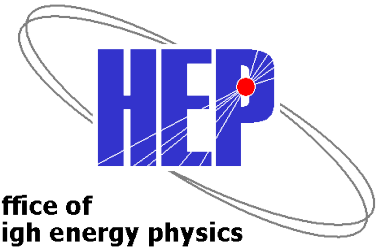




U.S. DEPARTMENT OF
ENERGY

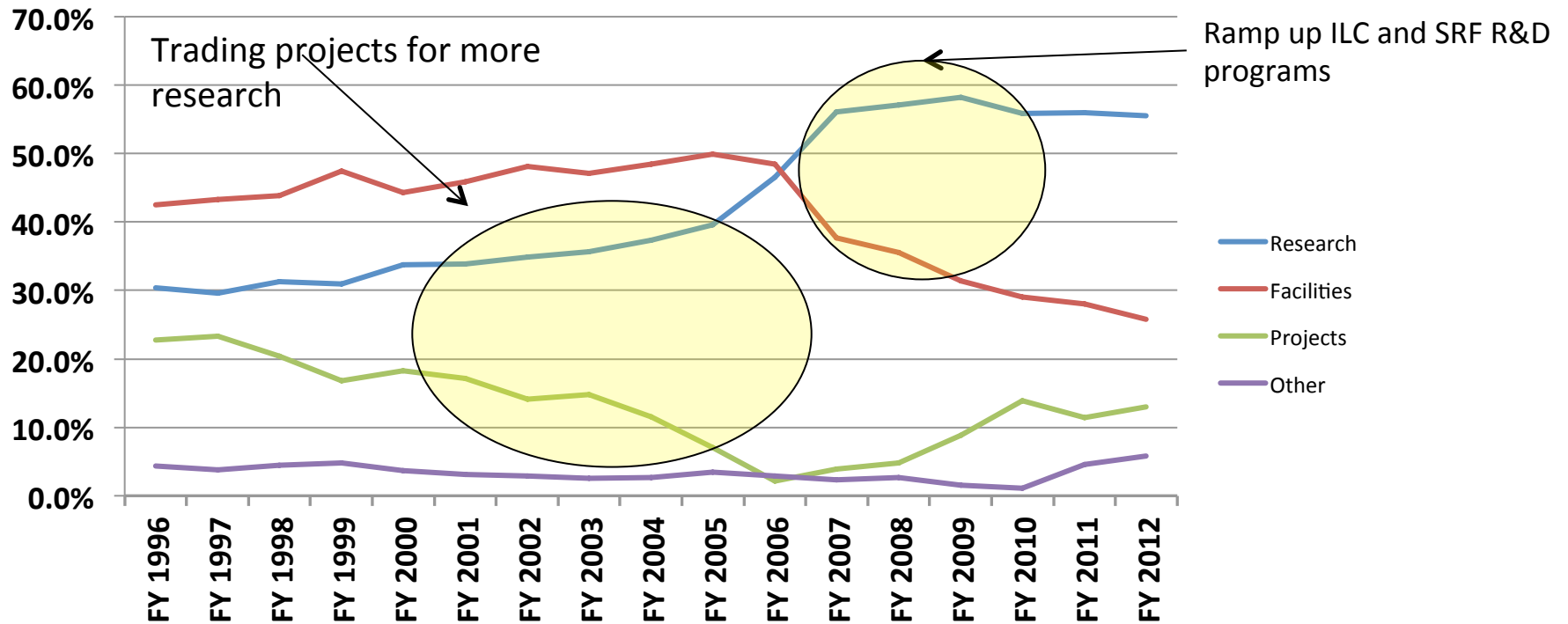
Office of
Science



Theory @ DOE

Simona Rolli
Program Manager
DOE Office of High Energy Physics
Snowmass on the Mississippi
August 4 2013

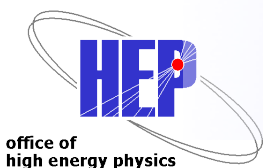
Recent Funding Trends



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

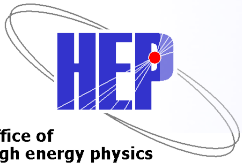
FY14 Budget

- FY2014 budget philosophy was to enable new world-leading HEP capabilities in the U.S. through investments on all three frontiers
 - **Accomplished through ramp-down of existing Projects and Research**
 - **When we were not able to fully implement this approach, converted planned project funds to R&D: Research \Rightarrow ~~Projects~~ \rightarrow Research**
 - Therefore, the FY14 Request shows *increases* for Research that are due to this added R&D “bump”, while Construction/project funding is only slightly increased
 - In the interim (since submission of FY14 Request), actual FY13 Research funding also increased because of inability to get projects started
 - Initial FY14 plan for Research will be down more than the originally advertised 2-3% relative to FY13
- Impact of these actions:
 - **Several new efforts are delayed: LBNE, LHC detector upgrades, 2nd Generation Dark Matter detectors**
 - **US leadership/partnership capabilities will be challenged by others**
 - **Workforce reductions at universities and labs**
- Key areas in FY2014 Request
 - **Maintaining forward progress on new projects via Construction and Research funding lines**



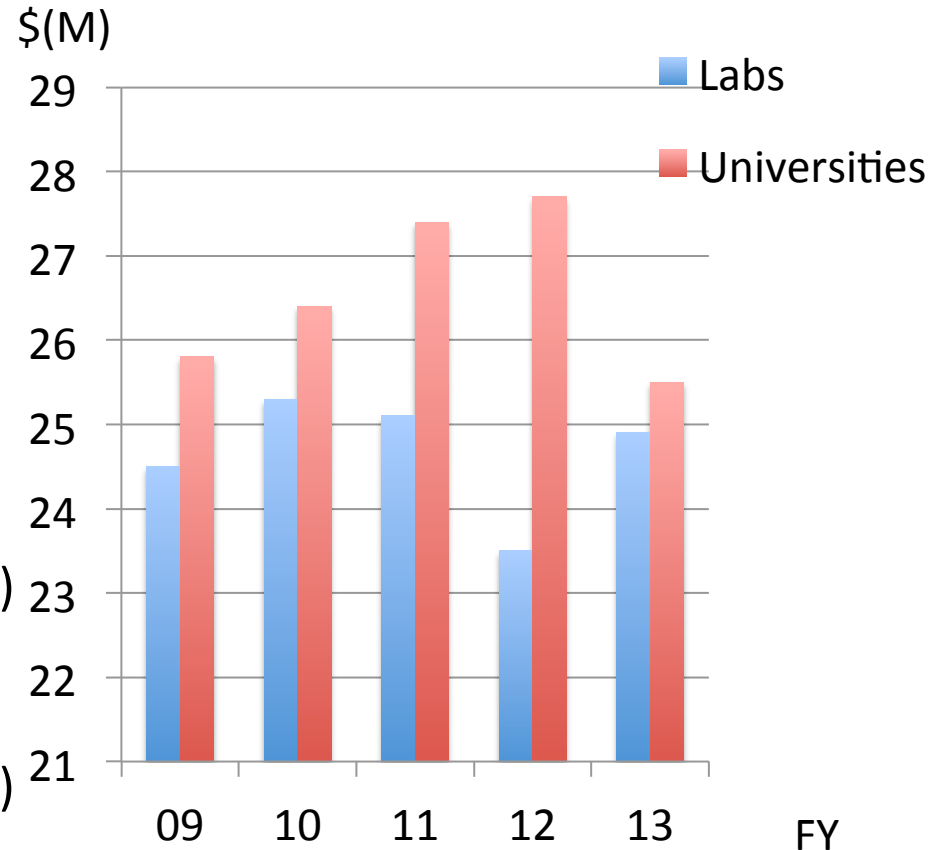
HEP Research Funding for FY14

- The FY 2014 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.
- Our 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 PED, \$2 million to SURF, and lower the overall HEP budget by \$4 million. The 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, such as the Early Career Program and other needs.
 - This 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 Congress passes a budget, there could be either an increase or a decrease in HEP research funding.



Theory Budget

- 2009
 - Labs 24,500M
 - Universities 25,800M*
- 2010
 - Labs 25,300M
 - Universities 26,350M *
- 2011
 - Labs 25,100M
 - Universities 27,400M** (26,972M)
- 2012
 - Labs 23,600M
 - Universities 27,700M ** (25,232M)
- 2013
 - Labs 24,950M
 - Universities 25,500 *



* Does not include EC

**Universities numbers include EC numbers w/o EC in parenthesis

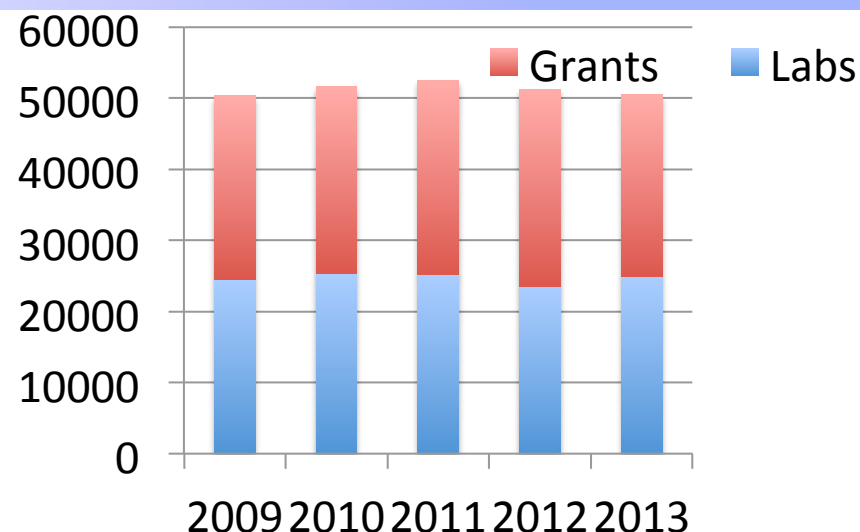
FTE/month Distribution (FY13)

- Labs FTE

- FNAL: 19 @ 12-months equivalent
- SLAC: 9.5 @12-months equivalent
- BNL: 8 @12-months equivalent
- ANL: 5 @12-months equivalent
- LBNL: 3.25 @12-months equivalent
- TOTAL: 44.75 x 12 = **537 months-equivalent**

- Universities FTE:

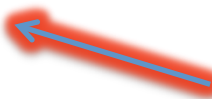
- FY12 Comp Rev : 42 @ 2-months equivalent (84 months)
- FY13 Comp Rev : 102.25 @ 2-months equivalent (204.5)
- FY14 Comp Rev : 70 @ 2-months equivalent (140)
- TOTAL: 216.25 x 2 = **428.5 months-equivalent** (not including EC recipients)



47k/month per Lab / per FTE

56k/month per Grant/ per FTE (not including EC)

Budget and Comparative Reviews

- Two goals are accomplished with the Comp Reviews:
 - Comparatively evaluate all proposals at the same time
 - Synchronize the starting date of all grants to April 1st
 - Why April 1st? Blame the US (dysfunctional) budget cycle
 - In the first three rounds → bridge funding
 - If the groups going into comp review in FY13 were funded at X level, in FY13 the level will be:
$$X' = X * .97 - (X * .97) * Z$$


Bridge Funding: Z up to 25%
 - Cannot be avoided
 - Will be better starting in 2015

Demographics Universities (FY12)

Postdocs: 95 FTE (0.43/PI)
Students : 122 FTE (0.55/PI)

Total: 221 PI
Cosmo 34
Pheno 97
Formal 70
Lattice 20

- **Comp Rev 2012: 45 PI**
 - Cosmo 12
 - Pheno 16
 - Formal 16
 - Lattice 1
- **Comp Rev 2013:114 PI**
 - Cosmo: 16
 - Pheno 57
 - Formal: 31 passed
 - Lattice 14 passed
- **Comp Rev 2014: 58 PI**
 - Cosmo 6
 - Pheno 24
 - Lattice 5
 - Formal 23

PIs



■ Cosmo
■ Pheno
■ Formal
■ Lattice

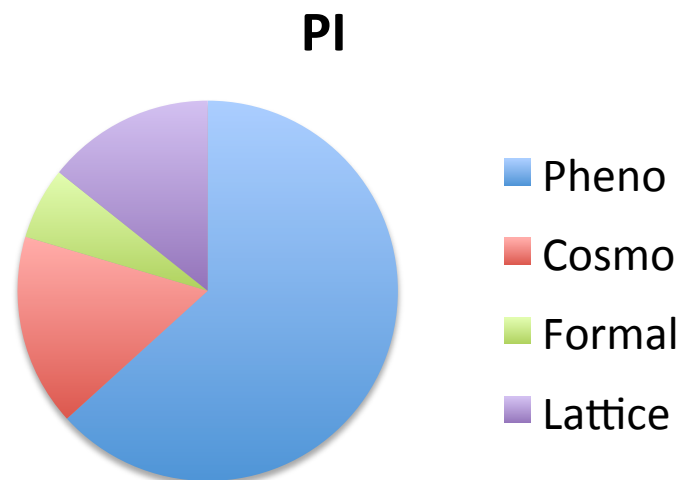
Demographics Labs (FY12)

- **FNAL**
 - Astro 5 (3 RA)
 - Particle Physics (8 RA)
 - Pheno 12
 - Lattice 3
- **SLAC**
 - KIPAC 3 (1.5 FTE) (1.5 RA, 1.4 GS)
 - Particle Physics (7 RA, 7 GS)
 - Pheno 6
 - Formal 3 (2)
- **BNL (3 RA)**
 - Lattice 3 (+1)
 - Pheno 4
- **LBNL (2 RA)**
 - Pheno 3
- **ANL (4 RA)**
 - Pheno 6
 - Formal 1 (phased out)

Postdocs: 28.5 FTE (.58/PI)

Students: 7.4 FTE (0.15/PI)

Total: 49 PI
Pheno 31
Cosmo 8
Lattice 7
Formal 3

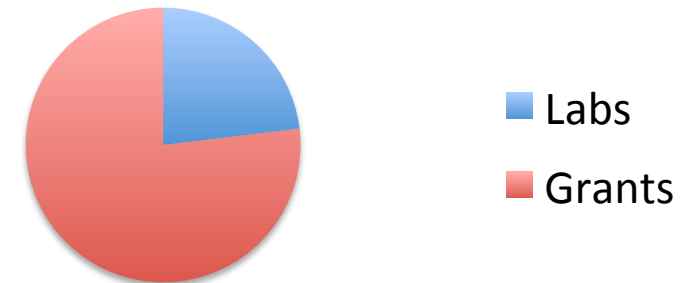


Students and PD at Universities

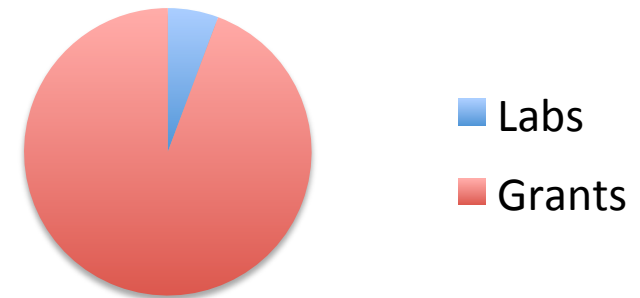
- Comp rev 2012 group
 - Students 30 FTE
 - PD 21.65 FTE
- Comp rev 2013 group
 - Students 52.6 FTE
 - PD 47.46 FTE
- Comp rev 2014 group
 - Students 39 FTE
 - PD 26.07 FTE

Total Students : 122 FTE
Total Postdocs: 95 FTE

Postdocs

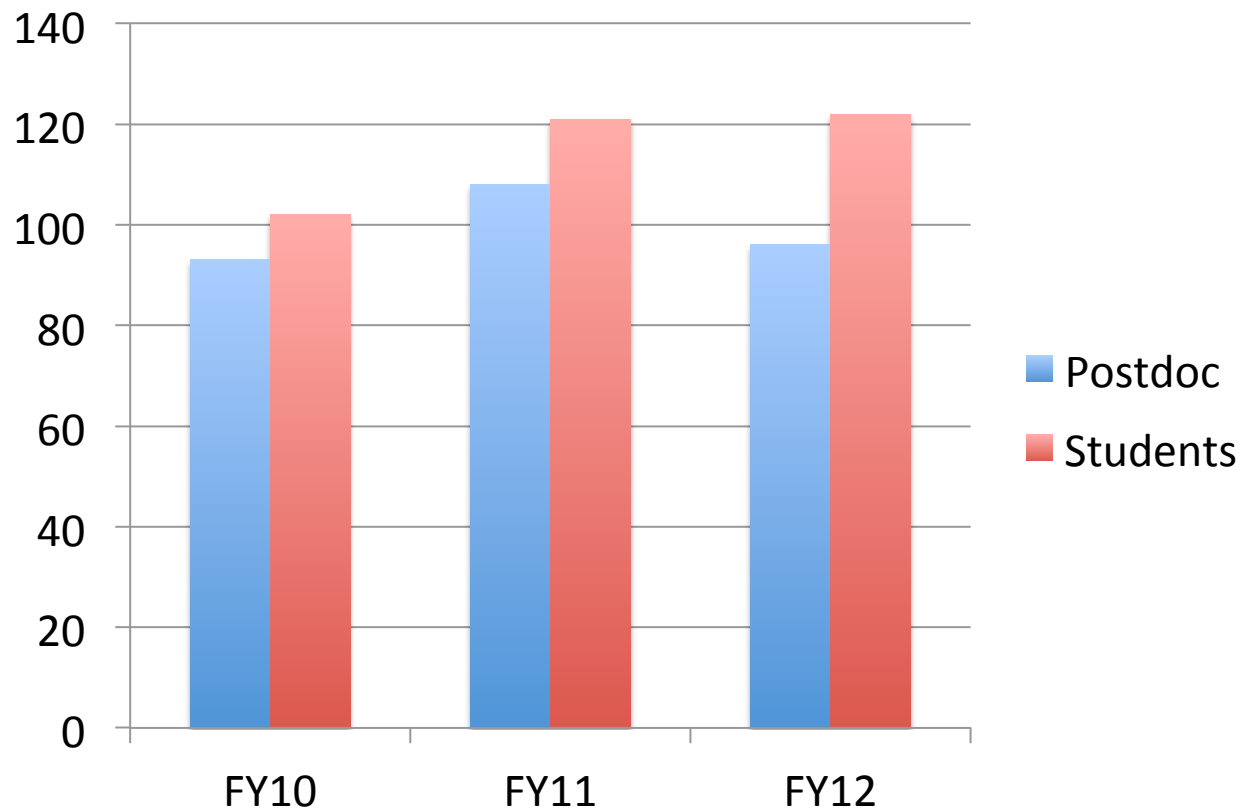


Students



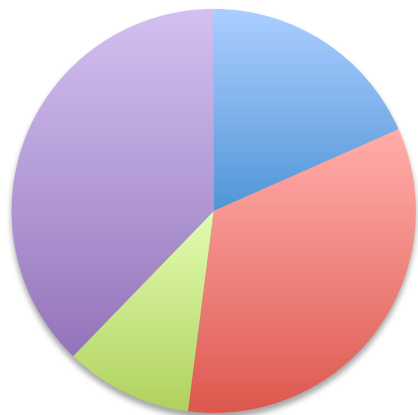
Demographics numbers refer to FY12
1FTE = 12 months

University Students and PD Trends



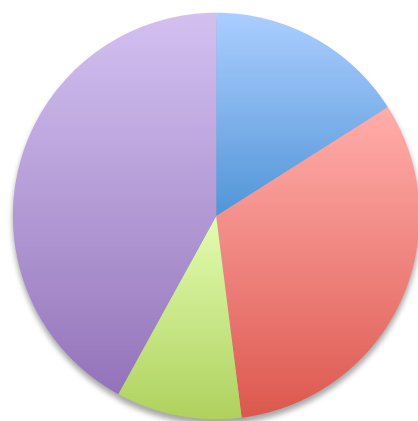
Students and PD at Universities

Students



- Cosmo
- Formal
- Lattice
- Phenomenology

Postdocs



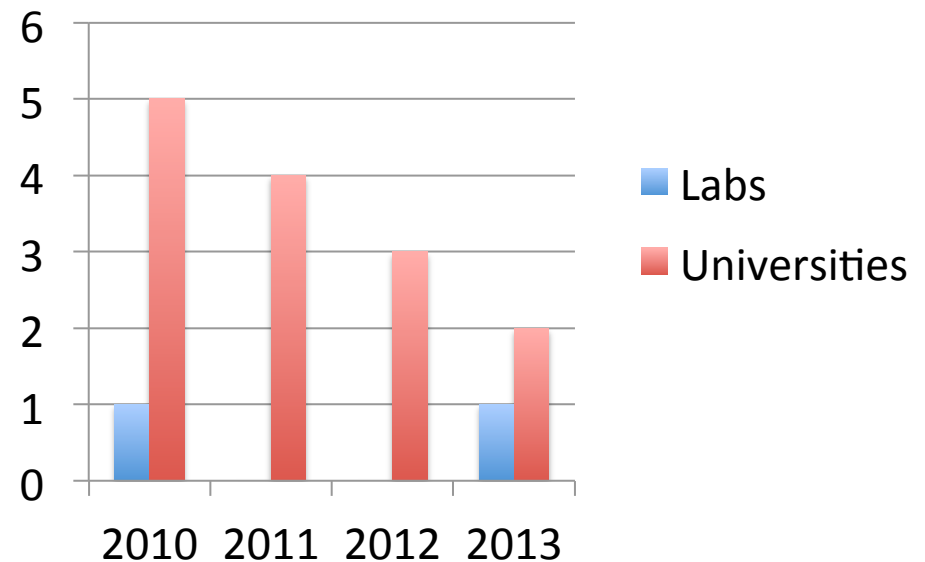
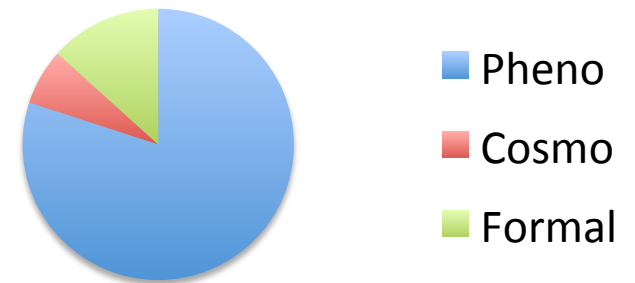
- Cosmo
- Formal
- Lattice
- Phenomenology

FY12

Early Career Awards (16)

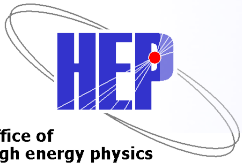
- 2010: 6 awards (out of 43)
 - 5 Universities (first 4 years from ARRA 5th year to be taken from theory budget)
 - 1 Lab (fully forward funded for 5 years - ARRA) 500k
 - Pheno 6
- 2011 : 4 awards (out of 45)
 - 4 Universities 600k
 - Pheno 2
 - Cosmo 1
 - Formal 1
- 2012 : 3 awards (out of 23)
 - 3 Universities 450k
 - Formal 1
 - Pheno 2
- 2013: 3 awards (out of 20)
 - 1 Lab 500k
 - 2 Universities 300k
 - 2 Pheno, 1 Cosmo

PI



The most successful Frontier in the HEP Office!

The award money is added every year and is shielded (except 2010 5th yr)



Early Career Demographics

Subprogram	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)
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)
Proposals	154 (46/108)	128 (43/85)	89 (34/55)	78 (29/49)	449 (152/297)
HEP Awards	14 (8/6)	13 (5/8)	12 (4/8)	9 (2/7)	48 (19/29)

* Funded by Office of Basic Energy Sciences (BES) as an EPSCoR [Experimental Program to Stimulate Competitive Research] award with grant monitored by DOE HEP.

- **Early Career Research Program is very competitive (~10% success rate)**

Comparative Review and Young Investigators

- In general young investigators (2nd-3rd year of tenure track career path) do well in the comparative review
 - Most of them have been funded
 - When there are other sources of funding (including startup) precedence is given to those who do not have other support
 - Submitting to both Comp Review and EC might weaken proposals
 - Office of Science does not accept the same proposal submitted to 2 different FOAs
 - NSF Career and EC/DOE grants cannot cover the same scope of work
 - But you can submit the same proposal to NSF and DOE → decide later which agency go with

Food for thought

- Role of theory in DOE-supported research
 - HEP mission at the frontiers
 - **Intensity Frontier** leadership → is the theory effort adequate?
 - **Energy Frontier** co-leadership → is the US effort comparable and competitive with the European one?
 - **Cosmic Frontier** co-leadership → DM and DE, relationship with astrophysics, active role of theorists in experimental collaborations
 - Relationship with other sectors/agencies
 - **Nuclear Physics** → neutrino physics at low/medium energy; Heavy Ions Physics (holography applications); IF synergies
 - **BES and Condensed Matter** → the re-branding of String Theory?
 - **Computational aspects of HEP theory** → Cosmology initiatives; Lattice (HEP vs NP); Monte Carlo simulation

Food for thought (II)

- The US budget climate for research is precarious
- The US does not rank as appealing as it used to be only 10-15 years ago
 - How many offers from Zurich??
 - How many Montecarlos from European groups ?
 - 70% of top hep-lat papers have European authors
- As a community we need to concentrate on **strength and competitiveness of our field in an international setting**
 - This might mean consolidating funding at centers of excellence and fund the best groups in the best places
 - Labs and University “faculty” fulfill different roles and places where research is allowed 100% of time should be preserved.
 - We can’t fund everything and everybody
 - We need to consider the job perspective of students and postdocs and train them accordingly
 - How many more Quants ?

Your Food for thought

“theory community” is **diverse**, so getting a consensus view on **all (any?)** points is challenging, but **theory panel report may want to discuss some so that we define the answers, not others**

- Do we have enough/too few/too many theorists? What would more theorists or more funding accomplish that isn't accomplished now?
 - Should certain areas be specifically targeted for increased funding?
 - If funding is tight, is it better to fund a smaller number of theorists well, rather than funding “everyone” by only a little?
- **Resources are fixed**
- **Don't waste effort criticizing funding agencies for this**
 - **Only Congress (or a big donor) can make the pot bigger**
- **Before asking for a larger slice of pie, be ready to argue why someone else should get smaller slice**

Need to have a frank discussion of



FY12 vs FY14 Budget

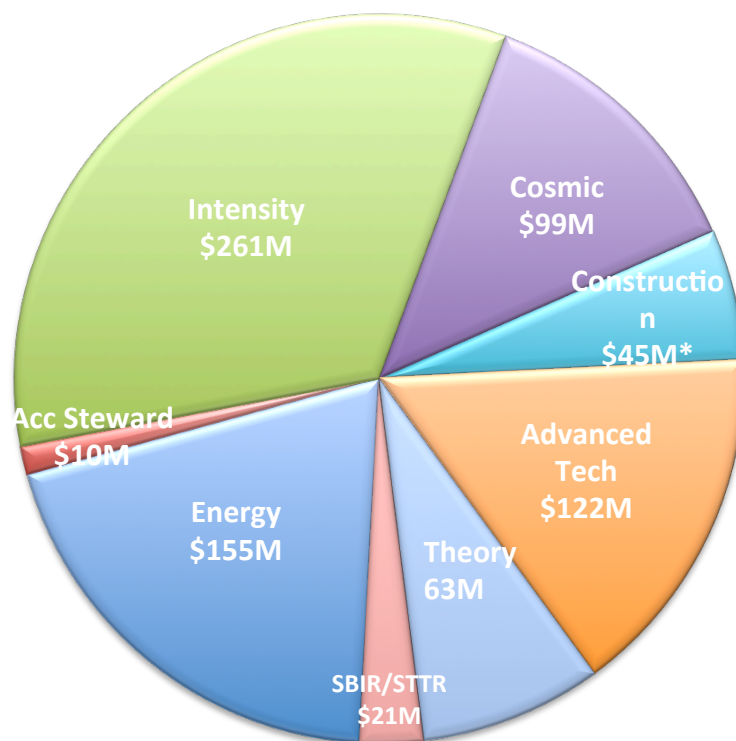
Description	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Explanation of Change
Energy Frontier Exp. Physics	159,997	148,164	154,687	Ramp-down of Tevatron Research
Intensity Frontier Exp. Physics	283,675	287,220	271,043	Completion of NOvA (MIE), partially offset by Fermi Ops
Cosmic Frontier Exp. Physics	71,940	78,943	99,080	Ramp-up of LSST
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	
Construction (Line Item)	28,000	11,781	35,000	Mostly Mu2e; no LBNE ramp-up
Total, High Energy Physics:	770,533^(a)	727,523^(a,c)	776,521	wrt FY12: Down -2% after SBIR correction wrt FY13: Up +3.6% after SBIR correction
Ref: Office of Science (SC):	4,873,634	4,621,075^(c)	5,152,752	

a) The FY 2012 Actual (FY13 CR) is reduced by \$20,327,000 (20,791,000) for SBIR/STTR

b) Reflects Sequestration

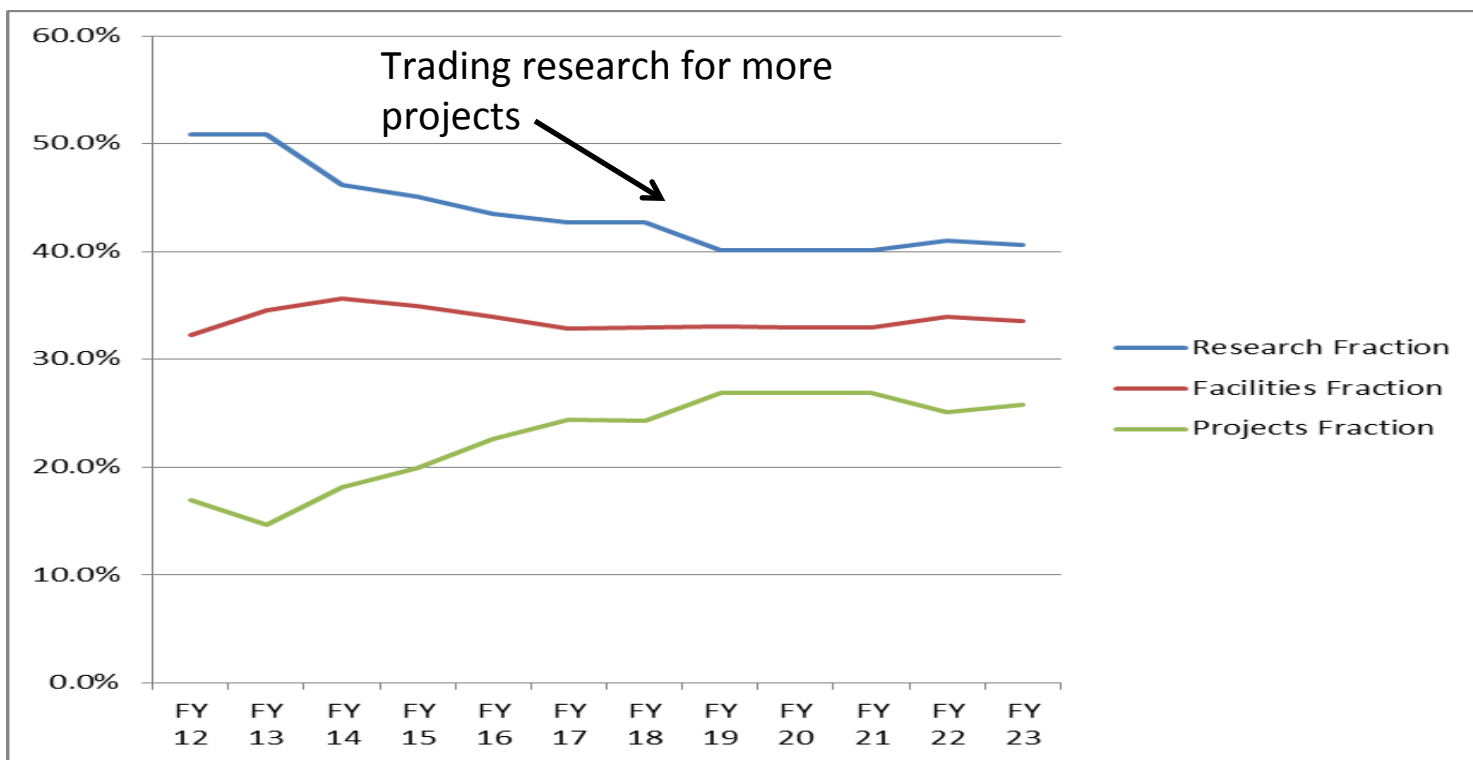
Budget breakdown

By "Frontier"



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

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.