



U.S. Department of Energy Office of Science

Nuclear Physics Program

Nuclear Science Advisory Committee

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Nuclear Physics Division
March 2003

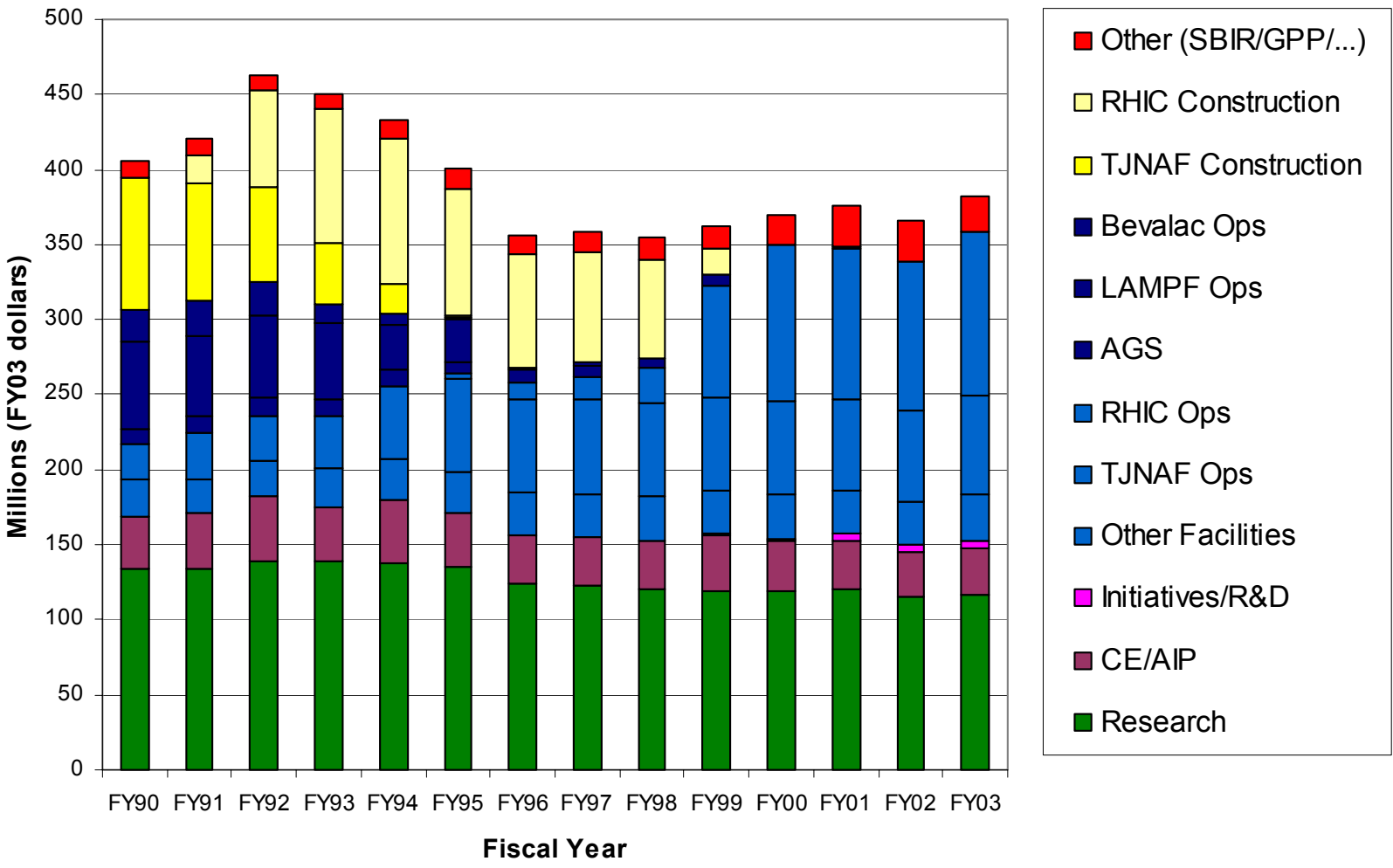


Nuclear Physics Program

- **Overview**
- **FY 2003 Budget**
- **FY 2004 Budget**
- **Program Office Activities**



DOE Nuclear Physics Funding





Overview (*retrospective*)

- **Over the last decade the NP program has evolved significantly:**
 - Facilities have been phased out (LAMPF & Bevalac)
 - New Facilities have been constructed (CEBAF & RHIC)
 - Capabilities have been upgraded (HRIBF, Bates, ATLAS & 88 Inch)
 - Promising initiatives pursued (Gammasphere, SNO, KamLAND, Mini-Boone, etc)
- **Positioned the U.S. for leadership role and produced significant results:**
 - RHIC & CEBAF provide world-leadership capabilities for the next decade
 - Competitive nuclear structure and astrophysics programs have been maintained
 - Non-accelerator initiatives have been extraordinarily successful (SNO, etc)
- **NSAC and nuclear science community have played an important role:**
 - Long Range Plans have identified the scientific opportunities
 - Reviews have identified priorities and maintained the quality
- **A world-leader/among the leaders in all major area of nuclear physics**
 - Significant discoveries and progress in understanding have been made



Overview (prospective)

- **Recent funding levels have not been sufficient for the existing program:**
 - New facilities are not operating at optimum levels (Lehman Reviews)
 - Research funding has been eroded by the focus on new facility operations
 - Ph.D. theses have decreased and national laboratory staff decreased.
- **There has been little opportunity for investments for the future:**
 - Nuclear structure & astrophysics need new accelerator capabilities to remain a leader
 - Promising opportunities are not being pursued.
 - Major facilities need to plan for the future
- **The case for additional funds has not been made:**
 - To address exciting opportunities for advancing our knowledge
 - To maintain leadership capabilities in nuclear physics
 - To train a highly-qualified, next-generation of nuclear physicists
- **Resources need to be focused on the essentials - highest priorities**



2002 NSAC Long Range Plan

Scientific Opportunities in all the major scientific areas of Nuclear Physics

<u>Scientific Area</u>	<u>Scientific Opportunities</u>
• Quark Structure	Upgrade of CEBAF to 12 GeV, R&D towards electron-ion collider
• Hot Nuclear Matter	Upgrade of RHIC's luminosity, involvement in LHC program
• Nuclear Structure	Proposed RIA, next generation Gamma-ray array
• Nuclear Astrophysics	Proposed RIA, neutrino measurements, underground lab
• Fundamental Symmetries	Next generation cold neutrons (at SNS), underground lab, RIA

Recommendations:

- The highest priorityis to exploit the extraordinary opportunities for scientific discoveries made possible by these [previous] investments
 - Increased funding for research and facility operations is essential to realize these opportunities.
 - Facility operations – University program – Nuclear Theory
- The Rare Isotope Accelerator (RIA) is highest priority for major new construction.
 - RIA will require significant funding above the nuclear physics base.
- Strongly recommend immediate construction of the world's deepest underground laboratory.
 - An outstanding new opportunity to create this laboratory has emerged.
- Strongly recommend upgrade of CEBAF to 12 GeV as soon as possible.



Program Planning – Budget Development

- **NSAC guidance is being utilized in setting Program’s scientific priorities:**
 - Effective operation and utilization of NP facilities
 - Enhancements of university and theory efforts
 - Development of capabilities to address forefront science
- **Federal Government Management Initiatives are being implemented:**
 - R&D Investment Criteria (Quality: Relevance: Performance)
 - Budget and Performance Integration (Performance Measures)
- **Additional guidance from NSAC is being requested:**
 - Education of nuclear physicists and chemists
 - Nuclear Theory
 - Fundamental physics with neutrons



FY 2003 Budget

FY 2003 Budget Level (\$379.6 M) provides ~+5.7 % over FY 2002.

After over 4 months of a Continuing Resolution an Omnibus Bill was passed

Nuclear Physics Congressional Budget Request:	\$ 382.4 M
Additions (RHIC/JLab/RIA R&D) :	+ 2.0 M
General Reduction :	~ - 2.3 M
Omnibus Rescission :	~ - <u>2.5 M</u>
<Nuclear Physics>	\$ 379.6 M

Continuing Resolution:

- **Introduced uncertainties in planning and execution of the program**
- **Delayed starts of new projects**

Context:

FY 2003 Funding is ~ +6% increase compared to FY 2001 funding (\$360.5M)



FY 2003 Budget

(millions of dollars)

	<u>FY01</u>	<u>FY02</u>	<u>FY03</u>	(plan)
Research	124.5	121.9	125.6	(+ 3.0 %)
RIA R&D/SciDAC	4.8	4.8	5.9	
Facility Operations	212.7	212.3	228.6	(+ 7.7 %)
Stewardship*	<u>18.0</u>	<u>20.0</u>	<u>19.5</u>	
	360.0	359.0	379.6	(+ 5.7 %)

Priorities were (are):

- Effective operation of user facilities (especially CEBAF and RHIC)
- Enhanced support for university/laboratory researchers and theory
- Support investments for the future (SciDAC and R&D for RIA and CEBAF upgrade)

Facility Operations support is increased by ~8% (+\$16.3M) over FY 2002

- Overall beam hours for research are increased by 18%.

Research support is increased by ~3% (+\$3.7M) increase over FY 2002

- Theory activities are enhanced by ~4%
- RIA R&D is increased (+\$1.1M → ~\$4.0M)
- Efforts in experimental research & computing (SciDAC) are maintained.

* SBIR/STTR included in FY01-02



FY 2004 Budget

FY 2004 Budget Level (\$389.4 M) provides ~+2.5 % over FY 2003.

In the Budget Request priority is given to:

- Strengthening the research base (universities, theory & labs) to do the science.
- Effectively operating user facilities: RHIC, TJNAF, Bates, HRIBF and ATLAS
- Making needed investments for the future

Program scope is maintained and priorities addressed:

- Research manpower/students increase – particularly for major facility and theory activities.
- Five national user facilities operate +5% more than in FY 2002.
- Modest investments will be made for the highest priority new initiatives/experiments.
(GRETINA, HRIBF “second platform” and Fundamental neutron Physics Beamline (SNS))
- R&D and pre-CDR activities for RIA and CEBAF 12 GeV upgrade supported.
 - Outstanding science will be produced -

Termination of 88-inch Cyclotron Operations driven by the budget constraints

- Negatively impacts the short-term productivity of the low energy nuclear physics program
- Investments must be made for future capabilities – facilities need to operated/utilized effectively



FY 2004 Budget Request

(millions of dollars)

		(plan)	Request	
	<u>FY02</u>	<u>FY03</u>	<u>FY04</u>	
Research	121.9	125.6	130.7	(+ 4.0 %)
RIA R&D/SciDAC	4.8	5.9	5.5	
Facility Operations	212.3	228.6	232.8	(+ 1.8 %)
Stewardship	<u>20.0</u>	<u>19.5</u>	<u>20.4</u>	
	359.0	379.6	389.4	(+ 2.5 %)

Priorities are:

- Enhanced support for university/laboratory researchers and theory
 - Effective operation of user facilities
 - Support needed investments for the future
- **Research support is increased by ~4% (+\$5.1M) over FY 2003.**
 - Theory funding increased by ~5% : Experimental funding increased >3%
 - RIA R&D & SciDAC supported: CE projects started GRETINA/Neutron Beam Line (SNS)
 - **Facility Operations support is increased by ~1.8 % (+\$4.2M).**
 - Operations of 88-Inch Cyclotron terminated (-\$3.3M)
 - Other facilities get ~4% increase and operate more than FY 2003
 - **Stewardship (BNL GPP/etc., SBIR/STTR, etc.) is increased by ~5% (+\$0.9M).**



Background

NSAC Low Energy Review (November 2001):

Charge: To review and evaluate current and future scientific capabilities in the area of nuclear structure and astrophysics and make recommendations of priorities...

Findings/Recommendations:

- Outstanding program of high impact science
- Need for balanced program: Utilization of existing facilities & preparing for RIA
- Constant effort funding (FY 2002 level) necessitates severe changes to address priorities.
 - Termination of 88-Inch Cyclotron and limiting R&D for RIA

Facility Operations Reviews of RHIC, TJNAF & HRIBF (Jan-March, 2002):

Charge: To evaluate present performance and cost of operations, and what funding is needed to effectively support their research missions.

Findings/Recommendations:

- Facilities well managed: resources were optimized: outstanding science produced
- FY 2002 funding levels limited operations and at levels that are not sustainable.
- Recommended funding levels above cost of living:

RHIC: ~+\$16-19M TJNAF: ~+\$6.5-9M HRIBF: ~+\$1M



Nuclear Physics Division Activities

Preparing for FY 2005 Budget Exercise (pre-CRB, CRB, OMB & President)

- Program Manager Site-Visits (February-March)
- Laboratory Management Budget Briefings (March)
- Nuclear Physics Division Retreat (end of March)
- Pre-Corporate Review Budget (mid-April)

Office of Science (SC) is in the process of setting priorities for future facilities

- SC-1 has requested NSAC evaluation of NP 20-yr projects
- SC Strategic Plan anticipated to be completed in early 2003

Reviews and NSAC

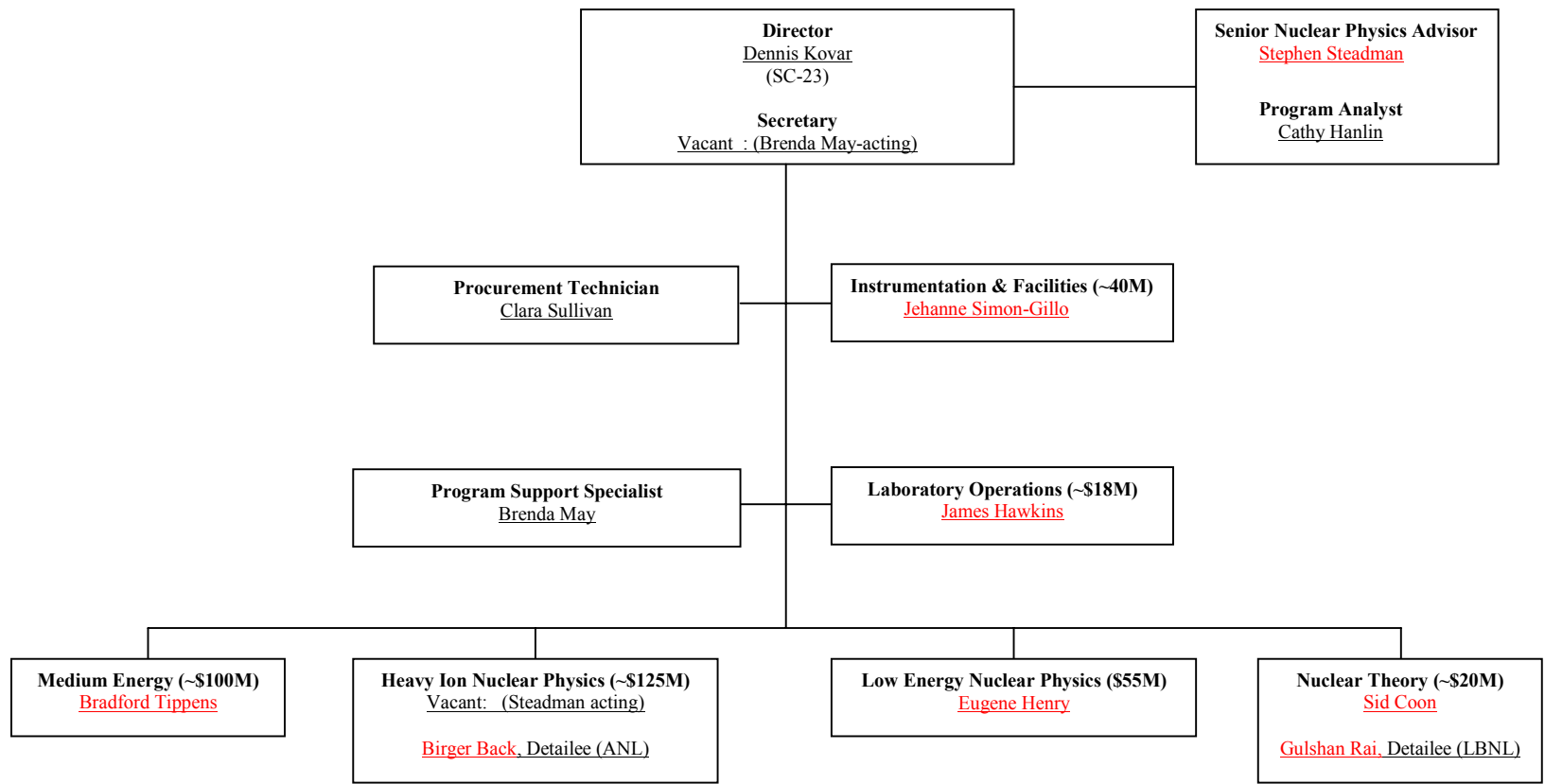
- Reviews of laboratory research and facilities being planned
- Anticipate that NSAC will be charged to perform reviews and provide guidance

Nuclear Physics Division is almost fully staffed

- Sid Coon has joined the Division as Program Manager for Nuclear Theory
- Anticipate filling the Heavy Ion Nuclear Physics Program Manager position soon.



Division of Nuclear Physics



Quark Structure
Of Matter

Phases of Nuclear Matter

Nuclear Structure
Nuclear Astrophysics
Fundamental Symmetries

All Nuclear Physics



FY 2003 Nuclear Physics Budget Request

(Millions of Dollars)

Office of Science

	<u>FY01</u>	<u>FY02</u>	Request <u>FY03</u>
<u>Research</u>			
Operating	112.8	113.3	116.8
Capital Equipment	<u>11.1</u>	<u>8.1</u>	<u>8.7</u>
	123.9	121.4	125.5
RIA R&D	2.8	2.8	3.5
Computing Initiative (SciDAC)	<u>2.0</u>	<u>2.0</u>	<u>2.0</u>
	4.8	4.8	5.5
<u>Facility Operations:</u>			
RHIC	104.0	103.3	117.5
AGS	1.4	1.0	-
TJNAF	66.7	67.2	72.5
Bates	13.0	12.4	13.3
LE Facilities	<u>21.7</u>	<u>22.5</u>	<u>23.8</u>
	206.8	206.4	227.1
<u>Stewardship:</u>	<u>24.5</u>	<u>26.4</u>	<u>24.3</u>
Nuclear Physics Total	360.0	359.0	382.4



FY 2003 Nuclear Physics Budget Request

(Millions of Dollars)

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Operating	112.8	113.3	116.8
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NSAC Charges

Review of the Nuclear Theory Program

- Identified in the 2002 NSAC Long Range Plan
- As part of the “validation of program directions” in Performance Measures

Review of the Nuclear Theory Program

Identified in the 2002 NSAC Long Range Plan

As part of the “validation of program directions” in Performance Measures

Review of the DOE Nuclear Data Program

- Identified in the Workshop on Combating Terrorism
- Need to better understand the resource and manpower needs

Review of the Neutron Physics Program

- Need to better understand the scientific priorities and impact of proposed programs



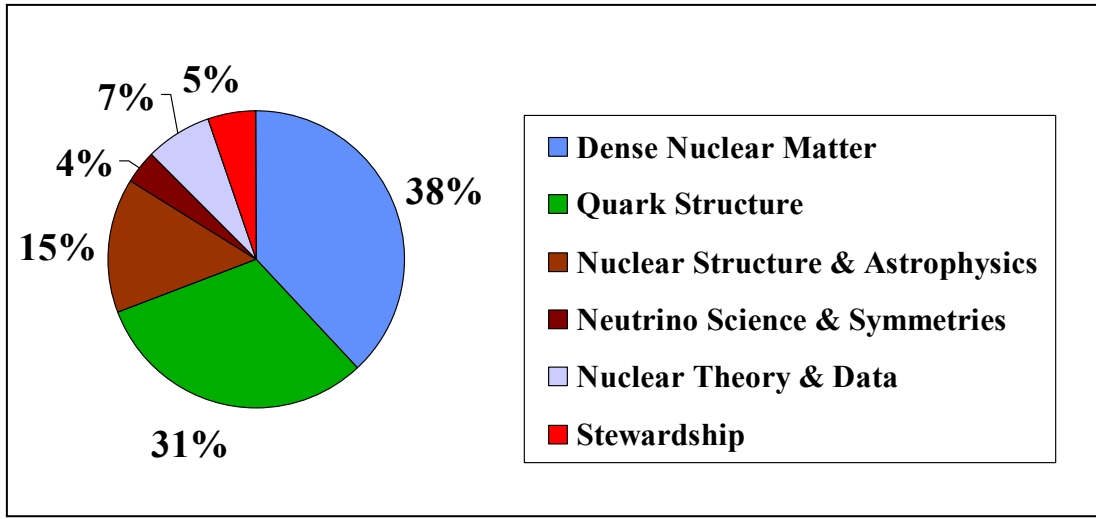
DOE Nuclear Physics Budget

(Millions of Dollars)

Subprograms are aligned with Scientific Thrusts

<u>Subprograms</u>	<u>FY 2002</u>	
Medium Energy	111.6	Quark Structure
Heavy Ions	151.3	Hot Nuclear Matter
Low Energy	62.5	Structure/Astrophysics/Symmetries
Nuclear Theory	<u>25.2</u>	All NP areas plus Nuclear Data
	350.6	

Two of the Scientific Thrusts Dominate the Budget



Facility Operations Dominate Budget

