U.S. Department of Energy's

Office of Science

SciDAC, FSP & High Performance Computing Updates

CEMM Meeting at Sherwood Boulder, CO

Office of Fusion Energy Sciences

Excellent Science Attractive Energy

www.ofes.fusion.doe.gov

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OFES

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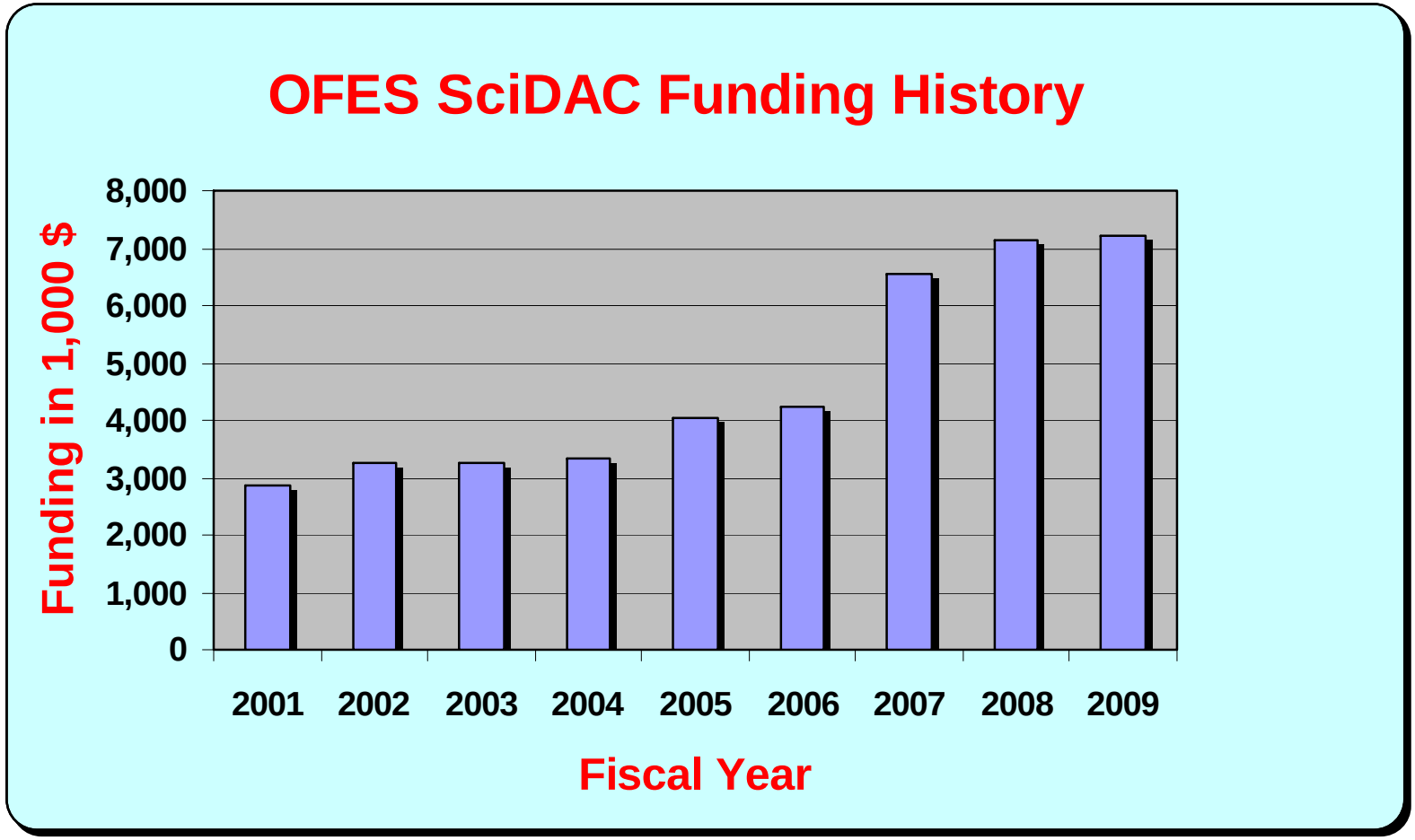
Status of FES Scientific Discovery through Advanced Computing (SciDAC) Projects

	FY 2007	FY 2008	FY 2009 (CONG)
Funding ($ Millions) (FES only)	**6.5**	**7.1**	**7.2**

- The current FES SciDAC portfolio includes ***eight*** projects
  - Five are focused on topical science areas (RF, MHD, Turbulence & Transport, Energetic Particles) and are funded entirely by OFES
  - Three are focused on integration (RF + MHD, plasma edge region, core + edge + wall) and are often referred to as *Fusion Simulation Prototype Centers* or "proto-FSPs". They are co-funded equally by OFES and OASCR
  - Together, the FES SciDAC projects address **9** out of the **15** topical scientific questions (T1-T6, T10-T12) and **4** out of the **6** campaigns of our 2005 FESAC Priorities Panel Report
- The FES SciDAC projects are set up as strong collaborations among **29** institutions. The institutional funding distribution is:
  - **National Labs: 44%**
  - **Universities: 38%**
  - **Private Industry: 18%**

SciDAC Funding History



Projects focused on topical science areas

Funded or renewed in FY08 through FY10

Project	Lead PI & Institution	Collaborating Institutions	
Center for Simulation of Wave-Plasma Interactions (*CSWPI*)	P. Bonoli MIT	CompX GA Lodestar	ORNL PPPL Tech-X
Center for Extended MHD Modeling (*CEMM*)	S. Jardin PPPL	GA LANL MIT NYU	Tech-X U Colorado Utah State U U Wisconsin
Gyrokinetic Particle Simulation of Turbulent Transport in Burning Plasmas (*GPS-TTBP*)	P. Diamond UCSD	Columbia U ORNL PPPL UC Irvine	UCLA UC Davis USC U Texas
NEW! Center for Simulation of Plasma Microturbulence (*CSPM*)	W. Nevins LLNL	GA MIT PPPL	U Maryland U Colorado
NEW! Gyrokinetic Simulation of Energetic Particle Turbulence and Transport (*GSEP*)	Z. Lin UC Irvine	GA LLNL	ORNL UCSD

Projects focused on integration (proto-FSPs)

Project	Lead PI & Institution	Collaborating Institutions	
Center for Simulation of Wave Interactions with MHD (*SWIM*)	D. Batchelor ORNL	Columbia U CompX GA Indiana U Lehigh U	MIT PPPL Tech-X U Wisconsin
Center for Plasma Edge Simulation (*CPES*)	C-S Chang NYU	Caltech Columbia U Hinton Assoc. LBNL Lehigh U MIT ORNL	PPPL Rutgers U U Colorado U Tennessee U Utah UC Irvine
Framework Application for Core-Edge Transport Simulations (*FACETS*)	J. Cary Tech-X	LLNL PPPL UCSD	ANL Colorado State U ORNL ParaTools, Inc.

- **CPES & SWIM:** *FY06-FY10, 3rd year progress review in 2008*
- **FACETS:** *FY07-FY11 (SciDAC-2)*

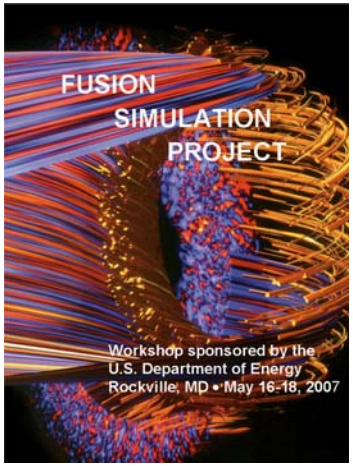
Important Dates

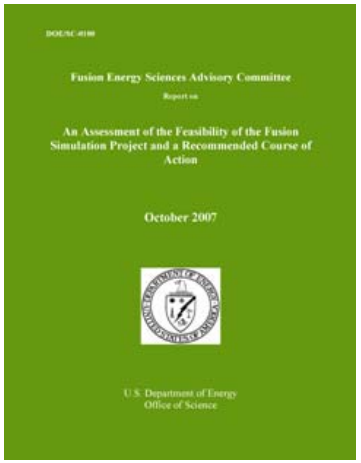
- **June 5-6:** PSACI-PAC meeting (PPPL)
- **June 23-24:** 3rd year review for ***CPES*** & ***SWIM*** (Washington, DC)
- **July 13-17:** SciDAC Conference (Seattle, WA)
  - **July 18:** Tutorials (Redmond, WA)
- **Summer, 2008:** INCITE Call for proposals

Status of the Fusion Simulation Project (FSP)

Progress since the May '07 workshop

- FESAC evaluated the FSP Workshop report and recommended to move forward to a *Project Definition* phase
- ASCAC has been charged to consider what is being proposed and to recommend an appropriate and mutually beneficial role for ASCR in the FSP (*final report due: August 2008*)
- The FES FY2009 CONG budget request includes **$1,976K** to start the FSP Project Definition Phase
  - A solicitation for selecting a national team to carry out this work will be issued later in 2008





OFES High Performance Computing Resources
2008 Allocation Year (AY)

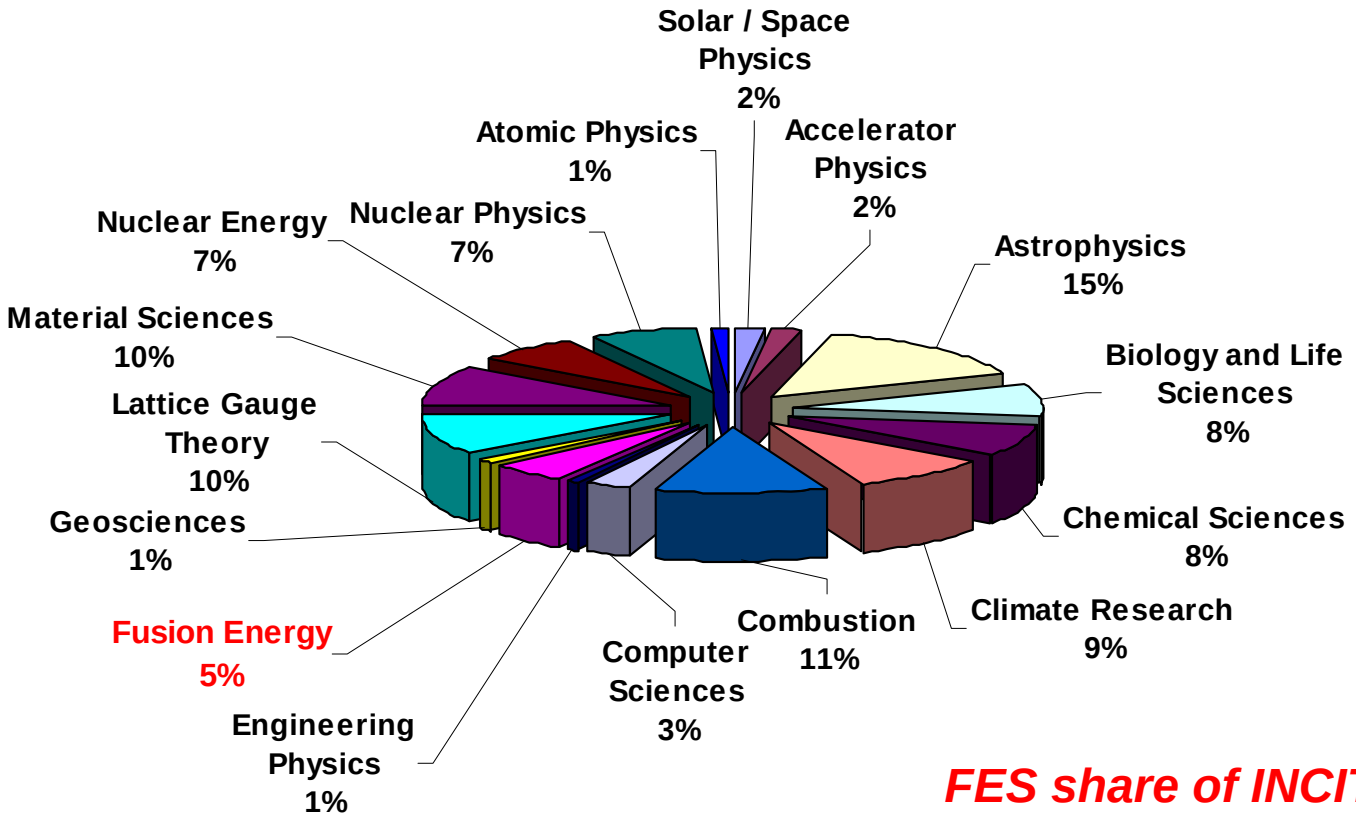
NERSC (*Franklin, Bassi, & Jacquard*)

- Significant increase in NERSC resources in 2008
- The **19,320** processor **101.5 TFlop/s** Cray XT4 ***Franklin*** replaced ***Seaborg*** as NERSC's flagship system
- **53** FES repositories
  - 12 SciDAC
  - 1 INCITE
- OFES AY 08 allocation: **69.1** M hours
  - *Compared to 16.7 M hours in AY07*
- No additional resources are expected in 2008

2008 INCITE Program

- The **I**nnovative and **N**ovel **C**omputational **I**mpact on **T**heory and **E**xperiment (**INCITE**) program provides resources to large scale computationally intensive projects that can make high-impact scientific advances
- Now in its *fifth* year, INCITE includes HPC resources at ORNL, LBNL (NERSC), ANL, PNNL
- In 2008, **55** projects (31 new, 24 renewals) received **265** million processor-hours:
  - DOE Labs: 20
  - Universities: 17
  - Industry: 8
  - Other: 10
- Largest award: **26,700,000** hours (*Lattice QCD*), ORNL & ANL
- Largest award on XT4 @ ORNL: **18,000,000** hours (*Combustion*)
- Seven FES projects were selected for INCITE awards in 2008 (3 new, 4 renewals)
- Largest FES award: **8,000,000** on XT4 @ ORNL

2008 INCITE Awards
Allocations by Discipline



***FES share of INCITE resources in 2007*: 11%**

FES INCITE Projects

New for 2008

Verification and validation of petascale simulation of turbulent transport in fusion plasmas

- PI: Patrick Diamond (UCSD)
- Cray XT4 (ORNL), 8,000,000 hours
- SciDAC: GPS-TTBP, GSEP, CPES

Fluctuation Spectra and Anomalous Heating in Magnetized Plasma Turbulence

- PI: William Dorland (U Maryland)
- Cray XT4 (ORNL), 4,000,000 hours
- *Fusion Science Center for Multiscale Plasma Dynamics*

High Resolution Global Simulation of Plasma Microturbulence

- PI: William Tang (PPPL)
- IBM Blue Gene / P (ANL), 2,000,000 hours
- SciDAC: -

Renewals

Computational Atomic and Molecular Physics for Advances in Astrophysics, Chemical Sciences and Fusion Energy Sciences

- PI: Mitch Pindzola (Auburn U)
- Cray X1E (ORNL), 2,000,000 hours
- SciDAC: -

Gyrokinetic Steady State Transport Simulations

- PI: Jeff Candy (GA)
- Cray XT4 (ORNL), 1,500,000 hours
- SciDAC: SSGKT (FACETS SAP)

High Power Electromagnetic Wave Heating in the ITER Burning Plasma

- PI: E. Fred Jaeger (ORNL)
- Cray XT4 (ORNL), 1,000,000 hours
- SciDAC: CSWPI

Three-Dimensional Particle-in-Cell Simulations for Fast Ignition

- PI: Chuang Ren (U Rochester)
- NERSC (LBNL), 2,000,000 hours
- Fusion Science Center for Extreme States of Matter

2009 INCITE Program

- Expansion of the DOE Office of Science's computational capabilities should approximately ***quadruple*** the 2009 INCITE award allocations to close to a ***billion*** processor hours.
- FES SciDAC PIs are ***strongly*** encouraged to apply for INCITE resources—expect an announcement this summer
- INCITE projects are expected to be ***computationally intensive*** and their use of the resources should reflect this fact:
  - *A computationally intensive research project will utilize a majority of the processors and multiple cores, if applicable, in the proposed research. A project that involves a large number of small independent jobs is not considered computationally intense* (from the INCITE FAQ)
- Avoid submitting unfocused proposals combining several projects or with overlapping scope of work
  - *Emphasize scientific discovery and ability to use HPC resources*
- A community discussion on INCITE will be held at the PSACI-PAC meeting in June