

Engagement with the User Community

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BCS subMIT Review

May 22, 2025





Outline



Annual SubMIT Workshop



Users Group Meetings



Classroom Usage



User-Run Workshops using SubMIT



Customizations / User Requests



Current Limitations & Open Challenges

Annual SubMIT Workshop

Project Team Contributions



subMIT

Getting physics things done at MIT

Workshop on Basic Computing Services in the Physics Department - subMIT

📅 Thursday Jan 30, 2025, 9:00 AM → 5:00 PM America/New_York

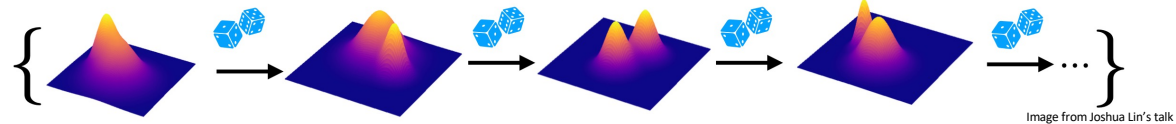
📍 26-414 (Kolker room)

Project Team Information / Tutorial Sessions

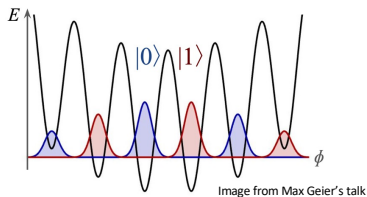
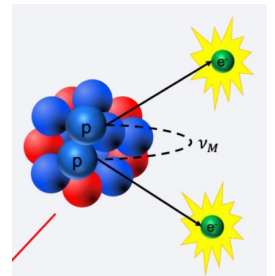
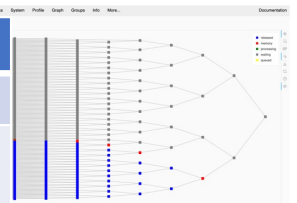
- System Overview
- Resources & How to Access Them
- Software Management
 - Environment / Package managers (Conda)
 - Containers (Docker/Podman, Singularity/Apptainer)
- Batch Jobs

2 NEW Tutorials Highly-Requested by Users

Annual Workshop: User-Contributed Talks



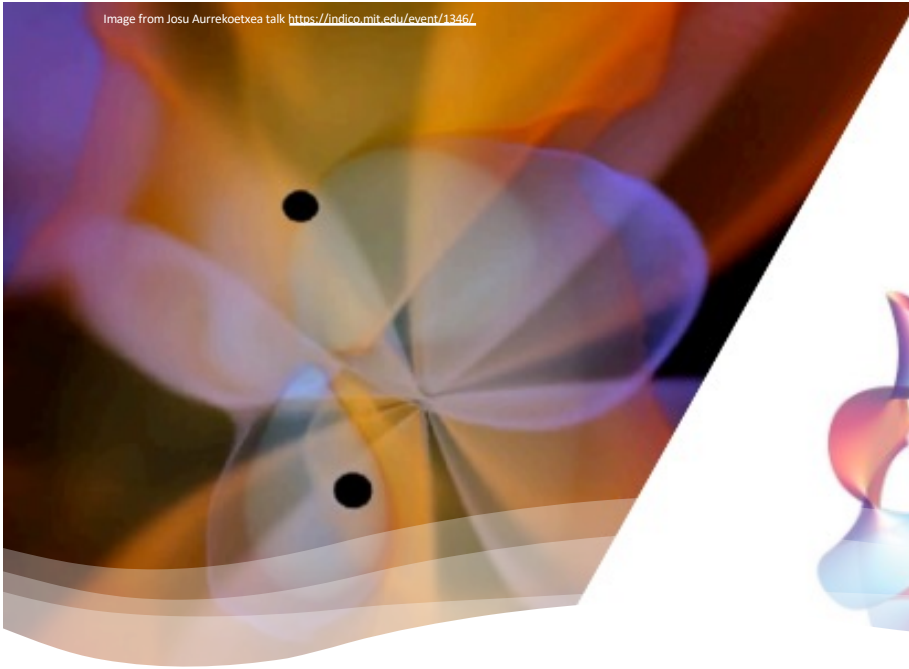
Title	Speaker (User)	User Position	
Emulating the atomic nucleus	Antoine Belley	Postdoc	LNS, IAIFI
Symbolic Learning Nuclear Relations	Jose Miguel Munoz Arias	Graduate student	LNS, IAIFI
The needle in a haystack problem of homology-directed DNA repair	Henrik Pinholt	Graduate student	Physics of Living Systems
Lattice-QCD 🤝 Software 🤝 Hardware	Joshua Lin	Graduate student	CTP
Soft unclustered energy patterns in CMS using dask	Pietro Lugato	Graduate student	LNS
Topological Chiral Superconductors beyond Fermi liquid pairing	Luke Kim	Graduate student	CMT
A qubit that corrects itself	Max Geier	Postdoc	CMT
subMIT for cosmological uses	Mikhail Ivanov	Professor / Faculty	CTP
Assessing a new analysis with batch jobs	Sumita Ghosh	Postdoc	LNS



Despite success of last year's user-given tutorials, no users volunteered to present tutorials this year. Although some user talks did heavily highlight tools.

Images from user talks; see details at <https://indico.mit.edu/event/1276/>

Image from Josu Aurrekoetxea talk <https://indico.mit.edu/event/1346/>



Users Group Meetings

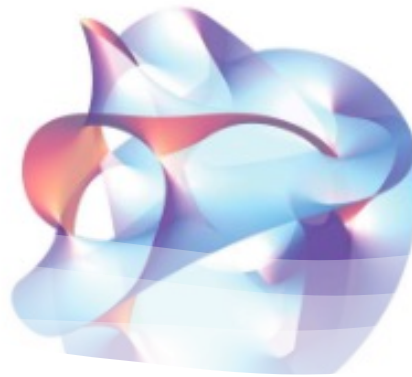
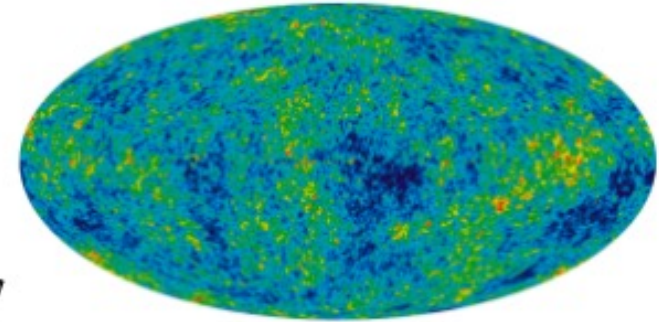


Image from Richard Nally talk <https://indico.mit.edu/event/1347/>



Good active exchange
of feedback/advice
between project team
and user participants
(in both directions)

Also synergistic
discussion between
users at meetings

Project Team
contributed additional
informational session

Efforts underway to
increase attendance /
engagement at these

User-Contributed Talks at User Group Meetings

	Title	Speaker (User)	Speaker Position	
July, 2024	Analysis of HERA data with subMIT	Frank Taylor	Professor / Faculty	LNS
October, 2024	W Boson Mass Analysis on subMIT	Josh Bendavid	Research Scientist / Staff	LNS
November, 2024	What I'd like to use submit for	Mortiz Günther	Research Scientist / Staff	MKI
February, 2025	Solving Einstein's Equations on the computer	Josu Aurrekoetxea	Postdoc	CTP
March, 2025	Computing Calabi-Yau Manifolds	Richard Nally	Postdoc	CTP
April, 2025	Modeling gravitational waves using highly distributed parallel computing	Scott Hughes	Professor / Faculty	MKI
June, 2025	Simulating heavy quarks in quark gluon plasma	Jean Du Plessis	Graduate student	CTP

Example Workflows & Tools Presented / Discussed by Users



Markov Chain Monte Carlo



Machine Learning



User-written code / scripts



Singularity Containers (reproducible, portable environments)



Dask (automatic parallelization)



MPI (calculation steps ~ 1 s each, 10^6 steps)



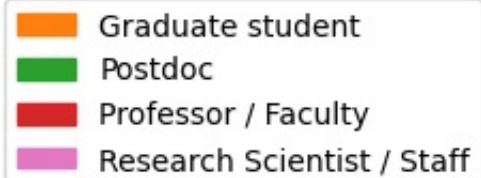
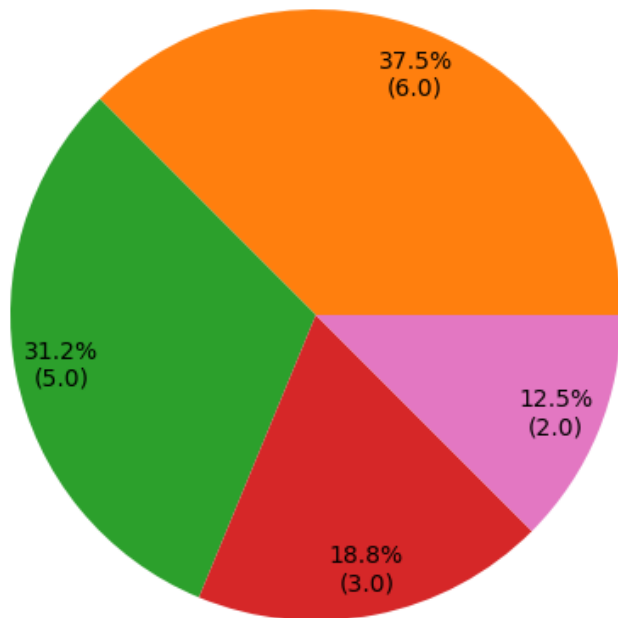
Slurm batch jobs / job arrays



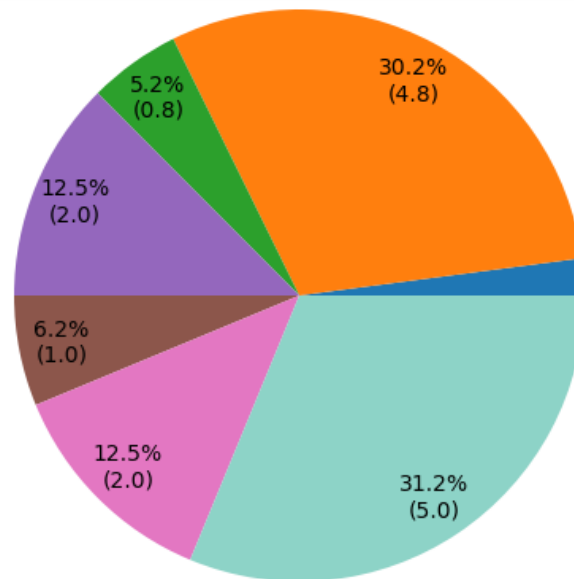
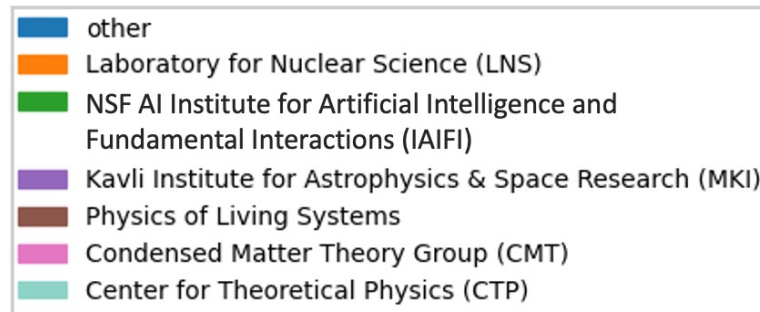
Homogenous, simultaneous tasks vs Heterogeneous, few queued (asynchronous) tasks

Which Users Gave Talks at SubMIT Events?

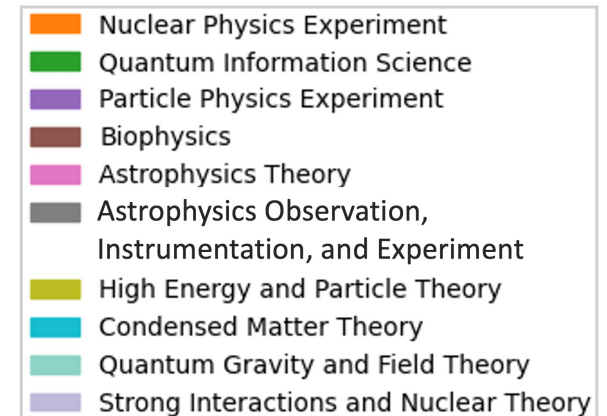
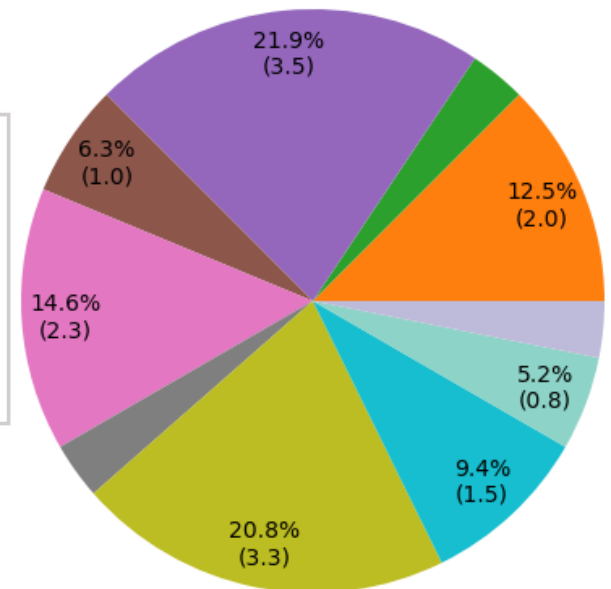
Speaker's Title



Speaker's Lab/Center



Speaker's Research Area



Classroom Usage



***Known* usage this year**

- 8.01 A2rchi usage
- ESG 8.022 (Jupyter notebook; periodic small reservations)
- 8.13/8.14 Jr Lab
- 8.006 (optional alternative to local development environment)



Lighter known classroom usage than last year

- Introductory Physics 8.02 did not use Jupyter Notebooks (consequently nor SubMIT) this academic year
- Less load on the system
- No large reservations

User Workshops

FCC Workshop January 2025

Research in Experimental Particle Physics in January

Jan 6, 2025, 9:00 AM → Jan 31, 2025, 9:35 PM America/New_York

24-506 (MIT, Building 24)

Description During January we give students (undergraduates and graduate students alike) the opportunity to learn about the Future Circular Collider project [1] at CERN and perform a small research project that can be adjusted to the skill level of the individual.

FRIDAY, JANUARY 31

2:00 PM → 5:00 PM Mini Conference: Presentations

24-506

2:00 PM Introduction and setup

IntroSlides.pdf

5m

FCC Tutorial April 2025



Gaia Hackathon

Astrophysics Hackathon

January 27-30, 2025.

All Welcome. Please register [HERE](#)

[Astrophysics Hackathon](#) Tutorials



Run by Prof. Lina Necib (MKI)
Audience: Undergraduates
Requested shared disk space
for datasets (~few TB)
<https://gaiadr3hack.mit.edu>



[ABOUT](#) [PPC](#) [NEWS](#) [PROJECTS](#) [Q](#)

From CERN to MIT for the FCC Workshop

JAN EYERMANS / JANUARY 26, 2025 / EVENTS, FCC, FUTURE, NEWS

Every January, I head from Geneva (CERN) to Boston for a couple of weeks to work with students on Future Circular Collider (FCC) Physics analysis projects at MIT. It's something I look forward to every year, and this time was no different. Alongside my colleagues Luca and Anja, we put together a program to help the students dive into their first physics analyses using Monte Carlo generated for the FCC.

We kicked things off with tutorials, covering the basics of Monte Carlo simulations, data handling, and the steps involved in a physics analysis. Plotting and understanding the invariant mass of the dimuon spectrum is always a must! After this quick intro, each student got their own project to work on, and we guided them through the process—whether it was understanding the physics behind their project or tackling technical challenges. After some time they gained the necessary skills and knowledge to explore their project on their own.

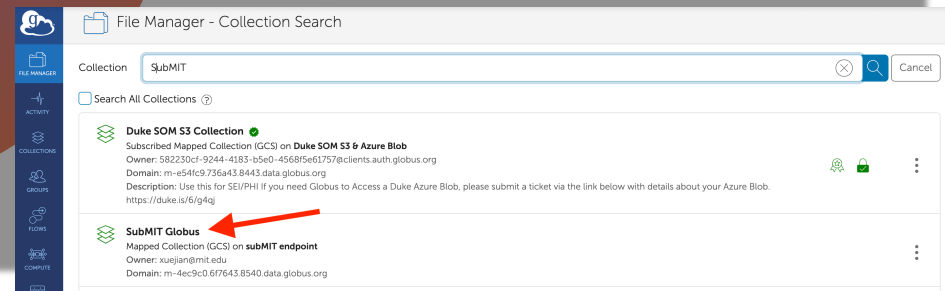
Customizations & User Requests

○

Image from <https://www.open-mpi.org/doc/5/11/2025>



- Central MPI installed upon user request
 - module system used to manage environment
 - uses RoCE (RDMA over Converged Ethernet) for faster communication



- Globus Endpoint established on SubMIT
 - Requested by many users
 - Easy fault-tolerant data transfers
 - User connection/interaction not required during transfer
 - Web Interface
- Priority Access for Purchasing Groups
 - Balance availability & sharing
 - Investigated several general policies
 - Choice: Currently done manually (case-by-case basis) to optimally adapt to changing usage patterns
 - E.g. LHCb required priority access to submit81, so it was temporarily removed from SLURM queue
 - Direct ssh (non-SLURM) access to purchased machines blocked for non-group members

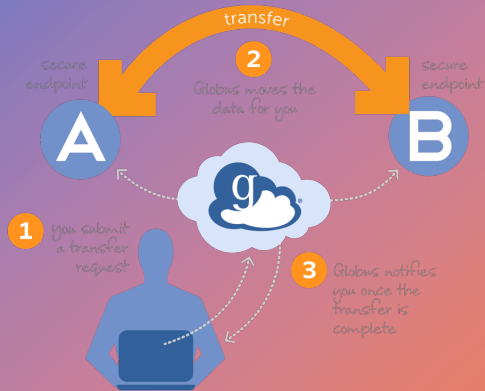


Image from <https://www.globus.org/data-transfer> 5/11/2025

Current Limitations & Open Challenges

Pilot Customizations

(require additional development before deploying to entire user base)

- Dropbox-like syncing of files (other tasks prioritized over scaling this to all users)

Was unable to accommodate

- Request to accommodate Windows software.
 - SubMIT servers run AlmaLinux 9. Workarounds to support Windows on AlmaLinux (i.e. virtual machines) are too resource-intensive for the shared SubMIT resources.
 - Windows system admin would require significant additional time & specialized Windows expertise (e.g. security, etc.), so SubMIT does not support Microsoft Windows
 - Most likely most efficient for user to run on their own workstation
 - Asked user to let us know if this is not a sufficient option

Open Challenges

- Balancing restrictions vs ensuring availability of resources (for purchasing or non-purchasing users)
- Turnaround Time / Availability vs Throughput
- Working to increase attendance of User Meetings
 - Some users thought these meetings were only for User Group Representatives
 - Some potential new users overlook announcements since they are not (yet) subMIT users
 - Great discussions between participants; would be great to expand this more
- User Group Representatives
 - Slow to find volunteers to be active representatives