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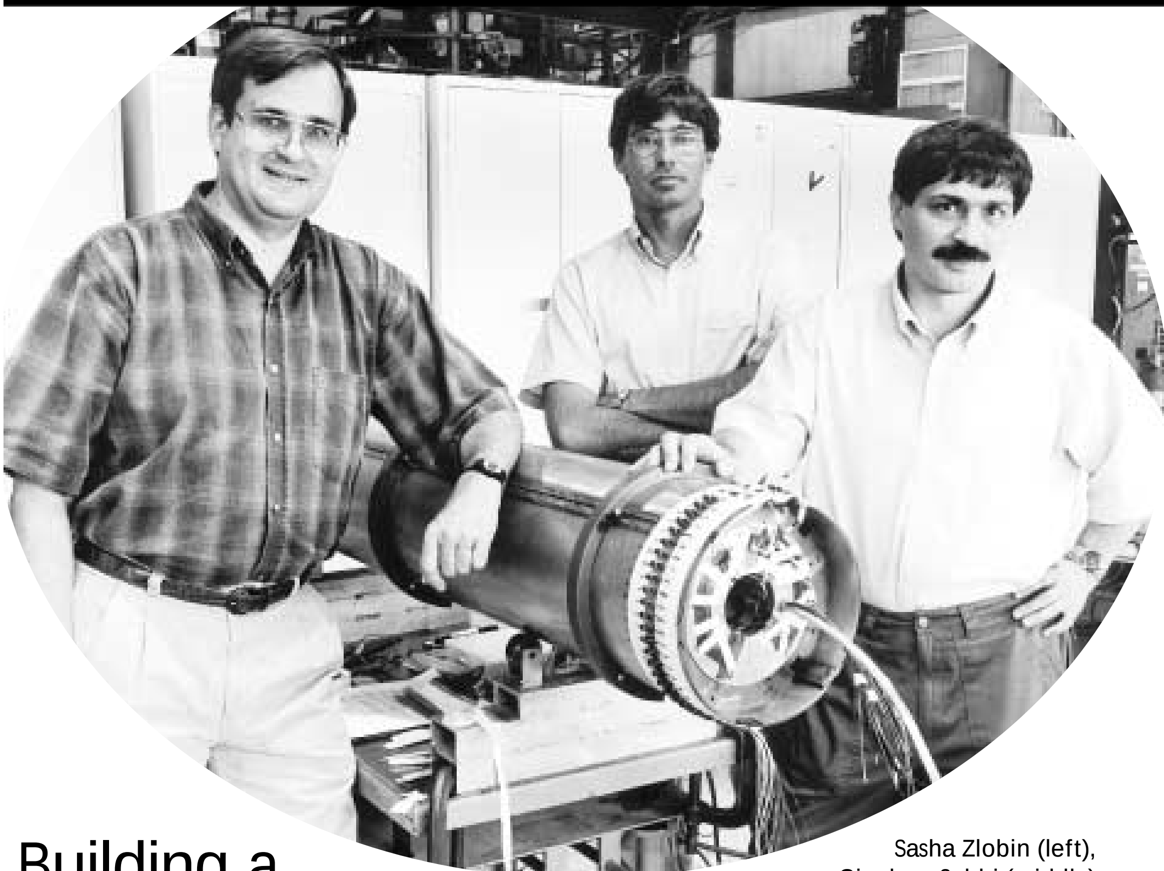

Sasha Zlobin (left), Gianluca Sabbi (middle) and Sandor Feher stand with a test magnet.

Building a Magnet Development 'Dream Team'

Fermilab's Technical Support Section builds a team of engineers and physicists to advance the science of superconducting magnet technology

by Donald Sena, Office of Public Affairs

To build a program, first build a team. Whether it's Olympic basketball, heart surgery or a symphony orchestra, achieving excellence depends on putting the right players together. The field of superconducting magnet technology is no different.

In the past year, Fermi National Accelerator Laboratory has hired six scientists, with plans to add more, in an effort to build a superconducting "dream team" and revitalize the magnet development program.

Magnets are at the heart of Fermilab's research tools, guiding the particles that speed around the accelerator. Building an advanced accelerator to take high-energy physics to a new frontier requires innovative thinking and consistent progress in magnet technology. Physicist Peter Limon, head of the Technical Support Section, said Fermilab was once the home of cutting-edge superconducting magnet development. That capability has waned in the last few

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INSIDE

Pat Colestock, here shown running past the rf building, explains proton acceleration in everyday language.

See page 4.

Dr. Lane Goes to Rotary

Rotary's mission is service. NSF's is science. Can the two missions mesh?

By Judy Jackson,
Office of Public Affairs

"Keep it short."

So advised one of 100-plus scientists who responded to National Science Foundation Director Neal Lane's plea for help in preparing for a speech to the Rotary Club of Arlington, Virginia on July 25. In a column in the May / June issue of *The American Scientist*, Lane described an invitation to speak before the club as an opportunity to practice what he has been preaching to fellow scientists for several months—and as a source of trepidation.

Beginning with a keynote address at the annual meeting of the American Association for the Advancement of Science in Baltimore in February, Lane has been exhorting U.S. scientists to recognize that "the good and great and grand contributions that science and technology have made to America's wealth and welfare have been little understood outside the science community." He has urged them to become "civic scientists," to spread the word about the value of science and engage in dialogue with the rest of the world.

"More than ever," Lane wrote in his *American Scientist* column, "you are needed outside the walls of your laboratories and the gates of your universities." When the invitation to speak at Rotary arrived, Lane "quickly realized that the challenge to 'practice what you preach' was upon me. I was both delighted and intimidated by the invitation. For many years, I, like all of you, presented papers to my peers at science conferences and seminars... But suddenly there was a completely different opportunity—a chance to speak to a group of people who were not in the science or science-policy business at all."

Lane declared in his column that he considered the Rotary speech one of his most important engagements and asked for advice "from any of you who would be good enough to share your experience."

Advice poured in. Besides the call for brevity, correspondents advised Lane not to talk down to his audience, not to act elitist, and to try to connect what he was saying to what Rotarians do. A lone voice advised him not to go, saying "You won't have a good time. Rotarians are grumpy."

The Arlington Rotarians must have been in a good mood. They gave Lane's speech a warm reception, "laughed in the right places and asked good questions," said NSF spokesperson Patricia Garfinkel, who was in the audience. Lane told the Rotarians that he admired the Rotarians' philosophy and purpose and told them, "I want to learn

Please advise...

The Fermilab Speakers' Bureau is one way for Fermilab scientists and technical professional to reach out in their communities. To help make the Bureau more effective, *FermiNews* invit readers to share their advi and experiences for the benefit of colleagues who may have some of Neal Lane's trepidation about speaking with the lights on. Write to *FermiNews* at ferminews@fnal.gov. *FermiNews* will publish th community's collective wisdom and pass it on to future speakers.

National Science Foundation Director Dr. Neal Lane spoke to the Council of Presidents of the Universities Research Association in January, 1996, where he focused on many of the issues he addressed in his speech to the Rotary Club.

> **"…this disconnect between the public being interested in science yet feeling that their knowledge is very limited should give all of us something to ponder."**

about how, as Rotarians, you promote the sense of service that is the hallmark of your membership."

"I am a physicist," Lane told his listeners, "and I have been told that physicists are a bit odd. About a year ago the wonderfully witty journalist with the Washington Post, Joel Achenbach, wrote a tongue-in-cheek description of a physics conference. He said, 'When you picture a physicist, you should imagine a person in darkness, holding a remote-control device, lecturing...' Frankly, I don't see what is so strange about that! It's how I grew up! I hope I can offer some thoughts today with the lights on and the language accessible."

With the lights on, he told them that "At NSF, all our surveys show that the public is interested in science and believe science is important, but nonetheless those surveyed also believe they have very limited scientific understanding. When I mention this to scientific audiences, I suggest to them that the survey results perhaps tell us more about the science community than about the American public. I have pointed out that this disconnect between the public being interested in science yet feeling that their knowledge is very limited should give all of us something to ponder."

Lane reminded the Rotarians of the contributions of science and technology to society, citing a rate of return of 20 to 30 percent on U.S. investment in scientific research. "Despite this," he said, "science by itself cannot answer the hardest questions. The most fundamental problems in all societies are human problems, and they are similar on the local and global scale. How can we nurture and educate all children, inhibit violence, provide meaningful work for all? Science can help solve these and myriad others that exist. But science is only one of numerous components that are needed."

Lane told Rotarians he is asking scientists and engineers "to actively reach out in their communities and engage in a genuine dialogue. I am asking you to reach out to scientists and technical professionals as you have done to me, and share with them the problems and issues of concern in this community." ■

This Week: rf

It's what makes the protons go 'round. The latest in a series explaining particle physics in everyday language.

Author Pat Colestock is shown here accelerating past the rf building at FZero in the proton direction. He accelerates 10^{27} protons around the ring daily at considerably higher efficiency and lower cost than is achieved in the Tevatron. However, at his mean energy level, the probability of a collision is remote.

Photo by Jenny Mullins

by Pat Colestock, Accelerator Division

All particle accelerators start from the principle that electrically charged objects experience a force in an electric field. An electric field exerts a force on a charged particle such as a proton, giving it a boost in energy. Electric fields can be steady, like those produced by a battery, or they can oscillate, like the alternating currents that power the electrical machinery around us. Electric currents at higher frequencies generate radio or television waves, as well as microwaves like those that heat food in a microwave oven.

A major accelerator breakthrough in the 1920s came with the introduction of alternating electric fields in the ***r***adio ***f***requency range, making possible the first high-energy circular accelerators. Since then, rf power has been at the heart of virtually every accelerator.

We can produce an electric field simply by connecting a battery to two electrodes. Charged particles between the electrodes will accelerate to the voltage of the battery; a 1.5 volt battery producing 1.5 electron-volts of energy, and so on. However, an accelerator based on this concept would be prohibitively large and costly. For instance, the Tevatron would require nearly a trillion batteries, at a cost approaching the national debt. Instead, accelerator physicists conceived the clever idea of making charged particles travel in a circle, experiencing a relatively small electric field at one point in the circle many times over, receiving a boost in energy with each revolution.

However, we can't use a steady electric field to accelerate the particles in a circular accelerator, because a steady electric field would necessarily point in the wrong direction for part of the particles' circuit—producing no net acceleration. Instead, accelerators use an alternating electric field, with oscillations precisely timed to the revolution of the particles around the ring. Thus, each particle feels only an electric field pointing in the right direction for acceleration.

As a consequence of this alternating field approach, only part of the circumference of the ring at any point in time has the electric field pointing in the right direction. This is why we must accelerate protons not in continuous streams but in bunches, and we must precisely time the bunches to be in phase with the oscillating electric field.

In the Tevatron and Main Ring, the rf systems are all located at the FZero service building. It houses the radio transmitters that produce the rf power that we apply to the beam. To produce the highest possible electric fields for a given available rf power, we use a highly evolved device called an rf cavity—typically a copper, barrel-shaped box with dimensions precisely chosen to exactly confine a radio wave between its walls. As the radio waves bounce back and forth between the walls of the box, the electric fields build up with each reflection, producing voltages up to 120 KV (120 thousand volts) across a short space that intersects the beam particles. Typically we use a series of these cavities, adjusting the timing of the oscillating electric fields in each cavity to coincide with the arrival of a proton bunch, producing an effective electric field wave traveling along with the protons, as surfers ride a wave.

We use a complex network of signal processing to maintain precise timing between the arrival of the beam and the cavity electric fields. Antennas installed near the passing beam sense the location of the protons, sending signals to adjust the timing of rf oscillations in the cavities. Such feedback loops, essential to every rf system, ensure the required precision for acceleration in the Tevatron. Much of the complex nest of equipment that confronts a visitor to the rf building belongs to a series of interrelated feedback loops for the rf systems.

In the future, pushing the energy frontier of high-energy physics will require the development of new methods to generate intense electric fields, to achieve higher energies with more compact, less power-consuming devices. Research on these new ideas has begun at Fermilab, and elsewhere, in the hope that at least one of them will someday usher in a new age in particle acceleration. ■

Profiles
PARTICLE PHYSICS

Chuck Andrle

Department Head
Equipment Support

Employee I.D. #628

"Our part maybe is not seen 'up front' by a lot of people, but it's nice to know that you've played a small part in the discovery of these particles."

by Leila Belkora,
Office of Public Affairs

Photos by Fred Ullrich

Chuck Andrle likes the fact that everybody's electronic equipment breaks down eventually—that way, he gets to interact with a large cross-section of Fermilab users and employees. "Sooner or later, they're going to come in," says the Department Head of Equipment Support in the Computing Division. "That's the nice thing about it, you get to meet all these people. You develop friendships, sometimes, as the experiments are very long, and people stay for a while. I've met an awful lot of nice people here," he says.

Andrle has been befriending Fermilab coworkers and experimenters for 27 years. He came from Argonne National Laboratory, where he had been chief technician for the Zero Gradient Synchrotron. He joined Fermilab as an electronics technician, working with Art Neubauer and for Hank Hinterberger to establish an instrument repair workshop. As Fermilab grew, his duties changed from technical to administrative. He now supervises the repair of oscilloscopes, power supplies, and "high-energy physics type modules" with names like NIM and CAMAC.

Some of those oscilloscopes and modules sit on shelves in the Feynman Computing Center, down the hall from Andrle's office. "This is not the whole thing, obviously, there's something like 50,000 pieces in the pool. I think I'm right in saying that the point of it is to keep 90 percent of it in use, and about 10 to 15 percent here for exchange purposes," says Andrle. To maintain all the equipment, Andrle works closely with Adam Walters, who is both Equipment Manager for the Computing Division and Andrle's second-in-command as Associate Department Head.

Fermilab technicians can repair most of the equipment on site, says Andrle, and they often train with electronics manufacturers like Tektronix, whose products are in wide use around the Lab. However, they occasionally face a problem with an instrument they've never seen before, like a theodolite—a type of telescope—that the surveying group once asked Andrle's group to look at. It's obvious that this is just the kind of challenge Andrle relishes. "That's the whole thing about instrument repair. That's why I liked it so much, that's why the technicians are into it. The point is that every instrument is a challenge. You have to be like a detective."

Vicky White, Deputy Head of the Computing Division, says Andrle is "very much a team player." Andrle explains why he feels he contributes to Fermilab's mission this way: "Our part maybe is not seen 'up front' by a lot of people, but it's nice to know that you've played a small part in the discovery of these particles. The physicists are the ones who really make the discoveries, and our job is to help them. And when they do make these discoveries and it's in the paper, it's kinda nice to say, "Well, I work at Fermilab!" It rubs off on you even though you're not at the experiment when the particle was discovered."

Andrle will retire on September 20, shortly after his 63rd birthday. He and his wife are planning to stay in the area, as they are both "heavily involved" in their church. Andrle says they may travel, perhaps to Italy which they visited earlier this year. Andrle acknowledges it will be hard, after all these years, to leave the Lab. "I'm used to coming in and seeing people that I've seen all my life, and you take that for granted. You don't call them a family, but they really are, these people… We'll see." ■

‘Dream Team’

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years, however, as a result of the demise of the Superconducting Super Collider. Fermilab transferred magnet research and development to the Texas facility at the beginning of this decade, with the expectation that the SSC would carry it further.

“When the SSC collapsed, it took magnet development with it, and the U.S. was left without a program. So, the idea is to restart that program,” said Limon.

The first order of business is to recruit the talent, and—just as a basketball team drafts the best athletes it can get—Limon wanted world-class players to complement the veterans already here. He’s hired an electromagnetic field expert from Italy, a Chinese heat transfer specialist, a Hungarian physicist and even an engineering phenom from Naperville, IL—all of whom are among the newer members of the program. The strong international flavor of the group illustrates the present state of the field, according to Limon.

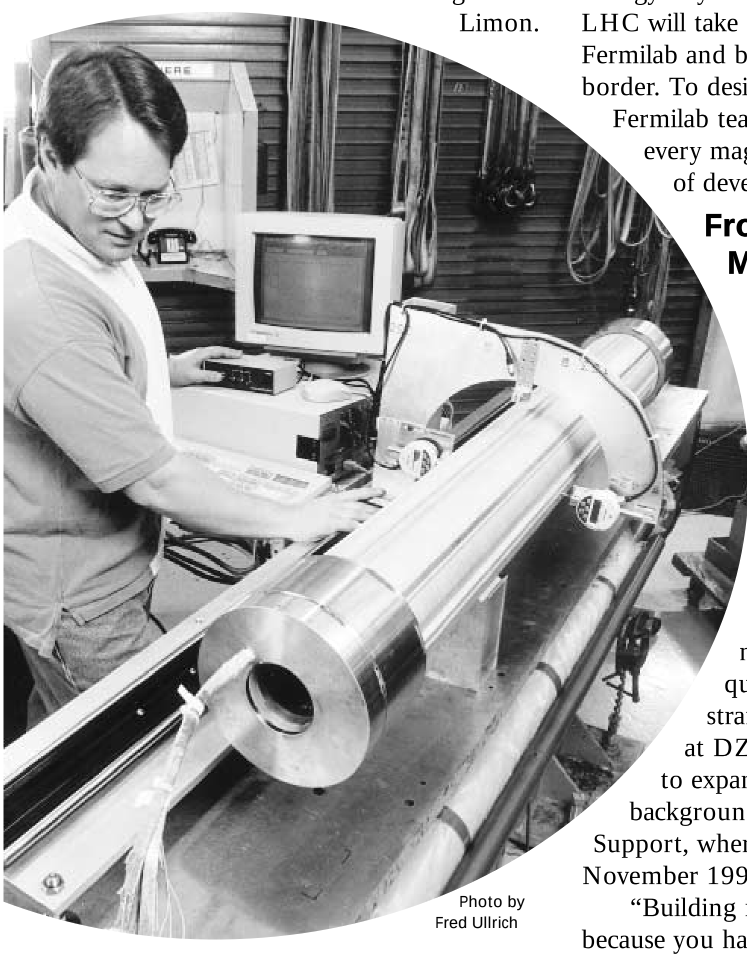

Photo by Fred Ullrich

Don Mitchell, an engineer in Technical Support, uses a magnet measuring device that he invented for work on the LHC project.

Of more than 20 people who applied for the electromagnetic field designer position, fewer than a handful were born and educated in the United States.

“The people who are doing the specialized studies—like electromagnetic calculations or studying to build superconducting magnets as a career—aren’t being trained in the U.S. for the most part,” said Limon.

The Tech Support leader also said that the newer members of the program will join some of Fermilab’s older guard, blending the younger talent with the deep experience and expertise already at Laboratory. Technical Support managers have already reassigned many engineers and scientists who had been working on other projects.

“We are actively redirecting them to work on these superconducting magnet issues,” said Limon.

Fermilab managers said they plan to design, test and build interaction region (IR) quadrupole magnets for the Large Hadron Collider (LHC), a new accelerator planned for CERN, the European Laboratory for High-Energy Physics. When it begins operating, the LHC will take the energy frontier away from Fermilab and bring it to the Swiss–French border. To design the magnets, the new Fermilab team is taking a fresh look at nearly every magnet component and every stage of development.

From Detector to Magnets

Physicist Sandor Feher explains passionately the goal of designing a magnet with a higher field—essentially more strength to control the particles. In a breath, he reviews nearly all the essential factors of developing a successful IR quadrupole, including the analysis of stress on the coils, the ability to understand magnetic fields, cryogenics and quench protection. Feher—no stranger to Fermilab, having worked at DZero for six years—said the desire to expand and challenge his physics background attracted him to Technical Support, where he transferred in November 1995.

“Building magnets is a real challenge, because you have to integrate at least three different aspects of your general physics knowledge: mechanical ... electromagnetism and cryogenics,” said Feher.

The physicist from Hungary added that the assemblage of talent in specific technologies is

Super or Not?

There are essentially two types of magnets used in an accelerator like the Tevatron or the LHC. A dipole generates a magnetic field that bends the path of the particles as they travel around the ring. A quadrupole focuses the particles into a narrow beam, countering their tendency to spread out as they travel around the ring. Standard accelerator magnets, such as those in the Main Ring or Main Injector, are typically made of iron and copper. As electricity passes through the coils to generate the magnetic field, the electrons face some resistance, which generates heat that must be carried away by water.

The coils of superconducting magnets use a special material called niobium titanium that, when cooled by liquid helium to about –452 degrees Fahrenheit, lets electricity flow through the coils with no resistance, allowing particles to reach higher energies and use less electrical power.

Quenching

A quench occurs when a piece of the superconductor of a magnet heats up and changes from a superconducting state to a “normal” state.

crucial for building such a complicated device, echoing many of his colleagues' words about the need for a team approach.

Engineering Mechanics

One floor above Feher, Don Mitchell is attacking the coil stress issue mentioned by his colleague. Mitchell's work is familiar around the Lab, as the engineer helped build various parts of CDF and KTeV before coming to Technical Support in April 1996. Mitchell, a Naperville native, is studying the mechanics of a superconducting magnet, specifically looking at how components hold together under temperature extremes.

As current courses through the magnet, its coils tend to move, generating heat, leading to a possible quench. Compressing the coils into aluminum collars keeps them from moving. However, as liquid helium flows through a superconducting magnet to keep it cool, the components contract due to the cold. As a result, magnet specialists must know the exact size of the collars and coils to gauge the perfect amount of stress to place on the components.

"Basically, I am an accountant right now, trying to meticulously understand the size of everything," Mitchell said. "We're trying to get a real good understanding of how much pressure we're putting on the coils."

Too little pressure may result in quenches, but too much pressure could cause short circuits within the magnet. Mitchell said engineers performed similar studies in the past, but their manual measuring techniques were not accurate nor efficient. Mitchell recently designed and built a device and accompanying computer program that greatly increases measuring capabilities. This magnet measuring device—Mitchell agrees it needs a better name—has helped in the study of the stress levels; measurements are now accurate to within 0.15 of a millimeter, compared with plus or minus two millimeters by hand. Mitchell is the first to say the work he is doing is not revolutionary, but an improvement over past methods.

"These are iterations of what's been done in the past...so, we're not doing anything brand new, we're just trying to do it better."

Magnetic Fields Forever

As Mitchell toils with the mechanics of the coils, Gianluca Sabbi concentrates on their output. The Italian physicist is performing magnetic field modeling for the IR quadrupole, calculating the field generated by the coils, the field quality, the manufacturing tolerances, the design of magnet parts and how best to correct errors.

Sabbi said the ability to push his knowledge of magnets and fields brought him to Fermilab. Although he has been at the Lab only since January, he said he feels the history of magnet technology here.

"Our glory days in the superconducting magnet business were 1974 - 1986, when names like John Carson, Helen Edwards, Dick Lundy, Paul Mantsch, Alvin Tollestrup and Rich Orr were writ large in magnet history," said Director John Peoples.

Sabbi added that there are not many places in the world where magnets are designed, built, tested and then installed in a physics machine. At CERN, scientists and engineers give much of the magnet development work to industry, and other places like universities rarely get to make the final step of installing the finished product.

"Here, you have the opportunity of going through the whole chain," he said.

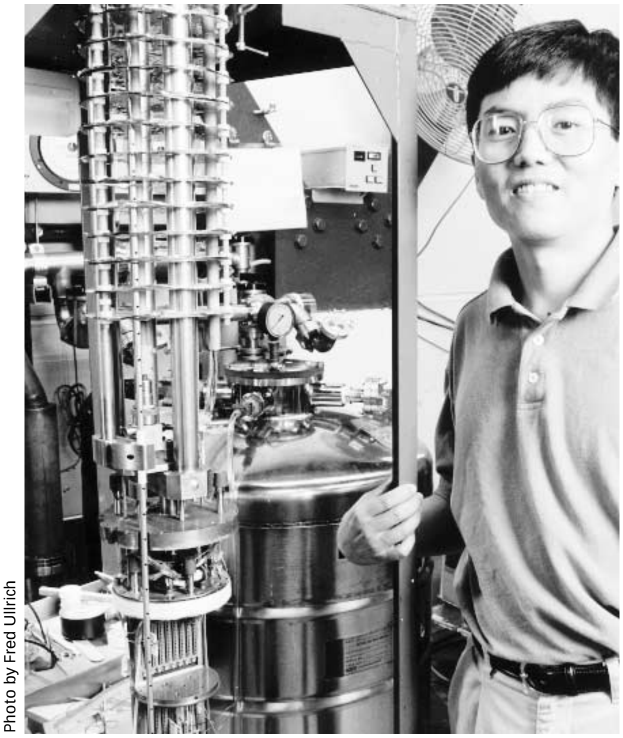

Photo by Fred Ullrich

Yuenian Huang, a heat transfer expert in the Technical Support Section, stands with a liquid helium test station.

Keeping Cool

Focusing beams in accelerator interaction regions brings with it a challenge: how to deal with heat produced in magnets by the particles flying off from collisions. Heat causes resistance and can lead to a quench.

Yuenian Huang came to Fermilab last year to take the heat off everyone worried about this problem. His job is to transfer heat away from the magnet coils to keep the current flowing properly. The heat transfer expert's main weapon in this battle is liquid helium. The superconducting magnets in the Tevatron presently run at about 4.4 degrees Kelvin, but the magnet team wants to run LHC magnets at 1.8 Kelvin, to allow for a higher field and particles with a higher energy. However, helium's properties change when its temperature drops below 2.17 Kelvin. At this point, the helium takes on superfluid properties, allowing it to flow nearly frictionless in tiny channels. Huang wants to use this property to drag heat away from the coils as efficiently as possible.

Presently, Huang is building a computer model to study temperature distribution in the magnets. Later, he expects to conduct experiments on a magnet model to better understand

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Photo by Fred Ullrich

Sasha Zlobin, a guest scientist from Russia, says the combination of "fresh new power" and Technical Support veterans should make for a successful magnet program at Fermilab.

'Dream Team'

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the properties and confirm or adjust his computer calculations.

It's just these thermal properties that interest Sasha Zlobin, a guest scientist from the Institute of High Energy Physics in Russia. Zlobin is participating in all aspects of the IR quadrupole's development, recently focusing on quench protection. Quench protection devices make it possible to detect a quench in the coils and shut down the power supply in milliseconds—at the same time weeding out false alarms.

Passing the Test

Once designers build a prototype magnet, they must test its performance, making adjustments or design improvements afterward. The Magnet Test Facility (MTF) at Technical Support has long served as a magnet proving ground, and Cosmore Sylvester and Phil Schlabach are its newest members.

With his team, Sylvester is developing a vertical test cryostat. Presently, all six magnet test stands are configured horizontally, but Sylvester believes that a vertical position will prove more efficient. The 15-foot tall, 26-inch wide dewar is now at Fermilab, and Sylvester is building a suspension system and hooking up the proper electronics. The team will simply lower a magnet into a bath of liquid helium for tests in either superfluid or normal helium.

Schlabach arrived at Technical Support in early 1996. Attempting to improve the science of magnet testing, he will measure magnet fields generated by the IR quadrupoles and study how cryogenics affect the magnets. Recently, as part of his work for the LHC, his group performed a cold test on a magnet to research quench issues.

On a recent tour of MTF, Schlabach said they are trying to develop a measurement R&D shop, allowing the group to anticipate magnet problems instead of just reacting when a magnet fails. He added that the ability to work at the ground level of the world's next accelerator advancement attracted him to Technical Support.

"The...program for the LHC is very interesting and challenging. I think in terms of having a real impact on future accelerator projects, it gives me a chance to make a real contribution," said Schlabach.

Team Approach

All of the new engineers and physicists agree that a team atmosphere is sweeping the magnet development project. Sabbi said that each person possesses specific skills along with a strong general physics background, making for a versatile program that allows scientists and engineers to learn from one another.

"Every single one of us is bringing his own knowledge and experience," said Sabbi. "It's like cross-fertilization."

The new members also all cite the confidence, knowledge and experience of the more established people in the section. Specifically, the engineers mention Jim Kerby, Patricia Heger, Tom Peterson and Fred Nobrega—all veterans of the superconducting magnet world. The scientists also stress the importance of the veterans in their own development. Zlobin speaks of Rodger Bossert, Jim Strait, Mike Lamm, John Tompkins and Steve Gourlay, among other people, saying he knew them all by publication, if not in person, when he engaged in research in Russia.

"There is...a balance of experience with people who have been working here for a while, and younger people who can introduce a new look...and bring some fresh new power," said Zlobin.

Limon acknowledged the versatility that is developing in Technical Support, but stressed that he is still molding the program. He also said that new members of the group and veterans alike want to look beyond the LHC.

"...The team's first and primary responsibility is to work on the LHC magnets. But when you have a strong team like this together, they are going to want to pursue a lot of different and innovative things," said Limon.

The Future of the Field

There is a mixed reaction when future magnet technology is discussed. Some say they haven't thought beyond the LHC, while others sit up in their chairs and talk of things like high-temperature leads, "pipetrons" and ac field distortion.

One of the first developments that may occur is the production of high-temperature power leads for the Tevatron, allowing accelerator operators to increase the Tevatron's energy

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Photo by Jenny Mullins

Phil Schlabach (left) and Cosmore Sylvester stand in the Magnet Test Facility.

Understanding Tesla

Tesla is the standard unit of magnetic field strength, as volts are the units of electrical strength. The magnetic field is what guides the particles around the accelerator. The higher the field, the higher the energy of particles that can go around the accelerator.

A typical nonsuperconducting magnet has a maximum strength of about two tesla. The superconducting magnets in the Tevatron operate at about four tesla, while LHC's magnets are expected to operate at about 8.5 tesla. Fermilab will develop IR quadrupoles for the LHC with a high field of 10.5 tesla.

Travelers

"A traveler from the cradle to the grave" is the poet Shelley's phrase for Man, but the description also fits a special kind of traveler at Fermilab. In the Technical Support Section a traveler is a document that journeys with a magnet or other device from its inception, recording every detail of its manufacture and testing. This traveler, you could say, goes from the cradle to the accelerator.

by Leila Belkora, Office of Public Affairs

"The traveler incorporates instructions for how, when, and where to build and measure a magnet," says John Carson, Deputy Head of Magnet Design and Fabrication. "Encoded in the traveler are all the design and engineering documents, the tooling to be used, and the sources of the components. It records who the people were that made the device," he says. Travelers also include methods for recording and resolving discrepancies between measurements and design specifications, and instructions that anyone may use to suggest improvements in the fabrication and quality assurance process.

Physically, the traveler is a 3-ring binder. Does it actually attach to the device like a suitcase tag? "There's kind of an invisible string that keeps it connected," says Carson. The travelers carry a number that links them to the device they describe, so the binders can sit on bookshelves when not in use.

Carson and Bob Jensen, who leads the Process Engineering group, say the advantage of the traveler system is that it involves everybody who has a hand in specifying, designing and making the devices. "Instead of a system with a production group and a watchdog group looking over their shoulder, everybody has responsibility," says Carson. Fermilab magnet builders began using the traveler system, distributing quality control to all contributing workers, with the construction of Tevatron superconducting dipoles in the late 1970s.

Carson says travelers help make building a magnet or other device reproducible. "In the past, we spent a lot of time trying to reconstruct what we had done before" on a particular device, he says. The traveler includes all relevant details. "The traveler might say, instead of a 2-pound hammer, use a 4-pound hammer."

Jensen says Fermilab requires vendors who supply his group with products to use travelers, as well. These include SVF Industries in Rock Falls, Illinois, makers of half-cores for dipole magnets, Everson Electric, who wind and trim magnet coils, and Tesla Engineering in England, who insulate dipole coils. Travelers have proved their worth; at least one coil manufacturer saw enough merit in the system to impose it on all their production, not just for Fermilab.

"Anywhere you're trying to end up with a product with zero defects, this is a good way to go," says Carson. ■

Photo by Fred Ullrich

The traveler contains everything you could ever want to know about the device it belongs to, from its serial number to directions for testing it. The traveler for this Main Injector magnet contains, among other things, a reference to the engineering drawing of the magnet; a "Stacking Recipe" listing the quantities and types of materials combined in the core; the serial numbers of the instruments used to test the magnet (since the results might depend on that instrument's calibration); instructions for testing the cooling water flow through the magnet; and plots of data taken during electrical and mechanical tests.

Accelerator Update August 7—August 21

A ten-day beam shutdown began on August 19 to address various infrastructure problems with the accelerator and its power feeders. The Accelerator Division and the Facilities Engineering Services Section will use the shutdown to repair three critical electrical feeders that had experienced failures in preceding days. The Accelerator Division expects to be back up and delivering beam to experiments by August 29.

At the August 19 All-Experimenters meeting, David Nevin, head of the Facilities Engineering Services Section, reported that the underground power cable network at the sites of these faults is nearly a quarter-century old, and it's beginning to show its age. One of the feeders that failed was Number 38, which brings electricity to the Central Helium Liquefier; the feeder failed on August 19, and the Fermilab staff had to turn off the nitrogen reliquefier. John Peoples, Fermilab's director, stressed the importance of getting Feeder 38 fixed as quickly as possible, as the supply of liquid nitrogen has a history of drying up around Labor Day, and the accelerator would require eight truckloads per day without the plant. Feeder 38 was subsequently fixed.

Peoples next asked about Feeder 21/22, which services the Main Ring and has failed nine times in 1996. Nevin said a possible solution involved installing temporary cable near the old Feeder 21/22 cable, which would keep the accelerator running. FESS staff could then dig up the 1970s cable and replace it, thus repairing the problem with minimal downtime. Nevin had no specific cost or time estimates, but said the job would probably take about five months.

Finally, as of this writing, Nevin said that FESS staff members are having Feeder 23 repaired; it supplies power to the Tevatron. Accelerator Division staff also removed and tested two Tevatron magnets that showed evidence of restricted helium flow.

Before deciding to shut down for the maintenance period, Peoples asked each of the experiments for their input. The decision, he said, was essentially a choice of keeping the Tevatron on, struggling for a week to get about 30 hours of beam and then shutting down, or shutting down now, repairing the problems and coming back—hopefully—with a smoothly operating beam. The majority of experiment representatives chose to shut down immediately and come back with a more reliable beam; however, at least one experimenter said he preferred to have beam stay on.

"While there is no unanimity, there is a preponderance of positions that a shutdown now would be better if you can come out with a smoothly operating machine," said Peoples.

The director also stressed that fixed-target maintenance must take priority during shutdowns, as this is their time for experimentation.

"Our goal has to be making fixed-target (experiments) operate over the next year," said Peoples. ■

Photo by Fred Ullrich

Dan Johnson of the Research Division addresses a recent all-experimenters meeting.

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 Lunch September 4

Shrimp and Crab Cannelloni
Marinated Vegetable Salad
Pineapple Cake

Thursday Dinner September 5

Booked

Wednesday Lunch September 11

Calypso Roast Pork Loin
with Salad of Black Beans,
Hearts of Palm and Corn
Tropical Fruit
with Ginger Sabayon

Thursday Dinner September 12

Wild Mushroom Soup
Grilled Jumbo Sea Scallops
with Balsamic Mignonetti
Wilted Greens
Lemon Cheesecake
with Berry Sauce

BENEFIT NOTES

Window of Opportunity to Change Health Plans

The Laboratory will hold its annual open enrollment period from September 16-27, 1996, for employees to make changes in health insurance coverage. Employees will have the opportunity to ask questions of representatives of the preferred provider organizations and health maintenance organizations that offer health plans at Fermilab. Representatives will distribute updated information and answer questions in the atrium of Wilson Hall on Monday, September 16, from noon to 5 p.m. and on Tuesday, September 17, from 8 a.m. to 1 p.m.

During the week of September 2, the Benefits Office will mail detailed information to employees' mailstops regarding plan changes, plan comparisons and costs. The Benefits Office staff asks any employees who do not receive information to call the office at x3395, 4362, or 4361. ■

Fermilab Community Gives Blood

"We forecast 60 donations for your blood drive July 31, 1996. We were able to collect 61 units with 6 deferrals," wrote Deb Milam of Heartland Blood Centers in a letter thanking Lab Services Section Head Chuck Marofske for Fermilab's support.

"Your support of the community blood program," she added, "helps us provide a safe and adequate supply of blood and blood products to 33 area hospitals. Thousands of patients benefit from your generosity." Marofske plans another blood drive in midwinter.

These Fermilab employees and visitors gave blood: Mitchell Adamus, Terry Asher, Sharon Austin, Peter Bagley, Diane Bergquist, Eileen Berman, Jeanette Chivari, Robert Cooper, Paul Crisostomo, Greg Deuerling, Joseph Dey, Bernadette Dugan, Ann Eighnor, Dianne Engram, Karin Etter, Jody Federwitz, Julia Fenn, Steven Fry, Consolato Gattuso, Michelle Gattuso, Reginald Gibbons, Larry Hammond, Nicholas Hankes, Steven Hays, Donna Hicks, Bruce Hoffman, Robert Joshel, Hans Jostlein, Jeffrey Kallenbach, Karen Kephart, Robert Kolar, Paul Kurylo, Norman Leja, Jean Lemke, Alfred Lilianstrom, Petar Maksimovic, Chuck Marofske, David Martin, Prakash Mathew, Elliott McCrory, Sergei Nagaitsev, William Nicholson, John Nowak, Luann O'Boyle, Elizabeth Peterson, Thomas Peterson, Valdis Peterson, Donald Poll, Patricia Poll, Mark Reichanadter, Robert Riley, Dave Ritchie, Jeffrey Ruffin, Charles Serritella, David Slimmer, Edward Stephens, Dorothee Swanson, Gianni Tassotto, Janelle Thompson, Jeff Utterback, Margaret Votava, Byron Wagner, Karl Whitten, Randy Zifko, Richard Zifko, John Zuk. ■

'Dream Team'

continued from page 8

slightly. Huang said he is very interested in pursuing this avenue.

Feher mentioned studying the possible applications for higher temperature superconductors in accelerator magnets, decreasing the need for liquid helium to cool the magnets. Limon said one possibility is to use higher temperature material in magnets for a "pipetron." The pipetron is an innovative concept for an accelerator that uses superferric magnets—magnets that use superconductor to carry the current, but iron or steel to shape the magnetic field. Presently, the superconductor carries the current and shapes the field. Steel or iron make a better field for manipulating the particles, but they run at a lower field strength, forcing the need for a larger ring.

Limon also mentioned investigating ac loss in niobium titanium, allowing scientists and engineers to address the problem with more focus and knowledge.

Zlobin said that regardless of which direction the superconducting team chooses, they must look forward unfettered by a specific project and advance the basic science of superconducting magnets. Specific projects can sometimes force people to solve particular problems or reach particular goals, but a wider program expands their thinking and leads to innovations.

A Different Type of Magnet School

Another important future issue for Limon is the possibility of making Fermilab a "magnet" for learning about magnet technology. Once he finishes assembling his team and progressing on the LHC work, he hopes to begin a program with universities so that students and faculty can participate in some of the pure and applied science of superconducting materials and magnet development. He envisions collaborations similar to other experimental groups at the Lab. This plan will allow Fermilab to educate a new generation of magnet specialists in the U.S., and is one of the more important aspects of Limon's vision for his section.

He said he hopes his team will eventually tackle all of these possibilities, and even some they haven't thought of yet.

"I would say that we hope, when we are done, that we will have the best development group for superconducting magnets in the world," said Limon. "That's my intention." ■

CLASSIFIEDS

FOR SALE

■ Three metal file cabinets $10-15 each; 30"x 80" wooden bookcase $20; elegant modular bookcase units $10 / unit; working 19" color TV (not cable-ready) $25; 5 ft. patio umbrella $12; 24" Navajo loom $25, 4 table lamps (some brass, some brass & glass) $15 each; portable whirlpool bath unit $30; various quality prints of great masters (Goya, El Greco and more) in carved wooden frames $20-50; more. Call Roy at x8364, or (630) 665-8246.

■ Extra large heavy duty Amana washer and gas dryer $500; Sears lawnmower $200; all in excellent condition. Queen-size mattress and box spring $75; twin mattress and box spring $50; twin mattress and iron frame $20; 3-piece couch $20; kitchen table $5; assorted desks, chairs, tables, lamps, ceiling lights, frame paintings, etc. Make an offer. Call Leslie, x8435 or (630) 665-8188.

LAB NOTES

1997 RECREATION FACILITY MEMBERSHIP

Recreation Facility memberships for 1997 will go on sale September 2 in the Recreation Office, WH15W. Sale hours are 8:30 a.m.-5 p.m., Monday through Friday. Regular memberships are $50 and student memberships are $25. Only renewal memberships may be purchased through Fermilab internal mail, MS 126. Please enclose completed application form and check. Applications are on the Web under the Benefits / Recreation page. All 1996 memberships expire October 1. For more information, call Jean x2548.

MILESTONES

BORN

Matthew James Huedem, on Saturday, August 3, to Emil (FESS, Eng.) and Elsa Huedem.

Kayla Savannah, Tuesday August 13, to Lee and Priscilla Trevino (RD, ES&H).

RETIRED

William Butler, on August 20, 1996. He started at Fermilab on August 1, 1968. Butler worked for FESS Operations as Executive Assistant.

Mitchell Tarkowski, on August 22, 1996. He started at Fermilab on March 14, 1978. Tarkowski worked for Technical Support in the Machine Shop as Instrument Maker.

Rolf Joseph, on August 23, 1996. He started at Fermilab on November 10, 1969. Joseph worked for Technical Support in the Machine Shop as Instrument Maker.

CALENDAR

SEPTEMBER 4

1996-97 bowling season begins. A 31-week, non-sanctioned, mixed league at the Bowling Green Sports Center, starting at 5:30 p.m. Cost is $10. For more information call Terry O'Brien, x4851.

SEPTEMBER 5

Wellness Works sponsors "Caring for Your Elders," a two-part brown bag seminar presented by Kathleen O'Laughlin RN, MS, JD; and Signe Gleeson RN, MS of Elder Care Solutions. Part 1: Home Care Options, Thursday, September 5, One West, noon-1 p.m. Part 2: Making Nursing Home decisions, Thursday, October 3, Curia II, noon-1 p.m.

SEPTEMBER 17

Wellness Works sponsors Blood Pressure Screening from 11:30 a.m. to 1 p.m. User Office.

SEPTEMBER 24

Wellness Works sponsors brown bag lunch on "Desktop Defense," ergonomic techniques by Maureen Huey. Noon-1 p.m., One West.

SEPTEMBER 28

Fermilab Arts Series to host Christian McBride Quartet. Christian McBride, still in his early 20's, is the most sought-after young bassist on the jazz scene. He has already made over 70 recordings as a side man with artists such as Joe Henderson, Betty Carter, Pat Metheny, Benny Green and Joshua Redman. He recently released his debut album as a leader on Verve. Born in Philadelphia in 1972, Christian studied classical bass with Neil Courtney, a bassist with the Philadelphia Orchestra. While a junior in high school, he met Wynton Marsalis who asked him to sit in with his band in a concert the following week at the Academy of Music. Set to go to Juilliard on scholarship, he was snatched up by Bobby Watson and has been touring every since. States frequent collaborator Joshua Redman, "I've been blessed to work with Christian. If genius exists he definitely has it." Tickets $15. 8 p.m., Ramsey Auditorium. Call 840-ARTS for information and reservations.

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Please send your article submissions, classified advertisements and ideas to the Public Affairs Office, MS 206 or E-mail: ferminews@fnal.gov

FermiNews welcomes letters from readers. Please include your name and daytime phone number.

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