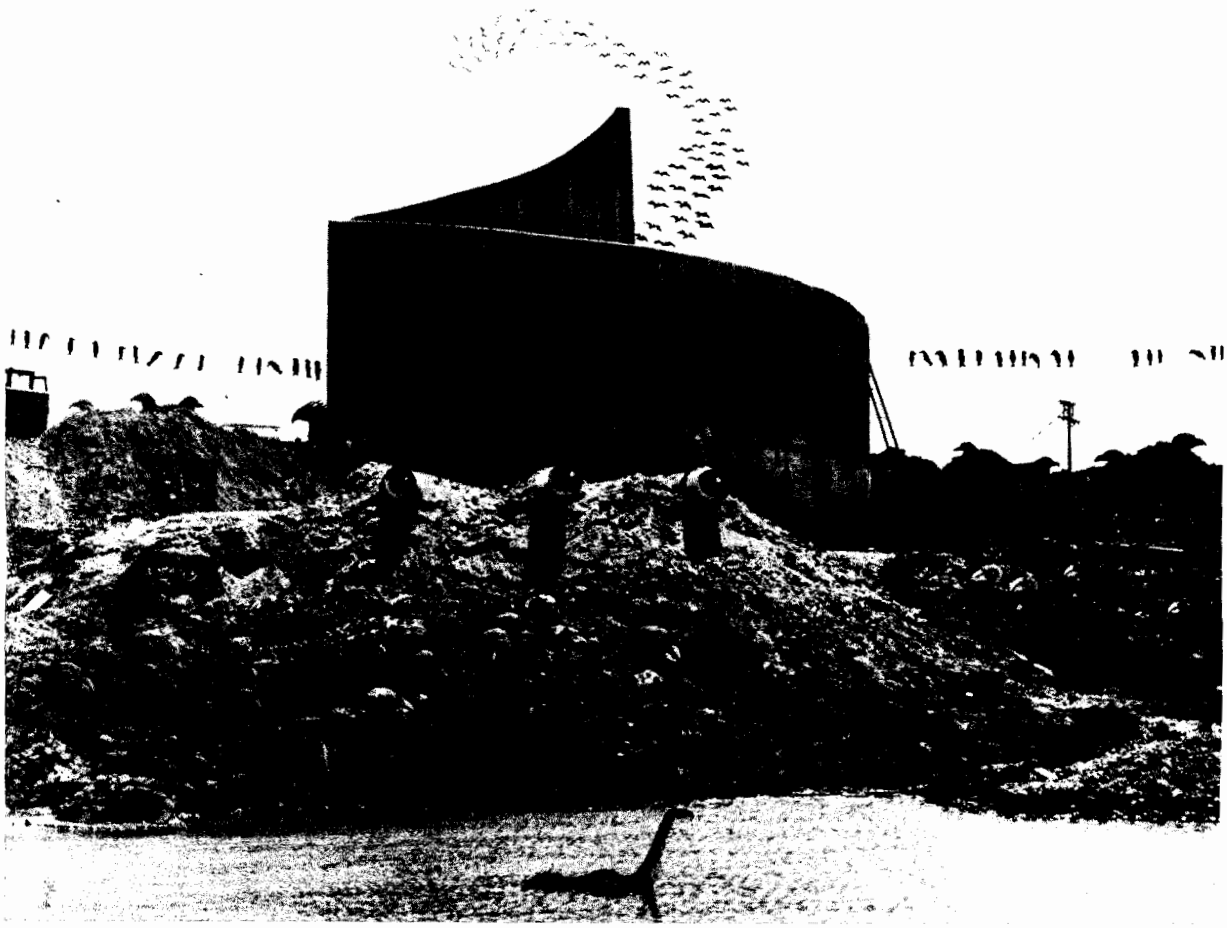
fermilab report

Fermi National Accelerator Laboratory Monthly Report

March 1977



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THE COVER: The long-awaited spring migration has begun with blackbirds arriving at the site first, followed by bats and bafflement. This photograph, taken at Casey's Pond off Wilson Road, sets the scene on site for the next couple of murky months. The warmer temperatures have broken the ice sheets and allowed the subterranean creatures to catch a glimpse of the weather to follow. (Photograph by Tony Frelo)

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A SUMMARY OF THE FERMILAB RESEARCH PROGRAM DURING 1976

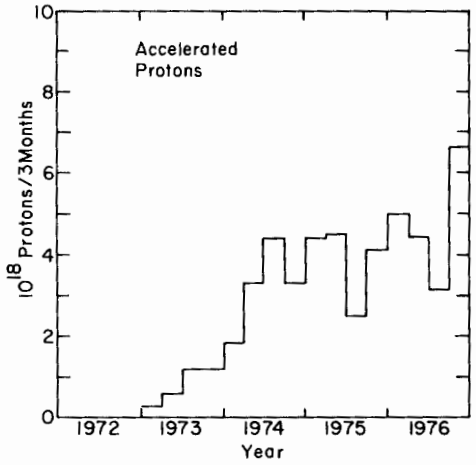
A. F. Greene

The facilities at Fermilab have served the research program well during the past year, and the capabilities of the extensive complex are now being fully realized. There is still growth at the Laboratory; for the most part, the motivation for growth has come from improvements suggested following the first round of experiments.

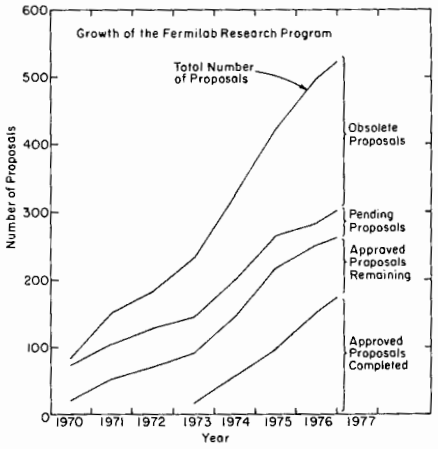
The Main-Ring accelerator was operated during 1976 at 400 GeV, except when there were specific requests by experiments for front-porch operation at lower energy. During the first part of the year, the standard accelerator cycle included a one-second flattop. There was, however, running during the year with flattops as long as 4.0 sec during a single accelerator cycle. Slow resonant extraction during the flattop was available for counter experiments and sometimes added to this were single-turn (20 μsec) extraction for the 15-ft bubble chamber or 1 to 10 msec extraction for neutrino counter experiments. At times, 1 msec extraction was used for simultaneous operation of bubble chamber and counter experiments.

There was a test of the energy capability of the Main-Ring accelerator in the spring. Success was achieved on May 14 when the record energy of 500 GeV was reached. An experiment in the Internal Area was actually able to collect data at 500 GeV for several hours. On December 12, peak intensity in the Main Ring reached nearly 2.5×10^{13} protons per pulse at 400 GeV.

The last three months of 1976 are particularly noteworthy because of the large number of protons accelerated. The figure at the top of the next page shows this graphically and compares it with other operating periods.



Total number of protons accelerated in the Main Ring for each three month period since startup in 1972. A total of 1.9×10^{19} protons were accelerated during 1976.



Growth of the Fermilab research program. During 1976 a total of 57 proposals were received, 29 were approved, and 36 completed data-taking.

This achievement during the months of October, November, and December was possible for two reasons: high accelerated intensity per pulse and reliable operation. The total accelerated beam during 1976 of 1.9×10^{19} protons was divided among the three external areas, with about one-half used in the Neutrino Area and the other one-half split between the Proton and Meson Areas.

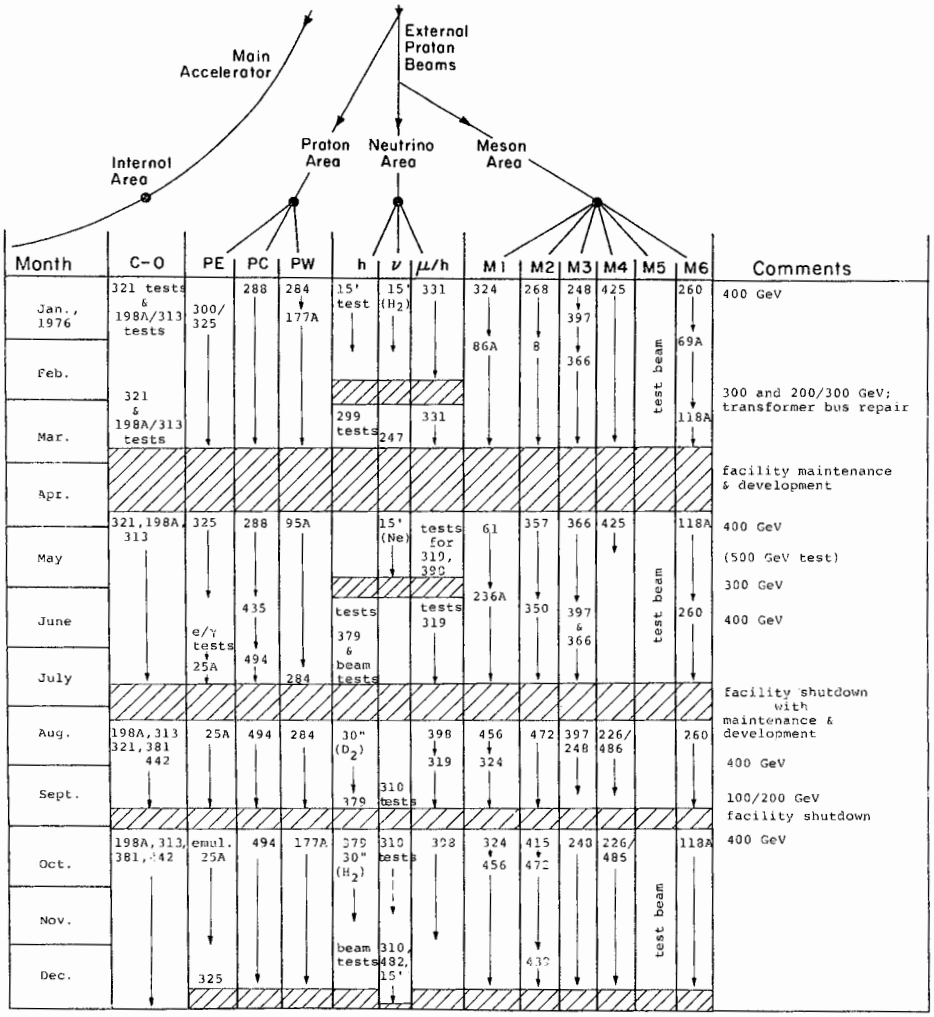
The demand for use of the research facilities continues to be high, as is evident from the 57 proposals received during the calendar year. The total number of submitted proposals is shown in the graph on the right, where the growth of the research program is summarized. A total of 36 experiments completed data-taking during 1976. It is noticeable that only 29 experiments were approved for running during the year. This is due in part to a financial pinch felt during the year and consequent concern about

the ability to expand the program. At the end of 1976, the total number of approved proposals remaining to be completed (88) was less than it has been since 1974. Consequently, there is some shrinkage of the backlog of experiments in beam lines. Financial restrictions aside, there are opportunities for new experiments in the M3 and M4 beam lines of the Meson Area and in the primary proton beam in the West Branch of the Proton Area.

There were three facility shutdowns for maintenance and development during the year, all of them related to the shortage of operating funds at the Laboratory. These shutdowns are shown by the large cross-hatched areas in the figure on page 4. Because of severe financial restrictions during the period from July through September, it was necessary for the accelerator to be off about one-third of the available time to save funds that would normally have been spent for electrical energy. As a result, the running period in August and September was very unsatisfactory; the time period was so short that stability of operation was never reached. Activities in the Proton and Meson Areas were ended on December 20 and those areas remained off until the end of the year. This opportunity was used to provide high-priority running for neutrino experiments. At that time, a faster accelerator cycle without flattop was employed and the full intensity of the accelerator was available for neutrino production.

During the past 1-1/2 years there has been an average of about 21 experiments per month in operation. A summary of the number of experiments using beam is shown in the graph on page 7. At any one moment, however, about 10-12 experiments are running. There is now a trend

1976 HISTORY OF FERMILAB EXPERIMENTS



DESCRIPTION OF RESEARCH HIGHLIGHTS
IN THE EXPERIMENTAL AREAS DURING 1976.
(The individual experiment numbers are shown in parentheses.)

Neutrino Area

Study of ν and $\bar{\nu}$ interactions in the 15-ft chamber filled with heavy neon and with emphasis on study of interactions with production of pairs of a muon and an electron or positron. (53A, 172)

Possible evidence for production of a short-lived particle from neutrino interactions in emulsion (247)

Study of neutrino interactions producing two or more muons in an electronic detector (310)

Continued study of deep inelastic muon scattering (319, 398)

Study of $\mu^+\mu^-$ production from pion and proton interactions at 230 GeV/c (331)

Use of the 30-in. bubble chamber for study of the features of hadron interactions in hydrogen and deuterium (194, 299, 338, 344, 345)

Proton Area

Evidence for photoproduction of a charmed baryon (87A - from running completed in December, 1975)

Measurement of photon total cross sections into hadrons at 20 to 200 GeV/c from hydrogen and nuclear targets (25A)

Large-p_t hadron production from p-p and p-d interactions at 200, 300, and 400 GeV/c (300)

Study of e^+e^- and $\mu^+\mu^-$ production from proton interactions at 200, 300, and 400 GeV/c (288, 325)

Hadron pair production from proton interactions at 400 GeV/c with emphasis on study of high mass pairs (494)

Study of muon polarization with p_t near 1.5 GeV/c from proton interactions at 400 GeV/c (435)

Multi-photon production from proton interactions at 300 and 400 GeV/c (95A)

p-p elastic scattering at $|t| = 4.5$ to 13 $(\text{GeV/c})^2$ with incident momenta of 300 and 400 GeV/c (177A)

Inclusive production of hadrons at $p_t < 2$ GeV/c from p-p interactions at 100, 200, and 400 GeV/c (284)

Meson Area

Search for charmed particles produced in proton and neutron interactions and decaying into hadrons with and without associated muons (357, 366, 397, 472)

Comprehensive study of inclusive production of charged particles from π, K, p, and $\bar{p}$ interactions at 30 to 275 GeV/c (118A, 324)

π^o production up to p_t of 5 GeV/c from π-p and p-p interactions at 100 and 200 GeV/c (268, 350)

Elastic scattering of pions and protons at 100 GeV/c from a polarized proton target (61)

Measurement of the charged kaon form factor using an incident beam at 250 GeV/c (456)

Λ^o elastic scattering from hydrogen and deuterium at 75 to 375 GeV/c (8)

Charged hadron elastic scattering at 50, 175, and 200 GeV/c (69A)

Measurement of K_S^o regeneration from K_L^o-p interactions at 30 to 120 GeV/c (425)

Study of hadron interactions producing single particles or "jets" containing many particles at large-p_t (236A, 260)

Measurement of the K_L^o-nucleon total cross section and the total cross section difference for K^o and $\bar{K}^o$ interactions with nuclei at momenta of 30 to 120 GeV/c (486)

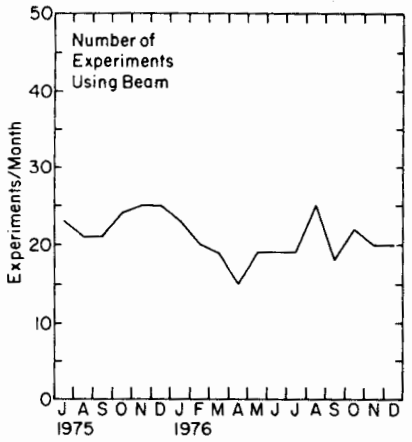
Study of neutron diffraction scattering from hydrogen up to $|t|$ of 3.6 $(GeV/c)^2$ and at momenta of 50 to 400 GeV/c (248)

Internal Area

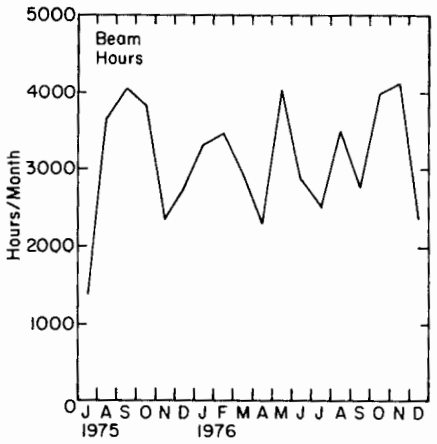
Measurement of p-p inelastic scattering at momenta of 8 to 500 GeV/c (321)

Study of p-p elastic scattering to $|t| = 2$ $(GeV/c)^2$ with incident momenta of 30 to 220 GeV/c (198A)

Measurement of the polarization of recoil protons produced in p-p elastic scattering to $|t| = 0.8$ $(GeV/c)^2$ with incident momenta of 20 to 200 GeV/c (313)



Number of experiments per month using beam at Fermilab. Emulsion experiments are not shown here, although 18 were completed during the second half of 1975 and 6 finished exposures in 1976.



Beam hours available for Fermilab experiments. A beam hour is defined as the total number of hours used in all the beams at Fermilab. The hours used for bubble chamber experiments are included here.

toward running fewer experiments each month because longer running periods and fewer changes are being scheduled to improve overall efficiency. As can be seen in the figure on the right, there was an average of approximately 3,100 beam-hours per month available for experiments during the 18-month period shown; this is the total number of hours of operation of all Fermilab beams. During 1976, there was an average of approximately 370 hours per month used for high-energy physics research.

Included in the summary of research activities in the figure on page 4 are the individual experiment numbers for many of those in operation during 1976. The arrows there describe the approximate length of each experimental run. The accompanying table, beginning on page 5, describes in more detail the type of measurements that were made in each experimental

area. The experiment number in the table is shown in parentheses and can be compared with the numbers in the figure. Some of the highlights of the research will be described here.

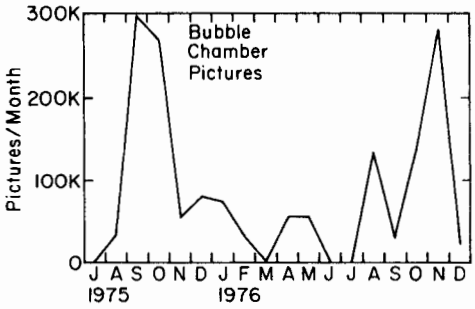
Neutrino Area

The description starts with the Neutrino Area because the activities there have such a strong influence on the operation of the entire facility, particularly with regard to need for intensity and type of beam spill. The 15-ft bubble chamber was used at the end of 1975 and the beginning of 1976 with a wide-band horn focusing system and hydrogen fill to take a total of 133,000 pictures of neutrino and antineutrino interactions; 62,000 of those were taken during 1976. During a test of double-pulsing the chamber, it was possible to take 74,000 pictures of hadrons during the neutrino running; 40,000 of those were taken after January 1, 1976. In April and May, the 15-ft chamber was filled with a heavy neon-hydrogen mixture for a neutrino and an antineutrino exposure; 110,000 pictures were taken then. The results so far obtained from the exposures are providing new insight into the production of μe pairs from ν and $\bar{\nu}$ interactions. At that time, a hybrid emulsion experiment was completed. Subsequent analysis of the emulsion and counter data has shown evidence for possible production of a short-lived particle.

Other neutrino-beam activities have included tests of two large new electronic detectors for study of neutrino interactions. These experiments were completely rebuilt and enlarged during 1976. A high-priority running period for their use was approved and was scheduled in December using a quadrupole-triplet focusing system. The preliminary analysis of the data of

one of the experiments has yielded roughly 500 neutrino interactions that produce two outgoing muons, and several trimuon events. The properties of some of the trimuon events appear to be inconsistent with a hadronic origin. This is an exciting result likely to require further study. The 15-ft chamber was operated parasitically at that time and 22,000 pictures were taken.

A program of muon physics began in June. It was centered around continuation of two experiments. These included a further test of scaling of deep-inelastic muon scattering and a study of muon scattering from a hydrogen target in a spectrometer facility. Muon running requires the availability of a high-intensity proton beam. Use was, however, made of lower intensity during simultaneous neutrino-beam operation earlier in the year to produce hadrons for dimuon studies in the same large spectrometer facility. During the fall, the 30-in. chamber was operated with hydrogen and with deuterium fills and 580,000 pictures were taken. The graph below gives a summary of pictures taken in the 15-ft and 30-in. chambers during an 18 month period in 1975 and 1976.



Bubble chamber pictures for Fermilab experiments. A total of 810,000 bubble chamber pictures were taken during 1976 as follows: neutrinos in the 15-ft chamber - 190,000; hadrons in the 15-ft chamber- 40,000; hadrons in the 30-in. chamber 580,000.

Proton Area

The most exciting news during 1976 was the observation of a charmed baryon, photoproduced in a broad-band beam. The measurements were actually completed in

P-East in late 1975, but the analysis yielding the result was completed during this past year. The tagged-photon beam also in P-East was used for measurement of photon total cross sections. This running represented the first substantial use of this beam, which relies on use of a unique high-energy electron beam. In another experiment in P-East, a single-arm spectrometer was used for study of high-p_t hadron production. Later this device was coupled with a simple muon detector to measure hadronic production of muon pairs.

In the P-Center branch, the activities were dominated by use of a large two-arm spectrometer for e^+e^-, $\mu^+\mu^-$, and dihadron measurements. This work has led to explorations of two-particle spectra in the high-mass region. There was also a search in that branch for polarization of directly produced muons from proton interactions. These measurements were similar to others completed during 1975, but in a different kinematic region.

The P-West branch was used by three experiments. These included measurements of multi-photon production, p-p elastic scattering, and inclusive production of hadrons. These measurements have marked the end of a long wait during construction of focusing enclosures to reduce background from beam halo.

Meson Area

The program in the Meson Area extended into many aspects of hadron interactions. One of the most prominent activities was the search for hadronic production of charmed particles. So far there has not been evidence for this production; it has only been possible to set upper limits on the

production cross section, in spite of the fact that four experiments searched for these particles using several techniques. There was an extensive program by four experiments to study inclusive production of single charged and neutral hadrons over a wide range of kinematic variables. One of the experiments used the single-arm spectrometer facility supplemented by an array of detectors to measure the multiplicity of charged particles accompanying the single forward hadron.

A new program began in the M1 beam to measure elastic scattering from a polarized-proton target. These measurements are now continuing in 1977 at higher energy and at higher t-values. There have also been measurements in that beam of kaon-electron scattering for the purpose of determining the form factor of the charged kaon. The M1 beam itself was upgraded during September so that now the secondary energies reached can be very close to the normal 400-GeV primary proton energy. Other work on elastic scattering included those using a beam of neutral hyperons and wrap-up measurements of charged-hadron scattering in the Coulomb-nuclear interference region (at very small angles).

In the M4 neutral beam, a program of K^o-regeneration measurements has continued. Earlier work had been with a carbon regenerator, but during the early part of 1976, liquid hydrogen was used. At year's end, nuclear targets were used for total cross-section measurements and there were plans to determine the K^o charge radius through study of K_S^o regeneration from electrons in lead. A search was begun for large-p_t production of "jets" of hadrons produced in hadron interactions. The multiparticle

spectrometer facility was commissioned with the completion of one of the two experiments involved in the search.

Internal Area

A highlight of 1976 was the measurement of p-p inelastic scattering using a circulating proton beam at 500 GeV. The superconducting spectrometer in the Internal Target Area became operational and was used by two experiments studying proton elastic scattering. Some of this work has relied on use of a proton polarimeter to measure the polarization of the recoil proton from p-p elastic scattering.

All in all it was a very productive year for research at Fermi National Accelerator Laboratory. Hopes are high for an even more successful research program during 1977.

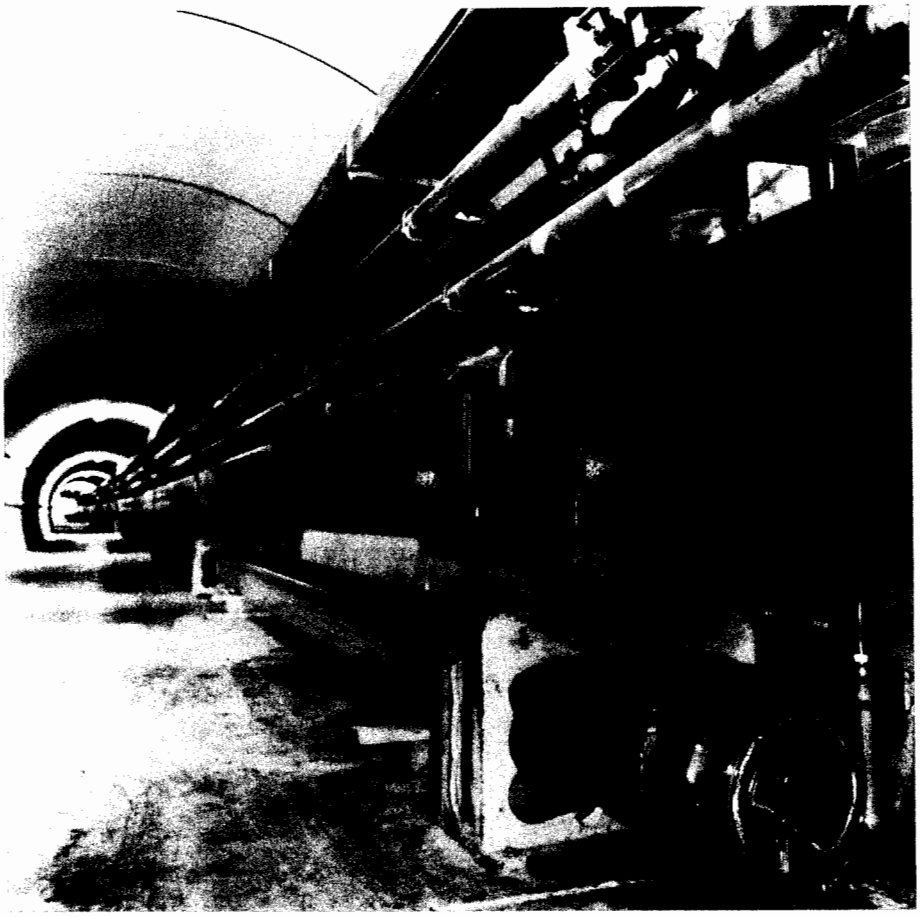
NOTES AND ANNOUNCEMENTS

FUTURE NEUTRINO EXPERIMENTS WORKSHOP. . .

This workshop is scheduled to be held at Fermilab April 21-22, 1977. Our purpose in holding this meeting is to consider proposals for new neutrino experiments and related facilities. There will be representatives from the Program Advisory Committee at this meeting, probably in the form of a panel, and the outcome of the discussions will form a major topic for consideration at the summer PAC meeting.

The Future Neutrino Experiments Workshop will be an open meeting, and all interested physicists are invited to attend and to participate in the discussion to the extent time permits. Groups interested in submitting proposals for future neutrino experiments/facilities to be presented at this workshop should observe the March 25 deadline.

Questions pertaining to the Future Neutrino Experiments Workshop should be addressed to T. Groves in the Director's Office.



Prototype Energy Doubler/Saver magnets installed in their design location 26 inches under the Main Ring.

RESEARCH ACTIVITIES DURING FEBRUARY 1977

James MacLachlan

The basic mode of accelerator operation for the entire month of February was a 400-GeV cycle with a one-second flattop. Both slow spill and a single-turn fast spill of about 10^{13} protons/pulse were provided. The first week continued the pattern of once-a-week Main-Ring feeder failure that prevailed in January and late December, but in mid-month two 2-day maintenance periods were taken to eliminate the routing of heavily loaded feeder cable through conduit at Main-Ring service buildings. All the recent faults have occurred where directly buried cable is brought up through conduit into an above-ground cubicle either to deliver load or simply for an access and tie point. The cables are within rating in the ground but substantially over rating in the conduit and cubicle and appear to have been significantly damaged during earlier running. The modification consisted of replacing non-load tie points by underground splices and delivering load to cubicles by an underground wye splice. This was a major project involving the reworking of 11 service buildings, the preparation of 45 in-line and 21 wye splices, the installation of 27 new terminations in the cubicles, and a total of 1682 man hours of electrical work in 5 shift sessions. It is believed that this effort has greatly reduced the likelihood of feeder failure. Several more service buildings will be given the same treatment during the April-May accelerator shutdown. The accelerator delivered beam for high-energy physics for 383 hours, which is 69% of the 557 hours scheduled. The repetition rate was generally about 11 seconds, and an intensity of about

1.8 to 2×10^{13} protons/pulse resulted in 2.1×10^{18} protons accelerated. In addition to the major interruptions several periods of accelerator instability and spill irregularity also disturbed the planned program. The week of February 7 was, practically speaking, a total loss with a two-day emergency feeder repair and a two-day feeder improvement maintenance period. Accelerator performance during the rest of the month was reasonably good.

The top priority in the experimental program was the antineutrino running in the 15-ft bubble chamber. The two-horn focusing system was used with a straight-ahead plug to reduce neutrino contamination. The chamber became operational on February 2. After about 4K pictures had been taken, it was discovered that one of the solenoid valves was being run at the wrong polarity for the experimenter's choice of field direction. Because of a coincidental failure of another solenoid valve, some chamber liquid was lost. The chamber was down because of this problem from February 4 to February 8. Thereafter, the chamber took pictures on about 90% of the available spills and ended the month with approximately 83K pictures with an average of approximately 10^{13} protons on target for each picture. The Neutrino Operations group devoted much effort to commissioning the bypass target for the N1 line to permit use of that beam by Particle Search #369 while the focusing horn is installed and to setting up of the N5 line to allow it to safely provide a diffracted proton beam to be used in Lab E by Particle Search #379.

The Proton Area started the month with the same experiments that have been running since mid December. Di-Hadron #494 was completed in

Proton-Central February 21, and Particle Search #325 was completed February 28, after having switched from dilepton production to a quark search at high p_T for the last 11 days of this run. The Princeton-Chicago group will now vacate the Proton-East Area, which they helped to bring into operation in June, 1973. Only p-p Elastic #177A remained at the month's end in P-West, struggling for statistics at their highest t-value while shutdowns were in progress in the Central and East branches; Photoproduction #401 was being installed in P-East and the changeover to the upgraded dimuon experiment, "Super 288," was underway in P-Central.

Highest priority in the Meson Area for most of the month was given to Polarized Scattering #61. The experimenters' top priority was to collect events for a 10% measurement of the scattering of 300-GeV protons from a polarized proton target in the dip region at $t \approx -1.4$ $(GeV/c)^2$. When their run ended February 24, they were close to their goal. The completion of Inclusive π^o #350 on February 24 marked the end of a series of experiments by the Cal Tech group that dates back to the earliest use of the M2 beam line in September, 1973. The M2 line was down at the end of the month for the installation of improved shielding in the tunnel and under the mezzanine in preparation for running with diffracted proton intensities as high as 10^{10} per pulse.

The installation of a second helium liquefier at the Internal Target Laboratory has permitted nearly continuous running of the superconducting spectrometer. Both p-p Polarization #313, which ran the first half of the month, and p-N Scattering #198A have had some solid running. During the

periods of marked accelerator instability early in the month, E-313 labored from time-to-time under restrictions on jet pressure, number of pulses, etc., because of possible effects on beam blowup. Despite the increased liquid-helium supply, there was seldom enough to permit useful running by p-N Scattering #381 which had made some effort to establish compatibility with the spectrometer experiments.

FACILITY UTILIZATION SUMMARY -- FEBRUARY 1977

I. Summary of Accelerator Operations

			Hours	
A.	Accelerator use for physics research			
	Accelerator physics research		31.7	
	High energy physics research		383.3	
	Research during other use		(37.4)	
		Subtotal		415.0
B.	Other activities			
	Accelerator setup and tuning to experimental areas		10.0	
	Program interruption — Scheduled 72.0, Adhoc 0.8		72.8	
	Unscheduled interruption		174.2	
		Subtotal		257.0
C.	Unmanned time			
		Total		672.0

II. Summaries of High Energy Physics Research Use

		# of Expts.	Hours	Results
A.	Counter experiments	14	2519.0	3 exp. completed
B.	Bubble chamber experiments	1	297.1	83,486 15-ft pictures
C.	Emulsion experiments	-	-	
D.	Special target experiments	2	-	2 target irradiations completed
E.	Test experiments	-	-	
F.	Engineering studies and tests	2	165.7	N5 & N1 beam tests
G.	Other beam use	-	-	
		19	2981.8	

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

A.	Beam accelerated in Main Ring @ 400 GeV		2.10
B.	Beam delivered to experimental areas		
	Meson Area		0.53
	Neutrino Area		1.00
	Slow Spill	0.03	
	Fast Spill	0.97	
	Proton Area		0.25
	Total		1.78

BEAM UTILIZATION BY

	Beam	Run Dates
MESON AREA		
Polarized Scattering #61	M1E	2/1-2/24
Nuclear Chemistry #81A	M0	
Multiparticle #110A	M6W	2/18-2/28
K^o Charge Radius #226/#486	M4	2/1-2/28
Backward Scattering #290	M6W	2/1-2/16
Inclusive π^o #350	M2	2/1-2/24
Form Factor #456	M1W	2/25-2/28
NEUTRINO AREA		
15' Antineutrino/H_2&Ne #180	N0	2/3-2/28
Particle Search #369	N1	2/20-2/28
Particle Search #379	N5	2/25-2/26
PROTON AREA		
p-p Elastic #177A	PW	2/1-2/28
Particle Search #325	P1	2/1-2/28
Nuclear Fragments #466	PE	2/1-2/28
Di-Hadron #494	PC	2/1-2/21
INTERNAL TARGET AREA		
p-N Scattering #198A	C0	2/18-2/28
p-p Polarization #313	C0	2/1-2/16
p-N Scattering #381	C0	2/1-2/28

EXPERIMENT -- FEBRUARY 1977

Activities

data: elastic scattering of protons @ 300 GeV from polarized proton target

data: one target exposed to 400-GeV protons

tests: setup and test of the multiparticle spectrometer

data: K_S^o regeneration from a lead regenerator

tests: continuation of checkout of the experiment, particularly PWC's

data: inclusive π^o production from 200 GeV π^-; experiment completed

tests: reestablish prior running conditions and work on rate dependence in PWC's

data: antineutrino events in 62% Ne/H_2 mixture from horn focused beam; beam; 83K pictures

tests: trigger studies and system tuneup

tests: trigger tests and system checkout

data: proton elastic scattering at 400 GeV in the range $12 \leq |\tau| \leq 18$

data: study of dilepton systems at high mass and a quark search at $t \approx 6$ $(GeV/c)^2$

data: completion of uranium foil exposure to 400-GeV protons started 1/21/77

data: high mass dihadron systems in various momentum and sign combinations

data: p-p elastic and inclusive scattering vs. s at $|t| \lesssim 2.4$ $(GeV/c)^2$

data: p polarization in p-p scattering by an analyzing scatter of the recoil proton

data: small-t elastic and inelastic scattering; parasitic running when adequate liquid helium is available

One of the Laboratory's Scottish Highland cattle models his winter coat.

MANUSCRIPTS AND NOTES PREPARED DURING FEBRUARY AND MARCH 1977

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

B. Y. Oh et al. Experiment #2B	Evidence for Double Pomeron Exchange at Fermilab Energies (Submitted to Phys. Rev. Lett.)
J. Whitmore Experiment #2B	Multiparticle Processes at Fermilab Energies (Submitted to the Division of Particles and Fields Meeting, American Physical Society, Brookhaven National Laboratory, October 6-8, 1976)
L. W. Mo Experiment #98	Review of Electron and Muon Scattering (Submitted to the Division of Particles and Fields Meeting, American Physical Society, Brookhaven National Laboratory, October 6-8, 1976)
J. Hébert et al. Experiment #233	Nuclear Interactions of 300 GeV Protons in Emulsion
J. Whitmore et al. Experiment #311	Properties of Inclusive $\pi^{\pm}$ Production in 100 GeV/c Antiproton-Proton Interactions (Submitted to Phys. Rev. Lett.)
M. D. Corcoran et al. Experiment #313	Preliminary Polarization Results at Fermilab Energies (Submitted to Coral Gables Orbis Scientiae, Coral Gables, Florida, January, 1977)
D. A. Garbutt et al. Experiment #418	Nuclear Size Dependence of Inclusive Particle Production (Submitted to Phys. Lett.)
W. Bozzoli et al. Experiments #419 and #462	Search for Short Lived Particles Produced By 300 and 400 GeV/c Protons in Nuclear Emulsions (Submitted to Nuovo Cimento Lett.)

Theoretical Physics

L. A. Balázs	Planar Bootstrap Without the Dual-Tree Approximation (FERMILAB-Pub-76/93-THY; submitted to Phys. Rev.)

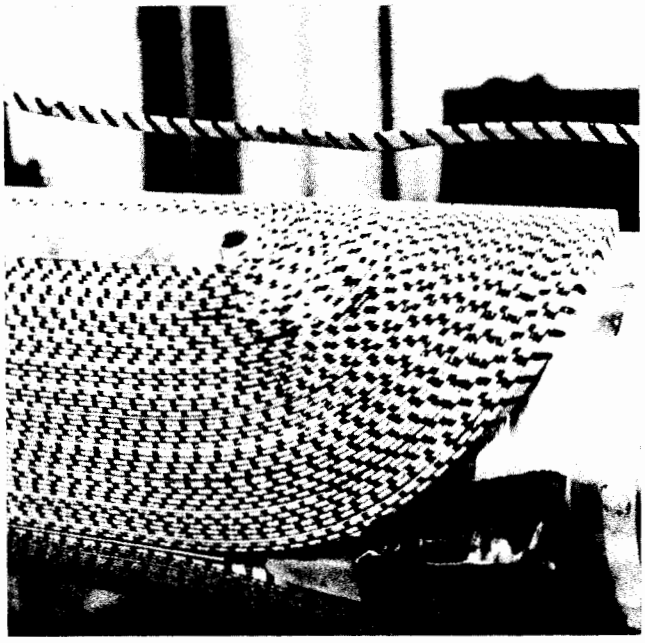
H. J. Lipkin	The Case Against the Pseudoscalar Nonet and SU(4) Symmetry in Meson Spectroscopy (FERMILAB-Pub-76/94-THY; submitted to Phys. Rev. Lett.)
V. A. Matveev	Cancellation of the Zero-Mode Singularities in Soliton Quantization Theory (FERMILAB-Pub-76/95-THY; submitted to Nucl. Phys. B)
D. W. Duke	Nucleon Exchange and Decay Angular Dependence in High Energy Nucleon Diffraction Dissociation (FERMILAB-Pub-76/96-THY; submitted to Phys. Lett.)
H. J. Lipkin	Can Pedestrians Understand the New Particles or Who Needs the Okubo-Zweig-Iizuka Rule (FERMILAB-Conf-76/98-THY; submitted to the Erice Conference, Italy, August, 1976)
K. Igi	Factorization of Regge Slopes for Ordinary and New Hadrons and their Spectroscopy (FERMILAB-Pub-76/100-THY; submitted to Phys. Rev. D)
B. W. Lee	Gauge Theories of Microweak CP Violation (FERMILAB-Pub-76/101-THY; submitted to Phys. Rev.)
K. M. Bitar	Instantons in Gauge Groups Larger Than SU(2) (FERMILAB-Pub-77/15-THY; submitted to Phys. Rev. D)
H. J. Lipkin	The Alexander. . . Zweig Rules and What Is Wrong with Pseudoscalar Mesons (FERMILAB-Conf-77/16-THY; submitted to Coral Gables Orbis Scientiae, Coral Gables, Florida, January, 1977)
B. W. Lee et al.	Muon and Electron Number Nonconservation in a V-A Six-Quark Model (FERMILAB-Pub-77/20-THY; submitted to Phys. Rev. Lett.)

Physics Notes

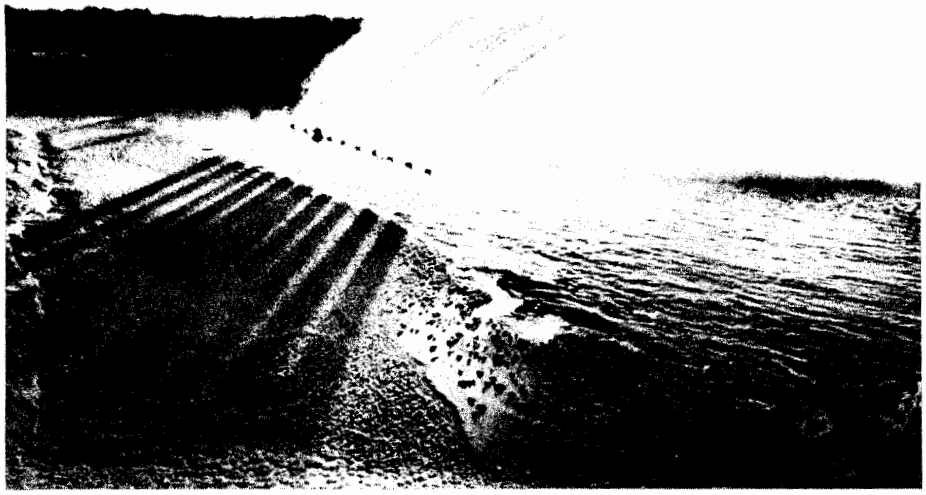
L. C. Teng	A "Conventional" Accelerator System for Inertial Fusion Using Heavy Ion Beams (FN-302)

DATES TO REMEMBER

March 31, 1977	Deadline for request for Fermilab Summer Housing. Please register as soon as possible.
April 21-22, 1977	Future Neutrino Experiments Workshop
May 6, 1977	Deadline for receipt of all new proposals and other written materials to be considered at the Summer meeting of the Program Advisory Committee
May 13-14, 1977	Users Annual Meeting
May 19-20, 1977	Proposal Presentation Meeting
June 18-24, 1977	Summer meeting of the Fermilab Program Advisory Committee



A close-up view of the winding of a superconducting dipole.



Main-Ring fountain casts haunting shadows across an ice-encrusted landscape.
(Photograph by Anthony R. Donaldson)