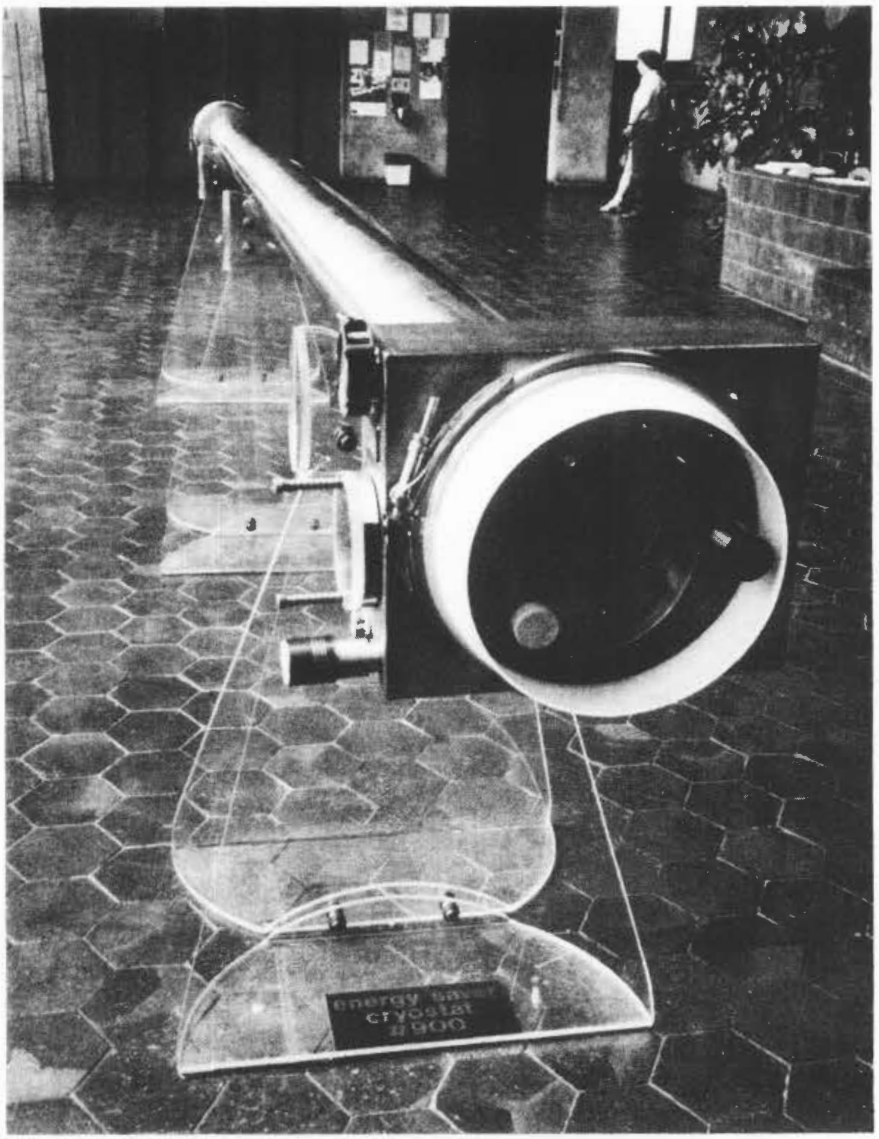
fermilab report

Fermi National Accelerator Laboratory Monthly Report

May 1982



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F. T. Cole, R. Donaldson, and L. Voyvodic, Editors

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THE COVER: The last Energy Saver dipole cryostat has been completed and put on temporary display in the Atrium. The 900 magnets include spares and magnets to be used in fixed-target experimental areas.
(Photograph by Fermilab Photo Unit)

CONTENTS MAY 1982

UNIVERSITIES RESEARCH ASSOCIATION ELECTS NEW PRESIDENT

Dr. H. Guyford Stever has been elected President of Universities Research Association which operates Fermilab under a contract with the Department of Energy.

Dr. Stever has had a distinguished career. He was a Professor of Aeronautics and Astronautics at Massachusetts Institute of Technology, as well as head of the Departments of Mechanical Engineering and Naval Architecture and Marine Engineering. He was president of Carnegie-Mellon University during the time when Universities Research Association was formed and was active in the work of founding URA. Dr. Stever was Director of the National Science Foundation and Science and Technology Advisor to the President, as well as Director of the Office of Science and Technology Policy and a member of the President's Committee on Science and Technology. He currently serves as Chairman of the Assembly of Engineering of the National Research Council.

H. Guyford Stever

ACCELERATOR OPERATION

William Merz

The accelerator achieved a new record intensity of 3.194×10^{13} protons at 400 GeV at 5:27 a.m. on March 18. The Booster also achieved a new record of 4.6×10^{13} protons per second.

There are many other good things happening in the accelerator these days:

(i) Extraction. The extraction loss is routinely a factor 2 lower than a year ago. The extraction efficiency, measured over a week, is very close to 99.2%

(ii) Left Bend. The reliability has improved greatly. The Meson line now routinely takes 6 to 8×10^{12} protons per pulse in slow spill.

(iii) Ion Source. The negative ion source has run with a lifetime three times larger than previously.

(iv) Booster. The Booster has achieved very good reliability at high intensity.

The present run is going well. User requests are high enough to keep pushing the accelerator intensity higher.

THE ENERGY SAVER

The cover photograph shows the last dipole cryostat sitting on exhibit in Wilson Hall. As of the end of April, 660 of 900 dipoles, 96 of 295 quadrupoles, and 144 of 273 spool pieces have been completed. The quadrupoles were a little behind but are catching up quickly.

Ramping tests are continuing on the first eighth of the ring (see March 1982 **Fermilab Report**). The sector has been ramped to a field level corresponding to 900 GeV for periods of more than 24 hours.

Work is going on to design the conventional components in long straight sections. *A la recherche du temps perdu*, the Lambertson magnets in the abort region are being built with close to a mile of copper salvaged from the ZGS. The warm bus connecting the Tevatron power supplies to the superconducting magnets as well as the bus connection across the 6 long straight sections make use of almost 2 miles of copper salvaged from the Chicago Cyclotron built by Enrico Fermi.

Richard Gustafson, president of the Users Organization, at the Users Annual Meeting (see adjoining story).
(Photograph by Fermilab Photo Unit)

ANNUAL USERS MEETING

Richard Gustafson
University of Michigan

The Annual Meeting of the Users Organization was held on Friday, April 30, and Saturday, May 1, in Ramsey Auditorium. Because 1982 is a year of change for Fermilab, with a new accelerator in sight, the Users Executive Committee had stressed the importance of users attending the meeting. More than 300 users from the U. S. and abroad were present. They were drawn by an excellent group of speakers coupled with the opportunity for discussions with the Laboratory management.

Leon Lederman welcomed the users with a briefing on the State of the Laboratory and its future program possibilities that ranged to the year 2001. He gave a set of vigorous imperatives: operate the 400-GeV program, complete the Energy Saver, produce an intense source of antiprotons for colliding-beam experiments, construct the fixed-target areas for the Tevatron and still work toward a long-range future with advanced research on such projects as high-field superconducting magnets. In the course of his review, he announced the achievement of a 900-GeV ramp in the 120 magnet string in A sector the previous night. He noted the publication list from the Laboratory for last year was long, varied, and included many Ph.D. theses. Still, there is a problem with available accelerator time. There has been a steady drop over the years, due principally to budget strictures. He indicated that the President's budget proposal for 1983 holds promise for the first real growth in the operating budget in nearly five years. Lederman also noted the Laboratory's extracurricular activities: technology transfer, including new contacts with Latin America, high school science lectures, and the Neutron Therapy Facility.

High on this year's list of user concerns was the basic planning process in particle physics. Although the users and the Laboratory have many common interests and attitudes, there is also a built-in divergence of views. Whereas the Laboratory's future depends strongly on large-scale efforts to build new facilities such as the ambitious Tevatron plan, the user's future depends strongly on current operation; the personal rewards of intellectual discovery and recognition motivate the user. This divergence has necessarily become more evident and more painful as our high-energy facilities run less of the time for ever-larger experiments. The Users Meeting is a forum for open candid discussion and reconciliation of or to this divergence.

Several of the distinguished speakers at the meeting helped to shed more light on the science policy process. Representative Don Fuqua, chairman of the U. S. House of Representatives Committee on Science and Technology, stressed the importance of good science education. He observed at one point his concern that

industry is attracting potential graduate students from the engineering and scientific field. He stressed that this was "like eating one's seed corn." He also judged the Reagan administration as enlightened in the area of basic scientific research.

Hugh Loweth, Deputy Director for Energy and Science of the OMB, gave an insightful discussion of the Washington budget process. Loweth noted that the President's proposed budget for particle physics in DOE for FY 1983 is up by almost 18% over FY 1982 and represents an increase as great as that proposed for DOD. Following his informal talk, he was joined by Martha Krebs, Staff Director of the Subcommittee on Energy Development and Application, in a lively and informative discussion with the audience.

There were the canonical reviews of Laboratory programs. Taiji Yamanouchi and Norman Gelfand reviewed the present experimental program and the proposals that have been received. Peter Koehler outlined the extensive program of improvements that had been carried out in the research areas over the last year. Rich Orr, John Peoples, and Tom Kirk reported on the progress on the large new projects now underway at Fermilab. With a fair fraction of the Saver installation complete, Orr anticipates commissioning of the Saver in the spring of 1983. He also summarized the initial conditions expected for Saver operation. Three new beams are planned, a polarized-proton beam in the Meson Laboratory, a high-intensity muon beam in the Neutrino Laboratory, and a new broad-band photon beam in the Proton Laboratory. A new plan has been devised for the Meson Laboratory beams that should considerably facilitate targeting and target handling (discussed below).

John Peoples presented the plans for the $\bar{p}p$ Collider as revised and presented in February 1982, including the new 8-GeV debuncher-accumulator rings. He announced that invitations to bid on B0 construction would go out Monday, May 3.

An interesting new proposal for an ep colliding-beam facility was aired by a U. S.-Canadian group represented by Nathan Isgur and Steve Holmes. The project would use a 5-GeV electron ring, nearly 500 meters in circumference. It would be tangent to the Saver ring at D0 and would reach a luminosity of $4\times10^{31}cm^{-1}sec^{-1}$. It could function as a booster for a larger more ambitious project.

John Cumalat, head of the Laboratory Computer Advisory Committee, and Al Brenner, head of the Computing Department, discussed the present and future computer situation at the Laboratory. Several roads are available for relieving the present problems of saturation of computing capability, but Brenner stressed that a substantial increase in capacity is not now budgeted until 1984.

A discussion was given of a Summer Study in Aspen, Colorado, sponsored by the Division of Particles and Fields of the American Physical Society, to look at intermediate and long-range national needs in particle physics. The study will be held from June 28 to July 16.

In the next talk Martinus Veltman of Michigan gave a perspective on the state of particle physics. After summarizing the predicted but as yet undiscovered particles, he cautioned that experimenters should not let themselves be dazzled by theoretical chimeras, but must concentrate on careful work to explore particle spectra to give a solid base for physics, and be sensitive to the unexpected.

On Saturday morning, H. Guyford Stever, the new president of Universities Research Association, was introduced. Stever reviewed the history of science advice in Washington, including his experience as Director of the National Science Foundation and Presidents' Science Advisor. He also reviewed the history of URA, of which he was one of the founders, and emphasized URA's dedication to the success of Fermilab and the users program.

There was a special Saturday afternoon session on Tevatron II beams, particularly in the Meson Laboratory. The original Tevatron II plan of 1980 included upgrades of all the meson beams. In February 1982 a new plan was outlined for the Meson Area in the Tevatron. It had only M1, M2, and M6 beams, with provisions for a switchable proton beam down M3 by 1985. This plan caused concern among the users and discussion between users and Fermilab staff because of the short time between the decision to change to this plan and the start of construction in summer 1982, and because it did not explicitly contain provisions for test beams such as M4 and M5 and for neutral beams such as M3 and M4.

Dave Carey presented a new design for an M6 East M6 West beam and a feasibility design for the first arm of an M5 test beam. The new M6 West beam will cross the access road near the current Multiparticle Spectrometer (MPS). It is possible to have the east branch also cross the road, necessitating the moving of the MPS into a new counting building currently being designed, an M6 East may connect to the old MPS, with some loss of beam quality. These two alternatives are being studied. Great interest was expressed in the M5 test beam. More design work is needed, but the preliminary stage looks good. Another test beam may be located in the Neutrino Area. The Collider Detector Facility envisions using one full test beam for calibrating and debugging, so two test beams are certainly necessary. The question of a Tevatron neutral M3 beam remains open until definite experimental proposals are submitted with beam type, beam size, and beam quality justified.

Interim Meson Area beams will be brought up for the Energy Saver run at 500 to 800 GeV, scheduled for the summer or fall 1983. The old target train will be removed and independent targets will be installed in the M1 and M6 beam lines 450 feet downstream of the current target box. A single target on a train will be placed in the old box for a neutral M3 beam. Some new magnets will have to be added to M6 to get a 400-GeV secondary beam from the new target down the old M6 channel and the beam is expected to be worse in intensity and momentum spread than the old beam, but M1, M3, and M6 should be operational for the next running period. An M4 test beam may be set up.

The new Tevatron M2, M5, and M6 beams should be constructed in time for the first TeV run, scheduled for fall 1984, if currently budgeted construction funds are provided. A neutral M3 beam is contingent on user need. Users are encouraged to discuss all these matters with Tom Kirk, head of the Tevatron II project, and ask questions, give opinions, and even offer their help to insure that the Meson Area can continue to do outstanding physics in the Tevatron era.

With new Laboratory projects coming to fruition, the interaction among users and Fermilab staff was especially valuable. It is through events like the Annual Users Meeting that users have a strong impact on Fermilab programs.

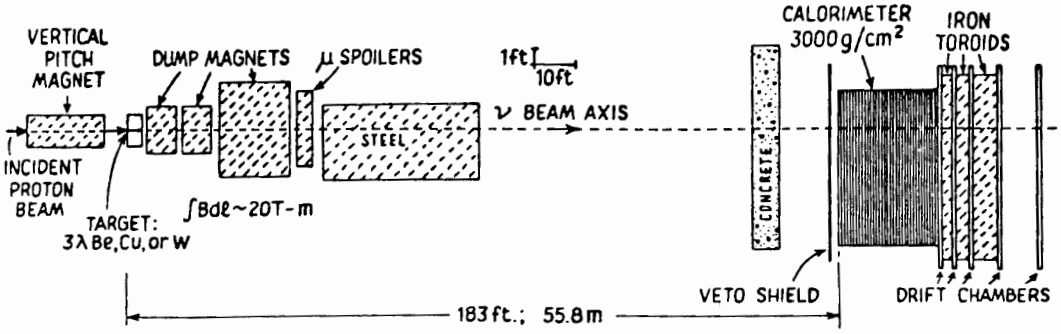
THE PROMPT NEUTRINO EXPERIMENT E-613*

Don D. Reeder
University of Wisconsin, Madison

At the end of the M2 beam in the Meson Laboratory is a dump. But before calling the EPA or bringing your trash, be assured that it was designed and constructed for a very precious commodity, the 400-GeV proton beam. The proton beam deposits all its energy in the dump in the course of which all varieties of particles are produced. The high density of the dump causes particles such as pions and kaons to interact before they decay into neutrinos and muons. However, for more exotic and massive particles such as charmed mesons and baryons the reverse is true, i.e., they decay before interacting. The study of the neutrinos produced by these "prompt" decays is the objective of E-613 and provides a window to look exclusively at new particles such as charm.

The experiment was constructed and installed in the summer of 1980 and about 1.6×10^{17} protons were dumped on a tungsten target last spring. Preliminary results based on these data will be discussed. A second run this spring will yield about twice the initial data.

The figure below shows a schematic diagram of the experimental arrangement. The detector which records the interaction



E-613 beam dump experimental arrangement.

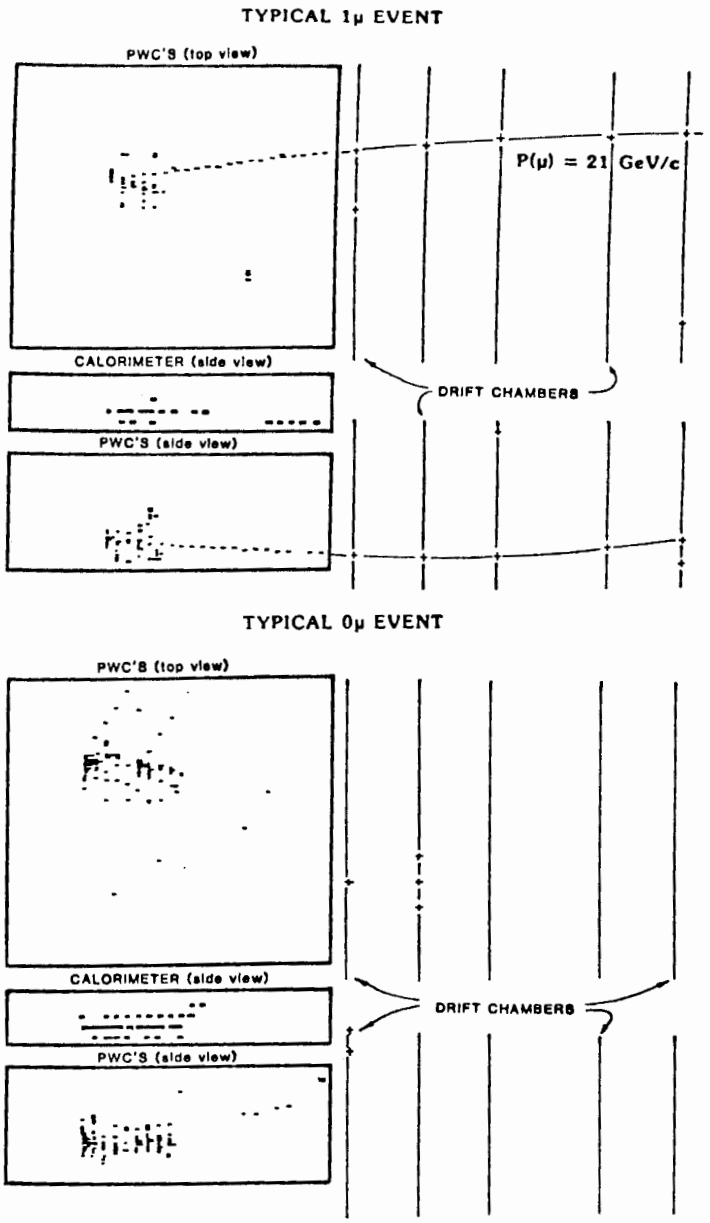
*This experiment is a collaboration of groups from Fermilab, National Institute for Nuclear Physics at Florence, Italy, the University of Michigan, Ohio State University, and the University of Wisconsin. The members are R. C. Ball, S. Childress, C. T. Coffin, G. Conforto, M. B. Crisler, M. E. Duffy, G. K. Fanourakis, H. R. Gustafson, J. S. Hoftun, L. W. Jones, T. Y. Ling, M. J. Longo, R. J. Loveless, D. D. Reeder, T. J. Roberts, B. P. Roe, T. A. Romanowski, D. L. Schumann, E. S. Smith, J. T. Volk, and E. Wang.

of the neutrinos is of relatively conventional design. The calorimeter is an active target in which the hadronic and electromagnetic cascades from the neutrino interaction are sampled by scintillators and photomultipliers. Muons which may be produced are measured using drift chambers and magnetized iron toroids. A novel feature of this detector compared to others is the use of lead in the calorimeter. The difference in energy deposition of hadron induced showers and electron (or photon) induced showers characteristic of a lead calorimeter is used to separate ν_e induced events from neutral current interactions.

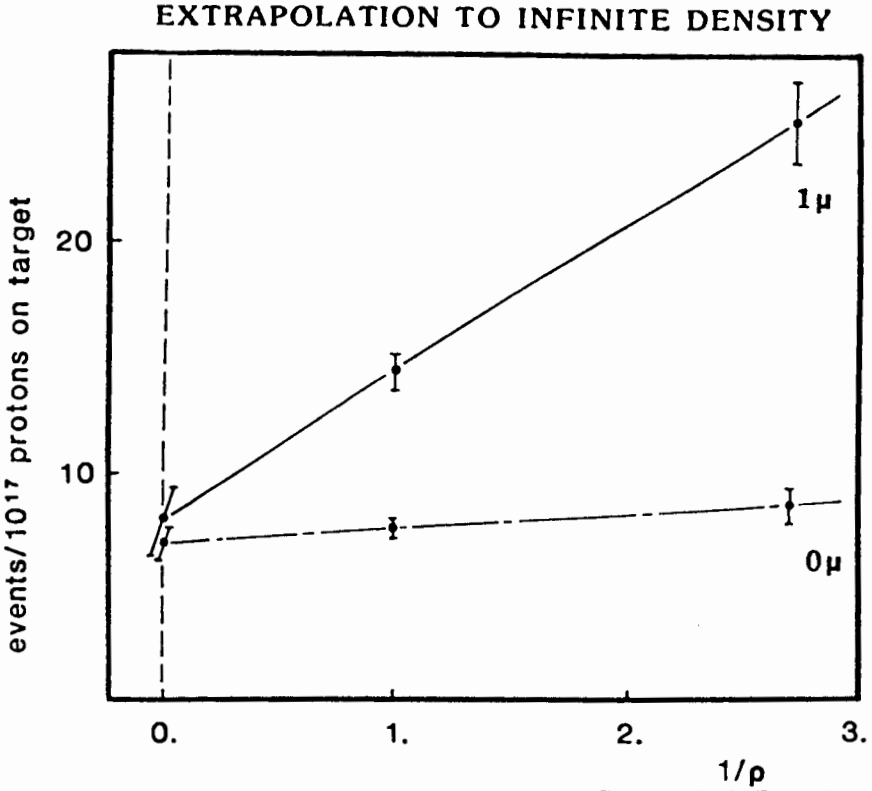
The most innovative feature of this experiment is the scheme used to reduce the large muon flux from the target to more manageable values at the detector. In conventional neutrino experiments extensive shielding is required in which the muons lose energy largely by ionization. The 1 km earth and iron shield in the Neutrino Laboratory is an example of this type. But a very large detector (3-4 m diameter) located one kilometer from the target will subtend a few milliradians only. This limitation on angular acceptance is removed if the detector is brought much closer to the target. In E-613 the distance from target to detector is 56 m which results in an angular acceptance to about 35-40 milliradians. This is achieved by using an active shield composed of several dipole magnets of solid iron (dump magnets). These dump magnets deflect negatively charged muons up (positives-down) so that they miss the detector and pass relatively harmlessly by. The $4\text{-}5\times10^{12}$ protons which are dumped each spill produce a few 10^9 muons. This muon flux is reduced by 4 orders of magnitude by the active shield. The detector is protected from the remaining muon flux by the scintillator anti-counter (veto counter).

The recording of the data was triggered by an energy deposition in the calorimeter exceeding a minimumn value (~7 GeV). The computer reconstruction of a typical event is shown on the next page. However, the bulk of the recorded events are not neutrino induced but caused by cosmic rays or particles leaking from the roof or the floor which are produced by the muons passing by above and below the detector. An initial selection is done using a computer program and the final sample is chosen by examination of the computer reconstruction. About 1600 events with the neutrino energy greater than 20 GeV were found in this preliminary analysis.

The dump target is of finite density of course so that the neutrinos due to decay of ordinary long-lived particles although reduced have not been eliminated. But by extrapolating the event rate in targets of different density to that value which would be observed in a physically impossible target of infinite density the true prompt neutrino event rate can be determined. This technique is shown in the figure on page 12 in which the event rates for various categories of events are shown. The rates for prompt neutrino events which have been so determined are underneath the figure.



Typical 1μ and 0μ events.



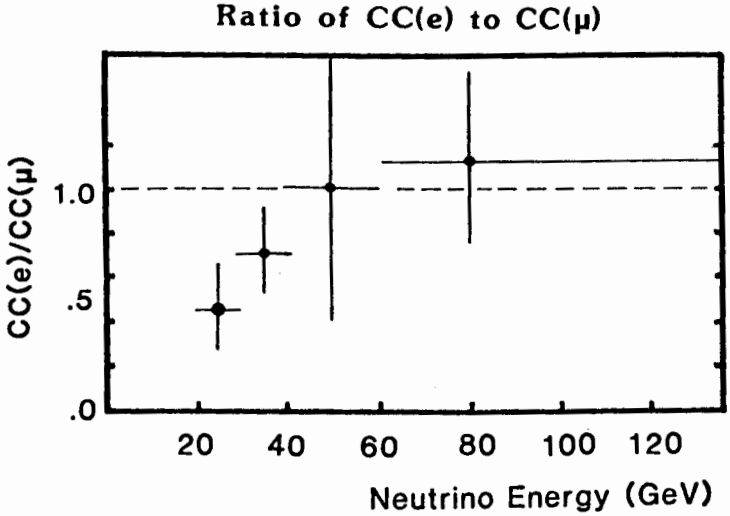
Type (E > 20 GeV)	Corrected Events 10^{16} protons on target
ν_μ(cc)	62±14
$\bar{\nu}_\mu$(cc)	19±8
muonless events (0μ)	79±8
ν_μ neutral currents (E_h > 20 GeV)	10±2

The ratio of $\bar{\nu}_\mu$ flux/ν_μ flux is found to be 0.65±0.30. The most naive expectation is that the charmed particles are produced in pairs, e.g. $D\bar{D}$, so that the ratio $\bar{\nu}_\mu/\nu_\mu$ would be 1. However, the D^+ and D^0 appear to have different lifetimes and thus different semileptonic branching ratios. Thus if the production of D^+ is unequal to D^- the ratio could deviate from 1. Similarly, the associated production of $\Lambda_c^+ \bar{D}$ could also produce a ratio unequal to one.

In order to infer the production cross section of charmed or other short-lived particles a model-dependent calculation must be performed. We assume the dependence on Feynman X_F and transverse momentum to be

$$E\frac{d^3\sigma}{dxdp^2} \quad \alpha \quad \begin{cases} (1 - X_F)^n e^{-bp} & \text{Model I} \\ (1 - X_F)^n e^{-bm} & \text{Model II} \end{cases}$$

muon and electron masses is negligible. The results from the earlier beam dump experiments at CERN indicated the possibility that this ratio was different from 1. For neutrino energy greater than 20 GeV our result is $\nu_e/\nu_\mu = 0.78 \pm 0.19$ (statistical error only). However, the systematic effects are most important near the lower energy boundary. The variation of this ratio with neutrino energy is shown in the figure. One sees that for energies in excess of 30 GeV the ratio is one, albeit with an uncomfortably large error.



In summary, the results of a preliminary analysis of the data obtained in E-613 have broken new ground in the study of hadronic production of charmed particles. They appear to contradict some of the results obtained in the pioneering experiments at CERN but the final analysis is not complete. These data, extended and augmented by this spring's running, will provide the definitive description of the hadronic production of particles producing "prompt" neutrinos.

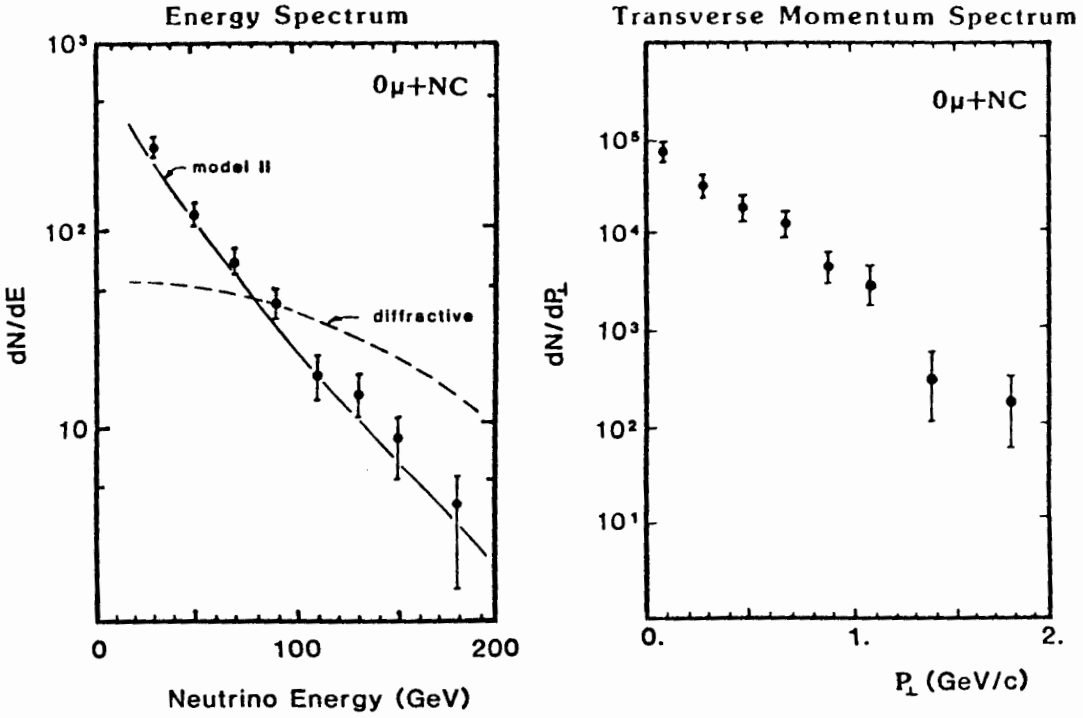
We wish to acknowledge the invaluable help provided by all branches of the Laboratory in achieving the successful completion of E-613. In particular, we wish to thank members of the Meson Laboratory for the superb support they afforded us.

with a couple of additional assumptions the cross section for $D\bar{D}$ production is

Model		$\sigma_{D\bar{D}}$ (μb)
I	n = 3 b = 2	18±3
II	n = 5 b = 3.45	30±6

So one can easily see that the value of $\sigma_{D\bar{D}}$ is quite dependent on the particular model chosen and that these systematic uncertainties outweigh the statistical error shown.

The energy distribution and transverse momentum distribution of the muonless events are shown in the accompanying figures. If the charmed particles are produced diffractively as appears to be the case at the ISR at CERN, then the energy distribution would be more nearly constant. A model calculation is shown in the figure.



We can infer with the usual necessary assumptions from the energy distribution that the diffractive production of $\Lambda_c\bar{D}$ is less than 3% of the centrally produced $D\bar{D}$.

Another quantity of interest is the ratio of ν_e to ν_μ which should be unity for massive particles where the difference in

SUMMARY OF OPERATIONS - FEBRUARY - MARCH 1982

Howard Fenker, Program Planning Office

Experimental operations continued for the last two months with beam being delivered 970 hours out of 1230 hours scheduled. Major interruptions were caused by shorted Main-Ring magnets and septa, ion-source problems, and a 3-day shutdown for work on Doubler components. On March 17 a new 400 GeV/c intensity record was set when 3.194×10^{13} protons were delivered in one pulse. As a result of the work done by accelerator crews in reaching this peak intensity, it has not been unusual to see the Main Ring operate at or near 3×10^{13} protons per pulse for long periods of time.

Experiment 594 in the Neutrino Area made good use of the increased available intensity in their study of neutral-current reactions. This group has been exposing the flash-tube calorimeter to a 1-millisecond high-intensity neutrino beam. In the same beam line, the neutrino-oscillation experiment E-701 has been taking data at the highest rate possible. To facilitate this effort the accelerator has been asked to produce several high-intensity bursts to beam ("super pings") during the 1-second slow spill. Preliminary tests of this running mode have been carried out and look very promising.

Two groups of experimenters have been using the 30-inch bubble chamber and associated external tracking devices. A total of 660,000 pictures have been taken by the E-565/570 and E-597 collaborations.

The Proton and Meson areas have seen several experiments come and go during these two months. A study of antiproton production of dimuons (E-537) finished running in the High Intensity Area and was replaced by E-326, which is studying dimuon production by pions. E-630, a high-resolution streamer-chamber charm search, completed data taking in Proton-Center. This area is now being readied for Transition Magnetic Moment E-619, which will be run by the same collaboration that recently completed the neutral-hyperon study in M2 (E-555). The TREAD time projection chamber has been in use in E-612 (P-East), which is investigating diffractive photon dissociation on hydrogen.

The CP violation experiment in M3, E-617, took data for all of the available time during this period. Hadron Jets E-609 would have enjoyed doing the same thing but has been plagued with M6 superconducting-magnet problems. Particle Search E-515 completed their run in M1, and E-613 (Beam Dump) has begun taking test data in M2. The M4 beam line has been used both by the Collider Detector Facility for extensive development tests of various calorimeters and tracking chambers and by E-660, a study of the deflection of particle beams by bent crystals.

FERMI NATIONAL ACCELERATOR LABORATORY
MONTHLY OPERATIONS HISTORY
FEBRUARY 1982

DATE	ACCELERATOR	PROTON AREA	NEUTRINO AREA	MESON AREA
Mon. 2/1	~2.3x10^{13}ppp	537 (PW)	594/701 (N0)	555 (M2)
Tue. 2/2	@400 GeV/c	612 (PE)	DPI Test (N7)	OFF (M6)
Wed. 2/3	1.0 sec flattop	630 (PC)	673 (N1)	617 Test (M3)
				515 (M1)
				CDF (M4)
Thu. 2/4	Accelerator Maintenance & Development (Studies 0600-1200)			
Fri. 2/5	~2.3x10^{13}ppp	537 (PW)	594/701 (N0)	555 (M2),
Sat. 2/6	@400 GeV/c	612 (PE)	673 (N1)	609 (M6)
Sun. 2/7	1.0 sec flattop	630 (PC)	565/570 (N7)	617 Test (M3)
				515 (M1)
				CDF (M4)
Mon. 2/8	Energy Doubler Safety Tests			
Tue. 2/9	~2.5x10^{13}ppp	537 (PW)	594/701 (N0)	555(M2),609(M6)
Wed. 2/10	@400 GeV/c	612 (PE)	565/570 (N7)	617 Test (M3)
		630 (PC)	673 (N1)	515(M1), CDF(M4)
Thu. 2/11	Accelerator Studies Accelerator Maintenance & Development			
Fri. 2/12	~2.5x10^{13}ppp	537 (PW)	594/701 (N0)	555 (M2)
Sat. 2/13	@400 GeV/c	612 (PE)	565/570 (N7)	609 (M6)
Sun. 2/14	1.0 sec flattop	630 (PC)	673 (N1)	515 (M1)
				617 Test (M3)
Mon. 2/15				CDF (M4)
Tue. 2/16				
Wed. 2/17				End 555
Thu. 2/18	Accelerator Studies Accelerator Maintenance & Development			
Fri. 2/19	~2.4x10^{13}ppp	537 (PW)	594/701 (N0)	617 (M3)
Sat. 2/20		630 (PC)	673 (N1)	609 (M6)
Sun. 2/21	Replace Extr. Septum	400 (PE)	565/570 (N7)	515 (M1)
Mon. 2/22	~2.2x10^{13}ppp			CDF (M4)
Tue. 2/23	@400 GeV/c			OFF (M2)
Wed. 2/24				
Thu. 2/25	Accelerator Maintenance & Development			
Fri. 2/26	Replace MR Dipoles ~2.0x10^{13}ppp	537 (PW)	594/701 (N0)	617 (M3)
Sat. 2/27		630 (PC)	673 (N1)	609 (M6)
Sun. 2/28	Replace MR Dipole ~2.0x10^{13}ppp	400 (PE)	565/570 (N7)	515 (M1)
				CDF (M4)
				OFF (M2)

FERMI NATIONAL ACCELERATOR LABORATORY
MONTHLY OPERATIONS HISTORY
MARCH 1982

DATE	ACCELERATOR	PROTON AREA	NEUTRINO AREA	MESON AREA
Mon. 3/1	~2.2x10^{13}ppp @400 GeV	630 (PC) End 537 400 (PE) 326 (PW)	594/701 (N0) 673 (N1) 565/570 (N7)	617 (M3), OFF (M6), 515 (M1), CDF (M4), OFF (M2)
Tue. 3/2				
Wed. 3/3	Accelerator Studies			
Thu. 3/4	Accelerator Maintenance & Development			
Fri. 3/5	~1.6x10^{13}ppp ~~M.R. Power Problems~~	630 (PC) 400 (PE) 326 (PW)	594/701 (N0) 673 (N1) 565/570 (N7)	617 (M3) OFF (M6) 515 (M1) CDF (M4) OFF (M2)
Sat. 3/6	~2.0x10^{13}ppp			
Sun. 3/7				
Mon. 3/8	~2.1x10^{13}ppp @400 GeV/c			
Tue. 3/9				
Wed. 3/10				End 515
Thu. 3/11	Accelerator Studies Accelerator Maintenance & Development			
Fri. 3/12	Stuck Wire Scanner ~2.3x10^{13}ppp @400 GeV/c	630 (PC) 326 (PW) 400 (PE)	594/701 (N0) 673 (N1) 565/570 (N7)	617 (M3) 609 (M6) CDF (M4) OFF (M2) OFF (M1)
Sat. 3/13				
Sun. 3/14		End 630		
Mon. 3/15	ES38 & ES39 Power		673 Calib.(N1)	
Tue. 3/16	~2.8x10^{13}ppp	326 (PW) 612 (PE) OFF (PC)		
Wed. 3/17	New Record: 3.194x10^{13}			
Thu. 3/18	Accelerator Studies and Necessary Repairs			
Fri. 3/19	~2.4x10^{13}ppp Replace M.R. Dipole	326 (PW) 612 (PE) OFF (PC)	594/701 (N0) 565/570 (N7) 673 Calib. (N1)	617 (M3) 609 (M6) CDF (M4) OFF (M2) OFF (M1)
Sat. 3/20	~2.4x10^{13}ppp Repl.& Align ES38			
Sun. 3/21				
Mon. 3/22	Accelerator Clock ~2.5x10^{13}ppp			
Tue. 3/23				
Wed. 3/24	ES37 Shorted ~2.3x10^{13}ppp			
Thu. 3/25	Accelerator Maintenance & Development			
Fri. 3/26	~2.7x10^{13}ppp @400 GeV/c 1.0 sec flattop	326 (PW) 612 (PE) OFF (PC)	701/594 (N0) 597 (N1) 673 (N1)	609 (M6) 613 (M2) 617 (M2) CDF (M4) OFF (M1)
Sat. 3/27				
Sun. 3/28				
Mon. 3/29	~2.9x10^{13}ppp			
Tue. 3/30	Accelerator Maintenance & Development			
Wed. 3/31				

BEAM UTILIZATION BY

	Beam	Hours
PROTON AREA		
Dimuon #326	PW	290
Particle Search #400	PE	280
Dimuon #537	PW	390
Photodissociation #612	PE	490
Charm Search #630	PC	480
NEUTRINO AREA		
30-in. Hybrid #565/570	N7	-
Neutrino #594	N0	890
30-in. Hybrid #597	N7	-
Chi Meson #673	N1	690
Neutrino Oscillations #701	N0	840
MESON AREA		
Particle Search #515	M1	420
Neutral Hyperon #555	M2	260
High Mass Pairs #605	M1	20
Hadron Jets #609	M6	330
Beam Dump #613	M2	80
CP Violation #617	M3	770
CDF Development	M4	790
TOTAL HOURS FOR HIGH ENERGY PHYSICS		7020

EXPERIMENTAL ACTIVITY - FEBRUARY and MARCH 1982

Activities
startup and dimuon data: nights and weekends
beam tuning and counter timing
high-intensity data; open geometry tests; experiment completed
data using time-projection chamber; completed
streamer chamber data on charm production; completed
577K pictures: 30-in. H_2 bubble chamber with foil inserts
neutrino interaction data
80K pix in the 30-in. bubble chamber
data: Chicago Cyclotron Magnet spectrometer
neutrino oscillation data
tests and data; with and without active target; completed
data; experiment completed
beam line and detector setup
tuning; calibration of calorimeter; data
setup; background studies
rate and targeting tests; data
detector development

FACILITY UTILIZATION SUMMARY - FEBRUARY 1982

I. Summary of Accelerator Operations

		Hours	
A. Accelerator use for physics research			
High energy physics research		472.6	
Accelerator physics research		16.7	
	Subtotal		489.3
B. Other Activities			
Program interruption		73.0	
Accelerator setup and tuning to experimental areas		-	
	Subtotal		73.0
C. Unscheduled interruption		109.7	
D. Unmanned time		-	
Total			672.0

II. Summaries of High Energy Physics Research Use

	# of Expts.	Hours	Results
A. Counter experiments	11	3330	2 exp. completed
B. Bubble chamber experiments	1		240K pictures
C. Emulsion experiments			
D. Special target experiments	1		4 targets exposed
E. Test experiments			
F. Engineering studies and tests	1	360	
G. Other Beam Use			
Totals	14	3690	

III. Number of Protons Accelerated and Delivered ($\times 10^{17}$)

A. Beam accelerated in Main Ring		28.8
B. Beam delivered to experimental areas		25.8
Proton Area		7.9
Neutrino Area		
	Slow Spill	1.2
	Fast Spill	13.5
Meson Area		3.2

FACILITY UTILIZATION SUMMARY - MARCH 1982

I. Summary of Accelerator Operations

		Hours	
A. Accelerator use for physics research			
High energy physics research		497.2	
Accelerator physics research		23.8	
	Subtotal		521.0
B. Other Activities			
Program interruption		92.5	
Accelerator setup and tuning to experimental areas		-	
	Subtotal		92.5
C. Unscheduled interruption		130.5	
D. Unmanned time		-	
Total			744.0

II. Summaries of High Energy Physics Research Use

	# of Expts.	Hours	Results
A. Counter experiments	12	2900	2 exp. completed
B. Bubble chamber experiments	2	-	418K pictures
C. Emulsion experiments			
D. Special target experiments	1	-	4 targets exposed
E. Test experiments			
F. Engineering studies and tests	1	430	
G. Other Beam Use			
Totals	16	3330	

III. Number of Protons Accelerated and Delivered ($\times 10^{17}$)

A. Beam accelerated in Main Ring		32.1
B. Beam delivered to experimental areas		29.5
Proton Area		4.6
Neutrino Area		
	Slow Spill	1.1
	Fast Spill	17.4
Meson Area		6.4

SITUATION REPORT -- APRIL 1982

PAGE 1 FERMI NATIONAL ACCELERATOR LABORATORY PROGRAM PLANNING OFFICE
16 APR 1982

EXPERIMENTAL PROGRAM SITUATION REPORT

THE EXPERIMENTAL PROGRAM SITUATION AT FERMILAB IS SUMMARIZED BELOW. THE EXPERIMENTS ARE LISTED BY EXPERIMENTAL AREA AND BEAMLINE UNDER CATEGORIES THAT BEST DESCRIBE THEIR STATUS ON APRIL 1, 1982. FOR EXPERIMENTS WHICH HAVE BEEN COMPLETED OR HAVE RECEIVED BEAM, THE AMOUNT OF RUNNING TIME OR EXPOSURE TO DATE IS LISTED. THE EXPERIMENTAL AREA NAMES ARE ABBREVIATED AS FOLLOWS: MESON AREA (MA), NEUTRINO AREA (NA), PROTON AREA (PA), INTERNAL TARGET AREA (ITA), AND COLLISION AREA (COL). PROPOSALS OR EXPERIMENTS THAT ARE REQUESTING TEVATRON ENERGY ARE PROCEEDED BY TEV.

TOTAL NUMBER OF APPROVED EXPERIMENTS - 322

AREA-BEAM		SPOKESPERSON		
A. EXPERIMENTS THAT HAVE COMPLETED DATA TAKING (282):			TOTAL RUN	DATE COMPLETED
(ONLY EXPERIMENTS COMPLETED SINCE 01 JAN 1982 ARE LISTED BELOW				
MA-M1	PARTICLE SEARCH #515	ROSEN	2,650 HOURS	10 MAR 1982
-M2	NEUTRAL HYPERON #555	DEVLIN	650 HOURS	17 FEB 1982
PA-PC	CHARM PARTICLE #630	SANDWEISS	1,150 HOURS	15 MAR 1982
-PW	DI-MUON #537	COX	2,700 HOURS	28 FEB 1982

B. EXPERIMENTS THAT ARE IN PROGRESS (17):			TOTAL RUN TO DATE	DATE OF RECENT RUN
MA-M2	BEAM DUMP #613	ROE	1,250 HOURS	1 APR 1982
-M3	CP VIOLATION #617	WINSTEIN	1,250 HOURS	1 APR 1982
-M4	CHANNELING #660	GIBSON	150 HOURS	1 FEB 1982
-M6	HADRON JETS #557	ZIEMINSKI	600 HOURS	1 JUN 1981
	PARTICLE SEARCH #580	GREEN	800 HOURS	1 JUN 1981
	HADRON JETS #609	SELOVE	300 HOURS	1 APR 1982
NA-NO-DICHROM	NEUTRINO #594	WALKER	3,500 HOURS	1 APR 1982
	NEUTRINO OSCILLATION #701	SHAEVITZ	1,200 HOURS	1 APR 1982
-NO-WB HORN	15-FCOT ANTI-NEUTRINO/H2&NE#180	ERMOLOV	273K PIX	1 JUN 1977
-MUON/HADRON	CHI MESON #673	COOPER	1,000 HOURS	1 APR 1982
-30 INCH	30-INCH HYBRID #565	PLESS	640K PIX	1 APR 1982
	30-INCH HYBRID #570	PLESS	640K PIX	1 APR 1982
	30-INCH HYBRID #597	WHITMORE	157K PIX	1 APR 1982
-OTHER	NUCLEAR FRAGMENTS #466	SUGARMAN	66 TARGETS EXPOSED	1 APR 1982
PA-PE	PARTICLE SEARCH #400	BUTLER	300 HOURS	1 APR 1982
	PHOTON DISSOCIATION #612	GOULIANOS	1,700 HOURS	1 APR 1982
-PW	DI-MUON #326	SHOCHET	1,750 HOURS	1 APR 1982

C. EXPERIMENTS THAT ARE IN TEST STAGE (2):			TOTAL RUN TO DATE	DATE OF RECENT RUN
MA-M1	HIGH MASS PAIRS #605	BROWN	20 HOURS	1 APR 1982
-M6	PARTICLE SEARCH #623	GREEN	60 HOURS	1 JUN 1981

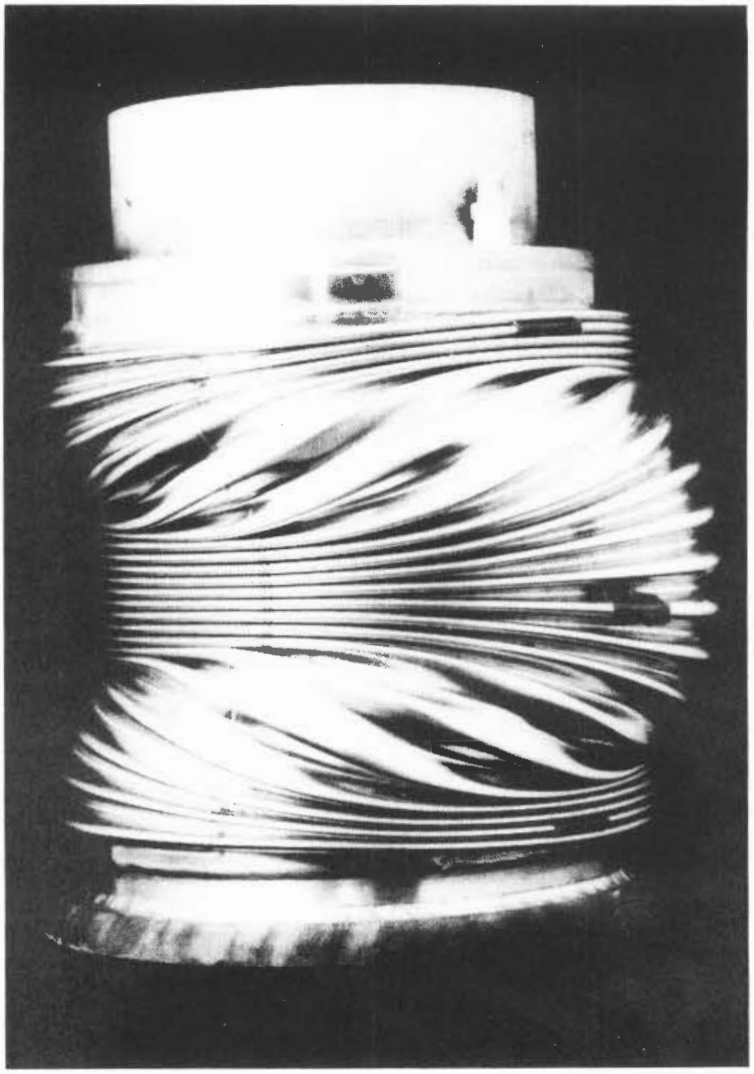
D. EXPERIMENTS BEING INSTALLED (2):			APPROVAL
PA-PC	TRANSITION MAGNETIC MOMENT #619	DEVLIN	250 HOURS
-PW	FORWARD SEARCH #615	ANDERSON	1,000 HOURS

F. OTHER APPROVED EXPERIMENTS (19):			APPROVAL
NA-NO-HORN	15-FCOT ANTI-NEUTRINO/D2 #390	GARFINKEL	250K PIX
-OTHER	EMULSION/PROTONS @ 500 #508	WOLTER	EMULSION EXPOSURE
	EMULSION/PROTONS @ 500 #524	WILKES	EMULSION EXPOSURE
	QUARK #549	LONGO	PARASITIC RUNNING
	EMULSION/PROTONS @ 500 #576	HEBERT	3 STACKS
PA-PE	PHOTOPRODUCTION #458	LEE	UNSPECIFIED
TEV- MA-PCL BEAM	POLARIZED BEAM #704	YOKOSAWA	UNSPECIFIED
- MA-M6	HADRON JET #672	DZIERBA	UNSPECIFIED
	DIRECT PHOTON #706	SLATTERY	UNSPECIFIED
TEV- NA-NEUTRINO	NEUTRINO #652	SCIULLI	UNSPECIFIED
- NA-EM DUMP	BEAM DUMP #636	PLESS	UNSPECIFIED
	15-FT BEAM DUMP #646	BALTAY	UNSPECIFIED
- NA-MUON	MUON #640	LOKEN	1,000 HOURS
	TEVATRON MUON #665	KIRK	UNSPECIFIED
- NA-N1	PARTICLE SEARCH #690	KNAPP	UNSPECIFIED
TEV- PA-PE	PHOTOPRODUCTION #687	BUTLER	UNSPECIFIED
- PA-PC	CP VIOLATION #621	THOMSON	UNSPECIFIED
	PARTICLE SEARCH #653	REAY	UNSPECIFIED
- PA-PW	CHI MESON #705	COX	UNSPECIFIED

PENDING PROPOSALS (36):			REQUEST
MA-M2	BEAM DUMP #716	ROE	UNSPECIFIED
PA-PC	SIGMA BETA DECAY #715	COOPER	UNSPECIFIED
ITA-C O	PARTICLE SEARCH #702	GLASS	400 HOURS
TEV- MA-PCL BEAM	POLARIZED BEAM #682	UNDERWOOD	1,700 HOURS
	POLARIZED BEAM #688	DITZLER	400 HOURS
	POLARIZED BEAM #699	STANEK	1,000 HOURS
- MA-M6	PARTICLE SEARCH #684	LAI	1,000 HOURS
	PARTICLE SEARCH #696	TROWER	UNSPECIFIED
TEV- NA-NEUTRINO	15-FT NEUTRINO/H2 & NE #632	MORRISON	250K PIX

PENDING PROPOSALS(CONT'D)

AREA-BEAM		SPOKESPERSON	REQUEST
	NEUTRINO #635	MO	UNSPECIFIED
	15-FT NEUTRINO/D2 #637	AMMOSOV	UNSPECIFIED
	15-FT NEUTRINO #641	KITAGAKI	200K PIX
	HYBRID NEUTRINO #647	PETERSON	UNSPECIFIED
	NEUTRINO #649	TAYLOR	UNSPECIFIED
	15-FT NEUTRINO/D2 #651	MILLER	100K PIX
- NA-EM DUMP	BEAM DUMP #644	LONGO	2,000 HOURS
	BEAM DUMP #656	WHITAKER	UNSPECIFIED
	NEUTRINO OSCILLATION #700	MILLER	UNSPECIFIED
TEV- PA-PE	PHOTON DISSOCIATION #670	GOULIANOS	UNSPECIFIED
	PHOTOPRODUCTION OF JETS #683	CORMELL	1,500 HOURS
	TAGGED PHOTON #691	NASH	1,000 HOURS
- PA-PW	DI-MUON #671	POPE	UNSPECIFIED
	LEPTON PAIR #693	MCDONALD	1,000 HOURS
TEV-ITA-C 0	PROTON-PROTON SCATTERING #500D	FRANZINI	1,000 HOURS
	P-P AND P-D SCATTERING #681	GUTAY	950 HOURS
TEV-COL-D 0	ELECTRON TARGET FACILITY #703	FRISKEN	1,000 HOURS
	ELECTRON TARGET FACILITY #708	LEE	UNSPECIFIED
	FORWARD DETECTOR #709	LONGO	UNSPECIFIED
	TOTAL CROSS-SECTION #710	RUBINSTEIN	UNSPECIFIED
	MUON PRODUCTON #712	BAPP	UNSPECIFIED
	HIGHLY IONIZING PARTICLES #713	PRICE	UNSPECIFIED
	LARGE ANGLE PARTICLE #714	GRANNIS	UNSPECIFIED
	FORWARD DETECTOR #717	LACH	UNSPECIFIED
TEV-UNSPEC BEAM	EMULSION/PI- @ 500 #667	WOLTER	EMULSION EXPOSURE
	EMULSION/PI- @ 800 #668	WOLTER	EMULSION EXPOSURE
	PARTICLE SEARCH #692	BUCHTI	1,000 HOURS



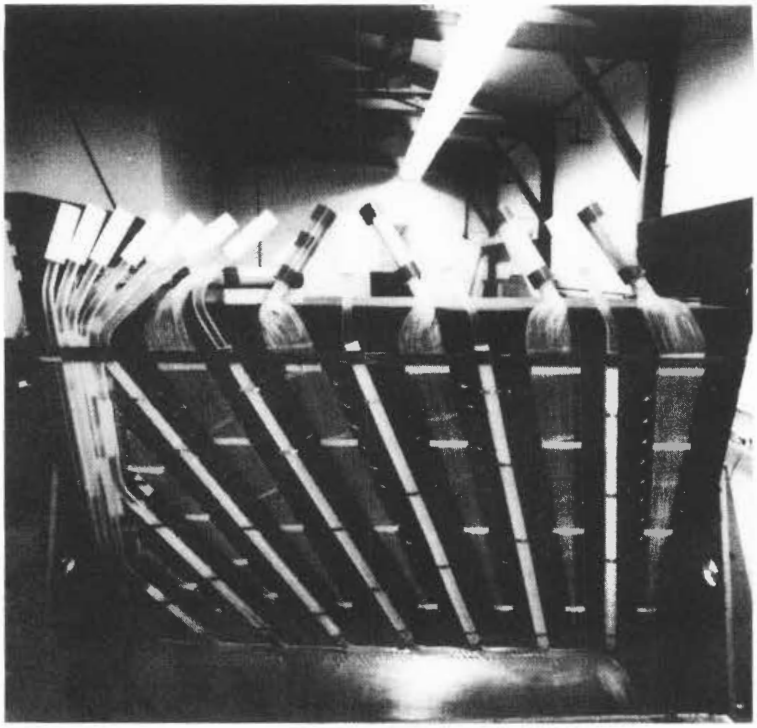
The valve that failed. A collapsed 8-inch Energy Saver bellows.

(Photograph by Fermilab Photo Unit)

SATURDAY MORNING PHYSICS STUDENT FIRST IN NATIONAL CONTEST

Bruce Karsten, Jr., a student at Larkin High School in Elgin, Illinois and a graduate of the Fermilab Saturday Morning Physics course, has won a national academic contest. Mr. Karsten placed first in the United States in physics and tied for first in chemistry in the Junior Engineering Technical Society (JETS). JETS is a national organization to promote interest in technical fields at the high-school level.

Mr. Karsten will attend the University of Illinois this fall.



Collider Detector light pipe assembly.
(Photograph by Fermilab Photo Unit)

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PROPOSALS RECEIVED FROM JUNE 16, 1981
THROUGH MARCH 1982

No.	Title	Spokesperson
702	A Search for Particles with Anomlous Values of M/q and Extremely Short Interaction Lengths (A Revision of P-607)	G. Glass
703	Electron-Proton Collisions at Fermilab	W. R. Frisken
704	Integrated Proposal on First Round Experiments with the Polarized Beam Facility	A. Yokosawa
705	A Study of Charmonium and Direct Photon Production by 300 GeV/c Antiproton, Proton, π^+ and π^- Beams (P669 Revised Objectives)	B. Cox
706	A Proposal to Measure Direct Photon Production at Tevatron Energies	P. Slattery
707	Measurement of the Electron Asymmetry Parameter in Sigma Minus Beta Decay	P. S. Cooper
708	Electron-Proton Interaction Experiment	W. Lee
709	Proposal for a Forward Detector for the D0 Area	M. J. Longo
710	Measurements of Elastic Scattering and Total Cross Sections at the Fermilab $\bar{p}p$ Collider	R. Rubinstein
711	In preparation	
712	Study of Muons from $\bar{p}p$ Collisions Up to $\sqrt{s}$ = 2 TeV	P. Rapp
713	Proposal for a Search for Highly Ionizing Particles for the D0 Area at Fermilab	P. B. Price
714	Large Angle Particle D0 Group	P. Grannis
715	Precision Measurement of the Decay $\Sigma^- \rightarrow ne^-\bar{\nu}$	P. S. Cooper
716	Proposal for Further Beam Dump Neutrino Running	B. P. Roe
717	A Forward Looking Detector for the D0 Area	J. Lach

MANUSCRIPTS, NOTES, LECTURES, AND COLLOQUIA PREPARED
OR PRESENTED FROM MARCH 6, 1982 TO MAY 14, 1982

Copies of preprints with Fermilab publication numbers can be obtained from the Publications Office or Theoretical Physics Department, 3rd floor east, Central Laboratory. Copies of some articles listed are on the reference shelf in the Fermilab Library.

Experimental Physics

B. Brown et al. Experiment #557	Properties of High Transverse Energy Hadronic Events (FERMILAB-Conf-82/34-EXP; presented at the XVIIth Rencontre de Moriond, Les Arcs, Savoie, France, March 14-26, 1982)
T. J. Chapin et al. Experiment #612	Development and Performance of a High Pressure Hydrogen Time Projection Chamber (Presented at the IEEE Nuclear Science Symposium, San Francisco, October 21-23, 1981)

Theoretical Physics

R. J. Oakes	Constraints on Charge 2/3 Quark Masses (FERMILAB-Pub-82/13-THY; submitted to Phys. Rev.)
H. P. Stapp and A. R. White	An Asymptotic Dispersion Relation for the Six-Particle Amplitude (FERMILAB-Pub-82/19-THY; submitted to Phys. Rev. D.)
R. Huerta	Cosmological Bounds on a Left-Right Symmetric Model (FERMILAB-Pub-82/21-THY; submitted to Nucl. Phys.)
A. N. Schellenkens et al.	Reduction of Tensor Products with Definite Permutation Symmetry: Embeddings of Irreducible Representations of Lie Groups into Fundamental Representations of SU(M) and Branchings (FERMILAB-Pub-82/23-THY; submitted to J. Math. Phys.)

A. N. Schellekens et al. — Preon Models with Dynamical Symmetry Breaking (FERMILAB-Pub-82/24-THY; submitted to Phys. Rev. D)

General

J. A. Appel — Charm and Beauty Photoproduction at Fermilab (FERMILAB-Conf-82/25-EXP; invited talk to the Europhysics Study Conference on Search for Charm, Beauty and Truth, Erice, Sicily, November 16, 1981)

L. Voyvodic — Workshop on A^{α} Physics (Copies of Transparencies) (FERMILAB-Conf-82/29-THY/EXP)

A. Ng et al. — The QCD Compton Process Up to Tevatron Energies (FERMILAB-Pub-82/30-THY/EXP; submitted to Z. Phys.)

D. Theriot et al. — The DUMAND Array Data Acquisition System (FERMILAB-Conf-82/31-EXP; submitted to the DUMAND Conference, University of Hawaii, Honolulu, Hawaii, February 8-14, 1982)

A. E. Brenner et al. — On-Shore Processing (FERMILAB-Conf-82/32-EXP; submitted to the DUMAND Conference, University of Hawaii, Honolulu, Hawaii, February 8-14, 1982)

R. Johnson — The Fermilab $p\bar{p}$ Project; A Comparison with $p\bar{p}$ at CERN (FERMILAB-Conf-82/33; invited paper presented at the XVIIth Rencontre de Moriond, Les Arcs, Savoie, France, March 14-26, 1982)

M. Atac and F. Bedeschi — Position Sensing by Charge Division Using Self-Quenching Streamer Pulses (Submitted to the IEEE Nucl. Sci. Symposium, San Francisco, October 21-23, 1981)

F. N. Rad — Is Polarization Transfer a Sensitive Test for Three-Nucleon Problem? (Talk given at the American Physical Society meeting, Washington, D. C., April 26-29, 1982)

Physics Notes

T. Vsevolozskaja et al.	Antiproton Source for the Accelerator-Storage Complex, UNK-IHEP (FN-353)
D. Neuffer et al.	Simulations of the Beam-Beam Interaction with Tune Modulation at the Tevatron $p\bar{p}$ Collider (FN-359)
R. A. Carrigan, Jr.	On the Possibility of a Crystal Septum (FN-362)
D. Neuffer et al.	A Search for Chaotic Trajectories in Simulations of the Beam-Beam Interaction (FN-363)

Colloquia, Lectures, and Seminars

A. White	"Confinement Through Regge-Limit Infrared Analysis of QCD" (Fermilab, March 9, 1982)
R. Huson	"Regional Accelerator Project" (Fermilab, March 16, 1982)
F. Cole and S. Ruggiero	"Report of Laser Acceleration Workshop" (Fermilab, March 23, 1982)
P. Livdahl	"The Livermore MTA Linear Accelerators and The Beijing Accelerator Projects" (Fermilab, March 30, 1982)
R. W. Brown	"Gauge Zeros: Their Explanation and Proliferation" (Fermilab, April 7, 1982)
L. Teng	"Heavy Ion Fusion in Europe" (Fermilab, April 20, 1982)
H. Jensen	"What Physics Do We Expect To Learn with the CDF?" (Fermilab, April 23, 1982)
A. Ruggiero	"Antiproton Source Design I - Debuncher Ring" (Fermilab, April 27, 1982)

C. Moore	"Survey Considerations in the Design and Construction of the Tevatron" (Talk presented at the American Association of Physics Teachers Meeting, South Holland, Illinois, May 1, 1982)
J. Schonfeld	"Anomalies in Soliton-Antisoliton Scattering" (Fermilab, May 4, 1982)
R. Orr	"Accelerator Division Informations Meeting" (Fermilab, May 4, 1982)

DATES TO REMEMBER

June 13-19, 1982	Physics Advisory Committee Meeting
July 1-12, 1982	Advanced Study Institute on Techniques and Concepts of High Energy Physics, Lake George, New York (see November 1981 issue for details)