June 2003

ON TARGET

THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY • A DEPARTMENT OF ENERGY FACILITY

1st Light for upgraded FEL

On June 17, scientists and technicians produced First Light from JLab's upgraded Free-Electron Laser (FEL). The machine was upgraded from the one-kilowatt Infrared Demonstration FEL, which broke power records by delivering 2,100 watts of infrared light in 2001. Now 1.5 years after the one-kilowatt FEL was dismantled, the upgraded FEL, designed to produce 10 kilowatts of infrared and one kilowatt of ultraviolet light, is undergoing commissioning toward the goal of producing 10 kilowatts by summer's end. Visit www.jlab.org for additional information.

CLAS physicists learn a little more about 'nothing,' get thrown for a spin

by Mac Mestayer in collaboration with Melanie O'Byrne

Measurements taken using Jefferson Lab's CEBAF Large Acceptance Spectrometer (CLAS) are telling us more about how matter is produced from "nothing," that is, the vacuum.

Using the CLAS in Hall B, Daniel S. Carman of Ohio University and nearly 150 members of the CLAS Collaboration studied the spin transfer from a polarized electron beam to a produced Lambda particle. Their results were recently published in *Physical Review Letters*.

The CLAS experimenters collided JLab's polarized electron beam into a proton target, producing a polarized Lambda (Λ^0) and a kaon (K^+). Physicists have long known that matter and anti-matter can be created when energetic particles strike one another. The new particles are not really created from "nothing." They are created from the available kinetic energy of the colliding particles. Visualize a bowling ball hitting its rack of 10 pins so hard that the 10 pins turn into 11 normal pins and one "anti-pin." Energy is conserved and so is matter; that's why a new anti-matter particle is created each time a matter particle is created.

In a simple quark model of the reaction dynamics, a circularly polarized virtual photon strikes an oppositely polarized up quark inside the proton (see graphic on page 2). The spin of the struck quark flips in direction and the quark recoils from its neighbors, stretching a flux-tube of gluonic matter between them. When the stored energy in the flux-tube is sufficient, the tube is "broken" by production of a

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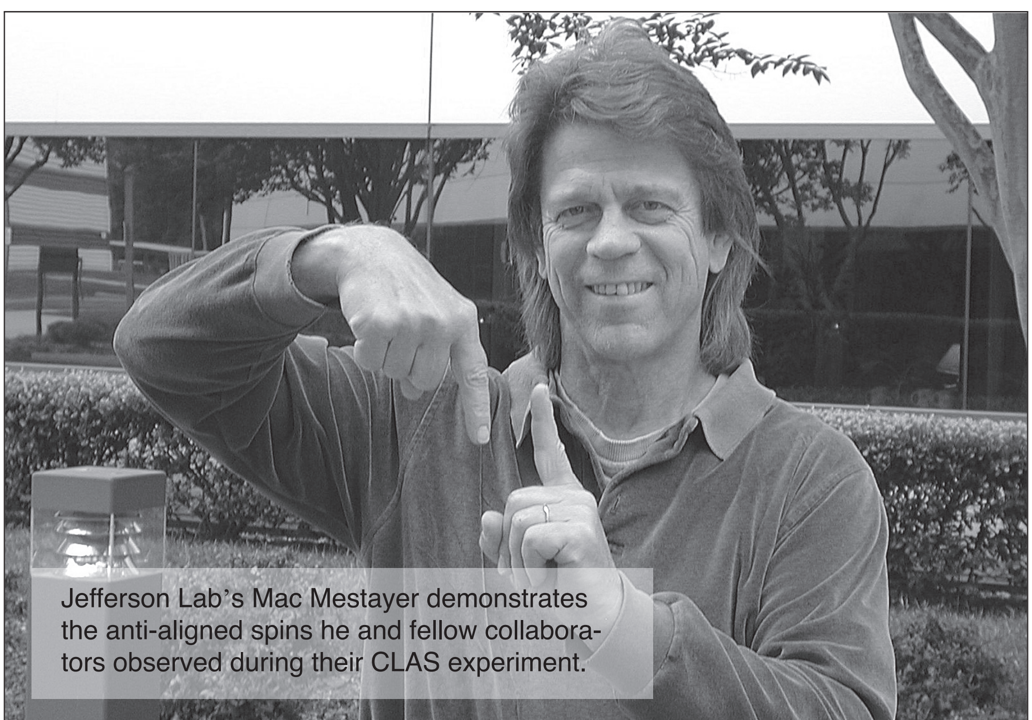
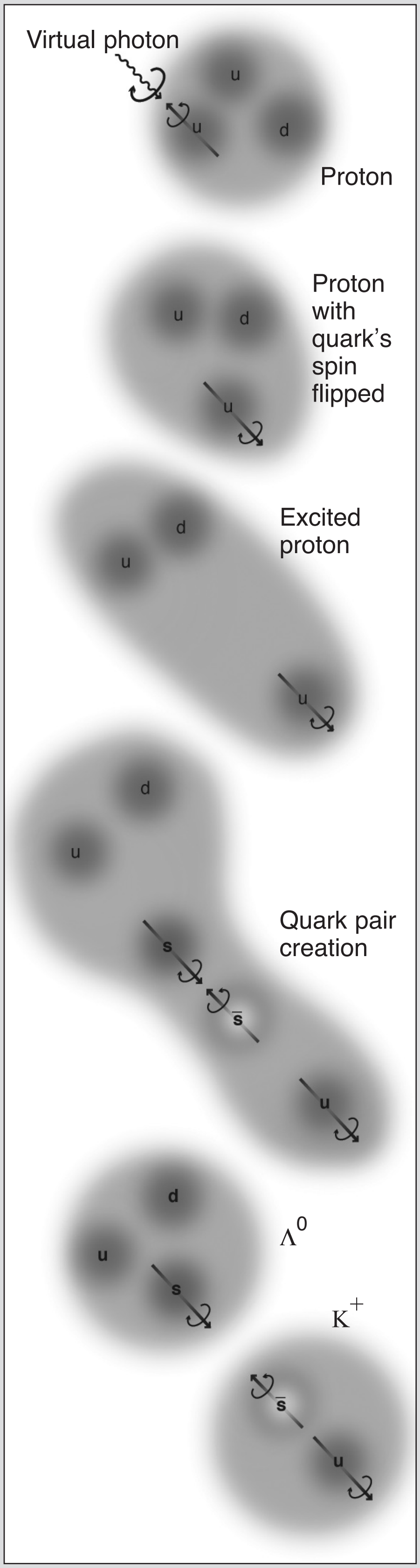


Jefferson Lab's Mac Mestayer demonstrates the anti-aligned spins he and fellow collaborators observed during their CLAS experiment.



Graphics as they appear in the June 2003 CERN Courier, by Mary Beth Stewart, JLab.

Vacuum throws physicists for spin...

Continued from page 1

strange quark-antiquark pair. Using this simple picture, the researchers could explain the angular dependence of the Lambda polarization if the quark pair was produced with the spins in opposite directions, or anti-aligned.

Putting the right spin on it

These anti-aligned spins could throw theorists into a spin. According to the popular triplet-P-zero ($^3P_0$) model, a quark-antiquark pair is produced with vacuum quantum numbers, and that means their spins should be aligned. These results imply that the $^3P_0$ model may not be as widely applicable as was thought.

Winston Roberts, a theorist at Jefferson Lab and associate professor of physics at Old Dominion University, finds the CLAS measurement very interesting. “If they are right, it means we have to rethink what we thought we understood about our models for baryon decays,” he says. “The CLAS results may also be saying something about what we understand of baryons themselves — our knowledge of how to describe scattering processes such as the one they measure, or even that there may be oddities, peculiarities, dare I say ‘strangeness,’ in the way strange quark-antiquark pairs are produced.”

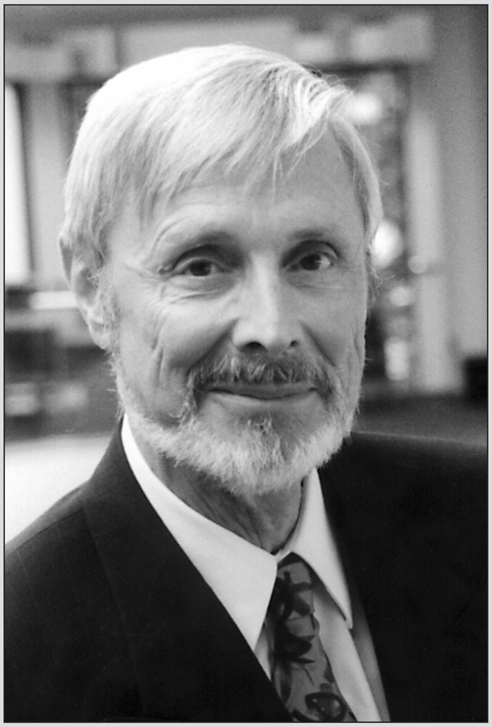
The experimenters expect further reaction from theorists. “Polarized Lambda production is obviously sensitive to the spin-dynamics of quark-pair creation,” says Mac Mestayer, a JLab staff scientist, and one of the lead authors on the paper. “We eagerly await confirmation, or refutation, of the conclusions of our simple model by realistic theoretical calculations.”

Meanwhile, Carman adds, the researchers are planning further experiments. “Our group is continuing this exciting research by extending our arguments to test our picture of the dynamics in different reactions.”

These results show that we have much still to learn about the basic structure of the vacuum. One hundred years ago the vacuum was thought to consist of an “ether” through which light propagated as waves. Albert Michelson, Edward Morley, Albert Einstein and others disproved this hypothesis and the vacuum became an empty void. Twentieth century quantum field theories have now filled this once-empty space with virtual particles. It’s now obvious that a vacuum is not the cold, empty place it was once thought to be. JLab physicists and researchers are studying the spin of the produced quarks in hopes of understanding the vacuum better, as well as the matter that populates it.

Note: For further reading, see D.S. Carman *et al*. 2003 First measurement of transferred polarization in the exclusive e-arrow p -> e′ K^+ Λ-arrow reaction *Phys. Rev. Lett.* **90** 131804.

In a simple model of the reaction (pictured at left), a circularly polarized virtual photon strikes an oppositely polarized up quark inside the proton. The spin of this quark flips and the quark recoils from its neighbors, stretching a gluonic flux-tube between them. When the stores energy is sufficient, the tube breaks and a strange quark-antiquark pair is produced.



Christoph Leemann
Jefferson Lab Director

SPAG provides invaluable service, outside perspective

From the Director

Dear Colleagues:

Since we have recently had a meeting of the Science Policy Advisory Group (SPAG), I wanted to take this opportunity to talk about the SPAG, who serves on the committee, what its charge is and the outcome of the latest meeting here at Jefferson Lab.

As you know there are several external advisory groups that provide insight, perspective and advice to the Director and Lab management. In the science arena, the Program Advisory Committee provides direction with regard to the experimental program at Jefferson Lab. In guiding the Lab's interactions with the Navy, the Maritime Technical Advisory Committee provides advice and insight into the needs of the military customers for our Free-Electron Laser. These groups provide an immeasurable service to the Lab and its leadership as we navigate challenging times.

I formed the Science Policy Advisory Group in August of 2002 to provide Director's Council and me with advice on the future scientific directions for the Laboratory. The idea behind SPAG was to form an advisory group of scientists of national and international renown that would meet at least once a year to get brief reports on where the Lab is going and to provide advice on the longer-term directions we should take to remain a forefront research facility. Chaired by Don Geesaman from Argonne National Laboratory, the SPAG includes Tom Applequist from Yale, Steve Koonin of CalTech, Steve Vigdor from Indiana University, Frank Close of Oxford, Maury Tigner from Cornell, Andy Sessler from Lawrence Berkeley Lab and Bob Austin from Princeton.

The first meeting of the SPAG was held in October 2002 with the membership hearing briefings from several Lab staff regarding our programs and plans for the future. The SPAG was very impressed at the first meeting and included in their final report a plea to the Department of Energy to approve the mission need of Critical Decision 0 (CD-0) for the 12 GeV upgrade calling it "an outstanding science initiative for the Laboratory and nation" and "vital to the continued health of the Laboratory." They also encouraged the Lab to aggressively seek funding for accelerator technology R&D, and to work toward a more stable source of funding for the FEL. The SPAG also agreed that their purpose would be best served if they met every 6 months in order to stay engaged with the Lab and its programs.

Discussion at the June 6 SPAG meeting centered on the Lab's recent efforts to secure CD-0 for the 12 GeV upgrade and the headway made in achieving sustained Navy funding, and possible DOE/Basic Energy Sciences (BES) funding, for FEL R&D. The final report states "The SPAG was very impressed with the thorough fashion in which the laboratory has positioned itself for the future. They have thought through the relevant issues…Significant progress has been made since the last meeting."

Groups such as the SPAG provide an invaluable service to the Laboratory, giving an outside perspective on issues that we face everyday; and they help us focus our efforts toward a strong and dynamic future for Jefferson Lab science and technology.

Working outside the box

RadCon group minimizes radiation risks for staff, users

JLab's Radiation Control group includes: (front, left to right) Becky Nevarez and Justine Jackson; (middle, l. to r.) Dave Hamlette and Dan Dotson; (back, l. to r.) Pavel Degtiarenko, Zach Edwards, Keith Welch, Earl Ratliff, and Melvin Washington. George Walker is represented in the photo being held by Hamlette.

by Judi Tull

The typical job of a radiation control technician in private industry can be a narrowly focused, do-it-by-the-book job, but at Jefferson Lab innovation and creativity are often the keys to getting the job done.

Under the longtime leadership of health physicist Bob May (see story on page 5), the Radiation Control group's primary responsibility is to provide support for Lab researchers and staff in minimizing their exposure to radiation from JLab's research activities. Health Physics is the science and practice of protecting people and the environment from the harmful effects of ionizing radiation. The technicians working under the Radiation Control group's acting group leader, Keith Welch, handle a variety of responsibilities and are expected to find efficient, creative ways to fulfill them.

"We have to rise to the challenge of what goes on here," Welch said.

RadCon group members know that they're sometimes viewed as the "radiation police," with their rules, requirements and controls. But, Welch said, over time, Lab staffers and researchers have come to appreciate their approach and involvement.

"We do everything we can to help people be safe and stay out of trouble," he said, "and we're always here to offer suggestions on how to get their jobs done with the most safety and the least amount of interference."

RadCon staff all have specialized duty assignments. Some of the group's members are primarily focused on keeping up with the 1,500 thermoluminescent dosimeter (TLD) badges that measure personal exposure to radiation for staff and researchers, as well as managing and safeguarding all the records generated through that monitoring. Other members oversee environmental monitoring and sampling of air, water and soil in areas around the Lab, and some specialize in the analytical measurements of those samples. The group is cross-trained, Welch added, "so everyone knows something about everyone else's specialty."

All the technicians, however, are responsible for a common set of core responsibilities in radiation safety, in addition to having their areas of specialization. These core duties are known collectively in RadCon circles as "radiological job coverage," and involve radiation surveys and sampling, establishing administrative work controls, and monitoring work in progress to ensure that good radiological practices are used.

"The feedback we get about how we implement radiation control is generally good," Welch commented.

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"People seem to want our input and appreciate our interest in what they're doing. We've taken them off their guard by giving them input into how to improve their own efficiency while doing radiation control by the rules. Sometimes they seem surprised that we actually want to help them."

According to Welch, establishing personal rapport at JLab has been made easier since everyone who works on the accelerator site or in any kind of job requiring radiation control or monitoring must go through RadCon safety training, another part of the group's job. Although there's less face-to-face interaction since on-line training was implemented last year, some personal interaction is still required.

About half of RadCon's technical group had previous experience in radiation protection in either private industry or the military. Several came to the group with expertise in instrumentation and electronics. None, however, had experience with a high-energy accelerator before coming to JLab. Those without prior radiation protection experience completed a formal training program, including an intensive six-week health physics course at Oak Ridge, Tenn.

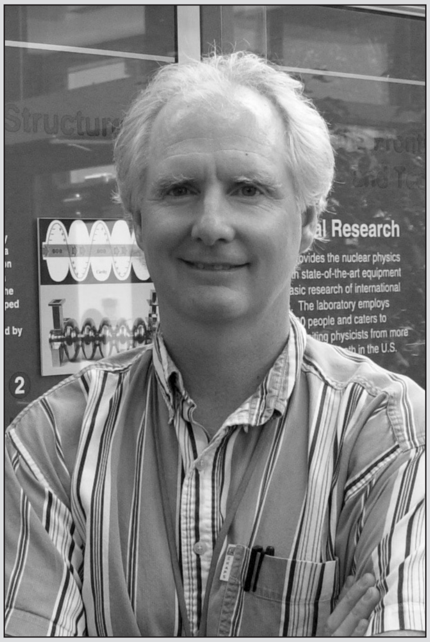
In addition, all RadCon technologists participate in a continuing training program, based on the Department of Energy's two-year training and re-qualification requirement. RadCon staffers attend seminars and training sessions twice a month to brush up on procedures and to do hands-on work practices, especially on situations that don't often arise. Welch explained that this process is designed to involve people in at least 40 hours of documented classroom or lab training over the two-year period. "We think this is more effective than a crash course once every two years," he added.

Turnover in RadCon is low. Welch has worked here almost 11 years, and the other technicians average about 8 years on the job, he noted. This high level of retention is largely due to the interesting nature of the work compared to more typical jobs in radiation control. "The opportunities for challenges and innovation in the industrial arena tend to be few and far between," Welch said.

One such challenge at JLab is the development of products and procedures necessary to monitor radiation within the unique context of a high-energy accelerator facility. The RadCon group also provides services for customers who want to measure radiation as a surrogate for some other condition. Examples include radiation mapping during cryomodule commissioning, and beam-loss monitoring to support accelerator operations.

"Sometimes people hesitate to ask for our input on a job," Welch said, "afraid that we'll hold things up. But, I think they're getting to know from the positive impact of our interactions that we are an asset to have around."

Note: For additional information about health physics, a good place to start is the Health Physics Society's web site at www.hps.org/.



Bob May
Accel. Div. EH&S dept. head

Bob May takes on lead Accel. Div. safety role

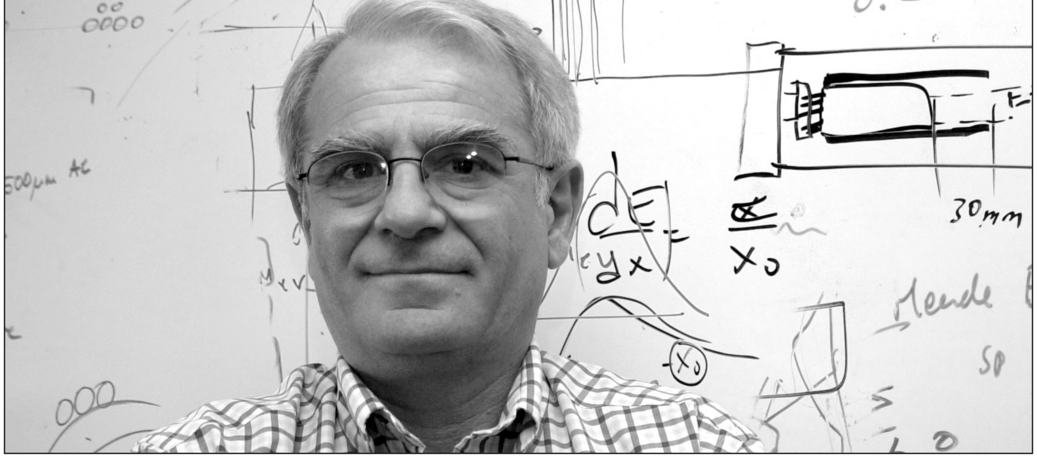
Effective May 12, Robert May took over as head of the Accelerator Division's Environment, Health and Safety department. He succeeds Charlie Reece who has acted as the division's EH&S department head, in addition to being the assistant director of the Institute of Superconducting Radiofrequency Science and Technology since May 2002.

May has extensive experience at JLab, particularly in the area of radiation monitoring and control for the Lab's major accelerators. He will keep this as his area of expertise as he supports CEBAF operations, and as Division EH&S officer, looks over the EH&S needs of the entire division.

Recruitment of a new RadCon Group Leader is under active development in the EH&S department.

From Georgia with innovation

A profile of staff scientist Youri Sharabian



by James Schultz

What looks like half a zebra-striped rugby ball sits solidly on a rectangular steel plate, on top of a chest-high file cabinet in Youri Sharabian's office. As the Jefferson Lab staff scientist pulls the contraption down from its resting place, holding the plate on either side and then handing it to a visitor, it's clear that the steel is by far the heaviest component. The white rugby-ball-like material, joined with thin strips of black epoxy, is actually lightweight Styrofoam, Sharabian explains. The Styrofoam is about three-fourths of an inch thick and weighs about one and a half ounces.

But this prototype chamber cell's size and appearance are deceiving. In initial tests, as air was withdrawn from its interior to create the purest possible vacuum, the handmade cell withstood an equivalent force of 1,300 pounds from atmospheric pressure bearing in from every direction. Meantime, inside, less than one-millionth of a normal atmosphere remained.

"It worked! Which surprised even me," Sharabian recalls. "It worked perfectly for one hour, and then I heard a crack. It was the foam shrinking while the epoxy joint remained the same. But even one hour meant that we could scale up [this design]."

Afterwards, using the same basic approach, Sharabian fashioned a second scattering chamber, which held nearly perfect vacuum for months without deteriorating. Now in Hall B, the full-scale scattering chambers, made from an ultra-light but strong plastic foam known as Polymethacrylimide (PMI) foam, are operating on a routine basis (the Hall B detector, known as CLAS, for CEBAF Large Acceptance Spectrometer, measures scattered beam and particles produced during interactions between the beam and a target material).

Construction is fast: a few days versus a month. Although not as resistant to radiation damage as those built from metal, the cells can be easily swapped out and replacements quickly added. Because the cells are spherical and far less dense than their conventional counterparts and also hold a vacuum, they will provide nearly 100 percent geometrical "acceptance;" that is, accurate measurements of particle interactions. Inadvertent collisions that interfere with sought-after experimental results will thus be greatly reduced or eliminated altogether.

"Designing new things, testing new things makes me happy," Sharabian says. "It's a very satisfying feeling when you come up with something and the result is good. Here I don't feel any limits. That feeling has always made me very excited."

Innovation comes naturally to the native of the former Soviet state of Georgia. Sharabian, whose father and two brothers were engineers, grew up in the capital city of Tbilisi. By the time he was in 7th grade, Sharabian had built a small workshop in his family's basement, outfitting it with an array of tools. Among his creations was a cylinder-and-piston engine that ran on compressed air, which he would later use as a home-aquarium pump.

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When Sharabian's father, who worked in a Tbilisi-area plant making large-motor parts, came home with a new design for small engine springs that kept components separated from electrical contact, but complained of the difficulties in making the springs quickly, Sharabian was intrigued. Working in his basement workshop, the younger Sharabian subsequently fashioned a specialized apparatus that included a small motor and gearbox capable of winding wire accurately and rapidly. Some 400 springs could thus be made per hour, more than 13 times the 30-per-hour-rate then possible at the plant. Sharabian's father was so impressed with the son's ingenuity that the innovation was adopted with minor modifications directly onto the factory floor.

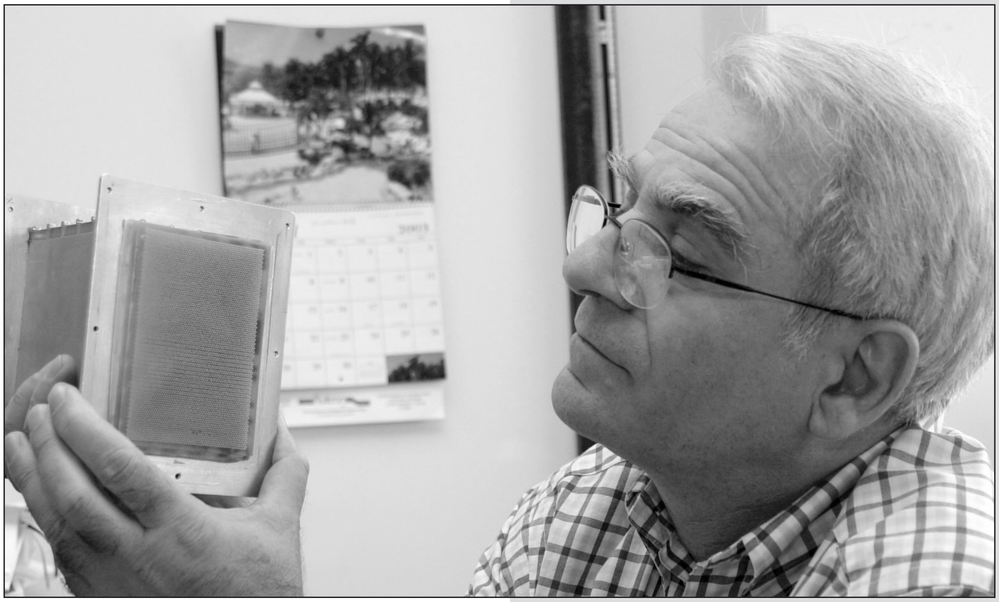
But it was the United States that really caught Sharabian's fancy. His eldest brother would bring home books and magazines on American culture. So it was that Sharabian became fascinated both by American architecture — skyscrapers and bridges in particular — and by a unique form of musical expression.

"I loved American jazz. That made me interested in American culture," he comments. "I knew about the United States well before I came here. What I knew was what I read and heard, maybe one percent [of reality]. What I experienced when I came here — the other 99 percent — was even better than I had imagined."

With a master's degree in experimental nuclear physics from Tbilisi State University in 1971, Sharabian set out for Yerevan Physics Institute in Armenia, where he obtained a Ph.D. in experimental and elementary particle physics in 1981. His leavetaking was not an easy one, a "very difficult time," Sharabian recollects, even though he eventually found a "very exciting and satisfying life" in Armenia. Even so, he says his arrival in the United States in the early 1990s and his decade-long stay at JLab have been equally rewarding: "People in the United States are very, very friendly. They're ready to help." If he had it to do all over, Sharabian says he would take the same career path.

Sharabian is now finishing up the evaluation of a new type of calorimeter he's designed. The first prototype being built is one in which 5,500 optical fibers are glued to a receiving plate and the gaps between them filled with flour-like tungsten powder. Because calorimeters measure the energy and position of emitted particles, more fibers of smaller diameter with the gaps between them filled translate into higher performance. In addition, the new calorimeter's configuration should provide an effective means of creating three-dimensional images of the resultant electromagnetic showers. Given the calorimeter's compact architecture, Sharabian estimates his design will increase individual calorimeter efficiency by at least 25-30 percent.

"These are exciting times at Jefferson Lab," Sharabian says. "I'm happy here. I'm not planning to stop anytime soon. As long as I'm needed, I'd like to stay."



JLab staff scientist Youri Sharabian examines a prototype of the tungsten powder/scintillating fiber calorimeter he's helping to develop for use in Hall B.

Teamwork, coordination bring about success

Cryomodule Test Facility undergoes major refurbishment, safety overhaul

by Melanie O'Byrne
contributing writer

Change is nothing new in the Test Lab building, an integral part of the Institute for SRF Science and Technology at Jefferson Lab, created by Associate Director Swapan Chattopadhyay shortly after his arrival at the Lab in 2001. From late 1966 until 1979, the building housed NASA's Space Radiation Effects Laboratory (SREL). By the time SREL closed its doors, proposals were being made for the National Electron Accelerator Laboratory (NEAL) — later called the Continuous Electron Beam Accelerator Facility (CEBAF) and now Jefferson Lab.

In the most recent round of change to move through the Test Lab, the cryomodule test facility (CMTF) within the Test Lab has undergone a major refurbishment and safety overhaul. The facility's control room and 1000-square-foot test area — known as the "test cave" — have always operated safely, but were only designed to test the original CEBAF cryomodules. With cryomodules of several different configurations on the horizon, for the Spallation Neutron Source (SNS), Jefferson Lab's proposed 12 GeV CEBAF upgrade and future Free-Electron Laser upgrades, the test cave needed to become a more flexible and efficient facility.

"The Test Lab was put together in the late 1980s," says Tom Powers, project engineer for the CMTF upgrade. "Whenever needed, people would work on it some more, test some more and so on. It never really got a good start from scratch."

In February 2001, Powers began discussing the CMTF upgrade with Henry Robertson from the Safety Systems Group. They had the choice of upgrading the existing facility or rebuilding it from the ground up. Powers and Robertson assembled a team of safety and radiofrequency (RF) professionals who opted for the latter, after extensively discussing what the system was, what it needed to be, and how it should work.

The team stripped the entire facility, knocked down one wall and repaired the raised floor in the test cave. They also improved the facility's magnetic shielding, reducing ambient fields to about 0.1 gauss, or five times less than Earth's magnetic field. Before this, magnetic fields in parts of the cave had been as high as 6 gauss, due to magnetized steel in reinforced concrete from the building's SREL days. This used to spoil measurements from the superconducting radiofrequency (SRF) cavities in the cryomodules, despite the cryomodules' own magnetic shielding.

With the facility gutted, a new safety system had to be developed. "We wanted to implement a system that paralleled the main features in the accelerator, rather than making a hybrid," says Robertson. "By starting from scratch, we met the highest safety standards in terms of the space we had."

Robertson explains that the best approach to safety is to do away with a hazard altogether or use a passive means of protection such as civil construction to keep people away from a hazard (e.g. concrete walls, locked doors). The second preference is to offer active systems like interlocks as protection. Human intervention, known as administrative procedures, is the least-preferred solution because of the chances for human error.

"Where possible, we use all three means of protection in parallel," affirms Chattopadhyay. "By using multiple layers of protection, we provide contingency mitigation. If one safety system fails the others are there

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to help protect our people and resources."

Cooperative effort

Some of the safety hazards in the CMTF were known, like radiation or a potential oxygen deficiency hazard (ODH) with cryogenics. Robertson says the various safety groups, although spread across Jefferson Lab, coordinated their efforts, which were backed up by engineering approaches to resolve hazard issues.

For example, Powers' team increased the safety of waveguides, adding a new lockout/tagout system to back up the Personnel Safety Systems. Radiation expert Bob May evaluated shielding while Robertson's group interlocked to radiation monitors, organized cabling and ensured functionality of the safety system. Dana Arenius from the Cryogenics Group and Patty Hunt, Industrial Hygiene, did an evaluation with system owners and worked out types of oxygen deficiency monitoring and the best locations for sensors. If there should be an oxygen deficiency event in the Test Lab, ODH alarms will sound off while a second safety system shuts down the hazard and an automatic exhaust fan turns on.

Eric Hanson, the Accelerator Division's EH&S Industrial Safety Group leader, describes the CMTF upgrade as an excellent example of Integrated Safety Management (ISM). "The umbrella principle of ISM is that people work together at all levels to get the job done — identifying and mitigating hazards and making sure everything works," says Hanson. "It tends to keep you pro-active and out of panic mode. Dealing with these concerns up front takes stress off of people and helps us get the scientific work done more efficiently."

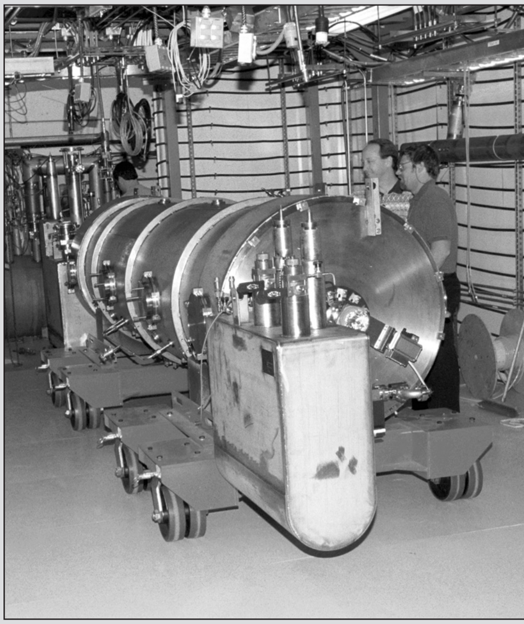
Planning is the key

Powers says planning well in advance is the key to making a large-scale upgrade like the CMTF work. "You need to involve the safety people as soon as you start thinking about doing these projects, before the funding is even approved," says Powers. "The advantage of planning in advance is that you can tell people ahead of time that you'll need them, and they will help you out."

After all of the planning and cooperative efforts across Jefferson Lab, the upgraded CMTF was certified and operational in May 2002. By all accounts, it has been a great success. "I'm really pleased with the quality of work that went into the facility — the extra inspections, attention to quality assurance, and the excellent product produced by all of the technicians and engineers for the project are what made the difference," Powers says proudly. "Now we have a test cave that will serve the Accelerator Division's cryomodule testing needs for years to come."

"The successful renovation of the CMTF gives JLab the most flexible cryomodule testing facility in the world," comments senior scientist Charlie Reece, who is the SRF Institute's Assistant Director and project manager for the next-generation "100 MV" cryomodule for CEBAF. "The robust engineering of safety and instrumentation systems enables us to confidently interweave a variety of production testing and more developmental types of tests. This facility will be a key asset as the SRF Institute continues to serve the cryomodule development and construction needs of JLab and other U.S. accelerator applications in the future."

"The CMTF is the first in a list of facility upgrades and face-lifts planned for the SRF Institute's Test Lab," confirms Chattopadhyay.



The newly refurbished Test Cave is currently being used to test the cryomodules Jefferson Lab is producing for the Spallation Neutron Source.

Marie & Pierre Curie's grand-daughter visits U.S.

Physicist discusses her work, passion for science, remarkable family history

Note: Hélène Langevin-Joliot comes from a remarkable family of distinguished scientists. Her grandparents, Marie and Pierre Curie, won the Nobel Prize for physics with Henri Becquerel in 1903, for the discovery of radium. Marie Curie won a second Nobel Prize, for chemistry, in 1911. And Langevin-Joliot's parents, Irène and Frédéric Joliot-Curie, won a Nobel Prize for chemistry in 1935, for their discovery of artificial radioactivity.

Langevin-Joliot is a respected nuclear physicist from the Institute of Nuclear Physics at Orsay, the laboratory set up by her parents. JLab science writer, Melanie O'Byrne, spoke with Langevin-Joliot during the recent International Symposium for Spinal Radiography at Georgetown University An excerpt of the interview follows.

What do you do when you're not traveling around the world, speaking about your family?

I try to save part of my time for research. My fields of interest are exotic nuclei and highly excited hole states in medium and heavy nuclei.

I don't travel too much. I generally speak about the Curies and Joliot-Curies in lectures on radioactivity and its applications, on nuclear physics, science, research or women in science, either for the general public or students. Visits to high schools are occasions for meeting kids, telling them stories and answering questions.

I think that improving the public scientific culture is a major challenge of our time. Showing that science is a human adventure, not only equations and techniques, may help.

Important efforts are needed to preserve scientific archives. I am involved in those through my parents' archives.

What sparked your interest in science?

I was a very good student at mathematics and science. I had the feeling that science was something interesting when I heard my parents speaking about it. My mother, especially, gave me the feeling that you didn't need to be a genius to become a researcher. That was very encouraging. I would otherwise have chosen to do something completely different.

You completed your baccalaureate exams toward the end of World War II, in a small village…

My father was a Resistant against German occupation. In spring 1944, he went into hiding in Paris and decided that it was safer for my mother to leave France and try to reach Switzerland with my brother and me. I took my baccalaureate exam on the way. It happened that the exam was over on June 5. On the morning of June 6, we heard about the Allies landing in Normandy and we left to cross the border. It was the best day for this expedition, the Germans having other things in their mind!

Where did you conduct your Ph.D. research?

At the nuclear physics and chemistry lab at the Collège de France. My thesis was on internal Bremsstrahlung

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and auto-ionization phenomena. I worked alone for some 5 years, preparing the apparatuses, performing the experiments and discussing them with theoreticians. I started as a probationer at the CNRS (France's national scientific research center) and became a permanent researcher even before defending my thesis.

And what did you do next?

I continued working on beta-gamma spectroscopy, parity non-conservation experiments. Then our lab moved to the new nuclear physics Institute at Orsay and I turned to medium-energy nuclear reactions. My mother had discovered the Orsay site; she had obtained government funding for a new lab and ordered a synchrocyclotron. Such a machine could not be built inside Paris at the Radium Institute or the Collège de France. She died in March 1956 before the lab was built. My father spent the remaining two years of his life realizing the program they had decided together.

Are others in your family interested in science, too?

Yes, my husband, Michel Langevin, was a nuclear physicist at the Institute. My son, Yves, is an astrophysicist mainly interested in planetology and asteroids. My brother, Pierre, is a biophysicist working on photosynthesis.

Did Pierre keep the Curie name of your parents?

No, he is Pierre Joliot. Many people used to name my parents Joliot-Curie, but they signed their scientific papers Irène Curie and Frédéric Joliot. My father asked me to sign Langevin-Joliot, not just Langevin, as I would have done otherwise.

What do you remember about Marie Curie?

I do not have a good memory of my childhood, and my parents did not tell me that I had a very famous grandmother! I have some memories of Marie with me in the Luxembourg Garden in Paris. My few direct memories are mixed with photographs, home movies and my parents' memories.

Do you remember your parents winning their Nobel Prize?

It was at a time when we shifted from Paris to the new house my parents built in the suburbs. I can recall them saying they won the Nobel Prize but it did not mean much to me at the time!

Irène and Frédéric observed the neutron but did not know what it was. James Chadwick went on to get the Nobel Prize for that. Later Irène observed what turned out to be fission.

… how did that make your parents feel?

When fission was discovered at the end of 1938, I heard my parents comment, "maybe if we had worked together, we could have discovered fission!" From 1935 on, you see, my father had focused on building accelerators.

The Joliot-Curies were not the first to "observe" neutrons. At the end of 1930, Walther Bothe and Herbert Becker had discovered a mysterious radiation, which penetrated matter

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Photo by Greg Murray, 21st Century Science & Technology

Getting to know the granddaughter of Marie & Pierre Curie...

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much more than usual ones, attributing it to very high-energy gamma rays. Note that physicists were much puzzled by cosmic rays; they did not know of the pair effect and of positrons. In mid-January 1931, my parents discovered that the Bothe and Becker radiation projected out energetic protons from hydrogenous matter. They published the result of this key experiment immediately, suggesting a kind of Compton effect. Their note (in French) was read in Cambridge, England, the next week. After confirming the surprising Paris results, James Chadwick started his decisive experiments to check if the radiation could be that neutral particle (a very tightly bound proton-electron system) suggested by Rutherford several years before. After the discovery at the end of February, the neutron finally turned out not to be the Rutherford particle but that is another story.

Your parents actually saw the first atomic bomb. What were their feelings and reactions?

They were stricken but not surprised with the power of the bomb dropped on Hiroshima and Nagasaki.

Then, as with many nuclear physicists, they were eager with the hope of preventing a nuclear arms race. The Cold War, unfortunately, prevented any agreements for years. My parents were very much involved in the Peace Movement and the Stockholm appeal against atomic bombs.

Marie and Pierre Curie met through their research. Irène and Frédéric Joliot met through science. How did you meet your husband [Michel Langevin]?

We met at the School for Physics and Chemistry when we were both students.

Marie Curie and Irène Joliot-Curie were never accepted into the French Academy of Sciences yet Frédéric Joliot was. What do you think of that?

No women, or at most very few, belonged to scientific academies, whatever the countries, in those times. The situation has improved slightly now, but not enough. Marie was not elected when

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she tried in 1911, and she never tried again because of the vicious attacks she had suffered — against her work, against women, against a woman of foreign origin. My mother presented her candidature after the Second World War, also without success. She found the situation comical and tried to be elected at every possible occasion, three times, but she died before succeeding. Marguerite Perey, who discovered francium, later became the first woman accepted into the French Academy of Sciences.

What is your advice to young students and physicists?

You need a love of the idea of physics and a love of doing physics — and they are not the same thing.

Try not only to read papers but also to visit labs to see what doing research means in the different fields. It is better not to choose the same thing as everyone else.

If you are becoming a physicist, try to resist the increasing tendency toward aggressive competition among individuals. Research is a very demanding activity, but perhaps the best success may be achieved by a right balance: between your involvement in personal as well as collective research efforts, personal and family life, and your responsibility as a scientist and a citizen in society.

What is your message to the public regarding fear of radiation?

Earth is naturally radioactive; otherwise it would already be a dead planet. We live in a bath of radiation from rocks, gas and space, with some 7000 becquerels (the number of nuclei that decay per second) inside our body. We get enormous benefits from the use of radiation, especially in medicine. Nuclear energy, whose wastes are hugely radioactive, has the advantage of producing no carbon dioxide.

I regret that the necessary efforts to handle nuclear wastes properly have been underestimated for many years. New programs are developing seriously now and I am convinced that safe answers could be found to the problem.

Photo by Greg Murray, 21st Century Science & Technology

Physicist Hélène Langevin-Joliot, granddaughter of Marie & Pierre Currie, during her recent visit to the U.S.

Milestones
for May 2003

Hello

Gloria Daniel, Travel Auditor, Office of the Chief Financial Officer

Tim Lock, Management Information Systems Manager, Office of the Chief Information Officer

Benjamin Welch, Imaging Detector Scientist, Physics Division

Stephen Witt, Maintenance, Administration Div.

Congratulations to…

Joe Wilson, Jr., Accelerator Div., received a Master's Degree of Science in Applied Physics and Computer Science from Christopher Newport University in May. Wilson is a staff engineer with the Cryogenics Group.

Charles Hutton recently graduated Magna Cum Laude from Averett University, earning a Bachelor's Degree of Business Administration. Hutton is a mechanical engineer in the Accelerator Division.

Both men used the Tuition Assistance Program available through JLab's Training and Performance Office.

"Milestones" highlights the achievements of JLab staff and users, full-time and term new hires, separations and retirements. To submit staff or users' promotions, special honors and awards send information to magaldi@jlab.org or call ext. 5102.

Forty golfers take part in spring tournament

The JLab Activities Group 2003 Spring Golf Tournament took place April 30 at The Riverfront Golf Course in Suffolk, Va. It was a picture "par-fect" day, as 40 golfers ventured to their tee boxes at 1:30 p.m. for a shotgun start, according to Julie Oyer, Office of Project Management and tourney co-coordinator.

Winners of the 1st flight were Bill Cash, Mark Stapleton, David Griffith and Steve Singleton with a score of 63. Winners of the 2nd flight were Sean Vulcan, Bill Vulcan, Paul Powers, and Bert Manzlak with a score of 72. Members of the winning teams picked a prize of their choice from the "prize table." Winning the Men's Longest Drive on #18 was Kelly Dixon. Winners for Closest to the Pin were Steve Oyer on #2 and Bill Carlton on #11. Each player received a ticket for playing and could obtain additional tickets by buying "mulligans" before play started.

Tickets were drawn at the end of the tournament for the remaining prizes, including free rounds of golf donated by The Riverfront.

Julie Oyer explained that the mulligan money is used to offer lower-cost tournament fees to the players by additionally subsidizing the cost, and for other incidentals involved with holding the tournament. Co-coordinators Ed Daly and Tommy Hiatt thanked everyone for playing and for a fun-filled day! Watch for information regarding the Fall Tournament, which will be held during September/October.

Unauthorized locks on site create delays, hazards; follow JLab policy

When staff put unauthorized locks on buildings, rooms, and containers it delays emergency access, creates safety hazards and interferes with Facilities Management functions including facility/property audits and inspections, according to Facilities Management.

JLab's Lock and Key Control Policy and Procedures require a Facility Management-issued Best Lock or Kwik Set Lock depending on the degree of protection required. Any locks not on the JLab Facility Management Access system are subject to being cut and replaced by an authorized lock.

For reference see www.jlab.org/intralab/security/secure/Security_Plan_Apr01.pdf

Hurricane season starts; run your RC3 checklist

With the start of the hurricane season on June 1, Jefferson Lab enters "Hurricane Readiness Condition 3" (RC3). Facilities Management staff reminds all Checklist owners (i.e. building managers, emergency planners) to complete all items on their list under "RC3."

The National Hurricane Center (NHC) is predicting a very active season with more storms than usual for the Western Atlantic Basin. See www.cpc.noaa.gov/products/outlooks/hurricane.html for the latest information.

Everyone should use the start of the season as a reminder to take a look at their preparations, both at JLab and at home, to be sure that you are fully prepared for what these powerful storms can bring. Individuals new to the area who are unfamiliar with these types of storms may want to visit the National Hurricane Center's information web site at www.nhc.noaa.gov/HAW2/ for more information.

JLab's 18th Annual Run-A-Round

JLab's annual Run-A-Round took place May 20. Just a few of the many special moments of the afternoon are shown below. Race results are available on the Jefferson Lab Activities Group (JAG) intranet at www.jlab.org/jag/archiveindex.html. Congratulations to all winners!

Mark your calendar

Join the fun, festivities at July 16 family summer luau

Plans are in full swing for Jefferson Lab's summer luau! The free event, open to all Lab employees and their families, users, contractors and students, will be from 3-6 p.m. Wednesday, July 16, on the lawn behind the Residence Facility.

"If you are looking for an afternoon of fun, mark your calendars," says Dave Williams, Jefferson Lab Activities Group (JAG) chair. "This is an event you won't want to miss."

The luau is geared toward families, especially children, but adults will be able to join in on the fun as well, according to Williams. "We'll be ready for the hottest weather July can throw at us, so we're planning several water-related activities. There will be a high chance of getting wet, so dress appropriately," he advises. Some of the activities planned include a dunk tank, slip-and-slide, watermelon-eating contest, water sprinklers, limbo, volleyball, face painting, and tug-of-war for the kids.

"And bring your appetites," Williams adds. "Refreshments will include a variety of summer favorites: hot dogs, burgers, chips, side dishes and cold beverages, as well as special summer treats like sno-cones and cotton candy."

The success of these JAG-sponsored events depend on everyone's participation," Williams points out. "With your help, everyone's time in the sun will be nothing but fun! JAG will need volunteers to help with a variety of preparation tasks, grilling, food and beverage attendants, staffing activities and games, and clean up." The JAG has posted an electronic Volunteer Sign Up page on the JAG web page at www.jlab.org/jag/.

JAG is planning to bring back the Wildest Hawaiian Shirt Contest, which was a hit last year. "We'd like to see folks dress the part for this event," Williams says. "We'll even have a prize for the best shirt. Mark Wednesday, July 16, on your calendar. Aloha!"

For additional information about the luau, visit the JAG web page or contact Gary Hays, haysg@jlab.org.

ON TARGET

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Editors
Linda Ware
Debbie Magaldi

Contributing Writers
Melanie O'Byrne
James Schultz
Judi Tull

Photographer
Greg Adams

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www.jlab.org

Jefferson Lab/MS 12C
12000 Jefferson Avenue
Newport News, VA 23606

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