



ASL

Advanced Sensors  
and Instrumentation

U.S. DEPARTMENT OF  
**ENERGY**

Office of  
**NUCLEAR ENERGY**

# Advanced Reactors and the Need for Advanced Control Systems

Argonne National Laboratory, Lemont, IL | July 12-14, 2023

## AGENDA

**Wednesday July 12, 2023**  
**Bldg. 241, Room D172**

- 7:30 Arrive at Argonne Information Center (9700 S. Cass Ave, Lemont, IL 60439)  
*Visitors check in at the Argonne Information Center upon arrival. Each visitor will be issued a gate pass for site access. Drive to Building 241.*
- 8:00 Check-in
- 8:30 Welcome .....Temitope Taiwo (ANL)
- 8:35 Workshop Introduction and Goals ..... Craig Primer (INL), Rick Vilim (ANL)

### *Topic 1: Advanced controls for advanced nuclear reactors: industry needs and requirements*

- 8:45 Session Moderator Introductory Remarks .....Ahmad Al Rashdan (INL)
- 8:55 Control for Micro-Reactors .....Anton Moiseyev (ANL)
- 9:10 Supervisory Control for Flexible AR Operation ..... Taeseung Lee (ANL)
- 9:25 Digital Twins for Health Monitoring to  
Support Advanced Control ..... Raj Iyengar (NRC)
- 9:40 Integration of Control Methods and Digital Twins  
for Advanced Nuclear Reactors ..... Jake Farber (INL)
- 9:55 Break**
- 10:10 Panel Session  
Daniel Althouse (TerraPower), Matt Hertel (X-Energy), Rob Meyer (NuScale)
- 10:30 Transition to Break-Out Session Rooms

10:35 Break-Out Session ..... All  
*What could advanced control systems be used for in advanced nuclear reactors? What are the resulting requirements for the control system?*

Group 1 (Room D172) ..... Facilitator: Craig Primer (INL)

Group 2 (Room D173) ..... Facilitator: Dianne Ezell/Wes Williams (ORNL)

Group 3 (Room B123) ..... Facilitator: Rick Vilim (ANL)

11:35 Transition to Room D172

11:40 Break-Out Session Reports ..... All

**12:10 No-Host Lunch** (Argonne Cafeteria) ..... All

**Topic 2: Current state of development and deployment of advanced control methods**

1:10 Session Moderator Introductory Remarks ..... Dianne Ezell (ORNL)

1:20 Data-Driven Control in the Existing Fleet ..... Haoyu Wang (ANL)

1:35 Digital Twins for Health Monitoring to  
Support Advanced Control ..... Tim Nguyen (ANL)

1:50 High Fidelity Sensing & Machine Learning  
Inside the Control Loop ..... Wes Williams (ORNL)

2:05 Model Predictive Control for  
Microreactors ..... Brendan Kochunas (University of Michigan)

2:20 Anticipatory Control for Microreactors ..... Linyu Lin (INL)

**2:35 Break**

2:50 Panel Session  
Roger Chin (Radiant), Bruce Greer (EPRI), Alan Smith (Oklo)

3:10 Transition to Break-Out Session Rooms

3:15 Break-Out Session ..... All  
*What are technology and non-technology barriers to deploy advanced controls for the envisioned advanced reactor applications?*

Group 1 (Room D172) ..... Facilitator: Vivek Agarwal (INL)

Group 2 (Room D173) ..... Facilitator: Ahmad Al Rashdan (INL)

Group 3 (Room B123) ..... Facilitator: Rick Vilim (ANL)

4:15 Transition to Room D172

4:20 Break-Out Session Reports ..... All

**4:50 Adjourn Day One**

**Thursday, July 13, 2023**  
**Bldg. 241, Room D172**

**Topic 3: Challenges and opportunities for advanced control**

- 9:00 Session Moderator Introductory Remarks ..... Rick Vilim (ANL)
- 9:10 Surrogate Models for Real Time Multi-Asset Control..... Haoyu Wang (ANL)
- 9:25 Synthesizing Advanced Reactor Control Systems:  
Achieving Security and Reliability.....Daniel Cole (University of Pittsburgh)
- 9:40 Intelligent, Risk Informed Asset-Management  
Decision-Making and Maintenance Optimization.....Vera Moiseytseva (ANL)
- 9:55 AI/ML for a Digital Twin of the  
Purdue Reactor PUR-1..... Lefteri Tsoukalas (Purdue University)
- 10:10 Reinforcement Learning for Performance Optimization.....Akshay Dave (ANL)
- 10:25 Break**
- 10:40 Unattended Operation of Fission Batteries .....Vivek Agarwal (INL)
- 10:55 Autonomous Controls for Nuclear Thermal Propulsion.....Dianne Ezell (ORNL)
- 11:10 A Path to Semi-Autonomous Operation.....Roberto Ponciroli (ANL)
- 11:25 Panel Session  
Corey Shore (GE), Thomas Tweedle (Westinghouse),  
Zach Hachmeister (Fauske and Associates)
- 11:45 No-Host Lunch** (Argonne Cafeteria) ..... All
- 12:45 Break-Out Session ..... All  
*What are high priority R&D activities that would aid greater efficiency and reduced O&M cost?*  
Group 1 (Room D172) ..... Facilitator: Craig Primer (INL)  
Group 2 (Room D173) ..... Facilitator: Ahmad Al Rashdan (INL)  
Group 3 (Room B123) ..... Facilitator: Dianne Ezell/Wes Williams (ORNL)
- 1:45 Transition to Room D172
- 1:50 Break-Out Session Reports ..... All
- 2:20 Break**
- 2:35 Summary Discussion ..... All  
*A facilitated group exercise will be conducted to identify and prioritize the significant technology gaps that would benefit by DOE-sponsored R&D. Research needs that are common to multiple advanced reactor types will be of particular interest.*
- 3:50 Closing Remarks ..... TBD
- 4:00 Adjourn Day Two**

**Friday, July 14, 2023**  
**Bldg. 241 Lobby**

*Optional Argonne Facilities Tour (Please register by Friday, July 7 to participate)*

*Tour locations are subject to change.*

8:30 Tour departs Building 241 Lobby ..... Rick Vilim (ANL)

8:40 **Mechanical Engineering Test (METL) Facility, Building 308**  
Sodium loop for testing of sensors and other components for fast reactors at prototypic operating temperatures.

9:15 **Digital-Twin Health Monitoring Facility, Building 208**  
Remote monitoring and diagnostic (M&D) video wall. Demonstration of diagnosis of health of sensors and components in the METL Facility.

10:15 **Aurora Exascale Supercomputer, Building 240**  
Due to begin operation in 2023, scientists will use this new machine to pursue science and engineering breakthroughs by combining machine learning and data science alongside traditional modeling and simulation.

11:00 **Advanced Photon Source, Building 401**  
EPICS Instrumentation and Control System - Distributed real-time control system for large-scale engineering and scientific experiments.

**12:00 Adjourn Day Three**