FERMI NEWS

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Photo by Reidar Hahn

Physics Conferences 10

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INSIDE:

B All You Can

by Sharon Butler

Back in the mid-eighties, said Fermilab Director Mike Witherell, it was hard to get anyone working on the CDF and DZero experiments excited about B physics, the physics of mesons containing the bottom quark. He remembers being rebuffed when he tried to organize a session on the topic at a Snowmass Summer Study for high-energy physics. The dominant reaction was: hadron colliders (like Fermilab's) can't do B physics, so why bother?

That sentiment changed with the advent of silicon vertex detectors, tiny electronic devices that wrap in layers around the hair-thin particle beams. These devices are able to resolve distances as small as 10 to 20 microns. Such fine resolution is critical for separating the tracks of B meson decays from the tracks of, say, W boson decays.

The introduction of silicon vertex detectors into the CDF detector reaped a nice reward when Run I data were analyzed. Last year, the scientific collaboration announced the best measurement yet suggesting evidence of CP violation in B mesons. With that measurement, the CDF scientists proved that B physics can indeed be done at hadron colliders like the Tevatron. Indeed, both the CDF and DZero collaborations will have silicon vertex detectors during Run II to pursue B physics.

The new excitement about the possibilities of doing B physics here at Fermilab drew nearly 200 physicists to a workshop on the subject earlier this month.

Photo by Reidar Hahn

The unitarity triangle, a cardboard cutout of which is held here by physicist Mark Wise, of Caltech, is a geometric translation of the constraints on various parameters of the Standard Model. Applying the triangle to B physics, scientists are hoping to find the values for each of the sides and the angles. If the Standard Model is correct, the values they find by experiment should obey the rules of trigonometry. If the values don't agree, then the experimenters will have discovered some new physics phenomena.

"Bless thee, **BOTTOM!** bless thee! Thou art translated."

~ Shakespeare, *A Midsummer-Night's Dream*

This was a "kickoff meeting to get people moving," said Andreas Kronfeld, a theoretical physicist at Fermilab who was one of the organizers. For experimenters who are now busy completing the upgrades of their detectors, it was a chance to think about the physics they are after, added Manfred Paulini, a physicist at Lawrence Berkeley National Laboratory and another workshop organizer. Other scientists involved in pulling the workshop together were Richard Jesik, of Indiana University, Robert Kutschke and Zoltan Ligeti, of Fermilab, and Barry Wicklund, of Argonne National Laboratory.

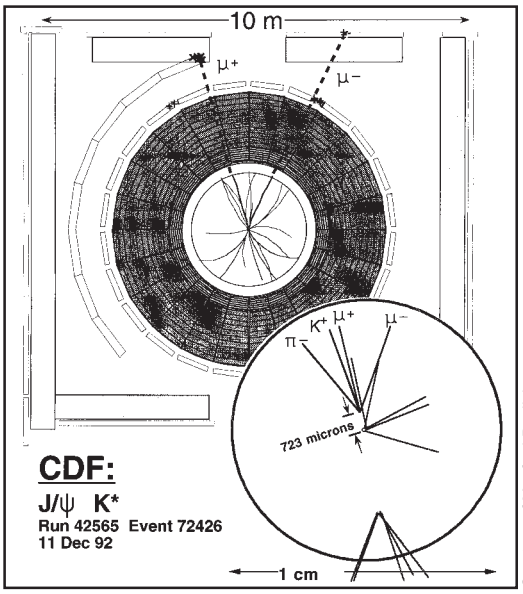
Scientists from Fermilab's two largest scientific collaborations, CDF and DZero, attended, presenting their expectations and aspirations for B physics experiments when the Tevatron cranks up again next year. Also present were representatives of a proposed experiment at Fermilab called BTeV, which will be dedicated to studying B physics.

Following plenary sessions, in which speakers reviewed the status of the field both theoretically and experimentally, the meeting broke into parallel sessions in several areas of B physics. In those sessions, experimenters confronted theorists in an exchange that sought to clarify the capabilities of the detectors, explore new means of making critical measurements, and plan simulations of Run II experiments.

As Ligeti put it, "It's important to lock the theorists and experimenters in one room. Features that are theoretically interesting aren't always feasible for experimental investigation.

"The interaction between theory and experiment is a matchmaking game," Ligeti said. "Experimentalists often have conservative views of what they can measure. The theorists have extravagant dreams about what they would like to see measured. Bringing them together can produce ideas that are both theoretically interesting and experimentally testable."

Physicists are eager to study the B meson because its oscillation between particle and antiparticle makes it a uniquely promising system for studying the nature of matter at the shortest distance scales, in a way that is complementary to experiments involving new particle production. It is this promise of B physics to test the Standard Model and probe for where it falls apart that has led SLAC, in California, and KEK, in Japan, to build e^+e^- "B factories," which can produce much purer samples of B mesons than hadron colliders can. On the other hand, the Tevatron offers certain advantages in the study of B physics. It produces all species of B particles, in contrast to the B factories, where only certain kinds of B particles appear.



Courtesy of Manfred Paulini

Left: A10-meter cross section of the CDF detector, showing an event in which a B meson decayed into a J/psi particle and a kaon. Inset: Enlargement of a 1-centimeter cross section showing the B decay at its point of origin, just 723 microns from the collision point of protons and antiprotons.

The Tevatron also produces about 3,000 times more B mesons than the new B factories. That allows experimenters to study rare decays: the more B mesons produced, the more likely the rare species will appear, and will appear in numbers large enough for analysis. Rare decays of particles delight physicists because of the hope that the unusual phenomena will reveal new physics.

"In rare decays," said Kronfeld, "you're always looking for a surprise."

Workshop participants were sent back to their academic and research institutions with homework to do: computer simulations of experiments (dry runs, but without real data) to flesh out ways of improving measurements—or, better yet, to push the limits of experimentation. The scientists will reconvene in February and issue reports in May.

HYPERONS At The CROSSROADS

by Mike Perricone

New results, new capabilities for precision measurements and questions about future directions: Hyperons are particles at a crossroads.

"What is the message we want to send to Fermilab and to the whole high-energy physics community in terms of accelerators and experimental programs?" asked Emmanuel Monnier of the University of Chicago, co-chairman with Fermilab's Doug Jensen of the Hyperon '99 conference held at Fermilab from September 27 to September 29, attracting 65 participants from 11 countries.

"What are we going to do in 10 years?" Monnier continued. "And what about the mid-term interval? The best result of this conference will be to have everyone convinced of the increasing value of this physics."

Like neutrons and protons, hyperons belong to the baryon family made up of three quarks. But hyperons are distinguished by having at least one strange quark in their three-quark makeup. They decay by the weak force with a lifetime of about 10^{-10} seconds.

The source of concern surrounding this three-quark challenge is the expected phase-out of the 800 GeV fixed target run of the Tevatron in January 2000, as the Lab continues preparations for Collider Run II.

As Vincent J. Smith of the University of Bristol pointed out, there were hopes among the participants that the conference wouldn't represent a forum for "what should have been done, and won't be done now."

Hyperon physicists declare that a high-energy beam such as the Tevatron's is a highly effective way to get the numbers of particles for the precision measurements they need. And in fact, the Tevatron is currently running in an unofficial "hyperon mode."

"From the beginning of this laboratory's history, Fermilab has been engaged in hyperon physics," said Fermilab Deputy Director Ken Stanfield in his opening remarks. "As we speak, the last planned 800 GeV fixed target run has two operating experiments, HyperCP and KTeV, both in the hyperon business."

HyperCP is searching for CP violation, or asymmetries between matter and antimatter, in hyperon decays, while KTeV is in the hyperon business by coincidence. KTeV (Kaons at the Tevatron) is mainly searching for CP violation in decays of the neutral kaon, a particle consisting of two quarks (one strange quark and one down quark). But hyperons—and lots of them—emerge as by-products of the process producing the kaons.

KTeV actually produced a significant hyperon result that Stephen Bright of the University of Chicago presented to the conference. KTeV measured a

Photos by Jenny Mullins

Lee Pondrom (top) of the University of Wisconsin-Madison, and Gary Goldstein (right) of Tufts University spoke on hyperon production and polarization. Nicola Cabibbo (left) presented his "personal shopping list" for future hyperon research, after hearing the announcement of a result bearing out his prediction from the early 1960s.

cascade or Ξ^0 hyperon beta decay (a weak decay emitting an electron) almost exactly matching a result predicted in the early 1960s by Nicola Cabibbo, whose contributions include the Cabibbo angle that led to the well-known CKM (Cabibbo-Kobayashi-Masakawa) Matrix critical to the advance of particle physics over the last four decades.

Monnier noted that KTeV's direct measurement of CP violation in the neutral kaon system occurred within 35 years of the discovery of CP violation in that system. By comparison, a similar phenomenon with hyperons is still unobserved. And nearly 40 years after the prediction, a hyperon decay similar to the well-known neutron beta decay has just been confirmed. Cabibbo attended the conference and heard the result bearing out his prediction.

"It was a neat thing," said Jensen. "Cabibbo presented his paper in 1963. We showed the results he had predicted at this conference. That shows how difficult these experiments are. It took from 1963 until now to produce the results he predicted."

The result came to be described as "the last hyperon beta decay" during the conference. While the term referred to a result that filled out the range of predictions, there was also the echo of hyperon physicists' fears of a dead end. But the picture might change quickly. Any evidence of CP violation among the billion decays of the HyperCP experiment would spark additional interest in hyperon experiments.

"If HyperCP gets a signal, maybe we'll continue an 800-GeV fixed-target run here," said Fermilab physicist Peter Cooper. "The Lab is keeping that option open."

In the long run, the biggest hope for the field appeared to lie in proposals for a 3-TeV accelerator that would serve as a "test machine" for a Very Large Hadron Collider, a possible next-generation successor to the Large Hadron Collider being built at CERN, the European particle physics laboratory in Geneva, Switzerland. Jensen said that very high energy for hyperon decays "makes the puzzle fit together much more easily." The newly-commissioned Main Injector was also described as a very interesting mid-term source of hyperons.

In his own presentation to the conference, Cabibbo posed the hard questions that researchers must face about their area of focus.

"For a program to be interesting, you must have a core result that continues the progress of knowledge," Cabibbo said. "Is it teaching you something really fundamental? Is it something you can't do any other way? To have a program for the future, the value of the results must increase over time."

Cabibbo also gave his own personal "shopping list," including precise studies of this "last hyperon beta decay," as well as the almost unexplored Σ^+ and discovery of hyperon CP violation.

"There has been a bubbling of new results, and we now have techniques available for high-precision measurements," Monnier concluded. "We hoped this conference would force people to bubble with ideas a bit."

Cabibbo takes His Place in the World

by Mike Perricone

Nicola Cabibbo grants that being a scientist has made him a citizen of the world in a special sense, and his early career saw him moving routinely from Italy to Princeton, New Jersey; to CERN in Geneva, Switzerland; to cities throughout Europe; and to Berkeley and Pasadena, California.

“Now the world is more closely knit together, but physics was very advanced that way in the 1950s and 1960s, and the experience was incredible,” said Cabibbo. “I was at home about half the time, and the rest of the time I was traveling all over. It was a very cosmopolitan experience, which was not common in other ways of life at the time. Some of my closest friends were American, or English.”

Cabibbo recently visited Fermilab to attend the Hyperon ’99 Conference and to offer a Fermilab Colloquium presentation. His 1963 theory of strange particle decays provided much of the foundation for the Standard Model.

“Very early on, he understood the structure of weak decays involving hadrons,” said Keith Ellis, head of Fermilab’s Theoretical Physics Department. “The ‘Cabibbo angle’ relates the rate for decays of a strange quark to the decay of a down quark and to the decay of a muon. His theory has grown into the standard model of hadronic weak interactions.”

Cabibbo is also the ‘C’ in the CKM Matrix, developed in 1974 (along with Kobayashi and Maskawa), showing that CP violation in weak interactions required three generations of quarks, and thus the existence of six quarks, though only four were known at the time. CP violation, the asymmetry between matter and antimatter, is generally regarded as the reason we exist in a universe of matter with virtually no known antimatter, except for that manufactured in places like Fermilab.

Yet this worldly elder statesman of particle physics quite contentedly lives about the length of a soccer field away from the place where he lived as a child in Rome, during and after World War II.

“I believe that roots are very important, and my roots are not just in Rome but in that particular part of Rome where we always lived,” said Cabibbo, “I remember when we were at Cal Tech in 1969, and my son was three years old. From time to time he would say to me, ‘Papa, you have not forgotten that we must go back to Rome!’”

Though he clearly remembers bombs exploding from Allied air raids, Cabibbo also recalls that the elementary school system in Rome ran uninterrupted during the war. His father was a lawyer, and his mother was a housewife, and Cabibbo recalls his childhood fascinations with astronomy and with building radios as the origins of his sense of inquiry. He traces his formal connection with science from the inspiration of a high school text book titled, “What Is Mathematics?” His university studies in physics led him to nuclear physics and electromagnetism; he wrote his thesis on weak interactions and muon decays.

PROFILE IN
PHYSICS

But a strong sub-theme had marked his development since the end of the war. Cabibbo became a devotee of American literature.

"In Rome, the American embassy had set up an excellent library just after the war," he said. "I would go there often to read and to borrow books. My favorites were Hemingway, Dreiser, Melville. I never finished 'Moby-Dick,' but I have read the Polynesian novels, 'Typee' and 'Omoo.' And Richard Henry Dana, 'Two Years Before the Mast.' I read many books about the sea."

Naturally, Cabibbo spent a period of his life as an enthusiastic sailor, owning a 30-foot sailboat named "Panda." He regretfully gave it up because the lack of a good harbor near Rome seriously curtailed his sailing time. But he had plenty of reading time, and he was later introduced to the work of F. Scott Fitzgerald by his wife—ironically and fittingly enough, a professor of modern American literature in Rome.

"Reading 'The Great Gatsby' was an interesting experience because I lived many years at Princeton and had often gone to Long Island with friends," Cabibbo said. "So I knew the places Fitzgerald described. I was familiar with 'the wasteland' and with the other surroundings."

His openness to ideas lends a context for the process he describes leading up to his breakthroughs in the unique concept of quark mixing.

"I was involved in the interactions of high-energy photons with crystals, where the crystal acts as a polarizer," he said. "It was very interesting, but in the end it was not of great practical interest with the advent in the 1960s of colliding beams. We had also been banging on this problem of weak interactions not fitting the universal scheme. I guess there was in my mind a sort of mental interference between my work on photons and crystals, which had to do with polarization, and my work on hyperon decays [mixing]. It was a kind of cross fertilization."

Cabibbo continues to bring ideas together. He has served as president of INFN, Italy's National Institute for Nuclear Physics, which is well represented in Fermilab experiments. He has been engaged for more than 15 years in a project to create computer simulations of weak interactions, and the effects of strong interactions on weak interactions. Those efforts grew into an enterprise for designing and building computers and software. He speaks knowledgeably of the Impressionist collection at the Art Institute of Chicago. He is well versed in the optics and electronics of the high-end camera equipment set up for his photographic portrait in the Fermilab library. And he continues to teach physics, as he has for nearly 30 years.

Photo by Reidar Hahn

"My wife says I always look too serious in photographs," says Nicola Cabibbo, a citizen of the world of science who values his lifelong roots in Rome.

"Nicola was a great figure even then, but always friendly, always approachable," recalled Ellis, a doctoral student at the University of Rome from 1971 to 1974.

Following Hyperon '99, Cabibbo prepared to return to Rome, to administer a final exam in theoretical physics to his fourth-year students.

"I try not to be too hard on them," he said, his smile growing. "But I would like them to understand nuclear physics."

STATE SENATE HEARINGS GIVE A BOOST TO TECHNOLOGY IN ILLINOIS

by Mike Perricone

The Illinois State Senate High Technology Task Force came to Fermilab seeking ideas for nurturing and expanding the influence of technology on the growth of the state's economy, and the state legislators found significant examples right below their feet.

"To high technology exports from Illinois, you can now add neutrinos," said Fermilab Director Michael Witherell, referring to the MINOS experiment that will send a beam of those puzzling subatomic particles through the earth from the Lab to a 5,000-ton detector nearly 450 miles away in Soudan, Minnesota.

The task force, chaired by State Senator Kirk Dillard (R-41), held a hearing at Fermilab on October 6. The panel heard Witherell describe the state's contribution of a $2.2-million challenge grant in 1991, which played a major role in enabling the start of construction on the new Main Injector accelerator and Antiproton Recycler, located 30 feet underground just a few hundred yards from the site of the hearings in Wilson Hall. The Main Injector will also supply the proton beam used to create the beam of neutrinos sent to the Soudan detector.

Senator Dillard emphasized that the goal of the High Technology Task Force is finding ways to help create "good, high-paying jobs" in the state, to formulate policies that encourage entrepreneurship in such areas as information technology, and to establish Illinois as a world technological leader.

As Witherell pointed out, the accelerator technology developed at Fermilab, and at other high-energy physics labs, has extended its reach into such wide-ranging fields as medicine and materials science. In developing the 1,000 superconducting magnets that make up the Tevatron, Fermilab also provided the technology basis for the Large Hadron Collider now being constructed at CERN, the European particle physics laboratory in Geneva, Switzerland.

Witherell cited the creativity of physicists in developing the tools they need for their work, specifically making use of the most advanced computers available, as well as developing software and making the most extensive use possible of PC's and workstations to build computing power. And no discussion of information technology can ignore the development of the World Wide Web at CERN, the European particle physics laboratory in Geneva, Switzerland.

Fermilab Director Michael Witherell described technology's contributions to the economy in testimony before the High Technology Task Force of the Illinois State Senate.

Observing the hearings, Sen. Chris Lauzen called for the use of economic incentives to encourage the growth of technology firms. But he noted that government programs often exhibit little urgency in their efforts. Lauzen represents Fermilab's district in the state legislature.

Invented by physicists to share data, the Web has spawned the incalculable commercialization potential we know today.

High-energy physics, Witherell stressed, has a time-honored history of cooperation among scientists, and of the sharing of information and expertise. Witherell noted that representatives of the R.R. Donnelley Corporation recently met with Fermilab physicist G.P. Yeh and his colleagues working on the introduction of the LINUX operating system to a Lab computing project. The Donnelley executives had seen a story about the Fermilab project in a computing journal, prompting an inquiry and the meeting.

Representatives from a wide range of companies spoke on an array of topics. The witnesses stressed the need for more information on government assistance available to start-up companies; the need for the private banking sector to loosen up its loan policies for start-up ventures; and the need for installing broadband technology throughout the state to encourage growth in the information technology and technology transfer sectors.

Addressing the question of technology transfer, Fermilab Associate Director for Administration Bruce Chrisman noted that 80 percent of the graduate students working at the Lab go on to work in other fields. He said the Lab's most effective means of spreading expertise was by moving van.

One of the witnesses personified that general concept. Barry Sullivan, now an Ameritech executive, recalled that he had worked summers at Fermilab as a technician while earning an electrical engineering degree from Marquette University.

"The role that the railroad played in the economic growth of the previous century," Sullivan told the panel, "will be played by information technology in this century."

Gary Bachula, the U.S. Dept. of Commerce Acting Undersecretary for Technology, called technology "the driving engine of economic growth." He had the numbers to prove Sullivan's assertion: Bachula said technology was responsible for 50 percent of the growth in the standard of living in the U.S. since the end of World War II; in the last five years, he said, information technology alone was responsible for one-third of the growth.

Rev. John Minogue, President of DePaul University and a board member of the National Aeronautics and Space Administration, said, "Government has to do the things that nobody else wants to pay for because there's no immediate commercial potential." He described his university's program for computer training aimed at older students. He said education had to move away from the old model of training a few bright people, and adopt an approach of helping the country develop "intellectual capital."

Sen. Dillard expressed concern about an obstacle to developing that intellectual capital. "When it comes to teaching science," he said, "we start to lose kids at around the fourth grade."

Witherell replied that Fermilab regards itself as an educational institution, with many educational programs geared not only for students but for teachers as well.

"We focus on explaining what science is, how it works, and why it's exciting," Witherell said. "That's most important, giving teachers a spark they can bring to their classrooms."

Chrisman added that while the Lab's goal is to improve the quality of science teaching, the education outreach extends from physics to ecological science. Many schools schedule field trips to view the Lab's ongoing prairie restoration program.

"Education is one of our prime activities," Chrisman concluded. "Knowledge is the foundation of future technology."

Photos by Reidar Hahn

Rev. John Minogue, president of DePaul University, testified that "Government has to do the things that nobody else wants to pay for because there's no immediate commercial potential."

Illinois State Senator Kirk Dillard hopes the task force's findings will encourage the growth of high-paying jobs in the state.

Let's Get Together

Photo by Reidar Hahn

Fermilab's Cynthia Sazama has been organizing physics conferences for 31 years. What she doesn't know about invitations, travel arrangements, housing, meeting rooms, poster sessions, message centers, computer connections, copy machines, laser pointers and the care and feeding of physicists, you probably don't need to know. "I'll tell you one thing," Sazama says. "The only thing these people talk about is physics. At the banquet, on the boat ride, wherever— they eat, drink and talk physics."

... and Talk Physics

By Judy Jackson

Conferences. Workshops. Colloquia. Seminars. Symposia. Every month, around the world, dozens of these physics get-togethers, large and small, formal and roll-up-your-sleeves informal, bring together the men and women who work at the science of particle physics. At Fermilab alone, in September and October a half-dozen workshops and conferences addressed such issues as B physics, hyperon physics and international collaboration for future accelerators. A survey of Wilson Hall bulletin boards one recent morning turned up posters for some 30 upcoming conferences, from "String Theory at the Millennium" at Caltech in January, to "International Computing in High Energy and Nuclear Physics" in Padua in February, to "Cosmic Genesis and Fundamental Physics" at Sonoma State at the end of this month.

What is it about these gatherings that makes physicists attend so many of them? In this age of instant electronic communication and ubiquitous videoconference facilities, what makes conferences so important that physicists will put up with almost anything to get together with their colleagues and talk about physics?

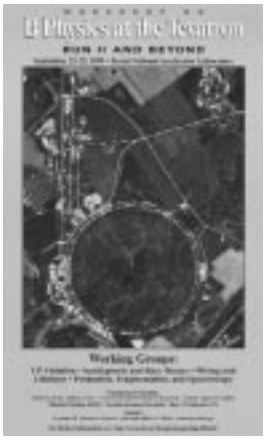
It certainly isn't the allure of exotic destinations.

"One thing I don't think I've ever heard anyone in our field say," said Fermilab Director Michael Witherell, "is, 'Gee, I sure wish I could travel more.' The fact is that most of the information exchange in our field today is through conferences."

Fermilab theorist Chris Quigg agreed. "Particle physics is extremely collaborative," Quigg said, "It advances through the collective intelligence of the field. Conferences are one classic way that this happens. Conferences benefit physics research in ways large and small, from a talk announcing a stunning new result, to a chance remark overheard at a coffee break. Sometimes, you might even find out that other people think you are wasting your time, which can be very valuable information."

Con·fer·ence, *n.* **1.a.** A meeting for consultation or discussion. **b.** An exchange of views…. […from Latin *conferre*, to bring together.]

Fermilab Computing Division Deputy Head Steve Wolbers is perhaps among the best-networked people on the planet. He knows from videoconferencing, he uses it frequently, and he believes it can be very useful. But, said Wolbers, "even if we imagine teleconferencing technology as perfect as it could possibly be, it would still be no substitute for what happens when people get together at the same time in the same place. No videoconference technology can accomplish the seamless communication of a large group of people. There is too much going on. For example, in a conference, you see how people are reacting to what the speakers are saying. Are they rolling their eyes, falling asleep, jumping out of their chairs with excitement?"



But it's not just the scheduled presentations that make conferences valuable, physicists say. It's also what happens in the hallways.

"In ways that only happen when people get together," said Associate Director Steve Holmes, "things can happen at a conference that are unplanned, spontaneous. In talking to someone during a break or at the conference reception, you may find something out that leads you to think about things in a whole new way. You always learn something that is not what you planned to learn."

Theorist Keith Ellis went still further.

"The conference is the most effective means of scientific interchange," Ellis said. "In the last few years, the method of diffusion of scientific information has changed radically. We now have instant access to all the written material. The problem with electronic communication, though, is that you only get what you are looking for. There is no opportunity for the unplanned, the unexpected information that is the invaluable result of face-to-face human interaction."

Holmes, who knows something about large physics projects, having served as project manager for Fermilab's Main Injector, highlighted another function that conferences serve in high-energy physics.

"Conferences and workshops are indispensable in developing consensus for very large projects. They are extremely valuable in airing issues. Our community consists of a few thousand people, and a significant fraction of them have to get together to make the information flow. Otherwise, you don't end up with the best program, the program that incorporates everybody's best thinking and knowledge and creativity."

In fact, for accelerator physicists, conferences may play an especially

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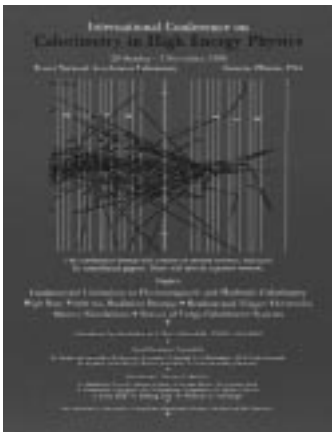
important role, said SLAC accelerator physicist Tor Raubenheim (interviewed at Fermilab while attending a conference).

"We are in a part of the field that doesn't rely so much on publications," Raubenheim said. "A lot of the information is in people's heads. In vacuum technology, or cryogenics, it is critical to talk to the experts, the people who have thought about the hard problems. We are, perhaps, in some ways a rather antisocial field. But conferences are a time when you have the opportunity, in fact you are almost forced to talk to people and exchange ideas. If you have a large-scale problem to solve, a conference or workshop gives you an opportunity to put a lot of experts to work on it, to divide it up in pieces and then put the pieces together."



But it isn't just the machine-builders who need opportunities to talk with their colleagues. At the theoretical end of the spectrum, said Fermilab theorist Joe Lykken, "conferences are one of the best ways that theorists and experimentalists have to get together. Often theorists find out at a conference or a workshop that something is experimentally testable, some problem is now capable of attack by the experimentalists. That can send them into whole new areas of theoretical work that had appeared closed before."

Fermilab Deputy Director Ken Stanfield pointed to the role of conferences in fostering collaborations across parochial laboratory boundaries, and even across international borders. It was at the 1979 Lepton-Photon Conference that physicists Giorgio Bellettini and Paolo Giromini, of the University of Pisa, decided to join CDF, a decision that changed the face of Fermilab and brought countless Italian physicists and Italian resources to the U.S. to help in the search for the top quark.

Sometimes, said Holmes, husband of Fermilab physicist and CDF Upgrade Project Co-manager Cathy Newman-Holmes, a physics conference can result in a collaboration that is even closer.

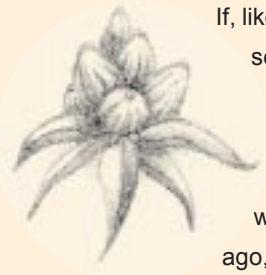
"Cathy and I had seen each other at Fermilab, and again at CERN," Holmes said, "but we really hadn't met. In October, 1980, I went to the CESR II Workshop in Ithaca. I arrived at my hotel the night before the conference. I opened the door from my room to go downstairs for dinner. At the same moment, across the hallway, Cathy opened the door from her room. We had dinner together. The rest, as they say, is history."

the talk of the lab

Nuts

Fermilab is a haven for nuts. Not only do we have large numbers of ordinary nuts, but rare nuts, nuts scarcely present anywhere else, thrive at the laboratory. Nuts love it here.

Take, for example, the kingnut, a variety of hickory, *Carya laciniosa*, of which the Fermilab site has the only native trees in northeastern Illinois. The definitive "Plants of the Chicago Region," by Swink and Wilhelm, which lists "all the plants that have been reliably recorded as growing wild here at any time since scientific collection began," assigns every Chicagoland plant a "coefficient of conservatism," from zero to 10. The higher the coefficient, the more likely it is that the plant comes from a remnant natural plant community—in other words, that it was part of the original landscape of the area, before the arrival of settlers, sodbusting and strip malls. A dandelion, for instance, gets a zero coefficient: it's definitely not rare, and it's a European immigrant. In contrast, a certain rare species of native prairie aster might get a 6 or a 7.



If, like Fermilab, you are trying to restore an area to something approximating its natural pre-McDonald's state, the appearance of species with high coefficients of conservatism is good. It means you're working your way back to the way things were. Thus, a couple of weeks ago, prairie experts were elated to discover blooming in the Fermilab prairie a downy gentian, *Gentiana puberulenta*, a beautiful little flower of a brilliant blue, with a coefficient of conservatism equal to 9. Its appearance means the Fermilab prairie restoration is doing fine. The downy gentian likes it here.

Coefficient-wise, the kingnut is a 10.

Here's what Swink and Wilhelm have to say about the kingnut: "A tree of floodplain and bottomland woods…still present in remnant woods in the Kankakee River Valley in Indiana….Mike Becker and Bob Lootens discovered a large population of this handsome tree at Fermilab in Kane County, where old, open-grown trees grow in a drained woodland…" Our kingnuts are famous.

As the name implies, the nuts of the kingnut are big, a good three inches in diameter, including the husk. A recent foray to the kingnut stand at the height of nut season, however, turned up very few nuts. Prairie guru Mike Becker, one of the kingnut trees' discoverers, explained that squirrels had gotten there first.

"Squirrels love them," Becker said. "They are the t-bone steak of nuts, If you want to find a kingnut, you practically have to catch it on the way down."

Just then, a nut fell off the tree. We caught it. The squirrels are onto something. It was delicious.

The Metaphors of Physics

High-energy physicists are heavy users of the metaphor and its (metaphorical) cousin, the simile. How else to explain to the world's non-physicists how a top quark looks (like a bowling ball) or how a particle detector is put together (like a Russian matryoshka doll)? Naturally, some figures of speech work better than others. A recent comparison of the number of particle collisions required to find a top quark with the size of the national debt led at least some readers to conclude that the former might have a causal relationship to the latter. An explanation of the action of the hypothetical Higgs boson in terms of the progress of former British Prime Minister Margaret Thatcher through a roomful of diplomats left many (metaphorically) scratching their heads.

But there is one expression that physicists universally embrace. They invariably use this phrase to convey the challenge of managing each other, a notoriously difficult task that becomes more difficult—some would say impossible—as the number of the managed increases. Ask the project manager for any particle

detector construction or upgrade project in the world this question: How do you get hundreds of independent-minded, independently funded physicists to agree on, design, engineer and build a multimillion-dollar state-of-the-art instrument for doing frontier physics? One and all will say the same thing: "It's like herding cats."

"It's like herding cats," physicists say, with a mixture of exasperation, ruefulness and pride. It's more than a metaphor—it's a management principle. And it has far-reaching applications.

For example, on October 4, the New York Times reported that "It took a physicist to galvanize many of New York City's most important cultural institutions to take a stand in the battle over the 'Sensation' show at the Brooklyn Museum of Art." The "Sensation" show, you may recall, is the one with the elephant dung and the pornographic cut-outs, the show of which New York Mayor Giuliani took such a dim view that he threatened to cut the museum's funding.

Physicist Alan J. Friedman, director of the New York Hall of Science, is chairman of New York's Cultural Institutions Group, made up of directors of such institutions as the Metropolitan Museum of Art and the American Museum of Natural History. Last week, Friedman rallied his colleagues in the Group to stick up for the Brooklyn Museum's right to exhibit what it chose, and to ask the mayor to change his mind.

Apparently it wasn't easy to persuade the Cultural Institutions Group to sign a letter protesting the "chilling effect" of the mayor's threat, but in the end even non-member museums like the Museum of Modern Art, the Whitney and the Guggenheim signed on. How did Friedman, the physicist, whose thesis topic was "Specific Heat of $MnBr_2$ Near the Critical Point," get so many of the directors of New York's most distinguished cultural institutions to act as one? No problem.

"It was like herding cats," Friedman said.

There's Thumping about Fermi

Fermilab's farflung facilities, all the accelerators, detectors, beamlines, workshops, labs, offices and so on that make up a physics lab, are knit together by hundreds of miles of underground electrical cable, carrying the power that operates everything on the site from superconducting magnets to light bulbs. As the cables age, they wear, and from time to time they break. The power stops, the lights go off, and the time has come to thump.

When you need to pinpoint the location of a fault in an electrical cable several feet underground, so that you can fix it, you do something called thumping. At Fermilab, we call 1-888-THUMPER, and the thumping experts from High Voltage Electric are on their way.

The first step in faultfinding is to identify the faulty cable and turn off the power source so that no electricity is flowing into it. Next, the thumping crew sends a small voltage, say 100 volts from a battery, into the cable. An instrument attached to the cable gives a general idea, within a couple of hundred feet, of the location of the fault.

Now, the thumping crew is ready for the main event. With a sudden discharge from a capacitor, they send a large jolt of power— 7,000 volts or so— into the cable. When it reaches the fault—THUMP!

"You can hear it and you can feel it," says Joe Pathiyil, Fermilab supervisor of high-voltage engineering. Using probes inserted in the ground, and with a few more thumps, sometimes at higher voltage, the thumpers can tell exactly where the fault lies.

Then what?

"Then," says David Nevin, head of the Facilities Engineering Section, "we dig."

—Judy Jackson

LETTER TO THE EDITOR

To the Editor of *FERMINEWS*:

I'd like to make a small correction to the informative article on the Fermilab buffalo herd in the October 1, 1999, edition of *FERMINEWS*, which refers to water buffalo (*Bubalus bubalis*) as being native to Africa and Asia. The water buffalo is native to Asia, but introduced into Africa during Roman times (see *A Field Guide to the Mammals of Africa*, T. Haltenorth and H. Dille). Its range is very limited, and the present population is reported to be the descendants of three survivors, the rest of the population having been shot in 1957. Much more common in Africa is the African Buffalo (*Syncerus caffer*) with a number of subspecies of which the Cape Buffalo is the largest (up to 800 kg) and the most widespread. The African buffalo are, like the bison, unpredictable, and reportedly are responsible for more human deaths than are lions.

Phil Martin

(Phil Martin is Deputy Head of Fermilab's Beams Division.)

MILESTONES

ELECTED

Dan Amidei, of Michigan State University, chair of the Fermilab Users' Executive Committee, on October 9.

LUMINOSITY RECORD SET

Recently the PEP II collider at DOE's Stanford Linear Accelerator Center achieved the highest luminosity ever reached by any electron-positron collider, 10^{33} events per square centimeter per second. Luminosity is a measure of the rate at which interesting events occur—in this case, production of a particle known as B mesons. Physicists hope that the study of these particles will lead to a better understanding of CP violation and the Standard Model, and the subtle differences in the behavior of matter and antimatter.

WORLD'S FASTEST NETWORK STANDARD

A demonstration Gigabyte System Network (GSN), eight times faster than any other existing operational standard, was built during a recent workshop organized by CERN, the European particle physics laboratory in Geneva, Switzerland, in collaboration with the High Performance Networking Forum (HNF). This was only the second time that GSN has been demonstrated in Europe, and it was the largest GSN to be built anywhere. CERN engineers helped to create GSN, a new type of network which allows data to be transferred between computers at speeds of up to 800 Mbytes/sec (800,000, 000 characters per second).

LUNCH SERVED FROM
11:30 A.M. TO 1 P.M.
$8/PERSON

DINNER SERVED AT 7 P.M.
$20/PERSON

Chez Léon MENU

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CAKES FOR SPECIAL OCCASIONS
DIETARY RESTRICTIONS
CONTACT TITA, X3524
HTTP://WWW.FNAL.GOV/FAW/EVENTS/MENUS.HTML

LUNCH
WEDNESDAY, OCTOBER 20

Rouladen
Spatzle with Dill
Julienne of Carrots, Thyme and Garlic
Baked Apples with Almonds, Dates and Lemon

DINNER
THURSDAY, OCTOBER 21

Sancocho
Pescado con Salsa de Coco
Moro de Guandules
Fried Plantains
Flan de Pina

LUNCH
WEDNESDAY, OCTOBER 27

Cheese Fondue
Mixed Autumn Salad
Orange Slices with Candied Rind and Grand Marnier

DINNER
THURSDAY, OCTOBER 28

Black Cats Feast
Witches Hare
RIP Rice
Dracula's Dream
Devil's Delight

F N E R W M S I
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The deadline for the Friday, October 29, 1999, issue is Tuesday, October 19, 1999. Please send classified advertisements and story ideas by mail to the Public Affairs Office MS 206, Fermilab, P.O. Box 500, Batavia, IL 60510, or by e-mail to ferminews@fnal.gov. Letters from readers are welcome. Please include your name and daytime phone number.

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CLASSIFIEDS

FOR SALE

■ '99 Goldwing SE (Silver) Under 11K Miles - runs great must sell asking $16,000 Has Markland Receiver Hitch and (5 pin) OEM Trailer Wiring Kit, Markland Floorboards, Foam Grips and Extra Windshield. Also have 2 headsets for the intercom one full-face helmet model and one that can be used either on a full-face or open-face. Still has 2+ yrs on original Warranty. Can get another 3 yrs extended. Terry X4572 or e-mail skweres@fnal.gov

■ '97 Ford Taurus G26K exc. cond. 553-6849 or 554-2149 $10,500 obo.

■ '93 Chrysler Concord, metallic red, fully loaded, 3.5L engine sun roof, 7yr/70K factory warranty till 2000 (transferable) $7,600, x4948. 195 Atomic Arc Carbon Skis with Bindings, Size 12 Boots, Poles and Bag. Asking $150. Call Terry X4572 e-mail skweres@fnal.gov

■ Brick ranch in West Aurora, 3 bd, 2.5 ba, laundry room off kit, cntry kit/ see-thru gas/wood burning fpl from fmlyrm to formal living rm, 3 season rm, 2 car attached garage. New AC/FA, April Aire, lovely home and area, 1/4-acre, $169,500, treend@fnal.gov.

■ Water heater - 30 gallon, Sears PowerMiser. Used 6 months. $75 or best offer. Dave Sabastion 879-0287.

■ Wooden frame white sofa (love seat) + 2 matching side tables $100, wood dining table + 4 chairs $75.00 srivasta@fnal.gov

■ Weed Eater Featherlite XT200Gas Powered NEVER USED! 16″ cut. $60 obo. Call Tom, 840-5193 or e-mail tsmeyer@fnal.gov.

■ Camper Trailer, 5 yrs old, exc. cond., very clean, hardly used. Free storage through winter, will reduce to sell this fall $5,300 obo. 21′ SunLine, loaded with all the bells and whistles. On quiet site up hill from Fox River at Rolling Oaks Camp Ground. Call Greg 630-898-2508.

■ Lab puppies – AKC registered, good hunting bloodline. Great with kids. $400, 815-872-9931 days, 815-875-2295 evenings.

■ Two Lyric Opera tickets for the November 18 presentation of Macbeth. Upper balcony, front section. $40 each (original price $44 each). Call Barbara at 3695 or e-mail bke@fnal.gov. Barbara Edmonson, x3695

■ Afghan - hand crafted by my 92 year old grandmother. 66″X48″. The colors are egg shell with mauve and green stripes. Has fringe.Makes a great Christmas gift! $75 or best offer. Afghans made to order also, any colors, any size. If interested, contact Tammie at (630) 393-7138 or carrier@inil.com.

CALENDAR

Web site for Fermilab events: http://www.fnal.gov/faw/events.html

OCTOBER 22

Art Series Presents:

Fermilab International Film Society Presents: **HALLOWEEN DOUBLE FEATURE SPECIAL!**
Ramsey Hall, 8:00 pm $4.

Frankenstein (Dir: James Whale, USA 1931, 70 min.) and *Bride of Frankenstein* (Whale USA 1935, 75 min.) THE definitive monster movies based on Mary Shelley's novel. Boris Karloff is wonderful as the monster in this original and its sequel.

OCTOBER 23

Fermilab Prairie Harvest. 10 am to 2 pm. Bringing a large group? Call ahead (630)-840-3303.

NALWO

Nalwo is changing the schedule for English Classes: they are now held on Mondays and Thursdays 9:30 a.m. to 11 a.m. at the Users' Center. The classes are free and can be joined at any time. For more information call Selitha Raja: 305-7769.

ONGOING

English Classes, Monday and Thursday at the Users' Center, 9:30-11:00 a.m., free classes. NALWO coffee for newcomers & visitors every Thursday at the Users' Center, 10:30-12, children welcome. In the auditorium, International folk dancing, Thursday, 7:30-10 p.m., call Mady, (630) 584-0825; Scottish country dancing Tuesdays, 7:30-9:30 p.m., call Doug, x8194 or e-mail folkdance@fnal.gov.

SKYDIVERS: LOOKING FOR THAT EXCUSE TO MAKE YOUR FIRST JUMP? Or are you a current student or experienced skydiver just interested in getting together with a group of fellow employees and taking advantage of group rates? We are looking for interested people for a proposed new club. Contact either Paul at 4495 or Rod at 2565.

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