

# 4<sup>th</sup> AI4EIC Workshop

Hosted by MIT/IAIFI

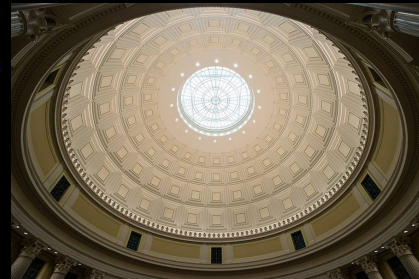


<https://eic.ai/>



C. Fanelli, T. Horn on behalf of AI4EIC

AI4EIC-2025 (4<sup>th</sup> workshop)



# Thanks to Organizing Committees (AI4EIC-2025)

## Local Organizing Committee (MIT):

- Ethan Cline
- Gian Michele Innocenti
- Marisa LaFleur
- Mike Williams
- Noah Wuerfel
- Or Hen
- Phiala Shanahan
- Thomas Bradford

MIT  
NSF AI Institute for Artificial Intelligence and  
Fundamental Interactions (IAIFI)



Special thanks to Marisa!!  
Local point of contact: [mlafleur@mit.edu](mailto:mlafleur@mit.edu)

# Thanks to Organizing Committees (AI4EIC-2025)

## Scientific Organizing Committee:

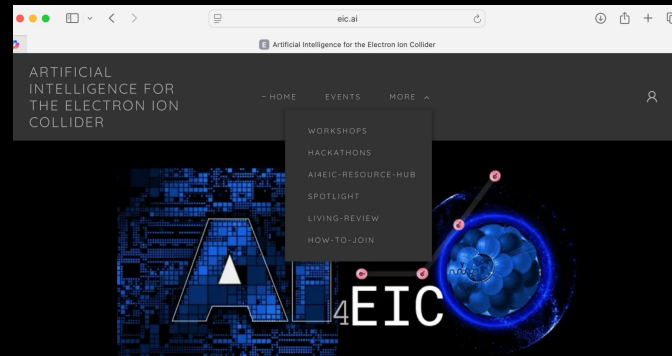
- Abhay Deshpande, BNL/SBU
- Ben Nachman, Stanford
- Cris Fanelli, W&M
- David Lawrence, JLAB
- Malachi Schram, JLAB
- Marco Battaglieri, INFN
- Mike Williams, MIT
- Or Hen, MIT
- Phiala Shanahan, MIT
- Tanja Horn, CUA
- Torre Wenaus, BNL

AI4EIC Contact: [ai4eic@gmail.com](mailto:ai4eic@gmail.com)  
[support@eic.ai](mailto:support@eic.ai)

Email [support@eic.ai](mailto:support@eic.ai) to subscribe to mailing list  
Check-out ai4eic Slack channel on [eic.ai](https://eic.ai)

# Resources

- AI4EIC-2025 Workshop Indico
  - <http://indico.bnl.gov/event/AI4EIC2025>
- AI4EIC Website
  - <https://eic.ai>
- We are aiming to share recordings of as many of the talks as possible. Please use this link or this QR code to fill out the consent form: <http://bit.ly/4hz6u5w>



# Format: 2 sessions/day for 3 Days (Oct 27-29)

## AI/ML for Accelerators

- Brahim Mustapha (Argonne National Lab)
- Kevin Brown (Brookhaven National Lab)

Day 1

## Calibration, Monitoring, and Experimental Control in Streaming Environments

- Torri Jeske (Jefferson Lab)
- Yeonju Go (Brookhaven National Lab)

Day 2

## AI/ML for ePIC and Beyond

- Anselm Vossen (Duke University)
- Rachel Montgomery (U. of Glasgow)
- Wenliang (Bill) Li (Mississippi State University)

## AI/ML for Data Analysis and Theory

- Brandon Kriesten (Argonne National Laboratory)
- Simonetta Liuti (University of Virginia)

Day 3

## Trends in Data Science

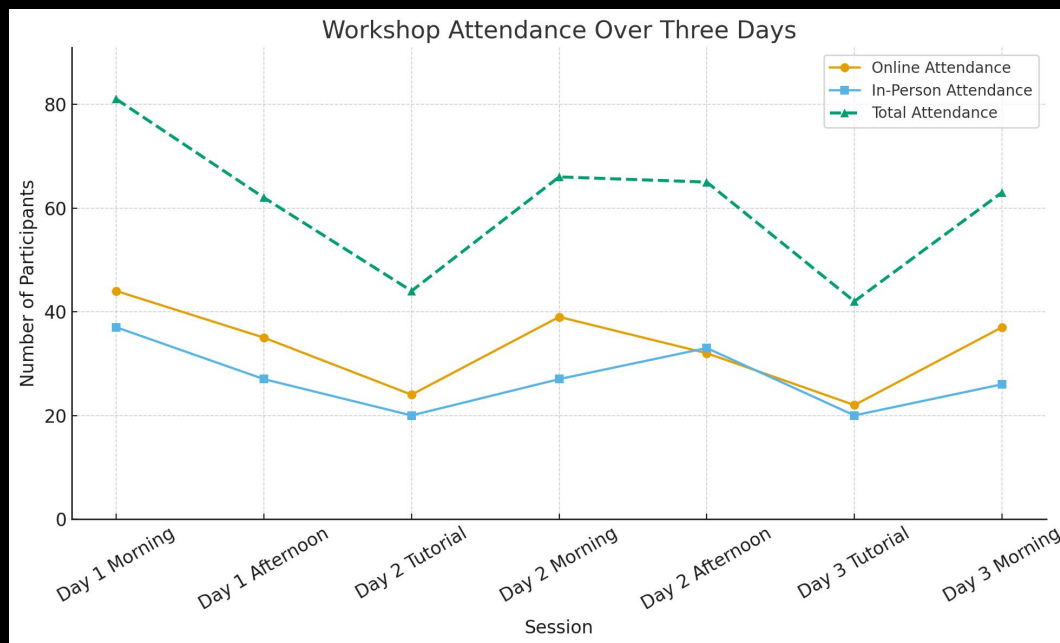
- Philip Harris (Massachusetts Institute of Technology)
- Yaohang Li (Old Dominion University)

## AI/ML in Production, Distributed ML

- Kishan Rajput (Jefferson Lab)
- Ray Ren (Brookhaven National Lab)

# Contributions

- 58 contributions + 2 tutorials, great talks! Thanks a lot to all the speakers!
- 160 registered participants. Average total attendance of 60+, with 30+ in person in the first 2 days



# Contributions

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- 58 contributions + 2 tutorials, great talks! Thanks a lot to all the speakers!
- 160 registered participants. Average attendance of 30+, with 30+ in person in the first 2 days and in the morning session
- Thanks also to the local and scientific advisory committee to make this workshop possible.
- Thanks to the Conveners for their great work in organizing the sessions and managing to handle unexpected changes in the program. Many talks presented novel methodologies and were extremely engaging.
- Reminder to the Convener: please complete your summary notes in the [Live Notes Document](#)

# Some Key-Points

- **AI opportunities at the new EIC:** from accelerator applications to emerging capabilities enabled by large language models.
- **Open data and benchmarks:** a shared need for accessible datasets and standardized evaluation frameworks.
- **Uncertainty Quantification in AI/ML:** a recurring theme across multiple sessions emphasizing its central role.
- **Vibrant research ecosystem at the nexus between AI and EIC:** DOE and NSF support a wide range of projects presented at AI4EIC involving universities, national labs, and industry.
- **Broad technical landscape:** AI serves as the common foundation connecting diverse research areas. Cross-community synergies: strong potential for collaboration with HEP, data science, and related fields.

**DE-FOA-0002875** (deadline: Jan 11, 2023; award ceiling \$2M/year)  
Artificial Intelligence and Machine Learning For Autonomous Optimization and Control of Accelerators and Detectors

NP held a one-day roundtable on “Machine Learning and Artificial Intelligence for NP Accelerator Facilities” on January 30, 2020, with focus on discussing opportunities in AI/ML for improving efficiencies of accelerator operations of NP facilities. Additional information on the workshop and copies of presentations can be found at: <https://science.osti.gov/np/Research/ai>. An NP community workshop at TJNAF in March of 2020 considered priority research opportunities in AI/ML. Also, an NP community computational science workshop in September 2022 was held to identify future directions in computational nuclear physics by a combination of high-performance computing combined with AI/ML and experimental data. And in October of 2022, an AI for EIC workshop was held to address how AI might contribute to advance research, design and operation of the future EIC. More information on these workshops and meetings can be found in the Reference section below.

**DE-FOA-0003845** (deadline: Jan 14, 2025; lab award ceiling \$3.5M/year)  
Artificial Intelligence and Machine Learning Applied to Nuclear Science and Technology

2022 identified future directions in computational nuclear physics by a combination of high-performance computing combined with AI/ML and experimental data. And in October 2022 and October 2023, AI for EIC workshops were held to address how AI might contribute to advance research, design and operation of the future EIC. More information on these workshops and meetings can be found in the Reference section below.

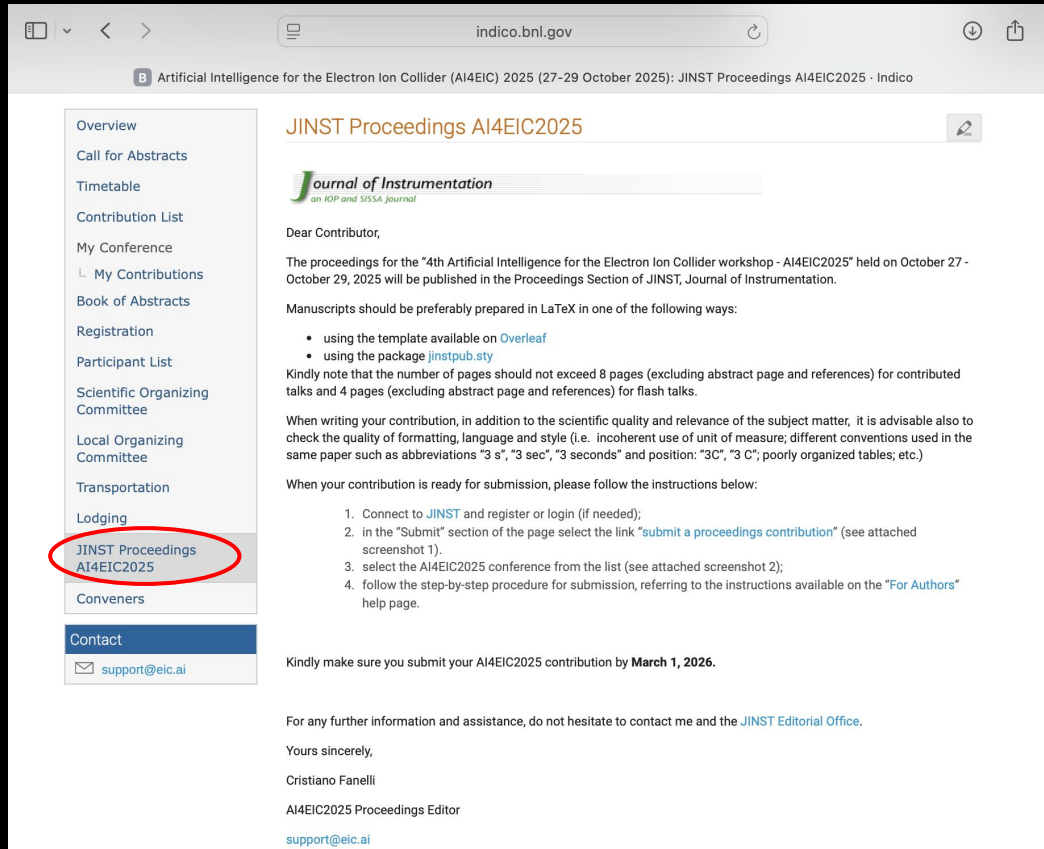
# Proceedings

<http://indico.bnl.gov/event/AI4EIC2025>

All contributions can result in a proceeding on JINST.

Note that the number of pages should not exceed 8 pages (excluding abstract page and references) for contributed talks and 4 pages (excluding abstract page and references) for flash talks.

More information will be sent to the speakers in the next few days



indico.bnl.gov

B Artificial Intelligence for the Electron Ion Collider (AI4EIC) 2025 (27-29 October 2025): JINST Proceedings AI4EIC2025 · Indico

Overview  
Call for Abstracts  
Timetable  
Contribution List  
My Conference  
My Contributions  
Book of Abstracts  
Registration  
Participant List  
Scientific Organizing Committee  
Local Organizing Committee  
Transportation  
Lodging  
**JINST Proceedings AI4EIC2025**  
Conveners  
Contact  
support@eic.ai

## JINST Proceedings AI4EIC2025

*Journal of Instrumentation*  
an IOP and SISSA journal

Dear Contributor,

The proceedings for the "4th Artificial Intelligence for the Electron Ion Collider workshop - AI4EIC2025" held on October 27 - October 29, 2025 will be published in the Proceedings Section of JINST, Journal of Instrumentation.

Manuscripts should be preferably prepared in LaTeX in one of the following ways:

- using the template available on [Overleaf](#)
- using the package [jinstpub.sty](#)

Kindly note that the number of pages should not exceed 8 pages (excluding abstract page and references) for contributed talks and 4 pages (excluding abstract page and references) for flash talks.

When writing your contribution, in addition to the scientific quality and relevance of the subject matter, it is advisable also to check the quality of formatting, language and style (i.e. incoherent use of unit of measure; different conventions used in the same paper such as abbreviations "3 s", "3 sec", "3 seconds" and position: "3C", "3 C"; poorly organized tables; etc.)

When your contribution is ready for submission, please follow the instructions below:

1. Connect to [JINST](#) and register or login (if needed);
2. In the "Submit" section of the page select the link "[submit a proceedings contribution](#)" (see attached screenshot 1).
3. select the AI4EIC2025 conference from the list (see attached screenshot 2);
4. follow the step-by-step procedure for submission, referring to the instructions available on the "[For Authors](#)" help page.

Kindly make sure you submit your AI4EIC2025 contribution by **March 1, 2026**.

For any further information and assistance, do not hesitate to contact me and the [JINST Editorial Office](#).

Yours sincerely,

Cristiano Fanelli  
AI4EIC2025 Proceedings Editor  
[support@eic.ai](mailto:support@eic.ai)

# Activities @ AI4EIC

<https://rag4eic.ds.wm.edu/>

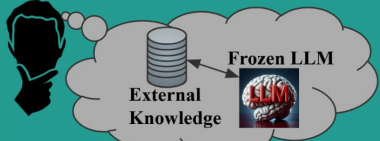

Checkout RAG4EIC project



<https://rag4eic.ds.wm.edu/>

Contact [support@eic.ai](mailto:support@eic.ai) if you want to contribute

See also [tutorials](#) given during AI4EIC-2025 by Karthik Suresh

The screenshot shows a web browser at the URL `rag4eic.ds.wm.edu`. The page title is "AI4EIC-RAG QA-ChatBot v-1.0.0". On the left is a sidebar with the following links: "AI4EIC-RAG4EIC", "RAG-ChatBot", "Generate Single Source Claims", "Login or Signup", and "View History". The main content area is titled "What is RAG and how it can be used for EIC ?" and contains four informational cards:

- What is RAG ?**
  - Retrieval Augmented Generation (RAG).
  - Access up to date information without explicitly training of LLM.
  - Reduce "Hallucination" of LLM.
  - Grounding LLM to truth to increase reliability by providing citations.
- Why need RAG for Large Scale Physics Experiments?**
  - Electron Ion Collider (EIC) is a large scale experiment.
  - Regular updates to documents, Run Wiki
  - Newbies may take 6 months to get to know the full experimental details.
  - Document size  $\propto$  Scale of experiment

1400 physicists, 240 institutions and 38 countries
- Ingestion**
  - Creation of the vectorized knowledge base.
  - Every node below influence RAG performance
  - 200 recent arxiv papers on EIC (since 2021)
- The inference\***
  - Given a prompt compute similarity index to most similar vectors in VectorDB
  - Use LLM to further narrow down and summarize the finding

# Other Events @ AI4EIC

- Contact [support@eic.ai](mailto:support@eic.ai) to subscribe to the AI4EIC mailing list
  - AI4EIC organizes workshops, tutorial, topical meetings, hackathons, etc.
  - Additionally, we are currently supporting the activities of two sub-working groups: 'AI for agents at EIC' and 'AI/ML for accelerators'
  - We are looking to form new sub-working groups - please reach out for ideas, initiatives

<https://eic.ai/events>

<https://eic.ai/ai4eic-resource-hub>

ARTIFICIAL INTELLIGENCE FOR THE ELECTRON ION COLLIDER		
HOME   EVENTS   WORKSHOPS   HACKATHONS   MORE +		
CALENDAR OF EVENTS		
Oct/27-30/2025	<b>4th AI4EIC Workshop - October 27-30, 2025</b> 4th General Workshop on Artificial Intelligence for the Electron Ion Collider <a href="https://indico.bnl.gov/event/AI4EIC2025">https://indico.bnl.gov/event/AI4EIC2025</a> Venue: Massachusetts IN... + Event Details	in presence + virtual
Jul/30/2025	<b>AI4EIC Topical Meeting - July 30, 2025</b> AI4EIC Meeting on RAG-based Summarization for EIC AI Working Group topical meeting on "RAG-based summarization for the Electron Ion Collider..." + Event Details	in presence + virtual
Jul/16/2025	<b>Joint eIC/ATLAS Meeting</b>	

AI4EIC RESOURCE HUB	
<b>Project Repositories</b> Below is provided a list to the AI4EIC Organization where Repositories can be found	
<a href="https://github.com/ai4eic">https://github.com/ai4eic</a>	AI4EIC.GITHUB
Ongoing projects:	
<ul style="list-style-type: none"><li>• AI4EIC RAG-Summarization <a href="https://github.com/ai4eic/EIC-RAG-Project">https://github.com/ai4eic/EIC-RAG-Project</a></li><li>• AI4EIC hackathons infrastructure <a href="https://github.com/ai4eic/AI4EICHackathon2023-Streamlit">https://github.com/ai4eic/AI4EICHackathon2023-Streamlit</a></li></ul>	
<b>Lectures/Tutorials</b> Below are provided links to lectures, tutorials on AI/ML applications useful for the EIC detector	
<a href="#">Deep Learning Tutorials for Experimental Nuclear Physics</a>	DEEP

# AI4EIC Workshops

<https://eic.ai/workshops>

Past Editions

- 5 workshops organized or co-organized by the AI4EIC WG. In the last 12 months we contributed to organize the joint session with the Streaming Readout at the Streaming Readout Workshop SRO-XII held in Tokyo Dec 2024, and we are currently organizing the 4th AI4EIC workshop that will be held at MIT supported by the Institute for Artificial Intelligence and Fundamental Interactions (IAIFI)

### Streaming Readout Workshop SRO-XII +AI4EIC (2024)

Dec 2–4, 2024  
University of Tokyo  
Asia/Tokyo timezone

Enter your search term

Overview

Timetable

Contribution List

Registration

Participant List

Final announcement

Organization Committee

Zoom connection

Code of Conduct

Travel information

Accommodation

Lunch

Social Event

SRO XI

SRO X

AI4EIC 2023

This meeting brings together DAQ specialist and experimentalist from all over the world, to discuss the learning experience from existing streaming DAQ system and collaborate on future Streaming DAQ system at many facilities and experiments and in particular the EIC.

This SRO XII edition will be held in Tokyo, Japan, from 12/2 to 12/4. The University of Tokyo will host the workshop.

At this time, we will have a joint session between SRO and AI4EIC to discuss the development and implementation of AI/ML based technologies in the streaming readout and DAQ.

The topics to be discussed in this workshop are:

- streaming DAQ and experiences at many facilities
- real-time calibration and data processing in SRO and heterogeneous computing
- application of AI/ML technologies
- ASICs, FPGAs, Data Aggregation, new challenges for SRO
- establishment of work plans for the future SRO system

We will provide zoom connection to allow the remote participation. However, we encourage in-person participation to have deep discussion.

The in-person registration is closed now.

Remote participation is welcome and please proceed with registration form if you attend remotely.

### MIT/IAIFI (2025)

Artificial Intelligence for the Electron Ion Collider (AI4EIC) 2025

Oct 27–29, 2025  
Aachen/New York timezone

Enter your search term

#### Artificial Intelligence for the Electron Ion Collider (2025)

Overview

Call for Abstracts

Registration

Participant List

Scientific Organizing Committee

Local Organizing Committee

Transportation

Lodging

JINST Proceedings AI4EIC2025

Conveners

The 4th AI4EIC Workshop will take place at MIT, Wong Auditorium (Tang Center), in Boston. Organized in collaboration with the AI Institute for Artificial Intelligence and Fundamental Interactions (IAIFI), the event will feature in-person participation, with live streaming available for remote attendees.

The previous three AI4EIC workshops each drew an average of 200 participants and fostered meaningful discussions on the full range of AI/ML applications for the EIC—including accelerator and detector design, theory, and analysis—resulting in published proceedings and a community paper (<https://eic.ai>).

Proceedings will be published in the **Journal of Instrumentation**. The abstract submission (1 page max, figures can be included) is now open.

In this MIT workshop, we will delve deeper into the active and emerging applications of AI/ML within the EIC community, with a focus on ongoing efforts related to the ePIC experiment and beyond.

Scientific Organizing Committee

40 contributions overall, with 1:4 on AI/ML in SRO.

### CFNS (2021)

Workshop: AI4EIC-EIC: Experimental Applications of Artificial Intelligence for the Electron Ion Collider

Dec 1–6, 2021  
Brookhaven/US Eastern Standard Time

### W&M (2022)

2nd workshop on Artificial Intelligence for the Electron Ion Collider

Nov 28–30, 2022  
MIT & MIT/Harvard & Harvard/Harvard Eastern, Asia & MIT/Harvard

### CUA (2023)

AI4EIC 2023 Annual Workshop

November 20, 2023 to December 1, 2023  
CERN/University of Geneva, Western Europe

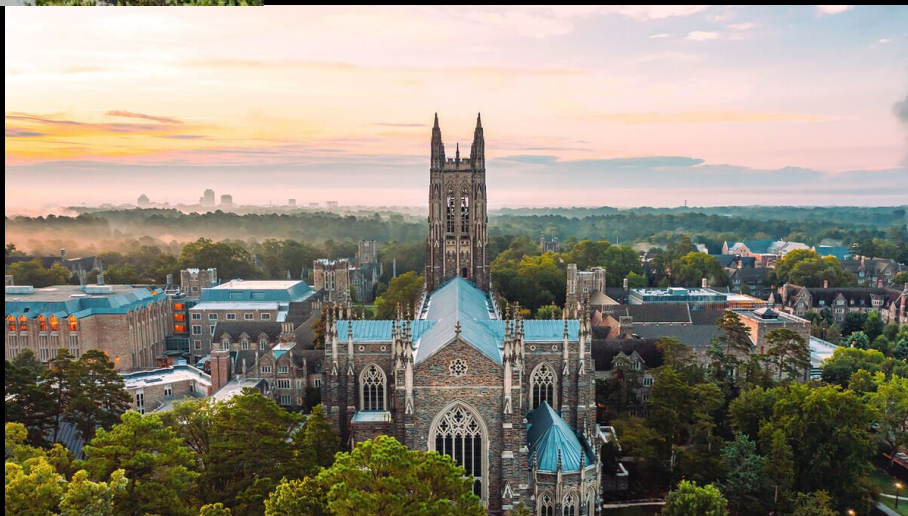
All contributions to AI4EIC-2025 can be published as proceedings on JINST

# Looking Ahead

- Announcement: AI4EIC-2026 workshop will take place at Duke University!



Durham, North Carolina, US



# Looking Ahead

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- There is still interest in organizing the next AI4EIC events in Europe.
- Reach out if your institution is interested to host in the following years.
- EIC's unique position: likely the only new collider in the U.S. for decades, making it a focal point for innovation.
- Progress since the last workshop: many of the ideas discussed have evolved into DOE-funded projects on AI/ML for the EIC and nuclear physics at large.
- Current stage: we are now reviewing ongoing efforts, identifying shared challenges, complementarities, and opportunities for synergy across projects.
- AI4EIC remains the key forum to connect these initiatives and strengthen collaboration across the community.

# See You at AI4EIC-2026!

<https://eic.ai>



[support@eic.ai](mailto:support@eic.ai)

- To subscribe to mailing list
- For reaching out to regarding AI4EIC events

