



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Evolution of the DOE HEP Research Program

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Outline

Goal: Answer recent questions from HEPAP (and community) on detailed research funding trends and impacts; and discuss future prospects

- **DOE HEP Recent Historical Funding Trends (FY2010-2017)**
 - Overall
 - Research
 - By Subprogram
 - Universities and Labs
- **Research workforce (FTE) Trends (2009-2013)**
 - By Subprogram
 - Universities and Labs
 - By job type
 - Universities and Labs
- **University FOA Outcomes**
 - Average funding per PI
 - Net gain/loss of PIs by subprogram integrated over recent years
- **Next Steps**

Overall HEP Budget Trend

- Note significant dips in FY13 (sequestration, “restored” in FY14) and FY15 (Request developed pre-P5)

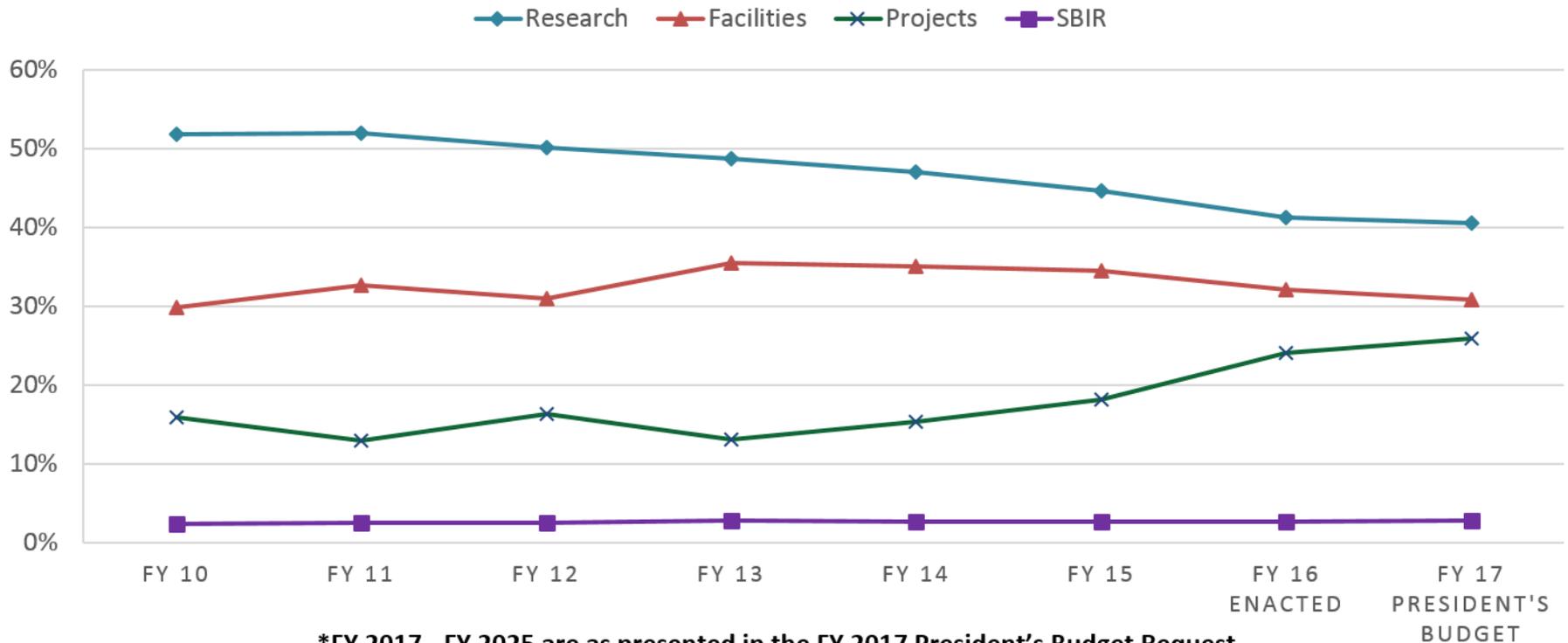
HEP BUDGET ALLOCATION BY FISCAL YEAR (\$ IN K)



HEP Budget Trend by Category

- Trading Research (R&D) for Project investments

HEP BUDGET ALLOCATION BY FISCAL YEAR (% OF TOTAL HEP BUDGET)



Notes on Research Subprogram Charts

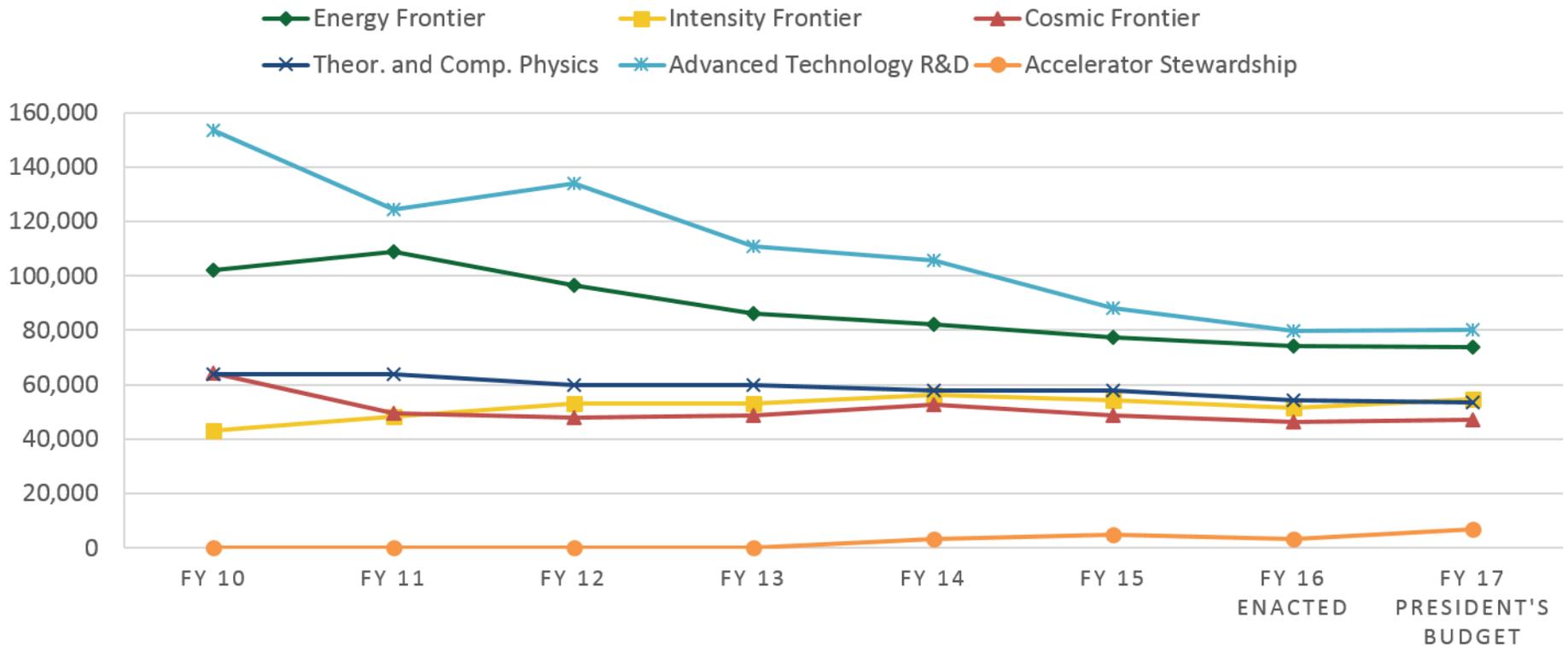
- The following charts show Research program funding for laboratories and universities from FY 2010 through the FY 2017 President's Request
- The funding shown does not include funding from the American Recovery and Reinvestment Act of 2009 (ARRA)
- Funding for these “program support” efforts are also not included:
 - Advisory and review committee support (incl HEPAP, P5, NAS BPA)
 - Particle Data Group
 - Major conferences
 - Student Exchange Program, traineeships
 - Other (IPAs, detailees, reserves)
- Other general notes:
 - Research support for Tevatron ramped down dramatically from 2011-2013
 - FY 2012 was first year of comparative review
 - Sequestration affected FY 2013
 - “Frontier” categorization began in FY 2013 budget submission
 - FY 2010-12 efforts are translated into the Frontiers as best as possible



HEP Research Subprogram Trends

- Total including both labs and universities.
- More detail on interesting cases in following slides.

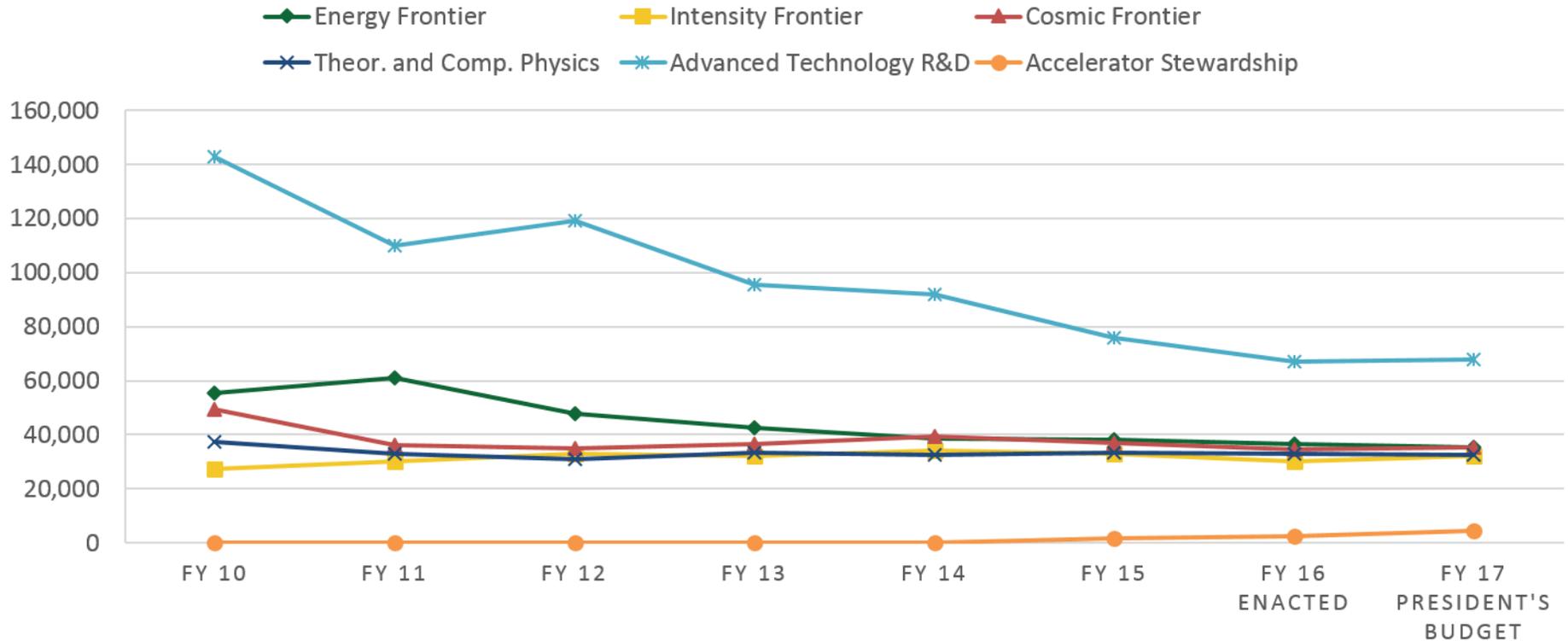
HEP RESEARCH FUNDS - BY FRONTIER/PROGRAM (\$ IN K)



HEP Research Subprogram Trends I

- HEP labs only. Note ~all reduction in Adv Tech R&D is at labs.

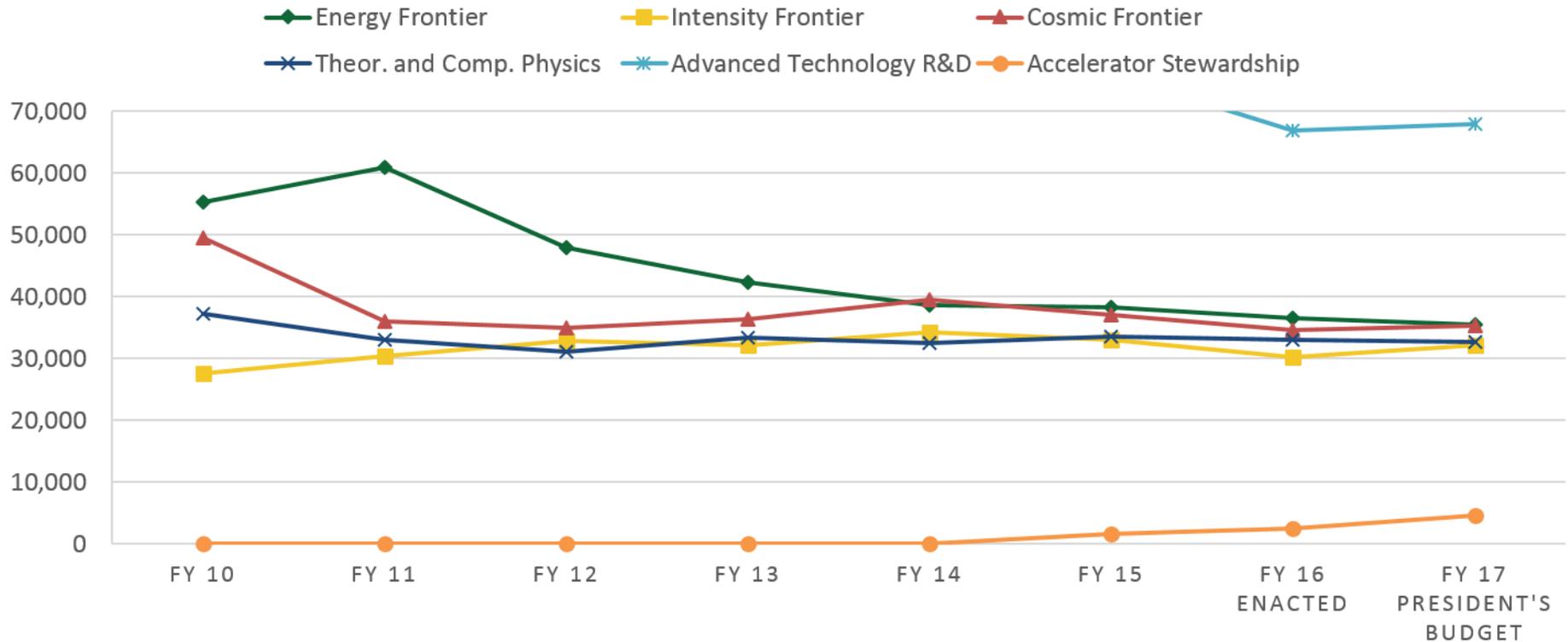
HEP LABORATORY RESEARCH FUNDS – BY FRONTIER/PROGRAM (\$ IN K)



HEP Research Subprogram Trends II

- Same plot, reduced in scale for comparison to University support

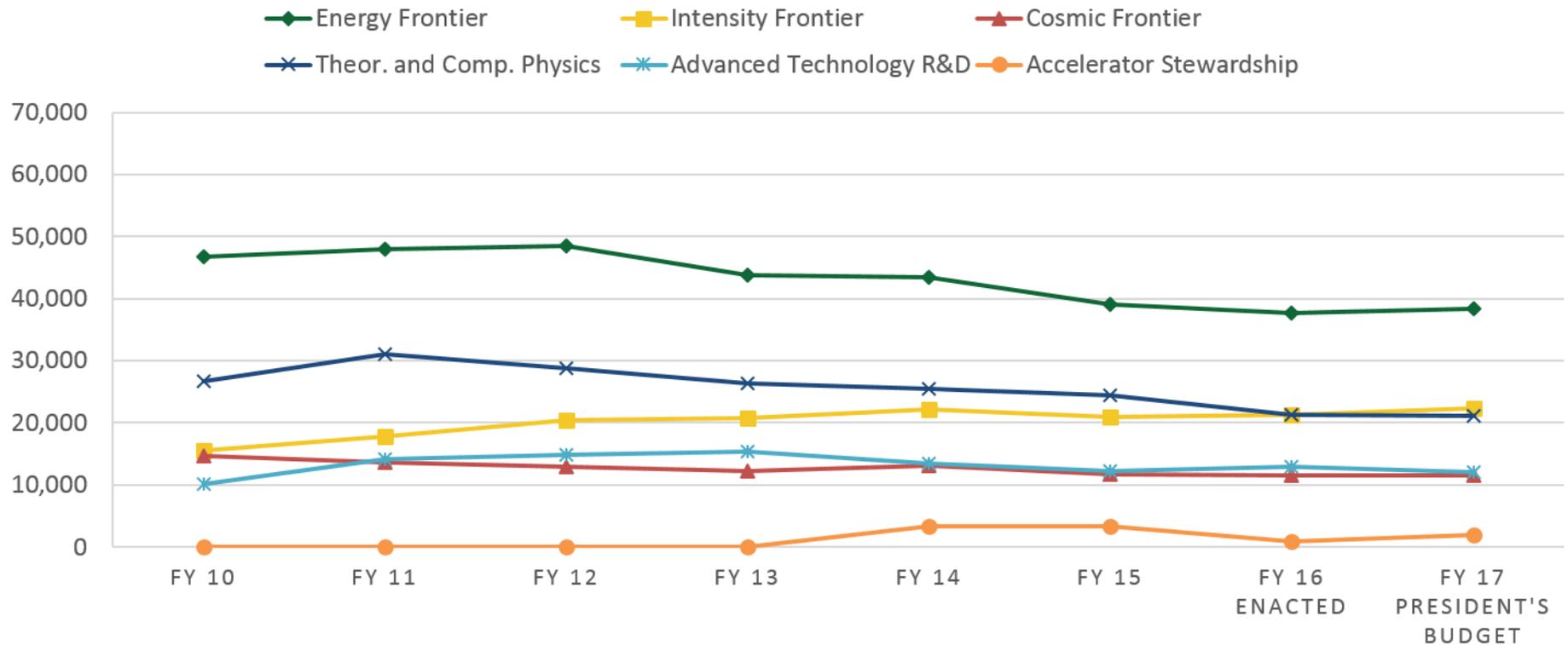
HEP LABORATORY RESEARCH FUNDS – BY FRONTIER/PROGRAM (\$ IN K)



HEP Research Subprogram Trends III

- University only

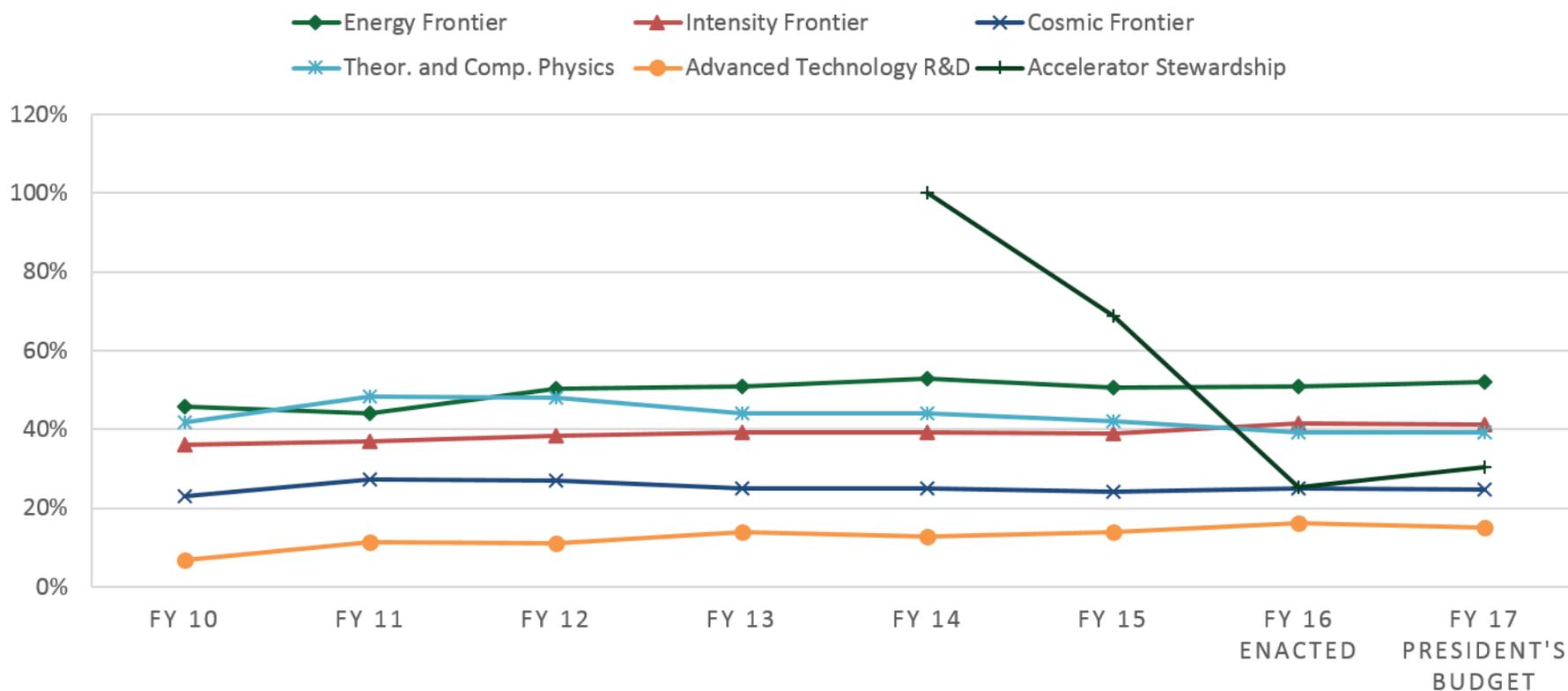
HEP UNIVERSITY RESEARCH FUNDS - BY FRONTIER/PROGRAM (\$ IN K)



Univ. Research Fraction by Subprogram

- On average, univ. programs doing as well as (or slightly better than) labs in terms of Research \$\$.

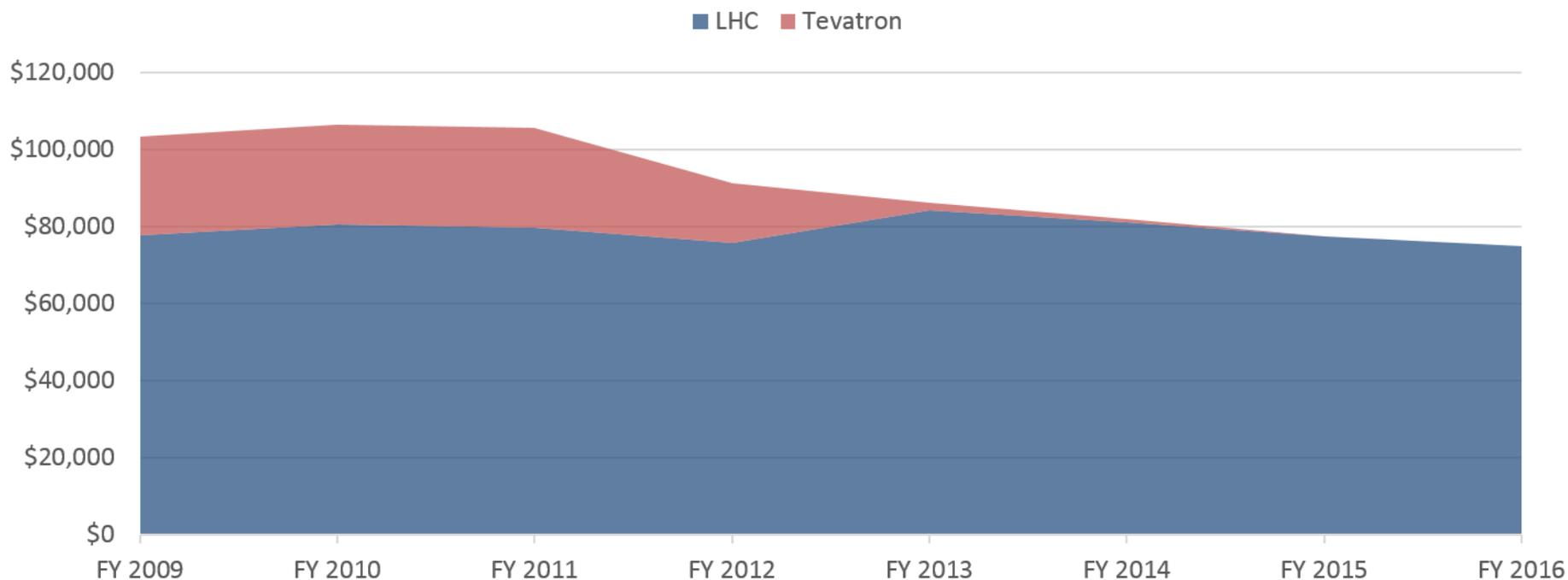
UNIVERSITY FRACTION OF RESEARCH BY SUBPROGRAM



Energy Frontier Detail

- **Some Tevatron research funding transitioned to LHC (but mostly elsewhere) in FY 2011-2013**
 - Also, FY 2012 was first year of HEP comparative review

ENERGY FRONTIER: TEVATRON AND LHC
(STACKED PROFILES; \$ IN K)



HEP Research Funding Summary

- To avoid the various comparability/transition issues, focus on Research Funding by subprogram in FY13-17
 - Table shows percent change in funding between FY13 and FY17 PR by subprogram
 - Accelerator Stewardship did not exist in FY13 and is not counted in the FY17 normalization in the “Overall” row

Subprogram	Univ. + Lab.	University	Laboratory
Energy Frontier	-14.3%	-12.5%	-16.3%
Intensity Frontier	3.3%	8.2%	0.1%
Cosmic Frontier	-3.4%	-5.1%	-2.8%
Theor. and Comp. Physics	-10.2%	-20.2%	-2.3%
Advanced Tech. R&D	-27.8%	-21.2%	-28.9%
Overall (no Acc. Stewardship)	-13.8%	-10.9%	-15.1%



Notes on Workforce Charts

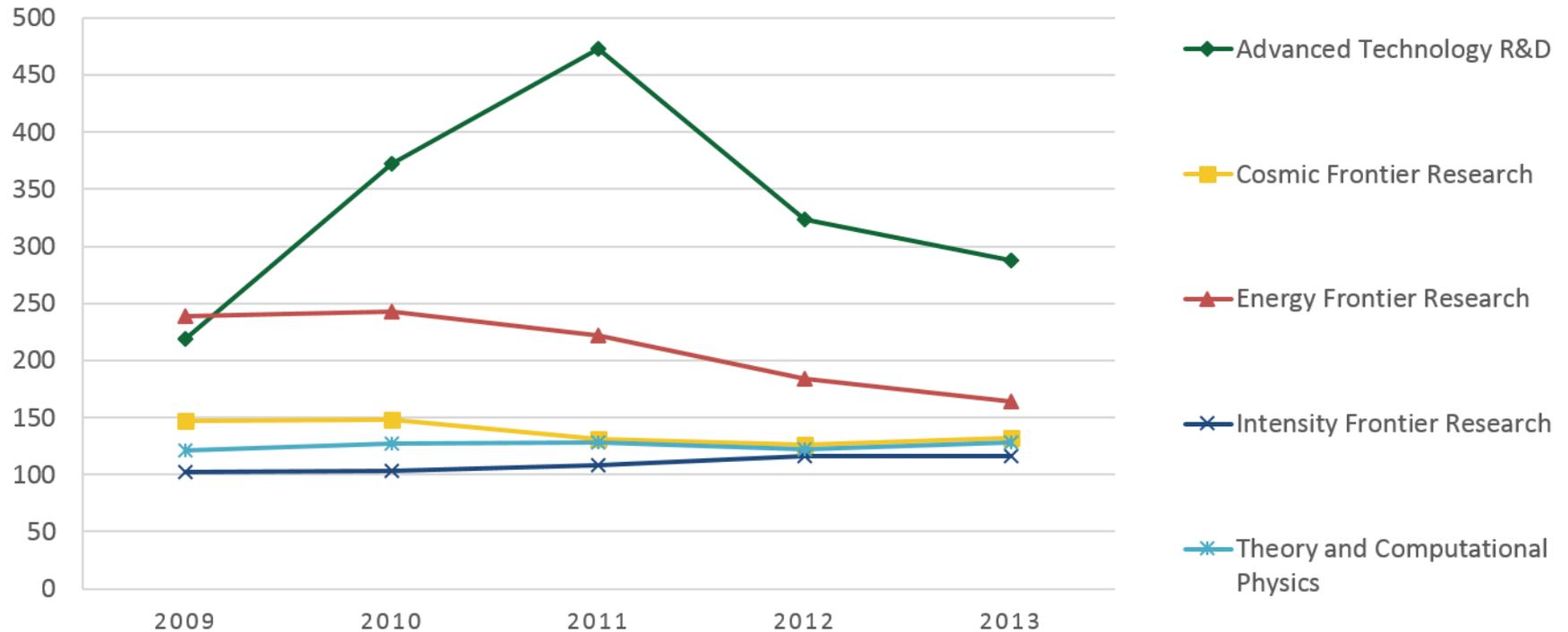
- All workforce data presented is based on voluntary, self-reported information for **2009-2013**
 - Not all institutions reported in every year
 - Not all institutions interpret FTEs and job classification in the same way
- Beginning this year, Annual Progress Reports collected through the Portfolio Analysis and Management System (PAMS) will provide standardized workforce information
 - As part of the progress report, all people supported on the grant have the opportunity to voluntarily provide demographic information regarding their gender, race, and ethnicity
 - The DOE does not use this information as the basis for any funding decisions
 - Providing this information would make it possible for the DOE to examine the distribution of awards across various demographic categories
 - A high response rate from the community would be valuable in helping identify and address diversity issues in our field



Laboratory Research Workforce Trends

- Advanced Technology R&D category has clear issues
- Energy Frontier trend driven by end of Tevatron at FNAL

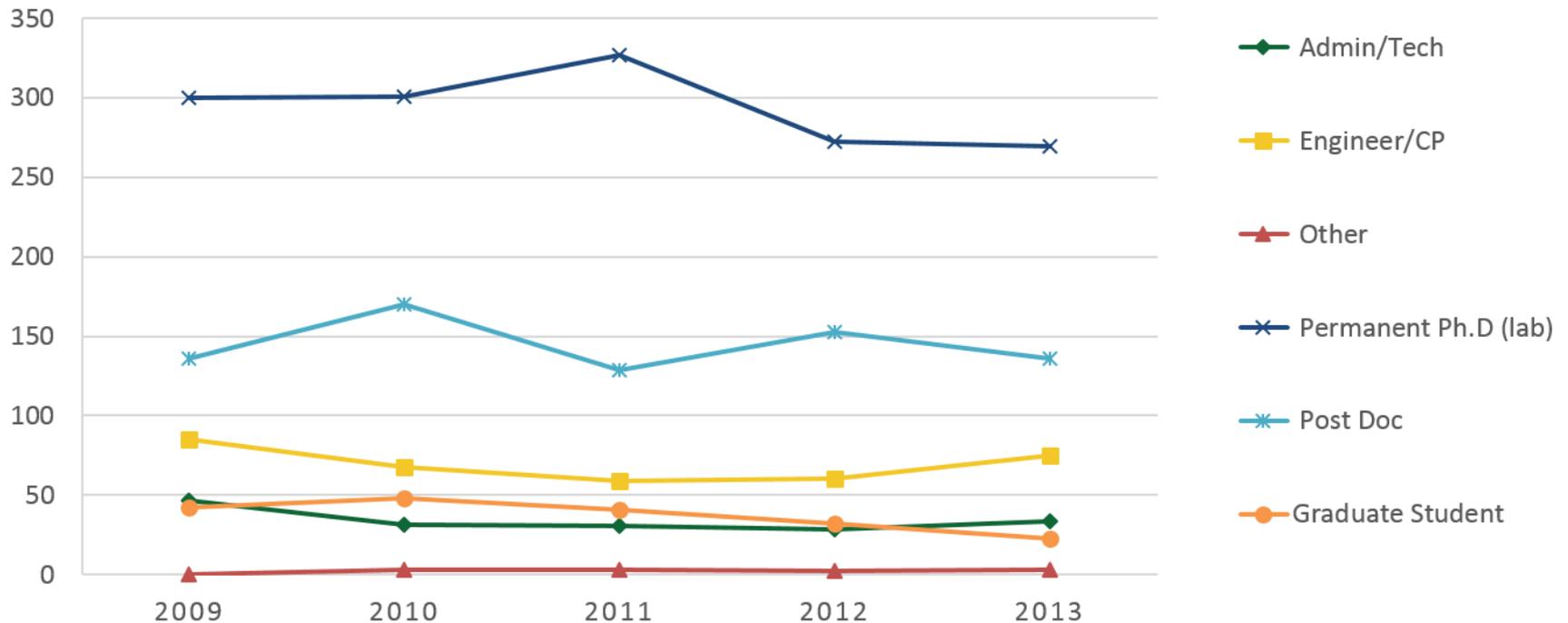
SELF-REPORTED LABORATORY FTE DATA
BY WORK CATEGORY



Laboratory Research Workforce Trends II

- Labs only, Advanced Tech excluded due to data issues

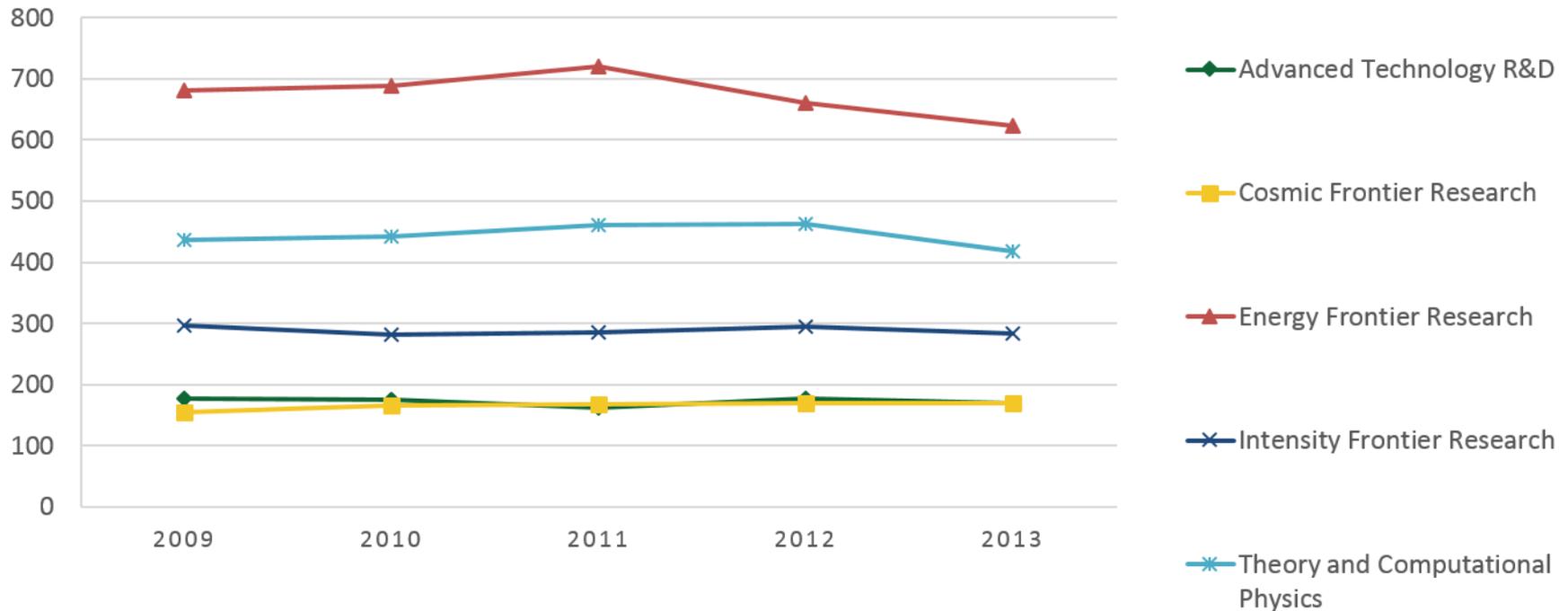
SELF-REPORTED LABORATORY FTE DATA
BY WORK CATEGORY
(ADVANCED TECHNOLOGY R&D EXCLUDED)



University Research Workforce Trends

- Very stable across frontiers, some losses in Energy Frontier (mostly Research Scientists, see next slide)
- Note this is mostly pre-Comparative Review

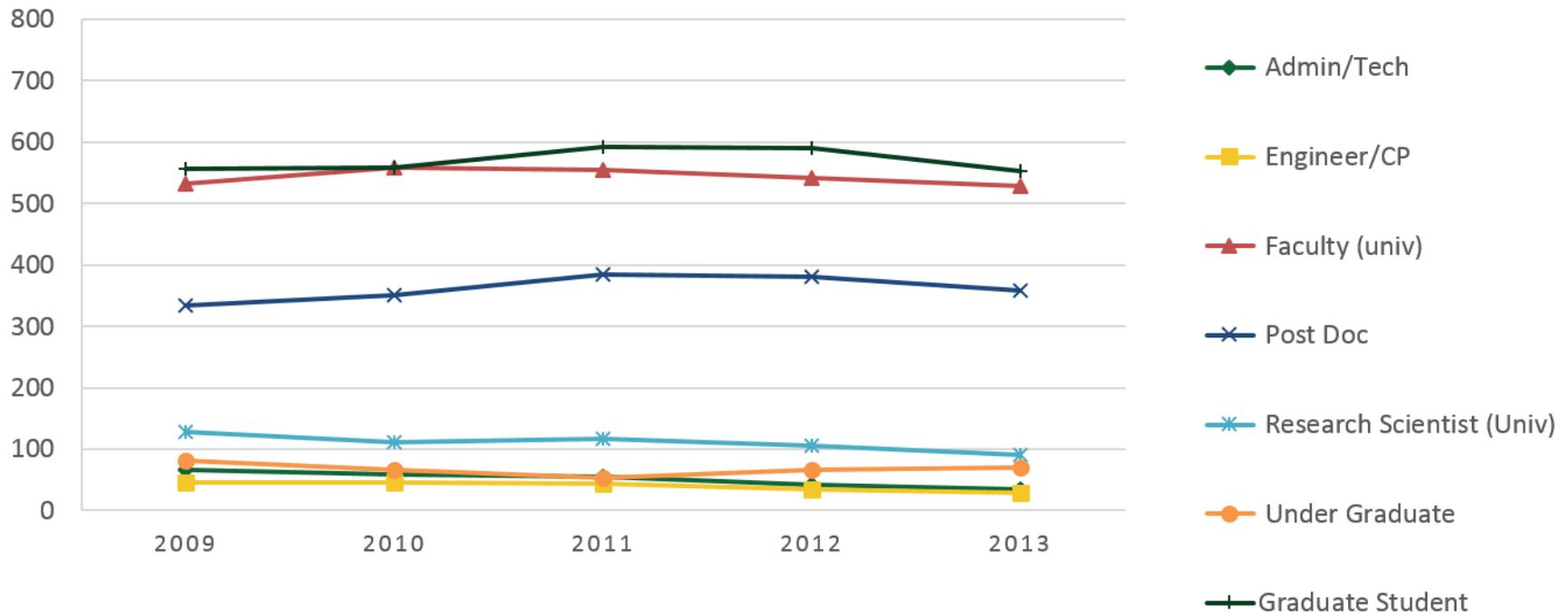
SELF-REPORTED UNIVERSITY FTE DATA
BY HEP SUBPROGRAM



University Research Workforce Trends II

- On average, trading Research Scientist and support positions for more postdocs and students

SELF-REPORTED UNIVERSITY FTE DATA
BY WORK CATEGORY



FOA Award Outcomes

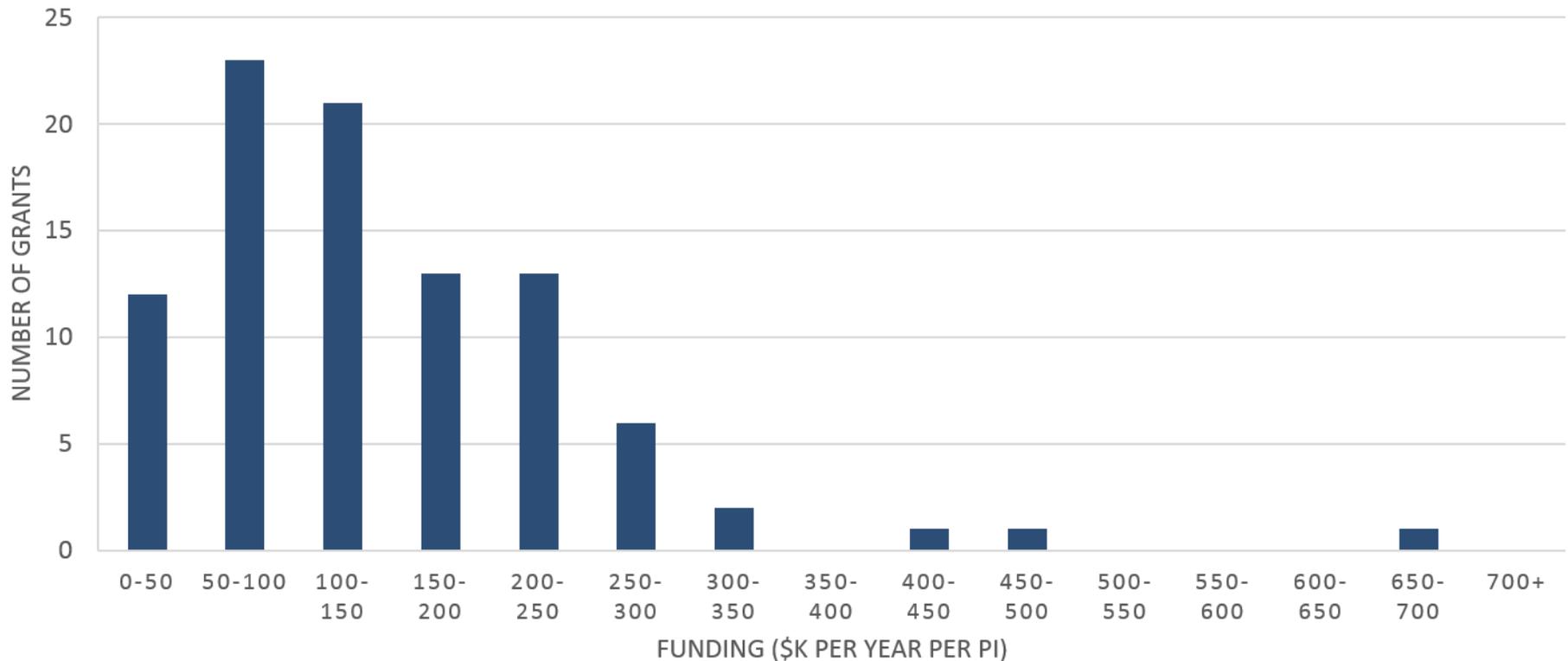
- **The following chart represents, as best as possible, the grants awarded in FY 2015 normalized to dollars per PI per year**
 - To the extent possible, normalization accounts for the supported fraction of PI research time
 - This information is based on information provided by HEP Program Managers and is not a standardized calculation
- **Many factors go into the determination of award size, including, but not limited to:**
 - Outcome of comparative review process
 - Program priorities
 - Available funding



FOA Award Outcomes in FY 2015

- Funding per PI averaged over entire HEP grant
 - Mean = \$152k, Median = \$138k, Standard Deviation = \$106k
 - Considering only values <\$350k:
 - Mean = \$140k, Median = \$131k, Standard Deviation = \$80k

FY 15 GRANT FUNDING (\$K PER YEAR PER PI)



Net University PI Changes FY13-16

- Can go back and look at Comparative Review outcomes for last 4 years to determine net flow of new/existing PIs into/out of the HEP university subprograms (we did not break down the data in this way in the first year of HEP Comparative Review, FY12)
 - Can also ask whether the incoming/outgoing PIs are junior faculty
 - Only includes PIs who were reviewed (e.g., retirements not included)
- Results:
 - Most programs are strongly adding Jr (non-tenured) PIs
 - PIs dropped due to poor reviews are dominantly Sr (tenured) PIs
 - Largest turnover in Cosmic, Accel R&D (relative to FY13 “core” FTEs*)

IN/OUT/Net	Energy (~200 PIs*)	Intensity (~75 PIs*)	Cosmic (~45 PIs*)	Theory (~200 PIs*)	Accel R&D (~40 PIs*)
All PIs	15/19/-4	28/23/+5	31/13/+18	27/52/-25	15/31/-16
Jr PIs	13/2/+11	15/3/+12	13/3/+10	17/2/+15	2/0/+2
Sr PIs	2/17/-15	13/20/-7	18/10/+8	10/50/-40	13/31/-18



Summary

- **DOE HEP Research Funding down overall FY10-17 by ~20%**
 - Largest impacts by far (50%!) in Advanced Technology R&D (partly ILC, P5)
 - Also significant reductions in Energy Frontier (partly Tevatron)
 - Modest growth in Intensity Frontier
- **On average, university programs doing as well as (or slightly better than) labs in terms of Research funding**
- **Workforce reductions (FY09-13) have come primarily in Research staff at labs and Research Scientists at universities**
 - Some issues with the self-reported data
 - Need to get more recent data to determine if trend continues
- **Mean funding per university HEP PI ~stable at \$150k/yr (+/- 100k)**
- **Comparative Review (FY13-16) process creating significant turnover in PIs in most university programs**
 - Strong support for Junior PIs
 - Lowest-performing 10-30% of PIs are not renewed
 - Net PI losses lower than one would naively expect from funding decreases (due to continued reduction of research scientists, then postdocs)



Next Steps

- **Projected slow (1-2%) growth of future HEP Research budgets will not keep pace with “cost of doing business”**
 - Cost reductions via Comparative Review may be nearing their limit
- **Working with HEP-funded labs to develop core programs that are sustainable for many years**
 - This is a further evolution of lab-based and subprogram-based optimization, across entire HEP program landscape
 - “Version 2.0” launched at HEP lab management meeting Feb 4
 - Will require some difficult choices
- **Targeting research priorities to advance implementation of P5**
 - Early Career
 - Strategic Investments (both labs and universities)
 - Larger emphasis on programmatic priorities in funding decisions

