



U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Science

# DOE HEP Portfolio Review

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*High Energy Physics Advisory Panel Meeting  
November 2017*

*Glen Crawford  
Director of Research and Technology Division  
Office of High Energy Physics  
Office of Science, U.S. Department of Energy*

# HEP Portfolio Review

DOE and NSF issued charge to HEPAP Oct 13 

- Copy of the Charge is available on the HEPAP website
- Requests two subpanels to review currently operating experiments
- Like all HEPAP charges, the charge letter is joint-agency, but reviews will only consider DOE-supported experiments



U.S. Department of Energy  
and the  
National Science Foundation  
OCT 13 2017



Dr. Andrew Lankford  
Chair, HEPAP  
University of California, Irvine  
4129H Frederick Reines Hall  
Irvine, California 92697

Dear Dr. Lankford:

The Department of Energy (DOE) Office of High Energy Physics (HEP) requests that the High Energy Physics Advisory Panel (HEPAP) charge subpanels to conduct an independent peer review of currently operating experiments supported by HEP [hereafter generically referred to as "HEP experiments"]. This review should focus on the scientific impact and productivity of HEP-supported contributions to these experiments within the context of the overall HEP portfolio. HEP will use the findings and recommendations from this review to help further define a detailed implementation plan for the strategic vision laid out in the Particle Physics Project Prioritization Panel ("P5") Report, as recommended by the recent HEP Committee of Visitors.

This review process is modelled in part on similar "Senior Review" or "Portfolio Review" processes employed by the National Aeronautics and Space Administration and the National Science Foundation to maximize the scientific productivity of their respective mission or facility portfolios within realistic budget constraints, with modifications as needed and appropriate for the DOE mission and experimental portfolio. Therefore, this independent review will serve primarily as advice to HEP. Specifically, HEP will use the outcomes from this process to:

- Prioritize the currently operating HEP portfolio of experiments (including contributions to HEP experiments at off-shore facilities);
- Define an implementation approach to best achieve the goals of the P5 science drivers; and
- Provide programmatic guidance to the HEP experiments concerned for FY 2019 and beyond.

Additional outcomes or programmatic guidance for future years may be provided to the experiments at the discretion of HEP management. Actions resulting from this review process could include changes to research support; extending the planned running of a particular experiment; maintaining the status quo; significantly restructuring the run plan; or terminating HEP support for experimental operations. **All currently-supported HEP experiments that have taken physics data for at least two years, and are expected to request significant DOE support for operations, or related activities (e.g., computing) beyond FY 2018 are subject to this review.**



# DOE HEP Portfolio Review

In this talk we cover general Frequently Asked Questions:

- ▶ What is it?
  - ▶ Why are we doing this?
    - ▶ Why are we doing this *\*now\**?
  - ▶ How are we doing this?
    - ▶ Why are we doing it *\*this way\**?
  - ▶ What evaluation criteria will be used?
  - ▶ How will the results be used?
  - ▶ What is the timeline?
  - ▶ Etc.
- ▶ Specific FAQ is available on the HEPAP website with the subpanel charge and supporting documents



# DOE HEP Portfolio Review – What is it?

- ▶ **Independent peer review of currently operating experiments supported by DOE/HEP**
  - ▶ Will focus on scientific impact and productivity of HEP-supported contributions
- ▶ **All currently-supported HEP experiments that have taken physics data for at least two years, and are expected to request significant DOE support for operations, or related activities (e.g., computing) beyond FY 2018 are subject to this review**
  - ▶ Experiments that have not yet taken physics data (e.g. Muon g-2, Belle II) are exempt
  - ▶ Experiments completing DOE-supported operations in FY2018 with modest future support (e.g. EXO-200, BES-III) are exempt
  - ▶ This encompasses 13 experiments on Intensity or Cosmic Frontiers plus the two large LHC experiments ATLAS and CMS



# DOE HEP Portfolio Review – Why?

- ▶ During development of the FY2018 President's Request it was realized that if the budget was enacted as requested, it would require significant reductions to current HEP operating experiments and associated research, in order to preserve P5 projects at a much lower budget level than P5 envisioned.
- ▶ Note that the then-current portfolio of operating HEP experiments was not directly addressed in the 2014 P5 report, but they did anticipate this issue:  
*"Increasing the project fraction will necessarily entail judicious reductions in the fractions of the budget invested in the research program and operations"*
- ▶ Specific scenarios were not spelled out in the FY2018 Request, but it was clear that major changes would require HEPAP input on science priorities
- ▶ The House and Senate Marks for FY 2018 are much more favorable but will still require some fine-tuning of the current DOE HEP experiment portfolio to meet budget bottom-line.



# DOE HEP Portfolio Review – Why Now?

- ▶ If FY18 Appropriation ~ FY18 Request: actions will need to be taken immediately.
- ▶ If FY18 Appropriation ~ House, Senate Mark: actions will need to be taken or initiated by the end of FY18
- ▶ Also, there was an explicit recommendation of 2016 HEP COV:  
*Work closely with the Laboratories and with Project Management and Program Management teams to develop a comprehensive strategic plan, consistent with P5 guidance, that anticipates the needs for future operating funds*
  - ▶ Although this recommendation was primarily targeted at the future P5-recommended portfolio, we are taking the opportunity to develop a process that can evaluate ongoing HEP experiments in the broader P5 context
- ▶ Currently operating HEP experiments have not had their science impact or performance evaluated in a consistent or comparative fashion



# DOE HEP Portfolio Review – How?

- ▶ We have requested a comparative, peer review process that will evaluate the **science impact and productivity** of currently operating HEP experiments for the near future:
  - ▶ Specific period covered by review is FY2019-22
  - ▶ Experiments to be reviewed are: **AMS, ATLAS, CMS, Daya Bay, DES, eBOSS, Fermi/GLAST, HAWC, KOTO, MicroBooNE, Minerva, NA61/SHINE, NOvA, SuperK, T2K**
  - ▶ LHC experiments get “special” treatment (more on this later)
  - ▶ Other experiments all evaluated together in one subpanel – obviously a broad range of science, scale, maturity
- ▶ Subpanel reports will go to HEPAP for final review, amendment (if needed) and approval



# DOE HEP Portfolio Review – Why like this?

- ▶ Modelled on similar “Senior Review” or “Portfolio Review” processes at NASA and NSF Astronomy
  - ▶ Differences in detail, but these agencies also manage ongoing, diverse portfolios of science missions/experiments within budget constraints
- ▶ Decided early on that we needed some reasonable thresholds for what was subject to review:
  - ▶ Don’t review experiments that have not yet taken significant physics data
  - ▶ Don’t review experiments that are essentially completed or close to completion
  - ▶ Don’t review experiments that are requesting very modest resources for the near future
  - ▶ Operations of many experiments have separate dedicated reviews, do not need to rehash those exercises. Assume operations *per se* are efficient and effective.
- ▶ Proposal requirements and evaluation criteria should be the same across experiments
  - ▶ However, the scale and priority difference of the LHC experiments requires some customization of process (see following slides)





# DOE HEP Portfolio Review – Why like this (more)?

- ▶ **Overarching goal is to maintain and optimally execute the P5 plan**
- ▶ For non-LHC experiments, a primary consideration should be *“how well are these experiments advancing the P5 plan”*?
  - ▶ This is one of three review criteria spelled out in the Charge
- ▶ The LHC program (including HL-LHC) was the highest-priority near-term project in the P5 plan and we do not intend to abandon the US commitment to LHC
  - ▶ We take pains to point this out in the Charge (see following slide)
  - ▶ We do not need to review further the impact of LHC on the P5 drivers, so that evaluation criteria is dropped for LHC experiments
  - ▶ Note that the LHC subpanel is not asked for Recommendations, only Findings



# DOE HEP Portfolio Review Subpanels

- ▶ Review includes two subpanels, each with specific review criteria to consider
- ▶ **Main subpanel** will assess the scientific merits and impact of DOE-supported contributions to the following operating experiments (in alphabetical order):
  - ▶ AMS, Daya Bay, DES, eBOSS, Fermi/GLAST, HAWC, KOTO, MicroBooNE, Minerva, NA61/SHINE, NOvA, SuperK, T2K
- ▶ **LHC Detectors subpanel** will assess the scientific merits and impact of DOE-supported contributions to the multipurpose LHC detectors ATLAS and CMS
  - ▶ ATLAS and CMS have been successfully operating since 2008
  - ▶ High-Luminosity LHC detector upgrades are in the advanced planning stages
  - ▶ DOE intends to support LHC operations and research through the HL-LHC era
  - ▶ U.S. contributions to LHC detector operations are regularly reviewed by the DOE and the NSF in a separate process
  - ▶ This subpanel will focus primarily on the efficiency and impact of DOE-supported contributions to ATLAS and CMS research efforts



# DOE HEP Portfolio Review Process

- ▶ Each experiment that is invited to the HEP Portfolio Review will submit a proposal outlining its **primary science goals** for the next four years and describing how its research program will benefit the HEP science drivers described in the P5 Report
- ▶ Performance factors to be assessed will include:
  - ▶ Science merit and productivity (including training and mentoring of junior researchers)
  - ▶ Present and anticipated future impact on the P5 science drivers
  - ▶ Efficiency and impact of DOE-supported contributions to the research efforts
- ▶ Operations budgets and schedule information will be requested from proposers but will not be an explicit review criteria
  - ▶ DOE will provide additional information about DOE responsibilities and budget scenarios to the review panels
  - ▶ Proposers have been asked to provide detailed resource needs (FTEs) but not budget profiles



# Review Proposals and Evaluation

- ▶ **Detailed instructions** have been provided to proponents on requirements for proposals and how they will be evaluated
  - ▶ See following slides. Full text available on HEPAP website
  - ▶ There is also a monitored email box for Q&A
- ▶ **Main Subpanel** – Discuss the experiment’s potential for advancing P5 science drivers during the FY 2019 to FY 2022 timeframe
- ▶ **LHC Subpanel** – Although LHC experiments are not being evaluated on the P5 impact criterion listed in the Charge to HEPAP (see slide 9), the Charge and Instructions to Proposers are mostly explicitly parallel
  - ▶ Many of the instructions refer to the P5 drivers, and proposers may include expected P5 science impacts as part of their proposal narrative; Reviewers may consider this information as part of their assessment of the other review criteria
- ▶ Proposals are due to the DOE Office of High Energy Physics no later than **5pm ET January 2, 2018**



# Instructions for Proposers

- ▶ The proposal should address the following topics, which are closely related to, but not exactly the same as, the evaluation criteria:
  - ▶ **Overall scientific merit**, including that of the experiment itself, and its unique capabilities and relevance to the P5 science drivers as part of the overall HEP portfolio;
  - ▶ **Promise of future science impact** and productivity during this timeframe, including key science results expected, based on nominal experimental operations and demonstrated detector performance and capabilities;
  - ▶ **Impact of past scientific results** as evidenced by refereed publications, citations, etc.; and how these results relate to the projected precision of expected future science results;
  - ▶ **Accessibility, usability, and utility of the data**, both for the experiment itself and as a member of the broader HEP community, including working groups that combine and analyze data from multiple experiments; and quality and completeness of the data management plan including archiving and distribution;
  - ▶ **Productivity and vitality of the science team**, including continuity and expertise in the operation, calibration, and validation of instrumental data; scientific research productivity; and mentoring and training of younger scientists.



# Proposal Guidance

## ► Proposals shall contain the following sections:

1. **Science Goals and Science Implementation Plan (up to 25 pages)**
  - a. Brief summary of key science accomplishments to-date
  - b. Top science or technology goals (up to 5) for the next 4 years
  - c. Detailed description of the resources and capabilities needed
  - d. Summary of other important science results expected in the next 4 years
2. **Technical Information (up to 5 pages)**
  - a. Brief discussion of current overall technical status of the experiment
  - b. Experiment run plan for FY2019 – FY 2022
  - c. Description of any upgrades for the next 4 years, including relevant technology R&D
  - d. List specific U.S. responsibilities for experiment operations or upgrades
3. **Data Management Plan (following standard DOE/SC requirements)**
4. **Appendices**
  - a. Total DOE-supported FTEs for (i) Operations, (ii) Physics Analysis, and (iii) Upgrades
  - b. Effort Spreadsheets that support the detailed implementation described in 1©
  - c. Acronym List
  - d. Bibliography



# Proposal Appendix A

**Tables of total direct DOE-supported effort by job type in FY 2017 (FTEs). Similar table for lab contributions.**

MONGO COLLABORATION DOE UNIVERSITY EFFORT	OPERATIONS	PHYSICS RESEARCH	UPGRADES	TOTAL UNIV FTES
FACULTY	1.5	12.4	6.6	20.5
POSTDOC	7.8	9.9	3.3	21.0
GRAD STUDENT	2.0	24.5	1.5	28.0
UNDERGRADUATE	--	1.0	3.0	4.0
RESEARCH SCIENTIST	2.0	--	1.5	3.5
ENGINEER/COMPUTING PROFESSIONAL	1.0	--	2.0	3.0
ADMIN/TECHNICIAN	--	--	--	--
<b>TOTAL</b>	14.3	47.8	17.9	80.0

This is a snapshot of **all** DOE-supported effort in FY2017. If there are significant shifts (>20% relative to FY17) in activities over the years covered by the review, a similar table should be provided for each year: FY 2019, FY 2020, FY 2021, and FY 2022



# Proposal Appendix B

This is detailed list of **all** US effort (DOE and non-DOE) in FY2019-22 (integrated) required to achieve the stated science goals. This is to help reviewers assess whether resources are well-matched to the Goals.

Use this worksheet to enter your Goal data (Appendix B)										
			Experiment Name : MONGO							
			Your Name : J. Random Scientist							
Worked Example. See below.										
MONGO is a hypothetical direct detection low-mass dark matter search [ hence its primary Goal is exactly that, and addresses the Dark Matter P5 driver] but the same experiment can be reconfigured to do axion-like particle searches [which in this Example is the same Goal but targeted to a different P5 driver; alternatively, one could have made the axion search a different Goal altogether]. The axion search tasks partially overlap with the main dark matter search, and are repeated in the Task list but noted as such in the Comments; tasks specific to this analysis are carried out by a subset of collaborators and are specifically called out. They have chosen to make general technology R&D one of their Goals as well. The collaboration utilizes low-background detector screening facilities at SURF, and HPC resources at a mythical DOE national lab. The research group at Erewhon U is supported by NSF and they also make use of computing expertise at a DOE/ASCR funded Institute. These non-DOE-funded resources are also called out in the Comments field.										
Enter data in light green highlighted cells only. Do not add columns to this worksheet.										
To enter a Goal against multiple P5 Drivers, insert a new row and copy down (ctrl+D)										
There are generally multiple Tasks associated with a given Goal/Driver, see Example below										
Goal Number	Goal Name	Type	P5 Driver Name	Task Name	Special Facility Utilization	Experiment Operations	Physics Analysis	Technology R&D	Est. Completion Date	Participants
[1-5]	[text]	[S1,S2,T]		[text]	[hrs]	[FTE-yr]	[FTE-yr]	[FTE-yr]	[month/year]	List US institutions or research groups contributing significantly to this task. If all US groups contribute (eg for Detector Operations), enter "ALL"
	Discover GeV-scale Dark Matter	S2	S2: Dark Matter	Detector Purity Screening	500	1.5	0.0	0.5	6/1/2019	Wassamatta U
				Detector Commissioning		4.0	0.0	0.0	12/1/2019	Rattlesnake State U, Hawkins Natl Lab
				Detector Calibrations		3.5	1.5	0.0	6/1/2020	Erewhon U, Wassamatta U
				Baseline Data Analysis		0.0	6.0	0.0	12/1/2021	Hudson U, Rattlesnake State U, Erewhon U
				Alternative Data Analysis		0.0	4.5	0.0	12/1/2021	Hawkins Natl Lab, Misty Mountain U
				Something to do with Machine Learning		0.5	2.0	0.5	3/1/2022	Institute for Advanced Intuition
				Machine Learning Simulations	2000	1.5	0.5	0.0	12/1/2021	Institute for Advanced Intuition, Hawkins National Lab
				Special MC Runs		1.5	1.5	0.0	6/1/2021	Wassamatta U, Lab of the Woods
				Systematic error studies		0.0	9.5	0.0	12/1/2022	ALL



# HEP Portfolio Review Evaluation Criteria I

- ▶ **Science Merit and Productivity (including training and mentoring of junior researchers)**
  - ▶ *What is the scientific scope and impact of the top research and technology goals?*
  - ▶ *How might the results of the proposed work impact the direction, progress, and thinking in relevant scientific fields of research?*
  - ▶ *What is the likelihood of achieving valuable results?*
  - ▶ *How does the merit of the proposed research, both in terms of scientific and/or technical merit and originality, compare with other efforts within the same research area for the overall HEP field?*
  - ▶ *How productive has the experiment been in terms of science or technology results?*
  - ▶ *How effective has the experiment been in terms of training and mentoring students and junior researchers?*
  - ▶ *Will the proposed research plan deliver significant productivity in terms of science/technology results and student training?*



# HEP Portfolio Review Evaluation Criteria II

## ▶ **Present and Anticipated Future Impact on the P5 Science Drivers** [Main Subpanel only]

- ▶ *How have recent results from this experiment contributed to one or more of the P5 science drivers?*
- ▶ *How do the proposed research/R&D goals of this experiment contribute to the P5 science drivers ?*
- ▶ *How significant are the current or anticipated science and technology results of this experiment in the context of the P5 plan?*
- ▶ *What are the unique contributions of this experiment to advancing the P5 science drivers?*
- ▶ *What are the key competitive advantages of this experiment relative to other experiments with similar research goals?*
- ▶ *Does the scope of the full proposed program provide important additional benefits to implementing the P5 plan beyond the top research and technology goals?*
- ▶ *How likely is the proposed research to impact the future direction of the overall HEP program?*



# HEP Portfolio Review Evaluation Criteria III

## ▶ **Efficiency and Impact of DOE-supported contributions to the physics analysis efforts**

- ▶ *Are the proposed staffing levels well-matched to the proposed work, for each of the top science and technology goals?*
- ▶ *Is the balance of effort by job type (e.g., faculty/staff, postdocs, graduate students) appropriate and well-matched to the proposed work, for each of the top science and technology goals?*
- ▶ *Does the proposed work take advantage of unique or leading facilities, personnel and capabilities at DOE-supported institutions?*
- ▶ *Are DOE-supported groups efficiently deployed to maximize their impact on the physics analysis effort?*
- ▶ *Do the DOE-supported groups have appropriate leadership roles in the physics analysis effort?*
- ▶ *Do the DOE-supported groups have critical impacts on the top science and technology goals?*



# Portfolio Review Process Outcomes

- ▶ HEP will use outcomes to:
  - ▶ Prioritize the currently operating HEP portfolio of experiments (including contributions to HEP experiments at off-shore facilities)
  - ▶ Define an implementation approach to best achieve the goals of the P5 science drivers
  - ▶ Provide programmatic guidance to the HEP experiments concerned for FY 2019 and beyond
- ▶ Additional outcomes or programmatic guidance for future years may be provided to the experiments
- ▶ Actions resulting from this review process could include:
  - ▶ Changes to research support
  - ▶ Extending the planned running of a particular experiment
  - ▶ Maintaining the status quo
  - ▶ Significantly restructuring the run plan
  - ▶ Terminating HEP support for experimental operations



# Communicating Outcomes

- ▶ After HEPAP makes its recommendations, DOE/HEP will contact each of the experiments and communicate guidance resulting from the HEP Portfolio Review.
  - ▶ This direction may include new budget guidelines and other specific instructions resulting from the Portfolio Review process, possibly including notices of intent to terminate DOE involvement.
  - ▶ DOE/HEP will also post the HEPAP subpanel reports and its response to the HEPAP website.
  - ▶ Each of the experiments will submit back to DOE/HEP their plan for complying with the new guidance and instructions.
- ▶ HEP management will ensure that key officials in institutions or agencies that are partners in operating experiments are apprised of DOE's decisions resulting from the HEP Portfolio Review.



# Portfolio Review DRAFT Timeline

Item	Due Date
Charge Issued	Oct 13 2017
Call for Proposals Issued	Nov 7 2017
Proposals Due	Jan 2 2018
Panels Meet	Jan/Feb 2018
Report Writing	Mar 2018
Report delivered to HEPAP	Apr 2018

- ▶ Nominal schedule; details still under discussion with subpanel Chairs



# Concluding Remarks

- ▶ Given the current budget outlook, we think it is imperative to take a close and critical look at currently operating HEP experiments and how effectively they are advancing the P5 plan
  - ▶ Portfolio Review is the process we have created to implement this
  - ▶ Overarching goal is to maintain and optimally execute the P5 plan
- ▶ There is a very diverse set of experiments under review
  - ▶ Will require diverse and broad-minded panelists
  - ▶ We have crafted the evaluation criteria and proposal guidelines to be as uniform as possible to enable meaningful comparisons
- ▶ We anticipate that this review process will allow DOE the ability to periodically rebalance its HEP experimental portfolio, and adapt as needed to different budget scenarios.
- ▶ **We feel the participation of HEPAP is critical in this important process and very much appreciate your assistance.**

