ARTIFICIAL INTELLIGENCE TO ACCELERATE ADVANCED NUCLEAR ENERGY

DECEMBER 10, 2025

1:00 – 2:00 PM ET

Moderator: Hon. Milt Doumit, Washington

Dr. Charalampos "Harry" Andreades, Senior Manager for Technology-to-Market and External Funding, Westinghouse

Dr. David Pointer, Director, Nuclear Energy and Fuel Cycle Division, Oak Ridge National Laboratory

Housekeeping

- Use the Q&A box on the Zoom toolbar to ask questions at any time
- Audience questions will be asked after all presentation
- The webinar recording and slides will be emailed to registrants after today's webinar

ARTIFICIAL INTELLIGENCE TO ACCELERATE ADVANCED NUCLEAR ENERGY

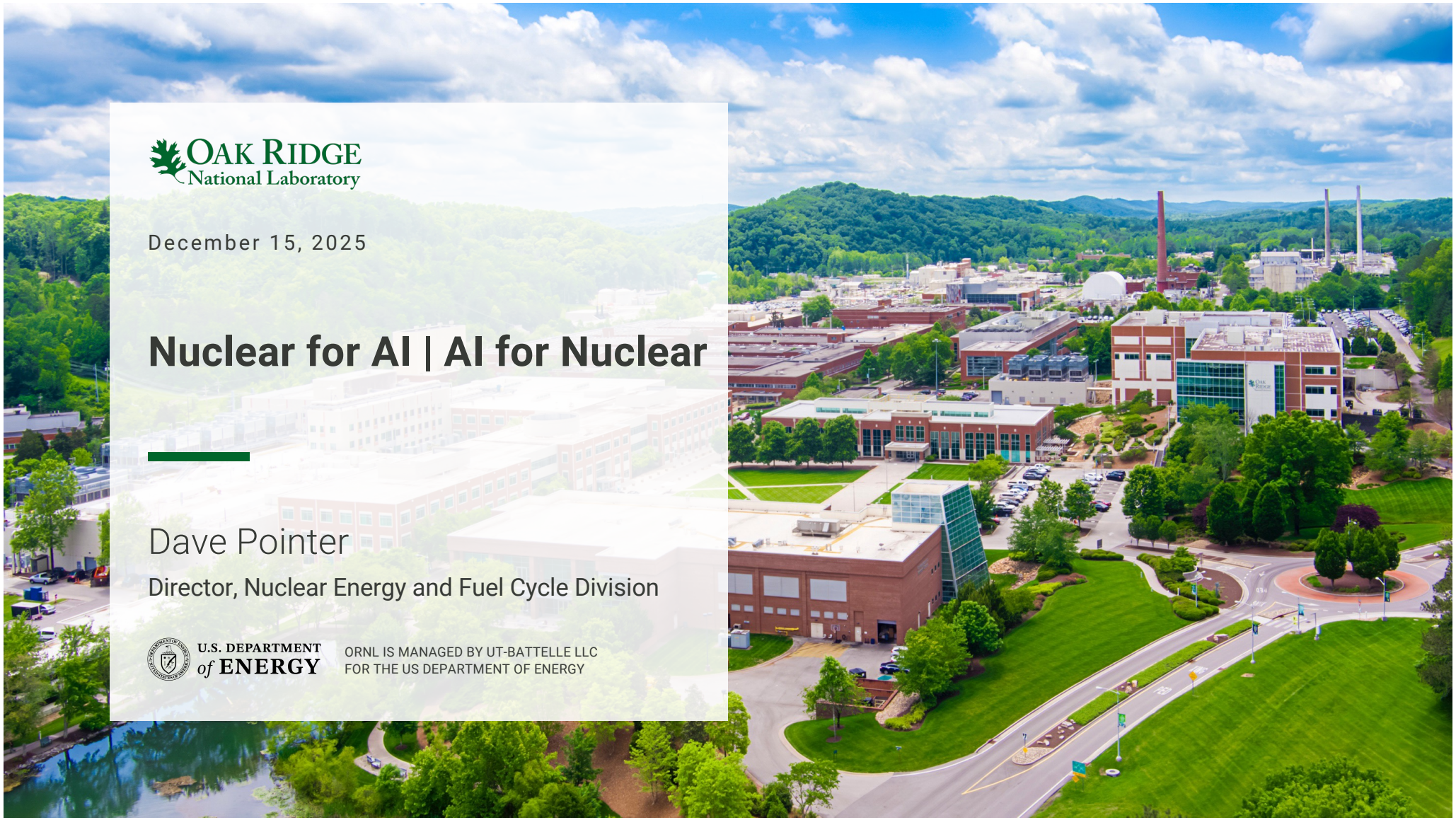
DECEMBER 10, 2025

1:00 – 2:00 PM ET

Moderator: Hon. Milt Doumit, Washington

Dr. Charalampos "Harry" Andreades, Senior Manager for Technology-to-Market and External Funding, Westinghouse

Dr. David Pointer, Director, Nuclear Energy and Fuel Cycle Division, Oak Ridge National Laboratory



OAK RIDGE National Laboratory

December 15, 2025

Nuclear for AI | AI for Nuclear

Dave Pointer

Director, Nuclear Energy and Fuel Cycle Division

U.S. DEPARTMENT of ENERGY

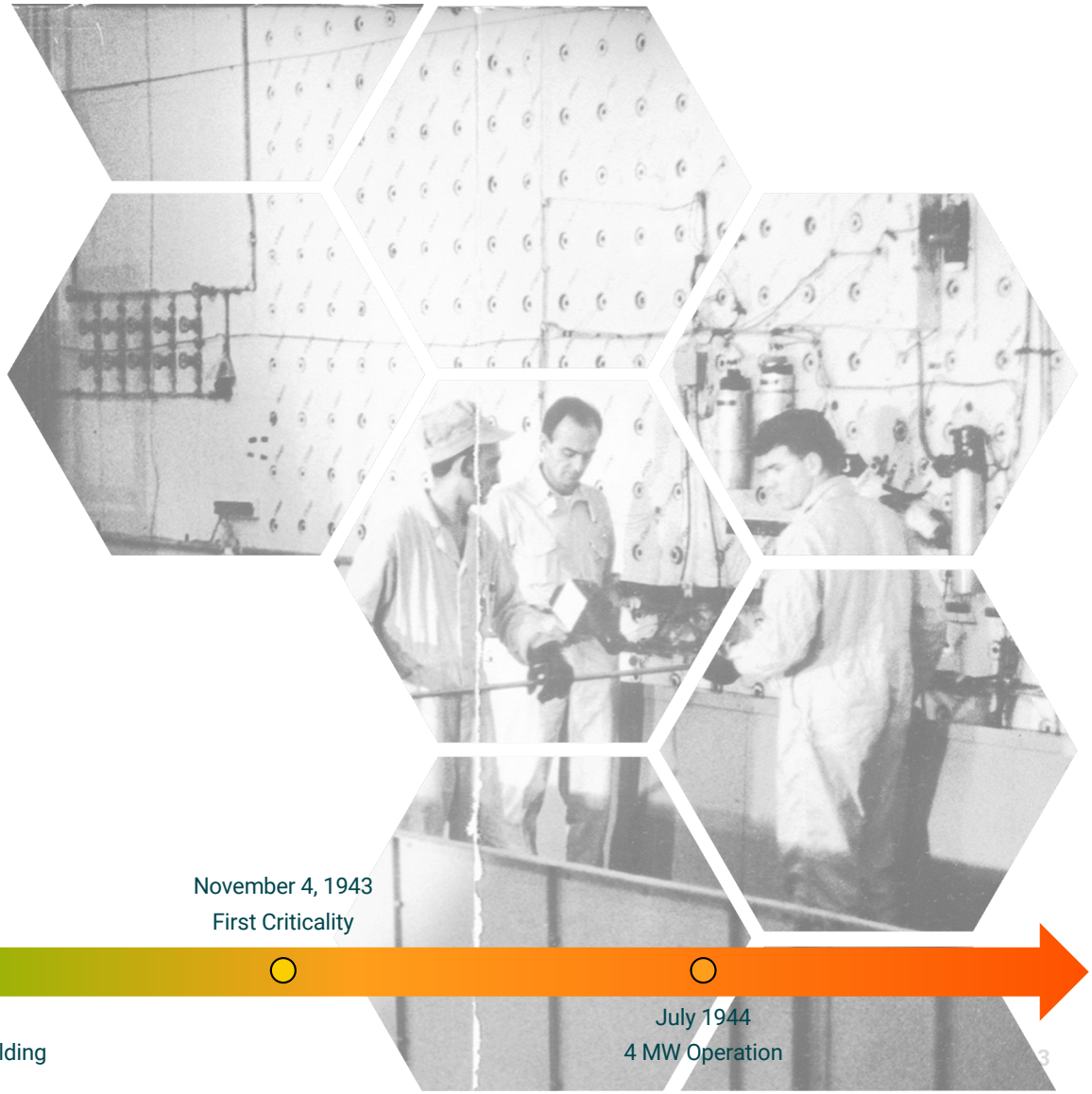
ORNL IS MANAGED BY UT-BATTELLE LLC
FOR THE US DEPARTMENT OF ENERGY


OAK RIDGE NATIONAL LABORATORY
BIG SCIENCE
BIG IMPACT
DEPARTMENT OF ENERGY
Ts
Tennessine
SPALLATION NEUTRON SOURCE
CRAY
OAK RIDGE National Laboratory
U.S. DEPARTMENT OF ENERGY
Hewlett Packard Enterprise
AMD
FRONTIER
OAK RIDGE National Laboratory

ORNL began in 1943 with the world's first continuously operating nuclear reactor

MISSION

Demonstrate that gram quantities of plutonium could be chemically separated from irradiated uranium



February 1943
Start of Construction

April 1943
Initial Excavation for Reactor Building

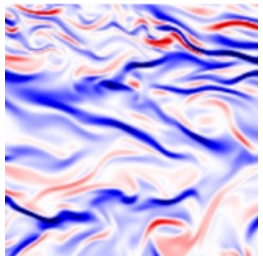
November 4, 1943
First Criticality

July 1944
4 MW Operation

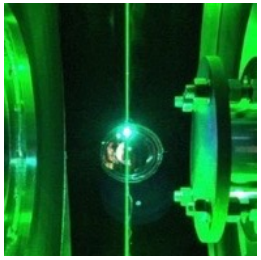
OAK RIDGE National Laboratory

ORNL's foundational expertise yields solutions to challenging problems with global impact

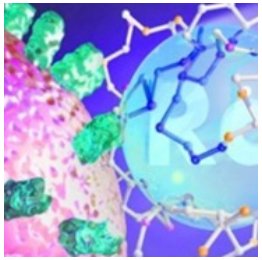
Biology and environment



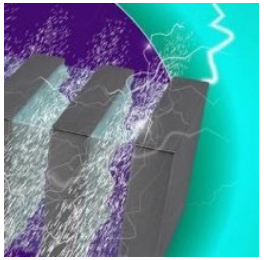
Fusion and fission



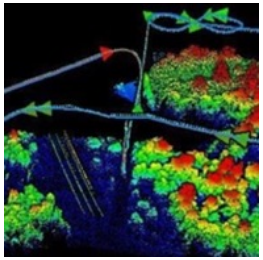
Isotopes

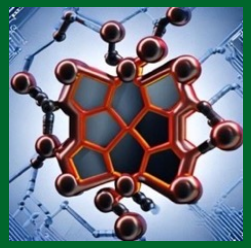


Energy science and technology



National security





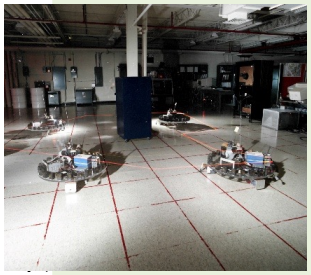
Computing, AI, and quantum

Neutrons

Materials, chemistry, and nuclear physics

ORNL has a rich history leveraging AI for science

1979
Oak Ridge Applied Artificial Intelligence Project



1991
Automated machines

2024
Frontier

- #1 HPL-MxP @10 exaflops for AI
- #2 on GREEN500
- 2021 ACM A.M. Turing Award
- Scaled to 1T+ parameter AI model training

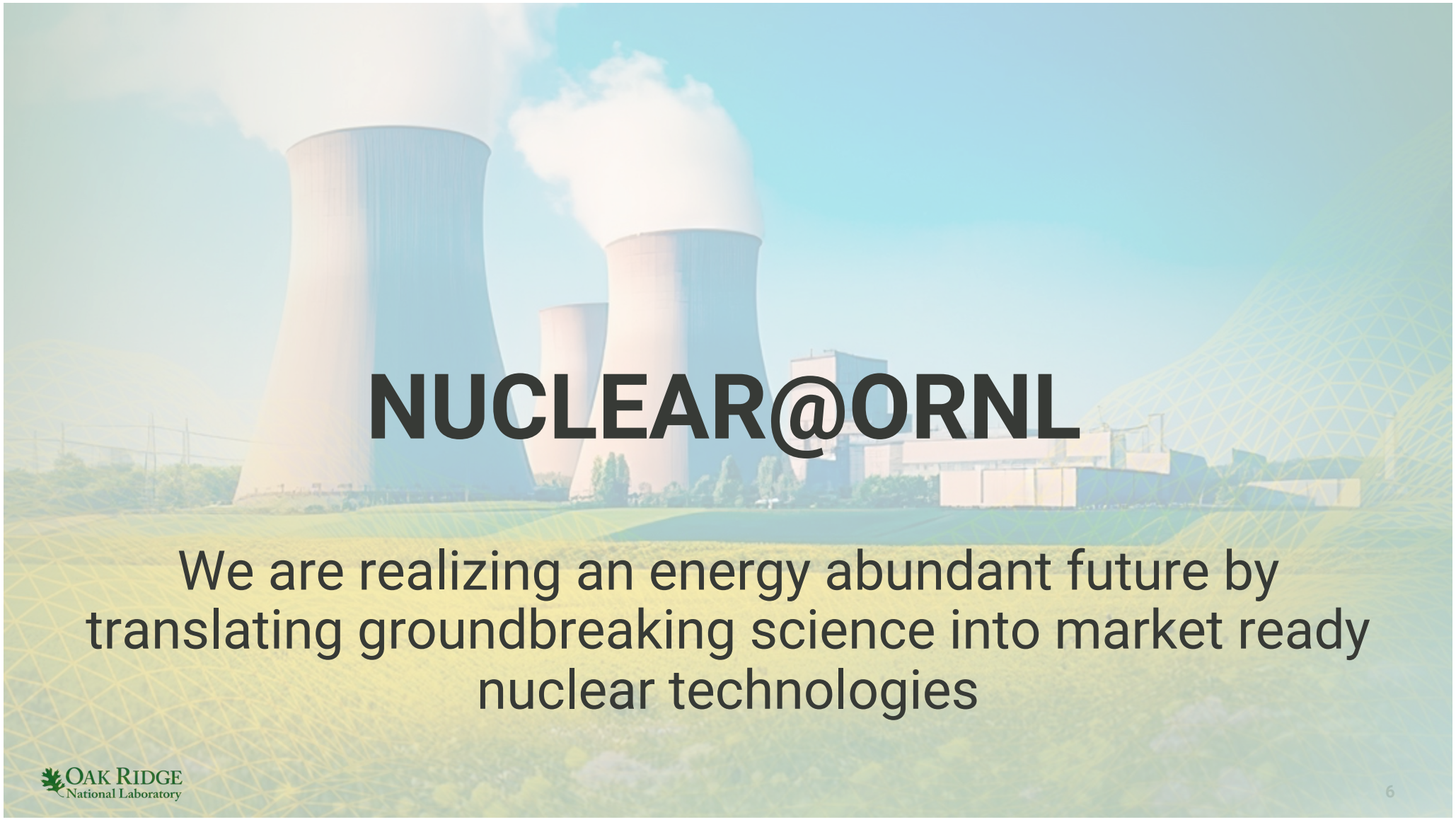
1940–1970 | 1980 | 1990 | 2000

1981
AI infrastructure supports spectroscopy, environmental management, nuclear fuel reprocessing, and programming assistance

1983
Robotics

2017
Summit:
World's "smartest" supercomputer optimized for AI

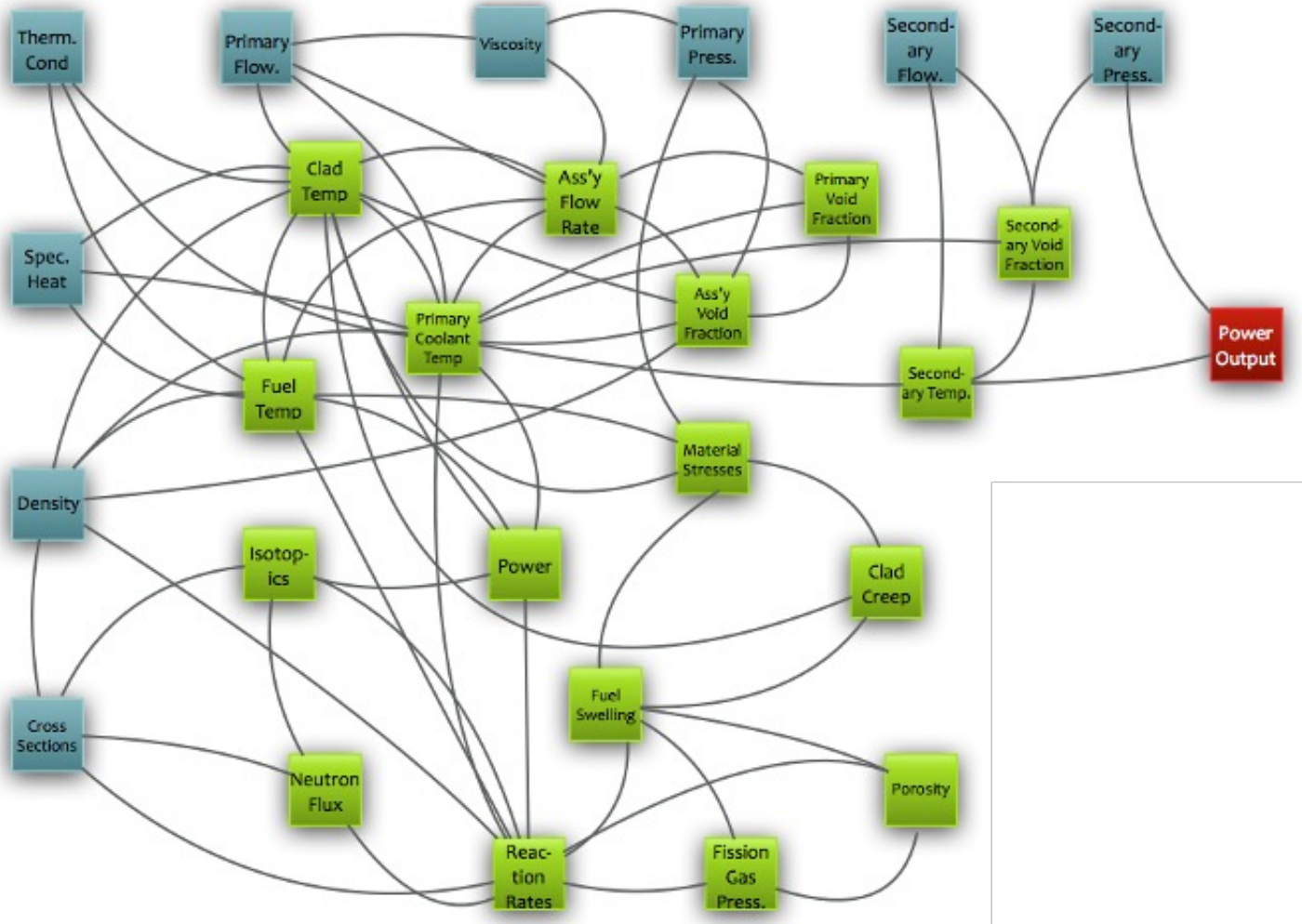
OAK RIDGE National Laboratory



NUCLEAR@ORNL

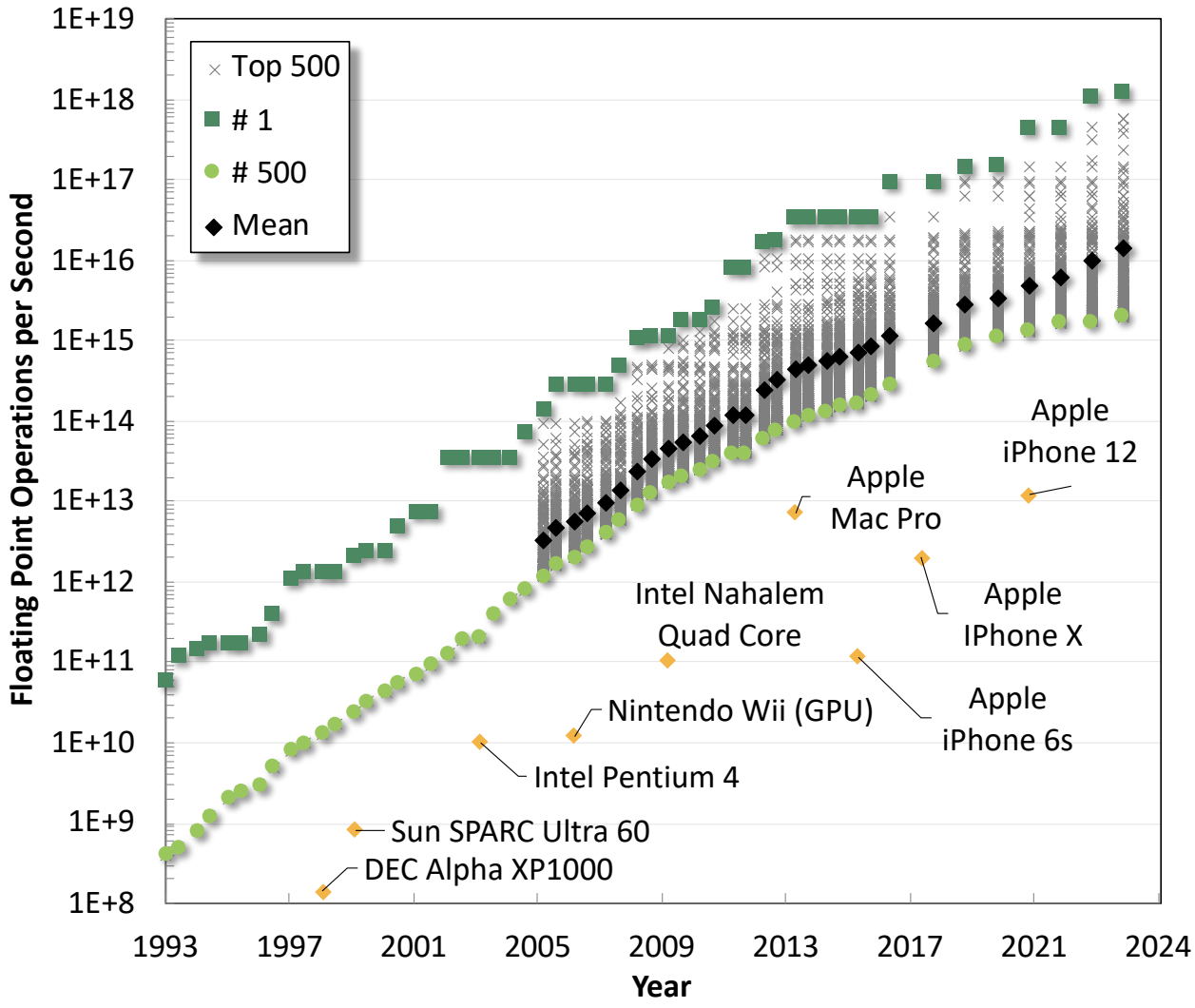
We are realizing an energy abundant future by translating groundbreaking science into market ready nuclear technologies

Evaluating the performance of a proposed nuclear reactor requires the integration of a lot of information

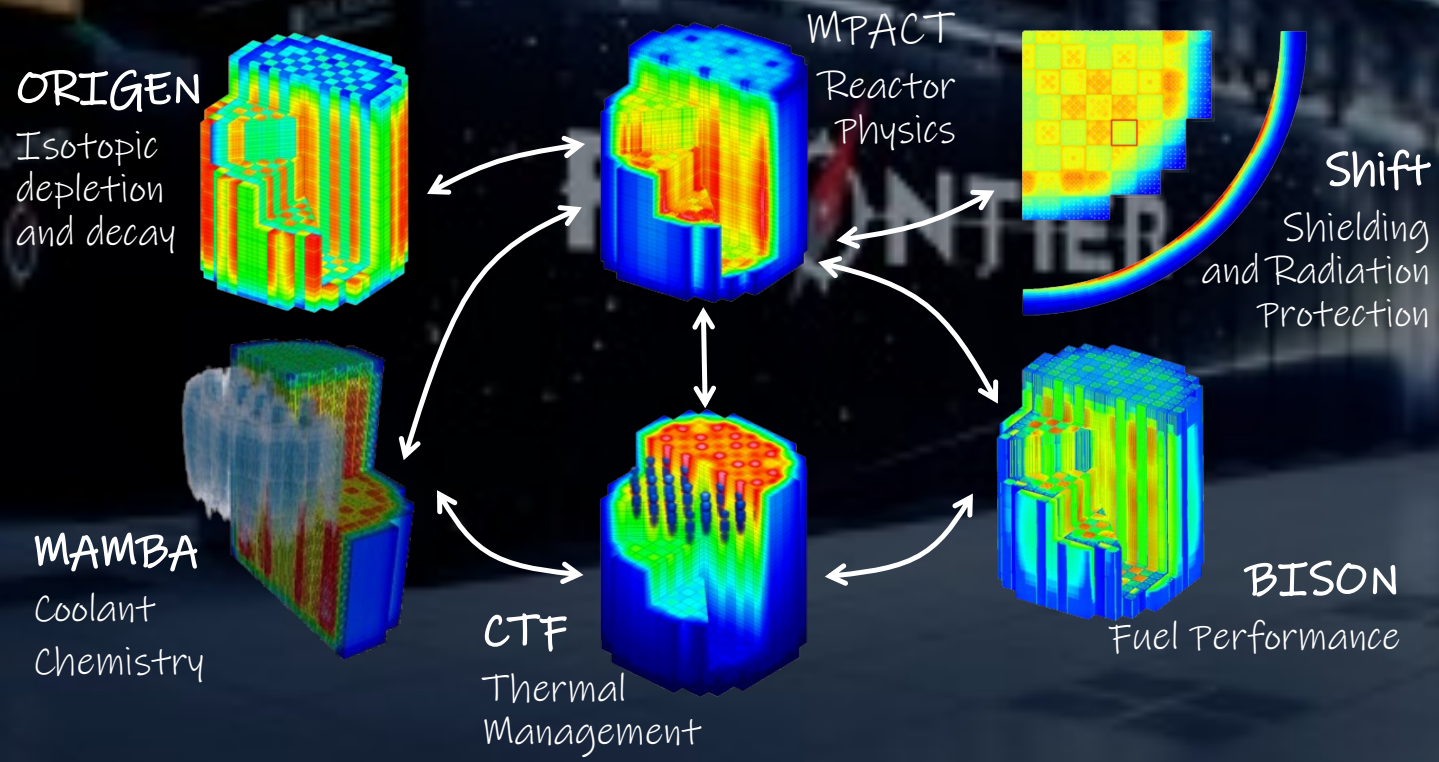


W. D. Pointer, et al., "Developing a Comprehensive Software Suite for Advanced Reactor Performance and Safety Analysis", 2013 International Conference on Fast Reactors, Paris, France, March 4-7, 2013

Evolution of modern computing tracks with advancements in many technologies, including nuclear energy

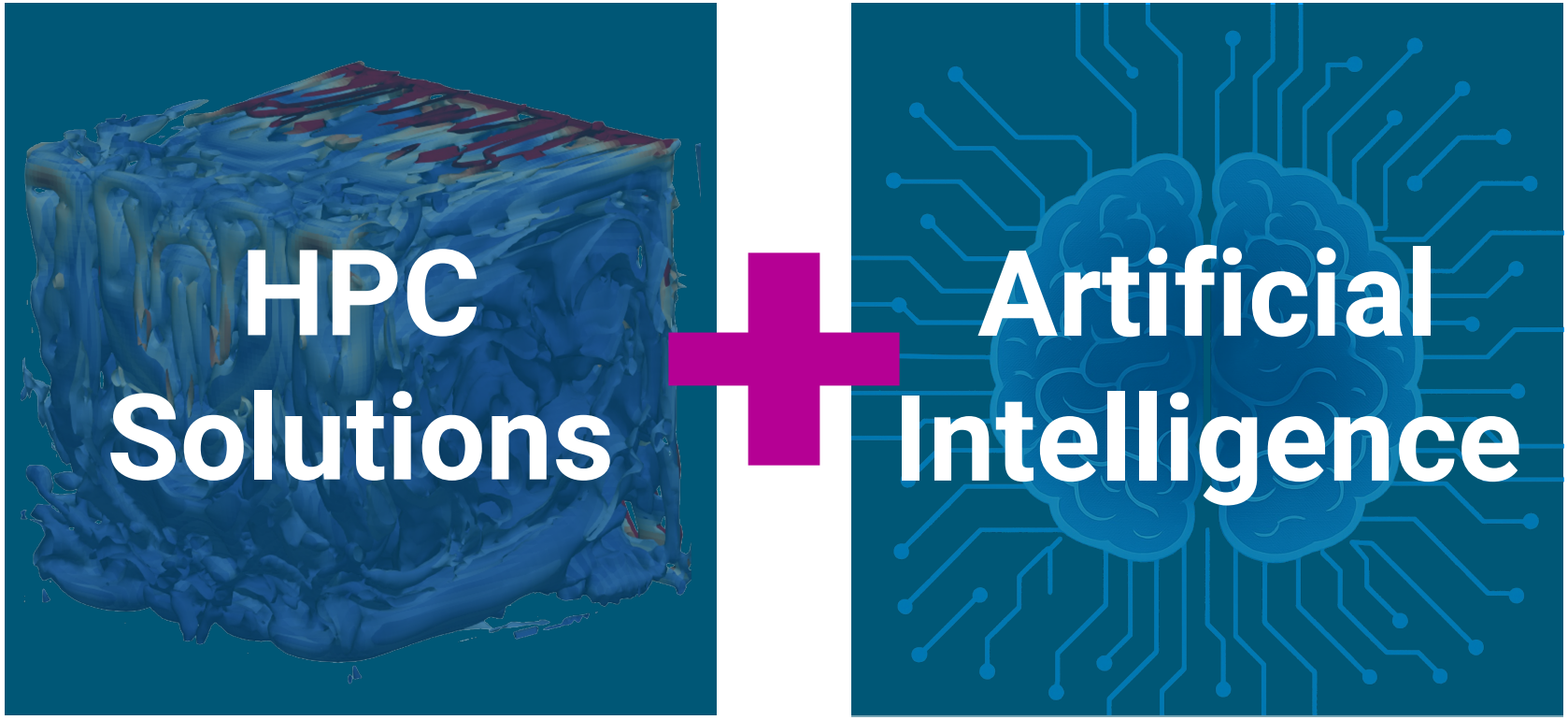


21st century computing advances enable high resolution engineering analysis methods for complex nuclear systems

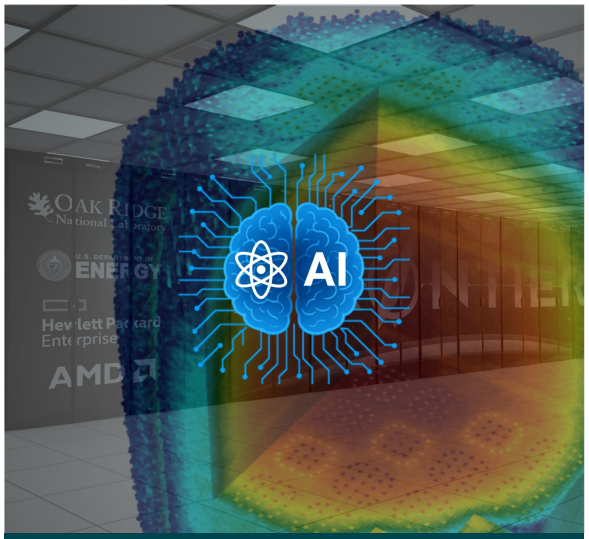


Virtual Environment for Reactor Analysis (VERA)

Artificial Intelligence is already changing our approach

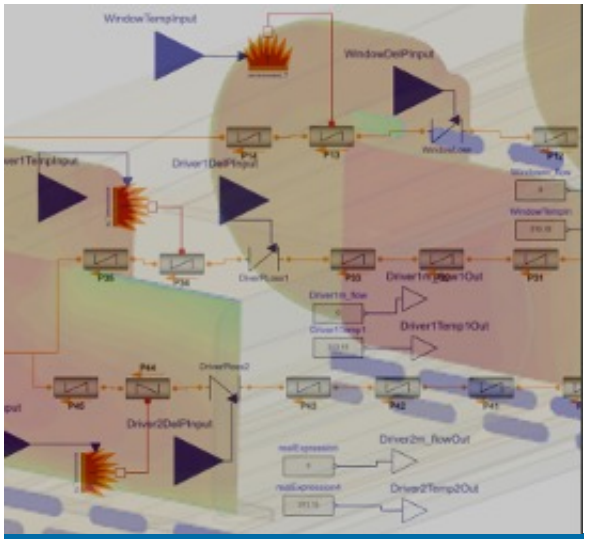


AI + HPC is changing our approach



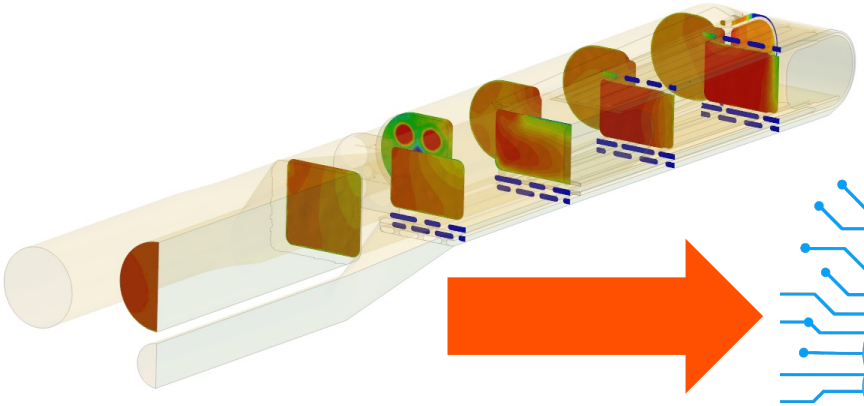
Automation of model development, model validation, and uncertainty quantification

Direct data integration for advanced diagnostics, prognostics and controls

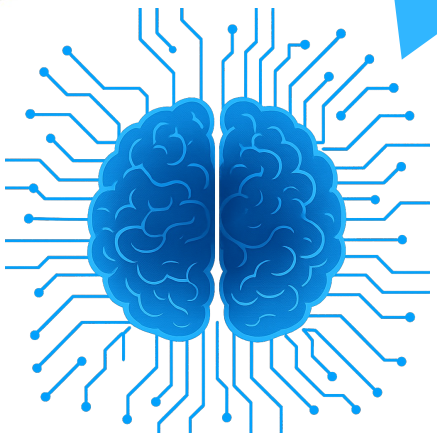


Multiscale integration of high-resolution simulation results in human-friendly system models

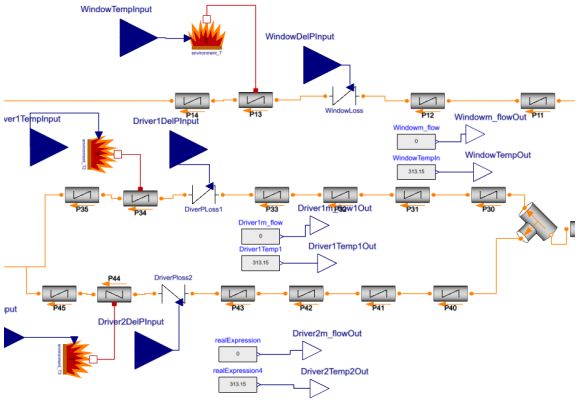
AI is accelerating the development of high resolution engineering models



High-resolution simulation data is the training basis for an AI network



Fast-running 1-D model provides boundary conditions to AI



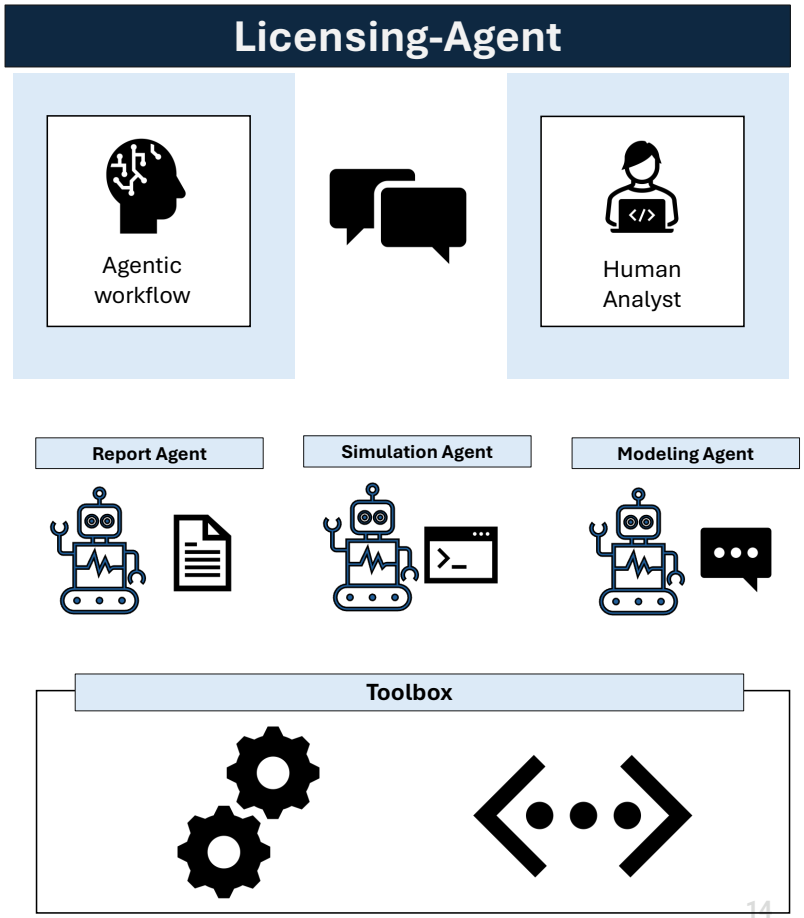
AI provides volume fraction to fast-running 1-D model

An agentic workflow is being developed to accelerate the licensing process of nuclear reactors

This approach will support preparation of reports, and significantly reduces the time and effort required for modeling and simulation activities throughout the licensing process.

Key capabilities include:

- **Automated simulation setup:** Agents generate input files for SCALE safety analysis.
- **Efficient execution and monitoring of simulation runs:** Automated workflows trigger, manage, and evaluate large sets of simulations.
- **Report generation and documentation support:** Drafts licensing-relevant deliverables with traceable links to underlying models and results.



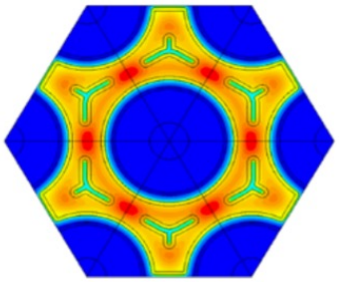
Integrating Artificial Intelligence (AI) and Additive Manufacturing (AM) into nuclear system design and development accelerates delivery of advanced technologies

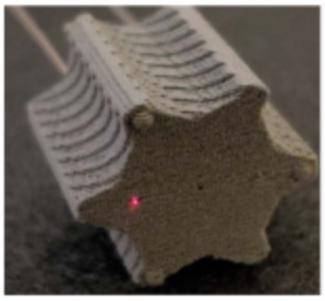
Using AI to navigate an unconstrained design space and realize superior performance

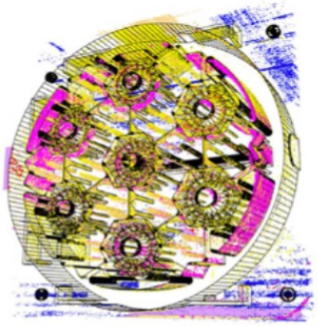
Leveraging AM to arrive at high-performance materials in complex geometries

Exploiting AM to incorporate integrated and distributed sensing in critical locations

Using AI to assess critical component quality using in situ manufacturing signatures







Thank You

Upcoming Events

- NASEO Energy Policy Outlook Conference, Feb. 3 – 6, Fairmont Washington DC https://energyoutlook.naseo.org/
- NARUC Winter Policy Summit, Feb. 8 – 11, Westin Washington DC Downtown https://www.naruc.org/winter-summit/