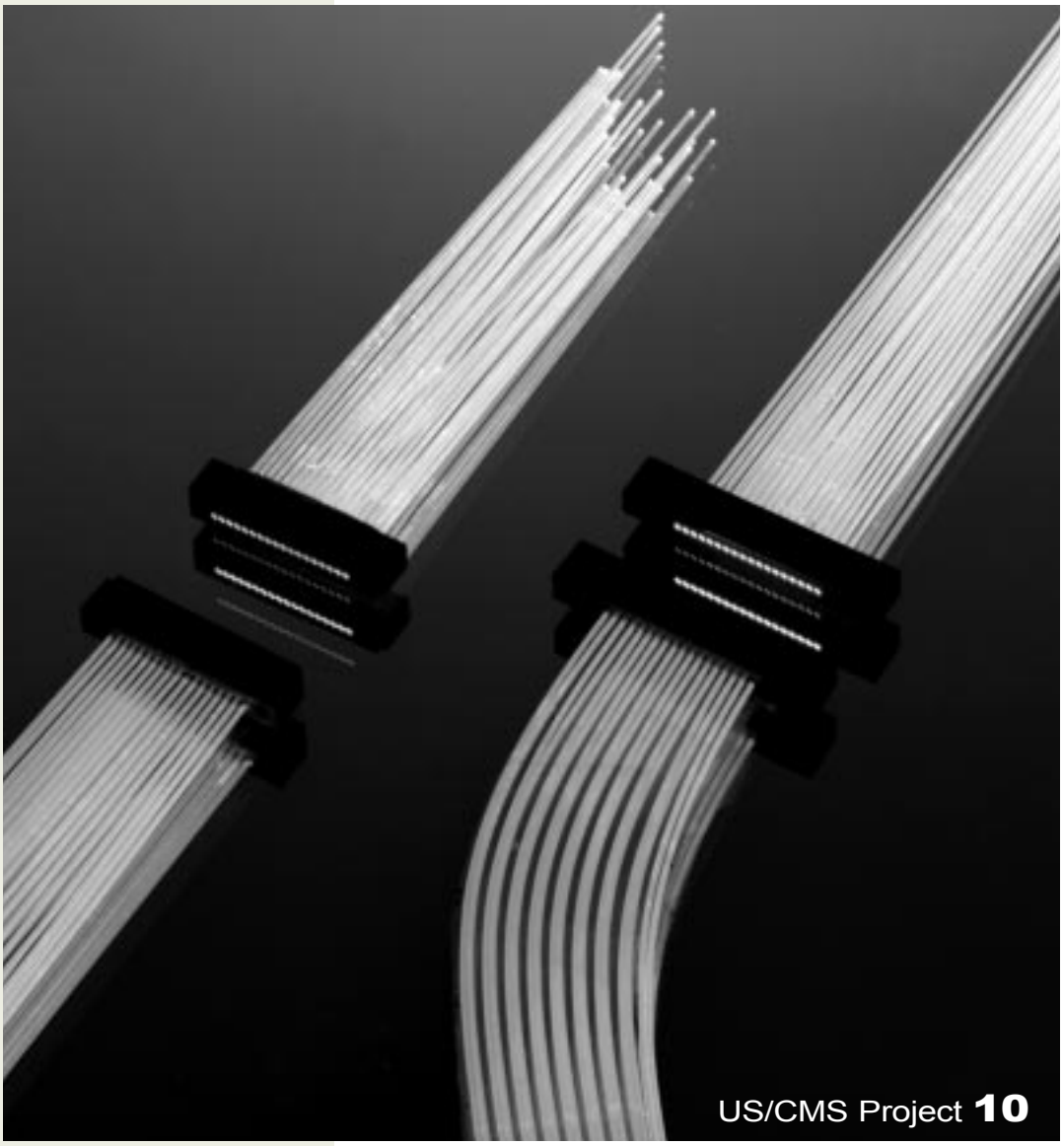
FERMI NEWS

FERMILAB A U.S. DEPARTMENT OF ENERGY LABORATORY



US/CMS Project **10**

Photo by Reidar Hahn

Volume 22
Friday, April 2, 1999
Number 7

INSIDE:

Eyewitness to HISTORY

Photo by Reidar Hahn

Happy 80th birthday to Ned Goldwasser!

by Mike Perricone

Ned Goldwasser was present at the beginnings of a great adventure in high-energy physics, but on a day dedicated to him, he couldn't forget that the cities were burning in that formative time for Fermi National Accelerator Laboratory.

Not a building had yet been raised on the 6,800-acre site in March 1967, when the newly named director, Robert R. Wilson, telephoned Goldwasser, then at the University of Illinois, asking him to come on board with the project. Goldwasser, who had served on the committee recommending potential laboratory sites to the Atomic Energy Commission, took the job and agreed to visit Wilson at Cornell University in Ithaca, New York. When they met, with Goldwasser agreeing to become the Lab's first deputy director, they spoke not only about relationships in particle physics, but about relationships among people.

"We spent a large fraction of that meeting," Goldwasser recalled, "discussing our independent but similar notions that the opportunity of building a laboratory at that time, with what was happening in the country, was an opportunity that shouldn't be missed. We wanted to demonstrate that such a project could be started and run in a manner sensitive to some of the racial problems the country was suffering from. Cities were burning. There were large-scale protests against discrimination. Bob felt, and I agreed, that we could and should do something to address those problems."

"The Early Days of Fermilab," an informal mini-symposium honoring Goldwasser's 80th birthday, was held March 10 at Ramsey Auditorium—which was named for Norman Ramsey, the first speaker at the symposium.

Ramsey won the Nobel Prize winner in 1989 for his invention of the separated oscillatory fields method and its use in the hydrogen maser and other atomic clocks. Ramsey was the first president of Universities Research Association, Inc., the consortium of universities (currently numbering 89) that manages Fermilab for the U.S. Department of Energy.

Bill Fowler, currently associate project manager for the Fermilab Main Injector, joined Fermilab in 1970 to construct the 15-foot hydrogen bubble chamber. He later served as Wilson's deputy project leader in developing the Tevatron. Fowler summed up the feeling of the Lab's early days as "cooperation—we had it at that time."

But those early days also are often characterized by the crisis management, "beam-or-bust" outlook described by Rich Orr, who served the Lab in many capacities over 20 years. Orr lauded Wilson and Goldwasser as being "responsible for how Fermilab became Fermilab, as opposed to what it started out to be."

Those early days were a time when buildings were put up before funds were authorized. "We try to start before we've been approved," joked current Director John Peoples, "so we know we can finish."

NED GOLDWASSER recalls FERMILAB'S "BEAM-OR-BUST" days— with HUMAN RIGHTS as the FIRST PRIORITY.

Those early days, at what was then called the National Accelerator Laboratory (the dedication to Enrico Fermi came in 1974), were a time when lines were drawn on such issues as whether the offices of theoretical physicists should be wide open or should have walls and doors.

"Bob Wilson offered us walls and GI furniture, or no walls and real furniture," said Chris Quigg, then as now a puckish theorist. "We took the walls. He never forgave us."

Those days were a time when, even in the midst of the Cold War, experiment collaborators were welcomed from the Soviet Union. Physics experiments transcended international politics.

"Experiments were open to users from all areas," said Yoshio Yamaguchi, a former president of the International Union of Pure and Applied Physics. "I'm very glad that high-energy physics started such a wonderful idea."

Of course, international political considerations were not completely ignored, as Goldwasser remembered from a visit of the director of the Soviet Union's equivalent of the Atomic Energy Commission. The new Lab's goal, which Goldwasser said was "encouraged" by the Atomic Energy Commission, was to have beam circulating around the entire Main Ring.

"We worked all night, but we didn't get it," Goldwasser said. "The whole Soviet entourage was there and we said we were sorry, but we weren't able to get it done. Later, the Soviet commissioner was alone with Bob Wilson and he told Bob the admission had been very stupid. 'In the Soviet Union,' he said, 'we have learned

Fermilab Archives Project Photo

Fermilab's founding director, Robert Wilson addresses the staff in 1968. Note the elaborate podium and seating arrangements.

Goldwasser (left) and Wilson at the controls in 1971.

Wilson Hall exhibit digs into Lab's archives

The photos of the "old days" included with this story are part of a current exhibit on the first floor of Wilson Hall, titled "The Creation of a Laboratory: Fermilab, the First Five Years (1967-1972)."

Fermilab Assistant Director Ernie Malamud, who also played a key role in the birth and growth of the Lab, originated the idea for the history display to coincide with the March 10 symposium honoring former Deputy Director Ned Goldwasser's 80th birthday. The search for photos and documents went into high gear in November 1998, with Malamud guiding the efforts of Adrienne Kolb of the Lab's History and Archives Project, along with Fred Ullrich, Reidar Hahn and Diana Canzone of Visual Media Services, who executed the design and construction. Most of the photos were printed from negatives in the VMS inventory.

Although Robert Wilson, the Lab's first director, was unable to attend the day's activities honoring Goldwasser, the Wilson Hall display offers extensive videotape of Wilson expressing his plans and hopes for the Lab. Ullrich produced the video "Water to the Ropes" in 1988 commemorating the Lab's 20th anniversary.

that it doesn't matter. They don't know if it's a full turn or not. We just tell them we made a full turn and that's just as good.'"

Those early days, with informality reinforcing grand notions of possibilities, were a time of great hopes for the future of accelerator physics. But the cities were burning. To Goldwasser's memory, the very location of the new lab grew from the civil rights struggle—and from practical national politics.

"My feeling," Goldwasser said, "is that President Lyndon Johnson made the decision at least in some measure as a tradeoff with Senator Everett Dirksen of Illinois. At the time this site selection was being made, the Federal Open Housing Bill was before Congress, and it was a very tight matter whether or not it would pass. Everyone knew that when the bill came to a vote in the Senate, it would be very close to a tie. What surprised everyone was that Everett Dirksen, who had a long record of strong positions against anything in the nature of open housing, withheld his vote to the very end, and then he cast his vote in favor of the bill to break a tie. My own feeling is that this had something significant to do with the choice of Illinois for the site."

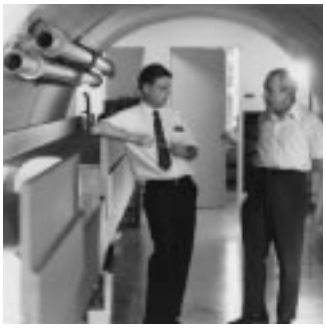
An early group of technical trainees prepares to depart for Oak Ridge National Laboratory in 1969.

The Rev. Martin Luther King, angry that the Illinois legislature had soundly rejected a similar bill, had threatened to lead demonstrations blocking the construction of the laboratory in Illinois. The subject of racial tensions dominated the first official meeting of the National Accelerator Laboratory on June 15, 1967, at the design offices in nearby Oak Brook's Executive Office Plaza.

"Bob asked me to take on the job of going into Chicago," Goldwasser recalled, "and meeting with the leaders of minority groups in an effort to persuade them that we intended to have a very active program for what would now be called affirmative action. There was no such thing in those days, and I'm not sure we coined those exact words, but we told them we expected to find employment for minority people and we expected to try to recruit many of them from among the inner-city gangs in Chicago.

"Those were some of my interesting days. I met with leaders of the Urban League and the National Association for the Advancement of Colored People, but I also met with leaders of the Black Panthers, as well as with gangs in Chicago. I told them what our intentions were, and asked them to give us ideas about how we might proceed."

Soon, the informal affirmative action program took a major step forward when Ken Williams joined the Lab from one of the local hospitals. Williams headed the Lab's affirmative action efforts for many years.



Wilson (left) and Goldwasser in a tunnel mockup at the Lab's first offices in Oak Brook, Illinois in 1967.

The Lab's original Fire Department, circa 1969.

"The first thing he did," Goldwasser recalled, "was a great relief to me. He took over the responsibility of going into the city and meeting with the gangs. In those meetings, he interviewed individual gang members, trying to evaluate who was really serious about getting out of gang life and getting a real job in the outside world. I felt he had unerring taste and judgement in the people he chose."

Among their efforts, the Lab and the Chicago community leaders cobbled together a program taking kids out of gangs in the city, and sending them to a six-month technical training program. Those who stayed the course would return to the Lab with jobs as technicians. The training program was located at Oak Ridge National Laboratory, and spending six months in Tennessee in the 1960s might have seemed daunting to young black men from Chicago. But the program worked.

"Over a period of years, many people went through that program," Goldwasser said. "Around the time I left the Lab (in 1978), I think we were about 90 percent successful in retaining those trainees. And most of the people who left had gone on to better jobs. Ken Williams made an enormous contribution to the Laboratory."

Within the first year of the Lab's operation, Wilson and Goldwasser had also issued a policy statement on human rights, written with the contributions of many people. The one-page document was posted as often and as visibly as possible. On the stage of Ramsey Auditorium, Goldwasser read from the statement's final paragraph:

"Our support of the rights of the members of minority groups in our Laboratory and in its environs is inextricably intertwined with our goal of creating a new center of technical and scientific excellence."

Those early days of the Lab were a time that won't soon be forgotten.

Fermilab Archives Project Photos

Wilson Hall's twin towers begin rising in 1972.

DIALOGUE BOX

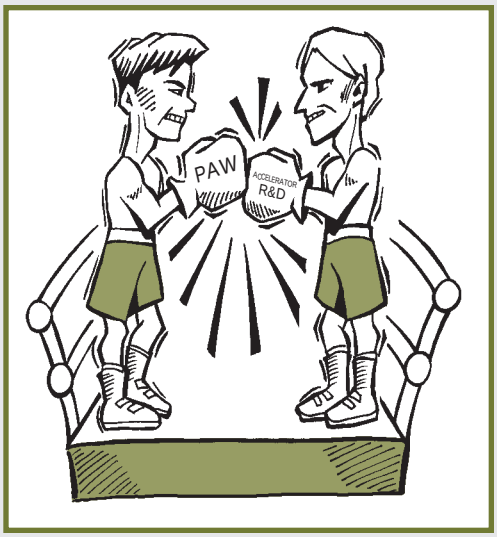
Dear Alvin,

I enjoyed your open letter to the physics community, and I am glad to see it is generating discussion in the halls of our national labs. I think you may be right about the “impending disaster’’ in high-energy physics, but your solutions ignore too many realities. The workshops are a good idea—we should all be thinking about the future of our field— but your recipe for jump-starting accelerator R&D would fail because it tries to recreate a high-energy physics culture that no longer exists.

In many ways the situation you describe is a result of our great success at building bigger and better accelerators; unfortunately, the scales of time, money and complexity associated with these machines have increased along with their energy and luminosity. These changes of scale signaled the end of the university accelerator programs when the size and cost of a forefront accelerator could no longer be accommodated in the basement of the physics building or in the university research budget. The centers of accelerator physics research moved to the national labs, and the accelerator physicists went with them. How can universities restore accelerator physics to its “rightful place’’ (whatever that may be) if there are few accelerator physicists in academia any more?

The same problem would plague any effort on the part of the labs to involve the academic community in accelerator experiments, though it’s an admirable goal. Who is going to supervise these students? Who will run interference with their home institutions? It’s one thing to offer students greater exposure to the physics of accelerators and some hands-on experience, but quite another to get these students involved in accelerator R&D. And unless you can convince the

Physicist Alvin Tollestrup's open letter to the physics community *(FERMINEWS, February 19, 1999)* **prompted debate in the halls of Fermilab, and brought this response from Glen Crawford, a fellow physicist at the Stanford Linear Accelerator Center.**



universities that such a program would benefit their research portfolio, I doubt you would get many takers. So far, the success rate has not been good, as you know: there are very few university groups involved in future accelerator R&D.

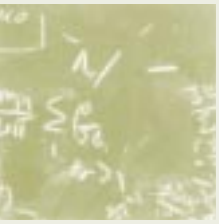
Which brings us to the question of money, and here I agree with you that more "seed money" would help the situation. But the "half-and-half" postdoc position to do machine-related R&D while also working on ongoing experiments, although a great idea for accelerator R&D, is a questionable proposition at best for the postdoc who might accept such a position. Why would any smart postdoc invest half of her time working on a project that is at least 10 years away when all the other smart postdocs are working full-time on projects with more immediate impact? What university would hire someone who made such choices, when it could have another talented person who would immediately enhance the university's position (and perhaps, funding) on The Big Collider Experiment? This, Alvin, is why you hear, "We can't work on that...it will be 20 years to...," etc. Postdocs cannot afford to think that far ahead, or their children will go hungry.

Instead, the money for accelerator R&D would be better spent enticing smart people to move from academia to the labs, as you did 24 years ago, or getting some of the smart people already at the labs to work on accelerator physics full-time. People who have job security can work on making the dream a reality. Once that effort becomes viable, you may find more universities knocking at your door asking if they can help out.

I'd love to continue this discussion, but I've got to get back to my PAW session running in the background. I have to get some analysis done.

Sincerely,

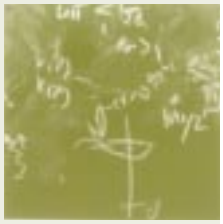
Glen Crawford



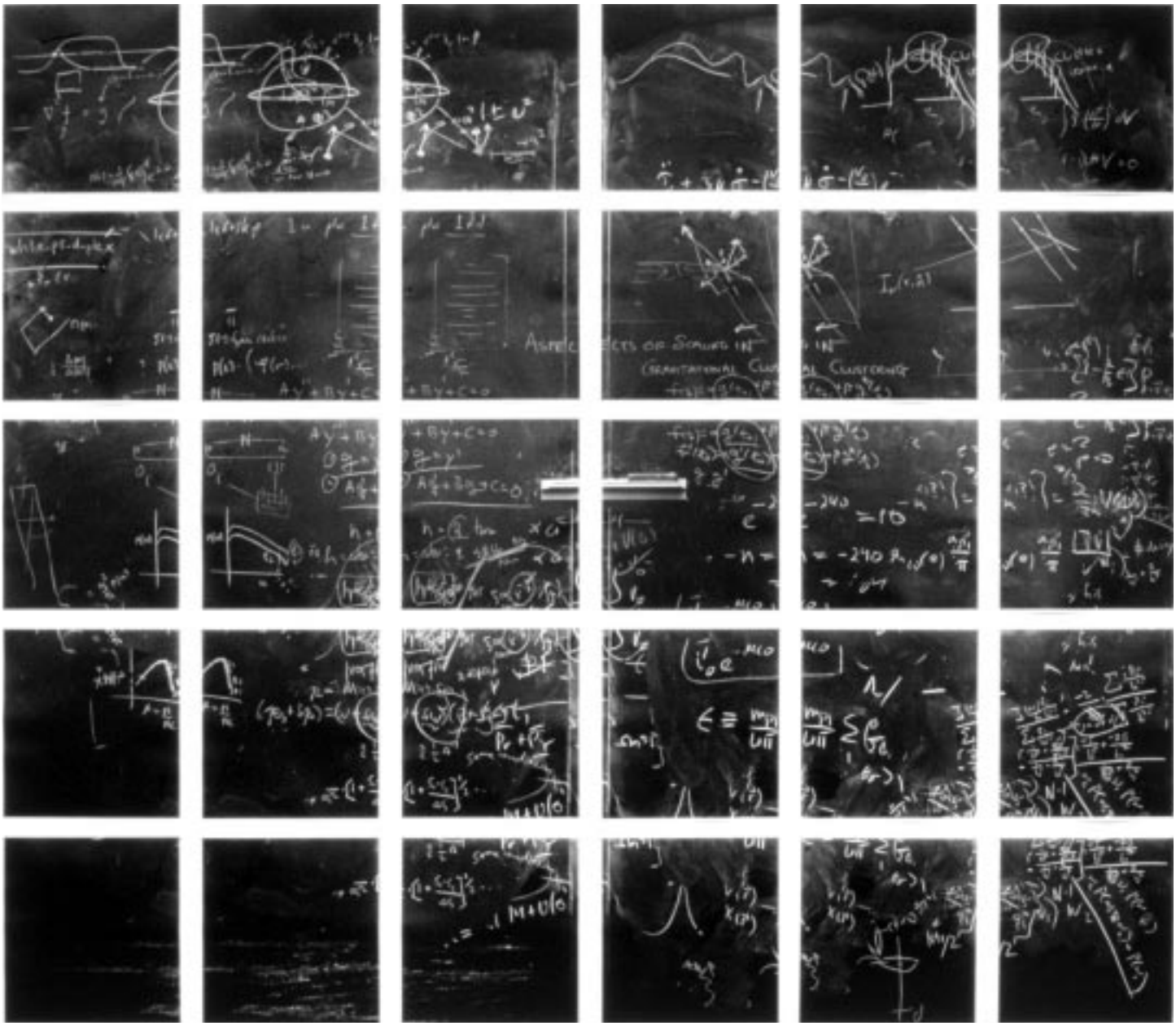
The *Art* of BLACKBOARD SCRIBBLING

Over the course of several months in 1997 and 1998, photographer Jean Therrien-Gottschalk took pictures of Fermilab astrophysicist Lam Hui's blackboard, creating a series of four compositions titled according to the day on which the blackboard was photographed. Each is composed of multiple views of Hui's blackboard, laid out in a grid pattern. Together they depict the process, not just the final product, of research, representing visually and aesthetically the unfolding of scientific ideas.

Says Therrien-Gottschalk of her work: "The erasures and corrections [on the blackboard] show the evolution of ideas and thoughts represented by mathematical symbols and sketches. Photography has been used to document scientific subjects since its inception, and my work has aspects of a documentary approach. However, I am also striving to use photography to elucidate a more conceptual representation of scientific process. For example, the blackboard is photographed in its entirety, including all symbols and sketches. I take the liberty to group the subject matter by photographing the blackboard in segments with overlapping content, and I present the work as individual building blocks depicting the entire subject. My goal is to engage the viewer in the scientific process by showing subject matter that is identifiable…, yet encourages exploration and discovery."



Hui was thrilled to see his "scribbles transported in space and time onto [Therrien-Gottschalk's] photos." He said it gave his "work a depth that I didn't appreciate before. It was interesting and a pleasure to see how my daily struggle on the chalk board evolved with time."



Therrien-Gottschalk photographed Hui's blackboard with black-and-white film, using available light. She printed the film on color paper to produce rich tones that added depth and enhanced the "blackboard quality." All four boards were exhibited at Gallery 400, School of Art and Design, University of Illinois at Chicago, in April 1998. The composition titled "September 21, 1997" (above) is currently on view at Central Arts Collective Gallery in an exhibit titled "Merged Realities Symposium: Artists and Scientists in a Discussion at the Crossroads of Two Cultures."

US/CMS Project Relies on Full Contact

COMPONENTS FOR CERN'S LARGE HADRON COLLIDER ARE MOVING INTO THE PRODUCTION STAGE.

by Mike Perricone

Photo by Reidar Hahn

In Lab 5, fiber assemblies (pictured on the cover) for the hadron calorimeter scintillator systems are glued together by technicians Dan Ruggiers and Jaska Gielata, both of the University of Rochester.

From teleconferencing to kicking the tires, communication and contact are the critical issues as Fermilab's US/CMS Project swings into production mode.

"Things are cooking," said the project's technical director, Dan Green.

The project is building components for the Compact Muon Solenoid detector, a major element of the Large Hadron Collider being constructed at CERN, the European particle physics laboratory in Geneva, Switzerland.

When the LHC begins operating, projected to be sometime around 2005, it will shift the frontier of high-energy physics away from Fermilab's Tevatron. But by making integral contributions to the LHC, Fermilab maintains its stake in the future of accelerator and detector development. Scientists, engineers and technicians at Fermilab establish their status as "co-pioneers" for the new frontier, and build the Lab's credentials for the opportunity to build a future machine for moving beyond the LHC's capabilities.

But US/CMS efforts are rooted in the present, aimed at creating what Green called "the best detector we can deliver for the money." The Fermilab projects for the CMS detector focus on the hadron calorimeter, which measures the angle and intensity of energy produced in a particle collision; and the muon cathode strip chambers, which measure the momenta of the muons (heavy cousins of the electron) in CMS interactions.

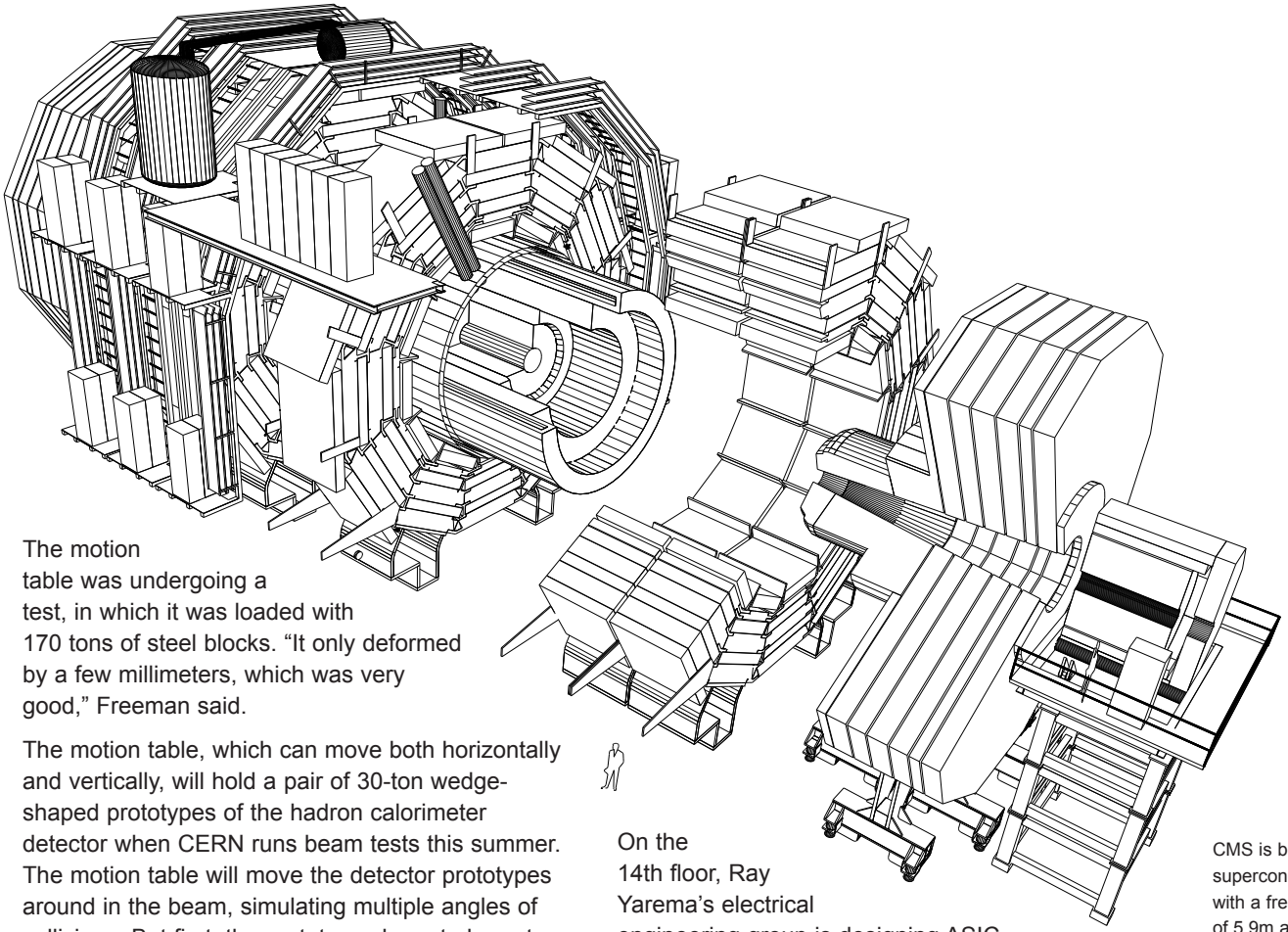
Several members of the Lab's CMS Project recently returned from a regular quarterly meeting of the entire collaboration at CERN. The collaboration also holds weekly teleconferences on technical progress, but Green emphasized that the weeklong meetings at CERN are as valuable as they are grueling.

"You have to learn how to attack problems in an international collaboration," he said. "Our view is that if problems arise, they are common problems—not just the problem of one country, or the problem of a subsystem where one country bears most of the responsibility. If you adopt that strategy, then you *can* imagine building the best detector with the collective money we have.

"We do have a common language, the language of physics. If we keep the discussion on the level of physics, we can often come to an agreement."

Another common language: kicking the tires, which is what Jim Freeman did at CERN during the quarterly meeting.

"I went over and kicked the tires on the motion table, which is now installed over there," said Freeman, referring to the 40-ton platform fabricated by the Industrial Maintenance Welding and Machining Company on Chicago's South Side.



CMS is built around a long superconducting solenoid with a free inner diameter of 5.9m and a uniform magnet field of 4T. The magnet flux is returned via a 1.5m thick saturated iron yoke instrumented with muon chambers.

The motion table was undergoing a test, in which it was loaded with 170 tons of steel blocks. “It only deformed by a few millimeters, which was very good,” Freeman said.

The motion table, which can move both horizontally and vertically, will hold a pair of 30-ton wedge-shaped prototypes of the hadron calorimeter detector when CERN runs beam tests this summer. The motion table will move the detector prototypes around in the beam, simulating multiple angles of collisions. But first, the prototypes have to be put on the table.

“We can put the first one on using lifting straps, which are the nylon ropes that you hang from a crane hook,” Freeman explained. “But with the second one, we can’t use the straps. They fit tightly together. The first one has clearance, so we can use the straps to lower it down, and then we can clear the straps out of way. But the straps would be pinched between the two if we lowered the second one that way. We have a consulting engineering company in the Fermilab area that’s designing a lifting fixture. But if it’s not done in time, we’ll have to jury-rig something at CERN.”

Freeman said CMS activity is taking place “everywhere” at Fermilab. Some examples:

Down the hall from Freeman’s and Green’s offices on the sixth floor of Wilson Hall, a group of four engineers working full time on the hadron calorimeter has completed the calorimeter design and is moving on to the task of designing the tooling, including the cradle that will be used in constructing each half of the calorimeter—with each half weighing about 500 tons.

On the 14th floor, Ray Yarema’s electrical engineering group is designing ASIC (Application Specific Integrated Circuits) chips. “They have to be right from the beginning,” Freeman said. “They’re not like circuit boards that can be touched up and fixed. There’s no way to modify these and correct errors.”

In Lab 5, 11 technicians (approaching the planned full strength of 13) are working on the scintillators for the actual detector wedges, not just for the prototype wedges.

Components for the summer test beam run are also being produced at universities ranging from two in the South (Florida State and Mississippi) to two in the East (Maryland and Rochester) to five in the Midwest (Minnesota, Purdue, Iowa, University of Illinois-Chicago and Notre Dame).

“In principle,” Freeman said, “all the components will be shipped to Fermilab around the first of April. We’ll spend a month integrating them, making sure everything works together, running tests, ironing out bugs. Then around the first of May, we’ll pack it all up and ship it to CERN.”

Late in May, a team led by Fermilab will go to CERN to install the readout system, cabling and

Photo by Reidar Hahn

Fermilab's Todd Nebel checks plastic cover plates for the hadron calorimeter, which are cut on the Thermwood at Lab 8.

Computer simulation of the LHC as it will appear in the tunnel that currently houses CERN's Large Electron-Positron Collider.

electronics onto the detector prototype, with test beam activities scheduled for June.

"Things always get hectic right before test beams, but that's also a good thing," Freeman said. "It brings everything together. Everybody knows there's a deadline, and that serves as motivation. It focuses your attention."

After his trip to CERN, Freeman swung by a factory in northern Spain where Spanish collaborators are building detector wedges. The second wedge is assembled and mounted on a giant milling machine (the bed is 50 feet long by 15 feet wide) built in the Czech Republic. Each half of the calorimeter (called a half-barrel) consists of 18 wedges, for a total of 36. The first 18 are scheduled for delivery to CERN in May 2000.

"That's only 13 months from now, and it's a tight schedule to keep," Freeman said.

Maintaining contact is critical for quality control, and a Fermilab engineer, Igor Churin, will travel to Spain in April to supervise stress testing of the prototype detector components. Then he will supervise a full survey using photogrammetry, in which digital images of several selected points are used to create a three-dimensional reconstruction of the wedge.

"We purchased a photogrammetry system for our quality control," Green explained. "After the prototype, the factory workers themselves can do the photogrammetry, and then send the file for us to check for quality."

Last month's review by the Department of Energy gave the overall project high marks for quality. US/CMS was told it could expect to expand the scope of its efforts by about $4 million at the time of the next full baseline review in February 2000.

"We'll get proposals, set priorities and then get together with the full experiment," Green said. "I believe very strongly that if we're going to have the best detector, we must fully consult with all our colleagues. We're not going to change the scoping in some way defined only by the U.S."

One obstacle to full consultation is the diplomatic strain between the U.S. and India over India's testing of nuclear weapons. Sanctions by the U.S. State Department prevent US/CMS members from visiting India's Tata Institute, where some intricate plastic detector components are being fabricated. An engineering review of the work will be conducted at CERN, but Green, who is responsible for coordinating all the international efforts, would like to see what's going on for himself.

"I hope the issue can be settled," he said. "I really want to go over there and see the factory in operation."

Not to mention kicking the tires.

the talk of the lab

Bowling balls

The detectors that particle physicists build to peer deep into matter are enormous, multiton devices fitted with delicate systems of vacuum tubes, chips, wires, relays, and switches, all intent on converting the energies and paths of particles into digital data.

In the KTeV detector, alongside these state-of-the-art electronic tools, are some unusual and decidedly mundane parts: four bright-red bowling balls, purchased at the local bowling lanes in North Aurora.

Hogan Nguyen, now a Wilson Fellow physicist at Fermilab and the person who was responsible for introducing the bowling balls, believes that no other detector in the world has anything like them. He got the idea of using them from Donald Goloskie, now in the Particle Physics Division working on the DZero upgrade.

Of course, the bowling balls don't look much like bowling balls anymore. KTeV collaborator Ed Blucher says they look more like porcupines, though they function like power strips.

The bowling balls are part of the calibration system in the KTeV detector for the photomultiplier tubes that convert light to current and for the electronics that convert the current to digital signals. The calibration system is distinctly high-end. "It's not an easy job to calibrate a 17-bit device," said Nguyen, referring to the highly sensitive cesium iodide crystals that make up the heart of the KTeV detector. These crystals can pick up a wide range of signals—whether from a transverse muon from a cosmic ray (depositing an energy of only about 15 to 30 MeV) or from a photon (60 to 80 GeV).

To fit the bowling balls to their new role, their north and south poles were shaved off; their insides were hollowed out; and each was pierced with 800 one-millimeter holes, using a pneumatic drill. To each bowling ball, a powerful laser sends pulses of light, whose wavelength is shifted and redistributed by a fluorescent dye inside a vial in the bowling ball. From there, fiber optic cables threaded through the one-millimeter holes send the light to the 3,100 cesium iodide crystals.

Nguyen said that when designing the calibration system, he realized he needed each of the fiber optic cables to "see" the same light, and to sit at the same distance from the light source. Clearly, a symmetrically shaped vessel to hold and position the cables would work, but what sort of vessel? Nguyen thought of aluminum—it was hard enough to be machined—but he couldn't find any available in a perfectly round shape. The bowling ball idea met his criteria, so long as the balls were not the cheaper variety with soft-foam cores, but the $100 kind that are nearly solid throughout.

When Nguyen picked them up at the bowling lanes and said he wasn't headed for the championships, he got a few quizzical looks. But what better use for a top-of-the-line bowling ball?

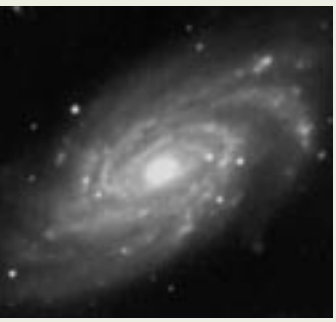
—Sharon Butler

Infinity as an illusion

Is the universe actually finite, tricking us into thoughts of infinity with multiple images of distant stars and galaxies? Does light make multiple passes through some as-yet-unimagined (and possibly unimaginable) geometry of space?

In an article in *Scientific American* ("Is Space Finite?" April 1999),

the team of Jean-Pierre Luminet, Glenn D. Starkman and Jeffrey R. Weeks proposes to use data from the Sloan Digital Sky Survey to study whether there are patterns in galaxy-to-galaxy distances. They theorize that peaks in such patterns could represent the true size of a finite universe that is tricking us with multiple images.



In commenting on the article, astrophysicist and SDSS collaborator Rich Kron, of Fermilab and the University of Chicago, indicated he is maintaining some healthy skepticism on the question.

"In some cosmologies, or models of the universe," Kron said, "light rays can follow multiple paths to the observer—so that you see more than one image of the same galaxy, for example. This phenomenon is already seen in the case of 'gravitational lenses,' associated with mass concentrations bending the light from distant galaxies and quasars.

"The cosmology application," he continued, "has the whole universe acting as a gravitational lens. The notion that we are seeing several versions of the same thing when we look at the distant universe is, I think, pretty speculative. The conventional wisdom is that the geometry is not that bizarre. Still, it is a question worth asking."

The SDSS will create a three-dimensional map of one-quarter of the entire sky, determining the positions and absolute brightnesses of more than 100 million celestial objects. It will also measure the distances to more than a million galaxies and quasars. It has already observed three of the four most distant quasars ever detected.

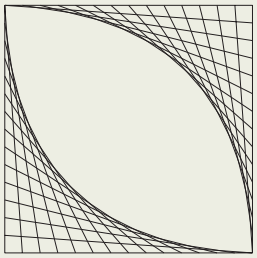
Kron said that testing the multiple-image theory would require first, a large total sample ("to get good statistics," he explained); and second, large distances measured in the data ("since the effect, if it exists, is likely to manifest itself only over very large distances"). In terms of data and distances, Kron said, "the SDSS is in a class by itself in terms of fulfilling both of these desiderata."

But, Kron concluded: "While the SDSS *could* do this project, I don't think we should think of this as a *featured* goal of the SDSS—since it is speculative."

Finite double exposure

In the same issue of *Scientific American*, Fermilab theoretical physicist Chris Quigg reviews "The Elegant Universe: Superstrings, Hidden Dimensions and the Quest for the Ultimate Theory," by Brian Greene (W.W. Norton & Company, 1999).

Quigg describes string theory as the attempt by "an intrepid band of theoretical physicists and mathematicians" to resolve the fundamental incompatibility between general relativity and quantum mechanics:



"It (string theory) holds that the fundamental constituents of the universe are not the elementary particles that we idealize as having no size, like geometric points, but tiny strings. The resonant patterns of vibrations of the strings are the microscopic origin of the masses of what we perceive as particles and the strengths we assign to the fundamental forces. Because strings have a finite, though fantastically tiny, size, there is a limit to how finely we can dissect nature. That limit—set by the size of the strings—comes into play before we encounter the devastating quantum fluctuations that rend space-time. Thus, the conflict between quantum mechanics and general relativity is resolved."

—Mike Perricone

CALENDAR

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

APRIL 8
Special Seminar: "New Results from HERA" by Camille Ginsburg, Ohio State University, at 11 in Curia II.

APRIL 9
International Film Society presents: *Karakter* dir: Mike van Diem (Netherlands, 124 mins.) Film at 8 p.m. in Ramsey Auditorium, Wilson Hall, $4. (630) 840-8000.

APRIL 11
Barn dance in the Kuhn Village Barn, 7 p.m. All dances are taught, people of all ages & experience are welcome. Admission is $5, children under 12 are free (12-18, $2). Sponsored by the Fermilab Folk Club. For more info, Lynn Garren, x2061 or Dave Harding, x2971.

APRIL 15
"Exercise Your Resources," Fermilab Library, 8:30 a.m.–4:30 p.m. Library staff will be on hand to show you how to trim the fat of information overload and find just what you need in just the right form.

APRIL 16
Fermilab Lecture Series presents: *"The Peopling of The Americas: New Evidence from South & North America"* by Dr. Anna Roosevelt, Professor of Anthropology, University of Illinois at Chicago. Ramsey Auditorium in Wilson Hall at 8 p.m., Admission $5, for tickets call (630) 840-ARTS.

APRIL 20
Wellness Works presents: *Breast Cancer Support Group*, Fu Sing Temple, noon–1 in the Snake Pit, WH2NE.

APRIL 22
Daughters And Sons To Work Day
The kids are coming to Fermilab—both boys and girls—on Thursday, April 22, for DASTOW '99 (Daughters And Sons To Work, 1999). Kids will see what goes on at the Lab and learn what their parents' work day is like. Visit the DASTOW '99 web site at http://www.fnal.gov/faw/dastow/.

Earth Day
Plant a tree, spread native prairie seeds and enjoy a picnic lunch on Earth Day at Fermilab, also on April 22. Bring a shovel if you have one, and be prepared with boots and other appropriate clothing. Visit the Earth Day website at http://www.fnal.gov/faw/dastow/arbor.html/.

ONGOING
English conversation group for foreign visitors, 10-11:30 a.m., Users' Center. No charge. For more info, call Betty Fernandez (630) 208-9728. NALWO coffee, Thursdays, 10 a.m. in the Users' Center, call Selitha Raja, (630) 305–7769. In the barn, International folk dancing, Thursdays, 7:30–10 p.m., call Mady, (630) 584–0825; Scottish country dancing Tuesdays, 7–9:30 p.m., call Doug, x8194. Sundays 11-1:30, classical ballet classes for teens & young adults 12 & over, free, in Ramsey Auditorium on stage. For more info call Irina Polubotko, (630) 208-9529.

MILESTONE

DIED
John R. Clarke, of Support Services and, before that, the Booster Group, on March 22.

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

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

Chez Léon MENU

FOR RESERVATIONS, CALL X4512
CAKES FOR SPECIAL OCCASIONS
DIETARY RESTRICTIONS
CONTACT TITA, X3524
HTTP://WWW.FNAL.GOV/FAW/EVENTS/MENUS.HTML

LUNCH
WEDNESDAY, APRIL 7
Marinated Chicken Breast with Cilantro Peanut Pesto Sauce
Lentil Risotto
Vegetable of the Season
Country Pear Cake

DINNER
THURSDAY, APRIL 8
Risotto Cakes with Shrimp Mustard Sauce
Grilled Duck Breast with Pan-Asian Flavor
Vegetable Stir Fry
Pear Pecan Napoleon

LUNCH
WEDNESDAY, APRIL 14
Grilled Flank Steak with Spicy Guajillo Sauce
Corn Curry
Red Rice
Pineapple Banana Compote with Mango Sauce

DINNER
THURSDAY, APRIL 15
Roasted Asparagus with Prosciutto and Basil Vinaigrette
Crab Cakes with Red Pepper Butter
Green Beans with Lemon Essence
Grand Marnier Soufflé with Chocolate Caramel Sauce

FERMINEWS
FERMILAB
A U.S. DEPARTMENT OF ENERGY LABORATORY

Editor: Sharon Butler
Assistant Editor: Mike Perricone
Design: Performance Graphics

FERMINEWS is published by Fermilab's Office of Public Affairs.

The deadline for the Friday, April 16, 1999, issue is Tuesday, April 6, 1999. Please send classified advertisements and story ideas by mail to the Public Affairs Office MS 206, Fermilab, P.O. Box 500, Batavia, IL 60510, or by e-mail to ferminews@fnal.gov. Letters from readers are welcome. Please include your name and daytime phone number.

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CLASSIFIEDS

FOR SALE

- ’86 Saab 900S, 4 dr, red, 75K miles, excellent condition, no rust, no problems, $3,500. Contact Peter, x2629 or pcooper@fnal.gov.

- ’82 Pontiac Gran Prix, 105K miles, newer brakes, water pump, runs good, $750 obo; Late 1970s-mid 80s Christmas ornaments, Enessco, Hallmark, American Greetings, mostly 3-D (no complete series). Leave message (630) 393-6744, after 6 p.m.

- ’68 Yamaha Grand Prix YR-2 motorcycle, 10K original miles, good shape, been sitting in garage 3 yrs. Make offer, x3011 or (630) 557-2523.

- Sofa & love seat, good cond., beige, $400 obo. Coffee table & console table $120 obo. (630) 213-0878.

- Queen size waterbed w/oak frame & side cabinets, newer, quality mattress, $200 obo. Call Jeff, x3951 or (630) 876-3293.

- Golf Clubs: Lynx pro model irons 3-PW, reg. flex lightweight steel shafts, exec.cond., $200; Yonex Super ADX pro model driver, stiff flex H.M. graphite shaft, like new, $90; Trident #1, 3&5 metal woods, reg. flex true temper dynamic lite steel shafts $25 ea. or $65 for set; Tour LE #1 iron, stiff true temper T-T lite shaft, $25. Call Jack, x2812 or mateski@fnal.gov.

- Golf eq; Cobra metal woods, Titanium driver, 3&5, reg. flex, graphite shafts, exc. cond.,$250; Titleist DCI irons, 2-SW, reg.flex, steel shafts, exc. cond.,$250; umbrella, new, $10; Balls, new & like new. Call Jim, x4293 or (630) 585-0907.

- Baby Cockatiels, hand-raised, very tame, beautiful & prized cinnamon/Pied variation, $50. Call Tom x3230.

- Townhouse in Bloomingdale, off Bloomingdale Rd between Army Trail Rd & Lake St., 2 large bdrm w/lots of closet space, 1 bath & 1.5 att. garage. Remodeled >3 yrs, neutral decor, including new carpet & tile throughout home & new kitchen appliances. Exterior recently painted & new garage door, $101,300. Call Filis or Rob, (630) 894-7517.

- House in Warrenville, Summer Lakes Subdivision, 3 bdrm ranch w/central air, vaulted ceilings & exposed beams, oak parquet floor in kitchen, dining & living rms, 99% energy efficient gas fireplace, 2 car garage, screened & carpeted front porch, tri-level cedar deck w/seating. Custom wood fence w/lighted planters. School district 200, club house w/pool & sauna, ping pong table, big screen TV, pool tables, gym, tennis & basketball courts, weight room.$146,900. To make an appointment call Karen, x5427.

FOR RENT

- Large bedroom plus living room, quiet residential Naperville, 25 min from lab. One car garage, private bath, laundry & kitchen privileges, available June 1, $395/mo. Call x2574 or (630) 983-3575 eve.

WANTED

- The Fermilab Tuesday night Hughes Creek Golf League is looking for golfers who can say, “Fore, oops, I think it went right, it’s a beauty”. There is a need for two 4-person teams for this season. Play begins April 27, greens fees are $12. If interested, contact Don Arnold, x2871 or Dean Sorensen, x8230.

- Old Canon AE1 or AE1 Programmable camera, or camera body only. Please call Romesh, x4071 or (630) 682-4226.

LAB NOTES

NEW MILEAGE RATE

Effective April 1, 1999, the IRS has reduced the standard mileage rate from 32.5 cents to 31 cents per mile. Therefore, Fermilab will use the reduced IRS rate for mileage reimbursement requests for all travel on and after this date.

“TUNNEL VISIONS” SYMPOSIUM SCHEDULE

Date	Subject	Speaker
March 25	NLC	Marc Ross
April 8	CLIC	Jean-Pierre Delahaye
May 6	TESLA	Reinhard Brinkmann
May 13	Muon Collider	Bob Palmer
May 27	Neutrino Beams	Steve Geer
June 3	VLHC high field	Peter Limon
July 1	VLHC low field	Bill Foster

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