MOOSE MULTIPHYSICS
FOR ENERGY & ENVIRONMENTAL APPLICATIONS

MOOSE Workshop Schedule | March 10-13 | Idaho Falls, Idaho

MONDAY, MARCH 10, 2025

Time	Event
8 AM	**Check-in**
8:20 PM	**Open workshop:** Rob Podgorney, Idaho National Laboratory
Opening plenaries | 8:30 - 10 AM | MC: Rob Podgorney	
8:30 AM	Todd Combs, Idaho National Laboratory Welcome to INL
8:50 AM	Derek Gaston, U.S. Department of Energy MOOSE: A Retrospective
9:30 AM	Cody Permann, Idaho National Laboratory MOOSE: What's next?
10 AM	**Break**
10:30 AM	**Technical session 1**

- **Nuclear 1** (Room A111)	- **Renewables | storage** (Room A112)	- **Framework 1** (Room A113)	- **Special topics 1** (Room A114)
Chair: Logan Harbour	*Chair: Cody Permann*	*Chair: Peter German*	*Chair: Wen Jiang*
MOOSE equivalence calculation for a multigroup model of neutron albedo: Gabriele Burgio (Research Neutron Source Heinz Maier-Leibnitz, FRM II)	***Dendrite Inhibition Using Heteroepitaxial Residual Stress in Zn Metal Batteries:*** Musanna Galib (The University of British Columbia)	***Overview of Thermal-Hydraulics Capabilities in MOOSE for Nuclear Reactor Modeling:*** Mauricio Tano (Idaho National Laboratory)	***New Crystal Plasticity Capabilities in MOOSE/NEML2:*** Mark Messner (Argonne National Laboratory)
Multiphysics and Multiscale Simulation using Cardinal: April Novak (University of Illinois, Urbana-Champaign)	***A Three-Dimensional, Thermodynamically and Variationally Consistent, Fully Coupled, Electro-Chemo-Thermo-Mechanical Model of Solid-State Batteries:*** Tianchen (Gary) Hu (Argonne National Laboratory)	***Enhancement of System Thermal-Hydraulics Simulations Using Block-Dependent and Time-Dependent Scaling Factors: Development and Implementation in the SAM Code:*** Eric Cervi (Argonne National Laboratory)	***Modeling of Liquid Infiltration in Powder Processing Manufacturing Techniques:*** Huy Tran (Argonne National Laboratory)
Toward a MOOSE-Based Model for Fission Products Transport and Source Term Estimation for High-Temperature Gas-Cooled Reactors: Nicolas Martin (Idaho National Laboratory)	***Parameterizing the Influence of Moisture on the Thermal Performance of TES:*** Abhishek Bhesania (Argonne National Laboratory)	***The Functor System: A New On-The-Fly Take on Material Properties Based on C++ Functions:*** Guillaume Giudicelli (Idaho National Laboratory)	*** A Numerical Study on Adaptive Printing Velocity Control in Frontal Polymerization-Assisted Thermoset Polymer 3D Printing:*** Xiang Zhang (University of Wyoming)

	Fast Molten Salt Reactor Modeling with Moltres: Kyra Lawson (University of Tennessee, Knoxville)	*Studying Cyclic H2 Injection in Underground Storage Using a Digital Rock Physics Framework:* Sijmen Zwarts (TU Delft)	*Coupling of Scalar and Field Variables in MOOSE Using the Scalar Augmentation Class System:* Timothy Truster (University of Tennessee, Knoxville)	
12 PM	**Hosted lunch**			

Afternoon plenaries | 1 - 2:45 PM | MC: Rob Podgorney

1 PM	Steve Bajorek, U.S. Nuclear Regulatory Commission The U.S. Nuclear Regulatory Commission Approach to Modeling and Simulation of Advanced Non-LWRs; Preparing for Today's Nuclear Renaissance
1:45 PM	Fusion panel Casey Icenhour (INL), Pierre-Clement Simon (INL), Andy Davis (UKAEA), Carlo Fiorina (TAMU)
2:45 PM	**Break**
3 PM	**Technical session 2**

	- **Nuclear 2** (Room A111)	- **Geoscience 1** (Room A112)	- **Special topics 2** (Room A114)
	Chair: Stephanie Pitts	*Chair: Rob Podgorney*	*Chair: Mauricio Tano*
	A Dislocation Transport Based Crystal Plasticity Model to Study Structure-Property Relations in Polycrystalline Materials: Brayan Murgas (Los Alamos National Laboratory)	*Multiphysical Couplings and Cosserat Continua to Model the Localization of Deformation in a Fault Core:* Hadrien Rattez (UCLouvain)	*Coupling MOOSE's Electromagnetic Module and Plasma Fluid Application for the Study of Microwave-Driven Discharges:* Corey DeChant (Idaho National Laboratory)
	Modeling The Impact of Morphological Features of Complex Microstructures Using Moose Based Crystal Plasticity Finite Element Model: Sagar Bhatt (Argonne National Laboratory)	*A Coupled Discontinuous Galerkin and Cohesive Zone Implementation for Modeling Hydraulic Fractures in Porous Media:* Ming Yang (Idaho National Laboratory)	*Modeling Spectral Phonon Transport at Thermal Interfaces in Heterostructures:* Jackson Harter (Idaho National Laboratory)
	Mechanistics Model for Predicting Uniaxial Creep, Multiaxial Creep, and Stress Relaxation Behavior of Alloy 709: Tianchen (Gary) Hu (Argonne National Laboratory)	*Three-Scale Multiphysics Framework Modelling Fault Reactivation:* Martin Lesueur (Delft University of Technology)	*Using the MOOSE Framework to Model Thermoelectric Generators:* Lise Charlot (Idaho National Laboratory)
			Computational Phantoms in MOOSE for Medical Physics: Matthew Anderson (Idaho National Laboratory)

4:30 PM	**Poster session and reception with cash bar**

BISON Modeling of ZIRLO Cladding for Reactivity Initiated Accident Separate Effects: Landry Wells (University of Tennessee Knoxville)

Generating a High-Quality Mesh for Helicoidal Cruciform Accident Tolerant Fuel in MOOSE: Guillaume Giudicelli (Idaho National Laboratory)

The Strength Reduction Method Applied to The Hardening Multi-Plasticity Model to Numerically Study Flank Collapses of Volcanoes: Jens Niclaes (UCLouvain)

Multiphysical Couplings and Cosserat Continua to Model the Localization of Deformation in a Fault Core: Hadrien Rattez (UCLouvain)

Developing a Coupling Between the AEGIS Charged Particle Tracking Code and MOOSE to Enable Scalable Thermal Analysis of Plasma Facing Components: Waqar Butt (UK Atomic Energy Authority)

Development of Liquid-Metal MHD for Fusion Multiphysics in MOOSE: Rupert Eardley-Brunt (UK Atomic Energy Authority)

Levelling Up the Support for H(curl) and H(div) Spaces in MOOSE: Nuno Nobre (STFC Hartree Centre)

Development of a Simulation Tool for Liquid Metal MHD Flows in MOOSE: Daniel Suarez, (Oak Ridge National Laboratory)

A Numerical Study on Adaptive Printing Velocity Control in Frontal Polymerization-Assisted Thermoset Polymer 3D Printing: Xiang Zhang (University of Wyoming)

Using the MOOSE Framework to Model Thermoelectric Generators: Lise Charlot (Idaho National Laboratory)

MOOSE Model of the LOBO Lead Loop: Son Quang (University of Tennessee)

Using MOOSE to Quantify the Impact of Solid Precipitates on Bubble Coalescence: Tanvir Sakib (University of Florida)

Digital Rock Physics Framework for Energy Geomechanics: Sijmen Zwarts (TU Delft)

6 PM	**Adjourn**

TUESDAY, MARCH 11, 2025

8 AM	Check in
8:20	**Open workshop:** Rob Podgorney, Idaho National Laboratory

Opening plenaries | 8:30 - 10 AM | MC: Logan Harbour

8:30 AM	Andy Davis, United Kingdom Atomic Energy Authority How We Learned to Stop Worrying and Love MOOSE
9:15 AM	Andy Wilkins, Commonwealth Scientific Industrial Research Organization Tales From the Depths
10 AM	**Break**
10:30 AM	**Technical session 3**

	- Nuclear 3 (Room A111)	**- Fusion 1** (Room A112)	**- Nuclear experimental design 1** (Room A113)
	Chairs: Guillaume Giudicelli and Vasileios Kyriakopoulos	*Chair: PC Simon*	*Chair: Zachary Prince*
	Modeling Clad Damage Propagation in Liquid Metal Fast Reactors Using MOOSE-SC: Aydin Karahan (Argonne National Laboratory)	*Stress, Strain, Neutron Transport and Radiation Effects in a Full Fusion Tokamak Device: A Virtual MAST-U Study:* Luca Reali (UK Atomic Energy Authority)	*Thermal Property Inversion with Lock-in Thermography:* Lynn Munday (Idaho National Laboratory)
	Toward Development of a Low-Temperature Failure Envelope of Cases for High-Burnup RIAs Under PWR Operational Conditions: Luiz Aldeia Machado (The Pennsylvania State University)	*Development of Liquid-Metal MHD Simulation for Fusion Multiphysics in MOOSE:* Rupert W Eardley-Brunt (UK Atomic Energy Authority)	*An Element Reduced Order Model Framework for Lattice Structures with Geometric Parameterization:* Max Nezdyur (Idaho National Laboratory)
	MixcoatITM 2.0: BWXT's Improved MOOSE-based Conjugate Heat Transfer Software for Reactor Applications: Vincent Laboure (BWXT)	*Development of a Simulation Tool for Liquid Metal MHD Flows in MOOSE:* Daniel Suarez (Oak Ridge National Laboratory)	*Modified Burst Testing for Reactivity Initiated Accident Separate Effects Testing on Cladding: from Experimentation to Modeling:* Jennifer I. Espersen (University of Tennessee-Knoxville)
	Temperature Field Reconstruction of Surfaces Heated Through Radiative Heat Transfer Using Convolutional Neural Networks: Luiz Aldeia Machado (The Pennsylvania State University)		*Deimos, an Advanced Reactor Testbed and Criticality Experiment:* Alexis Maldonado (Los Alamos National Laboratory)

12 PM	**Hosted lunch**

Afternoon plenaries | 1 - 2:45 PM | MC: Derek Gaston

1 PM	John Dolbow, Duke University Recent Advances in Regularized Models of Fracture and Accompanying Discretization Methods
1:45 PM	AI/ML panel Yang Liu (TAMU), Daniel Schwen (INL), Mengnan Li (INL), Som Dhulipala (INL), Gary Hu (ANL)
2:45 PM	**Break**

3 PM	Technical session 4

	- Nuclear 4 (Room A111)	**- Fusion 2** (Room A112)	**- Nuclear experimental design 2** (Room A113)	**- Special topics 3** (Room A114)
	Chair: Larry Aagesen	*Chair: Casey Icenhour*	*Chair: Lynn Munday*	*Chair: Zachary Prince*
	Simulating Hydrogen Evolution in Metal Hydrides Using SWIFT: William Neilson (Los Alamos National Laboratory)	***New Developments and Verification of Fusion Blanket Simulation Capabilities in the MOOSE Framework:*** Trevor Franklin (Virginia Commonwealth University)	***Platform of Optimal Experiment Management via RAVEN and MOOSE to Accelerate the Discovery of Optimal Solutions:*** Congjian Wang (Idaho National Laboratory)	***Concurrent Multiscale Simulations of Nonlinear Random Materials using Probabilistic Learning:*** Tianchen (Gary) Hu (Argonne National Laboratory)
	Model of Hydrogen Corrosion of Nuclear Thermal Propulsion Carbide Fuel Using SWIFT: Christopher Matthews (Los Alamos National Laboratory)	***Fusion Energy System Liquid Immersion Blanket System Modeling using SAM:*** Lane Carasik (Virginia Commonwealth University)	***Assessing Influence of Fission Gas Release in MiniFuel Irradiation Capsule Design:*** Nicholas Meehan (University of Tennessee Knoxville)	***MOOSE ProbML: Parallelized Probabilistic Machine Learning and Uncertainty Quantification for Computational Models:*** Somayajulu L N Dhulipala (Idaho National Laboratory)
	Centipede: A MOOSE-Based Cluster Dynamics Code to Connect Lower-Length Scale Data to Fuel Performance Simulations: Christopher Matthews (Los Alamos National Laboratory)	***MOOSE Model of the LOBO Lead Loop:*** Son Quang (University of Tennessee, Knoxville)	***Development of Copper Corrosion Simulation Code for Performance Assessment of Deep Geological Repository Systems: HADES (High-level rAdiowaste Disposal Evaluation Simulator):*** Pilhyeon Ju (Seoul National University)	***A Galilean-Invariant Neural Network Closure for Enhanced Turbulence Modeling in MOOSE-Based Nuclear Thermal-Hydraulics Simulation:*** Yang Liu (Texas A&M University)
	Three-Dimensional Welding Simulation of a Pressure Vessel and Validation Against UK R5 Procedure: Bipul Barua (Argonne National Laboratory)			***Controller Training With Reinforcement Learning in MOOSE:*** Peter German (Idaho National Laboratory)

4:30 PM	**Adjourn**

WEDNESDAY, MARCH 12, 2025

8 AM	Check in
8:20 AM	**Open workshop:** Rob Podgorney, Idaho National Laboratory

Opening plenaries | 8:30 - 10 AM | MC: Jason Hales

8:30 AM	Mike Tonks, University of Florida Using MOOSE to Investigate Material Behavior in Harsh Environments
9:15 AM	Wen Jiang, North Carolina State University Multiphysics Modeling of the Additive Manufacturing Process Using the MOOSE framework
10 AM	**Break**
10:30 AM	**Technical session 5**

	- **Nuclear 5** (Room A102)	- **Fusion 3** (Room A113)	- **Framework 2** (Room A111/A112)	- **Geoscience 2** (Room A114)
	Chair: Mauricio Tano	*Chair: Corey DeChant*	*Chair: Cody Permann*	*Chair: Andy Wilkins*
	In Memory Coupling of BISON and RELAP5-3D to Simulate LOCA Behavior in LWRs: Kyle A. Gamble (Idaho National Laboratory)	*Modeling Magnetic Confinement Fusion Systems With MOOSE-based Capabilities:* Pierre-Clement Simon (Idaho National Laboratory)	*Prelude to Simulation Diagnostics in MOOSE: Diagnosing Meshes:* Daniel Yankura (Idaho National Laboratory)	*THM Modeling and Simulation of Circulation Tests for Optimized Development at the Utah FORGE Site:* Robert Podgornery (Idaho National Laboratory)
	BISON and RELAP5-3D For Pressurized Water Reactor Safety Applications: Mason A. Fox (University of Tennessee, Knoxville)	*Developments and Updates Within the MOOSE Electromagnetics Module to Facilitate Fusion Multiphysics:* Casey Icenhour (Idaho National Laboratory)	*Physics and Components Syntax for a Systems-Based Approach to Multiphysics:* Guillaume Giudicelli (Idaho National Laboratory)	*Combine the Phase-Field Description With a Discrete Element Method to Model Chemo-Mechanical Couplings (Pressure-Solution):* Alexandre Sac-Morane (Duke University & UCLouvain)
	Meso-Scale Modeling for Restructuring in the High Burnup UO2 Nuclear Fuel: Sudipta Biswas (Idaho National Laboratory)	*Platypus on the Device: Results and Lessons from GPU Acceleration:* Henrique Bergallo Rocha (UK Atomic Energy Authority)	*RACCOON: A Versatile Framework for Variational Approaches to Fracture with Coupled Field Phenomena:* Tianchen (Gary) Hu (Argonne National Laboratory)	*PFEM to Simulate Earthen Dikes Failure Due to Overtopping: A Coupled Surface-Subsurface Approach:* Nathan Delpierre (UCLouvain)
	Fission Gas Behavior Modeling in BISON for Fuel Performance Calculations: Pierre-Clement Simon (Idaho National Laboratory)		*Isogeometric Analysis in MOOSE:* Greg Vernon (Coreform)	*HADES (High-level Radiowaste Disposal Evaluation Simulator) Development for Performance Assessment of Deep Geological Repository:* Samuel Park (Seoul National University)

12 PM	**Hosted lunch**

Afternoon plenaries | 1 - 2:45 PM | MC: Guillaume Giudicelli

1 PM	Kallie Metzger, Westinghouse Electric Company Modeling and Simulation of the eVinci Microreactor Using MOOSE-Based Tools
1:45 PM	MOOSE team panel Cody Permann (INL), Logan Harbour (INL), Guillaume Giudicelli (INL), Roy Stogner (INL), Derek Gaston (DOE)
2:45 PM	**Break**

3 PM	Technical session 6		
	- Nuclear 6 (Room A102) *Chair: Daniel Schwen* ***Phase-Field Simulation of Electric Field Assisted Sintering:*** Larry Aagesen (Idaho National Laboratory) ***Phase Field Modeling of Stress Corrosion Cracking of Structural Alloys in Molten Salt Reactors:*** Harsha Pandey (University of Illinois, Urbana-Champaign) ***Quantitative Phase Field Modeling of Void Growth Under Irradiation in Single-Crystalline Metals: An Accurate Capture of the Thermodynamics of Void Phase:*** Rayaprolu Goutham Sreekar Annadanam, (Purdue University)	**- Fusion 4** (Room A113) *Chair: Casey Icenhour* ***Verification, Validation, and Demonstration of the MOOSE-Based Tritium Migration Analysis Program, Version 8 (TMAP8) Application for Fusion Systems:*** Pierre-Clement Simon (Idaho National Laboratory) ***Evaluating the Impact of Tritium Permeation Membrane Performance and Direct Internal Recycling on Fusion Fuel Cycle Efficiency Using TMAP8:*** Lin Yang (Idaho National Laboratory) ***Development and Validation of MALAMUTE Simulations for Electric Field Assisted Sintering of Structural Materials:*** Stephanie A. Pitts (Idaho National Laboratory)	**- Framework 3** (Room A111/A112) *Chair: Logan Harbour* ***Integrating Accelerators Into MOOSE:*** Alexander Lindsay (Idaho National Laboratory) ***Hippo: A MOOSE Mulitapp Wrapping OpenFOAM:*** Harry Saunders (UK Atomic Energy Authority) ***Levelling Up the Support for H(curl) and H(div) Spaces in MOOSE:*** Nuno Nobre (STFC Hartree Centre) ***Platypus: A MOOSE Application Enabling FE Problem Assembly and Solution on GPU Architectures using MFEM:*** Alexander Blair (UK Atomic Energy Authority)
4:30 PM	**Adjourn**		

THURSDAY, MARCH 13, 2025   Optional Workshop Trainings

8 AM	**Check in**			
8:20 AM	**Open workshop:** Cody Permann, Idaho National Laboratory			
Opening plenaries | 8:30 - 10 AM | MC: Cody Permann				
8:30 AM	Ben Spencer, Idaho National Laboratory Solid Mechanics in MOOSE: History, Nuclear-Energy Applications and Ongoing Development			
9:15 AM	Daniel Schwen, Idaho National Laboratory Rapid Model Development and Execution With MOOSE			
10 AM	**Break**			
10:30 AM	**Training session 1**			
	- NEML (Room A111/A112)	- libTorch (Room A102)	- Mortar (Room A113)	- PorousFlow (Room A114)
12 PM	**Hosted lunch**			
1 PM	**Training session 2**			
	- NEML (cont.) (Room A111/A112)	- Finite volume (Room A113)	- Stochastic tools (Room A102)	- Subchannel (Room A114)
2:30 PM	**Break**			
3 PM	**Training session 3**			

	- NEML (cont.)
	  (Room A111/A112)
		- Optimization (Room A112)	- Stochastic tools (cont.)
			  (Room A102)
				Coreform Cubit (Room A114)

4:30 PM	**Adjourn**			