

Energy Frontier Program and Program Review FOAs

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Outline

- Overview and P5
- Energy Frontier Program Status, Planning, and P5 Implementation
- HEP Budget and Issues
- DOE/HEP Comparative Reviews
- DOE Early Career Research Program
- Closing Remarks

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



Science Drivers and Research Frontiers

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P5 identified 5 science Drivers that establishes the scientific motivation of a HEP program while the 3 Research Frontiers provide a useful categorization of experimental techniques



These science Drivers map into the Physics Frontiers

Adapted from the May 28, 2014 P5 Strategic Plan for U.S. Particle Physics; and the May 29, 2008 Report of the P5 Panel.



Particle Physics Is a Global Field

From Chapter 1 of the P5 Report:

 The scientific program required to address all of the most compelling questions of the field is beyond the finances and the technical expertise of any one nation or region.





ENERGY FRONTIER





HEP Energy Frontier Experiments

Experiment	Location	Center-of-Mass Energy; Status	Description of Science	<pre># Institutions; # Countries</pre>	#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., 2 National Labs	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	191 Institutions; 38 Countries	41 Univ., 4 National Labs	565
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	200 Institutions; 43 Countries	48 Univ., 1 National Lab [+1 National Lab as sub-institute]	571

Tevatron data as of October 2014; LHC data as of July 2015.

Main scientific thrusts

- Complete in FY15 <u>Tevatron</u> research at Fermilab [pp̄ collider]: DØ Collaboration, CDF Collaboration
- <u>LHC</u> at CERN [pp collider]: CMS Collaboration, ATLAS Collaboration
- U.S. is single biggest collaborator outside of CERN in both ATLAS and CMS experiments at LHC
 - U.S.-ATLAS: ~23% of the international ATLAS Collaboration
 - U.S.-CMS: ~27% of the international CMS Collaboration
- Lepton Collider [mainly <u>ILC</u>]: modest support (~2-3 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]



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Energy Frontier Highlights

First Results from the LHC at 13 TeV - Presented at EPS-HEP 2015 (Vienna)



- Many results presented by CMS at EPS-HEP 2015 (Vienna, Austria) with up to 43 pb⁻¹ of Run 2 data
 - incl. first suite of performance checks completed
- Standard Model re-discovered including signatures of J/ ψ -, ϕ -resonances, top, and Z \rightarrow ee, $\mu\mu$, $\tau\tau$
- First measurement on the production of charged strongly-interacting particles – submitted to PLB
- Searches for new physics also commencing

- Many ATLAS results with up to 85 pb⁻¹ of Run 2 data
- Also, measured charged strongly-interacting particles
- Extraction of top-pair production cross section
 - $-\sigma_{tt}$ (13 TeV) = 825 ± 49 (stat) ± 60 (syst) ± 83 (lumi) pb
 - in good agreement with SM predictions
- Also actively pursuing searches for new physics



LHC experiments are now looking at new data at an unexplored energy!



Energy Frontier Status & Planning

- LHC is planned to be central component of the U.S. Energy Frontier program for next ~20 year
 - U.S. investments \Rightarrow leading roles in the [global] LHC physics collaborations

Current Program

- 430+ LHC Run 1 papers submitted by *each* CMS and ATLAS Collaborations
 - ~100 more/exp. in the pipeline (1000+ Run 1 papers!)
- June 3, 2015: Run 2 begins with stable 13 TeV beam
- U.S. active in executing initial, Phase-1 upgrades of the ATLAS and CMS detectors
 - CD-2/3 [baseline & construction start] approved for both detectors on November 12, 2014
 - MIE fabrication start in FY 2015 appropriations

Planned Program

- Considering high luminosity update to LHC around 2024 to extend discovery potential
 - Increase LHC luminosity by a factor of 10 beyond its design value to explore new physics and new dynamics for W/Z, top, and Higgs at TeV energies
 - DOE/HEP actively working with U.S.-CMS/ATLAS to begin mounting the HL-LHC Detector Upgrade Projects
 - more on these efforts on next few slides...







Energy Frontier Status & Planning (II)

- U.S. leadership in superconducting magnet technology generally, and now Nb₃Sn in particular, is widely recognized and acknowledged
- U.S. LHC Accelerator Research Program (LARP) aims to leverage this expertise to serve needs of HEP community
 - Consists of four U.S. laboratories: BNL, Fermilab, LBNL, and SLAC (+ industrial firms)
 - LARP has been charged to begin prototyping accelerator components for the HL-LHC upgrades in order to reduce risk for the eventual project
- New bilateral DOE-NSF-CERN International Co-operation Agreement was signed at the White House Eisenhower Executive Office Building on the 7th of May 2015
 - Highlights important future international scientific and technological collaborations between the U.S. and CERN
 - Annexes (≡ Protocols) to the agreement now at U.S.
 State Dept. pending OMB C-175 authorization in order to proceed towards negotiations with CERN
 - Accelerator Protocol for contribution towards LARP and HL-LHC accelerator upgrades
 - Experiments Protocol for contribution towards the HL-LHC ATLAS and CMS detector upgrades
 - Neutrino Protocol for contribution towards an international neutrino program hosted by U.S.





HL-LHC Detector Upgrades and P5

- Rec. #10 of P5 strategic plan noted that the U.S. continue the strong collaboration in the LHC with the Phase-2 (HL-LHC) upgrades of both general-purpose experiments: ATLAS, CMS
 The LHC upgrades constitutes P5's *highest-priority near-term* large project
- Thus far, agencies' efforts for HL-LHC detector upgrades have progressed on three fronts:
 - DOE and NSF cooperating as part of its interagency partnership, needed for success
 - Current U.S. 'pre-project' planning is within U.S. LHC Operations Program: discussions to define plan of prioritized scope/costs, institutional roles & responsibilities, and project timeline
 - Series of productive meetings by DOE-NSF on progress, agency requirements, and future plans
 - Planning was part of March 2015 DOE/NSF U.S. LHC Operations Review
 - Regular discussions during [bi-weekly] Ops teleconference
 - Continued U.S. discussions with CERN and the international funding agencies to understand costs of overall upgrades and scope
- HL-LHC CMS and ATLAS Detector Upgrades
 - Experiments requested core cost estimates for HL-LHC: CMS = 265 MCHF; ATLAS = 230–275 MCHF
 - CERN directed CMS and ATLAS to develop performance optimization proposals with [de-]scoping and re-costing matrices under 3 scenarios/experiment: a) 200 MCHF, b) 235 MCHF, c) 275 MCHF
 - Scoping Documents will be sent to LHCC & Upgrade Cost Group by early-Sept. 2015 for review; subsequent discussion at October 2015 LHC Resources Review Boards
 - Funding agencies collectively working with CERN to define the complete process

HL-LHC Detector Upgrades and P5 (cont.)

- Project Scope and Schedule
 - Further discussions with CMS, ATLAS, CERN, and other funding agencies are required before converging on nominal U.S. scope for HL-LHC detector upgrades
 - Construction schedule largely driven by date of LS3 (2024 2026) for installation
 - DOE aiming for 'Mission Need' [CD-0] in FY 2016
- DOE project scope being coordinated with NSF MREFC scope
 - Initial discussions with U.S. CMS and U.S. ATLAS indicate that DOE project scope will include components of Inner Tracker for ATLAS, CMS; High-Granularity (silicon-based) Calorimeter for CMS
 - DOE scope driven by long-lead procurement items (e.g., silicon sensors)
- End-June 2015, DOE provided its preliminary budget guidance for the HL-LHC ATLAS and CMS Upgrade Projects
 - U.S. ATLAS and U.S. CMS HL-LHC project managements now developing DOE scope
 - to be presented at next U.S. LHC DOE/NSF Joint Oversight Group Mtg (end-Sept. 2015)
- Opportunities for initial R&D activities on Phase-2 are possible through:
 - U.S. DOE LHC Ops program: in near term, ~\$3–4 M/year per experiment for R&D activities
 - An application for a financial assistance award, submitted by a U.S. institution to the DOE Energy Frontier research program, that contains a "balanced" LHC research & upgrade scope
 - In either case, U.S. CMS and U.S. ATLAS requested by DOE to develop a prioritized list of plans



ILC, FCC, CepC

- P5 Recommendation #11 noted that the U.S. should 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 in continued discussions with the Americas Linear Collider Committee (ALCC) to develop program for future R&D efforts — for both Accelerator R&D and Detector R&D
- Thus far, modest ground-level R&D efforts continue, as funding allows, through the period of Japanese decision making (viz. 2017–2018)
 - for e.g., support via Energy Frontier research program
 - physics and detector modeling and optimization studies, electron / hadron calorimetry development, pixellated vertex detectors, particle flow algorithms
- Interest from HEP community to pursue R&D studies for other future collider options
 - Future Circular Collider (FCC) Europe
 - 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)
 - Comment: CepC is currently not on the U.S. roadmap, but may be a viable backup particularly if ILC is not hosted by Japan (and based on results from LHC Run 2)
- However, given tight fiscal budgets, near-term R&D priorities directed to HL-LHC upgrades



HEP BUDGET Belle Holes

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FISCAL YEAR 2015

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The FY 2016 HEP Budget Request

- HEP is implementing the strategy detailed in the May 2014 report of the Particle Physics Project Prioritization Panel (P5), formulated in the context of a global vision for the field
 - HEP Addresses the five compelling science drivers with research in three frontiers and related efforts in theory, computing and advanced technology R&D
 - Increasing emphasis on international partnerships (such as LHC) to achieve critical physics goals
- Energy Frontier: Continue LHC program with higher collision energy (13+ TeV)
 - The U.S. will continue to play a leadership role in LHC discoveries by remaining actively engaged in LHC data analysis and the initial upgrades to the ATLAS and CMS detectors
- Intensity Frontier: Develop a world-class U.S.-hosted Long Baseline Neutrino Facility
 - Continue the design process for an internationalized LBNF and development of a short baseline neutrino program that will support the science and R&D required to ensure LBNF success
 - Fermilab will continue to send world's highest intensity neutrino beam to NOvA, 500 miles away to Ash River, MN
- Cosmic Frontier: Advance our understanding of dark matter and dark energy
 - Immediate development of new capabilities continue in dark matter detection with baselining of 2nd-generation experiments; and in dark energy exploration with baselining of DESI and fabrication of LSST camera.



FY 2016 HEP Funding by Program

HEP Funding Category [\$ in K]	FY 2014 Actual	FY 2015 Enacted	FY 2016 Request	Explanation of Changes (FY16 vs. FY15)		
Energy Frontier	152,386	147,584	154,555	LHC Phase-1 detector upgrade fabrication; R&D for high-luminosity LHC upgrades		
Intensity Frontier	250,987	264,224	247,196	Operations and upgrade of NuMI for NOvA and MicroBooNE; R&D for LBNF and SBN		
Cosmic Frontier	96,927	106,870	119,325	Planned ramp-up of LSSTcam; support of DESI and 2 nd generation dark matter experiments		
Theoretical and Comp.	64,275	59,274	60,317	Planned increase in Lattice QCD project; slight reduction in theory research efforts		
Advanced Technology R&D	150,270	120,254	115,369	Reductions reflect shift to P5 priority areas; MAP reduction continues in response to P5		
Accelerator Stewardship	9,075	10,000	14,000	Increase supports new research topic areas and expands open test facility efforts		
Construction (Line-Item)	51,000	37,000	56,100	Planned profile for Mu2e; engineering and design for LBNF		
SBIR/STTR	21,601*	20,794	21,138			
TOTAL	796,521*	766,000	788,000	House mark: \$776M; Senate mark: \$788.1M		

* SBIR/STTR added to FY 2014 for comparison to FY 2015/2016 – i.e., Actuals reduced post appropriation.



Energy Frontier Research Budgets



- Reductions in Research during past fiscal years due to: a) ramp-down of Tevatron research program and b) trading Research for Projects to enable future investments for discoveries
- 2014 P5 recommendation suggests increasing the project budget fraction to 20%–25% for renewed investment of projects; but also recommended that research reductions be "planned with care"
 - as a result of P5 guidance, DOE/HEP anticipates FY16 research is at ~flat with respect to FY15; but any final budget will also depend on Congressional appropriations



FY 2016 HEP Budget: House and Senate Marks

- The FY 2016 [President's] Request for HEP was \$788M, about a 2.9% increase compared to FY 2015
- The House recently released its FY 2016 Markup of the Energy and Water Appropriation, which overall is slightly below the FY 2016 Request (at \$776M), but above FY 2015 (by ~1.3%)
 - The mark is aligned with Scenario B of the P5 strategic report and notes:
 "The Committee strongly supports the Department's efforts to advance the recommendations of the Particle Physics Prioritization Panel and urges the Department to maintain a careful balance among competing priorities and among small, medium, and large scale projects."
 - Energy Frontier is marked at the FY 2016 requested level and includes LHC Experimental Research, Operations, and ATLAS and CMS [Phase-1] Detector Upgrades
- The Senate FY 2016 Markup for HEP was at \$788.1M, near the FY 2016 Request
- Important to note that the House and Senate marks are "budget indicators" and <u>not</u> the final word on FY 2016
 - When an appropriation for the full-year is determined by Congress, there could be either an increase or a decrease in HEP research funding.
- Actual allocation to research groups will continue to be based on funding availability, programmatic factors and priorities, and the results of peer [merit] reviews



HEP FUNDING OPPORTUNITY ANNOUNCEMENT (FOA): COMPARATIVE REVIEWS

University HEP Comparative Reviews

- In FY2012, DOE/HEP started a process of comparative grant reviews for university research grants which were scheduled for renewal (+ any new proposals as desired)
 - National Labs also reviewed every 3 years; Energy Frontier Review: July 27 31, 2015 (last week)
- Process was recommended by several DOE advisory committees, including the 2010 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 <u>comparative review panels</u> on a regular basis;
 - And 2013 COV: <u>Continue</u> 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
- With FY16 FOA, we are now in the 5th round of annual university comparative review process



FY16 HEP Comparative Review FOA and FAQ

- DE-FOA-0001358 issued July 14, 2015
- 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 13, 2015 by 5 PM Eastern Time
 - Strongly encouraged
- Final Proposal deadline September 17, 2015 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/



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

Table of Contents Registrations and Eligibility	
Proposal Types	
New Faculty Members and Those without Current HEP Grants	
For Principal Investigators (PIs) with Existing HEP Grants	
Proposal and Application Requirements	
Budget	
Review Process	
HEP Program Questions and Agency Contacts	

Note: Book the FY 2016 HEP Comparative Review Fanding Opportantly Announcement [<u>The FOA</u> <u>5001153</u>] and the questions and answers below use technical terms and acrossin specific. To grant and the overall review process. Please efforts the Glossary' contained in Section IX of the Fusik Onswerhmith Announcement for combined efficiency of their terms.

Registrations and Eligibility

Q1: In order to submit Letters of Intent (LOI) and/or Final Applications in response to the QI: In order to submit Letters of Index() and/or Final Applications in response to ML. The complete hist of systems that applicants are required to register with an block 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 mine digit identification number for applicants: Obtaining a Tuksyn (ML). Subsection NUME: The Section IV 31.1. Communication Number (Tile), as specified to accion IV 31.1. Communication Number (Tile). Subsection IV 31.1. Section IV 31.1.

- Grants.gov: DOE's Portfolio Analysis and Management System (PAMS): FedConnect;

 Fold-offerst Finding 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 OHIce of Science (SC) encourages you to register in all systems as sible and well before the relevant deadline



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Energy Frontier Review: Fermilab Tevatron

- Tevatron program
 - Complete ramp-down of Tevatron research program with final physics results
 - Legacy measurements
 - Final studies on Higgs with full dataset
 - W mass ($\delta M_W^{Tevatron} \rightarrow$ 10 MeV) with ~10 fb⁻¹
 - Top studies, EW, QCD, and heavy-flavor
 - Past year reviews: based on budgetary factors, guidance provided to DOE-funded institutions to complete Tevatron research by end-FY14
 - Modest [~\$400k] provided thru end-FY 2015 to support remaining research at DØ and CDF
 - Timing coincides with start of LHC Run 2 physics program







Energy Frontier Review: LHC

- Energy Frontier supports *research* studies on ATLAS and CMS:
 - Physics analyses including precision Higgs, top, electroweak measurements, searches for new physics BSM, QCD, and heavy-flavor
 - Activities which support analyses such as reconstruction, calibration studies, object-ID and performance studies, trigger development
 - Within these topical areas, reviews evaluate:



- group's research plans and timeline for deliverables in the Run 2 program
- ... and in next ~5-10 years with the planned LHC upgrades
 - Phase-1 or Phase-2 upgrade activities will mix with physics research-related efforts
 - PIs are encouraged to discuss their activities in the proposal and to provide plans [for HL-LHC] that are *aligned* with respect to the U.S.-CMS or U.S.-ATLAS plans for the project
- Other general observations
 - In addition to activities at CERN, encourage university community to exploit and interact with CMS LHC Physics Center (LPC) and ATLAS Analysis Support Center 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 staffs with term appointments are <u>not</u> included in the 9-page limit 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 Areas or Thrusts
 - Common narrative that provides overview of each group's activities in different research areas to describe synergies and connections between areas
 - Proposed Research Methods, Resources, Project Objectives
 - Timetable of activities, ...

HEP Research Activities Supported

What DOE supports

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

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 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 operations and/or project-related activities:
 - Engineering, major items of equipment, consumables for prototyping or production
- Non-HEP related efforts
 - Gravity waves (LIGO), Heavy Ion (RHIC), AMO Science, etc...

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 with a project narrative describing:
 - Overall research activity, including fractional time planned in each subprogram
 - Timeline for any transitions of effort (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 for 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
 - ✓ 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

(In descending order of importance)

1) Scientific and/or Technical Merit of the Project

For 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 research compare with other research in its field, both in terms of scientific and/or technical merit and originality? Is the Data Management Plan suitable for prosed 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

For 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

For e.g., what are the past performance and potential of each senior investigator? How well qualified is the research team to carry 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? 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

Are the proposed resources and staffing levels adequate to carry out the proposed research? Are all travel, student costs, and other ancillary expenses adequately estimated and justified? Is the budget reasonable and appropriate for the scope?

5) Relevance to the mission of the DOE Office of High Energy Physics (HEP) program

For 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 mission and priorities? For PIs proposing to work and/or transition across multiple research thrusts during the project period, will their overall efforts add value in the context of HEP program goals & mission? How likely is the research to impact the mission or direction of the overall HEP program?

6) General Comments and Overall Impression

Include any comments you may wish to make on the overall strengths and weaknesses of the proposal, especially as compared to other research efforts in this area. Include any comments if there are significant or unique elements of the overall proposal, including institutional setting/resources/synergies with other relevant subprograms, or other broader considerations.

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



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Office of Science (SC) Digital Data Management

- 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
 - FOAs issued after October 1, 2014, will require a Data Management Plan (DMP) and compliance with the SC Statement
 - Requirement for a DMP will be strictly enforced
 - FY16 comparative review FOA: see Section IV, subsection on 'Appendix 8'
 - Any HEP research thrust in a proposal requesting support will require a DMP for it to be reviewed, and therefore, considered for funding
- SC requirements and additional HEP-specific guidance on DMPs are available at:
 - <u>http://science.energy.gov/hep/funding-opportunities/digital-data-management/</u>
- CMS and ATLAS have developed DMPs for their collaborations
 - When applying for financial assistance grants [universities] or submitting FWPs [labs] for research,
 Pls 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?In=en



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)
 - Award's lead-PI
- Renewal Proposal Products [see Section II.G. of the FY16 comp rev FOA]
 - Beginning with FY16 FOA, PI must complete and submit 'Renewal Proposal Products' section in PAMS by entering each product created during the course of the previous project period
 - 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
- 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 <u>not</u> be considered complete and therefore cannot be reviewed until the product list has been submitted



EARLY CAREER RESEARCH PROGRAM (ECRP)

Early Career (EC): Next Round in FY16

- FY16 FOA [DE-FOA-0001386; LAB_15-1386] posted July 31, 2015 at the EC website:
 - <u>http://science.energy.gov/early-career/</u>
- Read the FY16 FAQ, also available on the above website
 - addresses most of the common Q&A collected over the last 6 years
- Features of FY16
 - Entering 7th year
 - some population of candidates will no longer be eligible due to the "3-strikes rule"
 - Mandatory Pre-application requirement. Two pages.
 - Deadline: September 10, 2015 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]
 - Full proposals due: November 19, 2015 by 5 PM Eastern Time
 - candidates 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
 - <u>http://science.energy.gov/about/honors-and-awards/pecase/</u>



HEP Early Career General Observations

- Reviewers often look for innovative proposals
 - Usually something a bit off the beaten track that the PI can claim as their own
 - during preparation, PIs should address "why is it critical that I carry-out this research?"
 - Provide unique capabilities. What does not get done?
 - Somewhat speculative but not too risky
 - Award spans support for 5-years: address research plan over this period plus future directions
- Experimental HEP proposals that are submitted to ECRP FOA
 - Looking for a *balanced* program
 - strong physics effort and a hardware project attached to an experiment, where PI takes a lead (*e.g.*, Phase-1 upgrades or Phase-2 upgrade R&D, each aligned with U.S. program for LHC)
 - For searches, discuss discovery reach and not just "in the absence of signal, a limit will be set."
- Many lab and some university proposals suffered from "isn't the lab/project going to do that anyway?"
 - Some proposals were clear efforts to start funding some project or R&D that HEP has not yet approved – "the camel's nose under the tent"
 - The theory lab proposals were questioned on cost-effectiveness
- Prior to submission, applicants may want to seek guidance from senior faculty and/or staff while preparing proposals (including budget material)
- Because different reviewers weigh the criteria differently (or have their own physics biases) there is a larger spread in panel rankings

HEP Early Career FY10-15 Demographics

					L = National Lat	oratory Proposal;	U = University Proposal
Subprogram	FY10	FY11	FY12	FY13	FY14	FY15	Total
Awards	(L/U)	(L/U)	(L/U)	(L/U)	(L/U)	(L/U)	(L/U)
Energy	3 (1/2)	3 (1/2)	1 (0/1)	2 (0/2)	2 (1/1)	0 (0/0)	11 (3/8)
Intensity	2 (1/1)	1 (0/1)	3 (2/1)	1 (0/1*)	1 (1/0)	2 (1/1)	10 (5/5)
Cosmic	2 (0/2)	3 (2/1)	3 (1/2)	2 (1/1)	1 (0/1)	0 (0/0)	11 (4/7)
HEP Theory	6 (1/5)	4 (0/4*)	3 (0/3)	3 (1/2)	1 (0/1)	3 (0/3)	20 (2/18)
Accelerator	1 (1/0)	2 (2/0)	2 (1/1)	1 (0/1)	1 (1/0)	0 (0/0)	7 (5/2)
HEP Awards	14 (4/10)	13 (5/8)	12 (4/8)	9 (2/7)	6 (3/3)	5 (1/4)	59 (19/40)
Proposals	154 (46/108)	128 (43/85)	89 (34/55)	78 (29/49)	75 (35/40)	73 (26/47)	597 (213/384)

* 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).

- Early Career Research Program has become even more competitive
 - Since FY14, Congress enacted legislation requiring SC grants of less than \$1,000K to be fully funded in the year the award is issued ⇒ requires awarded university EC grants to be fully-funded
 - Award rate across Office of Science is now ~6-8%

Given reduced success rates, PIs also encouraged to apply to comparative review FOA

• May submit proposals with similar research scope to both FOAs while complying with requirements of each FOA — *for e.g.*, page limits, appendix material, ...

Closing Remarks

- P5 strategic plan is a compelling, unified vision for HEP
 - Five intertwined science Drivers define big issues
 - HEP *is* global: both the P5 plan and DOE's implementation of the plan recognizes this fact
 - Balanced approach: time-phased, projects of different scales, balanced across Frontiers, on- and off-shore
- Energy Frontier LHC activities on CMS & ATLAS now across many different fronts:
 - Complete Run I data analyses with total 500+ publications expected from each experiment
 - Operations have now resumed for Run II with physics data taking
 - Execute construction of LHC Phase-1 [2019] Detector Upgrades
 - Execute R&D for HL-LHC Phase-2 [2024] Upgrades
- DOE/HEP is working with U.S. ATLAS, U.S. CMS and the international process to define U.S. contributions to the HL-LHC detector upgrades
 - In order to proceed forward in coming years, it is important that U.S. collaborators are aligned to U.S. collaboration's plans
- Opportunities exist to apply for research funding within the DOE/HEP-supported programs
 - Important that applicants carefully read the FOAs and corresponding FAQs for guidelines and requirements, available at: <u>http://science.energy.gov/hep/funding-opportunities/</u>



REFERENCE SLIDES

LHC Roadmap

(as of June 2015 CERN Council Mtg.)



U.S. DEPARTMENT OF ENERGY Office of Science