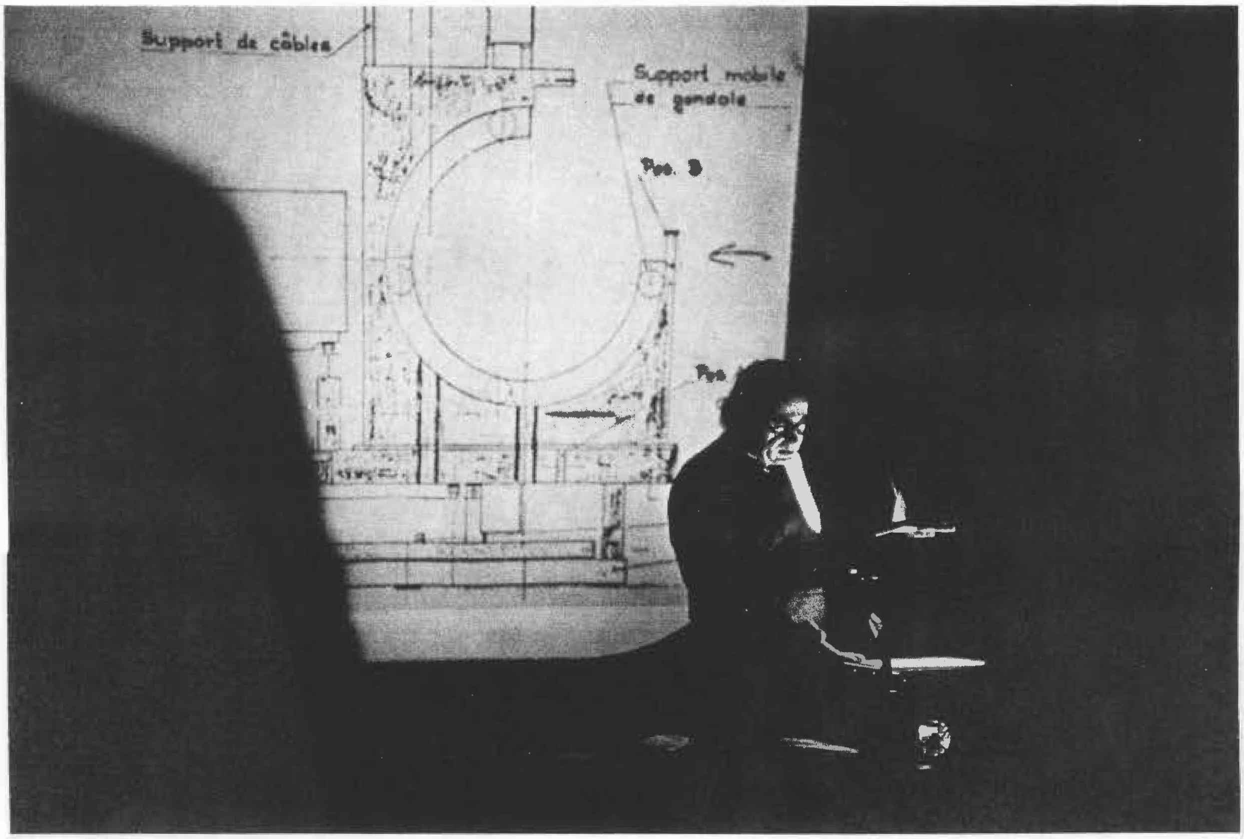
fermilab report

Fermi National Accelerator Laboratory Monthly Report February 1983



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

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FERMILAB-83/2 Fermi National Accelerator Laboratory 0090.01

THE COVER: David Cline of the University of Wisconsin reporting evidence for the W from the CERN UA1 experiment at a special seminar.
(Photograph by Fermilab Photo Unit)

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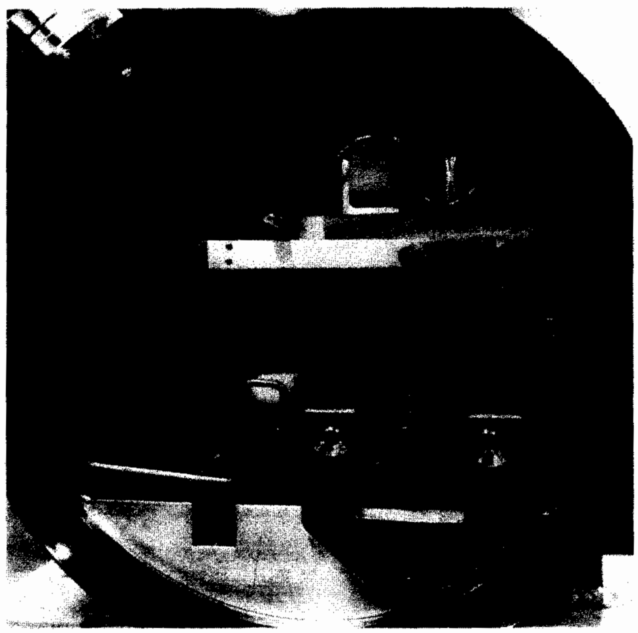
PROGRESS ON THE TEVATRON UPGRADE IN THE FIXED-TARGET AREAS

Tom Kirk

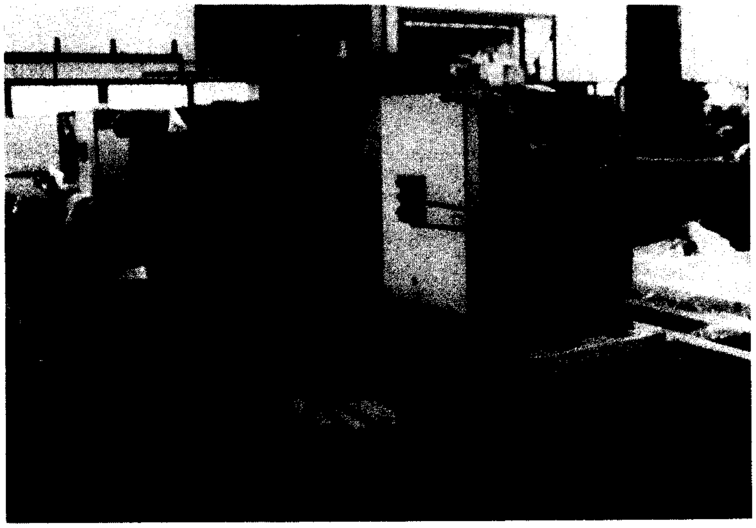
The program of facility upgrades and new beam construction to utilize the 1-TeV capability of the Fermilab superconducting accelerator in the fixed-target physics program is called "Tevatron II." The TeV II project is now officially one year old (counted from first release of funds from DOE); it is proving a vigorous and active baby. This is a report on status and progress at the one-year mark. The project is divided into several parts which form natural divisions for this report.

Proton Beam Extraction

Extraction of the proton beam from the accelerator is included in the TeV II project. Proper operation of the extraction system is clearly needed at the beginning of any high-energy physics running; accordingly, it has been given high priority and is far advanced. All the new magnets, electrostatic septa and their stands, and support systems are complete and about 50% installed (see figures below). This task required the fabrication from scratch of thirty-five new conventional magnets of



End view of the new, improved version of the Tevatron electrostatic septum. The unit is 12 feet long and is used for extracting beam from the Saver accelerator.
(Photograph by Fermilab Photo Unit)



A completed Lambertson septum magnet used in the Saver accelerator for splitting beam away from the internally circulating beam and transporting it to the external experimental areas. (Photograph by Fermilab Photo Unit)

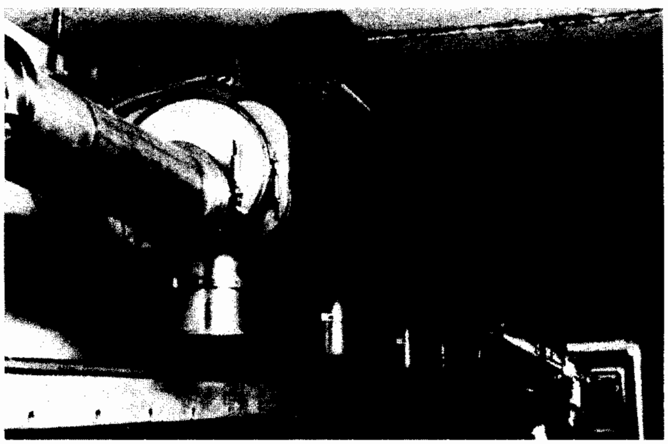
A view of the DO straight section showing the beam dogleg deflection dipoles installed for the Tevatron program. The straight pipe above the magnets is the Main Ring beam pipe. (Photograph by R. Dixon) various types (including spares) and four special electrostatic-septum units. Four Saver-type superconducting dipoles are also needed.

The power supplies, controls, and protection devices for the extraction elements are in the late design and fabrication stage. They are all compatible with the new Saver controls system and are expected to debut with a minimum of novel startup "bugs." The not glamorous but critically important items of hookup, survey, and power testing are in progress. All indications point to a completion of the entire Saver extraction system on schedule for the machine commissioning in late spring of 1983.

Primary Proton Beam Switchyard

A few nanoseconds after the proton beam emerges from the Saver extraction system, something must be done with it! The switchyard is that something. On completion, the TeV II project will allow the primary beam to be split electrostatically into nine simultaneous, slow-spill beams (8-20 seconds), plus one switched, fast-spill beam (1.5 msec). For initial operation in 1983, equipment will be in place to implement seven of the slow-spill beams plus the fast beam.

To accomplish this, the two biggest tasks in the switchyard area were the building and installation of the cryogenic magnets and systems for a superconducting right bend to the Proton area and the construction and placement of eighteen new electrostatic-septum units to split off the Tevatron-energy proton beam to the Proton and Meson experimental areas and to resplit these beams three ways within each area (below). The superconducting left



Newly installed electrostatic splitter septa. This group of eight septa is located in the Proton switchyard where they start the Proton triple split.

(Photograph by R. Dixon)

bend to the Meson area was installed in 1980 and is ready for the Tevatron. Other large tasks involved the remounting in new positions in the Switchyard beam enclosures of many conventional quadrupole magnets and other devices used for the higher-energy beam optics. Lots of power and controls cable pulling, survey work, and software revamping were also necessary.

The plans for all this work have been complete for some time. Most of the magnets, septa, and cryogenic devices are built, and the installation is well along. At present, the cryogenic transfer lines, turn-around and lead boxes, and other right-bend cryogenic elements are being fabricated and installed at a rapid rate. The controls and quench-protection systems are going together as well. Careful conformance to the Saver cryogenic protocols is being maintained so that the design and operating experience gained in the Saver can be used to propel the turn-on of the Switchyard forward at a rapid rate.

At the present time, it appears that primary beam to Meson, Proton, and Neutrino areas will be available (as required in the High Energy Physics schedule) by October 2, 1983, and could be somewhat earlier if demanded. This plan gives appropriate, if not leisurely, time for commissioning and debugging the new Switchyard systems prior to the official start of HEP.

Primary Beam Target Areas

The Experimental Areas Department takes over responsibility for focusing primary beams onto the particle-production targets and for operation of the secondary beams needed in HEP experiments. For the first period of operation, starting in the fall of 1983, an attenuated primary-proton beam will be delivered to the Meson M6 and Neutrino N3 experiments, a direct primary beam to the Meson M1 beam line and secondary beams from the East, Center, and West primary targets will be available in the Proton area. Test beams will also be ready in the Meson and Neutrino areas during this period to serve the needs of experiments testing out equipment for later runs.

To make this all happen according to schedule, a tremendous effort is being mounted in the Research Division with heavy loads falling on all the operating departments. The Meson area primary beam and pretarget areas are being totally rebuilt to a completely new design. The Proton and Neutrino primary beam areas are undergoing large modifications and upgrades demanded by the increased primary energy; in the case of the M1 and N3 secondary beams, the entire beam lines are being rebuilt to meet the demands of the HEP program.

For good measure, the hardware and software of the experimental-areas beam-line control system are being replaced by a new system to rid Fermilab of the burden of supporting a computer system that has been obsolete and out of production for many years. As in any undertaking of this magnitude, the successful completion of the controls system on schedule by the Research Services Department is hoped for and expected, but is not yet guaranteed. To aid in judging progress, a milestone system has been established and progress relative to this plan is approximately on schedule.

Recent activity in the Experimental Areas Department has been concentrated on cryogenic work in the Proton and Meson areas, beam device and utilities reworking in Meson, primary target and dump construction for Meson, and Neutrino target train fabrication in the Neutrino area. A large effort is simultaneously going forward to plan later phases of the TeV II upgrade, including new secondary-beam design, experimental laboratory conceptual design, and other associated civil and technical conceptual planning.

It would take a much longer report than this to indicate, system-by-system, the current state of completion. It will have to suffice to say that, if present plans, budgets, and manpower levels can be maintained as presently agreed upon and foreseen, the scheduled experimental areas will be ready for HEP as needed starting in October 1983. Certainly, the dedication and enthusiasm by the staff necessary for meeting their goals are present in abundance and the prognosis at this time is favorable for success.

New Secondary Beams

Within the formal scope of the TeV II project, four new beams (prompt neutrino, muon, wide band, and polarized proton) will be put into service by the end of 1985. The other Meson and Proton area secondary beams will be upgraded for 1-TeV operation in an associated equipment upgrade over the next few years.

Activity in the secondary beams areas to date has principally involved new beam design and area planning; hardware progress has been limited to the construction of beam-line magnets for the new beams. This work, though limited in scope, is associated with long lead times; it is encouraging to see the first magnets for these beams already on the brink of completion in the Fermilab conventional magnet facility. Of special interest has been the performance of our commercial vendor of large-conductor copper magnet coils. These items are tricky to fabricate successfully but recent excellent production rates and product quality achieved by this supplier give us reason for optimism in meeting all the magnet production schedules.

Design for special technical items such as the gigantic magnets needed to sweep muons from the prompt neutrino beam and the large-aperture, low-current superconducting dipoles and quadrupoles needed in the polarized proton and upgraded P-West hadron beams have proceeded apace as R&D projects for the past year and a half. These projects have faced novel and difficult design criteria, making apparent progress seem slow. The work has paid off, however, and we will soon start the process of detailed engineering design and construction of these items.

A vigorous and significant activity associated with the new beam lines has been the siting and conceptual-layout plans for the new experimental halls that will house the experimental apparatus for doing HEP in these beams. An important goal of the TeV II project has been to push the construction of these buildings ahead as fast as money and manpower will permit, so as to allow liberal amounts of setup time for the experiments prior to arrival of the first beam. This has been quite successful and plans exist for new halls in the muon, prompt neutrino, wide band, M8 hadron, polarized proton, and N3 hadron beams. The prompt neutrino and N3 hadron labs are well along with their civil engineering designs. Engineering design work on the muon and wide band labs will begin in the immediate future.

Conventional Construction

The Tevatron Construction Group was formed about one year ago to carry out the engineering design for and oversee the construction of buildings, beam enclosures, vacuum beam pipes, earthworks, and utilities needed for both the fixed-target and colliding-beams projects. This group has been very busy and very productive since its inception and the pace of activity has increased steadily from the start.

Civil projects underway at present include a large project in the switchyard area to extend existing primary beam enclosures, improve equipment and people accesses to existing enclosures, lay new beam pipe, reinforce radiation shielding, and provide a pathway for liquid-helium transfer lines and pressure vessels (see following photograph).

A second project is just getting underway in the Meson area. This project will provide new targeting flexibility for all the meson primary beams plus establish a new primary beam line to replace the old M6 beam line. Several perennial radiation-shielding problem areas will be greatly improved by this work. The project will also permit primary-proton beams up to 1-TeV to reach the existing Meson multiparticle spectrometer in the old M6 line.

Nearing completion are project blueprints for two primary-beam pretarget enclosures, a service building, and associated vacuum beam pipes in the Proton area. This project will provide civil structures needed to split off and transport primary protons for the new wide-band beam. When these three civil projects are complete, the construction of conventional facilities will be largely (if not completely) decoupled from operation of the experimental areas for HEP. All these projects will be complete in time to allow resumption of the HEP program in October 1983 as scheduled.

Extension of the Meson switchyard F1 beam enclosure showing the techniques for combining precast concrete standard forms with cast-in-place special sections.
(Photograph by Fermilab Photo Unit)

As noted previously, design of the new experimental halls has begun and will be stepped up to a high level in the immediate future. Construction work has also begun on a large industrial building in the Industrial Area. This building will initially be used for TeV I magnet production and will switch in later years to become a center for construction of large apparatus for various Fermilab projects; among these will be large pieces of apparatus and magnets for the fixed-target program.

Summary

In summary, the TeV II project is alive and buzzing with a bewildering (but exhilarating) variety of activities and projects. At this point the schedule looks good for all the near-term goals (the October 1983 HEP run) and the longer-term projects also appear to be moving ahead at a proper pace.

An impromptu party to celebrate the award of the Wolf Prize to Leon Lederman.

(Photograph by Fermilab Photo Unit)

The following is an excerpt from a paper published by Lillian Hoddeson, Historian of Modern Physics at Fermilab, in ***Social Studies of Science,*** *Vol. 13, No.1 (1983), published by Sage Publication, London and Beverly Hills. It is reprinted with permission of the author and the publisher.*

THE ESTABLISHMENT OF FERMILAB

Lillian Hoddeson

In 1959 all operating machines were producing relatively low intensity beams, and it was believed that one had to choose between high intensity and high energy. For not until August 1960 would the CERN Proton Synchrotron (CPS), after operating for eight months, demonstrate (to almost everyone's surprise) that AG-focusing synchrotrons could produce both high energies and remarkably high intensities, of the order of 10^{11} protons per second.

Several proposals for high intensity machines were made in the U. S. One came from an innovative group of physicists from various midwest universities called the Midwestern Universities Research Associatioin (MURA). This group, led by Donald Kerst of the University of Illinois, had formed soon after the Brookhaven Cosmotron was completed in 1952. MURA hoped to design the next large U. S. accelerator facility, which reasonably, they felt, should be located in their part of the country. The concept of a 'fixed-field alternating-gradient accelerator' (FFAG), which would produce an intense proton beam with an energy of approximately 300 GeV, achieved by colliding 10-15 GeV beams, was conceived of first at MURA in the summer of 1954 by Keith Symon, and independently by Snyder, A. A. Kolomensky, L. H. Thomas, and Ohkawa of Miyamoto's laboratory. It was developed further in 1955 by several members of the MURA group.

In the summer of 1959 the MURA group held a study-conference in Madison, Wisconsin, aimed at generating support for MURA and reconsidering the FFAG design in relation to all the existing schemes of achieving high energy or high intensity. The conceptual root of both the Fermilab and KEK accelerators grew out of the discussions at this meeting. It was generally felt then that the only practical way to produce energies in the several hundred GeV range was by colliding accelerated beams. Furthermore, it was believed that fixed target machines of very high energy would be exorbitantly expensive (if even feasible technically)--and perhaps not useful for physics anyway, because above approximately 5 GeV all the existing schemes for identifying particles were suspect. (The fear was that all particles would look alike, being confined to a narrow forward-moving cone.)

During the meeting, Matthew Sands, an iconoclastic participant from the California Institute of Technology (Caltech), became challenged by the problem of designing a reasonable cost fixed target machine aimed at approximately 300 GeV. He reinvented the concept, suggested several years earlier by Wilson and others (including F. Heyn and Lee Teng), of forming a cascade of accelerators, injecting an accelerated beam from one machine into another. By first accelerating the particles up to a high energy in a 'booster' synchrotron and then, with a reasonably high injection field, feeding the beam into a main synchrotron, Sands hoped to avoid the use of very large (and therefore very costly) magnets in the highest energy machine. Although it was thought then that one could not control such a large system or use magnets as small as Sands specified, working out details with a subgroup of the MURA study (which included Courant and M. Hildred Blewett from Brookhaven, and Alvin Tollestrup from Caltech), Sands showed mathematically that the magnet aperture in the main ring could be but a few square centimeters in size. Optimization of parameters gave the result that to achieve 300 GeV most efficiently one should inject from a 10 GeV range 'rapid cycling', or 'high repetition rate' (HR) 'booster', synchrotron into the main ring. The high repetition rate of such a booster would enable a high intensity to be achieved.

Fermilab's pre-history begins at this point. Most of the participants at the MURA summer study did not take the Sands proposal seriously. However, Sands and Tollestrup continued to work on the idea after returning to Caltech, also involving their colleague Robert Walker in the project. They convinced Caltech to support a study during the following summer to complete the design. Those invited included Snyder, Courant, M. H. Blewett from Brookhaven, Kenneth Robinson from the Cambridge Electron Accelerator, and Robert Hulsizer from the University of Illinois.

Since Caltech judged building the machine Sands had designed to be too large a project for them to support alone, a sponsoring group formed called the Western Accelerator Group (WAG), which included physicists from Caltech, the University of California at both Los Angeles and San Diego, and the University of Southern California. Berkeley declined the offer to join WAG, for in the late '50's, researchers there (for instance, David Judd and Lloyd Smith) had been working on their own concept for a very high energy machine based on a proposal of Christofilos. In April 1961, WAG submitted its proposal to the AEC.

One of those who appreciated WAG's design was Wilson, whose earlier suggestion of cascade injection had stimulated the Sands design. Several years later Wilson would build Fermilab on this model. Presciently, Wilson wrote to Sands on 25 April 1961: 'I have been watching your efforts with the 300 GeV machine with open-mouthed admiration. It seems to me that you are working on the right problem and at the right time, and I am sure that something will come of it all.'

Meanwhile, interest in a several hundred GeV machine was mounting in other parts of the U. S. Ten months earlier, in

August 1960, Wilson had organized an unofficial conference in Rochester, NY, at which approximately thirty physicists who were attending the concurrent Rochester Conference on High Energy Physics, took part in 'intensive discussion of. . .the desirability of super energy from the point of the theory of particles. . .[and] the experimental practibility of constructing and using ultrahigh energy machines.' Wilson summarized:

> It was generally agreed that for, say, 100 million dollars--or at most 200 million--it would be feasible to push the design of a conventional alternating gradient proton synchrotron to 100 GeV or even higher and that this might also cover the first round of experiments. With the same reasoning, but pushing the kind of tolerances that must be held, we could even think of attaining 1000 GeV and at a cost of less than one billion dollars--really a bargain of course.

Further support for such projections came at a meeting in September 1960 at the American Institute of Physics in New York (attended by five leading Russian physicists, including Veksler and N. Bogoliubov), and at the 1961 International Particle Accelerator Conference at Brookhaven (attended by Kitagaki, Nishikawa, Shigeki Suwa, and Kobayashi), at which the most recent machine concepts were discussed. In February 1962, Brookhaven submitted a proposal to the AEC for a 300-1000 GeV design study. In February and December of 1962, Berkeley submitted proposals for study of machines in the 100-300 GeV range. WAG's proposal for a 300 GeV machine was now in serious competition with proposals from the established accelerator laboratories.

The AEC, having at the same time to evaluate proposals for other large machines, including one by Cornell to upgrade its machine and one by MURA to build a 10 GeV FFAG, found itself in need of advice. For the first time in America there was too little funding available to support all the accelerator proposals. From this point on, high energy physicists would be spending more and more time on panels, both with other physicists, and with members of the government, to discuss funding. Extensive participation by the U. S. Congress had already begun with hearings in 1959-60 over the issue of supporting Stanford's linear accelerator, the first machine with a budget in the 100 million dollar range.

Most influential of the American accelerator panels in this period was that headed by Norman Ramsey during 1962 and 1963. After extended discussion, this panel ranked the proposals and, in a report in April 1963, suggested thirteen steps to be taken in order. The first was that Berkeley, rather than Brookhaven or Caltech, construct a proton accelerator of approximately 200 GeV; this was the machine that eventually became Fermilab. The next three steps were: that Brookhaven construct storage rings 'after a suitable study'; that design studies be conducted at Brookhaven for a 600-1000 GeV national accelerator; and that MURA in fiscal year 1965 construct 'a super-current accelerator without permitting this to delay the steps toward high energy. . .' WAG's proposal was not mentioned. Brookhaven and Berkeley were favored for the very high energy machines because they were the most experienced accelerator laboratories. Ranking the MURA machine fourth effectively phased it out; this move would later enter into the selection of Fermilab's site.

Two other features of the Ramsey panel's report are notable. First, the recommendation emphasized that studies for new high energy facilities 'should be permitted to proceed to greater detail with explicit authorization so that ideas can be explored conclusively without implying any commitment to proceed.' Thus accelerator development advanced officially into the era of the 'design study,' in which groups of physicists are authorized to prepare detailed designs over a period of several years, without any commitment to build. Secondly, the panel stressed that future high energy laboratories be nationwide rather than regional facilities, having a strong users' representation as well as in-house research staff.

An informal but influential paper, prepared in June 1963 by Fermilab's present director Leon Lederman, then participating in the committee headed by M. L. Good appointed to review the Ramsey panel's report, defined the concept of the 'Truly National Laboratory', or TNL--a laboratory whose ultimate governing body, to which even the director would be responsible, is a nationally represented committee, and whose users' group is 'at home and loved'. Not only, Lederman argued, should users have the right of access to the machine, ancillary equipment and any specialized services that are offered, but also (1) laboratory and office space on site; (2) a 'substantial' support budget to supplement their own grants; (3) strong representation on the scheduling committee; and (4) an active users' advisory committee. He suggested that the site be selected with a view towards 'ease in airport-to-site transportation, housing, and school facilities and general pleasantness'. This concept would be put into operation four years later in the design of Fermilab.

After the Good Committee endorsed the Ramsey panel's recommendations, the AEC appropriated money for Berkeley to conduct, under the direction of Edward Lofgren, a detailed study to design a 200 GeV accelerator. And two years later, in June 1965, the design study appeared, described in two thick blue books a four accelerator cascade as in the Sands proposal, but differing substantially from Sands' concept in technical features, most notably in its size. In the Berkeley design, the magnet apertures were comparatively huge, resulting in a budget of over 340 million dollars.

It was a poor time for Berkeley to present such an expensive proposal, for Congress was just then beginning to feel that high energy physics was oversupported, and that too large a proportion of funds was going to California. Furthermore, non-Berkeley physicists were complaining that in the past they had not been granted enough time on Berkeley's machines. In this context, in the fall and winter of 1965, Wilson dramatically entered the story of the 200 GeV accelerator. He had had an opportunity during the previous summer to study the Berkeley design, as presented by McMillan at a meeting in Frascati, Italy. Feeling strongly that the Berkeley design was too conservative, and thus too expensive, Wilson wrote a series of critical papers. By December, he had drawn up an alternative proposal for a 200 GeV machine at a cost of only 50 million dollars, estimating only 100 million dollars to achieve 600 to 1000 GeV. He based his estimates on economizing features used in the Cornell electron synchrotron--for example, small magnets and austere experimental facilities. Another alternative, suggested by Samuel Devons of Columbia University, was to add a further level of acceleration to the Brookhaven machine, using the AGS as injector. While the Berkeley physicists tended to dismiss the economizing suggestions of both Wilson and Devons, the AEC did not, and announced a cost ceiling of 240 million dollars, so that Berkeley had to prepare a 'reduced scope' design.

The debates in 1965 further focused on the location of the new laboratory. While Berkeley had assumed throughout that the site would be in California, physicists and politicians in other states actively began to question this assumption. In April 1965, after receiving Colorado's independent site proposal, the AEC began to advertise for other proposals. One hundred and twenty-five were received, suggesting over 200 sites, with one or more from each of 46 states. By September 1965, the AEC had reduced the number of proposals to 85, and in March 1966, with the help of a National Academy of Sciences site evaluation committee headed by Emanuel Piore of IBM, only six remained.

The final choice of Weston, Illinois, about 30 miles west of the centre of Chicago, was made in December 1966. It is rumoured to have been the result of political agreements through which Lyndon Johnson repaid a debt to the midwest incurred by the closing down of MURA in 1965, at the same time obligating the Illinois senator Everett Dirkson to support Civil Rights legislation.

Meanwhile, Frederick Seitz, President of the National Academy of Sciences, took the initiative of organizing a national university-supported organization, modeled after Brookhaven's AUI, and named the Universities Research Association (URA), to build and operate the new accelerator laboratory. In June 1965, the URA consortium, composed originally of 34, and later of over 50, universities broadly distributed throughout the United States, was incorporated. Ramsey was selected as its President.

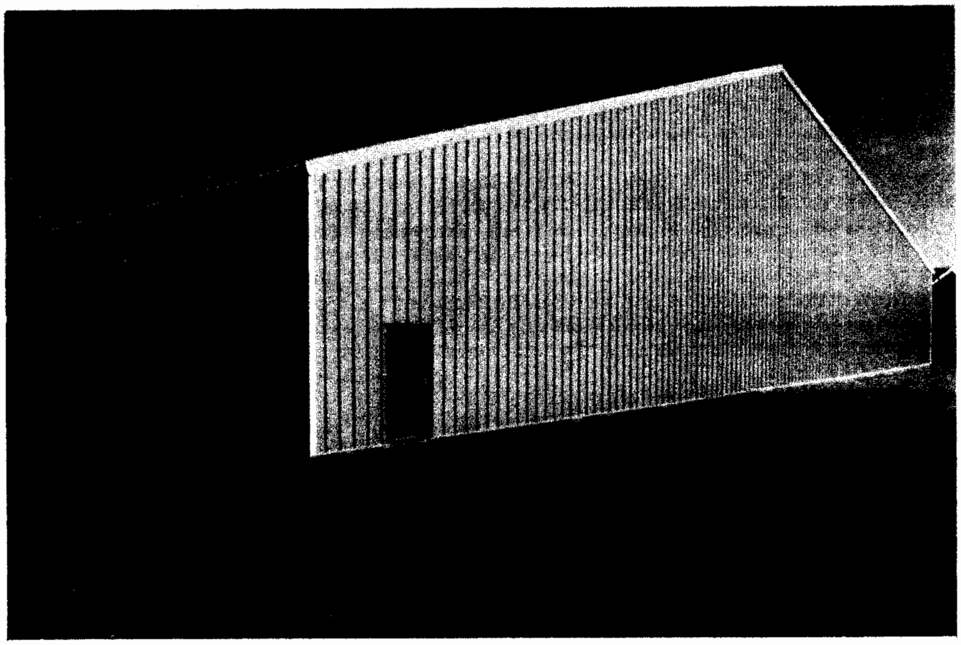
The URA's first job was to choose a director for the new laboratory. It was initially intended to have the position divided into a physics and an accelerator director. The first offer, that of accelerator director, went to Lofgren, who had been head of the Berkeley design project. But Lofgren, apparently supporting Berkeley's hope that the laboratory be in California, turned the offer down on the grounds that the Illinois site was unsuitable and the 240 million dollar budget impossibly low. Then on 6 February 1967, the URA formally offered Wilson the combined position of accelerator and laboratory director. Wilson accepted on 1 March 1967.

Wilson spent the remainder of the academic year 1966-67, operating from his home base in Cornell, on staffing, designing, planning conferences, and arranging for an engineering firm to take on the construction. Staffing was somewhat hindered by the fact that the Illinois site--6800 acres of totally flat corn-field--was quite unappealing as a place to live; summers were hot and humid, winters cold and icy, and there were no nearby moun-tains or ocean. Staffing was aided, however, by the fact that MURA and the Cambridge Electron Accelerator were then both at the point of closing down.

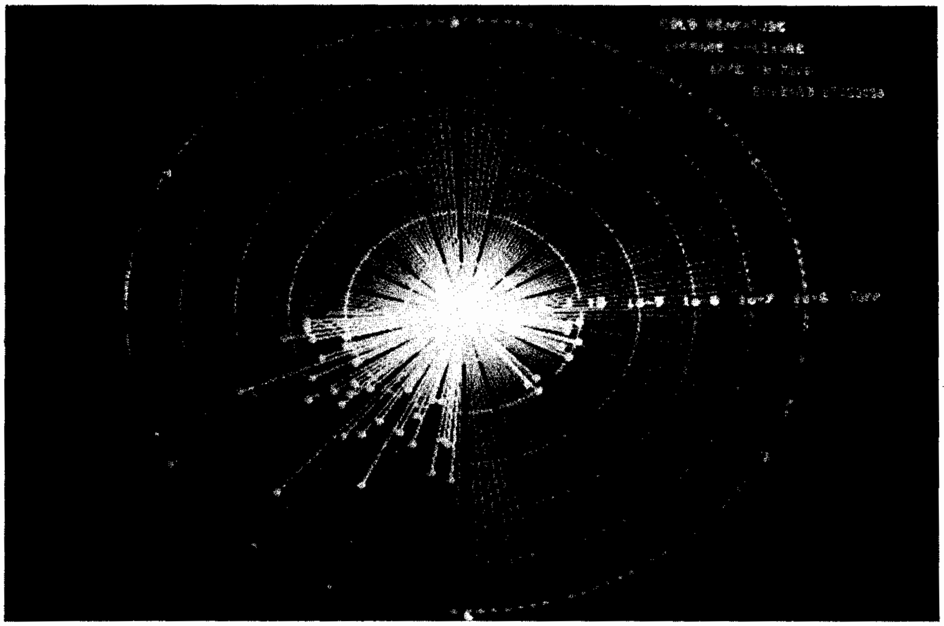
Throughout the summer of 1967, Wilson held workshops to design the laboratory. To emphasize his intention to make the facility 'truly national', as discussed by Lederman, he named it 'The National Accelerator Laboratory', NAL. Since Illinois was having local difficulties buying the land that was to be turned over to the Federal government, the new laboratory was not able to move to Weston until fall 1968. The design workshops, atten-ded on the average by 25 participants from various parts of the U. S., supported by their home institutions, were therefore held in temporary offices in Oak Brook, a suburb of Chicago. The con-ferees played important roles in choosing basic parameters, such as the radius of the main synchrotron ring, and deciding where on the site to place particular components. The workshops also gave Wilson and the conferees a chance to look each other over as potential staff and boss. Indeed, at the end of the summer, approximately half those attending the workshop joined Wilson's staff.

The design report for NAL, completed during the fall of 1967 and issued in January 1968, described a cascade machine quite similar to that proposed by Sands in 1959, but with some features of the Berkeley design. Many innovations reduced costs: small 'H design' magnets with minimal enclosures and a relatively small main-ring tunnel, separated-function magnets for bending and focusing in the main ring, modular equipment in the main ring, a single emergent beam split after extraction, newly developed solid state rectifiers (instead of traditional flywheel gener-ators) tying the magnets directly to AC power lines, an electro-static septum invented by Alfred Maschke, a main ring tunnel built directly on glacial clay, and simple stands rather than expensive girder supports for the magnets. The design also included a built-in option to go later to 400 GeV. By mid-April, Congress had passed and Johnson had signed the bill authorizing the project at 250 million dollars.

Only the linac group was working at Weston in 1967-68. The rest of the staff moved there in October 1968. Then a frantic three-year period of actual construction began in December 1968 with the linac groundbreaking. The emphasis was constantly on economy and speed; Wilson and his Deputy Director, Edwin Goldwasser, both kept setting tight schedules and trying to motivate the staff to beat them in order to save labour costs. Experimental facilities (including a meson area, a neutrino area, and a proton area) were planned by a national group at summer studies held in 1968 and 1969 in Aspen, Colorado, and in 1970 at NAL. The first 200 GeV beam passed through the main ring in March 1972; later, the energy rose to 500 GeV and will soon, through the addition of a superconducting second ring in the main tunnel, increase to 1000 GeV. In May 1974, NAL was renamed Fermi National Accelerator, or Fermilab for short, in honour of Enrico Fermi.



New gym in the village for visiting experimenters.
(Photograph by Fermilab Photo Unit)



A graphics display in the Control Room of vacuum pressure around the Energy Saver.

(Photograph by Fermilab Photo Unit)

MANUSCRIPTS, NOTES, LECTURES, AND COLLOQUIA PREPARED OR PRESENTED FROM JANUARY 21, 1983 TO FEBRUARY 13, 1983

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

R. M. Kalbach et al. Experiment #577	Elastic Scattering of $\pi^{\pm}$ and $K^{\pm}$ on Protons at 100 and 200 GeV/c (FERMILAB-Pub-83/20-EXP; submitted to Phys. Rev.)

Theoretical Physics

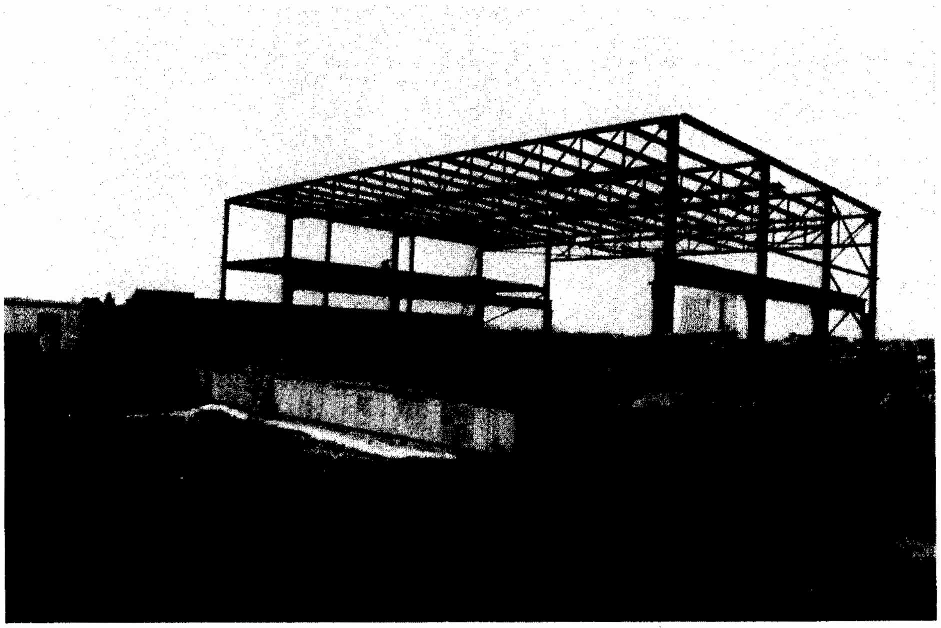
T. R. Taylor	Light Composite Supermultiplets (FERMILAB-Pub-82/100-THY; submitted to Phys. Lett.)
A. Sen	Asymptotic Behavior of the Fermion and Gluon Exchange Amplitudes in Massive Quantum Electrodynamics in the Regge Limit (FERMILAB-Pub-82/101-THY; submitted to Phys. Rev. D)
R. W. Brown et al.	Classical Radiation Zeros in Gauge Theory Amplitudes (FERMILAB-Pub-82/102-THY; submitted to Phys. Rev. D)

Physics Notes

K. Takayama	Alternative Method for Asymptotic Formula of Adiabatic Ratio (Formula for Adiabatic RF Manipulation) (FN-354-A)
D. Neuffer	Principles and Applications of Muon Cooling (FN-378)
A. J. Lennox	Skin Effect in Electrically Pulsed Cylindrical Conductors Used as Focusing Devices (FN-379)

Colloquia, Lectures, and Seminars

C. Briegel, R. Goodwin, and M. Shea	"Installation of the New Linac Controls System" (Fermilab, January 25, 1983)
R. Orr	"Accelerator Division Informations Meeting" (Fermilab, February 1, 1983)



Steelwork being erected at the CDF Hall.
(Photograph by Fermilab Photo Unit)

Ground breaking for the IB Center Building (left to right) Andy Mravca (DOE), Bob Adams, Ali Sajadi, Leon Lederman, Wayne Nestander, Tom Kirk, Dick Lundy, Norm Eallonardo (Wil-Freds vice president), Phil Livdahl, and Ken Norton (Wil-Freds project manager).

(Photograph by Fermilab Photo Unit)

DATES TO REMEMBER

February 25, 1983	Users Executive Committee Meeting
March 24, 1983	Deadline for receipt of reservations for on-site summer housing
April 7-8, 1983	PAC Proposal Presentation Meeting
April 22-23, 1983	Annual Users Organization Meeting
April 29-30, 1983	Calorimeter Calibration Workshop
May 30, 1983	As part of the AAAS Meeting (May 26-31), Detroit, Michigan, a symposium on High Energy Physics will be chaired by Robert G. Sachs, University of Chicago, and moderated by Leon Lederman. Other speakers include Professer Martinus J. Veltman, University of Michigan; Professor Lee G. Pondrom, University of Wisconsin, Madison; and Professor Robert R. Wilson, Columbia University.
June 18-24, 1983	PAC Extended Summer Meeting