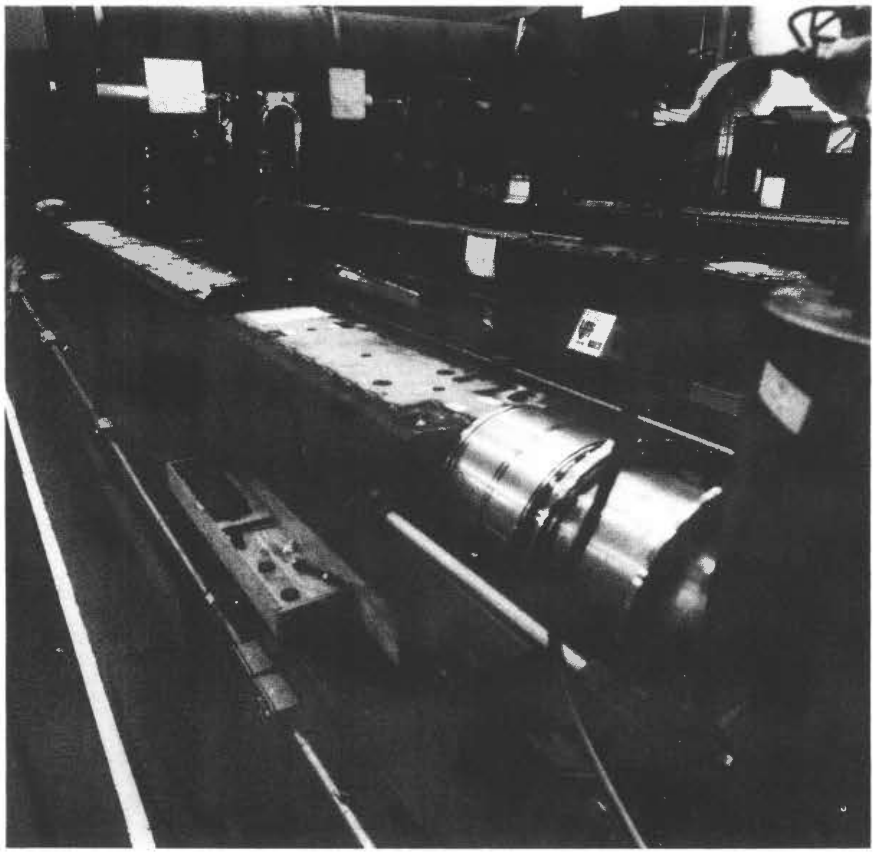
fermilab report

Fermi National Accelerator Laboratory Monthly Report

July 1980



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THE COVER: A new-style Energy Saver magnet installed at the Magnet Test Facility. One of the new anchors that keep the cryostat in place can be seen at the nearest corner of the yoke.
(Photograph by Fermilab Photo Unit)

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CONTENTS JULY 1980

A recent photograph from the 15th floor that shows the Energy Saver helium-transfer line along the top of the Main Ring shielding berm.

(Photograph by Fermilab Photo Unit)

SUMMER 1980 MEETING OF THE PHYSICS ADVISORY COMMITTEE

Norman Gelfand

The Fermilab Physics Advisory Committee held its 1980 summer meeting June 21 through 27 in Aspen, Colorado. In addition to discussing experimental proposals, they heard and discussed several presentations about Laboratory activities and plans. The meeting concluded with several important general recommendations to Fermilab and final recommendations on a number of proposals. The PAC recommended that decision be deferred on other proposals pending additional information and clarification of the situation at Fermilab.

The meeting heard reports from Tom Kirk, Ernie Malamud, and Ken Stanfield on the status of the current experimental program in the Neutrino, Meson and Proton Laboratories and the plans for the near-term future. These formed a backdrop for the discussions of the PAC.

The Meson Department is doing construction in preparation for the installation of several new experiments. This summer, a pit and building for E-605 are being constructed. Improvements in the M3 line for E-617 will also be made. Later, another pit will be constructed for E-609. In addition, the superconducting Left Bend will be installed to transport primary protons to the Meson targets. This improvement will eventually allow 1-TeV protons to be targeted for Meson Area experiments. The installation of the Left Bend is scheduled for completion by October 1, 1980, in time for the fall running period. Another major goal of the Meson Department will be to convert the M6 bend point at 1300 ft to a string of 5 Saver magnets operating on a satellite refrigerator.

There is also a major construction project currently underway in the Neutrino Area. This project will result in a much improved muon shield for the 400-GeV neutrino program. This shield will also be suitable for Tevatron neutrino beams. The work being done now is also a necessary precursor to the construction of Neutrino Area beam-dump (prompt neutrino) and muon beams. The schedule for Neutrino Area construction shows the wide-band neutrino beam for E-53A, the 15-ft bubble chamber and for neutrino emulsion experiment E-531 reinstalled by December 1, 1980, and the hadron beam N3 for the 30-in. bubble chamber ready for the spring running period.

Major construction is planned for the Proton Area in the summer of 1981. During the past year, the Proton Department has installed and operated a large-aperture, low-current superconducting magnet, 900 ft of transfer line, and a satellite refrigerator the P-West beam line. Low-current magnets and the experience gained in their operation in a beam line are necessary for the improvement of Proton Area beam lines for operation at Tevatron energies.

Rich Orr discussed the progress and schedule for the construction of the Energy Saver. All the major technical problems that have been identified in the production of Saver magnets and their cryostats have been solved. In addition, the procurement of materials and components is proceeding satisfactorily. As a result of these successes, a realistic schedule has been drawn up in which the construction of the Saver can be completed and commissioned in early 1982. With the expected funding of the necessary refrigeration for raising the energy to 1 TeV in FY82, it is reasonable to expect initial operation of the Tevatron in 1983.

The proposed plans for the fixed-target facilities of the Laboratory in the Tevatron decade were described by John Peoples and discussed by the PAC. The objective with first priority is to create the ability to transport and target 1-TeV protons in each of the experimental areas. The Left Bend to Meson and a future Right Bend to Proton are part of this effort. On completion of the Neutrino construction, 1-TeV protons could be targeted with the present dichromatic beam tuned for secondary energies up to 450 GeV, or approximately twice the current energy. Other projects planned for the Neutrino Area include a high-quality muon beam, a beam dump and a new high-energy dichromatic beam.

The Tevatron program in the Meson Area includes an additional target in Meson East to feed the M1 beam line. This beam line will initially transport 1-TeV protons and will be later upgraded into a high-intensity pion beam. The Meson Center target wil produce a neutral beam in M3 and a polarized proton beam in M2. The Meson West target will feed the M5 test beam and M6. The M6W beam, which has already been upgraded with superconducting magnets, will be further upgraded in order to be able to transport the full 1-TeV energy of the Tevatron. The present M6E beam will be replaced by an upgraded beam.

The secondary beams in the Proton Area will be greatly improved, both in energy and intensity, by the targeting of 1-TeV protons. In addition to upgrading the beam lines to transport the high-intensity secondaries, the Proton Department has designed a new high-intensity high-energy broad-band photon beam for Proton East. This new beam will replace the present broad-band photon beam. In addition to photons, this new beam will deliver a high-intensity neutral beam to a new experimental hall to be constructed in Proton East.

With this background information, the PAC began its deliberations. Facing it were a large number of specific proposals for both existing beams and Tevatron beams. In addition, the PAC was asked to advise the Laboratory about the configuration of beams described for the Tevatron and to establish priorities for the different beams. The PAC received a presentation from Tom Collins and J.D. Bjorken on the design and physics oportunities of a proposed ep colliding - beam facility. Finally, the PAC heard and discussed a report from the Colliding Detector Facility Review Committee.

Meeting all day and several nights during the week, members of the PAC carefully considered the proposals and the information they had before them. Given the highly complex nature of many of the proposals and the rapidly changing physics situation, the PAC was unwilling to make final recommendations on many of the proposals. The Committee did, however, make a number of general recommendations that will help establish the priorities of Fermilab's activities during the period of Tevatron construction. These recommendations are printed in full below.

The PAC will have its next meeting on November 13 and 14, 1980. All matters for which PAC consideration is desired should be received by Fermilab by September 25, 1980. Presentations for Tevatron hadron and photon proposals will be scheduled in the spring of 1981 and will be discussed by the PAC at its summer meeting in 1981.

PROGRAM ADVISORY COMMITTEE GENERAL RECOMMENDATIONS

1. The 400 GeV Program and "Disaster Scenarios."

a) We endorse the 400 GeV program as presented to us with three running periods between November 1980 and May 1982.

b) In case the second running period (March to June of 1981) has to be cancelled because of fiscal constraints, then the priorities in the program are such that the run starting in November 1980 should proceed as scheduled. The PAC will give advice at a later meeting (November 1980 or June 1981) on how to proceed with the fall 1981 run.

c) We support the stated policy of the Laboratory that during the uncertain transition period between the 400 GeV and the 1000 GeV operation an effort should be made to operate the accelerator periodically to maintain a flow of physics results. A continuous shutdown for a period of much more than six months seems inadvisable.

2. General Recommendations on Tevatron Beams

The Committee reviewed the Laboratory's plans for external beams in the Tevatron era and strongly supports the position that there should be 1000 GeV extracted proton beams targeted in each of the three major research areas as soon as possible. In order to achieve this goal, it is important to start the Tevatron II construction project before completion of parts of the Tevatron I project, as requested by the Laboratory.

Because the bulk of Tevatron proposals considered by the Committee involve beams in the Neutrino Area, we are not prepared to present a list of priorities involving beams in the other research areas. Within the Neutrino Area, we support the provision of at least three different beams. High priority should be given to a conventional neutrino beam suitable for electronic detectors and to a prompt neutrino beam suitable for the 15 ft Bubble Chamber and electronic detectors. The next highest priority in the Neutrino Area should be given to a high quality muon beam design for a wide range of muon scattering experiments. Of lower priority would be special efforts to run the 15 ft Bubble Chamber for conventional neutrino physics.

3. **ep Colliding Beams at Fermilab**

A Canadian group and a Nevis Laboratory group have each expressed interest in building an electron storage ring of 10 to 15 GeV tangent to the Tevatron ring. The prospect of colliding 10 GeV electrons and 1000 GeV protons is exciting and we encourage serious study. It is premature, however, for us to comment further before the proposals are made more explicit, both on technical matters and in regard to the load on the Fermilab staff, funds, and the rest of the Lab program. For the immediate future, Fermilab's resources should not be diverted from the Tevatron construction, the fixed target program, and the $\bar{p}p$ collider. We expect that a decision to build or not to build the ep collider would follow detailed technical review by outside experts and by the PAC. PAC guidance should be sought concerning proposals for the experiments to be run on such a device.

4. The Committee endorses the spirit of the Laboratory's proposal to develop a facility for carrying out modest experiments on a very short time scale. Proposals for using such a facility should be considered by the PAC. The facility should be sufficiently well-equipped with both hardware and personnel that an approved experiment can be implemented quickly. The facility should not displace present test beams nor should it be considered as a test beam.

5. **Approval Procedure**

The Committee recommends that a new two stage approval procedure be adopted. This procedure need not be used uniformly for all proposals but only for those where it is appropriate.

a) The Committee may recommend **Stage I Approval** if :

i) the proposed physics goals are worthwhile,
ii) the experiment seems technically feasible, and
iii) the cost in Lab resources and running time of the experiment appear to be appropriate for the expected physics results.

b) Following a Stage I approval the experimenters and the Laboratory will carry out a careful technical design and cost study for the experiment, and a first draft of the Agreement between the Laboratory and the experimenters will be prepared. If the results of this procedure are acceptable to the PAC, and the experiment fits into the overall priorites of the experimental program, **Stage II Approval** would normally be recommended.

It must be recognized that Stage I approval does not represent a commitment of Laboratory resources, either in support for setting up the experiment or in running time. Rather, it is a mechanism for aiding Laboratory staff and experimenters in the planning of long range projects. It is essential that the detailed PAC review preceed Stage II consideration, just as with any normal proposal.

INTERNATIONAL COMMITTEE ON FUTURE ACCELERATORS

L. M. Lederman

The fifth meeting of ICFA was held at CERN on July 9, 1980. The U. S. delegation consisted of Burton Richter, R. R. Wilson and L. M. Lederman. Representatives from CERN member states, Japan, Soviet Union and members of JINR (Eastern Europe) attended. In addition, E. L. Goldwasser represented the parent body, IUPAP.

The mission of ICFA is to foster communications between the different regions active in high energy physics with the aim of: i) coordinating the development of regional facilities in order to minimize duplication and ii) work to the eventual creation of a World Laboratory which would house an accelerator larger than any region could afford (VBA for Very Big Accelerator).

A policy statement on access to regional accelerators was approved and will be circulated to all the major accelerator labs for adoption. It follows closely on the Fermilab PAC policy recommendation that proposals for experiments should be judged on merit and not on the return address.

The ICFA committee has also encouraged the parent group to proceed with its negotiations with the Peoples Republic of China so that the large commitment of that country to high-energy physics can be reflected in representation on ICFA. One of the tasks of ICFA is the sponsorship of workshops addressed to problems of future accelerators. A workshop on superconducting magnets is tentatively scheduled for next year in Serpukhov.

Finally, the Committee, at its next meeting, will begin to address the complex problems of the organization of a World Laboratory. How will a site be selected? How will the staff be organized? Will there be international treaties? How will the funding be allocated?

This is a very long range and idealistic program. Someday, our science may require an accelerator beyond the means of any single region. The ICFA efforts will then have paid off in its years of preparatory work.

SUMMARY OF OPERATIONS - JUNE 1980

Program Planning Office

With budgetary constraints on the number of weeks in a year that the accelerator can run, and the need for access into the Main Ring tunnel in order to install the Saver, there is more and more need for steady and reliable accelerator performance during times when the accelerator is scheduled to run for experiments.

During the last few weeks up to the scheduled shut-down on June 23, the accelerator performance was better than ever, culminating in a record week with 150 hours of delivered beam, which was 93% of that scheduled.

In addition, the intensities needed by the experiments simultaneously on the 7 targets in the Proton, Neutrino and Meson Areas placed demands on the Switchyard Group's beam splitting techniques that only a few months before were considered impossible to meet.

In the final weeks of the run, 9 experiments were simultaneously using beam from the accelerator, with up to 7 taking data and the others in the startup stage. In addition, two experiments in the Neutrino Area, Particle Search #595 and Particle Search #610, were successfully completed during the month of June.

BEAM UTILIZATION BY

	Beam	Hours
PROTON AREA		
Charged Hyperon #497	PC	410
Photoproduction #516	PE	310
Di-Muon #537	PW	410
NEUTRINO AREA		
Nuclear Fragments #466	N0	-
Neutrino #594	N0 & N5	400
Particle Search #595	N5	230
Particle Search 610	N1	360
MESON AREA		
Particle Search #515	M1	110
Elastic Scattering #577	M6	350
Kaon Charge Exchange #585	M4	410
Beam Dump #613	M2	310
INTERNAL TARGET AREA		
Particle Search #591	C0	400
TOTAL HOURS FOR HIGH ENERGY PHYSICS		3700

EXPERIMENTAL ACTIVITY - JUNE 1980

Activities
startup and tests; hyperon flux measurements, target studies, and test data
data and drift chamber and S.L.I.C. calibrations
tuneup; apparatus checkout, $\bar{p}$ flux measurements, and preliminary data-taking
data; two targets exposed
test data, using the neutrino beam and detector calibrations using the N5 hadron beam
completed; finished data-taking with pions and did final calibrations
completed; data at -225 GeV/c and lead glass calibrations
data at -220 GeV/c and calibration runs
data at $\pm$200 and $\pm$100 GeV/c
data at -70 and -120 GeV/c
tests; checked - out equipment and studied muon background
data; to study nuclear fragments produced by proton - heavy nucleus collisions

FERMI NATIONAL ACCELERATOR LABORATORY
MONTHLY OPERATIONS HISTORY
JUNE 1980

Date	Accelerator	Internal Target Area	Proton Area	Neutrino Area	Meson Area
Sun. 6/1	~2×10^{13} ppp @350 GeV 1.5 sec flattop	591	516 (PE) 537 (PW) 497 Tests (PC)	595 (N5) 610 (N1) 594 Tests (NO)	515(M1);577(M6) 585(M4);OFF(M3) 613 Tests (M2)
Mon. 6/2					
Tue. 6/3					
Wed. 6/4	Accelerator Research & Maintenance				
Thu. 6/5					
Fri. 6/6	~2×10^{13} ppp @350 GeV 1.5 sec flattop	591	516 (PE) 537 (PW) 497 (PC)	595 (N5) 610 (N1) 594 Tests (NO)	515 (M1) 577 (M6) 585 (M4) 613 Tests (M2) OFF (M3)
Sat. 6/7	ES38 Shorted				
Sun. 6/8	~2.0×10^{13} ppp @350 GeV 1.5 sec flattop				
Mon. 6/9					Same as above but, 613(M2) 515(M1) {para.}
Tue. 6/10					
Wed. 6/11	Accelerator Research & Maintenance				
Thu. 6/12	Linac #8				
Fri. 6/13	~2.0×10^{13} ppp @350 Gev 1.5 sec flattop	591	516 (PE) 537 (PW) 497 (PC)	595 (N5) 610 (N1) 594 Tests (NO)	577 (M6) 613 (M2) 585 (M4)
Sat. 6/14					
Sun. 6/15					
Mon. 6/16	N.R.			610 (N1) 594 (N5)	
Tue. 6/17	>2×10^{13} ppp @350 GeV 1.5 sec flattop				
Wed. 6/18					
Thu. 6/19	N.R.				
Fri. 6/20	>2×10^{13} ppp @350 GeV 1.5 sec flattop				
Sat. 6/21					
Sun. 6/22					
Mon. 6/23	Accelerator Research				
Tue. 6/24					
Wed. 6/25	Facility Shutdown				
Thu. 6/26					
Fri. 6/27					
Sat. 6/28					
Sun. 6/29					
Mon. 6/30					

FACILITY UTILIZATION SUMMARY - JUNE 1980

I. Summary of Accelerator Operations

	Hours	
A. Accelerator use for physics research		
High energy physics research	412.7	
Accelerator physics research	98.7	
Subtotal		511.4
B. Other Activities		
Program interruption	150.7	
Accelerator setup and tuning to experimental areas	10.0	
Subtotal		160.7
C. Unscheduled interruption		47.9
D. Unmanned time		-
Total		720.0

II. Summaries of High Energy Physics Research Use

	# of Expts.	Hours	Results
A. Counter experiments	11	3700	2 experiments completed
B. Bubble chamber experiments	-	-	
C. Emulsion experiments	-	-	
D. Special target experiments	1	-	2 targets irradiated
E. Test experiments	-	-	
F. Engineering studies and tests	-	-	
G. Other Beam Use	-	-	
Totals	12	3700	

III. Number of Protons Accelerated and Delivered ($\times 10^{18}$) at 350 GeV

A. Beam accelerated in Main Ring	1.98
B. Beam delivered to experimental areas	1.90
Proton Area	0.59
Neutrino Area	
Slow Spill	0.53
Fast Spill	0.18
Meson Area	0.60

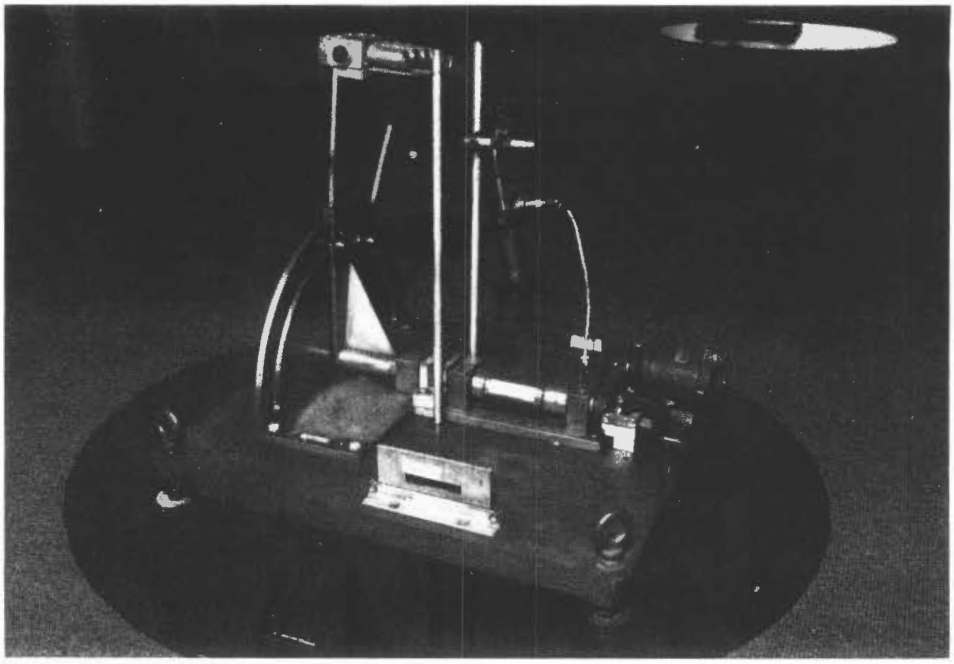
Signing of the new collaboration agreement between the People's Republic of China and the U.S. by James Leiss of the Department of Energy and Zhang Wen-Yu, Director of the Institute for High Energy Physics, Beijing. Members of the joint committee of the collaboration observe.

(Photograph by Fermilab Photo Unit)

CHINA - U.S. AGREEMENT

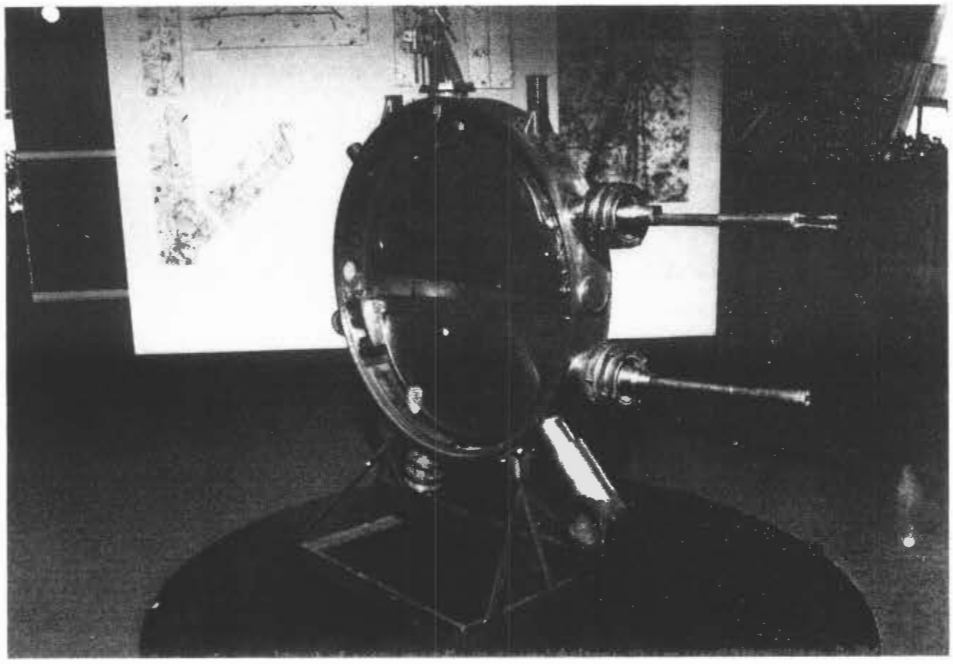
An agreement was signed on June 19 at the Laboratory for extension of the high-energy physics collaboration between the People's Republic of China and the United States. Professor Zhang Wen-Yu, Director of the Institute for High Energy Physics in Beijing and Dr. James Leiss of the U.S. Department of Energy signed for their countries.

The agreement continues the exchange of information and collaboration that began January 1, 1979. Fermilab is headquarters for the cooperative effort between the U.S. laboratories aiding the effort and the Chinese scientists. A 50-GeV proton synchrotron will be constructed near Beijing. More than 100 Chinese scientists have worked at Fermilab under this agreement.

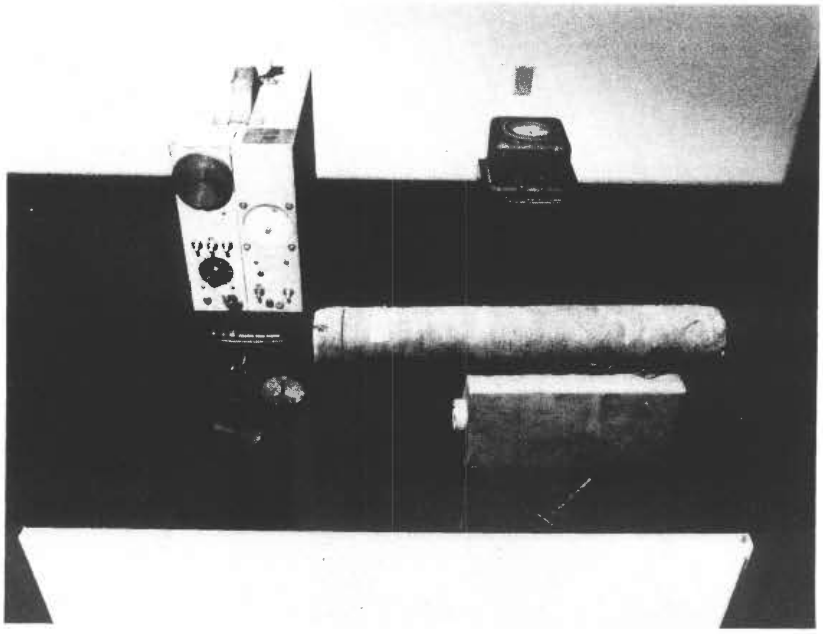


This and the following photographs show exhibits of memorabilia of the history of high-energy physics. These pieces of equipment were shown in the gallery during the History Symposium. This is a neutron chopper used by Fermi and his collaborators at the University of Chicago in 1946. Its purpose was to pass only neutrons within a desired velocity band.

(Photograph by Fermilab Photo Unit)



University of Michigan cyclotron built in 1937 by Cork and Thornton. Crane and Halpern used this accelerator to demonstrate nonconservation of momentum in the beta decay of chlorine-37, evidence for the existence of the neutrino.
(Photograph by Fermilab Photo Unit)



Portable Ionic Counter, 1942. This device was taken to Washington by Kennedy and Seaborg to demonstrate the fission of U-235 to Secretary of War Stimson.

(Photograph by Fermilab Photo Unit)

An early electrostatic generator, built in the late 19th century. This device, loaned to us by the Baaken Museum of Electricity in Life, Minneapolis, can generate potentials up to 10^5 volts when powered by a motor.

(Photograph by Fermilab Photo Unit)

MANUSCRIPTS AND NOTES PREPARED
FROM JUNE 12 TO JULY 11, 1980

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

Yu. K. Akimov et al. Experiment #317	Slope Parameter for the Differential Cross-Section For the Reaction p + d X + d in the Region of Small Momentum Transfer at Fermilab Energies (FERMILAB-Conf-80/56-EXP; submitted to the XXth International Conf. on High Energy Physics, Madison, July 1980)
T. Yamanouchi et al. Experiment #608	Upper Limits on Production in 350 GeV/c Proton-Beryllium Collision (FERMILAB-Conf-80/57-EXP; submitted to the XX International Conf. on High Energy Physics, Madison, July, 1980)

Theoretical Physics

H. J. Lipkin	SU (5) Without SU(5); Conservation Laws in Unified Models of Quarks and Leptons (FERMILAB-Pub-80/37-THY; submitted to Nucl. Phys. B)
H. J. Lipkin	BL Parity, A New Conserved Quantity in Weak Interactions of Quarks and Leptons (FERMILAB-Pub-80/42-THY; submitted to Phys. Rev. Lett.)
A. J. Buras	Higher Order QCD Corrections To Quarkonium Decays (FERMILAB-Pub-80/43-THY; submitted to Phys. Rev. Lett.)
P. W. Johnson and Wu-Ti Tung	Testing the Spin of the Gluon in Large Transverse Momentum Lepton Pair Production (FERMILAB-Pub-80/50-THY; submitted to Phys. Rev. D)

G. Karl and H. J. Lipkin — Short Range Correlations and Baryon Decay (FERMILAB-Pub-80/54-THY; submitted to Phys. Rev. Lett.)

Physics Notes

D. Neuffer and A. Ruggiero — Enhancement of Diffusion by a Non-Linear Force (FN-325)

DATES TO REMEMBER

July 24-25, 1980 July 28-August 1, 1980	Fixed Target Workshop (contact Program Planning Office for details).
Sept. 25, 1980	Deadline for submitting materials for PAC consideration
Nov. 13-14, 1980	Next PAC Meeting

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