NP Accelerator R&D Principal Investigators Exchange Meeting

December 2, 2024

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Nuclear Physics Program

U.S. Department of ENERGY | Office of Science

Energy.gov/science

Outline:

- This Meeting
- NP Accelerator R&D
- FY 2022 Accelerator R&D FOA and awards
- FY2023 AI/ML FOA awards- in Accelerator
- FY 2024 Accelerator R&D FOA and awards
- PIER Plan
- Communications and Presentation Guidelines

DOE SC Statement of Commitment

- The DOE SC Diversity, Equity and Inclusion webpage: https://science.osti.gov/SWI/SC-Statement-of-Commitment/
- "The DOE Office of Science (SC) is fully committed to fostering safe, diverse, equitable, and inclusive work, research, and funding environments that value mutual respect and personal integrity. Effective stewardship and promotion of diverse and inclusive workplaces that value and celebrate a diversity of people, ideas, cultures, and educational backgrounds is foundational to delivering on the SC mission. The scientific community engaged in SC-sponsored activities is expected to be respectful, ethical, and professional.

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- If you are subject to or witness harassment or discrimination, please contact any of the NP PM present or our Division Director. You can also visit the following:
  How to Report a Complaint | U.S. DOE Office of Science (SC) (osti.gov)

DOE Office of Nuclear Physics Accelerator R&D

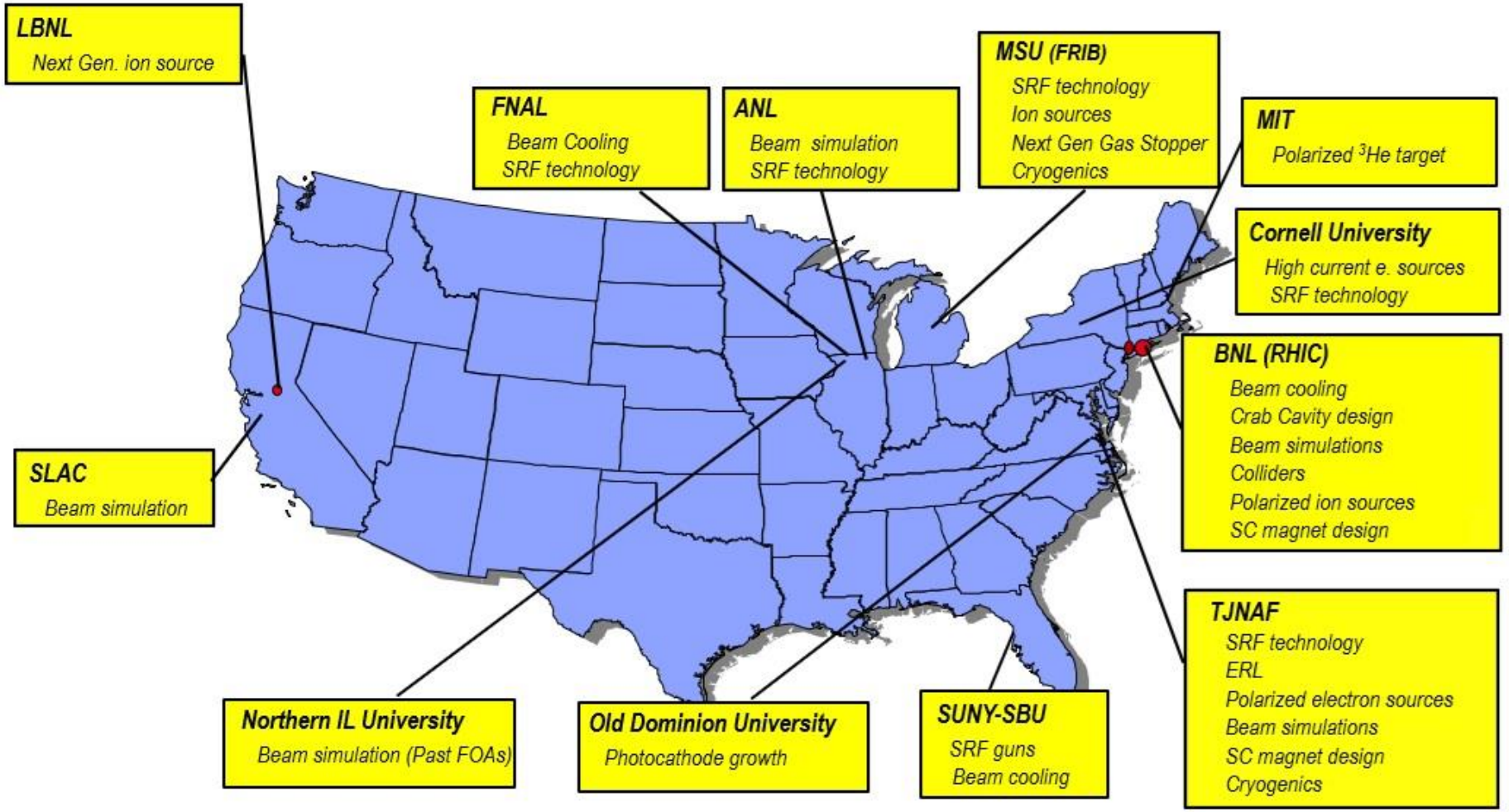
- Annual direct NP investment in accelerator R&D through the competitive funding opportunity announcement (FOA) and National Laboratory Accelerator R&D for FY2022-23 is on the order of $20 M per year.

- NP is also investing in non-EIC accelerator R&D with focus on key technology areas and in core competencies at NP laboratories

- NP publishes biennial FOAs with 2-year duration awards last of which was in FY2024.

- **NP published a new FOA in ~January 2024 for FY2024-25 funding. Awards have been made.**

Core Competencies at NP Labs and Universities



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FY22: Accelerator R&D FOA
(Topic of this Exchange meeting

***FUNDING OPPORTUNITY ANNOUNCEMENT** (FOA)*

Research and Development for Next Generation Nuclear Physics Accelerator Facilities
Funding Opportunity Number : DE-DE-FOA-0002670
ISSUE DATE: February 10, 2022
Application Due Date: April 8, 2022

- *Accelerator R&D for this announcement was in the following general categories:*
  - *Accelerator R&D that significantly advances the state-of-the art accelerator capabilities of relevance to next generation machines for the study of nuclear physics.*
  - *Accelerator R&D that significantly advances the state-of-the art accelerator capabilities of relevance to improving the performance of existing facilities studying nuclear physics.*
- Proposals in the following areas were encouraged:
  - *Transformative accelerator R&D in SRF technology for restoring cryomodule performance at SRF-based accelerator facilities.*
  - *Transformative accelerator R&D in next generation ion and electron sources.*
- Artificial Intelligence and Machine Learning was not included in this FOA because of a standalone AI and data science call in this area.

FY22: Accelerator R&D FOA Awards

Award #	Proposal ID	Institution	Proposal Title	Topic Area	New/ Existing Work	PI Name	Lead
1	0000267565	LBNL- 88 Inch	Development of a MARS superconducting cold mass for future generations of ECRIS	Next Gen Ion Source	New	Xie, Daniel	
2	0000267790	ODU/TJNAF	Enhancing the Design of Photocathodes with 90% polarization and QE > 1% for DOE NP	Pol Photocathode	Existing	Marsillac, Sylvain	ODU, TJ subcon.
3	0000267812	Cornell	Long lifetime spin-polarized electron sources: high current performance of alternative GaAs activation materials and novel spin-polarized sources via epitaxial growth	Pol Source	Existing	Bazarov, Ivan	
4	0000267656	ANL	A Practical Niobium-Tin Cavity for the ATLAS Superconducting Linac	SRF	Existing	Kelly, Michael	Lead
	0000267831	FNAL	Collaboration			Posen, Sam	
	0000267694	Radiabeam Technologies	Collaboration			Kutsaev, Sergey	
5	0000267691	TJNAF	In situ plasma processing of superconducting cavities	Plasma Processing	Existing	Powers, Tom	
6	0000267794	MSU	Development of Transformative Preparation Methods to Push up High Q&G Performance of FRIB Spare HWR Cryomodule Cavities	SRF Cryomodules	New	Saito, Kenji	
7	0000267789	BNL	Development of high current highly charged laser ion source	Laser Ion Source	New	Okamura, Masahiro	
8	0000267801	LBNL	Advanced Modeling of Beam Physics and Performance Optimization for Nuclear Physics Colliders	Beam dynamics modeling	New	Qiang, Ji	Lead
	0000267652	MSU	Collaboration			Hao, Yue	
	0000267677	BNL	Collaboration			Gu, Xiaofeng	
9	0000267811	TJNAF	1497 MHz Vertical Slice Test of Magnetron & Superconducting Cavity	RF sources		Jordan, Kevin	

Subject of this year's PI meeting (no significance to color codes in rows)

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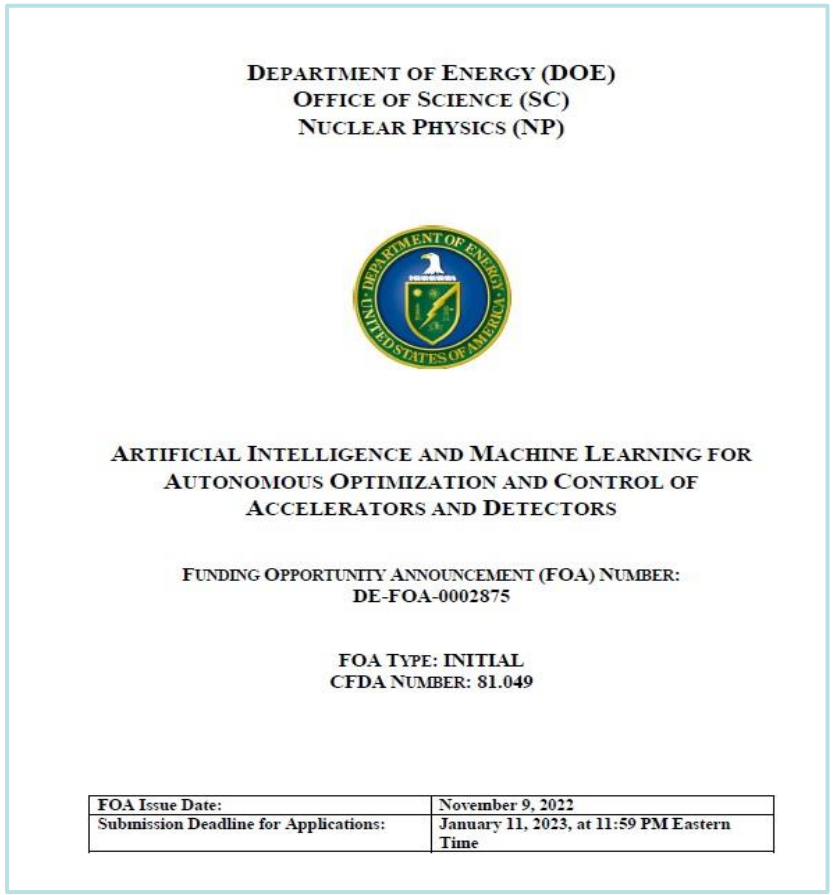
NP AI/ML FOA DE-FOA-0002875

FY2023

FY2023 AI/ML General approach: Application of AI/ML tools and methods for **experiments, simulation, theory and accelerator operation to expand scientific outreach**

- *FOA: DE-FOA-0002875*
- *Issue Date: Nov 9, 2022*
- *Proposals due: Jan 11, 2023*
- *Total funding ~$16M FY23-24*

Proposal Topic	Submitted	Awarded
Accelerator	**11**	**4**
Detectors	8	4
Experiments + EIC	15	5
Theory	4	2
Totals	**38**	**15**



DEPARTMENT OF ENERGY (DOE)
OFFICE OF SCIENCE (SC)
NUCLEAR PHYSICS (NP)

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FOR AUTONOMOUS OPTIMIZATION AND CONTROL OF ACCELERATORS AND DETECTORS

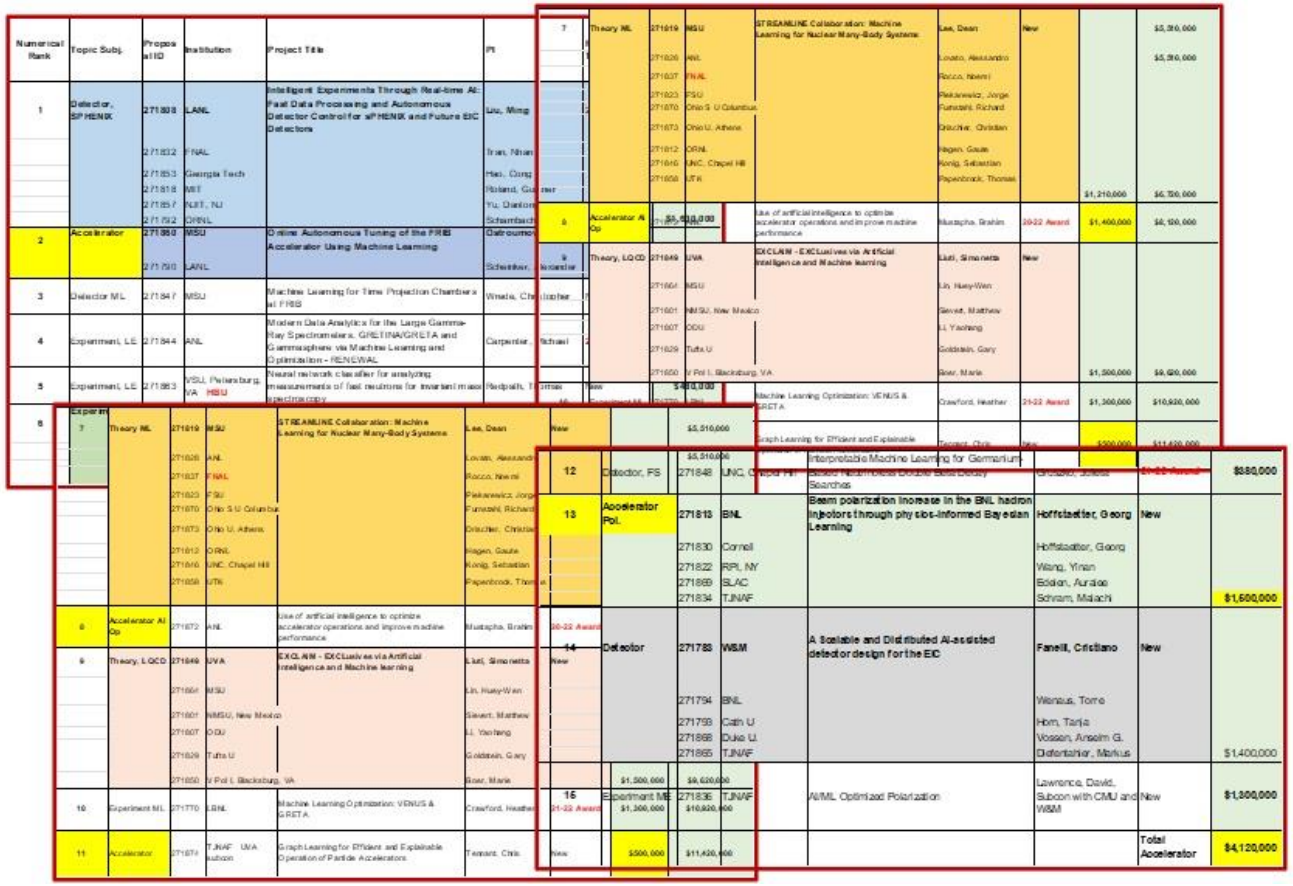
FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) NUMBER:
DE-FOA-0002875

FOA TYPE: INITIAL
CFDA NUMBER: 81.049

FOA Issue Date:	November 9, 2022
Submission Deadline for Applications:	January 11, 2023, at 11:59 PM Eastern Time

FY23: AI/ML FOA Awards (All 15 awards)

- **Total applications** : 38, with 16 collaborative and 22 single institution applications.
- **Breakdown:** A total of 15 independent awards- with 4 related to accelerator totaling ~$4.8M over two years (these 4 awards)



Numerical Rank	Topic Subj.	Proposal ID	Institution	Project Title	PI							
1	Detector, sPHENIX	271808	LANL	Intelligent Experiments Through Real-time AI: Fast Data Processing and Autonomous Detector Control for sPHENIX and Future EIC Detectors	Liu, Ming							
		271832	FNAL		Tran, Nhan							
		271853	Georgia Tech		Hao, Cong							
		271818	MIT		Roland, Gunther							
		271857	NJIT, NJ		Yu, Dantong							
		271792	ORNL		Schambach, Joseph							
2	Accelerator	271880	WSU	Online Autonomous Tuning of the FRIB Accelerator Using Machine Learning	Ostroumov, Vadim							
		271790	LANL		Scheinker, Alexander							
3	Detector ML	271847	MSU	Machine Learning for Time Projection Chambers at FRIB	Wiseta, Cheukfai							
4	Experiment, LE	271844	ANL	Modern Data Analytics for the Large Gamma-Ray Spectrometers, GRETINA/GRETA and Gammasphere via Machine Learning and Optimization – RENEWAL	Carpenter, Michael							
5	Experiment, LE	271883	WSU, Petersburg, VA HBCU	Neural network classifier for analyzing measurements of fast neutrons for invariant mass spectroscopy	Redpath, Thomas							
6	Experiment ML	271770	LBNL	Machine Learning Optimization: VENUS & GRETA	Crawford, Heather	21-22 Award	$1,300,000	$10,920,000				
7	Theory ML	271819	MSU	STREAMLINE Collaboration: Machine Learning for Nuclear Many-Body Systems	Lee, Dean	New		$5,510,000				
		271826	ANL		Lovato, Alessandro							
		271837	FNAL		Rocco, Nicmi							
		271823	FSU		Piekarewicz, Jorge							
		271870	Ohio S. U Columbus		Furnstahl, Richard							
		271873	Ohio U. Athens		Drischler, Christian							
		271812	ORNL		Hagen, Gaute							
		271846	UNC, Chapel Hill		Konig, Sebastian							
		271858	UTK		Papenbrock, Thomas							
8	Accelerator AI Co	271872	ANL	Use of artificial intelligence to optimize accelerator operations and improve machine performance	Mustapha, Brahim	20-22 Award	$1,400,000	$8,120,000				
9	Theory, LQCD	271849	UVA	EXCLAIM - EXCLusive via Artificial Intelligence and Machine learning	Lisi, Simonetta	New						
		271864	MSU		Lin, Huey-Wen							
		271801	NMSU, New Mexico		Sievert, Matthew							
		271807	ODU		Li, Yaohang							
		271829	Tufts U		Goldstein, Gary							
		271850	W Pol I, Blacksburg, VA		Boer, Marie			$1,500,000	$9,020,000			
10	Experiment ML	271770	LBNL	Machine Learning Optimization: VENUS & GRETA	Crawford, Heather	21-22 Award	$1,300,000	$10,920,000				
11	Accelerator	271874	TJNAF UVA subcon	Graph Learning for Efficient and Explainable Operation of Particle Accelerators	Tennant, Chris	New	$500,000	$11,420,000				
12	Detector, FS	271848	UNC, Chapel Hill	Interpretable Machine Learning for Gemarium Based Neutrinoless Double Beta Decay Searches	Grzadkowski, Jolanta	21-22 Award						$880,000
13	Accelerator Pol.	271813	BNL	Beam polarization increase in the BNL hadron injectors through physics-informed Bayesian Learning	Hoffstaetter, Georg	New						
		271830	Cornell		Hoffstaetter, Georg							
		271822	RPI, NY		Wang, Yinan							
		271869	SLAC		Edelen, Auralee							
		271834	TJNAF		Schram, Malachi							$1,600,000
14	Detector	271788	W&M	A Scalable and Distributed AI-assisted detector design for the EIC	Fanelli, Cristiano	New						
		271794	BNL		Wenzus, Torre							
		271793	Cath U		Horn, Tanja							
		271868	Duke U		Vossen, Anselm G.							
		271865	TJNAF		Diefenthaler, Markus							$1,400,000
15	Experiment ML	271836	TJNAF	AI/ML Optimized Polarization	Lawrence, David, Subcon with CMU and W&M	New						$1,300,000
						Total Accelerator						$4,120,000

FY23: AI/ML Awards in Accelerator R&D

4-5 awards in Accelerator related AI-ML applications

Topic Subj.	Proposal ID	Institution	Project Title	PI	Total Collabo. Award ($k)
Accelerator	**271860**	**MSU**	**Online Autonomous Tuning of the FRIB Accelerator Using Machine Learning**	**Ostroumov, Peter**	[redacted]
	271790	LANL		**Scheinker, Alexander**	
Accelerator Op	271872	ANL	**Use of artificial intelligence to optimize accelerator operations and improve machine performance**	**Mustapha, Brahim**	
Experiment and Accelerator ML	271770	LBNL	**Machine Learning Optimization: VENUS & GRETA**	**Crawford, Heather**	
Accelerator Op	271874	TJNAF /UVA subcon	**Graph Learning for Efficient and Explainable Operation of Particle Accelerators**	**Tennant, Chris**	
Accelerator	**271813**	**BNL**	**Beam polarization increase in the BNL hadron injectors through physics-informed Bayesian Learning**	**Hoffstaetter, Georg**	
	271830	Cornell		**Hoffstaetter, Georg**	
	271822	RPI, NY		**Wang, Yinan**	
	271869	SLAC		**Edelen, Auralee**	
	271834	TJNAF		**Schram, Malachi**	
				Total Accelerator $4.8M	**$4,770**

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FY 2024 NP Accelerator FOA DE-FOA-0003261

- FOA: DE-FOA-0003261
- Issue Date: Jan 18,2024
- Proposals due: March 4, 2024
- No LOIs or preapplications

- Subject of next year's presentations from this FOA

Number of Proposal	Submitted	Awarded
Applications	25	9

FY2024 RESEARCH AND DEVELOPMENT FOR NEXT GENERATION NUCLEAR PHYSICS ACCELERATOR FACILITIES

FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) NUMBER:
DE-FOA-0003261

FOA TYPE: INITIAL
CFDA NUMBER: 81.049

FOA Issue Date:	January 18, 2024
Submission Deadline for Applications:	March 4, 2024 at 11:59 PM, Eastern Time

FY2024 NP Accelerator FOA DE-FOA-0003261 P-2

- *Accelerator R&D in the following general categories:*
  - *Accelerator R&D that significantly advances the state-of-the art accelerator capabilities of relevance to next generation machines for the study of nuclear physics.*
  - *Accelerator R&D that significantly advances the state-of-the art accelerator capabilities of relevance to improving the performance of existing facilities studying nuclear physics.*
- *Proposals in the following areas were particularly encouraged:*
  - *Transformative accelerator R&D in SRF technology for restoring cryomodule performance at SRF-based accelerator facilities.*
  - *Transformative accelerator R&D in next generation ion and electron sources.*
- *Application requirements:*
  - **Eligible Institutions:** Universities/colleges, non-profit and small business as collaborators, DOE/NNSA labs
  - **Estimated award size/duration:** Up to $1.0M/year; Award duration: 2 years
  - **Estimated total funding:** up to $8M over two years (~$4.6 in FY 2024). Actual FY204: $3.7M total
- *Reviews and Awards:*
  - ***Panel reviewed:*** *April 29-May 2, 2024*
  - ***Total Applications****: 25, 2 collaborative, 23 single institutions*
  - ***Number of awards:*** *9*

FY2024 NP Accelerator FOA Awards

- Subject of next year's Exchange meeting presentations

	NP FY2024 Accelerator R&D DE-FOA-0003261 and invited proposal awards			
#	Proposal ID	Institution	Proposal Title	PI
1	0000280525	LBNL	Development of a MARS superconducting cold mass for future generations of ECRIS	Todd, Damon
2	280493	ODU sub/ w TJNAF	Fabrication of Spin Polarized Electron Sources with High Polarization and QE for DOE NP	Marsillac, Sylvain
3	0000280552	MSU	Research and Development of a Solid-Stopper for the Facility for Rare Isotope Beams (SOL)	Camargo Villari, Antonio
4	0000280528	MSU	Development of Novel Diagnostics and Tuning Techniques for High-Intensity Multiple-Charge Heavy-Ion Beams in Accelerators	Ostroumov, Peter
5	0000280558	Cornell U	Testing of polarized and unpolarized photocathodes with high average current at the enhanced HERACLES facility at Cornell University	Bazarov, Ivan
6	280519	TJNAF	In Situ Plasma Processing of Superconducting Cavities	Powers, Thomas
7	280527	TJNAF	Develop a high-power, continuous beam positron target	Covrig Dusa, Silviu
8	280544	ANL	Toward Ion Linac Accelerators Based on Niobium-Tin	Kelly, Michael
	0000280555	FNAL	same	Eremeev, Grigory
	0000280294	Radiabeam	same	Kutsaev, Sergey
9	280551	BNL sub w/ SNL	Superlattice structures with Distributed Bragg Reflector for intense spin polarized electron beams	Cultrera, Luca

PIER Plan

Promoting Inclusive and Equitable Research

- ***For all FY2023 and beyond SC FOA applications:***

  - *All new and renewal applications must provide a Promoting Inclusive and Equitable Research (PIER) Plan as an appendix to the research narrative.*

- As a result, a new criteria (PIER) is added to the four existing SC Merit Review criteria
  - *Scientific and/or Technical Merit of the Project;*
  - *Appropriateness of the Proposed Method or Approach;*
  - *Competency of Applicant's Personnel and Adequacy of Proposed Resources;*
  - *Reasonableness and Appropriateness of the Proposed Budget; and*
  - *Quality and Efficacy of the Promoting Inclusive and Equitable Research (PIER) Plan.*

  Link to SC website https://science.osti.gov/grants/Applicant-and-Awardee-Resources/PIER-Plans

- *PIER Criterion Questions:*
  - *Is the proposed Promoting Inclusive and Equitable Research (PIER) Plan suitable for the size and complexity of the proposed project and an integral component of the proposed project?*
  - *To what extent is the PIER plan likely to lead to participation of individuals from diverse backgrounds, including individuals historically underrepresented in the research community?*
  - *What aspects of the PIER plan are likely to contribute…*

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Communications between NP and PI for Accelerator R&D work

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 are asked to submit quarterly reports to NP in a “Small Project” format. The FY2023 4th quarter request was received recently. Quarterly reports are reviewed by the Division (they are not just filed away).

- 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:** In-person AI/ML exchange meeting Dec 4-5 to cover 15 FY2023 FOA awards and remaining awards for the FY2021 FOA

NP Matrix for Quarterly Report Review and PM Assessment.

Include brief and clear responses to these NP Matrix questions in your quarterly reports.

- *NP matrix for Quarterly Report and progress assessment.*
- *Make sure your quarterly reports addresses elements of this matrix for our evaluation*
- *Continue to use the NP "small Project" template Ms. Saryna Camron sends you.*

These questions are for the NP PM and your response are only part of the information I use to arrive at my own assessments.

1-	**PI's performance during the quarter**
a	Progress made
b	Milestones met
c	Any breakthrough
2-	**Assessment of risk mitigation**
a	Issue comunicated?
b	appropriate mitigation strategies
3-	**Likelihood of achieving project goals**
a	Will they meet cost and schedule
b	Will they deliver the promised scope
4-	**Recommendation on need for action**
a	Are there any actions you need to take in response to points above

PI Exchange Meeting, Dec 2, 2024- Virtual

- Presentations on status of work by all Principal Investigators (PIs) who received awards
  - All 8 FY 2022 FOA DE-FOA-0002670 awards
  - One FY 2020 FOA DE-FOA-0001230 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 2022 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				

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.

Here is the link on Acknowledgment:
https://science.osti.gov/Funding-Opportunities/Acknowledgements

DRAFT AGENDA : 2024 NP Accelerator R&D PI Exchange Meeting, MONDAY, December 2, via Zoom

https://www.zoomgov.com/j/1617754962?pwd=RVdIeNTHHN7gpsVcp60b7HXsEIQSNM.1

Meeting ID: Passcode:

Work #	Time (E.S.T)	Dur. (min)	Principal Investigator	Institution	R&D Area	Presentation Title	Speaker(s)
	10:00	5	-	DOE NP	-	Introductory Remarks	Mantica
	10:05 AM	35	-	DOE NP	-	NP supported Accelerator R&D and AI/ML	Farkhondeh
1	10:40 AM	35	Marsillac, Sylvain Poelker, Matthew Wang, Erdong	ODU TJNAF BNL	Polarized Sources	Enhancing the Design of Photocathodes with 90% polarization and QE > 1% for DOE NP	Marsillac
2	11:15 AM	35	Bazarov, Ivan	Cornell	Electron Sources	High current sources for spin polarized and un-polarized electron beams	Andorf/ Bazarov
	11:50 AM	**15**	**Break**				
3	12:05 PM	35	Kelly, Michael Kutsaev, Sergey Posen, Sam	ANL RadiaBeam FNAL	SRF	A Practical Niobium-Tin Cavity for the ATLAS Superconducting Linac	Kelly
4	12:40 PM	35	Ferracin, Paolo	LBNL-88 inch	Next Gen Ion source	Development of a MARS superconducting cold mass for future generations of ECRIS	Ferracin
	1:15 PM	**60**	**Lunch**				
5	2:15 PM	35	Powers, Tom	TJNAF	Plasma Processing	In Situ Plasma Processing of Superconducting Cavities	Powers
6	2:50 PM	35	Saito, Kenji	MSU	SRF Cryomodules	Development of Transformative Preparation Methods to Push up High Q&G Performance of FRIB Spare HWR Cryomodule Cavities	Saito
7	3:25 PM	35	Okamura, Masahiro	BNL	Laser Ion Source	Development of high current highly charged laser ion source	Okamura
	4:00 PM	**15**	**Break**				
8	4:15 PM	35	Qiang, Ji Hao, Yue Gu, Xiaofeng	LBNL MSU BNL	Beam dynamics modeling	Advanced Modeling of Beam Physics and Performance Optimization for Nuclear Physics Colliders	Qiang
9	4:50 PM	35	Jordan, Kevin	TJNAF	RF sources	1497 MHz Vertical Slice Test of Magnetron & Superconducting Cavity	?
	Accelerator R&D FY2020-2021 Awards -under No Cost Extension (NCE)**						
10**	5:25 PM	25	Hernandez-Garcia, Carlos	TJNAF	Electron Sources	High Voltage Insulators and Electrodes for 500 kV DC High Voltage Photogun with Inverted Insulator Design	Hernandez-Garcia
	5:50 PM	5	Closing Remarks				
	5:55 PM		**Adjourn**				
**	**No Cost Extension**						

BACKUP SLIDES

FY2024 NP Accelerator FOA DE-FOA-0003261 P-2

Solicitation S&T Scope: **DE-FOA-0003261; issue date: January 18, 2024**

- Research focused on accelerator relevant to current- or next-generation Office of Nuclear Physics (NP) accelerator facilities.

Program Planning/Context:

- Accelerator R&D that significantly advances the state-of-the art accelerator capabilities of relevance to next generation machines for the study of nuclear physics.
- Accelerator R&D that significantly advances the state-of-the art accelerator capabilities of relevance to improving the performance of existing facilities studying nuclear physics.

In particular, applications in the following areas are encouraged:

- Transformative accelerator R&D in SRF technology for restoring cryomodule performance at SRF-based accelerator facilities. One example is R&D to establish practical and reproduceable in situ plasma processing techniques.
- Transformative accelerator R&D in next generation ion and electron sources.

Program Coordination: NP-only FOA, coordinated with SC Working Group in Accelerator R&D.

Application requirements:

- **Eligible Institutions:** Universities/colleges, non-profit and small business as collaborators, DOE/NNSA laboratories only; New single- or multi-PI proposals.
- **Estimated award size/duration:** Up to $1.0M/year for universities and DOE Laboratories; Award duration: 2 years
- **Estimated total funding:** up to $8M over two years (~$4.6 in FY 2024).
- **Preproposals are required:** No Preproposal is required.