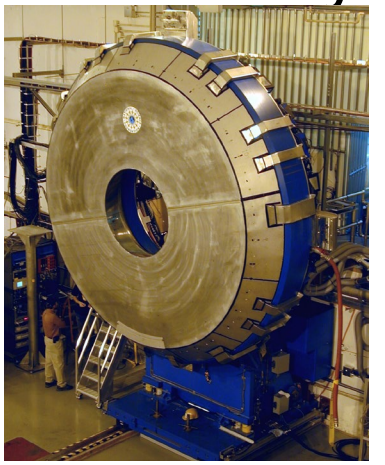
Federal Agencies and Nuclear Physics

James Sowinski

My Background

- PhD in Nuclear Physics – Univ. of Wisconsin
- 26 years as Research Scientist at Indiana University
  - Indiana University Cyclotron Facility
  - DESY/HERMES
  - RHIC/STAR
  -



- 12.5 years at DOE Office of Nuclear Physics
  - Program Manager for Facilities and acting Heavy Ions

My Background

- Currently retired
- I no longer represent DOE/NP
- Information I present is publicly available
  - Much presented is directly from agency web sites

DOE History

- Manhattan Project -1942
  - Los Alamos, Oak Ridge, Hanford
- 1944 congressional authorization for establishment of energy research laboratories
- 1946 Atomic Energy Commission established
- 1947 Brookhaven, Livermore, Savannah River
- 1953-4 Atoms for Peace, Civilian Nuclear power
- 1954 Bevatron at Berkeley Radiation Lab
- 1962 Grant issued to construct Stanford Linear Accelerator
- Civilian power reactors coming on line, weapons testing

DOE History

- 1967 National Accelerator Lab (later called Fermi Lab) authorized
- 1973 Oil crises – decades of conventional and nuclear energy concerns – Federal Energy Office
- 1974
  - Federal Energy Administration
  - AEC becomes Energy Research and Development Administration
  - Nuclear Regulatory Commission established
- 1977 ERDA and FEA combined into Dept. of Energy
- 1992 Superconducting Super Collider canceled
- 1992 Last weapons test

DOE History

- 1995 Fermi Lab announces top quark discovery
- 1998 Office of Energy Research changed to Office of Science
- 1999 National Spherical Torus Experiment begins at Princeton Plasma Physics Laboratory
  - National Ignition Facility at Livermore
  - Spallation Neutron Souce at ORNL initiated
- 2000 National Nuclear Security Admin. Established
  - Human Genome project initiated by DOE
  - Tau neutrino discovered at Fermi Lab

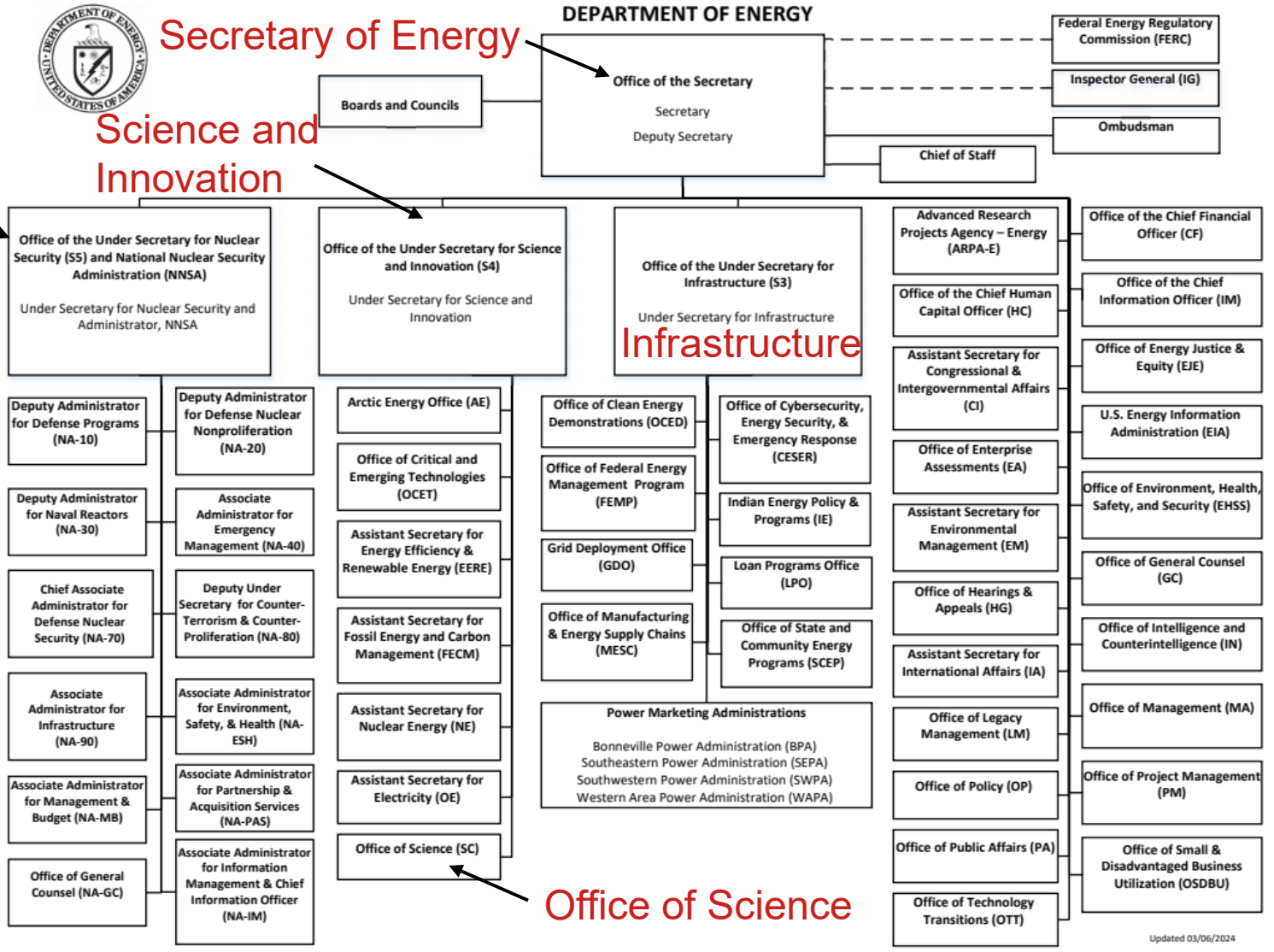
https://www.energy.gov/lm/doe-history https://science.osti.gov/About/History

National Nuclear Security Admin.

3 Under Secretaries

Secretary of Energy

Science and Innovation

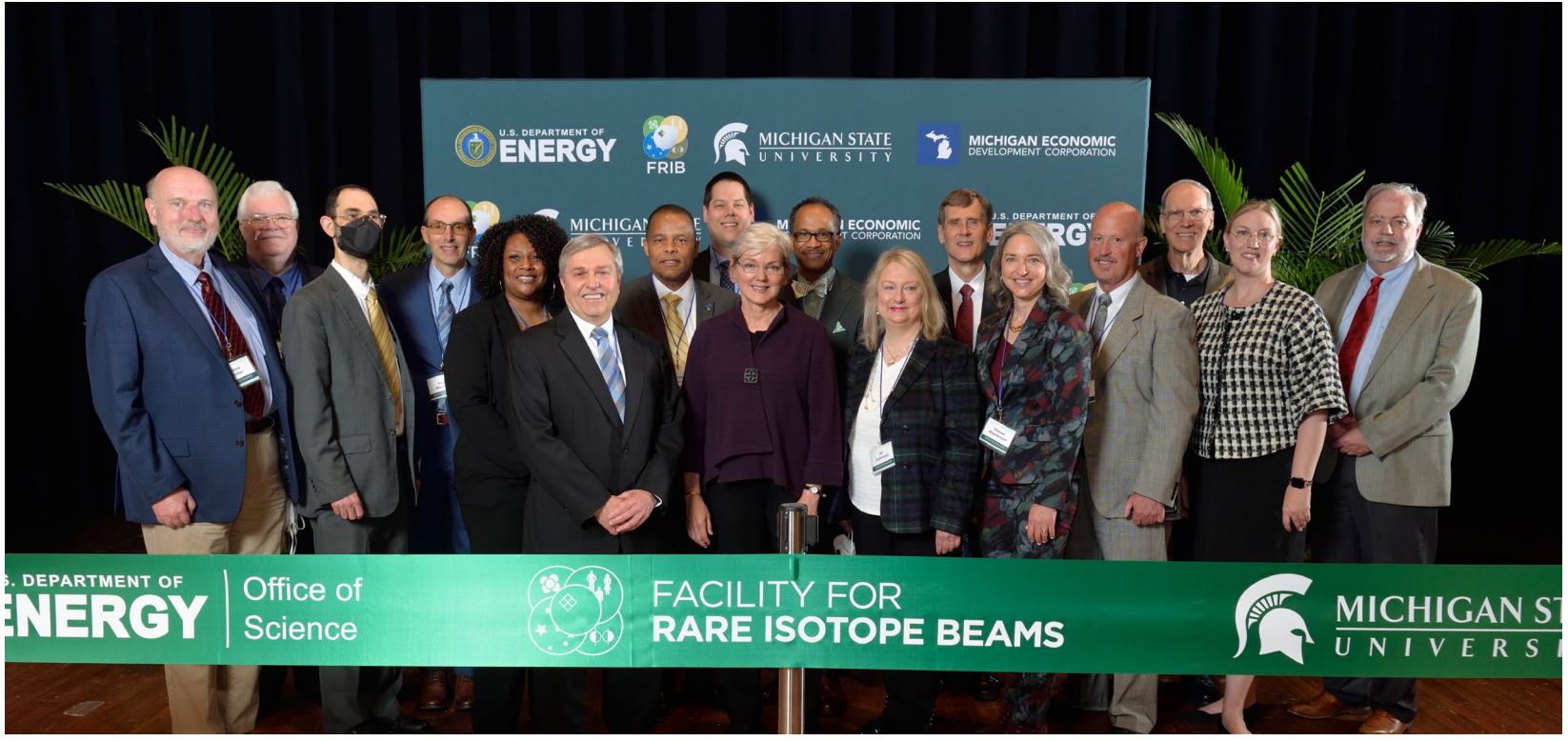


Office of Science

DOE

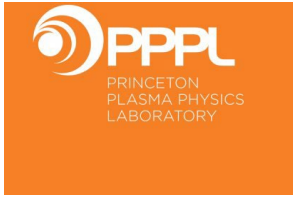
- Recent Secretaries
  - Steven Chu – Physicist – Nobel Laureate
  - Ernest Moniz – Nuclear Physicist – Energy Policy
  - Rick Perry – ex-Governor of Texas
  - Dan Brouillette – Congressional staffer, Deputy Secretary
  - Jennifer Granholm – ex-Governor of Michigan -current
- Typically change with presidential administrations
- One or two presentations to Office of Science a year
- Regularly tour DOE labs and Science Facilities

Secretary Granholm (and me) at RHIC Ribbon Cutting



DOE Laboratories

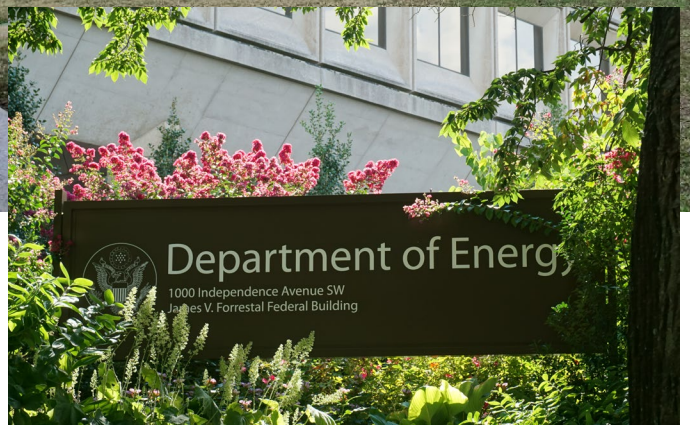
Office of Science



NNSA

Other DOE

DOE Headquarters Forrestal Building



In DC just off the Mall across from the Smithsonian Castle

Offices of leadership and their staff including Secretary and Director of Office of Science

Small publicly available historical display in lobby

Program Offices in Germantown Building

Original AEC and current Secretary remote offices

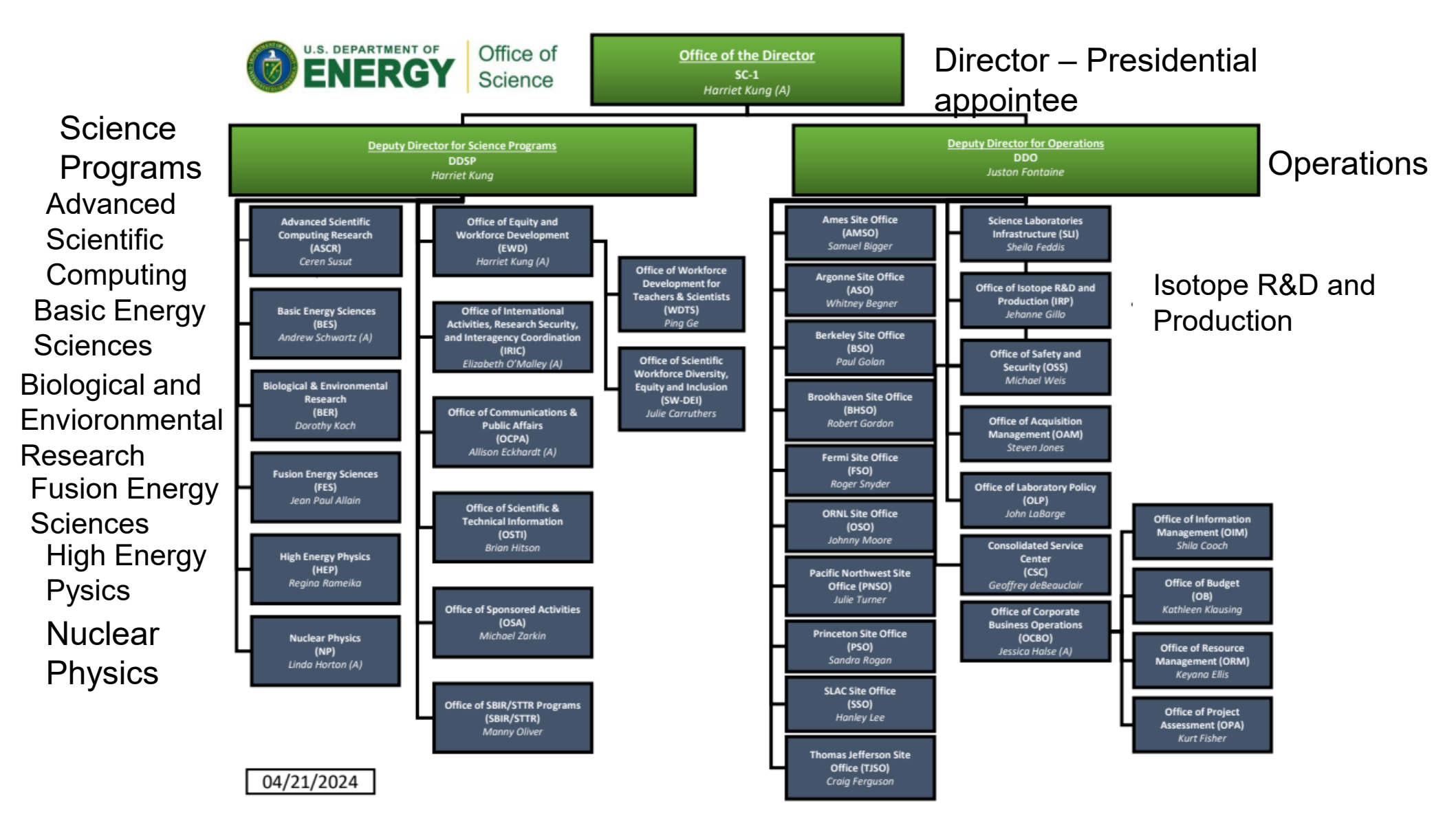
My office on 4 floor

DC to south east

- 1950's AEC in DC
- Worried about nuclear weapon on DC and losing AEC staff
- Build new building outside the radius of 20 M-ton bomb
- Aligned to adsorb blast from south
- Reinforced and other features
- Office of Science has other business offices around country

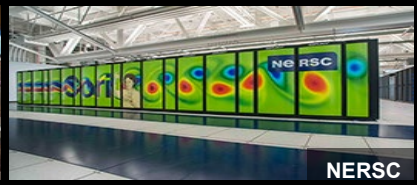
DOE Office of Science

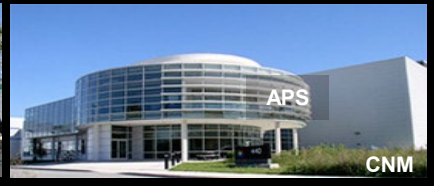
- The mission of DOE's Office of Science is to deliver scientific discoveries and major scientific tools to transform our understanding of nature and advance the energy, economic, and national security of the United States.

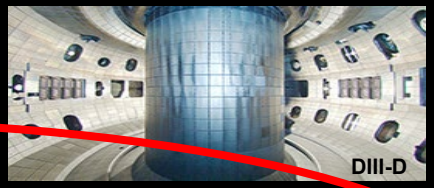

U.S. DEPARTMENT OF ENERGY
Office of Science
Office of the Director
SC-1
Harriet Kung (A)
Director – Presidential appointee
Deputy Director for Science Programs
DDSP
Harriet Kung
Deputy Director for Operations
DDO
Juston Fontaine
Operations
Science Programs
Advanced Scientific Computing
Basic Energy Sciences
Biological and Envioronmental Research
Fusion Energy Sciences
High Energy Pysics
Nuclear Physics
Isotope R&D and Production
Advanced Scientific Computing Research (ASCR)
Ceren Susut
Basic Energy Sciences (BES)
Andrew Schwartz (A)
Biological & Environmental Research (BER)
Dorothy Koch
Fusion Energy Sciences (FES)
Jean Paul Allain
High Energy Physics (HEP)
Regina Rameika
Nuclear Physics (NP)
Linda Horton (A)
Office of Equity and Workforce Development (EWD)
Harriet Kung (A)
Office of Workforce Development for Teachers & Scientists (WDTS)
Ping Ge
Office of Scientific Workforce Diversity, Equity and Inclusion (SW-DEI)
Julie Carruthers
Office of International Activities, Research Security, and Interagency Coordination (IRIC)
Elizabeth O'Malley (A)
Office of Communications & Public Affairs (OCPA)
Allison Eckhardt (A)
Office of Scientific & Technical Information (OSTI)
Brian Hitson
Office of Sponsored Activities (OSA)
Michael Zarkin
Office of SBIR/STTR Programs (SBIR/STTR)
Manny Oliver
Ames Site Office (AMSO)
Samuel Bigger
Argonne Site Office (ASO)
Whitney Begner
Berkeley Site Office (BSO)
Paul Golan
Brookhaven Site Office (BHSO)
Robert Gordon
Fermi Site Office (FSO)
Roger Snyder
ORNL Site Office (OSO)
Johnny Moore
Pacific Northwest Site Office (PNSO)
Julie Turner
Princeton Site Office (PSO)
Sandra Rogan
SLAC Site Office (SSO)
Hanley Lee
Thomas Jefferson Site Office (TJSO)
Craig Ferguson
Science Laboratories Infrastructure (SLI)
Sheila Feddis
Office of Isotope R&D and Production (IRP)
Jehanne Gillo
Office of Safety and Security (OSS)
Michael Weis
Office of Acquisition Management (OAM)
Steven Jones
Office of Laboratory Policy (OLP)
John LaBarge
Consolidated Service Center (CSC)
Geoffrey deBeauclair
Office of Corporate Business Operations (OCBO)
Jessica Halse (A)
Office of Information Management (OIM)
Shila Cooch
Office of Budget (OB)
Kathleen Klausing
Office of Resource Management (ORM)
Keyana Ellis
Office of Project Assessment (OPA)
Kurt Fisher
04/21/2024

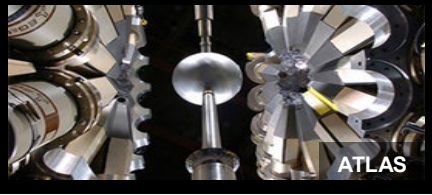
Office of Science User Facilities

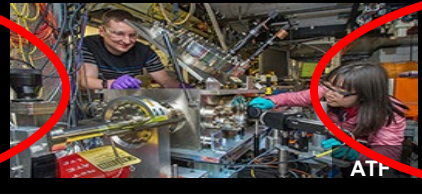
Number of User Facilities
28





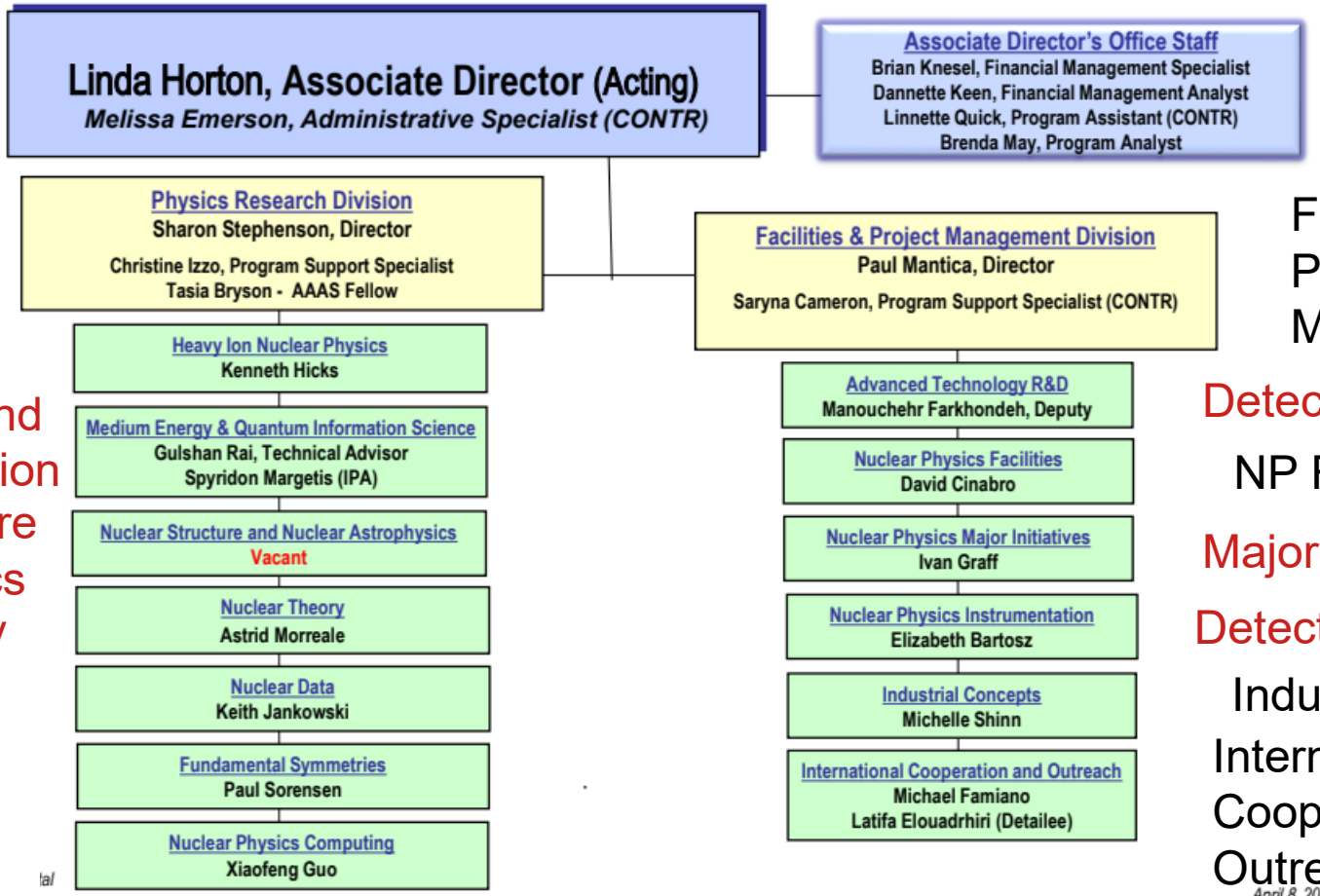






U.S. DEPARTMENT OF ENERGY | Office of Science

Office of Nuclear Physics



Physics Research

Heavy Ions

Medium Energy and Quantum information

Nuclear Structure and Astrophysics

Nuclear Theory

Nuclear Data

Fundamental Symmetries

NP Computing

Facilities and Project Management

Detector R&D

NP Facilities

Major Projects

Detector Projects

Industry R&D

International Cooperation and Outreach

April 8, 2024

Nuclear Physics Funding

2025 President's Request

(dollars in thousands)

	FY 2023 Enacted	FY 2024 Annualized CR	FY 2025 Request	FY 2025 Request vs FY 2023 Enacted
Nuclear Physics				
Medium Energy, Research	59,083	50,055	50,592	-8,491
Medium Energy, Operations	149,834	138,620	147,244	-2,590
Total, Medium Energy Physics	**208,917**	**188,675**	**197,836**	**-11,081**
Heavy Ion, Research	46,149	45,474	43,349	-2,800
Heavy Ion, Operations	182,087	166,993	181,126	-961
Heavy Ion, Projects	20,000	2,850	2,850	-17,150
Total, Heavy Ion Physics	**248,236**	**215,317**	**227,325**	**-20,911**
Low Energy, Research	77,651	75,159	72,334	-5,317
Low Energy, Operations	128,579	120,401	135,646	+7,067
Low Energy, Projects	23,940	9,259	5,259	-18,681
Total, Low Energy Physics	**230,170**	**204,819**	**213,239**	**-16,931**
Theory, Research	67,873	67,392	84,691	+16,818
Total, Nuclear Theory	**67,873**	**67,392**	**84,691**	**+16,818**
Subtotal, Nuclear Physics	**755,196**	**676,203**	**723,091**	**-32,105**
Construction				
20-SC-52 Electron Ion Collider (EIC), BNL	50,000	95,000	110,000	+60,000
Subtotal, Construction	**50,000**	**95,000**	**110,000**	**+60,000**
Total, Nuclear Physics	**805,196**	**771,203**	**833,091**	**+27,895**

https://www.energy.gov/science/office-science-budget

The NP Mission:
Discovering, Exploring, and Understanding all Forms of Nuclear Matter

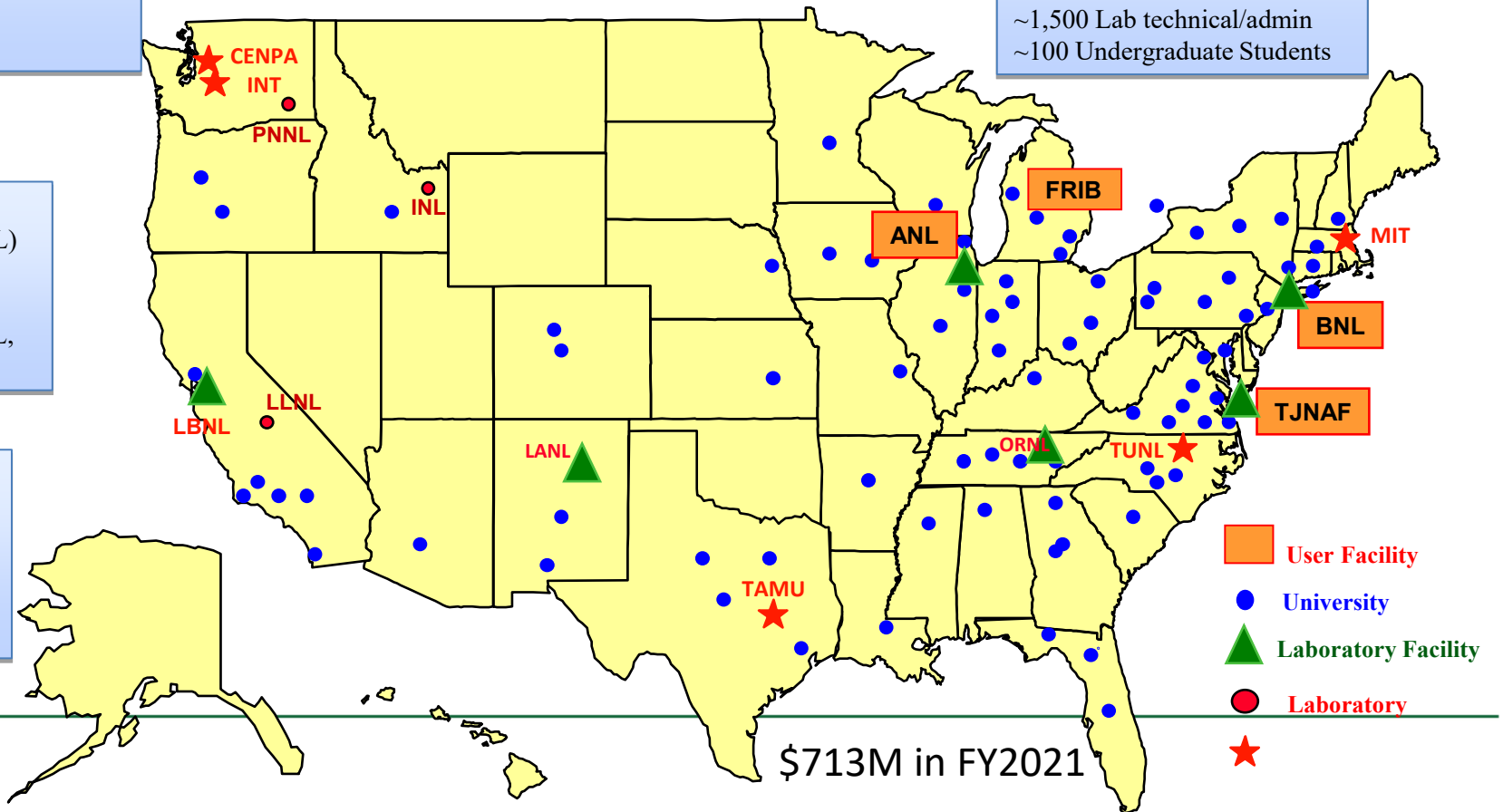
National User Facilities ~4,300 users
- RHIC (BNL)
- CEBAF (TJNAF)
- ATLAS (ANL)
- FRIB (MSU)

Research Groups
- 9 National Laboratories
- 93 Universities

NP Workforce
~807 Faculty & Lab Res Staff
~376 Post-docs
~540 Graduate Students
~1,500 Lab technical/admin
~100 Undergraduate Students

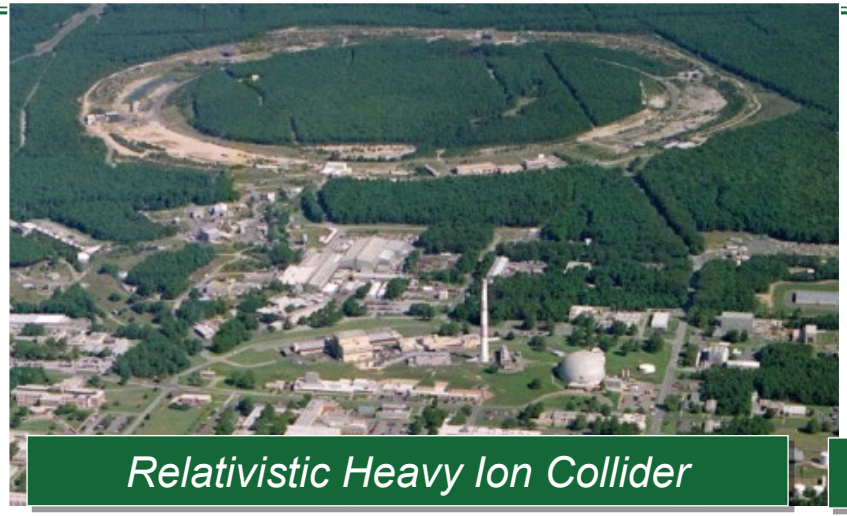
Other Lab. Facilities
- 88-Inch Cyclotron (LBNL)
- 200 MeV BLIP (BNL)
- 100 MeV IPF (LANL)
- Hot Cell Facilities at BNL, LANL, ORNL

Centers of Excellence
- CENPA (U. of Wash)
- INT (U. of Wash.)
- TAMU (Texas A&M)
- TUNL (Duke)
- REC (MIT)

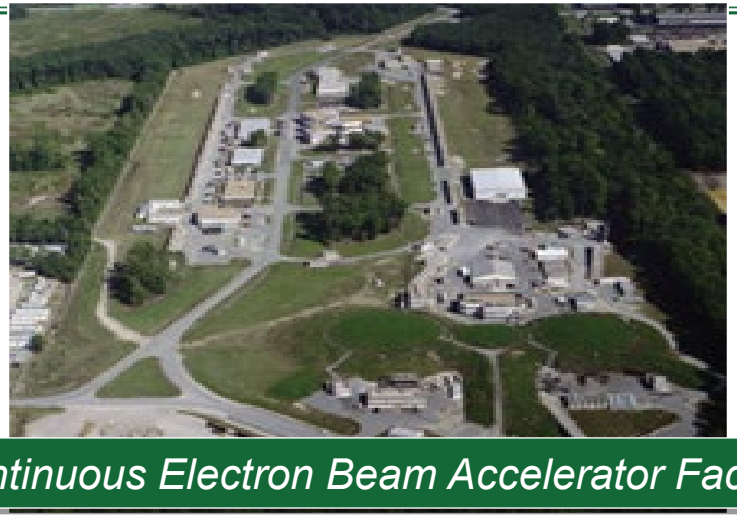


$713M in FY2021

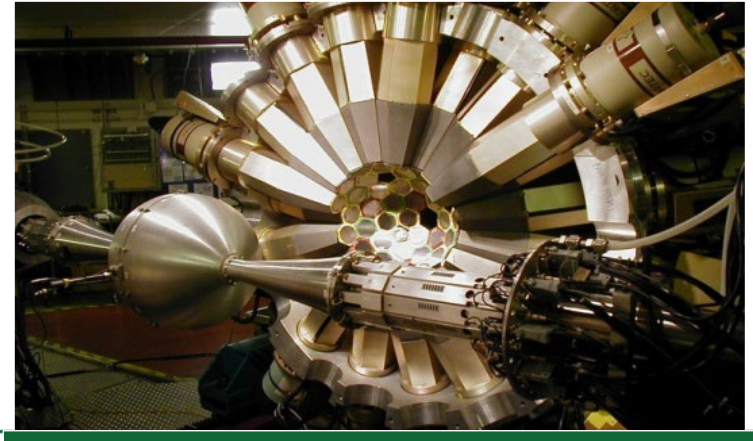
The four NP User Facilities



Relativistic Heavy Ion Collider



Continuous Electron Beam Accelerator Facility



Argonne Tandem Linac System

Facility for Rare Isotope Beams

Medium Energy Program

- Tests of QCD
  - What is the internal landscape of the protons and neutrons (collectively known as nucleons)?
  - What does QCD predict for the properties of strongly interacting matter?
  - What is the role of gluons and gluon self-interactions in nucleons and nuclei?
- CEBAF/JIab and spin physics at RHIC/BNL
- Select experiments at HIGS/TUNL, FNAL, MIT Engineering Center
- Electron Ion Collider in future
- Lab groups at TJNAF, BNL, ANL, LANL, and LBNL

Heavy Ion Program

- Nuclear matter at extremely high densities and temperatures
  - What are the phases of strongly interacting matter, and what roles do they play in the cosmos?
  - What governs the transition of quarks and gluons into pions and nucleons?
  - What determines the key features of QCD and their relation to the nature of gravity and space-time?
- RHIC and EIC in future
- LHC with ALICE, ATLAS and CMS
- Lab Groups at BNL, LBNL, LANL, and ORNL

Nuclear Theory

- Theoretical support needed to interpret experimental data in the subprograms and to advance new ideas and hypotheses that identify potential areas for future experiments
  - Development of an understanding of the mechanisms and effects of quark confinement and deconfinement
  - New theoretical and computational tools are developed to describe nuclear many-body phenomena
  - Nuclear astrophysics - 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.
- Institute for Nuclear Theory at University of Washington and the FRIB Theory Alliance at Michigan State University
- Lattice QCD, SciDAC, Quantum Information Sciences, Quantum Computing
- Nuclear Data, RENEW FAIR programs
- Lab Groups at ANL, BNL, LANL, LBNL, LLNL, ORNL,and TJNAF

Nuclear Structure and Nuclear Astrophysics

- Questions addressed include
  - What is the nature of the nuclear force that binds protons and neutrons into stable nuclei and rare isotopes? What is the origin of simple patterns in complex nuclei? What is the nature of neutron stars and dense nuclear matter?
  - What are the origins of the elements in the cosmos? What are the nuclear reactions that drive stars and stellar explosions?
- Operations of FRIB/MSU and ATLAS/ANL user facilities
- Three Centers of Excellence, Cyclotron Institute at Texas A&M Univ., Triangle Universities Nuclear Laboratory at Duke Univ., Center for Experimental Nuclear Physics and Astrophysics at the Univ. of Washington
- Operations of LBNL 88-Inch Cyclotron for an in-house program
- Lab Groups at ANL, LBNL, LLNL, and ORNL

Fundamental Symmetries

- Questions addressed include
  - What is the nature of neutrinos, what are their masses, and what role have they played in creating the imbalance between matter and antimatter in our universe?
  - Is there evidence from the electric-dipole moments of atomic nuclei and the neutron that indicate our current understanding of the fundamental laws governing nuclear physics is incomplete?
  - Will precise measurements in electron scattering and the decay of nuclei indicate the existence of forces that were present at the dawn of the universe, and disappeared from view as the universe evolved?
- SC steward of neutrino mass measurements KATRIN and PROJECT8 and neutrino-less double beta decay CUORE, LEGEND-200, planning for ton scale
- Parity violating electron scattering MOLLER
- Electric dipole moments and other neutron properties at the FNPB/SNS/ORNL
- Lab Groups at BNL, LANL, LBNL, LLNL, ORNL, PNNL and SLAC

Other DOE NP Programs

- Nuclear Data
  - multi-disciplinary with applications to energy, defense, space, and medicine
  - collects, evaluates, and disseminates nuclear data with support of the U.S. Nuclear Data Program and the National Nuclear Data
  - Research funded in coordination with the Nuclear Data InterAgency Working Group

Other DOE NP Programs

- Nuclear Physics Computing
  - Research in nuclear physics that rely on large-scale, high-performance computing
  - Scientific Discovery through Advanced Computation (SciDAC) and Nuclear Theory Topical Collaborations
  - Lattice QCD
  - Exascale projects in LQCD and nuclear astrophysics
  - Access to computing resources at DOE leadership computers and the National Energy Research Scientific Computing center (NERSC)

Other DOE NP Programs

- Quantum Information Science
  - Research that could, in the long-term, have a transformative impact on the NP mission area and/or advance QIS development enabled by NP-supported science, technologies, and laboratory infrastructure
  - Topics may include quantum computation, quantum simulations and simulators, quantum sensing, quantum-enhanced nuclear physics detectors, nuclear many-body problem, ‘squeezed’ quantum states, nuclear qubits quantum entanglement, and implementation of NP theories on quantum hardware
- Industrial Concepts – Small Business Innovation Research
  - Technology development of interest to NP with potential for commercialization

Grant Process for Universities at DOE NP

- FY 202x CONTINUATION OF SOLICITATION FOR THE OFFICE OF SCIENCE FINANCIAL ASSISTANCE PROGRAM
  - Medium Energy, Heavy Ions, Low Energy/Astrophysics, Fundamental Symmetries, Nuclear Theory
  - Accept proposals each year, new and renewal - format indicated in FOA
  - Group or individual PIs
  - Typical proposal is for 3 years
  - Summer salary, post docs, grad students, possibly other staff, travel, possibly some equipment
  - Proposals are letter reviewed and then rated by panel separately for each program
  - For successful proposals, 3yr budget negotiated (but subject to approp.)
- Lab groups funded and reviewed separately

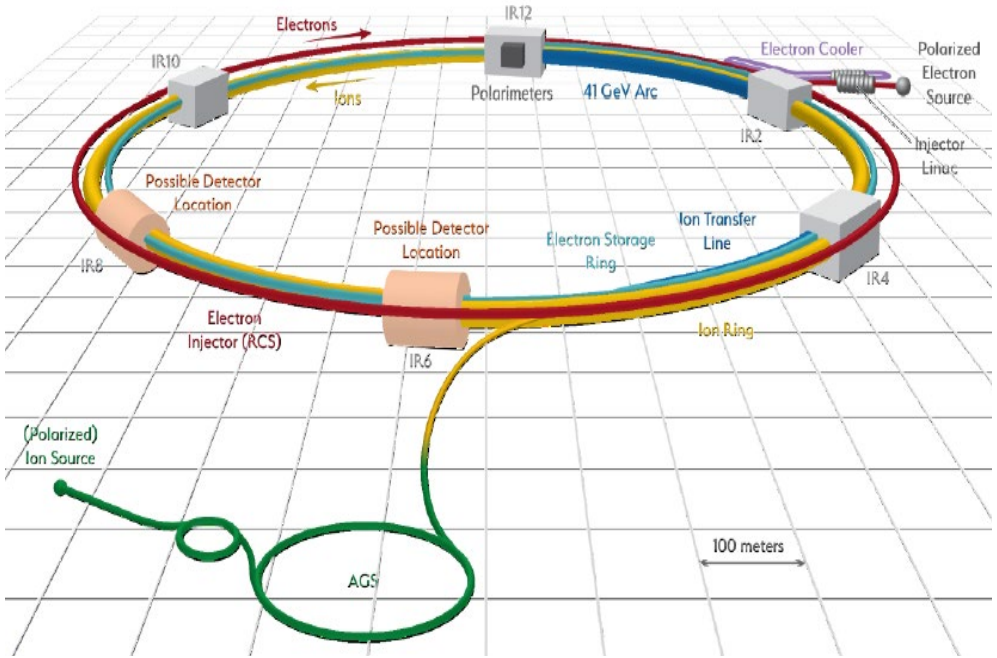
https://science.osti.gov/grants/FOAs/Open

DOE support for Graduate Students Research at National Labs

- Office of Science Graduate Student Research Program
  - Advance PhD thesis research while working at a Department of Energy National Laboratory
  - U.S. citizens or lawful permanent residents
  - Conduct part of their PhD thesis research at a host DOE laboratory/facility in collaboration with a DOE National Laboratory scientist

https://science.osti.gov/wdts/scgsr

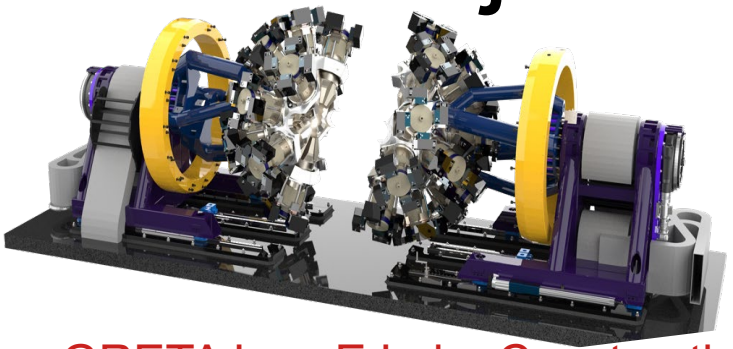
DOE NP Construction – Electron Ion Collider



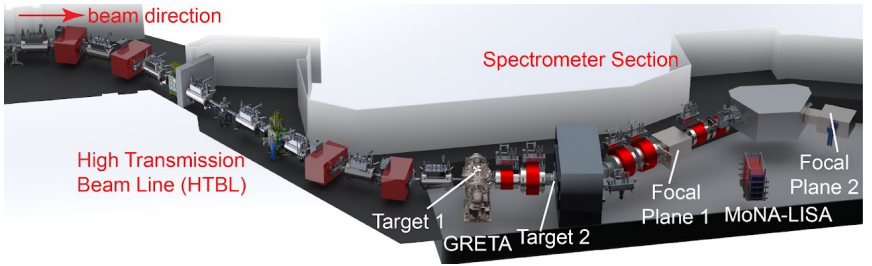
- RHIC converted to EIC
- Estimated completion FY33
- How does the mass of the nucleon arise?
- How does the spin of the nucleon arise?
- What are the emergent properties of dense systems of gluons?”

BNL and TJNAF $1.7B-$2.8B Large international participation
Funded project includes one detector -ePIC

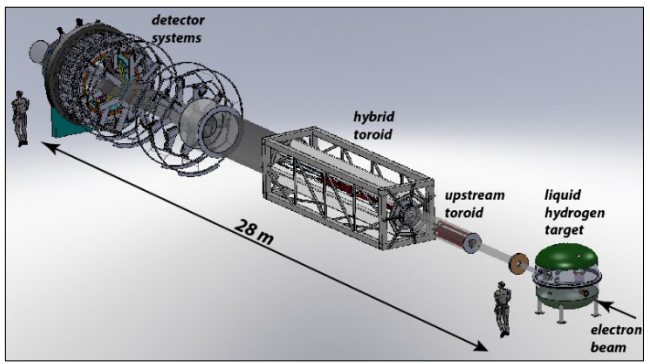
Major Items of Equipment



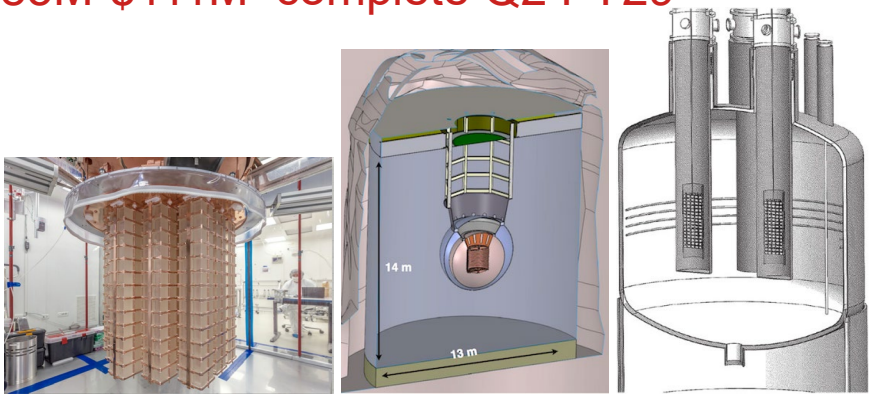
GRETA Low E Labs Construction underway $58.3M complete 3/28



HRS FRIB Alternative and cost range defined $85M-$111M complete Q2 FY29

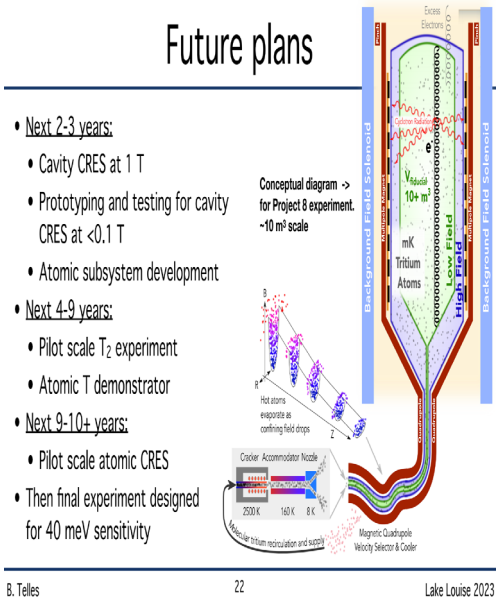


Moller Jlab Long Lead Procurement $45.8M to $56.6M complete Q2 FY28

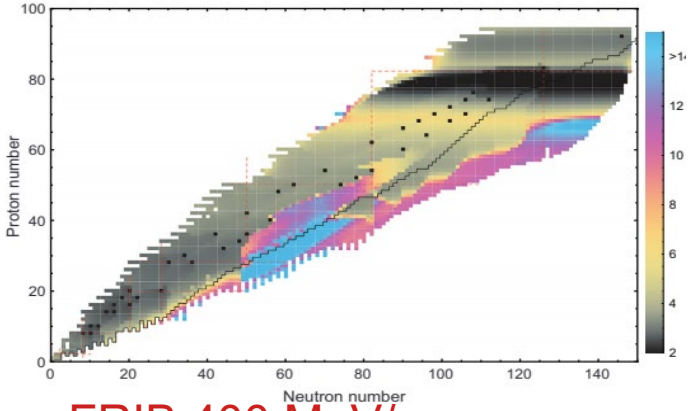


Ton scale NLDBD Mission Need established $350M - $500M timescale TBD

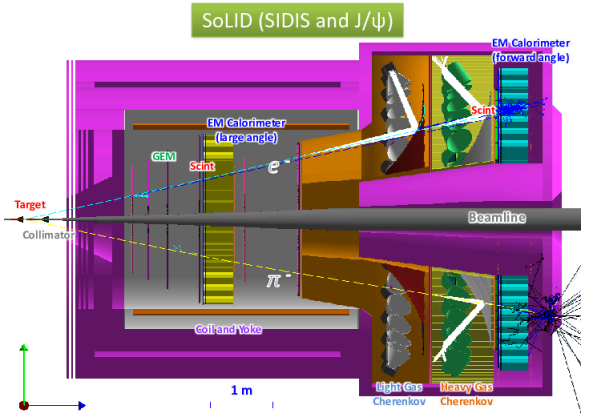
Envisioned Future Major Projects



Project 8 neutrino mass

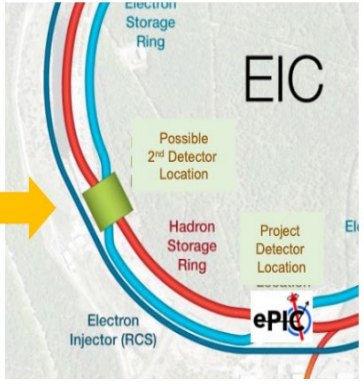


FRIB 400 MeV/c upgrade



SoLID at Jlab

EIC Detector II at 2nd interaction point



Most Program Managers are Federal Employees

- Federal employees take an oath:
  - I will support and defend the Constitution of the United States against all enemies, foreign and domestic; that I will bear true faith and allegiance to the same; that I take this obligation freely, without any mental reservation or purpose of evasion; and that I will well and faithfully discharge the duties of the office on which I am about to enter. So help me God.
- Subject to Hatch Act
  - Restricts partisan activities at work
  - Restricts running for partisan office and fund raising
- Temporary university or lab personnel, IPAs, can serve under Intergovernmental Personnel Act

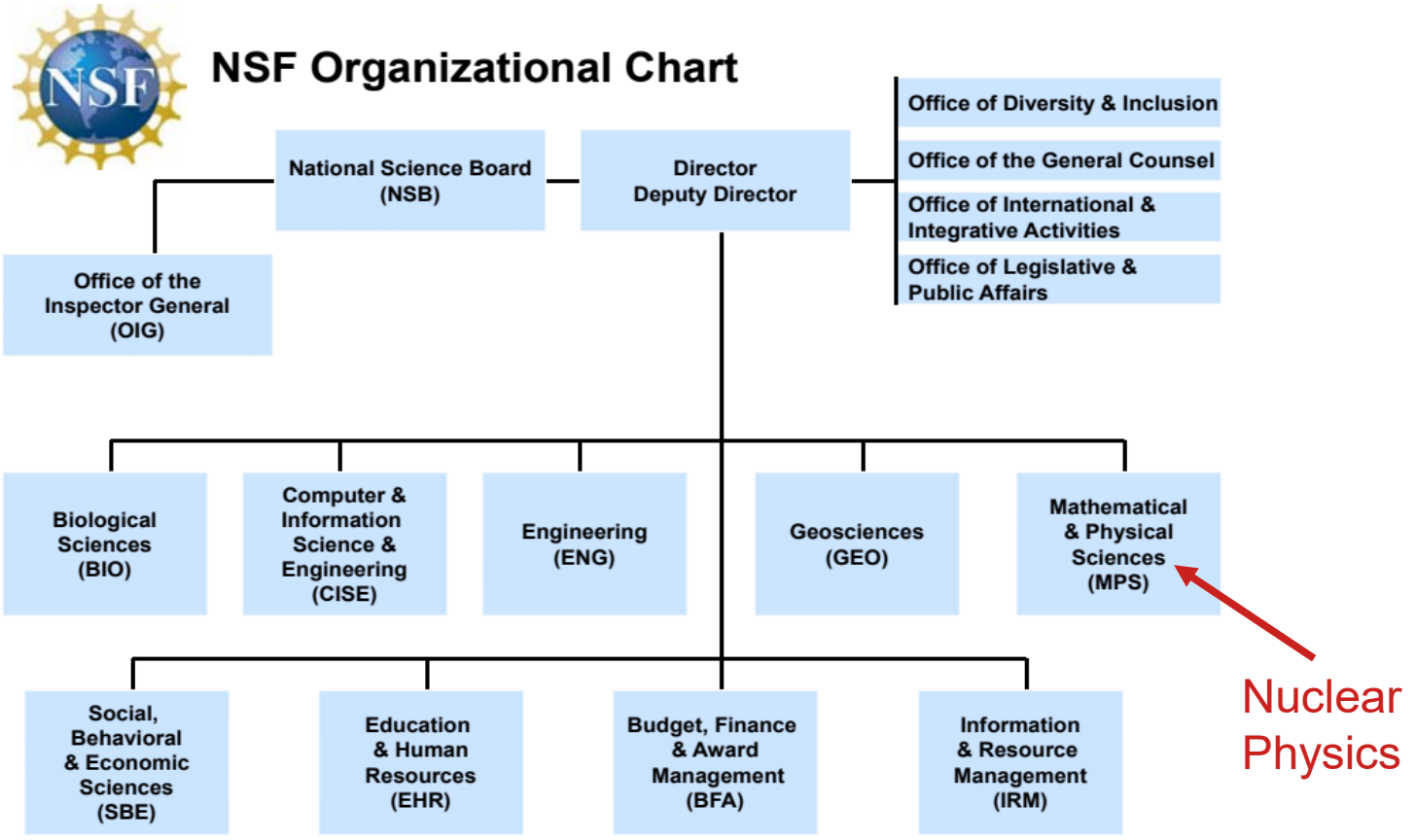
National Science Foundation

- In 1945, Vannever Bush report, Science: The Endless Frontier. The report envisioned a new agency whose mission would promote the progress of science by supporting basic research at colleges and universities.
- Established by law in 1950
- Mission: To promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense; and for other purposes.

NSF In New Building

Moved to Alexandria VA in 2017

National Science Foundation - NP



NSF

- Recent Directors
  - Arden L. Bement, Jr PhD Metalurgical Engineering
  - Subra Suresh PhD Mechanical Engineering
  - France A. Córdova PhD Astrophysics
  - Sethuraman Panchanathan PhD Electrical and Computing Engineering
- Appointed by President and Senate confirmed to 6 year terms

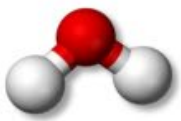
Mathematical and Physical Sciences (MPS)

Science at the Scales of the Universe

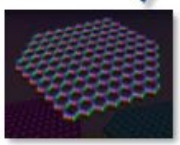
Images from Wikipedia Commons

quarks

nuclei
proton



molecules
atoms



nanostructures
polymers
proteins

100 Hz
gravitational
wave

planets

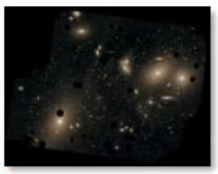
Sun

solar
system

Crab
Nebula

galaxies
Milky Way

Virgo
cluster



observable
universe

v

10^{-24} 10^{-20} 10^{-16} 10^{-12} 10^{-8} 10^{-4} 1 10^{4} 10^{8} 10^{12} 10^{16} 10^{20} 10^{24} m

CHE, DMR

PHY

AST

DMS

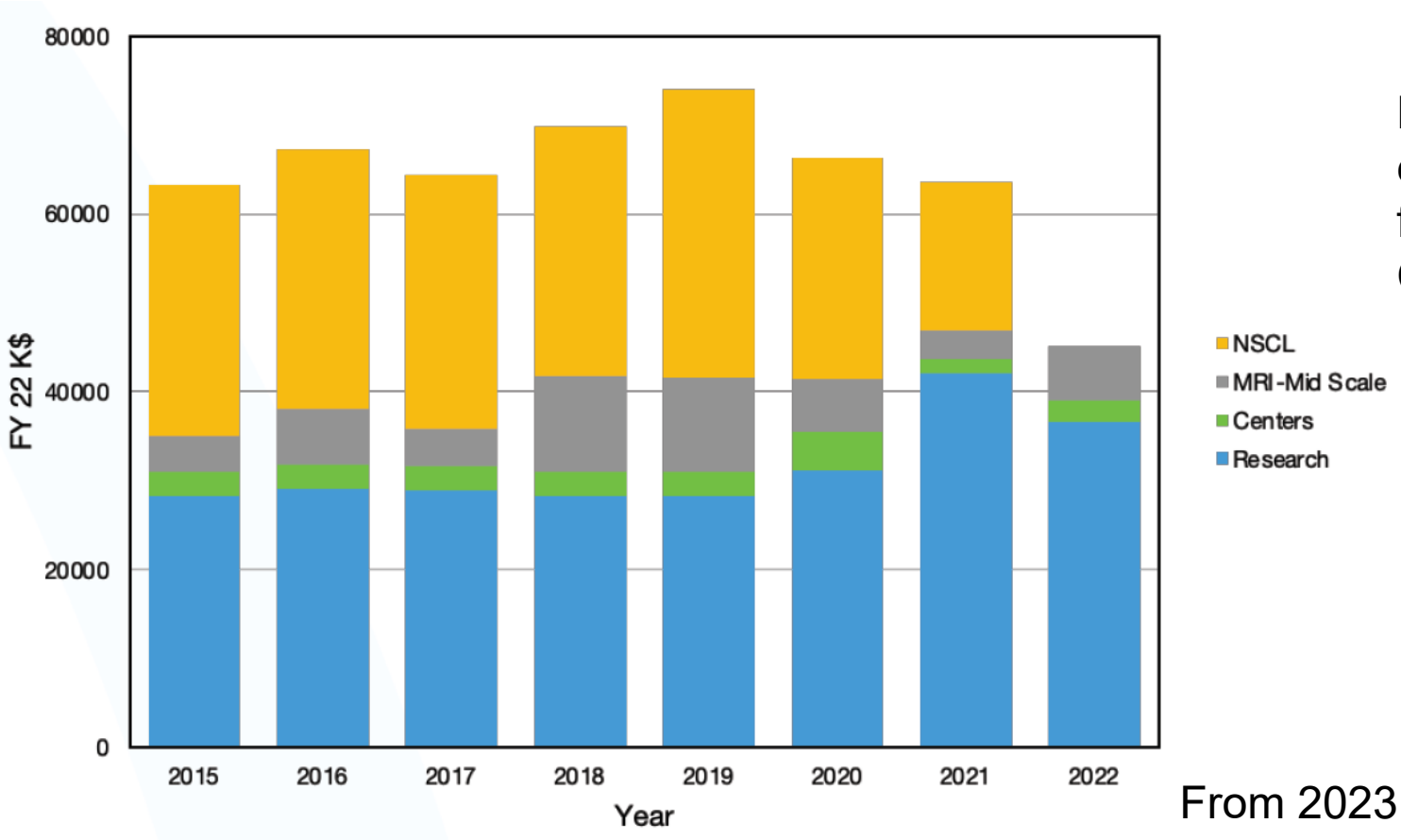
Directorate for Mathematical and Physical Sciences (MPS)

- Division of Astronomical Sciences
- Division of Chemistry
- Division of Materials Research
- Division of Mathematical Sciences
- Division of Physics -> Nuclear Physics
- Office of Strategic Initiatives

Nuclear Physics at the NSF

- Staffed by three program officers
  - Experiment Allena Opper – NSF employee
  - Experiment “Rotator” Vicki Greene – IPA
  - Theory Bogdan Mihaila – NSF employee
- NSF uses IPAs extensively and at all levels of management

NSF NP Funding



NP Funding is not called out in NSF funding request to Congress

From 2023 Long Range Plan

Nuclear Physics at NSF

- Nuclear and hadron QCD
- Nuclear astrophysics, reactions, and structure
- Nuclear precision measurements of fundamental symmetries and constants
- University labs at Florida State Univ. and Univ. of Notre Dame
- Nuclear Theory & Theory Hubs
- Co-review and co-funding with other NSF programs
- Equipment Projects through NSF wide Major Research Instrumentation Mid-scale Research Infrastructure competitions

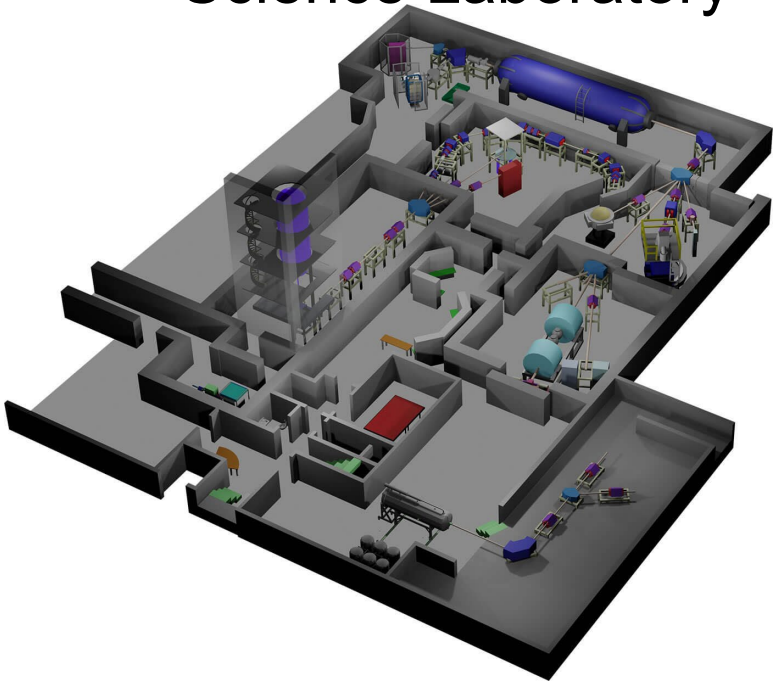
Nuclear Physics at the NSF

- Experiment
  - “Supports experimental research at the frontiers of nuclear physics in the following areas: nuclear astrophysics, structure and reactions; nuclear and hadron quantum chromodynamics; precision measurements of fundamental symmetries and constants.”
- Theory
  - “Supports research on fundamental theoretical aspects of nuclear physics, model building and applications to astrophysical phenomena and experimental programs at particle accelerator facilities.”

NSF Funded Labs

- John D. Fox Lab FSU

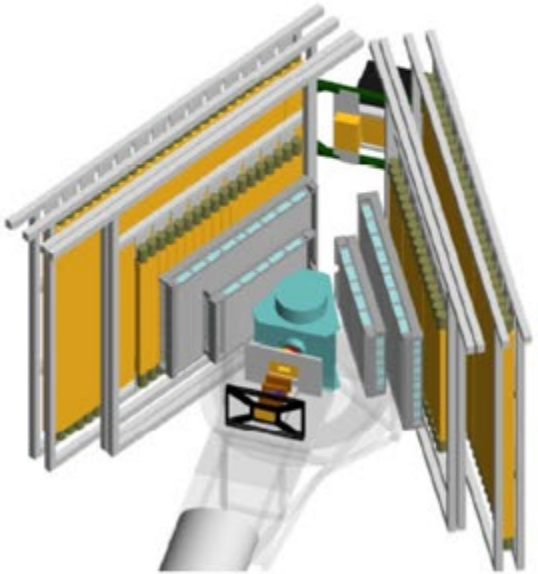
Notre Dame Nuclear Science Laboratory



Example NSF MSRI Projects

MUSE

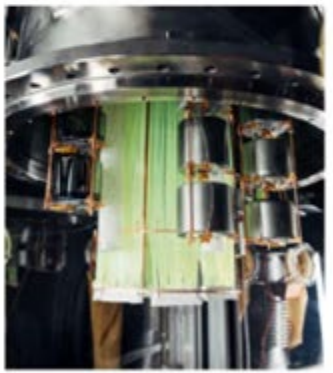
- Simultaneous e/μ scattering from LH_2
- Lepton universality
- Proton radius

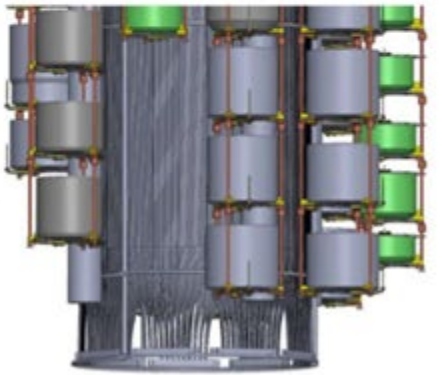


LEGEND – 200

Large Enriched Germanium Experiment for Neutrinoless ββ Decay

- Beginning to take "production" data; ~ 140 kg Ge
- Additional ~ 60 kg to be installed late 2023

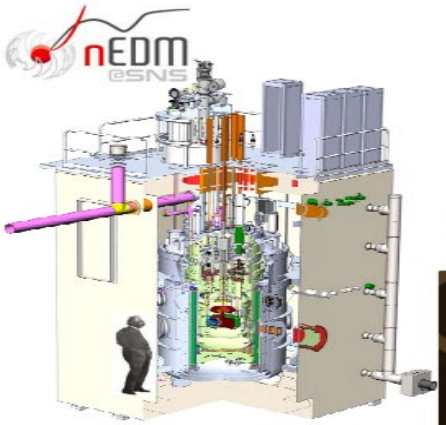


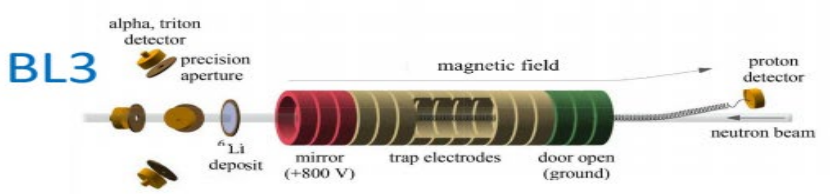


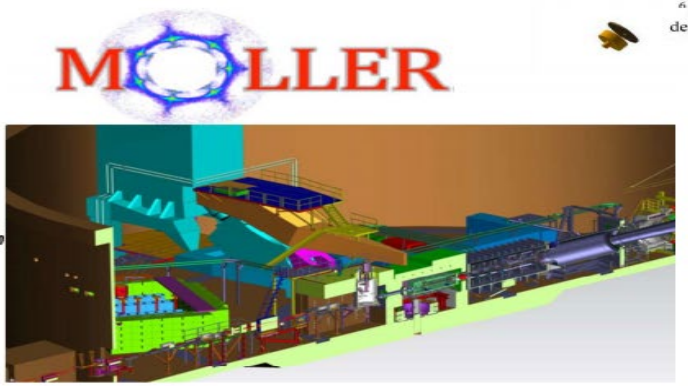
Example NSF MSRI Projects

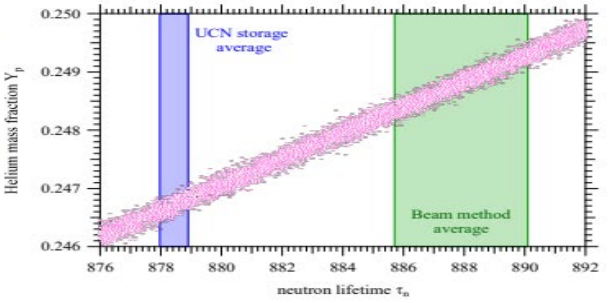
PHY Mid-scale Research Instrumentation (cont)

Currently 5 ENP Midscale projects: nEDM@SNS, MUSE, LEGEND-200, MOLLER, BL3









NSF Grant Process

- NSF 2x-xxx: Division of Physics: Investigator-Initiated Research Projects (PHY)
  - Accept proposals each year, new and renewal - format indicated in FOA
  - Group or individual PIs
  - Typical proposal is for 3 years
  - Summer salary, post docs, grad students, possibly other staff, travel, possibly some equipment
  - All physics areas in one review process
  - Proposals are letter reviewed and then rated by panel
  - For successful proposals, 3yr budget negotiated (but subject to approp.)
- At times NSF initiatives that match NP areas
- MRI and MSRI separate process

Early Career Awards

- Separate solicitation for early career scientists
- Both DOE and NSF have programs
  - DOE both early career faculty and lab scientists
  - NSF early career faculty
  - They have different eligibility requirements – definition of “early”
- Awards for 5 years

DOE NP 2022 Workforce Survey

FY2022 Nuclear Physics Workforce Survey

Statistics on Ph.D.s Awarded

*Data Collected Since 2004

- ***Average Number of Years to Obtain a PhD***
  - **5.7** Years (Average Based on 1679 data points)
- ***% U.S. Citizen 53 .7%*** (% Based on 1679 data points)
- ***Males/Females:* 81.2% / 18.8%** (% Based on 1679 data points)
- ***Race:*** (% Based on 1616 data points)
  - ***White: 65.8 % Asian: 27.6 % Black or African American: 2.1%***
  - ***Hispanic or Latino*** : ***4.1%***
  - ***Native Hawaiian and Other Pacific Islander:* 0.2%**
  - ***American Indian and Alaska Native:* 0.2%**
  - ***Some Other Race:* 0.0%**

DOE NP 2022 Workforce Survey

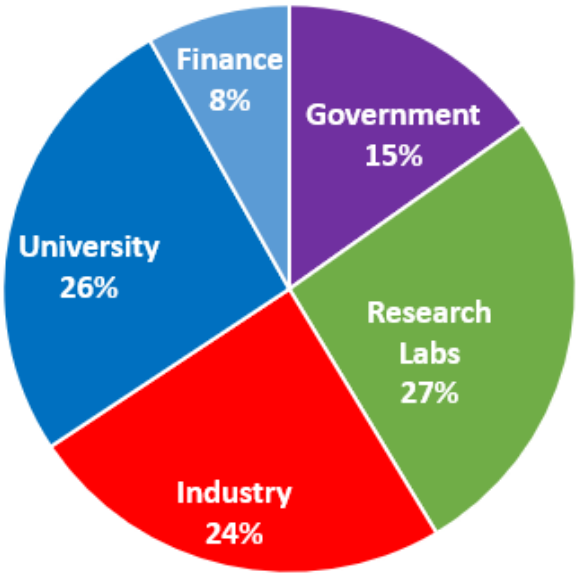
FY2022 Nuclear Physics Workforce Survey

Statistics on Ph.D.s Awarded

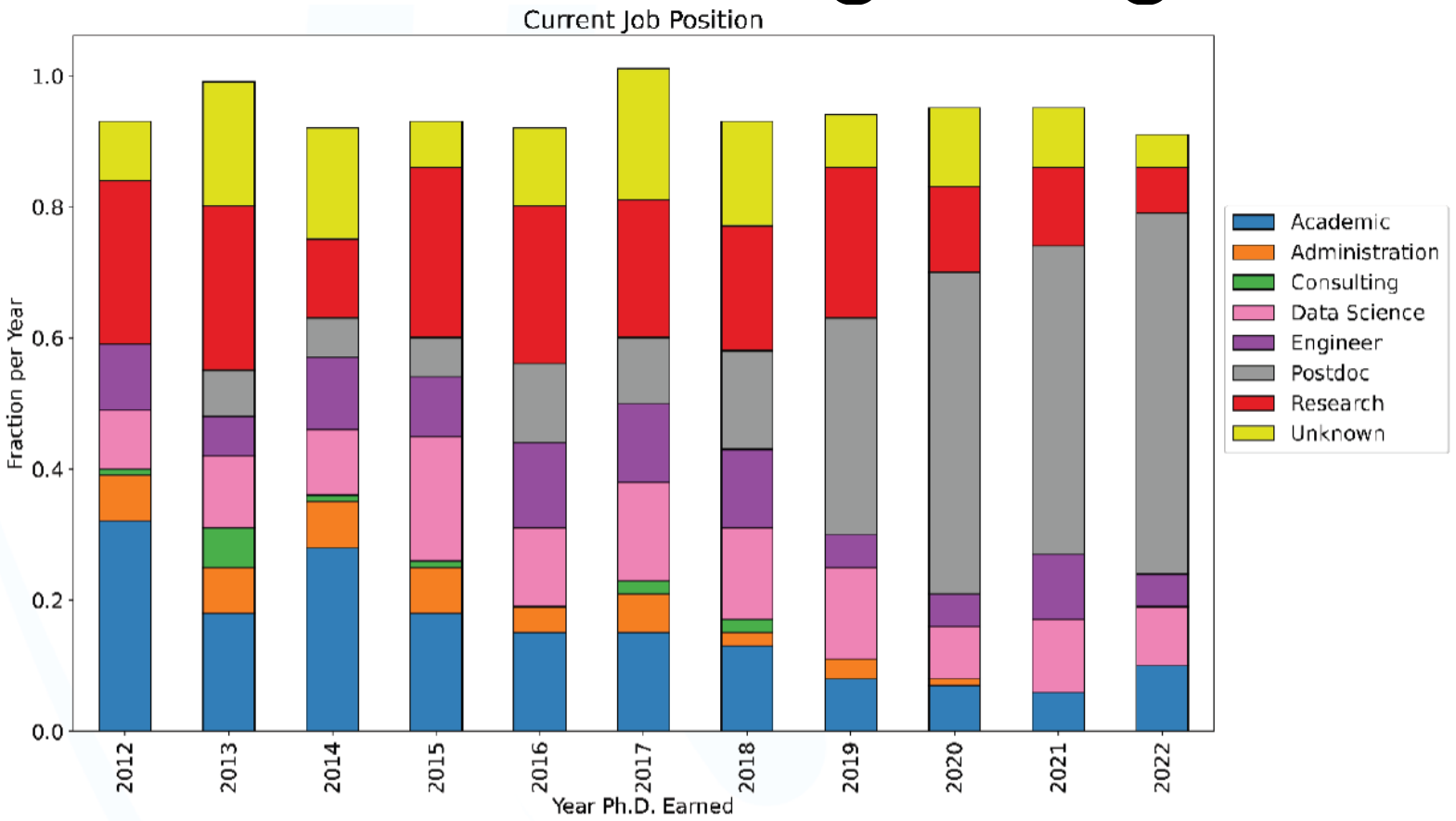
*Data Collected Since 2004

- ***Initial Career Location: USA / Non- USA / Undecided***
  - ***80.0% / 15.0% / 5.1%*** (% Based on 1681 data points)

- ***Initial Career Path:*** (% Based on 1681 data points)
  - ***Applied Research/ National: 2.5%***
  - ***Business or Non-Nuclear: 12.7%***
  - ***Medical School/ Hospital: 1.6%***
  - ***NP Basic Research / National Laboratory: 15.2%***
  - ***NP Basic Research/ University: 33.0%***
  - ***NP Teacher / Professor: 4.6%***
  - ***Other Teacher / Professor: 5.9%***
  - ***Other Basic Research / National Laboratory: 1.9%***
  - ***Other Basic Research / University: 6.8%***
  - ***Research / Nuclear Industry: 4.7%***
  - ***Non-Profit: 0.1%***
  - ***Other: 2.7%***
  - ***Undecided: 8.3%***



2023 Long Range Plan



Where Nuclear Physics PhDs are employed

10 yr post PhD

Most recent grads

Beyond Assertion: How NP Trained Workforce Benefits the Nation

Sample of Non-Defense Roles Based on Breakthrough Prize Questionnaire

- Sr. Chemist at a mining company
- Sr. Research Scientist at a Fotune-100 conglomerate
- Head of bioinformatics at a molecular therapy company
- Director of Radiological Product Development of a global healthcare technology company
- Vice President of Engineering of a software application development company
- Chief Researcher at an international industrial research lab
- Director of Innovation at a popular data science platform company
- Senior Manager at an EU-listed company providing micro structuring equipment to the semiconductor industry.
- Accelerator and materials technical lead at the radiation effects laboratory of a major Fortune-50 aerospace company.
- Owner of a private technology/consulting company
- President of a high-tech company that provides geotechnical monitoring solutions and instrumentation to mining and industry
- CTO of a web design and software design company
- Principal Scientist (Global Research and Technology) of a major international healthcare company
- CEO of an international water purification technology company
- Principal Scientist (electronics and software development) at a company that provides radiation and explosive solutions to homeland security and industry
- Owner of a nuclear electronics, instrumentation and data analysis company
- Manager of the R&D department of a FTSE-100 detection and screening technology company
- Sr. Radiation Physicist, health science company that provides gamma technologies and medical isotopes
- Sr. Scientific Director (R&D) at a radiation analytic company

From Tim Hallman NSAC talk 10/23

Nuclear Science Advisory Committee

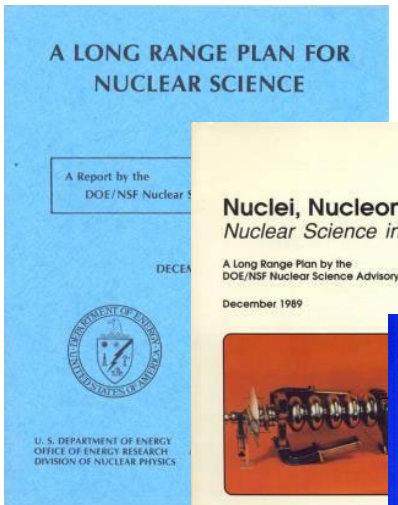
- Provides official advice to DOE and the NSF on the national program for basic nuclear science research
- The Committee will provide advice and recommendations to the Director, Office of Science (DOE), and the Assistant Director,Mathematical & Physical Sciences Directorate (NSF), on determining the scientific priorities within the field of basic nuclear science research among the possible opportunities.
- Responsibility for the direction of NSAC itself, selecting members, putting together meeting agendas and developing charges is shared by the two agencies.
- Meets a few times a year for updates from agencies and to address charges as needed

Recent NSAC Charges

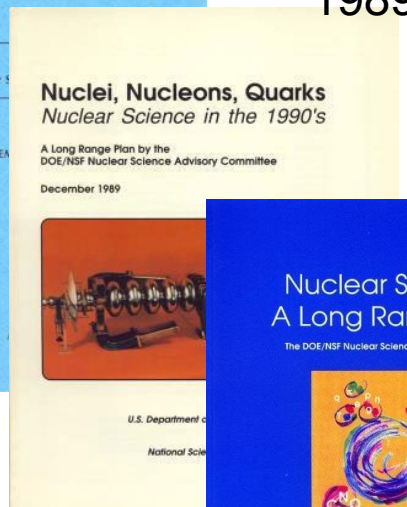
- Charges can originate from NSF/DOE-NP, higher in DOE or even Congress
  - December 2023 – Charge to Office of Science Advisory Committees – Facilities Construction Projects
  - July 2022 – Nuclear Science Advisory Committee (NSAC) conduct a new study of the opportunities and priorities for United States nuclear physics research and recommend a long-range plan
  - April 2022 – NSAC Sub-Committee to assess challenges, opportunities, and priorities for effective stewardship of nuclear data.
  - March 2021 – Subcommittee on 99Molybdenum Seventh Annual Charge

A Long History to NP Long Range Plans

1979

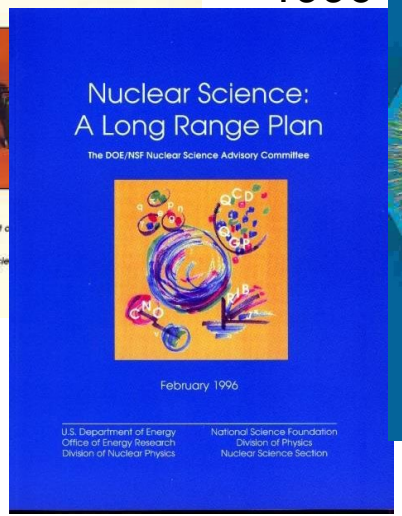


1983

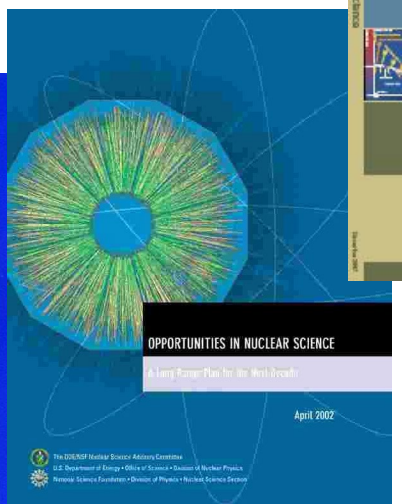


1989

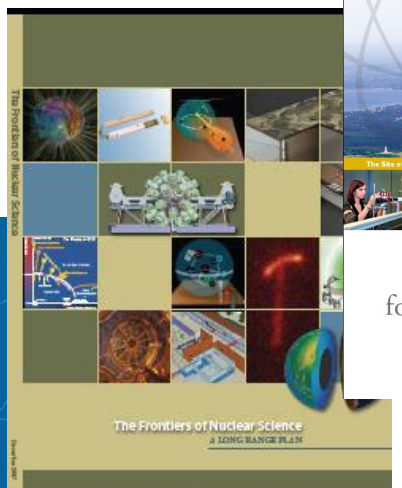
1996



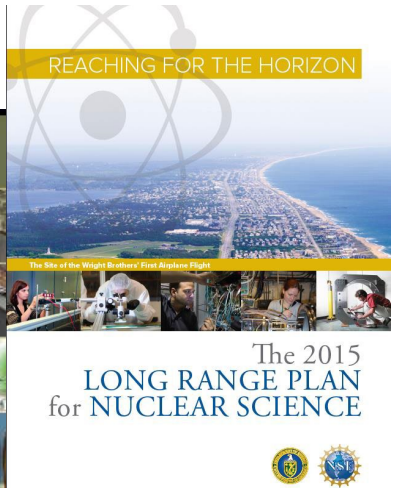
2002



2009

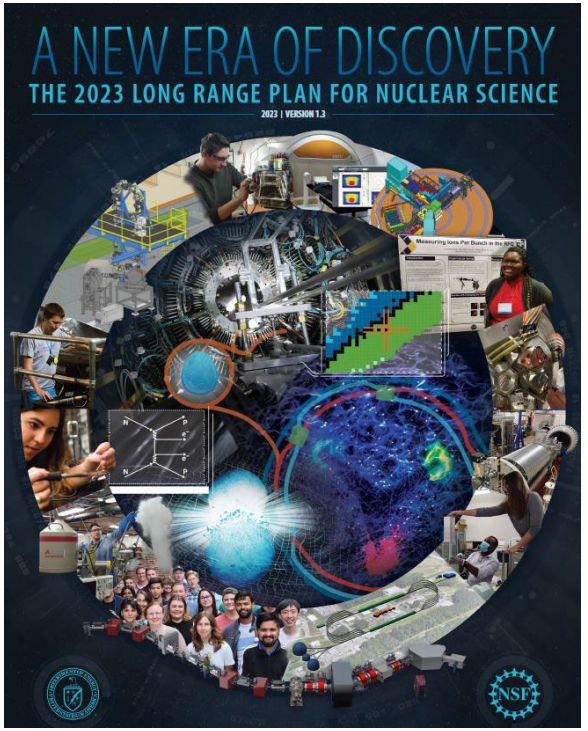


2015



Plans presented to Congress. Generally well received for setting priorities within realistic budgets.

2023 Long Range Plan



- LRP charged to NSAC by DOE and NSF – July 2022
- Writing Committee established – 62 members
- White papers from community Town Hall meetings
- Resolution meeting to finalize priorities
- Released Oct. 2023
- Nuclear Physics Day on Capitol Hill (November 8, 2023)

Long Range Plan Physics Questions

- Nuclear science addresses some of the outstanding challenges to modern physics, including the properties and limits of matter, the forces of nature, and the evolution of the universe:
  - How do quarks and gluons make up protons, neutrons, and, ultimately, atomic nuclei?
  - How do the rich patterns observed in the structure and reactions of nuclei emerge from the interactions between neutrons and protons?
  - What are the nuclear processes that drive the birth, life, and death of stars?
  - How do we use atomic nuclei to uncover physics beyond the Standard Model?

Long Range Plan

- Vision for the future builds on the ongoing, world-leading US program in nuclear science
  - Quark gluon structure and symmetries at CEBAF-12GeV
  - The nature of quark–gluon matter and the spin structure of the nucleon at RHIC and the heavy ion program at the Large Hadron Collider (LHC)
  - Breakthroughs in our understanding of nuclei and their role in the cosmos through research at the nation's low-energy user facilities, ATLAS and FRIB, the ARUNA laboratories, and key national laboratory facilities.
  - A targeted program of experiments that reaches for physics beyond the Standard Model through rare process searches and precision measurements.
  - Explaining how data gathered in these endeavors are connected and consistent through theory and computation. Nuclear theory motivates, interprets, and contextualizes experiments, opening up fresh research vistas.

Long Range Plan Priorities

- RECOMMENDATION 1 – The highest priority of the nuclear science community is to capitalize on the extraordinary opportunities for scientific discovery made possible by the substantial and sustained investments of the United States. We must draw on the talents of all in the nation to achieve this goal.
  - Increase the research budget
  - Continuing effective operation of the national user facilities ATLAS, CEBAF, and FRIB, and completing the RHIC science program
  - Raising the compensation of graduate researchers to levels commensurate with their cost of living without contraction of the workforce, lowering barriers and expanding opportunities in STEM for all
  - Expanding policy and resources to ensure a safe and respectful environment for everyone

Long Range Plan Priorities

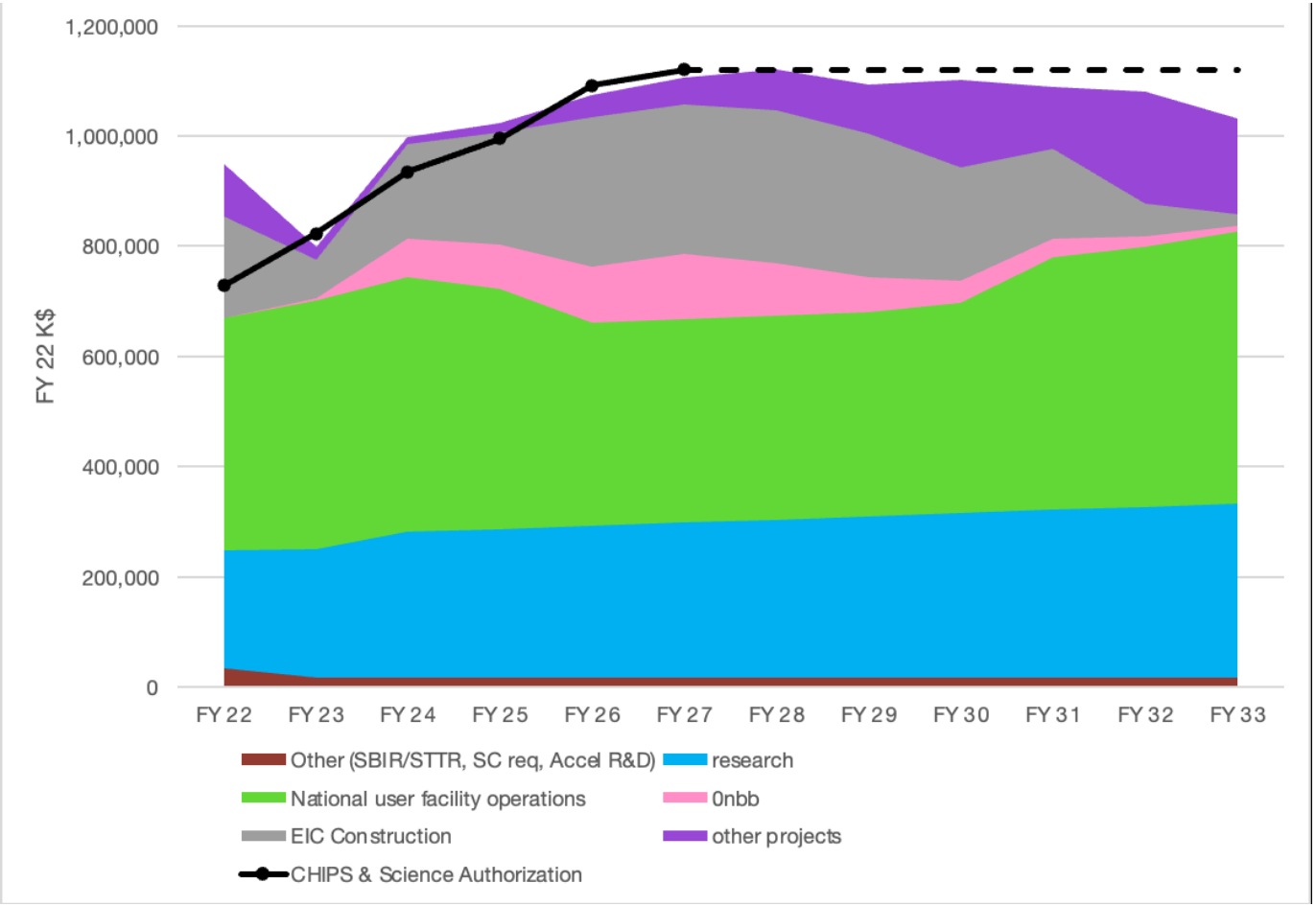
- RECOMMENDATION 2 – As the highest priority for new experiment construction, we recommend that the United States lead an international consortium that will undertake a neutrinoless double beta decay campaign, featuring the expeditious construction of ton-scale experiments, using different isotopes and complementary techniques.
- RECOMMENDATION 3 – We recommend the expeditious completion of the EIC as the highest priority for facility construction.

.

Long Range Plan Priorities

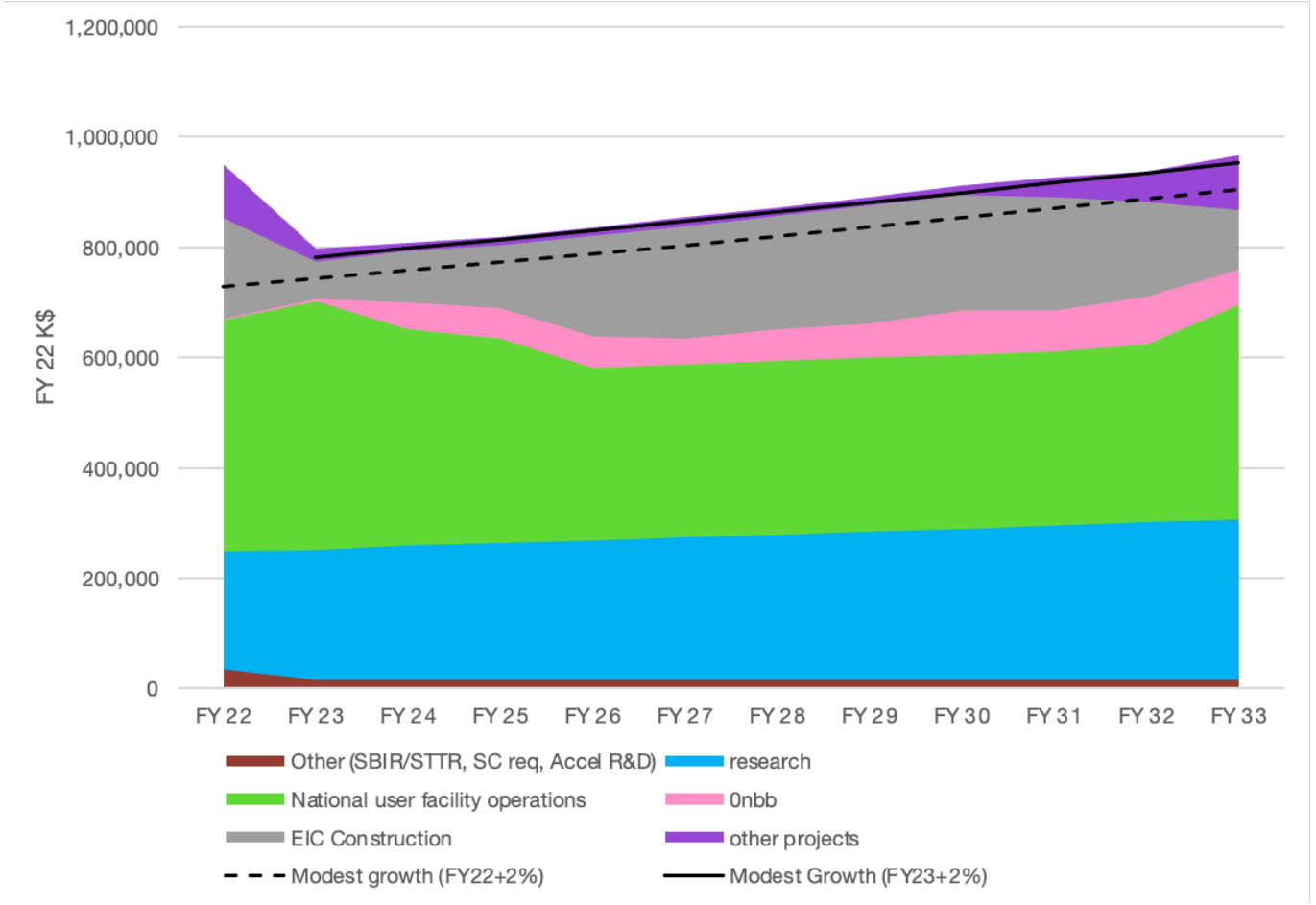
- RECOMMENDATION 4 – We recommend capitalizing on the unique ways in which nuclear physics can advance discovery science and applications for society by investing in additional projects and new strategic opportunities.
  - FRIB400, SoLID/Jlab, LHC Heavy Ion detector upgrades
  - Emerging technologies for measurements of neutrino mass and electric dipole moments
  - detector and accelerator R&D
  - quantum information science and technology
  - DOE Scientific Discovery through Advanced Computing (SciDAC) and NSF Cyberinfrastructure for Sustained Scientific Innovation programs
  - Nuclear Data

Long Range Plan DOE/NP Budget Scenarios



- CHIPs act
  +12% in FY24
  +2% per year
- Robust program that addresses the priorities

Long Range Plan DOE/NP Budget Scenarios



- Modest Growth +2% per year
- Deliver a compelling program
- Operations impacted to complete a delayed EIC and NLDBD
- A modest investment in the research community

Appropriations Process

- Two types of bills passed
  - Authorizations
    - Set policies and authorized activities
    - Include funding limits, usually optimistic for science agencies
  - Appropriations
    - Provides annual funding
    - May provide specific direction

Appropriations Process

- House and Senate both have Appropriations Commitees with 12 subcomittees
- They prepare 12 individual bills, one per subcommittee
- Science agencies are in different subcommittee bills
  - DOE including the Office of Science is in Energy and Water subcommittee with e.g. Army Corps of Engineers
  - NSF is in Commerce subcommittee along with the Commerce Dept, Justice, NASA and more
  - NIH in Labor, Health and Human Services, and Education

Appropriations Timeline

Current FY+2 Agency

Start formulation

February

Office of Mgmt. And Budget

Secretary

Undersecretary

Office of Science

Program

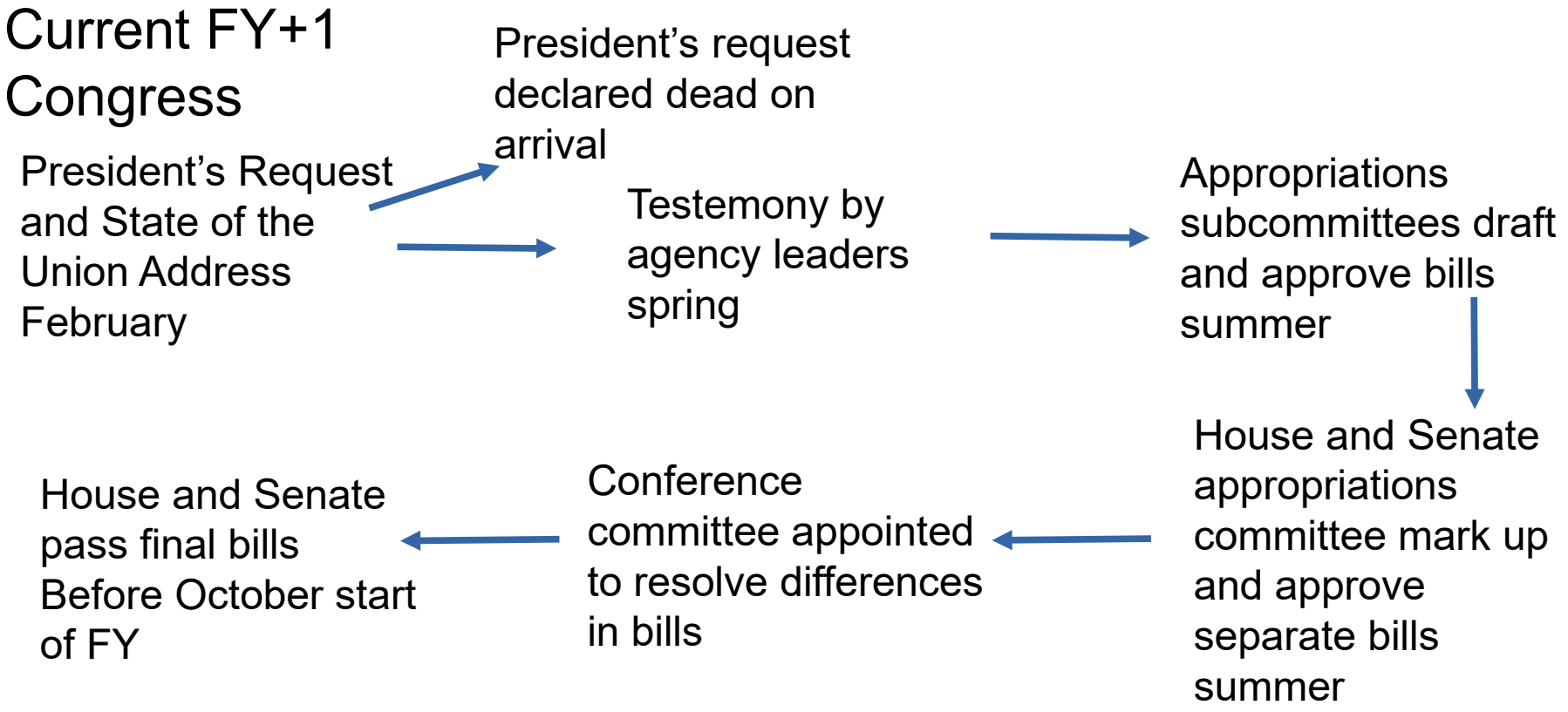
Spring

November

Final Resolution
January

President's Request
February

Appropriations Timeline



Appropriations Timeline

Current FY
Agency

Begin execution of budget (often under continuing resolution) October

Finalize budget when have final appropriation Timing varies

NSF provides details of lower level budgets to Congress for approval

Most grants need to be recommended by early June for awards by end of FY

Action on FY25 Bills

- House Energy and Water approved by full Committee
  - The actual bill has no detail only for Office of Science “$8,390,000,000, to remain available until expended”
  - Guidance in associated committee report
  - “The Nuclear Physics program supports research into the fundamental particles that compose nuclear matter, how they interact, and how they combine to form the different types of matter observed in the universe today. The recommendation includes not less than $105,000,000 for operations at the Facility for Rare Isotope Beams (FRIB) and not less than $150,000,000 for operations at the Continuous Electron Beam Accelerator Facility. The recommendation provides $15,000,000 for the High Rigidity Spectrometer. The Committee supports the FRIB Isotope Harvesting projects.”

Action on FY 2025 Bills

- Senate Appropriations has held markup on Energy and Water bill but not yet approved by subcommittee
- NSF
  - House +5.2% for Research and Related Activities
  - Senate does not yet have a bill approved by subcommittee

Thanks for your attention

Radiation Effects

BREAKING NEWS | ScienceInsider Friday 7/12/2024

Europa Clipper threatened by electronics flaws

NASA's $5 billion flagship mission to explore Jupiter's icy moon Europa, due for an October launch, could be in big trouble because some of its electronics may be vulnerable to Jupiter's intense radiation. Recently, engineers discovered that some radiation-hardened transistors already sealed up inside the probe do not meet specifications. NASA is investigating the extent of the problem.