets
Search for similar datasets

NRDS Portal

- Collaborative space
- Metadata collection
- Embargos will be enforced
  - Length to be decided
- DOIs will be automatically created for each dataset
- Allows drag and drop for files
- The project PI and NSUF review team will both have to either approve or reject dataset before it is published to NRDS



All users' view

Projects | **Datasets**

Filter by Status

- 1 Adding
- 1 Under Review
- 0 Needs Revision
- 0 Completed
- 0 Live
- 2 All

Create Dataset

Review Datasets

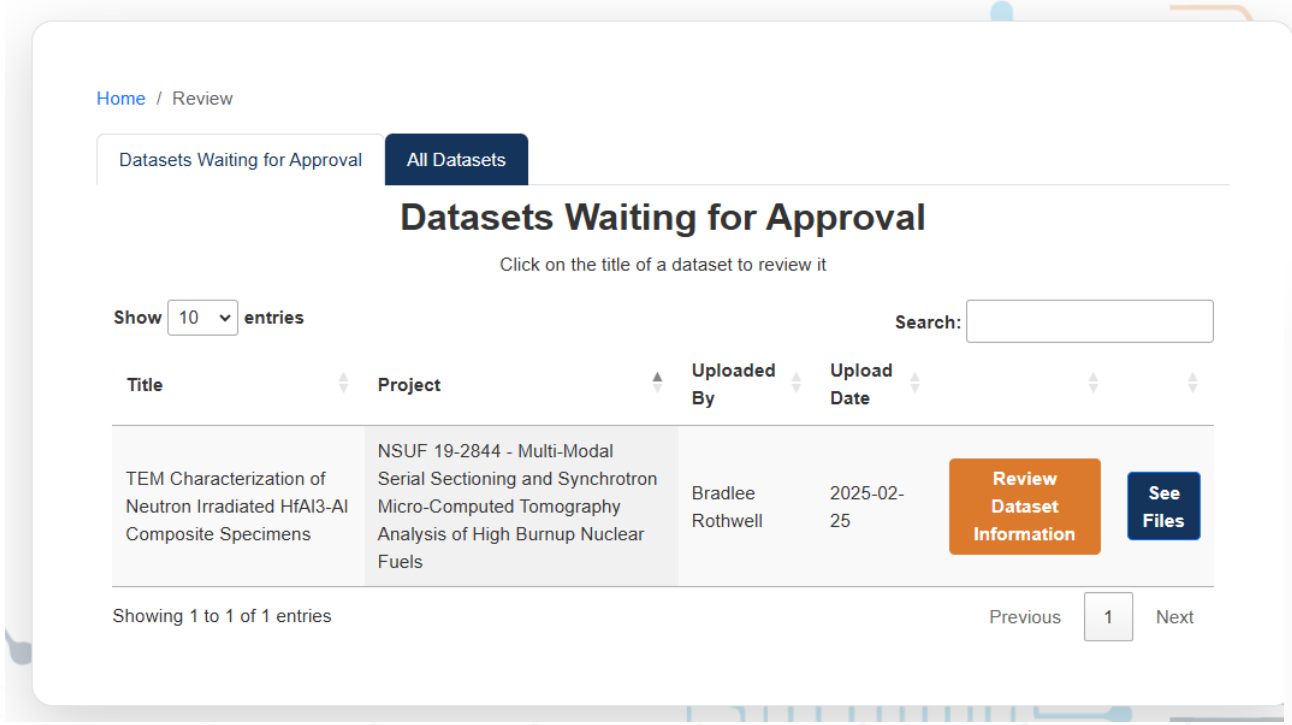
Show 10 entries

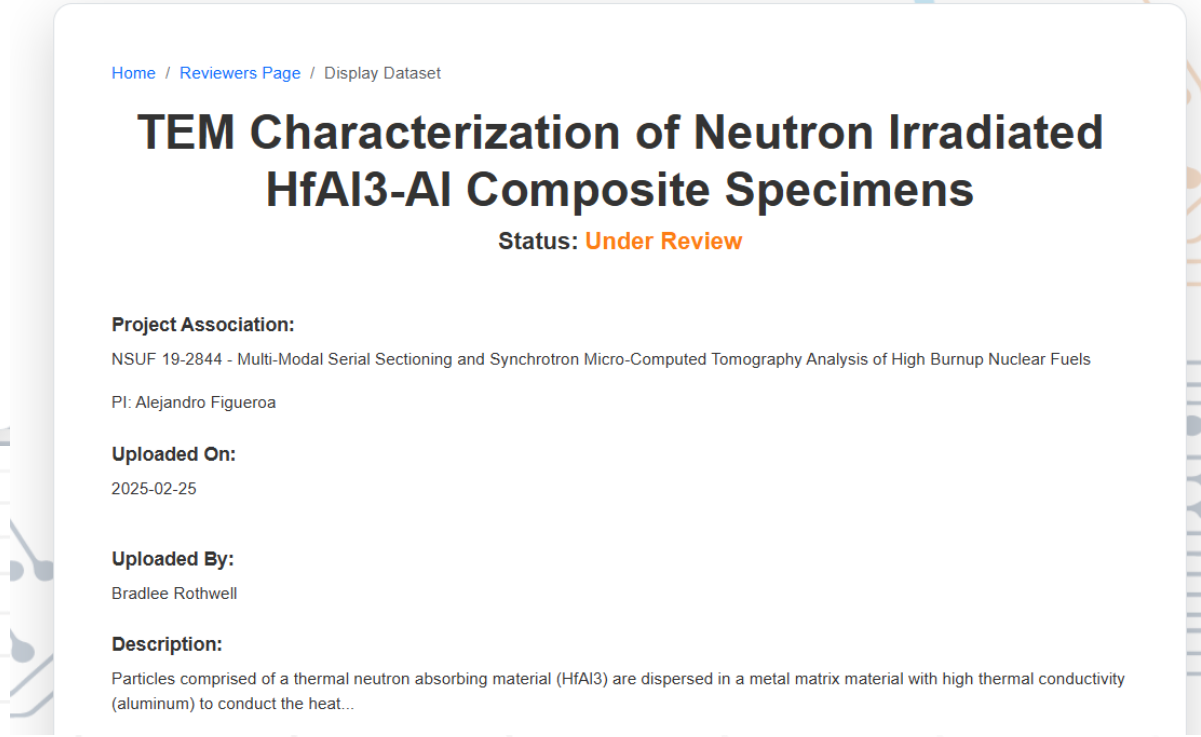
Search:

	Title	Project	Embargo Date	Status	Creator	
👁	Report Files	NSUF 08-139: Characterization of the Microstructures and Mechanical Properties of Advanced Structural Alloys for Radiation Service: A Comprehensive Library of ATR Irradiated Alloys and Specimen	2016-03-27	Under Review	Jeremy Sharapov	Add Files
👁	Mesopore Images for 2021-01-14	NSUF 18-1157: Understanding the mechanism for mesopore development in irradiated graphite by high resolution gas adsorption measurements (N2 and Kr at 77 K)	2021-01-08	Under Review	Jeremy Sharapov	Add Files
👁	Research files	NSUF 19-1635: Atom probe tomography study of the fuel cladding chemical interaction (FCCI) layer in irradiated U-10Zr fuel with HT-9 cladding	2021-01-14	Under Review	Bradlee Rothwell	Add Files
👁	Irradiation Files	NSUF 20-4118: Tritium Permeation from High Temperature Flibe under Neutron Irradiation	2022-04-14	Completed	Jeremy Sharapov	View Files
⚠	June Dataset 2	NSUF 20-4118: Tritium Permeation from High Temperature Flibe under Neutron Irradiation	2022-04-14	Needs Revision	Jeremy Sharapov	Add Files
✎ ✓	Analysis Report	NSUF 19-2844: Multi-Modal Serial Sectioning and Synchrotron Micro-Computed Tomography Analysis of High Burnup Nuclear Fuels	2024-05-09	Adding	Bradlee Rothwell	Add Files

tps://nrds-portal-dev.hpc.inl.gov/home

PI's view

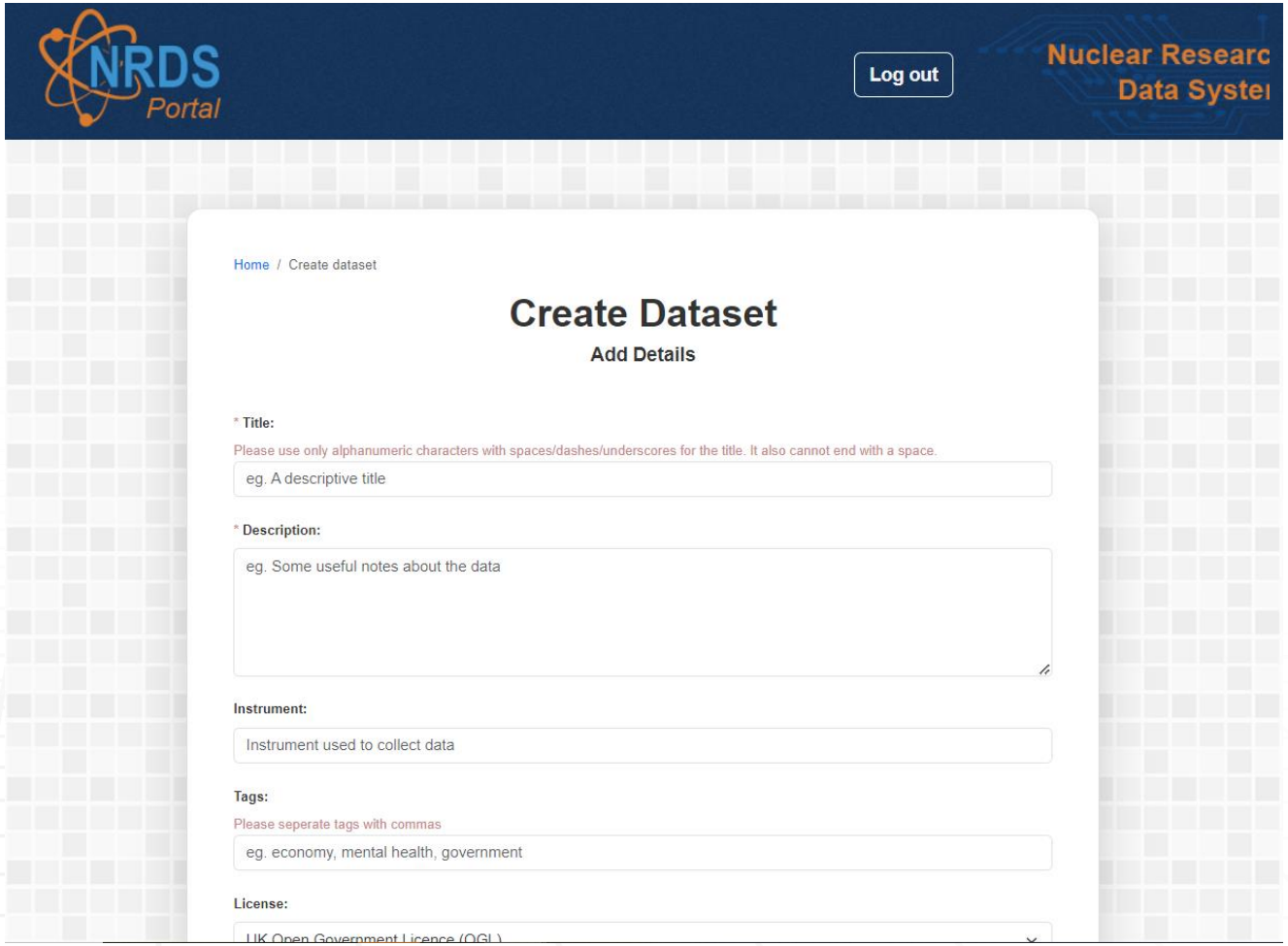




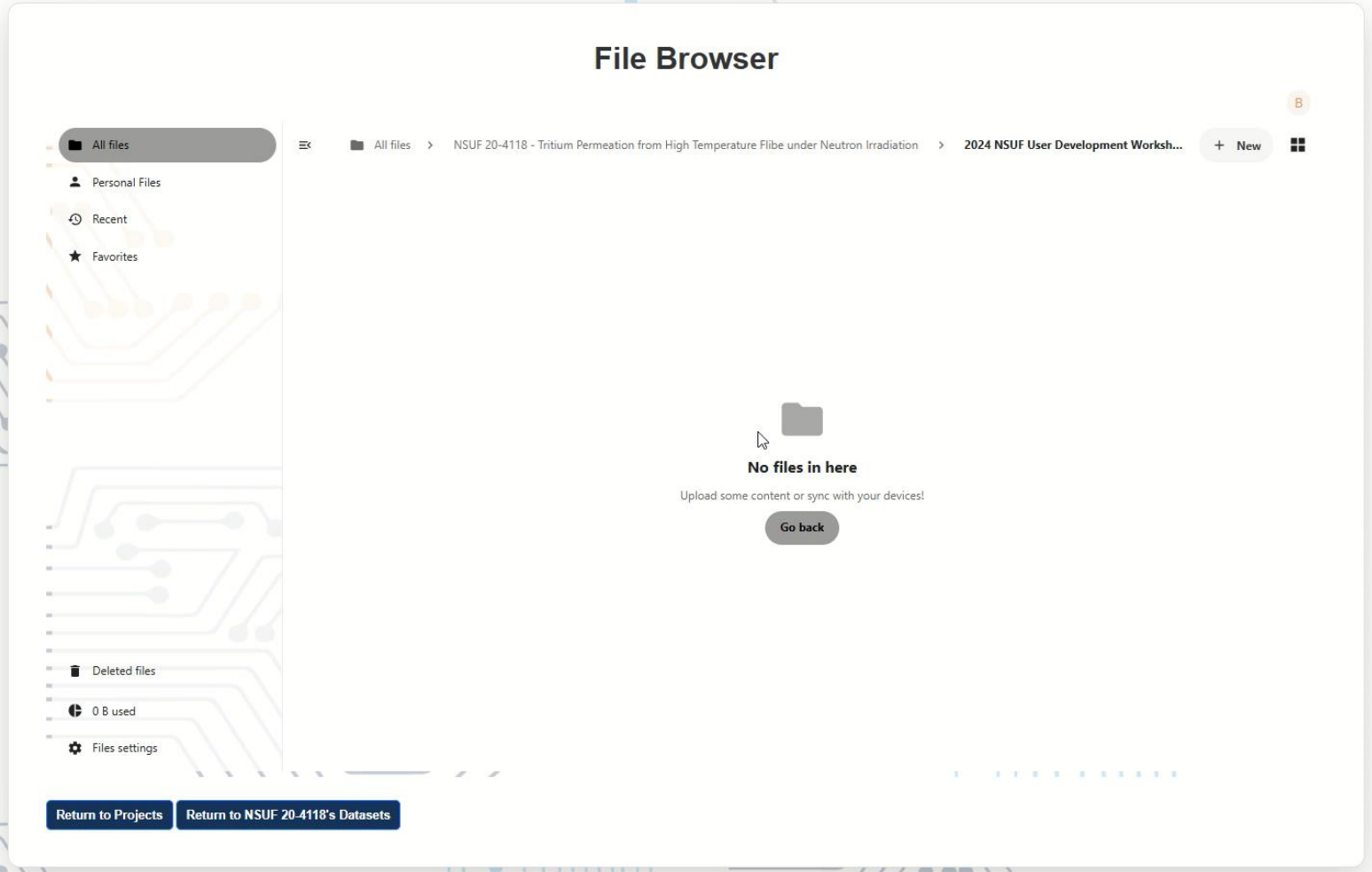
NSUF Nuclear Science User Facilities

Dataset Fields

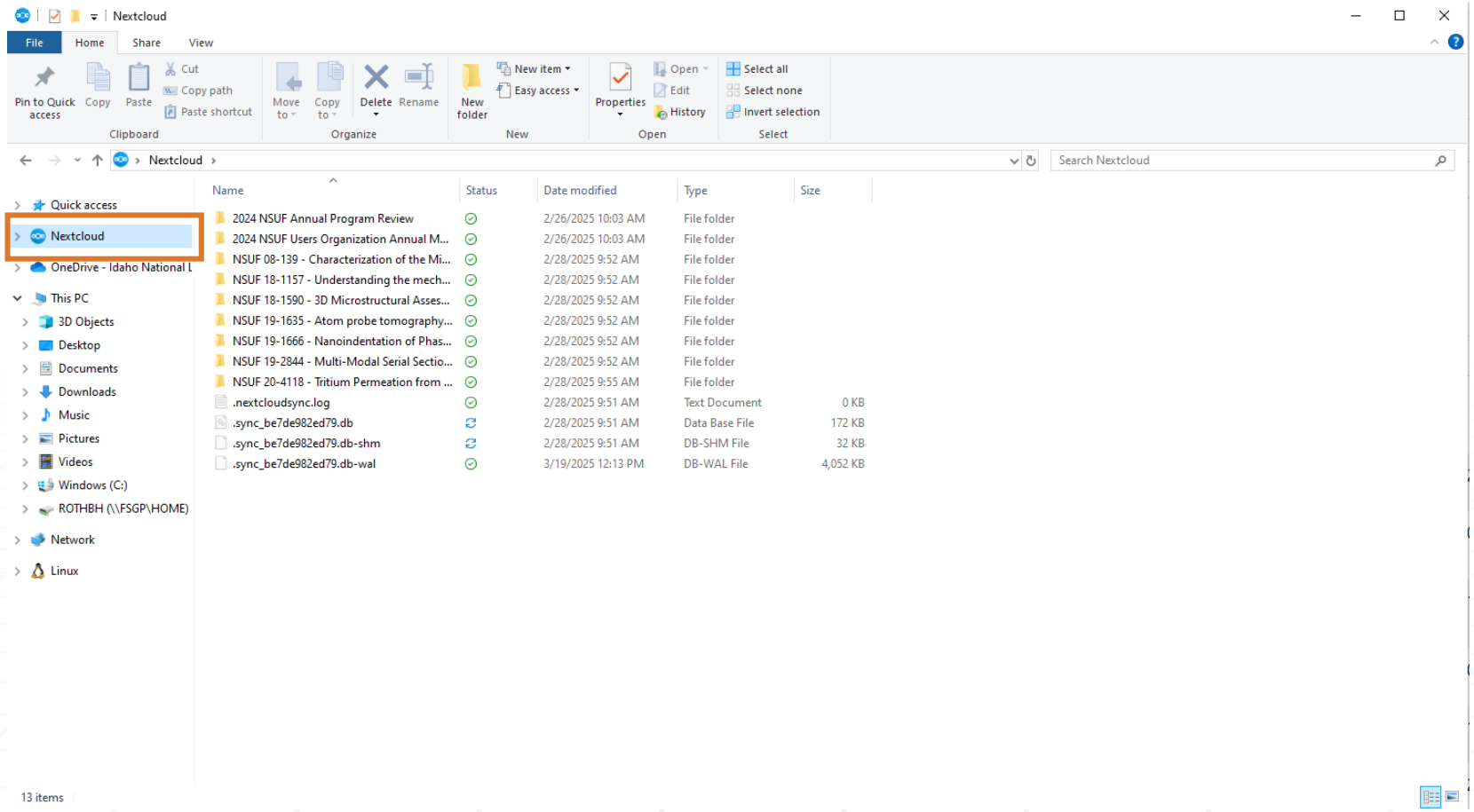
Field name	Explanation	Required?
Title	A descriptive title that the dataset will be released as on the main NRDS website.	Yes
Description	Some useful information about the data, similar to a project abstract.	Yes
Instruments	The device(s) used to collect/generate the data, including any model numbers.	No
Tags	Keywords that describe the dataset and will be able to be used as filters.	No
License	The copyright license this dataset will be released under.	Yes
Project Association	The project that this data was collected as part of and funded by.	Yes
Embargo Expiration	The date the data associated with this dataset will be released for the public.	No
Author(s)	The author(s) of the dataset to be listed on the main NRDS website.	No
Statement of Credit	The statement that others will use to give you credit for/cite your work.	Yes
Dataset DOI	If no DOI is entered, NRDS will automatically generate one and email it to you.	No

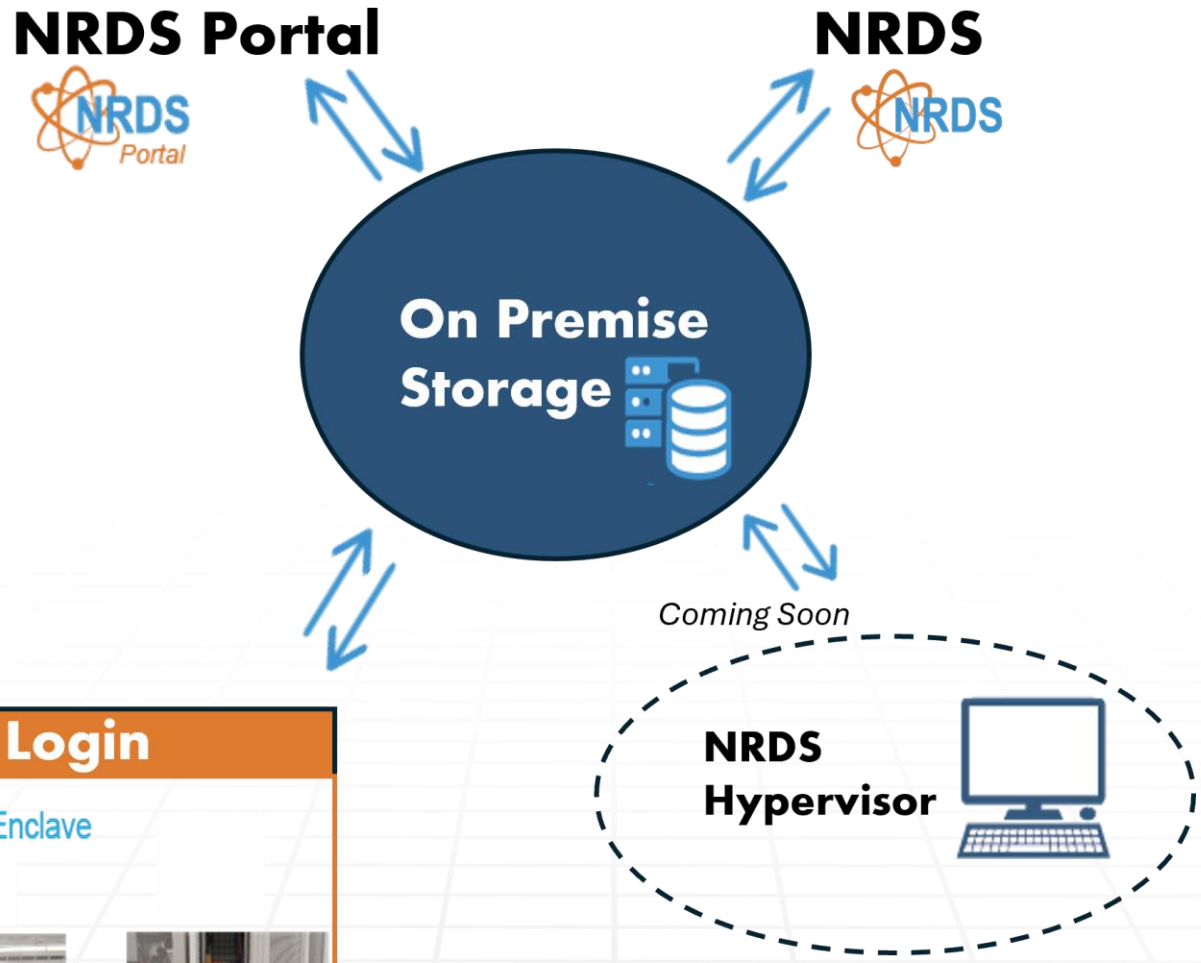


Uploading Files – Website App



Uploading Files – NextCloud App



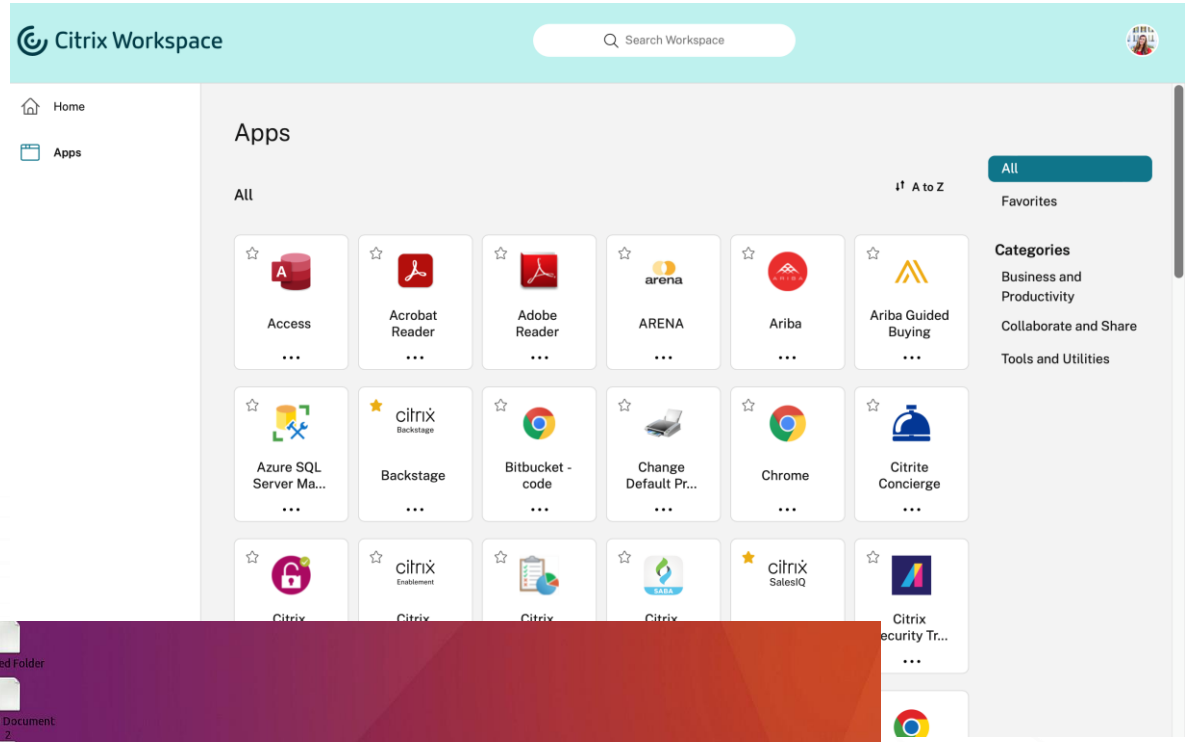

NRDS Portal
NRDS Portal
NRDS
NRDS
On Premise Storage
Coming Soon
NRDS Hypervisor


Account Login
HPC Enclave
Sawtooth
Bitterroot
Hoodoo

NRDS Portal Hypervisor

(coming soon)

- Will allow HPC access via Citrix Hypervisor which will include:
  - Virtual Windows desktops
  - Direct access to GPUs
  - Access to run software such as Avizo and VGStudioMax
- All data available to the user is accessible here
- Only users within the specific project can view or use the data for the project
- Access to AI Models



NSUF Nuclear Science User Facilities

NRDS Public Domain
Guidelines

PI provides input
- Label releasable data
- If no response, all data will be deemed releasable

Evaluated for public dissemination
- NRDS will submit to LRS
- Non-INL partner facilities should evaluate per their institution's policies and procedures

All data submitted to NSUF program office

Will be reviewed for CUI/DC including export control review

NSUF Director reviews

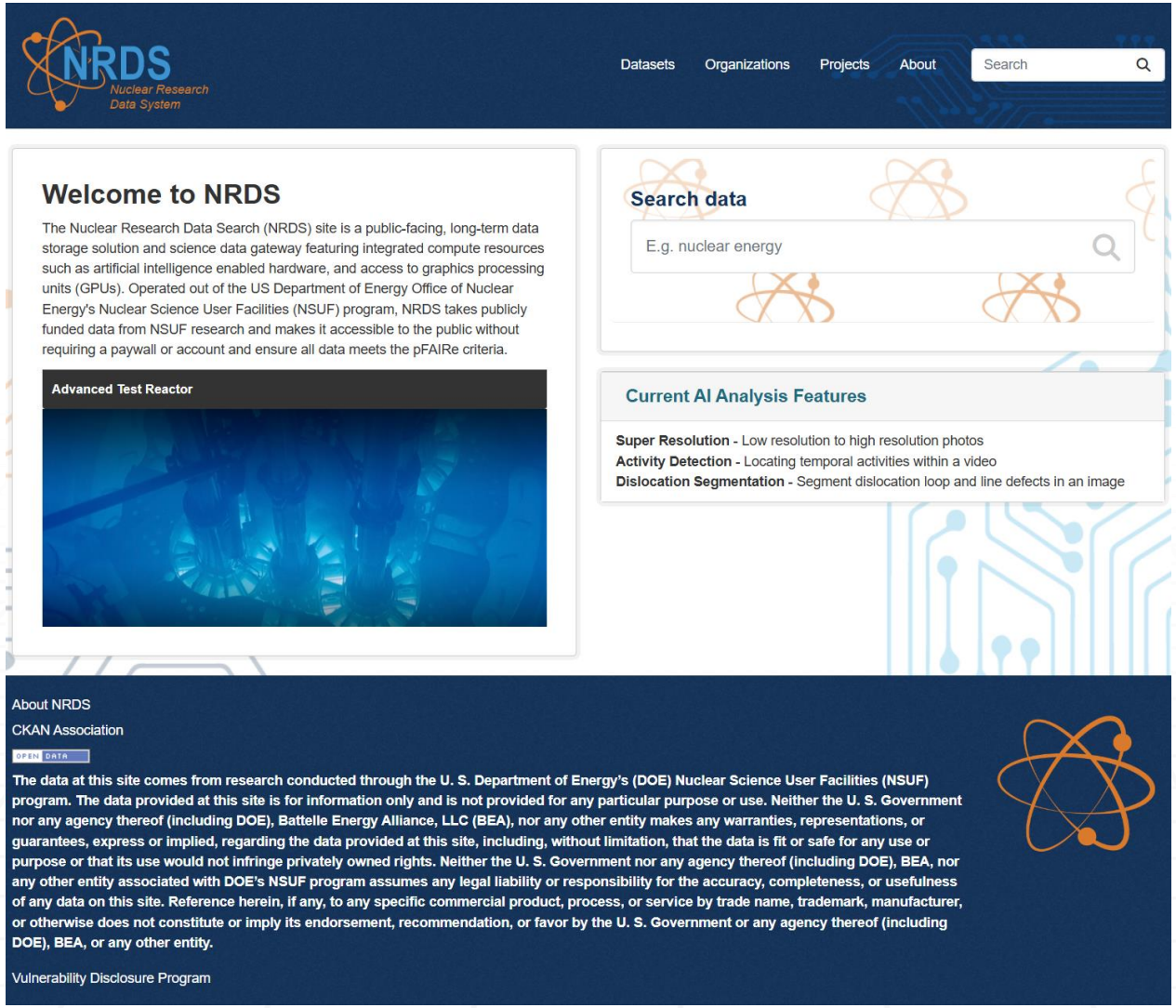
Director will review every dataset

Data goes from private to public

On NRDS after embargo (TBD)

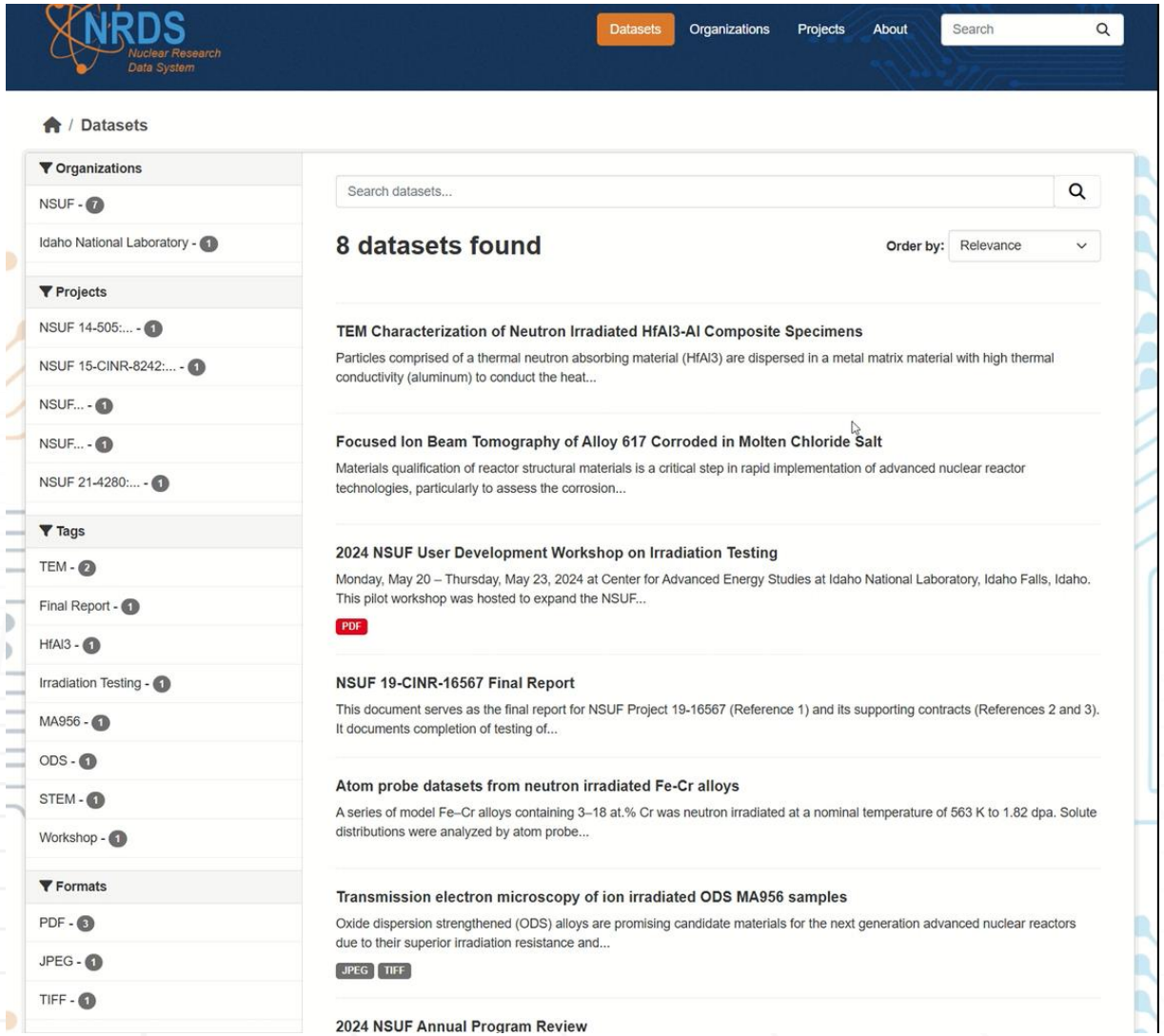
NRDS
Nuclear Research Data System

NRDS.inl.gov


NRDS
Nuclear Research Data System
Datasets
Organizations
Projects
About
Search
Welcome to NRDS
The Nuclear Research Data Search (NRDS) site is a public-facing, long-term data storage solution and science data gateway featuring integrated compute resources such as artificial intelligence enabled hardware, and access to graphics processing units (GPUs). Operated out of the US Department of Energy Office of Nuclear Energy's Nuclear Science User Facilities (NSUF) program, NRDS takes publicly funded data from NSUF research and makes it accessible to the public without requiring a paywall or account and ensure all data meets the pFAIRe criteria.
Advanced Test Reactor
Search data
E.g. nuclear energy
Current AI Analysis Features
Super Resolution - Low resolution to high resolution photos
Activity Detection - Locating temporal activities within a video
Dislocation Segmentation - Segment dislocation loop and line defects in an image
About NRDS
CKAN Association
OPEN DATA
The data at this site comes from research conducted through the U. S. Department of Energy's (DOE) Nuclear Science User Facilities (NSUF) program. The data provided at this site is for information only and is not provided for any particular purpose or use. Neither the U. S. Government nor any agency thereof (including DOE), Battelle Energy Alliance, LLC (BEA), nor any other entity makes any warranties, representations, or guarantees, express or implied, regarding the data provided at this site, including, without limitation, that the data is fit or safe for any use or purpose or that its use would not infringe privately owned rights. Neither the U. S. Government nor any agency thereof (including DOE), BEA, nor any other entity associated with DOE's NSUF program assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any data on this site. Reference herein, if any, to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not constitute or imply its endorsement, recommendation, or favor by the U. S. Government or any agency thereof (including DOE), BEA, or any other entity.
Vulnerability Disclosure Program

NRDS FpAIRe Data

- Findability
  - DOI Links, tags, search
- **Peekable**
  - pdfs, excel, txt, images, videos
- Accessibility
  - Licensing attribution
- Interoperable
  - NRDS Portal collaboration
- Reusable
  - 1.2 PB storage initially
- **Extensible**



AI Analysis

- Currently Available
  - **Predictive Automation of Novel Defect Anomalies (PANDA)**
  - Super Resolution
  - Activity Detection
- Coming Soon
  - Dislocation Line Segmentation
  - Anomaly Detection
  - Object Detection
  - Stitching

Dislocation Segmentation

Dislocation Segmentation

Segment dislocation loop and line defects in an image

Images will be deleted after one day of generation. Please make sure to download the image or else the image will have to be regenerated

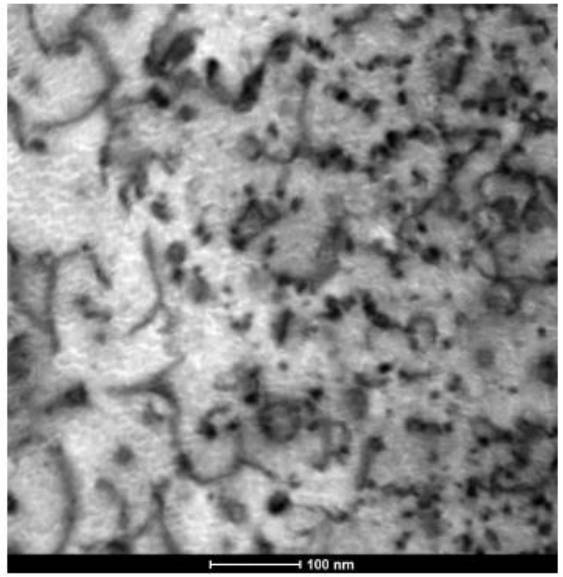
Generated label files are in the YOLO format. Please see Ultralytics YOLO format for more details. For this model a class index of 0 corresponds to dislocation lines and a 1 corresponds to dislocation loops.

Segment

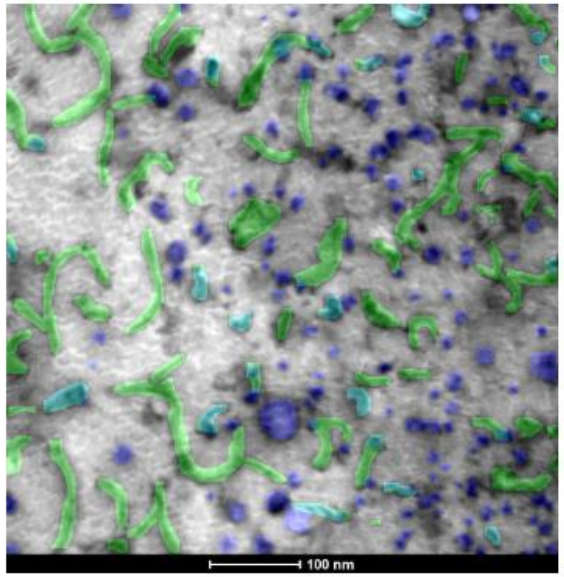
- Dislocation Loop
- Dislocation Line
- Prediction Loop/Line Overla

Compare Images

Original



Dislocation



Loops: 228 Lines: 157

Download Predicted Labels

Super Resolution

Super Resolution

Low resolution to high resolution photo

Images will be deleted after one day of generation. Please make sure to download the image or else the image will have to be regenerated

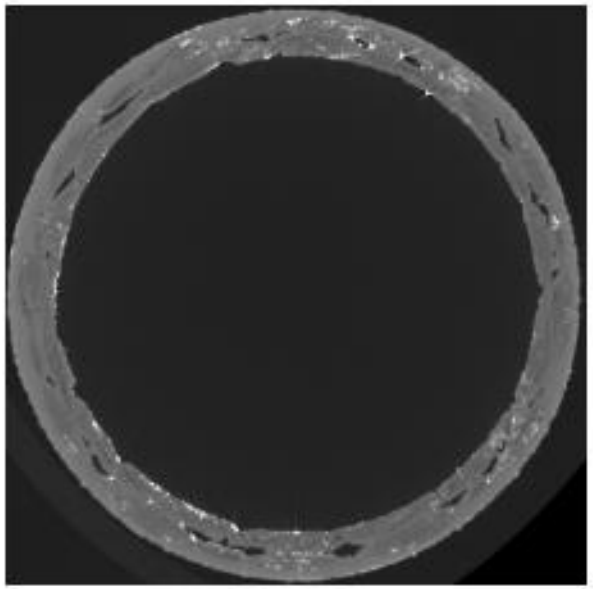
Upscale

Sharpen

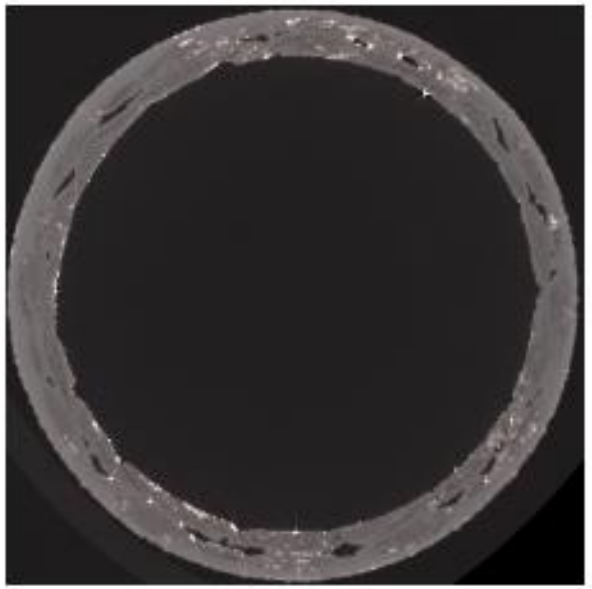
Compare Images

rot0625_low_res.png

Original ▼

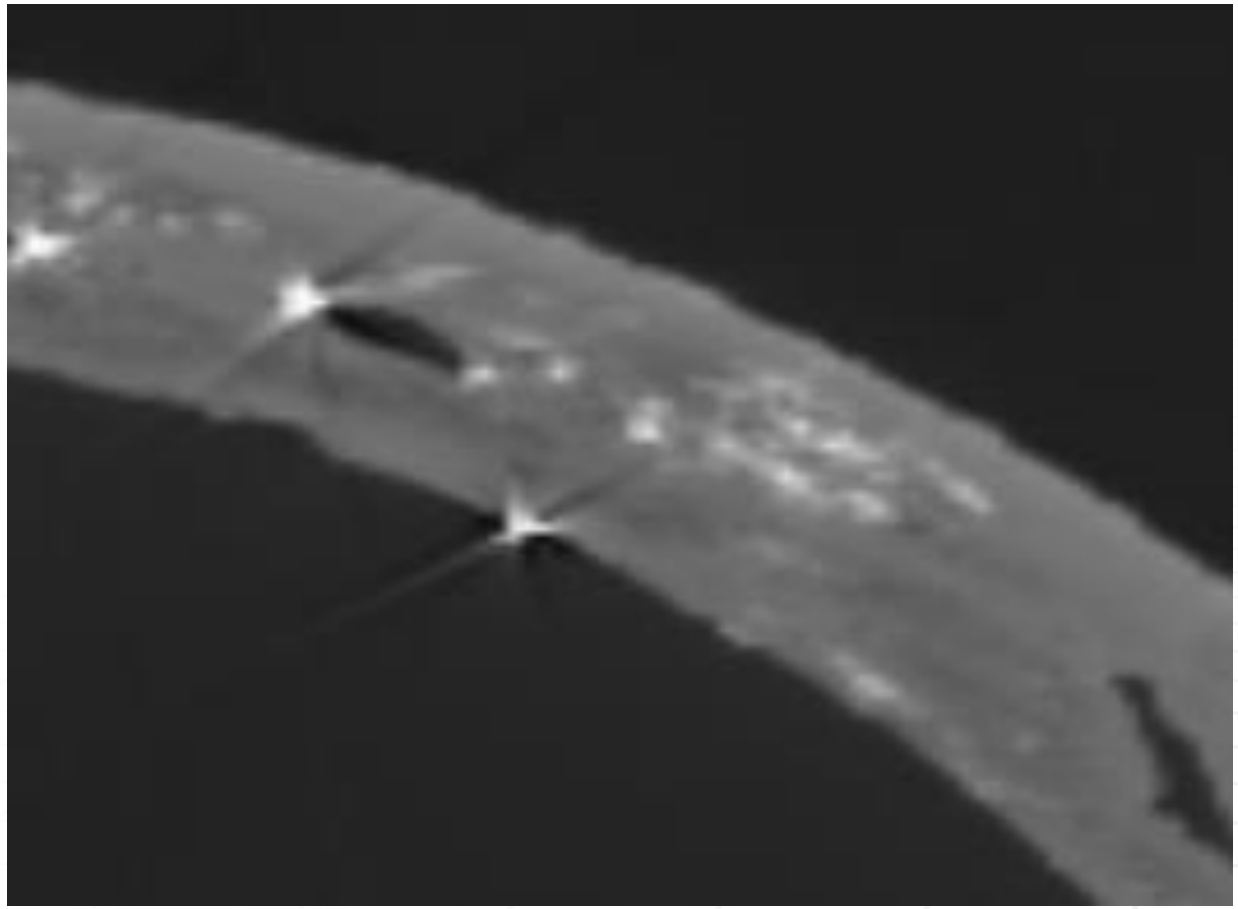


Upscaled ▼

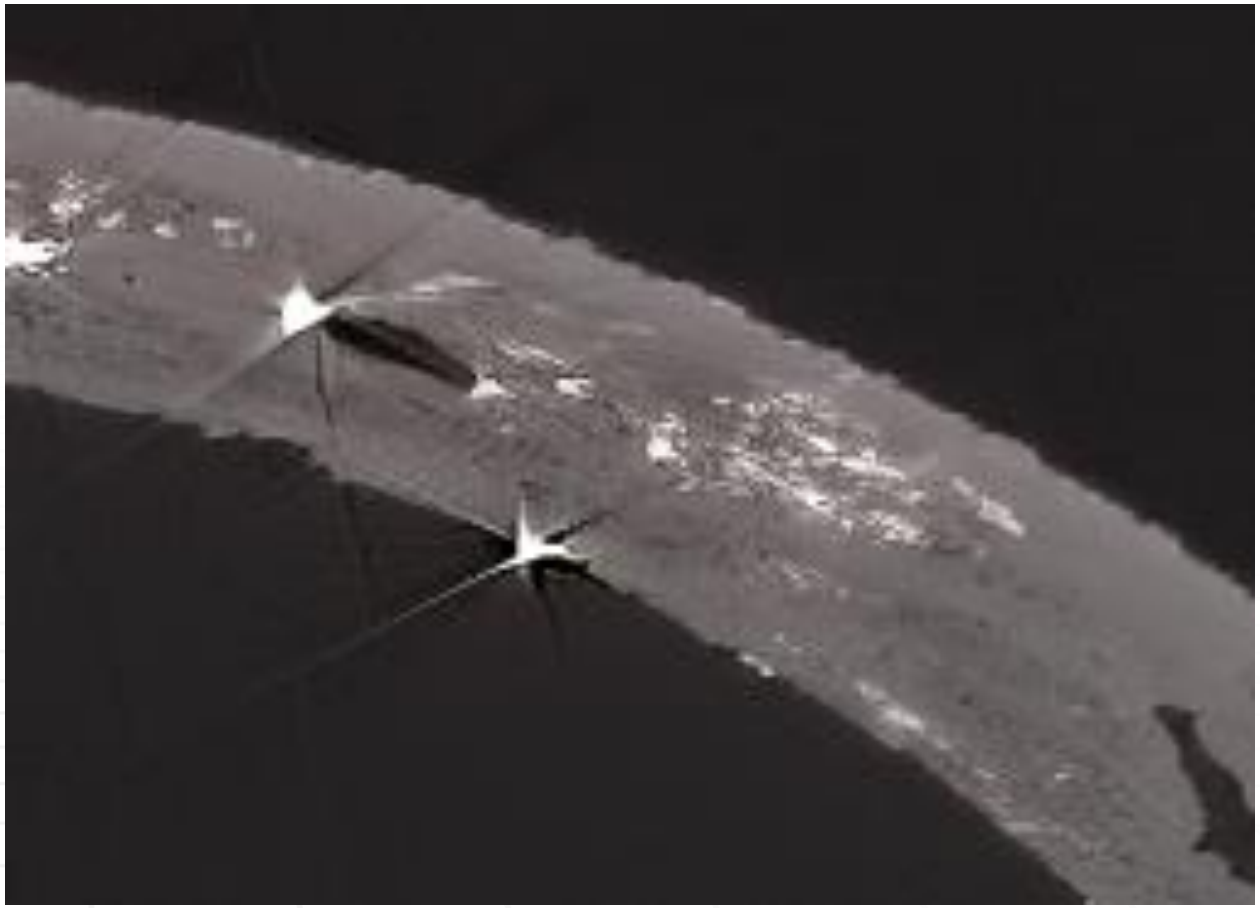


Super Resolution

Before



After



Questions?

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NSUF Nuclear Science User Facilities

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