DOE-NE Modeling and Simulation in Support of Advanced Reactor Development

Christopher R. Stanek
NEAMS National Technical Director

February 8, 2017

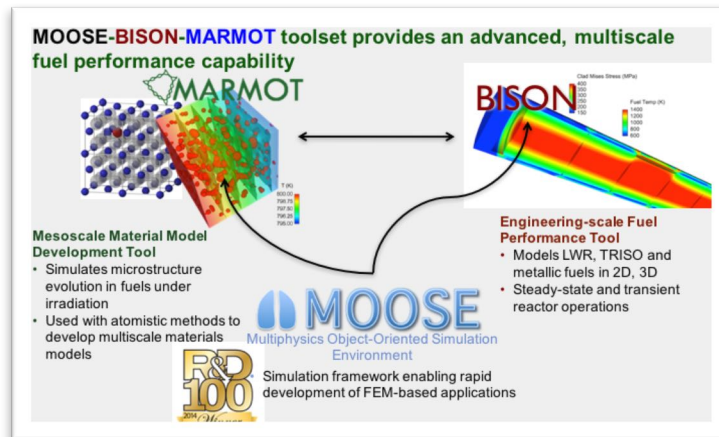**Advanced Reactors Technical Summit IV**
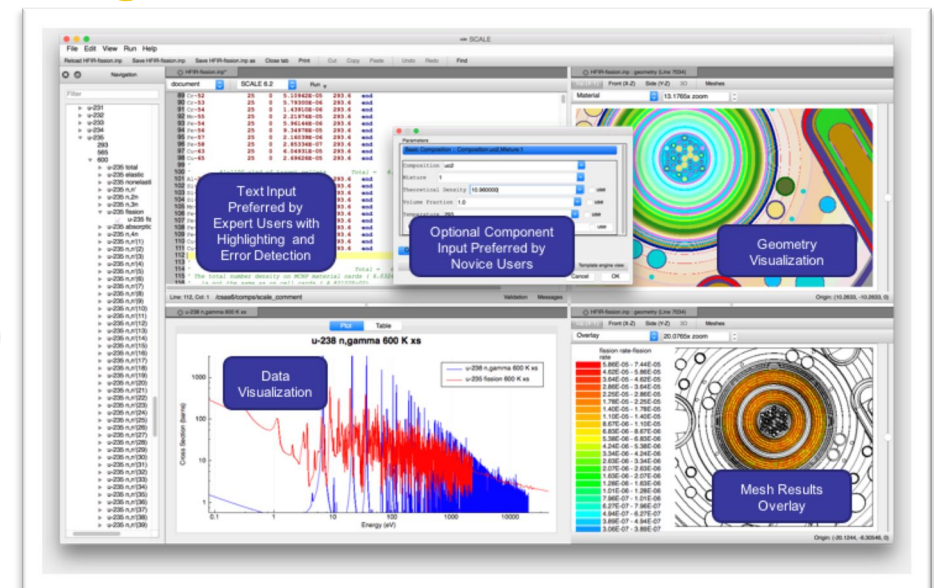**Argonne National Laboratory**

NEAMS (Nuclear Energy Advanced Modeling and Simulation) Program

Aim: Develop, apply, deploy, and support a predictive modeling and simulation toolkit for the design and analysis of current and future nuclear energy systems using computing architectures from laptops to leadership class facilities.
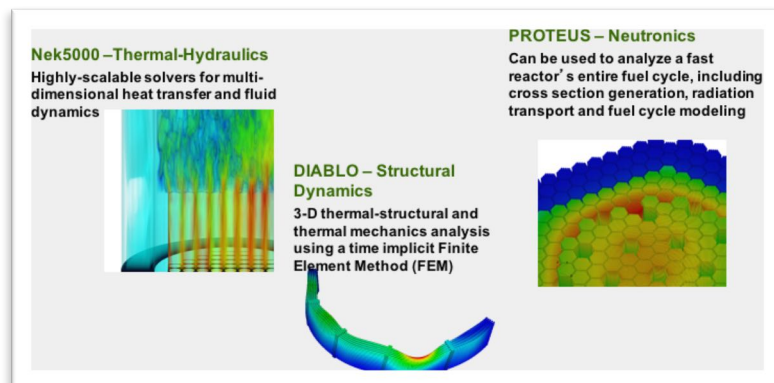
Fuels Product Line

Reactor Product Line

Integration Product Line

NEAMS
NUCLEAR ENERGY ADVANCED MODELING & SIMULATION PROGRAM

U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

What is GAIN?

Through GAIN, DOE is making its state-of-the art and continuously improving RD&D infrastructure available to stakeholders to achieve faster and cost-effective development of innovative nuclear energy technologies toward commercial readiness. The capabilities accessible through GAIN include:

- Experimental capabilities with primary emphasis on nuclear and radiological facilities but also including other testing capabilities (e.g. thermal-hydraulic loops, control systems testing, etc.).

- Computational capabilities along with state-of-the art modeling and simulation tools.

- Information and data through knowledge and validation center.

- Land use and site information for demonstration facilities.

- Assistance through the regulatory process. The Nuclear Regulatory Commission (NRC) will provide regulatory expertise and guidance through GAIN.
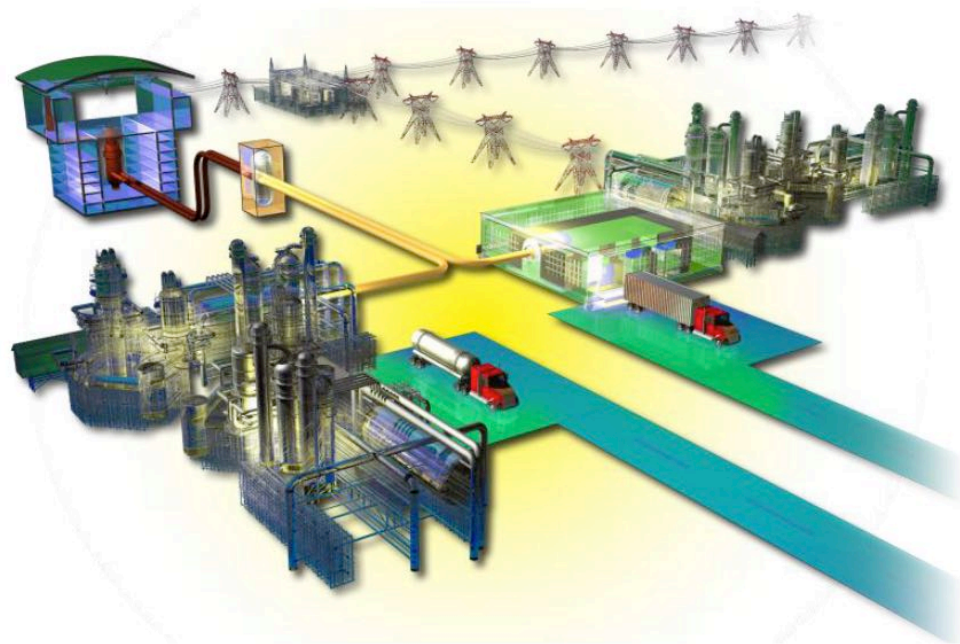
https://gain.inl.gov/Shared%20Documents/GAIN-FactSheet_rev4.pdf

Emphasis of NEAMS program on proactive customer engagement is consistent with GAIN.

NEAMS
NUCLEAR ENERGY ADVANCED MODELING & SIMULATION PROGRAM

Gov. Perry Nomination Hearing

Sen. Joe Manchin: **"I'm interested to hear, what you will do, if confirmed, to work with the bipartisan group of Senators to continue to ensure that DOE is equipped with adequate funding to continue researching and developing these advanced reactor designs."**

Gov. Rick Perry: "Nuclear energy is a critical component of America's energy future, and entrepreneurs are developing promising new technologies that could truly spur a renaissance in the United States and around the world. DOE, through the National Labs complex, maintains unique government facilities that can assist in the development of advanced nuclear energy technologies. **The GAIN initiative provides the potential for public-private partnerships to thrive in the future.** If I am confirmed, I look forward to learning more about how DOE can support advanced nuclear reactor development."

NEAMS
NUCLEAR ENERGY ADVANCED MODELING & SIMULATION PROGRAM

GAIN Mod-Sim Workshops

GAIN *Gateway for Accelerated Innovation in Nuclear*

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Advanced Reactor Modeling and Simulation Workshop #2

EPRI Charlotte Campus - Building 2; 1300 West W.T. Harris Blvd; Charlotte, NC 28262
January 24-25, 2017; 8:00 a.m. to 6:00 p.m.

AGENDA

January 24, 2017

7:30	Registration and Continental Breakfast	
8:00	Welcome	Neil Wilmshurst (EPRI CNO & Nuclear VP) Shane Johnson (DOE-NE)
	Logistics and Safety Message	Andrew Sowder (EPRI)
	Introductions/Purpose	Rita Baranwal (GAIN)
	Overview of Gap Analysis & Workshop Agenda	Chris Stanek (NEAMS)

Goal of workshop was to connect DOE mod-sim capabilities, with GAIN advanced reactor working group needs.

Initial advertisement of DOE-NE mod-sim capabilities. Continued interaction is critical to achieve successful public-private partnership.

NEAMS
NUCLEAR ENERGY ADVANCED MODELING & SIMULATION PROGRAM

Role for advanced mod-sim:
Licensing vs Design Optimization/R&D

- When considering advanced mod-sim for advanced reactor designs, unlike for LWRs, licensing is understandably the highest priority (compared to e.g. reactor operation/margin).

- Advanced mod-sim tools may not obviously lend themselves to licensing. So GAIN provides important mechanism to match advanced mod-sim capabilities with vendor needs – whether licensing, or otherwise.

- Future may include use of some DOE-NE advanced mod-sim tools for NRC confirmatory calculations. If those codes maintain independence, potential exists for their use also in license application.

- Apart from licensing, many R&D issues exist where advanced mod-sim can assist, by e.g. revealing governing phenomena, targeting experiments, etc.

NEAMS
NUCLEAR ENERGY ADVANCED MODELING & SIMULATION PROGRAM

NEAMS: High Impact Problems (HIPs)

- **High impact program concept introduced as a mechanism by which to direct NEAMS tools to address problem of applied relevance.**
  - Core program is the "chassis" upon which HIP is built

- **3-year, ~$3M projects with a defined customer.**

- **Two HIPs initiated in FY15:**
  - *Evaluation of Representative Accident Tolerant Fuel (ATF) Candidates for the Advanced Fuels Campaign*
    - Customer = DOE Advanced Fuels Campaign (and by extension, ATF vendors)

  - *Numerical Evaluation of Advanced Steam Generators for SMRs*
    - Customer = NuScale

NEAMS is currently designing FY18 HIP program to center around GAIN-relevant topics.

NEAMS

NUCLEAR ENERGY ADVANCED MODELING & SIMULATION PROGRAM

Summary

- **Relative maturity of DOE-NE advanced mod-sim tools is coinciding with surge in advanced reactor start ups.**

- **A particular "critical path" issue (though there are many, e.g. validation) of immediate interest relevant to advanced mod-sim:** *connecting mod-sim capability with industrial need.*

- **GAIN initiative is catalyzing necessary interactions between NEAMS (and other DOE-NE programs) and industry community that will enable productive use of advanced mod-sim tools.**

- **The NEAMS program is eager to play an important role in the GAIN mod-sim effort and help industry address problems of relevance.**

NEAMS

NUCLEAR ENERGY ADVANCED MODELING & SIMULATION PROGRAM