SLAC BEAM LINE

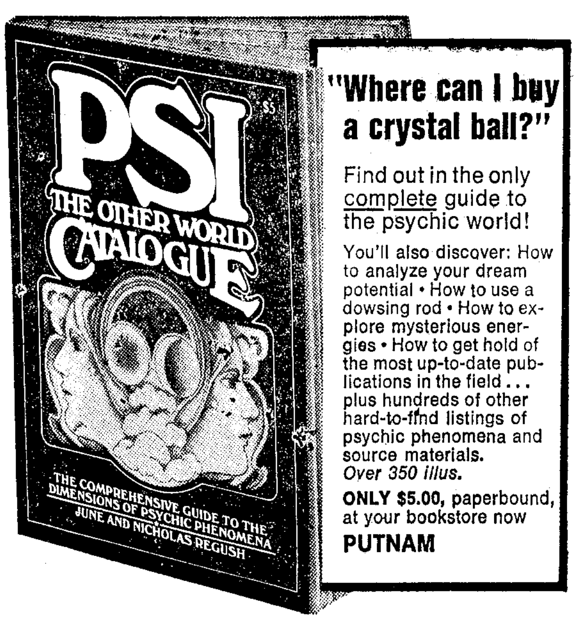
"There are therefore Agents in Nature able to make the Particles of Bodies stick together by very strong Attractions. And it is the Business of experimental Philosophy to find them out." -- Isaac Newton, Opticks (1704)

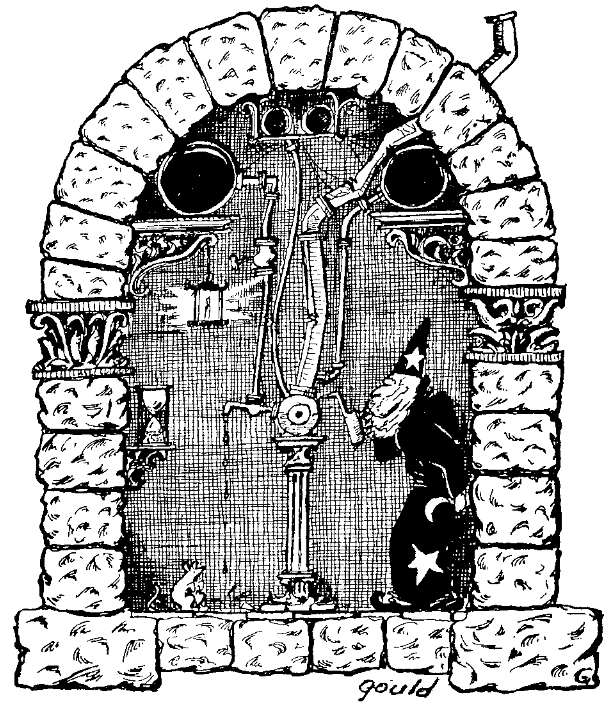
Volume 6, Number 2 *February 1975*

IN THIS ISSUE

A complaint often heard about high-energy physics is that it is impractical. How, for example, do quarks help solve life's little everyday problems? At the risk of damaging our already shaky reputation for scientific objectivity, we commend to your attention the recent *New York Times* advertisement (below) in the hope that it will establish, once and for all, the amazing practical benefits that inevitably follow new scientific discoveries.

--BK





POSITRON SOURCE REPAIRED

The illustration directly above is a recent photograph of Dr. Gandalph LeBlanc ("Ganny" to his friends), who was a consultant to the Positron Source Repair Consortium at SLAC for most of the months of December and January. Though trained in theoretical physics (note his informal attire--so characteristic of theoretical scholars), Dr. LeBlanc's strong practical bent always comes to the fore when something has to be fixed. In the photo, Ganny is shown applying a special lubricant to the Positron Source for the purpose of allowing the positrons to slip more easily into phase. Also shown in the photo (lower left) is LeBlanc's diminutive assistant, a former graduate student whom Ganny has turned into a mouse until he finishes his thesis. The photograph also provides a particularly clear view of the powerful laser that is used to align the SLAC accelerator (upper left).

Although Dr. LeBlanc's attempted solution to the Positron Source problem seemed brilliantly simple, sad to report that it did not work. However, his superb analytical effort on the problem has recently won Ganny a handsome offer from SLAC's Theory Group. For a description of how the Positron Source repair job was actually carried out, see page 5.

SPEAKING OF PEOPLE: FAYE WILLIAMS

The charming young lady pictured here, who has been seen by many of you in the Mail Room or while delivering your mail, is Faye Williams. Faye is SLAC's Chief Mail Clerk, and she is responsible for supervising the work of the SLAC Mail Unit.

Before coming to SLAC as a Mail Clerk in 1970, Faye served in the Womens' Army Corps of the U. S. Army. She considers herself a native Californian, even though she was actually born in Texas, because she came here at an early age.

Faye's husband works at Stanford, and the Williams are the proud parents of two young children. Even with her heavy daily schedule of working at SLAC and being a housewife and mother, Faye still finds time for such outside activities as bowling, dancing and bike riding.

To quote Faye: "I like working at SLAC because it's a wonderful place. I've met some very nice and friendly people here."

--Jim Moss

Photo by Joe Faust

MARVIN HOOKER TO RETIRE

The retirement rolls will grow by one more name at the end of February, when Marvin Hooker of the Labor Pool departs the SLAC scene. The man with the friendly smile and the helpful manner has been at SLAC for over nine years, doing his best to help solve the everyday, behind-the-scenes problems.

Marvin was born in Nebraska and spent his early years there and in Idaho, where he did all the chores necessary to make a farm run, including lots of TLC for the four-footed friends. At age 24 he joined the Civilian Conservation Corps (n.b. for the younger reader: the CCC was an early 1930's government work project) and was sent to the Black Hills region of South Dakota, where he worked on trail- and road-building projects. Later, he was sent back to Nebraska to work on land-contouring.

Photo by Joe Faust

After his CCC stint, Marvin returned briefly to Idaho, then finally pulled up stakes for good in 1938 and made Palo Alto his permanent home. He did cement work for several years until the Army beckoned him in 1941. He served with the infantry at Honolulu, Makin, Saipan, and Okinawa.

By October of 1945 Marvin was back in the Palo Alto area and working at Moffett Field in the warehouse, supply and labor departments. He was at Moffett for over 19 years, and while there he became acquanted with other current SLAC employees Manuel Gutierrez, Merle Flowers and Frank Stella.

Marvin remained a confirmed bachelor until the age of 51, when a casual introduction via a family member brought a fairly quick end to his single status. Mrs. Hooker (Peggy) is head cashier at I Magnin's. She is also considering retiring at about the same time as her husband in order to spend more time pursuing her hobbies of art and stamp collecting. Marvin plans to bowl more often (a sport he really enjoys), spend lots of time outdoors, see more of Peggy's children, and enjoy with Peggy the pleasures of traveling. The Hookers will continue to make their home in the Palo Alto area.

Marvin's cheerful, helpful presence will be missed at SLAC. We all wish him the very best as he begins his retirement.

--Dorothy Ellison

HAVE YOU TOURED SLAC LATELY?

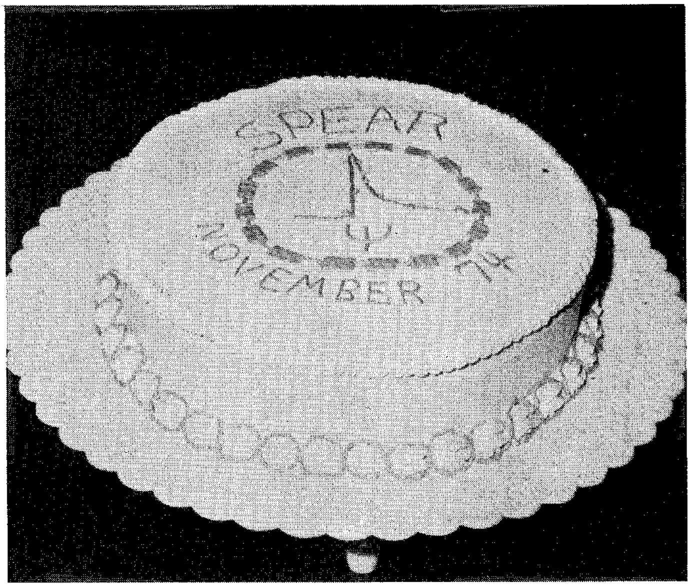
Recently a series of tours was organized for those of us whose talents and abilities are utilized in non-scientific endeavors. If you missed these tours, you missed a very nice opportunity to be reminded of the fact that the heart and soul of SLAC is behind the radiation fence. People who work with the machine and its experiments don't need to be reminded, but those of us who have neither occasion nor opportunity to observe the research area during our normal work assignments do need to be reminded and informed of the real work of the lab.

Several years ago, new employees were expected to participate in such a tour shortly after becoming employed at SLAC to familiarize themselves with the scope of the project, especially during the construction phase. It is regrettable that a policy of up-date tours was not actively pursued if for no other reason than to increase the level of interest one feels in their own work after being exposed to the "big picture."

Many of us hold jobs that can be thought of as research-support positions. We are not directly involved in SLAC's purpose for existing and, having skills that are among the most easily marketable, it is easy to miss entirely that feeling of enthusiasm which comes only from a gut-level awareness of being part of the total effort. It's exciting to hear about new particles and to know that basic science is being advanced, but the immensity of the effort doesn't really impress you until you have seen the size of the detectors, the complexity of the apparatus, and the computing equipment used to analyze the data. One feels a sort of revitalization from just being in the presence of the results of so much imagination, dedication to purpose, and sheer determination. The work that has been done is so impressive it isn't necessary to understand the details!

If you sometimes feel, as most of us do from time to time, that life at work might be easier to understand if you worked for an insurance company, take advantage of the next opportunity to tour the experimental area. Or, if your supervisor is willing, make your own opportunity by joining the next available tour group. (Better yet--take your supervisor along, too.) It feels good to know why you come to work in the morning, where your effort is being directed, and it's fun to know that something real is going on back there.

--Martha Zipf



WELL IF THAT DON'T TAKE THE CAKE

Note: We received in the mail the other day a larger version of the photograph shown above, along with the following caption, from the Public Information Office at the Fermi National Accelerator Laboratory:

Photograph of cake commemorating the discovery of a new fundamental particle, the psi, two months ago at the Stanford Linear Accelerator Center. The cake was served on Wed., Jan. 8 at Fermilab on the occasion of a talk by Professor Burton Richter on the nature of the new particle. The simultaneous discovery at both the Stanford Linear Accelerator Center and Brookhaven National Laboratory, coupled with that of a second particle several weeks later, has created a sensation that has rocked the field of high energy physics.

The pitchfork-like symbol is the greek letter psi. The graph inside the ring is a picture of the sharp resonant-like nature of the particle that appeared in the announcement of the discovery. The ring is a view from above of the storage rings, the instrument where the new particles were produced.

Good show, Fermilab!

STRANGESPEAK: ACADEMIC VARIETY

"*. . . the social structure should optimally be the consonant patterned expression of culture, and that higher education is enmeshed in a congeries of social and political change.*"
--Hampshire College

"*Terminal Behavior Objectives for Continuous Progression Modules in Early Childhood Education.*" [Report cards.]
--Dallas Grammar School

Photo by Joe Faust

TONY SANCHEZ: FROM WELDER TO REALTOR

After more than ten years at SLAC, Tony Sanchez is putting aside his welding gear and moving into an office. During his time here, Tony provided strong support to the idea that much of SLAC's welding work requires a degree of craftsmanship that approaches artistry. Many of Tony's welding masterpieces lie hidden from view in the darkness of the accelerator housing or in the beam switchyard, often buried under tons of radiation shielding, in locations where a failure or a leak would require a huge effort to repair.

Tony's career at SLAC has followed the action. In 1964 he started work at the Mark III accelerator on the Stanford campus. Three months later he moved out to the SLAC site and joined the mechanical engineers and designers who were concerned with welding techniques and weld-joint designs for some of the innumerable welded structures that went into the two-mile accelerator. In 1965-66, Tony worked on the high-power slits and collimators for the beam switchyard--truly awesome weldments--which have been in almost continuous use, under the most severe operating conditions, ever since the first accelerator turn-on. Tony later worked with the Hydrogen Bubble Chamber Group, and also on the R&D phase of SPEAR.

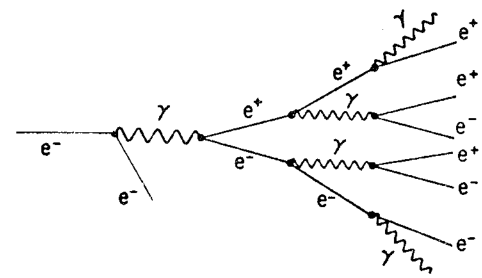
About two years ago, Tony became interested in real estate. He went to night school, took the exam that is required, and recently obtained his real estate license. Last month he decided to make this new interest his full-time career, so he submitted his resignation here at SLAC.

If Tony turns out to be as good a realtor as he is a welder, he will be an outstanding success in his new field--which his many friends at SLAC both hope and expect.

--Herb Weidner

The Positron Source Job

Note: This article is based on information supplied by Al Lisin and Roger Miller. The repair of the positron source is a good example of the variety of skills and talents that it takes to keep a place like SLAC functioning productively. All told, about 100 SLAC people played a part, large or small, in getting this job done. Although we can't describe all of these contributions in this brief article, we hope that some sense of the breadth and variousness of the work comes through. When the repair was completed, Lisin invited everyone who had helped to come to a T.G.I.O. celebration. One of the latter parts of this article lists the people who were invited. Way to go, people.



When a high-energy electron strikes matter, it can emit a gamma ray (wiggly line). This kind of radiation is called *Bremsstrahlung*, which is the German word for "braking radiation." The gamma ray, in turn can strike something else and create an electron-positron pair *(pair creation)*. If there is enough energy to start with, a *cascade* or a *shower* like that shown in the sketch occurs. Equal numbers of electrons and positrons are created in such showers. To form a positron beam, rejecting the electrons, requires other devices such as magnets or RF separators located downstream of the positron target.

Making Positrons

At present, the main experimental user of positron beams at SLAC is the SPEAR electron-positron storage ring. However, there have been other experiments in the past, and probably will be some in the future, which require positron beams. The positron beam at SLAC is produced by a technique that is similar to that used at other electron accelerators, and which works as follows. An electron beam is accelerated through the first 1/3 of the SLAC accelerator to an energy of about 7 GeV. This beam then strikes a tungsten or copper target which is placed on the axis of the accelerator. The tungsten target (used for SPEAR beams) is about 3/4-inch thick, while the copper target is about 2 inches thick. From the back of the target comes a shower of newly created particles--electrons, positrons, and many other kinds. A small fraction of positrons which emerge from the target are focused into and accelerated by the remaining 2/3 of the accelerator. Thus the maximum positron beam energy that can be achieved is 2/3 of the maximum electron beam energy, or about 15 GeV. For the special requirements of SPEAR, the positron beam is only accelerated to 1.5 GeV.

Heat & Radiation

The positron beam *intensity* (number of particles per second) depends mainly on the *power* which the 7 GeV electron beam deposits in the target. More power creates more positrons. If the 7 GeV electron beam has an average current of 15 microamperes (easily possible), then this beam will ram about 100 kilowatts into the target, and a large fraction of this power will come roaring out the back of the target in the form of created particles and electromagnetic radiation (x-rays and gamma rays). This huge concentration of energy causes several problems. First, it heats up not only the target but also any other components that are close by on the downstream side of the target. Second, the high radiation flux causes many kinds of materials (especially insulators) to deteriorate rapidly. Finally, many of the materials exposed to this radiation become and remain radioactive long after the beam is turned off (years after). Thus heat, radiation damage and radioactivity are all critical problems in the design, operation and maintenance of a positron source.

The Beam Scraper

One way to limit the effect of these difficult problems is to try to concentrate them in one very special component, rather than having them spread over a variety of components. In this case the "whipping boy" is a device called a "beam scraper," which is a doughnut-shaped gadget located just in back of the target. The beam scraper used at SLAC consists of an array of concentric copper and tungsten cylinders. It is water-cooled to a fare-thee-well, and it is designed to absorb as much as possible of the "wrong" radiation that emerges from the back of the target. (The "right" radiation passes through the central hole of the doughnut and on toward the remaining 2/3 of the accelerator.)

The Accelerator Vacuum Problem

In order to operate properly, the beam area of the SLAC accelerator must be evacuated down to a pressure level of about 10^{-6} Torr (about a billionth of atmospheric pressure). With higher pressures than this the beam electrons would make so many collisions with air molecules in the accelerating structure that they would be scattered against the walls and thus lost from the beam. For this reason, the SLAC accelerator has several vacuum-sensing systems that can detect undesirably high pressure conditions and take protective action (fast-acting vacuum valves seal off the affected area).

On the morning of Tuesday, December 3, it was observed that the accelerator vacuum in the vicinity of the positron source had deteriorated so badly that the machine could not operate. Considerable investigation of this problem finally led to the following conclusion: the accelerator vacuum seemed to get better when the cooling-water supply to the beam scraper was shut off. This curious connection was an indication that water from the cooling passages in the beam scraper was leaking through a small hole into the accelerator vacuum system. Further tests showed that the leak seemed to stop if low-pressure cooling water was fed to the beam scraper, rather than the high-pressure water that was normally used.

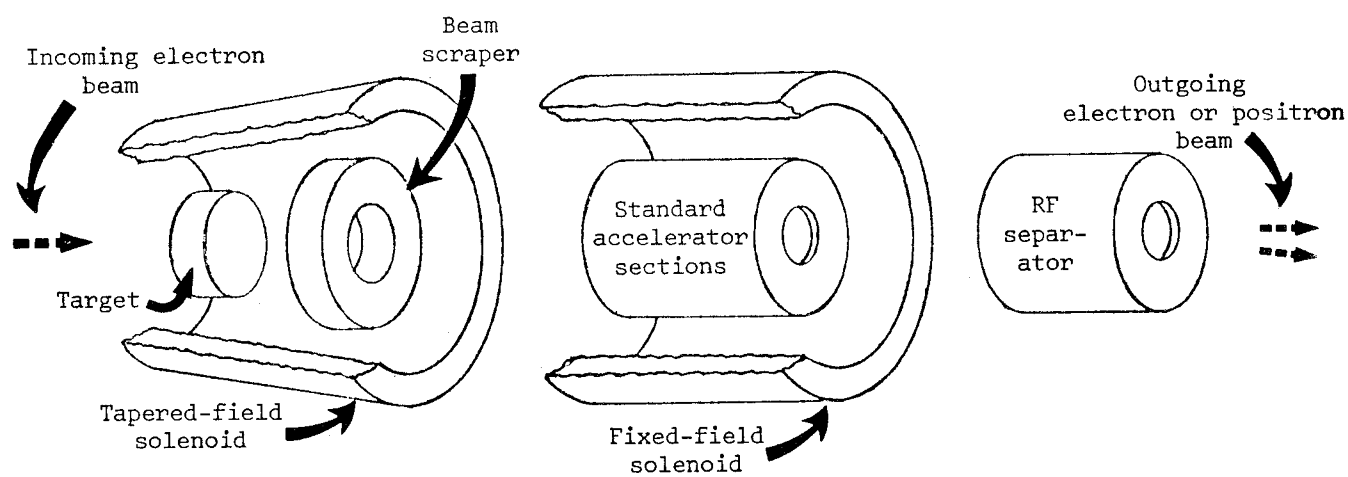
Damn The Torpedoes . . .

When the problem had been diagnosed, there were still about ten days left to go in the accelerator's running schedule for December. Since there were some very interesting experiments going on at SLAC during that time (the second psi particle had been discovered on November 20), certain physicists suggested that it might be nice to try sticking a finger in the dike for awhile and hold off making the full repair until ten more days of psi-chasing could be accomplished. Specifically, B. Richter, in hip boots and defending the accelerator *OFF* button against all possible attack . . .

So a temporary fix was agreed to, and Plant Engineering managed to rig up an *ad hoc* low-pressure water system to cool the beam scraper while the run continued. At the same time, work began on the design of the more permanent repair that was to be started after the accelerator went down for the Holiday off-period. The first design decision was that there did not appear to be an immediate need for a new beam scraper that could handle very high levels of radiation and heat. With SPEAR the only customer for positrons presently foreseen, its needs could be met with a scraper of relatively modest capabilities.

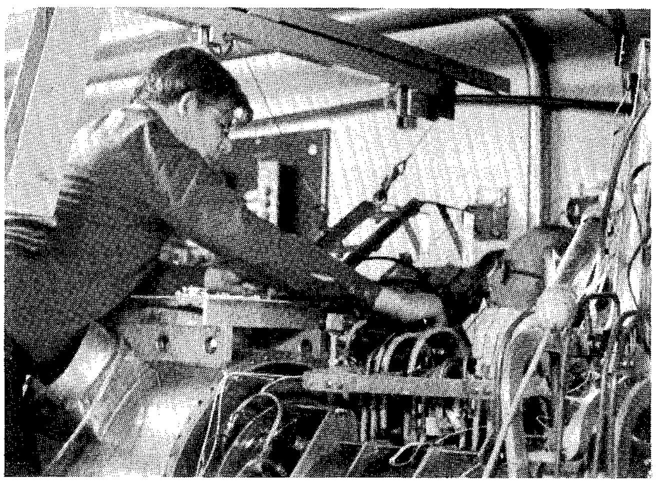
Getting Ready

With design and fabrication of the new components under way, Al Lisin and Ernie Frei put together a plan for dismantling the existing system and installing the replacements. Ernie



The main elements of the SLAC positron source as shown schematically in this sketch. The incoming electron beam strikes the positron target or *radiator* and creates a shower of new particles. Those particles that are headed in roughly the right direction for further acceleration pass through the central hole in the *beam scraper*, which is intended to absorb most of the wrong-direction particles. The combination of *tapered-field solenoid* and *fixed-field solenoid* produces an axial magnetic field which acts to capture as many positrons (and electrons) as possible and feeds them into 20 feet of standard accelerator waveguide, which accelerates both kinds of particles to an energy of about 70 MeV. This well-formed beam of both electrons and positrons is then sent through a short section of *RF separator*, which gives the particles a transverse (sideways) kick of acceleration. The combination of the separator and a deflecting magnet (not shown) is used to select either positrons or electrons for further acceleration through the remaining 2/3 of the SLAC accelerator. The rejected particles are not "aimed" correctly, so they strike the inner walls of the accelerator and are lost from the beam.

took on the job of supervising all of the work that would have to be done "down in the pit"--that is, inside the accelerator housing. Since the area around the positron source was quite radioactive, Ernie's supervision would most often have to be done from a distance. And even though the work was expected to extend through most of the four weeks of the shutdown period, the main ground rule for Ernie's task was the decision that he would not be allowed to receive any more radiation than any other worker. SLAC's Health Physics Group set up a system to monitor the actual levels of radiation, and a work routine was established whereby the various parts of the job were parcelled out to many different people, each of whom stayed with it for only as long as the time permitted to remain within the allowable radiation exposure level.

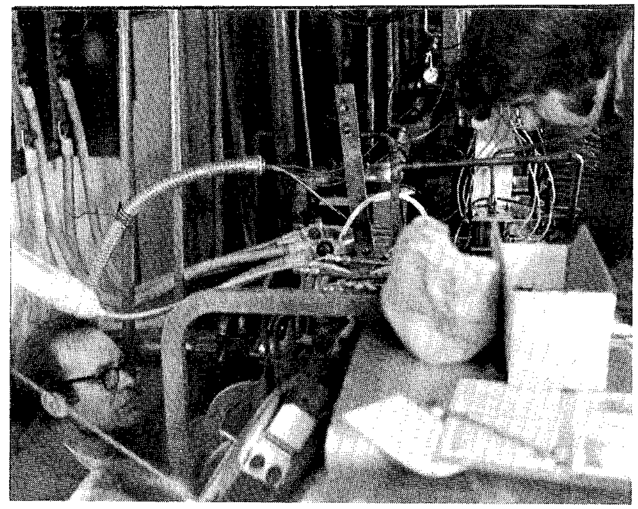


--Photo by Al Lisin

Al Johnston (left) and Ernie Frei are shown working on the "wand" positron target after its reinstallation. The wand target is used to produce fairly low intensity positron beams; it operates by "flicking" across the path of the incoming electron beam at rates of a few pulses per second. The heavier duty "wheel" target works by rotating (actually the motion is called "trolling") its periphery through the incoming beam path, thus spreading the heat input over a large surface area.

Knee Bone Connected To The Thigh Bone

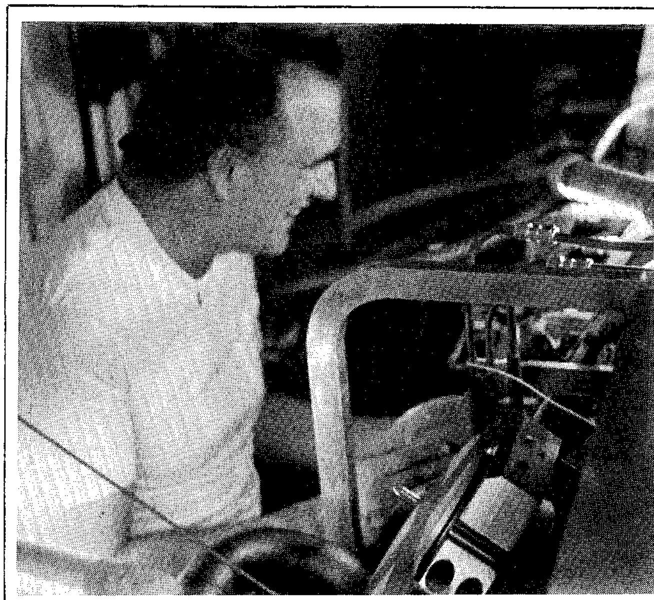
The removal of the defective beam scraper was not as simple a job as it might sound. In order to remove the scraper, it was first necessary to remove the fast-acting vacuum valve just downstream. But in order to remove the fast-acting valve, it was first necessary to remove a pair of solenoid focusing coils. Once the valve was out of the way, the remaining solenoid coils which comprise the tapered-field solenoid were loosened from their mountings. Then, since the beam scraper itself had been brazed to the large stainless steel housing which contains the



Wayne Shetler (left) and Bill Shell are shown connecting bus bars on the tapered-field solenoid.

positron source target, it was first necessary to saw off the housing before the tapered-field solenoid coils could be removed. And then finally, after the housing had been sawed off, the scraper itself and some of the solenoid coils were removed together.

Once the coils were off, it was found that their insulation had been badly damaged by radiation. So the whole tapered-field solenoid assembly was removed and brought up to the shop for disassembly, insulation repair, reassembly and realignment. In the meantime, more of the components related to the beam scraper were being removed from the original apparatus.



--Photo by Al Lisin

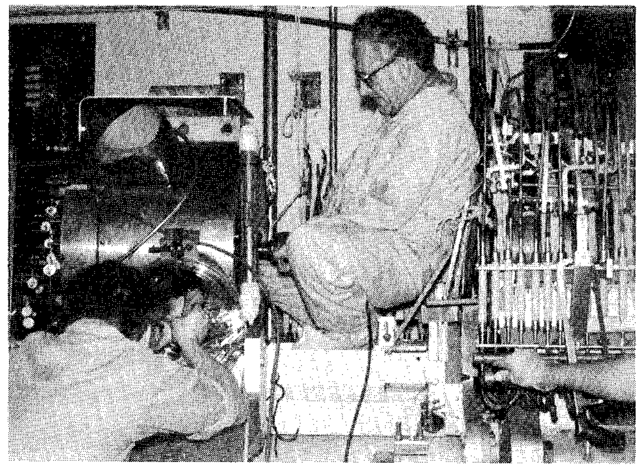
Roger Miller is shown checking over the reinstalled tapered-field solenoid.

On With The New

By January 2, all of the old components which had to be removed were out, the entire area had been cleaned, and installation of some of the new parts had begun. This was just 10 working days from the time that the shutdown period had started. By January 8 all of the major new and repaired components had been reinstalled, and everything appeared to be on schedule for the planned lock-up and turn-on on January 15. All that remained was to make some water, electrical, and instrument connections, but these turned out to be a good deal more difficult than expected, and they used up most of the remaining time. (The fact that Ernie Frei was called to Jury Duty on January 14 didn't help very much.)

Bad Conditions/Good Work

In all, about 100 different SLAC people had a hand in carrying out this major repair job. The people who worked down near the positron source deserve particular praise, since this area does not provide a very favorable working environment. Even with the ventilating fans going full blast, the temperature in this area never went below 80° F. During the times when the cooling water system was cut into, the required Uniform Of The Day was boots worn over shoes, pink coveralls, and rubber gloves. Probably about 20% of the water on the floor during those times was good, honest sweat.



--Photo by Al Lisin

Danny Ibrisimovic (left) and Glenn Howard are shown working on the job of cutting into the positron source housing.

Turn On: AOK

On Friday evening, January 17, a positron beam was obtained with the remodeled source for the first time. This was two days after the work had been completed and the accelerator housing had been secured. The positron intensity with the new beam was the same as it had been prior to the failure of the old system. Much satisfaction was felt by all.

With Al Lisin & Roger Miller,
Bill Kirk

100 SLAC WINNERS

Hoping that we haven't inadvertently left out someone who belongs, here are the SLAC people who made the positron-source repair such a success:

Marion Adams
Jack Beardsley
Earl Beeman
Bill Bergen
Al Berkman
Jack Bottarini
Hardy Bowden
Ken Brandenburg
Kurt Breymeyer
Don Busick
Stan Butler
Augie Bysheim
Lee Cain
Dick Callin
Merrill Card
Vic Carty
Charlie Cochrane
Dan Connelly
Pat Conroy
Tom Conway
George Crane
George Cruikshank
Hobie DeStaebler
Larry Didier
Al Dillard
Bill Dozhier
Don Ewings
Merle Flowers
Bill Freet
Ernie Frei
Don Fuller
Don Goldsberry
Dick Gross
Lee Hawkins
Emmitt Henderson
Charlie Hoard
Bob Holm
Everett Holt
Harry Houghton
Glenn Howard
Hutch Hutchinson
Danny Ibrisimovic
Tom Inman
Bill Jacopi
Fred Johnson
Tim Johnson
Al Johnston
Ray Jones
Clyde Kennedy
Cliff Kimber
Tony King
Vern King
Bill Lemay
Ralph Lewis
John Maes
John Mark
Omer Martin
Val McCartney
Herb McIntye
Nolan McKee
Wade Milner
Larry Monus
Ralph Nelson
Jack Nicol
Cathy Nissen
Jim Nolan
Tony Osterman
Jim Pope
Karel Porzuczek
Donn Robbins
Bernie Romero
Frank Roos
Cliff Royal
Danny Roman
Herm Zaiss
Dale Sartain
Wally Schmidt
Alan Schmierer
Rex Sharp
Bill Shell
Tom Sherry
Wayne Shetler
Art Shore
John Sikeotis
Bob Smith
Ernie Stevens
Fred Stiver
Ralph Thompson
Phil Trainer
Jose Trevino
George Tunis
John Voss
Kent Walker
Gary Warren
Carleton Washington
Howard Webb
Ralph Wise
Charlie Xuereb
Joe Zink
Hal Zeiss

ON TV: THE ASCENT OF MAN

KQED, Channel 9, is presently carrying two program series that are concerned with science, *The Ascent Of Man* and *Nova*. Both are good, and *Ascent*, in particular, seems to us to be even better than that. The *Ascent* series is shown on Tuesday evenings, with reruns on Sunday evenings. *Nova* is also shown on Sunday evenings. Since KQED tends to let the actual starting times wander a little from week to week, some program guide should be consulted for the time.

The Ascent Of Man has been described by its creator, the late Jacob Bronowski, as "a personal view of human cultural progress as seen through man's intellectual and scientific achievements." In the following paragraphs we reprint the thumbnail sketches of the remaining *Ascent* programs that appeared in the January 18 issue of *Science News:*

Feb. 4 *The Music of the Spheres*. Traces the development of mathematics from earliest studies of the musical scale to the modern understanding of DNA based on the fundamental geometry of nature.

Feb. 11 *The Starry Messenger*. The Copernican Revolution challenges the established order through the figure of Galileo, with an intensely personal recounting of Galileo's trial and imprisonment.

Feb. 18 *The Majestic Clockwork*. A 3-century progression of the understanding of the most fundamental concepts of the physical world, from Newton's "clockwork" universe to Einstein's relativity.

Feb. 25 *The Drive for Power*. How the industrial revolution changed the daily lives of the world's people and how it represented a democratization of both political power and the power of nature.

Mar. 4 *The Ladder of Creation*. Bronowski says that biology as we know it began with the 18th [?] century naturalists, and he traces the careers of two of the most famous: Charles Darwin & Alfred Wallace.

Mar. 11 *World within World*. Within molecules were atoms and within atoms was energy unimagined; the development of atomic theory is traced from Mendelyeev's table of the elements to the realization that the sun is a hydrogen reactor.

Mar. 18 *Knowledge or Certainty*. The most personal and moving program of the series, which poses the tolerant skepticism of science against the "monstrous certainty" of ideology; ends with Bronowski scooping up mud from the pond at Auschwitz where the ashes of prisoners were dumped--including members of his own family.

Mar. 25 *Generation upon Generation*. The mechanism of heredity and discovery of the genetic code, a photographic essay on human relationships and sexuality.

Apr. 1 *The Long Childhood*. An upbeat finale to the series, posing the knowledge, understanding and ability to reason that man has gained in his "ascent" as the means by which he can survive and prosper.

HANGIN' IN THERE

The year-end issue of the journal *Science News* contains a brief summary of the most important developments in the various fields of science during the preceding year. The items listed under "Physics" for the year 1974 were the following:

1. The discovery of two new, unexpected, extra heavy particles threatened a revolution in particle-physics theory.

2. Experiments at the Stanford Linear Accelerator Center raised doubts about the applicability of the quark-parton theory of the structure of hadrons.

3. Discovery of neutral currents in the weak interaction, a phenomenon that tends to support theories that unify the weak interaction and electromagnetism, was confirmed twice.

4. Quasifission, a new kind of interaction between atomic nuclei, was reported in heavy-ion collisions.

5. A method for enriching the amount of the fissionable isotope in a sample of uranium using lasers was reported from the Lawrence Livermore Laboratory.

6. A general rise in hadron-hadron total cross sections at high energy was discovered in scattering experiments at the Fermi National Accelerator Laboratory (FermiLab).

7. A possible new high-energy relation between hadrons and leptons was reported from FermiLab.

8. The quantum behavior of vortices in superfluid helium was made visible.

9. A critical magnetic field of 500,000 gauss was measured in a new superconducting material.

--*Science News*, Dec. 21 & 28, 1974

Items 1, 2, 3, 6 and 7 on this list are results from elementary-particle physics. SLAC played a key role in items 1 and 2, and also contributed to item 7. Not bad for a poor old middle-aged laboratory.

EARLY RETIREMENT FOR NORMA BACON

How would you like to pay 125,000 bills for things you had never ordered and, in most cases, for things you had never seen? Well, that's a pretty fair guess of the number of invoices for SLAC procurements that Norma Bacon has processed during her career in the Accounts Payable Section. But Norma says that "enough is enough," and she has decided to take early retirement in February.

Norma was the first Accounting employee assigned full-time to SLAC. After earlier employment with the Oregon State Tax commission, she began working in the Accounts Payable Section in Encina Hall at Stanford in May 1961, with the assignment of processing invoices only for the then "Project M." In those days, many services for Project M were provided by existing departments on the campus, and Norma's assignment was official recognition by the Controller's Office that the project had reached the stage where the paying of its bills required the full-time attention of at least one employee.

The characteristics of a good accounts payable processor include, among other things, a good memory and the ability to pay careful attention, day after day, to the many details involved in comparing payments to vendors with the varying terms of procurement documents. Norma has those characteristics, and the literally millions of dollars worth of payments that she has processed since 1961 have always reflected her pride in doing the best possible job for SLAC. Vendors have often expressed their appreciation for her help in resolving problems, and her friends at SLAC also know of her conscientious efforts to keep a never-ending stream of paper moving on its way.

Some unusual transactions have crossed Norma's path since 1961--invoices for a 40-ton forklift, a fire engine, freight on a cut-up battleship, and gopher snakes. (Yes, Virginia, SLAC did buy some gopher snakes, but no one knows where the little darlings are now.) But Norma doesn't seem disturbed by the fact that any future bills she pays will be her own and will mostly be limited to such things as travel to see her son in Oregon, and gifts for her daughter and two grandchildren in Palo Alto.

Photo by Joe Faust

Norma is planning to move into a mobile home in Palo Alto in the near future. She expects to devote at least some of her leisure time to various civic groups in which she is interested, and she is also looking forward to the resumption of her long-neglected hobby of knitting.

Good luck, Norma. Bill #125,001 will certainly miss your careful touch.

--Walter Messing

SERA SEMI-ANNUAL MEETING

SERA's semi-annual meeting was held on January 13, 1975 at Noon in the Orange Room. The purpose of the meeting was twofold: to discuss the organization's general business; and to hold an election to select one person to fill a new 18-month term as one of SERA's three Directors (the other two are Constance Logg and Jim Ketcher).

The nominating committee--Al Ashley, Dorothy Ellison and Don Farwell--presented a fine slate of candidates: Al Dunham (Test Lab), Ed Keyser (Research Yard), and J. J. Lipari (A&E Bldg.). Following self-introductions from each of the candidates, the election was held, and incumbent Ed Keyser was returned the winner. (Ed was elected last fall to fill a remaining 6-month term created by the resignation of Urban Cummings.)

At a subsequent meeting of the three Directors, the offices of the organization were filled as follows: President, Constance Logg; Vice President, Jim Ketcher; Secretary, Ed Keyser.

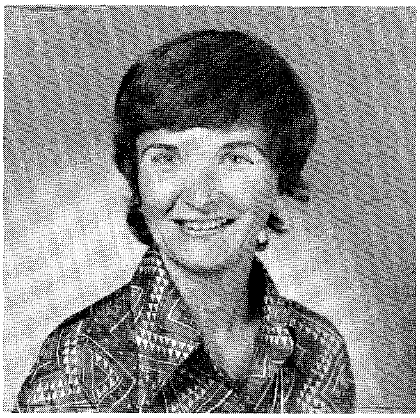
If you do not expect the unexpected, you will not find it.

You cannot step twice into the same rivers; for fresh waters are ever flowing in upon you.

Time is a child playing draughts, the kingly power is a child's.

It is opposition that brings things together.

--Heraclitus



MARGE MUELLER LEAVING SLAC

Margaret Mueller will soon be leaving her post as head of the Documentation Group in the Computation Center at SLAC. The Center is operated for SLAC by SCIP (Stanford Center for Information Processing), which also operates the computation facilities on the Stanford campus and at the Medical School. Marge joined SCIP at SLAC (then called SFSCC) back in October, 1969 as a technical writer, having come here from a programming position at Control Data Corporation. As far as program documentation is concerned, when Marge started here she was *it*--the only one. Since that time, however, she has become the leader of a group which now includes two writers and three programmer aides.

The Documentation Group is responsible for writing and updating user instructions, software manuals, WYLBUR exec files, and so on. In addition to supervising this work, Marge has also served as co-editor of the Computing Services Bulletin. When Marge leaves SCIP, on February 7, his duties will be taken up by Dan Lynch.

Marge is originally from Michigan, and has lived in California for eight years. Her husband, Jim, is the chief of the computation center at the U. S. Geological Survey in Menlo Park. The Muellers have two boys, ages 11 and 13, and they have recently bought a 10-acre parcel of land in Los Altos Hills on which they plan to build a new home. Marge is eager to get involved in this project. She plans to act as sub-contractor for the building work, and expects to tackle some of the jobs--such as floor tiling--herself.

The Muellers are a traveling family, who have recently been on trips to India and to Iran. Since Marge is also planning to pursue an MBA degree in the near future, it seems plain that she will have a very busy time ahead. From all the evidence of her work at SCIP-SLAC, however, she will be more than equal to whatever task she sets for herself. Bon voyage! from all of us, Marge.

SANTA CLARA COUNTY RESIDENTS: SIGN UP FOR POSSIBLE BUS TO SLAC

Many SLAC employees who are residents of Santa Clara County have asked about the possibility of a Dial-A-Bus service that would connect directly to SLAC. The County Transit District has informed us that, because of the unexpectedly large demand for direct routes, they cannot accommodate all requests. However, if enough people are interested, there is a chance that we can work out a suitable arrangement with the District. In order for us to receive some consideration, the SLAC group would have to meet the following requirements: (1) Approximately 25-30 daily riders. (2) All riders meet at a designated pick-up point. (3) All riders purchase a monthly ride book (the cost would be about 50¢ per 12 miles one way).

If you are interested in the possibility of direct bus service to SLAC, please fill in the form below and send it to the Employee Relations Office, Bin 11. We'll keep you informed about the survey and what's happening in future issues of the *Beam Line*.

--Bernie Lighthouse

Name: ______________________ *SLAC Phone Ext:* ________ *Home Phone:* ____________

Address: ____

Street *City* *Zip*

____

Regular Santa Clara County Transit Busline Nearest Your Home

______________________ ______________________

Time You Want To Arrive At SLAC *Time You Want To Leave SLAC*

WANT ADS

Share a kiln? If there were about a dozen people at SLAC willing to put up maybe $2 to 5 each for a kiln for hobby purposes, we could probably locate it at SLAC, and all the contributors could share in its use. If interested, please contact Tom Hostetler, Bin 55, Ext. 2157

For Sale: 2 white vinyl lounge chairs, armless. $40. D. Ellison, Ext. 2723.

Plantology Club. Do you love plants? Want to contribute your knowledge to or learn about Landscaping, Soil Mixtures, Plant Environmental Requirements, Nursing a Sick Plant Back to Health, Propagation Techniques, Plant Exchange? Call Frank Martinez, Ext. 2707.

For Sale: AMF "Air Hockey" game. Good shape, Half price ($150). Bill Kirk, Ext. 2605.

CREF UNITS

The SLAC Benefits Office often gets questions from those on the TIAA-CREF Retirement Plan about the present value of CREF units. Bernie Lighthouse sent along the following figures for the slippery-slope year of 1974:

Jan.	$40.75
Feb.	40.83
Mar.	39.32
Apr.	37.58
May	35.11
Jun.	34.29
Jul.	31.71
Aug.	29.09
Sep.	25.39
Oct.	30.27
Nov.	29.23
Dec.	28.35

A correspondent writing to us from Los Angeles, Calif., states that there are two openings in that county for branches of the arts which will make a permanent business and prove profitable. "The locality," he says, "is one of the choicest spots on earth, as regards climate and good fruits." These latter involve the requirements of the two branches of business alluded to. They are glassmaking and the manufacture of pottery ware. The glass will be required for wine bottles, as that section will yet supply vast quantities of wines, the grapes being of superior quality, and yielding wine surpassing that which we now import from Europe. . . . Preserved fruits will yet constitute an important business in Los Angeles, and great quantities of earthenware vessels to contain them will yet be needed.

--*Scientific American*, May 1857

SLAC Beam Line (Bin 80)
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BUS CONNECTIONS TO SLAC

Santa Clara County To S.P. Depot In Palo Alto

The Santa Clara County Arterial Bus Service now has four routes which stop at the Southern Pacific Depot in Palo Alto. This service now makes it possible to make convenient connections with the SLAC Bus at the Depot. In the mornings, the SLAC Bus leaves the S.P. Depot at about 7:48 AM, just after the train from San Jose has made its Palo Alto stop. In the evenings, the SLAC Bus arrives at the Depot at about 5:16 PM.

Maps of the Santa Clara Bus Routes will be posted in various public places around SLAC, along with the time schedules. If there is enough increased interest in using the SLAC Bus, additional service can be offered. A bike rack was recently installed on the back of the SLAC Bus for anyone who wishes to peddle to the Depot.

Any questions about the SLAC Bus Service should be directed to the Plant Office, Bin 04, Ext. 2675.

--Gordon Ratliff

Beam Line Dist.													
	0-2	6-14	11-19	21-6	26-22	34-4	52-7	60-20	65-35	70-5	75-17	82-12	87-8	92-3
	1-15	7-2	12-8	22-13	27-3	40-65	53-42	61-21	66-16	71-56	78-24	83-9	88-27	94-12
	2-8	8-4	14-4	23-12	30-41	45-7	54-30	62-47	67-12	72-3	79-85	84-20	89-20	95-37
	3-6	9-3	15-5	24-11	31-7	50-25	55-31	63-19	68-10	73-13	80-8	85-23	90-3	96-15
	4-5	10-9	20-20	25-3	33-17	51-30	56-10	64-15	69-13	74-8	81-50	86-11	91-6	97-88

THE STATE OF SLAC

W.K.H. PANOFSKY

Note: This is the text of the annual "State of SLAC" talk that was presented by the Director to the SLAC staff on February 5, 1975. Part A is concerned with the information contained in the President's Budget Message to the Congress for Fiscal Year 1976 (FY 1976), delivered on February 3, and with the implications of this Budget Message for SLAC. (FY 1976 covers the period from July 1, 1975 to June 30, 1976.) Part B describes some of the plans for improved facilities that SLAC expects to be working on throughout the balance of the present fiscal year and into FY 1976. This printed version of the Director's talk includes several figures which were not used in the talk itself, as well as all of the budgetary tables there were used in the talk. The talk consists of the following sections:

A. *Budget Implications*

1. *The Prospect For FY 1976*
2. *President's Budget*
3. *FY 1976 Funding*
4. *Impact On SLAC*
5. *PEP Not Included For FY 1976*
6. *Importance Of New Construction*
7. *Laboratory Operations*

B. *New Facilities*

8. *Accelerator Energy Increase*
9. *Polarized Electron Source*
10. *Computation Facilities*
11. *LASS*
12. *Hybrid Bubble Chamber*
13. *SPEAR II*
14. *Flexible Program*

The President delivered his annual Budget Message to the Congress yesterday, and as usual it contained information that is of direct interest to SLAC. In previous years we have generally sent out the new budgetary information in an All-Hands' memo prior to this talk, but this year (because the Budget Message is only two days old) I shall be giving the new budget information directly in my talk.

The President's Budget Message, as it relates to SLAC, contains both good and bad news. The good news concerns the proposed level of operating funding for SLAC, which for the first time in a number of years represents an increase that may be large enough to compensate for the effects of inflation. The bad news is the fact that the Budget Message does not request authorization for FY 1976 of the large storage-ring project, PEP, that has been jointly proposed by SLAC and by the Lawrence Berkeley Laboratory.

A. BUDGET IMPLICATIONS

1. The Prospect For FY 1976

As far as operating funds for FY 1976 are concerned, SLAC has been treated very favorably within the over-all pattern of support for high-energy physics, and high-energy physics has also been treated very favorably within the over-all pattern of support for basic physical research. I can say with a good deal of certainty that this favorable treatment is directly related to our research achievements. In particular, the recent new-particle discoveries have provided convincing evidence that the degree of utilization of SLAC should not be permitted to drop any further than it already has, and also that the research momentum generated by these discoveries should definitely be maintained. Our record of keeping SLAC going productively under the difficult circumstances of the past few years has indeed been impressive. However, I believe that we have been able, recently, to persuade the government that to a certain extent we have been "living on borrowed time": we can no longer defer some much-needed work in connection with the general upkeep of the laboratory; nor can we continue to use an ever-increasing fraction of our funds for staff salaries and benefits while an ever-decreasing fraction is left for the supplies and materials that are needed to carry out our work.

2. President's Budget

Before I show the figures contained in the Budget Message, let me first emphasize the fact that I shall be talking about the "President's Budget" figures--that is, the money which the Administration has asked the Congress to authorize and to appropriate for FY 1976. During this particular year the budget process in the Congress will be quite different from that of previous years, and it is therefore quite difficult for me to predict whether the proposed budget will or will not run into trouble in the Congress. There are several reasons for this uncertainty. First, since we have a new Congress this year, many of the new members of the various Congressional Committees will not be familiar with the

Physical Research Program--let alone high-energy physics or SLAC. Second, our sponsoring agency, the AEC, went out of business on January 19, and all of its contracts were transferred at that time to ERDA, the Energy Research and Development Administration.

ERDA. The mission of ERDA will be broader than that of the AEC because this new agency will be responsible for research and development in *all* forms of energy, not just nuclear energy. ERDA has been charged with the task of unifying most of the Federal activities which relate to the development of future energy sources: nuclear, solar, geothermal and fossil fuel (gas, coal, oil), as well as explorations of other possible new ideas. Thus SLAC will now be a somewhat smaller fish in the total energy pond. Even with this broader mission, however, we expect that our relationship with ERDA will follow much the same pattern as that with the AEC. Though the superstructure has changed, we shall be dealing with many of the same government officials as before.

Congressional supervision. What does complicate matters is the fact that the Congress has not yet clearly decided how its supervision of ERDA is going to function. In the past a single committee of the Congress, the Joint Committee on Atomic Energy, was charged with overseeing the work of the AEC. At present, however, several different committees (the Joint Committee on Atomic Energy, the Interior Committees of the House and Senate, the Science and Astronautics Committee of the Senate, and the Science and Technology Committee of the House) are involved in reviewing different aspects of the work of the new agency. In addition, the Congress has recently changed its procedures and its timetables for carrying out hearings and thus in producing legislation. We don't even know at present whether the Physical Research Program of ERDA, of which high-energy physics is a part, will be reviewed by the JCAE, as before, or by one of the other committees mentioned above. The result of all this uncertainty is the fact that it is unusually difficult for me to predict this year how the proposed budget for FY 1976 is likely to fare through the Congress. In the following discussion, then, I shall be using the figures from the President's Budget submission, and I shall make the assumption that these figures will stick even in view of the uncertainties just described.

3. FY 1976 Funding

Table I shows the proposed level of operating funds for SLAC for FY 1976 as it appeared in the President's Budget Message. In government lingo, this funding is identified as "New Obligational Authority" (NOA), which means the amount that SLAC would be authorized to commit to new expenditures. From the figure you can see that the NOA for SLAC for FY 1976 is about 11% greater than the actual NOA for FY 1975. It is important to point out that the NOA figure does not precisely determine the amount of money we will actually have to spend; what counts is what the accountants calls "Costs," which are also shown in Table I. "Cost" represents the amount of money we can spend on our payroll and as payment for goods and services received from outside. The reason why Cost and NOA are different is because some of the new obligational authority we re-

TABLE I: COMPARISON OF FY 1975 AND FY 1976 RESOURCES

A. *New Obligational Authority: FY 1975 & FY 1976*

	Dollars In Thousands			
	FY 1975	*FY 1976*	*Change*	*% Change*
Operating Funds	$24,750	$27,600	$2,850	11.5
Capital Equipment Funds	2,400	2,750	350	14.5
Accelerator Improvement Funds	900	700	-200	-22.2
General Plant Improvement Funds	650	820	170	26.2
Total New Obligational Authority*	$28,700	$31,870	$3,170	11.0

B. *Estimated Cost: FY 1975 & FY 1976*

	FY 1975	*FY 1976*	*Change*	*% Change*
Operating Funds	$24,750	$27,600	$2,850	11.5
Capital Equipment Funds	2,100	2,400	300	14.3
Accelerator Improvement Funds	800	1,225	425	53.1
General Plant Improvement Funds	400	900	500	125.0
Total Estimated Cost*	$28,050	$32,125	$4,075	14.5

*Excludes SLAC Computation Building

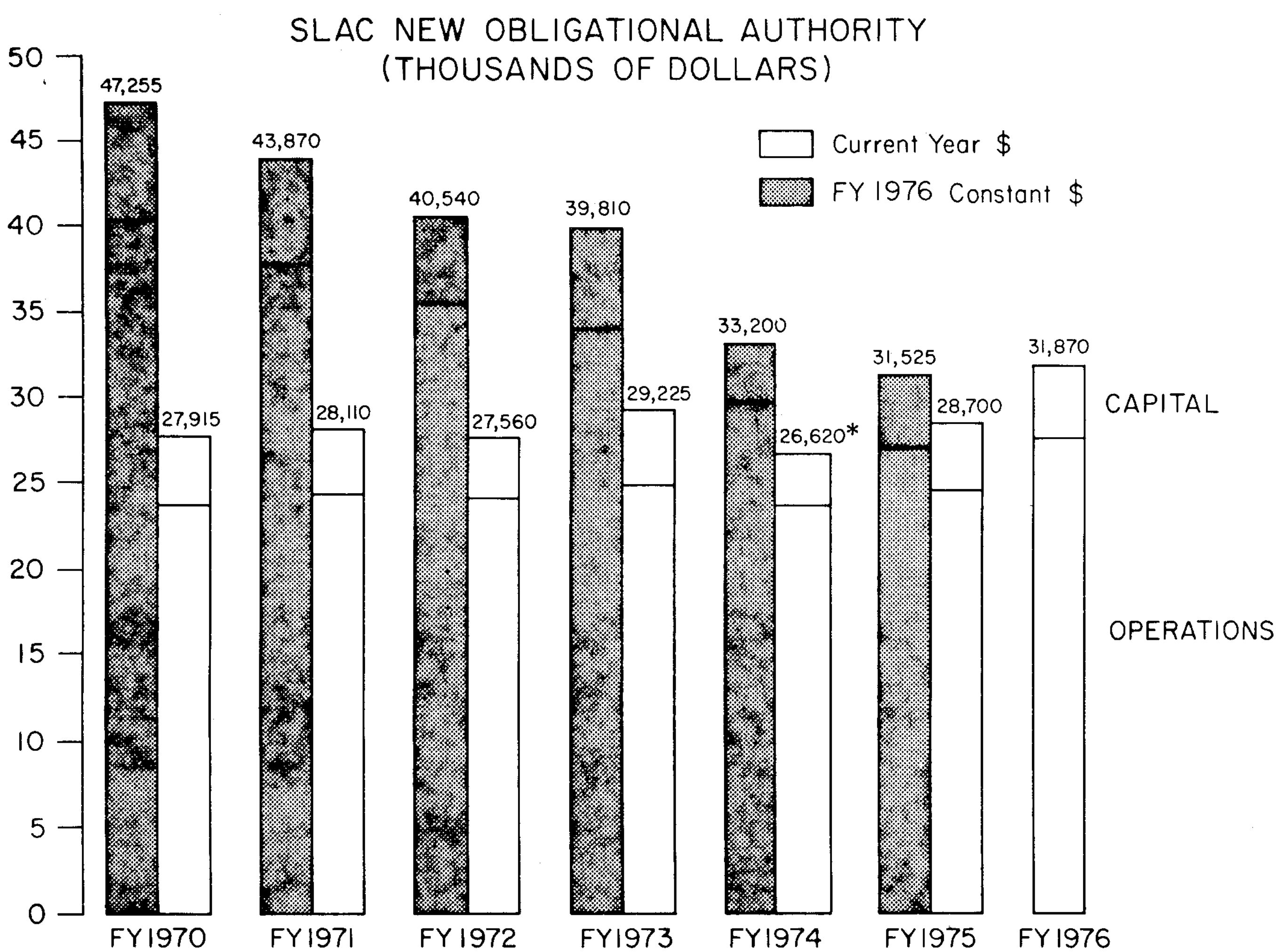
ceive is for capital goods (such as equipment and new construction), and such capital funds can be carried over from one fiscal year to the next, whereas operating funds cannot. Thus the exact relationship between Costs and NOA depends on the details of our planned program to spend capital funds. This relationship is also shown in Table I for FY 1975 and FY 1976, which indicates that the proposed increase in terms of costs for FY 1976 is about 14½%. This estimate is based on some optimistic assumptions about the amount of capital improvement work we will be able to complete during FY 1976.

The pattern of support for SLAC's work from FY 1970 through FY 1976 is shown in Table II (in NOA) and in Table III (in Costs). These figures illustrate the fact that the proposed level of operating funds for FY 1976 represents the first time during this seven-year period when the trend toward reduced support (in real purchasing power) has been reversed.

4. *Impact On SLAC*

On the whole, then, the proposed level of operating funds for SLAC in FY 1976 appears quite encouraging. Even if we assume that this proposed level is approved by the Congress, however, there are several other factors that tend to make our optimism somewhat cautious. The first of these is the future course of inflation, and in this area my crystal ball is too cloudy to allow reliable predictions. In addition, we expect a few unusual costs to arise during FY 1976, mostly connected with our new computer facility. We shall have to pay the costs of moving the computation equipment from its present location to the new Computation Building, and we shall also have to pay an increased rate for computer maintenance after the maintenance provisions of the original procurement contract have expired. These and several other smaller costs are not related to meeting our payroll nor to paying for our usual outside goods and services. After we subtract these

TABLE II



(*) Excludes $2,900 For The Construction Of The Computer Building In FY1974.

special costs, we estimate that the proposed funding for FY 1976 will probably just about make it possible for us to keep up with inflation. To state this conclusion in different words: If we assume that our salary scales increase in a way that keeps us generally competitive with the local labor market, and if we further assume that the cost of materials and supplies increases by about the anticipated inflation level of 12%, then we believe it will be possible for SLAC to plan for no further decreases in total staff through FY 1976. Naturally, there will be certain changes in emphasis among the different activities of the laboratory during this time, which could well require reduction in staff in certain areas with corresponding increases elsewhere.

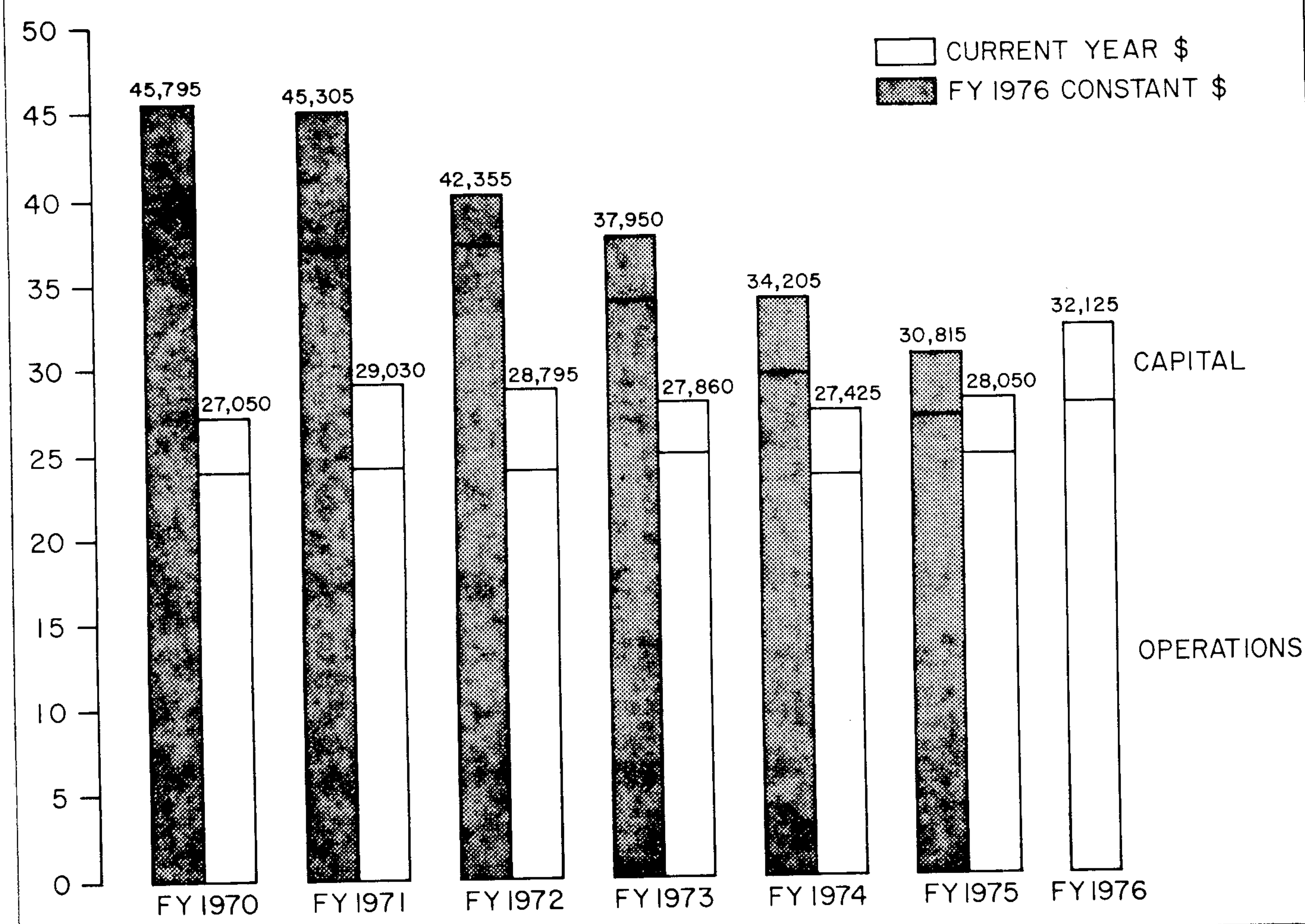
I would like to again caution that these conclusions are based upon the President's Budget Message to the Congress; they would certainly have to be changed if the Congress made significant cuts in the proposed funding level. I hope, however, that these cautions will not detract too much from the fact that the proposed operating funding for FY 1976 is really quite encouraging, especially during this difficult economic period when most of the news on the national scene is about layoffs, decreasing productivity, and rising costs. And let me say again that it has been SLAC's excellent research --which in a very direct way means the excellent work that each of you has done--that is responsible for this good budget news about next fiscal year.

5. *PEP Not Included For FY 1976*

I have to turn now to the part of the news that is not so good: The President's Budget Message to the Congress did not include a request for authorization in FY 1976 of the PEP storage-ring project that has been proposed jointly by SLAC and by the Lawrence Berkeley Laboratory (LBL). This omission does not in any way reflect a negative judgment on the part of ERDA nor of the government's budgetary officials with regard to the technical or scientific merit of the project. It stems, rather, from the general policy that President Ford has mentioned in sev-

TABLE III

SLAC COST BY FISCAL YEAR (THOUSANDS OF DOLLARS)



eral of his speeches: that during the coming year there is to be a general moratorium on new-program starts. An additional reason may be the fact that budget officials have tended to adopt a "wait and see" attitude toward new programs in order to give the newly appointed management of ERDA an opportunity to become more familiar with the existing and proposed programs that they inherited from the AEC. What this means is that the individuals who are responsible for the proposed PEP project--starting with its Director, John Rees, and including both LBL's Director, Andy Sessler, and myself--will continue to work as hard as possible in our efforts to make PEP a reality.

This effort will have two main directions. On the one hand, we expect to maintain the momentum of the R&D work that is a necessary preliminary to the construction of PEP. This R&D work, both at SLAC and at LBL, will continue at about the same level of activity as it did in FY 1975, which implies some increase in the actual costs in order to offset inflation. On the other hand, we will also intensify our efforts to persuade the Administration and the Congress that the prospective scientific merit of PEP warrants the earliest possible authorization of the project.

6. *Importance Of New Construction*

The recent discoveries of the new psi particles have significantly strengthened the case for PEP. These discoveries have solidly demonstrated the great power of the electron-positron colliding-beam method in producing important new data in high-energy physics research (a fact that a number of skeptics had doubted), and the results themselves have raised many new questions that can only be answered by extending that method to higher energies. In the larger sense, construction of major new facilities within the United States' high-energy physics program has essentially stopped during the last two years, as Fig. 1 indicates. This figure also points up the fact that the last major new construction project (Fermilab) was authorized 8 years ago. The funding pattern shown in Fig. 1 does not

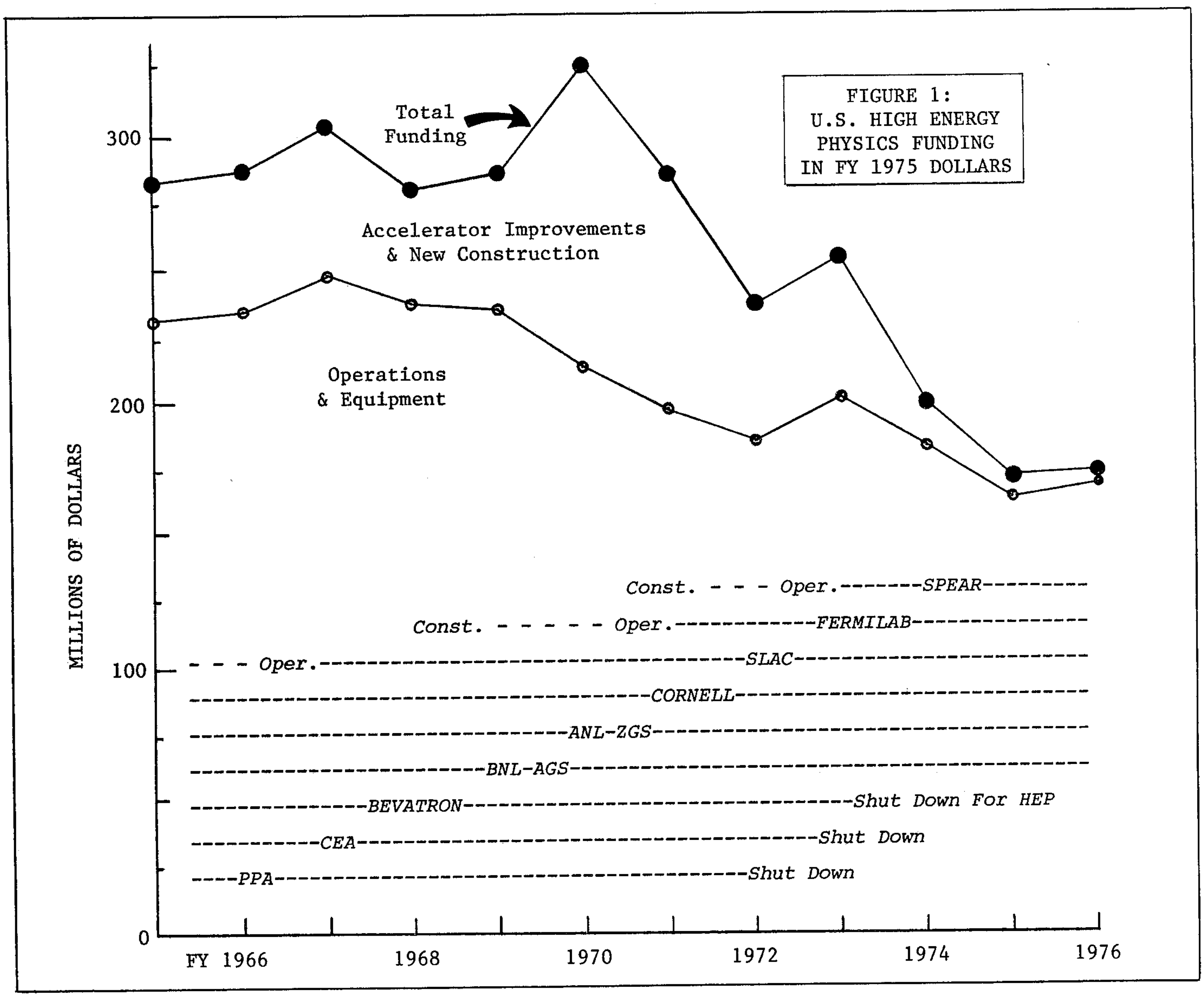


FIGURE 1:
U.S. HIGH ENERGY PHYSICS FUNDING IN FY 1975 DOLLARS

bode well for the future productivity of American high-energy physics research. Unless a major new project, such as PEP, is started soon, it is difficult to see how our research in this important field of science can continue to be competitive with that of Europe and possibly with that of the Soviet Union for very long.

Thus, although the present difficult economic circumstances may be an argument for a temporary moratorium on new construction, they should not be permitted to interrupt the continuing evolution of new knowledge. I should like to remind you that construction of PEP was recommended as the next logical step in the U.S. program by the High Energy Physics Advisory Panel (HEPAP), the committee of senior American physicists that advises the AEC, now ERDA, on these matters. As a result of all these factors, I am personally still optimistic about PEP, and I will continue to work hard to try to secure authorization. I cannot, however, give you any sort of a meaningful forecast as to how or when such authorization might occur.

7. *Laboratory Operations*

Let me come back now to a more detailed description of the prospect for SLAC's ongoing operations during the remainder of this fiscal year and also during FY 1976. As I stated earlier, if the funding for FY 1976 requested in the President's Budget Message is approved by the Congress, and if our assumptions about inflation, etc., prove to be reasonably accurate, then it appears likely that our total staff will remain about constant from now through FY 1976. We must, however, make certain changes in the way we run our program. During the present fiscal year, for example, the schedule of accelerator operations has been such that only about 41% of the accelerator pulses that could reasonably be expected at full operation were planned to be delivered. This low level of operation has been a source of much concern to the experimental physicists who are the accelerator's "customers," and we have been under a good deal of pressure to provide more running time at higher pulse repetition rates. As might be expected, many new proposals have been received as a result of the new-particle discoveries, and these have served to intensify the pressure even more.

As a consequence of these increased demands, we are presently undertaking the following two steps: (1) We are requesting an add-on to our operating funds for the present fiscal year which would provide for the same number of shifts but at a higher average repetition rate during the next few months. (2) We are also planning for FY 1976 to schedule as much accelerator running time as the anticipated funding will allow. Let me describe these two steps in a little more detail.

Balance of FY 1975. The request for additional operating funds for FY 1975 must pass through the new administration of ERDA, and it is not certain what the result will be. It appears that the decision on this request cannot be reached any earlier than about March 30, 1975, which means that only three months of the fiscal year would remain in which to effect any changes. If the request for supplemental funds is turned down, it is likely that we may not even be able to afford the amount of accelerator running that is *presently* scheduled, in which case the change would have to be a reduction in machine operations (but not in people) from the present plan.

Plan for FY 1976. The tentative plan for FY 1976 is to schedule approximately 700 shifts of accelerator operation during the year; this is about the same number of total shifts that are now planned for the present year. Of the planned FY 1976 shifts, about 100 would be at the full rate of 360 pulses per second (pps), about 250 shifts would be at 180 pps, and the remaining 350 shifts would be at 60 or 120 pps. Since SPEAR is normally "filled" with electrons or positrons at a rate of 30 pps, it would be able to run for the full 700 shifts. This plan for accelerator operations during FY 1976 should contribute toward a very productive year of research--although we certainly cannot promise any new discoveries that are as dramatic as those that were made at SPEAR last November!

B. NEW FACILITIES

In the remaining sections of this talk I would like to discuss some of the programs that are presently under way or planned for adding either new or improved facilities to the laboratory, and thus increasing its potential for carrying out important research in the study of the basic constituents of matter. Then, at the very end, I'll conclude with a few comments about the need for a flexible approach to this research.

8. *Accelerator Energy Increase*

For convenience, the SLAC accelerator is divided into 30 separate "sectors," each of which is 333 feet long. Our present plans include conversion of some of these sectors to the new scheme (previously called "SLED") by which the energy gain per unit length of the accelerator can be increased by about 40% (using the present 2.5 microsecond pulse length), or by about 75% (by altering the modulators to produce a pulse length of 5 microseconds). Since there are no special funds available for this activity beyond the usual Accelerator Improvement and Equipment funds, this project will proceed relatively slowly. We will, however, soon be starting production in the SLAC shops of the special copper cavities that are required for this program, and if all goes well we expect to have several sectors of the accelerator converted to higher energy by the end of FY 1976.

The energy increase resulting from this new technique will supplement the energy gain that is already being achieved as our 20 MW klystrons (which provide RF power to the accelerator) are gradually replaced, as they fail, by 30 or 40 MW tubes. The increased energy that will be available from these combined programs may well have an important bearing on our research program. In fact, some very recent evidence supports this conclusion: apparently the probability of making psi particles with high-energy gamma-ray beams rises quite sharply at energies that are near the present SLAC limit. Thus electron and photon energies that are only slightly higher than what SLAC can presently produce will likely prove very useful in the study of psi-particle phenomena. There is an incentive, therefore, to gear up the energy-improvement program now so that higher energies could be achieved more rapidly in, say, late FY 1976.

9. Polarized Electron Source

As many of you know, SLAC and Yale University have been collaborating on the development of a special source of polarized electrons called "PEGGY." This device is now being used in an experiment at SLAC. As a reminder, let me explain briefly how such a device works. Electrons have a certain property called "spin," which can be thought of as a rotation of the electron about an axis (like a spinning top). In normal operation, the electrons that are accelerated in the SLAC machine emerge with their spin axes oriented in a random manner (that is, pointing every which way), and thus what is observed when these electrons scatter from such particles as protons is necessarily an average over all these different spin orientations. PEGGY, however, is a device which lines up a bunch of spinning electron "tops" so that their spin axes are almost all pointing in the same direction, and these *polarized* electrons are then injected into the SLAC accelerator. Experiments carried out last year proved conclusively that, in spite of the buffeting around, the spin orientation of the electrons was preserved through the acceleration process. Since knowing the polarization of the electron beam has important experimental advantages, we are using the experience gained with PEGGY to develop a new kind of polarized electron source that is expected to produce higher intensity (more electrons per pulse) and also to avoid some of the complications involved in PEGGY's operation.

10. Computation Facilities

I have already mentioned that some of our resources will go into the move of SLAC's central pool of computer equipment from its present quarters into the new Computation Building. Construction of this building is proceeding very well, and the move should occur some time during the Fall. Incidentally, I believe that this new building is the only project among

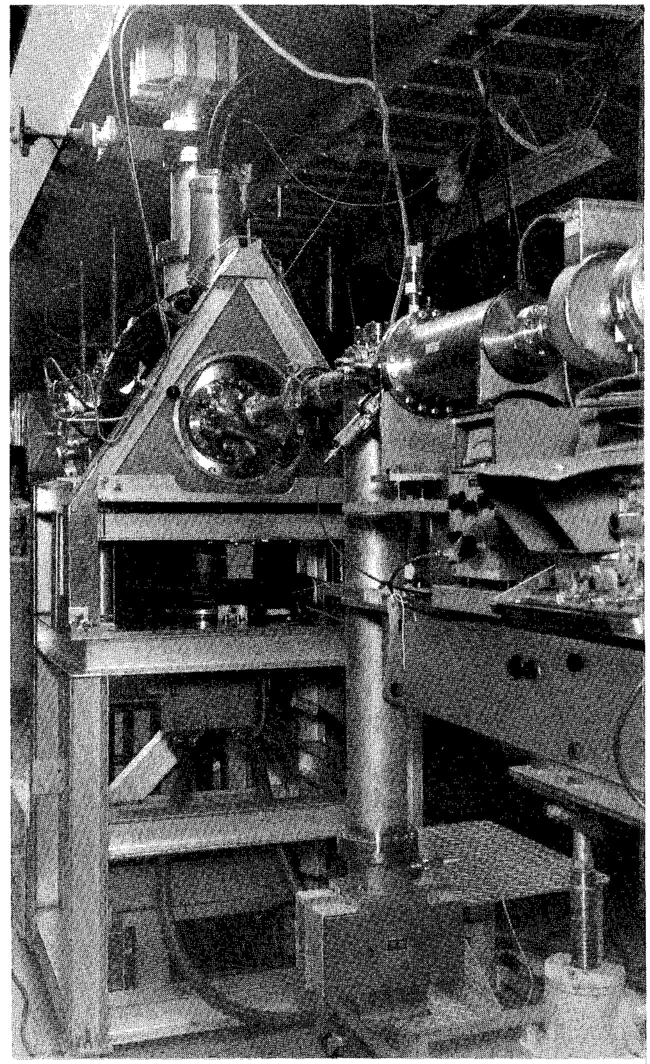
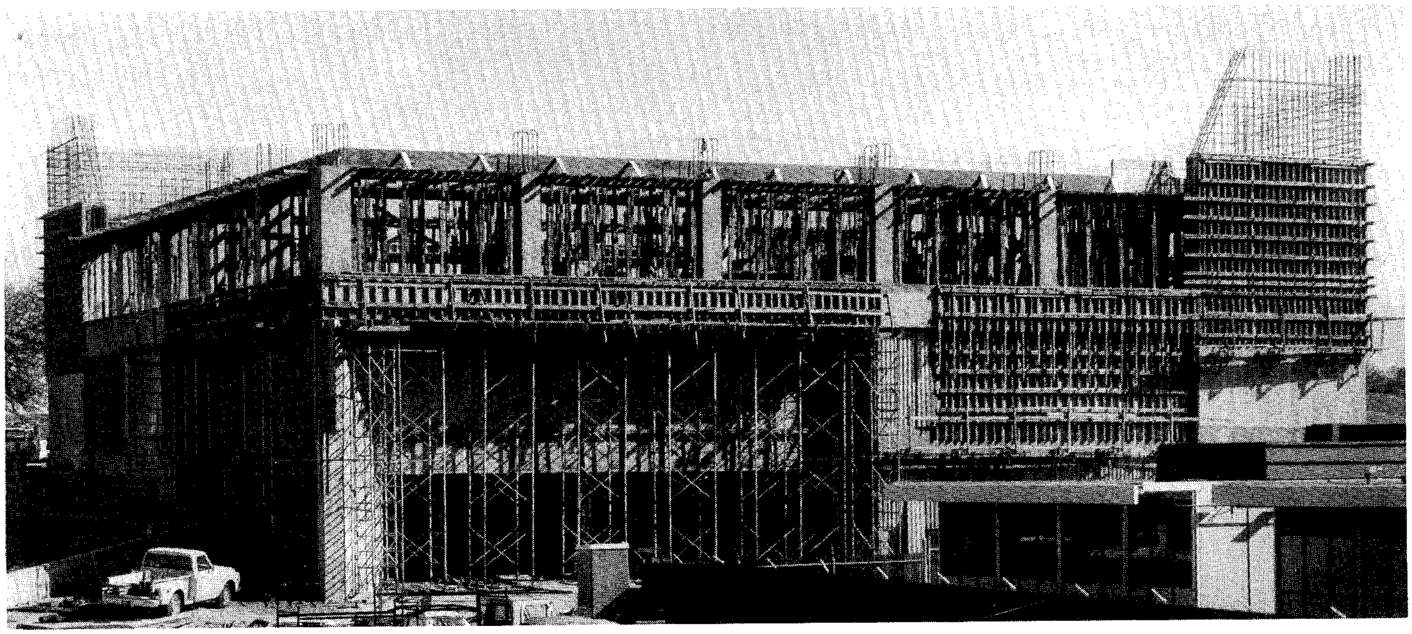


Photo by Dick Muffley

This is part of the apparatus that is used to inject a beam of polarized electrons into the SLAC accelerator. This device, called PEGGY, was developed in collaboration with Yale University. The triangular-shaped unit shown in the photograph contains a powerful lamp which is flashed at rates up to 180 pulses per second. These light flashes ionize (knock off electrons) a beam of lithium-6 atoms. Under the proper conditions, the liberated electrons can have their axes of rotation, or *spin*, aligned with each other. Such spin alignment is called *polarization*, and knowledge of polarization is an important advantage in analysing particle-physics experiments. Building on the experience gained with the PEGGY source, recent work at SLAC has concentrated upon different techniques for producing polarized beams. A reasonable goal for SLAC's polarized electron beam would be a polarization of about 90%, an intensity of about 10^9 electrons per pulse, and a pulse repetition rate of 180 pulses per second. The prospect for achieving this goal with the new types of sources now being developed is promising.



The new Computation Building taking shape in February 1975. Photo by Dick Muffley.

the AEC's (now ERDA's) construction activities that is presently on schedule, within budget, and within specifications! I very much doubt that this is simply a matter of good luck; it speaks well, rather, for the highly competent effort that SLAC's Plant Engineering Department and our associated architectural firm have brought to bear on this project

SLAC's computer facilities are unique. Not only are they very large but they are also a pioneering effort in what is called "real time" data processing. In contrast to the computation centers at most other laboratories and universities, which serve a rather broad community of users and do a large variety of different jobs, much of SLAC's computer capacity is used in connection with direct "hook-ups" to specific particle-physics experiments. A large fraction of the data generated by these experiments is analyzed on the spot, and this information is fed back to the experimenters to provide them with a continuous guide to what is happening during the course of the experiment. You may be interested to know that this new analysis and feedback system was in operation for the first time when the spectacular discovery of the first of the new psi particles was made at SPEAR, and it provided a great deal of help to the experimenters in trying to figure out what was going on. It is expected that the real-time operation of the SLAC triplex system will expand greatly during the next year; IBM is using SLAC as a field-test site for developing advanced software that will later be used in many other applications.

11. LASS

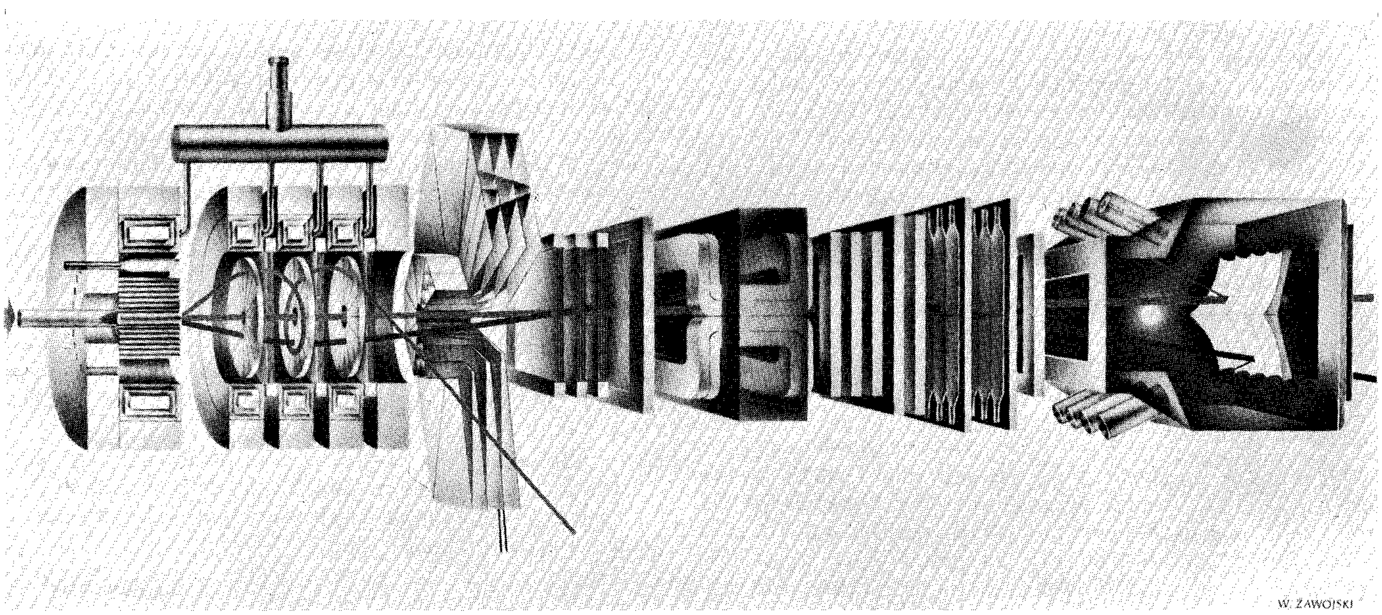
The Large Aperture Solenoid Spectrometer (LASS) now being built at SLAC is expected to become the single largest real-time user of the computation facilities. LASS is one of our large equipment projects, and it has also proved to be a rather difficult one. During the past year we have run into several setbacks during the initial tests of the large superconducting solenoid coils. These have included certain leaks in the system, a shorted turn in one of the coils, and problems connected with filling the system with liquid helium. Difficulties of this sort are not surprising for so large and complex an apparatus, but the time required to effect repairs to the system is stretched out in the case of a large superconducting installation because of the extended warm-up and cool-down periods that are required. However, some of this time has found good use in the testing of the rest of the LASS gear: spark chambers, proportional chambers, and electronics. LASS has the potential to be a major contributor to SLAC's scientific output. We hope this new facility will be nearing full research operation by the end of the calendar year.

12. Hybrid Bubble Chamber

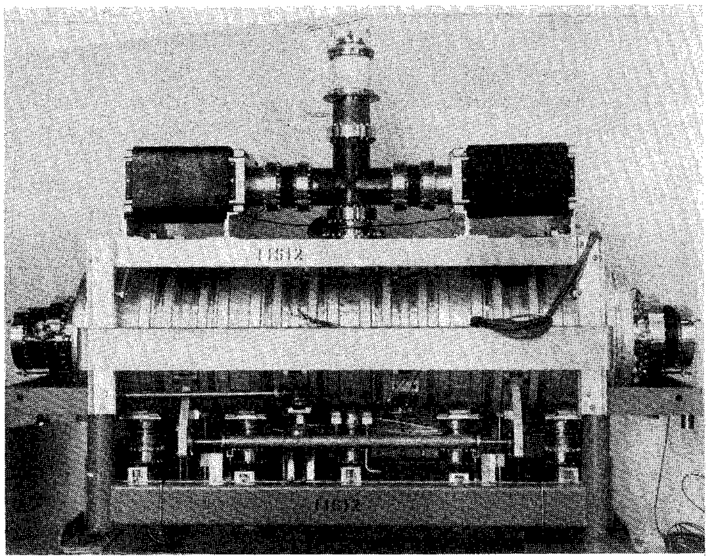
Another experimental installation that is expected to come into full operation during FY 1976 is the 40-inch hybrid bubble chamber facility. As you may recall, SLAC has pioneered in developing the bubble chamber technique to much higher sensitivities than has been possible in the past. This is accomplished through a process of "selective triggering," in which an array of spark chambers and counters located near a bubble chamber is used to detect an event and feed it into a computer. The computer then decides (within a thousandth of a second) whether the event was interesting enough to be recorded. If the decision is "yes," then a signal from the computer causes the bubble chamber lights to be flashed, a photograph is taken, and the film advances to the next frame. Thus bubble chambers can be operated at expansion rates that are considerably more rapid than the typical value of one expansion per second or so without filling the world with (mostly uninteresting) photographs. (One photograph per second adds up to 30 million photographs per year!) SLAC's 40-inch bubble chamber can now operate reliably at 10 to 12 expansions per second and can thus be used efficiently in experiments with very selective triggers. This method has been tested extensively with excellent results in earlier work at SLAC, and as a result the 40-inch chamber and its associated detection apparatus are being rebuilt and added to in order to provide a complete hybrid facility that should prove a powerful tool for a variety of experiments.

13. SPEAR II

The improvement program called SPEAR II is designed to increase the energy of the SPEAR electron-positron storage ring from the previous maximum of 2.5 GeV for each beam to a goal of about 4.2 GeV for each beam. In addition, it is expected that SPEAR II will also provide a higher luminosity (rate of interaction of the two beams) than was possible in SPEAR I. As you may recall, SPEAR I was shut down early last summer for installation of the radiofrequency and other systems that were needed for the conversion to higher energy. The SPEAR II schedule called for turning the storage ring back on in October and using the months of October and November to iron out the bugs in the new systems before the experimentalists were unleashed on it in full force. The October work went well--so well, in fact, that some experimental time was made available earlier than expected. But then came November the 9th, when the first psi particle was discovered at SPEAR, and at that point the excellent progress that we had been making from SPEAR I to SPEAR II was interrupted rather rudely by the spectacular progress of psi I and psi II.



The Large Aperture Solenoidal Spectrometer (LASS) which is now being constructed at SLAC. The beam direction is from left to right. The LASS system is designed to handle a broad variety of particle-physics experiments. The large superconducting solenoidal magnet provides effective momentum analysis for large-angle events produced in the target (where the "tracks" begin at the left). Momentum analysis of small-angle events is provided mainly by the large-gap bending magnet. The particles are identified by the two threshold Cerenkov counters, which differentiate between particles traveling at different velocities. Other detectors in the LASS system include scintillation counters, spark chambers and wire chambers. The full LASS spectrometer will be connected on-line to an IBM 370/168, which will control the triggering and data-acquisition systems. LASS is expected to begin operating during Calendar Year 1975. It's exceptional experimental versatility should add significantly to SLAC's potential for particle-physics research.



This is one of the radiofrequency accelerating cavities (resonant boxes) that was developed for use in the SPEAR II energy-upgrading program. Such cavities provide the means by which RF power from the new SPEAR klystrons is coupled into the circulating electron and positron beams to compensate for the energy lost through synchrotron radiation. The RF power requirements rise steeply as the energy of SPEAR's beams is increased. As an example, a beam energy of 4 GeV produces radiation losses that are 16 times larger than a beam energy of 2 GeV. SPEAR II will have a total of four accelerating cavities like the one pictured here, each driven by a single klystron power amplifier. The experience to date on SPEAR II has indicated that the new RF cavities are performing very well.

Now that things have quieted down a bit, the work of getting SPEAR II shaken down and running smoothly has resumed, and so far the following performance has been achieved: (1) An energy of 3.8 GeV per beam, as compared with the goal of about 4.2 GeV. (2) A maximum current in one bunch of about 70 milliamps, as compared with the design goal of 100 milliamps. In general we can say that the SPEAR II luminosity behaves as predicted up to energy levels of about 3 GeV, but that above that energy there is still some work to be done in achieving the higher luminosity goals.

14. Flexible Program

There is an important reason why I will not be able to tell much more about the details of next year's program of research operations at SLAC. Just because we are determined to make the fullest use of the opportunities that the new particle discoveries have given us, we plan explicitly to leave the program quite flexible so we can schedule our work as our understanding of these new phenomena increases. I do not plan to discuss these new discoveries here--the *Beam Line* has been brimming with news about both our knowledge and our ignorance of them. I hope that the efforts of Bill Kirk and the other *Beam Line* contributors have helped in sharing this information with everyone at SLAC.

To summarize, this past year at SLAC has been exceedingly productive as far as physics is concerned, but also quite difficult because of limited funds, inflation, and decreasing staff. For next year I believe we can look forward to a time of continued productivity in our work, and I very much hope that our days of cutting back have come to an end.

W.K.H. Panofsky

A ROSE BY ANY OTHER NAME . . .

SLAC was first proposed in 1957, and it was finally authorized in 1962. During most of that time the proposal was known as *Project M*. No one liked that name very much, so in August 1960 we had a little contest among the 40 or so people who were involved to see if someone could come up with a good name. Here are some of the suggestions that came in:

SEA *S*tanford *E*lectron *A*ccelerator
STELLA *ST*anford *EL*ectron *L*inear *A*ccelerator
SLAP *S*tanford *L*inear *A*ccelerator *P*roject
SELA *S*tanford *E*lectron *L*inear *A*ccelerator
STMA *S*tanford *T*wo *M*ile *A*ccelerator

Certain other ideas, while clever, do not bear repeating in this family newspaper.

Perhaps the most far-sighted suggestion was that of Professor Felix Bloch of Stanford, who wrote:

. . . While I believe that my proposal most accurately describes the ultimate purpose of the project, I am aware of the small chance it has to win the support of the majority:

SNAFU *S*tanford's *N*ew *A*cquisition *F*or *U*lcers

Cordially yours,
Felix