U.S. DEPARTMENT OF ENERGY | Office of Science

Informational Webinar:

Machine Learning, Artificial Intelligence, and Data Resources for Fusion Energy Sciences
DE-FOA-0002905

FOA Issue Date:	December 22, 2023
Submission Deadline for Pre-Application:	January 31, 2023 at 5pm Eastern
Pre-application Response Date:	February 7, 2023 at 5pm Eastern
Submission Deadline for Applications:	March 15, 2023 at 11:59 PM Eastern

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Disclaimer : This presentation summarizes the contents of the FOA. Nothing in this webinar is intended to add to, take away from, or contradict any of the requirements of the FOA. If there are any inconsistencies between the FOA and this presentation or statements from DOE personnel, the FOA is the controlling document.

Program Office Introduction

Fusion Energy Science Program Mission: The mission of the Fusion Energy Sciences (FES) program is to expand the fundamental understanding of matter at very high temperatures and densities and to build the scientific foundations needed to develop a fusion energy source. This is accomplished by the study of the plasma state and its interactions with its surroundings.[1]

The Office of Science (SC) has a unique combination of capabilities to lead the nation in AI and ML research and development (R&D) for science:[2]

- A broad mission that presents new and unique research problems

- Sources of massive and/or complex science and engineering data

- World-class high-performance computing (HPC) infrastructure

- World-class high-performance network infrastructure

- An exceptional workforce with large numbers of domain scientists, computer scientists, and mathematicians currently engaged in AI and related fields.

1   https://science.osti.gov/fes
2   https://science.osti.gov/Initiatives/AI

FOA Scope

▸ The goal of this FOA is to support multi-disciplinary teams aiming to apply advanced and autonomous algorithms to address high-priority research opportunities across the FES program.

▸ Applicants are encouraged to propose research in new systems for managing, formatting, curating, and accessing experimental and simulation data, provided in publicly available databases.

▸ Of high programmatic importance are approaches that support the realization of a fusion pilot plant on a decadal timescale.

▸ **FOA Topics:** Collaborative Research and Data Resources (see next slides)

Priority Research Opportunities[1] for Collaborative Research

1. **Science Discovery with Machine Learning** includes approaches to bridge gaps in theoretical understanding through identification of missing effects using large datasets, accelerating hypothesis generation and testing, and optimizing experimental planning to help speed up progress in gaining new knowledge;

2. **Machine Learning Boosted Diagnostics** involves application of methods to maximize the information extracted from measurements, enhancing interpretability with data-driven models, fusing multiple data sources, and generating synthetic diagnostics that enable the inference of quantities that are not directly measured;

3. **Model Extraction and Reduction** includes construction of models of fusion systems and plasmas for purposes of both enhancing our understanding of complex processes and accelerating computational algorithms;

4. **Control Augmentation with Machine Learning** involves plasma control research using control-level models improved through data-driven methods, real-time data analysis algorithms designed and optimized for control, and optimization of plasma discharge trajectories using algorithms derived from large databases;

5. **Extreme Data Algorithms** includes methods for in-situ, in-memory analysis and reduction of extreme scale simulation data, and methods for efficient ingestion and analysis of extreme-scale fusion experimental data;

6. **Data-Enhanced Prediction** involves algorithms for prediction of key plasma phenomena and plant system states, especially in a manner that enables real-time system state prediction, health monitoring, and fault prediction; and

7. **Fusion Data Machine Learning Platform** includes development of systems for managing, formatting, curating, and enabling access to fusion experimental and simulation data for optimal usability in applying AI/ML algorithms.

Fusion Data Resources

- Applicants are encouraged to make research products (e.g., curated databases, trained network models, design tools) publicly available in an expeditious manner, ideally during the award project period, to facilitate collaborations across SC program elements and enable the broadest possible access to capabilities developed during federally funded research.
- In the management of scientific data, applicants should strive to implement the facets of FAIRness as described in the FAIR Data Principles.
- Applicants may propose to make existing fusion and plasma data available publicly to enable AI/ML research supported under other awards.
  - SC Examples: Publica Reusable Research Data (PuRe) https://science.osti.gov/Initiatives/PuRe-Data
- Requested support for data resource activities may include the procurement and operation of data servers.
- There is potential overlap between data resources and PRO 7: Fusion Data Machine Learning Platform.

FOA Key Elements

▸ **Eligibility Requirements**

- All types of domestic applicants are eligible. However, this FOA does not support an applicant's commercial activity.

- Collaborative and subawards for team awards are possible.

- Three pre-apps/applications per institution; one per PI

▸ **Application Requirements**

- Program Narrative

- Multi-institutional proposals should provide a budget table (rows: institution, columns: budget period)

- Data Management Plan (mandatory): Critical for data resources

- PIER Plan (mandatory): new in FY 2023

FOA Award Information

- Total Estimated Funding: $33M over three years

- Period of Performance: Typically 3 years

- Ceiling/Floor: See table in Section II.C (next slide)

- Expected Number of Awards: 6-10 team awards

- Types of Awards: Collaborative and single institution
  - Short-term (1-2 year) awards for high-risk scope are permitted

- Estimated Award Date: August 1, 2023

MAXIMUM AND MINIMUM AWARD SIZE

FOA Topic	# of distinct institutions	Ceiling	Floor
AI/ML	Multi-institutional team	$2,500,000 per year	$50,000 per year
AI/ML	Single Institution including possible subawards	$1,500,000 per year	$50,000 per year
Data Resources	One or more	$1,000,000 for three years	$50,000

It is anticipated that AI/ML award sizes for an individual institution may range from $80,000 per year to $1,500,000 per year, with a median award size between $200,000 per year and $500,000 per year. Award amounts at the ceiling are anticipated to include subawards to multiple institutions.

FOA Pre-application Requirements

‣ Pre-application is required

‣ Requirement Deadline: January 31, 2023 at 5:00 PM Eastern

‣ Program Narrative Page Limit: 4 pages

‣ List of Conflicted Persons: Please use the Collaborator Template

  – https://science.osti.gov/media/grants/excel/Collaborator_Template.xlsx

‣ Feedback/Response deadline: February 7, 2023 at 5:00 PM

Question & Answers

Please submit questions using Zoom Q&A window, which should be accessible at the bottom of your zoom window

▸**Where will this recording be posted**
- Viewgraphs/Recording/Transcript/FAQs: https://science.osti.gov/fes/funding-opportunities

▸**Whom to contact**
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