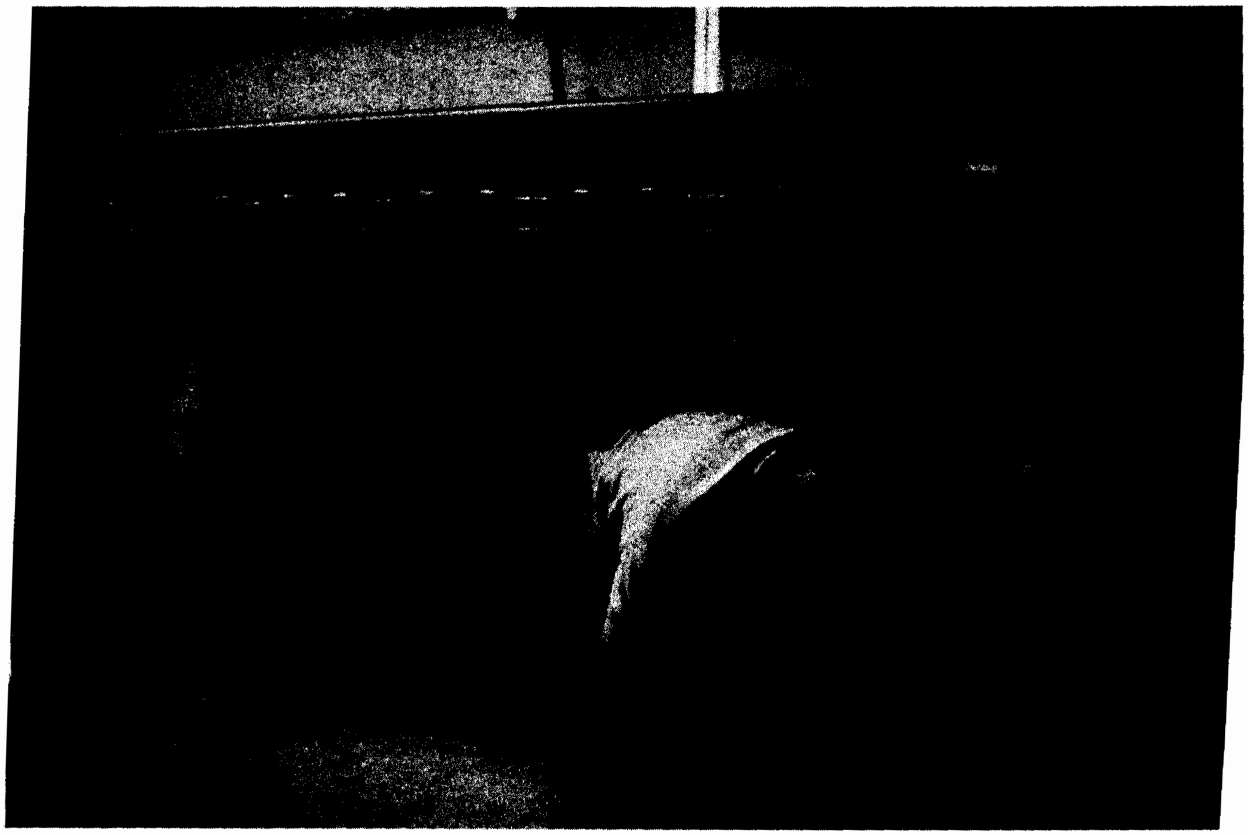
fermilab report

Fermi National Accelerator Laboratory Monthly Report

July 1978



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

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

The presentation of material in fermilab report 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, comments, and requests for copies should be addressed to the Publications Office.

FERMILAB-78/7 Fermi National Accelerator Laboratory 0090.01

THE COVER: Peter Koehler checking connections of a superconducting magnet being installed as part of the "Sector Test," installation of Energy Doubler/Saver magnets in Sector A.

(Photograph by Fermilab Photo Unit)

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

MANUSCRIPTS AND NOTES PREPARED FROM JUNE 8, 1978 TO JULY 14, 1978

Copies of preprints with Fermilab publications 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. C. Barish et al. (Experiment #21A)	Charged Current Neutrino and Antineutrino Cross Section Results from the CITFR Experiment (FERMILAB-Conf-78/46-EXP; submitted at the 3rd International Conf. on New Results in High Energy Physics, Vanderbilt University, March 6-8, 1978)
J. Bell et al. (Experiment #45)	Experimental Study of Hadrons Produced in High Energy Charged Current Neutrino-Proton Interactions (FERMILAB-Pub-78/57-EXP; submitted to Phys. Rev. D)
A. M. Cnops et al. (Experiment #53)	Measurement of the Cross Section for the Process $\nu_\mu + e^- \rightarrow \nu_\mu + e^-$ at High Energies (Submitted to Phys. Rev. Lett.)
H. C. Ballagh et al. (Experiment #172)	μ-e Universality in Charged Current Neutrino Interactions in a Neon-H_2 Mixture
H. Rudnicka et al. (Experiment #172)	Characteristics of Hadrons Produced in ν_μNe and $\bar{\nu}_\mu$Ne Interactions
J. P. Berge et al. (Experiment #180)	Probing Nuclei with Antineutrinos (FERMILAB-Pub-78/55-EXP; submitted to Phys. Rev. D)
D. F. Bartlett et al. (Experiment #202)	Search for Tachyon Monopoles in Cosmic Rays
A. L. Read et al. (Experiment #247)	Search for Short-Lived Particles in High Energy Neutrino Interactions Identified Using a Hybrid Emulsion-Spark Chamber Arrangement (FERMILAB-Pub-78/56-EXP; submitted to Phys. Rev.)
J. K. Yoh et al. (Experiment #288)	Study of Scaling in Hadronic Production of Dimuons (FERMILAB-Pub-78/52-EXP; submitted to Phys. Rev. Lett.)

D. L. Burke et al. (Experiment #438)	Charged Particle Production from Neutron-Nucleus Collisions at Fermilab Energies
W. P. Oliver et al. (Experiment #439)	Dimuon Production by Protons in Tungsten (Submitted to the Proc. of the 3rd International Conf. on New Results in High Energy Physics, Vanderbilt University, March 6-8, 1978)
E. G. Boos et al. (Experiment #463)	Diffractive Coherent Production in Interactions of 400 GeV/c Protons on Emulsion Nuclei (Submitted to Nucl. Phys. B)
D. Cutts et al. (Experiment #469)	A Search for Long Lived Heavy Particles (FERMILAB-Pub-78/45-EXP; submitted to Phys. Rev. Lett.)
R. Vidal et al. (Experiment #596)	A Search for New Massive Particles (FERMILAB-Pub-78/47-EXP; submitted to Phys. Lett.)
J. K. Walker (General)	Neutrino Detector Developments (FERMILAB-Conf-78/58-EXP; invited talk at the International Conf. on Neutrino Physics and Astrophysics, Purdue University, April 28-May 2, 1978)

Theoretical Physics

W. A. Bardeen and K.-I. Shizuya	The Structure and Renormalizability of Massive Yang-Mills Field Theories (FERMILAB-Pub-78/29-THY; submitted to Phys. Rev. D)
H. D. I. Abarbanel	Using Field Theory in Hadron Physics (FERMILAB-Conf-78/33-THY; lectures given at the Topical Seminar on Particles and Fields, Tübingen, June 20-July 1, 1977)
C. Quigg	Lectures on Charmed Particles (FERMILAB-Conf-78/37-THY; presented at the XIth International School for Young Scientists on High Energy Physics and Relativistic Nuclear Physics, Gormel, Byelorussia, September 12-23, 1977)
H. D. I. Abarbanel	The Behavior of Homogeneous Turbulence Mixed at Long Wavelengths (FERMILAB-Pub-78/40-THY; submitted to Phys. Fluids)
W. A. Bardeen et al.	Deep Inelastic Scattering Beyond the Leading Order in Asymptotically Free Gauge Theories (FERMILAB-Pub-78/42-THY; submitted to Phys. Rev. D)

T. Inami et al. A Dynamical Relationship Between Baryon Structure Functions and Baryonium Trajectories (FERMILAB-Pub-78/50-THY; submitted to Phys. Rev. Lett.)

Erection of the new West Gate at the Pine Street Entrance to the Laboratory.

(Photograph by Fermilab Photo Unit)

PHYSICS ADVISORY COMMITTEE SUMMER MEETING 1978

E. L. Goldwasser

The annual extended meeting of the Fermilab PAC was held again this summer in Aspen, Colorado from June 17 to June 23. It was the first of these meetings for which the Committee met under its new name "Physics Advisory Committee," replacing the previous designation "Program Advisory Committee." The change in name is intended to symbolize the fact that the Committee now bears a more explicit responsibility for serving in an advisory capacity to the Laboratory with regard to choices of direction of the long-range program as well as for choices among proposals for experiments submitted to the Laboratory.

Reflecting the addition of this new responsibility, the Laboratory staff spent more than a full day discussing with the Committee the status and prospects of various aspects of the Tevatron program. That program includes possibilities for pp and $\bar{p}p$ colliding-beam physics as well as for fixed-target physics at 1000 GeV. In response to the Laboratory's presentations, the Committee held several executive sessions to discuss what they had learned and to formulate their own opinions. The consensus that was reached by the Committee is now expressed in a document entitled "Comments on the Doubler/ Saver and Colliding Beam Options." That document is appended to this article.

One of the important reasons for involving the PAC in questions concerning the long-range program is that we have now reached the time when commitments that might be made to newly approved experiments could be in conflict with the potential for doing new kinds of physics using one or another of the unique features of the Tevatron. It is estimated that the superconducting accelerator ring, which is the heart of the Tevatron, might be finished as early as the summer of 1980. Less optimistically, one might with some confidence project its completion in the fall of 1981. Those possibilities were kept in mind as the Committee considered the new proposals that had been submitted to the Laboratory.

As far as the normal activity of the PAC is concerned, more than forty different proposals were discussed and acted upon. As a result of those actions, four new proposals were approved and allotted new running time in the future. One proposal was approved for running within time already approved for other work. One request for an extension of an old experiment was approved. Action is being deferred on two of the proposals that were before us. Eighteen proposals were rejected. Three groups with previously approved experiments were served notice that the existing approvals were in some jeopardy of being withdrawn. About twenty other miscellaneous requests for changes in priority, extensions of running time, etc., were turned down.

The statistics on new approvals are somewhat dismal, but in working with the Physics Advisory Committee we kept closely in mind the broad advice we have received from many sources, namely, given the present circumstances of underfunding of Fermilab and of the relative funding of Fermilab and CERN, we should be doing fewer experiments but doing them better. We are also keeping very much in mind the caution that we must not enter the coming era of 1000-Gev physics and of colliding-beam physics with such a heavy commitment to 400-Gev physics that it will be difficult or impossible to carry out the transition in an orderly fashion.

Among the specific current problems that were discussed with the PAC was the question of running the 15-ft bubble chamber with a system of plates inside. That problem had received considerable attention during the past year and a decision was made in November to carry out the approved deuterium runs with plates in the chamber. The decision was also made that an engineering test of the system of plates should be carried out. That test was carried out just before the recent accelerator shutdown. The test was a failure in that the quality of pictures obtained was not adequate to permit the use of the initially designed system of plates in the run that is scheduled for October. As a result, a decision was made in the Laboratory not to try to undertake a crash program to modify the plate design and to carry out another test during the one available running period prior to October. Instead we intend to use that interim period for parasitic running of a bubble-chamber experiment. In that run the chamber, filled with a heavy neon mix, is to be exposed to a neutrino beam formed in the new dichromatic train. Then in October the neon fill will be exchanged for deuterium and the long-awaited deuterium runs will be made without plates in the chamber.

As a further result of our discussions with the Committee on this subject, we have decided not to press ahead aggressively with the redesign and installation of plates directly following the deuterium run. Instead, a careful design study will be carried out that will not only provide us with a new design but that will also provide us with reasons why the original design, which was expected to work without question, was not in fact satisfactory. With that kind of report in hand, we shall await results of further analysis of data from hydrogen and deuterium runs. If the progress of that physics is such as to argue for a system of plates in a future run, then we shall proceed to convert the design study into a hard engineering design and to produce a new system of plates at the appropriate time. We do not expect that to happen for a period of at least a year.

The general question of beam-dump experiments received considerable attention. An experiment has been carried out at CERN and the results are intriguing. They seem consistent with a rather large cross section for the production of charmed particles, but other experiments do not appear to be in good agreement with that result. There is then still the question whether the source of the events which are observed at CERN may be something other than charm, something new.

There is a strong temptation to undertake a beam-dump experiment at Fermilab in an attempt to resolve this question. On the other hand, it is not simply a matter of obtaining more statistics on the kind of events that were observed at CERN. It is desirable to be able to differentiate, in a qualitatively better way, among ordinary background events, events that result from the decay of charmed particles and events that might stem from some new process. After our discussions with the Committee, we decided that the present physics situation is not such as to argue urgently for an immediate run at Fermilab. In particular, it is recognized that there is no point in carrying out such a run unless we can be sure that the beam that is used and the detectors that are deployed have the capability of making new information available.

One interesting suggestion has come forward in a proposal submitted by Luke Mo and collaborators, P-599. That is to run a beam-dump experiment in a charged-particle beam in the Meson Laboratory rather than in the Neutrino Laboratory, as had always been proposed before. That location could provide a substantial advantage in data rate, by reason of geometry and the large available acceptance that would not be possible in the stretched out Neutrino Laboratory configuration. Furthermore, the physics capability of an experiment in that geometry is also enhanced by reason of the larger angular acceptance of the detector. On the other hand, a beam-dump experiment in the Neutrino Area has the advantage of bringing to bear three powerful detectors comprising hundreds of tons of neutrino-detection capability.

In light of the various possibilities and uncertainties cited above, it seems desirable to hold a beam-dump experiment workshop some time during the coming year. We have early spring in mind and any experimenters who are interested in participating, or even better, in helping to organize such a workshop should get in touch with Tom Groves.

Much of the attention of the PAC during the past six months has been focused on the future program in the Meson Laboratory. With the "Mesopause" upon us, it has been essential to lay out a program of experiments that will be installed during the Mesopause and that will be ready to come into operation directly following the Meson Laboratory shutdown.

The Proposal Presentation Meeting, which normally occupies two days in toto, prior to the summer meeting of the PAC, actually turned out to consist of two days devoted solely to presentation of proposals for the Meson

Laboratory and one day for odds and ends of other proposals pertaining to work to be done in other parts of the Laboratory. More than a dozen proposals were submitted for future work in the Meson Laboratory. Three of the four new approvals that were granted following the PAC meeting were for experiments to be located in the Meson Laboratory. One of those, P-580, is for a study of double-V production using the Multiparticle Spectrometer. The group proposing that experiment will be the first, other than groups composed of the initial builders, to use that facility. The Laboratory is now organized to provide the assistance that is required to make such use possible.

Another new experiment has been approved for the M6 beam line. This one is a large-angle elastic-scattering experiment, P-577, which can be run in the area upstream of both the Single Arm Spectrometer and the Multiparticle Spectrometer.

A third approval in the Meson Laboratory is for an experiment, P-584, that will be run in the neutral M3 beam line. That experiment uses the apparatus of E-533, which is now being commissioned for the study of π-μ correlations in K_L^o decay products. The new experiment will be a search for long-lived neutral objects, for example for the predicted stable states of the $u\bar{b}$ or $\bar{u}b$ quark pairs referred to as "bare-bottom."

The above experiments have been approved for the Meson Laboratory. In addition, it is expected that a program of previously approved experiments will hold over in some locations. In the M1 beam line, the study of coherent dissociation processes, E-272, is expected to continue after the mesopause. Similarly, E-490, the recently initiated search for charmed-particle decays using a high-resolution high-pressure Argonne streamer chamber may be continued in M1 after the mesopause. Finally, a new search for hadronically produced charmed particles, E-515, will be running in the M1 beam line when the Meson Laboratory comes back into operation next year.

An unexpected outcome of the recent PAC meeting is that the M4 beam line, recently converted from a neutral to a charged beam line, is currently uncommitted in the post-pause period. The same will be true of the M2 beam line after completion of some unfinished work. Similarly, the M6-East beam line, currently occupied by the Single Arm Spectrometer, has no new commitments for the period following the Meson Laboratory pause.

The decisions not to commit those beam lines have not been made lightly. There are clearly opportunities for new proposals of substantial physics experiments which could be done in any of these locations. On the other hand, there were a number of such proposals before us at the summer meeting, and they were rejected, not because of their requirement in terms of primary protons nor because of their priority relative to other experiments, but simply because the physics promise of the proposals did not seem to warrant the cost that would have been involved in running the experiments. Those funds, in our judgment, can better be used to build and run other facilities more effectively.

Those decisions, do not however, preclude the approval of new, more-promising experiments proposed for the beam lines in question. In particular, the M6-East beam line, now containing the Single Arm Spectrometer, is available for use either with or without the Single Arm Spectrometer. Whether or not that facility, which has served a number of experiments well during the past years, remains in place, will depend upon whether a new proposal comes forth with physics sufficiently interesting to warrant the continued maintenance and operation of the SAS. A proposal for the use of that beam line with a detector other than the Single Arm Spectrometer is also in order and will be judged on its merits.

In other areas of the Laboratory, the research program following the PAC meeting remains pretty much as it was in outline prior to the meeting. In the Proton Area, a Compton-scattering experiment is now in progress in the tagged-photon beam line, and it is scheduled to be followed by the installation of the tagged-photon beam spectrometer that is to be used for the photoproduction experiment E-516. An attempt will be made to install E-516 in such a manner that other apparatus can also be installed in the P-East beam line with minimum new cost or disruption of the program.

In the P-East beam line, further work is also projected in the broad-band photon beam during the next two years (E-401 and E-458). In E-400, it is planned to bring a proton beam through the normal photon-production and neutron-filter system so that the products of proton interactions can be directly studied in the detector that has been developed in the broad-band photon beam.

In P-Center, the dilepton study is scheduled to be finished prior to the autumn shutdown. Present plans are to commission the charged-hyperon beam and area at that time and to run experiment E-497, a study of the production and elastic scattering of charged hyperons. On the other hand, the strength of that program, as well as that of the program in the broad-band photon beam, will be studied, and the extent to which those programs are supported will depend on the present promise of the physics and the commitment of strong groups of physicists to carry out the work.

In P-West, the high-intensity pion facility will be commissioned starting in late summer and early fall. That facility will gradually develop during the next year so that it can accommodate the five experiments that have already been approved for initial running in that area.

Another subject of discussion had to do with neutrino physics and with the possible development of a new large detector appropriate for carrying the neutrino program beyond the present generation of 400-GeV physics and into the coming generation of Tevatron neutrino experiments. There were three specific proposals submitted involving the development of substantial new large detectors. There is a fourth detector-development project which has been encouraged by the Laboratory, but which has not yet reached the stage of a definite proposal. All three of the actual proposals that had been submitted were rejected.

Early tests of the new dichromatic beam and of the associated calorimeter-spectrometer are just now getting underway. That device represents a substantial upgrading of the original beam-detector combination that was used for the first experiments in the dichromatic beam. Furthermore, the development and construction of a second large detector has just recently been approved and is now getting underway. That detector contains a finer-grained calorimeter and is designed primarily for the study of neutral-current interactions and for νe scattering events. Initial operation of that detector is expected to come in 1979. Finally, the 15-ft bubble chamber remains an extremely powerful tool to be used for the study of neutrino interactions.

Given these three detectors, two of which have not even been tested, it was decided that a third new major detector, having substantial uncertainties associated with its own capabilities, could not be justified at this time. Any sizable new investment will almost certainly be delayed until there is some operating experience with the two major new detectors that are now being commissioned and built.

One new approval that was granted following the June PAC meeting was for an additional 300, 000 pictures to be taken in the 15-ft chamber with a broad-band neutrino beam incident on a heavy neon fill in the chamber. The previous run (E-53) by a Columbia group for which Charles Baltay is the spokesman, has yielded eleven well-identified νe scattering events. An extension of the previous exposure is intended to bring that number to about forty, a level of statistics that should resolve some of the uncertainties and discrepancies in existing data. In view of the success of E-53 in identifying νe scattering events and in view of the extension of that experiment, it was decided to reject a proposal to study νe scattering through the use of an ingenuously designed but very large Cerenkov detector.

There are two smaller detectors being assembled in the Neutrino Area to perform emulsion searches for short-lived decays. Those experiments were previously approved and are expected to be run this autumn in conjunction with neutrino and antineutrino bombardments of the deuterium-filled 15-ft bubble chamber. At that time, it is also planned to expose a set of emulsions inside the chamber, using the chamber tracks themselves as downstream detectors of interesting interactions in the emulsion.

A new experiment, P-595, proposed by a Rochester-Caltech-Stanford collaboration, was also approved in the Neutrino Area. This is actually an extension of previous work that is interpreted as giving direct evidence for the hadronic production of charmed particles. The earlier experiment, E-379, performed by a Caltech-Stanford group, used a proton bombardment of a heavy target and observed events in which μ mesons were produced. A calorimetric measurement then established whether or not all of the energy of the incident proton could be accounted for between the μ mesons and the hadronic and electromagnetic components of the secondary particles. Events with missing energy were then consistent with events in which charm particles were produced, later to decay semi-leptonically.

The same group has now proposed a follow-on experiment in which some of their techniques will be refined and in which π mesons as well as protons will be used in the bombardment. An approval for 600 hours of running has been given to this new experiment. The proponents wish to study high-p_t as well as low-p_t events, but there are severe problems in targeting a beam of sufficient intensity for the high-p_t studies. Therefore the present approval covers only that part of the experiment that is proposed for study of low-p_t events.

During the course of the meeting, the Committee discussed the question of the two new beams that have been proposed for the Meson Area, a modified M1 beam that could provide a source of protons and pions of the highest energy and intensity and a polarized proton beam. The Committee encouraged the Laboratory to make detailed studies of both of these options and the Laboratory intends to follow through on that recommendation.

One of the proposals that was before us at our recent meeting was for a second-generation study of high-mass lepton pairs, using the higher energy capability of the Tevatron with both protons and pions incident. Although no action was taken on that proposal, it was noted that the M1 beam, upgraded in the manner that has been suggested, would be well suited for such an experiment in the future.

The members of the Committee have asked the Laboratory to provide them, in the future, with "impact statements" for each experimental proposal that is referred to them for consideration. We envision these impact statements as one-page forms that would incorporate much of the basic information which later, in a more advanced stage, would form the core of an Agreement that might be drawn up between the Laboratory and the experimenters. We have been working toward a goal of providing the PAC with information of this kind and it is now our intention to meet their request for future meetings. This will place some additional burden upon proponents of experiments, but the Laboratory staff will work with them in developing the requested new information.

APPENDIX

In presenting the PAC's 1978 comments about long-range opportunities at Fermilab it is helpful to record, also, relevant comments of previous PAC's stemming from the annual meetings in 1976 and in 1977.

1976

General Comments on Modest Storage Ring Proposals. The modest storage-ring-related proposlas (P-478, P-480, P-491, P-492, P-493) hold out the prospect of doing physics experiments at center-of-mass energies between 200 GeV and 2 TeV and of doing so on a time scale of a few years. Such experiments could lead to important new discoveries and, in any case, would provide a wealth of new information. In bringing the high energy community's attention to these possibilities the proponents of these proposals have made an extremely important contribution. However, it is the Committee's view that the way for Fermilab to pursue the goal of ultra-high energy at an early date is to push as hard as possible on the Energy Doubler/Saver effort and on its colliding-beam applications.

To arrive at an optimal set of experimental facilities, detectors, etc., to do actual experiments with colliding beams, the Laboratory might proceed in the following way. Within about a year, a workshop could be held to help define optimal configurations of the Energy Doubler/Saver, the experimental halls, and detectors for various representative experiments. At a somewhat later time, as the development of the colliding-beam facilities becomes more specific, there might be a call for particular physics proposals from interested users.

Until such time as these proposals are invited, the Committee expects to recommend rejection of proposals for specific experiments in colliding-beam facilities. This avoids the staking out of priorities for various pieces of physics on the basis of a low proposal number. It is in line with this approach that the Committee has recommended the rejection of P-480, P-491, and P-493.

Comments on $\bar{p}p$ Storage Rings and Antiproton Cooling. The long-range implications of producing intense stored beams of antiprotons are very great. As pointed out in P-492, one might ultimately anticipate, at Fermilab, $\bar{p}p$ collisions at a center-of-mass energy of the order of 2 TeV, considerably higher than that anticipated in P-491. The attainable luminosity will probably be less than for pp rings of similar energy. However, the probability of processes dependent on conjectured quark-antiquark interactions, such as resonant formation of an intermediate boson, W, is expected to be greater by a factor 10-100 for a $\bar{p}p$ collision than for a pp collision of the same energy. This, as well as the possible higher center-of-mass energy, may help to mitigate any disparity in luminosity.

When, in addition to this, one takes into account the implications of antiproton sources for the more distant future, one finds that the physics goals of such systems are considerable and the development work easily justifiable.

The Committee recognizes and appreciates the efforts of the proponents of P-492 toward realizing the goal of obtaining intense cooled antiproton beams. The Committee, however, feels that the development of the cooling and colliding-beam techniques and facilities are so intimately tied to the development and operation of the accelerator that such a project should not be treated as a normal experimental proposal. Instead, the development of the techniques and the facilities for colliding beams should be a primary responsibility of Fermilab. The Committee feels that a strong group of physicists should be brought together to study these problems and to carry out this important work. This might be implemented by first organizing a workshop on this topic. The Committee hopes that the proponents of P-492 will participate fully in these activities.

1977

General Comments on the Colliding-Beams Organization. The Committee discussed the suggestion that a Fermilab-directed collaboration be organized to construct a detector for the planned colliding-beam facility involving the Energy Doubler. The close interaction between the ring design and detector considerations makes such a collaboration logical, both from the point of view of convenience as well as optimization of resources. However, the detector design and progress on construction, as it may impact on the future research program, should be monitored by the PAC. Any running time approved for this detector should result from formal requests to the Laboratory in the form of experimental proposals subject to traditional review by the PAC. Precedents for this can be found at SLAC, BNL, and CERN where the initial proposals for utilizing large "in-house" constructions were still brought before Program Committees before committing beam time.

The Committee also debated the wisdom of advertising that a second Laboratory for colliding-beam experiments would be available for outside proposals. This would clearly relieve user frustration at a closed situation, one in which, to make a point, the Director is appointing the discoverer of the W meson. The Committee's discussion of this topic ended in no consensus largely because there is a widespread fear that colliding-beam research will require a very long time before an experiment can be completed and that the rest of the program, and in particular fixed-target 1-TeV physics, will be delayed too long.

At this stage it is difficult to compare the high risk features of colliding beams with the physics potential of fixed-target research. The situation may become clearer in the next few years. The PAC should be kept informed on the progress of the colliding-beams program; the detector as well as problems of luminosity, backgrounds, impact on extraction, etc. A detailed progress report could be made next summer.

1978

Comments on the Doubler/Saver and Colliding-Beam Options. The PAC would like to express its great admiration for the program of superconducting magnet production and installation. We view the progress here as very significant. We are now convinced that Fermilab can make useable accelerator magnets in a production mode. Given the required financial support, a 1000 magnet ring could be completed in 1980. In view of the vast world-wide efforts on superconducting magnets, the accomplishments at Fermilab are impressive and seminal in the evolution of future accelerator technology. We are also impressed with the state of planning towards the realization of circulating beam in the Doubler/Saver and of extraction. We recognize the beginning of a program of deployment of 1000-GeV protons to the experimental areas, although we note that uncertainties in funding and in user response may result in significant modifications here.

Finally we note the very exciting options that exist for capitalizing on the proximity of the Main Ring and the Doubler for the observation of colliding beams with extraordinary energy in the center-of-mass. Here the variety of options, the interaction of colliding efforts with the fixed target (TEVATRON) program, and the scheduling uncertainties make careful planning much more difficult and provide clear hazards as well as opportunities. Through the confusion, the PAC sees several very well defined goals:

1. A TEVATRON program with an experimental area capability for 1000 GeV which will evolve as the physics priorities and fiscal constraints permit. The Committee supports the beginning already made in this direction.

2. A colliding ring facility where 1 TeV protons collide with 1 TeV $\bar{p}$'s with a luminosity of at least 10^{30} sec^{-1}. The goal of such a facility, with energies unmatched anywhere else, is enthusiastically supported by the PAC.

3. A more controversial but defensible objective is the "race for the W-boson" in recognition of the CERN efforts along these lines and of the outstanding consequences for our science of the determination whether or not this particle exists at or near the mass predicted by theory. This may be generalized to a glimpse of physics at $\sqrt{s} \sim 400\text{-}1000$ GeV.

The challenge lies in the balancing of these objectives. There are many forks where the pursuit of one goal detracts and endangers the success of another goal particularly with limited overall funding. However, it seems obvious to us that those tasks which underlie all three goals should be pursued most vigorously, e.g., Doubler magnet program, improvement of Main Ring vacuum and general reliability, etc.

The path toward goal 1, the TEVATRON program, seems relatively well defined although we recognize that there are still residual uncertainties before a 1 TeV beam is achieved and extracted. In the planning for deployment of 1 TeV protons, mechanisms should be sought to increase user input.

The $\bar{p}p$ goal is more difficult. At this stage it is not clear that the required luminosities are in fact achievable. It is hoped that vigorous experimental and theoretical efforts will illuminate these matters so that decisions toward this goal may be sensibly phased.

The $\bar{p}p$ program implies efforts in cooling, beam gymnastics and almost surely some attempts at observing collisions in the Main Ring. This will provide the Colliding Detector Facility Department with opportunities to carry out some simple physics tests in a relatively modest arrangement, keeping in mind the low luminosity that such an arrangement implies. It is here that we recognize the temptations to convert those tests into goal 3. The PAC is skeptical about the physics potentialities of $\bar{p}p$ collisions at 10^{28} cm^{-2} sec^{-1}. If there are good technical arguments that encourage a more serious effort at this stage, we suggest that these be presented and supported with solid and defensible analysis. The PAC, therefore, requests a presentation on the luminosities expected for $\bar{p}p$ collisions in the Main Ring and the physics expected to be explored, perhaps by our March meeting.

The alternative route to goal 3 is the collisions of protons in the Main Ring with protons in the Doubler. Here, the luminosities can more confidently be estimated to be sufficient for W-detection as well as for a more serious glimpse at the new energy domain. The PAC recognizes then, that there are three alternatives for goal 3: $\bar{p}p$ in the Main Ring or in the Doubler, pp using the Doubler and Main Ring, and not doing it at all. A lack of early decision makes life hard for the accelerator group and almost impossible for the detector group. Some time scale must be established so that a sensible decision can be taken, before or during our next summer meeting.

Finally we would like to reiterate our 1977 statement that decisions which commit significant fractions of accelerator time should be reviewed by the PAC.

NEW FERMILAB COMPUTING FACILITY

A. E. Brenner

On July 5, 1978, an order was placed with Control Data Corporation to provide a new computing facility at Fermilab. In general terms, CDC will deliver to Fermilab three CYBER 175 computers to replace the two CDC 6600 and one CDC 6400 computers currently installed. The three CPUs will be loosely coupled in a fashion somewhat similar to the scheme currently in use for the existing older equipment. The total computing power of the new equipment when fully installed will be about nine times the power of a single 6600 CPU.

The installation of this equipment will start in October. To the largest extent possible, the user community should not be seriously affected as new pieces of equipment are brought in and are introduced into the system. By the end of the year, two CPUs and additional disk storage and magnetic tape units should have been integrated into the system and should have brought our computational capability up to a comfortable level which will allow us to maintain the current style of operation with more than enough CPU cycles for a very responsive operation. By April of 1979, most of the rest of the equipment will be delivered, including the third CPU.

By mid 1979 the style of operation of the facility will slowly be modified by adding enhancements to the existing operational features. This will include the ability to access files on the main system in an interactive mode. All files will be available through all channels, either direct input, RJE, or or interactively. Thus, users at that time will be able to modify batch control files and program files, and initiate the execution jobs from consoles.

There will be no direct interaction with running programs on the facility.

NOTES AND ANNOUNCEMENTS

APPOINTMENTS. . .

Safety. A. Lincoln Read has been named Head of a newly formed Safety Section that will be responsible for all safety activities of the Laboratory.

Research Services. Paul Mantsch has been named Head of Research Services, succeeding Lincoln Read. Marvin Johnson becomes Associate Head.

Neutrino. T. B. W. Kirk has been named Head of the Neutrino Department and Shigeki Mori has been named Associate Head. Dennis Theriot, who has completed his term as Head, will be working on Fermilab Experiment #356.

Meson. Ernest Malamud has been named Head of the Meson Department. Timothy Toohig, who has completed his term as Head, will be active in the Meson Area construction and will make an extended visit to the Soviet Union to work on Fermilab Experiment #456 collaboration. John Elias will continue as Associate Head.

WORKSHOP ON ACCELERATOR AND DETECTOR POSSIBILITIES. . .

A Workshop on Accelerator and Detector Possibilities and Limitations will be held at Fermilab on October 15 through 21, 1978. The Workshop which will be sponsored by the International Committee on Future Accelerators, will concern itself with the next major step in accelerators (sometimes called colloquially the Very Big Accelerator, or VBA). Attendance is by invitation and approximately 40 builders and users from many countries will attend.

SUMMARY OF OPERATIONS - JUNE 1978

Program Planning Office

The shutdown for facility maintenance and development which began on May 22 was ended during the month of June and there was a resumption of activities in the experimental areas. The startup of the accelerator following this shutdown was slower than usual and there was some difficulty in achieving the normal operating intensity. During the two weeks of operation in June there were several interruptions for repairs, as can be seen in the operations history on the facing page.

Fortunately the experimental program fared reasonably well with the lower-than-normal intensities. This was due to the fact that most experiments were in a startup phase. In the Neutrino Area a new dichromatic train was tuned using a 300-GeV proton beam extracted especially for that purpose. Later new counter apparatus on the neutrino beam line in Lab E was also tested.

Very soon after the startup of operations the photoproduction experiment using the tagged-photon beam in P-East began collecting data. Consequently most of the available intensity was sent to that experimental area. There was a continuation of experiments in the Meson Area with a goal of completing or providing a significant amount of data for all of them before the "Pause." This interruption of experimental activities is now planned to begin on September 5. This date is projected as the tentative start of the next shutdown for maintenance and development if additional funds are available this fiscal year for electrical power.

FERMI NATIONAL ACCELERATOR LABORATORY
MONTHLY OPERATIONS HISTORY
JUNE 1978

Date		Accelerator	Internal Target Area	Proton Area	Neutrino Area	Meson Area
Thu.	6/1					
Fri.	6/2					
Sat.	6/3	Facility Maintenance & Development				
Sun.	6/4	(since May 22)				
Mon.	6/5					
Tue.	6/6					
Wed.	6/7					
Thu.	6/8					
Fri.	6/9	Reprs:345 KV Pwr Lines				
Sat.	6/10					
Sun.	6/11					
Mon.	6/12	Accelerator Startup & Tuneup				
Tue.	6/13	for High Energy Physics				
Wed.	6/14					
Thu.	6/15					
Fri.	6/16	~4x10^{12}ppp	OFF	Photoprod.152B (PE)		Had.Dissoc. 272 (M1E)
Sat.	6/17	Tuning:Encl.C losses ~5.0x10^{12}ppp		Di-Lepton 288 (PC)		
Sun.	6/18	@300/400 GeV			Tune dichro.train	Bkwd. Scatt. 290 (M6W)
Mon.	6/19	Reprs: ES40		Nuclear Scaling 592 (PW)	Neutrino 356 (NO)	K Charge Exch.585 (M4)
Tue.	6/20					OFF (M2,M3)
Wed.	6/21	Accel. Repairs, Switch to H+ ion source Tuneup for HEP				
Thu.	6/22	~1.0x10^{13}ppp @400 GeV (1 sec.flattop)	OFF			
Fri.	6/23					Same as above but Ξ^0 Prod.495 (M2)
Sat.	6/24					
Sun.	6/25					
Mon.	6/26	Accelerator Maintenance & Development				
Tue.	6/27					
Wed.	6/28	Accelerator Startup				
Thu.	6/29	Lambertson Installation continues				
Fri.	6/30	Alignment of extraction devices				

BEAM UTILIZATION BY

	Beam	Hours
PROTON AREA		
Photoproduction #152B	PE	140
Di-Lepton #288	PC	140
Nuclear Scaling #592	PW	90
NEUTRINO AREA		
Neutrino #356	N0	80
MESON AREA		
Nuclear Chemistry #81A	M0	-
Hadron Dissociation #272	M1E	110
Backward Scattering #290	M6W	100
Ξ^{o} Production #495	M2	10
K Charge Exchange #585	M3	120
TOTAL HOURS FOR HIGH ENERGY PHYSICS		790

EXPERIMENTAL ACTIVITY -- JUNE 1978

Activities

tuneup and data: for study of elastic and inelastic Compton scattering

data: for high resolution study of the dimuon spectra produced by 400-GeV protons

data: to study connection between scaling phenomena and the determination of structure functions in the inclusive reaction $pA \rightarrow (p, d, t, \pi, K)X$

tuneup: for study of deep inelastic $\nu, \bar{\nu}$ scattering using a dichromatic beam

data: 2 targets exposed

tuneup and data: for study of inelastic Coulomb excitation and diffractive production of hadrons

tuneup and data: $\pi^- p$ backward elastic scattering at 70 GeV/c incident momentum

tuneup: for measurement of the production spectrum and polarization of Ξ^0 and $\bar{\Lambda}^0$ hyperons

tuneup and data: for study of KN charge exchange scattering

FACILITY UTILIZATION SUMMARY -- JUNE 1978

I. Summary of Accelerator Operations

		Hours	
A. Accelerator use for physics research			
Accelerator physics research		0	
High energy physics research		161.1	
	Subtotal		161.1
B. Other activities			
Accelerator setup and tuning to exp. areas		39.0	
Program interruption		333.4	
Unscheduled interruption		186.5	
	Subtotal		558.9
C. Unmanned time			----
	Total		720.0

II. Summaries of High Energy Physics Research Use

	# of Expts.	Hours	Results
A. Counter experiments	8	790	
B. Bubble chember experiments			
C. Emulsion experiments			
D. Special target experiments	1		2 targets exposed
E. Test experiments			
F. Engineering studies and tests			
G. Other beam use			
Totals	9	790	

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

A. Beam accelerated in Main Ring		0.44
B. Beam delivered to experimental areas		0.42 (all 400 GeV except some 300 GeV to Neutrino Area)
Meson Area		0.08
Neutrino Area		
	Slow Spill	0.0
	Fast Spill	0.04 (300 & 400 GeV)
Proton Area		0.30

Victor Kirkman feeding one of this year's crop of buffalo calves. This one was rejected by its mother, but is doing fine with bottle feeding.

(Photograph by Fermilab Photo Unit)