U.S. DEPARTMENT OF ENERGY | Office of Science

High Energy Physics Budget, Early Career, Diversity and Inclusion

DOE/HEP PI Meeting 2019

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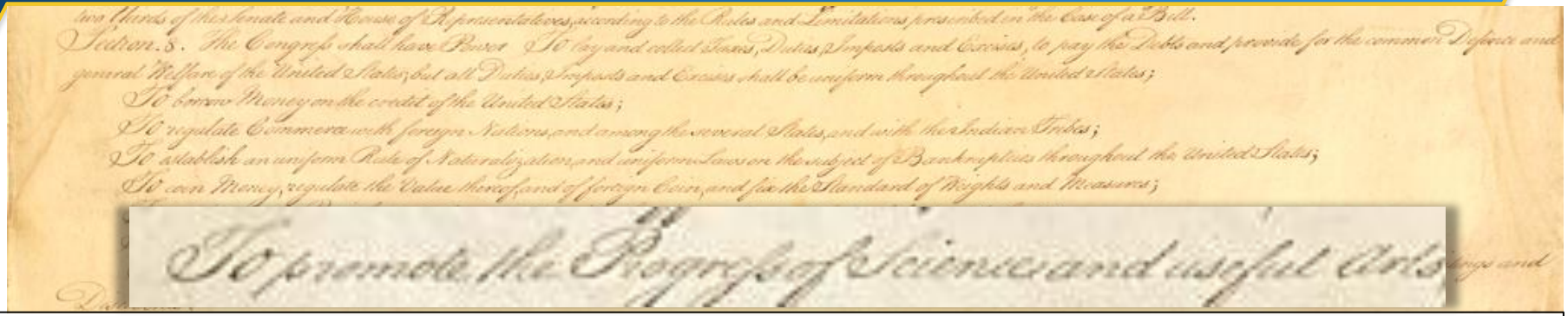
Outline

- HEP and the Federal Budget Process
- SC Early Career Research Program
- Diversity and Inclusion

Federal Budget Process

Constitution and Disclaimers



U.S. Constitution. Article 1, Section 8: "The Congress shall have Power…To promote the Progress of Science and useful Arts"

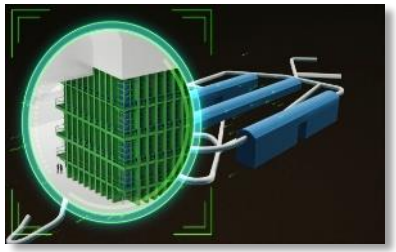
- This talk aims to illuminate the DOE/HEP role in the Federal budget process
- For additional HEP budget information, everyone is encouraged to view the slides from the November 2018 HEPAP meeting:

https://science.osti.gov/hep/hepap/

- **Lobbying (http://energy.gov/management/lobbying)**
  - Generally prohibited from contacting or encouraging others to contact a state or federal legislator or executive branch official in an attempt to influence the enactment or modification of legislation or other specified activities
- **Partisan Political Activity (https://osc.gov/Pages/HatchAct.aspx)**
  - In general, executive branch federal employees may not:
    - Use official authority or influence to interfere with an election
    - Solicit or discourage political activity of anyone with business before their agency
    - Engage in political activity while: on duty, in a government office, wearing an official uniform, or using a government vehicle
    - And more…

U.S. Long-Term Particle Physics Strategy

- The global vision presented in the 2014 Particle Physics Project Prioritization Panel (P5) report was the culmination of years of effort by the U.S. particle physics community
  - 2012 – 2013: Scientific community organized year-long planning exercise ("Snowmass")
  - 2013 – 2014: U.S. High Energy Physics Advisory Panel convened P5 to develop a plan to be executed over a ten-year timescale in the context of a 20-year global vision for the field
- P5 report enables discovery science with a balanced program that deeply intertwines U.S. efforts with international partners
  - **U.S. particle physics community** strongly supports strategy
  - **U.S. Administration** has supported implementing the P5 strategy through each President's Budget Request
  - **U.S. Congress** has supported implementing the P5 strategy through the language and funding levels in appropriations bills
  - **International community** recognizes strategy through global partnerships



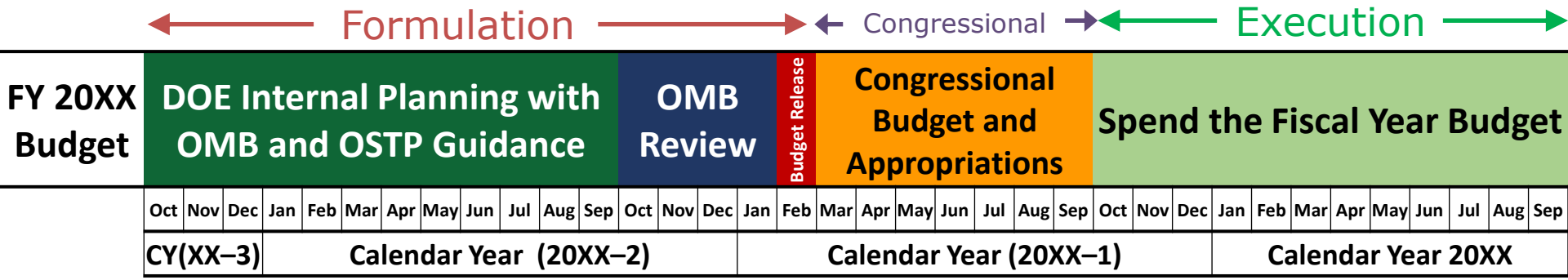
Budget and Accounting Act of 1921

- Before the Budgeting & Accounting Act of 1921, no single government entity oversaw the entire budget
  - Departments submitted budget requests directly to Congress
- After WWI, the Act was passed to provide more control over government expenditures
  - Budgeting debates hinge on powers given to Congress and President in this Act
  - Restrictions keep either branch from dominating budget decisions

- The Act requires the President to submit a budget to Congress every year
- The act created:
  - **Bureau of the Budget** (BoB), giving President control over individual departments, evaluating competing requests
  - **General Accounting Office** tells House and Senate what may be necessary to balance the budget
- **Reorganization Act of 1939** created the Executive Office of the President (**EOP**), and BoB moved from Treasury to EOP
  - In **1970**, BoB reorganized by Executive Order (Nixon) as the **Office of Management and Budget**
  - OMB is the largest agency within the EOP

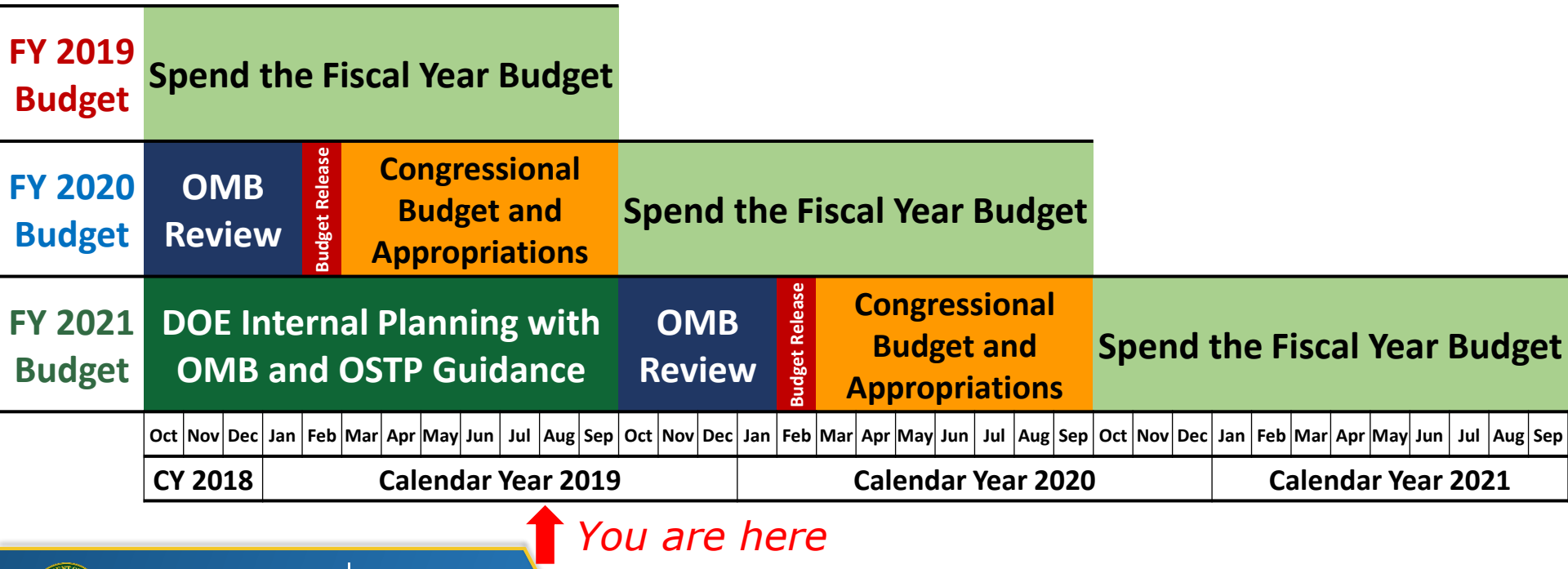
Three Phases of Budget Process

- **Formulation**: Executive branch prepares the President's Budget Request
  - White House Office of Management and Budget (OMB) controls this process, providing guidance to Executive branch agencies
- **Congressional**: Enacts laws that control spending and receipts
  - Congress considers the President's Budget proposals, passes a budget resolution, and enacts the regular appropriations acts and other laws that control spending and receipts
- **Execution**: Executive branch agencies carry out program
  - OMB apportions funds to Executive Branch agencies, which obligate and disperse funding to carry out their programs, projects, and activities



The U.S. Federal Budget Cycle I

- Typically, three budgets are being worked on at any given time
  - Executing current Fiscal Year (FY; October 1 – September 30)
  - OMB review and Congressional Appropriation for upcoming FY
  - Agency internal planning for the second FY from now



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Overview of Budget Formulation Process

Spring

→ OMB provides policy guidance for Executive branch agency budget requests
- Absent more specific guidance, agencies start with outyear estimates from previous budget

Spring & Summer

→ OMB works with agencies
- Identify major issues, develop plans for fall review, plan analysis of issues that will require decisions

June

→ OMB provides detailed instructions for submitting budget material

Sept.

→ Agencies submit budgets to OMB

Fall

→ OMB reviews budget proposals
- Considers Presidential priorities, program performance, budget constraints

Late Nov.

→ OMB provides recommended budget proposal to President and provides passback to agencies

Dec.

→ December: Agencies may appeal to OMB and the President

Jan.

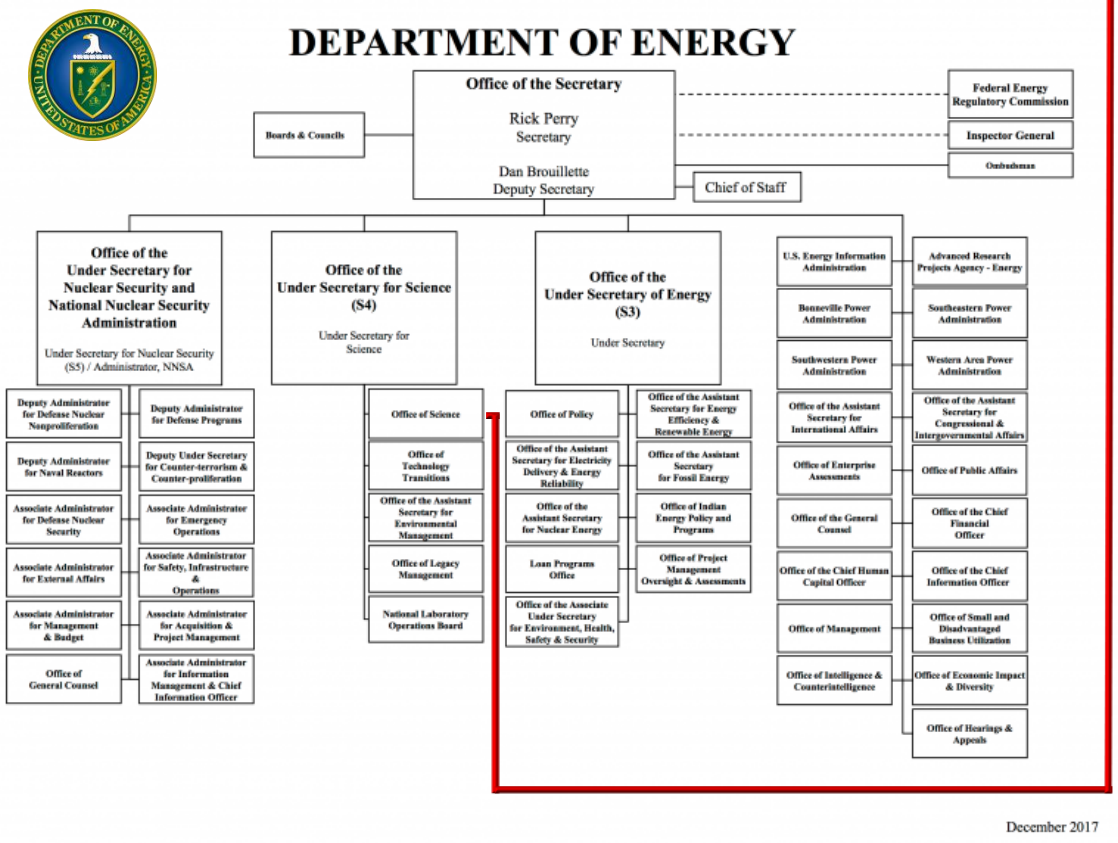
→ January: Agencies prepare and OMB reviews final congressional budget justification materials

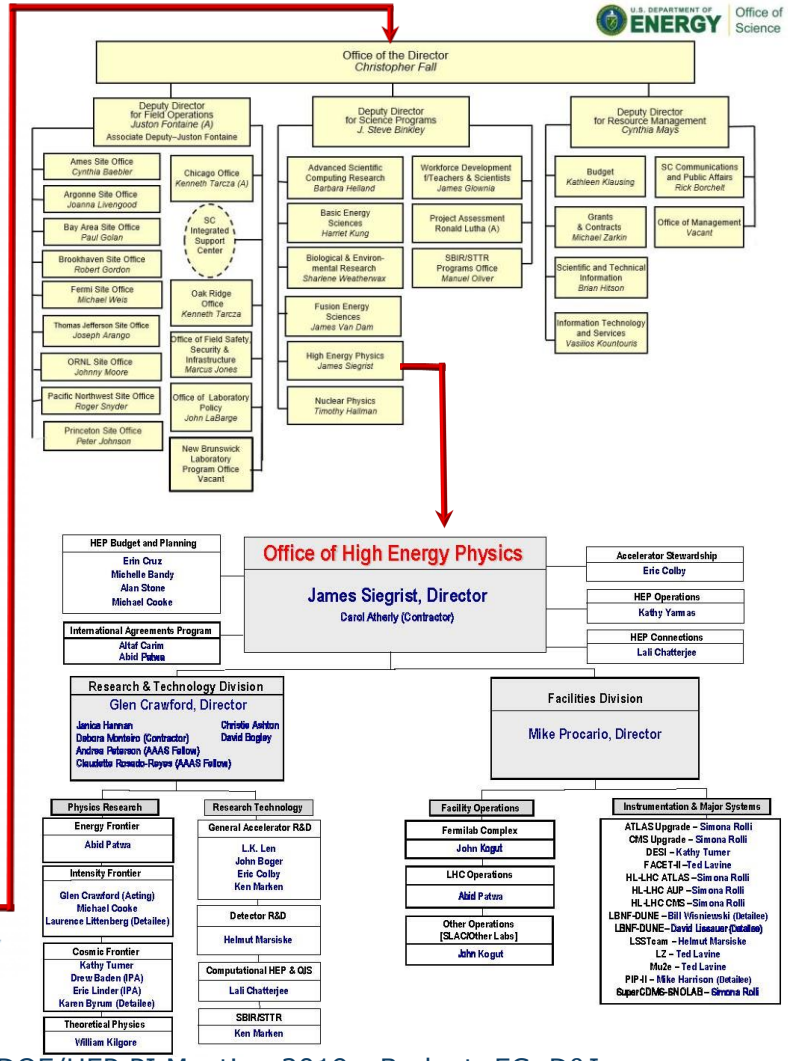
→ February: President transmits budget to Congress

Mission of the Department of Energy

- The mission of the Energy Department is to ensure America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions.
  - Catalyze the timely, material, and efficient transformation of the nation's energy system and secure U.S. leadership in clean energy technologies.
  - **Maintain a vibrant U.S. effort in science and engineering as a cornerstone of our economic prosperity with clear leadership in strategic areas.**
  - Enhance nuclear security through defense, nonproliferation, and environmental efforts.
  - Establish an operational and adaptable framework that combines the best wisdom of all Department stakeholders to maximize mission success.

DOE Organization Chart



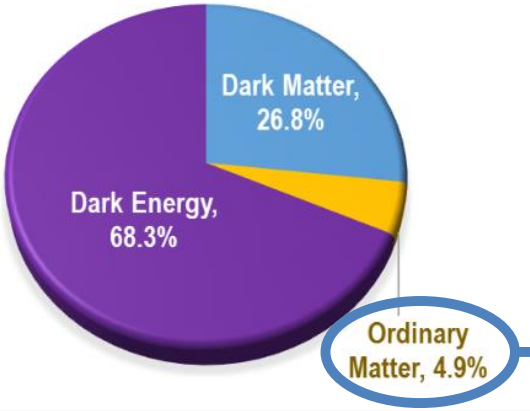


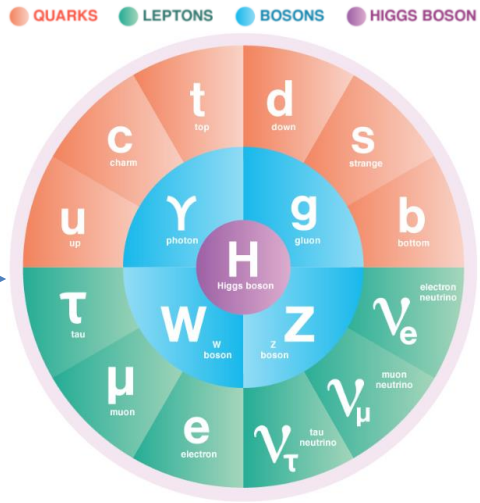
The High Energy Physics Program Mission

… is to understand how the universe works at its most fundamental level:

- Discover the elementary constituents of matter and energy
- Probe the interactions between them
- Explore the basic nature of space and time

- The DOE Office of High Energy Physics fulfills its mission by:
  - Building **projects** that enable discovery science
  - Operating **facilities** that provide the capability for discoveries
  - Supporting a **research** program that produces discovery science





Creating the DOE HEP Budget Request

Top-down and bottom-up influences to the DOE HEP budget

White House

White House Priorities

OMB Directives

Advisory Panels (HEPAP, AAAC)

Community-driven Strategic Plans (P5)

Review Committee & Workshop Reports

Particle Physics Community

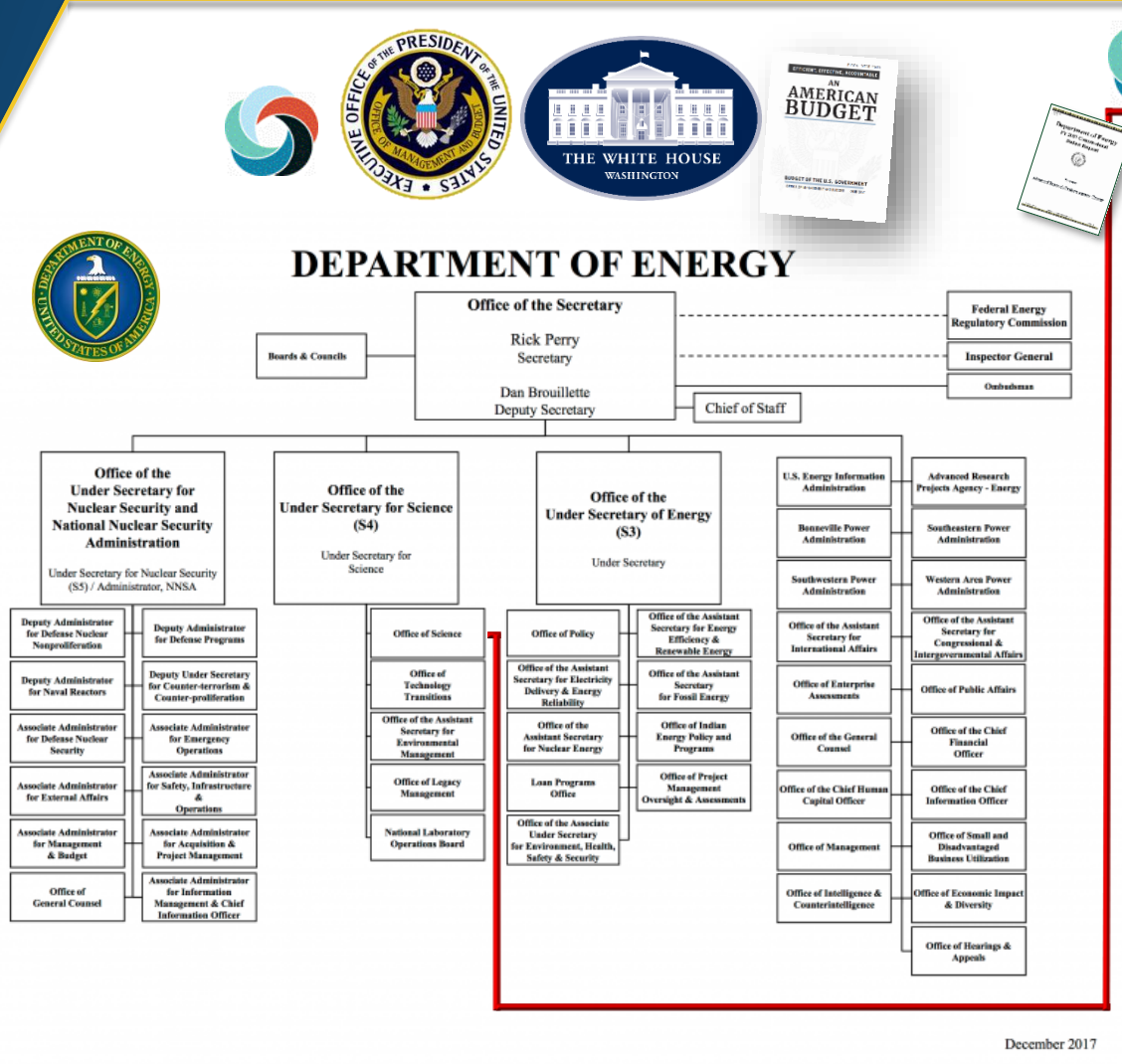
Project Performance

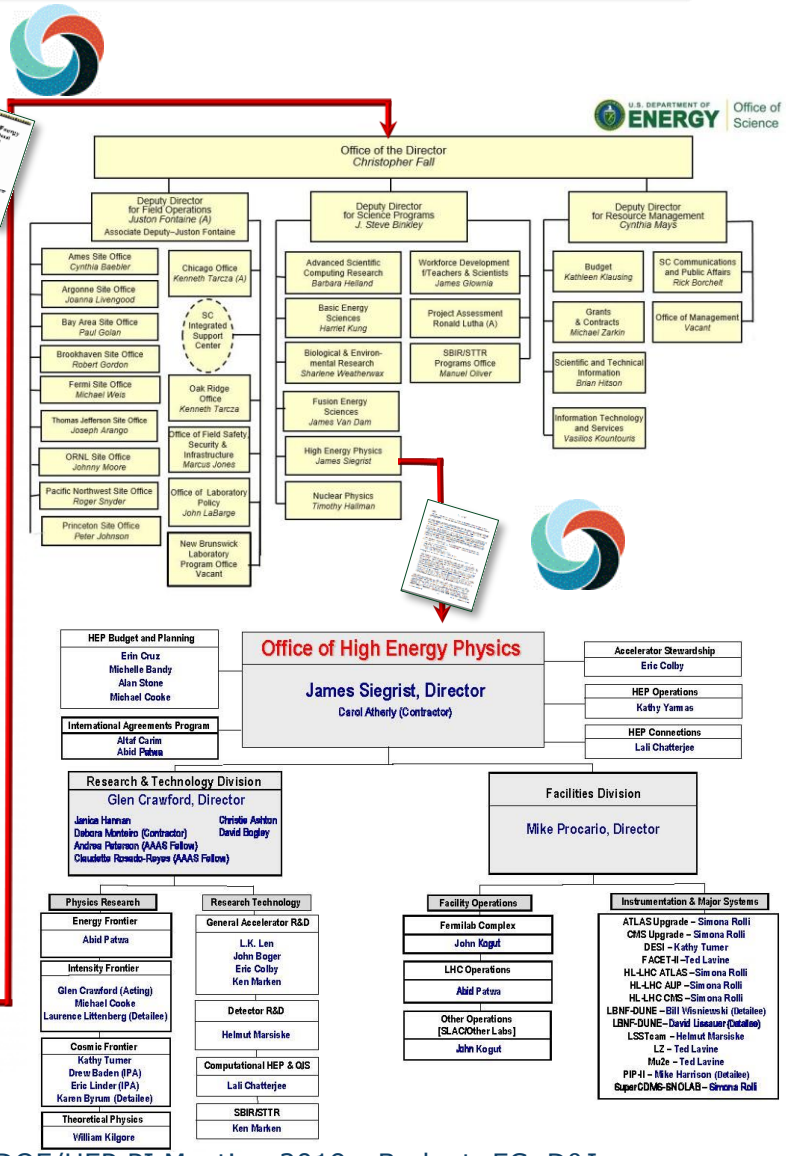
DOE/SC Management

DOE/HEP Program

Department of Energy

Path to the President's Budget Request



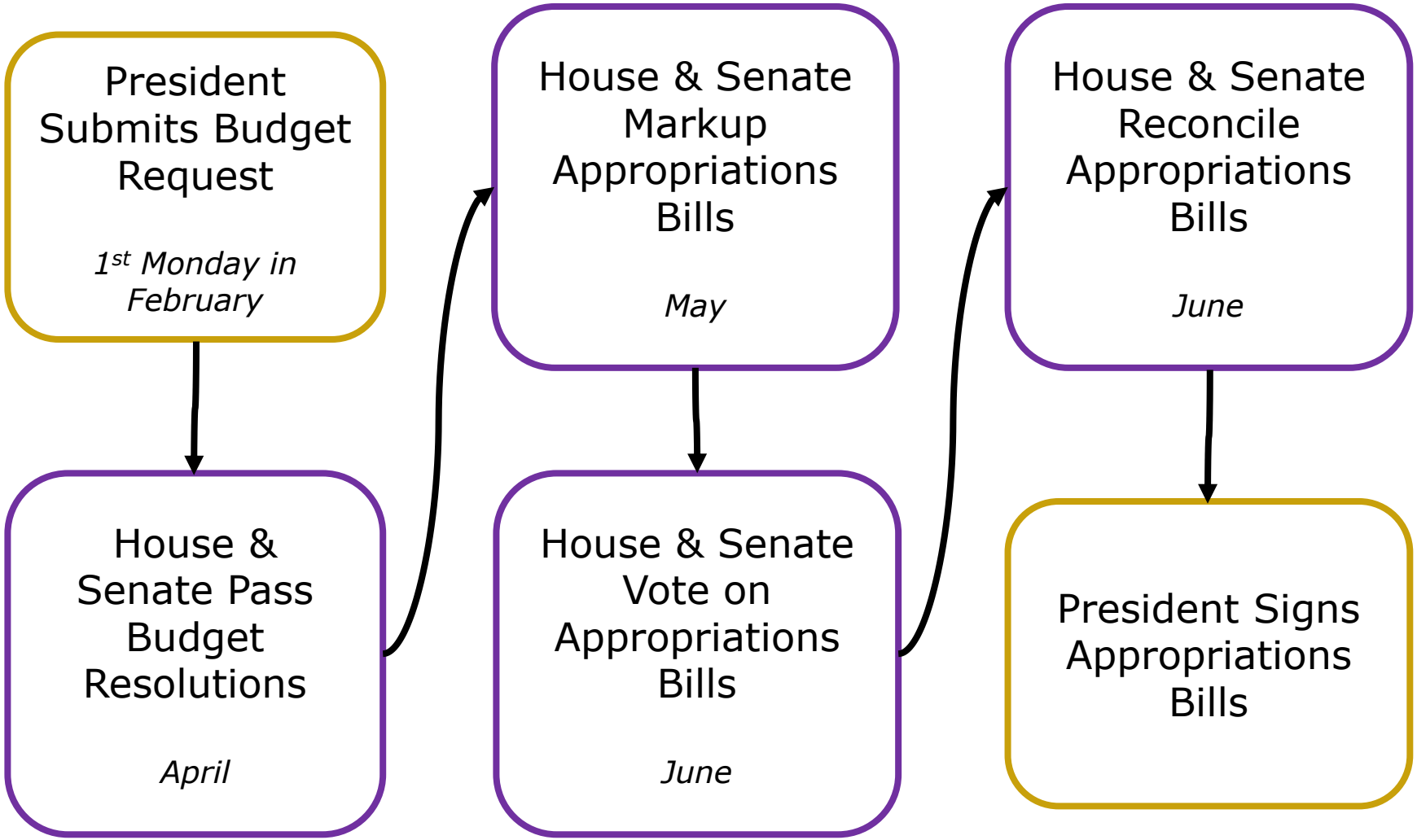


Congressional Budget and Impoundment Control Act of 1974 [aka CBA]

- Prior to 1974, Congress had no formal process for establishing a federal budget. The Act was passed in response to feelings in Congress that the President was **abusing his power of impoundment** by withholding funding of programs he opposed.
- CBA **created the Congressional Budget Office** (CBO), which gained more control of the budget, limiting the power of the OMB
- Established **timetable for the budget process**, and **Committees on the Budget** in the House and Senate

On or Before:	Action to be completed:
1st Mon. in Feb.	President submits his budget
<6 weeks after PBR submitted	Committees submit views and estimates to Budget Committees
April 15	Congress completes action on the concurrent resolution on the budget
May 15	Annual appropriation bills may be considered in House
June 10	House Appropriations Committee reports last annual appropriation bill
June 15	Congress completes reconciliation
June 30	House completes action on bills
October 1	Fiscal year begins

Congressional Budget Process



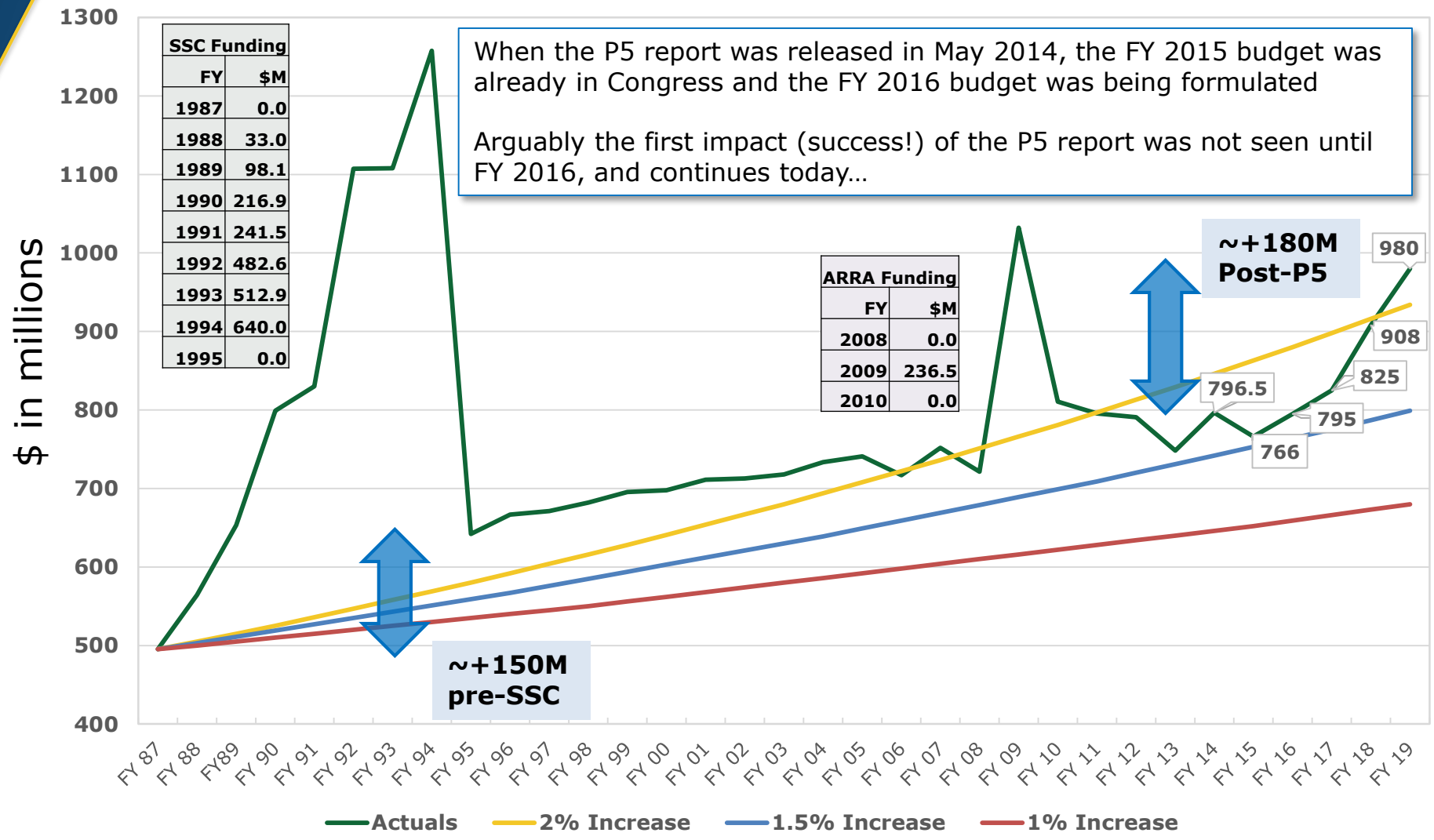
Appropriations Subcommittees

- Agriculture, Rural Development, Food and Drug Administration, and Related Agencies
- Commerce, Justice, Science, and Related Agencies
  - National Aeronautics and Space Administration
  - National Science Foundation
- Defense
- **Energy and Water Development**
  - **Department of Energy**
- Financial Services and General Government
- Homeland Security
- Interior, Environment, and Related Agencies
  - Specific portions of Department of Health and Human Services
- Labor, Health and Human Services, Education, and Related Agencies
  - Department of Health and Human Services (with above exceptions)
- Legislative Branch
- Military Construction, Veterans Affairs, and Related Agencies
- State, Foreign Operations, and Related Programs
- Transportation, Housing and Urban Development, and Related Agencies

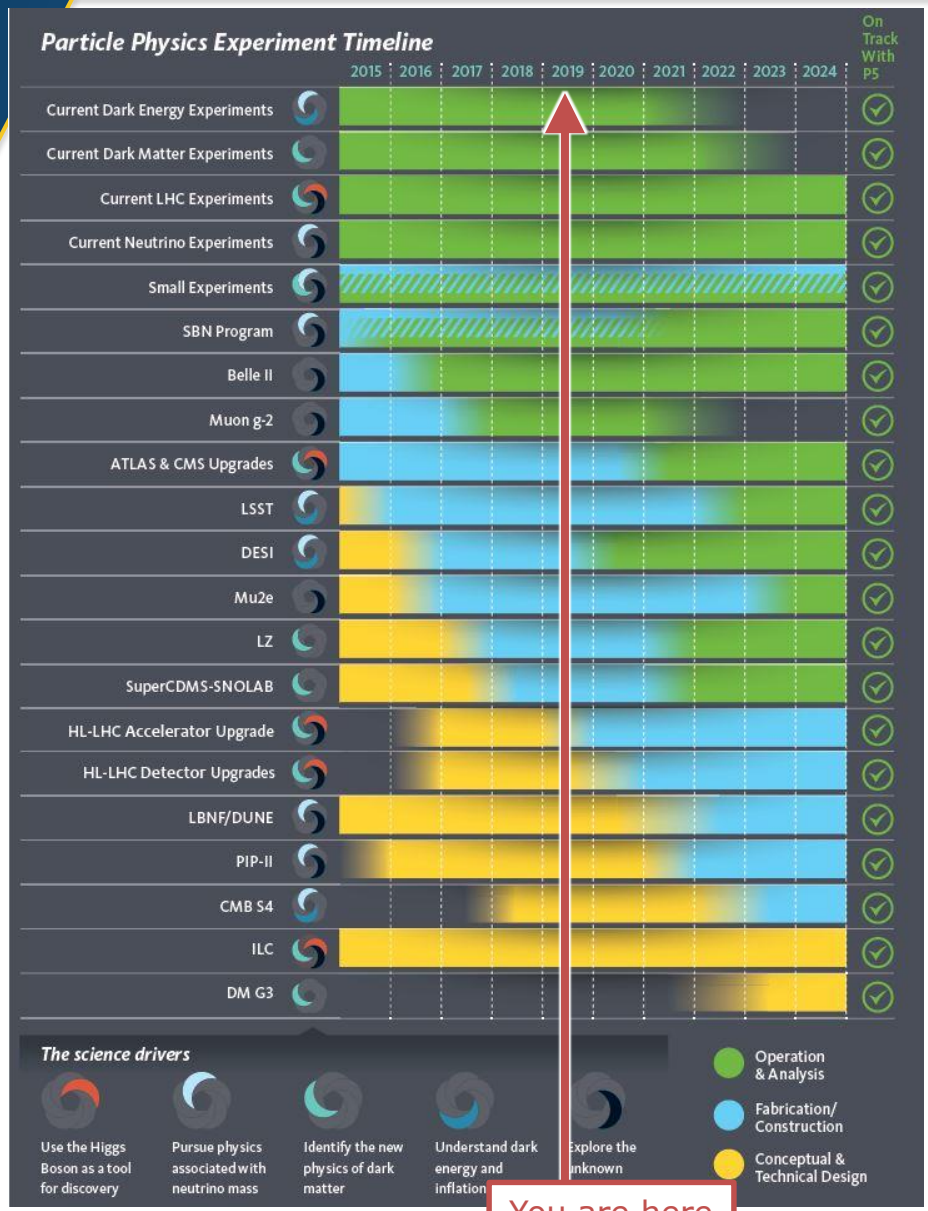
HEP Role in Congressional Process

- The budget narrative provides the justification for the level of support in the President's Budget Request
  - Narrative provides overview of the HEP program, highlights from the past year, and discussion of:
    - Line Item Construction, Major Items of Equipment, New Initiatives or New Starts, Facilities Operations, and Research program priorities
  - Detailed funding for Budget Request vs. Prior Year Request (or Enacted)
  - "Explanation of Changes"
    - **Additional scope of work (Increase) or Emphasis/Focus/Priority (Decrease)**
    - Current Administration wants focus on what can be done, with priorities
- Agencies usually invited to brief Congress on budget request
  - Opportunity to reinforce overall strategy and highlight key elements of the request
    - Congress must individually approve each DOE project >$10M
  - Informational request for additional detail
  - Respond to requests regarding impact of alternative funding decisions

FY 2019 HEP Funding in Historical Context



P5 Implementation Status – FY 2019



All projects on budget & schedule

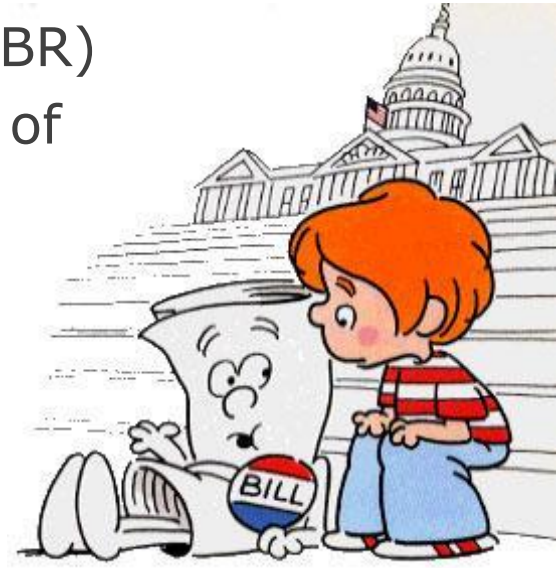
- Projects fully funded as of FY19
  - Muon g-2: 1st beam 2017
  - LHC detector upgrades: on track for 2019/20 installation
  - Mu2e : 1st data in 2020
  - LSST: full science operations 2023
  - DM-G2 (superCDMS & LZ): 1st data 2020
  - DESI: 1st light on lenses, April 2019
- HL-LHC accelerator and detector upgrades started on schedule
- LBNF/DUNE & PIP-II schedules advanced due to strong support by Administration & Congress
- CMB S4: developing technically-driven schedule to inform agencies, NAS Astro 2020 Decadal Survey
- DM-G3: R&D limited while fabricating G2
- ILC: cost reduction R&D while waiting for decision from Japan
- Broad portfolio of small projects running

The U.S. Federal Budget Cycle II

- The President submits a Budget Request (PBR)
- Each house of Congress passes their vision of a draft budget (called a "mark")

For FY 2020, we are here

- Both houses agree on a single bill (through "reconciliation")
  - No amendments are allowed beyond this point, to ensure the process converges
- Congress passes this legislation
- The President signs it and it becomes law



Credit: "I'm Just a Bill", America Rocks, 1976. 3rd season, Schoolhouse Rock.

- If this process does not complete by the end of the fiscal year (September 30th), Congress may pass a "continuing resolution", or without any action, U.S. Government can [partially] "shutdown"

Impacts of a Continuing Resolution

- If the U.S. Congress and the President have not passed all appropriations bills by September 30, a Continuing Resolution (CR) may be passed to avoid a U.S. Government shutdown
  - Must pass some level of appropriations to have legal authority to spend money!
  - CRs typically extend level of funding from the previous year for a set amount of time *with no significant programmatic changes* (a.k.a. "no new starts")
- Therefore, a CR may impede the start of new projects
  - Projects with total cost >$10M must be approved by Congress in an appropriations bill before funding can begin
  - It is possible, though not typical, for CRs to include "anomalies" that would allow new starts
- A CR may also impact the ramp-up of new projects
  - DOE is committed to the successful execution of projects that have reached CD-2 and aims to provide the baseline funding profile
  - Projects that have not reached CD-2 are most likely to be impacted under a CR
- A CR may also impact future-year planning…

FY 2020 HEP Budget Request

HEP Funding Category ($ in K)	FY 2018 Actual	FY 2019 Enacted	FY 2020 Request	FY 2020 vs. FY 2019
Research	359,177	380,847	301,357	-79,490
Facilities/Operations	270,488	260,803	239,746	-21,057
Projects	278,335	338,350	226,935	-111,415
Total	**908,000**	**980,000**	**768,038**	**-211,962**

- FY 2020 President's Budget Request is overlay of Administration, SC, P5 priorities
  - SC: interagency partnerships, national laboratories, accelerator R&D, QIS, AI/ML
  - P5: preserve vision, modify execution
- FY 2020 HEP Budget continues support for P5-guided investments
  - Research support advances P5 science drivers and world-leading, long-term R&D in Advanced Technology, Accelerator Stewardship, and Quantum Information Science
  - "Building for Discovery" by supporting HL-LHC, LBNF/DUNE, and PIP-II
  - Operations support enables research at HEP User Facilities and science ops. of P5 experiments
- The Administration and Congress support the overall P5 strategy
  - FY20 House Mark for HEP: **$1,045,000,000** ; FY20 Senate Mark not yet released

FY 2020 Funding by Subprogram

- Each subprogram has a different balance of investments in research, operations, and projects

HEP Funding Category ($ in K)	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 20 vs. FY 19
Energy Frontier	190,938	238,920	197,599	-41,321
Intensity Frontier	246,768	240,980	193,682	-47,298
Cosmic Frontier	121,246	101,036	57,468	-43,568
Theoretical, Computational and Interdisciplinary Physics	78,156	89,834	94,705	+4,871
Advanced Technology R&D	114,962	113,506	91,707	-21,799
Accelerator Stewardship	15,530	15,724	12,877	-2,847
Construction (Line Item)	140,400	180,000	120,000	-60,000
Total	**908,000**	**980,000**	**768,038**	**-211,962**

FY 2020 House Marks

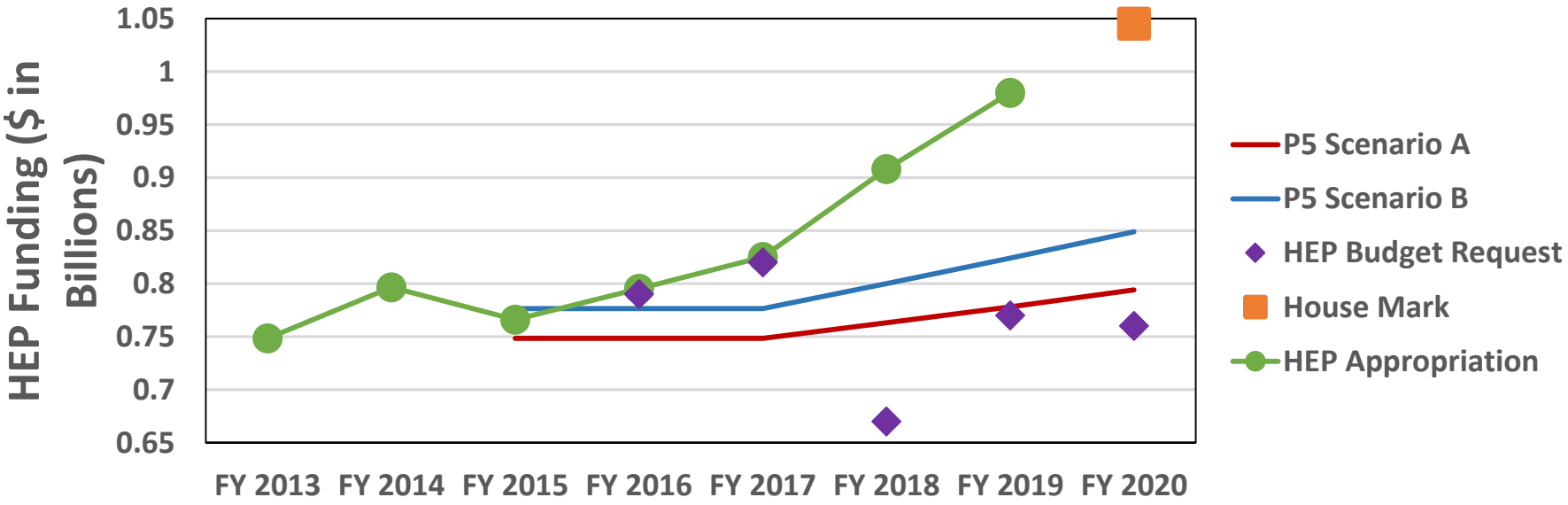
- DOE Office of Science: **$6.87B**
  - $285M above FY19 enacted and $1.32B above FY20 request
    - Supports Artificial Intelligence (AI)
- High Energy Physics: **$1.045B**
  - [*HEP Core Program*]—Within available funds, the recommendation provides $25,000,000 for the Sanford Underground Research Facility, not less than $50,000,000 for Accelerator R&D, and $97,975,000 for the HL–LHC Upgrade Projects.

    The Committee strongly urges the Department to **maintain a balanced portfolio** of small, medium, and large scale experiments, and to **ensure adequate funding for research** performed at universities and the national laboratories. The Committee encourages the Department to fund facility operations at levels for **optimal operations**.

HEP ($ in K)	FY19 Enacted	FY20 Request	FY20 House Mark	HM vs Request		HM vs FY19 Enacted	
HEP Core Program	800,000	648,038	814,000	165,962	25.6%	14,000	1.8%
Line Item Construction	180,000	120,000	231,000	111,000	92.5%	51,000	28.3%
PIP-II	*20,000*	*20,000*	*60,000*	*40,000*	*200%*	*40,000*	*200%*
LBNF/DUNE	*130,000*	*100,000*	*171,000*	*71,000*	*71.0%*	*41,000*	*31.5%*
Mu2e	*30,000*	*……*	*……*	*……*	*……*	*-30,000*	*-100.0%*
Total	**980,000**	**768,038**	**1,045,000**	**276,962**	**36.1%**	**65,000**	**6.6%**

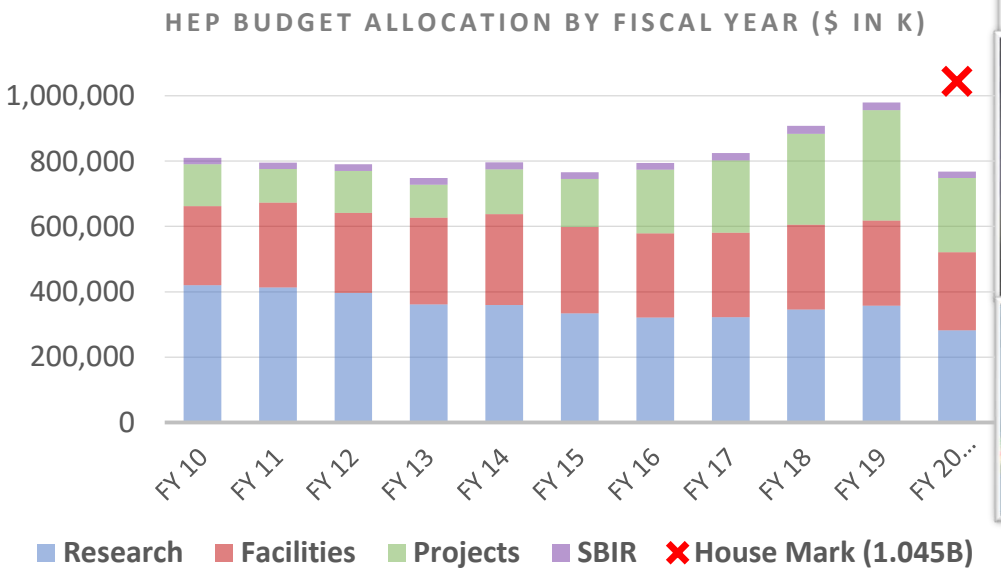
U.S. Congress Supports P5 Strategy

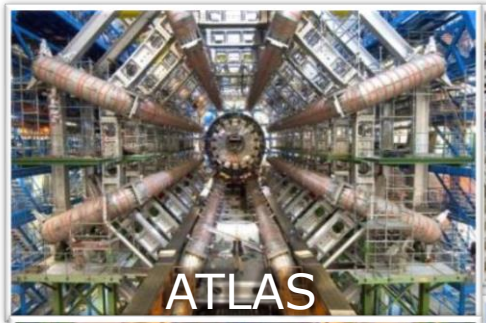
- Recent appropriations reports include language recognizing community's efforts:
  - FY19 Senate EWD: "Four years into executing the P5, the Committee commends the Office of Science and the high energy physics community for achieving significant accomplishments and meeting the milestones and goals set forth in the strategic plan…"
- FY 2020 appropriations process is progressing
  - Senate Mark not released; still awaiting final Congressional actions for FY 2020
  - **Final language of appropriations bill/report impact how funding is directed**

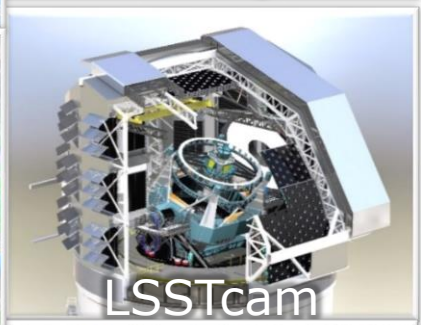


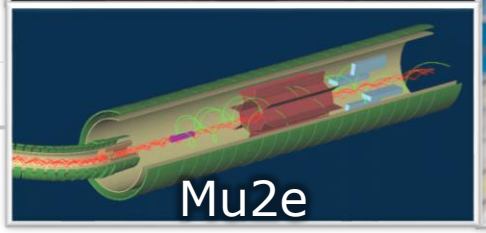
Delivery of Early Science from New Projects

- By FY 2020, **eight** projects recommended by P5 will have received final funding
  - Muon g-2, CMS Upgrade, ATLAS Upgrade, LSSTcam, Mu2e, LZ, SuperCDMS-SNOLAB, DESI
  - **DOE Total Project Costs ~ 650M (FY 2010-2019)**
  - Research has been reduced/constrained for a decade while building next generation of instruments for HEP
- Recognize urgency to increase support to Research to **ensure efficient, reliable, and high quality physics data taking**, and to augment efforts towards early & visible science.
  - Boost the number of graduate students & post-docs



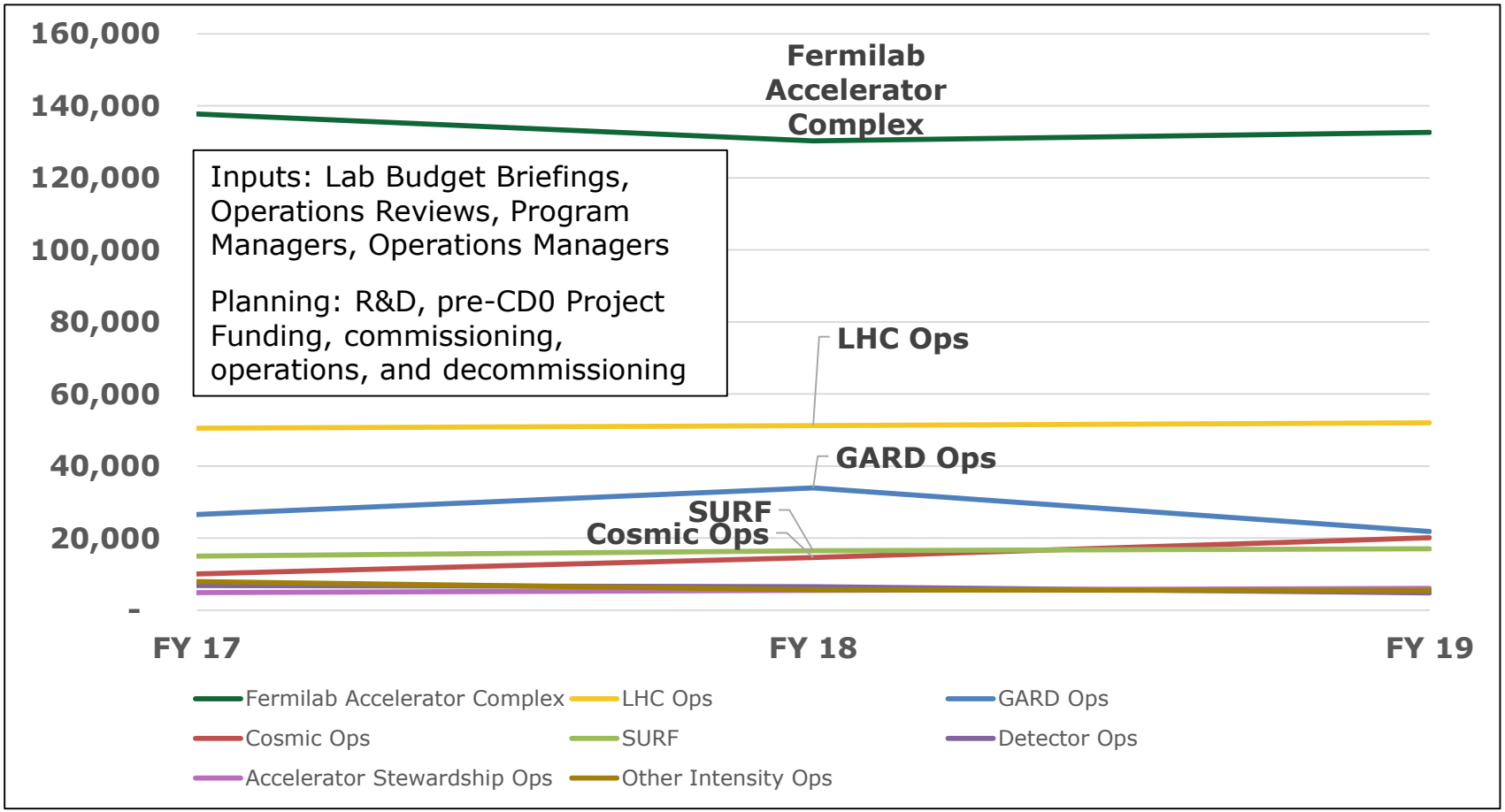




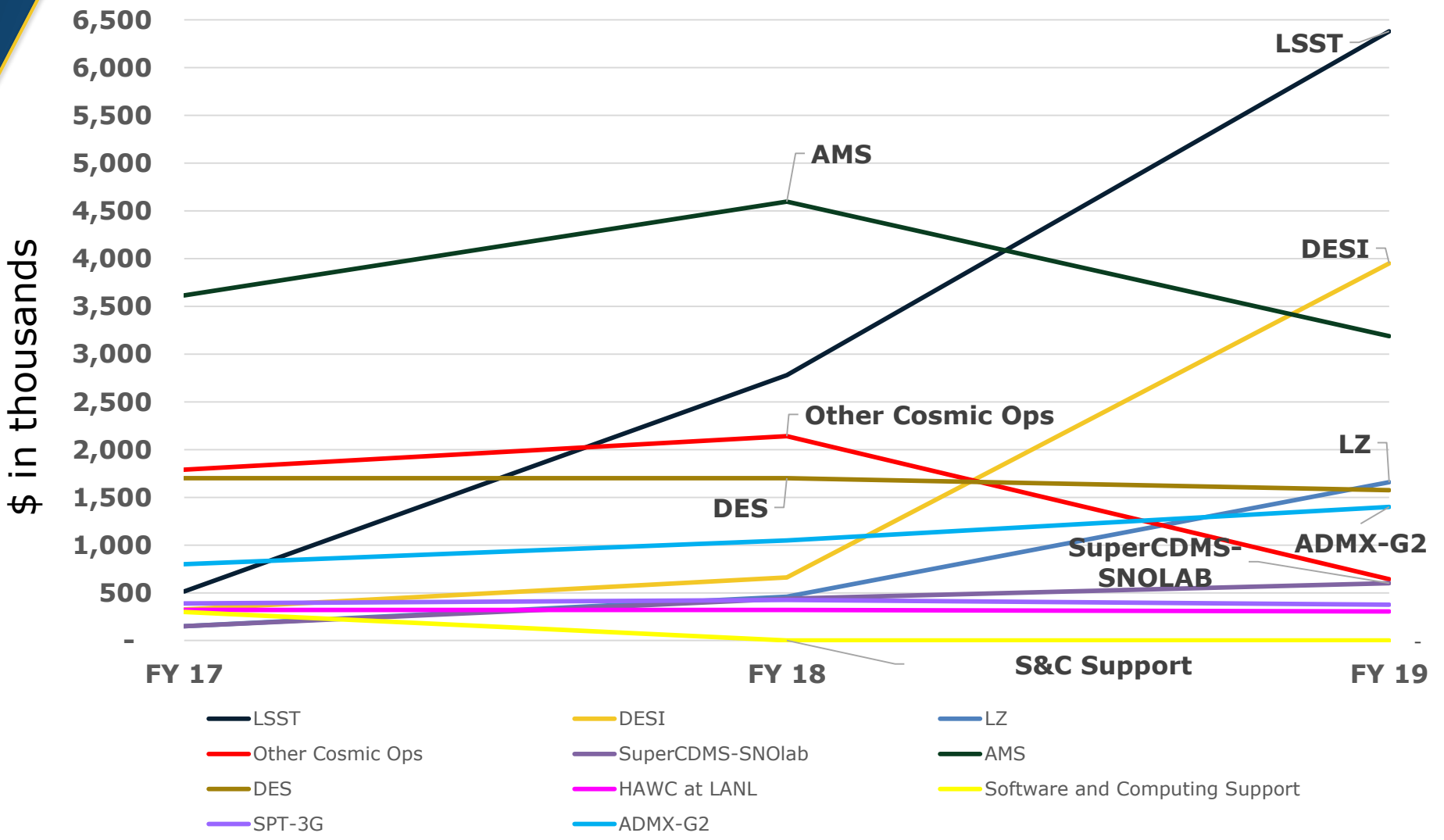


Facilities/Operations funding for FY 2017-2019

Within Fermilab Accelerator Complex, we have detailed planning for the Accelerator & Technical Divisions, GPPs, AIPs, Detector & Computing by experimental thrust, etc.



Cosmic Frontier Facilities/Operations funding for FY 2017-2019



The Challenges

Most of the recent HEP budget growth is in Projects, without similar increases in Operations and Research

- HEP-style Projects depend heavily on Research and Ops support for R&D, QA/QC, integration, installation, and commissioning
- Given that there is a lot of current Research and Ops effort committed to active experiments, this is not optimal for successful project execution
- Balancing Research and Ops with the needs of current and future projects will require careful prioritization

This is a complex interlocking problem with many contributing factors

- Cannot simply "trim the big projects" (or other "simple" solutions) without having impacts elsewhere
- **HEP PMs work on this ~every day**

Compounding Effects of Success

- A number of smaller issues have created a cumulative effect that impacts the Core Research program
  - Cost of doing business has increased significantly, year by year, reducing the buying power of research dollars
  - The community has grown, which adds more competitors to the pool for comparative review
  - Research efforts necessary to support large projects are increasing as the projects ramp up
  - Operations costs necessary for experiments are increasing as P5 projects are successfully completing and starting to take data
- These effects are tied to the high level of support received through appropriations based on the very successful execution of the P5 strategy so far
  - FY 2020 House Marks and Report language suggest that the message is getting through that healthy growth of the program requires Research and Operations growth in addition to Project support

Typical FOAs & New Initiatives

- In recent years, there is one "continual" FOA (DOE/SC Open Solicitation) and these annual FOAs:
  - Research Opportunities in HEP (a.k.a. Comparative Review FOA)
  - Early Career Research Program
  - Research Opportunities in Accelerator Stewardship
  - Quantum Information Science
  - Traineeship in Accelerator Science & Technology
  - U.S.-Japan Science and Technology Cooperation Program
- FOAs that launch new initiatives are informed through:
  - Strategic plans
  - Whitepapers
  - Roundtables
  - Workshops or working groups

New R&D Initiatives for FY 2021+

- FY 2020 Budget Cycle is too advanced to insert a new initiative
- Going forward, promote new **initiatives** (20M+) that:
  - Address the priorities of the Administration, DOE, and Office of Science
  - Builds R&D by a distinct thrusts, not general "Increase Research" to obtain support
  - Typical timeline of 3-5 years to realize investments
  - Is NOT restricted to only serving the needs of the HEP community
- A successful model is to host a Basic Research Needs (BRN) Workshop to identify opportunities in an area of interest
  - Potential to guide investments in R&D, Theory, Computing, Advanced Technology, Cross-cutting areas (SC, Federal Agencies, Private Sector)
  - Recent BRNs: Dark Matter (HEP), Microelectronics (BES), Compact Accelerators (HEP)
- Your input on FY 2021 will be crucial. We also need a continuous pipeline of new initiatives for FY 2022 and beyond.

Small Projects Portfolio

- HEP supports a number of "small projects" and will continue to pursue timely physics opportunities with new experimental techniques. For example:
  - ADMX-G2, Belle-II, COHERENT, eBOSS, FACET-II, HAWC, HPS, FAST/IOTA, LQCD, NA61/SHINE, SBN Program, SPT-3G
- Intermediate Neutrino Research Program workshop and FOA enabled: PROSPECT, ANNIE
- Basic Research Needs workshops will help define and prioritize additional opportunities for small project investments
  - Topic areas include: Accelerator applications (compact accelerators), Light dark matter, Detector R&D

SC WDTS Research Opportunities

- Office of Science Graduate Student Research Program (SCGSR)
  - Two annual solicitations in May and November
  - Most recent solicitation included 15 applications for HEP
- Science Undergraduate Laboratory Internships (SULI)
  - Annual cycle closed on January 10, 2019
- Community College Internships (CCI)
  - Annual cycle closed on January 10, 2019
- Visiting Faculty Program (VFP)
  - Annual cycle closed on January 10, 2019
- Albert Einstein Distinguished Educator Fellowship
  - Annual cycle closed on November 15, 2018

Community Communications Efforts

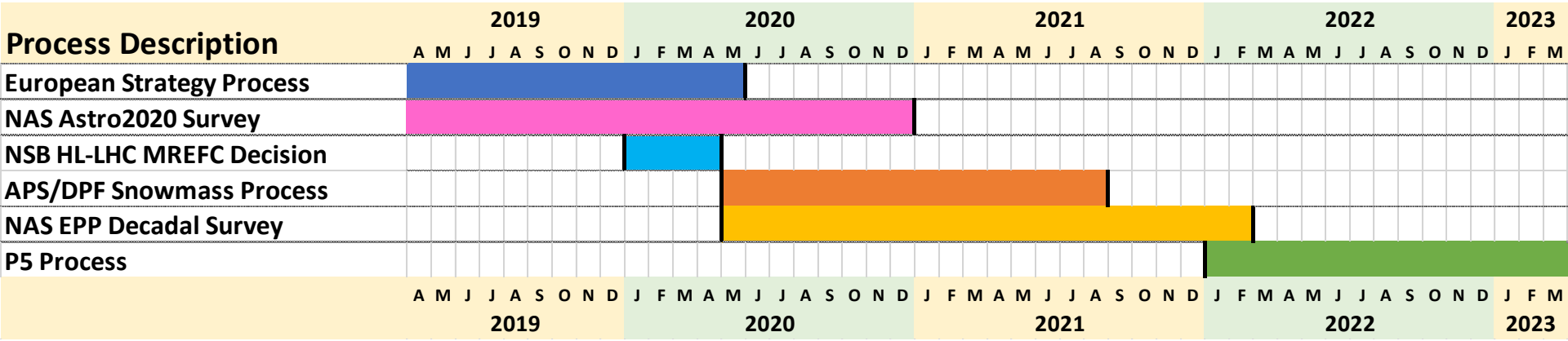
- Community groups and Steve Ritz working to update content on usparticlephysics.org
  - Coordinated effort of DPF Executive Committee, Fermilab UEC, SLUO, and USLUA
    - With help from AAAS S&T Policy Fellow Andrea Peterson
  - New brochure will describe collaborative nature of particle physics
    - Universities, national laboratories, private industry, international partners
- Produced additional material for science drivers
  - LHC (Higgs)
  - Cosmic Acc.
  - Dark Matter
  - Neutrinos

Timeline for Updating the U.S. Strategy

- **The May 2014 P5 report was successful because it was well informed by the science community**, including information from:
  - 2010 New Worlds, New Horizons in Astronomy and Astrophysics
  - 2012 Report of the Subcommittee on Future Projects of High Energy Physics (Japan)
  - 2013 European Strategy for Particle Physics Report
  - 2013 U.S. Particle Physics Community-driven "Snowmass" process
- The timeline of processes that impact the next strategic plan:
  - 2018-20: New NAS Astronomy and Astrophysics Decadal Survey
  - 2018-20: European Strategy for Particle Physics Process
  - 2019/20: Anticipated Japanese decision on ILC
  - 2020: Earliest opportunity for National Science Board to approve obligating HL-LHC MREFC
- **From a DOE perspective, the earliest that new APS/DPF Snowmass, NAS Elementary Particle Physics Decadal Survey, and P5 processes could begin is 2020**
  - **Relative timing of Snowmass, P5, and NAS EPP Decadal Survey to be determined**
  - **Enables receiving next P5 recommendations by March 2023, in time to inform FY 2025 budget formulation**

Possible Strategic Planning Timeline

- To provide timely input to the FY25 budget formulation, the next P5 report will be required by March 2023
- U.S. Community considering Snowmass process with major meeting occurring in summer 2021
- Potential timeline for the next NAS EPP Decadal Survey could be mid-2020 through early-2022
  - Overlap with Snowmass could enable synergy with Snowmass processes and delivery of report as P5 process begins



Community Participation

- Broad community participation in the U.S. particle physics strategic planning process is essential
  - The 2014 P5 report was successful because it built upon a solid foundation of community effort
- PIs are encouraged to be active in all phases of the process:
  - Submit whitepapers to the NAS Astro2020 and possible EPP decadal surveys
  - Actively participate in the DPF-led Snowmass process
  - Develop new concepts for future projects
- PIs on HEP research grants may contribute to planning processes as aligned with scope of work
  - Discuss any questions with your Program Manager!

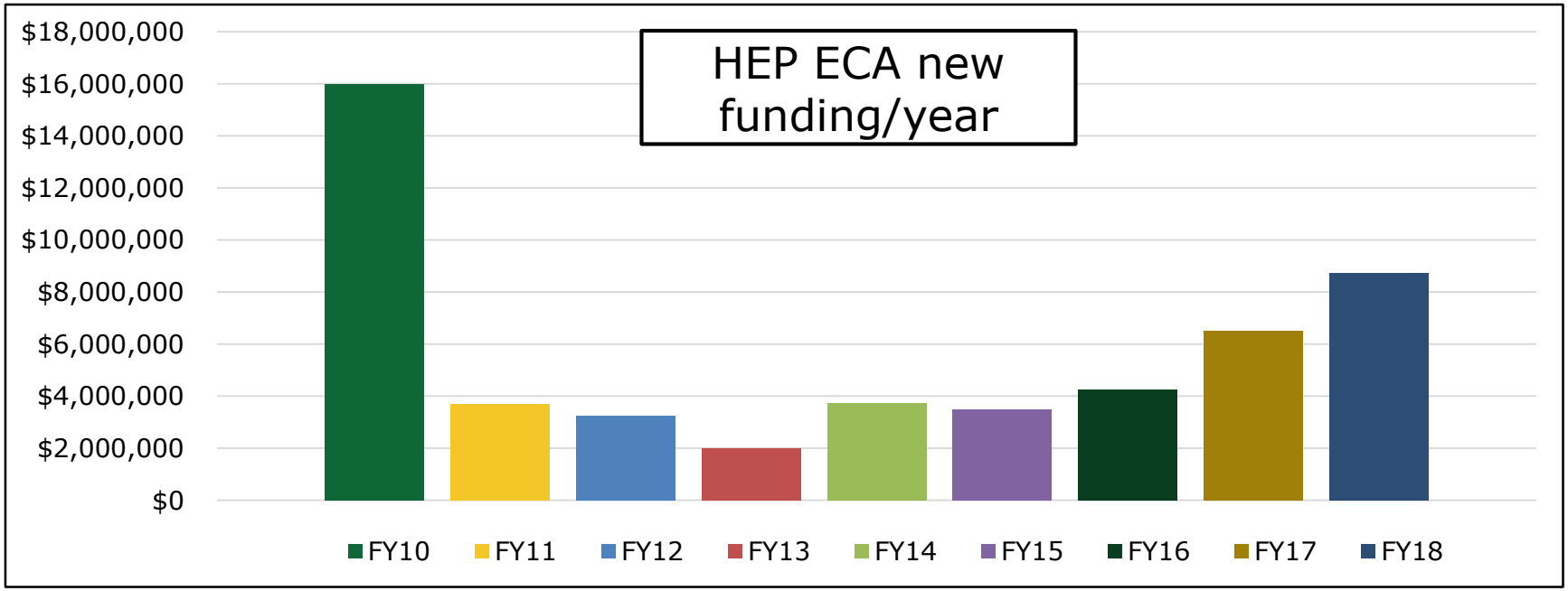
Closing Remarks on Budget

- The annual Federal budget process is long and complex
  - Excursions from "standard order" are possible
  - The community-driven P5 strategy plays an important role in all phases of the process
- Broad support is enabling us to implement the P5 strategic plan and achieve its vision!
  - Many thanks to the DOE Management, the Administration, and Congress for their support
  - SC programs in QIS, Computing, and Science Laboratories Infrastructure (SLI) provide additional support to enable P5 goals
- The particle physics community continues to perform well on delivering projects, a foundation of the long-term strategy
- **Community continues to be unified in support of P5 strategy**
  - Communications are effectively supporting the community's goals
  - A long-term view is necessary to provide feedback in a context that is most helpful

Early Career

Increasing Investments to Early Career Research Program

- Launched in FY 2010 with ARRA funding
- Established Program to Stimulate Competitive Research (EPSCoR) supported 1 Theory ECA in FY 2011 and 1 Intensity ECA in FY 2013
- Funding nadir was FY 2013, the first year impacted by sequestration
- Full-funding requirement took affect in FY 2014 (awards < $1M)
- 92 total awards to date: 57 University and 35 National Labs



Not Just Organizational Abstractions!

- All proposals requesting Office of Science support must be written in the context of the agency mission
- Proposals responding to the *FY20XX Research Opportunities in High Energy Physics* and *Early Career Research Program [HEP]* Funding Opportunity Announcements (FOAs) need to align with at least one of the P5 science drivers

"The DOE supports mission-driven science"

Funding Vehicles

- DOE National Laboratories
  - Most are Government Owned/Contractor Operated (GOCO) Federally Funded Research and Development Centers (FFRDCs) and operate under Management and Operating (M&O) contracts
  - Laboratory research is mission driven and funded through Field Work Proposals (FWPs)
    - Comparative reviews of the Lab Research programs held every 3-4 years
  - **Laboratories propose yearly financial plans based on DOE guidance**
    - Mechanisms exist to tune funding each month
- Universities
  - **Submit grant proposals in response to a Funding Opportunity Announcement (FOA)**
    - Independent peer review informs the selection of awards
  - Award is ~fixed once made, with funding cycle of 1-5 years
    - Funding adjustments (downward) are possible if circumstances change
    - Changes are also possible through submission of supplementary proposals

Grant Process

- **Grant applications must be submitted through Grants.gov**
- Instructions for preparing and submitting grant applications are contained in the **Funding Opportunity Announcements posted** on Office of Science web pages, at www.grants.gov, and at www.FedConnect.net
- The rules governing SC's grants and cooperative agreements are regulations codified in the Code of Federal Regulations (CFR).
- Acquisition and contracting services are provided by the DOE Office of Science Integrated Support Center (ISC).
  - The ISC is a virtual organization comprised of the combined support capabilities of offices in Chicago, Illinois, and Oak Ridge, Tennessee.

- More info: SC Grants & Contracts support: **science.osti.gov/grants/**

Step 1: Registration

- Obtain a DUNS number
- Obtain an EIN number
- Register with the System for Award Management
- Register with FedConnect
- Register with the Federal Funding Accountability and Transparency Act Subaward Reporting System
- Register with grants.gov

Step 2: Application

Use Grants.gov to find open SC Funding Opportunity Announcements (FOAs). The FOAs contain the required application forms and instructions. Complete the forms and submit all required information through Grants.gov. Only applications submitted through Grants.gov will be accepted by SC.

Step 3: Receipt

Applications are received by SC and undergo an initial review for completeness and responsiveness.

Step 4: Referral

Applications are assigned to SC Program Managers who conduct the merit reviews.

Step 5: Review

Technical experts (Federal and non-Federal) review the applications and provide their assessments to the SC Program Manager.

Step 6: Preaward

The SC Program Manager recommends funding an application. The recommendation is concurred by a series of senior officials, and the entire package is reviewed by Grants and Contracts Support. After final concurrence, the Integrated Service Center reviews the file, negotiates with the applicant, and prepares the award documents.

Step 7: Award

The Integrated Service Center releases the binding award documents. The Notice of Financial Assistance Award contains an assistance agreement, terms and conditions of award, and other items incorporated by reference.

Step 8: Performance

The applicant, which is now an awardee, performs the project for which support was received, by complying with all terms and conditions of award. Changes that require prior approval may be made only after official SC approval of the official request by the awardee.

Step 9: Reporting

Performance and financial reports are required as indicated in the terms and conditions in the award.

Step 10: Closeout

When the project ends, the awardee prepares and submits its final reports as indicated in the terms and conditions in the award.

Step 11: Public Access

DOE supported research projects provides their results of research through scholarly publications and announcing their scientific and technical information to the Office of Scientific and Technical Information.

Starting Notes

- A faculty position does not guarantee anyone a DOE grant
- A laboratory position does not guarantee new resources
- All proposals are subject to peer-review
- Review process is comparative and competitive
- A grant is financial assistance funded by taxpayer dollars
- A contract is the purchase of a product or service for federal use

Core Research vs. Early Career

- All proposals are subject to scientific/technical merit and program policy factors, and a comparative review is used to enhance the validity of the written evaluations
- Many factors weigh the selection process (and funding recommendations)
  - ***Compelling research proposal*** for next ~3-4 years
    - ✓ **Interesting? Novel? Significant? Plausibly achievable?**
    - ✘ **Incremental? Implausibly ambitious? Poorly presented?**
  - ***Significant recent contributions*** in last 3-4 years
    - Synergy and collaboration within group (as appropriate)
    - Contributions to the research infrastructure of experiments
  - ***Alignment with HEP*** programmatic priorities
  - ***Balanced program*** of R&D/design, support of construction or operations, data analysis
    - This may span multiple experiments over the proposal's project period
- For the Early Career Research Award, the proposal success rate is much lower than for proposals submitted to the "Comparative Review" FOA
  - **92 HEP awards in nine years out of 858 proposals reviewed = 10.7%**
  - Select the most outstanding proposals
    - Did the PI lay out a robust five-year program? Are there novel elements?
    - **Has the PI demonstrated leadership?**

Leadership in HEP

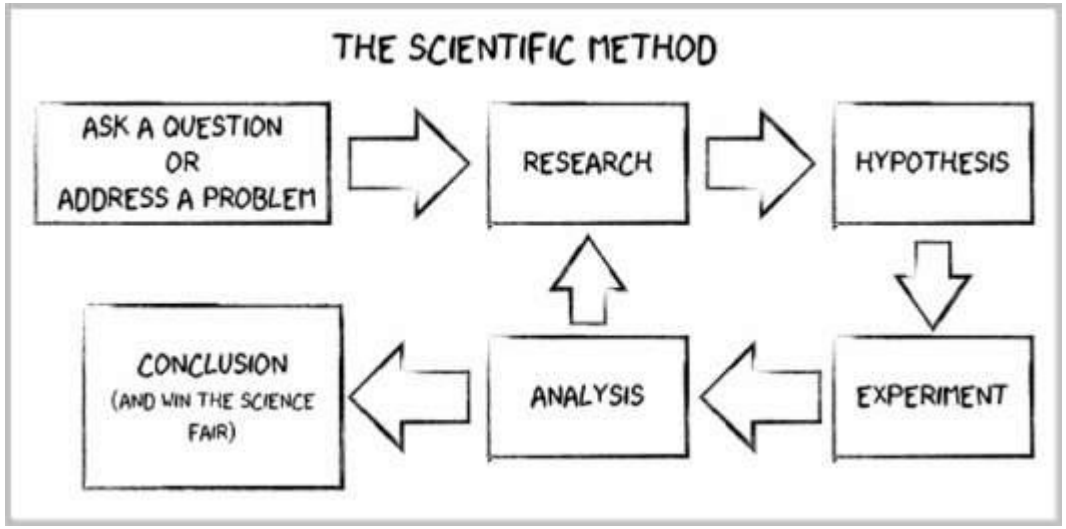
- Timescales for HEP projects from conception to first data will only get longer in the continued pursuit of discovery science **due to cost, size and complexity**
- HEP academic research track (Univ. or Lab) will benefit from developing a near-, mid- and long-term research plan
  - Balance research between ongoing experiment, upgrades and R&D with future experiment
- New tenured-track faculty or scientist is likely to **"hit the ground running"** by continuing the research conducted during their most recent post-doc position
  - This is perfectly normal. Most people are hired with this consideration.
  - A rising trajectory, clear leadership positions, track record of accomplishments, mentoring, etc.

- **Before preparing that first proposal, map out your long-term strategic goals (10+ years)**
- Will you be working on that same experiment in 5 years? How about 10 years? In 20 years?!
- Optimize your start-up or LDRD funds by expanding your research portfolio and seeding a future looking project/experiment
- With your strong participation, major projects like DUNE, LSST and HL-LHC will complete on time and be poised to reap the physics data on Day 1
- **Can you envision you (and your colleagues) shepherding the "post-P5" projects?**

Early Career Proposal Framework

1. What are the problems you are trying to solve?
2. Isn't someone else doing it? Alternatively isn't that already being funded?
3. How does this research exploit/engage the unique capabilities of your institution?
4. What are the resources you need to do this project?
5. Outline a five year timeline, with key deliverables and personnel.
6. Why you are a future leader in high energy physics?

Identify The Problem

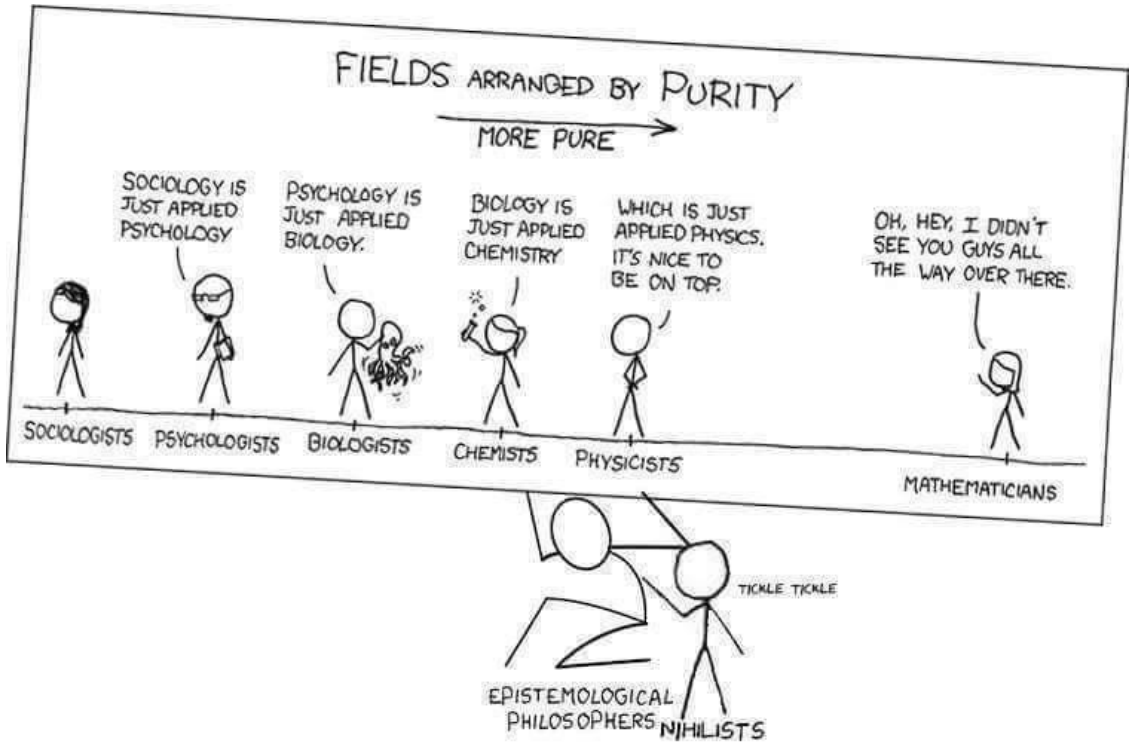


- Always start with the **big** question.
  - What are the major obstacles?
  - Is this an interesting challenge?
  - Can you articulate the problem to a general audience?

- Are you creating a new tool or capability for a larger audience?
- Will you reduce the risk/cost to a project?
- Can you substantially increase the sensitivity of the experiment?
- Are you advancing the knowledge of the field in a significant way?

Justify that You can solve the Problem

- There are two key takeaways
  1. Provide compelling argument backed up with evidence (simulation, R&D, letters of support, track record, etc.)
  2. Explain how the proposed research is above and beyond currently supported effort, not supported on project, not duplicative, etc.



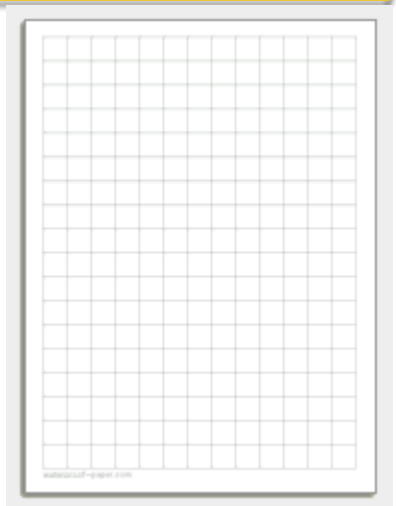
What Is Your "Unfair Competitive Advantage?"

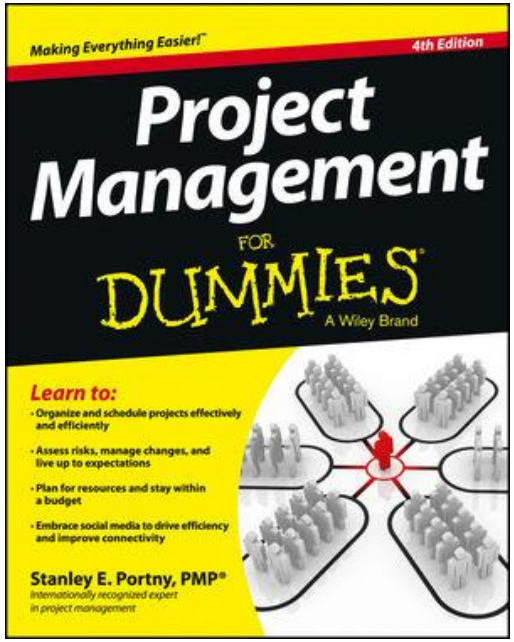
- This has greater weight for the proposals submitted from the DOE National Laboratories
  - In particular, we are interested in how the proposals leverage a lab's unique facilities and capabilities.
  - If this is not called out, a lab proposal has a lower chance in getting funded.

- For the experimental and technology proposals submitted from the Universities
  - We are also interested in how the proposals leverage the Universities facilities and resources
  - Reminder: Grants are financial assistance agreements and do not cover all costs

Validate: Costs, Resources, Schedule

- Outline a five year timeline, with yearly key deliverables, all personnel, roles and responsibilities
  - Consider month by month plan
  - What is a credible hiring plan?
  - Do you need to front-load funding to support engineering and equipment?
    - For example: 200/200/150/100/100
  - Do you have external dependences, and if so, does your schedule and deliverables make sense?
  - Have you validated all expenses?





Demonstrate Leadership

- Presidential Early Career Awards for Scientists and Engineers (PECASE)
  - PECASE-eligible candidates are selected from the pool of Early Career awardees

    http://science.osti.gov/about/honors-and-awards/pecase/

- Scientific leadership can be defined very broadly and can include direct research contributions.
  - How has the PI demonstrated the potential for scientific leadership and creative vision?
  - How has the PI been recognized as a leader (collaboration, institution, community service)?
  - Does the PI have a track record for mentoring students and post-docs?
- Ensure the CV is correct and current
  - Polish up your public profile (institution web page, social media)

Proposals: What To Do

Do Follow Instructions

- Read the current FOA thoroughly, as well as any supporting materials, e.g. FAQ
- SC rules & procedures and HEP program requirements are regularly updated

Do seek out advice & support from trusted colleagues & mentors

- Your institution has invested a lot of time and money hiring you. They want you to succeed. Let them help you
- Request a review of the proposal.

  There are resources at most institutions

Do learn the rules, regulations, and costs of your institution

- Funds are awarded to the institution. Understand direct and indirect rates, benefits, and restrictions
- Establish a relationship with your budget office or sponsored research office

Do follow through on reviewer feedback

- Give weight to the critical reviews

  Arguing with HEP that 3 out of 5 reviewers thought your proposal was excellent does not address the 2 reviewers who had a different opinion

Do follow proper English grammar and composition

- Careless editing will annoy or confuse reviewers
- Hire someone to proof-read your proposal

Do ask for what you reasonably need

- Standard research requests
  - Salary and travel
  - Other Personnel including post-docs, students, Engineer, etc.
  - Equipment, M&S, Tuition remission
- Realistic funding expectations
  - Early Career >$150k Univ & >$500k Lab
  - 50% FTE to proposal
  - Stagger personnel

Proposals: What **Not** To Do

Do Not submit a proposal late

- You should assume that applications received after the deadline will not be reviewed or considered for award
- Use the weeks or months after the FOA is made public to prepare and then submit your proposal early

Do Not brag or exaggerate

- Be professional and objective.
- Fully list your accomplishments in the bio. Include your mentoring.
- Accurately and reasonably describe research plan

Do Not preach to the choir

- The narrative should be accessible to a review panel with a wide range of expertise
- Avoid jargon when possible. Same with acronyms.
- Describe in clear and concise language. Tell a story.

Do Not dwell on the past

- General rule of thumb (1/3:2/3).
- No more than one-third of proposal devoted to past efforts
- Majority of proposal narrative should be forward looking

Do Not submit a sloppy budget

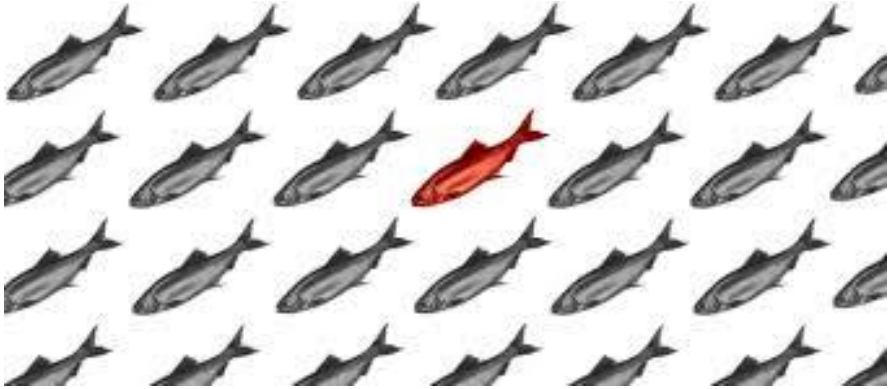
- The budget sheets and justification should be prepared with the same care as the narrative
- Reviewers will call out any:
  - Excessive or inappropriate requests
  - Arithmetic errors
  - Poorly justified expenses

Do Not be discouraged

- Competition is strong.
- Some very good proposals are declined due to limited resources.
- That first feedback is so valuable.

Beware of Red Herrings

- A red herring is something that misleads or distracts from a relevant or important issue.



- Examples include
  - Vague descriptions or budget requests that lead reviewers/panel to make their own interpretations
  - Other (funded) research that is not crisply delineated from the proposed research
  - Unclear explanations of resources and timelines

Final Word: Engagement

- Review criteria for HEP Comparative Review and Early Career includes "leader within the proposed effort and/or potential future leader in the field"
  - Important to seek out and/or volunteer for roles and responsibilities which increase visibility and provide career advancement opportunities
  - Editorial Boards, Sub-detector systems, Physics Working Groups, Run Coordinator, Analysis Coordinator, etc.
  - Service work for community is also valued, e.g. co-chairing a conference committee or serving on a DOE or NSF review panel
- When asked to review, co-chair, attend, speak, etc. **try NOT to say no!**
  - You need the experience
  - Ask for feedback (if possible)
  - Respond promptly to all communication

- Talk to your community representatives
- HEPAP: High Energy Physics Advisory Panel
  - http://science.osti.gov/hep/hepap/
- AAAC: Astronomy and Astrophysics Advisory Committee
  - https://www.nsf.gov/mps/ast/aaac.jsp
- APS Division of Particles and Fields
  - https://www.aps.org/units/dpf/
- HEP Organization
  - Introduce yourself to the DOE Program Managers
- Ask questions

Diversity and Inclusion

What's the Difference? Diversity

- **Diversity:** the presence of difference in individual attributes such as national origin, language, race, color, disability, ethnicity, gender, age, religion, sexual orientation, gender identity, socioeconomic status, veteran status, and family structures. Diversity can also refer to differences of thought and life experiences.

  - *"How can we get more people with marginalized identities into our pipeline?"*
  - *"How can we incentivize recruiting 'diverse candidates'"?*
  - *"How many more of [pick any minoritized identity] group do we have this year than last?"*

Drawn in part from Dafina-Lazarus Stewart, Bowling Green State University
https://www.insidehighered.com/views/2017/03/30/colleges-need-language-shift-not-one-you-think-essay

What's the Difference? Inclusion

- **Inclusion:** a culture that connects each employee to the organization; encourages collaboration, flexibility, and fairness; and leverages diversity throughout the organization so that all individuals are able to participate and contribute to their full potential.

  - *"What is the experience for individuals who are the minority within the organization?"*
  - *"Do people with marginalized identities feel a sense of welcome and belonging?"*
  - *"What don't we realize we are doing that is negatively impacting our new, more diverse, teams?"*

Drawn in part from Dafina-Lazarus Stewart, Bowling Green State University
https://www.insidehighered.com/views/2017/03/30/colleges-need-language-shift-not-one-you-think-essay

What's the Difference? Equity

- **Equity:** a set of conditions that allows everyone to access the same opportunities. Equity acknowledges that individuals start out with different advantages, and identifies and seeks to mitigate structural barriers.

  - *"What can we do to make sure everyone can succeed?"*
  - *"What conditions have we created that maintain certain groups as the perpetual majority here?"*
  - *"Are our structures and processes having the intended consequences and outcomes?"*

Drawn in part from Dafina-Lazarus Stewart, Bowling Green State University
https://www.insidehighered.com/views/2017/03/30/colleges-need-language-shift-not-one-you-think-essay

2015 GAO Report: Women in STEM Research

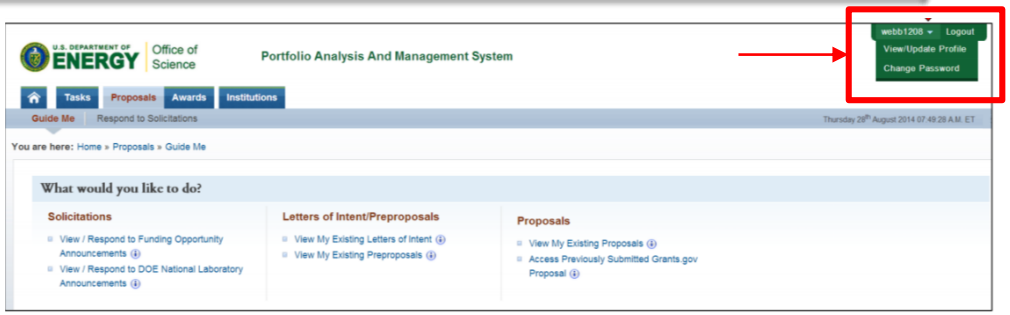
- At DOD and DOE, **GAO found evidence of disparities** in success rates for women and men within certain agency components. However, **there were limits to the data** available for review at these agencies.
  - GAO analyzed STEM award grants for the period of 2009-2013.
- GAO recommended that DOE (and other agencies) **collect additional data**.
- In addition, GAO identified 13 potential actions federal agencies could take to address the underrepresentation of women in STEM research. These actions fell into four areas:
  - (1) enhancing **agency leadership** and collaboration
  - (2) establishing **family-friendly policies** for grantees
  - (3) overseeing the research **proposal review process**
  - (4) funding and **assisting academic institutions**

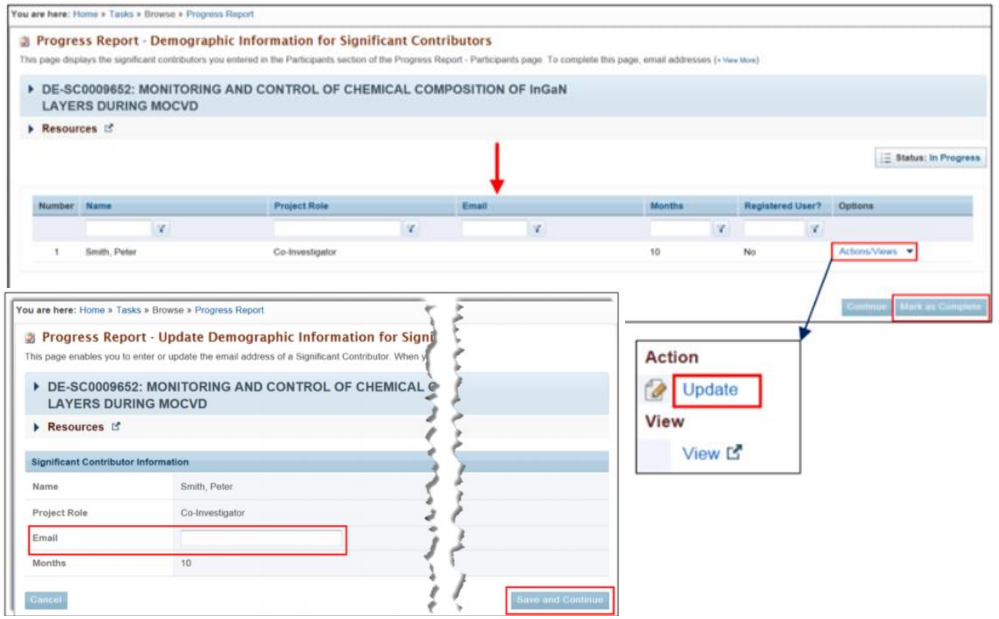
HEP Committee of Visitors

- The **2016 HEP Committee of Visitors** recommended that HEP **"develop a plan for increasing diversity in the programs HEP supports."**
- HEP is working with **Office of Science** management to develop strategies for improving diversity in its research programs
  - HEP is participating in a new SC-wide diversity and inclusion working group that aims to establish shared **best practices across program offices**
  - HEP works with the **DOE National Laboratories** to monitor and encourage diversity and inclusion efforts through its contracts, annual planning processes, and budget briefings
  - HEP participates in **Workforce Development for Teachers and Scientists** programs
    - WDTS supports >1,000 students and faculty annually
- The 2015 GAO report on Women in STEM Research and the 2016 HEP COV recommended that HEP **collect further demographic data** for grant applicants:
  - HEP should **work with the Office of Science to obtain demographic information**, including information at the proposal stage. Inadequate demographic information is available to assess the success rate of different populations that apply for funding by HEP.
  - Implicit bias in reviews is a concern, but conclusions cannot be drawn without data. **Improved demographic information would facilitate tracking of progress in achieving diversity** in particle physics
  - **Grant applicants and contributors can voluntarily supply information in PAMS**

Demographics Information through PAMS

- Grant applicants can ***voluntarily*** supply the following information through their **PAMS profile** at any time: gender, ethnicity, race, citizenship, and disability status.
- At the time of the first progress report, you will be asked to provide the names and email address for **"significant contributors"** on your grant.
- Each contributor will be able to report **their own demographic information**.
- HEP is developing a process to track and evaluate the data we collect.



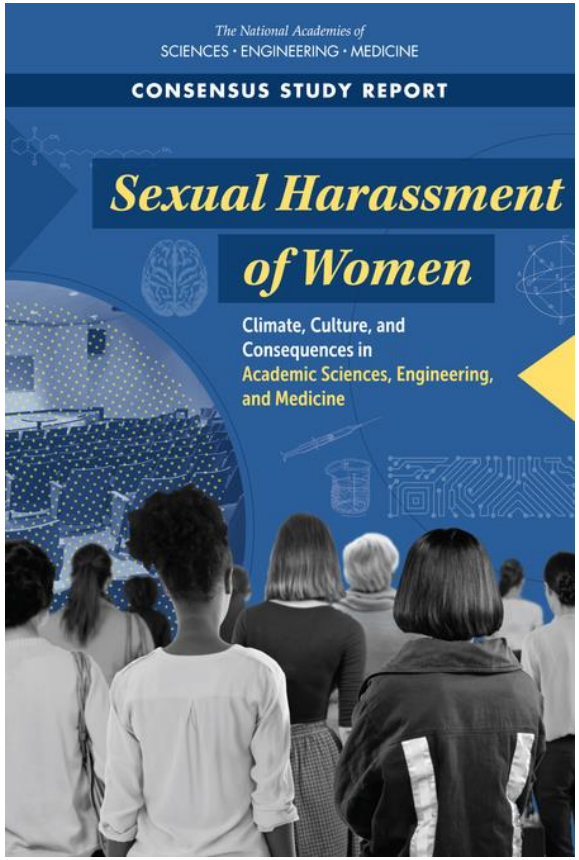


Sexual Harassment

"[S]exual harassment is a serious issue for women at all levels in academic science, engineering, and medicine, and that these fields share characteristics that create conditions that make harassment more likely to occur. **Such environments can silence and limit the career opportunities** in the short and long terms for both the targets of the sexual harassment and the bystanders—with at least some leaving their field. The consequence of this is a significant and costly loss of talent in science, engineering, and medicine.

However, we are encouraged by the **research that suggests that the most potent predictor of sexual harassment is organizational climate**—the degree to which those in the organization perceive that sexual harassment is or is not tolerated. This means that **institutions can take concrete steps to reduce sexual harassment** by making system-wide changes that demonstrate how seriously they take this issue and that reflect that they are listening to those who courageously speak up to report their sexual harassment experiences."

- The National Academies of Science, Engineering, and Medicine, 2018



http://sites.nationalacademies.org/shstudy/index.htm

NAS Recommendations (I)

- **RECOMMENDATION: Move beyond legal compliance to address culture and climate**. The following five recommendations offer specific ways to progress toward this goal.
- **RECOMMENDATION: Create diverse, inclusive, and respectful environments**.
  - Leaders should prioritize taking actions that will result in **greater gender and racial equity in hiring and promotions**, thus improving the representation of women at every level.
  - Institutions should combine **anti-harassment and civility-promotion programs**. They should ensure that training…is tailored for specific populations, teaches how to **interrupt and intervene when harassment occurs**, and focuses on changing behavior. Critically, institutions must **evaluate training programs** for efficacy.
- **RECOMMENDATION: Strive for strong and diverse leadership**.
- **RECOMMENDATION: Diffuse the hierarchical and dependent relationship between trainees and faculty**.

NAS Recommendations (II)

- **RECOMMENDATION: Improve transparency and accountability**
  - Academic institutions should develop and readily share **clear, accessible, and consistent policies** on sexual harassment and standards of behavior.
  - Academic institutions should **strive for greater transparency** in how they are handling reports of sexual harassment while balancing a need for confidentiality.
  - Academic institutions should **be accountable for their organizational climate**, and utilize climate surveys to further investigate and address systemic sexual harassment.
  - Academic institutions should consider **sexual harassment equally important as research misconduct** in terms of its effect on the integrity of research.
- **RECOMMENDATION: Provide support for the target**
  - Academic institutions should convey that **reporting sexual harassment is an honorable and courageous action** and provide

    (1) **access to support services** (social services, health care, legal, career/professional) regardless of if a formal report is filed

    (2) alternative and **less formal ways to record information** about an incident

    (3) approaches that prevent the target from **experiencing or fearing retaliation**.

NAS Recommendations for Federal Agencies

- **Increase support for research and evaluation** of the effectiveness of policies, procedures, and training on sexual harassment.
- **Attend to sexual harassment with at least the same level of attention and resources devoted to research misconduct.**
  - They should increase collaboration among offices that oversee the integrity of research (i.e., those that cover ethics, research misconduct, diversity, and harassment issues)…
- **Require institutions to report to federal agencies** when individuals on grants have been found to have violated sexual harassment policies or have been put on administrative leave related to sexual harassment, as the National Science Foundation has proposed doing.
- **Reward and incentivize colleges and universities** for implementing policies, programs, and strategies that research shows are most likely to and are succeeding in reducing and preventing sexual harassment.

- https://www.nap.edu/resource/24994/Sexual%20Harassment%20of%20Women%20ReportHighlights-Federal%20Policy%20Makers.pdf

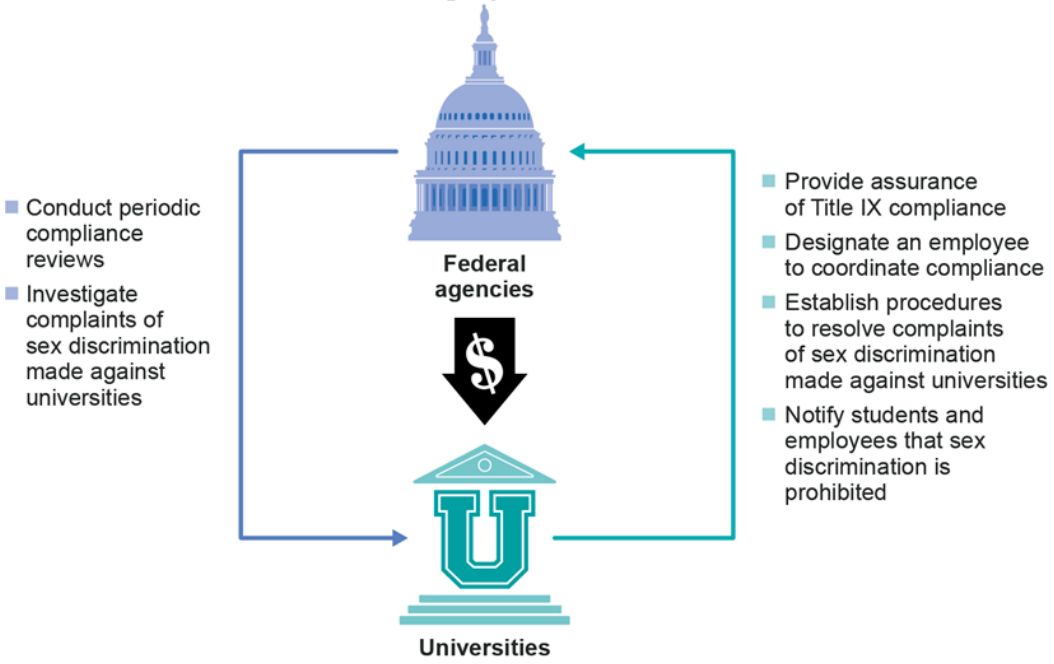
DOE Office of Science Statements on Diversity, Equity, and Inclusion

- The DOE Office of Science (SC) is fully committed to fostering safe, diverse, equitable, and inclusive work, research, and funding environments that value mutual respect and personal integrity.
  - Effective stewardship and promotion of diverse and inclusive workplaces that value and celebrate a diversity of people, ideas, cultures, and educational backgrounds is foundational to delivering on the SC mission. The scientific community engaged in SC-sponsored activities is expected to be respectful, ethical, and professional.
  - https://www.energy.gov/science/diversity-equity-inclusion
- Office of Science Statement of Commitment
  - The DOE Office of Science (SC) is fully and unconditionally committed to fostering safe, diverse, equitable, and inclusive work, research, and funding environments that value mutual respect and personal integrity.
  - https://science.osti.gov/sc-2/Research-and-Conduct-Policies/Diversity-Equity-and-Inclusion/SC-Statement-of-Commitment
- Office of Science Statement on Harassment
  - Harassment of any kind, including sexual and non-sexual harassment, bullying, intimidation, violence, threats of violence, retaliation, or other disruptive behavior is not tolerated in the federal workplace, including Department of Energy (DOE) site offices, or at DOE national laboratories, scientific user facilities, academic institutions, other institutions receiving Office of Science funding, or at locations where activities are funded by the DOE Office of Science.
  - https://science.osti.gov/sc-2/research-and-conduct-policies/diversity-equity-and-inclusion/harassment/

DOE Title IX Process

- DOE has **enforcement responsibilities under Title IX**, including issuing regulations, conducting periodic compliance reviews at these institutions, and investigating timely written complaints of sex discrimination against these recipients.
- Title IX of the Education Amendments of 1972 is the primary federal law that addresses sex discrimination in all federally funded grant programs at educational institutions.
- Recipients of federal assistance—in this case, **university grantees**—also have some compliance responsibilities.

- Complaints are filed through DOE's Office of Economic Impact and Diversity: https://www.energy.gov/diversity/office-economic-impact-and-diversity



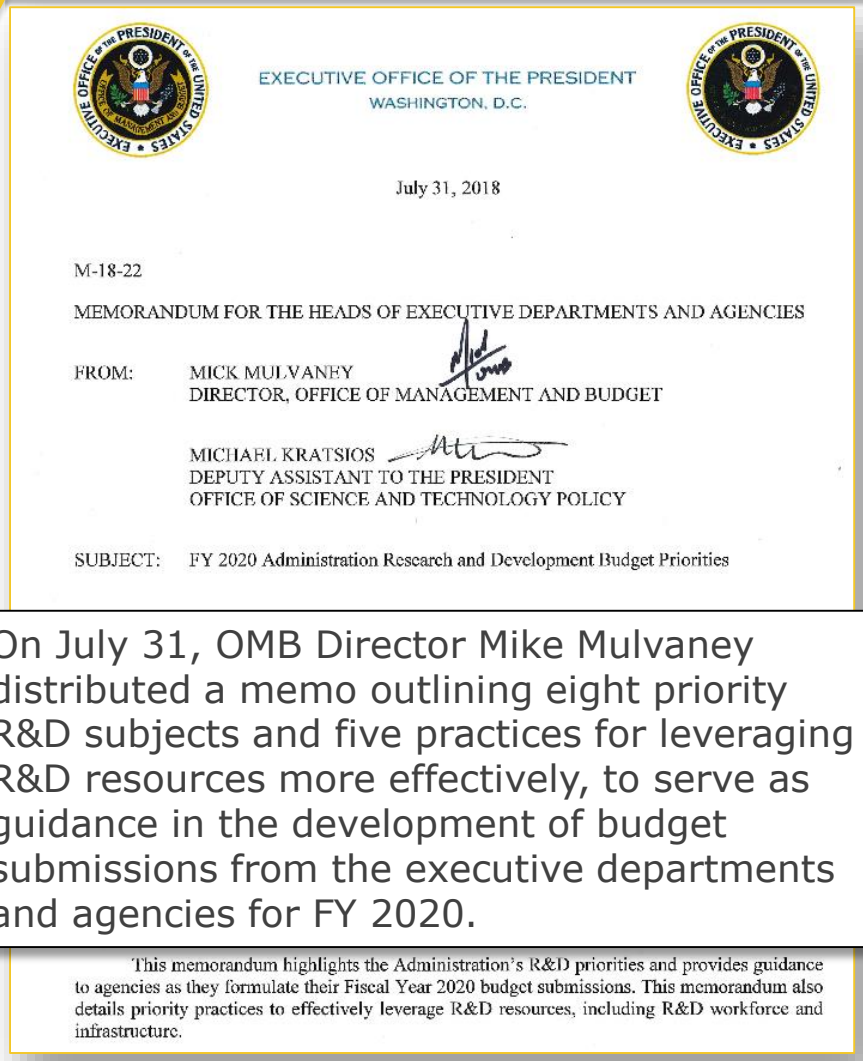
Discussion


Race
Gender
Military
Diversity
Respect
Awareness
Community
Culture
Socioeconomic
Human-Rights
Equity
Equality
Inclusion
Dialogue
Nationality
Identity
Social-Justice
Sex
Caring
Ethnicity
Disability
LGBTQI
Service
Affirmative-Action
Empathy
Religion

U.S. DEPARTMENT OF
ENERGY

Office of
Science

White House FY 2020 R&D Priorities



EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C.

July 31, 2018

M-18-22

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: MICK MULVANEY
DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET

MICHAEL KRATSIOS
DEPUTY ASSISTANT TO THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY

SUBJECT: FY 2020 Administration Research and Development Budget Priorities

This memorandum highlights the Administration's R&D priorities and provides guidance to agencies as they formulate their Fiscal Year 2020 budget submissions. This memorandum also details priority practices to effectively leverage R&D resources, including R&D workforce and infrastructure.

On July 31, OMB Director Mike Mulvaney distributed a memo outlining eight priority R&D subjects and five practices for leveraging R&D resources more effectively, to serve as guidance in the development of budget submissions from the executive departments and agencies for FY 2020.

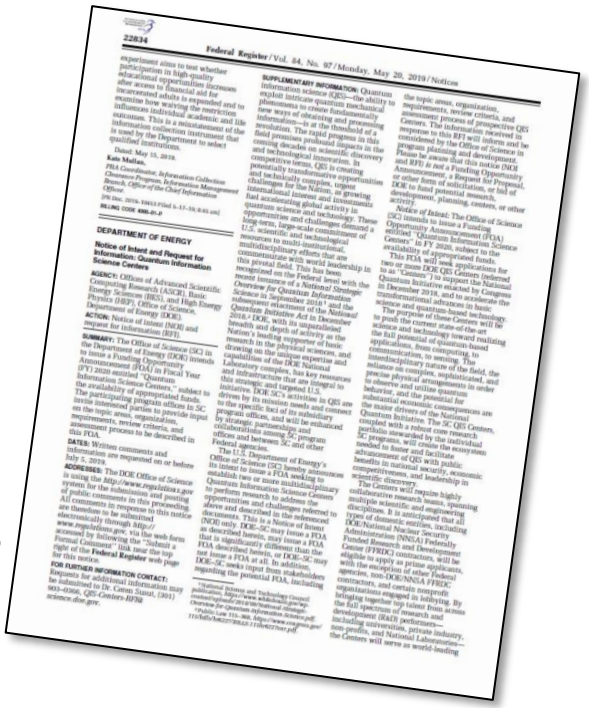
- **Priority R&D Areas**
  - "Security for the American people" — emphasizing military superiority, cyber security, border surveillance and weather prediction;
  - **Artificial intelligence, quantum information sciences and strategic computing;**
  - Communications connectivity and autonomy of driving and unmanned vehicles;
  - **Next generation manufacturing, including digital manufacturing, robotics, industrial Internet of Things, machine learning and AI;**
  - Space exploration, including research into long-duration spaceflight, in-space manufacturing, cryogenic fuel storage, space-related power and propulsion;
  - "American Energy Dominance";
  - Medical innovation — personalized medicine, disease prevention, health promotion and translation, veteran health care and aging populations; and,
  - Agriculture, including precision agriculture, aquatic technologies and input minimization and yield maximization.
- **Priority R&D Practices:**
  - **Support educating & training workforce in STEM fields**
  - **Managing and modernizing the R&D infrastructure**
  - Improve interagency coordination and cross-disciplinary collaboration
  - Increase technology transfer
  - **Facilitate industry-academia partnerships.**

HEP Overlap with White House FY 2020 R&D Priority Areas and Practices

- **American Leadership in Artificial Intelligence, Quantum Information Sciences, and Strategic Computing**
  - Agencies should invest in fundamental and applied AI research, including machine learning, autonomous systems, and applications at the human-technology frontier.
  - **Agencies should prioritize QIS R&D**, which will build the technical and scientific base necessary to explore the next generation of QIS theory, devices, and applications.
  - Agencies should prioritize investment in research and infrastructure to maintain U.S. leadership in strategic computing…
- **American Manufacturing**
  - In order for the United States **to maintain leadership in semiconductor design and fabrication**, including assured access to advanced microelectronics, agencies should work in collaboration, and, when appropriate, in partnership, with industry to develop new design tools, materials, devices, interconnect solutions, and **architectures needed for future computing and storage paradigms**.
- **Educating and Training a Workforce for the 21st Century Economy**
  - Agencies should prioritize initiatives that reskill Americans for the jobs of today and the future. **Education in science, technology, engineering, and mathematics (STEM), including computer science…**
  - Agencies should work to ensure the STEM workforce includes all Americans, including those from urban and rural areas as well as underrepresented groups.
- **Managing & Modernizing R&D Infrastructure**
  - Agencies should prioritize infrastructure investments that enable shared resources and improve capabilities across a range of disciplines.
  - Long-term stewardship of scientific infrastructure also **necessitates that agencies decommission or divest out-of-date or obsolete facilities** quickly and efficiently.
- **Partnering with Industry and Academia**
  - **Innovative partnership models involving other agencies, state and local governments, the private sector, academia, and international parties can help maximize utilization of Federal facilities and lead to sharing the costs of new R&D facilities.**
  - Agencies should seek to rapidly field innovative technologies from the private sector, where possible, that are easily adaptable to Federal needs, rather than reinventing solutions in parallel.

Quantum Information Science Centers

- The FY2020 budget request includes funds in HEP, BES, and ASCR for at least one jointly-supported and multidisciplinary QIS Center, as per the National Quantum Initiative Act signed into law in December 2018
- May 20, 2019, DOE published a notice in the Federal Register (FR) with two components:
  - A Notice of Intent (NOI) indicating that DOE-SC is considering issuing a Funding Opportunity Announcement in FY2020 for Quantum Information Science Centers
  - A Request For Information (RFI) seeking stakeholder input on the topic areas, organization, requirements, review criteria, and assessment process for prospective QIS Centers
- Comments were due by July 5, 2019
  - Information will inform next steps in considering QIS Centers


22834 Federal Register / Vol. 84, No. 97 / Monday, May 20, 2019 / Notices

DEPARTMENT OF ENERGY

Notice of Intent and Request for Information: Quantum Information Science Centers

AGENCY: Office of Advanced Scientific Computing Research (ASCR), Basic Energy Sciences (BES), and High Energy Physics (HEP), Office of Science, Department of Energy (DOE).

ACTION: Notice of intent (NOI) and request for information (RFI).

SUMMARY: The Office of Science (SC) in the Department of Energy (DOE) intends to issue a Funding Opportunity Announcement (FOA) in Fiscal Year (FY) 2020 entitled "Quantum Information Science Centers," subject to the availability of appropriated funds. The participating program offices in SC invite interested parties to provide input on the topic areas, organization, requirements, review criteria, and assessment process to be described in this FOA.

DATES: Written comments and information are requested on or before July 5, 2019.

ADDRESSES: The DOE Office of Science is using the http://www.regulations.gov system for the submission and posting of public comments in this proceeding. All comments in response to this notice are therefore to be submitted electronically through http://www.regulations.gov via the web form accessed by following the "Submit a Formal Comment" link near the top right of the Federal Register web page for this notice.

FOR FURTHER INFORMATION CONTACT: Requests for additional information may be submitted to Dr. Lenny Susuri, (301) 903-0266, QIS-Centers-RFI@science.doe.gov.

SUPPLEMENTARY INFORMATION: Quantum information science (QIS)—the ability to exploit intricate quantum mechanical phenomena to create fundamentally new ways of obtaining and processing information—is at the threshold of a revolution. The rapid progress in this field promises profound impacts in the coming decades on scientific discovery and technological innovation, in potentially transformative opportunities for the Nation's economic, and growing international interest and investments in quantum science and technology. These opportunities and challenges demand a U.S. scientific and technological response to multi-institutional, multidisciplinary efforts that are commensurate with world leadership in this pivotal field. This has been recognized on the Federal level with the announcement of a National Strategic Overview for Quantum Information Science in September 2018[1] and the subsequent enactment of the National Quantum Initiative Act in December 2018.[2] DOE, with its unparalleled breadth and depth of activity as the Nation's leading supporter of basic research in the physical sciences, and capabilities of the DOE National Laboratory complex, has key resources and infrastructure that are integral to this strategic and urgently needed U.S. initiative. DOE SC's activities in QIS are driven by its mission needs and connect to the specific foci of its subsidiary program offices, and will be enhanced by strategic partnerships and collaborations among SC program offices and between SC and other Federal agencies.

The U.S. Department of Energy's Office of Science (SC) hereby announces its intent to issue a FOA seeking to establish two or more multidisciplinary Quantum Information Science Centers to perform research to address opportunities and challenges referred to above and described in the referenced [NOI] only. DOE–SC may issue a FOA as described herein, may issue a FOA that is significantly different than the FOA described herein, or DOE–SC may not issue a FOA at all. In addition, DOE–SC seeks input from stakeholders regarding the potential FOA, including the topic areas, organization, requirements, review criteria, and assessment process of prospective QIS Centers. The information received in response to this RFI will inform and be considered by the Office of Science in program planning and development. Please be aware that this notice (NOI and RFI) is not a Funding Opportunity Announcement, a Request for Proposal, or other form of solicitation, or bid of DOE to fund potential research, development, planning, centers, or other activity.

Notice of Intent: The Office of Science (SC) intends to issue a Funding Opportunity Announcement (FOA) entitled "Quantum Information Science Centers" in FY 2020, subject to the availability of appropriated funds.

This FOA will invite applications for two or more DOE QIS Centers (referred to as "Centers") to support the National Quantum Initiative enacted by Congress in December 2018, and to accelerate the transformational advances in basic science and quantum-based technology. The purpose of these Centers will be to push the current state-of-the-art science and technology toward realizing the full potential of quantum-based applications, from computing to communication, to sensing. The interdisciplinary nature of the field, the promise of physical arrangements in order to observe and utilize quantum behavior, and the potential for substantial economic consequences are the major drivers of the National Quantum Initiative. The SC QIS Centers, coupled with a robust core research portfolio stewarded by the individual SC programs, will create the ecosystem needed to foster and facilitate advancements of QIS with public benefits in national security, economic competitiveness, and leadership in scientific discovery.

The Centers will require highly collaborative research teams, spanning multiple scientific and engineering disciplines. It is anticipated that all types of domestic entities, including DOE/National Nuclear Security Administration (NNSA) Federally Funded Research and Development Center (FFRDC) contractors, will be eligible to apply as prime applicants with the exception of other Federal agencies, non-DOE/NNSA FFRDC contractors, and certain nonprofit organizations engaged in lobbying. By bringing together top talent from across the full spectrum of research and development (R&D) performers—including universities, private industry, non-profits, and National Laboratories—the Centers will serve as world-leading

Authorizations and Appropriations

Basic Purposes of Authorization

- **Establish/continue/modify** federal programs
- Provide Congress **budget authority and guidance** for appropriations

Direct or Mandatory Spending

- **Mandatory spending** is done automatically based on eligibility or formula, includes entitlement programs like Medicare and Social Security
- **Authorization must change** to reduce funding; not part of annual appropriation process

Annual Appropriations

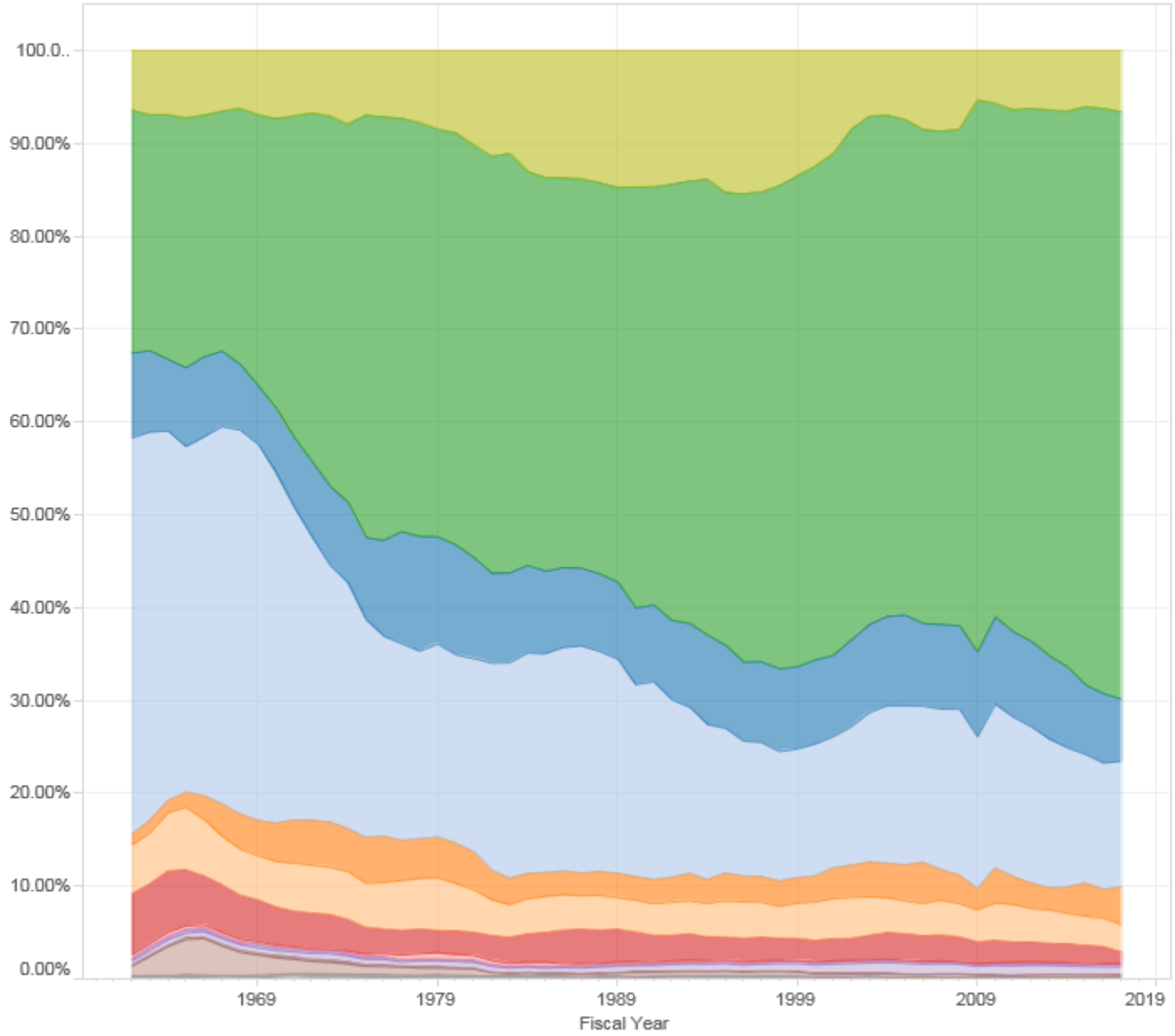
- **Discretionary spending** determined by appropriations process, includes National defense, food safety, education, and science research
- Provided in **12 appropriation acts**, is less than 1/3 of current federal expenditures

Renewing Authorizations

- **Reauthorization** can extend a program
- Unless prohibited, **new appropriations** may also extend a program

Composition of the Federal Budget

(outlays)



Fiscal Years

1962 — 2017

Metric

Share of Federal Budget

Spending Categories

- Net Interest
- Mandatory Outlays
- All Other Outlays
- Defense Outlays (non-R&D)
- Education and Training
- Infrastructure (Nondefense)
- R&D: Defense Function
- R&D: Energy Function
- R&D: General Science
- R&D: Health Function
- R&D: Other Functions
- R&D: Space Function
- R&D: Ag and Environment
- R&D: Transportation

Spending Categories

(All)

"Mandatory outlays" are mostly composed of Medicare, Medicaid, and Social Security. "Defense Outlays (non-R&D)" include non-R&D activities of the Defense Department, the National Nuclear Security Administration, and other programs. Based on OMB historical data tables from the FY 2019 request. Last updated May 2018.

Stewardship of DOE National Laboratories

- Together, the 17 DOE laboratories comprise a preeminent federal research system, providing the Nation with strategic scientific and technological capabilities. The laboratories:
  - **Execute long-term government scientific and technological missions**, often with complex security, safety, project management, or other operational challenges;
  - **Develop unique, often multidisciplinary, scientific capabilities** beyond the scope of academic and industrial institutions, to benefit the Nation's researchers and national strategic priorities; and
  - **Develop and sustain critical scientific and technical capabilities** to which the government requires assured access.

HEP MIE Project Status

Subprogram	TPC ($M)	CD Status	CD Date
INTENSITY FRONTIER			
Long Baseline Neutrino Facility / Deep Underground Neutrino Experiment (LBNF/DUNE)	1,300 – 1,900	CD-3A	September 1, 2016
Proton Improvement Project (PIP-II)	653 – 928	CD-1	July 23, 2018
Muon g-2	46.4	CD-4	January 16, 2018
Muon-to-Electron Conversion Experiment (Mu2e)	273.7	CD-3	July 14, 2016
ENERGY FRONTIER			
LHC ATLAS Detector Upgrade	33	CD-3	November 12, 2014
LHC CMS Detector Upgrade	33	CD-4A	September 19, 2017
High-Luminosity LHC (HL-LHC) Accelerator Upgrade	208 – 252	CD-1/3A	October 13, 2017
High-Luminosity LHC (HL-LHC) ATLAS Detector Upgrade	125-155	CD-0	April 13, 2016
High-Luminosity LHC (HL-LHC) CMS Detector Upgrade	125-155	CD-0	April 13, 2016
COSMIC FRONTIER			
LUX-ZEPLIN (LZ)	55.5	CD-3	February 9, 2017
Super Cryogenic Dark Matter Search - SNOLAB (SuperCDMS-SNOLAB)	18.6	CD-2/3	May 2, 2018
Dark Energy Spectroscopic Instrument (DESI)	56.3	CD-3	June 22, 2016
Large Synoptic Survey Telescope Camera (LSSTcam)	168	CD-3	August 27, 2015
ADVANCED TECHNOLOGY R&D			
Facility for Advanced Accelerator Experimental Tests II (FACET-II)	25.6	CD-2/3	June 8, 2018

HEP Early Career FY10-18 Demographics I

L = National Laboratory Proposal
U = University Proposal

Subprogram Proposals	FY10 (L/U)	FY11 (L/U)	FY12 (L/U)	FY13 (L/U)	FY14 (L/U)	FY15 (L/U)	FY16 (L/U)	FY1 (L/U
Energy	47 (7/40)	32 (5/27)	18 (2/16)	15 (4/11)	14 (4/10)	10 (3/7)	18 (4/14)	15 (3/1
Intensity	16 (6/10)	21 (10/11)	17 (9/8)	7 (4/3)	14 (9/5)	15 (8/7)	19 (7/12)	14 (7/7
Cosmic	20 (8/12)	12 (5/7)	17 (5/12)	22 (9/13)	13 (7/6)	14 (6/8)	14 (6/8)	13 (5/8
HEP Theory	49 (6/43)	45 (7/38)	23 (5/18)	20 (3/17)	23 (3/20)	25 (3/22)	21 (1/20)	29 (2/2
Accelerator	19 (18/1)	18 (16/2)	10 (9/1)	8 (6/2)	11 (11/0)	7 (6/1)	10 (9/1)	8 (6/2
Detector	3 (2/1)	0 (0/0)	4 (4/0)	6 (3/3)	2 (2/0)	2 (1/1)	2 (0/2)	4 (3/1
Total Proposals	154 (47/107)	128 (43/85)	89 (34/55)	78 (29/49)	77 (36/41)	73 (27/46)	84 (27/57)	83 (26/

FY18 (L/U)	Total (L/U)
16 (8/8)	185 (40/145)
15 (8/7)	138 (68/70)
16 (5/11)	141 (56/85)
31 (3/28)	266 (33/233)
6 (4/2)	97 (85/12)
8 (7/1)	31 (22/9)
92 (35/57)	**858 (304/554)**

HEP Early Career FY10-18 Demographics II

M= Male
F= Female

Subprogram Awards	FY10 (M/F)	FY11 (M/F)	FY12 (M/F)	FY13 (M/F)	FY14 (M/F)	FY15 (M/F)	FY16 (M/F)	FY1 (M/	FY18 (M/F)	Total (M/F)
Energy	3 (2/1)	3 (2/1)	1 (1/0)	2 (1/1)	2 (1/1)	0 (0/0)	2 (2/0)	2 (2	3 (2/1)	15 (11/5)
Intensity	2 (1/1)	1 (1/0)	3 (1/2)	1 (0/1*)	1 (1/0)	2 (2/0)	1 (0/1)	2 (2	2 (2/0)	14 (10/4)
Cosmic	2 (2/0)	3 (3/0)	3 (2/1)	2 (2/0)	1 (1/0)	0 (0/0)	1 (1/0)	2 (1	2 (0/2)	15 (11/4)
HEP Theory	6 (6/0)	4 (3/1*)	3 (3/0)	3 (3/0)	1 (1/0)	3 (2/1)	1 (1/0)	2 (0	3 (3/0)	25 (21/4)
Detector	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	1 (1	2 (2/0)	3 (3/0)
Accelerator	1 (0/1)	2 (2/0)	2 (2/0)	1 (1/0)	1 (0/1)	0 (0/0)	2 (2/0)	2 (2	1 (1/0)	10 (8/2)
QIS	NA	NA	NA	NA	NA	NA	NA	NA	1 (1/0)	1 (1/0)
HEP Awards	14 (11/3)	13 (11/2)	12 (9/3)	9 (7/2)	6 (4/2)	5 (4/1)	7 (6/1)	11 (8/3	14 (11/3)	91 (71/20)
Proposals	**154 (131/23)**	**128 (110/18)**	**89 (75/14)**	**78 (64/14)**	**77 (62/15)**	**73 (57/16)**	**84 (65/19)**	**83 (59/**	**92 (72/20)**	**858 (695/163)**

*** Two awards funded by DOE Office of Basic Energy Sciences (BES) as an EPSCoR [Experimental Program to Stimulate Competitive Research] award with grant monitored by DOE Office of High Energy Physics (HEP).**

HEP Early Career FY10-18 Lab vs. Univ Awards

L = National Laboratory Proposal
U = University Proposal

Subprogram Awards	FY10 (L/U)	FY11 (L/U)	FY12 (L/U)	FY13 (L/U)	FY14 (L/U)	FY15 (L/U)	FY16 (L/U)	FY1 (L/	FY18 (L/U)	Total (L/U)
Energy	3 (1/2)	3 (1/2)	1 (0/1)	2 (0/2)	2 (1/1)	0 (0/0)	2 (0/2)	2 (1	3 (2/1)	18 (6/12)
Intensity	2 (1/1)	1 (0/1)	3 (2/1)	1 (0/1*)	1 (1/0)	2 (1/1)	1 (1/0)	2 (2	2 (2/0)	15 (10/5)
Cosmic	2 (0/2)	3 (2/1)	3 (1/2)	2 (1/1)	1 (0/1)	0 (0/0)	1 (0/1)	2 (1	2 (0/2)	16 (5/11)
HEP Theory	6 (1/5)	4 (0/4*)	3 (0/3)	3 (1/2)	1 (0/1)	3 (0/3)	1 (1/0)	2 (0	3 (0/3)	26 (3/23)
Detector	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	1 (1	2 (2/0)	3 (3/0)
Accelerator	1 (1/0)	2 (2/0)	2 (1/1)	1 (0/1)	1 (1/0)	0 (0/0)	2 (2/0)	2 (2	1 (0/1)	12 (9/3)
QIS	NA	NA	NA	NA	NA	NA	NA	NA	1 (1/0)	1 (1/0)
HEP Awards	14 (4/10)	13 (5/8)	12 (4/8)	9 (2/7)	6 (3/3)	5 (1/4)	7 (4/3)	11 (7/	14 (7/7)	91 (37/54)
Proposals	154 (47/107)	128 (43/85)	89 (34/55)	78 (29/49)	77 (36/41)	73 (27/46)	84 (27/47)	83 (26/	**92 (35/57)**	**858 (304/554)**

*** Two awards funded by DOE Office of Basic Energy Sciences (BES) as an EPSCoR [Experimental Program to Stimulate Competitive Research] award with grant monitored by DOE Office of High Energy Physics (HEP).**