



U.S. DEPARTMENT OF
ENERGY

Office of
Science

The Administration's Proposed Budget for FES in FY 2014

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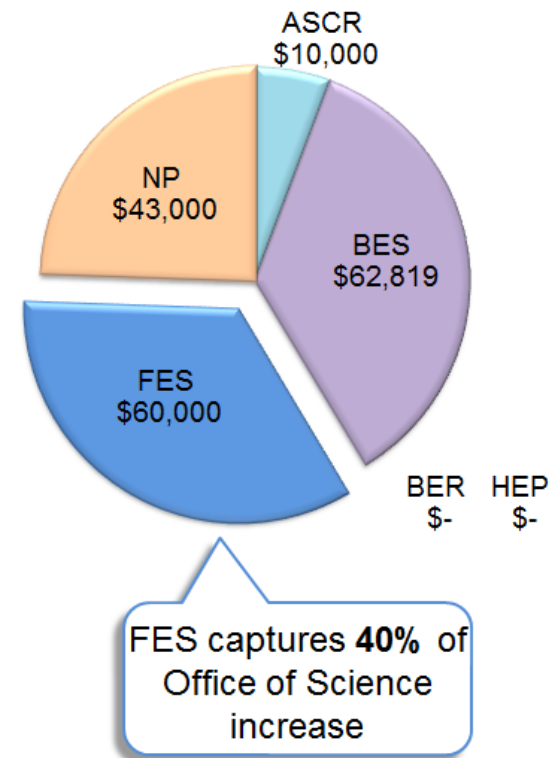
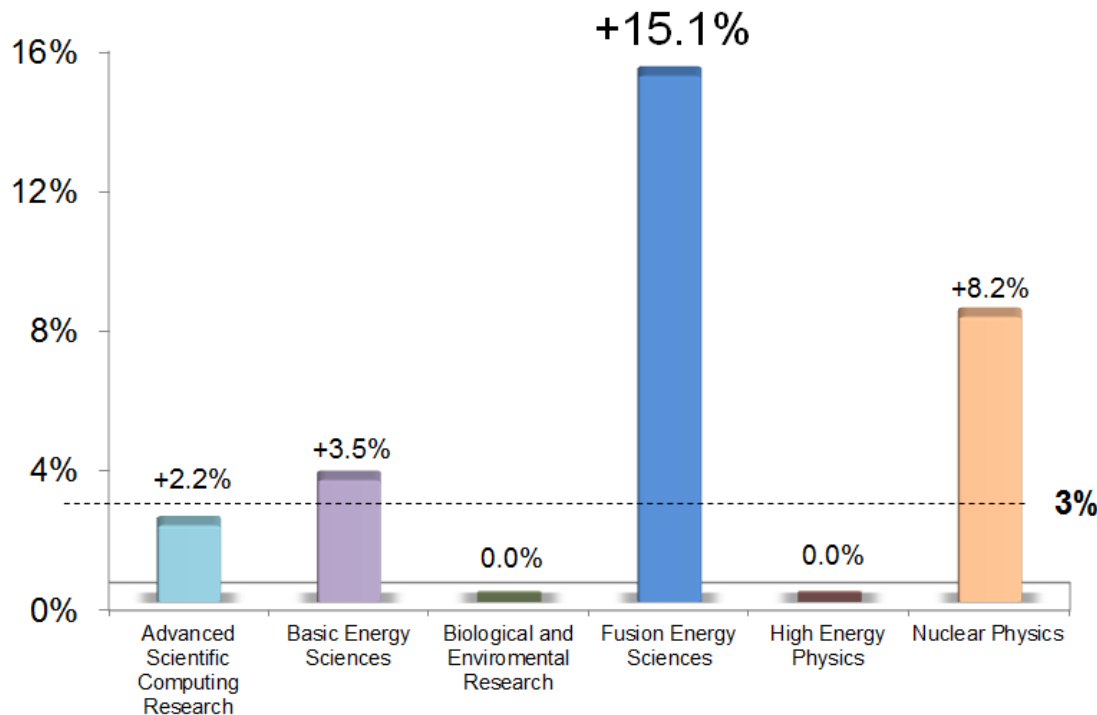


This proposal makes decisive moves into the burning plasma era

- **The Administration affirms a strong commitment to ITER**, recognizing its importance to fusion and potentially to the energy economy in the second half of this century. The Administration has developed a sustainable plan for US ITER support. Support for ITER research needs will include investments in DIII-D and NSTX-U, focused theory and simulation, and complementary university research programs
- **This budget invests in gap areas, including preparing for a heightened emphasis in fusion materials and long pulse challenges later this decade.** Our two largest facilities will be the centerpieces of a broader research effort involving labs, universities, and private companies to enable informed assessments for the requirements for a fusion nuclear science research program.
- **FES is still making world-leading contributions in the plasma sciences beyond MFE, but there is a narrowing of scope.** There is no support for the HEDLP joint program with NNSA. In the reduced HEDLP program, the emergent MEC station at LCLS is poised with one-of-a-kind capability, and the General Plasma Sciences portfolio grows

This budget reflects strong Administration support for FES

- Total FES budget request is \$458.324M, an increase of \$60M from the FY 2013 request. This FES increase is 40% of the total increase in the Office of Science spending as compared to the FY 2013 request, and is the largest fractional increase of any Office of Science program office





The budget includes a sustainable funding approach for the US ITER project

Q: Is the funding approach responsive to the out-year needs of US fusion and plasma science?

A: Yes

Q: Does US ITER need all of the construction funding requested to meet its near-term obligations?

A: Yes

- The Administration took into detailed consideration out-year spending requirements, in light of potential impacts on the non-ITER FES program, affordability within the Office of Science, and US obligations to deliver its contributions in a timely manner. This has yielded an Administration agreement to not exceed \$225M per year, the spending level for FY 2014
- The US plan follows the rigorous project management principles of DOE Order 413.3b and is tailored recognizing the unique nature of the ITER project.



From the FY 2014 budget narrative:

- “The U.S. ITER Project CD-1 cost range established in 2008 is \$1,450,000,000 - \$2,200,000,000. Since that time, factors that delayed CD-2 approval (e.g., schedule delays, design and scope changes, and risk mitigations) have also placed upward pressure on the cost range. In the spring of 2012, in efforts to address budgetary constraints, DOE and its oversight organizations agreed to support an annual funding level of no more than \$225,000,000 per year beginning in FY 2014. DOE believes these annual funding levels will enable the U.S. to fulfill its obligations...”
- “Until such time as CD-2 can be approved, the U.S. contributions will be managed with a performance plan that focuses on a two-year time horizon and that is also supportive of the longer-term project requirements. This two-year plan is developed, executed, and monitored with the use of the project management principles in DOE Order 413.3b with project management systems (Earned Value, Risk Management, Project Reporting) tailored specifically to this project’s circumstances.”



DIII-D National Fusion Facility

The DIII-D research goal is to establish the scientific basis for the optimization of the tokamak approach to magnetic confinement fusion, including near-term scientific issues for ITER and advanced operating scenarios.

Research	FY'13 CONG Request	FY'13 Operating Plan w/ Sequestration	FY'14 CONG Request
DIII-D	26,703	TBD	28,200

Operations	FY'13 CONG Request	FY'13 Operating Plan w/ Sequestration	FY'14 CONG Request
DIII-D	33,260	TBD	36,960

FY 2014 budget highlights

- **Research:** Support operations to address milestones on 3D field effects, divertor geometry studies, transport in ITER scenarios, and disruption avoidance near stability limits.
- **Facility Operations:** 16 weeks of operation, and support for some high-priority facility upgrades and system refurbishments.



NSTX Upgrade

The NSTX Upgrade program will evaluate the potential of the ST to achieve the high plasma performance required for a fusion nuclear science facility

Research	FY'13 CONG Request	FY'13 Operating Plan w/ Sequestration	FY'14 CONG Request
NSTX	16,836	TBD	17,500

Operations	FY'13 CONG Request	FY'13 Operating Plan w/ Sequestration	FY'14 CONG Request
NSTX	6,593	TBD	12,600

Construction Projects	FY'13 CONG Request	FY'13 Operating Plan w/ Sequestration	FY'14 CONG Request
NSTX Upgrade	22,800	TBD	23,700

FY 2014 budget highlights

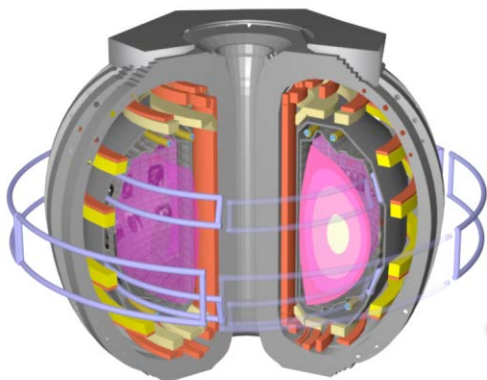
- **NSTX Upgrade construction:** On track for project completion by or ahead of the agreed-upon baseline.
- **NSTX Facility Operations and Research:** Support is ramped up to prepare the power supplies, diagnostics, auxiliary heating systems, etc., for rapid resumption of research operations upon project completion and to complete preparations for the NSTX Upgrade research program.



DIII-D & NSTX are a Scientifically Powerful Pair

Together, provide access to extended range of key physics parameters

DIII-D

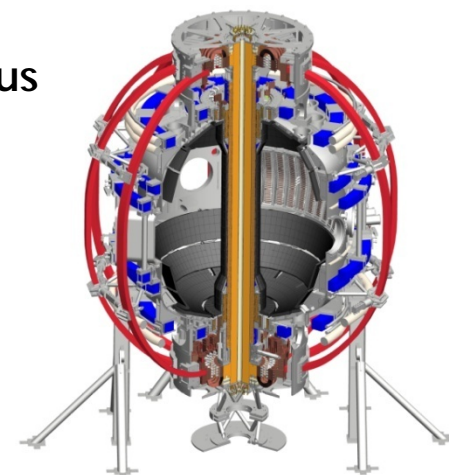


- ✓ Aspect ratio
- ✓ Normalized Size
- ✓ Collisionality
- ✓ High β

- ✓ Rotational Shear
- ✓ Electron gyroradius
- ✓ Sub vs super Alfvénic
- ✓ T_e / T_i



NSTX-U



- ✓ Transport in ITER burning plasma regime
- ✓ Advanced Scenarios

- ✓ Fast ion parameter space overlaps and extends beyond ITER in V_{fast}/V_{alfven} and β_{fast}/β_{tot}

- ✓ Dynamics and control of self-sustained plasmas
- ✓ Power and particle exhaust



Alcator C-Mod

C-Mod has operated as a national scientific user facility through FY 2012. C-Mod scientists have made significant contributions to the world's fusion program.

Research	FY'13 CONG Request	FY'13 Operating Plan w/ Sequestration	FY'14 CONG Request
Alcator C-Mod	8,396	TBD	0

Operations	FY'13 CONG Request	FY'13 Operating Plan w/ Sequestration	FY'14 CONG Request
Alcator C-Mod	7,848	TBD	0

FY 2014 budget highlights

- **FY 2013:** The facility will go into a cold shutdown mode as soon as possible to conserve funding.
- **FY 2014:** The Alcator C-Mod facility is closed down. Funding provided in FY 2013 will be used for the safe shutdown of the facility.



International Research

A new generation of international facilities provides exciting opportunities for U.S. scientists to collaborate on research on long-pulse control of high-performance plasmas, both tokamaks and stellarators.

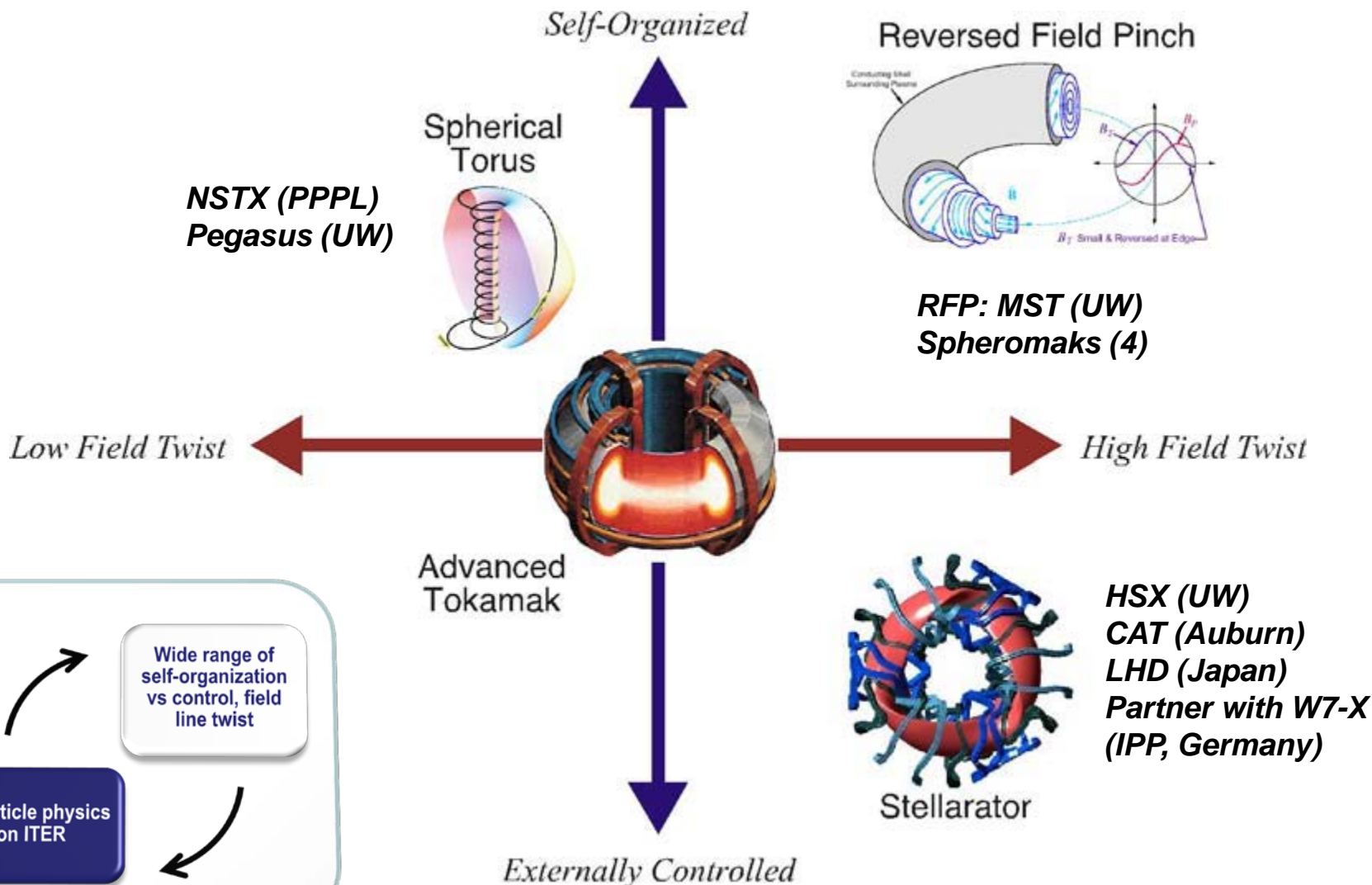
Research	FY'13 CONG Request	FY'13 Operating Plan w/ Sequestration	FY'14 CONG Request
International Research	8,946	TBD	8,300

FY 2014 budget highlights

- Funding will support soon-to-be-established U.S. research teams working on major international fusion research facilities in Asia and Europe.
- Funding will also support an additional research team to work on international stellarator facilities.



A wide range of magnetic confinement concepts contributes to and benefits from burning plasma science





Experimental Plasma Research provides data in regimes of relevance to mainline magnetic confinement and materials science efforts, supports V&V efforts, and contribute to discovery science. MST increases fundamental understanding of the RFP configuration as well as has an important place in V&V and discovery science.

	FY'13 CONG Request	FY'13 Operating Plan w/ Sequestration	FY'14 CONG Request
MST	5,750	TBD	5,700
Experimental Plasma Research	10,500	TBD	10,500

FY 2014 budget highlights

- **EPR:** Examine range of magnetic confinement concepts to establish scientific connections and help establish experimentally validated predictive capability
- **MST:** RFP experiments and modeling on density and magnetic field fluctuation, with equilibrium reconstructions.



Theory and SciDAC

Advance scientific understanding of fundamental physical processes governing the behavior of magnetically confined plasmas and develop predictive capability by exploiting leadership-class computing resources.

	FY'13 CONG Request	FY'13 Operating Plan w/ Sequestration	FY'14 CONG Request
Theory	20,836	TBD	20,670
SciDAC	6,556	TBD	6,875

FY 2014 budget highlights

- **Theory:** Emphasis on research relevant to burning plasmas and ITER and on closing gaps in critical areas.
- **SciDAC:** Maintain support for continuing joint FES-ASCR partnership.



Enabling R&D

Enabling R&D addresses ITER operational issues and development of the scientific understanding of materials under extreme conditions needed to realize fusion energy.

FY 2014 budget highlights

- **Plasma Technology:** Research on fueling, heating, chamber technologies for fuel cycle development, and safe operation of future facilities.
- **Advanced Design Studies:** Identify ways to address the gaps in materials and nuclear science research and help crystallize the FNSF concept.
- **Materials Research:** Elucidate the complicated response of materials under extreme fusion conditions and provide critical data for future fusion devices.

	FY'13 CONG Request	FY'13 Operating Plan w/ Sequestration	FY'14 CONG Request
Plasma Technology	11,666	TBD	11,660
Advanced Design Studies	1,611	TBD	1,400
Materials Research	9,371	TBD	8,300
Total, Enabling R&D	22,648	TBD	21,360



HEDLP involves cross-cutting research in areas ranging from laboratory astrophysics to materials under extreme conditions.

	FY'13 CONG Request	FY'13 Operating Plan w/ Sequestration	FY'14 CONG Request
High Energy Density Laboratory Plasma	16,933	TBD	6,575

FY 2014 budget highlights

- HEDLP program will be contracted to focus on MEC at LCLS, a world-leading capability for broad HEDLP science unique to the Office of Science.
- However, FES will be unable to support the Joint NNSA/FES HEDLP program in FY 2014. NNSA will still support elements of the NNSA/FES joint program and other aspects of HEDLP, including the SSAA, and still seeks FES engagement in program development
- Elements of HEDLP are retained in General Plasma Science portfolio



General Plasma Science

The General Plasma Science (GPS) program focuses on increasing the understanding of basic and low-temperature plasma science through research addressing outstanding questions related to fundamental plasma properties and processes, as well as multidisciplinary activities.

	FY'13 CONG Request	FY'13 Operating Plan w/ Sequestration	FY'14 CONG Request
General Plasma Science	13,151	TBD	15,000

FY 2014 budget highlights

- The Administration support for the NSF/FES Partnership, is strong.
- Core activities will be continued, including interagency partnerships, Plasma Science Centers, and user activities at the Basic Plasma Science Facility.



Budget summary, FES

**Fusion Energy Sciences
FY 2014 Congressional Budget**
(Budget Authority in thousands)

	FY 2013 Request	FY 2013 Operating Plan w/ Seq.	FY 2014 Request
Science			
DIII-D Research	26,703	TBD	28,200
C-Mod Research	8,396	TBD	0
International Research	8,946	TBD	8,300
Diagnostics	3,519	TBD	3,500
Other	9,193	TBD	8,312
NSTX Research	16,836	TBD	17,500
Experimental Plasma Research	10,500	TBD	10,500
HEDLP	16,933	TBD	6,575
MST Research	5,750	TBD	5,700
Theory	20,836	TBD	20,670
SciDAC	6,556	TBD	6,875
General Plasma Science	13,151	TBD	15,000
SBIR/STTR	6,881	TBD	6,672
Total, Science Research	154,200	TBD	137,804

	FY 2013 Request	FY 2013 Operating Plan w/ Seq.	FY 2014 Request
Facility Operations			
DIII-D	33,260	TBD	36,960
C-Mod	7,848	TBD	0
NSTX	6,593	TBD	12,600
MIE: NSTX Upgrade	22,800	TBD	23,700
Other, GPE, and GPP	975	TBD	900
MIE: U.S. Contributions to ITER Project	150,000	TBD	225,000
Total, Facility Operations	221,476	TBD	299,160
Enabling R&D			
Plasma Technology	11,666	TBD	11,660
Advanced Design	1,611	TBD	1,400
Materials Research	9,371	TBD	8,300
Total, Enabling R&D	22,648	TBD	21,360
Total, Fusion Energy Sciences	398,324	TBD	458,324



Summary

- **The Administration affirms a strong commitment to ITER**, recognizing its importance to fusion and potentially to the energy economy in the second half of this century. The Administration has developed a sustainable plan for US ITER support. Support for ITER research needs will include investments in DIII-D and NSTX-U, focused theory and simulation, and complementary university research programs
- **This budget invests in gap areas, including preparing for a heightened emphasis in fusion materials and long pulse challenges later this decade.** Our two largest facilities will be the centerpieces of a broader research effort involving labs, universities, and private companies to enable informed assessments for the requirements for a fusion nuclear science research program.
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