fermilab report

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THE COVER: Placard on the last superconducting magnet installed for the Energy Saver bears testimony to the hard work of many for months to achieve "the end of the beginning." (See inside article.)

(Photograph by Fermilab Photo Unit)

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THE END OF THE BEGINNING

Thornton Murphy

On Friday afternoon, March 18, the last of the 990 superconducting magnets which comprise the Energy Saver was installed beneath the Main Ring with much fanfare. About 70 Fermilab officials and workers and representatives of the Department of Energy gathered at A-49 in the Main Ring to witness the event. There followed an even larger celebration in the atrium of Wilson Hall.

During the morning of the same day, the last of the 774 dipoles had been unceremoniously set-apart from a handwritten sign on the magnet saying "The Last Dipole-Treat Me Nicely" and a videotape unit which recorded the installation technique for posterity. At 3:30 p.m. that afternoon, following an earsplitting whistle to clear the spectators, the last quadrupole was towed into the area. Riding shotgun on the tractor was Leon Lederman, wearing a necktie and appearing to be in command. In a record time of 12 minutes, three millwrights offloaded the magnet and inserted it in its slot under the Main Ring. Following a round of applause, the workers and the assembled dignitaries all signed a large placard on the magnet bearing the inscription "The Last Magnet Installed in the Energy Saver" (see cover). In addition to the Director, Associate Director, and nearly all the division and section heads of Fermilab, the ceremony was attended by Jim Leiss and Bill Wallenmeyer of DOE, who flew in from Washington, and Fred Mattmueller and Bob Bauer of Chicago DOE.

This milestone brings to a close 21 months of steady effort to install magnets in the Energy Saver. The effort was interrupted only by the 400-GeV physics run during the first six months of 1982 and occasional pauses while waiting for more magnets to be produced. The actual work was done by a seven-man team of operators, ironworkers, and millwrights supplied by Belding Corporation, under the supervision of the Accelerator Mechanical Support Group.

This doesn't mean that the Energy Saver can be turned on tomorrow. There remain a few spool pieces and non-magnetic elements to install before the ring is complete, and the major task of connecting the magnets and leak checking the strings of magnets has yet to be completed in one-sixth of the ring. In addition, mechanical, electrical, cryogenic, and controls technicians are working feverishly to complete their parts of the Saver. The Main-Ring group and the Accelerator Operations group are working around the clock on three-day weekends to recommission the Main Ring, now reduced to a 150 GeV "injector" to the Energy Saver.

In much the same spirit as the last lap of a very long foot race, there is much excitement, enthusiasm, and extra adrenalin

being expended as the end comes in sight. The Energy Saver project is on course for its goal of cooling and powering the entire ring and circulating beam sometime in June of this year.

The last magnet in the tunnel. Thornton Murphy is in the foreground. Also visible (left to right) are Phil Martin, Jim Finks, Bill Cooper, Craig Moore, Bob Morrison, Bruce Chrisman, Lee Teng, Bill Wallenmeyer (DOE), Bob Wendt, Fred Mattmueller (DOE), Leon Lederman, Bob Bauer (DOE), Tom Collins, and Jim Fritz.

(Photograph by Fermilab Photo Unit)

Rine DeKing with other Belding personnel, Ken Meisner (standing) and Wally Peterson (kneeling), fit the last quadrupole as Fermilab staff and well-wishers gather to view the installation of the last Saver magnet. Elsewhere, celebrants gathered in the atrium of Wilson Hall to mark the occasion.
(Photograph by Fermilab Photo Unit)

FACILITIES SUPPORT GROUP (FSG)

Dan Green and Stephen Pordes

The Facilities Support Group was formed as part of the Experimental Areas Department (EAD) during the recent reorganization. The group consists of 14 people and has been charged with the maintenance and upgrade of Fermilab experiment facilities, viz: 1) the Multi-Particle Spectrometer (MPS) in the Meson Area, 2) the electronic detectors associated with the 15-ft bubble chamber, 3) the neutrino flux monitoring system, 4) the Tagged Photon Spectrometer (TPS), and 5) test beams. With support and advice from other groups in the Research and Accelerator Divisions, FSG is also undertaking some projects which are of general utility to experimenters at Fermilab, including the development of a transition radiation counter for particle identification, the installation of a simple phototube testing facility, and the establishment of a standard two-component gas system for drift and proportional chambers based on the TPS design.

At the MPS the apparatus is being upgraded for experiments E-557/E-672. In particular, the FSG has been involved with evaluation of the Laboratory standard multiwire proportional chamber readout (TM-1158); the first use of this Laboratory standard system will be at the MPS for E-557/E-672. A chamber winding machine (TM-1164) has been installed and commissioned in Lab 6 as a new facility. This winder is available to all Fermilab user groups, but with priority given to support of the facilities. Initially, it will be used to wind the 10 ft × 10 ft proportional chambers for the new E-706/E-672 spectrometer facility in the new MW beam. (See **Fermilab Report**, March 1983 for the beam-line naming convention.) Prototypes will be tested in the E-557/E-672 apparatus during the next running period.

In the Neutrino Area, a new Cherenkov counter for the dichromatic beam is under design and new ion chambers will be fabricated for monitoring the muon flux (FN-382). The Tevatron-era neutrino flux monitoring scheme was discussed at the recent Neutrino Beams Workshop (**Fermilab Report**, March 1983). The addition of electronic detectors to the 15-ft bubble chamber is in progress. A new Internal Picket Fence (IPF), which will cover the upstream half of the bubble chamber as well as the downstream one, is being built at CERN and will be installed in December of 1983. A new External Muon Identifier (EMI) will also be installed at this time. The EMI, consisting of about 3000 proportional tubes, is being constructed by the FSG using a mechanical design developed by the MIT group in E-594.

The definition of specific projects in the Proton Area and on the TPS in particular will start soon. As projects of general utility to Fermilab experiments, we have accumulated, repaired, and tested all leftover beam-line scintillation counters.

Additional counters for beam tagging facilities will be repaired upon request. Cherenkov grade PMTs have also been accumulated, tested, and inventoried. Additional tubes will be tested upon request.

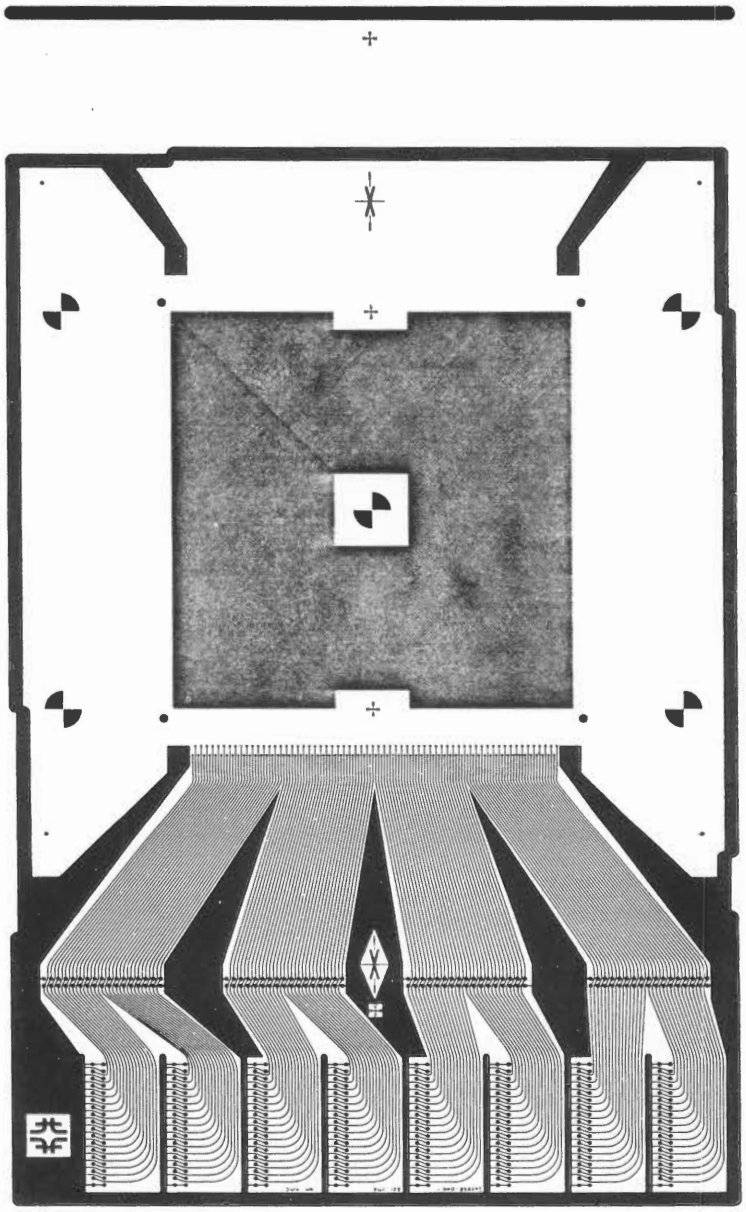
As regards gas systems, we have adopted the TPS two-component, gas-mixing system as a standard. This system is well documented, satisfies all safety requirements, and will rapidly pay for itself in a large volume drift-chamber system. It will probably be used in the new Lab E drift-chamber system. We have also adopted a standard alcohol bubbler system which is installed in the TPS and the MPS. Documentation is available upon request.

Recently, we have extended our services by designing a standard beam PWC. The chamber (TM-1179) has 1-mm wire spacing, with 128 wires per plane and can be mounted on a standard EAD air SWIC stand. The operating gas can be Ar/CO_2, and the output connectors mate to the Fermilab standard PWC readout electronics. We have decided to install these in all test beams (MB, NW, NT), and we have solicited orders from experimenters. The MPS and the new muon beam have so far responded with requests.

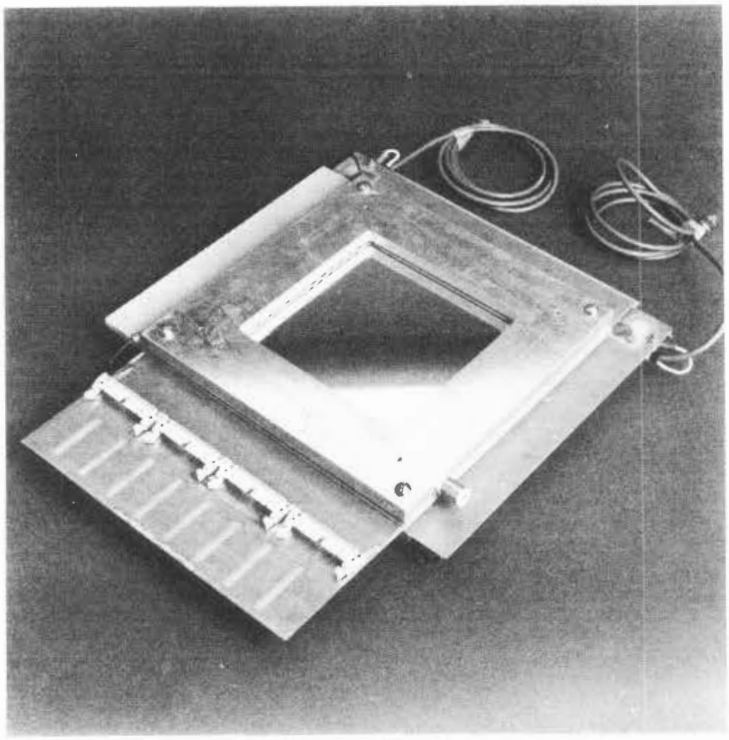
Several experiments in Tevatron-era secondary beams require particle identification. To this end, the FSG has recently tested a prototype Transmission Radiation Detector module at Brookhaven consisting of 200 polyethylene foils followed by 3 gaps of FSG standard PWC filled with xenon/methane. The proposed detector will consist of 10 such modules and the tests demonstrated that the detector will yield ~10 detected transition X rays per 500 GeV pion.

Finally, the FSG has been involved in design and commissioning of test beams. Typically, the FSG will outfit these beams with scintillators, threshold Cherenkov counters, and PWC beam spectrometers. In the Tevatron era, the test beams will be MB ($\leq$ 200 GeV, clean $e^{\pm}$ beam), NW ($\leq$ 250 GeV, hadrons), NT ($\leq$ 500 GeV, calibration and Lab F test beam), and MT (old MPS after 1985, $\leq$150 GeV, hadrons).

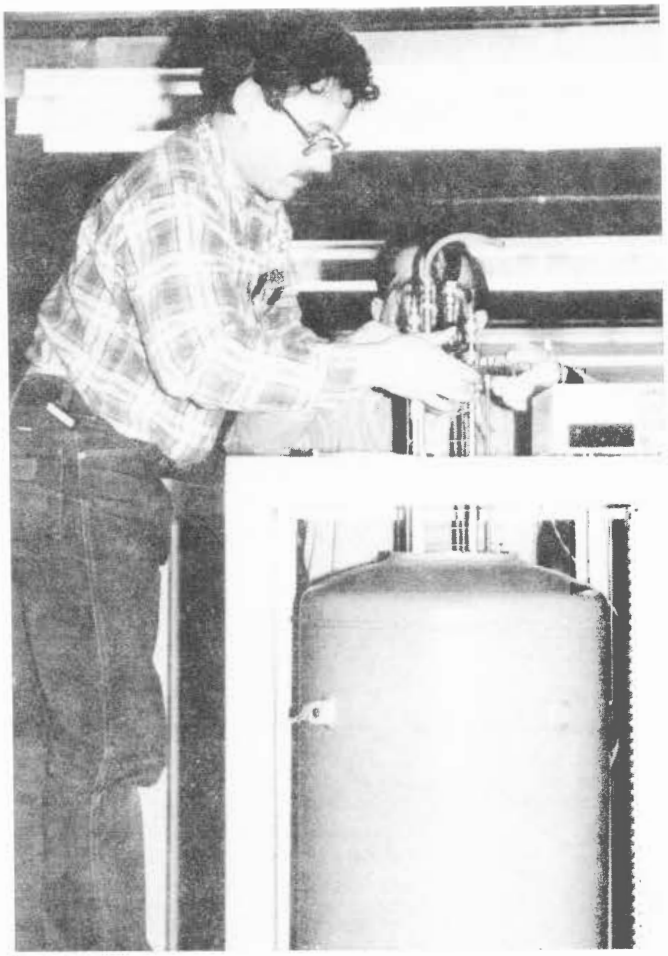
In general, the goal of the Facilities Support Group is to provide beam-line instrumentation services and to help maximize the physics produced in the experimental area facilites.



Sense Plane Artwork for the EAD beam PWC module.



A single-plane EAD beam PWC module.
(Photograph by Fermilab Photo Unit)



Ralph Pasquinelli (left) and Moyses Kuchnir lowering a superconducting stochastic-cooling filter assembly into a dewar for tests.

(Photograph by Fermilab Photo Unit)

THE DEDICATED COLLIDER

Fermilab has submitted to the HEPAP Subpanel on Long Range Planning a draft of a proposal for a Dedicated Collider. It is proposed that we build a proton-antiproton superconducting storage ring to reach 4-5 TeV center-of-mass energy. The ring is to be built within the present Laboratory site boundaries and will use the Tevatron I system as a 1-TeV injector. It can be in operation before 1990.

As presently planned, the Dedicated Collider will be 2.1 kilometers in radius. It will have four collision straight sections and four utility straight sections. The design luminosity is more than 10^{31} $cm^{-2}sec^{-1}$ and there is capacity for beating this figure.

An interesting feature of the design is that an electron ring will be located at one of the utility straight sections to give, in the first phase, ep collisions at 10 GeV × 2 TeV. This ring is included in the design and a decision can be made later as to which option shall be initiated first.

The preliminary draft is being circulated to the HEPAP subpanel that will meet in June at Woods Hole. A more definitive proposal will be issued in a month or so.

The Dedicated Collider can help the 1-TeV fixed-target program by permitting essentially 100% utilization and can at the same time give us a window into a new and important energy range in particle physics.

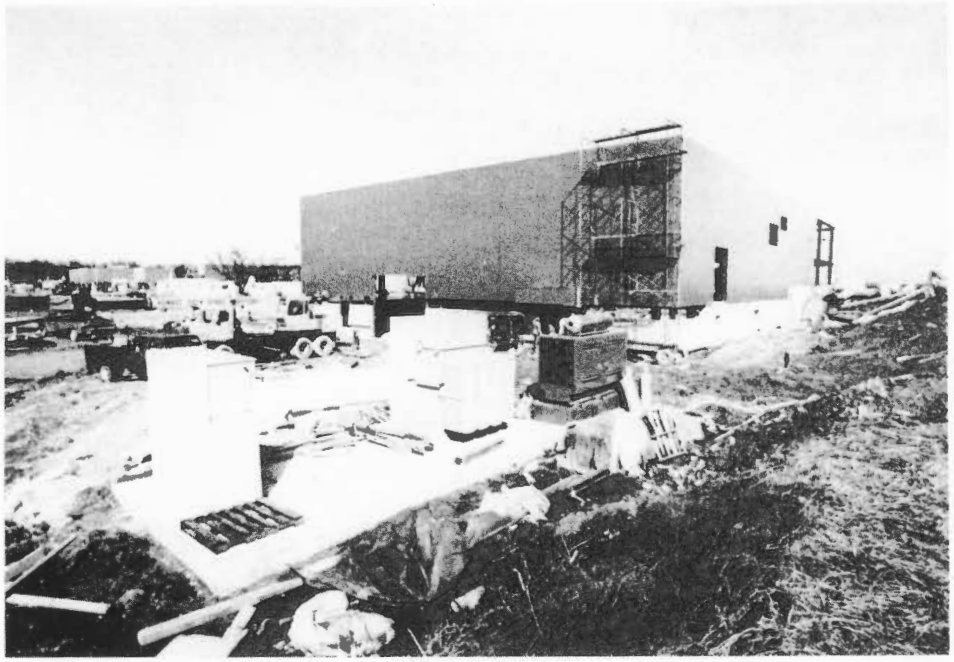
FERMILAB PAPERS AT THE 1983 PARTICLE ACCELERATOR CONFERENCE

Title	Author
Effects of RF Stacking on Cooling Tail in the Fermilab Antiproton Accumulator	A. Ando and K. Takayama
Synchrotron Oscillation with Very Small η	A. Ando and K. Takayama
Design of an 8-GeV Accumulator Ring for the Fermilab Tevatron I Project	A. Ando et al.
Suppressed Bucket RF System in the Fermilab Antiproton Facility	C. Ankenbrandt et al.
Hysteresis Effects in Injection Fields of Fermilab Energy Saver Superconducting Dipoles	B. C. Brown et al.
Report on the Production Magnet Measurement System for the Fermilab Energy Saver Superconducting Dipoles and Quadrupoles	B. C. Brown et al.
Achromaticity vs. Isochronicity	D. C. Carey
Antiproton Beam Transport in the Fermilab Tevatron I Project	E. Colton and C. Hojvat
Cryogenic System for Production Testing and Measurement of Fermilab Energy Saver Superconducting Magnets	W. E. Cooper et al.
Long Term Stability of Fermilab Energy Saver Magnets	W. E. Cooper et al.
Storage Ring Filling via Direct Production of Electrons and Positrons by Targeting a High Energy Proton Beam	S. Conetti and A. G. Ruggiero
Mechanical and Electrical Design of the Fermilab Lithium Lens and Transformer System	G. Dugan et al.
Electron Cooling and Accumulation Results at 200 MeV	T. Ellison et al.
Design of the RF Cavity and Power Amplifier for the Fermilab Antiproton Source	J. Griffin et al.
RF Exercises Associated with Acceleration of Intense Antiproton Bunches at Fermilab	J. Griffin et al.

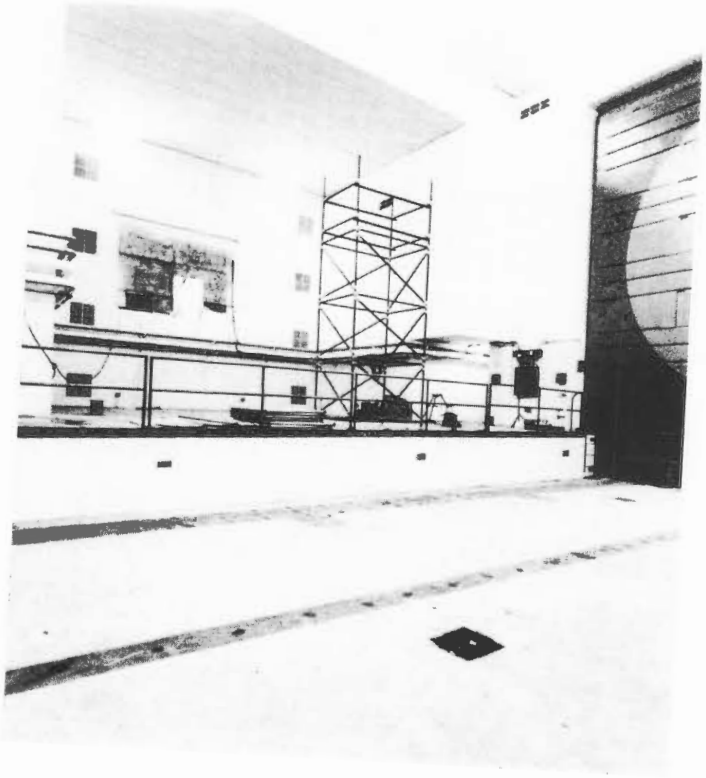
Time and Momentum Exchange for Production and Collection of Intense Antiproton Beam at Fermilab	J. Griffin et al.
Magnetic Field Properties of Fermilab Energy Saver Dipoles	R. Hanft et al.
Further Development of Instrumentation for the Tevatron Beam Dump	E. Harms et al.
120-GeV Proton Transport for Antiproton Production in the Fermilab Tevatron I Project	C. Hojvat et al.
The Fermilab Tevatron I Project Target Station for Antiproton Production	C. Hojvat et al.
Stability of Beam Cooling Systems	W. Kells
An RF Device for Precision Location of the Beam Position Detectors in the Energy Saver	Q. A. Kerns et al.
Superconducting Delay Line for Stochastic Cooling Filters	M. Kuchnir et al.
The Design Parameters for a Lithium Lens as Antiproton Collector	A. J. Lennox and C. Hojvat
Beam Transport and Targetry in the 1 TeV Fermilab Meson Experimental Area	E. Malamud et al.
Fast Betatron Cooling in the Debuncher Ring for the Fermilab Tevatron I Project	J. Marriner et al.
Lambertson Magnet Design for the Tevatron Extraction Channel	M. P. May and M. Harrison
Cryogenic Correction Coil Testing	A. McInturff et al.
High Field Accelerator Magnet Design (10T, 2T/cm), Material and Model Development	A. McInturff et al.
Dipole Shuffling in the Fermilab Energy Saver	L. P. Michelotti S. Ohnuma
A Search for "Arnold Diffusion" and Chaotic Motion in Beam-Beam Interaction	D. Neuffer et al.
A Theoretical Model and Computer Simulation to Describe Diffusion Enhancement by the Beam-Beam Interaction	D. Neuffer et al.

Study of the Periodic Tune Modulation on the Beam-Beam Effect	D. Neuffer et al.
The Fermilab RFQ Project	D. Neuffer et al.
Status of the Energy Saver	J. R. Orr
Bunch by Bunch Intensity Monitor for Fermilab Main Ring	R. J. Pasquinelli
The Fermilab Antiproton Source	J. Peoples
A Bipolar High Precision, Low Ripple Power Supply	H. Pfeffer and R. J. Yarema
Field Shaping of Lambertson Magnet	F. N. Rad
Operation of the Tevatron Satellite Refrigerators for 0.5 and 1.4-Mile Long Magnet Strings	C. H. Rode et al.
Operation of the Tevatron Six Kilometer-Long Transfer Line	C. H. Rode et al.
Signal Suppression Analysis for the Momentum Stochastic Cooling with a Multiple System	A. G. Ruggiero
The Fermilab Tevatron I Debuncher Ring	A. G. Ruggiero
Momentum Precooling in the Debuncher Ring for the Fermilab Tevatron I Project	A. G. Ruggiero and J. Simpson
Magnetic Field Data on Fermilab Energy Saver Quadrupoles	E. Schmidt et al.
Note on the Courant and Snyder Invariant	K. Takayama
Potential of a 3-Dimensional Halo Charge Distribution	K. Takayama
Kaon Factory with TRIUMF as Injector	L. C. Teng
Choice of Focusing Strength and Aperture for High Energy Colliders	L. C. Teng
Long Ceramic Beam Tubes for Accelerator Magnets	E. B. Tilles et al.
Energy Saver Partial Ring Power Tests	G. Tool et al.
The Fermilab Injection Kicker	R. C. Trendler and M. Harrison
Maximum Field Capability of Energy Saver Superconducting Magnets	F. Turkot et al.

Construction progress on the Industrial Center Building.
(Photograph by Fermilab Photo Unit)



A recent exterior view of the Collider Detector Building at B0. The view is from the ring berm.
(Photograph by Fermilab Photo Unit)



Recent interior work in the Collider Detector Building at B0.
(Photograph by Fermilab Photo Unit)

MANUSCRIPTS, NOTES, LECTURES, AND COLLOQUIA PREPARED OR PRESENTED FROM MARCH 14, 1983 TO APRIL 17, 1983

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

W. P. Oliver et al. Experiment #236	A Measurement of High-P_T Correlations in 340-GeV/c pp and 280-GeV/c p Reactions (FERMILAB-Pub-83/30-EXP; submitted to Nucl. Phys. B)
M. Adams et al. Experiment #605	π/K/p Identification with a Large-Aperture Ring-Imaging Cherenkov Counter (Presented at the Vienna Wire Chamber Conference, Austria, February 1983)
Kam-Biu Luk Experiment #620	A Study of the Omega Minus Hyperon (Ph.D. Thesis, Rutgers The State University of New Jersey)

Theoretical Physics

W. A. Bardeen and M. Moshe	Phase Structure of the O(N) Vector Model (FERMILAB-Pub-83/23-THY; submitted to Phys. Rev. D)
A. Sen	Conservation Laws in the Monopole Induced Baryon Number Violating Processes (FERMILAB-Pub-83/28-THY; submitted to Phys. Rev. D)

General

R. E. Craven and W. P. Trower	Magnetic Monopole Bibliography 1981-1982 (FERMILAB-82/96)

Physics Notes

S. Mikamo et al.	CDF End Cap E.M. Calorimeter and Test Results (FN-381; presented by M. Mishina at the Gas Sampling Calorimetry Workshop, Fermilab, October 28-29, 1982)

P. Auchincloss et al.	Design, Construction, and Calibration of Large Ion Chambers for Muon Flux Monitoring in Neutrino Beams at Fermilab (FN-382)

Colloquia, Lectures, and Seminars

C. Albright	"Preon Models of Composite Quarks and Leptons" (Fermilab, March 15, 1983)
J. Peoples	"The Fermilab Antiproton Source" (Fermilab, March 15, 1983)
F. Nagy and K. Cahill	"Application Programming on the ACNET Control System" (Fermilab, March 29, 1983)
J. Peoples	"Short Introduction and Overview of Tevatron I Project Quadrupoles and Dipoles" (Fermilab, March 30, 1983)
J. Peoples	"Quadrupoles and Dipoles" (Fermilab, April 4, 1983)
R. Orr	"Accelerator Division Informations Meeting" (Fermilab, April 5, 1983)
E. Malamud	"Motion of Charged Particles in Magnetic Fields" (Fermilab, April 6, 1983)
T. Collins	"Principles of Lattice Design with the Accumulator and Debuncher Ring Used as Illustrations" (Fermilab, April 11 and 13, 1983)
D. Edwards	"Cornell Workshop on 20-40 TeV CMS Colliders" (Fermilab, April 12, 1983)

DATES TO REMEMBER

April 29-30, 1983	Calorimeter Calibration Workshop
May 30, 1983	As part of the AAAS Meeting (May 26-31), Detroit, Michigan, a symposium on High Energy Physics will be chaired by Robert G. Sachs, University of Chicago, and moderated by Leon Lederman. Other speakers include Professer Martinus J. Veltman, University of Michigan; Professor Lee G. Pondrom, University of Wisconsin, Madison; and Professor Robert R. Wilson, Columbia University.
June 18-24, 1983	PAC Extended Summer Meeting