Introduction to ATPESC

Ray Loy
ATPESC Program Director, ANL
Outline

Welcome

Argonne National Laboratory

ATPESC Overview

Logistics

Tour
**Welcome!**

### ATPESC 2023
47 Institutions

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Together, the 17 DOE laboratories comprise a preeminent federal research system, providing the Nation with strategic scientific and technological capabilities. The laboratories:

- Execute long-term government scientific and technological missions, often with complex security, safety, project management, or other operational challenges;
- Develop unique, often multidisciplinary, scientific capabilities beyond the scope of academic and industrial institutions, to benefit the Nation’s researchers and national strategic priorities; and
- Develop and sustain critical scientific and technical capabilities to which the government requires assured access.
Aerial view of Argonne National Laboratory

- Advanced Photon Source (APS)
- Nuclear Energy Exhibition Hall (NEE)
- Argonne Tandem Linac Accelerator System (ATLAS)
- Northgate
- Argonne Information Center
- ALCF @ Theory and Computing Sciences (TCS) Building
Argonne’s mission: Provide science-based solutions to pressing global challenges

Use-Inspired Science and Engineering …
... Discovery and transformational Science and Engineering

https://www.anl.gov
The origin of Argonne National Laboratory
CP-1 under the bleachers of Stagg field at U. Chicago

Chicago Pile-1 was the world's first artificial nuclear reactor. The first man-made self-sustaining nuclear chain reaction was initiated on December 2, 1942.

See also
Chicago Pile-1: A Brick History
Major Scientific User Facilities at Argonne

Advanced Photon Source

Argonne Tandem Linear Accelerator System

Center for Nanoscale Materials

Argonne Leadership Computing Facility

Electron Microscopy Center
AVIDAC (1949-1953)
Argonne’s Version of the Institute’s Digital Arithmetic Computer

- **AVIDAC**: based on a prototype at the Institute for Advanced Study in Princeton
- **Margaret Butler wrote AVIDAC’s interpretive floating-point arithmetic system**
  - Memory access time: 15 microsec
  - Addition: 10 microsec
  - Multiplication: 1 millisecond
- **AVIDAC press release**: 100,000 times as fast as a trained “Computer” using a desk calculator

“Moll” Flanders, Director
Jeffrey Chu, Chief Engineer

extremecomputingtraining.anl.gov
Early work on computer architecture

Margaret Butler helped assemble the ORACLE computer with ORNL Engineer Rudolph Klein.

In 1953...

ORACLE was the world’s fastest computer, multiplying 12-digit numbers in .0005 seconds (2Kop/s).

Designed at Argonne, it was constructed at Oak Ridge.
ALCF Timeline

2006-2008  Blue Gene/L
2008-2013  Blue Gene/P – Intrepid
2012-2019  Blue Gene/Q – Mira
2017       Theta (KNL)
2022       Polaris
2023       Aurora - Exascale!
Motivation for ATPESC

Founded by Paul Messina in 2013. This year is #11!

- Today’s most powerful supercomputers have complex hardware architectures and software environments
  - and even greater complexity is on the horizon on next-generation and exascale systems

- The scientific and engineering applications developed for these systems are themselves complex

- There is a critical need for specialized, in-depth training for the computational scientists poised to facilitate breakthrough science and engineering using these systems
Curriculum Tracks and their leaders

- **Track 1:** Hardware Architectures – Kalyan Kumaran, Vitali Morozov
- **Track 2:** Programming Models and Languages – Rajeev Thakur, Yanfei Guo, Thomas Applencourt
- **Track 3:** Software Productivity and Sustainability – Anshu Dubey
- **Track 4:** Visualization and Data Analysis – Joseph Insley and Silvio Rizzi
- **Track 5:** Numerical Algorithms and Software for Extreme-Scale Science – Richard Tran Mills
- **Track 6:** Performance Tools and Debuggers – JaeHyuk Kwack
- **Track 7:** Data-intensive Computing and I/O – Rob Latham and Phil Carns
- **Track 8:** Machine Learning and Deep Learning for Science – Bethany Lusch
ATPESC Computing Resources

ALCF – Polaris, Theta, ThetaGPU, Cooley, Sambanova, Cerebras, Graphcore

NERSC – Perlmutter

OLCF – Ascent

AMD Devcloud

ALL TIMES ARE U.S. CENTRAL DAYLIGHT TIME (UTC-5)

SUNDAY, July 30, 2023

1:00PM  Registration opens.
2:00PM  Welcome and Introduction to ATPESC  Ray Loy, ANL
2:30PM  Quick Start on ATPESC Computing Resources  JaeHyuk Kwack, ANL
3:15PM  Break  All
3:45PM  Hands-on  All
4:30PM  Participant Introductions  All
6:30PM  Adjourn/Dinner
ATPESC Slack

alcf-workshops.slack.com
#announce
#atpesc-2023-general for discussion and Q&A during the program

Topic-related channels (#track-1-hardware)
  See #announce channel pinned items for a list
  Or Channels + option to browse

#atpesc-2023-helpdesk
  Assistance with Zoom or ALCF login issues (see next slide for OLCF and NERSC)

Please do not DM if you can avoid it
  You will get help faster via #atpesc-2023-helpdesk
Help!

ALCF accounts (Polaris, Theta, ThetaGPU, Cooley)
   support@alcf.anl.gov (put ATPESC in subject) and slack #help-desk-general

OLCF accounts (Ascent)
   Token issues, call: 865.241.6536 (24x7). Other questions, email: help@olcf.ornl.gov (put ATPESC in subject)

NERSC accounts (Perlmutter)
   accounts@nersc.gov (put ATPESC in subject) or call 1-800-666-3772

ATPESC general support
   support@extremecomputingtraining.anl.gov
   #atpesc-2023-helpdesk
Behind the scenes at ATPESC support
Argonne National Laboratory Tour (Sat 8/5)

• APS – Advanced Photon Source (synchrotron)
• Nuclear Engineering Exhibit
• Data Center (Machine Room) in the Theory and Computing Sciences Building (TCS)
  • Aurora, Polaris, and Theta
• ALCF Visualization Lab
ATPESC Conduct

- Over 70 speakers have taken time out to travel and speak *for your benefit*
  - *Please give them your attention.*
- You are expected to be present when we are in session
  - *You should not be leaving ATPESC to participate in other meetings*
- After dinner, please return to the Amphiteater on time for the Dinner Speaker

*In case of illness or other unexpected problems – please talk to me.*
Acknowledgments

Exascale Computing Project

Website: https://exascaleproject.org

This training and research was supported by the Exascale Computing Project (17-SC-20-SC), a collaborative effort of the U.S. Department of Energy Office of Science and the National Nuclear Security Administration.
If an associate is interested in attending

Subscribe to mailing list [https://extremecomputingtraining.anl.gov](https://extremecomputingtraining.anl.gov) (at top and bottom of page)

Call for applications usually opens in early January

*Read the application instructions carefully*

Statement of Purpose and Letter of Recommendation should address how the candidate meets the prerequisites *in detail*. Lack of detail is the number one reason applications do not rate highly in the review.
Next up: Aurora Exascale System