

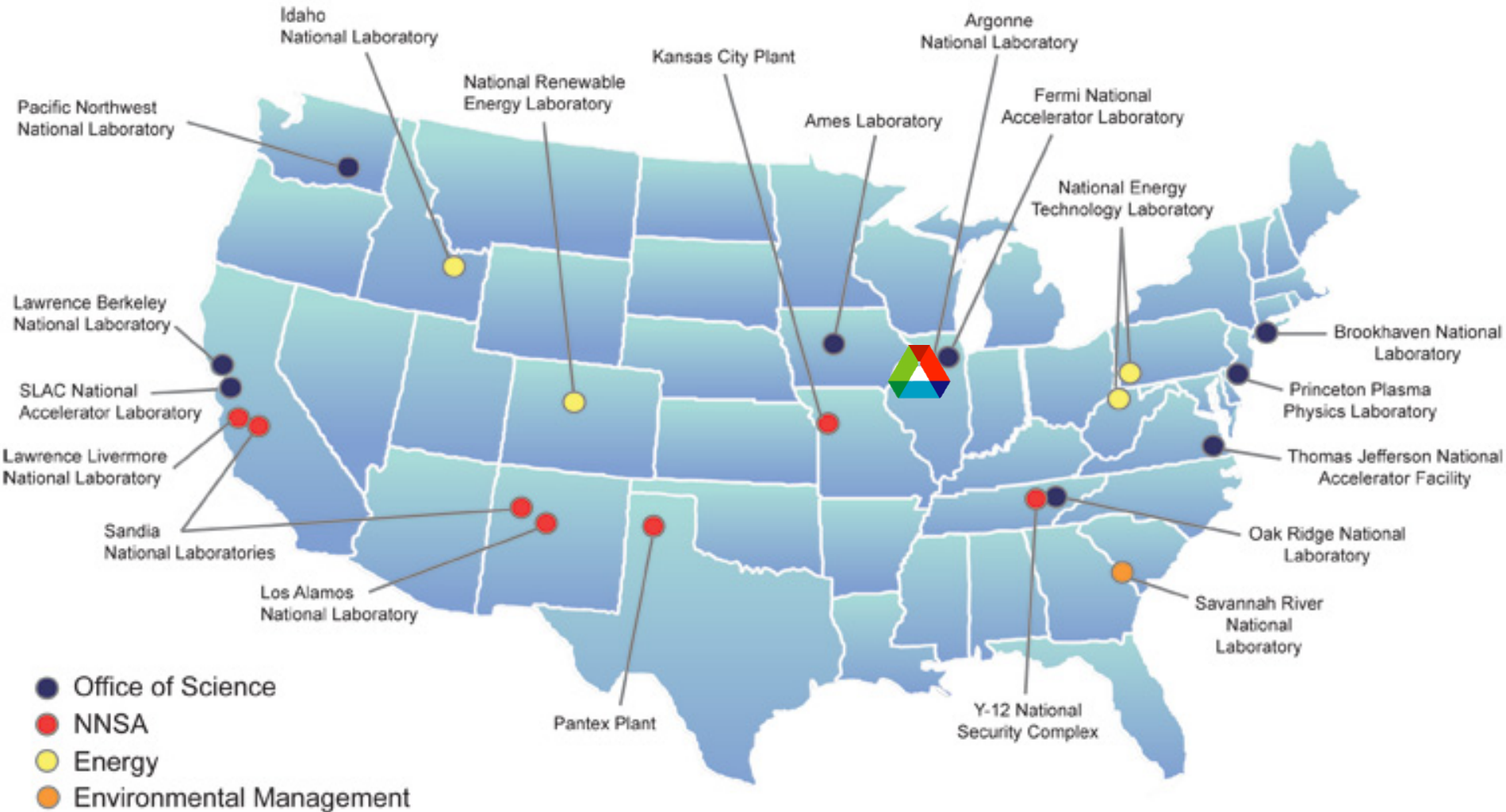
MCS/ANL

Marc Snir

Director, Mathematics and Computer Science Division,
Argonne National Laboratory

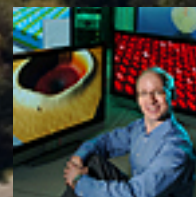
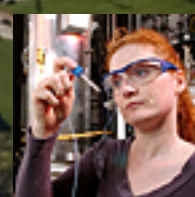
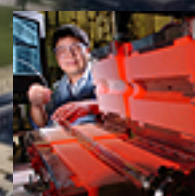
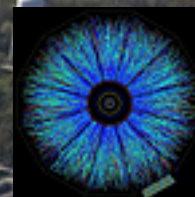
Michael Faiman and Saburo Muroga Professor,
Department of Computer Science, University of Illinois at Urbana
Champaign

DOE National Laboratory System



About Argonne

- \$675M operating budget
- 3,200 employees
- 1,450 scientists and engineers
- 750 Ph.D.s



Argonne provides a vital ecosystems for major DOE scientific user facilities

APS

Protein facility
Nanoscience

Chemical engineering

Chemistry

Accelerator physics

Materials and
energy sciences

Biology

High performance
computing & data

Argonne National Laboratory: 4 Directorates

Computing,
Environment & Life
Sciences (CELS)



Energy Engineering &
Systems Analysis
(EESA)



Photon Sciences
(PS)



Physical Sciences &
Engineering (PSE)



CELS: 4 Divisions

The Argonne
Leadership Computing
Facility



Mira: 10 PF BG/Q,
~750,000 cores,
0.75 PB

Biosciences
Division



Environmental
Science Division



Mathematics and Computer
Science Division



MCS

- **Extreme Computing Group:** Software infrastructure for extreme scale computers (exasflops)
- **Big Data Group:** Software infrastructure for storage, communication and analysis of large & complex data sets (exabytes)
- **Applied Math Group:** Scalable numerical algorithms and scientific libraries
 - Sparse linear algebra (PETSc), PDE solvers (MOAB), Optimization (TAO)
- **Computational Science Group:** Application of advanced compute methods to selected application areas
 - Bioinformatics, climate modeling, nuclear engineering, cosmology
- **Computational Institute** (joint with U. of Chicago): Collaborative environments
 - Grid, cloud
- ~120 people (off season)



Production Systems: ALCF-2

Mira – *BG/Q system*

- 49,152 nodes / 786,432 cores
- 786 TB of memory
- Peak flop rate: 10 PF

Vesta - *BG/Q system*

- 4,096 nodes / 65,536 cores
- 64 TB of memory
- Peak flop rate: 832 TF

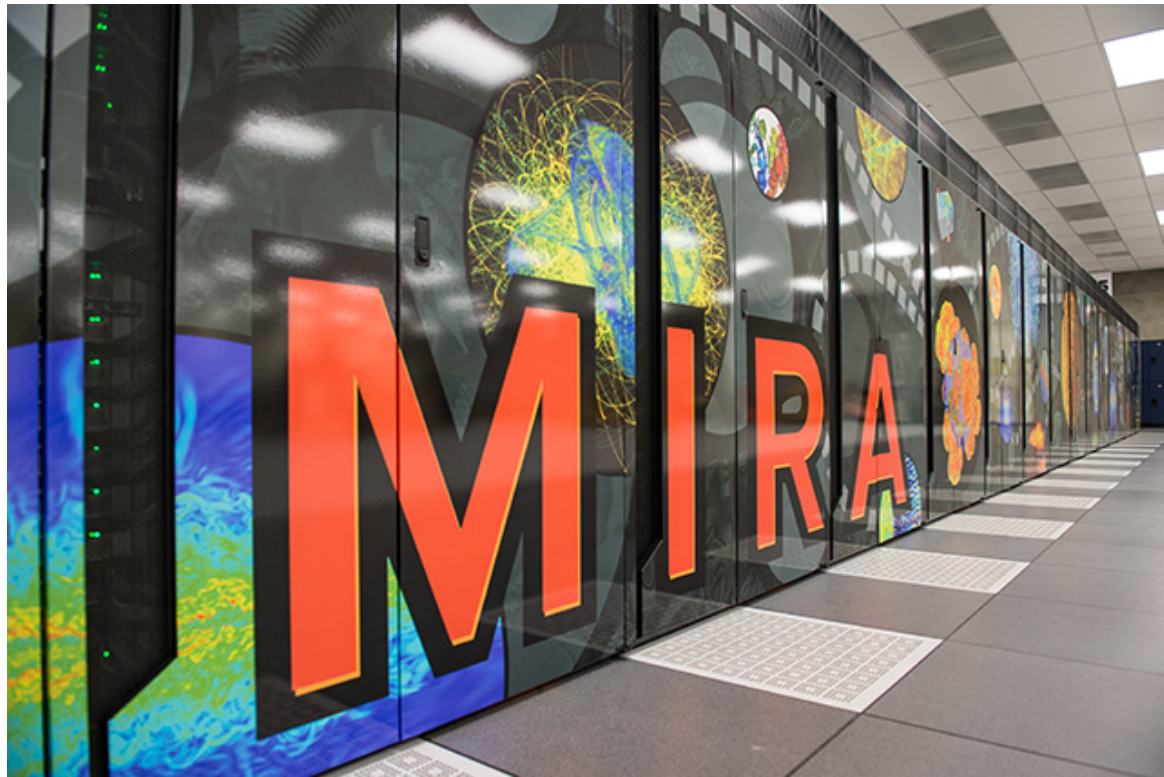
Cetus - *BG/Q system*

- 2,048 nodes / 32,768 cores
- 32 TB of memory
- Peak flop rate: 416 TF

Tukey – *NVIDIA system*

- 100 nodes / 1600 x86 cores
- 200 M2070 GPUs
- 6 TB x86 memory / 1.1TB GPU memory
- Peak flop rate: 220 TF

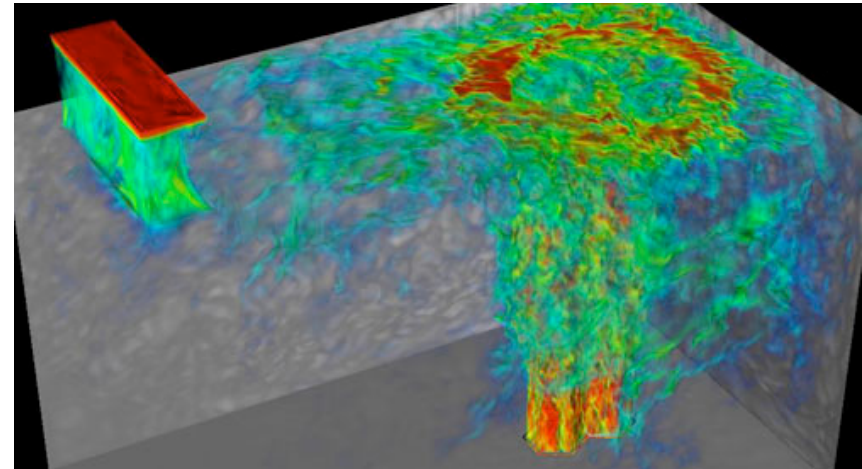
Storage - Scratch: 28.8 PB raw capacity, 240 GB/s bw (GPFS); Home: 1.8 PB raw capacity



MAJOR PROJECTS

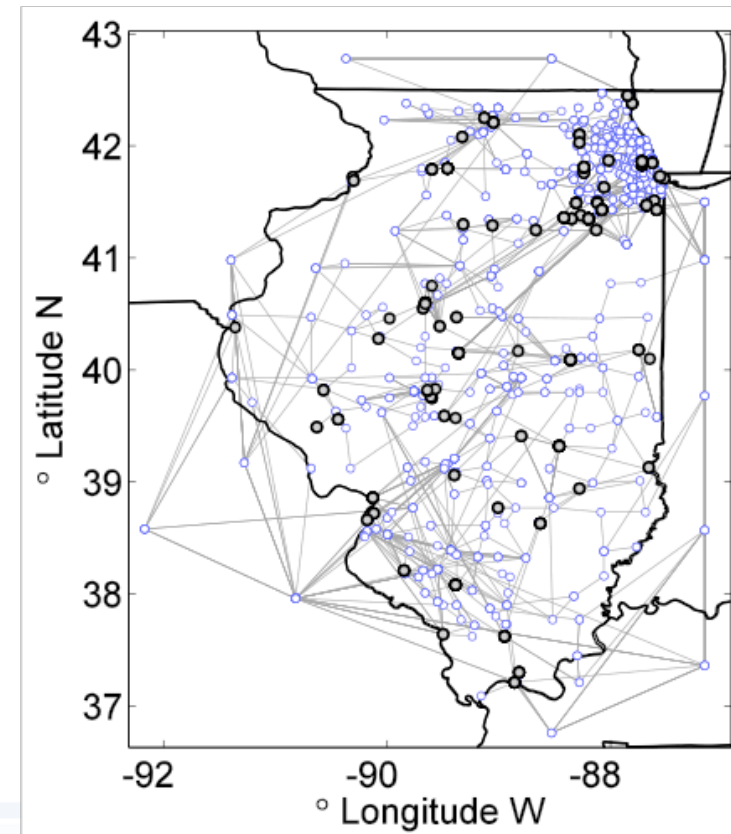
CESAR

- Center for Exascale Simulation of Advanced Reactors
 - Co-design center
 - Thermal Hydraulics (Nek) + Neutron Transport (OpenMC)
 - Miniapps



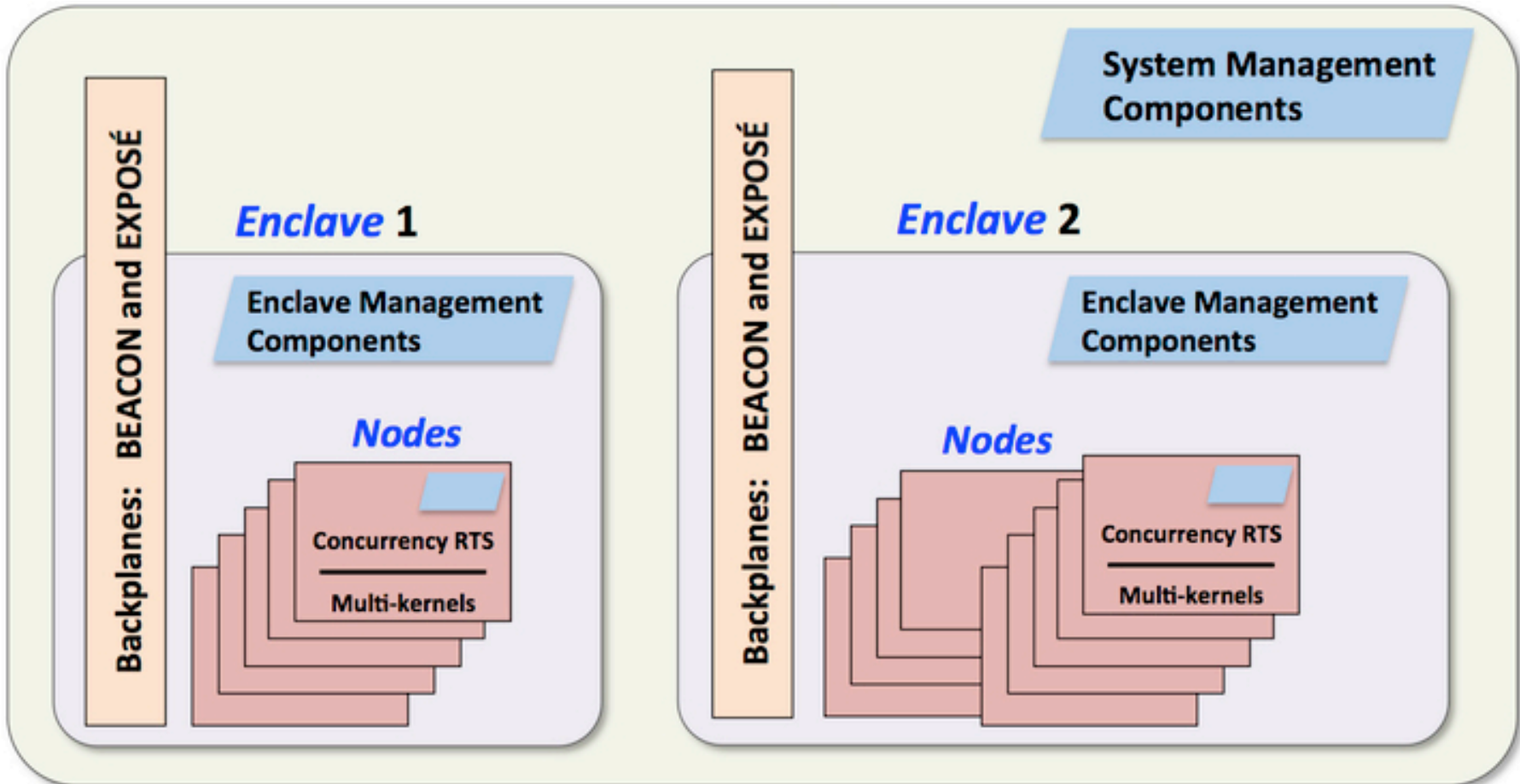
M2ACS

- Multifaceted Mathematics for Complex Energy Systems Project
- Predictive modeling that accounts for uncertainty and errors,
- Mathematics of decisions that allow hierarchical, data-driven and real-time decision making,
- Scalable solution algorithms for optimization and dynamic simulation,
- Integrative frameworks leveraging model reduction and multiscale analysis.



Argo

- Exascale Operating System & Run-time



SDAV

- Scientific Data Management, Analysis, and Visualization Institute

