SLAC BEAM LINE

If the Lord Almighty had consulted me before embarking upon Creation, I should have recommended something simpler.
—Alphonso X, King of Castile and Leon, 1221-1284

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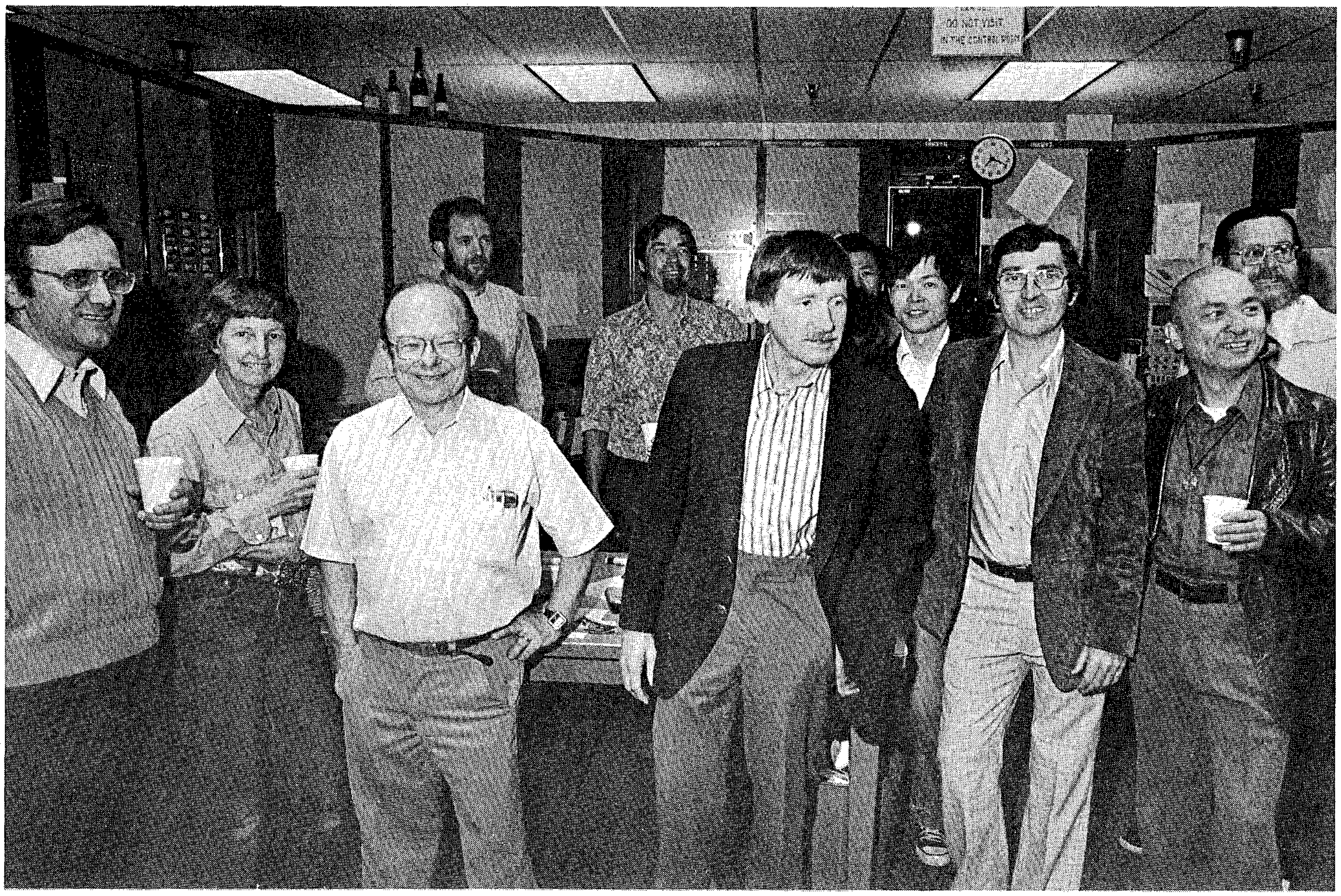


An electron beam was stored for the first time in the PEP storage ring at SLAC on the morning of April 21, 1980. Among those present to share in the celebration were, left to right, Helmut Wiedemann, Adele Panofsky, SLAC Director Wolfgang Panofsky, Robin Gray, Phil Morton, PEP Director John Rees, Dave Tsang, Alex Chao, Ewan Paterson, Martin Lee and Gerry Fischer. (Stanford News Service photo.)

In This Issue

KRYS CIOLKOSZ RETIRES

A long-time stalwart of the Business Services Division at SLAC has regrettably retired. Krystyna Ciolkosz officially retired on May 1, after working at SLAC for more than 18 years. However, Krys will occasionally still be seen here when she fills in for the Petty Cash Cashier or helps out in the Budget Office.

Krys was born in Poland and educated in that country, Belgium and France. During World War II, she moved from Belgium to work for the Polish Embassy in exile in both England and France. At the end of 1948, she and her husband, a prominent aerodynamicist, moved to Philadelphia. Later moves took them to Los Altos and then to Seattle, where Mr. Ciolkosz accepted a job in aircraft engineering with the Boeing Company. After his death, in 1958, Krys returned to the Palo Alto area, which she "likes best."

When Krys first joined Project M in the proposal stages on the Stanford Campus, in 1962, she typed purchase requisitions and handled petty cash for the entire project. At that time the University had provided the pre-SLAC project with housing in a new "Butler-type" building (now the Service Operations Building) that had few partitions, was heated only by suspended space heaters, and had no air conditioning. Krys recalls it as working in a warehouse with a leaky roof and a long walk through the woods to the rest rooms. She claims it was one big family in those early days, with many practical jokes to remember. "I still can't be serious," she admits with a grin. "It was livelier in those miserable conditions."

After Project M had become the reality known as SLAC, the staff, the budget and the problems all increased rapidly. Krys's growth in capability and responsibility were recognized by her promotion to Assistant Financial Analyst in 1966 and to Financial Analyst I in 1971. During the past few years Krys's duties have been those of a financial analyst in the Budget Office. These have included responsibility for the monthly budget cost summaries and for the Business Services Division budget. She has also helped out from time to time in Accounting and Purchasing. Krys has handled conference liaison with outside groups and accounting for all campus funds made available for SLAC use. She has also served at the registration table at international conferences held at SLAC, where her knowledge of Slavic and Western European languages has proved to be most helpful. For nine years Krys also served as Treasurer of the SLAC Emergency Relief Association (SERA).

Those who have worked with Krys have found her to be a gracious and charming woman. She leads an active social life, entertaining many visitors from Europe, and attending the San Francisco opera and symphony regularly.

Krys's plan for the future include driving back east this summer, and from there flying to London for the winter. Asked how she was enjoying her retirement so far, Krys retorted, "Give me five days off and I'll tell you."

--Business Services Division

SUMMER CAMPING PLANNED

If you have tents, coolers or camping stoves you'd be willing to loan or rent for a SLAC camping trip this summer, please contact Nina Adelman at ext. 3113. I hope to visit Yosemite this summer with some foreign guests of SLAC who are unequipped with the proper gear.

Also, if you have reservations for a campsite during the summer, please let me know. If you have a small group, perhaps we could join you; if you are cancelling a trip, we could use the spot. Thanks.

--Nina Adelman

Photo by Joe Faust

This is to introduce Betty Hansen, the new Assistant Manager for Shipping and Receiving. Betty has been at SLAC for 9 years and was initially hired as a Posting Clerk for SLAC Stores. In 1976 she was promoted to Journal Clerk in Shipping and Receiving, and subsequently was appointed Supervisor of the Journal and Receipts Control Section. Betty attended San Francisco Business College and Los Angeles Community College, where she majored in Business Administration. She can be reached on ext. 2486.

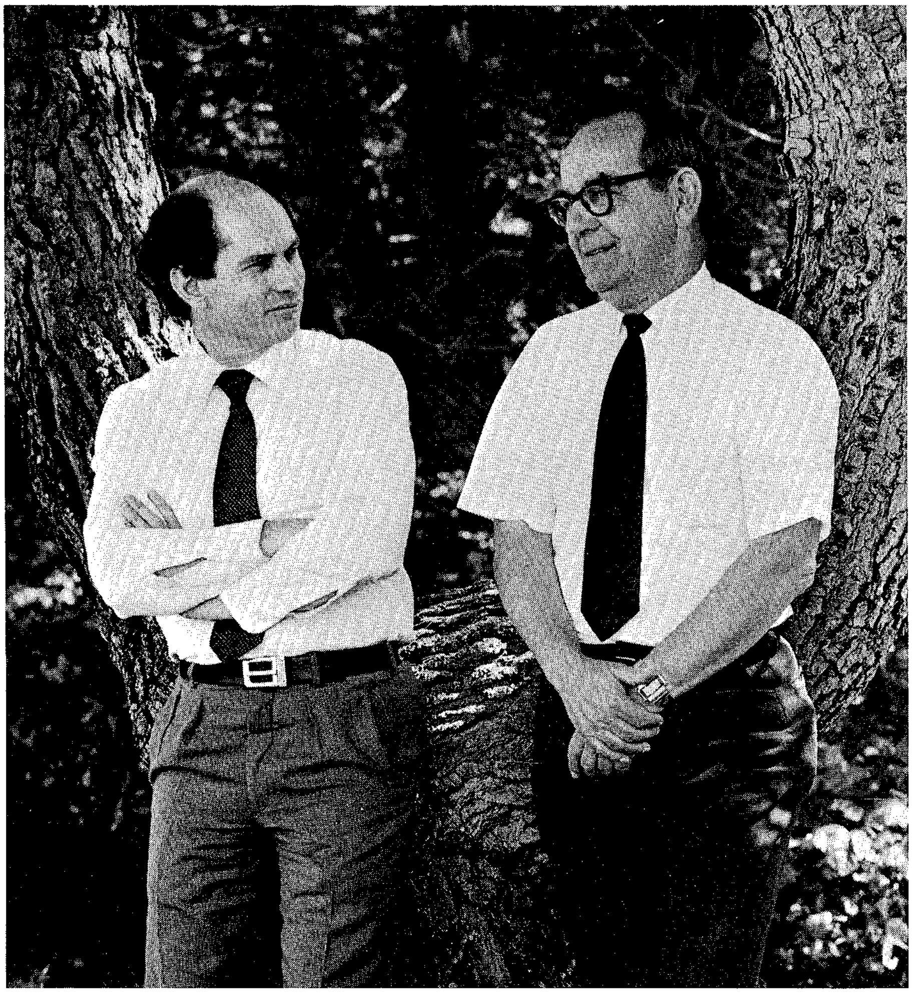


Photo by Joe Faust

CURRY LEAVES; WOMACK TAKES OVER

Bill Curry (on the left) left SLAC at the end of April to take a position as a subcontract administrator with Lockheed Space Systems Division. Prior to coming to SLAC, Bill had been an officer in the Air Force with considerable procurement experience, particularly in the administration of cost-type contracts. He holds an M. B.A. degree from Ohio State University.

Bill became Assistant Purchasing Officer at SLAC in October, 1977, when we were in the midst of buying the large, specialized hardware for construction of the PEP storage ring. We appreciate Bill's contribution in rapidly rolling up his sleeves and assuming responsibility for the procurement of mechanical components and systems. He was very effective in his handling of many specialized procurement actions, which by their nature would challenge any purchasing agent. In addition to working on many of the PEP fabrication items, he and his group were kept busy on some of the key elements for the large particle detectors that are being used in PEP experiments.

We shall certainly miss Bill, and we thank him for a job well done.

I am pleased to announce that Larry Womack (on the right in the photo) has assumed the duties of Assistant Purchasing Officer as of May 1. Larry has had valuable experience in almost every aspect of the mechanical buying group. He was recently awarded a Master of Arts degree in Management/Business Administration from the University of Redlands. His experience and service-minded attitude will be of great value in his new assignment.

All of us join in wishing continuing success to Bill Curry and Larry Womack.

--Ralph Hashagen

PEP BECOMES A STORAGE RING

The first electron beam was stored in PEP at 3:30 AM on Monday morning, April 21, 1980.

This was the culmination of about three weeks of hectic activity aimed at getting all of the components working properly and, more importantly, all working at the same time. We had first begun to receive beam from the SLAC linac on April 1, but it turned out to be more difficult than we had expected to contain the beam within the small PEP vacuum chamber (typically 1½ by 2 inches) around the full circumference of the ring (1¼ miles). We then began to use various combinations of the 96 steering magnets in the ring to help keep the beam in the vacuum chamber.

We could observe beam losses as the beam circulated for up to 12 turns around the ring by using a counter from the DELCO experiment in Interaction Region 8. However, since the object of the tests was not to lose the beam but to prevent losses, we soon realized that we would also need a signal from the portion of the beam which was staying in the ring. This was accomplished by installing a photomultiplier in Region 7 to look at the synchrotron light emitted by the circulating beam.

Finally, late on Sunday evening, April 20, we had the system tuned to the point where the beam was surviving for more than 1000 turns, or until the next injection pulse from the linac would kick out the surviving beam and replace it with a new pulse. This was significant progress. There still remained, however, the problem of building up the stored current in the ring by accumulating a large number of linac pulses. After a few more hours of work in adjusting the orbit and the RF acceleration, we finally began to accumulate linac pulses in the ring. At 3:30 AM, we observed signals that indicated the beam was being stored for about 1½ minutes—the equivalent of 12 million turns around the ring, or a total travel distance of about 15 million miles.

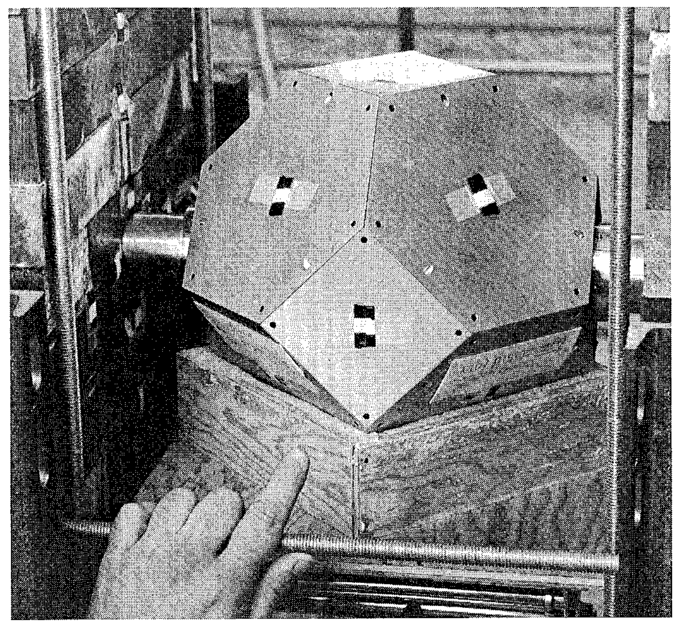
By 6:00 AM the operating crew was finally convinced that everything was working properly and that we had indeed stored a beam. Phone calls then went out to John Rees, Wolfgang Panofsky and others to tell them the good news, and not long afterward the champagne corks began to pop.

--Helmut Wiedemann

<u>PEP performance</u>: As of early July, PEP had run at a maximum energy of 11 GeV for each beam, with a maximum luminosity of 1.5×10^{30} $cm^{-2}sec^{-1}$ The next planned step is to increase the electron beam energy up to about 15 GeV in order to establish the conditions needed for operating both beams at this higher energy.

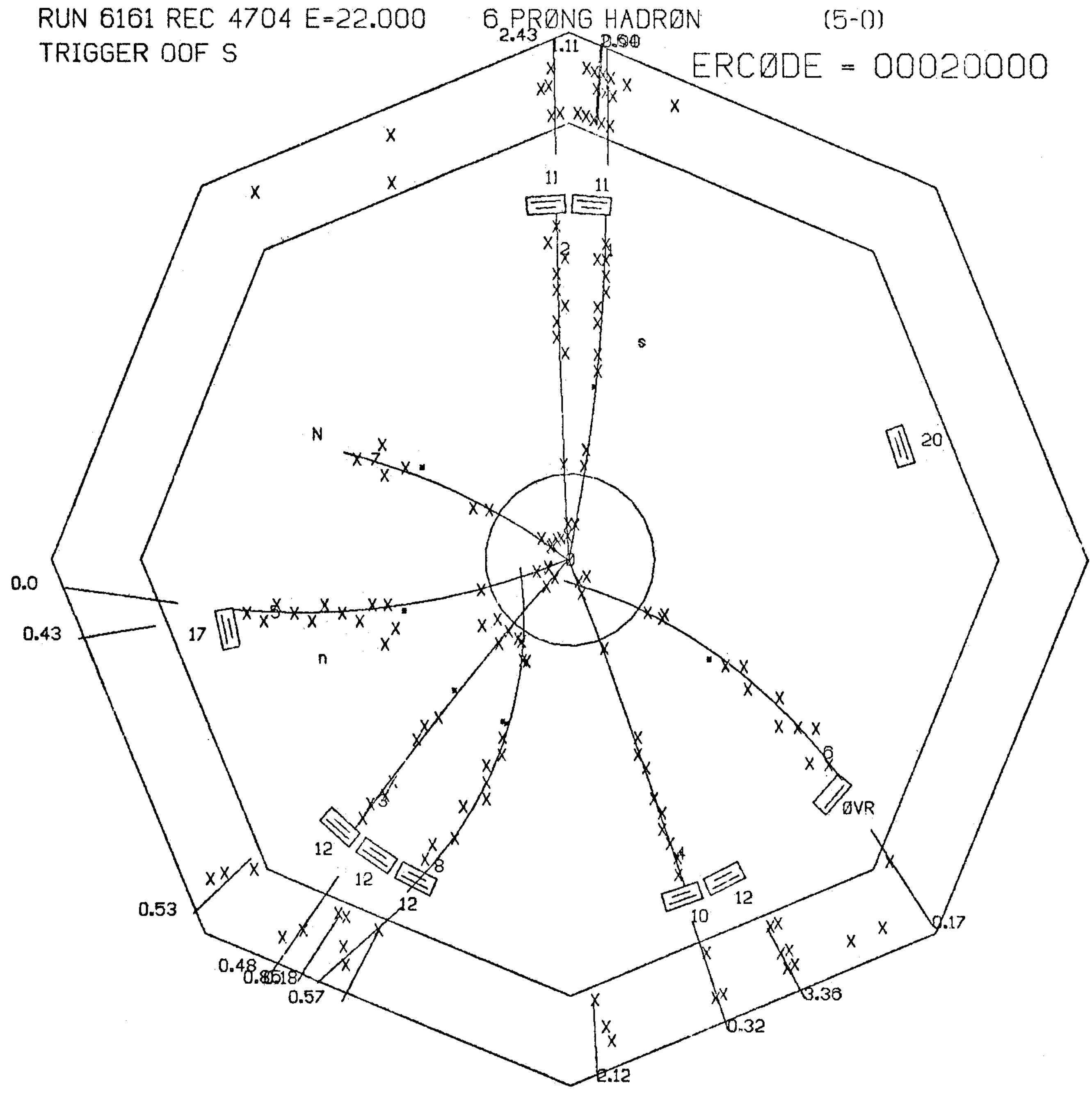
EXPERIMENTS AT PEP

Five experiments have now begun taking data at PEP, and four others are either in preparation or waiting to be transferred from SPEAR to PEP. As the work evolves, we hope to have descriptions of these experiments, and of PEP itself, in later issues of the *Beam Line*. As a reminder to SLAC readers, there already exists a pretty good description of the PEP storage ring and of its prospective experimental program in the following article: "PEP: An Introduction," Beam Line Report No.6, June 1977. Copies of this article can be obtained from Bill Kirk, Bin 80 (ext. 2605).



PEP-2: THE MONOPOLE SEARCH

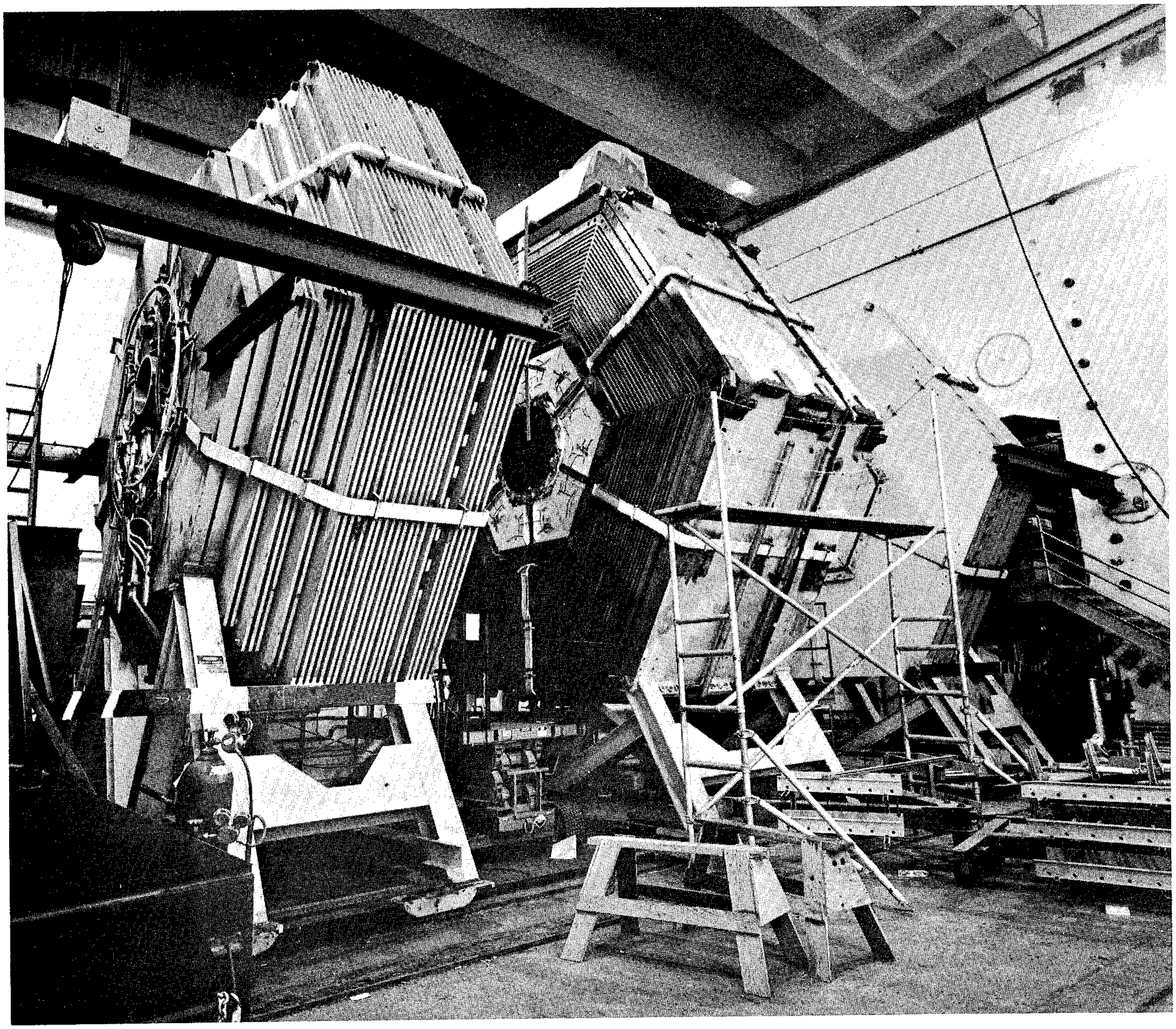
The exception to the rule of massive and elaborate particle detectors at PEP is the small device shown above. The aim of Experiment PEP-2 is to search for the possible existence of very highly ionizing particles, such as the postulated magnetic monopole. The device makes use of a combination of two kinds of plastic, Lexan and CR-39, that are placed in layers on the inner surfaces of of the 12 faces of the aluminum polyhedron. The detector is placed in Interaction Region 10 at PEP. After long exposure to the colliding beams at this point, the detector will be removed, and the plastic sheets will be etched to look for evidence of the passage of highly ionizing particles through the material. Lead bricks are stacked on either side of the detector to shield it from synchrotron radiation and scattered electrons. PEP-2 is a collaborative experiment between physicists from LBL and SLAC. (Photo by Joe Faust.)



PEP-5: MARK II

The figure shown here is a computer reconstruction of the first hadronic event observed with the Mark II detector at PEP. The center-of-mass energy was 22 GeV. The eight charged particles shown in the event have a total energy of 18 GeV, while the (invisible) neutral particles account for the remaining 4 GeV. (The figure is incorrectly labeled "6 prong"; it is actually an 8-prong event.)

PEP-5 is a collaborative experiment between physicists from the Lawrence Berkeley Laboratory and SLAC. The Mark II detector was originally used at the SPEAR storage ring, and was then moved to Interaction Region 12 at PEP in August of 1979. The Mark II contains a number of different particle-detection systems and makes use of a large solenoidal magnetic field.

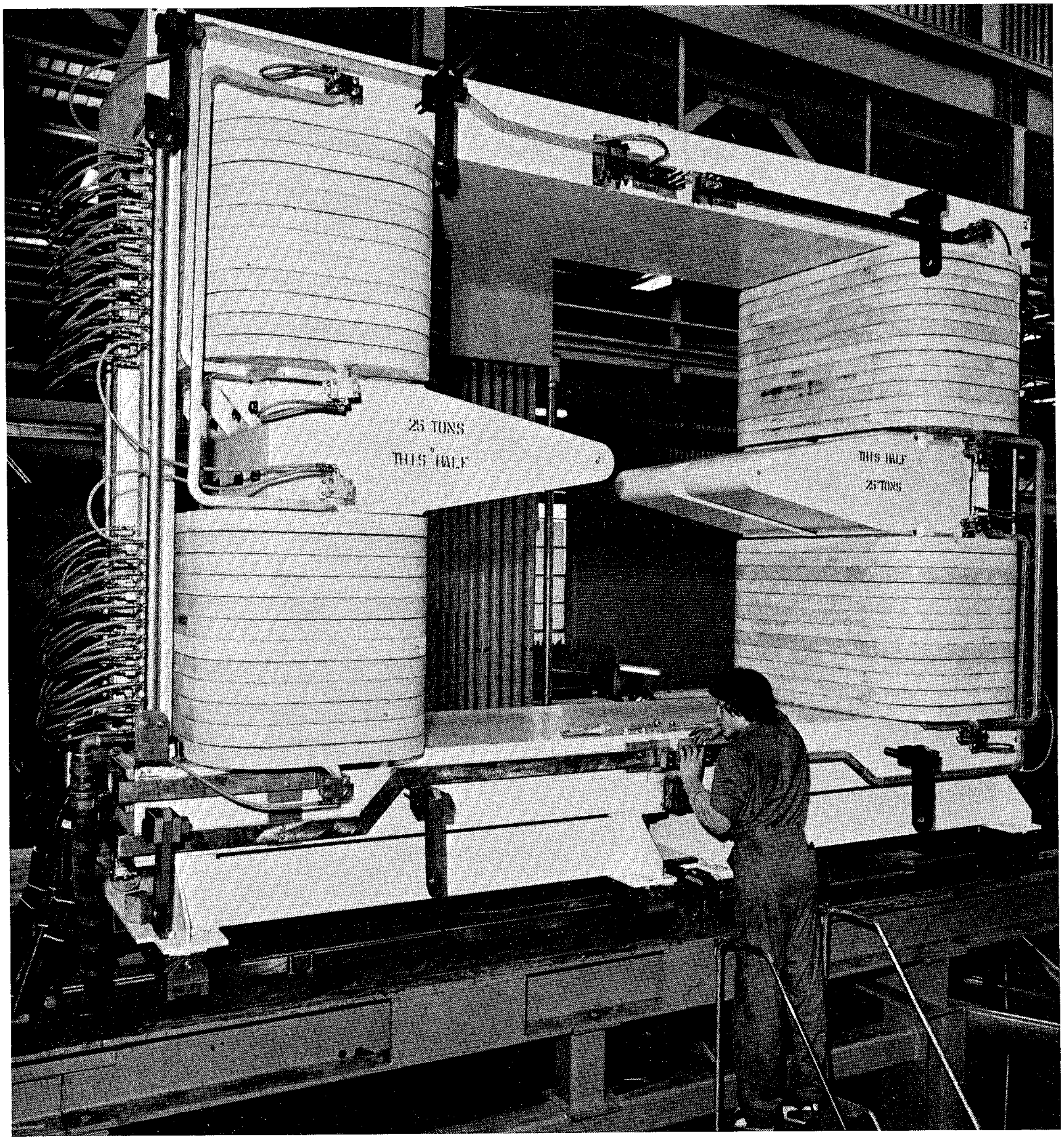


PEP-6: MAC

The photo shows the large MAC (MAgnetic Calorimeter) particle detection system in its final assembly stages in Interaction Region 4 at PEP. The PEP-6 collaboration consists of physicists from Colorado, Northeastern, SLAC, Utah and Wisconsin. The MAC detector is optimized for detecting leptons and for performing total-energy measurements over nearly the full solid angle. There is an inner drift chamber with about 1200 channels for tracking charged particles, which is immersed in a 5 KG solenoidal magnetic field. This is surrounded by an electromagnetic shower detector consisting of a 30-layer lead/proportional chamber system made up of six separate modules.

The bulk of the detector consists of a 600-ton hadron calorimeter system. This is made up of a cylindrical center section and two planar end-cap sections (shown clearly in the photo), each containing 30 layers of magnetized steel interleaved with proportional chambers.

Identification of muons is made by penetration through the segmented steel, and momenta are measured by both the toroidal magnetic field of the steel and the inner solenoidal field. Surrounding the calorimeter there are two layers of drift chambers that are used to determine both the direction and position of the penetrating particles. (These outer drift chambers are not shown in the photo.) Photo by Joe Faust.

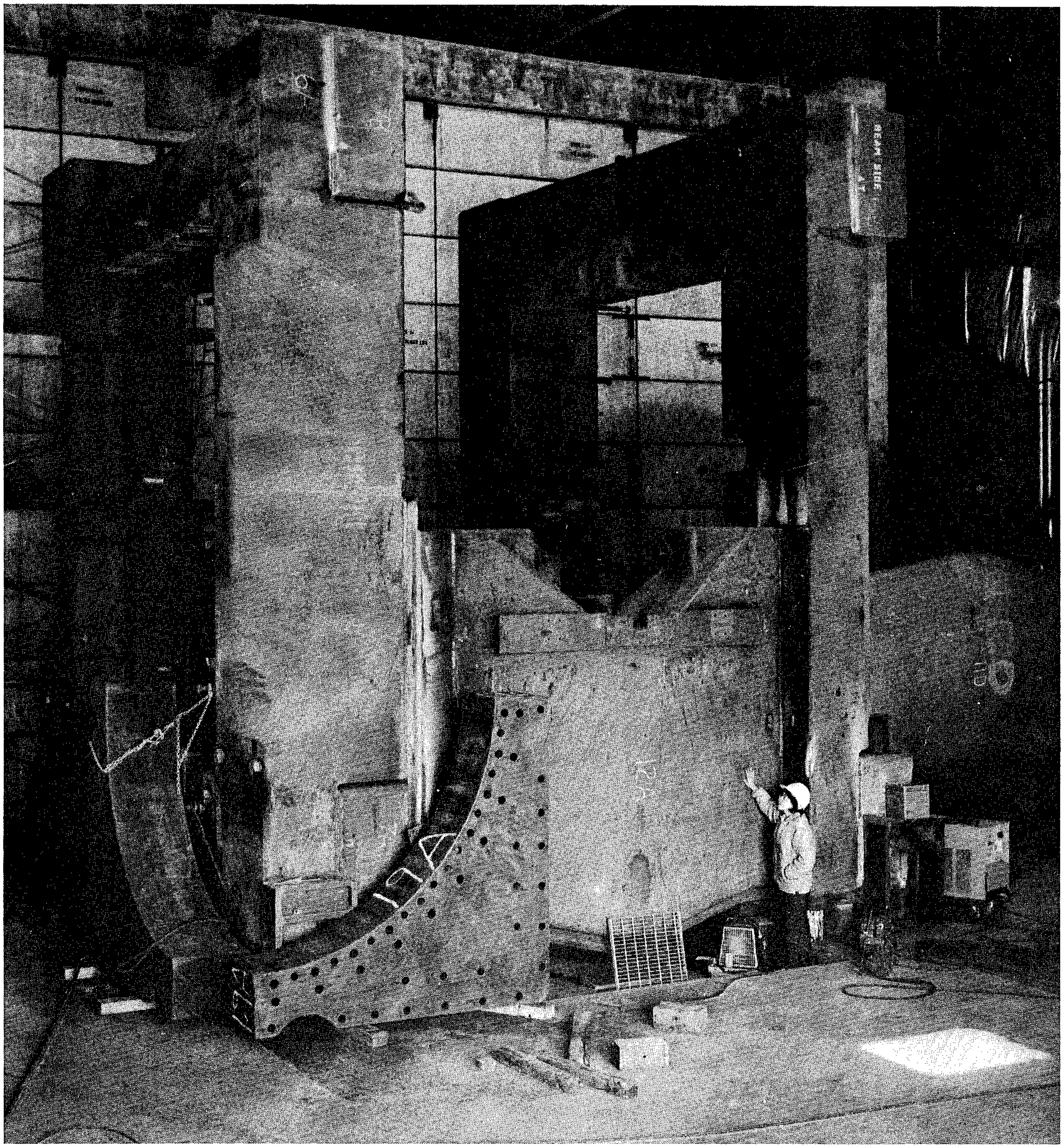


PEP-9: TWO-GAMMA

The photo shows one of the two large septum magnets that form a part of the two-photon (or two-gamma) detection apparatus. This apparatus consists of two identical detection systems that will be located at either end of the Time Projection Chamber (TPC) in Interaction Region 2 at PEP. The PEP-9 detectors provide magnetic tracking through the septum magnets, an inner detector of sodium iodide crystals, a time-of-flight system, a muon detector, and a lead scintillation shower detector.

PEP-9 is a collaboration among physicists from three different University of California campuses—Los Angeles, Santa Barbara and Davis—and from the Netherlands.

The two-photon physics that PEP-9 is designed to study is expected to be relatively much more important at PEP energies than it was at the lower energies available at SPEAR. Most of the particles produced in two-photon events will tend to emerge at small angles relative to the direction of the colliding beams in PEP.

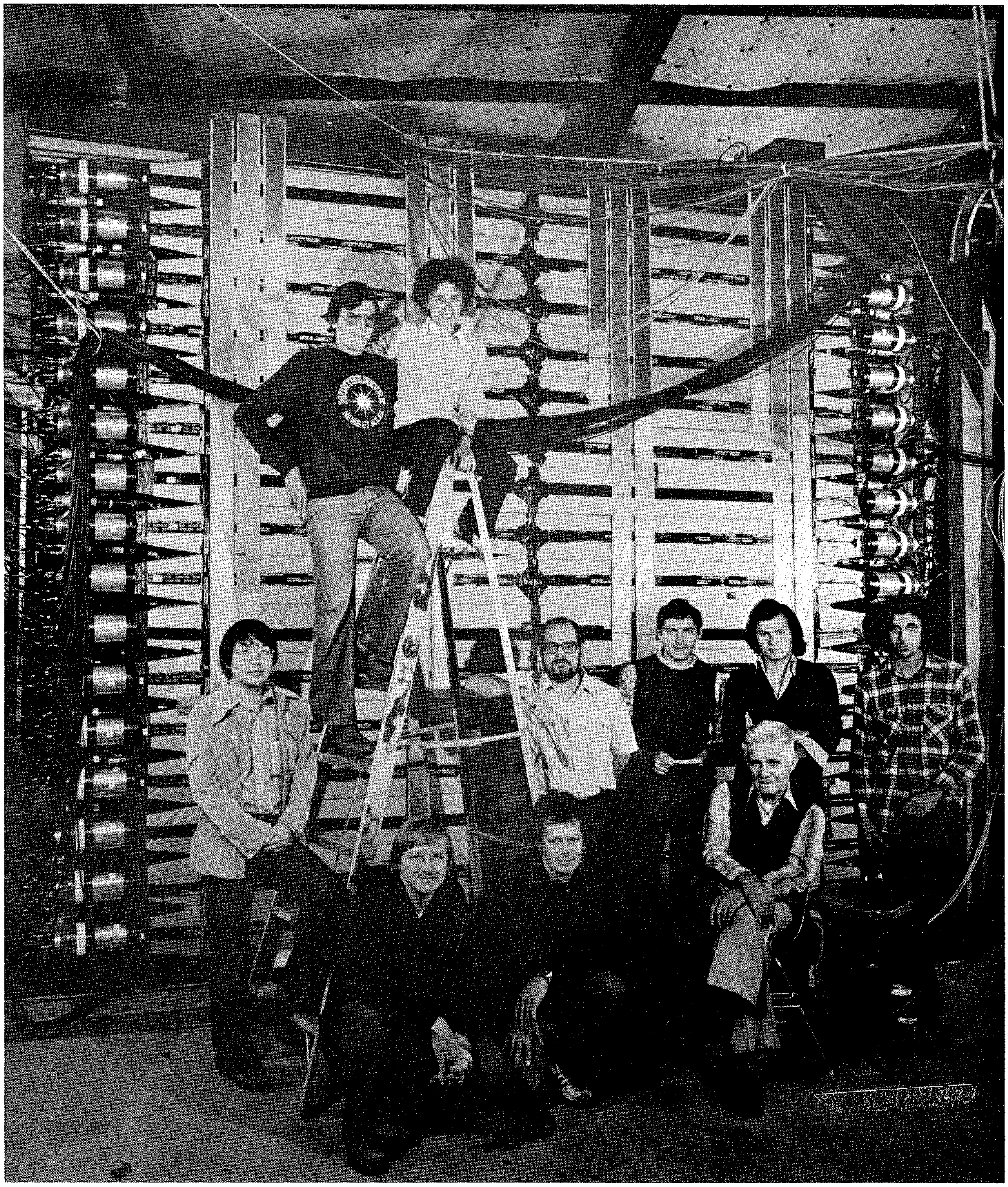


PEP-12: HIGH RESOLUTION SPECTROMETER

This photo, taken in May, shows part of the iron framework of the very large magnet of the High Resolution Spectrometer (HRS) facility, which is presently being installed in IR 6 at PEP. The superconducting coil for this magnet was installed in May. The magnet coil arrived at SLAC last Thanksgiving Day, after a well-publicized trip across the country from Argonne National Laboratory in Illinois, where it had previously been used with the 12-foot bubble chamber there. When the entire magnet is assembled, it will weigh about 2000 tons. Detection systems to be installed inside the coil include drift chambers and shower counters. Sometime this fall, after a checkout period, the entire HRS will be ready to be rolled into the PEP beam (on the far side of the concrete shielding wall shown in the background of the photo).

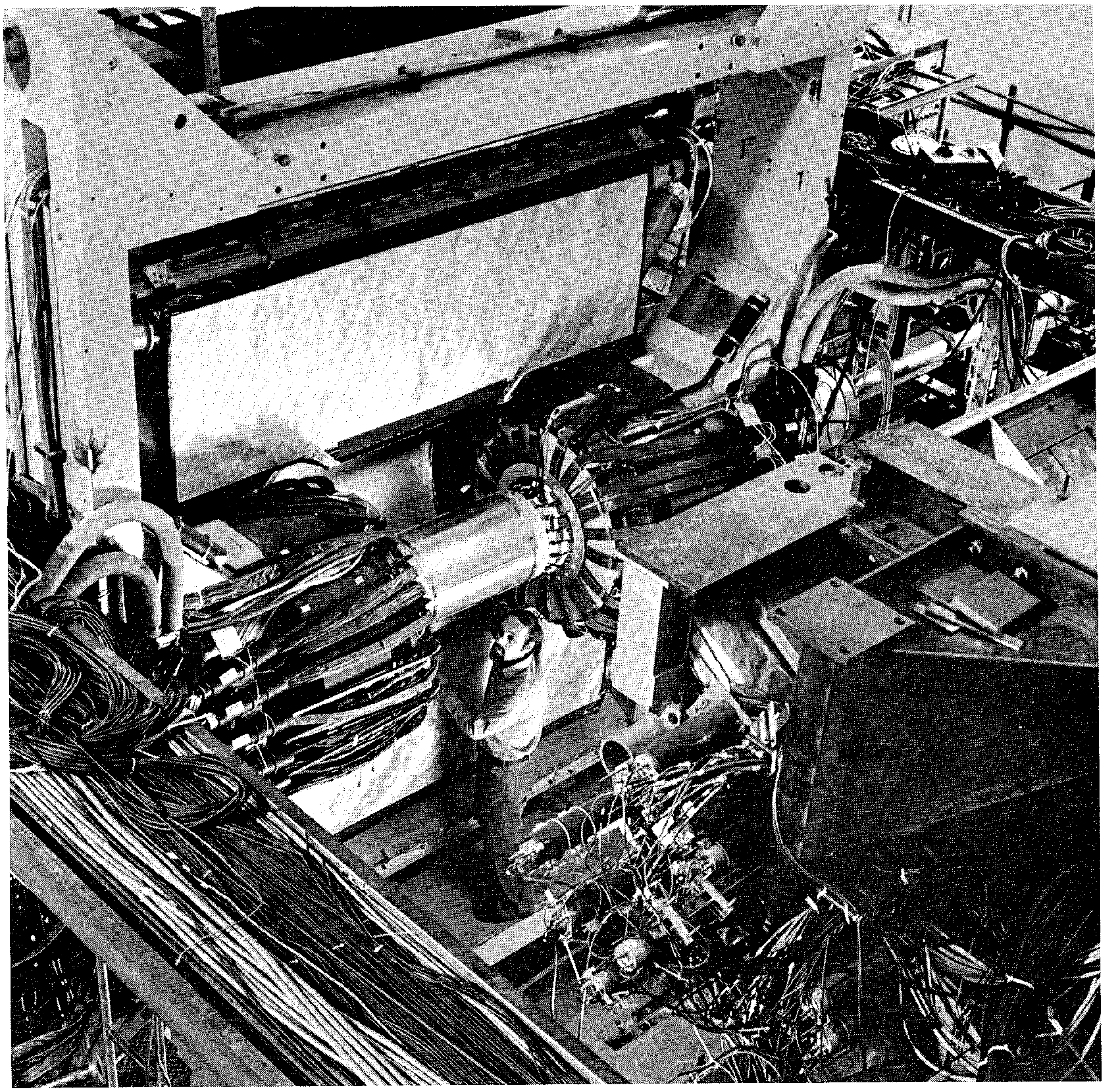
Initial use of the HRS facility will be by the physicists in the PEP-12 collaboration, which includes members from Argonne, Indiana University, LBL, University of Michigan, Purdue University and SLAC. (Photo by Joe Faust.)

—Russ Klem



PEP-14: FREE QUARK SEARCH

Some of the members of the PEP-14 collaboration are shown here in front of their completed detector. On the ladder, left to right, are Didier Besset and Inga Karliner. In the middle row are Ting Pun, Alan Litke, Wlodzimierz Guryn, Rene Fries and Paulo Galtieri. In front are Paul Madden, Vincent Vuillemin and Norm Anderson. The Free Quark Search is installed in Interaction Region 6 at PEP. (Photo by Joe Faust.)



PEP-15: DELCO

PEP-15, DELCO, is a collaborative experiment among physicists from CalTech, SLAC and Stanford. The DELCO detector operated successfully for about two years at the SPEAR storage ring before it was upgraded and moved to Interaction Region 8 at PEP. The detector consists of a magnet containing tracking chambers surrounded by a large array of Cerenkov counters, as well as shower detection and muon detection. The magnet has a very open geometry, thus allowing the use of Cerenkov counters for particle identification.

The central tracking detector consists of a 4-layer proportional chamber immediately adjacent to the beam pipe, and a 10-layer drift chamber consisting of about 1000 sense wires. The drift chambers are surrounded by a 36-cell Cerenkov counter to accomodate the high multiplicities expected at PEP. Outside the Cerenkov counters there are six 4-layer modules of planar drift chambers that provide accurate momentum reconstruction. Outside these chambers lie time-of-flight counters to provide particle identification at low momentum. In addition, the detector has lead-scintillation shower detectors and muon identification covering approximately 40% of the full solid angle. The gas Cerenkov counter will provide π/K separation for particles of momenta greater than 5 GeV. (Photo by Joe Faust.)

NEXT SLIDE, PLEASE

"I thought that in the eight minutes I've got I'd bring you up to date on what our group has been doing in the last year; in a sense this is a progress report and updates the paper we gave here last year; I won't go over the nomenclature again; could I have the first slide please —oh, I think you must have someone else's box —mine is the grey one with my name on top, no, wait a minute, not my name, whose name was it now? ah yes, you've found it; there's a red spot on the top right hand side of each slide that is the side that becomes the bottom left when you project it, OK, you've got it now, let's have a look, no, that's the last slide not the first, yes, now you've got the right one but it's on its side, what about the red dot? there are two? well anyway turn it through ninety degrees, no, the other way, yes now we're there, perhaps we could have the lights off, well I'm sorry there are probably too many words on this slide, and the printing is a bit thin; can you read it at the back? you can't; well I'd better read it out; no I won't; it's all in the paper which should be published within a month or so, and anyone who wants I'll give a preprint to afterwards, anyway, for those who can read it this slide is a block diagram of the purification process we used and before I go any further I should mention that there are a couple of misprints; on the third row, fourth box from the left, well of course that's the second box from the right, if you can read it, it says alkaline, now that should be acidic; also you can perhaps see the word mebmrane, that should of course be membrane; now if I can have a look at the next slide—now which one is this? ah yes, it's the scatter diagram, I haven't marked the quantities but we are plotting concentration against particle size; if I remember rightly this has been normalized; perhaps I could have the lights for a moment to check in the text, yes, here we are, well it doesn't actually say—we could work it out but it's probably not worth the time, so if I could have the lights off, let's have a look at the plot; well I think you can see a sort of linear relationship—there's a fair bit of scatter of course, but I think the data are at least suggestive; perhaps if I held up a pointer you could see the relationship more clearly—I expect there's a pointer around somewhere, no I won't need the lights, yes here it is, now you can see the trend and there's just a hint of another trend running subparallel to it through this other cluster of points, you may see that more clearly if I slide the pointer across to the other—no, I wasn't saying next slide, just that I would slide the pointer; anyway now the next slide is up let's keep it on the screen, now this is a thin section—it could take just a bit of focusing—yes, that's better, it's difficult to get the whole slide in focus at once, now the scale is, well that bar is one micron long, hang on what am I saying? it's ten microns long—oh dear, the chairman is giving me the two-minute warning, it's difficult to give you a clear picture of this work in only eight minutes, but let's plough on, what was I saying? ah yes, the bar is ten microns long, now if we turn to the next slide, please, this is the result of a chemical analysis of the dark region that is near the centre of that thin section, is it possible to go back a slide? well not to worry, you can see in the analysis how dominant —sorry what was that? oh yes, the errors are plus or minus a percent or so—that's the standard deviation, no it can't be, it must be the standard error of the mean—oh dear, the chairman says my time is up, can I beg a half a minute—are there any more slides? really? well let's skip the next two, now this one is pretty important, it brings together several of the threads that you've probably been able to discern running through this talk, but rather than go through it in detail perhaps I should have the lights and just put up one or two key numbers on the blackboard—the chairman says there's no chalk, well it's all in the paper I was mentioning anyway, perhaps I've been able to give you the gist of what we've been doing, I guess that's all I have time for."

—*Nature*, 27 April 1978

John Ehrman has provided us with another collection of his conversion factors:

.001 ner = 1 milliner

10^6 phone = 1 megaphone

10^9 ntic = 1 gigantic

10^{-12} boo = 1 picoboo

10 cards = 1 decacards

10^6 lomaniac = 1 megalomaniac

2 gamy = 1 bigamy

10 dent = 1 decadent

.1 pher = 1 decipher

.001 cent = 1 millicent

10^{12} Haute = 1 Terre Haute

.01 ment = 1 centiment

10^{12} wrist = 1 terawrist

10^{12} Φ = 1 teraΦ

½ 4 = 1 semifour

10^{-6} scope = 1 microscope

10 pitate = 1 decapitate

10 y = 1 decay

THEORETICAL PROGRESS

We report here on the recent theoretical experiment to test QSD (Quantum Softball Dynamics), which failed to confirm the prediction of AV (Asymptotic Victory). For seven innings its was thought that sufficiently high momentum had been developed to confirm AV, but the final score (18-16) showed that small (< 20%) higher twist corrections are still required. The theoretical team stood behind a pitcher who was fed California lattice for many years, but he failed to deliver the expected glueballs. The infield obeyed a Ward identity, but certain anomalies were seen. At first base the miscalculation of Penguin diagrams resulted in CB (caught ball) violation. The outfield claimed Centauro events, but those came from a moribund theory, QCD (Quantum Cricket Dynamics). There was also much talk about QSD in the early universe (the first 10^{-30} seconds) but this produced no points. Because this model of QSD has 23 players, CIM (Constituent Interchange Model) played an important role.

The experiment was attempted by a Chinese (PRC)-u.s. Of a.-Polish-Indian-Nipponese-German collaboration (the collaboration is COPING). While the team played with a lot of GUTS, their SO(23) theory turned out to be a lot of U(1)'s. Their effort was technicolored by very massive blunders. Post-game activities proved, however, that the team does understand Beer-can scaling.

We have no excuses, but some of the fault must be laid on laboratory management. The facilities were not well-maintained (grass not cut); we were given inadequate equipment (cheap gloves); and our computers were mostly the completely outmoded 1940's models, while the other team made use of some of the more recent offspring models.

However, it is hoped to mount a new experiment *next year*, on the 25th anniversary of the discovery of softball at Stanford, and theorists are already hard at work trying to achieve the appropriate momentum even if there is no PEP.

--Mike Barnett

Lalit Kumar Panda, 25, of India died in an automobile accident in Nevada on May 21, 1980. Lalit was a graduate student in the Physics Department of Yale University and had been working at SLAC for about two years with the Yale group on SLAC experiment E-130.

—Vernon Hughes

WARNING: MAGNETIC FIELDS MAY BE HAZARDOUS—TO YOUR CREDIT CARDS

As technology proceeds ever forward and computers become an integral part of our lives, we must realize that many SLAC people carry specialized "keys" to these computers, often without knowing it. These "keys" of course are credit cards. Specifically, bank cards such as Master Charge and Visa, and personal banking cards such as Crocker 24-hour banking, are involved, as well as many others. To check, simply look at the back of the card. If there is a black or dark brown strip running the length of the card, then you have one of these "keys." This strip is actually magnetic tape, no different from that used for computer storage or the common tape recorder.

This tape contains, in code, all of the necessary information regarding your charge account. The code is a specific arrangement of iron particles that are translated by the computer into information. Everyone knows what happens when a ferrous metal, such as iron, comes near a magnet: it is attracted. This holds true for the iron particles in the magnetic strip. The effect on the magnetic tape is disorientation of the particles, thus rendering the card useless.

There are many areas at SLAC where this can occur. Examples are the large magnets associated with LASS and the 40-inch bubble chamber, and the magnets along the PEP storage ring. Take care not to enter a magnetic field with credit cards in your possession. A 4- to 6-week replacement time is a high price to pay for a few moments exposure.

—Bob Reif
Cryogenics Operations

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