

U.S. DEPARTMENT OF
ENERGY

Office of
NUCLEAR ENERGY

Office of Nuclear Energy Technologies

Suibel Schuppner, Director

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NE-51

Office of Nuclear Energy Technologies

Enabling Technologies Team

Nuclear Energy Enabling Technologies

- Advanced Modeling and Simulation
- Advanced Materials and Manufacturing Technologies
- Advanced Sensors and Instrumentation
- Nuclear Cybersecurity
- Nuclear Science User Facilities

University and Competitive Research Team

University Support

- Nuclear Energy University Program
- University Fuel Services
- University Nuclear Leadership Program

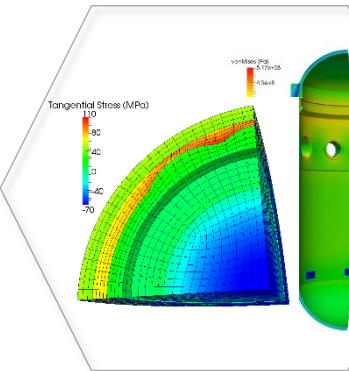
Industry Support

- Advanced Nuclear Energy Funding Opportunity (Industry FOA)
- Gateway for Accelerated Innovation in Nuclear
- Small Business Innovative Research (SBIR) / Small Business Technology Transfer (STTR)
- Technology Commercialization Fund (TCF)

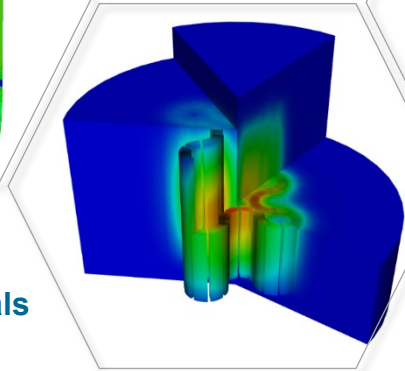
Nuclear Energy Advanced Modeling and Simulation (NEAMS)

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

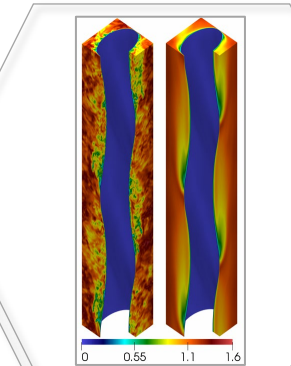
NEAMS core competencies:



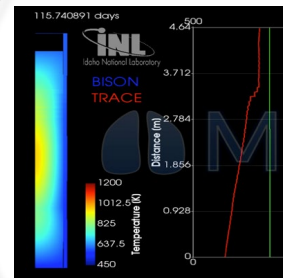
Multiscale fuel performance and structural materials degradation modeling:
BISON, GRIZZLY, YellowJacket



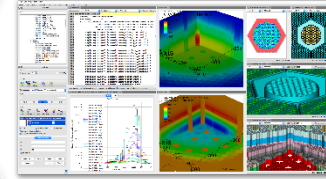
Reactor Physics:
GRIFFIN, MPACT, Shift



Multiscale thermal fluids:
CTF, SAM, PRONGHORN, Sockeye, Nek5000



Multiphysics:
MOOSE, VERA



Workflow Management:
Workbench

NEAMS develops modeling tools for others to use, thus coordination and interaction with industry 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

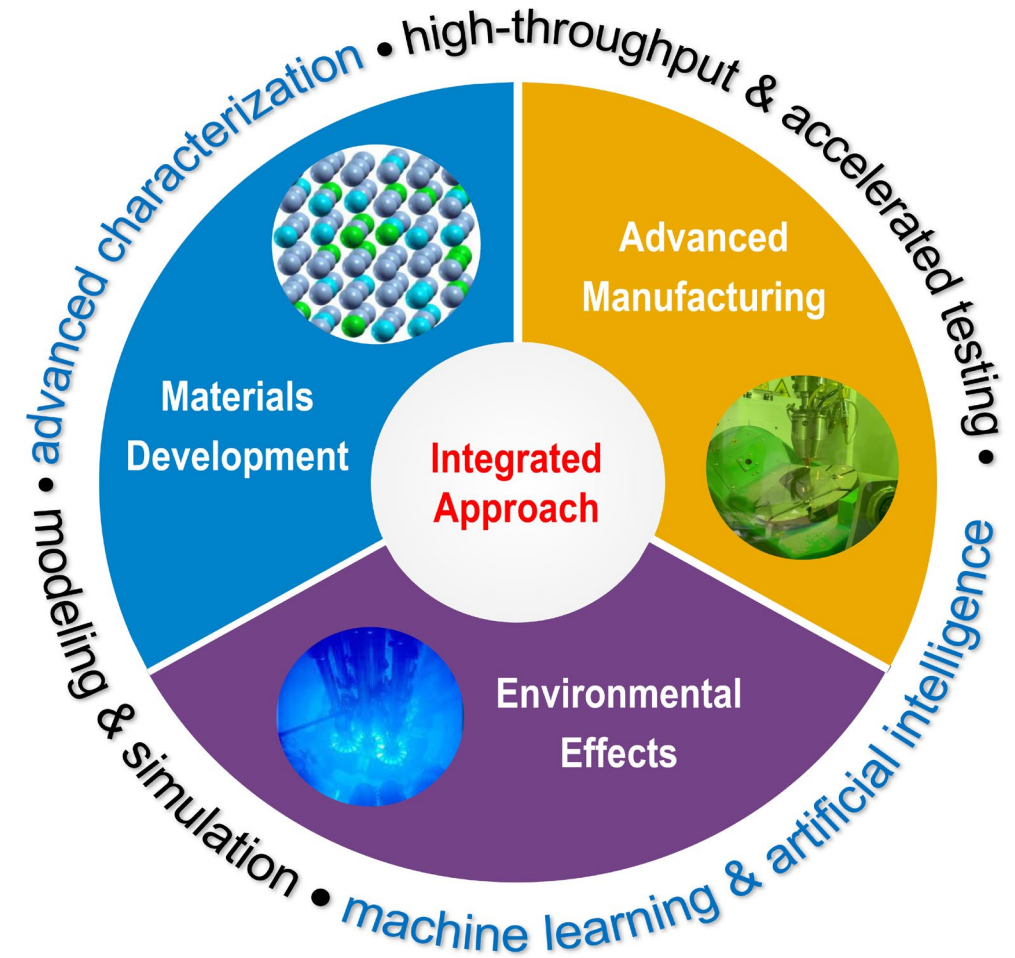
- Develop advanced materials & manufacturing technologies
- Establish a rapid qualification framework
- Evaluate material performance in reactor environments
- Technology demonstration and deployment

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

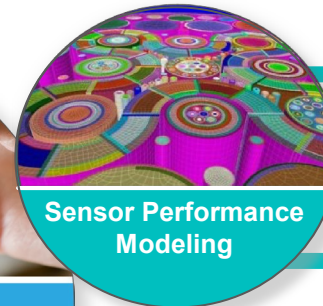
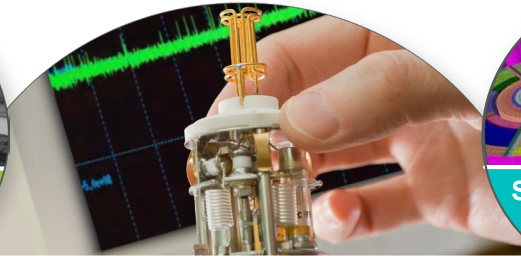


[Advanced Materials and Manufacturing Technologies 2022 Roadmap | Department of Energy](#)

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 Cybersecurity Research

- Emphasizes NE mission, enabling advanced technology deployment and improving efficiency/performance - not primarily a security program.
- Address any nuclear-specific needs not addressed by broader programs, emphasizing technologies to enable innovative implementation of modern digital tools
- Address barriers to adoption of best-in-class cybersecurity solutions developed for other sectors



[Gateway for Accelerated Innovation in Nuclear - Cybersecurity \(inl.gov\)](https://www.inl.gov/gateway-for-accelerated-innovation-in-nuclear-cybersecurity)

Key R&D Products:

- Techniques to identify and mitigate cybersecurity hazards during design
- Support for longer-term, post-deployment use cases that are currently cybersecurity-limited (e.g., wireless safety-related controls, remote/autonomous operations, advanced applications of digital twins)
- Technical tools, such as control system design requirements, supply chain protection methods and test beds

Nuclear Science User Facilities (NSUF)

Neutron Irradiations

Ion Irradiations

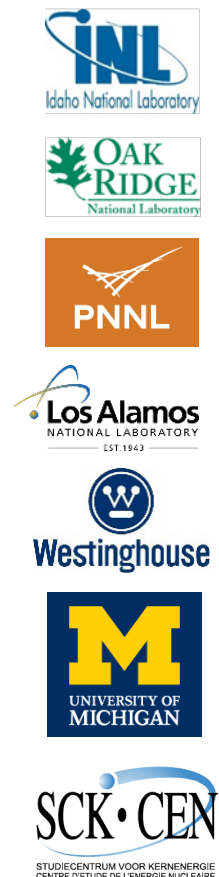
Hot Cells & Shielded Cells

Low Activity Laboratories

Beamlines

Gamma Irradiations

High Performance Computing



Coordinates a consortium of institutions to provide access, at no cost to the user, to unique and highly specialized nuclear research facilities and technical expertise.

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



Thank you!

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