



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

Advanced Modeling and Simulation

Accident Tolerant Fuel Application

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Advanced Modeling & Simulation – Program Overview



Energy Innovation Hub for Modeling and Simulation (Hub)

Objective: Develop and deploy the Virtual Environment for Reactor Applications (**VERA**) M&S tools suite focused on LWR technologies. High resolution, high fidelity LWR fuel, core & vessel modeling, with direct multi-physics coupling.

Nuclear Energy Advanced Modeling & Simulation (NEAMS)

Objective: Develop and deploy predictive analytic computer methods (**NEAMS ToolKit**) for the analysis and design of advanced reactor and fuel cycle systems focused on non-LWR technologies.



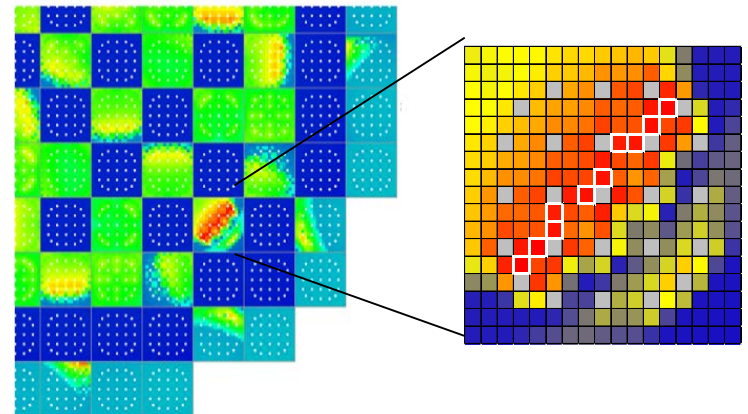
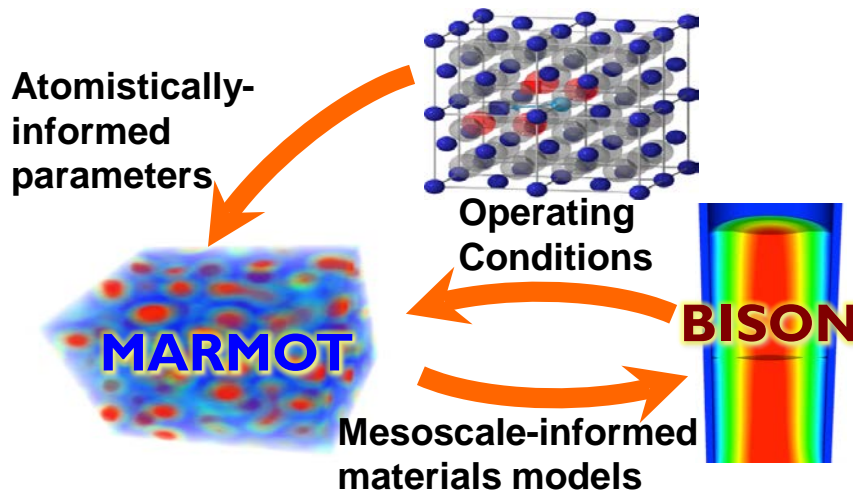
Modeling & Simulation Capability – ATF Analyses Focus with Industry

- **NEAMS/VERA tool suite being adapted to address ATF concepts:**

- Multiscale Fuel Performance Modeling
 - Atomistic Simulations
 - Mesoscale Models (MARMOT)
 - Engineering Scale Fuel Performance (BISON)
- BISON extension to ATF
 - FeCrAl, Coated Cladding, SiC-SiC
 - Doped UO_2 , U_3Si_2

- **Industry Applications**

- Westinghouse Electric VERA Test Stand Deployed with M&S tools applicable to ATF
- EPRI engagement in use of VERA capabilities for ATF
- NuScale VERA Test Stand – Not ATF





Advanced Modeling & Simulation – *Ongoing Engagement with NRC in ATF*

- NRC expressed an interest in understanding, and perhaps leveraging use of NE's advanced M&S tools for evaluation of more advanced ATF and advanced concepts.
- Cooperation was formalized in an addendum to the R&D MOU between NRC and DOE.
- Deployment of NRC Test Stand/Pilot Project with BISON-TRACE coupled capability is underway (*This is a Hub-NEAMS-NRC collaboration*)
 - Coupling NRC's TRACE thermal hydraulics code with NE's BISON fuel performance code as foundation for ATF analysis capability has started
 - NRC will be provided training on the BISON code, initial training provided in October 2017. Technical support for Bison use will be provided as required.
- DOE/NRC ATF Coordination Workshop in Idaho Falls (May 1-4) will highlight Industry's and DOE-NE's (R&D/M&S) planned ATF activities.
- NRC and NE leadership will continue to explore use of NE's advanced M&S tools and any needed coupling with appropriate NRC tools.



Summary

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- Advanced M&S codes will be available for ATF and advanced reactor analyses.
- NRC and DOE-NE are working together to ensure capability is available for NRC analyses of ATF concepts.
- The DOE-NE ATF test program will provide valuable experimental test data for code validation.
- While some fuel vendors are not planning to use these advanced M&S tools, DOE-NE will continue to engage industry to ensure ATF models are accurate and to access available test and experimental data for code validation purposes.

