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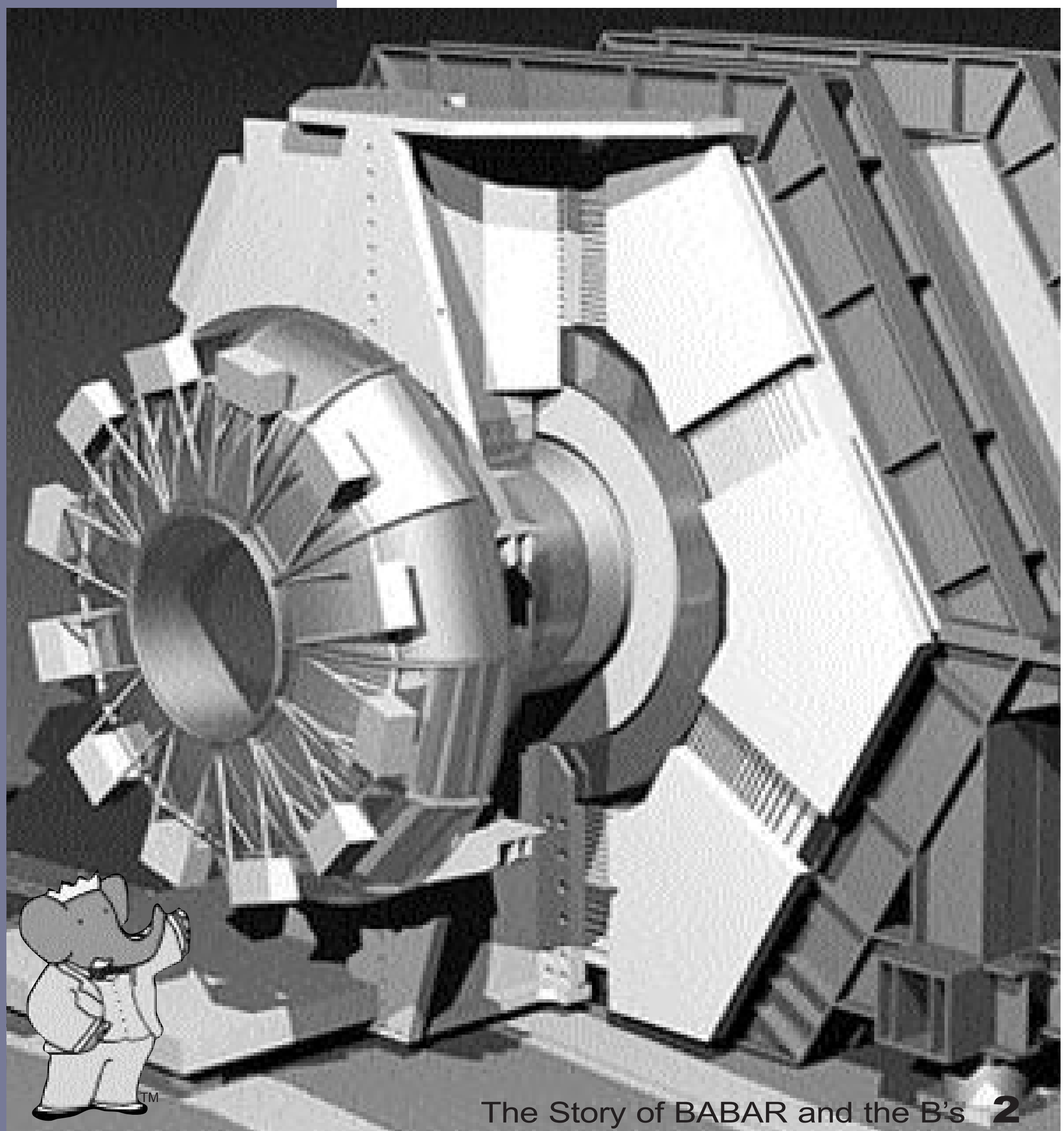

The Story of BABAR and the B's 2

Illustration courtesy of SLAC

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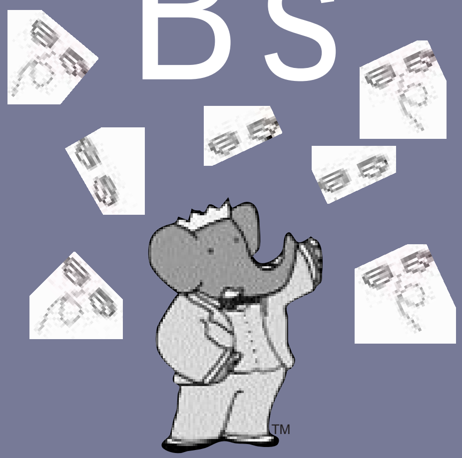
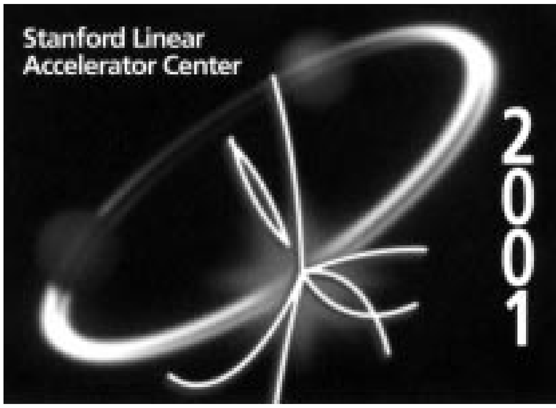
The Story of BABAR and the B's



Cover: A computer generated model of the BABAR detector, a hive of *B* physics activity.

By Judy Jackson



New Year greetings from SLAC bore a "Golden Event," an image representing the first results from the BABAR detector, showing tracks of *B* and anti-*B* mesons.

Much of the buzz in particle physics these days comes from *B*'s. More specifically, from *B*'s and *B*-bars. That's because experiments studying these particles—*B* mesons and their antimatter counterparts, anti-*B* mesons—are on the verge of generating dramatic new insights into the enigmatic asymmetry between matter and antimatter. The buzz will reach a crescendo when the Stanford Linear Accelerator Center's BABAR collaboration announces major new results at physics conferences next month.

"We've already written the paper; we just have to fill in the numbers," said collaborator David Hitlin, a physicist from the California Institute of Technology and BABAR's founding spokesman. "We know the statistical error."

The "numbers" Hitlin and his collaborators will fill in for the worldwide gathering of *B* physics experimenters refer to the value of something called "sine two beta," a measure of the difference in the behavior of subatomic particles known as *B* mesons and their antimatter counterparts, "*B* bars," or anti-*B* mesons. The value of sin2β can vary from zero, indicating no difference in how *B*'s and *B*-bars behave, to plus or minus 1, the maximum difference. The Standard Model, the theory that serves as the particle physicist's playbook, allows for a value somewhere between 0.5 and 0.9. Earlier results from BABAR and other experiments, including Fermilab's CDF, have not yet pinned down a value. Physicists everywhere will be listening eagerly for BABAR's latest results.

They should be interesting. That's because BABAR is up to its collaborative ears in what scientists live for: data. Since the experiment began operating in January, 2000, particle collisions have poured into BABAR's detector at a rate beyond the experimenters' wildest dreams. Those billions upon billions of electron-positron collisions from SLAC's new *B* Factory accelerator mean that BABAR experimenters can close in on the key matter-antimatter difference they are seeking with an ever-diminishing margin of error.
The more collisions, or integrated luminosity, the BaBar detector records, measured in units called "inverse femtobarns," the more accurate will be the determination of sin2β.

"BABAR has recorded 23 inverse femtobarns of integrated luminosity," said BABAR spokesman Stew Smith of Princeton University. "The results announced in February will be based on 20 inverse femtobarns in the upsilon

Fermilab Photo

Exactly half of the 544 members of the BABAR collaboration, many of whom gathered for this summer 2000 portrait, come from U.S. institutions, half from universities and laboratories around the world.

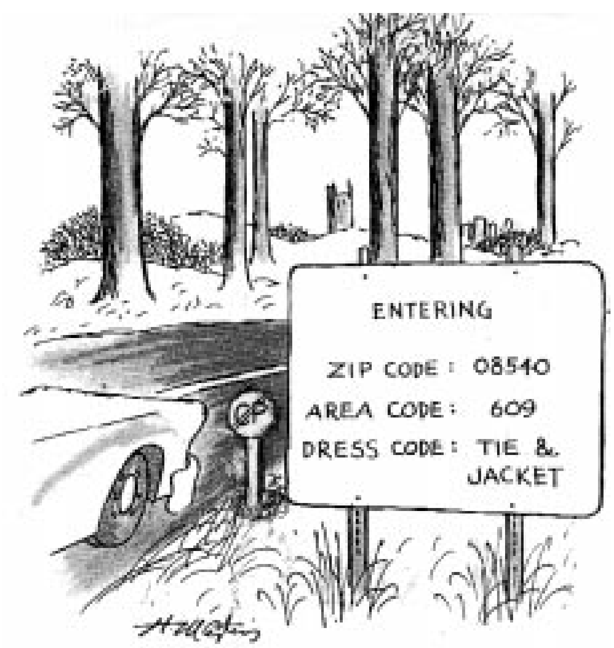
4S resonance, [the principal pattern of *B* meson behavior observed by the experiment] as well as another 15 percent of off-resonance data."

In fact, Smith explained, BABAR's wealth of data amounts almost to an embarrassment of riches. In contrast to the experience at many new particle accelerators, which often start slowly and gradually approach their design luminosity, the *B* Factory immediately began delivering particle collisions "like a firehose," in Smith's phrase.

"This flood of data creates pressure on the experiment to deal with it all," Smith said. "The biggest stress is on off-line computing. We have much more data to deal with than we expected. We're a victim of our own success, which is a nice problem to have but is still a major challenge."

BABAR appears to be up for the challenge. In something of a departure from earlier SLAC experiments, BABAR set out from its start in 1993 to create a thoroughly international collaboration. The 554 members of BABAR are evenly split, with 277 from U.S. institutions and 277 from abroad. Universities and laboratories from Canada, China, France, Germany, Italy, Norway, Russia and Taiwan make up exactly half of BaBar's 74 member institutions.

"This international aspect is absolutely crucial to the success of the experiment," Smith said. "The costs of building the detector were split about 60/40 between the U.S. and other countries, but we share the costs and responsibilities 50/50 when it comes to detector operation, data analysis, technical coordination and leadership of the collaboration."



"I don't get it....."
For FermiNews readers who aren't from the northeastern U.S, the zip code and area code are those of Princeton, New Jersey, home to a university with a certain reputation for sartorial formality—now known also for covering the waterfront of CP violation research, with Princeton physicists taking part in both the BABAR and BELLE experiments. BABAR spokesman and Princeton physicist Stew Smith penciled a CP-violation road sign into this cartoon by his neighbor, Henry Martin.

BABAR

International relations extend, in fact, beyond the collaboration itself to a “collegial” relationship with BABAR’s main rival in the *B* physics enterprise, the Japanese experiment BELLE, said Caltech’s Hitlin.

“There is a fair amount of contact between the BABAR and BELLE collaborations,” Hitlin said. “But the value of having two experiments is to have two independent measurements, so collegiality ends where the data begins. However, relations between the two experiments are very good.”

BELLE has so far recorded about 11 inverse femtobarns of luminosity to BABAR’s 23, but “BELLE is breathing down our neck,” Smith said. “In their best week, they recorded 800 inverse picobarns. BABAR’s best week was 970.”

BELLE will also report results at the BCP4 conference.

At a collaboration meeting at SLAC last month, BABAR seemed as busy as a highly successful beehive, and one on the edge of yet more success. True, the collaboration has a swarm of technical problems to solve. Bakelite panels in a detector component called the flux return have begun to deteriorate, for example; and computing needs have risen faster than budgets based on Moore’s law of shrinking computing costs allowed for. BABAR collaborators must plan for dealing with still more—much, much more—data in the near future, and for upgrading their detector for the long haul. But for the moment, at their December meeting, they were savoring the enviable and imminent prospect of announcing results that will significantly change the scientific understanding of the way the universe behaves.

“It’s a tremendous thrill to have come so far in so short a time,” said SLAC Director Jonathan Dorfan. “February 2001 will usher in an exciting new era of discovery from the *B* factories.”

That’s the buzz from BABAR and the B’s. ☐

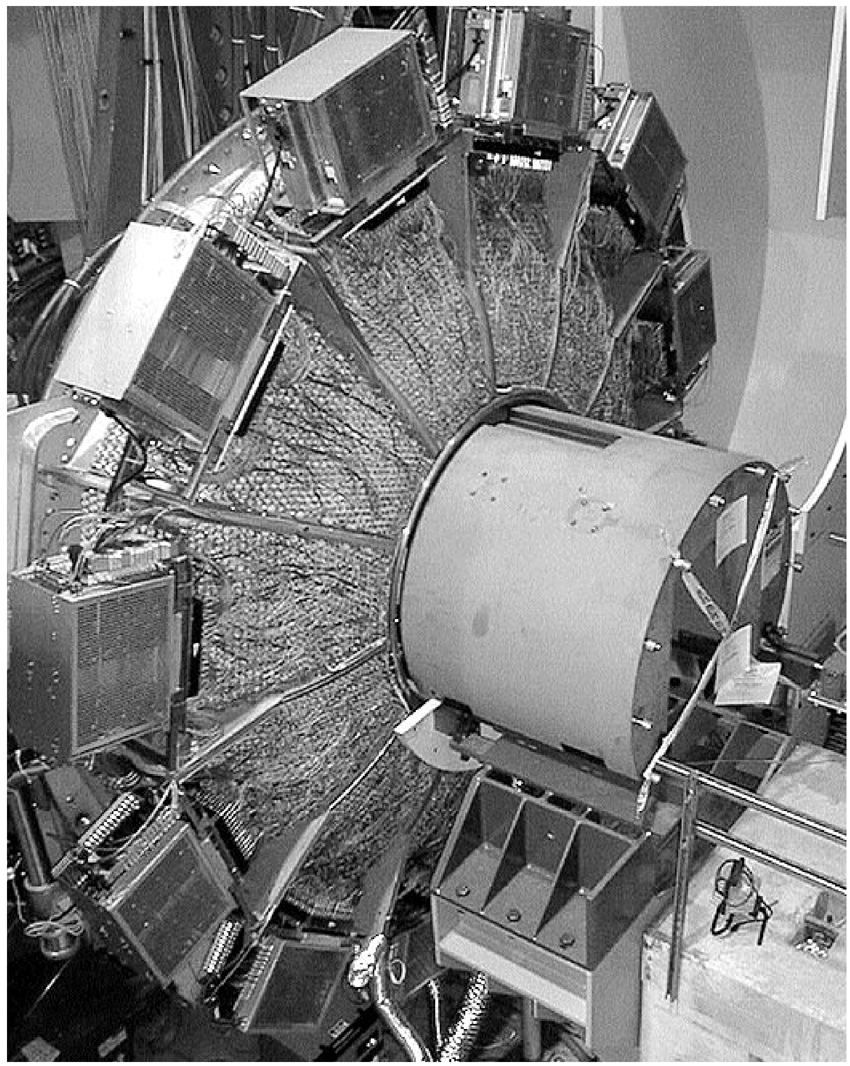
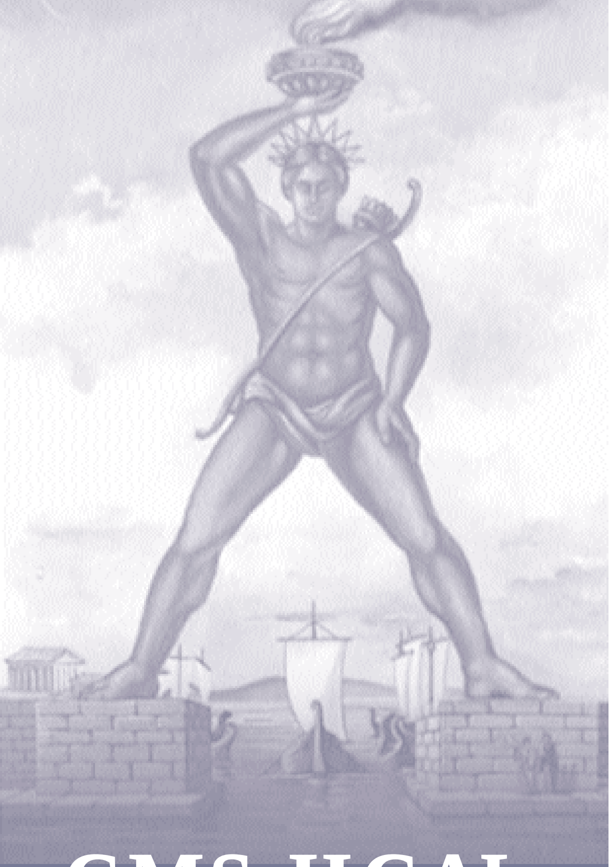


Photo courtesy of SLAC

The BABAR detector, under construction above, has exceeded expectations, but the Asymmetric *B*-Factory that provides the B’s is “the real hero” of the BABAR adventure, said spokesman Stew Smith.

For more information on BABAR, *B* physics and the BCP4 conference:

www.slac.stanford.edu/BFROOT
bsunsrv1.kek.jp
www.hepl.phys.nagoya-u.ac.jp/public/bcp4



CMS HCAL: Copper Colossus

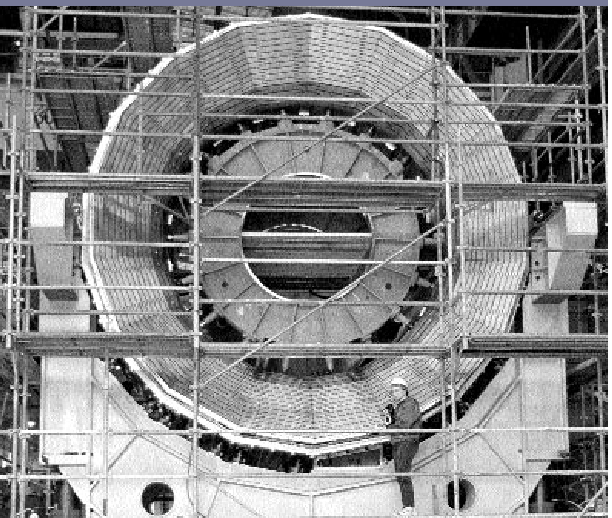


Photo by Igor Churin

The CMS Hadron Calorimeter (here being assembled at the Felguera plant in Spain) is "good to the last millimeter," as summed up by US/CMS project manager Dan Green. When in place, the central calorimeter is supported on side rails, meaning the circular cross-section would sag slightly into an egg shape. The design challenge was to make HCAL rigid enough to minimize that sag, which Fermilab engineer Igor Churin and his team of three visiting Russian engineers accomplished virtually to perfection. "We were expecting about three millimeters of deflection, and it actually was only about a millimeter," said technical coordinator Jim Freeman.

by Mike Perricone

Jim Freeman doesn't need hyperbole when describing the stature of the Hadron Calorimeter for the Compact Muon Solenoid. The facts alone place this detector subassembly in rare company.

Statue of Liberty

"The CMS HCAL barrel and endcap will weigh about 1600 tons when completed, and most of that is copper. It will be the heaviest copper alloy structure ever built," said Freeman, technical coordinator for the HCAL construction.

Freeman has become something of a monument maven during this project, providing a major component for the Large Hadron Collider at CERN, the European particle physics laboratory in Geneva, Switzerland. He offered these HCAL comparisons: "The Statue of Liberty weighs 254 tons, about half of which is cast iron and the other half copper sheet. The legendary Colossus of Rhodes is estimated to have weighed 275 tons. Probably 90 percent of it was bronze, a copper alloy, with some iron bracing inside. It's interesting to note that the Colossus was just about the same size as the Statue of Liberty, ignoring the different pedestals."

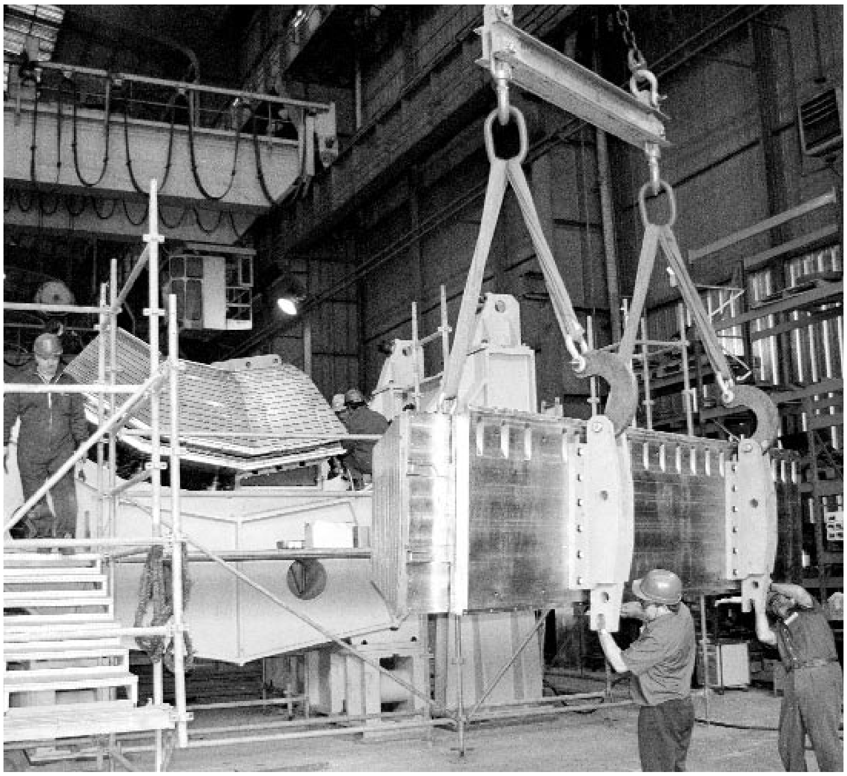
The November decision by CERN to suspend operations of the Large Electron-Positron collider, and proceed on schedule with construction of the LHC, turned a spotlight on Fermilab's Run II research prospects for the next five years while CERN retools.

The spotlight also illuminated Fermilab's major partnership in building the LHC. Alongside its own all-out campaign to begin Run II of the Tevatron in March, and construction of neutrino experiments NuMI and MiniBooNE, Fermilab is also managing an effort for both LHC accelerator and detector components extending throughout virtually every lab production facility. CMS alone could consume the resources of some institutions.

"This is a $167 million project. So far we've committed about $80 million, meaning we're just about half done," said Dan Green, project manager for the US/CMS collaboration. "CERN typically keeps strict schedules, and the clock is ticking now that LEP has ended its run. The present CERN schedule calls for a trickle of beam and some collisions in late 2005, and then for the LHC to start running in 2006."

The new collider will achieve a center-of-mass energy of 14 TeV, some seven times the energy of the Tevatron. In mounting proton-proton collisions, LHC will have beam crossings every 25 nanoseconds (compared to 396 nanoseconds to begin Run II, and 132 nanoseconds by the end of Run II), anticipating 20 to 30 collisions at every beam crossing. The luminosity, a measure of the collision rate, will reach 10^{34}cm ^{2}/sec, about 100 times that of the Tevatron.

CMS HCAL: Copper Colossus

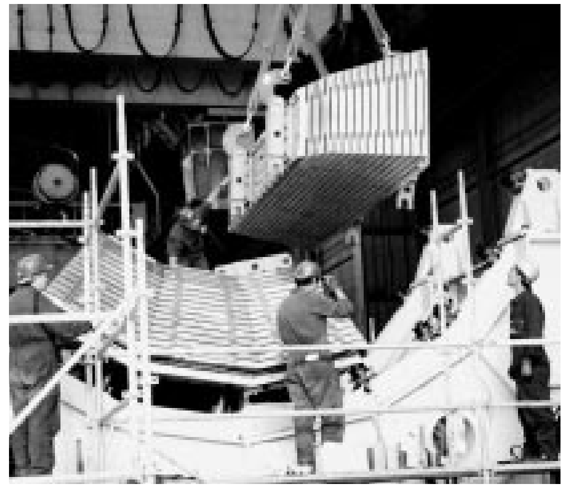


Each half-barrel contains 18 wedges, joined by thin stainless steel plates bolted into place. The entire barrel uses 80,000 bolts, each tightened to stringently measured torque values. A framework consisting of a cradle beneath, and "spiders" on the ends, is built first just to support the assembly process and then removed. After a trial assembly at Felguera, the barrel is disassembled and shipped to CERN for re-assembly. The first half-barrel has already been shipped to CERN. The second half-barrel will ship this summer, ahead of schedule.

"The physics goals for LHC are approximately the same as for Run II, but with a higher guarantee of success for physics beyond the Standard Model," said John Womersley, cospokesperson for Fermilab's DZero detector, and a CMS collaborator who has also served as physics coordinator for US/CMS. "While the Tevatron can search for the Higgs up to about 200 GeV, LHC can cover the whole Higgs mass range to more than 800 GeV. LHC can also guarantee a mass range up to the highest levels we can conceive of for Supersymmetry particles."

Those goals translate into stringent standards for CMS, which must offer precision measurements with the high collision rate.

The CMS electromagnetic calorimeter (ECAL) design is based on a lead tungstate crystal similar



Photos by Igor Churin

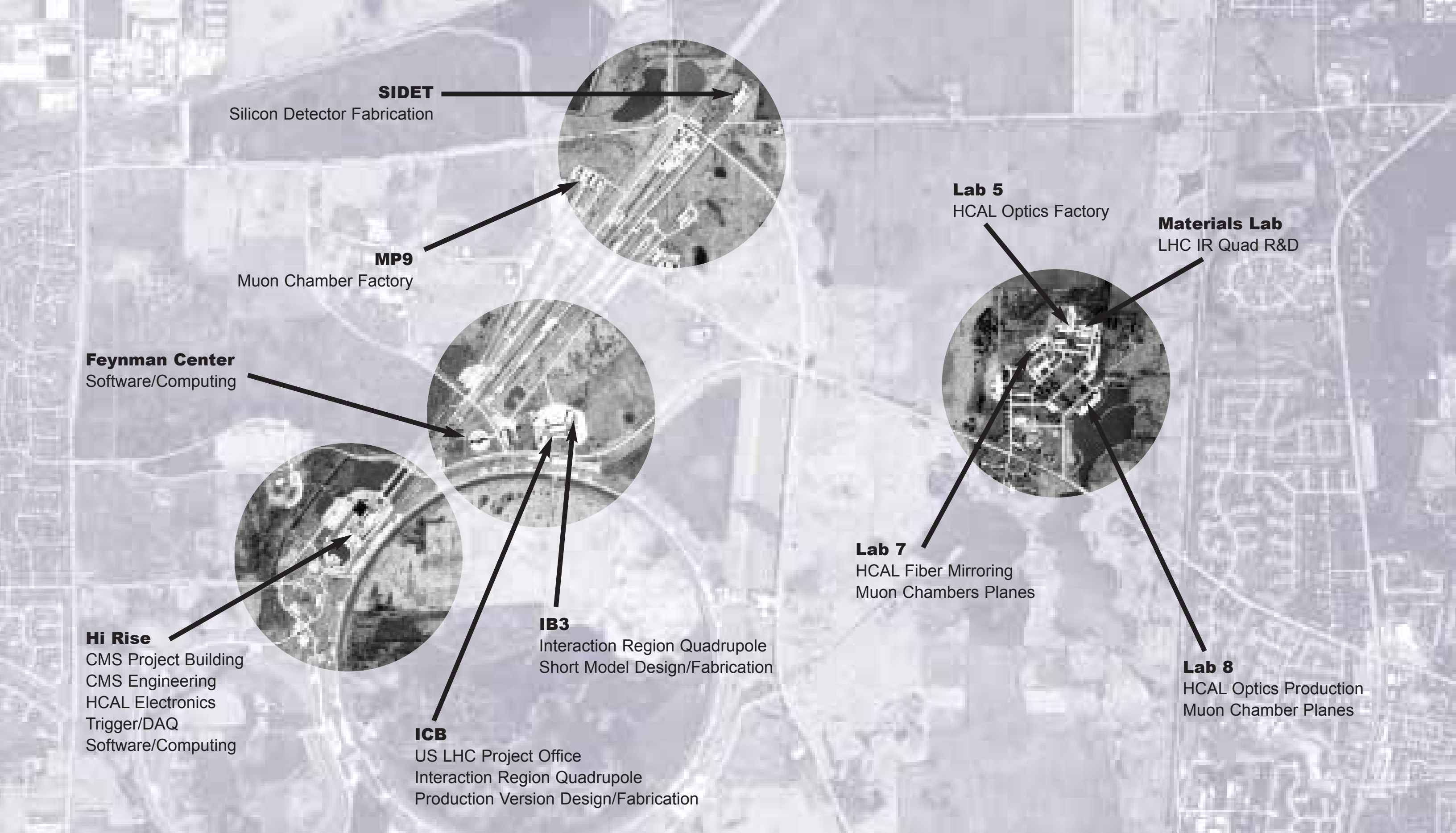
Igor Churin made at least four trips a year to Felguera, to inspect progress and speak directly to workers about the importance of precision and close tolerances. The calorimeter barrel is made of brass and stainless steel, non-magnetic materials to avoid any interference with the strong magnetic field generated by the superconducting solenoid inside.

to that used in Fermilab's KTeV fixed-target experiment, which broke new ground in CP violation research with direct observations of time asymmetry. Fermilab is building the hadron calorimeter (HCAL), the copper colossus located directly behind the crystal ECAL. HCAL is similar in design to the end plug calorimeter at Fermilab's CDF detector, and the proposed SDC calorimeter at the SSC. The magnetic field inside CMS will be 4 Tesla, double the strength of DZero (2T) and nearly three times that of CDF (1.4T). The higher magnetic field produces more bending, and thus higher differentiation, in particle tracks. CMS has an all-silicon tracker, with a critical production role for Fermilab's Silicon Detector Facility, already setting new standards with Run II detectors.

Fermilab also will serve as the regional computing center for US/CMS, which includes nearly 400 scientists from 37 institutions across the country. (The worldwide CMS collaboration numbers approximately 1,800 scientists in 144 institutions.) They all need data, and Fermilab is building the system for taking data from CERN and sending it through the US/CMS distribution grid by turning a "reverse angle" on its own experience as a data source for national and international collaborations.

"A major Fermilab contribution will be showing how to extract physics from this complex environment, how to make sense out of LHC," Womersley said. "We're not just knocking on the door asking to be invited to the party. Fermilab knows how to do all this." □

Fermilab Activity on the LHC



US/CMS Roundup

US/CMS Project Manager Dan Green says his role is to "find good people and turn them loose. I run interference so they can do useful work. And they're cooking away." Some high points:

Computing: Lothar Bauerdick, recently of DESY, is the new Level I manager for the US/CMS software and computing project building the regional computing hub at Fermilab. "We're already using fully functional prototypes of the software," he says. The head of the CMS computing group in Fermilab's Computing Division, Vivian O'Dell is now working with a staff of 11 people, and buying computing facilities that she expects eventually to surpass the computing for Run II "simply because the same amount of computing gets cheaper the later you buy it." Fermilab has already simulated more than four million Monte Carlo events for US/CMS.

SiDet: The unique facility is in the early stages of producing silicon strip modules for the CMS tracker outer barrel, and silicon pixel disks for the CMS forward tracking system. The first of two robots will arrive shortly. They will use precision linear encoders and optical pattern recognition to assume and automate some tasks formerly performed by technicians building CDF and DZero detectors. "Aside from the use of the robots, assembling the strip detectors is pretty much the same," reports SiDet associate head Lenny Spiegel. "Pixel detectors, on the other hand, represent a new challenge for SiDet."

Muon chambers: The endcap muon chambers, or cathode strip chamber (CSC) system being machined and assembled at Lab 8 and MP9, is the largest of its kind anywhere by a factor of 10. More than 20 chambers have been built, including prototypes for the Russian and Chinese chambers. In all, nearly 500 chambers will be built with six layers in each chamber.

Pixels: A revised design for the forward tracker has three disks at each end, for a total of 43 million pixels. Arranged like turbine blades on the disk, each individual detector is 8 mm x 10.45 mm, with a 52x53 pixel array, and is equivalent to 380K transistors. Beam tests will establish the best overlap angle for charge sharing, producing a resolution up to 15 microns (millionths of a meter). Among these detectors' responsibilities: putting a time stamp on the bunch crossings, 25 nanoseconds (billionths of a second) apart.

New chips: Ray Yarema's microelectronics group is developing two radiation-hard chips for HCAL, one (QIE) based on earlier chips for CDF and KTeV and the other (CCA) an entirely new design. QIE takes signals from photomultiplier tubes and digitizes them over a wide dynamic range at high frequency. CCA takes output data from QIE chips and provides phase adjustment for data, and interfaces to the DAQ system.

—Mike Perricone

**For more information,
see the Fermilab website for US/CMS:**

http://uscms.fnal.gov/

**Also visit the CERN website for CMS:
http://cmsinfo.cern.ch/Welcome.html**

**Real-time webcam from CMS Assembly hall SX5 at CERN:
http://cmseye01.cern.ch/cgi-bin/push.html**

(Remember, the CMS webcam operates on European time)

Moving In for a Closer Look Silicon

by Mike Perricone

One of the smallest sub-assemblies in the revamped 5,000-ton DZero detector crams 800,000 electronic channels into a volume you can wrap your arms around, and it will bring physicists an up-close and personal look at particle collisions unlike anything they've experienced in this detector's history.

Photos by Reidar Hahn

The tracker came gift-wrapped on December 18, when it was installed at the center of the DZero detector by Mike McKenna. "It's the smallest detector subassembly with the largest channel count," said sub-project co-manager Marcel Demarteau.

With the joining of the two half-cylinders of the Central Silicon Detector around the beam pipe at the very heart of DZero, the silicon era came to the huge experimental apparatus. And when Collider Run II of the Tevatron makes its debut in March, this new silicon region will give DZero a state-of-the-art chance at once more making history in the search for the Higgs and other particle discoveries.

Jim Fast prepares the central silicon for transport. The detector wraps around the DZero beam pipe, with a clearance of about 1.8 mm.

"The high resolution offered by silicon will allow us to identify b [bottom] quarks by their decay lifetimes, and the b quark is a strong sign for new physics," said DZero cospokesperson John Womersley. "We will be able to tell whether a particle originated at the collision point, or from a secondary decay. We will now have extremely precise particle tracking, with precise measurements of every charged track."

Without silicon, DZero nevertheless shared in the discovery of the top quark with silicon-equipped CDF in 1995; with silicon added, only 1.8 mm away from the beam pipe, the anticipation for Run II at DZero is tangible.

"Silicon has 10 to 20 times the resolution of other detectors," emphasized Ron Lipton, one of two sub-project managers for building the central detector. "We'll be able to distinguish particles with relatively short lifetimes—especially, telling b and c [charm] quarks from their less-interesting friends. That gives us a tremendous advantage in looking for new physics. Identifying these heavy quarks is crucial to the kind of forefront physics we want to do."

The morning of December 18 was typical of this early and severe winter sweeping across the Illinois plains: gray, windy and frigid, with snow threatening any minute. Lipton, his co-manager Marcel Demarteau and DZero associate upgrade project manager Jon Kotcher supervised moving the 35-pound half-cylinder from SiDet, Fermilab's Silicon Detector Facility, onto a special rolling cart dubbed "the lunar rover" or "baby carriage" and then to the back of a truck for the careful two-mile ride to the detector's assembly building, where it joined the waiting first half-cylinder.

"The cold was more of a problem for the people riding along in the back of an unheated truck," Kotcher said. "When a device is designed to operate at

installation heralds NEW ERA at DZero

around -10 degrees Celsius, a cold winter's day isn't much of a problem."

No problem, that is, unless the unit were to warm up in a moist atmosphere, with moisture condensing inside it. "Purging" the device with dry air averted that threat. But shifting the detector into position by crane only marked the end of the journey, not the end of the process. The entire cylinder plus cables weighs about 70 pounds. Most of the cylinder's weight comes from the cables attached to it; connecting those cables and testing the circuits is in some ways as big a project as building and installing the detector.

"All the components have to work in concert," said Demarteau. "Reading out 800,000 channels isn't peanuts. Essentially, you have to check out every bit of data that comes out of the detector."

During the "10 percent test" at SiDet, it took more than a year to read out 80,000 channels without error during construction. Commissioning is a 100 percent test.

"We'll have to verify that all readout systems work well and reliably before they're connect to each ladder or wedge," said Kotcher.

"We'll connect one at a time, read them out, check them electronically to make sure the channel orders are right, and the noise looks right. It's a major effort to go through each one, to get ready for beam."

When the checking is done, it will mark the completion of a project dating back a decade, when the concept for the Run II detector emerged at about the time Run I began. Along the way, as many as 50 physicists and technicians worked on the central tracker during peak times. In addition to the painstaking work by SiDet technicians, physicists in the DZero collaboration took shifts to help with the testing.

"It's been an intense effort by the collaboration and by the lab as well," said Kotcher. "I think you could rightly call this a technical tour de force." □

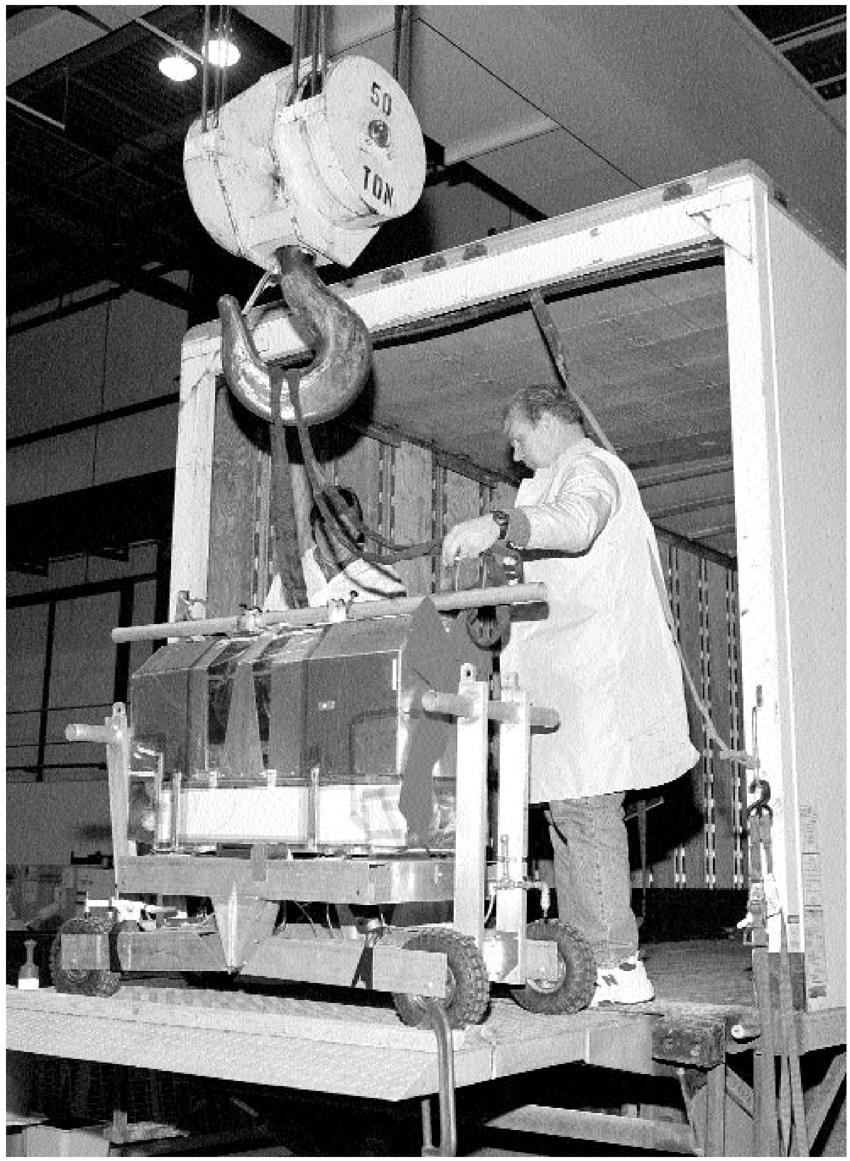


Photo by Reidar Hahn

Dave Butler (left) and Delmar Miller unload the central silicon detector onto the crane at DZero. The detector is mounted on a carrier called the "baby carriage" or the "lunar rover."

For more information on the DZero detector and silicon upgrades, see:

http://d0server1.fnal.gov/projects/Silicon/www/silicon.html

Protons Against Cancer

10 years of therapy with an

by Kurt Riesselmann

In contrast to biology and medicine, physics is not usually considered one of the life sciences. Yet basic research in physics makes critical, though often unsung, contributions to saving lives.

Fermilab's role in cancer treatment is a case in point.

Last month the Loma Linda Proton Treatment Center celebrated 10 years of treating cancer patients using particle beams from a compact proton accelerator completely designed and built at Fermilab. In the decade of the Center's operation, accelerator technology from Fermilab has provided cancer therapy at Loma Linda for more than 6000 patients from around the world.

The Loma Linda accelerator, shown here in 1989 during its assembly at Fermilab, consists of an injector (straight section with a 180-degree bend at the end) and a 20-foot-diameter ring. In less than a second, the system accelerates protons to energies between 70 and 250 million electron volts (MeV).

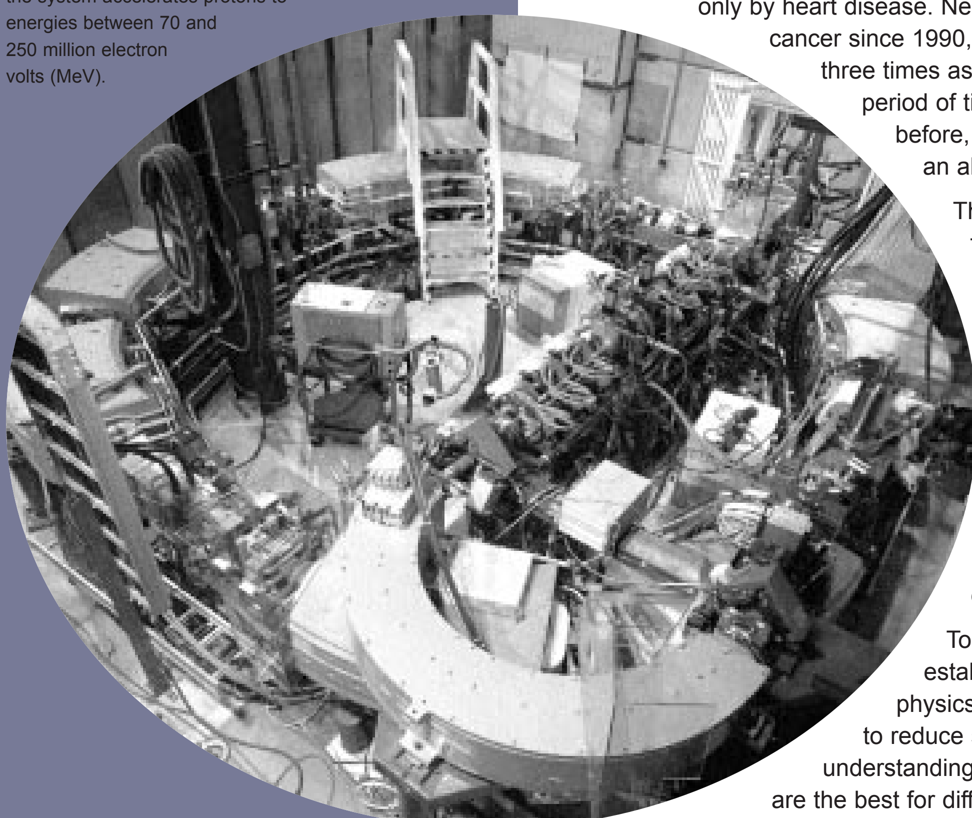


Photo by Fred Ullrich

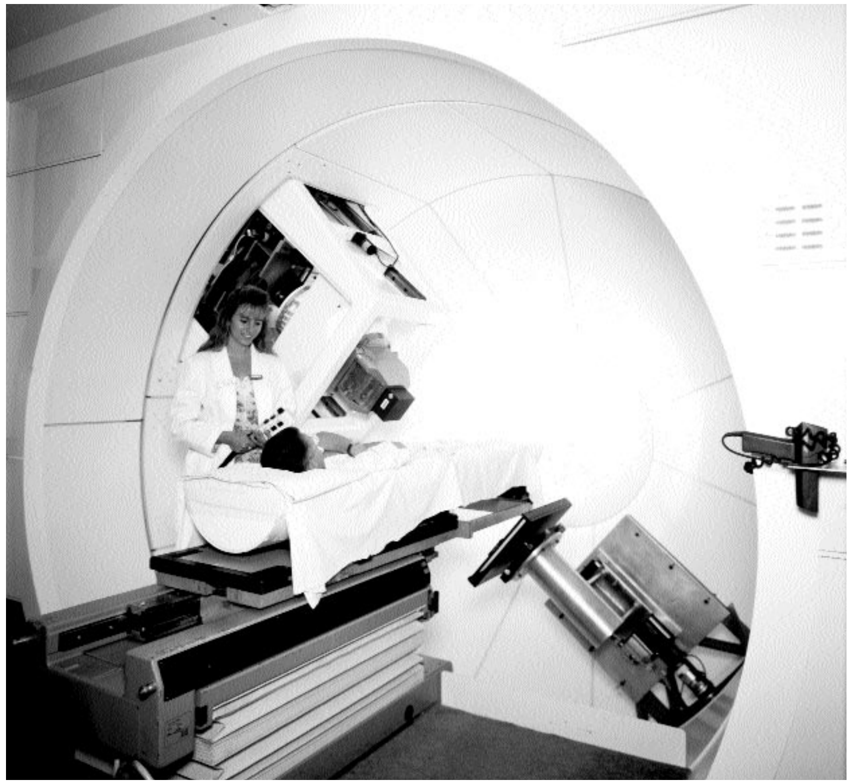
Cancer is the second leading cause of death in the United States, exceeded only by heart disease. Nearly five million lives have been lost to cancer since 1990, and physicians have diagnosed almost three times as many people with cancer during the same period of time. With people living longer than ever before, their chance of developing cancer is at an all-time high.

The good news is that improved techniques for early diagnosis and more effective treatment methods save millions of lives. As alternatives to chemotherapy, hormone treatment and surgery, physicians have worked with physicists to develop therapies based on the properties of subatomic particles. The use of radioactive seed implants and beams of photons (x-rays), electrons, protons or neutrons have become standard treatments, refined through decades of research and clinical trials.

Today, therapy with particle beams is a well-established medical field, and progress in beam physics and accelerator technology have helped to reduce side effects. Physicians have a much better understanding of what forms and amounts of particles are the best for different types of cancer.

"Improved control of cancer and reduced treatment side effects have now been documented," said James Slater, M.D. and director of the Proton

Loma Linda celebrates accelerator from Fermilab.


Loma Linda Medical Center

At Loma Linda Medical Center, a beam guidance system brings the protons from the accelerator to one of four treatment rooms. The proton treatment is a painless procedure, and less than one percent of all patients experience side effects.

Treatment Center. He welcomed more than 600 patients who had returned to Loma Linda on November 12 for the 10th anniversary celebration. “[Our] proton radiation treatment system has been highly successful, although it is still in its infancy in terms of its ultimate potential.”

In particle beam therapy, physicians treat cancer by directing beams of particles at cancerous cells. Patients are carefully positioned, and a beam is applied to cancerous body tissue for one to three minutes. The beams damage the DNA strands of cells, destroying the cells’ ability to divide and grow. Depending on the type of beam, it either destroys atomic nuclei inside the cells (high energy transfer by neutron beams; patients typically receive 10 to 15 applications) or the beam particles knock electrons off molecules, causing chemical reactions that damage the DNA (low energy transfer by photon, electron or proton beams; typically 30 to 40 applications).

Depending on the size and type of a cancerous tumor, physicians develop an individualized treatment plan for each patient, to minimize damage to healthy cells.

Particle accelerator laboratories have been home to clinical studies on cancer treatment for decades. The first studies involving neutron beams started in 1938, only six years after the discovery of that particle. In 1946, physicist Robert R. Wilson, who later became Fermilab’s first director, published an article on the medical implications of particle beams. He recognized the qualities that made proton beams attractive for medical applications, and, he predicted, “precision exposure of well defined small volumes within the body will soon be feasible.”

Wilson’s optimism sprang from the observation that fast protons deposit only a minimal amount of energy as they traverse a body. As they slow down, the amount of energy they deposit gradually increases. When their speed drops below a certain limit (the “Bragg peak”), the protons suddenly transfer all their remaining energy within less than a centimeter.

By varying the initial energy of the proton beam, radiation oncologists can determine how deep the beam penetrates before depositing most of its energy. Using computer simulations, they can adjust the maximum reach of the protons to within a millimeter, thus sparing all tissue beyond the tumor. This unique capability makes proton beams an excellent choice for treating tumors located next to sensitive organs, brain stems, spinal columns or eye nerves.

A pioneering proton facility to investigate the medical potential of proton beams opened at Lawrence Berkeley Laboratory in 1954. Over decades, physicists operated and optimized their particle sources and beams while physicians studied and developed the best treatment plans for various forms of disease, particularly the treatment of cancerous tumors.

"I want to thank Dr. Slater for giving me a second chance–to have life."

-Jennifer Gardner, cancer patient

It wasn't until the mid-1980s that proton therapy was ready to leave the physics laboratories that had invented it. Slater and fellow physicians at the Loma Linda Medical Center made the decision to build a dedicated proton therapy facility at their hospital, the first proton facility independent of a research laboratory.

Slater called Fermilab.

"What would it take to get Fermilab to build an accelerator for us?" he asked physicist Philip Livdahl, at the time deputy director of Fermilab.

Photo by Reidar Hahn

In February 1989 physicists at Fermilab celebrated the completion of the proton accelerator for the Loma Linda Medical Center. After a press conference, Philip Livdahl (right) and James Slater, physician and director of the new Proton Treatment Center at Loma Linda, pose inside the accelerator ring at Fermilab's Industrial Building.

Livdahl thought the project would be good for both the Medical Center at Loma Linda University and Fermilab. Getting approval, however, was not straight forward.

"I was apprehensive," Livdahl recalled. "We needed to get the required approvals from the laboratory, from Universities Research Association [which operates Fermilab], and from the Department of Energy." A congressional bill requiring laboratories to spin off their technology to industry, passed a year earlier, helped to convince all parties to approve the project.

Slater investigated funding possibilities. With the help of Congressman Jerry Lewis, Loma Linda University obtained federal support for the $80 million proton therapy facility. In 1986, Loma Linda University and Fermilab signed an agreement, and Fermilab took on the task of building the $25 million proton accelerator for the facility. Fermilab could build from experience in operating its own Neutron Therapy Facility. Since 1976, more than 2500 patients have received treatment at the Midwest Institute for Neutron Therapy at Fermilab.

While the Medical Center built the complex to host the accelerator and treatment rooms, Fermilab went to work on the accelerator. Fermilab assigned employees to work part-time on the design and construction of the accelerator at Industrial Center Building 1.

"There were a large number of people involved in the Loma Linda project," said Livdahl, recalling almost 20 names. As the project progressed, however, the need for a full time project leader, arose. Livdahl, close to retirement at Fermilab, decided to take on the job. For the next three years he spent most of his time in Loma Linda.

On December 29, 1988 Fermilab announced the first successful operation of the new proton accelerator, which measures 20 feet in diameter and delivers protons from 70 to 250 million electron volts (MeV). The accelerator features precise energy control and long "beam spill," which make therapy more efficient.

The following year, the accelerator was disassembled, crated and shipped to the new clinical facilities in Loma Linda. After a year of commissioning the machine at its new location, the Center treated the first patient in October 1990.

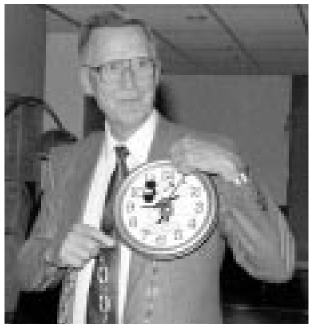
In a poignant twist, Livdahl became a proton therapy patient himself when, in 1991, he was diagnosed with prostate cancer. He was the first Loma Linda prostate cancer patient to be treated by proton therapy alone, without receiving other treatment. Livdahl, now 77 years old, is fully recovered.

"I feel great, despite the fact that I'm no longer employed," Livdahl joked.

Other speakers at the event praised their experience at the Loma Linda Proton Treatment Center, too. They were proof that proton treatment usually creates no side effects.

"What do you do when you're here as a patient?" asked Roy Butler, who received proton treatment at the Loma Linda Medical Center. "You're playing golf. You're hiking. You're playing tennis."

Butler, a 62-year-old chemist, spent three months at Loma Linda. In 1999, he was one of 180,000 men diagnosed with prostate cancer, the second most common cancer among American men. Of the patients treated at the center, about half are men diagnosed with this disease.



Philip Livdahl, with ID 40 one of Fermilab's pioneers, retired as deputy director in 1987. He went on to serve at Loma Linda University as deputy project director for the Loma Linda proton therapy project.

"I hope that all persons at Fermilab who participated in this project feel proud that the facility has reached this milestone and that its promise has been fulfilled," said Livdahl.

James Slater had a key role as well. Patients at the celebration cited the importance of his persistence and dedication in the Proton Treatment Center's success. Jennifer Gardner received proton treatment for two brain tumors that couldn't be removed by surgery.

"I want to thank Dr. Slater for giving me a second chance–to have life," Gardner said. □

Information on the web:

www.llu.edu/proton
adwww.fnal.gov/www/ntf/ntf_home.html

Loma Linda Medical Center

Since 1954, almost 30,000 patients have received proton treatment at about 20 facilities worldwide. A fifth of these patients went to the Loma Linda Proton Treatment Center, which recently celebrated its 10th anniversary. About 600 patients attended the celebration.

Project Leader, Linear Collider R&D Program at Fermilab

Fermilab seeks an experienced scientist to lead the linear collider R&D program at Fermilab. This expanding program is currently pursuing R&D on room-temperature structures for a second generation electron-positron linear collider. Responsibilities will include providing management and technical direction for a program aimed at developing cost effective approaches to an electron-positron linear collider over the next several years, and for coordinating the Fermilab effort both within the U.S. NLC Collaboration and within the larger world effort. The project leader will report to the Associate Director for Accelerators. This position requires previous experience with linear accelerators or high power RF systems, and demonstrated leadership abilities.

Interested parties requiring more information, or applicants for this position, should contact:

Steve Holmes, Associate Director for Accelerators
Fermilab, MS105
P.O. Box 500
Batavia, IL 60510, USA
holmes@fnal.gov
630-840-3211

Applications should include a curriculum vitae, publication list, and the names of three references.

Fermilab is a U.S. Department of Energy Laboratory and is an Equal Opportunity/Affirmative Action Employer M/F/D/V

Associate Scientist, Superconducting Magnet Development at Fermilab

Fermilab's Technical Division has an excellent research position for an Associate Scientist in superconducting magnet development. Fermilab's world-class magnet R&D program is a leader in developing magnet technology for upgrading the Tevatron; for CERN's Large Hadron Collider; and for the particle accelerators of the future.

The successful applicant will play a leading role in magnet design, fabrication and testing as part of an experienced team of physicists, engineers and technicians.

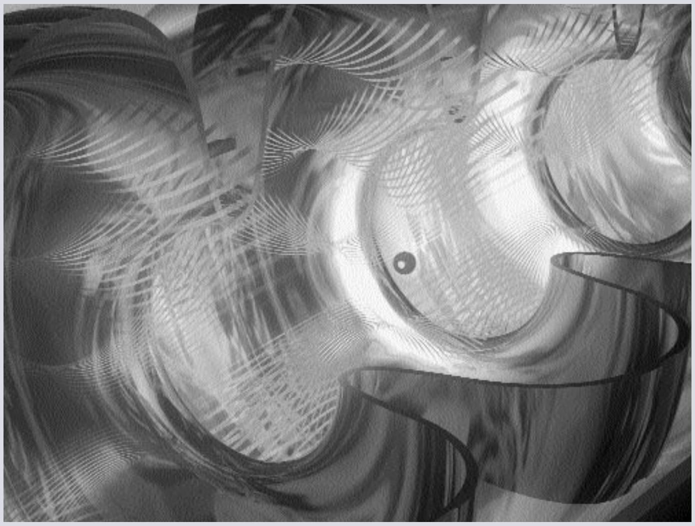
The Associate Scientist position has an initial term of three years with the possibility of growth into a regular research appointment on the Fermilab scientific staff. A Ph.D. or equivalent in physics or engineering is required, and at least two years of experience in experimental high-energy physics, accelerator science or superconducting-magnet or materials technology. The successful applicant must demonstrate a record of accomplishment as evidenced by publications, reports and presentations; and have leadership potential and good English communication skills.

Please forward a CV and three letters of recommendation to

Dr. Peter Limon, Fermilab
P.O. Box 500, MS 316
Batavia, IL 60510-0500
pjlimon@fnal.gov

Fermilab is a U.S. Department of Energy Laboratory and is an Equal Opportunity/Affirmative Action Employer M/F/D/V

TESLA Colloquium at DESY



A Colloquium on the Scientific Perspectives and Realization of TESLA, the 500-800 GeV Electron-Positron Linear Collider with an X-Ray Free Electron Laser Laboratory will be held March 23-24, 2001 at DESY in Hamburg, Germany. The institutes which have contributed in an international effort to the Technical Design Report will present the prospects of TESLA for particle physics and science with X-Ray Free Electron Lasers as well as its technical realization.

On Friday 23 March the program will start with plenary talks on the status and perspectives of particle physics and of research with photons, followed by presentations of the technical aspects of TESLA. On Saturday morning, the multiple aspects of the X-Ray FEL and TESLA's potential for particle physics will be presented. Further information is available at http://www.desy.de/tesla_colloquium

CALENDAR

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

FERMILAB INTERNATIONAL FILM SOCIETY PRESENTS:

January 26
Killer's Kiss
USA (1955), 67 min., Dir: Stanley Kubrick

Stanley Kubrick's first "official" feature, a stylish film noir thriller, involves the troubles of a struggling New York boxer protecting a nightclub dancer from her gangster boss.

February 9
After Hours
USA (1995), 96 min. Dir: Martin Scorsese

In this brilliant, paranoid comedy, a man (Griffin Dunne) stranded in SoHo with no money after an aborted date experiences an increasingly bizarre series of misadventures in his attempts to return home.

All shows are Friday nights at 8 p.m., in Wilson Hall's Ramsey Auditorium. Tickets are $4 for adults and $1 for children (under 12) and are sold only at the door.

ONGOING

■ Ask a Scientist: Fermilab scientists are available to answer your questions in the Wilson Hall cafeteria on Sundays from 1:30 p.m. to 3:00 p.m. Bring your family, friends and curiosity.

PHYSICS FOR EVERYONE

A Brown Bag Seminar Series

A series of seminars to make the wonderful, exotic world of particle physics more accessible to everyone. Noon to 1:00pm, 1 West. Next presentation Tuesday, February 6: The DZero Experiment Speaker: Don Lincoln, Particle Physics Division.

NALWO

■ Free English classes in the Users' Center for FNAL guests, visitors and their spouses. The schedule is: Monday and Friday, 9:30 a.m. – 11:00 a.m. Separate classes for both beginners and advanced students.

■ NALWO (National Accelerator Laboratory Women's Organization) and the Housing Office cordially invite Fermilab women, guests, and visitors to a Coffee Morning at Aspen East, Thurs. January 25, 2001 from 10:30am - noon. Please join us for casual conversation and light refreshment; children most welcome!

DANCING

■ International folk dancing, Thursdays, 7:30-10 p.m., Village Barn, newcomers always welcome. Scottish country dancing, Tuesdays, 7:30 – 10 p.m., Village Barn, newcomers always welcome. For information on either dancing group, call Mady, (630) 584-0825 or Doug, x8194, or e-mail folkdance@fnal.gov.

■ The Fermilab Barn Dance series, featuring traditional square and contra dances, takes place every second Sunday evening at 6:30 p.m., Village Barn. Come with or without partner and family. Admission: $5 for adults, $2 age 12-18, free for under 12. For information contact Dave Harding, x2971 or Lynn Garren, x2061, or check the webpage at www.fnal.gov/orgs/folkclub/.

■ The Barn Dance series presents an afternoon barn dance on Sunday, January 14 from 2 to 5 p.m. Music by Band Name Pending, with calling by Paul Ford. Admission is $5 for adults, $2 for age 12-18, and free for under 12 years old.

MILESTONES

RETIRING

■ Fred Walters, ED 1626, BD-AS Cryogenic Systems, effective January 31.

■ William P. Lidinsky, ID 9445 CD-Data Communications, last day was January 4.

■ Richard Worland, ID 1952, PPD-Engineering and Tech Teams, effective February 28.

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

LUNCH
WEDNESDAY, JANUARY 24

Closed

DINNER
THURSDAY, JANUARY 25

Closed

LUNCH
WEDNESDAY, JANUARY 31

Trout with Sage and Almonds
Lemon Rice
Vegetable of the Season
Orange Yogurt Cake

DINNER
THURSDAY, FEBRUARY 1

Coquille St. Jacques
Navarin of Lamb
Basmati Rice
Caesar Salad
Lace Cup with Apricot Mousse

F E R M I N E W S

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The deadline for the Friday, February 2, 2001, issue is Tuesday, January 9, 2001. Please send classified ads 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

CARS FOR SALE

■ ’97 Hyundai Tiburon FX, black, 58K miles, 5-spd stick, sun roof, leather, fully-equipped (CD, A/C, cruise, etc.). Exc. cond. asking $9,000 o.b.o., must sell. Call Marco Mambelli, x2207 or marcom@fnal.gov.

■ ’91 Ford F-150 pickup, 6-cylinder, auto, A/C, AM/FM, long bed with tonneau cover, $3,995. Phone x3697 or 630-668-8087.

■ ’90 Toyota Corolla 4 cyl, auto, 159K, runs good well maintained $900 firm. Contact Roger at x8257 or rkramme@fnal.gov.

■ ’89 Toyota Corolla 130k, runs great, some rust, $1800 o.b.o call x4898 or mostafa@fnal.gov

■ ’89 Pontiac Sunbird, automatic, air, tilt, cruise, AM/FM Cassette, black with tan interior. Good in cold and snow. 93K miles. Regular maintenance. A few minor imperfections, but a good daily driver. Mother-in-Law’s car (aka Sweet Little Old Lady). $1,500. Call Bob at x2905, or kessler@fnal.gov.

WANTED

■ The Wednesday night league, needs a bowler. 10 weeks remaining, Call Dale Miller X-3875 or dale@fnal.gov. End those winter blues.

FOR RENT

■ 2 bedroom house in lovely, secluded area. Wayne, Ill.,15 minutes North of Fermilab. Suitable for 1 or 2 adults. $895/mo plus utilities. Maureen 630-377-7300.

■ Spacious bedroom on independent floor; use of kitchen and laundry; big living room never accessed by us; garage; in quiet residential Naperville. 10 miles from Lab $395/mo. silvia@fnal.gov

FOR SALE

■ 3 br, 2 ba 2 story house in St.Charles, 9 min to FNAL, quiet neighborhood/desired schools, fireplace in large family room with sliding glass door to 26′x17′ deck overlooking nice sized fenced yard, oak kitchen, all appliances stay. Contact J.Bowgren 630-377-6100 or leave message at x5241.

■ 2-story Cape Cod on the west side of Aurora. 3-4 bedrooms, 1.5 baths, fenced yard with deck and gazebo; new roof and siding. Close to historic district, grade school, high school and university. Lots of updating done. Asking $141,900. Call Noell ext.6534 or e-mail at nhealy@fnal.gov

■ Solid Cherry dinning room set - Drop-leaf table w/2 leafs - four chairs and hutch. Excellent condition $800. Call Jerri @ X6363 or 630/897-2820

■ Couch, 2 swivel chairs, and end table, $100/set; doghouse, $45; lg dog carrier, $20; Weber charcoal grill, $15, martial arts gear. Call Lucy x2241, or brega@fnal.gov.

■ Scanner, HP 3300C. Like new. $40 markl@fnal.gov, x4776 Mark

■ Wilson X-31, Golf Club Set, 1970, 2 iron - SW; 1-3-4 woods. Reg. length, stiff shaft, excellent condition. $500 firm. Call John x2927, home (630) 482-2083, sollo@fnal.gov.

■ Moving sale: TV $80, VCR $ 40, audio $40, blender $10, etc. call x4898 or mostafa@fnal.gov

■ Kodak Pageant 16mm sound movie projector, like new, $50. Pyle hatchback speaker box, 2-12″ $50. Hamilton gas clothes dryer, very old but still work well, $20. Bicycles, 24″ 10 speed, 1 boys and 1 girls, with generator lighting sets, $10 each. Crosley console radio-phono, built 1946, AM-FM-SW, plays 78rpm records, everything works, cabinet fair, $50 (very early set with FM). Call Ken 2083, sievert@fnal.gov.

SPECIAL INVITATION

■ Fermilab Recreation Department invites you to attend “Tony ‘n’ Tina’s Wedding,” Feb. 24, 2001 with bus service from Fermilab. Deadline to purchase tickets to this event is January 19. For more information look on our website at http://fnalpubs.fnal.gov/benedept/recreation/announce.html

TRIO SETTECENTO

8 PM, Saturday, Jan. 27, 2001, Ramsey Auditorium, Wilson Hall, $18 ($9 ages 18 and under)

Violinist Rachel Barton is widely recognized as one of the most gifted performers of her generation. She has appeared as soloist with many prestigious ensembles, including the Chicago Symphony Orchestra, the St. Louis Symphony, the Montreal Symphony, the Vienna Symphony, the Belgian National Orchestra and the Budapest Symphony, working with such eminent conductors as Semyon Bychov, Neeme Jarvi, Erich Leinsdorf and Zubin Mehta. As a recitalist, she has been heard at the Ravinia Festival and in live broadcasts on WFMT radio.

John Mark Rozendaal performs on the baroque ‘cello and the viola da gamba, and is artistic director of the critically acclaimed Chicago Baroque Ensemble. David Schrader has achieved international renown as a keyboard soloist performing on the harpsichord, organ, fortepiano, clavichord and modern piano.

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