TEVATRON II

T. B. W. Kirk

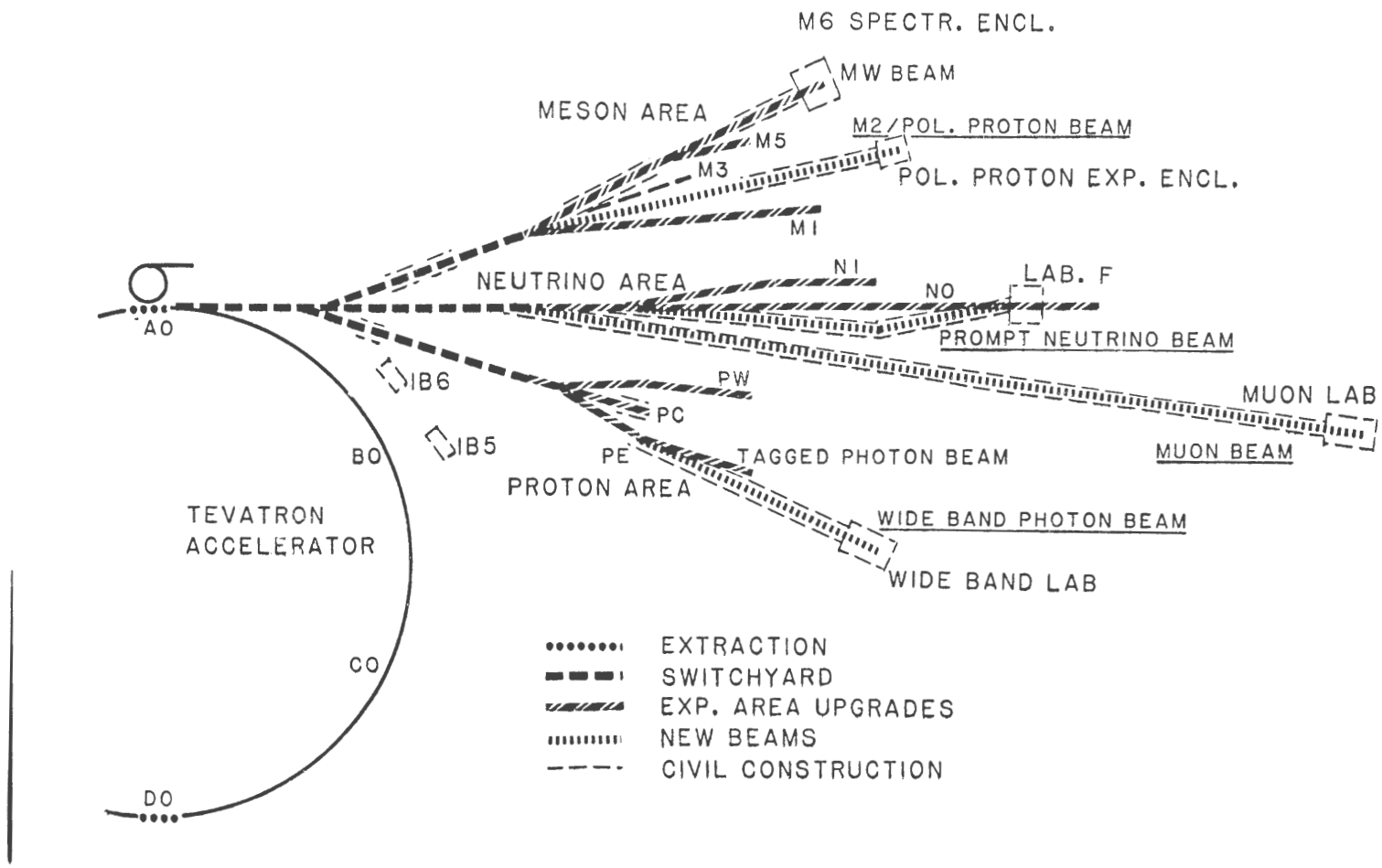
The main purpose of the Tevatron II project is to upgrade external beams and experimental areas to bring fixed-target physics into the TeV era. Extraction of slow spill beam from the superconducting accelerator is also included in the project. The project has not been discussed in these pages since April, 1980 and there has been enormous progress since that time. It is therefore appropriate to review the program, which is a major effort of both the Research and Accelerator Divisions. This report will cover many Fermilab people's work, as well as the contributions of many users.

Planning. The Tevatron II project touches closely on the aspirations of almost every user and it is entirely natural that there has been a deep, continuing involvement of users in the planning of the project. The basic design of Tevatron II was blocked out in a 1976 Aspen Summer Study with 65 participants. The papers from that study have been published in a two-volume Summer Study Report. There have been many workshops since that summer, including a Photon Workshop (80 people) in August, 1978, a Meson TeV workshop (100 people) in August, 1979, a Bubble-Chamber Physics Workshop (75 people) in October, 1979, a workshop on Tevatron Neutrino and Muon Physics (230 people) in January, 1980, a workshop on Hadron and Muon Physics (200 people) in May, 1980, a Fixed Target Workshop (200 people) in July, 1980, and a workshop on Holographic Techniques (90 people) in November, 1980. Users are continuing to be active in Tevatron II planning.

Pre-Project Work. By recognizing the future 1 Tev needs of the experimental areas in the normal upgrading programs of the past two years, it has been possible to get an advanced start on projects related to the goals of Tevatron II. A useful upstream extension to Neuhall was built in the summer of 1980 and 14,000 tons of additional steel shielding were buried in the muon absorber earth berm in the Neutrino Area. The entire superconducting Left Bend to the Meson Area has been installed and commissioned; it operated very reliably and successfully in the 400-GeV run that ended in June of this year. A number of other improvements and small construction additions have been made in the Meson and Proton Areas.

Project Status. The Tevatron II project is now a fully authorized construction line item. The total plant funds authorized for the project is $49.8 million. In addition, a total of $18 million in other funds will be spent for research and development associated with the project. There will be a substantial increase in equipment funding required to support the Tevatron II project for secondary beamline equipment and for equipment to be used in Tevatron experiments.

TEV II CONSTRUCTION AREAS



Present Work. The accompanying diagram shows the areas of construction work for Tevatron II. We are about to go out for bids on a large amount of civil construction to upgrade switch-yard tunnels and to reroute a number of primary beams. The beams to be affected are:

(i) the Wide Band Beam in the Proton Area, where in the future, both the Wide Band and Tagged Photon Beams will be generated by separate primary beams and separate targets,

(ii) the new Muon Beam,

(iii) the new Dichromatic Beam in the Neutrino Area, and

(iv) the new triple split of th primary beam in the Meson Area.

This last beam is the result of a complete rethinking and redesign of the beam and targeting system. The three primary beams in the new plan will go all the way into the Detector Building, which will become a primary target building.

A large amount of other conceptual and engineering design work and technical component construction is also in progress. A new prompt neutrino shield design using superconducting magnets has been completed. Work is in progress on designs for many special magnets needed in the project. Many other needed devices of various types are also being designed and built.

There is also a large ongoing research and development activity that supports project activity. A large-aperture low-current superconducting quadrupole has been designed and built at Argonne National Laboratory and brought (cold) to Fermilab for tests in the beam. The preliminary indication is that this magnet will be successful in a high-radiation area. Work is also going on to improve the electostatic septa on which low-loss extraction and beam splitting depend. By careful prestressing of the wire-support frames, it is possible to bring the projected septum width down to 3 mils for a wire diameter of 2 mils. This development represents a factor two improvement over existing septa and has important consequences for slow spill beam in the Tevatron.

Future Work. Next year we will build a number of new experimental halls. These include:

(i) Neutrino Lab F. This is an extension of Lab E for prompt neutrino physics and possibly for hadron experiments.

(ii) A new Wide Band Photon Experimental Hall in the Proton Area.

(iii) A new Muon Experimental Hall at the end of the new muon beam.

(iv) A new M-West Experimental Hall to house experiments in the upgraded M6 beam.

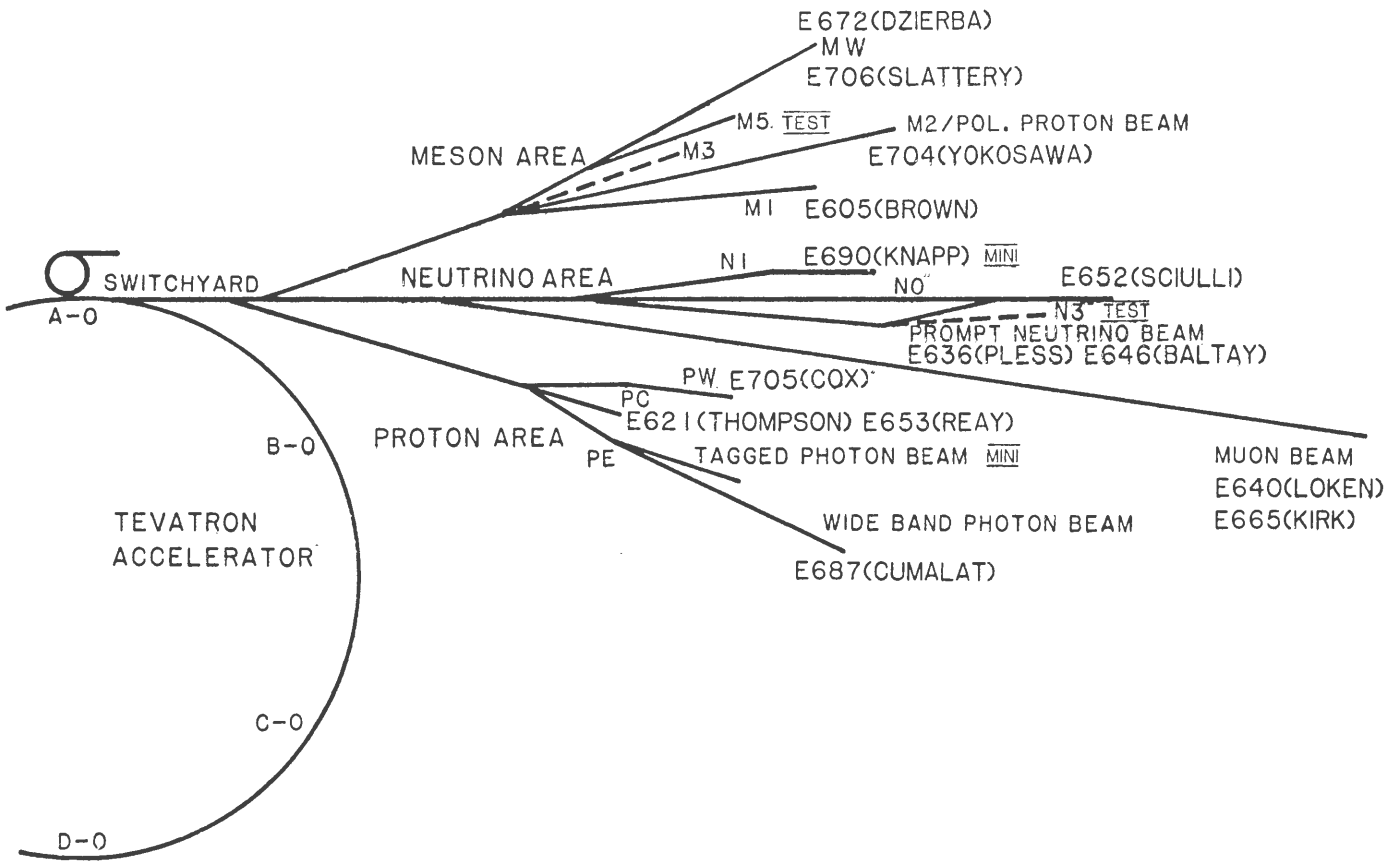
(v) A Polarized Proton Experimental Hall.

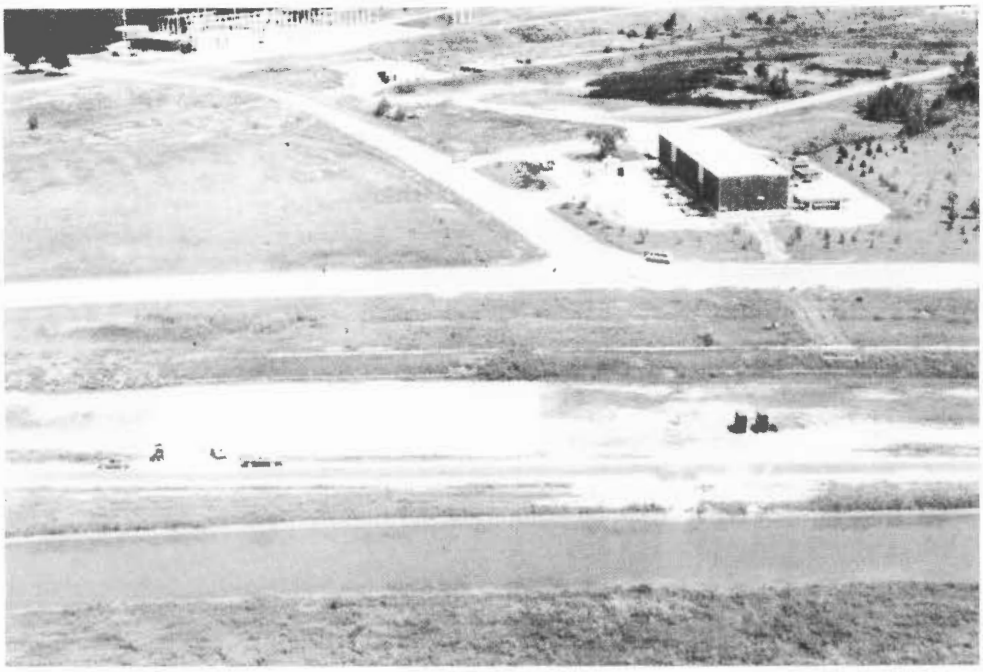
A polarized proton beam is being built in collaboration with Argonne National Laboratory. The beam is planned in two phases, a first phase utilizing conventional magnets at energies up to 200 GeV and a later phase that would utilize superconducting magnets to produce polarized beams at higher energies if the physics indicates this as an interesting direction to pursue.

Thus we are in high gear and moving ahead rapidly on our preparation for the future of fixed-target physics. We will finish the new experimental halls by the Fall of 1984 and will finish the entire project in 1985. In all this work, we continue to seek and will gratefully receive the advice of Fermilab users. Any work that can be donated to help in the concepted design will also be welcome.

The Physics Advisory Committee has approved a number of Tevatron experiments. A schematic layout of the first round of Tevatron experiments is shown in the accompanying drawing.

TEVATRON EXPERIMENTS





An aerial view of the construction of the helium storage facility. The Main Ring pond is in the foreground, the Central Helium Liquefier and the Substation beyond the Main Ring. (Photograph by Fermilab Photo Unit)