

PHYSICS ADVISORY COMMITTEE MEETING

June 15-22, 1984

Introduction

The construction of a cryogenic accelerator, its operation at 800 GeV, and the delivery of extracted beams for fixed-target experiments are supreme achievements of modern technology. The Committee congratulates the Laboratory on its splendid work. We note that the major construction projects for the Tevatron and its associated facilities have stayed within the budget and are on schedule.

Over the past five years, in anticipation of the commissioning of these facilities, this Committee has recommended a comprehensive program of experiments which utilize innovative electronic and visual detectors. This program directly confronts important issues at the forefront of elementary particle physics and provides unique opportunities for the discovery of new phenomena. The Laboratory Director has enthusiastically accepted our recommendations, and with the help of his staff, has developed plans to bring these experiments into operation in an efficient and timely fashion. A large number of physicists from all parts of the United States and from more than twenty other countries have committed their time and resources to these projects.

It is in the context of these major commitments of construction funds, scientific personnel, and resources, that the Committee is compelled to express its dismay at the inadequate level of funding currently in prospect to equip and operate the experiments and beam lines. Adequate and properly phased funding for equipment and operation must accompany such a large construction project in order to realize the goals of the program.

The Committee has been asked to advise the Director on how the Laboratory should react to the current low level of funding and possible further cuts in the budget. After carefully evaluating the program, we cannot recommend that any part of the currently approved program be cancelled. We are deeply concerned about the chilling effects the current funding situation will have on physics opportunities we envision for the future. We therefore strongly urge the Laboratory to continue seeking adequate funds to carry out this program, and to emphasize forcefully to the Department of Energy and HEPAP the value of the physics opportunities which are in jeopardy, and the disproportion between the magnitude of the Tevatron construction projects and the level of funding available to exploit the opportunities they offer.

Tevatron I

The Committee reiterates its very strong support for the physics opportunities of the Tevatron I program and the desire to realize those opportunities as soon as possible. It is pleased with the rapid progress on the Antiproton Source and the CDF detector. It recognizes that implementation of a test run in June-July 1985 implies a very tight schedule for both the \bar{p} source and CDF and that that goal may not be realized. However, it supports strongly the present schedule of a serious test run in the spring of 1986, followed by a physics run of several months duration in the fall of 1986. The Committee urges the Laboratory to adhere to that schedule if at all practical.

The Committee reaffirms its earlier commitment to the existence of a high quality second detector to exploit fully the physics of Tevatron I. It feels that the conceptual design of the D0 detector addresses well the physics opportunities, emphasizing those complementary to CDF. It is desirable to bring D0 into operation at an early date. It seems unlikely, given the current budget, that this detector will be ready to produce physics before 1988. The Committee notes that the physics output of Tevatron I will continue to be rich through the mid-1990's and considers it important to have a second detector in place for as much of this period as possible. It endorses the D0 Technical Review, and notes that the full capabilities of D0 are not really known until a cryogenic and mechanical design of the calorimeter is available. The Committee urges the Laboratory to provide manpower to help in this effort. It also notes the importance of finalizing the design of the D0 Hall as soon as possible so that its construction may begin during the 1985 shutdown.

The funding profile suggested by the Laboratory should enable construction of the D0 detector on a time scale nearly matched to the technical limitations, but it has little contingency. The Committee realizes that if the cost were to increase dramatically without a corresponding budget increase, it could only be accommodated by a stretch-out, staged implementation, or change in scope. The Committee feels that there may be opportunities for an optimization of the detector design leading to a reduction in the number of channels or a staged implementation.

Tevatron II

The Committee has reviewed in detail the entire Tevatron II experimental program. It is a vigorous and well-balanced program in a unique energy range which studies programmatically lepton, photon, and hadron interactions, conducts crucial tests of QCD and electro-weak theories, studies production and decay of heavy quark states, and searches for new phenomena in the higher energy range of Tevatron II. There is little overlap in the physics potential of individual experiments, and the Committee found that no major experiment could be eliminated without significant

reduction in the physics yield of Tevatron II. Thus, the present Committee reaffirms the scientific approval given by previous PACs to all of the approved Tevatron II experiments.

As mentioned above, the DOE guidelines on capital equipment funding communicated to the Laboratory in March do not permit the timely utilization of Tevatron I and Tevatron II facilities. The Laboratory has submitted a plan (see page 7) that trims and stretches out the Tevatron II program (including the deferral of upgrades of the Proton-West and Meson-East beam lines). This scenario comes close to fitting within the guidelines, and, if there is no improvement in the budget, the Committee feels that this is a reasonable solution to an unfortunate problem.

In previous years the Committee assigned physics priorities within the Tevatron II program as follows: (1) Prompt Neutrino; (2) the Muon Beam and the Wide-Band Photon Beam; (3) the Meson-West Pion Beam; and (4) the Polarized Proton Beam. In reassessing this assignment of priorities the Committee has been unavoidably influenced by budget constraints and the cost to complete the Prompt Neutrino Beam and has separated that facility from the other major new beam lines. The Committee now ranks them in the following order: the Wide-Band Photon Beam, the Muon Beam, the Meson-West Pion Beam, and the Polarized Proton Beam. The Committee regards the Prompt Neutrino program as comparable in physics priority with the best of the programs ranked above.

Scenarios and Relative Priorities

If the DOE is unable to supply even the inadequate capital equipment funds specified in its March guidelines, it will not be possible to realize the physics opportunities of Tevatron I and Tevatron II without a substantial delay in one or more of the programs. How the Laboratory should react to such a cut depends on its magnitude. If the shortage in FY 85 is at the level of \$1-2M the Lab could delay the Polarized Proton Beam. In the event of a more drastic shortfall in FY 85, the Committee reluctantly concludes it may be necessary to delay or reduce in scope the Prompt Neutrino program. The Committee makes this recommendation only because other attempts to save an equivalent amount of capital equipment funds would require substantial delay in the entire TeV I program or in at least three other TeV II experimental programs. The Committee feels that it is important that the TeV II programs in the existing beams and in the new Neutrino, Muon, Photon, and Meson-West Pion beams and the TeV I program, as realized by CDF, proceed on schedule. It thus reluctantly accepts some delay in the Polarized Proton or Beam Dump programs, if necessary, to allow this.

The Committee believes that the Beam Dump does offer unique physics opportunities, that it is important to make a start on D0 and that one cannot sacrifice opportunities for future fixed target experiments. Their relative priority in future years must

depend on a reevaluation of the Beam Dump program, on the technical progress of D0, and on proposals received for new TeV II experiments. It encourages the Laboratory to hold a workshop on the opportunities for experiments using the Beam Dump.

Future Fixed Target Opportunities

Tevatron II, as the highest energy fixed-target machine in existence, presents unique experimental opportunities in hadron, photon, and lepton physics. The program in place exploits these opportunities with a combination of revised older experiments and new experiments and facilities. Results from the initial round of experiments as well as other concurrent measurements will certainly point the way to a new generation of TeV II experiments.

The diversity and flexibility inherent in fixed-target work will continue to provide important windows into interesting and perhaps unforeseen phenomena. Given the long time scale in the design and construction of modern experiments, the Committee recommends that the Laboratory encourage initiatives by holding workshops to explore future fixed-target experimentation. At the same time, it is important that long-range planning of the Laboratory take into account the financial impact of the construction of possible major new fixed target facilities.

Physics Advisory Committee

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DATE: 06-22-84

| | | FY84 | FY85 | FY86 | FY87 | FY88 | FY89 |
|----|------|-------------|-----------------------|--------------|--------------|---------------------|---------------------------|
| | | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
| ME | 5700 | 605 | 605 | 690 | 690 | OPEN | STRETCHED-OUT SCHEDULE |
| MP | X | X | X | X | 704 | 704 | |
| MC | X | X | 731 | 731 | X | X | |
| MT | 6000 | 557/ 672 | 743 672 | TEST BEAM | TEST BEAM | TEST BEAM | |
| MW | X | X | X | 706 | 672 | 706 | |
| NC | X | X | 632, 733, 744, 745 | 649/ 652 | 649/ 652 | X | |
| NP | X | X | X | X | X | 635, 638, 646 | |
| NE | X | X | 653/711 | 653/711 | 653 | OPEN | |
| NM | X | X | X | 665 | 665 | OPEN | |
| PE | 4000 | X | 691 | OPEN | OPEN | OPEN | |
| PB | X | X | X | 687 | 683 | OPEN | |
| PC | 7155 | 621 | 621 | OPEN | OPEN | OPEN | |
| PW | 6155 | 615 | 705 | 705 | OPEN | OPEN | |

SHUTDOWN FOR CONSTRUCTION: F-18, D-ø OVERPASS, ETC.

SHUTDOWN FOR CONSTRUCTION: B-ø OVERPASS, D-ø COLL. HALL

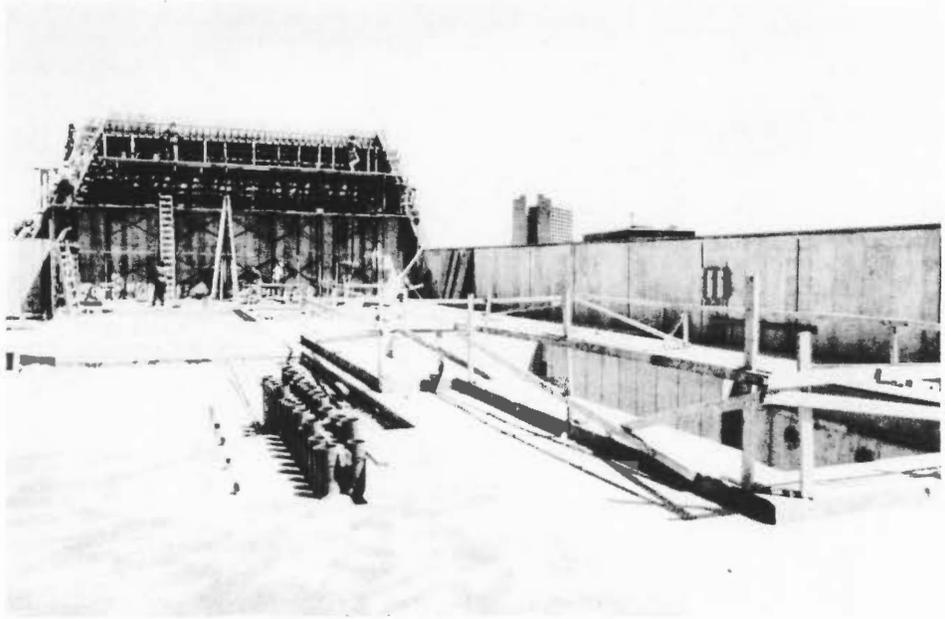
TEVATRON I AND CDF TESTS

TEVATRON I OPERATION

TEVATRON I OPERATION

X = OFF

← TeV I TEST



Target Building for Tevatron I.
(Photograph by Fermilab Photo Unit)