



From Research to Industry: Scaling National Lab Impact with Cloud Platforms

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Rescale



U.S. DEPARTMENT
of ENERGY

ORNL IS MANAGED BY UT-BATTELLE LLC
FOR THE US DEPARTMENT OF ENERGY



Scalable Modeling Software for Manufacturing



U.S. DEPARTMENT of ENERGY | Office of Critical Minerals and Energy Innovation

Early-stage R&D to improve energy and material efficiency, productivity, and competitiveness for American manufacturers



MDF Modeling Tools

 **EXACA**

 **ADAMANTINE**

 **ADDITIVEFOAM**

 **MYNA**

 **TOUCAN**

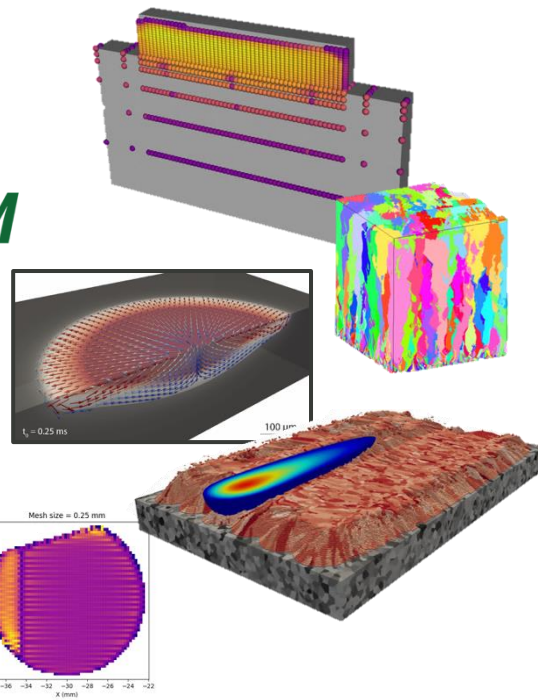
 **CONDOR**

 **RAPTOR**

 **STORK**

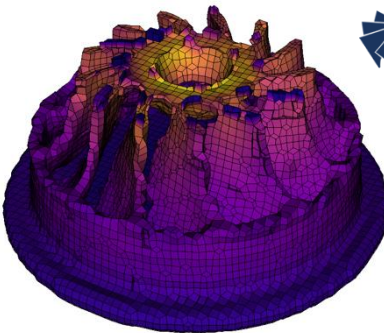
 **3DTHESIS**

 **EQUILIPY**




Computation for Manufacturing Challenges

ADAMANTINE



MDF



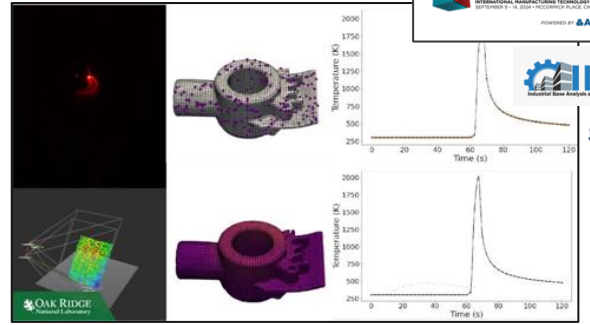
HPC4
MANUFACTURING

Lawrence Livermore National Laboratory

OAK RIDGE National Laboratory

Large-scale printing for hydroelectric power

ADAMANTINE



IMTS2024
INTERNATIONAL MANUFACTURING TECHNOLOGY SHOW
SPONSORED BY THE MANUFACTURING CHALLENGE INITIATIVE

POWERED BY **AAMT**

IBAS
Industrial Base Analysis and Simulation Program

MDF

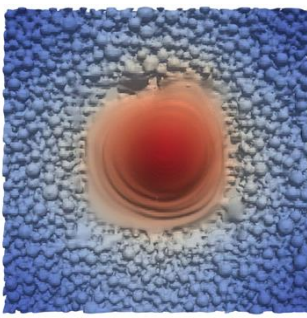
OAK RIDGE National Laboratory

8760 Fastems

OKUMA

Real-time digital twins for process control

ADDITIVEFOAM



Wall Clock Time (h)

Before	12.6
After	0.53

23X speedup

Novel laser processes

SEURAT

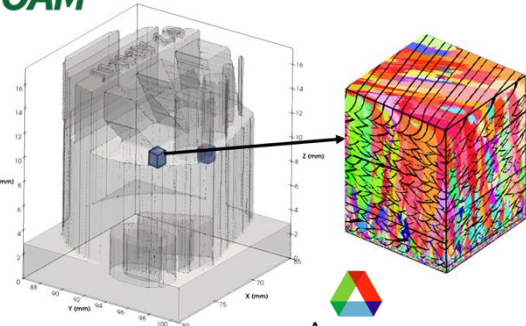
MDF OAK RIDGE National Laboratory

ADDITIVEFOAM

3DTHESIS

EXACA

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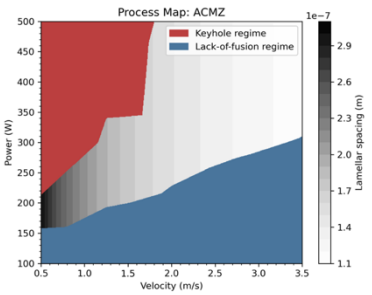
Argonne NATIONAL LABORATORY

AMMT
ADVANCED MATERIALS AND MANUFACTURING TECHNOLOGIES

Accelerate qualification of AM parts in nuclear energy

ADDITIVEFOAM

AMPE



Process Map: ACMZ

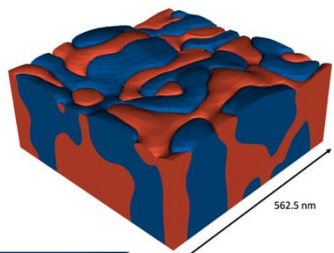
Power (W)

Velocity (m/s)

Keyhole regime

Lack-of-fusion regime

Lamellar spacing (m)



562.5 nm

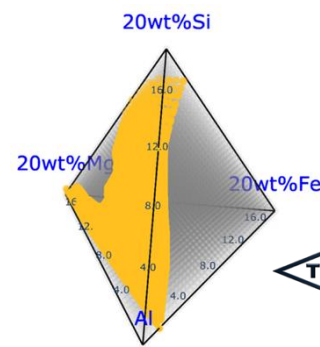
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gm

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Process mapping for new materials


EQUILIPY



20wt%Si

20wt%Mg

20wt%Fe



TRIALCO

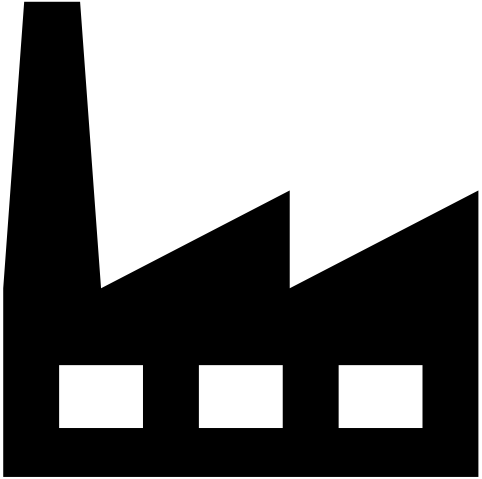
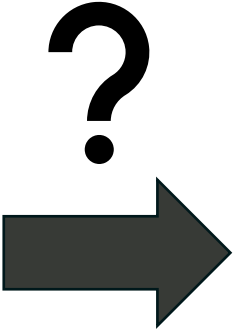
OAK RIDGE National Laboratory

Falcon Lakeside Manufacturing

U.S. DEPARTMENT of ENERGY | Office of Critical Minerals and Energy Innovation

Scrap tolerant alloy design

Translating HPC Software to Industry



Barriers to Industry Usage of Advanced Manufacturing Software Tools

Infrastructure Barrier

- Compute availability
- Managing compiling and dependencies
- IT requirements
- Cybersecurity

Expertise Barrier

- Selecting the correct tools
- Managing model inputs and outputs
- Managing data
- Analyzing results

Cloud Deployment Lowers the Infrastructure Barrier

- Preconfigured installations without need for compilation
- Avoid IT bottlenecks for approval
- Eliminates conflicting software stacks, versioning, and environments
- Removes need for on-site compute and IT support for SMEs
- Availability of wide range of computing environments
- Enterprise admin support for distributed software

Accelerating Additive Manufacturing Innovation with Oak Ridge National Laboratory and Rescale

SimCamp 2025 brought together industry leaders and national lab researchers at ORNL's Manufacturing Demonstration Facility (MDF) for an immersive workshop on additive manufacturing simulation. Supported by Rescale, the event featured technical talks and hands-on tutorials led by ORNL code developers, giving participants direct access to newly published MDF codes on the Rescale platform.

Throughout the workshop, attendees worked with cutting-edge models for predicting microstructures, analyzing melt pool behavior, and simulating part-scale heat transfer. This hands-on experience allowed industrial partners to test these advanced tools while providing valuable feedback to ORNL's R&D team, helping align research efforts with real-world manufacturing challenges.

In order to take advantage of the ORNL MDF codes on the Rescale platform, request a free trial.

[Get a Free Trial](#)

ORNL MDF codes available on Rescale

ADAMANTINE

Adamantine

Adamantine is a thermomechanical simulation code written in C++ for additive manufacturing, built on deal.II, ArborX, Trilinos, and Kokkos. It models the evolution of solid, liquid, and powder states during processing and leverages experimental data via ensemble Kalman filtering to improve accuracy.

ADDITIVEFOAM

AdditiveFOAM

AdditiveFOAM is a simulation framework for transport phenomena in additive manufacturing, built on OpenFOAM. It solves multiphysics problems with finite volume methods, simulates detailed geometries and scan paths, and couples with ExaCA for process-structure predictions.

EXACA

ExaCA

ExaCA is a C++ code for predicting as-solidified grain structures from thermal history data. Built with MPI and Kokkos for scalable, portable performance on CPUs and GPUs, it models nucleation, solidification dynamics, and dendrite geometry. Coupling with process models enables efficient simulations with billions of cells.

MYNA

Myna

3DTHESIS

3D Thesis



INNOVATION DAYS SERIES: *SimCamp 2025*

- Hands-on training for ORNL simulation tools for manufacturing
- **5 codes in 2 days**
- Intended as the first of an annual series



Successful cloud deployment of ORNL tools on rescale platform

Government



Academia



Industry



"By using the ORNL simulation tools we believe we can cut out large amounts of physical work and only invest our time in parameter sets that offer the best chances of success. This **saves us valuable time** in the research and development portion of our process development, which **saves expense**, but more importantly it allows us to **take products to market quicker** - giving us a **competitive advantage**."

Graham Jackson, GE Vernova

Rescale: The Digital Engineering Platform

1,400+ Leading Engineering & Scientific Applications



Software and Licensing

Optimized HW-SW Configurations

Flexible Job Submission

Data Sharing & Collaboration

Workflows Automations

Full-stack
**Engineering &
Scientific**
Computing



Unified
**Visibility &
Control for IT**
Management

End-to-End Security & Compliance

Total Spend and Consumption

Multi-Team & Access Controls

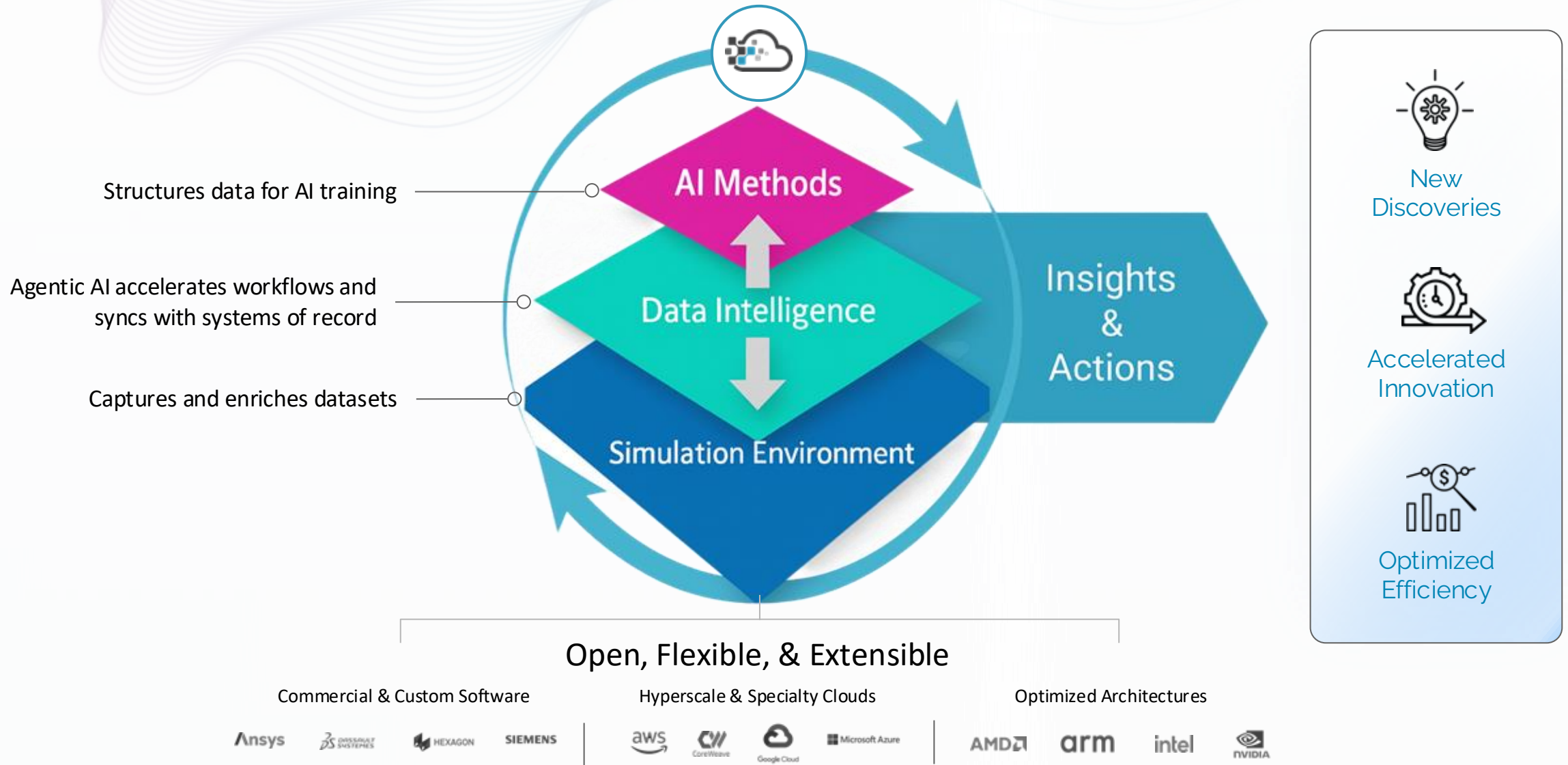
Data Platform Integration

Multi-Cloud, Region, & Cost-Model

100+ High Performance Computing Architectures



Unifying Simulations, Data Intelligence, AI Methods



Agentic AI to Streamline Complex Simulation Tasks

Agent for automated thermodynamic calculations

Based on the provided information, the composition of Aluminum 6061 alloy is approximate

Here's a comparison of the Scheil and Nucleo-Scheil solidification calculations:

Constituent	Scheil (wt. %)	Nucleo-Scheil (wt. %)
Al	97.90	97.90
FCC_A1 (Aluminum Solid Solution)	0.94	0.98
Mg	1.00	1.00
Si	0.60	0.60
DIAMOND_A4+FCC_A1+Mg2Si_MG2SI(s)	0.019	0.019
FCC_A1+Mg2Si_MG2SI(s)	0.04	N/A
Mg2Si_MG2SI(s)	N/A	0.004

Agentic workflow using ORNL and cloud compute for AM process controls



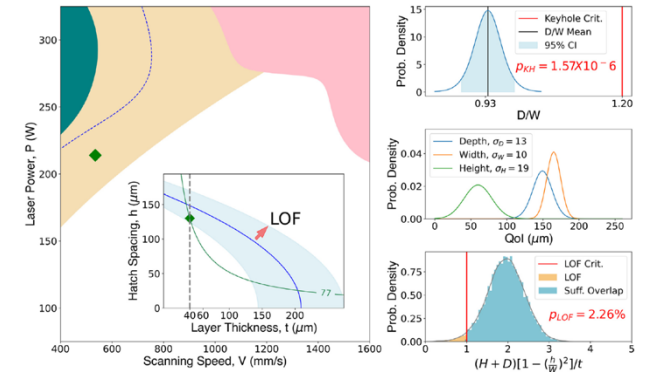
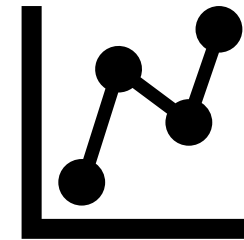
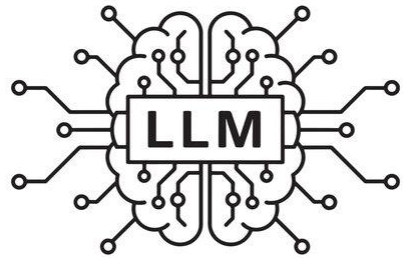
ORNL and Rescale: MDF Technical Collaboration for Agentic AI to Drive Manufacturing Simulation Workflows

User prompt to agent

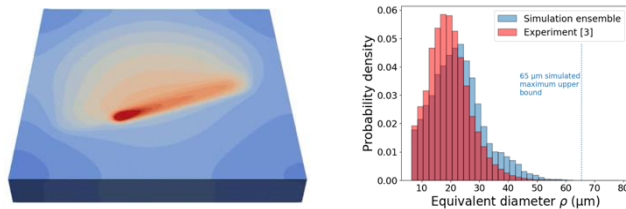
Interface with rescale platform

Data analysis

Report results




ADDITIVEFOAM **RAPTOR**



Launching simulation ensembles and collecting data

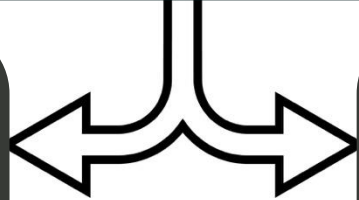
Agentic simulation workflows for advanced manufacturing






Technology Validation
Cloud service providers and vendors will validate technologies against extreme-scale scientific and national security workloads, co-design solutions with a high-value research community, and evolve pilot deployments into sustainable offerings.


Long-term Partnerships
Participation strengthens long-term partnerships with DOE and expands opportunities for innovation. Secure data access in CSP environments creates new avenues for industry and the public to leverage scientific data.


Strategic Computing Reserve
This model charts a path toward a National Strategic Computing and AI Reserve, supporting both steady-state research and surge capacity in times of crisis, ensuring resilience and U.S. competitiveness.




Optimize Your HPC
Accelerate full-stack modeling and simulation with Rescale Compute™
[Learn More...](#)


Harness Your Data
Transform fragmented data into actionable insights with Rescale Data Intelligence™
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Unlock AI Insights
Discover new products at unprecedented speed with Rescale AI Physics™
[Learn More...](#)





INNOVATION DAYS SERIES: *SimCamp 2026*

- Summer 2026
- Expanding to a 3-day event
- Covering tools for:
 - Laser processing
 - Large-scale AM
 - Microstructure evolution
 - Coupled workflows
 - ...and more!



Join the mailing list



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