

# Frontier Tips and Tricks

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- Programming Models
- AI on Frontier
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- Link to Tips from Balint's February talk

# Training Calenar & Archive

- Training Calendar:

- <https://www.olcf.ornl.gov/for-users/training/training-calendar/>
- Includes past events back to Jan 2022

- Training Archive:

- [https://docs.olcf.ornl.gov/training/training\\_archive.html](https://docs.olcf.ornl.gov/training/training_archive.html)
- Previous OLCF Training Events going back to 2017

- ⊕ Contact & Support
- ⊕ Accounts and Projects
- ⊕ Connecting
- ⊕ Systems
- ⊕ Services and Applications
- ⊕ Data Storage and Transfers
- ⊕ Software
- ⊖ Training

[OLCF Training Calendar](#)

[OLCF Tutorials](#)

[OLCF Training Archive](#)

[OLCF GPU Hackathons](#)

[OLCF Vimeo Channel](#)

[New User Quick Start](#)

# Training Calendar

olcf.ornl.gov/for-users/training/training-calendar/

OLCF IN THE NEWS

MIT TECHNOLOGY REVIEW - *THE DOWNLOAD: EXASCALE COMPUTING, AND AI*

CALENDAR

STAFF DIRECTORY

MYOLCF

SEARCH SITE



ABOUT OLCF ▾

OLCF RESOURCES ▾

R&D ACTIVITIES ▾

SCIENCE AT OLCF ▾

FOR USERS ▾

COMMUNITY ▾

## TRAINING CALENDAR

GETTING STARTED

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SYSTEM USER GUIDES

Find upcoming and past training events presented either on-site or via webcast by the OLCF.

TRAINING

### Upcoming Training Events

OLCF POLICY GUIDE

DOCUMENTS & FORMS

CENTER STATUS

MYOLCF

Contact Support

Need assistance from a trained OLCF

01 MARCH  
24

[AMD & HPE PROFILER TUTORIAL](#) ●



[VIEW DETAIL](#)

04 MARCH  
24

[FRONTIER HACKATHON - MARCH 2024](#) ●



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# Training Archive

 LEADERSHIP COMPUTING FACILITY

Need Help? Contact us.  
help@olcf.ornl.gov

Search docs

- >Contact & Support
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- Training
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  - OLCF Tutorials ↗
  - OLCF Training Archive**
  - OLCF GPU Hackathons
  - OLCF Vimeo Channel ↗
  - New User Quick Start
- Quantum
- Scalable Protected Infrastructure (SPI)
- Contributing to these docs

## OLCF Training Archive

The table below lists presentations given at previous OLCF training events. For a list of upcoming training events, please visit the [OLCF Training Calendar](#) ↗

Date	Title	Speaker	Event	Presentation
2024-01-31	First experiences at the exascale with Parthenon	Philipp Grete (Hamburg Observatory)	January 2024 OLCF User Conference Call ↗	(slides ↗   recording ↗)
2023-12-06	Quantum Computing User Program	Michael Sandoval (OLCF)	December 2023 OLCF User Conference Call ↗	(slides ↗   recording ↗   Q&A ↗)
2023-10-16	HIP Training Series: GPU Profiling (Performance Profile: Omniperf)	Ian Bogle (AMD), Cole Ramos (AMD)	HIP Training Series ↗	(slides ↗   recording ↗)
2023-10-12	AI Training Series: AI for Science at Scale - Part 2	Sajal Dash (OLCF)	AI for Science at Scale - Part 2 ↗	(slides ↗   recording ↗)
2023-10-02	HIP Training Series: GPU Profiling (Performance Timelines: Rocprof and Omnitrace)	Suyash Tandon (AMD)	HIP Training Series ↗	(slides ↗   recording ↗)
2023-09-27	In Situ Visualization with Ascent	Cyrus Harrison, Nicole Marsaglia (LLNL)	September 2023 OLCF User Conference Call ↗	(slides ↗   recording ↗)
2023-09-18	HIP Training Series: AMD Memory Hierarchy	Alessandro Fanfarillo (AMD)	HIP Training Series ↗	(slides ↗   recording ↗)
2023-08-28	HIP Training Series: Porting Applications to HIP	Maria del Carmen Ruiz Varela (AMD)	HIP Training Series ↗	(slides ↗   recording ↗)
2023-08-14	HIP Training Series: Intro to GPUs and HIP	Bob Robey (AMD)	HIP Training Series ↗	(slides ↗   recording ↗)
2023-07-27	Coarray Fortran Tutorial	Damian Rouson, Computer Languages and Systems Software Group Lead (LBNL)	Introduction to High-Performance Parallel Distributed Computing using Chapel, UPC++ and Coarray Fortran ↗	(slides ↗   tutorial site ↗)

# Programming Models

- Frameworks/methodologies for software dev that can efficiently utilize HPC resources
  - MPI, OpenMP, and PGAS
  - optimizing performance for complex calculations and data-intensive tasks
- Training Calendar/Archive > Aug/Feb 2023 Frontier Workshops
  - GPU Programming Models (Subil Abraham)
  - HIP, Kokkos, OpenMP Offload
  - [https://www.olcf.ornl.gov/wp-content/uploads/8-24-23-gpu\\_programming\\_models.pdf](https://www.olcf.ornl.gov/wp-content/uploads/8-24-23-gpu_programming_models.pdf)
  - <https://vimeo.com/858462039?share=copy>
- HIP Training series.
  - <https://www.olcf.ornl.gov/hip-training-series/>

# AI on Frontier

- Enablement more efficient processing/analysis of vast datasets
- Optimizing HPC resource allocation
- Accuracy/speed improvement of simulations and predictive models
- Long-Term Goal: tackling complex analysis tasks that were previously unmanageable
- Pytorch on Frontier (Upcoming, April 24<sup>th</sup> 1-2pm, see training calendar)
- Aug 23/Feb 23 Frontier Workshops
  - AI on Frontier (Junqi Yin)
    - Recording: <https://vimeo.com/858471449>
    - Slides: <https://www.olcf.ornl.gov/wp-content/uploads/8-24-23-AlonFrontier.pdf>
- AI for Science at Scale
  - PART 1: <https://www.olcf.ornl.gov/calendar/ai-for-science-at-scale-intro/>
  - PART 2: <https://www.olcf.ornl.gov/calendar/ai-training-series-ai-for-science-at-scale-part-2/>
- SmartSim at OLCF
  - <https://www.olcf.ornl.gov/calendar/smartsim-at-olcf/>

# NVMe's

- NVMe = Non-Volatile Memory express, “Burst Buffer”
  - Better I/O performance for high-I/O demand workloads
- Training Calendar > Aug 23/Feb 23 Frontier Workshops
  - NVMe Usage (Chris Zimmer)
    - Recording: <https://vimeo.com/803630815>
    - Slides: [https://www.olcf.ornl.gov/wp-content/uploads/2-17-23\\_nvme.pdf](https://www.olcf.ornl.gov/wp-content/uploads/2-17-23_nvme.pdf)

# Checkpointing

- Practice of periodically saving the state of an ongoing job and data
- Allows computation to be restarted from the most recent checkpoint in case of a failure
- Minimizes the loss of computational work and effort
- Aug/Feb 2023 Frontier Workshops
  - Checkpointing Tips (Scott Atchley)
    - Recording: <https://vimeo.com/803634715>
    - Slides: <https://www.olcf.ornl.gov/wp-content/uploads/Checkpointing-Tips-Frontier-Training-Workshop-20230217.pdf>
- Mar 2023 User Call: Checkpointing Best Practices for Frontier
  - Recording: <https://vimeo.com/814713985>
  - Slides: <https://www.olcf.ornl.gov/wp-content/uploads/Checkpointing-Tips-OLCF-User-Call-20230329.pdf>

# Profiling

- Analyzing performance bottlenecks within applications and systems
  - Measuring the execution time of application components
  - Mapping resource utilization
  - Finding where optimizations can boost efficiency and speed
- Goal: maximizing the performance of HPC applications
- MyOLCF Office Hours Aug/Feb 23 Frontier Workshop
  - Application Profiling (Trey White, HPE)
    - Recording: <https://vimeo.com/840552061>
    - Slides: [https://www.olcf.ornl.gov/wp-content/uploads/2-17-22\\_application\\_profiling.pdf](https://www.olcf.ornl.gov/wp-content/uploads/2-17-22_application_profiling.pdf)
  - GPU Profiling (Asitav Mishra)
    - Recording: <https://vimeo.com/858481088>
    - Slides: <https://www.olcf.ornl.gov/wp-content/uploads/8-25-23-Introduction-to-omniperf-with-roofline-AMishra-OLCF.pdf>
- HIP Training series
  - <https://www.olcf.ornl.gov/hip-training-series/>

# Debugging

- Identifying + resolving errors/bottlenecks
- Challenges: synchronization issues, memory access errors, I/O lag, etc.
- Specialized tools and techniques to ensure efficient and correct execution of applications at scale
- Aug/Feb 2023 Frontier Workshops
  - GPU Debugging (Mark Stock, HPE)
    - Recording: <https://vimeo.com/840552596>
    - Slides: [https://www.olcf.ornl.gov/wp-content/uploads/2-17-23\\_GPU\\_Debugging\\_distribute-2.pdf](https://www.olcf.ornl.gov/wp-content/uploads/2-17-23_GPU_Debugging_distribute-2.pdf)

# Balint Joo's Feb 2023 Workshop Tips & Tricks Talk

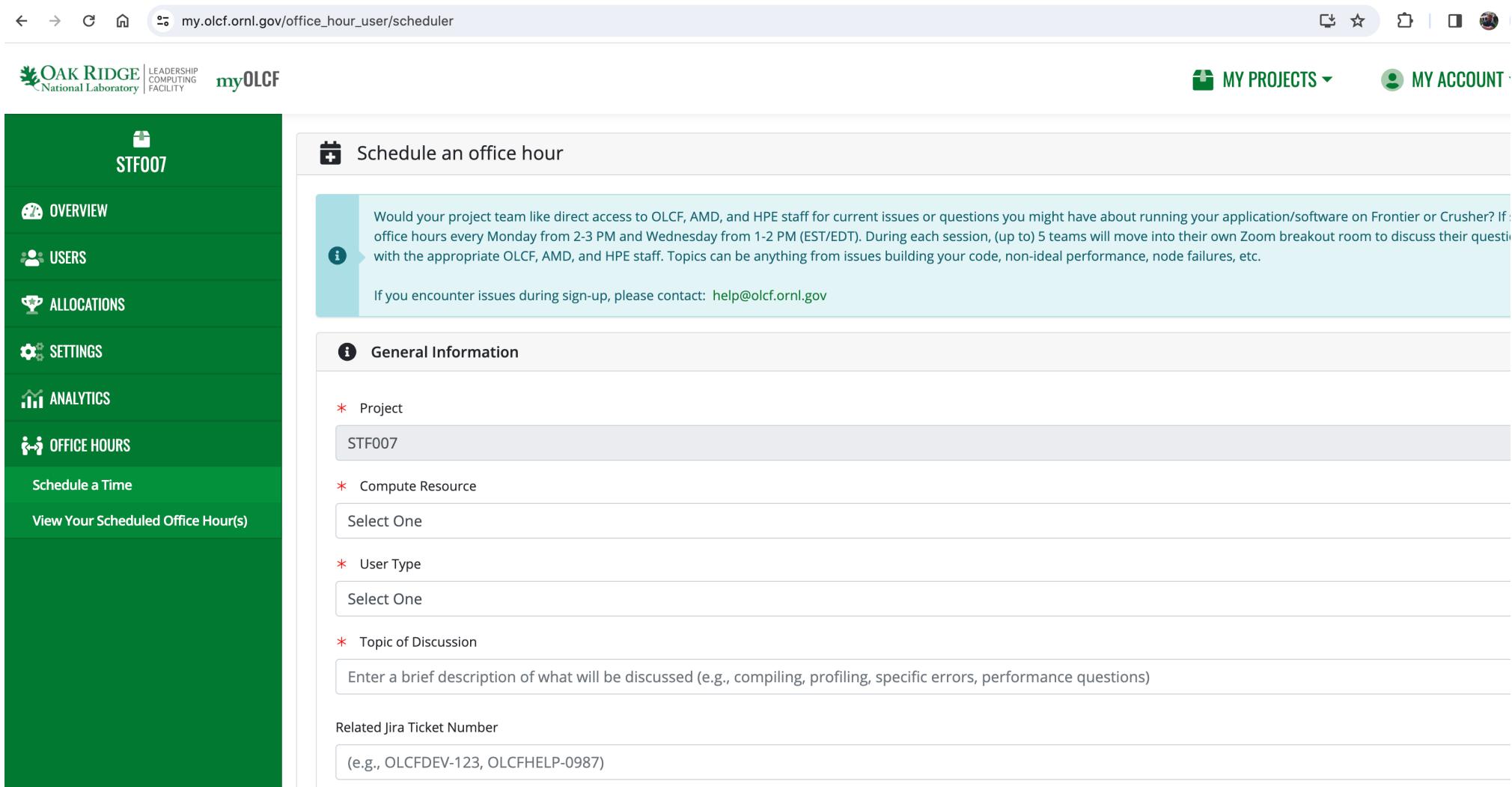
- Recording: <https://vimeo.com/803633277>
- Slides: <https://www.olcf.ornl.gov/wp-content/uploads/Joo-FrontierTipsAndTricks.pdf>
- Contents:
  - ROCm Building Tips
  - Interactive/Testing
  - SLURM Process binding and NIC Binding
  - Using the NVMEs
  - CMakeTips
  - Debugging
  - Profiling

# Getting Help

- Submit a ticket to [help@olcf.ornl.gov](mailto:help@olcf.ornl.gov)
- Consult the documentation at:
  - [https://docs.olcf.ornl.gov/systems/frontier\\_user\\_guide.html](https://docs.olcf.ornl.gov/systems/frontier_user_guide.html)
  - [https://docs.olcf.ornl.gov/systems/crusher\\_quick\\_start\\_guide.html](https://docs.olcf.ornl.gov/systems/crusher_quick_start_guide.html)
- Consider attending an “Office Hour”
  - Mondays 2-3pm ET & Wednesdays at 1-2pm ET
  - Sign up at <https://www.my.olcf.ornl.gov/>
    - Login to your Moderate account at [myOLCF](#)
    - Expand the OFFICE HOURS dropdown (on the sidebar navigation)
    - There are 2 options to select: **Schedule a Time** and **View Your Scheduled Office Hour(s)**

# Getting Help

## Office Hours



The screenshot shows a web interface for scheduling office hours. The top navigation bar includes the URL [my.olcf.ornl.gov/office\\_hour\\_user/scheduler](https://my.olcf.ornl.gov/office_hour_user/scheduler) and various browser controls. The header features the Oak Ridge National Laboratory logo and the text "LEADERSHIP COMPUTING FACILITY" and "myOLCF". On the right, there are links for "MY PROJECTS" and "MY ACCOUNT".

The main content area is titled "Schedule an office hour" and is associated with project "STF007". A sidebar on the left lists project management options: OVERVIEW, USERS, ALLOCATIONS, SETTINGS, ANALYTICS, OFFICE HOURS, Schedule a Time, and View Your Scheduled Office Hour(s). The "Schedule a Time" option is currently selected.

The "Schedule an office hour" form contains the following fields:

- General Information**
  - Project:** STF007
  - Compute Resource:** Select One
  - User Type:** Select One
  - Topic of Discussion:** Enter a brief description of what will be discussed (e.g., compiling, profiling, specific errors, performance questions)
- Related Jira Ticket Number:** (e.g., OLCFDEV-123, OLCFHELP-0987)

A note in the form states: "Would your project team like direct access to OLCF, AMD, and HPE staff for current issues or questions you might have about running your application/software on Frontier or Crusher? If so, we are scheduling office hours every Monday from 2-3 PM and Wednesday from 1-2 PM (EST/EDT). During each session, (up to) 5 teams will move into their own Zoom breakout room to discuss their questions with the appropriate OLCF, AMD, and HPE staff. Topics can be anything from issues building your code, non-ideal performance, node failures, etc." It also provides a contact email: [help@olcf.ornl.gov](mailto:help@olcf.ornl.gov).

# Ticket Tips

- The most helpful tickets
  - Clearly state the problem, the key modules/env vars
  - Have a small reproducer (either attached or identified in the text)
  - detail any other investigation you may have undertaken before you got stuck
- Less helpful tickets:
  - “Please help! My code stopped working.”
- The least helpful ticket:
  - “”

# Thanks!

- Questions?