



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Energy Frontier Program and Program Review FOAs

**38th International Conference on High Energy Physics
DOE-PI Meeting Session • Sheraton Grand Chicago
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Outline

- HEP Program Planning and Budgets
- Energy Frontier Program Overview
- DOE/HEP Comparative Reviews
- DOE Early Career Research Program
- Closing Remarks

This talk will emphasize the Energy Frontier program — which includes research at the LHC and future particle colliders — within the broader context of the overall HEP program



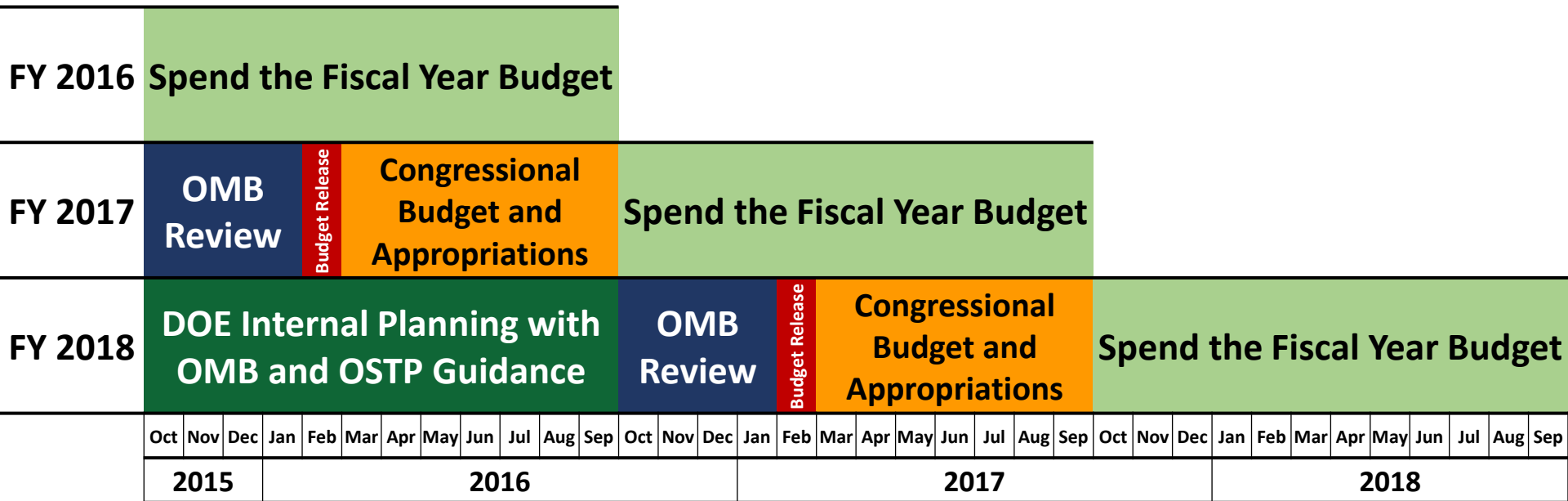
A Global Vision for Particle Physics

- The global vision presented in the May 2014 P5 report addresses the five Science Drivers with a balanced program that deeply intertwines U.S. efforts with international partners
 - “The United States and major players in other regions can together address the full breadth of the field’s most urgent scientific questions if **each hosts a unique world-class facility at home** and **partners in high-priority facilities hosted elsewhere.**”
- CERN is an important partner in achieving this vision
 - The LHC and its upgrades are a core part of the U.S. program
 - CERN is a key partner in the U.S.-hosted international LBNF
- DOE execution of the P5 strategy requires navigating many factors, including:
 - Balancing scope of HEP program: projects, operations, research
 - U.S. budget formulation and execution
 - Coordination among U.S. and international partners



The 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 coming FY
 - Agency internal planning for the second FY from now

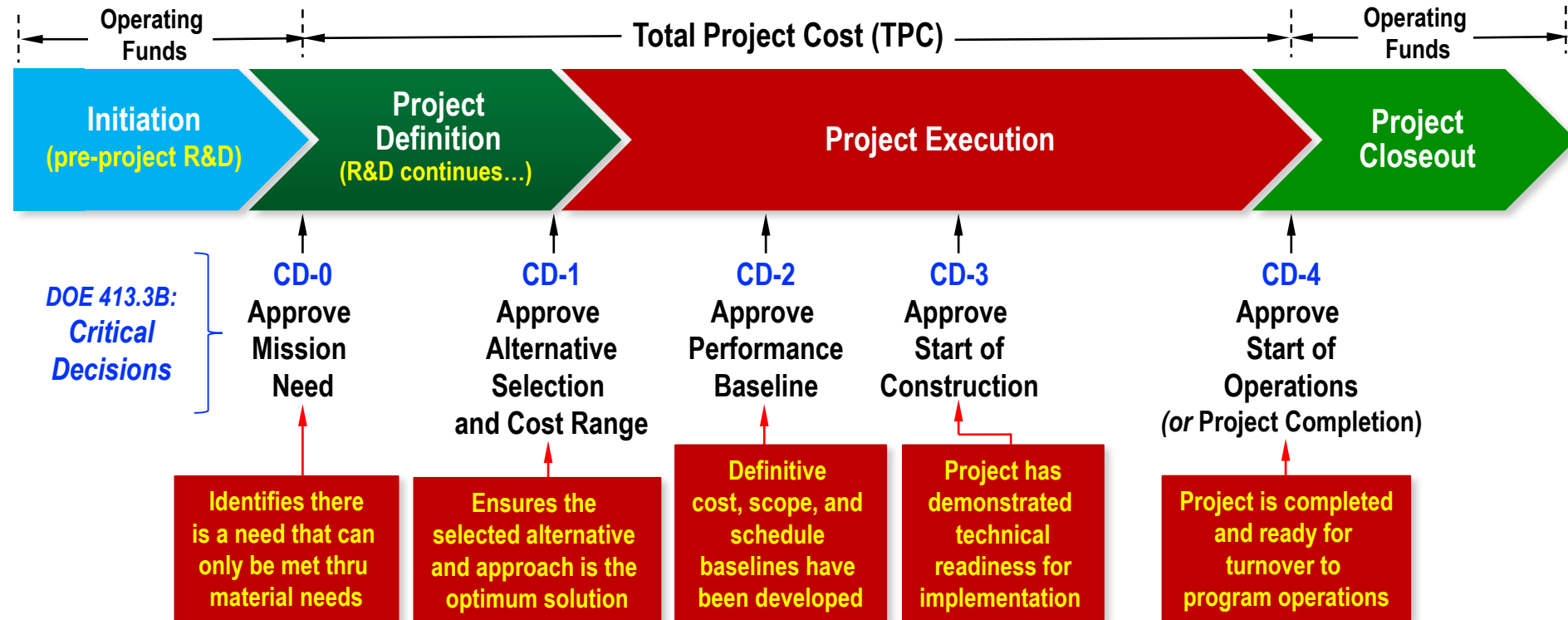


 *You are here*



DOE Project Management

- Construction projects and fabrication of large pieces of experimental equipment costing over \$10M are managed through a series of “Critical Decision” milestones
- The CD process ensures successful project execution and scientific return on agency investments, but funding must still be appropriated
 - Projects reaching CD-3 may have technical readiness, but they must be supported in the President’s Budget Request and receive funding from Congress before they can begin
- U.S. projects require use of U.S. accounting (contingency, labor, etc.) vs. CORE (M&S only)



HEP FY 2017 Budget: Research Thrusts

- **Energy Frontier:** Continue to support leadership roles in the successful LHC program
 - Initial (Phase-1) LHC detector upgrade project funding completes in FY17
 - Develop TDRs for **High Luminosity (HL)-LHC experiments**; CD-0 April 2016
 - Continue R&D/prototyping towards **HL-LHC accelerator**; CD-0 April 2016
 - The U.S. will continue to play a leadership role in LHC discoveries by remaining actively engaged in LHC operations and 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 FY17 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 leadership efforts in the dark matter, dark energy programs
 - Fabrication funding ramp-up in FY17 supports key P5 recommended Cosmic Frontier projects: **LSSTcam, DESI, SuperCDMS-SNOlab, LZ**
- **Theoretical Physics:** Support a vibrant program that plays essential roles in all areas
 - Interpreting results from current experiments, motivating future experiments, and pursuing the deepest questions about the foundations of particle physics

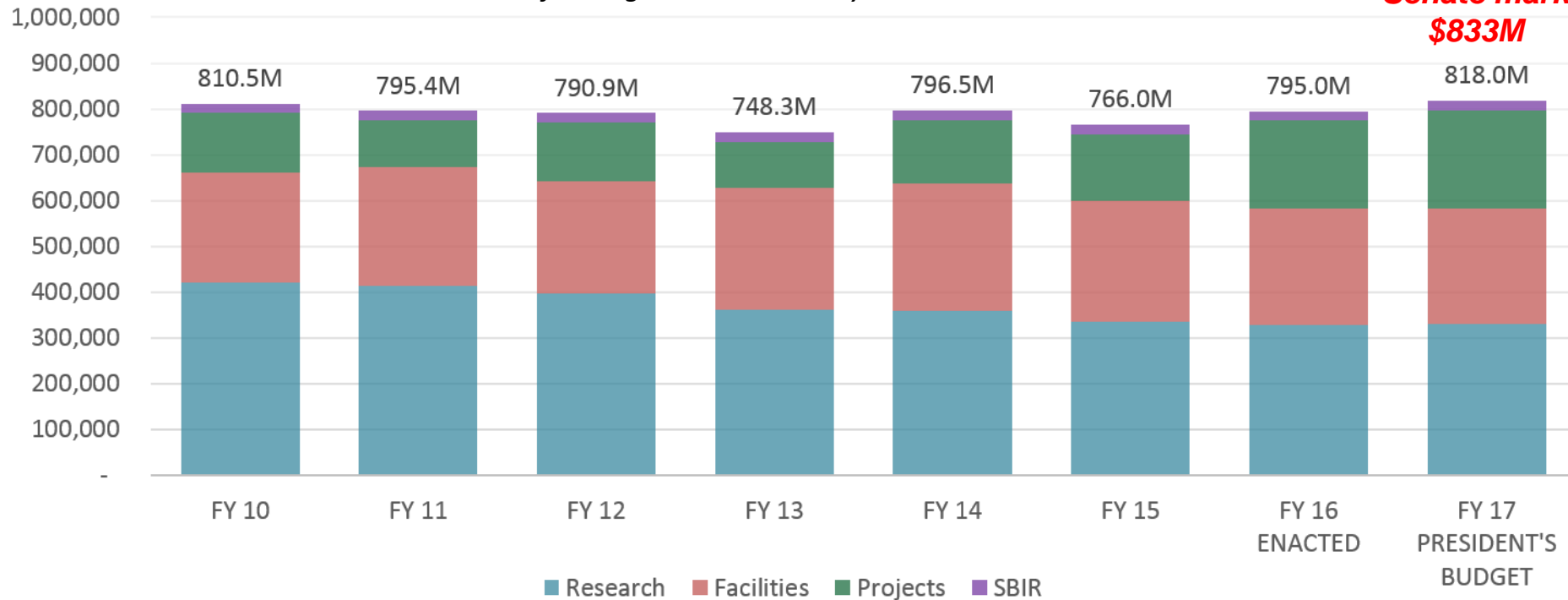


Overall HEP Budget Trend

- Significant dip in FY13 from Congressional sequestration
- FY15 request developed prior to P5 report release

HEP BUDGET ALLOCATION BY FISCAL YEAR (\$ IN K)

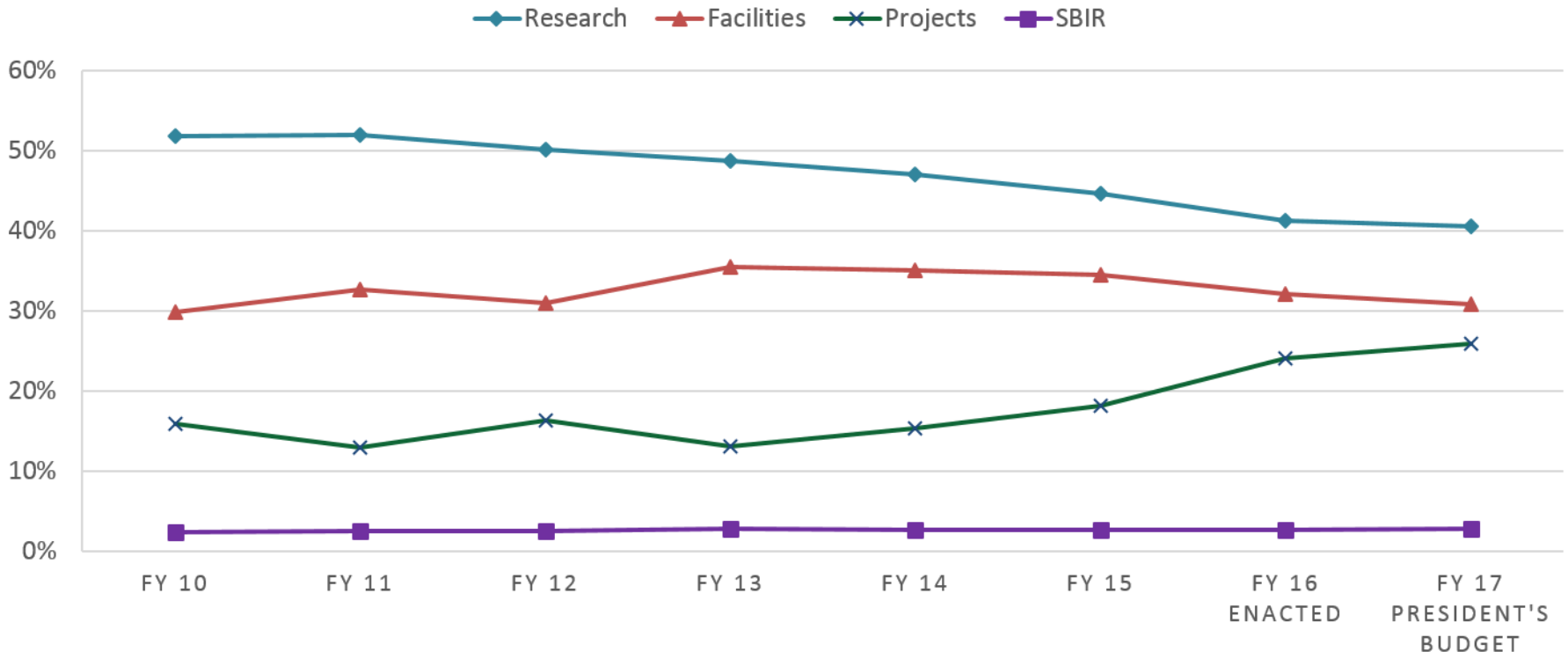
All funding shown in "then-year" U.S. dollars



HEP Budget Trend by Category

- HEP must coordinate **Projects**, **Facilities/Operations**, and **Research** efforts in order to succeed in its mission
- Recently, trading Research for Project investments

HEP BUDGET ALLOCATION BY FISCAL YEAR (% OF TOTAL HEP BUDGET)



Breaking the Cycle: 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
 - CRs typically extend the level of funding from the previous year for set amount of time
- A CR may impede the start of new projects
 - Projects with total cost >\$10M must be line-items 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 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 through such effects...
- Given the current political climate, we expect a CR for at least part of FY 2017 and are planning accordingly
 - DOE has limited flexibility for adjustments under a CR, but will work closely with laboratory and project management to minimize any impacts



Research Support

- We are carefully planning the Research program to maximize the impact of the science enabled by the P5 strategy
 - We aim to end the trend where Research has been declining during past fiscal years, but the projected slow (1-2%) growth in coming years will not keep pace with “cost of doing business”
- Research support is flat in the FY17 President’s Budget Request
 - Funding not determined until an actual appropriation passes Congress, and a CR could cause difficulties
- *More details on Research program budgets later...*



ENERGY FRONTIER

HEP Energy Frontier Experiments

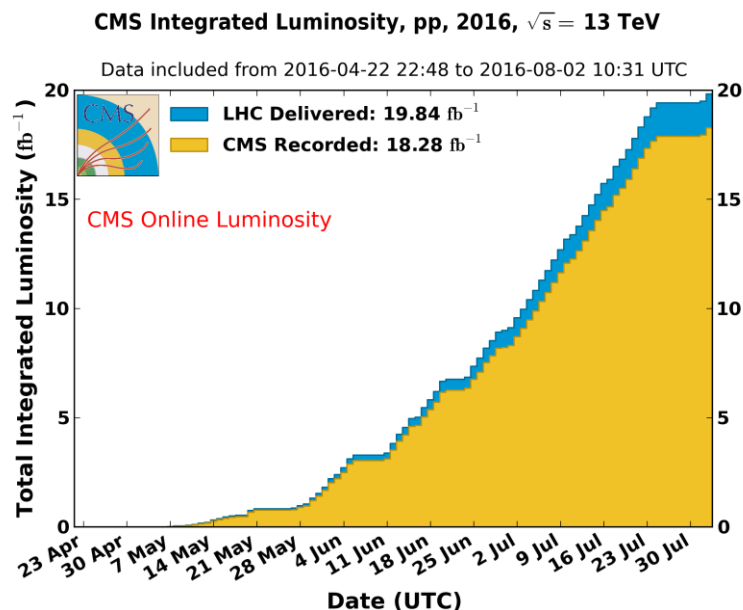
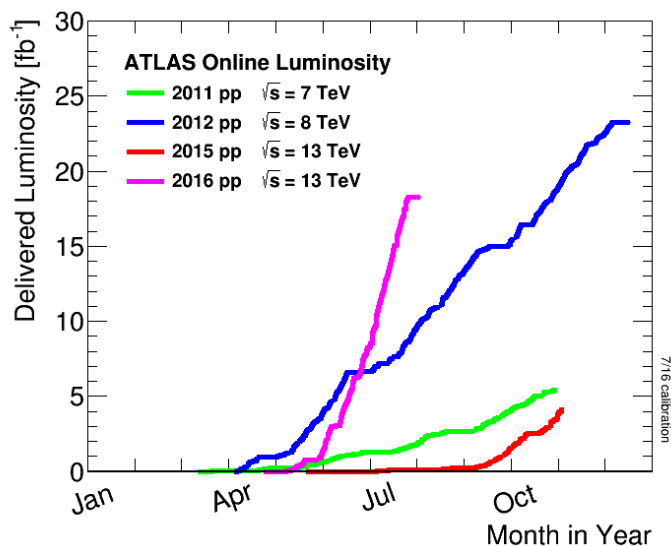
Experiment	Location	Center-of-Mass Energy; Status	Description of Science	# Institutions; # Countries	#U.S. Institutions	#U.S. Coll.
DØ (DZero)	Fermilab Tevatron Collider [Batavia, Illinois, USA]	1.96 TeV; Operations ended: Sept. 30, 2011	Higgs, Top, Electroweak, SUSY, New Physics, QCD, B-physics	74 Institutions; 18 Countries	31 Univ., 1 National Lab	187
CDF (Collider Detector at Fermilab)	Fermilab Tevatron Collider [Batavia, Illinois, USA]	1.96 TeV; Operations ended: Sept. 30, 2011	Higgs, Top, Electroweak, SUSY, New Physics, QCD, B-physics	54 Institutions; 14 Countries	26 Univ., 1 National Lab	194
ATLAS (A Toroidal LHC ApparatuS)	CERN, Large Hadron Collider [LHC; Geneva, Switzerland / Meyrin, Switzerland]	7-8 TeV; 13-14 TeV Run 1 ended: Dec. 2012 Run 2 start: May 2015	Higgs, Top, Electroweak, SUSY, New Physics, QCD, B-physics, and Heavy-Ion	180 Institutions; 38 Countries	41 Univ., 4 National Labs	629
CMS (Compact Muon Solenoid)	CERN, Large Hadron Collider [LHC; Geneva, Switzerland / Cessy, France]	7-8 TeV; 13-14 TeV Run 1 ended: Dec. 2012 Run 2 start: May 2015	Higgs, Top, Electroweak, SUSY, New Physics, QCD, B-physics, and Heavy-Ion	209 Institutions; 45 Countries	48 Univ., 1 National Lab [+1 National Lab as sub-institute]	670

Tevatron data as of October 2014; LHC data as of July 2016.

- **Main scientific thrusts**
 - **LHC at CERN [pp collider]: CMS Collaboration, ATLAS Collaboration**
 - **Completing Tevatron research at Fermilab [p \bar{p} collider]: DØ Collaboration, CDF Collaboration**
- **U.S. is the single largest collaborating nation in both the ATLAS and CMS experiments at LHC**
 - **U.S.-ATLAS: ~22% of the international ATLAS Collaboration**
 - **U.S.-CMS: ~27% of the international CMS Collaboration**
- **Future collider initiatives: modest support (~2-3 total FTEs) for detector R&D activities from the Energy Frontier research program**
 - **at universities through DOE financial assistance awards [grants] and at national labs [FNAL]**

LHC is Performing Excellently!

- LHC continues to set new performance records:
 - Unprecedented peak instantaneous luminosity of $\sim 1.25 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$ exceeds design luminosity by 25%!
 - Number of proton bunches
- Data accumulation on track for over 40 fb^{-1} by end of 2016
- Congratulations to the CERN accelerator team for the hard work in operating the LHC, and to the experiments for the high performance efficiency in acquiring data!



Many exciting new results from the 13 TeV data to be presented at this conference (ICHEP-2016)!

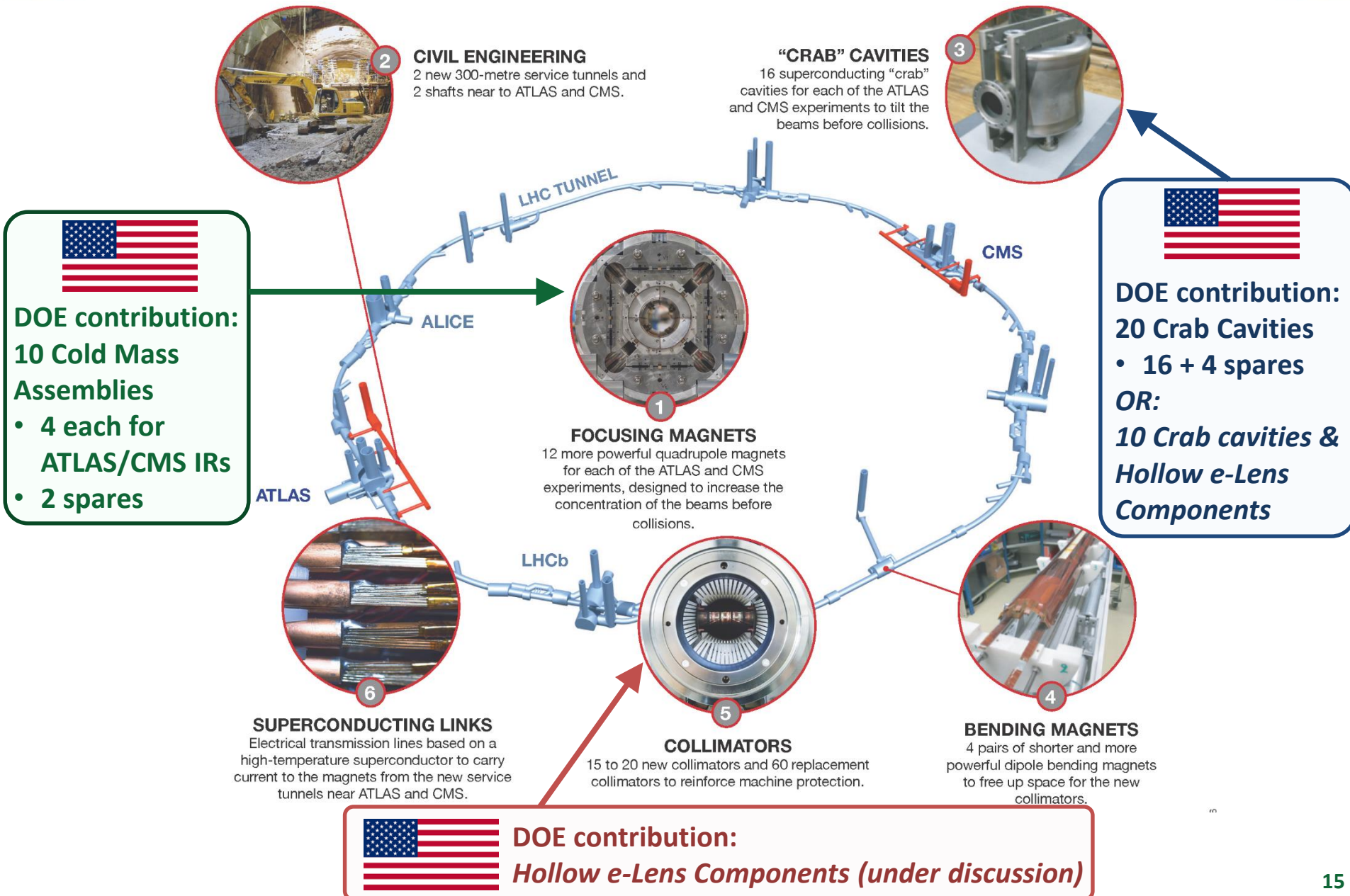
U.S. Contributions to the LHC

- **The LHC and its upgrades are a core part of the U.S. program**
 - DOE participated in the design, construction, and operation of the LHC and its detectors since the original 1997 International Cooperation Agreement between CERN, DOE, and NSF
 - The unique scientific capabilities of the LHC promise compelling science for decades to come
- **DOE contributions to the HL-LHC accelerator and detector upgrades will leverage our areas of technical expertise and capitalize on previous investments**
 - Long-term investments in the U.S. LHC Accelerator Research Program (LARP) enables accelerator contributions that will be key to the HL-LHC program
 - Long-term investments in silicon-based detector R&D enable U.S. leadership in the ATLAS and CMS inner trackers and the CMS high-granularity calorimeter



HL-LHC Accelerator Upgrades:

Enabling U.S. Science Participation



ATLAS HL-LHC Upgrade

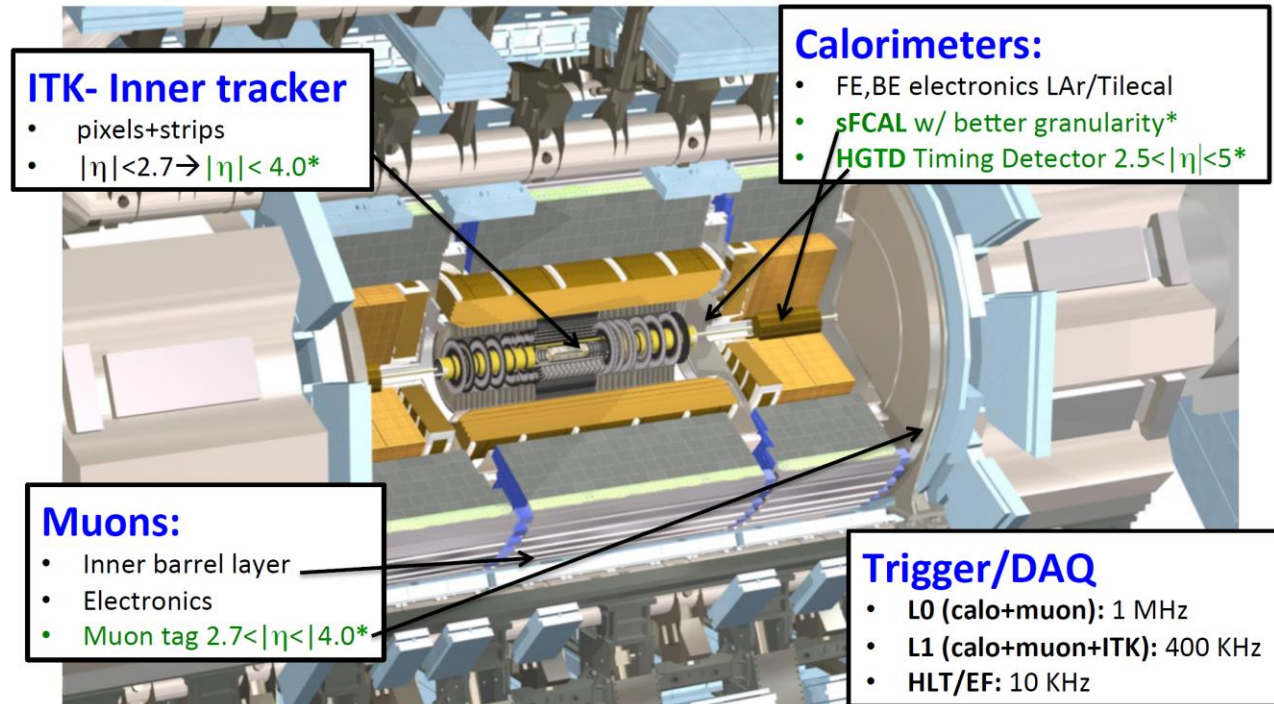
- U.S. ATLAS has defined the scope of its potential contributions to the HL-LHC upgrades
 - Driven by future science discovery potential while leveraging the interests and experience of U.S. groups
 - Active coordination with international ATLAS — at all levels

- DOE Scope:

- Barrel ITK (pixel & strip detector)
- DAQ hardware (data flow elements)
- LAr front end analog chip development

- NSF Scope:

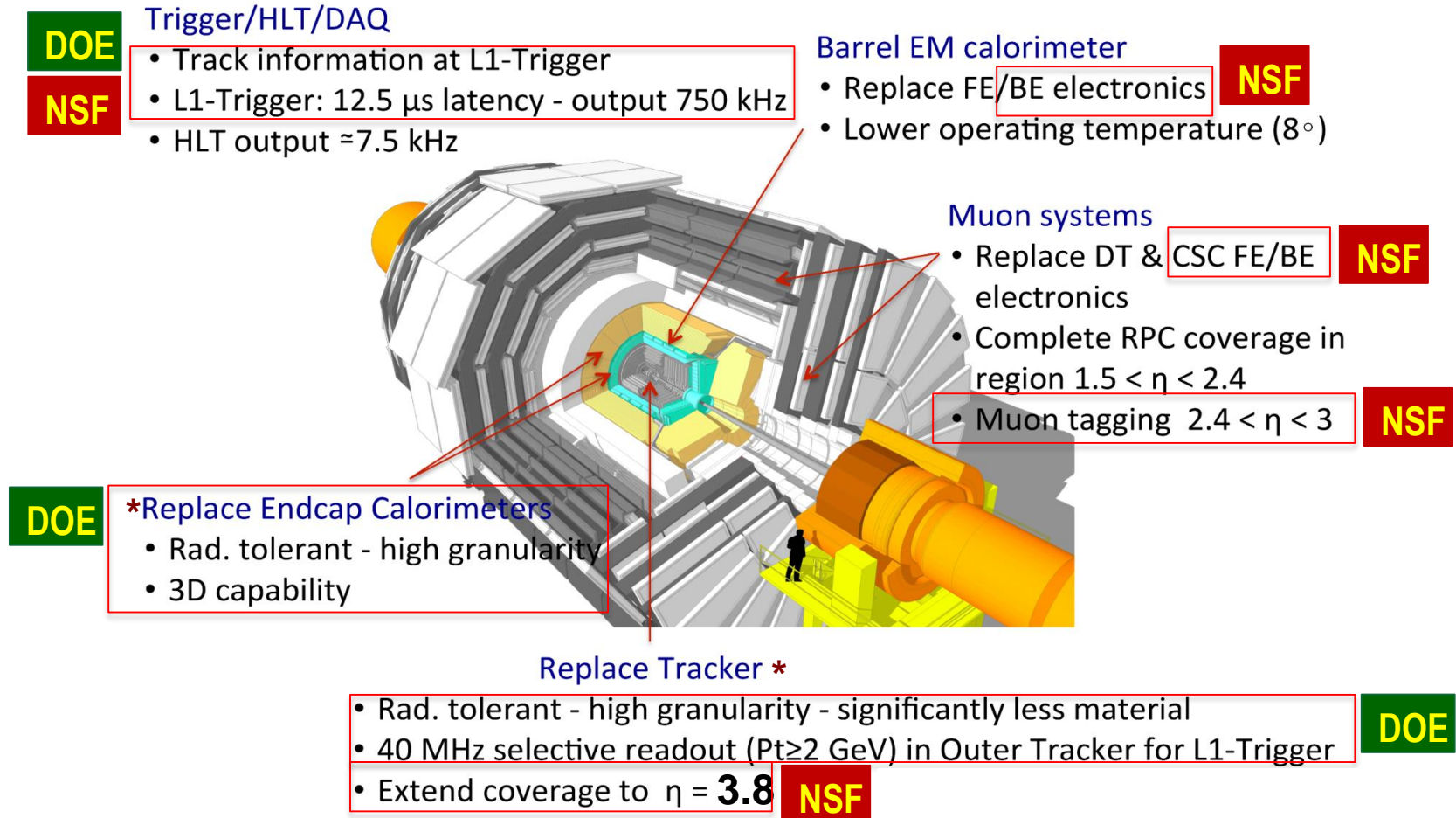
- Trigger and readout electronics for LAr, Tile, Muons



** Large eta scenarios, as described in the 2015 scoping document for the reference 275 MCHF CORE cost scenario*

CMS HL-LHC Upgrade

- U.S. HL-LHC CMS upgrade scope driven by future science opportunities, expertise by U.S. scientists, and coordination with international CMS



NSF & DOE Partnership

- The U.S. HL-LHC ATLAS and CMS Detector Upgrade Projects are a partnership between NSF and DOE
 - Each detector upgrade is managed as a single project
 - A single resource loaded schedule
 - A single Earned Value Management System with agency specific financial reporting to measure performance and progress
 - Integrated project controls team
 - Partitioning of scope and deliverables to the maximum extent as possible in order to minimize dependencies
 - Maintaining oversight and coordination through the DOE-NSF U.S. LHC Joint Oversight Group (JOG)
 - Both DOE and NSF have long and successful experience with this single project management model
 - Agency processes for approval are distinct (CD, MREFC), but agencies, OMB, and OSTP are experienced at managing these differences
- ⇒ Community needs to support (complex) agency plans through flawless execution



HL-LHC Detector Upgrades Budget

- U.S. ATLAS and U.S. CMS are planning towards NSF MREFC contributions not to exceed \$75M (in U.S. accounting) for each experiment
- Profile DOE used for planning now needs to be fine-tuned and optimized to ensure U.S. “fair-share” commitments to the HL-LHC Detector Upgrades are met
 - Plan at CD-0 targeted U.S. scope for each upgrade as a fair-share of ~235 MCHF CORE cost
 - *i.e., CD-0 TPC in U.S. accounting: \$155M (DOE) + 75M (NSF) per experiment*
 - October 2015 RRB approved “scale of funds between 235–275 MHCF CORE cost”, DOE plans to increase contributions to target total fair-share for U.S. near midpoint of range
 - *An updated profile will be given before CD-1*
- FY17 President's request includes \$1.25M for each DOE ATLAS/CMS HL-LHC project
 - U.S. responsibilities will be finalized after TDRs are complete in FY17
 - Remaining R&D support required for TDRs are planned redirections from LHC Ops funds
 - *U.S. LHC Operations already contained the R&D component for HL-LHC prior to CD-0*
 - *R&D funding to support TDR delivery in 2017 is a concern (see next slide...)*

CD-0 Funding Profile: HL-LHC Detector Upgrade Projects (AY \$M; in U.S. accounting)

<i>Fiscal Year</i>	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	Total
ATLAS TPC	1.5*	5.0*	14.0	31.5	42.3	26.1	20.1	10.0	4.5	155.0
CMS TPC	1.5*	5.0*	14.0	31.5	42.3	26.1	20.1	10.0	4.5	155.0

* Upper limits, based on redirection of funds from U.S. LHC Operations R&D line-item to Other Project Costs (OPC)



Addressing HL-LHC Concerns from U.S. LHC

- Recent concerns from the U.S. HL-LHC project managements
 - Accelerator: long-lead procurement of coil strands for Nb₃Sn magnets to begin fabrication in FY18 and meet scheduled delivery by end of 2023
 - Detector: R&D support necessary for completion of TDRs in 2017 and begin long-lead procurement of silicon-based subsystems
- Steps are being taken to address immediate FY17 concerns
 - Accelerator Upgrades: ***Additional \$2M in FY17***
 - This is a first step, with funding redirected from lower-priority directed accelerator R&D to LARP for HL-LHC
 - LARP and HL-LHC completely coordinated for U.S. to deliver Nb₃Sn magnets
 - Detector Upgrades: ***Additional \$1.25M in FY17 for each of ATLAS/CMS R&D***
 - HEP identified this additional \$2.5M total that can be redirected to HL-LHC ATLAS and CMS R&D from lower-priority tasks
 - These funds are in addition to the CD-0 profile shown earlier

In the longer term, we plan to continue working with U.S. HL-LHC projects to optimize HL-LHC project profiles, including increasing TPC, as we move toward CD-1 (planned for FY17)



ILC, FCC, CepC

- P5 recommended that the U.S. engage in modest and appropriate levels of ILC accelerator and detector design in areas where the U.S. can contribute critical expertise and consider higher levels of collaboration if ILC proceeds
 - DOE has been discussing with the international community the framework of the ILC program
- Interest from HEP community to pursue R&D studies for other future collider options
 - Future Circular Collider (FCC) — Europe/CERN
 - five-year (2014–2019) international design study with an emphasis on 100 TeV hadron collider
 - Circular electron-positron Collider + Super pp Collider (CepC + SppC) — China
 - Phase-1: CepC Higgs factory (240-250 GeV); Phase-2: SppC (50-70 TeV)
- *Very modest* R&D towards these future collider initiatives may continue, *as funding allows*

However, given tight fiscal budgets in the Energy Frontier program, near-term priorities will aim to support the LHC program as well as R&D for the HL-LHC upgrades

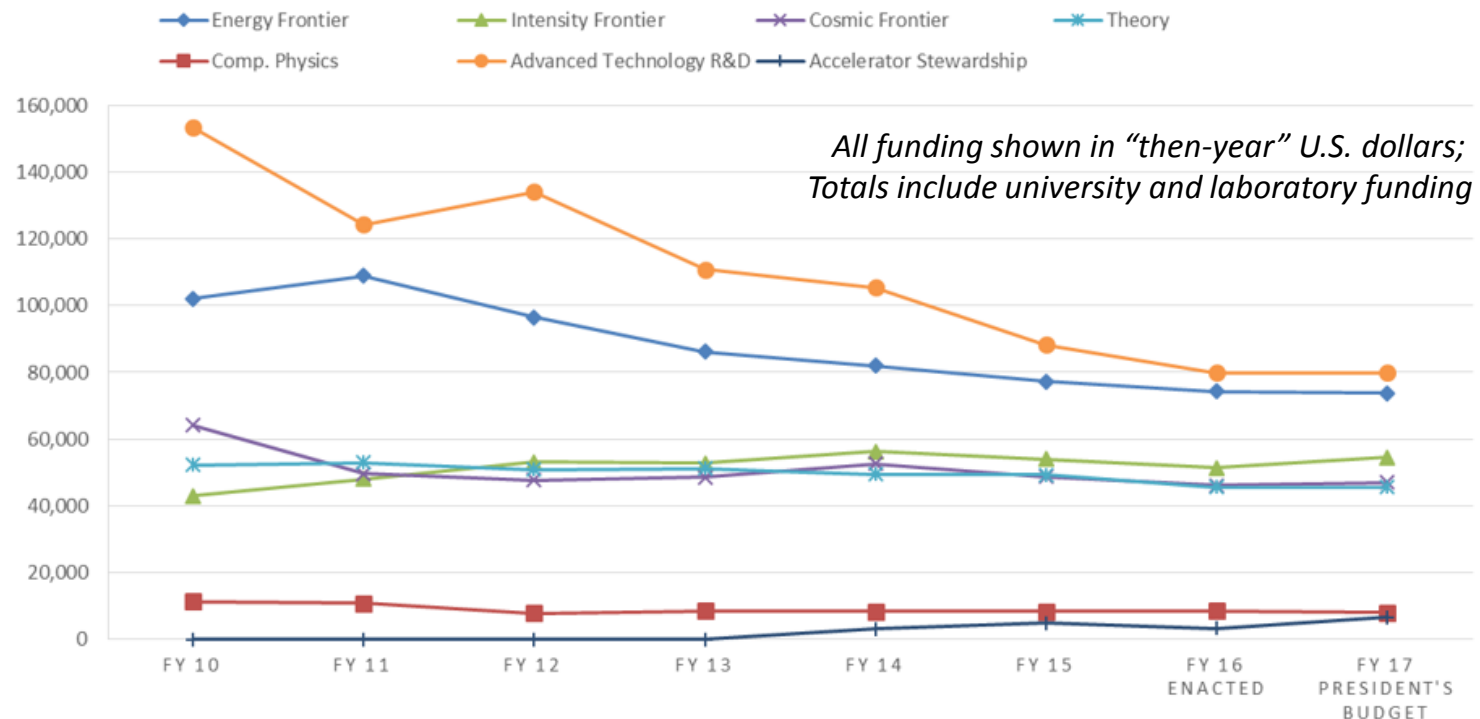


LHC RESEARCH SUPPORT

HEP Research Subprogram Trends

- Research reductions aimed to re-balance HEP subprograms as the Tevatron era ended while ramping down ILC R&D support within Advanced Technology R&D subprogram
 - University comparative reviews initiated in FY12 as basis to select activities with the highest scientific merit and potential impact within each subprogram
- Going forward, future adjustments in Research are planned to be targeted
 - However, a CR may impact plans for FY17 and beyond...

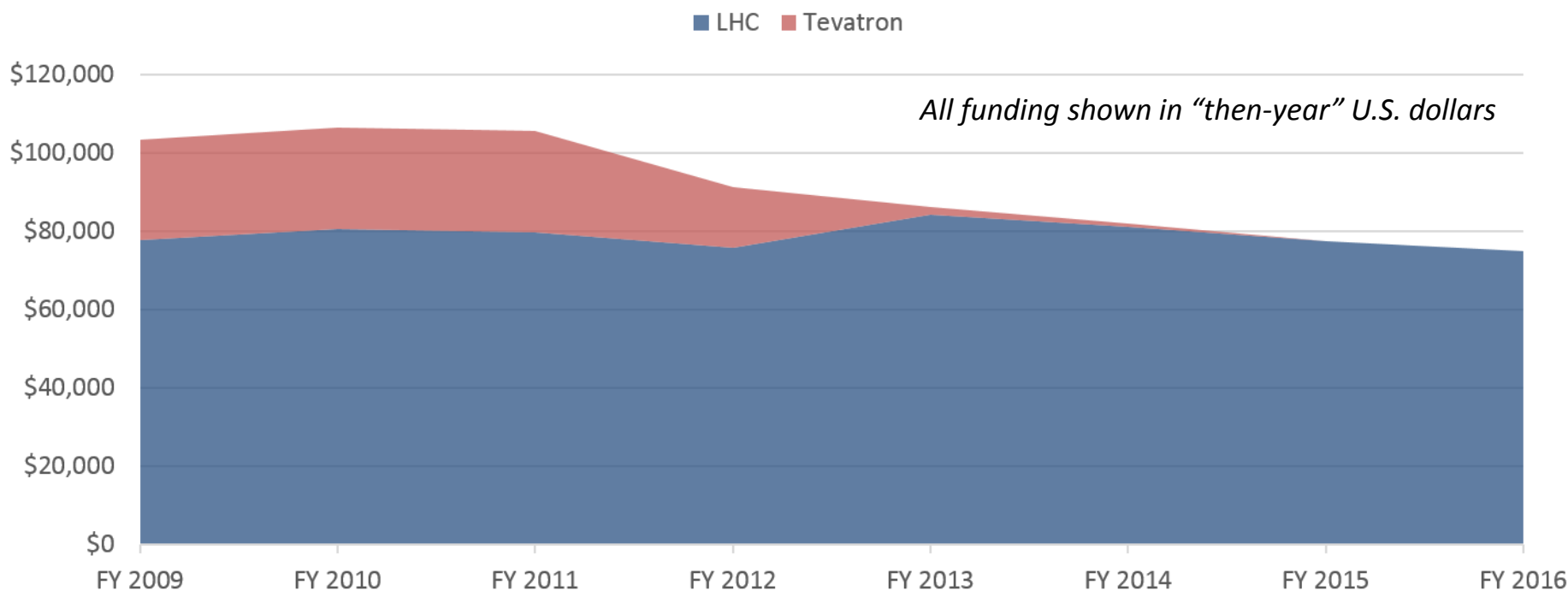
HEP RESEARCH FUNDS - BY FRONTIER/PROGRAM
(\$ IN K)



Energy Frontier Research Details

- Tevatron shut down on September 30, 2011 (end of FY11)
- Some Tevatron funding transitioned to LHC (but mostly elsewhere) in FY11-13

ENERGY FRONTIER: TEVATRON AND LHC
(STACKED PROFILES; \$ IN K)



A photograph of several stacks of US pennies. The stacks are of varying heights, with some reaching up to about 10 coins. The pennies are copper-colored and show some signs of wear. The background is a plain, light-colored surface.

HEP FUNDING OPPORTUNITY ANNOUNCEMENT (FOA): COMPARATIVE REVIEWS

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.

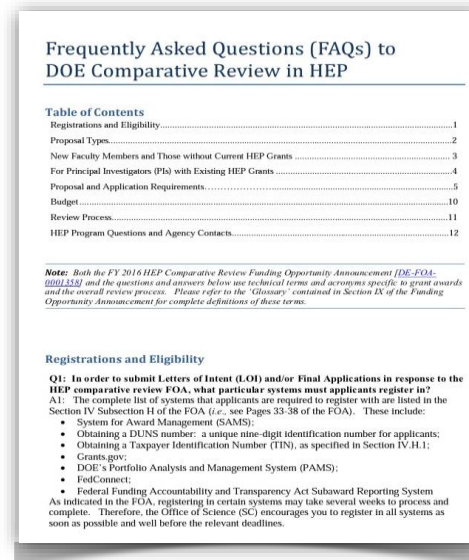
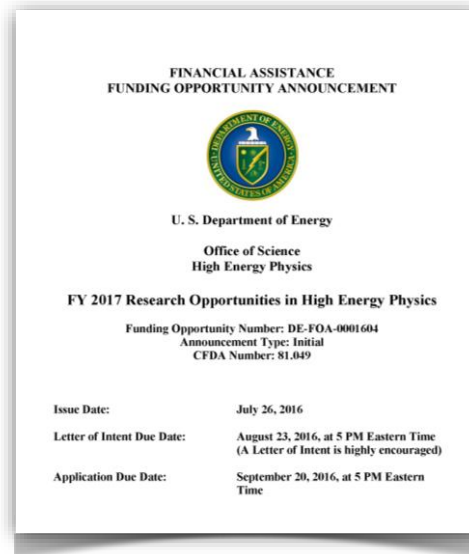
Goal: improve overall quality and efficacy of the HEP research program by identifying the best proposals with highest scientific impact and potential

FY17 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 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/>

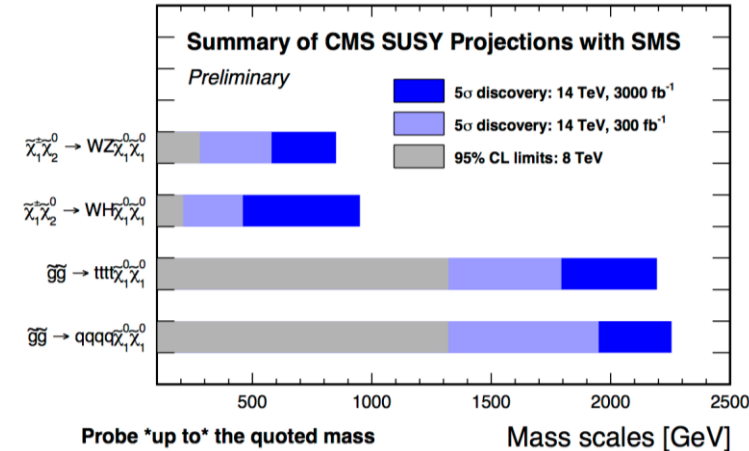


Key Items to Keep in Mind

- Proposed research will review best if closely aligned with the DOE/HEP mission, its program, and the 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” research that is not to be carried out as part of a specific HEP experimental collaboration should be directed to the HEP Theory or Detector R&D programs, as appropriate.
- 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 without review.
Requirements that are most often missed or overlooked include: data management plans, page limits, separate budget sheets (if needed) for each research subprogram or thrust, and inclusion of Personally Identifiable Information (PII)

Energy Frontier Merit Reviews: LHC

- Energy Frontier Research supports science analysis efforts on ATLAS and CMS:
 - Physics analyses
 - Activities that support analyses (*e.g.*, reconstruction, object-ID, triggers, ...)
 - Within these topical areas, reviews evaluate:
 - Scientific output, impact and accomplishments by each PI and overall group
 - Group's research plans and timeline for deliverables during the Run 2 program
- ... and in next ~8-10 years with the planned LHC upgrades
 - Upgrade activities will mix with physics research-related efforts
 - PIs are encouraged to provide a **balanced** proposal illustrating the group conducts activities across: research + operations + upgrade
 - HL-LHC plans should be aligned with respect to the U.S.-CMS or U.S.-ATLAS projects
- Other general observations
 - In addition to activities at CERN, encourage the university community to exploit and interact with CMS LHC Physics Center (LPC) and ATLAS Analysis Support Centers (ASCs)



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, ...

HEP Research Activities Supported

■ What DOE supports

- Efforts that are in direct support of our programs
- Research efforts (mainly scientists) on R&D, experiment design, fabrication, data-taking, analysis-related activities
- Theory, simulations, phenomenology, computational studies
- Some engineering support may be provided in the Detector R&D subprogram
 - support depends on merit review process and programmatic factors

■ 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

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
- From 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

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 — *e.g.*, merit review questions consider:
 - 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?

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 (project period)
 - ☑ 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

- The merit review criteria items and corresponding questions 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

- The merit review criteria items and corresponding questions are given 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/>
- CMS and ATLAS have developed DMPs for their collaborations
 - When applying for financial assistance grants [universities] or submitting FWPs [labs] for research, proposals can cite the DMPs for their experiments with the appropriate links:
 - CMS Data Policy Document: CMS Document 6032-v1 (2012)
 - <https://cms-docdb.cern.ch/cgi-bin/PublicDocDB/ShowDocument?docid=6032>
 - ATLAS Data Policy Document: ATLAS-CB-PUB-2015-001 (2015)
 - <https://cds.cern.ch/record/2002139?ln=en>

Each research thrust in a proposal requesting research support and submitted to DOE, including the FY17 Comparative Review FOA, will require addressing the DMP requirements 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 change in
 - Recipient/applicant institution; research thrust(s) and research scope(s); and award’s lead-PI
- 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/WebPAMSEPSEExternal/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 FY17 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 not 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?	<input checked="" type="checkbox"/>
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.	<input checked="" type="checkbox"/>
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.	<input checked="" type="checkbox"/>
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.	<input checked="" type="checkbox"/>
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.	<input checked="" type="checkbox"/>
Page limits for each section comply with the FOA requirements (as defined in Section IV of the FOA).	<input checked="" type="checkbox"/>
Biographical sketches carefully follow the FOA instructions and avoid PII.	<input checked="" type="checkbox"/>
Current and Pending Support information completed, including an abstract of the scope of work.	<input checked="" type="checkbox"/>
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.	<input checked="" type="checkbox"/>
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.	<input checked="" type="checkbox"/>
Post-submission of the application, timely submitted the Renewal Proposal Products (RPP) in PAMS.	<input checked="" type="checkbox"/>

HEP Proposal Review and Award Process

Pre-review

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

FY17 Early Career (EC)

- 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
 - PhD's no earlier than 2006 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 at the EC website]
 - Encourage/discourage feedback: October 6, 2016
 - Full proposals due: **November 14, 2016 by 5 PM Eastern Time**
 - Candidates normally have more than 3 months to develop a plan, write a narrative, and submit an application
- **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 EC Proposal

Address the following questions:

- What challenges/problems are you trying to solve? Communicate this in the proposal.
- Is someone else doing it already? Alternatively aren't those research activities already being funded elsewhere? 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? What will be the outcome after 5-years, if funded?
- Have you led the activities that you are proposing? Why are you a future leader in HEP?

General observations for proposals submitted for research at the LHC (ATLAS, CMS)

- Provide **unique** capabilities. What does not get done?
 - during preparation, PIs should address “why is it critical that I carry-out this research?”
- A **balanced** program: strong physics effort + a hardware project attached to an experiment, where PI takes a lead
- For searches, discuss the **discovery reach** and do not just state: “in the absence of a signal, a 95% C.L. limit will be set.”

Prior to submission, applicants may want to seek guidance from appropriate senior faculty and/or staff while preparing proposals (including the narrative and budget material)

- Applicants are also encouraged to draw guidance from any members within the collaboration

Messages for the U.S. LHC Community

- The lion's share of DOE HEP investment remains the LHC program and will be for many more years
- Our traditional partnership with CERN has been strong and we look forward to continuing it through the U.S.-CERN Agreement and Protocols signed in 2015
- We realize that with the initial (Phase-1) and HL-LHC upgrades, as well as ongoing LHC Operations, resources are quite stretched
 - We are actively taking steps to address this in FY17-18 as the HL-LHC upgrade projects ramp-up and Phase-1 projects ramp-down
 - As a first step, we have added resources to the HL-LHC upgrade projects, for the accelerator, ATLAS R&D, and CMS R&D
 - DOE is leveraging its expertise in high-field magnets and silicon-based detectors to help enable the strong scientific and technological performance of the LHC
- P5 recognized that a compelling and comprehensive LHC program is a core part of U.S. particle physics, and DOE intends to support key leadership roles in all areas of the ATLAS and CMS experiments
 - **U.S. participation is enabled by leveraging U.S. expertise in accelerator science and technology to exploit future opportunities at the LHC**



REFERENCE SLIDES

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