U.S. DEPARTMENT OF ENERGY | Nuclear Energy

Nuclear Energy Advanced Modeling and Simulation (NEAMS) Annual Review

Christopher R. Stanek
NEAMS National Technical Director

January 24, 2017

Advanced Reactor Modeling and Simulation Workshop #2
EPRI, Charlotte, NC

NEAMS
NUCLEAR ENERGY ADVANCED MODELING & SIMULATION PROGRAM

U.S. DEPARTMENT OF ENERGY
Nuclear Energy

NEAMS (and DOE-NE) Organizational Structure

Leadership Council

National Technical Director
Chris Stanek (LANL)

ATF HIP
Jason Hales (INL)

Fuels Product Line
Steve Hayes (INL)

Integration Product Line
Brad Rearden (ORNL)

Reactors Product Line
Tanju Sofu (ANL)

SGFIV HIP
Elia Merzari (ANL)

Shane Johnson
Deputy Assistant Secretary for Nuclear Technology Demonstration and Deployment (NE-5)

Tom Miller
Office of Accelerated Innovation in Nuclear Energy (NE-51)

Dan Funk
National Laboratory and Industry Capabilities Team

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.

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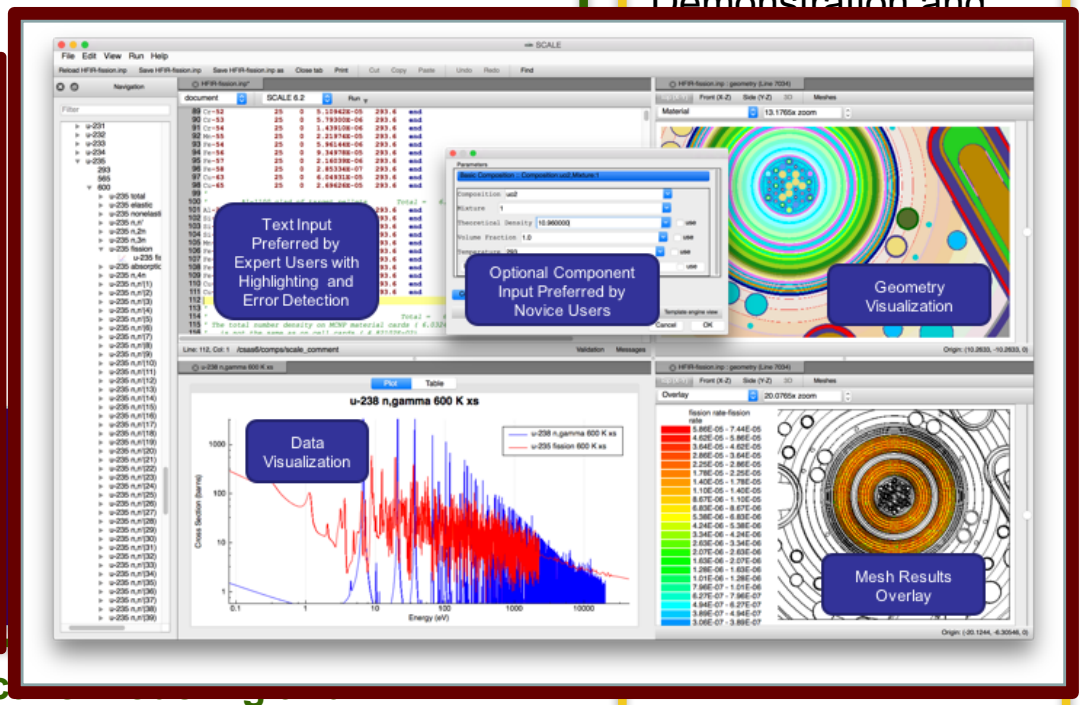

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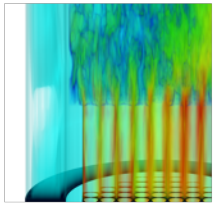
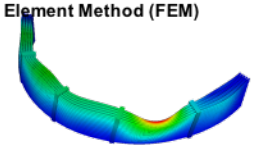
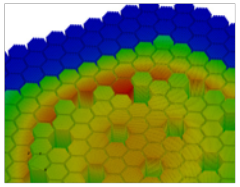
Nek5000 –Thermal-Hydraulics
Highly-scalable solvers for multi-dimensional heat transfer and fluid dynamics



DIABLO – Structural Dynamics
3-D thermal-structural and thermal mechanics analysis using a time implicit Finite Element Method (FEM)



PROTEUS – Neutronics
Can be used to analyze a fast reactor's entire fuel cycle, including cross section generation, radiation transport and fuel cycle modeling



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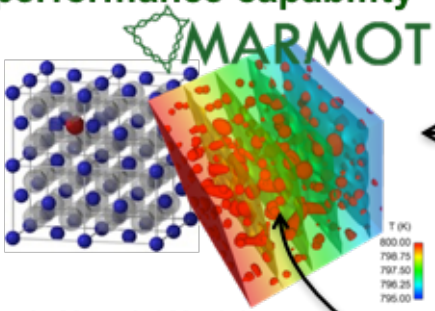
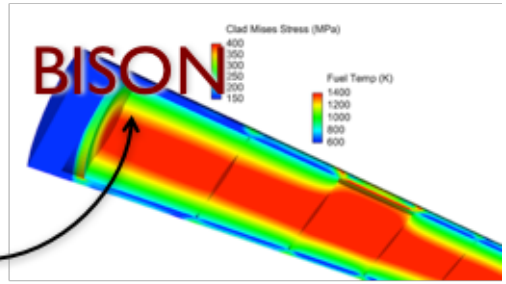
MOOSE-BISON-MARMOT toolset provides an advanced, multiscale fuel performance capability





Mesoscale Material Model Development Tool
- Simulates microstructure evolution in fuels under irradiation
- Used with atomistic methods to develop multiscale materials models

Engineering-scale Fuel Performance Tool
- Models LWR, TRISO and metallic fuels in 2D, 3D
- Steady-state and transient reactor operations

MOOSE
Multiphysics Object-Oriented Simulation Environment

Simulation framework enabling rapid development of FEM-based applications

R&D 100 2014 Winner

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

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