U.S. DEPARTMENT OF ENERGY | Office of Science

Office of Science Perspective

High Energy Physics Advisory Panel

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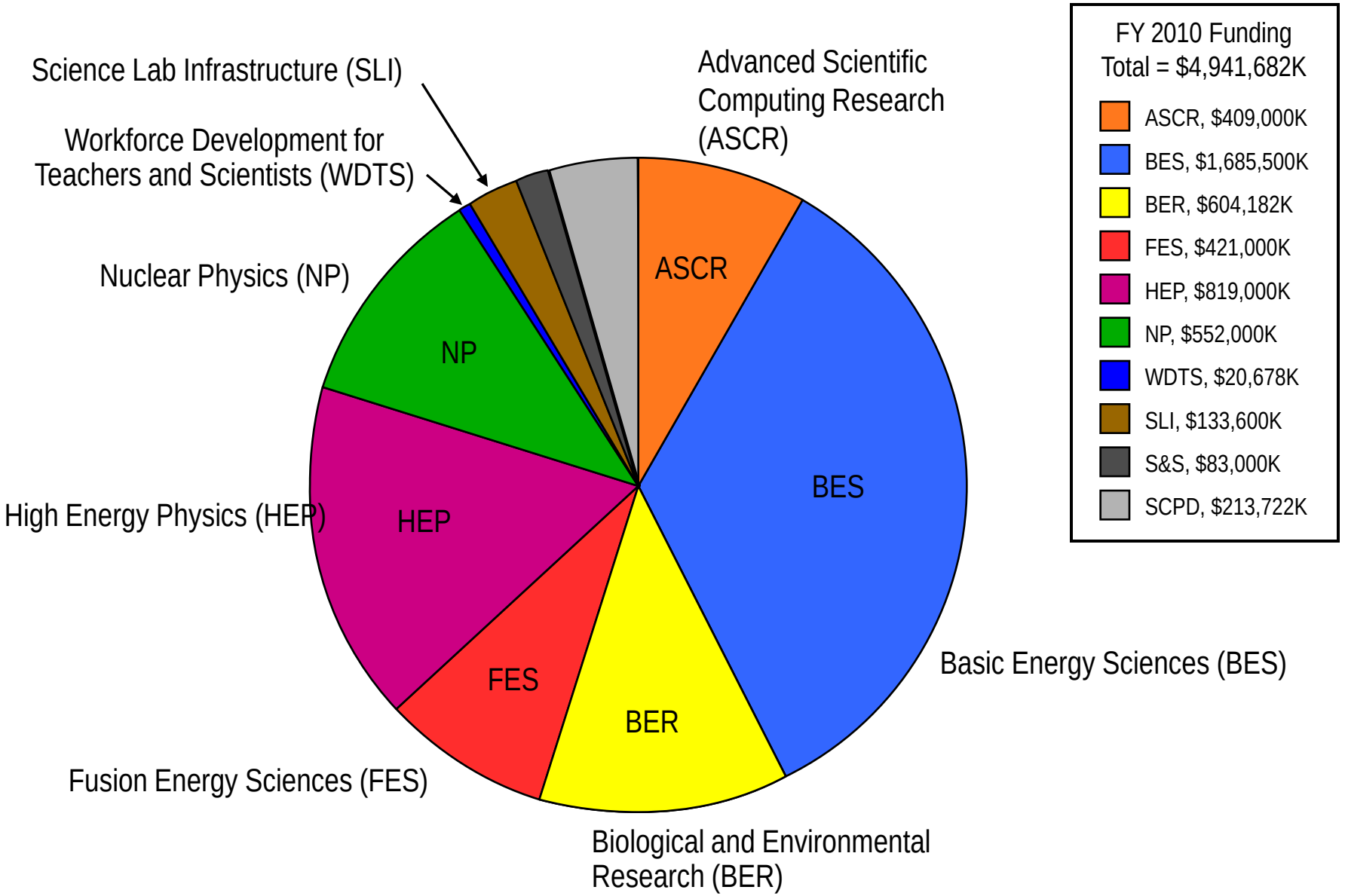
DOE's Office of Science

The Office of Science is one of the nation's largest supporters of peer-reviewed basic research, providing 40% of Federal support in the physical sciences and supporting ~25,000 Ph.D.s, graduate students, undergraduates, engineers, and support staff at more than 300 universities and at all 17 DOE laboratories.

Three themes describe the work supported by the Office of Science:

- **Science for discovery**
  - Unraveling Nature's deepest mysteries—from the study of subatomic particles; to atoms and molecules that make up the materials of our everyday world; to DNA, proteins, cells, and entire natural ecosystems
- **Science for national need**
  - Advancing a clean energy agenda through basic research on energy production, storage, transmission, and use
  - Advancing our understanding of the Earth's climate through basic research in atmospheric and environmental sciences and in climate modeling
  - Supporting DOE's missions in national security
- **National scientific user facilities, the 21st century tools of science**
  - Providing the Nation's researchers with the most advanced tools of modern science including accelerators, colliders, supercomputers, light sources and neutron sources, and facilities for studying the nanoworld, the environment, and the atmosphere

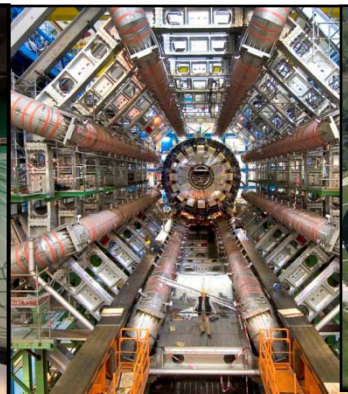
Office of Science Programs



User Facilities

- Advanced **computational resources** – terascale to petascale computing and networks for open science
- Four **synchrotron light sources**, and two next-generation light sources in construction
- Three **neutron sources** for scattering
- **Particle accelerators/colliders/detectors** for high energy and nuclear physics
- **Fusion/plasma facilities**, including **ITER** which seeks to demonstrate a burning plasma
- Five **Nanoscale Science Research Centers** – capabilities for fabrication and characterization of materials at the nanoscale
- **Joint Genome Institute** for rapid whole genome sequencing
- **Environmental Molecular Science Laboratory** – experimental and computational resources for environmental molecular sciences
- **Atmospheric and Environmental Facilities** – capabilities for cloud and aerosol measurement and for carbon cycling measurements





Distribution of Users by Facility

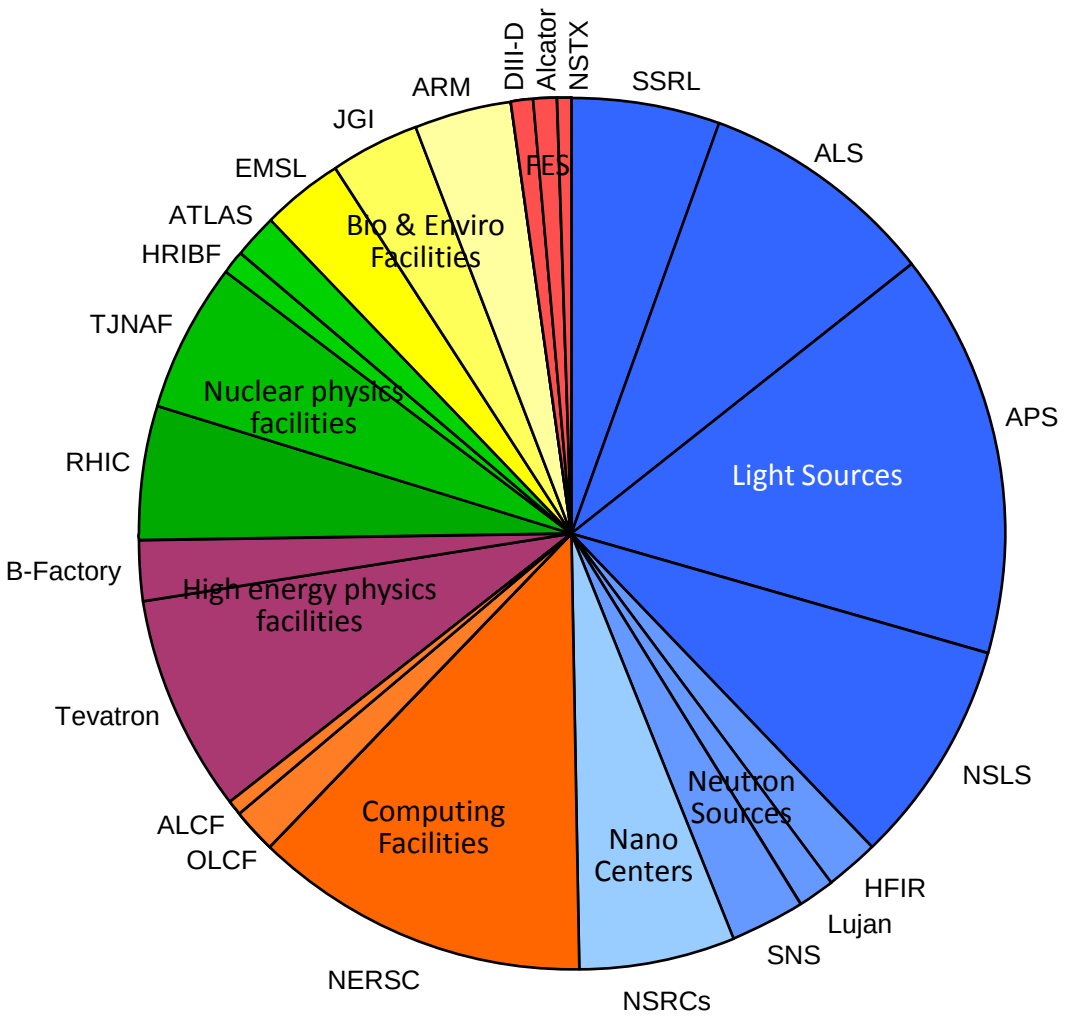
~25,000 users at the facilities in FY 2010:

~1/2 from universities;

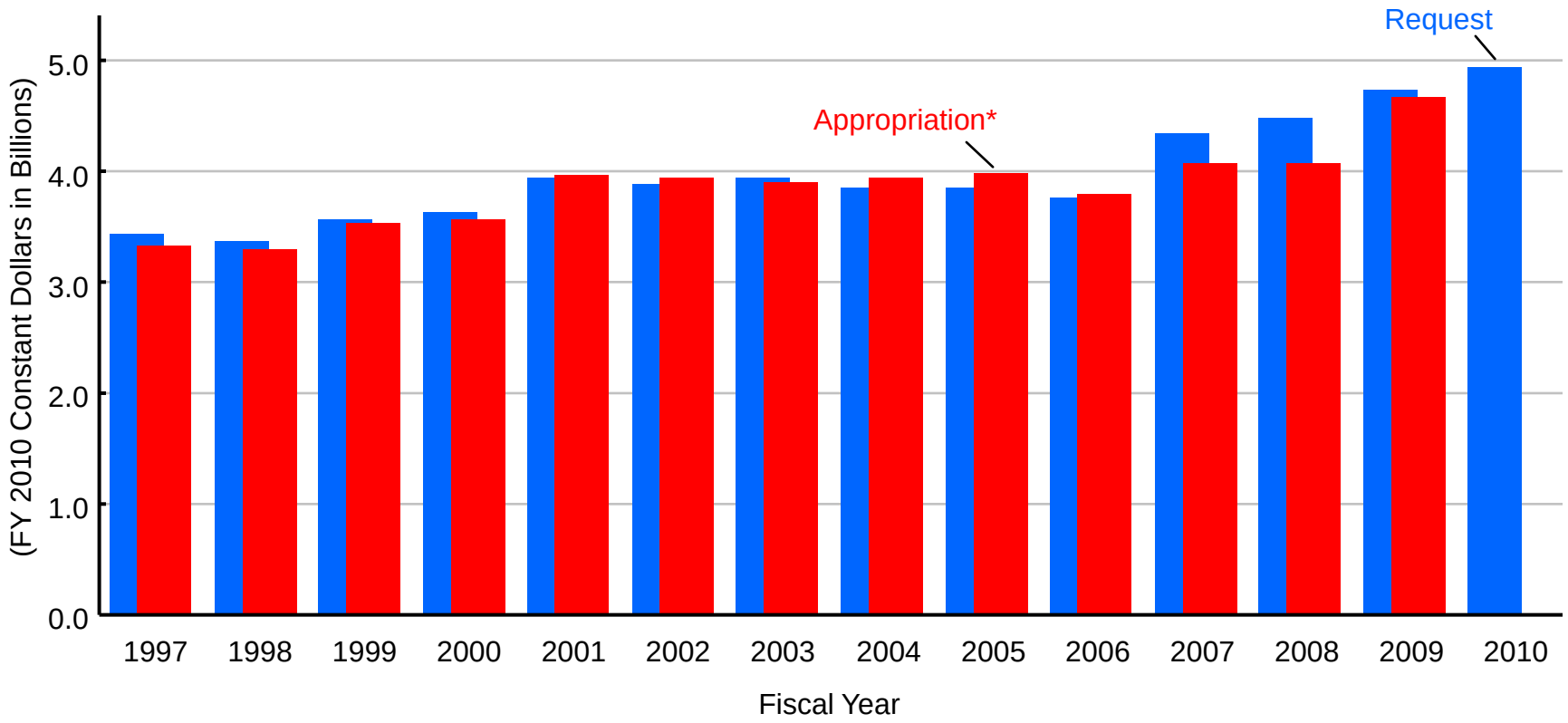
~1/3 from national labs;

and the remainder from industry, other agencies, and international entities.

Breakdown by facility of ~25,000 users in FY 2010



SC Request vs. Appropriation (FY 2010 Constant $s)



* Appropriation amounts exclude Congressionally directed projects.

Training the Next Generation of Scientists and Engineers

The Department of Energy has >50 year history of training scientists, mathematicians, and engineers through research grants, the DOE national laboratories, and targeted education programs.

- In FY 2008, more than 300,000 K-12 students; 21,000 educators; 3,000 graduate students; and 4,200 undergraduate students participated in opportunities at the DOE labs, funded by DOE and other federal and non-federal sources.
- SC will support over 4,400 graduate students and 2,700 post docs in FY 2009.
- In FY 2009, the Office of Workforce Development for Teachers and Scientists will support ~550 undergraduates in research internships at the DOE laboratories (and 1,175 in FY 2010 request) and ~280 K-16 educators.
- The DOE National Science Bowl attracts ~22,000 high school and middle school students every year.
- With Recovery Act funds and the FY 2010 request, SC initiated the DOE SC Graduate Fellowship Program, supporting over 160 graduate students in fields important to SC missions.
- SC proposes to increase the Graduate Fellowship Program to support approximately 400 graduate students in the out-years.

Early Career Research Program

The Department of Energy is now reviewing proposals for the DOE Office of Science Early Career Research Program to support the research of outstanding scientists early in their careers.

Purpose: To support the development of individual research programs of outstanding scientists early in their careers and to stimulate research careers in the disciplines supported by the Office of Science.

Status of FY 2010 Appropriations

(dollars in thousands)

	FY 2009		FY 2010			
	Base Approp.	Recovery Act Approp.	Request	House	Senate	Conf.
Office of Science						
Basic Energy Sciences	1,571,972	+555,406	1,685,500	1,675,000	1,653,500	1,636,500
Advanced Scientific Computing	368,820	+161,795	409,000	409,000	399,000	394,000
Biological and Environmental Research	601,540	+165,653	604,182	597,182	604,182	604,182
High Energy Physics	795,726	+232,390	819,000	819,000	813,000	810,483
Nuclear Physics	512,080	+154,800	552,000	536,455	540,000	535,000
Fusion Energy Sciences	402,550	+91,023	421,000	441,000	416,000	426,000
Science Lab Infrastructure	145,380	+198,114	133,600	133,600	133,600	127,600
Science Program Direction	186,695	+5,600	213,722	190,932	194,722	189,377
Workforce Development	13,583	+12,500	20,678	20,678	20,678	20,678
Safeguards and Security	80,603	—	83,000	83,000	83,000	83,000
Subtotal, Science	4,678,949	+1,577,281	4,941,682	4,905,847	4,857,682	4,826,820
Safeguards and Security (reimbursable charge)	—	—	—	—	—	—
Congressionally-directed projects	93,687	—	—	37,740	41,150	76,890
SBIR/STTR	—	+18,719	—	—	—	—
Use of prior year balances	-15,000	—	—	—	—	—
Total, Office of Science	4,757,636	+1,596,000	4,941,682	4,943,587	4,898,832	4,903,710

FY 2009 excludes transfers of SBIR/STTR from other DOE programs.

DOE Energy Innovation Hubs

Hubs approved for FY 2010:

- **Fuels from Sunlight (SC)**
- **Energy Efficient Building Systems Design (EERE)**
- **Modeling and Simulation for Nuclear Fuel Cycles and Systems (NE)**

Each Hub will comprise a world-class, multi-disciplinary and highly collaborative research and development team working largely under one roof. This team will focus on solving critical technology challenges that prevent large scale commercialization and deployment of the energy systems needed to address our Nation's greenhouse gas emission, energy security and workforce creation goals

Hope to add additional Hubs in FY 2011

Status of SC Recovery Act Projects

51 projects totaling $1.6B

- **Acceleration of Ongoing Line-Item Construction Projects - $338.2M**
  - NSLS-II ($150.0M)
  - TJNAF 12 GeV upgrade ($65.0M)
  - Science Laboratory Infrastructure (SLI) Construction ($108.5M)
- **Acceleration of Major Items of Equipment - $171.1M**
  - NOvA MIE ($55.0M)
- **Upgrades to SC User Facilities - $391.0M**
  - Advanced Networking ($66.8M)
  - Atmospheric Radiation Measurement (ARM) Climate Research Facility ($60.0M)
  - Environmental Molecular Sciences Laboratory ($60.0M)
  - Light Source Instrumentation/Enhancements ($24.0M)
  - Nanoscale Science Research Center Instrumentation ($25.0M)
- **Laboratory General Plant Projects - $129.6M**
- **Scientific Research - $562.1M**
  - Energy Frontier Research Centers ($277.0M; forward-funded 5 years)
  - Energy Sciences Fellowships and Early Career Awards – ($97.5M; forward-funded 3-5 years)
- **Management and Oversight - $8.0M**

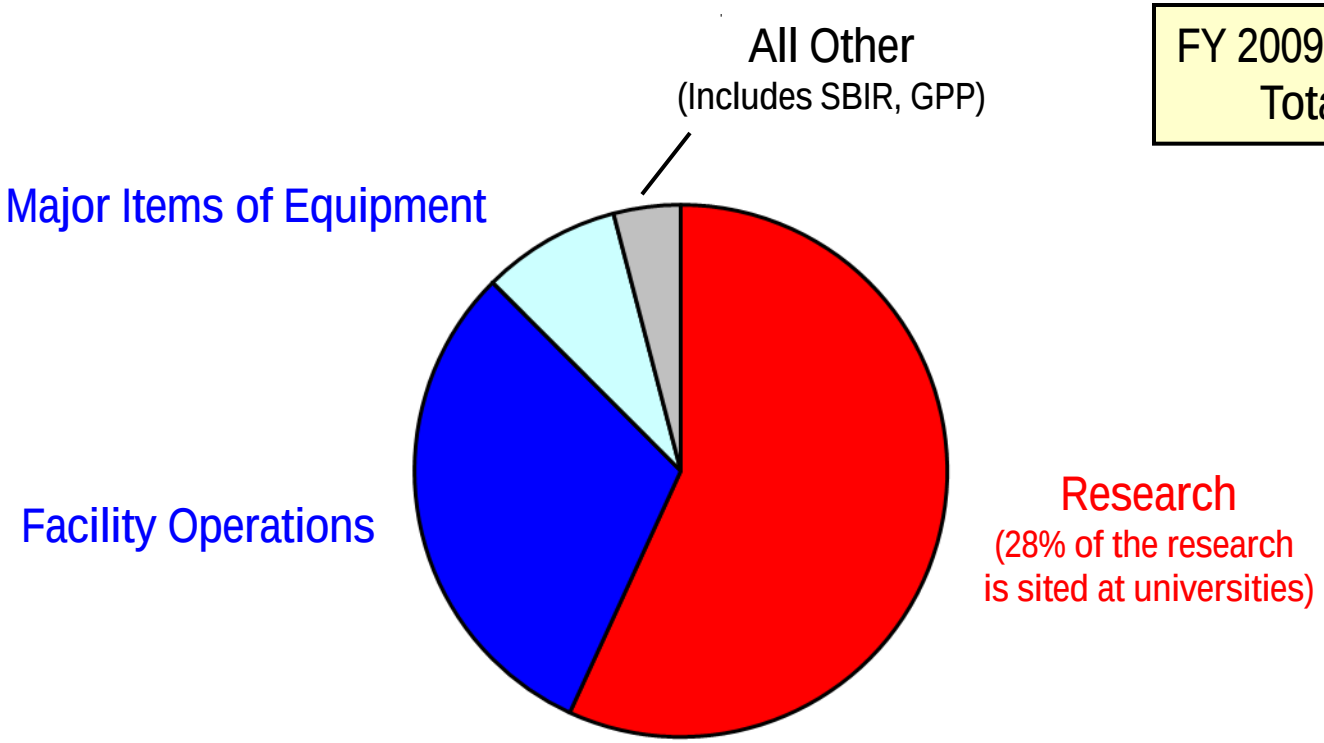
Status of HEP Recovery Act Projects

	Amount
Advanced Plasma Acceleration Facility MIE	**33,718**
Advanced Technology R&D Augmentation	**20,000**
Fermi GPP augmentation	**25,000**
Long Baseline Neutrino Experiment	**15,000**
NOvA MIE	**55,000**
Research and Infrastructure Augmentation at Universities	**15,000**
Superconducting Radio Frequency R&D	**52,672**
Total HEP	**216,390**

(dollars in thousands)

HEP FY2009 Support by Major Function

FY 2009 Appropriation
Total = $810K



HEP Strategic Directions- 2010 & Beyond

National Scientific User Facilities – the 21st century tools of science

- Ensure successful operation and scientific impact of the Tevatron at Fermilab and the Large Hadron Collider at CERN.
- Participate in the planned upgrades of the LHC.
- Conduct a comprehensive R&D plan to lay the foundations for a future TeV-scale lepton collider.
- Continue a world-leading program in neutrino physics.
- Plan for increased proton beam power at Fermilab, a long baseline neutrino experiment, and a program of rare decays.
- Continue a targeted program of experiments to investigate dark matter and dark energy.
- Steward a program of advanced accelerator and detector R&D.

Science for National Need – Bringing forefront scientific knowledge and state-of-the-art tools to serve the nation

The technology developed for high energy physics has found broad application in other scientific disciplines, medicine, national security, and industry.

- Particle accelerators are now found in synchrotron light sources, intense neutron sources, heavy ion accelerators, and very short pulse, high-brightness electron beams for research in materials science, nuclear physics, and chemistry (see "Symposium on Accelerators for America's Future," http://www.acceleratorsamerica.org/, October 26, 2009, Washington, DC)
- Advances in state-of-the art accelerator systems and magnet systems.
- Development of advanced electronics, detector technology, and Petascale computing.

Training the next generation of scientists.

Challenges for the Community

- **Develop a compelling scientific justification for an expanded neutrino program**

- **We want to keep alive high-energy experiments in the U.S., but need continued, strong justification**