SLAC BEAM LINE

Moreover, the chemical revolution ... happened as a result of a lab experiment to find the secret of life in the back legs of a frog.
—Derek J. deSolla Price

Volume 15, Number 1 January 1984

THE REAL SLC GROUNDBREAKING

Ceremonial shovels are all very nice, but when you really want to get the job done, you should use machines like these. This work near *PEP* region 12 will screen the site from view at Sand Hill Road. This kind of equipment moves quickly, and the landscape has already changed from the time of this photograph in December. Site preparation is well underway for the Collider experimental hall behind *PEP* region 2, and an impressive slice has been made behind region 4 to admit the tunneling equipment. (Photo by Joe Faust.)

INSIDE ...

SLAC Beam Line, x2979, Mail Bin 94

Editorial Staff: Bill Ash, Jan Adamson, Dorothy Edminster, Bob Gex, Herb Weidner.
Photography: Joe Faust.
Graphic Arts: Walter Zawojski.
Illustrations: Publications Department.

Stanford University operates SLAC under contract with the US Department of Energy.

BURTON RICHTER NAMED NEW DIRECTOR OF SLAC

Burton Richter, Nobel Laureate and Professor at *SLAC*, has been selected as the new Director of the laboratory effective September 1, 1984. The appointment was announced on December 13 in a memorandum to all staff by Director W.K.H. Panofsky, who last year had announced his intention to step aside. By an informal *SLAC* policy top administrators relinquish their posts at age 65.

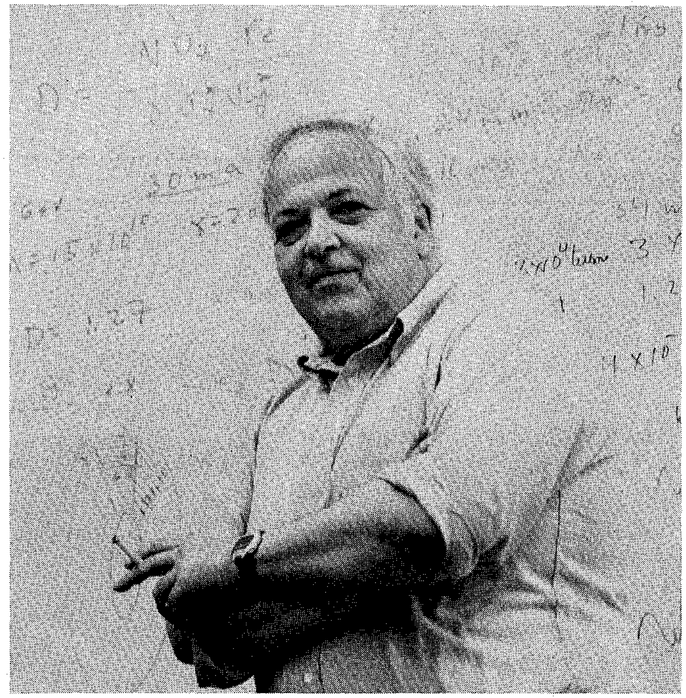
Panofsky noted "... I am extremely happy that as able a person as Burt will take over leadership of the laboratory. I cannot imagine a better set of qualifications for the *SLAC* Director than those possessed by Burt Richter. There are few people in the world whose record is as replete with accelerator and collider achievements as well as research in particle physics. *SLAC* will be in good hands!"

In a Stanford University news release, Richter commented that "Panofsky has done a wonderful job building up this lab, and will be a very hard act to follow." When questioned about the direction he thinks *SLAC* will take, Richter said, "All high-energy physics labs like this have to do not only first-rate scientific research now but also have to look toward the development of new research tools and accelerators so we can continue to do research in the future. ... The real challenge is not so much to maintain what is going on, but to keep things moving and to make sure *SLAC* continues to be a first-rate institution five and ten years from now."

Richter was born in Brooklyn, N.Y., and earned his bachelor's and Ph.D. degrees at *MIT*. He came to Stanford in 1956 as a research associate in the High Energy Physics Laboratory, and became a professor in 1960. He was named to the Paul Pigott professorship in the Physical Sciences in 1980.

In 1976 Richter shared the Nobel Prize for Physics with Samuel C.C. Ting of *MIT* for simultaneous discovery of the J/ψ particle, which previous theories of subatomic structure had not predicted. Richter's discovery was made with the *SPEAR* positron-electron storage ring, which Richter designed.

Richter served as a member of the High-Energy Physics Advisory Panel to the Atomic Energy Commission from 1970-1974; a member of the Visiting Committee for the *ZGS* Complex at Argonne National Laboratory from 1972 to 1974 and chairman in 1974; a member of the visiting committees at Brookhaven National Laboratory's Physics and Accelerator Department, 1972 to 1976; the Lawrence Berkeley Laboratory, High Energy Physics Division, 1974 to 1977; and the Princeton Plasma Physics Laboratory, 1979 to 1981.



SLAC Director Designate Burton Richter

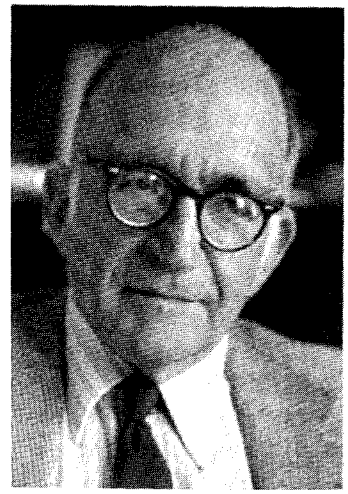
He was a member of the Department of Energy Ad Hoc Fusion Review Committee from 1977 to 1979; a Loeb Lecturer at Harvard University in 1974; and a De Shalit Lecturer at Weizmann Institute in 1975.

He has been a member of the Science Council of the Deutsches Elektronen-Synchrotron, Hamburg, Germany, since 1975 and a director of the Electron Storage Ring Corporation since 1977.

He also is a member of the National Academy of Science, a fellow in the American Physical Society; a fellow of the American Association for the Advancement of Science; a member of the GM Science Advisory Committee; a director of Teknowledge, Inc.; a member of the Accelerator Advisory Committee for *CERN*, Geneva; and a member of the Visiting Committee, Max Planck Institute, Munich, Germany. In 1975, he was awarded the E. O. Lawrence medal by the U.S. Energy Research and Development Administration.

Richter's selection was based on a search carried out by Stanford University with the help of a committee chaired by Provost Albert Hastorf. Following approval by the Department of Energy, which funds the laboratory's program, the appointment was confirmed by the university's Board of Trustees.

DRELL TO HEAD DISARMAMENT STUDY

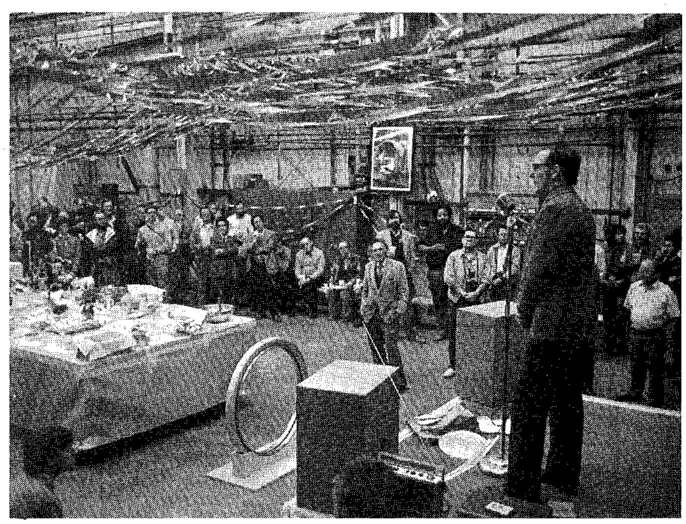


Deputy Director Sidney Drell has been named co-director of the Center for International Security and Arms Control at Stanford University, joining the center's director, John W. Lewis, with whom he has worked closely since the program began in 1970. Drell, contrary to an earlier newspaper account, will continue his work at *SLAC* during this time.

Drell will lead a new project at the center resulting from a four-year grant by the Carnegie Corporation to fund two or three fellowships annually for mid-career scientists interested in arms control. The fellowships will allow scientists from several disciplines to pursue research in technical and political problems of arms control and international security.

The announcement, carried in the Stanford University *Campus Report*, noted Drell's longtime involvement with the issues of security, defense, and disarmament. He has been a member of the President's Science Advisory Committee and has consulted for both the National Security Council and the US Arms Control and Disarmament Agency.

BUBBLE CHAMBER FAREWELL



A retirement party for the Forty Inch Bubble Chamber was held in the research yard in December. The chamber has pulsed nearly a billion times in its lifetime, and the experimental programs using it are coming to a finish. In the photograph at right Dick Neal, former Director of the Technical Division, addresses the friends of the fine machine. In the photo below, Neal reminisces with Joe Ballam, who led the *SLAC* group which has accomplished so much with the facility.

The crews who built this facility and kept it running are now deeply involved in other projects at the lab, including the linear collider. The following tribute was written by crew chief, Don Day.

The Chamber has pulsed its last; sixteen years since infancy. No longer will the shrill whine of pumps and the deep hollow sound of its heart beating be heard. No longer the hiss of air, clicking of cameras, or billowing clouds of nitrogen be seen. Her crews have seen to her every whim and at times she has asked the most of us all. We have lived with this machine, never knowing if the next pulse might be the one which breaks the window or cracks a tube. We have struggled in early morning, when she was at her worst. She has done all that was asked of her, and now she is through.

We have given a great deal of ourselves — shift work brings out the best and worst in us all. Our only reward is in knowing we have done our best. Thanks from one who appreciates the best. A big job well done!

SLD: A NEW DETECTOR FOR THE COLLIDER

A group of physicists from 18 laboratories and universities has begun work on a new detector to be used at the Linear Collider. The collaboration, which is headed by Charles Baltay of Columbia and Marty Breidenbach of *SLAC*, has completed a preliminary design and is in the midst of studying prototypes for several major components. The facility will incorporate the latest techniques for particle measurement and identification, and it will be designed to exploit the special features of the collider.

The schematic below is an idealized cross section of part of the *SLD* showing its six primary systems. The complete facility will stand about thirty feet tall and weigh about 2000 tons.

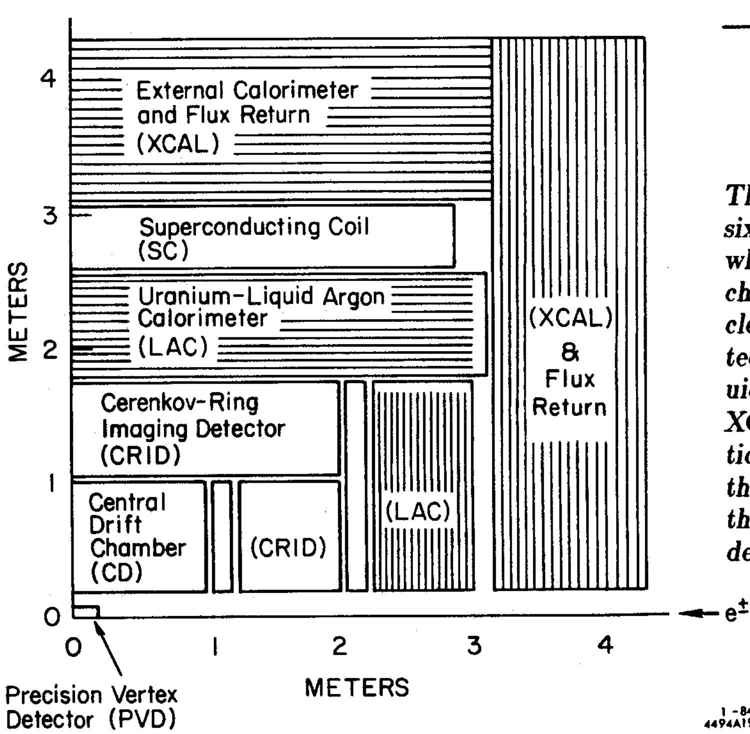
Collisions of a high-energy electron and positron at the *SLC* will produce events, like the one illustrated on the facing page, in which many different particles with various energies emerge. The job of the detector is to measure thoroughly all the particles produced so that the event can be reconstructed and understood.

The example shows one part of that measurement, in which the charged particles are bent in a magnetic field so their energies can be determined. This section of the detector is called the central drift chamber, labeled *CD* in the drawing.

Unstable particles are often produced and travel a very short distance before they decay into other particles. A magnified look at the center of the event would then show that some of the tracks do not point directly at the collision point. This job is performed by the Precision Vertex Detector, *PVD*, a beer-can sized shell of semiconducting chips surrounding the interaction region. These exotic devices can measure the location of a particle track to about one thousandth of an inch.

Then there is the question of the uncharged particles, which are invisible in any of the parts so far discussed. These show up only by stopping in heavy material, such as an iron plate, and producing a flood of lower energy charged particles that can be detected. In addition to revealing neutral particles, this technique (called calorimetry) provides a measurement of energy for both charged and neutral particles.

In the *SLD* the calorimeter will be built up of uranium plates. Uranium is very dense so that the calorimeters can be compact, which is important, but it has another greater advantage. When the particles to be measured stop in most materials, such as lead or iron, some of their energy is lost in unobserved nuclear reactions and the total measurement of energy is degraded. In uranium this effect is compensated by extra energy given up in the interactions so a much better energy measurement results.



This preliminary study of the SLD detector shows the six big systems: the precision vertex detector (PVD) which locates the origins of particles; the central drift chamber (CD) which measures the deflection of particles in a magnetic field; the Cerenkov ring imaging detector (CRID) which identifies particle types; the liquid argon-uranium and external calorimeters (LAC and XCAL) for measuring energy and detecting neutral particles; and the superconducting coil (SC) for producing the magnetic field. The detector will stand more than thirty feet tall and weigh over 2000 tons. The detailed design will develop after months of engineering study.

Although the particles lose most of their energy in the calorimeter, some energy escapes out the back into the iron shell. This 'tail' of energy can be picked up by building the iron shell in layers with detectors sandwiched between, thus finishing off the calorimetry without much extra space.

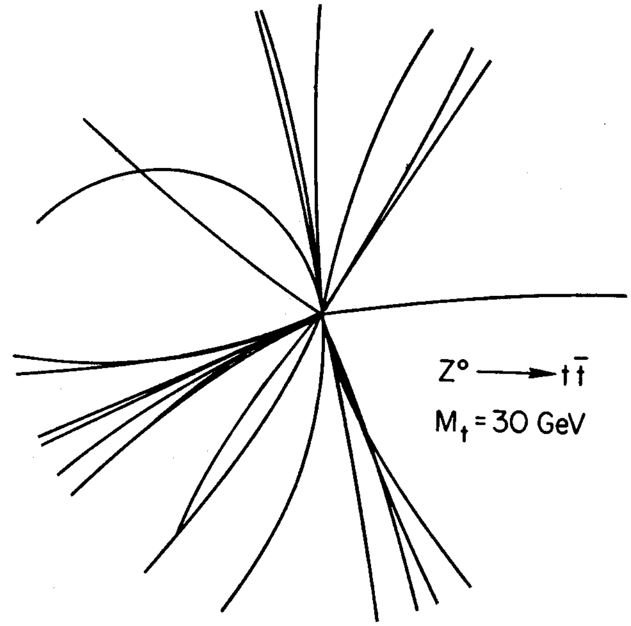
Still this is not enough. Measuring the energy of the particle does not identify its kind. Different particles can give identical tracks and particle identification is the most difficult job in a detector. There are several techniques, but most work well in only one energy range and not well in others. One that does have a wide range is based on an effect called Cerenkov radiation, which is the light produced by high-energy particles traveling through a gas.

Unfortunately, Cerenkov light is quite faint and the traditional devices using this effect require bulky pressurized tanks with large photomultiplier tubes to amplify the light signals. The *SLD* requires a system that takes up little space, has no thick walls, can measure the pattern as well as the presence of Cerenkov light, and can do so for many particles over the full detector region. Tricks that make this possible have been developed and small versions are being tested. This system, called *CRID* for Cerenkov Ring-Imaging Detector, fits between the drift chambers and the calorimeters.

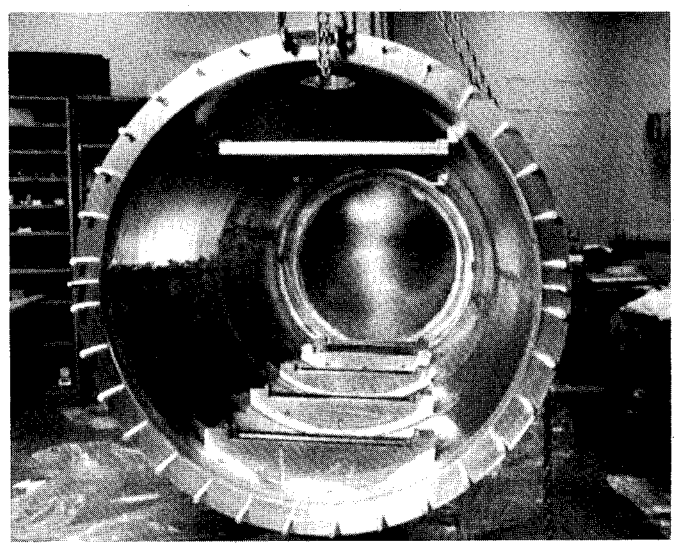
The magnetic field which bends the tracks for measurement in the drift chamber is produced by a large electric coil carrying several thousand amps of current. This coil could in principle be just outside the drift chamber since this is the only component which requires the field. Unfortunately, the substantial thickness of the coil would cause many particles to interact before they were identified in the *CRID*'s or measured in the calorimeters. It would also make it more difficult to mesh together the different pieces of the detector without leaving gaps. So the coil is very large, about twenty feet in diameter. Such a large magnet must be made with a superconducting coil to avoid huge electric power costs.

The only element in the detector that has not been spelled out is the detector itself; what does *SLD* stand for? According to its proponents, the acronym stands for *SLAC*'s Littlest Detector, and it just grew and grew and grew.

The *SLD* is a very large project and is not intended to be ready for use when the collider turns on at the end of 1986. Instead, the Mark II detector now at *PEP* is being partially refitted to accommodate the higher energies so that a completely checked-out system will be ready for the first beams. The Mark II upgrade and the continuing progress of the *SLD* are subjects for future articles.



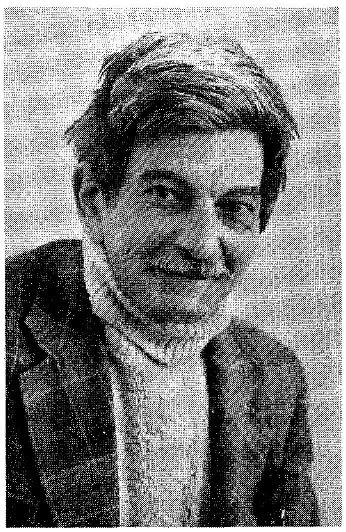
A computer simulation of an event at the collider in which a Z is produced and decays into two top quarks. The quarks are never seen directly but decay into two opposing clusters, or jets, of particles. This shows the pattern of tracks in a drift chamber which determines the energy of the charged tracks. Other measurements on these and on the unseen neutral particles occur farther out.



This steel cylinder is part of the cryostat for testing the liquid argon calorimetry of the SLD detector. This apparatus, built at the University of Washington, is now in place in a SLAC test beam. The bars along the bottom support the calorimeter itself which consists of parallel plates of uranium metal and electrodes to pick up the signals.

ERNEST ALLTON

Physicist Ernest Allton died just before Christmas, following a career which brought him close to many different parts of the *SLAC* community. He was known to the Bubble Chamber group as a whiz with computer calculations and as a highly skilled technician who fixed electronics during the owl shift.



He was known to the particle physics community as a co-author of the first major paper on inelastic electron-proton scattering. He was known to members of the theoretical physics group as a tireless calculator of radiative corrections. He was known to some members of *SLAC* and Stanford University as a fellow graduate student, and he was one of my first students when I came from Berkeley to Stanford in the early fifties.

Ernie was a unique and memorable graduate student. His presence always insured a lively and interesting time at a physics discussion, a bull session, or a party. He made everyone feel better by his presence.

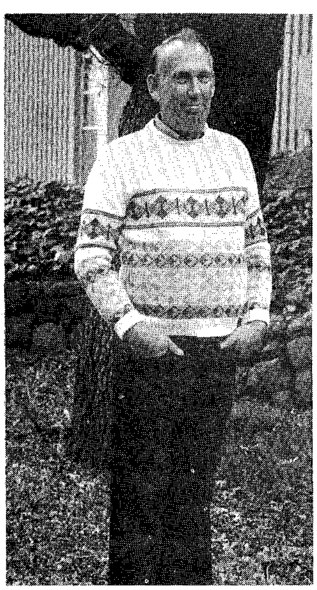
Ernie was a thoroughly delightful person. He enjoyed everything from Latin scholarship to music, mountain climbing, and physics. He was a totally honest investigator who wanted everything he did to be just right. This absolute dedication to correctness gave him some difficulty throughout his career, as he sometimes found it difficult to finish completely a particular task. After all, when was a job really perfect?

Ernie received his Bachelor of Science degree at the City College of New York, coming to Stanford in 1954. He completed his studies at Stanford in 1960, executing a highly acclaimed experiment on inelastic scattering which showed that the first excited state of the proton had a physical size similar to that of the proton itself. Because of the prominence of that experiment he was offered several jobs in Europe, so he continued his work there. Because of his search for perfection, however, it took some time for him to complete his thesis, and he continued to work toward his degree while participating in physics experiments all over Europe.

Allton received his Ph.D. in 1972 at an age which made it difficult to continue along the standard career of a research physicist. After several attempts to go in other directions, he came back to Stanford and worked on technical problems, rather than in the research end of things.

Ernie's life was indeed an unusual one, not only professionally but also personally. Throughout all his checkered career he maintained a sense of humor and sense of perspective both toward himself and his associates. All those with whom he worked were enormously fond of him, and we will all miss him.

–W.K.H. Panofsky



HUBERT A. STRANGE RETIRES

Hugh Strange, long a mainstay of the Power Supply Operations and Engineering groups, has decided to try retirement again. His first try came in 1967, after a career in the military which began in 1942.

Following graduation from the Naval Communication School at the University of Idaho, he served with the Atlantic fleet, becoming an expert in radio and radar maintenance. He joined the Air Force in 1950, and saw service in many places including Viet Nam. Retirement was not for him, so in 1969 he came to *SLAC*, where he worked in the *EFD* Power Supply Operations Group.

Hugh is one of those quiet and unassuming people who contribute so much, but who do not always get the recognition they deserve. Engineers loved working with him, because he made us look good and productive. You have earned your retirement Hugh, stay healthy and drop in to see us now and then.

–Martin Berndt

EARTHQUAKE COUNTRY

We are constantly reminded that we live in earthquake country. Recently some of us attended an earthquake symposium of the Central Peninsula Civil Defense and Disaster Association. The speakers included a fireman, policeman, and a city official who were all eyewitnesses to the drama of the Coalinga Earthquake of May 2, 1983. Other speakers, including a physician and engineer, played a part in the subsequent disaster-relief operations.

Several points were made during the symposium that are of interest to us living near the infamous San Andreas fault. Although the Coalinga earthquake was small compared to what might be expected in this area, it had all of the elements required to test the response of the local community.and the surrounding

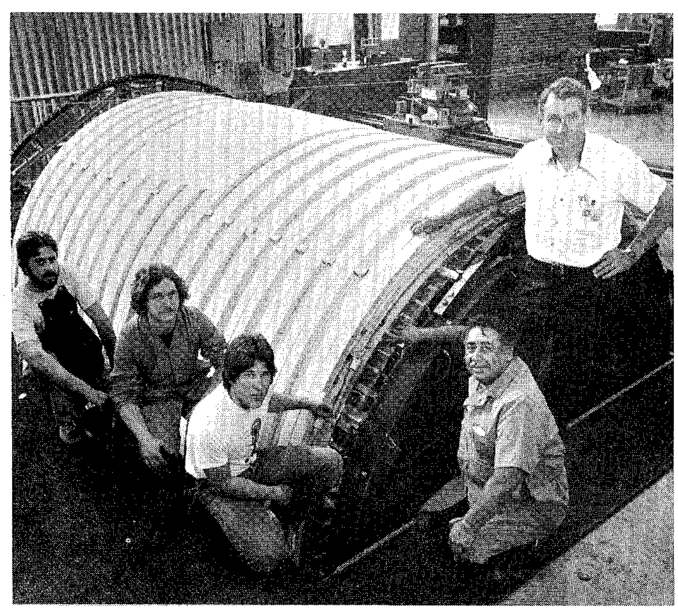
First, people were magnificent. There were many acts of thoughtfulness and unselfish heroism immediately after the earthquake and in the following days and weeks. Volunteers were abundant; people wanted to help, and did. Some went around their neighborhoods turning off gas valves, others worked with the firemen, several people in the area owned backhoes and other construction machines and used them unstintingly.

Initially, there was confusion. Some people ran about shouting and screaming — just like in the movies. The reactions of people were unpredictable during and immediately after the earthquake. The trauma of such intense shaking is difficult to describe and individual responses varied greatly. It was obvious that people who had been trained to do a job following such a disaster were better off than those who had no training. The trained people went right to work. They had a purpose and a direction to their activities. Since the earthquake occurred in the late afternoon, many of the city's public-works employees had left for the day. They immediately returned to work. All of the policemen, firemen, hospital employees, public-works employees and others involved with the routine operation of the city services returned to work, or stayed on the job. Even though people were concerned about the condition of their families, homes and neighborhoods, they remained on the job. Later, supervisors were able to determine local conditions and inform those remaining on duty how their families and property had weathered the earthquake.

Second, the response of the surrounding area was excellent. Within minutes, emergency relief operations were underway. In Fresno the Red Cross activated its volunteer system. The California Highway Patrol, Division of Forestry, Fish and Game Department, Civil Air Patrol, National Guard, Medical Society, ham radio operators and many others quickly swung into action. A command post and medical aid stations were set up. There were no deaths, but there were some injuries, one of which was serious. Since the hospital had no operating utilities, it was evacuated. Most of the patients were sent home, but five were transported to Fresno hospitals.

I left the symposium resolved to make some personal preparations for the coming earthquake, both on the job and at home. There are some simple precautions. Do you have a flashlight and spare batteries, a supply of water, a battery-operated radio, matches, a camp stove and fuel, a wrench to turn off the gas, a reserve of food, a family or neighborhood emergency plan? How about a tent? Many people in Coalinga lived out-of-doors for weeks. An excellent brochure entitled "Earthquakes, How to Protect Your Life and Property," by Professors James Gere and Haresh Shah of the Stanford Civil Engineering Department was distributed in October of 1980. Look around for your copy. There are a few left in the Benefits Office.

-Ken Johnson



REPLACEMENT COIL FOR MARK II DETECTOR

The coil-winding team poses proudly with the nearly-completed coil. From left to right they are Matt McColloch, Bob Turner, Jeff Garcia, Genaro Rosalez, and Engineer John Mark. Larry Didier and Leo Giannini helped with contributions from their vast stores of knowledge and experience.

YOUR BEAM LINE THANKS YOU

The *Beam Line* depends on its readers for articles, photographs, drawings, business help, typing, and suggestions. We thank the following good people for their help in 1983.

Nina Adelman	*David Leith*
Wanda Alexander	*Bill Lusebrink*
Bob Bell	*Rudy Maldonado*
Wayne Bennett	*John Mark*
Joe Cobb	*Tom Nakashima*
Dave Coward	*Conrad Ouellette*
Jeff Fisher	*Fred Peregoy*
Bob Gould	*Vern Price*
Rick Hamman	*Gerry Renner*
Charlie Hoard	*Gene Rickansrud*
Tom Kamakani	*Norman Silveira*
Gerry Konrad	*Madlyn Stein*
Ray Larsen	*Alex Tseng*

SUCCESSFUL HOLIDAY BLOOD DRIVE

The blood drive held on December 19 was a tremendous success. Seventy people turned out for the record-length event. Having the unit open after lunch gave donors extra time to drop in, decreasing the waiting time for the busy *SLAC* crowd.

A donor's drawing for a fifty dollar gift certificate at Palo Alto Home Video was won by Tom Kamakami, famous coach of the *SLAC Accelerators.* Many thanks to the all those who show up so regularly in order to help others in need. See you next time!

–Nina Adelman

ENGINEERING LANDMARK CEREMONY

The San Francisco Bay Area Council of the Institute of Electrical and Electronic Engineers has decided to join the American Society of Mechanical Engineers in honoring the engineering accomplishments which have contributed to *SLAC*'s eminence as a research center. Through their joint efforts, *SLAC* has been designated a National Historic Engineering Landmark.

On Wednesday, February 29, 1984, there will be a brief ceremony during which Frank Scott, President of the *ASME*, will present *SLAC* with a bronze plaque commemorating the award.

The ceremony will be conducted at 4:00 pm in the *SLAC* auditorium. Refreshments will be served afterwards. The ceremony will have special significance for *SLAC*'s engineering staff, but all employees and visitors are invited to participate.

SLAC CHRISTMAS PARTY

T'was four days before Christmas and all through the site, all the protons were stirring with electrons alike, and by the accelerator what did appear, a familiar red-suited man without reindeer. Thus began the annual *SLAC* Christmas party.

The party opened with lunch including a choice of either traditional ham or turkey, plenty of good spirits and lots of holiday cookies. In the photo below Santa Claus Axel Golde welcomes Jan Adamson and Vern Price while the Ensembles added to the fun by singing Christmas carols.

–Janet Sauter