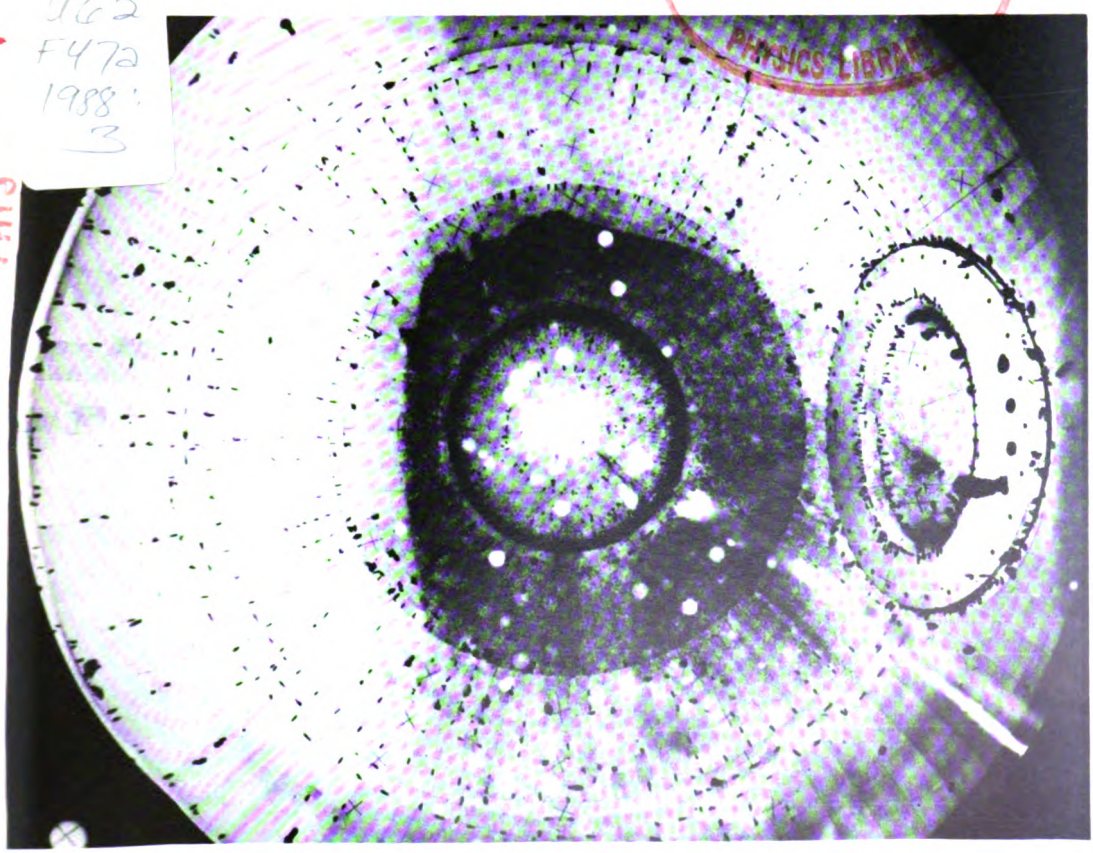
fermilab report

March/April
1988

Fermi National Accelerator Laboratory Monthly Report



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88/3 **Fermi National Accelerator Laboratory**

On the covers: *On the front cover is the first picture taken with the 15-ft Bubble Chamber for Experiment 28, which carried out a search for heavy leptons and hard penetrating radiation with a neutrino beam.* *(Fermilab photograph 73-953)*

On the back cover is the last event taken with the 15-ft Bubble Chamber for Experiment 632, which exposed a neon-hydrogen mixture to the wideband neutrino beam from the TEVATRON. *(Fermilab photograph 88-378CN)*

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Fermilab in Retrospect - 20 Years and Counting

Lots of things happened at Fermilab 20 years ago and one of them was the creation of *Fermilab Report*, then the *National Accelerator Laboratory Monthly Report of Activities*, the first issue of which is reproduced on the next seven pages. These now provide an invaluable source book for historians, and this is a good reminder to the authors of the next 20 years' worth of *Reports*: Write as if you are reporting history, because. . . you are! This simply reflects the conviction that the next 20 years of Fermilab will, in fact, make history.

Leon M. Lederman

MM-101
0090

NATIONAL ACCELERATOR LABORATORY

MONTHLY REPORT OF ACTIVITIES

F. T. Cole

April 1, 1968

This is the first of a series of monthly reports summarizing the status of the work of the National Accelerator Laboratory. This first report will cover developments since the publication of the Design Report in January.

General

1. Authorization hearings were held before the Joint Committee on Atomic Energy on February 21, 1968. Dr. Wilson described the plans and designs of the Laboratory*.

2. The present plan of the Laboratory is that the Village of Weston will be utilized for office, laboratory, and shop space during construction. The Laboratory business office is already occupying several houses. The linac section is occupying three houses for offices and construction of an 8,000 sq ft laboratory building for linac work is almost complete. Another house is being used and a 4,500 sq ft inflatable building is being constructed for model-magnet and vacuum testing. Other temporary buildings will be constructed for use by other sections. We plan to move into the village as rapidly as is feasible and it is planned that the entire technical staff will be located there by October.

The Laboratory staff totals 132 people as of April 1. Of these, 47 are physicists and engineers.

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*Note added in proof -- The AEC authorization bill has been passed by both houses of Congress.

Conventional Facilities

Design effort has been somewhat concentrated on architecture in order to push toward decisions needed for next year's construction.

As a result of "Architecture Month," beginning February 19, we have fixed the positions and levels of the main ring, the booster, the linac, and the EPB on the site. We have also determined the approximate position and junctions within the "foot print" of the high-rise building. A particularly dramatic concept of the building has been suggested by the architects--a building of triangular cross-section that leans and is partly supported by an external core that intersects the building near the top. This building will be given further detailed study until April 15 in order to clarify the problems that will arise for a specific building. We will then make a choice as to whether we should develop an entirely new design concept.

In addition, the positions of the accelerator buildings on the site have been fixed and are being suitably memorialized (on paper) by DUSAF.

A site coordinate system has been adopted. It is described in technical specification TS-1.

Theory

The theory section is working with the component sections in design of the lattices (see main ring below) and in digital computation of magnetic fields.

Space-charge effects at transition energy and at full energy are being studied. It is of interest that neutralized space-charge defocusing is rather

large. In addition, the negative-mass longitudinal space-charge effect will also affect debunching for extraction and targeting.

The DCT-2000 remote-terminal link to the NYU CDC-6600 is now in operation. Efforts are being made to translate programs for the IBM-360 at ANL. A data link will be installed later.

Main Ring

1. Lattice. Injection from the booster will take place into the long straight section from which the proton beam is to be extracted. This replaces the injection into a medium straight section described in the Design Report. The medium straight sections have been relocated in cell 13 of the superperiod, chosen for optimum beam-scraper positions, and now two magnets are omitted in each, rather than three.

The parameters of the main-ring lattice have been frozen except for a possible small change in length of the long straight-section quadrupoles. A note giving these parameters is in preparation.

2. Model Magnet Program. Tooling and materials for construction of a pair of 3-ft model magnets have been ordered. The lamination die is under construction in the vendor's shop and part of the steel sheet for the laminations has been delivered. Coils are on order and the copper has been delivered to the fabricator. The stacking fixture from LRL has been delivered to the EBWR building at Argonne where the models will be fabricated and the large magnet stacking experiments will be performed. The design of coils for a quadrupole model was started.

3. Mechanical Design. Effort has concentrated on studies of the techniques of fabricating the 20 ft long magnets, including the mounting of the coils, and the problems of carrying the water and power to them. Simplifications seem to be possible, lowering costs and improving reliability. Present thinking on the water pipe bus system is to have all joints, water cooling as well as electrical, welded. An analysis of the field shape requirements for the magnets has shown that the magnet profile design (reported by the theory group) is close to satisfying the criteria.

4. Power Supplies. An analysis of the transmission-line modes of the magnet ring has shown that a problem exists, but that it is not too serious. A curious result is that the perturbation of the beam due to this effect is essentially independent of the relative phases of the power supplies. A proposed system for an "off-line" local energy-storage system seems promising. Its cost would be more than offset by a reduction of the cost of substations.

5. Plans for the Coming Month. The LRL core stacking fixture will have its modifications completed to adapt it for stacking NAL magnet cores. The lamination die will be finished at about the end of the month, and the coils will be available soon afterwards. The instrumentation for preliminary model measurements will be gathered together and tested. Meetings with all of the major steel suppliers are being scheduled for discussions of the basis for specifying the magnet steel.

Booster

1. Booster Injection Energy. A reexamination of 150 MeV injection into the booster was carried out in collaboration with the linac section. It was concluded that there is no cost reduction as compared with 200 MeV injection and the linac energy is fixed at 200 MeV.

2. Booster Lattice. Work is being carried out on the booster lattice design, including straight-section lengths and auxiliary magnets.

3. Plans for the Coming Month. The booster lattice will be frozen. Materials will be ordered for two 3-ft magnet models. Design work on a power supply for full-scale magnet prototypes will be completed. Work on low-level rf, kicker, and septum magnets will be continued. Work will continue on linac-to-booster beam transport.

Linac

1. The possibility of a 90° bend in the linac was considered. It was concluded that it would be entirely possible to make such a bend, but that it would not aid the architectural arrangements.

2. Model Program. The "scaled-frequency" model of a linac cavity has undergone electrical measurements. Post couplers have been added to stabilize the structure and further measurements will be made. A 3-ft model to test cavity mechanical features has been constructed. Two NAL people have gone to Brookhaven to work on cooperative fabrication of quadrupoles.

3. Plans for the Coming Month. An immediate objective is to build and test as a design prototype a 10 MeV linac in the temporary building at Weston. Mechanical-design work on the 10 MeV cavity will be completed in April, so that bids can be solicited on rolling and machining the cavity. Design work will continue on other mechanical features of the 10 MeV cavity, using the 3-ft mechanical model for tests. Development work is also in progress on high-gradient columns and emittance-measuring devices.

RF

1. Main Ring. Modes are being investigated in a model cavity at LRL. A ferrite-investigation program is being carried out.

2. Booster. Changes in the design of the booster rf cavity are under consideration. These changes would make a slimmer cavity using less ferrite. The possibility of changing the location of the power-amplifier tube from the booster ring enclosure to the equipment gallery is also being studied.

3. Plans for the Coming Month. The development program will continue at LRL. The entire rf program will move here during the summer.

Radiation Physics

1. The linac shielding has been specified, including penetrations.

2. Earth shielding over the accelerator enclosure has been specified.

3. Calculations of muon energy loss, neutron transport and other aspects has been initiated.

4. Plans for the Coming Month. An experiment to measure neutron fluxes in a labyrinth has been proposed at the Princeton-Pennsylvania Accelerator. Preliminary runs will be carried out. Work will also continue on the calculations in (3) above.

Research Facilities

1. Preparations are being made for the 1968 Summer Study on experimental areas, facilities, and equipment, to be held at Aspen, Colorado.

2. Development work on shielding in target stations and experimental areas is being carried out, including calculations of muon range-energy and straggling curves.

3. An experiment is being planned at the Brookhaven AGS to measure production cross-sections for various particles and different momenta and angles. It is hoped that this experiment will be performed in late 1968 and that it will provide much more data for extrapolation to 200 BeV proton energy.

Experiment 765 Measures the Ω^- Magnetic Moment

Kam-Biu (Bill) Luk

Experiment 765 (a collaboration of Fermilab, the University of Michigan, the University of Minnesota, and Rutgers University), has made the first measurement of the magnetic moment of the Ω^- particle.

Baryon magnetic moment measurements play an important role in probing the structure of hadrons. The most simple quark model predicts the baryon magnetic moments to about 10% of the experiment values, which are determined to better than 2% as seen in Table I. This disagreement with the data has triggered new theoretical efforts in attempting to explain the differences. Even these refined models have difficulties in understanding the precise measurements without losing their predictive power.

	experiment	broken SU(6)
p	2.794	input
n	-1.913	input
Λ	-0.613±0.005	input
Σ^+	2.38±0.02 2.479±0.025	2.67
Σ^0	?	0.79
Σ^-	-1.166±0.017	-1.09
$\Sigma \rightarrow \Lambda$	-1.59±0.09	-1.63
Ξ^0	-1.250±0.014	-1.44
Ξ^-	-0.69±0.04	-0.49
Ω^-	?	-1.84

Table I.
A comparison of the current baryon magnetic moment measurements with the broken SU(6) predictions. The unit of the magnetic moments is in nuclear magnetons.

The Ω^- hyperon is a very simple and unique system made up of three identical, spin parallel strange quarks. In the simplest quark models, the Ω^- magnetic moment is just three times the lambda magnetic moment, or -1.83 nuclear magnetons (n.m.). However, the corrections used in the more sophisticated models can destroy the equality between the lambda and the strange quark magnetic moments. Consequently, the Ω^- magnetic moment may well be the most direct measurement of the strange quark magnetic moment.

Fermilab experiments have contributed significantly in determining the magnetic moments of the hyperons. Beginning with Experiment 8's discovery that lambda particles pro-

duced inclusively by protons were polarized, a series of Fermilab experiments subsequently found that the Ξ^0, Ξ^-, Σ^+, and Σ^- were also polarized in a similar fashion. Since, at Fermilab energies, hyperons are copiously produced and typically travel several meters before they decay (due to the time dilation effect), the magnetic moments of these hyperons can be measured by processing their spin in a conventional magnetic field.

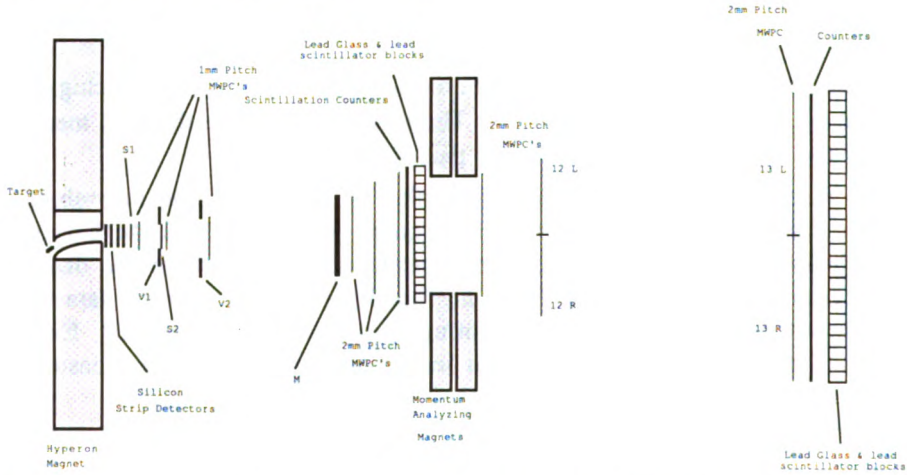
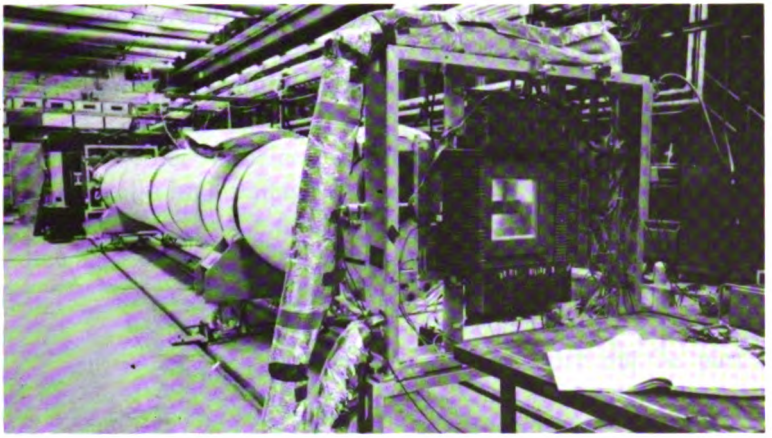


Fig. 1. *A schematic drawing of the plan view of the E-765 spectrometer (not to scale). It is 67 m long and 1.3 m wide. Most of the spaces between detectors are filled with helium bags. M is a multiplicity counter. The last two MWPC's (multiwire proportional chambers) are electronically divided into left and right halves for triggering purposes.*

The first question E-756 had to address was whether they could produce polarized Ω^-'s with the apparatus. E-765 was run during the 1987-1988 fixed-target run in the Proton Center beamline using an 800-GeV primary proton beam. The layout of the experimental apparatus is shown in Fig. 1. The proton beam could be targeted at an incident angle between plus/minus 3.5 mrad either vertically or horizontally, as well as at 0 mrad. Much effort went into the design of the transport system to ensure equal and opposite targeting angles could be achieved to better than 0.1 mrad. This capability is vital to systematic cancellation in the polarization measurement.

Downstream of the production target, a curved charged hyperon channel was imbedded in a magnetic field of 3.35 tesla produced by the P-Center hyperon magnet. Used as a magnetic collimator, the hyperon magnet selected the momentum of the secondary negatively charged beam which was rich in hyperons. The magnetic field was also used to precess the polarization vector of the hyperon.

After exiting the magnetic channel, the negatively charged beam entered a spectrometer designed for detecting the decay products of the Ω^- and the Ξ^- (see Fig. 1). The spectrometer is 67 m long and 1.3 m wide and consists of six 2-mm wire spacing MWPC's, three 1-mm pitch MWPC's, 8 planes of silicon strip detectors and scintillators used for triggering purposes. Photons from the decays were detected by two electromagnetic calorimeters made up of lead glass and lead scintillator blocks.



(Fermilab photograph 87-288-11)

The apparatus for Experiment 756 looking upstream.

Experiment 756 was proposed and approved in the fall of 1984, with preparation and installation of the experiment beginning in 1986. The proton beam was delivered to the spectrometer by the middle of June 1987. It took the experiment about two months to understand the intricacies of the beamline (tuning up the detector elements and doing trigger studies), with data taking beginning in August 1987. By the end of September, E-756 had collected a sample of more than 20,000 Ω^-, which was enough to show that the polarization of the Ω^- was too small to yield a precise measurement of its magnetic moment in the amount of time allotted for the run. With excellent support from the Fermilab staff, the targeting scheme was quickly changed so that a high-energy polarized neutral hyperon beam was produced by the primary proton beam at an incident angle of 2 mrad. After collimation, the polarized neutral beam was directed onto the charged hyperon production target at 0 mrad. It took approximately one month to design and install this second stage of the experiment, and the data accumulated showed that the spin transfer technique worked well. In addition, the experiment gathered enough Ω^-'s to determine the magnetic moment for the first time.

Having completed the 1987-1988 fixed-target run, E-756 has begun systematically analyzing the data which will result in high-precision measurements of the Ξ^- and Ω^- polarizations, magnetic moments, decay parameters, and lifetimes. The following results described here have emerged from the preliminary analysis. In the first targeting scheme, E-756 collected about 70 million three-track triggers which will yield on the order of 10 million Ξ's and 100,000 Ω^-'s. The mass plots of the Ξ^- and Ω^- are given in Figs. 2A and 2B and represent only a fraction of the data. The data also shows very little background. Experiment 756's preliminary analysis of the Ξ^- polarization is in good agreement with the 400-GeV results recorded by E-620. When the full analysis is completed, the

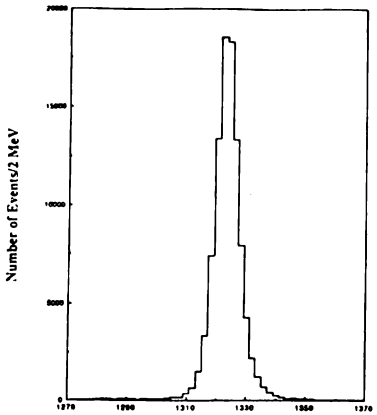


Fig. 2A

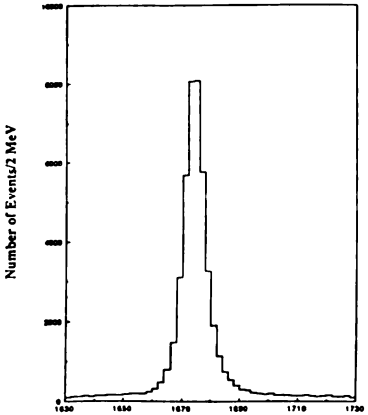


Fig. 2B

Figs. 2(A) and 2(B). *Figure 2(A) shows the mass distribution of a small sample of Ξ^- events produced by protons, while Fig. 2(B) shows the mass distribution of Ω^- events produced by protons. There are 41,000 events between 1.662 GeV which corresponds to approximately 50% of the total sample that can be used to Ω^- polarization measurements.*

magnetic moment of the Ξ^- will be measured to a precision of 1%. It is also interesting to note that the sample of Ω^-'s is more than four times larger than the previous world record held by the CERN hyperon group. The quality of the data collected in the spin transfer method is similarly high. Approximately 1.5 million Ξ^-'s and 22,000 Ω^-'s were produced by the polarized neutral beam. The preliminary analysis shows that the Ξ^-'s and Ω^-'s produced by this technique were polarized. This will allow us to determine the Ω^- magnetic moment with an uncertainty of 0.2 n.m. The experiment has been approved to run again, with the goal of measuring the Ω^- magnetic moment to a precision of 0.04 n.m.

Fermilab/URA Sign First Technology Licensing Agreement

John Paulk

Marking an official entry into the business of transferring technology to industry for commercial purposes, Universities Research Association (URA) and Vern Kiebler Associates, Inc., recently signed a product license agreement. The license permits Kiebler Associates of Wheaton, Illinois, to commercially manufacture and market a high-voltage power supply developed at Fermilab by Tom Droege. In exchange for the technology received, Kiebler Associates will pay URA a percentage of the sales price as royalty.

(Fermilab photograph 88-447-3)

Pictured above (l. to r.), are Richard Lundy, Fermilab's Associate Director for Technology, Thomas Droege, inventor of the high-voltage power supply that is the subject of Fermilab's first licensing agreement, and Vern Kiebler, President of Vern Kiebler Associates, Inc.

The first license negotiated by URA and Fermilab involved a great deal of work on the part of many people. URA personnel, including Ezra Heitowit, Vice President/Secretary of URA, and Maurice Glicksman, Provost at Brown University and Chairman, Administrative Committee of the Board of Trustees, along with Bruce Chrisman, Fermilab Associate Director for Administration, oversaw the review by URA. Dick Lundy, Fermilab Associate Director for Technology, and Chuck Brown, Chairman of the Fermilab Sub-Committee for Electrical Safety, suggested innovative techniques to allow the power supply to be used in a less sophisticated environment than Fermilab. Bob Fieseler of the Neuman, Williams, Anderson, & Olson patent law firm retained by URA/Fermilab, processed the patent documents and drew up the license agreement, working closely with Bill Schmidt, Fermilab general counsel, and John Albrecht, patent counsel for the Department of Energy's Chicago Operations Office. The general licensing activity was handled by John Paulk, Fermilab license officer, and Dick Carrigan, Head of the Office of Research and Technology Applications in the Director's Office.

The power supply is used to provide a selectable, precise current and voltage to drift chambers. Drift chambers are used for detecting and tracking particles during Collider or fixed-target interactions. Several hundred power supplies are needed for the drift chambers in the collider detectors at B0 and D0. Because drift chambers are usually located in inaccessible areas, a great improvement over an earlier design allows the power supplies to be remotely monitored and controlled by a computer.

Each power supply is very compact, about the size of a 35 mm camera, so they can be closely mounted, eight across, onto a common-sized printed circuit board. The board with eight units attached is packaged as a module that plugs into a standard electronic crate of the type used extensively at Fermilab and other facilities.

Kiebler Associates is a small-business electronics firm. They have done business with Fermilab for many years and are a frequent manufacturer of electronic components needed for the research program.

Tom Droege, a senior engineer working with the Collider Detector at Fermilab (CDF), invented the HV supply in response to the CDF design group's specifications. He filed a Record of Invention late last year and, subsequently, assisted by patent attorney Bob Fieseler, filed for patent. He is currently testing and putting final touches on an operational prototype so that it will be ready for production later this year. An earlier power supply developed by Droege was successfully manufactured by Kiebler and sold commercially in hundreds to places all over the world.

Under provisions of federal legislation and the prime contract with DOE, URA may claim patent rights for technology developed at Fermilab. It is a relatively new government program. With a valid patent, URA is permitted to seek a royalty-bearing license agreement with firms in the private sector which may be interested in manufacturing and marketing the product. Royalties from the product sales are used to reimburse the costs of patenting and commercializing the product. Depending on the amount of royalties received, up to 50% are also shared with the inventors.

The Laboratory is currently soliciting licenses with industry for several inventions to which URA holds patent rights. Other inventions are being evaluated for patentability and market potential.

Decommissioning of the 15-ft Bubble Chamber Marks the End of an Era

Mark Bodnarczuk

Fermilab's 15-ft Bubble Chamber recently completed it's last physics run and will now be decommissioned. To mark the occasion of the decommissioning, Fermilab sponsored the "15 Foot Fest" on April 8, 1988, a half-day celebration honoring the people who built, operated, and used the 15-ft Bubble Chamber for the last 19 years. Talks highlighting the bubble chamber's history, humorous anecdotes, and individual experiences were followed by an old-fashioned Bubble Chamber party for all those people who have worked to make the Bubble Chamber so effective (2,991,103 pictures!).

Some things move awfully fast in high-energy physics these days. For instance, if a data acquisition system takes more than 1-2 years from the design phase to implementation, not only will the components probably be available commercially in off-the-shelf products, but the technology may even be out of data. Even candidate theories seem to come and go almost fadishly. But one aspect of high-energy physics that tends to change more slowly is the general type of detectors used in experimental apparatus.

Over the last 20 years, high-energy physics detectors have been classified into a few different categories. Two of the most widely used were counter and bubble chamber apparatus. Ever since Donald A. Glaser developed the first bubble chamber in 1952 at the University of Michigan, these chambers have been used successfully in myriad high-energy physics experiments, including the discovery of the ρ and Ω^- particles.

Glaser's original bubble chamber was a transparent glass device which was only a few inches across. He knew that if he placed a pure liquid in a sealed container, he could superheat the liquid beyond its normal boiling point and the liquid would not boil. Once superheated, boiling could be triggered by dropping something into the liquid. Glaser calculated that the energy that charged particles deposited in the superheated liquid while penetrating and ionizing the gas was enough to trigger boiling along the trajectory of the particle and these events could be observed and permanently recorded by taking a picture of the chamber before the bubbles dispersed. Glaser later won the Nobel Prize for this work. Shortly after this first design proved successful, bubble chambers were

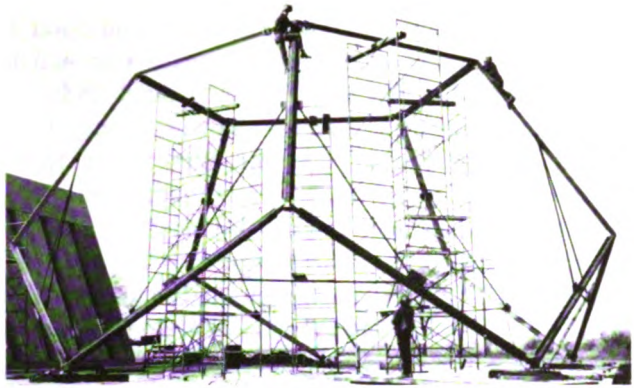
constructed from metal-glass combinations and the photographing was done via optical glass windows built into the chamber. Eventually a group at Berkeley, headed by Luis Alvarez, extrapolated on this technology, moving from a chamber that was only a few inches across to one that was six feet across. This helped establish an outstanding high-energy physics research program at LBL and SLAC for a number of years. Alvarez also won the Nobel Prize for this work.

Fermilab's 15-ft Bubble Chamber is the last in a long developmental line of large bubble chambers both in the United States and Europe. On the Continent, the Gargamelle Bubble Chamber, installed at CERN in 1969, was used to probe the nucleus by inelastic scattering with a neutrino beam, providing evidence for quarks as the constituents of nucleons, and later, conclusive evidence for the existence of neutral currents.

(Fermilab photograph TN71)

The original site of Lab A and the 15-ft Bubble Chamber, looking to the west. Shown here is the construction of the caisson used to support the chamber and associated apparatus.

Other large bubble chambers included the Big European Bubble Chamber (BEBC), also at CERN, and the Mirabelle Bubble Chamber designed at Saclay, France, for use at the 70-GeV accelerator at Serpukhov, U.S.S.R. In the United States, Tom Fields and his Northwestern University group developed the first bubble chamber in a superconducting magnet at Argonne National Laboratory (ANL), leading the way for Gale Pewitt and his colleagues who developed the 12-ft Bubble Chamber, also at ANL. In this tradition, Fermilab's 15-ft Bubble Chamber is the last large cryogenic bubble chamber to operate anywhere in the world, and its decommissioning marks the end of an era. The first tracks were recorded on September 29, 1973, in conjunction with Experiment 28, and the last tracks were recorded on February 1, 1988, in conjunction with Experiment 632.



(Fermilab photograph TN71-421)

Construction of the iron structure for the 15-ft Bubble Chamber's geodesic dome.

In all, there were 17 approved and completed experiments performed with the chamber, covering a wide variety of physics topics. In his "15 Foot Fest" presentation, Charles Baltay (Columbia University) described some of the unique aspects of the 15-ft Bubble Chamber as the ability to see electrons, strange particles (K^0 and λ^0), detection of hadrons, and detection of the details of decay verticies. The chamber provided unique contributions to neutrino physics, including charm production by neutrinos, rare neutral current processes, and tests of QCD through hadronic production by neutrinos. A complete list of all 17 approved and completed experiments performed with the 15-ft Bubble Chamber and their results is given at the end of this article.

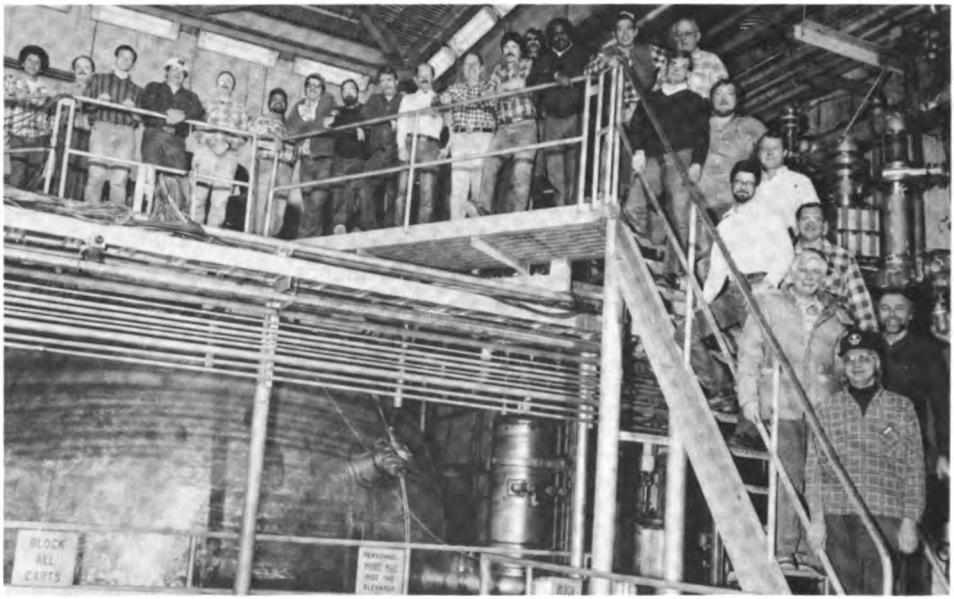
(Fermilab photograph 71-870-2)

The 15-ft Bubble Chamber vessel (without plumbing) on the truck used to move it. Pictured are Russ Huson (left) and Bill Fowler.

(Fermilab photograph 72-460-6)

The 15-ft Bubble Chamber vessel, with plumbing installed, in Lab A.

In addition to the short presentations given by Charles Baltay, Jim Ellermeier, Gert Harigel, Russ Huson, Douglas Morrison, and John Purcell, Fest Chairman Thornton Murphy read a number of telexes that had been sent by those who could not attend the Fest but wanted to thank those who were intimately involved in the chambers' success (Fowler, Harigel, Huson, Hans Kautzky, Jim Kilmer, George Mulholland, and Wes Smart, to name a few). Gerald Myatt (Oxford) said of the 15-ft, "The important scientific results which have come out of previous runs, and which will come over the next few years from analysis of the final run, are a fitting tribute to the success of the 15-ft Bubble Chamber program." Echoing an international sentiment that the decommissioning of the 15-ft Bubble Chamber has indeed marked the end of an era, Paul Hernandez (Lawrence Berkeley Laboratory) remarked that, "After 34 years of bubble chamber connections and the last 16 or so with the 15-ft, I see the 15-ft Bubble Chamber as the Jewel in the Crown. . ." The proceedings of the "15 Foot Fest" will be published.



(Fermilab photograph 88-118-6)

The last operating crew for the 15-ft Bubble Chamber. Pictured left to right and down the stairs are Jerry Domoleczny, Bill Kellogg, Mike McGee, Jim Fagan, Bruce Lambin, Camilo Flores, Bill Hughes, Gene Desavouret, John Worster, Dan Burke, Bob Pucci, Dan Markley, Pat Healey, Chuck McNeal, Ivan Stauersboll, John Ramus, John Urbin, Bill Henchel, Jim Ellermeier, Kelly Dixon, Jim Kilmer, Wes Smart, Harry Carter, and John Foglesong.

LISTED BELOW ARE ALL EXPERIMENTS THAT HAVE BEEN APPROVED AND COMPLETED USING THE 15-FOOT BUBBLE CHAMBER AS PART OF THE APPARATUS. THIS LIST WAS TAKEN FROM THE 'WORKBOOK' PUBLISHED BY FERMILAB'S PROGRAM PLANNING OFFICE.

1) **28A 15-FOOT NEUTRINO/H2&NE #28A** — FRY, WILLIAM F. — CERN (SWITZERLAND)

BEAM: NEUTRINO AREA-W B HORN NEUTRINO BEAM — HAWAII, UNIVERSITY OF; LAWRENCE BERKELEY LABORATORY; WISCONSIN, UNIVERSITY OF, MADISON

SEARCH FOR HEAVY LEPTONS AND HARD PENETRATING RADIATION IN THE NEUTRINO BEAM. STUDY OF DIFFRACTION SCATTERING OF NEUTRINOS; STUDY OF DEEP INELASTIC MUON-NEUTRINO SCATTERING IN A NEON BUBBLE CHAMBER AT NAL, AND TEST OF THE DELTA S = DELTA Q RULE AT HIGH MOMENTUM TRANSFER USING INCLUSIVE REACTIONS.

REQUEST	15 JUN 70	1,000K PIX	TO INCLUDE 500K PIX WITH THE PRIMARY PROTONS INCIDENT ON THE HADRON SHIELD AND 500K PIX WITH NORMAL TARGETRY
APPROVED	1 DEC 71	100K PIX	WITH 50K PIX OF NEUTRINOS IN NEON (GREATER THAN OR EQUAL TO 30%) WITH THE CONSTRAINT THAT RUNNING CONDITIONS YIELD AT LEAST 10,000 EVENTS; AND 50K PIX OF NEUTRINOS USING SPECIAL TARGETING
	9 MAY 75	100K PIX	TOTAL OF NEUTRINOS IN THE 22% NEON MIXTURE UNDER HORN FOCUSING CONDITIONS
COMPLETED	11 JUN 75	97K PIX	

2) **31A 15-FOOT ANTI-NEUTRINO/H2 #31A** — DERRICK, MALCOLM — ARGONNE NATIONAL LABORATORY

BEAM: NEUTRINO AREA-W B HORN NEUTRINO BEAM — CARNEGIE-MELLON UNIVERSITY; PURDUE UNIVERSITY

PROPOSAL TO INVESTIGATE MUON-ANTINEUTRINO INTERACTIONS IN HYDROGEN AT NAL.

REQUEST	15 JUN 70	1,000K PIX	REQUIRING A TOTAL EXPOSURE OF 10 TO THE 19TH PROTONS WITH 10 TO THE 13TH PROTONS PER PULSE ON TARGET
APPROVED	1 DEC 71	200K PIX	MAXIMUM WITH THE CONSTRAINT THAT THE RUNNING CONDITIONS YIELD AT LEAST 7,000 ANTINEUTRINO INTERACTIONS
COMPLETED	13 AUG 77	211K PIX	

3) **45A 15-FOOT NEUTRINO/H2 #45A** — NEZRICK, FRANK A. — FERMI NATIONAL ACCELERATOR LABORATORY

BEAM: NEUTRINO AREA-W B HORN NEUTRINO BEAM — HAWAII, UNIVERSITY OF; LAWRENCE BERKELEY LABORATORY; MICHIGAN, UNIVERSITY OF

PROPOSAL TO STUDY NEUTRINO INTERACTIONS WITH PROTONS USING THE 15-FOOT BUBBLE CHAMBER AT NAL.

REQUEST	15 JUN 70	200K PIX	WITH 10 TO THE 13TH PROTONS/PULSE OF AT LEAST 200 GEV
	19 JUL 71	500K PIX	WITH 10 TO THE 13TH PROTONS/PULSE AT 350 GEV
APPROVED	17 DEC 71	300K PIX	MAXIMUM WITH THE CONSTRAINT THAT THE RUNNING CONDITIONS YIELD ON THE ORDER OF 15,000 EVENTS OF NEUTRINOS IN HYDROGEN
COMPLETED	13 JAN 76	162K PIX	

4) **53A 15-FOOT NEUTRINO/H2&NE #53A** — BALTAY, CHARLES — BROOKHAVEN NATIONAL LABORATORY

BEAM: NEUTRINO AREA-W B HORN NEUTRINO BEAM — COLUMBIA UNIVERSITY

SEARCH FOR THE INTERMEDIATE BOSON, LEPTON PAIR PRODUCTION, AND A STUDY OF DEEPLY INELASTIC REACTIONS UTILIZING HIGH ENERGY NEUTRINO INTERACTIONS IN LIQUID NEON.

REQUEST	15 JUN 70	1,000K PIX	OF NEUTRINO INTERACTIONS IN 15-FOOT WITH 70% NEON AND 30% DEUTERIUM AND WITH INSERTED PLATE
	6 JUL 71	11,000K PIX	WITH 900K PIX OF NEUTRINO INTERACTIONS IN NEON WITH SINGLE PLATE AND 100K PIX IN HYDROGEN WITH TWO PLATES
	16 JUN 76	200K PIX	REQUESTED INCREASE OF THE APPROVED PICTURE TOTAL FROM 100K TO 200K
	25 JAN 78	450K PIX	TO INCLUDE AN INCREASE OF 300K BEYOND THE APPROXIMATELY 150K PIX ADDITIONAL ARE REQUESTED DURING THE SUMMER OR FALL OF 1978
	19 JUN 78	450K PIX	TO INCLUDE AN INCREASE OF 300K PIX; THIS FOLLOWS REJECTION OF THE
APPROVED	17 DEC 71	100K PIX	IN NEON OR PLATES TO YIELD AT LEAST 20,000 EVENTS
	29 JUN 76	150K PIX	TOTAL INCLUDING ABOUT 50K PIX ALREADY TAKEN
	28 JUN 78	450K PIX	TOTAL INCLUDING AN EXTENSION FOR 300K PIX
COMPLETED	9 MAR 81	440K PIX	

5) **155 15-FOOT EMI TEST #155** — PETERSON, VINCENT — HAWAII, UNIVERSITY OF
BEAM: NEUTRINO AREA-W B HORN NEUTRINO BEAM — LAWRENCE BERKELEY LABORATORY
PROPOSAL TO DEVELOP A PHASE I EXTERNAL MUON IDENTIFIER (EMI) FOR USE WITH THE NAL 30 CUBIC METER BUBBLE CHAMBER.

REQUEST	15 JUL 71		TEST RUNNING
APPROVED	27 AUG 71		PARASITIC RUNNING WITH UNDERSTANDING THAT COMPLETION OF PHASE I WILL INCLUDE TESTS IN NEUTRINO BEAM WITH 15-FT BUBBLE CHAMBER IN OPERATION AND NUMBER OF PIX TO BE DETERMINED AT A LATER DATE
	17 DEC 71		PARASITIC RUNNING WITH 100K PIX TO BE TAKEN FROM EXP# 45A EXPOSURES TAKEN WHEN EMI WAS OPERATING; FILM CONTAINING ABOUT 200 EVENTS TO BE DELIVERED AS SOON AS FEASIBLE TO AID IN PRELIMINARY TUNEUP AND CHECKING
	26 JUN 74	50K PIX	WITH FORMAL APPROVAL FOR DEDICATED PICTURES TO FOLLOW SUCCESSFUL ANALYSIS OF 200 EVENTS FROM EXP# 45A EXPOSURES
COMPLETED	30 NOV 74	14K PIX	

6) **172 15-FOOT ANTI-NEUTRINO/H2&NE#172** — LUBATTI, HENRY J. — CALIFORNIA, UNIVERSITY OF, BERKELEY
BEAM: NEUTRINO AREA-W B HORN NEUTRINO BEAM — HAWAII, UNIVERSITY OF
LAWRENCE BERKELEY LABORATORY
WASHINGTON, UNIVERSITY OF
ANTINEUTRINO INTERACTIONS IN THE 15-FOOT H2-NEON BUBBLE CHAMBER.

REQUEST	16 MAY 72	50K PIX	
APPROVED	19 JUL 72	50K PIX	
COMPLETED	25 MAY 76	49K PIX	

7) **180 15-FOOT ANTI-NEUTRINO/H2&NE#180** — ERMOLOV, PAVEL — FERMI NATIONAL ACCELERATOR LABORATORY
BEAM: NEUTRINO AREA-W B HORN NEUTRINO BEAM — INST. OF THEOR. & EXPER. PHYSICS, MOSCOW (USSR)
INSTITUTE OF HIGH ENERGY PHYSICS, SERPUKHOV (USSR)
MICHIGAN, UNIVERSITY OF
STUDY OF ANTINEUTRINO INTERACTIONS IN THE NAL 15-FOOT BUBBLE CHAMBER, FILLED WITH HYDROGEN AND NEON.

REQUEST	23 JUN 72	200K PIX	
APPROVED	11 JUL 72	50K PIX	OF ANTINEUTRINOS TO RUN BEFORE EXP# 172 AND TO HAVE FIRST CHOICE OF THE TWO H2/NEON MIXTURES
	29 JUN 76	200K PIX	INCLUDING AN ADDITIONAL 150K PIX; WITH THE EXPECTATION THAT THE EXPERIMENT WILL INVOLVE A TOTAL OF 500K PIX
APPROVED/INACTIVE	14 FEB 84	273K PIX	AS OF 01 JUN 1977

8) **234 15-FOOT ENGINEERING RUN #234** — HUSON, FRED RUSS — FERMI NATIONAL ACCELERATOR LABORATORY
BEAM: NEUTRINO AREA-15-FT HADRON BEAM — FLORIDA STATE UNIVERSITY
AN ENGINEERING RUN FOR THE NAL 15-FOOT CRYOGENIC BUBBLE CHAMBER.

REQUEST	1 AUG 73	50K PIX	
APPROVED	6 AUG 73	50K PIX	
COMPLETED	5 NOV 74	57K PIX	OF PI- - P INTERACTIONS AT 250 GEV

9) **341 15-FOOT P - P @ 400 #341** — KO, WINSTON — CALIFORNIA, UNIVERSITY OF, DAVIS
BEAM: NEUTRINO AREA-15-FT HADRON BEAM — LAWRENCE BERKELEY LABORATORY
INTERACTIONS OF PI+ MESONS AND PROTONS IN A HYDROGEN-NEON MIXTURE.

REQUEST	1 OCT 74	100K PIX	
APPROVED	4 DEC 74	25K PIX	OF TAGGED PI+ AND P AT 150 GEV IN H2 TO DEVELOP ANALYSIS TECHNIQUES FOR 15-FOOT BUBBLE CHAMBER FILM
	8 DEC 75	25K PIX	OF P - P INTERACTIONS AT 400 GEV
COMPLETED	21 DEC 75	34K PIX	

10) **343 15-FOOT P - P @ 300 #343** — ENGELMANN, RODERICH J. — ARGONNE NATIONAL LABORATORY
BEAM: NEUTRINO AREA-15-FT HADRON BEAM — KANSAS, UNIVERSITY OF
NEW YORK, STATE UNIVERSITY OF, STONY BROOK
TUFTS UNIVERSITY
PROPOSAL TO STUDY NEUTRAL PARTICLE PRODUCTION IN 250 GEV P - P INTERACTIONS IN THE FERMILAB 15-FOOT BUBBLE CHAMBER.

REQUEST	3 OCT 74	25K PIX	
APPROVED	4 DEC 74	25K PIX	
COMPLETED	13 JAN 76	27K PIX	

1) 300 15-FOOT NEUTRINO/H2&NE #300 — BALTAY, CHARLES — BROOKHAVEN NATIONAL LABORATORY
BEAM: NEUTRINO AREA-DICHROMATIC NEUTRINO BEAM — COLUMBIA UNIVERSITY

STUDY OF THE PROPERTIES OF WEAK NEUTRAL CURRENTS IN THE INTERACTIONS OF A NARROW BAND NEUTRINO BEAM IN LIQUID NEON

REQUEST	6 FEB 75	200K PIX	
APPROVED	7 JUL 75	200K PIX	IN A HEAVY NEON-HYDROGEN MIXTURE CONTINGENT UPON THE CONSTRUCTION AND ADEQUATE PERFORMANCE OF AN IMPROVED NARROW-BAND BEAM
	24 JUN 77	200K PIX	AT HIGHER ENERGIES USING THE D C DICHROMATIC TRAIN; NEW REQUESTS FOR USE OF THE DICHROMATIC HORN TO BE CONSIDERED LATER
COMPLETED	31 OCT 79	196K PIX	

2) 308 15-FOOT ANTI-NEUTRINO/H2&NE#308 — PETERSON, VINCENT Z. — FERMI NATIONAL ACCELERATOR LABORATORY
BEAM: NEUTRINO AREA-DICHROMATIC NEUTRINO BEAM — HAWAII, UNIVERSITY OF
LAWRENCE BERKELEY LABORATORY

PROPOSAL TO STUDY NEUTRAL CURRENT NEUTRINO AND ANTI-NEUTRINO INTERACTIONS IN THE 15-FOOT BUBBLE CHAMBER USING THE EXTERNAL MUON IDENTIFIER AND A DICHROMATIC BEAM.

REQUEST	24 APR 75	200K PIX	
	7 JUN 78	500K PIX	OR 5 X 10 TO THE 18TH PROTONS
APPROVED	7 JUL 75	200K PIX	OF ANTINEUTRINO BOMBARDMENT WITH A HEAVY NEON-HYDROGEN MIXTURE CONTINGENT UPON THE CONSTRUCTION AND ADEQUATE PERFORMANCE OF AN IMPROVED NARROW-BAND BEAM; SEE PROPOSAL #455
	24 JUN 77	200K PIX	AT HIGHER ENERGIES USING THE D C DICHROMATIC TRAIN; NEW REQUESTS FOR USE OF THE DICHROMATIC HORN TO BE CONSIDERED LATER
	28 JUN 78	200K PIX	WITH A DECISION TO MAINTAIN THE APPROVAL AS IT STANDS
COMPLETED	12 SEP 79	181K PIX	

3) 309 15-FOOT ANTI-NEUTRINO/D2 #309 — GARFINKEL, ARTHUR F. — ARGONNE NATIONAL LABORATORY
BEAM: NEUTRINO AREA-W B HORN NEUTRINO BEAM — CARNEGIE-MELLON UNIVERSITY
PURDUE UNIVERSITY

ANTI-NEUTRINO INTERACTIONS IN THE DEUTERIUM-FILLED 15-FOOT BUBBLE CHAMBER.

REQUEST	29 APR 75	300K PIX	
APPROVED	7 JUL 75	300K PIX	
	28 JUN 78	300K PIX	WITH A TOTAL OF 150K PIX PRESENTLY SCHEDULED FOR THE EXPERIMENT DURING THE FALL 1978 RUN
	19 MAR 79	250K PIX	
APPROVED/INACTIVE	26 OCT 81	10K PIX	AS OF 1 APR 1979

4) 545 15-FOOT NEUTRINO/D2&HZ #545 — SNOW, GEORGE A. — ILLINOIS INSTITUTE OF TECHNOLOGY
BEAM: NEUTRINO AREA-W B HORN NEUTRINO BEAM — MARYLAND, UNIVERSITY OF
NEW YORK, STATE UNIVERSITY OF, STONY BROOK
TOHOKU UNIVERSITY (JAPAN)
TUFTS UNIVERSITY

PROPOSAL FOR AN EXTENSION OF E-151/E-227 TO STUDY NEUTRINO INTERACTIONS IN DEUTERIUM IN THE 15-FOOT BUBBLE CHAMBER WITH PLATES. (AN INITIAL RUN WILL BE WITHOUT PLATES)

REQUEST	18 APR 77	300K PIX	
	21 DEC 77	500K PIX	TO BE RUN IN THE WIDE BAND BEAM WITH 1.3 X 10 TO THE 13TH PROTONS PER PULSE INCIDENT ON THE TARGET AT 400 GEV
APPROVED	16 MAR 78	350K PIX	OR EQUIVALENTLY 3.5 X 10 TO THE 18TH PROTONS; WITH THE ASSUMPTION THAT THE TEST OF THE PLATE SYSTEM WILL BE SUCCESSFUL
	8 JUN 78	350K PIX	TO BE RUN IN THE 15-FT CHAMBER WITHOUT PLATES
COMPLETED	17 JAN 79	317K PIX	

15) 546 15-FOOT NEUTRINO/H2&NE #546 HUSON, FRED RUSS
BEAM: NEUTRINO AREA-TRIPLET NEUTRINO BEAM

CALIFORNIA, UNIVERSITY OF, BERKELEY
FERMI NATIONAL ACCELERATOR LABORATORY
HAWAII, UNIVERSITY OF
LAWRENCE BERKELEY LABORATORY
WASHINGTON, UNIVERSITY OF
WISCONSIN, UNIVERSITY OF, MADISON

HIGH ENERGY NEUTRINO AND ANTINEUTRINO INTERACTIONS IN THE 15-FOOT BUBBLE CHAMBER USING THE QUADRUPOLE TRIPLET TRAIN LOAD AND THE TWO-PLANE EMI.

REQUEST	27 APR 77	250K PIX	WITH SPECIFIC INTEREST IN AN EXPOSURE OF 5 X 10 TO THE 18TH PROTONS
APPROVED	29 JUN 77		PARASITIC RUNNING CONCURRENT WITH OTHER NEUTRINO RUNNING WITH THE QUAD TRIPLET TRAIN
COMPLETED	26 JAN 78	375K PIX	

16) 564 15-FOOT & EMULSION/NEUTRINO#564 VOYVODIC, LOUIS
BEAM: NEUTRINO AREA-W B HORN NEUTRINO BEAM

FERMI NATIONAL ACCELERATOR LABORATORY
LINOIS INSTITUTE OF TECHNOLOGY
INST. OF THEOR. & EXPER. PHYSICS, MOSCOW (USSR)
INSTITUTE OF HIGH ENERGY PHYSICS, SERPUKHOV (USSR)
INSTITUTE OF NUCLEAR PHYSICS, CRACOW (POLAND)
JOINT INSTITUTE FOR NUCLEAR RESEARCH, DUBNA (USSR)
KANSAS, UNIVERSITY OF
NUCLEAR PHYSICS, UNIVERSITY OF, SOFIA (BULGARIA)
SYDNEY, UNIVERSITY OF, SYDNEY (AUSTRALIA)
WASHINGTON, UNIVERSITY OF

DIRECT DETECTION OF SHORT-LIVED PARTICLES FROM NEUTRINO INTERACTIONS IN NUCLEAR EMULSIONS INSIDE THE 15-FOOT BUBBLE CHAMBER.

REQUEST	11 MAY 77	1,500 HOURS	WITH A SPECIFIC REQUEST FOR NEUTRINOS FROM A TOTAL PROTON FLUX OF 3 X 10 TO THE 18TH; RUNNING IS PROPOSED DURING THE 15-FOOT RUNNING PERIOD WITH A DEUTERIUM FILL PLANNED FOR THE SPRING OF 1978
	8 MAY 79	1,100 HOURS	ADDITIONAL TO BE RUN PARASITICALLY IN THE 15-FT CHAMBER. FILM FROM TWO AUXILIARY CAMERAS IS REQUESTED FOR THE NEUTRINO PORTION OF THE RUNNING
APPROVED	24 JUN 77		PARASITIC RUNNING WITH THE UNDERSTANDING THAT THE EXPERIMENT IMPOSE ONLY A SMALL IMPACT ON THE 15-FT CHAMBER OPERATIONS
	1 JUL 79		PARASITIC RUNNING WITH THE UNDERSTANDING THAT THE EXPERIMENT IMPOSE ONLY A SMALL IMPACT ON THE 15-FT CHAMBER OPERATIONS
COMPLETED	9 MAR 81	277K PIX	

17) 632 15-FT NEUTRINO/H2 & NE #632 MORRISON, DOUGLAS R. O.
PETERS, MICHAEL W.
BEAM: NEUTRINO AREA-CENTER

BIRMINGHAM, UNIVERSITY OF (GREAT BRITAIN)
BRUSSELS, UNIVERSITE LIBRE DE, (BELGIUM)
CALIFORNIA, UNIVERSITY OF, BERKELEY
CEN-SACLAY (FRANCE)
CERN (SWITZERLAND)
FERMI NATIONAL ACCELERATOR LABORATORY
HAWAII, UNIVERSITY OF
ILLINOIS INSTITUTE OF TECHNOLOGY
IMPERIAL COLLEGE, LONDON (GREAT BRITAIN)
JAMMU UNIVERSITY, JAMMU-TAWI (INDIA)
MAX-PLANCK INSTITUTE, MUNICH (GERMANY)
OXFORD, UNIVERSITY OF (GREAT BRITAIN)
PUNJAB UNIVERSITY, CHANDIGARH (INDIA)
RUTGERS UNIVERSITY
RUTHERFORD APPLETON LABS (GREAT BRITAIN)
TUFTS UNIVERSITY

AN EXPOSURE OF THE 15-FOOT BUBBLE CHAMBER WITH A NEON-HYDROGEN MIXTURE TO A WIDEBAND NEUTRINO BEAM FROM THE TEVATRON.

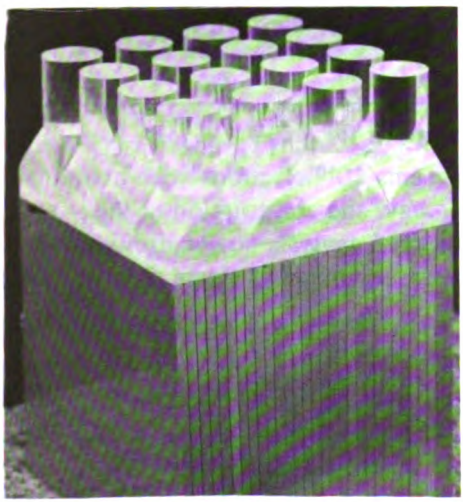
REQUEST	25 APR 80	250K PIX
APPROVED	18 JUN 82	1E18 PROTONS STAGE I APPROVAL.
	15 DEC 83	1E18 PROTONS STAGE II APPROVAL.
COMPLETED	1 FEB 88	154K PIX

Experimental Notes

Experiment 774 Completes Its Test Run

Michael B. Crisler

Experiment 774 is a new Fermilab fixed-target experiment designed to search for short-lived neutral particles that couple to the electron. The observation of narrow, correlated electron and positron peaks in heavy-ion collisions suggests the existence of such objects and has focused attention on a region of mass and lifetime where they could exist and yet would not have been seen. E-774 exploits the exceptionally high energy and flux of electrons available in Fermilab's Wide Band Electron Beam to probe this unexplored region. The experiment is a collaboration of Fermilab, the University of Illinois, Krakow, Northeastern University, and SLAC. During the recent fixed-target run, tests were performed to ensure that E-774 could run simultaneously with E-687, the photo-production experiment which is the primary user of the beam. The experiment was also able to obtain 48 hours of data with which it should already be sensitive beyond the best limits from previous search experiments.



(Fermilab photograph 87-737)
The E-774 calorimeter with light guides in place.

E-774 is a "beam dump" experiment in which an electron beam is directed onto a totally absorbing target calorimeter (the "dump"). The reactions it looks for are ones in which an electron interacts in the dump to produce a light neutral particle which then decays back into an electron-positron pair some distance downstream. Since observation of the decay depends on the neutral particle emerging from the target calorimeter before it decays, the large time dilation factor obtained at high energy plays an important role in the sensitivity of the experiment; a particle of 2-MeV mass produced with an energy of 200 GeV has its lifetime increased 100,000-fold.

It is equally important for the target calorimeter to be as short as possible. To that end, a novel calorimeter has been constructed from tungsten plates instrumented with scintillating fiber ribbons, 200 microns thick (photo, page 23). This allows sampling every radiation length, with the sampling material comprising only 6% of the thickness of the device. The downstream apparatus (Fig. 1.) is a simple neutral decay spectrometer followed by a trigger calorimeter. The target and trigger calorimeters were in place for the test run.

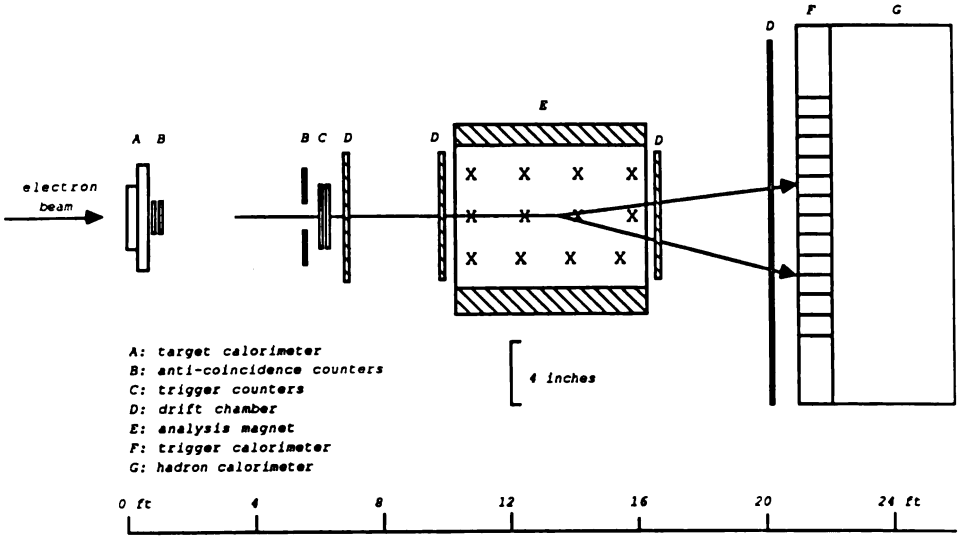


Fig. 1. *The downstream apparatus for E-774.*

The data accumulated in the test run represents 10^{10} electrons with an average energy of 275 GeV. An analysis is under way, and construction of the magnetic spectrometer has begun. With the additional analysis power provided by the magnet, the collaboration is expecting a clean separation of signal from background for 10^{12} electrons on target.

Lab Notes

Prairie View A&M University Team Visits Fermilab. . .

Percy A. Pierre, President of Prairie View A&M University (PVAMU), Prairie View, Texas, and key representatives of the university faculty conducting research at Fermilab, met with Fermilab Director Leon Lederman to discuss the prospect of PVAMU becoming a member of the Universities Research Association (URA). The trip was also arranged for Pierre by members of the E-705/771 collaboration, Dennis Judd and David Wagoner. Membership in the URA would make PVAMU the first historically black university to join the consortium of universities that operate Fermilab for the Department of Energy.

(Fermilab photograph 88-118-6)

Prairie View A&M University President Percy Pierre (l.) and Fermilab Director Leon Lederman.

Other agenda items for the visit included discussions of the current status of the E-705 analysis and the possible timeline for Physics Advisory Committee second-stage approval of E-771. Prairie View professors Dennis Judd and David Wagoner, and Brad Cox, the Fermilab spokesman for E-705/E-771, gave President Pierre and Vice President for Development Donald L. Hense a special tour of the Proton West beamline, pointing out proposed beamline up-grades for the E-771 Beauty experiment. Bob Wagner, of the Collider Detector at Fermilab collaboration, showed the visitors other Fermilab facilities.

Prairie View A&M University, 40 miles west of Houston, is a predominantly black university and the second oldest institution of higher education in the state of Texas. The university is celebrating its 110th anniversary this year.

PVAMU is the only predominantly black college in the nation to have a high-energy physics center. The university is also known for creating Benjamin Banneker Honors College, the first honors college in the nation on an historically black college campus, and for producing the most black engineers in the country from 1983 to 1985. PVAMU is experiencing a resurgence of growth and development, with new leadership and with public and private support. Last fall, the university had the largest percentage enrollment increase in the

state of Texas. The honors college during the same period saw its enrollment double in size.

Recently, Prairie View received an award from President Reagan, on behalf of the White House Office of Science and Technology Policy, for its model alliances with private companies, federal agencies, and national laboratories that "have significantly enhanced the academic and research capabilities of black engineers and scientists."

"We came to Fermilab to get a better understanding of the work going on here," said President Pierre of the meeting. An electrical engineer by training, Pierre showed an appreciation of the world-class research at Fermilab and its relation to academic institutions in the country.

"Fermilab is an extremely impressive facility," said Vice President Hense. "We appreciate the opportunity to see what our research team is doing here, and above all what it can mean for our students working with them and for the university's programs as a whole."

Dr. Pierre added, "We have had some of our engineering students intern here in the past. This new relationship between Prairie View and Fermilab will significantly enhance our physics program and expose our students to some of the most advanced technical training available."

The Friends of Fermilab Receives an NSF Grant. . .

The National Science Foundation (NSF) has awarded a $193,552 grant to the Friends of Fermilab for the development of a special program at Fermilab focusing on the teaching of modern physics at the secondary-school level.

The project, which grew out of recommendations from two recent conferences on the teaching of modern physics, will concentrate on updating high school physics courses by augmenting the curriculum and improving instruction.

Designed for use in northeastern Illinois, the program seeks to enhance the professional competence of high school physics teachers by expanding their knowledge of particle physics and cosmology and demonstrating successful teaching techniques for discussion, laboratory work, and problem solving.

The NSF grant will fund the development of a resource manual that will illustrate how teachers can incorporate new subject matter on modern physics into existing curricula. Included in the resource book will be various classroom materials, lesson outlines, and suggestions for demonstrations and laboratory experiments that can easily be adopted.

The second objective of the education project is to develop an in-service training program for master teachers which will begin with an intensive three-

*(**Lab Notes** cont'd.)*
week summer workshop for 20 high school physics teachers from the area. Upon completion of the program, these master teachers will return to their respective school districts to serve as resource personnel, helping to implement and monitor the new techniques. - *Marge Bardeen*

The First of Two Amdahl Computers Arrives at Fermilab. . .

Fermilab received the first of two deliveries of its new large-scale, general purpose, scientific computer. This first phase consisted of the delivery of an Amdahl 5890 300E (2 CPU's 96 Mbytes of main storage) and a large portion of the peripherals. After unloading the CPU's, which were delivered in seven pieces, and lashing them into a single unit, two crews from Amdahl and Systemhouse, Inc., began an around-the-clock installation marathon that lasted about 48 hours. Software engineers began installing the basic operating system, and tangentially the configuration of disks and other peripheral hardware and telecommunications. These were installed, checked out, and finally brought together as part of the overall system. Currently, on-going installation of over 30 software products is under way. This will be followed by validation diagnostics at the sub-system and user level. The present goal is to provide users access to the new machine in early August 1988. The remainder of the system is expected to arrive in January or February 1989. The total system will be composed of an Amdahl 5890 600E CPU with 4 central processors and 192 Mbytes of main storage, 40 Gbytes of disk storage, and a variety of tape drives, cassette drives, DECnet and Ethernet gateway links, and other peripheral equipment.

- *M. Bodnarczuk*

Manuscripts and Notes

prepared or presented from April 1, 1988, to May 24, 1988. Copies of Fermilab TM's, FN's, and preprints (exclusive of Theoretical and Theoretical Astrophysics preprints) can be obtained from the Fermilab Publications Office, WH3E,, or by sending your request to BITNET TECHPUBS@FNAL. For Theoretical and Theoretical Astrophysics preprints, contact those departments directly.

Experimental Physics Results

Experiment #710

N. A. Amos et al., "Measurement of B, the Nuclear Slope Parameter of the $p\bar{p}$ Elastic Scattering Distribution at $\sqrt{s}$ = 1800 GeV," (FERMILAB-Pub-88/38-E; submitted to Phys. Rev. Lett.)

Experiment #715

S. Y. Hsueh et al., "A High Precision Measurement of Polarized Σ^- Beta Decay," (FERMILAB-Pub-88/17-E; submitted to Phys. Rev. D)

Experiment #741/CDF

G. Brandenburg et al., "An Electromagnetic Calorimeter for the Small Angle Regions of the Collider Detector at Fermilab," (FERMILAB-Pub-87/171-E; submitted to Nucl. Instrum. Methods A)

S. Cihangir et al., "The CDF Forward/Backward Hadron Calorimeter," (FERMILAB-Pub-87/170-E; submitted to Nucl. Instrum. Methods A)

The CDF Collaboration, "The CDF Detector: An Overview," (FERMILAB-Pub-88/25-E; submitted to Nucl. Instrum. Methods A)

General Particle Physics

J. D. Bjorken et al., "Search for Neutral Metastable Penetrating Particles Produced in the SLAC Beam Dump (SLAC Experiment E-137)" (FERMILAB-Pub-88/44; submitted to Phys. Rev.)

B. Cox, "Beauty Physics at Fermilab Fixed Target Energies," (FERMILAB-Conf-88/48; invited talk presented at, and to be published in the proceedings of, the B-Meson Factory Workshop, Stanford Linear Accelerator Center, Stanford, California, September 8-9, 1987)

B. Cox, "Beauty Physics at the Ultrahigh Energies of the Eloisatron," (FERMILAB-Conf-88/32; invited talk presented at the Fifth INFN-ELOISATRON Workshop on New Aspects of Very High Energy Proton Proton Physics, Ettore Majorana Center for Scientific Culture, Erice-Trapani, Sicily, Italy, June 1987)

B. Cox, "Experimental Possibilities for Observation of CP Violation in B Decay," (FERMILAB-Conf-88/33; invited talk presented at the International Symposium on Heavy Flavors, Stanford University, Stanford, California, September 1987)

P. H. Garbincius, "Fixed Target Beauty Physics Experimental Programs," (FERMILAB-Conf-88/39; presented at the Workshop on High Sensitivity Beauty Physics at Fermilab, Fermilab, Batavia, Illinois, November 11-14, 1987)

Accelerator Physics

J. E. Griffin, "RF Cavity Primer for Cyclic Proton Accelerators," (TM-1519; presented at the INFN-ELOISATRON Project 4th Workshop: Very High Energy Proton-Proton Physics, Ettore Majorana Center for Scientific Culture, Erice-Trapani, Italy, May 31-June 7, 1987)

G. Jackson, "A Phase Space Tomography (PST) Monitor for Adjusting Bunch Rotation During Coalescing," (FN-469)

J. A. MacLachlan, "Application of the Argonne Advanced Acceleration Test Facility to Development for Conventional Accelerators," (TM-1522; expansion of remarks made at the Advanced Acceleration Test Facility Workshop, Argonne National Laboratory, Argonne, Illinois, April 6-7, 1988. To be included in the proceedings of same)

J. A. MacLachlan, "Fundamentals of Particle Tracking for the Longitudinal Projection of Beam Phasespace in Synchrotrons," (FN-481)

S. R. Mane, "Coherent Betatron Oscillations and Emittance Growth Due to Random Kicks," (FN-479)

Theoretical Physics

C. H. Albright et al., "Three Family Fritzsch and Stech Models with Minimal and Two-Doublet Higgs Structures," (FERMILAB-Pub-88/23-T; submitted to Phys. Rev. D)

W. A. Bardeen, "Schrödinger Approach to Ground State Wavefunctionals," (FERMILAB-Conf-88/46-T; talk presented at the Workshop on Variational Methods in Quantum Field Theories, Wangerooge, West Germany, September 1-4, 1987)

S. Boukraa et al., "On a Generalization of BRS and Gauge Transformations," (FERMILAB-Pub-88/37-T; submitted to Nucl. Phys.)

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