NP Artificial Intelligence Principal Investigators Exchange Meeting

November 19-20, 2025

Manouchehr Farkhondeh,
Program Manager, Advanced Technology R&D,
Nuclear Physics Program

U.S. DEPARTMENT of ENERGY | Office of Science

Energy.gov/science

Outline:

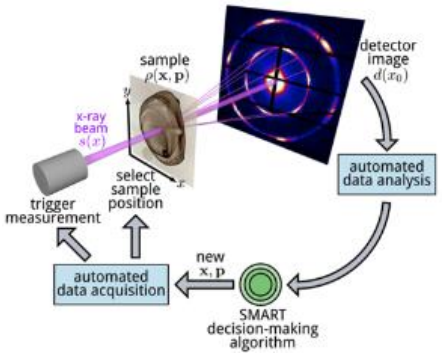
- Overview of DOE-SC and NP AI/ML initiative
- FY2023 Data, AI and ML FOA and Lab call
- FY2025 Data, AI and ML NOFO and Lab call
- Office of Science American Science Cloud initiative -AmSC
- NP Data Provider Program (DaPP)
- NP AI/ML opportunities in FY2026
- Communications and Presentation Guidelines
- Acknowledgements of Federal Support for your award
- This meeting and agenda

Overview of AI/ML initiative

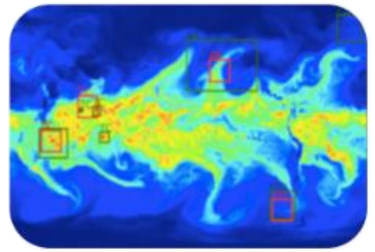
- DOE and the Office of Science (SC) recognize the power that AI will have to accelerate progress in scientific research and missions. AI is one of the current initiatives for SC with focused efforts and fundings.
- Nuclear Physics (NP) – NP has been supporting applications of artificial neural networks in the analysis of nuclear physics data for decades.
- NP has published biennial NP only funding opportunity in FY2021, FY23 and FY25 for FY25-26 funding.
- SC American Science Cloud (AmSC) – ASCR office Lab calls, August 2025
- NP Data Provider Program (DaPP) Laboratory invitations, August 2025
- NP AI/ML opportunities for FY26:

AI in the Office of Science (FY 2020-25)

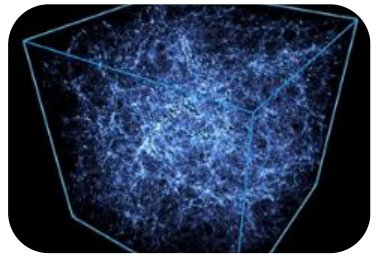
- AI for User Facilities and Advanced Technology
  - Optimize design of experiments and operations
  - Enable real-time analysis and integrated workflows
  - Predict and mitigate instrument and facility down time
  - Increase particle beam availability to users through optimization of beam tuning and risk reduction in accelerator machine protection
  - Create Self-driving instruments and experiments
- AI for Science
  - Accelerate scientific discovery through federated learning to gather broader insight via shared datasets
  - Develop surrogate models for expensive or time constrained experiments
  - Make sense of multi-modal, noisy data
  - Reduce time for complex scientific instrument calibration
- AI Tools
  - Incorporate uncertainty quantification and domain-knowledge
  - Increase robustness, interpretability and repeatability
  - Develop new storage and archival tools to make data FAIR (Findable, Accessible, Interoperable, and Reusable)
  - Develop privacy-preserving algorithms for use of AI in edge devices and to support biopreparedness research efforts
- The current focus is on strategic, large-scale, collective AI efforts for data preparation and cloud integration (American Science Cloud - AmSC).



Autonomous experiments



Deep learning for extreme weather events



Analyze relationship between 10 billion galaxies in LSST

Outline

- Overview of DOE-SC and NP AI/ML initiative
- FY2023 Data, AI and ML FOA and Lab call
- FY2025 Data, AI and ML NOFO and Lab call
- Office of Science American Science Cloud Initiative -AmSC
- NP Data Provider Program (DaPP)
- NP AI opportunities in FY2026
- Communications and Presentation Guidelines
- Acknowledgements of Federal Support for your award
- This meeting and agenda

NP AI/ML FY2023 DE-FOA-0002875 Statistics

Applications and Awards

Total of 15 independent awards

Subject of today's meeting

Institutions	# of Applications	# of Awards	Fraction (#)	Requests (K$)	Award (K$)	Fraction (%)
Laboratories	22	8	36%	-	9,600	
Universities	16	7	44%	-	6,400	
Totals	**38**	**15**	**39%**	**47,200**	**16,000**	**34**

Application/Award Types

Type of Proposal	Submitted	Awarded	Fraction (%)
Collaborative	16	7	44
Single PI	22	8	36
Totals	**38**	**15**	39.4

Application/Award Topics (note the diverse areas)

Proposal Topic	Submitted	Awarded	Fraction (%)
Accelerator	11	4	36
Detectors	8	4	50
Experiments + EIC	15	5	33
Theory	4	2	50
Totals	**38**	**15**	39.4

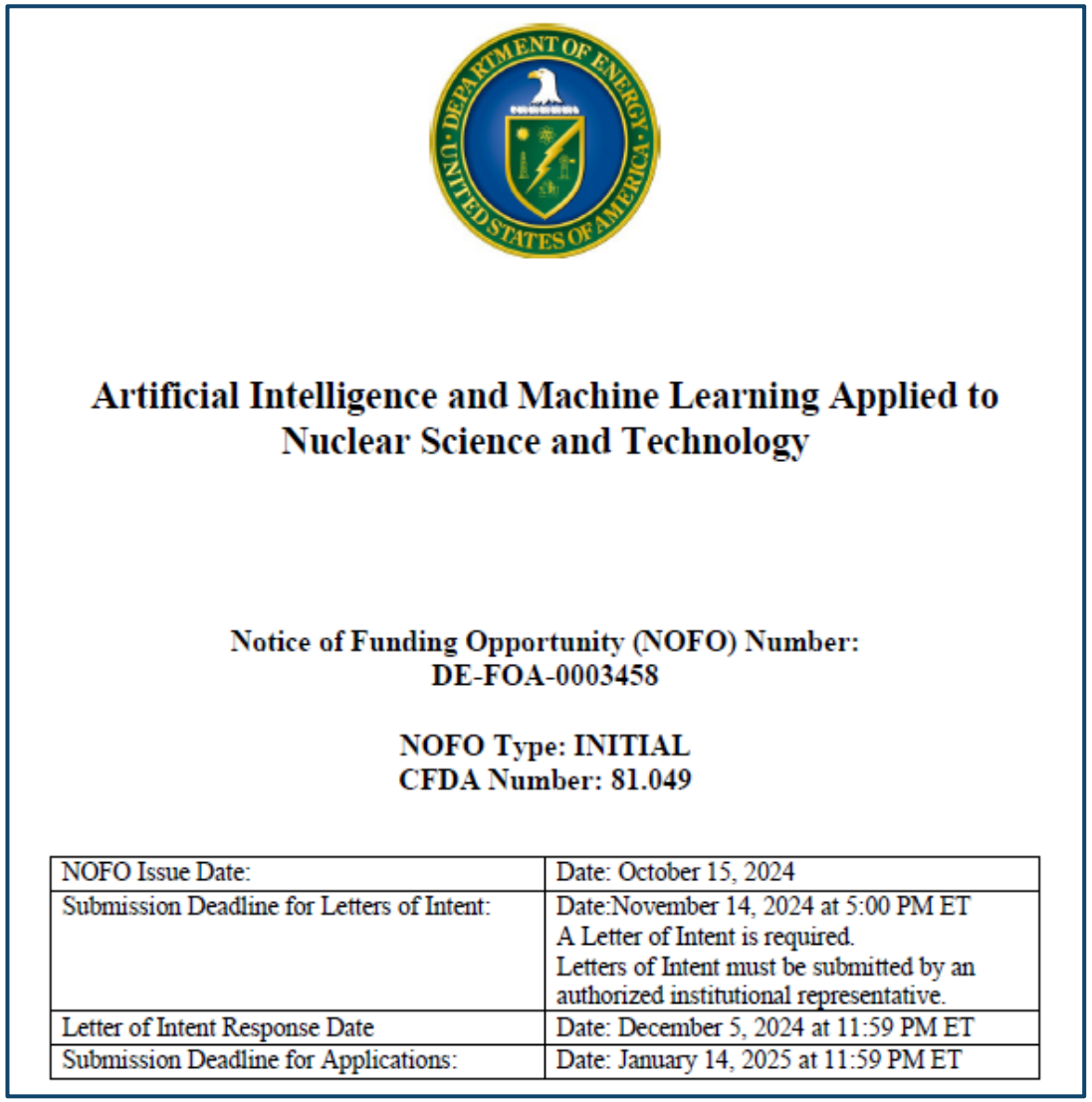
Outline

- Overview of DOE-SC and NP AI/ML initiative
- FY2023 Data, AI and ML FOA and Lab call
- FY2025 Data, AI and ML NOFO and Lab call
- Office of Science American Science Cloud Initiative -AmSC
- NP Data Provider Program (DaPP)
- NP AI opportunities in FY2026
- Communications and Presentation Guidelines
- Acknowledgements of Federal Support for your award
- This meeting and agenda

FY2025 NP AI/ML NOFO DE-FOA-0003458

- FOA: DE-FOA-0003458
- Issue Date: Oct 15, 2024
- LOI due: Nov 14, 2024
- LOI Response due: Dec 5, 2024
- Proposals due: Jan 14, 2025

- This announcement builds on NP's efforts to address technical challenges in theory, simulations, control, data acquisition, and data analysis. AI methods and techniques promise to address these challenges and shorten the timeline for experimental and computational discovery.



Artificial Intelligence and Machine Learning Applied to Nuclear Science and Technology

Notice of Funding Opportunity (NOFO) Number:
DE-FOA-0003458

NOFO Type: INITIAL
CFDA Number: 81.049

NOFO Issue Date:	Date: October 15, 2024
Submission Deadline for Letters of Intent:	Date:November 14, 2024 at 5:00 PM ET A Letter of Intent is required. Letters of Intent must be submitted by an authorized institutional representative.
Letter of Intent Response Date	Date: December 5, 2024 at 11:59 PM ET
Submission Deadline for Applications:	Date: January 14, 2025 at 11:59 PM ET

FY 2025 NP AI/ML NOFO

General approach: Application of AI/ML tools and methods for experiments, simulation, theory and accelerator operation to expand scientific outreach

- Technical areas and scope for FY2025 FOA
  - Efficiently extract critical and strategic information from large complex data sets,
  - New Development and implementation of digital twins for future colliders
  - Address the challenges of autonomous control and experimentation,
  - Efficiency of operation of accelerators and scientific instruments,
  - AI for data reduction of large experimental data.
- Application Requirements
  - Eligibility: Universities/colleges, non-profit/ small business as collaborators, DOE/NNSA laboratories only;
  - Award size/duration: National Labs: Up to $1.75 M/Y; Universities: up to $1M/Y: 2-year awards
  - Funding by Fiscal Year: FY 2025-26 ~ up to $22M, - subject to budget appropriations.
  - New Preproposals: Letters of Intent required
  - New Proposal Types: Single and multiple institutions
    - Multi-institutional teams must submit one application from a designated lead institution with all other team members proposed as subrecipients.

Proposals and Awards Statistics

Funding	
FY 2025	$12.7M
Total	~$17.4M

Letters of Intent (LOIs)	
Number received	91
# Institutions	**64**
Total # of States	**25**
Encouraged to submit	42

Award Statistics		
Number of awards		8
Overall success rate		20%
Early career	2	25%
University-led	4	50%
Lab-led	4	50%

Peer Review Statistics (Panel)	
Total # proposals received	39
Total # of reviews	78
Total unique reviewers (**Panel**)	20

FY2025 NP AI/ML NOFO Awards

PI Name (Lead)	Institution +(Subrecipients)	Proposal Title	Topic areas
Peter Jacobs	**Lawrence Berkeley National Laboratory** +(Duke U, UC Berkely, UC San Diego, and Wayne State U.)	**Bayesian Probabilistic Methods to Enable Cross-Cutting AI Research in Nuclear Science**	**Heavy Ion, 0νββ, QGP**
David Lawrence	**Thomas Jefferson National Accelerator Facility** + (UVA, W&M, and FSU)	**Coupling Experiment to Accelerator Control**	**Medium Energy/Accelerator**
Georg Hoffstaetter	**Brookhaven National Laboratory** + (Cornell, TJNAF, SLAC, RPI, FNAL, MSU, and LANL)	**Toward higher brightness and polarization of hadron beams: Digital-Twin-based autonomous control of BNL's hadron accelerator chain**	**Accelerator, EIC**
Peter Ostroumov	**Michigan State University/FRIB** + (LANL)	**Online Autonomous Tuning of the FRIB Accelerator Using Machine Learning**	**Accelerator, FRIB**
Simoneta Liuti	**University of Virginia** + (MSU, New Mexico U, ODU, Tufts U, and Virginia Tech.)	**EXCLAIM - EXCLusives via Artificial Intelligence and Machine learning**	**Nuclear Theory, quark-gluon structure**
Cristiano Fanelli	**College of William and Mary** + (BNL, Catholic U of America, Duke, and TJNAF)	**A Scalable and Distributed AI-assisted Detector Design and Optimization for the EIC**	**Heavy Ion/Medium Energy**
Edelen Auralee	**Stanford Linear Accelerator** + (MSU, TJNAF, and ANL)	**Towards Self-driving NP Scientific User Facilities through an AI-based Controls Framework**	**Accelerator, ATLAS, FRIB**
Dean Lee	**Michigan State University/FRIB** + (ANL, FNAL, FSU, NCU, ORNL, Ohio U, and UTK)	**STREAMLINE 2 Collaboration: Machine Learning for Nuclear Many-Body Systems**	**Nuclear Theory, many body systems**

Outline

- Overview of DOE-SC and NP AI/ML initiative
- FY2023 Data, AI and ML FOA and Lab call
- FY2025 Data, AI and ML NOFO and Lab call
- Office of Science American Science Cloud Initiative -AmSC
- NP Data Provider Program (DaPP)
- NP AI opportunities in FY2026
- Communications and Presentation Guidelines
- Acknowledgements of Federal Support for your award
- This meeting and agenda

The American Science Cloud – AmSC

Advanced Scientific Computing Research (ASCR) **THE AMERICAN SCIENCE CLOUD (Am SC)** DOE National Laboratory Program Announcement Number: LAB 25-3555	
Announcement Issue Date:	August 22, 2025
Submission Deadline for Proposals:	September 15, 2025, at 5 PM ET
Expected Total: available funding	$40.M, : Number of awards: 1-10, : Project period: 1-2 years

- DOE ASCR announced its interest in receiving proposals from eligible DOE National Laboratories to establish an integrated team to lead the development and deployment of AmSC. AmSC will serve as the enabling software and hardware infrastructure for DOE's AI data and model development efforts in furtherance of SC's mission and in fulfillment of Section 50404 of the OBBB Act (H.R.1).
- A companion announcement solicits laboratory-led proposals to establish The Transformational AI Models Consortium, and a subsequent funding opportunity will solicit proposals for public/private partnerships, referred to as AI Model teams, to develop self-improving AI models across various science and engineering domains as part of the Transformational AI Models Consortium.
- This call distinguishes three roles: AmSC Lead, Host, and Infrastructure Partner:
- Total number of awards: 1, Total Partners:17, 13 host labs
- Phase I Expectation: Deliver Minimal Viable Product in 12 month

The AI Models Consortium-ModCon

Advanced Scientific Computing Research (ASCR) **THE TRANSFORMATIONAL AI MODELS CONSORTIUM** DOE National Laboratory Program Announcement Number: LAB 25-3560	
Announcement Issue Date:	August 22, 2025
Submission Deadline for Proposals:	September 15, 2025, at 5 PM ET
Expected Totals: available funding $30.M, : Number of awards: 1, : Project period: 2 years	

- DOE ASCR announced its interest in supporting the formation of the Transformational AI Models Consortium which will mobilize National Laboratories to partner with industry sectors within the United States to curate the scientific data of the Department of Energy (DOE) across the National Laboratory complex so that the data is structured, cleaned, and preprocessed in a way that makes it suitable for use in AI/ML models.
- A companion announcement solicits laboratory-led proposals to establish the American Science Cloud (AmSC).
- Total number of awards: 1 as lead and several partner labs
- There will be a companion NOFO for AI Consortium Model team (under development)

Outline

- Overview of DOE-SC and NP AI/ML initiative
- FY2023 Data, AI and ML FOA and Lab call
- FY2025 Data, AI and ML NOFO and Lab call
- Office of Science American Science Cloud Initiative -AmSC
- NP Data Provider Program (DaPP)
- NP AI opportunities in FY2026
- Communications and Presentation Guidelines
- Acknowledgements of Federal Support for your award
- This meeting and agenda

NP American Science Cloud (AmSC) Data Providers Program (DaPP) funded by OBBB (H.R.1)

- Lab Invitation Scope: (August-September 2025)
  - Multi-laboratory teams to develop domain-specific data standards and meta-data for multi-modal data to accelerate NP science and align with ASCR initiatives.
  - Priority: Data-focused activities rather than equipment or computational hardware.
  - Focus on use of AI to accelerate discoveries for two key NP science questions:

    #1: How do the rich patterns observed in the structure and reactions of nuclei emerge from the interactions of neutrons and protons?

    #2: How do quarks and gluons make up protons, neutrons, and ultimately, atomic nuclei?
  - This science requires unleashing the full potential of SC accelerator-based user facilities. Therefore, accelerator-related proposals were also encouraged.
- Application requirements:
  - Teams led by SC National Labs with NP core capability (ANL, BNL, TJNAF, LBNL, ORNL).
  - Award size: $3,000,000 to $5,000,000, up to 3-year awards.
  - Each lab limited to one application.
  - Peer review process: Applications reviewed by SC Program Managers.

Nuclear Physics: DaPP Lab Invitation

- Provides support consistent with Administration and Congressional priorities, working in coordination with the ASCR.
- NP invited National Labs with Nuclear Physics as a core capability (ANL, BNL, LBNL, ORNL, TJNAF) to submit ambitious pilot applications to advance the NP scientific mission through the development of AI-ready datasets.
- First NP invitations to labs for the Data Providers Program in direct connection with ASCR's AI Consortium and AmSC opportunities. NP had previously released NOFOs focused on AI/ML for Nuclear Science and Technology.
  - Total past NP award funding: FY20-25: ~$37M
  - Total number of NP awards: FY20-FY25: 35 (Labs and universities as Leads with many Co-PI awards)

Recommended Laboratory DaPP Selections

Lead PI, Institution (Partner Institutions)	Title	Area of Nuclear Physics	Scope/Objectives
Malachi Schram, TJNAF (BNL, LBNL, PNNL, Stony Brook, and ODU)	**Developing AI-Ready Data Framework for DOE NP Particle Accelerators**	**Accelerators**	Define a shared vocabulary with site specific profiles to standardize data units and provenance; Create compact AI-ready data structures for efficient analysis; Develop connectors to integrate existing archives into this unified framework.
Jamie Dunlop, BNL (LBNL, ORNL, ANL, TJNAF)	**Preparing QCD Data for Foundation Models**	**QCD**	Curate experimental and theoretical data, engaging subcommunities to agree on common code, data, metadata, and other information needed for FAIR and AI-ready data and workflows.
Mario Cromaz, LBNL (FRIB, ANL, ORNL, NVIDIA)	**AI/ML-Ready Data Labeling for Low Energy Nuclear Physics**	**Low Energy Nuclear Physics**	Identify schemas and metadata to synchronize data and nuclear observables across experiments; Define structuring of theoretical data for auditability, emulator training, and simulation-based inference.

Total Funding $9.635M

Outline

- Overview of DOE-SC and NP AI/ML initiative
- FY2023 Data, AI and ML FOA and Lab call
- FY2025 Data, AI and ML NOFO and Lab call
- Office of Science American Science Cloud Initiative -AmSC
- NP Data Provider Program (DaPP)
- NP AI opportunities in FY2026
- Communications and Presentation Guidelines
- Acknowledgements of Federal Support for your award
- This meeting and agenda

NP AI Opportunities in FY26

- Subject to appropriation, awardees of the FY2025 NOFO will be funded for their Year-2 awards
- In the annual SC Notice of Funding Opportunity (NOFO) published on September 30, 2025, DE-FOA-0003600: under Section: (i) Artificial Intelligence and Machine Learning Applications.
- Also, the following instruction (box below) is in the main NP section of the open NOFO to identify budget in NP research proposals related to AI/ML (P. 101)
- Subject to availability and level of appropriated FY 2026 NP AI/ML funds, NP funded laboratories may be invited to submit expressions of interest (EOIs) and subsequently proposals consistent with guidance in section(i) of the DE-FOA-0003600 NOFO.

Language in the main NP section of the open call

"For all applications, a table in the budget justification section should specify the funding request by subprogram and, if relevant, AI/ML and microelectronics. An example follows.

	FY 2026	FY 2027	FY 2028
Medium Energy	$50,000	$40,000	$50,000
Microelectronics	$15,000	$25,000	$10,000
AI/ML	$60,000	$80,000	$90,000

Outline:

- This Meeting
- NP Accelerator R&D
- FY 2022 Accelerator R&D FOA and awards (under NCE)
- FY2023 AI/ML FOA awards- in Accelerator
- FY 2024 Accelerator R&D FOA and awards
- FY2026 Accelerator R&D
- Communications and Presentation Guidelines
- Acknowledgements of Federal Support for your award
- This meeting and agenda

Communications between NP and PI

- Two modes of communications between PIs and NP office: Quarterly reports and an annual face to face meeting with all PI in one place.

- Quarterly Reports:
  - PIs were asked to submit quarterly reports to NP in a "Small Project" format. The FY2025 2nd quarter was the last report NP requested.
  - **NP stopped requesting Quarterly reports** after 2nd quarter of FY2025.

- PI Exchange Meeting:
  - Accelerator R&D: Since 2015, NP conducts annual "PI Exchange" meetings with presentations on current status of work by all Principal Investigators who received awards under previous fiscal year funds.
  - AI/ML: AI/ML exchange meeting November 19-20 to cover 15 FY2023 FOA awards and remaining awards for the FY2021 FOA

Outline

- Overview of DOE-SC and NP AI/ML initiative
- FY2023 Data, AI and ML FOA and Lab call
- FY2025 Data, AI and ML NOFO and Lab call
- Office of Science American Science Cloud Initiative -AmSC
- NP Data Provider Program (DaPP)
- NP AI/ML opportunities in FY2026
- Communications and Presentation Guidelines
- Acknowledgements of Federal Support for your award
- This meeting and agenda

Acknowledgements of Federal Support for your award

- For peer reviewed and technical papers, the following acknowledgment of support is required:
  - For Financial Assistance (grants, etc.):
    - Acknowledgment: "This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office of [insert the sponsoring SC Program Office, e.g., Nuclear Physics], [Add any additional acknowledgements or information requested by the sponsoring SC Program Office] under Award Number(s) [Enter the award number(s)]."
    - Example: "This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics under Award Number DE-SC-000yyy."
  - For National Lab awards:
    - Example: "This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office Nuclear Physics program under Award Number DE-SC-000zzz.
- A link on Acknowledgment:
  - https://science.osti.gov/Funding-Opportunities/Acknowledgements

Outline

- Overview of DOE-SC and NP AI/ML initiative
- FY2023 Data, AI and ML FOA and Lab call
- FY2025 Data, AI and ML NOFO and Lab call
- Office of Science American Science Cloud Initiative -AmSC
- NP Data Provider Program (DaPP)
- NP AI/ML opportunities in FY2026
- Communications and Presentation Guidelines
- Acknowledgements of Federal Support for your award
- This meeting and agenda

PI Exchange Meeting, November 19-20- Virtual

- Presentations on status of work by all Principal Investigators (PIs) who received awards
  - All 15 FY 2023 FOA DE-FOA-0002875 awards
  - 2 FY 2021 FOA DE-FOA-0002490 awards still in progress

- This is not a review, and no review panel is involved. Presentations will be made to NP Office Program Managers and Division Directors, and possibly a few PMs from HEP and BES Program Offices.

- To facilitate exchange of information between PIs and the NP Office and among PIs and institutions on all current NP Accelerator R&D awards activities.

PI Meeting Presentation Guidelines:

- Each presentation should include the following information:
  - Description of the project and the current status;
  - The main goal of the project for which you received the FY 2021- 23 AI/ML awards,
  - A table showing annual budget and the total received to date (see below);
  - A table showing major deliverables and schedule; and
  - There will be no written report or follow up actions required for this meeting.
  - Summary of expenditures by fiscal year (FY):
  - All talks will be posted on PI Exchange meeting page on NP website.
  - **35 min talks should allow 7 min for Q/A.**

	Year 1	Year 2	Year 3	Totals
a) Funds allocated				
b) Actual costs to date				

2025 PI Meeting Agenda- Day 1

DRAFT AGENDA : Day 1: 2025 NP AI-ML PI Exchange Meeting, Wednesday, November 19, Virtual

Zoom link: https://science-doe.zoomgov.com/j/1603754427?pwd=MdlP8sY9bmk29HXhmMLovXazGWHazU.1

#	Time (E.S.T)	Dur. (min)	Principal Investigator	Institution	Collaboration	FOA Year	R&D Area	Presentation Title	Speaker(s)
	11:00 AM	5	-	DOE NP			-	Introductory Remarks	NP DD
	11:05 AM	35	-	DOE NP			-	NP supported AI/ML	Farkhondeh
1	11:40 AM	35	Liu, Ming Xiong	LANL	Yes	FY2023	Detectors	Intelligent Experiments Through Real-time AI: Fast Data Processing and Autonomous Detector Control for sPHENIX and Future EIC Detectors	Liu
2	12:15 PM	35	Wrede, Christopher	MSU	No	FY2023	Detectors	Machine Learning for Time Projection Chambers at FRIB	Wrede
	12:50 PM	15	Break						
3	1:05 PM	35	Jacobs, Peter	LBNL	Yes	FY2023	Experiment AI	New approaches to Bayesian uncertainty quantification for Nuclear Science	Jacobs
4	1:40 PM	35	Carpenter, Michael	ANL	No	FY21-23	Experiment, LE	Modern Data Analytics for the Large Gamma-Ray Spectrometers: GRETINA/GRETA and Gammasphere via Machine Learning and Optimization	Carpenter
	2:15 PM	40	Lunch Break						
5	2:55 PM	35	Redpath, Thomas	VSU	No	FY2023	Experiment, LE	Neural network classifier for analyzing measurements of fast neutrons for invariant mass spectroscopy	Redpath
6	3:30 PM	35	Liuti, Simonetta	UVA	Yes	FY2023	Theory, LQCD	EXCLAIM - EXCLusives via Artificial Intelligence and Machine learning	Liuti
	4:05 PM	15	Break						
7	4:20 PM	35	Lee, Dean	MSU	Yes	FY2023	Theory ML	STREAMLINE Collaboration: Machine Learning for Nuclear Many-Body Systems	Lee
8	4:55 PM	35	Ostroumov, Peter Scheinker, Alexander	MSU	Yes	FY2023	Accelerator	Online Autonomous Tuning of the FRIB Accelerator Using Machine Learning	Ostroumov
	5:30 PM		Adjourn	End of Day 1					

2025 PI Meeting Agenda- Day 2

DRAFT AGENDA : Day 2: 2025 NP AI-ML PI Exchange Meeting, Thursday, November 20, Virtual
Zoom link: https://science-doe.zoomgov.com/j/1603754427?pwd=MdlP8sY9bmk29HXhmMLovXazGWHazU.1

#	Time (E.S.T)	Dur. (min)	Principal Investigator	Institution	Collaboration		R&D Area	Presentation Title	Speaker(s)
9	11:00 AM	35	Mustapha, Brahim	ANL	Yes	FY2023	Accelerator	Use of artificial intelligence to optimize accelerator operations and improve machine performance	Mustapha/Santiago
10	11:35 AM	35	Crawford, Heather	LBNL	No	FY21-23	Accelerator	Machine Learning Optimization: VENUS & GRETA	Crawford
	12:10 PM	15	Break						
12	12:25 PM	35	Gruszko, Julieta	UNC	No	FY21-23	Detector, FS	Interpretable Machine Learning for Germanium-Based Neutrinoless Double Beta Decay Searches	Gruszko
13	1:00 PM	35	Fanelli, Cristiano	W&M	Yes	FY2023	Detectors	A Scalable and Distributed AI-assisted detector design for the EIC	Fanelli
	1:35 PM	50	Lunch Break						
14	2:25 PM	35	Arratia, Miguel	UC, Riverside	Yes	FY2021	Detectors	AI-driven detector design for the EIC	Arratia
15	3:00 PM	35	Lawrence, David	TJNAF	No	FY2023	Polarization	AI/ML Optimized Polarization	Lawrence
16	3:35 PM	35	Tennant, Christopher	TJNAF	No	FY2023	Accelerator	Graph Learning for Efficient and Explainable Operation of Particle Accelerators	Tennant
	4:10 PM	15	Break						
17	4:25 PM	35	Hoffstaetter, Georg	BNL/Cornell	Yes	FY2023	Accelerator	Beam polarization increase in the BNL hadron injectors through physics-informed Bayesian Learning	Hoffstaetter
	5:00 PM	5	Closing Remarks					Closing Remarks	
	5:05 PM		Adjourn						

BACKUP SLIDES