Nuclear Physics

Overview
The Nuclear Physics (NP) program's mission is to explore the nature of matter: understanding how protons and neutrons are formed from elementary particles and how they interact to form elements, observed properties, and phenomena. Addressing this mission requires a broad range of experimental capabilities and theoretical approaches. Best-in-class accelerators at scientific user facilities are used to collide particles at nearly the speed of light, producing short-lived forms of nuclear matter for experimental investigation. Theoretical advances use leadership computing facilities to explore the interactions of quarks and gluons as described by quantum chromodynamics. The program's science output benefits society in numerous fields: energy, commerce, nuclear medicine, and national security.

Highlights of the FY 2026 Request
The NP FY 2026 Request for $767.9 million is a decrease of $57.7 million below the FY 2025 Enacted level. The Request balances support for priorities in forefront fundamental nuclear physics research, including initiatives in artificial intelligence (AI) and quantum information science (QIS), facility operations, and facility construction.

Research
NP is the primary steward of the nation's nuclear physics research portfolio, providing approximately 95 percent of the U.S. investment in this area. The program focuses on the highest priorities in nuclear physics to maintain U.S. leadership by:
- Characterizing the quark-gluon plasma using data from the Relativistic Heavy Ion Collider (RHIC) and the Large Hadron Collider (LHC)
- Exploring the fundamental structure of nucleons at the sub-femtometer scale at the Continuous Electron Bean Accelerator Facility (CEBAF) and in preparation for the future Electron-Ion Collider (EIC)
- Probing the limits of nuclear existence and the process for heavy element production in stars at the Facility for Rare Isotope Beams (FRIB) and the Argonne Tandem Linac Accelerator System (ATLAS)
- Discovering if the neutrino is its own anti-particle via the search for neutrino-less double beta decay (NLDBD)
- Advancing forefront methods and techniques in nuclear theory, and interpretation of experimental data
- Curating reliable, accurate Nuclear Data for basic nuclear research and nuclear technologies
- Advancing AI and machine learning (ML) analysis tools to increase the efficiency of nuclear data analyses and to improve the quality of accelerator operations and experimental planning
- Applying key nuclear science expertise for innovation in qubit research and quantum theory, for QIS technologies for future sensors, and for the pursuit of ultraprecise nuclear clocks.

Facility Operations
Funding balances support for user access with the need to ensure safe operations of the NP scientific user facilities, enabling world-class science:
- RHIC will operate up to 1,500 hours to complete the super Pioneering High Energy Nuclear Interaction eXperiment (sPHENIX) science program.
- CEBAF operates 3,300 hours for the highest priority 12 GeV experiments.
- ATLAS operates 5,950 hours for compelling research in nuclear structure and astrophysics.
- FRIB operates 4,000 hours discovering and characterizing nuclei at the extremes of the nuclear chart.

Projects
The Request for Construction and Major Items of Equipment (MIEs) includes:
- Continued support for design and early construction for the EIC, the highest priority for facility construction in the Long Range Plan for Nuclear Physics to maintain U.S. leadership in nuclear physics and accelerator technology.
- No new funding is requested for two ongoing MIEs, the LEGEND-1000 ton scale NLDBD experiment and the High Rigidity Spectrometer at FRIB. These projects will make progress using prior year balances.

Nuclear Physics
Funding

	(dollars in thousands)			
	FY 2024 Enacted	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
Nuclear Physics				
Medium Energy, Research	51,555	51,455	36,464	-14,991
Medium Energy, Operations	141,930	146,242	151,060	+4,818
Total, Medium Energy Physics	**193,485**	**197,697**	**187,524**	**-10,173**
Heavy Ion, Research	47,454	47,454	37,004	-10,450
Heavy Ion, Operations	187,000	187,000	196,805	+9,805
Heavy Ion, Projects	2,850	2,850	2,850	–
Total, Heavy Ion Physics	**237,304**	**237,304**	**236,659**	**-645**
Low Energy, Research	76,667	76,967	51,243	-25,724
Low Energy, Operations	125,617	134,646	140,003	+5,357
Low Energy, Projects	6,000	5,259	–	-5,259
Total, Low Energy Physics	**208,284**	**216,872**	**191,246**	**-25,626**
Theory, Research	69,927	63,727	42,431	-21,296
Total, Nuclear Theory	**69,927**	**63,727**	**42,431**	**-21,296**
Subtotal, Nuclear Physics	**709,000**	**715,600**	**657,860**	**-57,740**
Construction				
20-SC-52 Electron Ion Collider (EIC), BNL	95,000	110,000	110,000	–
Subtotal, Construction	**95,000**	**110,000**	**110,000**	**–**
Total, Nuclear Physics	**804,000**	**825,600**	**767,860**	**-57,740**

SBIR/STTR funding:

- FY 2024 Enacted: SBIR $7,622,000 and STTR $1,147,000
- FY 2025 Enacted: SBIR $7,622,000 and STTR $1,072,000
- FY 2026 Request: SBIR $5,303,000 and STTR $746,000

Nuclear Physics
Explanation of Major Changes

	(dollars in thousands) FY 2026 Request vs FY 2025 Enacted
Medium Energy Physics The Request will support CEBAF accelerator complex operations for 3,300 hours. The Request will support the highest priority research, including participation in the SC initiatives for QIS, AI/ML, and Microelectronics.	-10,173
Heavy Ion Physics In anticipation of discontinuing RHIC operations for the construction of the EIC, RHIC will operate up to 1,500 hours to complete the sPHENIX science program. Funding will support the highest priority research in heavy ion nuclear physics at universities and national laboratories, including support for the SC initiatives for QIS and AI/ML. The Request will continue other project costs (OPC) for the EIC, which will enable scientists to complete R&D and the development of scientific instrumentation and accelerator components for the EIC. The Request also will support Established Program to Stimulate Competitive Research (EPSCoR) and early career awards in EPSCoR jurisdictions.	-645
Low Energy Physics The Request will support operations of two low energy user facilities: the ATLAS facility, which operates for 5,950 hours, and FRIB, which will provide beam time for 4,000 hours. The Request will sustain operations of the 88-Inch Cyclotron for a limited in-house nuclear science program focused on the search for element 120 and an electronics irradiation capability. Funding will support the highest priority nuclear structure and astrophysics at universities and national laboratories.	-25,626
Nuclear Theory Funding will support the highest priority theory research efforts at laboratories and universities, the U.S. Nuclear Data Program, specialized Lattice quantum chromodynamics (QCD) computing hardware at Thomas Jefferson National Accelerator Facility (TJNAF), and participation in the Scientific Discovery through Advanced Computing (SciDAC) program. The Request will support initiatives in AI/ML and QIS.	-21,296
Construction The Request will provide funding for the EIC to continue Project Engineering and Design activities and execute long-lead procurements and early construction.	$ —
Total, Nuclear Physics	-57,740

Basic and Applied R&D Coordination

The NP mission supports the pursuit of unique opportunities for R&D integration and coordination with other DOE Program Offices, Federal agencies, and non-Federal entities, including coordination across DOE on AI/ML; across SC and with other agencies on QIS; coordination of neutrino research and international partnerships in accelerators with HEP; on forefront computing resources and technical expertise through the SciDAC projects and Lattice QCD research (ASCR and HEP); cross-section and decay data coordination through the U.S. Nuclear Data Program (Federal Bureau of Investigation [FBI], National Nuclear Security Administration [NNSA], Nuclear Energy [NE], FES and BES); capabilities and techniques to test electronics for radiation sensitivity (NASA and DOD); accelerator research and enhancing U.S.-based supply chains for critical accelerator technologies (HEP); and research in developing neutron, gamma, and particle beam sources with applications in cargo screening (NNSA, DHS, and the FBI).

Program Accomplishments

Leading the Way to Discovery of New SuperHeavy Elements

The discovery of a new element is fundamentally significant for chemistry and physics. Today, the element with the highest number of protons (118) is oganesson. An international team led by Lawrence Berkeley National Laboratory (LBNL) has shown a new path to expanding the nuclear chart to higher proton using beams of titanium ions on actinide (radioactive) targets. The measurement showed that the element livermorium (Lv) with 116 protons can be produced with a titanium-50 beam incident on a plutonium-244 target. This demonstration marks the beginning of a new chapter of superheavy element production and research, setting the stage for concerted efforts within the U.S. to produce nuclei having 120 protons.

Discovery of New Isotopes to Better Understand the Cosmos

Accelerating a uranium beam with unprecedented power at the Facility for Rare Isotope Beams (FRIB) enabled the production and identification of three new isotopes, gallium-88, arsenic-93, and selenium-96, within the first 8 hours of operation with this beam. FRIB has also accelerated a platinum beam, leading an international team to produce and identify five more new isotopes: thulium with masses 182 and 183, ytterbium-186 and 187, and lutetium-190. The identification of these new isotopes requires distinguishing them from hundreds of simultaneously produced isotopes, then characterizing the new isotopes in detail – information important for understanding the elemental fingerprint of the universe.

Nuclear Data Efforts for Future Nuclear Reactors

Molten Chloride Salt Fast Reactors (MCFRs), such as the ones being developed commercially, offer a new path for reliable energy production. It was believed that these reactors, which utilize uranium chloride salt fuel, would require the use of isotopically-enriched chlorine to mitigate absorption of the required neutrons, increasing the cost of each reactor by tens of millions of dollars. A coordinated experiment and modeling effort involve industry, national laboratory, and university researchers showed that enrichment of chlorine would not be necessary, saving cost and advancing the timetable associated with the fielding of an MCFR.

Quantum Computing to Understand Entanglement of Quark Jets

Quantum entanglement is at the heart of the difference between quantum and classical physics: it states that two entangled particles cannot be described as independent even when they are separated by a large distance. Physicists from Stony Brook University and Brookhaven National Laboratory (BNL) have used quantum computing methods to investigate the entanglement of narrow cones, or jets, of elemental particles produced by high-energy quarks. They find that the produced jets are indeed entangled, and this entanglement is significantly affected by the confinement of quarks. Their findings are useful for experiments that seek to establish entanglement experimentally in physics experiments and also demonstrate how to leverage existing computing assets for quantum calculations until more practical quantum computers come along.

Description

The Medium Energy Physics subprogram focuses primarily on experimental tests of the theory of the strong interaction, known as Quantum Chromodynamics (QCD), aiming to address specific questions including: How does QCD generate the spectrum and structure of conventional and exotic hadrons? How do the mass and spin of the nucleon emerge from the quarks and gluons inside and their dynamics? How are the pressure and shear forces distributed inside the nucleon? How does the quark–gluon structure of the nucleon change when bound in a nucleus? How are hadrons formed from quarks and gluons produced in high-energy collisions?

The research activity supports high priority research at universities and national laboratories and carries out high priority experiments at CEBAF at the Thomas Jefferson National Accelerator Facility (JLab) and elsewhere. Scientists use various experimental approaches to determine the distribution of up, down, and strange quarks, their antiquarks, and gluons within protons and neutrons, as well as clarifying the role of gluons in confining the quarks and antiquarks within hadrons. Experiments that scatter electrons off protons, neutrons, and nuclei are used to elucidate the effects of the quark and gluon spins within nucleons, and the effect of the nuclear medium on the quarks and gluons. The subprogram also supports experimental searches for higher-mass "excited states" and exotic hadrons predicted by QCD, as well as studies of their various production mechanisms and decay properties.

CEBAF operations provide high quality beams of polarized electrons that allow scientists to extract information on the quark and gluon structure of protons and neutrons from measurements of how the electrons scatter when they collide with nuclei. CEBAF also uses highly-polarized electrons to make very challenging precision measurements that may reveal processes that violate a fundamental symmetry of nature, called parity, in order to search for physics beyond what is currently described by the Standard Model of particle physics. These capabilities are unique in the world. Universities and national laboratories conduct complementary, focused experiments that require different capabilities.

A high scientific priority for this community is addressing an outstanding grand challenge question of modern physics: how the fundamental properties of the proton such as its mass and spin are dynamically generated by the extraordinarily strong color fields resulting from dense systems of gluons in nucleons and nuclei. In the future, the Electron-Ion Collider (EIC) will address this science. Scientists and accelerator physicists from the Medium Energy subprogram are strongly engaged and play significant leadership roles in the development of the scientific agenda and implementation of the EIC.

Transformative accelerator research and development (R&D) efforts advance approaches in superconducting radiofrequency (SRF) technology and accelerator science aimed at improving the operations of existing facilities and developing next-generation facilities for nuclear physics. Nuclear physicists participate in activities related to quantum information science (QIS) and quantum computing (QC), in coordination with other SC research programs. NP-specific efforts include R&D on quantum sensors to enable precision measurements, development of quantum sensors based on atomic-nuclear interactions, and development of quantum computing algorithms applied to quantum mechanical systems and NP topical problems. Scientists develop cutting-edge techniques based on artificial intelligence and machine learning (AI/ML) of relevance to nuclear science research and accelerator facility operations. Scientists participate in the SC initiative on microelectronics (R&D), emphasizing unique microelectronics that survive in cryogenic and high radiation environments.

The Request also continues support for honoraria for awards, including the Enrico Fermi Awards and the Ernest Orlando Lawrence Awards.

Activities and Explanation of Changes

(dollars in thousands)

FY 2025 Enacted		FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
Medium Energy Physics	**$197,697**	**$187,524**	**-$10,173**
Research	$51,455	$36,464	-$14,991
Funding continues to support core research. Scientists, resident at TJNAF, RHIC, universities, and other national laboratories, participate in high priority experiments to acquire data; develop, implement, and maintain scientific instrumentation; analyze data and publish experimental results; and train students in nuclear science and accelerator science. Funding supports continued analysis of RHIC polarized proton beam data to learn more about the origin of the proton's spin. Funding supports the development of detector design to be used at the EIC and further develop the scientific program. Funding continues to support researchers to pursue transformative accelerator science to improve operations of current and future NP facilities including applications of AI/ML. Research on Microelectronics continues to study detector materials, devices, advances in front-end electronics, and integrated sensor/processor architectures. Scientists conduct research on quantum sensors to enable precision NP measurements, development of quantum sensors based on atomic-nuclear interactions.		The Request will continue to support high priority experiments; develop, implement, and maintain scientific instrumentation; analyze data and publish experimental results; and train students in nuclear and accelerator science. The Request will support continued analysis of RHIC polarized proton beam data to investigate the origin of proton spin and will support the development of the EIC scientific program. The Request will continue transformative accelerator science to improve operations of current and future NP facilities including applications of AI/ML. Research on microelectronics and quantum sensors to enable precision measurements will continue.	The Request will focus investment on the highest priority research that utilizes CEBAF, RHIC data, and other facilities. Funding will increase for AI/ML approaches for NP research.

(dollars in thousands)

FY 2025 Enacted		FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
Operations	$146,242	$151,060	+$4,818
Funding for operations of the CEBAF facility supports the continuation of the high priority experiments in the 12 GeV science program. Funding provides 3,294 operational hours for research, beam development, and beam studies. Funding supports CEBAF operations, including mission readiness of the accelerator, all power and consumables of the site, cryogenics plant, activities to reduce helium consumption, activities to improve accelerator performance and reliability, high priority facility and instrumentation capital equipment, high priority accelerator improvement and GPP projects, and the key computing capabilities for data taking and analysis. Funding supports maintenance of critical core competencies and accelerator scientists, engineers, and technicians, and operations staff. Funding supports targeted facility capital equipment and accelerator improvements to modernize SRF equipment. Lab GPP investments advance the most urgent components of the Campus Strategy for infrastructure. Funding supports the participation of accelerator scientists in accelerator R&D activities, including those for the EIC.		The Request for operations of the CEBAF facility will support high priority experiments in 12 GeV science, providing 3,300 operational hours for research, beam development, and beam studies. The Request will support mission readiness of the CEBAF accelerator including all power and consumables, activities to reduce helium consumption and improve accelerator performance and reliability, high priority capital equipment, accelerator improvement, and key computing capabilities. The Request will support required staff for operations and participation in accelerator and SRF R&D. Lab GPP will advance the most urgent components of the campus strategy for infrastructure.	The Request will increase operations hours while continuing support of the highest priority experiments and activities to improve CEBAF reliability and performance.

Note:

- *Funding for the subprogram above includes 3.65 percent of research and development (R&D) funding for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs, excluding facility operations.*

Description

The Heavy Ion Physics subprogram focuses on studies of nuclear matter at extremely high densities and temperatures, directed primarily at answering overarching questions in nuclear physics, including: How do the fundamental interactions between quarks and gluons lead to the perfect fluid behavior of the quark-gluon plasma (QGP)? What are the limits on the fluid behavior of matter? What are the properties of quantum chromodynamic (QCD) matter? What is the correct phase diagram of nuclear matter?

Scientists have used the Relativistic Heavy Ion Collider (RHIC) to pioneer the study of condensed quark-gluon matter at the extreme temperatures, characteristic of the infant universe. With careful measurements, nuclear physicists have been accumulating data using the Solenoid Tracker at RHIC (STAR) detector and the super Pioneering High Energy Nuclear Interaction eXperiment (sPHENIX) detector to gain insights into the processes early in the creation of the universe, and how protons, neutrons, and other parts of normal matter developed from that plasma. Important avenues of investigation are directed at learning more about the physical characteristics of the QGP and discovering whether a critical point exists demonstrating a first order phase transition between normal nuclear matter and the QGP. Scientists working in Heavy Ion physics leverage discovery opportunities in sensing, simulation, and computing with QIS and QC. AI/ML applications are also pursued to optimize operation of the complex accelerators and detectors at RHIC with applications to other user facilities in the NP program.

Collaboration at the Large Hadron Collider (LHC) at CERN provides U.S. researchers the opportunity to investigate states of matter under substantially different initial conditions than those provided by RHIC. Data collected by A Large Ion Collider Experiment (ALICE), the Compact Muon Solenoid (CMS), and ATLAS detectors confirm that the QGP discovered at RHIC is also seen at the higher energy, and comparisons of results from LHC to those from RHIC have led to important new insights.

Understanding how the fundamental properties of the proton such as its mass and spin are dynamically generated is a U.S. nuclear science community high scientific priority. The answer to this question is key to addressing an outstanding grand challenge problem of modern physics: how QCD—the theory of the strong force that explains all strongly interacting matter in terms of quarks interacting via the exchange of gluons—acts in detail to generate the “macroscopic” properties of protons and neutrons. The NSAC Long Range Plan identified the EIC as the highest priority for facility construction and recommended its expeditious completion. BNL is partnering with JLab to design and establish the EIC at BNL. Scientists and accelerator physicists from the Heavy Ion and the Medium Energy sub-programs are partnering to advance the EIC, both playing significant leadership roles in the development of the scientific agenda and implementation of the EIC.

Over the course of the construction and implementation of the EIC, RHIC operations funding will decrease as scientific staff, engineers and technicians move from RHIC operations to the EIC project. These individuals represent the scientific and technical workforce that are essential to the operations of RHIC, and eventually the EIC. RHIC accelerator scientists have critical core competencies in collider operations that cannot easily be replaced; their support is embedded in the EIC total project cost, and they represent the core facility operations force of RHIC and the EIC. Throughout the EIC project, the temporary reprioritization of funds from the collider facility operations budget to the construction budget will effectively offset funds needed to implement the EIC, enabling a cost-effective path forward to the implementation of this world-leading facility.

Completion of the RHIC science program is expected in FY 2026. RHIC injector complex operations will continue to maintain readiness for EIC operations and to allow for symbiotic, parallel, cost-effective operations of the Brookhaven Linac Isotope Producer Facility (BLIP) supported by the DOE Isotope Program to produce research and commercial isotopes critically needed by the Nation, and of the NASA Space Radiation Laboratory Program for the study of space radiation effects applicable to human space flight as well as electronics.

EPSCoR will focus on implementation awards for development of research capacity and infrastructure for NP topics in EPSCoR jurisdictions.

Activities and Explanation of Changes

(dollars in thousands)

FY 2025 Enacted		FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
Heavy Ion Physics	**$237,304**	**$236,659**	**-$645**
Research	$47,454	$37,004	-$10,450
Funding supports scientists resident at RHIC, universities, and other national laboratories to develop, fabricate, implement, and maintain scientific instrumentation; participate in experimental runs to acquire data; analyze data and publish experimental results; develop scientific plans and instrumentation for the EIC; and train students in nuclear science. U.S. scientists participate in the high priority heavy ion efforts and instrumentation upgrades at the international ALICE, CMS, and ATLAS LHC experiments. Funding supports accelerator R&D relevant to NP programmatic needs. Research activities support the recompetition/renewal of the NQISRCs, and AI/ML aimed at applications of artificial neural networks to nuclear physics research and the optimization of accelerator performance. Funding supports EPSCoR implementation grants and early career awards.		The Request will continue to support heavy ion research at universities and national laboratories for high priority experiments; to develop, implement, and maintain scientific instrumentation; to analyze data and publish experimental results; to contribute to the future EIC science program; and to train students in nuclear and accelerator science. Support will continue for participation and instrumentation upgrades for international experiments (ALICE, CMS, and ATLAS LHC). The Request will continue transformative accelerator science for current and future NP facilities, including applications of AI/ML. Research will continue for QIS and EPSCoR grants and early career awards.	Funding will focus on the highest priority heavy ion and QIS research. Funding will increase for AI/ML approaches for NP research.

(dollars in thousands)

FY 2025 Enacted		FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
Operations	$187,000	$196,805	+$9,805
Funding supports RHIC operations at 3,264 hours. Funding supports the RHIC accelerator complex, including mission readiness and development of the experimental halls and instrumentation, mission readiness of the suite of accelerators, all power and consumables of the site, cryogenics plant, activities to reduce helium consumption, high priority facility and instrumentation capital equipment, high priority accelerator improvement projects, and computing capabilities for data taking and analysis. Support provides critical core competencies and accelerator scientists, engineers, and technicians, for collider operations. Accelerator scientists conduct research aimed at improving the operations of the RHIC accelerator complex.		The Request will support RHIC operations at 1,500 hours to complete the science program with sPHENIX and support the RHIC injector complex including high priority facility and instrumentation capital equipment, high priority accelerator improvement projects, and computing capabilities for analysis.	Funding for operations will aim to complete the RHIC science program and maintain the RHIC injector complex that will eventually support the EIC. Funding will continue to support the reprioritization effort to support EIC.
Projects	$2,850	$2,850	$ —
EIC OPC funds supports continued design efforts as well as research and development to increase technical readiness as the project prepares for CD-2.		EIC OPC funds will support the research and development that mitigates technical risk for design of accelerator and detector subsystems.	No change.

Note:

- *Funding for the subprogram above includes 3.65 percent of research and development (R&D) funding for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs, excluding facility operations.*

Description

The Nuclear Theory subprogram includes activities in Nuclear Theory, Nuclear Data, Nuclear Theory Computing, and the AI and QIS initiatives.

The Nuclear Theory activity provides theoretical support to interpret the wide range of data obtained from the experimental nuclear science subprograms and to advance new ideas and hypotheses for future experimental investigations. A major theme of theoretical nuclear physics research is understanding the mechanisms and effects of quark confinement and deconfinement. A quantitative description of these phenomena through quantum chromodynamics (QCD) is one of this subprogram's greatest intellectual challenges. New theoretical and computational tools are also under development to describe nuclear many-body phenomena; these approaches will likely impact applications in condensed matter physics and other areas of the physical sciences. Theoretical nuclear astrophysics research includes efforts to understand the origins of the elements in the cosmos and what the nature of the neutrino may reveal about the evolution of the early universe. This subprogram supports collaborations within the university and national laboratory communities to address highest priority topics in nuclear theory that merit concentrated, team-based theoretical efforts.

The Nuclear Data activity maintains the U.S. Nuclear Data Program (USNDP), targets high-priority nuclear data needs of relevance to the NP mission, and leads an interagency working group including the NNSA, NE, FES, DOE IP, and other federal agencies to coordinate targeted experimental efforts. The USNDP provides current, accurate, and authoritative data to basic and applied areas of nuclear science and engineering, maintaining public access to extensive nuclear physics databases of national and international importance and supporting approximately five million nuclear data retrievals annually. Research addresses gaps in nuclear data through targeted experiments and development/use of theoretical models. The National Nuclear Data Center (NNDC) at BNL manages the USNDP. The NNDC is designated as an SC Public Reusable Research (PuRe) Data Resource, a designation commensurate with high standards of data management, resource operation, and scientific impact.

The Nuclear Theory Computing activity leverages lattice QCD calculations that are critical for understanding and interpreting many of the experimental results from RHIC, LHC, and CEBAF. NP supports lattice QCD computing with investment in dedicated computational resources at TJNAF. The activity supports SciDAC, a collaborative program with ASCR that partners NP scientists and computer experts to address major scientific challenges that require capabilities of supercomputer facilities.

Nuclear theorists are active in quantum information science (QIS) and quantum computing, through R&D on quantum sensors to enable precision measurements, development of quantum sensors based on atomic-nuclear interactions, R&D on nuclear physics techniques to enhance qubit coherence times, and development of quantum computing algorithms applied to quantum mechanical systems and NP topical problems. In partnership with other SC programs, NP continues its role in jointly stewarding NQISRCs that focus on building the fundamental tools necessary for the U.S. leadership in QIS.

The Request provides growing support for the development of cutting-edge techniques to accelerate nuclear science by incorporating next generation AI/ML at the nexus of experiment, simulation, and theory that cross multiple energy scales.

Activities and Explanation of Changes

(dollars in thousands)

FY 2025 Enacted		FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
Nuclear Theory	**$63,727**	**$42,431**	**-$21,296**
Research	$63,727	$42,431	-$21,296
Funding supports high priority QIS efforts. LQCD computing investments continue at TJNAF. Funding supports high priority theoretical research at universities and national laboratories for the interpretation of experimental results obtained at NP facilities, and the exploration of new ideas and hypotheses that identify potential areas for future experimental investigations. Theorists focus on applying QCD to a wide range of problems from nucleon structure and hadron spectroscopy, through the force between nucleons, to the structure of light nuclei. Advanced dynamic calculations to describe relativistic nuclear collisions and nuclear structure and reactions continues to focus on activities related to the research program at the upgraded 12 GeV CEBAF facility, the research program at FRIB, and ongoing and planned RHIC experiments. Funding supports the fourth year of SciDAC-5 grants, as well as the third year of theory topical collaborations. Funding will target investments in an initiative to develop cutting-edge AI/ML techniques of relevance to nuclear science research, and accelerator facility operations. Within available resources, NP is prioritizing transitioning ECP researchers, software, and technologies into core research efforts and other DOE priority research areas as ECP concludes.		The Request will support high priority theoretical research at universities and national laboratories. Theorists will focus on applying QCD to nucleon structure and hadron spectroscopy, the force between nucleons, and the structure of light nuclei. Advanced dynamic calculations to describe relativistic nuclear collisions and nuclear structure and reactions will continue. The Request will support the fifth year of SciDAC grants, the fourth year of theory topical collaborations, and high priority QIS efforts. Target investments will develop cutting-edge AI/ML techniques of relevance to nuclear science research.	Investments will focus on the highest priority research in nuclear theory, with expanded support for AI/ML.

(dollars in thousands)

FY 2025 Enacted	FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
Funding continues the expanded USNDP efforts to collect, evaluate, and disseminate nuclear physics data for basic nuclear research and for applied nuclear technologies and their development.	The Request will continue USNDP efforts to collect, evaluate, and disseminate nuclear physics data for basic nuclear research and for applied nuclear technologies.	USNDP will target areas most impactful to nuclear science and interagency partners.

Note:
- *Funding for the subprogram above includes 3.65 percent of research and development (R&D) funding for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs, excluding facility operations.*

Nuclear Physics
Low Energy Physics

Description

The Low Energy Physics subprogram includes activities in Nuclear Structure and Nuclear Astrophysics and Fundamental Symmetries.

Questions associated with nuclear structure include: What is the nature of the nuclear force that binds protons and neutrons into stable nuclei and rare isotopes? What are the limits of nuclear existence? What is the nature of neutron stars? How does matter behave at the most extreme densities in the universe? Relevant nuclear astrophysics questions are: What makes the sun shine? What are the origins of the elements in the cosmos? What are the nuclear reactions that drive stars and stellar explosions? NP research activities address these questions primarily using beams of stable and rare isotopes to develop a comprehensive description of nuclei and reveal new nuclear phenomena.

The ATLAS facility at the Argonne National Laboratory (ANL) is an SC scientific user facility and is the world's premiere facility for stable beams, providing high-quality beams of all stable elements up to uranium and selected short-lived nuclei beams using the Neutron-generator Upgrade to the Californium Rare Ion Breeder Upgrade (nuCARIBU) ion source. Increasing ATLAS capabilities via a Multi-User Upgrade are underway to address user demand. FRIB at Michigan State University (MSU), an SC scientific user facility since FY 2020, provides beams of rare isotopes to test the limits of nuclear existence and advance understanding of the atomic nucleus and the evolution of the cosmos. FRIB's scientific reach will be enhanced with the implementation of the Gamma-Ray Tracking Array (GRETA) and the High Rigidity Spectrometer (HRS). This subprogram supports operations of the LBNL 88-Inch Cyclotron for an in-house program studying the properties of newly discovered elements as well as conducting searches for new super-heavy elements. DOD and NASA exploit capabilities at the 88-Inch Cyclotron to develop radiation-resistant electronics for their missions. In addition, smaller university-based accelerator facilities are supported through this program to address specific research areas.

Questions related to fundamental symmetries of nature addressed in low energy nuclear physics experiments include: What is the origin of the matter–antimatter imbalance in the universe? Are neutrinos their own antiparticles, and how do they acquire mass? Are there more forces than the four we know about? Are there undiscovered, light, weakly-interacting particles? NP research addresses these questions through precision studies using neutron and electron beams and decays of nuclei, including beta decay, double-beta decay, and the search for neutrino-less double beta decay (NLDBD). NP is the steward of neutrino mass measurements and the search for NLDBD. NP has funded neutrino experiments, playing critical roles in partnerships with NSF and in successful international experiments that include U.S. scientific leadership. This subprogram supports experiments probing electric dipole moments of the neutron and atoms that would provide evidence for the violation of time reversal invariance and shed light on the matter/anti-matter imbalance in the universe.

The NSAC LRP recommended as the highest priority for new experiment construction that the U.S. lead an international consortium that will undertake a NLDBD campaign. The observation of NLDBD would have profound consequences for understanding the physical universe. NP, including this subprogram, has invested in R&D on candidate technologies for next–generation ton-scale NLDBD experiments. In the near-term, within the NLDBD program, NP will focus on implementing the Large Enriched Germanium Experiment for Neutrinoless Double Beta Decay one tonne (LEGEND-1000) project, in collaboration with international partners. LEGEND-1000 will deploy germanium-76 isotope incorporated into an array of solid-state detectors to reach a NLDBD lifetime limit of 10^{28} years within a planned ten-year measurement window.

Specific efforts include R&D on quantum sensors to enable precision measurements, development of quantum sensors based on atomic-nuclear interactions, and development of quantum computing algorithms applied to quantum mechanical systems and NP topical problems. Scientists develop cutting-edge techniques based on artificial intelligence and machine learning (AI/ML) of relevance to nuclear science research and accelerator facility operations.

Activities and Explanation of Changes

(dollars in thousands)

FY 2025 Enacted		FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
Low Energy Physics	**$216,872**	**$191,246**	**-$25,626**
Research	$76,967	$51,243	-$25,724
Funding supports high priority university and laboratory nuclear structure and nuclear astrophysics efforts at ATLAS and FRIB. Scientists participate in the characterization of recently discovered elements and search for new ones. Research will continue at the university-based Centers of Excellence at TUNL, CENPA, and TAMU. Scientists utilize AI/ML that can promote automated platforms to improve machine performance and reliability and advance detector design and data processing. High priority research in NLDBD continues. Funding continues support for U.S. participation in the operations of the international KATRIN experiment.		The Request will support high priority university and laboratory nuclear structure and nuclear astrophysics efforts. Scientists will participate in the characterization of recently discovered elements and search for new ones. Scientists utilize AI/ML that can promote automated platforms to improve machine performance and reliability and advance detector design and data processing. High priority research in NLDBD and fundamental symmetries will continue with a strategic mix of efforts.	Investment will focus on the highest priority research, including experiments at ATLAS and FRIB, and precision studies with neutron and electron beams. Funding will expand AI/ML research.
Operations	$134,646	$140,003	+$5,357
ATLAS will operate for 5,952 hours. Funding supports the operations, staff, maintenance, and high priority accelerator improvement projects and capital equipment for the facility and scientific instrumentation, including the development of a multi-user capability. Funding also supports operations at FRIB for 3,713 hours (89 percent of optimal funding) to execute the FRIB scientific program. Funding sustains operations of the 88-Inch Cyclotron for high priority experiments studying newly discovered elements.		ATLAS will operate for 5,950 hours and FRIB will operate for 4,000 hours. The Request will fund operations, staff, maintenance, as well as the implementation of new detector and accelerator capabilities at both facilities. The Request will sustain operations of the 88-Inch Cyclotron with focus on newly-discovered heavy elements.	The Request will increase operating hours while continuing support for the highest priority experiments at FRIB, ATLAS, and the 88-Inch Cyclotron.

(dollars in thousands)

FY 2025 Enacted		FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
Projects	$5,259	$ —	-$5,259
Funding continues support for the NLDBD MIE and the HRS research project.		The Request does not provide additional funding for the NLDBD MIE and the HRS research project.	Progress will continue with prior year funds on HRS and NLDBD focused on LEGEND-1000 in the near term.

Note:

- *Funding for the subprogram above includes 3.65 percent of research and development (R&D) funding for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs, excluding facility operations.*

Nuclear Physics
Construction

Description
This subprogram supports line-item construction for NP, including engineering, design, and construction. OPCs are funded in the relevant subprograms.

20-SC-52, Electron Ion Collider EIC, BNL
The FY 2026 Request, $110 million, will continue the construction effort for the EIC, which will be located at BNL. The estimated TPC range for the EIC project at CD-1, Approve Alternative Selection and Cost Range, is $1.7 billion to $2.8 billion. BNL has teamed with TJNAF to lead the development and implementation of the EIC. The EIC scope includes an electron injector, rapid cycling synchrotron, an electron storage ring, modifications to one of the two RHIC ion rings, one interaction region with a detector, support buildings, and other infrastructure. The project has attracted international collaboration and contributions. On February 7, 2024, the State of New York agreed to contribute $100 million for the construction of buildings to house equipment and technical infrastructure supporting the EIC accelerator and detector.

The EIC project will increasingly rely on RHIC scientists, engineers, and technicians as RHIC activities ramp down. This workforce has critical core competencies in collider operations essential to RHIC now and eventually to EIC operations. They cannot easily be replaced. The temporary reprioritization of funds from the collider facility operations budget to the construction budget will enable a cost-effective path forward to the implementation of this world-leading facility.

The EIC will maintain U.S. leadership in nuclear physics and accelerator technology and will address an outstanding question on how the fundamental properties of the proton, such as its mass and spin, are dynamically generated by the extraordinarily strong color fields resulting from dense systems of gluons in nucleons and nuclei, which has been a high priority for the U.S. nuclear science community for decades. The answer to this question is key to addressing a grand challenge problem of modern physics: how quantum chromodynamics—the theory of the strong force, which explains all strongly interacting matter in terms of quarks interacting via the exchange of gluons—acts to generate the "macroscopic" properties of protons and neutrons. The NSAC LRP recommends "…the expeditious completion of the EIC as the highest priority for facility construction."

A National Academies study, charged to independently assess the impact, uniqueness, and merit of the science that would be enabled by U.S. construction of an electron-ion collider, gave a strong endorsement to a U.S.-based EIC, and recognized its critical role in maintaining U.S. leadership in nuclear science and accelerator R&D. Scientists and accelerator physicists from both the Medium Energy and Heavy Ion subprograms are actively engaged in the development of the scientific agenda, design of the facility, and development of scientific instrumentation for the proposed EIC scope. Critical Decision-0 (CD-0), Approve Mission Need, was received on December 19, 2019, followed by CD-1, Approve Alternative Selection and Cost Range, on June 29, 2021, and CD-3A, Approve Long Lead Procurements, on March 28, 2024.

Activities and Explanation of Changes

(dollars in thousands)

FY 2025 Enacted		FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
Construction	**$110,000**	**$110,000**	**$ —**
20-SC-52 Electron Ion Collider (EIC), BNL	$110,000	$110,000	$ —
TEC Funding supports engineering and design to reduce technical risk after completion of the conceptual design and limited long lead procurements. RHIC operations includes a “reprioritization” of expert workforce from the RHIC facilities operations budget to support the EIC OPC and TEC activities.		The Request will continue to advance engineering and design and initiate construction. RHIC operations includes a “reprioritization” of expert workforce from the RHIC facilities operations budget to support the EIC OPC and TEC request.	Funding will continue to support engineering and design efforts and early construction activities with the completion of the RHIC science program.

Nuclear Physics
Capital Summary

(dollars in thousands)

	Total	Prior Years	FY 2024 Enacted	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
Capital Operating Expenses						
Capital Equipment	N/A	N/A	18,048	14,861	12,048	-2,813
Minor Construction Activities						
General Plant Projects	N/A	N/A	1,642	1,642	1,642	–
Accelerator Improvement Projects	N/A	N/A	5,211	2,675	5,211	+2,536
Total, Capital Operating Expenses	**N/A**	**N/A**	**24,901**	**19,178**	**18,901**	**-277**

Capital Equipment

(dollars in thousands)

	Total	Prior Years	FY 2024 Enacted	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
Capital Equipment						
Low Energy Physics						
High Rigidity Spectrometer	122,241	42,080	3,000	3,259	–	-3,259
Ton-Scale Neutrinoless Double Beta Decay (NLDBD) MIE	413,660	10,800	3,000	2,000	–	-2,000
Total, Non-MIE Capital Equipment	N/A	N/A	12,048	9,602	12,048	+2,446
Total, Capital Equipment	**N/A**	**N/A**	**18,048**	**14,861**	**12,048**	**-2,813**

Notes:
- *The Capital Equipment table includes MIEs with a Total Estimated Cost (TEC) > $10M.*
- *The High Rigidity Spectrometer (HRS) is not an MIE, but a research project supported on a cooperative agreement with Michigan State University.*
- *The current estimated TEC for the NLDBD MIE is $410,660,000. With the focus of this MIE on the LEGEND-1000 project and a planned CD-1 review in 1Q FY 2026, revisions to the TEC are likely. In FY 2024 and FY 2025, $3,000,000 and $2,000,000, respectively, were redirected to OPC funding not reflected in this table.*

Minor Construction Activities

	(dollars in thousands)					
	Total	Prior Years	FY 2024 Enacted	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
General Plant Projects (GPP)						
Total GPPs $5M or less	N/A	N/A	1,642	1,642	1,642	–
Total, General Plant Projects (GPP)	**N/A**	**N/A**	**1,642**	**1,642**	**1,642**	**–**
Accelerator Improvement Projects (AIP)						
Total AIPs $5M or less	N/A	N/A	5,211	2,675	5,211	+2,536
Total, Accelerator Improvement Projects (AIP)	**N/A**	**N/A**	**5,211**	**2,675**	**5,211**	**+2,536**
Total, Minor Construction Activities	**N/A**	**N/A**	**6,853**	**4,317**	**6,853**	**+2,536**

Notes:
- *GPP activities $5M and less include design and construction for additions and/or improvements to land, buildings, replacements or addition to roads, and general area improvements. AIP activities $5M and less include minor construction at an existing accelerator facility.*

Nuclear Physics
Major Items of Equipment Description(s)

Low Energy Physics: Nuclear Structure and Nuclear Astrophysics Research Project:

High Rigidity Spectrometer (HRS) Research Project
The HRS will enhance the scientific impact of the FRIB fast beam science program by providing luminosity gain factors up to one hundred for neutron-rich isotopes, with the largest gains for the most neutron-rich species. The HRS will allow experiments with beams of rare isotopes at the maximum production rates for fragmentation or in-flight fission. The NSAC LRP recognized that the HRS will push the study of unstable nuclei toward the driplines, increasing the scientific reach of FRIB. The HRS is funded through a cooperative agreement with MSU and is not a capital asset (MIE). HRS received CD-0 approval in November 2018, and CD-1 in September 2020, with a TPC range of $85,000,000 to $111,400,000. The performance baseline for the High Transmission Beam Line (HTBL) subproject of HRS was approved in March 2025 with a TPC of $49,700,000 and CD-4 in Q2 FY 2030. The FY 2026 Request does not include new funding for the HRS. Prior year funds will support the construction of the HTBL as well as the management team, coordination of collaboration activities, and preliminary engineering and design work for the Spectrometer Section (SPS) subproject of HRS towards future critical decision points.

Low Energy Physics: Fundamental Symmetries MIEs:

Ton-Scale Neutrino-less Double Beta Decay (NLDBD) Program MIE
The Ton-Scale NLDBD Program, implemented by deploying experiments instrumenting a large volume of a specially selected isotope to detect neutrino-less nuclear beta decays where within a single nucleus, two neutrons decay into two protons and two electrons with no neutrinos emitted, directly supports the NP mission to explore all forms of nuclear matter. NLDBD can only occur if neutrinos are their own anti-particles and the observation of “lepton number violation” in such neutrino-less beta decay events would have profound consequences for present understanding of the physical universe. The goal of the ton-scale program is to reach a lifetime limit of 10^{28} years with high confidence within a measurement window of five to ten years. NLDBD received CD-0 approval in November 2018 with a TPC range of $215,000,000 to $250,000,000. Leading up to FY 2025, three different technology approaches were considered in the Ton-Scale NLDBD program. NP informed the leaders of the three technology approaches in December 2024 that only the LEGEND-1000 project, making use of germanium-76 isotope incorporated in an array of solid-state detectors, would be pursued in the near term. The FY 2026 Request does not include new funding for LEGEND-1000. Management activities and preparations for establishing the cost range and evaluation of alternatives are supported by prior year funds.

Nuclear Physics
Construction Projects Summary

(dollars in thousands)

	Total	Prior Years	FY 2024 Enacted	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
20-SC-52, Electron Ion Collider (EIC), BNL						
Total Estimated Cost (TEC)	2,493,500	204,240	95,000	110,000	110,000	-
Other Project Cost (OPC)	306,500	89,450	2,850	2,850	2,850	-
Total Project Cost (TPC)	2,800,000	293,690	97,850	112,850	112,850	-
Total, Construction						
Total Estimated Cost (TEC)	N/A	N/A	95,000	110,000	110,000	-
Other Project Cost (OPC)	N/A	N/A	2,850	2,850	2,850	-
Total Project Cost (TPC)	N/A	N/A	97,850	112,850	112,850	-

The treatment of user facilities is distinguished between two types: TYPE A facilities that offer users resources dependent on a single, large-scale machine; TYPE B facilities that offer users a suite of resources that is not dependent on a single, large-scale machine.

(dollars in thousands)

	FY 2024 Enacted	FY 2024 Current	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
Scientific User Facilities - Type A					
Relativistic Heavy Ion Collider	187,000	186,042	187,000	196,805	+9,805
Number of Users	1,050	1,083	990	1,000	+10
Achieved Operating Hours	–	3,106	–	–	–
Planned Operating Hours	2,303	2,303	3,264	1,500	-1,764
Unscheduled Down Time Hours	–	758	–	–	–
Continuous Electron Beam Accelerator Facility	141,930	142,038	146,242	151,060	+4,818
Number of Users	1,900	1,668	1,650	1,650	–
Achieved Operating Hours	–	3,808	–	–	–
Planned Operating Hours	3,243	3,243	3,294	3,300	+6
Unscheduled Down Time Hours	–	1,207	–	–	–
Facility for Rare Isotope Beams	96,266	96,266	102,336	106,406	+4,070
Number of Users	1,000	995	900	1,050	+150
Achieved Operating Hours	–	4,006	–	–	–
Planned Operating Hours	3,570	3,570	3,713	4,000	+287
Unscheduled Down Time Hours	–	236	–	–	–
Argonne Tandem Linac Accelerator System	24,351	24,351	25,110	26,110	+1,000
Number of Users	300	437	430	450	+20
Achieved Operating Hours	–	6,154	–	–	–
Planned Operating Hours	5,803	5,803	5,952	5,950	-2
Unscheduled Down Time Hours	–	291	–	–	–
Total, Facilities	449,547	448,697	460,688	480,381	+19,693
Number of Users	4,250	4,183	3,970	4,150	+180
Achieved Operating Hours	–	17,074	–	–	–
Planned Operating Hours	14,919	14,919	16,223	14,750	-1,473
Unscheduled Down Time Hours	–	2,492	–	–	–

Notes:

- *Achieved Operating Hours and Unscheduled Downtime Hours will only be reflected in the Congressional budget cycle which provides actuals.*

Nuclear Physics
Scientific Employment

	FY 2024 Enacted	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
Number of Permanent Ph.Ds (FTEs)	845	790	743	-47
Number of Postdoctoral Associates (FTEs)	365	312	220	-92
Number of Graduate Students (FTEs)	520	440	302	-138
Number of Other Scientific Employment (FTEs)	1,028	1,044	989	-55
Total Scientific Employment (FTEs)	**2,758**	**2,586**	**2,254**	**-332**

Note:
- *Other Scientific Employment (FTEs) includes technicians, engineers, computer professionals, and other support staff.*

20-SC-52 Electron Ion Collider (EIC), BNL
Brookhaven National Laboratory, BNL
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary
The EIC project will acquire facilities, infrastructure, systems, and equipment that will enable scientists to investigate the basic building blocks of nuclei and how quarks and gluons, the particles inside neutrons and protons, interact dynamically via the strong force to generate the fundamental properties of neutrons and protons, such as mass and spin. The FY 2026 Request for the EIC is $110,000,000 of TEC funding and $2,850,000 of OPC funding. The current TPC range is $1,700,000,000 to $2,800,000,000. The Critical Decision (CD)-1, Approve Alternative Selection and Cost Range, attained on June 29, 2021, included a TPC range with an upper bound of $2,800,000,000.

Significant Changes
The EIC project was initiated in FY 2020. The project most recent Critical Decision (CD) is CD-3A, Approve Long-Lead_Procurement, received on June March 28, 2024. The estimated completion date (CD-4) is 1Q FY 2036 and includes schedule contingency validated by peer review. The most recent Federal review completed in January 2025 confirmed the need for continued elaboration of the scope to define the subprojects strategy intended to leverage different levels of design maturity and improve the project's affordability. The project estimates that the first subproject CD-2, Approve Performance Baseline, could be in Q2 FY 2026.

In FY 2025, the EIC team focused on preliminary design of the infrastructure, collider machine, and detector instrumentation while preparing for a second set of long-lead procurements. Research and development to increase technical readiness for certain detector and technical scope and fostering relations with potential in-kind contributors continued. The team began executing a list of long-lead procurements approved at CD-3A. FY 2026 activities include completing planning and design for conventional infrastructure and technical systems, executing approved long-lead procurements, pursuing agreements with potential in-kind contributors, and preparing the first subproject performance baseline. FY 2026 funding will support constructability adjustments, to validate technical assumptions and to reduce project risk.

The project does not have an assigned Federal Project Director (FPD). Per DOE Order 413.3B, Program and Project Management for the Acquisition of Capital Assets, in the absence of an appointed FPD, the program manager fulfills the roles and responsibilities of the FPD.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	CD-4
FY 2026	12/19/19	01/12/21	6/29/2021	2Q FY 2026	3Q FY 2025	2Q FY 2027	1Q FY 2036

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range; **Conceptual Design Complete** – Actual date the conceptual design was completed (if applicable); **CD-1** – Approve Alternative Selection and Cost Range; **CD-2** – Approve Performance Baseline; **Final Design Complete** – Estimated/Actual date the project design will be/was complete(d); **CD-3** – Approve Start of Construction; **D&D Complete** – Completion of D&D work; **CD-4** – Approve Start of Operations or Project Closeout.

Fiscal Year	Performance Baseline Validation	CD-3A	CD-3B
FY 2026	TBD	3/28/2024	2Q FY 2026

CD-3A – Approve Long-Lead Procurements, for specialty materials procurement, including electrical infrastructure, magnets, refrigerators for the satellite cryogenics plant, and components for the injector, radio frequency power amplifier, and the detector.
CD-3B – Approve Long-Lead Procurements, for transportation, inspection, and refurbishment of excess magnets from Argonne National Laboratory and additional materials for the accelerator and detector.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, Total	TPC
FY 2025	256,000	1,870,000	2,126,000	292,450	292,450	2,418,450
FY 2026	262,000	2,231,500	2,493,500	306,500	306,500	2,800,000

Note:
- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *In FY 2025, the CD-1 point estimate was used as the basis for this table. Beginning in FY 2026, the upper bound of the CD-1 TPC range was the basis for this table.*

2. Project Scope and Justification

Scope

The scope of this project is to design and build the EIC at BNL that will fulfill the scientific gap as identified in the 2023 NSAC LRP. BNL is partnering with TJNAF in the implementation of the EIC. The EIC will have performance parameters that include a high beam polarization of greater than 70 percent from both electrons and light ions, and the capability to accommodate ion beams from deuterons to the heaviest stable nuclei. The EIC will also have variable center of mass energies from 29 to 100 GeV and upgradable to 140 GeV, high collision luminosity from 10^{33} -10^{34} $cm^{-2}s^{-1}$, one detector and one interaction region at project completion, and the capacity to accommodate a second interaction region and a second detector.

The scope also includes a new electron injection system and storage ring while taking full advantage of the existing infrastructure by modifying the existing hadron facility of the RHIC infrastructure at BNL.

The electron system will include a highly polarized room temperature photo-electron gun and a 3 GeV electron linac injector. It will include a transfer line that brings the electrons into the storage ring at the energy of 5, 10, and 18 GeV that will be installed in a new tunnel adjacent to the existing 2.4-mile circular RHIC tunnel.

Modifications to the existing hadron system include the injection, transfer line and storage ring to increase beam energy to 275 GeV. It will include a strong-hadron-cooling system to reduce and maintain the hadron beam emittance to the level needed to operate with the anticipated luminosity of 10^{33} -10^{34} $cm^{-2}s^{-1}$.

The interaction region will have superconducting final focusing magnets, crab cavities, and spin rotators to provide longitudinally polarized beams for collisions, where the outgoing particles will be collected by one detector.

An enhanced 2 K liquid helium cryogenic plant is provided for the superconducting radiofrequency cavities, with enhanced water-cooling capacity and cooling towers and chillers to stabilize the environment in the existing tunnel. Civil construction will also include electrical systems, service buildings, and access roads.

It is anticipated that non-DOE funding sources such as international collaborators and the State of New York, will contribute $250 million to the EIC Project ($100 million from New York state, and $150 million from international collaborators). The timeframe for commitments by non-DOE contributors will vary throughout the life of the project and become more certain as planning for the project progresses. New York state committed to its contribution on February 7, 2024. All non-DOE funding sources will be incorporated into the project through the change control process once baselined.

Justification

The last four NSAC LRP reports have supported the EIC. The current NSAC LRP recommends the EIC as the highest priority for new facility construction. Consistent with that vision, in 2016 NP commissioned a National Academies of Sciences, Engineering, and Medicine study by an independent panel of experts to assess the uniqueness and scientific merit of such a facility. The report, released in July 2018, strongly supports the scientific case for building a U.S. based EIC, documenting that an EIC will advance the understanding of the origins of nucleon mass, the origin of the spin properties of nucleons, and the behavior of gluons.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*.

Key Performance Parameters (KPPs)

The KPPs are preliminary and may change prior to setting the performance baseline at CD-2. The Threshold KPPs represent the minimum acceptable performance that the project must achieve for success. The Objective KPPs represent the project performance stretch goal. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Approve Project Completion.

Performance Measure	Threshold	Objective
Center-of-Mass	Center-of-mass energy measured in the range of 20 GeV- 100 GeV.	Center-of-mass energy measured in the range of 20 GeV- 140 GeV.
Accelerator	Accelerator installed and capable of delivering beams of protons and a heavy nucleus such as Au.	Ability to deliver a versatile choice of beams from protons and light ions to heavy ions such as Au.
Detector	Detector installed and subsystems tested with cosmic rays.	Inelastic scattering events in the e-p and e-A collisions measured in Detector.
Polarization	Hadron beam polarization of > 50 percent and electron beam polarization of > 40 percent measured at E_{cm} = 100 GeV.	Hadron beam polarization of > 60 percent and electron beam polarization of > 50 percent measured at E_{cm} = 100 GeV.
Luminosity	Luminosity for e-p collisions measured up to 1.5×10^{32} cm^{-2} s^{-1}.	Luminosity for e-p collisions measured up to 1.0×10^{33} cm^{-2} s^{-1}.

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs	IRA Supp. Costs
Total Estimated Cost (TEC)				
Design (TEC)				
Prior Years	76,000	76,000	55,131	5,362
Prior Years - IRA Supp.	20,000	20,000	—	—
FY 2024	76,000	76,000	77,707	9,872
FY 2025	50,000	50,000	69,162	4,766
FY 2026	40,000	40,000	40,000	—
Total, Design (TEC)	**262,000**	**262,000**	**242,000**	**20,000**
Construction (TEC)				
Prior Years - IRA Supp.	108,240	108,240	—	—
FY 2024	19,000	19,000	—	20,000
FY 2025	60,000	60,000	75,000	15,000
FY 2026	70,000	70,000	60,000	58,240
Outyears	1,974,260	1,974,260	1,988,260	15,000
Total, Construction (TEC)	**2,231,500**	**2,231,500**	**2,123,260**	**108,240**
Total Estimated Cost (TEC)				
Prior Years	76,000	76,000	55,131	5,362
Prior Years - IRA Supp.	128,240	128,240	—	—
FY 2024	95,000	95,000	77,707	29,872
FY 2025	110,000	110,000	144,162	19,766
FY 2026	110,000	110,000	100,000	58,240
Outyears	1,974,260	1,974,260	1,988,260	15,000
Total, Total Estimated Cost (TEC)	**2,493,500**	**2,493,500**	**2,365,260**	**128,240**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs	IRA Supp. Costs
Other Project Cost (OPC)				
Prior Years	79,450	79,450	65,302	8,164
Prior Years - IRA Supp.	10,000	10,000	–	–
FY 2024	2,850	2,850	12,932	1,751
FY 2025	2,850	2,850	6,000	85
FY 2026	2,850	2,850	3,000	–
Outyears	208,500	208,500	209,266	–

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs	IRA Supp. Costs
Other Project Cost (OPC)				
Total, Other Project Cost (OPC)	306,500	306,500	296,500	10,000

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs	IRA Supp. Costs
Total Project Cost (TPC)				
Prior Years	155,450	155,450	120,433	13,526
Prior Years - IRA Supp.	138,240	138,240	–	–
FY 2024	97,850	97,850	90,639	31,623
FY 2025	112,850	112,850	150,162	19,851
FY 2026	112,850	112,850	103,000	58,240
Outyears	2,182,760	2,182,760	2,197,526	15,000
Total, TPC	2,800,000	2,800,000	2,661,760	138,240

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design	178,000	173,000	N/A
Design - Contingency	84,000	83,000	N/A
Total, Design (TEC)	262,000	256,000	N/A
Construction	1,624,500	1,262,000	N/A
Construction - Contingency	607,000	608,000	N/A
Total, Construction (TEC)	2,231,500	1,870,000	N/A
Total, TEC	2,493,500	2,126,000	N/A
Contingency, TEC	*691,000*	*691,000*	*N/A*
Other Project Cost (OPC)			
R&D	86,500	84,150	N/A
Conceptual Design	11,000	11,000	N/A
Other OPC Costs	209,000	197,300	N/A
Total, Except D&D (OPC)	306,500	292,450	N/A
Total, OPC	306,500	292,450	N/A
Contingency, OPC	*N/A*	*N/A*	*N/A*
Total, TPC	2,800,000	2,418,450	N/A

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total, Contingency (TEC+OPC)	*691,000*	*691,000*	*N/A*

Note:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *In FY 2025, the CD-1 point estimate was used as the basis for this table. Beginning in FY 2026, the upper bound of the CD-1 TPC range was the basis for this table.*

5. Schedule of Appropriations Requests

(dollars in thousands)

Fiscal Year	Type	Prior Years	FY 2024	FY 2025	FY 2026	Outyears	Total
FY 2025	TEC	204,240	95,000	110,000	—	1,716,760	2,126,000
	OPC	89,450	2,850	2,850	—	197,300	292,450
	TPC	293,690	97,850	112,850	—	1,914,060	2,418,450
FY 2026	TEC	204,240	95,000	110,000	110,000	1,974,260	2,493,500
	OPC	89,450	2,850	2,850	2,850	208,500	306,500
	TPC	293,690	97,850	112,850	112,850	2,182,760	2,800,000

Note:

- *In FY 2025, the CD-1 point estimate was used as the basis for this table. Beginning in FY 2026, the upper bound of the CD-1 TPC range was the basis for this table.*

6. Related Operations and Maintenance Funding Requirements

Over the course of the acquisition of the EIC, experienced RHIC scientists, engineers, and technicians will assume EIC project responsibilities. A gradual transition will balance the need for the scientific experts to continue to support RHIC while ramping up the EIC project. These individuals represent the scientific and technical workforce that are essential to the operations of a complex facility like RHIC and eventually, the EIC. They have critical core competencies in collider operations that cannot easily be replaced, and they represent the core facility operations force of RHIC and the EIC. In the FY 2026 Request, RHIC Operations includes a "reprioritization" of the expert workforce from the RHIC facility operations budget to support the project under the EIC OPC and TEC request. The temporary reprioritization of funds from the facility operations budget to the construction budget will reduce the amount of "new funds" needed to implement the EIC, enabling a cost-effective path forward to the implementation of this world-leading facility. As the EIC nears CD-4 when the machine will be restarted, the scientists, engineers and technicians that are needed to operate the EIC will be transferred back to the facility operations budget.

Start of Operation or Beneficial Occupancy	1Q FY 2036
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	1Q FY 2086

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations, Maintenance and Repair	167,000	167,000	13,500,000	13,500,000

7. D&D Information

As part of the upgrade and renovation of the existing accelerator facilities, up to 175,000 square feet of new industrial space will be built as service buildings to house mechanical and electrical equipment. Construction will also include a new tunnel to house the electron injection and rapid cycling synchrotron. The new area will not replace existing facilities.

	Square Feet
New area being constructed by this project at BNL	175,000
Area of D&D in this project at BNL	0
Area at BNL to be transferred, sold, and/or D&D outside the project, including area previously “banked”	N/A
Area of D&D in this project at other sites	N/A
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”	N/A
Total area eliminated	0

8. Acquisition Approach

SC selected BNL as the site for the EIC on January 9, 2020. NP approved the Acquisition Strategy in conjunction with CD-1. DOE will utilize the expertise of the Management and Operating contractors at BNL and TJNAF to manage the project including the design, fabrication, monitoring cost and schedule, and delivering the technical performance specified in the KPPs. A certified Earned Value Management System based on those that already exist at both laboratories and will evaluate project progress and ensure consistency with DOE Order 413.3B, Program and Project Management for the Acquisition of Capital Assets. SC will evaluate the M&O contractor’s performance through the annual laboratory performance appraisal process. SC and the M&O will draw from lessons learned from other SC projects and other similar facilities in planning and executing the EIC project.