U.S. DEPARTMENT OF ENERGY

Office of Science

DOE Office of High Energy Physics Perspectives

US LUO • 2013 Annual U.S. LHC Users Organization Meeting
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November 6 – 8, 2013

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Outline

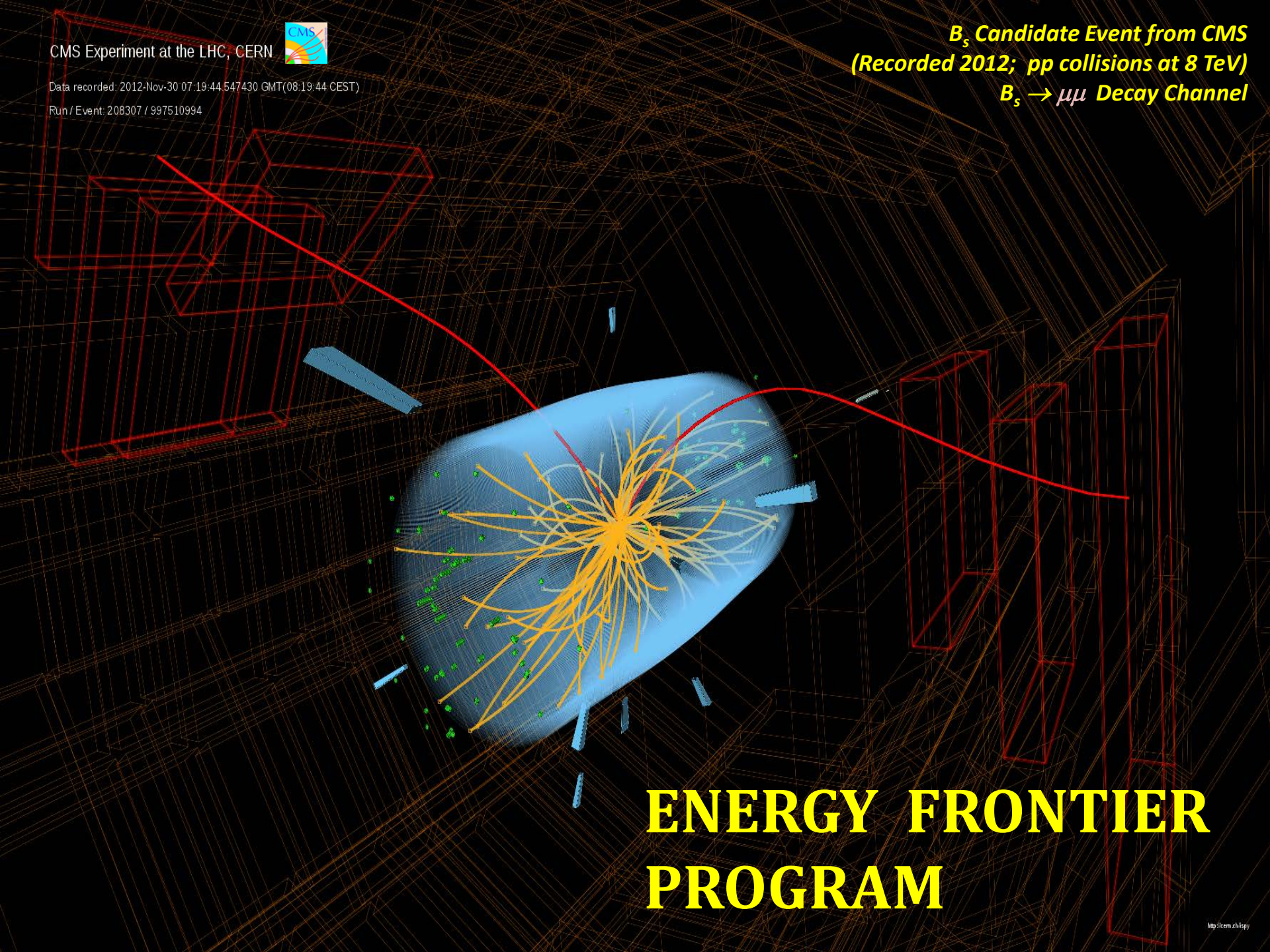
- Energy Frontier Program & Issues
- Budget and Issues
- A few remarks on P5
- DOE HEP FY 2014 Funding Opportunities
- Summary

The Higgs and The Nobel

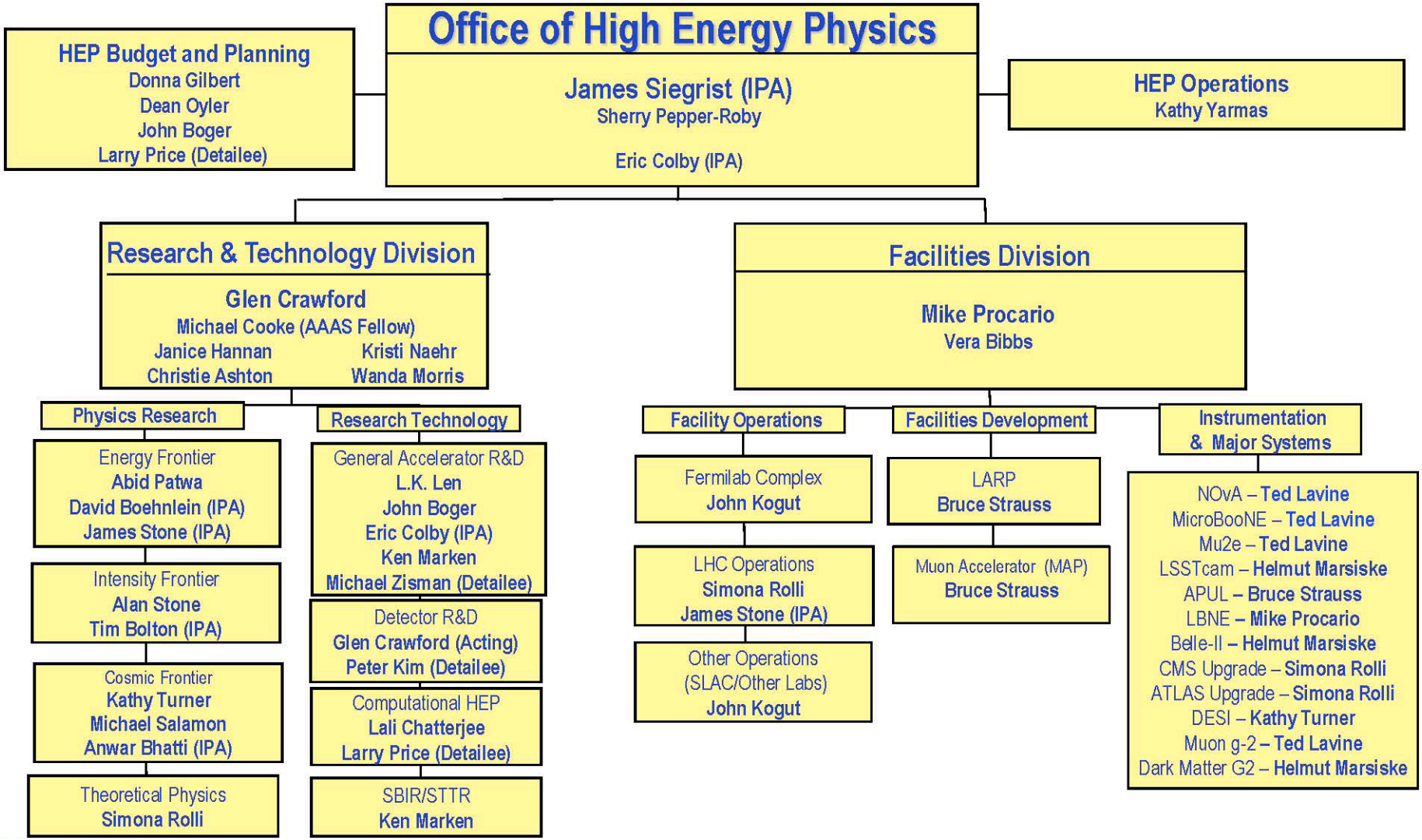
- **2013 Nobel Prize in Physics awarded for work on the Higgs boson jointly to:**
  - **François Englert (Université Libre de Bruxelles, Belgium) and Peter W. Higgs (University of Edinburgh, UK)**
    - ***"For the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles, and which recently was confirmed through the discovery of the predicted fundamental particle, by the ATLAS and CMS experiments at CERN's Large Hadron Collider."***

On behalf of the U.S. Department of Energy,
Congratulations to Professors François Englert and Peter Higgs for the pioneering work on the Higgs theoretical framework;

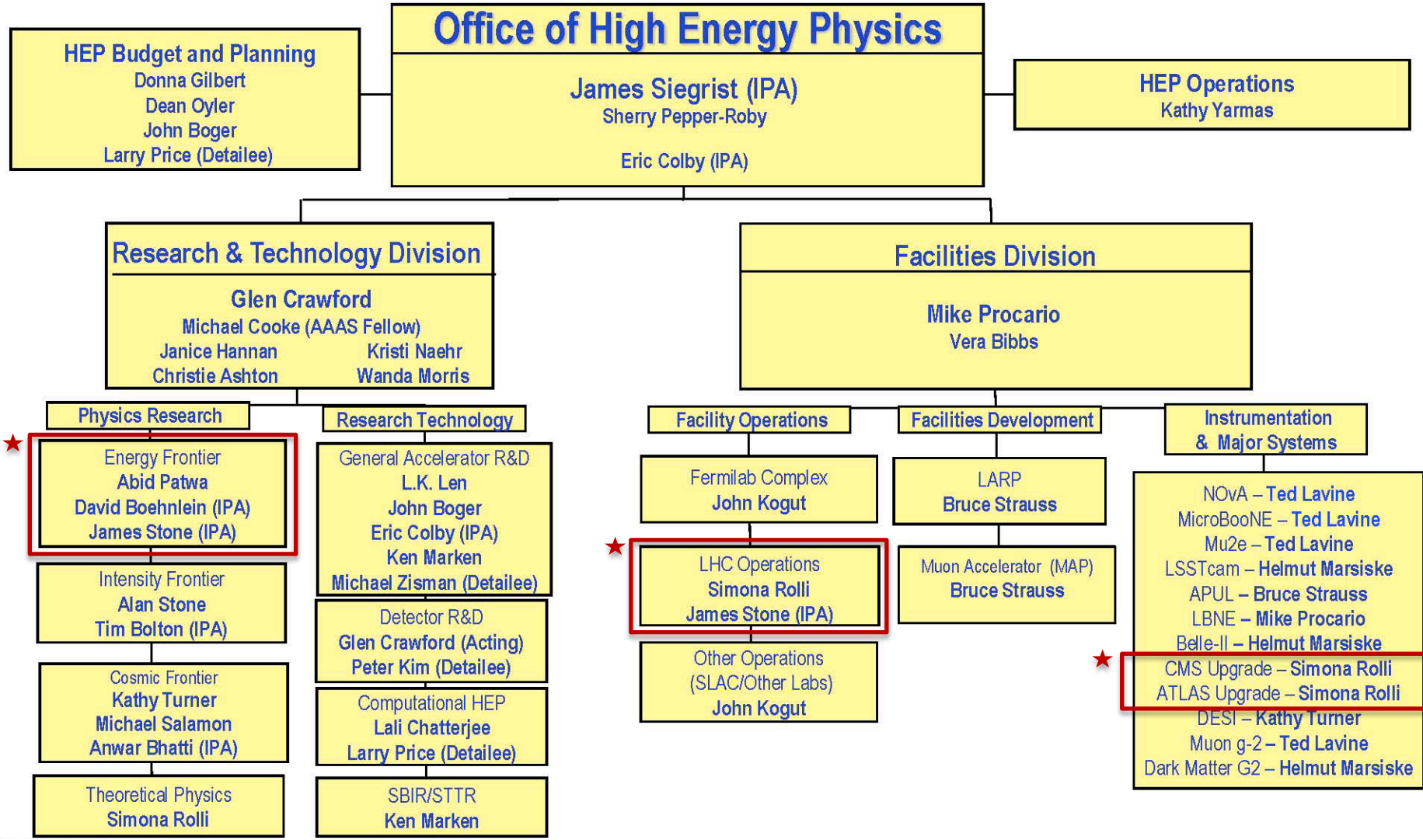
and **Congratulations to CERN and the ATLAS and CMS Collaborations — including all U.S. members — for the groundbreaking work that led to the discovery of the Higgs boson.**


CMS Experiment at the LHC, CERN
Data recorded: 2012-Nov-30 07:19:44.547430 GMT(08:19:44 CEST)
Run / Event: 208307 / 997510994
B_s Candidate Event from CMS
(Recorded 2012; pp collisions at 8 TeV)
$B_s \rightarrow \mu\mu$ Decay Channel
ENERGY FRONTIER
PROGRAM

DOE OHEP Organization



DOE OHEP Organization



HEP Energy Frontier Experiments

Experiment	Location	CM 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	33 Univ., 1 National Lab	192
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	55 Institutions; 14 Countries	26 Univ., 1 National Lab	224
ATLAS (A Toroidal LHC ApparatuS)	CERN, Large Hadron Collider [Geneva, Switzerland / Meyrin, Switzerland]	7-8 TeV; 13-14 TeV Run 1 ended: Dec. 2012 Run 2 start: 2015	Higgs, Top, Electroweak, SUSY, New Physics, QCD, B-physics, and Heavy-Ion	169 Institutions; 37 Countries	40 Univ., 4 National Labs	583
CMS (Compact Muon Solenoid)	CERN, Large Hadron Collider [Geneva, Switzerland / Cessy, France]	7-8 TeV; 13-14 TeV Run 1 ended: Dec. 2012 Run 2 start: 2015	Higgs, Top, Electroweak, SUSY, New Physics, QCD, B-physics, and Heavy-Ion	179 Institutions; 41 Countries	48 Univ., 1 National Lab	678

Collaboration data as of August 2013.

- **Two main scientific thrusts**
  - **Tevatron at Fermilab ($p\bar{p}$ collider): DØ Collaboration, CDF Collaboration**
  - **LHC at CERN (pp collider): CMS Collaboration, ATLAS Collaboration**
- **U.S. is single biggest collaborator in both ATLAS and CMS experiments at LHC**
  - **US-ATLAS: ~23% of the international ATLAS Collaboration**
    - **175 U.S. graduate students**
  - **US-CMS: ~33% of the international CMS Collaboration**
    - **247 U.S. graduate students**

Energy Frontier PhD's and Publications

Experiment	CY 2009		CY 2010		CY 2011		CY 2012		CY 2013		
	# of PhD's Awarded [US]	# of Pub.	# of PhD's Awarded [US]	# of Pub.	# of PhD's Awarded [US]	# of Pub.	# of PhD's Awarded [US]	# of Pub.	# of PhD's Awarded [US]	# of Pub. [to date]	# of Pub. [estimate, expected]
DØ	16	36	16	32	9	44	8	35	7	29	24
CDF	7	57	13	42	12	46	10	51	4	28	18
TOTAL Tevatron:	23	93	29	74	21	90	18	86	11	57	42
ATLAS	3	0	8	11	28	56	49	126	27	76	25
CMS	4	0	6	32	51	73	33	96	16	64	30
TOTAL LHC:	7	0	14	43	79	129	82	222	43	140	55

Data provided by respective collaborations.
Tevatron data as of June 2013; LHC data as of September 2013.

- **Since 2009,**
  - **Over 325 total U.S. PhD's awarded through mentorship from the LHC and Tevatron experiments, producing the next generation of innovators and leaders.**
  - **Over 930 publications in peer-reviewed scientific journals, providing important Energy Frontier science results to the HEP community.**

Energy Frontier: Physics and Machines

- **Energy Frontier (EF) addresses questions across a comprehensive and broad range of topics studied at colliders** *(see R. Brock's Aug. 6, 2013 Snowmass Summary talk for details)*

Physics Topics/Areas	Origin of EWSB	Origin of Flavor	ν mass	Origin of Matter	Inflation	Strong CP	Naturalness	New Spacetime	Unification	New Forces	Elementary?	Dark Matter
Higgs Boson	✓			✓			✓		✓	✓	✓	✓
EW Physics	✓						✓		✓	✓	✓	
Top Quark	✓	✓					✓			✓	✓	
QCD Physics				✓		✓			✓		✓	
NP/Flavor	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

- **Present machines and future proposed enablers advance our knowledge across each of these physics areas & organizational "groups": Higgs, Electroweak, Top, QCD, and New Physics/Flavor**

	LHC 100/fb (Run 2)	LHC 300/fb	LHC 3/ab	ILC 250/500	ILC 1 TeV	CLIC >1 TeV	Muon Collider	TLEP	VLHC
	yrs beyond TDR	TDR	LOI	TDR	TDR	CDR			
Status: DOE EF Prgm.	High Priority	CD-1	—— Need further guidance from Snowmass/P5 Process ——						

Energy Frontier Program Status

Fermilab Tevatron (DØ and CDF)

- Working with DØ and CDF collaborations on completion of **legacy** analyses as part of its ramp-down research program
  - most effort completed in FY13 and FY14
  - final papers (*e.g.*, $M_W^{Tevatron}$): FY15

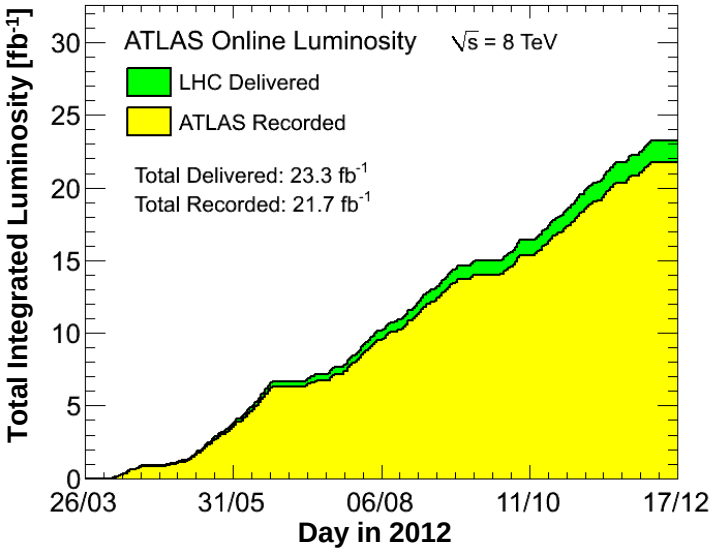
Large Hadron Collider (LHC) at CERN

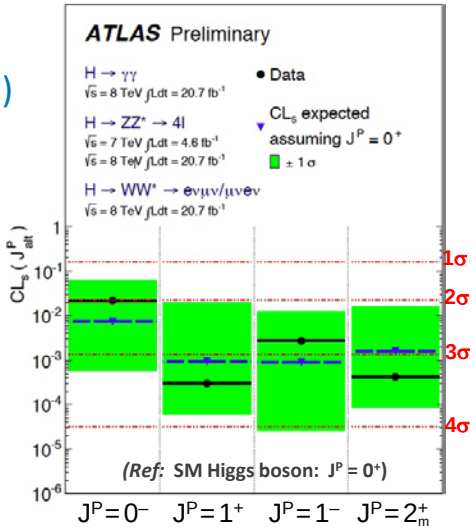
- **Run 1 (proton) completed in Dec. 2012**
- Working with experiments to execute plan for U.S. contributions to "Phase-1" [2018] upgrades
  - CD-0 approval: September 2012
  - CD-1 approval: October 17, 2013
    (CMS: $29.2M – 35.9M; ATLAS: $32.2M – 34.5M)

Current program

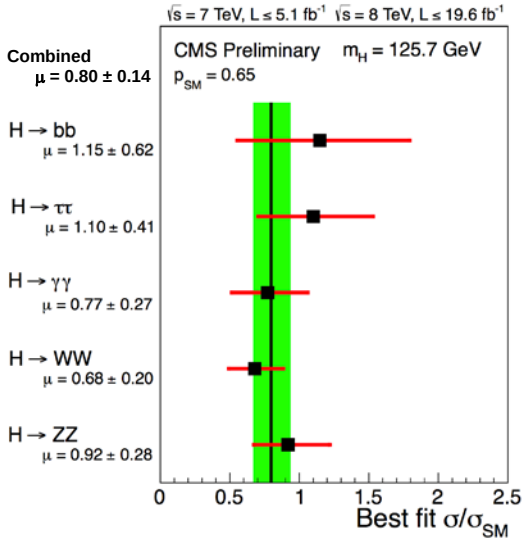
- Analyze and publish results from LHC Run 1
- 2013-2014 shutdown: repair splices in LHC magnets; detector maintenance and consolidation, upgrades and repairs
- In 2015: resume [Run 2] at 13~14 TeV: 100 fb^{-1}
  - Continue precision Higgs measurements
  - **Focus on new physics**

Completion of Run I; CMS & ATLAS recorded: ~22 fb^{-1}





ATLAS Spin-Parity
[Lepton-Photon 2013]



CMS Signal Strength
[Lepton-Photon 2013]

DOE Critical Decision (CD) Process

Project Timeline Plan

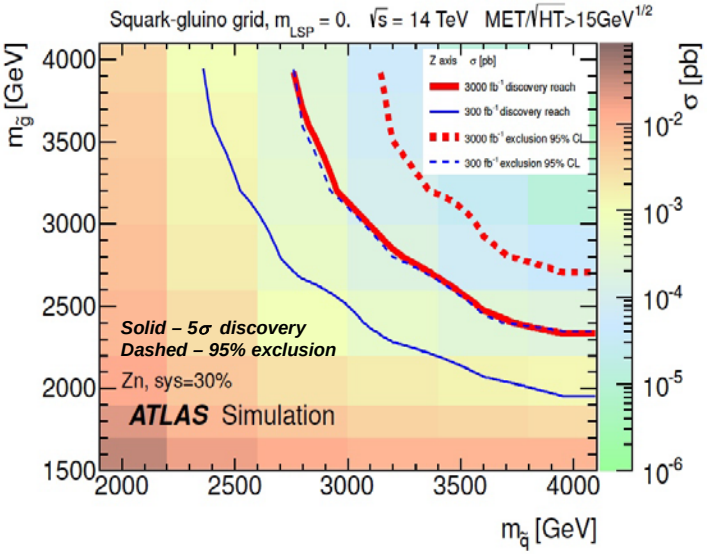
Project Phase:	Initiation	Definition	Execution	Execution	Transition/Closeout
		Selected Alternative & Approach is Optimum	Definitive Cost, Scope, Schedule	Ready for Implementation	Ready for turnover or to Operations
	CD-0 Approve Mission Need	CD-1 Approve Alternate Selection and Cost Range	CD-2 Approve Performance Baseline	CD-3 Approve Start of Construction	CD-4 Approve Start of Operation *or* Project Completion

Project (MIE/LIC)	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019
Daya Bay	CD-0		CD-1	CD-2/3a			CD-4a	CD-4b							
DES	CD-0			CD-1, 2/3a	CD-3b			CD-4							
NOvA		CD-0	CD-1	CD-2	CD-3a	CD-3b					CD-4				
BELLA				CD-0	CD-1/2a/3a	CD-2b/3b			CD-4						
FACET				CD-0	CD-1	CD-2/3		CD-4							
APUL					CD-0	CD-1	CD-2/3			CD-4					
LBNE					CD-0				CD-1		CD-3a	CD-2	CD-3b		
MicroBooNE					CD-0	CD-1	CD-2/3a	CD-3b			CD-4				
Mu2e						CD-0		CD-1		CD-2/3a	CD-3b				
LSST							CD-0	CD-1		CD-3a	CD-2				
Belle-II							CD-0	CD-1, 3a		CD-2/3b		CD-4			
DESI								CD-0		CD-1				CD-4	
DM-G2								CD-0		CD-1			CD-4		
ATLAS Upgrade*								CD-0		CD-1 →	CD-2/3				CD-4
CMS Upgrade*								CD-0		CD-1 →	CD-2/3				CD-4
Muon *g*-2								CD-0		CD-1				CD-4	

*Phase-1 Upgrades Only

Energy Frontier Research:
Next Steps and General Observations

- **LHC**
  - Discovery of a Higgs boson by ATLAS and CMS
    - ⇒ measure properties for consistency with SM: couplings, spin/parity
      - enhance our understanding of the particle
  - Publish physics results with $\sqrt{s}$ = 8 TeV data [Run I]
    - Higgs, top, and electroweak measurements
    - Search for new physics BSM: exotic particles, SUSY, …
    - QCD, heavy-flavor physics



- **… and steps in next ~5 years**
  - LHC will increase energy ($\sqrt{s}$ = 13~14 TeV) and luminosity (L > 10^{34} $cm^{-2}s^{-1}$) for 2015-2017 Run 2 (~100 fb^{-1}); and post-Phase-1: 2019-2021 Run 3 (~300 fb^{-1})
    - expand sensitivity reach for new physics
  - Phase-1 upgrade activities will mix with physics research-related efforts
    - proposals submitted to DOE are encouraged to address a *balanced* effort in both
- **Other general observations within DOE Energy Frontier program**
  - Encourage community to exploit and interact with LHC Physics Center (LPC, CMS) or Analysis Support Center (ASC, ATLAS)

Energy Frontier Planning & Issues

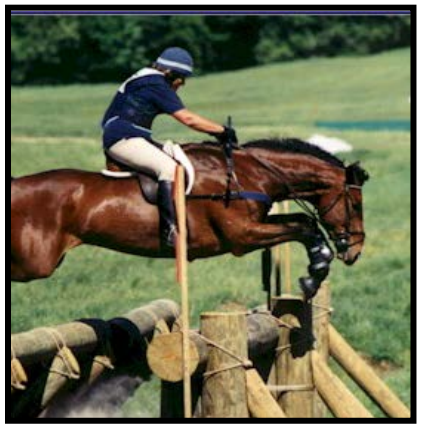
- **LHC is planned to be central component of the U.S. Energy Frontier program for next ~20 year**
  - **U.S. investments $\Rightarrow$ leading roles in the [global] LHC physics collaborations.**
  - **Energy Frontier science program will require high-energy, high-luminosity LHC running to explore new physics and new dynamics for W/Z, top, and Higgs at TeV energies**
  - **Ensure that U.S. scientists are at the forefront of full physics opportunities offered at the LHC**
- **Discussions with CERN about follow-on to LHC Agreement proceeding**
  - **Framework of an agreement currently under review at DOE**
  - **Necessary precursor to planning for "Phase-II" upgrades; U.S. scope for "Phase-II" TBD.**
- **Significant collaborations with other regions on future colliders will require a high-level approach between governments**
  - **Modest ground-level R&D efforts can continue as funding allows**
  - **We support an international process to discuss future HEP facilities that respects the interests of major national and regional partners as well as realistic schedule and fiscal constraints**
  - **Once P5 process is complete (~ early-Summer 2014), we will be in a better position to evaluate future U.S. priorities for the HEP program in detail**
- **In planning U.S. Energy Frontier science program—including LHC Phase-II and future colliders—Snowmass/P5 process is an important element, along with European & Japanese HEP strategies**

HEP BUDGETS

Budget Process: The Hurdles

#1 – Inside SC
(Feb. – April FY 201N)

- Each Associate Director (AD)-ship in DOE determines priorities within constraints of the funding guidance from the Director of Office of Science (SC).
- Each AD presents program priorities to Director of SC.
- The Director of SC determines program priorities within constraints of the funding guidance provided by DOE.



#2 – Inside DOE
(April – July FY 201N)

- The Director of SC and the DOE Assistant Secretaries present their program priorities to DOE.
- DOE determines overall agency priorities.
- SC prepares President's Budget. Each SC AD responsible for preparation of AD-ship budget.

#3 – OMB
(Aug. – Dec. FY 201N)

- DOE budget sent to OMB.
- Each AD defends program budget at OMB hearing in early September.
- OMB provides "Passback" guidance to DOE in late November.
- Discussions between DOE and OMB refine final budget.
- SC prepares President's Budget. Each SC AD responsible for preparation of AD-ship budget.

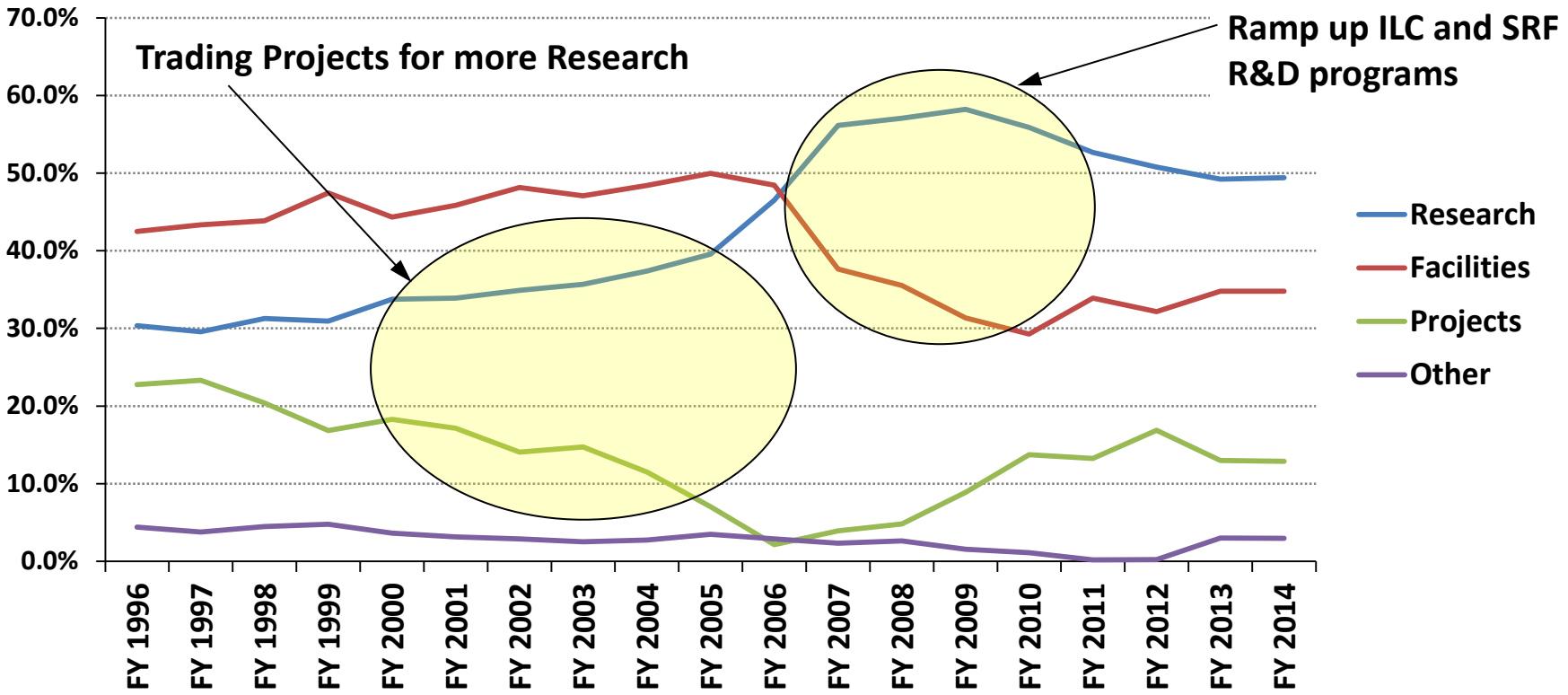
#4 – Congress
[February FY 201(N+1)]

- President's Budget presented to Congress.
  [Feb. – Sept. FY 201(N+1)]
- Agencies (e.g., DOE) present their budgets to Congress in formal hearings.
- Congress appropriates funding for 13 appropriations bills for FY 201(N+2), using the "President's Budget as a starting point for the Congressional Budget and appropriations."

FY14 HEP Budget Overview

- **Current FY2014 funding based on a CR until January 15, 2014 with FY2013 "bottom-line"**
  - In order to accommodate FY13 "sequestration" level ($748M), initial HEP FY14 "plan" is based on FY14 House Mark ($772M) with modifications of funds to certain projects (*i.e.,* Mu2e, LSST)
- **Original FY14 budget philosophy was to enable new world-leading HEP capabilities in the U.S. through investments on all three frontiers**
  - Accomplished through ramp-down Research and operations of existing Projects
  - When we were not able to fully implement this approach (*i.e.,* start new projects), converted planned project funds to R&D: Research → ~~Projects~~ → Research
    - Hence, the FY14 Request shows *increases* for Research that are due to this added R&D "bump", while Construction/MIE funding is only slightly increased
- **Impact of these actions:**
  - Several new efforts are delayed:
    - LHC detector upgrades, LBNE, 2nd Generation Dark Matter detectors, DESI
  - US leadership/partnership capabilities will be challenged by others
  - Workforce reductions at universities and labs
- **Key areas in FY14 Request**
  - Maintaining forward progress on new projects via Construction and Research (incl. R&D for projects) funding lines
- **Congressional response for FY14**
  - House and Senate Marks add $$$ for SURF Ops and LBNE (both houses) and accelerator stewardship (Senate). Senate adds $$$, House re-allocates within reduced bottom-line.

Recent Funding Trends



- In the late 90's the fraction of the budget devoted to projects was about 20%.
- The projects started in 2006 are coming to completion.
- Progress in many fields require new investments to produce new capabilities.
  - new investments are needed to continue U.S. leadership in well-defined research areas.
- Possibilities for future funding growth are weak. Must make do with what we have.

Notes on FY14 HEP Research Funding

- The FY 2014 [President's] Request for HEP Research was $384M, about a 6% increase compared to FY 2013, but $26 million of this is planned to go to R&D for Dark Matter G2, DESI, and LHC upgrades.
- Current FY 2014 planning is based on the House Markup of the Energy and Water Appropriation, which is overall slightly below the Request
  - The House mark directed HEP to move $8 million to LBNE Project Engineering & Design (PED), $2 million to SURF, and lower the *overall* HEP budget by $4 million.
  - Choice was made to take all of these reductions from Research due to our priority to increase Project spending.
- These two effects reduce Research to $343M → about a –5% reduction w.r.t. FY 2013
- At the beginning of the year, it is necessary to hold back funds for decisions to be made later in the year; *e.g.,* for Early Career Research Program and other needs.
  - Results in an *approximately –6% reduction* relative to FY 2013 for the initial distribution of funds. This is the average effect on initial HEP research funding.
- There is some small variation in the impact to individual HEP subprograms, and Program Managers have the authority to provide more or less than the average reduction based on program priorities and the results of merit review.
- The House mark is a "budget indicator" but not the final word on FY 2014.
  - When an appropriation for the *full-year* is determined by Congress, there could be either an increase or a decrease in HEP research funding.

FY 2014: House and Senate Marks

	Funding (in $K)			
	Ref: FY 2013	*Ref:* FY 2014 [President's] Request	FY 2014 House	FY 2014 Senate
Research, Operations, Projects	715,742	720,064	708,308	729,828
SURF (non-add)	14,000	10,000	12,000	15,000
Accelerator Stewardship (non-add)	3,132	9,931	—	20,000
SBIR/STTR	20,791	21,457	21,213	21,762
LBNE (Project Engineering & Design, PED)	3,781	—	8,000	20,000
Mu2e	8,000	35,000	35,000	35,000
Total, High Energy Physics:	748,314[(a)]	776,521	772,521	806,590

SBIR = Small Business Innovation Research
STTR = Small Business Technology Transfer

[(a)] Includes $20,791,000 for SBIR/STTR, allocated eventually to SBIR/STTR office upon approval of FY13 appropriation; FY13 Total also reflects sequestration, enacted March 1, 2013.

FY 2014 High Energy Physics Budget

(Data in new structure, dollars in thousands)

Description	FY 2012 Actual	FY 2013 Plan	FY 2014 Request	Explanation of Change [FY14 Request *vs.* FY13]
Energy Frontier Exp. Physics	159,997	148,164	154,687	Ramp-down of Tevatron Research
Intensity Frontier Exp. Physics	283,675	287,220	271,043	Completion of NOνA (MIE), partially offset by Fermi Ops
Cosmic Frontier Exp. Physics	71,940	78,943	99,080	Ramp-up of LSST-Camera
Theoretical and Computational Physics	66,965	66,398	62,870	Continuing reductions in Research
Advanced Technology R&D	157,106	131,885	122,453	Completion of ILC R&D
Accelerator Stewardship	2,850	3,132	9,931	FY14 includes Stewardship-related Research
SBIR/STTR	0	0	21,457	FY12 and FY13 to SBIR/STTR office.
Construction (Line-Item)	28,000	11,781	35,000	Mostly Mu2e; no LBNE ramp-up
Total, High Energy Physics:	**770,533**[a]	**727,523**[b,c]	**776,521**	**wrt FY13: Up +3.6% after SBIR correction** **wrt FY12: Down -2% after SBIR correction**
***Ref:* Office of Science (SC):**	**4,873,634**	**4,621,075**[c]	**5,152,752**	

SBIR = Small Business Innovation Research
STTR = Small Business Technology Transfer

[a] **The FY 2012 Actual is reduced by $20,327,000 for SBIR/STTR.**

[b] **The FY 2013 [Plan] is reduced by $20,791,000 for SBIR/STTR.**

[c] **Reflects sequestration.**

HEP Energy Frontier

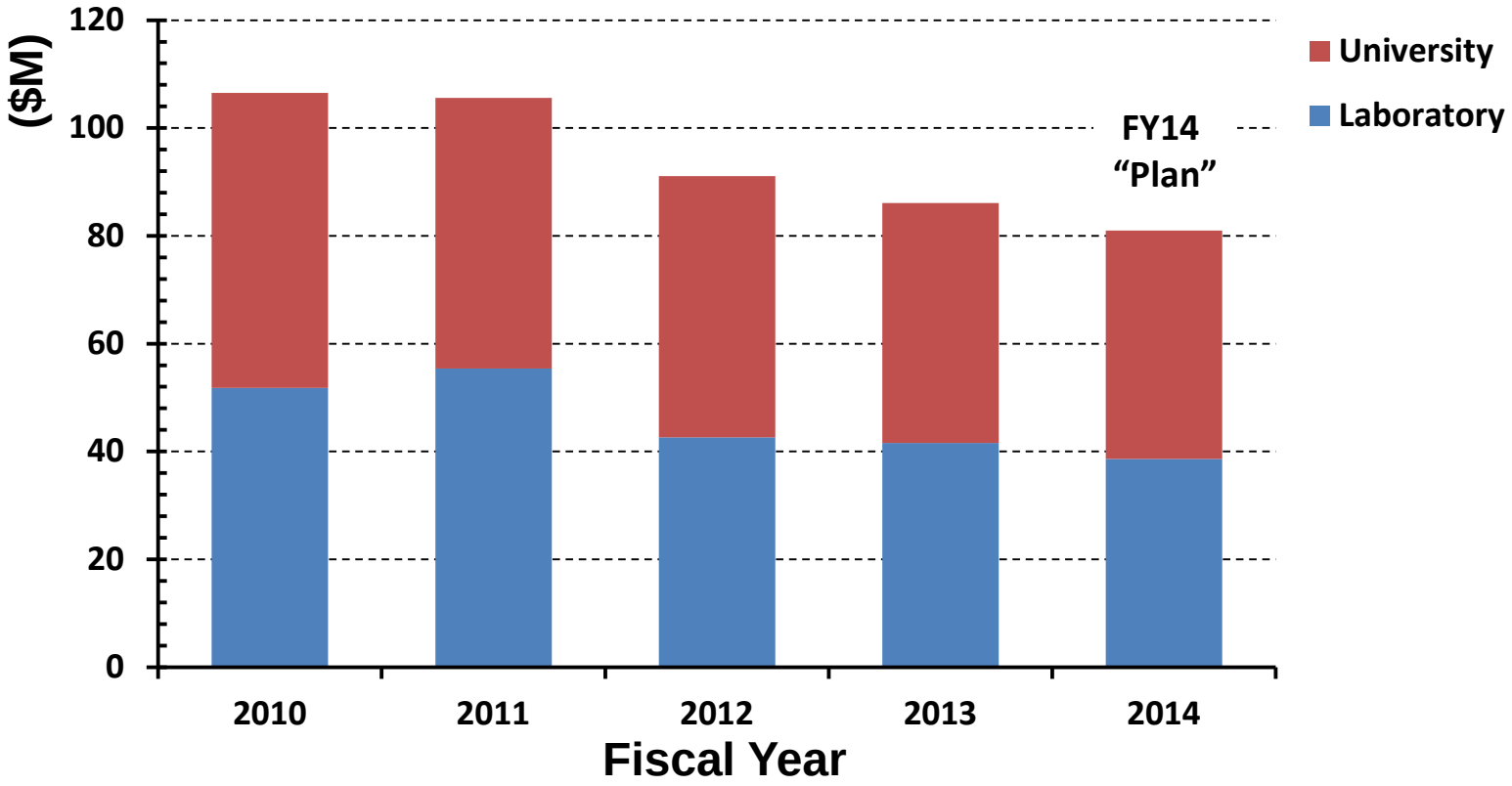
Funding (in $K)	FY 2012 Actual	FY 2013 Actual	FY 2014 Request	Comments
1) Research	**91,757**	**86,172**	**96,129**	Tevatron ramp-down offset by R&D for LHC detector upgrades
2) Facilities	**68,240**	**61,992**	**58,558**	
LHC Detectors: Ops	64,846[(a)]	56,912	56,774	LHC down for maintenance
LHC Upgrades: Project	0	3,000	0	LHC detector upgrades (OPC)
Other	3,394	2,080	1,784	IPAs, Detailees, Reviews
TOTAL, Energy Frontier:	**159,997**	**148,164**	**154,687**	

[(a)] **Per interagency MOU, HEP provided LHC Detector Ops funding during FY12 CR to offset NSF contributions to Homestake de-watering activities.**

OPC = Other Project Costs

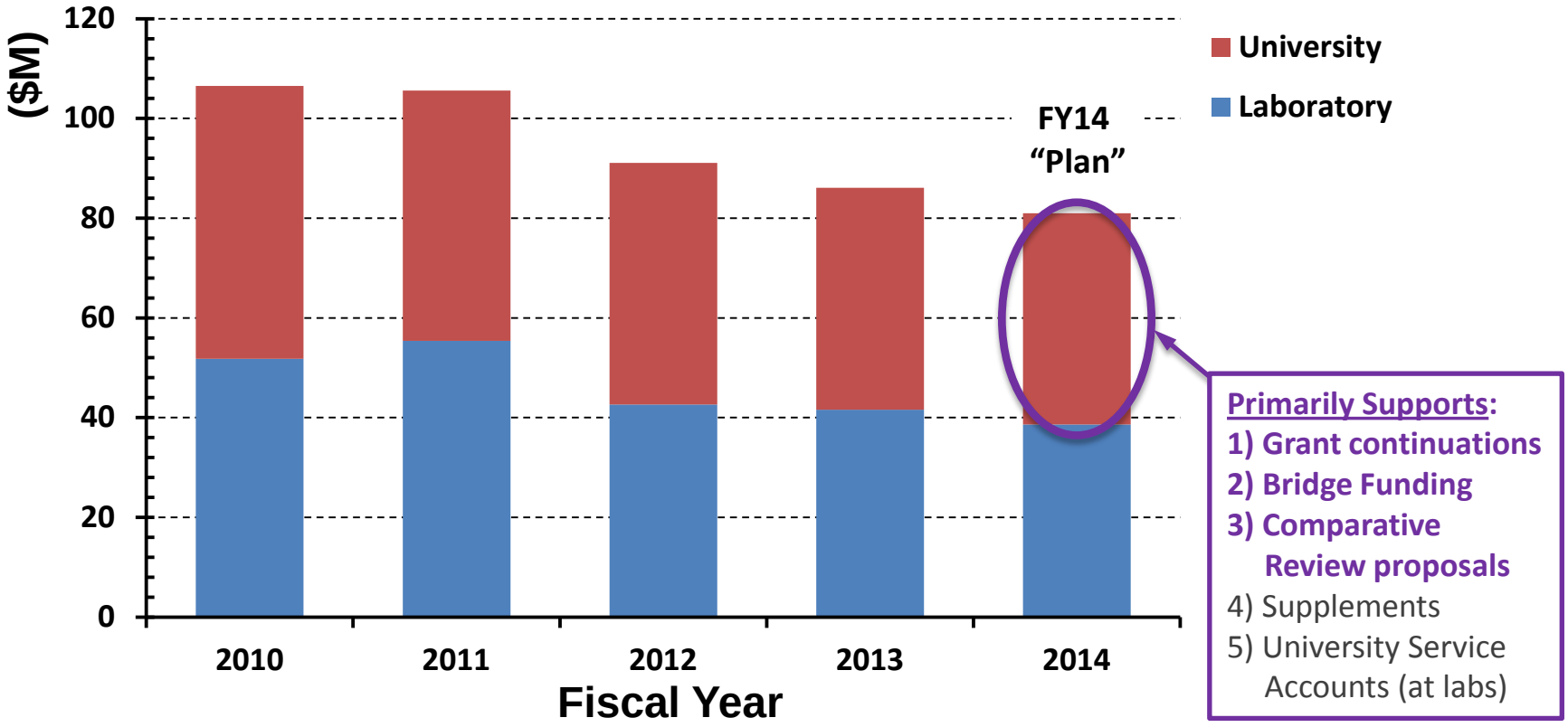
- **FY14 President's Request**
  - **Includes $12M (= $6M CMS + $6M ATLAS) for Phase-1 detector upgrades [R&D]**
  - **Energy Frontier core research in FY14 Request = $84,129k**
- **But, FY14 Energy Frontier "initial plan" is based on House mark at $93,002k**
  - **Retains $12M towards Phase-1 detector upgrades [R&D]**
  - **$81,002k towards Energy Frontier core research**
    - **FY14 research sees reduction of ~6% relative to FY13 Actual, applied equally to all Frontiers**

Energy Frontier Research Budget



- FY12 and FY13 core research budget saw reductions relative to previous years
  - driven by completion of Tevatron run [September 2011] and subsequent end-game of Tevatron physics program
- FY14 plan is to give priority to university 2nd, 3rd year grant continuations and HEP comparative review process as well as to support national laboratories

Energy Frontier Research Budget



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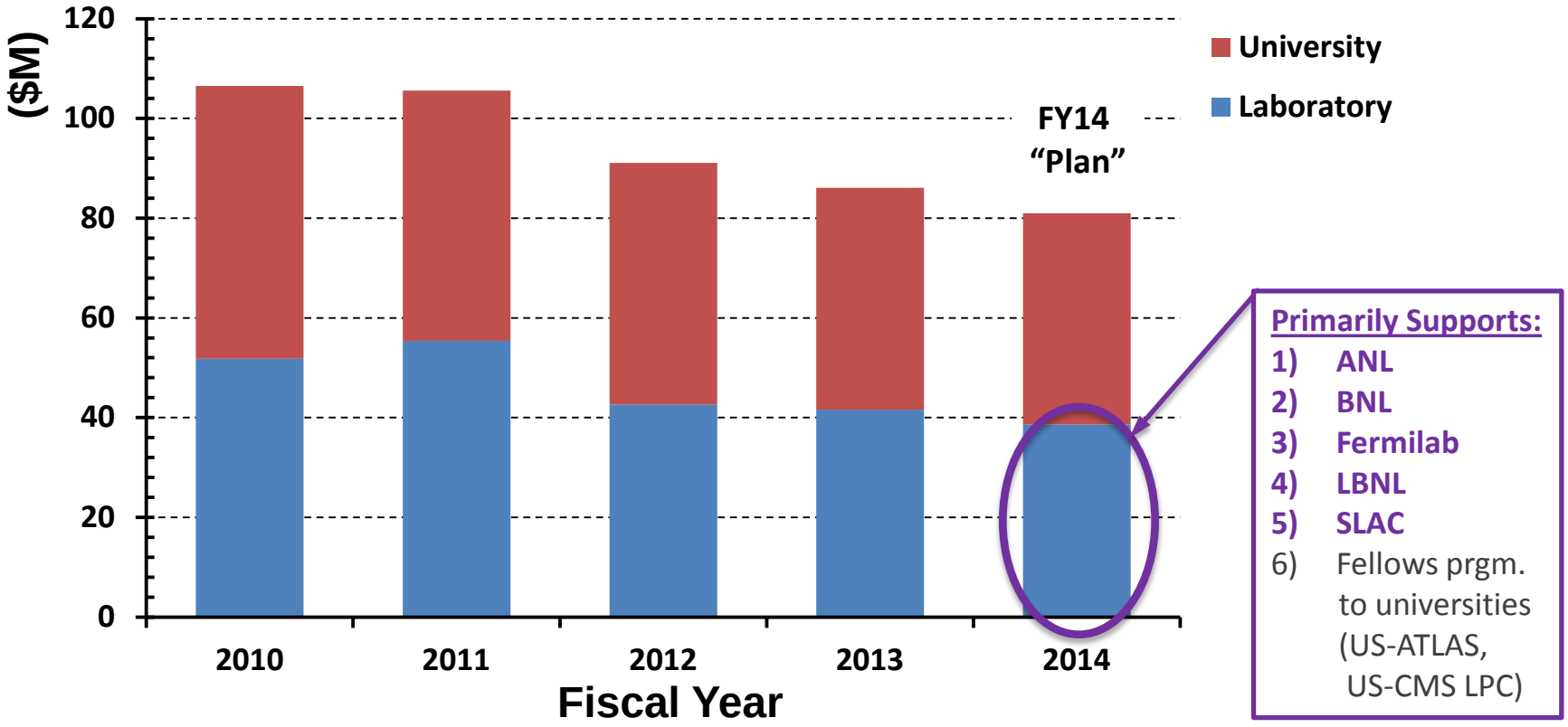
Energy Frontier Research Budget



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Major Item of Equipment (MIE) Issues

- **We were not able to implement [most] new MIE-fabrication starts in the FY14 request**
  - **Muon *g*-2 experiment is the only new start in HEP that was not requested in FY13**
  - **LSST-Camera and Belle-II, which didn't receive approval in FY13, were requested again in FY14**


Brookhaven National Laboratory
Muon g-2 Ring: On Barge, Departing Southern Long Island
June 25, 2013


On Barge, Through Joliet Locks; July 20, 2013


Entering Fermilab-site, Eola Rd. Gate; July 26, 2013

- **This upsets at least 2 major features of our budget strategy:**
  - **Strategic plan: "Trading Research for Projects"**
  - **Implementation of facilities balanced across Frontiers**

COMMENTS ON PARTICLE PHYSICS PROJECT PRIORITIZATION PANEL (P5): PROCESS

Snowmass / P5 Interface

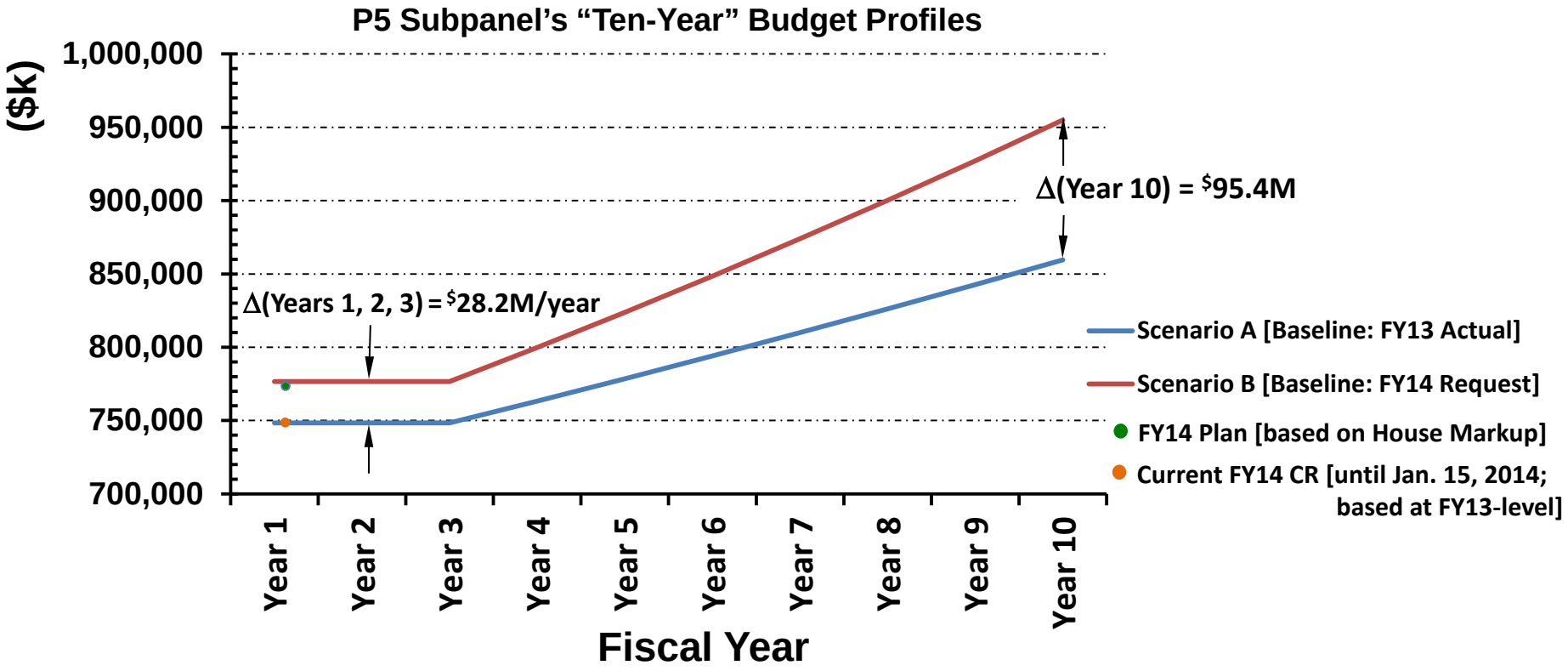
- **What we hoped to see from Snowmass 2013:**
  - ✓ **What are the most compelling science questions in HEP that can be addressed in the next 10 to 20 years and why?**
  - ✓ **What are the primary experimental approaches that can be used to address them?**
    - **are they likely to answer the question(s) in a "definitive" manner *or* will follow-on experiments be needed?**
  - ✓ **What are the "hard questions" (science, technical) that a given experiment or facility needs to answer to respond to perceived limitations in its proposal?**

- **These topics are covered in the Snowmass reports and White Papers**
  - **P5 will use these reports and white papers as its starting point.**
  - **Draft Summary Working Group Reports available on the P5 webpage: *http://www.usparticlephysics.org/p5***

P5 Considerations

- **P5 will assess and prioritize HEP projects over a 20-year timeframe within reasonable budget assumptions and position the U.S. to a be a leader in some (but not all) areas of HEP.**
  - **Identify priorities with 10-year budget profiles but may well extend past the next decade**
    - **consider technical feasibility as well as fiscal plausibility of future projects that can be executed in a 20-year timescale.**
  - **This will include an explicit discussion of the necessity (or not) of domestic HEP facilities in order to maintain such a world leadership position.**
  - **Consideration of possible international partnerships will be required.**
  - **Among other factors, any developed plan should include a full understanding of the nature of physics to be explored at the LHC.**
- **Final P5 report due by May 1, 2014.**
- **The charge to P5 does NOT include explicit examination of**
  - **DOE agency review processes**
    - **addressed by separate HEP Committee of Visitors (COV) process completed in Oct. 2013, report due to HEPAP by December 2013 meeting.**
  - **Roles, responsibilities and funding of labs *vs.* universities**
  - **Relative funding of experimental HEP *vs.* theory *vs.* technology R&D**
- **Working with HEPAP Chair to address some of these issues by HEPAP in the future.**
- **More on P5 to follow in S. Ritz [P5 Chair] talk… *later this meeting*.**

P5 Charge: Budget Scenarios



- **Prioritize an optimized HEP program under 10-year HEP budget profiles: FY 2014 – 2023 period**
  - **Scenario A: FY 2013 budget baseline: flat for 3 years, then +2% per year.**
  - **Scenario B: FY 2014 President's budget request baseline: flat for 3 years, then +3% per year.**
    - **difference between Scenarios A and B integrated over the 10-year period: ~$540M**
  - **Scenario C *(not shown in above plot)*: Unconstrained budget scenario.**

P5 Charge: Budget Scenarios (Notes)

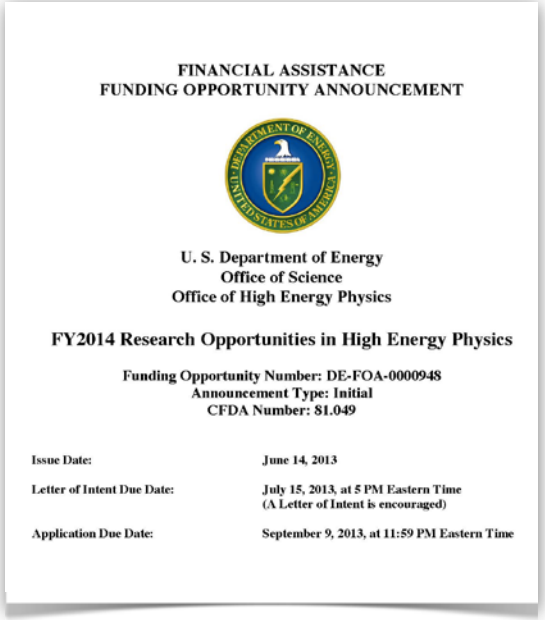
- ***Ref.:*** **10-year HEP budget profiles for P5: FY 2014 – 2023 period**
  - **Scenario A: FY 2013 budget baseline: flat for 3 years, then +2% per year.**
  - **Scenario B: FY 2014 President's budget request baseline: flat for 3 years, then +3% per year.**
  - **Scenario C *(not shown in above plot)*: Unconstrained budget scenario**
    - **Beyond A and B, prioritize *"… specific activities … … needed to mount a leadership program addressing the scientific opportunities identified by the research community."***

- **For budget guidance to P5, some specific language in the charge:**
  - ***"… need to understand the priorities, options, impacts and scientific deliverables for the U.S. program under more stringent budgets than were considered by the previous P5 panel."***
  - ***"… consider these scenarios not as literal budget guidance but as an opportunity to identify priorities and make high-level recommendations."***
  - ***"… budget scenarios should not drive the prioritization to the degree that projects are promoted solely for their ability to fit within an assumed profile."***
  - ***"[P5] report should articulate the scientific opportunities which can and cannot be pursued and the approximate overall level of support that is needed in the HEP core research and advanced technology R&D programs to achieve these opportunities in the various scenarios."***

HEP
FY2014
FUNDING OPPORTUNITIES

Funding Opportunity Announcements (FOA)

1) **DE-FOA-0000948, application deadline: Sept. 9, 2013**
   - FY14 HEP Comparative Review for universities
   - FOA now "closed" for proposals
- Research in six HEP subprograms
   - Energy, Intensity, and Cosmic Frontiers
   - HEP Theory, Accelerator Science and Technology R&D, and Particle Detector R&D
- Expect new FOA issued ~ mid-June 2014 for FY15



FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT

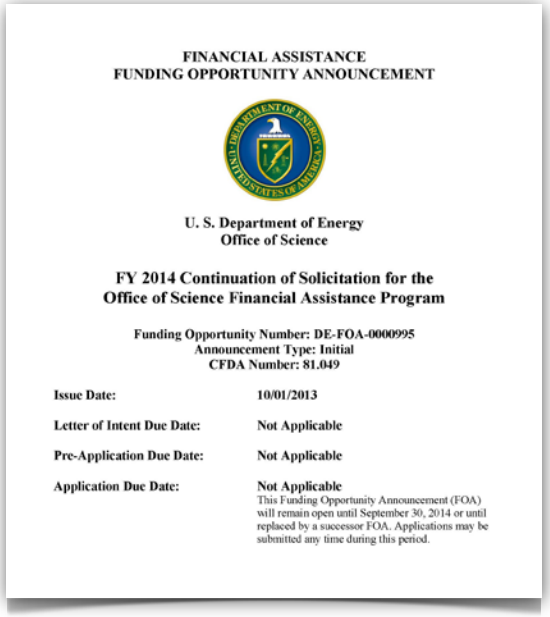
U. S. Department of Energy
Office of Science
Office of High Energy Physics

FY2014 Research Opportunities in High Energy Physics

Funding Opportunity Number: DE-FOA-0000948
Announcement Type: Initial
CFDA Number: 81.049

Issue Date:	June 14, 2013
Letter of Intent Due Date:	July 15, 2013, at 5 PM Eastern Time (A Letter of Intent is encouraged)
Application Due Date:	September 9, 2013, at 11:59 PM Eastern Time

2) **DE-FOA-0000995, application deadline: Sept. 30, 2014**
   - General SC open solicitation
   - FOA "open" for FY14: supplement proposals in HEP
- Research in seven HEP subprograms
   - Energy, Intensity, and Cosmic Frontiers
   - HEP Theory, Accelerator Science and Technology R&D, Particle Detector R&D, and Computational Research
- Generally, proposals will have lower priority than those submitted to comparative review process
- Info available at: *http://science.energy.gov/hep/funding-opportunities/*



FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT

U. S. Department of Energy
Office of Science

FY 2014 Continuation of Solicitation for the
Office of Science Financial Assistance Program

Funding Opportunity Number: DE-FOA-0000995
Announcement Type: Initial
CFDA Number: 81.049

Issue Date:	10/01/2013
Letter of Intent Due Date:	Not Applicable
Pre-Application Due Date:	Not Applicable
Application Due Date:	Not Applicable This Funding Opportunity Announcement (FOA) will remain open until September 30, 2014 or until replaced by a successor FOA. Applications may be submitted any time during this period.

Early Career (EC): Next Round in FY14

- **FY14 FOA [DE-FOA-0000958] posted on July 23, 2013 at the Early Career website:**
  - http://science.energy.gov/early-career/
- **Read the FY14 FAQ, also on above web site**
  - addresses most of the common Q&A collected over the last 4 years
- **Features of FY14**
  - Entering 5th year
    - some population of candidates will no longer be eligible due to the "3-strikes rule"
  - Mandatory Pre-application requirement. Two pages.
    - Deadline: September 5, 2013, 5 PM Eastern ☑ deadline passed
    - DOE/HEP received 94 pre-proposals (up from FY2013).
  - Full proposal due (soon): November 19, 2013, 5 PM Eastern
    - since the announcement, candidates will have had 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/

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?"
  - Somewhat speculative but not too risky
  - Provide unique capabilities. What does not get done?
- Given size of LHC experiments and physics groups, many LHC proposals suffered from comment: *"isn't the experiment going to do that anyway?"*
  - Guidance to PIs submitting future proposals is to stress how the PI is critical to performing research
- In experimental HEP proposals that are submitted to ECRP FOA
  - Looking for a *balanced* program
    - strong physics effort and hardware project attached to an experiment (*e.g.,* Phase-1 upgrades for LHC)
- Prior to submission, applicants are encouraged to seek guidance from senior faculty and/or staff while preparing proposals (including budget material)

EC Recipients: Energy Frontier

FY10

"Model-Independent Dark-Matter Searches at the ATLAS Experiment and Applications of Many-core Computing to High Energy Physics"

— Dr. Amir Farbin (ATLAS Experiment)
University of Texas, Arlington

"Diamond Pixel Luminosity Telescopes"

— Dr. Valerie Halyo (CMS Experiment)
Princeton University

"Enhancing the LHC Discovery Potential with Jets, Missing E_T, and bit -tagging Physics Signature Reconstruction in ATLAS"

— Dr. Ariel Schwartzman (ATLAS Experiment)
SLAC National Accelerator Laboratory

FY11

"Taus and the Trigger for Discovery at ATLAS"

— Dr. Sarah Demers (ATLAS Experiment)
Yale University

"Precision Physics and Searches with Top and Bottom Quarks"

— Dr. Aran Garcia-Bellido (CMS Experiment)
University of Rochester

"Enhancement of the Trigger Capability for New Physics at the Large Hadron Collider"

— Dr. Jinlong Zhang (ATLAS Experiment)
Argonne National Laboratory

FY12

"Search for New Physics and Upgrade of the Muon Spectrometer at ATLAS"

— Dr. Junjie Zhu (ATLAS Experiment)
University of Michigan, Ann Arbor

FY13

"Quest for a Top Quark Partner and Upgrade of the Pixel Detector Readout Chain at the CMS"

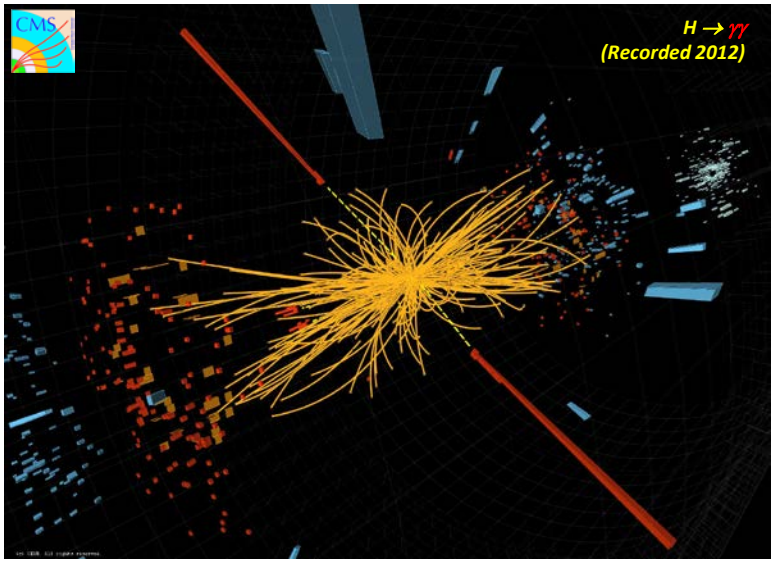
— Dr. Andrew Ivanov (CMS Experiment)
Kansas State University

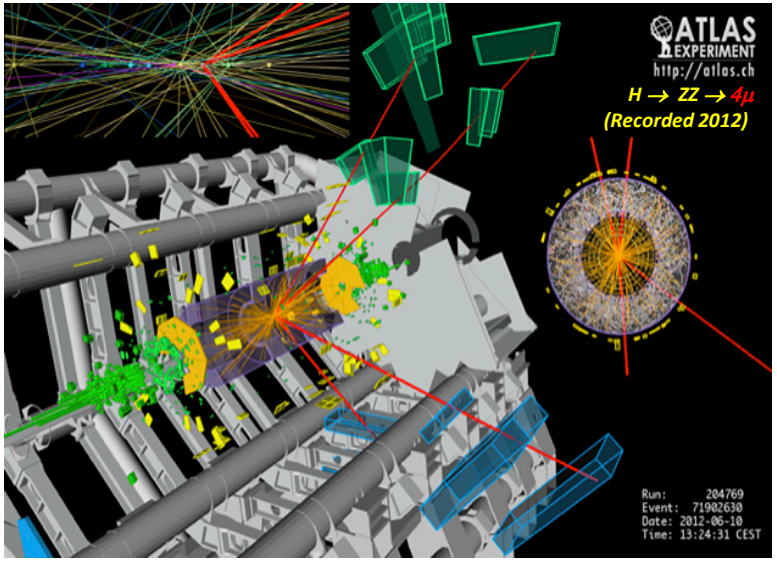
"Search for the Higgs and Physics Beyond the Standard Model with the CMS Electromagnetic Calorimeter"

— Dr. Toyoko J. Orimoto (CMS Experiment)
Northeastern University

Closing Remarks

- U.S. HEP program is following the strategic plan laid out by the previous [2008] HEPAP/P5 studies
- Though some boundary conditions have changed, we are still trying to implement that plan within the current constraints
  - FY 2014 budgets generally support this, though funding constraints have led to delays in some key projects (*e.g.,* LHC Phase-1 upgrades)
  - Need to maintain progress with projects currently "on the books"
  - Working to attract partnerships that will extend the science impact
- Engaged with community in developing new HEP strategic plan
  - Outstanding work done by the HEP community on Snowmass studies and active participation
  - Important for active participation in upcoming P5 Face-to-Face and Town-Hall meetings
    - Dec. 2-4 at SLAC: Cosmic Frontier topics: dark energy, dark matter, CMB, etc…
    - Dec. 15-18 at BNL: Energy Frontier, Detector and Accelerator R&D topics: includes LHC upgrades, future colliders, etc…





REFERENCE SLIDES

Office of

High Energy Physics

Fundamental

to the

Frontiers of

Discovery

HEP's Mission:

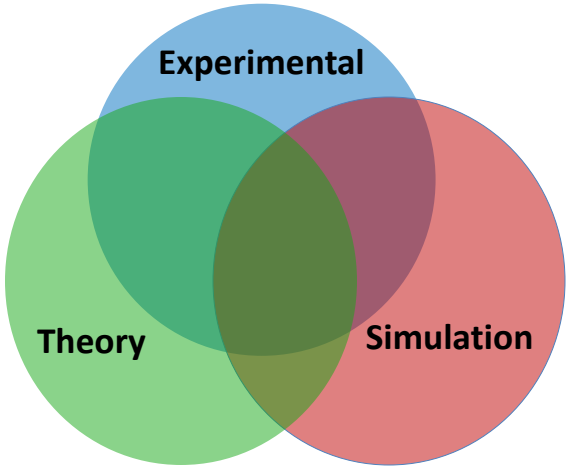
To explore the most fundamental questions about the nature of the universe at the Cosmic, Intensity, and Energy Frontiers of scientific discovery, and to develop the tools and instrumentation that expand that research.

HEP seeks answers to Big Questions:

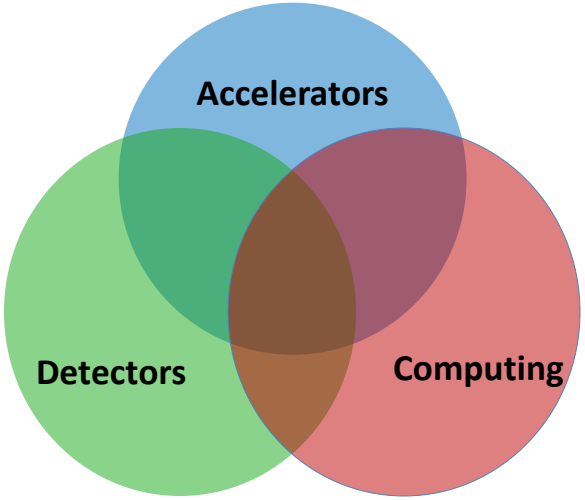
How does mass originate?
Why is the world matter and not anti-matter?
What is dark energy? Dark matter?
Do all the forces become one and on what scale?
What are the origins of the Universe?

HEP offers high-impact research opportunities from small-scale to large international collaborations at each of the three HEP Frontiers.
More than 20 physicists supported by the Office of High Energy Physics have received the Nobel Prize.

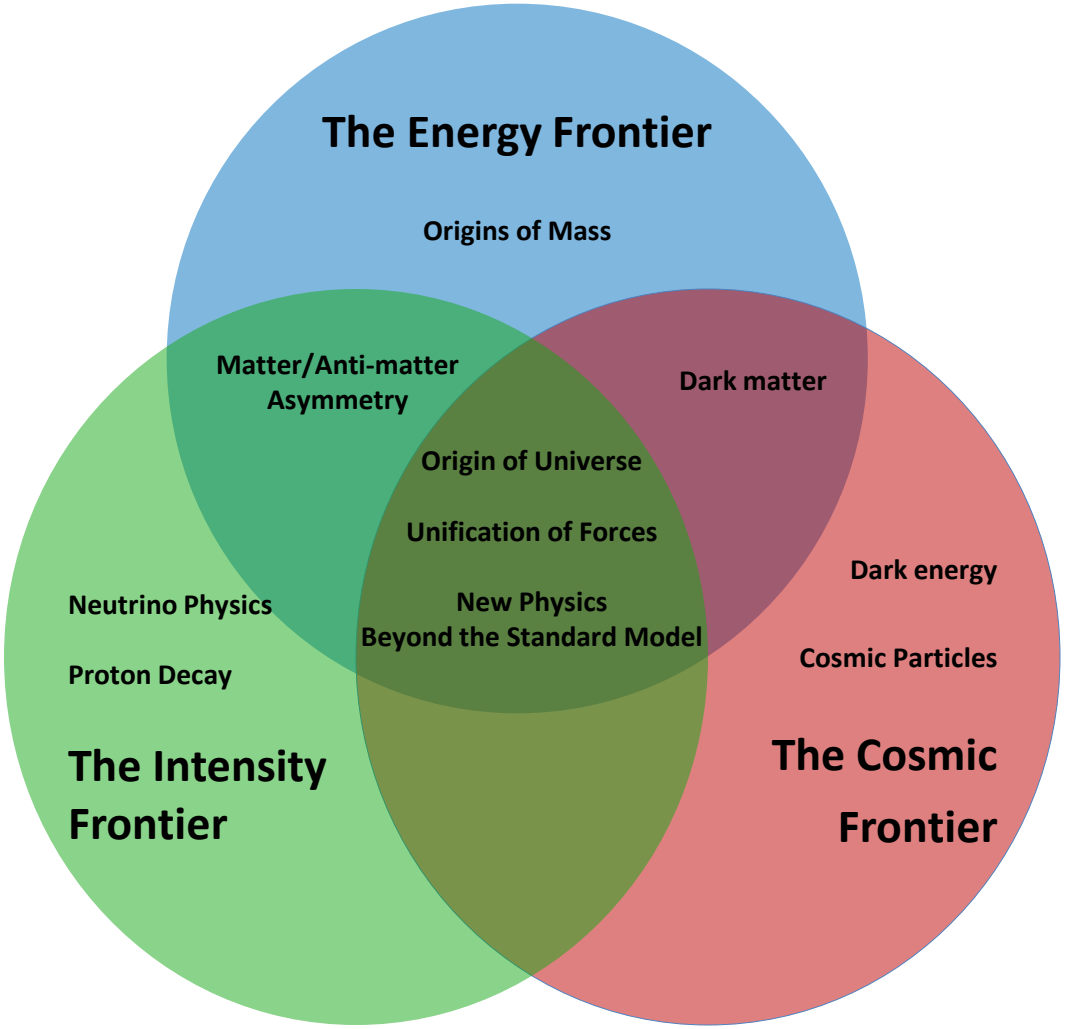
HEP Physics and Technology



Along Three Paths



Enabled by
Advanced Technologies



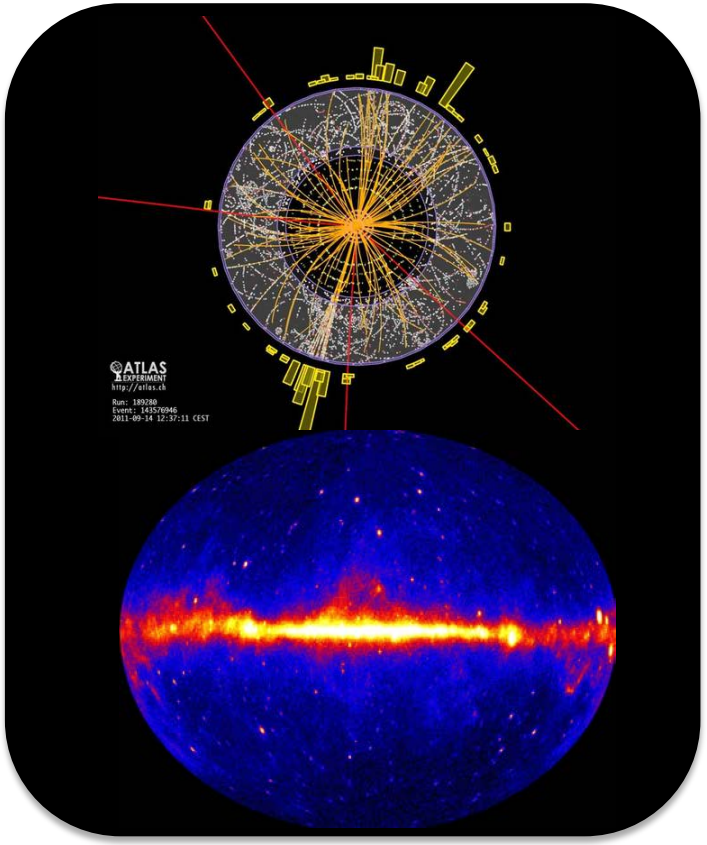
Physics Frontiers

From Deep Underground to the Tops of Mountains, HEP pushes the Frontiers of Research

Research at the Energy Frontier — HEP supports research where powerful accelerators such as the LHC are used to create new particles, reveal their interactions, and investigate fundamental forces, and where experiments such as ATLAS and CMS explore these phenomena.

Research at the Intensity Frontier — Reactor and beam-based neutrino physics experiments such as Daya Bay and LBNE may ultimately answer some of the fundamental questions of our time: why does the Universe seem to be composed of matter and not anti-matter?

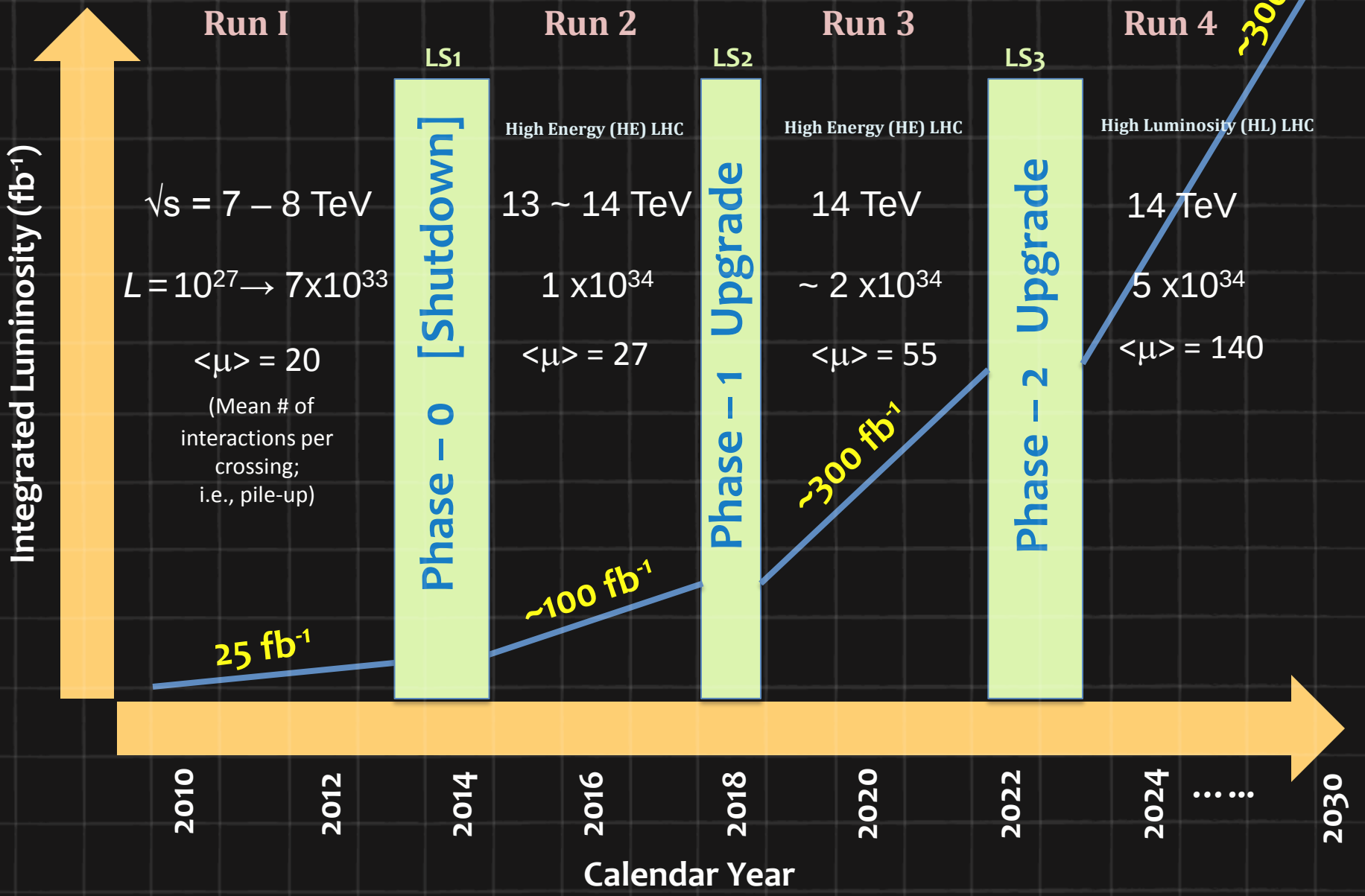
Research at the Cosmic Frontier — Through ground-based telescopes, space missions, and deep underground detectors, research at the cosmic frontier aims to explore dark energy and dark matter, which together comprise approximately 95% of the universe.



Theory and Computation — Essential to the lifeblood of High Energy Physics, the interplay between theory, computation, and experiment drive the science forward. Computational sciences and resources enhance both data analysis and model building.

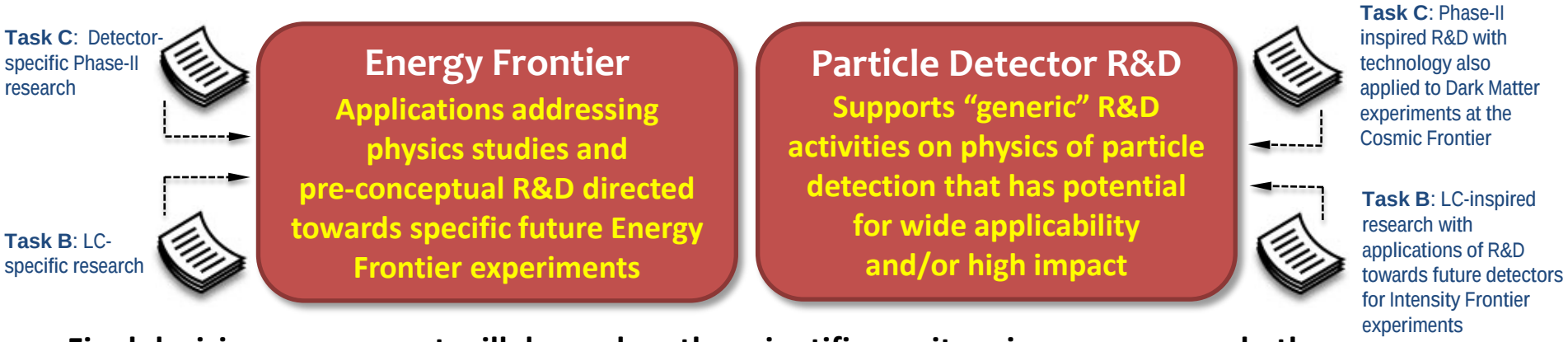
Accelerator Science — Supports R&D at national labs and universities in beam physics, novel acceleration concepts, beam instrumentation and control, high gradient research, particle and RF sources, superconducting magnets and materials, and superconducting RF technology.

The LHC Forecast



Future Lepton Colliders and LHC Phase-II

- **Guidance for proposals on e.g., future lepton colliders (LC) and/or LHC Phase-II detector upgrades**
  - **General approach to such R&D proposals, where LC and Phase-II are common examples**
  - **Proposals in such research areas may be submitted in addition to a group's research activities on one of the LHC experiments (CMS or ATLAS)**
  - **If so, proposals encouraged to address project narrative separately – one for each research area as part of an "umbrella" proposal on multiple research tasks**
    - ***for e.g.,* Task A devoted to ATLAS research efforts, Task B on LC, etc…**
    - **as specified in Section IV of FOA, list all PIs and budget info for *each* area in the 'Cover Page Supplement for Proposals with Multiple Research Areas or Thrusts' material of the proposal**
    - **proposal must comply with all FOA requirements, including page limits**
  - **Detector R&D may support some level of engineering/M&S whereas Energy Frontier typically does not**
  - **Depending on scope of work described in these tasks, DOE Program Managers will assess which Panel (*i.e.,* Energy Frontier or Particle Detector R&D) to solicit reviews**



- **Final decisions on support will depend on the scientific merit review process, and other programmatic and budgetary factors**

Planning

- **HEP is putting in place a comprehensive program across the frontiers**
  - **In five years,**
    - **The CMS and ATLAS upgrades will be installed at CERN**
    - **NOνA, Belle-II, Muon g-2 will be running on the Intensity Frontier**
    - **Mu2e will be in commissioning, preparing for first data**
    - **DES will have completed its science program and new mid-scale dark energy spectroscopic instrument and DM-G2 should begin operation**
    - **The two big initiatives, LSST and LBNE, will be well underway**
- **Need to start planning now for what comes next**
  - **Engage with DPF community planning process – [Snowmass] that concluded this summer**
  - **Set up a prioritization process – [á la P5] using that as input**
- **Research funding will decrease each year for the next few years**
  - **Programmatic priorities and comparative reviews will be used to optimize the resources**
  - **See also 'Budget' slides, this talk…**
- **Both the universities and the laboratories will be affected**
  - **University Comparative Reviews (held annually each ~Fall)**
  - **Lab Comparative Reviews in: Detector R&D (July 2012); Energy Frontier (July 2012); Accelerator Science (March 2013); Intensity Frontier (May 2013); Cosmic Frontier (this Sept.)**

HEP Intensity Frontier Experiments

Experiment	Location	Status	Description of Science	#US Inst.	#US Coll.
Belle II	KEK, Tsukuba, Japan	Physics run 2016	Heavy flavor physics, CP asymmetries, new matter states	10 Univ., 1 Lab	55
CAPTAIN	Los Alamos, NM, USA	R&D; Neutron run 2015	Cryogenic apparatus for precision tests of argon interactions with neutrinos	5 Univ., 1 Lab	20
Daya Bay	Dapeng Penisula, China	Running	Precise determination of θ_{13}	13 Univ., 2 Lab	76
Heavy Photon Search	Jefferson Lab, Newport News, VA, USA	Physics run 2015	Search for massive vector gauge bosons which may be evidence of dark matter or explain g-2 anomaly	8 Univ., 2 Lab	47
K0TO	J-PARC, Tokai , Japan	Running	Discover and measure $K_L \rightarrow \pi^0 \nu\nu$ to search for CP violation	3 Univ.	12
LArIAT	Fermilab, Batavia, IL	R&D; Phase I 2013	LArTPC in a testbeam; develop particle ID & reconstruction	11 Univ., 3 Lab	38
LBNE	Fermilab, Batavia, IL & Homestake Mine, SD, USA	CD1 Dec 2012; First data 2023	Discover and characterize CP violation in the neutrino sector; comprehensive program to measure neutrino oscillations	48 Univ., 6 Lab	336
MicroBooNE	Fermilab, Batavia, IL, USA	Physics run 2014	Address MiniBooNE low energy excess; measure neutrino cross sections in LArTPC	15 Univ., 2 Lab	101
MINERνA	Fermilab, Batavia, IL, USA	Med. Energy Run 2013	Precise measurements of neutrino-nuclear effects and cross sections at 2-20 GeV	13 Univ., 1 Lab	48
MINOS+	Fermilab, Batavia, IL & Soudan Mine, MN, USA	NuMI start-up 2013	Search for sterile neutrinos, non-standard interactions and exotic phenomena	15 Univ., 3 Lab	53
Mu2e	Fermilab, Batavia, IL, USA	First data 2019	Charged lepton flavor violation search for $\mu N \rightarrow eN$	15 Univ., 4 Lab	106
Muon g-2	Fermilab, Batavia, IL, USA	First data 2016	Definitively measure muon anomalous magnetic moment	13 Univ., 3 Lab, 1 SBIR	75
NOνA	Fermilab, Batavia, IL & Ash River, MN, USA	Physics run 2014	Measure ν_μ-ν_e and ν_μ-ν_μ oscillations; resolve the neutrino mass hierarchy; first information about value of δ_{cp} (with T2K)	18 Univ., 2 Lab	114
ORKA	Fermilab, Batavia, IL, USA	R&D; CD0 2017+	Precision measurement of $K^+ \rightarrow \pi^+ \nu\nu$ to search for new physics	6 Univ., 2 Lab	26
Super-K	Mozumi Mine, Gifu, Japan	Running	Long-baseline neutrino oscillation with T2K, nucleon decay, supernova neutrinos, atmospheric neutrinos	7 Univ.	29
T2K	J-PARC, Tokai & Mozumi Mine, Gifu, Japan	Running; Linac upgrade 2014	Measure ν_μ-ν_e and ν_μ-ν_μ oscillations; resolve the neutrino mass hierarchy; first information about value of δ_{cp} (with NOνA)	10 Univ.	70
US-NA61	CERN, Geneva, Switzerland	Target runs 2014-15	Measure hadron production cross sections crucial for neutrino beam flux estimations needed for NOνA, LBNE	4 Univ., 1 Lab	15
US Short-Baseline Reactor	Site(s) TBD	R&D; First data 2016	Short-baseline sterile neutrino oscillation search	6 Univ., 5 Lab	28

HEP Cosmic Frontier Experiments

Experiment	Location	Description of Science	Current Status	# Collaborators (# US, HEP)	# Institutions (# US, HEP)	# Countries
Baryon Oscillation Spectrosopic Survey (BOSS)	APO in New Mexico	dark energy stage III (spectroscopic)	operating through FY14	160 (36 HEP)	(15 US, 8 HEP)	6
Dark Energy Survey (DES)	CTIO in Chile	dark energy stage III (imaging)	operations started Sept. 2013	300	25 (13 US, 9 HEP)	6
Large Synoptic Survey Telescope (LSST), including Dark Energy Science Collaboration (DESC)	Cerro Pachon in Chile	dark energy stage IV (imaging)	CD1 for LSSTcam approved; FY14 Fabrication start requested	232 (201 US)	55 (43 US, 16 HEP)	3
Dark Energy Spectroscopic Instrument (DESI)	expected to be at KPNO in AZ	dark energy stage IV (spectroscopic)	CD0 approved Sept 2012; planning CD1 in FY14	180 (95 US, 72 HEP)	42 (23 US, 18 HEP)	13
Axion Dark Matter eXperiment (ADMX-IIa)	University of Washington	dark matter – axion search	Operating	24 (20 US, 17 HEP)	7 (6 US, 3 HEP)	2
Chicagoland Observatory for Underground Particle Physics (COUPP-60) → PICO	SNOLab in Canada	dark matter - WIMP search	Operating	60 (26 US, 8 HEP)	14 (6 US, 1 HEP)	5
DarkSide-50	LNGS in Italy	dark matter - WIMP search	Operating	122 (66 US, 12 HEP)	26 (12 US, 3 HEP)	7
Large Underground Xenon (LUX)	SURF in South Dakota	dark matter - WIMP search	Operating	102 (86 US, 56 HEP)	17 (13 US, 9 HEP)	3
Super Cryogenic Dark Matter Search (SuperCDMS-Soudan)	Soudan in Minnesota	dark matter - WIMP search	Operating	83 (70 US, 38 HEP)	19 (16 US, 6 HEP)	3
Very Energetic Radiation Imaging Telescope Array System (VERITAS)	FLWO in AZ	gamma-ray survey	Operating	92 (74 US, 32 HEP)	20 (15 US, 5 HEP)	4
Pierre Auger Observatory	Argentina	cosmic-ray	Operating	463 (51 US, 12 HEP)	100 (20 US, 5 HEP)	18
Fermi Gamma-ray Space Telescope (FGST) Large Area Telescope (LAT)	space-based	gamma-ray survey	June 2008 launch; operating	319 (157 US, 73 HEP)	49 (14 US, 3 HEP)	9
Alpha Magnetic Spectrometer (AMS-02)	space-based (on ISS)	cosmic-ray	May 2011 launch; operating	600	60 (6 US, 2 HEP)	16
High Altitude Water Cherenkov (HAWC)	Mexico	gamma-ray survey	Fabrication; Operations starts summer 2014 in Mexico	111 (54 US, 8 HEP)	31 (16 US, 2 HEP)	2

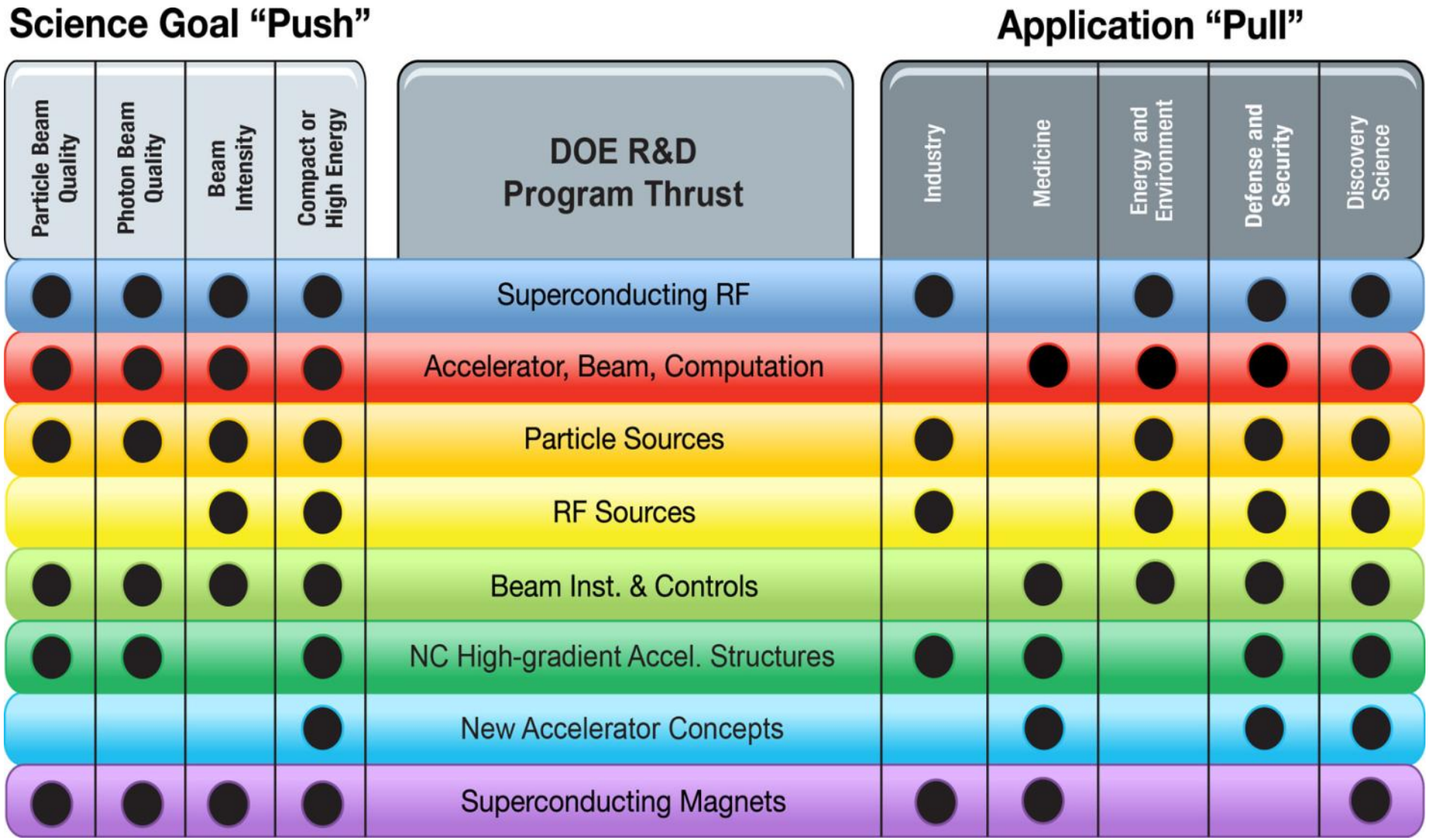
BROADER IMPACTS OF HEP

The Accelerator R&D Stewardship Program

- **The mission of the HEP long-term accelerator R&D stewardship program is to support fundamental accelerator science and technology development of relevance to many fields and to disseminate accelerator knowledge and training to the broad community of accelerator users and providers.**

- **Strategies:**
  - **Improve access to national laboratory accelerator facilities and resources for industrial and for other U.S. government agency users and developers of accelerators and related technology;**
  - **Work with accelerator user communities and industrial accelerator providers to develop innovative solutions to critical problems, to the mutual benefit of our customers and the DOE discovery science community;**
  - **Serve as a catalyst to broaden and strengthen the community of accelerator users and providers**
- **Strategic plan sent to Congress in October 2012**
- **Incorporated into FY2014 Budget Request as new subprogram in HEP**

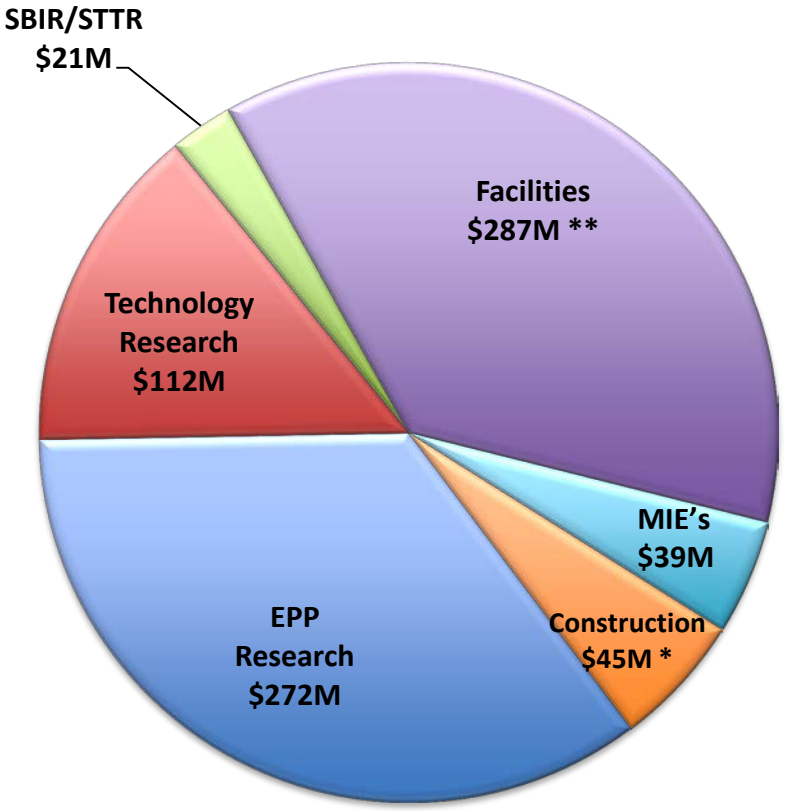
Connecting Accelerator R&D to Science and to End-User Needs



BUDGET
REFERENCE SLIDES

FY 2014 Request Crosscuts

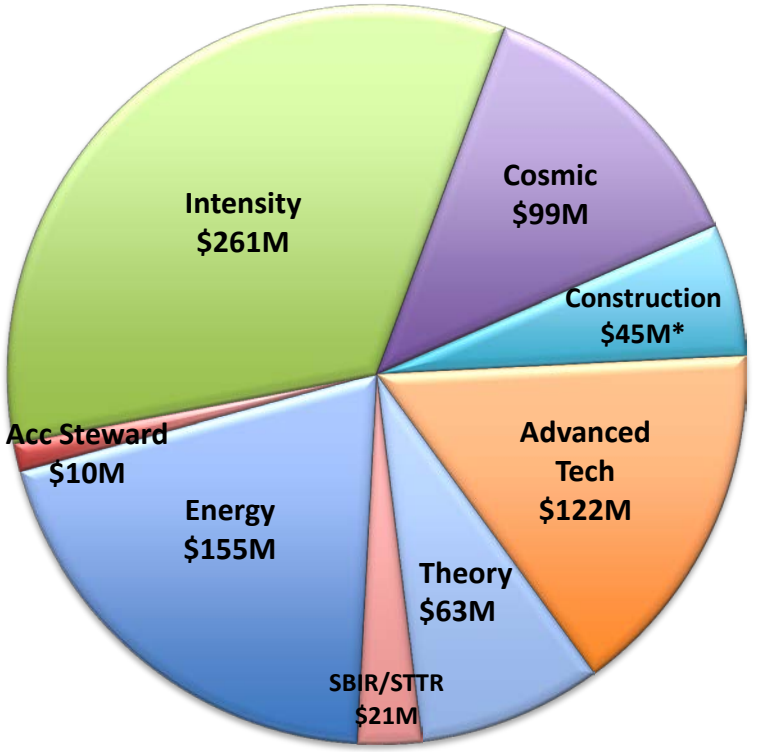
By Function



*Includes Other Project Costs (R&D) for LBNE

**Includes $15.9M Other Facility Support

By Frontier



*Includes Other Project Costs (R&D) for LBNE

HEP Physics Funding by Activity

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Explanation of Change wrt FY12
Research	**391,329**	**362,284**	**383,609**	Reduction mostly ILC R&D
Facility Operations and Exp't Support	**249,241**	**265,305**	**271,561[a]**	NOνA ops start-up and Infrastructure improvements
Projects	**129,963**	**99,934**	**99,894**	
Energy Frontier	0	3,000	0	Phase-1 LHC detector upgrades
Intensity Frontier	86,570	62,794	37,000	NOνA ramp-down, start Muon g-2
Cosmic Frontier	12,893	19,159	24,694	LSST
Other	2,500	3,200	3,200	LQCD hardware
Construction (Line Item)	28,000	11,781	35,000	Mostly Mu2e; no LBNE ramp-up
SBIR/STTR	**0**	**0**	**21,457**	
TOTAL, HEP	**770,533**	**727,523[b]**	**776,521**	

[a] Includes $1,563K GPE.

[b] Reflects sequestration.

HEP Intensity Frontier

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Comment
Research	**53,261**	**52,108**	**53,562**	Ramp-down of B-factory research offset by increased support for new initiatives
Facilities	**143,844**	**172,318**	**180,481**	
Expt Ops	6,615	7,354	7,245	Offshore and Offsite Ops
Fermi Ops	119,544	143,128	156,438	Accelerator and Infrastructure improvements
B-factory Ops	10,031	5,654	4,600	Completion of BaBar D&D
*Homestake**	5,478	14,000	10,000	
Other	2,176	2,182	2,198	GPE and Waste Mgmt
Projects	**86,750**	**62,794**	**37,000**	
Current	73,770	52,794	27,000	NOνA + MicroBooNE ramp-down
Future R&D	12,880	10,000	10,000	
TOTAL, Intensity Frontier	**283,675**	**287,220**	**271,043**	

***Per interagency MOU, HEP provided LHC Detector Ops funding during FY12 CR to offset NSF contributions to Homestake dewatering activities.**

HEP Cosmic Frontier

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Comment
Research	**47,840**	**48,836**	**62,364**	R&D for G2 Dark Matter
Facilities	**11,207**	**10,948**	**12,022**	Offshore and offsite Ops
Projects	**12,893**	**19,159**	**24,694**	
Current	9,153	9,500	23,200	LSSTcam fabrication begins
Future R&D	3,380	9,659	1,484	Dark energy and dark matter projects move to conceptual design
TOTAL, Cosmic Frontier	**71,940**	**78,943**	**99,080**	

HEP Theory and Computation

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Comment
Research	**64,465**	**63,198**	**59,670**	
HEP Theory	55,929	54,621	51,196	Follows programmatic reductions in Research
Computational HEP	8,536	8,577	8,474	
Projects	**2,500**	**3,200**	**3,200**	Lattice QCD hardware
TOTAL, Theory and Comp.	**66,965**	**66,398**	**62,870**	

HEP Advanced Technology R&D

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Comment
Research	**134,006**	**111,888**	**105,303**	
General Accel. R&D	59,280	61,791	57,856	Selected long-term R&D moves to Accelerator Stewardship
Directed Accel. R&D	46,587	22,692	23,500	Completion of ILC R&D
Detector R&D	28,139	27,405	23,947	Funding for liquid argon R&D is reduced
Facility Operations	**23,100**	**19,997**	**17,150**	Completing SRF infrastructure at Fermilab
TOTAL, Advanced Technology R&D	**157,106**	**131,885**	**122,453**	

Accelerator Stewardship

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Comment
Research	**0**	**82**	**6,581**	Recast of Accelerator R&D activities relevant to broader impacts
Facility Operations	**2,850**	**3,050**	**3,350**	Incremental FACET ops for stewardship research
TOTAL, Accel. Stewardship	**2,850**	**3,132**	**9,931**	

HEP Physics MIE Funding

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Description
MIE's	**55,770**	**45,687**	**39,000**	
Intensity Frontier	41,240	19,480	0	NOνA ramp-down
Intensity Frontier	6,000	5,857	0	MicroBooNE
Intensity Frontier	500	0	0	Reactor Neutrino Detector at Daya Bay
Intensity Frontier	1,030	5,000	8,000	Belle-II
Intensity Frontier	0	5,850	9,000	Muon g-2 Experiment
Cosmic Frontier	1,500	1,500	0	HAWC
Cosmic Frontier	5,500	8,000	22,000	Large Synoptic Survey Telescope (LSST) Camera
TOTAL MIE's	**55,770**	**45,687**	**39,000**	

HEP Physics Construction Funding

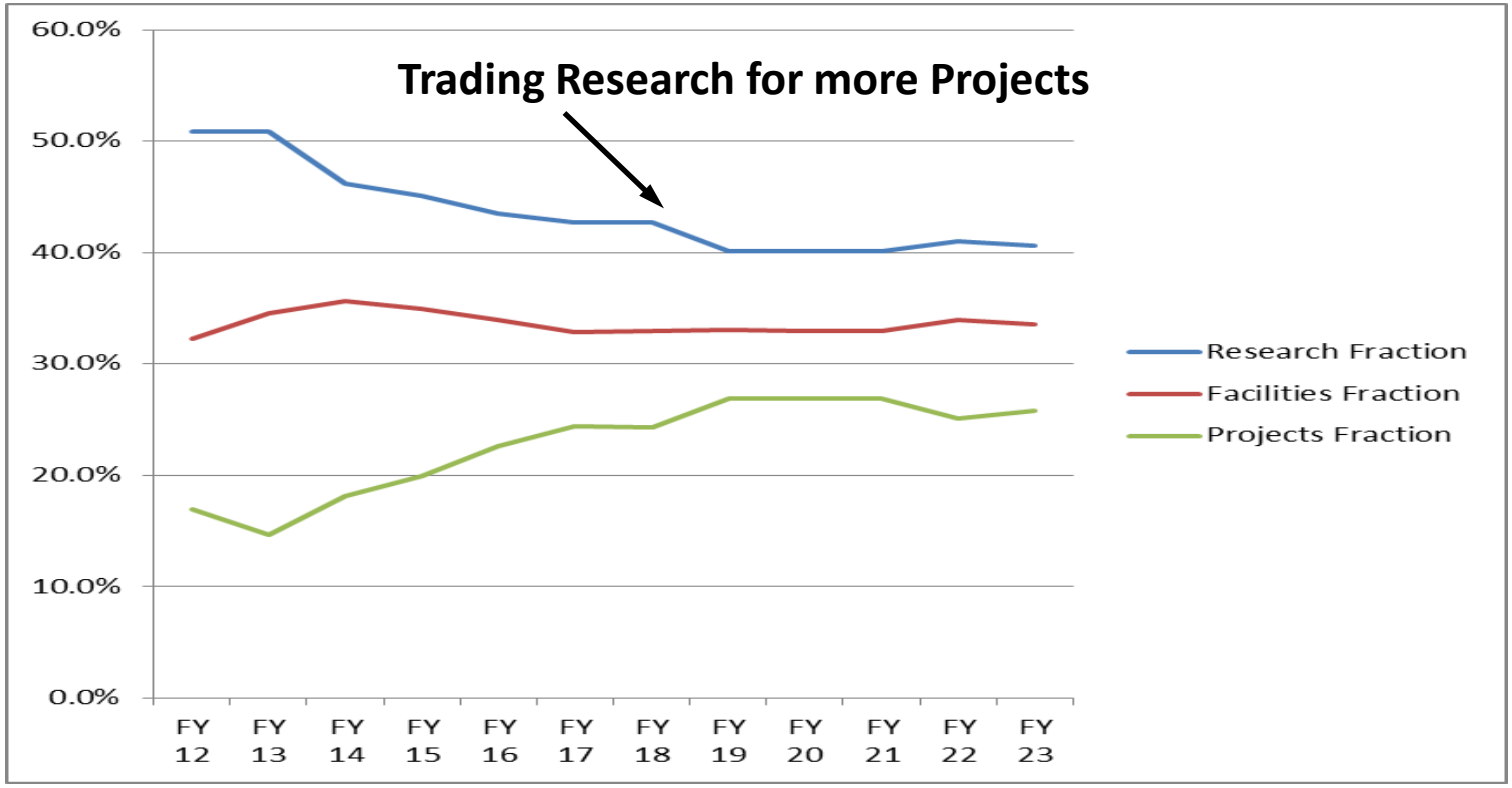
Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request
Construction - TPC	**53,000**	**28,388**	**45,000**
Long Baseline Neutrino Experiment	**21,000**	**17,888**	**10,000**
TEC	4,000	3,781	0
OPC	17,000	14,107	10,000
TPC	21,000	17,888	10,000
Muon to Electron Conversion Experiment	**32,000**	**10,500**	**35,000**
TEC	24,000	8,000	35,000
OPC	8,000	2,500	0
TPC	32,000	10,500	35,000

TEC = Total Estimated Cost (refers to Capital Equipment expenses)
OPC = Other Project Costs
TPC = Total Project Cost

HEP Project Status

Subprogram	TPC ($M)	CD Status	CD Date
INTENSITY FRONTIER			
Long Baseline Neutrino Experiment (LBNE)	TBD	CD-1	December 10, 2012
Muon g-2	40	CD-0	September 18, 2012
Mu2e	249	CD-1	July 11, 2012
Next Generation B-Factory Detector Systems (BELLE-II)	16	CD-3a	November 8, 2012
NuMI Off-Axis Electron Neutrino Appearance Exp't (NOνA)	278	CD-3b	October 29, 2009
Micro Booster Neutrino Experiment (MicroBooNE)	19.9	CD-3b	March 29, 2012
Main INjector ExpeRiment for ν-A (MINERνA)	16.8	CD-4	June 28, 2010 [Finished]
Daya Bay Reactor Neutrino Experiment	35.5	CD-4b	August 20, 2012 [Finished]
ENERGY FRONTIER			
LHC ATLAS Detector (Phase-1) Upgrade	TBD	CD-0	September 18, 2012
LHC CMS Detector (Phase-1) Upgrade	TBD	CD-0	September 18, 2012
COSMIC FRONTIER			
Dark Matter (DM-G2)	TBD	CD-0	September 18, 2012
Mid-Scale Dark Energy Spectroscopic Instrument (MS-DESI)	TBD	CD-0	September 18, 2012
Large Synoptic Survey Telescope (LSST)	173	CD-1	April 12, 2012
Dark Energy Survey (DES)	35.1	CD-4	June 4, 2012 [Finished]
ADVANCED TECHNOLOGY R&D			
Accelerator Project for the Upgrade of the LHC (APUL)	11.5	CD-2/3	July 29, 2011
Berkeley Lab Laser Accelerator (BELLA)	27.2	CD-4	January 17, 2013 [Finished]
Facility for Advanced Accelerator Experimental Tests (FACET)	14.5	CD-4	January 31, 2012 [Finished]

One Possible Future Scenario



- About 20% (relative) reduction in Research fraction over ~5 years
  - *In order to address priorities, this will not be applied equally across Frontiers*
- This necessarily implies reductions in scientific staffing
  - Some can migrate to Projects but other transitions are more difficult
- We have requested Labs to help manage this transition as gracefully as possible

Current LBNE Strategy

- **We are trying to follow the reconfiguration [phased] plan for LBNE, though it has hit some snags**
  - **Out-year budgets are challenging**
  - **Some members of the community objected that the phased LBNE was not what the previous P5 [or they] had in mind**
- **The plan, as it currently stands:**
  - **Use time before baselining to recruit partners (international and domestic) that expand scope and science reach**
- **We also take note of the House language on LBNE:**

"The Committee recognizes the importance of this project to maintaining American leadership in the intensity frontier and to basic science discovery of neutrino and standard model physics. However, the Committee also recognizes that LBNE construction must be affordable under a flat budget scenario. As such, the Committee supports the Office of Science's challenge to the High Energy Physics community to identify an LBNE construction approach that avoids large out-year funding spikes or to identify viable alternatives with similar scientific benefits at significantly lower cost."

HEP Early Career FY10-13 Demographics

L = National Laboratory Proposal
U = University Proposal

Subprogram Awards	FY10 (L/U)	FY11 (L/U)	FY12 (L/U)	FY13 (L/U)	Total (L/U)
Energy	3 (1/2)	3 (1/2)	1 (0/1)	2 (0/2)	9 (2/7)
Intensity	2 (1/1)	1 (0/1)	3 (2/1)	1* (0/1)	7 (3/4)
Cosmic	2 (0/2)	3 (2/1)	3 (1/2)	2 (1/1)	10 (4/6)
HEP Theory	6 (1/5)	4 (0/4)	3 (0/3)	3 (1/2)	16 (2/14)
Accelerator	1 (1/0)	2 (2/0)	2 (1/1)	1 (0/1)	6 (4/2)
HEP Awards	**14 (4/10)**	**13 (5/8)**	**12 (4/8)**	**9 (2/7)**	**48 (15/33)**
Proposals	**154 (46/108)**	**128 (43/85)**	**89 (34/55)**	**78 (29/49)**	**449 (152/297)**

*** 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).**

- **Strong interest in Early Career program across HEP (and other fields)**
- **Early Career Research Program is very competitive (~10% success rate)**