

MaLAPA 2025

Discussion Sessions

How to participate, and what to expect

April 8-11, 2025 @ CERN

Informal Feedback from previous MaLAPAs

- We want more discussion time!
- We want to build more community to stay connected!
- We want avenues for collaboration!
- We want to share and build resources/references together!

Plan for MaLAPA 2025

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LINK TO GOOGLE FORM "MALAPA 2025: DISCUSSION ITEMS COLLECTION"

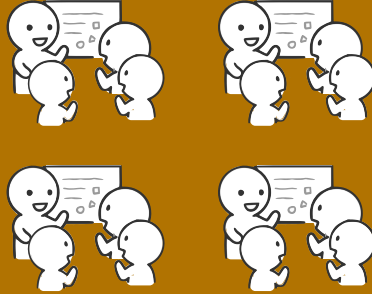
<https://forms.gle/qpyPV2WjQr73TvdV8>



You submit topics, ideas, questions, comments

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MALAPA 2025 DISCUSSIONS!



Responses guide four MaLAPA25 discussions

3

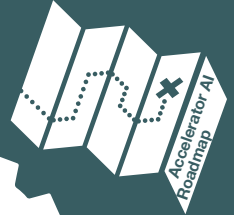


Discussion leads extract desired outcomes

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MALAPA COMMUNITY RESOURCES



We work together to achieve our desired outcomes

Discussion Session Topics 2025

MaLAPA Community Resources

- Scope: Shared resources and collaborations on open-source software packages for ML implementation.
- Possible outcomes: A set of shared community resources, software packages & more for sharing knowledge, limiting work duplication.

MLOps

- Scope: Data and model pipelines in operation
- Possible outcomes: Shared solutions

Framework for Digital Twins

- Scope: Frameworks and algorithms that combine measurements and simulations, to drive decisions in accelerator operation
- Possible outcomes: Identify challenges and avenues for collaborations across labs

AI for Accelerators Roadmapping

- Scope: AI will transform how we design, build, and operate particle accelerators.
- Possible outcomes: How to get from R&D to AI-at-scale as fast as possible

MaLAPA Community Resources

Gathering community resources for ML in accelerator physics aims to create a structured and accessible foundation that enhances innovation, reproducibility, and the practical deployment of ML solutions in accelerator science.

Scope:

- Creating educational resources and documentation to guide researchers (both inside and outside the MaLAPA community) in adopting ML techniques.
- Developing open-source ML frameworks that the MaLAPA community contributes to.
- Curating and sharing high-quality datasets relevant to accelerator operations.
- Establishing benchmarks and evaluation metrics for ML techniques in accelerator applications.

Prompts/ Example Submissions

- *How can we best foster/leverage community engagement and development for common needs (e.g. software infrastructure for deployment, in-depth deployment practicalities that are often not addressed in the academic literature)?*
- *What community resources are already available?*
- *What tools do we already have that might be worth sharing more widely with the community?*
- *How can shared community resources help us do our work and accelerate deployment into operations?*
- *What do you need that the community might be able to provide?*
- *How could community resources be managed (especially considering sustainability and longevity)?*

MLOps

To integrate ML into the operational workflows of particle accelerators with a focus on both hardware and software aspect to address real-time decision support, data driven control and optimization. This includes development of infrastructure that supports seamless deployment, monitoring, and maintenance of ML models.

Scope:

- Data pipeline and infrastructure as relevant to data movement, storage, tagging and retrieval
- ML model deployment for real time inference, monitoring and model up-keep
- Code pipelines, integration of mlflow, gitlab etc for seamless updates to code and models
- Scalability with regards to data from number of sensors fed to ML system

Prompts/ Example Submissions

- *What are the current ML integration challenges including both software and hardware for real-time decision support?*
- *What are the data challenges relevant to global ML deployment (on data from multiple sensors)?*
- *How to enable efficient maintenance of ML models and adapt with drifting data?*
- *How to efficiently allow human in the loop pipelines for fast paced decision support?*

Framework for Digital Twins

Developing a framework that can tightly **integrate knowledge gained from measurements and simulations** and can be leveraged to **improve accelerator operation**

Scope:

- Different ways to combine knowledge from measurements and simulation
- Aspects for which digital twins can enhance accelerator operation
- Algorithms for digital twins
- Open-source software packages that can be leveraged
- Challenges in overcoming mismatch between simulations and measurements

Prompts/ Example Submissions

- *What is the definition of a digital twin in the context of accelerators? Are there examples of them being used concretely in operation?*
- *How to overcome accelerator drifts, when matching simulations to experiments?*
- *What are the different ways to communicate data between the machine and the digital twins? What are the tradeoffs?*
- *What are the key software pieces of a digital twin? Are there open-source solutions for these different pieces.*

AI for Accelerators Roadmapping

Designing, building, and operating the next generation particle accelerators and, in particular, colliders will require new approaches due to the unprecedented scale and complexity while remaining affordable, and becoming sustainable. AI will be an enabler in all of these aspects.

What is our vision of AI for particle accelerators?

Which building blocks do we need?

What needs to be prepared within the community and when to be ready with design choices of AI building blocks for decision making on the next projects?

Prompts/ Example Submissions

- *Overall control system challenges and requirements for AI-ready accelerators?*
- *How to include robotics?*
- *What should the place of LLMs be?*
- *How can we best foster/leverage community engagement and development for common needs (e.g. software infrastructure for deployment, in-depth deployment practicalities that are often not addressed in the academic literature)?*
- *How can we ensure efforts for real-world deployment are recognized / encouraged especially for junior scientists/engineers (academic literature can skew toward simpler conceptual demos vs. real world deployment)*

SHARE YOUR IDEAS AND
COMMENTS AT THE GOOGLE
FORMS SURVEY!

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ITEMS COLLECTION"



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