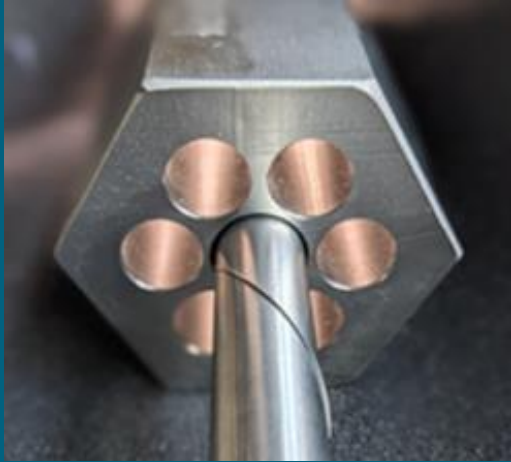


Office of Crosscutting Capabilities (NE-72)

Suibel Schuppner, Director

May 2024

Crosscutting Capabilities



Strategic investments in crosscutting research development and capabilities to advance innovative nuclear energy technologies for the existing reactor fleet, advance reactors, and fuel cycle systems



Crosscutting Research and Development

- Nuclear Energy Advanced Modeling and Simulation (NEAMS)
- Advanced Materials and Manufacturing Technologies (AMMT)
- Advanced Sensors and Instrumentation (ASI)

Crosscutting Research Capabilities

- Nuclear Science User Facilities (NSUF)
- High Performance Computing (HPC)
- University Fuel Services (UFS)

Office of Crosscutting Capabilities (NE-72)



Suibel Schuppner, Director



Dave
Henderson

NEAMS



Dirk
Cairns-Gallimore

AMMT



Daniel
Nichols

ASI



Chris
Barr

NSUF



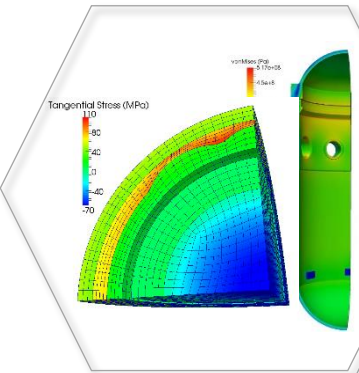
Andrew
Boulanger

UFS

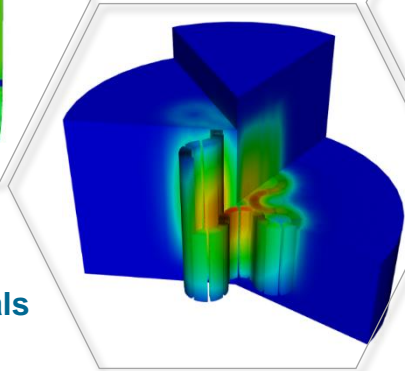
Nuclear Energy Advanced Modeling and Simulation (NEAMS)

NEAMS aims to develop and deploy predictive M&S tools and methods to enable and accelerate advanced reactor deployment and improve existing fleet operations.

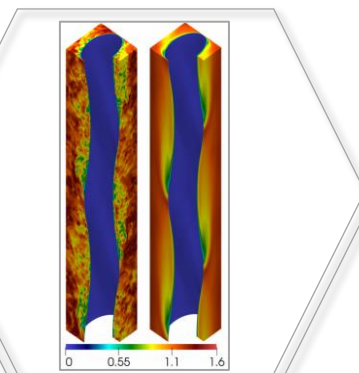
NEAMS core competencies:



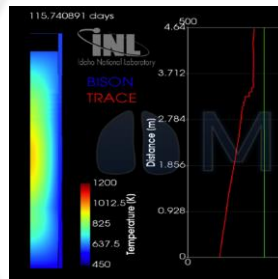
Multiscale fuel performance and structural materials degradation modeling:
BISON, MAMBA, GRIZZLY, Mole, MOSCATO, LAROMANCE



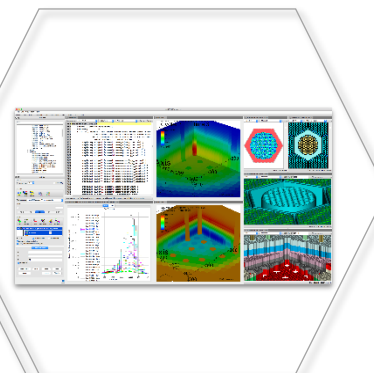
Reactor Physics:
GRIFFIN, MPACT, Shift



Multiscale thermal fluids:
SAM, CTF, PRONGHORN, Sockeye, NekRS/5000



Multiphysics:
MOOSE, VERA



Workflow Management:
Workbench

NEAMS develops modeling tools for others to use, thus coordination and interaction with industry, NRC, and NE's reactor and fuels R&D programs is critical.

NEAMS work needs to be informed by experimental capabilities and data in order to best support reactor deployment and operation.

<https://neams.inl.gov/>

Key Success Metric: Use of NEAMS technology (either software or R&D) by stakeholder to improve how they “do business.”

Advanced Materials and Manufacturing Technologies (AMMT)

Development, Qualification and Demonstration

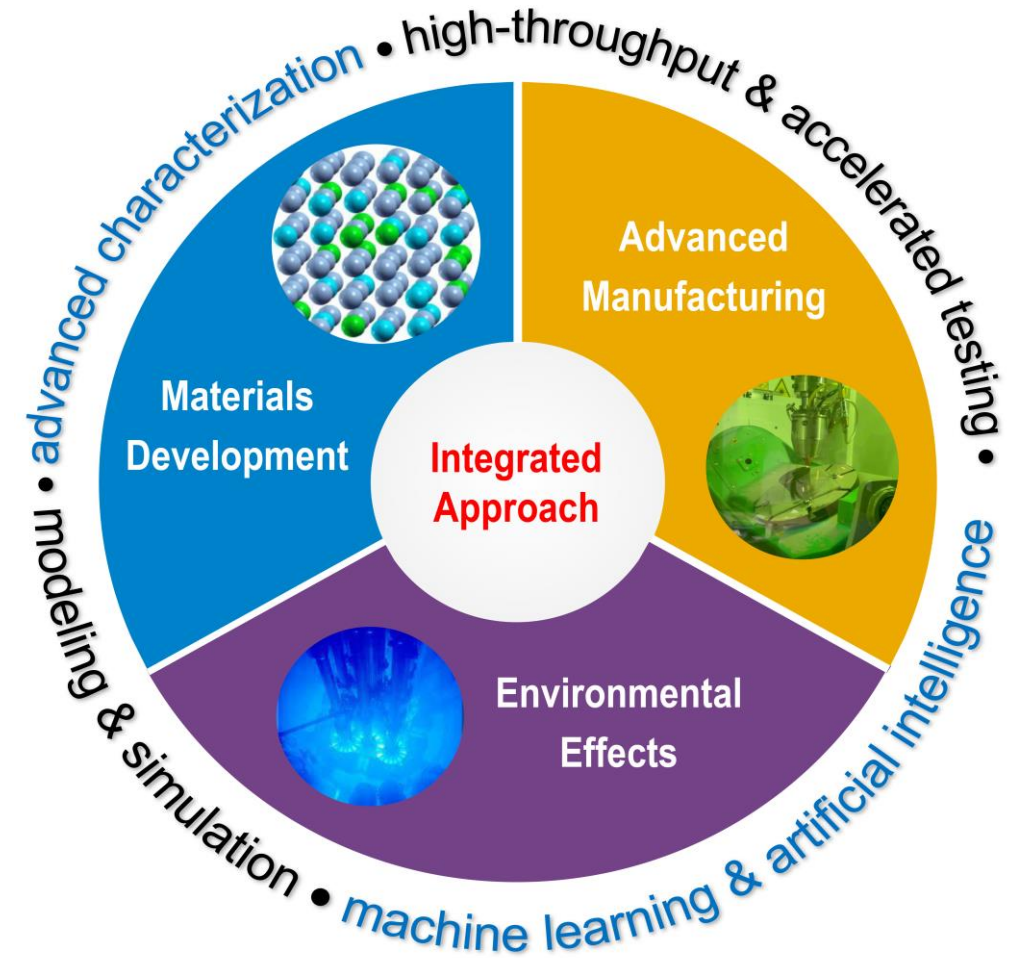
- Develop advanced materials & manufacturing technologies
- Establish a rapid qualification framework
- Evaluate material performance in reactor environments
- Technology demonstration and deployment

Capability Development & Transformative Research

- Develop high-throughput, accelerated testing and characterization techniques
- Develop modeling capabilities for materials design, development and qualification
- Perform transformative research to develop new material concepts and design

Collaborative Research and Development

- Investigate a broad range of advanced materials and manufacturing technologies
- Address reactor-specific issues
- Provide near-term material solutions to nuclear industry

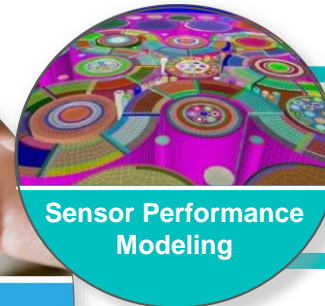
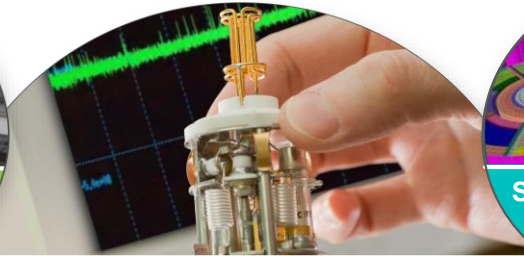


[AMMT Program Webpage](#)

Advanced Sensors and Instrumentation (ASI)

Develop advanced sensors and instrumentation & controls (I&C) that address **critical technology gaps** for monitoring and controlling existing and advanced **reactors** and supporting **fuel cycle** development

Resilient, real-time transmission of sufficient amount of data for online monitoring and advanced data analytics



Modeling of instrumentation performance to enable predictive capabilities and integration in Digital Twins

Sensors and Instrumentation

Reliable, cost-effective, real-time, accurate, and high-resolution measurement of the performance of existing and advanced reactors core and plant systems

Machine learning and artificial intelligence processes to enable semi-autonomous operation and maintenance by design



Innovative sensor materials and advanced manufacturing techniques applied to instrumentation design and fabrication



Enable near real-time control of plant or experiments process variables to enhance performance

<https://asi.inl.gov>

Nuclear Science User Facilities (NSUF)

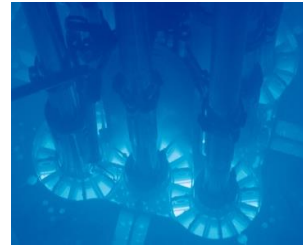
- Distributed user facility that leverages national laboratory and university infrastructure to provide unparalleled research opportunities for nuclear energy researchers.
- Users are provided access (at no cost) to partner facilities and technical expertise to advanced nuclear energy technologies including nuclear fuel and materials.



<https://nsuf.inl.gov/>



Neutron Reactors



Reactor facilities at national laboratories and universities including the Advanced Test Reactor (ATR) at INL



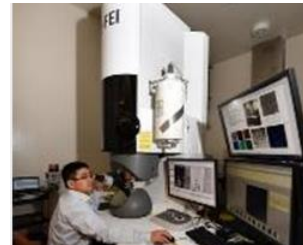
Gamma & Ion Irradiation



Gamma irradiation and ion beam facilities at national laboratories and universities



Post-Irradiation Examination



Multiple hot cell and broad post-irradiation examination facilities including advanced characterization methods



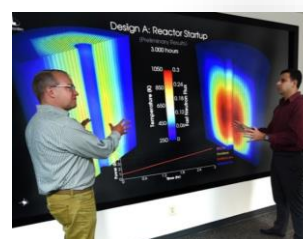
Beamlines



Synchrotron and pulsed neutron beamlines for nuclear fuel and materials studies



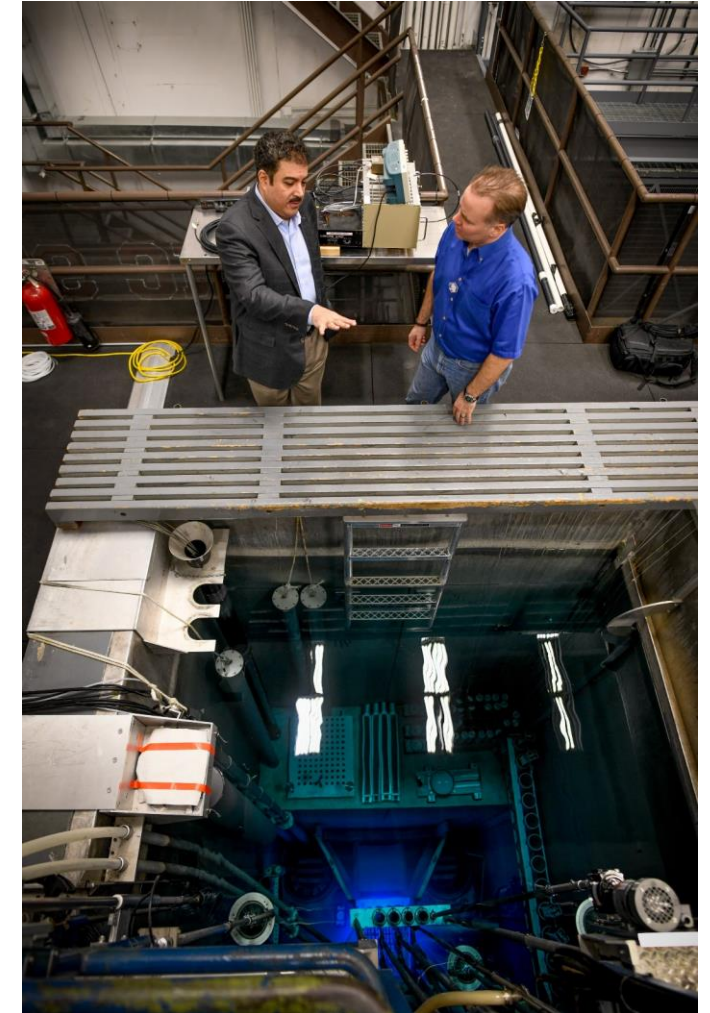
Computational Resources



Scientific high-performance computing for advanced modeling and simulation at INL

University Fuel Services (UFS)

- Provides U.S. government-owned fuel to 25 NRC-licensed university-based research and test reactors at low or no cost to the universities
- Removes spent or damaged used fuel for disposition
- **UFS Support Impact**
 - Education and training of the next generation of nuclear engineers and scientists
 - Research and development for current and advanced power reactors
 - Materials development
 - Control system and sensor developments (e.g. fiber optic sensors, machine learning and artificial intelligence systems, etc.)
 - National defense applications
 - Production of research level quantities of medical radioisotopes for imaging and cancer therapies
- **Outside current UFS mission**
 - Development of new fuel types for NRC review and approval
 - Providing reactor operating equipment
 - Providing enriched uranium (e.g. HALEU) directly to universities
 - Providing universities with ancillary components related to fuel fabrication or assembly



[The National Organization of Test, Research and Training Reactors - TRTR](#)



Thank you!

U.S. DEPARTMENT OF
ENERGY

Office of
NUCLEAR ENERGY