THE COVER: The Collider Detector at Fermilab’s (CDF) Central Detector making its way from the 20 Assembly Area into the Collision Hall in preparation for first in-place tests. Motive force for the 109 ft, 16-hour move was provided by a system of two hydraulic cylinders and eight, 500-ton Hillman rollers much like miniature tank treads. These treads allowed the 2000-ton Detector to crawl over minor floor debris and imperfections which could not be eliminated. The upper left quadrant of the photograph, which was taken on September 10, shows the cable-mover described in the June issue of Fermilab Report. (Fermilab photograph 85-680-10)
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Dates to Remember  

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On June 23, the world's highest-energy electron/photon beam was commissioned successfully at Fermilab. This beam, constructed in the Proton East area, is capable of producing electrons of energies in excess of 650 GeV. The beam is named "Wideband" because it gathers up electrons over a very large momentum range and this results in a very high intensity. The first experiments to be performed with this beam use the high-energy electrons to create the highest-energy photon beam available anywhere in the world. Because of its unique design, the beam can also operate in several other modes--as a high-intensity pion beam, a primary proton beam, or a neutron beam.

The major systems of this beam are:

1) A beam-splitting station to create a second primary proton beam in Proton East.

2) A system of Energy Doubler/Saver (ED/S) dipoles and quadrupoles which direct the primary beam to the production target and focus it to a small spot.

3) An 800-ton steel target pile which contains the production target, and the shielding and magnets required to remove unwanted radiation and charged particles emerging from the target. A hole at the downstream end admits photons and neutrons to the remainder of the beam.

4) A thin piece of lead (about 3/8 in.) which converts the high-energy photons to electrons and positrons. The neutrons essentially don't react in the converter.

5) A 1200-ft-long secondary beam transport which collects the electrons over a very large range of momentum and bends them away from the neutrons and positrons. The electrons are refocussed to a reasonably small spot near the Experimental Hall. After the electrons are separated from the neutrons and positrons, these unwanted particles are absorbed in a dump--called the "neutral dump"--located about halfway down the beam.

6) Just before the Experimental Hall, the electron beam is passed through a "radiator"--which is another thin piece of lead. As the electrons pass through the lead, they are jiggled and this causes them to radiate photons. The electrons, whose energy is now somewhat depleted by the emission of the energetic photons, are no longer needed and
7) The photons interact at one of two experimental target stations located in the new Wideband Photon Laboratory.

This scheme, shown below, of going from photons to electrons to photons, is a classic approach to the production of photon beams. It is necessary in order to be able to separate the photons from the unwanted neutrons. If this separation did not take place, the interactions of the neutrons in the experimental
target would totally dominate and obscure the interactions by the photons. Of course, each stage costs energy and intensity. It is, therefore, necessary to collect the electrons over the widest possible range of angles and momenta; this is the approach taken in designing the Wideband beam. The figure below is a schematic showing the beam optics.

Wideband beam optics schematic.
This project took over four years to complete. The civil construction and the technical components of the primary beam were funded under the Tevatron II project, directed by Tom Kirk. The civil design was done by the Tevatron Construction Group under Wayne Nestander's supervision. The secondary beam components and the installation were provided by the Research Division. Ken Stanfield, Research Division Head, was involved in the original design of the beam and contributed to its construction in many ways, as did Roger Dixon.

The upstream beam enclosures were constructed in 1983 and the downstream enclosures in 1984 and 1985. Each enclosure was operated as soon as all components were installed. No enclosure required more than one half hour to commission. The final components were installed on Wednesday, June 19, 1985 and the beam was sent to the Experimental Hall on Sunday, June 23, 1985. The beam was confirmed to be a highly pure electron beam by observing its interaction in a lead-lucite shower counter built by Peter Garbincius. Typical pulse height spectra derived from this counter are shown in Figs. (a), (b), and (c) on the opposite page. The contamination of charged pions in the electron beam is revealed by inserting a lead block into the beam. This brick removes essentially the entire electron component of the beam, but hardly affects the charged pion component at all. Figure (d) shows the shower counter response with the lead brick inserted. In the course of the recently completed run, the beam was operated at central energy settings as low as 15 GeV and as high as 650 GeV. At the 650-GeV central setting, the beam accepts charged particles at energies up to 780 GeV. The beam is capable of running at a central setting of greater than 800 GeV and is therefore capable of using the higher proton energies expected to become available in the future.

Some of the most difficult technical components associated with this project are shown in the photos on page 6. The top photo shows the 800-ton target pile. The design and construction of this huge object were the responsibility of the Research Division Mechanical Department. The pile is serviced by an overhead crane which can be operated from a distance so as to avoid personnel exposure to radiation. The basic concepts were worked out by Dave Eartly and were employed first in the target pile for Meson Center. The detailed design of this station was worked out by Ron Currier and Bill Strickland. Bill Strickland supervised installation. The bottom photo shows part of the cryogenic system for the string of ED/S dipoles and quadrupoles that convey the beam to the target station. The driving forces behind this effort were Rich Stanek, Jim Bywater, and Bob Pighetti. The top photo on page 7 shows the electron sweeper magnets. The magnets were made in the Fermilab Magnet Facility and use laminations and copper conductor from the Antiproton Accumulator large- and small-aperture dipoles. The bottom photo on page 7 and the photo on page 8 show the Wideband Experimental Hall with some of the detectors from Experiment 687 already in place. The installation
(a) Shower counter spectrum at 250 GeV/c.

(b) Shower counter spectrum at 500 GeV/c (horizontal scale changed by a factor of 2).

(c) Spectrum at 250 GeV/c (log scale).

(d) Shower counter spectrum at 250 GeV/c (log scale) with lead brick in beam to remove electrons.
Upstream end of the Wideband Target pile. On the right is the last magnet of the primary beam. Visible at the upstream end of the target pile are the stand of the target (vertical) drive and the coils of the first sweeping magnet. The pile is about 80-ft long. Additional shielding components are (left to right) Dave Early, Ross Doyle, and Bill Strickland.
(Fermilab photograph 85-645-20)

Cryogenic system for string of ED/9 dipoles and quads in primary proton beam. On the right, the ED/9 dipoles are barely visible. Shown in the picture are Jim Bywater (RD/Cryol), Terry O'Brien (RD/Electrical), Tom Neustadt (RD/Cryol), Don Walsh (RD/Electrical), and Al Logan (RD/Electrical). Rich Stanek and Bob Pighetti were supposed to be in the picture but couldn't find their Oxygen Deficiency Hazard qualification cards.
(Fermilab photograph 85-645-5)
Upstream end of the electron sweeping magnet system. Shown in the picture are Debbi Cobb, Dick Nelson, Lee Bradstreet, Julius Lents, Junus Santoso, Ron Davis, and Don Byrd. (Fermilab photograph 85-645-31)

View of Wideband Experimental Hall with components of E-687 partially installed. (Fermilab photograph 85-646-21)
The new, large analysis magnet for E-687 in Wideband Lab. Shown in the picture are: John Bockman, John Gran, Jack Jaggar, Ron Currier, Tom Gutierrez, Jim Humbert, Jim Coblet, Andy Neumann, Dave Smiley, and Tom Bennett. Missing is Ed Black, who ran out of the Hall screaming after hearing an experimenter say, "Well, maybe we should see what happens at 3000 amps."
(Fermilab photograph 85-946-2)

Effort was coordinated by Al Guthke and Ron Currier. The electrical design and installation was coordinated by Age Visser, Stan Orr, Leon Beverly, Paul Czarapata, Gianni Tassetto, Fred Rittgarn, and Dwight Featherston. Julius Lentz was responsible for the power supplies; Gary Ross lead the effort to install the radiation interlocks. Ross Doyle installed the water system.
The radiation shielding was designed by Mike Gerardi. The Accelerator Division contributed the electrostatic septa and controls for the beam split and, of course, deliver to us the 800-GeV/c protons which make this the world's highest-energy photon/electron beam.

In any project of this size, a large number of people work in design, construction, fabrication, and installation. We can't list them all for fear of leaving someone out. Thanks to one and all for a splendid job.
"A New Map of America" by John Senex.
Published in 1720.
Size of original: 19-1/8 x 22-1/4 in.
(From Antique Maps for the Collector by Richard Van De Ghம, The Macmillan Co.)
THE NSF/APS GRANT FOR PHYSICS IN LATIN AMERICA

Roy Ruhinstein

Introduction

This article describes the history and administration of a grant to the American Physical Society to aid physics in Latin America. It is felt that the experience we have gained so far could be valuable to others who are contemplating similar activities, and so we discuss mainly the work entailed and problems that have arisen, as this is probably of most interest to those who would like to learn from our activities. However, we do not want the reader to be left with a negative impression. Helping physics in less industrialized nations really does work; a relatively small amount of money can have a big impact on physics in countries where foreign currency for this type of activity is severely limited. One broken small component of a large piece of equipment can often halt a whole research project if funds are not available for its replacement. Our experience has been very positive, and the feedback from the recipient countries convinces us that the effort has been extremely worthwhile.

History

The initial idea for this grant arose in discussions at the 2nd Symposium on Pan American Collaboration in Experimental Physics, held in Rio de Janeiro, Brazil in July/August 1983. A number of U.S. participants, including Leo Falicov (Professor of Physics, U. C. Berkeley) and Leon Lederman (Director, Fermilab), wrote a letter to the U.S. National Science Foundation (NSF) and the U.S. Department of Energy (DOE) expressing concern at the effects of the economic crisis on the growing scientific infrastructure of the most developed countries of Latin America. The writers suggested that a relatively small amount of money would be enormously helpful in tiding their Latin American physics colleagues over the difficulties caused by the hard-currency shortages in those countries.

The response to the letter, from E. Knapp (NSF) and A. Trivelpiece (DOE) was encouraging. In late 1983, at the urging of R. Marshak who was then President of the American Physical Society (APS), Falicov and Lederman as principal investigators submitted a grant proposal, through the APS, for $375,000 to the NSF for assistance to physics in Argentina, Brazil, Chile, Mexico, and Venezuela. In July, 1984, the NSF approved a grant of $300,000 for this purpose to the APS, with direction of the grant under Falicov and Lederman; about half of the money was from DOE. The grant was to be used in four areas: (i) library subscriptions to U.S. scientific journals, (ii) payment of page charges for articles by Latin American authors submitted to refereed U.S. journals, (iii) spare parts and maintenance items.
for existing equipment in Latin American physics laboratories, and (iv) per diem support for Latin American physicists visiting the U.S. for short periods of time.

The APS set up an Oversight Committee for the grant, consisting of L. Lederman (Chair), L. Falicov, R. Park, D. Scott, and S. Sinha; because Falicov is also Chair of the Executive Committee of the APS International Physics Group (IPG), there is a close connection between the grant and IPG. Two representatives from each of the designated countries were selected to ascertain, in a fair manner, the most critical items needed in the above areas. A strong effort was made to select outstanding members of the physics community in each country and, where practical, to have one from the government science establishment and one from academia.

Processing of Requests

The representatives of the countries sent lists of their approved items to the U.S. (Falicov and Lederman); initially the U.S. Oversight Committee gave guidelines for the approval process to Falicov and the author, who oversee the day-to-day operation of the grant. Fermilab, which has had a history of interactions with Latin America over a number of years, was designated to administer the grant; this administration, which involved placing orders with manufacturers, paying for the orders, issuance of per diem checks, etc., was under the direction of the author. The services of Fermilab’s Purchasing and Accounting Departments, administrative and secretarial assistance, computerized record keeping, telephones, etc. were provided at no cost to the grant.

Following some trial and error, procedures evolved for processing the requests, and after a somewhat slow start, the operation became reasonably smooth. It may be of some interest to give the fractions of expenditures in the different categories. Although these varied from country to country, a typical breakdown is: per diem 15%, journal subscriptions 25%, page charges 15%, and equipment 45%.

Experience So Far

1. Per Diem

Following the intent of the grant that only short visits (not long-term fellowships) should be covered, it was decided to put an upper limit of 30 days per diem to any visitor. Air fare to and from the U.S. were not paid. The NSF allowed the per diem details to be handled similarly to those of the receiving organization, in this case the APS. Consequently, the per diem amount was that of the APS, namely $70 per day to cover all expenses in the U.S.; this simplified the reporting. In order to make payment, proof of the visit was necessary, usually by a copy of the
airline ticket to and from the U.S. Also, copies of either a conference registration receipt, or a letter from the visitor's university or laboratory host in the U.S., were required.

A few difficulties arose in the early days of the grant. One was that some physicists came to the U.S. expecting to receive per diem for vacation days before and after their working visit. The other was that some came to the U.S. with no funds, and were told that Falicov or Lederman or the author would instantly supply money. Both problems were soon corrected.

Generally, a check would be issued by Fermilab about a week after receipt of the required information described above. It was mailed to the visitor, either in the U.S. or to his home address. No funds were advanced prior to travel.

2. Journal Subscriptions

This part of the grant gave rise to few problems. When funds became available in mid-1984, all requests for subscriptions were placed for one year starting January 1985. A small number of requests for non-U.S. journals were not placed, since this would violate the intent of the grant.

3. Page Charges

This also gave rise to few problems. Invoices for page charges for articles in U.S. journals were sent by the authors, via the country representatives, to Fermilab, and payment was then made to the journal. A problem occurred when, on occasion, incomplete information, rather than the invoice itself, was sent; several phone calls were sometimes necessary in order to obtain adequate information from which to make payment. Occasionally even this was not adequate and payment could not be made. In one instance, the authors' reprints were delivered to Fermilab rather than to the authors.

4. Equipment

The largest fraction of all requests was for equipment; in addition, the largest number of administrative problems per request occurred in this category.

Requests were received at Fermilab, in the form of item description, suggested vendor, and approximate cost, and fed to the Fermilab Purchasing Department in the form of purchase requisitions; orders were then placed, with instructions that the items were to be sent air-freight by the vendor to the requesting country. This circumvented the need at Fermilab for receiving, inventory, and trans-shipment activity.

Among the difficulties encountered were the following:

a) insufficient information was given by the requestor, so that the order could not be placed. Component part numbers
were sometimes incorrect or omitted; the number of items required was sometimes unclear; crucial descriptions, such as item sizes, were sometimes unavailable; vendor name and address were sometimes too unclear or incomplete. In all these cases, no action was taken until clarifying information could be obtained from the requisitioner.
b) Some vendors would not ship equipment to non-U.S. countries, possibly because of the additional paper-work effort this caused them. These orders thus could not be placed. Other vendors required information on the end-use of their product.
c) Customs regulations in the receiving countries differed from country to country. After many letters, telexes, and phone calls, procedures appropriate for each individual country were instituted. Generally the vendor was instructed to enclose a letter with each item stating that it was a gift for scientific purposes, so that local customs charges could be avoided. (Occasionally the vendor forgot to include the letter, so that additional effort on the administrator's part was needed.) One country initially wanted equipment shipped only on their national carriers, which was not allowable under the relevant U.S. regulations.
Some receiving countries wanted items shipped to the original physicist requester, while others, in order to circumvent their customs problems, wanted the items shipped only to a single agency in the country for subsequent distribution.
d) Fermilab's Purchasing Department has a standard procedure of not paying a vendor until proof of delivery is obtained. This caused some problems due to the time delays involved.

5. Comments

Many lessons have been learned during the past several months, during which almost two-thirds of the funds have already been disbursed; perhaps the most obvious one is that distributing $300,000 in a fair (and auditable) way involves a very large amount of effort!

The representatives of the countries have to be chosen with care: they should be people who have the respect of the physicists in their country, and who also have the necessary administrative resources to carry out this work. The appearance of U.S. paternalism in the choice should be avoided if possible; it is probably a good idea to involve the country's Physical Society or equivalent in this selection.

Having two people, rather than one, in charge of the day-to-day operation was important. It meant that discussions of new problems with someone else was immediately possible, and ideas could be exchanged on possible solutions. The Oversight Committee gave general guidelines, but many small problems arose daily
and required decisions that would be difficult to obtain in a timely manner if many people had to be consulted. In our case, the good communication between Falicov and the author by mail, phone, and electronic mail has been crucial.

It was found valuable to have the detailed administration of the grant carried out at a large institution such as Fermilab, which has considerable facilities for this type of activity. The author has spent perhaps 15% of his time working on this grant. Part-time assistance available to him included an Administrative Assistant, a Secretary, and a Systems Analyst—the latter to create and keep updated a crucial computer record of all transactions. The Fermilab Purchasing and Accounting Departments were obviously essential to smoothly place all of the orders and make all payments. The frequent use of telephones, telexes, and sometimes electronic mail was necessary. By arrangement with DOE, which funds Fermilab, all of these activities were carried out at no cost to the grant. The smooth flow of the NSF funds from the APS to Fermilab was helpful in overcoming bookkeeping problems.

Lastly, it should be noted that there are still one-third of the funds to be disbursed. Based on experience so far, many other problems have yet to surface! However, as noted in the Introduction, the impression we want to emphasize is that in spite of the difficulties, the program really does work. It appears that the goal of significantly helping Latin American physics has been successful.

Acknowledgements

Many people made working on this project possible, and actually fun. It is a pleasure to thank Fermilab's Jackie Coleman, Doris Bart, Anne Burwell, and Don Beatty together with many others in our Purchasing and Accounting Departments. Leon Lederman's enthusiastic support of Latin American physics, and this program in particular, was essential. Joe Burton and Bill Havens of the APS were generous with their time and advice. Many people in the receiving countries were very gracious in the long telephone conversations necessary to solve detailed problems. My most sincere thanks are due to Leo Falicov, whose humor, advice, and encouragement helped to make all this possible.
U.S. PARTICLE ACCELERATOR SCHOOL NEWS

Marilyn Paul

The 5th U.S. Summer School on Particle Accelerators was held at SLAC, July 15-26, 1985. The main portion of the School was its usual intensive set of accelerator physics courses given by lecturers from around the world. Afternoon sessions of the second week hosted a symposium of accelerator-based sciences including lectures on the nuclear physics program, the light source program, the U.S. program for intense particle beams, and high-energy physics. Over 300 students and lecturers participated in the two-week program; there were 79 from U.S. universities, 179 from U.S. laboratories, 42 from foreign institutions, and 27 from other affiliations in attendance.

In addition, the School offered its first history symposium with talks by F. Amman (University of Pavia), N. Cabibbo (University of Rome), E. Courant (BNL), K. Johnsen (CERN), D. Kerst (University of Wisconsin), M. S. Livingston (MIT), N. Ramsey (Harvard), and R. R. Wilson (Cornell). The symposium was followed by a celebration including a luau and presentation of awards for achievements in physics. The awards, consisting of a parchment scroll and a metal sculpture (both prepared by A. Gonzales of Fermilab), were presented to Ernest D. Courant and M. Stanley Livingston for the discovery of the principle of strong-focusing, and to Robert R. Wilson for building the first strong-focusing synchrotron.

A new addition to the School this year was the presentation of the 1985 prize for Achievement in Accelerator Physics and Technology. The prizes were awarded to Helen Edwards (Fermilab) for making the first superconducting synchrotron a reality, and to John Madey (Stanford University) for the discovery of the free-electron laser. Edwards and Madey were chosen following review of nominations submitted by the physics community to the selection committee of Burton Richter (SLAC), Andrew Sessler (LBL) and Maury Tigner (SSC Central Design Group). Both awardees received a certificate of accomplishment as well as a cash prize of $1500 made possible through contributions from the Houston Area Research Center, Universities Research Association, Varian, and the Westinghouse Electric Company.

To the award and prize recipients we offer our congratulations for their excellence.
John Stull (Machine Shop), Don Tinsley, Franco Bedeschi (CDF), Bruce Smyth (Machine Shop), and John Kowalski (Technical Services) pose for the camera after installing a high-precision survey machine on one of the circular CDF central tracking chamber endplates. Two endplates were delivered at the end of April from an outside vendor. The survey arm was built at Fermilab, and is used to survey the endplates to 0.0005 in. in two coordinates. Both devices were designed by Technical Services at Fermilab. Other full-time members of the CDF Tracking Group (not pictured) include Peter Berge, Walter Coleman, Lisa DesJardine, Bill Foster, Bert Gonzalez, Sara Gonzalez, Mike Hrycyk, Richard Kadel (Project Leader), John O'Meara, Ron Nodruff, Annette Schultz, Al Schoberlein, Jerry Watgens, Bob Wagner, and Ray Yarema (Research Services).
Participants in the third Summer Institute for Science Teachers assembled on the front steps of Wilson Hall. (Fermilab photograph 85-511-2)
THE 1985 SUMMER INSTITUTE FOR SCIENCE TEACHERS

Marjorie Bardeen

Introduction

The third Summer Institute for Science Teachers of secondary schools was held at Fermi National Accelerator Laboratory from June 17 to July 12, 1985. This project was made possible by a partnership among the National Science Foundation, private foundations, and local school districts, and was sponsored by the Friends of Fermilab Association.

The Summer Institute is an unusual approach to continuing education for practicing high school science teachers. For four weeks they are brought into contact with scientists working at the very forefront of research. Here, an energetic exchange of ideas, facts, and excitement takes place. This is a two-way exchange; not only does the teacher benefit from exposure to new or perhaps forgotten ideas, but the researcher also benefits by encountering the problems which teachers of high school science are facing and how these problems may be better approached and solved.

Objectives

The ultimate goal of the Summer Institute is to attract more students to science classrooms by helping teachers update and improve high school instruction and curriculum in biology, chemistry, and physics. The program endeavors to:

1. Target successful and lively teaching techniques for existing materials, including laboratory preparation and techniques, and computer applications.
2. Improve the teaching of problem-solving skills.
3. Enhance teachers' backgrounds in basic subject matter.
4. Expose teachers to current developments in scientific research and basic objectives and problems in modern science.
5. Strengthen the awareness and teaching of contemporary relations among science, technology, and society.

Curriculum Highlights

The 1985 program included both separate sessions in biology, chemistry, and physics which focused on lectures; and laboratory and computer sessions and plenary sessions in which all participants gathered for lectures and discussions. Participants received three graduate credits in science from Northern Illinois University upon successful completion of the program.
Speakers from seven institutions presented three-hour plenary sessions devoted to advanced topics in various scientific disciplines and societal problems. Titles included "The Integrated Mind: How the Two Halves of the Brain Talk to Each Other"; "How Trace Chemical Analysis of Meteorites Unveils the Solar System's History"; "The Teaching of Science"; "Everything You Want to Know about Particle Physics"; "The Role of the Arboretum in Society"; "Cholesterol in Health and Disease"; and "Recent Research Advances in the Study of Severe Local Storms."

The parallel sessions included morning lectures and afternoon laboratory sessions. The theme of these sessions was sharing. The goal was to give teachers materials which they could use in their classrooms next year. Some experiments and demonstrations were presented by the Institute staff. However, equally important was the opportunity for each participant to present a classroom activity that he or she developed. The Institute will publish these materials and make them available at cost to interested teachers and schools.

The biology program was coordinated by Lowell Nicolaus (Northern Illinois University) and Geoye Zahrobsky (Glenbard West High School). Lecturers from four Illinois universities presented material on current developments in genetics, evolution, ecology, and cell physiology and anatomy. In the afternoon, participants critiqued and improved labs related to the lecture topics and developed new labs. Because teachers indicated little exposure to computers, they learned some basic programming and how to use some readily available software. They were required to use the word processor to prepare lab handouts.

The chemistry program was coordinated by Morley Russell (Northern Illinois University) and William West (Naperville Central High School). The curriculum followed the main topics in a first-year college chemistry course. Participants made half-hour presentations of favorite demonstrations and experiments. They received five computer disks containing software for the chemistry classroom and learned some computer basics.

The physics program was coordinated by Christopher Hill (Fermilab), John Schaffer (Northern Illinois University), James Ruebush (St. Charles High School), and Peter Ogilvie (Wheeling High School). Topics followed the successful Saturday Morning Physics program but at a level appropriate for teachers. Fermilab lecturers included Chris Hill, Drasko Jovanovic, Leon Lederman, Ernie Malamud, and Terry Walker. Lou Voyvodic (Fermilab) supervised a laboratory session. The afternoon sessions offered a variety of experiences so that each participant could develop further his or her own school's laboratory offerings in physics. Experiments, demonstrations, and computer utilization were featured.
Participants

45 participants (15 biology teachers, 15 chemistry teachers, and 15 physics teachers) were selected for the 1985 Institute.

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<td>20's - 25</td>
<td>2 - 5 years</td>
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<td>30's - 35</td>
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<td>50's - 55</td>
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<td>30 - 40 years</td>
<td>1 teacher</td>
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In the three years that the program has operated, teachers from 76 schools in Northeastern Illinois have participated.

Follow-Up

As the number of teachers with a common inservice experience grew, the follow-up program was expanded to include not only the four half-day sessions for the current participants, but also a continuing education program, Physics West, for previous participants and other science teachers in the western suburbs of Chicago. Physics West began in 1985 under the supervision of Allan Etzbach, Jim Ruebush, and Walt Schearer, all laboratory supervisors of the Institute. Monthly meetings in area high schools were scheduled during the school year. After an informal gathering with coffee and donuts, teachers shared successful experiments and demonstrations with one another. The first session was held at Fermilab where Lou Voyvodic gave teachers bubble chamber pictures for film analysis. This program was modeled on the successful Illinois State Physics Project carried on in the Chicago schools by Earl Zwicker (Illinois Institute of Technology). The mailing list includes some 80 secondary and college physics teachers. This fall, Chemistry West will begin with the same format.

Impact

It is difficult to assess the impact of the Summer Institute on the students we hope to reach. Teachers do report using lecture notes, experiments, demonstrations, and computer programs in their classrooms. They have also shared Institute materials with other teachers, not only those in their own school, but also those in other buildings and districts. We know that a few students were able to work with one of the plenary session speakers on an advanced independent research project. Other students will have a chance to participate in Saturday Morning Physics because
of their teacher's involvement in the Summer Institute. Research suggests that it takes as many as three years for a teacher to change his or her method of teaching. That is why Physics West and Chemistry West play such an important role in the impact the program has.

Perhaps the best evidence of rejuvenated science programs comes from the comments of the participants as they evaluate their summer experience. Those include:

"The 1985 Summer Institute was by far the most worthwhile institute that I have attended. It was professionally and personally stimulating, exciting, and at times overwhelming! The awareness of physics groups and networks gives needed help and encouragement." (Physics teacher)

"I definitely feel that my time and efforts were well directed and that I'll be a better teacher because of the program." (Chemistry teacher)

"You people need to keep this kind of program going. This is the only way to get science teachers out of their mold and help stretch their minds." (Biology teacher)
The Chicago Cyclotron Magnet, built after World War II for Enrico Fermi's research at the University of Chicago, was converted at Fermilab in 1979 to a superconducting analysis magnet. It is presently being prepared to run for E-683, a Tevatron experiment in muon scattering.

(Fermilab photograph 86-325-4)
The Production of Massive Muon Pairs in \( \pi^- \) Nucleus Collisions (Submitted to Phys. Rev. Lett.)


Forward Charge Flow in Hadronic J/\( \psi \) Production (Ph.D. Thesis, University of Illinois, Urbana, Illinois, August 1985)

Pion Structure as Observed in the Reaction \( \pi^- N \rightarrow \nu \bar{\nu} X \) at 80 GeV/c (Submitted to Phys. Lett. B)
Observation of $\Delta K^*$ Decay of the $K^*(2060)$ (FERMILAB-Pub-85/117-E; submitted to Phys. Lett. B)


Theoretical Physics

A General Analysis of the Chiral Phase Transition (FERMILAB-Conf-85/92-T; based on a talk given at the Quark Confinement and Liberation Conference, Lawrence Berkeley Laboratory, Berkeley, California, May 22-24, 1985)

Hadronic Coupling Constants in Lattice Gauge Theory (FERMILAB-Pub-84/98-T; submitted to Phys. Rev. D)

Astrophysics


The Cosmology/Particle Physics Interface (FERMILAB-Pub-85/113-A; submitted to Comments on Nucl. and Part. Phys.)

Spectrum and Anisotropy of the Cosmic Infrared Background (FERMILAB-Pub-85/115-A; submitted to Astrophys. J)

The Lee-Weinberg Bound Revisited (FERMILAB-Pub-85/116-A; submitted to Phys. Rev. D)
General


R. Raja et al.  The Tevatron Orbit Program (FERMI-LAB-Pub-85/106; submitted to Nucl. Instrum. and Methods A)

J. Slaughter  Heavy Quark Workshop - May 6-7, 1985 (Fermilab publication)


Physics Notes

Q. S. Shu et al.  An Experimental Study of Heat Transfer in Multilayer Insulation Systems from Room Temperature to 77 K (FN-423; presented at the 1985 Cryogenic Engineering Conference, Massachusetts Institute of Technology, Cambridge, Massachusetts, August 12-16, 1985)
Colloquia, Lectures, and Seminars

C. Hojvat
"Perspectives for 1.6TeV Collisions This Summer at Fermilab" (CERN Particle Physics Seminar, July 30, 1985)

E. W. Kolb
"A Hitchhiker's Guide to the Universe" (Fermilab, August 5, 7, 12, and 14, 1985)

T. Murphy
"Is the Direct Neutral Lepton Facility Real?" (Fermilab, August 8, 1985)

P. Rapidis
"A Plan to Automate Tune Measurements" (Fermilab, August 15, 1985)

G. Dugan
"Analysis of the Injection and Extraction Orbits in the Debuncher and Accumulator" (Fermilab, August 15, 1985)

D. Peterson
"First Results Using the Accumulator Core Cooling System" (Fermilab, August 15, 1985)

T. Sjostrand
"Multiple Parton-Parton Scatterings in Hadronic Events" (Fermilab, August 20, 1985)

J. Morfin
"The New Muon Beam" (Fermilab, August 22, 1985)

R. Johnson
"Storage of Dense Bunches" (Fermilab, August 29, 1985)

G. Dugan
"The Transfer of $\bar{p}$ to the Tevatron" (Fermilab, August 29, 1985)

W. Baker
"The New M-West" (Fermilab, September 5, 1985)

and D. Carey
CDF Central Detector (right) in position in the BO Collision Hall. The Tevatron and Main-Ring beam pipes can be seen at left. The overpass scheduled for construction this winter will move the Main-Ring orbit above the Detector. (Fermilab photograph 85-886-3)
The first quadrant of the E-706 electromagnetic calorimeter is removed from its assembly jig in Lab 6. The calorimeter consists of a stack of interleaved lead plates and G-10 readout boards separated by liquid argon gaps. Experiment 706, a collaboration of Delhi, Michigan State, Minnesota, Northeastern, Penn State, Pittsburgh, Rajastan, and Rochester will run in the MW spectrometer hall and is designed to measure direct photons at large transverse momentum.

(Photo courtesy of Dane Skow)
<table>
<thead>
<tr>
<th>Date Range</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>September 21, 1985</td>
<td>Users Executive Committee meeting, Fermilab, Batavia, Illinois 60510.</td>
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<tr>
<td>October 11, 1985</td>
<td>Dedication of Tevatron I, the particle-antiparticle collider, Fermilab, Batavia, Illinois 60510.</td>
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<tr>
<td>October 31-November 1, 1985</td>
<td>Gas Calorimetry Workshop, Fermilab, Batavia, Illinois 60510. For information contact: Masa Mishina, Fermilab (312) 840-4603; George Brandenber, Harvard University (617) 495-2824; or Muzzaffer Atac, Fermilab (312) 840-3960.</td>
</tr>
<tr>
<td>November 11-14, 1985</td>
<td>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.</td>
</tr>
<tr>
<td>January 16-17, 1986</td>
<td>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.</td>
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