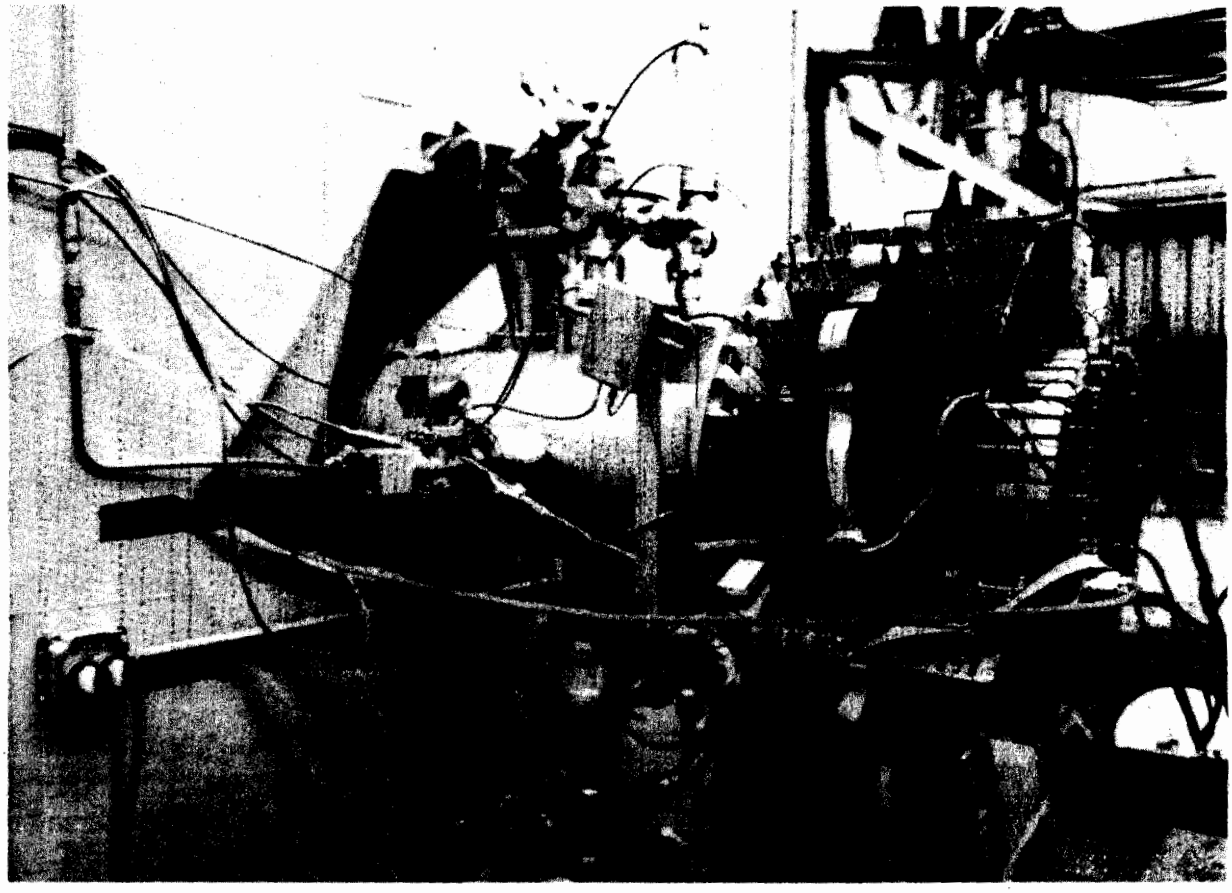
fermilab report

Fermi National Accelerator Laboratory Monthly Report

February 1984



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F. T. Cole, R. Donaldson, and L. Voyvodic, Editors

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FERMILAB-84/2 **Fermi National Accelerator Laboratory** 0090.01

THE COVER: A prototype detector for ring-imaging the Cherenkov light from very high energy charged particles. The 2,500 needle points in the Saclay-designed single photoelectron detector plane enable the radius of the ring image to be determined with an uncertainty of 1.6 mm. The detector is one of several detectors being studied for an eventual large-solid-angle ring-imaging system in Tevatron experiment E-665.

(Photograph by Fermilab Photo Unit)

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EARLY BIRD REPORT #871
Feburary 16, 1984

800 GeV BEAM HAS BEEN EXTRACTED FROM THE TEVATRON TO THE SWITCHYARD DUMP.

For the past 24 hours, the accelerator has been engaged in high energy studies. The objectives of the studies included; establishment of 800 GeV beam to switchyard and ultimately to transport the beam to the meson area. Though beam was extracted to the dump, attempts at transporting beam to the meson area were thwarted due to an inability to power up the left bend magnets.

The push for an 800 Gev ramp began early during the day shift. Recovery from two mid-afternoon quenches (770 and 700 Gev) attributed to a delay in the efforts. Improper helium flow for the magnet leads at E3 necessitated a Tevatron access at the start of the evening shift. By 1830 hrs, an 800 Gev Tevatron ramp had been established. By 2044 hrs, beam had been accelerated to flattop, and was extracted to the switchyard dump 10 minutes later.

During the owl shift, attempts were made at establishing beam to the meson experimental area. Due to a noisy transducer on the left bend power supplies, at 0400 hrs the efforts to establish beam to that area were abandoned. Tuning to increase the extracted beam intensity continued throughout the owl shift. Intensities of $>7 \times 10^{12}$ ppp were achieved.

High energy studies are scheduled to continue throughout the week.

T. Louis Williams

STATUS OF THE TEVATRON II PROJECT

Tom Kirk

The first phase of the Tevatron II project has now been operational for approximately three months. During this period, the slow-extracted beam from the Tevatron and the completely reworked beam switchyard, plus many of the Tevatron primary-target systems, have been brought into operation. Most important, the Tevatron high-energy physics program has started.

The second phase of Tevatron II will involve construction and commissioning of the new secondary beam lines. These consist of the Wide Band Photon Beam in the Proton Area, the Muon and Prompt Neutrino Beams in the Neutrino Area, and the Meson Area MW Pion and MP Polarized Proton Beams. Many of the components that will be needed for construction of these beams have already been started and plans for the associated civil-construction projects are far advanced. In some cases, the work is already underway. Next spring and summer will be a period of intense activity for the Tevatron II Project; a great deal of civil construction will take place that will ultimately house the new beam facilities. Large experimental halls needed for the experiments to be done in these beams will also be constructed in this period.

The rapid and successful operation of the facilities associated with the superconducting Tevatron accelerator, and its associated extraction and switchyard systems bode well for the success of the entire fixed-target physics program. So far, the goals of the project and the fixed-target program have been met in a very pleasing way. Of course, not **everything** has proceeded smoothly. This is the first superconducting accelerator in the world, and it was always expected that there would be an extended period of commissioning, during which the many novel Tevatron systems could be proved. The expectation certainly came to pass and has produced a certain amount of frustration and impatience among the first users. Already, however, a smoother and more satisfactory operation of the program is in place, and if we look back and compare the duty factor for operation of the present superconducting accelerator with that of its predecessor, the improvement obtained has been well worth the period of adjustment.

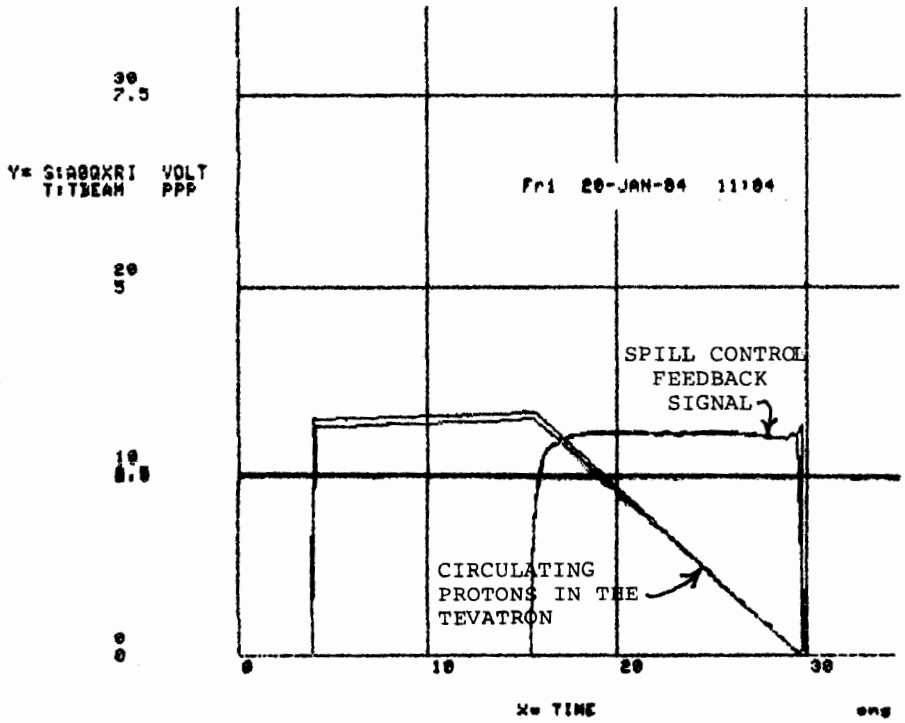
In the immediate future, the energy of the accelerator will be raised from its present 400 GeV to 700 GeV or greater. At this time, the Tevatron will come fully into its potential, not only in providing a superior spill and duty factor for fixed-target physics, but in increasing the energy by a factor of 2 over the old Main-Ring capability. Experimenters in all three of the operating areas are looking forward to initial operation at the higher energy with a great deal of anticipation and with high hopes for rapid success. It is the feeling of the people who operate the accelerator that these hopes will be justified and

that it will soon be operating routinely in the full Tevatron mode.

Extraction

The first area to be completed in the Tevatron II project was the slow resonant-extraction system for extracting beam from the superconducting accelerator and directing it into the Switchyard. Critical to the extraction success was the development of greatly improved wire septa for splitting off the beam that leaves the accelerator from the beam that continues circulating (and doing this in a controlled manner that minimizes losses in the process).

In the graph below, the result of careful work and planning for the slow-extraction system is seen. The beam from the superconducting accelerator is extracted smoothly and uniformly over a



Slow beam extraction from the superconducting Tevatron accelerator. The traces show two successive cycles of the accelerator. One pair shows beam being spilled uniformly over a 15-second period. The second pair shows the feedback signal that controls the beam spill rate.

15-second period! What cannot be seen from this figure is the modulation of the beam intensity at higher frequencies, such as 60, 180, and 360 Hz, etc. In the initial operating stages, various frequency modulations on the intensity of the beam spill were seen. This modulation is a normal consequence of starting up a new system. Over a period of two months, most of the modulation was removed through various technical means. The spill is now quite smooth and satisfactory to all the experimental areas.

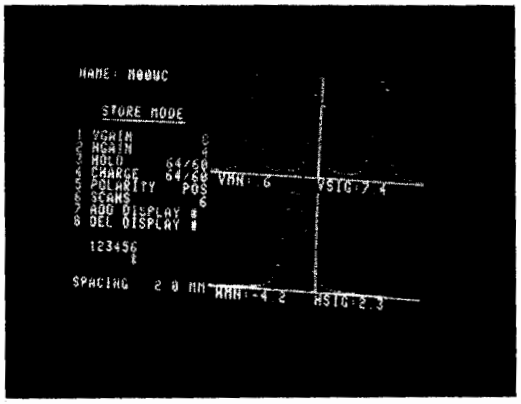
Switchyard

Once the beam leaves the accelerator, it passes into the Tevatron switchyard area where electrostatic splits divide the beam into multiple primary beams that continue on to production targets for the various experiments. The largest project in the Tevatron switchyard was the superconducting right bend to the Proton Area. This project, completed during the long 1983 accelerator shutdown, has two strings of superconducting Energy-Saver dipoles that take the beam split off to the Proton Area by the electrostatic and magnetic septa and bend it sharply to the East.

After passing through the superconducting right bend, the Proton primary beam is again split into three parts. The three primary beams in the Proton Area are subsequently targeted independently for the P-East, P-Center, and P-West beams. In Phase Two of the Tevatron, the P-East beam will pass through yet another electrostatic split, allowing photon beams to be used simultaneously in the Tagged Photon Laboratory and in the new Wide Band Neutral Beam. The primary beam transport for all parts of the Proton Lab are now complete except for the two-way split to the Wide Band target. The Wide Band split will be installed during the summer 1984 shutdown.

The primary beam to the Meson Area passes through the superconducting left bend which was installed prior to the Tevatron II Project. Once through the left bend, the Meson primary beam is split into three parts, as in the Proton area (see top of next page). The three primary beams pass through the old Meson target box and are focused on new targets in the former Meson Detector Building, henceforth to be known as the Meson Target Building.

Work in the Neutrino switchyard area has been relatively low key so far, but there will soon be a significant increase in activity with the installation of an electrostatic split and a superconducting bend that will split off primary beam to the new muon-production target. Construction of components for the muon split is presently underway and the equipment will be installed during the summer of 1984.



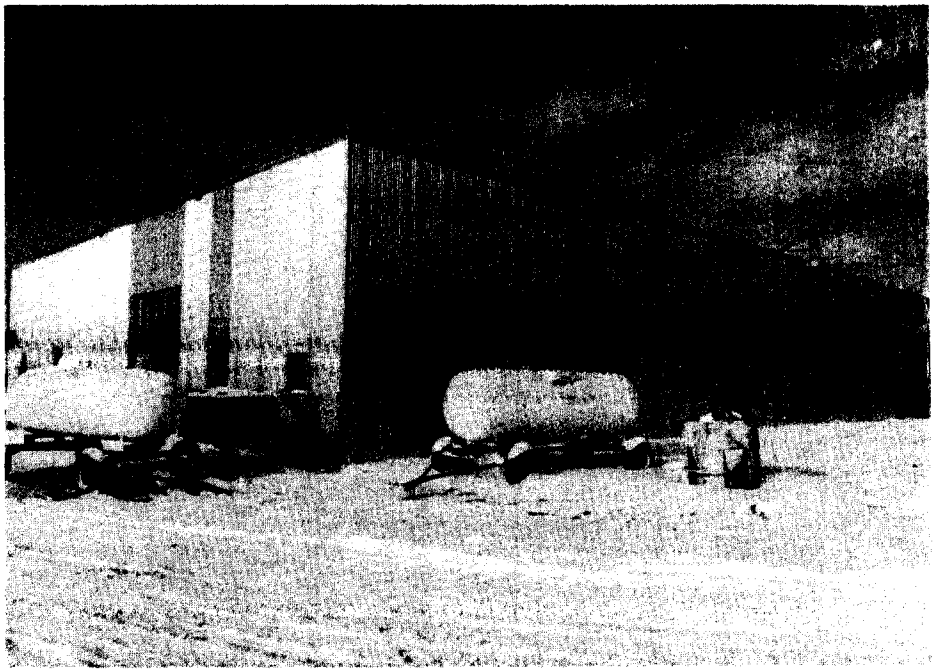
Primary beam SWIC traces after the Meson triple split septa. The beams are clearly separated in the vertical direction, but have not yet been bent apart horizontally by the Lambertson septum magnets.

Current Activities

Currently, the areas of maximum activity in the Tevatron II project involve construction of new experimental halls for the Phase II physics program (experiments in the new particle beams). Lab F, the first of these laboratories, has been under construction since July; it will be complete about March 1 (next page). At that time, experiment E745 will begin to install their equipment, the largest part of which consists of a large heavy-liquid bubble chamber with holographic optics. The bubble chamber and its associated spectrometer will later be used for E636, an experiment to study production of tau leptons and other phenomena in the Prompt Neutrino Beam.

Two new experimental halls will start construction in February and March. These are the new Muon Laboratory and the Wide Band Experimental Hall. Both of these buildings are major structures that will each house two experiments in tandem. Construction of these buildings is hoped to be complete by the Fall of 1984 in order to allow installation of experimental apparatus to be used in testing and shakedown runs in the spring of 1985 for E640, E665, and E687.

Two more large experimental halls are planned for construction in the Meson Area. These experimental laboratories (MP and MW) will house, respectively, the polarized-proton experiment E704 and a new multiparticle hadron spectrometer to accommodate E672 and E706. The design phase of these buildings has begun and it is expected that the construction will commence early in fall of 1984,



A view of the new Lab F experimental hall in the Neutrino Area. This structure will be complete in March 1984.

In parallel with design and construction of the experimental halls, there has been a large amount of design effort for civil structures that will house the secondary-beam elements. In particular, there are eighteen small quadrupole enclosures needed for the new Muon Beam and two extended tunnel enclosures in the Wide Band Beam. Two long surface tunnel enclosures are also needed to house beam-line components in the M-West and Polarized Proton Beams in the Meson Area.

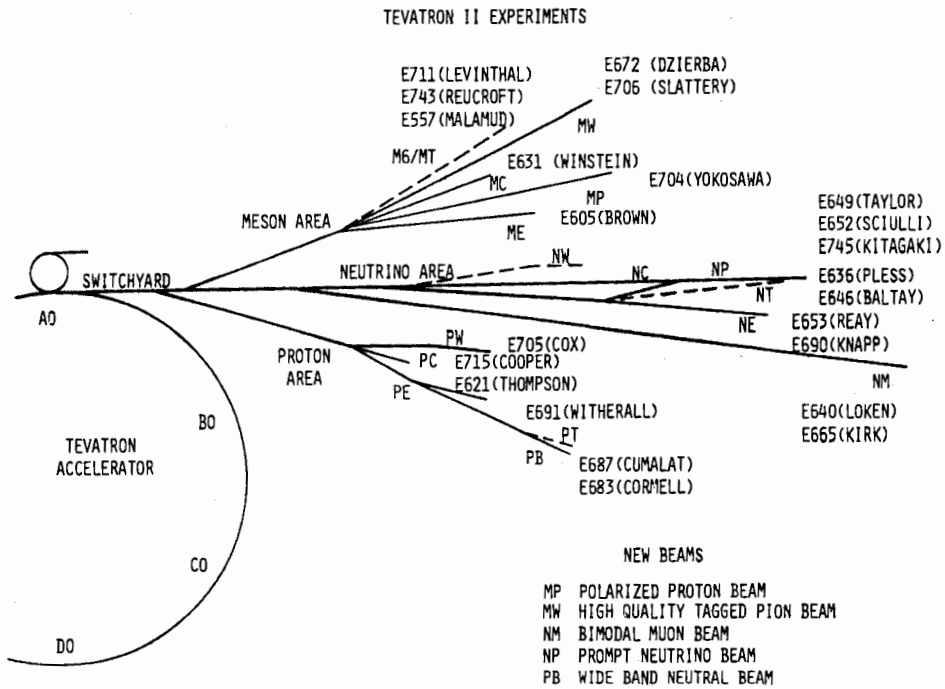
In parallel with the civil facilities being designed and constructed to house the new beams and experiments, a strong coordinated effort is going ahead to construct magnets, beam dumps, controls, and other technical components that will go into these facilities.

Physics!

When it all comes together in 1985, the TeV II physics program will be fully deployed and Fermilab will resume its role as peerless world leader for fixed-target physics through the

80's and into the 90's. In the diagram that follows, the current array of approved fixed-target experiments for the Fermilab program is shown in reference to the site topology. From hyperons to muons, from neutrinos to antiprotons, from pions to photons, the Fermilab community can look forward to a rich and productive decade of physics ahead.

And it's starting NOW!



WEEK	Avg/pulse for MEP (x 10^{12})	Scheduled MEP Hours	Actual MEP Hours	Number of Quenches	Quench Recovery Time	Total Systems Downtime [1]	Total TEV Downtime [1]	CHL Downtime	Total Non-overlap Downtime [2]
10/3 - 10/9/83	3.29	96.0	55.55	15	8.00	60.83	31.39	0.88	55.15
10/10 - 10/16	2.72	96.0	16.58	7	4.74	182.70	76.51	0.00	125.23
10/17 - 10/23	0.88	168.0	28.86	1	0.40	181.80	108.65	0.00	138.77
10/24 - 10/30	0.00	169.0	0.00	0	0.00	157.50	155.80	0.00	169.00
10/31 - 11/6	3.76	168.0	79.63	29	13.32	93.65	73.77	0.00	85.33
11/7 - 11/13	3.77	96.0	75.22	18	12.18	41.25	28.12	0.00	37.14
11/14 - 11/20	3.53	96.0	54.05	16	9.20	63.31	29.41	0.00	56.31
11/21 - 11/27	5.08	128.0	75.73	25	12.09	83.93	57.94	1.30	70.92
11/28 - 12/4	4.82	96.0	51.98	31	15.21	74.47	57.76	0.00	60.05
12/5 - 12/11	3.51	88.0	10.02	36	13.87	117.90	74.29	4.27	98.94
12/12 - 12/18	4.60	143.25	92.69	17	11.28	67.62	41.55	0.00	53.90
12/19 - 12/25	3.51	72.0	38.08	6	1.94	36.73	24.51	0.00	49.08
12/26 - 1/1/84	3.24	132.0	51.38	8	3.94	87.04	55.61	8.92	69.82
1/2 - 1/8	4.65	106.0	62.29	20	21.68	68.73	49.55	7.78	57.47
1/9 - 1/15	6.64	132.0	94.22	13	6.69	43.53	30.48	0.00	30.40
1/16 - 1/22	7.41	137.0	83.35	7	2.73	61.21	24.99	21.15	50.79
1/23 - 1/29	7.91	144.0	114.39	7	2.18	37.24	16.93	0.00	31.90
1/30 - 2/5	5.39	136.0	60.91	4	1.84	85.93	29.89	3.85	72.70

1) Does not have overlap of simultaneous downtimes subtracted out. Does not include tuning time.

2) Does have overlapping downtimes subtracted out. In cases where this is larger than total systems downtime, it means there were conflicting amounts of tuning time between my two sources.

WEEK	Cryogenic Downtime	TEV/Total Downtime (%) [3]	Quench/Total Downtime (%) [4]	Quench/TEV Downtime (%) [5]
10/3 - 10/9/83	11.75	51.5	13.1	25.5
10/10 - 10/16	13.07	41.9	2.6	6.2
10/17 - 10/23	0.00	59.8	0.2	0.4
10/24 - 10/30	0.00	98.9	0.0	0.0
10/31 - 11/6	1.84	78.8	14.2	18.0
11/7 - 11/13	2.43	68.2	29.5	43.3
11/14 - 11/20	5.77	46.4	14.5	31.3
11/21 - 11/27	10.04	69.0	14.4	20.9
11/28 - 12/4	12.94	77.6	20.4	26.3
12/5 - 12/11	35.34	63.0	11.8	18.7
12/12 - 12/18	8.03	61.4	16.7	27.1
12/19 - 12/25	8.72	66.7	5.3	7.9
12/26 - 1/1/84	15.55	63.9	4.5	7.1
1/2 - 1/8	12.21	72.1	31.5	43.8
1/9 - 1/15	9.93	70.0	15.4	21.9
1/16 - 1/22	5.40	40.8	4.5	10.9
1/23 - 1/29	3.32	45.5	5.8	12.9
1/30 - 2/5	14.91	34.8	2.1	6.2

3) Column 7 divided by column 6 (on previous page).

4) Column 5 divided by column 6 (on previous page).

5) Column 5 divided by column 7 (on previous page).

NEWS FROM THE ENERGY SAVER

The major objective of the Energy Saver in the last several months has been to run at 400 GeV for the high-energy physics program with as high an intensity and reliability as possible. The Accelerator Division has worked hard to make this possible. There has also been a considerable amount of work directed toward solving problems in a longer time interval. This article will discuss a small part of this longer-range effort.

Reliability

One thing that was learned last time on the Main Ring was that detailed information on the frequencies and causes of failures is a necessary condition for improving reliability. We are now collecting such information in considerable detail. Frank Turkot and Duane Plant are working on this program. The accompanying tables are a summary of down times in the accelerator system.

The period October through January was the first four months of operation for the Tevatron. There were 2,200 hours of scheduled HEP and 1,039 actual hours delivered to at least one experimental area between October 3, 1983, and February 5, 1984. Major losses of operating hours were suffered during three weeks in October when a failure of the quench-protection system made it necessary to replace three damaged spool pieces. At about the same time, a broken water pipe kept the rf systems off for a considerable time. There were two power failures in December and one in January. The January failure was sitewide. The bad weather at the end of December interrupted nitrogen deliveries, all of which resulted in bad operating weeks. The bar graphs on the next page show reliability and down time in this period.

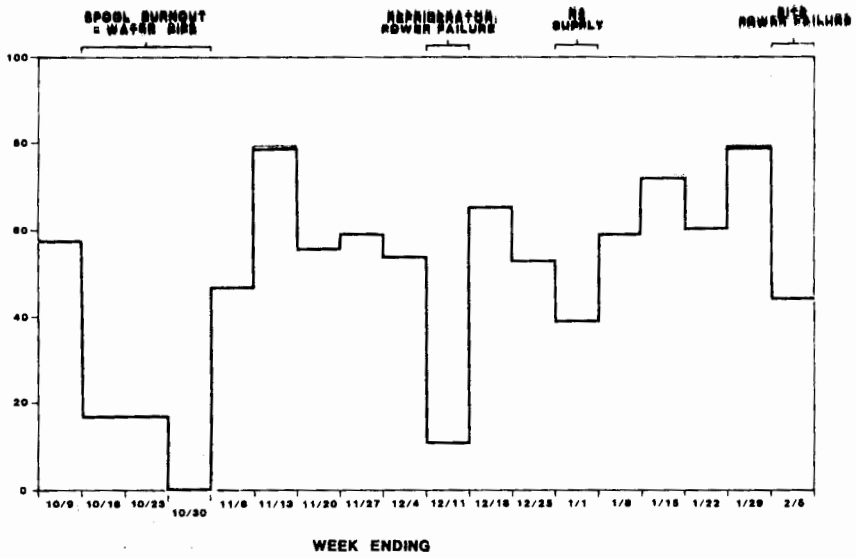
Typical operation is 60% of scheduled whereas it was about 80% before the turn off of the Main Ring for Energy Saver installation. Continual work will be required to get back to higher reliability.

Orbits

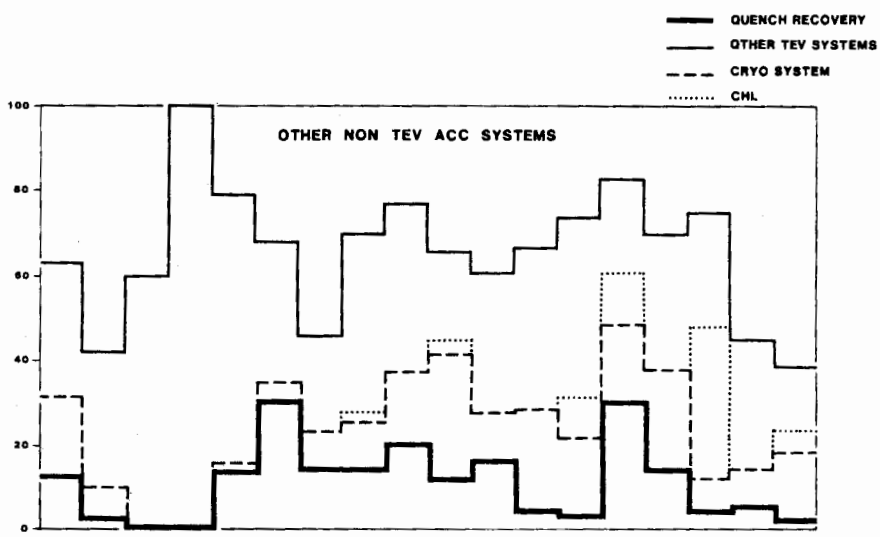
The ORBIT program described in these pages (October 1983) by Rajendran Raja has been used extensively to correct orbits to very small (<1 millimeter) deviations. It is worth noting that the orbit correction depends not only on ORBIT, but on the beam-position monitor (BPM) system designed and built by Bob Shafer and on the correction-magnet system.

Previous BPM systems have only been able to measure closed orbits--the sum over many turns. The Energy Saver BPM can measure positions of either closed orbits or single turns.

PERCENT OF SCHEDULED HEP



TEV PERCENT OF TOTAL DOWN TIME



Previous orbit correction at high fields has been done by realigning magnets; it has never been possible to provide a completely corrected orbit because of the time required to align magnets over the large distances of our accelerator. Realignment as a method for orbit correction is not feasible in the Energy Saver, because of the complicated cryogenics plumbing at the ends of the quadrupoles. Instead, the Energy Saver has a correction-magnet system that will move the beam across the chamber even at 1 TeV. In addition, the system has programmable waveform generators that give the capability of correction at all energies.

The accompanying plots show some recent results for the first turn and for the closed orbit at injection. In the first-turn plot (labelled FLASH FRAME) the horizontal positions at E11, E13, and E15 are set as prescribed for injection. The kicker at E17 kicks the first turn on to a centered path. There is a shorted horizontal correction coil at E26 and centering is not possible. In both horizontal and vertical, the positions at A0 and D0 are set to move the beam around extraction devices. The non-zero positions at D48 and D48 are part of the orbit-closing process.

In the closed-orbit plot (DISPLAY FRAME) the differences from the first turn are that horizontally E11 is now set to avoid the injection Lambertson and E15 is dictated by the closure process.

Studies

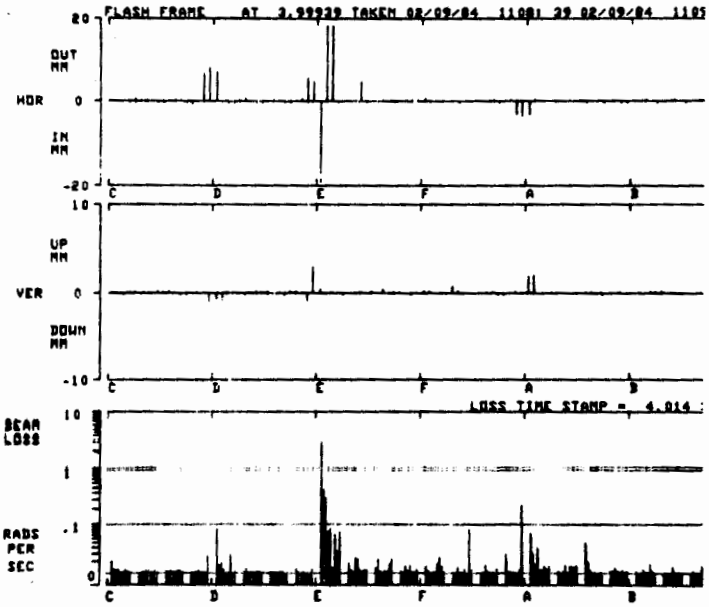
As part of the national effort on the design of the Superconducting Super Collider (SSC), many accelerator studies have been done. Rolland Johnson has summarized this effort.

The primary purpose of the Tevatron for the present and the next two years is to provide beams for fixed-target physics. As a consequence, virtually all studies have been directed toward the goals relevant to extraction and high-intensity fixed-target physics. The present situation is that low-intensity beams have been accelerated to 700 GeV and extraction to experimental areas has been accomplished up to 512 GeV. The present operating mode is at 400 GeV, about 10^{13} ppp, 15-sec flat-top, with a 39-sec cycle.

Some data from the commissioning of the fixed-target program are particularly relevant to the SSC, even if the SSC is not used for fixed-target physics. These data are mostly to answer the question "How predictable is/was the Tevatron?"

Collider

In 1983, there were three sessions of coasting-beam studies. These were directed towards the development of storage techniques and to get a first look at the Tevatron as a collider. Indeed, the techniques were quickly implemented and the initial coasting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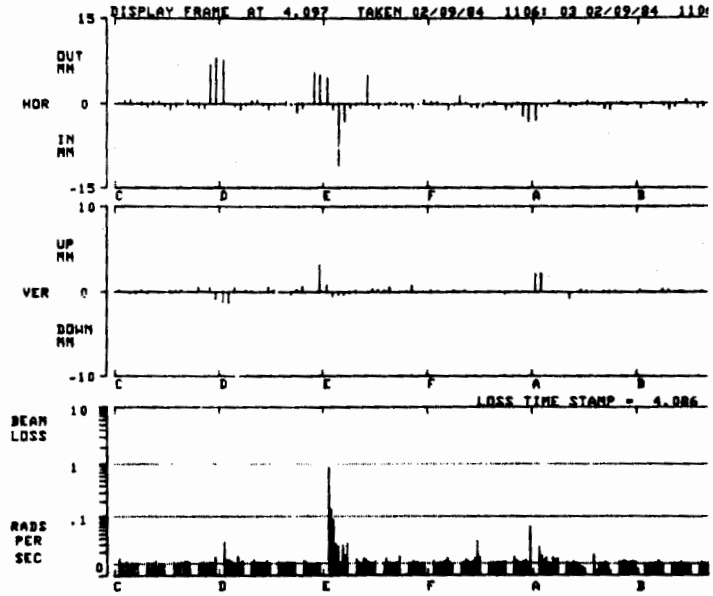
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beam studies at 400 GeV were very encouraging. The transverse stability of the coasting beam seems to be very good at low intensity, with long lifetimes (> 24 hours) even on potentially strong resonances. Longitudinal dilution seems to occur rapidly, and may need individual bunch damping.

Machine Studies

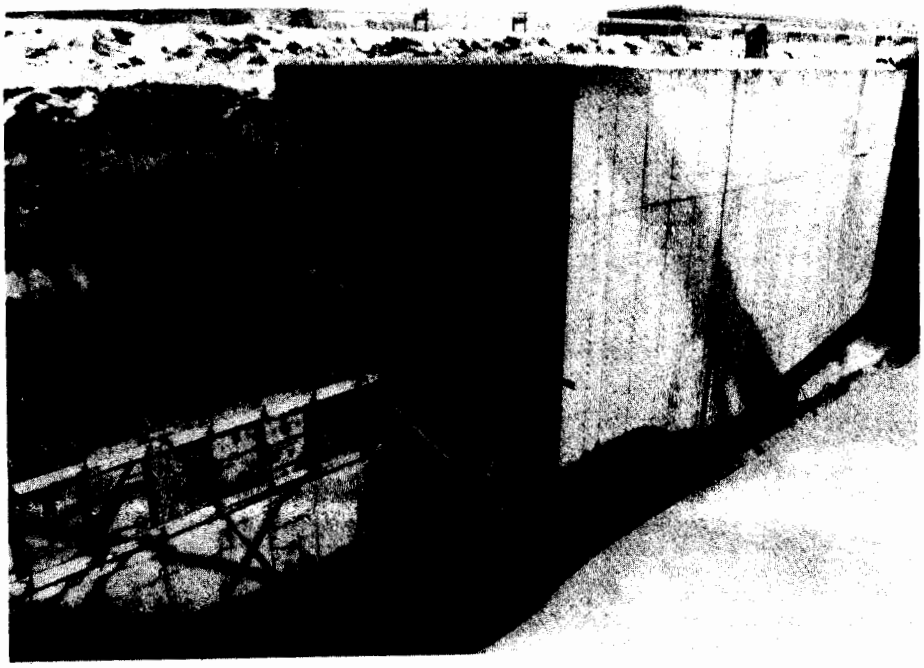
In 1983, there were two machine study sessions devoted to the dynamic range of superconducting magnets. These studies are particularly relevant for HERA, which will have an injection energy of 40 GeV and a top energy of 820 GeV, more than a factor of 20 higher. As well, the magnets and lattice are similar to the Tevatron design.

For the SSC to operate between 1 and 20 TeV implies that the Tevatron should certainly have a reasonably good field aperture from 50 GeV to 1 TeV. Details of SSC magnet construction such as bore diameter and filament size, as well as lattice design, make the measurements described here relevant, but not directly scaleable.

For these studies, the beam was injected into the Tevatron at the normal 150 GeV Main-Ring energy and then decelerated. This technique has several advantages over trying to inject directly at 50 GeV. First, it isn't necessary to change anything in the Main Ring itself or in the MR to Tevatron transfer system. Second, by starting from a known set of operating conditions the beam can be decelerated in a more controlled fashion in small steps, if necessary. The major disadvantage of the deceleration technique is that it is necessary to understand the hysteresis of the Tevatron magnets.

Detailed studies have also been done to compare the betatron tunes predicted from the measured field data with the measured tunes. The measured values of 19.6 and 19.2 horizontally and vertically differ from the predicted 19.4. This can be interpreted as a systematic error of approximately 1 mm in the sagitta of the dipole magnets when they were bent to have the same radius of curvature as the beam, although there is as yet no confirmation. The average sextupole behavior of the dipole magnets corresponds to the predicted chromaticity of the machine, although not perfectly.

The general conclusions of these studies are by no means discouraging for SSC. There are plenty of problems to be worked on in the Energy Saver, but they look solvable to the people working on them.



Construction of the Target Station for TeV I.
(Photograph by Fermilab Photo Unit)

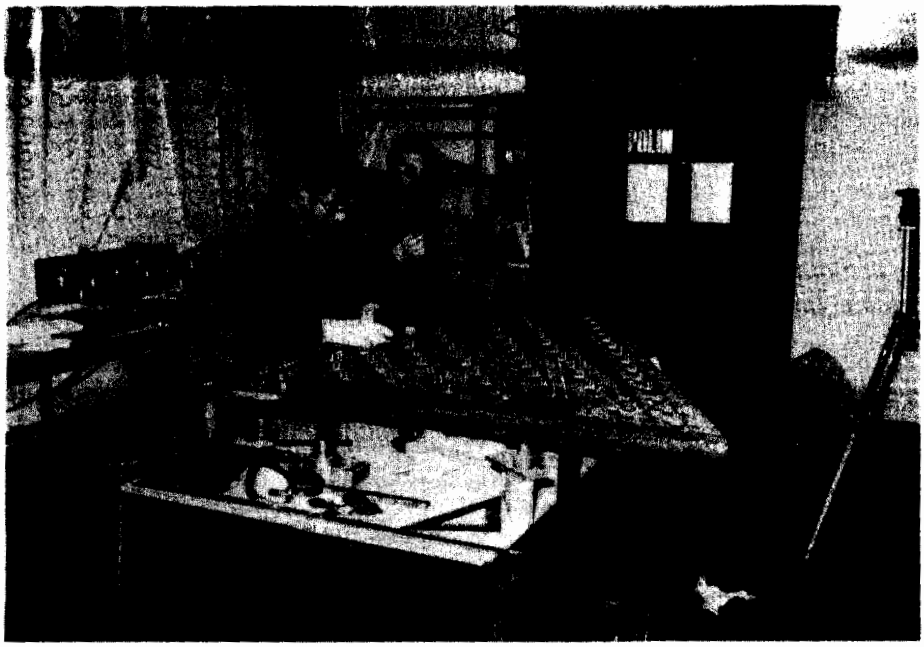
1984 SNOWMASS SUMMER STUDY

John Peoples, Chairman of the Division of Particles and Fields of the APS, has announced plans for the Snowmass Summer Study scheduled to take place June 23-July 13 at Snowmass, Colorado. The meeting is to be devoted to the design and utilization of the SSC. Attendees will work toward defining the properties of the SSC machine, as well as the experimental environment including test beams and discuss the physics opportunities of the SSC and how they impact the machine design. The Snowmass meeting will be the culmination of the various workshops being held around the country.

The attendance at the Snowmass summer study will have to be restricted to roughly 250 physicists because of the size of the facilities, but the meetings are open and are intended to have a broad participation from all the Users' Groups in the U. S. Preference will be given to those attending the full three weeks. Peoples made a special note of the intent to include younger physicists in the meetings and he mentioned that there may be some travel money for them.

This year's meeting will be organized somewhat differently from the last Snowmass meeting. Peoples expects that roughly one-third of the conference will be devoted to joint sessions hearing speakers and two-thirds to working on various specific topics. These topics will be the test of the standard model, pp, $\bar{p}p$, fixed target, accelerator properties, optics, test beams, and a set of more specialized topics defined by the physics. There will be a small library and, it is hoped, better computing facilities than were available in 1982. Announcements will be sent out in mid-February.

A range of accommodations for the sessions will be available. Joanne Day of Argonne National Laboratory is organizing the accommodations. Interested individuals should contact her (312) 972-6181.



Light pipes for the CDF central hadron calorimeter being fabricated at Frascati.

(Photograph by Fermilab Photo Unit)

MANUSCRIPTS, NOTES, LECTURES, AND COLLOQUIA PREPARED OR PRESENTED FROM JANUARY 23, 1984 TO FEBRUARY 19, 1984

Copies of preprints with Fermilab publication numbers can be obtained from the Publications Office or Theoretical Physics Department, 3rd floor east, Central Laboratory. Copies of some articles listed are on the reference shelf in the Fermilab Library.

Experimental Physics

D. E. Wagoner et al. Experiment #705	A Measurement of the Energy Resolution and Related Properties of an SCG1-C Scintillation Glass Shower Counter Array for 1-25 GeV/c Positrons (FERMILAB-Conf-84/21-E; submitted to the 1983 Nuclear Science Symposium, San Francisco, October 19-21, 1983)
R. Rameika et al. Experiment #705	Measurement of Electromagnetic Shower Positions and Size with a Saturated Avalanche Tube Hodoscope and a Fine Grained Scintillation Hodoscope (FERMILAB-Conf-84/22-E; submitted to the 1983 Nuclear Science Symposium, San Francisco, October 19-21, 1983)
B. Cox et al Experiment #705	A Measurement of the Response of an SCG1-C Scintillation Glass Array to 4-14 GeV/c Pions (FERMILAB-Conf-84/23-E; submitted to the 1983 Nuclear Science Symposium, San Francisco, October 19-21, 1983)

Theoretical Physics

A. Sen	A Locally Supersymmetric SU(6) Grand Unified Theory Without Fine Tuning and Strong CP Problems (FERMILAB-Pub-83/106-THY; submitted to Nucl. Phys. B)
S. Fajfer and R. J. Oakes	Twist-Four Effects on the Asymmetry in Polarized Electron Deuteron Scattering and $\sin^2\theta_W$ (FERMILAB-Pub-84/16-T; submitted to Phys. Rev. D Brief Notes)

T. R. Taylor	Stability of Supersymmetric Ground State in Chiral Theories (FERMILAB-Pub-84/20-T; submitted to Phys. Lett. B)

Astrophysics

M. S. Turner	Particle Physics and Cosmology: The Inner Space/Outer Space Connection (FERMILAB-Conf-83/109-AST; summary of invited talk given at the APS Division of Particles and Fields Meeting, Blacksburg, Virginia, September 1983)
P. J. Steinhardt and M. S. Turner	A Prescription for Successful New Inflation (FERMILAB-Pub-84/19-A; submitted to Phys. Rev. D)

General

M. Fischler and T. Nash	Computing Tools for Accelerator Design Calculations (FERMILAB-Conf-84/18; submitted to the Workshop on Accelerator Physics Issues for a Superconducting Super Collider, Ann Arbor, Michigan, December 12-17, 1983)
J. F. Bartlett et al.	The EPICS System: An Overview (Submitted to the Digital Equipment Computer User Society, Las Vegas, October 1983)
T. E. Lahey et al.	EPICS System: RSX Implementation Issues (Submitted to the Digital Equipment Computer User Society, Las Vegas, October 1983)
R. E. West et al.	EPICS System: System Structure and User Interface (Submitted to the Digital Equipment Computer User Society, Las Vegas, October 1983)

N. M. Gelfand	Calculations of the Dynamic Aperture at the Tevatron (Submitted to the Workshop on Accelerator Physics Issues for a Superconducting Super Collider, Ann Arbor, Michigan, December 12-17, 1983)
L. Teng	Design Considerations and Procedures for the SSC (Submitted to the Workshop on Accelerator Physics Issues for a Superconducting Super Collider, Ann Arbor, Michigan, December 12-17, 1983)

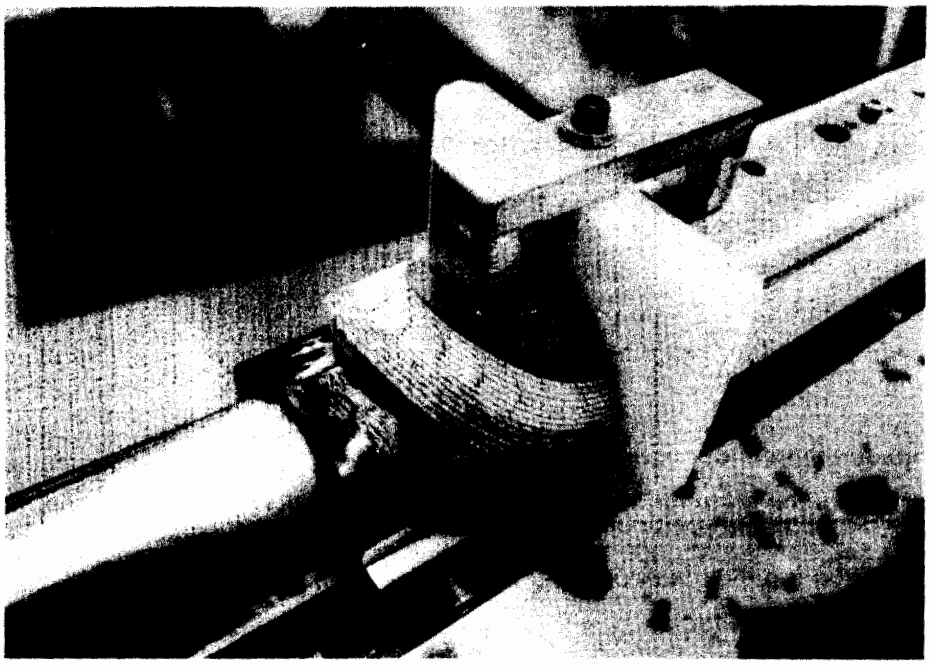
Physics Notes

R. A. Carrigan	Particle-Cosmology Desk Companion (FN-395)
R. P. Johnson	The Tevatron as an SSC Prototype: Experience Versus Predictions (FN-396; submitted to the Workshop on Accelerator Physics Issues for a Superconducting Super Collider, Ann Arbor, Michigan, December 12-17, 1983)

Colloquia, Lectures, and Seminars

H. Thacker	"Lattice Gauge Theory of Quarks and Gluons" (Fermilab, January 30 and February 1, 1984)
H. Casebolt	"Antiproton Source Safety System" (Fermilab, February 2, 1984)
J. Hangst	"Pulsed Magnet for Antiproton Target Station" (Fermilab, February 2, 1984)
S. Love	"Introduction to Supersymmetry (SUSY)" (Fermilab, February 6, 8, 13, and 15, 1984)
J. McCarthy	"Preliminary Report on Power Supply Procurement" (Fermilab, February 9, 1984)
A. Moretti	"Status Report on the Debuncher Cavity" (Fermilab, February 9, 1984)

R. Orr	"Accelerator Division Informations Meeting" (Fermilab, February 14, 1984)
M. Kuchnir	"The Chicago/Fermilab/Michigan Magnetic Monopole Detectors" (Illinois Institute of Technology, Chicago, February 15, 1984)



Coil of a 2-in. superconducting dipole prototype.
(Photograph by Fermilab Photo Unit)

DATES TO REMEMBER

March 1, 1984	Deadline for submission of material for consideration by the Physics Advisory Committee at the June meeting
April 19-20, 1984	PAC Proposal Presentation Meeting
April 27-28, 1984	Annual Users Meeting
April 28, 1984	Dedication Ceremony, Energy Saver
May 2-4, 1984	"Inner Space-Outer Space," Workshop on High-Energy Physics, Astrophysics, and Cosmology
June 16-22, 1984	Extended Summer Meeting of the Physics Advisory Committee
August 13-24, 1984	U. S. Summer School on Particle Accelerators, Fermilab