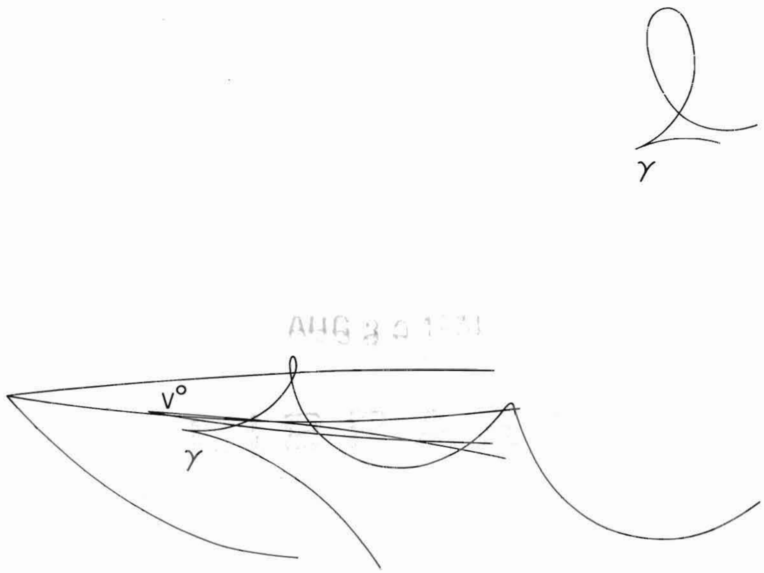
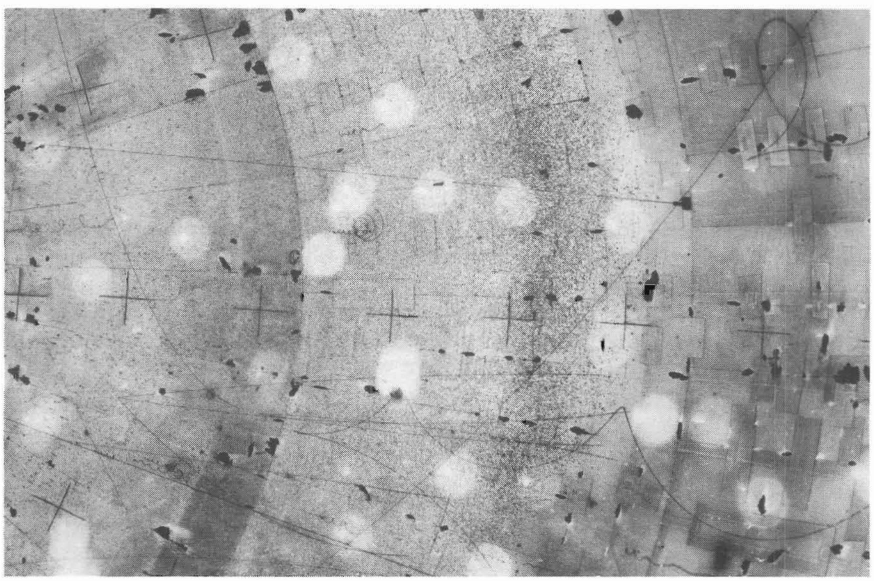
NALREP





Monthly Report of the Fermi National Accelerator Laboratory

August 1974

Fermi National Accelerator Laboratory

NALREP is published monthly by the Fermi National Accelerator Laboratory, P. O. Box 500, Batavia, Illinois 60510.

J. R. Sanford, Editor
N. Stiening, Assistant Editor

The presentation of material in NALREP is not intended to substitute for or preclude its publication in a professional journal, and reference to articles herein should not be cited in such journals.

Contributions and comments should be addressed to the Program Planning Office. Requests for copies should be addressed to the Publications Office.

NAL-74/9 0090.01

THE COVER: The first event believed to be a neutrino interaction observed in the Fermilab 15-foot hydrogen-filled bubble chamber with the horn-focused neutrino beam operating. A possible interpretation is $\nu + p \rightarrow 3$ charged tracks $+ \gamma + \gamma + V^0$, where the two gamma rays convert to electron-positron pairs. The other tracks visible in the photograph are from cosmic rays. The magnetic field in the chamber was 18 kG.

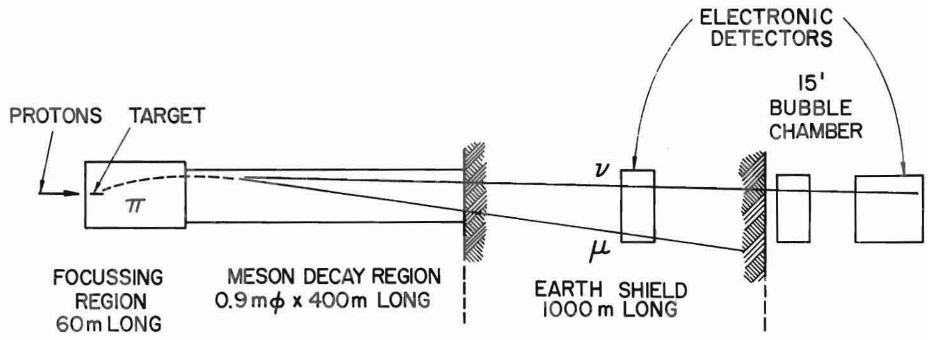
CONTENTS August 1974

THE FERMILAB NEUTRINO HORN BEAM

On July 29, 1974, the first neutrino interaction was recorded in the 15-foot bubble chamber with the Fermilab horn-focused neutrino beam operating. This marked the successful operation of the first phase of the horn-focused beam for neutrinos. Over the past four years many groups at the Laboratory have contributed to the design and construction of this system. Herein are presented the concepts of the system and its development.

Neutrino beams at high energy accelerators originate from the two-body decay in flight of intense beams of π and k mesons. Since the angles of the neutrinos from meson decays are in general smaller than the production angles of the mesons at the target, the neutrino flux passing through a finite-sized detector is enhanced by focusing the mesons toward the detector before they decay. The elements of a neutrino beam, therefore, consist of a high intensity proton beam, a meson production target, a meson focusing region, a meson decay region, an absorber to range out the muons which are the other meson product, and experimental detector regions. The Fermilab beam is shown schematically on the following page.

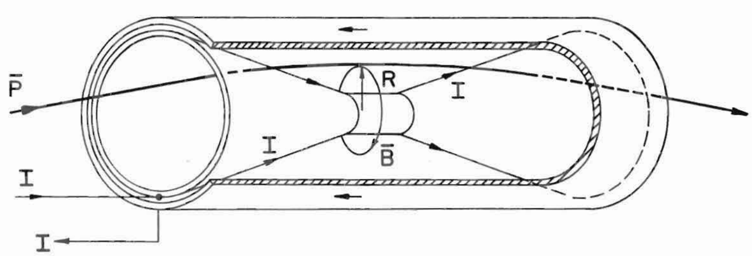
For many neutrino experiments, particularly in their early exploratory phase, a neutrino beam with the highest possible intensity over the widest possible neutrino energy range is required. Focusing systems composed of dipole and quadrupole magnets can efficiently focus a beam of particles from a target into a parallel beam for only a small range of momenta of the produced mesons. However, in 1962 S. van der Meer, working at CERN, realized that a new type of focusing system--the horn--could focus a beam of



Schematic layout of the Fermilab neutrino beam.

particles from a target into a parallel beam with an extremely large momentum range, producing many more neutrinos. Neutrino flux enhancements of at least an order of magnitude could be obtained easily from the new system. The Fermilab horn system is an extension and development of the original van der Meer concept.

What is a horn? A horn is a device which produces an intense magnetic field between two cylindrically symmetric coaxial current-carrying sheets, the inner conductor and the outer conductor. The basic idea of the horn is shown below.



The principle of horn focusing. When the particle passes through the inner conductor, it encounters a magnetic field given by $B = \mu_0 I/2\pi R$, where I is the current passing through the horn and R is the radial distance of the particle.

When a charged particle penetrates the inner conductor and passes between the two sheets, it encounters a circular magnetic field which is proportional to the current passing through the inner conductor, and which varies as the inverse of the particle distance from the horn axis. The length of the trajectory in the magnetic field region is determined by the shape of the inner conductor surface. Several horns can be used in series, so that the later ones act to improve the focusing of the previous ones. Good focusing over a large angle-momentum region is therefore obtained by choosing horn currents (peak magnetic fields) and inner conductor shapes to balance (or cancel) the transverse momentum distribution of the mesons. For a given current direction in the horn, mesons of one sign are focused, while mesons of the opposite sign are defocused. Therefore, either neutrino or antineutrino beams can be produced. The name horn still properly describes these devices, since they resemble segments of an English coach horn.

The Fermilab horn system is composed of a pulsed power supply, three horns packaged as two modules, and interconnecting buss work. The design parameters of the system were chosen to minimize mechanical and electrical problems in the hope that a reliable horn structure and power supply could be built without a lengthy development program. Toward this end, the horn current was chosen to be nominally 140,000 A, produced by a power supply operating at about 7000 V. Since such high currents cannot be sustained continuously, the horn current is pulsed. Eighty microseconds was chosen as the time during which good focusing should be possible. These requirements were achieved without compromising the efficiency of the focusing system.

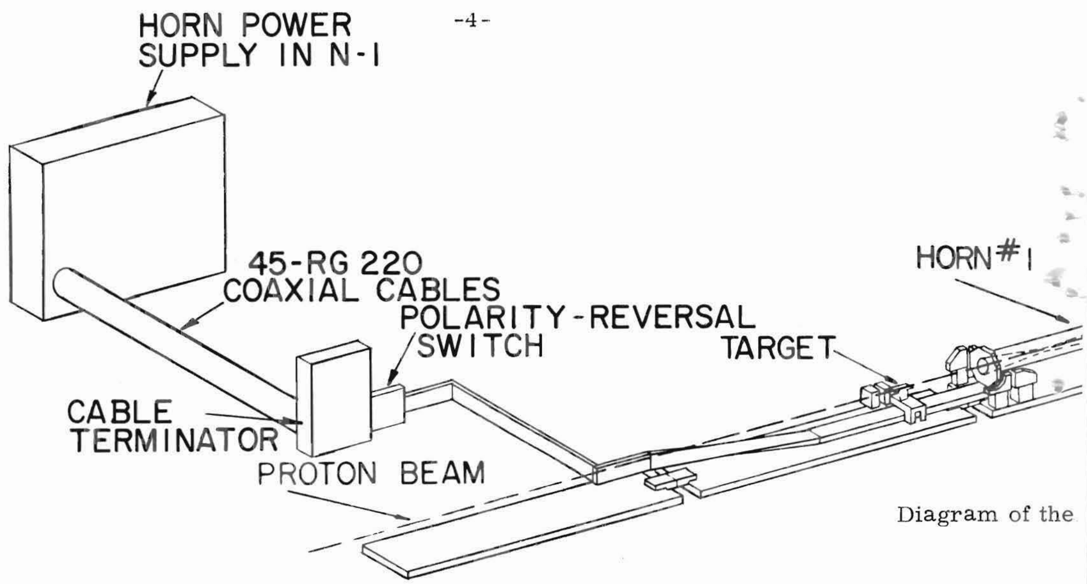
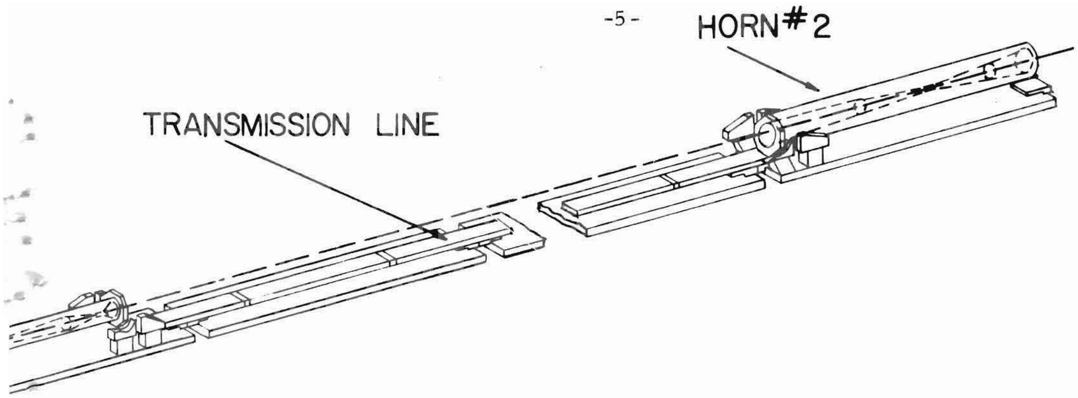


Diagram of the

A schematic of the horn system is shown above. The power supply in Service Building N1 is connected to the horn polarity reversal switch in Neuhall via 45 coaxial cables in parallel. The switch allows the direction of the current through the horn to be reversed. It is connected to Horn #1 by a parallel three-plate transmission line. The current passes through the inner conductors of both horns, connected in series, and then through the outer conductors, also connected in series. Horn #1 is water-cooled using a pulsed water system in Neuhall. Because of the smaller amount of electrical heating in Horn #2, it is forced-air cooled. The horns, target, transmission lines, and assorted controls and instrumentation are mounted on bedplates which can be transported by the Neutrino Area railroad system to the Target Service Building for storage, modification, or repair.

The pulsed power supply is a capacitor energy-storage system which is discharged through the horn load at the time the beam is to be focused. Electrically the horn system is a lightly damped L-R-C circuit with a natural frequency of about 1700 Hz. The 2400-μF capacitor bank is composed of

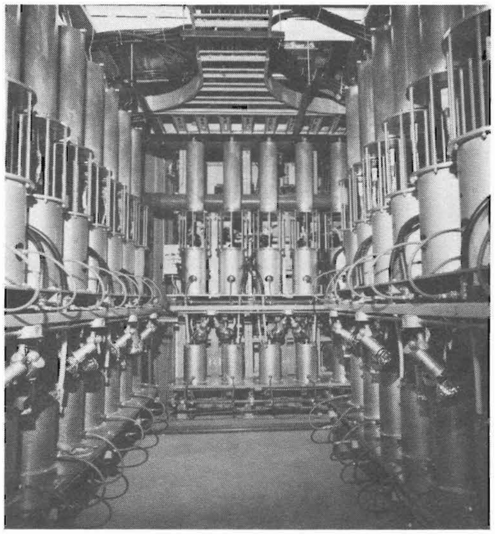


horn focusing system.

three sub-banks each of 800 μF. Each sub-bank can be charged at a rate of 15 A to a maximum of 14,000 V. The capacitor bank is discharged into the horn load using 15 ignitrons connected in parallel. After the bank voltage swings through zero the current in the horn is "crowbarred" to ground through another set of ignitrons in series with 0.5-Ω air-cooled resistors. The interior of the capacitor bank room is shown on page 6. The pulsed power supply is controlled by a sequencer unit which checks interlocks and coordinates the safety and timing of the capacitor bank operation and horn cooling.

The controls of the power supply are extremely flexible. The individual sub-banks can be operated independently into different loads. This option has been used during the past years to power pulsed bypass magnets for more than one million pulses, to deliver beam to the 30-inch bubble chamber beam line. In addition, the entire bank can be discharged into two different loads at different times during an accelerator cycle, so that testing of prototypes can proceed in parallel with normal horn operation.

At present, only Horn #1 is in operation. It is shown on page 8. Since the inner conductor has two constrictions, or "neck" regions, it is often referred to as two horns attached together. The inner conductor is machined from aluminum billets and electron-beam-welded into three units. These units are bolted together and mounted in the outer conductor. The wall of the inner conductor is 2 mm thick except in the neck regions, where it is 4 mm thick. Attached to the outer conductor is the water manifold which supplies the many sprays which cool the inner conductor. Horn #1 was successfully tested at Brookhaven National Laboratory in 1972. Except for one piece which was accidentally deformed, it is still in operation after nearly one-half million pulses.

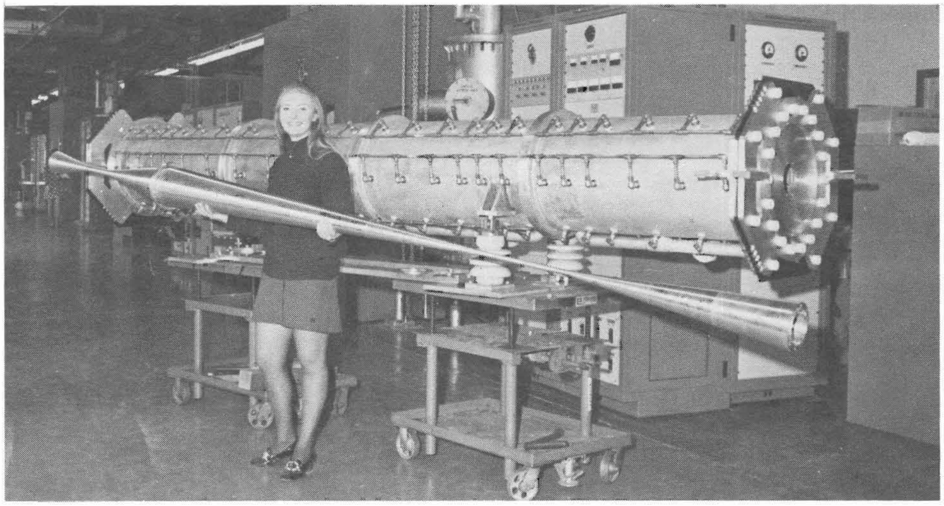


Interior of the 2400-μF capacitor bank room for the Fermilab neutrino horn system, showing the row of series ignitrons on the lower level and the row of crowbar ignitrons and resistors on the upper level.

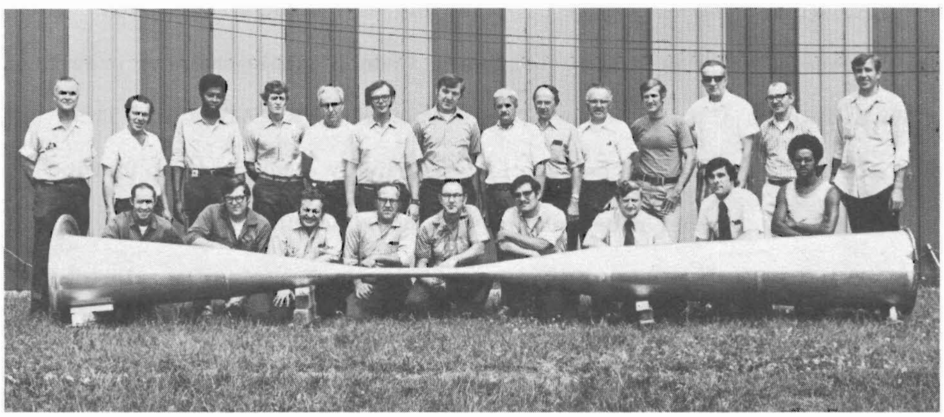
Horn #2, which will be ready for use in the October running period, is in an advanced state of construction. Because of its physical size, the inner conductor was spun in segments and welded together. The inner conductor is shown on page 8, bottom photograph. The wall thicknesses are the same as those in Horn #1.

The neutrino horn system has been designed and constructed by a collaborative effort of the Accelerator Division and the Neutrino Department. The concepts and parameters of the system were crystallized in early 1970 through the efforts of G. Lee, R. Winje, and F. Nezrick. The construction of the horn system was initiated in 1971. The first horn was designed by G. Lee and detailed and fabricated in the Linac Shop. Other pieces of the horn system have been constructed in all of the machine shops on site, as well as by many outside shops. F. Krzich produced the water system for the pulsed power supply and the pulsed water system to cool Horn #1.

R. Winje spearheaded the power supply design and construction. The basic power supply was constructed by the 30-inch bubble chamber crew in about five weeks of concentrated effort organized by W. Williams. This phase of the power supply construction was rapidly completed, so that the 30-inch bubble chamber research program could be initiated using the pulsed bypass beam. During the past year and a half, the Neutrino Department beam technicians, under G. Woods and W. Williams, have developed the power supply interlocks and controls and evolved the system into an operating unit of high reliability. The assembly of Horn #1 into an operating target train load was undertaken by J. Simon and the Target Handling Group under D. Theriot.



Photograph of Horn #1. Inner conductor is being held in foreground, outer conductor is on racks behind.



Photograph of the inner conductor for Horn #2. Some of those involved in its design and construction stand behind it.

Under the leadership of J. Grimson, this group also undertook the completion of Horn # 2 and implementation of the transmission lines. So many individuals and groups have contributed to this system that it is difficult to give appropriate acknowledgments. F. Nezrick acted as Project Physicist. The successful materialization of this system was possible because of the excellent cooperation of P. Livdahl and many others in the Accelerator Division as well.

Reported by F. Nezrick

THE FUNDING SITUATION AT FERMILAB

Fiscal Year 1975 represents the first year in the history of the Fermilab project when new construction funds have not been appropriated. Of the originally authorized $250 million, $235 million have been expended in the construction of the facility. The remaining funds have now been allocated in order to extend, as effectively as possible, the capabilities of this Laboratory.

Up to $10 million have been set aside for the implementation of the Proto-Doubler project. This project includes the acquisition of a number of superconducting magnets and refrigerators suitable for construction of a segment of what may eventually become the Energy Doubler.

The remaining funds will be used for improvements to the accelerator and experimental areas. Examples of the work to be done in the experimental area include the extension of the M1 beam enclosure, expanded detector stations for neutrino experiments, and the construction of secondary beam lines in the Proton Area. In order to have a fully developed facility for 500-GeV research at Fermilab, more facility improvement funds have been requested. Although no such monies have been provided for FY '75, we certainly expect that such money will become available in '76 to maintain and extend the physical plant and the research facilities.

Perhaps the most critical problem that will face the Laboratory in the years ahead concerns operating funds. These funds make it possible to operate and use the facilities that have been constructed at the Laboratory. They provide the manpower, the materials and supplies, the electrical power, and most of the consumed items that are the lifeblood of the

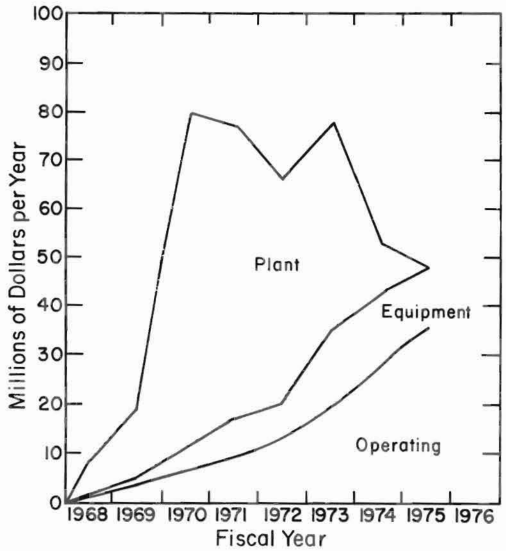
Laboratory. Approximately $60 million will be needed to support the facilities that have been developed. For the operation of the presently available facilities in the current fiscal year, the Laboratory requested $48 million. The various budgetary processes have reduced this request to $34.6 million.

Another source of money consists of equipment funds. These are usually used to purchase the apparatus needed to form the secondary beams, and provide the general-purpose particle detector and experimental apparatus needed to implement the research program. In the current fiscal year, we are expecting nearly $12 million, although the original request was considerably higher. It will be necessary to design apparatus as carefully as possible, and to reuse it whenever possible as experiments follow one another.

The operating, equipment, and facility improvements funds allocated to the Laboratory total nearly $46 million for the present fiscal year, whereas the original requests were for $71 million. The $46 million actually represents a decrease from the available funding of the past year since no plant funds have been appropriated for FY '75. The recent history of these funds and the Laboratory request for the next and crucial fiscal year is as follows:

	FY'74	FY'75	FY'76
	(in millions of dollars)		
Operating	$28.9	$34.6	$60.0
Equipment	14.9	11.3	25.0
Plant	10.3	0	11.1
Totals	$54.1	$45.9	$96.1 (requested)

Just how the three major sources of funding have gone over the past eight years is shown in the diagram on the next page. As can be seen, in its



Total funds available consist of operating plus equipment plus plant funds. This curve is an integral one, in which the uppermost value represents the sum of the several sources of money

period of maximum construction activity the Laboratory was spending approximately $80 million a year. This has now shrunk to under $50 million per year in the time of rapidly growing research activity.

The FY'76 budget requests prepared by the Laboratory represent realistic estimates of what is needed to fully utilize the facilities constructed at the Laboratory. The operating funds are based upon the staff size foreseen in the Design Report, although the facilities constructed at Fermilab are considerably larger than originally foreseen. Half of the proposed equipment funds will be used to acquire a larger computer for the analysis of research data. In addition, equipment funds will be used to acquire beamforming apparatus such as magnets and power supplies, hydrogen targets, detectors, electronics, and on-line computers for the mass of data to be available by that time.

Facility improvement funds will be used for improving the main ring radiofrequency system to provide more rapid acceleration, adding higher field magnets in the Switchyard to increase the energy capability of the Meson Area, hardening the Neutrino Area shielding, and extending the secondary beams in the Proton Area. These projects are designed to round-out the research facilities and increase the energy and intensity capabilities of the accelerator.

In the future, the major support for the project must be borne by the operating and equipment funds. Without sustained funding, we will have to restrict the staffing of the Laboratory including replacements for individuals who leave the project. In addition, we will not be able to utilize adequately the new beam lines and detector arrays. We will not be able to afford additional electric power, and we will have to restrain the acquisition of materials and supplies so necessary to our growing research program.

We intend, however, to maintain the best research program possible with the available funds. We expect that the quality and significance of the research undertaken at this Laboratory will be recognized and supported through increased and sustained funding. In this the Users of the Laboratory will play a major role.

Reported by J. R. Sanford

THE USERS EXECUTIVE COMMITTEE--A SUMMARY REPORT

The Users Executive Committee serves as the interface between the Users and the Laboratory administration, the URA Board of Trustees, and the URA administration. The Committee has worked with all three of these groups in the past year. Let me give some examples.

In the course of the year, the Committee conducted a survey of user facilities and services at Fermilab, at the request of the Director. It contacted each group which was then actively operating an experiment at the Laboratory, requesting a written response about those services they felt were most needed. The replies were given to a subcommittee, T. Kycia and D. Drickey, who then issued a summary report to R. R. Wilson. In many instances, changes were instituted on the basis of preliminary discussions, before that report was formally submitted to the Director. A major complaint registered prior to the report was the lack of Laboratory-User communication. The Committee suggested a monthly publication; NALREP, which is now in its fourteenth issue, was the result.

We have worried about transportation, living accommodations, and communications for Users at the Laboratory. The Laboratory administration is dealing with these problems. In addition, a Users Office has been established on the Atrium floor of the Central Laboratory, east wing. This office is a message center; in an emergency, it can help with housing, transportation, and typing; and it is an excellent source of general information. Bicycles may be rented there, and desks and telephones for short-term visitors can be arranged. C. Sazama, who heads the office, can be reached on Ext. 3136.

The mailing address is: Users Organization
Fermi National Accelerator Laboratory
P. O. Box 700
Batavia, Illinois 60510

Members of the Users Organization should feel free to contact either Miss Sazama or any member of the Executive Committee with problems (or compliments!).

Just recently, the Executive Committee suggested that mini-courses similar pedagogically to the summer courses offered at CERN be offered at Fermilab. These courses are aimed at graduate students and beginning post-docs, and the first series, "Lectures on Hadron Dynamics" is being presented by H. D. I. Abarbanel this August.

We have also had extensive discussions with the Laboratory administration about setting up a Users Club, similar to a university faculty club, on site. J. Rosen and L. Lederman have assisted in planning the arrangements, management, and scope of this club.

One of the functions of the Users Executive Committee has been to communicate, in a semiformal fashion with the Trustees of URA. Several members of the committee have presented the Users' point of view of various topics to the Trustees at their meetings. This communication has probably been useful, but could be improved. We feel the need for more dialogue between the two groups, and have had the full cooperation of URA, and in particular B. Bennett, in bringing this to pass.

Altogether, this has been an active and a formative year for the Laboratory. I would like to thank the administrators of URA and Fermilab, particularly R. R. Wilson, for their cooperation with our Committee.

Reported by W. D. Walker
Duke University

Outgoing Chairman, Users
Executive Committee

FOR THE COMING YEAR . . .

Following the annual meeting on May 17, 1974, members of the Users Organization voted by mail for new members of the Users Executive Committee. For the coming year, members of the Executive Committee will be:

*D. Caldwell	University of California, Santa Barbara
D. Drickey	University of California, Los Angeles, on leave at Fermilab
T. Ferbel	University of Rochester
*L. N. Hand	Cornell University
*G. R. Kalbfleisch	Brookhaven National Laboratory
*R. L. Lander	University of Washington
M. Law	Harvard University
W. Y. Lee	Columbia University
U. Nauenberg	University of Colorado
*J. Peoples	Fermi National Accelerator Laboratory
J. Rosen	Northwestern University
*M. L. Stevenson	University of California, Berkeley
W. D. Walker	Duke University

At its first meeting on July 24, the Users Executive Committee elected D. Drickey as Chairman and L. Hand as Secretary for the year. A report of other matters discussed at that meeting will be presented in the September issue of NALREP.

---

*Newly elected members.

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 July 1, 1974. For experiments which have been completed or have received beam, there is indication of the amount of running time or exposure. Publications have been prepared or talks given about the experiments marked with an asterisk (*).

Total Number of Approved Experiments - 146

EXPERIMENTS THAT HAVE COMPLETED DATA TAKING (57):

Internal Target Area (6)

*Proton-Proton Scattering #36A	700 hours
*Photon Search #63A	2,550 hours
*Proton-Proton Missing Mass #67A	600 hours
*Photon Search #120	1,200 hours
*Particle Search #184	800 hours
*Proton-Nucleon Inclusive #188	1,050 hours

Meson Area (18)

*Neutron Cross Section #4	1,450 hours
Monopole #22	350 hours
*Neutron Dissociation #27A	850 hours
*Quark #72	500 hours
*Quark #75	1,050 hours
Super-Heavy Elements #147	3 exposures
Multiplicities #178	500 hours
Multigamma #230	50 hours
*Emulsion exposures to protons @200 GeV for experiments 90, 103, 105, 114, 116, 117A, 156, 171, 183, 189	45 stacks

Proton Area (2)

*Particle Search #100A	1,150 hours
*Particle Search #187	200 hours

Neutrino Area (31)

*30-Inch Hybrid #2B	479K pix
*Proton-Proton Inelastic #14A	140 hours
*Muon #26	900 hours
Detector Development #34	50 hours
*30-Inch p-p @300 #37A	51K pix
*30-Inch π^- - p @100 #121A	104K pix
*30-Inch π^- - p @100 #125	53K pix
*30-Inch π^- -p @200 #137	48K pix
*30-Inch p-p @200 #141A	67K pix
30-Inch π^- - p @300 #143A	51K pix
30-Inch Hybrid #154	105K pix
30-Inch p -p&Ne @300 #161	51K pix
30-Inch π^- -p&Ne @200 #163A	52K pix
*Massive Particle Search #199	2 targets
Emulsion/Muons @150 #205A	2 stacks
Beam Dump #211	2 hours
30-Inch π^+ - p @200 #217	85K pix
30-Inch π^+/p - p @60 #228	37K pix
Long-Lived Particles #239	350 hours
*30-Inch p-p @100 #252	33K pix
Emulsion/Muons @150 #255	1 stack
*Neutrino #262	400 hours
Emulsion exposures to protons @300 GeV for experiments 181, 195, 232, 233, 237, 242, 244, 250, 275	34 stacks

EXPERIMENTS THAT ARE IN PROGRESS (22):

Internal Target Area (2)

*Proton-Deuteron Scattering #186	400 hours
Proton-Proton Inelastic #221	700 hours

Neutrino Area (8)

*Neutrino #1A	1,000 hours
Monopole #3	4 targets
*Neutrino #21A	1,050 hours
*Monopole #76	3 targets
Muon #98	750 hours
*30-Inch p-p @400 #138	21K pix
Super-Heavy Elements #142	1 target
Quark #297	50 hours

Meson Area (11)

*Elastic Scattering #7	1,050 hours
Missing Mass #51A	250 hours
*Nuclear Chemistry #81A	66 bombardments
K Zero Regeneration #82	1,050 hours
Elastic Scattering #96	700 hours
*Total Cross Section #104	800 hours
Beam Dump #108	4 targets
*Pion Charge Exchange #111	1,350 hours
Detector Development #229	150 hours
Detector Development #261	150 hours
Neutron Dissociation #305	150 hours

Proton Area (1)

*Lepton #70	1,850 hours

EXPERIMENTS THAT ARE IN TEST STAGE (5):

Meson Area (3)
- Neutron Backward Scattering #12 — 200 hours
- Elastic Scattering #69A — 450 hours
- Photon Inclusive #268 — 100 hours

Neutrino Area (1)
- 15-Foot Neutrino/H_2 #45A — 50 hours

Proton Area (1)
- Photoproduction #87A — 400 hours

EXPERIMENTS BEING INSTALLED (8):

Neutrino Area (2)
- 15-Foot EMI Test #155
- 15-Foot Engineering Run #234

Proton Area (2)
- Photon Search #95A
- Particle Production #284

Meson Area (4)
- Neutral Hyperon #8
- Diffractive Dissociation #86A
- Multiparticle #110A
- Neutron Elastic Scattering #248

EXPERIMENTS TO BE SET UP WITHIN A YEAR (30):

Meson Area (3)
- Form Factor #216
- Hadron Jets #236A
- Hadron Jets #260

Proton Area (5)
- Photon Total Cross Section #25A
- Muon Search #48
- Proton-Proton Elastic #177A
- Di-Lepton #288
- Particle Search #300

Neutrino Area (22)
- 15-Foot Anti-Neutrino/H_2 #31A
- 30-Inch p - D @100 #194

Neutrino Area (Cont'd)
- 30-Inch p - D @400 #196
- Tachyon Monopole #202
- 30-Inch p - D @300 #209
- 30-Inch π^- - D @200&400 #218A
- Emulsion/π^- @200-300 #264
- Emulsion/Protons @200 #271
- Quark #276
- 30-Inch p - D @200 #280
- Super-Heavy Elements #285
- 30-Inch π^+ - D @200 #295
- 30-Inch $\bar{p}$ - p @100 #311
- Neutrino #320
- Emulsion exposures to protons @400 GeV for experiments 238, 243, 245, 249, 251, 265, 279, 292

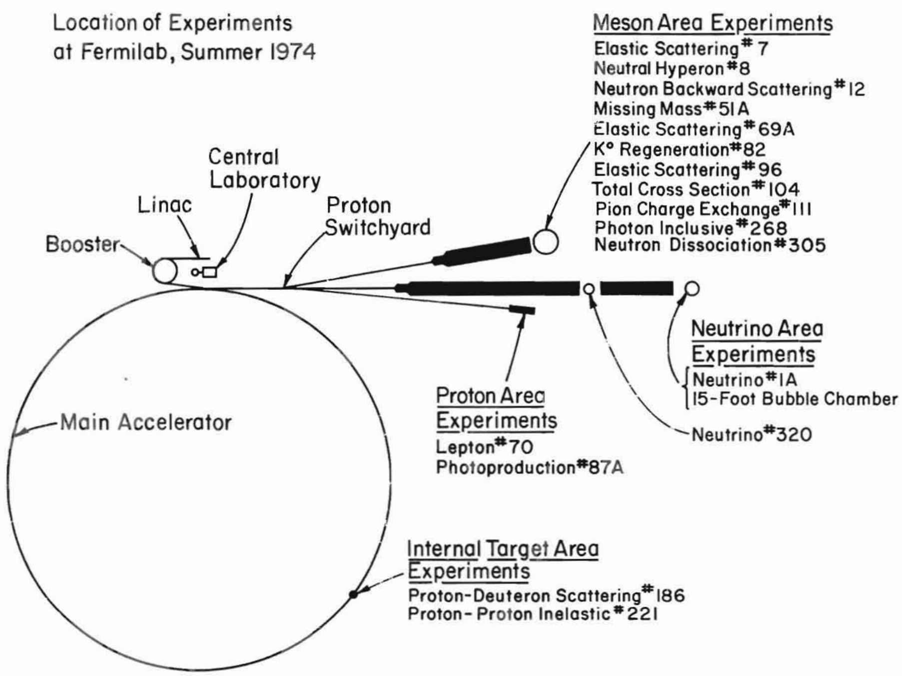
OTHER APPROVED EXPERIMENTS (24):

Internal Target Area (5)
- Proton-Nucleon Scattering #198A
- Proton-Helium Scattering #289
- Proton-Proton Polarization #313
- Proton-Nucleon Inelastic #317
- Proton-Proton Inelastic #321

Proton Area (6)
- Photoproduction #152B
- Multigamma #192
- Hadron Jets #246
- Pion Inclusive #258
- Phi Photoproduction #263
- C-Test #302

Meson Area (3)
- Polarized Scattering #61
- Charged Hyperon #97
- Inclusive Scattering #324

Neutrino Area (10)
- 15-Foot Neutrino/H_2&Ne #28A
- Detector Development #32
- 15-Foot Neutrino/H_2 or Ne #53A
- Long-Lived Particles #115
- 15-Foot Anti-Neutrino/H_2&Ne #172
- 15-Foot Anti-Neutrino/H_2&Ne #180
- Detector Development #206
- 30-Inch p - p @500 #207
- 30-Inch π^- - p @Hi E #215
- 30-Inch π^+ - p @300 #277


Location of Experiments
at Fermilab, Summer 1974
Meson Area Experiments
Elastic Scattering # 7
Neutral Hyperon #8
Neutron Backward Scattering # 12
Missing Mass # 51A
Elastic Scattering # 69A
K° Regeneration #82
Elastic Scattering # 96
Total Cross Section # 104
Pion Charge Exchange # 111
Photon Inclusive # 268
Neutron Dissociation # 305
Central Laboratory
Linac
Proton Switchyard
Booster
Neutrino Area Experiments
Neutrino # 1A
15-Foot Bubble Chamber
Proton Area Experiments
Lepton # 70
Photoproduction # 87A
Neutrino # 320
Main Accelerator
Internal Target Area Experiments
Proton-Deuteron Scattering # 186
Proton-Proton Inelastic # 221

NOTES AND ANNOUNCEMENTS

SINGLE-ARM SPECTROMETER WORKSHOP SCHEDULED . . .

A one-day workshop will be held on October 25, 1974, to discuss the future experimental program for the Single-Arm Spectrometer (SAS) facility. Representatives of groups having proposals or letters of intent for use of the SAS and any other interested persons are invited to participate. In keeping with the new Fermilab policy of establishing deadlines for the submission of written materials prior to PAC or PAC subcommittee meetings, the deadline for submission of written materials to be considered at this meeting is September 25, 1974.

The purposes of the workshop are: to re-examine the physics potential of the SAS facility, after appreciable operating experience has been gained in the course of Elastic Scattering #96; and to explore how well the "second generation" experiments proposed utilize the capabilities of the facility. Tentative plans are to include a discussion of the current SAS configuration and a review of future plans for the Meson Area as they relate to the SAS program. Pertinent results for the aforementioned elastic scattering experiment will be described.

Representatives of each group which has submitted a proposal will be invited. A panel composed of some PAC members, possibly augmented by additional persons knowledgeable in the areas of hadron physics for which the SAS is well suited, will formulate recommendations for presentation to the Program Advisory Committee at their fall meeting.

Final arrangements for the workshop will be announced in the September issue of NALREP.

DI-LEPTON WORKSHOP PLANS COMPLETED . . .

Final arrangements have now been made for the Di-Lepton Workshop scheduled for September 13, 1974. The meeting will be held in the Curia II conference room (second floor, west, Central Laboratory), beginning at 9:00 a.m. Representatives of groups having proposals or letters of intent on this topic and any other interested persons are invited to participate.

The meeting will begin with a discussion of the theoretical and experimental background leading to interest in studying di-lepton production. Representatives of each group which has submitted a proposal will then be invited to present their ideas (approximately one-half hour per proposal). A workshop panel, consisting of B. Barish, J. D. Bjorken, R. Diebold (Chairman), and S. Wojcicki, will formulate recommendations for presentation to the Program Advisory Committee at their fall meeting.

BUBBLE CHAMBER SUBCOMMITTEE TO MEET . . .

The PAC Bubble Chamber Subcommittee will hold a two-day meeting Monday and Tuesday, November 4 and 5. The primary objectives of the meeting will be to provide guidance to the Laboratory on the future of the 30-inch bubble chamber hybrid systems and on the hadron physics program for the 15-foot chamber. Proposals for the 30-inch chamber which have been deferred or not yet considered will be reviewed and recommendations formulated, if possible. The Subcommittee's recommendations will be presented to the Program Advisory Committee at their fall meeting. The deadline for submission of written material to be considered at this meeting is October 4, 1974.

PROGRAM ADVISORY COMMITTEE TO MEET . . .

The fall meeting of the Fermilab Program Advisory Committee has been scheduled for Thursday through Saturday, November 14 to 16, 1974. The principal focus of the meeting will be further consideration of the muon and neutrino experimental programs. In addition, consideration will be given to the reports from three other meetings--the Di-Lepton Workshop, the Single-Arm Spectrometer Workshop, and the Bubble Chamber Subcommittee meeting (see separate announcements). The deadline for submitting written materials to be considered at this meeting is October 14, 1974.

CONFERENCE SCHEDULED . . .

The 1974 Applied Superconductivity Conference will be held at the Sheraton Oakbrook Motor Hotel, in Oak Brook, Illinois, September 30, and October 1 and 2, 1974. Argonne National Laboratory and Fermi National Accelerator Laboratory will co-host the meeting. Anyone interested in attending the technical sessions should contact W. Fowler or B. Strauss on Ext. 3674 for further information and preregistration forms.

USERS CENTER OPENED . . .

A portion of the former Village Cafeteria is being converted for use as a Users Center. On a very limited scale, the Center was opened on August 1. Eventually it will have three sections--a reading room with hi-fi equipment, chess sets, writing tables, comfortable chairs, etc.; a game room with ping pong and pool tables; and a more elaborate cocktail lounge.

Plans for the Center are being guided by a committee consisting of D. Drickey, L. Lederman, J. Peoples, and J. Rosen. C. Sazama helped to organize and launch the Center.

Until further notice only the lounge will be open, from 5:00 to 7:30 p.m., Monday through Friday. Once a manager/bartender has been hired these hours will be extended.

APPOINTMENTS . . .

David Sauer joined the Laboratory staff as of July 1, 1974. In charge of Site Services, he is working out of the Director's Office. Sauer came to Fermilab from Indiana University, Bloomington, where he was Director of Construction Management for the State University system. A Registered Architect and a Registered Structural Engineer, Sauer holds the Master of Science Degree in Architectural Engineering from the University of Illinois.

FACILITY UTILIZATION SUMMARY--JULY 1974

The two-week period of 400-GeV operation, which started June 27, ended at 9:35 a.m. on Wednesday, July 10, when a splice in one of the 13.8-kV feeders to the main ring failed. By the standards to which we have become accustomed at 300 GeV, the operating reliability and intensity were poor. Beam for high energy physics research was available for about 69 hours or 23% of the scheduled time, yielding 5.8×10^{16} protons for the experimental areas. Typical accelerated intensities were approximately 0.4×10^{13} protons per pulse, limited by extraction losses. However, performance was improving noticeably in the last days. A wide range of problems was encountered, many of which had no clear connection with the higher energy operation. Those problems, which appeared to be related to the somewhat greater main-ring power dissipation, were undoubtedly aggravated by the greater than 90° F air temperatures which occurred during most of the period. Temperatures in the cooling ponds exceeded 100° F in some locations and the temperature of the low conductivity cooling water (LCW) reached 135° F. The comparison of this 400-GeV running to that in December 1973 is, however, rather favorable. On that occasion there was little beam in the first two weeks of running, whereas good beam was obtained on the fourth day of the recent run. Magnet power-supply problems were clearly much better in hand this time. Thus, the indications of accelerator performance seem favorable for future 400-GeV operation.

Operation at 300 GeV was resumed on Friday, July 12. The power and control cable harnesses for all twenty-four main ring air cooler fans were temporarily installed in a crash program in the day and a half before startup. They reduced the LCW temperature considerably. Typical accelerated intensity had increased from 0.5 to 0.7×10^{13} protons per pulse by the end of July; 6.4×10^{17} 300-GeV protons were extracted to the experimental areas. Accelerator reliability continued somewhat below the recent average. The 251 hours of high energy physics time was 64% of that scheduled. Both the debuncher, which reduces the momentum spread of the beam into the booster, and the ORBUMP, which stacks multiple turns into the booster, were returned to service the last week of the month. The restoration of intensity to close to the 10^{13} level was underway at the month's end.

In the Meson Area, the interruption in operation during the 400-GeV running period was used to repair leaks in the water-cooled aluminum insert to the C-2 collimator. These repairs were successfully completed, allowing the use of the closed-loop target cooling system. Thus, the long standing intensity limitation of about 1.5×10^{12} protons per pulse was removed. Many hours of operation with $\sim 5 \times 10^{12}$ protons per pulse were achieved with little indication of the previously noted rate-dependence of the secondary flux. A maximum intensity of 7.48×10^{12} was delivered to the Meson Area on July 30. Seven experiments were active. Elastic Scattering # 7, Charge Exchange # 111, K^O Regeneration # 82, and Neutron Dissociation # 305 continued data taking. Elastic Scattering # 69A completed its testing and setup, and began taking data. The transition radiation detector development groups, Experiments # 229 and # 261, remained downstream of Elastic Scattering # 7 in the M1 line.

Lepton # 70 and Photoproduction # 87A took data in the Proton Area during the 400-GeV operating period. Lepton # 70 completed its program of measurement of $e^{\pm}$ production at 90° in the center of mass at 400 GeV (83 mrad) with the low transverse momentum setting of their spectrometer. They were just preparing for some measurements at higher p_t when the 13.8-kV feeder failed. Photoproduction # 87A ran for the first three days of the 300-GeV period; both 300 GeV and 400 GeV running was without the liquid deuterium neutron filter. The Proton Area was then turned off for construction work until July 26. Lepton # 70 reset its spectrometer position to a laboratory angle of 100 mrad, corresponding to 90° in the center of mass at 200 GeV. When the Proton Area returned to operation, Lepton # 70 began check-out at the new angle; Photoproduction # 87A remained off to await the availability of the neutron filter.

During the 400-GeV run, a few hundred neutrino pictures in the 15-foot bubble chamber were taken for Neutrino # 45A using the triplet target load. Neutrino # 1A also collected some limited data at the low intensities. Quark # 297 completed running in the N3 hadron line. After three days of 300-GeV operation, during which Neutrino # 1A and Neutrino # 21A calorimeter tests were the principal activities, the Neutrino Area was shut down so that the train load with a single focusing horn could be installed. After two days of problems with the power supply and plumbing, the horn became operational. It ran reasonably well for the rest of the month. In the 15-foot bubble chamber, 1168 neutrino pictures and 587 hadron pictures were taken. Activities also included extensive tuning of the N-7 and N-5 hadron beam lines to the 15-foot chamber, tests of the muon beam as a hadron beam, tests of the External Muon Identifier (Experiment # 155), and target exposure for Monopole # 76.

Both Proton-Deuteron # 186 and Proton-Proton # 221 ran in the Internal Target Area during the 400-GeV run. Because of damage to the super insulation on the jet, Experiment # 221 was almost the sole user of 300-GeV beam. The repaired jet was reinstalled on July 25. The Internal Target Area scheduled two shifts for much of the month, but returned to three-shift operation July 30.

The facility utilization for the month of July is summarized as follows:

I. Summary of Accelerator Operations

		Hours	
A. Accelerator use for physics research			
Accelerator physics research		37	
High energy physics research		320	
Research during other use		(72)	
	Subtotal		357
B. Other activities			
Accelerator setup and tuning to experimental areas		24	
Scheduled interruption		37	
Unscheduled interruption		326	
	Subtotal		387
C. Unmanned time		0	0
	Total		744

II. Summaries of High Energy Physics Research Use

	# of Expts.	Hours	Results
A. Counter experiments	14	1706	1706 hours
B. Bubble chamber experiments	1	24	1168 pictures
C. Emulsion experiments	0	-	-
D. Special target experiments	1	102	1 target
E. Test experiments	4	240	240 hours, 587 pictures
F. Engineering studies and tests	5	136	136 hours
G. Other beam use		135	135 hours
	25	2343	

III. Number of Protons Accelerated and Delivered

		Protons (300 GeV)	Protons (400 GeV)
A. Beam accelerated in main ring	Total	8.16×10^{17}	0.81×10^{17}

B. Beam delivered to experimental areas	300 GeV	400 GeV
Meson Area	4.13×10^{17}	-
Neutrino Area		
Main beam	1.94×10^{17}	0.52×10^{17}
Bubble chamber beam (estimated)	0.10×10^{17}	0.02×10^{17}
Proton Area	0.23×10^{17}	0.06×10^{17}
Total	6.40×10^{17}	0.60×10^{17}

IV. Beam Hours by Experiment

	Hours	Results
A. Meson Area		
Elastic Scattering # 7	182.6	
Charge Exchange # 111	234.5	
Elastic Scattering # 69A	208.2	
K^o Regeneration # 82	241.6	
Neutron Dissociation # 305	197.1	
Detector Development # 229	79.3	
Detector Development # 261	132.6	
B. Neutrino Area		
Quark Search # 297	43.2	
Neutrino # 1A	182.5	
Neutrino # 21A	31.5	
EMI Test # 155	20.5	
Neutrino # 45A	24.5	1168 pictures
Monopole # 76	102.0	1 target (partial)
Engineering Run # 234	8.1	587 pictures
C. Proton Area		
Lepton # 70	117.4	
Photoproduction # 87A	70.3	
D. Internal Target Area		
Proton-Deuteron # 186	38.6	
Proton-Proton # 221	136.7	
Photon Search # 63A	10.7	
Particle Search # 184	10.8	

PROPOSALS RECEIVED DURING JUNE AND JULY 1974

No.	Title	Submitted By
305	Proposal to Study the Coherent Dissociation of Neutrons	B. Gobbi
306	A Proposal to Search for Anomalous or "Direct" Neutrino Production	B. Barish
307	Muon-Nucleon Scattering with Extraordinary Momentum Transfer	L. T. Kerth
308	A Proposal for a Detailed Study of Dimuon Production	J. E. Pilcher
309	15-ft. Bubble Chamber Proposal for 486 GeV/c $\pi^- p$ Interactions Using a Track Sensitive Target	A. R. Erwin
310	Further Study of High Energy Neutrino Interactions at NAL	D. Cline
311	Proposal to Study Multiparticle Production in High Energy Antiproton-Proton Interactions with the FNAL 30-Inch Bubble Chamber	W. W. Neale
312	Hadronic Interactions in Complex Nuclei	R. M. Edelstein
313	Polarization in p-p Elastic, Inelastic and Inclusive Reactions at NAL Energies	H. A. Neal
314	A Proposal to Measure Neutral Weak Currents in Muon Nucleus Inclusive Scattering	A. C. Melissinos W. C. Carithers
315	Proposal to Test the ν_μ-ν_e Universality in the 15-Foot Bubble Chamber and Make a Preliminary Investigation of the Four Fermion Interaction	F. A. Nezrick
316	Gargantua: A New Facility for Neutrino Physics at NAL	D. R. Nygren
317	Proton Diffraction Dissociation on Hydrogen and Deuterium	S. Mukhin
318	Pion Diffraction Dissociation	G. Ascoli
319	Further Test of Scaling at High Momentum Transfers in Deep Inelastic Muon Scattering	K. W. Chen

320	Proposal to Measure Neutral Current Cross Sections and Associated Inelastic Distributions in the Narrow-Band Beam	F. J. Sciulli
321	A High Precision Experiment to Measure the Inelastic P-P Cross Section and Its Associated Forward Multiplicities at Small Momentum Transfer	J. Lee-Franzini
322	Search for Direct Production of Mu-pairs at CO	P. Wanderer
323	A Proposal for a Detailed Study of Dimuon Production	J. E. Pilcher
324	A Proposal to Study Particle Production Spectra and Multiplicities in High Energy Hadron-Hadron Collisions, and for a Beam Survey and Quark Search	H. Weisberg
325	Study of Di-Muon Production at High Transverse Momenta	J. W. Cronin
326	A Proposal to Measure Muon Pairs Produced at High Transverse Momentum by Pions	P. A. Piroué
327	Tests of Particle Identification by Ionisation Loss (ISIS)	W. W. M. Allison

DATES TO REMEMBER

September 13, 1974	Di-Lepton Workshop at Fermilab.
September 25, 1974	Deadline for receipt of material to be considered at Single-Arm Spectrometer Workshop.
September 29, and October 1-2, 1974	1974 Applied Superconductivity Conference, Oak Brook, Illinois.
October 1, 1974	Deadline for submission of material to be considered for inclusion in the 1975 Procedures for Experimenters handbook. Users should direct their comments to M. L. Stevenson, c/o Users Office.
October 4, 1974	Deadline for receipt of material to be considered by PAC Bubble Chamber Subcommittee.
October 14, 1974	Deadline for receipt of material to be considered at fall meeting of the PAC.
October 25, 1974	Single-Arm Spectrometer Workshop at Fermilab.
November 4-5, 1974	PAC Bubble Chamber Subcommittee m meeting.
November 14-16, 1974	Fall meeting of Fermilab Program Advisory Committee.

For additional information about any of these meetings or deadlines, telephone T. Groves, Secretary of the Program Advisory Committee, at 840-3211.

LAST MINUTE ANNOUNCEMENT

A workshop for the preliminary design of the POPAE (Proton on Proton and Electron) colliding beam storage rings will be held at Fermilab from September 9 to 20, 1974. The objective is to arrive at a conceptual design for a pair of 400 to 1000 GeV p-p colliding-beam storage rings together with an electron ring in the same tunnel for e-p colliding beams. The requirements for physics experiments will be studied and incorporated into the design. Plans are to produce a preliminary layout and a set of design and performance parameters. Problem areas which must be investigated in greater detail will also be identified. Approximately ten accelerator physicists from other laboratories, including CERN, will participate in the workshop along with Fermilab physicists. Anyone interested in participating in the workshop should contact D. Edwards or L. Teng.