U.S. DEPARTMENT OF ENERGY | Office of Science

Office of High Energy Physics Detector R&D Program

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Helmut Marsiske
Program Manager for Instrumentation
(Helmut.Marsiske@Science.DOE.gov)

Outline

- HEP Detector R&D Program
- HEP Budget
- DOE/HEP Comparative Review
- DOE Early Career Research Program

Detector R&D Program

- **Support research leading to fundamental advances in the science of particle detection, and develop the next generation of instrumentation for HEP**
  - **Program properly balanced between evolutionary, near-term, low-risk and revolutionary, long-term, high-risk detector R&D**
    - **Project-oriented vs Generic R&D**
    - **Focus on strategic areas (future promise; U.S. leadership)**
- **Provide graduate and post-doctoral research training in instrumentation ← next generation of detector experts**
- **Support "infrastructure"—technical personnel, equipment, "facilities", and test beams—required for experimental detector R&D and fabrication**

P5 Recommendations

- **Recommendation 27: Focus resources toward directed instrumentation R&D in the near-term for high-priority projects. As the technical challenges of current high-priority projects are met, restore to the extent possible a balanced mix of short-term and long-term R&D.**

  ← Flavor of R&D is changing: less generic, more project-oriented

  Total R&D funding shrinking because of other, higher-priority initiatives

- **Recommendation 28: Strengthen university-national laboratory partnerships in instrumentation R&D through investment in instrumentation at universities. Encourage graduate programs with a focus on instrumentation education at HEP-supported universities and laboratories, and fully exploit the unique capabilities and facilities offered at each.**

  ← Find appropriate laboratory/university balance to optimize overall productivity; find mechanisms to foster university instrumentation programs

Program Funding and Effort

- Total funding ~$21M in FY2016
  - Research (~$16M) as well as facilities/test beam operations (~$5M) ,with 80-85% of research funding to national labs
- Supports efforts at 5 national labs (~80 FTEs at ANL, BNL, FNAL, LBNL, SLAC) and ~20 universities (~25 FTEs)
- National labs: annual budget briefings, field work proposals (FWPs), and lab comparative review (last in 2012 and 2016)
- Universities: annual funding opportunity announcement (FOA) and university comparative review (since 2012)
- Special solicitations for Advanced Detector R&D and Collider Detector R&D in the past (last in 2011)

Detector R&D Efforts by Frontier

- **Energy Frontier**
  - LHC phase-II upgrades
  - "Future Collider" further off into the future
- **Intensity Frontier**
  - DUNE/SBN
    - Liquid Argon TPC, etc
- **Cosmic Frontier**
  - Dark Matter/Dark Energy
  - Cosmic Microwave Background
- **"Instrumentation" Frontier**
  - Large Area Picosecond Photon Detector (LAPPD)
  - Blue-Sky/Grand Challenges??

Most R&D efforts also supported out of the corresponding Research Frontier, or out of Operations programs (e.g., LHC operations)

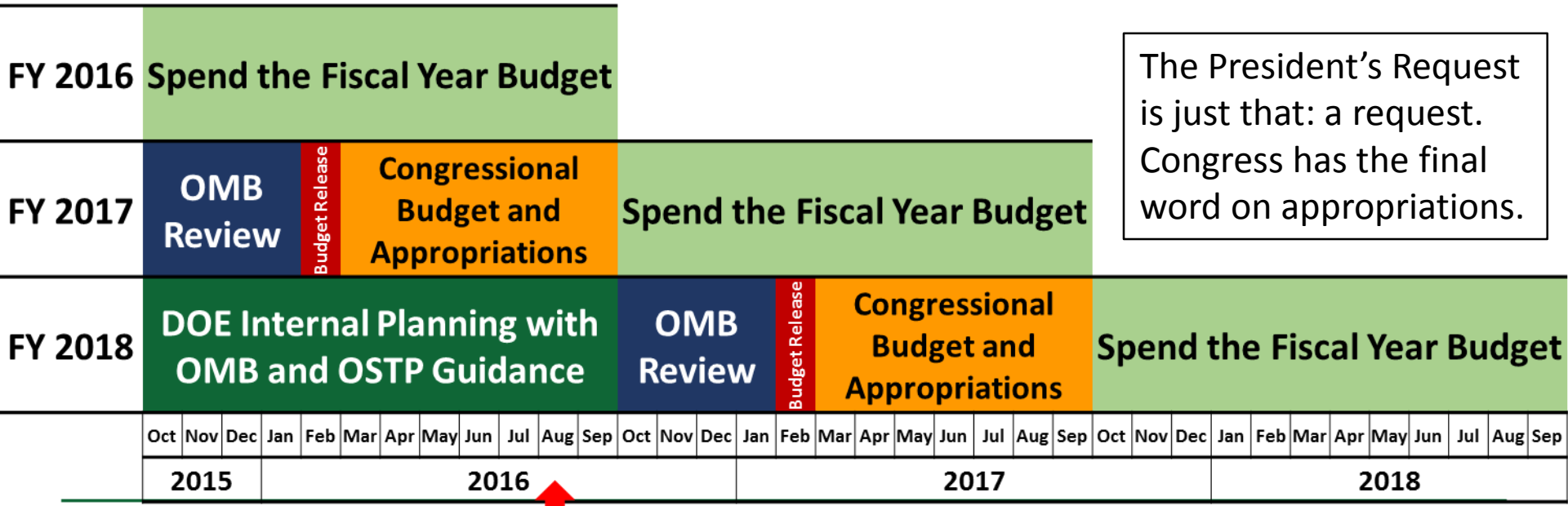
Interim Summary

- **Innovation in instrumentation historical strength of HEP**
  - Need to preserve and invigorate this core competency
- **Near-term priority is to support P5 research priorities**
  - LHC phase-II upgrades
  - Long- and short-baseline neutrino program
  - Dark Matter/Dark Energy and CMB
- **Need to restore short-/long-term balance: more Blue-Sky**
- **Stewardship of instrumentation efforts has historically rested with national labs and (some) university groups**
  - Need to establish new, collaborative models to do more with less, and to better engage universities in the R&D enterprise
  - Continue to examine raison d'etre of existing detector facilities within the (changing) national HEP program
- **Community plays key role in identifying scientific and technological opportunities and in making them happen**
  - Still awaiting CPAD report on Strategic Directions/Grand Challenges

HEP FY 2017 BUDGET

U.S. Federal Budget Cycle

- **Typically, three budgets are being worked on at any given time**
  - Executing **current Fiscal Year** (FY; October 1 – September 30)
  - White House Office of Management and Budget (OMB) review and Congressional Appropriation for **FY+1**
  - Agency internal planning for formulating the President's Request for **FY+2**



The President's Request is just that: a request. Congress has the final word on appropriations.

FY 2017 HEP Funding by Activity

HEP Funding Category ($ in K)	FY 2015 Final	FY 2016 Enacted	FY 2017 Request	Explanation of Changes (FY17 vs. FY16)
Research	334,225	327,389	331,123	Sustain support for research program
Facilities	264,634	254,979	252,037	Overall operations support reductions due to scheduled completion of projects
Projects	109,373	125,635	123,736	**Other Project Costs (OPC) includes CDR, project-specific R&D, prototyping and testing, installation and commissioning/pre-operations before CD-4*
Energy Frontier Projects	*15,000*	*19,000*	*18,967*	*Initial ATLAS/CMS upgrades complete in FY17; OPC* begins for HL-LHC detector upgrades*
Intensity Frontier Projects	*46,970*	*35,700*	*24,569*	*Reduction from ramp down of g-2 & end of LBNF/DUNE OPC*; SBN Program increases*
Cosmic Frontier Projects	*46,403*	*66,835*	*70,200*	*Planned ramp up supports fabrication of LSSTcam, DESI, SuperCDMS-SNOLab, LZ*
Other Projects	*1,000*	*4,100*	*10,000*	*Increase to support the FACET-II project*
Construction (Line Item)	37,000	66,100	88,521	Request engineering design, site preparation and long-lead procurement for the LBNF/DUNE; planned profile for Mu2e
SBIR/STTR	20,768*	20,897	22,580	
Total	**766,000***	**795,000**	**817,997**	***House mark $823M, Senate mark $833M Potential Continuing Resolution in FY2017***

**** SBIR/STTR added to FY 2015 for comparison to FY 2016/2017***

Advanced Technology R&D

Advanced Technology R&D	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Explanation of Changes (FY17 vs. FY16)
Research	88,217	83,644	83,360	
General Accelerator R&D	*45,903*	*46,722*	*44,510*	*Focus on high priority areas in SC magnets, SRF, and high–power beam targets; $1M of funding to initiate traineeship activity*
Directed Accelerator R&D	*23,000*	*20,640*	*21,500*	*Reductions from MAP ramp down offset by increase in LARP SC magnet effort to meet schedule for delivery of magnet prototypes*
*Detector R&D**	*19,314*	*16,282*	*17,350*	*Modest detector R&D support with focus on high-priority R&D identified by P5*
Facility Operations and Experimental Support	35,870	29,750	26,925	Reduction dominated by end of operations funding for FACET
Projects	0	2,100	8,000	Increase to support the FACET-II project
Total	**124,087**	**115,494**	**118,285**	

*Research only. Does not include detector/test beam facilities.

Detector R&D FY 2014: 24,402

RESEARCH OPPORTUNITIES IN HIGH ENERGY PHYSICS FUNDING OPPORTUNITY ANNOUNCEMENT (FOA): UNIVERSITY COMPARATIVE REVIEW

University HEP Comparative Reviews

- **Since FY 2012, DOE/HEP uses a process of comparative grant reviews for university research grants – those scheduled for renewal and any new proposals**
  - **Incoming FY 2017 FOA applicants with typical 3-year university grants that plan to renew will have been reviewed at least once**
  - **HEP subprograms at the DOE national laboratories are also reviewed every 3-4 years**
- **Process was recommended by several DOE advisory committees, including the 2010 and 2013 HEP Committee of Visitors (COV):**
  - ***"In several of the cases that the panel read, proposal reviewers expressed negative views of the grant, but only outside of their formal responses. Coupled with the trend in the data towards very little changes in the funding levels over time, this suggests that grants are being evaluated based on the historical strength of the group rather than the current strength or productivity of the group. This is of particular concern when considering whether new investigators, new science, or high-risk projects can be competitive. Comparative reviews can be a powerful tool for addressing these issues and keeping the program in peak form."***
  - **Recommendation of 2010 COV: Use comparative review panels on a regular basis;**
  - **and 2013 COV: Continue comparative reviews. Augment with independent mail-in reviews.**

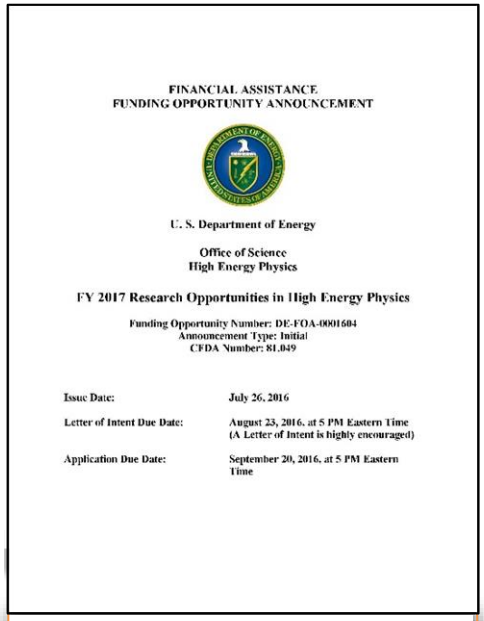
Goal: improve overall quality and efficacy of the HEP research program by identifying the best proposals with highest scientific impact and potential

FY2017 HEP Comparative Review FOA and FAQ

- DE-FOA-0001604 issued July 26, 2016
- Six HEP research subprograms
  - Energy, Intensity, and Cosmic Frontiers
  - HEP Theory
  - Accelerator Science and Technology R&D
  - Detector R&D
- Letter of Intent due August 23, 2016 by 5 PM Eastern Time
  - *Strongly encouraged*
- Final Proposal deadline September 20, 2016 by 5 PM Eastern Time

- In addition to information provided in the FOA, a FAQ is available and addresses topics on:
  - Registration and eligibility requirements
  - Proposal types and proposal requirements
  - Guidance for new faculty and those without current HEP grants
  - Guidance for PIs with existing HEP grants
  - Letter of Intent
  - Budget information and guidance on scope of request(s)
  - Information on overall scientific merit review process

Both the FOA and FAQ available at:
http://science.energy.gov/hep/funding-opportunities/



FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT

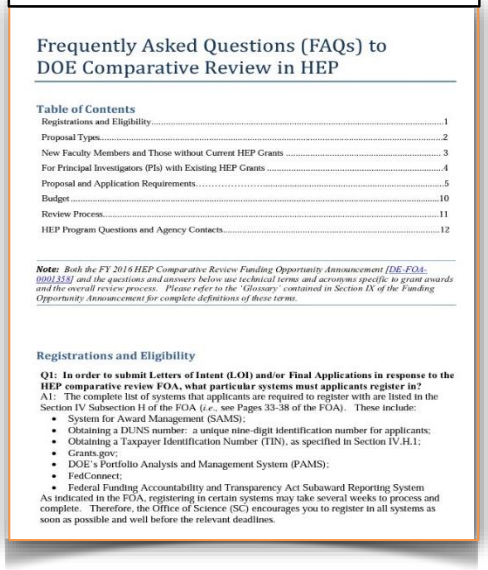
U. S. Department of Energy

Office of Science
High Energy Physics

FY 2017 Research Opportunities in High Energy Physics

Funding Opportunity Number: DE-FOA-0001604
Announcement Type: Initial
CFDA Number: 81.049

Issue Date:	July 26, 2016
Letter of Intent Due Date:	August 23, 2016, at 5 PM Eastern Time (A Letter of Intent is highly encouraged)
Application Due Date:	September 20, 2016, at 5 PM Eastern Time



Frequently Asked Questions (FAQs) to DOE Comparative Review in HEP

Table of Contents

Note: *Both the FY 2016 HEP Comparative Review Funding Opportunity Announcement [DE-FOA-0001358] and the questions and answers below use technical terms and acronyms specific to grant awards and the overall review process. Please refer to the 'Glossary' contained in Section IX of the Funding Opportunity Announcement for complete definitions of these terms.*

Registrations and Eligibility

Q1: In order to submit Letters of Intent (LOI) and/or Final Applications in response to the HEP comparative review FOA, what particular systems must applicants register in?
A1: The complete list of systems that applicants are required to register with are listed in the Section IV Subsection H of the FOA (*i.e.*, see Pages 33-38 of the FOA). These include:

- System for Award Management (SAMS);
- Obtaining a DUNS number: a unique nine-digit identification number for applicants;
- Obtaining a Taxpayer Identification Number (TIN), as specified in Section IV.H.1;
- Grants.gov;
- DOE's Portfolio Analysis and Management System (PAMS);
- FedConnect;
- Federal Funding Accountability and Transparency Act Subaward Reporting System

As indicated in the FOA, registering in certain systems may take several weeks to process and complete. Therefore, the Office of Science (SC) encourages you to register in all systems as soon as possible and well before the relevant deadlines.

Key Items to Keep in Mind

- Proposed research will review best if aligned with the DOE/HEP mission, its program, and the Particle Physics Project Prioritization Panel (P5) strategy
- Investigators in experimental HEP research frontiers (Energy, Intensity, Cosmic) will review best if they are closely integrated into HEP experiment collaborations and have key roles and responsibilities on those experiments
- "Generic" detector research that is not to be carried out as part of a specific HEP experimental collaboration should be directed to the HEP Detector R&D program
  - Concern about program balance ➔ "Proposals for "Blue-Sky" scientific research on innovative technologies not already in contention for implementation in future DOE HEP projects are specifically encouraged"
  - Would like to see university-lab collaborative proposals
- Read the FOA carefully and follow the requirements on content, length, etc.;
  - **Several requirements in the FOA are set from outside the DOE/HEP office, and there is little to no flexibility to modify. Non-compliant proposals submitted to the FOA will not be reviewed.**
  - **In recent years, 10-15% of incoming proposals are declined w/o review. Requirements that are most often missed or overlooked include: data management plans, page limits, separate budget sheets for each frontier (if needed), and inclusion of Personally Identifiable Information (PII)**

Proposal: Project Narrative

- **Project Narrative comprises the *research plan* for the project**
  - Should contain enough background material in the introduction to demonstrate sufficient knowledge of the research
  - Devote main portion to a description and justification of the proposed project, include details of the methods to be used and any relevant results
  - Indicate which project personnel will be responsible for which activities
  - Include timeline for the major activities of the proposed project
- **Must not exceed 9 pages per senior investigator when printed on standard 8 ½" x 11" paper with 1-inch margins (top, bottom, left, and right). Font must not be smaller than 11 point.**
  - Senior investigator ≡ active tenured or tenure-track faculty member at the sponsoring institution
  - Non-tenure track faculty (*e.g.,* research faculty) or senior research staff with term appointments are not included in the 9-page limit per senior investigator unless they are the sole senior investigator on the application
  - Faculty members at collaborating institutions listed on the proposal (if any) are not included
- **Encouraged to refer to Section IV of the FOA**
  - Includes useful information to help PIs in preparing better narratives – *for e.g.:*
    - What to address for the Background/Introduction
    - Multiple Investigators and/or Multiple Research Subprograms or Thrusts
    - Common narrative that provides overview of each group's activities in different research areas to describe synergies and connections between areas
    - Proposed Project Objectives, Research Methods, Resources
    - Timetable and Level of Effort of different activities, …

Supported HEP Research Activities

- **Efforts that are in direct support of HEP programs ← selection depends on merit review process and programmatic factors**
  - **Research efforts (mainly scientists) on R&D, experiment design, fabrication, data-taking, analysis-related activities**
  - **Theory, simulations, phenomenology, computational studies**
  - **Some engineering/technician support may be provided in the Detector R&D subprogram**
- **Faculty support**
  - **Based on merit reviews and/or optimizing the number of research personnel supported by financial assistance awards, support of up to 2-months faculty summer salary**
  - **Summer support should be adjusted according to % time the faculty is on research effort**
- **Research Scientists**
  - **Support may be provided, but due to long-term expectations, need to consider case-by-case on merits: whether the roles and responsibilities are well-matched with individual capabilities and cannot be fulfilled by a term position**
  - **Efforts are related towards research; not *long-term* operations and/or project activities**

× **What's not supported by research grants**

- **Any significant HEP operations and/or project-related activities:**
  - **Engineering, major items of equipment, consumables for prototyping or production**
- **Non-HEP related efforts — *for e.g.:***
  - **Gravity waves (LIGO), heavy-ion (RHIC *or* at LHC), AMO Science, astronomy**
  - **As of FY 2017, neutrinoless double beta decay is under the DOE Office of Nuclear Physics**

Research Scientists (RS)

- Panel will evaluate RS efforts where support is requested in a comparative review proposal
- Guidance to PIs given in Q&A of FAQ…
  - Requests to support RS dedicated full-time (and long-term) to operational and/or project activities for an experiment will not be supported by respective frontier research areas
  - If RS conducting physics research-related activities, requests [scaled to % of time on such efforts] can be included
    - Any final support will be based on the merit review process
- Common [past] reviewer comments that result in unfavorable merit reviews:
  - 'RS conducting scope of work typically commensurate at the postdoctoral-level…'
  - 'RS involved in long-term operation/project activities with minimum physics research efforts…'
    - Such efforts may review well in a DOE review of the operation/project program but not as well in a review of the experimental research program
- What is "physics research-related activities"?
  - Object reconstruction/algorithm development, performance studies, data taking and analysis, and mentorship of students & postdocs in these areas
  - Scientific activities in support of detector/hardware design and development
- For the research program, cases become an issue when operations/projects become the *dominant* activity 'long-term'
  - A well-balanced portfolio that includes physics research-related activities is encouraged
  - Important to narrate complete plans in 2-page "appendix narrative" + provide 1-page bio sketch

Programmatic Considerations

- Generally very useful to have head-to-head reviews of PIs working in similar areas, particularly for large grants
- Lots of discussion of relative strengths and weaknesses of individual proposals and PIs
- Many factors weigh into final funding decisions
  - Compelling research proposal for next ~3 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 programmatic priorities

- Supportive of excellent people, including excellent *new* people, even when times are tough!

Comparative Merit Review Criteria

[Sub-questions are provided in Section V of FOA and to merit reviewers/panel to evaluate proposal and PI(s)]

1) **Scientific and/or Technical Merit of the Proposed Research**
   e.g., What is the scientific innovation of proposed effort? What is the likelihood of achieving valuable results? How might the results of the proposed research impact the direction, progress, and thinking in relevant scientific fields of research? How does the proposed work compare with other efforts in its field, both in terms of scientific and/or technical merit and originality? What is the merit of the proposed research, compared to other efforts within the same research area for a) applications submitted to this FOA and b) those in the overall HEP field? Is the Data Management Plan suitable for the proposed research and to what extent does it support the validation of research results? ***Please comment individually on each senior investigator.***

2) **Appropriateness of the Proposed Method or Approach**
   e.g., How logical and feasible is the research approach of each senior investigator? Does the proposed research employ innovative concepts or methods? Are the conceptual framework, methods, and analyses well justified, adequately developed, and likely to lead to scientifically valid conclusions? Does the applicant recognize significant potential problems and consider alternative strategies?

3) **Competency of Research Team and Adequacy of Available Resources**
   e.g., What is the past performance of each senior investigator? How well qualified is each senior investigator and their team, and what is the likelihood of success in carrying out the proposed research? Are the research environment and facilities adequate for performing the research? Are PIs or any members of the group leaders on proposed effort(s) and/or potential future leaders in the field? Does the proposed work take advantage of unique facilities and capabilities? Are any proposed plans for recruiting any additional scientific and/or technical personnel including new senior staff, students and postdocs reasonable, justified, and appropriate? For PIs proposing work across multiple research thrusts, are the plans for such cross-cutting efforts reasonably developed and will the proposed activities have impact?

4) **Reasonableness and Appropriateness of the Proposed Budget**
   e.g., Are the proposed budget and staffing levels adequate to carry out the proposed work (scope)? Are all travel, student costs, and other ancillary expenses adequately estimated and justified? Is the budget reasonable, appropriate for the scope?

5) **Relevance to the mission of the DOE Office of High Energy Physics (HEP) program**
   e.g., How does the proposed research of each senior investigator contribute to the mission, science goals and programmatic priorities of the subprogram in which the application is being evaluated? Is it consistent with HEP's overall priorities and strategic plan? For PIs proposing to work and/or transition across multiple research thrusts during the project period, will their overall efforts add value in the broader context of HEP program goals? How likely is the research to impact the mission or direction of the overall HEP program?

Comparative Merit Review Criteria (cont.)

For Reviewers/Panelists

- Merit review criteria items and corresponding questions in Section V of the FOA are given to all reviewers to input their reviews in DOE's Portfolio Analysis and Management System (PAMS)
  - Serves as a guide for reviewers to address each review criteria for written reviews
- Are highlighted by DOE PMs at the beginning of panel deliberations
- Are presented and discussed by individual panelists for each proposal

For Principal Investigators

- Merit review criteria items and corresponding questions in Section V of the FOA
- Serves as an additional guide for PIs to address in their proposal's project narratives
  - Do not just write an explicit paragraph answering each question-by-question, but instead, PIs should integrate and adapt these (as appropriate) when narrating the group's activities and research plans

Office of Science (SC): Data Management Plan (DMP)

- **Data management involves all stages of the digital data life cycle including capture, analysis, sharing, and preservation. The focus of the SC Digital Data Management is the sharing and preservation of digital research data**
  - See Dr. Laura Biven's presentation on SC Digital Data Management, Sept. 2014 HEPAP meeting: *http://science.energy.gov/hep/hepap/meetings/201409/*
  - FOAs issued after October 1, 2014 require a DMP and compliance with the SC Statement
    - Requirements for DMPs and guidelines are available at: *http://science.energy.gov/funding-opportunities/digital-data-management/*
    - Additional HEP-specific guidance on DMPs is available at: *http://science.energy.gov/hep/funding-opportunities/digital-data-management/*
- **Most experiments have developed DMPs for their collaborations**
  - When applying for financial assistance [universities] or submitting FWPs [labs] for research, PIs can cite the DMPs for their experiments with the appropriate links
    - if a DMP is cited, PIs must briefly describe how the proposed research relates to the experiment
  - Detector proposals need DMPs: explain how data (*e.g.,* plots) can be accessed or validated
  - If there is no data of any sort generated by the proposed research, the DMP must state this.
    - a blank or a DMP stating "not applicable" is not acceptable

Each research thrust in a proposal requesting research support and submitted to DOE, including the FY17 Comparative Review FOA, will require a DMP for it to be reviewed, and hence, to be considered for funding

Renewal Proposal Products

- ‘Renewal’ proposals are accepted
  - Such proposals are appropriate where funds are requested for an award first awarded in 2012 or later with no (significant) change in
    - Recipient/applicant institution; award’s lead PI; and research thrust(s) and research scope(s)
- Renewal Proposal Products [see Section II.G of the FY17 comp rev FOA]
  - Since Feb 2015, PI must complete and submit ‘Renewal Proposal Products’ section in PAMS by entering each product created during the course of the previous project period
    - Details with step-by-step instruction set in PAMS Users’ Guide, Sec. 9.2: https://pamspublic.science.energy.gov/WebPAMSEPSExternal/CustomInterface/Common/ExternalUserGuide.pdf
  - Types of products include:
    - Publications (note: for collaborators on large experiments, list those where you were primary)
    - Intellectual property, technologies or techniques
    - Databases or software (made public)
- Renewal Proposal Products are submitted *after* the application submission
  - DOE will assign the renewal proposal to a Program Manager, resulting in an automated email from PAMS to the PI with instructions ← be on the look-out for this email in your Inbox
  - Navigate in PAMS to ‘Tasks’ and enter all products within 5-days after the proposal submission
  - Application will not be considered complete and therefore cannot be reviewed until the product list has been submitted

Guidance Checklist for FY2017 Comp Rev

- **Non-compliant applications will not be reviewed, and therefore, will not be considered for funding. As a convenience and courtesy, DOE/HEP has provided a checklist in the FY17 FOA.**
  - **The list, on the opening pages of the FOA, is <u>not</u> intended to be complete; applicants should review the FOA in-detail and follow all instructions.**

FY 2017 Comparative Review FOA – GUIDELINE FOR APPLICATION REQUIREMENTS	COMPLETED
Is the proposed research scope aligned with programmatic priorities of DOE-HEP?	☑
Personally Identifiable Information (PII): Do not supply any information, such as birth date or place, citizenship, home address, personal phone nos., etc., that should not enter into the merit review.	☑
A Data Management Plan is required for each and every research thrust (*e.g.,* ATLAS, LSST, lattice gauge theory, etc.), and must appear in Appendix 8 of the application.	☑
Project Summary/Abstract Page: contains the name(s) of the applicant, the project director/principal investigator(s) and the PD/PI's institutional affiliation, and any Co-Investigators and their affiliations.	☑
DOE Cover Page: list each HEP research subprogram (*e.g.,* Energy Frontier, HEP Theory) for which funding is requested. If there is more than one, be sure to attach the Cover Page Supplement.	☑
Page limits for each section comply with the FOA requirements (as defined in Section IV of the FOA).	☑
Biographical sketches carefully follow the FOA instructions and avoid PII.	☑
Current and Pending Support information completed, including an abstract of the scope of work.	☑
In addition to the budget information for the full proposal: separate budget and budget justification narratives for each HEP research subprogram in the proposal for each year in which funding is being requested and for the cumulative funding period has been provided in Appendix 7.	☑
Level of Effort Tables completed in Budget Justifications in Appendix 7: for each person for whom funding is requested in a research thrust, on the scope of activities during proposed project period.	☑
Post-submission of the application, timely submitted the Renewal Proposal Products (RPP) in PAMS.	☑

HEP Proposal Review and Award Process

Pre-review

- August: Letter of Intent (LOI) received from PI. Program planning at DOE/HEP.
- September: Proposal received. FOA compliance checks at DOE/HEP: PI qualifications, scope, page limits, budget pages, etc.

Panel Review

- Sept-October: Proposals assigned to *at least* three merit reviewers via DOE's Portfolio Analysis and Management System (PAMS);
- October-November: Reviewers' input written evaluations in PAMS.
- November: Panel discussion of all proposals and all senior personnel. Add additional reviews and make comparative reviews & evaluations.

Post-review and award

- December: Assessment of each proposal and each PI by DOE/HEP using merit review, grant monitor input, programmatic priorities, budget constraints.
- Early-to-mid January: Prioritized budget guidance sent to PIs and requests for revised budgets and budget justifications using proper DOE forms.
- End-January - March: Route proposal's procurement packages through DOE/SC and DOE Chicago Operations Office for approval.
- March-April: Awards to university from DOE Chicago Operations Office.

EARLY CAREER RESEARCH PROGRAM (ECRP)

FY2017 ECRP

- FY17 FOA [DE-FOA-0001625; LAB_16-1625] posted July 28, 2016 at the EC website:
  - *http://science.energy.gov/early-career/*
- Read the FY17 FAQ, also available on the above website
- Features of FY17 FOA
  - PhDs from 2006 onwards are eligible
  - Some population of candidates will no longer be eligible due to the "3-strikes rule"
  - Mandatory Pre-application requirement. Two pages.
    - Deadline: September 8, 2016 by 5 PM Eastern Time
    - All interested PIs encouraged to register as soon as possible in DOE/SC Portfolio Analysis and Management System (PAMS) for submission [link provided in EC website]
    - Encourage/discourage feedback: October 6, 2016
  - Full proposals due: November 14, 2016 by 5 PM Eastern Time
- Would like to see (more) Detector R&D proposals
- Presidential Early Career Awards for Scientists and Engineers (PECASE)
  - PECASE-eligible candidates are selected from the pool of Early Career awardees
    - *http://science.energy.gov/about/honors-and-awards/pecase/*

How to Prepare for an ECR Proposal

- **Address the following questions:**
  - **What challenges/problems are you trying to solve?**
  - **Is someone else doing it already? If you carry out these efforts, why are they unique and require 'you'?**
  - **How does this research exploit/engage the unique capabilities of your institution?**
  - **What resources are needed to complete the project?**
  - **Does your proposal outline a 5-year timeline, with key deliverables and personnel profiled during this project period?**
  - **Have you led the activities that you are proposing? Why are you a future leader in high energy physics?**
- **Reviewers look for innovative, balanced proposals**
  - **Can be speculative, but not implausible**
  - **Needs to have the potential for impact**
  - **Should have a detector physics component**
- **Prior to submission, applicants may want to seek guidance from senior faculty/staff, and/or topical experts, and /or previous applicants while preparing proposals (including the budget material)**

HEP Detector R&D Summary

- Need to preserve/invigorate innovation in instrumentation within constrained budgets
- Near-term priority is to support P5 research priorities
- Long-term priority is to support research into transformational, broad-impact technology advances
- Need to optimize the program across the lab/university divide using new, collaborative models
- Community needs to step up identifying strategic Detector R&D opportunities and making them happen
- HEP program needs to find adequate resources to support balanced program, including **Blue-Sky** research

Backup

Need Ideas for "How to Do More with Less"

- More (detector) science
  - Also from other fields
- More generic/high-risk/high-impact R&D
  - Strategic Directions? Grand Challenges?
- More university involvement
  - Large, under-utilized intellectual potential
- More young people
  - Future instrumentation leaders
- More communication/interaction
  - Workshops/conferences
- More cost-effective
  - E.g., more sharing of resources; better execution
  - Non-HEP funding sources: other SC, other agencies, SBIR, etc.

DOE HEP Research Priorities: Snapshot

- **Energy Frontier**
  - Analysis of LHC Run 2 data
  - Contribute to operational responsibilities and complete “Phase I” upgrades
  - Prepare for leading roles in HL-LHC upgrades
- **Intensity Frontier**
  - Neutrino Program
    - NOvA, T2K/SK, Minerva, MINOS+ data analysis
    - Develop near-future short-baseline program
    - Prepare to host LBNF/DUNE and PIP-II
  - Muon Program : complete Mu2e and g-2 and take data
  - Heavy Flavor Program : complete Belle-II and take data
- **Cosmic Frontier**
  - Dark Matter : Complete G1 analysis, construct G2 experiments, modest R&D
  - Dark Energy : Complete BOSS, DES analysis; construct LSST and DESI
  - Begin planning for CMB-S4
- **Accelerator R&D**
  - Hosting workshops to work through R&D plan following P5 and GARD panels
- **Detector R&D**
  - Seeking community input to identify Strategic Directions/Grand Challenges in the wake of P5
- **HEP Theory**
  - Maintain an overall “thriving” program as per P5

Execute P5-Driven Budget

- **Energy Frontier: Continue to support leadership roles in highly successful LHC program**
  - Initial LHC detector upgrade project funding ends in FY 2017
  - Scope being determined for High Luminosity (HL)-LHC, P5's highest priority near-term project; CD-0 in April 2016
  - The U.S. will continue to play a leadership role in LHC discoveries by remaining actively engaged in LHC data analysis
- **Intensity Frontier: Solidify international partnerships for U.S.-hosted LBNF/DUNE**
  - Rapid progress on LBNF/DUNE has attracted attention from interested international partners and FY 2017 investments in site preparation and cavern excavation aim to solidify international partnerships
  - Fermilab will continue improvements to accelerator complex while serving high-intensity neutrino beams to short-and long-baseline experiments, enabling full utilization of the FNAL facilities
- **Cosmic Frontier: Advance our understanding of dark matter and dark energy**
  - Fabrication funding ramp up in FY 2017 supports key P5 recommended Cosmic Frontier projects to study dark matter and dark energy: LSSTcam, DESI, SuperCDMS-SNOLab, LZ
- **Instrumentation Frontier: Detector R&D in support of P5 priorities**
  - Current focus on near-term, project-oriented R&D

Cross-cut or Transitional Proposals

- **Applications where a PI is proposing to conduct research across multiple HEP research subprograms during the project period will be considered**

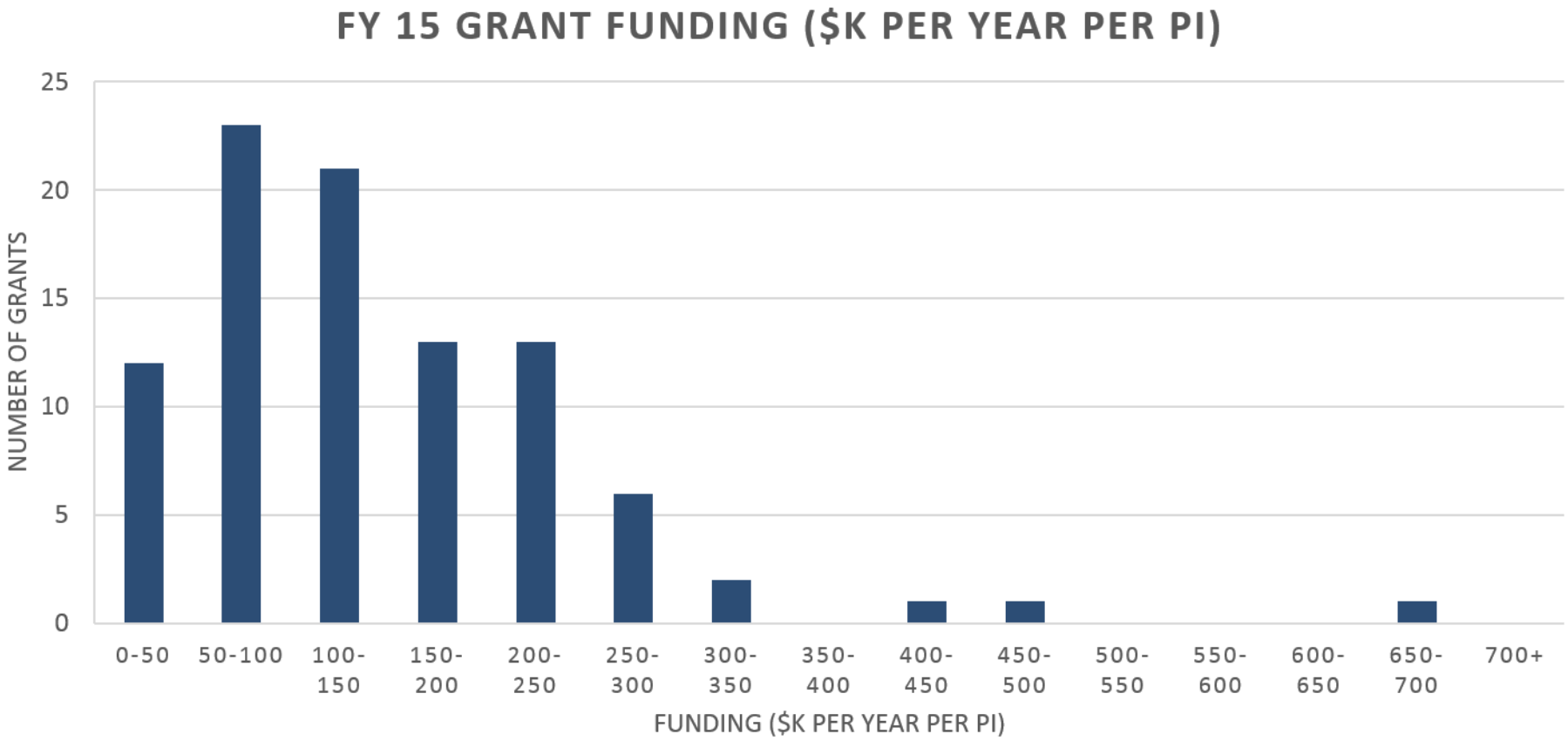
- **PIs are encouraged to submit only one application, describing:**
  - **Overall research activity, including fractional time planned in each subprogram**
  - **New in FY17 FOA: in proposal's Budget Justification material (Appendix 7), include level of effort table for any transitions of effort during project period, as appropriate**

- **As part of their overview of the subprogram and review process, DOE PMs will provide the panel with details regarding such research plans across multiple HEP thrusts**

- **Reviewers with appropriate topical expertise in the research area(s) will assess the full scope, relevance, and impact of the proposed research in the merit review process, *i.e.,* merit review questions:**
  - **Are the plans for such cross-cutting efforts reasonably developed and will the proposed activities have impact?**
  - **Does the scope of the full proposed program provide synergy or additional benefits to the HEP mission beyond the individual thrusts?**
  - **Will PI's overall efforts across multiple thrusts add value in the context of HEP program goals and mission?**

FOA Award Outcomes in FY 2015

- **Funding per PI averaged over entire HEP**
  - **Mean = $152k, Median = $138k, Standard Deviation = $106k**
  - **Considering only values <$350k:**
    - **Mean = $140k, Median = $131k, Standard Deviation = $80k**



U.S. DEPARTMENT OF
ENERGY

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Science

FY 2017 HEP Funding by Subprogram

HEP Funding Category ($ in K)	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Explanation of Changes (FY17 vs. FY16)
Energy Frontier	146,040	150,723	150,998	LHC initial detector upgrades complete; HL-LHC detector upgrade activities begin; research slightly reduced to support projects
Intensity Frontier	259,750	243,121	234,144	LBNF/DUNE OPC ramps down; SBN, NuMI ops, and accelerator refurb. supported at Fermilab; research increases; SRF R&D/ops activities move to ATR&D
Cosmic Frontier	106,507	130,582	130,069	MIE projects (LSSTcam, DESI, LZ, SuperCDMS-SNOLab) ramp up according to profile
Theoretical and Computational Physics	61,848	59,083	59,656	Research slightly reduced; Lattice QCD project held constant as in planned profile
Advanced Technology R&D	124,087	115,494	118,285	LARP increases to complete prototype magnets LHC upgrade; FY17 is last funding year for MAP as MICE deliverables complete
Accelerator Stewardship	10,000	9,000	13,744	Research increases; BNL ATF upgrade continues
Construction (Line Item)	37,000	66,100	88,521	Request engineering design, site preparation and long-lead procurement for the LBNF/DUNE; planned profile for Mu2e
SBIR/STTR	20,768*	20,897	22,580	
Total	**766,000***	**795,000**	**817,997**	

**** SBIR/STTR added to FY 2015 for comparison to FY 2016/2017***

Energy Frontier

Energy Frontier Experimental Physics	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Explanation of Changes (FY17 vs. FY16)
Research	77,370	77,270	76,811	Reduced to support current and future experimental capabilities; some research staff redirected to complete LHC detector upgrade projects and begin leading HL-LHC upgrade projects
Facility Operations and Experimental Support	53,670	54,453	55,220	Some detector maintenance personnel redirected to complete LHC detector upgrade projects and begin leading HL-LHC upgrade projects
Projects	15,000	19,000	18,967	Initial ATLAS/CMS upgrades complete in FY17; OPC begins for HL-LHC detector upgrades
Total	**146,040**	**150,723**	**150,998**	

- **LHC continues Run II operations at 13+ TeV**
- **Phase-1 LHC Detector upgrade projects receive final funding in FY 2017, are on track to reach CD-4 in 2019**
- **As part of international process, HL-LHC detector upgrade efforts begin in FY 2017**

Intensity Frontier

Intensity Frontier Experimental Physics	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Explanation of Changes (FY17 vs. FY16)
Research	54,122	56,104	56,509	Increase supports current and future experimental capabilities; some research staff redirected to lead the internationalization of LBNF/DUNE or development of SBN Program
Facility Operations and Experimental Support	158,658	151,317	153,066	Reduction primarily from completion of four AIP projects in Fermilab MC complex in FY 16
Projects	46,970	35,700	24,569	Reduction from ramp down of g-2 & end of LBNF/DUNE OPC; SBN Program increases
Total	**259,750**	**243,121**	**234,144**	

- **Active research program will take advantage of new data from:**
  - **NOvA, MicroBooNE, Belle II**
- **Site preparation and excavation of caverns begins at SURF for LBNF/DUNE**
- **R&D will continue on SBND and ICARUS for the Short-Baseline Neutrino (SBN) Program**
- **Fabrication continues on Muon g-2, Mu2e**

Cosmic Frontier

Cosmic Frontier Experimental Physics	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Explanation of Changes (FY17 vs. FY16)
Research	48,777	49,910	49,934	Research slightly increases to support: planning for calibration, simulation, and operation of new projects; data analyses for operating or recently completed experiments
Facility Operations and Experimental Support	11,327	13,837	9,935	Facilities activities decrease for Working Capital Fund costs; increased support for early operations planning activities for future experiments, particularly LSST
Projects	46,403	66,835	70,200	Planned ramp up supports fabrication of LSSTcam, DESI, SuperCDMS-SNOLab, LZ
Total	**106,507**	**130,582**	**130,069**	

- **Research activities continue for ongoing experiments:**
  - **AMS-2, HAWC, FGST, DES, eBOSS, SPT**
- **Ramp up in project support for fabrication efforts on:**
  - **2nd generation dark matter experiments LZ and SuperCDMS-SNOLab**
  - **Dark energy experiments DESI and LSSTcam**

Accelerator Stewardship

Accelerator Stewardship	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	
Research	4,891	3,378	6,853	Research increased to handle full breadth of translational R&D challenges in the laser, medical, and energy & environmental application areas
Facility Operations and Experimental Support	5,109	5,622	6,891	Increases as the BNL-ATF relocation to a larger building reaches a peak year of activity; Accelerator Stewardship Test Facility Pilot Program is expanded
Total	**10,000**	**9,000**	**13,744**	

- **Continue support for research activities at laboratories, universities, and in industry for technology R&D areas such as laser, ion-beam therapy, and accelerator technology for energy and environmental applications**
- **Support ATF relocation and user facility operations and the expansion of the Accelerator Stewardship Test Facility Pilot Program**

Construction

Accelerator Stewardship	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Explanation of Changes (FY17 vs. FY16)
11-SC-40, LBNF/DUNE	12,000	26,000	45,021	TEC funding increased to continue site preparation and start excavation of caverns for the neutrino detectors and cryogenic infrastructure
11-SC-41, Mu2e Experiment	25,000	40,100	43,500	Funding increases according to planned funding profile as construction continues
Total	**37,000**	**66,100**	**88,521**	

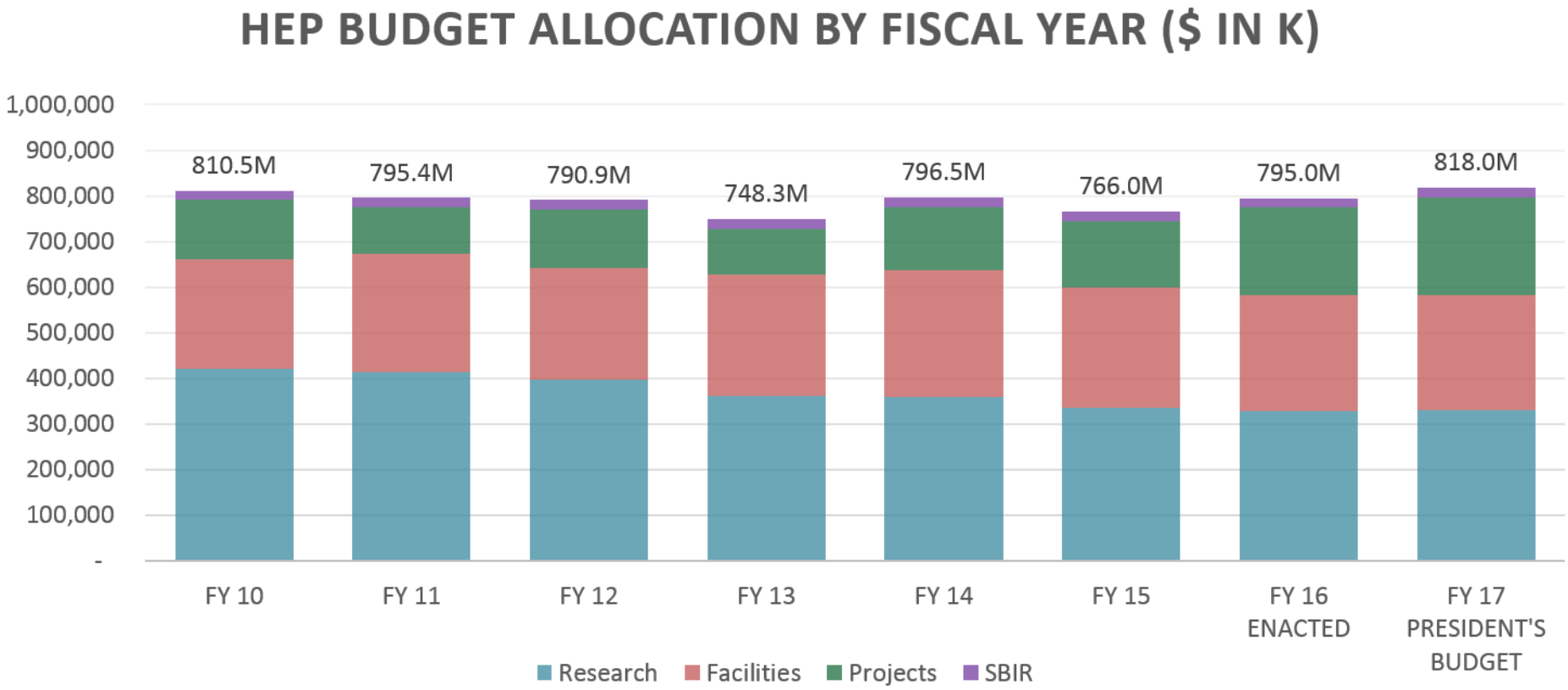
- **LBNF/DUNE:**
  - **TEC funding is requested to continue technical design of the facility and the experiment**
  - **The design of cryogenic infrastructure is the next part of the facility design that needs to be completed**
  - **Funding is also needed to continue site preparation and start excavation of the large caverns for the neutrino detectors, as long-lead procurement**
- **Mu2e:**
  - **Construction funds are requested to finish civil construction and continue fabrication of technical components (solenoid magnets and particle detectors)**

HEP MIE Project Status

Subprogram	TPC ($M)	CD Status	CD Date
INTENSITY FRONTIER			
Long Baseline Neutrino Facility (LBNF) / Deep Underground Neutrino Experiment (DUNE)	1,260 - 1,860	CD-1(R)	November 5, 2015
Muon g-2	46	CD-2/3	August 20, 2015
Mu2e	273	CD-2/3	March 4, 2015
Next Generation B-Factory Detector Systems (BELLE-II)	15	CD-2/3	April 23, 2014
ENERGY FRONTIER			
LHC ATLAS Detector (Phase-1) Upgrade	33	CD-2/3	November 12, 2014
LHC CMS Detector (Phase-1) Upgrade	33	CD-2/3	November 12, 2014
HL-LHC ATLAS Detector (Phase-2) Upgrade	150	CD-0	April 13, 2016
HL-LHC CMS Detector (Phase-2) Upgrade	150	CD-0	April 13, 2016
COSMIC FRONTIER			
LZ	46-59	CD-1/3A	April 28, 2015
SuperCDMS-SNOlab	16-21	CD-1	December 21, 2015
Dark Energy Spectroscopic Instrument (DESI)	56	CD-2	September 17, 2015
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)	TBD	CD-1	December 21, 2015
Proton Improvement Project (PIP-II)	TBD	CD-0	November 12, 2015
HL-LHC Accelerator Upgrade	200	CD-0	April 13, 2016

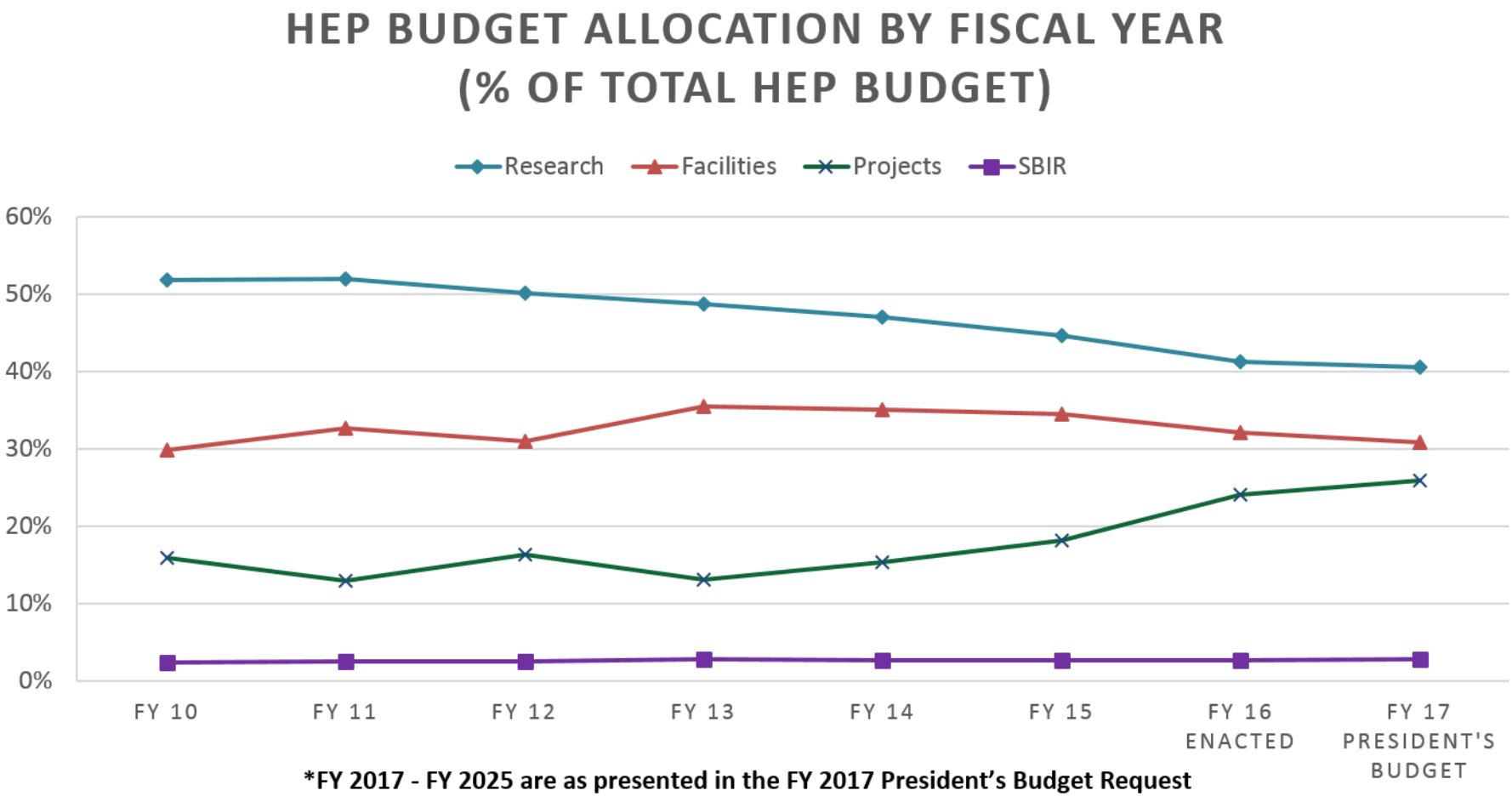
Overall HEP Budget Trend

- **Note significant dips in FY13 (sequestration, "restored" in FY14) and FY15 (Request developed pre-P5)**



HEP Budget Trend by Category

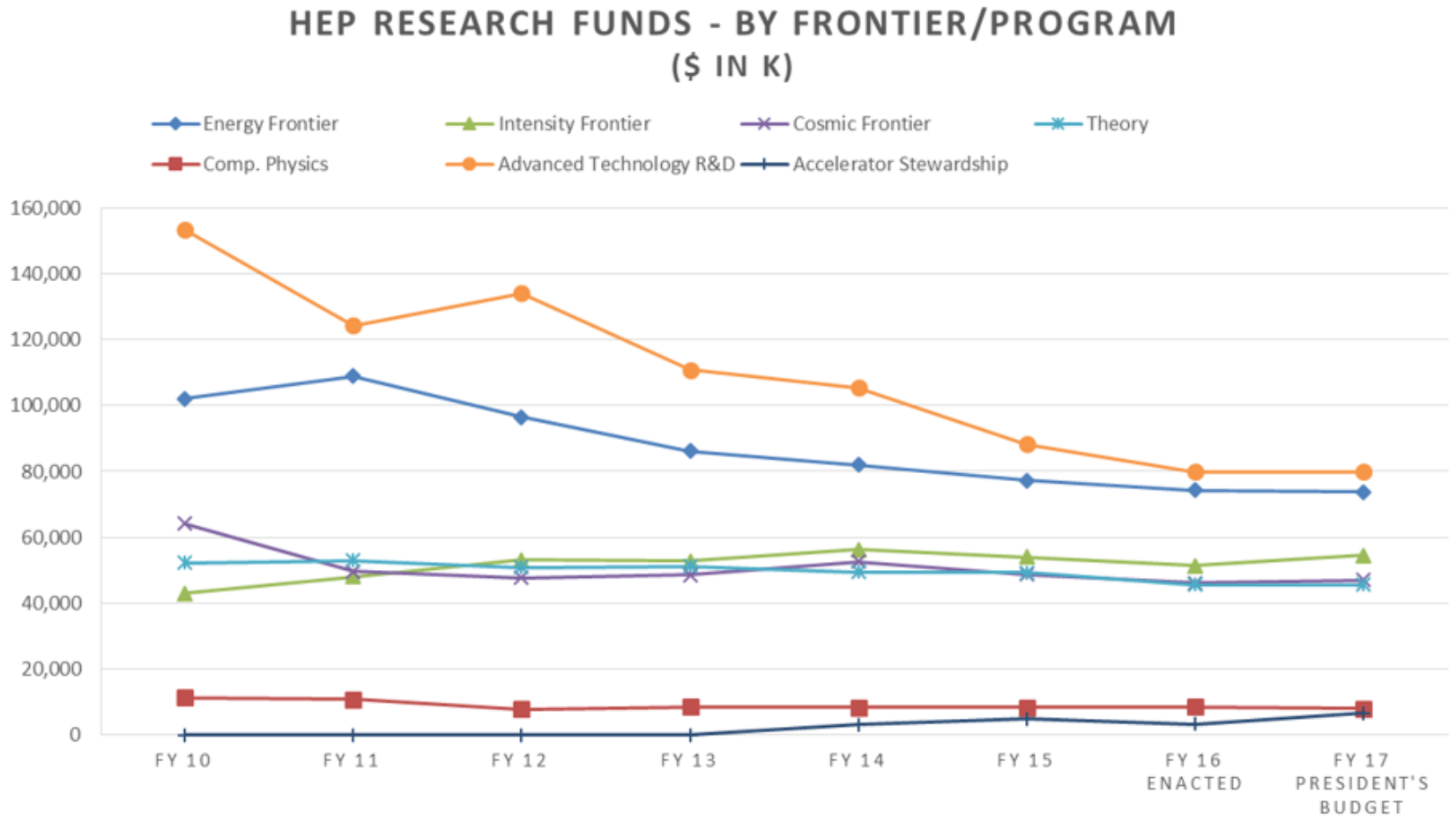
- **Trading Research (R&D) for Project investments**



*FY 2017 - FY 2025 are as presented in the FY 2017 President's Budget Request

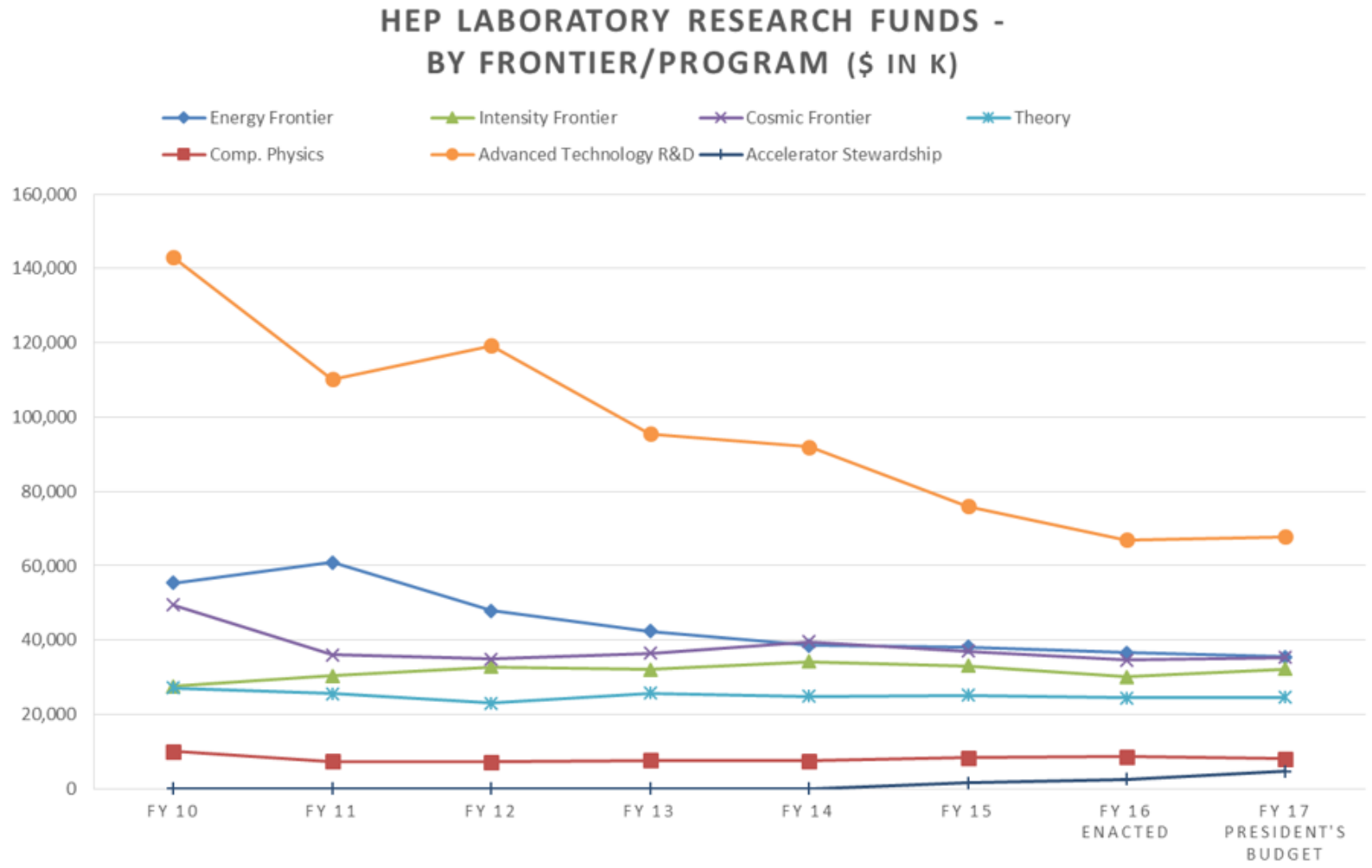
HEP Research Subprogram Trends

- **Total includes both labs and universities**



HEP Research Subprogram Trends I

- **HEP labs only. Note ~all reduction in Adv Tech R&D is at labs.**



HEP Research Subprogram Trends III

- **University only**