NSAC Meeting
November 1, 2002

Dennis Kovar
Director
Division of Nuclear Physics
FY 2002: Key Activities and Accomplishments

New Research Programs Have Produced Significant Results:
• SNO: Established the solar neutrino flux
• RHIC: Data have revealed tantalizing results

Facilities Performing Well:
• CEBAF, Bates, ATLAS, HRIBF, and 88-Inch Cyclotron
• University accelerators (TAMU, TUNL, Washington and Yale)

Priority Initiatives Supported:
• KamLAND and MiniBoone started data taking
• HIGS, LANSCE neutron experiments, LEGS upgrade on cost and schedule
• SciDAC Projects (Astrophysics & Lattice Gauge)
• R&D for proposed Rare Isotope Accelerator (RIA)

NSAC Long Range Planning and Guidance:
• Major priorities and recommendations of Long Range Plan established
• NSAC reviewed the Low Energy program

Nuclear Physics Division:
• Operations Reviews (RHIC, TJNAF and HRIBF)
• Workshop on Role of NP research community in Combating Terrorism (with NSF)
• Incorporation of Performance Measures into Budget Request
Scientific Opportunities are identified in all the major scientific areas of Nuclear Physics.

<table>
<thead>
<tr>
<th>Scientific area</th>
<th>Scientific Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quark Structure</td>
<td>Upgrade of CEBAF to 12 GeV, R&amp;D towards electron-ion collider</td>
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<tr>
<td>Hot Nuclear Matter</td>
<td>Upgrade of RHIC’s luminosity, involvement in LHC program</td>
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<tr>
<td>Nuclear Structure</td>
<td>Proposed RIA, next generation Gamma-ray array</td>
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<tr>
<td>Nuclear Astrophysics</td>
<td>Proposed RIA, neutrino measurements, underground lab</td>
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<tr>
<td>Fundamental Symmetries</td>
<td>Next generation cold neutrons (at SNS), underground lab, RIA</td>
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</tbody>
</table>

Recommendations:

• The highest priority of the nuclear science community is 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. This is essential so that our international leadership positions at CEBAF and at RHIC can be maintained.

• We strongly recommend immediate construction of the world’s deepest underground science laboratory.
  – An outstanding new opportunity to create this laboratory has emerged.

• We strongly recommend the upgrade of CEBAF at Jefferson Laboratory to 12 GeV as soon as possible.
Information for Budget Requests

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
**Status of the FY 2003 Budget Request**

**President’s Budget Request ($382.4M) provides ~ 6 % increase over FY 2002**
- House Appropriations: President’s Request – General Reduction (~1%)
- Senate Appropriations: President’s Request + $5M (RHIC & CEBAF) – General Reduction (~1%)

**Appropriations Bill has not been passed.**
- Continuing Resolution – until November 22 (spending at FY 2002 levels)
- Not clear when Appropriations Bill will be passed

<table>
<thead>
<tr>
<th></th>
<th>Request FY02</th>
<th>Request FY03</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>125.8</td>
<td>131.0</td>
<td>+4.1%</td>
</tr>
<tr>
<td>Facility Operations</td>
<td>206.4</td>
<td>227.1</td>
<td>+10.0%</td>
</tr>
<tr>
<td>Stewardship</td>
<td>18.4</td>
<td>24.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>350.6</td>
<td>382.4</td>
<td></td>
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</table>

**Facility Operations support is increased by ~10% (+$21M) over FY 2002**
- Overall beam hours for research are increased by 18%.
- RHIC running schedule is doubled compared to FY 2002.

**Research support is increased by ~4% (+$5M) increase over FY 2002**
- Theory activities are enhanced by ~5% and enhanced support for RIA R&D.
- Efforts in experimental research & computing (SciDAC) are maintained.
Subprograms are aligned with Scientific Thrusts

<table>
<thead>
<tr>
<th>Subprograms</th>
<th>FY 2002</th>
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<tr>
<td>Medium Energy</td>
<td>111.6</td>
</tr>
<tr>
<td>Heavy Ions</td>
<td>151.3</td>
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<tr>
<td>Low Energy</td>
<td>62.5</td>
</tr>
<tr>
<td>Nuclear Theory</td>
<td>25.2</td>
</tr>
<tr>
<td>All NP areas plus Nuclear Data</td>
<td>350.6</td>
</tr>
</tbody>
</table>

Two of the Scientific Thrusts Dominate the Budget

- Quark Structure: 38%
- Dense Nuclear Matter: 31%
- Nuclear Structure & Astrophysics: 15%
- Neutrino Science & Symmetries: 7%
- Nuclear Theory & Data: 5%
- Research: 5%
- Facility Operations: 59%
- Stewardship: 4%
2002 NSAC LRP recommends RIA as the highest priority for major construction.

RIA’s capabilities will make U.S. a leader in addressing three topics at the heart of fundamental nuclear physics:
- The nature of nucleonic matter
- The origins of the chemical elements
- Physics beyond the Standard Model.

A proposed RIB facility has been studied and supported by the community since 1995:
- NSAC 1996 Long Range Plan recommendation
- NRC 1998 Physics Survey recommendation
- NSAC 1999 Taskforce established RIA paradigm.

RIA R&D efforts are now in their third year. No technical impediments have been identified.

Workshops were held in 2002 on facility component R&D and a RIA Physics Summer School.

Argonne National Laboratory (ANL) and Michigan State University (MSU) continue to express interest in hosting RIA with support from their institutions and their States.

Office of Science and DOE have made no decision regarding construction of RIA.
2002 NSAC LRP strongly recommends the upgrade of CEBAF at TJNAF to 12 GeV as soon as possible.

The upgrade will open the opportunity to:
• Address the question “What is the nature of quark confinement in QCD?”
• Map out the quark & gluon wave-functions of the nucleons
• Extend and complete ongoing studies of the transition from a nucleonic composition (nucleons) to a quark composition of nuclei.

Very cost-effective because of advancements in superconducting RF technology and the use of existing conventional facilities.

No technical issues identified.

Office of Science and DOE have made no decision regarding construction.
FY 2003: Nuclear Physics Division Activities

DOE FY 2004 Budget Request has been submitted to OMB
- OMB passback expected after Thanksgiving
- Budget format revised to address OMB/OSTP R&D Investment Criteria Initiative

R&D Solicitations
- Proposals for RIA R&D are under review: decisions expected by the end of calendar 2002
- Deadline for Outstanding Junior Investigator (OJI) proposals: November 6, 2002
- SC Early Career Awards for Scientists and Engineers: Watch NP website for notice

Office of Science (SC) is in the process of setting priorities for future facilities
- House Appropriation language expressed support for facility investments (if priorities set)
- Nuclear Physics has submitted a 20-year plan (using guidance of NSAC Long Range Plan)
- 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.
## FY 2003 Nuclear Physics Budget Request

*(Millions of Dollars)*

<table>
<thead>
<tr>
<th></th>
<th>FY01</th>
<th>FY02</th>
<th>FY03</th>
<th>Request</th>
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<tr>
<td><strong>Research</strong></td>
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<td></td>
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<tr>
<td>Operating</td>
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<td>116.8</td>
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<tr>
<td></td>
<td>123.9</td>
<td>121.4</td>
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<td></td>
<td>4.8</td>
<td>4.8</td>
<td>5.5</td>
<td>+ 14.6 %</td>
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<tr>
<td><strong>Facility Operations:</strong></td>
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<td></td>
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<tr>
<td>RHIC</td>
<td>104.0</td>
<td>103.3</td>
<td>117.5</td>
<td>(+ 13.7 %)</td>
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<tr>
<td>AGS</td>
<td>1.4</td>
<td>1.0</td>
<td>-</td>
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<tr>
<td>TJNAF</td>
<td>66.7</td>
<td>67.2</td>
<td>72.5</td>
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<tr>
<td>Bates</td>
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<td>12.4</td>
<td>13.3</td>
<td>(+ 7.3 %)</td>
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<tr>
<td>LE Facilities</td>
<td>21.7</td>
<td>22.5</td>
<td>23.8</td>
<td>(+ 5.8 %)</td>
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<tr>
<td></td>
<td>206.8</td>
<td>206.4</td>
<td>227.1</td>
<td>+ 10.0 %</td>
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<tr>
<td><strong>Stewardship:</strong></td>
<td>24.5</td>
<td>26.4</td>
<td>24.3</td>
<td>- 8.0 %</td>
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<tr>
<td><strong>Nuclear Physics Total</strong></td>
<td>360.0</td>
<td>359.0</td>
<td>382.4</td>
<td>+ 6.5 %</td>
</tr>
</tbody>
</table>
Discussion of possible 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 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

(Guidance on Implementation of the 2002 NSAC Long Range Plan)
• Guidance on priorities and impacts of proposed programs/projects
• Programs/Projects include:
  New: GRETA, GARBO, SNS Beamline, EDM (Electric Dipole Moment)
  R&D for RHIC II/eRHIC, Heavy Ion LHC program
  Underground Lab detector

  Upgrades: HRIBF (2nd platform), LANSCE (detector upgrades)
  KamLAND (solar neutrino)
  RHIC (EBIS), RHIC (Detector upgrades)