



Cornell University

Jefferson Lab



AI4EIC Accelerators Working Group & EIC-BeamAI Meeting

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Agenda

- Summary of the 6th Workshop on Machine Learning Applications for Particle Accelerators
- Summary of International Particle Accelerator Conference activities
- Overview of the Multi-Office Accelerator Team (MOAT) collaboration activities
- Overview of the NP AI Ready Accelerator Data (NARAD) project
- Overview of the EIC-BeamAI collaboration

Quick Overview

The particle accelerator community meets a few times every year to present and discuss work being done in AI/ML efforts.

Major workshops and conferences include;

- Machine Learning for Particle Accelerators Applications Workshop
- Reinforcement Learning for Accelerator Applications Workshop
- International Particle Accelerator Conference
- North American Particle Accelerator Conference
- International Conference on Accelerator and Large Experimental Physics Control Systems
- And more....

6th Workshop on Machine Learning Applications for Particle Accelerators

Hosted by RIKEN SPring-8 Center, in Himeji-city, Hyogo, Japan

April 21-24, 2026

Topics included,

- Surrogate modelling/digital twins
- Optimization and Control
- MLOps, Infrastructure, and Scalability
- Anomaly Detection and Diagnostics
- LLMs/AI assistants
- Others (AI for facility design, AI data analysis, etc.)

With Tutorials on Agentic AI and Machine state embedding with LLMs

Major efforts

Multi-Office Accelerator Team (MOAT), led by Berkeley Lab

- focus on Agentic Workflow (Osprey), Particle Accelerator Language Standard (PALS), and Genesis Mission Coordination

Nuclear Physics AI Ready Accelerator Data (NARAD), led by Jefferson Lab

- Using PALS and Knowledge graphs to present data to AI systems

SciBMad, led by Cornell University

- Differentiable nonlinear dynamics simulation, analysis, and optimization

EIC-BeamAI, led by Cornell University and BNL

- Experimentally developing algorithms for AI based control of Accelerators

ARTificial Intelligence For Accelerators, user Communities and associated Technologies (ARTIFACT), EU project

Himeji Workshop Info

86 registered participants, 100+ abstracts, 30+ talks, 60+ posters

SOC Chair: Masako Iwasaki (Osaka Metropolitan Univ.)

LOC Chair: Hirokazu Maesaka (RIKEN SPring-8 Center)

Goal

- To bring together the worldwide community of researchers applying machine learning techniques to particle accelerators.
- To share state-of-the-art machine learning techniques.
- To discuss current challenges and future directions in machine learning application to particle accelerators.
- To encourage collaborative activities in machine learning R&D.

Presentations of note

Genesis Mission discussion – great interest given timing of WS

Workforce Development discussion – long discussion with great participation from younger attendees

- What does an "AI-ready accelerator physicist" look like in the next several years?
- Are we training accelerator physicists who use ML/AI or genuinely hybrid professionals?
- School Pipeline (CAS/JUAS/USPAS/ISBA)
- Got perspectives from Japan, Europe, and US
- Covered Retention/Competition, International collaboration, and what the future workforce might look like

Sampling of talks

- Intelligent scientific facility operations via active learning algorithms: AI/ML developments at SLAC MeV-UED
- End-to-End Emittance Optimization at EuXFEL: Differentiable-Model-Based Laser Pulse Shaping
- AI for Particle Accelerators: French and European Efforts
- The EIC-BeamAI Collaboration: Preparing Machine Learning for the Electron- Ion Collider
- Optimization and stabilization of Fermilab Booster using hybrid Bayesian/RL framework
- Reproducible MLOps Workflow for Online Deployment of ML Models in Accelerator Control Systems
- AI-Ready Semantic Infrastructure for CEBAF: From CED to PALS Knowledge Graphs
- Continual Learning for Production-Level Machine Learning in Particle Accelerators
- Real-time autonomous 6D phase-space tomography for LCLS-II injector monitoring
- Safety and security of ML/AI for accelerators
- The US DOE Multi-Office particle Accelerator Team (MOAT) project
- Plus many talks and posters on DTs, Virtual Diagnostics, Prognostics, Parameter estimation, etc.

Interesting trends

Since the first workshop, topics have changed from algorithms to frameworks

7. 2027 LBNL @ Berkeley, USA us TBD, 2027

6. 2026 SPring8 @ Himeji, Japan JP April 21-24, 2026

5. 2025 CERN @ Geneva, Switzerland CH April 8–11, 2025

first mention of LLMs, more AI for elogs and text processing, integration to ops

4. 2024 PAL @ Gyeongju, Korea KR March 5–8, 2024

first mention of transformers, model adaption, continual learning, MLOps, AI-Ready data

3. 2022 BNL @ Chicago, USA us November 1–4, 2022

break from WS's due to covid. Start to see shift to data, UQ, Diff. Models, AI for elogs, DT's, and virtual diagnostics

2. 2019 PSI @ Villigen, Switzerland CH February 26 - March 1, 2019

similar to 2018 topics, more experience, focus on optimization

1. 2018 SLAC @ Palo Alto, USA us February 27 - March 2, 2018

facility needs, neural networks, BO, RL, supervised/unsupervised