



HIGH FLUX  
ISOTOPE  
REACTOR

SPALLATION  
NEUTRON  
SOURCE

2026 Instrument Suite Review

# HIDRA & VULCAN

GL Report

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U.S. DEPARTMENT OF  
**ENERGY**

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## **This review is incredibly valuable to us!**

- The Instrument Suite Reviews are an opportunity for us to bring in outside expert and do a “deep dive” into where we are, how we got here, and where we are going.
- Your comments will not be filed away and ignored – as with the previous two reviews (in 2017 and 2020) we will absolutely use your review feedback to inform our priorities.

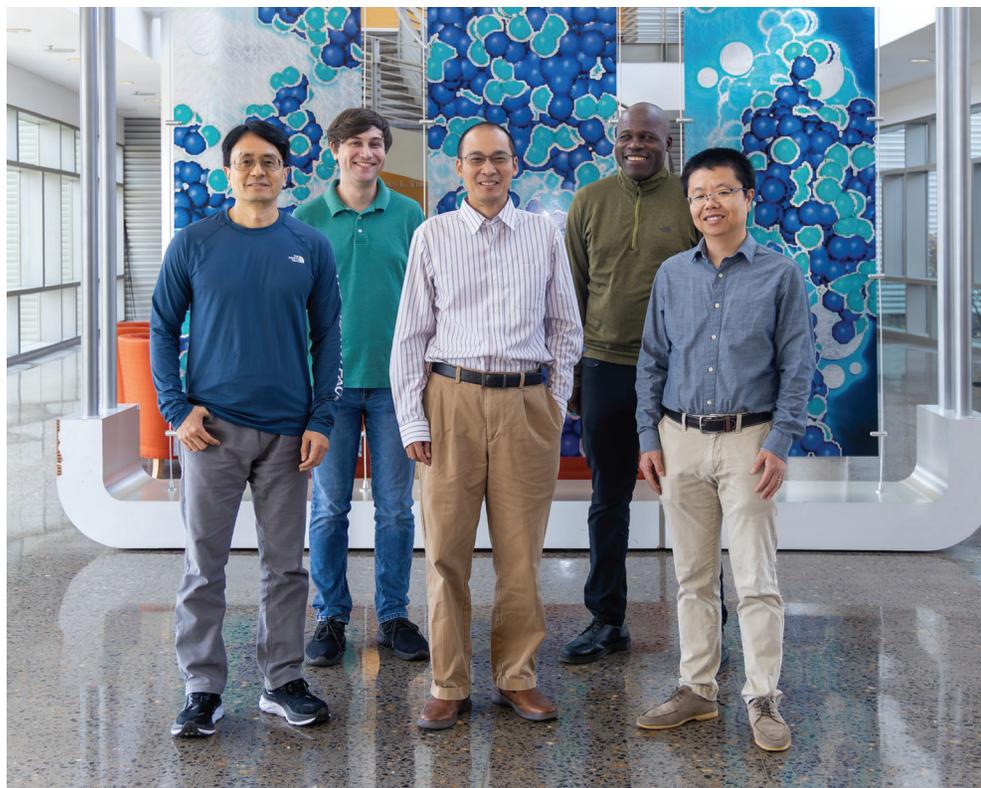
# The Suite of Instruments - Introduction

- The MATENG Group is home to two engineering instruments
  - **HB-2B HIDRA** at HFIR (high spatial resolution strain mapping)
    - **Jeff Bunn, Andrew Payzant, Chris Fancher**, and SA Cody Pratt
  - **BL-7 VULCAN** at SNS (engineering materials diffractometer)
    - **Ke An, Yan Chen**, Dunji Yu, CIS Luc Dessieux, and SA Jordan Bogdan
  - Shared Staff
    - Saurabh Kabra recently (last week) joined MATENG and will partly support MARS and HIDRA this year

comments:

- **staff in bold are the only ones who were here in the same positions for the last review in 2020!!!**
- Additional staff from DAC and SE provide essential support
- Thanks to Paris Cornwell and Doug Kyle for past SA support on HIDRA, and Ducu Stoica who retired from VULCAN team.
- Instrument teams may tell you about best paper awards, NSSA Fellow, and ORNL Scientist of the Year, professional society engagement, etc.

# The Suite of Instruments – Instrument Staff



HIDRA

VULCAN

# A lot has happened since the last review!

- 2020:

- we had just recovered from an 11-month unexpected HFIR shutdown the previous year
- We had just completed the upgrade of NRSF2 to HIDRA
- We had just started VULCAN-X instrument upgrade project
- ... and then COVID hit (no onsite Users in 2020 or 2021)

- 2021-25:

- We have had to manage with very limited HFIR fuel cycles, 4/2022, 3/2023, 7/2024, 3/2025
- We have had a 6-month SNS outage (for PPU)

- 2026 outlook:

- Moving to 2 MW operation at SNS over the next year
- We are looking ahead to the Cold Source (Feb 2028 – Apr 2029) and HBRR outage (starting Oct 2029)
- New HIDRA opportunities post-HBRR (shielding, monochromator illumination, robots...)
- STS moving forward – possible new engineering beamline MENUS, Science Case for STS

## Comparable Programs at Peer Facilities

- KOWARI (ANSTO)
- SALSA (ILL)
- TAKUMI (J-PARC)
- ENGIN-X (ISIS)

No doubt by next review the China Spallation Source will be a major player

# Scientific Productivity

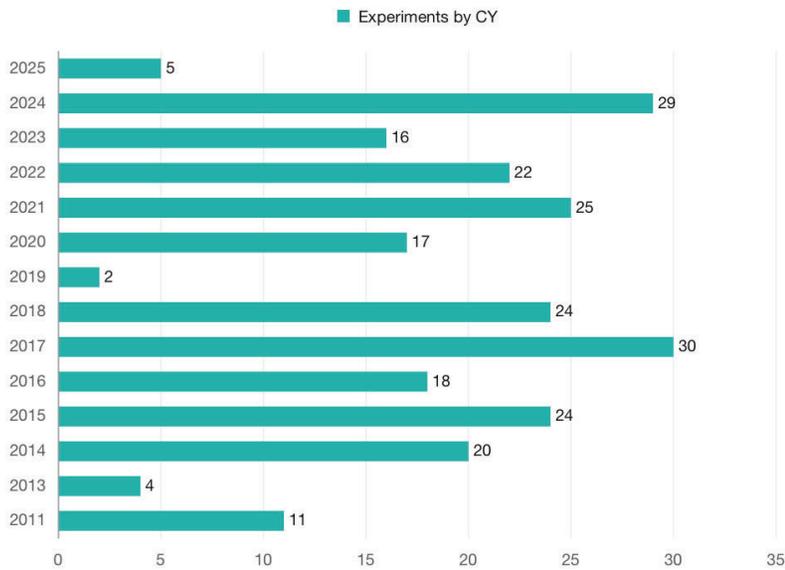
Do the scientific productivity and impact of the “engineering” program compare favorably with programs at peer facilities?

	HIDRA	KOWARI	SALSA		VULCAN	TAKUMI	ENGIN-X
2021	11	15	7		30	24	20
2022	4	24	9		43	30	13
2023	8	14	10		28	18	8
2024	5	14	9		28	30	9
2025	5	15	4		25	30	9
2026	3*	2*	1*		7*	3*	*

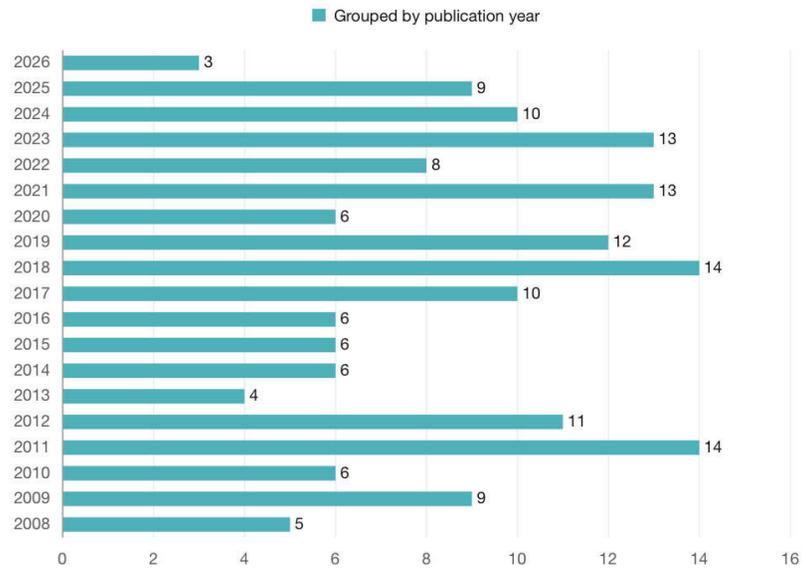
- Peer-reviewed journal publications only (\* = incomplete data)
- OPAL/ANSTO runs 300-340 days/year at 20 MW; HFIR ran 3-7 23-day cycles at 85 MW
  - HIDRA User days nearly always limited mainly by neutron availability
  - VULCAN has been impacted by VULCAN-X upgrade and PPU limiting User days

# HIDRA publication details

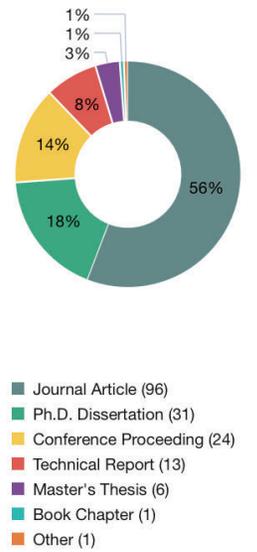
Experiments by CY



Publications by CY

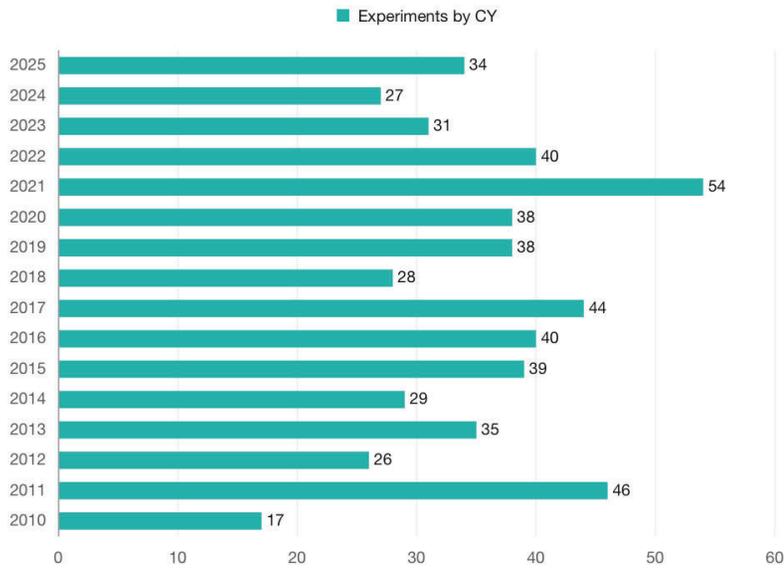


Publications by Type

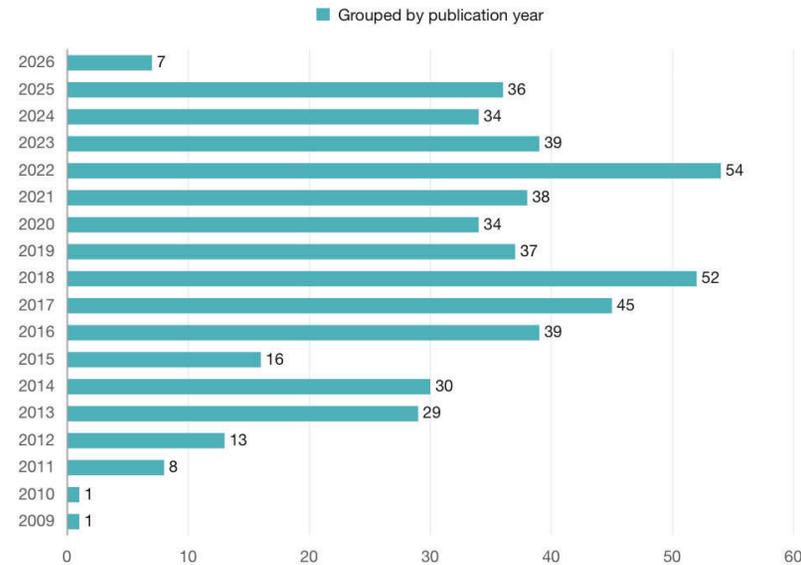


# VULCAN publication details

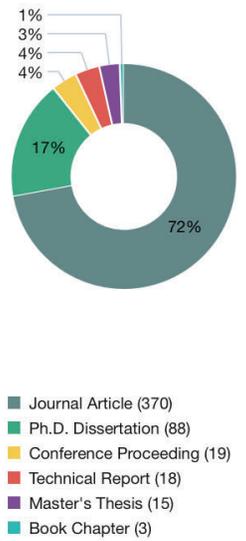
Experiments by CY



Publications by CY



Publications by Type



# Two sources provide robust support for community

## Oak Ridge National Laboratory Neutron Production Overview

FY26														
	Oct-25	Nov-25	Dec-25	Jan-26	Feb-26	Mar-26	Apr-26	May-26	Jun-26	Jul-26	Aug-26	Sep-26		
SNS	1.9 MW Ops		FY26A			1.9 MW Operations		2.0 MW Ops		FY26B		1.9 MW Operations		
HFIR	EOC 512A	512 B&C	EOC 512C	513	EOC 513		514	EOC 514	515	EOC 515	516	EOC 516	517	
FY27														
	Oct-26	Nov-26	Dec-26	Jan-27	Feb-27	Mar-27	Apr-27	May-27	Jun-27	Jul-27	Aug-27	Sep-27		
SNS	2 MW Operations		FY27A			2 MW Operations			FY27B		2 MW Operations			
HFIR	EOC 517	518	EOC 518	519	EOC 519	520	EOC 520	521	EOC 521	522	EOC 522	523	EOC 523	
FY28														
	Oct-27	Nov-27	Dec-27	Jan-28	Feb-28	Mar-28	Apr-28	May-28	Jun-28	Jul-28	Aug-28	Sep-28		
SNS	2 MW Operations		FY28A			2 MW Operations			FY28B		2 MW Operations			
HFIR	EOC 523	524	EOC 524	525	EOC 525 Cold Source Outage/Hx Outage/Pool Cleanout									
FY29														
	Oct-28	Nov-28	Dec-28	Jan-29	Feb-29	Mar-29	Apr-29	May-29	Jun-29	Jul-29	Aug-29	Sep-29		
SNS	2 MW Operations		FY29A			2 MW Operations			FY29B		2 MW Operations			
HFIR	EOC 525		Readiness Assessment/Review				526	EOC 526	527	EOC 527	528	EOC 528	529	EOC 529
FY30														
	Oct-29	Nov-29	Dec-29	Jan-30	Feb-30	Mar-30	Apr-30	May-30	Jun-30	Jul-30	Aug-30	Sep-30		
SNS	2 MW Operations		FY30A			2 MW Operations			FY30B		2 MW Operations			
HFIR	EOC 529 - Beam Room Cleanout/HBRR Outage													
FY31														
	Oct-30	Nov-30	Dec-30	Jan-31	Feb-31	Mar-31	Apr-31	May-31	Jun-31	Jul-31	Aug-31	Sep-31		
SNS	2 MW Operations		FY31A			2 MW Operations			FY31B - 2k cold box replacement					
HFIR	Beam Room Cleanout/HBRR Outage				Readiness Assessment/Review				HFIR Schedule TBD					

■ Neutron Production
 ■ Outage
 Revised 12/30/25. The working schedule for the Spallation Neutron Source (SNS) and the High Flux Isotope Reactor (HFIR) is subject to change in response to evolving operational and project needs. The community will be notified as soon as possible if changes occur.

# How about the strength of the User Community?

In the VULCAN and HIDRA presentations, you will see there is a large (based on oversubscription) and diverse (based on User-defined research areas) User community that relies on these instruments

It continues to be a challenge to:

- (1) educate the materials science & engineering community as to how neutron scattering can be impactful in their science
- (2) communicate how to access our instruments and provide means of access that are timely and inexpensive
- (3) provide the necessary expertise and provide the necessary education for Users to become adept in using neutrons

## Expectations for Future Demand

- Accurate non-destructive RS mapping is and will be needed to validate materials modeling codes
- Versatile multimodal neutron scattering instruments to study materials in-situ and operando continues to be valued by our academic and industrial User communities
- Biggest challenge is how to increase our experiment throughput
  - Improved software planning tools
  - Better/enhanced instrument capabilities with integrated SE
  - Use of AI tools to optimize data collection
  - Development of new software tools for data visualization and analysis

# SWOT Analysis – HIDRA

## Strengths

- World-leading strain mapping with fine gauge volumes
- High neutron flux over six monochromatic wavelength options
- Unique experimental planning tools
- Broad scientific impact across welding, additive manufacturing, nuclear, aerospace, and related fields
- Strong complementarity with VULCAN for in-situ vs. ex-situ capabilities

## Weaknesses

- **Beam room background limits ultra-small gauge-volume measurements**
- **Staffing gaps including IS overload, CIS role unfilled, retirements, and upcoming SA leave**
- Lack of radial-collimator suite and limited  $\sim 16^\circ 2\theta$  field of view
- Geometry and space constraints with current goniometer and Z-stage
- Currently sample alignment requires extensive Local Contact support

## Opportunities

- Reduced background through walls/hutches/shielding
- HIDRA 2.0 modernization
- Robotic sample-handling system
- Virtual planning tools
- AI-assisted real-time adaptive data acquisition

## Threats

- **Funding and timeline uncertainties post-HBRR**
- HFIR reliability issues
- Broad user community not neutron scattering experts.
- Heavy reliance on skilled instrument staff
- Limited staffing resources.
- Other techniques are always improving

# SWOT Analysis – VULCAN

## Strengths

- Flexibility, versatility, broad scientific and engineering applications.
- Unique sample environments.
- Rapid data collection.
- TOF polarized diffraction.
- Applied research connected to industry

## Weaknesses

- Limited sample environment support for engineering application.
- Lacking cryo and magnetic capabilities under mechanical loading.
- atypical engineering diffraction related data reduction and analysis needs

## Opportunities

- Investment in fully autonomous experiment.
- Enable ultra low temperature mechanical loading.
- Advance data management and implement live and AI assisted reduction and analysis.

## Threats

- Broad user community not neutron scattering experts.
- Heavy reliance on skilled instrument staff
- Limited staffing resources.
- Other techniques are always improving

# The Case for Future Engineering Instruments

- Engineering beamline at the STS
  - The MENUS beamline concept reviewed well last time, but at least another round of instrument proposals are likely before the final STS instrument layout is settled
  - Challenging case why high-brightness cold neutrons are well-matched to our User community needs
- Instruments for a potential future HFIR guide hall
  - HOMER instrument concept