U.S. Department of Energy's
Office of Science

Closeout Report

on the *Department of Energy Committee Report* on the
Facility Operations Review of the

TEVATRON
at the
Fermi National Accelerator Laboratory

March 18, 2004

Charge to the Committee

Based on the mission of the facility provided by the laboratory, it is requested that your review committee evaluate the Laboratories' maintenance and operations plan for FY 2004 – FY 2009 with an assumed funding profile and address the following questions:

1. Is Laboratory management effectively setting priorities, tracking progress, resolving problems and communicating with key stakeholders?
2. Are resources sufficient and appropriately allocated with a proper mix of skill sets and optimized to meet the stated mission, goals and objectives (bottoms up analysis)?
3. Are there any programmatic, technical and infrastructure risks?
4. Is there an ongoing program of self-assessment aimed at continuously improving maintenance and operations?
5. Is ES&H planning and implementation receiving appropriate attention?

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Review Committee

Department of Energy Operations Review of the Tevatron at Fermi National Accelerator Laboratory
March 16-18, 2004
Daniel R. Lehman, DOE, Chairperson

SC1
Accelerator

* * Rod Gerig, ANL
* Ewan Paterson, SLAC
* Kem Robinson, LBNL

SC2
Research

* * Jim Siegrist, LBNL
* Howard Gordon, BNL
* Roy Whitney, TJNAF

SC3
Business and Finance

* * Mike Derbidge, ANL
* Don Boyd, PNNL
* Mary Erwin, TJNAF

SC4
Infrastructure and ES&H

* * Dave McGraw, LBNL
* Mike Bebon, BNL
* Dave Goodwin, DOE/SC
* John Yates, DOE/SC

SC5
Management

* * Marty Breidenbach, SLAC
* Klaus Berkner, consultant
* Howard Gordon, BNL
* Steve Meador, DOE/SC

Observers

* Aesook Byon, DOE/SC
* Michael Procario, DOE/SC
* Ronald Lutha, DOE/FAO
* Jane Monhart, DOE/FAO

LEGEND

SC Subcommittee
* Chairperson
[ ] Part-time Subcommittee Member

Count: 18
(excluding observers)

Report Outline and Writing Assignments

Executive Summary	Meador
1. Introduction	Procario
2. Accelerator	Gerig/Subcommittee 1
2.1 Findings	
2.2 Comments	
2.3 Recommendations	
3. Research	Siegrist/Subcommittee 2
4. Business and Finance	Derbidge/Subcommittee 3
5. Infrastructure and ES&H	McGraw/Subcommittee 4
6. Management	Breidenbach/Subcommittee 5

2. Accelerator

Operations Review of the Tevatron

2.0 Accelerator and Technical Divisions

- Rod Gerig
- Ewan Paterson
- Kem Robinson

Charge Point 1: Priorities

Is management effectively setting priorities, tracking progress, resolving problems, and communicating with key stakeholders?

Findings:

- Fermilab has made considerable progress in improving Tevatron performance.
  - Run II integrated luminosity expectations
  - High level of enthusiasm among the staff.
  - DOE review underscored these improvements.

Charge Point 1: Priorities

Accelerator and Technical Divisions priorities are thought out and well communicated.

- The immediate needs receive focus
- Longer term operational issues are not ignored.
  - Proton Plan
  - Aging of the linac and booster

Charge Point 1: Priorities (cont.)

Findings (cont.):

- The Technical Division
  - Supports the accelerator program
  - Meets its obligations to the Large Hadron Collider
  - Maintains portion of accelerator R&D program.
- At every level of the organization (AD&TD)
  - priorities are managed,
  - progress is tracked,
  - problems are addressed,
  - Implications are communicated

Charge Point 1: Priorities (cont.)

Comments:

- Priorities are properly established
- Focus of the laboratory is consistent with priorities.
- The highest priorities are clearly Tevatron operations and Run II upgrades.
- We encourage Fermilab to maintain the focus and support level on the operational needs of the accelerator complex that has been developed recently to address Run II needs.
- **Recommendation:**

None

Charge Point 2: Resources

Are resources sufficient and appropriately allocated with a proper mix of skills sets and optimized to meet the stated mission, goals and objectives?

- **Findings:**
- Effort for accelerator operation and projects is now coming from all laboratory divisions.
- Personnel are being transferred from Particle Physics Division (PPD) and Computer Division (CD) into the Accelerator Division.
- A significant number of PPD and CD people who are assigned to work on the accelerator during shutdowns.
  - This can be a very effective

Charge Point 2: Resources (Findings cont.)

- The labor / Materials & Supplies fraction of "core" operational accelerator activities is 66% labor and 33% M&S
  - This is reasonable
- If AD received additional resources it would request additional M&S rather than labor
- Assistance is being received from other national laboratories and some universities.

Charge Point 2: Resources (Findings cont.)

- Areas exist where skills are duplicated throughout the Division, e.g.:
  - Computer support.
  - Controls / Software
  - Designers / Drafters
  - Accelerator diagnostics

Charge Point 2: Resources (Findings cont.)

- The Division has been successful in recruiting accelerator physicists.
- Key areas in the workforce is nearing retirement
  - engineering
  - skilled technicians
- Technical Division has maintained an organizationally centralized workforce appears to function efficiently.
  - Machinists
  - Welders

Charge Point 2: Resources (cont.)

Comments:

- Difficult to assess the appropriateness of the overall level of effort.
  - May be some inefficiencies in the distribution of skills.
  - Don't expect to see large efficiency gains
    - ~ Few percent level
- Applaud effort to attract young engineers through proposed fellowship program.

Charge Point 2: Resources (cont.)

- Technical Division is organized in an intelligent and effective manner
- We encourage additional collaboration between Fermilab and other national laboratories and universities.

Charge Point 2: Resources (cont.)

Recommendations:

1. Explore areas where efficiencies can be gained by consolidating skill sets.

Charge Point 3: Risks

Are there any programmatic, technical and infrastructure risks?

- **Findings:**
- Fermilab's accelerator infrastructure is aging
  - Vacuum tube supplier for drift tube linac
  - Aging cryogenic system
  - Aging and obsolescent electronics
  - Inadequate diagnostic systems

Charge Point 3: Risks

- Technical risks involve accelerator R&D projects
  - Electron cooling in the recycler ring,
  - The Proton Plan
- Programmatic risks: shifting programs and the resulting resource allocation

Charge Point 3: Risks (cont.)

Comments:

- Fermilab is aggressively managing these risks.
  - Directed M&S at remediating accelerator infrastructure problems.
  - Lists of high risk items are maintained and prioritized
- Encouraged to see the effort in high risk technical areas.
  - Proton Plan is critical to the neutrino program

Charge Point 3: Risks (cont.)

Comments:

- Proton Plan is critical to the neutrino program
- Consider electron cooling to be a technical risk.
  - Needed performance for the Recycler has yet to be demonstrated.
- Fine tuning reprioritization of future activities (e.g., proton plan, BTeV, accelerator R&D) requires ongoing effort

Charge Point 3: Risks (cont.)

Recommendations:

1. Maintain an active risk assessment program in all areas.
   - Infrastructure
   - Technical
   - Programmatic

Charge Point 4: Self Assessment

Is there an ongoing program of self-assessment aimed at continuously improving maintenance and operations?

- **Findings:**
- Recent improved Tevatron performance evidences program focused on operation and maintenance
- The program involves supplementing the Accelerator Division staff with personnel from PPD and CD, particularly during work intensive accelerator shutdowns.
- Accelerator Division management reevaluates program and resources regularly to achieve integrated luminosity goal.

Charge Point 4: Self Assessment (cont.)

Comments:

- It is important to recognize that additional resources coming from PPD and CD during shutdowns are critical to the ongoing success of Run II and the ultimate success of the neutrino program.

- **Recommendations:**

None

Charge Point 5: ES&H

Is ES&H planning and implementation receiving appropriate attention?

- **Findings:**
  - Centralized ES&H group supports entire lab
  - Each division has a group which supports that division
  - Expertise in the divisions is well aligned to the division's unique needs

Charge Point 5: ES&H (cont.)

- **Comments:**
  - Both the Accelerator Division and the Technical Division, the committee observed a rigorous and thorough implementation of safety in terms of training, work planning and management involvement.
  - Integrated Safety Management appears to truly be a part of the culture.

- **Recommendations:**

None

3.0 Research Program

Findings and Recommendations
FNAL Operations Review
18-Mar-04

Howard Gordon, Jim Siegrist (Chair), and Roy Whitney

Charge Point 1
Setting Priorities, Tracking Progress, Resolving Problems, Communication

- Findings
  - The committee sees an effective team for setting priorities and tracking progress
  - Communication and transfer of labor/responsibilities among the Divisions seems very good
  - Problems are systematically uncovered and addressed
  - Principal challenges for research in FY04-09 are managing the program transitions
    - CDF/D0->LHC->BTeV
    - MINOS -> operation
    - Etc.
  - We find that the planning in the Directorate for the period FY04-09 was articulated well for CD and for PPD through FY06. In both cases, some changes in the staff mix will be necessary.

Charge Point 1
Setting Priorities, Tracking Progress, Resolving Problems, Communication

- Comments:
  - The decision to focus on the Open Science Grid for Fermilab's program is a wise investment of resources.
  - The Laboratory has demonstrated a commitment to a strong relationship with its user community. It is important that this continue during the multiple transitions of the FY04-09 timeframe.
  - There are concerns about the manpower available from the collaborations for CDF/D0 in the future due to competition from the LHC.

Charge Point 1: Recommendations

1) Implement two year rolling MOUs with the CDF/D0 collaborations in the FY04-09 era to be reviewed by the Research Director. This will facilitate the Laboratory in matching the support of the operations to the needs of the experiments.

Charge Point 2

Are resources sufficient and appropriately allocated…

- Findings
  - Resources to support the program seem adequate but not excessive, where the committee could check.
  - There seems to be a skills-mix issue – a shortage of high level staff and perhaps a surplus of low level staff. For example there are needs for more database experts, high level grid developers, more high level engineers and less for limited skills technicians.
  - A significant and recognized challenge for both CDF and D0 is the continuous requirement for training of their rapidly changing short-term scientific collaborators.
  - Computing Division's work on the Accelerator Beam Position Monitors appears to be going well and demonstrates close coordination between the Divisions.
  - Within a few months, Computing Division will achieve "lights-out" operation of all of its media servers. This improves access for the users and allows for the redirection of manpower.
  - The operation of the MINOS data acquisition system from the United Kingdom is a good demonstration of the forward thinking taking place in the Particle Physics Division.
  - With Run II data rates 20-30 times those in Run I, the Computing Division has put in place an advanced data management/storage system for the scientific users.
  - Funding from sources such as SciDAC that is beyond the base program level plays a critical role in support of key programs such as Lattice QCD and advanced accelerator modeling.

Charge Point 2: Comments

- Comments:
  - The project management budgeting function is a positive development. This was evident in the WBS budget tables and FTE skills breakdown seen from the various divisions. The fact that people at the department level were using these same tools showed it was useful.
  - The Committee applauds the creation of an engineering fellowship to target the increase in critical skills.
  - While the Kerberos implementation for cyber authentication has been useful, the approach has not been adopted by the wider community. A more aggressive move to PKI based solutions may be appropriate.
  - Consider the evaluation of centralized computer and engineering support vs. the current distributed situation.
  - Consider evaluation of centralizing the root/systems management of <u>all</u> desktops and work group servers.

Charge Point 2: Recommendations

1. Extend the bottom-up manpower analysis for the period FY05-09 to determine the required skills mix and staffing levels needed for the anticipated program. Divisional management should perform this exercise with a view of the needs across the Laboratory.

Charge Point 3 Risks

- Findings
  - There are significant risks in the research program
  - The management is well aware of these risks, both programmatic and in the infrastructure
    - Examples are the silicon detectors, the CDF Central drift chamber, critical engineering skills such as in power supplies, or demands for serving Run II data escalating to a point where the central storage and caching systems fail to scale.
  - In most cases, mitigation plans have been developed and are being enacted
  - The "Flat-Flat Scenario" straw man budget for FY04-09 showed a significant delay for BTeV and accelerator R&D.

Charge Point 3: Risks

- Comments:
  - The Committee is concerned about how the program would respond if there were major unanticipated resource needs in the accelerator complex in FY06-07. Would this mostly affect BTeV?
  - The large fixed commitments in the program complicate the ability of the Laboratory and DOE to manage the program during this period.
  - The Laboratory should evaluate how to ensure that the stakeholders are not surprised should evolution and adjustment of the program be necessary.

Charge Point 4
Self-assessment program

- Findings
  - The Committee sees an active and successful program of self-assessment in place
  - Assessment items are developed through a bottom-up procedure resulting in assessment studies directly useful to the program
- Comments
  - It was unclear how the ‘lessons learned’ will survive the various research program transitions over FY04-09; Where is the reservoir of ‘corporate’ knowledge?
  - Lessons learned from ES&H are aggressively transmitted to the staff. Consider doing the same for key self assessment findings.
  - More comparisons with other high energy and nuclear physics laboratories may be useful.
  - Consider other areas for assessment: Staff Diversity; Staff Development; Workplace Life issues

Charge Point 5
ES&H

- Findings
  - ES&H planning and implementation in the Computer and Particle Physics Divisions has the attention of the Divisions' leadership and appears to have been integrated through the line managers and staff in the Divisions. There are proactive incentive programs for outstanding suggestions, and their current DART metrics indicate success of their activities. The most recent near miss in decommissioning some equipment in the Particle Physics Division is leading the Laboratory to take a more inclusive approach to what is considered work.

4. Business and Finance

Department of Energy Operations Review
of the
Tevatron at Fermi National Accelerator Laboratory
March 16-18, 2004

SC 3 Business and Finance

***Mike Derbidge, ANL**
Mary Erwin, TJNAF
Don Boyd, PNNL

Business and Finance

1. **Is the laboratory management effectively setting priorities, tracking progress, resolving problems and communicating with key stakeholders ?**

Findings:

The Administration Sections of FNAL provide the operational support essential for the forefront scientific research. The challenges of flat budgets have placed stress on the entire Laboratory to achieve all of the desired research goals for the programs in Accelerators, CDF and DO, and the BTev. Support organizations recognize their primary mission is to enable research while meeting requirements set by the

Business and Finance

Senior management (the Laboratory Director and the Deputy Laboratory Director) use information obtained through operational awareness and the many meetings throughout the year to establish the first cut of the budget. The full budget setting process occurs over several months to allow full and open discussion of issues. The first step of the process provides target level budgets for each of the sections. Sections have the opportunity to discuss how they will meet the target and areas/services that will have to be reduced based on the target level. There is an open discussion of budget requirements and needs in the Business and Finance areas.
Budgets are presented to the Laboratory Director for final approval.

Business and Finance

Division/Section heads are an integral part of the review process.

The process used for establishing Laboratory Goals in the business systems is based largely on the use of the prime contract (Appendix A and B). Business system goals are identified through that process.

Stakeholders are fully engaged in the planning and budgeting process.

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Office of Science

Business and Finance

Comments:

While the budget is constrained "critical" issues are evaluation and consideration for funding. A balanced approach to the budget setting process including risk assessment is evident.

Division/Section heads are an integral part of the review process. Priorities are set and there is an opportunity to discuss financial and operational issues. Sections are provided open access to the Directors Office to bring forward critical operational issues (e.g. upgrade costs for Oracle, obtaining Visa for visiting scientist).
It is not clear the establishment of Section goals includes full participation of the operations managers.

Corrective actions identified during audits and external reviews are captured in data bases and are monitored for progress on a monthly basis.

Business and Finance

The setting of goals that state laboratory vision and laboratory expectations should be identified and shared with stakeholders. Goal setting will help to focus the importance of the laboratory vision and ensure that the necessary services are provided in concert with the vision. Services deliverables can then be better aligned with lab goals.

Recommendations:

Develop and communicate Business and Finance goals.

Business and Finance

2. Are the resources sufficient and appropriately allocated with a proper mix of skill sets and optimized to meet the stated mission, goals and objectives (bottoms up analysis) ?

Findings:

Flat budgeting is putting stress on the entire laboratory. However, the senior leadership is providing appropriate management and operations for a balanced approach to research and operational support at the Laboratory.

Succession planning is an area that needs attention and has been identified in past reviews (e.g. Lehman and URA reviews).

Business and Finance

A formal bottoms up analysis for budget planning is not done in the Administration sections.

Several administrative functions have limited staff depth for key positions (e.g. visa processing, labor relations).

HR recognizes the need for workforce planning for the appropriate skill mix in the divisions. This process has not been implemented.

Lessons learned from the NuMI project have been identified and action is being taken in the Procurement Section to mentor

Business and Finance

and train the employees. Another area for concern is the demographics of the procurement section and indicates succession planning is required.

The budgeting process reviews the skill sets for the Administrative area and details are reviewed as part of the annual process. The Lab management recognized that there are many areas which have a single point (staff member with subject matter expertise) of failure.

Business and Finance

Comments:

The current year budget has been reviewed for risk impact and is adequate to meet the needs of the organization. Out year projections are largely based on the current year budget and will rely on continuous cost efficiency improvement to ensure that customer needs are met. The budget projections seem to be reasonable based upon those tasks and services identified in the current year budget. Bottoms up budget planning is not essential for the successful budget allocation in the administrative organizations.

It is essential that the support organizations meet contractual requirements and identify opportunities for improvement in critical areas and cost reduction where possible. Investment in systems can pay off in reduced labor requirements in the future.

Business and Finance

The current leadership can provide the management for the administrative areas. However a plan needs to be developed and executed to make sure that the right leadership is in place for the future of the laboratory.

The Directorate needs to pay attention to the "lean" support services functions. While the organization is now capable of meeting the needs and demands, the budget process needs to ensure that appropriate consideration is given to properly staff and fund the Business and Finance section.

Business and Finance

Recommendations:

Develop a succession plan for the administrative sections.

Develop a laboratory wide workforce plan to ensure the appropriate skills mix for the future (Human Resources can provide the resources for this task).

Business and Finance

3. Are there any programmatic, technical and infrastructure risks ?

Findings:

Senior Management of FNAL ensures that a risk based and balanced budget allocation process is used to meet the research goals.

Oracle has announced a planned change to their pricing model which will be announced soon and affect the business system in March 2005. Due to lack of detailed knowledge, this price change is not included in the current budget forecasts. Cost increase for this important system that supports the indirect activities could be in the few hundred thousand dollar range

Business and Finance

An area of concern for ability to bring Visiting (foreign) Scientist to FNAL is in jeopardy due to the complex Visa processing. The Visa administration is handled by one person with limited backup support.

Nationally medical costs are projected to increase at a rate higher then the 2% budget increase assumptions. This increase is not included in the budget forecasts.

A single person in human resources is providing support for the increasing number of retirees.

Business and Finance

identified the need for improvements. The lessons learned from this project have been evaluated and corrective actions are in place.

Comments:

When the cost of the Oracle software algorithm is known and the cost increase is identified, the budget needs to be revised to account for this change.

Recommendations:

See recommendation for staff planning in charter #

4. Is there an ongoing program of self-assessment aimed at continuously improving maintenance and operations ?

Findings:

Self assessment is a part of the laboratory continuous improvement process.

The self assessment process is used in Business and Finance. It is one of the tools used for budget formulation and immediate corrective actions. Contract metrics and balanced score cards in procurement, property management and human resources are additional tools.

Business and Finance

There is not a formal benchmarking process used for the administrative areas (e.g. HR, Finance, Procurement). However, informal processes are used to match against national standards and other laboratory standards. Workload statistics are tracked (eg taxi use) but used only for future budget and service demands.

Balanced Scorecard for HR, Property, Procurement and Finance is used.

Laboratory-wide benchmarking is potentially hampered by the distributed nature of services and functions (IT and effort reporting are examples).

Business and Finance

The Lab Director communicates the overall budget picture to his management team.   Employees are provided information on the overall budget in "FERMI Today"

Comments:

The distributed services model does not easily lend itself to external bench marking; however the Business and Finance areas are encouraged to find external bench marks to ensure that the services delivered are right sized.

Continued interaction with the DOE site office will improve the formal self assessment process identified in the prime contract.

Business and Finance

Additional management metrics for self assessment, risk management, and opportunity to identify areas for continuous improvement are encouraged. These metrics should be discussed with DOE for inclusion in the formal Self Assessment process.

Recommendations:

None

Business and Finance

5. Is ES&H planning and implementation receiving appropriate attention ?

Findings:

The Laboratory Director has clearly established the importance of a strong safety culture at FNAL.

ES&H issues are appropriately addressed in the Administrative Sections. Each Section completes and individual needs assessment and it leads to a tailored training program.

The use of the medical organization is encouraged and first aid cases are recorded.

Under reporting does not appear to be an issue.

Business and Finance

Walk around activities are required and properly planned and completed. Safety gets high attention in the organization

Comments:

The laboratory has the necessary elements to apply for the DOE or OSHA Voluntary Protection Program (VPP). The laboratory is encouraged to evaluate the value for obtaining the external certification of VPP.

Line management must maintain and encourage the safety posture and culture to ensure continued success in having all staff and visitors to return home without injury.

Submit a best practices white paper to DOE-EH for the Safety Statistics Website.

Recommendations:

None

5. Infrastructure and ES&H

DOE Operations Review of the Tevatron

- 5.0 Infrastructure & ES&H Subcommittee

- David McGraw, LBNL – Chair
- Mike Bebon, BNL
- Dave Goodwin, DOE/HEP
- John Yates, DOE/SLI

Infrastructure & ES&H

- **Charge 1:** Is Laboratory management effectively ***setting priorities, tracking progress, resolving problems and communicating*** with key stakeholders
- **Findings:**
  - Infrastructure and ES&H needs are prioritized through planning done by Facilities Organization (FESS) and Lab budget processes
  - Progress tracked through self assessment, performance measures, series of management meetings and ES&H metric reporting (best practice)
  - Problems resolved through Sr Mgmt intervention/redirection of resources
  - Effective communication through FESS-Program Landlord interactions, building managers and central and embedded ES&H professionals
- **Comments:**
  - Growing infrastructure "recapitalization" (replacement) needs will require continued effective prioritization and redirection of resources
- **Recommendations:**

  Consider instituting a space charge to drive increased space utilization efficiency

Infrastructure & ES&H

- **Charge 2:** Are ***resources sufficient*** and ***appropriately allocated*** with a ***proper mix of skill sets*** and ***optimized*** to meet the stated mission, goals, and objectives?
- **Findings:**
  - Infrastructure needs exceed available current and out-year funding (GPP); ES&H resources appear sufficient
  - Infrastructure resources split among Facilities and Program organizations
  - Lab has been innovative in identifying and addressing infrastructure needs; $60M addressed through alternative financing (commendable)
  - Planning for $12M transmission line replacement also robust (City of Batavia with GPP fallback); flat & 2% growth scenarios will result in stretch-out of replacement
  - Allocation well balanced between infrastructure, ES&H and program
  - Skill sets adequate but little depth in FESS mechanical crafts; ES&H has downsized staff (commendable), staffing adequate; may be opportunities for outsourcing
- **Comments:**
  - Review possible vulnerabilities in FESS staffing depth
- **Recommendations:**
  - Evaluate potential for savings by grouping procurements of similar infrastructure projects currently being done by individual facility owners
  - Evaluate using a Lab-wide team to evaluate outsourcing potential in ES&H

Infrastructure & ES&H

- **Charge 3:** Are there any programmatic, technical and ***infrastructure risks***?
- **Findings:**
  - FNAL infrastructure largely built within same decade; recapitalization needs are likely to be closely spaced in time
  - Typical examples are Wilson Hall Safety Improvements, electrical distribution system, potable water mains, industrial cooling water system concerns
  - Electrical feeder faults have already impacted Tevatron operations
  - Additional recapitalization needs are likely to emerge through the condition assessment survey process over the FY04-09 period
  - Price escalation associated with utility contracts for electricity and natural gas is an out-year risk; Defense Energy Supply Center (DESC) being used for utility procurements
- **Comments:**
  - Alternative plans to address the other known recapitalization needs should be developed
- **Recommendations:**
  - **FAO should seek authority to exploit alternatives to DESC for future utility procurements**

Infrastructure & ES&H

- **Charge 4:** Is there an ongoing program of ***self assessment*** aimed at continuously improving maintenance and operations?
- **Findings:**
  - Performance measures are utilized to assess infrastructure and ES&H performance
  - Measures have been reduced and integrated with science
  - Peer review is used by the Lab and URA to assess aspects of ES&H and infrastructure performance
  - FESS and ES&H participate in the Lab-wide self assessment program
  - The Lab has been responsive to external assessment recommendations
- **Comments:**
  - FESS should provide more timely data on program landlord stewardship performance to senior management (similar to ES&H "dashboard" report)
- **Recommendations: None**

Infrastructure & ES&H

- **Charge 5:** Is *ES&H planning and implementation* receiving appropriate attention?
- **Findings:**
  - **Core ES&H programs strong; injury rates lowest ever!**
  - **Radwaste is shipped to Hanford; not allowed to accumulate on-site**
  - **Task managers, construction coordinators and construction managers are required to take construction safety courses**
  - **Director's ES&H Letter a part of all contract packages (best practice)**
  - **Contractors' ES&H performance evaluated and used in selection and local debarment**
  - **Senior management tracks ES&H performance weekly; data available in real time**
- **Comments:**
  - **Significant progress at institutional level in subcontractor/construction safety; will take some time and continued management emphasis to achieve permanent culture change in the field**
- **Recommendations: None**

6.0 Management Subcommittee

- M. Breidenbach
- K. Berkner
- S. Meador
- H. Gordon

DOE Charge Questions Priorities, etc

- 6.2.1 Is the laboratory management effectively setting priorities, tracking progress, resolving problems and communicating with key stakeholders?
- **Findings**
  - At a high level, the Laboratory sets long-range priorities at the time of choosing projects. There is a rigorous multi-year process that starts with the Physics Advisory Committee, moves through Director Reviews and HEPAP subpanels/P5, and ends with CD-0 approval. An annual retreat with the PAC and the Long-range Planning Committee are used to look at the whole program over several years.
  - On an annual basis, the priorities are reflected in the plan of work. Currently high priority is given to meeting the project goals of NuMI in FY04 and to follow the Run II plan; levels of support for other activities (e.g. analysis of data, R&D on future accelerators and experiments), are adjusted to match the Laboratory priorities. Resource allocations are made accordingly.

- Finally, throughout the year, problems are identified and communicated through various regular meetings (weekly: Directors, All Experimenters, and Scheduling meetings; biweekly: Division Heads and Scientific Advisory meetings; and monthly: Project Management Groups (for the various projects), Run II Strategy, and Run II Task Force meetings) and adjustments to resource allocations are made accordingly.
- Laboratory management is clearly focused on meeting Run II goals. The Si-detector upgrades of CDF and D0 were canceled by the Director (after due consultation with stakeholders) to free resources for Run II. Manpower was shifted from other programs to support the Accelerator Division, and the other Divisions have contributed significant numbers of personnel to help during the shutdowns. The Director has also significantly reduced other projects, such as removing one side of BTeV and reducing muon R&D, to free resources for the main physics program.
- The new "Project Accounting" accounting system seems to be very useful in tracking progress and in cost control.

- **Comments**
  - Improvements in Run II operations are encouraging. Communications within the Accelerator Division seems good. Communications with the experiments seems satisfactory. The committee is impressed by the comprehensive grasp by the Directorate of the concerns of the collaborations, and the fact that the directors seem to be optimizing the physics potential of the laboratory over the full range of time scales.
  - While the ordering of laboratory priorities seems reasonable, budget pressures may force more of the lower priority projects to be cut.

Resource Allocation

- 6.2.2 Are resources sufficient and appropriately allocated with a proper mix of skill sets and optimized to meet the stated mission, goals and objectives (bottoms up analysis)?
- **Findings**
  - The Laboratory is involved in many activities in Particle Physics, and, when resources are not sufficient, priority decisions are made by the Director to eliminate or postpone activities as necessary. The committee was not able to get into detail on the mix of skill sets, but based on discussions with the AD's and the Division/Section Heads, the committee believes that they are anticipating skill set needs and correcting as opportunities arise through attrition and retraining.
  - The laboratory does not have a formal program of benchmarking best practices with similar organizations in the DOE complex or with industry.
  - The collider experiments are well aware of the anticipated first beams at LHC in 2007 and are concerned that their university collaborators are already redirecting manpower towards the LHC program.

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- The Computing and Particle Physics Divisions are engaged in strategic planning for the transitions from predominantly CDF and D0 support to CMS and then to BTeV.
- The neutrino experiments have a strong interest in more protons on target than previously planned. The laboratory has completed a study of "proton economics" (Finley et al).
- The laboratory has a substantial base of technical talent including scientists, engineers, and technicians. The laboratory is concerned about the challenge of maintaining this talent base in the face of both declining budgets and fewer interesting projects. The lab is considering a program of engineering fellowships.
- Engineering, computer support, and building maintenance are distributed among the divisions.

- **Comments**
  - Adiabatic corrections to the skill mix of the staff through attrition and retraining may not be sufficient in a time of declining budgets.
  - While many laboratory operations are unique, there are programmatic component operations and activities that could benefit from comparison with others. The situation appears to be similar at the other HEP and Nuclear Physics laboratories.
  - The collider experiment European collaborators are heading towards LHC and are planning to start decreasing support of the detectors starting in 2006. CDF and D0 appear to be losing postdocs due to competition for effort on ATLAS and CMS in a time of rather stressed budgets. This is a significant concern for the detectors.

- The neutrino program challenges the laboratory in its ability to provide the proton flux desired by the neutrino experiments. A "Proton Plan" is under development. Funding for this plan is included in the laboratory budget planning. This is a prudent approach to avoid expectations that may exceed technical capabilities.
- There is an impressive number of engineers with advanced degrees, as seems appropriate for the complex and novel problems that need to be addressed. The committee believes the engineering fellowship program should be encouraged to ensure an influx of new talent.
- Enhanced efficiencies may be achieved by centralizing appropriate aspects of computer support, building maintenance and engineering that are currently distributed across the divisions and sections of the Laboratory.

- **Recommendations**
  - Institute a formal benchmarking program with other HEP and Nuclear Physics laboratories to assess the efficiency of laboratory operations.
  - Implement rolling two-year MOU's among the collider collaborations, their university collaborators, and FNAL that define their responsibilities and commitments for support, so that the FNAL Directorate can anticipate future manpower needs.
  - Explore trade-offs in centralizing common support activities.

Risks

- 6.2.3 Are there any programmatic, technical and infrastructure risks?
- **Findings**
  - There are significant risks to the Run II program as described by the DOE Review Committee that met earlier in 2004. These risks, which are primarily technical, could jeopardize the Run II physics program.
  - The Laboratory has an aging infrastructure, and there are risks from failure of aging equipment, e.g. transmission line poles and underground electric feeds. The Laboratory is aware of these risks and folds them into the priority process. The laboratory had attempted to implement the improvements with the UIP and then the SLI programs, but these plans were thwarted by legal concerns and DOE budgetary constraints. The lab is now exploring other options.
  - The laboratory is facing flat to flat-flat budgets.

- **Comments**
  - The committee believes that the Run II organization is quite effective.
  - The committee notes that the lab staff spends substantial time preparing for and participating in a broad spectrum of reviews.
  - The aging laboratory infrastructure is going to require a steady commitment of funds for capital renewal. If new funding sources cannot be found, the laboratory will have to allocate some programmatic funds to these issues.
  - The laboratory plan for flat-flat budgets maintains the Run II program, delays BTeV construction, and severely cuts R&D for future accelerators and detectors. Cutting the R&D threatens the FNAL leadership position.

- Recommendations
  - Develop a realistic plan for infrastructure renewal. "Pay now or pay more later"

Self-Assessment

- 6.2.4 Is there an ongoing program of self-assessment aimed at continuously improving maintenance and operations?
- **Findings**
  - The Laboratory is now in its third year of self-assessment. The program is not yet mature, but it appears to be steadily improving and being incorporated into the various divisions/sections.

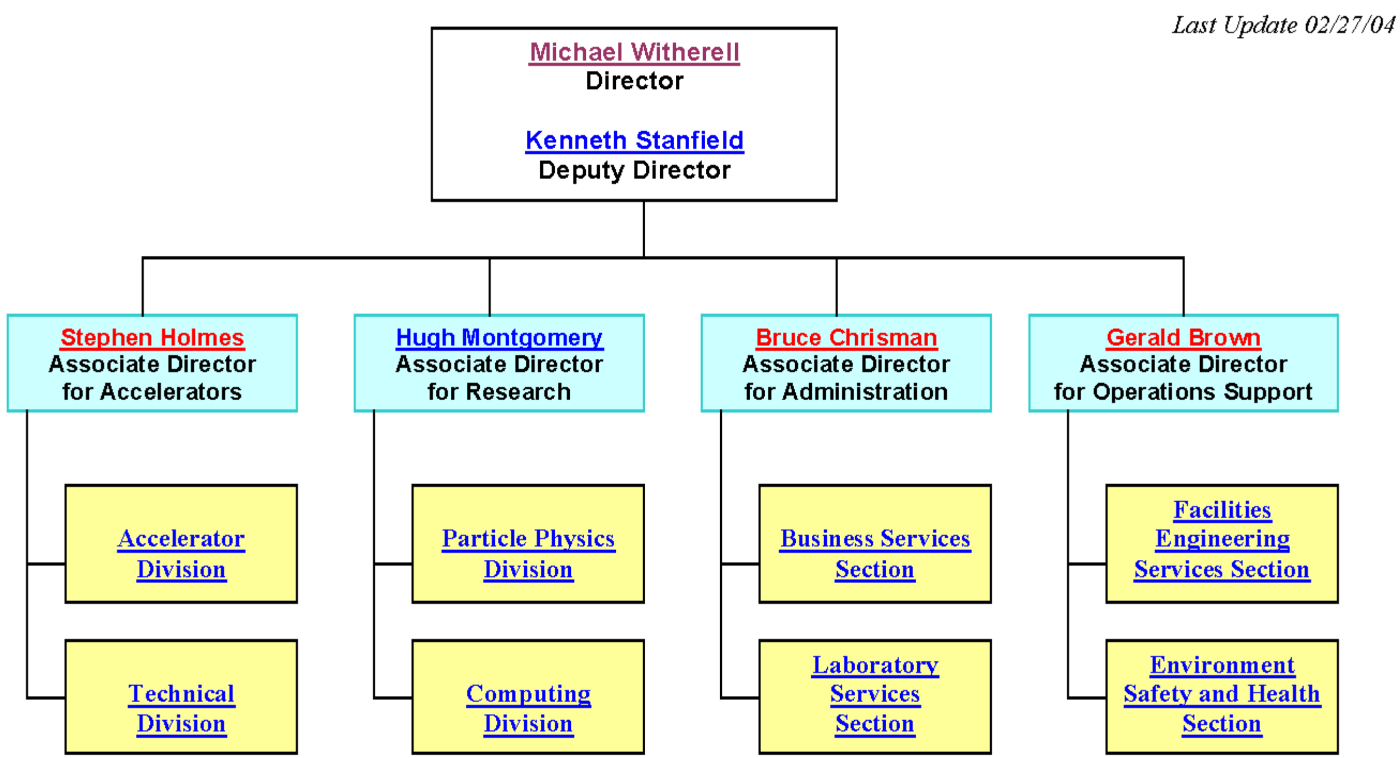
ES&H

- 6.2.5 Is ES&H planning and implementation receiving appropriate attention?
- **Findings**
  - In discussions with the Directorate and the Division/Section Heads, it is clear that Integrated Safety Management (ISM) planning and implementation is integrated into the leadership's thinking and actions. ISM has permeated the laboratory culture and now reaches sub-contractors working on the site.
- **Comments**
  - The emphasis on improved ES&H performance has clearly paid off, as seen by the downward trends in Lost Work Day and Recordable Injury metrics.

Appendices

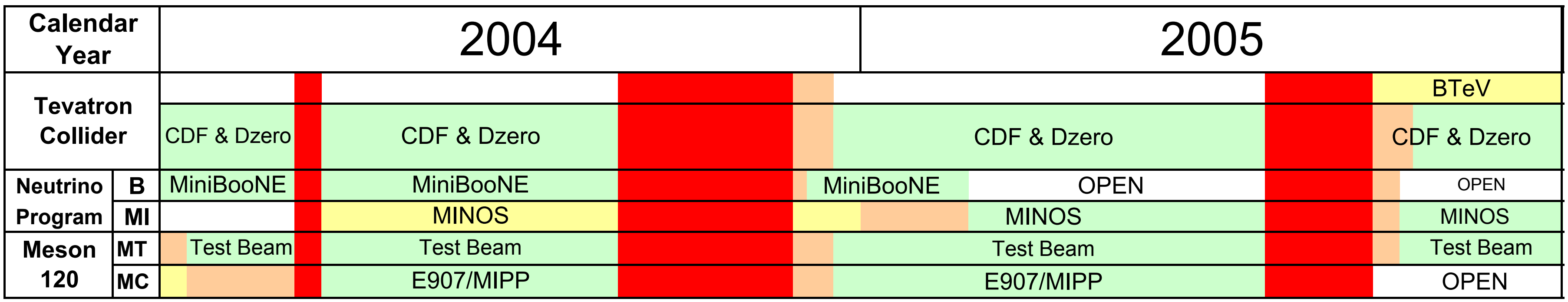
The Directorate

Fermilab Directorate Organization Chart



2004-5 Fermilab Accelerator Experiments Schedule

This Schedule will be updated regularly, as plans change.



Shutdown for M&D and CDF COT work, beginning March 15, 2004.
Summer 04 Shutdown is scheduled to begin on August 23, and is planned to last a nominal 13 weeks.
The length of the shutdown is driven by installation of electron cooling in the Recycler Ring.
The major 2005 shutdown is scheduled for the last 8 weeks of FY05.

This draft schedule will be updated as more precise information is made available.

Additional shutdown periods will be added, typically allowing 38-40 weeks of scheduled accelerator operation per year.

- RUN or DATA
- STARTUP/COMMISSIONING
- INSTALLATION
- M&D (SHUTDOWN)

4 March, 2004

Draft 2006-9 Fermilab Accelerator Experiments Schedule

Revised Annually - This Version from March, 2004.

Calendar Year		2006	2007	2008	2009
Tevatron Collider		BTeV	BTeV	BTeV	BTeV / BTeV
		CDF & D0	CDF & D0	CDF & D0	CDF & D0 / Open
Neutrino Program	B	OPEN	OPEN	OPEN	OPEN / OPEN
	MI	MINOS	MINOS	MINOS	MINOS / OPEN / OPEN
Meson 120	MT	TestBeam	TestBeam	TestBeam	TestBeam / TB
	MC	OPEN	OPEN	E906#	E906# / E906#
	ME	OPEN	OPEN	OPEN	E921* / E921*

This draft schedule is meant to show the general outline of the Fermilab accelerator experiments schedule.

Major components include:

Minimum of 6-8 week shutdown each summer, ~12 weeks estimated for Tevatron in 2009 for C0 IR installation.

Further action is required to establish scheduling of E906.

* Formerly CKM; approach being reconsidered.

Additional shutdown periods will be added, typically allowing 38-40 weeks of accelerator operation per year.

RUN or DATA

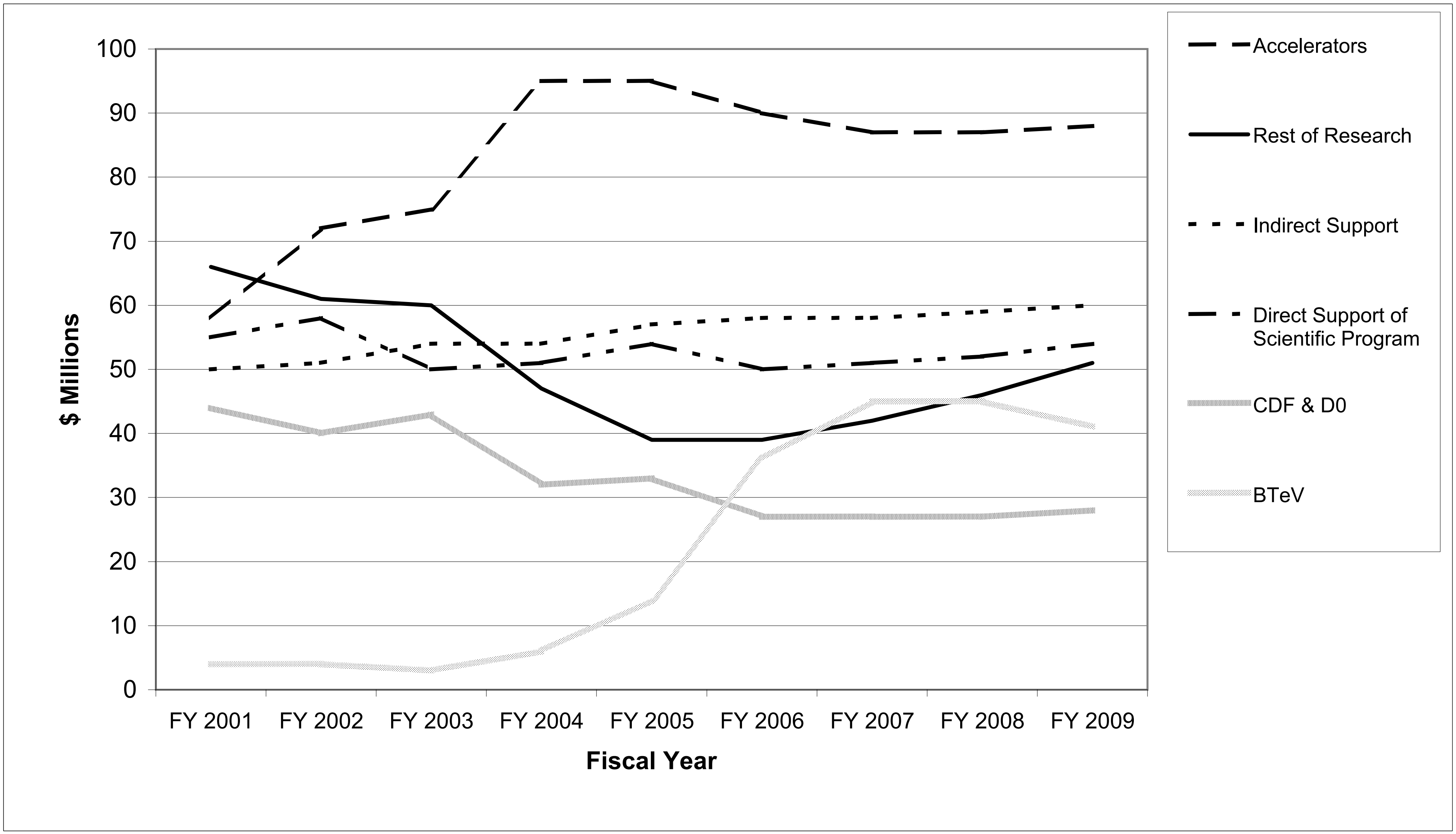
STARTUP/COMMISSIONING

INSTALLATION

M&D (SHUTDOWN)

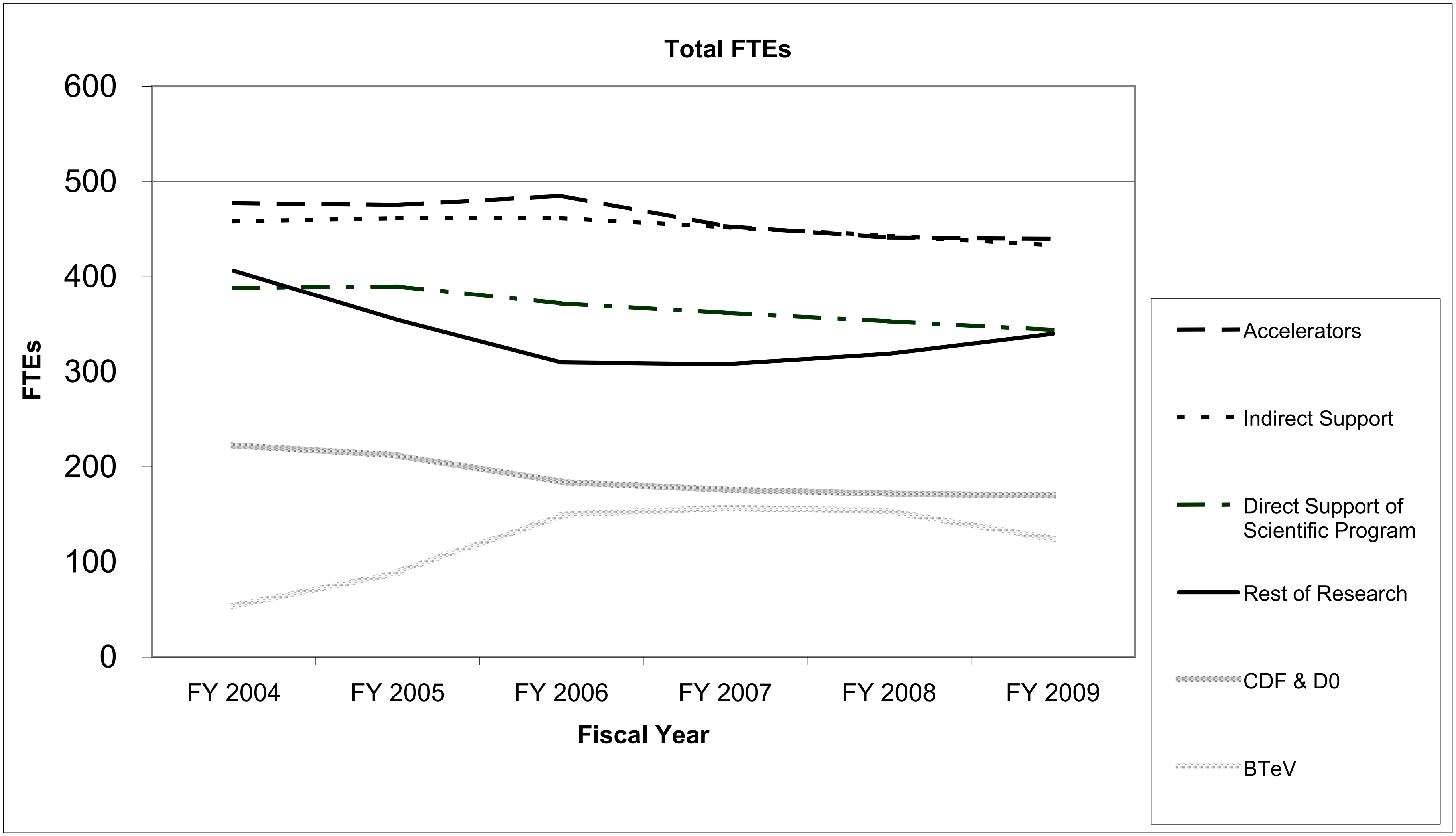
Funding Profile by Major Activity and Year - Up 2% Scenario

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Accelerators	58	72	75	95	95	90	87	87	88
Rest of Research	66	61	60	47	39	39	42	46	51
Indirect Support	50	51	54	54	57	58	58	59	60
Direct Support of Scientific Program	55	58	50	51	54	50	51	52	54
CDF & D0	44	40	43	32	33	27	27	27	28
BTeV	4	4	3	6	14	36	45	45	41
Total	277	286	285	285	292	300	310	316	322

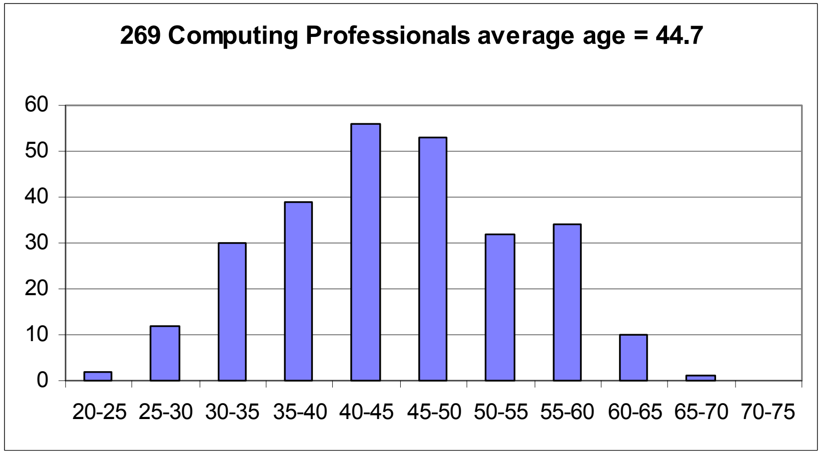


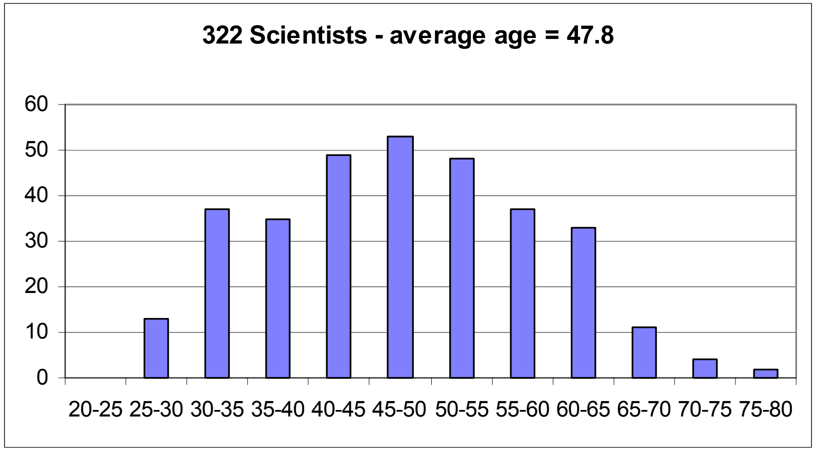
FTEs by Major Activity and Year - Up 2% Scenario

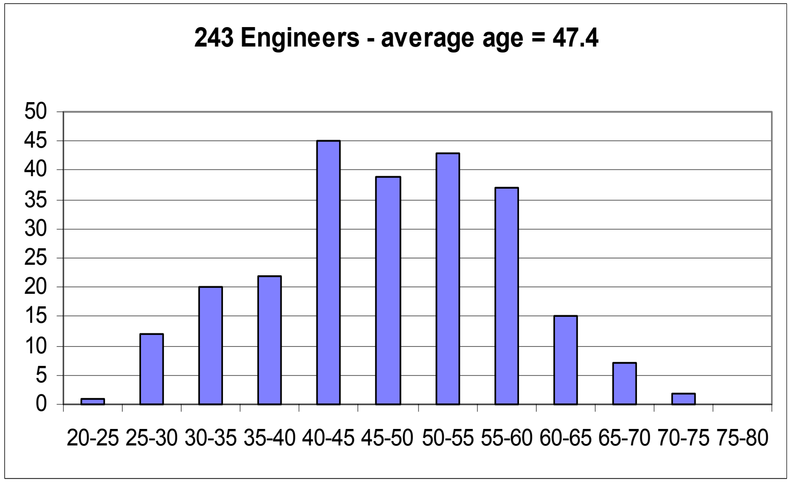
	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Accelerators	477	475	485	453	441	440
Indirect Support	458	462	462	452	443	433
Direct Support of Scientific Program	388	390	372	362	353	344
Rest of Research	406	355	310	308	319	340
CDF & D0	223	212	184	176	172	170
BTeV	53	89	150	157	154	124
Total	2,006	1,982	1,962	1,908	1,882	1,851



Lab – Age of Computing, Scientific and Technical Staff







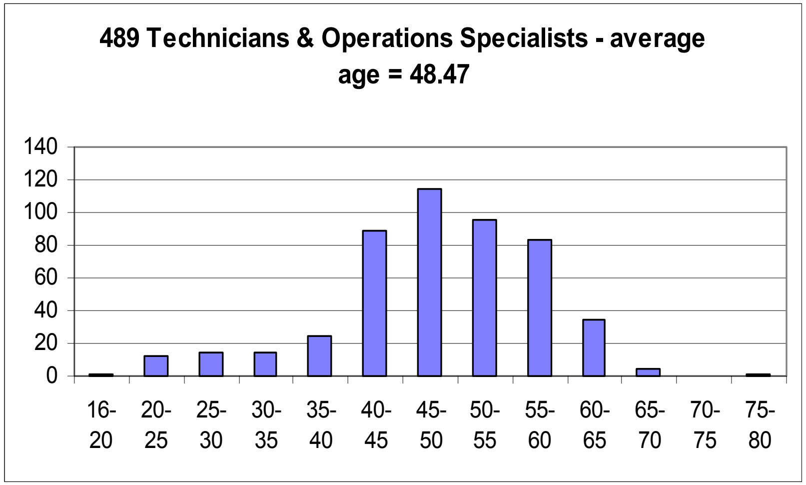


Table 3

Table 3: Financial planning profile - approx 2% increase per year						(K$)
BASE PROGRAM ONLY	FY04	FY05	FY06	FY07	FY08	FY09
Run 2						
Accelerator Operation	67,526.7	71,561.8	75,227.0	80,796.7	84,077.2	88,287.9
Accelerator Improvement	28,229.2	15,059.3	10,080.6	735.0	0.0	0.0
Detector Operation	19,865.5	20,580.1	19,944.1	20,572.8	21,261.4	22,045.1
Detector Improvement	5,175.1	6,325.2	775.8	0.0	0.0	0.0
Non-Run 2						
Accelerator Operation	6,328.8	7,515.8	6,476.5	6,735.6	6,986.2	7,266.3
Accelerator Improvement	0.0	8,098.5	5,000.0	5,000.0	2,500.0	0.0
Detector Operation	4,079.5	4,208.9	3,890.6	3,865.4	4,031.2	4,165.7
Detector Improvement	1,854.8	439.8	36.8	37.7	38.5	39.4
Others						
LHC	2,688.8	3,049.6	3,744.2	3,896.9	4,452.6	5,269.1
Non-accelerator physics	4,541.5	4,627.3	4,830.7	5,023.7	5,085.5	5,272.4
Theory	5,426.9	5,674.3	5,976.3	6,215.2	6,446.2	6,704.5
Physics Research	7,352.8	6,976.6	6,793.7	6,485.4	6,224.2	6,245.6
NuMI Line Item	11,364.0	403.0	0.0	0.0	0.0	0.0
Future Accelerator R&D	9,607.0	11,002.8	12,460.5	13,887.7	16,073.0	19,278.0
Future Detector R&D	6,919.1	9,545.4	5,794.8	5,364.1	5,000.6	6,486.2
BTeV						
unburdened cost	0.0	5,850.0	31,300.0	41,688.0	42,022.0	36,490.0
Indirect overhead	0.0	900.0	7,690.0	9,482.0	9,643.0	8,380.0
Other Direct	50,608.9	53,938.1	50,000.3	51,124.7	52,238.9	53,899.7
Indirect	53,896.4	57,199.7	58,021.2	58,161.7	59,324.9	60,511.4
Total	285,465.0	292,056.0	300,353.1	309,590.4	315,762.4	321,961.2
	FY04	FY05	FY06	FY07	FY08	FY09
Running weeks/year						
Run2	37	37	40	40	40	40
Non-Run2	37	37	40	40	40	40

LWWBS FY04-FY09 APPROX 2% INCREASE PER YEAR

Laboratory WBS Structure Total

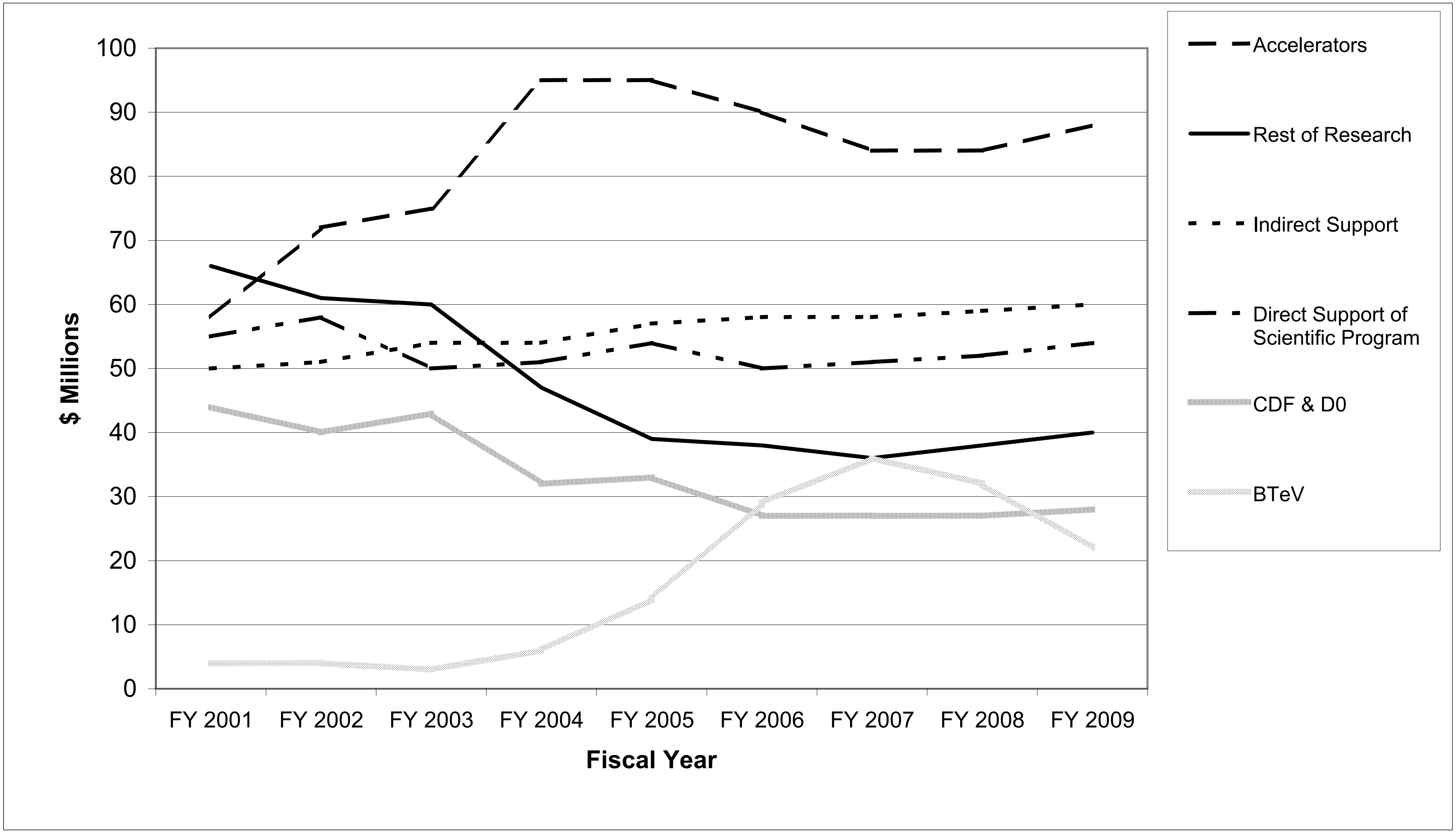
Division/Section: (All)

DIRECT COSTS - BASE PROGRAM ONLY		FY04 BASE	FY05 BASE	FY06 BASE	FY07 BASE	FY08 BASE	FY09 BASE
1.1	Accelerators	95,755.9	94,719.6	90,307.6	86,531.6	86,577.3	88,287.9
1.1.1	Accelerator Maintenance and Operations	67,526.7	71,561.8	75,227.0	80,796.7	84,077.2	88,287.9
1.1.2	Accelerator Upgrades	28,229.2	23,157.8	15,080.6	5,735.0	2,500.0	0.0
1.2	Collider Experimental Program	31,658.6	33,339.7	26,950.1	27,058.2	27,485.6	28,290.7
1.2.1	CDF	9,732.9	9,990.8	8,130.0	8,068.9	8,107.0	8,308.1
1.2.2	DZero	11,892.7	13,302.7	8,973.7	8,795.4	8,860.3	9,091.5
1.2.3	Run II Computing	9,966.7	10,003.1	9,846.4	10,193.8	10,518.3	10,891.1
1.2.4	Si-Det Facility Support for Run IIb	66.3	43.1	0.0	0.0	0.0	0.0
1.3	LHC	2,688.8	3,049.6	3,744.2	3,896.9	4,452.6	5,269.1
1.4	BTeV	5,607.9	13,778.1	35,513.8	45,474.5	45,396.3	41,293.5
1.4.1	MIE	0.0	5,850.0	31,300.0	41,688.0	42,022.0	36,490.0
1.4.2	Operations, Support & R+D	5,607.9	7,928.1	4,213.8	3,786.5	3,374.3	4,803.6
1.5	Experimental Initiatives	5,896.0	5,931.0	5,619.9	5,035.9	5,264.3	5,465.5
1.5.1	Future Kaons	740.2	351.0	56.0	0.0	0.0	0.0
1.5.2	External Beamlines & Fixed Target Exps	4,584.8	4,313.7	4,038.9	3,458.3	3,638.0	3,782.8
1.5.3	Off-Axis Neutrinos	571.0	1,266.3	1,525.0	1,577.6	1,626.3	1,682.6
1.6	Neutrino Experiments	19,777.4	8,795.9	6,928.5	7,180.4	7,417.8	7,688.6
1.6.1	NuMI / MINOS	19,383.0	8,462.1	6,582.1	6,820.2	7,044.3	7,300.3
1.6.4	MiniBooNE	394.5	333.9	346.4	360.2	373.5	388.3
1.7	Future Accel. & Advanced Accel. R&D	9,607.0	11,002.8	12,460.5	13,887.7	16,073.0	19,278.0
1.7.1	Superconducting Magnets	3,064.9	3,581.0	3,722.0	3,861.8	3,994.8	4,145.3
1.7.2	Fermilab NICADD Photoinjector Laboratory	2,400.6	1,843.4	2,558.5	2,922.4	3,451.6	4,237.2
1.7.3	Muon Storage Ring	695.0	707.0	661.7	686.0	708.9	735.0
1.7.4	Linear Collider	2,994.6	3,697.5	3,837.0	4,541.1	5,588.3	7,152.6
1.7.5	Site Studies	100.0	104.0	108.0	0.0	0.0	0.0
1.7.6	Advanced Accelerator Concepts	0.0	0.0	0.0	0.0	0.0	0.0
1.7.7	New Proton Driver	351.9	1,069.9	1,573.3	1,876.4	2,329.5	3,007.8
1.8	Theory	5,426.9	5,674.3	5,976.3	6,215.2	6,446.2	6,704.5
1.8.1	Particle Theory	3,580.0	3,787.3	3,988.1	4,150.7	4,308.6	4,484.5
1.8.2	Astrophysics Theory	1,235.0	1,259.5	1,327.4	1,381.2	1,433.4	1,491.5
1.8.3	Lattice Gauge Theory Computing	611.9	627.5	660.8	683.3	704.3	728.5
1.9	Experimental Particle Astrophysics	4,541.5	4,627.3	4,830.7	5,023.7	5,085.5	5,272.4

1.9.1	SDSS	1,768.2	1,774.7	1,828.7	1,902.4	955.4	740.5
1.9.2	CDMS	879.7	850.8	876.3	908.8	939.6	974.6
1.9.3	Pierre Auger	1,211.1	1,150.1	1,181.0	1,228.6	1,274.8	1,326.3
1.9.4	KDI	0.0	0.0	0.0	0.0	0.0	0.0
1.9.5	JDEM	682.5	851.7	944.6	983.9	1,915.7	2,231.0
1.10	Programmatic Support (Direct)	18,108.5	18,283.1	17,617.8	17,537.8	17,537.8	17,537.8
1.10.1	Central Computing	7,965.9	7,870.0	7,830.1	7,830.1	7,830.1	7,830.1
1.10.2	PREP	125.8	128.4	131.0	131.0	131.0	131.0
1.10.3	Computer Networking	3,160.2	2,938.0	2,984.3	2,904.3	2,904.3	2,904.3
1.10.4	DAQ/Online/R&D	952.6	1,273.6	691.9	691.9	691.9	691.9
1.10.5	Technical Facilities	3,304.6	3,343.4	3,146.2	3,146.2	3,146.2	3,146.2
1.10.6	Engineering Support	1,288.0	1,387.1	1,451.1	1,451.1	1,451.1	1,451.1
1.10.7	TV System Support	170.0	177.0	179.3	179.3	179.3	179.3
1.10.8	Survey & Alignment	315.1	322.4	329.9	329.9	329.9	329.9
1.10.9	Machine Shops	0.0	0.0	0.0	0.0	0.0	0.0
1.10.10	Russian Scientists Support	0.0	0.0	0.0	0.0	0.0	0.0
1.10.11	Travel for Conferences	341.0	359.0	363.0	363.0	363.0	363.0
1.10.12	U.S. Particle School Office	146.0	194.4	202.2	202.2	202.2	202.2
1.10.13	Conference/Workshop Support	339.3	289.8	308.8	308.8	308.8	308.8
1.11	Other Projects	0.0	0.0	0.0	0.0	0.0	0.0
1.12	Other Support (Direct)	7,994.4	8,569.8	8,464.0	8,778.4	9,076.4	9,414.7
1.12.1	Buildings/Facilities	3,781.6	4,142.4	4,087.7	4,228.5	4,359.1	4,509.9
1.12.2	ES&H	4,212.8	4,427.3	4,376.3	4,549.8	4,717.3	4,904.8
1.13	Division Management and Support (Direct)	14,713.9	15,085.2	15,418.6	15,808.5	16,124.7	16,447.2
1.13.1	Management/Supervision	10,827.4	11,229.5	11,767.4	12,340.4	12,587.2	12,838.9
1.13.2	General Purpose Equipment and Support	709.7	719.0	546.0	557.0	568.1	579.5
1.13.3	Computing Support/Information Systems	2,485.3	2,514.9	2,456.2	2,586.9	2,638.7	2,691.4
1.13.4	Training and Education	691.5	621.9	648.9	324.3	330.8	337.4
1.14	Indirect Support	53,896.4	57,199.7	58,021.2	58,161.7	59,324.9	60,511.4
1.15	GPP & UIP	9,792.0	12,000.0	8,500.0	9,000.0	9,500.0	10,500.0
1.15.1	GPP	3,542.0	6,500.0	3,000.0	3,500.0	4,000.0	5,000.0
1.15.2	UIP	6,250.0	5,500.0	5,500.0	5,500.0	5,500.0	5,500.0
1.0	TOTAL	285,465.3	292,056.0	300,353.1	309,590.4	315,762.4	321,961.2

Funding Profile by Major Activity and Year - Flat Budget Scenario

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Accelerators	58	72	75	95	95	90	84	84	88
Rest of Research	66	61	60	47	39	38	36	38	40
Indirect Support	50	51	54	54	57	58	58	59	60
Direct Support of Scientific Program	55	58	50	51	54	50	51	52	54
CDF & D0	44	40	43	32	33	27	27	27	28
BTeV	4	4	3	6	14	29	36	32	22
Total	277	286	285	285	292	292	292	292	292



FTEs by Major Activity and Year - Flat Budget Scenario

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BTeV	53	89	150	157	154	124
Total	2,006	1,982	1,962	1,877	1,843	1,810

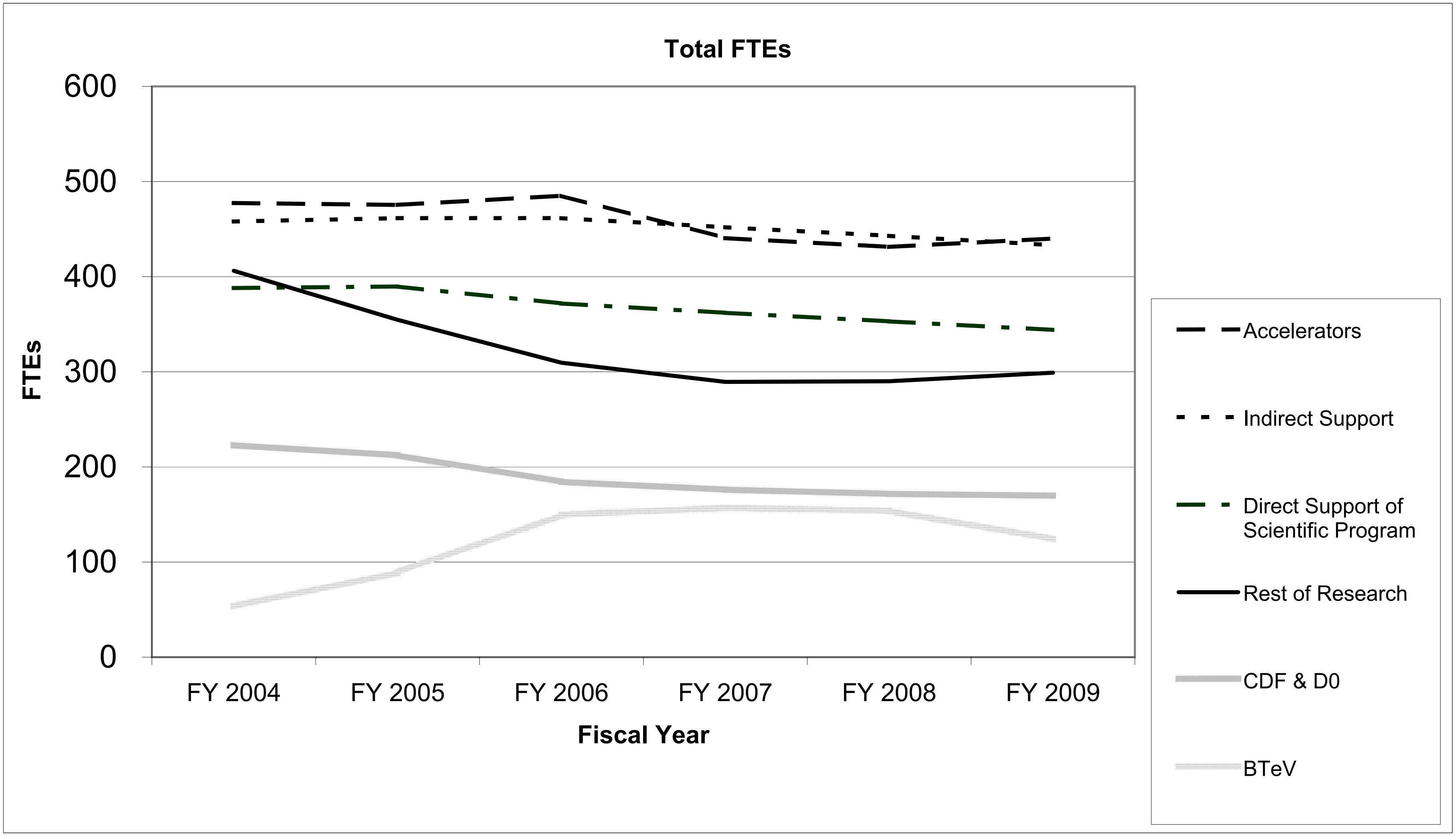

Table 3

Table 3: Financial planning profile - Flat Budget						(K$)
BASE PROGRAM ONLY	FY04	FY05	FY06	FY07	FY08	FY09
Run 2						
Accelerator Operation	67,526.7	71,561.8	75,227.0	80,796.7	84,077.2	88,287.9
Accelerator Improvement	28,229.2	15,059.3	10,080.6	735.0	0.0	0.0
Detector Operation	19,865.5	20,580.1	19,944.1	20,572.8	21,261.4	22,045.1
Detector Improvement	5,175.1	6,325.2	775.8	0.0	0.0	0.0
Non-Run 2						
Accelerator Operation	6,328.8	7,515.8	6,476.5	6,735.6	6,986.2	7,266.3
Accelerator Improvement	0.0	8,098.5	4,327.9	2,000.0	0.0	0.0
Detector Operation	4,079.5	4,208.9	3,890.6	3,865.4	4,031.2	4,165.7
Detector Improvement	1,854.8	439.8	36.8	37.7	38.5	39.4
Others						
LHC	2,688.8	3,049.6	3,744.2	3,896.9	4,452.6	5,269.1
Non-accelerator physics	4,541.5	4,627.3	4,830.7	4,984.4	4,114.4	3,986.0
Theory	5,426.9	5,674.3	5,976.3	6,215.2	6,446.2	6,704.5
Physics Research	7,352.8	6,976.6	6,793.7	6,485.4	6,224.2	6,245.6
NuMI Line Item	11,364.0	403.0	0.0	0.0	0.0	0.0
Future Accelerator R&D	9,607.0	11,002.8	12,460.5	10,470.2	11,155.3	12,117.5
Future Detector R&D	6,919.1	9,545.4	4,269.8	3,786.5	3,374.3	4,803.6
BTeV						
unburdened cost	0.0	5,850.0	25,200.0	32,187.9	28,330.8	16,714.2
Indirect overhead	0.0	900.0	6,191.3	7,321.2	6,501.2	3,838.5
Other Direct	50,608.9	53,938.1	50,000.3	51,124.7	52,238.9	53,899.7
Indirect	53,896.4	57,199.7	58,021.2	58,161.7	59,324.9	60,511.4
Total	285,465.0	292,056.0	292,056.0	292,056.0	292,056.0	292,056.0
	FY04	FY05	FY06	FY07	FY08	FY09
Running weeks/year						
Run2	37	37	40	40	40	40
Non-Run2	37	37	40	40	40	40