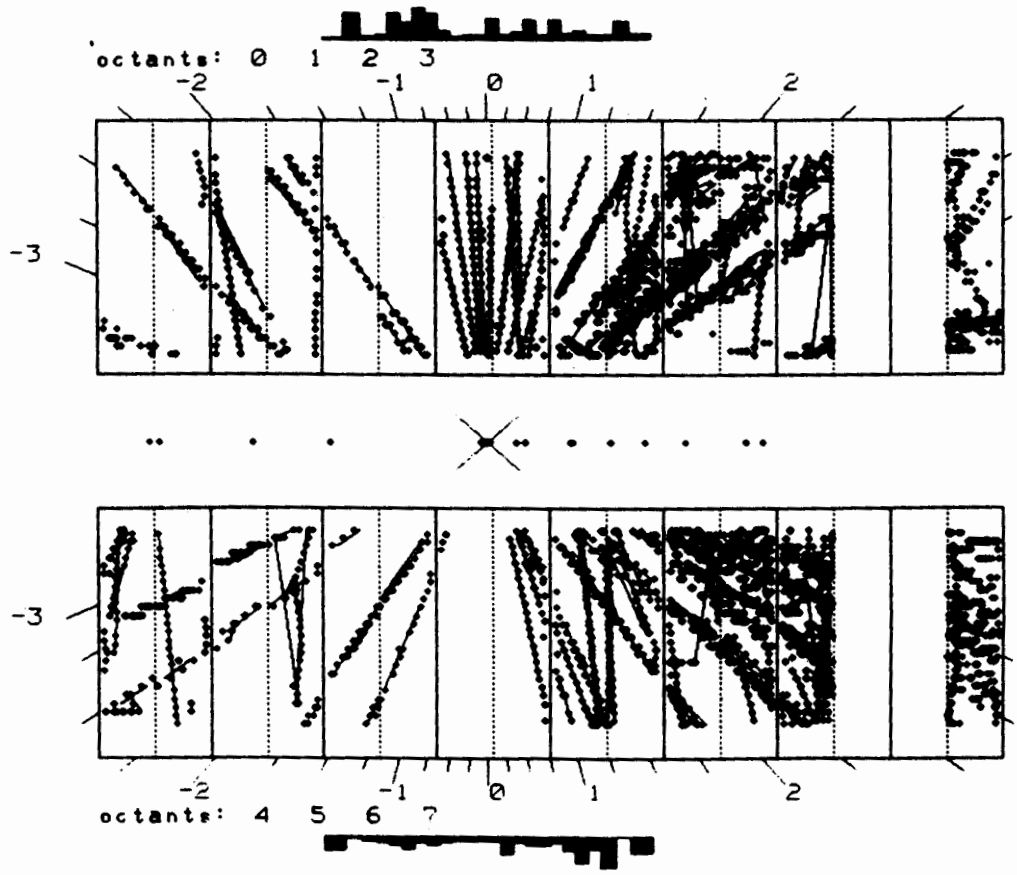
fermilab report

Fermi National Accelerator Laboratory Monthly Report

October 1985



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THE COVER: The Collider works! At 3:30 a.m., Sunday, October 13, 1985, the first $\bar{p}p$ collisions at 1.6 TeV were observed at BO by the Collider Detector at Fermilab (CDF) detector. The picture on the cover shows one of these collisions as observed by the Vertex Time Projection Chamber (VTPC). This chamber surrounds the Tevatron beam pipe and consists of eight modules of eight octants each. The view shown is an rz view where the tracks have all been rotated about the beam axis so that they appear in a plane. (These tracks appear in color on the original hardcopy.) Altogether, about 30 such events were collected from two separate shots of $\bar{p}$'s into the Tevatron from the Antiproton Source during which the was about $10^{24}cm^{-2}sec^{-1}$. The detector trigger required a deposit of about 2 GeV in coincidence with signals from forward-backward counters surrounding the beam pipe.

The test during September and early October was primarily to commission the Source and to allow CDF to conduct engineering tests on its data acquisition system, the central calorimetry, and the VTPC. Additional tests with the very-small-angle silicon detectors located a few millimeters from the Tevatron beam were also completed. The electronics tested included the RABBIT system for calorimeters, the TDC system for the VTPC, and the FASTBUS system. At present only about one-third of the final systems are in place, but the test encompassed the majority of the different type systems used in the complete detector. The tests were extremely successful, and the results will be crucial in bringing the CDF detector on-line next fall.

The members of CDF express their appreciation and admiration of the Source and Accelerator groups for successfully commissioning the machines, and opening up a new area of collider physics at Fermilab.

--Alvin Tollestrup

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HEPAP STUDY

Peter F. M. Koehler

In early June the High Energy Physics Advisory Panel (HEPAP) carried out an in-depth study of the U.S. high energy physics program for the period 1985-1995. Prior to this study, HEPAP working groups met at Brookhaven National Laboratory, Fermilab, and the Stanford Linear Accelerator Center (SLAC) to gather information covering the areas of e^+e^- facilities, fixed-target facilities, hadron colliders, the Superconducting Super Collider, accelerator operations and advanced accelerator R&D, and non-accelerator physics and interfaces with other fields. As part of each of these informal meetings, a "town meeting" was held which provided an opportunity for an exchange of views between interested physicists and HEPAP members. Another gathering was held at the National Academy of Sciences in Washington, DC, with the directors (or their representatives) of CERN, DESY, KEK, and the U.S. high energy physics laboratories at which the future plans for each of the laboratories were presented and discussed.

The findings and conclusions resulting from this study were discussed and finalized at a HEPAP meeting in Germantown, Maryland, July 1-2, 1985. They were also presented at the meeting of the Division of Particles and Fields in Eugene, Oregon in August. The formal "Report of the 1985 High Energy Physics Advisory Panel Study of the U.S. High Energy Physics Program 1985-1995" is to be issued soon by the U.S. Department of Energy, Office of Energy Research, Division of High Energy Physics. The following is the Executive Summary taken from this report.

Executive Summary

Motivated by the need to gain a better understanding of the U.S. high energy physics program, including a reassessment of the goal of building the Superconducting Super Collider (SSC), the High Energy Physics Advisory Panel (HEPAP) has carried out an in-depth study of the U.S. High Energy Physics Program. The HEPAP Study, which covered all aspects of the U.S. program, was held June 2-8, 1985, at the Coolfont Conference Center in Berkeley Springs, West Virginia. In preparation for the Study, a major information -gathering activity was carried out during the spring of 1985.

The Panel has concluded that the physics justification for a multi-TeV, high-luminosity hadron-hadron collider is even stronger today than it was in 1983 at the time of the original HEPAP recommendation. Furthermore, the technical successes achieved in the SSC

research and development program reinforce the confidence that this facility can be built within the costs and on the time scale estimated in the Reference Designs Study.

The Panel has evaluated the physics opportunities in the program for the period of approximately 10 years before the SSC would come into operation. These opportunities provide for a rich physics program with excellent prospects for fundamental discoveries. The superconducting Tevatron at the Fermi National Accelerator Laboratory (Fermilab) is operating at an energy of 800 GeV and provides the highest energy fixed-target facility in the world. The Fermilab Collider will become operational in 1987 and will be the world's highest energy hadron collider, extending the energy range to 1.8 TeV from 0.6 TeV available now at the CERN $S\bar{p}pS$. The Stanford Linear Collider (SLC), which will come into operation in 1987 at the Stanford Linear Accelerator Center (SLAC), will be the first e^+e^- collider to reach the energy of the Z^0 and also represents a pioneering effort toward a new class of electron-positron colliders. The effective utilization of these new facilities is an essential requirement.

The physics opportunities also include major U.S. participation in research programs at new facilities abroad: at CERN, the Large Electron Positron (LEP) project will become operational in 1989, providing e^+e^- collisions initially in the Z^0 range and later at higher energies, up to 200 GeV in the center-of-mass; in Japan, the TRISTAN project will become operational in 1987, providing e^+e^- collisions up to a center-of-mass energy of about 60 GeV. In West Germany, the Hadron Elektron Ring Anlage (HERA) project, which is expected to begin operations in 1990, will provide $e^{\pm}p$ collisions up to center-of-mass energies above 300 GeV, opening new opportunities for research.

The Panel has identified a limited number of programs which, because of their intrinsic importance, their likely impact on the course of future research, and their key role in the U.S. program, should proceed with priority. The Panel places the following major programs in this category: The Collider Detector Facility (CDF) and DO projects at TeV I, the L3 program at LEP, the Mark II and Stanford Linear Detector (SLD) projects at the SLC, and the CESR program at Cornell. The Panel also considers the smaller scale efforts involving studies of CP violation with kaons, high sensitivity studies of rare kaon decays, and certain parts of the non-accelerator program to be in this category.

It is clear that a project of the magnitude of the SSC will require major redirection of high energy physics resources during the next 10 years. However, this Study shows that it will be possible to achieve a reasonable transition into the SSC program. Some of the existing programs will be terminating just as extensive effort on SSC detectors will need to commence. The timely completion of the SSC will provide a truly forefront facility for the world's high energy physics community. The Panel notes, however, the inevitable deterioration of the U.S. program and the difficulty of maintaining continuity of the field if the SSC were delayed appreciably beyond the presently-anticipated time scale. If this were the case, there would be no frontier facility in high energy physics in the U.S. in the mid-1990's.

Finally, the Panel notes the importance of maintaining and strengthening the technology research in advanced accelerator R&D. This research is essential to the long term progress of the field.

On the basis of this Study, HEPAP makes the following recommendations:

1. We recommend that the SSC R&D be given highest priority in the U.S. High Energy Physics Program so that the project can proceed to an early construction start and rapid completion. In particular, for FY 1986, we support the requested incremental allocation of $7 million to SSC R&D, primarily so that early substantial industrial involvement in the magnet R&D effort can be initiated.

2. We recommend that the limited category of forefront programs identified in the report proceed with priority.

3. We recommend that the overall funding be adequate to permit the effective implementation of the broadly-based program providing essential diversity and scope with high priority to the special programs and to pursue the crucial SSC R&D effort.

   Comment: For FY 1987 this would require a small increase beyond the FY 1985 total level of effort. With reduced construction activity, this would allow the increased funding required for the utilization of the new capabilities coming into operation (the SLC at SLAC and the Tevatron at Fermilab) and for the SSC R&D effort.

It is clear that construction of SSC and fabrication of detectors for SSC will require incremental funding above this level. A funding profile such as shown in Section IV would ensure the scientific vitality and stature of U.S. high energy physics during the period prior to SSC operation. After the SSC is completed, it appears that an excellent program, including the SSC and a reduced non-SSC program, could be supported at a funding level about 10 percent above the current (FY 1985) level of effort.

4. We recommend that advanced accelerator R&D be strongly supported. A continued and strengthened effort in this area is essential to the long term progress of the field.

A STUDY OF THE WEAK NEUTRAL CURRENT E-594

Frank E. Taylor
Massachusetts Institute of Technology

"Everything in nature is lyrical in its ideal essence; tragic in its fate, and comic in its existence."

- George Santayana

Introduction

In the Standard Model of electroweak interactions, neutrinos scatter off the quarks inside the nucleon by one of two mechanisms: the charged-current interaction, or the neutral-current interaction. The charged-current interaction proceeds by the exchange of a $W^{\pm}$ boson, thereby transforming the incident-muon neutrino into a muon and altering the flavor of the target quark. The neutral-current interaction is mediated by the neutral Z^0 boson, and leaves the identity of the incident neutrino and the flavor of the target quark intact. Figure 1 is a schematic representation of these two neutrino-nucleon interactions.

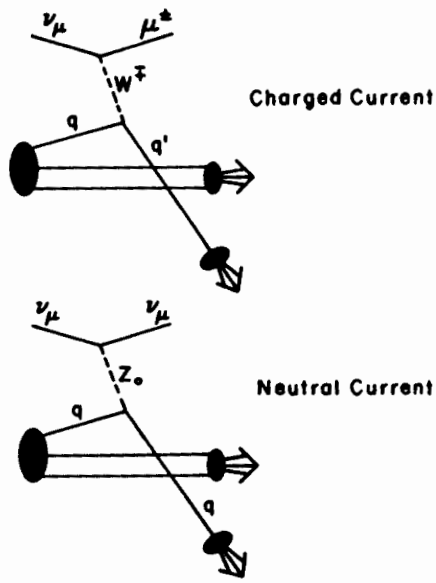

Figure 1. The Feynman diagrams for (a) the charged-current interaction and (b) the neutral-current interaction.

An experiment here at Fermilab, E-594, is in the final stages of analysis on a comparison of these two neutrino interactions. An analysis of our data has recently been published where we searched for deviations from the predictions of the Standard Model. Certain questions can be confronted with the data. Is the quark sea inside the nucleon the same in the neutral-current interaction as it is in the charged-current interaction? Are there any exotic objects in the nucleon which seem to couple preferentially to the neutral current?

We have also made a measurement of the neutrino-nucleon total cross section, searched for neutrino-flavor oscillations, estimated the mean-parton transverse momentum inside the nucleon, and checked the V-A theory of the charged-current interaction by the means of inverse-muon decay.

The experimental team was a collaboration between Fermilab, the Massachusetts Institute of Technology, and Michigan State University. The people involved were: D. Bogert, R. Burnstein, R. Fisk, S. Fuess, J. G. Morfin, T. Osaka, L. Stutte, J. K. Walker; J. Bofill, W. Busza, T. Eldridge, J. I. Friedman, M. C. Goodman, H. W. Kendall, I. G. Kostoulos, T. Lyons, R. Magahiz, T. Mattison, A. Mukherjee, L. Osborne, R. Pitt, L. Rosenson, A. Sandacz, M. Tartaglia, F. E. Taylor, R. Verdier, S. Whitaker, G. P. Yeh; M. Abolins, R. Brock, A. Cohen, J. Erwein, D. Owen, J. Slate, and H. Weerts.

The Experimental Technique

The study of the weak neutral current presents several experimental challenges. The key difficulties are the separation of the neutral-current interaction from the charged-current interaction and the reconstruction of the kinematics of neutral-current scattering. The solution to both of these problems is to sample the reaction products of the neutrino-nucleon interaction in very fine steps. This enables the two interaction types to be separated, and the angle and energy of the recoil hadron shower to be measured. By taking data in a narrow-band neutrino beam where the incident-neutrino energy can be inferred, the full kinematics of both the neutral-current and the charged-current events can be reconstructed.

Other benefits of building a fine-grained detector are that rare event topologies, e.g., inverse-muon decay, and quasi-elastic scattering, can be studied. Electron showers can be separated from hadron showers. In addition, certain details of deep-inelastic scattering events are accessible, such as the angle between the lepton-scattering plane and the hadron-shower plane.

Figure 2 shows a plan view of the neutrino detector used in E-594. The apparatus is based on plastic flash chambers and proportional wire chambers. Most of the mass of the detector is

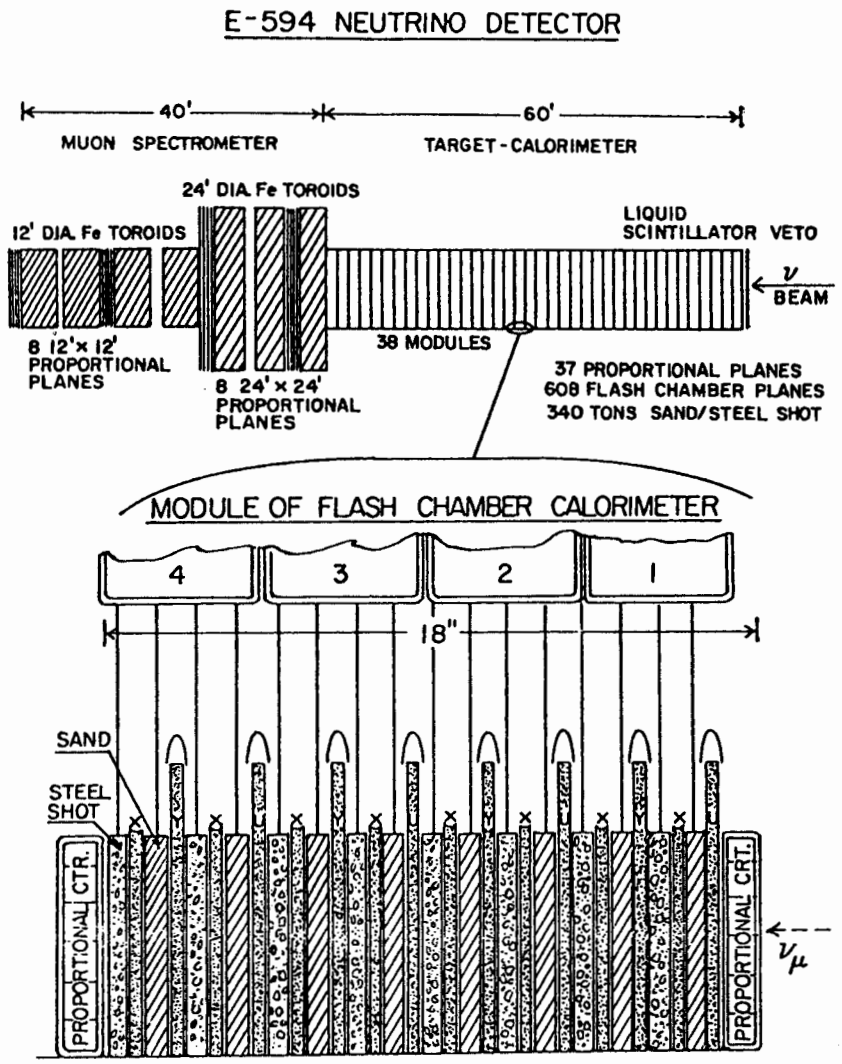

Figure 2. The E-594 detector is shown in plan view. The mass of the calorimeter is about 340 metric tons. The iron toroids measure the momentum of the muons from charged-current interactions.

in thin plastic sheets filled with either sand or steel shot. The detector is unique in that it samples the shower every 22% of a radiation length and every 3% of an absorption length, which is a finer-grained sampling than any other electronic neutrino detector.

The Neutral Current Nucleon Structure Functions

The experiment recorded 12,400 neutrino interactions after acceptance cuts in data taken in the narrow-band neutrino beam. The kinematical variables of the neutral-current and the charged-current scattering have been reconstructed by using the observed energies and angles of the recoil hadron showers. To reduce the systematics of the neutral-current/charged-current comparison, we presented our result as a ratio of the respective x distributions of the two interactions. (The variable x is the Bjorken scaling variable which is given by $x = Q^2/2M_p\nu$ and is a measure of the ratio of the momentum of the struck quark to that of the target nucleon.)

The comparison of the neutral-current and the charged-current x distributions is shown in Fig. 3. The charged-current data have been normalized to the same number of events as the neutral-current data at each momentum setting of the narrow-band train to make the comparison of the two distributions more direct.

The neutral-current/charged-current ratio as a function of x is shown in Fig. 4. All of the neutrino data have been combined, since there is no systematic difference between the various momentum settings. The figure indicates that the x dependence of the ratio is essentially flat, implying that the nucleon structures probed in the two interactions are the same as expected by the Standard Model. Detailed fits have been made to these ratios and they indicate no systematic difference between the two interactions.

Work is in progress to actually determine the structure functions themselves by deconvoluting the resolution smearing. This will be complementary to the ratio comparison described above.

Determination of $\sin^2\theta_W$

The strength of the weak neutral current depends on the quark electric charge, the quark weak isospin, and on the free parameter $\sin^2\theta_W$. Deep-inelastic neutrino-nucleon scattering offers the most statistically potent data from which to determine $\sin^2\theta_W$. To exploit this statistical power, it is necessary to minimize the theoretical and experimental systematic uncertainties of the determination. This requires knowledge of the quark structure of the nucleon, and the neutral-current and charged-current events must be well separated. The nucleon structure complications have been tested in our determination of the neutral-current structure functions described above, and the fine granularity of the neutrino detector allows the two event types to be distinguished with small corrections on an event-by-event basis.

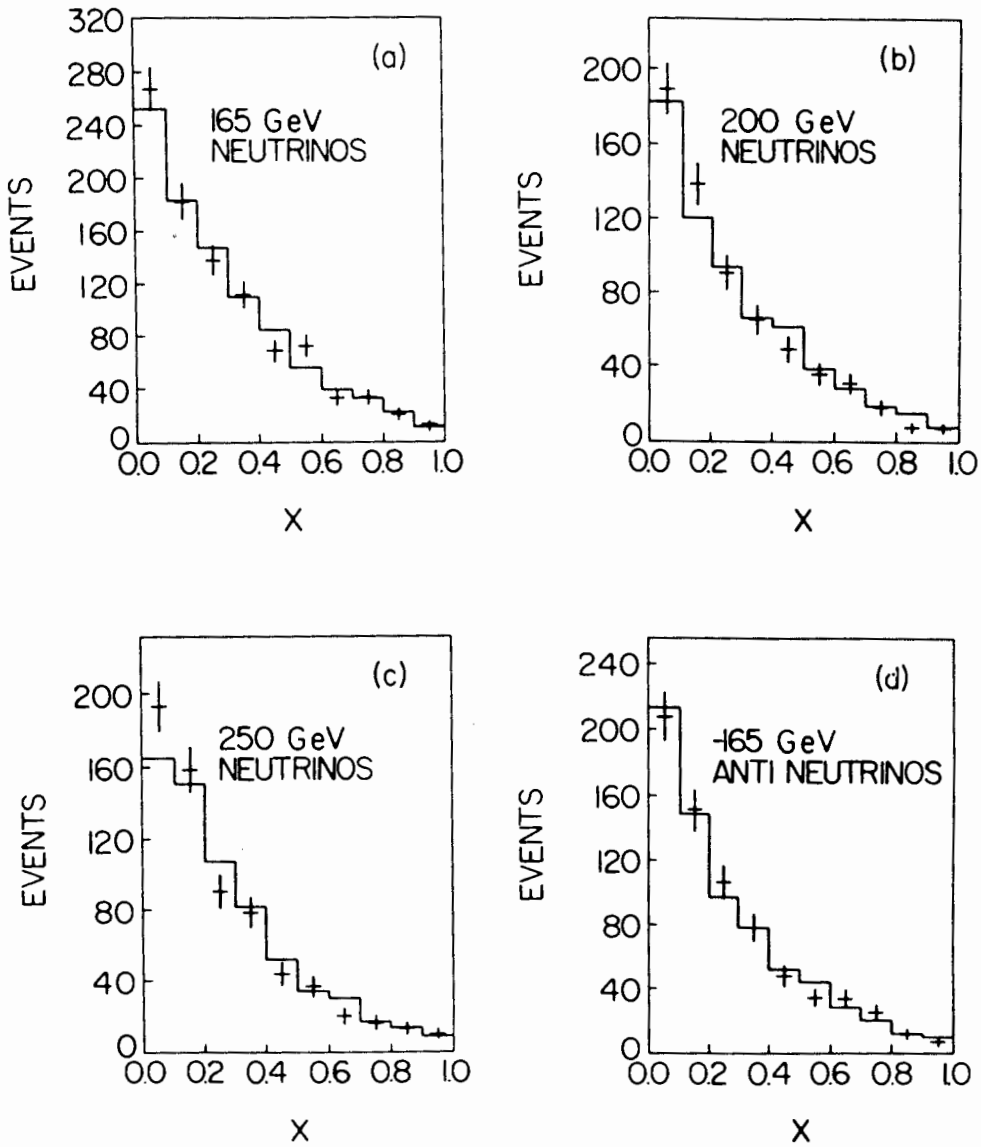

Figure 3. The neutral-current and charged-current x distributions at the four beam settings of the experiment. The neutral-current data are indicated by the error bars and the charged-current data by the histogram.

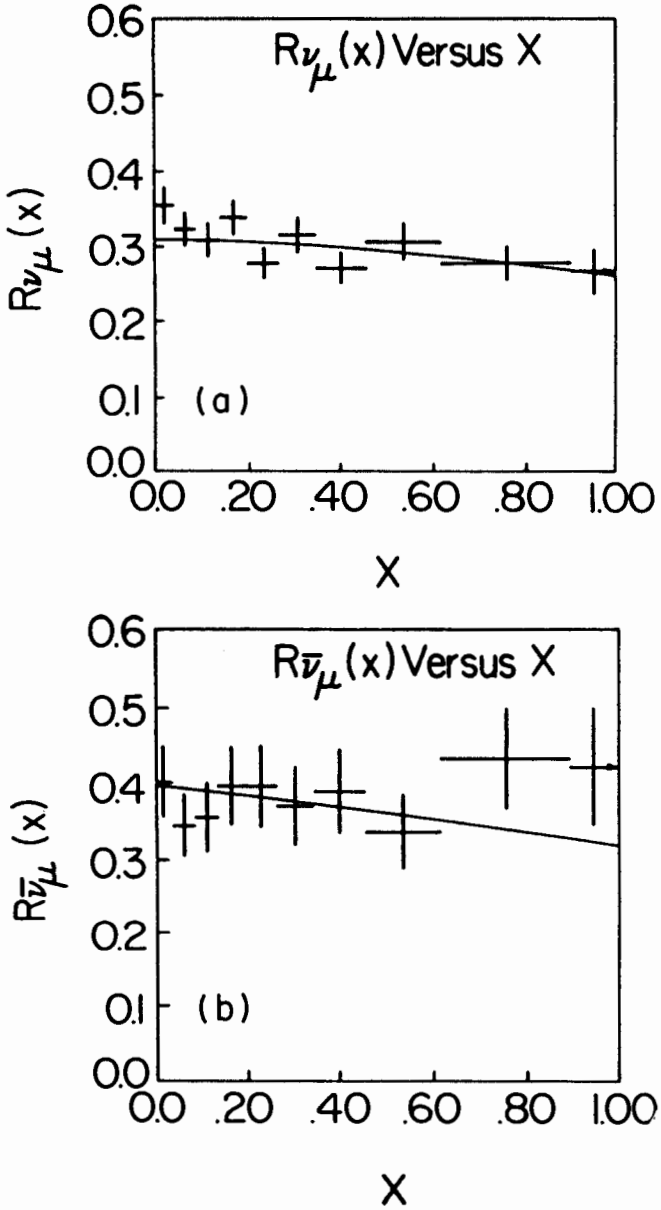

Figure 4. The neutral-current to charged-current ratio as a function of x for (a) neutrinos, and (b) antineutrinos. The solid line indicates the result of a fit to the neutral-current structure functions.

The value of $\sin^2\theta_W$ was extracted from the data by using the ratio of the total number of neutral-current events which satisfy certain experimental cuts to the corresponding number of charged-current events. This ratio is computed for both neutrinos and antineutrinos and is shown in Fig. 5. The line is the expectation of the Standard Model as a function of $\sin^2\theta_W$. We obtained

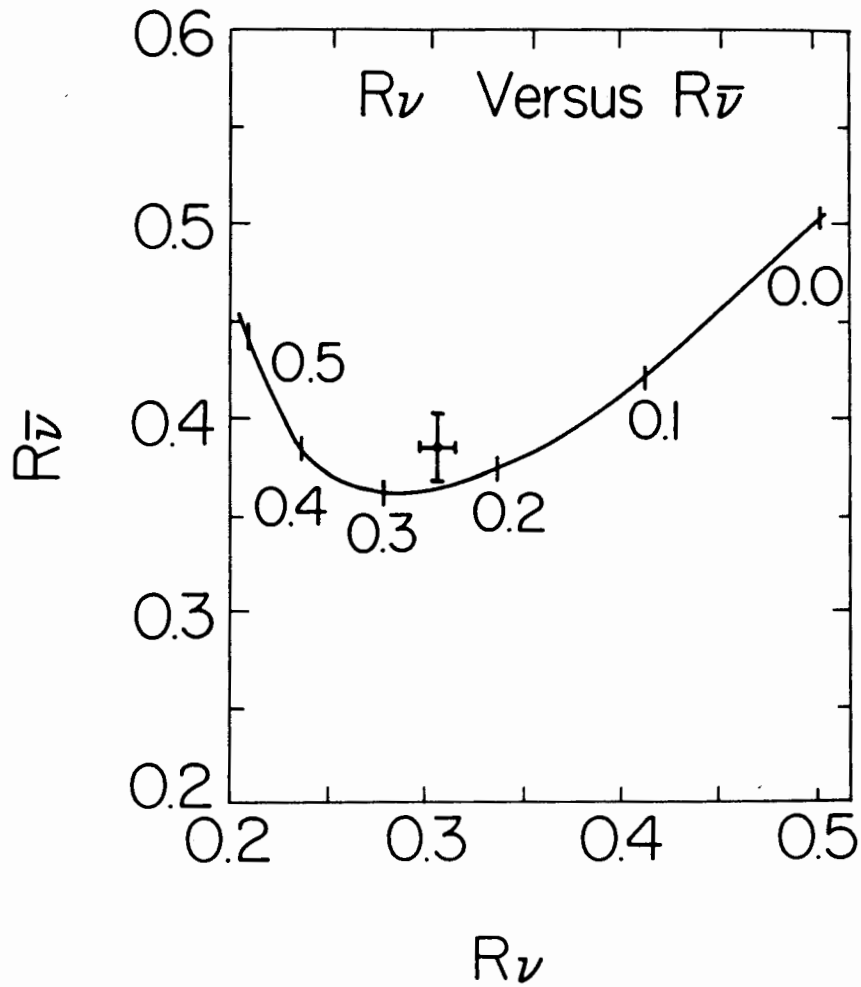

Figure 5. The neutral-current to charged-current ratio for antineutrinos is plotted against the corresponding ratio for neutrinos. The line is the expectation of the Standard Model as a function of $\sin^2\theta_W$.

the value $\sin^2\theta_W = 0.246 \pm 0.012 \pm 0.013$, where the first error is statistical and the second is an estimate of systematic effects. This number is in agreement with other determinations both here at Fermilab and at other labs.

The extraction of $\sin^2\theta_W$ depended on small effects in the charged-current cross section. In particular, it was sensitive to the amount of the strange sea and to the mass of the charmed quark.

Measurement of the Total Cross Section

The narrow-band beam technique allows the incident-neutrino flux to be measured by monitoring the beam of the pions and kaons which decay to produce the neutrino beam. By measuring the ratio of observed events in the neutrino detector divided by the inferred neutrino-beam flux the total neutrino cross section can be determined. Our preliminary value for incident neutrinos is given by

$$(\sigma_T/E)_\nu = (0.613 \pm 0.007 \pm 0.031) \times 10^{-38} cm^2/GeV$$

and for the antineutrino beam by,

$$(\sigma_T/E)_{\bar{\nu}} = (0.332 \pm 0.009 \pm 0.022) \times 10^{-38} cm^2/GeV.$$

The first error is the statistical error and the second estimates systematic effects. Further checks and refinements of these numbers will be done, but at present they are equal within errors to the earlier determinations.

Search for Neutrino Oscillations

We have searched for neutrino oscillations in the narrow-band beam where we hypothesize that the original muon-neutrino beam oscillates into tau neutrinos. The search exploited the energy constraints afforded by the narrow-band beam and the ability of our detector to reconstruct quasi-elastic events.

The energy of the outgoing muon will essentially equal the energy of the narrow-band beam in muon-neutrino quasi-elastic scattering. In tau quasi-elastic scattering, the outgoing-tau energy is again constrained to be nearly equal to the incident-neutrino energy, but only a portion of the energy is observable, since the tau decays into a muon and two unobserved neutrinos. By selecting events with the quasi-elastic signature, but with a muon energy less than the narrow-band neutrino energy, an oscillation limit can be computed. The result expressed in terms of the mass difference parameter Δm^2 at maximal neutrino flavor mixing at the 90% confidence level upper limit is $\Delta m^2 < 8\ eV^2$ for incident neutrinos and $\Delta m^2 < 7\ eV^2$ incident antineutrinos.

These results are comparable with other determinations (within a factor of 3) and present another way of searching for the oscillation effect in a simple scattering channel.

Other Analysis Projects

Other analyses near completion are a study of the transverse momentum of the quarks inside the nucleon, and a check of the V-A structure of the inverse-muon decay.

The mean-parton transverse momentum has been estimated by the distribution of the angle between the hadron plane and the lepton-scattering plane in charged-current events. We can determine the lepton-scattering plane from the incident-neutrino beam direction and the outgoing-muon track. The hadron plane is estimated by the pattern of energy deposition in the flash chambers. The cosine of this angle will have a small but finite average arising from the energy dependence of the neutrino-parton cross section and geometric factors expressing the incident-neutrino energy in the parton-rest frame. The preliminary value of the parton-transverse momentum is $\langle p_T \rangle = 0.35 \pm 0.10$ GeV/c, where the error is statistical only.

Inverse-muon decay is a beautiful reaction where a muon-neutrino scatters off an electron, giving a muon and an electron neutrino. The reaction involves only leptons and can proceed by only the charged-current interaction. Thus, it is a nice test of the V-A theory. The chief difficulty is that the cross section is tiny. Nevertheless, we have observed a few of these events in the narrow-band beam and have been able to test the theory. The ratio of theory to data, assuming the standard V-A structure for charged-current events, is given by $S = 1.00 \pm 0.28$ verifying that pure V-A is a good model. Our result confirms the earlier measurements at CERN.

Future Program

We are anticipating that the sequel experiment to E-594 (E-649) will carry these studies to the uniquely high energies produced by the new narrow-band beam operating at the Tevatron. The energy constraints of the narrow-band beam and our fine-grained calorimeter will allow several incisive studies of neutrino physics in a new high-energy regime. The collaboration has recently taken data in the wide-band beam at the Tevatron (E-733) to study the dimuon production process, and to look at deep-inelastic neutrino-nucleon scattering at high energies. These data will nicely complement the narrow-band program of E-594 and E-649.

NOTES AND ANNOUNCEMENTS

Director's Special Colloquia on Topics in High-Energy Physics...

A series of colloquia designed for the non-specialist physicist will address areas of unusual interest in theoretical and experimental high-energy physics. Topics range from the construction of super computers for numerical calculation of the predictions of current theory to the mystery of not-yet-identified dark matter whose gravitational effects are observed. Other subjects covered include superstring theory and the unification of all forces via an approach involving a hypothesized ten-dimensional universe.

The following colloquia are to be presented in Fermilab's Wilson Hall Auditorium.

"Towards a Unified Theory of All Interactions," by John Schwarz (California Institute of Technology) on November 7, 1985, at 3:00 p.m.

"A Supercomputer for Lattice Gauge Theory: Results and Prospects," by Norman Christ (Columbia University) on November 14, 1985, at 4:00 p.m.

"Supersymmetry, Gravity, and Unification," by Bruno Zumino (Physics Department, University of California at Berkeley) on December 6, 1985, at 4:00 p.m.

"The Ongoing Search for Dark Matter Candidates," by Frank Wilczek (Institute for Theoretical Physics, Santa Barbara, California) on December 10, 1985, at 3:00 p.m.

"Superstring Theory," by Edward Witten (Princeton University) on January 23, 1986, at 3:00 p.m.

MANUSCRIPTS, NOTES, LECTURES, AND COLLOQUIA PREPARED
OR PRESENTED FROM SEPTEMBER 9, 1985 TO OCTOBER 13, 1985

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

Experimental Physics

Y. W. Wah et al. Experiment #497	Measurement of Σ^- Production Polarization and Magnetic Moment (FERMILAB-Pub-85/128-E; submitted to Phys. Rev. Lett.)
S. Mikocki Experiment #580	Inclusive Resonance Production in Single-Vee Events in π^-N Interactions at 200 GeV (Ph.D. Thesis, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, August 1985)
T. F. Eldridge Experiment #594	Total Cross Section Measurements for Muon Neutrino and Antineutrino Charged Current Deep Inelastic Scattering (Ph.D. Thesis, Massachusetts Institute of Technology, Cambridge, Massachusetts, June 1985)
J. A. Slate Experiment #594	A Comparison of Neutral to Charged Current, Neutrino-Nucleon Interacions in a Wide Band Neutrino Beam at Fermilab (Ph.D. Thesis, Michigan State University, East Lansing, Michigan, 1985)
G. P. Yeh Experiment #594	Neutral Current and Charged Current Structure Functions of the Nucleon (Ph.D. Thesis, Massachusetts Institute of Technology, Cambridge, Massachusetts, 1985)
C. H. Georgiopoulos Experiment #623	Observation of the Cabibbo-Suppressed Decay $D^{\pm} \to \phi\pi^{\pm}$ (Ph.D. Thesis, Tufts University, Medford, Massachusetts, May 1985)
D. R. Green et al. Experiment #623	Observation of a Narrow Enhancement in ϕKK and $\phi\pi\pi$ Final States Produced in 400 GeV p-N Interaction (FERMILAB-Pub-85/120-E; submitted to Phys. Rev. Lett.)

D. Green et al. Experiment #740	Hadron Showers and Muon Trajectories in Thick Absorber from 25 GeV/c to 150 GeV/c (FERMILAB-Pub-85/121-E; submitted to Nucl. Instrum. Methods A)

Theoretical Physics

A. Das and V. S. Mathur	Path Integral Solubility of Two Dimensional Models (FERMILAB-Pub-85/105-T; submitted to Phys. Rev. D)
W. A. Bardeen	Anomalies (FERMILAB-Conf-85/111-T; presented at the MESON50 Symposium, Kyoto, Japan, August 1985)

Astrophysics

E. W. Kolb et al.	A Peek into the Shadow World (FERMILAB-Conf-85/114-A; invited talk given by E. W. Kolb at the IX Johns Hopkins Workshop on Current Problems in Particle Physics, Florence, Italy, June 1985)
K. A. Olive	Dark Matter: Cosmological Limits and Applications (FERMILAB-Conf-85/123-A; presented at the 6th Workshop on Grand Unifications, University of Minnesota, Minneapolis, Minnesota, April 18-20, 1985)

General

R. L. Allen and S. I. Baker	Regulating the Waste Generator (FERMILAB-Pub-85/131; submitted to Professional Safety)
A. J. Bianchi et al.	Operational History of Fermilab's 1500 W Refrigerator Used for Energy Saver Magnet Production Testing (TM-1353; presented at the 1985 Cryogenic Engineering Conference and International Cryogenic Materials Conference, Massachusetts Institute of Technology, Cambridge, Massachusetts, August 12-16, 1985)

J. D. Bjorken — "Will the Next Fifteen Years of High Energy Physics Match the Last Fifteen?" (FERMILAB-Conf-85/133; summary talk presented at the Tenth Hawaii Topical Conference in Particle Physics, Honolulu, Hawaii, August 26-31, 1985)

W. Craddock et al. — Test Results and Design Details of the Tohoku Bubble Chamber Magnet (TM-1346; presented at the 1985 Cryogenic Engineering Conference and International Cryogenic Materials Conference, Massachusetts Institute of Technology, Cambridge, Massachusetts, August 12-16, 1985)

J. D. Gonczy et al. — Heat Leak Measurements Facility [TM-1348 (SSC-N-28); presented at the 1985 Cryogenic Engineering Conference and International Cryogenic Materials Conference, Massachusetts Institute of Technology, Cambridge, Massachusetts, August 12-16, 1985]

M. Kuchnir et al. — Measuring Heat Leak with a Heatmeter (TM-1344; presented at the 1985 Cryogenic Engineering Conference and International Cryogenic Materials Conference, Massachusetts Institute of Technology, Cambridge, Massachusetts, August 12-16, 1985)

F. W. Markley et al. — Cryogenic Compressive Properties of Basic Epoxy Resin Systems (TM-1347; presented at the 1985 Cryogenic Engineering Conference and International Cryogenic Materials Conference, Massachusetts Institute of Technology, Cambridge, Massachusetts, August 12-16, 1985)

T. H. Nicol et al. — Thermal Shield Bowing in Long Superconducting Magnets [TM-1351 (SSC-N-31); presented at the 1985 Cryogenic Engineering Conference and International Cryogenic Materials Conference, Massachusetts Institute of Technology, Cambridge, Massachusetts, August 12-16, 1985]

R. C. Niemann et al.	Design, Construction, and Performance of a Post Type Cryogenic Support [TM-1349 (SSC-N-29); presented at the 1985 Cryogenic Engineering Conference and International Cryogenic Materials Conference, Massachusetts Institute of Technology, Cambridge, Massachusetts, August 12-16, 1985]
R. C. Niemann et al.	The Cryostat for the SSC 6 T Magnet Option [TM-1350 (SSC-N-30); presented at the 1985 Cryogenic Engineering Conference and International Cryogenic Materials Conference, Massachusetts Institute of Technology, Cambridge, Massachusetts, August 12-16, 1985]
R. J. Powers et al.	5cm, No Iron SSC Dipole 12m Model Cryostat Thermal Performance [TM-1352 (SSC-N-32); presented at the 1985 Cryogenic Engineering Conference and International Cryogenic Materials Conference, Massachusetts Institute of Technology, Cambridge, Massachusetts, August 12-16, 1985]
R. C. Trendler	Operational Experience with the Fermilab 150 GeV Injection Kicker [Submitted to the 1985 Particle Accelerator Conference (NPS), Vancouver, British Columbia, May 13-16, 1985]

Physics Notes

N. V. Mokhov and J. D. Cossairt	A Short Review of Monte-Carlo Hadronic Cascade Calculations in the Multi-TeV Energy Region (FN-424; submitted to Nucl. Instrum. Methods A)
F. Willeke	Analytical Study of the Tevatron Nonlinear Dynamics (FN-422)

Colloquia, Lectures, and Seminars

J. J. Van der Bij	"Some Two-Loop Corrections to Weak Interaction Parameters" (Fermilab, September 10, 1985)

J. Lach	"P-Center Changes and Upcoming Experiments" (Fermilab, September 19, 1985)
M. H. Reno	"Phenomenology of O(18)" (Fermilab, September 24, 1985)
J. Marriner	"Current Status of the Accumulator Performance" (Fermilab, September 26, 1985)
R. Orr	"Accelerator Division Information Meeting" (Fermilab, October 1, 1985)
J. Peoples	"Next Week, Next Year - the $\bar{p}$ Source Department" (Fermilab, October 3, 1985)
D. Cossairt	"The Polarized Proton Beam" (Fermilab, October 3, 1985)
T. Yamanaka	"Search for Right-Handed Currents in Kaon Decay" (Fermilab, October 4, 1985)
D. Harding	"The Booster to Debuncher Line - Beam Optics" (Fermilab, October 10, 1985)
J. Misek	"The Booster to Debuncher Line - Mechanical Layout" (Fermilab, October 10, 1985)
R. Oberholtzer	"The Booster to Debuncher Line - Electrical Installation" (Fermilab, October 10, 1985)

DATES TO REMEMBER

October 28-30, 1985	Workshop on New Solid State Devices for High Energy Physics, Lawrence Berkeley Laboratory, Berkeley, California 94720; for information contact David Nygren, (415) 486-7162 or FTS 451-7162.
October 31-November 1, 1985	Gas Calorimetry Workshop, Fermilab, Batavia, Illinois 60510. For information contact: Masa Mishina, Fermilab (312) 840-4603; George Brandenburg, Harvard University (617) 495-2824; or Muzzaffer Atac, Fermilab (312) 840-3960.
November 11-14, 1985	Workshop on Triggering, Data Acquisition, and Computing for High Energy/High Luminosity Hadron-Hadron Colliders, Fermilab, Batavia, Illinois 60510; for more information contact Brad Cox, (312) 840-3152 or FTS 370-3152.
November 12, 1985	Deadline for submission of material to be considered at the December Physics Advisory Committee meeting.
December 12-13, 1985	Physics Advisory Committee meeting.
January 16-17, 1986	Workshop on Radiation Damage to Wire Chambers, Lawrence Berkeley Laboratory, Berkeley, California 94720; for more information contact John Kadyk, (415) 486-7189 or FTS 451-7189.