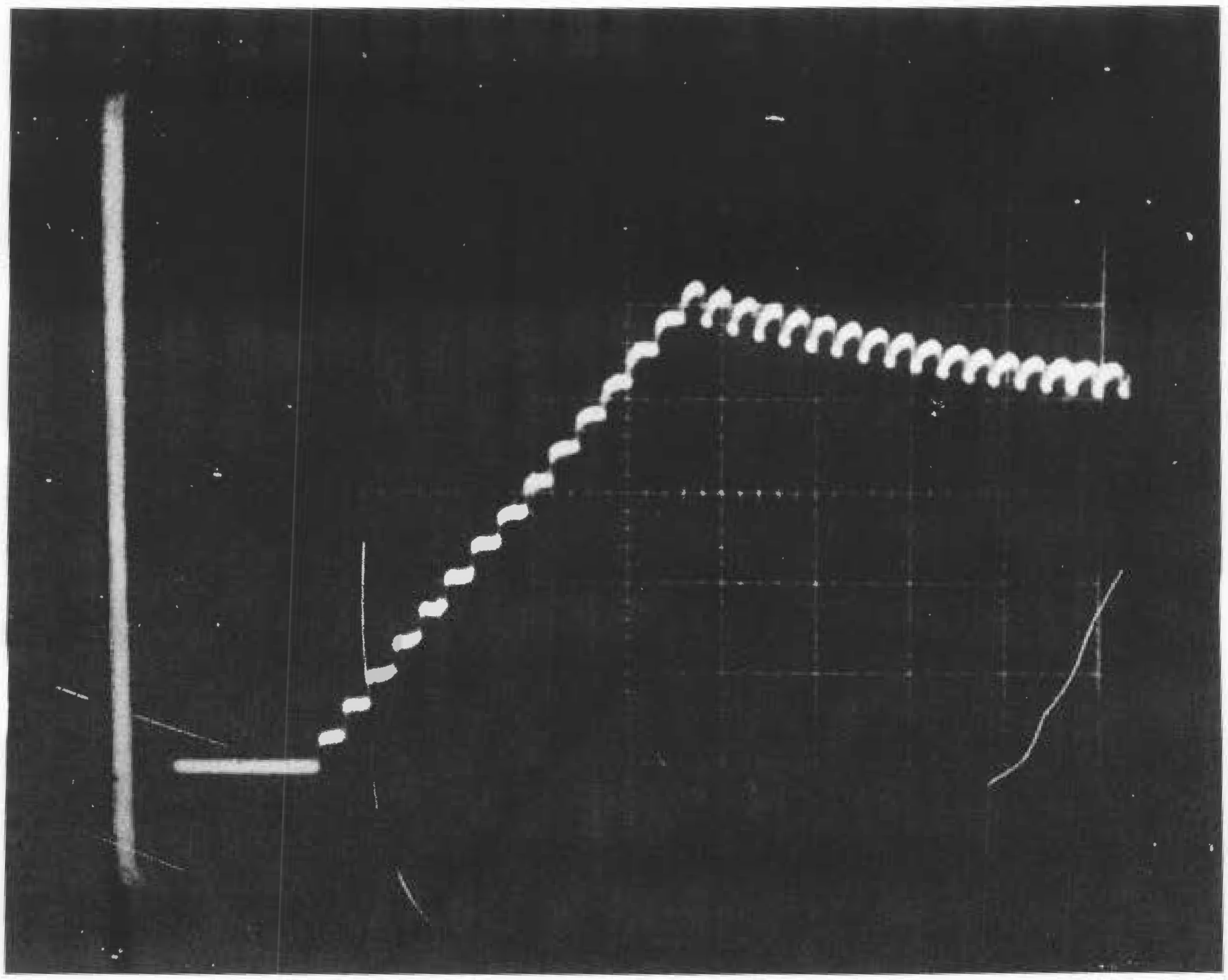
fermilab report

Fermi National Accelerator Laboratory Monthly Report

April 1978



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F. T. Cole, Editor R. Donaldson, Assistant Editor

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THE COVER: Injection of 14 H^- Linac pulses into the Booster. The stripped beam then circulated in the Booster (in the right-hand part of the oscilloscope trace).

Operated by Universities Research Association Inc. under contract with the United States Department of Energy

Charles Schmidt, Wesley Smart, Cyril Curtis, Curt Owen (at the linac controls), Lawrence Allen and Lin Winterowd during the initial H^- tests.
(Photograph by Fermilab Photo Unit)

POSITIVE RESULTS WITH NEGATIVE HYDROGEN-ION INJECTION

C. M. Ankenbrandt, C. W. Owen, and
the Staffs of the Linac and Booster Groups

Initial trials of H^- injection into the Booster were carried out with very encouraging results during the coal-strike shutdown. A high point was the establishment of a new Booster intensity record of 3.46×10^{13} protons per Main-Ring cycle, a significant improvement over the previous record of 3.06×10^{13}. The new record was attained while injecting 15 turns of 24 mA H^- beam at 200 MeV from the Linac, corresponding to 8×10^{13} protons per Main-Ring cycle. The rapid success testifies both to the careful preparations by the Linac and Booster groups during the last two years and also to the essential simplicity of the method.

To appreciate the advantages of H^- injection, it is instructive to consider the limitations of previous injection methods. The original Fermilab design called for the injection into the Booster of four turns $\times$ 75 mA of protons from the Linac. Conventional injection into a circular accelerator requires the use of time-varying electromagnetic fields to move the particle orbits; otherwise the particles will hit the inflector electrodes on successive turns. The time-varying fields cause successive turns to be stacked side-by-side, thereby increasing the size of the injected beam. This illustrates the general restriction on beam density imposed by Liouville's theorem; it is impossible to increase the density of particles in phase space by means of conservative forces. In the case of the Booster, this so-called stacking in radial betatron space produces beams larger than the Booster can accept.

Since the acceptances of the Booster, the 8-GeV transport line, and the Main Ring are approximately matched, increasing the acceptance of the Booster would not solve the problem, but would merely transfer the losses downstream. Another drawback is that it is operationally difficult to set up and maintain the time-varying fields required for this method.

Use of one-turn injection into the Booster led to considerable improvement. This was made possible by a major change in the Linac mode of operation: the acceleration of very intense (up to 300 mA), short (4 μsec) beams of protons. The breakthrough was the realization that the Linac could provide very intense current for a short pulse. In time, record Booster and Main-Ring intensities, 3.06×10^{13} and 2.52×10^{13}, were achieved with very much simplified injection into the Booster. A single-turn kicker corrects the injection offset by deflecting the incoming beam onto the closed orbit, thereby avoiding large betatron oscillations that lead to beam growth.

The drawbacks of the single-turn mode of operation are that space-charge forces of the intense beam in the beam transport cause the beam qualities to degenerate and that control of the beam properties becomes more difficult as the current is raised. The Booster itself imposes additional limitations because of space-charge forces, particle instabilities, and barely adequate rf voltage. The net result is that Booster transmission declines from nearly 100% at very low current to about 60% with 5×10^{13} injected.

H^- injection circumvents the aforementioned limitations of the other injection methods. Relatively modest currents of 30 mA or less are used, for which the Linac can produce a long (50-100 μsec) pulse of very high quality and stability without subsequent deterioration due to space-charge forces. It is possible to inject many turns into the same phase space, avoiding the limitation of Liouville's theorem, because protons and H^- bend in opposite directions in magnetic fields and because a non-conservative process is used to change the H^- into protons. The trajectories of circulating protons and injected H^- are brought together by pulsed magnetic fields at injection; both protons and H^- then encounter a thin carbon stripping foil, where the H^- ions lose their two electrons and become protons, augmenting the circulating beam. After injection, the pulsed magnetic fields die away, moving the circulating beam off the foil. The multiple scattering and energy loss caused by the foil during the injection process are relatively small. The optimization of foil thickness, number of turns and magnitude of current for a given intensity must be determined empirically.

Although the primary motivation for the H^- project is added intensity for the high-energy physics program, there are other advantages. The addition of a second preaccelerator system and another injection method into the Booster provide redundancy, diminishing the probability of extended downtime because of failures of preaccelerator or injection apparatus. It should also be easier to vary the intensity with minimal retuning in response to varying requirements by changing the number of turns injected into the Booster.

The H^- ions also provide flexibility for the Linac, which serves not only the high-energy physics program but also the Cancer Therapy Facility and, in the future, the Electron Cooling Ring. The varying beam requirements of these three programs can be served relatively easily by varying the pulse width on a time-sharing basis.

Although charge-exchange injection has been used for almost 20 years in low-current heavy-ion accelerators, application to high-energy physics awaited the development of a high-current H^- ion source. The pioneering work on such a source was carried out by G. I. Dimov at Novosibirsk. Subsequently, Th. Sluyters built a similar source at Brookhaven. The success of H^- injection into the ZGS at Argonne added to the confidence necessary to proceed with the Fermilab project. The source developed at Fermilab by C. Schmidt is a highly modified version of the Brookhaven source. This source is fundamental to the success of H^- injection.

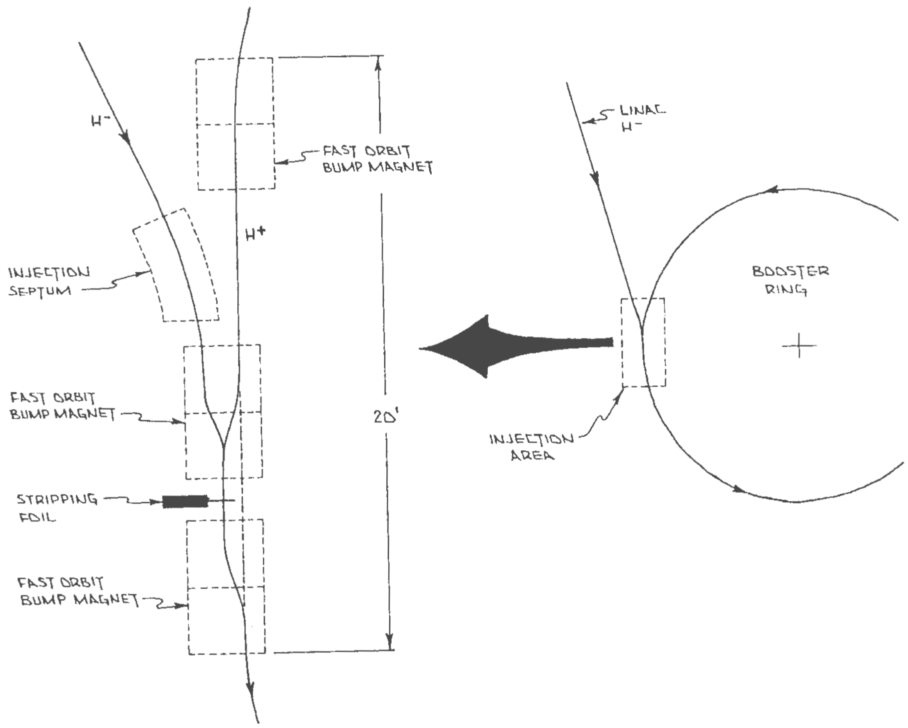
A second Cockcroft-Walton preaccelerator system incorporating the new source was developed under the guidance of C. D. Curtis. The necessarily complex beam-transport system which matches the negative-ion beam to the Linac was designed and successfully commissioned by W. Smart. M. Shea and R. Goodwin developed a new microprocessor-based control system interfaced to the existing Linac control system. Electrical and mechanical engineering efforts were overseen by A. Donaldson and G. Lee, respectively.

C. Owen carried out the modifications of the Linac itself. H^- beam was first accelerated through the Linac to 200 MeV last October 12. Since then, currents as high as 42 mA have been reached, well above the design goal of 30 mA for 70 μsec (25 turns). This design goal corresponds to 1.7×10^{14} protons per Main-Ring cycle, about 2.5 times the capability with single-turn proton injection. How many of the available protons the Booster can successfully accelerate to full energy is a question of intense current interest.

C. Hojvat is in charge of the work at the Booster end. The design was initiated by R. Johnson when he was group leader and continued under C. Ankenbrandt. The first step was to replace three dipoles in the 200-MeV line, which were strong enough to cause premature field stripping of the H^- ions. Schemes to reverse the dipoles and quadrupoles in the 200-MeV line were also worked out.

The injection apparatus in the Booster itself has been completely replaced with components for both H^- and single-turn proton injection, all mounted on a box girder. The layout is shown in the figure on the next page. The Fermilab Magnet Facility has aided in the construction of the pulsed magnets needed for the two injection methods. K. Bourkland developed the necessary pulsed power supplies. D. Cosgrove was responsible for the mechanical design of the girder, aided by T. Schmitz. D. Maxwell and J. Wildenradt spearheaded the mechanical assembly and installation and provided expertise with vacuum techniques.

The most delicate component is the stripper itself, a carbon foil 2-in. × 1.4-in. in area. Thicknesses of 100, 200, and 300 $\mu g/cm^2$ are being tried. The foils are mounted in a C-shaped frame; the beam moves across the free

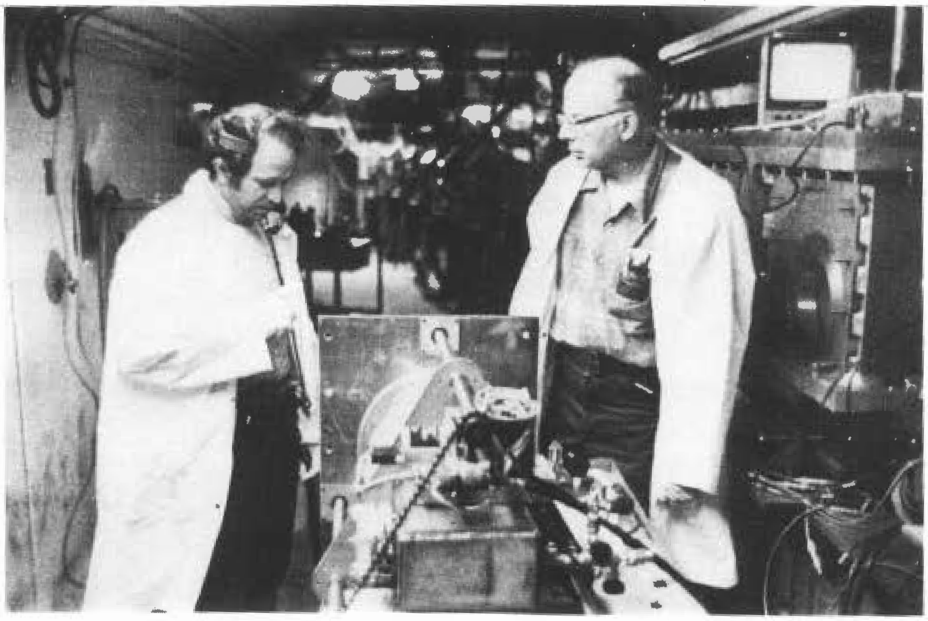


Schematic layout of H^- injection into the Booster.

edge after injection. Foil lifetimes greater than 120 hours have been obtained in beam-exposure tests. A simple conveyor-belt device for remotely changing foils has been incorporated in the design.

The application of negative-ion injection to Fermilab was originally suggested by L. Teng, who has supported and helped the work at all stages.

Many other people have also contributed to the success of this project. Their contributions are gratefully acknowledged.



Carlos Hojvat (left) and David Cosgrove (right) in the Booster tunnel working on the new injection girder.

(Photograph by Fermilab Photo Unit)

Sparking across the terminals of a 150-kV high voltage switch. The switch and dummy load are employed in the testing of the power supply for the electron cooling ring high voltage. The switch and load were designed and fabricated by A. R. Donaldson and M. R. Palmer.

(Photograph by Fermilab Photo Unit)

ANTIPROTON-PROTON COLLISION WORKSHOP

A lively and productive workshop on High-Luminosity Antiproton-Proton Collisions was held from March 27 to 31 at the Lawrence Berkeley Laboratory, jointly sponsored by LBL and Fermilab. The focus of the workshop was on beam cooling and its use for producing antiproton beams useful for colliding beams.

It is believed by both groups working on adaptations of existing accelerators for $p\bar{p}$ collisions, Fermilab and CERN, that with some development they will be able to achieve luminosities approaching $10^{30}/cm^2$-sec. One of the conclusions of the workshop was that a luminosity of $10^{31}/cm^2$-sec is not beyond the bounds of technical feasibility. Beyond 10^{31}, one may be limited by the increasing size of the beam-beam tune shift. In any case, such higher luminosities may well swamp the detectors planned.

Methods of increasing the luminosity also were made more clear by the work of the meeting. There are significant gains in antiproton production to be made by increased target efficiency, for example by using a field-immersion lens to concentrate the antiprotons as they are produced. Thus higher luminosities appear both useful and feasible.

The theory of cooling also received attention during the week. In the case of stochastic cooling, the theory is well understood for unbunched beams, but is not so clear when bunching is included. Stochastic cooling is more efficient than electron cooling when the antiproton (or more generally, the heavy-particle) beam emittance is large, that is, when its temperature is high. But for a low-temperature beam, electron cooling is more efficient.

One of the outstanding results of the workshop was the demonstration that electron cooling can be done at high energy, say 50 GeV. Budker himself understood that cooling could be done at these high energies and mentioned the possible use of an electron storage ring. The energy given to the electrons by the antiprotons is radiated away by them as synchrotron radiation. Electron storage rings had been considered in the Fermilab studies in 1976 and had shown that reasonable cooling rates could be achieved under some conditions. At the workshop, it was demonstrated that the cooling conditions at 50 GeV (density, temperature, etc.) can be scaled directly from those realized experimentally in the NAP-M work at Novosibirsk.

High-energy cooling is an important new development that may well have profound implications for Fermilab cooling in particular and for accelerator design in general.

NOTES AND ANNOUNCEMENTS

SPECIAL PRESENTATION MEETING FOR HADRON JET PROPOSALS. . .

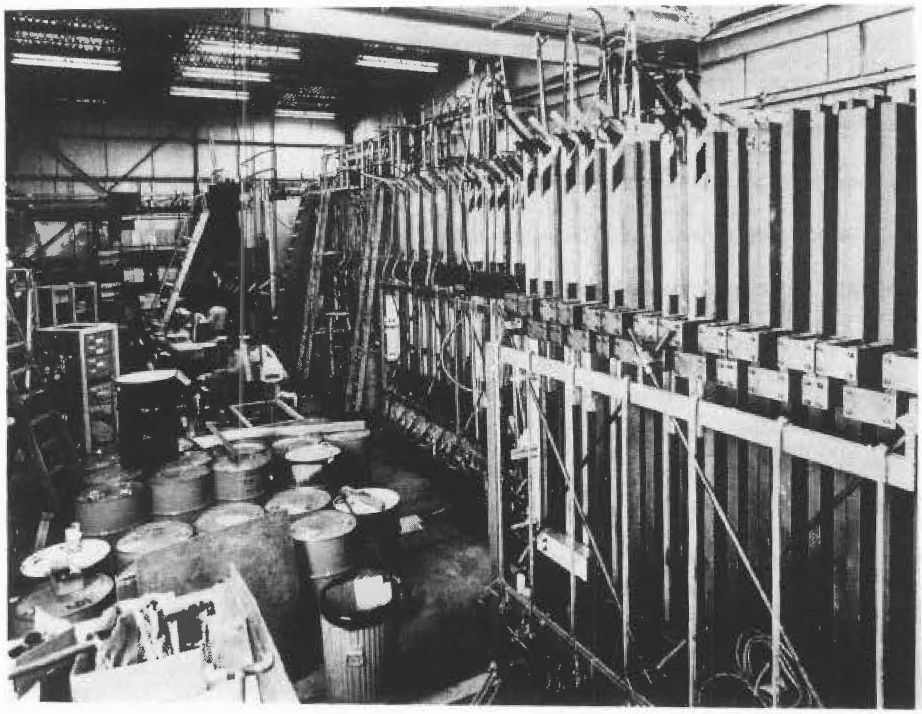
At the request of our Physics Advisory Committee, proposals for hadron jet experiments that are before us for consideration following the May 5 deadline will be presented in a special meeting rather than at the general Proposal Presentation Meeting May 18-20. This special meeting will be held at Fermilab on Friday, June 2. Our plans for that meeting include a presentation on current theoretical interpretations of the significance of hadron jets, a summary of what has been learned to date from hadron-jet experiments already carried out at Fermilab, a review of the objectives of the currently approved hadron-jet experiment E-557 and presentations of the new proposals. At the present time these include P-246 (Selove), P-587 (Schlein) and P-590 (Young).

This special presentation meeting will be open to all interested physicists. The new proposals will be considered at the summer meeting of the PAC in Aspen in June. A panel of PAC members will be in attendance at the special presentation meeting to make a preliminary evaluation of the new proposals. Questions regarding this special presentation meeting should be directed to T. Groves in the Director's Office.

OPERATIONS CENTER DEACTIVATED. . .

On Monday, April 3, the Operations Center at Fermilab was deactivated. The Center had provided liaison between personnel in the experimental areas and the accelerator main control room. With a reorganization, this responsibility for liaison is now being handled by Crew Chiefs in the experimental areas. To aid in resolving conflicts, two Duty Physicists are on call for four-week periods. Those presently serving are Gene Fisk and Tom Nash.

Detailed information about the status and progress of the experimental program is available from the Program Planning Office. Two Experiment Coordinators assigned there, Dave Burkhart and Ken Shafer, are available primarily weekdays to answer questions about the operations schedule or the status of the research program. All records regarding the use of the accelerator and experimental facilities are also being kept by the Program Planning Office.



The E356 Lab E neutrino detector under construction. Pictured in the right foreground is one of the 112-ton modules of the iron, scintillator, spark chamber target calorimeter. Following the six modules of target is the 750-ton iron toroidal muon spectrometer used in E379, E482, and E356 to identify muons. The barrels in the foreground and on top of the target contain liquid scintillator used in the eighty 10 ft × 10 ft counters.

(Photograph by Fermilab Photo Unit)

SUMMARY OF OPERATIONS - MARCH 1978

Program Planning Office

The most important feature of research operations at Fermilab during the month of March was that activities were allowed to begin again following a two-week shutdown. The Department of Energy had directed the research program to be interrupted on February 22 due to concern over the availability of energy during the coal strike. The directive was withdrawn on March 8 and after about a day to complete a few development projects which had been underway, and another day for tuneup of the accelerator, the research program again was in full swing. Most remarkable was the fact that within a couple of hours after stable beam was available several experiments were again taking data. Running for the first weekend was accomplished using the new H^- injection system. However, it was necessary to return again to H^+ injection after complications due to contamination in the new source briefly interrupted operations.

As a result of study of operating the accelerator and experiments with day/night pricing it was decided during March to make changes which will hopefully improve the overall operating efficiency. The daytime power demand level was raised slightly to enable shorter times between accelerator cycles; normal daytime cycles are now 16-17 sec. Also, the time scheduled for accelerator studies and maintenance and development was rearranged to reduce the number of startups.

FERMI NATIONAL ACCELERATOR LABORATORY
MONTHLY OPERATIONS HISTORY
MARCH 1978

Date		Accelerator	Int. Target Area	Proton Area	Neutrino Area	Meson Area
Wed.	3/1	Shutdown Imposed by the Department of Energy				
Thu.	3/2	Due to the Coal Strike				
Fri.	3/3	(since Wed., Feb. 22)				
Sat.	3/4					
Sun.	3/5					
Mon.	3/6					
Tue.	3/7					
Wed.	3/8					
Thu.	3/9					
Fri.	3/10	Accelerator Startup				
Sat.	3/11	~1.4x10^{13}ppp	Proton Polariz. 522	Photoprod. 87A (PE)	Muon 203A/391 &	Multi-μ 439 (M2) Incl. K^o_s 383 (M4)
Sun.	3/12	@400 GeV (1.25 sec flattop)		Di-Lepton 288 (PC)	Muon 448 (N1)	Multipart. 110A (M6W)
Mon.	3/13	Reprs: Ret. to H^+ Injection		P 519 Tests (PW)	Yield Meas. (N3)	Part. Search 490 (M1W)
Tue.	3/14				ν253 (N0) Yield Meas. (N3)	
Wed.	3/15	Reprs: MR Magnet			Muon 203A/391 &	
Thu.	3/16				Muon 448 (N1)	
Fri.	3/17	Reprs: MR Feeder			Yield Meas. (N3)	
Sat.	3/18	~1.4x10^{13}ppp @400 GeV				
Sun.	3/19	(1.25 sec flattop)				
Mon.	3/20					
Tue.	3/21	Accelerator Studies				
Wed.	3/22					
Thu.	3/23	~1.8x10^{13}ppp @400 GeV	p-N Scattering 552		Muon 203A/391 &	
Fri.	3/24				Muon 448 (N1)	
Sat.	3/25				Neutrino 310 Calib. (N5)	
Sun.	3/26					
Mon.	3/27					
Tue.	3/28					
Wed.	3/29	Accelerator Studies and Maintenance & Development				
Thu.	3/30					
Fri.	3/31	Repairs: Booster and Linac				

BEAM UTILIZATION BY

	Beam	Hours
MESON AREA	M6W	220.4
Multiparticle #110A	M4	245.1
Inclusive K_s^o #383	M2	250.3
Multi-Muon #439	M1W	210.5
Particle Search #490	M0	-
Nuclear Chemistry #81A		
NEUTRINO AREA	N1	223.4
Muon #203A/391	N0	25.7
Neutrino #253	N5	122.6
Neutrino #310 Calibration	N1	222.9
Muon #448	N0	-
Nuclear Fragments #466		
PROTON AREA	P1	284.2
Photoproduction #87A	PC	269.2
Di-Lepton #288	PW	196.7
P #519 Tests		
INTERNAL TARGET AREA	C0	156.6
Proton Polarization #522	C0	115.9
p-N Scattering #552		2543.5
Total Hours for Experiments		147.1
Engineering tests (N3 meas.)		2690.6
TOTAL HOURS FOR HIGH ENERGY PHYSICS		

EXPERIMENT -- MARCH 1978

Activities

data: primarily for study of the reaction $\pi^- p \rightarrow \pi^+ \pi^- n$ at 20, 50, and 175 GeV

data: for study of the reaction $K^- p \rightarrow K_S^O X$ at 200 GeV

data: for study of the high mass dimuon & multimuon spectra produced by 400-GeV proton interactions

tuneup: including tests of a new high pressure streamer chamber

data: 3 targets exposed

data: including a search for heavy neutral leptons produced in muon interactions at 225 GeV

tests: of ability to collect data using a 1.25-sec slow spill

calibration: of liquid and iron calorimeters using a hadron beam

data: study of muon interactions with nuclear targets at 225 GeV

data: 2 targets exposed

data: search for charmed states produced in photon interactions

data: for study of the high mass dimuon spectrum produced by 400-GeV proton interactions

tests: of ability to collect data using a high-intensity proton beam

data: complete; study of recoil proton polarization from inclusive pp scattering

data: pp and pd scattering studies using an internal proton beam

FACILITY UTILIZATION SUMMARY--MARCH 1978

I. Summary of Accelerator Operations

		Hours	
A. Accelerator use for physics research			
Accelerator physics research		51.1	
High energy physics research		300.6	
Research during other use		-	
	Subtotal		351.7
B. Other activities			
Accelerator setup and tuning to experimental areas			
Program interruption		225.8	
Unscheduled interruption		166.5	
	Subtotal		392.3
C. Unmanned time		-	
	Total		744.0

II. Summaries of High Energy Physics Research Use

	# of Expts.	Hours	Results
A. Counter experiments	12	2346.8	1 exp. complete
B. Bubble chamber experiments	-	-	-
C. Emulsion experiments	-	-	-
D. Special target experiments	2	-	5 targets exposed
E. Test experiments	1	196.7	P 519 tests
F. Engineering studies and tests	(1)	147.1	N3 yield measurements
G. Other beam use	-	-	
	15	2690.6	

III. Number of Protons Accelerated and Delivered @ 400 GeV ($\times 10^{18}$)

A. Beam accelerated in Main Ring		1.61
B. Beam delivered to experimental areas		1.52
Meson Area		0.32
Neutrino Area	Slow Spill	1.07
	Fast Spill	0.00
Proton Area		0.13

Prof. M. Stanley Livingston during a recent visit to Fermilab, which he helped to found.

(Photograph by Fermilab Photo Unit)

SITUATION REPORT - APRIL 1978

PAGE 1 — FERMI NATIONAL ACCELERATOR LABORATORY — PROGRAM PLANNING OFFICE, 12 APR 1978

EXPERIMENTAL PROGRAM SITUATION REPORT

THE EXPERIMENTAL PROGRAM SITUATION AT FERMILAB IS SUMMARIZED BELOW. THE EXPERIMENTS ARE LISTED SEPARATED BY EXPERIMENTAL AREA UNDER CATEGORIES THAT BEST DESCRIBE THEIR CIRCUMSTANCE AS OF APRIL 1, 1978. FOR EXPERIMENTS WHICH HAVE BEEN COMPLETED OR HAVE RECEIVED BEAM THERE IS INDICATION OF THE AMOUNT OF RUNNING TIME OR EXPOSURE. THE EXPERIMENTAL AREA NAMES ARE ABBREVIATED AS FOLLOWS: MESON AREA (MA), NEUTRINO AREA (NA), PROTON AREA (PA), INTERNAL TARGET AREA (ITA).

TOTAL NUMBER OF APPROVED EXPERIMENTS - 284

A. EXPERIMENTS THAT HAVE COMPLETED DATA TAKING (223):

(ONLY EXPERIMENTS COMPLETED SINCE 1 JAN 1978 ARE LISTED BELOW)

AREA-BEAM	EXPERIMENT	SPOKESPERSON	EXTENT OF RUN TO DATE	DATE COMPLETED
MA-M1	DETECTOR DEVELOPMENT #427	YUAN	40 HOURS	10 JAN 1978
-M3	PARTICLE SEARCH #540	LONGO	600 HOURS	21 FEB 1978
-M6	ASSOCIATED PRODUCTION #99	DIEBOLD	750 HOURS	24 JAN 1978
NA-NO-TRIPLET	NEUTRINO #482	BARISH	1,600 HOURS	3 JAN 1978
	15-FOOT NEUTRINO/H2&NE #546	HUSON	375K PIX	26 JAN 1978
-MUON/HADRON	DI-MUON #444	SMITH	1,100 HOURS	3 JAN 1978
-OTHER	EMULSION/PI- @ 300 #481	TAKAHASHI	7 STACKS	18 JAN 1978
	EMULSION/PI- @ 300 #503	OGATA	4 STACKS	18 JAN 1978
	EMULSION/PI- @ 300 #506	DAKE	2 STACKS	15 JAN 1978
	EMULSION/PI- @ 300 #525	WILKES	2 STACKS	15 JAN 1978
	EMULSION/PI- @ 300 #568	HEBERT	3 STACKS	15 JAN 1978
	EMULSION/PI- @ 300 #573	USHIDA	3 STACKS	15 JAN 1978
	EMULSION/PI- @ 300 #574	WOLTER	4 STACKS	18 JAN 1978
	EMULSION/PROTONS @ 400 #499	IWAI	5 STACKS	15 JAN 1978
	EMULSION/PROTONS @ 400 #547	JACQUOT	24 STACKS	15 JAN 1978
	EMULSION/PROTONS @ 400 #575	LORD	2 STACKS	15 JAN 1978
ITA-C-O	PROTON POLARIZATION #522	OGREN	700 HOURS	21 MAR 1978

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B. EXPERIMENTS THAT ARE IN PROGRESS (23):

AREA-BEAM	EXPERIMENT	SPOKESPERSON	EXTENT OF RUN TO DATE	DATE OF RECENT RUN
MA-M2	MULTI-MUON #439	GARELICK	1,300 HOURS	1 APR 1978
	PARTICLE SEARCH #468	STEINBERG	300 HOURS	1 OCT 1977
-M4	INCLUSIVE K-SHORT #383	KOBRAK	1,800 HOURS	1 APR 1978
-M6	MULTIPARTICLE #110A	DZIERBA	1,500 HOURS	1 APR 1978
	BACKWARD SCATTERING #290	BAKER	950 HOURS	1 JAN 1978
-OTHER	NUCLEAR CHEMISTRY #81A	KAUFMAN	164 BOMBARDMENTS	1 APR 1978
NA-NO-HORN	15-FOOT NEUTRINO/H2 #45A	STEVENSON	162K PIX	1 APR 1976
	15-FOOT ANTI-NEUTRINO/H2&NE#180	KAFTANOV	273K PIX	1 JUL 1977
-NO-TRIPLET	NEUTRINO #310	CLINE	3,650 HOURS	1 APR 1978
	NEUTRINO #253	MO	450 HOURS	1 APR 1978
-MUON/HADRON	TEST MUON IRRADIATION #501	LANDE	2 TARGETS EXPOSED	1 JAN 1977
	MUON #203A	KERTH	650 HOURS	1 APR 1978
	MUON #391	KERTH	UNSPECIFIED	
	MUON #448	LOOMIS	500 HOURS	1 APR 1978
-15-FT	15-FOOT PI- - P @ 100 #83A	KITAGAKI	11K PIX	1 APR 1975
	15-FOOT PI- - P&NE @ 200 #89	FRETTER	4K PIX	1 JUL 1975
	15-FOOT PI- - P @ 360 #384	LANNUTTI	20K PIX	1 APR 1976
-OTHER	MONOPOLE #502	BARTLETT	COSMIC RAY RUNNING	1 JUL 1977
	NUCLEAR FRAGMENTS #466	KAUFMAN	9 TARGETS EXPOSED	1 APR 1978
PA-PE	PHOTOPRODUCTION #87A	LEE	4,400 HOURS	1 APR 1978
	PHOTOPRODUCTION #152B	HEUSCH	900 HOURS	1 JAN 1978
-PC	DI-LEPTON #288	LEDERMAN	5,950 HOURS	1 APR 1978
ITA-C-O	P-N SCATTERING #552	SANNES	850 HOURS	1 APR 1978

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C. EXPERIMENTS THAT ARE IN TEST STAGE (2):

AREA-BEAM	EXPERIMENT	SPOKESPERSON	EXTENT OF RUN TO DATE	DATE OF RECENT RUN
MA-M1	HADRON DISSOCIATION #272	FERBEL	300 HOURS	1 APR 1978
	PARTICLE SEARCH #490	SANDWEISS	200 HOURS	1 APR 1978

****

D. EXPERIMENTS BEING INSTALLED (7):

AREA-BEAM	EXPERIMENT	SPOKESPERSON	EXTENT OF APPROVAL
MA-M2	XI-ZERO PRODUCTION #495	HELLER	400 HOURS
	LAMBDA BETA DECAY #361	PONDROM	300 HOURS
-M3	PI-MU ATOMS #533	SCHWARTZ	500 HOURS
-M4	KAON CHARGE EXCHANGE #585	ABOLINS	600 HOURS
-M6	PARTICLE SEARCH #469	CUTTS	150 HOURS
	INCLUSIVE SCATTERING #451	BARTON	400 HOURS
NA-NO-DICHROM	NEUTRINO #356	BARISH	1,000 HOURS

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E. EXPERIMENTS TO BE SET UP WITHIN A YEAR (16):

AREA-BEAM	EXPERIMENT	SPOKESPERSON	EXTENT OF APPROVAL
-NO-DICHROM	15-FOOT NEUTRINO/H2&NE #380	BALTAY	200K PIX
	15-FOOT ANTI-NEUTRINO/H2&NE#388	PETERSON	200K PIX
	NEUTRINO #594	WALKER	PARASITIC RUNNING
-NO-WB HORN	15-FOOT NEUTRINO/D2&HIZ #545	SNOW	240K PIX
	15-FOOT ANTINEUTRINO/D2&HIZ#542	CARMONY	150K PIX
	NEUTRINO #531	REAY	PARASITIC RUNNING
	NEUTRINO #553	RAND	PARASITIC RUNNING
	15-FOOT & EMULSION/NEUTRINO#564	VOYVODIC	PARASITIC RUNNING
PA-PE	PHOTOPRODUCTION #401	GORMLEY	600 HOURS
	PHOTOPRODUCTION #516	NASH	1,000 HOURS
-PC	CHARGED HYPERON #497	LACH	400 HOURS
-PW	NUCLEAR SCALING #592	FRANKEL	300 HOURS
	PION INCLUSIVE #258	SHOCHET	800 HOURS
	DI-MUON #326	SHOCHET	800 HOURS
	C-TEST #302	CESTER-REGGE	400 HOURS
	PARTICLE SEARCH #567	CESTER-REGGE	500 HOURS

NOTE: THE ABILITY TO SET UP THESE EXPERIMENTS DURING THE NEXT YEAR IS CONTINGENT ON THE AVAILABILITY OF FUNDS.

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F. OTHER APPROVED EXPERIMENTS (13):

AREA-BEAM	EXPERIMENT	SPOKESPERSON	EXTENT OF APPROVAL
MA-M1	PARTICLE SEARCH #515	ROSEN	800 HOURS
-M6	HADRON JETS #557	MALAMUD	1,600 HOURS
NA-15-FT	15-FOOT P - P & NE @ 400 #291	MANN	25K PIX
-30-IN	30-INCH HYBRID #570	PLESS	1,500 HOURS
	30-INCH HYBRID #565	YAMAMOTO	PARASITIC RUNNING
	30-INCH HYBRID #597	WHITMORE	1,000 HOURS
-OTHER	EMULSION/PROTONS @ 500 #508	WOLTER	EMULSION EXPOSURE
	EMULSION/PROTONS @ 500 #524	WILKES	EMULSION EXPOSURE
	EMULSION/PROTONS @ 500 #576	HEBERT	3 STACKS
	QUARK #549	LONGO	PARASITIC RUNNING

AREA-BEAM		SPOKESPERSON	EXTENT OF APPROVAL
PA-PE	PARTICLE SEARCH #400	PEOPLES	400 HOURS
	PHOTOPRODUCTION #458	LEE	1,000 HOURS
-PW	DI-MUON #537	COX	1,000 HOURS

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PENDING PROPOSALS (36):			EXTENT OF REQUEST
MA-M1	HADRON JETS #246	SELOVE	1,500 HOURS
	ELASTIC SCATTERING #577	RUBINSTEIN	1,000 HOURS
	DI-HADRON #586	MCCARTHY	1,400 HOURS
	HADRON JETS #590	YOUNG	1,200 HOURS
-M2	PROTON POLARIZATION #505	YAMIN	100 HOURS
	NUCLEAR CHEMISTRY #529	TURKEVICH	100 HOURS
	NEUTRAL HYPERON #555	DEVLIN	250 HOURS
	DI-MUON #583	RUTHERFOORD	2,500 HOURS
	DI-MUON #589	MOCKETT	750 HOURS
-M3	INCLUSIVE NEUTRON #579	JONES	800 HOURS
	POLARIZED SCATTERING #581	YOKOSAWA	1,200 HOURS
	POLARIZED SCATTERING #582	YOKOSAWA	750 HOURS
	PARTICLE SEARCH #584	WINSTEIN	300 HOURS
-M6	MULTIPARTICLE #523	DZIERBA	800 HOURS
	PARTICLE SEARCH #580	JENKINS	800 HOURS
	INCLUSIVE SCATTERING #588	ELIAS	600 HOURS
NA-NO-DICHROM	NEUTRINO #355	BARISH	1,400 HOURS
-NO-WB HORN	15-FOOT NEUTRINO/H2&HIZ #489	NEZRICK	450K PIX
	15-FOOT ANTINEUTRINO/H26HIZ#544	KAFTANOV	500K PIX
-NEUTRINO	BEAM DUMP #599	MO	1,000 HOURS
-MUON/HADRON	PION DISSOCIATION #318	ASCOLI	400 HOURS
	MUON #348	WILSON	800 HOURS
	PARTICLE SEARCH #596	LEDERMAN	150 HOURS
-15-FT	15-FOOT P - P @ > OR = 300 #208	TAKIBAEV	75K PIX
	15-FOOT PBAR - P @ 100 #526	LANDER	150K PIX
	15-FOOT PBAR - D @ 100 #527	LANDER	150K PIX
	DETECTOR DEVELOPMENT #528	ROBERTS	100 HOURS
	15-FOOT PI- - D @ 1006360 #538	FRETTER	150K PIX
	PARTICLE SEARCH #595	BODEK	1,000 HOURS
-30-IN	30-INCH PI&P - P&NE @100 #504	GULJAMOV	20K PIX
	DETECTOR DEVELOPMENT #550	ATAC	TEST RUNNING
PA-PC	CHARGED HYPERON #353	ECKLUND	600 HOURS
	FORM FACTOR #446	ECKLUND	800 HOURS
-PW	HADRON JETS #587	SCHLEIN	1,000 HOURS
ITA-C-0	PROTON-PROTON SCATTERING #500D	FRANZINI	1,000 HOURS
	PARTICLE SEARCH #591	GUTAY	800 HOURS

MANUSCRIPTS AND NOTES PREPARED FROM MARCH 11, 1978, TO APRIL 10, 1978

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

C. E. DeHaven et al. (Experiment #4)	Neutron-Proton Elastic Scattering from 70 to 400 GeV/c
J. E. Elias et al. (Experiment #178)	Projectile Dependence of Multiparticle Production in Hadron-Nucleus Interactions at 100 GeV/c (FERMILAB-Pub-78/36-EXP; submitted to Phys. Rev. Lett.)
C. Halliwell et al. (Experiment #178)	Energy Dependence of the Pseudorapidity Distributions in Proton-Nucleus Collisions Between 50 and 200 GeV/c [Phys. Rev. Lett. 39, 1499 (1977)]
M. A. Abolins et al. (Experiment #366)	Search for Charm Production in Neutron Interactions Near 250 GeV/c [Phys. Lett. 73B, 355 (1978)]
D. J. Bechis et al. (Experiment #468)	A Search for Long-Lived Neutral Heavy Leptons in 400 GeV/c Proton Interactions
D. J. Bechis et al. (Experiment #468)	Sensitivity of a Search for Long-Lived Neutral Heavy Leptons (L^0) Arising from $\tau^+\tau^-$ Pair Production in 400 GeV/c Proton Interactions

Theoretical Physics

C. Quigg	New (Quark) Flavors (FERMILAB-Conf-78/17-THY; invited talk presented at Orbis Scientiae, Coral Gables, Florida, January 1978)
J. L. Rosner et al.	Determining the Fifth Quark's Charge: The Role of Υ Leptonic Widths (FERMILAB-Pub-78/19-THY; submitted to Phys. Lett.)
W. A. Bardeen et al.	Phenomenology of the New Light Higgs Boson Search (FERMILAB-Pub-78/20-THY; submitted to Phys. Rev.)

H. I. Miettinen and J. Pumplin	Diffraction Scattering and the Parton Structure of Hadrons (FERMILAB-Pub-78/21-THY; submitted to Phys. Rev.)
Y. J. Ng and S.-H. H. Tye	Is the Upsilon a Bound State of Exotic Quarks? (FERMILAB-Pub-78/30-THY; submitted to Phys. Rev. Lett.)

Physics Notes

A. Van Ginneken	AEGIS - A Program to Calculate the Average Behavior of Electromagnetic Showers (FN-309)
A. Roberts	Measurement of Muon Energies of 1-2 TeV and Above in the DUMAND Detector (FN-310)

DATES TO REMEMBER

April 14, 1978	Meson Lab Workshop.
May 5, 1978	Fermilab Users Organization Annual Meeting.
May 5, 1978	Deadline for receipt of all new proposals and other written materials to be considered at the summer meeting of the Physics Advisory Committee.
May 18-19, 1978	Proposal Presentation Meeting.
June 2, 1978	Special Presentation Meeting for Hadron Jet Proposals (see page 11).
June 17-23, 1978	Summer meeting of the Fermilab Physics Advisory Committee.

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