



U.S. DEPARTMENT OF
ENERGY

Office of Science

Office of High Energy Physics

HEPAP

November 18, 2010

Washington, DC

Dennis Kovar

Associate Director of the Office of Science

for High Energy Physics

News from DOE

FY 2011 Budget

- **FY 2011 Budget Request is with Congress**
 - House and Senate Markups
 - Continuing Resolution until Dec 3
 - Then ???

Planning

- **FY 2012 Budget Request is with OMB**
 - Submitted to OMB in early September
 - OMB Passback November 29
- **Out years**
 - Funding projections revised over the last year
 - Additional changes might be expected

HEP planning utilizes guidance of HEPAP (P5, PASAG, etc), Astro2010, etc.

- Adapting to changing circumstances
- Incorporating additional/refined guidance

HEP Office

- COV Review
- HEP Staff

**The FY 2010 HEP Program
And
FY 2011 HEP Budget Request**

High Energy Program (HEP)

FY 2010 Statistics

(millions)

FY 2010					
Research Areas	Research	Projects	Facility Ops and Devel	Total	
Energy Frontier Experimental	104.0	9.0	177.0 *	290.0	36%
Intensity Frontier Experimental	48.1	91.0	61.5 *	200.7	25%
Cosmic Frontier Experimental	65.3	10.1	0.0	75.4	9%
Theoretical Physics	68.4	0.0	0.0	68.4	8%
Advanced Technology R&D	67.7	0.0	108.4 **	176.0	22%
High Energy Physics	353.5	110.1	346.9	810.5	
	43.6%	13.6%	42.8%		

* Fermilab Operations pro rated
** Includes SBIR/STTR

	FY 2010 estimate		
	University	Laboratory	Total
# University Grants /Group	200	45	
# Permanent Ph.D.'s (FTEs)	625	515	1,140
# Postdoctoral Associates (FTEs)	390	160	550
# Graduate Students (FTEs)	545	50	595
# Undergraduates	80	-	80
# Eng/Tech/Admin Staff	<u>105</u>	<u>1,810</u>	<u>1915</u>
	1,745	2,535	4,280
# Ph.D.'s awarded	110		110

Research Area	Approx FTEs
Tevatron	220
LHC	550
Neutrinos	160
B-factory	70
Non Accelerator	280
Theory	550
Technology R&D	250
All Other	200

FY 2011 Budget Request to Congress

(B/A in thousands)

	FY 2009		FY 2010	FY 2011		
	Current Base Approp.	Current Recovery Act	Current Approp.	Request to Congress	Request to Congress vs. FY 2010 Approp.	
Advanced Scientific Computing Research.....	358,772	161,795	394,000	426,000	+32,000	+8.1%
Basic Energy Sciences.....	1,535,765	555,406	1,636,500	1,835,000	+198,500	+12.1%
Biological & Environmental Research.....	585,176	165,653	604,182	626,900	+22,718	+3.8%
Fusion Energy Sciences.....	394,518	91,023	426,000	380,000	-46,000	-10.8%
High Energy Physics.....	775,868	232,390	810,483	829,000	+18,517	+2.3%
Nuclear Physics.....	500,307	154,800	535,000	562,000	+27,000	+5.0%
Workforce Development for Teachers & Scientists.....	13,583	12,500	20,678	35,600	+14,922	+72.2%
Science Laboratories Infrastructure.....	145,380	198,114	127,600	126,000	-1,600	-1.3%
Safeguards & Security.....	80,603	---	83,000	86,500	+3,500	+4.2%
Science Program Direction.....	186,695	5,600	189,377	214,437	+25,060	+13.2%
Small Business Innovation Research/Technology Transfer (SC).....	104,905	18,719	---	---	---	---
Subtotal, Science.....	4,681,572	1,596,000	4,826,820	5,121,437	+294,617	+6.1%
Congressionally-directed projects.....	91,064	---	76,890	---	-76,890	-100.0%
Small Business Innovation Research/ Technology Transfer (DOE).....	49,534	36,918	---	---	---	---
Use of prior year balances.....	-15,000	---	---	---	---	---
Total, Office of Science.....	4,807,170	1,632,918	4,903,710	5,121,437	+217,727	+4.4%

HEP is 17% of the Office of Science Budget

FY 2011 HEP Budget Request

Highlights

- **Tevatron will operate in FY 2011** with possibility of observing hints of new physics or ruling out a significant fraction of the allowed mass region for the Higgs boson in the Standard Model at the 95% confidence level
- **U.S. LHC program is supported at a level that will allow U.S. researchers to play an leading role** in extracting physics from the data obtained and in planned upgrades to the detectors
- **On-going MIE projects are supported on planned schedules** to address physics at the Intensity Frontier (NOvA and Daya Bay), and Cosmic Frontier (DES)
- **First investments (MicroBooNE, Mu2e and LBNE) are made to secure a U.S. leadership program at the Intensity Frontier**
- **Research program is supported at a level that will maintain scientific workforce** and the ability to be productive
- **Projects/Construction are down slightly overall** as NOvA profile starts to roll off and new Intensity Frontier projects begin to ramp up
- **Advanced Technology R&D is continuing to support high risk, high impact initiatives as well as developing infrastructure and maintaining core competencies important for the U.S.**

FY 2011 Budget Request

Congressional Actions

- **House Mark is a directed \$12.5M reduction**
- **Senate Mark is a general \$8.915M reduction**

FY 2010*** Current Appropriation	Delta	Percent	FY 2011 Request	FY 2011 House Mark	FY 2011 Senate Mark
--	-------	---------	--------------------	-----------------------	------------------------

High Energy Physics

Proton Accelerator Based Physics	435,392	3,870	0.9%	439,262	436,262	430,347
Electron Accelerator Based Physics	30,208	-5,501	-18.2%	24,707	24,707	24,707
Non Accelerator Based Physics	99,914	-11,375	-11.4%	88,539	88,539	88,539
Theoretical Physics	68,934	590	0.9%	69,524	68,024	69,524
Advanced Technology R&D	176,035 *	13,933	7.9%	189,968	181,968	189,968
Subtotal, High Energy Physics	810,483	1,517	0.2%	812,000	799,500	803,085
Construction	0	17,000		17,000	17,000	17,000
Total, High Energy Physics	810,483 *	18,517	2.3%	829,000	816,500	820,085
				2.3%	0.7%	1.2%

**** * Allocation as of August, 2010**

*** Total in FY 2010 includes \$19,672,000 that was transferred to SBIR and STTR programs**

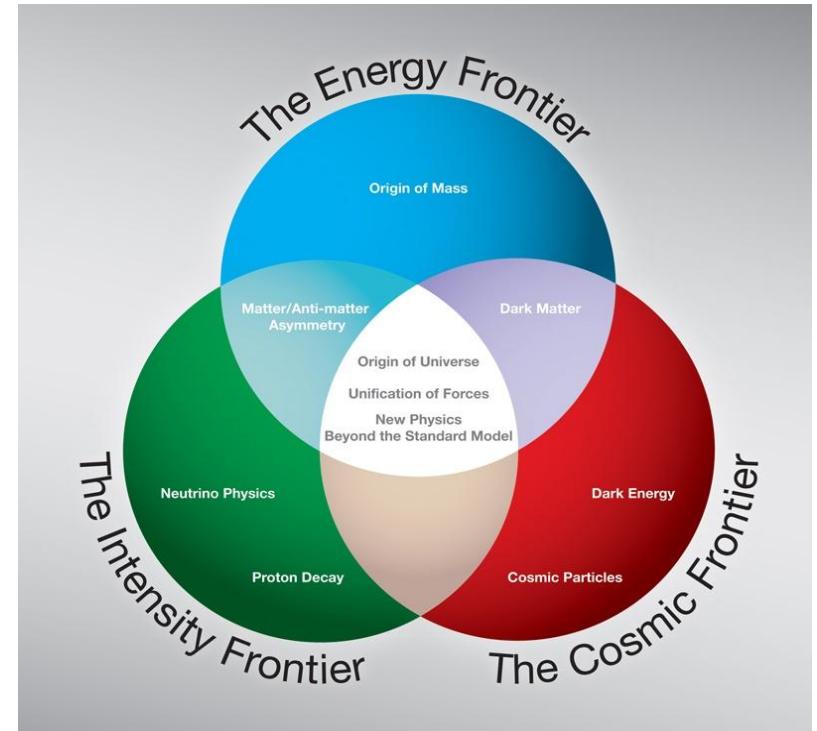
Planning

FY 2012 and Out-years

Strategic planning

The Scientific Frontiers

- **The Energy Frontier**, powerful accelerators are used to create new particles, reveal their interactions, and investigate fundamental forces;
- **The Intensity Frontier**, intense particle beams and highly sensitive detectors are used to pursue alternate pathways to investigate fundamental forces and particle interactions by studying events that occur rarely in nature; and
- **The Cosmic Frontier**, ground and space-based experiments and telescopes are used to make measurements that will offer new insight and information about the nature of dark matter and dark energy, to understand fundamental particle properties and discover new phenomena.



The three frontiers have been excellent framework for our discussions of the program with the Office of Science, DOE, OMB, and Congress.

What has happened

Since 2008 P5 Report

Energy Frontier:

- LHC research program has been delayed (now performing outstandingly!)
- CERN has a new mid-term and long-range plan for LHC
- Tevatron performance continues to be outstanding! (Run in 2012-2014?)

Intensity Frontier

- Significant progress on initiating implementation of a U.S. leadership intensity frontier program
- Established a model for a joint agency DUSEL Physics program
 - This has been articulated in a draft DOE/NSF MOU now in concurrence
- Additional guidance obtained on other opportunities identified in HEPAP P5 Report

Cosmic Frontier

- Guidance received:
 - HEPAP (PASAG) Report: opportunities/priorities for HEP particle astrophysics program
 - Astro2010 Report: opportunities/priorities for the U.S. Astronomy/Astrophysics program
 - OSTP has worked for a coordinated agency (DOE, NASA and NSF) response

Advanced Technology R&D

- Delay in LHC schedule has driven delay in anticipated “decision” on next lepton collider
- Accelerator R&D Workshop Report provided guidance on opportunities/priorities

Funding Projections

- HEP budgets have been between FY2007 and FY2008 level-of-effort

Energy Frontier

Changing circumstances

▪ Tevatron Program

- Many interesting new results : closing in on the Higgs, hints of BSM physics?
- **Supporting Tev Operations and analysis in FY2011 is a HEP priority**
- With the delay in the LHC there is a case for running the Tevatron in FY 2012-4
- Currently in the middle of FY2012 budget development
 - **HEPAP recommended extending Tevatron running if additional resources can be found**

▪ LHC Program

- Performance of accelerator, detectors, software and computing have been exemplary
 - **Support for LHC research is another HEP priority.**
 - US groups are very visible and active. On to the physics!
- CERN is in the process of defining its mid-term plan for the LHC program
 - U.S. is planning to participate
 - Participation includes detector / accelerator upgrades but **not** LHC operating costs
 - Present US-CERN agreement until 2017
- U.S. proposes that its relations with CERN remain basically the same as now:
 - CERN planning for the future of the LHC are driving discussions of global projects

Intensity Frontier

Implementation started

DOE's Neutrino/Rare Decay Program at Fermilab

- MiniBooNE, MINOS, and MINERVA are taking data
- MicroBooNE will soon be in fabrication
- Mu2e, LBNE Project Engineering and Design (PED) in FY 2011
- Project X R&D and pre-conceptual design supported
- Muon Anomalous Magnetic Moment (G-2) - depends upon funding

Possible construction/running schedules (assuming Tevatron down in 2012)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Fermilab Projects					Shut										
MiniBooNE		Running			dow n	???									
MINOS		Running				???									
Minerva		Fabrication				Running									
NOvA		Fabrication					Running								
MicroBooNE		R&D	Fabrication			Running									
LBNE		R&D		PED		Construction							Running		
Project - Mu2e		R&D		PED		Construction		Running							
Project X			R&D			Construction							Running		
G-2						Fabricaton									

Intensity Frontier

DOE/NSF discussions on collaboration on DUSEL

- NSF/DOE have established a DUSEL Physics Joint Oversight Group (JOG)
 - To coordinate & oversee DUSEL experimental physics program
- Agencies collaborating in defining the DUSEL physics program.
 - Discussions underway to establish DUSEL stewardship roles & core research program:

Program Element	Steward	Other
DUSEL facility	NSF	
Dark matter	NSF	DOE OHEP
Neutrino-less double-beta decay	DOE ONP	NSF, DOE OHEP?
Long baseline neutrinos	DOE OHEP	NSF
Proton decay	DOE OHEP	NSF
Other disciplines (Bio, Geo, Eng)	NSF	

- An Interagency Memorandum of Understanding (MOU) will define in more detail the roles and responsibilities

Intensity Frontier

Other Scientific Opportunities

DOE/HEP has received proposals for 3 possible “small” Intensity Frontier projects:

1. US participation (SLAC + university groups) in SuperB/Italy at 3 different levels:
 - Provision of reusable PEP-II and BABAR components (est. 130MEuro value)
 - + additional funding for US participation in detector program
 - + additional funding for US participation in accelerator program
2. US participation in Belle-II (university groups) at Super-KEKB/Japan
 - Participation in detector subsystems
3. Implementing/remounting g-2 experiment at Fermilab (universities + FNAL)
 - Utilizes existing Fermilab infrastructure and planned upgrades
 - Utilizes planned BNL D&D funding

HEP has conducted peer review evaluations of these proposals

Support for these scientific opportunities depends upon:

- **funding in FY 2012 Budget Request**
- **guidance on funding projections in the out years.**

Cosmic Frontier

Guidance from Astro2010 Report

Budgetary scenarios

- | | |
|------------------------------------|---|
| ▪ Levels given by agencies: | Level used by Astro2010 for recommendations: |
| DOE, NSF – constant with inflation | DOE, NSF – doubling trajectory |
| NASA – constant dollars | NASA – constant with inflation |

Recommended a coordinated ground/space-based Dark Energy program

- Highest priority in space: WFIRST
- Highest priority on ground: LSST

Recommendations to DOE :

- The optimistic funding profile allows investment in:
 - LSST – DOE should partner with NSF
 - WFIRST – DOE should contribute (note that this is not a dedicated dark energy mission)
- **At lower funding level:**
 - **LSST is recommended as the priority because DOE role is critical**
- **Other identified opportunities:**
 - Contributions to NSF mid-scale experiments (2nd priority in ground-based) e.g. BigBOSS, CMB, HAWC experiments, etc.
 - NSF & DOE contribute as a minor partner (4th priority in ground-based) to a European-led AGIS/CTA ground-based gamma-ray observatory

Astro2010 & PASAG

DOE HEP Comments

Budgetary scenarios:

- Our current projections tend towards the lower funding amounts
- Do not have the same profile as assumed by Astro2010.

DOE OHEP Objectives:

- Contributions to select, high impact experiments with discovery potential
- that address particle-astrophysics goals
- where DOE HEP researchers and investments can play a significant role in and make significant contributions (PASAG recommended criteria)
- Achieve earliest, best, and most cost-effective U.S. dark energy and dark matter science results
- Partnerships with NASA and NSF and international collaborators as appropriate

Priorities

- **Dark matter** – direct detection experiments are a priority (not part of Astro2010 study)
- Maintain a **leading U.S. role in dark energy research** (Astro2010 recommendation)
- **Other opportunities** for contribution **as funding permits**

Cosmic Frontier

HEP Strategy

DOE HEP priorities are (per HEPAP/PASAG):

1. **Dark Matter (with NSF) - emphasizing direct detection.**
 - a. R&D and prototype detectors
 - b. Down select to a few solid/liquid/gas phase detectors for next generation
 - c. Choose technology for one or two ton-scale detectors

2. **Dark Energy (with NSF and NASA) - what is it? how does it evolve?**
 - a. Ground-based program with NSF (as a major partner)
 - b. Space-based program with NASA (as a minor partner)

3. **Cosmic Rays/High Energy gamma-rays**
 - a. Complete currently operating experiments—will review in 2011
 - b. Not participating in Auger North given current budget projections
 - c. Discussing role in AGIS/CTA merger

Accelerator R&D

Significant Changes

Accelerator R&D activities are in transition to better serve HEP, SC, and the Nation

- **Over last few years investments have developed US competency in SRF Technology**
 - This position US to construct Project X or participate in construction of an ILC
 - The funding for ILC and SRF R&D will be ramped down as planned activities are completed
- **Investments have been made in plasma wakefield acceleration demonstration projects**
 - Recovery Act funding used to proceed on BELLA and FACET projects
 - Will be operated over the next few years to determine the promise for future accelerators
- **Investments are planned for a five-year national muon accelerator R&D campaign**
 - To understand whether the technical challenges can be overcome
 - Fermilab has been charged to organize this national effort
- **Investments planned to address opportunities identified in the Accelerator R&D Workshop**
 - With broader perspective
 - To better serve the needs of other scientific programs and national endeavors

Plan to go to HEPAP for an evaluation of HEP's Accelerator R&D Strategic Plan

- **to get guidance for refinement**
- **in particular on how to incorporate information obtained from Accelerator Workshop**

Accelerator R&D Workshop Report

identified Research Opportunities

Areas of R&D identified by each working group. All areas are of importance to each working group. Color coding indicates areas with greatest impact.

R&D Need	Energy & Environment	Medicine	Industry	Security & Defense	Discovery Science
Reliability	High	High	High	Medium	High
Beam Power/RF	High	Low	Medium	High	High
Beam Transport and Control	Medium	High	Low	Medium	Medium
Efficiency	Medium	Low	Medium	High	Medium
Gradient (SRF and other)	Low	High	Medium	High	High
Reduced Production Costs	High	Medium	High	Low	High
Simulation	Medium	High	Low	Medium	Low
Lasers	High	Low	Low	Medium	Medium
Size	Low	Medium	High	Low	Medium
Superconducting Magnets	Low	Medium	Medium	Medium	Low
Targetry	Medium	Medium	Low	Low	Low
Particle Sources	Low	Low	High	Low	Low

Color code: Increased priority

HEP Outyear Funding Projections

Significant Change/Guidance

Guidance on HEP out-year funding has changed since last year

- Funding levels have been reduced (compared to last year) and forced programmatic decisions
 - What initiatives should be pursued?
 - What is proper balance between development/operations of tools and research?
- The delays in LHC/decisions for Astro2010 have postponed drastic (seminal) decisions
- Results from recent elections and national financial status imply additional adjustments

Guidance from HEPAP (P5) - further amplified by HEPAP(PASAG) - is relevant/has been used

- Dealt with mounting an optimum U.S. program with constrained funding (Scenario A)
- Requires a downsizing and re-scoping of the program with an eye on the scientific priorities identified

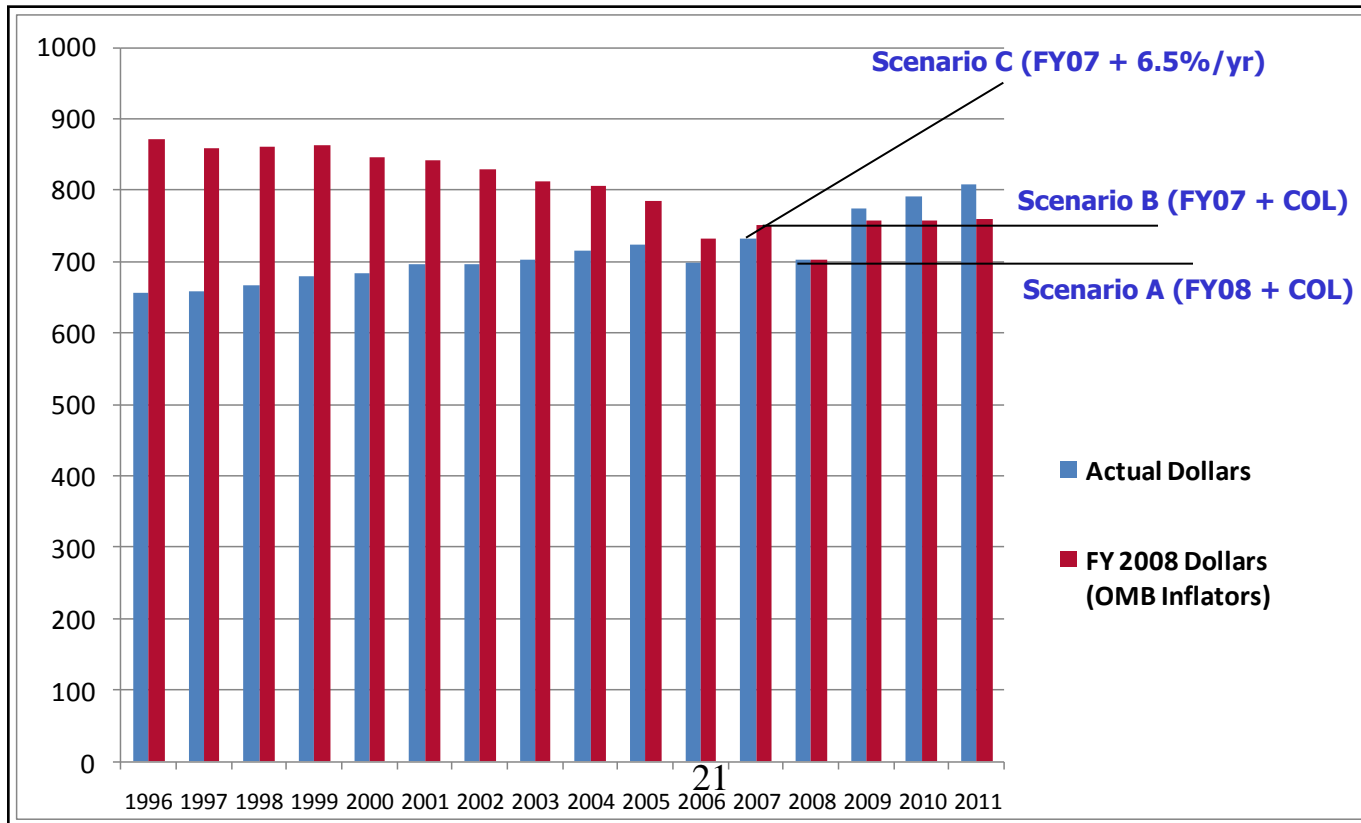
Priorities remain the same as those identified in HEPAP (P5) Report (and HEPAP (PASAG))

- HEP has focused on developing domestic Intensity Frontier program for the future
- Preserving key investments at Energy Frontier (LHC) and Cosmic Frontier (Dark Matter)
- Take advantage of other scientific opportunities if investment is modest and provides important US role.

FY 2009-2010 and FY 2011 Request change trend

However, above COL needed to implement the P5 Plan

- HEP funding has been eroded by inflation: FY 2008 / FY 1996 ~ 20 % (OMB COL)
- HEP FY 2009 funding was +10 % compared to FY 2008 and above OMB COL from FY 2007
- HEP received 220.0 million in Recovery Act funding (additional \$16.5 million Early Career)
- HEP FY 2011 Request is above OMB COL (+2.3 %) compared to FY 2010



HEP Office

Program Activities

HEPAP/Advisory

- HEPAP Committee of Visitors (COV)
 - **Report being presented at this meeting**

HEP Laboratory Reviews conducted in FY 2010:

- Electron Accelerator-Based Physics and Non Accelerator Physics
- Fermilab and BNL HEP peer-reviews: ANL, LBNL and SLAC HEP Office reviews

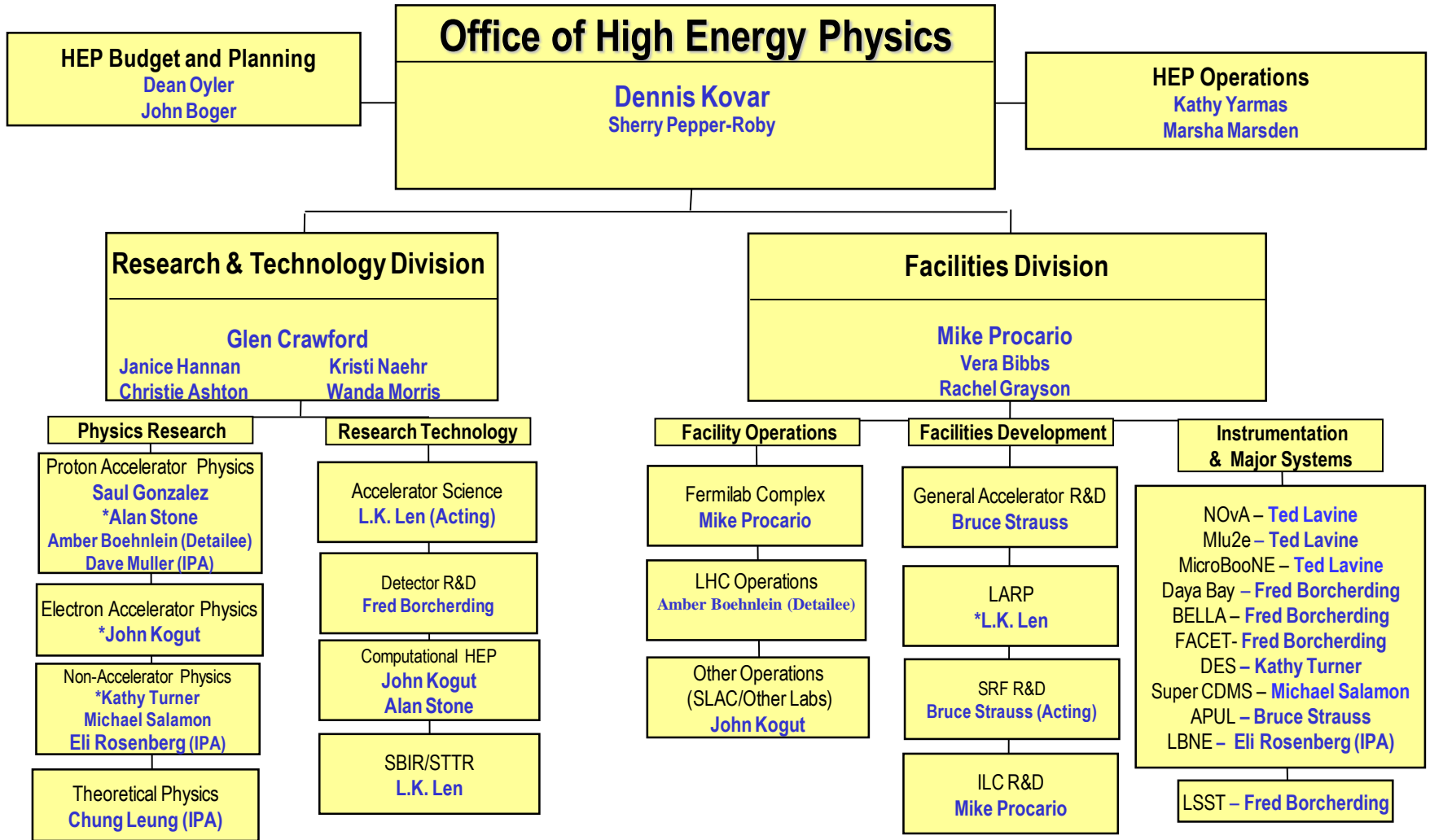
Office of HEP Staff

- Federal Vacancies
 - Theoretical Physics Program Manager – Nov 4 deadline – applicants being evaluated
 - Accelerator Science Program Manager – Nov 4 deadline – applicants being evaluated
- Need for IPAs & Detailees (a number of appointments ending in FY2010 and FY2011)

Annual collection of demographic information underway

- **Everyone should respond – important for understanding what federal funding supports**

HEP Organization Chart



*Denotes base position