

Fermi News

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The CDF Remote Control Room

Getting in on the Action, from Afar

by Leila Belkora, Office of Public Affairs



An invisible hand draws a white circle against a black background, almost filling the screen of a computer monitor. The circle represents the outer edge of the CDF detector at Fermilab. A spray of green, blue, and red lines blooms rapidly from the center of the circle, revealing the trajectories of particles stemming from the latest collision of a proton and an antiproton in the Tevatron accelerator. One green line arcs toward the upper right of the screen, two more curl around to the lower left. Faster than you can say data visualization, the invisible hand draws a yellow box around the green line on the right, the path of the particle with the highest calculated momentum. The screen goes black again. The image of another proton-antiproton collision at CDF—an ordinary event, as these collisions go, or a rare one that will send up a flag to physicists on the experiment—is due on the screen in less than ten seconds.

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G.P. Yeh, seated at a demonstration unit of the CDF remote control room in the lobby of Wilson Hall. The monitors on the upper right display cross-sections of the detector. Monitors on the left show the “head-on” view of the colliding region in the detector, and a “lego plot” of the secondary particle energy. Yeh is filmed by a small video camera mounted at about eye-level; he’s looking into the display from those cameras on the monitors below. Two graduate students are seated behind Yeh.

PHOTO BY REIDAR HAHN

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Fixed Targets and Beyond

Kansas State University researchers have long histories at Fermilab—and their eyes on future physics research

By Donald Sena, Office of Public Affairs

When Kansas State University administrators called on physicist Bill Reay in the early '90s to help them launch a high-energy physics program, they got more than they bargained for. Not only did Reay take the job, but 11 people from his former institution followed him to Kansas.

In an instant, Kansas State University had faculty, technicians, students and active physics experiments at Fermi National Accelerator Laboratory. The arrival of those 11 people illustrates the cohesiveness of the program, anchored by Reay, Noel Stanton and Ronald Sidwell—professors and physicists at KSU who have a strong history of experiments at Fermilab.

Since its beginning in 1993, the KSU program has expanded to 22 people, including five faculty members (Donna Naples and Tim Bolton recently joined the KSU faculty). The team also has four full-time postdocs working at Fermilab and KSU, and plans to hire a theorist.

The K-State Department of Physics has about 40 undergraduates with physics majors and 50 graduate students, seven of whom are specializing in particle physics in the tradition established by Reay, Stanton and Sidwell at Fermilab.

Though KSU's high-energy physics program is relatively young, the research history of these three scientists greatly influences the university's direction and experimentation at Fermilab.

A LONG HISTORY

In 1971, Reay and Stanton, then at Ohio State University, and Sidwell, then at Michigan State University, worked on E12, one of the Laboratory's first experiments. In a technically simple study, researchers slammed a neutron into a proton looking for particle exchange. Using the same apparatus as E12, Reay and other experimenters began a search for the charm quark in 1974—a particle that researchers at the Stanford Linear Accelerator found first.

"It was a worthy try, but we didn't discover it," said Reay.

However, that experiment began a fruitful association with the charm quark for Reay and his team. In 1977, Sidwell was on board with Reay and Stanton at Ohio State for a study of charm lifetimes (E531), another fixed target experiment.

In 1981, Reay's team collaborated on another experiment that calculated properties of charm semileptonic decays (E653).

Experiment 791, begun in 1988, was significant for Reay's team for two reasons. First, the group moved to KSU during this study. Also, the experiment produced the highest number of charm particle decays ever, up to that point. The analysis that followed was significant for the volume of data that researchers studied. At that time, it was probably the biggest reconstruction project in all of high-energy physics, according to Stanton.

He added that KSU and OSU researchers did 40 percent of the reconstruction for E791, and a major part of the physics analysis. Nick Witchey, a KSU graduate student, recently published the first of what will be many papers from the charm study.

Reay said his team favors the fixed-target experiments over collider physics because of the expertise the group has forged over the years in subjects like charm. The fixed-target experiments also tend to have more intimate collaborations than the 450-member teams at the two collider detectors.



Postdoc David Woods and Donna Naples, assistant professor at Kansas State University, working on a prototype drift cell on the Manhattan, Kansas campus.

Photo courtesy of KANSAS STATE UNIVERSITY

“We like experiments with a smaller number of people. Also, we have expertise in certain areas and that expertise leads us to do certain things,” said Reay of their past work.

However, that past has laid the groundwork for the future of KSU’s experimentation at Fermilab, in which the university’s two newest faculty members are playing a leadership role.

GETTING READY TO RUN

Donna Naples, formerly of the Fermilab staff, and Tim Bolton, formerly of Columbia University, became KSU faculty members in the last two years, and are the university’s leaders for an upcoming fixed target experiment set to begin in the summer. E815, or NuTeV, is a precision neutrino experiment that will test the parameters of the standard model by measuring the weak mixing angle, according to Naples. She added that physicists will be able to compare the data taken from NuTeV to other similar experiments around the world, such as those at the Large Electron-Positron collider at CERN. LEP runs at an energy of 90 GeV and uses electron-positron collisions to produce a Z particle, which eventually decays. NuTeV, operating at a lower energy, uses a neutrino that interacts by exchanging a virtual Z particle. However, by comparing measurements with CERN, experimenters can see similarities or differences, which could signal some “new physics,” according to Naples.

Specifically, Naples designed the calibration beam and its detector system while a postdoc at Fermilab. The calibration beam is important because it gives experimenters a precise understanding of how the neutrino detector will respond to the interacting particles, according to Bolton. KSU also upgraded the calorimeter’s photomultiplier tubes and wrote much of the experiment’s online software.

The KSU faculty brings many students, including undergraduates, into the preparation for the newest fixed-target run. Naples says this gets students excited about science, and gives them hands-on experience.

NEUTRINO WORK IN THE FUTURE

KSU’s future holds more work with neutrinos, as the university will be part of the Neutrinos at the Main Injector project. NuMI is an experiment that will search for neutrino mass—a study that Reay says is a long time coming.

“We’ve been pushing this [neutrino oscillation] concept for a very long time, and now it seems to be gathering momentum,” said Reay.



Bruce Lowery and Tim Bolton (right), both of Kansas State University, inspect part of the detector for Fermilab Experiment 815.

Neutrinos come in three flavors. Although no experiment has ever observed a neutrino change from one flavor to another, such a change—called flavor mixing or oscillation—is possible. Scientists hope to conduct two experiments that will take advantage of the Laboratory’s newest accelerator, the Main Injector, now being built. Experimenters will direct a particle beam of pure muon neutrinos toward a nearby detector on Fermilab’s campus (short baseline) and toward a far-off detector in Minnesota (long baseline). If either detector finds another flavor of neutrino besides muon, then neutrinos must have oscillated, and hence must have mass.

The KSU team will work with the short-baseline experiment called COSMOS, for Cosmologically Significant Mass Oscillation Search. The Main Injector is scheduled to begin operating in 1999.

URA INDUCTION

On January 25, the Universities Research Association’s Council of Presidents elected KSU to its membership, an event that will give the university a greater role in Fermilab’s future, according to Reay.

“Fermilab is undergoing possible new changes of direction beyond the [Large Hadron Collider turn-on at CERN], and URA has a major impact” on that direction, said Reay. “We wanted to play a role in this new direction.” □

Covering Fermilab From All Sides

The University of California–Davis participates in both collider and fixed-target experiments

by Donald Sena, Office of Public Affairs

At Fermi National Accelerator Laboratory, there are two principal ways to unravel the mysteries of the physical world: smash protons into antiprotons at great energies (collider physics) or send particles crashing into a fixed material and then detect what emerges on the other side of the target (fixed-target physics).

Many of the 100 or so institutions that collaborate on Fermilab experiments choose one of the two methods on which to focus their energies; however, others, like the University of California at Davis, have their hands in both jars.

The UC–Davis team arrived at Fermilab before the first beam of protons passed through the Main Ring, and they are already planning to take advantage of the Laboratory's newest accelerator, the Main Injector, when it switches on in 1999. The California group has two separate teams here—one collaborates on the DZero collider experiment, and the other

is getting ready to launch a fixed-target study of the last lepton of the standard model that researchers have not yet directly observed.

The Department of Physics at UC–Davis has 93 undergraduates with physics majors and 79 graduate students, eight of whom are specializing in particle physics. Physicist Richard Lander founded the high-energy physics program in 1967. Of the 30 faculty members, six are experimental high-energy physics professors. The department also includes theory faculty and engineers.

Recognition of the contribution to high-energy physics made by UC–Davis goes beyond Fermilab's boundaries. Congressman Vic Fazio (D–Calif.), a strong and consistent supporter of science, said that research and development supported by the government is important to the nation and its future.

"The collaborative effort between Fermilab and the University of California is an example of the vital work being done," said Fazio in a recent news release.

However, the California Democrat is also concerned about funding for science and research in the future.

"Recognizing the significant consequences of R&D cutbacks, I have worked with the House Democratic leadership to form a task force, made up of seventeen members including myself, designed to enhance the visibility of science and technology issues in the legislative agenda of Congress," said Fazio.

A FIXED-TARGET DESTINY

UC–Davis researchers arrived at the Fermilab campus early in its development and participated in some of the first experiments, according to Phil Yager, physics professor at UC–Davis. In particular, the UC–Davis team first experimented with 100 GeV positive pions in the hydrogen bubble chamber. Over the years, other bubble chamber experiments followed.

"We were out [at Fermilab] when they were digging trenches," said Lander. Bob Wilson, Fermilab's founding director, "had everybody out there. It was a real exciting time...there was a good spirit."

During the late seventies, UC–Davis partic-



Steve Mitani, a UC–Davis junior majoring in physics, doing detector work as part of his university's collaboration at Fermilab. A total of five detectors will be transported to Fermilab at the end of February for installation in the wide-band experimentation hall in the Proton Area.

Photo courtesy of UC-DAVIS

ipated in a series of experiments in the Meson Area. The neutral particle spectrometer was used for E383, E585 and E663.

UC-Davis also collaborated on E653, which began in 1981. Vittorio Paolone, a staff scientist at the university, did his thesis on this Fermilab experiment while a graduate student at Davis. Paolone said this experiment studied the properties of the charm quark.

In 1990, the UC-Davis group joined the second run of E687, the photo-production of charm; this study yielded nearly 100,000 charm decays. Paolone said UC-Davis has been studying charm for over a decade now and the expertise they have gained fosters more interest in the quark. In the tradition of fixed-target work, UC-Davis is collaborating on two experiments set to begin in the summer. The first, E831, is similar to E687 but will run at a higher intensity and slightly lower photon energy. Researchers expect to increase the charm yield by a factor of 10 over E687.

At the same time, another UC-Davis group is preparing to start E872, the direct search for the tau neutrino. Yager and Paolone are the university's leaders on 872, and Paolone is serving as one of the experiment's cospokesmen. There are two main reasons researchers are going after the tau neutrino, according to Paolone. The first, quite simply, is to find the mysterious particle and understand its properties. Since the discovery of the top quark, Paolone said news reports often state that scientists have observed all of the fundamental particles in the standard model.

"It is just not true," he said. "There is a lot of indirect evidence, but [the tau neutrino] has never been directly observed, like the electron and muon neutrinos."

The neutrino search is a precursor to the Neutrinos at the Main Injector (NuMI) project, the search for neutrino mass. Paolone says it is important that researchers first directly observe the tau neutrino from an understood source before they embark on the quest to see if it and the other two neutrino flavors have mass. He and his UC-Davis colleagues have already joined the NuMI project.

UC-DAVIS AT DZERO

In parallel with the fixed-target program, other students and faculty from the university collaborate on the DZero collider experiment. Sudhindra Mani and Lander, both eager to get involved with the collider detector, joined DZero in 1993. Since then, they have ended some research at other laboratories and added to their team at Fermilab, which now consists

of five faculty members and about five graduate students.

"We are strengthening our participation in DZero as we phase out some of the other experiments" around the world, said Lander. "We're coming back home, so to speak."

The UC-Davis team is working on hardware upgrades for the collider detector, as well as software and analyses. As Fermilab looks toward the future, the Laboratory must maintain a certain parallelism. If accelerator technology advances, other areas must also progress, as with the DZero detector. The Main Injector, a new accelerator being built at Fermilab and

scheduled to begin operating in 1999, will greatly increase the luminosity of the Tevatron, resulting in many more particle collisions per second at the DZero detector. Without upgrades, DZero would not be able to keep up with the Main Injector and the extra luminosity would be wasted.

Specifically, the UC-Davis group is developing an applications-specific integrated circuit, a computer chip that captures and processes signals from the scintillating fiber tracking system within the detector. Lander added that students and faculty are testing these chips on the Davis campus. Winston Ko and Yuri Fisyak from UC-Davis are also developing collider simulation software.

Student involvement in the DZero upgrades and other areas is important to Lander. He said all students, including undergraduates, working on the actual experiments get a feel for the high-energy physics as well as the "dirty work" of the field.

"Because they are associated [with hardware development], they get to talk about the physics, and they get to see some of the fun stuff," said Lander.

UC-Davis was recently elected into the Universities Research Association. Lander said the membership provides a higher profile for the high-energy physics group on the UC-Davis campus and within the administration.

"It gives us visibility and therefore recognition within the campus," said Lander. □



Photo by REIDAR HAHN

Vittorio Paolone with the magnet that will be used for E872, the direct search for the tau neutrino.

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— Richard Lander,
physics professor
at UC-Davis

Main Injector Construction Reaches Critical Point

by Leila Belkora, Office of Public Affairs

Dixon Bogert worries about the Southwest Booster Building collapsing into the adjacent Main Injector construction pit. Because he worries about it, the rest of us don't have to give this possibility a second thought.

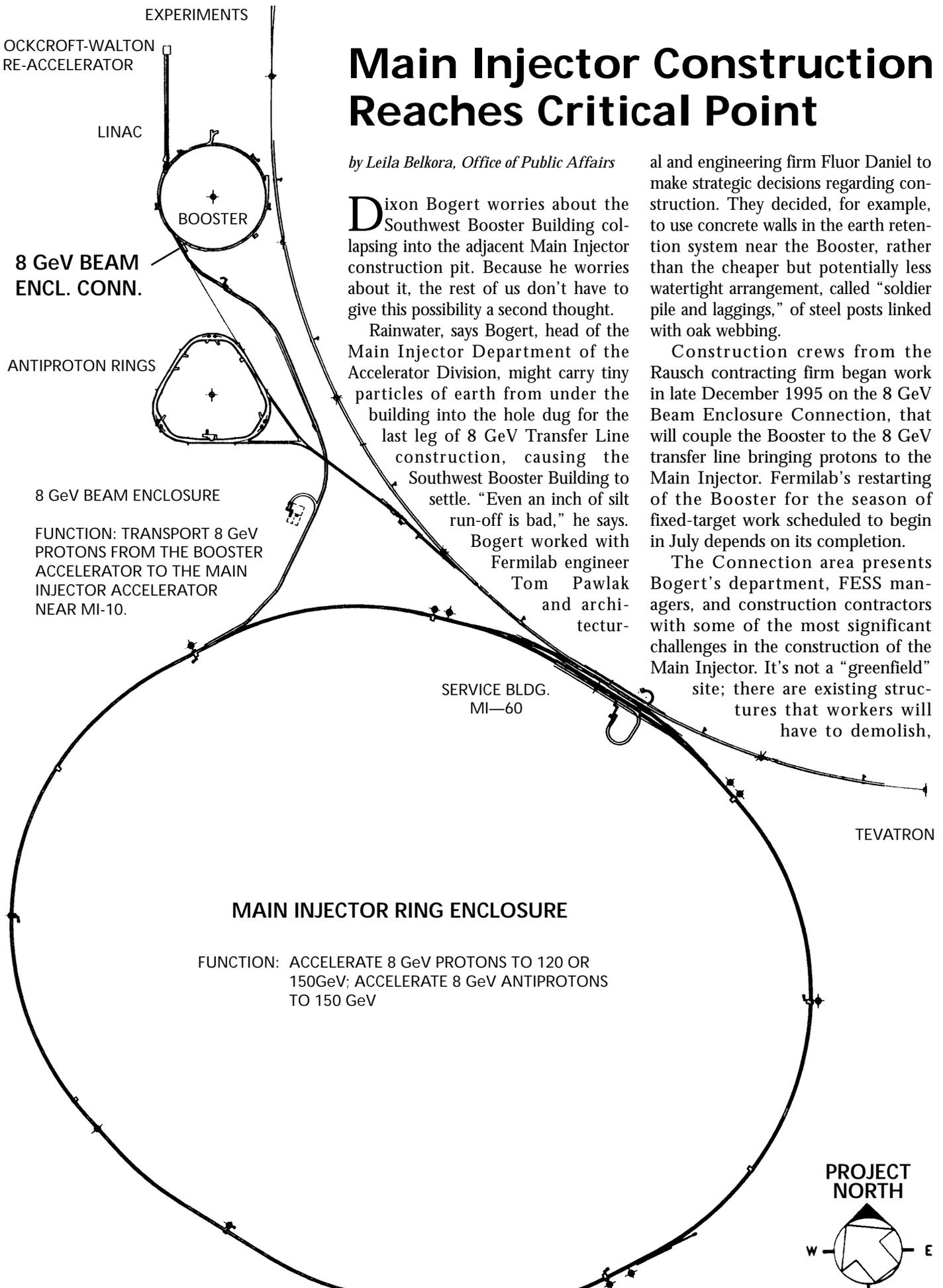
Rainwater, says Bogert, head of the Main Injector Department of the Accelerator Division, might carry tiny particles of earth from under the building into the hole dug for the last leg of 8 GeV Transfer Line construction, causing the Southwest Booster Building to settle. "Even an inch of silt run-off is bad," he says.

Bogert worked with Fermilab engineer Tom Pawlak and architect-

al and engineering firm Fluor Daniel to make strategic decisions regarding construction. They decided, for example, to use concrete walls in the earth retention system near the Booster, rather than the cheaper but potentially less watertight arrangement, called "soldier pile and lagging," of steel posts linked with oak webbing.

Construction crews from the Rausch contracting firm began work in late December 1995 on the 8 GeV Beam Enclosure Connection, that will couple the Booster to the 8 GeV transfer line bringing protons to the Main Injector. Fermilab's restarting of the Booster for the season of fixed-target work scheduled to begin in July depends on its completion.

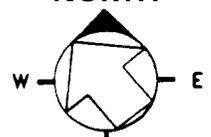
The Connection area presents Bogert's department, FESS managers, and construction contractors with some of the most significant challenges in the construction of the Main Injector. It's not a "greenfield" site; there are existing structures that workers will have to demolish,



MAIN INJECTOR RING ENCLOSURE

FUNCTION: ACCELERATE 8 GeV PROTONS TO 120 OR 150GeV; ACCELERATE 8 GeV ANTIPROTONS TO 150 GeV

PROJECT NORTH



and vital utility lines for power and water criss-cross the area. The Connection Enclosure comes very close to the Booster, raising concerns that water run-off or the hammering jolts of pile driving will undermine the Booster building foundations. The Connection Enclosure slopes downward from 722.6 feet above sea level at the Booster to 713.6 feet at the Main Injector ring, posing additional construction challenges. Finally, workers may only have access to the enclosure when the Booster is off, because of the radiation when the particle beam is on.

MI PROJECT DWARFS ALL

The connector area that crews are beginning to excavate this week is just one part of the mammoth Main Injector project, the largest piece of civil construction at Fermilab since the lab's founders first broke ground. The civil construction project consists of the Main Injector Ring, of two miles' circumference, south of Wilson Hall; a gently curving section leading from the Booster to the Main Injector; two areas of more intricate design, the Main Injector-Tevatron connection at F0 (the Tevatron RF location) and the 8 GeV Connection Enclosure; and the associated Service Buildings and utilities.

The Main Injector will replace the Main Ring as the next-to-last stage of Fermilab's five accelerators. The purpose of the Main Injector is to enhance the luminosity of the particle beams in the Tevatron. Steve Holmes, Project Manager, explains, "What we're looking for with the Main Injector is at least a factor of five increase in the number of in how many collisions we can generate for the experimenters to look at every hour." Fermilab proposed the project in 1989, and is now receiving funding for the fifth of seven years of construction.

The bill for the Main Injector Project is \$250 million, of which \$229.6 million comes from line-item funding in the budget presented to the president of the United States. Because of the large scope of the project, Fermilab called for engineer-

ing design help from Fluor Daniel, one of the world's largest engineering-architectural firms. Fluor Daniel made detailed plans based on FESS's initial drawings.

Shin Inouye, a former project manager at Fluor Daniel's Chicago offices, says Fluor Daniel employees have "really, really enjoyed" working with Fermilab in the past. "I have people lined up who want to work on [any] Fermilab job," he says. "The interesting aspect," he continues, "was the accuracy with which the Main Injector project design had to be worked out; the structure and beam alignment had to be very accurate—and we had to concern ourselves with radiation, which we don't usually do."

CONTRACT ALLOWS 16 WEEKS OF ACCELERATOR SHUTDOWN

The Main Injector ring is now nearly complete, as is most of the transfer line leading from the Booster to the ring. Six major contractors have participated in the civil construction to date: Wil-Freds Construction on the Main Injector ring, Herlihy Mid-Continent on the MI-60 enclosure, Oliver Structures on the MI-60 service building, Martam on the 8 GeV line, George Sollitt on the Main Injector Service Buildings, and Rausch on the 8 GeV Beam Enclosure Connection. Rausch bid on the Connection work in late November 1995, and received the go-ahead from Fermilab only a month later. Bogert notes that this is a fast turnaround time in the construction business, and one that his team strove for because of Fermilab experimenters' keen interest in resuming fixed-target work as soon as possible.

Rausch has until the first week of October 1996 to complete all their work on the Connection enclosure. This includes the time allotted for excavating the site, building an earth retention system, dismantling an old section of beamline that took protons from the Booster to the Antiproton Source, adding steel shielding to the beam absorber just outside the Booster, and completing

the Connection Enclosure. Workers have begun to excavate the site, have stripped the existing parking lots, and have built a run-around road so that traffic may still flow to the Main Ring/Tevatron access road.

"The critical feature of their schedule," says Bogert, speaking of Rausch's time-line, "is the time we want the accelerator off. During that time they should finish the work up close to the Booster." Fermilab agreed to turn the accelerator off for 16 weeks, to allow work in proximity to the Booster. This accelerator shutdown is expected to begin on February 26, and could end early if the contractor is willing to accelerate the pace of construction in the beam absorber area.

Bogert says Main Injector managers will attempt to keep the shutdown as brief as possible. Turning on the accelerator before the nominal shutdown period ends on July 1, 1996, will require some combination of negotiation with the contractor to pay overtime for longer workdays or weekends, and good luck with the weather. "If we have a rainy spring," says Bogert, "no amount of money can shorten the construction period."

That's one more reason to hope it doesn't rain. □



Photo by AL JOHNSON

In January, construction workers made progress on the 8 GeV Transfer Line. Wilson Hall is in the background. The 8 GeV Connection Enclosure will complete the segment from this area to the Booster in the left background.

CDF Remote Control Room

continued from page 1

The screen showing the paths of particles after a collision event is part of the CDF control room at Fermilab, alongside displays of cross-sectional views of the detector, diagnostic signals, and other information relating to the stream of data. At all times when the accelerator is running, a researcher on shift monitors the detector operation from the control room at Fermilab, and takes care of any problems that arise. Now, thanks to duplicate displays and Internet communication lines, a researcher in Japan or Italy may participate in operating the detector. The fleeting signature of a top quark born in Batavia may catch the eye of a physicist in Pisa.

CDF collaborators thought of a remote control room several years ago, but the plan was too costly to implement until recently. The first test of the CDF remote control room, about one year ago, came about thanks to Internet-based video links and the strong support of Alvin Tollestrup and Joel Butler at Fermilab, Kuni Kondo of the

The fleeting signature of a top quark born in Batavia may catch the eye of a physicist in Pisa.

University of Tsukuba, and leaders at KEK, a national high-energy physics laboratory in Japan. Earlier video links required Fermilab to lease dedicated phone lines or a dial-up line from the telephone company, at a cost of a few hundred dollars an hour. The new system is less expensive for Fermilab to use, because it makes use of the Energy Sciences Network (ESnet), a communication network within the Internet serving

the DOE Energy Research community and supported by the Department of Energy. Three institutions besides Fermilab have experimented with a CDF control room on a trial basis: the University of Tsukuba and KEK in Japan, and the University of Pisa in Italy.

Not only can collaborators in the CDF team monitor the progress of their experiment from faraway institutions using the CDF remote control room, they can also interact with the shift operator on duty at Fermilab and issue commands to control the data acquisition. If, for example, a researcher at the University of Tsukuba noticed that a section of the detector display was blank, indicating a "dead" component of the instrument, he or she could call a shift operator at CDF using a microphone installed over the computer monitor. Within minutes, these experts separated by about 6,000 miles could start solving the problem they both see on the screen.

G.P. Yeh, a CDF physicist who designed some of the on-screen event displays and worked to implement the remote control room in its trial run in Japan, says the innovation was necessary because of the increasing scope of the collaborations. "Experiments are getting bigger and bigger, more international, and everyone wants to have access from their own lab," he says. He adds that many high-energy physicists believe that only international collaborations can sustain the big experiments they are hoping to build in the future.

The CDF remote control room has other advantages, besides fostering international collaboration. Although physicists will still travel to Fermilab, the remote control room would allow graduate students who otherwise would not have funds to make the trip to participate in running the detector. Yeh says the remote control room may also make shift work easier. Collaborators take turns at the control room, each monitoring the displays eight hours a day over a nine-day period that comes around two or three times a year.



Photo by FRED ULLRICH

When You're a Jet, You're a Jet All the Way: They may look poised to dance, but this team's fancy footwork was in setting up the CDF remote control room (at left, behind).

Front row, left to right: G.P. Yeh, Dick Adamo, Mark Leininger, Chuck Andrews.

Back row: Dave Bundy, Al Thomas, Ken Stox, Mark Schmitz (Research Division), Marc Haibeck, and Nick Karonis. All but Yeh and Schmitz work for the Computing Division.

SCIENCE ARTICLE SPAWNS INTEREST IN CDF RESULTS

An article in the February 9 issue of *Science*, describing the results of a CDF paper, touched off a small media blitz recently. Upon release of the article and a press release by the magazine, a number of media outlets, including many major metropolitan newspapers, published news stories recounting the *Science* story and CDF's results.

Many people at the Laboratory expressed surprise at the level of national media interest. However, James Glanz, the *Science* reporter who broke the story, said he was not surprised by the interest because of the topic and the history of good physics at Fermilab.

"The subject matter has such intrinsic interest. Everybody wants to know what is the final, basic building block...from astrophysicists to cab drivers..." said Glanz.

The 450-member CDF collaboration recently submitted the paper that touched off the news to *Physical Review Letters*. The paper reports results that appear to be at odds with predictions based on the current theory of the fundamental structure of matter.

The paper, submitted January 21, reports the collaboration's measurement of the probability that the fundamental constituents of matter will be deflected, or will "scatter" when very high energy protons collide with antiprotons.

The experimenters found that the probability of particle scattering for the most violent collisions is significantly higher than that predicted by current theoretical models. Collaborators believe that more studies of both experimental data and theoretical analyses will show whether relatively small adjustments to theory can reconcile the discrepancy between theory and the recent measurements; or whether the data are the first hints that the fundamental constituents of matter may not be fundamental after all. □

LAB NOTES

1996 SUMMER DAY CAMP

Fermilab will again sponsor three supervised day camp sessions for children of employees, visitors, and Fermilab contractors. Session dates are June 17-July 5, July 8-July 26, and July 29-August 16. The fee is \$225 per child and per session. Admission is by lottery drawing on April 1. Contact Jean Guyer at x2548 for more information and for a registration form.

CLAIMS DEADLINE

The filing deadline for submitting 1995 claims to your Health Care Reimbursement Account and Dependent Care Reimbursement Account is March 31, 1996. CIGNA must have claims in their claims office by the close of business on that date. Some employees have substantial funds left in their accounts. Under IRS regulations, "If you don't use it, you lose it."

URA SCHOLARSHIP INFORMATION

Candidates for Universities Research Association (URA) scholarships are reminded that applications are due March 1. URA awards a number of scholarships to regular, full-time Fermilab employees' children who are currently high school seniors and who will begin a four-year college degree program next fall. Applications are available from, and should be returned to, Personnel, WH 15SE, Mail Station 124.

Scholarships are awarded on the basis of S.A.T. scores. The maximum amount of the scholarship is \$3,000 for tuition and fees and is renewable for four years if the student progresses in good academic standing. Applicants will be notified regarding the scholarships in early April.

Chez Léon MENU

Lunch served from 11:30 a.m. to 1 p.m. - \$8/person
Dinner served at 7 p.m. - \$20/person

For reservations call x4512

Dietary Restrictions - Contact Tita, x3524

WEDNESDAY, FEBRUARY 28

Catfish Filet with Coarse-Grained Mustard Sauce
Glazed Carrots with Dill
New Potatoes with Mint and Peas
Banana Bourbon Cake with Bourbon
Creme Anglaise

WEDNESDAY, MARCH 6

Cheese Fondue
Mixed Salad
Fresh Fruit Compote
Chantilly

THURSDAY, FEBRUARY 29 -

CARNIVAL
Wear a Costume - Get a Gift
Roast Suckling Pig
Coconut Rice
Vegetables of the Season
Rum Cake

THURSDAY, MARCH 7

Minestrone Soup
Roast Leg of Lamb with Ratatouille
Parsleyed Rice
Apple Walnut Cake with Creme

In Memory

THOMAS L. COLLINS, ACCELERATOR PHYSICIST

Thomas L. Collins, a physicist and the inventor of the Collins straight section, an important advance in the design of particle accelerators, died near his home in Anacortes, Washington, on January 15, 1996. He was 74.

Collins' rigorous analytical methods were especially well suited to solving the design problem of the accelerator straight section, and his expertise at complex and subtle calculations found many other applications in accelerator physics. His understanding and inventiveness in beam optics live on as vital elements of Fermilab's Tevatron and Antiproton Source, and his insights continue to shape the design of the particle accelerators of the future.

Collins received his B.S., M.S. and Ph.D. in physics from the University of British Columbia. He spent summers working for his uncle's large construction firm, experience that later served him well at Fermilab.

In 1957, Collins joined the Cambridge Electron Accelerator, located at Harvard University, as assistant to Director M. Stanley Livingston. "The CEA was a wonderful place for a young physicist in the 1960s," Collins told an interviewer in 1993. "We were a small group, and everybody was in on everything. All ideas were discussed by everybody, more or less nonstop... There were all kinds of opportunities to look at new ways to do things. Over and over again, we were the first to try some new idea in accelerator design."



At the CEA in 1961, Collins worked out and published the idea for the straight section. "It had been thought," wrote physicist Ernest Courant in a letter describing Collins' work, "that for alternating gradient accelerators, the length of field-free straight sections was limited by the effective focusing strength. After all, the reason AG focusing had been found to be a good thing was just that it made focusing strong by building the ring with many short repetition periods. Collins saw that one could interrupt the periodicity with long insertions having straight sections of arbitrary length, provided appropriate quadrupole focusing magnets were incorporated in the insertion, in such a way that the betatron oscillating functions matched at the transition points between the end of the regular periodic structure and the insertion."

The resulting long straight sections were quickly incorporated into accel-

erator designs. Physicist Donald Edwards, then a graduate student, brought the idea from the CEA back to Cornell, where his boss, Robert Wilson, immediately incorporated it into the 2 GeV synchrotron he was building. "Thus, Cornell's machine was the first to use the Collins straight section, in about 1964," Edwards says, "although Collins didn't know about it until after it was built." Collins straight sections have been used in all subsequent large proton synchrotrons, including the Fermilab Main Ring and the Tevatron.

In April, 1967, Robert Wilson, the newly appointed director of the National Accelerator Laboratory, offered Collins a position as physicist at the new laboratory. "I do beg you to accept this position," Wilson's offer letter said, "for we will need the kind of innovations you are capable of making to be successful."

Collins accepted. Edwards writes that Collins "was one of the first physicists to join what was to become the Fermi National Accelerator Laboratory. Those of us who worked with Tom over the years remember him as a superb physicist, a congenial antagonist, and as a man who never hesitated to go into the tunnel with whatever instruments were necessary to diagnose whatever malady afflicted the accelerator that day. His enthusiasm for accelerators never diminished."

He retired from Fermilab in 1988. In April, 1994, the American Physical Society awarded the Robert R. Wilson Prize to Thomas L. Collins "in recognition of outstanding achievement in the physics of particle accelerators."

MILESTONES

HONORED: Fermilab physicist Patricia McBride, recipient of a Visiting Professorship for Women grant from the National Science Foundation to carry out her research, entitled "B Physics at Collider Detectors," at Princeton University. In the letter announcing

her award, NSF Director Neal Lane wrote, "Dr. McBride is considered to be an excellent scientist and a positive role model for women pursuing careers in science and engineering."

DIED: Dominic Carullo, on February 3, 1996. Carullo worked for Technical Support Administration.

He started at Fermilab in October, 1974.

DIED: Bernard Eaves, on February 3, 1996. Eaves worked in material controls for the Technical Support Group. He started at Fermilab in January, 1978.

FERMILAB CALENDAR

FEB. 24

Fermilab Arts Series presents Altan, playing with a distinctive style that combines the melodic quality of Irish tunes with the power and drive of Scottish music. Tickets \$15. 8 p.m., Ramsey Auditorium. Call (708) 840-ARTS for information and reservations.

FEB. 27

Jess Toussaint of the American Heart Association will present a Brown Bag Seminar on Coronary Heart Disease and Heart Attacks from Noon to 1 p.m. in 1 West.

MARCH 4

Mammography Screening March 4 through March 8. Screening times: Mon., Wed., Fri. 8 a.m. - 5 p.m. Tue., Thur. 8 a.m. - 3 p.m. Call the Benefits Office at x3395 or x4362 for more information.

MARCH 13

The Fermilab Barnstormers Radio Control Model Club will host their annual Delta Dart Night at the Kuhn Barn starting at 5:30 p.m. Everyone is invited. Delta Darts are rubber-band-powered airplanes constructed of balsa wood and tissue paper. For a \$1 materials fee, club members will provide guidance in constructing and flying these planes. (You can build one in about half an hour.) No experience is necessary. Children under 12 are exempt from the materials fee, and there will be a "juniors' fly-off" at 7 p.m. For more information, call Jay Hoffman, x4156, Kurt Krempetz, x4657, or Jim Zagel, x4076.

MARCH 20

The Wellness Committee presents Dollars and Cents, a lecture on debt management and budget counseling by Diane Bedenbaugh of Consumer Credit Counseling in Aurora. Noon-1 p.m. in 1 West.

CLASSIFIEDS

FOR SALE

■ 1990 Mitsubishi Eclipse GSX, all-wheel drive, 16 valve dual overhead cam intercooled turbo, 5 speed, AC, cruise, FM/AM cassette, 68,461 miles. New: 1KA battery, brakes, timing belts, Pirelli P7000 205/55ZR16. Must see (no rust) and test drive; \$8763. Call Bob x3769, (708) 879-6355, or FLORA@ADMMAIL.FNAL.GOV.

■ Three-bicycle trunk-mount carrier \$25; kitchen hutch (laminated particle board) \$40; electric stove and microwave unit \$100. Call Greg at x3011.

■ Bally Fireball Pinball Machine, excellent condition, \$750 - \$850 refurbished, asking \$600 o.b.o. call (708) 393-0570 or x8361.

■ 1988 Ford Bronco II XLT 4 wheel drive, 5 speed, 62,000 miles, ABS, AC, power windows and door locks, FM/AM stereo cassette, tilt wheel, cruise control, luggage rack, running boards, cargo cover; new

tires, exhaust and battery. Clean, little rust. Great winter care. \$6500 o.b.o. Call x2279

■ IBM-compatible P.C. Tower case, Intel 486-DX2-66 Mhz processor 8 m.b. memory (RAM), 256 kb L2 cache, Vesa local bus motherboard, Vesa local bus video accelerator with 1 mb display memory, 600mb hard drive, x2 cd rom drive, 16 bit sound card, Keytronics keyboard, Microsoft mouse, VGTA monitor, \$500.00. Upgrade your P.C. with enough memory to run today's memory hungry applications at less than half market price \$15 per megabyte installed, 30 pin simms, 70 nanosec, 1 and 4 MB, call Dorothy (708) 393-3239.

FREE

■ Upright Freezer. Very big, perfect for garage. Works great! Will deliver close to lab or please pick up ASAP! Call Denise at x8277.

The deadline for the Friday, March 8 issue of FermiNews is Tuesday, February 27.

Please send your article submissions, classified advertisements and ideas to the Office of Public Affairs, MS 206 or Email: TOPQUARK@fnal.gov

FermiNews welcomes letters from readers.

Please include your name and daytime phone number.

FermiNews

Fermi National Accelerator Laboratory

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