SLAC BEAM LINE

Work, Finish, Publish. --*Michael Faraday*

Volume 13, Number 12 *December 1982*

THE END OF AN OPERATING SYSTEM

(SLAC's computer system is not a constant thing; in the past year three older computers have been replaced with a single new machine. These changes usually don't make waves outside the computer building, because these machines all use the same "operating system" that makes them look the same to the user. This time, however, that system changed too. Its passage after nearly 20 years is here mourned.)

Somewhere back in the halcyon days of the middle 1960s the first operating system, called OS/360, was brought up on the IBM 360/50 computer at SLAC. Now, some 2 quadrillion ($2\ 10^{15}$) computer instructions later, the OS era has ended at SLAC. The world of computing has changed tremendously during that time:

- In the 1960s the standard tool of the engineer was the slide rule. It is still used, but only to scratch one's back.
- The old 360/91 had 2 million bytes of memory that took over 100 square feet of floor space. By the mid 1970s the newer 370/168s had 8 million bytes of memory housed in 20 square feet. Now our very new 3081 has 16 million bytes of memory housed in 4 square feet of floor space. The 91 memory cost $1 per character, the 168's $.20, and the 3081's $.025.
- The 91 used 70 gallons of cooling water a minute to run at about 3 MIPS (million instructions a second) and the 3081 uses 8 to run at about 14 MIPS.
- The 3081 is priced today (in 1982 dollars) less than the 168s were in 1974 (in 1974 dollars). Yet the 3081 is many times more powerful than the 168s.

All of this says the world has changed. What was state of the art slightly over a half a decade ago is now obsolescent if not obsolete. Computing, unlike most other things, has become significantly cheaper per unit of work over the last decade. This trend is expected to continue for at least another decade.

OS/360 and its follow-on system OS/VS reigned supreme at SLAC during the years from 1966 until the installation of the new 3081 computer. OS/360 was a wonderful system designed by wizards and full of their mystical incantations. Some of its more famous features were:

- JCL - This was described in a document that I recently read as: "Job Control Language. This was one of IBM's first attempts to make computing easy - JCL has only 5 command verbs. Unfortunately, one of these verbs has grown to have over 192 different modifiers."
- ASP - This started out as Attached Support Processor and ended up meaning Asymmetrical Multiprocessing System (?). You must admit the name was impressive. So was the asymmetry. It was also asymmetrical to the way anybody ever thought. It controlled multiple CPUs according to a set of rules that only it understood (they also changed randomly in time). Some people who had considerable dealings with it felt that the S stood for Sleepy, for when it didn't have much to do it refused to do anything else.
- Orvyl and Wylbur - Systems built at Stanford in days of yore. The functions of Orvyl are subsumed in CMS, and Wylbur lives on as still one of the better line-by-line text editors available.
- Catalogued Procedures - Not to be confused with cataloged tapes. A set of canned JCL routines that did almost what you wanted. We probably had amongst the most complex such procedures that existed in western civilization. This is roughly equivalent to bragging about being the designer of the Los Angeles Freeway System.
- Condition Codes - With these one could control the flow of job steps within a job. That is what one thought until one tried to use them fully. One then discovered that they were designed by Uncle Fester of the Addams Family. If you liked hanging upside down, then you would probably be comfortable with the syntax.
- Utilities - A remarkable collection of functions that almost worked correctly, and had a collection of syntaxes that challenged all of us (a knowledge of Parsi, Phrygian, Sanskrit, Gaelic, and Frisian and their interrelationships helped in keeping their functions straight).

So on a brillig day we bid fond adieu to this slithy tove. At slightly after 12 noon on November 5, 1982 a group of us pushed the Power Off button of the last 168 and ended the era of OS/360 at SLAC. I wonder who will be writing the eulogy in 1992 or so for the not so brave new world of VM/370 that we are currently embarked upon. It would be very depressing to think that there wouldn't be one.

–T.Y. Johnston

A NOTE ABOUT PRINTING

The *Beam Line* has been experimenting with some of the new computer programs and equipment available at SLAC. The above article was typed, bounced around among several terminals, edited, formatted with a program called TEX , and printed on a new laser printer. The poem on page 3 and the article on page 4 are furthur examples. We hope to compose the entire issue this way very soon.

BEAT, REACH, AND RUN

Sean Dyer cuts a line into the mud with the toe of his hiking boot and warms up to his subject. "The race starts ten minutes before the gun goes off as the boats circle around back here fighting for position. Across the line you sail a triangular course, with legs called the beat, reach and run." Sean's boat is next to him on the high ground above the Mark II Expermental Hall where Sean works as coordinator. And we're here taking pictures and notes for a story that began about a year ago when Sean won the Yachtsman of the Year trophy in the Small Boat Racing Association of Northern California.

The original plan was to get a picture of Sean with the tall oak prize, but we never got man, brass, and camera all together. Now in November he was having the cup engraved with the name of the next winner. Well, it's a nice enough trophy, but a picture of the boat would probably be more interesting anyway; did he have any such around? Being a man of action, Sean had a better idea. If he could get the boat to SLAC, could we get a camera?

Three days later Sean unhooked the trailer with his Flying Junior class racer, set the sails, angled for the best wind, and stood by proud. Good wind, bad light—Joe Faust had him turn it around and the picture was taken.

For good measure there was another trophy. Though proudest of the Yachtsman award, Sean also holds the divisional championship two years running. He's not just a good sailor, but a fast one.

The boat is 13 feet and 2 inches exactly, and the class is tightly controlled as well for weight, sail, and balance. Yes, there are some tricks and small modifications, but Sean says that the sailors keep these things to themselves and says no more about it. All the rest, though, what would you like to know? "To detune, just take the fullness out of the camber...look at the way the jib lines up with the main...with more than 5 degrees you create a weather helm... the maximum speed in knots is set by 1.4 times the square root of the water line in feet..."

Yes, he admits, it can be complicated. The 12 meter yachts have onboard computers now, "but you still can't beat the man at the helm." And the woman—this is a two man boat with skipper and a crew of one; Sean's crew in the races has been his 18 year old daughter, Theresa.

Sean and his family took up the sport about 8 years ago, jumping right into racing in this class. Sean had had a little experience with sailing earlier in Canada, on his way here from Ireland. Those roots show up in the small shamrock on the transom and the pale green color of the bow. Sean notes, with a light touch of the brogue, "You can learn this sport in about two months, but you spend the rest of your life becoming a good sailor."

--BA

SONNET #1

Shall I compare thee to a charmèd psi?
Thou art much sharper and more resonant.
Uncertainty doth widen peaks of chi,
And background fits show all too great a slant.
Sometimes the stable proton doth decay,
And violated parity we see,
The SU(5) will not in order stay,
When TeV's do break its symmetry.
But thine excited state shan't fall to ground,
Nor shall strange currents drain thy charm from thee,
Nor shall the strong force brag that thou art bound,
While quarks become free asymptotically.
So long as bosons spin and muons flee,
So long lives this, and this gives mass to thee.

—Janine Adler

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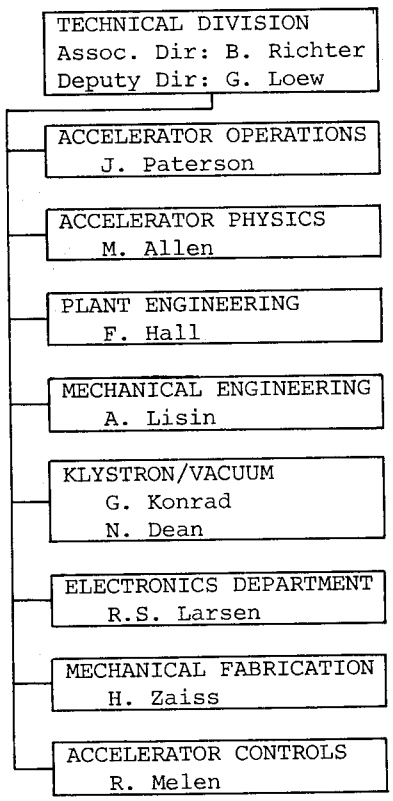
SLAC REORGANIZATION—PART 3

The August and October issues of the *Beam Line* described the changes in the organization of SLAC Divisions as outlined in two memoranda to the staff from the laboratory Director, W.K.H. Panofsky.

The changes within the Technical Division itself are included in the new organization chart at right. The structure of this division is much the same as in the past but its mission has been expanded to include operation of PEP and SPEAR. The Experimental Facilities Department has been transferred from the Technical Division to the Research Division.

Accelerator Operations will manage PEP, SPEAR, and the linac operations. Accelerator Physics is responsible for support of the present linac program and SLC as well as for research and development of advanced accelerator projects beyond the SLC. The combined Klystron/Vacuum department will support the present machines and the SLC, and will work on the development of new power sources for very high energy colliders. The Electronics Department will now handle all DC power supplies in addition to its current responsibilities.



WORD PROCESSING AT SLAC

A little more than one year ago a committee at SLAC began looking at what the lab should do about "word processing"—one of several buzz words which mean using computers to help you type papers, send memos, and organize paperwork. There are lots of machines on the market which claim to do all these things, including personal computers. Experience at other labs and tests here have shown, however, that such commercial equipment has limitations when used at a place like SLAC. On the other hand, SLAC has a very powerful central computer system which is used for scientific computation and data analysis; could this system with its 600 terminals also be used for this other work?

The committee (Committee on Text and Information Processing at SLAC, or CTIPS) concluded that there was a need for computer tools for text processing at SLAC and that the central system was the best way to provide them. Their conclusions are given in a report which is an eminently readable introduction to text processing in general and at SLAC in particular. Copies of the report may be obtained from the committee chair, Louise Addis (extension 2411).

As a key part of the plan, the committee recommended that the SLAC Computing Services (SCS) establish an office to coordinate training, documentation, maintenance, equipment selection, and program development. SCS has been offering basic training on the system to staff who wish to learn how to prepare memos, letters, and reports. This training is one-on-one with priority to those who have access to a terminal. To get on this waiting list, call Hilda Korner at extension 2203.

There are now enough regular users of the system for text work that they have formed the Text Processing Users Group (TPUG) which meets regularly to share information and experience. Details on this group are available from Arla LeCount at extension 2318.

Although the laboratory has endorsed this report and its conclusions, there is no off-the-shelf product which will magically appear on everyone's desk. The success of the central computer system in these new applications will depend very much on the interest and effort of those who wish to use it. There are many uses already, from keeping stockroom lists to "electronic mail" to typing technical papers. If you wish to join in this or find out more about it, please call me at extension 2368.

—Ilse Vinson

SCS Text Processing and Documentation

Stanford's hope for heavy boson

Stanford Pulls Off a Novel Accelerator

A 600-meter-diameter loop at the end of an upgraded 3-kilometer-long linear accelerator is aimed at lassoing the fabulous Z^o particle

SLC—THE STANFORD LINEAR COLLIDER

These recent headlines from *Science* and *Nature* about the SLC project at SLAC show the strong interest that this new idea is drawing in the scientific press. It's time for the *Beam Line* to catch up.

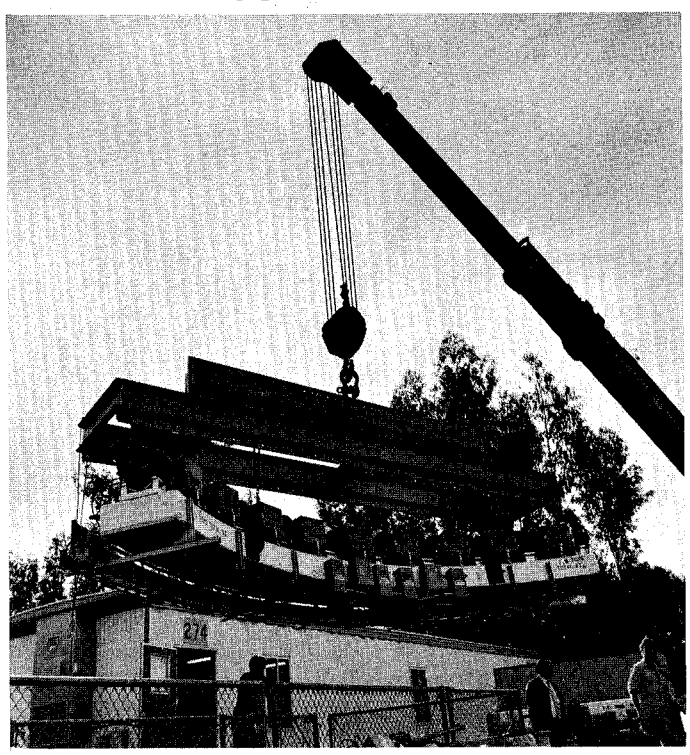
First, in twenty-five words or less, what is the SLC? It is—a new kind of machine in which electrons and positrons from the linac are focused to single pass collisions with energies up to 100 GeV. The idea is illustrated in the diagram below. The thick, broken line is our two-mile-long linear accelerator. At the end of the linac on the right, one bunch of high energy electrons and one of positrons take the separate looping paths (about the size of the PEP ring) and collide. This sounds sensible enough, and a lot like PEP; but it doesn't sound very difficult or novel. What's the big deal?

The name of the game in high-energy physics is, of course, energy. We have at SLAC now two machines which collide beams: SPEAR with nearly 4 GeV per beam, and PEP with about 15 GeV. The next desired step is by that same factor of 3 or 4 to 50 GeV. Now here is the problem: a short walk and a long walk will convince you that PEP is not just 3 or 4 times bigger than SPEAR; it is 10 times bigger. Three times the energy takes ten times the size. A 50 GeV machine built like PEP and SPEAR would have to be about 15 miles around.

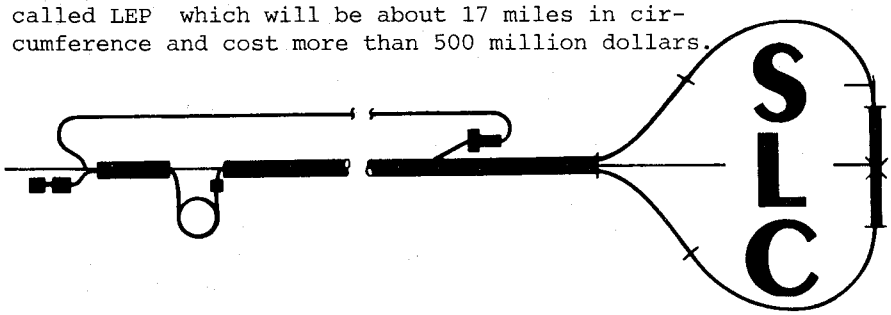
Such a project is not completely out of the question, given enough money and room. The big European lab CERN, in fact, is starting a machine called LEP which will be about 17 miles in circumference and cost more than 500 million dollars.

The SLC avoids the rule of "Ten times the size for three times the energy," giving SLAC a new step in energy and giving physicists a new way to get still higher. How this is done will be discussed in a series of articles for the *Beam Line*.

The first of this series (on the following two pages) is a measure of the interest and planning for the SLC. Nearly four years before the first beams, the experiments for this new machine are being planned.



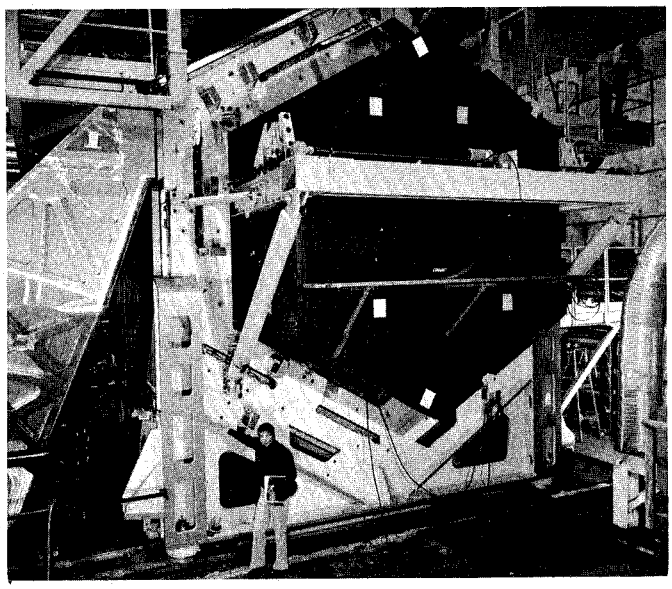
A raft of magnets is lowered into the vault of the damping ring of the SLC. The ring is the small circle on the bottom left of the diagram. Electrons and positrons are stored in this SPEAR-sized ring to improve the quality of the beam before final acceleration in the linac.



THE BEGINNINGS OF SLC DETECTORS

On May 18, 1982, SLAC sent out a call for Letters of Intent for SLC experiments. The nine letters received are listed in the table. Four of the Letters are for detectors now at PEP: MAC, MARK II, TPC, and HRS; one is for the Crystal Ball, now at DORIS in Germany; one is for a Monopole Search; one is for a new Crystal Ball using Bismuth Germanate (BGO); and two are for new magnetic detectors (one using the HRS magnet).

Public meetings were held on November 4 and 5 for the proponents to explain and justify their intentions. The meetings were held in the SLAC auditorium and were well attended.

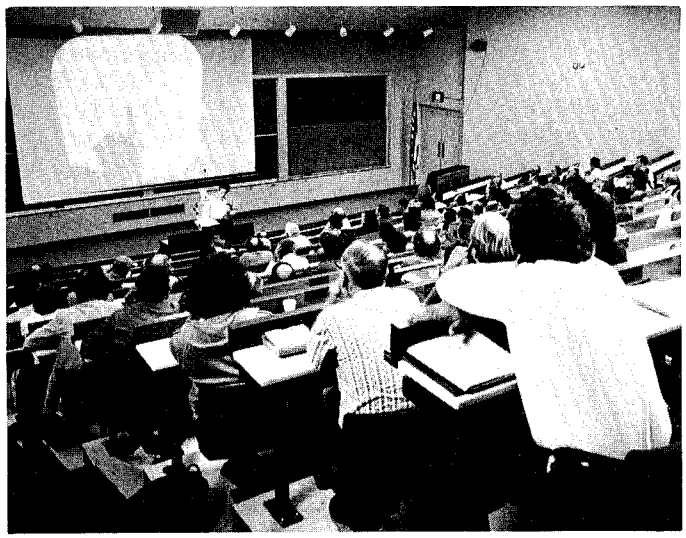


George Trilling makes a point to an attentive audience in the SLAC auditorium.

The SLAC Experimental Program Advisory Committee was given the unenviable task of sorting through this menu to advise the Laboratory on which of these should be picked for the SLC. Unlike storage rings which have room for several simultaneous experiments, the SLC can deliver beam to just one at a time. The plan is to have room for two in the experimental hall so they can be exchanged quickly. One possiblity is to select one 'used' (and thoroughly checked out) detector and one brand new facility with all the latest technology.

The Committee deliberations stretched into the weekend, and they succeeded in narrowing the choices for the first detector to three: the TPC, the MARK II, and the HRS. No conclusions were reached on the selection of the second detector.

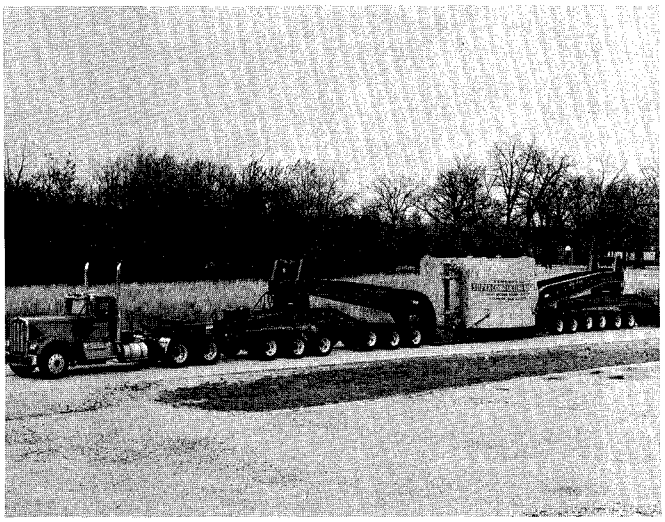
The candidates for first detector are large general purpose magnetic detectors. The TPC has a unique particle identification capability. MARK II was originally used at SPEAR; its liquid argon shower counters give excellent energy measurements for electrons and photons. HRS uses the superconducting magnet from Argonne's 4-meter bubble chamber and has superior momentum resolution.



The TPC detector in the assembly hall at IR-2.

These are all large devices. The HRS weighs over 2000 tons, and when its 110 ton superconducting coil was shipped across the country, it was national news. The detectors are also precise, delicate and complex electronic devices. To eliminate the arduous work of taking a detector apart at PEP and putting it together again at the SLC (with no lost parts), the experimenters plan to transport their machines to SLC with as little dismantling as possible.

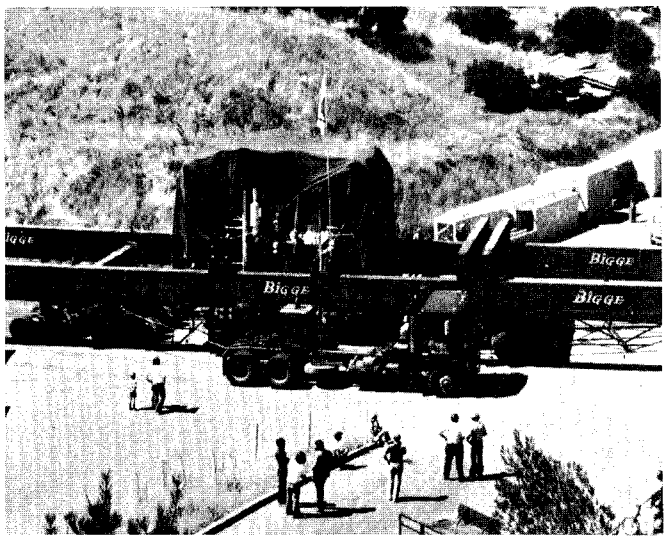
To those of you who have seen 160 ton pieces of MAC and a 350 ton piece of MARK II make their laborious trips to PEP, this might not seem to be an impossible dream, but there's a difference.



The superconducting magnet coil from the Argonne 4 meter bubble chamber on its way to SLAC.

The SLC IR will lie under a big hill. This makes it impossible to excavate an IR hall down to the beam level or to dig a tunnel to bring in a detector at beam level from the side.

The current design calls for a 15.5 meter deep pit (about the height of a 4 story building). After the detector has been inched along the road from its home at PEP to the SLC IR, it will have to be lowered into the yawning pit. In discussions with rigging firms and from a perusal of the literature, it appears that the job can be done. Now it is a question of how to do it quickly, safely and at minimum cost.



The Mark II detector on its way to PEP.

When will all this happen? If Congress appropriates funds this fiscal year and authorizes construction, ground-breaking will occur early in 1984; the interaction region pit will be ready in the summer of 1986. The chosen first detector will be on the road just before that, arriving in time to be lowered into the pit as soon as it is ready for occupancy.

Once in place the detector will be reconnected and checked out with cosmic rays. Then it will be ready to make new discoveries in physics with the SLC colliding electron-positron beams.

--HAW

SLC LETTERS OF INTENT

1. An SLC Spectrometer Facility, SSF
University of Michigan.

2. Search for Highly Ionizing Particles
UC Berkeley and Cornell.

3. The Crystal Ball at the SLC
Caltech, DESY, DPHEP at Saclay, University of Erlangen, INFN at Firenze, University of Hamburg, Institute of Nuclear Physics at Krakow, University of Nijmegen, Universitat Wurzburg, SLAC, and Stanford.

4. The MAC Detector at the SLC
University of Colorado, Frascati, University of Houston, Johns Hopkins, Northeastern, UC Santa Barbara, SLAC, Stanford, University of Utah, and University of Wisconsin.

5. The PEP-4 Facility (TPC) at the SLC
Iowa State University, Johns Hopkins, LBL, UCLA, UC Riverside, University of Massachusetts.

6. The MARK II Detector at the SLC
Caltech, University of Hawaii, LBL, University of Michigan, UC Santa Cruz, and SLAC.

7. The High Resolution Spectrometer (HRS) at the SLC
Argonne, Indiana University, LBL, Purdue, and University of Michigan.

8. A BGO Ball at the SLC
Caltech, Princeton, and Stanford.

9. SLD, a New SLC Detector
Caltech, Johns Hopkins, MIT, SLAC, University of Illinois, and University of Washington.

NEWS & EVENTS...

EVENTS ON CAMPUS

MESSIAH SING: Sunday, Dec. 12, Mem Chu, 7:00 pm Free

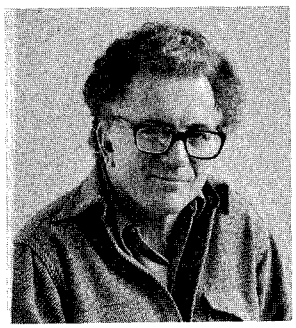
STANFORD FLICKS: *My Fair Lady*, Sunday, Dec. 12, Mem Aud, 6:30 & 9:45 pm, $1.50

ALMA TRIO: Schubert's *Trout Quintet* and more, Thursday, Dec. 9, Dinkelspiel, 8:00 pm, $4.00

ALMA TRIO: Beethoven's *Archduke Trio* and more, Friday, Jan. 14, Dinkelspiel, 8:00 pm, $4.00

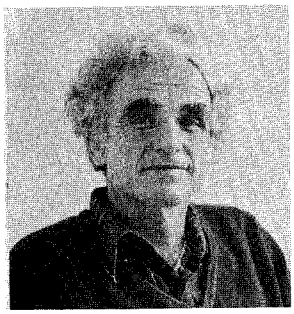
TRAVEL MOVIE: *The Danube*, Monday, Jan. 3, Mem Aud, 7:45, $4.00

NEW PROGRAM COORDINATOR



Hobey DeStaebler, of Experimental Group A, took over in November as Program Coordinator. Seeing that the experimental program runs smoothly is the Program Coordinator's main task. He will be responsible for coordinating the running schedule of the PEP and linac experimental programs.

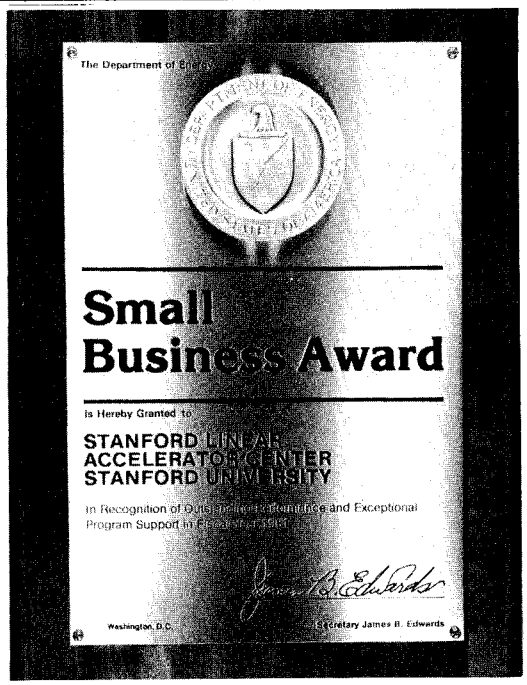
NEW EPAC SECRETARY



David Fryberger, member of the Experimental Facilities Department staff, has been appointed Secretary to the Experimental Program Advisory Committee. The EPAC reviews proposals for experiments at SLAC and advises the Director of the Laboratory.

CHRISTMAS CHEER

SLAC's annual Christmas party will be held on December 21 in the Cafeteria/Auditorium breezeway from noon-2:00. A special lunch will be served from 11:20 for which discount tickets will be made available. After lunch, free dessert and punch will be served in the breezeway. SLAC carollers will entertain until Santa arrives to announce ten winners of the drawing from the entire SLAC staff. (You need not be present to win these prizes.) Additional names will be drawn during the party for the remaining prizes. For these you must be present to win unless you are on shift. Look for ALL HANDS BULLETINS for further information.



HONORS TO PURCHASING DEPT.

SLAC has received 2 awards from DOE recently. The first, a Small Business Award plaque, was presented by Susan Brechbill of DOE's San Francisco Office for exceeding SLAC's goal that 50% dollar volume of purchasing orders be awarded to small businesses. The Purchasing Dept. awarded 61.8% to small businesses in 1981.

SLAC was presented with a certificate on Nov. 18 by Maurice Carcamo of DOE San Francisco for exceeding the disadvantaged small business goal of 4.5%. In this category SLAC awarded 5.2% dollar volume to disadvantaged businesses.

Ralph Hashagen, Purchasing Officer, attributes this remarkable record to the SLAC buyers and contract administrators and their effort to encourage small and disadvantaged firms to compete for SLAC business.

PEP FACILITIES COORDINATOR

Pier Oddone, LBL physicist, has resigned his position as PEP Facilities Coordinator. He was responsible for advising the laboratory on the several PEP detectors and their programs during the critical installation and checkout. These duties will be absorbed now by members of the SLAC staff.

IN MEMORIAM

RAY ROBBERS (2/1910-6/1982) Friends of former SLAC employee Ray Robbers will be saddened to know that Ray succumbed to cancer last June. Ray was employed at SLAC from 1962 until his retirement in 1975.